Kinetic Scheduling Technical Reference Guide

Version 2025.1

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Understanding Scheduling

The scheduling engine is a time management tool that uses the principle of **supply** and **demand**. It evaluates the supply of time available within your manufacturing center to answer the demand of time generated by your jobs.

When there is enough supply available to meet demand, your jobs are completed by their 'Due' dates.

The principle of supply and demand is behind the design of the scheduling calculation logic. The scheduling logic measures the time needed to work on your jobs, and then balances this demand by finding a supply of time that can satisfy it.

This principle also applies if you want to calculate your schedule using something other than time, like a rate of materials that can be produced per day. This type of calculation is referred to as non-time capacity. The scheduling engine will still calculate how much non-time supply is available to satisfy the demand.

You can schedule jobs 'Forward' and 'Backward'.

- **Forward Scheduling** - Is logic used by the scheduling engine to calculate the length of time it will take to complete a job. This logic begins with the 'Start Date' on the job and then moves forward through the 'Production Calendar' used at the resource, resource group, site, or company, and uses the lengths of time required on each operation (Operation Time) - taking into account any operations that can run concurrently (peer assemblies) - to arrive at the 'End Date'.
- **Backward Scheduling** - Is a type of logic used by the scheduling engine to calculate the length of time it will take to complete a job. This logic begins with the 'End Date' on the job and then moves backward through the 'Production Calendar' used at the resource, resource group, site, or company, and uses the lengths of time required on each operation (Operation Time) - taking into account any operations that can run concurrently (peer assemblies) - to arrive at the 'Start Date'.

Scheduling Concepts

The Scheduling module can help you prevent potential problems and more accurately predict when jobs complete – ensuring that your job production runs both smoothly and efficiently.

This module evaluates the schedule based on the principle of supply and demand. It does this by calculating the load on all resources (machines, employees) the job uses. The load is the hours needed to start and finish each operation, so load during a specific time period equals the demand on the resource. For example, an operation takes one hour to set up the machine and five hours to produce the production quantity. This means that this operation requires six hours of load (demand) on the resource, and this time is placed on the schedule.

Capacity defines the supply of a resource. It measures either how much time is available on the resource or the number of units that can be produced. A resource can either have finite (limited) or infinite (unlimited) capacity. Regardless of how capacity is measured by the resource, however, capacity cannot be stored - if it is not used during the schedule, this value disappears.

Scheduling Times

The scheduling functionality considers several factors when calculating how long it takes to complete a job's production quantity.

- Queue Time is the length of time a job waits at a resource before setup work is performed on the job.
- Setup Time defines how long it takes a resource to prepare the operation for the job.
- Production Time indicates how much time is needed to produce the part quantity.
- Move Time is the length of time it takes to transport the part quantity to the next resource.
- Production Preparation Time is the time added to the lead time of the manufactured item to determine the start date.
- Kit Time is the number of days required to assemble the materials for a manufactured part before the job starts.
- Receive Time is the number of days subtracted from the PO Release Due Date to account for unpacking and inspecting the purchased items. On job suggestions or unfirm jobs, this value can also indicate how many days from the Required By Date it takes to move the manufactured items to the next job.

Scheduling Horizons

Kinetic uses three distinct calculations to determine how much load to schedule against your upcoming jobs. Each scheduling calculation is run against jobs whose Start Dates fall within a horizon calendar range. You specify how many days are included within each horizon calendar range, so you can set up the scheduling engine to generate results that best match your production planning needs.

The following graph illustrates these calculations and their different horizons.

Finite Scheduling

Finite Scheduling calculates the most detailed scheduling results. When the scheduling engines determines the load to place against these jobs, it takes into account the existing resource load (capacity) for each operation on the job method. Resources cannot be scheduled above their

available capacity per day, so resources cannot be overloaded in this section of the schedule. Any jobs with Start Dates that occur on or before the Finite Horizon are finitely scheduled.

For example, if the Finite Horizon is 30 days and the Scheduled Start Date for the scheduling process is March 1, all jobs with Start Dates from March 1- March 30 are finitely scheduled.

Infinite Scheduling

Infinite Scheduling calculates less detailed results by ignoring existing resource load (capacity). Job operations are scheduled without constraints against each resource. You use this calculation because at some point in the future schedule, you do not care your resources are overloaded. You can then manage the overload by either shifting load or increasing capacity. Shop load records are created to provide the overload visibility.

For example, if the MRP process calculates you need 500 parts one week from today, it schedules them all to be built at the same time, even though you can only do 100 at a time. If the Finite Horizon is 30 days and the Scheduled Start Date for the scheduling process is March 1, all jobs with Start Dates on March 31 and later are infinitely scheduled.

Rough Cut Scheduling

Rough Cut Scheduling ignores resource and shop load records normally included in other scheduling calculations. It does not create resource time used or shop load records normally created by other scheduling calculations. Instead, this calculation schedules every job using the Need By Dates, Operation Production Standards, and the Rough Cut Parameters (by operation) to calculate the start dates. These jobs are infinitely scheduled, but the load is not placed against these resources. This reduces the processing time needed to generate the overall schedule. Rough Cut Scheduling also gives you a general idea of the production plan required in the future.

For example, If the Rough Cut Horizon is 90 days and the Scheduled Start Date for the scheduling process is March 1, all jobs with Start Dates on or after May 29 are rough cut scheduled.

To avoid confusion with 'Material Requirements Planning', the concept of supply will be referred to as capacity within scheduling. Supply typically refers to the availability of materials.

Scheduling Logic

Several possibilities must be accounted for during the scheduling process. Each part can have a different method of manufacturing, which creates multiple methods by which operations are handled on the same resource groups.

Planned and actual demand on resources can vary from one day to the next. And the availability of materials required on operations can cause scheduling estimates to generate unexpected results, causing jobs to be completed after their original due dates.

Because of these issues, you must estimate the demand required each day or week to make sure that there is enough supply of time or other capacity to complete production quantities by the date on which they are due. Some jobs are also more important than others. For example, a job for a good customer may take precedence over a job manufactured for inventory.

The scheduling engines uses several factors that affect production - quantity, setup time, production time, capacity, priority, and so on - to calculate how long it will take each job to complete. It then displays the schedule through visual tools like the Job Scheduling Board.

If you have the Advanced Planning and Scheduling module, you can also use the Multi-Resource Scheduling Board to display the results. Likewise, if you use Material Requirments Planning (MRP), the MRP engine leverages the results from the scheduling engine to calculate job and purchase suggestions.

Other areas of Kinetic, like the Shipping and Receive module, are also affected by the results of the scheduling engine.

If you are not satisfied with this schedule or the results are in error, you can change the values on various records to generate a schedule that more accurately reflects your manufacturing process. By understanding the technical dynamics of this tool, you will be able to generate results that accurately match your production workflow.

Primary Scheduling Components

The scheduling engine handles the supply and demand of time through three main components - Capacity, Load, and Scheduling Blocks. The purpose of each component is discussed here, but these items are explored in more detail later within the Primary Components information.

- **Capacity** - This component measures how much time or production output (non-time capacity) is available for the resources within your manufacturing center; capacity represents the supply available in the schedule. Each resource has a capacity limit that is available during each working day. Depending on how you want the scheduling engine to handle capacity, resources can or cannot be assigned more demand than can be satisfied through their capacity. A resource can have either finite or infinite capacity.
- **Load** - This component measures how much time or production output is required by operations to complete part quantities. Load represents the demand that is placed against the schedule. It is the amount of time or production output that the resource needs in order to

complete the operation. The load required for each job is calculated by the part quantity needed, the operations required to complete production, and the availability of resources to complete the job's part quantity.

- **Scheduling Blocks** - The scheduling engine uses this component to calculate the amount of load that is required to complete an operation. A scheduling block is a record that measures the length of time during which work will be done on one operation. First, the scheduling engine determines how much time it will take to complete the operation. For example, it will take 40 hours to complete production on the quantity required for operation. This is the total amount of load needed for this operation. Then the engine calculates how many scheduling blocks are required to handle the load. The length of these time allocation records will vary, depending upon the quantity produced, the number of resources (machines or operators) available, whether the operation can be divided, and so on. When the scheduling engine calculates how many scheduling blocks will handle the load, it checks how much capacity in time is available on the resources that will complete the operations. At this point, each scheduling block resembles a puzzle piece, as the engine tries to fit each block into a segment of open time on a resource. When all of the scheduling blocks are placed into the resource's time, the job is scheduled. The job's Start Date and End Date represent the entire length of time it will take to work on the job.

Scheduling Example

Assume you are a scheduler within your company's Paint division.

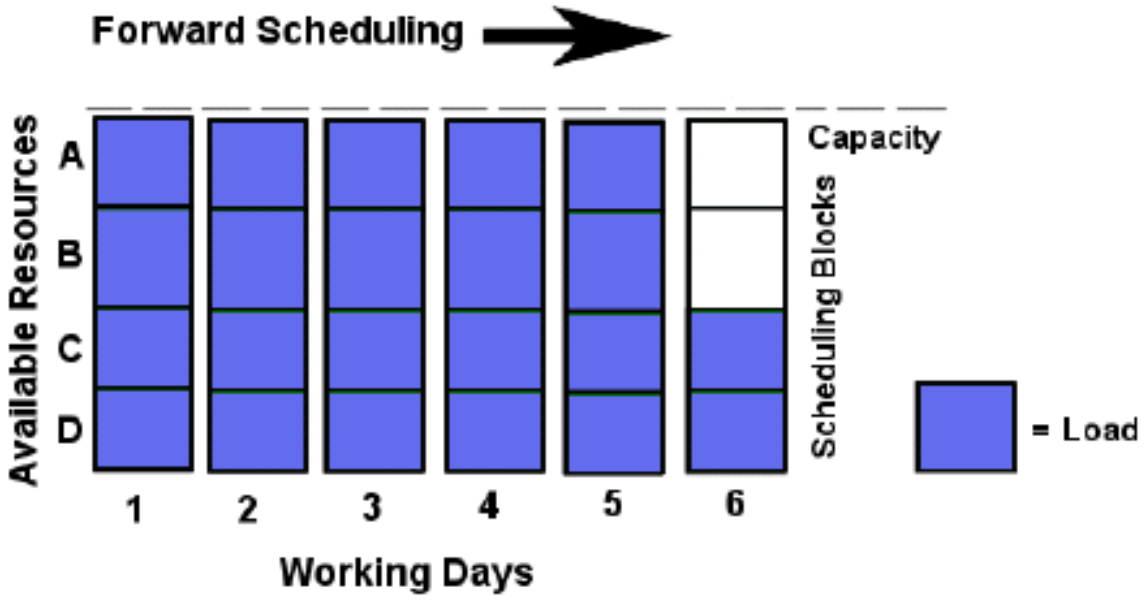
You receive a sales order for a 220 part quantity. In your Paint resource group, you have four Paint Machine resources that can prepare, paint, and dry 10 parts each day. Using this data, the scheduling engine can calculate how long this job will take to complete.

First, the scheduling engine calculates the total capacity available within your Paint resource group. For this example, it measures the capacity in time. It takes 8 hours for each machine to finish 10 pieces, and 8 hours represents one working day at your company. The total capacity available at the Paint resource group is 32 hours each working day.

On the Paint operation detail within your job method, you indicate that 4 scheduling blocks are available to use for this operation. Because the Paint operation has to run from start to finish (the work cannot be divided), the scheduling engine determines that each scheduling block for this operation must be 8 hours in length.

Based on these calculations, each resource has enough capacity to handle one scheduling block of load per day. Because there are 4 resources to handle these scheduling blocks, 4 scheduling blocks of load can fit into the available capacity at the Paint resource group each working day.

The scheduling engine places this load as follows:



Four scheduling blocks can be placed within the Paint resource group per working day. Ten pieces will be painted during each scheduling block, so the Paint resource group can complete 40 pieces per working day.

You will Forward Schedule this job, which means that the engine will use the Start Date on the job to begin the calculations, and then move ahead through the schedule to assign the scheduling blocks to any open time segments that it finds closest to the Start Date.

This paint job's Start Date is August 1st. The scheduling engine estimates that it will take 22 scheduling blocks to complete work on this job, which is 6 working days. The entire job is estimated to be complete by August 6th.

Note this example does not take into account a number of factors like peer assembly relationships, constrained materials, and other items that affect scheduling. The rest of this guide explains these and other factors so that you can accurately calculate each job's production schedule.

Scheduling Components

Kinetic uses three distinct calculations to determine how much load to schedule against your upcoming jobs. Each scheduling calculation is run against jobs whose Start Dates fall within a horizon calendar range. You specify how many days are included each horizon calendar range, so you can set up the scheduling engine to generate results that best match your production planning needs.

The scheduling horizons include:

- **Finite Scheduling** - Calculates the most detailed scheduling results. When the scheduling engines determines the load to place against these jobs, it takes into account the existing resource load (capacity) for each operation on the job method. Resources cannot be scheduled above their available capacity per day, so resources cannot be overloaded in this section of the schedule. Any jobs with Start Dates that occur on or before the Finite Horizon are finitely scheduled.

  For example, if the Finite Horizon is 30 days and the Scheduled Start Date for the scheduling process is March 1, all jobs with Start Dates from March 1 - March 30 are finitely scheduled.

- **Infinite Scheduling** - Calculates less detailed results by ignoring existing resource load (capacity). Job operations are scheduled without constraints against each resource. You use this calculation because at some point in the future schedule, you do not care your resources are overloaded. When overload is allowed the you manage the overload either by shifting load or increasing capacity. Shop load records are created to provide the overload visibility.

  For example, if the MRP process calculates you need 500 parts one week from today, it schedules them all to be built at the same time, even though you can only do 100 at a time.

- **Rough Cut Scheduling** - ignores resource and shop load records normally included in other scheduling calculations. Instead, this calculation schedules every job using the Need By Dates, Operation Production Standards, and the Rough Cut Parameters (by operation) to calculate the start dates. These jobs are infinitely scheduled, but the load is not placed against these resources. This reduces the processing time needed to generate the overall schedule. Rough Cut Scheduling also gives you a general idea of the production plan required in the future.

  For example, if the Rough Cut Horizon is 90 days and the Scheduled Start Date for the scheduling process is March 1, all jobs with Start Dates on or after May 29 are rough cut scheduled.

Primary Components

The scheduling engine uses several primary components together as a base for generating schedules. Each component contains several values that affect how Kinetic handles scheduling.

When you set up these primary components to reflect how your manufacturing center produces quantities, you fine-tune the scheduling engine calculations. The engine will use the component values to accurately estimate the time it will take to build a job and calculate the Start Date and End Date.

The list of primary components include:

- Assemblies
- Calendar
- Capability
- Capacity
- Critical Path
- Job Record Structure
- Load
- Materials
- Operations
- Operation Time
- Resource
- Resource Group
- Sites
- Scheduling Blocks
- Sub-assemblies
- Subcontract Operation

Assemblies

An assembly defines a specific step, or component, on a job or quote method that produces each material required to make the final part. A method can have one assembly or multiple assemblies.

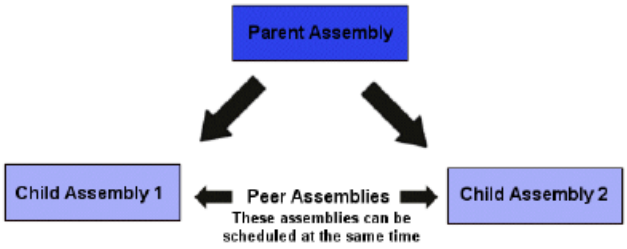
An assembly can also contain one or more subassemblies and a subassembly can become a parent assembly by containing one or more subassemblies. This hierarchy lets you engineer part methods of manufacturing that are as simple or as complex as you need.

Each assembly has its own number and material requirements. A parent assembly is any assembly that is made up of one or more child subassemblies. Parent assemblies are used by the engine to

determine the correct manufacturing hierarchy of the operations defined for the job. The hierarchy lets the scheduling engine calculate when each operation should begin and end - which then results in the engine calculating the Start Date and End Date on a job.

If a part, job, or quote method does not have subassemblies, only one parent assembly is needed for the production part quantity. If a part requires several assembles, however, there can be as many parent assemblies as needed. Each tier on a complex method is typically called a level within the manufacturing hierarchy.

One reason to create multiple parent assembly levels is to let the engine concurrently schedule these assemblies. Each parent assembly typically contains operations and subassemblies that are unique for that area of the method of manufacturing. If an assembly can run at the same time (concurrently) as another assembly they are considered peer assemblies.

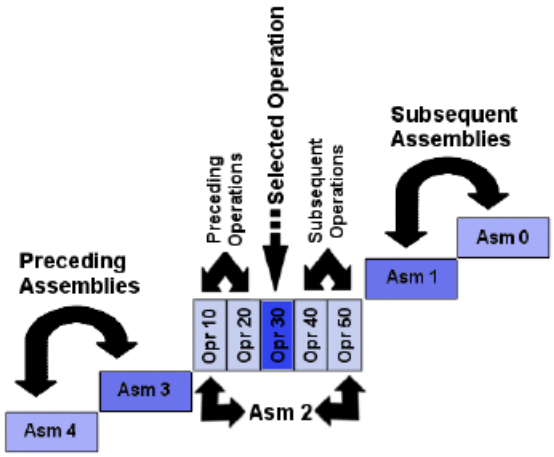


The scheduling engine can calculate which operations can occur at the same time, instead of scheduling these assemblies to start one after the other. Another reason to define subassemblies is if you manufacture internal parts used as materials on multiple finished products. You can use subassemblies to manufacture additional inventory quantities or overproduce these quantities.

Modifiers

You can manipulate how the scheduling engine handles assemblies for specific jobs and operations. When you move a job or an operation on a scheduling board, the Move Job window appears. On this window, use the Move Option drop-down list to indicate the method by which you will move the assembly.

Move Options are dependent on the currently selected operation. Any operation that occurs before the selected operation is considered a preceding operation, while any operation that comes after it is considered a subsequent operation. The following illustration shows how this works:



Notice that the assemblies are manufactured in reverse numeric order. An assembly with a higher number, like 4, is manufactured before an assembly with a lower number, like 2. The final assembly is Assembly 0.

The following are the move options you can use to adjust operations:

- **Branch-Preceding Operations** - This option reschedules the selected operation and any preceding operations within the current assembly. Then it reschedules operations contained in any preceding assemblies.
- **Branch-Subsequent Operations** - This option reschedules the selected operation and any subsequent operations within the current assembly. Then it reschedules operations contained in any subsequent assemblies - up to the final assembly (Assembly 0).
- **Assembly-All Operations** - This option reschedules all the operations on the assembly around the selected operation. If multiple operations for a single assembly are scheduled at a resource group, the method leaves open time available for other operations required on any other resource groups.
- **Assembly-Preceding Operations** - This option reschedules only the preceding operations contained within the current assembly. It reschedules the selected operation and any operations that come before it.
- **Assembly-Subsequent Operations** - This option reschedules only the subsequent operations contained within the current assembly. It reschedules the selected operation and any operations that come after it.

Location

You can access the Assemblies functionality through the following locations:

- **Job Entry** - Where you define which assemblies you need for a job's method of manufacture. You also enter the subassemblies needed for the current assembly (the parent assembly).

- **Opportuntity/Quote Entry**- Where you enter materials that you need for a quote's method of manufacture. You also enter the subassemblies needed for the current assembly (the parent assembly).

Logic

The Assemblies functionality uses the following logic to calculate its results.

- Assembly 0 must exist; all other assemblies are optional.
- If two or more child subassemblies are considered peer assemblies, these child subassemblies can be scheduled at the same time.

Example

You are making a table that has a top and four legs. The Table is the top assembly level (Assembly 0), while the Leg and Top are subassembly levels. The top and legs can be made at the same time, or run concurrently. They are considered peer assemblies by the scheduling engine, and so are scheduled to run at the same time.

When these part quantities are finished, they can be assembled to make the table.

The Table assembly is the parent assembly to both the Leg and the Top subassemblies. If the Leg subassembly required additional components, such as a Wheel Base subassembly and a Wheel subassembly, the Leg would be the parent assembly to those subassembly steps. These subassemblies can also be run concurrently, so they are peer subassemblies that can be scheduled at the same time.

Calendar

Production Calendars allow you to define the specific hours per day production will run, the days on which work is performed (Working Day), and the days on which work is not performed (Non-Working Day).

You can create as many production calendars as you need and then select them on specific records. You can select an overall production calendar for your company. Also, you can select specific calendars for your resources, resource groups, sites, and suppliers.

The scheduling engine reviews all production calendars to calculate how much capacity is available for operations. Calendars contain the base amounts of time that the scheduling engine uses to schedule blocks of load against the time available at each resource.

Because time might be available in one area of the company and not in another, certain calendars take precedence over other calendars. This is the production calendar hierarchy:

- **Resource Calendar** - The production calendar selected at the resource level is evaluated first.
- **Resource Group Calendar** - If a calendar is selected at the resource group level, it is evaluated second by the scheduling engine.
- **Site Calendar** - If a calendar is selected on a site record, it is evaluated third by the scheduling engine.
- **Company Calendar** - The overall production calendar selected on the company record is evaluated last.

The production calendars selected on supplier records are used to calculate the arrival of materials or part quantities in subcontract operations.

Modifiers

You can modify the following values:

- **Working Days/Non-Working Days** - On each calendar, you indicate on which days work will be performed, and which days work will not be performed (like holidays and weekends). You modify these values in Production Calendar Maintenance.
- **Resource Group Exceptions**- On a selected date, you can indicate the times when a resource group will not be available. You indicate group exceptions using a twenty-four hour clock. For example, you can indicate that the Mold Machine resource group will not be available on 7/22 between 21-24 hours. You modify these values in Resource Group Maintenance. Using resource exceptions, on a selected date, you can indicate the times when a resource will not be available. You indicate the exception time using a twenty-four hour clock. For example, you can indicate that the Ten Ton Mold Machine will not be available on 7/22 between 21-24 hours. You modify these values in Resource Group Maintenance.

Location

You can access the calendar functionality through the following locations.

- **Production Calendar Maintenance** - You use this app to define various production calendars.
- **Resource Group Maintenance** - You can select a calendar at either the resource level or the resource group level. Also, you can define exceptions at either the resource group or the resource level. You locate this app by opening the Production Management folder, the Scheduling folder, and the Setup folder.
- **Resource Group Maintenance** - You can select a calendar at either the resource level or the resource group level. Also, you can define exceptions at either the resource group or the resource level.
- **Site Maintenance** - You can select a production calendar for a specific site in Site Maintenance.

- **Company Configuration** - You can select a production calendar for the entire company in Company Configuration.
- **Supplier Maintenance** - You can select a production calendar for a specific supplier in Supplier Maintenance.

Logic

The Calendar functionality uses the following logic to calculate its results.

Total Work Time Available *= Working Days- (Calendar Exceptions Day 1 + Calendar Exceptions Day 2 + Calendar Exceptions Day 3 + and so on)*

Examples

- **Working Days/Non-Working Days** - Your company's Blue site is in production for 10 hours each day and is open from Monday to Friday. You create a production calendar that defines Monday - Friday as Working Days and Saturday-Sunday as Non-Working Days. On the Hours Per Day card, you indicate that production will run from 7 to 5 each Working Day. You label this calendar as "5 days 10 hrs" and select this calendar on the Blue site record.
- **Resources and Production Calendars** - Your Drill Machine Operator works 8 hours each day. Because of this, you select a production calendar on the Drill Machine Operator resource that indicates this person works 8 hours each Working Day. The Drill Machine, however, has a production calendar that indicates the resource can work for 24 hours a day.

  You are setting up a Drilling operation on a job method. You indicate that these two resources - the Drill Machine resource and the Drill Machine Operator resource - are required to complete this operation. They are dependent resources.

  When the scheduling engine calculates load for this operation, it will discover that 8 hours of capacity are available on the dependent resources during each working day. Because the Drill Machine Operator resource has an exception of 16 hours, the scheduling engine will use this same exception against both dependent resources.

  When scheduling, Kinetic checks to see if Calendar Exceptions exist at the resource level first. If exceptions exist, then Kinetic will create the schedule around those exceptions. If no calendar exceptions exist at the Resource level, Kinetic checks for calendar exceptions at the resource group level. If exceptions exist here, Kinetic will schedule appropriately around those exceptions. If the resource has a calendar defined, only the exceptions for the resource will be honored.

Capability

A capability is a skill or ability that a resource can possess. For example, a machine resource can have a Shear capability or a human resource can have an Engineer capability.

Other typical capabilities include Turn, Set, Paint, Drill, and so on. Capabilities support the concept of manufacturing cells, collections of resources that act as independent production units within your manufacturing center. When you link resources together through a capability, the scheduling engine can schedule operations using these different cells.

Available if your company purchases the Advanced Planning and Scheduling (APS) module, capabilities provide the scheduling engine with additional flexibility. They let the scheduling engine search for available resources that can complete an operation that requires a specific capability. Resources can be linked to multiple capabilities, so that they are available for a variety of scheduling situations.

If one resource that shares a capability with an operation is not available, the engine searches for another resource that shares the same capability. If there is capacity available on this second resource, the scheduling engine assigns the operation to it. If multiple resources that share the capability are available, the scheduling engine selects the resource that can start on the operation at the earliest date.

To resolve a tie between resources that share both the capability and the same Start Date, you can assign a Resource Priority to each resource. Resource priorities define the scheduling precedence for each resource contained within the capability. If the scheduling engine discovers that two or more resources are available at the same time, the resource that has a higher resource priority is selected first. For example, a resource with a "2" resource priority is selected before a resource with a "1" resource priority.

Tip: If You can also use a resource priority value of 99999999. Any resource that has a 99999999 priority value cannot be scheduled by the engine. However, the resource is available to select when shop employees report labor against this resource.

Capabilities can be both **finitely** (Finite Capacity Calculation) and **infinitely** (Infinite Capacity Calculation) scheduled. When a capability is finitely scheduled, the scheduling engine only places load against a resource's available capacity. When a capability is infinitely scheduled, the scheduling engine places load against a resource on the day it is due, ignoring capacity limits.

Modifiers

You can modify the following values:

- **Additional Resources Required?** - Select this check box to indicate that more resources are required to complete operations that use this capability.

- **Operation**- Defines the default operation that will be linked to a capability. When the capability is added to a method of manufacturing, this operation is used to create the operation sequence.
- **Operation Standard**- Defines an set of values that will be used for all operations linked to this capability.
- **Resource Priority** – This modifier defines the scheduling precedence for each resource contained within the capability. To resolve a tie between resources that share both the capability and the same Start Date, you can assign a Resource Priority value to each resource. If the scheduling engine discovers that two or more resources are available at the same time, the resource that has a higher resource priority is selected first. For example, a resource with a priority of 5 is selected before a resource which has a priority of 1.
- **Resources**- You can select which resources share this capability in Capability Maintenance.
- **Set Up Group Required?**- Select this check box to indicate that a setup group is needed to prepare operations that use this capability. A setup group is used to help sort schedules on the scheduling boards.

Location

You can access capabilities through the following locations:

- **Capability Maintenance** - Use this app to create the capabilities for your production center. You can then add the operations and the resources that you want linked together through this capability. To locate this app, open the Production Management folder, the Scheduling folder, and the Setup folder.
- **Job Entry**- You can select capabilities manually in Job Entry. You can drag and drop a capability onto a specific operation within the Nav Tree. Also, you can select a capability and a resource group for each operation, which causes the scheduling engine to use only the resources that share this capability within the selected group.

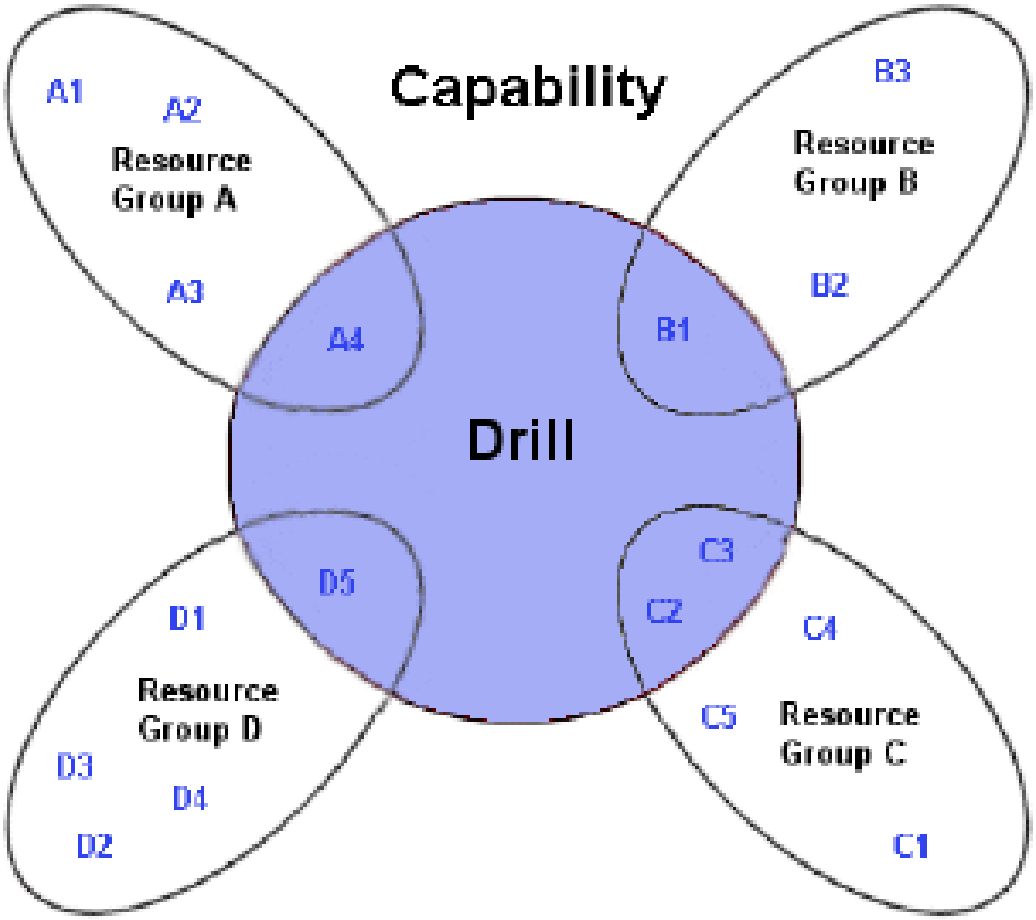
Logic

If a resource that includes a capability does not have capacity to run the operation, search for another resource that shares the capability.

Example

The following graphic defines how the scheduling engine handles capability:

A



In this example, your company has a Drill capability. There are four resource groups with resources who share the Drill capability. When the engine schedules a Drill operation by capability, it can search for all the resources that share this capability. As shown above, the A4, B1, C2, C3, and D5 resources can all be used for the Drill operation.

When calculating the load for a Drill operation, the scheduling engine matches the capability needed on the operation with the first resource that has the capacity to handle the load.

Capacity

Capacity defines the supply of a resource. You can measure it in two ways. The time available at the resource (time capacity) or the number of units that can be produced during a set period (non-time capacity).

The total available capacity is the sum of available time or units produced on a daily basis.

Capacity can be viewed as supply that can used to satisfy the demand, or load, against each resource. The relationship between load and capacity is best described as a funnel. The funnel

represents the resource. The size of the opening at the bottom of the funnel is the resource's output capacity. The input that you pour into this funnel represents the load. No matter how much load you pour into the funnel (resource), the output will continue at a regular, measurable rate. The more load in the funnel, the higher the load there is against the available capacity. Too much load results in a bottleneck.

To continue the illustration, imagine that a second funnel is added beneath the first funnel. The output from the first funnel becomes the input of the second funnel. Thus, the second funnel's load is restricted by the output of the first funnel. The only way to increase output is to increase the size of the opening on the first funnel to increase its output rate.

A resource can either have finite (limited) or infinite (unlimited) capacity. Of course, all resources are truly finite in their capacity. But by allowing infinite capacity, the scheduling engine lets you see where potential bottlenecks might occur within the schedule. When planning capacity infinitely, Kinetic calculates Start Dates and End Dates that meet the Required By Date and then provides the material and quantities necessary to build the final quantity. This logic, however, does not consider any limits to the resource's capacity, which will cause too much load to be assigned at different points in the schedule. It becomes the job planner's task to relieve the overloaded, bottlenecked resources by locating the capacity required to meet the production schedule.

Of course, you can also set up Kinetic to plan schedules against finite capacity. Finite planning means that the scheduling engine will not schedule more work than a resource can perform during a given period. When using finite capacity, jobs might be rescheduled to match the available capacity, which can cause these jobs to be finished late. The End Dates might not meet the job's original Required By Date.

Note that if a resource's full capacity is not scheduled, or consumed, during a specific working day, the capacity clears from future scheduling calculations.

Modifiers

You can modify the following capacity values. You define these values in Resource Group Maintenance.

- Non-time constraints, an Advanced Planning and Scheduling (APS) module function, only work when you use the Finite Capacity calculation (finite scheduling). There are two types of non-time constraints:
    - **Concurrent Capacity** - This value defines the amount of capacity that can be run at the same time on a resource. This capacity setting is a constraint that prevents the resource from being overloaded. The resource has, at any given time, only this much capacity. For example, an oven might only have a certain number of racks that can be filled at any specific moment. You use concurrent capacity when you have several jobs that have run quantities at the same resource during the same time. When this capacity is reached, no more operations will be scheduled against the resource - even if time is available.

    - **Daily Production Capacity** - This value defines the amount of non-time units the resource can produce in a day. You can use this setting to indicate that a resource is constrained in a way other than time. For example, a resource might be able to produce only a certain number of cubic yards of cement per day.

- **Calendar** - The calendar you select on the resource further defines the amount of time a resource is available. Note that if this resource is dependent on another resource, the amount of time that is available may be limited by this other resource. If an operator is not required on a machine, for example, that machine may be available twenty-four hours per day. If an operator is required, however, the available hours will need to be equal to the available hours of the operator resource.

Location

You can access capacity through the following locations.

- **Resource Group Maintenance** - Use this app to create the resource groups (areas of related production) within your manufacturing center. You can enter the resources (machines, operators) that make up the resource group.
- **Shop Load Report** - Displays the shop capacity. It is a summary of available resource capacity for the day or week. The ShopLoad table records the load per day of the resource or resource group.
- **Site Schedule Load Graph** - Displays the load currently placed against the capacity of your company's sites. Use this tool to identify where bottlenecks are occurring within your production flow and to evaluate if something can be done to remove these bottlenecks.
- **Resource Schedule Load Graph** - Displays the load currently placed against the capacity of your company's resources. Use this tool to identify where bottlenecks are occurring within your production flow and to evaluate if something can be done to remove these bottlenecks.

Logic

The capacity uses the following logic to calculate results.

- Capacity = Hours per Resource per Day
- Resource Time Used = ShopLoad/ShopCapacity
- **Daily Production Capacity** - Take the remaining Production Quantity multiplied by the Production Rate to get the total remaining capacity:

  *d_JobNonTimeCap = bJobOpDtl.DailyProdRate * maximum((bJobOper.RunQty - bJobOper.QtyCompleted), 0)*

  then

  Take the value and divide it by the estimated operation hours

This calculation gives you the Capacity Unit Per Hour:

d_NonTimeCapUnitPerHour = (d_JobNonTimeCap / bJobOper.EstProdHours)

- **Concurrent Capacity** - This value is stored in a sub-table to track how many units are used in an hour. When the units equal this value, the engine considers that the resource has reached its full capacity.

Examples

The following examples illustrate how you use the Capacity functionality:

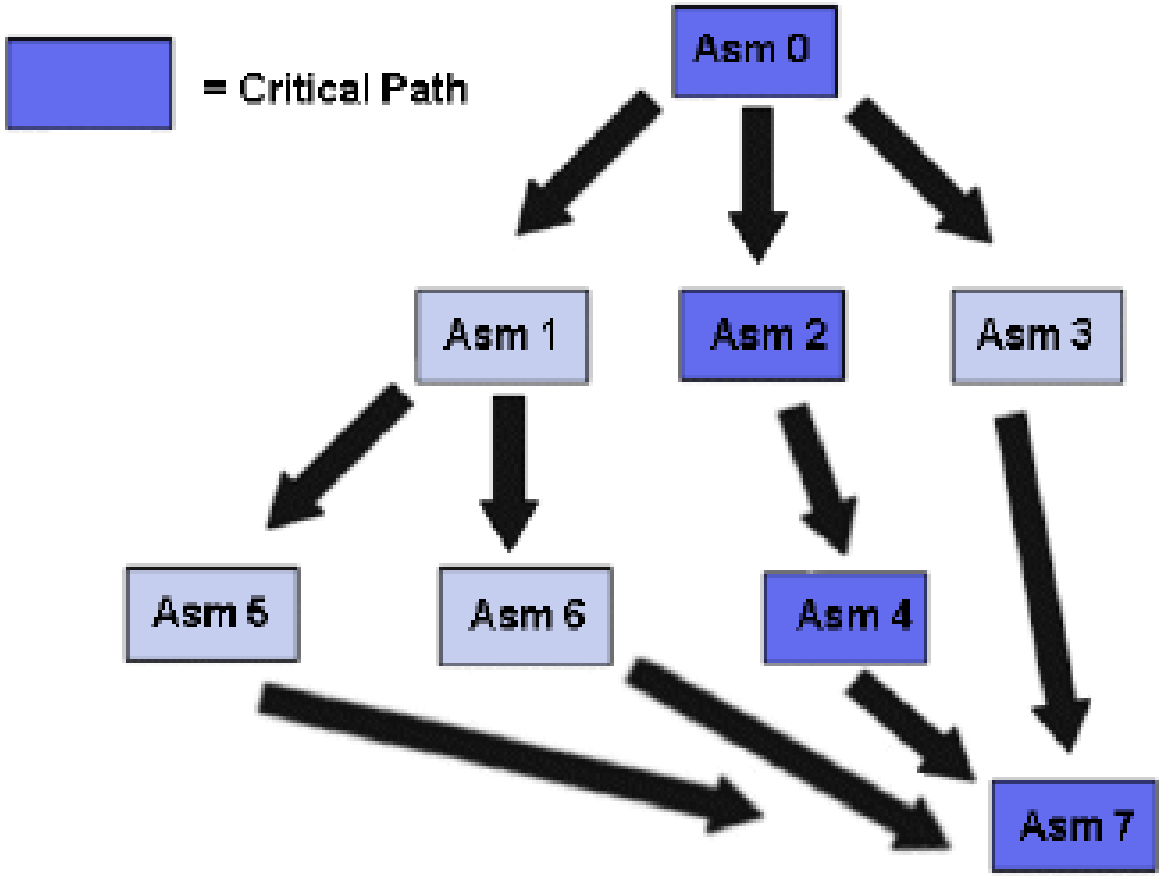
- **Time Capacity Example** - Resource Group ARC has three resources that work 10 hours per day. The calendar also indicates that this resource group works Monday - Friday each week. Resource Group ARC has a total capacity of 150 hours per week (3 resources x 10 hours = 5 days).
- **Daily Production Capacity** - You have a Molding operation in your production workflow. It takes one hour to fill the mold with material, so the Daily Production Capacity is constrained by the rate at which the molding material flows into the mold. Because of the flow rate, the Daily Production Capacity of this operation is 10 cubic yards of molding material each day.
- **Concurrent Capacity** - An oven resource has 4 racks. The 4 racks on the oven can be used simultaneously for the same operation, but once they have been selected for that operation, they are not available until this operation is complete.

  For the oven resource, the Concurrent Capacity is set to 4, which is the highest capacity that can be scheduled against the resource during an operation. Likewise, the Concurrent Capacity for the resource on the operation detail within the part method is also set to 4; this is the number of racks needed for the operation.

  Note that if the operation needs more capacity than the resource can produce, the scheduling engine will display an error message explaining that the resource is overloaded.
- **Concurrent Capacity and Competing Resources** - Operation A needs an oven rack during the 1:15 to 3:30 time capacity. If Operation B is already using 4 racks between 2:01 to 2:15, Operation A will not be scheduled during the requested time slot. If you forward schedule, Operation A is rescheduled with a start time of 2:15. If you backward schedule, Operation A is rescheduled using an end time of 2:01.

Critical Path

Each job has a critical path, which is the sequence of assemblies and sub-assemblies that determine how long it will take to produce the part quantity on a job. The scheduling engine uses the longest assembly and sub-assembly sequence to determine the Critical Path for each job.



The Critical Path is used to determine the Start Date if Backward Scheduling or the End Date if Forward Scheduling. When you use Backward Scheduling, you start scheduling the job from its End Date (usually the Required By Date) and then flow backwards through the production calendar to determine the job's Start Date. When you use Forward Scheduling, you start scheduling the job from its Start Date and then flow forward through the production calendar to determine the job's End Date.

Modifiers

These are the values you can modify for this item:

These are the values you can modify for this item:

- **Job Entry** - As you create a job method, you can enter and update the assemblies or operations required to produce the part.
- **Opportunity/Quote Entry** - As you create a quote method, you can enter and update the assemblies or operations required to produce the part.
- **Engineering Workbench** - As you create a part method, you can enter and update the assemblies or operations required to produce the part.

Location

You can access the Critical Path functionality through the following locations:

- **Schedule Jobs** -You can schedule each job individually through Job Entry.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs within your database.

Logic

The Critical Path equals the longest amount of time it takes to manufacture the entire job.

Example

The method for Part 345-98F contains four assemblies. Assembly 1 and Assembly 2 are peer assemblies, which means that they can be scheduled at the same time. Assembly 2, however, takes a day longer to complete. Because Assembly 2 takes longer than Assembly 1, the critical path for the Part 345-98F method will be the sum of Assembly 0 + Assembly 2 + Assembly 3.

Job Record Structure

The job record structure contains several items used by the scheduling engine. Each job record is comprised of linked tables that contain key values.

These values are used by the scheduling engine to identify the operations to be run and the resources that will work on the operations. When the engine completes its calculations, the job's operations will be assigned to resources that have the capacity to handle them.

The key value is the Required By Date on the Job Header (JobHed table). The engine uses this date as a starting point in the calendar for scheduling the job. Based on how long it will take the operations to run, it calculates the Start Date and End Date that will be used for this job. These values are then saved on the JobHead record.

Before a job can be scheduled, it must be selected as Engineered. This check box indicates that the job's method of manufacturing is finalized and that the scheduling engine can generate scheduling blocks of load to place against available capacity. The JobAsmbl, JobOper, and OpDtl tables contain this information. The JobOpDtl table holds the resource and capability data.

Note that in reality, all materials are constrained. You should only constrain materials that are absolutely necessary at certain points in the schedule. If you indicate that all materials are constrained, the scheduling engine will add too much time to each job schedule.The materials required to manufacture the job are recorded in the JobMtl table. If any of the materials are defined as constrained (required by the operation), the constraints will impact the schedule. The engine will schedule an operation with constrained material only when it calculates the materials will be available.

