Application Help for Production Process Designer

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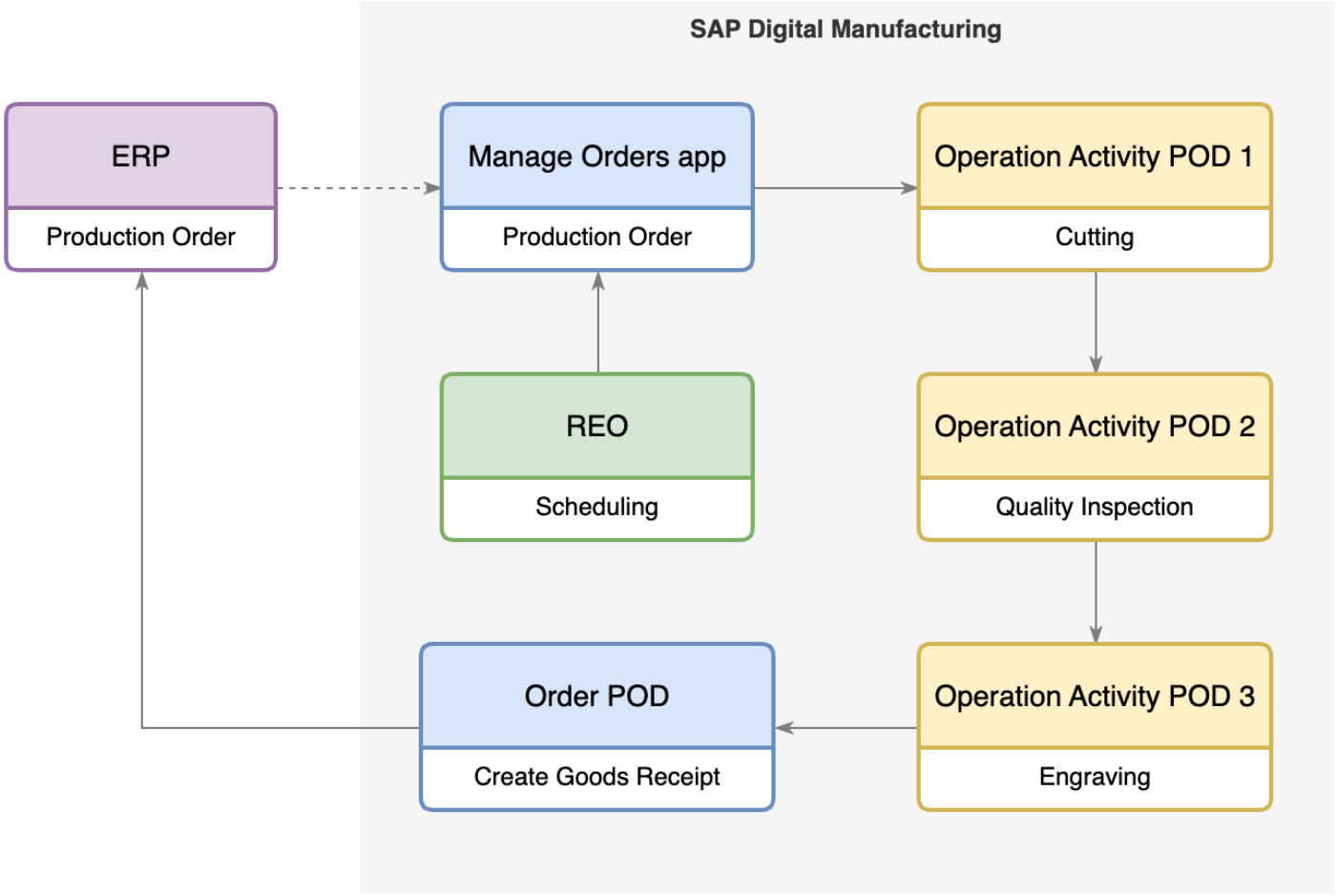
Tutorial: Automation with Production Process Design

The SAP Digital Manufacturing solution provides a series of components across both process and discrete industries, including manufacturing automation in SAP Digital Manufacturing for execution, scheduling in SAP Digital Manufacturing for resource orchestration, and monitoring production KPIs in SAP Digital Manufacturing for insights.

