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EnterpriseOne Production Scheduling

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EnterpriseOne Production Scheduling
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Contents

EnterpriseOne Production Scheduling Preface

This preface discusses:

- Related documentation.
- Typographical Conventions and Visual Cues.

Note. This Implementation Guide documents only page elements that require additional explanation. If a page element is not documented with the process or task in which it is used, then it either requires no additional explanation or is documented with the common elements for the section, chapter, or Implementation Guide.

Related Documentation

This section discusses how to:

- Obtain documentation updates
- Order printed documentation

Obtaining Documentation Updates

The *EnterpriseOne Production Scheduling Implementation Guide* provides you with information about how to implement and use the EnterpriseOne Production Scheduling system. Additional essential information describing deployment and supplemental third-party software options resides in the *EnterpriseOne Hardware and Software Requirements Guide*. You should be familiar with the contents of this guide.

You can find updates and additional documentation for this release, as well as previous releases, on the Customer Connection web site. Through the Documentation section of Customer Connection, you can download files to add to your documentation library. You'll find a variety of useful and timely materials, including updates to the full documentation that is delivered on the CD-ROM.

Note. Before you upgrade, you must check Customer Connection for updates to the upgrade instructions. EnterpriseOne Supply Chain Planning continually posts updates as the upgrade process is refined.

Ordering Printed Documentation

You can order printed, bound volumes of the complete documentation that is delivered on the CD-ROM. EnterpriseOne Supply Chain Planning makes printed documentation available for each major release shortly after the software is shipped. Customers and partners can order printed documentation by using any of these methods:

- Web
- Telephone
- Email

Web

From the Documentation section of the Customer Connection web site, access the PeopleSoft Press web site under the Ordering PeopleBooks topic. The PeopleSoft Press web site is a joint venture between PeopleSoft and Consolidated Publications Incorporated (CPI), the book print vendor. Use a credit card, money order, cashier's check, or purchase order to place the order.

Telephone

Contact CPI at 800 888 3559.

Email

Send email to CPI at psoftpress@cc.larwood.com.

Typographical Conventions and Visual Cues

This section discusses:

- Typographical conventions
- Visual cues

Typographical Conventions

The following table contains the typographical conventions that are used in PeopleBooks:

Typographical Convention or Visual Cue	Description
PIT" " (quotation marks)	Indicate chapter titles in cross-references and words that are used differently from their intended meanings.
PIT{ } (curly braces)	Indicate a choice between two options in code syntax. Options are separated by a pipe (|)).
PIT[ ] (square brackets)	Indicate optional items in code syntax.
PITCross-references	Implementation Guides provide cross-references either following the heading "See Also" or on a separate line preceded by the word See. Cross-references lead to other documentation that is pertinent to the immediately preceding documentation.

Visual Cues

This implementation guide contains the following visual cues.

Notes

Notes indicate information that you should pay particular attention to as you work with the EnterpriseOne Supply Chain Planning system.

Note. Example of a note.

A note that is preceded by Important! is crucial and includes information that concerns what you must do for the system to function properly.

Note. Example of an important note.

Warnings

Warnings indicate crucial configuration considerations. Pay close attention to warning messages.

Note. Example of a warning.

Comments and Suggestions

Your comments are important to us. We encourage you to tell us what you like, or what you would like to see changed about this implementation guide and other EnterpriseOne Supply Chain Planning reference and training materials. Please send your suggestions to:

EnterpriseOne Product Documentation Manager

Oracle Corporation

500 Oracle Parkway

Redwood Shores, CA 94065

USA

or

EnterpriseOne Product Documentation Manager

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Or email comments to: appsdoc_us@oracle.com.

While we cannot guarantee to answer every email message, we will pay careful attention to your comments and suggestions.

CHAPTER 1

Getting Started

This chapter provides an overview of EnterpriseOne Production Scheduling and discusses:

- EnterpriseOne Production Scheduling business processes.
- EnterpriseOne Production Scheduling integrations.
- EnterpriseOne Production Scheduling implementation.

EnterpriseOne Production Scheduling Overview

EnterpriseOne Production Scheduling uses a constraint-based approach to automated scheduling. Unlike traditional automated scheduling tools that are limited to simple dispatch rules and have known bottlenecks, constraints in EnterpriseOne Production Scheduling can be assigned to every element-resources, operations, and due dates in a schedule. Through an advanced solver technology, feasible solutions can be found, if they exist, for virtually any floating constraints.

EnterpriseOne Production Scheduling is a finite scheduling product that addresses discrete batch processing with floating multistage problems. EnterpriseOne Production Scheduling can process an almost limitless number of variables and constraints. Using the power of the Windows NT operating system, the total cost of ownership decreases.

Using the advanced scheduling capabilities of EnterpriseOne Production Scheduling you can:

- Create a model
- Solve a model
- Publish a production schedule.
- Dispatch schedule information.

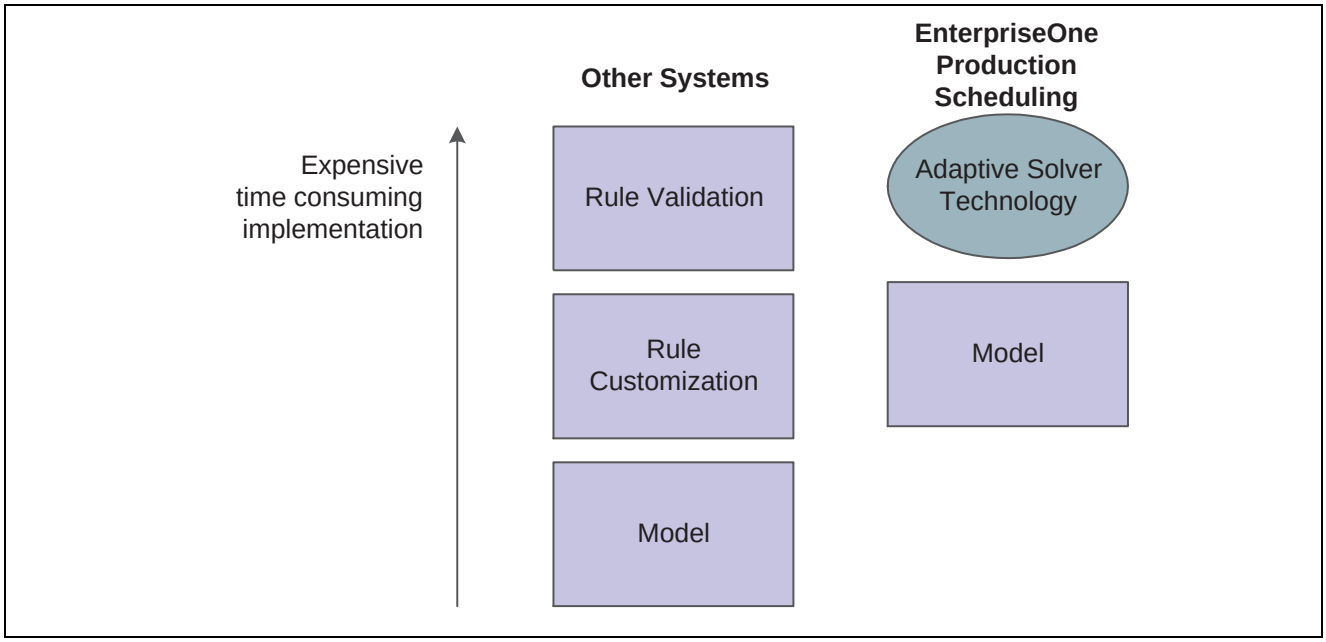
EnterpriseOne Production Scheduling is designed to schedule discrete manufacturing environments that have the following characteristics:

- Many components comprise each product.
- Few final products exist in relation to the large number of components.
- Subassemblies can be out-sourced to third-party manufacturers.
- Many production stages exist.
- Multistage, floating production bottlenecks exist.
- Large numbers of customer orders exist, often make-to-order as opposed to make-to-stock.
- Products are produced in discrete batches or consistent lot sizes.

- Multiple operations and routings can exist for the production of an item, and the user is able to specify a preference.
- Minimum and maximum delays exist between work center operations.
- Setups, changeovers, and cleanups are required.
- Capacity constrained resources exist in production routings.

Unlike other scheduling systems, EnterpriseOne Production Scheduling has a self-configuring solver. This technology enables the solver to adapt as the model changes and includes item propagation, which immediately determines item feasibility; adaptive propagation, which starts and stops propagation only as it is needed; and effective backtracking.

This graphic illustrates the advantages of implementing EnterpriseOne Production Scheduling compared with other systems:



Advantages of EnterpriseOne Production Scheduling

EnterpriseOne Production Scheduling Business Processes

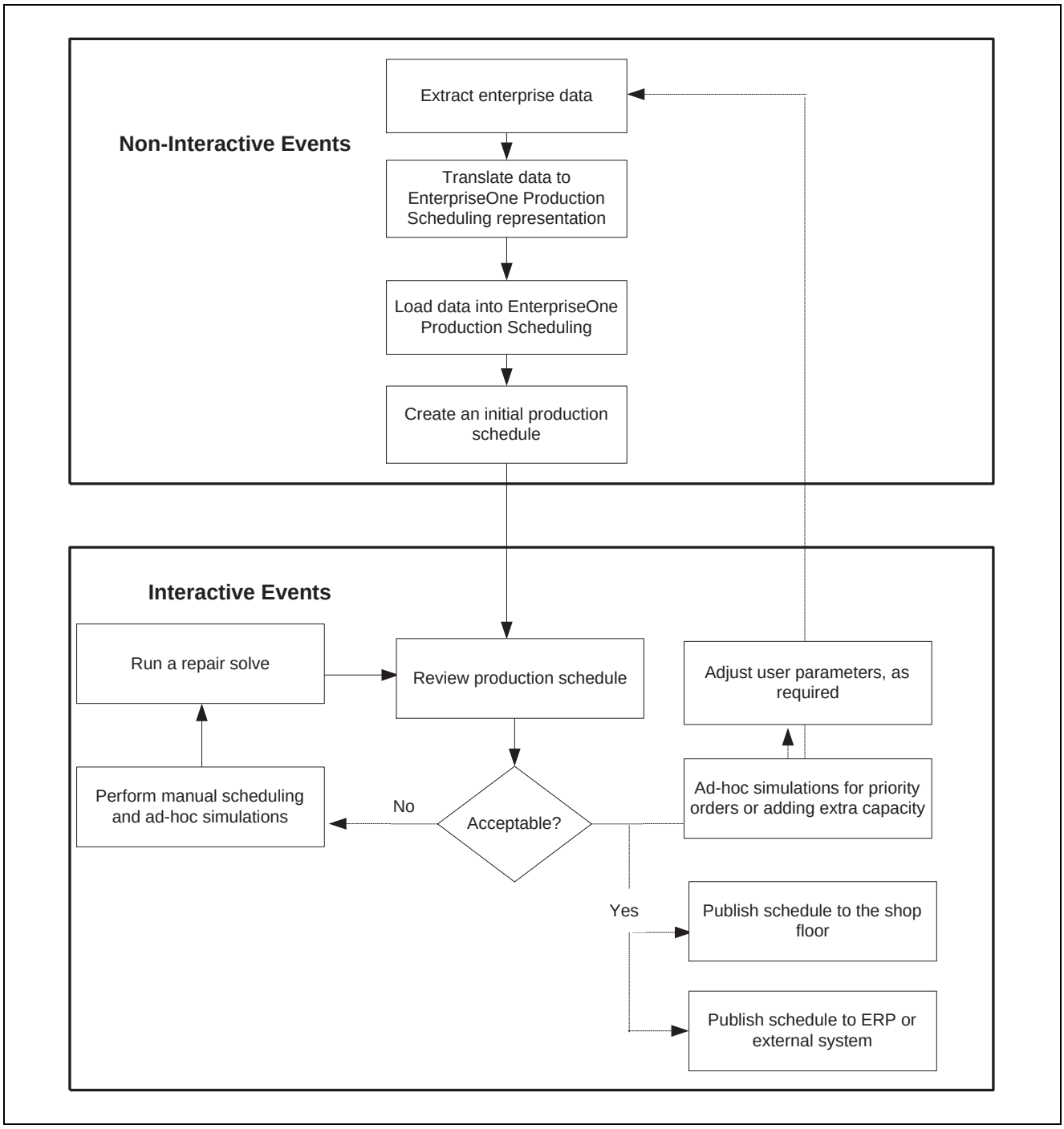
Through the seamless integration of Production Scheduling (PS) with Oracle APS, you can create high level supply chain plans and refine these plans to create optimal production schedules that can be implemented using Oracle transaction systems.

Using data from Oracle transaction systems and, if available, demand forecasts from Oracle Demand Planning, ASCP can create planned orders with a granular horizon and detailed multi-level pegging of supply and demand. PS can then take planned orders from ASCP and produce an optimized production schedule. You can then review and release the production schedule to Oracle transaction applications for implementation.

Using data from Oracle transaction systems and forecasts from Oracle Demand Planning, you can balance the conflicting objectives and limitations of supply, production, and distribution in your supply chain to determine how to meet demand with the least cost or with the most profit. You can also determine which facilities should be opened or closed, and in what order, throughout the horizon of a model.

EnterpriseOne Production Scheduling business processes are a part of the EnterpriseOne Supply Chain Planning Plan to Produce business process. The EnterpriseOne Supply Chain Planning Plan to Produce business process fulfills an organization's requirements for planning, deploying, producing, and assessing production. Production Scheduling is a part of the manufacturing execution phase of Plan to Produce. Production schedules produced by Production Scheduling are used as a basis for production deployment. To create a production schedule used to deploy production in an enterprise, this application relies on a series of interactive and non-interactive events.

This process flow in the following diagram illustrates the non-interactive and interactive business processes for EnterpriseOne Production Scheduling:



Non-interactive and interactive scheduling events

Non-Interactive Events

EnterpriseOne Production Scheduling business processes rely on non-interactive events to extract enterprise data from an ERP system and import it into the application. As a result of these non-interactive events, EnterpriseOne Production Scheduling is kept up to date with enterprise data in order to produce a production schedule that will be reviewed each morning to determine the daily production.

The following non-interactive events typically occur overnight or after the daily production shift has ended:

1. Enterprise data is automatically extracted from an ERP system such as EnterpriseOne.
2. Enterprise data is translated into an acceptable format for EnterpriseOne Production Scheduling.
3. Enterprise data is loaded into EnterpriseOne Production Scheduling.
4. The initial production schedule is produced and awaits review.

Interactive Events

After non-interactive events are complete for the scheduling cycle, interactive scheduling tasks can be performed to modify or streamline the schedule according to business needs. Interactive scheduling tasks begin with the initial production schedule that is created as a result of the non-interactive events that occur overnight.

1. Review the production schedule.
2. Decide if it is acceptable or not acceptable.
3. Perform manual scheduling and simulations that enable you to evaluate different scenarios (for unacceptable initial schedules).
4. Run a repair solve to incorporate the manual scheduling changes (for unacceptable initial schedules).
5. Perform simulations that represent the introduction of priority orders or extra production capacity into the schedule.
6. Publish the production schedule to the shop floor using the web dispatch list.
7. Publish the schedule to EnterpriseOne or a similar ERP system.

Creating or Importing a Model

The creation of a production schedule requires a model of your production process to be either created or imported from an external system. The model represents the production capacity of your enterprise. A working model is the first step towards creating a feasible production schedule. It consists of the resources, operations, and routings that combine to form a representation of your production process.

An accurate production schedule requires up-to-date model data, including starting item levels, safety stocks, work orders, and supply and demand information. Model data is often updated on a daily basis.

The steps for building models, which are explained in more detail throughout the rest of this document, are only suggestions. You might find a different sequence that is better suited to your organization's needs.

Solving a Model

Solving the model produces a production schedule. You can make changes to the model and solve the model until a schedule that meets your requirements is produced. You can resolve scheduling problems by making changes to the data model including changing order priorities, increasing capacity, or by making manual changes to operations using what-if scenarios.

Additional information from the shop floor or other sources can also be reflected in the schedule. For example, real-time capacity changes, maintenance requirements, or supply and demand changes can exist.

Publishing a Production Schedule

Once you are satisfied with a production schedule, you can publish it for use on the shop floor. Once the schedule has been committed and published, EnterpriseOne Production Scheduling enables you to export operation schedules and reports to external systems.

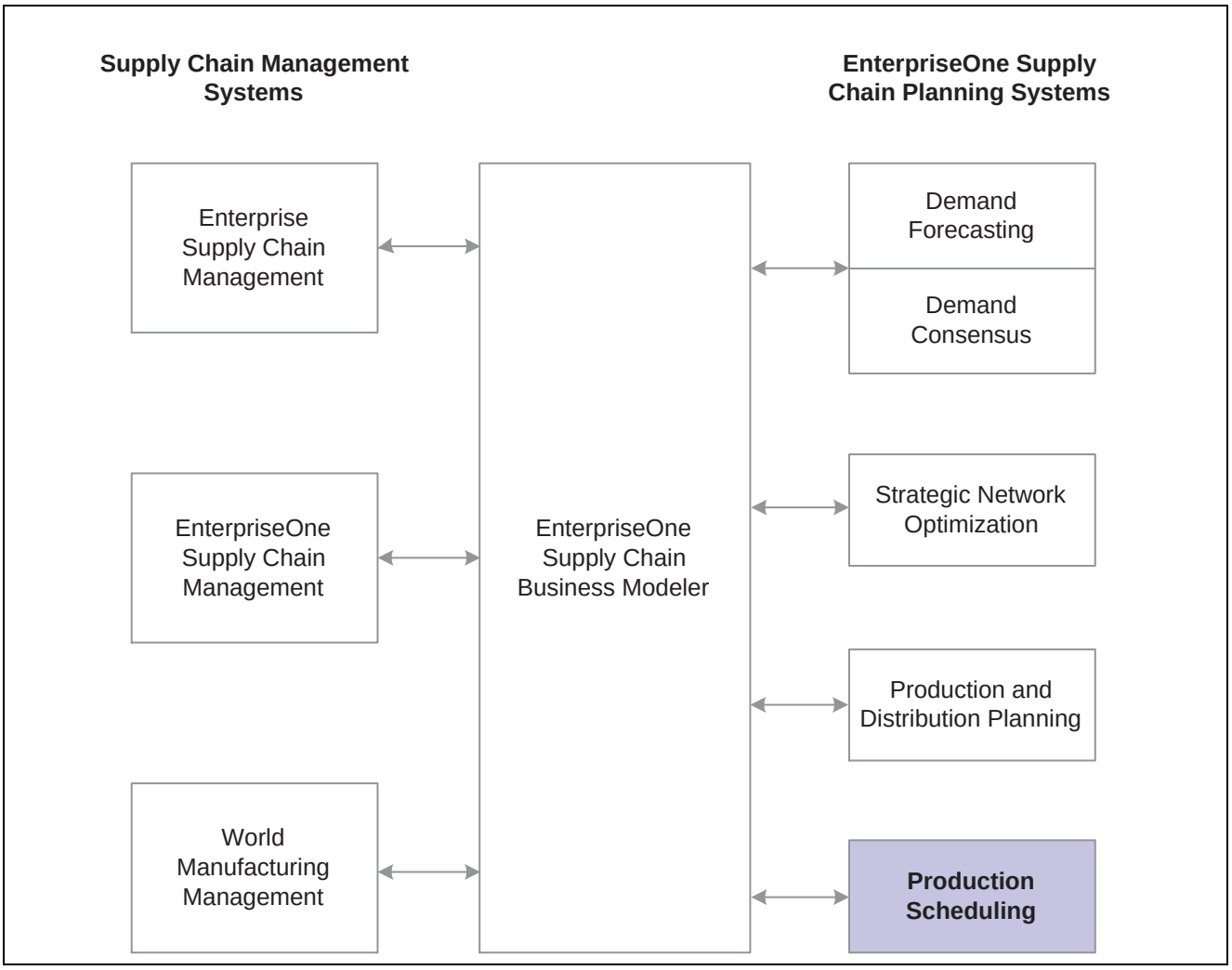
EnterpriseOne Production Scheduling Integrations

High level integration considerations are discussed in the implementation sections of this Implementation Guide. Supplemental information about third-party application integrations is located on the PeopleSoft Customer Connection website and the *Oracle Advanced Planning Implementation Guide*.

The following example illustrates how EnterpriseOne Production Scheduling integrates with EnterpriseOne Supply Chain Management applications using EnterpriseOne Supply Chain Business Modeler:

- EnterpriseOne
- EnterpriseOne Enterprise
- EnterpriseOne World

EnterpriseOne Production Scheduling integrates with these applications through EnterpriseOne Supply Chain Business Modeler:



EnterpriseOne Production Scheduling integrations

EnterpriseOne Supply Chain Business Modeler

EnterpriseOne Production Scheduling integrates with EnterpriseOne Supply Chain Business Modeler (SCBM), providing a flexible integration with enterprise systems such as EnterpriseOne EnterpriseOne. EnterpriseOne Production Scheduling uses a data connector to convert enterprise data stored in EnterpriseOne Supply Chain Business Modeler to flat files that can be imported for the purpose of generating and solving production schedules.

EnterpriseOne

EnterpriseOne Production Scheduling integrates with EnterpriseOne Sales Order Management, including Configurator, Sales Order Management, and MRP modules, to receive supply and demand data and work orders that are necessary to produce an accurate model.

EnterpriseOne Supply Chain Management Systems

EnterpriseOne Supply Chain Management systems, such as Enterprise Supply Chain Management, EnterpriseOne Supply Chain Management, and EnterpriseOne World Manufacturing Management, provide EnterpriseOne Supply Chain Business Modeler with the supply chain data that EnterpriseOne Production Scheduling needs to create optimal production schedules. The data includes information about items, branches, and manufacturing processes.

After EnterpriseOne Production Scheduling creates optimal production schedules, you can import the schedules into a EnterpriseOne Supply Chain Management system for implementation.

EnterpriseOne Demand Forecasting and EnterpriseOne Demand Consensus

EnterpriseOne Demand Consensus and Demand Forecasting can provide EnterpriseOne Production Scheduling with enterprise demand forecasts and inventory safety targets for a supply chain. Production Scheduling can then create optimal production schedules for meeting the forecast demand.

EnterpriseOne Strategic Network Optimization

EnterpriseOne Strategic Network Optimization can provide EnterpriseOne Production Scheduling with inventory build targets and sourcing recommendations for a supply chain. Production Scheduling can then create optimal production schedules for meeting the targets and recommendations.

EnterpriseOne Production and Distribution Planning

EnterpriseOne Production and Distribution Planning can provide deployment requirements, production targets, and purchase order recommendations to EnterpriseOne Production Scheduling. Production Scheduling can then produce optimal production schedules for meeting the production targets.

EnterpriseOne Production Scheduling Implementation

The EnterpriseOne Production Scheduling implementation can be divided into the following phases:

- Install EnterpriseOne Production Scheduling.
- Define production data
- Import enterprise data
- Deploy production schedules

Implementation Phases

This section provides an overview of the four phases of EnterpriseOne Production Scheduling implementation.

Installing EnterpriseOne Production Scheduling

This table lists the steps required to install the software.

Step	Reference
Install EnterpriseOne Production Scheduling.	EnterpriseOne Production Scheduling Installation.

Defining Production Data

This table lists the steps required to define production data.

Step	Reference
Define resources.	EnterpriseOne Production Scheduling Implementation Guide, "Defining Resources."
Define operations.	EnterpriseOne Production Scheduling Implementation Guide, "Defining Operations."
Define routings.	EnterpriseOne Production Scheduling Implementation Guide, "Defining Routings."

Importing Enterprise Data

Data can be imported into Oracle Production Scheduling in various formats. It can also be inported using EnterpriseOne Supply Chain Business Modeler.

See Importing From External Systems

Deploying Production Schedules

This table lists the steps required to deploy production schedules generated by EnterpriseOne Production Scheduling.

Step	Reference
Export schedule data to EnterpriseOne Supply Chain Business Modeler	EnterpriseOne Production Scheduling Implementation Guide, "Publishing Schedule Data to EnterpriseOne Supply Chain Business Modeler."
Publish the dispatch list.	EnterpriseOne Production Scheduling Implementation Guide, "Exporting Schedule Data."

CHAPTER 2

Starting the EnterpriseOne Production Scheduling System

This chapter discusses how to start the EnterpriseOne Production Scheduling system.

Understanding System Startup

EnterpriseOne Production Scheduling can be started from a Windows desktop or from a command prompt, depending on your implementation. Starting the system from the Windows desktop enables you to take advantage of the EnterpriseOne Production Scheduling desktop to create and evaluate scheduling scenarios.

EnterpriseOne Production Scheduling can be started directly from the Command prompt or a batch routine that can be automatically run at a specific time. A number of options that are available through this command enable you to perform any or all of the following functions:

- Start Production Scheduling.
- Create, name, and save a schedule.
- Write command and solve details to a log file.
- Terminate the session.

Starting EnterpriseOne Production Scheduling

This section discusses how to:

- Start the system from the Windows desktop.
- Start the system from a command prompt.

Starting the System From the Windows Desktop

Access the Windows desktop

From the Start button, go to EnterpriseOne Production Scheduling *x.xx* and the to Production Scheduling.

Starting the System From a Command Line Prompt

Access the Command Prompt window.

Enter the following command and press Enter:

```
run_ps.bat
```

Checking the Version of the Software

Access the Production Scheduling desktop.

1. From the Help drop-down menu, go to About Production Scheduling.
2. In the About Production Scheduling window, click Version Information.

Creating, Opening, and Importing a Scenario

This section explains how to:

- Create and open a new scenario
- Open or import an existing scenario.

Creating a New Scenario

Access the EnterpriseOne Production Scheduling desktop.

From the File menu, select New.

A new scenario is created in the Model Workspace.

Opening or Importing and Exporting an Existing Scenario

Access the EnterpriseOne Production Scheduling desktop

1. From the File menu, select Open and browse to the directory of your choice.
2. From the list of existing scenarios, choose the scenario you want to open and click Open. Alternatively, if no scenarios are listed, browse to the location where you have saved the scenario.

   The scenario can be an in .xml, .xml.gzip, or .dxt file. A .dxt file is a collection of scenarios.
3. If you already have a scenario open and you want to open another, the system will ask you if you want to import the file into the existing model. You have two alternatives:
   - Click Yes if you want the first scenario to remain open.
   - Click No if you want to close the first scenario. You are prompted to save the scenario.
4. To export the scenario, right click the scenario

If the scenario you are opening or importing is an XML file, the scenario will open along with the associated Gantt charts. If the file is a DXT file, the Gantt chart will not open until a scenario is opened.

CHAPTER 3

Creating Production Scheduling Models Using Supply Chain Business Modeler Data

This section provides an overview of creating Production Scheduling models using Supply Chain Business Modeler data and discusses how to create and modify model generation scenarios using Supply Chain Business Modeler.

Understanding Creating Production Scheduling Models Using Supply Chain Business Modeler Data

After exporting data from Supply Chain Business Modeler, you can specify how the Production Scheduling connector uses the data to build models in Production Scheduling. For example, you can specify.

To specify how Production Scheduling uses data exported from Supply Chain Business Modeler, you can create and run model generation scenarios in Supply Chain Business Modeler.

When you run the connector refresh command, you can specify this file as a parameter. You can then import data from EnterpriseOne Supply Chain Business Modeler.

Prerequisites

Before you complete the tasks in this section, you must:

- Ensure that an extract area and at least one data folder exists for saving data files that you export from Supply Chain Business Modeler.

  See "Creating Extract Areas and Data Folders," Setting Up Extract Areas and Data Folders, EnterpriseOne Supply Chain Business Modeler documentation.

- Save any Tcl scripts that you want to run as pre-export or post-export scripts in the Scripts folder of the extract area.

  See "Scripts Folders," Setting Up Extract Areas and Data Folders, EnterpriseOne Supply Chain Business Modeler Implementation Guide.

- On the Scenario Definition page, be sure to choose an operational model for Production Scheduling. These are depicted in green in the drop-down menu.
- On the Application Integration Profile page, make sure PS 8.11.2 full refresh is selected.

Creating and Modifying Model Generation Scenarios Using Supply Chain Business Modeler

Access the Add Model Generation Scenario window or the Modify Model Generation Scenario window.

Scenario Definition

Name Enter a name for the model generation scenario. The resulting model generation parameters document will have the same name as the model generation scenario.

Model Enter the name of the model from which the data was exported. Make sure you choose an Operational model, which are displayed in green.

Source Data

Extract area Enter the name of the extract area where the exported data packages are saved. You cannot create a model generation scenario until you create an extract area.

Data Folder Select the name of the data folder for saving the exported data package. Data packages that you want to export in an export scenario must be saved in one data folder in a single extract area.

Application Integration Profile

Application integration profile Application profile names include the abbreviation of the product name and the version.

Target Model Location

The following pages are specifically for EnterpriseOne Production Scheduling. Be sure to enter all the necessary information.

Demand Details

Demand Build Strategy When you define demand policies, you can specify how EnterpriseOne Production Scheduling fulfills demand.. Values are:

JIT

Pre-Build

Ship Complete for Transfer Order Select the check box if you want EnterpriseOne Production Scheduling demands that are created from transfer orders to be set as Ship Complete. Values are:

Yes(box checked)

No(box not checked)

Global Build Strategy Specify if production schedule will build demand JIT to due date or available date.

Available Date

Due Date

General Model Configuration Parameters

Scenario Code The name of the Production Scheduling scenario.

Work Day Start Time Specify the time that the work day starts. Repetitive manufacturing optimized resources use this time to identify the beginning of a production cycle.

Work Day Start Day Specify the day that starts your typical work week.

Currency Symbol Select a currency symbol. If the desired symbol does not appear, you can enter it in the space provided.

Cost Time Unit Enter one of the following base units to use when measuring costs: Minute, Hour, Shift, Day, or Week. This field provides the cost time unit for resource and operating costs.

Use Theory of Constraints Enter Yes in you want to use Theory of Constraints or No if you do not want to use Theory of Constraints.

Use Run Optimization Enter Yes if you want to use campaign run optimization or No if you don't want to use campaign run optimization.

Minimum Cycle Time For a given manufacturing cycle, the Minimum Cycle Time, this is the time for one cycle of an operation on an CRO resource. Values are:

Days

Weeks

Minimize Changeovers Between Cycles Select whether or not you want to minimize changeovers between production cycles on an CRO resource.

Ideal Operation Sequence Based on Select changeover optimization criteria for campaign run optimized resources. Values are:

Cost

Time

Model Folder Configuration

Create Default Item Folders Sorts items into folders based on whether the items are manufactured, purchased, saleable or a combination of the three options. If the check box is not selected, items will not be grouped.

Create Default Demand Folders Sorts demands into folders based on one of the following values. There is no folder grouping if this field is left empty. Values are:

Class

Priority

Type

Customer

Create Default Supply Folders Sorts supply into folders based on one of the following values. There is no folder grouping if this field is left empty. Values are:

Supplier

Type

Create Default Work Order Folders	Sorts work orders into folders based on one of the following values. There is no folder grouping if this field is left empty.Values are: *Routing* *Item*

Relative Weights for ERP Costs

Inventory Carrying Cost Weight	Specify the weighting of the cost of carrying inventory. Values are 0.01 to 100. The default is 1.0.
Inventory Stockout Cost Weight	Specify the weighting of the cost of inventory stockout. Values are 0.01 to 100. The default is 1.0.
Changeover Cost Weight	Specify the weighting of the cost of changeover. Values are 0.01 to 100. The default is 1.0.
Safety Stock Violation Cost Weight	Specify the weighting of the cost of safety stock violatio. Values are 0.01 to 100. The default is 1.0.

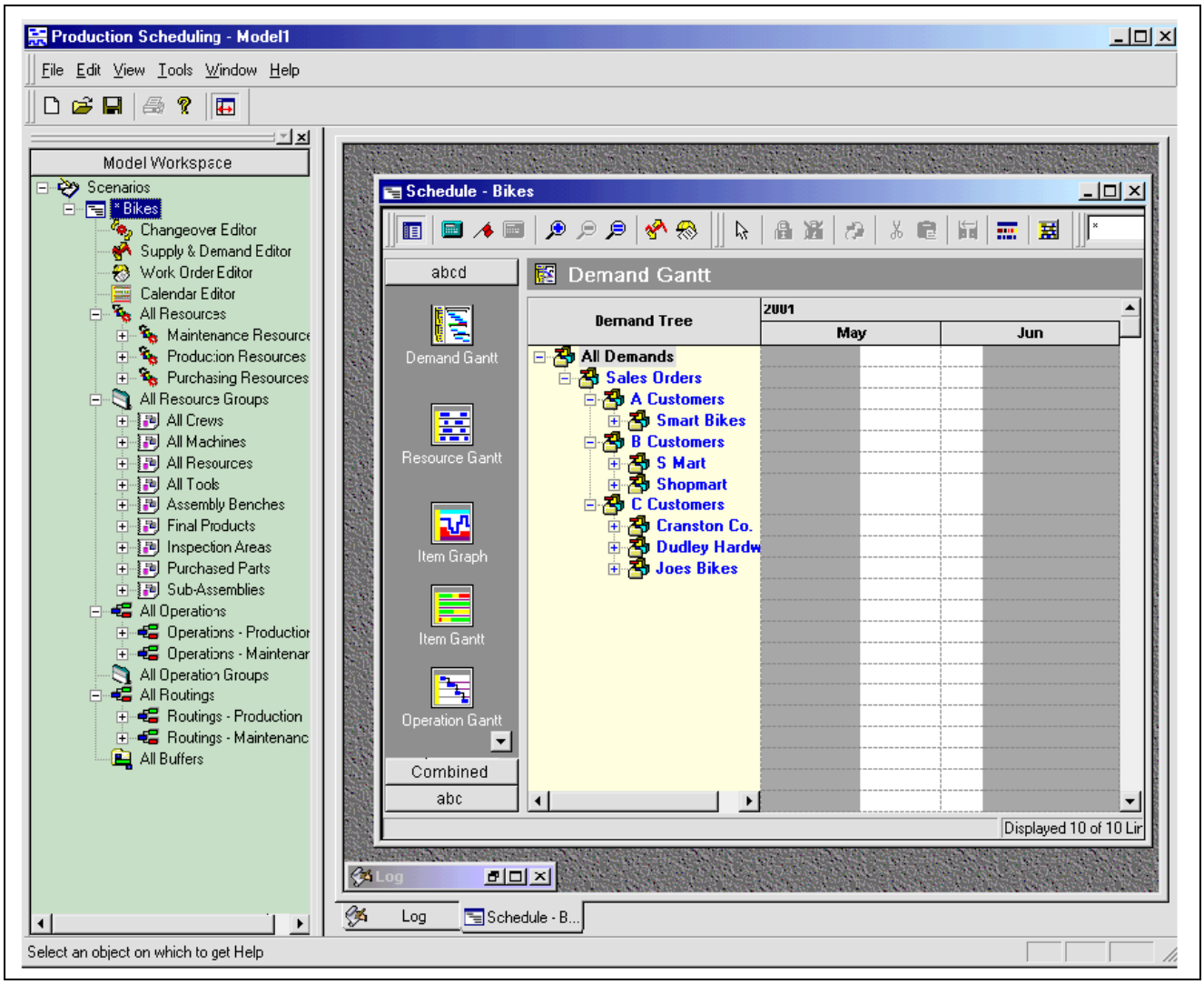
CHAPTER 4

Understanding the Production Scheduling Desktop

This chapter provides an overview of the Production Scheduling desktop and the components that are included in the desktop. The Production Scheduling desktop is the main user interface for creating and solving production schedules.

EnterpriseOne Production Scheduling Desktop

The EnterpriseOne Production Scheduling desktop is the principal user interface for all production scheduling activities. The robust desktop interface enables you to create, revise, and solve production schedules and view graphical representations of schedule data in a manner that is both efficient and valuable. This illustration depicts the EnterpriseOne Production Scheduling desktop, divided into its principal areas:



EnterpriseOne Production Scheduling desktop

Along the top of the screen are the File, Edit, View, Tools, Window, and Help menus. Immediately beneath these items are all the Production Scheduling buttons with which you can perform a variety of actions when you are working with your schedule. Below the buttons, on the left of the screen, is the Model Workspace. This area contains the tree structure of your scenario.

Along the bottom of the screen are the scenario workspace tabs, which display all the work spaces you have open and the Message bar in the bottom right corner.

The majority of the screen is occupied by the views of your scenario, such as the Gantt chart, Item graph, and so on.

Toolbars

The toolbars contain buttons representing each of the tools that you can use in EnterpriseOne Production Scheduling. To understand what each tool does, pass your cursor over each active or inactive button. Descriptive help about each tool is displayed in the tooltips and the status bar.

EnterpriseOne Production Scheduling enables you to easily build a model of your process. By using the tools in the toolbar included in EnterpriseOne Production Scheduling, you can graphically represent the model quickly and easily. After the model is built, you can then access and view every element of the model with a click of the mouse.

The EnterpriseOne Production Scheduling toolbars are context-sensitive. Depending on the task that you are performing, different sets of toolbars appear. For example, the Alignment toolbar appears only when you are working with an Operation diagram.

The Customize window enables you to select toolbar options. You can use these options to switch tooltips on and off, to select a display style and size for the buttons, and to create or delete new toolbars. Using the Customize window, you can:

- Select Show Tooltips to view bubble help on the tool that currently has the pointer on it.
- Select Cool Look to remove the button-like appearance.
- Select Large Buttons to display larger-sized buttons in the toolbar.

You can select which toolbars to display, and how their buttons look. You can also select to display tooltips, which provides a description as your pointer moves over the button.

Tools are arranged in sets on the toolbar for ease of use during view navigation. The following table describes the toolbars that are available in the EnterpriseOne Production Scheduling desktop:

Scenario Workspace

The scenario workspace contains a tree structure, which contains all the scenarios that make up your model, and the operations, resources, and schedule views, that make up each scenario.

When you create a new scenario, you need to first define all of your resources, then operations, and then the routings in your model. You can create several different scenarios to help optimize your schedule. Create what-if scenarios duplicating the scenario and then making modifications to the schedule and seeing how they affect production. Once you have a satisfactory production schedule, these modifications can be saved as a new model. You can hide the scenario workspace to enable additional space for working in the Workbook area.

The scenario workspace contains one or more scenario folders for your model. Each Scenarios folder contains all of the individual scenarios and schedules that you have created for the current model. Scenarios enable the operations and resources of a model to be manipulated to create what-if situations. Different scenarios can be analyzed using various Key Performance Indicators (KPIs) to determine the most ideal schedule.

When you create a new scenario, EnterpriseOne Production Scheduling automatically sets up a number of sub-folders to help you organize the information. The sub-folders are:

- All Resources
- All Resource Groups
- All Operation
- All Operation Groups
- All Routings
- All Buffers

In addition to the folders, the scenario contains the following data editors:

- Changeover editor
- Supply & Demand editor
- Work Order Editor
- Calendar editor

The data editors are explained in the following section.

Schedule Groups

Schedule groups enable multiple operations and resources to be combined as a group when viewed in the model workspace and schedule views. Using the model workspace, you can organize resources and operations into logical groupings to help you organize your model data. You can create a default resource group for each schedule that appears when views are first opened.

All schedule views except the Production Pegging have a drop-down menu that lists the defined groups. When you select a group from the menu, the schedule view changes to display only those resources or item belonging to the group. Each schedule view can have its own default group view. The current default group in each view appears with a check mark beside its name.

Data Editors

Data editors are views that enable you to record events, administer orders, and monitor supply and demand information. This section discusses the following data editors:

- Changeover editor
- Supply and Demand editor
- Work Order Editor
- Calendar editor

Changeover Editor

The Changeover editor enables you to record precise information about the time required to modify a machine between different operations. By using the Changeover editor, you can define relationships that enable you to define sequence dependent changeover relationships. In addition, you can create groups to save time in entering changeover information. All of the information entered into the Changeover editor is automatically saved in the schedule.

Supply & Demand Editor

Supply and demand information is usually imported. The Supply & Demand editor enables you to add, delete, change, or view properties of any supply or demand order or line item, as well as add customer particulars.

Work Order Editor

The Work Order Editor enables you to add, change, delete, and view production orders, maintenance orders, and engineering change orders. Using the Work Order Editor, you can create, delete, and modify work order views.

Calendar Editor

The Calendar editor enables you to record downtime and delay time events. For downtime, the operation must end before the down time event starts. For delay time, the operation can interrupt the delay event but resume after the delay event has finished.

Many calendars can be created for your organization. Resource availability for crews, machines, tools, and machine changeovers run according to a specified calendar, enabling you to create as many calendars as necessary to accurately communicate the time constraints affecting your resources. In the default calendar that ships with EnterpriseOne Production Scheduling, no down time or delays have been scheduled.

Using the Calendar editor, you can easily create recurring patterns, multiselect various events in a user defined range, and edit all at once.

Key Performance Indicators (KPIs) View

The Key Performance Indicators view displays schedule performance measurements in the Workbook Area. Performance indicators for all schedules in the model can be displayed at once, or analyzed to view a particular schedule. Key Performance Indicators are organized into Customer Service, Materials, and Manufacturing Metrics.

By making adjustments to different scenarios and then comparing Key Performance Indicators, you can determine the effect of these changes on your schedules. In addition, you can compare a baseline schedule to another schedule using the comparison capabilities in the bottom portion of the view.

Scenario Workspace Tabs

The Workbook area displays object windows, model editors, schedule views, and system messages. The Workbook area is designed to provide great flexibility for viewing different types of information in EnterpriseOne Production Scheduling.

You can display the Workbook area with or without tabs for each open diagram or model editor. Click Workbook from the View menu, to open up to 26 windows at the same time and display Workbook tabs to quickly identify and open the different views.

You can have several tabs for each view. For example, you can have several schedule views open at the same time, as well as model editors open at the same time. The tabs automatically size themselves to fit your screen. You can also hide the workbook tabs by deselecting the Workbook option from the View menu.

With Workbook tabs hidden, you can still toggle between different windows by choosing from the Windows menu.

Log Window

A Log window is launched by default every time that the system is launched. This window displays output from the solver file at the end of the solve, which consists of a report on the solve and any problem messages. You can right click in the log window to navigate to the log files themselves.

Understanding System Buttons

System buttons are compact graphical elements used throughout the system to denote items such as activities, groups, folders, and resources in the Model Workspace. These buttons help you to quickly and graphically identify objects in your model, as summarized in the following table:

Name	Explanation
Operation or Routing folders	This button represents either an operation or routing folder. Both operations and routings can be organized in folders for better accessibility.
Operation	Represents an operation to which resources are attached. The button appears automatically in an Object Window when the Open Diagram menu option is chosen. This button can be dragged from the Model Workspace into a Routing diagram.
Operation Set	Represents a group of alternate operations. The button appears automatically in an Object Window when the Open Diagram menu option is chosen. Like operations, this button can be dragged from the Model Workspace into a Routing diagram.
Operation Group folder	This button represents an operation group folder. Operation groups can be organized into operation group folders for better accessibility.
Operation or Resource Group	For analysis purposes, resources can be grouped together. Machine resources groups can also be available within the Changeover editor. Like resources, operations can be grouped together in operation groups.
Routing	Contains operations (and routings) that are connected together in a specific order.
Resource folder	Resources can be organized into folders for better accessibility.
Crew	Displays details of Crew resources, including properties. Crew resources can be dragged into operation diagrams from the Model Workspace.
Item	Displays details of Item resources, including properties. Item resources can be dragged into operation diagrams from the Model Workspace.
Storage Space	Displays details of storage spaces, including the name of the storage space and its properties.
Machine	Displays details of Machine resources, including properties. Machine resources can be dragged into operation diagrams from the Model Workspace. Machine resources appear in the Changeover editor.

Name	Explanation
Vendor	Displays details of Vendor resources, including properties. Vendor resources can be dragged into operation diagrams from the Model Workspace.
Tool	Displays details of Tool resources, including properties. Tool resources can be dragged into operation diagrams from the Model Workspace.
Schedule Folder	Schedules can be organized into schedule folders.
Supply & Demand Editor	Right-click this button to insert new demand orders or events.

CHAPTER 5

EnterpriseOne Production Scheduling Global Options

This chapter provides an overview of and discusses how to:

- Configure system logging
- Configure diagrams
- Specify supporting documents
- Configure contextual help
- Set global solver options

Understanding Global Options

You can set global options to govern the behavior of EnterpriseOne Production Scheduling. When you set global options in the Options window, you are defining rules that are globally applied to all schedules. Certain global options that are defined on a per-schedule basis will supersede other options that you have previously set. For example, you can set global export options for all schedules, but any schedule specific export options take precedence over the global options when exporting a schedule.

Configuring System Logging

This section discusses how to configure log files to capture scheduling information, performance statistics, and any validation warnings that may occur during a schedule solve.

Configuring Log Files

Access the Options window. Select the Logging tab.

To configure log files:

Messages Select this option if you want to log system messages. If you do not select this option, no logging occurs.

Manual schedule changes Select this option if you want the system to write all manual schedule changes to the log file.

Performance Statistics Select this option if you want to capture solver performance statistics in the log file. The following performance statistics will be captured:

	Field Time, in seconds, to load, save, and duplicate schedules Field Time, in seconds, to export to XML
Show validation warnings	Select this option if you want the system to notify you of operations that are missing items and routings that are missing primary operations. If you select this option, the system also writes this information to the log file.
Log file	Specify a location to store the log file.
Overwrite log file	Select this option to have the log file overwritten each time that the system runs. To keep old log records, save the log file with a different name each time that you start the system.
Maximum file size (KB)	Specify a file size or accept the default value of 1000 KB.
Truncate file at (%)	Specify the percentage of the log file that the system omits when the log file reaches the size in the Maximum file size field.
Lowest info display level	Select a value from 0 to 9 to specify the level of detail about system performance that is included in the log file. A value of 0 indicates the lowest level of detail, and 9 indicates the highest level of detail.

Configuring Diagrams

This section discusses how to configure the appearance of operation and routing diagrams to suit your individual requirements.

Configuring Operation and Routing Diagram Layout

Access the Options window. Select the Layout tab.

To configure diagram layout:

Top to bottom	Select this option to display operations and routings vertically beginning at the top of the screen.
Left to right	Select this option to display operations and routings horizontally beginning at the left of the screen.
Bottom to top	Select this option to display operations vertically beginning at the bottom of the screen.
Right to left	Select this option to display operations horizontally beginning at the right of the screen.
Use snake layout	Select this option to display a routing diagram that reads from left to right, and then from right to left on the next row. This option makes long routings easier to view on the screen or in printed form.

Specifying Supporting Documents

This section discusses how to create a document directory to store supporting documents for various elements in your supply chain.

Creating a Document Directory

Access the Options window. Select the Documents tab.

To specify supporting documents:

Documents base folder Specify the default directory for documents, or browse your system.

Setting Global Options

This section explains how to set global system options.

Setting EnterpriseOne Production Scheduling Global Options

You set the solver options in Scenario Properties.

Setting Updated Solver Options

Access the Solver Options in scenario properties.

1. Under the Solver Options tab, complete the following fields:

   Build JIT to This solver option governs the scheduling of operations that exist upstream and downstream from a bottleneck operation in a routing. Values are:

   - Available Date
   - Due Date

   Scheduling Work Order operations according to their unit of effort From the drop-down menu, choose Yes to enable units of effort or select No to disable units of effort.

   See Examples of Scheduling Work Order Operations With Units Of Effort Enabled and Disabled

   Adjacent operations referred Select this option if you want to enable adjacent operations.

   See Examples of Scheduling Work Order Operations With Units Of Effort Enabled and Disabled

   Resource critically priority based on: Select Most contention or Earliest contention.

   See Resource Contention

2. Under the Solve Sequence tab, set up the solve sequencing stages.

   See Solver Sequencing Stages

3. Under the Campaign Run Options tab, set up CRO to suit your needs.

See Chapter 11: Campaign Run Optimization

4. Click Apply and then OK.

Solver Sequence Stages

Resources within a schedule can be assigned to solver sequence stages. Solver sequence stages determine the order in which the solver activates constraints during a solve. By including resources in a stage, you can set the priorities in which the resources are addressed and solved by the solver. The solver addresses Stage 1, followed by Stage 2, Stage 3, and so on. Resources that are not included in a solve stage are scheduled last.

If no solver sequence stages are set up, the solver considers all resource constraints simultaneously.

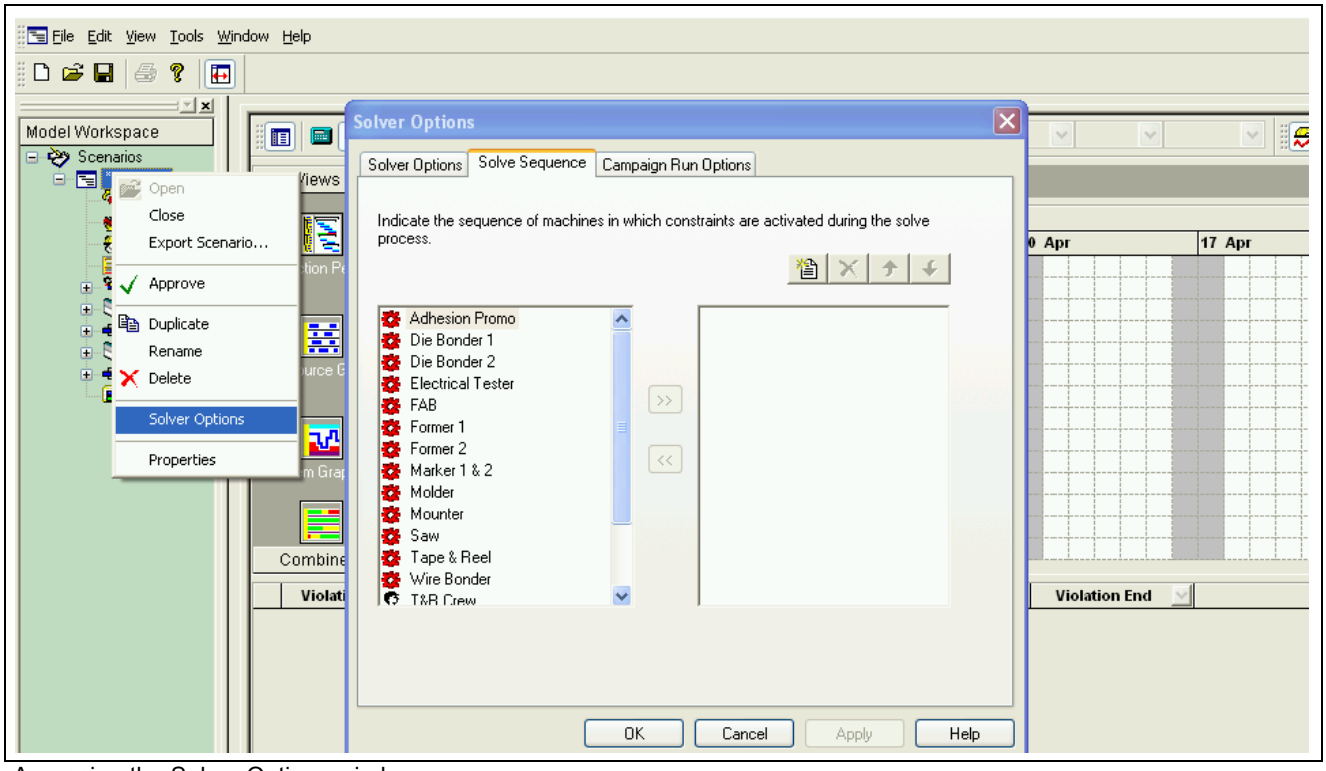
Accessing Solve Sequence Stages

Access the Oracle Production Scheduling desktop.

To set solver options:

1. Right click on your schedule in the Model Workspace and choose Solver Options from the drop-down menu.
2. In the General window, click the Solve Sequence tab.

The solver options and Solve Sequence window is shown below:



Accessing the Solver Options window

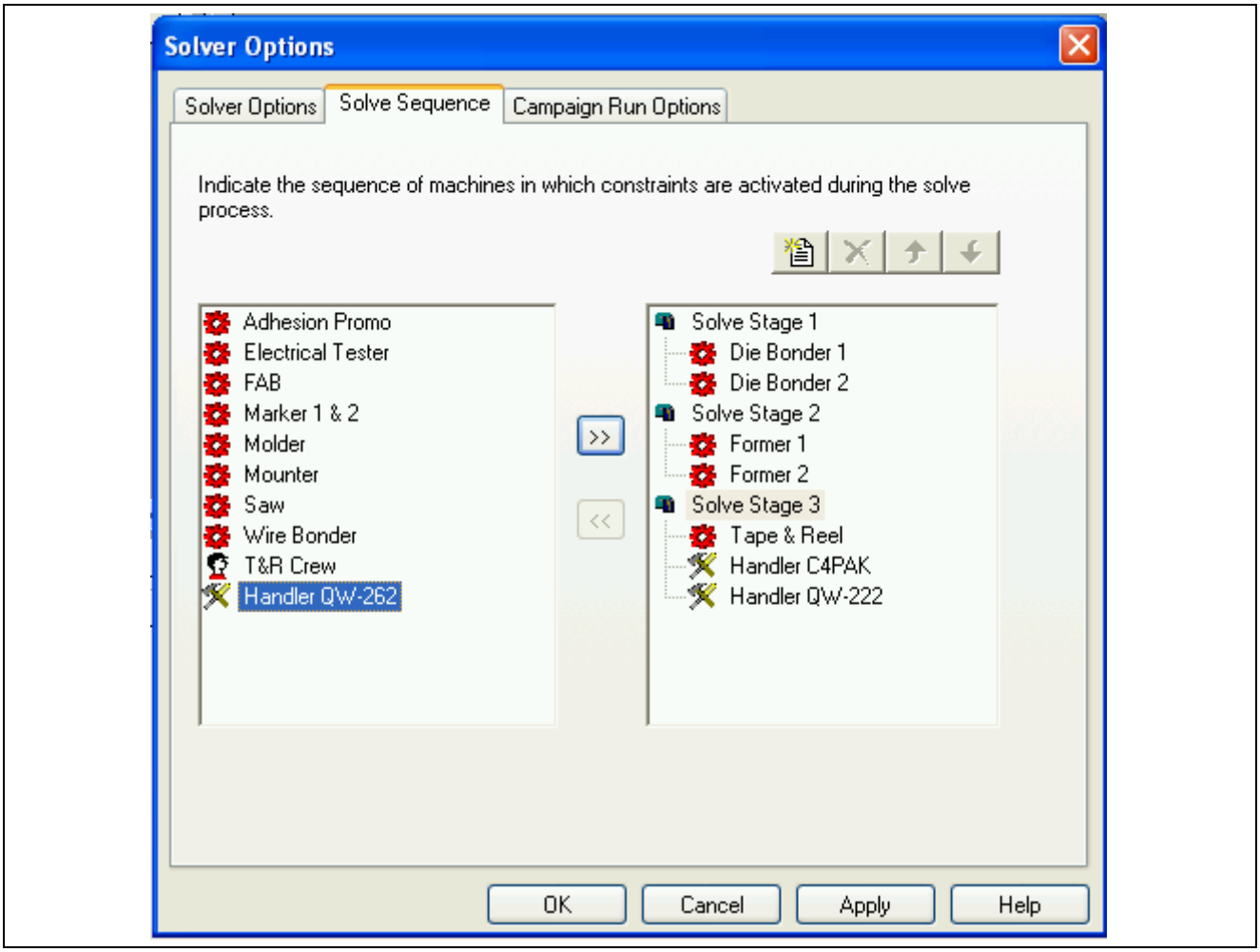
Creating Solver Sequence Stages

From the Solver Options window, you can set up machines in groups best suited to your business needs. On the left side of the Solver Option window is a list of all the resources in the model. On the right side of the screen is the pane in which you create a solve stage.

Access the Solver Options window

To create a new solver sequence stage:

1. Click on the Page icon. A new Solve Stage group is created in the right pane.
2. In the left pane, select the machines you want to add to this stage by clicking on it. To select more than one resource, hold down the shift key and select the machines.
3. Click the forward arrows, located between the two panes.
4. Click Apply, and then OK to save your changes.
5. Repeat the above procedure for each group you want to create, as shown below:



Solve Sequence Stages

Changing Solver Sequence Stages

Access the Solver Options window

To change solver sequence stages:

1. In the right pane of the Solver Options window, select the resource you want to move.
2. To move the resource up to the previous stage or down to the next stage, click the up or down arrows at the top of the pane, respectively.

3. To move stages, select the stage and click the up or down arrows at the tope of the pane, respectively.
4. To remove the item, click the back arrows between the two panes.
5. Click Apply, and then OK to save your changes.

Removing Solver Sequence Stages

Access the Solver Options window.

To remove a solver sequence stage:

Select the stage that you want to delete and click the X, delete, button at the top of the pane.

When you delete a solver sequence stage, all the contents of the stage are also deleted.

Resource Contention

EnterpriseOne Production Scheduling has the ability to configure whether the solver first addresses earliest or most resource criticality during solve sequencing. Resource contention, or criticality, is a measurement that occurs in the solver when two or more operations compete for the same resource at a given point in time in the scheduling horizon. The more operations that need to be scheduled on that resource at that given point in time coupled with its capacity, the higher the resource contention or probability that constraints will be violated. In EnterpriseOne Production Scheduling, you can set whether the solver first addresses earliest contention or most contention resource criticality during solver sequencing.

Focusing and resolving the most critical constraints in the horizon has generally been regarded as the most effective scheduling strategy to resolve floating bottlenecks when sequencing operations. Addressing the more critical problems first results into the problems being broken down into smaller sub-problems which are easier to resolve.

Solving in this fashion provides high quality results for most PS client models. However, sometimes resolving the highest levels of criticality in the horizon first may not necessarily be optimal from a scheduling perspective, but rather addressing the earliest instances of resource criticality may be more efficient in some cases, such as (but not limited to):

- Routings which contain recursive resources that are considered manufacturing bottlenecks
- Coupled with the recursiveness, a mixture of crewed / non-crewed operations which also require these bottleneck resources
- Preferred run times for non-crewed operations during non-business hours (e.g. Evenings and weekends)

It is advisable to implement this feature following the guidelines above and to run some trials with this option enabled and disabled to understand the differences in schedule quality.

CHAPTER 6

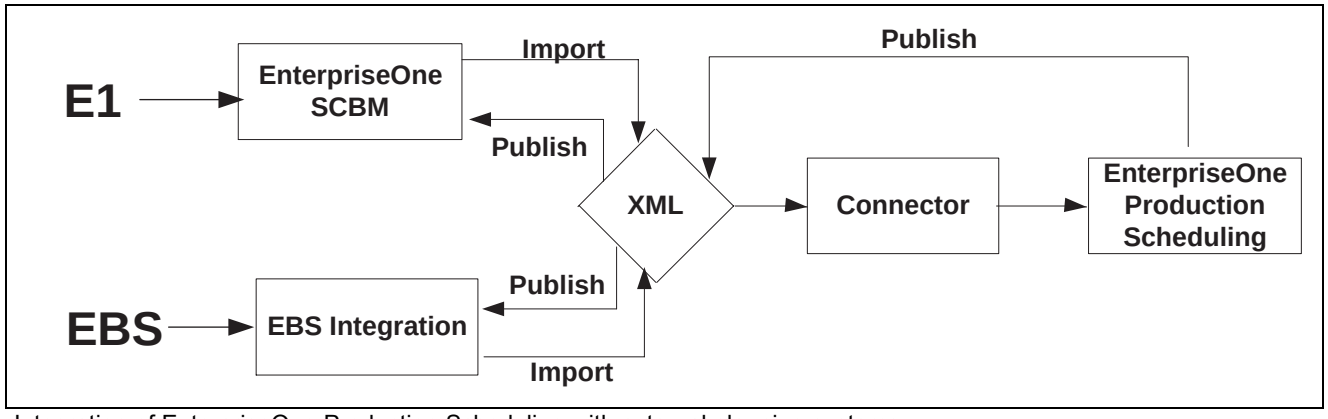
Integrating Production Scheduling With External Systems

This chapter Provides and overview of how Production Scheduling integrates with external systems and discusses the following topics:

- Production Scheduling integration with Oracle Advanced Planning suite
- Supply Chain Business Model (SCBM) to integrate with E-1

Overview of EnterpriseOne Production Scheduling Integration

EnterpriseOne Production Scheduling integrates with both the Oracle Advanced Planning suite, EBS, and with E-1 through the EnterpriseOne Supply Chain Business Modeler (SCBM). How the application integrations with each type of system is shown in the following diagram:



Integration of EnterpriseOne Production Scheduling with external planning systems

EnterpriseOne Production Scheduling Integration With the Oracle Advanced Planning Suite

This section provides an overview of EnterpriseOne Production Scheduling integration with the Oracle Advanced Planning suite (APS) and discusses:

- General overview.
- Business processes.
- Data flows.

- Implementation.
- Using PS in Oracle APS.
- Integrating PS with Oracle APS.
- Setting up Production Scheduling.
- Running collections.
- Creating and releasing production schedules.

EnterpriseOne Production Scheduling in the Oracle Advanced Planning Suite Overview

EnterpriseOne Production Scheduling (PS) has been integrated into the Oracle Advanced Planning Suite to enhance the capabilities of Oracle Advanced Planning and Scheduling (APS).

You can create optimized production schedules. The EnterpriseOne uses a constraint-based approach to automated scheduling. Unlike traditional automated scheduling tools that are limited to simple dispatch rules and have known bottlenecks, constraints in EnterpriseOne Production Scheduling can be assigned to every element – resources, operations, and due dates in a schedule. By employing an advanced solver technology, feasible solutions can be found, if they exist, for virtually any floating constraints.

Because PS is now integrated with the Oracle Advanced Planning Suite, you can create strategic plans and optimized production schedules using data collected from Oracle transaction systems and demand forecasts from Oracle Demand Planning. You can use sourcing recommendations from Strategic Network Optimization (SNO) when creating net requirements in ASCP and refine work orders from ASCP into optimal production schedules using PS.

Business Processes

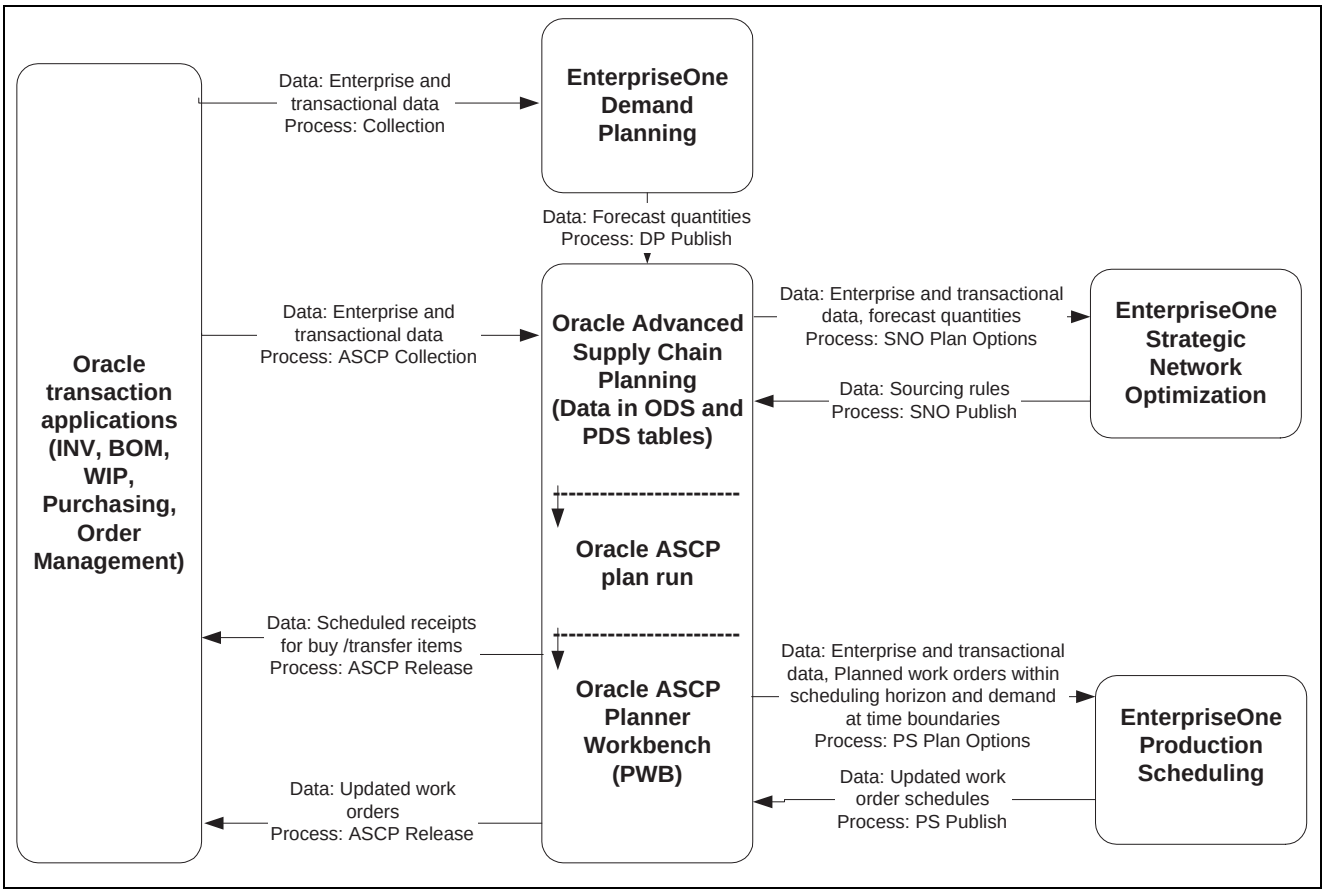
Through the seamless integration of PS with Oracle APS, you can create high level supply chain plans and refine these plans to create optimal production schedules that can be implemented using Oracle transaction systems.

