

SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02  
Document Version: 1.21 – 2017-10-24

# Installation of SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02



# Content

<b>1</b>	<b>Document History</b>	<b>3</b>
<b>2</b>	<b>Installation of SAP Predictive Maintenance and Service, on-premise edition</b>	<b>8</b>
2.1	Preparing to Install SAP Predictive Maintenance and Service, on-premise edition	9
	System Landscape	12
2.2	Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02	14
	Recommended Deployment Setup	17
	Extension File for pdms-router	18
	Extension File for Asset Health Control Center	20
	Extension File for Insight Provider for Derived Signals	20
	Extension File for Insight Provider for Work Activities	21
	Maintaining Role Collections and Users in SAP HANA	22
	Role Templates for SAP Predictive Maintenance and Service, on-premise edition	24
	Overview of Users, Roles, and Privileges	27
2.3	Data Model	39
	Views for Metadata	39
	Views for Data	51
2.4	Installing R Packages for Data Science Services	58
	Creating the Data Fusion View Schema	59
	Creating Data Fusion Views for Data Science Services	59
	Installing Dependent R Packages on RServe	61
	Installing R Packages for Data Science Services on RServe	62
	Testing the Installation of Data Science Services	64
	Uninstalling R Packages for Data Science Services on RServe	65
2.5	SAP IQ	65
	Data Model Variants	65
	Data Import to SAP IQ	70
2.6	Uninstalling Components of SAP Predictive Maintenance and Service, on-premise edition	73
<b>3</b>	<b>Installing Patches for SAP Predictive Maintenance and Service, on-premise 1.0 FP02</b>	<b>75</b>

# 1 Document History

## Caution

Before you start the implementation, make sure you have the latest version of this document. You can find the latest version at the following location: [https://uacp2.hana.ondemand.com/doc/ca99750d837946be97983b19249950fb/1.0%20FP02/en-US/Installation\\_of\\_SAP\\_Predictive\\_Maintenance\\_and\\_Service\\_on\\_premise\\_edition\\_1.0\\_FP02.pdf](https://uacp2.hana.ondemand.com/doc/ca99750d837946be97983b19249950fb/1.0%20FP02/en-US/Installation_of_SAP_Predictive_Maintenance_and_Service_on_premise_edition_1.0_FP02.pdf)

## Tip

You might need to refresh your browser to see the latest version of this document.

The following table provides an overview of the most important document changes:

Table 1:

Version	Date	Description
1.21	2017-10-24	Updated: <ul style="list-style-type: none"><li>• <a href="#">Overview of Users, Roles, and Privileges [page 27]</a></li></ul>
1.20	2017-06-16	Updated: <ul style="list-style-type: none"><li>• <a href="#">Installation of SAP Predictive Maintenance and Service, on-premise edition [page 8]</a></li></ul> Added: <ul style="list-style-type: none"><li>• <a href="#">Overview of Users, Roles, and Privileges [page 27]</a></li></ul>
1.19	2017-04-04	Updated: <ul style="list-style-type: none"><li>• <a href="#">Installing Dependent R Packages on RServe [page 61]</a></li></ul>
1.18	2017-04-03	Updated: <ul style="list-style-type: none"><li>• SAP HANA revision and SAP HANA XSA patch level in <a href="#">Preparing to Install SAP Predictive Maintenance and Service, on-premise edition [page 9]</a></li></ul>

Version	Date	Description
1.17	2017-02-09	<p>Added:</p> <ul style="list-style-type: none"> <li>Information concerning Patch Level 03 in the following chapters: <ul style="list-style-type: none"> <li>Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</li> <li>Installing Patches for SAP Predictive Maintenance and Service, on-premise 1.0 FP02 [page 75]</li> </ul> </li> </ul>
1.16	2017-01-03	<p>Updated:</p> <ul style="list-style-type: none"> <li>Installation of SAP Predictive Maintenance and Service, on-premise edition [page 8]</li> <li>Installing Patches for SAP Predictive Maintenance and Service, on-premise 1.0 FP02 [page 75]</li> <li>Views for Data [page 51]</li> <li>Uninstalling Components of SAP Predictive Maintenance and Service, on-premise edition [page 73]</li> </ul>
1.15	2016-12-09	<p>Updated:</p> <ul style="list-style-type: none"> <li>Guide structure</li> <li>Installation of SAP Predictive Maintenance and Service, on-premise edition [page 8]</li> <li>Preparing to Install SAP Predictive Maintenance and Service, on-premise edition [page 9]</li> <li>Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</li> <li>Recommended Deployment Setup [page 17]</li> </ul> <p>Added:</p> <ul style="list-style-type: none"> <li>Guide structure</li> <li>System Landscape [page 12]</li> </ul>