Modifiers

These are the values you can modify for this item. These modifiers are all within Job Entry:

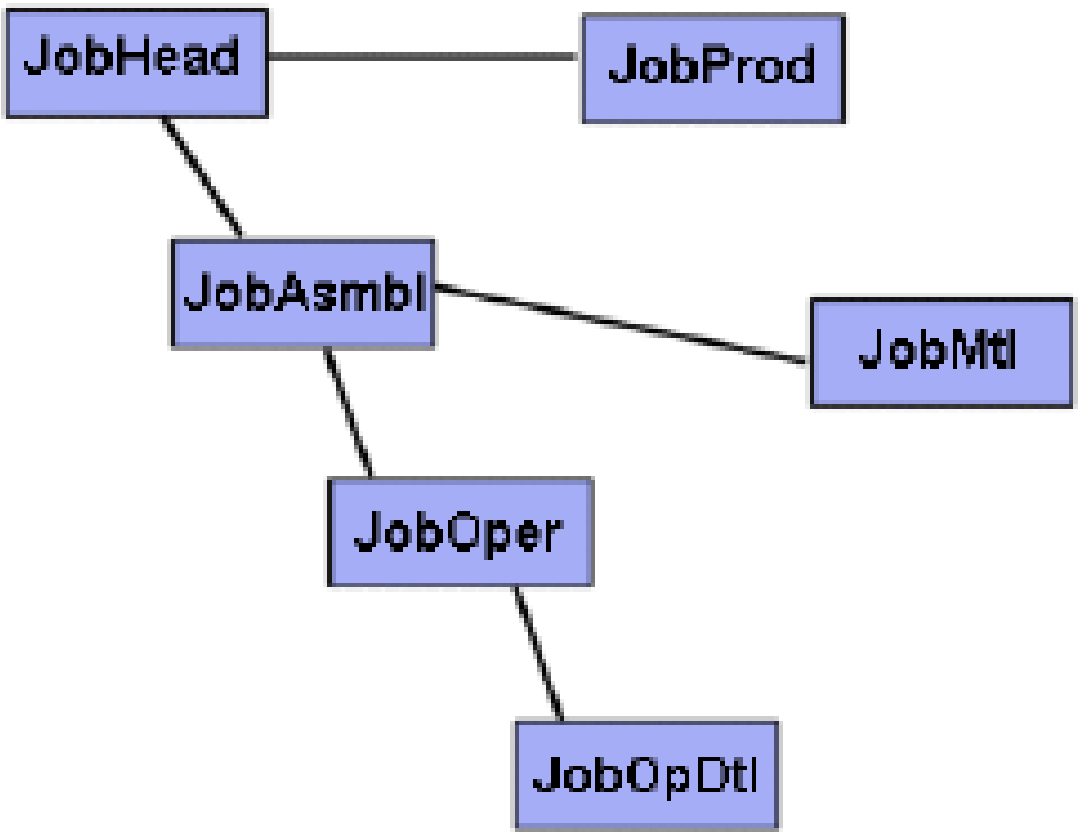
- **Job Header** - You can modify the values on this card, including the Required By Date, the part being manufactured, and so on.
- **Bill of Operations** -Job Entry also contains functionality that lets you engineer a new method on the job and then save it as a template for later use.
- **Bill of Materials**- You must define the various materials needed to manufacture the job quantity.
- **Get Details** - The Job Entry app contains functionality that lets you pull an existing method into each job.

Location

- Job Entry

Example

This graphic displays how each job record is structured and the relationship between the main tables and the sub-tables.



Load

Load is the demand of time or production placed against the resources (machines, employees) at your manufacturing center. Based on each job's method of manufacturing, the scheduling engine determines how many scheduling blocks are required to finish each operation.

It calculates how many time and production units, or load, are required to complete the quantity on the job.

This calculation is based on the principle of supply and demand. Think of the capacity on each resource as the available supply, while the hours and production units of load placed against each resource as the demand. The scheduling engine converts the load requirements on the job into scheduling blocks, the units of time that measure how long it will take to finish one production task. The scheduling blocks are placed against the available capacity on the resources that will perform the work.

Load is used by two functions by the scheduling engine. First, it is used to determine a new job's overall demand on your resources. Later, load is used to determine how much work is completed so

far on each operation. The updated load is used during rescheduling, as the scheduling engine calculates how much load remains to complete each job and reschedules your resources accordingly.

Also note that load is time-phased, so that the hours required to perform an operation are scheduled at the time the operation is scheduled to run. Load during a given time period, like a day or a week, represents the resource's time demand.

Logic

The Load uses this logic to calculate its results:

- *Load for an Operation (Run Time) = Setup Time + Production Time*
- *Total Load for a Job = Operation 1 Lead Time + Operation 2 Lead Time + Operation 3 Lead Time and so on*

Location

You can access the Load the following locations:

- **Shop Load Report**- Displays the shop capacity and the load against this capacity. It displays a summary of available resource capacity for the day or week. The ShopLoad table records the load per day of the resource or resource group.
- **Site Schedule Load Graph**- This dashboard displays the load currently placed against the capacity of your company's sites.
- **Resource Schedule Load Graph**- Displays the load currently placed against the capacity of your company's resources.
- **Overload Informer**- Displays which resources have more load than they can currently handle through their capacity.

Example

An operation takes one hour to setup the machine and five hours to manufacture the production quantity. This operation requires six hours of contiguous load on the resource, as this operation time cannot be divided into different scheduling blocks. The parts will wait about one hour before setup work can begin; this is its Queue Time. It will then take another hour for the part quantity to cool and then be transported to the next resource; this is Move Time.

The scheduling engine assigns a scheduling block for Setup Time that is one hour long; it then assigns another scheduling block for fives hours to handle the Production Time. It then adds the Queue and Move Times to the total length of the operation, which will take 8 hours to run from start to finish.

Materials

Materials are the items needed to produce a production quantity defined on a job. The required items are defined on the job's method of manufacturing; these materials are called the Bill of Materials.

Materials can be stock or non-stock items.

Materials can be constrained, which means that the materials must be available before the engine will schedule an operation. If the engine discovers that the constrained material cannot be issued to the operation at a specific time, it will locate another time when the material can be issued.

You indicate whether material is constrained on its part record. If the material is a Make Direct or a Purchase Direct part, it is automatically considered constrained by the scheduling engine. If a material's part record is defined as Purchase Direct, these materials are also automatically constrained by the PO Date on the purchase order.

When a material is constrained, the scheduling engine calculates when the material will be Available To Promise (ATP). Each constrained material is linked to its operation, and the ATP calculation is run to determine whether the material is available during the required scheduling block. The calculation determines availability by reviewing the Need By Date on each operation. If another operation requires the same material, and that operation has a Need By Date earlier than the current operation, the materials are given to that operation. If a material is not defined as constrained, the Available To Promise calculation is not run.

In reality, all materials are constrained. However, you should only constrain materials that are absolutely necessary at certain points in the schedule. If you indicate that all materials are constrained, the scheduling engine will add too much time to each job schedule.

Material availability frequently causes jobs to be scheduled too far into the future. If a required material is not available during the requested time, the scheduling engine will move the schedule out to find capacity where both the material and the resource are available at the same time.

This scenario typically occurs when Purchase Direct material is constrained by the PO Date on the purchase order. If the purchase order has been received after its PO Date, the schedule is pushed to a later date. If any quantity is received from the purchase order, however, the scheduling engine assumes that the operation can start.

The Available To Promise calculation constrains materials differently, because all the material must be available before the operation can begin. The scheduling engine locates a point when the entire material quantity can be issued to the operation.

Modifiers

When a material is defined as constrained, this material must be available to the operation on which it is linked. A material is defined as constrained through three methods:

- The Constrained Materials check box is selected on the part record.
- The Make Direct check box is selected within the manufactured material record defined on the part method.
- A PO Date is defined on the PO for a purchased material.

Location

You can access the Materials functionality through the following locations:

- **Part Maintenance**- You create part records for both manufactured and purchased materials through Part Maintenance. Here you can indicate that a material is manufacture, purchases, constrained, stock, or non-stock.
- **Job Entry**- You indicate which materials are needed for a job. You can also indicate that this material will be manufactured specifically for this job by selecting the Make Direct check box.
- **Opportunity/Quote Entry**- You indicate which materials are needed for a quote method and whether this material will be manufactured specifically for this job by selecting the Make Direct check box.
- **Engineering Workbench**- You indicate which materials are needed for a part method of manufacture.
- **Purchase Order Entry**- Use this app to create purchase orders for materials that must be purchased for the method of manufacture.
- **Available to Promise**- Use this app to review the availability of a part based on quantity or date.

Logic

If a material is constrained, do not schedule the operation until the entire quantity is available at the resource on the operation.

Examples

- **Constrained Material** - Part A is a constrained material that is required on Operation A. For job 3491, a 20 quantity is required on this operation. The Available To Promise calculation is run and Kinetic determines that only 10 parts are available. Because of this, the scheduling engine will search for a point within the capacity when both a 20 quantity is available and the resource is free.
- **Non-Constrained Material** - Part B is not a constrained material. Because of this, the Available to Promise calculation is not run and the operation is scheduled whenever its resource has available capacity.
- **Purchase Direct Material** - You are creating the method for Part 456U-098 on a new job. To produce these parts, you must buy some plastic material from PlasticPower, Ltd. On the

Materials-Detail card within Job Entry, you select this part record.

You then select the **Purchase Direct** check box. This activates the **Supplier ID** field. You indicate that PlasticPower, Ltd. will produce and ship this material to your site.

The part quantity will now be purchased specifically for this job. It won't be stocked within inventory. When you create a purchase order for this material, you can link the PO release to this job.

Operations

Operations define the processes your company uses to manufacture product.

They are manufacturing tasks like Welding, Painting, Cutting, Stamping, Bending, and so on. There are two types of operations:

- **In-house** - Perform through your company and subcontract operations you send out to an outside supplier.
- **Subcontract** - You send out to an outside supplier.

Resources

You set up the primary values for an operation in Operation Maintenance. One or more resources are required for each operation.

When you engineer the job method, you indicate how the resources will interact with each other. For example, to run a Cutting operation, you need a Fly Cutter resource. This resource is defined on the Operation Detail within the job method. The operation also requires a Block resource, so you create a second Operation Detail. Lastly, the Cutting operation requires an End Mill resource, so you create a third Operation Detail. The scheduling engine considers these resources to be dependent on each other. During its calculations, the scheduling engine will attempt to locate capacity that is available for all three resources at the same time.

You can only assign two resources or resource groups to each operation. If you use the Advanced Planning and Scheduling (APS) module, however, you can assign as many resources/resource groups as you need.

Capabilities

Operations can also be linked to a capability. A capability is a skill or ability that a resource can possess. When an operation has a capability, the scheduling engine searches for resources that share the capability. If a resources has available capacity, the resource is selected for the operation. In the case where multiple operations are competing for the same resource, the scheduling engine will place the operation load against the resource with the highest priority, then the next highest priority, and so on.

An operation standard can also have a capability. When an operation standard is selected on an operation, the scheduling engine searches for resources that share the capability defined on the operation standard.

Capabilities and resource groups can be combined on an Operation Detail. Linking capabilities to resource groups causes the engine to schedule only the resources that share a capability within the selected group. Thus, it restricts the options that the scheduling engine can use for this capability.

The capability functionality is only available if you use the Advanced Planning and Scheduling (APS) module.

Operation Time

Several values affect how the scheduling engine calculates each operation for a job method of manufacture. You can set up the Setup Time, Production Time, and Scheduling Blocks required for an operation at a specific point within the method. Also, you can define the Production Standard (Pieces/Hour, Hours/Piece, and so on) that the operation will follow, and you can add or update the default resources, resource groups, and capabilities that will be used to run the operation.

How long each operation takes to complete depends on the values you define for its Queue Time, Setup Time, Production Time, and Move Time. Queue Time and Move Time are defined on the resource group or resource that is assigned to the operation. The sum of these four values indicates how long it will take to complete an operation.

Split Operations

The length of time assigned to each scheduling block depends on whether you can divide or split the operation. Some operations, like painting, cannot be divided, as the paint has to be applied and dried during one contiguous scheduling block. A lens polishing operation, however, can be split up over multiple scheduling blocks, because the lens has to be polished and cooled, polished and cooled, and so on. The lengths of time required on this operation are not contiguous, so you can split this operation.

When you use this calculation, the load against the operation is divided evenly into the same amounts of time. For example, if an operation that takes 2 hours of Production Time can be split into 4 scheduling blocks, each scheduling block will have .5 (30 minutes) of allotted time.

Constrained Material

The scheduling engine can further limit when an operation is scheduled if it contains a constrained material. Constrained material is required in order to start an operation. If the material is not available during a scheduling block, the engine will look for a later capacity when both the resource and its material are available.

Operation Relationship

Operations do not need to be processed in linear relationships (one after the other). You can define more complex relationships within each assembly. The first operation (predecessor) can have a Start-To-Start, Finish-To-Start, and Start-To-Finish relationship with the operation that follows it (successor). These relationships affect how the scheduling engine calculates each operation's start and end dates and times; choosing a relationship save time in the schedule. See the Primary Calculations and Values section for a more detailed exploration of operation relationships.

Modifiers

You can modify the following values:

- **Constrained Materials** - You can define Materials can required, or constrained, for an operation. A constrained material limits when this operation can be scheduled. If an operation is linked to a constrained material, both the material and the resources must be available at the same time before the engine will schedule the load. In reality, all materials are constrained. We recommend that you only constrain materials that are absolutely needed at certain points in the schedule. If you define all materials as constrained, the scheduling engine will add too much time to each job's schedule.
- **Days Out** - For subcontract operations, you can indicate the estimated number of days that the parts will be out of your manufacturing center using the Days Out field. This field is located on the Subcontract card in Job Entry and the Engineering Workbench. The Days Out value will be used with the supplier calendar to determine actual dates during which the materials will be away from your manufacturing center.
- **Operation Relationships** - You can define how operations will start and end in respect to each other within each assembly. Operations can have a Start-To-Start, Finish-To-Start, and Start-To-Finish relationship with each other. You define this relationship through the Operation-Detail card on job methods, quote methods, and part methods.
- **Operation Time** - The Queue Time, Setup Time, Production Time, and Move Time are all crucial values used to determine how long it will take to perform an operation. You enter and adjust Queue Time and Move Time values on resources and resources groups. You enter and adjust Setup Time and Production Time values on Operation - Details card within job methods, quote methods, and part methods.
- **Production Standard** - This value, defined through the operation engineering functionality, defines the rate at which parts are produced through an operation. You must define both the quantity produced and the rate at which the operation can complete this quantity.
- **Send Ahead Offset** - Defines the default value used during scheduling to calculate when parts from this operation can be moved on to the next operation. These operations must share a Start-to-Start relationship. Use this functionality when finished quantities on the current operation can be advanced to the next operation before the current operation is complete. This generates a schedule that more accurately reflects your manufacturing process. You can override this default value on job, quote, and part methods of manufacture.
- **Send Ahead Type** - Defines what kind of scheduling offset value will be used for the operation that runs after this current operation when these operations share a Start-to-Start relationship. Select an option on the Send Ahead Type drop-down list to determine how this value will be measured during the scheduling process. The available type options are Hours (a set period of

time), pieces (a number of completed parts), and Percentage (a percentage of the operation duration)

- **Split Operation** - Within a resource group or resource, you define whether an operation's time can be split into a series of scheduling blocks.
- **Subcontract Operations** - You indicate that an operation will be run by a supplier by selecting the Subcontract Operation check box within Operation Maintenance. Note that once an operation is defined as an in-house operation, it cannot be changed to a subcontract operation.

Location

You can access the Operations functionality through the following locations:

- **Operation Maintenance** - You create the base operation records you will use on all your methods of manufacture. Be sure to use this app to create the operations you need.
- **Resource Group Maintenance** - You create all the resources and resource groups contained within your company through Resource Group Maintenance. You can link the resources and resource groups to each operation.
- **Opportunity/Quote Entry**- You define operation details while creating a quote method.
- **Capability Maintenance** - You can further link resources and operations through related skills, or capabilities. The scheduling engine uses capabilities to give you flexibility over which resources will be assigned to work on which operations.
- **Job Entry** - You define operation details while creating a job method.
- **Engineering Workbench** - You define operation details while creating a part method.

Logic

The Operations functionality uses the following logic to calculate its results:

- Production Time = Part Quantity/Production Standard
- Operation Time (Simple Equation) = Queue Time (Resource) + Setup Time (Operation) + Production Time (Operation) + Move Time (Resource)
- Production Time is a variable calculated for each operation detail. The quantity being produced, the number of resources available, and the number of scheduling blocks available determine how much time will be scheduled.
- A block is scheduled when all the resources linked to the operation are available at the same time.
- A subcontract operation's total time is calculated by using the Days Out value.

Examples

- **Concurrent Resources** - You are creating a Cutting operation. For this operation to complete, you need three resources to run concurrently:

  - Fly Cutter
  - Block
  - End Mill

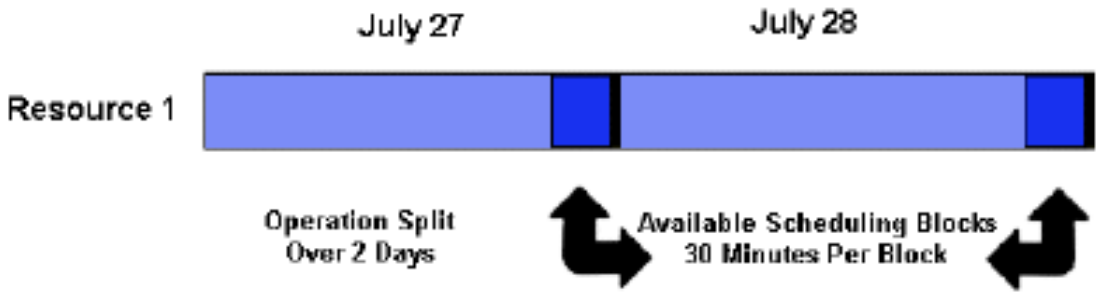
  You link all of these resources to the Cutting operation detail. When the engine looks for time to use on this operation, it will look for concurrent blocks that will allow all three resources to run at the same time.

  If you are Backwards Scheduling the job, the engine will move backwards through the production calendar to find capacity for all three resources at the same time. If it cannot find time after the current date, it uses the Bounce Condition to reverse the calculations. Now the job will use Forward Scheduling from tomorrow (the day after the Schedule Start Date) until it finds all three resources with capacity open at the same time.

- **Split Operations** - Your company manufactures lenses. The Polish operation can only work on a lens for a half hour at a time, because the lens needs to cool before the operation can resume and complete production. Because of the down time, the Polish operation can be divided, or split, into different time periods.

  On the part method, this operation has a Production Standard of 10 pieces per hour. As defined on the resource group's production calendar, the Polish operation can run 8 hours every working day. So you set up the resource group with a single Polish machine and a Scheduling Block value of 2. The result is scheduling blocks that have a time allocation of 30 minutes each. Because the operation can be split, the scheduler can place the scheduling blocks at whatever point capacity is available.

  The following illustration shows how the scheduling engine does this:



  Notice that the length of time available within each scheduling block is the same - 30 minutes.

  You have a job that requires a 200 lens part quantity. To complete the Polish operation, the job requires twenty hours of operation, so the engine determines that 40 scheduling blocks are

required. Because the engine can split the scheduling blocks, it can assign the forty scheduling blocks wherever there is capacity available to handle them.

Note that because this operation can be split, the quantity manufactured during each scheduling block can be divided into fractional values. Quantities that are only partially complete, like 10.5, can be calculated by the scheduling engine.

Operation Time

Operation Time is the total amount of time it takes to start and complete one operation. This length of time is typically referred to as the time it takes to setup the operation and then produce the required part quantity.

Operation Time also includes Inter-Operation Time. This is the time it takes for a part quantity to wait in a queue before it is setup on the operation, as well as the time it takes to move the completed quantity from one operation to another.

This illustration displays how the scheduling engine views operation time:

The Queue Time and Move Time are used to add additional time to the schedule. This time ensures that you are estimating the time it takes to move part quantities to different resources.

Modifiers

You can modify the following values:

- **Queue Time** - The length of time a part quantity will wait before it is processed. Use this time to account for additional time that might be required at each resource or resource group. This value is not used to consume the resource's actual time. It measures the wait time required before the operation can begin. You define Queue Time for either a resource group or a specific resource within Resource Group Maintenance.
- **Setup Time** - The length of time it takes for an operation to prepare for production. Each scheduling block uses this value. The Setup Time is a constant value that is added automatically in front of each scheduling block. You define this value within the Operation - Details cards on a quote method, job method, or part method.
- **Production Time** - The length of time it takes for an operation to complete work on a part quantity. The amount of time varies depending on the Production Factor, the quantity being produced, the scheduling blocks allowed on the resource, and so on. Production Time is converted into scheduling blocks of load that are placed against a resource's available

capacity. You define this value within the Operation - Details cards on a quote method, job method, or part method. You can have one resource handle the Setup Time, while another resource handles the Production Time. This lets you divide the Setup Time and Production Time between resources.

- **Move Time** - The length of time it takes a part quantity to be transported from one operation to another. Use this value to account for additional time that might be required at each resource or resource group. This value is not used to consume the resource's actual time, it measures the transportation time required before the part quantity can reach its destination. You define Move Time for either a resource group or a specific resource within Resource Group Maintenance.

Location

You can access the Operation Time through the following locations:

- **Schedule Jobs** - Operation Time is used to calculate how long it will take to complete a job's part quantity. You can schedule each job individually through Job Entry.
- **Job Entry** -For a job method, you define Setup Time and Production Time.
- **Opportunity/Quote Entry** - For a quote method, you define Setup Time and Production Time.
- **Engineering Workbench** - For a part method, you define Setup Time and Production Time.
- **Resource Group Maintenance** - Define the Queue Time and Move Time needed for each resource group or resource.

Logic

The Operation Time functionality uses this logic to calculate its results:

- Production Time = Part Quantity/Production Standard
- Operation Time = Queue Time + Setup Time + Production Time + Move Time

Example

You have a production quantity of 100 to manufacture on a job. The Cutting operation is linked to the Cutting Crew resource group. This resource group has a Queue Time of 1 hour and a Move Time of 15 minutes. The Cutting operation's Setup Time is 30 minutes, and this operation can cut 10 pieces per hour. The total Operation Time is 11 hours and 45 minutes.

Resource

A resource is an asset within your manufacturing center that performs a specific function. A resource can be a physical piece of equipment like a punch press, drilling machine, and so on.

It can be fixture, like a tool or gauge that is required to measure various parts. A resource can also be an employee, like a setter, operator, cutter, and so on.

Each resource must exist within a resource group. Resource groups contain one or more related resources. Use these groups to define specific work areas within your manufacturing center. A resource group can hold default values used on all resources in the group. However, each resource can also have its own set of values that are independent from the resource group values.

In certain situations, you might want one resource be dependent on another resource. This is the case, for example, when you want to indicate that the Drill Machine is available only when the Drill Machine Operator is also available. You indicate this on the job method by adding both resources to an operation detail. The scheduling engine will only schedule the operation when both resources have the available capacity at the same time. Available capacity is determined by the production calendar selected on each resource.

Finite/Infinite Capacity

A resource can have either Finite Capacity or Infinite Capacity. If a resource is finite, only a set amount of scheduling blocks (load) can be assigned each day to the resource. If a resource is infinite, all the scheduling blocks required for the load at that point in the schedule are assigned to the resource. You can review the overloaded resources and reassign the load as needed to meet the production schedule.

People Resources

Note that although a person can be entered as a resource, the scheduling engine does not treat people resources the same as physical resources, because the resource calculations are not directly linked with the labor shift calculations that are generated it her through Labor Entry or the Data Collection interface. To reflect your shifts accurately, use the Production Calendar to indicate the hours when work will be performed by a resource during each working day.

Resource Impact

Resources have a large impact on when Start Dates and End Dates are calculated for each job. If a calendar is selected on the resource, it determines which working days and hours the resource will be available. A resource's Queue Time defines how long a part quantity must wait at the resource before it is produced. A resource's Move Time defines how long a completed part quantity must wait before it is moved to the next operation. All of these factors are used together to determine the final job schedule.

Modifiers

You can modify the following values:

- **Calendar** - You can select a specific production calendar for each resource. The calendar determines on which days the resource is available for work.

- **Concurrent Capacity** - An APS module modifier, this value defines how many items can be run at the same time on a resource, letting you calculate the group's non-time capacity. When this concurrent capacity is reached, no more operation details will be scheduled at this resource during the same time period - even if time or capacity is available. Then engine will then locate concurrent capacity that is available within the next time period.
- **Daily Production Capacity** - An APS module modifier, this value defines maximum quantity that this resource can produce each day. This value lets you limit the capacity on a resource through its maximum production quantity instead of its time, which lets you use the scheduling engine's non-time capacity functionality.
- **Finite Capacity** - When this check box is selected, it indicates that the scheduling engine will use the Finite Capacity calculation against the resource. When this check box is clear, the scheduling engine will use the Infinite Capacity calculation against the resource.
- **Finite Horizon** - This value defines the limit at which the scheduling engine will stop using the Finite Capacity calculation against the resource and switch to the Infinite Capacity calculation. This value is added to the current system date to determine the last date on which the Finite Capacity calculation is used. After this point, scheduling blocks will be assigned against this resource's capacity using the Infinite Capacity calculation. The Finite Horizon is useful because at some point in the future schedule, you do not care that your resources are overloaded. You just want to keep track of potential jobs. When the schedule moves ahead towards these jobs, the engine will accurately reflect how much production must be run through your manufacturing center. You can reschedule these jobs using the Finite Capacity calculation.
- **Move Hours** - This value defines how long it takes part quantities from this resource to be transported to the next resource. This value is added to the Operation Time to calculate how it will take parts to be produced during an operation.
- **Minimum Overload Percentage** - Use this filter to define a threshold at which overloaded scheduling blocks will display on the Overload Informer app. This app lets you review which resources have scheduling blocks assigned to them that exceed their capacity. Any points in the schedule that are overloaded below this percentage will not display on the Overload Informer.
- **Operation** - You can link an operation directly to a resource. This link indicates that each time the operation is used on a Method of Manufacture, this resource will be the default used for scheduling the operation.
- **Operation Standard** - You can link an operation standard directly to a resource. This link indicates that, when an operation that uses this standard is placed on a method of manufacture, this resource will be the default used for scheduling the operation.
- **Queue Hours** - This value defines how long part quantities transported to this resource will wait before production begins. This value is added to the Operation Time to calculate how it will take parts to be produced during an operation.
- **Split Operations** - When this check box is selected, it indicates that Production Time at this resource group can be divided into separate scheduling blocks; these blocks can then be placed at different locations on the schedule. These scheduling blocks will each contain the same amount of time. Splitting operations gives you more flexibility when placing scheduling blocks against capacity. The engine can assign these scheduling blocks wherever there is

available time on the resource. When this check box is clear, the engine assumes that the work done at this resource must be done during one complete Operation Time. The scheduling blocks will be assigned together against the resource.

- **Use Resource Group Values** - Select this check box to indicate that the values defined at the Resource Group will also be used on a resource. This setting makes sure that all the resources contained within the resource group use the same scheduling (and costing) values.

Location

You can access the resource through the following locations:

- Resource Group Maintenance
- Operation Maintenance
- Capability Maintenance
- Job Entry
- Opportunity/Quote Entry
- Engineering Workbench
- Job Scheduling Board
- Resource Scheduling Board
- Multi-Resource Scheduling Board

Logic

The Resource functionality uses the following logic to calculate its results:

- Different types of resources- Time/Space/Production Capacity
- Resource TimeUsed = ShopLoad/ShopCap

Examples

- You have a Drill Center resource group that is made up of two resources – a Drill Machine and a Drill Machine Operator. Your Drill Machine Operator works 8 hours each day. Because of this schedule, you select a production calendar on the Drill Machine Operator that indicates this person works 8 hours during each working day. However, the Drill Machine has a production calendar that indicates it can work for 24 hours a day.
- You are setting up a Drilling operation on a job method. You select the Drill Center resource group. When the scheduling engine calculates load for this operation, it determines that 8 hours of capacity are available at this resource group during each working day. Because the Drill Machine Operator resource cannot work for 16 hours each day, the scheduling engine uses the Drill Machine Operator resource capacity, 8 hours/day, against both resources within the selected resource group.

Resource Groups

Resource groups contain one or more related resources. Use resource groups to define specific work areas within your manufacturing center.

A resource group can contain the machines used for a specific function, any tools used to measure parts manufactured from these machines, and the operators who run both the machines and tools. Resource groups also support the concept of manufacturing cells, which are collections of different resources that act as independent production units within your manufacturing center.

A resource must be part of a resource group. Depending on your production workflow, you can define factors that will affect scheduling at either the resource or the resource group level. If you define these factors at the resource group level, these factors are applied uniformly across all the resources contained in the group. The factors are used by the scheduling engine to determine when the resources are available to complete operations.

Capabilities

You can indicate that all the resources within a resource group are dependent on each other. You do this within a job method by selecting the resource group on an operation detail. For example, you might want to indicate that the Drill Machine should only be available when the Drill Machine Operator is also available. You create these resources within the Drill Center resource group, and then select this resource group on the operation detail. The scheduling engine will schedule this operation only when both resources have available capacity at the same time.

Capabilities and resource groups can be combined within an operation detail. This link causes the engine to schedule the only resources that share a capability within the selected group. It restricts the options that the scheduling engine can use for this capability.

Resource Group Impact

Just like resources, resource groups have a large impact on when Start Dates and End Dates are calculated for each job. If a calendar is selected on the resource group, it determines which working days and hours the resources contained in the group will be available. A resource group's Queue Time defines how long a part quantity must wait at this group's resources before it is worked on. A resource group's Move Time defines how long a completed part quantity must wait at this resource group before it is transported to the next operation. All of these factors are used together to determine the schedule.

Modifiers

You can modify the following items:

- **Calendar** - You can select a specific production calendar for each resource group. The calendar determines on which days resources in the group are available for work.

- **Concurrent Capacity** - An APS module modifier, this value defines how many items can be run at the same time on a resource, letting you calculate the group's non-time capacity. When this concurrent capacity is reached, no more operation details will be scheduled at this resource during the same time period - even if time or capacity is available. Then engine will then locate concurrent capacity that is available within the next time period.
- **Daily Production Capacity** - An APS module modifier, this value defines the maximum quantity that this resource group can produce each day. This value lets you limit the capacity on a resource group through its maximum production quantity instead of its time, which lets you use the scheduling engine's non-time capacity functionality.
- **Finite Capacity** - When this check box is selected, it indicates that the scheduling engine will use the Finite Capacity calculation against the resource group. Finite capacity means that the resource group will only work for a specific number of hours each day; the scheduling blocks assigned against this resource group's daily capacity cannot be greater than this limit. Any overloaded scheduling blocks will be moved to another point in the schedule where capacity is available. When this check box is clear, the scheduling engine will use the Infinite Capacity calculation against the resource group, which means there is no limit on the number of scheduling blocks that can be placed on the resource group each day. This feature lets you schedule the load when it is due, letting you resolve the capacity limits later.
- **Finite Horizon** - This value defines the limit at which the scheduling engine will stop using the Finite Capacity calculation against the resource group and switch to the Infinite Capacity calculation. This value is added to the current system date to determine the last date on which the Finite Capacity calculation is used. After this point, scheduling blocks will be assigned against this resource group using the Infinite Capacity calculation. The Finite Horizon is useful because at some point in the future schedule, you do not care that your resources are overloaded. You just want to keep track of potential jobs. When the schedule moves ahead towards these jobs, the engine will more accurately reflect how much production must be run through your manufacturing center. You can reschedule these jobs using the Finite Capacity calculation.
- **Move Hours** - This value defines how long it takes part quantities from this resource group to be transported to the next resource. This value is added to the Operation Time to calculate how it will take parts to be produced during an operation.
- **Minimum Overload Percentage** - Use this filter to define a threshold at which overloaded scheduling blocks will display on the Overload Informer. The Overload Informer lets you review which resource groups have scheduling blocks assigned to them that exceed their capacity. Any points in the schedule that are overloaded below this percentage will not display on the Overload Informer.
- **Operation** - You can link an operation directly to each resource group. This link indicates that each time the operation is used on a method of manufacturing, this resource group will be the default used for scheduling the operation.
- **Operation Standard** - You can link an operation standard directly to a resource group. This link indicates that each time an operation that uses this standard is placed on a method of manufacturing, this resource group will be the default used for scheduling the operation.

- **Queue Hours** - This value defines how long part quantities transported to this resource group will wait before production begins. This value is added to the Operation Time to calculate how it will take parts to be produced during an operation.
- **Scheduling Blocks** - Specifies the number of resources a single job operation requires. This field normally has a 1 value. The scheduling engine divides the production time by the number of scheduling blocks. This app then finds resources that have capacity available in the required time frame. If enough capacity is available, the operation's total time can be reduced.
- **Split Operations** - When this check box is selected, it indicates that Production Time at this resource group can be divided into separate scheduling blocks; these blocks can then be placed at different locations on the schedule. These scheduling blocks will each contain the same amount of time. Splitting operations gives you more flexibility when placing scheduling blocks against capacity. The engine can assign these scheduling blocks wherever there is available time on the resource. When this check box is clear, the engine assumes that the work done at this resource must be done during one complete Operation Time. The scheduling blocks will be assigned together against the resource.
- **Use Calendar for Move Time** – Select this check box to indicate that during the calculations for Move Time, the scheduling engine also considers the available working hours defined on the current production calendar. Move Time is the time period required to transport a quantity from one resource group to another resource group. If you select this function, the scheduling engine calculates that Move Time must occur during the working hours available at the current resource group. By default this check box is clear, indicating the working hours defined on the production calendar are ignored and Move Time is calculated without this constraint.
- **Use Calendar for Queue Time** – Select this check box to indicate that during the calculations for Queue Time, the scheduling engine also considers the available working hours defined on the current production calendar. Queue Time is the time period during which a quantity must wait at a resource group before work can be performed upon it. If you select this function, the scheduling engine calculates that Queue Time must occur during the working hours available at the current resource group. By default this check box is clear, indicating the working hours defined on the production calendar are ignored and Queue Time is calculated without this constraint.

Location

You can access the Resource Groups functionality through the following locations:

- **Resource Group Maintenance** - Create resource groups and the various resources that each group will contain.
- **Operation Maintenance** - Link resources to a specific operation. When an operation is used on a method of manufacturing, the engine will place scheduling blocks against these default resources.
- **Capability Maintenance** - Link resources to a specific capability. During its calculations, the scheduling engine searches for operations and resources that share the capability. When the engine finds a match, it assigns scheduling blocks against the resource that shares the capability with the operation.

- **Job Entry** - As you create a job method, you can add and update the resource groups that are assigned to each operation.
- **Opportunity/Quote Maintenance** - As you create a quote method, you can add and update the resource groups that are assigned to each operation.
- **Engineering Workbench** - As you create a part method, you can add and update the resource groups that are assigned to each operation.

Logic

The Resource Groups functionality uses this logic to calculate its results:

- Resource TimeUsed = ShopLoad/ShopCap

Example

You have a Drill Center resource group that is made up of two resources – a Drill Machine and a Drill Machine Operator. Your Drill Machine Operator works 8 hours each day. Because of this schedule, you select a production calendar on the Drill Machine Operator that indicates this person works 8 hours during each working day. However, the Drill Machine has a production calendar that indicates it can work for 24 hours a day.

You are setting up a Drilling operation on a job method. You select the Drill Center resource group. When the scheduling engine calculates load for this operation, it determines that 8 hours of capacity are available at this resource group during each working day. Because the Drill Machine Operator resource cannot work for 16 hours each day, the scheduling engine uses the Drill Machine Operator resource capacity, 8 hours/day, against both resources within the selected resource group.

Sites

A site is a physical facility used for producing parts within your manufacturing center. The facility might have one or more locations that contain the machines and skill sets used to manufacture parts.

These locations and skills sets are the resources and resource groups linked to the site. Each site must have at least one warehouse used to stock and distribute parts.

You define some key scheduling options on each site record. You indicate how the site will handle overload scheduling, a capacity calculation you can use to locate potential future bottlenecks on resources within the site. You can also define how the site evaluates rough cut scheduling, a calculation that uses Lead Time and Required By Date values to estimate a future job schedule. Lastly, you also indicate how start-to-start operations interact with each other by defining the Scheduling Send Ahead For option on each site. This value determines when work on the second operation can begin after the first operation starts production.

Set up each site record as you need in order to achieve accurate scheduling results.

Modifiers

You can modify the following values:

- **Overload Horizon** - Indicate the future point (in days) at which resource capacity is calculated against the demand that falls on or before this date range. This value is used by the Infinite Capacity calculation to evaluate the potential load being placed against each resource during each day.
- **Override Scheduling Constraints** - Typically when you try to move a job or an operation that has quantities for material constraints or subcontract POs, you receive an error. However if you select this check box, you can move any jobs created in this site to different areas of the schedule, ignoring both material constraint quantities and subcontract purchase order quantities.
- **Rough Cut Horizon** - Determines the future point of time (in days) after which the Rough Cut Scheduling formula is used to schedule jobs. Any jobs that fall outside of the Rough Cut Horizon date range uses the Need By Dates and Lead Time values on each material and operation to calculate how much time is required for each job to finish its operations and gather its materials. The rough cut scheduling formula infinitely schedules these future jobs. This data, or load, is not recorded against your resources, which reduces the processing time needed to generate the overall schedule.
- **Scheduling Send Ahead For** - Determines if the start-to-start job operation offset will be used for production or setup time.

Location

You can define scheduling options for a specific site on in Site Maintenance on the Planning card.

Logic

- **Overload Horizon** - If Demand Date <= Last Date on Overload Horizon and => the system date, include demand record in Overload Capacity calculation.
- **Rough Cut Scheduling** - If Required By Date > (Current System Date + Rough Cut Horizon), then schedule the job using Infinite Capacity and remove the Load required by the operations. Use the Need By Dates and Lead Time values on each material and operation to determine how much time is required for each job.
- Scheduling Send Ahead For - Available calculation options:
  - **Setup Option**

    Setup Start (Second Operation) = Production Start Time (First Operation) + Setup Time (Second Operation)

  - **Production Option**

    Production Start (Second Operation) = Production Start Time (First Operation) + Production Time (Second Operation)

Examples

- **Overload Horizon** - You want to review the potential bottlenecks that may occur three months in the future. You launch Site Maintenance and enter 90 within the Overload Horizon field. Each time scheduling is run, the percentage capacity overload is calculated against each resource and each day that falls within the Overload Horizon date range.

  You then launch the Overload Informer. Use this tracker to view the percentage capacity placed against each resource. Resources less than 100% are below capacity, while resources higher than 100% are above, or over, capacity.

- **Rough Cut Scheduling** - You enter a Rough Cut Horizon value of 15 on your Blue site record.

  Job 5692 is generated by MRP and its quantity will be produced by the Blue site; this unfirm job has a Required By Date of September 27. You automatically generate Global Scheduling every Monday morning. This process is run on the morning of September 10 so this is the Scheduled Start Date for this process run. The final date on the Rough Cut Horizon is September 25. Because the Required By Date on Job 5692 is September 27, it is calculated using Rough Cut Scheduling.

- **Scheduling Send Ahead For** - You schedule two operations, Deburr and Paint, using a Start to Start relationship. When you finish deburring a part quantity, however, you can immediately start applying the base coat of paint to the parts. You indicate within Site Maintenance that the Scheduling Send Ahead For value will be Setup within the site. This means that setup can begin on the second Paint operation after production begins on the first Deburr operation.

Scheduling Blocks

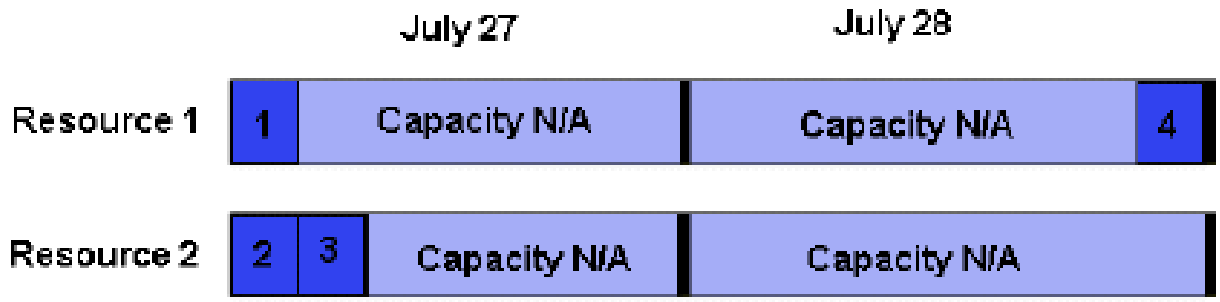
Scheduling blocks are base units of time calculated by the scheduling engine. They measure the load that needs to be placed against your resource's capacity.

Each scheduling block defines a specific amount of time that will be allocated to handle the load. Blocks are used to place Production Time on the schedule. The engine assigns scheduling blocks to a resource's available capacity. The blocks can vary in length, depending on the quantity being produced and any adjustments defined on the resource group or operation.

You define how many scheduling blocks will be calculated on an operation detail within a job method. Typically, you will enter the number of resources used to produce the part quantity through either the operation or the resource group. For example, if you have a Cut operation that can run on two machines at the same time, you enter 2 as the operation's Scheduling Blocks value. This value indicates how many scheduling blocks can be created at the same point in the schedule. The higher the Scheduling Blocks value, the more scheduling blocks that can be placed against the operation at the same time. Increasing this value can shorten the time required to complete an operation. Ultimately the scheduling engine calculates the smallest amount of time that can be placed against each resource's capacity.

The engine places these blocks at points in the schedule where it finds that there is capacity to handle the required amount of time. Each scheduling block is like a puzzle piece. The scheduling engine searches for places to fit each piece into the schedule. It checks each working day to see

where capacity is available, fitting the scheduling blocks into amounts of time large enough to contain them. The following illustration shows you how the scheduling engine performs this process:



In this example, the scheduling engine determines that it needs to place 4 scheduling blocks into the schedule. It locates places during the working days of July 27 and July 28 where Resource 1 and Resource 2 have available capacity. Notice that for July 27, this capacity is available at the beginning of the day, while on July 28 it is at the end of the working day.

Setup Time

The amount of Setup Time required for each scheduling block is defined on the quote, part, or job operation. You do this by entering how long it will take to setup the operation in the Hours field. This is a constant value that is added to the front of the Production Time required for each operation. The Production Time itself might be divided into multiple scheduling blocks, but the total Production Time value for each operation must begin with the Setup Time.

Split Operations

Another important option is that operations can be divided, or split. Thus work on one operation can be divided evenly between different time periods within the schedule. For example, if an operation requires four scheduling blocks, it might be possible to split these scheduling blocks up between different time periods.

If an operation cannot be split, the scheduling engine must place the scheduling blocks against a contiguous (start to finish) amount of time. If the operation can be split, the scheduling engine can assign the scheduling blocks wherever there is enough capacity to contain each block. Splitting might be an ideal way to schedule certain operations, particularly if parts need time to cool between cycles on the same operation.

Queue Time/Move Time

Queue Time and Move Time are not included in the scheduling block calculation. These time intervals are calculated only at the beginning or the end of an operation. They are used to pad the schedule to estimate when part quantities will arrive and leave the resource or resource group.

Modifiers

- **Production Calendars** - These records determine the number of working days available for the resource group, as well as the number of hours that are available during each working day.
- **Number of Resources** - This read only value displays how many resources are contained within the current resource group. As you add resources to the group, this value increases. This field is located on the Detail card in Resource Group Maintenance.
- **Scheduling Blocks** - Use this value to indicate how many scheduling blocks are available against each resource within a resource group. The default value is 1, which indicates that one scheduling block can be placed against each resource per working day. The higher the number you enter in this field, the more scheduling blocks are available each working day. As you increase the scheduling blocks, each scheduling block will have a smaller amount of time allocated to it. This field is in several locations throughout Kinetic. It is available in Opportunity/Quote Entry, Job Entry and the Engineering Workbench. It is also located in Resource Group Maintenance.
- **Split Operations** - When you select this check box, it indicates that Production Time at this resource group can be divided into separate scheduling blocks. These blocks can then be placed at different locations on the schedule. These scheduling blocks will each contain the same amount of time. Splitting operations gives you more flexibility when placing scheduling blocks against capacity. The engine can assign these scheduling blocks wherever there is available time on the resource. When this check box is clear, the engine assumes that the work done at this resource must be done during one complete Operation Time. The scheduling blocks will be assigned together against the resource. You can select this option for resources or resource groups. The Split Operations check is located in Resource Group Maintenance.
- **Setup Hours** - The amount of setup time required for each operation's Production Time is defined on the quote, part, or job method. You do this by entering how long it will take to setup the operation in the Hours field. This value is added to the front of each operation's Production Time amount. An operation's Production Time can be made up of one or multiple scheduling blocks.