Using data from Oracle transaction systems and, if available, demand forecasts from Oracle Demand Planning, you can create time-phased sourcing rules to provide to ASCP. In accordance with these sourcing rules, ASCP can create planned orders with a more granular horizon and detailed multi-level pegging of supply and demand. Production Scheduling can then take planned orders from ASCP and produce an optimized production schedule. You can then review and release the production schedule to Oracle transaction applications for implementation.

Data Flows

The following diagram shows data flows among EnterpriseOne Production Scheduling, EnterpriseOne Strategic Network Optimization (SNO), and the following Oracle applications:

- Oracle transaction systems, including Inventory, Bill of Materials, Work in Process, Purchasing, and Order Management.
- Oracle Demand Planning.
- Oracle Advanced Supply Chain Planning.



Data flows among SNO, PS, and Oracle applications

Implementation

The implementation of PS in APS can be divided into the following steps:

- Setting up the source.
- Setting up the destination.
- Setting up collections.
- Setting up profile options.
- Setting up plan options for PS.

Using Production Scheduling in the Oracle Advanced Planning Suite

This section provides overviews of using Production Scheduling in the Oracle Advanced Planning Suite.

You can use PS in the Oracle Advanced Planning Suite to take orders or planned orders from Oracle systems and create detailed, down-to-the-second manufacturing shop floor schedules and sequences. The PS scheduling engine automatically identifies and resolves floating bottleneck problems to help maximize shop-floor efficiency and throughput while minimizing cost. You can review the resulting work orders and release them to Oracle transaction applications for implementation, and use them as constraints in subsequent ASCP planning. While ASCP creates plans for entire supply chains, PS creates production schedules for individual plants.

To create production schedules, PS requires an accurate representation of how your manufacturing plant works, including machines, tools, crews, materials handling and other resource constraints. Because PS is integrated with the Oracle Advanced Planning suite, you can obtain the required data from Oracle applications by:

1. Running collections to transfer enterprise and transactional data from Oracle transaction applications to the ODS.
2. Launching a PS plan from Oracle EBS to transfer enterprise and transactional data from the ODS to create a model of your manufacturing plant in PS and, if available, ASCP planned orders or DP demand forecasts from the PDS.

   When you launch a PS plan, data is then imported into PS on the client machine to create a manufacturing plant model.

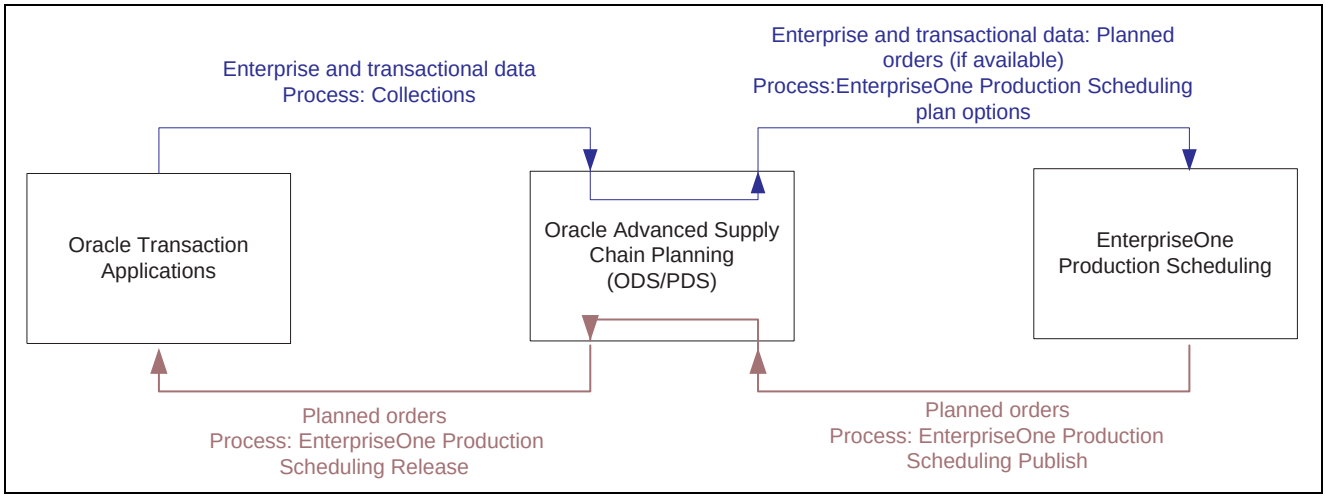
   If ASCP been used in planning, PS uses planned sales orders from ASCP as demand in the model. If ASCP has not been used, PS uses DP forecasts, if available, and sales orders from the transaction systems in the schedule horizon as demand.

Note. When you launch a PS plan from Oracle EBS, PS is automatically installed on the client if it is not already installed.

After transferring data to PS, you can create optimal production schedules for meeting the demand, review the schedules, and revise the schedules as desired.

You can then publish revised work orders from PS to the PDS. You can then examine work orders using the ASCP Planner workbench, and release them to Oracle transaction systems for implementation.

The following diagram shows the integration processes of transferring data from Oracle transaction applications to Production Scheduling and transferring planned order from Production Scheduling to ASCP and Oracle transaction systems:



Transferring data from Oracle Transaction systems to EnterpriseOne Production Scheduling and back from EnterpriseOne Production Scheduling to Oracle Transaction systems as planned orders

Production Scheduling Integration Through the EnterpriseOne Supply Chain Business Modeler

This section describes the data connector and the integration identification and discusses:

- Running the connector
- Connector batch commands
- Integration identification

The Data Connector

The data connector facilitates the round-trip data transfer between EnterpriseOne Supply Chain Business Modeler (SCBM) and EnterpriseOne Production Scheduling. Enterprise model data (such as Items or Operations Sets) and transaction data (such as sales orders and inventory levels) from EnterpriseOne SCBM is transformed into a Production Scheduling import file, which is then imported into EnterpriseOne Production Scheduling and used to create and solve a schedule. The resulting production schedule is then exported back to an XML file, and the data connector refreshes EnterpriseOne Supply Chain Business Modeler with the new schedule.

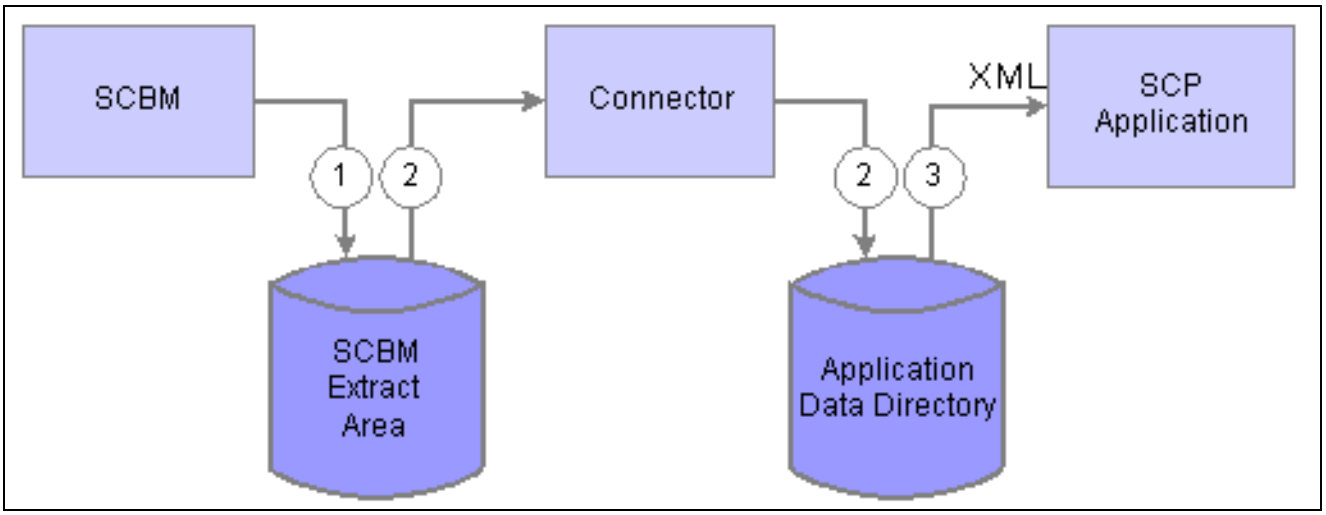
When importing enterprise data into EnterpriseOne Production Scheduling, you must include the following packages to create a model:

- Base
- Calendar (if you have calendars on resources in the manufacturing package)
- Configuration
- Manufacturing

The following packages are optional and can be included in your model, depending on your business requirements:

- PurchaseOrders
- SalesOrders
- EnterpriseForecast
- TransferOrders
- WorkOrders
- Supplier

This diagram illustrates the import process:



Importing Enterprise data from EnterpriseOne Supply Chain Business Modeler

When you synchronize EnterpriseOne Production Scheduling with production data from EnterpriseOne Supply Chain Business Modeler, the following events occur:

1. Enterprise data in XML format is exported from EnterpriseOne Supply Chain Business Modeler to an extract area.
2. The EnterpriseOne Production Scheduling data connector transfers the of the data and then copies the new file to the EnterpriseOne Production Scheduling data directory
3. EnterpriseOne Production Scheduling imports the newly created XML model.

Running the Connector

This section describes how to use the Connector and run batch commands on the Connector.

Connector Batch Commands

To run the Connector and convert enterprise data from EnterpriseOne Supply Chain Business Modeler. xml format:

1. From the command line, navigate to SCP*x.xx.x*\Common\ Start.
2. Type the following command:

   `Run_PSConnector`

   The EnterpriseOne Production Scheduling Connector command shell starts.
3. Enter the following command:

   `ps::model [-ebs] [-gzip] refresh`

   `packages {packageNameList} SCBMDataFolder appDataFile`

To process the Model Generation File:

1. From the command line, navigate to SCP*x.xx.x*\Common\ Start.
2. Type the following command:

   `Run_PSConnector`

   The EnterpriseOne Production Scheduling Connector command shell starts.
3. Enter the following command:

   `ps::model [-ebs] [–modelGen filename] [-gzip] refresh`

   `packages {packageNameList} SCBMDataFolder appDataFile`

Parameter	Description
SCBMDataFolder	The location of the source SCBM data folder. If the directory name includes a space, it must be enclosed in quotation marks.
appDataFile	The location of the destination EnterpriseOne Production Scheduling import file. If the directory name includes a space, it must be enclosed in quotation marks.

For example, the following command updates the entire model from SCBM Export extract area and copies it to the Model Data directory:

```
ps::model refresh "c:/SCBM/vers vers_x.xx.x/SCBM Export" "c:/temp
/filename.xml"
```

where temp could be any existing directory that is used for storing PS models.

The following command set your log file:

```
ps::model setLog [log file name]
```

See Also

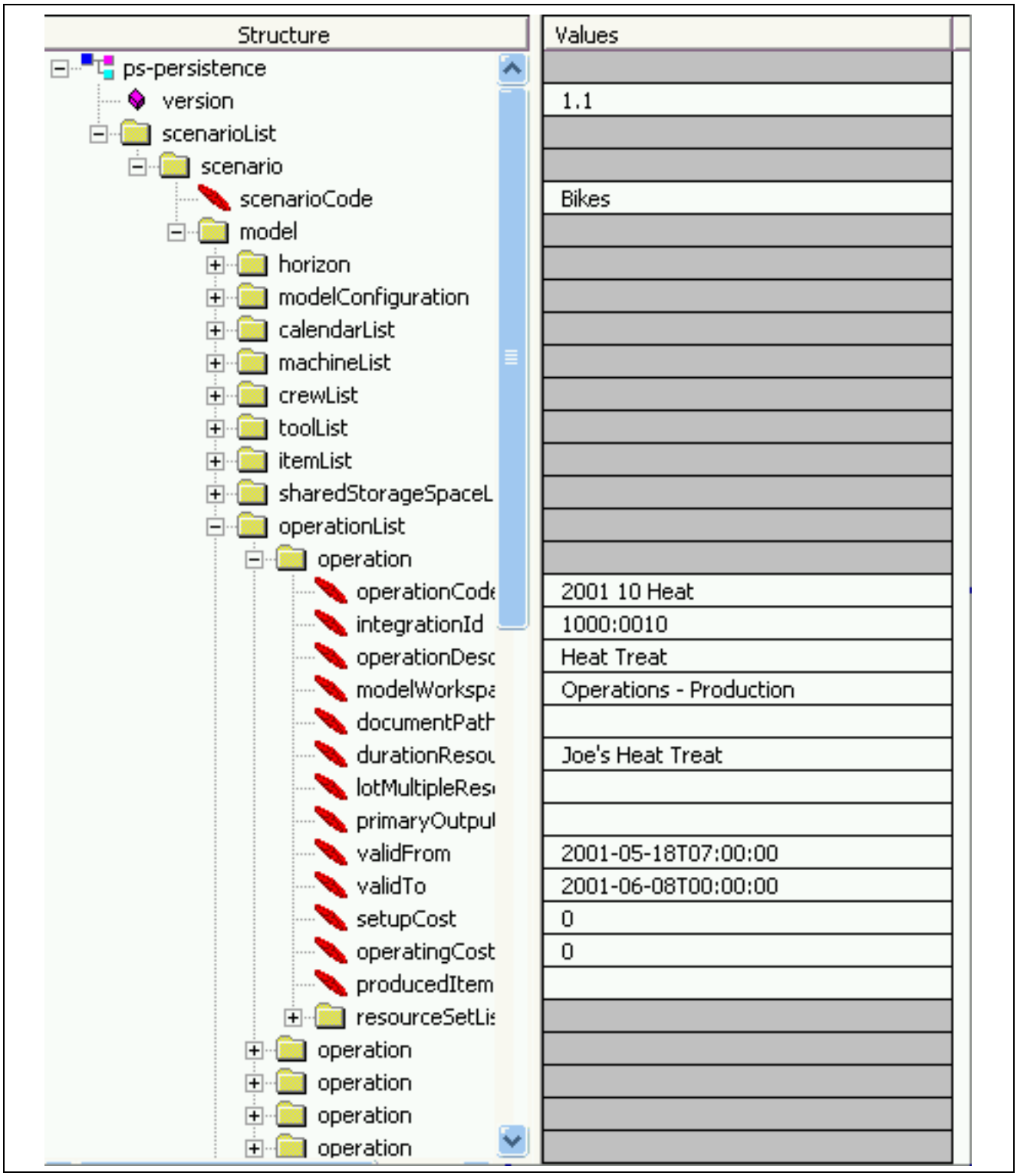
"Publishing the Schedule to EnterpriseOne Supply Chain Business Modeler"

Addition of an Integration Identification to the Underlying Model

Normally, when SCP applications are integrated with an ERP system, unique identifiers for objects such as item codes, routings, and operations, must be either a concatenation of >1 field from the ERP system, such as in the E1 integration framework, or a system generated unique identifier. The purpose is to eliminate the risk of duplicate codes, which can occur because names are not always guaranteed to be unique and primary keys, the unique identifiers, don't always line up across systems.

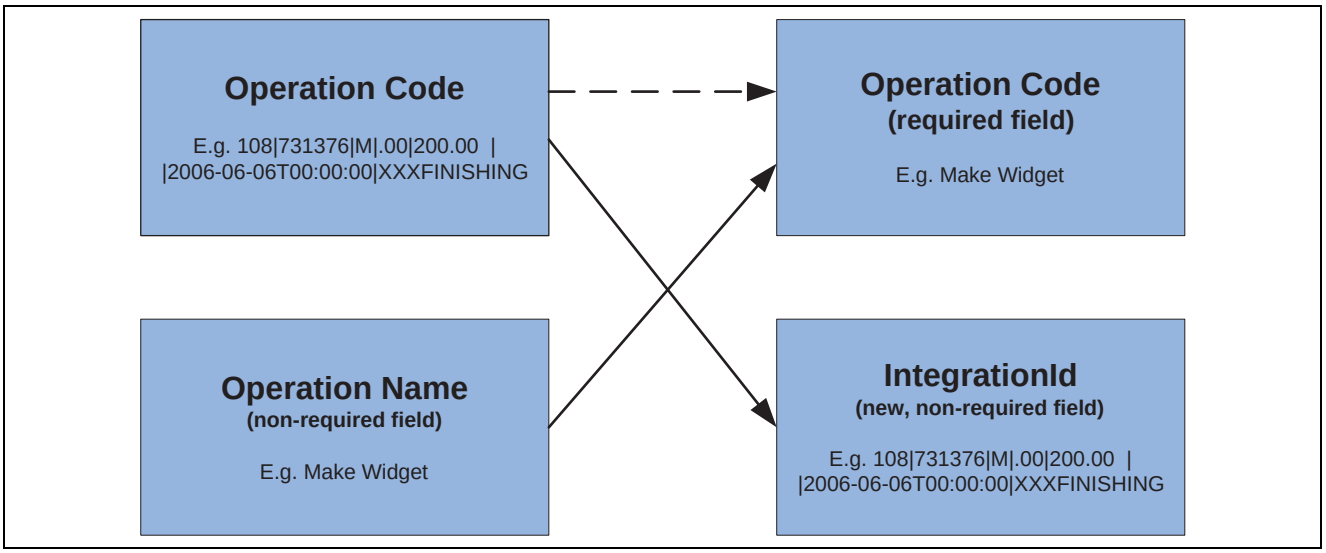
A unique code may be lengthy and occupy a large portion of screen space. If too much space is taken up by the unique code, information is difficult, if not impossible to read. For example, charts may not be properly visualized and information can be truncated.

To avoid such issues, Production Scheduling adds an integration identification, integrationId, to the underlying model, which lets you view selected objects by meaningful names rather than by a system generated unique identifier. The integrationId is specified in the XML model in the integrationId field as shown in the screen below:



IntegrationId field in the XML model

The following diagram shows the mapping logic within the Production Scheduling integration data connector:



Mapping logic in the Production Scheduling integration data connector

In summary, the connector logic is that:

- All existing or new Name fields in the SCBM API will be mapped to the Primary Keys in Production Scheduling for the object in question.
- Existing integration unique codes will be mapped to the integrationId object in Production Scheduling.
- If the name field is not defined, the code will be used , as shown with the dotted line in the graphic above.
- The integrationId will be carried through Production Scheduling and used as the code for communicating back with ERP in the WorkOrderSchedule.xml and ProductionSchedule.xml data packages.
- If a non-unique name comes through to Production Scheduling, the Production Scheduling application will append a (1) or (2)…(n) respectively in the application.

CHAPTER 7

Importing From External Systems

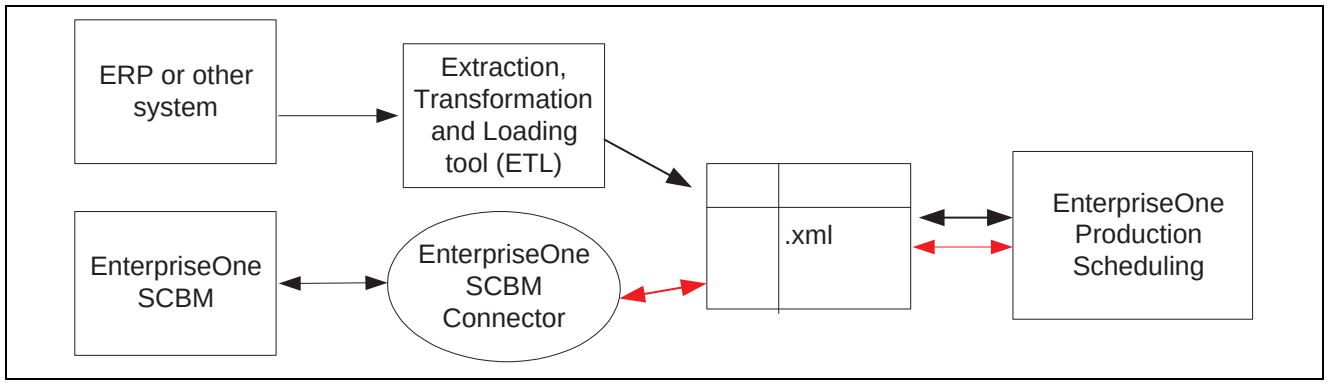
This chapter discusses how to import data in Production Scheduling.

Introduction to Importing Data in EnterpriseOne Production Scheduling

To import data in Oracle Production Scheduling, you can choose to import by creating an XML model, or ,if you are using Enterprise Supply Chain Business Modeler, you can utilize the Production Scheduling data connector to create a .xml model.

If your implementation is not using the SCBM, you can still create an XML model by using an ETL tool of your choice to create a series of CSV files. The CSV files represent the various objects in the Oracle Production Scheduling data model, such as crews, machines, tools, operations, routings, and so forth.

The import process is illustrated in the following diagram:



Importing data into EnterpriseOne Production Scheduling

CHAPTER 8

Publishing Data in EnterpriseOne Production Scheduling

This chapter describes:

- File|Publish within Production Scheduling
- EnterpriseOne Production Scheduling published reports
- Publishing schedules

File|Publish Within Production Scheduling

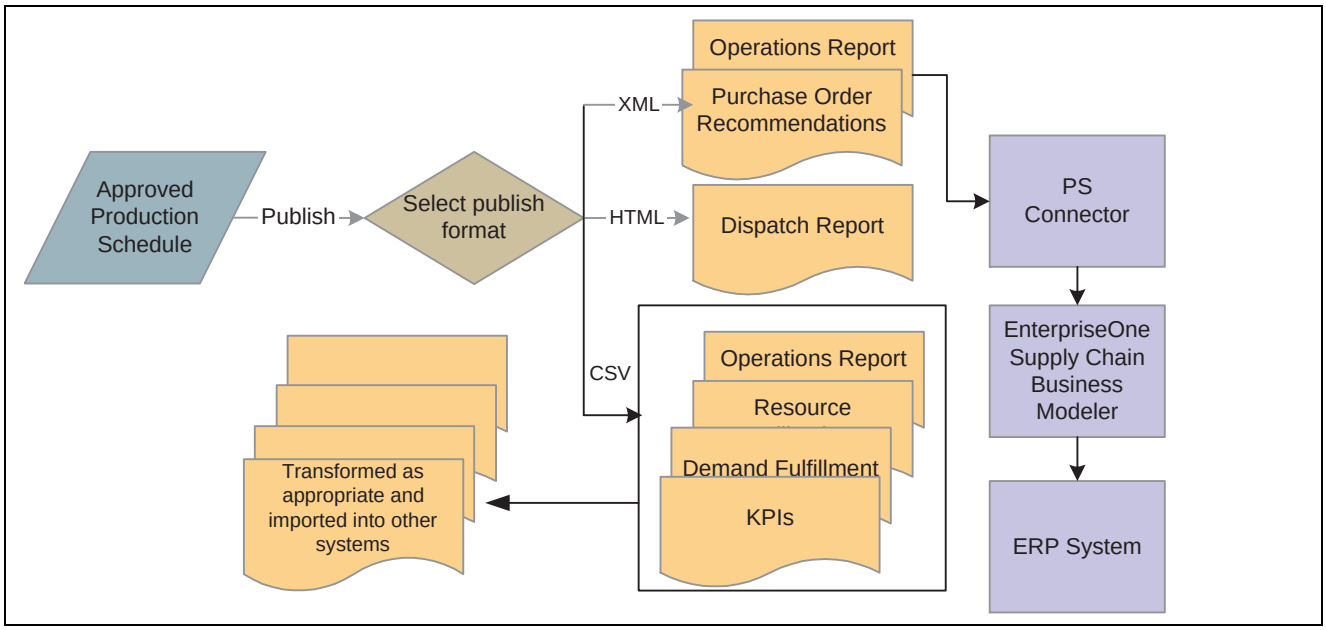
This section discusses:

- Data publishing process
- Production Scheduling published reports

Data Publishing Process

After you generate a production schedule, schedule data can be published in one or more of three formats, depending on the appropriate business context. For example, you can export the Production Schedule to create detailed work orders in ERP using the EnterpriseOne Supply Chain Business Modeler. If shop floor personnel require a detailed list of operations for a specific schedule horizon, you can publish the dispatch list directly to the shop floor using the html dispatch list.

This process flow diagram illustrates the data export process for EnterpriseOne Production Scheduling:



EnterpriseOne Production Scheduling importing process

Production Scheduling Published Reports

You can publish data from EnterpriseOne Production Scheduling in any of the following formats:

- CSV
- HTML
- XML

CSV File Reports

CSV files can be read into an ETL tool of your choice for transformation in preparation for import into other systems. When you publish in .csv file format, you can generate one or more of the following reports:

- Operations Report
- Resource Schedule
- Demand Fulfillment
- Key Performance Indicators (KPIs)

HTML Dispatch Report

HTML file format generates an html Dispatch Report that can be published directly to the shop floor.

Oracle E-Business Suite Integration

Oracle E-Business Suite Integration file format generates an XML, HTML, or CSV report. You can choose the format from a drop-down window.

XML File Reports

The standard XML file, which are exported out of Production Scheduling are:

- ProductionSchedule.xml
- PurchaseOrderRecommendations.xml
- WorkOrderSchedule.xml

XML files can be compressed.

Publishing Schedules

Before you can publish a schedule, you need a publishing profile and you must approve the schedule you want to publish. Basic publishing profiles are provided with EnterpriseOne Production Scheduling application. However, you may want to create personalized profiles that are more suited to your specific requirements.

This section explains how to:

- Create a publishing profile.
- Approve a schedule.
- Publish a schedule using profiles.

Creating a Publish Profile

Access the Production Scheduling desktop.

To create a publishing profile:

1. From the File menu, select Publish.
2. In the Publish window, click New.
3. Complete the following fields. Explanations of the fields follow this procedure.
   - Profile Name
   - Description
   - Publish Horizon
   - Format
   - Output Directory
   - Script (optional)
4. Click Apply and then the Data Selection tab at the top of the window.
5. If you chose XML as your publishing format:
   - Check the reports you want to publish.
   - Check the Compress Output if you want to compress the output report.
6. Click Apply and then OK.
7. If you chose CSV as your publishing format:

- Check the reports you want to publish.
- Click Apply and then OK.

8. If you chose HTML as your publishing format:
   - Check the boxes beside each heading you want to appear in the Dispatch Report.
   - Click Apply and then OK.
9. If you chose XML as your publishing format:
   - Check the reports you want to publish.
   - Check the Compress Output if you want to compress the output report.

Publishing Profile Field Descriptions and Explanations

This section describes the fields you need to fill in to create a publishing profile.

Profile Name

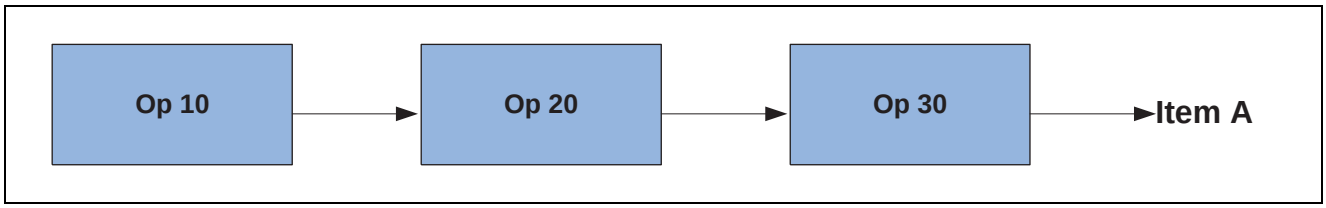
Specify a unique name for the profile. When you publish a schedule, you are asked to choose a profile. The profile you choose will follow the criteria you set out in this procedure.

Description

Enter a description for the profile.

Publish Horizon

Specify the number of hours, shifts, days, or weeks for the profile. The publish timefence within a publish profile specifies a period of time in which data is published from Production Scheduling. For example, assume the following three operations are part of a Routing to Make Item “A”. A publish timefence of 2 days in place. This scenario is displayed in the following diagram:



Publish timefence with pegging

The following logic indicates which data will be published when a timefence is being utilized:

If any of Operation 10, 20 or 30 is inside the publish timefence, the routing and operations for those operations will be included in the publish of the production schedule.

If the routing instance crosses the timefence, the operations will still be included as part of the publish. Only if none of the operations associated with the Routing do not cross or start within the timefence will the operations be published.

In terms of the pegging reports produced from Production Scheduling, only those demands which have operations that take place inside the timefence will have their pegging details published. If a series of operations do not have any activity within the timefence, the pegging details will not be published.

Format

Select CSV, HTML, Oracle E-Business Suite Integration, or XML. This is the format in which your data will be published.

CSV Report:

CSV files can be read into an ETL tool of your choice for transformation in preparation for import into other systems. When you publish in .csv file format, you can generate one or more of the following reports:

- Operations Report
- Resource Schedule
- Demand Fulfillment
- Key Performance Indicators (KPIs)

Operations Report

The Operations Report provides the actual start time, end time, and quantity of each item that is produced or consumed for each scheduled operation.

The Operation report is saved in the OperationsSchedule.csv file in the location you specified when you created the publish profile.

Resource Schedule Report

The Resource Schedule produces a report which includes machine and crew information that is published according to the time fence that is selected.

The Resource Schedule is saved in the ResourceSchedule.csv file in the location you specified when you created the publish profile.

Demand Fulfillment Report

The Demand Fulfillment report publishes detailed pegging information for each Demand line item. This includes the name of the customer, quantity of the desired item, available and requested dates.

The Demand Fulfillment report is saved in the Demand Pegging.csv file in the location you specified when you created the publish profile.

Key Performance Indicators

Oracle Production Scheduling can publish key performance indicators (KPIs) to a .csv file, using the File|Publish tool. When you export key performance indicators, information about key performance indicators, including fill rate, stock outs, inventory turns, substitutions, resource utilization and throughput is exported.

The Key Performance Indicators are saved in the KPI.csv file in the location you specified when you created the publish profile.

HTML Dispatch Report

HTML file format generates an html Dispatch Report that can be published directly to the shop floor.

Shop floor personnel can use the dispatch list to organize production tasks for the day. The scope of the data that is published to the dispatch list is configurable and can be adjusted depending on the level of schedule data required on the shop floor. Once schedule information is dispatched to the shop floor, it is available to view on any networked workstation with a web browser.

The dispatch list index page is a centralized portal for shop floor personnel to view operation, item, work order, demand, and customer information for specific resources in order to plan daily production tasks. The dispatch list home page is organized by machine, crew, and tool resources. Shop floor personnel can select the appropriate resource on the home page and view detailed schedule information for that resource, depending on the scope of data determined prior to the publishing process.

The following schedule data can be published to the shop floor:

Category	Data
Operations	Operation ID, Description, Start Time, End Time
Items	Item, Item Description, Quantity
Work Orders	Work Order Number
Demand	Demand Number, Demand Due Date, Demand Item, Demand Quantity
Customer	Customer Name, Customer Number

You can choose what headings you want in the report by checking the boxes in the profile's Data Selection window. EnterpriseOne Production Scheduling enables you to dispatch scheduling information to the shop floor efficiently without the need to write custom reports during the implementation phase. A web based dispatch list can be published and deployed to a web server in your enterprise for shop floor personnel to use.

Oracle E-Business Suite Integration

Oracle E-Business Suite Integration profile is used when running EnterpriseOne Production Scheduling in an integrated manner with Oracle EBS. When you choose this option, you can also choose the format for your reports:

- CSV
- HTML
- Oracle E-Business Suite Integration
- XML

XML File Reports

The standard XML files, which are exported out of Production Scheduling are:

- ProductionSchedule.xml
- PurchaseOrderRecommendations.xml
- WorkOrderSchedule.xml

The XML files can be compressed

Production Schedule Report

The Production Schedule report is saved in the ProductionSchedule.xml file in the location you specified when you created the publish profile. It is typically read into the Production Scheduling SCBM Connector where it is prepared for import into the SCBM. This report contains the detailed production schedule created and approved during the scheduling process. This includes any scheduled work orders and any new production not yet associated with a work order.

When you export a production schedule, purchase order information, including item, quantity, arrive date, and supplier information is published to EnterpriseOne Supply Chain Business Modeler for use in other systems. The date is translated from the application format to an XML file.

The Production Schedule report is saved as an .xml file in the location you specified when you created the publish profile.

Purchase Order Recommendations Report

You can publish purchase order recommendations to EnterpriseOne Supply Chain Business Modeler, depending on your requirements. When you export purchase order recommendations, purchase order information, including item, quantity, arrive date, and supplier information is published to EnterpriseOne Supply Chain Business Modeler for use in other systems. The date is translated from the application format to an XML file.

The Production Order Recommendation report is saved in the .xml file in the location you specified when you created the publish profile.

Work Order Schedule

Work Order Schedule report contains all the necessary information on work orders that you have scheduled.

The Work Order Schedule report is saved as an .xml file in the location you specified when you created the publish profile.

Output Directory

Specify the directory where the system will save the published data. You can explicitly specify the location of the directory or click Browse to browse for a directory location.

Script

Specify a script that will be initiated after the data is published. You can explicitly specify the location of the script or click Browse to browse for a script. This field is optional.

Data Selection tab

If you choose XML or CSV file format for the profile, check the box beside the report you want to publish. You can select more than one report.

XML files can be compressed by checking the Compress Output box. The output will be compressed into a GZIP file and .gz appended to the file name. For example, if you compress the Production Schedule report, the file will be ProductionSchedule.xml.gz.

If choose HTML, each box in the Data Selection window represents information that you can choose to include as a column heading in the Dispatch Report. Check the boxes beside the information you want to include in the Dispatch Report.

Approving a Schedule

The schedule you want to publish must be approved before it will publish.

Access the Production Scheduling desktop.

To approve a schedule.

1. Right click your mouse on the scenario whose schedule you want to publish.
2. Select Approve from the available options. The green check beside the word “Approved” will be set in a small box when the schedule is approved.

Publishing a Schedule Using Publish Profiles

Access EnterpriseOne Production Scheduling desktop.

Note. Make sure you have approved the schedule you want to publish

1. In the Model Workspace, right click the schedule you want to publish.
2. Select Approve from the available options.

   Note. You cannot publish a schedule until it approved.

3. From the File menu, select Publish.
4. In the Publish window, select the profile you want to publish.
5. Click Publish.

Editing an Existing Publishing Profile

Access EnterpriseOne Production Scheduling desktop.

1. From the File menu, select Publish.
2. In the Publish window, select the profile you want to edit.
3. Click the Edit button.
4. In the Edit Profile window, change the information you want to change under the General and Data Selection tab.
5. Click Apply and then click OK.

Deleting an Existing Publishing Profile

Access EnterpriseOne Production Scheduling desktop.

1. From the File menu, select Publish.
2. In the Publish window, select the profile you want to delete.
3. Click the Delete button.
4. Click OK when you are prompted to delete the profile.

CHAPTER 9

Batch Commands

You can use batch commands to publish data and perform a solve.

Using Batch Commands

This section discusses how to publish data and perform a solve using batch commands.

Solving and Publishing in Batch Mode

To solve and publish in batch mode.

Access a command prompt or a batch file.

1. Enter the following command:

   [directory path]`\scp\8.11.2\common\start\run_ps.bat -batch` *pathfilename*

   where *[directory path]* is the path to where the scp suite is installed and *path filename* is the path and name of the batch input you have created to be used as input into the process.

   Note. Please be sure to use forward slashes in the path to the file name. The batch file is an xml file that contains the appropriate model(s) to be used as input into the solve and publish process.

   For example:

   C:\scp\8.11.2\common\start>run_ps.bat -batch c:/scp/8.11.2/ps/sample_data/samplebatchcommands.xml

   You can find a sample entitled RunPSInBatch.bat in the /scp/8.11.2/ps/sample_data/ directory. There is also a sample batch command file entitled MyBatchScenarios.xml in the*installation drive and path*\\scp\8.11.2\PS\sample_data directory.

2. Create your batch file, as displayed in the sample file at the end of this procedure or refer to the example command file entitled SampleBatchCommands.xml in the *installation drive and path* \\scp\8.11.2\PS\sample_data directory for the appropriate structure and nomenclature.

Line Number	Input	Description and Values
1	`?xml version= "1.0" encoding="utf-8"`	SCP supports xml. version 1.0 and utf-8.
2	`PSBatch version=`	Enter the version of Production Scheduling you are using.

Line Number	Input	Description and Values
3	`model openUponCompletion=`	Specifies if you wish to launch the application after the process is finished. Value values are: Yes: Launches the application. No: Closes the application.
4	`outputFileName`	The is the name of the location of the output file. You must specify a path and name of the .dxt file if you wish to create the file. For example: C:\scp\8.11.2\PS\sample data\Bikes 8.11.2.dxt
5	`scenarioList`	This line begins the specifications for the scenarios you want to publish. You can publish more than one scenario in a single batch file.
6,	`scenario openUponCompletion=`	Specifies if you wish to open the specific scenario or not upon completion of the process. Values are: Yes: Opens the specific scenario. No: Does not load the scenario into memory.
7	`scenarioName`	Optionally, you can enter a name for the scenario. If you leave this field blank, Production Scheduling will automatically assign a name to the scenario.
8	`inputFile`	Enter the directory C:\scp*x.xx.*\PS \sample_data\Bikesath and name of your file. The file must be in XML format.
9	`logFile`	Optionally, you can specify a name for a log file. If you have the same log file name as for another scenario, the value in Tools | Options determines if the existing log file is overwritten or if the information is appended to it. For example: c:\scp\mylog.txt
10	`publishList`	Begins a list of the profiles you want to publish.

Line Number	Input	Description and Values
11	publishProfile	Enter the name of the profile you want to publish. To publish more than one profile, enter the same command again, followed by the next profile name.
15	/scenario	Ends the specifications for publishing the scenario. To publish more than one scenario, repeat the same information for the next scenario, beginning at line 6.

```
1. <?xml version="1.0" encoding="utf-8"?>
2. <PSBatch version="811.1">
3.    <model openUponCompletion="No">
4.      <outputFileName>c:\BikesConstrained.dxt</outputFileName>
5.       <scenarioList>
6.          <scenario openUponCompletion="No">
7.             <scenarioName>Bikes</scenarioName>
8.             <inputFile>C:\Development\dexter\Dexter\Samples\
                 Bikes 8.11.1 Paint Constrained.xls</inputFile>
9.             <logFile>c:\Mylog.txt</logFile>
10.             <publishList>
11.                <publishProfile>CSV Production Schedule</publishProfile>
12.                <publishProfile>HTML Dispatch Report</publishProfile>
13.                <publishProfile>My CSV Profile Name</publishProfile>
14.             </publishList>
15.         </scenario>
          <scenario openUponCompletion="No">
             <scenarioName>Bikes1</scenarioName>
             <inputFile>C:\Development\dexter\Dexter\Samples\bike.xml</inputFile>
             <logFile>c:\Mylog1.txt</logFile>
             <publishList>
                <publishProfile>CSV Production Schedule</publishProfile>
                <publishProfile>HTML Dispatch Report</publishProfile>
             </publishList>
          </scenario>
       </scenarioList>
    </model>
</PSBatch>
```

Example of a Production Scheduling batch file

CHAPTER 10

Configuring Model Properties

This chapter provides an overview of model properties and discusses how to:

- Define model and schedule properties
- Define work patterns and availability
- Create changeover rules
- Specify supply and demand events
- Create work orders

Note. You must complete the tasks discussed in this chapter to create production schedules in EnterpriseOne Production Scheduling.

Understanding Model Properties

When you set model properties, you can configure EnterpriseOne Production Scheduling globally for every model and schedule, or you can set properties for individual schedules.

Work Patterns and Availability

The Calendar editor enables you to set up work time, such as work patterns and planned down time. These calendars are assigned to resources on the Resource Properties page. You can view calendar event properties to review the start date, end date, and duration. In addition, you can revise the information, but revisions appear only after the schedule has been repaired.

Work patterns specify the type of work operation, such as two shifts, three shifts, or five days a week. Down time includes interruptible (delay) and non-interruptible (down) times. Operations can start before and continue after a delay. Operations cannot start before and continue after down time.

Planned down time periods include vacation shutdowns, planned maintenance, delays, and scheduled shutdown days. For example, if a plant works only during weekdays, then the calendar displays weekends as down time periods. By creating a calendar for the down times of each resource, you tell the system how to plan production more precisely and allocate resources more effectively.

Changeover Rules

You can record precise information about sequence dependent changeover time by using the Changeover editor. For example, when a machine die is changed to a larger bore or when a printing press changes to a different color, the machine has to be stopped and reconfigured. Using this feature, you can create rules that record those times when a machine cannot operate because it has to be set up for the next operation on this machine. Costs can also be recorded for each changeover rule. These costs are used to calculate the cost-based metrics in the Key Performance Indicators window.

A hierarchical order exists for the rules that are entered in the Changeover editor. When solving the schedule, the system uses the first rule on the list that applies to the changeover from one machine to another. For example, if you have two rules for the Chain Machines Group from operation 2004_Cut_10 to 2005_Cut_10, the schedule uses the top rule.

Note. If you create a rule at, or move a rule to the top of the Changeover editor, this rule effectively overwrites all of the other rules.

To save time, you can select groups of operations or machines when entering changeover rules. For any group other than All Machines or All Operations to appear, its property attributes must be set to display in the Changeover editor. You can use the filters at the bottom of the view to find out which changeover rule is applicable to the resource or operation to and from combinations.

Supply and Demand Editor

The Supply & Demand editor enables you to set up supply and demand events for your schedule. Although this data is usually imported into EnterpriseOne Production Scheduling, you can input supply and demand events directly within the application to facilitate simulations.

You can create demand orders and demand line items by creating a demand folder, adding demand orders, adding line items, specifying demand policies and dates, and completing the line item fields. You can edit demand information in either order view or line item view.

Supply and demand events can be modified globally or for a particular schedule. The global Supply & Demand editor is launched from the Model Workspace, and its contents form the basis for all future schedules. The Supply & Demand editor can be modified locally for a specific schedule. This ability enables you to revise requirements or purchased parts that are required for a schedule, and analyze what-if scenarios.

In addition to the maintenance of supply and demand orders and their status, the Supply & Demand editor also contains an analytical tool that provides pegging information for all demand orders. This pegging grid displays all of the items and processes that are involved in the manufacturing of a product; it also displays when each step is scheduled for completion. This grid provides you with specific production information for a particular line item when such information is required.

The Supply & Demand editor's appearance can also be configured to suit your preferences.

Build Strategy and Demand Priority

When you define demand policies, you can use the Build Strategy field to configure how EnterpriseOne Production Scheduling fulfills demand. You can use JIT (Just In Time) or Pre-Build fulfillment options.

If you select the JIT build strategy, items are scheduled for production at the last possible moment. The JIT build strategy is useful if you want to avoid storing inventory. If you select Pre-Build, the solver schedules production at the earliest available opportunity.

You can determine the order in which demand is filled by using the Demand Priority field. The higher the number, the higher priority that a demand item is given. For example, the solver fills demand orders with a priority of 1 before filling orders with a priority of 2.

If two or more demand orders have the same requested dates, then the system considers demand priority for each order. The solver schedules the demand that has the higher priority.

Working With Demand Priorities

In most manufacturing environments, demand priority setting is a common practice. These priorities are generally dictated by various factors, such as customer size, revenue contribution, length of time a sales order has been outstanding, predetermined agreements, as well as other factors. In the event of resource conflicts, higher priority orders are expected to receive preferential treatment over other orders in the system.

Demand priorities often change during planning simulations, such as when a scheduler is doing ad-hoc order promising to facilitate the effect of adding a hot order to the existing production schedule, that is, in which other demands are late or otherwise affected. This can be an iterative process to achieve the schedule and service levels that satisfy the user.

Production Scheduling provides very differentiating scenario comparison capabilities to support these types of scenarios.

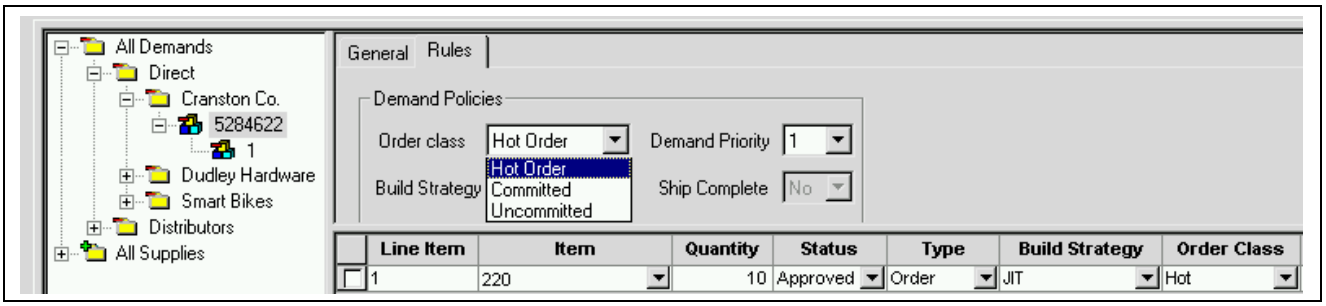
In the Supply & Demand Editor, there are three order classifications:

- Hot Order
- Committed
- Uncommitted

Within each category, you can set a demand priority from one to five. Therefore, in effect you have fifteen different priorities with which to set your demand.

The highest order class is Hot Order, followed by Committed, followed by Uncommitted. The highest Demand Priority is 1, the lowest Demand Priority is 5.

You set the class and priority in either the Rules tab of the order, or in the line item itself as shown in the following diagram:



Setting demand priorities

The importance of supporting these scenarios, and the shortcomings that result when if these types of scenarios are not supported is best demonstrated in the following example:

Two demands, Demand 1 and Demand 2, have stated priorities of 2 and 1 respectively. Demand 1 is due on Day 1 and Demand 2 is due on Day 2. Each demand shares a common machine, which is used to manufacture the respective items on the demand.

If there are no resource conflicts, that is, there is sufficient capacity:

- Demand 1 is scheduled first because the lower priority demand is due earlier. Demand 2 is scheduled next because the higher priority demand is due after Demand 1.
- If these demands compete for capacity, users expect that the higher priority demand would be fulfilled first.

This was previously not supported in the application unless the Build Priority was set to zero. Essentially, Build priority zero was the only high priority order. Everything greater than build priority zero is driven by demand due date, essentially ignoring the stated priority.

Demand priorities enables users to input 3 new order classes, Hot, Committed, and Uncommitted. Each of these classes contains priorities 1 to 5. Uncommitted orders are essentially opportunistic orders which look for holes in the schedule and inventory to fill a given demand.

The Production Scheduling solver schedules higher priority demands first in the event of a resource conflict. If no resource conflict exists, the schedule is driven by due date, which enables the lower priority orders to be scheduled first.

Work Orders

Work orders are statements of current or future production for an item. In EnterpriseOne Production Scheduling, work orders can be linked to demand orders. Work orders are usually imported from a Materials-Requirement Planning (MRP) system, although they can also be entered directly in the application. EnterpriseOne Production Scheduling supports three types of work orders:

- Production orders
- Maintenance orders
- Engineering changes

A production work order must specify an item that is produced on completion of all of the operations within the work order. Only manufactured items (as defined in the item properties) are available for selection. You then select a routing that produces the item.

Maintenance orders and engineering changes are a secondary type of work order. Maintenance orders and engineering changes do not produce items, but they still consume production capacity. These orders play a crucial role in the manufacturing process. For example, machines break down if they are not properly maintained, and machines and equipment are subject to enhancement due to technological and engineering advances. Maintenance orders support and repair anything involved in the production process. For example, maintenance orders can be issued to repair a drill press, inspect welding equipment, or lubricate a milling machine. xx

Engineering changes are used when machines and tools require capital improvements to perform new or improved operations.

Although work orders that are listed in the Work Order Editor and demand displayed in the Supply & Demand editor are different sources of production requests, they can be linked. The system considers both requirements when the model is scheduled.

Work orders can also be configured individually when the work order is not in the standard template when it is imported from and ERP system.

Configured Work Orders

Manufacturers generally fall into one of two categories, make-to-order (MTO) or make-to-stock (MTS). Within the MTO environment, there are sub-categories, including Assemble to Order (ATO), Configure to Order, (CTO),, and Engineer to Order (ETO). These sub-categories are briefly described below:

- Assemble-to-Order is an environment in which a product or service is assembled after receiving an order from the customer. The key components that are used in the assembly or finishing process, such as bulk, semi-finished, intermediate, subassembly, fabricated, purchased, and packaging, are planned and generally stocked in anticipation of a customer order. Receipt of an order initiates the assembly of the customized product.
- Configure-to-Order is an environment in which designs are created by the manufacturer's engineers, but design options are provided for most of the important components that go into the unit. Custom configurations are typically created by including different combinations of standard items.

- Engineer to Order is an environment in which products are specifically designed to the specifications of the customer. Sub-Assemblies components can be either standard items or custom items that are designed specifically to the customer order. It is common for Engineer to Order environments to utilize mixed mode manufacturing strategies, including elements of Make to Stock, Assemble to Order, Configure to Order, and Make to Order processes.

MTS is a production environment in which items can be finished and usually are finished before receiving a customer order. Customer orders are typically filled from existing stocks and production orders are used to replenish those stocks.

Scheduling Configured Work Orders

For scheduling purposes, the business requirement of effectively dealing with MTO environments presents various challenges to an enterprise looking to create optimal plans based on changing manufacturing processes. In addition, companies that are not a pure MTO environment also deal with dynamic manufacturing processes. This can be as simple as issuing a different material to a work order that was not part of the standard ERP routing, charging additional machines, crews, or tools, for which the jobs were not setup to run on, or running additional operations on a part. For scheduling purposes, any work order that is imported into Oracle Production Scheduling and varies from the standard template from ERP, other than from pre-designated alternates, can be considered a configured work order.

Typical Scenarios

The list below outlines some typical scenarios that present a configured work order to Oracle Production Scheduling:

- Work orders, which were generated in a “Configurator” program. Essentially, work orders are dynamically created and passed to Oracle Production Scheduling. No corresponding routing exists in Oracle Production Scheduling.
- Non-standard crews, machines, or tools that are included on the work order bill of resource.
- A work order that is missing crews, machines, or tools on work order operations.
- Non-standard items that are included on the work order bill of material.
- Missing items on the work order bill of material
- Additional operations that are included on the work order routing.
- Missing operations on the work order routing. For example, Oracle EBS does not pass “Closed” work order operations and send to Oracle Production Scheduling.
- Operation Sets that are specified on the work order routing.

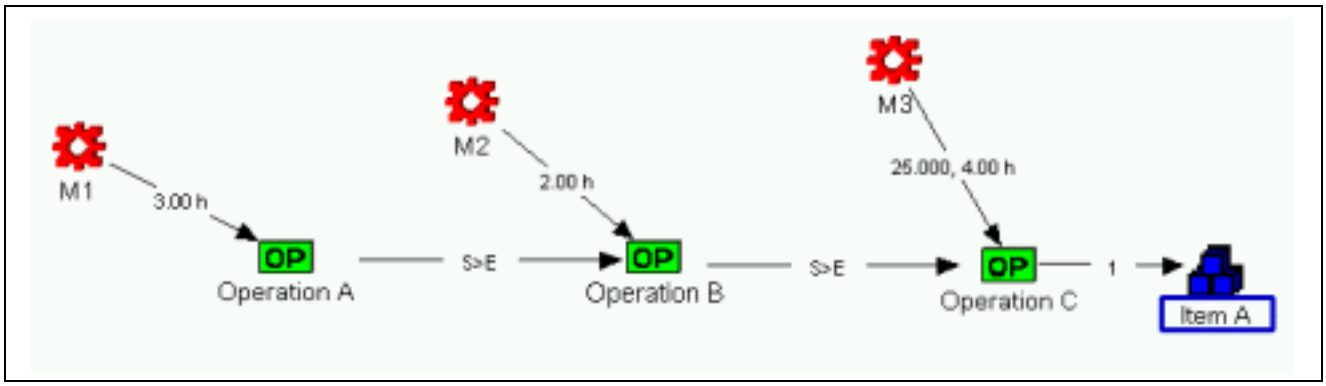
Oracle Production Scheduling has be capability to remove the dependency on having a routing template pre-created in the model for every work order in the application. The application dynamically cross references the work order routing against the routing template during the import process. If Oracle Production Scheduling comes across one of the problematic scenarios outlined above, it creates a new routing, which directly corresponds to the work order in question. If operations differ from their standard templates, Oracle Production Scheduling creates a new operation, which will be present in the routing.

See Also

Work Order Gantt

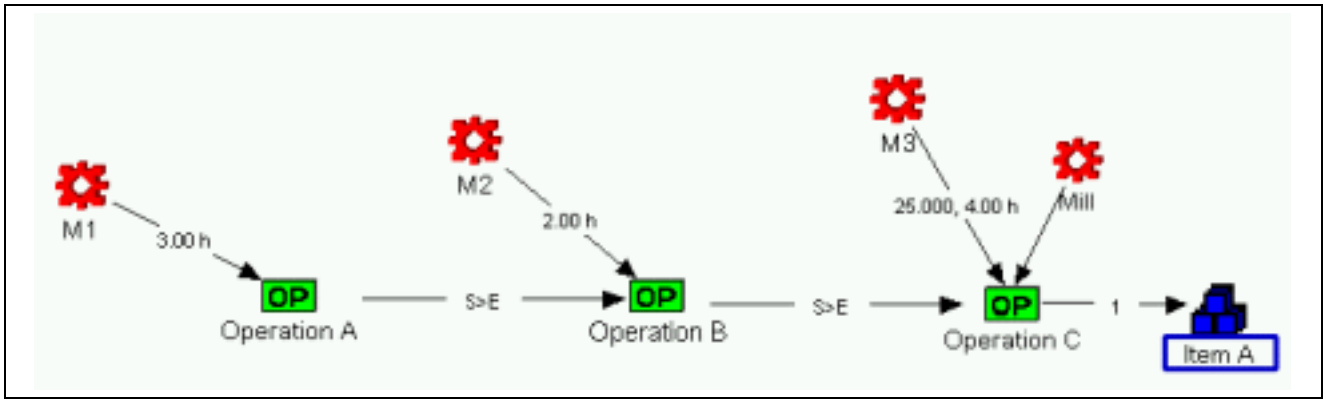
Example of a Configured Work Order

In this example, assume that the following routing exists in Production Scheduling as a standard template:



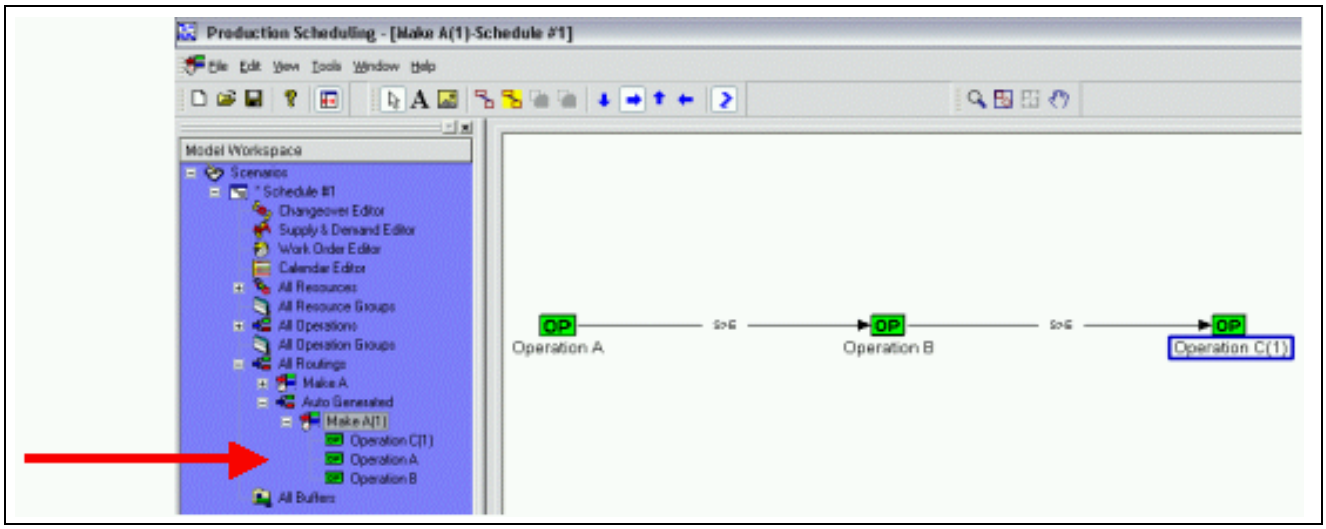
Standard routing template

Now, assume the work order which is created in ERP contains an additional machine “Mill” on Operation C, which is a non-standard machine for this part.



Additional Operation on Machine C

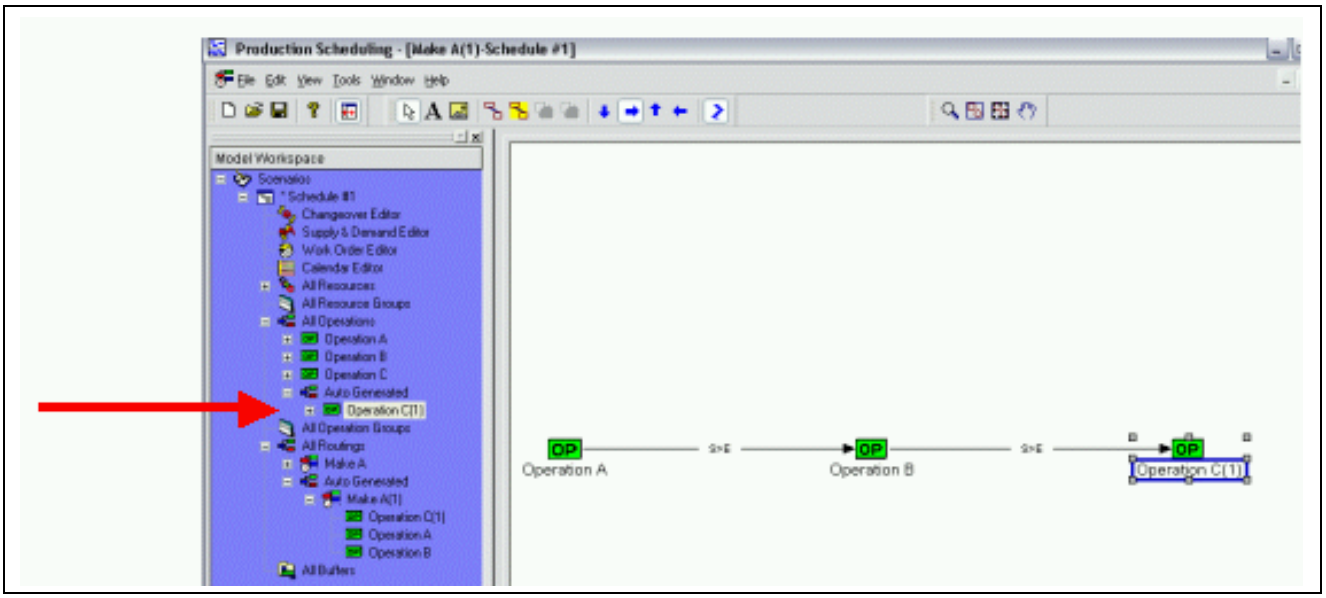
When this work order is imported into Oracle Production Scheduling, a subfolder of the All Routings folder is created, named Auto-Generated, as shown in the diagram below. Auto-Generated contains the newly created routing.