Taking the manufacturing automation of a trophy plaque production as an example, this tutorial guides you through the process of engraving letters on the sheet metal of the trophy plaque, so that you can have a general understanding of how the production process works in common scenarios.

Before You Begin

In this tutorial, we assume that you have already prepared the sheet metal to engrave the trophy plaque. After the sheet metal is prepared, the process of trophy plaque production starts and goes through the following steps:



1. The ERP system sends the production order. The production order (Order: 1882757) gets replicated in the Manage Orders app of SAP Digital Manufacturing.
2. The resource orchestration releases the production order (Order: 1882757) after scheduling is performed.
3. Three operations/phases are executed by the operator sequentially in separate Operation Activity PODs under one routing for all SFCs under (Order: 1882757):

    a. Cutting

    b. Quality inspection

c. Engraving

> **Note**
>
> This tutorial focuses on the engraving process. We assume you have already completed all previous steps. Before this step, you need to:
>
> i. Install the Production Connector (`WDF_Dobot_Training`) and Cloud Connector. Configure the Production Connectivity Model with the shop floor system (`WDF_Dobot_Training`) added. For details, see About Production Connectivity Model.
>
> ii. Create a service provider (`WDF_Dobot_Training`) and the following shop floor services (OPC UA methods) under it, along with the corresponding client proxy (in brackets):
>
> 1. `DobotMove_to` (`genNew`, `trxDobotMove_to`)
> 2. `DobotPick_up`
> 3. `DobotDrop`
> 4. `DobotSwitch_tool` (`trxDobotSwitch_tool`)
> 5. `DobotDraw_Letters` (`trxDobotDraw_Letters`)
>
> For details, see Configure Shop Floor Services (OPC UA Methods).

4. You confirm that the production order is completed by executing the Create Goods Receipt activity in the **Order POD**. This activity then posts back to the ERP system.

Step 1: Create a Production Process Design

Prerequisites

You have the role of `Automation_Engineer` or `Production_Engineer`.

Procedure

1. Open the **Design Production Processes** app.
2. Choose **Create**.
3. In the **Create Production Process Design** window, specify the required information.

   Name: `DMC_Nutshell_Course_new`

   Leave the rest blank.
4. Choose the **Create** button.