Location

- **Production Calendar Maintenance** - You can assign production calendars to various locations within Kinetic. The scheduling engine follows a calendar hierarchy to determine which calendar has precedence over another calendar.
- **Resource Group Maintenance** - Enter the number of scheduling blocks that can be generated against each resource or resource group.
- **Opportunity/Quote Entry** - Enter the number of scheduling blocks that can be placed against each resource on an operation. You can also define the setup hours required to prepare for Production Time as well as the Production Standard that defines the rate at which part quantities are produced.
- **Job Entry** - Enter the number of scheduling blocks that can be placed against each resource on an operation. You can also define the setup hours required to prepare for Production Time as well as the Production Standard that defines the rate at which part quantities are produced.

- **Engineering Workbench** - Enter the number of scheduling blocks that can be placed against each resource on an operation. You can also define the setup hours required to prepare for Production Time as well as the Production Standard that defines the rate at which part quantities are produced.

Logic

The Scheduling Blocks functionality uses this logic to calculate its results:

Scheduling Block Time Allocation = Production Time/Number of Scheduling Blocks

Examples

- **Scheduling Block Calculation** - The ASM Bench resource group contains four resources. If you change the number of scheduling blocks that are used by the resource group, you change the length of time that will be available within each scheduling block.

  For this example, you have an operation that will take 30 hours of load to complete. The resource group can work for 15 hours each day. You indicate that up to four resources can work on this quantity at the same time. You enter this value in the Scheduling Blocks field. The following table shows how the scheduling engine will calculate this load to determine how much time is required during each scheduling block. Assume there is no other load against the available capacity:

Scheduling Block Value	1	2	3	4
Scheduling Block Length (days)	2	1	0.667	0.5

  The total load against this resource group does not change. As the number of scheduling blocks increases, this operation spends a shorter amount of time at the resource group, because more resources are available to work on the operation.

- **Contiguous Scheduling Blocks** - The Mill Machine resource can finish twenty pieces every five hours, including setup time and production time. On the job operation, this is entered as a Production Standard of 20 pieces per hour. As defined by the production calendar used on the resource group, the Paint operation can run 10 hours every day. So you set up the resource group with a single Paint machine resource and a Scheduling Block value of 1.

  You have a Milling operation on a job that needs to finish 200 parts. This will require 10 continuous hours of operation. The scheduling engine assigns 1 scheduling block to the Milling operation.

  The scheduling engine calculates the schedule blocks as follows:

  - Production Standard = 20 pieces per hour
  - 200 pieces/20 pieces = 10 hours; this job requires one scheduling block that equals 10 hours of time

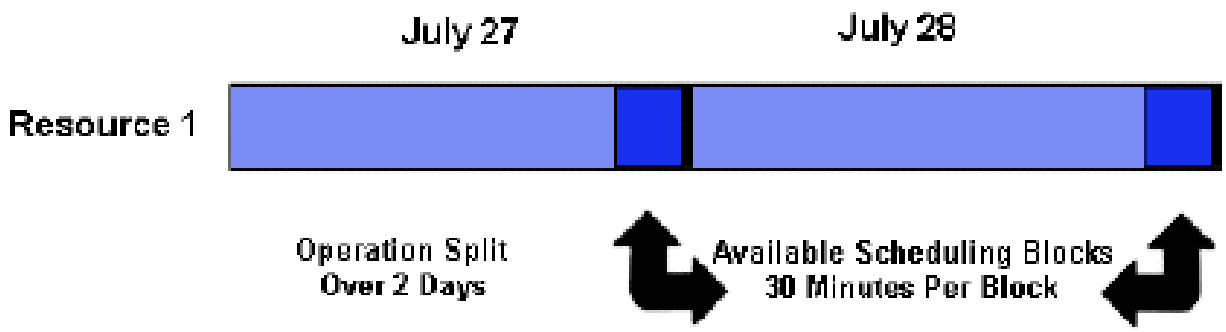
- 1 schedule block x 10 hours = 10 contiguous hours of load that need to be placed against a resource

Because this operation cannot be split, the quantity manufactured during each scheduling block cannot be divided into fractional values. Only whole number quantities, (in this example 20) can be used to place the load against this resource.

- **Split Operation** - Your company manufactures lenses. The Polish operation can work on a lens for only a half hour at a time, because the lens needs to cool before the operation can resume and complete production. Because of the cooling time, the Polish operation can be divided, or split, into different time periods.

  On the part method, this operation has a Production Standard of 10 pieces per hour. As defined by the resource group's production calendar, the Polish operation can run 8 hours every working day. So you set up the resource group with the single Polish machine and a Scheduling Block value of 2. The result is scheduling blocks that have a time allocation of 30 minutes each. Because the operation can be split, it can also place the scheduling blocks at whatever point capacity is available.

  The following graph shows how the scheduling engine does this:



  Notice that the length of time available within each scheduling block is the same - 30 minutes.

  You have a job that requires a 200 lens part quantity. To complete the Polish operation on this job, the resource requires twenty hours of operation, so the engine calculates that 40 scheduling blocks of load are required. Because the engine can split these scheduling blocks, it can assign the forty scheduling blocks wherever there is available capacity.

  Note that because this operation can be split, the quantity manufactured during each scheduling block can also be divided into fractional values. Quantities that are only partially complete, like 10.5, can be calculated by the scheduling engine.

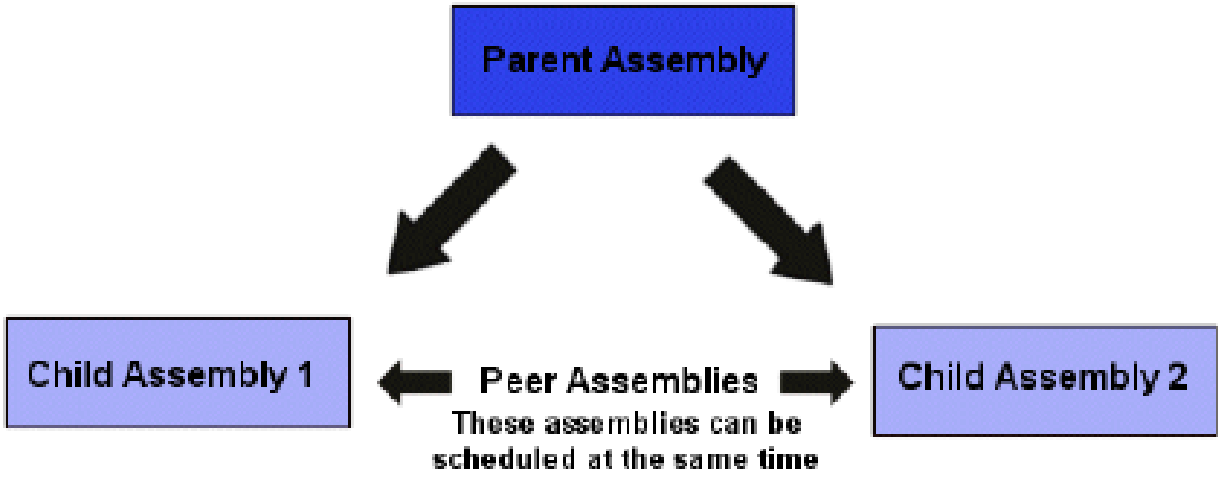
Subassemblies

A subassembly defines a specific step, or component, within a parent assembly. Each parent assembly can have one or more subassemblies.

Each subassembly can also contain one or more subassemblies, which causes the subassembly to become a parent assembly as well. This hierarchy lets you engineer as simple or as complex part methods of manufacturing as you need.

The primary purpose for creating parent assembly and subassembly levels is to let the engine concurrently schedule these assemblies. Each parent assembly typically contains operations or subassemblies that are unique for their area of the method of manufacturing. The scheduling engine can determine which operations can occur at the same time instead of scheduling the assemblies and subassemblies to start one after the other. Concurrent scheduling greatly improves the scheduling results.

The following graph shows you how the scheduling engine evaluates subassemblies that are peers:

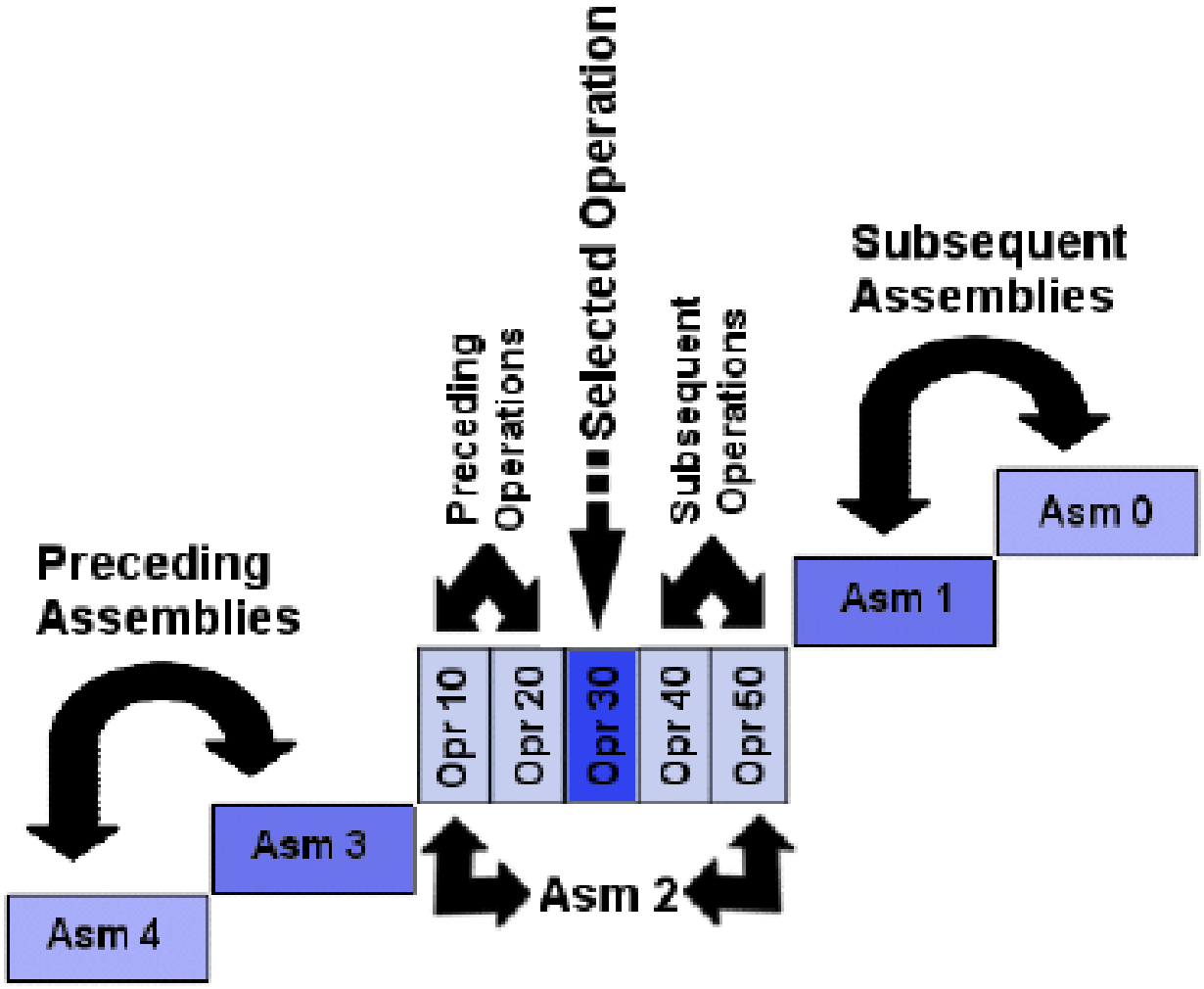


Modifiers

You can manipulate how the scheduling engine handles assemblies for specific jobs and operations. When you move a job or an operation on a scheduling board, the Move Job displays. The Move Option drop-down list indicates the method by which you will move the assembly.

The move options are all dependent on the currently selected operation. Any operation that occurs before the selected operation is considered a preceding operation, while any operation that comes after it is considered a subsequent operation. The following graph shows how this works:

A



Notice that the earlier the assembly occurs within the method of manufacturing, the higher number it will have for its identifier. You can also move where the assembly appears within the method. The final assembly, however, is always Assembly 0.

The move options include:

- **Branch-Preceding Operations** - This method reschedules the selected operation and any preceding operations within the current assembly. Then it reschedules operations contained in any preceding assemblies.
- **Branch-Subsequent Operations** - This method reschedules the selected operation and any subsequent operations within the current assembly. Then it reschedules operations contained in any subsequent assemblies - up to the final assembly (Assembly 0).
- **Assembly-All Operations** - This method reschedules all the operations on the assembly around the selected operation. If multiple operations for a single assembly are scheduled at a resource group, the method leaves open time available for other operations required on any other resource groups.

- **Assembly-Preceding Operations** - This method reschedules only the preceding operations contained within the current assembly. It reschedules the selected operation and any operations that come before it.
- **Assembly-Subsequent Operations** - This method reschedules only the subsequent operations contained within the current assembly. It reschedules the selected operation and any operations that come after it.

Location

You can access the Subassemblies functionality through the following locations.

- **Job Entry** - You enter the subassemblies needed for the current assembly (the parent assembly) on the Subassemblies card.
- **Opportunity/Quote Entry** - You enter the subassemblies needed for the current assembly (the parent assembly) on the Subassemblies card.

Logic

The Subassemblies functionality uses this logic to calculate its results:

- Final Assembly = Assembly 0
- If two or more child subassemblies are considered peer assemblies, these child subassemblies can be scheduled at the same time.

Examples

You are making a table that has a top and four legs. The Table is the top assembly level (Assembly 0), while the Leg and Top are subassembly levels. The top and legs can be made at the same time, or run concurrently. They are considered peer assemblies by the scheduling engine, and so are scheduled to run at the same time.

When these part quantities are finished, they can be assembled to make the table.

The Table assembly is the parent assembly to both the Leg and the Top subassemblies. If the Leg subassembly required additional components, such as a Wheel Base subassembly and a Wheel subassembly, the Leg would be the parent assembly to those subassembly steps. These subassemblies can also be run concurrently, so they are peer subassemblies that can be scheduled at the same time.

Subcontract Operation

A Subcontract Operation is an operation that is handled outside your manufacturing center by a supplier. The scheduling engine assumes that the quantity required by this subcontract operation is out of your manufacturing center during this time period and is not factored into any other scheduling calculations.

The scheduling engine uses the Days Out value defined on the subcontract operation and the Working Days values selected on the supplier's Production Calendar to calculate the exact dates during which the part quantity will be away from your manufacturing center.

Be sure to estimate the shipping, production, and receiving times that are required by this subcontract operation. The point at which the part quantity returns to your manufacturing center potentially affects the End Date that the scheduling engine calculates for a job.

Once an operation is defined as an in-house operation, it cannot be changed to a subcontract operation. Likewise, once and operation is defined as a subcontract operation, it cannot be changed to an in-house operation.

Modifiers

You can modify the following values:

- **Subcontract Operation** - You indicate that an operation is a subcontract operation by selecting this check box in Operation Maintenance. Selecting this check box causes other fields to become active within the Operation card, letting you define the default values for the operation. You can also indicate this on a job, part, or quote method by selecting the Subcontract check box.
- **Days Out** - This value defines the estimated number of Working Days during which the operation's part quantity will be out of your manufacturing center. The engine converts this value to hours to account for this time within the schedule.
- **Supplier** - You can define the specific supplier that will handle a subcontract operation on both the operation record and the operation details on a job, part, or quote method. The supplier you select determines the Production Calendar that will be used with the subcontract operation.
- **Production Calendar** - The scheduling engine uses the supplier's production calendar to determine the Working Days that are available for the subcontract operation. The Working Days are compared with the Days Out to calculate the specific dates on the schedule when part quantities will be out of your manufacturing center.

Location

- **Operation Maintenance** - Define the default values, like Buyer and Primary Supplier, used by a subcontract operation. You can also, update these values on the subcontract operation details within a job, quote, or part method.
- **Opportunity/Quote Entry** - Create, add, and update a subcontract operation within a quote method. Use this functionality to reflect how the subcontract operation will be handled by a specific method. Depending on the situation, you might, for example, use different suppliers on different methods.
- **Job Entry** - Create, add, and update a subcontract operation within a job method. Use this functionality to reflect how the subcontract operation will be handled by a specific method.

Depending on the situation, you might, for example, use different suppliers on different methods.

- **Engineering Workbench** - Create, add, and update a subcontract operation within a part method. Use this functionality to reflect how the subcontract operation will be handled by this specific method. Depending on the situation, you might, for example, use different suppliers on different methods.

Logic

The subcontract operation uses this logic to calculate its results:

Subcontract Operation Dates = Working Days on Supplier Production Calendar

Examples

A supplier, Decals Unlimited, specializes in applying adhesive decals to parts, so you subcontract this operation out to them. It usually takes them 5 working days to receive a part quantity and apply the decals to the parts, so you enter 5 in this subcontract operation's Days Out value. Decals Unlimited does not work over weekends, so you also link a production calendar, 5 Days/Week, to this supplier record.

The scheduling engine calculates that a part quantity will be ready to send out to Decals Unlimited on Thursday, 8/16. The scheduling engine sees that it will take 5 working days to complete the subcontract operation, but there are also two non-working days in calendar. Thus, it calculates that the part quantity will return to your manufacturing center seven days later on Wednesday, 8/22.

Calculations and Values

There are numerous values and calculations used by the scheduling engine. Most of these values are either defined by you or are automatically generated by the engine.

These values are factored into the main calculations of the scheduling engine to arrive at the required scheduling blocks, the amount of capacity available to handle the blocks, and ultimately, the Start Date and End Date for the job.

The primary calculations and values include:

- Adjust Global Scheduling Order
- Available to Promise
- Backward Scheduling
- Bounce Condition
- Calculate Global Scheduling Order Process
- Capable to Promise
- End Date
- Finish to Finish
- Finish to Start
- Finite Capacity
- Forward Scheduling
- Global Scheduling
- Hours Per Resource
- Infinite Capacity
- Overload Scheduling
- Production Load
- Production Standard
- Production Time
- Rough Cut Scheduling
- Save Resource Load
- Setup Load
- Start Date
- Start to Start
- Time Allocation

Adjust Global Scheduling Order

The Adjust Global Scheduling Order function lets you adjust the priority used on jobs during the Global Scheduling process run. The Priority value is defined on specific jobs to indicate scheduling precedence.

Using this function lets you change the hierarchy to better reflect your current scheduling needs. Note that this is an optional step in the Global Scheduling process. By adjusting the job priority sequence to the order you want, however, you will get better scheduling results.

Global Scheduling Process Order

The Global Scheduling process is divided into three components. You must run these components to globally schedule your jobs. The order is as follows:

1. **Calculate Global Scheduling Order** - Each time this process is run, it selects any job that is a candidate for the Global Scheduling process. It will forward schedule each selected job using the infinite capacity calculation. Then the jobs will be assigned a job priority sequence. Later, the Global Scheduling process will use this sequence to finish the scheduling process.
2. **Adjust Global Scheduling Order (optional)** - This is an optional component that is described above.
3. **Global Scheduling** - Run this process to schedule the jobs. All the jobs selected by the Calculate Global Scheduling Order process are placed within the schedule, either on the actual schedule or on a What-If schedule.

Note that if you want the Calculate Global Scheduling Order and the Global Scheduling processes to run automatically, you can assign them both to a Process Set. Make sure that the Calculate Global Scheduling Order process is run before the Global Scheduling process.

Modifiers

You can adjust the following Adjust Global Scheduling Order values:

You can change the following values:

- **Adjust Global Scheduling Order** -The global finite scheduling calculation uses the adjusted priority you define here to determine which job's scheduling blocks should be assigned to specific resources before another job's scheduling blocks.

Location

You can access the Adjust Global Scheduling Order functionality through the following locations:

- **Calculate Global Scheduling Order** - Determines which jobs are available for global scheduling, and the job priority sequence that will be used during the Global Scheduling process.

- **Adjust Global Scheduling Order** - Use this optional app to change the job priority sequence that was generated by the Calculate Global Scheduling Order process.
- **Global Scheduling** - Use this app to launch the Global Scheduling process.

Logic

If a job is given a higher priority, use the priority value during the Global Scheduling process.

Example

Job 4597 has a High Priority, while Job 3215 has a Medium Priority. The parts being manufactured on Job 3215, however, are needed on Job 4597. You use the Adjust Global Scheduling Order to give Job 3215 a higher priority over Job 4597.

When you run Global Scheduling, the load required to produce Job 3215 will be scheduled before the load required on Job 4597.

Available to Promise

The Available to Promise calculation places the total demand for a part on a specific date against the supply available on that same date. Depending on the demand required and supply available on that date, the ATP total quantity is either a positive or a negative value; a positive or zero value indicates enough supply is available on that date, while a negative value indicates that more supply is needed.

The results of this calculation are displayed within the Available to Promise app; each date has its own column (or bucket) on a grid; an ATP total value for that date displays on the bottom row.

To add together demand on a specific date column, the calculation totals the quantities of all sales order releases whose Need By dates either fall on or before the date. For example, sales order 237 has three releases - release 1 has a 5/14 Need By date, release 2 has a 5/15 Need By date, and release 3 has a 5/16 Need By date. Each release is for a 50 quantity. If no supply is available for the part quantities by 5/16, the Available to Promise calculation displays a -150 ATP quantity on the 5/16 date column.

Now in order to add together supply on a specific date, the Available to Promise calculation reviews all the forecast, master production schedule,transfer order, job receipt, and PO receipt quantities scheduled to be available on a specific date. The calculation does this by reviewing the Forecast Date value on the forecast detail, the Due Date value on the master production schedule detail,the Need By date on a transfer order release, the Due Date value on a PO release, and the Due Date value on a job. The detail lines that fall on a specific date are added as supply quantities available on that specific date column.

ATP uses the number of days defined in the Supply Due Date Horizon field in Supplier Maintenance or Site Maintenance, if this factor has not been defined for at the supplier

level.

If this total supply quantity is less than the demand quantity on this date, the entire quantity is consumed and a negative value displays for the ATP total on this date column. If this total supply quantity is greater than the demand quantity, a positive ATP value displays for the total on this date column. The remaining supply quantity is then included in the next date column, as the Available to Promise calculation assumes that this remaining supply quantity exists in stock.

Future Demand

The Available to Promise calculation also considers future demand as it generates the ATP totals. If a future demand quantity exceeds supply on a certain date, this quantity is subtracted from the supply quantities available on previous dates until it consumes all of the available supply and encounters a negative ATP total on a preceding date column. So even though enough supply may be available on a specific date, the Available to Promise calculation provides an accurate picture of the actual supply by including upcoming demand quantities.

Lead Time

To prevent too much future demand from being placed against supply quantities, the Available to Promise calculation uses the Lead Time value on part-site records to limit how much demand is placed against preceding date columns. When you enter a Start At date within the Available to Promise window, all sales order releases due on or before the Start At date plus the Lead Time are included as demand in the ATP totals. Any demand that falls on a date beyond the Lead Time window is ignored, as the calculation assumes that you have enough time to fulfill this future demand.

Purchase Order Threshold Rule

One key feature of the Available to Promise calculation is that it does not include, as a potential source of supply, incoming amounts from any purchase order release that is considered late, based on the setting of the Supplier Due Date Horizon field located in Supplier Maintenance, or as defined in Site Maintenance if none exists for the supplier.

- This setting defines the number of days from the purchase order (PO) release due date that the Scheduling engine considers purchase orders for this site to be late. Available to Promise (ATP) and Capable to Promise (CTP) also use this setting to determine if incoming purchase orders should be considered in their calculations.
- For ATP calculations, it subtracts this factor from the current system date to calculate an acceptable horizon date window, and then compares each PO release due date to the calculated horizon date window.

For example, if the current system date is **10/30**, and the factor is **10**, any PO release due date that falls between **10/20** and **10/30** is considered an acceptable due date,

even though it is late with respect to the current date. PO releases with due dates within this window are considered late, but are acceptable sources of supply. Any PO release with a due date earlier than **10/20** is unacceptably late and is not considered an acceptable source of supply. For purposes of the ATP calculations, Kinetic discards the PO release and then replans for it.

Modifiers

You can change the following Available to Promise values:

- **Sales Order Releases** - The calculation uses the quantity requested on each sales order release and its Need By date value to determine the demand quantity required on a specific date. The total sales order release quantity on a specific date displays within the Order row in the Available to Promise.
- **Forecast Details** - The calculation uses the quantity on each forecast detail and its Forecast Date to determine the forecast quantity predicted to be available on each date. The total forecast detail quantity available on a specific date displays within the Forecast row in the Available to Promise.
- **Master Production Schedule (MPS)** - The calculation uses the quantity on each master production schedule detail and its Due Date to determine the MPS quantity predicted to be available on each date. The total MPS detail quantity available on a specific date displays within the MPS row in the Available to Promise.
- **Transfer Order Lines** -The calculation uses the quantity requested on each transfer order detail line and its Need By date value to determine the demand quantity expected to be available on each date. The total transfer order detail line quantity available on a specific date displays within the Transfer Order row in the Available to Promise.
- **PO Release** - The calculation uses the quantity on each PO release and its Due Date to determine the PO release quantity predicted to be available on each date. Note that if the PO release is more than two days in the past, however, the release is not included in the Available to Promise calculation. The total PO release quantity available on a specific date displays within the Receipt row in the Available to Promise.
- **Job Receipt** - The calculation uses the quantity on each job and its Due Date to determine the job receipt quantity predicted to be available on each date. The total job receipt quantity available on a specific date displays within the Receipt row in the Available to Promise.

Location

You can access the Available to Promise functionality through the following locations.

- **Available to Promise** - Run this app to review what quantities for a specific part are available to ship on a specific date. You locate this app by opening the Material Management folder, the Inventory folder, and the General Operations folder. You can also launch this app by right-clicking a Part ID field; from the content menu, highlight the Open With... sub-menu and select Available to Promise.

Logic

The Available to Promise functionality uses this logic to calculate its results:

- Total Demand Quantity (Specific Date) = Total of All Order Releases that have Need By dates on a specific date + Any Previous Unresolved Demand Quantity
- Total Supply Quantity (Specific Date) = Total of All Forecast Detail Quantities, MPS Quantities, Transfer Order Quantities, PO Release Quantities, and Job Receipt Quantities available on a specific date + Any Previous Stock Quantities Not Consumed
- Available to Promise Quantity (Specific Date) = Total Supply Quantity - Total Demand Quantity

Receive Time and Lead Time Calculations

- The Receive Time is determined by a selected production calendar. The calculation uses the following hierarchy to determine which calendar to use:

  References to part/site record below refer to the site currently selected in the ATP form.

  1. It uses the Receive Time factor (if any) defined for the part/site record in Part Maintenance or Site Maintenance.
  2. If there is no receive time in the part/site record and the part has an assigned part class, it uses the Receive Time factor (if any) defined in Part Class Maintenance.
  3. The production calendar associated with the site is used.
  4. If the site has no production calendar, the production calendar associated with the company record is used.
  5. The result of the above steps displays in the Receive Time field in the ATP form.
- The Lead Time is calculated based on the following hierarchy:

  1. If the part/site record source is a Transfer type part, it uses Transfer Lead Time defined for the part/site record in Part Maintenance.
  2. If the part/site record source is for a Manufactured type part, and you select the Manual check box in the ATP form, it uses the Manual Lead Time defined for the part/site record in Part Maintenance. If you clear the Manual check box in the ATP form, it uses the Calc Lead Time defined for the part/site record in Part Maintenance.
  3. If the part/site record source is for a Purchased type part, and there is no supplier defined for the part/site record, it uses Purchasing Lead Time defined for the part/site record in Part Maintenance.
  4. If the part/site record source is for a Purchased type part, and there is a supplier designated for the part/site record, it uses the supplier number as follows to determine if there is a lead time defined for the supplier/part combination:

- If there is an effective price list defined for the primary supplier/part in Supplier Price List Maintenance, and the Default UOM for Purchasing check box is selected (true) then it uses the lead time defined for that price list.
- If none is found, it uses the lead time from the first effective price list defined for the primary supplier/part in Supplier Price List Maintenance.
- If one is found, it uses the Purchasing Lead Time defined for the part/site in Part Maintenance.

Once it determines the Receive Time and Lead Time, it calculates the Lead Date displayed in the ATP form as follows:

1. Adds the number of Lead Time days to the current system date (today's date). To calculate this, if the part/site record source is Purchase and a supplier is defined for the part/site record, it uses the supplier calendar. In all other cases, it uses the site calendar specified in the ATP form.
2. Adds the calculated number of Receive Time days to the date calculated in Step 1, using the site calendar, to calculate the lead time displayed in the ATP form.

Example

You want to see the Available to Promise calculation in action through a simple test run. To do this, you create ATPTest01, a purchase part record. This part record has a part-site Lead Time value of 15 days.

You now create a sales order that contains a series of order releases requesting this part. You enter the following order release values, where Today is the current date plus or minus the listed days:

Order Release	Need By Date	Quantity
1	Today - 10 Days	10
2	Today - 8 Days	5
3	Today - 3 Days	6
4	Today - 2 Days	3
5	Today - 1 Day	12
6	Today	8
7	Today + 5 Days	1
8	Today + 10 Days	32
9	Today + 20 Days	45

The sales order defines the total demand for this purchased part.

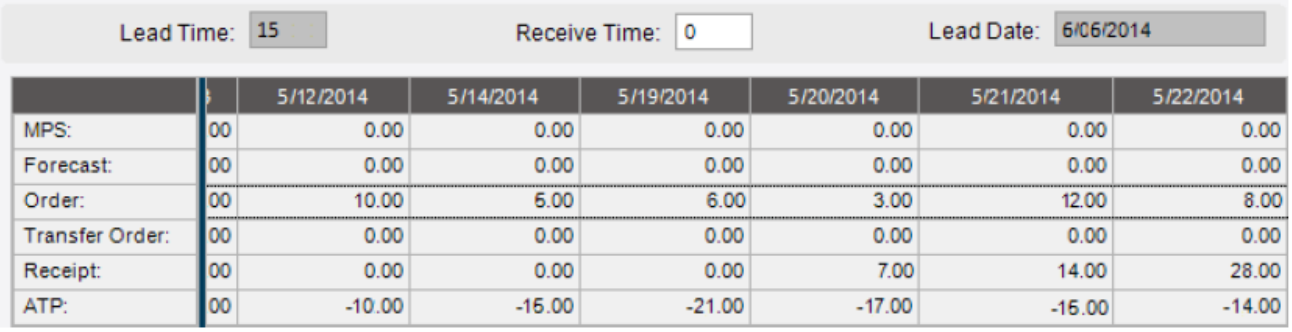
You now enter the total supply available for this part. For this example, you decide to limit the supply records to purchase order releases. To do this, you create a single PO that contains the following PO release schedule and incoming quantity values, where Today is the current date plus or minus the listed days:

PO Release	Due Date	Quantity
1	Today - 10 Days	1
2	Today - 7 Days	2
3	Today - 3 Days	3
4	Today - 2 Days	7
5	Today - 1 Day	14
6	Today	28
7	Today + 4 Days	6
8	Today + 9 Days	8
9	Today + 19 Days	11

You now launch Available to Promise and enter ATPTest01 in the Part field. The current date displays in the Start At field. Notice that for this example a date of 05/22 is used.

The Available to Promise grid displays the following results for the first half of the Lead Time date range:

A



		5/12/2014	5/14/2014	5/19/2014	5/20/2014	5/21/2014	5/22/2014
MPS:	00	0.00	0.00	0.00	0.00	0.00	0.00
Forecast:	00	0.00	0.00	0.00	0.00	0.00	0.00
Order:	00	10.00	6.00	6.00	3.00	12.00	8.00
Transfer Order:	00	0.00	0.00	0.00	0.00	0.00	0.00
Receipt:	00	0.00	0.00	0.00	7.00	14.00	28.00
ATP:	00	-10.00	-16.00	-21.00	-17.00	-16.00	-14.00

Notice that the PO threshold rule automatically ignores the PO releases scheduled on 5/19 or earlier. The first supply quantity the Available to Promise calculation includes is the 7 quantity on 5/20. The demand placed against this part continues to accumulate, however, so the total demand on 5/20 is -24, but the 7 supply quantity reduces the ATP total to a -17 quantity.

As you continue to review the results, you see that the Available To Promise calculation generates a -14 quantity on 5/22. A future demand quantity is included in this total, so you need to scroll to the right to see where this future demand value hits in the schedule:

A

Lead Time: 15 Receive Time: 0 Lead Date: 6/06/2014

	4	5/26/2014	5/27/2014	5/31/2014	6/1/2014	6/10/2014	6/11/2014
MPS:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forecast:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Order:	0.00	0.00	1.00	0.00	32.00	0.00	45.00
Transfer Order:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Receipt:	0.00	6.00	0.00	8.00	0.00	11.00	0.00
ATP:	0.00	-14.00	-14.00	-14.00	-14.00	-3.00	-48.00

You discover that on 5/27, you have a future demand for a 1 quantity and on 6/1, you have a future demand for a 32 quantity. Notice that the complete Lead Time range considered by the Available To Promise calculation is 6/06, which is the Start At date of 5/22 plus the 15 day Lead Time. Because of this, the 33 quantity is included by the calculation as future demand; it consumes all the supply quantities in the preceding date buckets until it reaches 5/21. A negative -15 quantity exists on this date, so the future demand is not added to the ATP total amount in this column, as no additional supply is available on this date. The total future supply you will receive is 34 and this only reduces the total demand by a 1 quantity, so a -14 quantity is displayed for all dates that fall either on or before the Lead Date back to 5/22.

However, the Available To Promise grid does display demand past the Lead Date. On 6/10, you receive a supply quantity of 11 and a demand quantity of 45. Because both quantities fall outside the Lead Time date range, however, these values are not calculated in the future demand displayed on 6/1 or earlier. The Available To Promise calculation assumes that you will satisfy this demand later.

The next page breaks out the Available To Promise calculation even further to illustrate how the calculation arrived at these numbers.

This table displays all the dates affected by either a demand quantity, a supply quantity, or both a demand and a supply quantity for part ATPTest01. The Net/Day row displays whether a negative or positive quantity is calculated on the specific day. These net values reflect the demand quantity and the supply quantity received/needed on each specific day.

The rest of the table displays the ATP total values that are generated as a result of these net values.

	5/12	5/14	5/19	5/20	5/21	5/22	5/26	5/27	5/31	6/1	6/10	6/11
Net/Day	-10	-5	-6	4	2	20	6	-1	8	-32	11	-45
5/12	-10											
5/14	-10	-15										
5/19	-10	-15	-21									
5/20	-10	-15	-21	-17								
5/21	-10	-15	-21	-17	-15							
5/22	-10	-15	-21	-17	-15	5						
5/26	-10	-15	-21	-17	-15	5	11					
5/27	-10	-15	-21	-17	-15	5	10	10				
5/31	-10	-15	-21	-17	-15	5	10	10	18			
6/1	-10	-15	-21	-17	-15	-14	-14	-14	-14	-14		
6/10	-10	-15	-21	-17	-15	-14	-14	-14	-14	-14	-3	
6/11	-10	-15	-21	-17	-15	-14	-14	-14	-14	-14	-3	-48

The first supply quantity is recorded on 5/20, reducing the demand quantity from the preceding day by 4. On 5/21 another net gain for a 2 quantity is recorded, which reduces the total demand to a -15 quantity.

Then on 5/22, the current date, the Available To Promise calculation records a 20 quantity net gain, which initially causes an ATP total of 5 to appear. As the Available to Promise calculation moves through the incoming PO releases, it discovers that a total 18 supply quantity is available through 5/31.

However, the calculation discovers that a future demand quantity of 33 falls within the Lead Time date range as well. The total supply from the 5/22 date on is 34. Because of this, you really only gain a 1 quantity during this time frame, so the calculation must regenerate these values. For the final results, the Available To Promise calculation returns -14 quantity throughout the Lead Time date range (The Lead Date value is 6/6) to account for this future demand.

Lastly, the supply quantity on 6/10 and the demand quantity on 6/11 fall outside the Lead Time date range. This demand is not evaluated for the ATP future demand total from 5/22 to 6/1. Because you

are carrying a -14 quantity however, this negative quantity value is included ATP totals generated beyond the Lead Date, resulting in a -48 quantity on 6/11.

Backward Scheduling

Backward Scheduling is a type of logic used by the scheduling engine to calculate the length of time it will take to complete a job.

This logic begins with the End Date on the job and then moves backward through the Production Calendar used at the resource, resource group, site, or company, and uses the lengths of time required on each operation (Operation Time) - taking into account any operations that can run concurrently (peer assemblies) - to arrive at the Start Date.

As a rule, the Due Date is typically the day before the date on which you will ship the part quantity. To calculate the Due Date, the scheduling engine uses the Required By Date and subtracts the Receive Days.

If you accept the default Due Time of 12:00 AM, the scheduling engine will schedule the job so that it is ready by 11:59 PM of the previous day. The part will be ready for the day required.

You can set up the Due Time default value in the Backward Scheduling Start field located in Site Maintenance.

When the Due Date is defined, the operations within the job's method of manufacturing are evaluated. Each operation's Setup Time and Production Time are either added together if the assemblies are run one after another in sequence, or evaluated together if they are peer assemblies that allow concurrent scheduling.

The routine also considers the Queue Time and Move Time defined on each resource group used by the operations. The sum of these time intervals are subtracted from the Due Date to arrive at the job's Start Date.

Modifiers

You can modify the following values:

- **Bounce Condition** - If the scheduling routine arrives at a Start Date that is earlier than the current date, the current date will be used as the Start Date and the job is scheduled using Forward Scheduling. The result is that the engine calculates a later Due Date for the job. This special logic is referred to as the Bounce Condition.
- **Allow Scheduling Before Today** - If this check box is selected within the Company Configuration, the scheduling engine lets the Backwards Scheduling routine calculate a Start

Date that is before the current system date. Setting this option prevents the Bounce Condition logic from automatically rescheduling the job using Forward Scheduling.

- **Global Reschedule Started Operations** - This is a rescheduling routine option. If this check box is selected within the Company Configuration, the scheduling engine lets operations that have labor reported against them be rescheduled. It does this by rescheduling the remaining time that is left to complete the operation.

Location

You can access Backward Scheduling through the following locations:

- **Job Entry** - You select backwards scheduling for a specific job when you schedule it.
- **Job Scheduling Board** - Within this scheduling board, you can select the Backwards Scheduling calculation on the Move Job panel. The Move Job panel displays when you manually select and drag a job on to the scheduling board.
- **Resource Scheduling Board** - Within this scheduling board, you can select the Backwards Scheduling calculation on the Move Job panel. The Move Job panel displays when you manually select and drag an operation on to the scheduling board.
- **Multi-Resource Scheduling Board** - Within this scheduling board, you can select the Backwards Scheduling calculation on the Move Job panel. The Move Job panel displays when you manually select and drag an operation on to the scheduling board.

This board is available if you use the Advanced Planning and Scheduling (APS) module.

Logic

The Backward Scheduling functionality uses the following logic to calculate its results:

- End Date = Required Date- Receive Days
- Operation Time = Queue Time + Setup Time + Production Time + Move Time
- Assembly Time for Peer Assemblies = The Peer Assembly Time that takes the longest to complete.
- Start Date = End Date- (Assembly 0 Time + Assembly 1 Time + Assembly 2 Time + and so on...)

Example

You will backwards schedule Job 5421. This job method has four assemblies, two of which are peer assemblies that are run concurrently. By calculating the Operation Times for operations within each assembly, the engine defines the required times:

- **Assembly 0** - 3 Days - 3 Days
- **Assembly 1** and **2** (Peer Assemblies)- Assembly 2 is the longest assembly. I will take 4 days to complete.
- **Assembly 3** - 5 Days

Your Receive Days value is 2.

The Required By Date on Job 5421 is August 17. The scheduling engine calculates an End Date of August 15. Now the engine determines the working days on which each assembly needs to begin (accounting for any non-working days in the schedule):

- **Assembly 0** - August 13
- **Assembly 2** (Longest of the Peer assemblies)- August 7 This value takes into account the two non-working days for the weekend.
- **Assembly 3** - July 31 This value takes into account the two non-working days for the weekend.

The scheduling engine calculates that the Start Date for Job 5412 will be July 31.

Bounce Condition

The Bounce Condition is special logic that prevents Backwards Scheduling from calculating a Start Date for a job in the past. If the backwards scheduling logic calculates a Start Date that is before the current date, the engine uses Bounce Condition logic.

The Bounce Condition recalculation applies to an entire job. If a job is bounced, the entire job schedule restarts using the current date as the Start Date. The scheduling engine uses Forward Scheduling and schedules operations forward through the production calendar. Because the requested Due Date cannot be met, the Bounce Condition causes the scheduling engine to create a new Due Date for the job.

Two items cause jobs to bounce. The most common is constrained materials. If any constrained materials must be issued to an operation earlier in the schedule, their scheduled arrival dates can cause the Start Date to occur before the current date. The second item is operation time. If the total time required for all the job operations pushes the schedule out before the Schedule Start Date, the Bounce Condition logic will activate and the job is forward scheduled.

Modifiers

You can modify the following value:

- **Allow Scheduling Before Today** - If this check box is selected within the Company Configuration, the scheduling engine will let the Backwards Scheduling routine calculate the Start Date for a job before the current system date. This option prevents the Bounce Condition logic from automatically rescheduling the job using the Forward Scheduling calculation.

Location

You can access the Bounce Condition functionality through the following locations:

- **Job Entry** - You select Backwards Scheduling for a specific job when you schedule it.

Logic

The Bounce Condition functionality uses this logic to calculate its result:

- Start Date = End Date- (Operation One Time + Operation Two Time + Operation Three Time and so on through all the operations on the job method)
- If Start Date occurs before Current System Date, Then Bounce Condition activates Forward Scheduling calculation.
- Because of the Bounce Condition: End Date = Current System Date + (Operation One Time + Operation Two Time + Operation Three Time and so on through all the operations on the job method)

Example

The scheduling engine calculates that it will take 15 working days to complete job 2873. It backwards schedules the job; the End Date is August 15. The current system date is August 1.

Accounting for non-working days, the scheduling engine determines that the Start Date on this job is July 27. Because this is earlier than the current system date, the Bounce Condition logic activates. August 1 is used as the Start Date, and the scheduling engine calculates that August 21 as the job's new End Date.

Calculate Global Scheduling Order Process

Calculate Global Scheduling Order is a pre-process app for the Global Scheduling process.

Each time the Calculate Global Scheduling Order Process runs, it first determines which jobs are candidates for the Global Scheduling process and then determines the priority order in which these jobs are scheduled. The following steps describe how this process determines the scheduling order:

1. The process first populates the temporary tables required to calculate the results. These tables store the generated data before it is saved to the database.
2. the process next selects job candidates. These jobs must have both the **Open** and **Engineered** statuses. This list of Open, Engineered jobs is placed in the temporary tables.
3. Any jobs marked as **Locked** are ignored and so no scheduling changes are made to these jobs. They keep their current **Start Dates** and **Due Dates**.
4. Each job is then scheduled one at a time to set its scheduling priority.

a. The job is forward scheduled from the global schedule Start Date using the Infinite Capacity calculation. Because the jobs are scheduled with unrestricted access to resources (Infinite Capacity), this process finds each job's best What-If Due Date.

b. The What-If Due Date is compared to the requested Due Date on the job header; if the Due Date is in the past, then today's date is used. This results in a **Days Early** or **Days Late** value.

c. The Days Early or Days Late value is then multiplied by 24 to determine the **Calc Hrs. EarlyLate** value.

d. The Calc. Hrs. EarlyLate value is next used to determine the scheduling priority. The process does this by using the following formula:

*(Calc Hrs EarlyLate -99,999) * Scheduling Factor = Calc Scheduling Priority*

5. The process now generates the Global Scheduling Order list by pulling the jobs in this priority sequence:

   a. Calc Scheduling Priority

   b. Requested Due Date

   c. Job Number

6. To complete the calculation, the process assigns each job a scheduling Sequence Number. Each number is incremented by 10. The scheduling priority order for these jobs is generated.