Subfolder created in All Routings

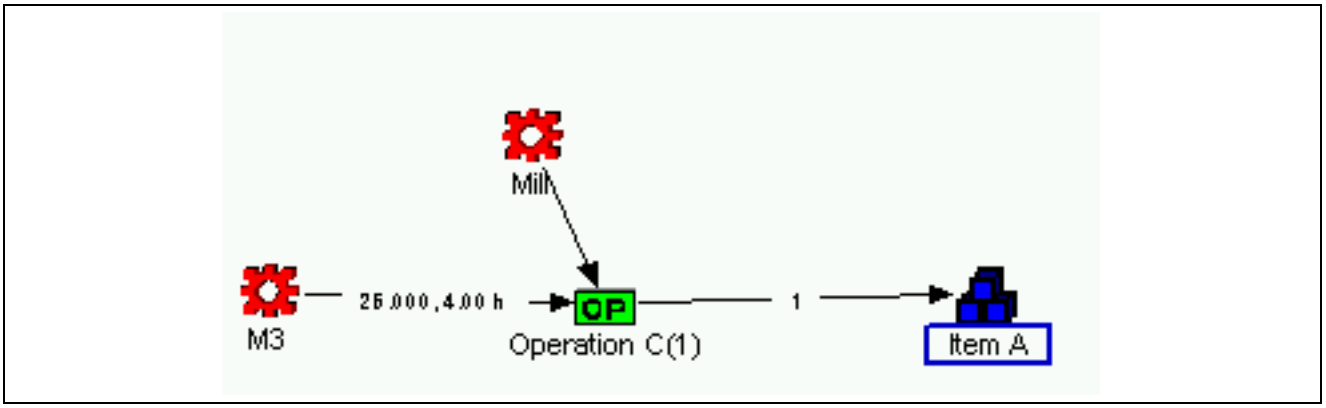
In addition to the new subfolder, the following events occur:

1. A new routing exists in Oracle Production Scheduling. The name is specified on the work order header. If the name already exists, Oracle Production Scheduling appends the number one in brackets, (1), to the routing code. The integration ID from the XML file is retained and sent back when the schedule is published. In this way, the inbound integration can continue to cros reference the original routing that was returned to fill in any relevant details.
2. The routing attribute, Use for Work Orders Only, is populated. No net new production recommendations will use this routing to create new production when total demand is grater than the sum of work order quantities.
3. The subfolder of the All Operations folder named Auto-Generated, contains a newly created Operation C(1). This is the operation which had the additional resource charged to it. If the name is the same as an existing operation, Oracle Production Scheduling appends a number one in brackets, (1) to its operation code. The integration ID from the XML is retained and sent back when the schedule is published so the inbound integration will continue to function, as shown in the diagram below:



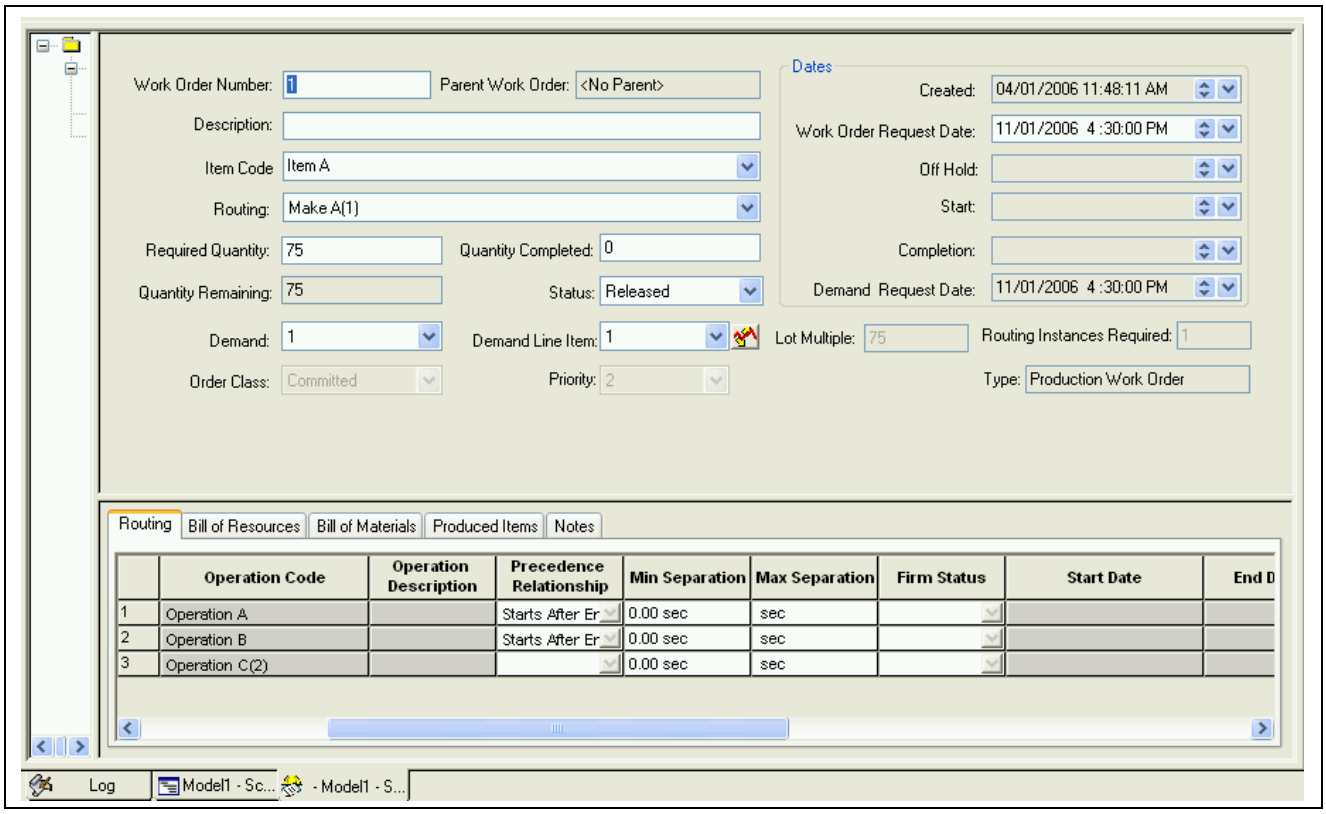
New operation folder, appended with (1)

Operation C is redefined, as shown below:



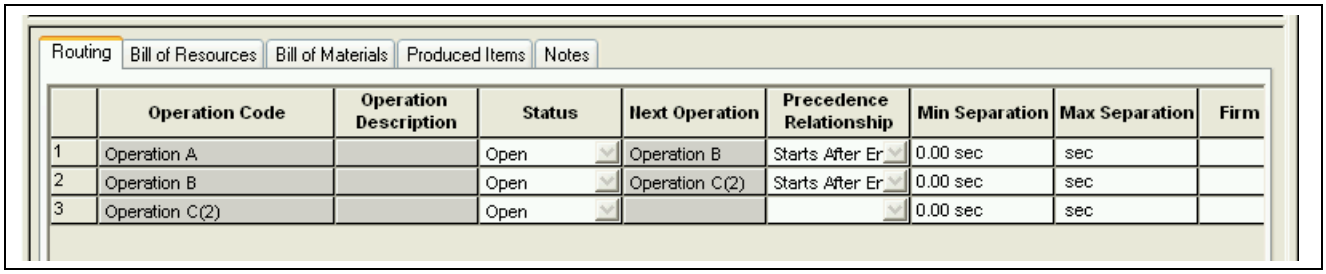
Operation C redefined

The Work Order now refers to the new routing and contains the new operation code and any additional resources, as shown below:



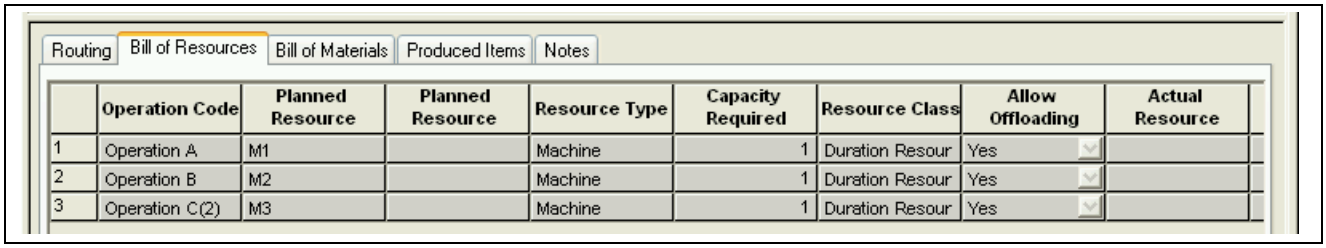
New Routing

The diagram below shows the newly assigned operation code:



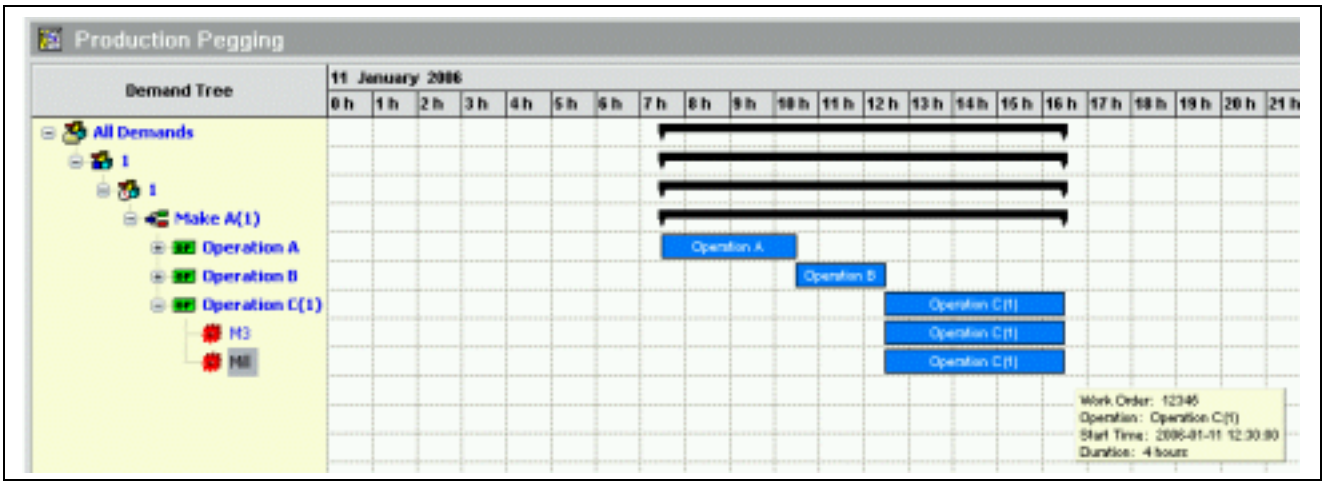
New operation code

The diagram below shows the additional resources:



Additional resources

The scheduled work order is depicted in Oracle Production Scheduling, as shown below:



Scheduled work order

Schedule Results

Oracle Production Scheduling solves the schedules for these work orders in the following manner:

Scenario	Result
A work order is generated in a “Configurator” program, which contains no corresponding routing in the Oracle Production Scheduling data model.	A routing is created and assigned the code that is present on the work order. All operations that were not previously defined are created in the Oracle Production Scheduling data model.
Non-standard crews, machines or tools included on the work order bill of resource.	A routing is created in Oracle Production Scheduling and the different operations will have a new operation created for them in the Oracle Production Scheduling data model as well. If there was an integrationID assigned to the routing code in the model, it will be assigned to this routing code as well, same for any operations created.
The work order operation is missing crews, machines or tools.	A routing is created in Oracle Production Scheduling and the different operations will have a new operation created for them in the Oracle Production Scheduling data model as well. If there was an integrationID assigned to the routing code in the model, the integrationID and the new operations will be assigned to this routing code.
Non-standard items included on the work order bill of resource.	A routing is created in Oracle Production Scheduling and the different operations will have a new operation created for them in the Oracle Production Scheduling data model. If there was an integrationID assigned to the routing code in the model, the integrationID and the new operations will be assigned to this routing code.
The work order operation is missing items.	A routing is created in Oracle Production Scheduling and the different operations will have a new operation created for them in the Oracle Production Scheduling data model as well. If there was an integrationID assigned to the routing code in the model, the integrationID and the new operations will be assigned to this routing code.

Scenario	Result
Additional operations included on the work order routing.	A routing is created in Oracle Production Scheduling and the additional operation will have a new operation created for it in the Oracle Production Scheduling data model. If there was an integrationID assigned to the routing code in the model, the integrationID and the new operations will be assigned to this routing code..
Missing operations on the work order routing.	A routing is created in Oracle Production Scheduling, which will contain only the operations on the work order routing. If there was an integrationID assigned to the routing code in the model, it will be assigned to this routing code.
Operation Sets specified on the work order routing	A routing is created in Oracle Production Scheduling and the specified member of the operation set will be chosen in the newly generated routing. If there was an integrationID assigned to the routing code in the model, the integrationID and the new operations will be assigned to this routing code.

Work Order Yield and Scrap

Work orders in EnterpriseOne Production Scheduling represent both yield and scrap on a given operation and across operations. Yield applies to operation output and scrap applies to consumed items.

The following examples illustration yield and scrap on operations.

Example of Yield Calculation

The following criteria are used in this example:

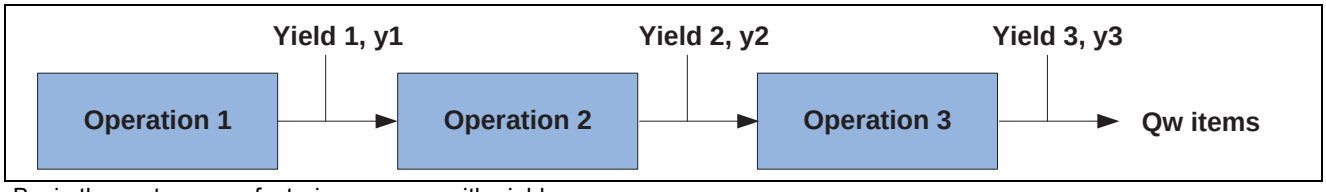
Work order quantity = Qw

Work order routing or operation yield = y

Work order parts list scrap factor = s

Work order parts list scrap factor quantity = Qc

The following diagram outlines a manufacturing process, which consists of three operations. Each operation has a quantity of material going into the operation, and a quantity as a percent yield coming out.



Basic three-step manufacturing process with yield

As a result of each operation, there is material that is unusable. This is represented by (1–y) x Qw (quantity of consumed items) and is expressed as a percent. In this example, we want to produce four bicycles. The yield for each operation is as follows:

- Operation 1 yield is 80 percent
- Operation 2 yield is 100 percent

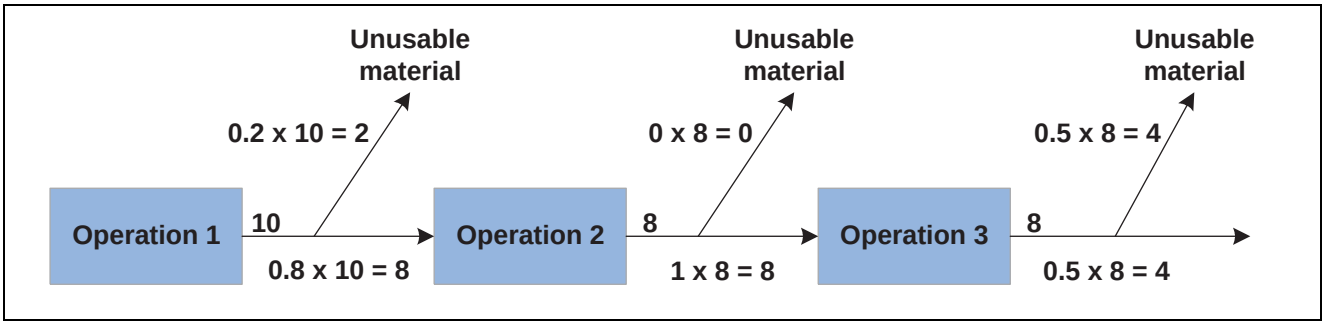
- Operation 3 yield is 50 percent

Operation 1 starts by trying to make 10 bikes. The yield for operation 1 is 80 percent so only 8 bikes are successfully produced. That is, 0.8 x 10=8. Eight good products are successfully produced. Two items are unusable.

Operation 2 continues the process with 8 good bikes because the yield is 100 percent, 1x 8=8.

Operation 3 is the last operation in the process. The yield for this operation is 50 percent so 4 good bikes are produced, 0.5 x 8=4. Four good products are produced. Four items are unusable.

Of the ten bikes that were started in operation 1, the routing delivers four good bikes. The cumulative yield is y1 x y2 x y3 = 0.8 x 1 x 0.5 = 0.4 This is illustrated in the following diagram:



Yield calculation

Example of Consumed Items

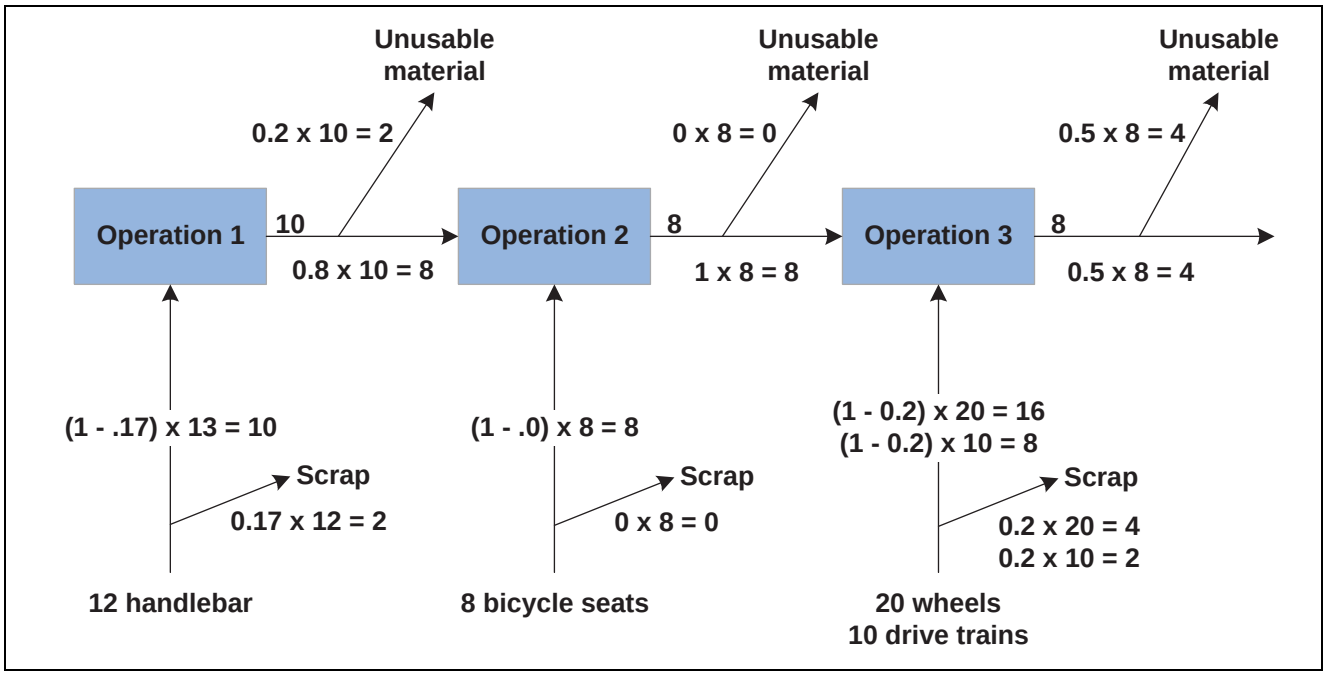
To make the bicycles in this example, each bike needs one handlebar, one seat, two wheels, and one drive train. The operations and their scrap factor are:

- Operation 1 consumes one handlebar per bike, scrap is 17 percent
- Operation 2 consumes one seat per bike, scrap is 0 percent
- Operation 3 consumes two items:
  - two wheels per bike, scrap is 20 percent
  - 1 drive train per bike, scrap is 20 percent
  - Operation 1 starts by trying to consume 12 handlebars. The scrap for operation 1 is 87 percent so only 10 handlebars are successfully consumed. That is, (1–0.17) x 12=10. Two items are unusable, leaving 12 good products.

    Operation 2 starts by trying to consume 8 bicycle seats. The scrap is 100 percent, (1–0) x 8, 8 seats are consumed.

    Operation 3 starts by trying to consume 20 wheels. The scrap for this operation is 80 percent so 16 good wheels are consumed, (1–0.2) x 20=16. The same scrap factor applies to making drive trains. It starts by consuming 10. Eight are successfully consumed (1 x 0.2) x 10 = 8

    This is illustrated in the following diagram:



Consumed items calculation

Numerically, the example looks as follows, where:

- AP is Attempted Production
- TP is Targeted Production (4 bicycles)
- QA is Quantity per Assembly
- QRFI is Quantity Removed From Inventory
- S is scrap
- Y is yield

Operation	Consumed Item	Quantity per Attempted Production	Yield (percent)	Scrap	Quantity Removed from Inventory Formula	Quantity Removed from Inventory
3			50		AP=TP/Y3	AP=4/0.5=8
	Wheel	2		20	QRFI=APxQA /(1–S)	QRFI=8x2 /0.8=20
	Drive Train	1		20	QRFI=APxQA /(1–S)	QRFI=8x1 /0.8=10
2			100		AP=(TP/Y3) /Y2	AP=8/1=8
	Bicycle Seat	1		0	QRFI=APxQA /(1–S)	QRFI=8x1/1= 80

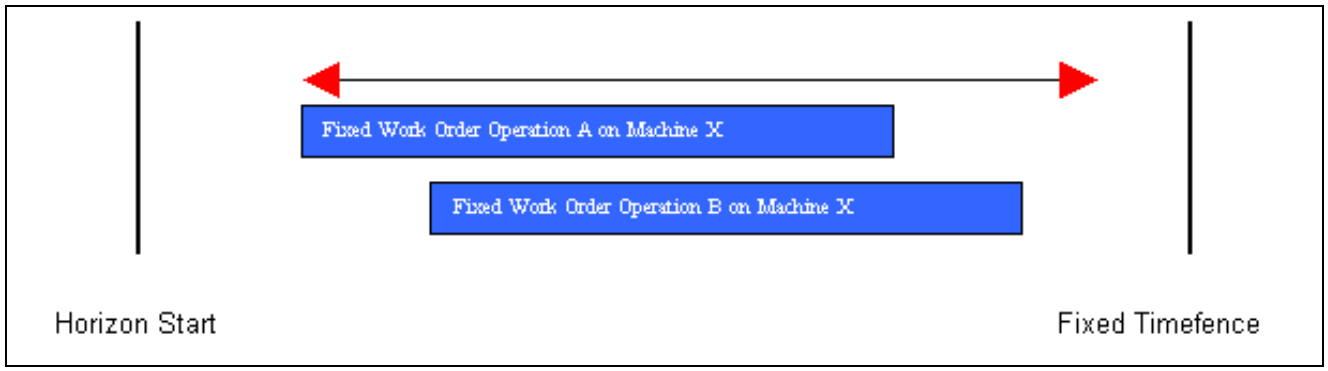
Operation	Consumed Item	Quantity per Attempted Production	Yield (percent)	Scrap	Quantity Removed from Inventory Formula	Quantity Removed from Inventory
1			80		AP=((SKP /Y#)/Y2)/Y1	AP=8/0.8=10
	Handlebar	1		17	QRFI=APxQA /(1–S)	QRFI=10x1 /0.83=12

Work Order Operations

In EnterpriseOne Production Scheduling, there is a feature that enables you to set a fixed production timefence on a given resource. This fixed production timefence dictates that any new production that is required to fulfill demand must occur beyond the end of the timefence duration.

Flexible Scheduling of Work Order Operations Within the Fixed Production Timefence

Within the fixed production timefence, you can have work orders that are specified to run which were created either from a previous planning cycle or by another process. These work orders may have operations with a fixed earliest start date, a fixed latest end date, or both. Because work order operations within a fixed timefence are considered fixed, a situation may arise for an infeasibility to occur within the solve process. For example, if there are two operations on different work orders that run on the same machine that have overlapping fixed dates, an infeasible solution may occur within the solve process. This concept is demonstrated in the following diagram:



Two different work orders on the same machine

Note. To fix operations on a work order within the fixed timefence, you must populate the Earliest Start Date field or the Latest End Date field or both. The fix dates must dictate that all or some of the operation duration falls within the resources fixed timefence.

To address the possibility of an infeasibility within the fixed timefence, the Production Scheduling solver may move work order operations around and possibly schedule work order operations to occur prior to the start of the planning horizon, indicating that your shop floor is running behind.

If any open work order operations within the fixed timefence are moved to start within the timefence or before the horizon start to avoid an infeasibility, you will receive either a Work Order Past Due or Work Order Fixed Date Violation alert. The alert will tell you on which work order this situation has occurred, the operation in question, and the relevant start and end times.

If you receive a Work Order Past Due alert in order to avoid an infeasibility, this indicates that a work order operation has been moved within the timefence and is scheduled to have a start time which occurs prior to the horizon start. The violation start-time is the time the operation starts within the past. The violation end time is the end of the operation.

If you receive a Work Order Fixed Date Violation, this indicates that a work order operation has been moved within the fixed timefence and is scheduled to have a start time different from the start date that is specified on the work order routing. The violation star time is the time the operation starts. The violation end time is the end of the operation.

You can filter these alerts using the filtering functionality in the Production Scheduling alert window to be those of type Work Order Operation Past Due or WorkOrderFixedDateViolation. By performing a right click the alert in question, you can navigate to the Work Order Editor routing tab to further investigate.

When scheduling work orders in conjunction with a fixed timefence on a resource, the solver will behave in one of the following ways, depending on the circumstances:

1. When work order operations do NOT have a start date or latest end date specified, that is, the Earliest Start Date or Latest End Date Field.
   - If a work order request date would suggest a work order be scheduled in the timefence, it will be scheduled beyond the timefence.
   - If a work order is attached to a demand and the demand has a latest date that would suggest the work order be scheduled in the timefence, the work order can be scheduled in the timefence.
2. When work order operations DO have a start date, that is, the Earliest Start Date Field.
   - All work order operations ending before the time fence are considered "unfixed" in the solver, so that they can move, if necessary, within the timefence or before the timefence.
   - All work order operations that cross the time fence (start before and finish after the time fence) will be fixed to their start times, unless an infeasibility occurs.
   - If the total capacity of all the fixed operations that cross the time fence boundary exceed the machine’s capacity, the latest operation will be fixed and the others moved earlier.
   - If there is not enough on-hand inventory, that is, starting inventory, work orders will not be moved before the horizon start and will be pushed to start after the fixed timefence or the first inventory injection based on supplier lead time or a supply event (which can be another work order producing the material or supply).
   - If a work order operation is fixed to start before the horizon start, it will be scheduled at that time.
3. When work order operations have a latest end date field, that is, the Latest End Date on the work order operation.
4. All work order operations ending before the time fence are considered "unfixed" in the solver, so that they can move if necessary within the timefence or before the timefence.
   - All work order operations that cross the time fence (start before and finish after the time fence) will be fixed to their end times.
   - If the total capacity of all these operations that cross the time fence boundary exceed the machine’s capacity, based on priority and due date and the earliest start date, the conflicting operations will be moved to start before the timefence when feasible and not be pushed later.

- If there is not enough on-hand inventory, that is, starting inventory, work orders will not be moved before horizon start and if they can not be moved past a given end date, then the application will inform the user that there is not enough inventory, that is, no producing operation error message.
- If a work order operation has a latest end before the horizon start, it should be scheduled at that time if possible.

5. Active Work Order Operations
   - If work order operations are "Active", they are generally scheduled at horizon start even with a fixed timefence. However, if there is no time fence, and two work order operations are marked as active on a single capacity resource, then one of them will to be moved to avoid an infeasibility.
   - If there is time fence, then all active work order operations will be unfixed and moved around according to due date. If this action pushes other operations out beyond the fixed timefence, then the solver will move it earlier. In this case, the work order attached to the lower priority demand will be moved. If there are no demands or the priorities are the same, one of them will be moved based on request date, then on alphanumeric key of the order itself.
   - If a work order operation is marked as Active and is also considered to be fixed, the fix date will essentially be ignored.

Schedule Horizon

After launching Horizon editor, you are working with global horizon dates. Global dates apply to all new schedule models, but you can change the horizon dates of the local schedule model.

Theory of Constraints Principles

EnterpriseOne Production Scheduling provides you with the option to apply Theory of Constraints principles and applicable business processes to your scheduling environment.

Theory of Constraints principles can be enabled in a particular schedule in order to take advantage of Buffer Planning functionality.

Defining Work Patterns and Availability

This section discusses how to:

- Create a global calendar
- Set calendar horizons
- Add calendar events
- Modify calendar events
- Delete calendar events

Creating a Global Calendar

Access the Calendar editor.

To create a global calendar:

1. Click Add Calendar.

2. Specify a name for the calendar in the Calendar Name field.
3. Click OK.

Setting Calendar Horizons

Access the Global Calendar Horizon window.

To set calendar horizons:

Start Time	Specify the beginning of the calendar horizon. You can enter the date manually in the field or use the calendar tool.
End Time	Specify the end of the calendar horizon. You can enter the date manually in the field or use the calendar tool.
Duration	Specify the duration as a value in seconds, minutes, hours, or days.

Adding Calendar Events

Access the Add Calendar Events window.

To add calendar events:

Uptime	Select this option to specify that all machines and activities are available.
Downtime	Select this option to specify down time when all machines and activities are stopped.
Delay Time	Select this option to specify a delay when machines and activities are temporarily suspended.
Start Time	Specify the date and time when the event begins. Alternately, you can leave the original date. When the end time and the duration are entered, the start time is automatically calculated.
End Time	Specify the date and time when the event ends. Alternately, you can leave the original date. When the start time and the duration are entered, the end time is automatically calculated.
Duration	Specify the event length in seconds, minutes, hours or days. If the start time is specified, the end time is automatically filled in, based on the duration. Similarly, if the end time is specified, the start time is filled in automatically. If both start and end time are specified, the duration is automatically calculated.
Recurring event	Select this option if you want the calendar event to repeat.
Daily	Select this option if you want the calendar event to repeat daily.
Weekly	Select this option if you want the calendar event to repeat weekly.
Monthly	Select this option if you want the calendar event to repeat monthly.
Yearly	Select this option if you want the calendar event to repeat yearly.
No limit	Select this option if the event occurs throughout the calendar horizon.
End after	Select this option, and select the number of occurrences if the event occurs for a specified number of times and then stops.

End by Select this option, and select an end date if the event ends by a specified date.

Click Add.

Modifying Calendar Events

Access the Edit Calendar Event window.

To modify calendar events:

1. Make any modifications to the event type and the event time and duration data.
2. Select one of the following options:
   - Edit Current Selection

     Modify the current calendar event.
   - Edit Matching Events In Range

     Modify all calendar events in the date range specified. Complete the Start Time and End Time fields. The default value of the End Time field is the end of the scheduling horizon.
3. Click OK.

Deleting Calendar Events

Access the Calendar editor.

To delete calendar events:

1. Click a calendar event in the list. To select multiple events, press Shift, for contiguous selections, or Ctrl, for non-contiguous selections.
2. Select one of the following options:
   - Remove Event

     The event is removed from the schedule.
   - Remove All Events

     All calendar events in the date range are removed from the schedule.
3. Click Yes to confirm the deletion of the calendar event.

Defining Changeover Rules

This section discusses how to:

- Create changeover rules
- Re-order changeover rules

Creating Changeover Rules

Access the Changeover editor.

To create a changeover rule:

Click Add new rule.

Machine	Select the machine, group, or wildcard (*) for which a changeover entry is being made.
From Operation	Select an operation, group, or wildcard (*).
To Operation	Select an operation, group, or wildcard (*).
Duration	Specify the amount of time that it takes to set up the machine between the From Operation and the To Operation. Select the time value (0 hours by default) and specify the expected time for the changeover. To enter other time values, use d for days, h for hours, m for minutes, or s for seconds. You must select, and then change the digit and the letter separately.
Calendar	Select a calendar that applies to the changeover from the list.
Cost	Specify the cost associated with the changeover. When the changeover rule is applied, this cost value is used to calculate KPIs.

Re-ordering Changeover Rules

Access the Changeover editor.

To re-order changeover rules:

1. Click the row number of the rule that you want to move.
2. Click Move rule up and Move rule down to move the changeover rule to its new location.

Specifying Supply and Demand Events

This section discusses how to:

- Create supply and demand folders.
- Create supply orders
- Create demand orders
- Define demand policies
- Change the properties of multiple demands
- Delete multiple demands
-

Creating Supply and Demand Folders

Access the Supply & Demand editor.

To create supply and demand folders:

1. Right-click All Demands or All Supplies, and select Add Folder.

2. Right-click the folder, select Rename, and enter a new name for the folder.
3. Press Enter.

Creating Supply Orders

Access the Supply & Demand editor.

To create supply orders:

1. Right-click the Supply folder to which the new supply order is to be added.
2. Select Add Supply to add an order.

   An order appears under the folder with a system-generated number.
3. On the General tab, complete the following fields:

Supply Number	The supply order is automatically assigned a supply number. You can edit this value if necessary.
Origin Address	Specify the address from which the vendor is shipping the supplies. This field is optional.
Type	Select Allocated Supply, Interplant Shipment or Purchase Order.
Status	Select Approved for the solver to consider the supply order, or Hold for the solver to ignore the supply order.

4. Right-click the order in the tree and select Add Line Item.
5. Complete the following line item fields:

Item	Select the item from the drop-down list box. Manufactured and purchased items are displayed here.
Quantity	Specify the quantity being supplied.
Status	Select the approval level of items supplied: Approved or Hold.
Earliest Date	Optionally, specify the earliest date when the order can be delivered. The default is the start of the horizon. If the date that is entered precedes the schedule horizon start, then this date is changed to the horizon start when solving. If the date entered follows the schedule horizon end, then the solver ignores this order.
Requested Date	Specify a date when the order is expected to arrive. The solver attempts to keep the supply event as close to the due date as possible. The solver is free to select a date within the earliest and latest date range if required.
Latest Date	Optionally, specify the latest date when the order must be delivered. The default is the end of the horizon. If the date that is entered falls after the schedule horizon end, then this date is changed to the horizon end when solving. If the date entered precedes the schedule horizon start, then the solver ignores this order.

6. Click Save.

Note. Selected Date is a system-generated, display-only field.

You must have created or imported item data before a line item can be added.

Creating Demand Orders

Access the Supply & Demand editor.

To create demand orders:

1. Right-click the Demand folder where you want to add the order and select Add Demand.

   An order appears under the folder with a system-generated number.
2. On the General tab, complete the following fields:

Demand Number	The demand order is automatically assigned a demand number. This value can be edited, if necessary.
Customer Name	This field is optional.
Customer Number	This field is optional.
Ship To Address	This field is optional.
Type	Select Order, Safety, or Forecast.
Status	Select Approved for the solver to consider the demand order or Hold for the solver to ignore the demand order.

3. Click Save.

Defining Demand Policies

Access the Supply & Demand editor.

To define demand policies:

1. Select a demand order from the tree.
2. On the Rules tab, complete the following fields in the Demand Policies section:

Order class	Select Hot Order, Committed, Uncommitted.
Build Strategy	Select JIT or Pre-Build.
Backorders Allowed	Select Yes to enable the requested date to be violated up to the latest order. Select No if all line items must be available at the requested date.
Demand Priority	Choose a value from 1 to 5.
Ship Complete	Select Yes to ship the order only when all of the line items have been produced. Select No to enable partial shipments of the order.

Note. Available Date is a system-generated, display-only field.

3. To add a new line item to the order, right-click the order in the tree and select Add Line Item.
4. For the line item, complete the following fields:

Item	Click the arrow by the code for the item and choose from the available options. Only saleable items are displayed.
Quantity	Specify the quantity of the item that is demanded.
Status	Select the approval level of the item that is demanded. The status can be Approved or Hold.
Type	Select one of the following options: Forecast. The aggregated demand estimates for a specific time period, based on historical sales information. Orders. The actual orders placed by customers. Safety Stock. Items that are needed to maintain safety stock levels.
Build Strategy	Select the type of build strategy: JIT or Pre-Build
Demand Priority	Specify a relative weighting (degree of build) with 1 being the highest priority. For example, with two JIT orders, the order with demand priority 1 is produced as late as possible, relative to the order with demand priority 2.
Requested Date	Specify the requested date for the item that is demanded.
Earliest Date	Optionally, specify the earliest date when the order can be delivered. The default is the start of the horizon. If the date entered precedes the schedule horizon start, then this date is changed to the horizon start when solving. If the date entered follows the schedule horizon end, then the solver ignores this order.
Latest Date	Optionally, specify the latest date when the order can be delivered if backordered. The default is the end of the horizon. If the date entered falls after the schedule horizon end, then this date is changed to the horizon end when solving. If the date entered precedes the schedule horizon start, then the solver ignores this order.

5. Click Save.

Changing Multiple Demands

In the Supply and Demand Editor, you can change the properties of multiple demands or delete multiple demands at one time.

Access the Supply & Demand editor.

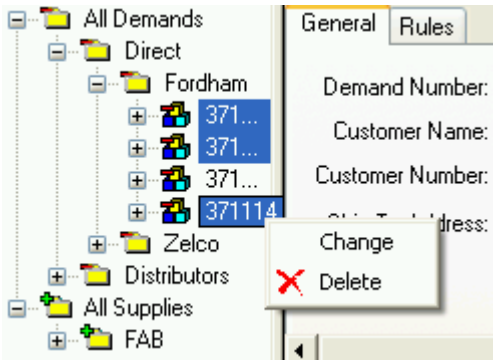
To change the properties of multiple demands:

1. Select the demands that you want to change by holding down the Shift key and highlighting the appropriate demands, folders, or line items. If the demands, folders, or line items are not listed sequentially, hold down the CTRL key and select the individual demands.

   Note. If you select a folder, all demands that are in that folder are considered.

2. Right-click and choose Change from the menu.

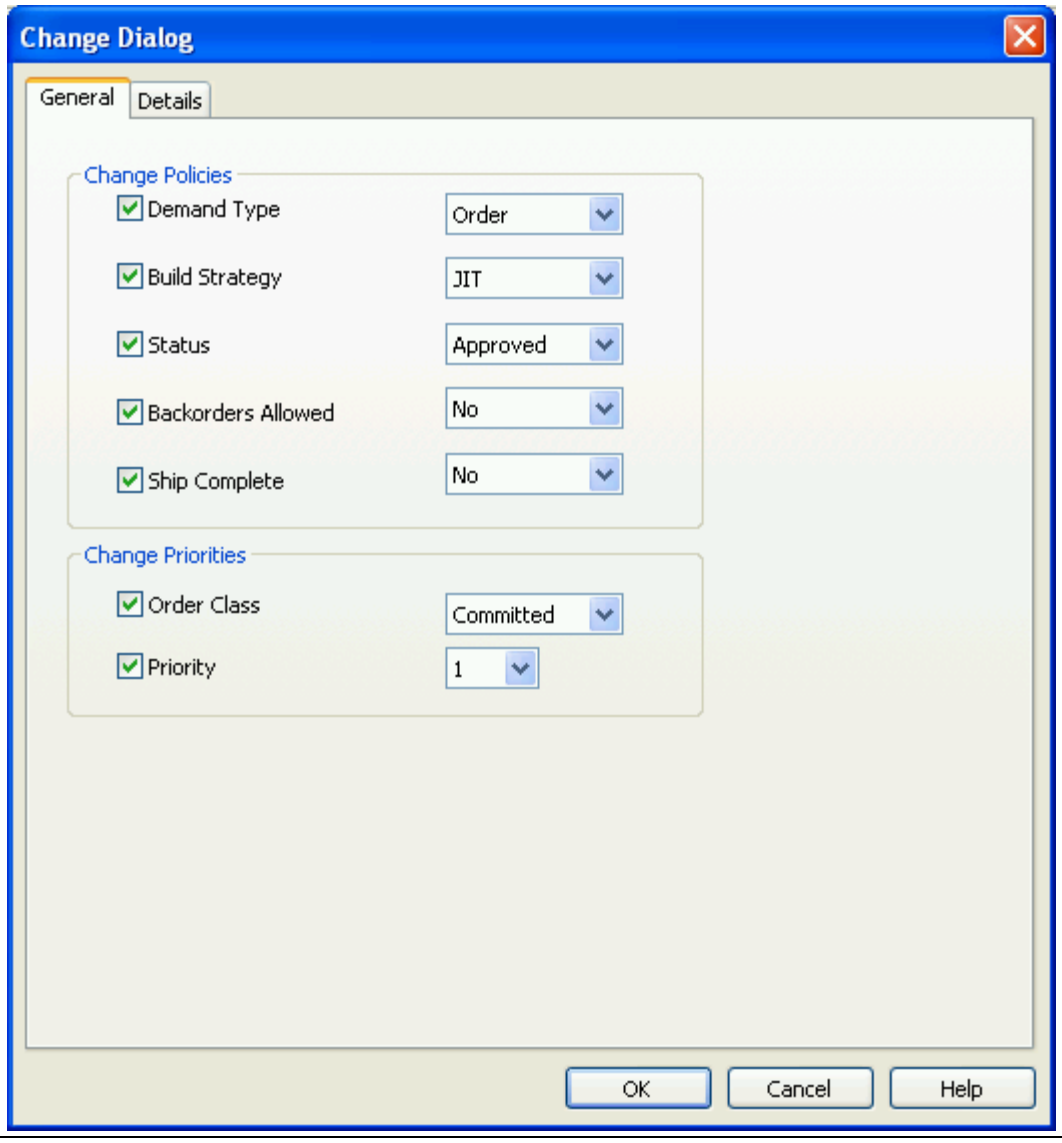
The menu is shown in the following screen:



The Change/Delete menu used to change or delete multiple demands

Changing General Properties of Demands

The General tab in the Change Dialog window lists the demand policies and demand priorities that can be changed in this window, as shown in the screen below:



General tab of the Change Dialog window

1. In the General window, select the policies and priorities you want to change by clicking the box next to the policy or priority type.
2. From the drop-down menus, beside the policies and priorities, select an option.
3. Click the Details tab and click the box beside the property you want to change.
4. From the drop-down menus, beside each property detail, select an option.

Note. An explanation of each field and its possible values is provided immediately following this procedure.

---

5. Click OK to save the changes and close the window.
6. To view the results of the changes, click on one of the modified demands.

The properties and the options that are available from the drop-down menu of the General window are outlined below:

General tab policy options are:

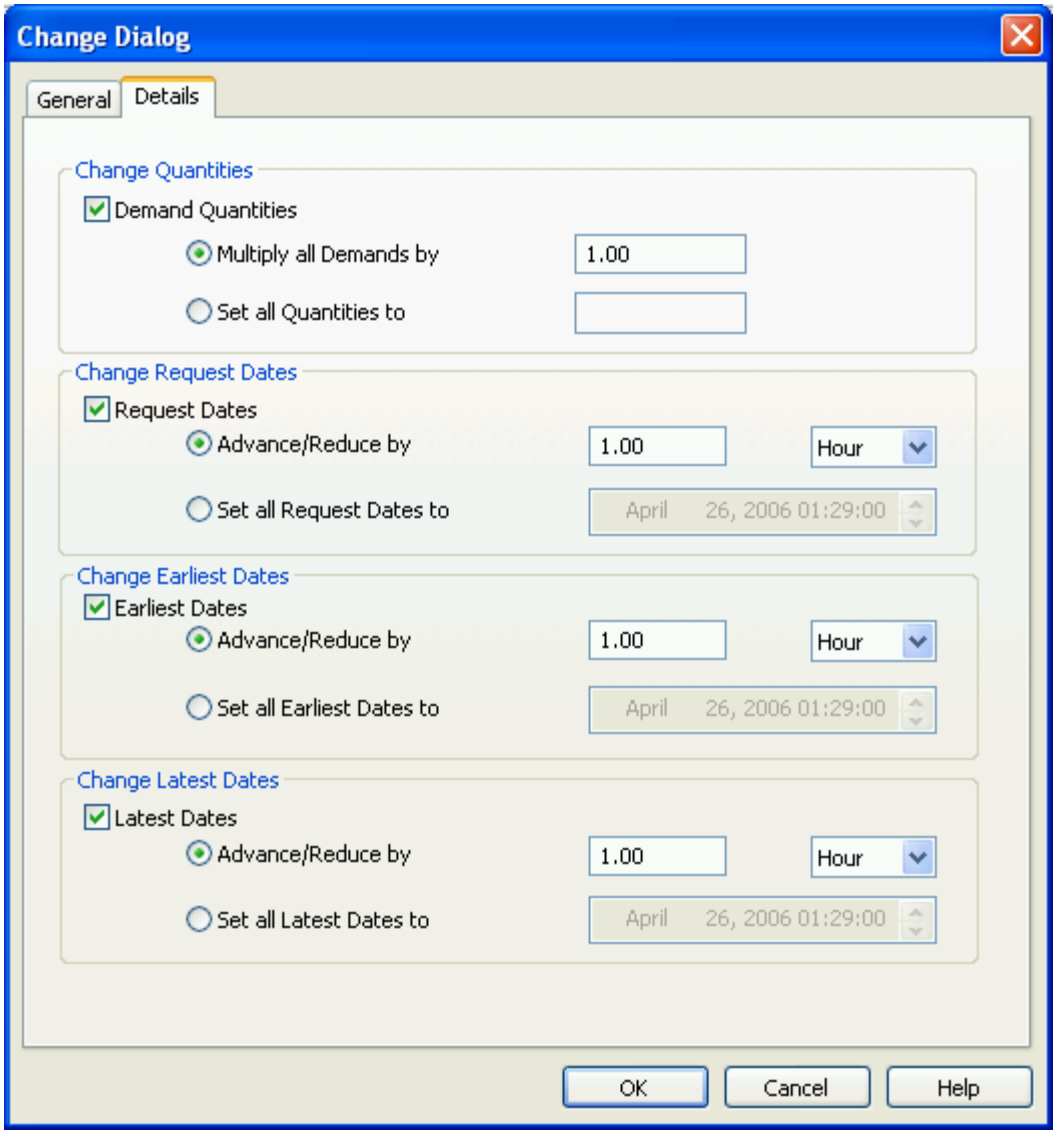
Demand Type	Choose Order, Forecast, or Safety
Build Strategy	Choose JIT or Pre-Build
Status	Choosee Approve or Hold
Backorders Allowed	Choose No or Yes
Ship Complete	Choose No or Yes

General tab priority options are:

Order Class	Choose HotOrder, Committed, or Uncommitted
Priority	Choose 1, 2, 3, 4, or 5. One is the highest priority and five is the lowest priority.

Changing Detailed Properties in Demands

The Details tab in the Change Dialog window demand quantities, request dates, earliest dates and latest dates that can be changed from this window as shown in the screen below:



Details tab of the Change Dialog window

The properties and the options that are available from the drop-down menu in the Details window are outlined below:

Multiply all Demands by Enter the factor by which you want to multiple the demands. For example, to double demands, enter 2.00. If you half the demands, multiply by 0.5.

Set all Quantities to If you want all your demands to be the same quantity, enter that quantity in this field.

Request Dates Advance/Reduce by

You can bring the request date forward (closer to the current date), or move it back (farther from the current date) in this field. To move the request dates forward, enter the number by which you want to advance it in the Advance/Reduce by field. Choose the increment of time from the drop-down menu. Valid values are: minute, hour, day, or week. For example, to advance the request date by 10 hours, enter 10 in the Advance/Reduce by field and choose hour from the drop-down menu.

You can also move request dates back in the same way you move the dates forwared with one exception: you must put a minus sign in front of the number. For example, to move the request date back by 10 hours, enter –10 in the Advance/Reduce by field and choose hour from the drop-down menu.

Set all Request Dates to

To set all the request dates of the selected demands to the same date, click the up or down arrow in this field to move the date forward or backward, respectively.

Change Earliest Dates

Advance/Reduce by

You can bring the earliest date forward (closer to the current date), or move it back (farther from the current date) in this field. To move the earliest dates forward, enter the number by which you want to advance it in the Advance/Reduce by field. Choose the increment of time from the drop-down menu. Valid values are: minute, hour, day, or week. For example, to advance the earliest date by 10 hours, enter 10 in the Advance/Reduce by field and choose hour from the drop-down menu.

You can also move earliest dates back in the same way you move the dates forwared with one exception: you must put a minus sign in front of the number. For example, to move the earliest date back by 10 hours, enter –10 in the Advance/Reduce by field and choose hour from the drop-down menu.

Set all Earliest Dates to

To set all the earliest dates of the selected demands to the same date, click the up or down arrow in this field to move the date forward or backward, respectively.

Change Latest Dates

Advance/Reduce by

You can bring the latest date forward (closer to the current date), or move it back (farther from the current date) in this field. To move the latest dates forward, enter the number by which you want to advance it in the Advance/Reduce by field. Choose the increment of time from the drop-down menu. Valid values are: minute, hour, day, or week. For example, to advance the latest date by 10 hours, enter 10 in the Advance/Reduce by field and choose hour from the drop-down menu.

You can also move latest dates back in the same way you move the dates forwared with one exception: you must put a minus sign in front of the number. For example, to move the latest date back by 10 hours, enter –10 in the Advance/Reduce by field and choose hour from the drop-down menu.

Set all Latest Dates to

To set all the latest dates of the selected demands to the same date, click the up or down arrow in this field to move the date forward or backward, respectively.

Deleting Multiple Demands

In the Supply and Demand Editor, you can delete multiple demands at one time.

Access the Supply and Demand editor.

To delete multiple demands:

1. Select the demands that you want to delete by holding down the Shift key and highlight the appropriate demands, folders, or line items. If the demands are not sequential in the list of demands, hold down the CTRL key and select the appropriate demands.
2. Right-click and choose Delete from the drop-down menu.

Creating Work Orders

This section discusses how to:

- Create work order folders
- Add a work order

Creating Work Order Folders

Access the Work Order Editor by clicking the icon in the menu bar.

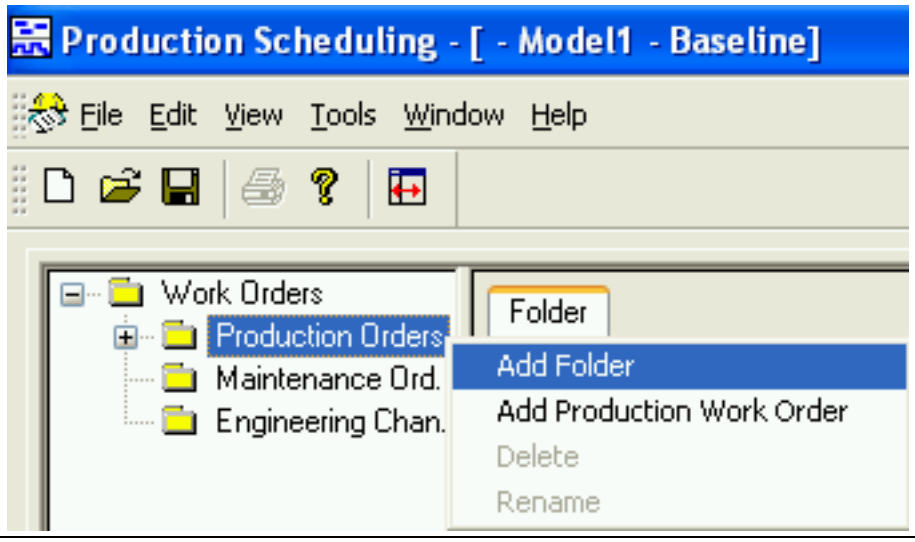
To create work order folders:

Note. To expand the Work Order Editor window and show or hide the work order tree, click on the Show/Hide icon in the menu bar.

---

1. Right-click on the type of work order folder you want to create. You can choose Production Orders, Maintenance Orders, or Engineering Orders.
2. Select Add Folder from the drop-down menu.
3. Right-click the folder, select Rename, and enter a new name for the folder.
4. Press Enter.

The Add Folder and Add Production Work Order menu is shown in the graphic below:



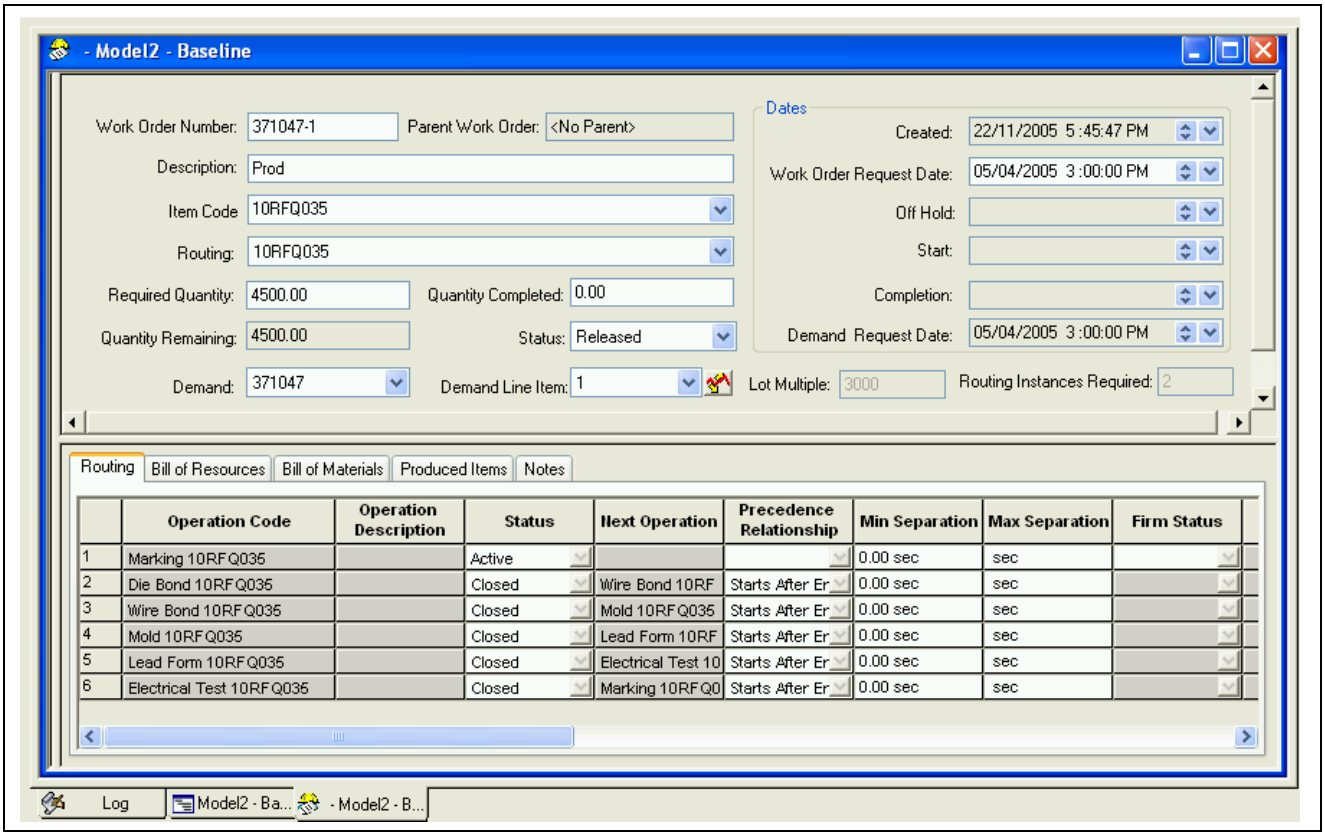
Work Order Editor Add Folder and Add Production Work Order menu

Adding a Work Order

Access the Work Order Editor.

To add a work order:

1. Right-click the folder or the work order category where you want the new work order to reside, and select the appropriate work order type:
   - Production Work Order
   - Maintenance Work Order
   - Engineering Work Order
2. Double-click the new work order.
3. Complete the fields in the main window of the Work Order Editor.
4. Complete the fields under the Routing, Bill of Resources, Bill of Materials, and Produced Item tabs.
5. Click Save and exit from the Work Order Editor.



Work Order Editor main window

Note. Fields that are grayed out are either calculated or predetermined. For example, the Lot Multiple field is grayed out because it is populated from the producing operation of the selected routing.

Work Order Number Enter a number for the work order.

Type The type of work order you have chosen to add.

Work Order Description Enter a description of the work order.

Routing	The routing for the work order. This field displays all applicable routings and stand-alone operations that can build the item.
Required Quantity	Enter the quantity of the item that is required to fulfill the work order. This field is not available for Maintenance or Engineering work orders.
Lot Multiple	This is a grayed out predetermined field, based on the selected routing.
Quantity Completed	Number of items that have been produced out of the total quantity that is specified in the work order. This field is not available for Maintenance or Engineering work orders.
Quantity Remaining	Number of items that need to be produced to satisfy the work order. This number is calculated by the system. This field is not available for Maintenance or Engineering work orders.
Demand	Used to link a parent work order to a demand order. **Note.** This field is not available for Maintenance and Engineering work orders.
Demand Line Item	The number assigned to the line item of the demand.
Order Class	If the demand is pegged, the order class is pre-assigned and assumes the class order of the pegged demand. If demand is not pegged, choose one of the options from the drop menu: Hot, Committed, or Uncommitted.
Priority	Inherits demand priority from the linked demand order line item.
No. of Routing Instances Required:	The number of routings needed to satisfy the work order. If Units of Effort is enabled, his will display "1". If Units of Effort is disabled, this number is the quanitity or lot multiple.
Parent Work Order	If there is a parent work order, the number of the work order is shown in this field. If there is no parent work order, the field is grayed out.
Status	Displays the current status of the work order: Valid values are: Unreleased: Information is not sent to the solver. Released: The work order is released to the shop floor for scheduling. Pending: Information is sent to the solver. It has been released, but the work has not yet started. WIP: Information is sent to the solver. The work has started. Complete: The work order has been completed. On Hold: Information is not sent to the solver until the Off Hold Date. In this case, the Off Hold Date becomes theEarliest Start Date for the work order. Cancelled: The work order has been cancelled.
Created Date	Date when the work order was created in the MRP program.
Requested Date	Requested date for the work order to be completed. When linked to demand order, inherits requested date from the Supply & Demand editor.
Off Hold	This field is applicable only if the Status is set to On Hold. If this date is populated, then the Earliest Start Date on the first operation assumes this date.

Start Start date and time of the first operation in the routing. This field is calculated by the Enterprise Production Scheduling solver.

Completion Date End date and time of the last operation in the routing. This field is calculated by the Enterprise Production Scheduling solver.

Demand Request Date If a work order is pegged to this demand, the field is auto-populated.

Complete the fields under the Routing tab. Some fields are predetermined and grayed out.

Operation Code The operation code for each routing stage. This field comes from the chosen routing and is display only.

Operation Description A description of the operation. This field is display only.

Status Displays the current status of the operation. Valid values are:

Open: the operation has not yet started

Active: the operation is in progress.

Closed: the operation is complete.

Next Operation Displays the name of the operation that follows the current operation. If no operation follows this operation, the field is blank.

Precedence Relationship Choose the precedence relationship for this operation from the drop-down menu. This overrides the routing template, if it is different. For more information, refer to the section Precedence Relationships in this document.

Min Separation Enter the minimum separation time between operations. This overrides the routing template, if it is different. For more information, refer to the section Separation Times in this document.

Max Separation Enter the maximum separation time between operations. This overrides the routing template, if it is different. For more information, refer to the section Separation Times in this document.

Firm Status Determines if the start date, end date, or both the start and end date are inflexible. Valid values are:

- Firm Start

  The start date is fixed. When you choose this option, the Start Date field becomes active. Set the start date by moving the up and down arrows or by clicking on the large arrow, which brings up a calendar.

- Firm End

  The end date is fixed. When you choose this option, the End Date field becomes active. Set the end date by moving the up and down arrows or by clicking on the large arrow, which brings up a calendar.

- Firm Range

  The start date and end date are fixed. When you choose this option, both the Start Date field and the End Date field become active. Set the date by moving the up and down arrows in the respective date fields or by clicking on the large arrow, which brings up a calendar.

Start Date The start date for the operation. This field is populated only if you specify a start or firm range.

End Date The end date for the operation. This field is populated only if you specify an end or firm range.

Planned Start Date The scheduled starting time of an operation as calculated by the solver. When a work order is broken down into its units of effort, this field reflects the start time of the operation instance.

Planned End Date The scheduled ending time of an operation as calculated by the solver. When a work order is broken down into its units of effort, this field reflects the end time of the operation instance.

Yield Percentage Enter the percentage of usable output from the operation. If you change this, Enterprise Production scheduling will scale upstream operation durations and Bill of Material quantities.

Cumulative Yield The composite yield percentage from the last operation to the first.

Complete the fields under the Bill of Resources tab.

Operation Code The operation code for each routing stage. This field is populated from the chosen routing and is display-only.

Planned Resource The resource that was planned to be used to complete this operation.

Actual Resource The resource that was used to complete this operation.

Scale Duration When selected, this option causes the machine run time in the Routing page to be scaled proportionally to changes in quantity. For example, if an operation takes 10 minutes to produce 20 units, and the quantity is reduced to 10 units, then proportionally, the reduced time is 5 minutes. Choose Yes or No from the drop-down menu.

Note. This field is not available for Maintenance and Engineering work orders.

Run Time The duration of the operation.

Remaining Run Time The amount of time that is required to complete operations with a status of Active or Open.

Complete the fields under the Bill of Materials tab.

Operation Code The operation code for each routing stage. This field is populated from the chosen routing and is display-only.

Planned Item Code The item that was planned to be consumed by this operation.

Planned Item Description A description of the item that was planned to be consumed by this operation.

Actual Item Code The item that was consumed to complete this operation.

Actual Item Description A description of the item that was consumed to complete this operation.

Scale Parts Displays if you want to scale parts. Choose Yes or No from the drop-down menu.

Quantity Required	The amount of material required for the operation.
Scrap Percentage	The percentage of input material that is unusable by this operation.
Scrap Adjusted Quantity	The amount of material required, adjusted for scrap.
Quantity Issued	The number of items that remain to be issued or consumed.
Quantity Remaining	Number of items that need to be consumed to satisfy the work order.

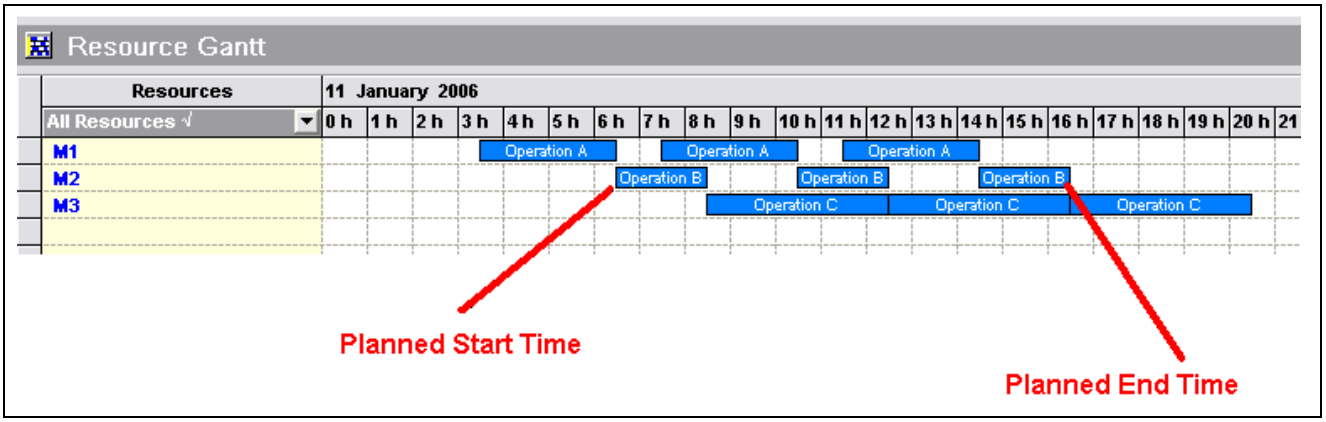
Complete the fields under the Produced Items tab.

Operation Code	The operation code for each routing stage. This field is populated from the chosen routing and is display-only.
Item Code	The unique identifier of this item.
Item Description	A description of the item.
Type	Displays the type of item, such as a primary item or a by-product.
Quantity Required	The number of items that need to be produced to satisfy the work order.
Quantity Completed	The number of items that have been produced.
Quantity Remaining	The number of items that still need to be produced to satisfy the work order.

Planned Start and Planned End Times

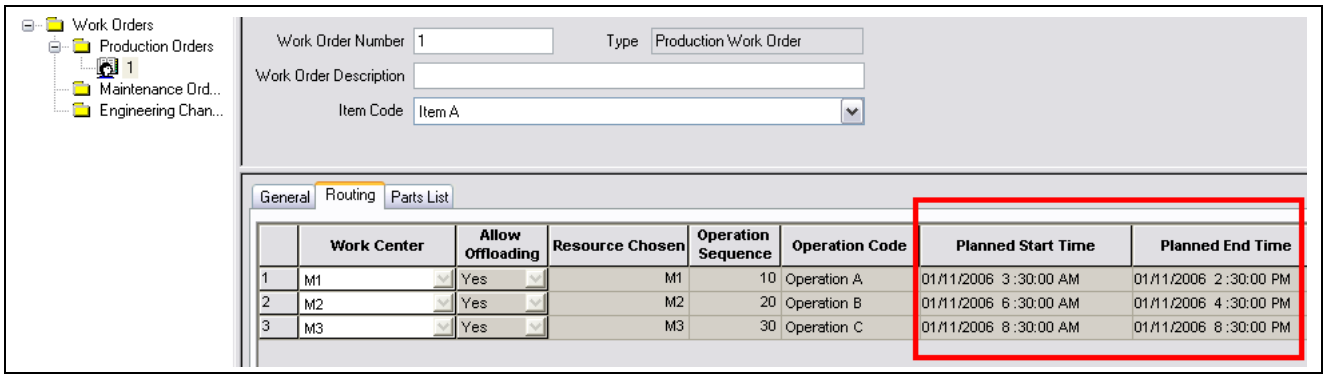
Because of the nature of work orders, a given operation within a work order cannot be split into several instances. This can pose problems when operations are broken down into their individual units of work. For example, Operation B becomes Operation B1, Operation B2 and Operation B3. Planned start time and Planned end time fields in the routing tab of the Work Order Editor address this issue. The difference between the two fields is in the logic of how the dates are rolled up into these fields.

When a work order is not broken down into its units of effort, the start and end dates reflect the start and end times of the operation, respectively. However, when a work order is broken down into its units of effort, the planned start date reflects the start time of the first operation instance, Operation B1, and the Planned End Date is the end time of the last operation instance, Operation B3, as illustrated in the following graphic:



Planned start time and planned end time as reflected in the Resource Gantt

The corresponding work order also reflects those dates as shown in the following diagram:



Planned start time and planned end time as reflected in the corresponding work order

When the Work Order units of effort is enabled, the number of routing instances which will be scheduled to fulfill the work order quantity is displayed in the work order header. The number takes into account the routing lot multiple that is required to perform this calculation. For example, if a work order for a routing is for 50 units and the lot multiple is 25, the quantity is displayed in the work order header.

Note. The number of routing instances which will be schedule to fulfill the work order quantity is displayed only if units of effort is enabled. If this feature is not enabled, the field shows a one ("1").

This field always appears as an integer value and will be rounded up if a work order is entered in a non-lot multiple quantity

---

Deleting Work Orders

Access the Work Order Editor.

To delete a work order:

1. In the Work Order tree, select the work order you want to delete. If you want to delete more than one work order, hold down the Shift key and highlight the appropriate work orders or folders. If the work orders or folders are not listed sequentially, hold down the CTRL key and select the individual work orders or folders.
2. Right click and choose Delete from the menu.

Ability to Incrementally Schedule Resources and Groups of Resources

From a resource perspective, EnterpriseOne Production Scheduling generically considers all crews, machines, tool capacity and calendar constraints simultaneously when sequencing operations. Focusing in on and resolving the most critical constraints in the scheduling horizon has generally been regarded as the most effective scheduling strategy to resolve multi-stage floating bottleneck problems when sequencing operations. Addressing the more critical problems first results in the sequencing problems being broken down into smaller sub-problems, which are usually easier to resolve.

It is sometimes desirable to be able to dictate which resources the solver should focus on first when creating a schedule as opposed to having the solver simultaneously consider all constraints and potentially jump between resources when contention levels stipulate this behavior. Supporting resources may be considered secondary in terms of the priority of having their constraints considered during the solve process.

EnterpriseOne Production Scheduling explicitly allows users to dictate to the solver which resource or group of resources should be focused on and in what order they should be considered. This approach enables scheduling in an incremental fashion by means of some simple configurations in the application without any manual intervention.

Determining the priorities by which the solver will address resources or groups of resources is achieved by setting up solver stages. The stages are “lined up” in the order in which the solver will address them.

