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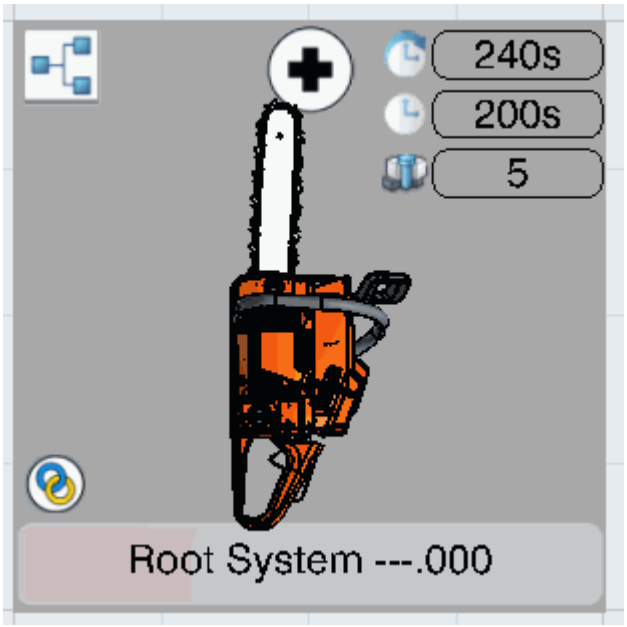
DIGITAL MANUFACTURING WITH DELMIA

INDUSTRIAL PROCESS PLANNING

Module-2. A: About the System Monitor

A. System Tile Description: System Editor visualizes systems by means of tiles. Information about the system is displayed on the tile using icons and numerical values. If parts are assigned to a system, the tile has a 3D representation of the parts on top of it.

The following image shows the top view of a typical system tile.



The icon in the upper-left corner represents the system type (for example, General System). The name of the system is displayed at the bottom of the tile.

If a scope is defined between the system and an item, an icon appears in the lower left corner.

If a scope is defined between the system and a resource, an icon appears in the lower left corner.

The following information is displayed in the upper-right corner of the tile:

- **Current Cycle Time**, which is the cycle time of the root system
- **Total Time of Operations**, which is the sum of the durations of all the operations under the system. The time type on the operations is considered as Estimated time.
- **Number of Assigned Fasteners**, which is the number of fasteners assigned to the system (or to child systems of the system).

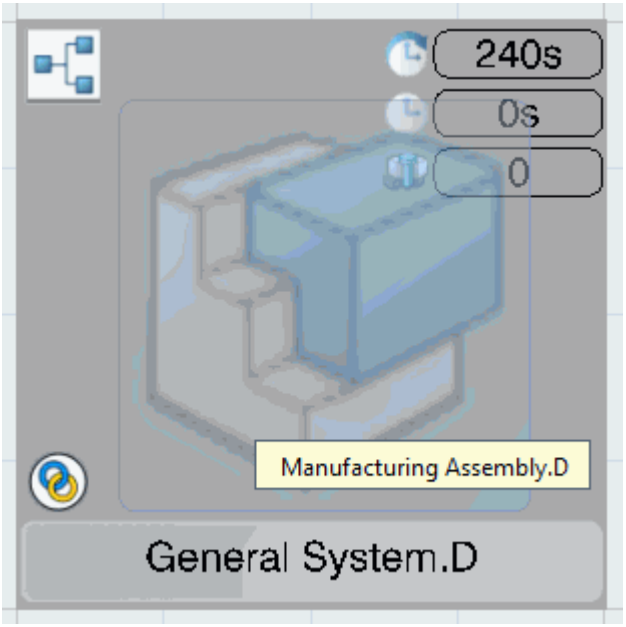
You can choose to show or hide this information using the Information on tile options in **Me > Preferences > App Preferences > Simulation > Process Engineering > Process Planning > System Grid Editor**.

B. Visual Feedback on Tiles with No 3D Representation

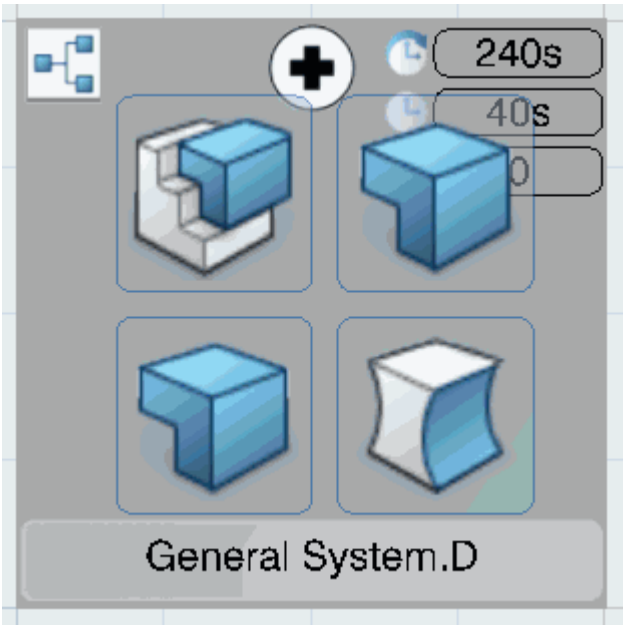
If there is no 3D representation of the assigned parts on a system tile, item icons are displayed on

the system tile.

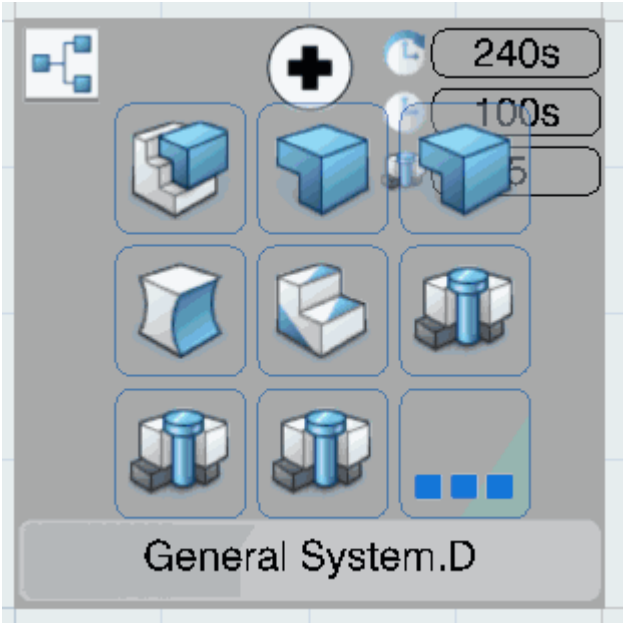
If the system has a scope with an item, an icon representing the item with a scope link to the system is displayed in transparent mode. An item is identified by means of a tooltip.



All items linked to operations within the system are taken into account. When there are several possible items, only the last items are shown. For example, if there is a data requirement between P1 to P2 and both items are implemented, then only P2 is shown. The icons have an opaque visualization.



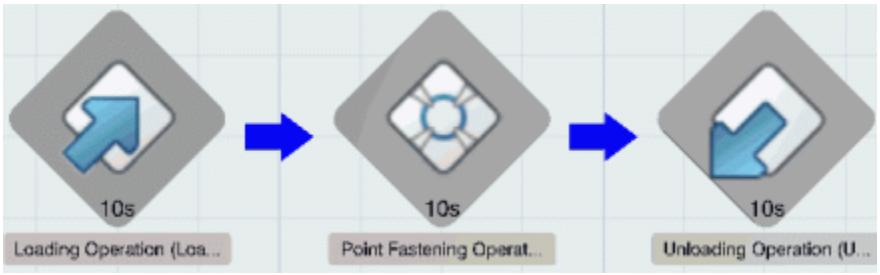
A maximum of nine icons can be shown. If there are more icons than that, then a symbolic icon "groups" the remaining items, which are identified by means of a tooltip.



C. Operation Tile Description: System Editor visualizes operations by means of colored tiles. Information about the operation is displayed on the tile by means of icons and numerical values. If parts are assigned, the tiles have a 3D representation of the parts on top of them.

All planning operations under a given system are displayed as tiles when the system tile is expanded. However, Source, Sink, and Buffer systems are not expandable and its operations are not displayed as tiles.

The following image shows the top view of typical operation tiles.



D. **Visual Feedback and Numerical Values on Operation Tiles:** The large 2D icon on the tile represents the operation type (for example, Loading operation). The name of the operation is displayed under the tile.

If the operation has a time analysis, an icon is displayed on the tile. Operation time is also displayed on the bottom corner of the tile. The time type on the operations is considered as Estimated time. The operation time on a collapsed operation tile is the sum of the operation times of the child operations.

If the operation is pinned, an icon is displayed on the tile.

If the operation implements an item and the item implements a product that has a 3D representation, the representation is displayed on the operation tile. If the same item is implemented by several operations, selecting the representation on one operation tile, also highlights the representation on the other operation tiles. Some item contextual commands are available by right clicking the representation.

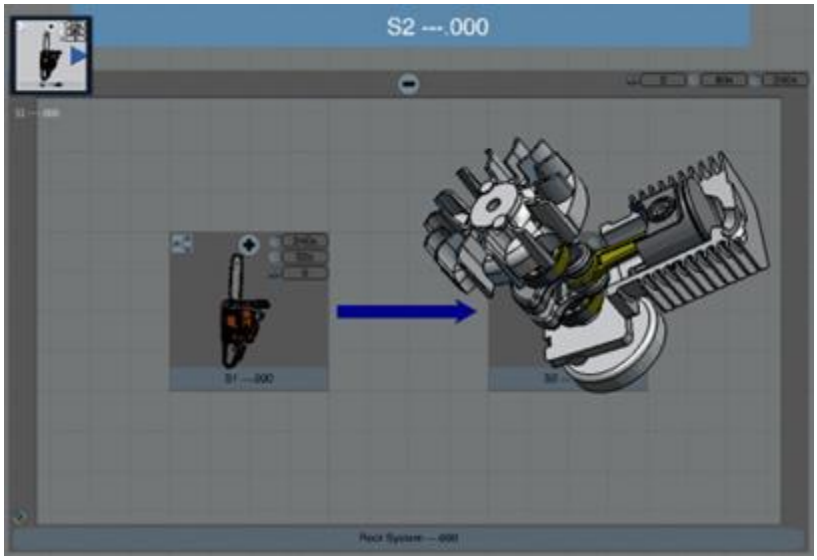
An icon representing the implemented item may appear on the operation tile: for example, if the implemented item does not implement a product, or the implemented product has no 3D representation.

Icon	Description
	Expands the selected tile only.
	Expands the selected tile and child systems. Available for systems only.
-	Expands the selected tile, child systems, and first level of operations. Available for systems only.
	Expands the selected tile and all its children.
	Collapses the selected tile only.
	Collapses the child systems. Available for systems only.
	Collapses the first level of operations. Available for systems only.
	Collapses the selected tile and all its children.

E. Selecting Parts and Assemblies:A number of capabilities are available for selecting parts and assemblies from the 3D representation (for example, to drag and drop).

Smart Zoom Capability

The Smart Zoom capability is useful to investigate the 3D representation and for better selection handling. The tile is zoomed until the 3D representation "takes off" from the tile. The 3D representation can be rotated and zoomed.



The Smart Zoom capability is deactivated by default. You can activate it at any time using the F6 key, or the Automatic Activation option in Me > Preferences > App Preferences > Simulation > Process Engineering > Process Planning > Grid Editors.

Module-2. B: About Systems

A. Default System

The system automatically creates a default root system on the PPR Context when you enter the application. This root system is usually a General system. However, you can also use a Transformation system as a root system.

It is possible to have several root systems.

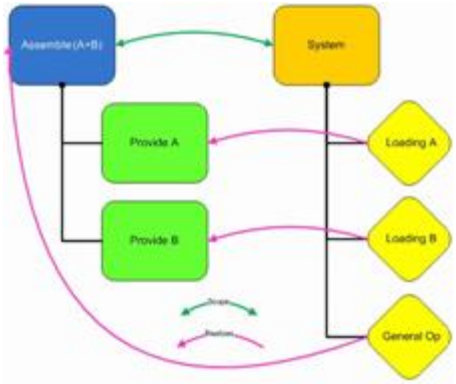
This allows you to define several work plans (or item plans) for the same item. You can easily compare

the different work plans by switching from one to another. You do that by double-clicking a root system. This changes the active root system, which the tree frames in blue, and the system structure that is displayed in the grid in the System Editor.
At a lower level of the tree, it is possible to insert new and existing objects. You can create systems and operations in Process Planning, Fastener Planning, and Planning Structure.

B. Links Between Systems, Items, and Operations
A system holds a group of operations (and possibly subsystems). These correspond to the steps required to realize completely the manufacturing assembly structure. The scope between the system and an item delimits this manufacturing assembly structure.

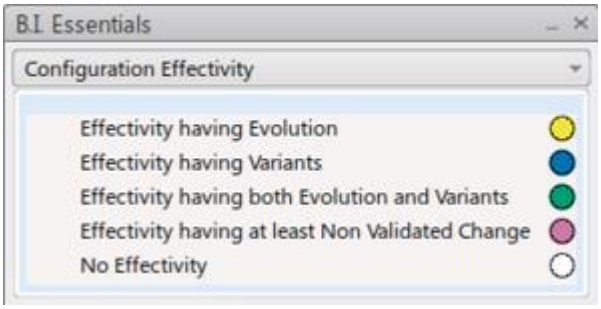
Each operation contributes to the realization of one or more child items related to the item dedicated to the system.

The figure below illustrates how you can link a General operation under a System to a Manufacturing Assembly "Assemble (A+B)." You can do this if there is a scope defined between the system and item.



C. **Creation of New Root Systems**
Root systems can be created under the PPR Context using **Add > New**.
Under **Add > Content**, the **Process Plan and Production System** section of the **New Content** dialog box lists the available root system types.
If you right-click a system type, the **Set attributes at creation** command allows you to you can specify (explicit mode) or not (implicit mode) the attributes of the system. User **Preferences** stores this information.
In addition, you can define the administrator as the implicit/explicit creation mode for each type.
When creating a new system in explicit mode, the attributes dialog box of the system appears.
When the creation mode for the system type is implicit, the attributes dialog box does not appear, and the creation mode creates the system directly. The application uses Implicit creation mode when entering with the creation of a root system.
Note: You can also directly create a Time Analysis in the **Process Plan and Production System** section of the **New Content** dialog box. In this case, the application creates the Time Analysis directly without attaching it to an operation, and the dedicated Time Analysis application opens.

D. **Configuration Effectivity and B.I. Essentials**
B.I. Essentials color codes the object tiles and the objects in the tree according to their configuration effectivity status. To compute the configuration effectivity status, B.I. Essentials takes into account Systems and Operations.
The **Configuration Effectivity** menu option in the **B.I. Essentials** panel contains the following information:



Color	Information
Yellow	The effectivity meets the evolution requirements.
Blue	The effectivity meets the variants requirements.
Green	The effectivity meets both the evolution and the variants requirements.
Pink	The effectivity contains nonvalidated change criteria.
White	There is no effectivity.

F. Creating a System

1. From the **Authoring** section of the action bar, click **General System**  .

Note: You can select any other system type by selecting the corresponding command.

2. Select the position in the tree where you want to create the system.

The new system is created.

Note: You can also create a system by doing one of the following:

- Use the **System/Operation Authoring** context toolbar in the System Editor.
- Right-click a system tile in the grid, or a system node in the tree. Then, select the required system type from the **Insert** context menu.

G. Creating Systems with Explicit Attributes

Right-click the system tile on the grid or the system node in the tree and click **Insert > General System** in the context menu.

The **General System** dialog box appears.

It provides access to the main attributes of the system to be created.

General System tab

- Name
- Title
- Description
- Applicability Date
- Capacity
- Mean time between failures.
- Mean time to repair.
- Total production time
- Cycle Time
- Route Queuing Mode
- Accept Queuing Mode.
- Route Mode
- Accept Mode.
- Operation Mode

1. Configuration tab

Configuration criteria for Variant and Evolution types

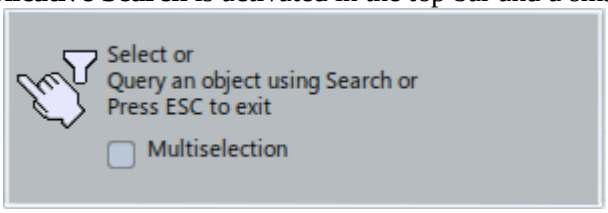
2. Enter any required attribute values and click **OK**.
   The system is created in the System Editor with the assigned attribute values.
3. Continue to add systems to the system structure in the same way, defining the attribute values for each system.

Notes:

- Sometimes the **Set attributes at creation** option is not selected when you right-click the required system type in the **New Content** dialog box. In this case, the attributes dialog box does not appear when creating a system. The system is created with default values.
- The attributes of a system can be modified at any time by right clicking the system tile or tree node and selecting **Properties**.

H. Inserting an Existing System

1. From the **Authoring** section of the action bar, click **Existing System** .
   Note: This command is also available in the System Editor context menu.
2. Select the position in the system structure of the tree where you want to insert the system.
   The **Applicative Search** is activated in the top bar and a small panel appears.

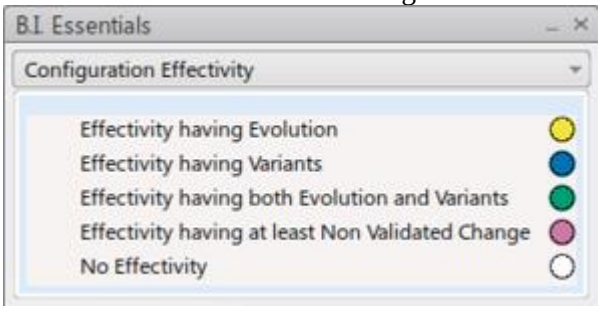


3. Select one or more systems as follows:
   - Type your search criteria in the **Applicative Search** box, click , then select the desired objects from the search results.
   - Select an object in the tree or work area.
   - Select the **Multiselection** check box, select several objects in the tree or work area, then click **Accept** .

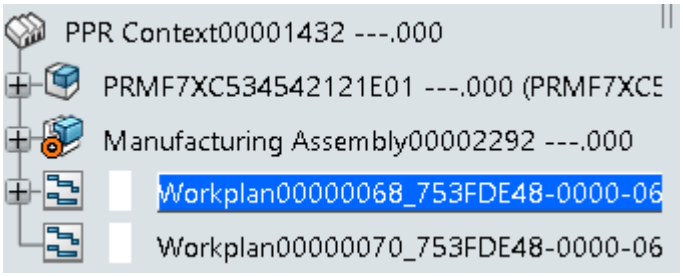
The selected systems (along with any associated operations) are inserted into the system structure.

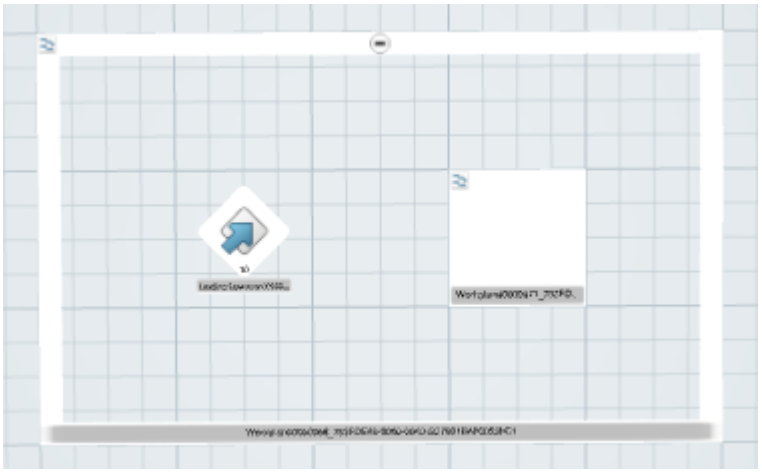
I. Checking the Status of the Configuration Effectivity with B.I. Essentials

1. Select a System or Operation in the tree.
2. From the **Tools** section of the Action Bar, click **B.I. Essentials** .
   The **B.I. Essentials** panel appears.
3. Click the **Configuration Effectivity** menu option in the **B.I. Essentials** panel.
   The list appears and contains information about the configuration effectivity status.



B.I. Essentials has now color-coded the selected system or operation in both the tree and the main 3D according to its status in the **B.I. Essentials** panel.





J. About System-Workplan Scope:

The System-Workplan scope can be created between a system, which is not a workplan, and a workplan. The system and the workplan must belong to two different root systems.

A mask appears on the system node in the tree to indicate that there is a scope link from the system to the workplan.

If a root system contains a system that has a scope to a workplan, it is considered as a line balancer system. You can no longer create an item scope in this root system.

Similarly, if a root system contains a system that has a scope to an item, it cannot be considered as a line balancer system. You can no longer create a system scope in this root system.

A check is done to ensure that there is no "crossing" system scope, similar to what is done for a scope between an item and a system.

Module-2. C: About Item to System Assignments

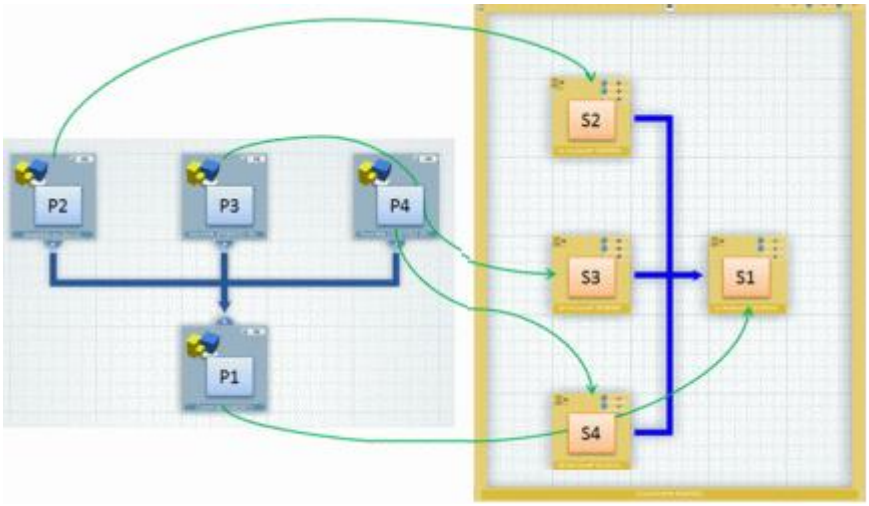
A. Item to System Assignments

There are a number of ways to assign items to systems. However, the assignments must respect the manufacturing assembly and system structures.

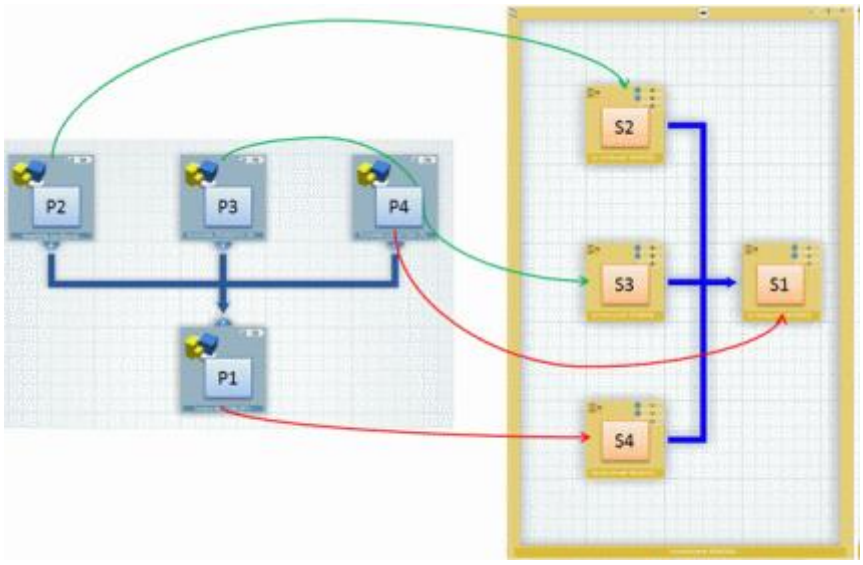
For example, assignments can be done as follows:

- Dragging and dropping an item in the Item Editor to a system tile in the System Editor
- Creating an operation under a system and linking the operation to an item
- Using Assignments Manager
- Using System Assignment Assistant

In the following example, the item to system assignments are done in a consistent manner. The assignments respect the constraints of the manufacturing assembly structure.



However, in the following example, some item to system assignments are inconsistent. The assignments of items P1 and P4 do not respect the constraints of the manufacturing assembly structure. It is not logical that P1 is realized before P4.



B. Managing Item to Operation Assignments

1. From the **Authoring** section of the action bar, click **Assignment Manager** .
2. Select an operation.

The **Assignment Manager** panel appears with the **Item to Operation Assignment** tab selected. It lists assigned and assignable items of the selected operation.

All the items that are listed are derived from the System-Item scope definition.

You can change the active object by double-clicking an assigned object in the **Assignment Manager** panel. After double-clicking an object in the panel, it is also highlighted in the tree and the main 3D.

The **Assigned Items** area lists the items that are already assigned to the selected operation. In the example above, one item is already assigned to the selected operation.

In the **Assignable Items** area:

- When selected, the **Show Lower Scope Objects** check box displays items from lower scopes.
- The tab lists the items that are not assigned, but can be assigned to the selected operation.

- The tab lists the items that are already assigned to other operations. These can also be assigned to the selected operation.

3. You can manage the assignments as follows:
   - Assign an item: in the tab, when you click an item from the **Assignable Items** list, you can assign it to the operation by clicking **Assign Selected Items** . The item is added to the **Assigned Items** list.

Note: When you assign an item clicked from the tab, it creates a new operation with an implement link to the item at the targeted position. The previously existing operation remains in the MBOM structure but its implement link to the item is removed.

   - Unassign an item: in the tab, when you click an item from the **Assigned Items** list, you can unassign it from the operation by clicking **Unassign Selected Items** . The item is added to the **Assignable Items** list.
   - Filter attribute content: you can filter the content of an attribute column by clicking **Filter** . A box appears in which you can specify the data to filter. Then, if you select a column header, the entire column is filtered. To deactivate the filter, click **Filter** again.
   - Customization: you can customize attribute columns by clicking **Attributes Customization**. In the **Customize** dialog box that appears, first select the Object Type, then move one or more available attributes in the **Available Attributes** column to the **Displayed Attributes** column. When you click **OK**, a new column corresponding to the selected attributes appears in the **Assignment Manager** panel.

4. Close the **Assignment Manager** panel to save any modifications made to the assignments.

In addition to the **Item to Operation Assignment** tab, the **Assignment Manager** panel also has:

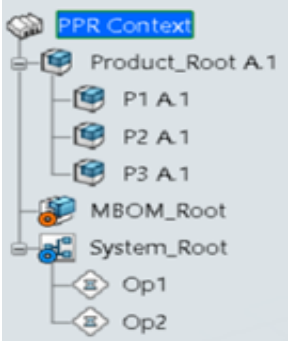
- A **Resource to Operation Assignment** tab for managing resource to operation assignments
- A **Requirement to Operation Assignment** tab for managing requirement to operation assignments.

These assignments are done in a similar way to the item assignments described above.
Note: When parts are clicked in the **Assignment Manager** panel, they are crossed highlighted in the tree and on the tiles of the Item Editor.

C. Creating and Assigning Items Automatically:

Open your PPR context.
In the example below:

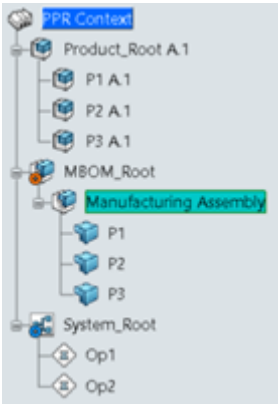
- Products P1, P2, and P3 are not yet implemented.
- MBOM_Root is scoped with Product_Root.
- System_Root is scoped with MBOM_Root.



Drag products P1, P2, and P3 to operation Op2.