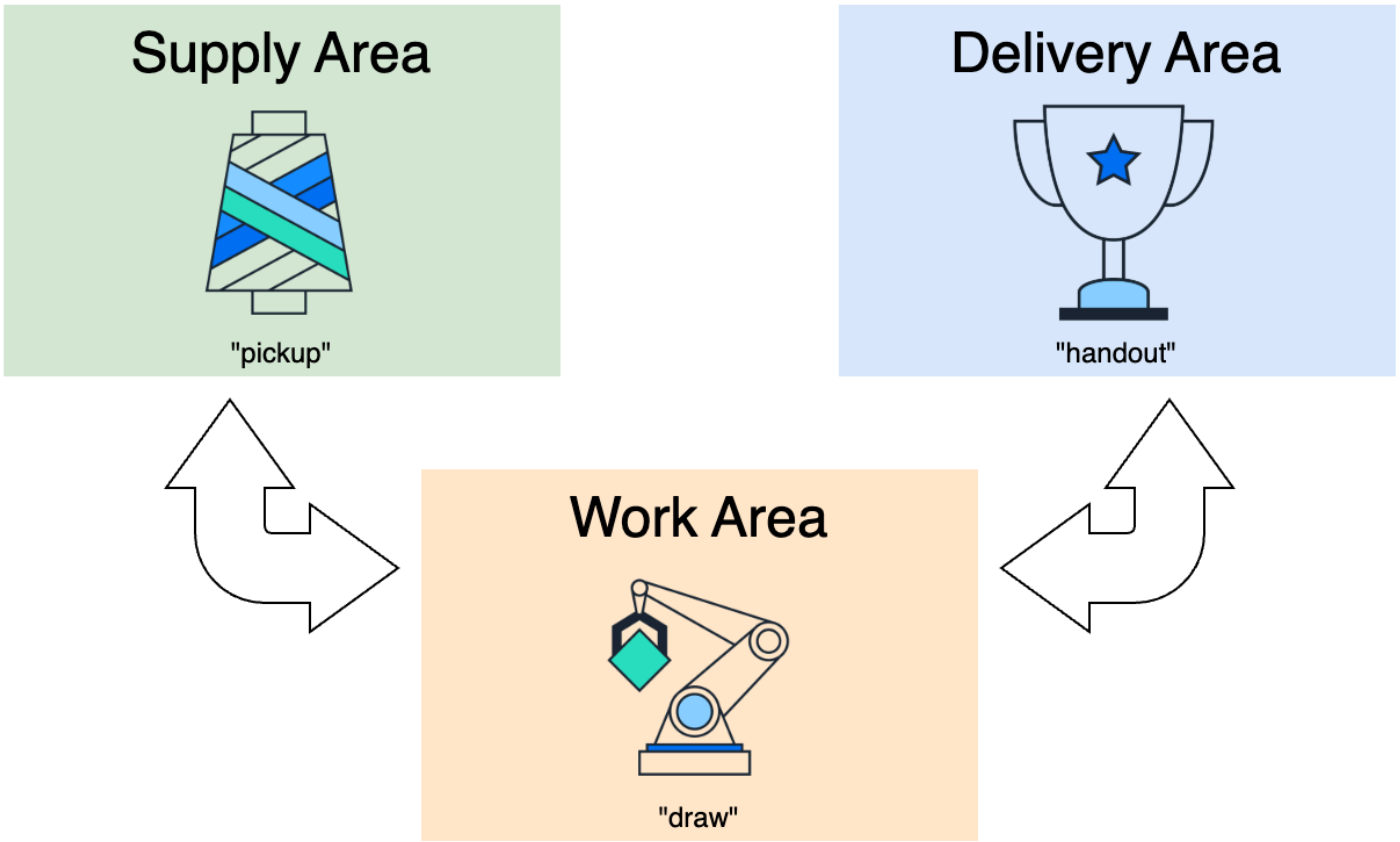
Related Information

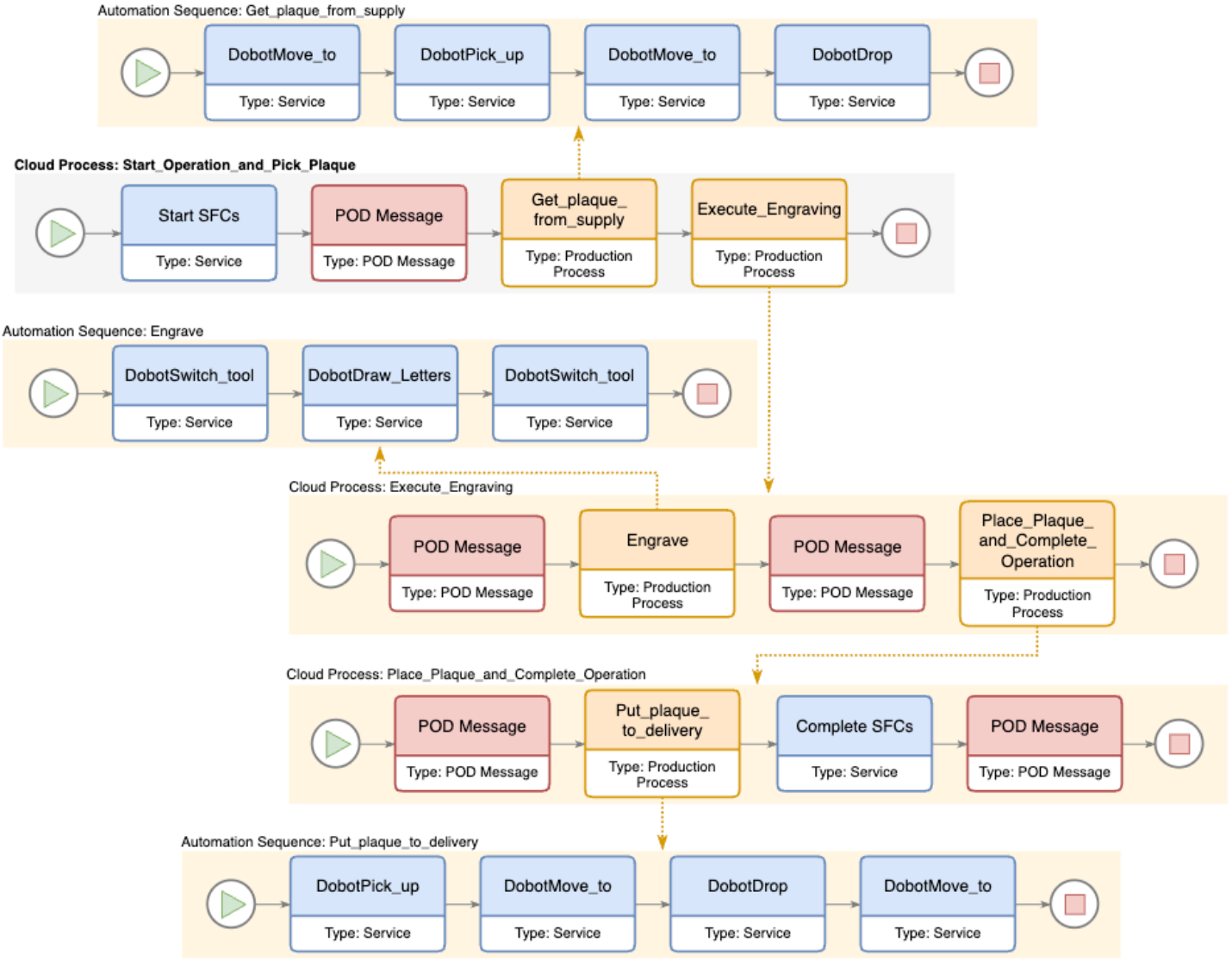
Create a Production Process Design

Step 2: Create and Define Cloud Process and Automation Sequence

The engraving process uses one main cloud process along with a series of nested subprocesses.

In the main process (`Start_Operation_and_Pick_Plaque`), after you start the shop floor control, a message displays on the POD: “Picking plaque from supply area and placing it in the work area.” Then, the machine performs a series of actions to move the plaque sheet metal from the supply area to the work area. The automation sequence (`Get_plaque_from_supply`) handles this. Next, another cloud process (`Execute_Engraving`) starts. It first displays the message “Engraving started” on the POD, then executes the subprocess (`Engrave`). Here, the machine changes its tool from “cup” to “pen” to draw letters on the sheet metal. After the machine finishes drawing and switches back to “cup,” you see another message on the POD: “Engraving finished.” The system then runs the cloud process (`Place_Plaque_and_Complete_Operation`) to move the plaque sheet metal from the work area to the delivery area. This process starts with a POD message: “Picking plaque from work area and placing it in the delivery area.” The automation sequence (`Put_plaque_to_delivery`) follows, and the machine acts accordingly. After the shop floor control completes, another message appears: “Carving process finished. Remove plaque from delivery area.”