Note that this process does not save any of the schedule date values to the database. To complete scheduling, you must now run the **Global Scheduling** process. You can also run the optional **Adjust Global Scheduling Order** to manually change the job priority order generated by the Calculate Global Scheduling Order.

You can also define how many process runs, or processors, used by the scheduling engine. Increasing the number of processors reduces the strain on the network while the scheduling engine runs, because it lets other processes to run between each processor.

Global Scheduling Process Order

The Global Scheduling process is divided into three components. You must run these components to globally schedule your jobs. This is the order:

1. **Calculate Global Scheduling Order** - This is the process described above. It must be run before you use the Global Scheduling process.
2. **Adjust Global Scheduling Order (optional)** - This is an optional component you can run. Launch this app to review the job priority sequence that was generated by the Calculate Global Scheduling Order process. You can use this app to manually change the sequence in which these jobs will be scheduled.

3. **Global Scheduling** - Run this process to schedule the jobs. All the jobs selected by the Calculate Global Scheduling Order process are placed within the schedule, either on the actual schedule or on a What-If schedule.

Note that if you want the Calculate Global Scheduling Order and the Global Scheduling processes to run automatically, you can assign them both to a Process Set. Make sure that the Calculate Global Scheduling Order process is run before the Global Scheduling process.

Modifiers

You can modify the following values:

- **Automatic Processing** - This function is a process, so you can set up the Calculate Global Scheduling Order Process to run using an automatic, recurring schedule. You create a daily, weekly, monthly, or yearly schedule within System Agent Maintenance. You can select this record from the Scheduling drop-down list and select the Recurring check box. Each time the system clock encounters the schedule, the Global Scheduling logic will run automatically.
- **Log File/Log Level** - To track how the scheduling engine runs, you can create a log file. You must define both a name and a directory path for the log. Note that the Log Level drop-down list lets you define which information will appear in the log. These are the options:
    - **Basic** - The log displays the Start Date and Start Time with the number of schedulers (processors) that were run. The log also displays when each processor finished - and if any errors occurred during the process.
    - **Process** - This log displays the Basic information described above. It also includes a log for each scheduler (processor) which displays the jobs that were scheduled.
    - **Process and Scheduling** - This log displays the Basic and Process information described above. It also includes a detail log that displays how each operation was scheduled, including constrained materials and the finite capacity used against each resource.
    - **Number of Processors** - This value defines the number of scheduling runs that will be started on the server to complete the schedule processing. This feature improves system performance as you can split one large scheduling process into smaller, multiple processes. You can enter a value from 1 to 99. Note that the first scheduler always handles finitely scheduled jobs. If the site does not have a Finite Horizon (a 0 value) and the resource is set to Finite Capacity, all jobs will be scheduled through the first scheduler. The remaining schedulers are not needed. If your manufacturing center uses finite calculations, enter a 1 in this field.
    - **Scheduled Start Date** - The date that will be used to globally schedule your open, engineered jobs.
    - **Scheduled Start Time** - The specific time from which you want to globally schedule your jobs. The default value is 12:00 AM, which is the beginning of the day selected in the Scheduled Start Date field.

Location

You can access the Calculate Global Scheduling Order Process functionality through the following locations:

- **Calculate Global Scheduling Order** - Run this app to determine which jobs are available for global scheduling, and the job priority sequence that will be used during the Global Scheduling process. You locate this app by opening the Production Management folder, the Scheduling folder, and the General Operations folder.
- **Adjust Global Scheduling Order** - Use this optional app to change the job priority sequence that was generated by the Calculate Global Scheduling Order process. You locate this app by opening the Production Management folder, the Scheduling folder, and the General Operations folder.
- **Global Scheduling** - Use this app to launch the Global Scheduling process. You locate this app by opening the Production Management folder, the Scheduling folder, and the General Operations folder.

Logic

The Calculate Global Scheduling Order Process functionality uses this logic to calculate its results.

- If a job can be globally scheduled, process the job using both the Forward Scheduling and Infinite Capacity calculation.
- Evaluate job priority codes. Place jobs with a high priority value higher in the job priority sequence. Jobs that are both late and have a higher priority value will be scheduled first.

Example

You want to run the Global Scheduling process. Before you can do this, however, you need to identify which jobs should get resources before other jobs. You run the Calculate Global Scheduling Order Process. The jobs are now placed within a job priority sequence. You can accept the priority or use the Adjust Global Scheduling Order app to change the order in which these jobs will be scheduled.

Capable to Promise

The Capable to Promise calculation determines the date by which a sales order quantity can be delivered (promised) to the customer. These dates are calculated for a current order selected within Sales Order Entry, or for a demand order selected in Demand Entry.

Jobs are then created for the demand calculated through this functionality - and these jobs can then be incorporated into the schedule.

You indicate whether this function should be run on all or selected detail lines on the current sales order. Additionally, you can enter a Projected Start Date overall for each order. If you need the Capable to Promise functionality to generate jobs for stocked manufactured parts, you also must select the Make Direct check box on each order release. Lastly, you can run the Set Order Promise

Date from withing the Overflow menu in Order Entry, to generate a date by which all the sales order lines can be shipped and schedule the jobs so that they complete at the same time.

Similar to Material Requirements Planning (MRP), this calculation creates one or more unfirm jobs that use the ìCTPî prefix. You can then leave Capable to Promise and use the scheduling boards to determine the impact these unfirm jobs have on the production schedule. When you are satisfied with the schedule, return to Capable to Promise and confirm these jobs. The CTP prefix is removed from each job number and these job records are added to the production schedule. Just like all jobs within Kinetic, each job is linked to the order release which defined the demand.

When creating an unfirm job, CTP calculates the pull quantity of subssemblies of parts checked for auto consume, and then schedules the job backwards from the required date. If the scheduling reaches today's date and bounces forward to calculate the new completion date, a recheck of available materials is performed.

This recheck takes into account any changes made to stock or supply that might affect the ability to fulfill the needed quantity. For example, if a purchase order is due in during the scheduled assembly period that will supply the job.

Log

If you run global rescheduling for a job that includes constrained material(s) in its Method of Manufacture (MOM), the Scheduling log includes the consumption details of constrained material(s), only when the material is pushed to its lead time. The consumption details only display if the debug.txt file exists and includes the word 'detail' or 'details'.

If you create a make to order, make to job, or make to stock job record for a part and define the debug.txt file in C:\ location, then the log file creates the following structure according jobs, orders and stock:

```
10:14:27 Checking stocked material constraint for operation 10 material 148
410P for 10/8/2014. --- Check_Mtl_LeadTimes
10:14:27 Running atp for start date of 10/8/2014 qty 2000.00000000 LeadTime
 10/22/2014. --- StockedMaterial
10:14:27 OnHandQty 1,500.00 . --- GetSchedAtp
10:14:27 SENDING TO LEAD TIME - Available quantity after prior requirements
 = 1,340.00 lesser than qty needed (2,000.00). Prior demand = (160.00) ---
GetSchedAtp
10:14:27 50.00 USED Job 2413 Asm 0 Mtl 10 Date 10/8/2014. (Total: 50.00) --
- GetSchedAtp
10:14:27 10.00 USED Job 2414 Asm 0 Mtl 10 Date 10/8/2014. (Total: 60.00) --
- GetSchedAtp
10:14:27 100.00 USED Job 2412 Asm 0 Mtl 10 Date 10/9/2014. (Total: 160.00)
--- GetSchedAtp
10:14:27 Ran
```

Modifiers

Values that can modify this calculation include:

- **Completion Date** - Specifies the date of completion for the order release. The default is the Completion Date generated by the Capable to Promise calculation. However, you can update this date later, or you can use the Update Order Promise Date functionality to make all dates the same.
- **Confirm** - Select this check box to indicate the order release is ready to be verified by the Confirm button. You must select this option in order for the CTP job generated for the order release to be converted into a standard job.
- **CTP** - Select this check box to indicate that you want the calculation to generate a Completion Date for the specific order release. You must also select this option in order for the calculation to create a CTP job for the current order release.
- **Finite Schedule** - Select this checkbox if the job generated from this order release should be finitely scheduled. Finite scheduled jobs cannot overload the available capacity on each finite resource on any date within the schedule.
- **Override Material Constraints** - Select this checkbox to indicate the generated job can ignore any material quantity limits placed against it. This check box is valuable if the date is too far in the future to realistically consider material constraints; you can then generate a closer End Date for the unfirm job.
- **Projected Start Date** - Specifies the start date for the entire sales order. If you enter a date in this field, it is used as the beginning value for the calculations that arrive at the Completion Date values for each order release.
- **Proposed Start Date** - Specifies the date on which work on the order release would begin. The default is today's date, but you can change this date if you need. This date is the starting point for the Capable to Promise calculation for the order release, and it overrides the value defined within the Projected Start Date field.
- **Shipment Options** - Specifies the shipment options for this order release. Available options:
    - **Ship Partial Quantities** - The existing release is for the stock parts whose quantity is currently available. A second release is created for the remaining back-ordered quantity.
    - **Ship Line Complete** - The available date is set for the release on the date when the entire quantity can be filled.
    - **Ship Order Complete** - The available date is set for the entire order. The logic considers all lines as "Ship Line Complete" as described above, and the farthest out date in the future for all lines is the available date value.

Location

You can access the Capable to Promise functionality through the following locations:

- **Order Entry** - You launch Capable to Promise from within Order Entry. You locate this app by opening the Sales Management folder, the Order Management folder, and the General Operations folder.
- **Demand Entry** - You launch Capable to Promise from within Demand Entry. You locate this app by opening the Sales Management folder, the Demand Management folder, and the General Operations folder.

Logic

This section describes how the CTP logic arrives at the end dates for the current sales order and/or order detail lines (or when run in Demand Entry, for demand order and/or demand schedule lines). This calculation first determines which detail lines to include in the results. Different logic is then run against each detail, depending on the part type, to determine when the part quantities can be delivered.

This processing logic also applies when you use Capable to Promise in Demand Entry. In this case, the terms 'demand schedule' and 'demand line' replace 'order release' and 'order line' references below.

- **Beginning Values** - After you select the Calculate button, the calculation is performed on those sales order release lines displayed in Capable to Promise for which you select the CTP check box. It uses the Ship By date as the starting point for the calculation. The following processing takes place:
    - **Non-Stock Part Quantities (or Make Direct Releases)**
        1. Each line creates an unfirm job as with MRP; each job bears a prefix CTP.
        2. The part method detail from the linked quote (if any) is added to the job record.
        3. The Engineered check box is selected on the job.
        4. The job is backward scheduled to determine the start date. If the process doesn't hit the proposed start date then the Ship By is set as the Calculated Completion Date. If the process hits the proposed start date, then the job will bounce forward from the proposed start date and the new Calculated Completion Date is determined.
- **Stock Parts** - Logic that runs against stock part quantities:
    1. Compares the order quantity on the order line or order release against the available on-hand stock quantity for the ordered part.

        The available on-hand stock quantity also includes purchase order receipts that are currently in inspection. It does not consider other types of transactions (work order receipts, RMAs) that are in inspection as potential sources of supply.

    2. If there is sufficient on-hand stock, the calculated Completion Date displays as the Ship By Date on each order release.
    3. If there is insufficient on-hand stock, Time Phase logic determines when sufficient stock will arrive, based on outstanding jobs or purchase orders. CTP moves forward within the specified lead time until enough stock is available to fulfill the quantity on the order line.

4. If insufficient stock is available and the part quantity needs to be manufactured, and the Make Direct check box is selected on the order release, or the Multi Level CTP check box is selected (true), CTP will create an unfirm job for the remaining quantity.

5. If insufficient stock is available, the part quantity needs to be manufactured and the Multi Level CTP check box is cleared (false), a job is not created; the part Lead Time and Receive Time settings are used to determine the day that it can be available.

   Lead Time is based on the associated site production calendar; if this field is blank, then a straight seven day calendar is used. Receive Time is a number of days but is checked against the site/company production calendar to account for work week and holidays.

6. If sufficient stock is not available and the part is purchased, the calculated Completion Date is the current date plus the purchase lead time.

7. After the dates are calculated, they can be changed to any date greater than the determined date. You can then select the Confirmed check box to indicate that this new date must be used instead in order to generate the unfirm jobs.

- **Purchased Parts** - Logic that runs against purchased part quantities:
  - Capable to Promise time is the sum of the Lead Time and Receive Time.
  - The Lead Time for a purchased part is determined based on the following hierarchy:
    1. If there is an effective price list defined for the primary supplier/part in Supplier Price List Maintenance, and the Default UOM for Purchasing check box is selected (true) in Part, it uses the lead time defined for that price list.

       If the Buy to Order check box has been selected for the order release being processed, the CTP calculation uses the supplier designated in the order release instead of the primary supplier assigned to the part/site in Part to find the proper supplier price list to use. For example, if the primary supplier defined in Part is supplier ABC, but an BTO order release for supplier XYZ is being processed, it attempts to locate the supplier price list defined for supplier XYZ.

    2. If none is found, it uses the lead time in Supplier Price List where the Supplier UOM field in Part is the same as the purchasing UOM code defined for the part itself in the Primary UOMs - Purchasing field in Part. For example, if the purchasing UOM code is set to BX (Box) in Part, it uses the lead time defined in Supplier Price List for which the Supplier UOM field is also set to BX.

    3. If none is found, it uses the lead time from the first effective price list defined for

the primary supplier/part in Supplier Price List.

4. If one is found, it uses the Purchasing Lead Time defined for the part/site in Part.

- The Receive Time is determined by a selected production calendar. The calculation uses the following hierarchy to determine which calendar to use:
  1. The production calendar associated with the site is used.
  2. If the site has no production calendar, the production calendar associated with the company record is used.
- The calculation uses number of days defined in the Supplier Due Horizon field to determine if a past due PO release should be considered as a potential source of supply, based on its due date falling within a calculated due date horizon. The Supplier Due Date Horizon is defined for the supplier in Supplier, or for the site in Site (if this factor has not been defined for the supplier associated with a PO release).

  For example, if the current system date is 10/30, and the Supplier Due Date Horizon is 10, any PO release due date that falls between 10/20 and 10/30 is considered incoming supply, even though it is late with respect to the current date. PO releases with due dates within this window are considered late, but are acceptable sources of supply. Any PO release with a due date earlier than 10/20 is "unacceptably" late and is not considered an acceptable source of supply. For purposes of the ATP calculations, Kinetic discards the PO release and then replans for it.

- **Part Lead Time** - If the Part Lead Time check box is selected Site Configuration Control, it designates that CTP calculations should net out all demand for the part against all expected supply within the part's lead time to determine whether an order can be filled on the requested shipment date. For purchased parts, it uses the Lead Time field in the Purchasing pane located in Part. If cleared, CTP does not honor the lead time window defined for the part and may possibly over promise available inventory.
- **Buy to Order** - If the Buy To Order check box has been selected for a sold part in the Order Entry, the sold item is included in Capable to Promise. This ensures that the appropriate lead time can be quoted to the customer, and is included in the order promising for the sales order delivery date.

  If a Buy To Order part is being processed, the setting of the Raise POs on CTP Confirmation check box in Company Configuration affects what happens when you select Confirm.

  - If this check box has been selected for this company, it calculates the completion date for the item, and generates firm purchase orders for BTO sales order releases. The jobs and the revised schedule are then added to the database.
  - If this check box has been cleared for this company, it generates actual purchase order suggestions for BTO sales order releases.

The settings of the PO Line Taxable and Ready for Processing check boxes in Company Configuration have the following impact on purchase orders generated for Buy To Order parts:

- The PO Line Taxable check box works within a structured processing hierarchy, involving the associated purchase line part and supplier, to set the default value for the Taxable check box for purchase order detail lines generated for Buy To Order parts.
- If the Ready for Processing check box has been selected for the associated company, it designates that inclusive and exclusive taxes are automatically calculated when you approve purchase orders (with taxable purchase order lines) generated for Buy To Order parts.

- **Planning Contracts** - Scheduling/Capable To Promise (CTP) only considers on hand quantities in the planning warehouse/bin location to fulfill demand tied to a planning contract. For example, if a sales order or job material is linked to a particular planning contract, Kinetic reviews the on hand quantities only in the warehouse/bin location defined in Planning Contract Maintenance to see whether the demand can be fulfilled. Kinetic ignores any other warehouses/bins that the item may be stored in.
  - When a sales order release is marked as Buy To Order and is linked to a planning contract, the PO suggestions or purchase order line created upon confirmation (depends on a Company Configuration settings) is linked to the planning contract.
  - When a sales order release is marked as Make Direct and is linked to a planning contract, the CTP displays the same dates as if the user was creating a job manually in Job Entry.
- **Sales Kit Processing** - The Sales Kitting functionality allows you to sell a part type that contains a series of related parts called a sales kit. These part records define the individual component parts needed to complete the kit. A sales kit is sold using a single detail line on a sales order.
  - **Sales Order Line Sales Kit Items** - As the sales order is processed, the component part quantities needed to satisfy each kit are manufactured and pulled from your stock in the quantities required to complete the final sales kit quantity.
    - The parameters you define in Part designate how Kinetic should process kit updates, shipping, and pricing. The Must Ship Kit Complete check box indicates if the parent kit part must be shipped complete or if individual kit components can be shipped in varying degrees of completeness.

      When selected, it designates that all the components of the kit need to be shipped at the same time and need to match the quantity of the kit parent item. The sales order line closes only if all the parts have shipped at one time.

If this check box is cleared, Kinetic allows individual components of this kit to be shipped separately and invoices them as individual sales order lines.

- In the Sales Order, if you select the Ship Lines Complete check box, designates that all the order line releases must ship at the same time. If this check box is clear, each order release can be shipped when it is ready to go.

For calculation of an accurate completion date for a selected order release with a kit parent and kit child lines, CTP always considers the Must Ship Kit Complete and Ship Lines Complete check boxes as selected, even if they have been cleared. In essence, it assumes that all of the components of the kit must be available to be shipped at the same time for calculation of an accurate complete date. To perform this calculation, it then uses the same standard logic it uses for non-kitted items.

If a kit component is manufactured and has Multi Level CTP selected, and insufficient stock is available, processing occurs based on the settings of the Make To Order and Make To Stock fields in the Site Configuration:

- If set to Create Firm Job, a firm job is created for the kit component.
- If set to Create Unfirm Job, an unfirm job is created for the kit component.
- If set to No Job, no job is created for the kit component.

You cannot select Multi Level CTP on the kit itself, only on its manufactured components.

- **Demand Schedule Sales Kit Items** - The following takes place when demand schedules containing sales kit items are processed in the Demand Management module:
  - When you manually run CTP from Demand Entry, Kinetic does not attempt to calculate completion dates for demand schedules containing sales kit items because it does not have access to kit component information. It skips these demand schedules and writes an error message to the Error Text field, located in Capable to Promise.
  - When processing demand using the Import EDI Demand Process, or using Demand Entry, demand schedules containing sales kit items are processed, but a warning message is written to the Demand Log indicating that CTP could not be calculated for the sales kit demand.
- **Shipping** - You can determine how the Capable to Promise process should consider shipments. This logic changes depending on which option is selected on the Shipment Options drop-down list:
  - **Ship Partial Quantities** - For stock parts with some quantity available, the existing release consumes this available quantity and a second release is created for the additional back ordered quantity.

    - **Ship Line Complete** - This option will set the available date for the release to the date when the whole quantity can be satisfied.
    - **Ship Order Complete** - This option moves through each order detail line as if the Ship Line Complete option is selected. When all the lines are processed, the calculation finds the furthest out date of any of the lines and then applies that date to all lines.
- **Completion Date Past Order Release Ship Date** - If the completion date calculated by the Capable to Promise functionality is past the Ship By date on the selected order release:
    - The Ship By check box displays as selected.
    - The Days Past Ship By field also displays the number of the days the calculated completion is past the order release Ship By date.
- **Confirmation Logic** - This is the logic used when you confirm use of the dates calculated by CTP for each selected order detail line. To confirm use of the calculated CTP date for a line, you select the Confirm check box. You must make any required adjustments (Projected Start Date, Override Material Constraints, and so on) for the line before you select the Confirm button.

  When you select the Confirm button, the following processing takes place:

    1. If the demand is for a Manufactured Non-Stock part, or a Manufactured Stock part, the Multi Level CTP check box is selected (true) and insufficient stock is available, the following processing takes place when you select the Confirm button, based on the settings of the Make To Order and Make To Stock fields in Site Configuration Control:
        - If set to Create Firm Job, a firm job is created.
        - If set to Create Unfirm Job, an unfirm job is created.
        - If set to No Job, no job is created.
    2. The associated jobs are rescheduled backward, using the calculated Completion Date.
    3. An actual job number is assigned, without the CTP prefix.
    4. The sales order line is updated with the new Ship Date.
- **Multi Level CTP** - The Multi Level CTP check box in Capable to Promise indicates the processing CTP should perform when it determines that there will be insufficient supply for manufactured stocked parts or manufactured kit components (within a kit) on an order release. The default for this check box comes from the setting of the Multi Level CTP check box for the part/site in Part.

  If the Make Direct check box has been selected for the order release in Order Entry, the Multi Level CTP check box in Capable to Promise is automatically selected and cannot be modified, regardless of the default setting you designated for the part/site. If the Make Direct check box has been cleared in the order

release, you can override the default in the Multi Level CTP check box for individual CTP sessions.

You cannot select the Multi Level CTP check box for kits. You can only select the Multi Level CTP check box for kit components within a kit.

1. If the Multi Level CTP check box is cleared, and there is insufficient supply available to cover the demand for the part, CTP calculates the completion date for the ordered item or kit component as the Proposed Start Date plus the Manufacturing Lead Time for the part, factoring in the shop floor open/closed days defined in the associated production calendar. In this case Lead Time displays in the Source field in Capable to Promise.
2. If the Multi Level CTP check box is selected, there insufficient stock is available and the part or kit component quantity needs to be manufactured, the following processing takes place when you select the Confirm button, based on the setting of the Make To Stock field in the Site Configuration Control:

    - If set to Create Firm Job, a firm Make to Stock CTP job is created for the outstanding unfilled amount (for the difference between the ordered quantity and the amount available for fulfilling the demand). The Completion Date is set as the date that the Scheduling engine calculates for the number of pieces being manufactured. If the Make Direct check box has been selected for the order release, it creates a Make to Order CTP job, with the same completion date.
    - If set to Create Unfirm Job, an unfirm Make to Stock CTP job is created for the outstanding unfilled amount (for the difference between the ordered quantity and the amount available for fulfilling the demand). The Completion Date is set as the date that the Scheduling engine calculates for the number of pieces being manufactured. If the Make Direct check box has been selected for the order release, it creates a Make to Order CTP job, with the same completion date.
    - If set to No Job, no job is created.

    For kit components, when jobs are created through the CTP process, a job is created for each manufactured kit component that has the Multi Level CTP check box selected and has insufficient supply to fulfill the order. For example, if a kit contains three manufactured items that have the Multi Level CTP check box selected and do not have sufficient supply, the CTP process creates three jobs, one for each kit component that must be manufactured to complete the kit and fulfill the order.

3. If insufficient stock is available and the part quantity needs to be manufactured, the Multi Level CTP check box is cleared (false), a job is not created; the part Lead Time and Receive Time settings are used to determine the day that it can be available.

- **CTP in a Multi-Site Environment** - The Capable to Promise (CTP) calculation determines the date by which a sales order quantity can be delivered (promised) to the customer. These dates are calculated for a current order selected within Order Entry. Jobs are then created for the demand calculated through this functionality - and these jobs can then be incorporated into the schedule.

  CTP calculations are based on the sales order release site; this can be the current site to which the user is logged into when creating a sales order line.

  For example, Site Alpha needs to stock Part 567-89K - it can be sold as an individual item to a customer, and can also be used as material for another part it manufactures. You manufacture Part 567-89K internally within Site Beta.

  - In Part, you create a part-site detail record for Site Beta, entering the MRP details you need for this part.
  - You then create another part-site detail record for Site Alpha. In the Type field, you indicate that this is a Transfer part. You then indicate that Site Beta will be the source for Part 567-89K.

    Within the Transfer Lead Time field, you also define that it usually takes 3 days to receive part quantities from Site Beta. You then enter a Minimum On-Hand Quantity value of 100. When the On-Hand Quantity at Site Alpha becomes 99 or less, the MRP engine will generate both a transfer order suggestion and an unfirm job for Part 567-89K.

Examples

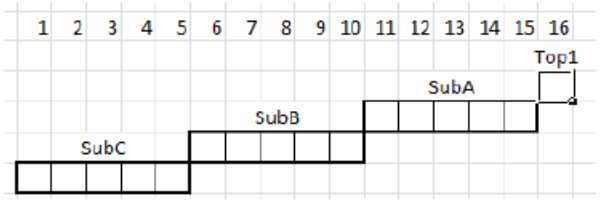
The following example(s) illustrate how you use the Capable to Promise functionality.

- **Example #1** - Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.
- **Example #2 (Recalculating the Pull Quantities)** - The top part in an assembly has three sub parts. The following is true:

  - The Top Part is called Top1. The operations to produce 10 pieces of this part take one day. To complete this part, you need 10 pieces of subassembly Sub_A.

- Sub_A is a subassembly. The operations to produce 10 pieces of Sub_A take 5 days. Each Sub_A needs a subassembly Sub_B.
- Sub_B is a subassembly. The operations to produce 10 pieces of Sub_B take 5 days. Each Sub_B needs a subassembly Sub_C.
- Sub_C is a subassembly. The operations to produce 10 pieces of Sub_C take 5 days.

Imagine today is August 1st. The typical schedule, assuming we have no stock or supply on hand, would be the following:



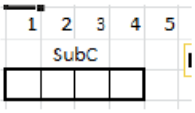
So an order for 10 pieces of Top 1 would be finished by August 17th.

Now imagine the following:

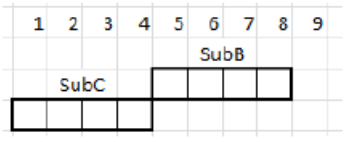
- We need the order complete by August 12th.
- We have a purchase order for 2 pieces of Sub_A on August 2nd.
- We have another purchase order for 6 pieces of Sub_A on August 8th.

The scheduler schedules the job normally, backwards from August 12th. From the rough cut schedule, he knows that the jobs don't fit. However, Kinetic bounces the job forward and recalculates the pull quantities.

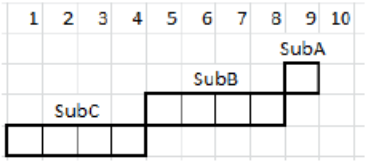
Starting with Sub_C today (August 1st), he has none ready. There is no Pull Quantity. He schedules Sub_C for 4 days to make 8 pieces, finishing on August 5th.



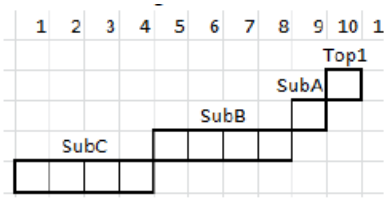
Using August 5th, Kinetic calculates the Pull Quantity for Sub_B. We need 8, but none are available. There is no Pull Quantity, so he schedules Sub_B for 4 days, finishing on August 9th.



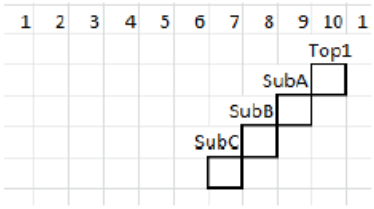
Using August 9th, Kinetic calculates the Pull Quantity for Sub_A. He requires 10, but he already has a Pull Quantity of 8 because he has received these items on purchase orders. He updates the Pull Quantity to 8, and changes the required quantities of Sub_B and Sub_C to only 2. As they were already scheduled, he need to reschedule with the new quantities after this run. He continues scheduling the operations to make just 2 pieces of Sub_A, which will take just 1 day when an end date of August 10th.



Using August 10th, he schedules the operation for the Top1 part. The Pull Quantity is not calculated for this. The end date is August 11th.



Using the end date of August 11th, everything is rescheduled backwards. This time, only the new required quantities (2 for Sub_B and 2 for Sub_C) are scheduled. The resulting schedule is as follows:



CTP calculated an on-time completion date for the sales order.

End Date

The End Date is the date when job work will finish. The scheduling engine always tries to place the Start Date and End Date as close together as possible on the production calendar.

By default, the Required By Date you enter on the job header is used to calculate the Start Date and End Date. The Start Date is an estimated value based on the job method; the Due Date is the Required By Date.

You can use Backwards Scheduling to enter the End Date manually to calculate a new Start Date, or Forward Scheduling to enter the Start Date manually to calculate a new End Date.

Modifiers

The following section describes the End Date values you can change.

These are the values you can modify for this item:

- If you use Forward Scheduling, you can either use the default Start Date or manually enter a new Start Date value. The engine will move forward through the schedule to arrive at the End Date that is closest to the Start Date.
- If you use Backwards Scheduling, you can either use the default End Date or manually enter a new End Date value. The engine will move backwards through the schedule to arrive at the Start Date that is closest to the End Date.

Location

You can access the End Date functionality through the following locations.

- **Job Entry** - You use Job Scheduling to schedule a job.
- **Job Scheduling Board** - Within this scheduling board, you can define the End Date (Due Date) on Move Job panel. The Move Job panel displays when you manually select and drag a job on to the scheduling board.
- **Resource Scheduling Board**- Within this scheduling board, you can define the End Date (Due Date) on the Move Job panel. The Move Job panel displays when you manually click and drag an operation on to the scheduling board.
- **Multi-Resource Scheduling Board** - Within this scheduling board, you can define the End Date (Due Date) on the Move Job panel. The Move Job panel displays when you manually click and drag an operation on to the scheduling board.

Logic

The End Date functionality uses this logic to calculate its results.

- When Backwards Scheduling, you enter the End Date value manually.
- End Date (Forward Scheduling) = Start Date + Assembly 0 Time + Assembly 1 Time + Assembly 2 Time + and so on...

Examples

- **Backwards Scheduling** - You will backwards schedule Job 5421. This job method has four assemblies, two of which are peer assemblies that are run concurrently. By calculating the Operation Times within each assembly, the engine defines the required times:
    - Assembly 0-3 Days
    - Assembly 1 and 2 (Peer Assemblies) - Assembly 2 is the longest assembly; it will take 4 days to complete.

- Assembly 3-5 Days
- Your Receive Days value is 2.

The Required By Date on Job 5421 is August 17. The scheduling engine calculates an End Date of August 15. Now the engine determines the working days on which each assembly needs to begin (accounting for any non-working days in the schedule):

- **Assembly 0** - August 13
- **Assembly 2 (Longest of the Peer assemblies)** - August 7 This value takes into account the two non-working days for the weekend.
- **Assembly 3** - July 31 This value takes into account the two non-working days for the weekend.

The scheduling engine calculates that the Start Date for Job 5412 will be July 31.

- **Forward Scheduling** - You will forward schedule Job 8724. This job method has four assemblies, two of which are peer assemblies that are run concurrently. By calculating the Operation Times for operations within each assembly, the engine defines the required times:

  - **Assembly 0** - 3 Days
  - **Assembly 1 and 2 (Peer Assemblies)** - Assembly 2 is the longest assembly; it will take 4 days to complete
  - **Assembly 3** - 5 Days

  You enter a Schedule Start Date value of August 1. The scheduling engine moves forward from this date to calculate the End Date. It begins by starting the first assembly tomorrow, which is the day after the Schedule Start Date. These are the dates:

  - **Assembly 3** - This assembly will end on August 8. This value takes into account the two non-working days for the weekend.
  - **Assembly 2 (Longest of the Peer assemblies)** - This assembly will end on August 14. This value takes into account the two non-working days for the weekend.
  - **Assembly 0** - August 17

  The scheduling engine calculates that the End Date for Job 8724 will be August 17.

Finish to Finish

Finish to Finish is a scheduling relationship that defines how two operations interact with each other. By using this relationship, you indicate that these two operations will finish at about the same time.

This relationship is useful for related operations where the first, or predecessor, operation has a much longer production time than the second, or subsequent, operation. This method assumes that the subsequent operation can start when there are enough units complete on the predecessor operation. As more units are completed on the first operation they are moved to the second operation, which lets both operations finish at about the same time.

The key to Finish to Finish scheduling is that the subsequent operation must never run out of parts. The overlap batch of parts sent to the subsequent operation must be large enough to prevent it from stopping once it has started production.

Modifiers

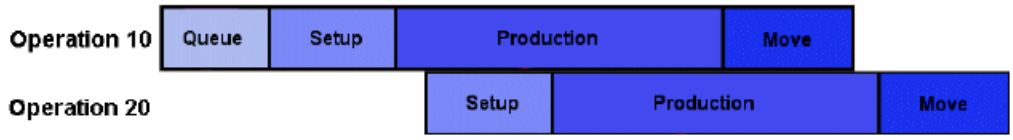
- **Finish to Finish** - You select the Finish to Finish scheduling relationship on the Operation card while engineering quote, part, and job methods. This modifier lets you define the relationship you will use for each operation on the method.

Location

- **Engineering Workbench**- You can select the Finish to Finish option within the Method of Manufacturing on the Operation card.
- **Job Entry** - You can select the Finish to Finish option on the Operation card.
- **Opportunity/Quote Entry** - You can select the Finish to Finish option on the Operation card.

Logic

When you use the Finish to Finish relationship, the Queue Time value on the subsequent operation's resource is ignored. This is illustrated below:



Example

You have a Drill operation that takes 5 minutes per piece to complete. It is followed by a Countersink operation that takes 1 minute per piece to complete. The Finish to Finish relationship is perfect for this situation.

If the Setup on the second Countersink operation can be finished before the parts arrive from the Drill operation, you can finish most of the parts at the Drill operation and then send them to the Countersink operation. Then you can complete the remaining parts at the Drill operation before the Countersink operation is complete.

These are the values that you use for these operations:

- **Job Quantity** - 100
- **Drill Operation** - 5 Minutes/Piece or 500 minutes production time for this operation.
- **Countersink Operation** - 1 Minute/Piece or 100 minutes of production time for this operation.

When you use the Finish to Start relationship, these operations will run one after the other and the total production time will be 600 minutes, or 10 hours.

If however, you use the Finish to Finish relationship, the Drill operation can first produce 80 parts at 5 minutes/piece. The 80 part quantity will take 400 minutes to run. Now these 80 parts are moved to the Countersink operation where they will take 80 minutes to complete. At the same time, however, the remaining 20 parts are being processed at the Drill operation. These 20 parts can then be moved to the Countersink operation at about the same time that the original 80 parts are complete.

Using the Finish to Finish relationship, you will remove 100 minutes from the schedule.

Finish to Start

Finish to Start is the default operation relationship used by the scheduling engine. This relationship assumes that the first, or predecessor, operation must be complete before work can begin on the second, or subsequent, operation.

Modifiers

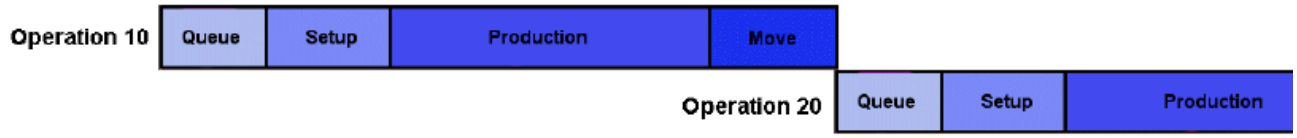
- **Finish to Start** - You select the Finish to Start relationship on Operation - Details card while engineering quote, part, and job methods. This lets you define the relationship you will use for each operation on the method.

Location

- **Engineering Workbench** - You can select the Finish to Start option within the Method of Manufacturing on the Operation card.
- **Opportunity/Quote Entry** - You can select the Finish to Start option on the Line Details card.

Logic

The Finish to Start logic looks like the following illustration:



Example

You have a Drill operation that takes 5 minutes per piece to complete. It is followed by a Countersink operation that takes 1 minute per piece to complete. You decide to use the Finish to Start relationship for these operations.

These are the values that you use for these operations:

- **Job Quantity** - 100
- **Drill Operation** - 5 Minutes/Piece or 500 minutes production time for this operation.
- **Countersink Operation** - 1 Minute/Piece or 100 minutes of production time for this operation.

  When you use the Finish to Start relationship, these operations will run one after the other and the total production time will be 600 minutes, or 10 hours.

Finite Capacity

The Finite Capacity calculation logic does not allow load to be scheduled if it exceeds a resource's available capacity. If a resource's capacity is fifteen hours per day, for example, only fifteen hours of load will be assigned to the resource.

Finite scheduling also takes into account any required, or constrained, materials that the operation needs. If these materials are not available, load will not be assigned to the resource.

Using this calculation logic, the scheduling engine attempts to place as much load as possible into a resource's earlier capacity. As long as both the constrained materials and the capacity are available, a scheduling block will be assigned at this point in the schedule.

Another consideration used by this logic is that the scheduling engine must find available capacity that is large enough to handle the load. If an operation needs one hour of setup time and six hours of production time, the operation's scheduling block must be assigned to the resource at a point when seven hours are available.

If there is not enough time available when the operation needs it, the scheduling engine moves the scheduling blocks forward until it finds capacity that contains both the scheduling blocks and the constrained material. Typically this move makes the job late (after the Required By Date), as other operations on the job might also be forced to move out.

Logic Purpose

Using this calculation logic guarantees that no resources will be overloaded during any time period. The main drawback to this method however, is that scheduling orders into the future will cause a job's Required By dates to be missed, which causes the production and shipping schedules to become late as well.

These are the pros and cons to using the Finite method:

Pros	Cons
No resource that is defined as finite will be overloaded.	Other resources that are not selected for Finite Capacity might become overloaded.
Kinetic automatically decides where to place operations based on the	Large gaps can appear within the schedule. Large gaps can appear within the schedule.

Pros	Cons
Required By date and Priority values. The Finite Capacity calculation can run while you are in What-If Mode.	When you change a job's Required By date, you can cause all job schedules to change.

Modifiers

- **Finite Capacity (Resources)** - You indicate that a resource is finite by selecting its Finite Capacity check box. The resource will be finitely scheduled.
- **Finite Capacity (Job Scheduling)** - You indicate that a job will be finitely scheduled by selecting the Finite Capacity check box. The job will be finitely scheduled.
- **Finite Capacity (Move Job)** - While you are changing a job's schedule on a scheduling board, you can select the Finite Capacity check box on the Move Job panel. This causes the scheduling engine move the job using finite scheduling.

Location

- Resource Group Maintenance
- Job Entry
- Global Scheduling
- Job Scheduling Board
- Resource Scheduling Board
- Multi-Resource Scheduling Board

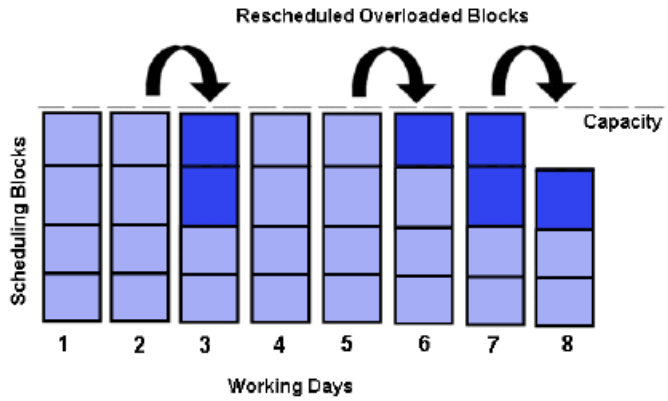
Logic

Finite capacity scheduling does not use Queue Time in its calculations, because Queue Time is considered a result of the schedule, but not one of the inputs required on the operation.

Using finite scheduling, a job is not scheduled to start until a resource is available and there is enough capacity available on the resource. If there isn't enough available capacity, the scheduling blocks are assigned to a different point in the schedule.

Example

The illustration below shows what happens when scheduling blocks are assigned to resources using finite capacity:



Notice that any excess scheduling blocks from the first two time periods are moved into the available capacity within the third period.

Then the excess scheduling blocks from the fourth time period are moved into any future working days that have available capacity available. The available capacity on the fifth working day is too small, but there is available capacity on the 6th, 7th, and 8th days.

Forward Scheduling

Forward Scheduling is logic used by the scheduling engine to calculate the length of time it will take to complete a job.

This logic begins with the Start Date on the job and then moves forward through the Production Calendar used at the resource, resource group, site, or company, and uses the lengths of time required on each operation (Operation Time) - taking into account any operations that can run concurrently (peer assemblies) - to arrive at the End Date.

If the resulting End Date is later than the job's Required By Date, a warning message will display.

Modifiers

- **Allow Scheduling Before Today** - If this check box is selected within Company Configuration, the scheduling engine lets you enter a Start Date for a job before the current system date.
- **Global Reschedule Started Operations** - This is a rescheduling routine option. If this check box is selected within Company Configuration, the scheduling engine will let operations that have labor reported against them be rescheduled. It does this by rescheduling the remaining time that is left to complete the operation.

Location

- Job Entry
- Job Scheduling Board

- Resource Scheduling Board
- Multi-Resource Scheduling Board

Logic

- Operation Time = Queue Time + Setup Time + Production Time + Move Time
- End Date = Start Date + (Operation One Time + Operation Two Time + Operation Three Time and so on)

Example

You will forward schedule Job 8724. This job method has four assemblies, two of which are peer assemblies that are run concurrently. By calculating the Operation Times for each assembly, the engine determines the required times:

- **Assembly 0** - 3 Days
- **Assembly 1 and 2 (Peer Assemblies)** - Assembly 2 is the longest assembly; it will take 4 days to complete.
- **Assembly 3** - 5 Days

You enter a Scheduled Start Date value of August 1. The scheduling engine moves forward from this date to calculate the End Date. It begins by starting the first assembly tomorrow, which is the day after the Scheduled Start Date. These are the dates:

- **Assembly 3** - This assembly will end on August 8. This value takes into account the two non-working days for the weekend.
- **Assembly 2 (Longest of the Peer assemblies)** - This assembly will end on August 14. This value takes into account the two non-working days for the weekend.
- **Assembly 0** - August 17

The scheduling engine calculates the End Date for Job 8724 will be August 17.

Global Scheduling

The Global Scheduling calculation process lets you schedule all of your open engineered jobs using either Finite Capacity or Infinite Capacity logic. Finite Capacity logic does not allow load to be scheduled if it exceeds a resource's available capacity.

Infinite Capacity uses the reverse logic, it allows load to be scheduled above the resource's available capacity.

To use this function, you enter a Scheduled Start Date and then define whether the jobs will be finitely scheduled or infinitely scheduled.

You will typically use Global Scheduling to schedule your jobs, because it leverages all the functionality within the scheduling engine. You can set up this process to run on an recurring schedule, which lets the scheduling engine update job schedules regularly.

- **Priority Values** - Because the open, engineered jobs are being scheduled at the same time, the scheduling engine evaluates the Priority value assigned to each job to determine which jobs should be scheduled ahead of other jobs.
- **What-If Mode** - Typically you will want to globally schedule jobs in What-If mode, which lets your planners review how the rescheduled jobs will affect the overall schedule. If the planner decides that a schedule will work, the What-If schedule can be accepted and placed within the actual schedule.
- **Allow Scheduling Before Today** - If this check box is selected within Company Configuration, the Global Scheduling process will be able to calculate a Start Date that is before the Scheduled Start Date value. Setting this option prevents the Bounce Condition logic from automatically rescheduling the job using Forward Scheduling.
- **Locked Jobs** - You can prevent Global Scheduling from moving a job by selecting its Locked check box. This value is found in the Scheduling Priority group box on each job header.
- **Global Scheduling Process Order** - The Global Scheduling process is divided into three components. You must run these components to globally schedule your jobs. This is the order:

  1. **Calculate Global Scheduling Order** - Each time this process is run, it will select any job that is a candidate for the Global Scheduling process. It will forward schedule each job using the infinite capacity calculation. These jobs will be assigned a job priority sequence; the Global Scheduling process will use the sequence to finish the scheduling process.
  2. **Adjust Global Scheduling Order (optional)** - This is an optional component you can run. Launch this app to review the job priority sequence that was generated by the Calculate Global Scheduling Order process. You can use this app to change the sequence in which these jobs will be scheduled.
  3. **Global Scheduling** - This is the process that is described above.