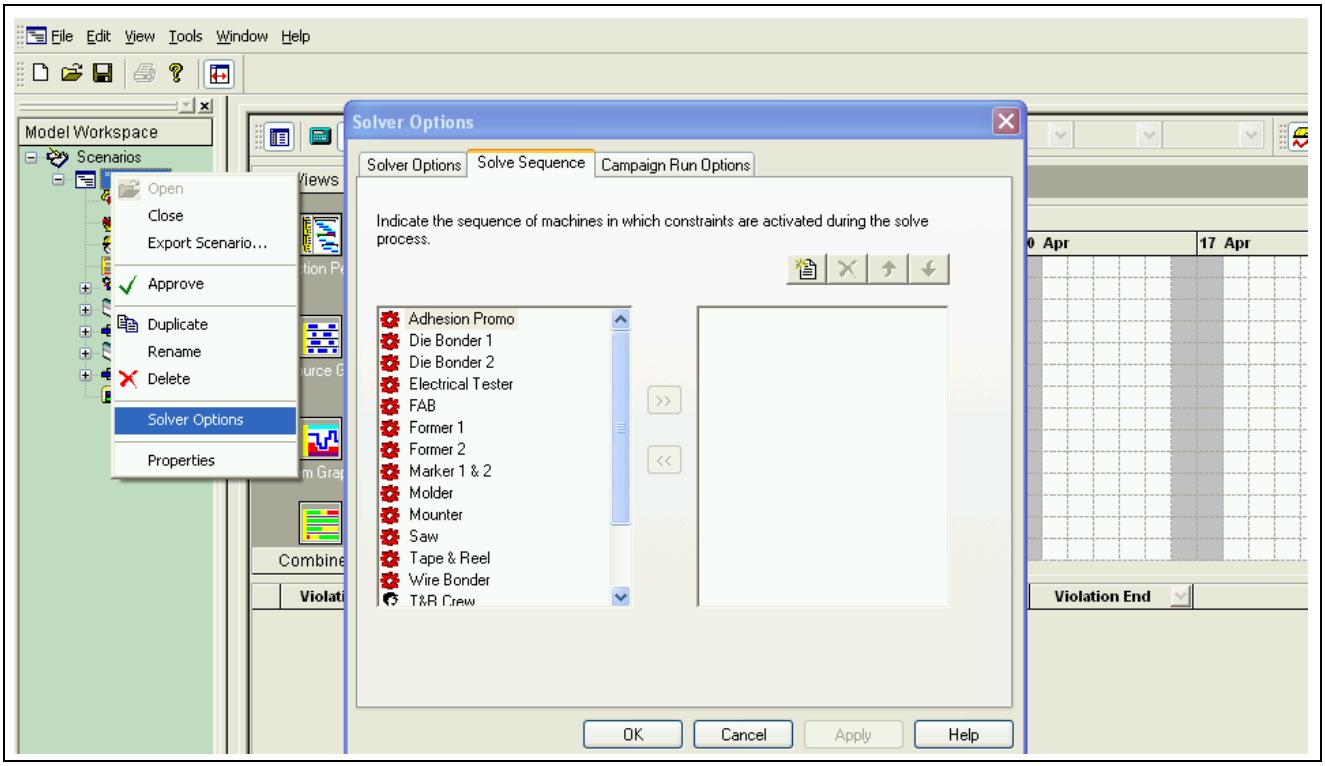
Accessing Solve Sequence Window

Access the EnterpriseOne Production Scheduling desktop.

To access the Solve Sequence window:

1. Right click on your schedule in the Model Workspace and choose Solver Options from the drop-down menu.
2. In the Solver Options window, click the Solve Sequence tab.

The solver options and Solve Sequence window is shown below:



Accessing the Solver Sequence window

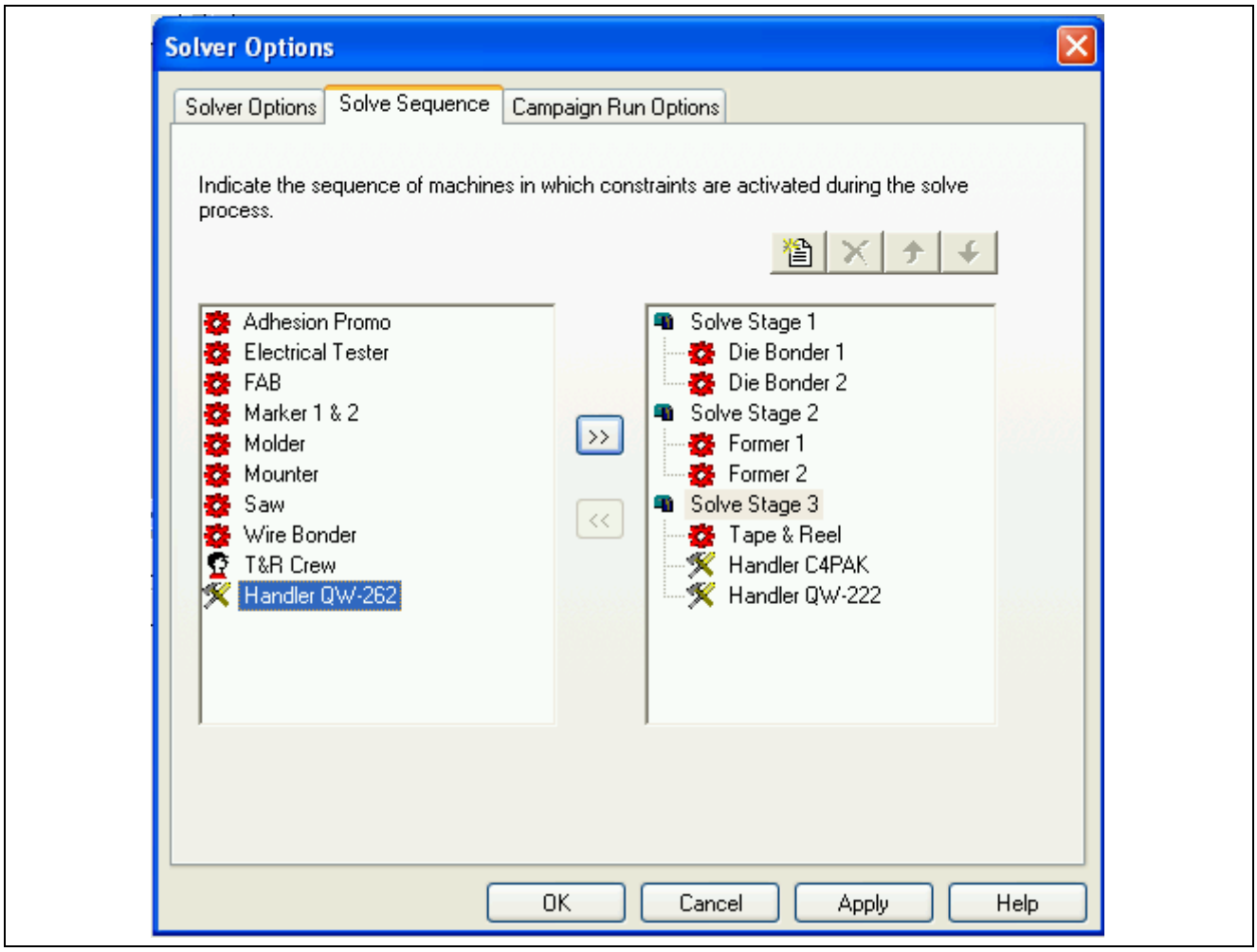
Creating Solver Sequence Stages

From the Solver Options window, you can set up machines in groups best suited to your business needs. On the left side of the Solver Option window is a list of all the resources in the model. On the right side of the screen is the pane in which you create a solve stage.

Access the Solver Options window

To create a new solver sequence stage:

1. Click on the Page icon. A new Solve Stage group is created in the right pane.
2. In the left pane, select the machines you want to add to this group by clicking on it. To select more than one resource, hold down the shift key and select the machines.
3. Click the forward arrows, located between the two panes.
4. Click Apply, and then OK to save your changes.
5. Repeat the above procedure for each group you want to create, as shown below:



Solve Sequence Stages

Changing Solver Sequence Stages

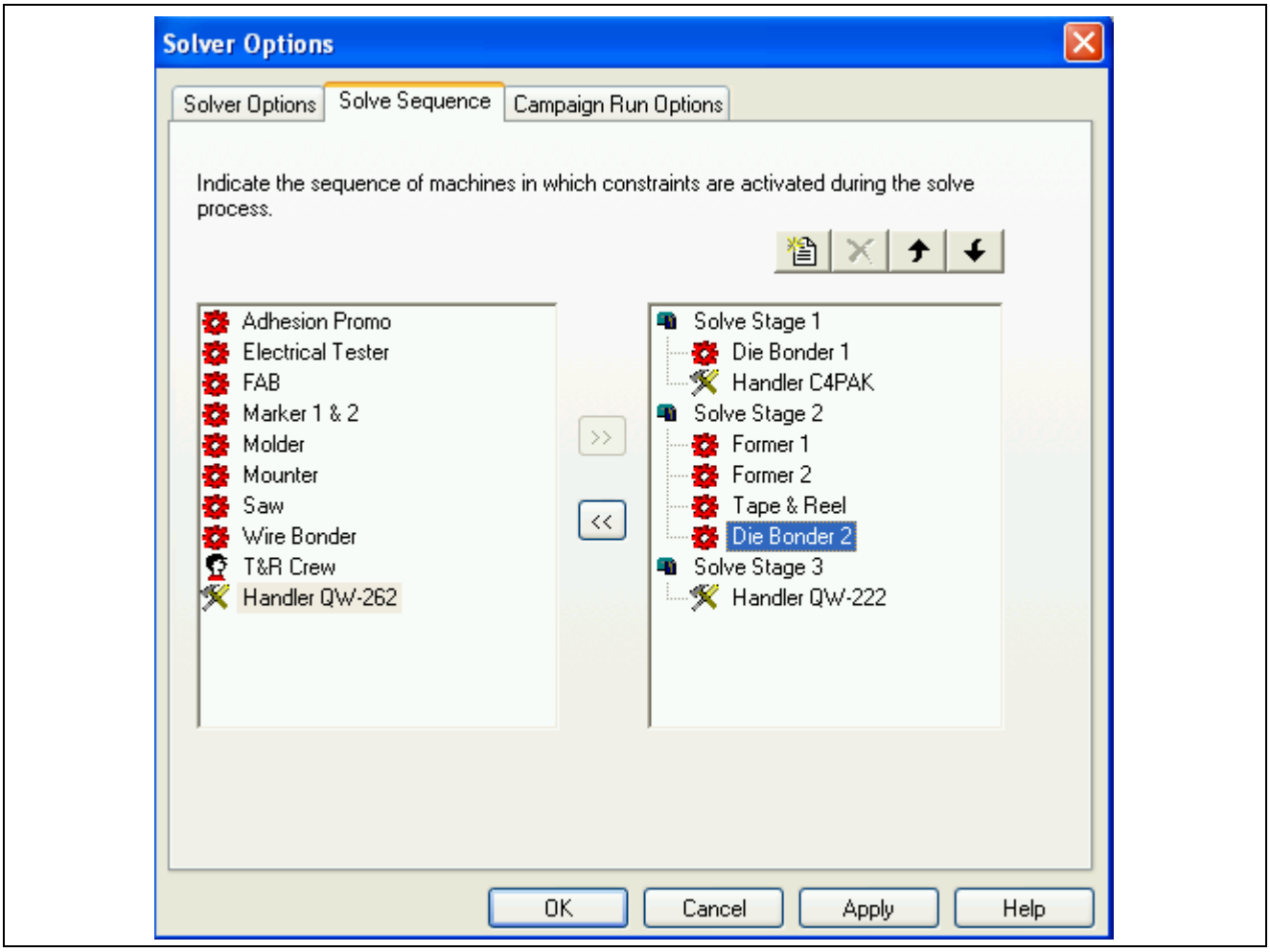
Access the Solver Options window

To change solver sequence stages:

1. In the right pane of the Solver Options window, select the item you want to move.
2. To move the item up to the previous group or down to the next group, click the up or down arrows at the top of the pane, respectively.
3. To move sequence stages, select the stage and click the up or down arrows at the tope of the pane, respectively.

4. To remove the item, click the back arrows between the two panes.
5. Click Apply, and then OK to save your changes.

Changing solver sequence stages is shown below:



Changing the contents of a solver sequence stage

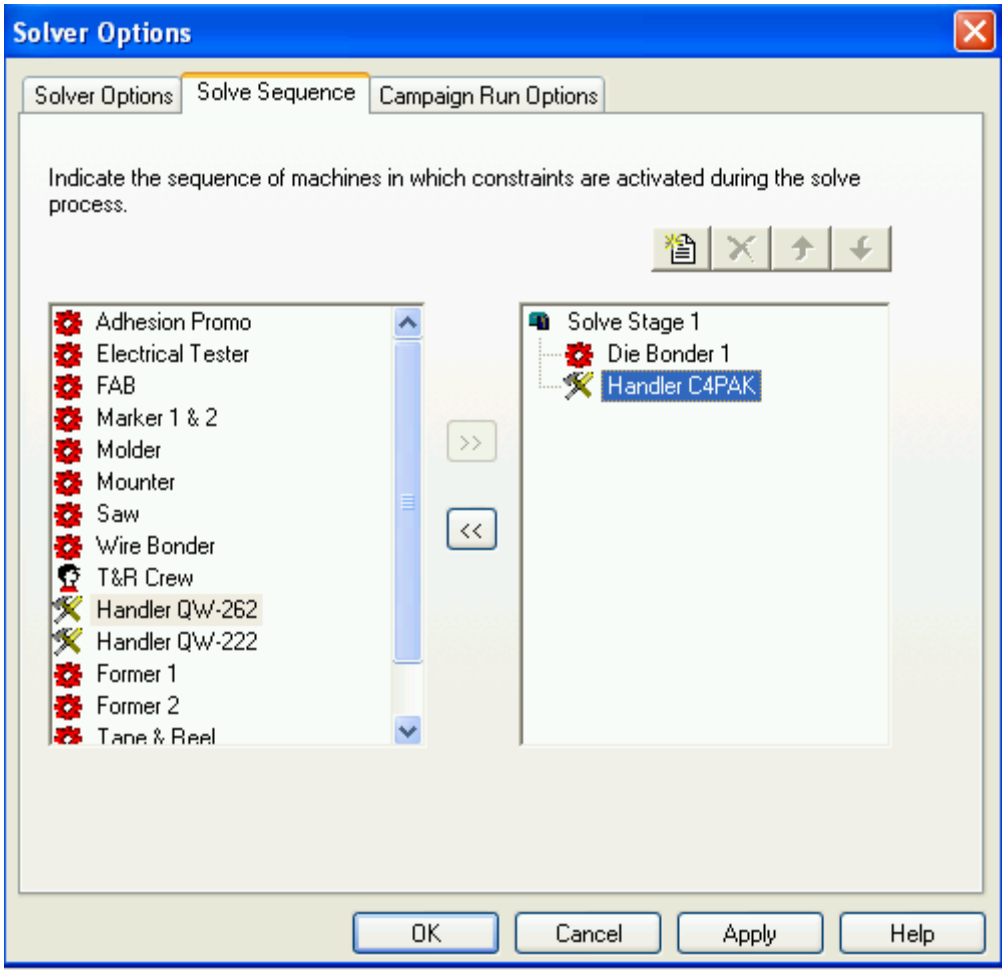
Removing Solver Sequence Stages

Access the Solver Options window.

To remove a solver sequence stage:

Select the stage that you want to delete and click the X, delete, button at the top of the pane.

When you delete a solver sequence stage, all the contents of the stage are also deleted, as shown below:



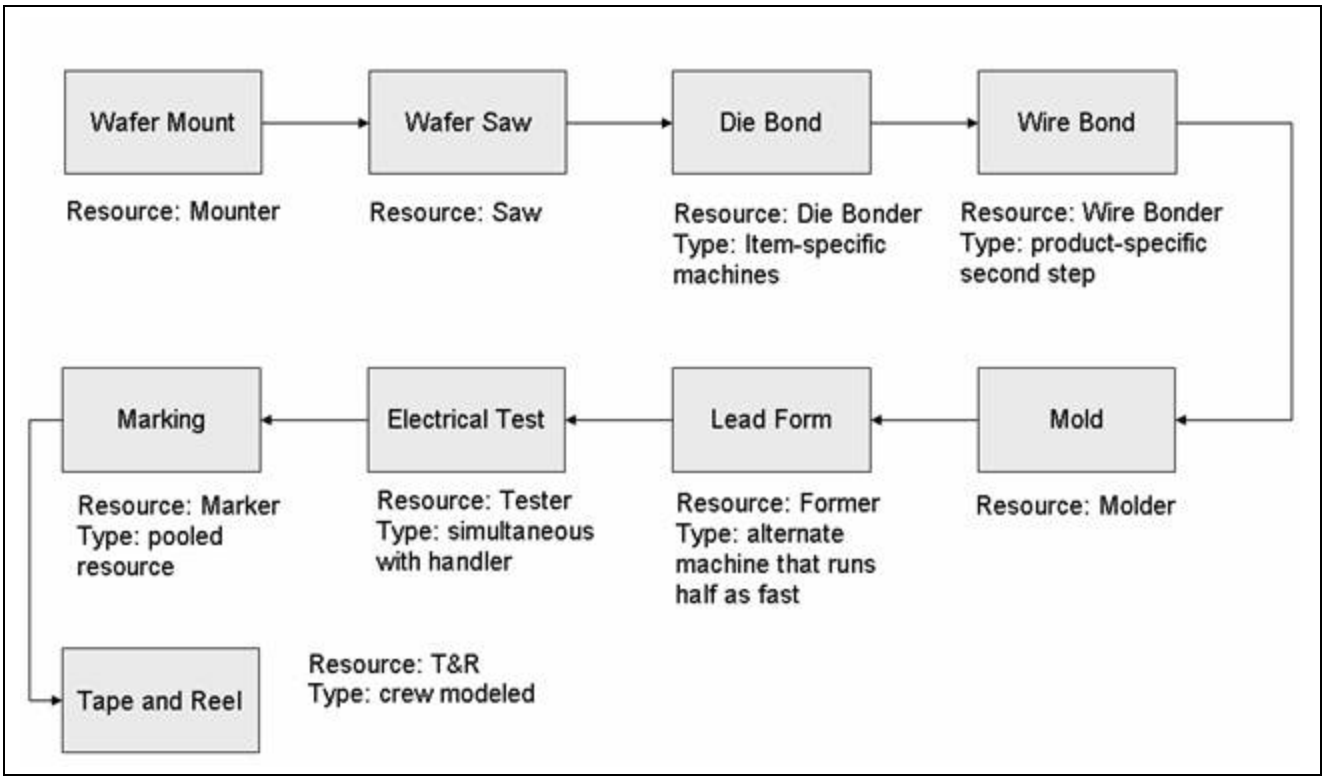
Deleting a solver sequence stage and its contents

Example of Using Solver Sequence Stages

The following example demonstrates scheduling resources and resource groups, using a general flow of product through a factory, starting with the Mounter and ending with the Tape and Reel resources.

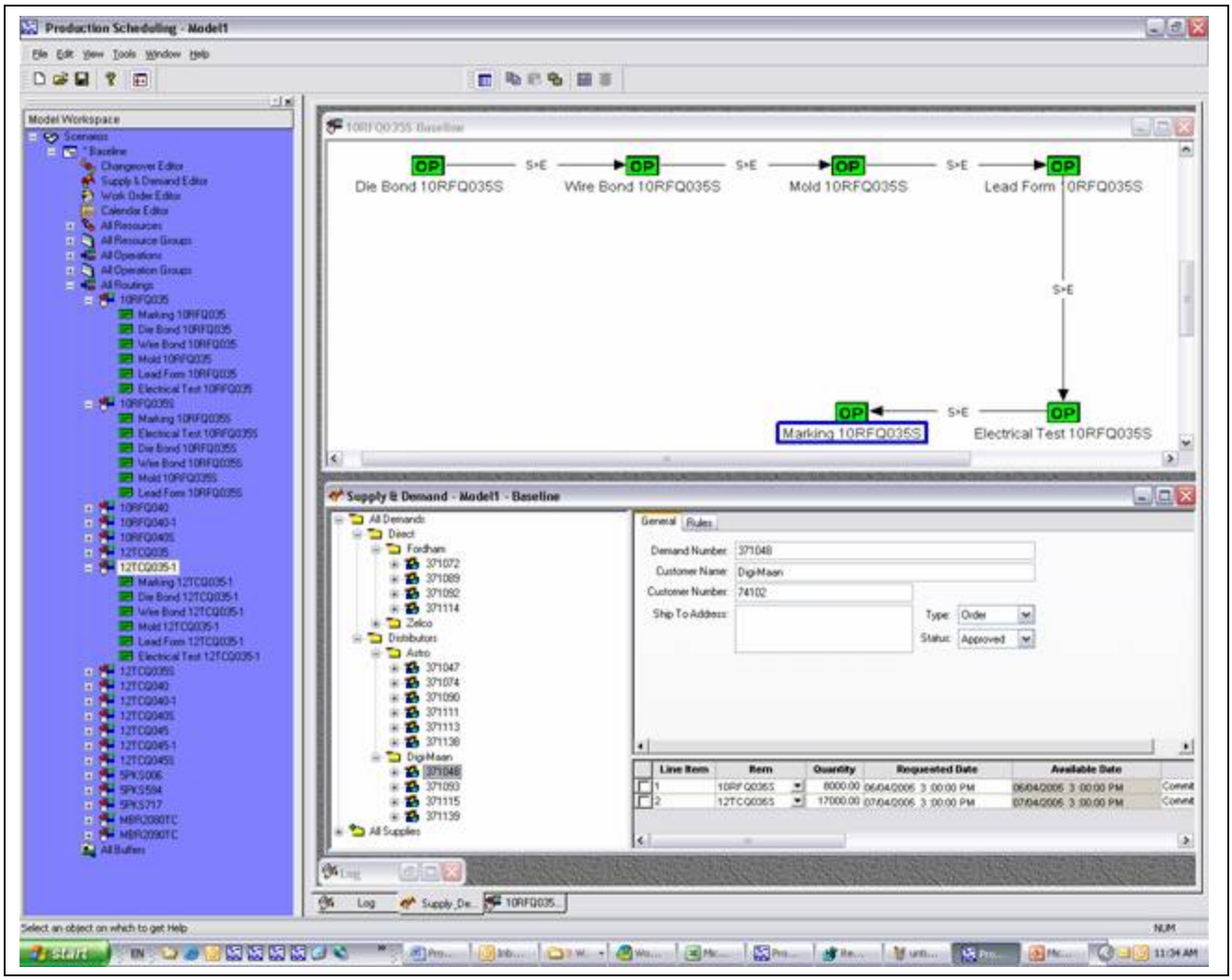
Note. The data for this example is taken from the Semiconductor model, which is shipped with the EnterpriseOne Production Scheduling.

The flow of resources is shown below:



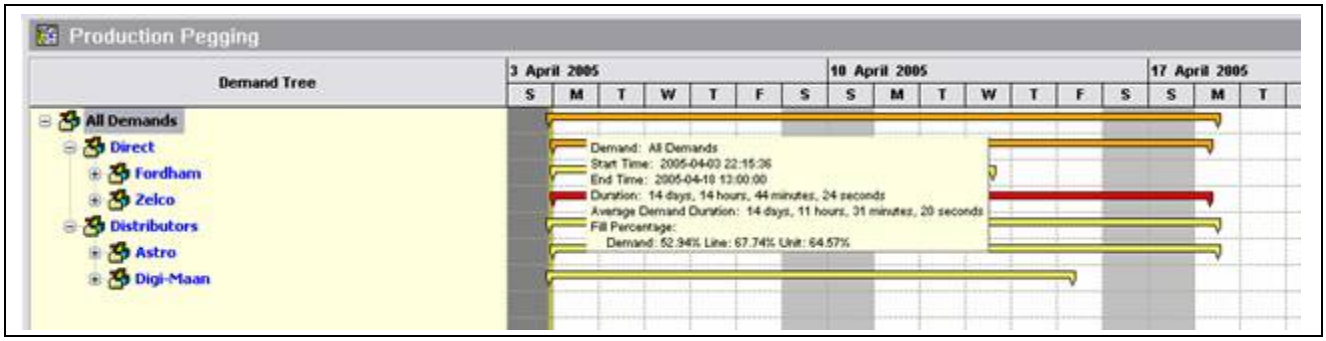
General flow of product through a factory

The manufacturing processes are set up to resemble the above routing. Demands have been entered for the various products.



Routing an incremental schedule

By running a coldsolve with all constraints enabled, a demand fulfillment of 52.94% is realized on a first pass schedule, as illustrated below:



Demand fulfillment after a coldsolve

Looking at the Resource Gantt, clearly, the electrical testing machine is the dominating bottleneck resource in the factory.

Resource Gantt

By using this feature, you can create a schedule by first solving the Electrical Test machine, and then incrementally enabling upstream constraints, followed by downstream constraints. The setup is outlined below:

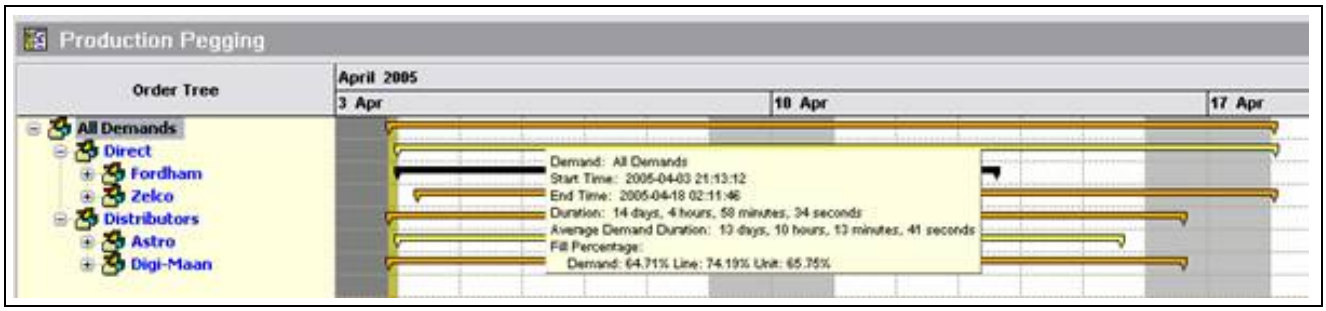
To setup your schedule to incrementally solve for resources, you need to create a solver stage and assign the Electrical Test machine to the new stage. The create the remaining solve stages and assign the resources appropriately. In this case, the solve stages cole downstream resources incrementally in order of precedence, followed by working backwards, upstream, from the Electrical Test machine, as illustrated below:

Creating the remaining solve stages

See Creating Solver Sequence Stages

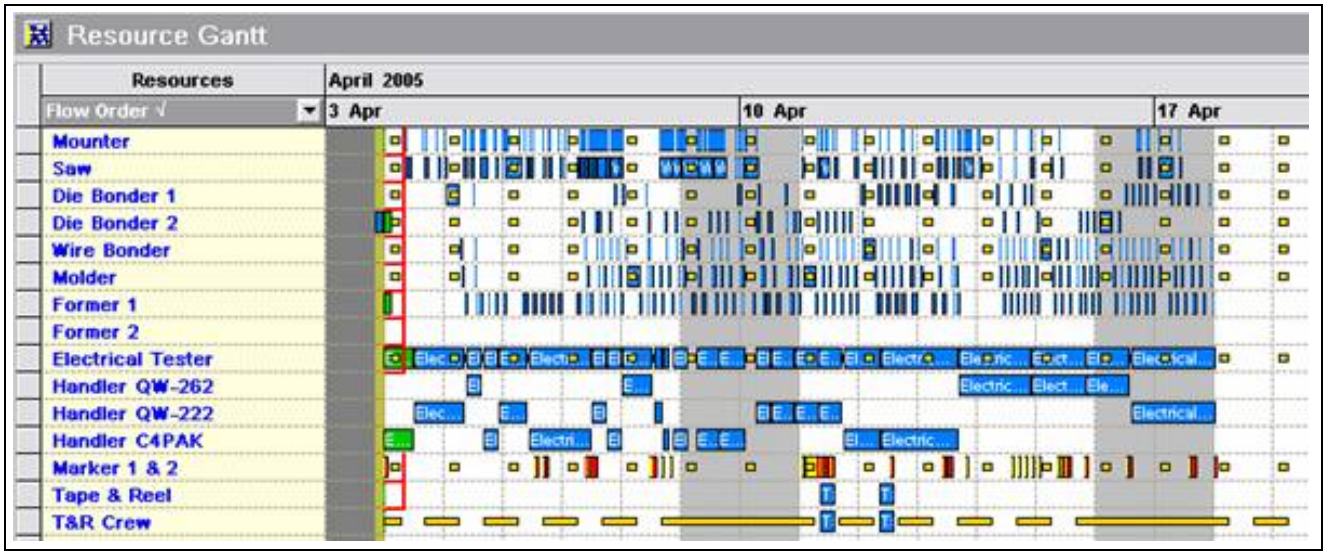
Note. All resources that are not assigned to a solve stage are solved last with constraints enabled.

By now running a solve, a demand fulfillment of 64.71% is realized on the first pass schedule as illustrated below.



Demand fulfillment increase

However, electrical test machine is still the bottleneck as shown in the Resource Gantt:



Resource bottleneck

By looking the key performance indicators (KPIs) view, you can see the improvements from both a customer service perspective and changeover minimization perspective. In all cases, fill rates are higher using the incremental approach, total stockouts and stockout time is lower and time lost due to changeovers is lower.

	Schedule	Customer Service						Manufacturing		
		Order Fill %	Line Fill %	Unit Fill %	No. of Stock Outs	Stock Out Time	WorkOrder Fill%	Change Over Time	Machine Util. %	Throughput Shift
1	Baseline	52.94 %	67.74 %	64.57 %	10	23.282	73.18 %	0.569	20.908	516372.092
2	Incremental	64.71 %	74.19 %	65.75 %	6	10.021	94.41 %	0.500	20.908	562221.204

Key performance indicators

When to Incrementally Schedule Resources and Resource Groups

There is no black and white answer as to when is the best time to use this functionality. Generally, if you are not satisfied with the first schedule using the generic solve logic, it may be a good idea to try incremental schedules for various solver trials.

The following are some general guidelines:

- Solve the dominating bottlenecks in the first solve stage.
- Work your way downstream by resource, keeping alternate resources in the same solve stages.
- Once you reach the end, work your way back upstream from the bottleneck resource.

The optimal sequence will result from testing various solve stage permutations and the order in which resources are solved.

CHAPTER 11

Campaign Run Optimization

This chapter discusses:

- Campaign Run Optimization (CRO)
- Setup and configuration of CRO
- Minimization of changeovers between cycles
- Specification of costs
- Specification of a campaign run optimized machine
- Minimum run lengths
- Logical lot sizes
- Work orders and CRO
- Campaign run optimization and calendar events
- CRO Manager
- Viewing RCB log files

Understanding Campaign Run Optimization (CRO)

In EnterpriseOne Production Scheduling, the solver assigns and sequences resources to respect resource and multistage constraints. This provides a fast and accurate solution for highly discrete, jobshop manufacturing environments. However, many discrete environments are highly repetitive and need to fully optimize sequence dependent changeovers, accommodate long ramp-up times on machines, and respect minimum run times and batch constraints.

To address these criteria, there is an optional step to the solve that is run if you have licensed Campaign Run Optimization in the application and have configured the data model appropriately.

Campaign Run Optimization (CRO) for specified resources provides:

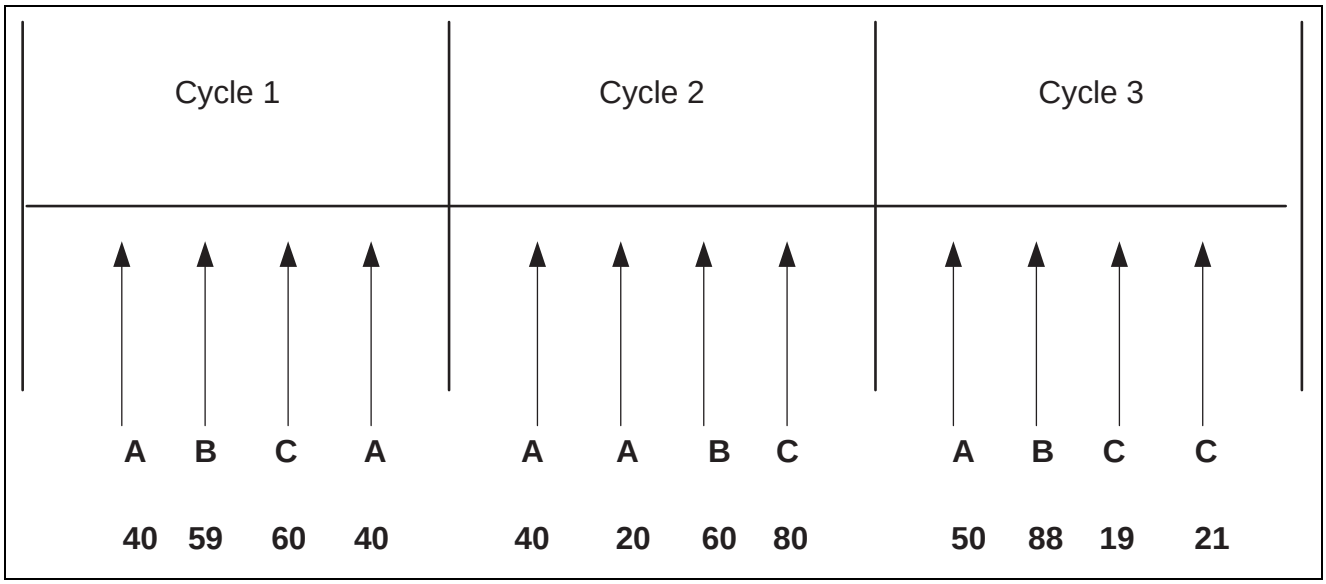
- Computation of dependent demands from campaign run optimized resource and operation steps
- Computation of ideal operation sequence (changeover optimization) for campaign run optimized resources
- Run length optimization
- Mid-Period due dates
- The exact quantity of each item that is required when calculating supply and demand netting
- Sequencing of operations so that runs are moved around as a whole and upstream/downstream operations are synchronized with the runs

An Example of How Campaign Run Optimization Functions

For a given manufacturing cycle, the Minimum Cycle Time, the run length and sequence dependant changeovers are optimized according to the following criteria:

- Inventory carrying costs
- Changeover costs and changeover time
- Safety stock violation costs
- Inventory stockout costs

This example assumes that we have three weekly manufacturing cycles. Within each cycle, there are demands for Items A, B, and C, which are displayed in the following diagram.

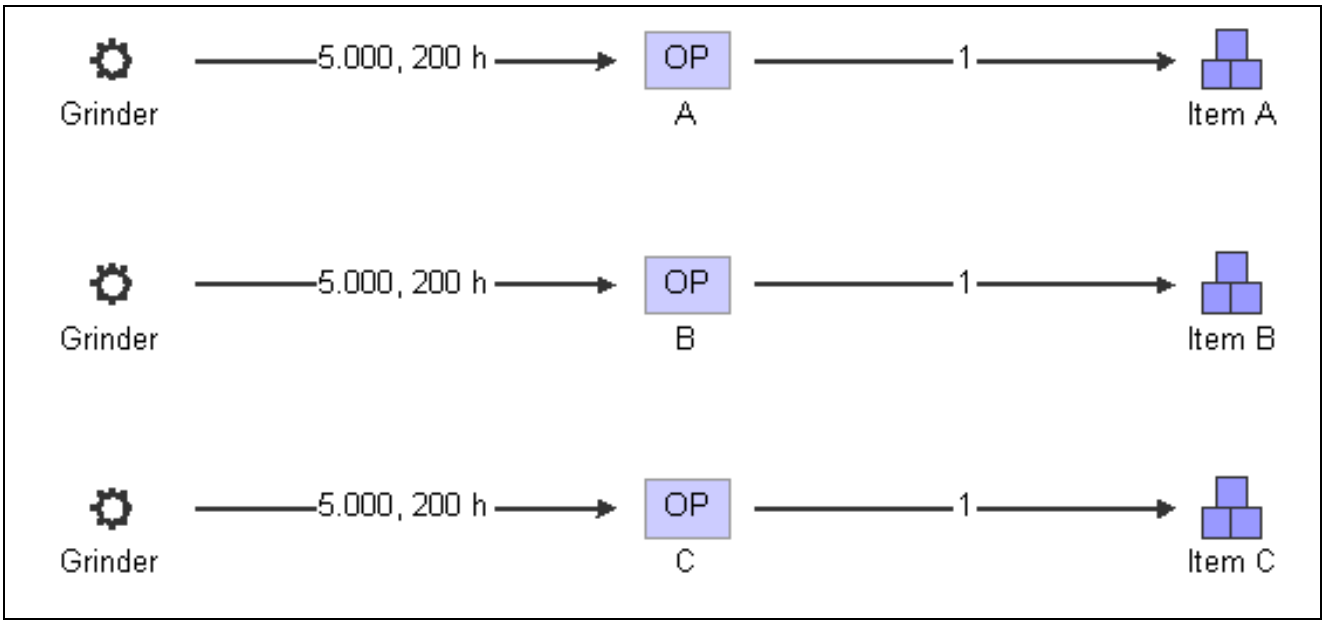


Manufacturing cycles and their demands

Each item also has a manufacturing process associated with it. The process is set up as follows:

- The grinder, which is used in the production of each item, is marked as a campaign run optimized resource.
- The minimum run length is 10 units of any item when run on the Grinder
- Batch size is 5 units
- The rate is 2 hours to make 5 units of any product on the grinder

The processes are displayed in the following graphic:

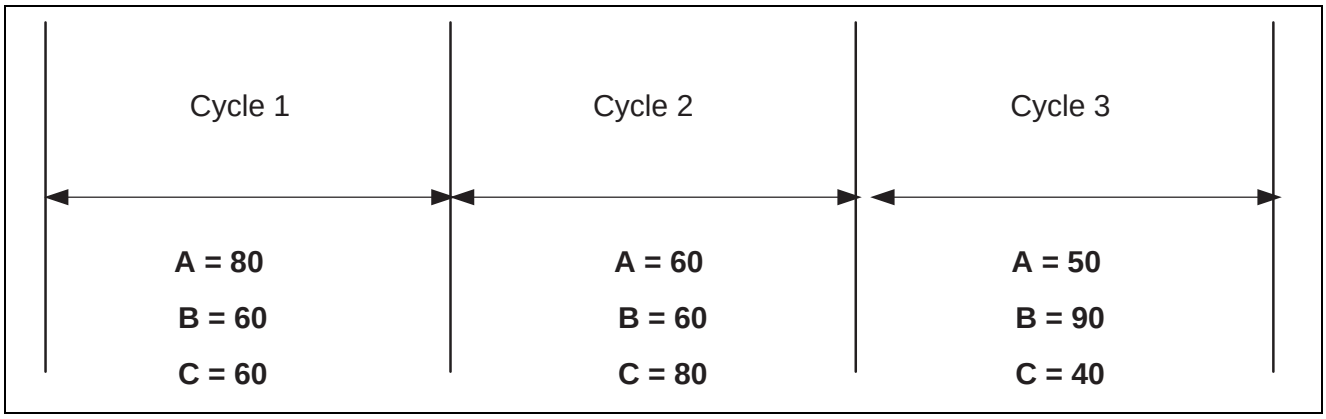


Manufacturing process for items A, B, and C

The changeover rules for this example are given in the following table:

Machine	From Operation	To Operation	Duration (hours)	Calendar	Cost (US$)
Grinder	A	B	1.00	Default	75.00
Grinder	B	A	1.50	Default	50.00
Grinder	B	C	4.00	Default	250.00
Grinder	A	C	2.00	Default	80.00
Grinder	C	A	4.50	Default	250.00
Grinder	C	B	3.00	Default	150.00
Grinder	*	*	1.00	Default	50.00

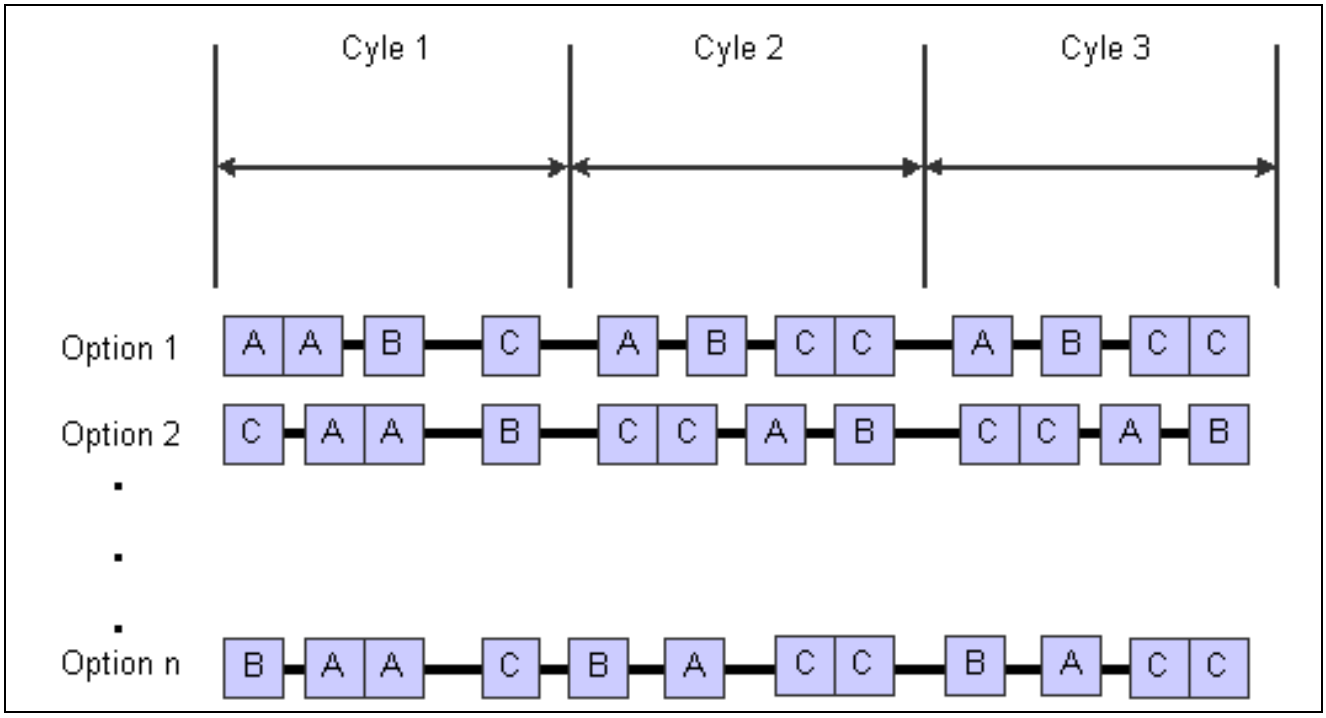
The CRO first determines how much of each item is needed in a given bucket. The ideal run length is calculated by aggregating demands in the user specified cycle. This is depicted in the following diagram:



CRO run length

For example, if there are demands for 125 units for an item in cycle 1, and there is a minimum run length of 100 items, CRO returns a series of operations for the same item to be 125 or more, depending on the operation lot multiple. If there is demand for only 25 units in cycle #1, the run length is calculated as 100 units.

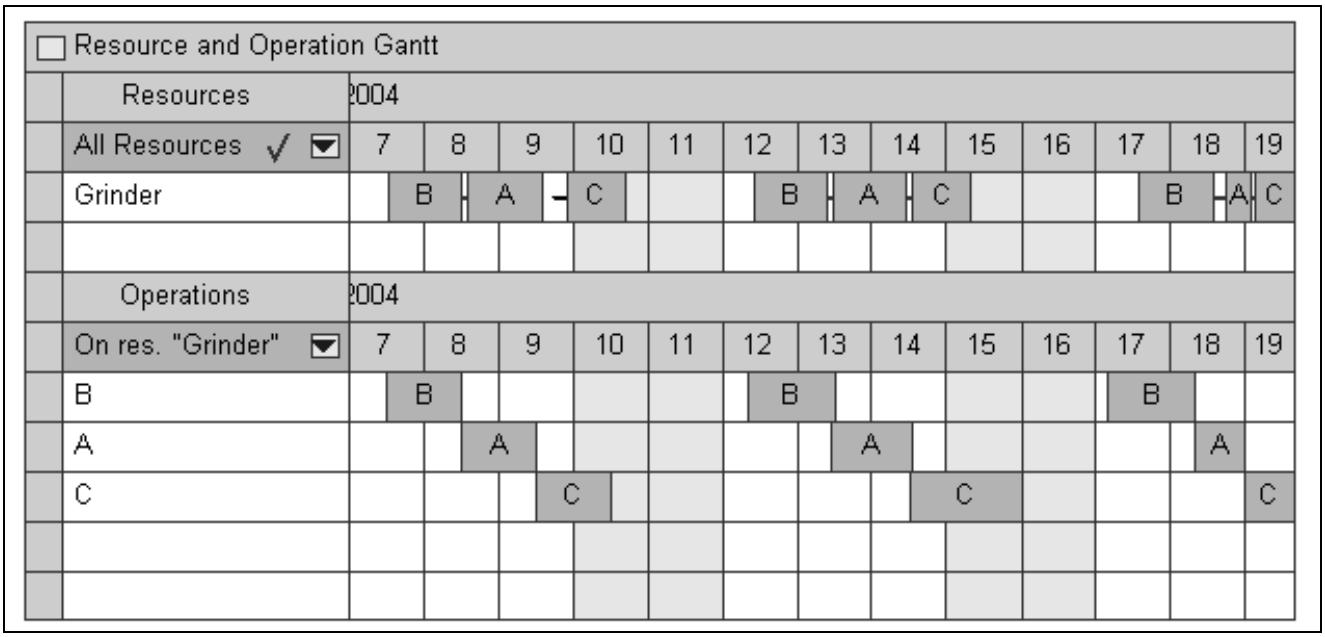
Next, the ideal sequence within each bucket is calculated. The purpose of this step is to minimize changeovers within the user-defined manufacturing cycle times. This is based on changeover cost or time, which is user-specified. This step is displayed in the following graphic:



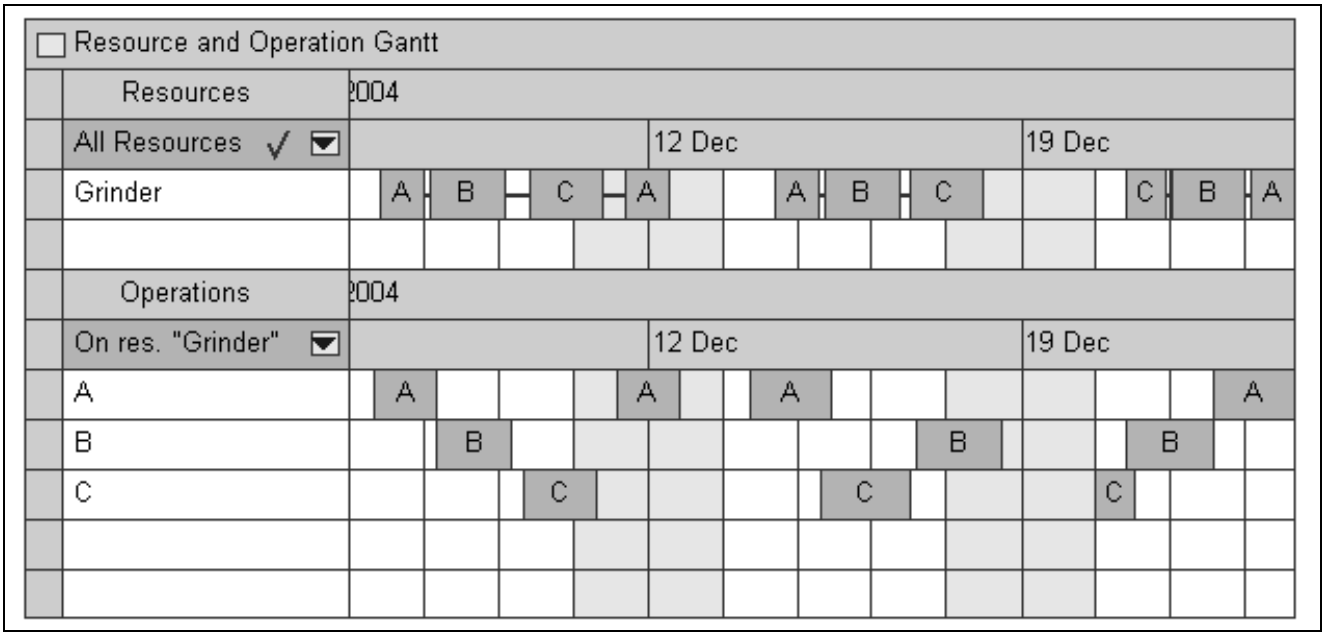
Calculation of ideal sequence

Because the CRO algorithm works in buckets, the solver will bucket demand for the CRO, based on the bucket boundaries. In this example the bucket boundaries are weeks. CRO then calculates a plan, based on the weekly bucketed demand, and Production Scheduling them sequences the runs according to the recommendations of the CRO.

Two solve results are given provided for the example. The screens display the results of solving the scenario using CRO and without using CRO, respectively:



Scenario solve results using CRO



Scenario solve results without using CRO

The results of the two scenarios are displayed numerically in the following table:

	Total Changeover Time in hours	Total Changeover Cost in US$
Using CRO	16.5	690.00
Without using CRO	25.0	1,335.00

Mid-Period Due Dates

Because the CRO algorithm is based on buckets, it is possible that the algorithm may not recognize demand if a given demand is late within a given bucket. For example, if demand is due at noon within a bucket, the CRO is solving on the basis of daily buckets, and the sequence of operations determines yields on available time of 4:00 p.m., the CRO phase of the solve will not see this demand as late.

Since the sequencing phase of the solver can not change the operation sequence of the CRO, the demand may appear as late. However, there is a logic in the solver that internally sets the due date of the late demand to a previous bucket if there is sufficient idle time on the campaign run optimized machine. The CRO is then run again.

Data Model Setup and Configuration for CRO

For each schedule, you must first set up your Model Configuration options before you run the CRO. The options are:

- Determination of the minimum cycle time
- Minimization of changeovers between cycles
- Criteria for setting the ideal run sequence

Minimum Cycle Time

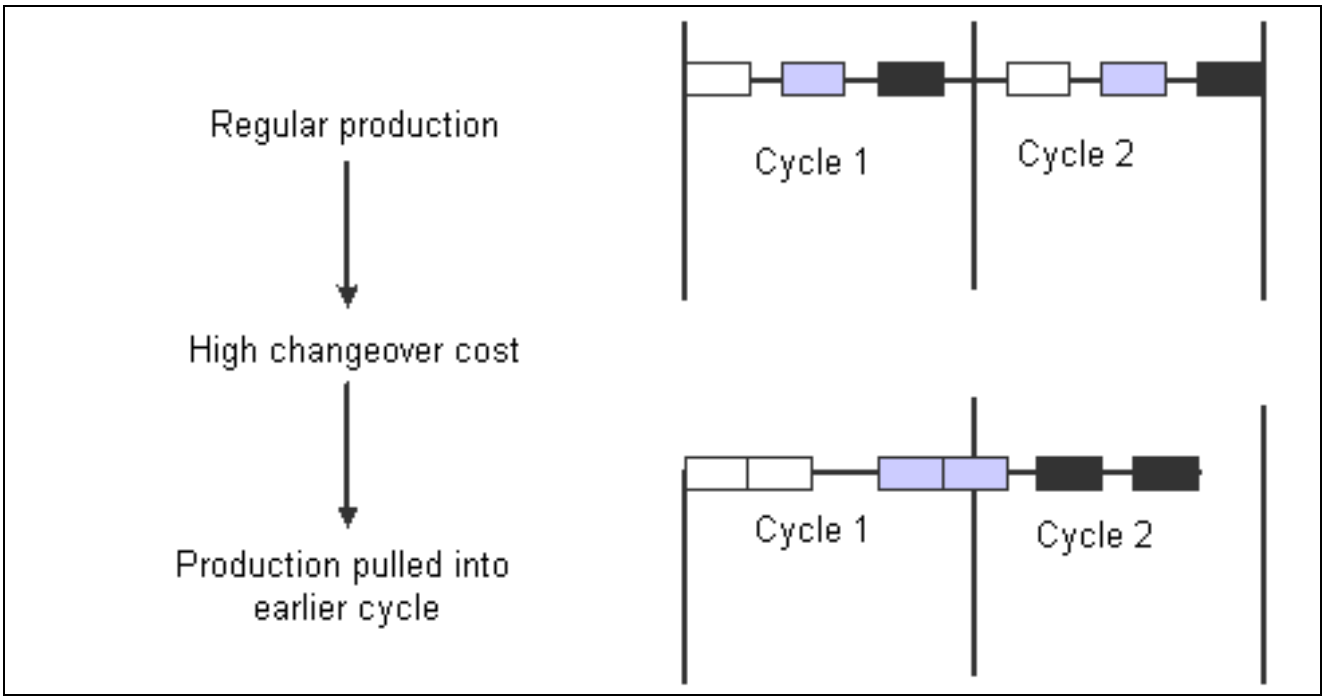
Before you can run the CRO algorithm, you need to specify the manufacturing cycle time that pertains to the run length calculation. That is, you need to set a minimum cycle time to run during a shift, a day, or a week. This is a global option, by schedule.

Setting a manufacturing cycle time gives the solver insight into you product manufacturing cycle and enables it to determine the appropriate run size length that is required to optimize product resources. Generally, the run pattern repeats across cycles.

Minimization of Changeovers Between Cycles

Minimizing changeovers between cycles avoids changeovers between the last operations of the previous manufacturing cycle and the first operation of the of the following cycle. The solver always calculates optimal sequence based on changeover durations or cost, which is consistent across cycles.

Minimizing changeovers between cycles enables the solver to weigh the changeover cost between cycles against the carrying cost of an item in the next cycle. Production of the item may be pulled forward into an earlier cycle to eliminate a subsequent changeover. This concept is displayed in the following diagram.



Minimizing changeovers

Ideal Run Sequence

Ideal run sequence is the order in which events happen within a cycle.

If changeovers are specified by cost, it may result in changeovers which are slightly longer, but cost optimal. If changeovers are specified by time, the time spent on changeovers is minimized but the costs may be higher.

Note. The costs you specify in your scenario greatly impact the quality of your schedule. Make sure you have accurately specified the costs of inventory carrying, changeovers, safety stock violation, and inventory stockout. Costs are normally calculated during model prototyping.

Enabling and Setting the Options for Campaign Run Optimization

Access the EnterpriseOne Production Scheduling desktop.

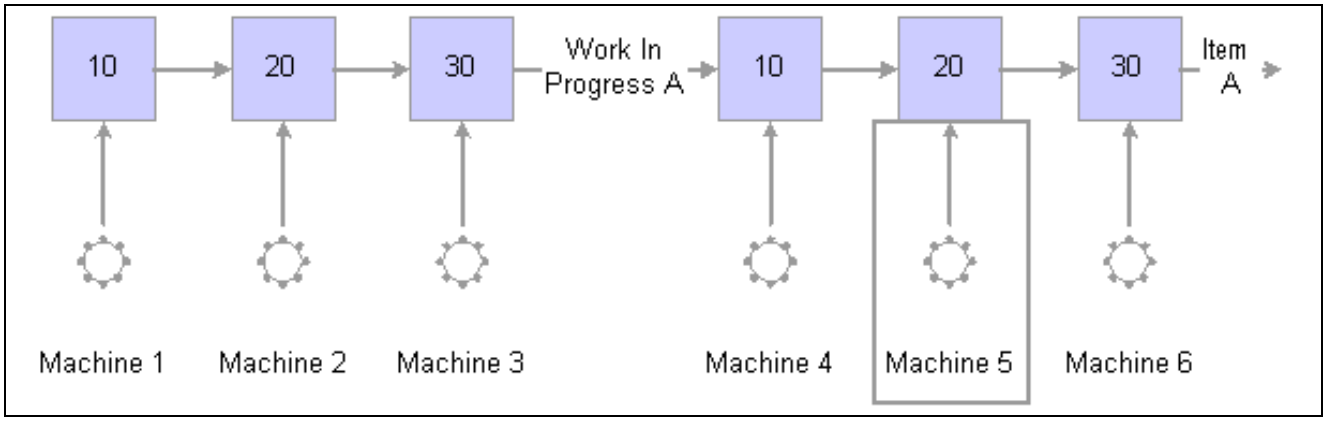
To enable Campaign Run Optimization:

1. Right click on the scenario and select Solver Options from the drop-down menu.
2. Click the Campaign Run Options tab.
3. In the Minimum Cycle Time list, select the amount of time required to cycle through demand for the items that are produced.

   Values are: Shift, Day, and Week.
4. Click Minimize Changeovers between cycles if you want to enable this feature.
5. In Calculate Ideal Run Sequence based on, click the option you prefer.

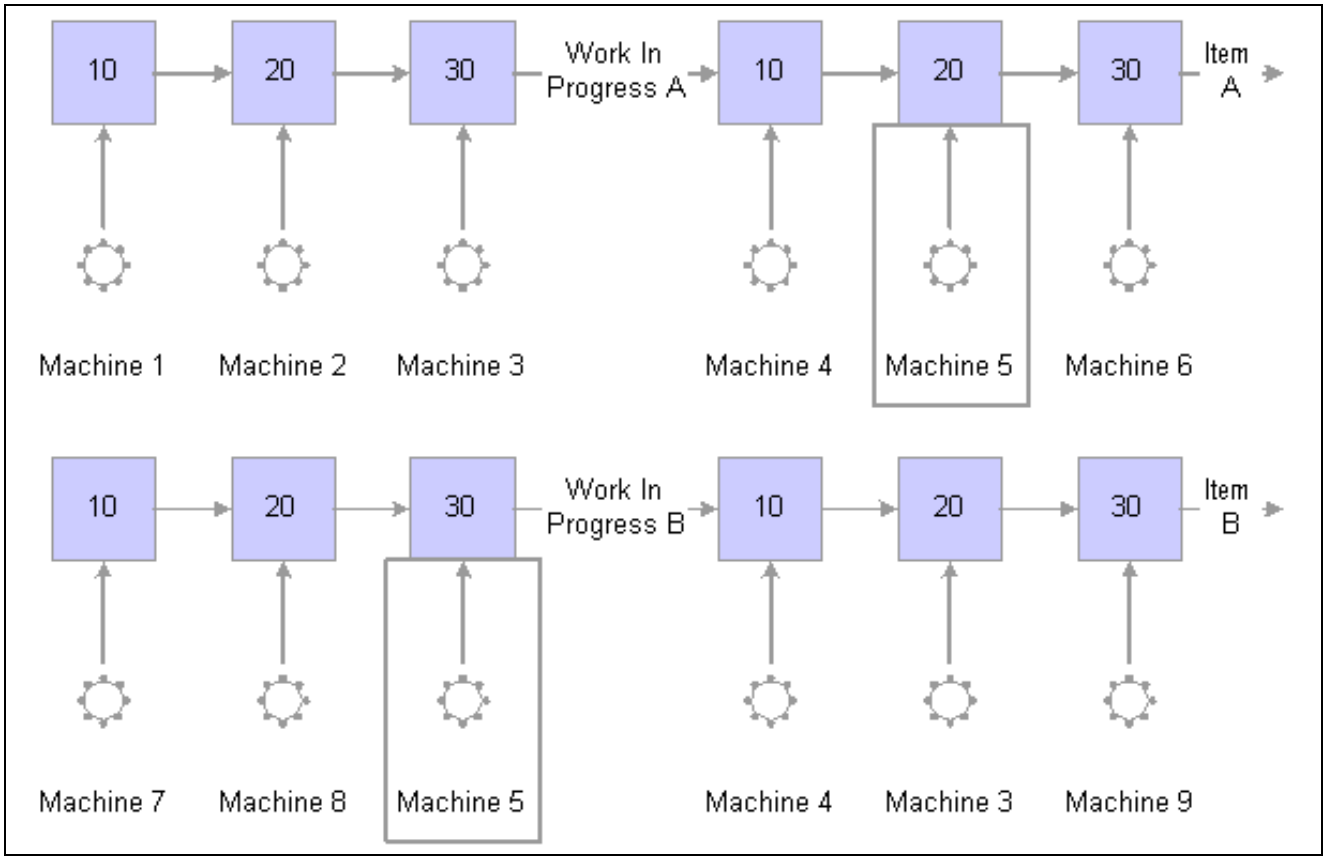
Campaign Run Optimized Machines

Within the manufacturing flow of an item, from raw materials to finished product, you can specify either one resource or resources in a resource set that can be campaign run optimized. The following diagram illustrates run optimization on a single resource.



Campaign run optimization with one resource optimized

The resource or resources in a resource set that you designate as campaign run optimized may be used in several different operations if the operations are not producing the same final item. This is illustrated in the following diagram:



Campaign run optimization with one resource campaign run optimized for different end products

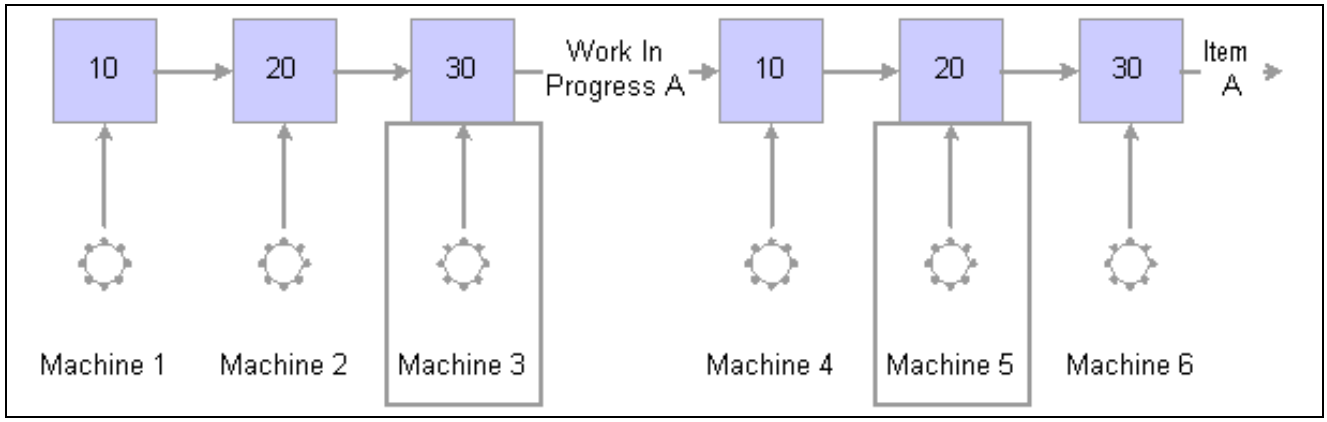
Note. Only single capacity machines can be designated as campaign run optimized.

A campaign run optimized resource cannot be set to relaxed.

Some scenarios, which are explained in the following paragraphs, are not conducive to run optimization.

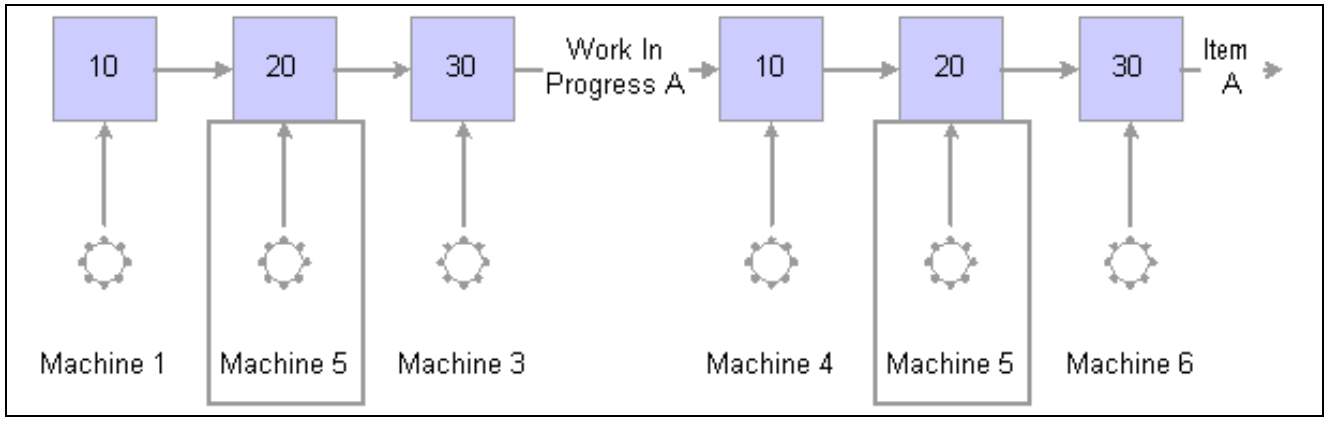
1. You cannot specify a resource as campaign run optimized if the machine is used in a material flow which feeds into another material flow, which has a campaign run optimized machine.
2. A resource can be used only once in the entire material flow. Multiple runs on the same resource in the same material flow presents conflicting objectives.