Related Information

Controls

Create and Define a Production Process

Step 2.1: Create and Define Automation Sequence: `Put_plaque_to_delivery`

Prerequisites

You have the `Automation_Engineer` role.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.
3. Choose *(Create)*.
4. In the **Create Production Process** window, enter the required information.
    - Name: `Put_plaque_to_delivery`

- Runtime Type: Production Connector
- Runtime Environment: `WDF_Dobot_Training_PCo_Webserver`
- Visible to Cloud/Edge Runtime: Check

5. Choose **Create**.
6. Open this automation sequence in the editor view.
7. Drag and drop the `DobotPick_up` shop floor service under `WDF_DoBot_Training` in the left panel.
8. Drag and drop the `DobotMove_to` shop floor service under `WDF_DoBot_Training` in the left panel.
9. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
   - `Direction` (String): `'handout'`
10. Add a client proxy `trxDobotMove_to` in the right panel.
11. Drag and drop the `DobotDrop` shop floor service under `WDF_DoBot_Training` in the left panel.
12. Drag and drop another `DobotMove_to` shop floor service under `WDF_DoBot_Training` in the left panel.
13. Under the `INPUT` tab in the right panel, assign value for the following input parameter:
    - `Direction` (String): `'draw'`
14. Add a client proxy `trxDobotMove_to` in the right panel.
15. Connect the elements with lines.
16. Choose **Save** in the header section of the process.