The MBOM structure is automatically generated. In the example below:

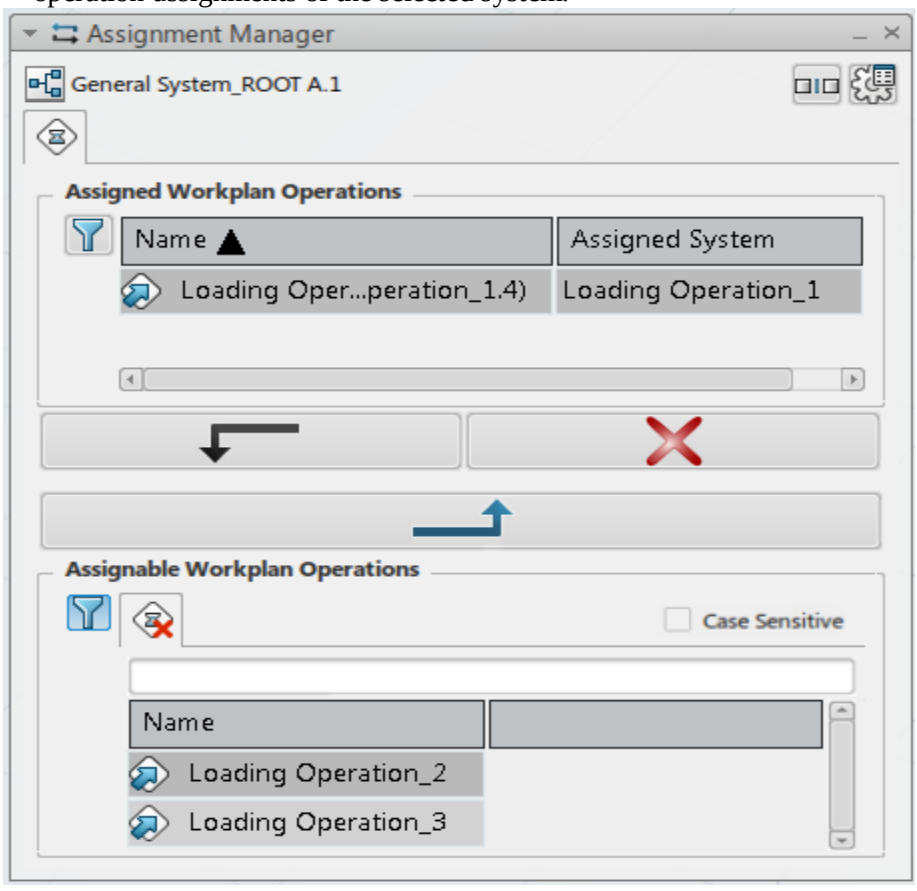
- A manufacturing assembly is created under MBOM_Root.
- Provided parts P1, P2, and P3 are created under the manufacturing assembly.
- Provided parts P1, P2, and P3 implement products P1, P2, and P3 respectively, and are implemented by operation Op2.



D. Managing Workplan Operation Assignments:

1. From the **Authoring** section of the action bar, click **Assignments Manager** .
2. Select the line-balancer system.

   The **Assignment Manager** panel appears showing the current and potential work plan operation-assignments of the selected system.



1. All the operations that are listed are derived from the system-workplan scope definition.
   The **Assigned Workplan Operations** area shows the list of work plan operations that are already assigned to the selected system. In the example above, one workplan operation is already assigned to the selected system.
   In the **Assignable Workplan Operations** area shows the list of work plan operations that are not assigned, but can be assigned to the selected system. The **Parent System** column identifies the parent system of each assignable workplan operation. Any operation that has suboperations has a colored background in the list to indicate that it is a "parent" operation.
2. You can manage the assignments as follows:
   - When you select a workplan operation from the **Assignable Workplan Operations** list, you can assign it to the system by clicking **Assign Selected Workplan Operations** . The workplan operation is added to the **Assigned Workplan Operations** list.

Note: If a parent operation is assigned, the child operations are also assigned. However, only the parent operation appears explicitly in the **Assigned Workplan Operations** list.

   - When you select a workplan operation from the **Assigned Workplan Operations** list, you can unassign it from the system by clicking **Unassign Selected Workplan Operations** . The workplan operation is added to the **Assignable Workplan Operations** list.
   - You can delete a linked line balancing operation and unassign the workplan operation- click .
   - You can filter the content of an attribute column by clicking **Filter** . A box appears in which you can specify the data to filter. Then, if you select a column header, the entire column will be filtered.

To deactivate the filter, click **Filter** again.

   - You can customize attribute columns by clicking **Attribute Customization**. In the **Customize** dialog box that appears, first select the Object Type, then move one or more available attributes in the **Available Attributes** column to the **Displayed Attributes** column. When you click **OK**, a new column corresponding to the selected attributes appears in the **Assignment Manager** panel.
3. Close the **Assignment Manager** panel to take into account any modifications made to the workplan operation to system assignments.

Module-2. D: Process Gantt Chart

A. Opening the Process Gantt

The Process Gantt chart is opened by selecting the **Process Gantt** command, then selecting either the root system or a child system under the root system.

Multi-selection is not available. Only one system and its children are displayed in the Process Gantt.

If a child system is selected:

- The constraints between operations are taken into account even if they are not displayed in the Gantt scope.
- The product flow is taken into account even if it is outside what is displayed in the Gantt scope.

B. Columns in the Process Gantt

The columns of the Process Gantt chart display information about systems, operations, parts, fasteners, and resources. Any of the columns (except **System-Operation**) can be hidden/shown by right-clicking in the header area and clearing /selecting any of the column check box options.

The columns in this Gantt chart are as follows:

- **System-Operation:** Displays a tree view of the systems and operations.
- **Duration:** Difference between the start and end time.
- **Begin Time:** Start time of an operation.
- **End Time:** End time of an operation.
- **Associated Parts:** Instance names of the assigned parts of an operation. Parts may be displayed as a list with a separator (,).
- **Type of Time:** Estimated, simulated, or analyzed time of an operation.
- **Utilization:** Percentage of time for which a resource is used.
- **Value Added:** The value added is an optional attribute that can be defined in each operation of the system. This value is shown for each operation, and the average value of all operations is shown for the system. For more information, see Value Added Information.
- **Number of Fasteners:** Displays the number of assigned fasteners for operation and resources. The first number on the resource indicates the number of fasteners assigned directly to this resources behavior. The number in brackets is the sum of the fasteners assigned to the resources direct behavior and all fasteners assigned to all child behaviors.
- **Number of Spots:** Displays the number fastener spots. See Time Bar for Point Fastening Operations in the Gantt Chart
- **Executing Resource:** The working resource assigned to the operation.
- **Localization Resource:** The organizational resource assigned to the operation.
- **Used Resource(s):** The not working resources assigned to the operation.
- **Resource used for positioning:** The resource used for parts positioning for a given operation.

To hide/show any of the columns (except **System-Operation**), right-click in the column header area and deselect/select any of the column check box options. To change the column size, place your cursor over the edge of the column. The cursor changes to arrow shape. Move the cursor left or right to change the column size. To move a column, select the column. The cursor changes to hand shape. Move the selected column to left or right as required. You can use the **Customize Column(s)** contextual command to customize the columns of the Gantt chart with operation, system, and resource attributes or any new customized attributes.

C. Tree Expansion

A set of contextual commands is available for expanding and collapsing the tree in the Gantt chart. When you right-click any rows of the Gantt chart, the following commands are available in the Tree

Expansion contextual menu:

- **Expand First Level:** Displays the first level child row.
- Expand Second Level: Displays the first and second level child rows.
- **Expand All Levels:** Displays all the child levels of the selected row.
- **Collapse All:** Collapses the row and hides all its child rows.
- **Expand Selection:** Displays a Specification depth dialog box where you can specify a tree depth for the expansion. You can select one of the available depth levels (1 to 5) or all levels, or key in a positive number.

D. Cycle Time Display

The cycle time of systems is displayed in the Process Gantt chart.
Cycle time is displayed by two vertical green bars. They appear if the system is a leaf system and has operations. The cycle bars stretch from the top of the system row to the bottom of its last operation row.
If the leaf system has a zero cycle time, only the first bar is displayed.

E. Flow View and System View

A Flow view and a System view are available in Process Gantt chart.

- **Flow View:** This view displays the flow between systems. It takes into account the full product flow and time constraints between operations. You can use this view to display the product flow according to the cycle time.
- **System View**: This view shifts every system instance at zero begin time. All systems are seen in parallel.

To switch from one view to the other, right-click the root object of the Gantt chart and select either Flow View or System View in the context menu.
The Flow View / System View is managed for all open Process Gantt charts.

F. Operation Creation

An operation can be created under a system or under another operation in the Process Gantt chart.

This is done as follows:
- Select the command of the required operation type.
- Select a system in the Gantt chart or any of its operations (parent of the new operation).
- Enter its name in the pop-up that appears.

The new operation is then displayed under the system after the last operation (if a system was selected) or under the operation, if an operation was selected.
It is also possible to copy, paste, and delete operations in the Process Gantt chart. The Gantt chart is updated after the copy, paste, or delete.

G. Operation and System Reordering

Operations and systems can be reordered in the Process Gantt chart.
To reorder operations and systems, drag and drop a row (system or operation) on another one.
The tree is also updated after the drag and drop.
Multi-Selection is not available. Only child nodes belonging to the same parent can be reordered in the Process Gantt chart.

H. Product Flow and Constraint Creation

Product flows and time constraints can be created in the Process Gantt chart by dragging and dropping systems/operations and using contextual commands.
The following drag and drop capabilities are possible in the Gantt chart:
- From a system to another system.
- From an operation to another operation.
- From a system to another operation.
- From an operation to another system.

In each case, a product flow is created.

If the drag and drop of a system or an operation to another system is done with the **Ctrl** key pressed, a context toolbar will appear with the following commands:

- **Create Product Flow** to create a product flow between the system or operation and the other system.
- **Move to System** to move the system or operation to the other system.

If the drag and drop of a system to an operation is done with the **Ctrl** key pressed, a context toolbar will appear with the following command:

- **Create Product Flow** to create a product flow between the system and the operation.

If the drag and drop of an operation to another operation is done with the **Ctrl** key pressed, a context toolbar will appear with the following commands:

- **Create Product Flow** to create a product flow between the two operations.
- **Create Precedence Link** to create a precedence constraint between the two operations.
- **Create Start-Start Link** to create a start -start synchronization link between the two operations. Both operations will start at the same time.
- **Create End-End Link** to create an end-end synchronization link between the two operations. Both operations will end at the same time.
- **Create End-Start Link** to create an end-start synchronization link between the two operations. You can specify a delay between the end of one operation and the start of the other.
- **Move Operation** to move the operation under another operation. The dragged operation becomes the child of the other operation.

I. Operation Colors

In the Process Gantt chart, colors can be assigned to systems using the **Color in Gantt View** contextual command.
In the context menu, the following commands are available:

- **Color by Resource**: when activated, operations are colored according to their implementing resource in the Process Gantt chart.
- **Default Colors**: when activated, the default color is applied to operations.

J. Specifying Scale Units

To specify the scale units of the Process Gantt chart, right-click the title bar showing the time units and select **Set Scale Units**.
The dialog box that appears allows you to specify the time unit (seconds, minutes, and so on), the zoom, and the scale to be applied to the Gantt chart. A preview allows you to try out any entered values before accepting them.

K. Modification of an Operation Duration

In the Process Gantt chart, time can be edited if it concerns an operation (and not a system) which has no child and it is displayed in estimated time.

The estimated time is the only time that can be modified manually. Simulated and analyzed times are deduced, so they cannot be modified by defining a value.

To modify the estimated duration of an operation, do one of the following:

- Right-click the operation, select **Properties** then modify the estimated time value.
- Double-click the **Duration** column and modify the value in the pop-up that appears.
- Double-click the **End Time** column and modify the value in the pop-up that appears.
- Increase the length of the bar representing the operation.
- Double-click the bar representing the operation. A **Properties** dialog box appears to let you modify the duration as well as the name of the operation.

Note: The operation must not have any children. An operation that has children is like a system: its duration is the sum of all the durations of its children.
When an operation duration is 0, the operation is represented by a red symbol.

L. Time Bar for Point Fastening Operations in the Gantt Chart

The length of the time bar for a Point Fastening operation depends if it is related to an item with fasteners or fastener groups linked to it or not.

Two fastener models are supported in Process Planning and Fastener Planning: the fastener model and the fastener group model.

Both fastener models handle "spots" that define the position of fasteners. A spot is where a fastening action is done, which is important to describe the Point Fastening operation.

- In the fastener model, there is one spot per fastener.
- In the fastener group model, there can be one of more spots per fastener.

Note: Fastener groups can no longer be created, but existing fastener groups are supported.

The length of the time bar for a Point Fastening operation is as follows:

- A Point Fastening operation can be created in Process Planning or Fastener Planning from scratch with no related item. In this case, the time bar value in the Gantt chart is the estimated time (10sec, par default).
- If a Point Fastening operation is related to an item with no fasteners linked to it, the time bar value is the estimated time (10sec).
- A Point Fastening operation can be related to an item with one or more fasteners or fastener groups linked to it. In this case, then the time bar value is an estimated time computed as follows:

Estimated time = time per fastening * number of spots

The time per fastening is 2.5sec by default.

M. Using the Process Gantt Chart

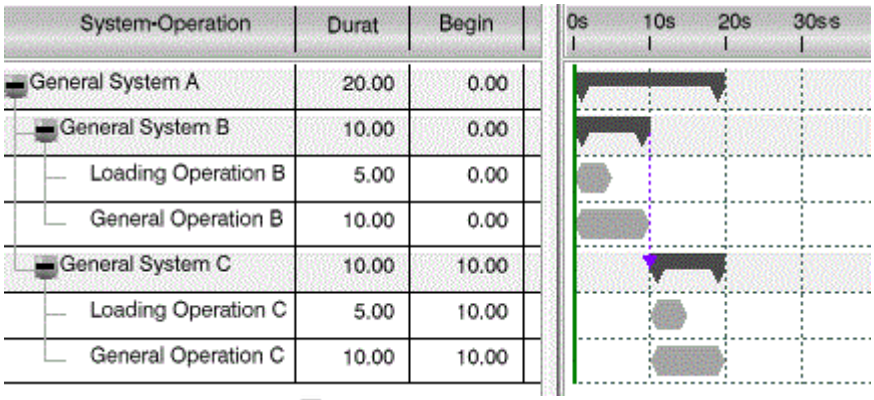
You can use the Process Gantt chart to display systems and their operations, create operations, and create time constraints between operations.

1. From the **Authoring** section of the action bar, click **Process Gantt**  .

2. Select a system in the tree or System Editor.

This can be the root system or a child system under the root system.
Multi-Selection is not available. Only one system and its children are displayed in the Process Gantt.

The image below shows an example of a Process Gantt chart:

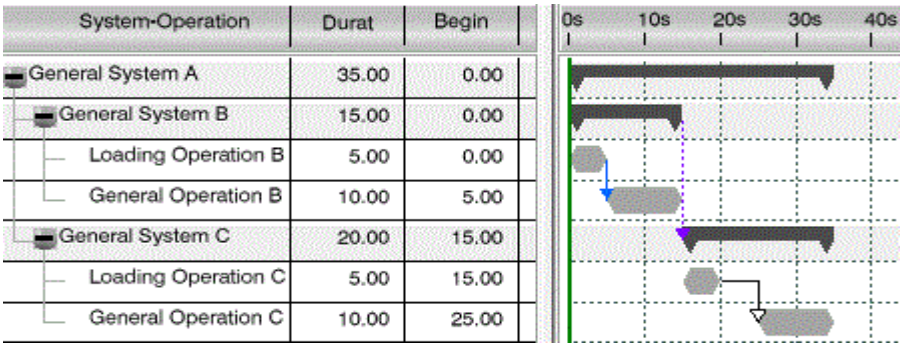


3. Click **Create Precedence Link** and select Loading Operation B then General Operation B in the Process Gantt chart.

A precedence constraint link appears in the Process Gantt chart between the two operations.
Note: Another way of creating this type of constraint is by dragging and dropping one operation on the other.

4. Select **Create End-Start Link** and select Loading Operation C then General Operation C in the Process Gantt chart. In the pop-up that appears, specify a delay of 5 seconds between these two operations.

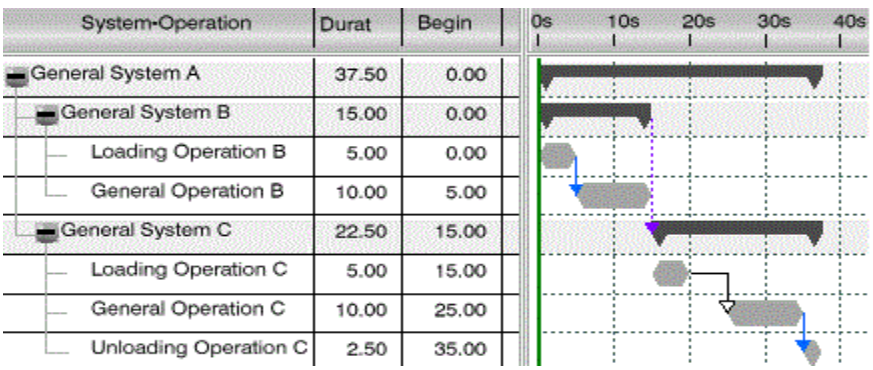
A synchronization link appears in the Process Gantt chart between the two operations.



Note: Another way of creating this type of constraint is by dragging and dropping one operation on the other while pressing the Ctrl key. You then select Create End-Start Link from the context toolbar that appears.

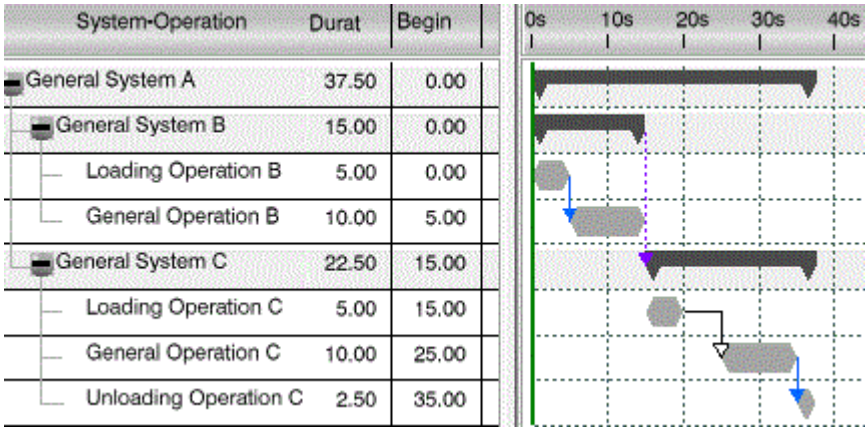
5. Select General System C in the Process Gantt chart and click Unloading .

In the Operation attributes dialog box that appears, enter an appropriate name and specify an estimated time of 2.5 seconds.
The new operation is created after the last operation in the selected system.



6. Create a precedence constraint link between General Operation C and the Unloading Operation C that you just created.

The link appears in the Process Gantt chart between the two operations.



You can choose to display or hide precedence constraints and synchronization links in the Process Gantt chart. Right-click in the chart and select or clear the corresponding check box options in the context menu.

N. Managing Display of Systems in the Process Gantt Chart

You can display systems in different views of the Process Gantt chart to have a better view of the systems, product flows, and cycle times.

This task shows you how to:

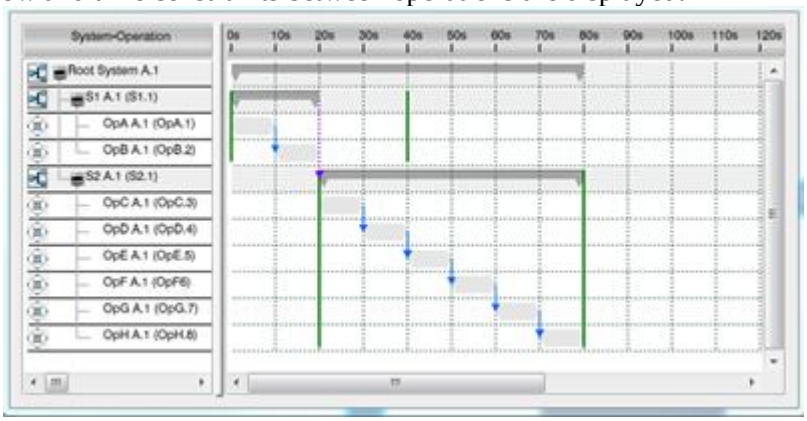
- Display Systems According to Product Flow
- Display Systems in Parallel
- Display Systems According to Cycle Time

O. Display Systems According to Product Flow

You can display the flow between the systems.

1. Right-click the root object of the Process Gantt chart.
2. In the context menu, select Flow View.

The full product flow and time constraints between operations are displayed**.**

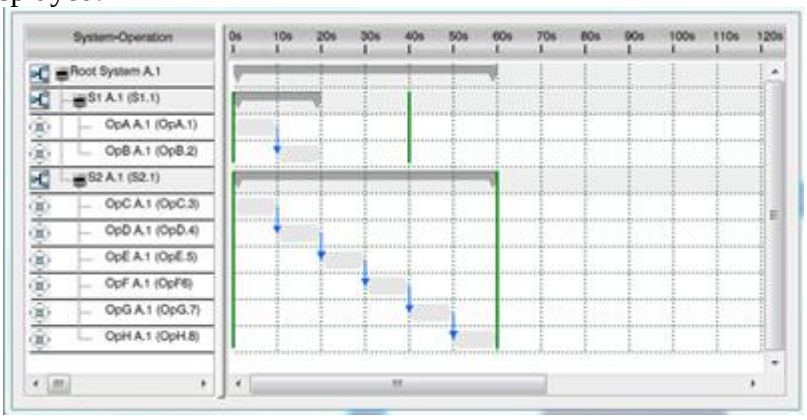


P. Display Systems in Parallel

You can display systems at zero begin time. Aligning systems in parallel is useful to see how they are balanced**.**

1. Right-click the root object of the Process Gantt chart.
2. In the context menu, select System View.

The system instances are displayed as if they begin at 0 sec. Time constraints between operations are displayed.

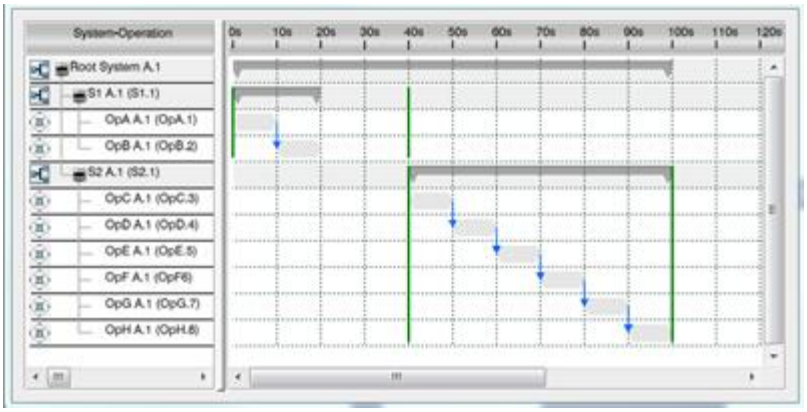


Q. Display Systems According to Cycle Time

You can display the product flow of the systems according to the defined cycle time.

1. Select Me > Preferences > App Preferences > Simulation > Digital Manufacturing Apps Common Services > Manufacturing Planning Apps Common Services > Process Gantt.
2. Select the Display product flow on cycle time option.
3. Right-click the root object of the Process Gantt Chart and select Flow View.

The systems are displayed according to the cycle time: for example, the second system begins at the end of the first system cycle time. Time constraints between operations are displayed.

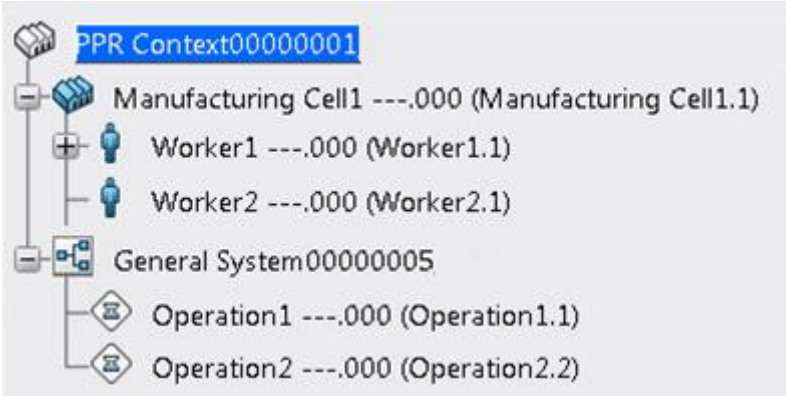


R. Displaying B.I. Essentials Colors in the Process Gantt Chart

You can select a B.I. from the B.I. Essentials list, to display colors in the Process Gantt chart to reveal information about operation status.

Context:

In this example, Operation1 is assigned to Worker1. Operation2 is not assigned to a resource.



1. Select the General System in the tree.
2. From the Authoring section of the action bar, click Process Gantt .

The Process Gantt chart appears showing the system structure. The bars representing the operations are colored gray, which is the default color.

3. From the Tools section of the action bar, click B.I. Essentials .

The B.I. Essentials list appears.

4. Click Operation to Working Resource Assignment Status from the list.

The bars representing the operations are colored according to the B.I. colors. Operation1 is colored green and Operation2 is colored red.

5. Assign Operation2 to Worker2 by dragging and dropping the operation on the resource in the tree.

Both operations are now colored green in the Process Gantt chart.

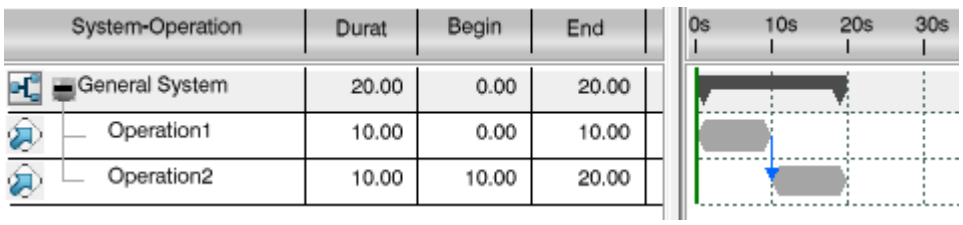
Note: When the B.I. Essentials list is closed, the bars representing the operations are colored gray again.

S. Using Value Added Information in the Process Gantt Chart

You can define a value added attribute on each operation of a system. This value can then be shown in the Process Gantt chart for each operation. The average value of all operations is shown for the system.

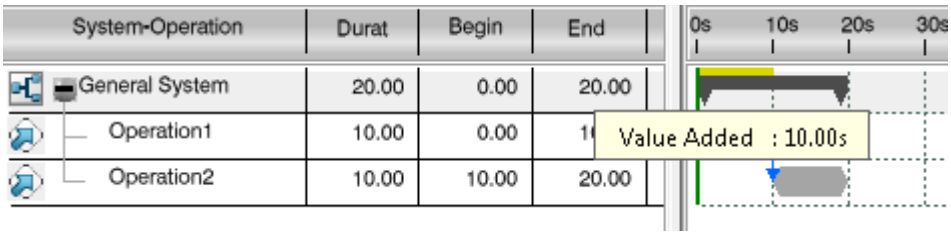
1. From the Authoring section of the action bar, click Process Gantt .

The Process Gantt chart appears showing the system structure.



2. Right-click Operation1 and define Value Added Ratio on Estimated Time to 60% in the Properties dialog box that appears.
3. Right-click Operation2 and define Value Added Ratio on Estimated Time to 40%.
4. In Me > Preferences > App Preferences > Simulation > Digital Manufacturing Apps Common Services > Manufacturing Planning Apps Common Services > Process Gantt,

select the Display value added ratio on system option.
A yellow bar representing the value added appears on top of the blue system bar. A tooltip on the system bar gives detailed information, including the value added for the system (50%).



Value added for the system and operations is also displayed in the Value Added column.
Note: System value added=Sum(Operation value added*Operation duration)/(total time)=(60*10+40*10)/20=50%.

T. Locating an Object in the Process Gantt Chart Using Auto-Scroll

You can search for an object in the Process Gantt chart using the Find panel. The Process Gantt chart then automatically scrolls to the located object.

1. From the Authoring section of the action bar, click Process Gantt .

The Process Gantt chart appears showing the system structure.

2. Click Ctrl+F to open the Find panel.
3. In the Name field of the General tab, enter the name of an object that is not visible in the Process Gantt chart (for example, Loading_1).
4. Press Find and Select.

The Process Gantt chart automatically scrolls to the searched object. The corresponding line is highlighted in the chart.

Tip: You can use other capabilities in the Find panel to search for objects. For example, in the Advanced tab, you can use attribute criteria such as Estimated time when searching for an operation.

U. Exporting Process Gantt Chart Information to an XML File

You can export information from the Process Gantt chart to an XML file.
Filtering and premises details information is also exported to an XML file even if it is not displayed in the Process Gantt chart.
The Export as XML contextual command is available on any row of the Process Gantt chart. It exports information such as object name and type, begin time, and duration to an XML file.

1. From the Authoring section of the action bar, click Process Gantt .
2. Right-click the first row of the Process Gantt chart and select Export to XML.

A file-browser dialog box appears.

3. Specify the name and location of the XML file, then click Save in the dialog box.

The Process Gantt chart information is exported to the XML file.
The XML file contains information about all the columns of the Process Gantt chart that are not hidden.

Tip: Any of the columns of the Process Gantt chart (except System-Operation) can be hidden by right-clicking in the header area and clearing any of the column check box options.

Information in a hidden column (except Duration and Begin Time) is not exported to the XML file.

You can use the Customize Column(s) contextual command to customize the columns of the Process Gantt chart with operation, system, and resource attributes or any new customized attributes. This information can be exported to the XML file.

V. Customizing Columns of the Process Gantt Chart

You can customize the columns of the Process Gantt chart with operation, system, and resource attributes or any new customized attributes.

1. From the Authoring section of the action bar, click Process Gantt  .
2. Select a system in the tree or System Editor.

The Process Gantt appears.

3. Right-click the root node in the Process Gantt chart and select Customize Column(s).

The Customize dialog box appears.

4. Select the Object Type, then select one or more available attributes in the Available Attributes column and use the arrows to pass the attributes to the Displayed Attributes column.
5. Click OK.

New columns corresponding to the selected attributes appear in the Process Gantt chart.