  Note that if you want the Calculate Global Scheduling Order and the Global Scheduling processes to run automatically, you can assign them both to a Process Set. Make sure you run the Calculate Global Scheduling Order process before the Global Scheduling process.

Modifiers

- **Automatic Processing** - Global Scheduling is a process, so you can set up this app to run using an automatic, recurring schedule. You create a daily, weekly, monthly, or yearly schedule within System Agent Maintenance. You can select the schedule from the Scheduling drop-down list and select the Recurring check box. Each time Kinetic clock encounters this schedule, the Global Scheduling logic will run automatically.
- **Log File/Log Level** - To track how the scheduling engine runs, you create a log file. You must define both a name and a directory path for the log. Note that the Log Level drop-down list lets

you define which information will display within the log. These are the options:

  - **Basic** - The log will display the Start Date and Start Time with the number of schedulers (processors) that were run. The log displays when each processor finished and if any errors occurred during the process.
  - **Process** - This log displays the Basic information described above. It also includes a log for each scheduler that displays the jobs that were scheduled.
  - **Process and Scheduling** - This log displays the Basic and Process information described above. It also includes a detail log that displays how each operation was scheduled, including constrained materials and the finite capacity used against each resource.
- **Number of Processors** - This value defines the number of scheduling runs that will be started to complete the schedule processing. This feature improves performance becuase you can split one large scheduling process into smaller, multiple processes. You can enter a value from 1 to 99. Note that the first scheduler always handles finitely scheduled jobs. If the site does not have a Finite Horizon (a 0 value) and the resource is set to Finite Capacity, jobs will be scheduled only through the first scheduler. The remaining schedulers are not needed. If your manufacturing center uses finite calculations, enter a 1 in this field.
- **Process Finite** - If you want the jobs to be rescheduled using Finite Capacity, select the Process Finite check box. When this check box is clear, the jobs are rescheduled using Infinite Capacity.
- **Scheduled Start Date** - The date that will be used to globally schedule your open, engineered jobs.
- **Scheduled Start Time** - The time from which you want to globally schedule your jobs. The default value is 12:00 AM, which is the beginning of the day selected on the Scheduled Start Date field.
- **What-If Schedule Only** - Select this check box to indicate that the jobs will be rescheduled in What-If mode.

Location

- Calculate Global Scheduling Order
- Adjust Global Scheduling Order
- Global Scheduling

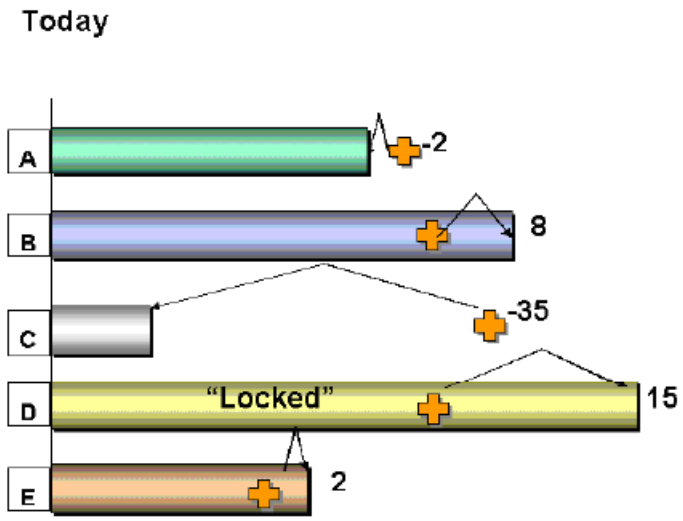
Logic

1. **Scheduling Order**

   First, the scheduling engine needs to determine the order in which jobs are selected for scheduling. These are all the jobs that are currently open on the Scheduled Start Date out into the future. The order in which these jobs are scheduled is calculated using the Priority selected on each job.

This priority order is determined by running the Calculate Global Scheduling Order process before you run the Global Scheduling process. You cannot run Global Scheduling without generating the priority order. If you need to change the sequence in which these jobs will be globally scheduled, use the Adjust Scheduling Order to arrange the jobs in the correct sequence.

The routine reschedules all open jobs using Infinite Capacity logic to calculate the number of days late (or early). The job that is the earliest (or least late) becomes the benchmark. The following illustration shows how the process works:



The numbers after the bars represent the number of days late or days early (negative). The earliest (or least late) job becomes the benchmark; its number of days late (early) is used to adjust all other job dates. Specifically, the scheduling engine calculates the "shifted days late" based on this benchmark days late by adding (if negative) or subtracting this value from the days late for all jobs.

In the above graphic, job "C" is the benchmark. It is the earliest of all jobs. This job becomes the least important because it is so far ahead of schedule that it can be delayed 35 days and still finish on time. By adding 35 to this job's "earliness" value, the scheduling engine computes a shifted days late of zero (0). But a zero value will not let us include the job priority in the calculations, so the scheduling engine adds 1 to this value. Because of this, the calculation for Shifted Days Late becomes...

Job Earliness (Lateness) + 35 (benchmark value) +1

...and the Shifted Days Late for job C becomes one (1).

To include the impact of the job priority, multiply the Shifted Days Late by the Priority Factor in the Scheduling Priority Code. Assuming a factor of 100, the calculation now becomes 100. The following table shows the calculations for all jobs:

Job	Days Late/Early	Shifted Days Late	Priority Factor	Weighted Priority
A	-2	34	100	3400
B	8	44	110	4840
C	-35	1	100	100
D	15	51	120	6120
E	2	38	90	3420

Ranking the weighted priority from highest to lowest shows that job D has the highest priority and would be selected first for scheduling. Job D would be followed by jobs B, E, A, and C in that order.

2. **Schedule Around Locked Jobs**

   The second phase of Global Scheduling logic is to schedule around locked jobs, and place the movable jobs into the remaining available capacity. In the above example, job D is locked. The scheduling engine makes sure that any job designated as Locked will not be changed.

3. **New Operation State Dates and End Dates**

   Now the logic calculates the Start Date and End Date for all operations. Its does this by attempting to place scheduling blocks (load) against the resources that have available capacity closest to the job Start Date.

   If available capacity cannot be found near the Start Date, the logic attempts to place the scheduling blocks into available capacity within an earlier time period. If the logic cannot do this, it then pushes the scheduling blocks into the future until it can find available capacity on the resource.

   When a job has a priority code that uses the Minimize WIP calculation, the scheduling engine will run another pass over the job schedule. If it discovers that the Start Date on a job will occur before the Scheduled Start Date, the engine will use the Bounce Condition to forward schedule the job. After the new End Date is calculated for the job, it will then backwards schedule from that date, tightening the points where the assemblies are placed within the schedule.

4. **Copy Final Schedule**

   The logic's last phase copies each job's Start Date and End Date to create either a What If Schedule (if this option is selected) or the actual schedule.

Example

Your company uses the MRP module. To help your planners keep track of the jobs suggested by this module, you set up Global Scheduling to run every Monday morning. You also indicate that the process should display its results in What-If mode, so that the planners can accept or reject this tentative schedule.

Hours Per Resource

This value defines how much time a resource is available for production each day. The scheduling engine calculates this value by pulling the number of hours selected for production on each working day. This information is taken from the production calendar.

Modifiers

- **Production Calendar** - These records define how many hours are available for production each working day. You can select a production calendar on each resource. Note that the scheduling engine will use a calendar selected for a resource first, a resource group second, a site third, and a company last.

Logic

- Hours Per Resource = Number of Hours Per Working Day
- **Finite Capacity Calculation** - This value is used to determine how much load can be assigned to each resource during each work day. If the load is higher than a resource's capacity for that day, the load is moved to a different working day.
- **Infinite Capacity Calculation** - This value is used to determine how much load can be assigned to each resource during each work day. If the load is higher than the resource's capacity, it is still assigned to the resource. The resource is overloaded, and the planner will need to resolve the capacity bottleneck.

Location

- **Resource Group Maintenance** - You can select a calendar at either the resource level or the resource group level. You can also define exceptions to the selected calendar that are needed at either the resource group or the resource level.

Example

- If an operator is not required on a machine, for example, that machine might be available twenty-four hours per day.
- If an operator is required, the available hours must be equal to the number of hours of that the operator is available. The Hours Per Resource value is limited by the production calendar selected on the operator.

Infinite Capacity

The Infinite Capacity calculation allows more scheduling blocks (load) to be placed against a resource even if the load exceeds the resource's capacity. This can cause resources to become overloaded.

For example, if a resource's capacity is fifteen hours per day, but twenty hours of load are required on a specific work day to meet the job's End Date, the capacity is ignored and the resource will have twenty hours of load placed against it.

This method also suspends other calculations that limit capacity. If additional scheduling blocks were previously assigned to these resources on the same working day, these blocks are ignored by the scheduling engine. Job Priority codes are also ignored.

Please note, however, that the scheduling engine still considers constrained materials during this calculation. If the engine discovers that a constrained material cannot be issued to the operation at a specific time, it will locate the next time when this material is available.

Logic Purpose

This calculation logic creates the best possible schedule, which you may want in some situations. For example, this calculation logic can help you find resources that are causing bottlenecks in your production workflow. It can also help you decide the best way to push a job for a good customer quickly through your production workflow. The results of this scheduling logic can help you determine the how to increase the capacity of your manufacturing center.

There are two choices for handling overloaded capacity: either decrease the load or increase the capacity. There are several ways to increase capacity, like running overtime hours, adding another shift, or working additional days. If it is possible, adding more resources to a resource group can also reduce overloaded periods in the schedule. Load can be decreased by moving it to another resource that has available capacity. You might be able to correct overloading by combining jobs that have similar setup requirements; the time saved by eliminating the Setup Time can be used for Production Time.

Pros	Cons
Information on both overloaded and under-loaded resources is easy to display.	Resource loads are not leveled automatically by this calculation logic.
The Planner makes all the final scheduling decisions.	This method causes more manual work for the Planner.
When you change a job's dates, it does not cause problems within the schedule.	This calculation relies on the Queue Time to allow for irregular arrival times at resources.

Location

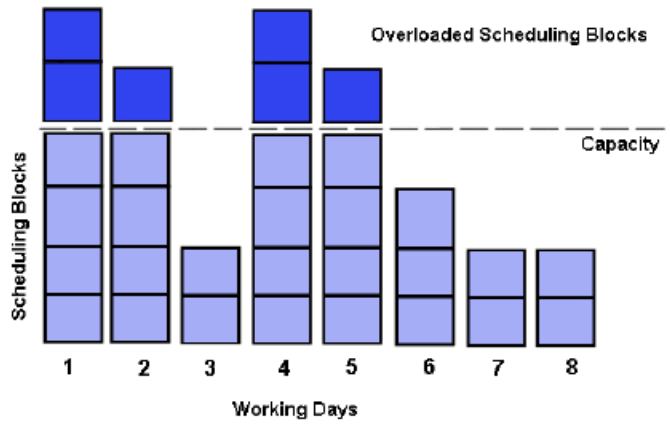
- **Resource Group Maintenance** - A resource is considered infinite when its Finite Capacity check box is clear.
- **Job Entry** - You schedule individual jobs through the Schedule Jobs panel.
- **Global Scheduling** - The Global Scheduling process can be set up to run using Infinite Capacity. To do use this setting, do not select the Process Finite check box.

Logic

Infinite scheduling uses Queue Time to separate jobs at a resource. This adds time to account for a part quantity that cannot be immediately placed into production when it arrives at the resource.

Example

When you use the Infinite Capacity calculation, the focus is on determining the amount of capacity that will be needed to meet the load. In order to meet scheduled production Due Dates or sales order Shipment Dates, the load calculations determine the amount of capacity needed, by time period. The following illustration shows what happens:



It is impossible to produce more at any resource in any time period than the resource capacity will allow, so the focus of Infinite Capacity planning is to prevent resources from being overloaded while still meeting Due Dates. The above illustration shows that this resource overloaded in four periods (1, 2, 4, 5), while there is capacity available in other time periods (3, 6, 7, 8). In this situation, you could move the overloaded scheduling blocks to the available capacity.

Overload Scheduling

You run the Overload Scheduling calculation when you want to evaluate how much of each resource's potential capacity is being used on each day. You define a future date range on which you want this daily percentage value calculated against each of your resources.

This calculation is only evaluated against infinitely scheduled demand so that you can find out at which points in the near future a resource is over its capacity. You then view the results of this calculation through the Overload Informer, a tracker that displays the Daily Percentage Capacity value. The capacity used on each resource per each day appears, indicating when a resource is below capacity (such as 72%), at capacity (100%), and above capacity (such as 117%). You use this tracker to evaluate where potential bottlenecks may occur within the near future. You can then adjust your short-term scheduling needs to correct these bottlenecks. Any demand placed on resources outside of this Overload Horizon date range are not included in this calculation.

On each site record, you indicate the future point (in days) at which resource capacity is calculated against the demand that falls on or before this date range. Any demand record that falls on or before this date range back to the current system date is scheduled with infinite capacity, while any demand record outside of this range is ignored. Each resource is then evaluated against the potential overload that may occur on each day.

A tracker app, the Overload Informer, then displays the capacity used on each resource per day, indicating when a resource is below capacity (such as 72%), at capacity (100%), and above capacity (such as 117%). Only resources scheduled with infinite capacity display on this tracker. Any demand placed on a future date that does not fall within this range is not included in the overload calculation.

The Overload Scheduling calculation differs from the Rough Cut Scheduling calculation, as it determines when each resource is potentially over its production capacity on a specific date. In contrast, Rough Cut Scheduling uses the date values to determine the Start Date and End Date for each job. Each calculation formula, however, infinitely schedules the jobs that fall within its horizon date range.

Modifiers

- **Overload Horizon** - Enter a value, in days, during which you want the overload calculation to run. Any demand scheduled with infinite capacity placed on or before this date is evaluated. The daily percentage capacity used on each resource during each date within the range is calculated; this value displays in the Overload Informer.

Using Non-Time Constraints

The scheduling engine can be set up to account for these quantity-limiting factors. Then the engine will use these values, instead of time, to calculate its results.

For example, you have a Molding operation in your production workflow. It takes one hour to fill the mold with material, so the Non-Time Constraint is the rate at which the molding material flows into the mold. Because of this contraint, only 10 cubic yards of molding material can manufactured each day. That is the non-time constraint within this operation.

The scheduling engine calculates the Non-Time Constraint using values you enter for operation details and resource groups. These values are all considered by the scheduling engine, and it uses them to calculate the job schedules. Non-Time Constraints are constant values and are not divisible by other scheduling factors.

Non-time constraints only work when you use the Finite Capacity calculation against your resources.

- **Modifiers**

    - **Production Consumption Rate** - This value defines the rate that is required to make one quantity on the operation. The value you enter is multiplied against the quantity to calculate the total job capacity. When the Daily Production Capacity for the resource is reached, the scheduling engine considers the capacity consumed for the day. You enter

these values on operation details within job, quote, and part methods.

- **Concurrent Capacity** - This value defines the amount of simultaneous capacity that can occur at the same time on a resource. This value is a non-time constraint that prevents operations from overloading a resource. This is because, at any given point in the schedule, this resource has only this much available capacity. Define this value when you have different operations with items you produce that use the same resource. If this value is defined, the engine adds another modifier in addition to time. When this Concurrent Capacity value is reached, the engine will not schedule additional operations at this resource - even if more capacity or time is available. The engine will then schedule the operation when both time and concurrent capacity are available. You can define Concurrent Capacity on resource records. You then enter the Concurrent Capacity required on operation details within job, quote, and part methods.
- **Daily Production Capacity** - This value defines the amount of non-time units that this resource can produce during a working day. For example, a resource might be able to produce only a 10 quantity of cubic yards of cement per working day, or an oven has only four racks that can be filled per working day. You can enter these values on resource group and resource records.

- **Location**
  - Engineering Workbench
  - Job Entry
  - Opportunity/Quote Entry
  - Resource Group Maintenance
- **Logic**
  - **Daily Production Capacity**
    1. Take the remaining Production Quantity multiplied by the Production Rate to get the total remaining capacity: **d_JobNonTimeCap = bJobOpDtl.DailyProdRate * maximum((bJobOper.RunQty - bJobOper.QtyCompleted), 0)**
    2. Then take the value and divide it by the estimated operation hours. This calculation gives you the Capacity Unit Per Hour: **d_NonTimeCapUnitPerHour = (d_JobNonTimeCap / bJobOper.EstProdHours)**
  - **Concurrent Capacity** - This value is stored in a sub-table to track how many units are used in an hour. When the units equal this value, the engine considers that the resource has reached its full capacity.
- **Examples**
  - **Daily Production Capacity** - You have a Molding operation in your production workflow. It takes one hour to fill the mold with material, so the Daily Production Capacity is the rate at which the molding material flows into the mold. Because of this capacity, only 10 cubic yards of molding material can manufactured each day, which is the Daily Production Capacity of this operation.

- **Concurrent Capacity** - An oven has 4 racks. The 4 racks on the oven can be used simultaneously for the same operation, but once they have been selected for that operation, they are not available until the operation is complete.

  The oven's Concurrent Capacity is set to 4; this is the highest capacity that can be scheduled against this resource during an operation. Likewise, the Concurrent Capacity for the resource on the operation detail is set to 4; this is the number of racks needed for the operation.

  Note that if the operation requires more capacity than the resource can produce, the scheduling engine will display an error message explaining that the resource is overloaded.

- **Concurrent Capacity and Competing Resources** - Operation A needs an oven rack from 1:15 to 3:30. If Operation B is already using 4 racks between 2:01 to 2:15, Operation A will not be scheduled during the requested time slot. If you forward schedule, Operation A will be rescheduled with a new start time of 2:15. If you backward schedule, Operation A will be rescheduled using a new end time of 2:01.

Location

- **Site** - You can define an Overload Horizon for a specific site in Site.
- **Overload Informer** - Use this tracker app to review the capacity of each resource that falls within the Overload Horizon range. The percentage overload capacity is calculated against each resource that falls within the Overload Horizon range.
- **Job Scheduling** - You schedule individual jobs through the Schedule Jobs panel.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs within your database.

Logic

If Demand Date <= Last Date on Overload Horizon and => the system date, include demand record in Overload Capacity calculation.

Example

You want to review the potential bottlenecks that may occur three months in the future. You launch Site and enter 90 within the Overload Horizon field. Each time scheduling is run, the percentage capacity overload is calculated against each resource and each day that falls within the Overload Horizon date range.

You then launch the Overload Informer. Use this tracker to view the percentage capacity placed against each resource. Resources less than 100% are below capacity, while resources higher than 100% are above, or over, capacity.

Production Load

Production Load is the total hours that remain to complete an operation's production. Use this value to measure the progress being made on your current operations.

This value is also used when the engine recalculates the schedule; it lets the engine account for operations that are currently in process.

To arrive at this value, first the scheduling engine calculates the operation's total production load. This value is calculated differently between in-house operations and subcontract operations. If this is an in-house operation, the total hours of Load from the operation is divided by the Number of Resources available in the resource group. If this is a subcontract operation, the Days Out on the operation is multiplied by the Hours Per Resource.

You can measure the remaining load through either the time remaining on the operation or the pieces that remain to be produced. Through either method, however, the Production Load is the estimated time left to complete the operation. As shop employees report either time or pieces against the operation, the Production Load is reduced.

Modifiers

- **Load Relieved By** - These options are located on the Job Configuration card within the Company Configuration app. There are two methods for relieving load. Select Quantity to relieve the load based on the number of pieces reported against the operation. Select Hours to relieve the load based on the number of hours reported against the operation. Most companies calculate the load based on the Quantity remaining.

Location

- **Shop Load Report** - The Shop Load report displays the shop capacity and the load against this capacity. It is as summation of resource's available capacity for the day or week. The ShopLoad table records the load per day of the resource or resource group.
- **Site Schedule Load Graph** - This dashboard displays the load currently placed against the capacity of your company's sites.
- **Resource Schedule Load Graph** - This dashboard displays the load currently placed against the capacity of your company's resources.
- **Overload Informer** - This app displays which resources have load that exceeds their capacity.

Logic

- **Hours Method**
    - Total Production Load = Total Hours/Number of Resources
    - Total Production Load (Subcontract Operation) = Days Out * Hours Per Resource

    - Remaining Production Load (Hours Method) = Total Production Load - Reported Actual Hours
- **Quantity Method**
    - Remaining Quantity = Operation Quantity - Reported Quantity
    - Remaining Production Load (Quantity Method) = Remaining Quantity x Estimated Hours Per Piece

Example

- **Quantity Example**

  You indicate that load is relieved by Quantity. You estimate an operation to take .5 hours per piece for 50 pieces, for a total estimate of 25 hours (.5 x 50). After an employee reports 8 hours and 15 pieces, the load remaining is 17.5 hours (35 pcs left x .5 hrs/pc). Note that the system assumes the remaining pieces will be completed in the time originally estimated.

- **Hour Example**

  You indicate that load is relieved by Hours. You estimate an operation to take 40 hours to complete 100 pieces. After an employee reports 8 hours and 15 pieces, the load remaining is 32 hours (40 hrs total - 8 hrs reported). Note that the reported pieces do not affect this calculation.

Production Standard

The Production Standard is the estimated rate of production for an operation. This value is used by the scheduling engine to calculate an operation's Production Time.

The Production Standard value is multiplied against the Scheduling Blocks value to determine the length of time allocated to each scheduling block. Then the scheduling blocks can be placed against a resource's the capacity.

There are different formats available for this value, so the value you enter for each operation varies depending on the format you select.

You can define an operation's Production Standard on quote, job, and part methods.

You can also define a Production Standard on an Operation Standard. This standard can then be selected on multiple operations, and Production Standard values will become the default on each operation.

Modifiers

- **Fixed Hours** - This format indicates that it will take an operation a set number of hours to complete, regardless of the quantity being manufactured.

- **Hours/Piece** - This format measures how many hours it takes to manufacture a defined part quantity through an operation. When you select this format, you must define the size of the part quantity unit used as the standard rate. The options are: Each, /100, /1000, or /10,000.
- **Minutes/Pieces** - This format measures how many minutes it takes to manufacture a defined part quantity through an operation. When you select this format, you must define the size of the part quantity unit used as the standard rate. The options are: Each, /100, /1000, or /10,000.
- **Pieces/Hour** - This format measures how many parts the operation can manufacture during each hour.
- **Pieces/Minute** - This format measures how many parts the operation can manufacture during each minute.
- **Operations/Hour** - This format indicates how many operations can be run each hour. When you use this Production Standard, you must indicate how many operations are required to produce one part in the Operations Per Part (Opr/Part) field.
- **Operations/Minute** - This format indicates how many operations can be run each minute. When you**Operations/Minute** use this Production Standard, you must indicate how many operations are required to produce one part in the Operations Per Part (Opr/Part) field.

Location

- **Operation Standard** - Use this app to define a series of default options, which you can then apply to all the operations you need.
- **Engineering Workbench** - You can define the Production Standard for a part method of manufacture on the Operation Detail card.
- **Job Entry** - You can define the Production Standard for a job method of manufacture on the Operation Detail card.
- **Opportunity/Quote Entry** - You can define the Production Standard for a job method of manufacture on the quote line.

Logic

- Production Time = Part Quantity/Production Standard

Example

The Mill Machine resource can finish twenty pieces every hour - this includes setup time and production time. On the job operation, this is entered as a Production Standard of 20 pieces per hour. As defined by the production calendar used on the resource group, the Mill operation can run 10 hours every day. So you set up the resource group with a single Mill machine resource and a Scheduling Block value of 1.

You have a Milling operation on a job that needs to finish 200 parts. This will require 10 continuous hours of operation. The scheduling engine assigns 1 scheduling block to the Milling operation.

The scheduling engine calculates this through the following:

- Production Standard = 20 pieces per hour
- 200 pieces/20 pieces = 10 hours; this job requires one scheduling block that equals 10 hours of time
- 1 schedule block x 10 hours = 10 contiguous hours of load that need to be placed against a resource

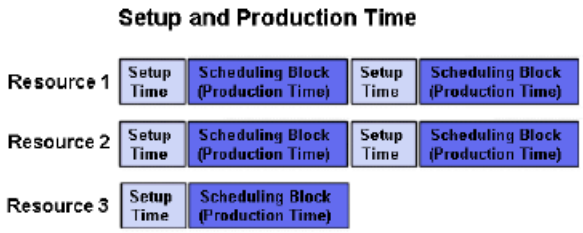
Note that because this operation cannot be split, the quantity manufactured during each scheduling block cannot be divided into fractional values. Only whole number quantities, (in this example 20) can be used to place the load against this resource.

Production Time

Production Time is the length of time its takes to manufacture the part quantity for the operation. The scheduling engine uses this value to calculate the scheduling blocks required to handle the load against the available capacity.

The engine generates this value based on the Production Standard, Operations Per Part, and the number of part quantities being produced. When this amount is multiplied against the number of Scheduling Blocks available at each resource/resource group, the engine determines the number of required scheduling blocks (load) for the operation.

The scheduling engine also places the Setup Time necessary to prepare for the operation in front of the calculated Production Time. This is a constant value defined on each operation detail. When the scheduling engine fits scheduling blocks into the capacity available at a resource, it includes Setup Time in the calculation.



Note that Setup Time and Production Time can be handled by two different resources. In this situation, the Setup Time value you enter on the operation is 0. You then enter the Setup Time within the operation handling the setup task.

Modifiers

- **Production Standard** - This value determines the rate of production for a specific operation. This value is used to calculate the number of pieces you can produce during a specific unit of time. There are a number of formats you can use to measure this rate, including Hours/Piece, Fixed Hours, and Operations/Hour. You can define the Production Standard on each operation within a job method, a quote method, and/or a part method.

- **Scheduling Blocks** - Use this value to indicate how many scheduling blocks are available against each resource within this resource group. The default value is one, which indicates that one scheduling block can be placed against each resource per working day. The higher the number you enter in this field, the more scheduling blocks are available each working day. As you increase the scheduling blocks value, each scheduling block will have a smaller amount of time allocated to it. This field is in several places throughout Kinetic. It is available in Opportuntity/Quote Entry, Job Entry and the Engineering Workbench. It is also found in the Resource Group Maintenance app.

Location

- Job Entry
- Job Scheduling Board
- Resource Scheduling Board
- Multi-Resource Scheduling Board

Logic

- Estimated Production Time = Production Time (JobOper) x Production Factor
- Scheduling Block Time = Production Time/Number of Scheduling Blocks
- If the operation can be split, scheduling blocks will contain the same amount of time.
- If the operation cannot be split, scheduling blocks will be grouped together within the schedule, using the smallest amount of time possible to complete the operation.

Example

The Mill Machine resource can finish twenty pieces every hour - this includes setup time and production time. On the job operation, this is entered as a Production Standard of 20 pieces per hour. As defined by the production calendar used on the resource group, the Mill operation can run 10 hours every day. So you set up the resource group with a single Mill machine resource and a Scheduling Block value of 1.

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- Production Standard = 20 pieces per hour
- 200 pieces/20 pieces = 10 hours; this job requires one scheduling block that equals 10 hours of time
- 1 schedule block x 10 hours = 10 contiguous hours of load that need to be placed against a resource

Note that because this operation cannot be split, the quantity manufactured during each scheduling block cannot be divided into fractional values. Only whole number quantities, (in this example 20) can be used to place the load against this resource.

Rough Cut Scheduling

The Rough Cut Scheduling calculation schedules jobs by using the Need By Dates and Lead Time values on each material and operation to determine how much time is required for each job to finish its operations and gather its materials. This scheduling formula infinitely schedules these future jobs.

This data, or load, is not recorded against your resources, which reduces the processing time needed to generate the overall schedule. Rough cut scheduling also gives you a general idea of the production plan you may require in the future.

You set up this calculation by define a Rough Cut Horizon value on each site record. Any job that is required on or before this date is scheduled using the actual schedule planned for your manufacturing center to both start and finish the operations and gather the materials required to complete each job. Any jobs due after this horizon date, however, are evaluated using rough cut scheduling.

The Rough Cut Scheduling calculation differs from the Overload Scheduling calculation, as it uses the date values to determine the Start Date and End Date for each job. In contrast, Overload Scheduling determines when each resource is potentially over its production capacity on a specific date. Each calculation formula, however, infinitely schedules the jobs that fall within its horizon date range.

Modifiers

- **Rough Cut Horizon** - This value indicates the number of days from the current system date or the Scheduled Start Date (Global Scheduling) used for the horizon. If a job begins on a date greater than the date defined for this horizon, it is calculated using Rough Cut Scheduling. Jobs that fall on or before this date range, however, are scheduled by placing the full load against the available scheduling blocks on each resource.

Location

- Site
- Save Resource Load
- Job Scheduling
- Global Scheduling

Logic

- If Required By Date > (Current System Date + Rough Cut Horizon), then schedule the job using Infinite Capacity and remove the Load required by the operations. Use the Need By Dates and Lead Time values on each material and operation to determine how much time is required for each job.

Example

You enter a Rough Cut Horizon value of 15 on your Blue site record.

Job 5692 is generated by MRP and its quantity will be produced by the Blue site; this unfirm job has a Required By Date of September 27. You automatically generate Global Scheduling every Monday morning. This process is run on the morning of September 10 so this is the Scheduled Start Date for this process run. The final date on the Rough Cut Horizon is September 25. Because the Required By Date on Job 5692 is September 27, it is calculated using Rough Cut Scheduling.

Save Resource Load

Use the Save Resource Load Process to add load back to jobs scheduled outside of the overload horizon. This scheduling method can be used to infinitely or finitely schedule jobs without placing any load against your resources.

To use this process, you first enter a Required By date range. When the process runs, it recalculates all jobs that were scheduled outside of the overload horizon and have Required By Dates within the specified date range. It also allocates load required to produce these jobs against resources.

This process adds the load by writing the load data from the Resource Time Used records of scheduled jobs to the Shop Load table. The Save Resource Load Process accepts entry of date range, reviews scheduling resources available, and restores the load from the Resource Time Used records that were created for the job resources.

Modifiers

- **Automatic Processing** - This function is a process, so you can set up the Save Resource Load process to run using an automatic, recurring schedule. You create a daily, weekly, monthly, or yearly schedule within the System Agent Maintenance app. You can then select this record from the Scheduling drop-down list and select the Recurring check box. Each time the system clock encounters this schedule, the Save Resource Load process automatically runs.
- **Edit List of Jobs** - Check this box if you want to view and edit the list. If the box is checked, click Submit to view jobs in this date range. You can add jobs or delete jobs using the Add or Delete buttons.
- **Number of Processors** - This value defines the number of scheduling runs started on the server to complete the schedule processing. This feature improves performance by splitting a large scheduling process into smaller, multiple processes. You may enter values 1-99. Note that the first scheduler handles finitely scheduled jobs. If the site does not have a Finite Horizon (a 0 value) and the resource is set to Finite Capacity, all jobs are scheduled through the first scheduler. The remaining schedulers are not needed. If your manufacturing center uses these finite calculations, enter a one in this field.

Location

- Save Resource Load
- Shop Load Report
- Overload Informer

Logic

- If a rough cut job has a Required By Date within the defined date range, then add the load to this job and place it within the schedule.

Example

You need to plan the production for a number of jobs that are rough cut scheduled. You run the Save Resource Load app to add the load (scheduling blocks) against the available capacity of the resources used for production.

You then run the Shop Load report to evaluate how these jobs affect your schedule.

Setup Load

Setup Load is the total hours that remain to complete an operation's setup. Use this value to measure progress on your current operations.

This value is also used when the engine recalculates the schedule; it lets the engine account for operations currently in process.

There are a couple factors that automatically reduce the Setup Load to 0 on an operation. If Production Time is started, the engine reduces the Setup Load to 0. If this operation is a subcontract operation, this value is also set to 0.

Location

- Shop Load Report
- Site Schedule Load Graph
- Resource Schedule Load Graph
- Overload Informer

Modifiers

- **Load Relieved By** - These options are located in the Company Configuration app. There are two methods for relieving load:
    - Select Quantity to relieve the load based on the number of pieces an employee reports against the operation. Most companies calculate the load based on the Quantity remaining to produce on the operation.
    - Select Hours to relieve the load based on the number of hours reported against the operation.

Logic

- Remaining Setup Load = Total Setup Hours- Complete Setup Hours

Example

While you were engineering Part 3489-J2, you indicate that the Mold operation will take two hours of Setup Time. A job is created for a quantity of Part 3489-J2, and on Monday, production began on this job. You run the Shop Load report on Tuesday morning and discover that setup was started on the Mold operation. The Shop Load value indicates that one hour of load remains against this operation.

Start Date

The Start Date is the date on which work will begin on this job. The scheduling engine always tries to place the Start Date and End Date values as close together as possible on the production calendar.

By default, Required By Date you enter on the job header populates the Start Date and End Date values within the Job Scheduling window. The Start Date can be used to begin scheduling for the job (Forward Scheduling) or calculated automatically by the scheduling engine (Backward Scheduling).

When you schedule a job, the Scheduling engine takes the Requested by Date and subtracts the Receive Time to calculate a net Requested by Date. Scheduling then takes the net calculated date and works backwards to calculate the Start Date. For example:

- Requested by Date = 30/05/2016
- Move Time = 5 days
- Calculated net Requested by Date = 25/05/2016
- Start Date = 23/05/2016 (calculated by Scheduling based on the net Requested by Date)

Modifiers

- If you use the Forward Scheduling calculation, you can either accept the default Start Date or enter this value manually. When the scheduling engine runs, it moves ahead, or forward, through the working days on the production calendar to arrive at the End Date closest to the Start Date.
- If you use the Backward Scheduling calculation, however, you enter the End Date for the job. The engine then moves back through the working days on the production calendar to locate the Start Date closest to the End Date.

Location

- Job Entry
- Job Scheduling Board
- Resource Scheduling Board
- Multi-Resource Scheduling Board

Logic

- When Forward Scheduling, you enter the Start Date value manually.

Example

- **Backwards Scheduling Example**

  You want to backwards schedule Job 5421. This job method has four assemblies, two of which are peer assemblies that are run concurrently. By calculating the Operation Times for operations within each assembly, here are the required times:

  - **Assembly 0** - 3 Days
  - **Assembly 1 and 2 (Peer Assemblies)** - Assembly 2 is the longest assembly; it will take 4 days to complete.
  - **Assembly 3** - 5 Days
  - Your Receive Days value is 2.

  The Required By Date on Job 5421 is August 17. The scheduling engine then calculates an End Date value of August 15. Now the engine figures out the working days on which each assembly needs to begin (accounting for any non-working days in the schedule):

  - **Assembly 0** - August 13
  - **Assembly 2 (Longest of the Peer assemblies)** - August 7 This value takes into account the two non-working days for the weekend.
  - **Assembly 3** - July 31 This value takes into account the two non-working days for the weekend.

  The scheduling engine calculates that the Start Date for Job 5412 will be July 31.

- **Forward Scheduling Example**

  You want to forward schedule Job 8724. This job method has four assemblies, two of which are peer assemblies that are run concurrently. By calculating the Operation Times for operations within each assembly, here are the required times:

  - **Assembly 0** - 3 Days
  - **Assembly 1 and 2 (Peer Assemblies)** - Assembly 2 is the longest assembly; it will take 4 days to complete.
  - **Assembly 3** - 5 Days

  You enter a Schedule Start Date value of August 1. The scheduling engine moves ahead from this date to calculate the End Date. It begins by starting the first assembly tomorrow, which is the next day after the Schedule Start Date. These are the dates:

  - **Assembly 3** - This assembly ends on August 8. This value takes into account the two non-working days for the weekend.
  - **Assembly 2 (Longest of the Peer assemblies)** - This assembly ends on August 14. This value takes into account the two non-working days for the weekend.

- **Assembly 0** - August 17.

The scheduling engine calculates that the End Date for Job 8724 as August 17.

Start to Start

Start to Start is an operation relationship that assumes you want to start two operations at the same time. In reality, however, you will likely start the first, or predecessor, operation before the second, or subsequent, operation.

By default, this relationship uses the Queue Time at the subsequent operation, as this calculation does not assume that the subsequent operation starts as soon as the parts arrive at the resource.

You can also define on each site how this offset time is calculated for the subsequent operation through the Send Ahead functionality. Leverage this functionality when you want to make sure a transport item like a pallet, container, skid, and so on is full and can be moved to the next operation. You define the quantity required to fill the transport item and then the scheduling engine calculates how long it takes to place this quantity within the item.

By using the Scheduling Send Ahead For drop-down list on a site record, you can indicate whether this Send Ahead time should be calculated for either the setup time or production time on the subsequent operation:

- If you indicate that setup time is used, the scheduling engine calculates that **setup** on the subsequent operation begins X minutes after production begins on the predecessor operation.
- If you indicate production time is used, however, the scheduling engine calculates that **production** begins on the subsequent operation X minutes after production begins on the predecessor operation.

You then define the specific Send Ahead value on each operation. To do this, you indicate whether this value type is based on hours, pieces, or a percentage. After you define the type, enter the specific offset value used on the operation. When the operation is included on a method and it is the subsequent operation, the scheduling engine uses this value to determine the offset time needed before the subsequent operation begins either its setup or production after the predecessor operation.

These offset values can also be defined on part, job, and quote methods. Within each method, you can override the default Send Ahead values from the operation record, or if these values do not exist, you can enter new Send Ahead values.

Modifiers

- **Start to Start** - You select the Start to Start scheduling relationship on Operation Details card while engineering quote, part, and job methods. This lets you define the relationship for each operation on the method.

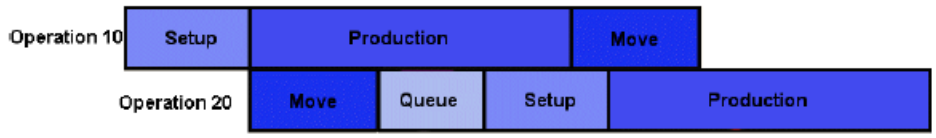
Location

You can select the Start to Start for an operation in the following apps:

- Engineering Workbench
- Job Entry
- Opportunity/Quote Entry

Logic

Some of the Queue Time at the subsequent operation may be consumed by the Move Time of the predecessor operation. This is shown in this illustration:



Example

You have two Drill operations that can work nearly simultaneously because they both drill specific holes into a metal brace. At the Drill A operation, the Queue Time value is 30 minutes. The Drill A operation requires 5 minutes per piece to complete. The second Drill B operation also requires 5 minutes per piece to complete.

These are the values that you use for these operations:

- **Job Quantity** - 100
- **Drill A Operation** - 5 Minutes/Piece or 500 minutes production time for this operation.
- **Drill B Operation** - 5 Minute/Piece or 500 minutes of production time for this operation.

When you use the Start to Start relationship, both operations will take 8.33 hours to complete. When determining when the part quantity will arrive at these resources however, the scheduling engine assumes that the part quantity will have to wait an additional 30 minutes before Setup Time and then Production Time can begin.

Time Allocation

The scheduling engine allocates time to the available capacity at a resource. The time it allocates is measured by calculating how many scheduling blocks (units of time) are required to complete each operation.

These scheduling blocks are then assigned, or allocated, against the available capacity on a resource. Ultimately the scheduling engine calculates the smallest amount of time that can be placed within each scheduling block.

Modifiers

- **Scheduling Blocks** - Use this value to indicate the available scheduling blocks for each resource within this resource group. The default value is one, indicating that one scheduling block can be placed against each resource per working day. The higher the number you enter in this field, the more scheduling blocks that are available each working day. As you increase the scheduling blocks value, each scheduling block will also have a smaller amount of time allocated to it. This field is in several places throughout Kinetic. It is available on the Operations Details card in Opportunity/Quote Entry, Job Entry and the Engineering Workbench. It is also found on the Detail card within the Resource Group Maintenance app.

Location

- Global Scheduling

Logic

- Scheduling Block Time Allocation = Production Time/Number of Scheduling Blocks

Example

The ASM Bench resource group contains four resources. If you change the number of scheduling blocks used by the resource group, you change the length of time available within each scheduling block.

For this example, you have an operation that will take 30 hours of load to complete. The resource group can work for 15 hours each day. You indicate that up to four resources can work on this quantity at the same time; you enter this value in the Scheduling Blocks field. The following table shows you how the scheduling engine calculates this load to determine the time required during each scheduling block. This table assumes that there is no other load against the avaiable capacity:

Scheduling Block Value	1	2	3	4
Scheduling Block Length	2 Days	1 Day	0.667 Day	0.5 Day

Note that the total load against this resource group does not change. As the number of scheduling blocks increases however, this operation will spend a shorter amount of time at this resource group, because more resources are available to work on the operation.

Scheduling in Action

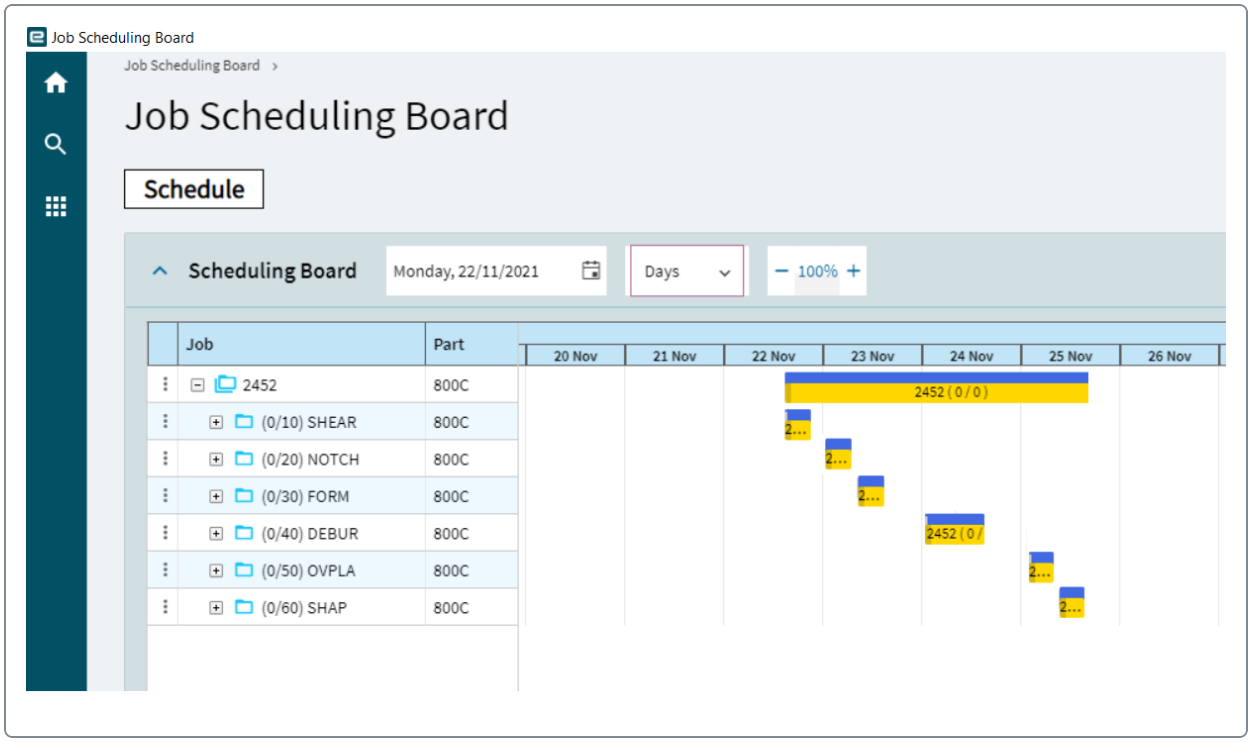
This section gives you some examples which show how the scheduling engine arrives at its results. If you compare these examples against your own scheduling results, you will better understand the logic behind these calculations.