The following diagrams illustrate these restrictions on run optimization. The first diagram illustrates a scenario in which machine 3 is campaign run optimized, but feeds into a material flow in which machine 5 is also campaign run optimized:



Two campaign run optimized machines with the same finished product

The second diagram illustrates one resource being campaign run optimized more than once in the same material flow:



One resource set twice to run optimization

Minimum Run Length Specification

In EnterpriseOne Production Scheduling, you can specify a minimum run length. The minimum run length can be set in either units or in time. If you set a minimum run quantity on the resource, the operation, which is producing the item, must run a minimum quantity of the item. Similarly, if you set a minimum run in terms of time, the operation must continue for the specified amount of time.

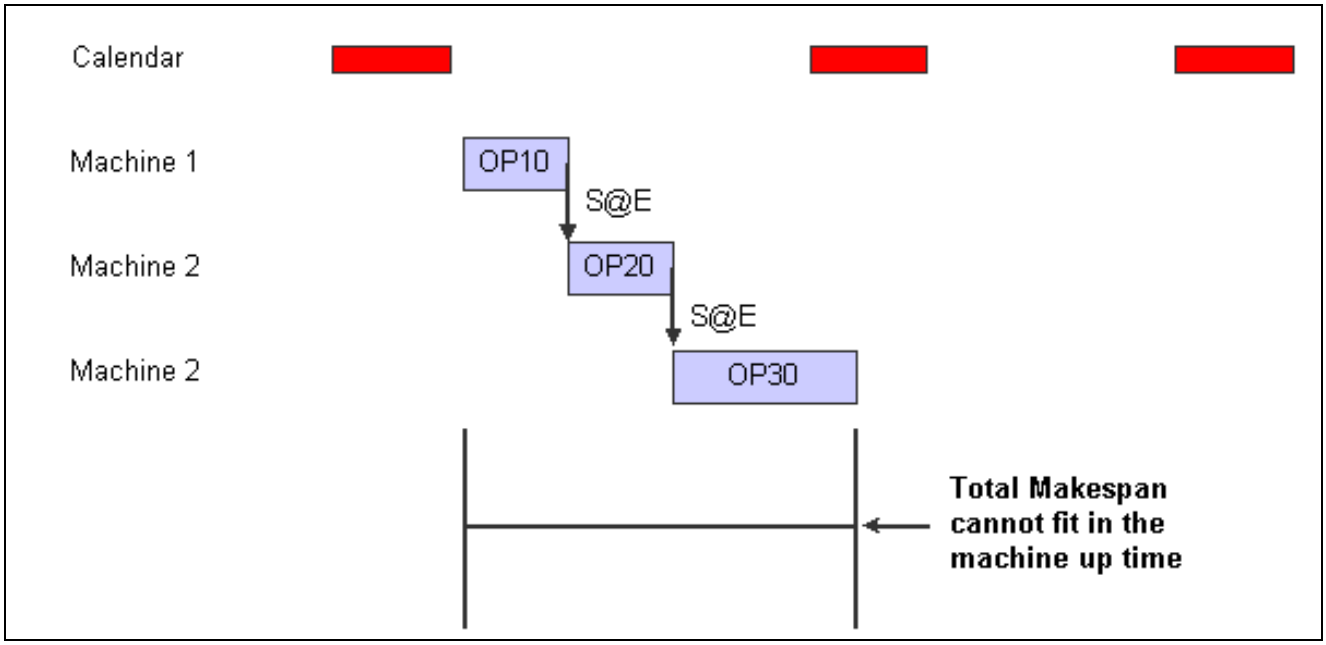
Using Work Orders or Calendar Events

The following is a list of items you need to consider when using work orders:

- Work orders must be matched to demand in each bucket.
- Work order dates must be the same date or earlier than the demand date
- The solver generates runs if demand quantities for a given item is larger than the quantity that the associated work orders produce within a bucket.
- Changeovers between work orders and runs are considered, but not necessarily minimized.
- Use downtime events in the calendar sparingly, particularly if you have tight temporal relationships between operations.
- If possible, use delay time.

An example of the advantage of using delay time follows and is displayed in the following graphic:

- All three resources share the same calendar with recurring down time events.
- Machine 2 is campaign run optimized..
- Each operation has a precedence relationship of Starts@End.



Down time events in the calendar

CHAPTER 12

Scenario Properties

This section discusses the properties of scenarios.

Setting Scenario Properties

This section discusses how to:

- Specify general schedule information.
- Specify a schedule horizon.
- Enable Campaign Run Optimization
- Minimize changeovers
- Specify a branch code
- Configure KPI cost parameters
- Enable Theory of Constraints principles

Specifying General Model Information

Access the Properties window. Select the General tab.

To specify model information:

Code	Specify a name for the schedule.
Notes	Specify any relevant information about this model or schedule. For example, if you have made what-if model changes, you can describe these changes here.

Specifying a Schedule Horizon

Access the Properties window. Select the Horizon tab.

To specify a schedule horizon:

Start Date	Specify the start date of the schedule horizon.
End Date	Specify the end date of the schedule horizon.
Work Day Start Time	Specify the time that the work day starts. Repetitive manufacturing optimized resources use this time to identify the beginning of a production cycle.

Work Week Start Day Specify the day that starts your typical work week. Repetitive manufacturing optimized resources use this day to identify the beginning of a production cycle.

Model Configuration

Access the Properties window. Select the Model Configuration tab.

Build JIT to: Select Due Date or Available Date. If you choose Build Prebuild target, enter the appropriate criteria.

Branch Code Enter the Branch Code for your schedule.

Note. If importing model data from SCBM, you must enter a branch code as it appears in SCBM.

KPI Cost Parameters Select a currency symbol. If the desired symbol does not appear, you can enter it in the space provided.

In the Cost Unit field, select one of the following base units to use when measuring costs: Minute, Hour, Shift, Day, or Week. This field provides the cost time unit for resource and operating costs.

Theory of Constraints Select this option to enable Theory of Constraints functionality.

In the Dispatch List Publish Destination, specify or browse for a directory location where the web dispatch list will be saved.

Campaign Run Optimization

To enable Campaign Run Optimization:

1. Select Campaign Run Optimization.
2. In the Minimum cycle Time list, select the amount of time required to cycle through demand for the items that are produced. Values are: Shift, Days, and Weeks.
3. Select Minimize Changeovers between cycles if you want to activate this option.

   Note. EnterpriseOne Production Scheduling considers what operations ran in the previous cycle. If possible, the application schedules an operation that can run on this resource without a changeover.

4. Select Changeover Time if you want to minimize the total changeover time in each cycle.
5. Select Changeover Cost if you want to minimize the changeover cost in each cycle.

   Note. To accurately minimize changeover cost, you must enter a cost value for each changeover rule.

6. Select View CRO solution results only if you want to view the CRO solve results.

Risk Adjusted Costs

When the CRO algorithm is run, it looks at various costs in the model, including inventory carrying, inventory stockout, changeover, and safety stock violation costs when it attempts to create an optimal production schedule. Typically, these costs are either imported from your ERP system through the Supply Chain Business Modeler or defaulted upon import if they are not defined. To facilitate the efficient manipulation of these costs in the CRO algorithm to run various scenarios and simulations, you can use the scaling factors defined in this tab to help understand and manipulate solve results.

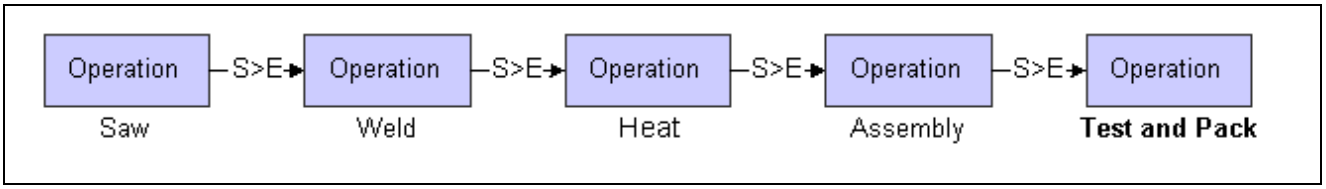
The Risk Adjusted Costs functionality in Production Scheduling enables you to quickly scale the relative costs of inventory carrying, inventory stockout, changeover and safety stock violation costs. The actual costs in the model do not change, but they are "scaled" in the Production Scheduling solver when it makes trade-off decisions in creating a schedule.

The cost factors default to a value of 1. You can quickly and easily change the relative importance of the specific cost by either moving the slider bar to the left or right of 1, or by manually typing in the value in the field beside the slider bar. The acceptable values for each of respective scale factors range from 0.01 to 100.

If you wish to automate the setting of these slider bars and are using the Supply Chain Business Modeler, you can leverage the model generation feature in SCBM to automatically provide these scale factors.

Building Just In Time (JIT) to Due Date or Available Date

Production Scheduling can govern the scheduling of operations that exist upstream from a bottleneck operation in a routing. For example, consider a routing with five operations, saw, weld, heat, assembly, and test and pack. The bottleneck resource is the oven, which is required for the heating operation. The routing and operations are displayed in the following diagram:



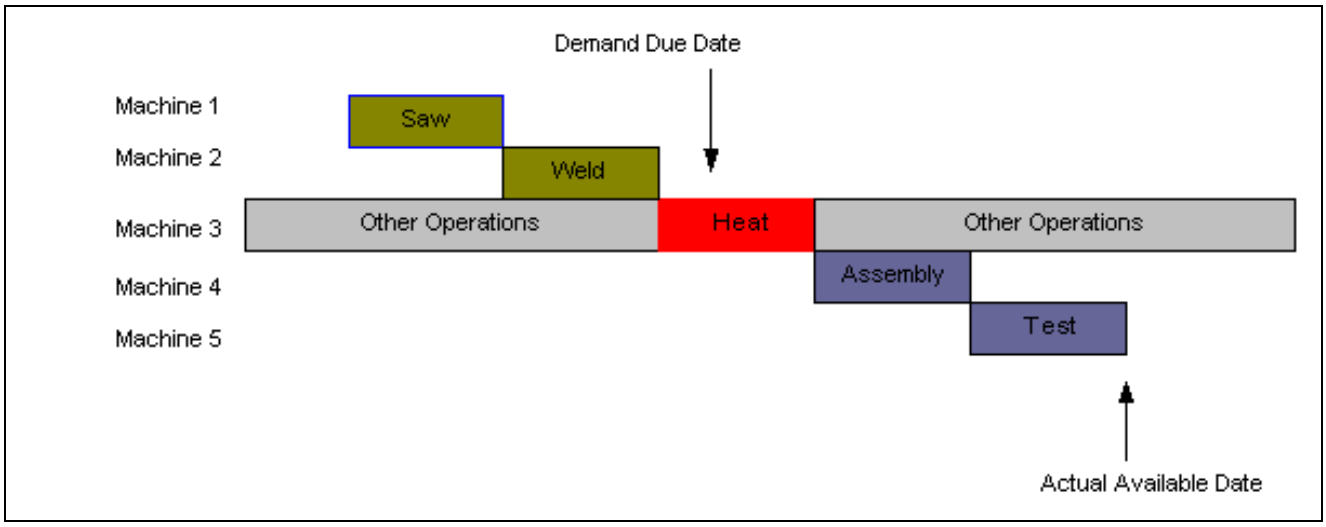
Just In Time (JIT) routing and operations

Manufacturing Routing

When Production Scheduling creates operations to satisfy demand, it posts Earliest date and Available date constraints that are associated with the operations. The operations are scheduled in a just in time (JIT) manner, according to their available date. This scheduling behavior is governed by any precedence constrains in the routing and can occur only if precedence constraints permit JIT to available date

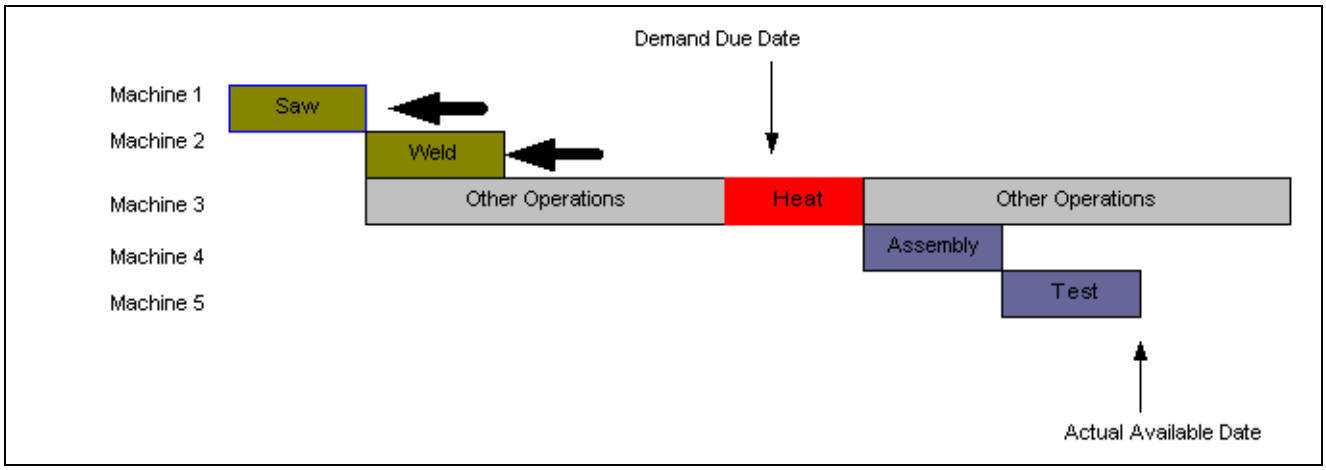
In this example, the Saw and Weld operations could have been made earlier in the process, however, these operations were schedule to align with the bottleneck operation, Heat. This is the default behavior in Production Scheduling.

Due to the bottleneck created by the oven, the demand has been scheduled late. A solve yields the schedule displayed in the following diagram:



Schedule for demand is late

Using the solver option, JIT to Due Date, you could pull the saw and weld operations forward and generate a schedule resembling the one in the following diagram.



Upstream operation pulled forward

With Saw and Weld pulled forward, the upstream operations are placed at a point that provides you with a more efficient way to manually schedule the remaining operations in the routing to a time earlier in the process. This helps to make the demand on time and is effective if you want to schedule operations close to the demand due date rather than close to the bottleneck operation on the routing.

Note. This tactic may result in a longer makespan for a routing if this solver option is set to Due Date. For example, in the example, if the solver places upstream operations earlier in the scheduling horizon and if the solver cannot move the bottleneck operation without manual intervention, the makespan will be longer for this demand.

Prebuild Target Value for Resource Off-loading

Resource off-loading enables you to dictate resource load levels prior to the utilization of an alternate resource within a set. Using the Prebuild Target option, you can define the timefence. This lets you specify a length of time prior to the point when a resource is required to fulfill the demand on time. This value is used by the software to check utilization when making off-load decisions.

This option is not enabled automatically. It must be explicitly set. To determine the best value for your needs, you will need to experiment with different values and understand the impact on the quality of your schedule.

CHAPTER 13

Configuring Desktop Components

This chapter discusses how to:

- Configure views
- Configure diagrams
- Configure the model workspace
- Configure toolbars

Configuring Views

This section discusses how to:

- Create new group views.
- Configure the Production Pegging view.
- Set Multi-Capacity Resource Graph colors.
- Set Item Graph colors.
- Set Item Gantt colors.
- Set Resource Contention view colors.

Creating New Group Views

Access a Schedule window.

To create a new group view:

1. Right-click the List Bar and select Add New Group.
2. Enter a name for the new group and click OK. The new group is added to the List Bar window.
3. click this new group in the List Bar window to display its affiliated views or to add new views.

Configuring the Production Pegging Layout

Access the Production Pegging.

To configure the Production Pegging layout:

1. Right-click the Order Tree header and select Layout Options.
2. In the Production Pegging Layout dialog box, select one of the following layout types:

- Show individual routing instances

  Each operation and routing instance appears on its own line.

- Show merged routing instances

  All routings of the same type are grouped on a single line.

3. If you selected the layout type for merged routing instances, select one or both of the following options:
   - Group multiple operation lines in a folder.

     All operations of the same type are grouped together in an operation folder.

   - Automatically expand operation folders.

     Operation folders automatically expand to display their contents. This option is available only if you selected the option to group multiple operation lines in a folder.
4. Show resource alternates as a set.

Setting Multi-Capacity Resource Graph Colors

Access the Edit Colors window.

To set the Multi-Capacity Resource Graph colors:

1. Double-click one of the following options to configure the color scheme:
2. Graph Background
3. Used Capacity Graph
4. Maximum Capacity Graph
5. Click OK to change the color scheme.

Setting Item Graph Colors

Access the Color Selection window.

To set the Item Graph colors:

1. Select an appropriate color option from the following available options:
2. Graph Color
3. Minimum Level Color
4. Maximum Level Color
5. Background
6. Click the close button in the Color Selection window to exit.

Setting Item Gantt Colors

Access the Customize Colors window.

To set the Item Gantt colors:

1. Click and drag a marker to the desired percentage.

By default, the Item Gantt displays color representations of inventory levels between -10 and 110 percent of the minimum and maximum levels.

2. To assign a color to a percentage range:
3. Right-click in the color bar.
4. In the Color dialog box, select a new color and click OK.
5. Click Update Slider when you have completed the changes to the color scheme.
6. Click Apply and then click OK.

Note. To return all of the values to the default colors and to the default number of color markers, click the Default button.

Setting Resource Contention Colors

Access the Customize Colors window.

To set the Resource Contention colors:

1. Set the following values:
   - In the Min. field, enter a value for the minimum percentage level.
   - In the Max. field, enter a value for the maximum percentage level.
2. To add markers, enter a new value in the # Markers field, and then click in the color bar where you want the new markers to appear.
3. To remove markers, enter a new value in the # Markers field.

   The appropriate number of markers is removed from the color bar from right to left.
4. To assign a color to a percentage range:
   - Right-click in the color bar.
   - In the Color dialog box, select a new color, and then click OK.
5. Click Update Slider when you have finished making changes to the color scheme.
6. Click Apply and then click OK.

Note. To return all of the values to the default colors and to the default number of color markers, click the Default button.

Configuring the Model Workspace

This section discusses how to:

- Hide the model workspace.
- Perform model workspace customization.
- Activate workbook menus.
- View multiple diagrams.

Hiding the Model Workspace

To hide the Model Workspace:

1. On the menu bar, click View.

   The Model Workspace is selected by default.

2. Click Model Workspace.

   The Model Workspace window is hidden.

3. Repeat steps 1 and 2 to alternately display and hide the Model Workspace.

Performing Model Workspace Customization

Access the Model Workspace.

To perform Model Workspace customization:

1. Right-click any blank area in the Model Workspace.
2. From the menu, select a menu option according to the following options:

Allow Docking	This choice enables the Model Workspace window to move anywhere on the screen and attach to any side. To dock the model workspace to a specific side, move the window as far as it goes towards the chosen side. The window expands to full size and locks in place when you release the mouse. When not chosen and Float in Main Window is selected, the Model Workspace moves anywhere within the EnterpriseOne Production Scheduling system window and does not attach to a side. When this option is not selected, select the Float in Main Window option. This action ensures that the right-click menu is available for use in the Model Workspace. Deselect Float in Main Window and select Allow Docking when you want to dock the Model Workspace window again.
Hide	Click the window's close button to hide the Model Workspace. To display the Model Workspace again, select Model Workspace from the View menu.
Default Background Color	Returns the background window color to the default color.
Background Color	Displays a color palette from which you can select a new background color. You can also define a custom color that you can save.
Float on Top	Move (float) the Model Workspace anywhere on your screen, including beyond the edges of the EnterpriseOne Production Scheduling system window. If Allow Docking is selected, the Model Workspace attaches (docks) to any side of the screen. If Allow Docking is not selected, the Model Workspace does not dock to any side of the screen. When this option is selected, the right-click menu is not accessible in the Model Workspace.
Float in Main Window	Move (float) the Model Workspace anywhere inside the edges of the system window.

Activating Workbook Menus

Access the Workbook area.

To activate workbook menus:

1. Open two or more diagrams or editors.
2. From the View menu, select Workbook.

   The Workbook tab disappears.
3. From the Window menu, select one of the listed views.

Viewing Multiple Diagrams

Access the Model Workspace.

To view multiple diagrams:

1. In the Model Workspace, click the operations routings to open two or more diagrams.
2. Select Windows from the Window menu. The Window List appears, displaying all currently open windows.
3. Press Ctrl and select the windows that you want to view.
4. Select one of the following options:
5. Select Tile Vertically to display the diagrams vertically, that is, tiled vertically, in the same window.
6. Select Tile Horizontally to display the diagrams side-by-side.
7. Click OK.

Configuring Toolbars

This section discusses how to:

- Hide toolbar options
- Create a custom toolbar

Hiding Toolbar Options

Access the Customize window. Click the Toolbars tab.

To hide toolbar options:

1. Select a toolbar from the list then select the toolbar options that you want to use on the toolbar. Toolbar options that are not selected do not appear on the toolbar.
2. Click OK.

Creating a Custom Toolbar

Access the Customize window. Click the Toolbars tab.

To create a custom toolbar:

1. Click New.
2. Specify a name for the toolbar and click OK.
3. Select the Commands tab and then select a category.

4. Select a button and drag it to the new toolbar.
5. Click OK.

CHAPTER 14

Understanding Resources and Operations

This chapter describes the following concepts:

- Modelling resources
- Modelling operations
- Campaign Run Optimization
- Upstream operation buffering

Modelling Resources

This section discusses the following concepts:

- Resources
- Resource categories
- Resource capacity
- Timefences
- Resource costs
- Resource constraints
- Resource groups

Resources

The first step in creating a model involves setting up the resources to use. Before attempting to create a schedule in EnterpriseOne Production Scheduling, all of the relevant resources must be entered in the system. Resources are any person, place, or thing that is used to perform an operation. Once entered, resources can be moved to different resource folders, if necessary. They can also be deleted if they are obsolete.

Resources are created in the Resources folder in the Model Workspace. Detailed information about each resource is collected and recorded in its properties, including its capacity, availability, cost, constraints, attached documents, and the operations and work orders where it is used.

You can attach any type of file-such as a specification document, graphic, or audiovisual-to a resource for identification. If the majority of your documentation files are stored in a specific directory on your computer, you can set your Documents Base Folder to default to this directory.

User-defined, logical folders are provided to categorize different resources. In addition, resources can be grouped together for analysis purposes and changeover setups.

Right-click in the Model Workspace, to perform various other operations, including adding properties to each resource type. For example, you can add capacity and availability properties to machines and crews, and you can add minimum, maximum, dynamic safety levels, and cost factors to items. Normally, you add properties to resources at the same time that you create them.

You can also set up resource groups. Resource groups let you specify two or more resources that are represented together in schedule views.

EnterpriseOne Production Scheduling enables you to organize resources using resource folders. Resource folders organize your resources into logical groupings for quick access. For example, you can create folders for crews, items, machines, storage spaces, tools, and suppliers. To keep your model organized, create relevant folders to store all of the resources of a particular type.

After you enter resources, you have to specify resource properties including capacity, availability, costs, constraints, and supporting document attachments. Depending on the type of resource that you are configuring, the type of details required can vary.

The following table describes each of the properties:

Property	Description
General	Accept or enter a new name for the resource and, optionally, any relevant information such as historical data or special requirements.
Capacity	Enter the maximum capacity for crew, machine, and tool resources. • For crews, enter the number of people in the crew. • For machines and tools, enter the number of operations that can be run simultaneously. Whether the resource has a dynamic capacity that increases or decreases, depending on the date, can also be specified.
Availability	For crews, machines, tools, select a calendar that reflects their availability. This calendar displays all down and delay time, and can be customized for each resource, if necessary. For suppliers, specify a fixed timefence that represents a point in time where an item is available for use in a routing.
Costs	• For crews, enter a fixed setup cost or a variable labor cost that is based on a combination of the duration of the operation; the amount of capacity consumed; and the time when the operation is scheduled, such as during regular or overtime hours. • For items, enter carrying costs and stock-out costs. • For machines, tools and suppliers, enter the setup and operating costs.

Property	Description
Constraints	For items, enter the minimum and maximum constraints. Check the Relax Minimum and the Relax Maximum box if you want to relax the maximum or minimum constraints. Enter start levels, decimal precision, storage location, and factor. Dynamic safety stock levels can also be input here. **Note.** By "Relaxing Minimum" or "Relaxing Maximum, you are giving the Production Scheduling solver permission to temporarily violate item minimum or item maximum levels, respectively, in order to produce a feasible solution. **Note.** The color in which a item is displayed depends on if you have relaxed the minimum constraints, maximum constraints, or both constraints in Item Properties. Refer to the table in the Item Gantt section of this document.
Documents	Attach a document, graphic, or audiovisual file that identifies the resource.
Attributes	• Indicate whether items are manufactured, purchased, or saleable. Supplier information for purchased items can be specified in the supplier attributes fields. • Specify a fixed timefence for crew, machine, and tool resources. This process fixes the operations that are scheduled on the resource for the timefence period, only enabling the solver to schedule other operations after the timefence ends.
Where Used	View the operations and work orders that use a resource.

Resource Categories

The standard resource categories are discussed in the following sections.

Crews

A crew is an individual or group of people who work together to perform an operation. This individual or group works according to a specific calendar that reflects working hours, down time, or vacation time. Any number of calendars can be maintained by EnterpriseOne Production Scheduling to ensure that the resource is accurately represented for scheduling purposes.

The properties for a crew resource enable you to rename the crew and add notes; set capacity, availability, and costs. Like other resources, you can attach a document of your choice for better identification, and look up the operations and work orders to which a crew is linked.

When working with crew that do not have any practical constraints, you can set the Maximum Inventory Level to "*". This tells the solver to remove all constraints from this resource when solving the schedule.

Items

Items are defined as inventory that is required to complete an operation. The product of an operation can also be represented as an item resource.

EnterpriseOne Production Scheduling records a great deal of information about each item used by the system, including inventory levels, storage location, and any costs associated with the part. Each item can further be identified as either manufactured or purchased, and flagged as saleable where applicable. You can associate purchased items with suppliers and indicate supplier preferences. Any type of file, such as a specification document or photograph, can be attached to each item resource to assist identification. Any item can be stored in only one storage space.

Storage spaces typically contain many items. You should define all necessary storage spaces prior to entering your items.

Machines

Machines required to perform an operation are defined as resources. Machines are affiliated with a calendar that defines when down time or delays are scheduled to occur.

When working with machines that do not have any practical constraints, you can set the Maximum Inventory Level to "*". This tells the solver to remove all constraints from this resource when solving the schedule.

Shared Storage Spaces

Shared storage spaces are locations where items can be stored. A storage space can contain more than one item.

Tools

Any specific tool required to complete an operation. Tools, like machines, are available according to a calendar that specifies when down time or delays are expected.

When working with tools that do not have any practical constraints, you can set the Maximum Inventory Level to "*". This tells the solver to remove all constraints from this resource when solving the schedule.

Suppliers

Suppliers are defined as any vendor who supplies purchased items or materials that are required to complete an operation or routing. Supplier data includes lead times, order multiples, and supplier preference in the event that multiple suppliers are available to supply the same purchased item or material. When you define a purchased item in the model, you can associate the item with a supplier. However, suppliers must be defined in the model before they can be associated with purchased items.

This category acts independently of the Supply and Demand editor where supply events are entered. It can provide a quick way to theoretically replenish inventory from a vendor at a strategic point in the schedule without specifying all of the details necessary for cutting a purchase order.

Resource Capacity

Resource capacity is the potential amount of production that a resource can complete. Resource capacity is defined differently for each resource category.

- For crew, capacity indicates the number of people who are available to perform an operation.
- For a machine, tool, or vendor, capacity indicates the number of simultaneous functions that can be performed by that resource when available.
- For a supplier, capacity indicates the quantity of purchased materials that must be procured for a specific operation to run.

Resource capacity is an important consideration when scheduling production in your enterprise. Resource availability affects the production of items in your enterprise. The definition of resource availability can vary according to the resource. For example, resource availability for suppliers is different than resource availability for crews or tools.

One of the key principles of lean manufacturing is the designation of a capacity constrained resource (CCR) in your supply chain. Production capacity of a supply chain is limited by the capacity of the CCR. The CCR is the resource that is the most loaded in your supply chain, often referred to as "the weakest link". A CCR has the ability to restrict the flow of production by affecting upstream operations.

A significant risk occurs when resources that are not capacity constrained are scheduled to produce more than the CCR can accommodate. Over-scheduling capacity on resources that are not capacity constrained results in unnecessary and expensive work-in-progress inventory and the need to mobilize material and human resources to handle the production backlog.

EnterpriseOne Production Scheduling uses Theory of Constraints principles that enable you to identify the CCRs in your supply chain and balance the load across resources using CCR buffers, assembly buffers, and shipping buffers.

You can also indicate the dynamic capacity of each resource. This feature enables you to specify when and to what level the capacity of the resource might vary, due to varying crew sizes, seasonality, or regularly scheduled maintenance.

You can configure resources to off load production when alternate resources exist. This offload threshold is configurable for any resource in a resource set.

Note. For crew, machines, and tools without any practical constraints, you can set the Maximum Inventory Level to *, which commands the solver to remove all of the constraints from this resource when solving the schedule.

Timefences

A timefence is a period of time during which operations are not altered for a crew, machine, or tool resource. During the initial solve or subsequent repairs, the solver is only given the freedom to schedule other operations after the timefence ends.

Timefences are established to maintain the current schedule for critical resources so that they are not affected by any scheduling changes before the next schedule is finalized. A timefence is depicted in a schedule view using a red line in the Gantt view.

Resource Costs

Resource costs are costs incurred when a resource is used. Resource costs can be set for a variety of resources including crews, items, machines, and tools. Carrying and stock-out costs are recorded for items. Setup and operating costs are gathered for all of the other resources. For schedules to be compared based on cost, the costs entered on the Cost tab must be as accurate as possible.

Note. The period that is specified on the cost tab is set in system options. From the Tools menu, select Options and click the Global Settings tab. From the Cost Time Unit field, the choices are minute, hour, shift, day, and week.

Resource Constraints

You can track item and shared storage space constraints including minimum and maximum quantities of items, and shared storage space resources. These quantities are very important and represented to the solver as hard constraints. If the solver determines that inadequate stock exists to fulfill the requirements of a schedule, it returns an error and does not continue. Stock can be replenished by creating a supply event representing a purchase order can be entered that provides additional stock upon its delivery.

The Constraints tab is available for only item and shared storage space resources. When solving, the system attempts to create a schedule that meets the safety levels as closely as possible. The minimum stock value is a hard constraint. If the stock level drops below the minimum stock value, the system displays an error message and the solver stops. Safety stock is a soft constraint that can be violated if necessary. Safety stock should be replenished immediately after a safety stock violation occurs.

Resource Groups

Resource groups enable multiple resources to be combined as a group when viewed in schedule views or represented in the Changeover editor (for machines or tools only). Organizing resources into logical groupings can help you to organize your model data. For example, you might want to organize resources by resource type or vendor. Similar to resources, resource groups can also be organized in folders. Additionally, resources can reside in more than one resource group.

You can set a default resource group when you first open schedule views. When a schedule view is opened, only those resources in the default group appear in the schedule. Each schedule view can have its own default group, with the currently selected default appearing with a dot beside the name.

Modelling Operations

This section discusses the following concepts:

- Operations
- Operation groups
- Duration
- Item and resource sets
- Operation sets
- Lot sizes
- Lot multiples
- Changeovers
- Primary outputs
- Changing multiple operations

Operations

An operation is a production event that consumes and produces items, and uses crew, machines, tool, and vendor capacity. Operations establish associations between different resources. Operations combine to form routings that are used to produce specific items. An operation can have various inputs and outputs, depending on the complexity of your production process. You must model all of the operations in your production process in order to generate a production schedule using EnterpriseOne Production Scheduling.

Operations are defined by the resources that they require. Operations can transform materials: they can consume one or more items when they start, and produce one or more items when they complete. Operations use resources and have durations. All operations have the following characteristics:

- Resource requirements. An operation can have capacity requirements for a resource that it needs. An operation can require more than one resource, or one or more of a subset of resources.
- Item consumption. All items are consumed when the operation starts. The consumption is a fixed amount that is based on the duration of the operation. An operation can have the flexibility to select from a set of items.
- Item production. All items are produced when the operation completes. Production can be a fixed amount or dependent on the duration of the operation. Production rates can also depend upon the resources that are involved.
- Costs. Costs can be fixed setup costs or production costs.

An operation diagram is used to detail all of the resources that are required to complete the operation and delineate which resource specifies the duration. The capacity and amount of resources that are consumed or produced are also modeled. The operations are created and organized in the Operation area of the Model Workspace. Logical folders are useful for maintaining model structure.

Operation Groups

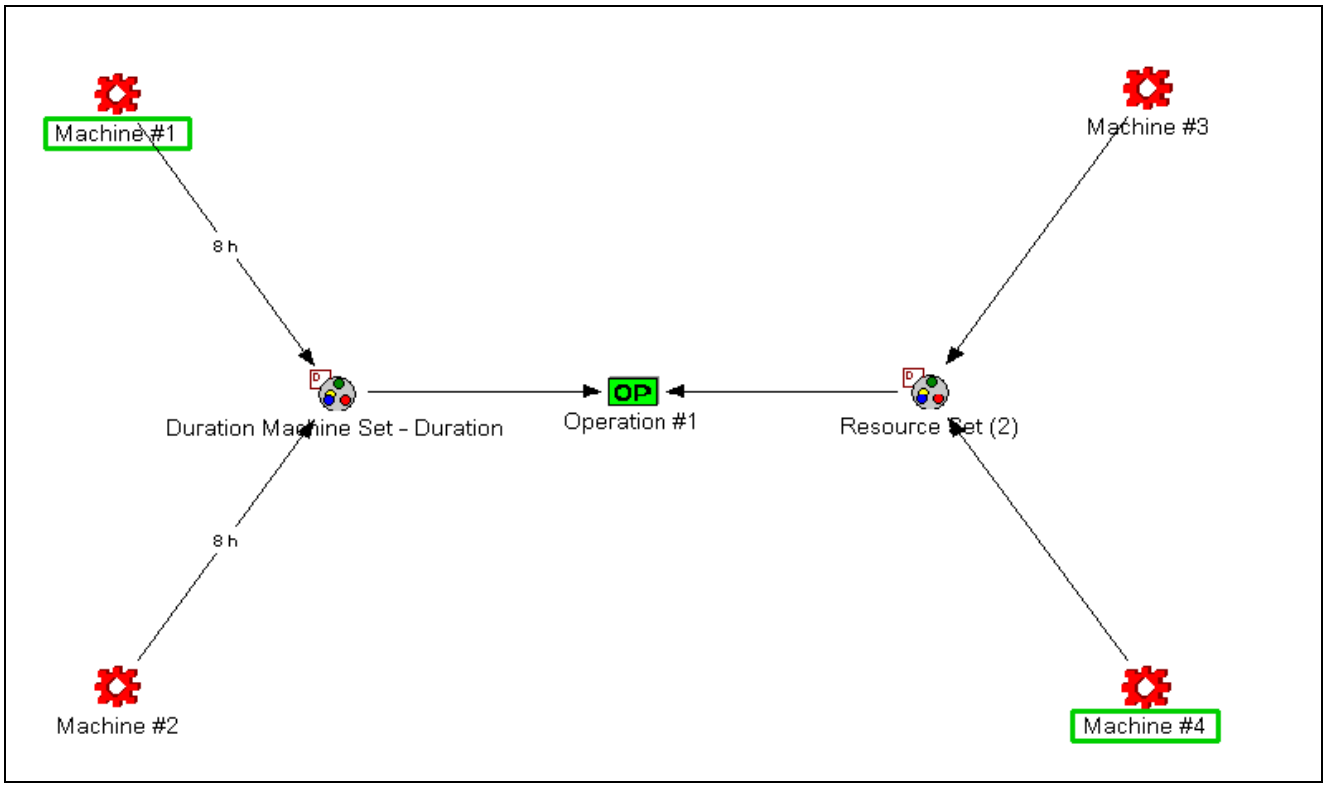
Operation groups can be created to assist with schedule analysis. Operation groups enable two or more operations to be combined as one within the Operation Gantt schedule view as well as the Changeover editor. For large models, operation groups filter the schedule views so that you can quickly review those operations, thereby saving time. Applying the same time for changeover to all group members reduces the number of rules required. Create as many groups as you need for your requirements. Operation groups can be organized in folders, similar to operations, if desired. Operations can reside in more than one operation group.

Duration

Every operation must have a defined duration, determined by only one resource or resource set. For instance, if an operation uses a machine with a duration of 30 minutes and a crew, EnterpriseOne Production Scheduling allots 30 minutes for the crew. Using item and resource sets, different durations can be recorded for those resources in the set to complete the same operation. For example, one machine can take much less time to perform an operation than another machine.

Duration can be attached to only one machine or crew resource in an operation. In this case, EnterpriseOne Production Scheduling uses the machine resource duration to determine the crew’s time.

This example illustrates an operation with a resource-dependent duration specified within a set:



Resource-dependent duration within a set

For duration to be attached to elements in a set, set properties first must have duration selected. Then all of the machines within the set can be defined with a duration attribute. No other durations are permitted in this operation.

Item and Resource Sets

You can define and insert groups of resources known as sets, which can be either item or resource sets. Item and resource sets (a collection of similar resources) can be used to represent alternatives for crews, machines, items, tools, and vendors. Sets are groups of resources that represent alternatives for machines, crews, items, tools, and vendors. EnterpriseOne Production Scheduling selects one component from each set when the operation is scheduled. You can create one or more item or resource sets. Item and resource sets enable EnterpriseOne Production Scheduling to select the most efficient resource for any given point in time, based on preference, capacity, lot multiple, and duration properties that you determine.

Sets allow choices to be made that are based on the availability of, and preference for, the operation. You can also specify lot multiple and duration for resource sets. Lot multiple specifies the quantity of items produced by an operation while duration specifies how long the operation runs. All operations must have a duration.

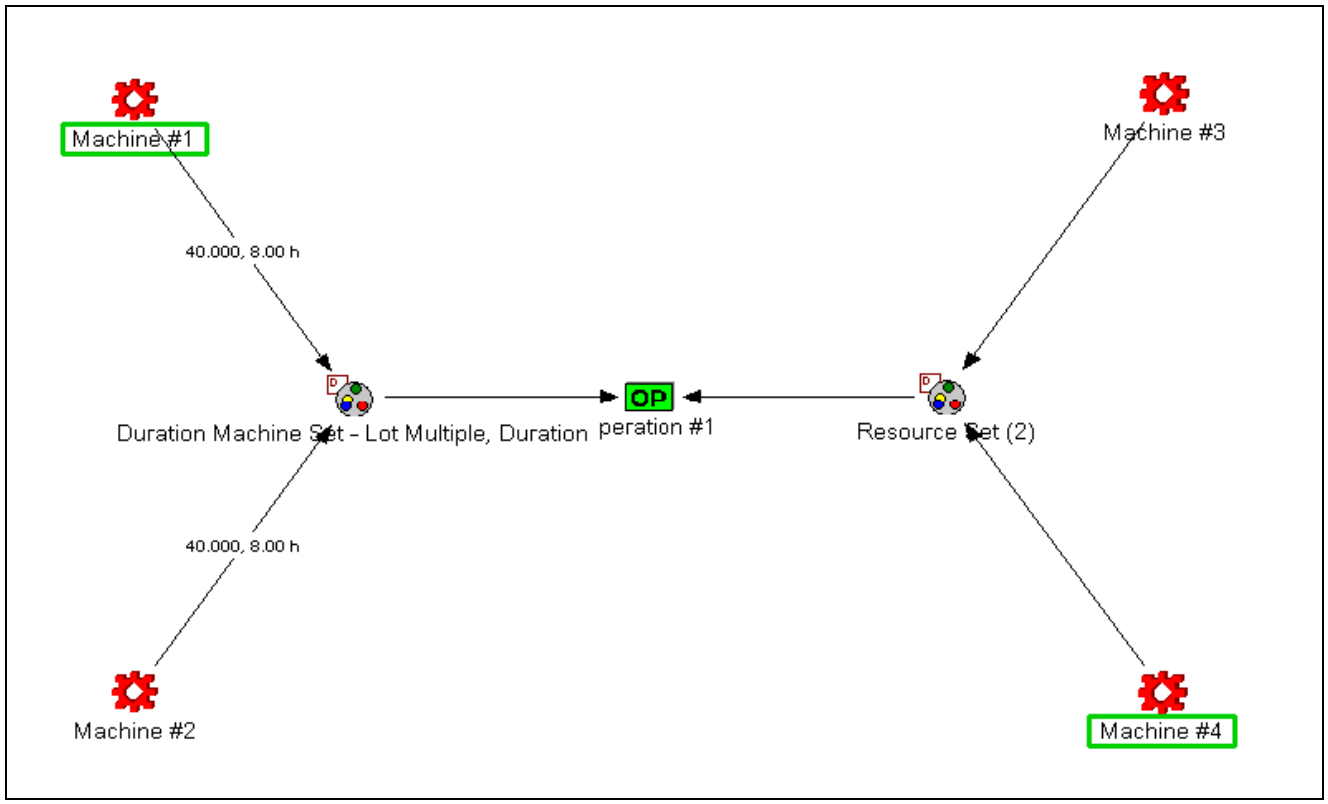
Sets provide operations with alternatives. For example, Operation A can be designated to use the set of machines M1, M2, and M3. Operation B can be designated to use a different set that also includes the same machines: M1, M2, and M3. By using sets, the schedule has the flexibility of using the most efficient combination of machines M1, M2, and M3 for the two operations. Use item and resource sets whenever options exist for completing part of an operation. By giving the solver alternatives, you have more potential ways of manipulating the schedule.

An item set can also be the output of an operation. The set determines the item produced, based on the preferences, availability of other resources, and demand. If you want to use the pegging capabilities of EnterpriseOne Production Scheduling, this set can be marked as the primary output.

Your solved schedule can be immediately updated by changing the suggested resource alternative if the sets feature is used.

Lot multiples can appear only once in an operation in either a non-item resource or in a resource set. For the lot multiple attribute to appear in a set, the lot multiple property must be selected in the set's properties. Then all of the elements in the set can be defined with a lot multiple.

This example illustrates an operation with both a resource-dependent lot multiple and duration specified within one set:



Resource-dependent lot multiple and duration within a set

Operation Sets

Operation sets represent alternate methods of completing a production step. An operation set links two or more alternate operations, similar to item and resource sets. During a solve, the application selects the operation set option that optimizes crew, machine, tool, and vendor loads.

Unlike resource and item sets, operation sets do not have resource constraints such as preference, lot multiple or duration. Instead, choices are made based on the availability of resources, crew, machines and so on.

For example, the operation 2002 Weld 10 A uses a machine to automatically weld a part that is required by a later operation, and this process takes 30 seconds. The operation 2002 Weld 10 B performs the same task, but instead it uses a crew and a tool to make the weld by hand and takes five minutes. By grouping these alternate methods of producing the same weld in an operation set, the schedule has the flexibility of using the most efficient combination for the two operations.

Operation sets are linked within a routing and have the same precedence constraints as individual operations. A maximum of one operation set can be specified in each routing and can be designated as the primary operation.

Note. The Work Order Editor does not support routings that use operation sets. Routings containing an operation set do not appear in the Work Order Editor's routing drop-down list box.

Lot Sizes

Whenever an operation produces more than one identical item, the resulting output is called a lot. For example, consider a stamping machine that produces eight identical items in a single operation. In this example, the lot size is eight.

You can use lots to reduce the total number of operations in your schedule. You can do the following:

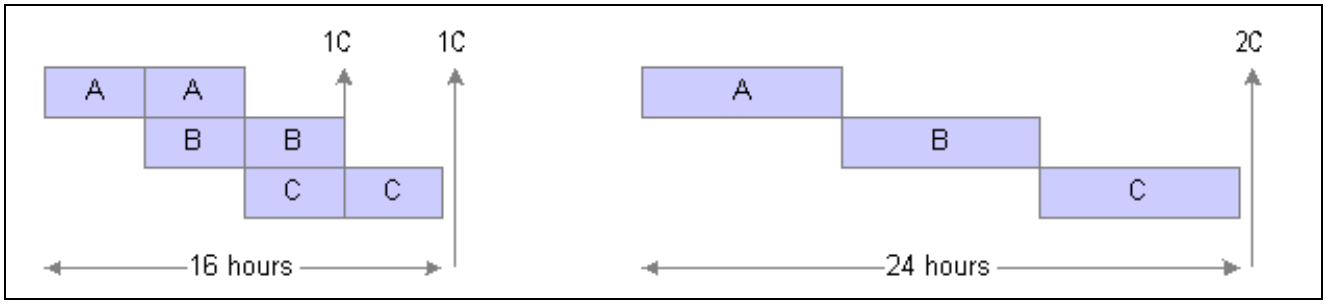
- Increase the operation lot-size and duration.
- Define logical lot sizes if physical ones do not exist.

You create a logical lot size by increasing the quantity that an operation produces, as well as increasing its duration. For example, an operation that runs for one minute and produces one item can also be represented as a single operation that runs for ten minutes and produces ten items. By using logical lot sizes, you can dramatically reduce the total number of operations that the solver must schedule.

Note. To avoid excess inventory, lot sizes should be divisible into demand.

Although using logical lot sizes can help you reduce the number of operations in a schedule, it can also artificially increase the amount of time required to produce a specified number of items. Item and precedence relationships are still enforced and because each operation takes longer to complete, subsequent operations are also delayed.

This example illustrates the effects of using a logical lot size:



Logical lot sizing

In the first illustration, each operation has a duration of four hours and produces one item. Operations B and C have a precedence relationship of Start after Start. In this example, item "C" is produced at 12 hours and again at 16 hours. In the second illustration, the number of operations has been reduced using a logical lot size of two. Because operations B and C cannot begin until the previous operation has started, the makespan has been exaggerated to 24 hours.

Lot Multiples

Crew and machine resources in an operation can, optionally, have a lot multiple attribute. This multiple is applied to all items that are consumed or produced by that operation. A lot multiple is used to specify that an operation can consume or produce different amounts of materials if the operation runs on a different resource. For example, a certain press can have a larger template that enables it to stamp out twice as many items at a time as a smaller template. This situation has a lot multiple of 2. The lot multiple is applied in the same way to all inputs and outputs of the operation, but the lot multiple does not affect the duration of the operation.

Only one resource determines the lot multiple for an operation, although with the use of sets, more than one lot multiple might be specified. Most operations do not need to specify a lot multiple. If a lot multiple is not specified, then the lot multiple is assumed to be 1. With the use of sets, different resource lot multiples can be specified. Within the set configured for a lot multiple, each resource must have a lot multiple recorded. EnterpriseOne Production Scheduling selects a resource in the set and uses the lot multiple specified for that resource.

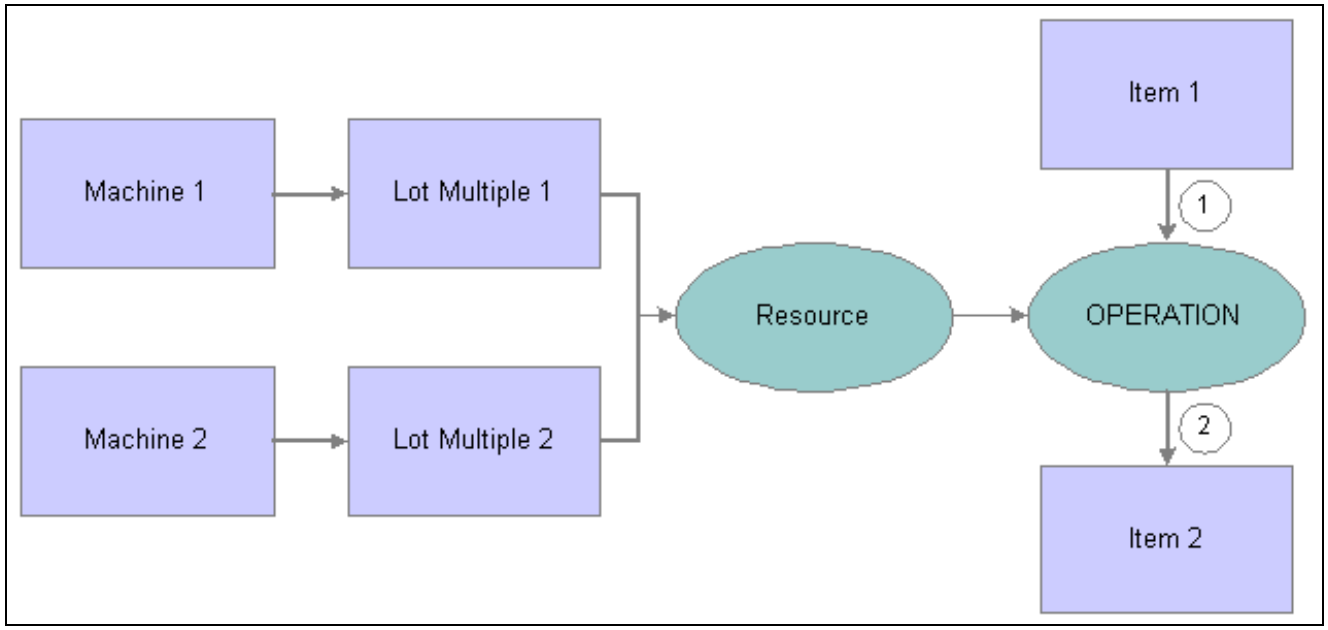
Operations can have both a duration and a lot multiple. The duration and lot multiple can depend on different resources. For example, the crew determines the duration of the operation, and the machine determines the lot multiple. Alternatively, they can depend on the same resource. For example, the machine can determine both the duration and the lot multiple of the operation.

In the event that an operation with an associated work order is offloaded to an alternate machine in a resource set, the item quantity produced by the primary machine will affect the duration of the operation on the alternate machine. The quantity of produced and consumed items will remain the same. The application will calculate the new duration on the alternate machine by applying the production rate of the alternate machine to the item quantity produced by the primary machine.

For example, machine A and machine B are a part of a resource set, and you want to offload an operation with an associated work order from machine A to machine B. The duration of the operation running on machine A is 1 hour, with a lot multiple of 100 units (100 units per hour). The duration of the operation running on machine B is 2 hours, with a lot multiple of 50 units (25 units per hour). The operation produces 1000 units and runs on machine A for 10 hours (1000 units ? 100 units per hour).

To produce 1000 units on the alternate machine that produces 25 units per hour, the new duration required is 40 hours (1000 units ? 25 units per hour).

This example illustrates the effect of different lot multiple attributes in sets:



Different lot multiples in sets

Primary Outputs

To take advantage of the pegging capabilities of EnterpriseOne Production Scheduling, the primary output of the operation needs to be identified. Pegging enables you to view all of the item resources and operations associated with each line item in a demand order, and how they have been allocated. In addition, the Resource, Demand, and Operation Gantt views can display all of the resources and operations related to a specific operation "upstream" (backward) or "downstream" (forward).

The primary output of an operation can be either a specific item or an item set. If an operation does not produce any items, a primary output does not need to be designated.

Changeovers

A changeover represents the time and cost associated with switching production from one operation to another operation. You can specify changeovers when you define operations or you can use the Changeover editor to create and edit changeover rules after operations have been defined. Before adding an operation, ensure that all of your resources have been entered.

All operations must be identified within EnterpriseOne Production Scheduling in detail before feasible schedules can be generated. As with resources, when operations are created manually within the application, they are started in the Model Workspace and can be organized with the use of folders.

As with resource folders, operation folders are designed to organize your operations. The organization of your operations is entirely defined by the user. The application does not draw any implications or conclusions from the order. The All Operations and All Resources folders appear in the Model Workspace by default.

You should establish a naming convention that clearly and uniquely identifies each operation. Distinctly named operations are helpful when analyzing schedules. Operation names are limited to 32 characters and can include any character. Models can be produced manually within EnterpriseOne Production Scheduling.

Identifying Operations

All operations must be identified within EnterpriseOne Production Scheduling in detail before feasible schedules can be generated. As with resources, when operations are created manually within the application, they are started in the Model Workspace and can be organized with the use of folders.

As with resource folders, operation folders are designed to organize your operations. The organization of your operations is entirely defined by you. EnterpriseOne Production Scheduling does not draw any implications or conclusions from the order. The All Operations and All Resources folders appear in the Model Workspace by default.

Before adding an operation, ensure that all of your resources have been entered. As with resources, you should establish a naming convention that clearly and uniquely identifies each operation. Distinctly named operations are helpful when analyzing your schedules.

Operation Diagrams

Once you have set up resources and operations, you can create a diagram by dragging resources from the Model Workspace into an Object Window. If you create item or resource sets, you must also drag buttons from the Resource toolbar into the diagram. All resources are available for use except the shared storage spaces.

An operation diagram is a graphic representation of your production environment that enables you to see relationships and intuitively make adjustments where necessary. The model also enables you to change the properties of objects so that the application can take into account every detail in your model.

Create operation diagrams-visual representations of your production environment-by dragging and dropping resources into the diagram, and then connecting them to the operation button. As resources are added to an operation, they appear beneath the operation's button in the Model Workspace.

Changing Multiple Operations

In EnterpriseOne Production Scheduling, you can change multiple operations at one time.

Access the Model Workspace

To change the properties of multiple operations:

1. In the Model Workspace, select the operations that you want to change by holding down the Shift key and highlighting the appropriate operations or folders. If the operations or folders are not listed sequentially, hold down the CTRL key and select the individual operations.

   Note. If you select a folder, all operations in that folder are considered.

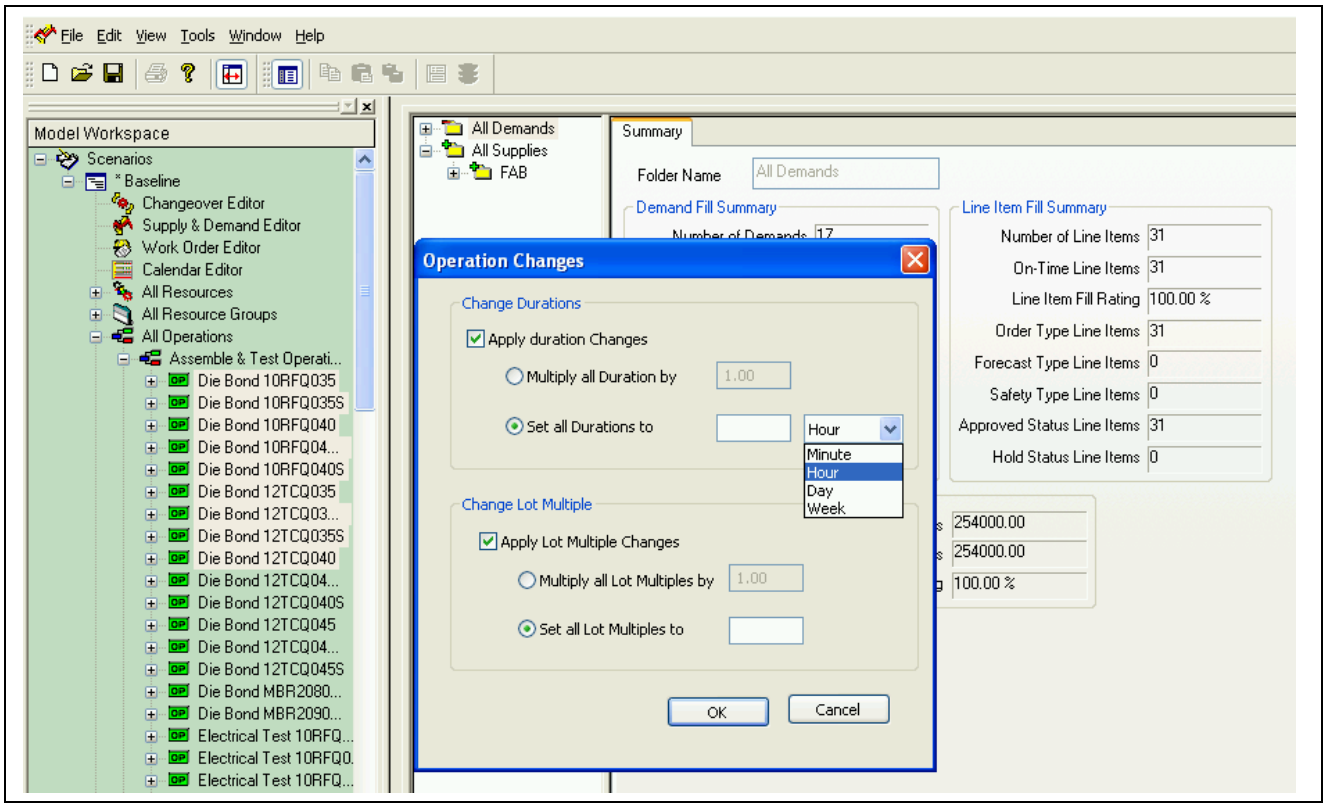
2. Right-click and choose Change from the menu.
3. To change operations durations, in the Operation Changes window, click the box beside Apply duration Changes.
4. To change operations lot multiples, in the Operation Changes window, click the box beside Apply Lot Multiple Changes.
5. Enter the new value in the field provided or choose an option from the drop-down menu.

   Note. An explanation of each field and its possible values is provided immediately following this procedure.

6. Click OK to save the changes and close the window.
7. To view the results of the changes, click on one of the modified operations.

Changing the Durations and Lot Multiples of Operations

Changes to multiple operations durations and lot multiples are made in the Operation Changes window, as shown in the screen below:



Multiple operations changes

The properties and the options that are available in the Operations Changes window are outlined below:

Deleting Multiple Operations

Access the Model Workspace.

To delete multiple operations:

1. Select the operations that you want to delete by holding down the Shift key and highlighting the appropriate operations or folders. If the operations or folders are not sequential in the list of demands, hold down the CTRL key and select the appropriate operations.
2. Right-click and select Delete from the menu.

Note. You can also multi-select operation shortcuts in the routing diagrams.

Campaign Run Optimization

In many production environments, operating certain machines continuously is more cost-efficient. For example, some machines have large changeover costs or long ramp-up times before they reach optimal efficiency. Such machines should be used to produce a certain quantity of one item before switching over to another. The process of running a machine dedicated to producing one item for an extended period of time is called Campaign Run Optimization.

Campaign Run Optimization minimizes changeover and setup costs, optimizes manufacturing cycles, and improves resource utilization. Models configured for repetitive manufacturing create production runs that satisfy demand over the production cycle.

Minimum cycle time represents the frequency at which items are typically manufactured. Minimum cycle time can be set to shift, day, or week, and should match the manufacturing pattern. For example, if items are manufactured on a daily basis, minimum cycle time should be set to day. If items are not typically produced more than once a week, the minimum cycle time should be set to week. EnterpriseOne Production Scheduling uses the cycle time to collect and aggregate demand when generating runs.

You can also specify an operation's minimum run length. EnterpriseOne Production Scheduling schedules continuous, consecutive operations until the specified minimum time or quantity has been met or exceeded.

Three operations (A, B and C) run on a single resource. In the first illustration, EnterpriseOne Production Scheduling uses the typical discrete approach to manufacturing, and schedules these operations in sequence. In the second example, the resource uses Campaign Run Optimization, and schedules all operation As, then all operation Bs, and then all operation Cs. This method minimizes changeover time and cost.

Only single-capacity duration machines can be optimized, and no more than one machine per routing can be optimized for repetitive manufacturing. If the machine is part of a resource set, then all machines within the set must be optimized for repetitive manufacturing.

Campaign Run Optimization is unavailable on resources that use upstream buffering.

Campaign Run Optimization requires separate licensing. This feature is only available if it has been enabled in the License Manager.

To use Campaign Run Optimization, you must do the following:

1. Configure your model to use Campaign Run Optimization
2. Set which resource should run continuously
3. Set the resource's minimum run length

Upstream Operation Buffering

In many production environments, certain resources are more cost-effective if they are run continually. For example, a glue gun might operate for only 20 minutes before the glue sets and must be reloaded. In this case, running the gun continuously until it is empty is most cost-effective.

You can buffer operations on a machine so that they don't start until the specified number of items are queued. The application attempts to buffer operations to build up ahead of downstream resources so that when they do run, the machine has a sufficient buildup (work in progress) to run continuously for a greater length of time.

CHAPTER 15

Defining Resources

This chapter lists common elements and discusses how to:

- Add resources
- Configure resource properties

Note. This chapter is required. You must complete the tasks discussed in this chapter to create production schedules.

Common Elements Used in This Chapter

Code Specify a name or a unique code for the resource.

Notes Specify any supplemental information about the resource. This field is optional.

Last Operation Run Optionally, you can specify the last operation run for this specific resource. This value is used to facilitate immediate changeovers, if required. This field requires the definition of an operation that uses this resource. This field is not required at the outset of an implementation, but it can be set after operations are defined. This field does not appear for suppliers.

Attached Document Attach a supporting document to this resource by specifying the filename of the document or browse to the appropriate directory.

Documents Base Folder Specify the preferred default directory where documents about this resource are stored.

Where Used This tab contains information about the work orders and operations that use the resource.

Adding Resources

This section discusses how to add resources.

Configuring Resource Properties

This section discusses how to:

- Define resource capacity

- Configure solver options for resources.
- Define resource availability
- Define resource costs
- Define resource constraints
- Define item specific attributes.
- Define resource groups

Defining Resource Capacity

Access the Resource Properties window. Select the Capacity tab.

To define resource capacity:

Single Select this option for single capacity resources.

Multiple Select this option for multi-capacity resources and specify the Maximum field.

Maximum Specify the maximum number of people in the crew (for crews) or the number of operations that can be run simultaneously (for machines, tools, and suppliers). If machines or tools are pooled together, the maximum capacity represents the combined amount for all machines. For crew, machines, and tools with no capacity constraints, enter an asterisk (*). When the system performs the solve, it relaxes all constraints from this resource.

Offload Threshold % Specify the percentage of capacity above which EnterpriseOne Production Scheduling offloads production to alternate resources in the set.

Dynamic Capacity Select this option for multi-capacity resources with a varying capacity level. Complete the Date and Value fields.

Date Specify the date when the capacity changes.

Value Specify the revised maximum capacity. The value must be less than or equal to the Maximum Capacity value. Click Update to revise the capacity or Delete to delete a capacity entry.

Prebuild Target Specifies the amount of time prior to the point in time that the resource is required to fulfill the demand on time. The prebuild target is used to check utilization when making off-loading decisions. You must specify a prebuild target value if this option is selected.

Values are:

- Minutes
- Hours
- Shifts
- Days
- Weeks

Configuring Solver Options for Resources

Access the Resource Properties window. Select the Solver Options tab.

To configure solver options for resources:

Minimize Changeovers Select this option if changeover minimization is important for this machine, and if this machine is not considred a campaign run optimized resource. Otherwise, select minimize work in progress.

Use Prebuild Maximum This option is available only if you have selected Minimize Changeovers. When meeting a demand, prebuild maximimum is the amount of time prior to the point in time that the resource is required to fulfill the demand that the solver will look to minimize changeovers on this resource. For example, if you specify seven days, the solver will consider the operations that are running th that resource for the past seven days when minimizing changeovers.

Minimize Work In Progress Select this option if changeover minimization or campaign run optimization is not required for this resource. The solver will still consider changeovers if specified, but the changeovers will not be considered by the changeover minimization algorithm.

Campaign Run Optimization Select this option to configure this resource to operate in defined run lengths. This option is only available for single-capacity resources, and the Enable Campaign Run Optimization option must be selected in the Model Properties window. Campaign Run Optimization requires a separate license.

See Chapter 11: Campaign Run Optimization

Use Prebuild Target Use this option to specify a length of time prior to the point when a resource is required to fulfill the demand on time.

Use Upstream Operation Buffering In some manufacturing environments, it may be desirable that a resource continues to run for as long as possible. This behavior may be dictated by a physical property of the device, such as a clean-out or purging that must occur after the resource has stopped running for some period of time. OracleProduction Scheduling strives to create a highly optimized schedule, meeting demands as closely as possible to their reqauest dates in order to avoid unnecessary inventory buildup and carry costs. In the scenario described here the physical attribute of the resource dictates that the solver should also consider placing operations in order to keep the resource running continuously.

See Buffer Planning

Target Buffer Size This option is set to represent the desired minimum amount of operations that the chosen resource should strive to run continuously before starting. This option is used in conjunction with the Upstream Operation Buffering option.

Relax Calendar and Capacity Constraints Select this option to relax all constraints on this resource including any capacity and calendar associated with this resource.