Module-2. E: Process Gantt Chart

A. About Time Modes on Operations

Manufacturing planning scenarios are based on Gantt resolution of operations executed with different resource types (such as workers and machines). The duration of each operation is computed depending on the resource where the operation is balanced. An Operation duration is computed using different methods, which are based on estimated time, measured time, analyzed time or simulated time.
The following topics are discussed:

- Time Modes, Systems, and Operations
- Operation Properties: Time Mode

B. Time Modes, Systems, and Operations

Manufacturing planning scenarios are based on Gantt resolution of operations executed with different resource types (such as workers, robots, and machines). To be as accurate as possible in the planning, the duration of each operation must be computed depending on the resource where the operation is balanced. The duration can be estimated, measured, calculated, or simulated.

In the Gantt chart, operations are displayed after their start and end times are computed by the time solver. An operation computation time can come from different computation modes.

In order to manage the time solving of operations having different time modes, you have the possibility to define directly on operations the time mode to be taken into account. So you can manage the time solving of several operations when their duration computation type is different.

The following Time Mode options are available in the Properties of an operation:

Estimated Time	A user-defined duration, corresponding to an estimated value. Operation duration is retrieved from the "Estimated Time" attribute.
Measured Time	A measured user-defined duration, corresponding to a measured value. Operation duration is retrieved from the "Measured Time" attribute.
Analyzed Time	The time specified using Time-Motion Study standards. Operation duration is retrieved from the Time Analysis defined on the Operation.
Simulated Time	The time obtained by the simulation of the operation. Operation duration is retrieved from the results of the simulation. For more information, see Updating the Simulated Time.
Work Instruction	Operation duration is computed from the duration of the children Work Instructions.
User Defined	Operation duration is retrieved from the DELPLMCustomizedTimeOnOperationID Business rule.

C. Operation Properties: Time Mode

The **Properties** dialog box of the operation proposes **Time Mode** options.
Proposed values are:

- Estimated time
- Measured time
- Analyzed time.
- Simulated time
- Work instruction.

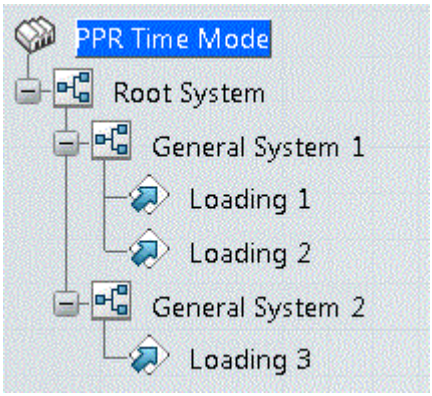
At operation creation, the default option is **Estimated Time**.
Time value editing is possible for **Estimated Time** and **Measured Time**. The other time modes are authored using Time-Motion Study (for **Analyzed Time**) and detailing applications (for **Simulated Time**).
Note: The business rule DELPLMCustomizedTimeOnOperationID can be used to compute a user-defined time for operations.

D. Using Time Modes on Operations

You can use various time modes on operations: estimated, measured, simulated, and analyzed times.

In the task below, only estimated and analyzed times are shown, and measured and simulated times work in a similar way.

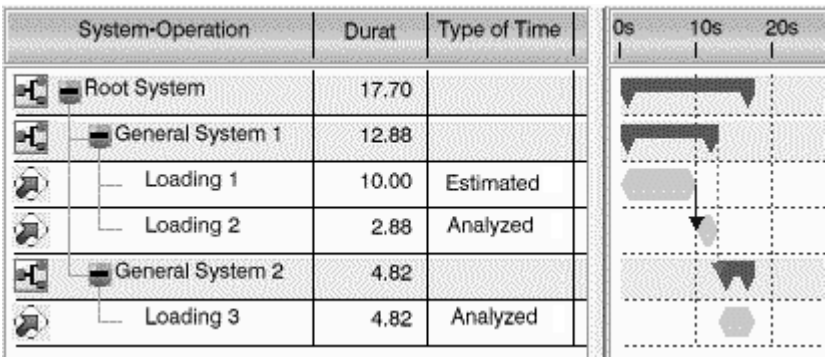
1. Open a system structure with operations similar to the one below in your app.



2. Defined time modes and estimated time values in the **Properties** dialog boxes of the operations as follows:
    - Right-click Operation 1 and specify the **Time Mode** as **Estimated Time** and the **Estimated time** to 10.
    - Right-click Operation 2 and specify the **Time Mode** as **Analyzed Time** and the **Estimated time** to 7.
    - Right-click Operation 3 and specify the **Time Mode** as **Analyzed Time** and the **Estimated time** to 25.
3. In the Gantt chart, create precedence time constraints between the Operations 1 and 2.
4. Using the Time-Motion Study app, create a time analysis for Operation 2:
    A. Enter a name and the required subsystem and click **Finish**.
    B. In the STM interface that opens, define, and save the time analysis.

See the Time-Motion Study User's Guide for more information.
In the same way, create a time analysis for Operation 3.

Click **Process Gantt** to display the Gantt chart.



The times in the **Duration** column are the times that were specified on the operations, which may be estimated or analyzed times.

E. Updating the Simulated Time

The simulated time associated with an operation is obtained from simulation results. You cannot specify or update it yourself. To update the simulated time, you need to configure and launch a new simulation.

1. Right-click an operation and select **Properties**.
2. From the **Time Mode** list, select **Estimated Time.**
3. In the **Estimated Time** field, enter a value greater than the time you expect the operation to take.

Note: If the Estimated Time is smaller than the actual duration computed for the operation, then the simulation stops at the Estimated Time value, even if the operation has not been completed.

4. Load your data in an app that supports level 3 simulation (**Behavior and Associated Detailing** simulation mode), for example:
    - Assembly Definition
    - Assembly Evaluation
    - Assembly Experience
    - Assembly Path Optimization
    - Ergonomics at Work
    - Ergonomics Evaluation
    - Robot Simulation
5. Click **Play** to launch the simulation.
6. Update the **Simulation Options**:

a. Check the **Update Cycle Time** option.
b. Under **Resource Simulation Level of Detail**, select **Simulation Specification Behavior and Associated Detailing**.
c. Check the **Graphics Update** options.

Click **Play** again to launch the simulation one more time.
Load your data back into Process Planning.
Right-click the operation and select **Properties**.
The **Time Mode** is now defined as **Simulated Time**.

From the **Authoring** section of the action bar, click **Process Gantt**  and verify that the Simulated Time is updated.

Module-2. F: Workload Balancing

This section provides background information about workload balancing. It also provides user tasks to illustrate how to balance operations between systems using the bar chart and data table of the Workload Balancing interface.

In this section:

- About Workload Balancing
- Balancing Workloads on a Selected System
- Balancing Workloads Using Operation Columns in Panel
- Balancing Workloads Using System Columns in Panel
- Calculating Time Based on Effectively in Workload Balancing
- Using Drifting Operations in Workload Balancing
- Managing the Workplan Structure When Balancing Operations
- Displaying B.I. Essentials in Workload Balancing
- Exporting Workload Balancing Information to an XML File
- Managing Inconsistent Links between Operations

A. Unloading Objects

You can unload objects from an assembly or system if they are no longer used in session.
Unloading object lets you display useful objects only and frees up memory.
This task shows you how to:

- Unload Objects
- Unload Evolved Instances of Objects

Before you begin: Save the objects before unloading them.

B. Unload Objects

You can unload instances of objects using Unload from a context menu or Tools section of the action bar. To use Unload from a context menu, select objects that are either systems or operations.

- An unload operation cannot be undone. To reload unloaded objects, reopen the content.
- The unload operation deletes the history of all finished actions. Therefore, you cannot undo or redo actions after unloading objects, even on objects that are kept in session.
- You cannot unload a root object from the tree.
- The selected objects are unloaded from all editing tabs.

1. In the tree, right-click one or more instances of objects.
2. From the context menu, select Unload.
3. To confirm the unload operation, click OK.

The object and its children are unloaded and no longer displayed.

C. Unload Evolved Instances of Objects

You can unload all the evolved instances of objects belonging to the same node using Unload Evolved Instance.

1. From the Authoring section of the action bar, click Unload Evolved Instance .
2. In the tree, select a node containing the evolved instances to unload.
3. To confirm the unload operation, click OK.

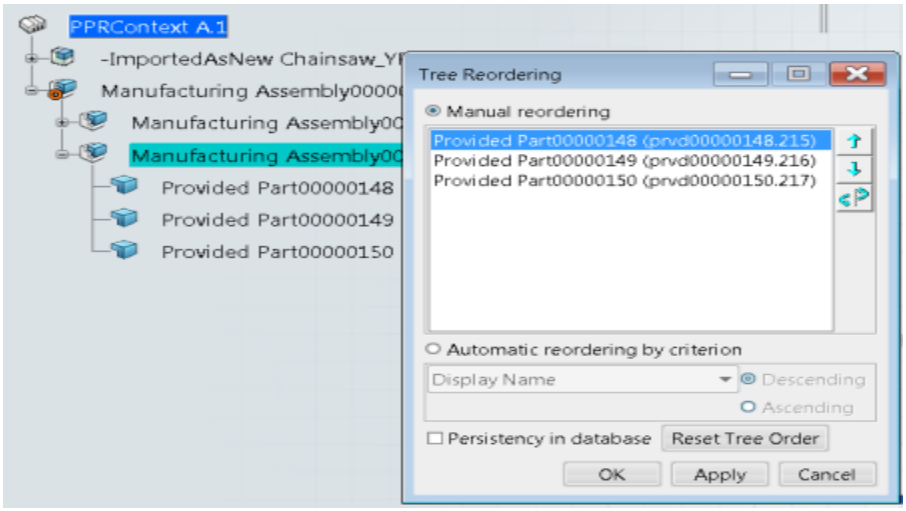
All evolved instances belonging to the selected node are unloaded and no longer displayed**.**

D. Reordering Objects in the Tree

You can reorder items, systems, and operations in the tree, manually or based on alphabetical order of display names.
The scenario below illustrates reordering items. A similar procedure can be applied to reorder operations or systems.
Systems and operations can be reordered in the Gantt chart, if a system or operation is present in the session or by drag and drop.
Before you begin: Load your session content, which must include a Manufacturing Assembly structure.

1. In the tree, select a manufacturing assembly that comprises items.
2. From the Authoring section of the action bar, click Tree Reordering .

The Tree Reordering dialog box appears. The Manual reordering mode is defined by default. The items of the assembly are listed in the dialog box.



3. Reorder the items as follows:
    a. Select the item you want to move and click Selection .
    b. Select another item: the first item is to be moved before this one.
    c. Click Apply to change the order of the items in the tree.

You can use the Up or Down arrow to move the selected item up or down the list.

4. Optional: Select Automatic reordering by criterion. Then reorder the items based on the alphabetical order of the display name or an attribute from the list such as creation date or last modification.
5. Optional: Select the Persistency check box if you want to memorize this tree structure for the next session.

In that case, the next time the structure is opened, the objects are listed in the newly defined order.

6. Click OK to save the new order of the objects in the tree.

Note:

- You cannot reorder the objects that are directly under the PPR Context.
- Tree Reordering can be run from the tree, the Item Editor, the System Editor, or the Gantt chart. After running the command, the tree, and Gantt chart are updated.

E. Selecting PPR Objects in the Tree

You can use various selection modes to select items, systems, operations, or resources from the tree in a single click.
The following scenarios illustrate how to use the selection modes on systems. You can use the same procedures on items, operations, or resources.

This task shows you how to:

- Use Select Children
- Use Select Others
- Use Select All
- Use Select Inversion
- Use Select Parent
- Use Select Siblings
- Use Select All Leaves

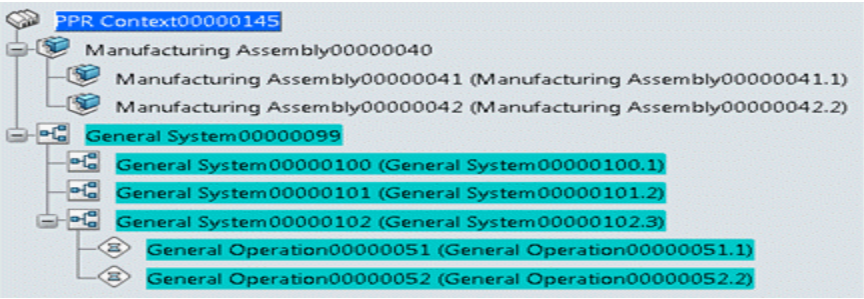
Before you begin: All the commands described below are also available from the context menu. Right-click an object in the tree, then go to Selection mode.

F. Use Select Children

You can use **Select Children** to select all the children of an item, system, or resource in the tree.

1. Select the root system in the tree.
2. In the **View** section of the action bar, click **Select Children** .

The root system and all of its child systems and operations are selected.

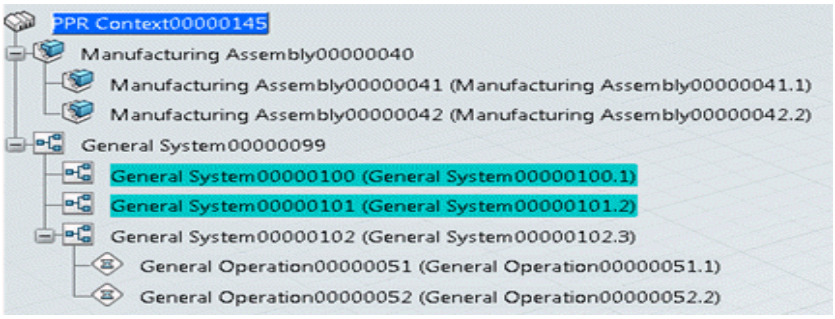


G. Use Select Others

You can use Select Others to select all items, systems, or resources in the tree other than those selected earlier.

1. Select the third child system of the root system in the tree.
2. In the View section of the action bar, click Select Others .

The two other child systems of the root system are selected.

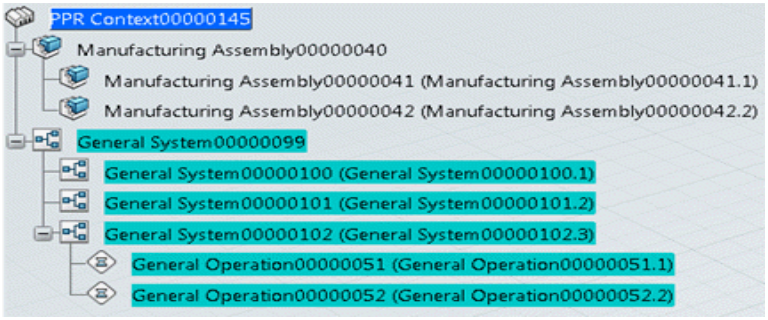


F. Use Select All

You can use **Select All** to select all the children of a root item, system, or resource in the tree.

1. Select one of the operations in the tree.
2. In the **View** section of the action bar, click **Select All** .

The root system and all of its child systems and operations are selected.

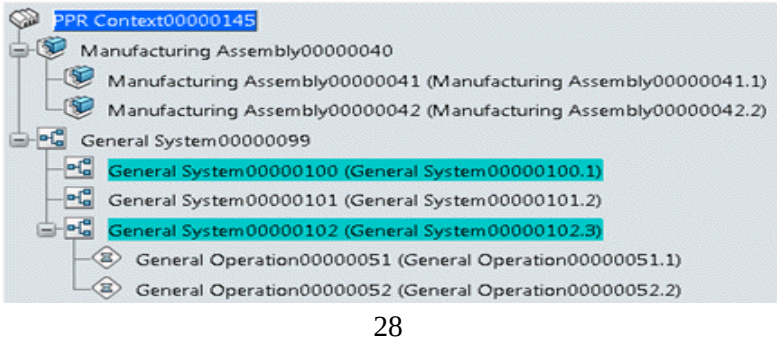


G. Use Select Inversion

You can use **Select Inversion** to select all the children of a root item, system, or resource in the tree.

1. Select the second child system of the root system in the tree.
2. In the **View** section of the action bar, click **Select Inversion** .

The two other child systems of the root system are selected.

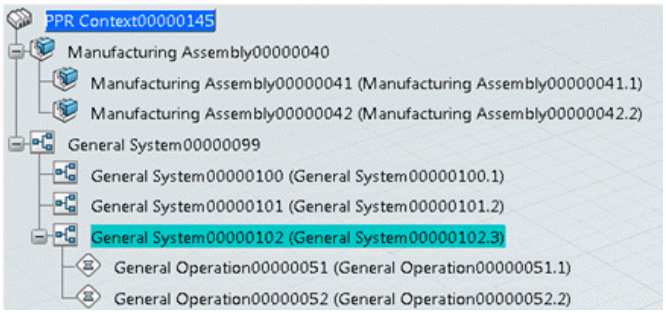


H. Use Select Parent

You can use **Select Parent** to select the parent of an item, system, or resource in the tree.

1. Select one of the operations in the tree.
2. In the **View** section of the action bar, click **Select Parent** .

The parent system of the operation is selected.

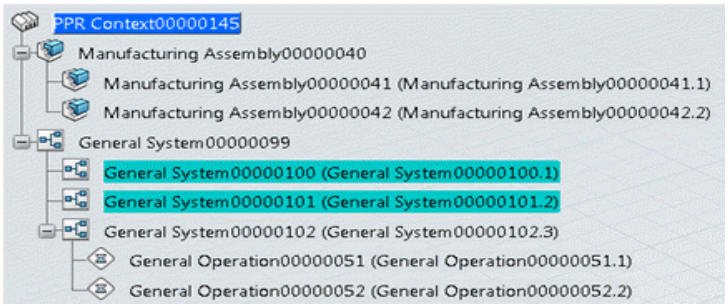


I. Use Select Siblings

You can use **Select Siblings** to select all the siblings of an item, system, or resource in the tree.

1. Select the third child system of the root system in the tree.
2. In the **View** section of the action bar, click **Select Siblings** .

The two sibling systems of the system are selected.



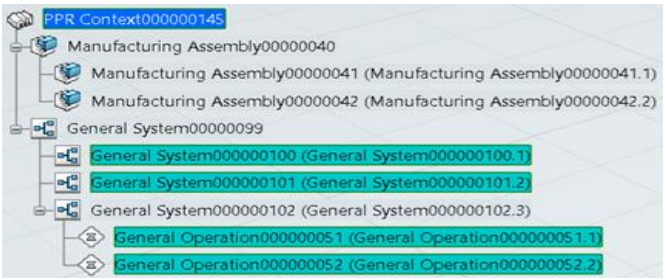
J. Use Select All Leaves

You can use **Select All Leaves** to select all leaf nodes under an item or a system in the tree.

1. Select the root system in the tree.
2. In the **View** section of the action bar, click **Select All Leaves** .

All the leaf-systems and leaf-operations of the root system are selected.

Note: Time Analysis and Work Instructions are not considered leaf nodes.

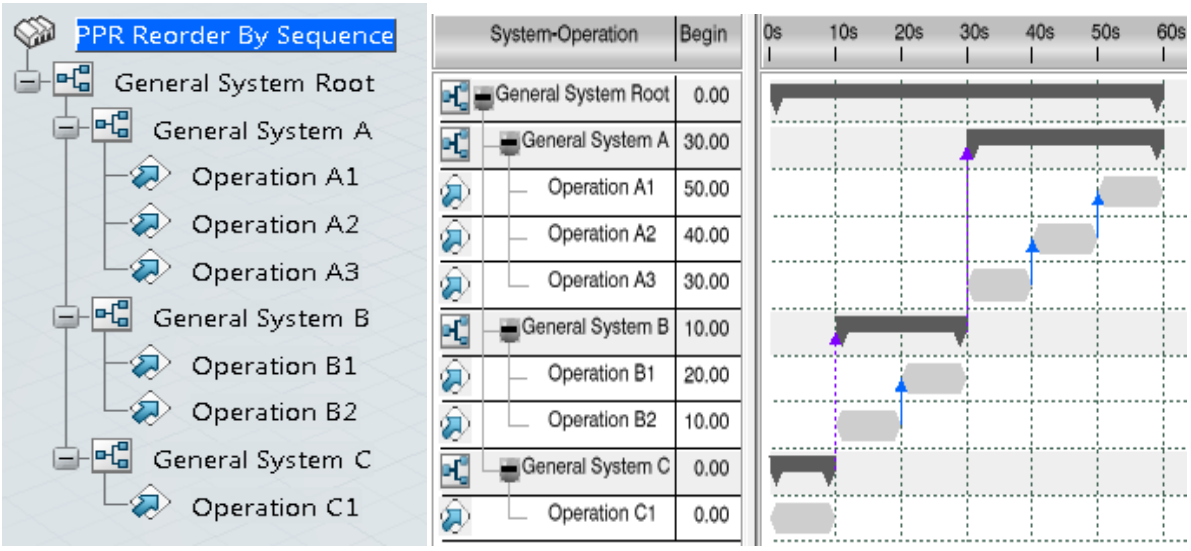


K. Ordering by Sequence

You can sort operations and systems in the tree and Gantt chart by taking into account their sequencing. That is, the Begin Times of the operations.
Note: The Gantt chart is not available in some apps.

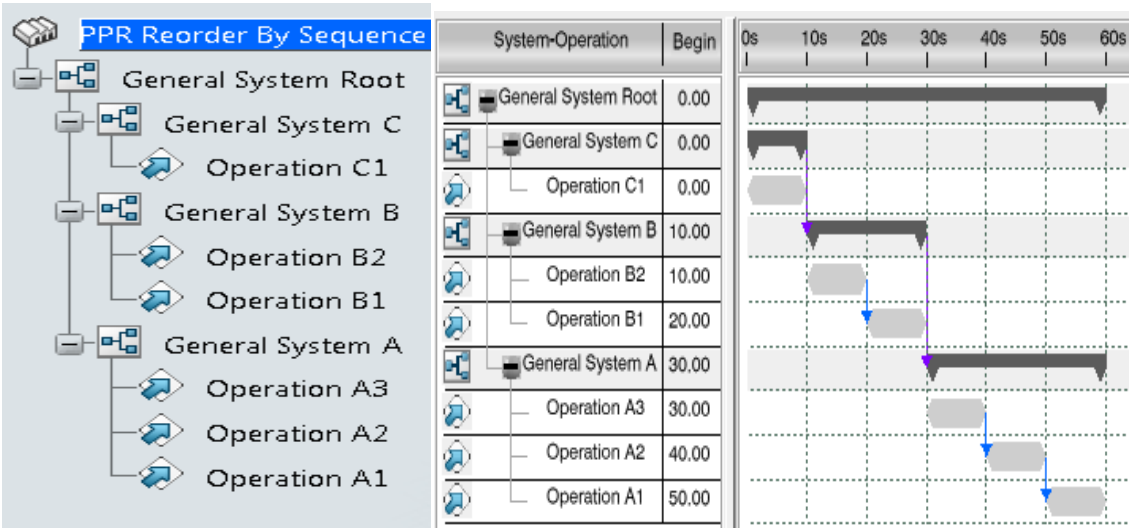
1. Load your session data: it must include a System structure with operations.

For example, a typical tree and Gantt chart are as follows:



2. Select the root system.
3. From the **Authoring** section of the action bar, click **Order by Sequence** .

The tree and Gantt chart are reordered according to the Begin Times of the operations as follows:



Notes:

- Once the command is run, the changes are persistent. If required, the **Tree Reordering** command can be used to modify the sequencing order.
- The layout of the System and Operation tiles in the System Editor are not changed when this command is run.

Module-2. G: Use The Relation Panel

A. About the Relations Panel

When an object is clicked in the tree, the Relations panel provides a list of all the relations with the other objects in the current session.

- Relations Listed After Object Selection
- Lock Mode for Input Selection
- Display of First Upper Scope Objects
- Cross Highlighting
- Panel Update Capabilities

B. Relations Listed After Object Selection

When you select an object, the Relations panel lists all the relations with the other objects in the current session.
Note:

- You can start and update the panel with one or more selected objects. These objects must be of the same type.
- You can select one or more listed objects directly in the panel.
- You can edit properties of objects that are listed in the panel.
- You can delete relations between objects using Remove Relation from the context menu. Remove Relation does not support Multi-Selection.

Relations listed in the panel depend on the selected objects, and can include scope links, implement links, data requirements, product flows, time constraints, and so on. For example, if you select a product, all items that have scope and implement links with it are listed in the panel. If you select an operation, all items and resources that have relations with it are listed in the panel, including scope, implement, and requirement links as well as time constraints.
For more information about possible relations, see the list of the Table 1.

C. Lock Mode for Input Selection

The Lock mode lets you restrict input selection to the Relations panel.
Lock mode is enabled and disabled by clicking the icon at the top of the panel.

In Lock mode  , you can select objects in the panel or update the panel by double-clicking an object of the panel. However, the panel is not updated if you select objects outside the panel, such as selecting objects in tree. If the selected objects are in one or more lists of the panel, the corresponding list objects are highlighted.

In Unlock mode  , selecting objects outside of the panel updates the panel with these objects. You can Multi-Select objects in the panel and in the tree at the same time.

D. Display of First Upper Scope Objects

All the implemented objects of all the first upper scopes are displayed in the implemented objects list. Selecting a first upper scope object highlights the corresponding implemented objects in the implemented objects list.

E. Cross Highlighting

You can cross highlight objects between the Relations panel and the tree is available.
Selecting an object in the Relations panel highlights the selected object in tree and on the tiles if

your app has a grid editor.
For each object shown in the Relations panel, it is possible to select it by a single click. This object is then highlighted in the tree.
Double-clicking an object in the panel will define this object as current, and update the panel accordingly.
In addition, other applications and panels such as the 3D View panel take the objects clicked in the Relations panel into account.

F. Panel Update Capabilities

The Properties panel is updated after structure modifications and during systems simulation.
The Relations panel is updated to reflect modifications in the model structure (such as adding a new item, operation or resource, creating new implement links, and so on).
The Relations panel is integrated in systems simulation. The panel is refreshed with the focused objects of the simulation each time these objects change. The Lock mode has no effect on systems simulation.

G. Listing Related Objects in the Relations Panel

When you select a product, item, resource, system, or operation, the Relations panel lists all the relations with the other objects in the current session**.**

1. From the Authoring section of the action bar, click Relations .

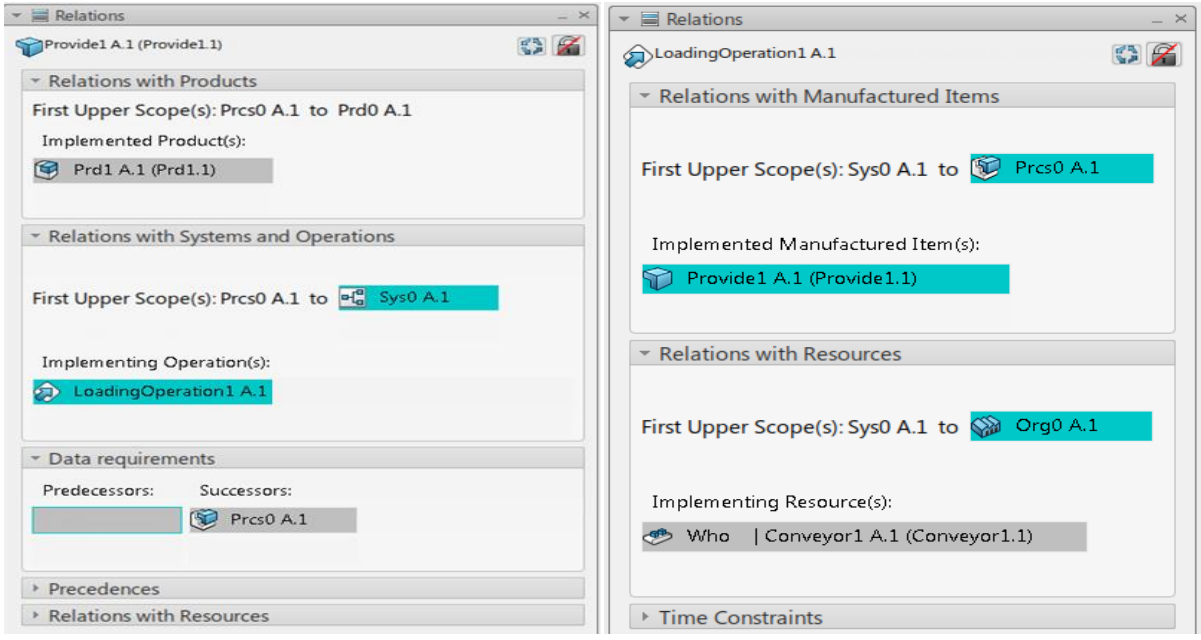
An empty Relations panel appears.

2. Select an item in the tree.

You can select an item tile if your app has a grid editor.
The Relations panel lists the relations of the selected item with products, systems, operations, and resources as well as data requirement and precedence links**.**

3. Select an operation in the tree.

You can select an operation tile if your app has a grid editor.
The Relations panel lists the scope links and implement links of the selected operation with items and resources, as well as the time constraints with other operations.