The scheduling in action case studies include:

- Finish to Start
- Start to Start
- Finish to Finish

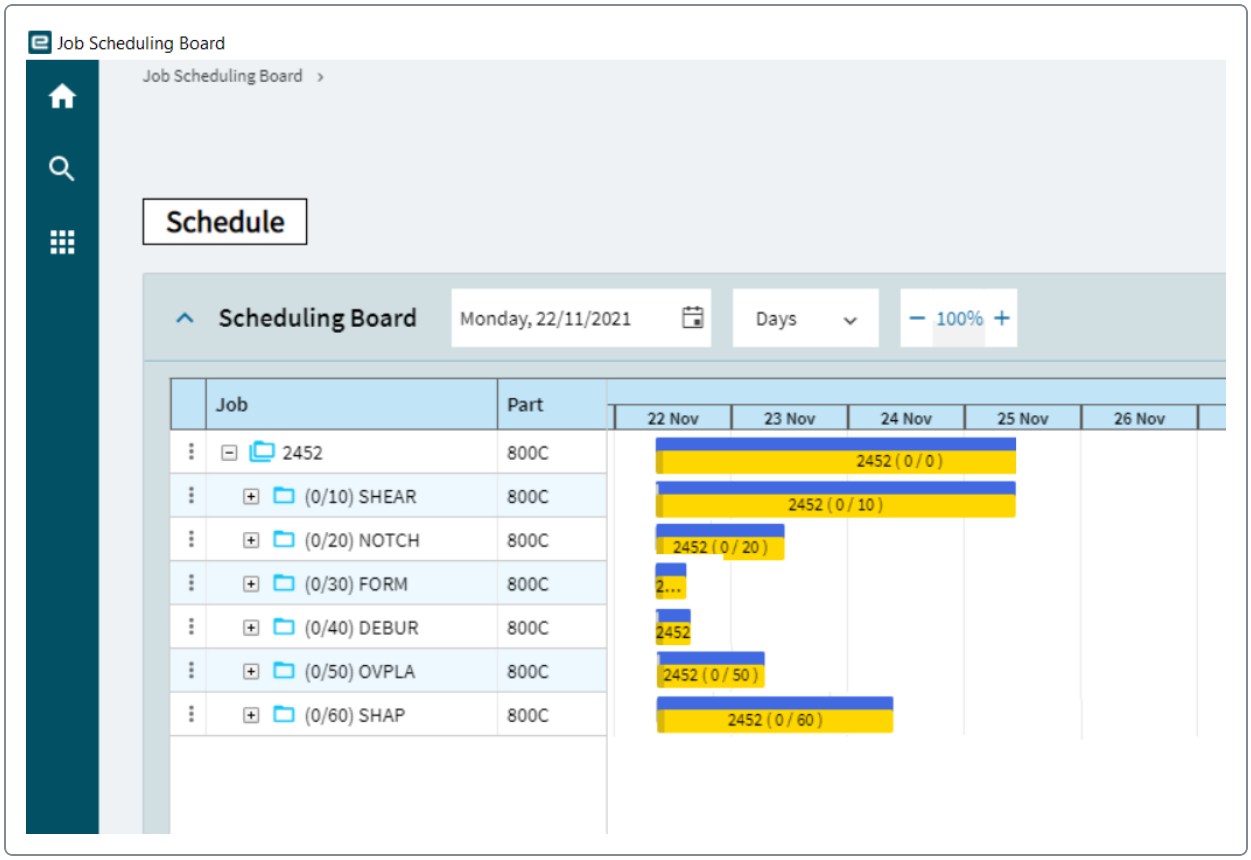
Case Study 1 - Finish to Start

The following scheduling board displays operations with a Finish to Start relationship.



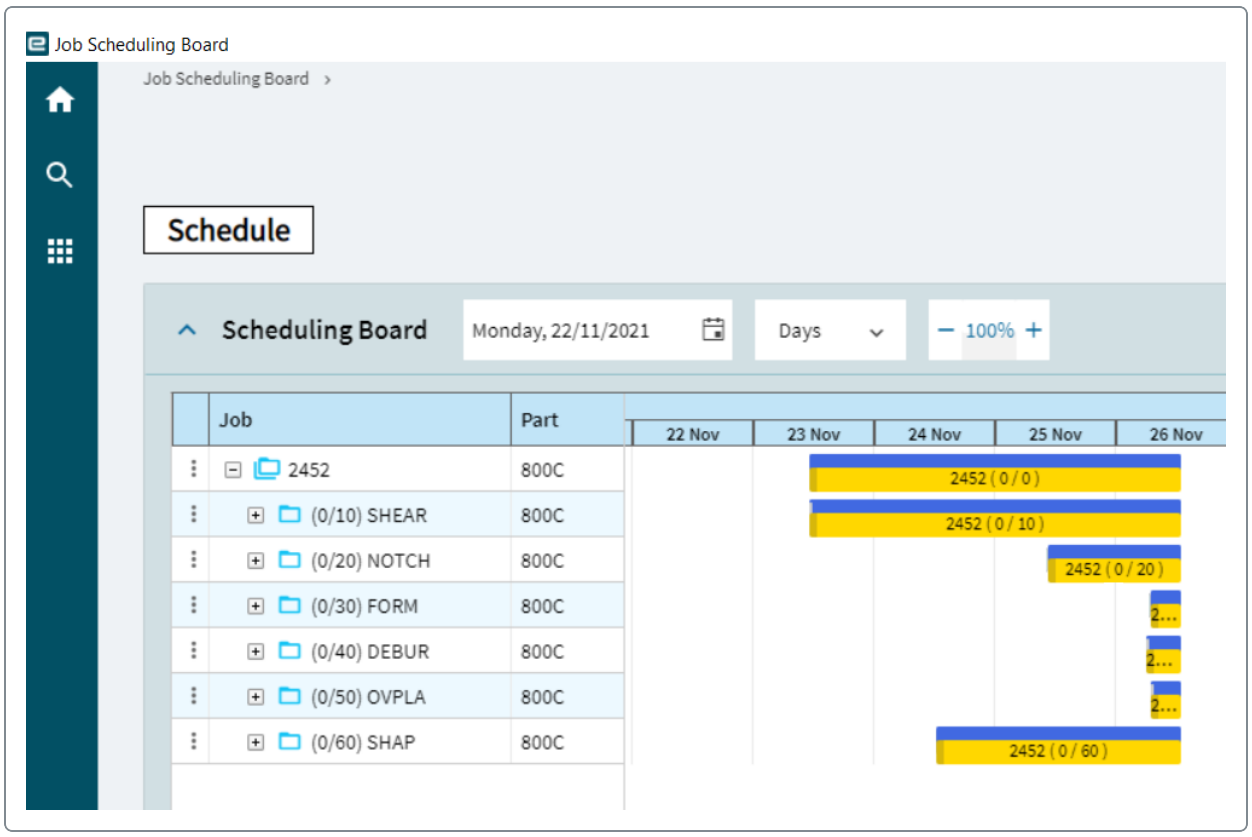
Case Study 2 - Start to Start

The following scheduling board displays operations with a Start to Start relationship.



Case Study 3 - Finish to Finish

The following scheduling board displays operations with a Finish to Finish relationship.


Job Scheduling Board
Job Scheduling Board ›
Schedule
Scheduling Board
Monday, 22/11/2021
Days
100%
Job
Part
22 Nov
23 Nov
24 Nov
25 Nov
26 Nov
2452
800C
2452 (0 / 0)
(0/10) SHEAR
800C
2452 (0 / 10)
(0/20) NOTCH
800C
2452 (0 / 20)
(0/30) FORM
800C
(0/40) DEBUR
800C
(0/50) OVPLA
800C
(0/60) SHAP
800C
2452 (0 / 60)

Modifiers

This section details the various fields and tools you can use to adjust the primary scheduling calculations. These items are located in jobs and scheduling apps.

Use the modifiers to generate scheduling results that best reflect your production workflow.

The modifiers include:

- Allow Scheduling Before Today
- Auto Consume
- Batch Scheduling
- Change Impact Grace Periods
- Change Impact Price List
- Completion Date
- Concurrent Capacity
- Concurrent Job
- Confirm
- Constrained Materials
- Capable To Promise (CTP)
- Daily Production Capacity
- Days Out
- Finite Horizon
- Finite Schedule
- Forced End Times
- Forced Start Times
- Global Reschedule Started Operations
- Lead Time
- Load Relieved By
- Load Leveling
- Locked
- Minimize WIP
- Minimum Overload Percentage
- Move Option
- Move Time
- Non-Working Day

- Operations Per Part
- Overload Horizon
- Override Material Constraints
- Override Scheduling Constraints
- Part Lead Time
- Priority
- Production Complete
- Production Consumption Rate
- Production Factor
- Projected Start Date
- Proposed Start Date
- Queue Time
- Required By Date
- Resource Priority
- Rough Cut Horizon
- Scheduling Direction
- Schedule Multi-Job
- Scheduling Blocks Modifier
- Scheduling Send Ahead For
- Send Ahead Offset
- Send Ahead Type
- Sequential Job
- Setup Complete
- Setup Factor
- Setup Time
- Shipment Options
- Splitting Operations
- Supplier Due Date Horizon (Site)
- Supplier Due Date Horizon (Supplier)
- Update Job Operation Detail
- What-If Scheduling
- Working Day

Allow Scheduling Before Today

This modifier lets the scheduling engine generate a Start Date that is earlier than the current system date or the Scheduled Start Date value within the Global Scheduling process. The engine uses this feature only when you are Backward Scheduling a job with the Infinite Capacity calculation.

This prevents the Bounce Condition logic from automatically rescheduling the job using Forward Scheduling.

If this feature is not active and the scheduling engine finds an operation that must scheduled earlier than the current date (Today) or Scheduled Start Date to meet its End Date, the Bounce Condition calculation is used. The engine will instead use Forward Scheduling and the current date or the Scheduled Start Date will be used for the Start Date value. This typically causes the job to have an End Date that is after its Required By Date value. When this situation occurs, you will receive a warning message.

Adjustments

- **Locked Jobs** - You can prevent a job and its operations from being automatically moved by either the Global Scheduling or MRP Processing apps. You do this by freezing, or locking it. When the scheduling engine encounters a locked job, the schedule remains unchanged. All other job operations are assigned to available operations capacity. Note that this only prevents jobs from being moved during these automatic processes. You can still manually move these jobs on the scheduling boards. To indicate that a job is locked, select its Locked check box. This check box is located in Job Entry.

Location

- **Company Configuration** - You activate this modifier within the Company Configuration app.
- **Job Entry** - When you schedule a job.
- **Global Scheduling**

Logic

- If the Start Date is < the current system date or Scheduled Start Date, then place this Start Date before this date.

Example

You enter 7/21 as the Scheduled Start Date for Global Scheduling. As the scheduling engine calculates the Start Date for Job 4821, it discovers that this job's Start Date must be 7/18. Because you have set up the Job Configuration within Company Configuration to allow scheduling to occur before the Scheduled Start Date, it uses 7/18 as the Start Date for the job.

Auto Consume

The Auto Consume Window % and Days modifier allows you to specify a window of time to look for goods needed to complete a job when the full quantity is not available on the required date.

The window is calculated by calculating a specified percentage of the Manufacturing Lead Time and then adding it to the Required Date. This determines the date on which Kinetic will check to see if the goods are available.

The percentage is specified for the site and that percentage is the default used for the part site record. When you run the Manufacturing Lead Time process or when you change the percentage for a part, the Auto Consume Window is recalculated to find the number of days for the auto-consume window. The value is read only to avoid performance issues during the scheduling process. The value will round down if it is less than 0.5 and rounds up if it is greater than or equal to 0.5.

Adjustments

- **Auto Consume Window (%)** - Determines the calculation of the Auto Consume Window by applying the percentage entered to the manufacturer lead time value. Enter a percentage value between 1 and 100.

Location

- **Site** - The default percentage value (between 1-100) for the site can be entered on the Planning card.
- **Part** - You can specify a percentage value for a part on the Planning card.

Logic

- When the full quantity is not available on the required date, the window is calculated by calculating a specified percentage of the Manufacturing Lead Time and then adding it to the Required Date. This determines the date on which Kinetic will check to see if the goods are available.

Example

Subassembly DSS-100 requires 10 pieces and there is an original pull quantity of 2. The job bounces forward and is scheduled on 7/25, at which time the worker tries to pull the remaining quantity. Only 3 more pieces are available (for a total of 5 of the necessary 10), and there is still not enough for the requirement. The window percentage is added to calculate a new date when the material should be reviewed to see if the pull quantity is available.

Batch Scheduling

The Batch Scheduling functionality lets you combine jobs that share the same operations so that the engine can schedule these operations simultaneously. Because these operations are run together, they are referred to as a batch.

This functionality lets you select an operation shared by the jobs and then indicate the direction within the operations - backwards or forwards - that the operations (routing) should be combined. When the batch job is created, the scheduling engine treats it like a regular job. This new job will manufacture the part quantities required from the original source job, but typically this will also save you time within the schedule. This functionality is very flexible allowing to you to combine batch jobs.

Material requirements are also pulled into the batch job; the materials pulled depend on the point at which the routing is combined. These material records are not, however, added together. Instead they are copied exactly from the source jobs. The material records on the source jobs are also marked complete. A job to job receipt is created to track the change in the material requirements.

The scheduling boards are updated with the operation changes. The operations on the source jobs are closed and the load is automatically transferred to the operations on the batch job. The quantities are calculated on the final operation. Kinetic displays the part quantities created through this operation as the total part quantity manufactured on the job.

Be sure to batch together jobs that share similar operations. Only the operations from the first job are used to create operations on the new job. If you batch jobs that do not have similar operations, you could get unexpected results. After source jobs are batched together, they cannot be separated, so be sure that you have selected the correct source job.

Note that it is not possible to batch operations in the middle of their routing in the schedule. You can only combine operations that are either all in front of a subsequent operation or all behind a predecessor operation.

Adjustments

- **Batch** - You indicate that a job can be batched with another job by selecting its Batch check box. This check box is available within the Resource Scheduling Board.
- **Batch Operations** - To combine all the jobs that are selected for batching, you use a command on the Resource Scheduling Board.
- **Primary Job Operation** -This value defines the operation from which the source jobs' routing will be combined. This must be an operation that all the jobs have in common. Only operations from the source jobs selected for this batch appear on this list; select the operation you need.
- **Pull Direction** - These options determine the direction within the routing through which the operations are combined. There are two options:
    - Select the Forward option to combine operations starting with the Primary Job Operation and moving forward through the schedule to combine identical operations.
    - Select the Backward option to combine starting with the Primary Job Operation and moving backwards through the schedule to combine identical operations.

- **Job Processing Mode** - Use these options to define the manufacturing mode through which a new batch job is produced. The mode you select indicates how the operations and material requirements are processed by the scheduling engine. There are two options:
    - The Sequential mode is the default option. A sequential job is processed through part quantities that are completed in a linear order. A quantity needs to be complete before work begins on the next quantity. This is the typical way jobs are manufactured.
    - The Concurrent mode indicates that the batch job's production is calculated on the number of operations performed- instead of the part quantity produced. For example, you select this option if the job has a stamping operation producing multiple parts. The production time on this job is measured by the number of operations performed.

Location

- **Resource Group Maintenance** - The Batch Operation command is located in the Overflow Menu.

Logic

- If Operation A on a job is the same as Operation B on another job, then combine these two operations and all subsequent operations.
- The part quantities on both jobs are added together to calculate the final production quantity.

Example

You are manufacturing several jobs for parts EAD-400-XXX, where XXX defines the various colors that can be painted onto the final part quantities. Except for the color, all of these jobs have identical operation routings. Because of this, you combine these jobs on the Resource Scheduling Board into a single batch.

Change Impact Grace Periods

The Change Impact Grace Period settings affect how the scheduling engine calculates and displays What-If changes within the schedule. A What-If schedule is a temporary schedule you can use to determine whether you can use these possible job Start Date and End Date values within the actual schedule.

The values you enter in these fields define the job duration to determine if the job is on time. You enter both an Early Grace Period value and a Late Grace Period value. The values you enter define the number of days required for both periods.

The Early Grace Period indicates by how many days ahead in the schedule a job will be considered early. If the job's calculated End Date is less than the Required By Date value minus the Early Grace Period value, the job is considered early. The Late Grace Period indicates by how many days ahead

in the schedule a job will be considered late. If the job's calculated End Date is more than the Required By Date value plus the Late Grace Period value, the job is considered late.

Adjustments

- **Early Grace Period (Days)** - This value is the number of days that a job can complete before the Required By Date and still be considered on time by the scheduling engine. A value of 0 means you do not wish to have an Early Grace Period.
- **Late Grace Period (Days)** - This value is the number of days that a job can complete after the Required By Date and still be considered on time by the scheduling engine. A value of 0 means you do not wish to have a Late Grace Period.

Location

- Company Configuration
- Schedule Impact Report
- Change Impact Informer

Logic

- If the End Date is less than Required By Date - minus the Early Grace Period (Days), then this is an early job.
- If the End Date is more than Required By Date - plus the Late Grace Period (Days), then this is a late job.

Examples

- **Early Grace Period** - You enter 4 as the Early Grace Period value. You then run the Schedule Impact Report. If a job is scheduled to end 5 days ahead of schedule, the job is considered Early. If the job is scheduled to end 4 days ahead of schedule, the job is considered on time.
- **Late Grace Period** - You enter 1 as the Late Grace Period value. You then run the Schedule Impact Report. If a job is scheduled to end 2 days after the due date, the job is considered Late. If the job is scheduled to end 1 day ahead of schedule, the job is considered On Time.

Change Impact Price List

The Change Impact Price List contains the prices for your company's products. The scheduling engine uses this price list to determine how income and expenses are affected by the What If changes you are considering in the schedule.

A What-If schedule is a temporary schedule you can use to determine if you can incorporate a job's Start Date and End Date into your actual schedule.

These What If changes in the income and costs are displayed on the Schedule Impact report and the scheduling boards. They help you decide whether you can accept the What-If schedule.

Adjustments

- **Change Impact Price List** - You create price lists within the Price List app. You can then find and select the price list record you need for the scheduling engine.

Location

- Company Configuration
- Schedule Impact Report
- Change Impact Informer

Logic

- During What-If Scheduling, pull prices from the Change Price List.
- Display these prices on the Schedule Impact report.

Example

You run the Global Scheduling process using the What-If Schedule. As the scheduling engine places these What-If jobs one the scheduling board, pull the prices for the move on the Change Impact Price List.

Completion Date

This Capable to Promise field specifies the date of completion for the sales order. The default value is the Completion Date generated by the Capable to Promise calculation.

However, you can update this date later, or you can use the Update Order Promise Date command from the Overflow menu to make all dates the same on the current sales order.

Adjustments

- **Completion Date** - You can automatically generate this value or enter this date manually.

Location

- **Sales Order Entry** - You launch the Capable to Promise from within Sales Order Entry.

Logic

- The quantity on the current order release arrives at the customer ship to location by this date.

Example

Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Concurrent Capacity

Concurrent Capacity defines the amount of simultaneous capacity available on the resource that can run during a specific moment of time.

This value is a non-time constraint that prevents scheduled operations from overloading the resource. This is because the resource has, at any given time, only this defined amount of simultaneous, or concurrent, capacity available.

Define this value when you have different operations with items you produce that use the same resource. If this value is defined, the engine adds another limiting modifier to the base time restriction. When this Concurrent Capacity value is reached, the engine will not schedule additional operations at this resource - even if more capacity or time is available. The engine will then schedule the operation when both time and concurrent capacity are available.

For example, Resource A has a concurrent capacity of 10. There are five operation details that need to use this resource at the same point in the schedule. The production time is insignificant, so it does not impact this calculation. These operation details require the following concurrent capacity:

- Operation Detail A - 3
- Operation Detail B - 4
- Operation Detail C - 2
- Operation Detail D - 3
- Operation Detail E - 5

The total capacity needed by A, B, and C is 9. When the scheduling engine attempts to schedule Operation Detail D to the same point in the schedule, this operation detail will exceed the concurrent capacity available on that resource. Because of this, the scheduling engine will place A, B, and C during the same time period but then move D and E to the next available time.

Notice that there is still a 1 concurrent capacity available during the first time period. The scheduling engine is prevented from dividing the capacity required on each operation detail, however, so it must locate capacity on the next available period of time.

The Concurrent Capacity non-time constraint only works when you use the Finite Capacity calculation (finite scheduling) against your resources.

Adjustments

- **Concurrent Capacity** - You enter a number value in this field to define how much concurrent capacity is available on the resource.

Location

- **Engineering Workbench** - You can define the Concurrent Capacity for a part method on the Scheduling Resources card for an operation that you select in the Nav tree.
- **Job Entry** - You can define the Concurrent Capacity for a part method on the Scheduling Resources card for an operation that you select in the Nav tree.
- **Opportunity/Quote Entry** - You can define the Concurrent Capacity for a part method on the Scheduling Resources card for an operation that you select in the Nav tree.
- **Resource Group Maintenance** - You can define the Concurrent Capacity on the Detail card for a resource you select in the Nav Tree.

Logic

- This value is stored in a sub-table to track how many units are used in an hour. When the units equal this value, the engine considers that the resource has reached its full capacity.

Examples

- **Example #1** - An oven resource has 4 racks. The 4 racks on the oven can be used simultaneously for the same operation, but once they are selected for that operation, they are tied up until this operation is complete.

  For this oven resource, the Concurrent Capacity is set to 4; this is the most capacity that can ever be scheduled against this resource during an operation. Likewise, the Concurrent Capacity for the resource on the operation detail is set to 4; this is the number of racks needed for the operation.

  Note that if the operation needs more capacity than the resource can produce, the scheduling engine displays a resource overload error message.

- **Example #2** - Operation A needs an oven rack from 1:15 to 3:30. If Operation B is already using 4 racks between 2:01 to 2:15, Operation A will not be scheduled during this requested time. If you forward schedule, Operation A is rescheduled with a new start time of 2:15. If you backward schedule, Operation A is rescheduled using a new end time of 2:01.

Concurrent Job

A Concurrent Job lets you manufacture multiple parts at the same time within the schedule. Unlike a typical job where the total quantities on the demand links determine the final quantity on a job, a concurrent job is based on the number of operations that are performed during the job.

To set up a concurrent job, you indicate the number of parts manufactured during each operation. As operations are completed, the total part quantity produced on the job is calculated.

Note that this feature is available if your company has an Advanced Production license.

Adjustments

- **Mode** - To produce parts concurrently, select the Concurrent option from the Mode drop-down list.
- **Production Consumption Rate** - Calculate available capacity for a resource or resource group using a value other than time. It defines the material required to produce 1 quantity on the operation.
- **Concurrent Capacity** - This value defines the amount of simultaneous capacity required by the operation. This value is a non-time constraint that prevents multiple operations from overloading the resource.
- **Daily Production Rate** - This value is a non-time constraint you can use to measure the available capacity on a resource. This value defines the amount of non-time units this resource can produce during a working day.

Location

- **Job Entry** - You indicate if the current record is a concurrent job on the Job card.
- **Get Details** - You can use the Get Details panel launched from the Overflow menu to pull in a job, part, or quote method. The operations on the selected method are then used to calculate the final production quantity for this job.
- **Resource Group Maintenance** - You can define the Daily Production Capacity for a resource group on the Details card. You can define the Daily Production Capacity and the Concurrent Capacity on the Detail card for a resource.

Logic

- Total Part Quantity = Operation 1 Quantity + Operation 2 Quantity + Operation 3 Quantity + and so on...

Examples

Your company manufactures washers. You can stamp multiple washer part sizes on a single sheet of metal; for every 10 part quantity of washer A that is manufactured, you will get a 20 part quantity of washer B. Because you can manufacture both washer parts at the same time, you select the concurrent mode on these jobs.

Confirm

Select this check box to indicate the order release is ready to be converted into a standard job by the Confirm button. You must select this option in order for the CTP job to be converted into a standard job.

When you select the Confirm button, all CTP jobs that have this check box selected are converted into a standard job linked to its original sales order release.

Adjustments

- **Confirm** - You indicate a CTP job can be converted by selecting this check box.

Location

- **Order Entry** - You launch the Capable to Promise from within Order Entry.

Logic

- If the Confirm check box is selected and the Confirm button is clicked, remove the CTP prefix from the job record. Link this job to its original order release, and add this job to the production schedule.
- If the Confirm check box is clear, ignore this CTP job when the Confirm button is selected.

Example

Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Constrained Materials

A material can be defined as a constrained material, indicating the materials must be available for issuing to schedule operation. If the engine discovers the constrained material cannot be issued at a specific time, it will locate the next available time.

You indicate that a material is constrained on its part record.

When the scheduling engine encounters a constrained material linked to an operation, it determines when the material is available for this operation. The date on which the material is available is used as the Start Date for the operation. If the Required By Date for the material is more than the Lead Time on the material (either the purchasing lead time or the manufacturing lead time, depending on the situation), the engine considers this material as available. The scheduling engine does this by

reviewing the Available to Promise calculation. For example, if 20 materials are required for an operation and only 10 are available, the engine will wait until all 20 are available before it assigns scheduling blocks for this operation against the available capacity.

Constrained materials also affect the Bounce Condition. If the engine is Backward Scheduling and discovers a constrained material that it cannot link to the operation, it will automatically switch to Forward Scheduling using the current date as the Start Date for the job. Next, the engine locates a point in the schedule where both the constrained material and capacity are available for the operation. The engine then calculates the schedule a third time to make sure that it has calculated the closest amount of time possible to the Start Date.

Note that in reality, of course, all materials are constrained. You should only constrain materials, however, that are absolutely necessary at certain points in the schedule. If you indicate that all materials are constrained, the scheduling engine will add too much time within each job schedule.

Adjustments

A material is considered constrained when:

1. The Constrained Materials check box is selected on the part record.
2. The Make Direct check box is selected within the manufactured material record defined on the part method.
3. A PO Date is defined on the PO for a purchased material.

Location

- **Part** - You use the Part app to indicate when a material is constrained.
- **Job Entry** - You schedule individual jobs through the Schedule Job panel. Select the Finite Capacity check box to schedule a job using a finite calculation.
- **Global Scheduling**

Logic

- If Material Lead Time > Required By Date on the operation, then schedule the operation.

Example

The scheduling engine is attempting to schedule Job 7831. Its Mold operation has a constrained material, resin. As the engine backwards schedules this job, it calculates a Mold operation Start Date of 4/15. The current date is 4/2.

The resin material, a purchased part, is not available, however, until 4/20. The scheduling engine activates the Bounce Condition calculation and the job is forward scheduled from 4/2, the current date. It then calculates that the Mold operation cannot begin until 4/20. The remaining operations are then scheduled after this date.

Capable To Promise (CTP)

Select the CTP check box to indicate that you want the Capable to Promise calculation to generate a Completion Date for the specific order line. You must select this option in order for the calculation to create a CTP job for the current order release.

When creating an unfirm job, CTP calculates the pull quantity of subassemblies of parts checked for auto consume, and then schedules the job backwards from the required date. If the scheduling reaches today's date and bounces forward to calculate the new completion date, a recheck of available materials is performed.

This recheck takes into account any changes made to stock or supply that might affect the ability to fulfil the needed quantity. For example, if a purchase order is due in during the scheduled assembly period that will supply the job.

When you click the Calculate button, CTP jobs are generated for all order releases which have their CTP check boxes selected.

Adjustments

- **CTP** - Select this check box to indicate that a CTP job can be created from this order release.

Location

- **Order Entry** - You launch Capable to Promise from within Order Entry.

Logic

- If the CTP check box is selected and the Calculate button is selected, generate a CTP job for this order release and display it within the scheduling boards as a CTP job.
- If the CTP check box is clear, ignore this order release when you select the Calculate button.

Example

Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Daily Production Capacity

Daily Production Capacity is a non-time constraint you can use to measure the available capacity on a resource.

This value defines the amount of non-time units a resource can produce during a working day. For example, a resource may only be able to produce a 10 quantity of cubit yards of cement per working day, or an oven only has 4 racks that can be filled per working day. When you enter the Daily Production Capacity for a resource or a resource group, the scheduling engine will not schedule more load against this capacity constraint - even if there is capacity available.

Resources that use non-time constraints to measure capacity typically referred to as Batch resources. These resources can combine materials from multiple jobs into a single batch for production.

Non-time constraints only work when you use the Finite Capacity calculation (finite scheduling) against your resources.

Adjustments

- **Resource Group Maintenance** - You can define the Daily Production Capacity available for an entire resource group.
- **Resource** - You can define the Daily Production Capacity available for a specific resource.

Location

- **Resource Group Maintenance** - You can define the Daily Production Capacity for a resource group on the Details card. You can define the Daily Production Capacity and the Concurrent Capacity on the Detail card for a resource.

Logic

1. Take the remaining Production Quantity times the Production Rate to get the total remaining capacity: **d_JobNonTimeCap = bJobOpDtl.DailyProdRate * maximum((bJobOper.RunQty - bJobOper.QtyCompleted), 0)**
2. Now take this value and divide it by the estimated operation hours. This will give you a Capacity Unit Per Hour value: **d_NonTimeCapUnitPerHour = (d_JobNonTimeCap / bJobOper.EstProdHours)**

Example

You have a Molding operation in your production workflow. It always takes one hour to fill the mold with material, so the Daily Production Capacity is the rate at which the molding material flows into the mold. Because of this, only 10 cubic yards of molding material can manufactured each day. That is the Daily Production Capacity of this operation.

Days Out

Days Out is a value you define on subcontract operations. It is the estimated number of working days during which the operation's part quantity is out of your manufacturing center for supplier work.

This value is used with the supplier calendar to determine actual dates during which the materials will be away from your manufacturing center.

The engine converts this value to hours in order to account for this time within the schedule.

Adjustments

- **Days Out** - If you use a subcontract operation on a job, part, or quote method the Days Out value is available on the Detail card for a subcontract operation. If you need, you can enter or update this value, letting you define how many days out this part quantity will be during this specific operation.

Location

- **Operation Maintenance** - You create subcontract operations within the Operation Maintenance app.
- **Engineering Workbench** - You can enter or update the Days Out value on the Detail card for a subcontract operation.
- **Job Entry** - You can enter or update the Days Out value on the Detail card for a subcontract operation.
- **Opportunity/Quote Entry** - You can select the Finish to Start option on the Detail card for an operation.

Logic

- Days Out Hours = Days Out x Hours

Example

You estimate that part quantities on a Paint subcontract operation will be out of your manufacturing center for 5 days. You enter 5 for this operation's Days Out value. When the engine calculates the schedule for this operation, it accounts for this time using 5 working days on the supplier's production calendar.

The engine is scheduling job 2985, and the Paint subcontract operation has a Start Date of 8/23. It checks the production calendar on the supplier record, and it discovers that this company does not work on weekends. The scheduling engine then calculates that the part quantity will return on 8/29, accounting for the two non-working days.

Finite Horizon

Use the Finite Horizon modifier to define a range of time during which a resource or resource group is scheduled using the Finite Capacity calculation. When the schedule passes the last day within this range, the engine assigns scheduling blocks to resources using the Infinite Capacity calculation.

This modifier accounts for load that is farther out in the schedule. Because there typically is less load in the future, scheduling that uses the Infinite Capacity calculation places these schedules closer to the current date or the Scheduled Start Date (on Global Scheduling). You can then review any overloaded resources and distribute this load elsewhere.

The Finite Horizon is useful because at some point in the future schedule, you do not care that your resources are overloaded. You just want to keep track of potential jobs. When the schedule moves ahead towards these jobs, you will more accurately know production capacity for your manufacturing center. You can then reschedule these jobs using the Finite Capacity calculation. As the schedule moves toward these infinitely scheduled jobs, the scheduling engine can be run again to more accurately reflect how much actual production time is required, as these jobs now fall within the Finite Horizon range.

The Finite Horizon value is useful in providing a long-term production view without committing resources to the schedule. It also reduces processing time for the scheduling engine.

Adjustments

- **Finite Horizon** - The value you enter in this field represents the number of days from the current date or Scheduled Start Date within the range used for the Finite Capacity calculation. If you enter a 0 in this field, it means that there is no horizon limit. The engine always calculate this resource or resource group using the Infinite Capacity calculation.

Location

- Resource Group Maintenance
- Job Entry
- Global Scheduling

Logic

The Finite Horizon functionality uses this logic to calculate its results.

- Finite Horizon Range = Current System + Finite Horizon

The following Finite Horizon rules apply:

- Finite Horizons are based on standard calendar days (today plus horizon days) rather than production days defined in the Production Calendar.
- If the Finite Horizon value defined in the Site app is less than the Finite Horizon value defined on a Resource/Resource Group, then the Site value is used and the Resource/Resource Group value is ignored.
- If the Finite Horizon value defined in the Site app is greater than the Finite Horizon value defined on a Resource/Resource Group, then the Resource/Resource Group value is used.
- If the Finite Horizon value on a Resource is different to its Resource Group, then the Resource value is used.

- If you set the Finite Horizon to ten days, then the jobs are scheduled on an infinite capacity within the Finite Horizon of ten days.
- If the Finite Horizon value on a Resource is greater than on its Resource Group and the Use Resource Group Values check box on the Resource is cleared, then the Finite Horizon value on the Resource is used.

Example

The MRP engine generates several unfirm jobs that will be produced next month. Because these jobs have Required By Dates past the finite horizon, they are all scheduled using infinite capacity.

You can then view these jobs within the Overload Informer to figure out how you can best allocate this load against the capacity available around that time period.

Finite Schedule

Select this Capable to Promise checkbox when you want the job generated from this order release to be finitely scheduled. Finite scheduled jobs cannot overload the available capacity on each finite resource on any date within the schedule.

Adjustments

- **Finite Schedule** - Select this check box to indicate that the CTP job will be generated using the finite scheduling calculation.

Location

- **Order Entry** - You launch Capable to Promise from within Order Entry.

Logic

- If the Finite Schedule check box is selected and the Calculate button is clicked, generate a CTP job which uses a schedule that does not overload any resources.
- If the Finite Schedule check box is clear, generate a CTP job which use the infinite scheduling calculation. This CTP job can overload resources on a specific day if needed; use this calculation to help discover any bottlenecks in your schedule.

Example

Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Forced End Times

Use this modifier to optionally force times to be Finish to Finish when scheduling operations.

Select this check box to force times to be Finish to Finish when scheduling operations. Finish to Finish is a scheduling relationship that defines how two operations interact with each other. By using this relationship, you indicate that these two operations will finish at about the same time.

This relationship is useful for related operations where the first, or predecessor, operation has a much longer production time than the second, or subsequent, operation. This method assumes that the subsequent operation can start when there are enough units complete on the predecessor operation. As more units are completed on the first operation they are moved to the second operation, which lets both operations finish at about the same time. The subsequent operation must never run out of parts. The overlap batch of parts sent to the subsequent operation must be large enough to prevent it from stopping once it has started production.

Location

- **Site** - You define the Forced End Times option on the Planning card in the Site app.

Forced Start Times

Use this modifier to optionally force times to be Start to Start when scheduling operations.

Select this check box to force times to be Start to Start when scheduling operations. Start to Start is an operation relationship that assumes you want to start two operations at the same time. In reality, however, you will likely start the first, or predecessor, operation before the second, or subsequent, operation.

By default, this relationship uses the Queue Time at the subsequent operation, as this calculation does not assume that the subsequent operation starts as soon as the parts arrive at the resource.

Location

- **Site**- You define the Forced Start Times option on the Planning card in the Site app.

Global Reschedule Started Operations

You can use Job Scheduling and Global Scheduling to reschedule an operation that is already in process. If an operation must be moved to adjust for updated needs in the schedule, its remaining scheduling blocks are assigned to the earliest available capacity on the resource.

This modifier only affects in-house operations. It will not change subcontract operations that have been started, as the scheduling engine assumes that the part quantity has left your manufacturing

center and is not affected by internal changes. If a subcontract operation has not been started, however, it is moved as needed just like any in-house operation.

If you do not use this feature, the scheduling engine never moves in-house operations that are in process. The scheduling engine considers any operation that has labor reported against it as being in process.

Adjustments

- **Locked Jobs** - You can lock or freeze a job and its operations to prevent automatic schedule adjustments. When the scheduling engine encounters a locked job, it leaves its schedule as previously calculated. All other operations on jobs will be assigned to the capacity that is not being used for the operations on this locked job. To indicate that a job is locked, select its Locked check box. This check box is located within the Scheduling group box on the Job Entry > Job card.

Location

- **Company Configuration** - You activate this modifier within the Company Configuration app. The Global Reschedule Started Operations check box is located on the Job card.
- **Job Entry** - You schedule individual jobs through the Schedule Job panel.
- **Global Scheduling**

Logic

- If the Global Reschedule Started Operations check box is selected, then allow an operation that is in process to be moved in the schedule.

Example

You are running the Global Scheduling process. You enter a Schedule Start Date that is 3 days in the future. To make sure the scheduling engine does not ignore any jobs that are currently in production, you select the Global Reschedule Started Operations check box.

Lead Time

Lead Time is the number of days required between ordering parts from your supplier until their arrival at your manufacturing center. You use this value to account for the time required to receive materials within the schedule.

The scheduling engine uses this value to determine when a specific operation will receive the purchased materials; the operation will then be scheduled.

This value represents the number of working days it takes to receive the materials. The available working days are calculated from the production calendar defined on the supplier record. If a calendar is not defined for the supplier record, the calendar defined for the part-site record is used.

When a material is constrained, it indicates this material is required to run an operation. If a purchased or manufactured part record is defined as constrained, the scheduling engine will not schedule the operation until the material quantity is available.

Adjustments

- **Lead Time** - Use this field to enter the number of days it takes a purchased material to arrive at your manufacturing center. You define this modifier on the site details (part-site record) for a part.
- **Production Calendar** - You must define the calendar you want to use with Lead Time. You can select this calendar on either a supplier record or on the site details for a part.

Location

- Supplier
- Part
- Job Entry
- Global Scheduling
- Available To Promise

Logic

- Estimated Arrival Date = PO Date + Lead Time

Example

You estimate that the Lead Time required to order paint from Acme Paints and Stains is 10 days. You create a purchase order for these materials on 8/1.

The scheduling engine checks the production calendar on the supplier record, and it discovers that this company does not work on Sundays. The scheduling engine then calculates that the paint will arrive on 8/11, accounting for the one non-working day.

Load Relieved By

The Load Relieved By setting adjusts the Load Hours calculation.

This value is the total number of hours that remain on an operation. Both remaining Setup Time and Production Time are included in this calculation. The scheduling engine tracks how much time

remains to complete on each operation. The Remaining Load value is used during both the Job Scheduling and Global Scheduling process.

Use Load Relieved By settings to define how you want Load Hours to be removed, or relieved, while the scheduling engine determines the Remaining Load value. You can relieve load based on Quantity or Hours. When you relieve load by Quantity, the engine uses the number of completed pieces against the operation to calculate the remaining load. When you relieve Load by Hours, the scheduling engine uses the number of labor hours reported against the operation to calculate the remaining load.

Note that most companies relieve load using the Quantity calculation. If your operations typically produces 1-piece quantities, or you cannot report quantities, you will then use the Hours calculation.

Adjustments

- **Quantity** - Use this method to remove load by calculating the quantity produced on the operation to date.
- **Hours** - Use this method to remove load by calculating the Actual Labor Hours reported against the operation to date.

Location

- **Company Configuration** - You select which Load Relieved By method you will use within the Company Configuration app.
- **Site Schedule Load Graph** - This dashboard displays the load currently placed against the your site capacity.
- **Shop Load Report** - The Shop Load report displays the shop capacity and the load against this capacity.
- **Resource Schedule Load Graph** - This dashboard displays the load currently placed against your resource capacity.
- **Overload Informer** - This app displays which resources have more load than they can currently handle.

Logic

- Remaining Load (Quantity) = (Total Quantity on Operation- Reported Quantity) x Production Standard
- Remaining Load (Hours) = Estimated Operation Hours- Actual Labor Hours

Example

- **Quantity Method** - You indicate that load is relieved by Quantity. You estimate an operation to take .5 hour per piece for 50 pieces, for a total estimate of 25 hours (.5 x 50). After an employee reports 8 hours and 15 pieces, the load remaining is 17.5 hours (35 pcs left x .5 hrs/pc). Note that the scheduling engine always assumes the remaining pieces will be

completed in the time originally estimated.

- **Hours Method** - You indicate that load is relieved by Hours. You estimate an operation to take 40 hours to do 100 pieces. After an employee reports 8 hours and 15 pieces, the load remaining is 32 hours (40 hrs total - 8 hrs reported). Note that the pieces worked do not affect the calculation.

Load Leveling

Load Leveling is a modifying calculation that lets you compress the required time for operations assigned to a specific resource group. Both the Forward Scheduling and Backward Scheduling calculations can leave gaps of capacity on resources or resource groups where no Production Time is scheduled.

This process eliminates these gaps, by rescheduling blocks assigned against these resources/resource groups.

This calculation can remove any peaks and valleys that may be currently occurring in your schedule, eliminating any idle time at resource groups that typically bottleneck your production workflow.

The scheduling engine does this by first reviewing all the jobs that are contained within a defined date range. The What-If schedule displays the changes you make through this calculation. This lets you examine how you can shorten the schedule at a resource. The goal of the load leveling calculation is to schedule as much load as possible on a key resource to help relieve the bottleneck.

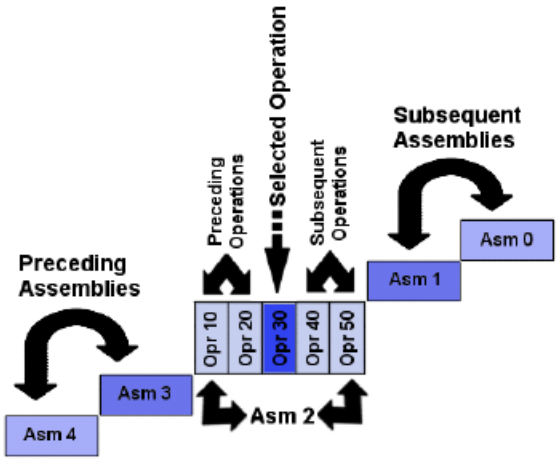
Note that this calculation can also consider the Priority assigned to each job. This lets the calculation give preference to jobs with a higher Priority value, eliminating most ties the engine may encounter while determining where to re-allocate the scheduling blocks.

After you review this potential schedule on a scheduling board or the Schedule Impact Report, you can then either accept or reject these What-If changes.

Adjustments

- **Load Level By** - This value by which you want the Load Level process to begin its calculations. You can level the load through these options:
    - If you use a Start Date, any operations that have scheduling blocks on or after this date will be rescheduling using load leveling.
    - If you select the Setup Group option, the Setup Group Scheduling Order panel displays. Use this panel to indicate the order you want to review groups for load leveling.
    - If you select the Operation Code option, the calculation levels the load by each operation in the schedule.
- **Start Date** - If you will level the load by using a Start Date, this field will activate on the Load Leveling panel. You can then define the date on which the load leveling process will begin.