Step 2.2: Create and Define Cloud Process: `Place_Plaque_and_Complete_Operation`

Prerequisites

You have the `Production_Engineer` role.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.
3. Choose *(Create)*.
4. In the **Create Production Process** window, enter the required information.
   - Name: `Place_Plaque_and_Complete_Operation`
   - Runtime Type: Cloud
   - Runtime Environment: `DMC_Cloud`
   - Visible to Production Connector / Plant Connectivity Runtime: Check
5. Choose **Create**.
6. Open a production process in the editor view. Select the **Start** element that is already in the canvas.
7. Under the **Input Parameters** tab in the right panel, choose **Manage Parameters** to add the following parameters, checking the **Required** checkbox for all of them:

- `inOperation` (String)
- `inOrder` (String)
- `inPlant` (String)
- `inResource` (String)
- `inSFC` (StringArray)

8. Under the **POD Connection** tab in the right panel, choose **Add**. Select **Operation Activity** as POD type and designate the following metadata in **Conditions to Select POD** and assign them with the parameters you've created in the previous step:
   - `operationActivity` (String): `'inOperation'`
   - `plant` (String): `'inPlant'`
   - `resource` (String): `'inResource'`
9. Drag and drop a **POD Message** control to the canvas and input the following message in the right panel:

   "Picking plaque from work area ...

   ... and placing it in the delivery area."
10. Drag and drop the `Put_plaque_to_delivery` automation sequence from the left panel.
11. Drag and drop the `Complete_SFCs` service under `DMC_Cloud` from the left panel.
12. Under the **INPUT** tab in the right panel, assign values for the following input parameters:
    - `operation` (String): `'inOperation'`
    - `plant` (String): `'inPlant'`
    - `quantity` (Double): 1
    - `resource` (String): `'inResource'`
    - `sfc` (StringArray): `'inSFC'`

    Leave the rest of the parameters blank.
13. Drag and drop a **POD Message** control to the canvas and input the following message in the right panel:

    "Carving process finished.

    Remove plaque from delivery area."
14. Connect the elements with lines.
15. Choose **Save**.

Step 2.3: Create and Define Automation Sequence: Engrave

Prerequisites

You have the `Automation_Engineer` role.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.

3. Choose *(Create)*.
4. In the **Create Production Process** window, enter the required information.
    - Name: `Engrave`
    - Runtime Type: Production Connector
    - Runtime Environment: `WDF_Dobot_Training_PCo_Webserver`
    - Visible to Cloud/Edge Runtime: Check
5. Choose **Create**.
6. Open this automation sequence in the editor view. Select the **Start** element that is already in the canvas.
7. Under the **Input Parameters** tab in the right panel, choose **Manage Parameters** to add the following parameter, checking the **Required** checkbox for it:
    - `letters` (String)
8. Drag and drop the `DobotSwitch_tool` shop floor service under `WDF_DoBot_Training` in the left panel.
9. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
    - `Tool` (String): `'pen'`
10. Add a client proxy `trxDobotSwitch_tool` in the right panel.
11. Drag and drop the `DobotDraw_Letters` shop floor service under `WDF_DoBot_Training` in the left panel.
12. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
    - `Letter` (String): `'letters'`
13. Add a client proxy `trxDobotDraw_Letters` in the right panel.
14. Drag and drop another `DobotSwitch_tool` shop floor service under `WDF_DoBot_Training` in the left panel.
15. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
    - `Tool` (String): `'cup'`
16. Add a client proxy `trxtrxDobotSwitch_tool` in the right panel.
17. Connect the elements with lines.
18. Choose **Save** in the header section of the process.

Step 2.4: Create and Define Cloud Process: `Execute_Engraving`

Prerequisites

You have the `Production_Engineer` role.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.
3. Choose *(Create)*.
4. In the **Create Production Process** window, enter the required information.