Tip:

- You can access the Constraint Properties panel to edit time constraints or manage product flows by right-clicking one of them, then by clicking Constraint Properties in the context menu. For more information, see Constraint Properties Panel.
- You can customize the panel to your needs using XML files to define which information appears in the panel. For more information, see Relations Panel Customization**.**

E. Loading Related Objects in Session Using the Relations Panel

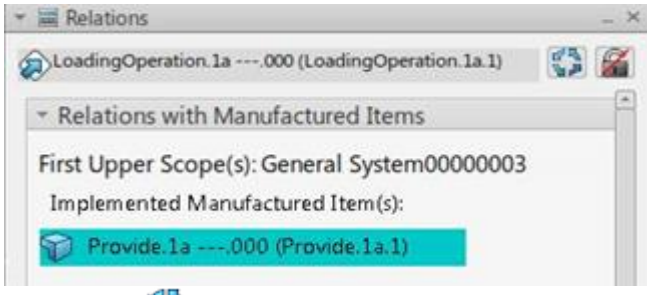
You can display linked objects that are not loaded in session and load these objects in session using the Update from database command in the Relations panel.
Before you begin: Load a Manufacturing Assembly and a System structure in your session. In this scenario, one or more items implemented by an operation must not be loaded in session.

1. From the Authoring section of the action bar, click Relations .

An empty Relations panel appears.

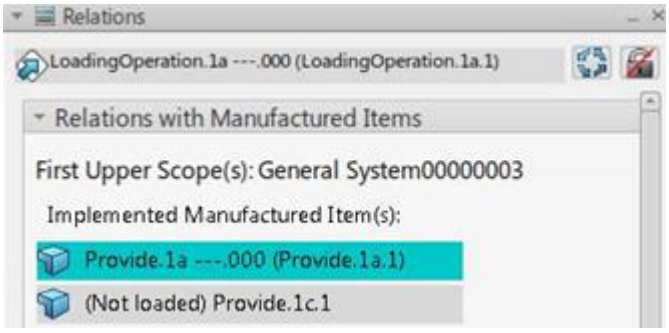
2. Select an operation in the tree (LoadingOperation.1a, for example).

You can select an operation tile if your app has a grid editor.
In this scenario, an item implemented by the selected operation is not loaded in session.
The Relations panel lists the related objects of the selected operation that are loaded in session.



3. Click Update from database in the panel.

The objects that are related to the selected operation that are not loaded in session are listed in the panel. They are prefixed with the text "Not Loaded" (item Provide.1c, in this example).



4. Double-click the unloaded item in the panel.

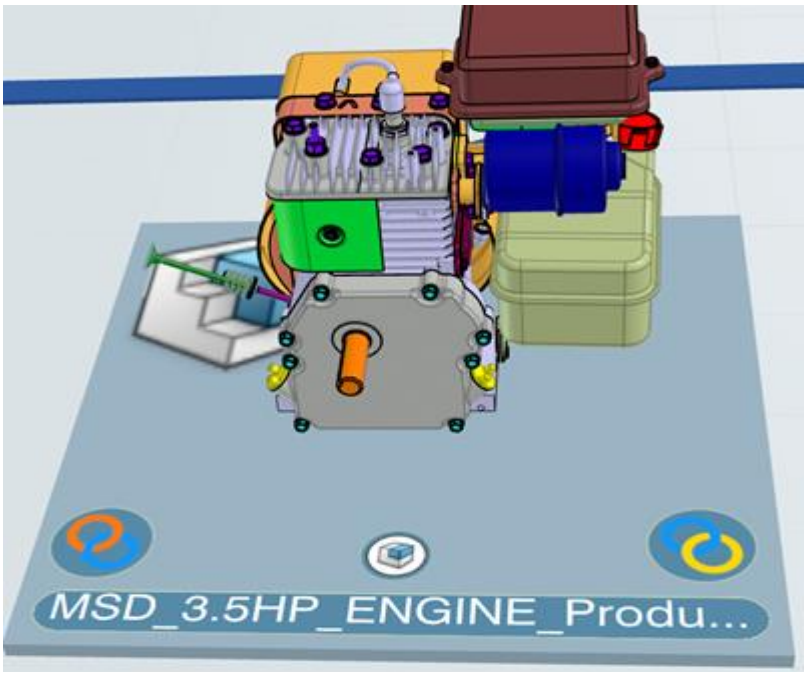
The item (Provide.1c, in this example) is loaded at its correct location in the System structure, and it is listed in the Relations panel.

F. Loading Outputs Using the Relations Panel

You can retrieve outputs, and load them in session using the Relations panel.
Before you begin: Load a manufacturing assembly with a system structure in your session. In this scenario, one or more systems or operations have linked outputs that are not loaded in the session.

1. Select a system or an operation with a linked output.

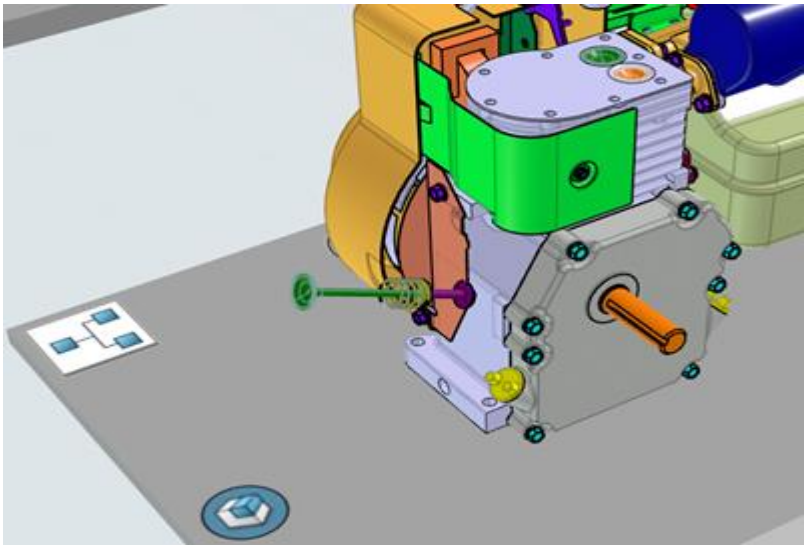
Systems and operations with unloaded linked outputs have a white icon on the tile.



2. From the authoring section of the action bar, click Relations.
3. In the Relations panel, click Displays the unloaded related component(s) from database.

In the Output section of the Relations panel, unloaded linked outputs are listed.

4. Double-click an output to load it in the session.



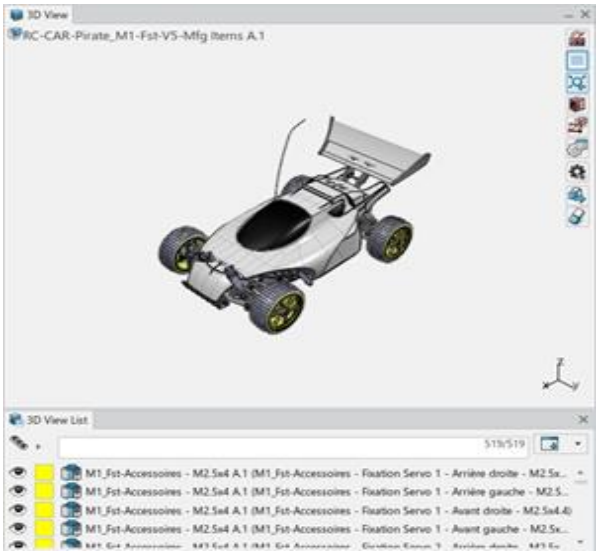
The output appears above the tile, the white icon is replaced by a blue icon.

G. Using the 3D View in Process Planning

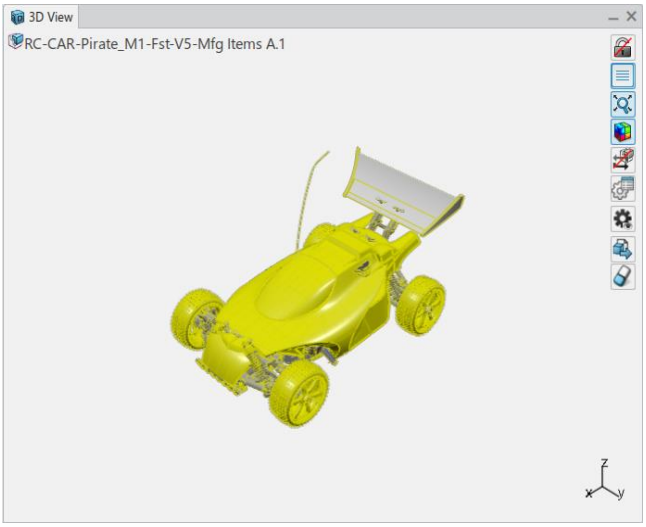
You can use the 3D View panel to visualize the 3D representation, FTA annotations, and product build-up of a selected item, product, system, operation, or resource.
The following scenario illustrates how to use the 3D View panel on a selected manufacturing assembly. The same procedure can be used for a product, system, operation, or resource.

1. Select a manufacturing assembly in the tree.
2. From the Authoring section of the action bar, click 3D View .
3. To show the 3D View List panel, from the 3D View panel, select List Shown .

The manufacturing assembly is displayed in the 3D View panel according to design colors. This is the default option.
The 3D View List panel lists the products implemented by the selected manufacturing assembly. The colored square next to the product indicates the build-up category.



4. To manage the display of the implemented products, select General Options in the 3D View panel.
5. To apply the build-up colors of the manufacturing assembly in the 3D viewer, select Show Build-Up Colors ON .



Notes:

- To manage the displayed build-up categories, select Display Options in the 3D View panel.
- You can click Product Build-Up options at the right edge of the work area to display the Product Build-Up options panel.
- For more information about the 3D View panel and the product build-up, see the Common Services for Process Engineering Apps User's Guide.

H. Using the Spreadsheet

You can use the spreadsheet to browse and edit planning content.

This task shows you how to:

- Insert PPR Objects
- Manage PPR Object Attributes
- Filter PPR Objects
- Group PPR Objects
- Manage Presets
- Export Content

Before you begin:

1. Open a PPR Context with a root Manufacturing Assembly in your app.
2. To open the spreadsheet panel, click PPR Spreadsheet from the Authoring section of the action bar and select the root Manufacturing Assembly.

Tip: To make the spreadsheet dialog boxes floatable, click Show Preferences and select the Show Managers as Floatable option.

I. Insert PPR Objects

Using the spreadsheet, you can insert PPR objects such as items, operations, and systems.
The scenario below illustrates how to insert several unloading operations.

1. In the spreadsheet, click Insert New Content .
2. From the list, select the type of PPR object you want to insert.
3. In the box, enter the number of PPR objects you want to insert.
4. Click Validate to confirm the insertion.

J. Manage PPR Object Attributes

You can hide or show, reorder, and edit attributes.

1. In the spreadsheet, click **Attributes Manager** .

The list of available attributes appears, in the order of the spreadsheet.

2. To manage attributes display, use the following commands:

Command	Description
	Hides or shows all attributes.
/	Hides or shows a single attribute.
/	Moves the selected attribute up or down the list.

3. To edit an attribute, select its value in the spreadsheet and enter a new one.

Tips:

- None valuated mandatory attributes are signaled by a highlight icon in their cell and header.
- You can check, filter, and export attribute validation messages in the Report Manager.

  Click Report Manager to start the Report Manager. You can use the PPRSpreadsheetAttributeValidation_ID and PPRSpreadsheetAttributeValuePropagation_ID business logics to test attribute values and generate messages based on defined rules.

K. Filter PPR Objects

You can filter PPR objects based on attribute values.

1. In the spreadsheet, select an attribute then click **Filters Manager** .

The list of available values for the attribute appears.

2. To filter values of the attribute, use the following commands:

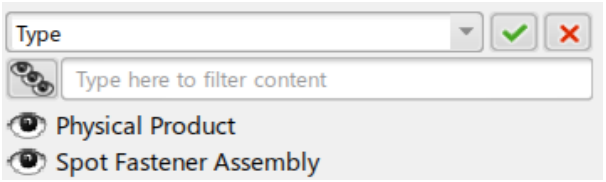
Command	Description
	Hides or shows all attribute values.
/	Hides or shows a single attribute value.

L. Group PPR Objects

You can create grouping nodes to group PPR objects based on attribute values. This enables you to select and edit all objects in a group simultaneously.
The scenario below illustrates how to group objects by type.

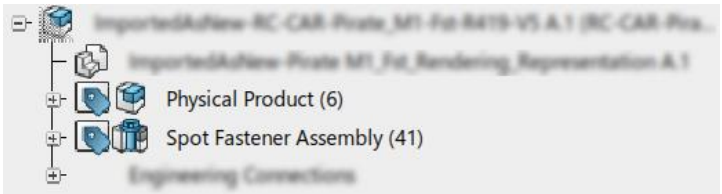
1. In the spreadsheet, click **Groups Manager** .
2. Click **Create Group** .
3. From the list, select an attribute such as **Type**.

The list of available values for the attribute appears.



4. Using **Hide** and **Show** , display only the values for which you want to create a group.
5. Click **Validate** .

A grouping node is created for each value.



M. Manage Presets

You can save the current configuration of the spreadsheet or apply an existing one.

1. In the spreadsheet, click **Presets Manager** .

2. To save the current configuration of the spreadsheet:
    a. **Optional:** In the box, enter a name for the preset.
    b. Click **Create Preset**  .

A preset containing the current attributes, filters, and groups of the spreadsheet is created.

Tip: You can share the preset using the file automatically downloaded in the CAT settings.

3. To apply a preset to the spreadsheet, click **Load Preset**  .

You can revert to the default configuration by clicking  .

4. To update a preset with the current configuration of the spreadsheet, click **Save Preset**  .

N. Export Content

You can export the spreadsheet content as a text, CSV, or TSV file.

1. Select the spreadsheet content.

Note: If only one line is selected, it will be the only line exported. To export the entire spreadsheet content, select all the lines.

2. Click **Export Content**  .
3. Specify the folder in which to export the file, name the file, and choose a file type from the list.
4. Click **Save**.

A file containing the selected spreadsheet content is created in the specified folder.

O. Managing System Output

You can compute an output for a system or an operation, which can then be saved as an independent product. System or operation output is a product assembly. This assembly is the state of the product for this system in the assembly line. If there is a flow from other systems, then the output shows those assemblies also.

You can manage system/operation output using a group of contextual commands that are available on system/operation tiles of the System Editor. As well as on system/operation nodes in the tree and Process Gantt chart.

This task shows you how to:

- Compute System Output
- Define System Output
- Open System Output in New Tab
- Remove System Output
- Compute System Output on a System with an Existing Output
- Update Existing System Output After Design Review
- Display System and Operation Outputs
- Reconnect a System and Operation with an Output Revision

Before you begin: Open your session data containing system/operation and product structures.

P. Compute System Output

You can compute the output for a system (or an operation) with an assigned item (3D on tile). Any input product flows are also included in the system output.

Before you begin: To display computed outputs on system or operation tiles, select the **Automatically Load Outputs** option in **Me** **> Preferences > Manufacturing Planning > System Editor > System/Operation Output**

1. Select a System tile.

2. Right-click the tile and select **System Output > Compute Output**.

The output product is then computed and associated with the system. A message is issued: a blue icon  is displayed at the middle left of the tile. This indicates that an output product is linked to the system, and the output product appears on the tile.

Note: You can display or hide the product output on one or more system/operation tiles using the **Show Output Context** and **Hide Output Context** contextual commands. This allows you to work on specific systems/operations with the correct 3D output without having to load all the PPR data. A blue icon  indicates that the system/operation has an output and the output is shown on the tile. If the icon is white  , this indicates that the system/operation has an output but the output is hidden on the tile.

Q. Define System Output

You can manually define an output on a system (or an operation) by selecting an existing product.

1. Right-click a System tile and select **System Output > Set Output**.

A dialog box appears allowing you to select a product.

2. Select the product that you want to link to the system as output.

The product appears on the System tile. An icon  is displayed on the tile to indicate that an output product is linked to the system.

Tip: The output is also displayed in the **3D View** panel as product build-up when the System or Operation is selected. For more information about product build-up, see the Common Services for Process Engineering Apps User's Guide.

R. Open System Output in New Tab

You can open the output that is linked to a system (or an operation) in a new authoring tab.

1. Select a System tile that has a link to an output product.
2. Right-click the tile and select **System Output > Open Output in New Tab**.

The system output that is linked to the system is opened in a new authoring tab, and can then be edited like any product.

S. Remove System Output

You can break the link between a system (or an operation) and the output.

1. Select a System tile that has a link to a system output.
2. Right-click the tile and select **System Output > Remove Output**.

The link from the system to the system output is broken. A message is displayed and the icon is no longer displayed at the middle left of the tile.

T. Compute System Output on a System with an Existing Output

You can use the **Output Comparison** panel to detect differences between an existing system output and the output resulting from a new computation.

1. Right-click a System tile that already has a system output and select **System Output > Compute Output**.

The **Output Comparison** panel appears. It comprises the following sections:

- **Managed Product**: **Added value** of the system or operation.
- **Input Product**: Products resulting from the input flow or from precedent operations.
- **Output Management Choice**:
  - **Update existing**: The output is updated by a local modification.
  - **Replace existing**: A new output is created and referenced by the system or operation.

2. Click **OK** in the panel to update or replace the system output.
3. Save to propagate changes.

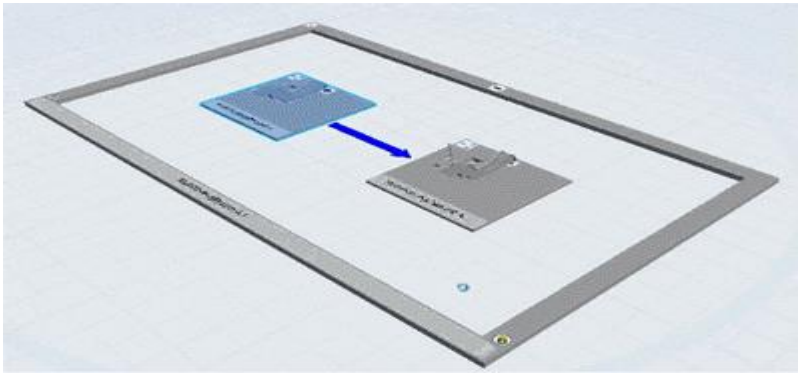
Possible modifications that can appear in the **Output Comparison** panel are as follows:

- New product in output: a product is added to the new output. An operation implements a product that was previously not implemented.
- Product removed from output: a product is missing in the new output. An operation no longer implements a product that was previously implemented.
- Product moved from input to managed: a product previously in the **Input Product** section is moved to the **Managed Product** section. An implementation was changed from input to system or operation.
- Product moved from managed to input: a product previously in the **Managed Product** section is moved to the **Input Product** section. An implementation was changed from system or operation to a previous system or operation.
- Position changed: Product position has changed. Implementation has not changed for the product but the geometry is not at the same position.

U. Update Existing System Output After Design Review

You can update an existing system output after a design review. Annotations are kept after the update.

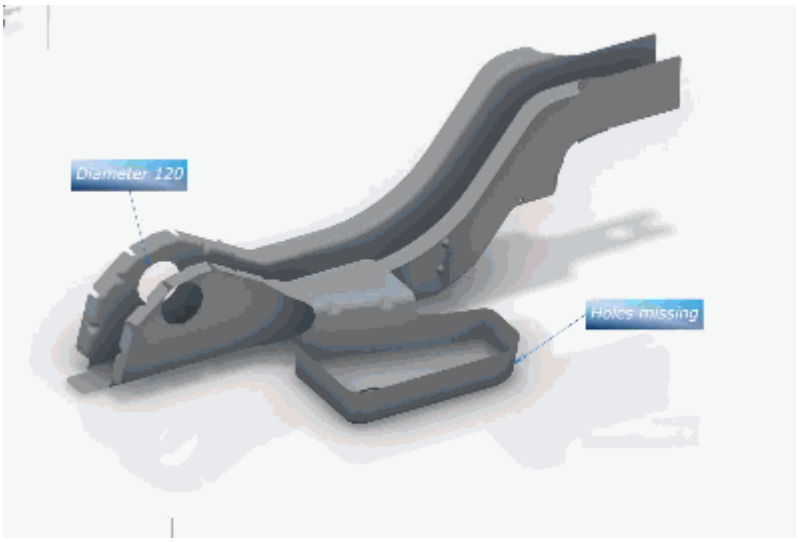
1. Open your PPR Context that has suitable product, system, and item structures in Process Planning.
2. Right-click "Station1" and select **Open Output in a new tab**.



A new tab opens showing the system output.

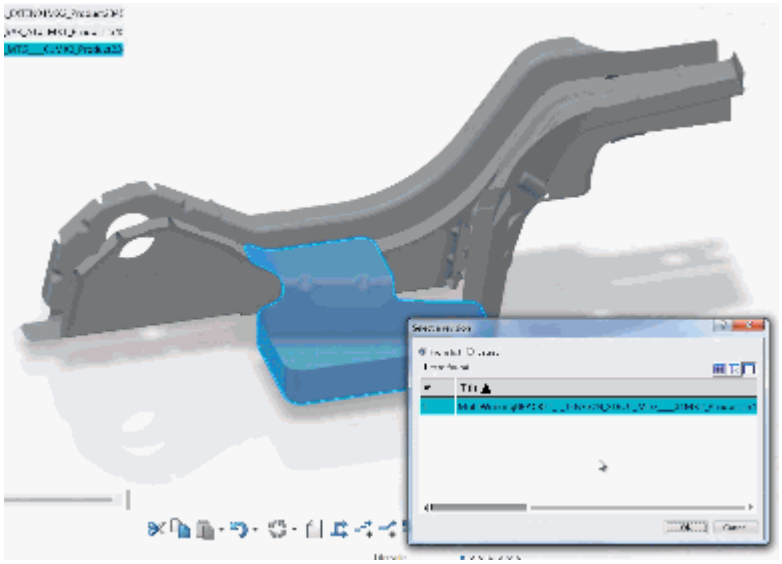
3. From the Compass, select the Design Review app.

The **Work on a Review** panel appears: it displays slides of current review (in this case showing one slide: Slide1).
The product displayed with annotations: "Diameter 120" and "Holes missing"

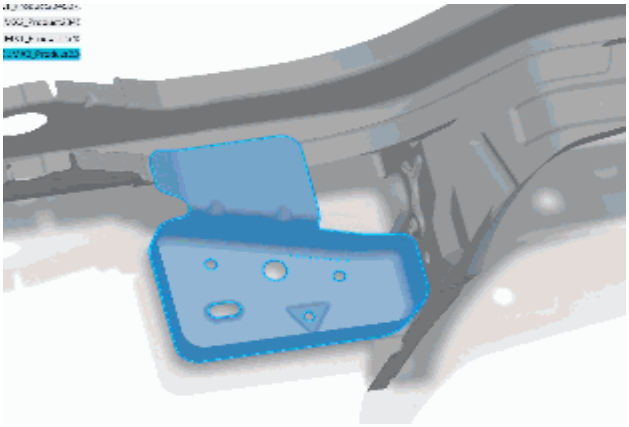


4. In the Collaboration Lifecycle Management app, right-click the **Tension Strut** product in the tree and select **Replace by Revision**.

The **Select a revision** panel appears (in this case showing one item).

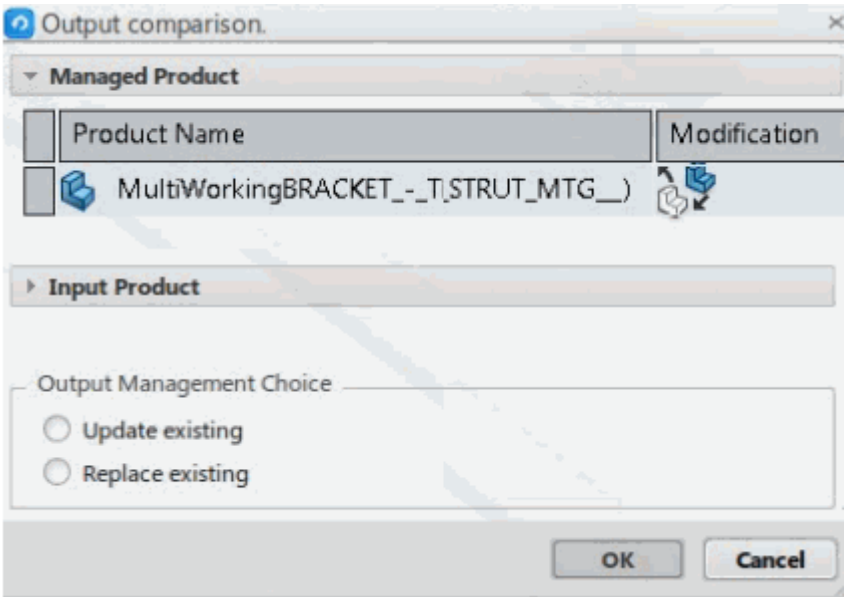


5. Select the item and click **OK**.



6. Save to propagate changes.
7. In Process Planning, right-click Station1 and select **Compute Output**.

The **Output Comparison** panel appears.



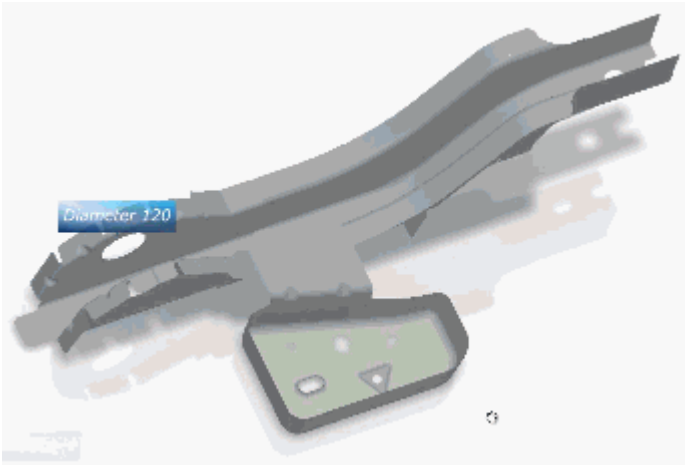
In the **Modification** column, an icon indicates that the product can be replaced compared to linked content.

8. In the **Output Management Choice** section of the panel, select **Update existing**, then click **OK**.
9. Right-click "Station1" and select **Open Output in a new tab**.

A new tab opens showing the system output.

10. From the Compass, select the Design Review app.

The **Work on a Review** panel appears: it displays slides of current review (showing one slide: Slide1). The product is updated with a new revision of the "Tension Strut" product: it has holes and the annotation "Diameter 120."



V. Display System and Operation Outputs

You can display outputs on system and operation tiles using **Load Resulting Product or System/Operation Output**. This command is useful to display outputs for specific systems or operations only.

1. Select one or more System tiles.
2. From the **Authoring** section of the action bar, select **Load Resulting Product or System/Operation Output** .

The output is displayed on the selected tiles.

Note:

- Alternatively, you can right-click a system or operation and select **Load Output**.
- If no system or operation is selected, **Load Resulting Product or System/Operation Output** loads the outputs of all the systems and operations in session.
- To automatically display outputs of all the systems or operations in session, select **Automatically Load Outputs** in **Me** > **Preferences** > **Manufacturing Planning** > **System Editor**.

W. Reconnect a System and Operation with an Output Revision

For outputs that have been manually defined, you can use **Reconnect on Revision** to reconnect a new version of an output on a system or operation.

1. Right-click a tile and select **System Output/Operation Output** > **Reconnect on Revision**.
2. In the panel that appears, select a revision from the list.

The new revision is loaded in session and the system or operation is automatically linked to this new revision.

Module-2. H: Requirements for Manufacturing Planning Objects

A. Requirements for Manufacturing Planning Objects

This section provides background information about managing requirements on Process Engineering objects, such as how to assign requirements to items and operations.

In this section:

- About Requirements
- Requirement Browser
- Requirements Manager
- Assignments Manager Panel
- Managing Requirements
- Using the Requirement Browser

B. About Requirements

Requirements associated with Item-Operation structures are managed using the **Requirement Browser** and the **Assignments Manager** panel.

Requirements are created and structured in ENOVIA Traceable Requirements Management.

For more information, see ENOVIA Traceable Requirements Management User's Guide.

The following tools are provided to manage requirements:

- The Requirement Browser enables you to search and open requirement structures, create Global Specification link with requirement specifications, assign requirements to items, operations, and work instruction. It also enables you to verify requirement attributes and assignment status to a planning object (item, operation, or work instruction).
- The Assignment Manager panel lets you manage requirement assignments on a specific planning object.

C. Requirement Browser

The **Requirement Browser** allows you to manage requirement structures, requirement assignments, and Global Specification links.

- Requirement Browser Panel
- Requirement Browser Commands
- Global Specification Link
- Requirement Assignment/Unassignment
- Lifecycle of Browser Content
- Visual Representation of Assignment Status

D. Requirement Browser Panel

The **Requirement Browser** opens when you click **Browse Requirements**  from the **Authoring** section of the action bar. The panel is laid out as a spreadsheet that comprises:

- A tree view with nodes
- A column for each requirement attribute

E. Requirement Browser Commands

Requirement Chooser

A PLM Chooser command that enables you to search for requirement structures (namely a specifications folder), for requirement specifications, for requirement chapters.

Each of these can hold one or several requirements.

Click the **Requirement Chooser** command, then search and select requirement structures.

This can be a specification folder, a requirement specification, or a chapter automatically added to the **Requirement Browser**.

Requirement Manager

A panel that enables you to work with individual requirement specifications, or with a requirement.

Click the **Requirement Manager** command, and do one of the following:

- Select requirement specifications.
- Select a requirement.
- Select the **Global Specification Link Manager** option.