- **Cut Off Date** - This value is the date on which you want the Load Level process to end its calculations. Any operations that have scheduling blocks on or before this date are rescheduled using load leveling.
- **Move Option** - Use the Move Option drop-down list to indicate the method by which you will move the assembly. The Move Options are all dependent on the current operation selected on the schedule. Any operation occurring before the selected operation is considered a preceding operation, while any operation that comes after it is considered a subsequent operation. The following illustration shows you how this works. Notice that the earlier the assembly occurs within the method of manufacturing, the higher number it will have. The final assembly is Assembly 0. These are the move options you can use to adjust operations:



- **Branch - Preceding Operations** - This option reschedules the selected operation and any preceding operations within the current assembly. It then moves on to reschedule operations contained in any preceding assemblies within the method.
- **Branch - Subsequent Operations** - This option reschedules the selected operation and any subsequent operations within the current assembly. It then moves on to reschedule operations contained in any subsequent assemblies within the method - up to the final assembly (Assembly 0).
- **Assembly - All Operations** - This option reschedules all the operations on the assembly around the selected operation. If multiple operations for a single assembly are scheduled at this resource group, the method leaves spaces (amounts) of time available for other operations required to be complete on any other resource groups.
- **Assembly - Preceding Operations** - This option only reschedules the preceding operations contained within the current assembly. It reschedules the selected operation and any operations that come before it within the assembly.
- **Assembly - Subsequent Operations** - This option only reschedules the subsequent operations contained within the current assembly. It reschedules the selected operation and any operations that come after it within the assembly.
- **Consider Priority** - When selected, this check box indicates that each job's Priority value will be reviewed during the Load Level calculation. Any jobs that have a higher priority will be scheduled before any jobs that have a lesser priority.

- **Locked Jobs** - You can prevent a job and its operations from being automatically moved in the schedule. You do this by freezing, or locking it. When the scheduling engine encounters a locked job, the schedule remains unchanged. All other job operations are assigned to the available operations capacity. To indicate that a job is locked, select its Locked check box located on the Job card.

Location

- **Resource Scheduling Board** - This scheduling board contains the Load Leveling app.
- **Schedule Impact Report** - This report lets you review changes that will occur in the schedule if you accept the What If changes.
- **Change Impact Informer** - This dashboard lets you review changes that will occur in the schedule if you accept the What If changes.

Logic

- Review all jobs that are within the defined date range.
- Reschedule all scheduling blocks assigned against the resources/resource groups used on the job so that no gaps of time remain between them.

Example

You review the scheduled jobs on the Job Scheduling Board. You notice that there are several gaps between operations. To remove these gaps, you run the Load Leveling app.

The gaps of time between each operation are now smaller then they were previously.

Locked

Select the Locked modifier to freeze the End Date on a job.

When the End Date is frozen, or locked, the scheduling engine cannot make change to the job. This job's load is then fixed in place within the schedule. Any jobs that are not locked will have their load placed against capacity the scheduling engine finds at other locations within the schedule.

Adjustments

- **Priority** - Select the Locked check box next to the Priority drop-down list to prevent the End Date from being changed during MRP processing. No expedite or postpone suggestions can now be generated against this firm job.

Location

- **Job Entry** - The Locked check box is located on the Job card.

Logic

- If the Locked check box is selected against the Priority value on a firm job, do not generate a suggestion that changes this job's End Date value.

Example

Job 8723 is producing a part quantity for Dalton Manufacturing. You do not want this job schedule to change during Global Scheduling. You select the Locked check box next to the Priority list on the job header (the Job card).

The next time Global Scheduling is run, the scheduling engine leaves Job 8723 alone. The scheduling blocks calculated for its load remain at the resources previously selected to handle the job.

The Global Scheduling process then places load on the remaining capacity at each resource.

Minimize WIP

The Minimize WIP modifier lets the scheduling engine reduce the gaps that can occur between operations and assemblies during the Global Scheduling process. It causes this process to run the scheduling engine a second time against the jobs that are using this modifier.

If the scheduling engine discovers that the Start Date on a job will occur before the Scheduled Start Date, it uses the Bounce Condition to forward schedule the job. After the new End Date is calculated for this job, it backwards schedules from that date - tightening the points where the assemblies are placed within the schedule.

This allows Just In Time (JIT) relationships for peer (predecessor) assemblies relative to their successor assemblies. This allows the engine to more accurately schedule unnecessary gaps between the assemblies.

You select this modifier on priority codes. This additional calculation is run when a job with this priority code is scheduled.

Note that using this calculation will cause the scheduling engine to take more time to complete its process run.

There is a Minimize WIP modifier on the Schedule Job panel that you can use to override the priority codes that define the scheduling order for all jobs. It functions in the same manner as described above. When you use this option, the scheduling engine will reduce the gaps between the operations within a single job or gaps between a group of associated jobs (if you are using the Schedule Multi-Job feature).

Adjustments

- **Minimize WIP** - To activate this calculation on a priority code, select the Minimize WIP check box.

Location

- **Scheduling Priority Code Maintenance** - You define which priority codes will use this calculation within this app.
- Job Entry - You select the priority code you want on a specific job from the Priority drop-down list. This list is available on the Job card.

Logic

- If the Minimize WIP check box is selected on the Priority Code, then run the Minimize WIP calculation.

Example

You are not satisfied with the scheduling results for Job 3487 because it will not meet its Required By Date. On the Job Scheduling Board, you notice that the operations on this job are being scheduled over several working days.

You have a Minimize WIP priority code set up. You open Job Entry and select this code on Job 3487. You then schedule the job.

When the scheduling process is complete, the Job 3487 assemblies are placed in a closer relationship with one another. The schedule is much tighter and the End Date occurs before the Required By Date.

Minimum Overload Percentage

The Minimum Overload Percentage modifier allows you to filter data you do not want to display on the Overload Informer. This app displays resources that have been assigned too much load (scheduling blocks).

Use this modifier to define a percentage filter value for each resource and resource group. This prevents unwanted information from appearing on this app.If the percentage of overload is equal to or less than this value, this information is not displayed on the Overload Performer.

By default, this value is set to 0. All overload information is displayed on the Overload Informer.

Adjustments

- **Minimum Overload Percentage** - You can define percentage values between 0 and 100. A 0 value indicates that all overloaded capacity will display on the Overload Informer. A 100 value indicates that no overloaded capacity will display on this app.

Logic

- Resource Overload Displayed = Total Resource Overload- (Total Resource Overload x Minimum Overload Percentage)

Location

- **Resource Group Maintenance** - You can define the Minimum Overload Percentage in the Resource Group Maintenance app.You can also define this value on resources using the Resources card.
- **Overload Informer** - This app displays the dates on which resources are scheduled above their available capacity. It shows you both Actual and What-If schedules. Use this app to locate bottlenecks in your current schedule and to correct potential bottlenecks in the schedule.

Example

You are not worried about any resources that are 5% over their capacity. There is usually enough capacity during each working day to account for this overload. You enter 5 in the Minimum Overload Percentage in all your resource groups.

As long as resource is overloaded by 5% or less, this information does not display on the Overload Informer.

Move Option

The Job Scheduling Board and the Resource Scheduling Board visually display the schedule you generate thorough the scheduling engine. You use the Move Options panel to select and drag jobs or operations to manually change the generated schedule.

You can also use the Multi-Resource Scheduling Board to display the generated schedule. This app is available if you have the Advanced Planning and Scheduling (APS) module.

Launch the Move Options panel to make changes to these scheduling boards. A key modifier on this panel is the Move Option list. Use this list to define the method you use to factor the change within the schedule. The Move Option you select defines how the engine handles schedule changes to jobs with multiple assemblies and sub-assemblies.

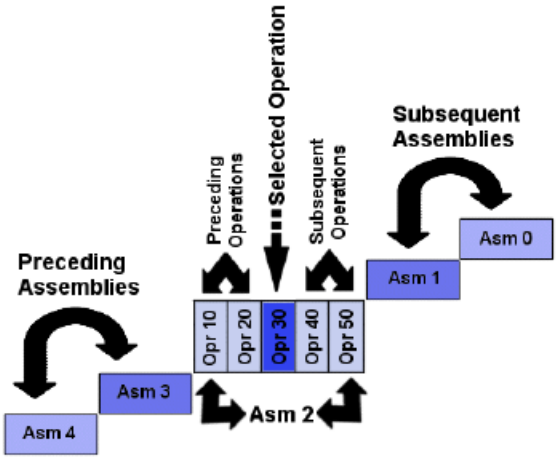
You must define the move method, because a change in one sub-assembly series, or branch, may or may not affect the End Date value on the job. This is because some assembly branches may not be part of the Critical Path on the job. The Critical Path is the longest sequence of assemblies and their sub-assemblies that determine job duration. The scheduling engine analyzes assembly and sub-assembly sequencing to determine the Critical Path for each job.

Use the Move Option to change the Critical Path.

Adjustments

You can change the Move Option modifier using the following options:

- When you move a job or an operation on a scheduling board, the Move Job panel displays. Use the Move Option drop-down list on this panel to define the move assembly method.
- The Move Options depend on the selected schedule operation. Any operation occurring before the selected operation is a preceding operation, while any operation that comes after it is considered a subsequent operation. The following illustration shows how this works:



Notice that the earlier the assembly occurs within the method of manufacturing, the higher number it will have. The final assembly is Assembly 0.

These are the move options you can use to adjust operations:

- **Branch Preceding Operations** - This method reschedules the selected operation and any preceding operations within the current assembly. It then moves on to reschedule operations contained in any preceding assemblies within the method.
- **Branch Subsequent Operations** - This method reschedules the selected operation and any subsequent operations within the current assembly. It then moves on to reschedule operations contained in any subsequent assemblies within the method - up to the final assembly (Assembly 0).
- **Assembly All Operations** - This method reschedules all the operations on the assembly around the selected operation. If multiple operations for a single assembly are scheduled at this resource group, the method leaves spaces (amounts) of time available for other operations required to be complete on any other resource groups.
- **Assembly Preceding Operations** - This method only reschedules the preceding operations contained within the current assembly. It reschedules the selected operation and any operations that come before it within the assembly.
- **Assembly Subsequent Operations** - This method only reschedules the subsequent operations contained within the current assembly. It reschedules the selected operation and any operations that come after it within the assembly.

Location

- **Job Scheduling Board** - The Move Job panel displays when you manually select and drag a job on this scheduling board.
- **Resource Scheduling Board** - The Move Job panel displays when you manually select and drag an operation on this scheduling board.
- **Multi-Resource Scheduling Board** - The Move Job panel displays when you manually select and drag an operation on this scheduling board.
- **Load Leveling** - The Load Leveling app also contains the Move Option list. Select the method you want to use while adjusting the load assigned to your resources.

Logic

- Use the selected Move Option to reschedule all the operations affected by the move.
- Change the Start Date and End Date values on each affected operation.

Example

You need to move job 9832 ahead in the schedule to allow room for job 8743. This is an emergency job that is producing a Hinge part that is needed on another job. Using the Job Scheduling Board, you select and drag job 9832.

The Move Job panel displays. Because this job is already started, you just move the remaining operations ahead. You select Operation 30. Then from the Move Options drop-down list, you select Branch - Subsequent operations.

The scheduling engine first reschedules the selected operation and all subsequent operations within the current assembly. It then reschedules Assembly 1 and Assembly 0 - causing the operations within these assemblies to have different Start Date and End Date values.

Move Time

Move Time is the amount of time required to physically move a part quantity from one resource to another resource, or to inventory. The scheduling engine uses information to more accurately reflect how long it takes to produce part quantities.

The engine use this value to allow for additional time required to move parts between resources.

This value measures the required transportation time to move the part quantity to its next destination and does not consume actual resource time.

You may not always need to enter Move Time values. These are some things to consider:

1. If you are moving a part quantity in the same building, you may not need to add Move Time if there is a Queue Time value defined at the next resource.
2. If you are moving the part quantity to another building or a site that requires using a company or supplier truck, you must enter a Move Time value for the resource/resource group.If the

move will require special equipment like an overhead crane or a forklift truck, it is probably a good idea to enter a Move Time value.

Note that Move Time values increase how long it takes an operation to complete on the resource or resource group.

Adjustments

- **Length of Time** - You can increase or decrease how much move time you want the scheduling engine to use. To do this, you change the value in the Move Hours field on either the resource group or the resource.
- **Use Calendar for Move Time** – Select this check box to indicate that during the calculations for Move Time, the scheduling engine also considers the available working hours defined on the current production calendar. Move Time is the time period required to transport a quantity from one resource group to another resource group. If you select this function, the scheduling engine calculates that Move Time must occur during the working hours available at the current resource group. By default this check box is clear, indicating the working hours defined on the production calendar are ignored and Move Time is calculated without this constraint.

Location

- **Resource Group Maintenance** - You can enter a Move Time value for each resource group. This becomes the default time for all resources in the group. Move Time values can also be entered for specific resources.

Logic

- Move Time and Queue Time (how long parts wait at the resource) add extra time to the schedule. This is sometimes called inter-operation time. The scheduling engine adds these two value together to calculate the extra time required for an operation. This value measures the required wait time before the operation can begin, and the required transportation to move the quantity to its next destination. This value does not consume actual resource time.
- Inter-Operation Time = Move Time of 1st Operation + Queue Time of 2nd Operation

Examples

The following example(s) illustrate how you use the Move Time functionality.

These are some examples of when you need the scheduling engine to use Move Time values:

- Use Move Time to allow for part inspection. This lets an inspection occur without having to add a Inspection operation to your job, part, or quote method.
- Some operations, like painting or epoxy, require that a part quantity cannot be moved until it is dry or cured. You can use Move Time to define how long this process will take.

- You want to complete a job a few days before it is scheduled to ship. This will let you make sure any necessary rework is complete and all shipment paperwork is printed. You can add a Move Time value to account for these extra days.

Non-Working Day

A non-working day is a day on a production calendar during which work is not scheduled. Typically you select holidays and weekends as non-working days.

The engine will ignore these days, as capacity is not available on this specific dates.

Adjustments

- **Non-Working Days** - You indicate on which days work will not occur by selecting these days on the production calendar.

Location

- **Production Calendar Maintenance** - This app lets you create the production calendars leveraged by the scheduling engine.
- **Job Entry** - You schedule individual jobs through the Schedule Job panel. Select the Finite Capacity check box to schedule the job using the finite calculation.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs within your database.

Logic

- Working Days = 365- Non-Working Days

Example

You are creating a production calendar that most of your resource groups will use. There are no holidays during the month of August. You need to indicate that the weekends are non-working days. You indicate that all the Saturdays and Sundays during this month are non-working days.

Operations Per Part

The Operations Per Part modifier defines how many times an operation must be performed on one part. This value is available when the Production Standard on an operation detail is set to either Operations/Hour or Operations/Minute.

The Operations per Part number is multiplied by the planned operation quantity to determine the number of times this operation must run to complete this operation. This quantity is divided by the production standard to determine total estimated production hours.

Adjustments

- **Operations Per Part** - This field is available on operation details. You enter numeric values in this field.

Location

- **Opportunity/Quote Entry** - The Detail card lets you enter Operations Per Part value on each operation.
- **Job Entry** - The Detail card lets you enter Operations Per Part value on each operation.
- **Engineering Workbench** - The Detail card lets you enter Operations Per Part value on each operation.

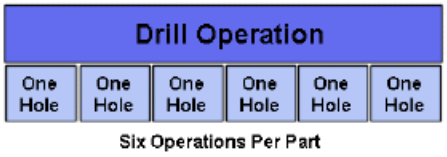
Logic

- Total Operations = Ops per Part x Operation Quantity
- Estimated Production Hours = Total Operations/Production Standard

Example

You have a Drill operation that requires you drill six holes in one part for each operation. Even though the Drill operation is only run once, it must perform this task six times. The Production Standard is 5 Operations/Hour.

The following illustration shows you how the scheduling engine views this operation:



Six Operations Per Part

You need to produce 10 parts through this operation. This means the drill operation must be performed 60 times to complete the quantity. Multiplying this value against the Production Standard, the scheduling engine calculates it will take 15 hours to complete this operation.

Overload Horizon

Use the Overload Horizon modifier to indicate the future point (in days) at which resource capacity is calculated against the demand that falls on or before this date range. This value is used by the Infinite Capacity calculation to evaluate the potential load being placed against each resource.

You use the Overload Horizon value to discover where bottlenecks may occur in the upcoming schedule. You can then adjust your short-term scheduling needs to correct these bottlenecks. Any demand placed on resources outside of this Overload Horizon date range are not included in this calculation.

This value defines the number of days from the current date the scheduling engine uses to create job records within the Shop Load table. These overloaded resource records then display in the Shop Load Graph and the Overload Informer. You can enhance scheduling performance by setting up an Overload Horizon time frame, which is typically the number of days you manage overloaded resources. You can then use the Shop Load Graph and the Overload Informer to manage overload in the site within this relative time frame without loading data beyond the point you currently need to manage.

However if you do not use these tools, enter a '1' value in this field to load only one day's records in the Shop Load table.

When you use the Overload Informer to review the results, this tracker displays the capacity used on each resource per each day, indicating when a resource is below capacity (such as 72%), at capacity (100%), and above capacity (such as 117%). Only resources scheduled with infinite capacity display on this tracker.

The Overload Horizon does not affect the Shop Load report. The Shop Load report prints load hours for each operation scheduled for a resource group, and so is separate functionality from the Overload Horizon.

Adjustments

- **Overload Horizon** - Enter a value, in days, during which you want the overload calculation to run. Any demand scheduled with infinite capacity placed on or before this date is evaluated. The daily percentage capacity used on each resource during each date within the range is calculated; this value displays in the Overload Informer.

Location

- **Site**- You can define an Overload Horizon for a specific site on the Planning card.
- **Overload Informer** - Use this tracker app to review the capacity of each resource that falls within the Overload Horizon range. The percentage overload capacity is calculated against each resource that falls within the Overload Horizon range.

Logic

- If Demand Date <= Last Date on Overload Horizon and => the system date, include demand record in Overload Capacity calculation.

Example

You want to review the potential bottlenecks that may occur three months in the future. You launch the Site app and enter 90 within the Overload Horizon field. Each time scheduling is run, the percentage capacity overload is calculated against each resource and each day that falls within the Overload Horizon date range.

You then launch the Overload Informer. Use this tracker to view the percentage capacity placed against each resource. Resources less than 100% are below capacity, while resources higher than 100% are above, or over, capacity.

Override Material Constraints

When a material is constrained, the scheduling engine determines the date on which a material will be available for issuing to an operation. It then uses this date as the operation's Start Date.

If a material is not available, the engine does not schedule the operation until it finds a date when this material is available.

In some situations, however, you may wish to ignore these material constraints. To do this, you can select the Override Material Constraints check box within some scheduling apps. This modifier causes the scheduling engine to ignore arrival dates for constrained materials. The operation will be scheduled at the resource group or resource at a point where capacity is available.

Adjustments

- **Specific Jobs** - You can ignore constrained materials while you are scheduling a specific job. You do this within Job Entry on its Schedule Job panel.
- **Moving Jobs** - You can ignore constrained materials while you are moving a specific job or operation. You do this within the scheduling boards on their Move Job panels.

Location

- **Job Scheduling** - You schedule individual jobs through the Schedule Job panel.
- **Job Scheduling Board** -The Move Job panel displays when you select and drag a job on this scheduling board.
- **Resource Scheduling Board** -The Move Job panel displays when you manually select and drag an operation on this scheduling board.
- **Multi-Resource Scheduling Board** -The Move Job panel displays when you manually select and drag an operation on this scheduling board.

Logic

- If the Override Constrained Materials check box is selected, then ignore constrained materials linked to the operations on the job method.

Example

You need to move job 8154, and want to test where this job could potentially be placed within the schedule. You move this job on the Job Scheduling Board and the Move Job panel displays. You select the Ignore Materials Constraints check box.

Operations on this job can now be scheduled in the time slots where capacity is available on the resources. If this schedule change is acceptable, you can recalculate when these materials constraints are needed for the operations.

Override Scheduling Constraints

Select the Override Scheduling Constraints check box to indicate you can move jobs on scheduling boards as you need.

Typically when you try to move a job or an operation that has quantities for material constraints or subcontract POs, you receive an error. However if you select this check box, you can move any jobs created in this site to different areas of the schedule, ignoring both material constraint quantities and subcontract purchase order quantities.

Adjustments

- **Moving Jobs** - If you select the Override Scheduling Constraints check box, you can ignore constrained materials and subcontract purchase orders while you are moving a specific job or operation. You move jobs within the scheduling boards on their Move Job panels.

Location

- **Site** - You can select this check box on the Planning card.

Logic

- If the Override Scheduling Constraints check box is selected, then ignore constrained materials and subcontract purchase orders linked to the operations on the job method.

Example

Normally while moving jobs on scheduling boards, you receive errors when you attempt to move a job that requires a certain material quantity be available on a specific date (material constraint) or requires a part quantity from a subcontract operation be available on a specific date. This feature helps you make sure you have the part quantities needed to complete a specific job.

Due to the fluid manufacturing process for your product line, you want more flexibility adjusting jobs when reviewing schedules in the Blue site. You launch Site Maintenance and select the Override Scheduling Constraints check box. Now when you need to move jobs on the scheduling boards in this site, you will not receive error messages because of material constraints or subcontract PO's.

Part Lead Time

Specifies if Capable to Promise (CTP) calculations, when determining whether an order can be filled on the requested shipment date for this site, should include all demand for the part when comparing demand against all expected supply within the part's lead time.

- Select the check box if CTP calculations should net out all demand for the part against all expected supply within the part's lead time to determine whether an order can be filled on the requested shipment date (default value).

  For purchased parts, it uses the purchasing lead time specified in the Lead Time field located on the Site Detail card in the Part app.

  For manufactured parts, it uses the manufacturing lead time (calculated or manually entered) located on the Planning card in the Part app.

- Clear the box if CTP should not honor the lead time window defined for the part and possibly over promise available inventory.

Location

- Site Configuration Control

Logic

Refer to the Capable to Promise topic.

Example

The following example(s) illustrate how the Part Lead Time setting is used in Kinetic:

- Current Date = 10/30
- Current Quantity on Hand = 50
- Existing Order Quantity =40, with a requested Ship Date of 11/4
- Newly Entered Order, with a Quantity =25, with a requested Due Date of 11/20
- Part Lead Time = 30 Days

If the Part Lead Time check box is selected (true), CTP compares the total demand quantity within the lead time window (65, which is the total of 40 from the existing order shipping on 11/4, and 25 for the newly entered order with a ship date of 11/20) against the quantity of 50 on hand, and verifies there is not enough stock available to fill the order. It also determines if incoming supply is available within the lead time expressed for the part, and compares it against the due date.

Priority

The scheduling engine uses the Priority modifier to resolve ties for competing operations. This occurs during the Global Scheduling process.

When the engine calculates that two or more operations are competing for the same capacity on a resource, it then checks the priority value assigned to the jobs. The job that has the highest priority value will have its scheduling blocks placed against the capacity first, followed by the job with the next highest priority, and so on.

Each priority record contains a numeric value that defines its ranking against other priority records; the larger the number the higher the priority. For example, a numeric value of 100 has a higher ranking over a priority with numeric value of 90.

Do not confuse the Priority value on a job with the Resource Priority value on a capability. Both values resolve ties, but they do this for different calculations. The Priority value defines the order the scheduling engine uses to place jobs against capacity on operations, while the Resource Priority defines the order the scheduling engines uses when scheduling and then selecting resources by capability.

Adjustments

- **Priority Ranking** - You define the ranking for your priorities within the Schedule Priority Code Maintenance app. Be sure to create a priority code hierarchy that matches your production workflow. The priority you consider to be a normal job priority should be the default. It is recommended that you use a 100 value for your normal priority code; this will give you more options for other priority codes.
- **Minimize WIP** - This modifier lets the scheduling engine reduce the gaps that can occur between operations and assemblies during the Global Scheduling process. It causes this process to run the scheduling engine a second time against the jobs that are using this modifier.
- **Adjust Global Scheduling Order** - This app lets you manually adjust the Priority order that will be used on jobs during the Global Scheduling process.
- **Calculate Global Scheduling Order Process** - Use the app to calculate and assign the priority order of the jobs using the Rough Cut Scheduling modifier.

Location

- Adjust Global Scheduling Order
- Calculate Global Scheduling Order Process
- Global Scheduling
- Job Entry
- Schedule Priority Code Maintenance

Logic

- If job A has a Priority ranking higher than job B, then schedule job A's operations first.

Example

To include the impact of the job priority, multiply this number by the Priority Factor in the Scheduling Priority Code. Assuming a factor of 100, the calculation now becomes 100. The following table shows the calculations for all jobs:

Job	Days Late/Early	Shifted Days Late	Priority Factor	Weighted Priority
A	-2	34	100	3400
B	8	44	110	4840
C	-35	1	100	100
D	15	51	120	6120
E	2	38	90	3420

Ranking the weighted priority from highest to lowest shows that job D has the highest priority and would be selected first for scheduling. This would be followed by jobs B, E, A, and C in that order.

Production Complete

The Production Complete modifier lets you manually indicate that Production Time on the operation is finished. The scheduling engine removes any remaining scheduling blocks left on this operation and it considers the operation's part quantity finished.

This Production Complete check box is available on the Move Job panel that displays within the scheduling the job or the operation.

Adjustments

- **Jobs** - You can select the Production Complete check box on any jobs you move within a scheduling board.
- **Operations** - You can select the Production Complete check box on any operations you move within a scheduling board.

Location

- **Job Scheduling Board** - The Move Job panel displays when you manually select and drag a job on this scheduling board.
- **Resource Scheduling Board** - The Move Job panel displays when you manually select and drag an operation on this scheduling board.
- **Multi-Resource Scheduling Board** - The Move Job panel displays when you manually select and drag an operation on this scheduling board.

Logic

- If the Production Complete check box is selected, then reduce Production Load on the current operation to 0.

Example

Job 5423 is complete ahead of schedule. You want to remove this job from the schedule so that you can free up the remaining capacity that is assigned to it. You launch the Job Scheduling Board, select the job, and launch the Move Job panel. You select the Production Complete check box; and the scheduling engine removes any scheduling blocks that remain for this job.

Production Consumption Rate

Production Consumption Rate is a modifier you can use to measure the Non-Time Constraint on an operation. This feature lets you calculate the capacity available at a resource or resource group using a value other than time.

It defines how much material is required to produce 1 quantity on the operation.

For example, if you enter a Production Consumption Rate of 20, this means it takes 20 quantities of the material (for example, cubic yards) to produce 1 quantity of the finished part (1 cubic yard). This rate is then multiplied against the job quantity to calculate the total amount of material required for the operation.

The scheduling engine compares this value to the Daily Production Capacity for the resource or resource group to determine available capacity for the resource or group. The Daily Production Capacity value defines the total number of parts that can be produced each day on this resource/group. When the resource/group reaches this capacity, the scheduling engine considers this resource consumed for the current working day. The remaining scheduling blocks are then allocated to the capacity available on the next working day.

Adjustments

- **Production Consumption Rate** - You define this value on resources within job, quote, and part methods.

Location

- **Engineering Workbench** - You can define the Production Consumption Rate for a selected resource. You select the required resource in the Nav tree.
- **Job Entry** - You can define the Production Consumption Rate for a selected resource. You select the required resource in the Nav tree.
- **Opportunity/Quote Entry** - You can define the Production Consumption Rate for a selected resource. You select the required resource in the Nav tree.

Logic

- Total Load = Job Quantity x Production Consumption Rate
- Remaining Total Load = Total Load- Daily Production Rate
- If the Remaining Total Load value is greater than 0, then apply the remaining scheduling blocks (load) against the capacity available on the resource during the next working day. Repeat this calculation until no scheduling blocks remain on the operation.

Examples

- **Example #1** - You use an oven resource to heat treat metal parts. It has 10 racks to hold parts during the Heat Treating operation, so 10 is used for its Daily Production Capacity. A part takes up 1/10 of the rack in space, so its Production Consumption Rate is 0.10. This means that the oven can produce 100 parts on any working day. If a job has a production quantity of 110, it means that this job will consume all of the oven capacity during one working day and only 10% of the oven capacity during the next working day.
- **Example #2** - An oven resource contains 4 racks. That is its Daily Production Capacity. If one part takes up 1/4 of a rack as its being manufactured, enter .25 here as the Production Consumption Rate. If a job has a production quantity of 16, it would consume all 4 racks for the day. (Production Qty) 16 * (Production Consumption Rate) .25 = 4 (Daily Production Capacity is 4 for the resource).

Production Factor

The Production Factor modifier is used on each resource linked to a capability. The scheduling engine uses this value to calculate how long Production Time will take for operations placing load (scheduling blocks) against this resource.

Each resource can have its own Production Factor value; this value can be entered as a decimal value. When you schedule your operations using capabilities, the scheduling blocks calculated against the resource are used as the base value multiplied against this modifier. This can change the amount of time available for each schedule block allocated to this resource. For example, if an operation's scheduling blocks are 1 hour in length, but the resource has a Production Factor of 1.1, each scheduling block placed against this resource can be 66 minutes.

This value calculates the length of Production Time that can be available for each scheduling block. The scheduling engine uses another value, Setup Factor, to calculate how long setup will take for each amount of Production Time assign to a resource.

Adjustments

- **Production Factor Value** - You enter decimal values in this field. The default value is 1, which means that the time available on each scheduling block for the specific resource/resource group will equal the amount of time calculated for each scheduling block on the operation. If you enter a 1.1 value, however, it means that Production Time takes 110% more time than the

base scheduling block. If you enter 0.9, it means that Production Time takes 90% less time than the base scheduling block.

Location

- **Capability Maintenance** - You link resources to each capability through the Capability Maintenance app. You then define the Production Factor on each resource.
- **Resource Group Maintenance** - Within this app, you create the resources and the resource groups that the scheduling engine will use.
- **Job Scheduling** - You schedule individual jobs through the Schedule Jobs panel.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs within your database.

Logic

- ProdTime = ProdTime x CapResLnk.ProductionFactor

Example

You have one machine, Drill Max Plus, which has more capacity available then the other drill machines at your manufacturing center. You enter 1.3 for its Production Factor value.

The scheduling engine is assigning load for Job 4981, which has a Drill operation. It discovers that the Drill operation and the Drill Max Plus resource share the Drill capability. The scheduling engine calculates that each scheduling block for the Drill operation will be 1 hour in length. Because the Drill Max Plus resource has a 1.3 Production Factor however, the scheduling blocks placed against this resource will be 78 minutes in length.

Projected Start Date

This Capable to Promise field specifies the start date for the entire sales order. If you enter a date in this field, it is used as the beginning value for the CTP calculations that arrive at the Completion Date values for each order release.

Adjustments

- Projected Start Date - You can enter the date you need in this field.

Location

- **Sales Order Entry** - You launch Capable to Promise from within Sales Order Entry.

Logic

- Work on the current order release is scheduled to begin on this date.

Example

Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Proposed Start Date

This Capable to Promise field specifies the date on which work on the order release would begin. The default is today's date, but you can change this date if you need.

This date is the starting point for the Capable to Promise calculation for the order release, and it overrides the value defined within the Projected Start Date field.

Adjustments

- Proposed Start Date- You can enter the date you need in this field.

Location

- **Sales Order Entry** - You launch Capable to Promise from within Sales Order Entry.

Logic

- If a date is entered in this field, use this value instead of the Projected Start Date value to calculate the date on which work begins.

Example

Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Queue Time

Queue Time is the amount of time a part quantity normally waits at a resource group or a resource before setup or production work (Setup Time and Production Time) is performed. This value lets the scheduling engine add time between operations, instead of assuming that one operation can begin the instant the previous operation is complete.

This value is typically not used to consume the actual resource actual time; it provides a way to measure the wait time required before the operation can begin. You can, however, override this default setting and indicate that the scheduling engine must include the working hours available on the production calendar as a constraint when calculating Queue Time amounts.

How long a part quantity waits in a queue changes from job to job. You should however, estimate an average Queue Time for each resource or resource group. Typically Queue Time accounts for much of the time needed for a job schedule. These are some factors to consider when estimating Queue Time:

1. How many jobs are typically scheduled at this resource or resource group each working day?
2. How often are jobs released to the manufacturing center during each working day?
3. How long does it take for part quantities to arrive at the resource or resource group? Note that you can use this value with Move Time to calculate the average time part quantities need to wait between operations. This is sometimes referred to as Inter-Operation Time.
4. How long will it take to complete part quantities that are in process because they these jobs have a higher priority?

The best way to determine the average Queue Time is to observe how long quantities wait during multiple working days. You can then add together these results and divide by the number of working days on which you recorded the Queue Time. You can then enter this average value for the specific resource group or resource.

As you use the scheduling engine, you can then evaluate the results to verify Queue Time amount is correct. Use this criteria to evaluate Queue Time:

- If your jobs complete ahead of their scheduled End Dates, there is too much Queue Time in the schedule.
- If your jobs complete after their scheduled End Dates, there is too little Queue Time in the schedule.

Adjustments

- **Queue Hours** - A Queue Time value can be entered for each resource group; this value then becomes the default time for all resources in the group. A Queue Time value, however, can also be entered for each resource.
- **Use Calendar for Queue Time** – Select this check box to indicate that during the calculations for Queue Time, the scheduling engine also considers the available working hours defined on the current production calendar. Queue Time is the time period during which a quantity must wait at a resource group before work can be performed upon it. If you select this function, the scheduling engine calculates that Queue Time must occur during the working hours available at the current resource group. By default this check box is clear, indicating the working hours defined on the production calendar are ignored and Queue Time is calculated without this constraint.

Location

- **Resource Group Maintenance** - Within this app enter Queue Time values on the Details card for a resource group and a resource.

Logic

- Move Time and Queue Time (how long parts wait at the resource) are related values that add extra time to the schedule. The scheduling engine adds these two values together to calculate the amount of extra time needed on an operation.
- Inter-Operation Time = Move Time of 1st Operation + Queue Time of 2nd Operation

Example

You keep track of how long parts wait to begin Setup Time at the Deburr machine. You track these times over a period of 5 days, and you come up with an average Queue Time of 30 minutes. You enter this value within the Queue Hours field on the Deburr machine.

When the scheduling engines schedules load against the Deburr machine, this value is added to the Setup Time and Production Time (scheduling blocks).

Required By Date

The Required By Date is the day on which the part quantity defined on a job is supposed to be finished. You enter this value within the Job Entry app.

This date is a fixed value that cannot be changed by the scheduling engine. The engine uses this date for different functions:

- If you use the Backward Scheduling calculation, the engine uses this value as the End Date and schedules back from this date to determine the Start Date for the job.
- If you use the Forward Scheduling calculation, the engine uses this value to determine if the job will be complete after the Required By Date. If this is the case, the job is displayed as late on the scheduling boards.

Adjustments

- **Required By Date** - Once this date is entered, it can not be modified by the scheduling engine. You can, however, update this value on the job record.

Location

- Job Entry
- Job Scheduling
- Global Scheduling

Logic

- Start Date (Backwards Scheduling) = Required By Date- (Operation Time 1 + Operation Time 2 + Operation Time 3 + and so on...)

Example

The Required By Date on Job 48973 is August 21. The scheduling engine backwards schedules the job and calculates that production needs to start on this job on August 1. The Start Date for this job will be August 1, and the End Date for the job will be August 21.

Resource Priority

Resource priorities define the scheduling precedence for each resource contained within the capability. To resolve a tie between resources that share both the capability and the same Start Date, you can assign a Resource Priority to each resource.

If the scheduling engine discovers that two or more resources are available at the same time, the resource that has a higher resource priority is selected first. For example, a resource with a '3' resource priority is selected before a resource with a '1' resource priority. The higher the number assigned to the resource, the more likely the resource will be used during capability selection.

If a resource priority value is not entered, the scheduling engine checks the resources for availability based on the order in which they are entered on resources list.

You can also use a resource priority value of 99999999. Any resource that has a 99999999 priority value cannot be scheduled by the engine. However, the resource is available to select within Start Activity (MES Interface) and Labor Entry. Shop employees can then report labor against this resource.

Do not confuse the Resource Priority value on a capability with the Priority value on a job. Both values resolve ties, but they do this for different calculations. The Priority value defines the order the scheduling engine uses to place jobs against capacity on operations, while the Resource Priority defines the order the scheduling engines uses when scheduling and then selecting resources by capability

Adjustments

- **Resource Priority** - The Resource Priority column is available on the Resource card. You define the ranking for your resources within this column. You can enter values between 1 to 99999999.

Location

- **Capability Maintenance** - Use this app to create and update capabilities. Note that this app is only available if you use the Advanced Planning and Scheduling (APS) module.

Logic

- If Resource A Resource Priority > Resource B Resource Priority, then use Resource A.

Example

You are setting up the Drill capability within Capability Maintenance. Your site has four resource groups A, B, C, and D, and each resource group has at least one drill press resource. You link all of these resources to the Drill capability and assign the following resource priorities:

- A4 - 1
- B1 - 2
- C2 - 3
- C3 - 99999999
- D5 - 4

If resources A4, B1, C2, and D5 are all available at the same time, the scheduling engine selects D5. However if D5 and C2 are not available, the scheduling engine selects B1. Notice that the C3 drilling station has a 99999999 resource priority; you want to keep this resource open for overflow situations. The scheduling engine will never select this resource, but shop employees can still place time against it.

Rough Cut Horizon

Use this modifier to determine the enter the future point of time (in days) after which the Rough Cut Scheduling formula is used to schedule jobs.

Any jobs that fall within this date range are scheduled using the demand requirements and supply capacity defined for each resource and resource group. The resulting values represent the actual schedule planned for your manufacturing center to both start and finish the operations and gather the materials required to complete each job.

Any jobs that fall outside of the Rough Cut Horizon date range, however, use the rough cut formula to generate the schedule. This formula uses the Need By Dates and Lead Time values on each material and operation to calculate how much time is required for each job to finish its operations and gather its materials.

The rough cut scheduling formula infinitely schedules these future jobs. This data, or load, is not recorded against your resources, which reduces the processing time needed to generate the overall schedule. Rough cut scheduling also gives you a general idea of the production plan you may require in the future.

Adjustments

- **Rough Cut Horizon** - This value indicates the number of days from the current system date or the Scheduled Start Date (Global Scheduling) used for the horizon. If a job begins on a date greater than the date defined for this horizon, it is calculated using Rough Cut Scheduling.

Jobs that fall on or before this date range, however, are scheduled by placing the full load against the available scheduling blocks on each resource.

Location

- **Site** - You activate Rough Cut Scheduling on the Planning card. To do this, enter a number of days value within the Rough Cut Horizon field.
- **Save Resource Load** - Use this app to add load to any rough cut scheduled jobs. Use this app to select a date range; any rough cut jobs that have Required By Dates within this range will be rescheduled with their load.
- **Job Scheduling** - You schedule individual jobs through the Schedule Job panel.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs within your database.

Logic

- If Required By Date > (Current System Date + Rough Cut Horizon), then schedule the job using Infinite Capacity and remove the Load required by the operations. Use the Need By Dates and Lead Time values on each material and operation to determine how much time is required for each job.

Example

You enter a Rough Cut Horizon value of 15 on your Blue site record.

Job 5692 is generated by MRP and its quantity will be produced by the Blue site; this unfirm job has a Required By Date of September 27. You automatically generate Global Scheduling every Monday morning. This process is run on the morning of September 10 so this is the Scheduled Start Date for this process run. The final date on the Rough Cut Horizon is September 25. Because the Required By Date on Job 5692 is September 27, it is calculated using Rough Cut Scheduling.

Scheduling Direction

Scheduling Direction determines the default direction when you manually schedule a job. Based on the selected option, the Forward or Backward option defaults in the following apps, when you manually schedule a job:

- Job Entry
- Service Job Entry
- Maintenance Job Entry
- Job Scheduling Board
- Multi Resource Scheduling Board
- Resource Scheduling Board

- Job Manager
- Project Entry

Adjustments

- **Forward** - The Forward option defaults, when you manually schedule a job.
- **Backward** - The Backward option defaults, when you manually schedule a job.

Location

- **Site** - The field is located on the Planning card.

Logic

- **Forward** - This logic begins with the Start Date on the job and then moves forward through the Production Calendar used at the resource, resource group, site, or company, and uses the lengths of time required on each operation (Operation Time) - taking into account any operations that can run concurrently (peer assemblies) - to arrive at the End Date.
- **Backward** - This logic begins with the End Date on the job and then moves backward through the Production Calendar used at the resource, resource group, site, or company, and uses the lengths of time required on each operation (Operation Time) - taking into account any operations that can run concurrently (peer assemblies) - to arrive at the Start Date.

Example

In the Multi-Resource Scheduling Board, you move the schedule one week forward using the Schedule's sheet graph. This opens the Move Job panel. If you selected the Forward option in the Schedule Direction field, the Forward radio button is selected by default. If you selected the Backward option, the Backward radio button is selected by default.

The same logic applies if you manually schedule a job from withing the following apps:

- Job Entry
- Service Job Entry
- Maintenance Job Entry
- Job Scheduling Board
- Resource Scheduling Board
- Job Manager
- Project Entry

Schedule Multi-Job

Use the Schedule Multi-Job option to schedule a group of associated jobs as if it were a single job.

Jobs are associated via make-to-job relationships. This functionality makes it possible to schedule and re-arrange manufacturing jobs for a parent assembly and its child subassemblies (called predecessor and successor) all at the same time. It is available when scheduling individual jobs in Job Entry and also when using the Global Scheduling feature. When using multi-job mode, you also have options to override any scheduling locks and to minimize WIP to reduce the time between related jobs on the schedule.

As part of the Global Scheduling Process, the Calculate Global Scheduling Order Process parameters include a check box to designate if the scheduling engine looks for assemblies and materials that have a direct job link. If you select to schedule rough cut jobs only, only rough cut scheduled jobs are selected to be scheduled. If the rough cut jobs have other jobs linked, they are scheduled in multi-job mode.

Adjust Global Scheduling Order displays the batch job (the top parent) to which a job is linked and the parent job (the direct parent) so that the production planner can see which jobs belong together. If the order is changed, jobs in the same batch move together. When scheduling the jobs through Global Scheduling, the production planner can see if the calculations were processed in multi-job mode.

There are several options set at the site level that determine how this functionality operates. You can set the default setting of the multi-job functionality throughout Kinetic, determine whether successor and predecessor jobs are loaded to scheduling boards when a job with links is selected, and determine whether a process to minimize gaps between related jobs runs as part of the functionality.

When you select a job in the scheduling board, Kinetic will automatically load related jobs as regulated by the options in Site. You can move the jobs as a unit or choose to move only predecessor or successor jobs.

Allow Move Jobs Across Sites

This check box is located in the Company Configuration app on the Job card.

Select this check box if you want to enable to functionality to move jobs across sites within the company. This option is associated with the Schedule Multi-Jobs function, which makes it possible to schedule and re-arrange manufacturing jobs for a parent assembly and its child subassemblies (called predecessor and successor) all at the same time.

When you select Allow Move Jobs Across Sites and you are running in Multi-Job mode, if you are working with a group of jobs that includes a job in another site, the scheduling engine will treat that job as part of the group and any rescheduling efforts will also reschedule the job in the other site. This works for any site; it is not limited to the site where the user is logged on.

The Scheduling Board shows jobs in other sites when they are linked to a job in the current site. The jobs from the other sites are read-only, but you can move them as a group by selecting and moving a linked job from the current site.

For example, a project to build a school includes several jobs (300, 310, and 320) to be completed on Site A, and one job (400) to be completed on Site B. When you are logged in to Site A, the

Scheduling Board will show all four jobs. You can see job 400, but it can only be moved if you move 300, 310, or 320. To move job 400 directly, you must log in to Site B.

If you do not select Allow Move Jobs Across Sites and you are working with jobs that are linked via multi-job, any job that is not in the same site for which you are scheduling is considered a constraint and cannot be moved. The job in the other site will behave as if it were a locked job.

Adjustments

- **Schedule Multi-Job** - Determines if the functionality is enabled in Kinetic. You can set a default value for the check box in Site, and you can also enable multi-job mode when scheduling a job in Job Entry and when using the Global Scheduling Process.
- **Auto Load Successor** Jobs - Determines if successor jobs that are related to a selected job are automatically loaded to the Job Scheduling Board. This check box is available in Site.
- **Auto Load Predecessor Jobs** - Determines if predecessor jobs that are related to a selected job are automatically loaded to the Job Scheduling Board. This check box is available in Site.
- **Minimize WIP** - Determines the setting of the Minimize WIP checkbox in scheduling apps. When selected, the scheduling engine will find the final date of a job's last operation or the final date of the successor job and then backward schedule all operations or jobs in the group to minimize gaps. You can set a default value for the check box in Site, and you can also enable Minimize WIP when scheduling a job in Job Entry and when using the Global Scheduling Process.
- **Ignore Locks** - Use this check box to override scheduling locks.