- Name: `Execute_Engraving`
- Runtime Type: Cloud
- Runtime Environment: `DMC_Cloud`
- Visible to Production Connector / Plant Connectivity Runtime: Uncheck

5. Choose **Create**.
6. Open a production process in the editor view. Select the **Start** element that is already in the canvas.
7. Under the **Input Parameters** tab in the right panel, choose **Manage Parameters** to add the following parameters, checking the **Required** checkbox for all of them:
   - `inLetters` (String)
   - `inOperation` (String)
   - `inOrder` (String)
   - `inPlant` (String)
   - `inResource` (String)
   - `inSFC` (StringArray)
8. Under the **POD Connection** tab in the right panel, choose **Add**. Select **Operation Activity** as POD type and designate the following metadata in **Conditions to Select POD** and assign them with the parameters you've created in the previous step:
   - `operationActivity` (String): `'inOperation'`
   - `plant` (String): `'inPlant'`
   - `resource` (String): `'inResource'`
9. Drag and drop a **POD Message** control to the canvas and input the following message in the right panel:

   "Engraving started."

10. Drag and drop the `Engrave` automation sequence from the left panel.
11. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
    - `Letters` (String): `'inLetters'`
12. Drag and drop a `POD Message` control to the canvas and input the following message in the right panel:

    "Engraving finished."

13. Drag and drop the `Place_Plaque_and_Complete_Operation` cloud process from the left panel.
14. Under the **INPUT** tab in the right panel, assign values for the following input parameters:
    - `inOperation` (String): `'inOperation'`
    - `inOrder` (String): `'inOrder'`
    - `inPlant` (String): `'inPlant'`
    - `inResource` (String): `'inResource'`
    - `inSFC` (StringArray): `'inSFC'`
15. Connect the elements with lines.
16. Choose **Save**.

Step 2.5: Create and Define Automation Sequence: `Get_plaque_from_supply`

Prerequisites

You have the `Automation_Engineer` role.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.
3. Choose *(Create)*.
4. In the **Create Production Process** window, enter the required information.
    - Name: `Get_plaque_from_supply`
    - Runtime Type: Production Connector
    - Runtime Environment: `WDF_Dobot_Training_PCo_Webserver`
    - Visible to Cloud/Edge Runtime: Check
5. Choose **Create**.
6. Open this automation sequence in the editor view.
7. Drag and drop the `DobotMove_to` shop floor service under `WDF_DoBot_Training` in the left panel.
8. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
    - `Direction` (String): `'pickup'`
9. Add a client proxy `genNew` in the right panel.
10. Drag and drop the `DobotPick_up` shop floor service under `WDF_DoBot_Training` in the left panel.
11. Drag and drop another `DobotMove_to` shop floor service under `WDF_DoBot_Training` in the left panel.
12. Under the **INPUT** tab in the right panel, assign value for the following input parameter:
    - `Direction` (String): `'draw'`
13. Add a client proxy `genNew` in the right panel.
14. Drag and drop the `DobotDrop` shop floor service under `WDF_DoBot_Training` in the left panel.
15. Connect the elements with lines.
16. Choose **Save** in the header section of the process.

Step 2.6: Create and Define Cloud Process `Start_Operation_and_Pick_Plaque`

Prerequisites

You have the `Production_Engineer` role.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.
3. Choose *(Create)*.
4. In the **Create Production Process** window, enter the required information.
    - Name: `Start_Operation_and_Pick_Plaque`
    - Runtime Type: Cloud
    - Runtime Environment: `DMC_Cloud`
    - Visible to Production Connector / Plant Connectivity Runtime: Uncheck
5. Choose **Create**.
6. Open a production process in the editor view. Select the **Start** element that is already in the canvas.
7. Under the **Input Parameters** tab in the right panel, choose **Manage Parameters** to add the following parameters, checking the **Required** checkbox for all of them:
    - `inOperation` (String)
    - `inOrder` (String)
    - `inPlant` (String)
    - `inResource` (String)
    - `inSFC` (StringArray)
8. Under the **POD Connection** tab in the right panel, choose **Add**. Select **Operation Activity** as POD type and designate the following metadata in **Conditions to Select POD** and assign them with the parameters you've created in the previous step:
    - `operationActivity` (String): `'inOperation'`
    - `plant` (String): `'inPlant'`
    - `resource` (String): `'inResource'`
9. Drag and drop the `Start_SFCs` service under `DMC_Cloud` in the left panel.
10. Under the **INPUT** tab in the right panel, assign values for the following input parameters:
    - `operation` (String): `'inOperation'`
    - `plant` (String): `'inPlant'`
    - `quantity` (Double): 1
    - `resource` (String): `'inResource'`
    - `sfc` (StringArray): `'inSFC'`