Note: This option enables you to create and remove the Global Specification link between the selected requirement specification, item, system, or operation.

- Select the **Requirement Link Manager** option.

Note: This option enables you to add and remove a link between a requirement and a planning object.

Filters Manager

A command that enables you to filter requirements based on attribute values.

For more information, see Filter Requirements

Attributes Manager

A command that enables you to hide or show, reorder, and edit requirement attributes.

All requirement attributes are listed in the **Attribute Mangers** panel.

For more information, see Manage Attribute Display

Group Manager

A command that helps you to create requirement groups for easy access to information.

You can create, for example, groups based on attribute values for requirements based on owner, maturity status, priority, difficulty, etc.

For more information, see Group Requirements.

Tips:

- Persistency of Requirement Browser Layout: When closing the **Requirement Browser** panel, changes made on columns order and width in the spreadsheet are saved.
- Hide Column Contextual Command: Right-click a column, then click **Hide Column** to quickly hide the selected column from the spreadsheet. You can perform this action from both, the **Requirement Browser** and the **Assignment Manager** panels.

F. Global Specification Link

The Global Specification link is a relation between a manufactured object (item, system, operation, work instruction) and a requirement specification. The constituent objects within the scope defined by the link must comply with the requirements.

You can define the link using the **Create Global Specification Link** command, which is available in the context menu on each root requirement. After the creation of the Global Specification link, a specific star icon is displayed on the root requirement in the browser.
The command is available only on a root requirement, which can be a specification folder, a requirement specification, or a chapter.
This link can be removed with the **Remove Global Specification Requirement** contextual command.

G. Requirement Assignment/Unassignment

Requirement Usages
You can set usage specification when a requirement is assigned to an item, an operation, or a work instruction. To do so, specify the Requirement options in Me > Preferences > App Preferences > Simulation > Process Engineering > Process Planning > Requirement.
The list of possible values for usage specification is defined using the following business rule: DELPPRRequirementUsages_ID.
By default, only the Ignore, Control, and Realize usage types declared in this business rule are available. It is possible with the same business rule to specify a combination of usages, and to customize usages and usage quantity.
When a requirement is assigned to a manufacturing object, you can define how it is consumed. For example, there can be a requirement to make a hole with a 10mm diameter. The requirement can be associated with a machining operation that realizes the requirement, and associated with another operation that controls the hole diameter.
With Manage Requirement Usages
If the Manage Requirement Usage option is selected:
Assign Requirement
To assign a requirement to a planning object, right-click the requirement, then click the Assign Requirement command from the context menu. From the submenu, select a planning object with specific usage to assign it to the requirement.
Note:

- All usages specified in the business rule are available in the submenu.
- To display the assigned usages of a requirement, add the usage column using the Attributes Manager .

Unassign Requirement
To unassign a requirement from a planning object, right-click an already assigned requirement, then click the Unassign Requirement command from the context menu. From the submenu, click a usage to unassign it from the planning object. Two behaviors are possible:

- If the requirement is assigned to a specific usage only once, unassigning it removes the link between the requirement and the planning object.
- If a specific usage is assigned multiple times when unassigning it, the Requirement Manager panel appears to show you objects that can be unassigned.

Without Manage Requirement Usages
If the Manage Requirement Usage option is not selected:
Assign Requirement
To assign a requirement to a planning object, select Attach Requirement in the context menu, then select a planning object in the PPR Tree.
Unassign Requirement
To unassign a requirement from a planning object, select Detach Requirement in the context menu.
Also with the Requirement Link Manager panel, you can assign/unassign requirements to/from planning objects in the PPR Tree.

H. Lifecycle of Browser Content

The first time the **Requirement Browser** is opened in a PPR window, only the requirement structures linked with a Global Specification link to the object in the session are available in the **Requirement Browser**.
For example, when you open the **Requirement Browser** in your app, all the linked requirement specifications to items are opened in the **Requirement Browser**.
The browser content is linked to life of the session. This means that if the **Requirement Browser** is closed and reopened in the same session, its content is kept. If the PPR session is closed and data reopened, then the content is not kept.
Note: Reopening the session reopens the linked requirement specifications.
The content is as follows:

- Requirement structures linked to a system or an operation with a Global Specification link
- Requirements assigned to the items linked to the system (except **Ignore** usage). There is a specific root node per item linked to a system.
- Requirements added manually in the browser using the **Requirement Chooser** .

I. Visual Representation of Assignment Status

To identify the assigned and unassigned requirement there is a specific color code for the requirement icon:

- Gray : the requirement is not assignable (for example, a requirement that has children)
- Orange : the requirement is unassigned (and can be assigned)
- Blue : the requirement is already assigned

This status is for requirements assigned to systems or operations.

J. Requirements Manager

The **Requirements Manager** panel enables you to work with individual requirement specifications, or with a requirement. It provides appropriate command to manage the selected object.

The **Requirements Manager** panel appears when you click from the **Requirement Browser**.

- Context Menu Commands
- Global Specification Link Manager
- Requirement Link Manager

K. Context Menu Commands

You can right-click in the **Requirements Manager** panel to access the following commands:

Command	Description
Hide Column	Hides a column in the Requirements Manager.
Customize Attributes	Show or hides attributes in the Requirements Manager.
Filter Column	Filters rows displayed in the Requirements Manager using attribute values.
Clear All Filters	Clears all filters applied in the Requirements Manager.

For more information, see Requirement Browser Commands and Using the Requirement Browser.

L. Global Specification Link Manager

The Global Specification link is a relation between a manufactured object (item, system, operation, work instruction) and a requirement specification. The constituent objects within the scope defined by the link must comply with the requirements.
When you select a requirement specification, the **Requirements Manager** panel changed for the **Global Specification Link Manager** panel. This panel enables you to manage Global Specification links with planning objects.

Add a New Global Specification Link
You can create Global Specification link between requirement specifications and planning objects in the PPR tree using the **Add a New Global Specification Link** command. This command is available only in the context menu on each root requirement. After the creation of the Global Specification link, a star icon is displayed on the root requirement.

Remove a Global Specification Link
You can remove existing Global Specification link between requirement specifications and planning objects using the **Remove a Global Specification Link** command.

M. Requirement Link Manager

When you select a requirement, the **Requirements Manager** panel changed for the **Requirement Link Manager** panel. This panel enables you to manage links between requirements and planning objects.

Add a New Requirement Link
You can create link between requirements and planning objects in the PPR tree using the **Add a New Requirement Link** command.

Remove a Requirement Link
You can remove existing link between requirements and planning objects using the **Remove a Requirement Link** command
With Manage Requirement Usages option, **Requirement Link Manager** enables you to manage quickly the links between requirements and planning objects with various usages.
Additional combination is available in the **Requirement Link Manager** panel to specify the usage while creating link between requirements and planning objects

N. Assignments Manager Panel

The Requirement tab of the Assignment Manager panel is used for managing requirements on planning objects. The Assi Manager also enables assignment, unassignment, rerouting, and multiassignment.

- Assignable Requirements Algorithm for Items
- Assignable Requirements Algorithm for Operations
- Assignable Requirements Algorithm for Work Instructions
- Assignment Manager Commands

The Assignable Requirement lower half of the panel manages the assignable requirements with two tabs.
For items, the content is as follows:

- : Assignable requirements to the item by the assignable requirements algorithm for items.
- : Requirements that are already assigned to another item.

For operations, the content is as follows:

- : Assignable requirements to the operation by the assignable requirements algorithm for operations.
- : Requirements that are already assigned to another operation.

For work instructions, the content is as follows:

- : Requirements assigned on the parent operation.

O. Assignable Requirements Algorithm for Items

Computation of assignable requirements is different for assemblies and individual items. The algorithm for assemblies is called Assembly Algorithm and the algorithm for individual parts is called Part Fabrication Algorithm**.**

Assembly Algorithm:

Assemblies include manufacturing assembly, manufacturing installation, manufacturing kit, service assembly, and service kit. The list of assignable requirements for assemblies is as follows:

Get Requirements from Engineering Items linked to selected Item

1. It retrieves the engineering item scoped by the selected manufactured item.
2. If there is no engineering item found, then it obtains the engineering items that are the assignment filter's direct targets on the selected manufactured item.
3. If there are no engineering items by scope or by assignment filter on the selected manufactured item, then it obtains the engineering items from the first upper scope or the first upper assignment filter respectively.

Note: The parent of the selected manufactured item is checked recursively for scopes and assignment filters.

From the retrieved engineering item, it obtains the published requirement specifications and all the requirements thereafter.

By default, this option is selected.

Include Requirements from Children of linked Engineering Items

It retrieves all the children of the previously identified engineering items and obtains the requirement specifications linked to the identified engineering item and all the requirements thereafter.

Note: When selected for assemblies, this option displays the **Display Requirements from lower scopes** check box in the **Requirement to Item Assignment** tab. Select this check box to obtain requirements below the lower scope.

By default, this option is not selected.

Get Requirements from Resulting Product defined on selected Item

If a Resulting Product is defined on the selected manufactured item, then it retrieves the requirement specifications published by the Resulting Product root and all FTA requirements thereafter.

By default, this option is selected.

Get Requirements from Global Specification Link

1. It retrieves all the requirement specifications linked with a Global Specification link to the selected manufactured item and lists all the requirements thereafter.
2. If there are no requirement specifications linked with a Global Specification link to the selected manufactured item, then it retrieves all the requirement specifications linked with a Global Specification link to the first upper parent scope and lists all the requirements thereafter.

By default, this option is not selected.

Part Fabrication Algorithm:

Part Fabrications include any other manufactured items that are not used in assemblies, such as provided part, continuous provided material, manufactured part, manufactured material and continuous manufactured material. The list of assignable requirements for individual items is as follows:

Get Requirements from Engineering Items linked to selected Item

1. It retrieves the engineering item scoped by the selected manufactured item.
2. If there is no engineering item scoped by the selected manufactured item, then it obtains the engineering items from the first upper scope or the first upper assignment filter respectively.

Note: The parent of the selected manufactured item is checked recursively for scopes and assignment filters.

From the retrieved engineering item, it obtains the published requirement specifications and all the requirements thereafter.

- By default, this option is selected.

Get Requirements from Resulting Product defined on selected Item

If a Resulting Product is defined on the selected manufactured item, then it retrieves the requirement specifications published by the Resulting Product root and all FTA requirements thereafter.

- By default, this option is selected.

Get Requirements from Global Specification Link

1. It retrieves all the requirement specifications linked with a Global Specification link to the selected manufactured item and lists all the requirements thereafter.
2. If there are no requirement specifications linked with a Global Specification link to the selected manufactured item, then it retrieves all the requirement specifications linked with a Global Specification link to the first upper parent scope and lists all the requirements thereafter.

- By default, this option is not selected.

P. Assignable Requirements Algorithm for Operations

The list of assignable requirements for operations is as follows:

Get Assigned Requirements on first upper scoped Items

1. It retrieves the manufactured item from the first upper scope.
2. It retrieves all the assigned requirements to this manufactured item scope.
3. If there are requirement specifications linked with a consumption link to this manufactured item scope, then it also retrieves all the requirements thereafter.

- By default, this option is selected.

Get Requirements from Output defined on selected Operation

If an operation output is defined on this operation, then it retrieves the requirement specifications published by the operation output root and all FTA requirements thereafter.

- By default, this option is not selected.

Get Requirements Assigned on Previous Operations

1. It retrieves the requirements assigned to the previous operations.
2. It retrieves the requirements defined on the output of these operations (which are not visible to the next operations).

- By default, this option is not selected.

Get Requirements from Global Specification link

It retrieves all the requirement specifications linked with a Global Specification link to the first parent system or workplan and all requirements thereafter.

- By default, this option is not selected.

Q. Assignable Requirements Algorithm for Work Instructions

The list of assignable requirements for work instructions is as follows:

1. It retrieves all the requirements assigned on parent operations.

R. Assignment Manager Commands

Assign Requirement

To assign a requirement not assigned to another object, you must select one or more requirements in the **Unassigned Requirements** list and click **Assign Selected Requirement** .

Unassign Requirement

To unassign a requirement, select the requirement in the **Assigned Requirements** list and click .

Move/Reroute Requirement

To assign a requirement assigned to another object (that is, move or reroute the requirement), you must select one or more requirements in **Assigned Requirements** list and click **Assign Selected Requirement** . This removes the old assignment and creates the assignation between the current object and the requirement.

Multi Assign Requirement

To assign several times a requirement to a planning object, use the command. This command is available on the **Assigned Requirements** tab.

Note: All the requirement lists (**Assigned Requirements**, **Unassigned Requirements**, and **Other Assigned Requirements**) support multiselection.

Search and Assign Requirement

To search a requirement and assign it to the current object opened in the **Assignment Manager** panel, click **Requirement Chooser** in the **Assigned Requirements** tab.

Filtering Requirement

To filter requirements based on substring, click **Filter** from the **Assigned Requirements** tab. Enter a text, then click the column header to filter rows based on the attribute value of that particular column.

Note: All the requirement lists (**Assigned Requirements**, **Unassigned Requirements**, and **Other Assigned Requirements**) enable **Filter** command.

Out of Scope Requirements Representation

The icon differentiates, with an orange background, the requirements that are consumed outside a Global Specification or outside the implement links.

Modify Usage of Assigned Requirements

You can modify the usage of assigned requirements, by means of a list available in the **Usage** column. The list of usages is still defined by the business rule DELPPRRequirementUsages_ID (usage definition and a combination of usages) minus the usage on other objects. If two usages are defined and the requirement is already assigned with the two usages, the usage cannot be modified.

S. Managing Requirements

You can manage requirements associated with Item-Operation structures using the Requirement Browser and the Assignment Manager panel.

This task shows you how to:

- **Manage Requirement Assignments to Items**
- **Manage Requirement Assignments to Operations**

Before you begin: Open your session content, which must have manufactured assembly and system structures and a System-Item scope

T. Manage Requirement Assignments to Items

You can manage requirement assignments to items in your app.

1. From the Authoring section of the action bar, click Browse Requirement .

The Requirement Browser appears.

2. Click in the browser.
3. Search or select a requirement and click OK.

The requirement is added to the Requirement Browser as root requirement.

4. Right-click the root requirement, select Create Global Specification Link, then select the root item.

A star icon on the root requirement in the browser indicates that the Global Specification link is set up.

5. Expand the chapters of the root requirement to show all requirements and comments.
6. Right-click a requirement and select Attach Requirement, then select the usage type from the

submenu: Control, Realize, Control and Realize, or Ignore.

7. Select the item to which the requirement is to be attached.

The usage type is added after the name of the requirement in the browser.

8. Attach requirements to other items in the same way.
9. Optional: Use a filter command  or  to display unassigned requirements or assigned requirements.

U. Manage Requirement Assignments to Operations

You can manage requirement assignments to systems and operations in your app.

1. From the Authoring section of the action bar, click Browse Requirement  .

The Requirement Browser appears.

The browser displays the requirement available for the system structure due to the System-Item scope and the Global Specification link that are already set up.

2. Right-click a requirement and select Attach Requirement, then select the usage type from the submenu: Control, Realize, Control and Realize, or Ignore.
3. Select the operation to which the requirement is to be attached.

The usage type is added after the name of the requirement in the browser.

4. Attach requirements to other operations in the same way.
5. Select an operation with attached requirements and click Assignments Manager  .

The Assignment Manager panel appears listing assigned and assignable requirements of the selected operation.

The Assigned Requirement area shows the list of requirements that are already assigned to the selected operation.

In the Assignable Requirement area:

- The  tab shows the list of requirements that are not assigned, but can be assigned to a selected operation.
- The  tab shows the list of requirements that are already assigned to other operations. These can also be assigned to the selected operation.

6. You can manage the assignments as follows:
   - Assign a requirement: when a requirement is clicked from the Assignable Requirements list you can assign it by clicking Assign Selected Requirement  .
   - Unassign a requirement: when a requirement is clicked from the Assigned Requirements list, you can unassign it by clicking Unassign Selected Requirement  .
   - You can search for requirements by clicking  .
   - Filter attribute content: you can filter the content of an attribute column by clicking Filter  . A field appears in which you can specify the data to filter. Then, if you select a column header, the entire column is filtered.
   - Customization: can customize attribute columns by clicking Attribute Customization  .
7. Optional: In the Tree, select a work instruction under an operation.

The Assignment Manager panel allows you to manage requirement assignments to the work instruction, in a similar way to assignments for operations.

You can change the rank of work instructions within assigned requirements using the up, down, and move before commands.

8. Close the Assignment Manager panel to take into account any modifications made to the requirement to operation assignments.

V. Using the Requirement Browser

You can use the Requirement Browser to browse and edit requirements for Process Engineering objects. The browser is laid out as a spreadsheet, comprising one column per attribute and a tree with grouping nodes.

This task shows you how to:

- Manage Attribute Display
- Filter Requirements
- Group Requirements

Before you begin: To open the Requirement Browser, click Browser Requirement  from the Authoring section of the action bar**.**

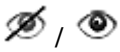
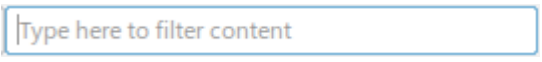
W. Manage Attribute Display

You can hide or show, reorder, and edit attributes.

1. In the **Requirement Browser**, click **Attributes Manager**  .

A side panel appears in the **Requirement Browser** with the list of all the attributes.

2. To manage attributes display, use the following commands:

Command	Description
	Hides or shows all attributes.
	Hides or shows a single attribute.
	Moves the selected attribute up or down the list.
	Filters the attribute values.

3. To edit an attribute, select its value in the spreadsheet and enter a new one.

X. Filter Requirements

ou can filter requirements based on attribute values.

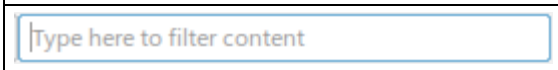
1. In the **Requirement Browser**, click **Filters Manager**  .

A side panel appears in the **Requirement Browser**.

2. Select a specific column to filter, that is, an attribute on the requirement.

The list of available values for the attribute appears.

3. To filter attribute values, use the following commands:

Command	Description
	Hides or shows all attribute values.
	Hides or shows a single attribute value.
	Filters the attributes values.

Note:

- To display only the required priority requirements, you can filter or hide the other priority requirements. If several values are present for a particular attribute, you can use the search bar to filter the attribute values.
- You can also filter rows based on attributes visible in the panel.
- Filtering is cumulative. Once you have obtained the required priority requirements, you can

further filter these requirements based on other attributes, for example, owner, difficulty, modified time, and so on.

4. To close the **Filters Manager** side panel, click again the **Filters Manager** command.

Y. Group Requirements

You can create grouping nodes to group requirements based on attribute values. This enables you to select and edit all requirements in a group simultaneously.

1. In the **Requirement Browser**, click **Groups Manager**.

A side panel appears in the **Requirement Browser**.

2. Click **Create Group**.
3. From the list, select an attribute.

The list of available values for the attribute appears.

4. Using **Hide** and **Show**, display only the values for which you want to create a group.
5. Click **Validate**.

A grouping node is created.

Module-2. I: Automatic Line Balancing

A. Automatic Line Balancing

This section describes the Automatic Line Balancing capability, which is used to balance systems and operations while respecting structural and time constraints**.**

In this section:

- About Automatic Line Balancing
- Automatic Line Balancing Using Optimized Cycle Time
- Automatic Line Balancing Using Minimum Number of Systems
- Automatic Line Balancing Using Pinned Operations

B. About Automatic Line Balancing

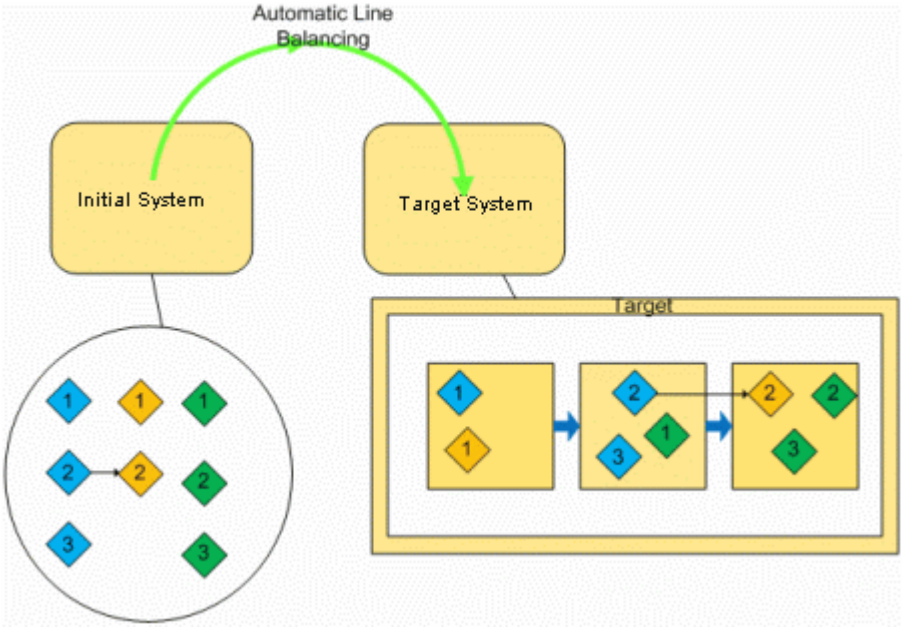
Automatic Line Balancing collects all operations from a source system then moves or copies them to a target system comprising a product flow structure that respects structural and time constraints.

- Principle
- Initial System
- Target System
- Scope Considerations
- Maximum Cycle Time
- Resource Utilization
- Overflow
- Pinned Operation Behavior in Automatic Line Balancing
- Consistency Between System and Operations
- Automatic Line Balancing Report

C. Principle

Automatic line balancing consists in balancing a group of operations from an initial system to a target system.

The top structure (that is, the first level of children) of the target system must comprise a single sequence of systems connected by a product flow.
In the figure below, if the global time of all operations in the initial system is 80 seconds, then the target system shows three balanced systems. With each system having a cycle time of about 30 seconds.



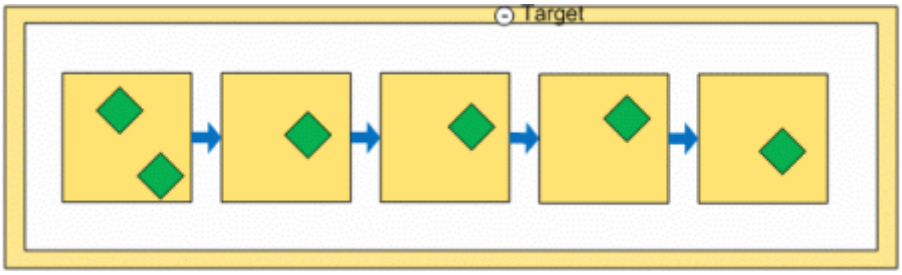
Automatic Line Balancing takes into account constraints defined between operations. In the figure above, the blue operation 2 precedes the orange operation 2 and this constraint is respected in the balancing result. The supported constraints are precedence constraints and product flows.

D. Initial System

The initial system is the system that contains the unbalanced operations.
The initial system can be a workplan system or any other system type and it can contain any type of operation. It has no relationship with any resource in a resource layout.

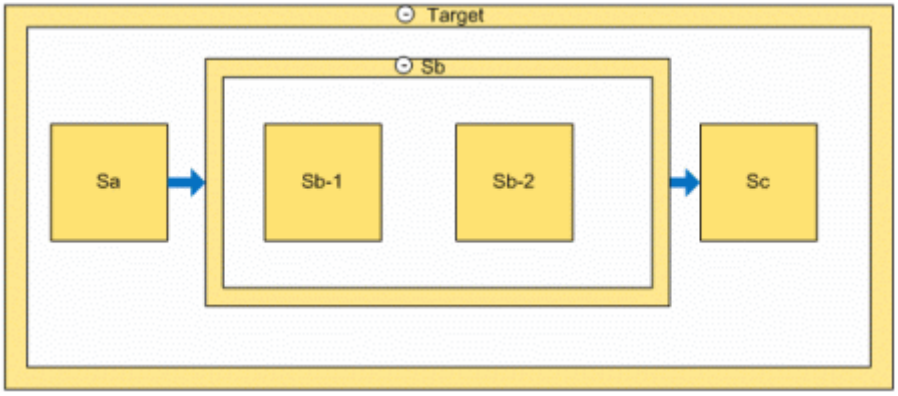
E. Target System

The target system is the system that receives the balanced operations. It can be the same as the initial system.
The target system must be made up of general systems.
The target system has child systems connected through a single product flow. The product flow must not have any "Y" branches. Each child system can comprise a system structure that ends with leaf systems.
A leaf system is a system with no child system nodes.
The target system can include operations that are not Transfer, Buffer, or Sink operations, see figure below.



After Automatic Line Balancing, all operations are balanced on the leaf systems of the target structure.

If any of the existing operations were locked, they will not be moved by the automatic balancing.
The target system can have a substructure of systems. In the figure below, the second system Sb of the product flow has two subsystems Sb-1 and Sb-2.



After Automatic Line Balancing, the operations are balanced on the leaf systems Sa, Sb-1, Sb-2, and Sc, but not on Sb, since Sb is not a leaf system.
Note: The time type taken into account for operations is **Estimated time**.

F. Scope Considerations

The initial and target systems must have a scope to the same item. This ensures a correct balancing of the operations assigned to the item, and that assignment links are maintained.
The initial and target systems must not have a scope to a resource structure. At the time when operations are balanced, there is no relation between systems and resources.
In any case, the planner intervenes before the resource assignment stage. The systems can be assigned to resources after the balancing stage.

G. Maximum Cycle Time

Each system that can receive operations shares a common cycle time known as maximum cycle time. The maximum cycle time is an Automatic Line Balancing parameter. Its value cannot be less than the maximum time of any operation to be balanced, nor can it be negative or zero. You can enter or edit the value in the **Automatic Line Balancing** dialog box when using the **Minimum Number of Systems** mode.
When you select the initial system, the **Maximum Cycle Time** is set by default to the longest operation time among its operations. You can specify an operation time in the properties of an operation, as **Estimated Time**.
After you select the target system, the **Maximum Cycle Time** is updated. Its value is now set by default to the longest cycle time among its systems. You can specify a cycle time in the properties of a system. Automatic Line Balancing also considers the **Time Mode** specified in the properties of each operation.

H. Resource Utilization

You can balance operations based on a percentage of utilization of your resources.
The cycle time of each system in the target system is multiplied by the utilization percentage and used for balancing. This is useful, for example, to simulate activity when assembly stations cannot perform at full capacity.
You can enter the percentage value in the **Automatic Line Balancing** dialog box, when using the **Minimum number of systems** mode. This value cannot be negative nor zero. In addition, all systems in the target system must have a cycle time greater than zero.

I. Overflow

You can allow balancing of operations that exceed the cycle time or utilization percentage.
These operations are balanced according to existing product flows and time constraints, and can overflow the system they are assigned to.
If you do not allow overflow, exceeding operations remain unbalanced.
Overflowing and unbalanced operations are flagged in the Automatic Line Balancing report. For more information, see Automatic Line Balancing Report below.

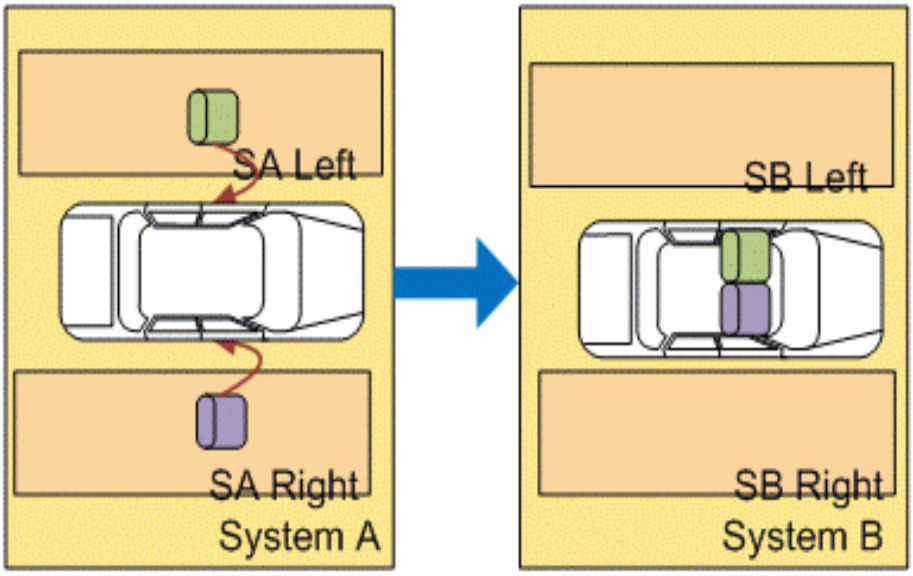
J. Pinned Operation Behavior in Automatic Line Balancing

An operation can be locked using a **Pin Operation** contextual command to prevent moving it during automatic balancing.
The behavior of pinned operations for Automatic Line Balancing is as follows:

- When the initial and target systems have a common parent system, only the initial system's unpinned operations are moved to the target system. The initial system's pinned operations do not move.
- When the initial and target systems do not have a common parent system, all the initial system's pinned and unpinned operations are reinstantiated in the target system.