Capacity Constrained Resource Select this option to designate this resource as a capacity constrained resource. You must select the Use Theory of Constraints Principles option in the Model or in a schedule before you use this option.

Minimize Resource Idle Time when using Prebuild Select this option to minimize idle time.

When using Prebuild as a scheduling strategy, sometimes the sequence of operations to fulfill demands results in idle time on a resource. Conversely, the best sequence of operations to minimize idle time may not necessarily fulfill demands on time.

Defining Resource Availability

Access the Resource Properties window. Select the Availability tab.

To define resource availability:

Calendar Select an applicable calendar. If no suitable calendar entries appear, click Open Calendar, and create an appropriate calendar for this resource.

Fixed Timefence For suppliers, enter the fixed amount of time beginning at the start of the scheduling horizon that precedes any supplier lead time. For all other resources, enter the time period during which the schedule is to remain fixed for this resource.

Note. When the schedule is modified and solved again, the operations that are assigned to this resource remain the same as the last schedule during the fixed timefence period.

Defining Resource Costs

Access the Resource Properties window. Select the Costs tab.

To define resource costs:

Setup Specify a fixed cost that is incurred each time that the resource is used. This cost applies to crews, machines, and tools only.

Operating Specify a cost that is incurred over time for the duration that the resource is used. This cost applies to crews, machines, and tools only.

Carrying Specify the unit cost of carrying this item for the period. This cost applies to items only.

Stock-out Specify the unit cost that is associated with running out of stock for this item during the period. This cost applies to items only.

Safety Stock Violation Specify the cost that is associated with violating the safety stock. This cost applies to items only.

Defining Resource Constraints

Access the Resource Properties window. Select the Constraints tab.

To define resource constraints:

Minimum For items only, specify the minimum amount of this item to be carried in inventory. If the minimum amount of this item is going to be violated while solving the schedule, the system tries to delay the operation as long as possible to allow replenishment. If restocking does not happen, then the solve fails, generating an error message. For shared storage spaces, specify the minimum amount of stock that can be stored. If the quantity of stock stored in this field is less than the minimum, EnterpriseOne Production Scheduling generates an error message and stops scheduling.

Maximum For items only, specify the maximum amount of this part to be carried in inventory. If the item is exceeded, an error is generated, and the solve is discontinued. For shared storage spaces, enter the maximum amount of stock

that can be stored. If the quantity of stored stock becomes greater than the maximum, EnterpriseOne Production Scheduling generates an error message and stops scheduling. When configuring a storage space, it must have capacity to store the initial inventories for all of the items allocated to it; otherwise an error message is generated.

Relax Minimum and Maximum Constraints Select this option to ignore minimum and maximum constraint values for this resource during a solve.

Start Level Specify the amount of inventory at the start of production.

Precision Specify the number of decimal places. For example, the number 5.125 has three decimal places so the precision is three. Setting a precision value is required when items are not measured using whole numbers (for example, by weight).

Storage Space Select a storage space location. An item can be assigned to only one shared storage space. The assigned storage space must have the capacity to store the initial inventories for all items allocated to it; otherwise an error message is generated.

Storage Factor Specify a value that represents how much of one storage unit of space (for example, a pallet, cubic meters, or other unit of measure) is used for one unit of item. For instance, if a pallet can store 100 units of this item, then the factor is .01. Therefore, if the maximum storage for this space is 40, then up to 4,000 items can be stored.

Date Specify the starting date for the safety level using the small arrows or the calendar. If you want to always have a safety level, set this date to the beginning of your schedule horizon.

Value Specify the item quantity (a number less than the number in the Maximum field) represents safety stock. You can input varying safety levels (for example, to account for seasonal variations) if required. Click the Update button. The system displays the entry in the Date Value field. You can input multiple entries. The system uses the first safety stock entry until the next entered date. The system displays each entry in the Date Value field, sorted in date order.

Note. Setting a precision value is required if the items stored here have a storage factor that is less than 1. In this case, the portion of a single storage space that is used by an item is represented using decimals.

Defining Item Specific Attributes

Access the Resource Properties window. Select the Attributes tab.

To define item specific attributes:

Manufactured Select this option if the item is manufactured.

Purchased Select this option if the item is purchased.

Saleable Select this option if the item can be sold through a demand order.

Receiving Calendar Select a receiving calendar for this item. If no suitable calendar entries appear, click Open Calendar editor, and create an appropriate receiving calendar for this item.

Supplier	Select a supplier to associate with this item if it is a purchased item. Suppliers must be defined as a resource in the model before they appear in this list.
Preference	Assign a supplier preference to this supplier. This value must be a positive integer 1 or greater. This value is used in the event that multiple suppliers can supply the same item.
Lead Time	Specify the lead time necessary to supply the purchased item.
Order Multiple	Specify the standard order multiple for the purchased item. For example, items must be purchased in batches of 1,000 units.
Unit Cost	Specify the total cost per purchased item ordered.
Buffer	Select a buffer value for the supplier. This value represents the time between the supply event and the start of the operation that uses the item. This value is used when EnterpriseOne Production Scheduling calculates purchase order arrive dates. You must create a buffer before you can select it from this drop-down list box.

Defining Resource Groups

Access the Resource Group Properties window.

To define resource groups:

1. Specify a new name for the group in the Code field.
2. Select the Attributes tab.
3. In the Used in Views section, select the schedule views for which this resource group will be available. For groups that consist of only machines or tools, you can also select the Changeover editor.
4. Click Apply, and then click OK.
5. Click the plus sign (+) beside All Resources and each folder to display all resources.
6. Drag and drop one or more resources into the new group.

   You can also add the same resource to different groups. Press Shift or Ctrl to make multiple selections.

CHAPTER 16

Defining Operations

This chapter lists common elements and discusses how to:

- Create operations
- Configure operations
- Define resource requirements
- Create operation sets

Note. The tasks discussed in this chapter must be completed to create production schedules.

Common Elements Used in This Chapter

Code	A name or a unique code for the operation.
Notes	Supplemental information about the operation. This field is optional.
Attached Document	A supporting document for this operation. This field is optional.
Documents Base Folder	Specify the preferred default directory where documents about this operation are stored.
Where Used	This tab contains information about the work orders and routings that use this operation. Routings must be defined before information appears on this tab.

Creating Operations

This section discusses how to:

- Create an operation diagram.
- Designate a primary output.

Creating an Operation Diagram

Access the Model Workspace.

To create an operation diagram:

1. Double-click an operation.
2. Select the operation button with the operation name appears in a window.

3. Under your Model, click the plus sign (+) beside All Resources to expand all of the relevant folders.
4. Click a resource to be added, and drag it into the Object Window.

   Repeat for each resource.

   You can optionally import a graphic to replace the default button by selecting Image from the Resources toolbar and selecting a .bmp, .dib, .ico, or .emf file.
5. From the Resource toolbar, click the Insert Link button.
6. In the operation diagram, click the source button once (produced resource), and then click the destination button (consumed resource).
7. arrow appears between the source and the destination with an empty square box in the middle of the line (the resource relationship). When a resource is linked to an operation, the property page for the created arc appears.
8. Specify the following link properties, and then click OK:

Capacity Required	Specify the capacity required to run this operation, or accept the default value of 1.
Lot Multiple	Select this option if the resource uses a lot multiple. A default lot multiple value of 1 is displayed. If you need a larger lot multiple, specify a different value. The value in this field is applicable only if the operation produces an item.
Duration	Select this option if the resource is determining the duration. If you select this option, select a time unit for the duration. The time unit can be days, hours, minutes, or seconds.
Quantity	Select this option to specify the size of the production run in terms of quantity of items produced. The value in this field is applicable only if you are using Campaign Run Optimization.
Run Time	Specify this option to specify the size of the production run in terms of run time. The value in this field is applicable only if you are using Campaign Run Optimization.

9. Repeat the previous step to link all of the resources with the operation.

Note. To have the arrow point in the correct direction, always begin with the source button and end with the destination button. The operation is usually the destination button with one exception: if any items are being produced, then the operation is the source, and the new item button is the destination.

Designating Primary Output

Access the Operation Diagram.

To designate primary output:

1. Click the item that you want to designate as the primary output of the operation.
2. Select Primary Output.

Configuring Operations

This section discusses how to:

- Define operation costs
- Define effective dates
- Modify resource information

Defining Operation Costs

Access the Properties window. Select the Attributes tab.

To define operation costs:

Setup Specify the one-time cost that is incurred every time that this operation is run (if applicable).

Operating Specify the cost of running this operation for a specific period of time.

Defining Effective Dates

Access the Properties window. Select the Attributes tab.

To define effective dates:

Effective Dates Select this option to define effective dates for this operation.

Valid from Specify the date when the operation becomes valid. The default value for this field is the beginning of the schedule horizon.

Valid to Specify the date when the operation ceases to be valid. The default value for this field is the end of the schedule horizon.

Modifying Resource Information

Access the Properties window. Select the Resources tab.

To modify resource information

1. Double-click the resource.
2. Modify the appropriate resource values.
3. Click Apply, and then click OK.

Defining Resource Requirements

This section discusses how to:

- Define item requirements
- Define requirements for crews, tools, and machines.

- Define requirements for item sets and resource sets.

Defining Item Requirements

Access the Link Properties window.

To define item requirements:

Quantity Specify the number of item units that are produced or consumed by one instance of this operation.

Precision This value is inherited from the item's property information.

Defining Requirements for Crews, Tools, and Machines

Access the Link Properties window.

To define requirements for crews, tools and machines:

Capacity Required Specify the capacity required to run this operation, or accept the default value of 1.

Lot Multiple Select this option if the resource uses a lot multiple. The system displays a default lot multiple value of 1. If you need a larger lot multiple, specify a different value. The value in this field is only applicable if the operation produces an item.

Duration Select this option if the resource is determining the duration. If you select this option, select a time unit for the duration. The time unit can be days, hours, minutes, or seconds.

Defining Requirements for Item Sets and Resource Sets

Access the Link Properties window.

To define requirements for item sets and resource sets:

Preference Specify a value for ranking resource use within a set. You can have preferences ranging from 1 to 100, with 1 being the highest. For example, a crew with a preference of 1 is chosen before one with a preference of 2. Two or more resources can have the same preferences. EnterpriseOne Production Scheduling determines which resource to use, based on availability.

Quantity Specify the number of item units that are produced or consumed by one instance of this operation.

Creating Sets

This section discusses how to:

- Create item and resource sets.
- Create operation sets

Creating Item and Resource Sets

Access the Operation Diagram window.

To create item and resource sets:

1. Select one of the following options:
   - On the Resource toolbar, click Insert Resource Set to create a resource set.
   - On the Resource toolbar, click Insert Item Set to create an item set.
2. Click an open area of the operation diagram.
3. process creates an empty set. The set button appears in the operation diagram.
4. On the Resource toolbar, click Insert Link.
5. In the operation diagram, click the set button, and then click the operation button (in the source-to-destination order).

   The set is now linked to the operation, as indicated by a connector line with an arrow pointing to the set.

   Note. To return the cursor to a pointer at any time, right-click your mouse.

6. If resources in the set require the Lot multiple or Duration property, you must define this property in the set to which they are connected.

   To set a lot multiple or duration:

7. Right-click the Resource Set, and then select Properties.
8. Select the Attributes tab.
9. For resources with a lot multiple, select the Lot multiple option.
10. For resources with duration, select the Duration option.

    When either the Lot multiple or Duration option is selected, this property becomes available to any resource that is attached to the set.

11. On the Model Workspace, drag and drop any crew, item, machine, tool, or supplier resources into the diagram according to the following rules:
    - For item sets, drag only item resources.
    - For resource sets, drag crew, machine, tool, or supplier resources.
12. On the Resources toolbar, click the Insert Link button.
13. In the operation diagram, click a resource, and then click its set button.
14. Right-click anywhere in the operation diagram to return the cursor to a pointer.
15. To define the properties of resources that are attached to the set, do the following:
16. Right-click the link between the set and resource button, and select Properties.
17. In the Preference field, enter a value between 1 and 100 to indicate the priority that you want assigned to this resource.

    The solver selects the resource with the lowest priority, if possible.

18. In the Capacity Required field, enter the number of that resource that is required to perform the operation.

    Note. The Lot multiple and Duration options only appear if they have been enabled in the Resource Set.

19. In the Lot multiple field, enter a value to scale item quantities for the operation.
20. In the Duration field, enter how long the operation runs.

Creating Operation Sets

Access the Model Workspace.

To create an operation set:

1. Right-click an operation folder and select New Operation Set.
2. Right-click the new operation set and select Rename.
3. Specify a new name for the operation set.
4. Double-click the operation set to open the Operation Diagram window.
5. On the Model Workspace, drag and drop any operation into the diagram.

   The new operation is automatically linked to the operation set.

CHAPTER 17

Understanding Theory of Constraints Solution Components

This chapter describes the following concepts:

- Buffer planning
- Buffer validation rules
- Web dispatch list

Buffer Planning

This section provides an overview of the following concepts:

- Theory of Constraints
- Drum Buffer Rope
- Shipping buffers
- Capacity Constrained Resource buffers
- Assembly buffers
- Supplier buffers

Theory of Constraints

EnterpriseOne Production Scheduling incorporates advanced functionality based on Theory of Constraints principles that have been adopted by leading manufacturers. The following sections provide details about how Theory of Constraints principles are used when creating production schedules.

Drum Buffer Rope

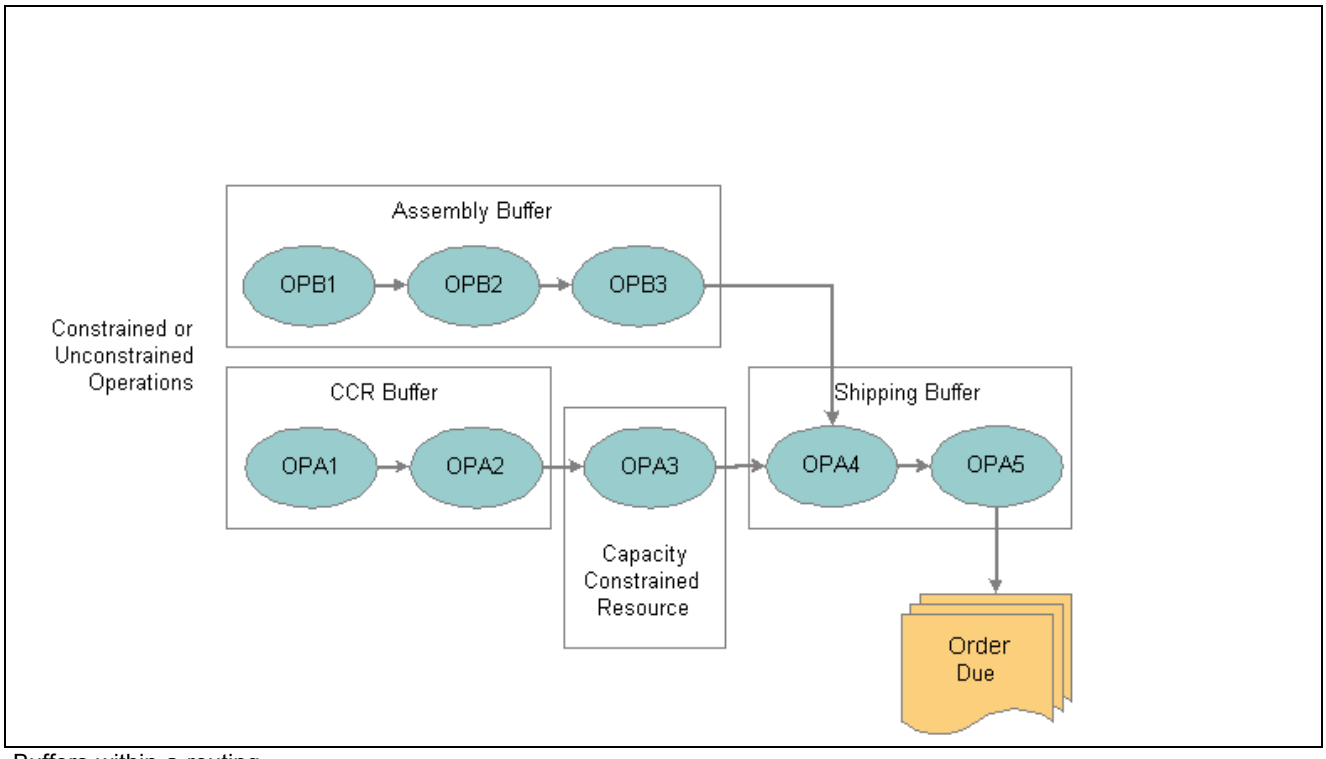
The Drum-Buffer-Rope (DBR) methodology is a Theory of Constraints principle that is designed to balance the flow of semi-finished assemblies or work in progress items through the production cycle. In order to achieve this balance, production is synchronized with the capacity constrained resource (CCR), a resource that is considered to be the "weakest link" in the production process. The DBR methodology is based on the principle that production in a supply chain is limited to the resource or resources with capacity constraints.

EnterpriseOne Production Scheduling incorporates Drum Buffer Rope (DBR) methodology through Buffer Planning functionality. The DBR methodology is designed to balance the flow of materials or work in progress items across the production cycle. In order to achieve this balance, production is synchronized with the capacity constrained resource (CCR) that is considered to be the "weakest link" in the production process. The DBR methodology is based on the principle that production in a supply chain is limited to the throughput on the resource or resources with capacity constraints.

The drum represents the production rate of the CCR. All production in the supply chain is determined by the rhythm of the drum. The rope ensures that materials are not inserted into the operation with the CCR at a faster rate than the CCR can process. Shipping, CCR, assembly, and supplier buffers allow you to build protection mechanisms within your production schedule to combat production variability.

You can use buffers in your model that help you manage the schedule variability that can occur in a manufacturing environment that depends on one or more CCRs. When you define buffers in your model, you specify a target buffer value and a minimum buffer value. The solver target buffer value is a soft constraint. The minimum buffer value is a hard resource constraint that can override the target buffer value and cause a delay in the schedule for a demand item in situations where there is insufficient resource capacity to produce a demand item on time. For all buffer types, the buffer value must be greater than or equal to the sum of the durations in the routing and minimum separation times between operations. Although you can create multiple buffers in a linear routing, only one buffer can exist between a pair of operations within the routing.

This diagram illustrates the use of buffers in a routing:



Buffers within a routing

Shipping Buffers

In a lean manufacturing environment that recognizes Theory of Constraints principles, a shipping buffer can be used to estimate the time between the point where an item is processed by a CCR and the point where the item is shipped. The purpose of the shipping buffer is to protect the shipping due date from downstream variability in the supply chain.

It is necessary to define a CCR in a routing for the solver to respect a shipping buffer. In certain scenarios where two operation paths combine to make a routing, the solver calculates the shipping buffer by identifying the path with the shortest duration between the primary operation and the CCR operation. The solver subtracts the shortest duration from the target and minimum buffer sizes and uses this value as the true buffer value.

Capacity Constrained Resource Buffers

Capacity constrained resource buffers (CCR buffers) are intervals of time that precede a CCR in a routing. CCR buffers are used to protect the schedule from variability caused by operations that are downstream from the CCR.

You can incorporate CCR buffers into your model in order to avoid CCR overload and CCR starvation. CCR overload occurs when work in progress items accumulate at the CCR due to a rate of material insertion that exceeds the CCR capacity. CCR starvation occurs when a CCR becomes idle due to lack of work in progress items caused by an upstream disruption in the manufacturing process. CCR starvation is often caused by a rate of material insertion that is sufficiently lower than the CCR capacity, causing the CCR to be "starved" for work.

Within a routing, operations that use a CCR are known as CCR operations. CCR buffers must be defined for CCR operations. In a linear routing, you can define as many CCR buffers as you require to effectively model bottlenecks in your manufacturing process. You must have one or multiple CCRs defined in your model before you begin assigning CCR buffers. Each resource that is designated as a CCR appears highlighted with a red border in the routing diagram.

Assembly Buffers

Assembly buffers are an extension of shipping buffers that you can use in a model to protect a schedule from variability that may be incurred when a non constrained item is combined with an item that is processed by a CCR. Assembly buffers specify the amount of lead time from the release of materials to an operation that involves assembling a non-CCR processed item with an item processed by a CCR.

The solver will respect assembly buffers that are appropriately defined in the model. The solver will not respect assembly buffer values in the following cases:

- The beginning or terminating operation used to define the buffer value is a CCR operation.
- A CCR operation exists between the beginning or terminating operation used to define the buffer value.

Supplier Buffers

You can define a supplier buffer for each item that is procured from a supplier. Supplier buffers are used by EnterpriseOne Production Scheduling to calculate arrival dates for purchase orders. You can create a supplier buffer to represent a period of time between the supply event (when the item is received from the supplier) to the beginning of the operation that uses the supplied item.

Supplier buffers represent a period of time between the supply event for an item and the beginning of the operation that uses the item. The supplier buffer enables you to build in a buffer to accommodate time between the arrival of the item from the supplier and the use of the item in an operation. Operations involving items with a supplier buffer will begin at the end of the supplier buffer. To use the supplier buffer functionality, the Theory of Constraints must be enabled for the model or for a specific schedule.

A supplier buffer is not an extension of the lead time required to supply the item. You can specify a target buffer value and a minimum buffer value when you define supplier buffers in your model. When you define supplier buffers, the following guidelines must be observed:

- The minimum buffer value must be greater than or equal to the lead time of the purchased item.

- The target buffer value must be greater than or equal to the combined values of the minimum buffer and the lead time between the estimated ship date and the arrival date of the purchased item.

Buffer Validation Rules

EnterpriseOne Production Scheduling has built in buffer validation rules that govern buffer behavior during a solve. You should observe the following buffer validation rules while you create buffers in a routing:

- Within a resource set, if a CCR is defined, every resource in the set must be defined as a CCR.
- The minimum buffer value must be less than the target buffer value.
- A negative buffer value is not allowed.
- The buffer value in a routing must be greater than the sum of the durations and separation times between connected operations.
- Buffers can not be defined in reverse in a routing.
- A maximum of one buffer is allowed per relationship.
- The solver will ignore buffers in any CCR constrained routing that does not have buffers defined in the routing or associated to the routing.
- All operations using a specific CCR should have a CCR buffer defined.

Defining Buffer Attributes

Access the Buffer Properties window. Select the Attributes tab.

To define buffer attributes:

Target Buffer Size Specify a target buffer value. You can specify a period of time in seconds, minutes, hours, and days. The value can include one decimal point. This value is a soft constraint.

Minimum Buffer Size Specify a minimum buffer value. You can specify a period of time in seconds, minutes, hours, and days. The value can include one decimal point. This value is a hard constraint.

Assigning Buffers to Routings

Access the Routing Properties window. Select the Attributes tab.

To assign buffers to routings:

1. Select a predefined buffer from the available options in the list box.
2. Click Apply, and then click OK.

Assigning Buffers in Routing Diagrams

Access the Routing Diagram window.

To assign buffers in routing diagrams:

1. Click the Buffer Link button on the toolbar.
2. In the operation diagram, click an operation to select the operation.
3. To create a buffer between two operations, click the first operation, and then click the second operation in the operation diagram.
4. In the Buffer Properties dialog box, select a predefined buffer from the available options in the Buffer list box.
5. Click OK.

Web Dispatch List

This section describes:

- Publishing options
- Index page
- Resource details page

Publishing Options

EnterpriseOne Production Scheduling enables you to send production schedule data to the production line using the web dispatch list. The web dispatch list eliminates the need to create custom reports and distribute them manually. Any production schedule that has been generated can be dispatched to a specific directory and posted online. Production personnel can access the web dispatch list to determine which scheduled operations are in the queue for a specific date range.

When you publish the web dispatch list, you specify a start date and a publishing horizon. The start date is the first day that you want to publish scheduled operations for resources in your supply chain. The publishing horizon is the length of the web dispatch list in days. The publishing horizon determines the size of the web dispatch list, according to your requirements. You can select publishing options to specify what data should be published in the web dispatch list. The following publishing options determine the level of data that is published on the resource details page:

Publishing Option	Data Published
Operation Description	A description of the operation that runs on the specific resource.
Start Time	The operation start time from the data model.
End Time	The operation end time from the data model.
Item	The item that is produced using this specific operation.

Publishing Option	Data Published
Item Description	A description of the item that is produced using this specific operation.
Quantity	The quantity of the item produced by this specific operation.
Work Order Number	Pegged work orders for this specific operation, indicating the work order that requires this operation.
Demand Number	Pegged demands for this specific operation, indicating customer demands that require this operation.
Demand Due Date	The due date for the customer demand.
Customer Name	The name of the customer who is requesting the item produced by this operation.
Customer Number	The customer code for the customer who is requesting the item produced by this operation.

Index Page

After the production schedule data has been published to the web dispatch list, the index page displays scheduled resources that are required for the current day. The dispatch list contains each resource that is required for the current schedule and a description of each resource. Resources are organized by the resource categories that are defined in the data model.

The index page is dynamically generated when you publish the web dispatch list in the desktop. You can define the location of the index page when you configure system options during initial system configuration. You must publish the dispatch list for each schedule that you generate or after you make manual scheduling changes and re-solve the schedule.

Resource Details Page

From the index page, scheduled resources can be selected in order to view detailed duration, item, quantity, pegging, and customer data for each operation that runs on that specific resource. Using this information, your production personnel can view an accurate schedule of production activities for a specific scheduling horizon, enabling them to meet the scheduled demands more efficiently.

CHAPTER 18

EnterpriseOne Production Scheduling Routings

This chapter discusses:

- Routing basics
- Routing diagrams
- Precedence relationships
- Separation times

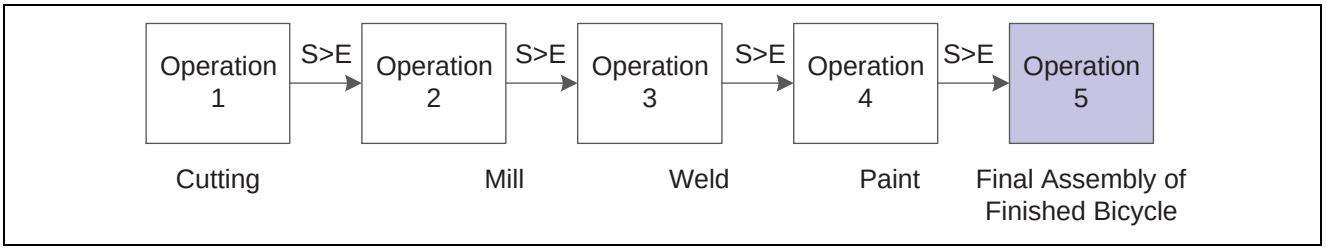
An Overview of Routings

A routing is a sequence of operations that are linked together to represent the production of an item. . Instead of each product being composed of many different variables that reside in inventory when complete, this approach provides you with a top-down overview of the process. To minimize inventory, when an order for a finished good is received, a routing or series of routings is scheduled to produce all of the items that are required.

Example of a Basic Routing

In this example, a bicycle is manufactured. To complete the bike, several processes must occur, among them: cutting the pieces for the frame, milling the pieces, welding the frame together, painting the bike frame, and final assembly. It is also important that some operations are completed before the next operation can start, that is, Starts After End.

The basic process is shown in the following diagram:



Basic routing of producing a bicycle

In the last operation, you can select to produce a subassembly product, which would then be recorded in inventory and may be consumed by a sales order or by another operation.

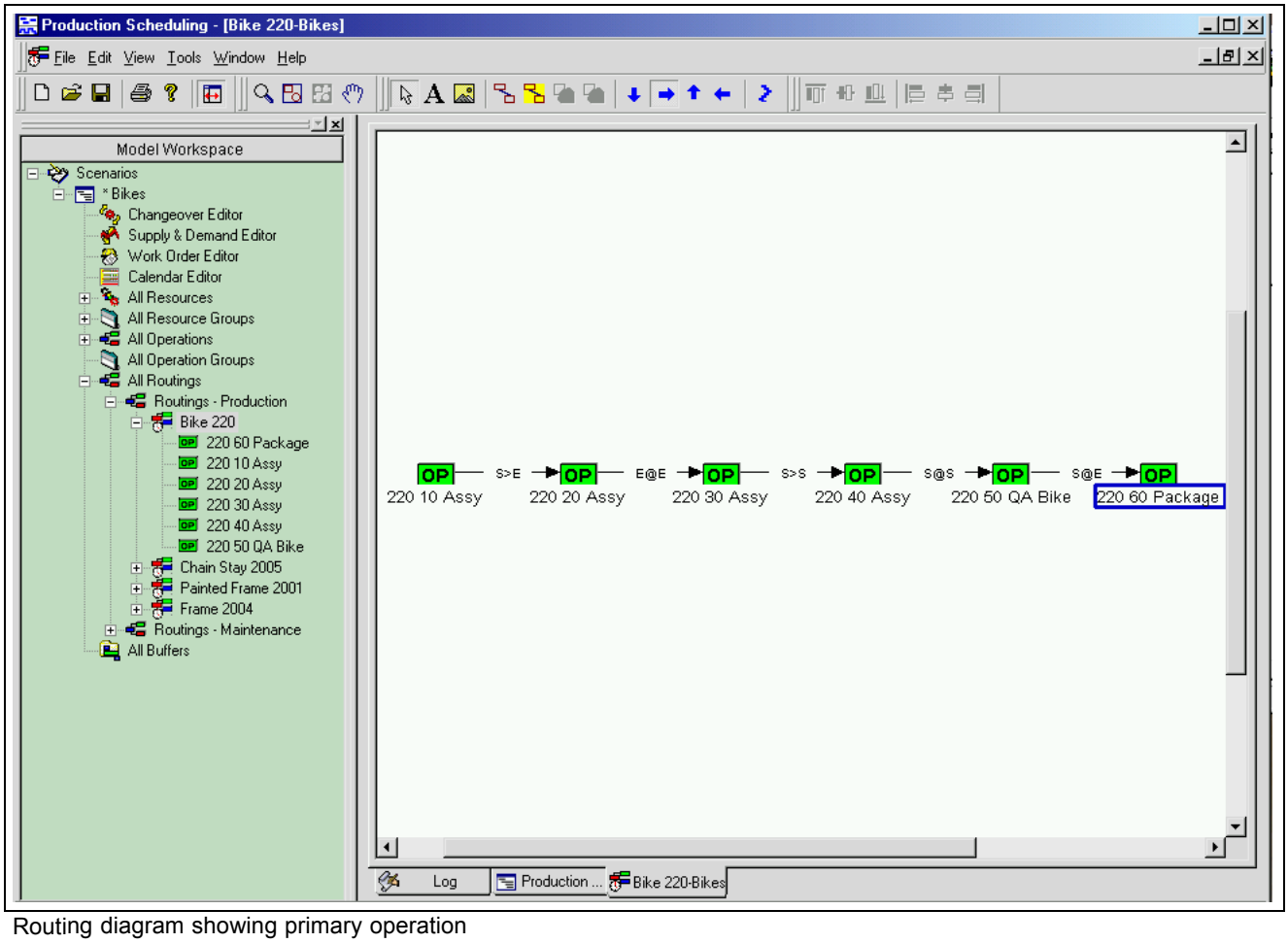
Routing Diagrams

The routing diagram is a graphic representation of the relationships between the operations that make up a routing. Like operations, routings can be organized in folders, if desired. Routings can be oriented in a number of directions for optimal presentation by applying the layout algorithm when you are working in the diagrams.

Within a routing, one operation can be designated as the primary operation. This information is important if you are planning to use the pegging capabilities of EnterpriseOne Production Scheduling. If you do not select a primary operation in a routing, then you cannot peg "upstream" from the final operation in the routing.

Pegging data is essential for several areas of the application, including various Gantt views, and Key Performance Indicators. To properly generate pegging data, you need to set primary operations in routings and primary output items in operations. The primary operation should be defined as the operation that produces either a subassembly item or the finished product.

The system uses a blue indicator to indicate primary operations in operation diagrams and output items in routing diagrams. You can right-click the operation or item in a diagram and deselect the primary operation option. The screen below shows a routing with the last operation designated as the primary operation:



Routing diagram showing primary operation

Designating Primary Operations

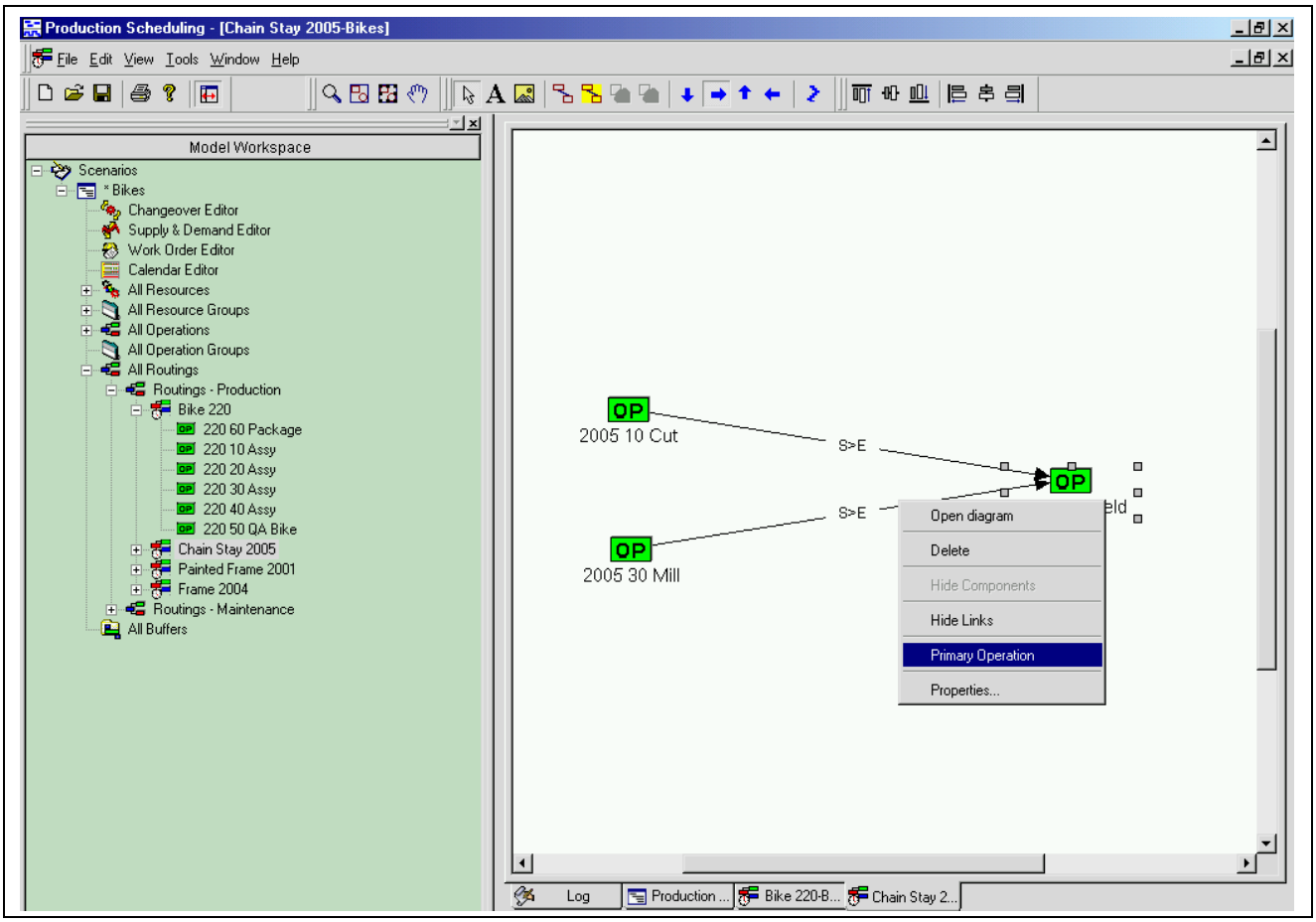
Access the Routing Diagram window.

To designate primary operations:

1. Right-click the operation that you want to designate.
2. Select Primary Operation.

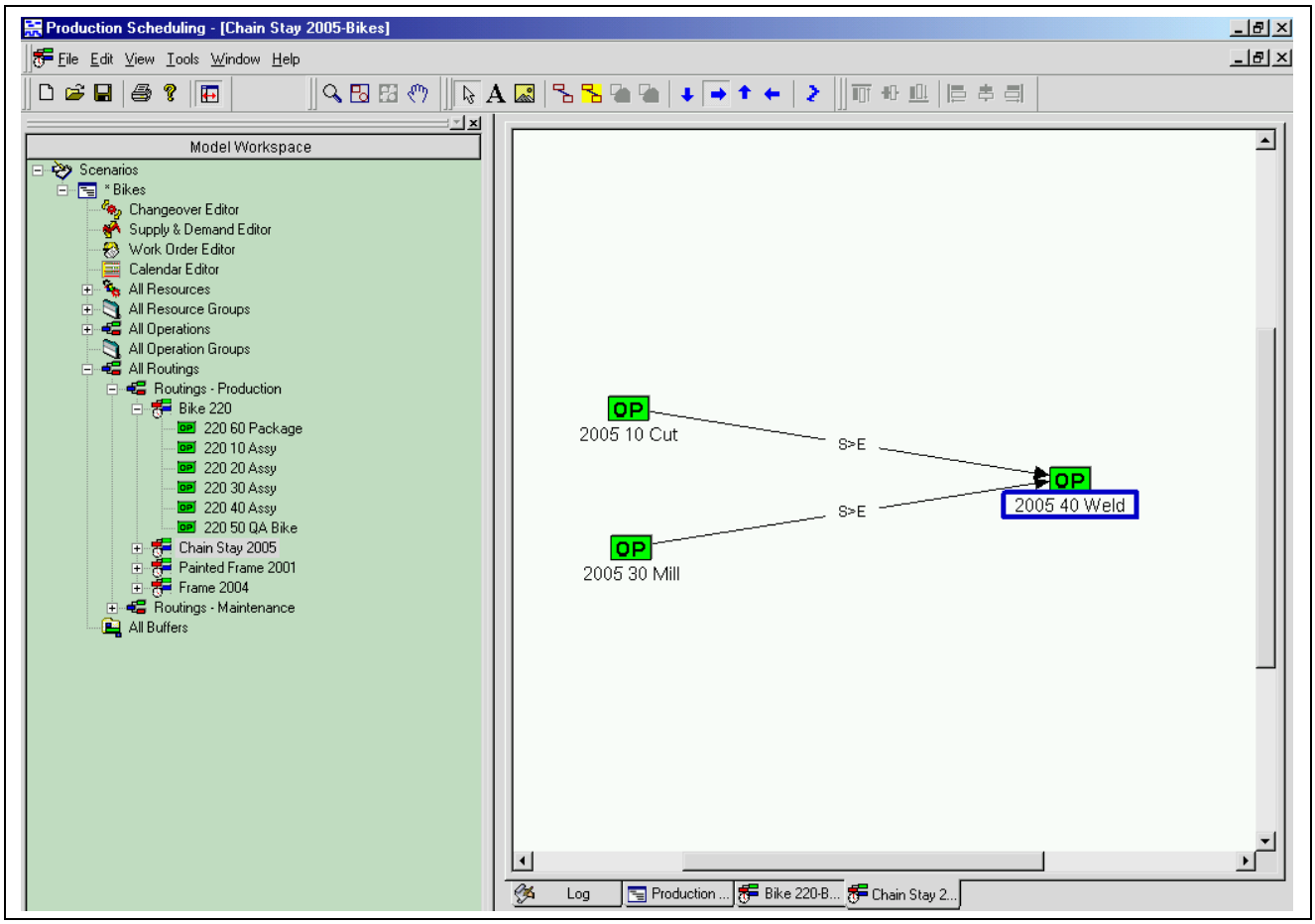
   The operation now appears with a heavy blue border around its name.

The following diagrams shows the drop down menu, which lets you assign a primary operation.



Designating a primary operation

The following diagram shows an operation, which has been designated as the primary operation:



Designated primary operations, emphasized with a blue box

Precedence Relationships

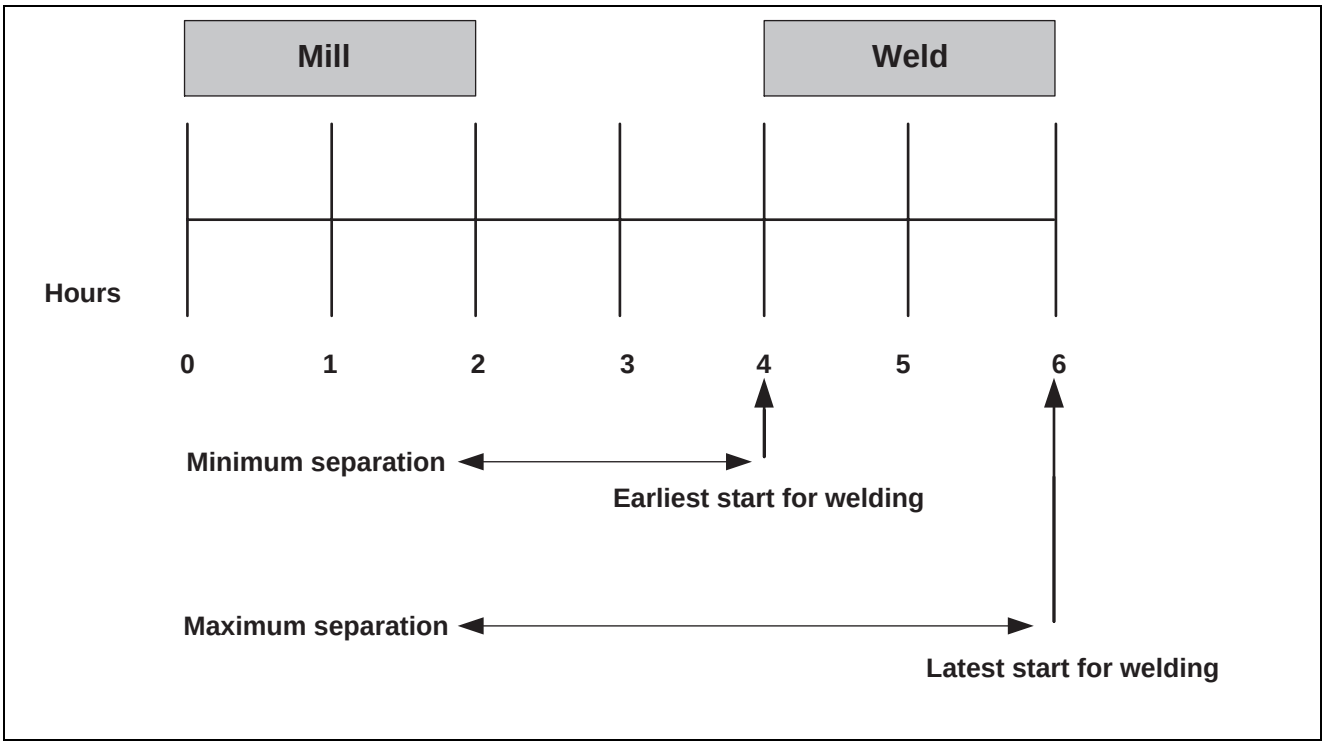
The relationships between the various operations in a routing are specified by the links between operations. These are called precedence relationships, and refer to the relationships and time between operations.

You can specify whether the relationship between two operations is sequential or overlapping. In addition, the amount of time required to move, queue, and set up the next operation is recorded as the minimum separation between the two operations. You can also specify a maximum separation, if required.

In the bike example, if a bike frame must be cut before it is milled, then the relationship of the weld operation to the mill operation is that milling must start after the cutting has finished. The corresponding precedence constraint properties, resulting from a right-click on the box in the connecting line, indicate that the Mill operation is a Starts After End type of constraint. This type of constraint allows for separation times, which, in this example, are a two-hour minimum separation and a four-hour maximum separation.

Using the diagram below as an additional example, assume that the weld operation starts after the two-hour mill operation has finished and the parts have been cooled for another two hours and the welding must start after a maximum of four hours. This dictates that the weld operation must start after two hours of the end of the mill operation.

This illustration represents the precedence relationship:

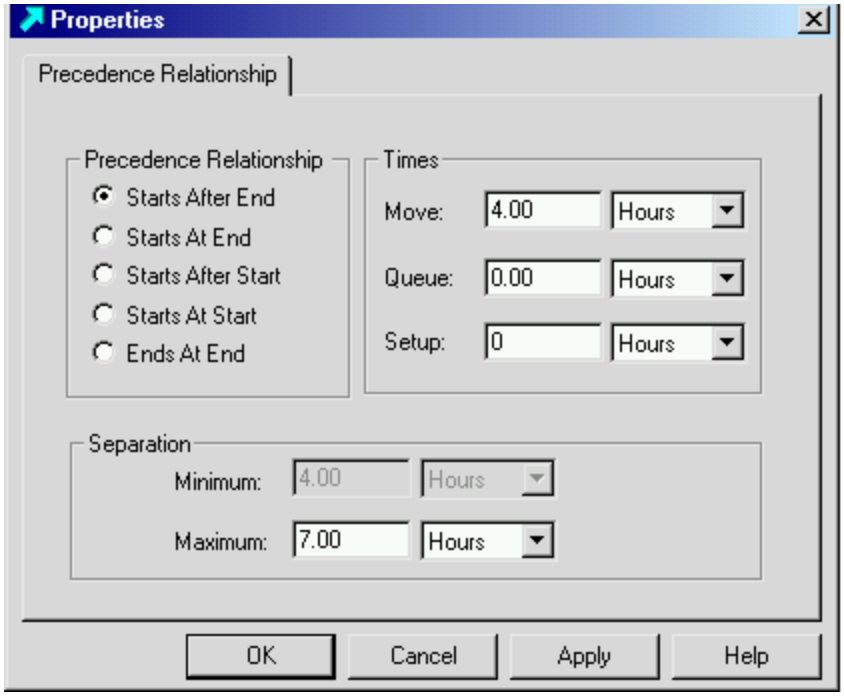


A typical precedence relationship

EnterpriseOne Production Scheduling supports the following precedence relationships:

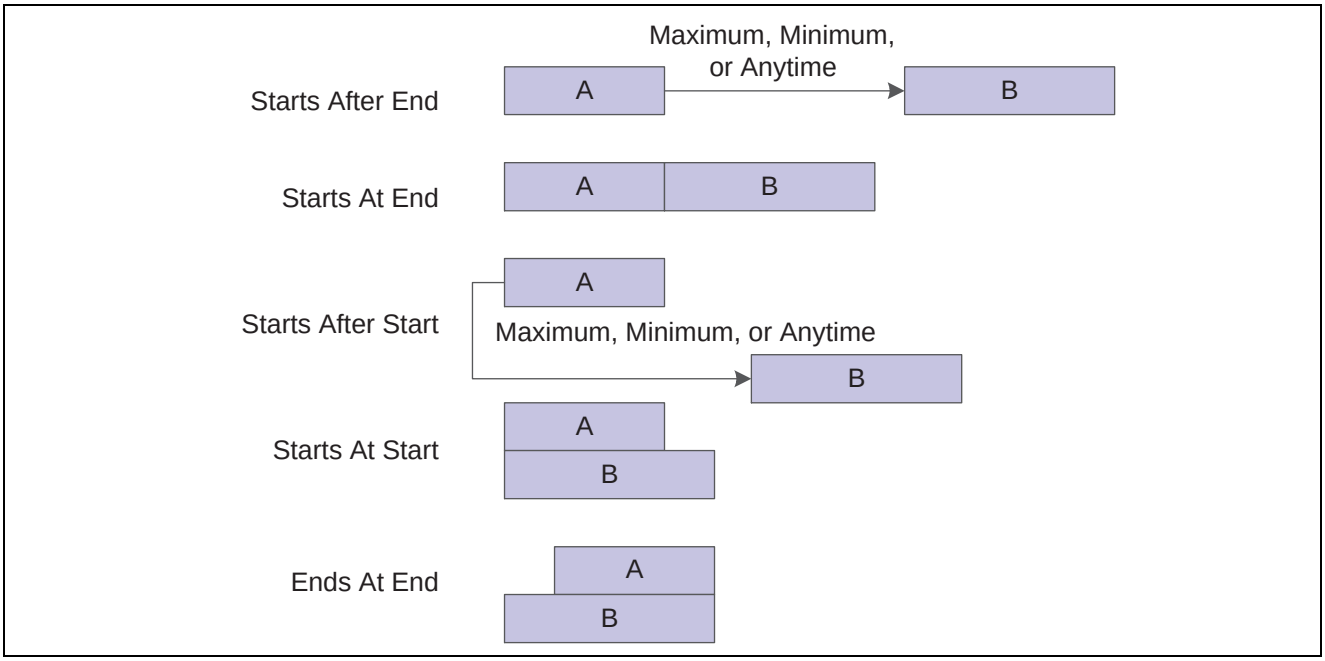
Name	Diagram Label	Description
Starts After End	S>E	One operation starts after the end of the previous operation, according to the time intervals displayed in the Minimum and Maximum separation fields.
Starts At End	S@E	One operation starts at the exact end of the previous operation.
Starts After Start	S>S	One operation starts after the start of the previous operation, according to the time intervals displayed in the Minimum and Maximum separation fields.
Starts At Start	S@S	One operation starts at the same time as the other operation.
Ends At End	E@E	One operation ends at the same time as the end of the other operation.
Minimum or Maximum	+	When S>S or S>E, indicates that the precedence relationship has a minimum or maximum separation

The following screen shows the property sheet for a routing link in which you set precedence relationships:



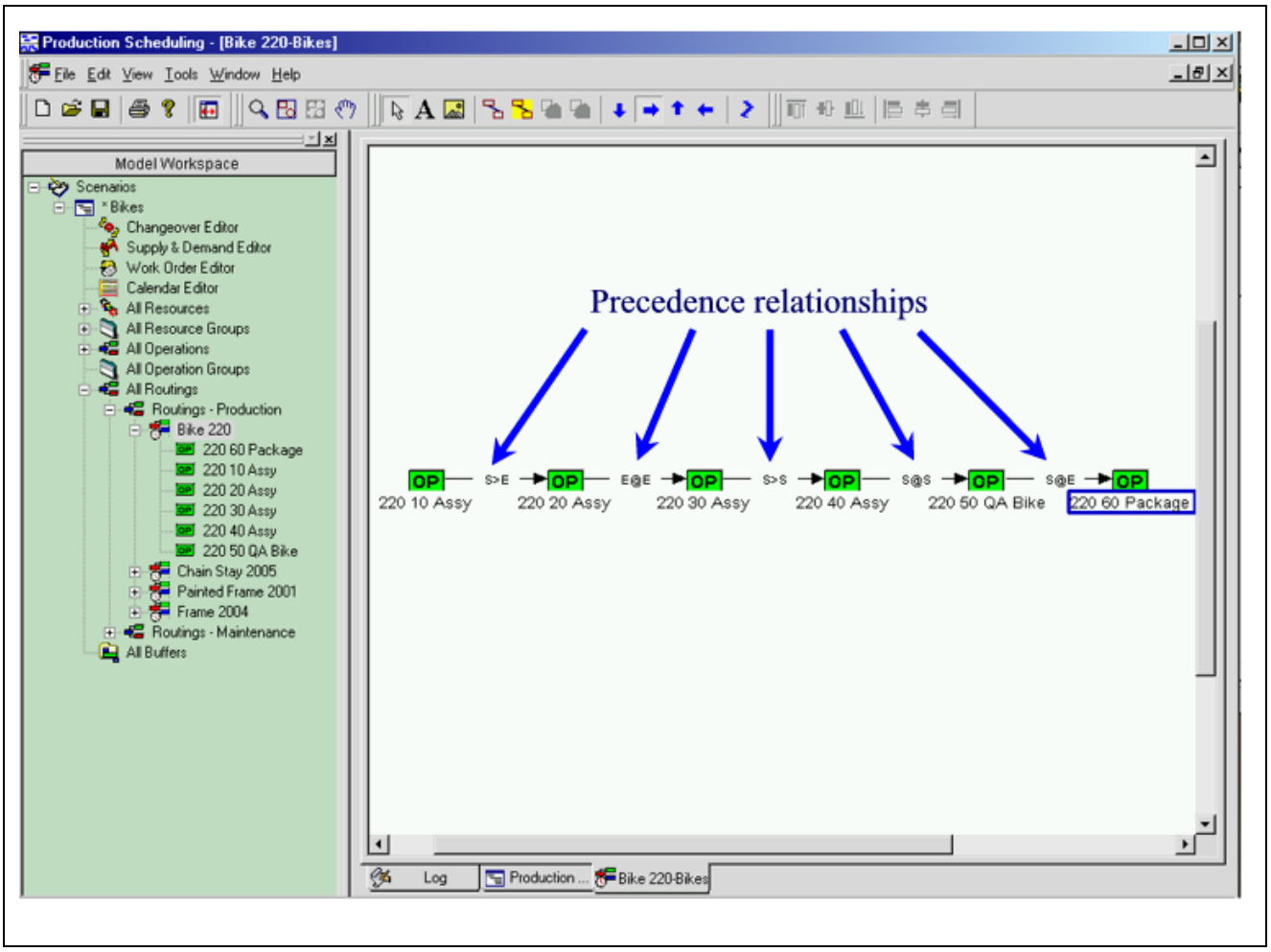
Precedence relationship property screen

This diagram illustrates the temporal constraints between operations:



Temporal constraints between operations

In a routing diagram, links between operations display the precedence relationship as text labels on the links between operations. The diagram below shows the precedence relationship between the operations.



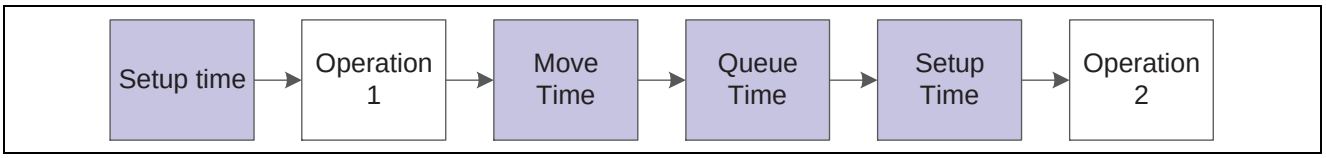
Routing diagram showing precedence relationships

Separation Times

For operations or routings that have either a Start After End or Start After Start relationship, you can specify the minimum and maximum separation times between the operations or routings.

The minimum separation is divided into three fields: setup, move, and queue. You can specify certain amounts of time for any of these categories, and EnterpriseOne Production Scheduling totals them in the minimum separation field.

This diagram illustrates the sequence of setup, move, and queue times in a routing:



Separation times between operations in a routing

This table includes a more detailed description of the separation times that are available between operations in a production routing:

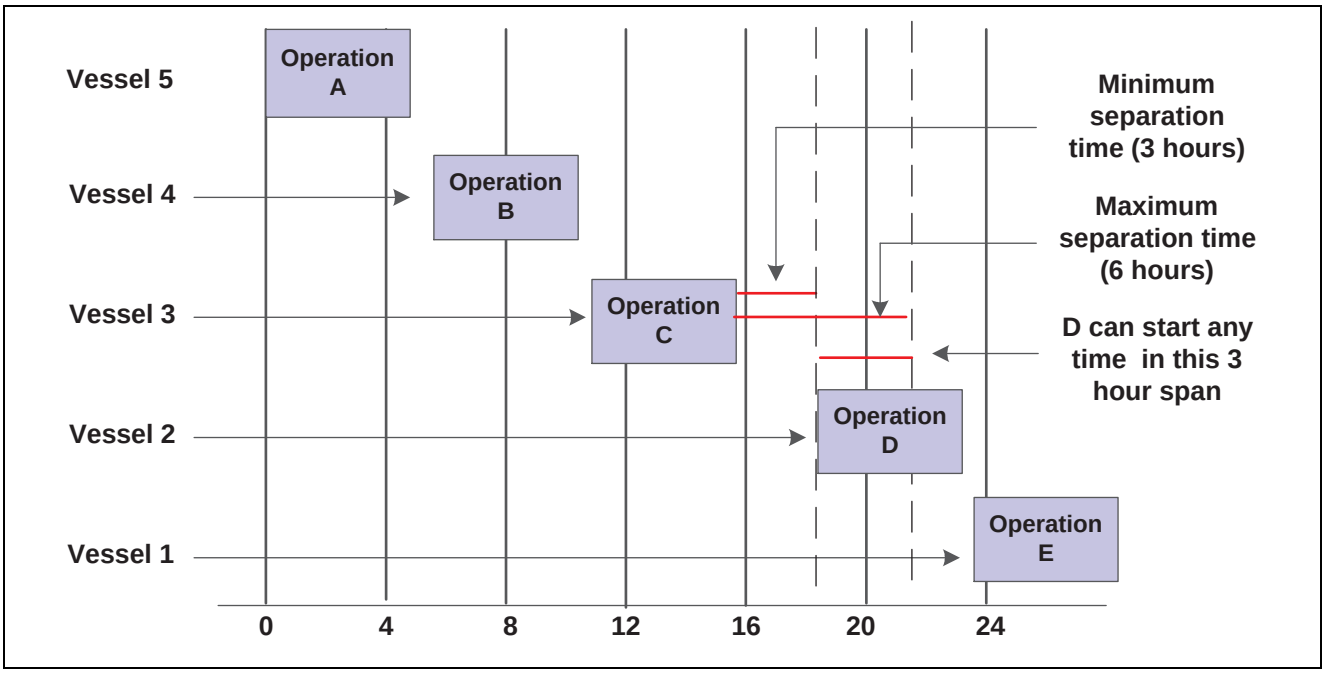
Attribute	Description
Move Time	This field specifies any time lost following the operation due to time that is required to move inventory to the next operation.
Queue Time	An optional field that specifies any time lost prior to the next operation due to time that is required to build inventory and enable the operation to run uninterrupted.
Setup Time	An optional field that specifies any time lost prior to this operation due to machine setup. This setup time is strictly product-related. The system records information about machine-oriented changeover maintenance on an operation-to-operation basis in the Changeover editor.

Note. For the Starts After End and Starts After Start constraint types, the system displays the Minimum and Maximum separation fields (only if populated with a plus (+) sign). For the three other constraints types-Starts At End; Starts At Start; and Ends at End-the Minimum and Maximum separation fields do not appear.

To demonstrate a model that uses several constraint types, assume that you want to represent a process in which batches of product are transferred from vessels 1 through 5 to create product E. The sequence of the tasks is fixed, but the time between them varies. Following operation A, a one-hour period is required for quality analysis. Following operation C, a three-hour period is required for cooling before the product passes to the next vessel. However, after six hours, the product cools too much and begins separating. To model this process, you must define the following precedence relationships:

- Operation B starts after the end of operation A with a one-hour delay.
- Operation C starts immediately after the end of operation B.
- Operation D starts three to six hours after the end of operation C.
- Operation E starts immediately after the end of operation D.

This diagram illustrates this process:



Precedence relationships

Creating Routings

This section discusses how to:

- Create a new routing and routing diagram
- Designate primary operations
- Set routing properties

Creating a New Routing and Routing Diagram

To create a new routing and routing diagram:

Access the Model workspace:

1. Right-click All Routings or right click a routing folder and choose New Routing.
2. Type a name for the routing and press Enter.
3. Double-click on the new routing.

   An empty work pane opens.
4. Open the All Operations folder and drag the operations you want to include in the diagram into the empty work pane.
5. On the toolbar, click the Insert Link icon.
6. To link two operations, click the first operation, and then click the second.

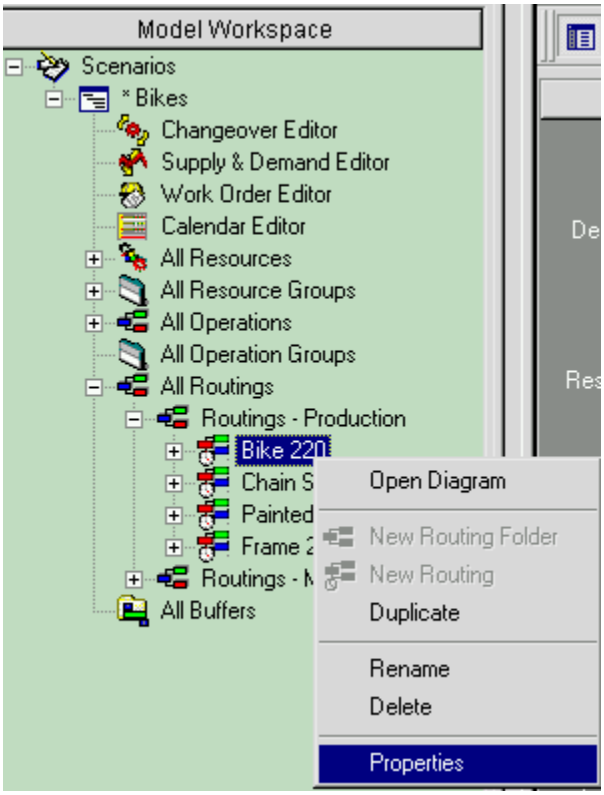
Setting Routing Properties

This section discusses how to:

- Set general routing properties
- Set specific attributes
  - Select routing type
  - Enable consistent resource assignment across operations steps
- Set work order configuration
  - Use routing for work orders only
  - Schedule work order operations according to their unit of effort
  - Schedule adjacent work orders

To set general routing properties:

Access the routing property sheet as shown in the following diagram:



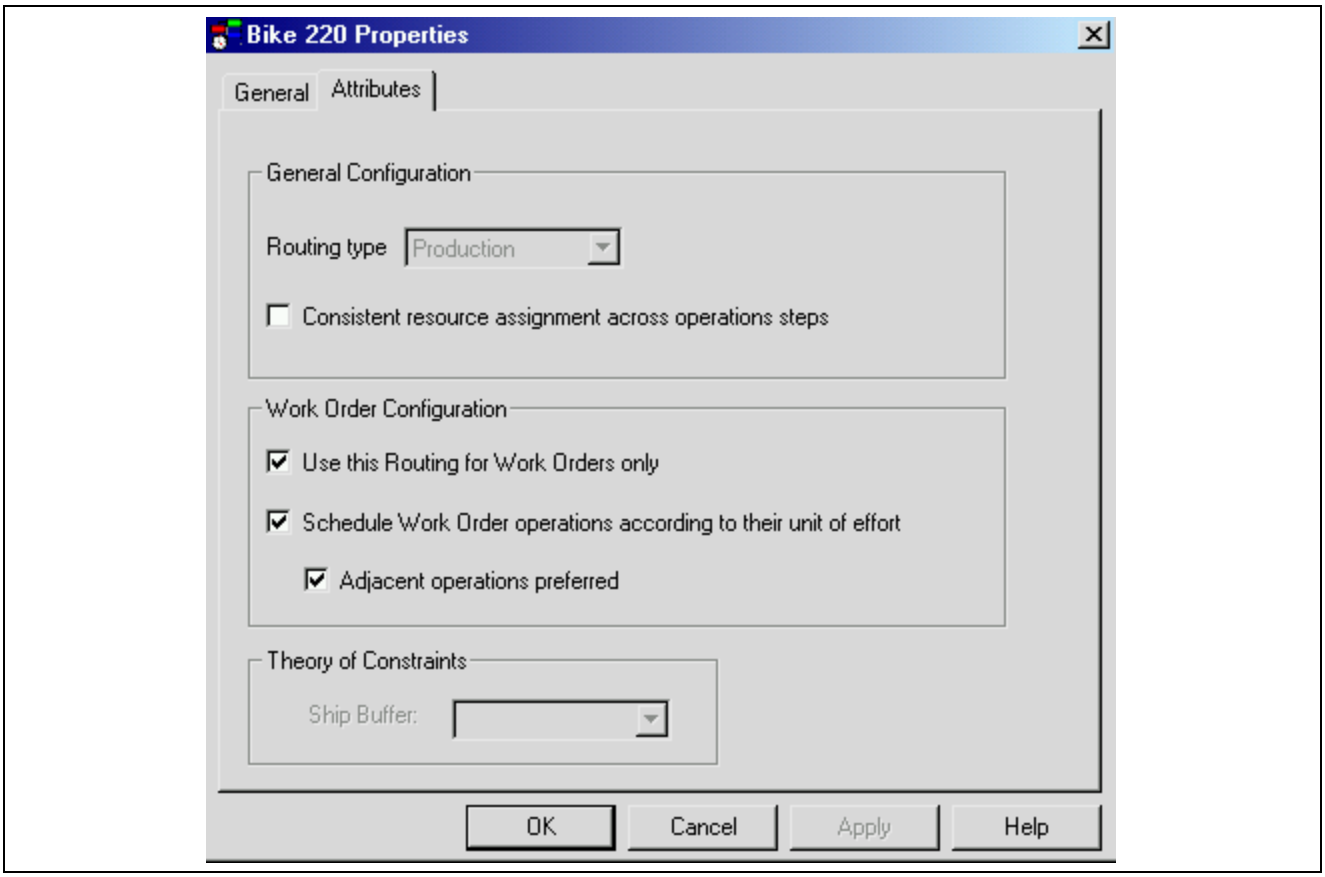
Accessing the routing property sheet

1. Access the General tab.

   Code Enter a unique code for the routing.