Location

- **Schedule Job** - You indicate that a job should be scheduled on the Schedule Job panel.
- **Calculate Global Scheduling Order** - Run calculations for scheduling in multi-job mode by selecting the Schedule Multi-Job check box on the Calculate Global Scheduling Order Process parameter app.

Logic

- If a selected job has links to other jobs through a make-to-job relationship, the jobs are considered associated and are scheduled and moved as a unit.
- When scheduling in multi-job mode, the End Date is determined by scheduling all the jobs related to the successor job so that the successor job is complete. To determine if the successor job is early or late, the End Date is then compared to the Requested By date of the successor job.
- If you schedule rough cut jobs only, only rough cut scheduled jobs will be selected to be scheduled. If the rough cut jobs are linked, they will be scheduled in multi-job mode.

Example

Successor job 2043 has three predecessor jobs: 2044, 2045, and 2046. You schedule job 2043. The related jobs (2044, 2045, and 2046) are also scheduled. If the jobs are rescheduled via the Move Job function, the related jobs can be moved together as a unit.

Scheduling Blocks Modifier

This modifier specifies the number of resources a single job operation requires. You define this modifier on resource groups.

Each resource group can have a number of scheduling blocks available for each resource. This modifier value is normally set to 1. If you indicate more scheduling blocks are available, you increase the capacity of the resource group. More load will then be calculated against the capacity available at the resource group.

Adjustments

- **Scheduling Blocks** - Enter the number of scheduling blocks available for each resource in this field. Do not enter more than 1 unless you typically set up more than 1 resource for the same operation on the same job. If you enter more than 1, operations schedule in this resource group will use more of the available capacity.

Location

- Resource Group Maintenance

Logic

The scheduling engine divides the production time by the number of scheduling blocks. The engine then finds resources that have capacity available in the required time frame. If there is enough capacity, the operation's total time can be reduced.

Example

For example, a resource group with 4 resources at 8 hours per day has production capacity of 32 hours and work day of 8 hours. If you enter a 2 here, a single operation will be scheduled for 16 hours in a day (using 2 resources) instead of just 8.

Scheduling Send Ahead For

Use this modifier to determine if the start-to-start job operation offset will be used for production or setup time.

You select either Setup or Production for this modifier. If setup is chosen, a secondary operation with a start-to-start relationship will schedule setup to begin xxx minutes (defined in the operation) after

the production starts on the primary operation. If production is chosen, then the production time of the secondary operation will be scheduled to start xxx minutes after the production starts on the primary operation.

Adjustments

- **Setup** - A secondary operation with a start-to-start relationship will schedule setup to begin xxx minutes (defined in the operation) after the production starts on the primary operation.
- **Production** - The production time of the secondary operation will be scheduled to start xxx minutes after the production starts on the primary operation.

Location

- **Site** - You define the Scheduling Send Ahead option on the Planning card.

Logic

- **Setup Option** - Setup Start (Second Operation) = Production Start Time (First Operation) + Setup Time (Second Operation)
- **Production Option** - Production Start (Second Operation) = Production Start Time (First Operation) + Production Time (Second Operation)

Example

You schedule two operations, Deburr and Paint, using a Start to Start relationship. When you finish deburring a part quantity, however, you can immediately start applying the base coat of paint to the parts. You indicate within Site that the Scheduling Send Ahead For value will be Setup within the site. This means that setup can begin on the second Paint operation after production begins on the first Deburr operation.

Send Ahead Offset

Defines the value used during scheduling to calculate when parts from this current operation can be moved on to the next operation. These operations must share a Start-to-Start relationship.

Use this functionality when finished quantities on the current operation can be advanced to the next operation before the current operation is complete. This generates a schedule that more accurately reflects your manufacturing process. You indicate on each site whether the Send Ahead Offset calculation starts from either the operation's Setup Time or Production Time.

You first define how the Send Ahead Offset value will be calculated using the Send Ahead Type drop-down list. Select a type option from this drop-down list. After you select a type, enter the Send Ahead Offset value you need in this field.

Adjustments

The Send Ahead Offset value you enter is defined by the Send Ahead Type. The type you select determines the value you enter for the offset modifier. Available types:

- **Hours** - Defines a set period of time. After you select this type, enter a value in hours within the Send Ahead Offset field.
- **Pieces** - Defines a number of completed parts. You will enter a Send Ahead Offset value that indicates the number of pieces that must be complete before the second operation can begin.
- **Percentage** - Defines a percentage of the operation duration that must be complete before the second operation can begin. You will enter a Send Ahead Offset value that defines a percentage duration of time that must pass on the first operation before the second operation can be scheduled.

Location

- **Operation Maintenance** - You define the default Send Ahead Offset value used on each operation within this app on the Detail card. When you add an operation to a quote, job, or part method, this default offset value displays on the operation. If you need, you can override this value on a specific method.
- **Engineering Workbench** - When you create a part method, you can override the default Send Ahead Offset value on each operation you include. You can change the type on the Detail card for an operation.
- **Opportunity/Quote Entry** - You can also override the default offset value for each operation included on a quote method. You can change the type on the Detail card for an operation.
- **Job Entry** - You can also override the offset value for each operation included on a job method. You can change the type on the Detail card for an operation.

Logic

- **Send Ahead Hours** - When the operation duration passes the Send Ahead Offset value (in hours) within either setup or production time, schedule the next operation.
- **Send Ahead Pieces** - When the operation completes either production or setup work on the number of parts specified within the Send Ahead Offset value (number of parts), schedule the next operation.
- **Send Ahead Percentage** - When the operation passes the Set Ahead Offset percentage of its overall setup or production time, schedule the next operation.

Example

You set up site A to generate Send Ahead values for production time. You have two operations, Mold and Paint, that have a Start-to-Start relationship. The Mold operation is the first operation, and some parts cool down fast enough so that work can start on the Paint operation before the Mold operation is complete. On the Mold operation, the Production Standard is 2 minutes/piece, and you observe that 50 pieces are cooled down enough to be painted during the next Paint operation. You decide to use the Send Ahead modifiers to indicate that these 50 pieces can be pushed ahead to the Paint operation during the scheduling process.

To do this, you define the Send Ahead values on the Mold operation. For the Send Ahead Type value, you select the Hours option. For the Send Ahead Offset value, you enter 2. This indicates that two hours must pass during production time before these first 50 pieces can be advanced to setup time on the Paint operation.

Send Ahead Type

Defines what scheduling offset value is used for the operation that runs after a current operation when these operations share a Start-to-Start relationship. These value can be calculated for setup time or production time.

Use this functionality when finished quantities on the current operation can be advanced to the next operation before the current operation is complete. This generates a schedule that more accurately reflects your manufacturing process. You indicate on each site whether the Send Ahead Offset calculation starts from either an operation's Setup Time or Production Time.

When you use this functionality, the following operation in a Start-to-Start relationship is scheduled to begin using the value you enter in the Send Ahead Offset field. Select an option on the Send Ahead Type drop-down list to determine how this value will be measured during the scheduling process. After you select the type, you can then enter the value you will use within the Send Ahead Offset field.

You define a default Send Ahead Type on each operation within Operation Maintenance. If you need, you can override this default type value on specific quote, part, and job methods.

Adjustments

- **Hours** - Defines a set period of time. After you select this option, enter a value in minutes within the Send Ahead Offset field.
- **Pieces** - Defines a number of completed parts. You will enter a Send Ahead Offset value that indicates the number of pieces that must be complete before the second operation can begin.
- **Percentage** - Defines a percentage of the operation duration that must be complete before the second operation can begin. You will enter a Send Ahead Offset value that defines a percentage duration of time that must pass on the first operation before the second operation can be scheduled.

Location

- **Operation Maintenance** - You define the default Send Ahead Type value used on each operation within this app on the Detail card. When you add an operation to a quote, job, or part method, this default type value displays on the operation. If you need, you can override this value on a specific method.
- **Engineering Workbench** - When you create a part method, you can override the default Send Ahead Type value on each operation you include. You can change the type on the Detail card for an operation.

- **Opportunity/Quote Entry** - You can also override the default type value for each operation included on a quote method. You can change the type on the Detail card for an operation.
- **Job Entry** - You can also override the type value for each operation included on a job method. You can change the type on the Detail card for an operation.

Logic

- **Send Ahead Hours** - When the operation duration passes the Send Ahead Type value (in minutes) within either setup or production time, schedule the next operation.
- **Send Ahead Pieces** - When the operation completes either production or setup work on the number of parts specified within the Send Ahead Type value (number of parts), schedule the next operation.
- **Send Ahead Percentage** - When the operation passes the Set Ahead Type percentage of its overall setup or production time, schedule the next operation.

Example

You set up site A to generate Send Ahead values for production time. You have two operations, Mold and Paint, that have a Start-to-Start relationship. The Mold operation is the first operation, and some parts cool down fast enough so that work can start on the Paint operation before the Mold operation is complete. On the Mold operation, the Production Standard is 2 minutes/piece, and you observe that 50 pieces are cooled down enough to be painted during the next Paint operation. You decide to use the Send Ahead modifiers to indicate that these 50 pieces can be pushed ahead to the Paint operation during the scheduling process.

To do this, you define the Send Ahead values on the Mold operation. For the Send Ahead Type value, you select the Hours option. For the Send Ahead Offset value, you enter 100. This indicates that a 100 minutes, or a hour and forty minutes, must pass during production time before these first 50 pieces can be advanced to setup time on the Paint operation.

Sequential Job

A Sequential Job is a job that produces part quantities in a linear order - one part quantity needs to be complete before production begins on the next part quantity. Typically jobs are sequential, so this is the default value when you create a new job record.

This mode is available, however, if your company manufactures concurrent jobs; these are jobs that can produce multiple part quantities at the same time. You then can indicate on each job record whether or not this is a sequential job.

You can select the Sequential or Concurrent job modes if your company has an Advanced Production license.

Adjustments

- **Mode** - To indicate that a job will produce parts sequentially, select the Sequential option from the Mode drop-down list.

Location

- **Job Entry** - You indicate if the current record is a sequential job on the Job card.

Logic

- Total Part Quantity = Demand Link 1 + Demand Link 2 + Demand Link 3 + and so on...

Example

Your company manufactures picture frames. One of your frame products has 4 x 4 dimensions. You run the wood material through the cutting machine in sequence to cut the frame pieces. Because of this, you select the sequential mode on the jobs that manufacture this 4 X 4 frame.

Setup Complete

The Setup Complete modifier lets you manually indicate that Setup Time on the operation is finished. The scheduling engine removes any remaining Setup Time left on this operation and considers the operation setup finished.

This Setup Complete check box is available on the Move Job panel that displays within the scheduling boards. After you select this check box and save the changes, the scheduling engine removes the load from either the job or the operation.

Adjustments

- **Jobs** - You can select the Setup Complete check box on any jobs you move within a scheduling board.
- **Operations** - You can select the Setup Complete check box on any operations you move within a scheduling board.

Location

- **Job Scheduling Board** -The Move Job panel displays when you manually click and drag a job on this scheduling board.
- **Resource Scheduling Board** -The Move Job panel displays when you manually click and drag an operation on this scheduling board.
- **Multi-Resource Scheduling Board** - The Move Job panel displays when you manually click and drag an operation on this scheduling board.

Logic

- If the Setup Complete check box is selected, then reduce Setup Load on the current operation to 0.

Example

Because there is a smaller quantity being worked on for the Drill operation, it has taken about half the time normally required to prepare work on this operation. Because of this, you launch the Job Scheduling Board and the Move Job panel. You select the Setup Complete check box, and the remaining time scheduled for setup is removed. You now have more capacity available at your Drill resource.

Setup Factor

The Setup Factor modifier is used on each resource linked to a capability. The scheduling engine uses this value to calculate how long Setup Time will take for operations that place load (scheduling blocks) against this resource.

Each resource can have its own Setup Factor value; this value can be entered as a decimal value. When you schedule your operations using capabilities, the scheduling engine uses the Setup Time defined on the operation detail as the base value. This base value is then multiplied against the Setup Factor. This can change how long setup will take on each resource. For example, if an operation detail indicates that setup will take 1 hour, but the resource has a Setup Factor of 1.1, the scheduling engine calculates that set up at 66 minutes.

This value only calculates the required Setup Time for each resource. The scheduling engine uses another value, Production Factor, to calculate how long scheduling blocks can be for the Production Time allocated against each resource.

Adjustments

- **Setup Factor Value** - You enter decimal values in this field. The default value is 1, which means that the Setup Time required on each resource equals the Setup Time defined on the operation detail. If you enter a 1.1 value, however, it means that Setup Time takes 110% more time than the Setup Time value entered on the operation detail. If you enter 0.9, it means that Setup Time takes 90% less time than the value entered on the operation detail.

Location

- **Capability Maintenance** - You link resources to each capability through the Capability Maintenance app.
- **Resource Group Maintenance** - Within this app, you create the resources and the resource groups that the scheduling engine will use.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs within your database.

Logic

- SetupTime = SetupTime x CapResLnk.SetupFactor

Example

You have one machine, Drill Max Plus, which takes less time to setup for production. You enter .7 for its Setup Factor value.

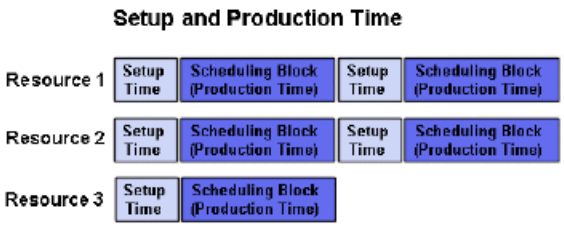
The scheduling engine is assigning load for job 4981, which has a Drill operation. It discovers that the Drill operation and the Drill Max Plus resource share the Drill capability. The scheduling engine discovers that the Drill operation detail on this job has a Setup Time of 1 hour. Because the Drill Max Plus resource has a .7 Setup Factor, however, the actual Setup Time calculated for this operation will be 42 minutes.

Setup Time

Setup Time defines how long it takes a resource to prepare for Production Time. This is the amount of time required, for example, to start up the machine, prepare the part quantities for the work that will be done, let the operators put on necessary safety gear, and so on.

Each amount of Production Time scheduled against a resource includes this Setup Time value. This is a constant value required for every scheduling block generated by the engine.

You can define Setup Time on each operation detail within a method. This value can be the overall time required to prepare for the operation. It can also be the specific time that is needed for setup by each resource assigned to the operation. Each scheduling block assigned against the resource will also have this accompanying Setup Time value. The following illustration shows you how the scheduling engine assigns these Setup Time values:



Setup Resources

You can also have resources that only perform setup. You indicate this by entering only Setup Time values on the operation detail, leaving the Production Standard value blank. The resources assigned to this operation will then only be scheduled to perform the setup.

You can then set up another operation detail to only have Production Standard values, leave the Setup Time values blank. The resources assigned to this operation will only perform production.

To make sure that this feature works properly, you cannot select the Setup Complete check box when the setup is done. Doing this will complete the setup time for the scheduling blocks generated on the related operation detail. If you do not need setup time for each Production Time, however, select this check box and the Setup Load will be removed.

Adjustments

- **Setup Hours Per Machine** - This value defines the estimated time it will take to setup each resource for the operation. This value is multiplied against the number of resources to calculate the Total Setup Hours for the operation. This will be the Setup Time value used for the Production Time generated for the operation.
- **Additional Setup Quantity** - If an extra quantity is required to complete the setup for this operation, you can enter this quantity value in the Additional Setup Quantity field. Note that if you enter a value in this field, you also have to enter this value within the Additional Setup Hours field.
- **Additional Setup Hours** - If any extra, special case setup time is needed on an operation, you can use this field to define the length of this time. This value is added to the Total Setup Hours value. Typically you enter this time when you have an Additional Setup Quantity required on the operation.

Location

- **Engineering Workbench** - You can define the Setup Hours Per Machine, Additional Setup Quantity, and Additional Setup Hours values for a part method within the method of manufacture on the Detail card for an operation.
- **Job Entry** - You can define the Setup Hours Per Machine, Additional Setup Quantity, and Additional Setup Hours values for a part method within the job's method of manufacture on the Detail card for an operation.
- **Opportunity/Quote Entry** - You can define the Setup Hours Per Machine, Additional Setup Quantity, and Additional Setup Hours values for a part method within the quote's method of manufacture on the Detail card for an operation.

Logic

- Total Setup Hours = (Setup Hours Per Machine x Number of Resources) + Additional Setup Hours

Examples

- You need .5 hours (30 minutes) to change a tool before each operation. Every time this operation is scheduled, an additional 30 minutes is added before the Production Time for this operation.
- Additional Setup Quantity and Time Example - A drilling machine must be inspected and adjusted every 5000 pieces. The inspection and adjustment takes 1 hour. Enter 5000 as the

Addl Setup Qty, and 1 as the Addl Hours. On an operation of 15,000 pieces with a setup of 2 hours, the total setup hours for that operation would be 5 = (2 + (15000/5000 x 1)).

Shipment Options

This Capable to Promise drop down list specifies the shipment options for this order release. These options determine how the part quantity is shipped to the customer.

Adjustments

- **Ship Partial Quantities** - The existing release is for the stock parts whose quantity is currently available. A second release is created for the remaining back-ordered quantity.
- **Ship Line Complete** - The available date is set for the release on the date when the entire quantity can be filled.
- **Ship Order Complete** - The available date is set for the entire order. The logic considers all lines as 'Ship Line Complete' as described above, and the farthest out date in the future for all lines is the available date value.

Location

- **Sales Order Entry** - You launch Capable to Promise from within Sales Order Entry.

Logic

- **Ship Partial Quantities** - For stock parts with some quantity available, the existing release consumes this available quantity and a second release is created for the additional backordered quantity.
- **Ship Line Complete** - This option will set the available date for the release to the date when the whole quantity can be satisfied.
- **Ship Order Complete** - This option moves through each order detail line as if the Ship Line Complete option is selected. When all the lines are processed, the calculation finds the furthest out date of any of the lines and then applies that date to all lines.

Example

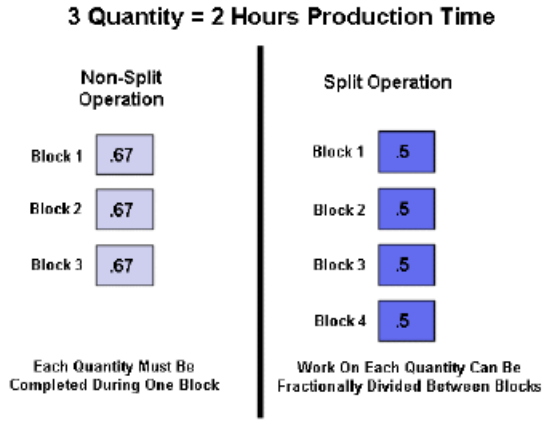
Paul likes to run CTP on any sales order created from a quote that has manufacturing details. He can then quickly determine when the part quantities quoted on the original estimate can be sent to the customer. If the sales order is for a non-stock part which has multiple lines, Paul can see different Completion Dates based on the quantity on each release. The larger quantities require more production time, and so these Completion Dates are further out in the future.

Splitting Operations

Use the Splitting Operations modifier to indicate that Production Time on a resource can be divided evenly between multiple scheduling blocks at different points within the schedule. As the engine allocates scheduling blocks against a resource, it can separate these blocks at points wherever capacity is available.

You define this value on resource and resource groups. If an operation can be separated into different time frames, the engine will divide the time required by wherever capacity is available. Because of this, the engine can create scheduling blocks that produce fractions of quantities like 33 , 33 , and 34. The split means that a part quantity can be started during one scheduling block but then finished during another scheduling block.

The following illustration shows you the difference between a non-split operation and a split operation. This illustration assumes that the operation is required to produce a 3 quantity, and it takes 2 hours of Production Time:



Notice that each scheduling block on the non-split operation must complete one quantity; so the scheduling blocks are each allotted .67 of the 2 hour Production Time. The split operation, however, can divide this quantity between 4 scheduling blocks, so they are each allotted .5 of the Production Time. These scheduling blocks will only produce a fraction of one quantity, as they are not limited to completing the entire quantity at once. These blocks can then be allocated against capacity wherever there is available time on the resource.

Before you use this modifier, determine whether or not an operation can be split. Some operations cannot use this feature, because work must start and end during the same time period. For example, a Paint operation cannot be split. If an operation can be split, it allows the engine to schedule operations with more flexibility.

Adjustments

- **Resources** - You can indicate a specific resource can divide operations by selecting its Split Operations check box.

- **Resource Groups** - You can indicate a specific resource group can divide operations by selecting its Split Operations check box.

Location

- **Resource Group Maintenance** - For resource groups, you can select the Split Operations check box on the Details card. For resources, you can select the Split Operations check box on the Resources > Detail card.
- **Job Scheduling** - You schedule individual jobs through Schedule Job panel.
- **Global Scheduling** - The Global Scheduling process schedules all open, engineered jobs.

Logic

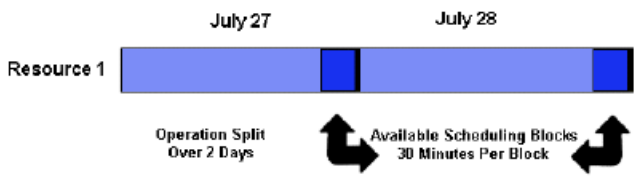
- If the Split Operations check box is selected, evenly divide the allotted time in each scheduling block.
- Place the operation's scheduling blocks in whichever time slots that they fit.

Examples

- **Cannot Split** - You run a Paint operation within your manufacturing center. Production Time on this operation cannot be divided, because applying and drying must all occur during the same time frame. Because of this contrtaint, the scheduling engine calculates that 4 hours are required to complete this operation. The engine can place this operation only at a point in the schedule where 4 contiguous hours are available.
- **Can Split** - Your company manufactures lenses. The Polish operation can work on a lens for only a half hour at a time, because the lens must cool before the operation can resume and complete production. Because of this down time, the Polish operation can be split into different time periods.

  On the part method, this operation has a Production Standard of 10 pieces per hour. As defined by the resource group's production calendar, the Polish operation can run 8 hours every working day. So you set up the resource group with the single Polish machine resource and a Scheduling Block value of 2. The result is scheduling blocks that have a time allocation of 30 minutes each. Because the operation can be split, it can also place the scheduling blocks whenever capacity is available.

  The following illustration shows you the scheduling engine does this:



  Notice that the length of time available within each scheduling block is the same – 30 minutes.

You have a job that requires a 200 lens part quantity. To complete the Polish operation on this job, the resource requires twenty hours of operation, so the engine calculates that 40 scheduling blocks are required. Because the engine can split up these scheduling blocks, it can assign the forty scheduling blocks wherever there is available capacity.

Note that because this operation can be split, the quantity manufactured during each scheduling block can also be divided into fractional values. Quantities that are only partially complete, like 10.5, can be calculated by the scheduling engine.

Supplier Due Date Horizon (Site)

Defines the number of days from the purchase order (PO) release due date that the Scheduling engine considers purchase orders for this site to be late. Available to Promise (ATP) and Capable to Promise (CTP) also use this setting to determine if incoming purchase orders should be considered in their calculations as a potential source of supply. The default for this field is 2, but can be overridden.

- If the PO release due date plus the specified supplier due date horizon is earlier than the current system date, Kinetic includes a given PO release in Scheduling engine and CTP calculations; the release is considered on time and thus, a potential source of supply.
- If the PO release due date plus the specified supplier due date horizon is equal to or later than the current system date, Kinetic does not include a given PO release in Scheduling engine and CTP calculations; the release is considered to be late and thus, is not a potential source of supply.
- For ATP calculations, it subtracts this factor from the current system date to calculate an acceptable horizon date, and then compares each PO release due date to the calculated horizon date.

  For example, if the current system date is 10/30, and the factor is 10, any PO release due date that falls between 10/20 and 10/30 is considered an 'acceptable' due date, even though it is late with respect to the current date. PO releases with due dates within this window are considered late, but are acceptable sources of supply. Any PO release with a due date earlier than 10/20 is 'unacceptably' late and is not considered an acceptable source of supply. For purposes of the ATP calculations, Kinetic discards the PO release and then replans for it.

Location

- **Site** - The Supplier Due Date Horizon field is located on the Planning card.

Examples

- **Example #1**
  - Site Supplier Due Date Horizon = **4**
  - PO Release Due Date = **10/25**

- Current System Date = **10/30**

Kinetic adds the horizon setting defined for the site (in this case, 4 days) to the PO release due date (10/25) to calculate an allowable due date of 10/29. Since it is earlier than the current system date (10/30), Kinetic includes the PO release in Scheduling engine and CTP calculations; the release is considered on time and thus, a potential source of supply.

- **Example #2**

  - Site Supplier Due Date Horizon = **6**
  - PO Release Due Date = **10/25**
  - Current System Date = **10/30**

  Kinetic adds the horizon setting defined for the site (in this case, 5 days) to the PO release due date (10/26) to calculate an allowable due date of 10/31. Since it is later than the current system date (10/30), Kinetic excludes the PO release in Scheduling engine and CTP calculations; the release is considered late and thus, is not a potential source of supply.

- **Example #3**

  - Supplier Due Date Horizon = **6**
  - PO Release Due Date = **10/20**
  - Current System Date = **10/30**

  For ATP calculations, the Kinetic subtracts this factor from the current system date to calculate an acceptable horizon date, and then compares each PO release due date to this date. In this example, any PO release due date that falls between 10/24 (current date of 10/30 less 6 days) and the current date of 10/30 is considered incoming supply, even though it is late with respect to the current date. PO releases with due dates within this window are considered late, but are acceptable sources of supply. Any PO release with a due date earlier than 10/24 is 'unacceptably' late and is not considered an acceptable source of supply. In this case, Kinetic discards the PO release with the due date of 10/20 and then replans for it.

Supplier Due Date Horizon (Supplier)

Defines the number of days from the purchase order (PO) release due date that the Scheduling engine considers incoming purchase order releases for this supplier to be late. Available to Promise (ATP) and Capable to Promise (CTP) also use this setting to determine if incoming purchase order releases for the supplier should be considered in their calculations as a potential source of supply.

- If the PO release due date plus the specified supplier due date horizon is earlier than the current system date, Kinetic includes a given PO release in Scheduling engine and CTP calculations; the release is considered on time and thus, a potential source of supply.
- If the PO release due date plus the specified supplier due date horizon is equal to or later than the current system date, Kinetic does not include a given PO release in Scheduling engine and

CTP calculations; the release is considered to be late and thus, is not a potential source of supply.

- For ATP calculations, it subtracts this factor from the current system date to calculate an acceptable horizon date, and then compares each PO release due date to the calculated horizon date.

  For example, if the current system date is 10/30, and the factor is 10, any PO release due date that falls between 10/20 and 10/30 is considered an "acceptable" due date, even though it is late with respect to the current date. PO releases with due dates within this window are considered late, but are acceptable sources of supply. Any PO release with a due date earlier than 10/20 is 'unacceptably' late and is not considered an acceptable source of supply. For purposes of the ATP calculations, Kinetic discards the PO release and then replans for it.

Location

- **Supplier** - The Supplier Due Date Horizon field is located on Detail card.

Examples

- **Example #1**

  - Supplier Due Date Horizon = **4**
  - PO Release Due Date = **10/25**
  - Current System Date = **10/30**

  Kinetic adds the horizon setting defined for the supplier (in this case, 4 days) to the PO release due date (10/25) to calculate an allowable due date of 10/29. Since it is earlier than the current system date (10/30), Kinetic includes the PO release in Scheduling engine and CTP calculations; the release is considered on time and thus, a potential source of supply.

- **Example #2**

  - Supplier Due Date Horizon = **6**
  - PO Release Due Date = **10/25**
  - Current System Date = **10/30**

  Kinetic adds the horizon setting for the supplier (in this case, 6 days) to the PO release due date (10/25) to calculate an allowable due date of 10/31. Since it is later than the current system date (10/30), Kinetic excludes the PO release in Scheduling engine and CTP calculations; the release is considered late and thus, is not a potential source of supply.

  If defined for thus supplier associated with the PO release, this setting takes precedence over the Supplier Due Date Horizon setting (if any) defined for the site in the Site app on the Planning card. The Scheduling engine, ATP and CTP only use the site level setting if the Supplier Due Date Horizon field in the Supplier app is set to zero.

- **Example #3**

- Supplier Due Date Horizon = **6**
- PO Release Due Date = **10/20**
- Current System Date = **10/30**

For ATP calculations, Kinetic subtracts this factor from the current system date to calculate an acceptable horizon date, and then compares each PO release due date to this date. In this example, any PO release due date that falls between 10/24 (current date of 10/30 less 6 days) and the current date of 10/30 is considered incoming supply, even though it is late with respect to the current date. PO releases with due dates within this window are considered late, but are acceptable sources of supply. Any PO release with a due date earlier than 10/24 is 'unacceptably' late and is not considered an acceptable source of supply. In this case, Kinetic discards the PO release with the due date of 10/20 and then replans for it.

If defined for thus supplier associated with the PO release, this setting takes precedence over the Supplier Due Date Horizon setting (if any) defined for the site in the Site app. The Scheduling engine, ATP and CTP only use the site level setting if the Supplier Due Date Horizon field in Supplier Maintenance is set to zero.

Update Job Operation Detail

Select this check box to change the resource originally defined in the Job Operation Detail with the resource currently specified on the Move Job panel. Both the resource group and the capability values also update to reflect the new resource.

Use this feature when you need to change the original resource defined on the job record.

If the costing rates are different between the new resource and the original resource, the Override Rates checkbox is also selected and the original costing rates are maintained. This check box does not create new rates for production labor costs or burden costs.

Adjustments

- **Update Job Operation Detail** - You can select this check box on any operations you move within a scheduling board. It is available on the Move Job panel.

Location

- **Resource Scheduling Board** - The Move Job panel displays when you select and drag an operation on to the scheduling board.
- **Multi-Resource Scheduling Board** - The Move Job panel dispslays when you select and drag an operation on to the scheduling board.

Logic

This check box is available under the following conditions:

- If the scheduling blocks assigned to this operation equal one.
- If the Prevent Changes check box is selected within Company Configuration, the Update Job Operation Detail check box is available and selected by default.

This check box is disabled under the following conditions:

- If the scheduling blocks assigned to this operation are greater than one.
- If the Prevent Changes check box is clear (not selected) within Company Configuration.

Example

You move the Deburr operation within the Resource Scheduling Board. Only one scheduling block is assigned to this operation. The original resource assigned to this operation, Deburr 1, is no longer available at this point in the schedule. You change this resource to Deburr 2, an available resource. After you verify that the Update Job Operation Detail check box is selected, you save the changes. The operation now reflects the resource group and capabilities linked to the Deburr 2 resource.

What-If Scheduling

What-If Scheduling is a scheduling option that gives you a preview of how a potential schedule might work against your actual schedule. You can select this option when you schedule a specific job or globally schedule all jobs.

This feature lets you work with the schedule by making temporary changes and then viewing the impact it will have on the scheduling boards.

What-If Scheduling uses all of the modifiers and components you have defined for your Actual schedule. It also uses the current Actual schedule and incorporates the potential changes from a job or global scheduling.

Within the database, the engine saves the results as separate schedules. Saving separate schedules ensures that the results you see are accurate, while the Actual schedule is not affected. The What-If schedule is displayed on the scheduling boards and the Overload Informer.

If you like the changes, you can accept them on the scheduling boards. The scheduling engine will then replace the Actual schedule with the the What-If schedule and the What-If schedule is removed.

Adjustments

- **Job Scheduling** - You can indicate that the current job will be calculated using What-If scheduling by selecting the What-If Schedule check box.
- **Global Scheduling** - This process can generate a What-If schedule. To do this, select the What-If Schedule Only check box.
- **Move Job** - You can select and drag a What-If job or an operation to display its Move Job panel. Use the panel to adjust the values generated by the What-If schedule calculation.

- **Accept All Changes** - To incorporate a What-If schedule within your Actual schedule, you select the Accept All Changes button. This button is available on all scheduling boards.
- **Accept Current Job Changes** - To incorporate a What-If schedule generated for a specific job within your actual schedule, you can select the Accept Current Job Changes button. This button is available on all scheduling boards
- **Undo All Change**s - To remove a What-If schedule from a scheduling board, you can select the Undo All Changes button. This button is available on all scheduling boards.
- **Undo Current Jobs Changes** - To remove a What-If schedule generated for a specific job from a scheduling board, you can select the Undo Current Job Changes button. This button is available on all scheduling boards.

Location

- Job Scheduling
- Global Scheduling
- Job Scheduling Board
- Resource Scheduling Board
- Multi-Resource Scheduling Board
- Overload Informer
- Schedule Impact Report

Logic

- A What-If schedule is saved in a separate file from the Actual schedule. The What-If Schedule starts as a copy of the Actual schedule, and the What-If schedule changes are incorporated into it.

Example

Dalton Manufacturing has placed a rush order for Part 893-J93. You enter Job 3214 to handle this emergency quantity, and schedule this job using What-If Scheduling. You then launch the Job Scheduling Board to review this job's impact will have on your Actual schedule.

After you make some changes using the Move Job panel, you accept the What-If schedule. This job is incorporated into your Actual schedule.

Working Day

A working day is a day on a production calendar during which work will be scheduled. The scheduling engine capacity.

Then the scheduling engine schedules the load, or scheduling blocks, against resources on these days.

You can also define the number of hours that are available for work during each working day, which further defines the capacity available to be consumed by load.

You can create as many production calendars as you need. Then you can assign the production calendars to specific resources, resource groups, sites, and companies. The engine will use calendars defined for resources first, followed by resource groups, sites, and lastly companies.

Also, calendars can be selected on supplier records. Adding a calendar to a supplier lets you define the number of days each year that production is run by a supplier that handles your subcontract operations. The working days on the supplier's production calendar and the Days Out on the subcontract operation are used together to calculate the specific dates when part quantities will be out of your manufacturing center.

Adjustments

- **Non-Working Days** - You indicate on which days work will not be run within the Production Calendar app. Select the days, like holidays, weekends, and other dates during which work will not be performed.
- **Hours Per Day** - Use the Hours Per Day card to define how many of production will be performed during each Working Day. The scheduling engine uses these hours to calculate how much capacity is available at each resource.

Location

- Production Calendar
- Job Entry
- Global Scheduling
- Resource Group
- Site
- Company Configuration
- Supplier

Logic

- Working Days = 365- Non-Working Days
- Capacity Per Day = Hours Per Day on each Working Day

Example

You are creating a production calendar for most of your resource groups. There are no holidays during the month of August, but you still need to indicate that weekends are non-working days. Thus, you indicate that all the Saturdays and Sundays are non-working days.

The rest of the days during this month are considered working days by the scheduling engine.

Troubleshooting

The troubleshooting section addresses some issues that may occur with Job Scheduling.

Because scheduling is a complex process, there may be times when you run into issues of some kind. If you experience problems with Scheduling, review the troubleshooting topics below for a potential solution.

The troubleshooting topics include:

- Error Message Log
- Performance
- Operations
- Production Calendar
- Production Hours
- Finite Horizon
- Resource Groups/Resources

Error Message Log

If an issue causes an error message to display, you have several features for viewing the log details.

Error messages display in a dialog box. This dialog box has options for reviewing the logged details for the message. To display, print, email and/or save the error message log:

1. Select the **Detail** button to display the error message log.

   The dialog box expands, showing you the following information:

   - Application Error - Displays the Kinetic error generated by the system.
   - Error Detail - Contains the primary information about the error, including the Message that displays, the app which initiated the error, and the Method that generated it.
   - Client Stack Trace - Displays the call trace that generated from your client installation.
   - Inner Exception - Contains the server stack trace and the exception thrown by Kinetic.
2. Select the **Summary** button to restore the original error message view.
3. Select the **Print** button to make a hard copy of the error message log.

   The Print window displays.
4. Now print the error message log.

a. From the Name drop-down list, select printer to which you will send the Kinetic error log.
b. Select **OK**.

5. Select the **Email** button to send the error details in an email.
   a. Type in the recipient's email address in the To field.
   b. If you want to send a copy of this email to other recipients, add their email addresses into the Cc field.
   c. In the Toolbar, select **Send**.
6. You can also copy and save the error message log to a file. To do this, in the error message dialog, select **Copy**.

   The error log is added to the clipboard.

   This action also adds some system information to the error log. This system information includes:

   - **AppServer Connection** - specifies the Kinetic server address and the ERP instance - for example, https://EpicorServer/Kinetic2022.2.3.
   - **Form Name** - specifies the name of the app the error occurred in - for example, Order Entry.
   - **Customization Name** - specifies the name of the customization layer applied to the current app, if any.
   - **Menu ID** - specifies the menu ID of the app - for example, OMMT3001.
   - **Software Version** - specifies the Kinetic version - for example, Kinetic2022.2.3.
7. Open a text editor like **Notepad** or a similar text editor.
8. Paste the error message log.

   The error message and related system information now display in the text editor.

9. Save the error message log.

You now have an error message file you can send to your Epicor consultant or Epicor Technical Support.

Performance

The most common issue with Scheduling is performance. At times it may run at a very slow speed, or take a long time to complete. The Scheduling engine may also hang or loop.

There are several reasons why Kinetic hangs or loops when running Global Scheduling. A loop repeats continually until the operating system senses it and terminates the app with an error or until some other event occurs, such as having the app automatically terminate after certain duration of

time. In most cases, it is due to a log file that is becoming too big. If this is the case, stop and restart the apps servers.

Follow the list of steps below to determine the cause for bad performance. These steps also apply if you schedule jobs finitely.

Operations

- **Issue** - Operations have both a resource group and a resource assigned as a scheduling resource.

1. Review the Scheduling logs to determine which job(s) is stuck in a loop. The logs usually display the same job number repeatedly. The logs also identify what assembly sequence/operation to look at. If you determine that the cause of looping relates to a resource group/resource conflict, use Job Entry to search for and correct the affected job.
2. In Job Entry, select the **Scheduling Resources** card and determine which resource group/resource you want to schedule. Remove the other one from the job operation and manually reschedule the job.
3. Review the Method Tracker for the manufactured item (parent part) to see whether the same resource group/resource conflict appears there. If it does, use the Engineering Workbench and modify the resources for the affected parent part.

Production Calendar

- **Issue** - A production calendar may include a space in front of its ID.

    1. Review the Scheduling logs to determine where the scheduler starts looping.
    2. Select **Job Entry** and retrieve the affected job.
    3. Review the assembly/operation sequence and verify that each resource group used on operations in the part's method of manufacture includes a Production Calendar ID that does not contain a space at the beginning of the ID. If it does, request a fix app to eliminate the space.

- **Issue** - A production calendar includes a time gap.

    1. The Scheduling engine requires a consistent time run, and is unable to move past the time gap. Time gaps may happen if a user sets up a calendar with a gap for lunch using the Production Calendar app, instead of the Shift app. For example, four consecutive hours followed by a three hours gap, followed by another four consecutive hours.

    2. Select the **Calendar Exceptions** card in the Resource Group app to verify whether the time gap problem exists on any certain days.

3. Select the Calendar card for a resource in the Resource Group app and identify similar exceptions that were established for a specific resource.

Production Hours

- **Issue** - Total production hours exceed the limit of one hundred.

  1. Review the **Scheduling** logs to determine where the scheduler starts looping.
  2. Select **Job Entry** and access the affected job.
  3. Review the assembly/operation sequence and verify that the total production hours do not exceed the limit of 100. If they do, determine whether this is a legitimate standard. If they don't, change the value to be less than 100 and manually reschedule the job.

Finite Horizon

- **Issue** - A Finite Horizon value is missing when using Finite scheduling.

  1. Review the **Scheduling** logs to determine where the scheduler starts looping.
  2. Select **Job Entry** and retrieve the job.
  3. If you determine that demand with long lead times exists (for example, a year from now), verify whether the resource group or resource used on operations in job's method of manufacture carry a Finite Horizon value.
  4. If they don't, select the **Resource Group** app and define the Finite Horizon value.
  5. Manually reschedule the job.

     The Finite Horizon value provides a long-term production view without committing resources to the schedule. Additionally, it reduces the Scheduling engine processing time.

Resource Groups/Resources

- **Issue** - In the Resource Group app, the number of resources listed in the Nav Tree differs from the Number of Resources field value.

  1. Review the **Scheduling** logs to determine where the scheduler starts looping.
  2. Select **Job Entry** and retrieve the affected job.
  3. Identify the resource groups used on the job's operations, and using the Resource Group app ensure that the number of resources listed in the Nav Tree view match the Number of Resources field value.

The Number of Resources field is located on the Details card in the Resource Group app.

4. If the value does not match, navigate to the Resource Group Maintenance > Resources card and remove or add a resource.

- **Issue** - You can define only one of the Capability, Resource Group or Resource field values for a single job operation.

  1. Review the Scheduling logs to determine where the scheduler starts looping.
  2. Select **Job Entry** and retrieve the affected job.
  3. In Job Entry, select the **Scheduling Resources** card for an operation and verify that only one of the Capability/Resource Group/ Resource fields are populated.
  4. Additionally, review the Method Tracker for the manufactured item (parent part) to verify that only one of these fields are populated. If multiple fields are populated, use the Engineering Workbench to modify the Scheduling Resources values for the affected parent part.

- **Issue** - In the Resource Group Maintenance on the Details card, verify the Use Calendar for Move Time and Use Calendar for Queue Time check boxes are selected and the related Queue Hours and Move Hours fields do not carry a value greater than zero.

  1. Select the **Resource Group Maintenance > Details** card and retrieve the affected resource group.
  2. Verify the **Use Calendar for Move Time** and **Use Calendar for Queue Time** check boxes are selected only if the **Queue Hours** and **Move Hours** fields include values greater than zero.

- **Issue** - Invalid production calendars assigned to resources.

  1. Select the **Resource Group Maintenance > Details** card and retrieve the affected resource group.
  2. In the Calendar field, verify a valid production calendar displays.
  3. Select the **Resources Details > Detail** card.
  4. In the Calendar field, verify the field displays a valid production calendar.

     If you leave the Calendar field blank, Kinetic searches for a default calendar defined in the Company and Plant apps.

- **Issue** - The Location check box is not selected for Input and Output Warehouse and Bin records.

  If you have the Advanced Material Management (AMM) license installed, you must select the Location check box and define the Input/Output Warehouse and Bin records.

1. Select the **Resource Group Maintenance > Details** card and retrieve the affected resource group.
2. Select the **Location** check box.
3. Define the **Input Warehouse** and **Bin** records.
4. Define the **Output Warehouse** and **Bin** records.

- **Issue** - Resources could not schedule concurrently.

  If there are multiple scheduling resources assigned to a single job operation, the related production calendars for these resources /resource groups must include availability hours that overlap.

  1. To check the production calendars assigned to the resources, select the **Resource Group** app and review the assigned production calendars.

  2. Next, select the Production Calendar app and review the selected production hours.

     If one production calendar has selected hours of 1 through 8 and the other calendar 10 through 18, the Scheduling engine locks up and hangs, because it must schedule these resources concurrently (at the same time). The Scheduling engine cannot schedule one resource for the 1 through 8 hours (for instance, Midnight to 8am) while it also tries to schedule the second resource at the same time, for the 10 through 18 hours (for instance, 10am to 6pm). You must verify that at least one or more hours overlap. Using this example, to achieve some overlap with the 10 through 18 hours, change the 1 through 8 hours to 4 through 12.

  3. If the hours overlap and the resources would not schedule concurrently, select the **Resource Group** app and, using the Calendar Exceptions and Resource Details > Calendar cards, verify the available default hours.