K. Consistency Between System and Operations

You can use the DELMSDCheckOperationMove_ID business logic to ensure that an operation is compatible with a system during Automatic Line Balancing.
This business logic enables you to allow or prevent balancing between right-handed and left-handed operations and systems.
For example, the figure below shows System A and System B (stations) that have subsystems SA Right/Left and SB Right/Left (working areas). You can use
the DELMSDCheckOperationMove_ID business logic to ensure that only left-handed operations can be moved to subsystem SA Left.



L. Automatic Line Balancing Report

The report provides a summary of balanced operations with their status and assigned system.
Once the Automatic Line Balancing is completed, the reports automatically opens in a dialog box.

Operations are divided into three states:

Status	Status Explanation	Possible Messages in Report
Success	Operation successfully balanced without overflow	Operation successfully assigned. Operation successfully reassigned to same system. Operation successfully reassigned to different system.
Warning	Operation balanced with overflow	Operation has overflowed. Operation has overflowed and it has time greater than cycle time.
Error	Operation unbalanced	Overflowed operation not assigned. Overflowed operation not assigned as it has time greater than cycle time.

Notes:

- Overflow is given priority over reassignment to another system.
- You can export the report into the following formats:.txt, .csv, and .tsv. Operation time is also exported along with the information displayed in the dialog box.

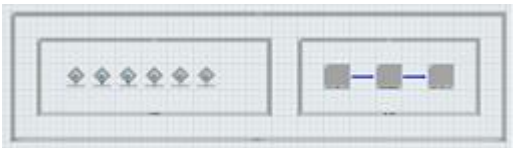
M. Automatic Line Balancing Using Optimized Cycle Time

You can balance an initial system's operations on the subsystems of a target system using the **Optimized Cycle Time** option.

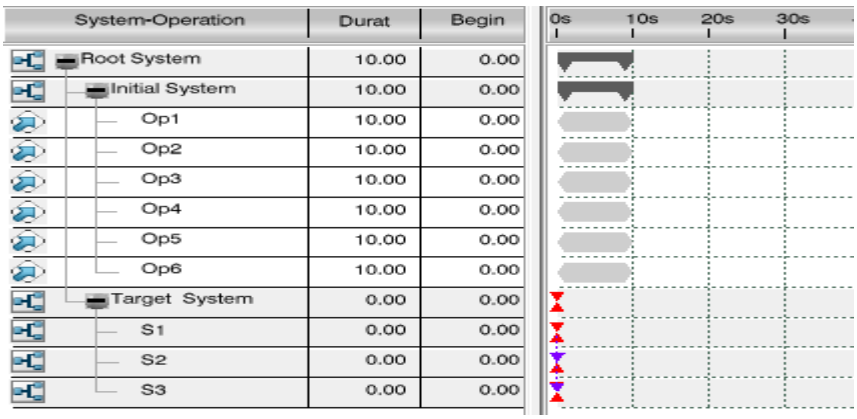
Before you begin: Open a system structure comprising the following:

- An initial system with operations
- A target system with subsystems

1. Create a product flow on the subsystems of the target system. For more information, see Creating a Product Flow.



2. From the **Authoring** section of the action bar, click **Process Gantt**, and select the root system.



3. From the **Authoring** section of the action bar, click **Automatic Line Balancing**.

The **Automatic Line Balancing** dialog box appears.

4. Select the initial system.
5. Select the target system.

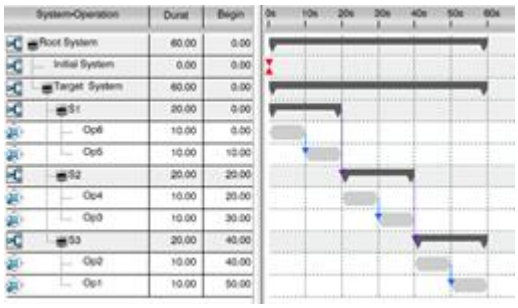
6. In the dialog box, select the **Optimized Cycle Time** option.
7. **Optional:** To remove all existing operations from the target system before balancing afresh, select the **Delete balanced operations under target system** option.

Notes:

- This option is useful to bypass unsolvable constraints for rebalancing.
- This option is ignored if the initial system and target system are the same.

8. Click **Generate**.

The operations are balanced on the subsystems of the target system.



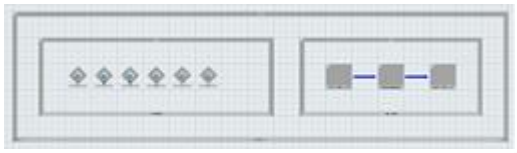
N. Automatic Line Balancing Using Minimum Number of Systems

You can balance an initial system's operations on the subsystems of a target system using the Minimum number of systems option.

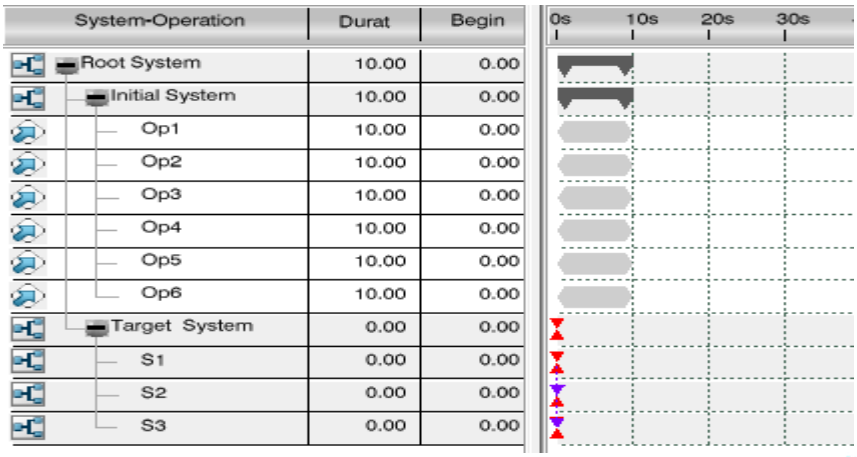
Before you begin: Open a system structure comprising the following:

- An initial system with operations
- A target system with subsystems

1. Create a product flow on the subsystems of the target system. For more information, see Creating a Product Flow.



2. From the Authoring section of the action bar, click Process Gantt , and select the Root system.



3. From the Authoring section of the action bar, click Automatic Line Balancing .

The Automatic Line Balancing dialog box appears.

4. Select the initial system.
5. Select the target system.
6. In the dialog box, select the Minimum number of systems option, and specify the Maximum Cycle Time as 40s.
7. Optional: To allow balancing of operations that exceed the cycle time, select the Overflow systems option.

Notes:

- If the option is cleared, these operations are not considered for balancing.
- This option is ignored if the initial system and target system are the same.

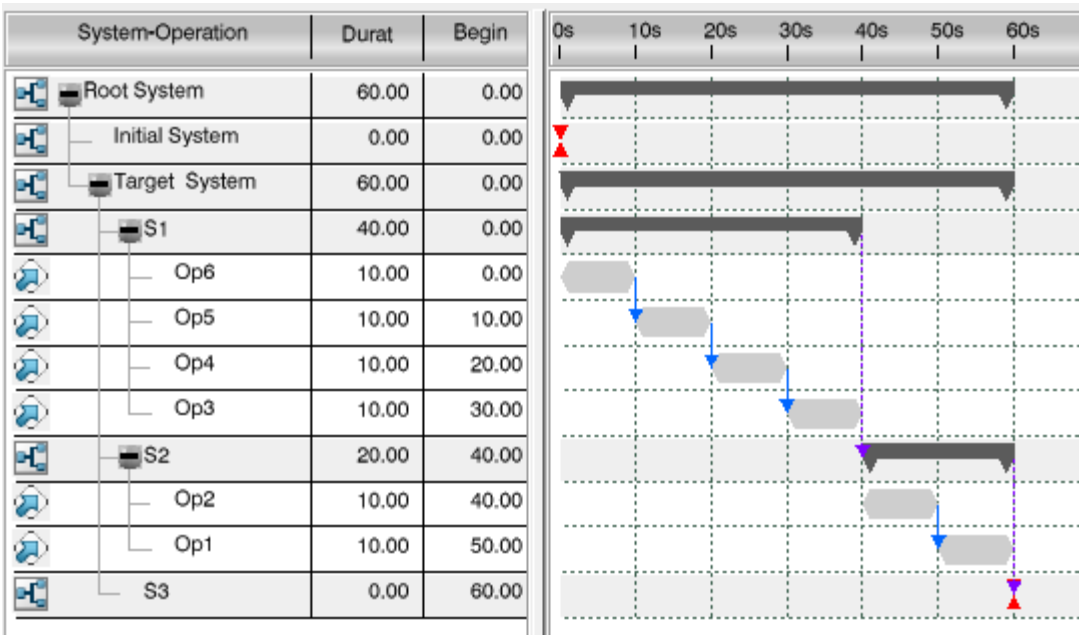
8. Optional: To remove all existing operations from the target system before balancing afresh, select the Delete balanced operations under target system option.

Notes:

- This option is useful to bypass unsolvable constraints for rebalancing.
- This option is ignored if the initial system and target system are the same.

9. Click Generate.

The operations are balanced on the subsystems of the target system.



The subsystems of the target system are filled according to the product flow sequence. Each subsystem has a cycle time less than or equal to the maximum cycle time (40s). The first subsystem comprises four operations and a cycle time of 40s, the second subsystem comprises two operations and a cycle time of 20s, and the third subsystem is empty.

Note: When the Minimum number of systems option is used, a Maximum Cycle Time parameter needs to be defined for the Automatic Line Balancing capability. However, this maximum cycle time value must not be persistent in the model: it is only used as a specific parameter in the user interface of the Automatic Line Balancing command.

O. Automatic Line Balancing Using Pinned Operations

You can lock operations in their initial system to prevent them being moved during Automatic Line Balancing. You lock operations using the Pin Operation contextual command, and unlock them using the Unpin Operation contextual command.

The behavior of pinned operations during Automatic Line Balancing is as follows:

- When the initial and target systems have a common parent system, only the initial system's unpinned operations are moved to the target system. The initial system's pinned operations do not move.

- When the initial and target systems do not have a common parent system, all the initial system's pinned and unpinned operations are re-instantiated in the target system.

This task shows you how to:

- Balance Operations in a Common Parent System
- Balance Operations in a Non-Common Parent System

P. Balance Operations in a Common Parent System

When the initial and target systems have a common parent system, you can move the initial system's unpinned operations to the target system.

1. Open a system structure comprising an initial system and a target system, both under a common parent system.
2. In the system structure:
    a. Right-click operation Op 3 in the initial system, then select **Pin Operation**.
    b. Right-click operation Balanced Op 2 in the target system, then select **Pin Operation**.

A pin symbol appears on these operations to indicate that they are locked.

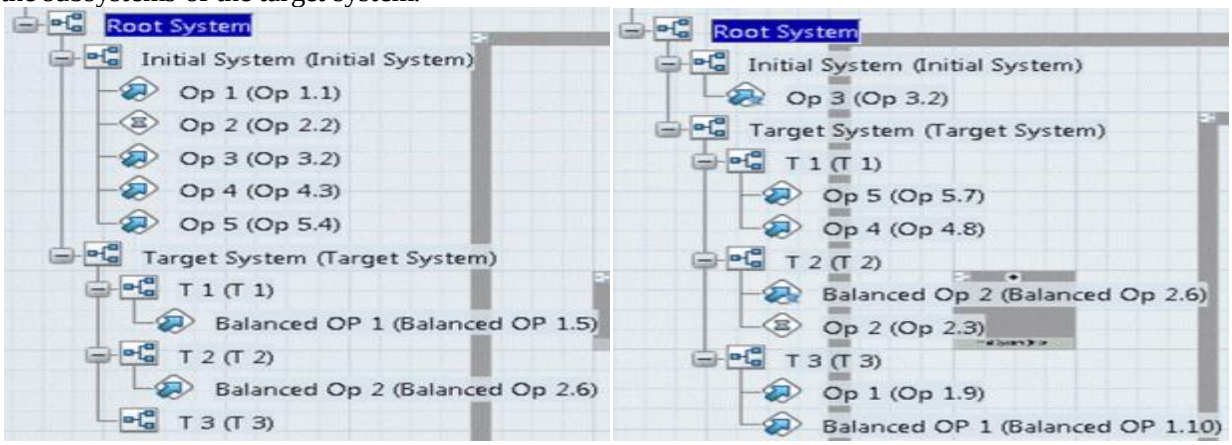
3. From the **Authoring** section of the action bar, click **Automatic Line Balancing** .

The **Automatic Line Balancing** dialog box appears.

4. Select the initial system and the target system.
5. **Optional:** To remove all existing operations from the target system before balancing afresh, select the **Delete balanced operations under target system** option.

Click **Generate**.

The pinned operations Op 3 and Balanced Op 2 do not move, and the other operations are balanced on the subsystems of the target system.



Q. Balance Operations in a Non-Common Parent System

When the initial and target systems do not have a common parent system, you can re-instantiate all the initial system's pinned and unpinned operations in the target system.

1. Open a system structure comprising an initial system and a target system that do not have a common parent system.
2. In the system structure:
    a. Right-click operation Op 3 in the initial system, then select **Pin Operation**.
    b. Right-click operations T Op 7 and T Op 9 in the target system, then select **Pin Operation**.

A pin symbol appears on these operations to indicate that they are locked.

3. From the **Authoring** section of the action bar, click **Automatic Line Balancing** .

The **Automatic Line Balancing** dialog box appears.

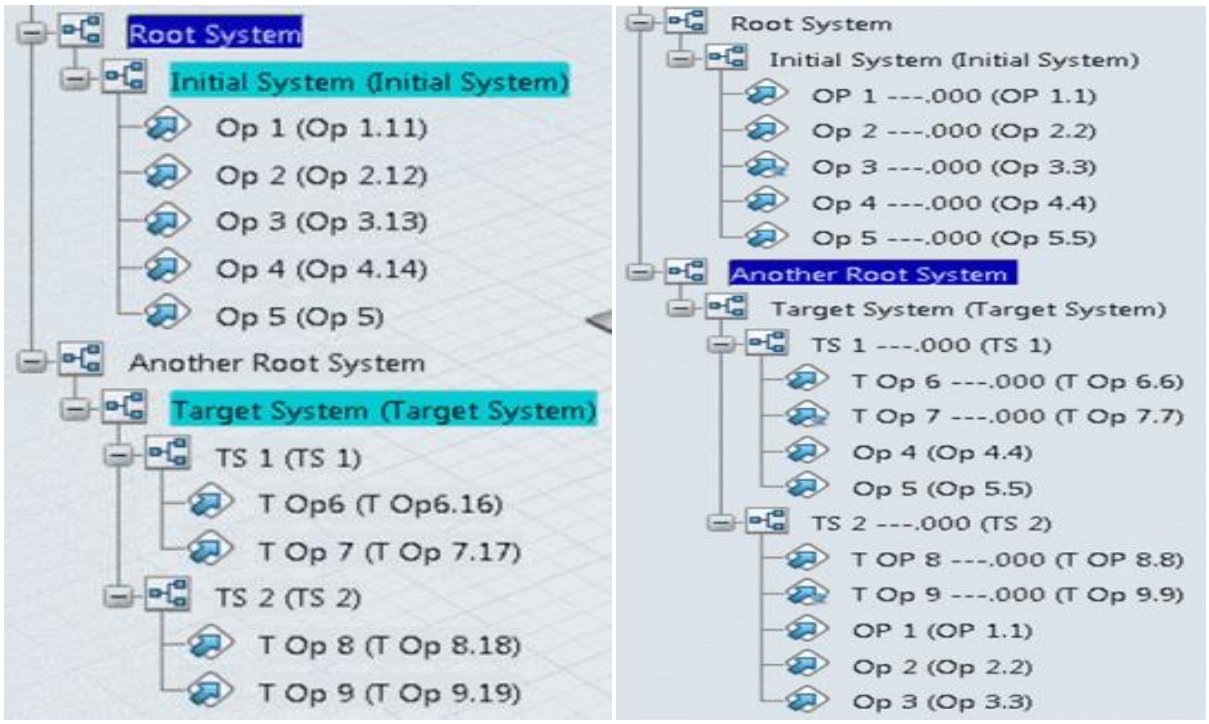
4. Select the initial system and target system.
5. **Optional:** To remove all existing operations from the target system before balancing afresh, select the **Delete balanced operations under target system** option.

Notes:

- This option is useful to bypass unsolvable constraints for rebalancing.
- This option is ignored if the initial system and target system are the same.

Click **Generate**.

Operations T Op 7 and T Op 9 do not move in the target system. A new operation Op 3 is instantiated in the target system and is not pinned. The initial system is unchanged because it is in another root system.



Module-2. J: Impact of Operation Move on Resource Assignment

This section describes how resource assignment is managed when an operation is moved from one system to another.

In this section:

- Resource Assignment Rules When Moving an Operation
- Managing Resource Assignment When Moving an Operation
- Defining Operation Position in Relation to a Resource

A. Resource Assignment Rules When Moving an Operation

An operation with assigned resources can be moved from one system to another by using drag and drop in the Process Gantt chart. A number of resource assignment rules apply depending on the type of link between the operation and resource.

An operation can be assigned to a resource by:

- An Execute link to a working resource
- A Used link to a nonworking resource
- A Where link to an organizational resource.

The following topics are discussed:

- Execute Link Management for Operation Move
- Where Link Management for Operation Move
- Used Link Management for Operation Move

B. Execute Link Management for Operation Move

Case 1

The Execute link management for operation move (case 1).

Initial Conditions

Target system and origin system share the same scope definition.

Rules

A list of possible working resources is proposed. The executing resource linked to the operation is selected by default.

Case 2

The Execute link management for operation move (case 2).

Initial Conditions

Target system and origin system do not share the same scope definition.

Rules

A list of possible working resources is proposed.

Case 3

The Execute link management for operation move (case 3).

Initial Conditions

Target system contains operations executed by working resources. Target system and origin system share the same scope definition.

Rules

A list of possible working resources is proposed.

The list contains the executing resource of the operation to be moved. It also contains the executing resources (each one realizing at least one operation) found under the System tree structure of the target system. All types of working resources are proposed as executing resources for the moved operation.

If you select a working resource from the list, the moved operation is executed by the selected resource.

Case 4

The Execute link management for operation move (case 4).

Initial Conditions

Target system contains operations executed by working resources. Target system and origin system do not share the same scope definition.

Rules:

- A list of possible working resources is proposed.
- The list contains executing resources, each one realizing at least one operation found under the System tree structure under the target system. The initial executing resource can no longer be assigned. All types of working resources are proposed as executing resource for the moved operation.
- You can select a working resource from that list.

C. Where Link Management for Operation Move

The operation to be moved is assigned to an organizational resource. There is a **Where link** between the operation and the organizational resource.

Case 1

Where link management for operation move (case 1).

Initial Conditions

Target system contains no operation or target system contains operations with no assigned organizational resource. Target system and origin system share the same scope definition.

Rules

- Moved operation is still assigned to the same organizational resource.

Case 2
Where link management for operation move (case 2).

Initial Conditions
Target system contains no operation or target system contains operations with no assigned organizational resource. Target system and origin system do not share the same scope definition.

Rules

- The **Where link** is removed and the moved operation is not assigned to any organizational resource.
- **Case 3**
- Where link management for operation move (case 3).

Initial Conditions
Target system contains operations assigned to organizational resources. Target system and origin system share the same scope definition.

Rules

- A list of possible localization resources is proposed.
- The list contains the localization resource of the operation to be moved. It also contains the localization resources (each one localizing at least one operation) found under the System tree structure of the target system.
- If you select a localization resource from the list, the moved operation is assigned to the selected resource.

Case 4
Where link management for operation move (case 4).

Initial Conditions
Target system contains operations assigned to organizational resources. Target system and origin system do not share the same scope definition.

Rules

- A list of possible localization resources is proposed. That list contains the localization resource of the operation to be moved. It also contains localization resources, each one localizing at least one operation found under the whole System tree structure under the target system.
- If you select a localization resource from the list, the moved operation is assigned to the selected resource.

D. Used Link Management for Operation Move

The operation to be moved uses one or more nonworking resources. There is a Used link between the operation and the nonworking resources.

Case 1
Used link management for operation move (case 1).

Initial Conditions
Target system contains no operation or target system contains operations with no localization resource. Target system and origin system share the same scope definition.

Rules

- Moved operation still uses the same nonworking resources.
- Note: As target system contains operations with no localization resource, no localization resource can be proposed for the moved operation.

Case 2
Used link management for operation move (case 2).

Initial Conditions
Target system contains no operation or target system contains operation with no localization resource.
Target system and origin system do not share the same scope definition.

Rules

- If a used resource is used only by the operation to be moved, then this resource can be moved or duplicated under the first organizational resource holding the scope definition. This resource is included in the proposed used resource list. You can move, duplicate, or unassign it during the operation move.
- If a used resource is shared by the operation to be moved and other operations, then this resource is duplicated under the first organizational resource holding the scope definition. This resource is included in the proposed used resource list. You can duplicate or unassign it during the operation move.
- Note: As target system contains operations with no localization resource, no localization resource is possible for the moved operation.

Case 3
Used link management for operation move (case 3).

Initial Conditions
Target system contains operations with localization resource assigned. Target system and origin system share the same scope definition.

Rules

- Sometimes a used resource is used only by the operation to be moved. In this case, this resource can be moved or duplicated under the localization resource you select the list of possible localization resources.
- This resource is included in the list of possible used resources. You can keep, move, duplicate, or unassign it during the operation move.
- If you do not select a localization resource, then the used resource is moved or duplicated under the organizational resource holding the scope definition.
- Sometimes a used resource is shared by the operation to be moved and other operations. In this case, this resource is duplicated under the localization resource you select the list of possible localization resources.
- This resource is included in the list of possible used resources. You can keep, duplicate, or unassign it during the operation move.
- If you do not select a localization resource, then the used resource is moved or duplicated under the organizational resource holding the scope definition.
- Note: As target system contains operations with localization resource assigned, the Where link management described above is possible. Depending on user selection during Localization Resource assignment, the moved operation has a Localization or not.
- In addition, if the target system contains operations with used resource assigned, those resources are proposed for being assigned to the moved operation.

Case 4
Used link management for operation move (case 4).

Initial Conditions
Target system contains operation with localization resource assigned.
Target system and origin system do not share the same scope definition.

Rules

- Sometimes a used resource is used only by the operation to be moved. In this case, this resource can be moved or duplicated under the localization resource you select the list of possible localization resources.
- This resource is included in the list of possible used resources. You can move, duplicate, or unassign it during the operation move.
- If you do not select a localization resource, then the used resource is moved or duplicated under the organizational resource holding the scope definition.
- Sometimes a used resource is shared by the operation to be moved and other operations. In this case, this resource is duplicated under the localization resource you select the list of possible localization resources.
- This resource is included in the list of possible used resources. You can duplicate or unassign it during the operation move.
- If you do not select a localization resource, then the used resource is moved or duplicated under the organizational resource holding the scope definition.
- Note: As target system contains operations with localization resource assigned, the Where link management described above is possible. Depending on user selection during Localization Resource assignment, the moved operation has a Localization or not.
- In addition, if the target system contains operations with used resource assigned, those resources are proposed for being assigned to the moved operation.

E. Managing Resource Assignment When Moving an Operation

You can reassign resources when an operation is moved from one system to another. When moving an operation
in the Process Gantt chart, the Resource Assignment Assistant appears to propose resources that can be assigned.

When an operation with assigned resources is moved to another system, the resources are analyzed and can be
Possibly replaced by other resources.

When an operation with no assigned resource is moved to another system, resources are proposed for possible
assignment to the moved operation.

Before you begin: Open your session data in Process Planning. In this example, the session data is as follows:

- A system structure with operations
- A product structure with organizational, working, and nonworking resources
- Operations assigned to resources
- Different scopes defined between systems and resources.

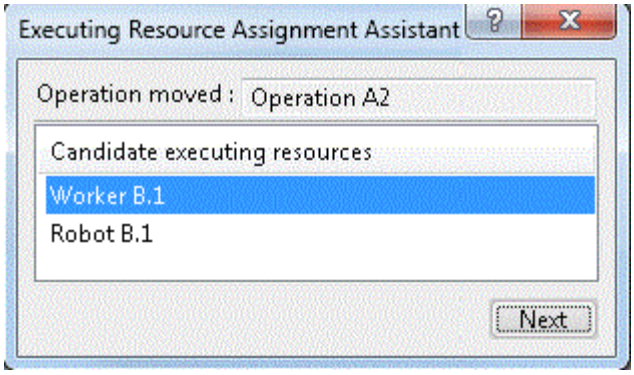
1. In the Process Gantt chart, select the operation to be moved (in the example below, GeneralOperationA2.1).

To do that, just select the bar representing the operation on the right-hand side of the chart.

2. Drag the bar representing the operation in the chart onto the target system or an operation under the target system (in the example below, GeneralSystem52485.1).

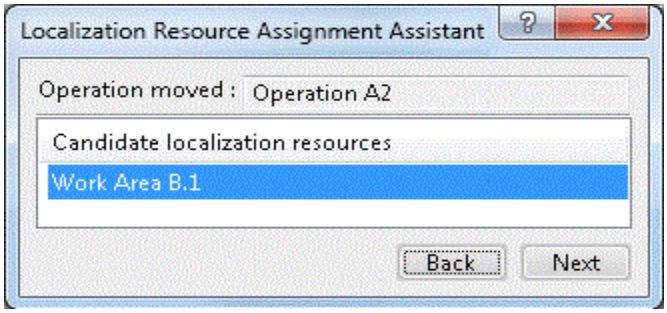
The first dialog box of the Resource Assignment Assistant appears.

It proposes Executing resources to be assigned to the operation.



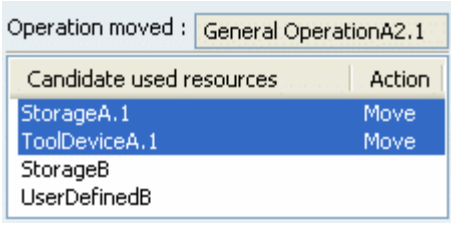
3. Select the required Executing resource in the list and click Next to continue resource assignment.

A second dialog box appears proposing Localization resources.



4. Select the required localization resource in the list and click Next to continue resource assignment.
   Clicking Back takes you back to the first dialog box.

A third dialog box appears proposing Used resources.
The Used resources of the operation being moved are preselected. Depending on the context, you have a choice
of actions you can perform on these resources: keep, move, duplicate, or unassign.
Used resources from the target system or operation are also proposed.



5. Select the required Used resources in the list. If you choose a preselected resource, you can right-click it to apply a move, duplicate or unassign action on that resource.

Click Finish to end the command. You can go back to previous dialog box by clicking Back.
The selected operation is moved, and has the selected resources assigned to it.

It is possible to select more than one resource proposed at each step of the Resource Assignment Assistant using the Ctrl key. When the selections are validated, the resources are assigned to operation.

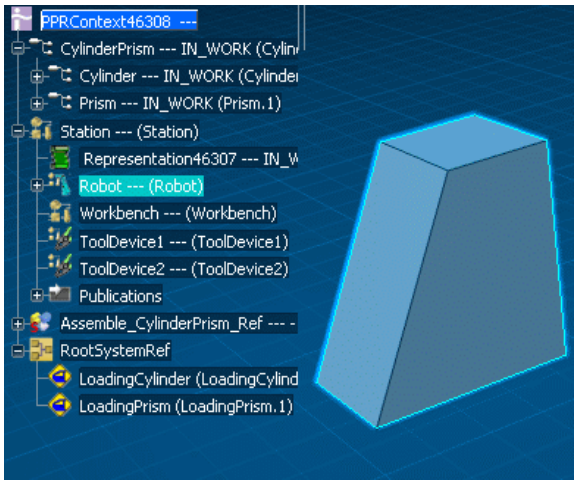
F. Defining Operation Position in Relation to a Resource

You can define the positioning of parts relative to a resource for a given operation using Define Position.

Before you begin: You need to set up the resources and layout using capabilities available in Plant Layout Design & Equipment Allocation.

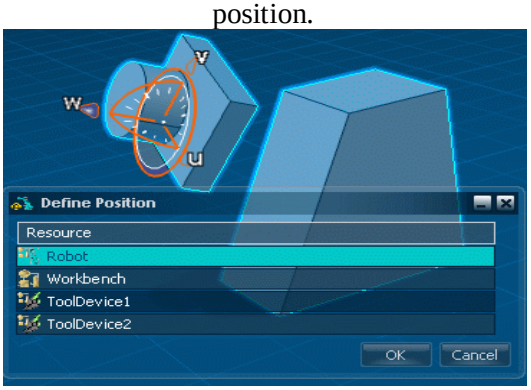
1. Load your session content and start Process Planning.

In this example, the content comprises a Manufacturing Assembly on which there are associated parts (a cylinder and a prism). The item is assigned to operations (one for loading the cylinder, the other for loading the prism). Each part is realized by an operation.
The parts are positioned with respect to a Robot resource.

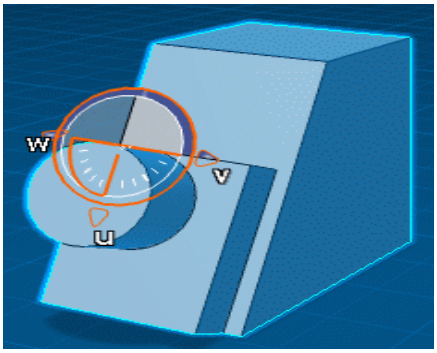


2. Right-click the Loading Cylinder operation and select Define Position.

The Define Position dialog box appears. The cylinder and prism parts are displayed in their defined position.