   Notes Enter any routing-specific notes.

2. Select the Attributes tab. The options on the Attributes tab are shown in the diagram below:



Attributes tab of the routing properties sheet

Routing Type

Select a routing type from the list. Options are:

Production. Choose this option if your routing produces one or more items.

Maintenance. Choose this option if your routing produces no items. This type of routing consumes time and may consume items. For example, a work order to clean a machine would be a maintenance routing.

Procurement. Choose this option if your model procures items from external sources.

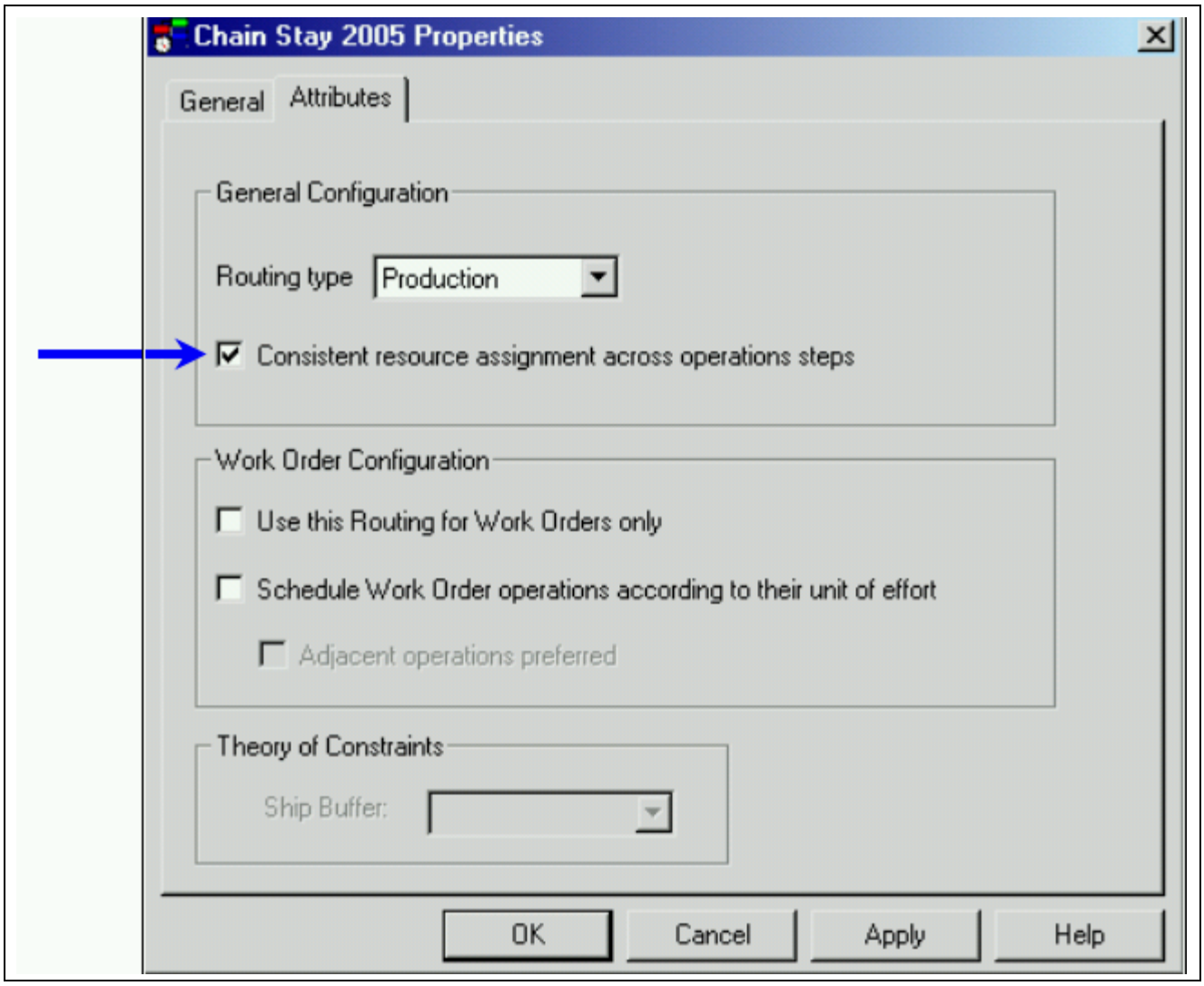
Note. If a routing is currently assigned to a work order, you cannot change the routing type.

Consistent resource assignment across operation steps

This option provides the flexibility to use different resources across routing steps. By default, this behaviour is off.

For example, if a rsource appears more than one time within a routing, and the resource is part of a set, the solver can ensure that only this resource is chosen in subsequent steps once the resource is assigned to a given operation.

This is not always advantageous. In some scenarios, you may not want the same resource to be used throughout the operation. By enabling this flag, you can ensure that the solver can choose different resources if necessary.



Consistent resource assignment

Use this routing for work orders only

Select this option if routing should only run when it is associated with a work order.

For special configurations or one-off production, you may want to create an alternate routing that produces an item using a different set of operations. The system identifies these routings so that the solver does not try to use them to fulfill demand. Routings identified for use with work orders are only run when they are specified in a work order. If demand exists for an item, but no associated work order exists, the solver does not run a routing that is marked to be used in work orders only.

Schedule work order operations according to their unit of effort

This option breaks up associated work order operations into their individual units of effort. By dividing operations into smaller units of effort, scheduling is both more flexible and accurate.

This principle is explained in more detail in the examples, which follow this section.

Adjacent operations preferred	When enabled, this flag instructs the EnterpriseOne Production Scheduling solver to schedule all work order operations adjacent to each other when the operations are broken down into their units of effort. See Example 3 in Examples of Scheduling Work Order Operations With Units of Effort Enabled and Disabled
Theory of Constraints	Assign a ship buffer if you have enabled Theory of Constraints.

See Theory of Constraints Principles

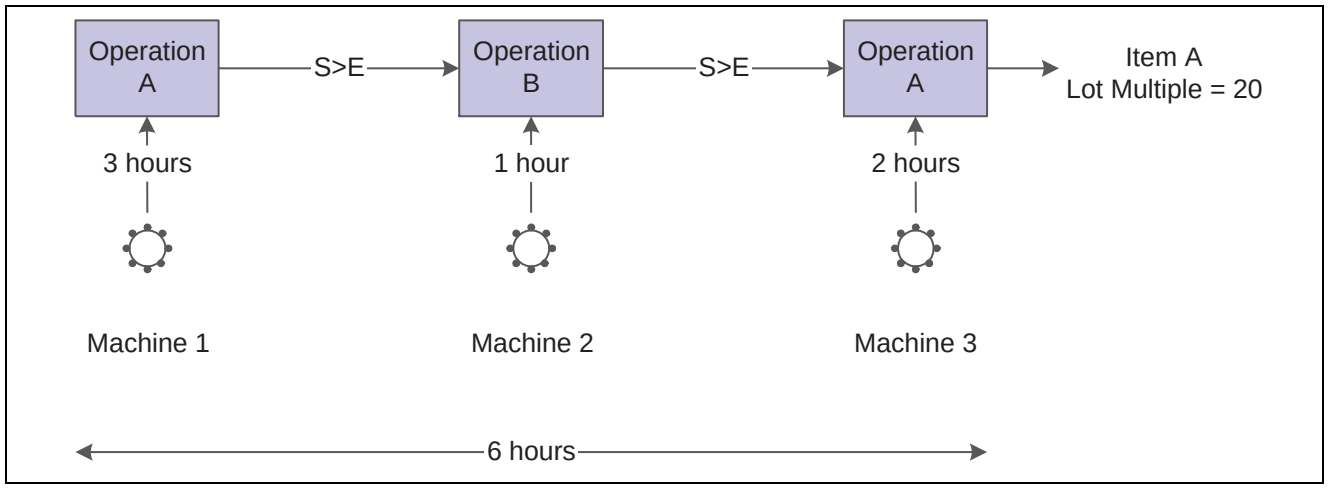
Examples of Scheduling Work Order Operations With Units of Effort Enabled and Disabled

The following examples compare three different scenarios:

- A schedule that has the units of effort flag disabled on the routing.
- A schedule that has the units of effort flag enabled and adjacent operations disabled on the routing.
- A schedule that has both the units of effort and the adjacent operations preferred flags enabled on the routing.

Scheduling Work Order Operations

In each of these examples, producing Item A requires three operations, Operation A, Operation B, and Operation C. Operation A runs on machine one for three hours; Operation B runs on machine two for one hour; Operation C runs on machine three for two hours. The lot multiple is 20 and Item A takes six hours to produce in this schedule. The routing is shown in the following diagram:



Basic routing for producing Item A

Scenario 1: Routing Schedule with Units of Effort Flag Turned OFF

Order due date: January 1, 4:00 p.m.

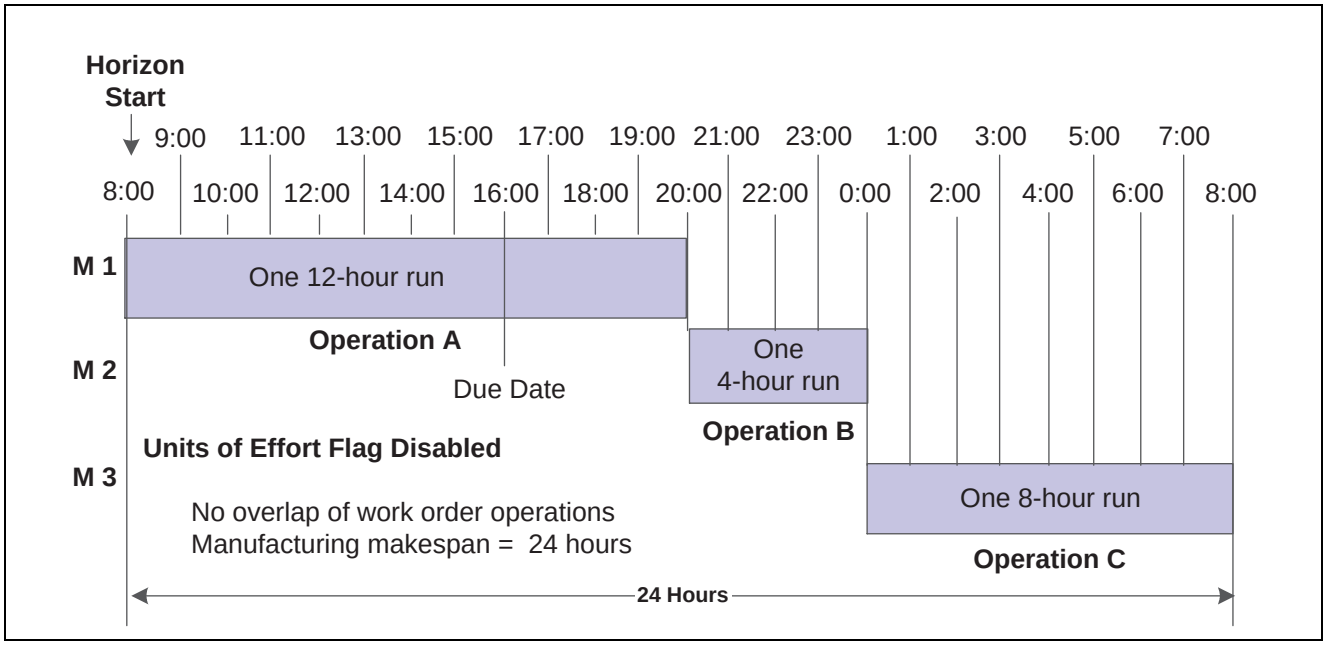
Horizon start: January 1, 8:00 a.m.

Order quantity: 80

Enable Units of Effort: NO

Machine Number	Runs per Operation
Machine 1	1–12 hour operation
Machine 2	1–4 hour operation
Machine 3	1–8 hour operation

The following diagram demonstrates the routing schedule with the Schedule Work Order operation according to their units of effort flag turned off:



Routing schedule with units of effort flag disabled

With this flag turned off, there is no overlap on work order operations. It takes 24 hours to product Item A.

Scenario 2: Schedule Work Order Operations According to Their Units Of Effort Flag Turned On

Order due date: January 1, 4:00 p.m.

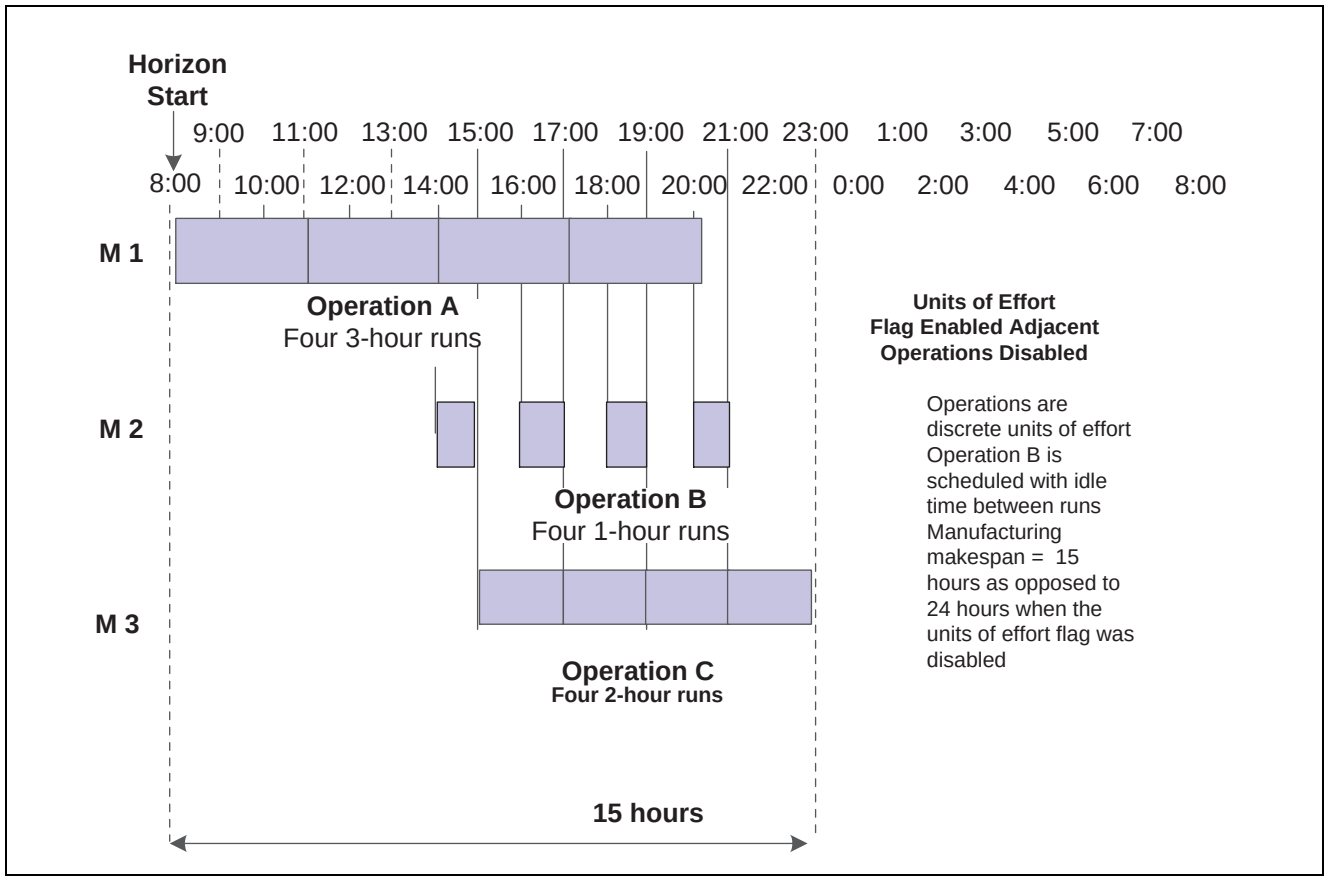
Horizon start: January 1, 8:00 a.m.

Order quantity: 80

Enable Units of Effort: YES

Machine Number	Runs per Operation
Machine 1	4–3 hour operations
Machine 2	4–1 hour operations
Machine 3	4–2 hour operations

The following diagram demonstrates the routing schedule with the Schedule Work Order operation according to their units of effort flag turned on:



Routing schedule with units of effort flag enabled, adjacent operations flag disabled

By enabling the scheduling to apply work order units of effort, there are substantial benefits realized:

- Manufacturing makespan is substantially reduced; manufacturing time is reduced from 24 hours to 15 hours
- Material consumption and production is more accurate
- Resource utilization is more accurate

Scenario 3: Schedule Work Order Operations According to Units of Effort Flag turned ON and Adjacent Operations Flag Turned ON

Order due date: January 1, 4:00 p.m.

Horizon start: January 1, 8:00 a.m.

Order quantity: 80

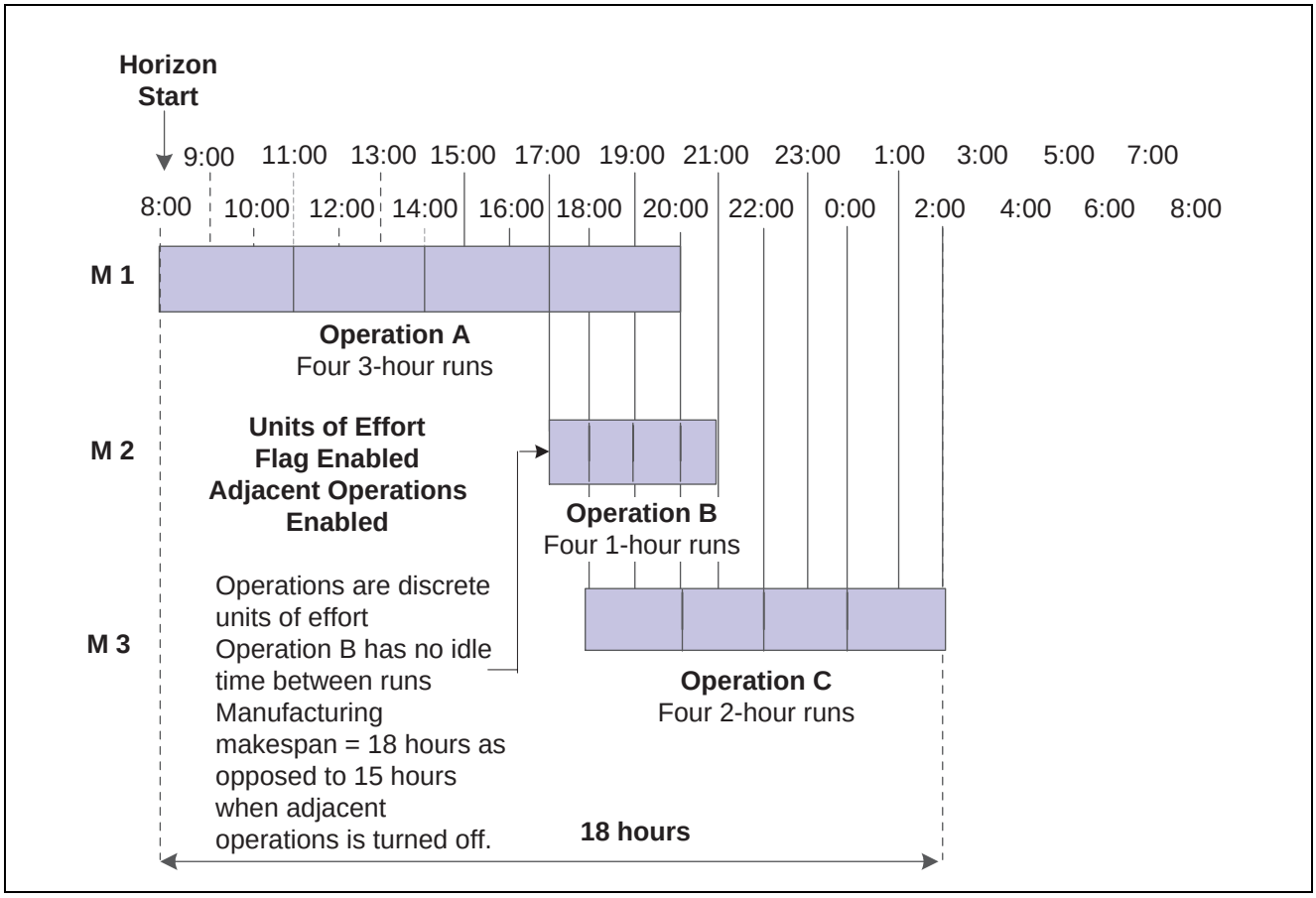
Enable Units of Effort: YES

Adjacent operations: YES

Note. You cannot enable adjacent operations unless units of effort is enabled.

Machine Number	Runs per Operation
Machine 1	4–3 hour operations
Machine 2	4–1 hour operations
Machine 3	4–2 hour operations

The following diagram demonstrates the routing schedule with both the Schedule Work Order operation according to their units of effort and Schedule adjacent operations flags turned ON:



Routing schedule with both units of effort flag and Adjacent operations preferred flags are enabled

By enabling both work order units of work and adjacent operations flags, you have sacrificed some makespan to keep operations on Machine 2 together. Without adjacent operations enabled, total manufacturing time was 15 hours. With adjacent operations on, total manufacturing time is 18 hours, but you have removed idle time on Machine 2.

Assigning a Ship Buffer

Access the Buffer Properties window. Select the General tab.

Note. In order to assign buffers, the theory of Constraints must be enabled.

To assign a ship buffers:

Code Select a pre-defined buffer.

See Also

Theory of Constraints

CHAPTER 19

Understanding Schedule Views

This chapter provides an overview of the following schedule views:

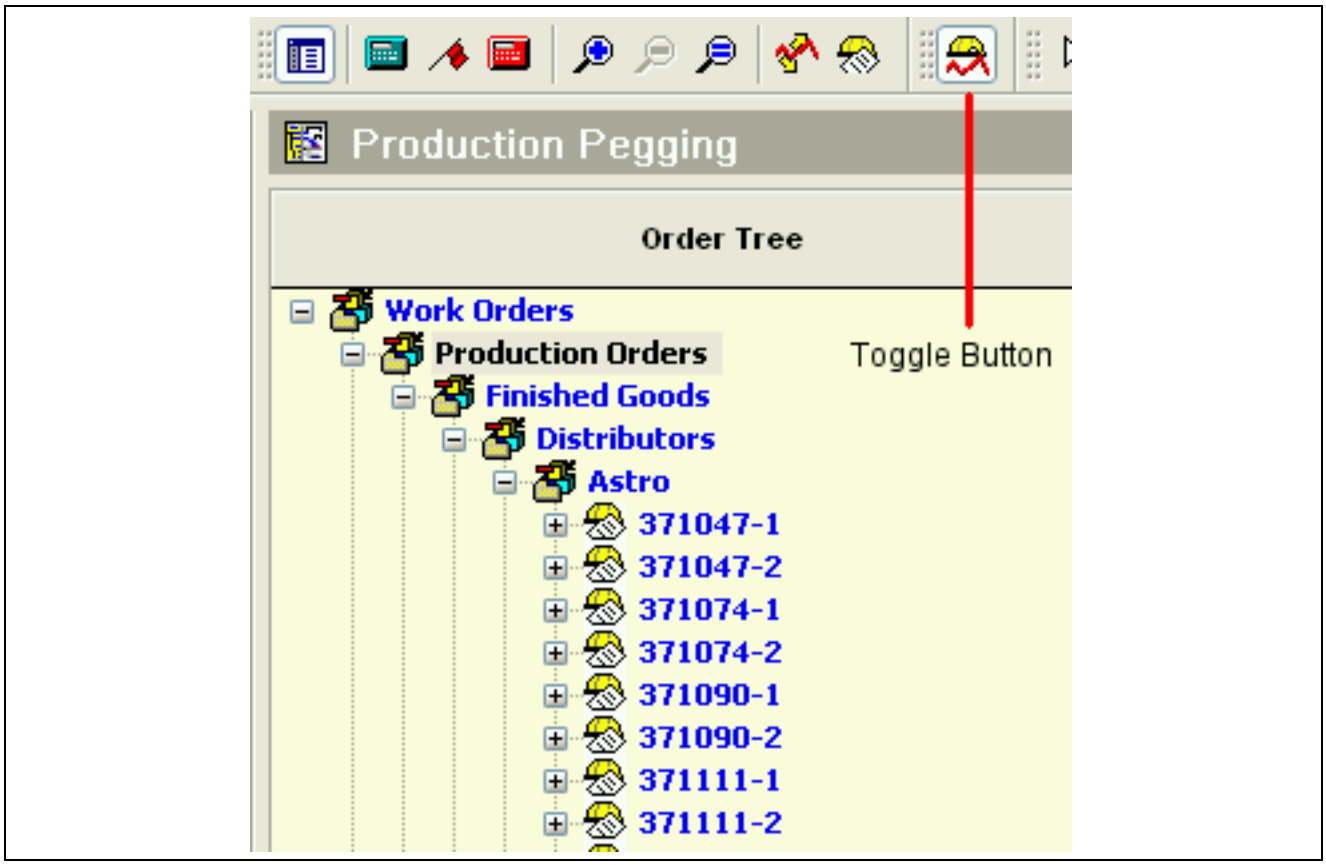
- Production Pegging
- Resource Gantt and Utilization Views
- Operation Gantt
- Item graph and Item Gantt
- Combination views
- From a number of schedule views, schedules can be improved using manual scheduling and repairing techniques. Schedules can be compared in the Key Performance Indicators window against a number of objective measures to determine the best schedule.
- Schedule views is the collective term for Gantt diagrams and graphs in EnterpriseOne Production Scheduling. The workspace in which these Gantt diagrams and graphs appear is known as schedule view. You can view problems with the schedule by browsing the alerts in the Alerts grid.

Production Pegging

In the Production Pegging view, you can display several important elements of your schedule in a simple, easy to use format. Among the many aspects you can access are:

- multi-stage pegging of work orders
- resource requirements
- consumed items
- net new production recommendations
- purchase order recommendations

Production Pegging lets you view production from a demand point of view, (demand centric) or a work order point of view (work order centric), which brings up a Work Order Gantt chart. To alternate between the demand centric and work order centric views, click the button at the top right of the menu bar. The location of the button is shown below:



Toggle button in the Production Scheduling view

See Also

Production Pegging — Demand Centric View

Production Pegging — Work Order Centric View

Order Tree

When open to the demand centric view, this order tree displays all of the scheduled demands as listed in the Supply and Demand editor. You can expand the tree to display the line items and operations that are associated with each work demand order.

When open to the work order centric view, the tree displays all the scheduled work orders as listed in the Work Order editor. You can expand the tree to display the details of operations and routings that are used by each work order, and also see pegged upstream work orders. In addition, you can look at the production recommendations and purchase recommendations.

The makespan for each folder and order appears in the time grid, similar to other schedule views. The makespan is represented by a bar with a diamond at each end to indicate the total amount of time that is required to fill an order. This bar appears in a contrasting color to provide information about the percentage of the orders filled either in demand orders or folders.

Production Pegging — Demand Centric View

The Production Pegging — Demand Centric view enables you to visually display the start times, end times, and duration for each demand, along with its associated line items and routings. From this view, you can see how complete the orders in a folder are; how complete a specific order is; and whether scheduled line items are early, on time, or late. The system distinguishes critical routings and operations. The system does not display demand orders on hold.

Note. For the Production Pegging demand centric view to properly function, you must specify the primary operation in routings and primary output items in operations. This pegging information is essential to display the sequence of operations and routings that are involved in the production of any order line item.

The Production Pegging — Demand Centric toolbar provides a number of buttons that are available only in Production Pegging. From this specialized toolbar, you can filter demand orders according to their criticality to assist you in analyzing the schedule's handling of demands. You can filter the demand orders to list only orders of a specific type, punctuality, and magnitude of punctuality. The Production Pegging retains the last filtering settings used for future analysis purposes.

Demand orders can be filtered to display only the demand orders that meet the specific type, punctuality, and magnitude of punctuality criteria that you specify. This information can help you to locate any problem fulfillment issues and resolve them by either modifying the resources or materials involved.

The following criteria are used to filter demand orders:

Filter	Name	Description
Primary	Order Type filter	Enables the demand orders to be filtered by the type of demand. Options include all, orders, forecasts, and safety.
Secondary	Order Punctuality filter	Enables the demand orders to be filtered by punctuality. Options include all, early, on time, and late.
Tertiary	Order Magnitude Filter	Enables the user to specify the magnitude of punctuality when filtering. By default, these options include all, >12 hours, >1 day, >2 days, and >3 days.

Note. The number of late orders is shown in the status bar at the bottom of the screen when you use the filtering in the view.

Makespan Bars for Line Items

The makespan of each line item and routing is displayed on a time grid. Similar to the makespan for demand orders and folders, the makespan is represented by a bar with diamonds at each end, symbolizing the start and finish of the line item or routing. If the demand line item is running later or is available early, the bar is partially displayed in color. Each line item can be further expanded to display the routings and operations that are involved, as well as the resource details and supply events.

Purchase order recommendations are represented by solid green bars with a trailing diamond. The bars for purchase order recommendations represent the lead time required to procure the purchased item. The diamond represents the date when the items in the purchase order become available to use in a routing.

An additional diamond is included on the bar to indicate either the requested date for line orders scheduled to be available late, or the available date for line items scheduled to be available earlier than requested.

In addition to the third diamond, the makespan bar is displayed in color between the second and third diamonds, indicating whether the line item is available earlier or later than its requested date, and by how much.

The following table summarizes the different types of line item makespan bars that are displayed in the Production Pegging:

Type	Significance
Solid black bar	Line item scheduled to be manufactured on time.
Black and red bar	Line item scheduled to be available after the requested date.
Black and green bar	Line item scheduled to be available before the requested date.
Solid red bar	Line item to begin manufacturing after the requested date.
Solid green bar	Line item scheduled to be early.
Green diamond	Line item is procured from a supplier and ready to be used in a routing.

Pop-up windows display the following information about each demand order when you place your cursor over a specific demand line item makespan bar:

Demand Number Name of the demand order.

Latest Requested Date Date when the order has been requested.

Latest Available Date Date when the order will be available

Start Time Start time for the line item.

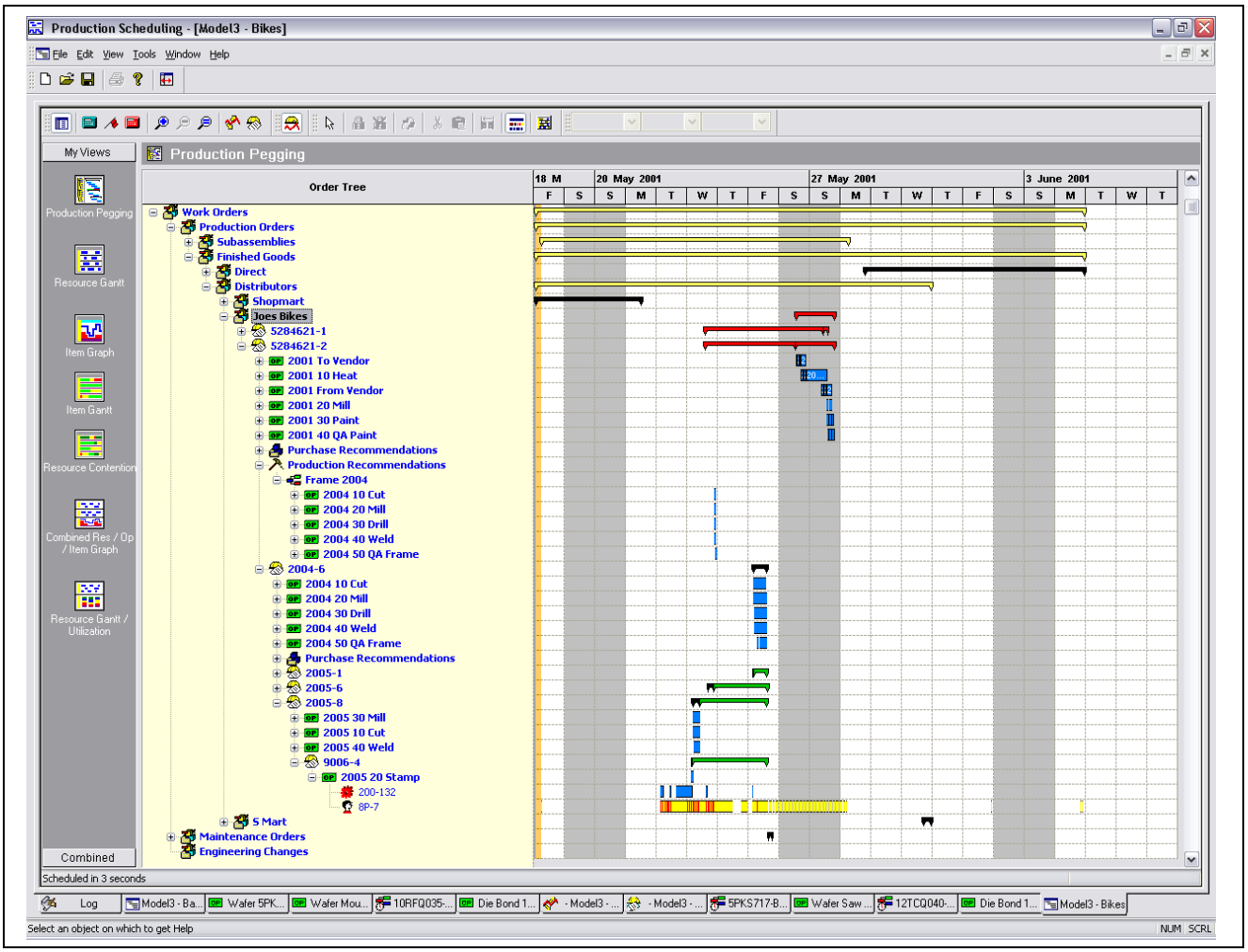
Duration Length of time between the start time and the end time.

Average Line Duration The average duration of one line item.

Production Pegging — Work Order Centric View

The Production Pegging — Work Order centric view enables you to visually display the start times, end times and duration for each work order , along with its associated operations and any pegged work orders. From this view, you can see how complete the orders in a folder are; how complete a specific order is; and whether it is early, on time, or late. The system distinguishes critical routings and operations. The system does not display work orders that are complete or cancelled.

The nested structure of Work Order Centric view also displays multi-level pegging between work orders, net new production recommendations, and purchase order recommendations, as shown below:



Production Pegging — Work Order Centric view

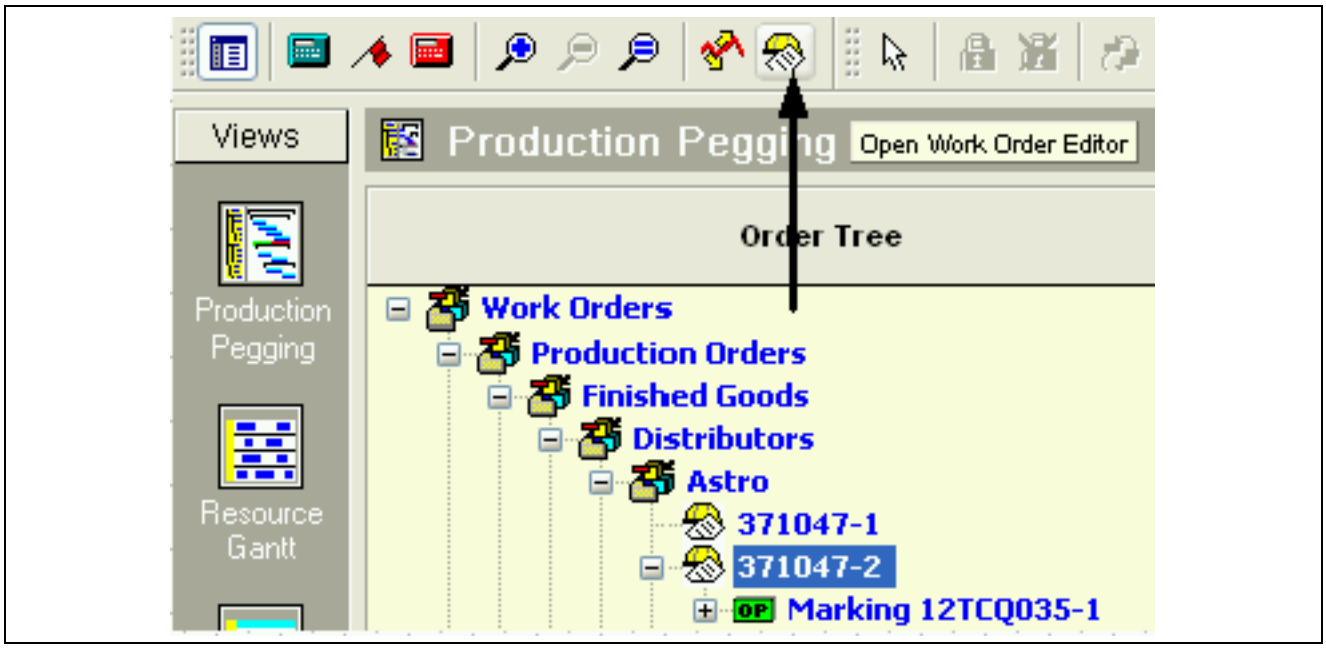
Production recommendations display Production Scheduling created production when your work order quantities are insufficient to fulfill demand or upstream/downstream production requirements.

The Production Pegging — Work Order Centric view has the same folder structure as the Work Order Editor and allows you to drill down into the Work Order Editor from the pegging view.

To open the Work Order Editor from the Production Pegging — Work Order Centric view:

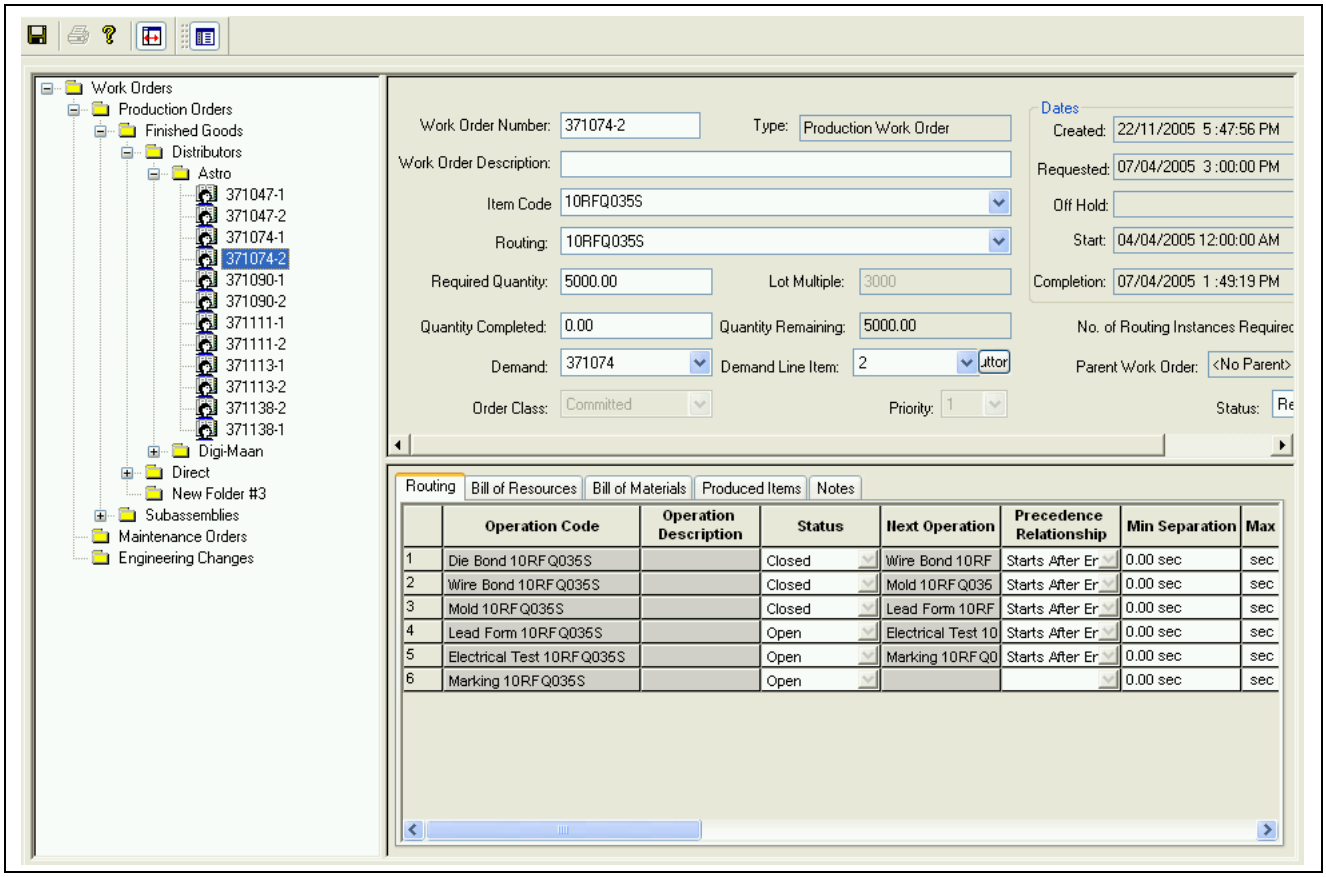
1. Select a work order in the work order tree.
2. Click the Work Order Editor icon in the menu bar.

The location of the Work Order Editor icon is shown below:



Work Order Editor icon location

The Work Order Editor opens the work order you selected and highlights the work order number in the Work Order tree, as shown below:



Work Order Editor highlighting selected work order

The Production Pegging — Work Order centric toolbar provides a number of buttons that are available only in Production Pegging. From this specialized toolbar, you can filter work orders according to their criticality to assist you in analyzing the schedule's handling of orders. You can filter work orders to list only those of a specific type, punctuality, and magnitude of punctuality. Production Pegging retains the last filtering settings and uses them for future analysis purposes.

Orders can be filtered to display only those that meet the specific type of criteria that yo specify. This information can help you to locate any problem issues and resolve them by either modifying the resources or materials involved.

The following criteria are used to filter work orders:

Filter	Name	Description
Primary	Work order filter	Enables the work orders to be filtered by the type of work order. Options are: Production, Maintenance, or Engineering.
Secondary	Order Punctuality filter	Enables the orders to be filtered by punctuality. Options include all, early, on time, and late.
Tertiary	Order Magnitude Filter	Enables the user to specify the magnitude of punctuality when filtering. By default, these options include all, >1 day, >2 days, and >3 days.

The number of late orders is shown in the status bar at the bottom of the screen when you use the filtering in the view.

Makespan Bars for Folders

The makespan and the order of each Work Order Centric or Demand Centric folder in Production Pegging are displayed in the time grid, similar to other schedule views. The makespan is represented by a bar with a diamond at each end to indicate the scheduled beginning and end of manufacturing for individual demand orders and their associated demand folders. The makespan bar is colored to provide information about the percentage of the orders filled in either orders or folders.

Type	Significance
Solid black bar	100 percent of orders filled, based on unit fill.
Solid yellow bar	Between 66 and 100 percent of orders filled, based on unit fill.
Solid orange bar	Between 33 and 66 percent of orders filled, based on unit fill.
Solid red bar	Less than 33 percent of orders filled, based on unit fill.

Pop-up windows provide information about each work order and folder when the cursor pauses on its makespan bar. Folder makespan bars represent aggregate information about contained work orders, and work orders summarize line item information. The following data is displayed in pup-up windows for demand and work orders in Production Pegging:

Demand Centric View	
Field	**Description**
Demand (demand folders only)	Name of the demand folder.
Demand Number (demand orders only)	Name of the demand order.
Start time	Start time for the first demand order in the demand order or folder.
End time	End time for the latest ending demand order in the demand order or folder.
Duration	Length of time between the start time for the earliest demand order or line item and the latest ending demand order or line item.
Average Demand Duration (demand folders only)	Average makespan for demands within the folder.
Average Line Duration (demand orders only)	Average makespan for line items within the demand order.
Fill Percentage	• Demand (only available for folders). Percentage of the orders that are filled in the selected folder. • Line. Percentage of the item lines that are filled within the order or in the folder. • Unit. Percentage of the units that are filled within the order or in the folder.
Instance Count (routings only)	The number of instances of this routing in this work order.

The following data is displayed in pup-up windows for work orders in Production Pegging:

Work Order Centric View	
Field	**Description**
Work Order	Type of work order. For example, Production , Maintenance, or Finished Goods, Distributors.
Start Time	Start date and time of the first operation in the routing or folder.
End Time	The end date for the operation.
Average Duration	Average makespan for orders within the folder.
Unit Fill Percentage	Percentage of the units that are filled within the order or in the folder.

Work Order Centric View	
Field	**Description**
Requested Date	The date on which the order is requested.
Available date	The date on which the order is available.
Duration	The duration of the work order.
Pegged Demands (for work order only)	The demands that are pegged to this work order.

Production Pegging Alerts

In the Production Pegging view, you can bring up alerts for both demand and work orders by alternating between the demand centric view and the work order centric view. You can also drill-down to both the Work Order Editor and Production Pegging.

Alerts for Production Pegging include:

- Minimum Level: The minimum level of inventory was violated.
- Maximum Level: The maximum level of inventory was violated.
- Safety Level: The safety level of inventory was violated.
- Work Order Fixes Date Violation: An attempt to fix the start or end date of a work order operation was not respected.
- Work Order Operation Past Due: The work order operation was scheduled before the start of the horizon.
- Demand: Demand is late.
- Demand (Backorder): Demand is late. The demand was not allowed back orders. Possibly
- Work Order Request Date- The work order is late.

See Also

Navigating Production Pegging Alerts

Operations

For each demand line item and routing, the related operations are displayed. The color of each operation is determined by whether it is a critical bottleneck operation. The start time of critical operations is the same as their earliest start time. No flexibility exists for the operation to start any earlier than its current start time. The start time for non-critical operations is later than their earliest start time.

Color	Significance
Blue box	Non-critical operation.
Red box	Critical operation.

A pop-up box displays the following information:

Operation name Name of the operation.

Start time Start time for the operation.

End time End time for the operation.

Duration Length of time between the start time and the end time.

Resources

The resources for each operation can be viewed in the Production Pegging. These details are similar to those displayed in the Resource Gantt view. The Time Grid displays each instance that the resource is used for an operation.

Element	Appearance
Single capacity resource	Blue with operation name.
Multicapacity resource	Multiple colors, depending on the percentage of capacity being used. Ranges from dark green for low usage to red for full capacity use.
Changeover	Thin black bar.

Supply Events

At times, you might need to see the demands that are dependent on specific supply events. From the Production Pegging, you can peg up from a supply event to all of the associated demands.

Supply events are displayed as diamonds in the Time Grid.

Color	Definition
Green	Any supply event.

Pop-up windows are also available for supply events. The following fields are included:

Supply Number Supply event order and line number.

Item Inventory item number on the supply order.

Quantity Quantity of item that is requested.

Requested Date Date when the item is expected to be fulfilled.

Operation Gantt

The Operation Gantt lists all of the scheduled operations. Each operation instance in the Operation Gantt indicates when the operation is run, and its duration, including any setup and delay times. You can expand the list of operations to display every operation instance. Pegging information is also available from this view. You can use the Operation Gantt to review operation properties. Right-click a displayed operation.

You can use the manual scheduling tools in the Operation Gantt to make detailed adjustments to your schedule. The Remove Idle Time command enables you to remove idle time between two or more selected operations or all idle time that precedes a selected operation. You can also manually resequence operations using the cut and paste commands.

Note. The cut, paste, and Remove Idle Time commands are enabled only for multiple instances of the same operation.

Resource Views

This section describes the following resource views:

- Resource Gantt
- Resource Utilization View
- Resource Contention View
- Resource Calendar View
- Multi Capacity Resource Graph

Resource Gantt

The Resource Gantt enables you to view the use of crew, machine, tool and vendor resources, including Resource Groups, in operations.

For multi-capacity resources, color is used to represent the percentage of capacity currently being used. The Set Colors button defines these colors. For example, if you have not changed the default color setting, dark green represents low (0-10 percent) capacity used, while red represents high capacity (90-100 percent).

Use the following guide interprets the chart elements:

Element	Appearance
Single capacity resource	Blue with operation name.
Multi-capacity resource	Multiple colors, depending on the percentage of capacity being used. Ranges from dark green for low usage to red for full capacity use.
Changeover	Thin black bar.
Delay	Thin yellow bar.
Down time	Thin red bar.

You can view all resources in the model at once, or display resources of a particular type. Resource usage is displayed for the entire schedule horizon, and can be zoomed to display a particular time period. You can view any resource group in the Resource Gantt, Resource Utilization, and Resource Contention views. The attributes of the resource group must be appropriately set for the group to be accessible in the Resource Gantt. If the group does not appear in the list, verify that the properties of the group are set to display in the Resource Gantt. If you add a group after the initial solve, you need to close and reopen the schedule, and then open the relevant view.

The default Resource Gantt sort order is alphanumeric by resource type. To more easily locate potential resource conflicts, you can sort the Resource Gantt view based on a resource's utilization as a percentage of its total capacity. When you sort by utilization, resources with the highest utilization appear at the top of the Resource Gantt. You can also change the view back to the default sort order.

You can use manual scheduling tools in the Resource Gantt to fine-tune your schedule. The Remove Idle Time command enables you to remove idle time between two or more selected operations or all idle time on a selected resource. You can also manually resequence operations using the cut and paste commands.

Resource Utilization View

The Resource Utilization view provides you with precise information about all of the defined resources that are used in the schedule horizon. If your model has changeovers, they also appear in Resource Utilization. Resource utilization appears as total number of hours utilized and as a percentage. By choosing from drop-down menus, you can display each resource and its utilization by shift, daily, weekly, or monthly time buckets.

The following table describes each item in the legend:

Legend Entry	Description
Idle	The percentage of time when the resource is available but not utilized.
Delay	The percentage of time when the resource is not used because of a delay.
Down	The percentage of time when the resource is not used because of down time.
ChOvr	The percentage of time that the resource is not used because of a changeover.
Run	The percentage of time when the resource is being run.
Start Time	The date and time of the start of the bucket set.
End Time	Date and time of the end of the bucket set

Note. If your schedule contains changeover, delays or down time, utilization statistics appear in the legend and the corresponding color-coding appears in the columns. If your schedule does not contain changeovers, delays, or down time, these events appear as zero percent in the legend.

Resource Contention View

The Resource Contention view captures the contention encountered for each resource throughout the solve process. This information is useful to find areas of resource contention in a schedule.

Color is used to represent contention intensity. The Set Colors button defines these colors. For example, if you have not changed the default color setting, the following colors are used to represent resource contention:

- Dark green represents low (0-10 percent) contention.
- Orange represents moderate contention (80-90 percent).
- Red represents high contention (90-100 percent).

Resource Calendar View

The Resource Calendar view displays calendars associated with each resource in your schedule. You can use the Resource Calendar to add calendar events to any crews, machines, tools, or vendors in the local schedule. The changes are implemented once a repair is run on the schedule. To add calendar events to all future schedules, use the Calendar editor.

The colors in the Resource Calendar indicate the following:

Color	Definition
Green	Available
Yellow	Delay time
Red	Down time

Multi-Capacity Resource Graph

The Multi-Capacity Resource Graph displays a resource's total available production capacity and how much of that capacity is used over time. You can select any resource and then view levels for that resource by moving your pointer to any point on the graph.

From the Multi-Capacity Resource Graph, you can view a resource's total available production capacity, and how much of that capacity is used over time.

Item Views

This section describes the following item views:

- Item Graph
- Item Gantt

Item Graph

The Item Graph presents schedule information on item levels in your supply chain using a line graph. This view is a line graph that displays current levels for each item in your model. On the Item Graph, you can select any item and then view levels for that item by moving your cursor to any point on the line.

Using the item graph, you can view inventory levels for a specific item at a specific time and access detailed property information for the item. You can customize the color scheme used in the Item Graph to suit your business preferences.

Note. If you set "Relaxing Minimum", "Relaxing Maximum", or both in Item Properties, you are giving the Production Scheduling solver permission to temporarily violate item minimum or item maximum levels, respectively, in order to produce a feasible solution.

The color in which a item is displayed depends on if you have relaxed the minimum constraints, maximum constraints, or both constraints in Item Properties. The colors are outlined in the following table:

	Maximum Constraints	Minimum Constraints
Relaxed	Default setting. Items are displayed in dark blue. If minimum constraints for an item are also set to relaxed, Items are displayed in orange	Items are displayed in the color you chose for item minimum levels. If maximum constraints for an item are also set to relaxed, Items are displayed in orange
Unrelaxed	Items are displayed in the same color as the color you chose for item maximum levels.	Items are displayed in dark blue.

Item Gantt

The Item Gantt is a bar chart that displays colored bars representing item levels. The Item Gantt displays a horizontal bar chart that represents items and storage spaces, and how they relate to the defined maximum and minimum levels. It can be filtered for specific resource groups. As with other schedule views, you can view current information at different levels of detail by using the zoom tools. Color-coding enables you to see the current status and problem areas immediately.

From the Item Gantt, you can view the inventory level of each item in relation to its minimum and maximum levels, and also access an item's property pages.

You can view any resource group in the Item Gantt. An item can be in more than one resource group. You can create as many resource groups as necessary to simplify your schedule analysis. To be accessible for the Item Gantt schedule view, the resource group's attributes must be appropriately set.

To view items that could inhibit the smooth implementation of your schedule, you can view the Item Gantt sorted by degree of violation in descending order. Sorting by degree of violation puts the most problematic items at the top of the view for further review and fine-tuning. Items are sorted in the following order:

- Items with at least one red (inventory that is below minimum levels) segment.
- To get a better view of an item's inventory levels, create a combined Item Gantt and Item Graph views.
- Items with at least one violet segment, that is, inventory that is greater than the maximum level, and no red segments.
- Items with only orange (inventory that is within 10 percent of the maximum or minimum levels) and green segments.
- Items with only green segments

The Item Gantt uses colors to represent item levels in relation to their minimum and maximum levels. You can click the Set Colors button to customize the colors that are used in the Item Gantt and to set the thresholds for each item. The following table is a summary of the colors that are used in the Item Gantt:

Color	Definition
Green	The item level is less than 10 percent of the difference between the minimum and maximum levels.
Yellow	The item level is greater than 10 percent of the difference between the minimum and maximum levels.

Color	Definition
Red	The item level is below the minimum level.
Violet	The item level is greater than the maximum level.

Combination Views

To get more detailed information about a generated schedule than from a single schedule view, you can select a combination view. With a combination view, two or more views are synchronized so that when an item is selected in the main view, the other view displays the related information only about that item. For instance, while reviewing the Resource Gantt, you can select a resource and simultaneously view its utilization, item usage, or operation details during a specific time frame. This powerful feature enables you to quickly analyze key elements of your schedule and determine whether any adjustments need to be made. The following combination views are available:

- Production Pegging and Item Graph. You can see the inventory levels of selected items when you are viewing the Production Pegging.
- Resource and Operation Gantt. You can see operations that run on selected resources in the Resource Gantt.
- Resource Gantt and Utilization. You can see the utilization of selected resources in the Resource Gantt.
- Item Gantt and Graph. You can see the inventory levels of selected items in the Item Gantt.
- Resource and Item Gantt. You can see the items produced or consumed by a single operation.
- Resource and Item Graph. You can see the inventory level of an item that is produced or consumed by a single operation.
- Operation and Item Graph. You can see the inventory level for an item that is produced or consumed by a single operation.
- Operation and Item Gantt. You can see the items that are produced or consumed by a single operation.
- Resource Gantt and Multi-Capacity Resource Graph. You can see the utilization of selected multi-capacity resources.

When you right click operation 2005 Weld 40 in the Resource Gantt (the main view) and choose Produced, the Item Gantt (the detail view) displays all of the items that operation produces. In this case, this operation produces the item 2005. Alternatively, consumed items or all items produced or consumed can be displayed.

Additional combination views can be created and added to the Combined group, if necessary. Each view can have the name and button of your choice. To organize your views, you can also set up group views that contain specific schedule views.

While in this view, you can use the scroll bars and zoom options to move to different areas in your view. As long as the synchronized scroll bars feature is active, both views stay synchronized as you move around in the view.

Note. Because the Production Pegging view does not display item resources, you cannot automatically drill-down on an item and review its inventory levels in the Item Graph view. Select the item in the Item Graph to compare it with the supply and demand information that is displayed in the Production Pegging view.

Item information that pertains to an operation in the Resource or Operation Gantt view can be further analyzed to display items that are produced or consumed. At any point in the schedule, this information can be immediately accessed so that you can understand the impact that each operation has on stock. In group view, you create a new view to display in the List Bar. The group can contain as few as one or as many as all of the schedule views. When you click the new group, the List Bar changes to display the schedule views that you selected for the group. Added group views appear as a view option in the List Bar. Views must be added in chronological order in each view group. Once they are added, they cannot be moved.

Although EnterpriseOne Production Scheduling comes with a number of combination views, you can create your own. For instance, some suggested three-view combinations include:

- The Resource Gantt with the Item Gantt and the Item Graph.
- The Operation Gantt with the Item Gantt and the Item Graph.

CHAPTER 20

Generating Production Schedules

This chapter discusses how to:

- Create a production schedule
- Solve a production schedule
- Viewing solver data

Understanding Production Schedule Generation

A production schedule is based on the snapshot of the model data in the Model Workspace. Any subsequent changes to the model after the schedule has been created are not reflected in the schedule. Once created, schedules can be opened and displayed in a number of ways. Schedules can be duplicated, if desired, before running various what-if scenarios against the original. These scenarios enable the user to evaluate the impact of potential scheduling decisions. The horizon, start and end dates, resource calendar, supply, demand, work orders, and inventory levels can be modified within a schedule. Schedules also can be deleted when no longer needed.

You can save schedules and schedule folders so that they can be used later. Schedules with unsaved modifications appear in the Model Workspace highlighted in blue and with an asterisk (*) beside them. When you save a schedule, it automatically closes and unloads from memory. Saving a schedule folder also saves all of the schedules and folders that it contains. To quickly load a schedule, double-click its button in the Model Workspace.

Note. Each loaded schedule is stored in system memory. Depending on your model size and system configuration, having too many models open at once affects system performance. If you notice longer than usual response times, try saving and closing unneeded schedules.

Loaded schedules appear in the Model Workspace with a plus (+) sign beside them, which can be clicked to reveal the schedule contents. Buttons for saved and closed Schedules still appear in the Model Workspace, but you cannot see the contents.

The algorithm used in EnterpriseOne Production Scheduling to solve the scheduling problem considers all of the relevant constraints (capacity constraints; minimum, safety, and maximum inventory levels; precedence relationships; and so on) in the schedule model, which essentially is a snapshot of the model at the time of the schedule creation.

The two types of solves are:

- The initial solve considers all resource and operation constraints, and produces an optimized schedule.
- The "repair" solve, performed after manual changes have been made to the original schedule, only repairs the schedule for the resources and time periods that are specified.

The schedule model must be properly set up and have consistent data, or the solver might fail. If the schedule is infeasible, the solver returns with an error message. These error messages can be used to either modify the data or relax certain constraints in the schedule model for analysis purposes.

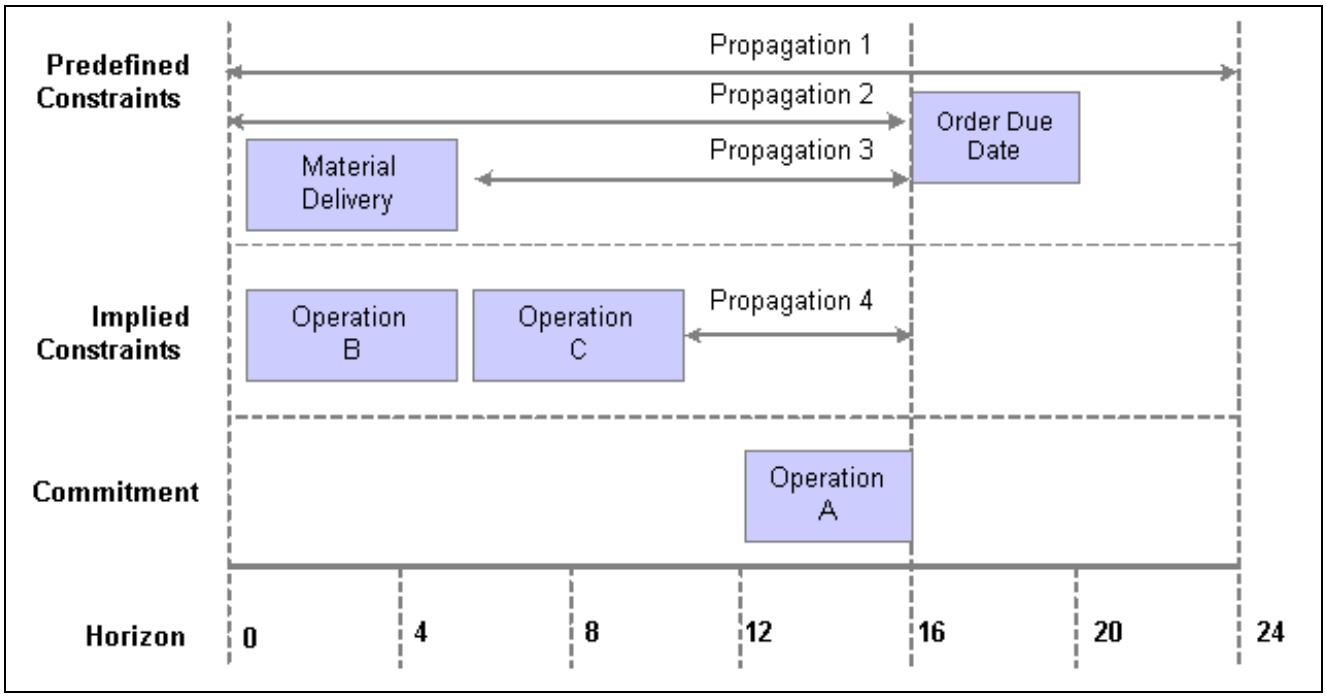
Using the manual scheduling capabilities of EnterpriseOne Production Scheduling, you can make changes to a feasible schedule. For example, you can modify delay events in the Resource Calendar, reassign operations to resources or re-sequence operations, and so forth; and then start a repair to take these manual changes into account.

Production schedules can be duplicated in order to evaluate the implications of a potential decision without making changes to the original schedule. To make a copy of a schedule, including any schedule-specific horizon, supply, demand, or work order information, use the duplicate command. This command can save you time by limiting the amount of manual schedule customization that may be required.

Scheduling Example

In the following example, the initial interval when Operation A can be scheduled is defined by the start and end of the 24-hour schedule horizon. The interval is then reduced, based on the due date for the order that is associated with Operation A and its earliest start time. The interval is further reduced, based on a critical item component delivery required to perform Operation A. Operation A can now be scheduled between hours 6 and 16. However, some operations have already been scheduled on the resource required by Operation A.

This illustration illustrates a calculated time window with a just-in-time (JIT) build strategy selected. For simplicity, changeovers are not considered.



Scheduling using JIT build strategy

This process reduces Operation A to the interval between hour 9.5 and hour 16. Operation A is then committed to this interval. If the minimum time to perform Operation A exceeds this interval, then the schedule is not feasible. Previous order due dates must then be changed, and a new commitment made.

Interpreting Solve Status

When the EnterpriseOne Production Scheduling is solving a schedule, a number of messages appear in the status bar to indicate what tasks the solver is performing at that moment. Real-time messages enable you to keep track of each phase of the solve process as it occurs. The application produces the following messages while solving a production schedule:

Solver Message	Expanded Definition
Preparing Model	The model is being prepared for the solver.
Solving - Instantiating Operations	Based on the model information, the solver is creating all of the operations that are required to meet the model demand.
Solving - Sequencing	In this phase, the solver is sequencing the operations while respecting all of the constraints and trying to meet demand due dates.
Preparing Schedule	In this phase, the solver data is converted into a schedule.
Refreshing Views	The solver is updating any open schedule views to reflect the current schedule.
Schedule Infeasible	This message appears if the schedule is infeasible. Check the log window for details.
Scheduled in <x seconds/minutes>	The schedule has been solved in the specified time. Multiple views are available for analysis of the resulting schedule.
Solver Stopped	The user has stopped the solver.
Generating Pegging Information	The solver is creating pegging information.

Solver Statistics

EnterpriseOne Production Scheduling creates a solver statistics file that captures important solver information after solving every schedule. If you have chosen the Log Messages option in the Options dialog box, then solver statistics are written to a SolverStatistics.txt file every time that you solve a schedule. This file can be viewed directly from the Log window.