    Leave the rest of the parameters blank.
11. Drag and drop a **POD Message** control to the canvas and input the following message in the right panel:

    "Picking plaque from supply area ...

    ... and placing it in the work area."
12. Drag and drop the `Get_plaque_from_supply` automation sequence from the left panel.
13. Drag and drop the `Execute_Engraving` cloud process from the left panel.
14. Under the **INPUT** tab in the right panel, assign values for the following input parameters:

- `inLetters` (String): `TS`
- `inOperation` (String): `'inOperation'`
- `inOrder` (String): `'inOrder'`
- `inPlant` (String): `'inPlant'`
- `inResource` (String): `'inResource'`
- `inSFC` (StringArray): `'inSFC'`

15. Connect the elements with lines.
16. Choose **Save**.

Step 3: Deploy and Activate the Production Process Design

Prerequisites

You have the role of `Automation_Engineer` or `Production_Engineer`.

Procedure

1. Open the **Design Production Processes** app.
2. Open the production process design `DMC_Nutshell_Course_new`.
3. Choose **Quick Deploy**.

Related Information

Deploy and Activate a Production Process Design

Step 4: Configure the Trigger (POD)

Procedure

1. Open the **POD Designer** app.
2. Choose **Create**.
3. In the **Create POD** window, enter the required information.
   - Name: `OP_POD_NUTSHELL_DOBOT`
   - POD Type: Operation Activity
   - Display Mode: Cozy
4. Choose **Create**.
5. Choose the **POD Notifications** in the header and check the following subscription and event:
   - Operation Activity
   - Production Process
6. Add an action button to the horizontal toolbar with the following configurations:

- Text: Do All
- Width: 240px
- Show Text: On
- Visible: Off
- Configurable: On
- Height: 120px
- Icon Font Size: 50px
- Icon Color: rgb(255,255,255)
- Background Color: rgb(30,74,250)
- Font Size: 40px
- Font Weight: Bold
- Font Color: rgb(255,255,255)

7. Choose **Assign Actions** in the same configuration panel.
8. In the **Configure Action Button** window, choose **Add** and provide the following information:
   - Type: Production Process
   - Type Definition: select the `Start_Operation_and_Pick_Plaque` process you have created previously.
9. On the added process, choose **Configuration** and provide the following information:
   - Call Type: Synchronous
   - Response Type: Start and Complete
   - Parameters:
     - `inOperation`: Operation Activity
     - `inOrder`: Order
     - `inPlant`: Plant
     - `inResource`: Resource
     - `inSFC`: SFC
10. Choose **Close** to close the **Configure Action Button** dialog and save your entries.
11. Select **Publish** from the menu bar.
12. In the **Tile Details** dialog box, enter a name `Dobot POD`.
13. Choose **Publish** to finish creating a tile for your POD. The POD is automatically saved and the tile is published on the launchpad.
14. Refresh the launchpad to view the published tile.
15. Choose the **Dobot POD** tile on the launchpad.
16. In the POD, you can see under the worklist all SFCs from the order released by REO.
17. Choose one SFC. On the detail page, choose the **Do All** button. The production process is executed.

Related Information

Step 5: Monitor

Prerequisites

You have one of the following roles:

- Production Supervisor
- Production Engineer
- Production Operator
- Automation Engineer
- Production Engineer Limited

Procedure

1. Open the **Monitor Production Processes** app.
2. On the list page, choose `DMC_Cloud` as the runtime environment and select `Start_Operation_and_Pick_Plaque` in the **Production Process** value help.
3. Choose **Go**.
4. You can see the related process instance on the list page. Choose the corresponding entry to see further details on the detail page.

Related Information

Monitor and Track Production Processes