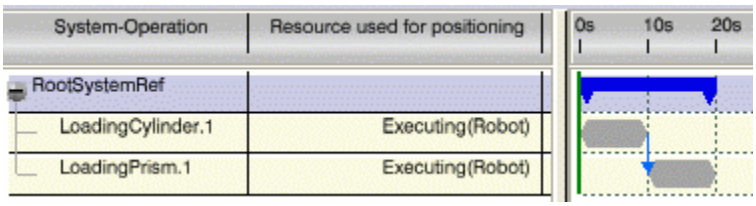


3. Move the cylinder and prism parts to the required position using the robot handle.

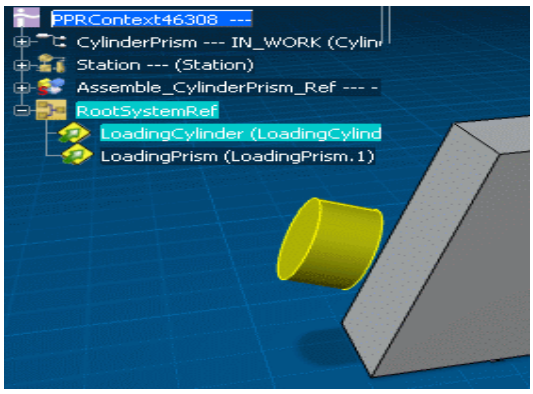


4. Select the Robot resource in the dialog box and click OK.
5. Check in resource used for positioning in the Manufacturing Gantt Chart.

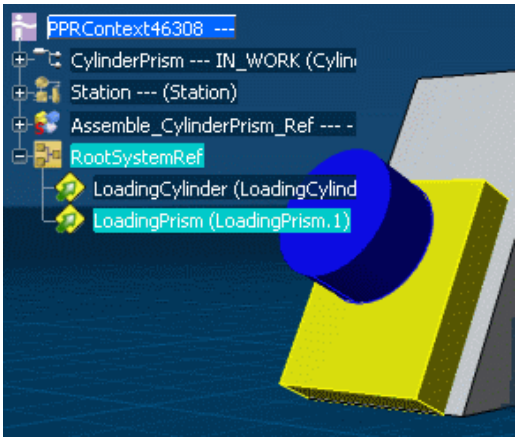
The two operations are sequenced with a time constraint.



6. Simulate the first operation (loading the cylinder).



Simulate the second operation (loading the prism).



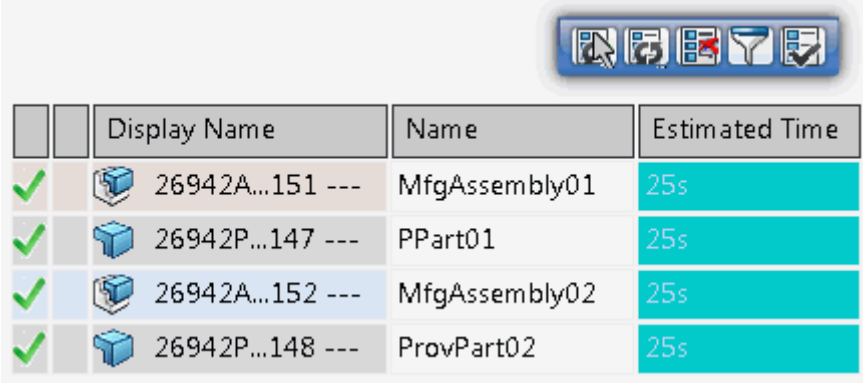
G. Using the Sheet Editor

The Sheet Editor allows you to view and edit the properties of multiple objects in a spreadsheet view.

1. Select several items that are under the same node.
2. From the Authoring section of the action bar, click Sheet Editor  .

The Sheet Editor dialog box appears.

3. Click the Name cell of an item and modify the name. Rename the other items in the same way.
4. Multi-Select the Estimated time cells of the items and enter a new value in one of the cells.



5. Click Commit to save your modifications in the session.

If you want to keep the new values, you must save your modifications.

6. Close the Sheet Editor dialog box.

7. Select several operations that are under the same system and click Sheet Editor .

The Sheet Editor dialog box appears.

8. Click the Title cell of an operation and modify the operation title. Rename the other operations in the same way.

9. Multi-Select the Estimated time cells of the operations and enter a new value in one of the cells.

10. Click Commit to save your modifications in the session.If you want to keep the new values, you must save your modifications**.**

For more information, see the Collaborative Lifecycle User's Guide: Using Attributes with the Sheet Editor.

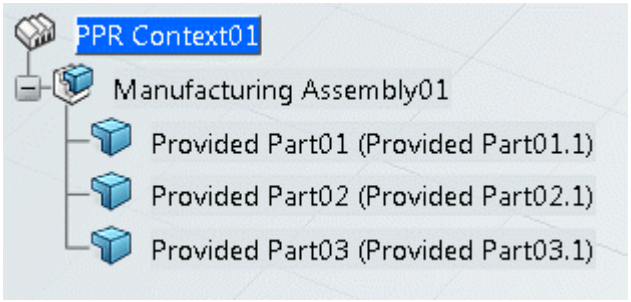
H. Using the Manage Origins Panel

You can use the Manage Origins panel for assigning or removing origin links on items, systems, operations, or resources.
An origin link is defined between objects of the same type and lets you determine from which object the selected object was derived. For example, a locally manufactured product could be derived from a centrally manufactured product.
The following scenario illustrates how to use the Manage Origins panel for items. The same procedure can be used for systems, operations, or resources.

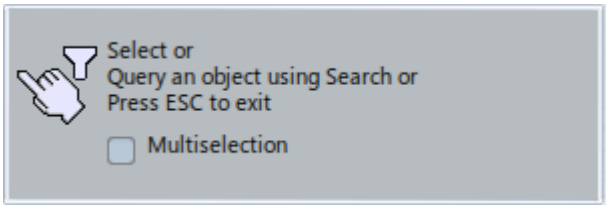
1. From the Authoring section of the action bar, click Manage Origins .

The Manage Origins panel appears.

2. Select an item in the work area or tree (Provided Part01, for example).



3. Click Add an Origin in the panel.
The Applicative Search is activated in the top bar and a small panel appears.



4. Select an item in the work area or tree, or using the search facility.
For more information, see Using the Applicative Search.
If you selected Provided Part02, for example, an origin link is assigned between Provided Part01 and Provided Part02.

5. Click Add an Origin, then select another item.
If you selected Provided Part03, for example, an origin link is assigned between Provided Part01 and Provided Part03.

Note:

- You can use Reconnect on Revision in the panel to reconnect the selected object. These objects include item, system, operation, or resource, and can be reconnected to a new revision of the object even if it is not loaded in the session. A panel is displayed to let you select any available revision of the selected object.
- You can delete origins using Delete in the panel.
- You can filter origins using Edit Filters in the panel. A Filter section appears that lets you filter values on selected columns.
- You can manage origin attributes using Edit Attributes in the panel. An Attributes section appears that lets you hide/show columns of attributes.
- You can manage panel preferences (status bar and messages) using Preferences in the title bar of the panel.

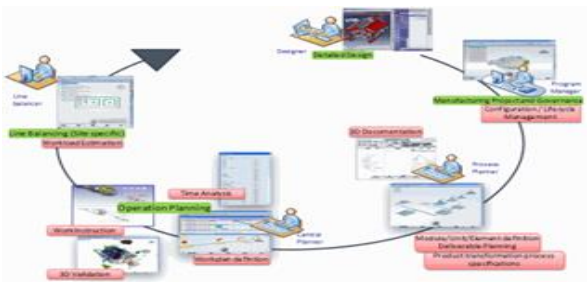
I. Final Assembly Workflow

Final assembly workflow involves managing the exchanges between process planner, central planner, and line balancer.

- Introduction
- Roles
- Final Assembly Workflow Scenario

J. Introduction:

Final assembly workflow involves managing the exchanges between process planner, central planner, and line balancer.



The capabilities available for creating the required manufacturing assembly and system structures include:

- Process planner has the possibility to create an item node called Manufacturing Installation. The Manufacturing Installation has an input that allows the user to specify on which body the items are installed.
- Central planner can create a Work plan system to manage the final assembly workflow.
    - A Work plan system can have scopes to items but not scopes to systems.
    - A Work plan system can have another Work plan system as a child. Other system types are not allowed as children.
    - All types of operations can be created under a Work plan system.
- Scope can be created between a Work plan system and a Manufacturing Installation.
- Scope can be created between a system and a Work plan system.
    - All the system types except for a Work plan system can create a scope with a target Work plan system.
    - If a system scope is created inside a root system, all the systems belonging to the root system cannot create an item scope.
    - A root system containing a system that has a scope to a Work plan system is considered as a root system that belongs to a line balancer.
- Implement links between operations from central planner and operations from line balancer.

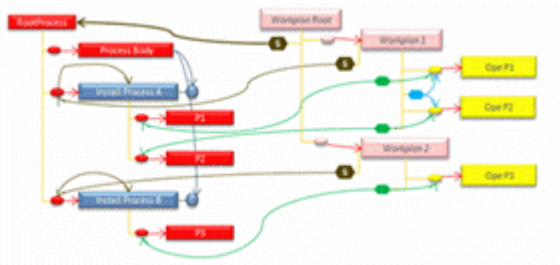
Roles:

The central planner defines a standard work plan that has to be followed by local planners, who are known as line balancer. Line balancers can later enrich the central planner's work plan.
The central planner is responsible for operations planning and works on the definition of the work plan that will realize the items. This planner creates a system and operations linked to each item, and possibly defines the time analyses, work instructions, and assembly tracks.
The line balancers work on balancing operations across systems to respect cycle times and adapt the central work plan to their own needs. These planners use a system structure corresponding to their resources and dispatch the operations created by the central planner.
The general procedure is as follows:

- The central planner defines which operations are required to implement the items. These operations are specifications that the line balancers have to follow. Line balancers can use the operations defined by the central planner and add specific operations.
- The central planner can define an estimated time or compute accurate time analyses on these operations, which are then reflected on the work plan of the line balancers.

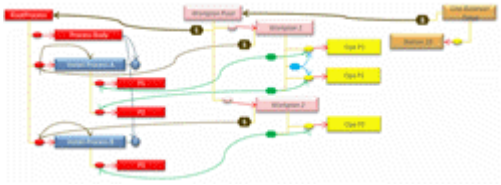
K. Final Assembly Workflow Scenario:

Here is an example of a typical scenario for Final Assembly Workflow.
The central planner defines the Work plan system structure for the manufacturing assembly structure, which was defined by the process planner. The central planner also creates scope links from the Work plan systems to the corresponding Manufacturing Installations.
Note: In the figures below: "S" represents a scope link, time constraints are in blue, and implement links are in green and violet.

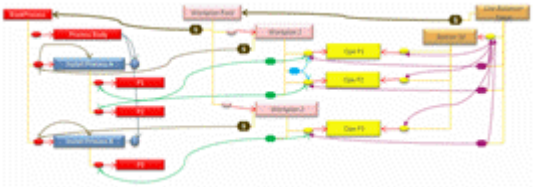


The line balancer (for example, located in Tokyo) creates a local system structure with a new line "Station

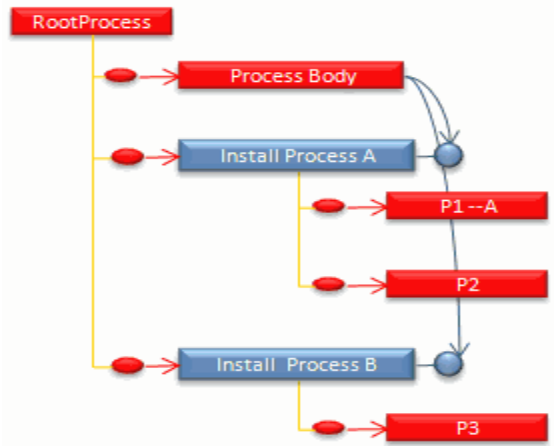
10."
The line balancer creates a system-system scope between the local root system "Line Balancer Tokyo" and the "Work plan Root."



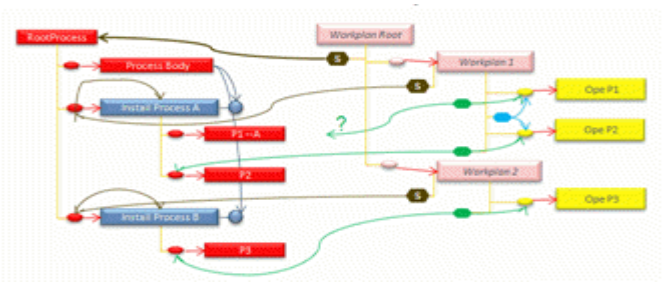
The line balancer performs Implement Link Analysis and checks Operation Assignment Status for "Line Balancer Tokyo".
The line balancer implements the operations from the Work plan by a drag and drop of operations. These operations are Ope P1, Ope P2, and Ope P3 from the Work plan to Station 10.



The line balancer performs Implement Link Analysis again.
Sometimes the line balancer selects Ope P1 from "Line Balancer Tokyo." In this case, the corresponding operation from the Work plan, the associated item, and associated product are highlighted thanks to cross highlighting.
Any time constraint for "Line Balancer Tokyo" cannot be deleted since it is engendered by the Work plan.
The process planner creates a new revision of item P1.

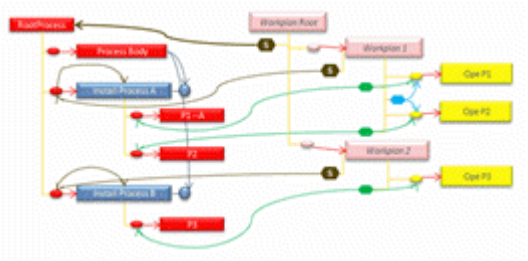


Central planner checks for conflicts with the Work plan by using System Update Status and detects a problem on the Work plan operation Ope P1.
The central planner needs to reroute the new revision of item P1 to operation Ope P1.

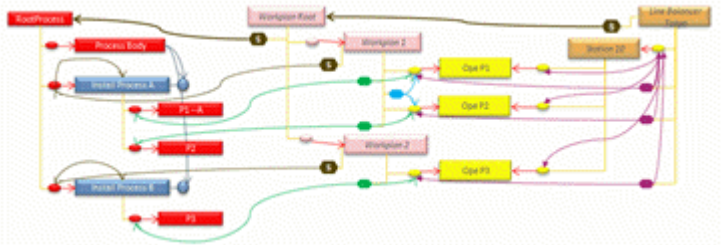


The central planner reroutes the new revision of P1 to operation Ope P1 using Manage Inconsistent

Links .



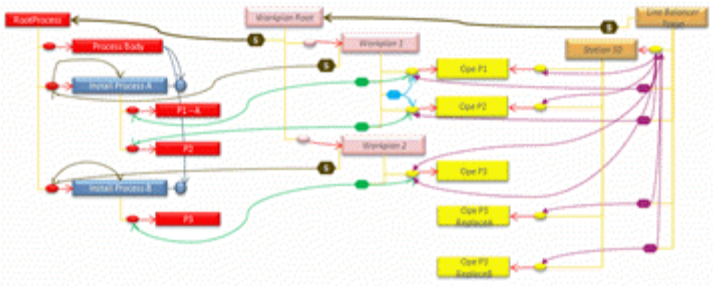
Line balancer checks that there are no conflicts with the Work plan.



Next, the line balancer decides to replace operation Ope P3 by two other operations. The line balancer:

- Deletes Ope P3.
- Creates two new operations, Ope P3 ReplaceA and Ope P3 ReplaceB.

The line balancer uses drag and drop or the Assignment Assistant to replace Ope P3.
Drag and drop Ope P3 from Work plan to Ope P3 ReplaceA and Ope P3 ReplaceB.



Perform Implement Link Analysis for operation Ope P3.
Note: Sometimes the line balancer reuses an operation of the work plan (from a reference point of view). If a central planner also modifies an attribute of the operation reference, the line balancer's operation automatically inherits that modification.

L. Associating a Picture to a System/Operation Tile

You can include a customized picture (2D representation) on a System or Operation tile.

1. Right-click a System tile and select Picture Definition > Define Picture.

A dialog box appears allowing you to select the required picture.

2. Choose a picture and click OK.

The picture is added to the System tile.
Notes:

- You can select bmp, jpg, jpeg, and png images.
- A picture can be removed by right-clicking the tile and select Picture Definition > Remove Picture.

A. About Systems Simulation

The Systems Simulation capability enables simulation of operations defined in a system structure. The different states of a product are simulated by navigating through the operations in the system structure. This is done using the Compass and the Product Buildup Options panel.
For more information, see the Common Services for Process Engineering Apps user's guide.

The following topics are discussed:

- Capabilities
- Simulating Systems

B. Capabilities

Systems simulation provides capabilities to validate your system structure.
It allows the following:

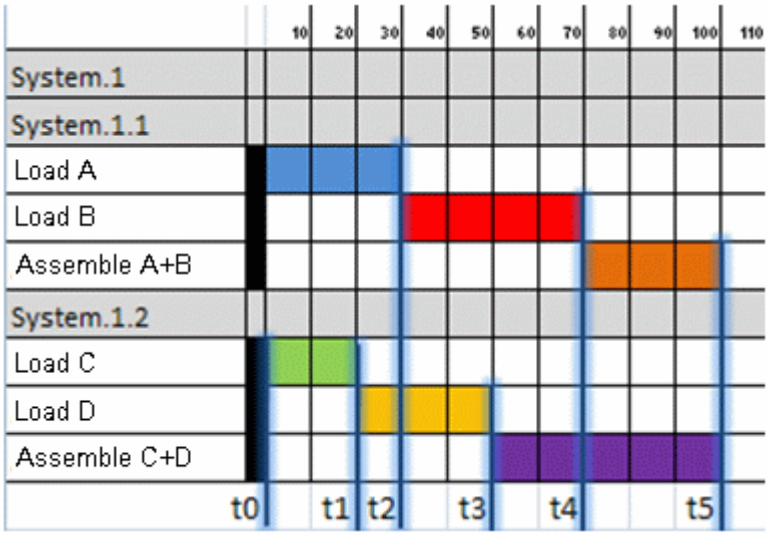
- Scheduling of operations by highlighting the current operations in the Process Gantt chart and the tree
- 3D product transformations positioned in the context of the engineering product if the operations are not yet balanced on organizational resources.
- Part coloring according to the item type assigned to the current operations.
- Displaying the resource structure, if it exists.

C. Simulating Systems

Systems are simulated using the Compass, the Experience Player, and the Product Buildup Options panel.

Simulation Tools
The Play command of the Compass enables you to run the simulation after selecting a system or an operation.
The Experience Player appears. It provides a number of controls for running the simulation. For more information, see Players.
When you click Product Buildup Options  at the right edge of the work area, the Product Buildup Options panel appears. This panel lets you define the transparency and the color of objects that are part of the product buildup.
Simulation Sequence
If you select a system before launching the simulation, the first simulated step is the leaf operations of the system with the earliest end time.
If you select an operation that is not a leaf operation, the first simulated step is the leaf operations with the earliest end time. Only the operations with the earliest end time are simulated.
Each simulation step corresponds to the state of the product at the end time of 1 or N operations. A step shows the state of the product at the end of more than one operation, if the operations finish at the same time.

Note: It is the product states at the end of the operations that are taken into account in the simulation.
The example below describes the behavior of the simulation launched from System.1 that includes operations with the same end time included in two different subsystems.



Simulation step by step:

- The state of the product at the end of "Load C" is displayed at time t1.
- The state of the product at the end of "Load A" is displayed at time t2.
- The state of the product at the end of "Load D" is displayed at time t3.
- The state of the product at the end of "Load B" is displayed at time t4.
- The state of the product at the end of "Assemble A+B" and "Assemble C+D" is displayed at time t5.

The simulation is always replayed in the context of the root system of the session. That means that all previous operations executed before the initial operation or the system that you selected are taken into account.

When two operations end at the same time, only one position can be applied for the simulation. Since the positioning is applied to the root Product to produce. The state of the product cannot be displayed at the same time (end of two operations) at two different places.

Such a situation (two operations ending at the same time) occurs if the end time is the same for both operations and particularly:

- If both operations are linked by an end/end constraint.
- If both operations have the same duration, and are linked by a start/start constraint**.**

D. Cross Highlighting for Systems Simulation

During systems simulation, when the **System by System** option is activated in the **Product Buildup Options** panel, at each step of the simulation:

- If **Highlight Active Operations** is defined in the **Simulation Options** dialog box, the corresponding system is highlighted in the tree.
- In the 3D and tree, all the products and manufacturing items implemented by the operations of the current system are highlighted. In this case, the **Highlight product from item** and **Highlight item from product** options must be selected in **Me** **> Preferences > App Preferences > Simulation > Digital Manufacturing Apps Common Services > Simulation and Planning Apps Common Services > Display**.
- If **Center tree on operation** is defined in the **Product Buildup Options** panel, the tree is centered on the current system node.

E. Using Systems Simulation

You can use Systems Simulation capabilities to check that parts are correctly shown or hidden and displayed with the right color and position in the work area. You do this using the **Play** command of the **Compass** and the **Product Buildup Options** panel.

Before you begin: Start Process Planning.

1. Open the session with appropriate product, item, system, and operation data.

Some items must be assigned to operations.

2. From the Authoring section of the action bar, click Process Gantt and select the root system of the session.
3. Click Play in the Compass.

The Simulation Player appears. It provides a number of controls for running the simulation. For more information, see Players.

Note: A Simulation Options panel appears when you select Simulation Options in the Experience Player and lets you define specific simulation options. For more information, see Simulation Options Dialog Box.

4. Click three times on Play Step Forward .
5. Click Play Step Backward .
6. Click Play Forward to run the simulation continuously to end of the simulation.

Check that the current operations are correctly highlighted in the Process Gantt chart and the tree.

7. Use the slider to go back to the beginning of the simulation.
8. Click Product Buildup Options that appears at the right-hand side of the work area.

The Product Buildup Options panel appears. For more information, see Product Build-Up Options Panel.

9. In the Product Buildup Options panel, modify some of the display and color options.
10. Repeat steps 2 to 6.

Check that the parts are correctly shown or hidden and that they are displayed with the correct color and position.

11. Click Play in the Compass to quit the simulation.

Module-2. L: Product Flow

This section describes the capabilities for creating product flow links between systems, between operations, and between systems and operations

In this section:

- About Product Flows
- Creating a Product Flow
- Modifying Product Flow Display
- Inserting a System or Operation Into an Existing Product Flow

A. About Product Flows

Product flows enable you to define sequences of systems and operations.
The following topics are discussed:

- General Principles
- Display
- Automatic Reconnection
- Transient Flows and Constraints

B. General Principles

A product flow specifies a precedence constraint from a source to a target.
For example, a product flow from Operation A to Operation B specifies that Operation A must be completed before Operation B. Operation A is the source, while Operation B is the target.
A product flow can link two systems, two operations, or a system and an operation. Operations can belong to the same system or to different systems.
A product flow can only have one source and one target at a time. However, an operation or system can be part of different product flows at the same time.

C. Display

A product flow is symbolized by an arrow in the System Editor.
The arrow starts from the source tile and points to the target tile. If the source and target belong to different systems, the arrow crosses over system borders.
When you collapse tiles, the source or target may become hidden. In that case, the arrow appears between the first visible parents instead until you expand the tiles again. Several arrows, corresponding to different product flows, may appear stacked between the same parents.

By default, product flow arrows are blue. You can customize this color in the Display options in **Me > Preferences > App Preferences > Simulation > Process Engineering > Process Planning > System Grid Editor**.
Note: Time constraints are displayed like product flows, using a different color. They follow the same behavior. For more information, see Creating Time Constraint Links Between Operations.

D. Transient Flows and Constraints

Transient flows and constraints symbolize product flows and time constraints of Unloading and filtered operations. Like product flows and time constraints, they are displayed as arrows. The colors are similar to the ones defined for product flows and time constraints, but slightly transparent.

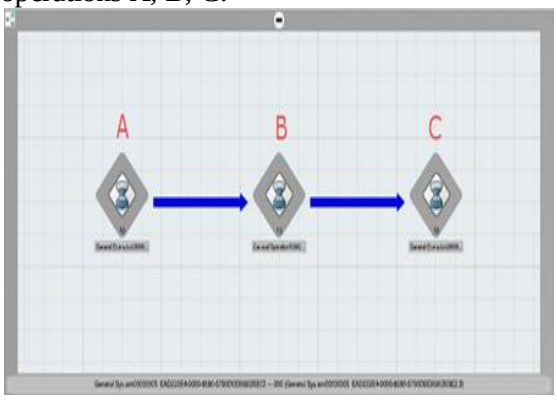
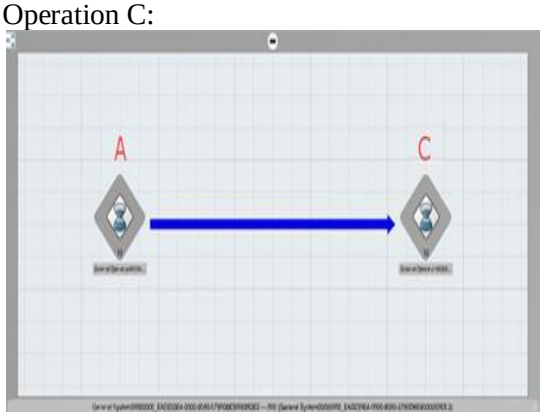
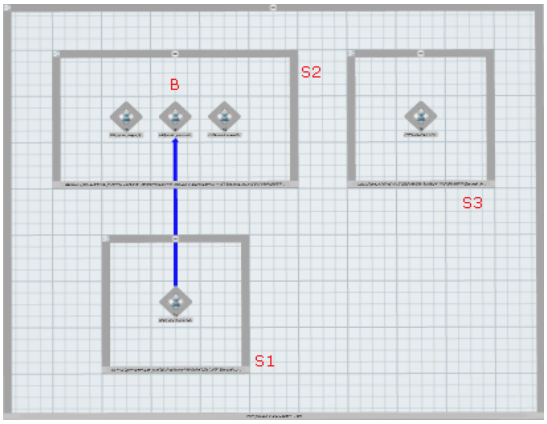
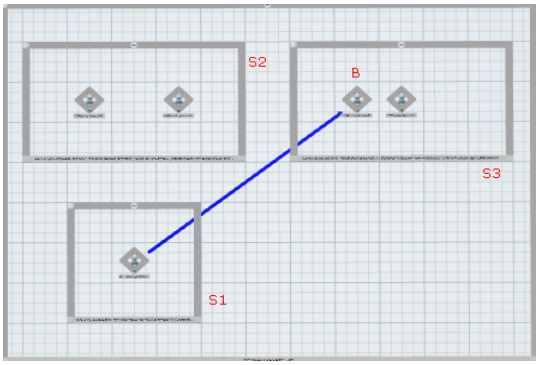
When you filter operations, product flows and time constraints defined on the filtered operations are still displayed:

- If a product flow exists between filtered operations, it appears as a transient product flow. In this case, the product is moved to the next operation.

- If a time constraint exists between filtered operations, it appears as a transient time constraint. In this case, the product remains on the current operation.

E. Automatic Reconnection

When you move or delete the target of a product flow, the sequence can be automatically reconnected.
The following rules apply:

	Origin and Target in the Same System (Sibling Operations)	Origin and Target in Different Systems
Rule	If the target is deleted, the product flow is reconnected with the target successor.	If the target is moved from one exterior system to another, the product flow is maintained.
Example	Consider a sequence of three sibling operations A, B, C:  If you delete Operation B, its successor becomes the new target. The product flow is reconnected with Operation C:  	Consider the structure below:  If you move operation B from System S2 to System S3, the product flow with System S1 is maintained: 

F. Creating a Product Flow

Using the **Create Product Flow** command, you can create a product flow between two systems, between two operations, or between a system and an operation.
A product flow specifies a precedence constraint between a source and a target.

1. From the **Authoring** section of the action bar, click **Create Product Flow** .
2. Select the source system or the source operation.
3. Select the target system or the target operation.

Important:

- You can select operations from different systems.
- To create a product flow between two systems, both systems must be under the same parent. However, they can be at different levels in the hierarchy of systems.

The product flow is created and symbolized by an arrow in the System Editor.