You can examine the solver statistics file to obtain more information about the following solve characteristics:

- Determine the solver performance for the solved schedule.
- View demand details for the solved schedule including demand fill percentage, demand total, and on-time and late demand statistics.
- View operation and resource totals for the solved schedule.
- View iterative and heuristic information about the solve.

Solver Log Data

The solver log provides information about the number of demands that were met on time within each solve that is performed by EnterpriseOne Production Scheduling during the current session. By viewing these solver statistics in the Log window, you can determine how successful the solve was.

When the schedule is infeasible, the system displays one of the following messages in the log:

Solver Message	Explanation
Insufficient Resource Capacity	Not enough crew, machine, tool, or vendor capacity is available for the specified resource.
No Producing Operation in Model	Too little inventory exists for the specified item.
Insufficient Item Maximum Storage Capacity	Too much inventory is being produced to fit in the allocated storage space.
Routing Precedence Constraint Error	The solver has identified an improperly set time constraint. For example, demand events exist that are out of the schedule horizon.
Could not Compute Ideal Operation Sequence for Campaign Run Optimization	The solver was unable to generate a sequence of operations based on your choice of using changeover duration or cost.
Unable to Initialize Repetitive Manufacturing Solver	An internal or licensing error has prevented the Campaign Run Optimization from initializing.
Specified Minimum Cycle Time too Short for Campaign Run Optimization	An operation's minimum run length parameters cannot fit within one cycle. Decrease the minimum run length.

Note. If you have chosen the Log Messages option in the Options dialog box, then these statistics are saved to a SolverStatistics.txt file every time that you solve a schedule. This file is written to the same location as your log file.

Prerequisites

Before you attempt to view solver statistics, ensure that the following prerequisites are met:

- Select the Log Messages option in system options.
- Open a schedule
- Solve a schedule

Note. To display the View Solver Statistics menu option, the Log Messages option must be chosen from the Options dialog box.

Creating a Production Schedule

This section discusses how to:

- Create a production schedule folder.

- Create a production schedule.
- Duplicate a production schedule.
- Save a production schedule.

Solving a Production Schedule

This section discusses how to:

- Load scenarios for a saved production schedule.
- Open a production schedule.
- Solve a production schedule.
- Interpret solver status
- Stop the solve process.

Viewing Solver Data

This section discusses how to:

- View solver statistics
- View solver log data.

CHAPTER 21

Adjusting Production Schedules

This chapter discusses how to:

- Interpret alert messages
- Correct the data model
- Invoke manual schedule changes

Working with a Solved Production Schedule

After an initial schedule has been created, some schedule adjustment may be required to make improvements to the schedule. EnterpriseOne Production Scheduling provides the necessary tools to analyze and modify the schedule.

Any item or demand violations that are identified during the solve are displayed in the alerts grid. The suspected operation that is causing the violation is listed in the alerts grid, and can be expanded and highlighted within the Resource, Demand, and Operation Gantt schedule views. Once the operation is identified, then the root cause of the violation can be further investigated and corrected.

A wide range of changes can be made to the schedule after its initial solve, including changes to the following:

- Operation durations
- Operation start and end times.
- Assignment of operations to resources.
- Sequence of operations
- Downtime
- Demands
- Quantities

Operations can also be fixed to run at a specific time. Changes that are made to the schedule are highlighted for easy identification.

Item and Demand Alerts

Alerts are available from either a solved or unsolved schedule to display any violations of soft constraints. The alerts grid displays information about each violation so that you can remedy the problem that is identified. You can expand the alert itself to the suspect operation and review its properties. Within the Resource and Operation Gantt views, the suspect operation is highlighted.

The Suspected Cause column of the alerts grid provides information to guide you to any problem operations. For instance, a message such as "Purchased Part Constraint for Deliver 9011" indicates a possible shortage of purchased parts on hand for the operation called Deliver 9011. To further expand on the operation itself, you can view the operation properties directly from the alerts grid. The Properties dialog box displays the time when the operation is scheduled to run and its associated resources. Collectively, this feedback can help to identify the root of the problem.

You can navigate from a demand alert in the alerts view and view the demand violation in the Production Pegging. When you navigate to the Production Pegging, the Production Pegging is displayed and the line item violation is highlighted.

The following information is provided for demand and item alerts:

Alert Field	Expanded Definition
Violation Type	The type of violation that has occurred. Values are: • Minimum Level • Maximum Level • Safety Level • Demand (Backorder) • Work Order Request Date
Suspected Cause	Values are: • Purchased Parts Constraint for <Supplier> - Item <Item Code> • Maximum Inventory Level Constraint for <Operation x> • Maximum Capacity Constraint for <Operation x> • Demand cannot be met by requested date. •
Item	The item that is violating a constraint.
Violation Start	The starting date of the violation. With demand alerts, this data is usually the requested date.
Violation End	The date when the violation ends. With demand alerts, this represents the available date.
Quantity	Quantity of the violation.
Demand #	Displays the demand number from the Supply & Demand editor. This field is not applicable to item alerts.
Line Item	Displays the line number from the Supply & Demand editor. This field is not applicable to item alerts.

Alert Field	Expanded Definition
Demand Type	Displays the demand type from the Supply & Demand editor. This field is not applicable to item alerts. Values are: • Order • Forecast • Safety
Demand Priority	Displays the demand priority that is associated with the line item from the Supply & Demand editor. This field is not applicable to item alerts.
Target Inventory Level	Displays the inventory levels that are associated with the violation type. This field is not applicable to demand alerts. Values are: • Minimum inventory level for the Min. Inventory alert • Maximum inventory level for the Max. Inventory alert • Safety inventory level for the Safety Inventory alert

Alerts Grid

The alerts grid displays information about any solver-based constraint violations. These violations do not necessarily mean that the schedule is infeasible but, rather, that a soft constraint could not be met. For example, the solver might be required to temporarily violate a minimum inventory level to meet demand. The alerts grid displays these violations in a detailed table, so that you can investigate and improve the schedule.

If desired, the alerts grid can be modified to better view its contents. By adjusting the alerts grid window size and column width, you can expand or reduce the amount of information visible. Columns can be reordered or hidden.

Using the Smart Columns feature, you can select which alert fields to display or hide. Using Smart Columns, you can also rearrange the order in which demand information is displayed.

Start Levels

Start levels are the inventory on hand at the beginning of the schedule horizon. In EnterpriseOne Production Scheduling, the start level for an item is maintained in its properties on the Constraints tab.

If you imported your model data, item levels can also be found in the workbook under StartLevel in the Items worksheet.

You can update start levels item properties. For large numbers of items, completing the spreadsheet and then opening it in EnterpriseOne Production Scheduling might be the most efficient method. For a small number of item start levels, opening the properties page of each item might be the most efficient method.

Horizon Adjustment

When you right-click a schedule and select Horizon editor, the horizon start date and end date appear. These dates surround the requested date, earliest date, and latest dates in the Supply & Demand editor.

If supply and demand dates do not fall within horizon dates, they are either changed or ignored. If the earliest date precedes the schedule horizon start, then the solver changes this date to the horizon start. If the earliest date comes after the schedule horizon end, then the solver ignores this order. If the latest date falls after the schedule horizon, then the solver changes this date to the horizon end. If the latest date precedes the schedule horizon start, then the solver ignores this order.

Maximum Inventory Levels

Having maximum inventory levels set too low in relation to start levels and production can result in an infeasible schedule. For example, suppose that an item's maximum inventory level is set to 15, and it is replenished in lots of 10. If this item has a start quantity of 6 and demand of 7, then this schedule is infeasible because replenishing the item violates the maximum level constraint. To eliminate this constraint, increase your maximum inventory levels.

Manual Scheduling

Manual scheduling enables you to make manual changes to the schedule so that you can respond to new information from the shop floor, alerts generated by the solver, or changes to the maintenance calendar.

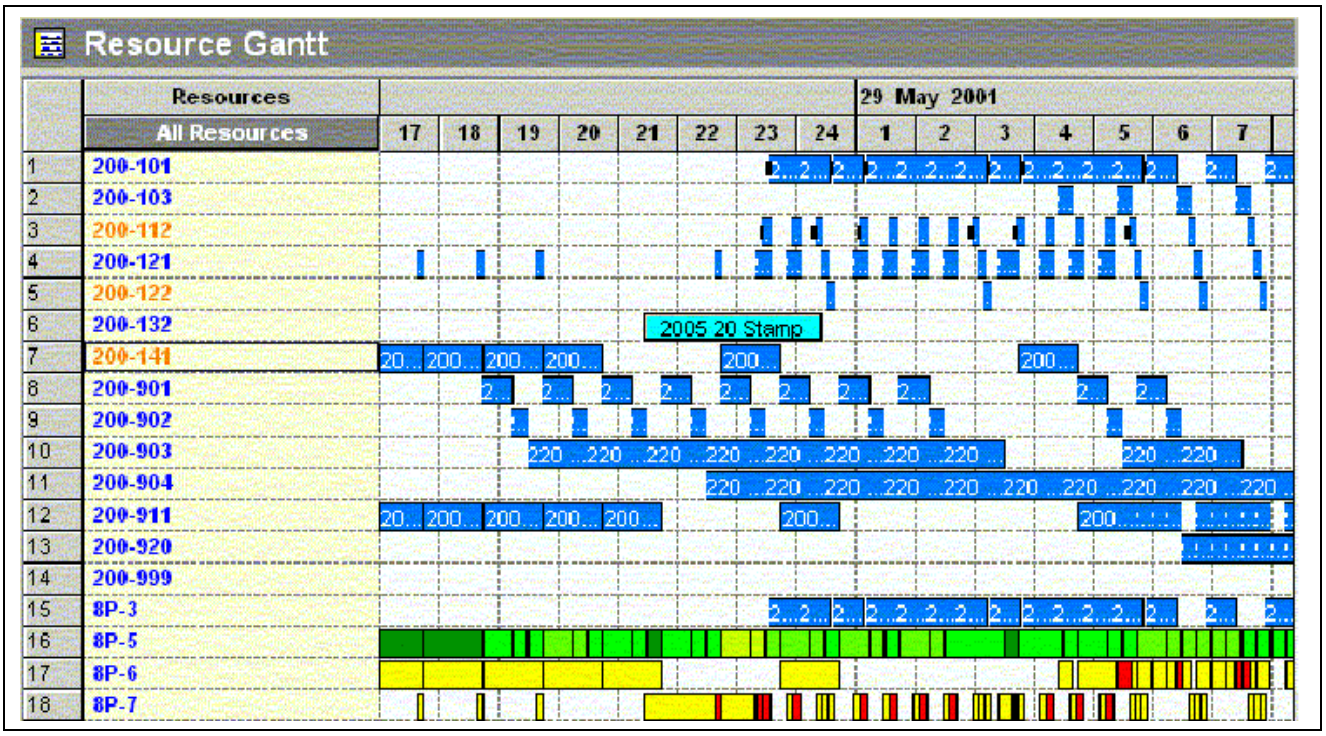
A wide range of changes can be made to the schedule after its initial solve:

• Add new demands • Modify operation durations • Modify start and end times • Change assignment of operations to resources. • Re-sequence operations • Modify delay and down time events in the Resource Calendar.	• Remove idle time between operations • Adjust resource capacities • Adjust inventory levels • Adjust demand quantities • Adjust dates

Operations can also be fixed to a run at a specific time. Demand can be modified locally for the active schedule.

This toolbar enables you to make some of the manual changes to the schedule and run a repair solve to update the schedule.

This example illustrates manual scheduling changes in the Resource Gantt:



Manual scheduling changes

Manual scheduling changes are highlighted in light blue for easy identification, as displayed with the operation 2005 20 Stamp in the example. In comparison with the original solve, the repair solve only focuses on those areas that are changed in the schedule when producing a new schedule. In many cases, this action can represent a significant time savings. The manual scheduling changes are logged to the log window for later reference. After the repair solve is complete, manual scheduling changes are highlighted in orange in the Resource Gantt.

Operation Adjustment

You can use the cut and paste commands to move operations within the Demand, Operation and Resource Gantt views. These commands can move operations to a new time on the same machine, or onto another machine that can perform the same operation. When you cut an operation, any downtime or delay time that is associated with the operation is not included. The operation is pasted to the new time or machine and the solver will correct the schedule to accommodate any delays.

EnterpriseOne Production Scheduling uses the following rules when pasting operations:

- In the first scenario, an operation is pasted into idle time. In this case, the operation is pasted at that point.
- In the second scenario, operation A is pasted onto operation B. In this case, operation A is pasted into idle time immediately following operation B. If another operation immediately follows operation B, then operation A is pasted between these two operations.

When you run a repair, the solver tries to move the operation to the exact point specified. If constraints prevent the operation from moving to the specified start time, then the solver will try to reschedule the operation later during the idle time. If pasting the operation results in an infeasible schedule, then the system cancels the paste command and moves the operation back to its original location.

If you enable the Fix option in the Paste Operation dialog box, then the operation must start at the time specified in the Start Time field. Pasting a fixed operation into idle time or on top of an existing operation might result in an infeasible schedule.

Note. When you cut and paste multiple operations with at least one operation that has the same target resource as the original resource, the system disables the Ignore paste start time and sequence option.

When an operation is pasted into its new location, the solver can resequence some of the adjacent operations to accommodate this change (for example, if the idle time that the operation being pasted into is not long enough). EnterpriseOne Production Scheduling gives you the option of performing either multi- or single-stage resequencing.

Single-stage resequencing honors any solver-imposed constraints on the operation. If the resulting paste violates these logical constraints (for example, if an operation that produces an item is moved after the operation that requires the item), then the system does not move the operation.

Multistage resequencing enables the solver to move all of the operations that constrain the pasted operation. For example, assume that an operation is pasted before the operation that produces an item that it requires. In this instance, multistage resequencing enables the solver to move the affected downstream and upstream operations.

The duration of an operation can be quickly modified to display its impact on an existing schedule. If any resources are affiliated with the changed operation, they are also modified to stay consistent with the new duration.

By changing an operation's start and end times you can manually reschedule an operation within the schedule. An operation's start and end times can be changed from Demand, Operation, or Resource Gantt views.

The Start Time and End Time fields represent the actual times when the operation instance is scheduled. The Earliest Start Time and Latest End Time fields represent the time frame in which this operation instance could be scheduled without definitely causing infeasibilities. You should select a start time and end time within these parameters to render a feasible schedule.

The start and end times of merged operations can be modified as a single entity. After changing a time, the groups of merged operations are each shifted accordingly. Note that the Run Time, Delay, Earliest Start, Latest End and Elapsed Time properties cannot be changed for merged operations.

When the start or end times are changed, the duration remains unchanged and the operation is moved to the chosen date and time. To change an operation's duration, modifying the value in the Duration field.

Note. You can also modify start and end times by cutting and pasting operations from the Operation and Resource Gantt views.

Resource Assignment

For operations that use sets, EnterpriseOne Production Scheduling tries to solve the schedule based on the preferences that you apply to each set, while considering all constraints and priorities in the model. For instance, if you have specified one crew set with the option of using either Crew A or Crew B, the solver creates a schedule trying to use your preferred crew, as indicated in the properties of the operation model. However, after creating the schedule, you might want to change the resource actually used by the operation.

Note. You cannot manually change resource assignments for merged operations.

Resource Idle Time Removal

Although the Just In Time (JIT) build method is often a good strategy to avoid excessive prebuilding, it can sometimes cause a fragmented schedule. Running machines nonstop for a period of time is often more efficient, especially if you also remove idle time from the schedule. You can use the Remove Idle Time command from the Resource, Demand and Operation Gantt views to:

- Remove idle time between two or more selected operations.
- Remove a resource's idle time between an operation and a specified time within the schedule horizon.
- Remove all idle time on a selected resource.

Note. You can use the Remove Idle Time command only on a multicapacity resource from within the Operation Gantt. If a multicapacity resource is selected on the Resource or Production Peggings, the Remove Idle Time button is disabled.

Resource constraints can prevent the Solver from removing all idle time. For example, assume that items that are required by an operation must be in inventory or a crew must be available to run a machine at the new time slot. In cases where operations cannot be moved, the Solver removes as much idle time as possible.

Resource Calendar Event Modification

You can add, delete, or modify calendar events in the Resource Calendar. Alternatively, you can delete or modify calendar events in the Resource Gantt. This function enables you to analyze the effect of adding another shift or resource to the schedule. After repairing the schedule, EnterpriseOne Production Scheduling updates the schedule to reflect the new events.

Calendar events can be added directly from the Production Pegging and Resource Gantt views. This feature is helpful when fine-tuning the schedule once it has been solved. These changes are only reflected in this schedule and are not applied globally to the Calendar editor.

Calendar events can be deleted directly from the Resource Gantt, which is helpful when fine-tuning the schedule, once it has been solved. These changes are only reflected in this schedule and are not applied globally to the Calendar editor.

You can delete calendar events for a resource as required. After repairing the schedule, EnterpriseOne Production Scheduling updates the schedule to reflect the deleted events. When you delete a calendar event from a resource, the system does not remove the event from the parent calendar.

Note. When an event has been added in a schedule, the resource reassignment is not applied until the schedule is repaired. When a delay event has been deleted in a schedule, the resource reassignment is not reflected until the schedule is warm solved

Resource Contention

By default, the Resource Contention view displays the contention events that are encountered during the solve using the time bucket.

Schedule Horizon	Default Time Bucket
Greater than 3 months	Month
Between 2 weeks and 3 months	Weeks
Less than 2 weeks	Days

You can change the time bucket used by the Resource Contention view to calculate the contention. Time bucket options include month, week, day, shift, and hour. The time bucket setting is independent of the view that is currently displayed using the zoom buttons.

For example, if you change your time bucket to the day option, then the Resource Contention view evaluates and compares the contention during each day, and displays its findings using the color scale. The colors are representative of the contention for each resource over each day. The smaller the time bucket, the more differentiated the results are, due to the smaller pool of data.

You can use the default color scheme where dark green represents low contention (0-10 percent) while red represents high contention (90-100 percent), or you can use the Set Colors command to set up different colors. Using the Set Colors command, you can set new color levels by adding new sliders or moving existing sliders in either direction. This ability enables you to assign a color to represent different percentages of contention. The colors that you set in the color bar are then displayed in schedule views, so that you can always see a consistent color representation of the schedule at a glance.

Schedule Repair

Repairing a schedule enables you to implement changes that are made to the schedule. To minimize the effect on the schedule, the repair solve only modifies the schedule for the resources and time periods that are specified. Depending on the changes that are made, a repair usually takes less time to complete than the initial solve.

Whenever a change is made to the schedule that cannot be incorporated with a repair solve, then the Repair button is disabled. If a manual scheduling change results in an infeasible schedule, all of the changes since the last successful solve are undone. After the repair solve is complete, manual scheduling changes are highlighted in orange in the Resource Gantt.

Interpreting Alert Messages

This section discusses how to:

- Expand alert messages
- navigate to the Production Pegging.
- Filter alert messages
- Customize the alerts grid.

Expanding Alert Messages

Access the Alerts Grid.

To expand alert messages:

1. Right-click the alert row.
2. Select Open Operation Properties.

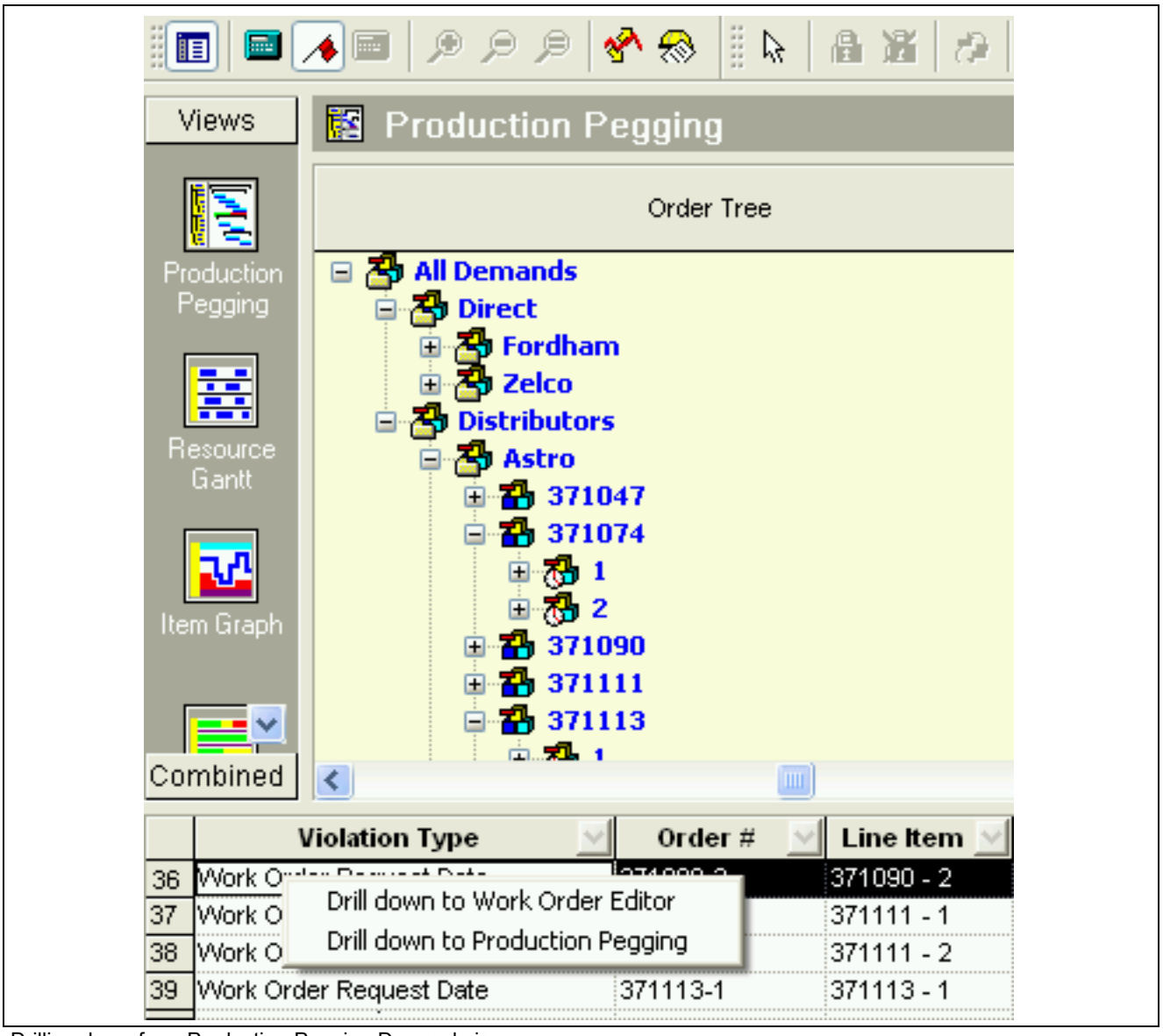
Navigating Production Pegging Alerts

From Production Pegging Demand view, access the Alerts Grid.

To navigate to the Production Pegging or Work Order Editor:

1. Right-click the alert row.
2. Select Drill down to Production Pegging or Work Order Editor.

The drill down screen is shown below:



Drilling down from Production Pegging Demand view

From Production Pegging — Work Order Centric view, access the Alerts Grid.

To navigate to the Production Pegging or Work Order Editor:

1. Right-click the alert row.
2. Select Drill down to Production Pegging or Work Order Editor.

If you want to see the work order from both the Work Order Gantt and the demand perspectives, you can alternate between the Production Pegging — Work Order Centric view and the Production Pegging — Demand Centric view by clicking in the main screen and then clicking on the toggle button.

See Production Pegging

When you select an alert and toggle between the Production Pegging — Demand Centric view and the Production Pegging — Work Order Centric view, the system automatically focuses in on the same work order and its demand.

Filtering Alert Messages

Access the Alerts Grid.

To filter alert messages:

1. Select the column heading of the field that you want to filter.
2. Select a field variable from the available options in the menu.

Customizing the Alerts Grid

Access the Alerts Grid.

To customize the alerts grid:

1. Right-click the upper left corner of the alerts grid and select Hide Columns.
2. In the Show/Hide Alerts Grid Columns window, click to select one or more entries.
3. Click the button with the double arrows facing either right or left to move the selected entries from Shown Columns to Hidden Columns, or the reverse.

   Entries that appear in Shown Columns appear in the alerts grid, while those entries displayed in the Hidden Columns do not appear.
4. Rearrange columns by following these steps:
5. In either column, click to highlight a single entry.
6. Click the up or down arrow to move the highlighted entry up or down in the list.

   The order in which entries appear in the Shown Columns column determines how the information displays in the alerts grid. For example, the second entry appears in the second row in the alerts grid, and so on.
7. Click OK.

Correcting the Data Model

This section discusses how to:

- Verify demand events
- Verify start levels
- Verify maximum inventory levels.
- Adjust horizon dates
- Relax resource constraints
- Reactivate resource constraints

Verifying Demand Events

Access the Supply & Demand editor.

To verify demand events:

1. Open the demand event.

2. Ensure the following fields are completed:
   - Item
   - Quantity
   - Requested Date
   - Earliest Date
   - Latest Date

   Note. Ensure that the requested, earliest and latest dates fall inside the schedule horizon.

Verifying Starting Inventory Levels

Access the Items worksheet.

To verify starting inventory levels:

1. Navigate to the StartLevel column.
2. Verify the starting inventory levels for a specific item in inventory, and change the value if necessary.
3. Save the workbook.

Verifying Maximum Inventory Levels

Access the Item Properties window. Select the Constraints tab.

To verify maximum inventory levels:

1. Verify the value in the Maximum field
2. Change the value if necessary.
3. Click OK.

Adjusting Horizon Dates

Access the Schedule Properties window. Select the Horizon tab.

To adjust horizon dates:

1. Update the Start Date and End Date fields.
2. Click OK.

Relaxing Resource Constraints

Access the appropriate schedule view.

To relax resource constraints:

1. Right-click the resource and select Relax Constraints.

   To select more than one resource at a time, hold down Ctrl to select individual resources, or press Shift to select a block of resources.
2. Click Solve to solve the schedule.

   The relaxed resources appear in orange in the schedule views.

Removing Maximum Capacity Constraints

Access the Resource Properties window. Click the Capacity tab.

To remove maximum capacity constraints:

1. In the Maximum field, enter *.

   When you solve the schedule, the application considers the maximum capacity for this resource as unlimited.

2. Click Apply and click OK.

Reactivating Resource Constraints

Access the appropriate schedule view.

To reactivate resource constraints:

1. Right-click the resource that you want to activate.

   Alternately, select a number of resources pressing Ctrl and Shift.

2. Select Activate Constraints.

   The resources constraints are now considered when the schedule is solved.

Invoking Manual Schedule Changes

This section discusses how to:

- Move operations within a routing.
- Modify operation durations
- Modify operation start and end times.
- Modify operation resource assignments.
- Fix operations
- Resequence operations
- Remove resource idle time
- Repair a schedule
- View schedule changes

Prerequisites

Before you begin to make manual scheduling changes, ensure that you meet the following prerequisites:

- Solve your schedule
- Use either Demand, Resource or Operation Gantt view.

Moving Operations within a Routing

Access the Operation Gantt, Resource Gantt, or Production Pegging.

To move operations within a routing:

1. Select the operation that you want to move. To select multiple operations, hold down the left mouse button and surround the operations.

   The system displays the selected operation(s) in red.

2. On the Schedule view toolbar, select Cut Operation from the menu bar or right click your mouse.

   The cursor changes to a horizontal scroll bar that displays the current date and time. Allowable destination resources for the cut operation appear highlighted in blue.

   Note. If you select operations across multiple resources that are not able to run on the same machine, the Cut Operation button is disabled.

3. Click the location corresponding to the date and machine where you want to move the operation. The selected time appears in the status bar.

4. Right-click and select Paste.

   The Paste Operation dialog box appears and displays the selected start and end times.

   You can set the operation to start at the earliest available start time by checking the Earliest Start Time box or you can manually adjust where you want to paste the operation by changing the Start Time and End Time fields.

5. Select one of the following options to indicate how you want to resequence adjacent operations:

   - Multi-stage Resequencing

     Select this option to enable the solver to move all of the operations that constrain the pasted operation.

   - Single-stage Resequencing

     Select this option to honor any solver-imposed constraints on the pasted operation.

6. To offload an operation from one machine to another, select Ignore paste start time and sequence.

   When you run a repair, the solver then schedules the moved operation. This option is only enabled if the machine that you are using is a part of a resource set.

   Note. When you enable the Ignore paste start time and sequence option, the Start Time, End Time, Duration and Fix fields are disabled.

7. Select OK.

Modifying Operation Durations

Access the Operation Properties window. Select the Times tab.

To modify operation durations:

1. In the Run field, enter the duration of time that you want to use.

   The End Date field is adjusted to reflect the new operation duration.

2. Click OK.

Note. When changing operation duration, the new time must fall within the bounds set by the Earliest Start Time and Latest End Time fields.

Modifying Operation Start and End Times

Access the Operation Properties window. Select the Times tab.

To modify operation start and end times:

1. In the Start Time field, enter the time when you want the selected operation to begin.
2. In the End Time field, enter the time when you want the selected operation to end.
3. Click OK.

   The change in start and end times is displayed on the schedule. Any scheduled operations to be executed after the end of the changed operation are modified as well.

Modifying Operation Resource Assignments

Access the Operation Properties window. Select the Resources tab.

To modify operation resource assignments:

1. Select the code field for the set with resources that you want to change.
2. Select the down arrow to view the resource options.
3. Select the resource that you want from the list.
4. Click OK.

Fixing Operations

Access the Schedule view.

To fix operations:

1. Select Multiple Selection from the schedule toolbar.
2. Click once on each operation that you want to fix. The operations change from blue to red.

   If you select an operation by accident and want to deselect it, click the operation once again. It reverts to its original blue color.
3. Select Fix Operations from the schedule toolbar.

   The fixed operations change from red to green.
4. To undo the fixed operations, select Unfix Operations from the schedule toolbar.

Resequencing Operations

Access the Production Pegging or Resource Gantt.

To resequence operations:

1. Select the operations that you would like to resequence.
2. Select Resequence Operations.

The Operation Resequencing dialog box appears, listing all of the operations that are selected for resequencing in chronological order.

3. From the left row headings, select one of the operations. The Move Up and Move Down arrow options at the top of the dialog box activate.
4. Click the appropriate button to move this operation up or down.
5. Repeat steps 3 and 4 for each operation that you want to move.
6. Click OK when complete.

Removing Resource Idle Time

Access the Production Pegging, Operation Gantt, or Resource Gantt.

To remove resource idle time:

1. Choose one of the following options:
2. On either the Resource or Production Pegging, use the multiselection functionality to select two or more operations on a single-capacity resource.
3. On the Operation Gantt, use the multiselection functionality to select an operation type.
4. Select Remove Idle Time.

   All of the operations within the selected range are moved to an earlier time so that all of the idle time between them is removed. If more than two operations were selected, the solver removes idle time between the earliest and the latest selected operation.

   Note. If the operations that you select do not run on the same resource, the system disables the Remove Idle Time command.

5. Select Repair to repair the schedule.

   Note. After a repair, the solver attempts to move all of the selected operations to remove excess idle time. However, resource constraints (for example, an operation running within a fixed timefence, or an operation that is waiting for inventory) can prevent the solver from removing all idle time. In cases where operations cannot be moved, the solver removes as much idle time as possible.

Repairing a Schedule

Access the Schedule window.

To repair a schedule:

1. Complete manual scheduling adjustments.
2. Select Repair.

   The schedule is refreshed with the incorporated changes. If the repair results in an infeasible schedule, a message appears on the status bar indicating that the schedule is infeasible. The schedule returns to the previous solved state.

   Note. Some manual scheduling changes require that you perform a solve. For example, schedules containing modifications to routing and operation properties, work orders, and supply and demand data cannot be repaired and require a solve. In these cases, the Repair tool becomes unavailable for input.

Viewing Manual Schedule Changes in the Change Log

Access the Schedule Properties window. Select the Change Log tab.

To view manual scheduling changes:

Examine the manual scheduling changes in the change log.

The change log displays all of the modelling changes that have been made to the schedule since the last solve. You must enable logging of manual schedule changes when you set system options.

Viewing Manual Schedule Changes in the Gantt Views

Access the Production Pegging, Operation Gantt, or Resource Gantt.

To view manual scheduling changes:

Select Highlight operations changed by Repair on the Gantt toolbar.

The operation that you manually changed before a repair will be highlighted in red. Related operations in the routing that have been changed by the solver during a repair will be highlighted in orange.

Adding Calendar Events in the Resource Calendar

Access the Resource Calendar.

To add calendar events:

1. Click the down arrow under Resources, and select the resources or groups that you want to view.
2. Click a resource, and then click the Add Event button.
3. Click one of the following options to specify the event type:

Up Time	All machines and activities are available.
Down Time	Actual down time when all machines and activities are stopped. This option imposes significant constraints and should be used infrequently. Use the Delay Time option whenever possible.
Delay Time	A delay when machines and activities are temporarily suspended.

4. Complete the following fields:

Start Time	The date and time when the event begins. Alternately, you can leave the original date. When the end time and the duration are entered, the start time is automatically calculated.
End Time	The date and time when the event ends. Alternately, you can leave the original date. When the start time and the duration are entered, the end time is automatically calculated.

Duration	The event length in seconds, minutes, hours or days. If the start time is specified, the end time is automatically filled in, based on the duration. Similarly, if the end time is specified, the start time is filled in automatically.
Recurring Event	Select this option if you want the calendar event to repeat. Select one of the following options in the Recurrence Pattern section: Daily, Weekly, Monthly, or Yearly.

5. Click one of the following options in the Recurrence Limit section:

No end date	Select this option if the event occurs throughout the calendar horizon.
End after occurrences	Select this option and select the number of occurrences if the event occurs for a specified number of times, and then stops.
End by	Select this option and select an end date if the event ends by a specified date.

6. Click Add.

   EnterpriseOne Production Scheduling adds the calendar event to the Resource Calendar.

CHAPTER 22

Evaluating Production Schedules

This chapter discusses how to:

- View production schedule details
- Analyze scheduled demand
- Analyze scheduled resources
- Analyze scheduled items
- Analyze scheduled operations
- Use combined views

Understanding Schedule Evaluation

This section provides an overview of schedule evaluation and discusses:

- Schedule view groups
- Operations
- Changeovers
- Makespan bars
- Merged operations
- Order pegging
- Key Performance Indicators

Prerequisites

Before you attempt to analyze a production schedule, ensure that the following prerequisites have been met:

- Create and solve a schedule.
- Create the resource and operation groups that you want to appear in the schedule views.

Schedule View Groups

Groups enable multiple operations and resources to be combined as a group when viewed in the model workspace and schedule views. Organizing resources and operations into logical groupings can help you organize your model data. You can create a default resource group for each schedule that appears when views are first opened.

All schedule views except the Production Pegging have a drop-down menu that lists the defined groups. When you select a group from the menu, the schedule view changes to display only those resources or item belonging to the group. Each schedule view can have its own default group view. The current default group in each view appears with a check mark beside its name.

Operations

When using some of the schedule views, information is available about the scheduled operations to assist you when evaluating your schedule. In addition, the run times, duration, and assigned resources (if a resource set is used) can be changed directly from schedule views.

You can view information about all operations from the Demand, Operation and Resource Gantt views. Only information about single-capacity operations is available from the Resource Gantt view.

The Operation Properties window contains the following tabs:

Tab Name	Description
General	This tab contains the operation name, code, and the demand and work order that it is fulfilling. From this tab you can launch the Work Order and Supply & Demand editors to view and edit the associated demand and work orders.
Times	This tab contains the selected operation's start and end times, earliest start and latest end times, duration, run, and delay. This tab also indicates whether the operation has been set to run at a specific time
Resources	This tab contains all of the resources that are associated with this operation, including their quantities. Item resources are displayed as negative when they are consumed, because they are not renewable
Document	This tab indicates lists any associated files and the location of the files.

A quick summary of an operation can be viewed for unary operations. Details including the name, start time, and duration of the operation are included in this quick summary. A quick summary for an operation is available in the Demand, Resource, and Operation Gantt views.

Changeovers

The transitional time between one operation running on a specific machine and another operation is called a changeover. Changeovers appear in schedule views as solid black lines between operations.

Changeover events that affect resources appear in the Production Pegging, Resource Gantt and Resource Utilization views, according to the rules set in the Changeover editor.

Makespan Bars

Routings are also displayed on the time grid by makespan bars. The color of these makespan bars is based on whether the routing is on time, or late.

Type	Significance
Solid black bar	Routing is on time.
Solid red bar	Routing contains critical bottleneck operations.

Although subroutings are not displayed with a makespan bar, their operations are displayed on the Production Pegging view.

A pop-up box displays the following information:

Routing	Routing name
Start time	Start time for the routing
End time	End time for the routing
Duration	Length of time between the start time and the end time

Merged Operations

To help simplify your schedule views, adjacent operation instances of identical types can be represented as one production run. Within the Resource and Operation Gantt views, you can view the schedule with each operation instance displayed separately or as a single operation. This option is toggled with the Merge Operation button. Click the Merge Operation button again to display, the operations separately.

As a result, manual scheduling is simplified. Instead of re-assigning each batch in a run, you only need to re-assign the total production run by using the Cut and Paste buttons. Properties for merged operations can be viewed, but they cannot be modified. The properties for merged items display the aggregated properties for each discrete operation in the merged operation. Pegging can also be performed on merged operations.

Once operations have been merged, you can view information about these consolidated operations from the Operation and Resource Gantt views. The Resource Gantt views only provide merged information about unary operations, whereas the Operation Gantt displays information about all the operations.

Pegging

The pegging feature enables you to view all of the operations that are both "upstream" and "downstream" in relation to a selected operation. Pegging enables you to view the impact that an operation has on other scheduled operations. The pegging information can be re-ordered so that the pegged operations are sorted according to the routing sequence. This feature works identically to the pegging options that are documented in the Resource Gantt view.

Order pegging enables you to view all of the item resources and operations that are associated with the items ordered, and how they have been allocated for the order. Order pegging provides you with in-depth information that is required to know when specific customer orders have been scheduled, the steps involved, and the time when the order will be fulfilled.

To enable order pegging, information about the primary operation output and primary operation must be entered when operations and routings are defined. Once specified, the Supply & Demand editor can display a detailed list of all of the items and processes that are involved with the production of each line item of an order. This list clearly displays each item component, its name, the quantity required, which operation consumes it, whether it is in inventory or needs to be produced, and the date and time proposed for completion of each step.

Viewing Production Schedule Details

This section discusses how to:

- View work order data
- View demand data
- Merging operations

Viewing Work Order Data for Operations

Access the Production Pegging, Resource Gantt, or Operation Gantt.

To view operation properties:

1. Right-click an operation.
2. Select Properties.
3. Select Work Order Number.

   This field indicates all work orders associated with this operation. If no work order is associated with this operation, the field is blank.
4. Select Work Order Editor.

   The Work Order Editor opens and the current work order is highlighted.

Merging Operations

Access the Production Pegging, Resource Gantt, or Operation Gantt.

To merge operations:

1. Select Merge Operation to merge adjacent operations into one run.
2. Right-click any merged operation, and then select Properties. The following information is provided:
   - Total production or consumption of the involved items
   - Start times, end times and duration for crew and machine resources
3. Click OK to close the operation properties.

Analyzing Scheduled Demand

This section discusses how to:

- View demand data for operations.
- Filter demand orders
- Peg supply events to demand.

Viewing Demand Data for Operations

Access the Production Pegging, Resource Gantt, or Operation Gantt.

To view demand data for operations:

1. Right-click an operation.
2. Select Properties.
3. Select Demands.

   This field indicates the demand items associated with this operation. You can scroll to various line items if the operation satisfies multiple demands.
4. Select Supply & Demand editor.

   The Supply & Demand editor opens, with the demand item for this operation highlighted.

Note. If an order is marked in the Supply and Demand editor as "Ship Complete", then the Operations property page only displays demand numbers and not individual line items.

Filtering Demand Orders

Access the Production Pegging.

To filter demand orders:

1. Select the type, punctuality, and magnitude of punctuality that is needed to filter your demand orders. Any combination is acceptable. The Production Pegging immediately displays only those orders that meet your criteria.

   Note. All of the folders are included in the resulting filtered list, even if they do not contain any demands meeting the criteria.

   ---
2. To view the Magnitude of Punctuality drop-down, you must have selected either Late or Early from the Demand Punctuality filter.
3. Select Customize from the Demand Magnitude Filter list box.
4. To edit a value in the available options, do the following:
   - Double-click the value that you want to edit.
   - Type a new value (in days), and press Enter.
5. To reorder a value in the available options, do the following:
   - Select the value that you want to reorder.
   - Click the arrow buttons to move the value into its new location.
6. When you have finished customizing the filter, click OK.

Pegging Supply Events to Demand

Access the Production Pegging.

To peg supply events to demand:

1. Right-click the supply event that you want to peg.

2. Select Peg Demands from the menu.

   A dialog box appears that displays all of the associated demands, line items, and revenue.

Viewing Supply and Demand Order Details

Access the Production Pegging.

To view supply and demand order details:

1. Click the demand folder, order, supply event, or line item for which you want more details.
2. Click Open Supply & Demand editor from the Production Pegging toolbar.

Analyzing Scheduled Resources

This section discusses how to:

- View a resource group
- View pegging information
- View resource utilization
- View resource contention
- View total capacity for a resource.
- View alternate resources

Viewing a Resource Group

Access the Resource Gantt.

To view a resource group:

Select a resource group from the Resources available options.

Viewing Pegged Resources

Access the Resource Gantt.

To view pegged resources:

1. Select one of the following options:
   - Peg Upstream

     This option will display upstream operations.
   - Peg Downstream

     This option will display downstream operations.

   Note. To display both upstream and downstream operations, click both options.
2. Click on the first operation for which you want to view pegging information.

The Resource Gantt highlights the upstream operations in brown and the downstream operations in purple.

3. Repeat the previous step for other operations to view pegging information.
4. Click the pegging buttons again to turn off this option.

Sorting Resources

Access the Resource Gantt.

To sort resources:

1. On the schedule view toolbar, click Zoom In to increase the size of the columns until “days” are displayed.
2. On the default sort order drop-down list box, select one of the following options:

Utilization Sort	Re-orders the resources in the Resource Gantt in order of their utilization. Resources are sorted by utilization from highest to lowest.
Peg Sort	Re-orders the operations in the Resource Gantt according to the routing order and their associated resources. You can turn off this feature when it is not required. Doing so returns the resource order to its original sequence.

Viewing Resource Utilization

Access the Resource Utilization view.

To view resource utilization:

1. Click Zoom In, Zoom Out, or Zoom to 100 percent to view the schedule at the required level of detail.
2. Select a resource from the Resources list box.

   The vertical bars in the graph represent the utilization level for that resource.
3. Select one of the following time periods from the Bucket Set available options:
4. Shift
5. Daily
6. Weekly
7. Monthly
8. In the graph, click a time period to display utilization statistics for that time period.

Viewing Resource Contention

Access the Resource Contention view.

To view resource contention:

1. Click Zoom In, Zoom Out, or Zoom to 100 percent to view the schedule at the required level of detail.
2. Select a resource from the Resources available options.

   The horizontal bars in the graph represent the contention level for that resource.

Note. You should refer to the Resource Contention view after the schedule has been solved. Watching the Resource Contention view during the solve slows down the solve because of the necessary graphical updates.

Viewing Total Capacity for a Resource

Access the Multi-Capacity Resource Graph view.

To view total capacity for a resource:

1. From the Resources list box, select All Resources, a resource group, or a single multi-capacity resource.
2. On the Resource list, click an item.

   The chosen item is selected, and the level for that item displays as a line in the graph.
3. Move your pointer over any point on the chart line.

   A pop-up window appears that displays the resource name, used capacity, and level start and level end dates.
4. Click Zoom In, Zoom Out, or Zoom to 100 percent to view the required level of detail.

Viewing Alternate Resources

Access the Production Pegging.

To view alternate resources:

1. Select a resource from the Demand Tree.
2. Right-click and select Show Resource Alternates.

   Alternates for the specific resource are displayed in the Production Pegging.

Analyzing Scheduled Items

This section discusses how to:

- View item graph data.
- View item Gantt data.
- View item properties.
- View item groups.
- View item production and consumption.
- Sort items by degree of violation.

Viewing Item Graph Data

Access the Item Graph.

To view item graph data:

1. Select one of the following options from the Items list box:

2. All Items
3. An item group
4. An individual item
5. On the Items list, click an item.

   The chosen item is selected, and the level for that item displays as a line in the graph.
6. Move your cursor over any point on the chart line.

   A pop-up box that displays item description, current quantities, and level start and end dates appears.
7. Click the zoom buttons to display more or less detail.
8. On the toolbar, click the item graph buttons as follows:
9. Click the Scale buttons to change the scaling on the Y axis.
10. Click the Show Spikes button to display overlapping supply and demand events that occur at the same time.

Viewing Item Properties

Access the Item Graph or Item Gantt.

To view item properties:

1. Use the Items list box to view a specific item or display a group of items.
2. Right-click an item and select Properties.

Viewing Item Groups

Access the Item Gantt.

To view item groups:

1. Click All Items.
2. Select the specific item group that you want displayed in the Item Gantt.

Note. If the group does not appear in the list, verify that the properties of the group are set to display in the Item Gantt. If you add a group after the initial solve, close and re-open the schedule, and then select the Item Gantt.

Viewing Item Production and Consumption

Access a Resource and Operation Gantt view combined with the Item Gantt and Graph view.

To view item production and consumption:

1. Click on the operation for which item data will be displayed.
2. Click the Produced Items or Consumed Items button from the toolbar.

   The Item Gantt (or Graph) view is filtered for the option that is selected.

Sorting the Degree of Violation

Access the Item Gantt.

To sort the degree of violation:

1. Click Sort Items.

   The items are sorted in descending order with the most contentious items at the top of the view.
2. To return the view back to its original sort order, click Sort Items again.

   The view returns to its original appearance.

Analyzing Scheduled Operations

This section discusses how to:

- View an operation quick summary.
- View operation groups
- View pegged operations

Viewing an Operation Quick Summary

Access the Operation Gantt.

Hold your cursor over any operation.

Information about the operation-including its name, start time, and duration appears in a pop-up window.

Note. This procedure can be used to view quick summary information in the Production Pegging and Resource Gantt.

Viewing Operation Groups

Access the Operation Gantt.

To view operation groups:

1. On the Operation Gantt, select the operation group you want to view from the Operations available options.
2. Obtain schedule information as described in the following paragraphs:
3. Click the Alerts button to view any alert messages.
4. Click the zoom buttons to view different levels of detail.
5. Right-click any operation to view and make changes to Properties.

   Note. If you rename the group or change properties, you need to close and reopen the schedule, and then select the Operation Gantt.

   If the group does not appear in the list, verify that the group properties are set to display in the Operation Gantt.

Viewing Pegged Operations

Access the Operation Gantt.

To view pegged operations:

1. Select one of the following options:
2. To display pegged operations upstream of the selected operation, click Peg Upstream.
3. To display pegged operations downstream of the selected operation, click Peg Downstream.
4. To display all pegged operations, click Peg Upstream and Peg Downstream.
5. Select the first operation for which you want to display pegging information.

   The Operation Gantt view highlights the upstream operations in brown and the downstream operations in purple.

Using Combined Views

This section discusses how to:

- Add a combined view
- View combined views

Adding a Combination View

Access the View Wizard window.

To add a combination view:

1. In the List of available sub-views, select a schedule views that you want to appear in your combination view.
2. Click Next to move the sub-view to the Selected subviews area.
3. Repeat steps 1 and 2 for each additional view.
4. If necessary, click the Set Order buttons to delete or reorder views. When the new view is created, the views are displayed in the same order that they are displayed in the Selected subviews list. A full description of each button is described in the following table:

Button	Name	Description
Button	Delete view	If a view has been moved into the Selected subviews list by mistake, select the view, and then click this button to remove it from the list.
Icon	Move up view	To move a view up in the Selected subviews list, select the view, and then click this button to move it up in the list.
Icon	Move down view	To move a view down in the Selected subviews list, select the view, and then click this button to move it down in the list.

5. Click Next, enter a view name, and click Next again.

6. On the View Wizard, select an button for the group, and click End.

   The button that you select and the name is added to the bottom of the current view group on the screen.

Viewing Combined Views

Access the List Bar.

To view combined views:

1. Click on the button for the combined view that you want.
2. Click on an element in the main view for which you want more details.
   - In a Resource Gantt, you can click any resource. The detail view might display how this resource is being used or the operations to which it is associated, depending on your choice of detail view.
   - In the Resource or Operation Gantt views, you can right-click any operation and display either the produced or consumed items, or all of the items that are produced and consumed by the operation.

In the Item Gantt, you can click any item. The detail view (the Item Graph) displays further information about that item's stock levels.

CHAPTER 23

Exporting Schedule Data

This chapter discusses how to:

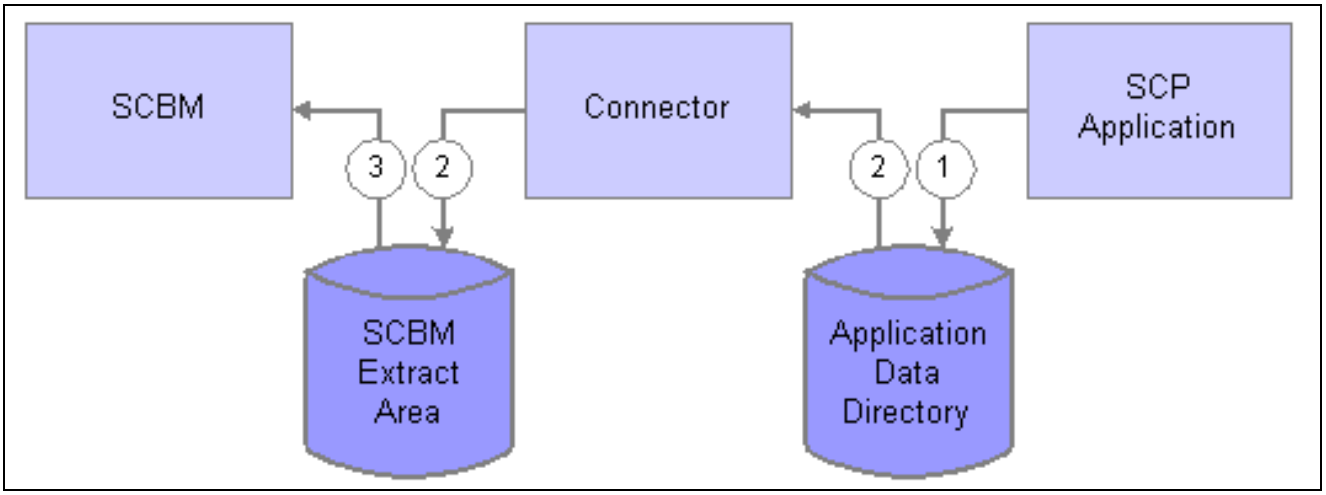
- Publish data to EnterpriseOne Supply Chain Business Modeler
- Export schedule data
- Publish schedule data in batch
- Publish the dispatch list

Publishing Production Scheduling Data to EnterpriseOne Supply Chain Business Modeler

You can use the data connector to publish production scheduling plans to EnterpriseOne Supply Chain Business Modeler. Before publishing, you must export your plan to an extract area.

When publishing to EnterpriseOne Supply Chain Business Modeler, you can select the data granularity level that suits your business requirements. You can update all plans or specific packages. To ensure that you are publishing all of the data that is required by EnterpriseOne Supply Chain Business Modeler, see the topic for the Supply Chain Planning Connector that you are using.

This diagram illustrates the Publish process:



Publishing production scheduling data to EnterpriseOne Supply Chain Business Modeler

When you publish production scheduling data to EnterpriseOne Supply Chain Business Modeler, the following events occur:

1. Application data from EnterpriseOne Production Scheduling is copied into the data directory.

2. The data connector transforms the data and copies it to the EnterpriseOne Supply Chain Business Modeler extract area.
3. An import scenario imports the data from the extract area into EnterpriseOne Supply Chain Business Modeler.

When you publish a schedule to EnterpriseOne Supply Chain Business Modeler, the data connector updates the ProductionSchedule package.

Prerequisites

Before you begin publishing data to EnterpriseOne Supply Chain Business Modeler, ensure that the following prerequisites are met:

- Create and solve a schedule.
- Use the Export Schedule command to generate the ProductionSchedule.xml file.

Publishing the Schedule to EnterpriseOne Supply Chain Business Modeler

To publish data using the data connector:

1. From the Command Prompt, navigate to the data connector directory:

   ```
   cd c:\scp\vers._xxx\start\
   ```

2. Type the following command:

   ```
   PsConnector
   ```

   _Continue -

   The data connector command shell starts.

3. Enter the following command:

   ```
   ps::model publish scbmDataFolder appDataFile
   ```

   For example, the following command publishes the ProductionSchedule package to the SCBM Import extract area:

   ```
   ps:model publish -packages {ProductionSchedule} "c:/temp/Model Data"
   ```

   _Continue -

   where temp could be any existing directory that is used for publishing PS data.

Exporting Schedule Data

This section discusses how to:

- Set global data export options.
- Export schedule data to EnterpriseOne Supply Chain Business Modeler.
- Publishing the dispatch list.

Setting Data Export Options

Access the Export Schedule Options window.

To set data export options:

1. Select the schedule data that you want to export from the available export options.
2. Click the Interval button to specify the time period or bucket, if necessary.
3. In the Interval Definition window, specify the following information:

Start Date	Specify the start date for the data. The default date is the beginning of the horizon.
Bucket	Select Shift, Daily, Weekly, or Monthly time buckets when exporting the current schedule.
End	Select the end of the interval. Choose No end date for the end of the horizon. Choose End after to select the number of time bucket occurrences that the exported schedule data will represent. Choose End by to specify a specific end date for the schedule data that you want to export.

4. Click OK to save the interval definition.
5. Click OK to save the data export options.

Exporting Schedule Data in XML Format

Access the Export Schedule window.

1. Select the XML option.
2. Select one or both of the following options:

Export Schedule	Export all schedule data to an XML file.
Export Purchase Order Recommendations	Select this option to export purchase order recommendations to an XML file. This file can be imported into EnterpriseOne Supply Chain Business Modeler to create an optimized plan.

3. Click OK.
4. In the Save As dialog, give the output XML file a descriptive name, or browse to an existing XML file.
5. Click Save.

CHAPTER 24

Using Key Performance Indicators

This chapter provides an overview of key performance indicators (KPIs) that can be used to evaluate a production schedule and discusses how to:

- Use the KPI view
- Evaluate a production schedule

Understanding Key Performance Indicators

After you create the initial schedule, it can be duplicated as many times as necessary, and you can make different changes to each version using manual scheduling. To determine which version of the schedule is the most cost-efficient or best fulfills customer orders, you can evaluate all the schedules against each other using key performance indicators (KPIs). KPIs are objective measures that can provide you with important information about how well the schedules perform from the customer service, material, cost, and manufacturing perspectives. KPIs are available for solved schedules and are dynamically refreshed each time a schedule is solved or repaired.

Key performance indicators (KPIs) are calculated values that enable you to evaluate schedules and select a schedule that best suits your specific criteria. KPI values range from 0 to * representing infinity. The KPIs are categorized into the following groups:

- Customer service
- Materials
- Costs
- Manufacturing

You can review the KPIs for all of the schedules or a subset of the schedules. Schedules are displayed chronologically in the same order that is displayed in the Model Workspace. You can sort the schedules according to your choice of KPI, rearrange the order of the columns, or hide specific columns or groups from displaying in this view. The schedules that are displayed in the Key Performance Indicators windows can be returned to the original sorting order if you no longer want to sort by a specific KPI.

Column width and row height can also be changed. If you do not want to view a specific KPI or if you want to keep it from general view, you can hide that column. Hiding all of the columns in a group hides the group. If you prefer to evaluate schedules based on a specific KPI group like Costs, you can reorder the KPI groups so that the group appears first in the grid.

Note. A number of the KPIs depend on pegging information for their calculations. Verify that you have specified the primary operations for each routing and the primary outputs.

Schedule Comparison

This approach is ideal if you want to make a change to an existing schedule and assess its impact to the original schedule. You begin by renaming the original schedule Baseline Schedule. A duplicate of this schedule can be made as many times as necessary. Then, as changes are made to each of the duplicate schedules and repaired, rename the schedules with more descriptive names. With all the schedules contained in a schedule folder, you can then compare these schedules.

You can compare the KPIs for a schedule against a baseline schedule to determine the net difference in customer service between schedules. You can also select the colors used to highlight the baseline and comparison schedules in the Key Performance Indicator window.

By comparing and refining schedules in the KPI window, you can continually improve the production planning process and ensure that your enterprise has the materials available to meet the requirements in the production plan. The KPIs displayed in the Key Performance Indicators window are updated automatically when you solve your schedule.

The Demand Details pane highlights changes in demand fill data between a schedule and a baseline schedule. The following table describes the demand fill data that is included in the Demand Details pane.

Field	Description
Demand	The demand code for the schedule and the associated line item.
Item	The item that is scheduled for production.
Demand Priority	The demand priority of the item that is scheduled for production.
Customer	The customer that is requesting the item.
Change in Makespan	The change in the duration of the demand, including associated line items and routings. The value is expressed in days and hours. A negative value indicates a shorter makespan.
Change in Lateness	The change in lateness between the baseline schedule and the schedule used in a comparison. The value is expressed in days and hours. A negative value indicates that the lateness of the demand is reduced.
Request Date	The request date indicated by the baseline schedule. For new a demand, the request date is taken from the comparison schedule.
Available Date	The available date indicated by the baseline schedule.
Available Date (Comparison Schedule)	The available date indicated by the comparison schedule.

Customer Service Indicators

The customer service KPIs indicate how well the schedule fulfills demand orders, as well as the availability of saleable inventory during the schedule horizon.

KPI	Description
Line Fill %	The percentage of demand order line items that are filled by the schedule over the horizon. This information is also displayed in the summary of the Supply & Demand editor.
Order Fill %	The percentage of demand orders that is filled by the schedule over the horizon. This information is also displayed in the summary of the Supply & Demand editor.
Unit Fill %	The percentage of units that is filled by the schedule over the horizon. This information is also displayed in the summary of the Supply & Demand editor.
No. of Stock Outs	The number of times that saleable items fall below the minimum quantity that is required to be on-hand over the schedule horizon.
Stock Out Time	The cumulative amount of time that saleable items fall below the minimum quantity that is required to be on-hand over the schedule horizon. How this amount is displayed depends on the cost time unit that is selected as the default when you configure KPI cost parameters.

Materials Indicators

This KPI category provides information about saleable inventory stock levels compared with the total demand over the schedule horizon. Data is also provided about item substitutions and the average time that is required to produce finished products.

KPI	Description
Inv. Turns	The number of times that inventory cycles, or "turns over," during the schedule horizon. This number is computed by dividing the total demand order value by the average saleable inventory value over the horizon.
Periods of Cover	The number of periods that your existing saleable inventory will last to meet future demand. You can display this KPI using shift, daily, weekly, or monthly periods. The inventory levels for this calculation are taken from the inventory level at the beginning of the horizon.
No. of Subs.	Number of times that items are substituted during the schedule horizon by less preferred items. Substitution only occurs when item sets are used to specify secondary item choices.
Mfg. Cycle Time	The average amount of time that it takes to manufacture products during the schedule horizon. This amount is calculated by totaling the amount of manufacturing time that is available by the number of units produced.

Cost Indicators

To use cost criteria for comparing schedules to each other, resource, operation changeover, and miscellaneous fixed costs must be accurately entered into the model. You begin by entering the KPI cost parameters that define the currency and cost time unit for the entire model. These settings impact all of the time units that are used when entering resource and operation costs.

When you define KPI cost parameters, you can also enter any miscellaneous fixed costs that are not related to resources or operations. The currency and cost time unit are set globally, and these settings affect the resource and operation time unit used for entering costs. The cost time unit options are Minute, Hour, Shift, Day, and Week.

In addition to KPI cost parameters, costs must be input for each crew, item, machine, and tool resource. Fixed setup and operating costs can be entered for crew, machine and tool resources. Carrying and stock-out costs for each unit can be entered for item resources Costs can also be entered for each operation and changeover rule. Once all of the costs have been entered into your model, you can compare your scenarios and schedules, and evaluate them based on cost factors. Fixed setup and operating costs can be entered for each operation. Costs can also be associated with each changeover rule and applied to the overall costs of a schedule.

The Cost KPIs summarize the costs that are involved with your production, changeover, and inventory during the schedule horizon. For these KPIs to be accurate, entering the appropriate KPI cost parameters and the cost properties for each resource, operation, and changeover is critical.

KPI	Description
Changeover Cost	The cost that is involved with all of the changeovers that are included in the schedule. Costs are derived from the Changeover editor.
Inv. Cost	The carrying cost of all the items over the schedule horizon.
Mfg. Cost	The total resource and operation costs over the schedule horizon. This cost does not include costs that are associated with inventory or changeover times.

Manufacturing Indicators

Manufacturing KPIs provide information about your overall manufacturing efficiency. The overall machine utilization percentage is calculated, as is the throughput from the first operation to the last. The total time that is devoted to changeovers is also tabulated.

KPI	Description
Changeover Time	The total changeover times for all machines in the schedule horizon.
Machine Util. %	The percentage of machine utilization for the schedule horizon. If there are no machines in the model, a zero is displayed.
Throughput	Total material output from the first operation to the last operation. You can display the throughput using the shift, daily, weekly, or monthly time buckets.

Prerequisites

Before comparing a subset of all of the existing schedules, ensure that the following prerequisites are met:

- Create a schedule folder with an appropriate descriptive name.
- Move all of the schedules that you want to compare into the schedule folder.

Evaluating Schedules Using KPIs

This section discusses how to:

- View key performance indicators
- Compare production schedules
- Sort schedules by KPI
- Re-order KPI groups
- Hide KPI groups
- Hide KPI columns
- Reorder KPIs in groups

Viewing Key Performance Indicators

Access the Key Performance Indicators window.

To view Key Performance Indicators:

1. Select a schedule.
2. View the KPIs in the following categories:
   - Customer Service
   - Materials
   - Costs
   - Manufacturing

Comparing Schedules

Access the Key Performance Indicators window.

To compare schedules:

1. In the Schedule Comparison pane, select a schedule to use as the baseline from the Baseline Schedule menu.
2. Select a schedule to compare with the baseline from the Compare to menu.

   The baseline schedule and the schedule used to compare with the baseline schedule are highlighted in the Key Performance Indicators window. You can change the highlighting colors by selecting Customize Colors on the toolbar.

3. From the Demands menu, select one of the following values to display changes to demand in the new schedule:
   - Was On-time - Now Late
   - Was Late - Now On-time
   - Was Late - Less Late
   - Was Late - More Late

   An asterisk (*) displays all demands that exist in both schedules.
4. Select Include New Demands In Comparison Schedule to include any new demands that were not included in the original schedule.

   Metrics for the baseline schedule and the comparison schedule are displayed in the Demand Details pane.

Sorting Schedules by a KPI

Access the Key Performance Indicators window.

To sort schedules by KPI:

1. Click on the KPI column heading for the KPI by which you want to sort.

   This action sorts your schedules in ascending order.
2. Click the KPI column heading again to sort your schedules in descending order.
3. Click on the top left blank column heading.

   The schedules are returned to the original order.

Reordering KPI Groups

Access the Key Performance Indicators window.

To reorder KPI groups:

1. Right-click in the top left blank column heading and select Hide Groups.
2. In the Shown Groups field, select the group you want to move to a different position.
3. Click either the Move Up or Move Down button to change the position of the group relative to the other groups.
4. Click OK.

Hiding KPI Groups

To hide KPI groups:

Access the Key Performance Indicators window.

1. Right click in the top left blank column heading and select Hide Groups.
2. On the Show/Hide Grid Columns window, in the Shown Groups field, select the group that you want to hide.
3. Click the button with the double arrows pointing to the right to move the group to the Hidden Groups field.
4. Click OK.

Hiding KPI Columns

Access the Key Performance Indicators window.

To hide KPI columns:

1. Right-click the KPI column that you want to hide and select Hide Columns.
2. On the Show/Hide Grid Columns window, in the Shown Columns field, click the KPI that you want to hide.
3. Click the button with the double arrows pointing to the right to move the KPI to the Hidden Columns field.
4. Click OK.

Reordering KPIs in Groups

Access the Key Performance Indicators window.

To reorder KPIs in groups:

1. Right-click in the column heading and select Hide Columns.
2. In the Shown Columns field, select the KPI that you want to move to a different position.
3. Click either the Move Up or Move Down button to change its position relative to the other KPIs in the group.
4. Click OK.

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