Tips:

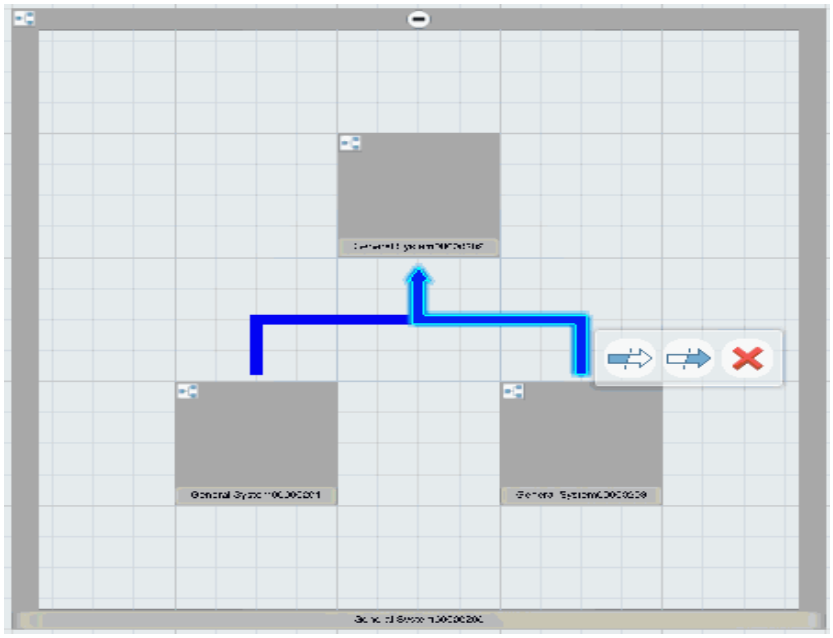
- To delete a product flow, select the arrow then press the **Delete** key. Alternatively, right-click the arrow then click **Delete**.
- When tiles are collapsed, arrows appear stacked between the parents. To make sure you delete the right product flow, expand the tiles before selecting it.
- Dropping an operation tile or a system tile and its children from one parent system to another keeps internal Product Flow and Time Constraint links (inside the same System structure). Moved tiles must be in the same System structure.
- When creating a product flow between two operations, right-click the arrow, then click **Constraint Properties** on the context menu to open the **Constraint Properties** panel and manage the product flow. It allows you define attributes such as delay, dependency, and category. For more information, see Constraint Properties Panel.

G. Modifying Product Flow Display

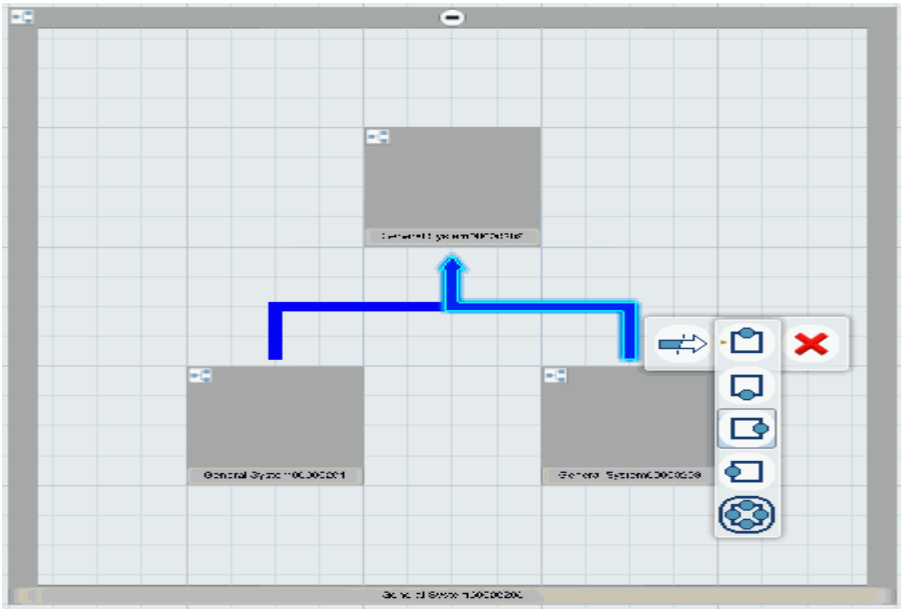
For each product flow, you can choose the start and end anchor positions on the previous and next systems. When dealing with a large number of systems, the layout of the product flows can become complex and difficult to understand. For each product flow, you can choose the start and end anchor positions on the previous and next systems. This helps you organize flows and build a layout that fits your needs.
Four anchor positions (north, south, east and west) are defined on each system tile. This is so that you can attach the flow on a preferred side, allowing you more control of the layout.

1. Select a product flow link.

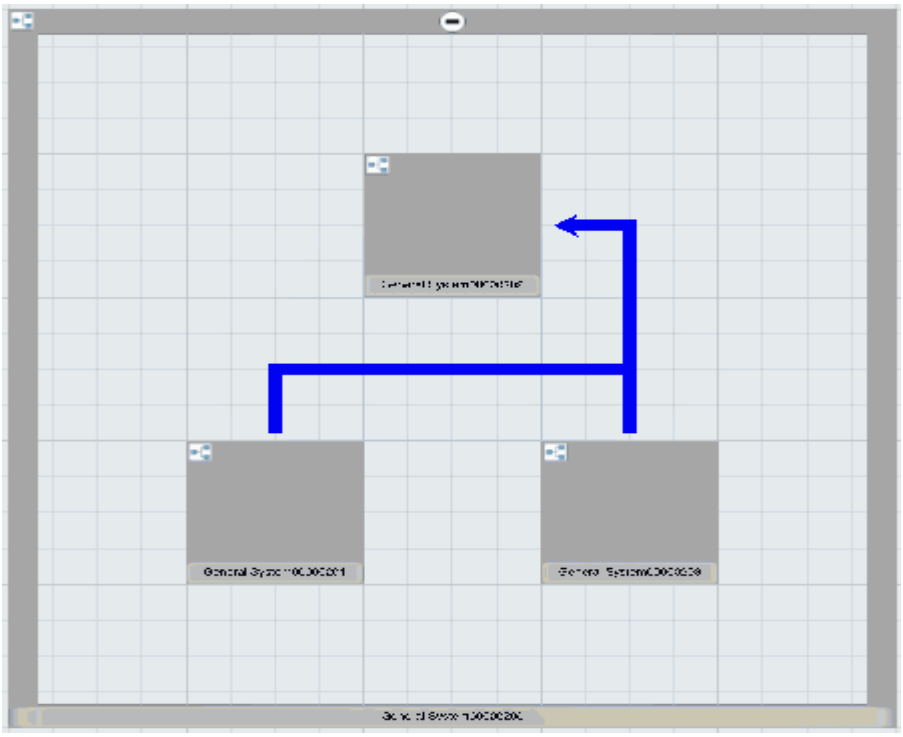
A context toolbar appears allowing you to choose the start or end positions of the Link.



2. Click End anchor position then select one of the positions for the end point of the link (East , for example).



The product flow now ends at the right-hand side of the target system.



Note: When the product flow starts or ends on an operation, there is no choice for defining the position: for an operation, the product flow goes straight in the direction of the center of the operation. However, you can define the position of the end of the arrow at the top of the parent system.

H. Inserting a System or Operation Into an Existing Product Flow

You can insert a new or existing system or operation into an existing product flow.
This scenario shows how to insert a new General Operation in an existing product flow.

1. Select an operation in a product flow.
2. From the Authoring section of the action bar, click Insert Options  .

Alternatively, right-click an operation in the tree and select Insert > Insert Options.

3. In the System/Operation Insert Options panel, select one of the following options:
   - As child: Inserts the operation under the selected operation.
   - After in flow: Inserts the operation after the selected operation and under the same parent. The inserted operation becomes successor of the selected operation.
   - Before in flow: Inserts the operation before the selected operation and under the same parent. The inserted operation becomes predecessor of the selected operation.
4. From the Authoring section of the action bar, click General Operation  .

The operation is inserted according to the selected option. Product flow links are automatically created between the new operation and its predecessor, and the new operation and its successor.

Recommendation: The inserted operation appears at the nearest available position from the source operation. Reorganize the layout of the product flow to ensure that it matches the sequence order. For more information, see Modifying Product Flow Display.

Tip: You can also insert operations and systems by dragging them to the existing product flow. They are added to the product flow sequence according to their selection order. For example:

- If you select Operation A, then Operation B, and drag them to a product flow: Operation A precedes Operation B in the product flow sequence.
- If you select Operation B, then Operation A, and drag them to a product flow: Operation B precedes Operation A in the product flow sequence.

Module-2. M: Premises Usage

A. About Premises

Planning premises is the systemic and logical estimation of factors affecting planning. In Process Planning, premises are based on two key concepts: the production demand and the shift model. For any system, you can update the planning according to the specified production demand and shift model.

To analyze a system via its cycle time, the system stores its shift schedule information. A shift model allows calculating an aperture time in the system. This aperture is then divided by the production demand to get the required time cycle of the system.

The following topics are discussed:

- Production Demand
- Shift Model
- Premises Usage Computation
- Variants Management on Parallel Operations

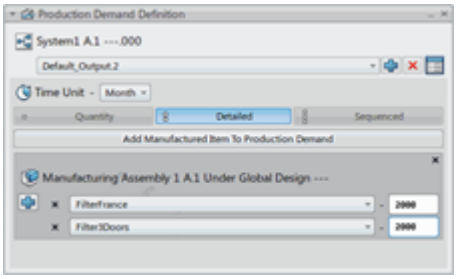
B. Production Demand

The production demand represents the quantity to be manufactured for each item and configuration.
It is possible to create a production demand comprising one or more items, or one or more configurations of one or more items.

A production demand can be defined in the following modes:

- Quantity mode: Specify how many items you want to produce.
- Detailed mode: Specify how many configurations of various items you want to produce.
- Sequenced mode: Specify how many configurations of various items you want to produce and in which order.

Here is an example of the Production Demand Definition panel for managing production demands on a selected system. In this example, the production demand is defined in Detailed mode and comprises one item that has two configurations.



Production Demand Authoring commands

Add New Production Demand adds a production demand to the selected system.

Delete Production Demand deletes the production demand. The production demand is no longer associated with the system.

Edit Production Demand Names lets you rename the production demand.

Time Unit
Lets you specify the time period for the production demand.

Production Demand modes
Quantity lets you specify how many items you want to produce.
Detailed lets you specify how many configurations of various items you want to produce.
Sequenced lets you specify how many configurations of various items you want to produce and in which order.

Add Item to Production Demand button.
Lets you select an item for the production demand. If you want to associate several items to the production demand, must use this command each time you need to select an item.
The 'x' command lets you remove an item.

Configuration commands
You can add configurations in Detailed and Sequenced modes.

In Detailed mode, Add Configuration lets you add more than one configuration for an item.
You can specify a quantity for each configuration.
The 'x' command lets you remove a configuration.

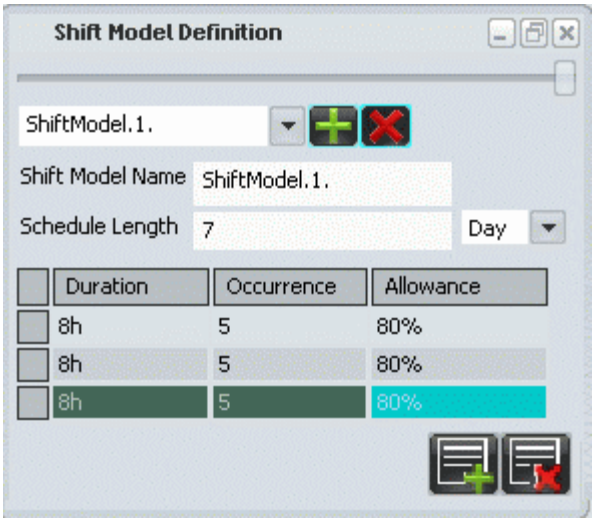
Sequence command

In Sequenced mode, the Repeat Selected Item Sequence lets you create a sequence of selected items in the production demand.

C. Shift Model

The purpose of the shift model is to store information of its shift schedule. The shift model allows calculating an aperture time of the system. This aperture time can be linked to a production demand to compute the required cycle time of the system.

Here is an example of the dialog box for managing shift models on a selected system.



Shift model list.
This list contains all the shift models associated with a system. If no shift model has been associated with the selected system, the list is empty.
For a selected shift model, you can modify its name and the duration of its schedule.
Authoring commands
New command to create a shift model.
Remove to remove the shift model from the list. The shift model is no longer associated with the system.
List view of shifts associated with shift model
Shifts are displayed in a list. By default, at least one shift is associated with a shift model. All the fields of the list can be edited. The columns in this list are:

- Duration: the duration of a shift.
- Occurrence: the number of times a shift is sequenced in the shift model duration.
- Allowance: this parameter is a production indicator that helps to specify how the shift effectively works. For example, employees' breaks can be taken into account here, as opposed to just the run times of the machinery.

Add Shift and Remove Shift.
The **Add Shift** and **Remove Shift** command allow adding and deleting a shift in the list.
It is impossible to delete all shifts associated with a shift model. The remove command is disabled when only shift remains in the list.

D. Premises Usage Computation

You can use the **Premises Usage** command to manage planning premises, if there is at least one production demand and one shift model defined on the system.
When Premise Usage criteria is applied, a ratio is computed for each operation in the system. The ratio is the sum of all the quantities for which each operation is valid, divided by the total quantity. This computes

the weighted time of the operation.

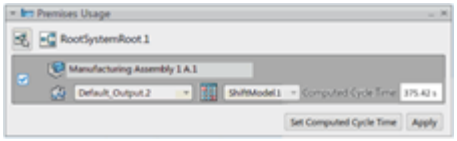
For the **Quantity** mode, a configuration is not used when defining the production demand. The only way to know if an operation is valid for a given item is to analyze the implement links. If the operation does not have an implement link, then the product flow is used to retrieve its previous operations and so implement links of these operations can be analyzed.

For **Detailed** and **Sequenced** modes, an operation is valid for a given "item-effectivity" couple in the following cases:

- The operation does not implement an item and does not have an effectivity: in this case, the ratio is 1.0.
- The operation does not implement an item and has an effectivity that matches the expected effectivity.
- The operation implements an item in the hierarchy of the expected root item and does not have an effectivity.
- The operation implements an item in the hierarchy of the expected root item and has an effectivity that matches the expected effectivity.

A cycle time is computed from the production demand and shift model criteria.

Computation Example
Consider the data shown in the shift model and production demand panels above.
The shift model defines a working time ratio. The working time for each line of the shift model is computed as follows:
Duration * Occurrence * Allowance
For the 3 lines:
3(8hr * 5 * 0.8) = 96hr
For a schedule duration of 7 days, which is 168hr, the working time ratio is as follows:
96hr/168hr = 0.5714
The production demand specifies that a total quantity of 4000 needs to be produced in a time unit of 1 month.
The computed cycle time is as follows (knowing that 1 month is 2628000sec):
(Production Demand Time Unit/Total Quantity)* Working Time Ratio
= (2628000sec/4000)* 0.5714
= 375.42sec
This computed cycle time is displayed in the **Premises Usage** panel:



E. Variants Management on Parallel Operations

When a parent operation contains parallel operations with different configurations, **Variants Management** computes the duration of the parent operation so that the duration equals the sum of the child operations.
To activate **Variants Management**, right-click the parent operation, select **Properties**, and in the **Reference** tab select **True** next to **Variants Management**.
The computed duration appears in Workload Balancing and in the Gantt Chart, and is automatically exported to an XML file.

F. Working with Premises

When working with Premises, you can define production demand and shift model information on systems.
This task shows you how to:

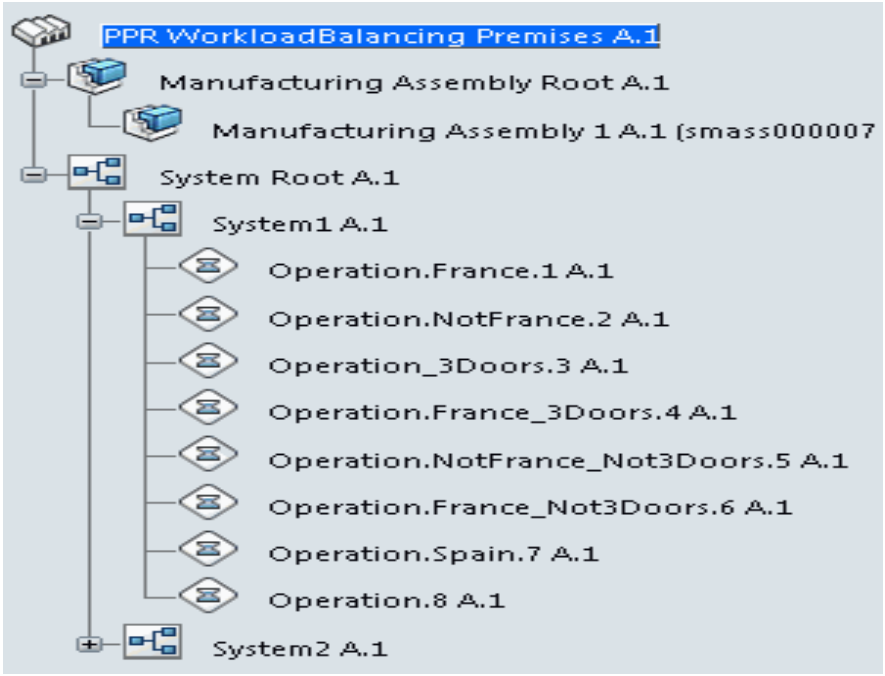
- Open Content and Check Configurations
- Define Production Demand
- Define a Shift Model
- Manage Premises Usage with Workload Balancing

Before you begin: Your session content must include Manufacturing Assembly and System structures.

G. Open Content and Check Configurations

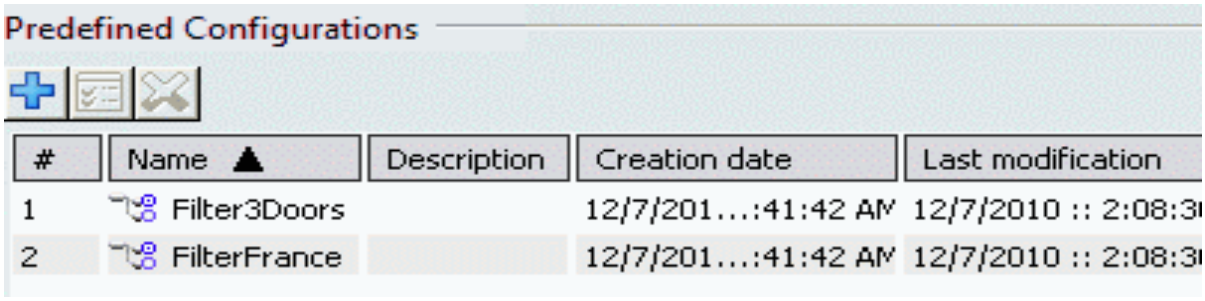
The manufacturing assembly must have a configuration context and at least two predefined configurations.

1. Open your content in Process Planning.



2. Right-click the manufacturing assembly in the tree and select **Properties**.

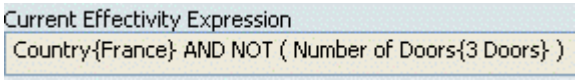
The **Properties** dialog box shows the context and the configurations defined on this manufacturing assembly.



3. Right-click an operation under System1 in the tree and select **Properties**.

The **Properties** dialog box shows the effectivity expression defined on this operation.

Other operations have different effectivity expressions depending on the required configuration.



H. Define Production Demand

You can define the production demand to represent the quantity to be manufactured for a number of items and configurations.

1. Right-click a System and select **Premises Definition > Define Production Demand**.

The **Production Demand Definition** panel appears.

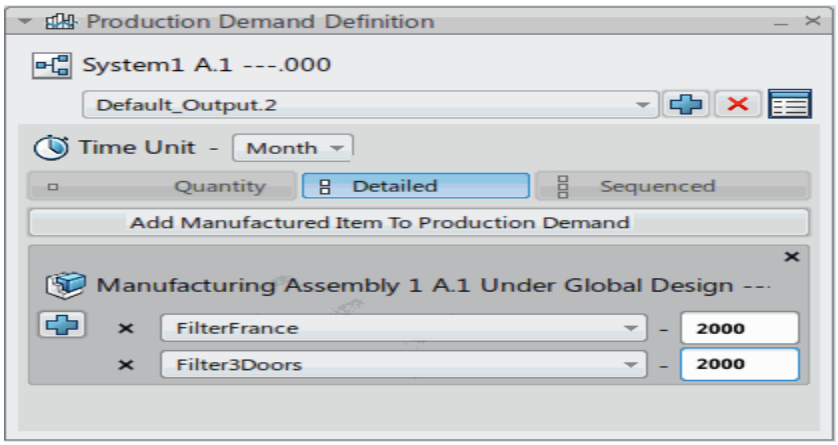
2. Click **Add New Production Demand** to initialize a new production demand.
3. Define the required time period using the **Time Unit** list.
4. Click **Detailed** to select the Detailed mode.
5. Click **Add Item to Production Demand** and select an item in the tree.

The selected item must have defined configurations.

A item area is added to the panel, which enables you to specify configurations and quantities.

6. Select the required configuration using the list.
7. Enter a quantity for the configuration.
8. Click **Add Configuration** to select a new configuration.
9. Enter a quantity for the configuration.

The **Production Demand Definition** panel is updated with this information.



10. Close the **Production Demand Definition** panel to save your definitions

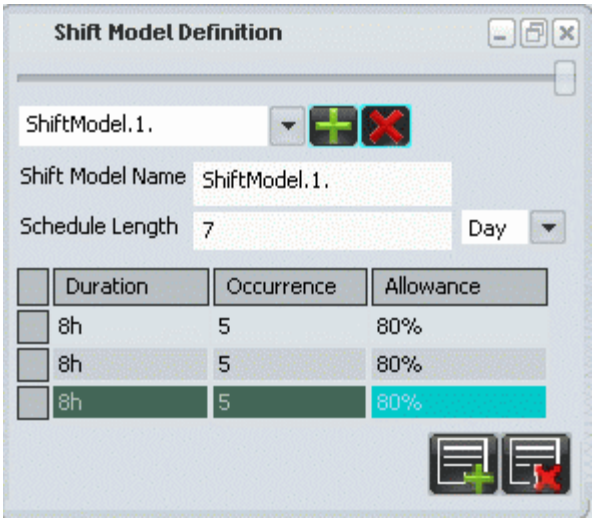
I. Define a Shift Model

You can define shift models to store information of the shift schedule. The shift model allows calculating an aperture time of the system. This aperture time can be linked to a production demand to compute the required cycle time of the system.

1. Right-click a System and select **Premises Definition > Define Shift Model**.

The **Shift Model Definition** dialog box appears.

2. Add a shift model by clicking **New Shift Model** .
3. Rename the shift model.
4. Modify the schedule length (for example, 7 days).
5. Click **Add Shift** to add shifts to the table.
6. Modify the shifts (for example: duration = 8 hours, occurrence = 5 times, allowance = 80%)



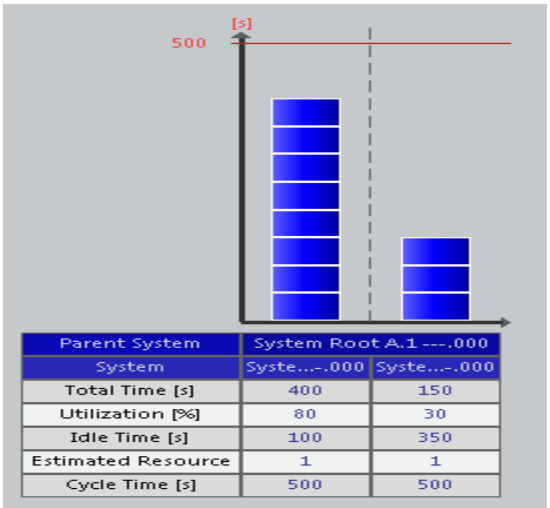
7. Create other shift models in the same way.
8. Close the **Shift Model Definition** dialog box to save your definitions.

J. Manage Premises Usage with Workload Balancing

You can use the **Premises Usage** command to manage planning premises, if there is at least one production demand and one shift model defined on the system. When the premises usage criteria is applied, the result can be visualized on the **Workload Balancing** panel.

1. Select the System Root and click **Workload Balancing** .

The **Workload Balancing** panel appears.



Each column in the bar chart represents a system: the operations in each column are represented by blue rectangles. The table under the bar chart shows information for each system. **Cycle Time** is the cycle time of the root system. For more information, see About Workload Balancing.

2. From the action bar, click **Premises Usage** and select the required item.

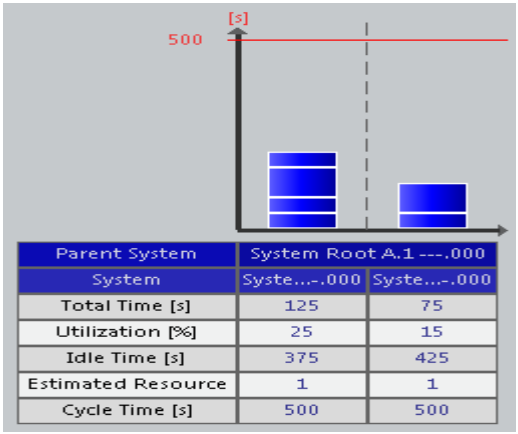
The **Premises Usage** panel appears. It shows a production demand, a shift model, and the computed cycle time corresponding to that criteria.

You can select a different production demand and shift model using the lists.

3. Click **Apply** in the **Premises Usage** panel.

The **Workload Balancing** panel is updated according to the premises usage criteria.

An additional orange horizontal line in the **Workload Balancing** panel to indicate the computed cycle time according to the premises usage criteria. The cycle time of the selected system is not modified in this case.



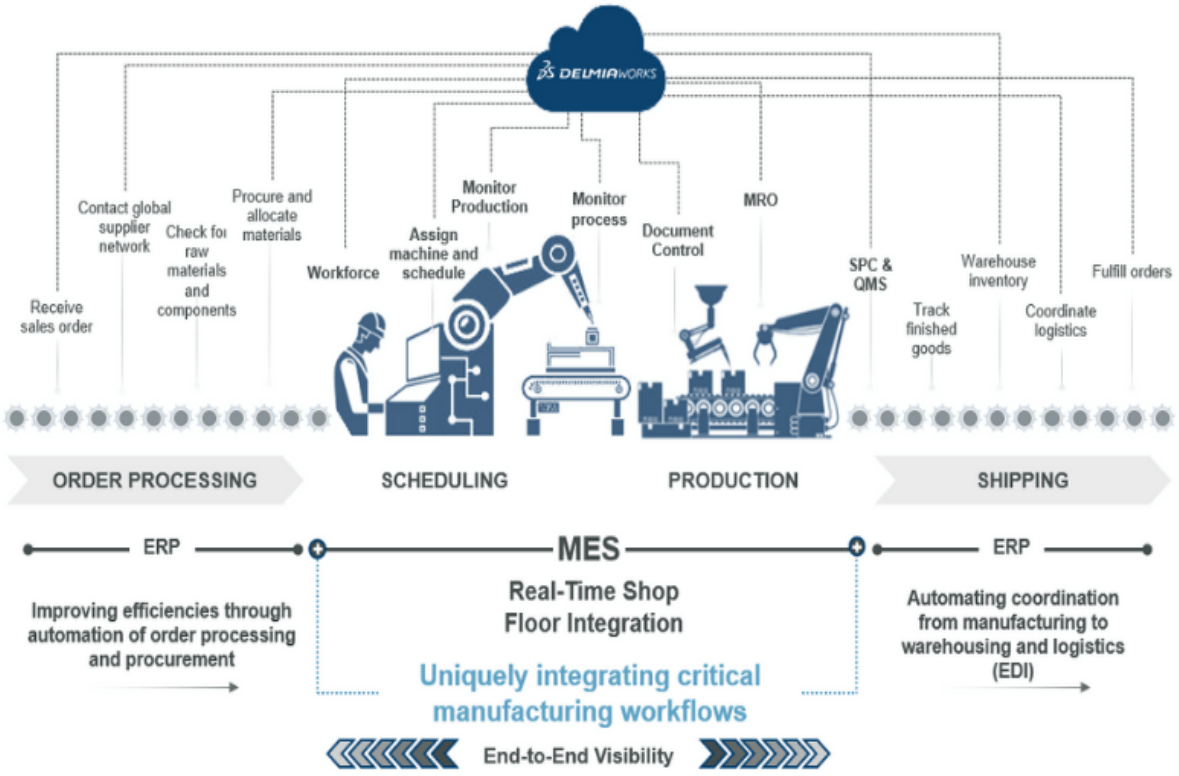
Parent System	System Root A.1 ---.000	
System	Syste...-.000	Syste...-.000
Total Time [s]	125	75
Utilization [%]	25	15
Idle Time [s]	375	425
Estimated Resource	1	1
Cycle Time [s]	500	500

Note: **Cycle Time** in the table is the cycle time of the root system and its subsystems.

4. **Optional:** Click **Set Computed Cycle Time** in the **Premises Usage** panel .

The computed cycle time is stored on the current selected system (in this case, the root system and its subsystems).

For more information, see Premises Usage Computation.


DELMIAWORKS
Receive sales order
Contact global supplier network
Check for raw materials and components
Procure and allocate materials
Workforce
Assign machine and schedule
Monitor Production
Monitor process
Document Control
MRO
SPC & QMS
Track finished goods
Warehouse inventory
Coordinate logistics
Fulfill orders
ORDER PROCESSING
SCHEDULING
PRODUCTION
SHIPPING
ERP
MES
ERP
Improving efficiencies through automation of order processing and procurement
Real-Time Shop Floor Integration
Uniquely integrating critical manufacturing workflows
Automating coordination from manufacturing to warehousing and logistics (EDI)
End-to-End Visibility


Daily: Action Log
Daily: Team Pad
Improvement: Pb solving
Daily Team Meeting
Employee of the month
EMPLOYEE OF THE MONTH
16
13
Tools
Customize
Select

THANK YOU