Version	Date	Description
1.14	2016-12-08	Updated: <ul style="list-style-type: none"> <li>• <a href="#">Maintaining Role Collections and Users in SAP HANA [page 22]</a></li> <li>• <a href="#">Role Templates for SAP Predictive Maintenance and Service, on-premise edition [page 24]</a></li> </ul>
1.13	2016-12-06	Added: <ul style="list-style-type: none"> <li>• Limitation to <a href="#">Preparing to Install SAP Predictive Maintenance and Service, on-premise edition [page 9]</a></li> </ul>
1.12	2016-12-05	Updated: <ul style="list-style-type: none"> <li>• Required SAP HANA database revision in <a href="#">Preparing to Install SAP Predictive Maintenance and Service, on-premise edition [page 9]</a></li> <li>• Required SAP HANA database revision in <a href="#">Extension File for pdms-router [page 18]</a></li> <li>• Required SAP HANA database revision in <a href="#">Extension File for Asset Health Control Center [page 20]</a></li> <li>• Required SAP HANA database revision in <a href="#">Extension File for Insight Provider for Derived Signals [page 20]</a></li> <li>• Required SAP HANA database revision in <a href="#">Extension File for Insight Provider for Work Activities [page 21]</a></li> </ul>
1.11	2016-12-02	Updated: <ul style="list-style-type: none"> <li>• User descriptions in <a href="#">Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</a></li> </ul>

Version	Date	Description
1.10	2016-11-30	<p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</a></li> <li>• <a href="#">Extension File for pdms-router [page 18]</a></li> <li>• <a href="#">Extension File for Asset Health Control Center [page 20]</a></li> <li>• <a href="#">Extension File for Insight Provider for Derived Signals [page 20]</a></li> <li>• <a href="#">Extension File for Insight Provider for Work Activities [page 21]</a></li> </ul>
1.09	2016-11-28	<p>Corrected:</p> <ul style="list-style-type: none"> <li>• <a href="#">Maintaining Role Collections and Users in SAP HANA [page 22]</a></li> </ul>
1.08	2016-11-24	<p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Preparing to Install SAP Predictive Maintenance and Service, on-premise edition [page 9]</a></li> </ul>
1.07	2016-11-16	<p>Added:</p> <ul style="list-style-type: none"> <li>• <a href="#">Installing Patches for SAP Predictive Maintenance and Service, on-premise 1.0 FP02 [page 75]</a></li> </ul> <p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Installation of SAP Predictive Maintenance and Service, on-premise edition [page 8]</a></li> <li>• <a href="#">Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</a></li> </ul>
1.06	2016-11-04	<p>Updated:</p> <ul style="list-style-type: none"> <li>• <a href="#">Recommended Deployment Setup [page 17]</a></li> <li>• <a href="#">Preparing to Install SAP Predictive Maintenance and Service, on-premise edition [page 9]</a></li> </ul>

Version	Date	Description
1.05	2016-10-24	Corrected: <ul style="list-style-type: none"> <li>• <a href="#">Creating the Data Fusion View Schema [page 59]</a></li> </ul>
1.04	2016-10-20	Updated: <ul style="list-style-type: none"> <li>• <a href="#">Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</a></li> <li>• <a href="#">Extension File for pdms-router [page 18]</a></li> <li>• <a href="#">Extension File for Asset Health Control Center [page 20]</a></li> </ul>
1.03	2016-10-19	Corrected: <ul style="list-style-type: none"> <li>• <a href="#">MASTER_DATA view description and LOCATION view description in Views for Data [page 51]</a></li> </ul>
1.02	2016-10-13	Updated: <ul style="list-style-type: none"> <li>• <a href="#">Views for Metadata [page 39]</a></li> </ul>
1.01	2016-09-29	Updated: <ul style="list-style-type: none"> <li>• <a href="#">Link to this document</a></li> <li>• <a href="#">Extension File for pdms-router [page 18]</a></li> <li>• <a href="#">Extension File for Asset Health Control Center [page 20]</a></li> <li>• <a href="#">Extension File for Insight Provider for Derived Signals [page 20]</a></li> <li>• <a href="#">Extension File for Insight Provider for Work Activities [page 21]</a></li> </ul>
1.0	2016-09-28	Initial Version

## 2 Installation of SAP Predictive Maintenance and Service, on-premise edition

An overview of the steps you need to complete to install SAP Predictive Maintenance and Service, on-premise edition.

To install SAP Predictive Maintenance and Service, on-premise edition, you first need to complete the following preparation steps:

[Preparing to Install SAP Predictive Maintenance and Service, on-premise edition \[page 9\]](#)

[System Landscape \[page 12\]](#)

After you have completed the preparation steps, and your landscape is prepared, you install SAP Predictive Maintenance and Service, on-premise edition as explained in the following sections. The installation procedure contains information about how to install the individual software components of SAP Predictive Maintenance and Service, on-premise edition 1.0.

Table 2: Installation Procedure

What do you want to do?	Installation Step
You want to install SAP Predictive Maintenance and Service, on-premise edition for the first time.	<a href="#">Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 [page 14]</a> <a href="#">Recommended Deployment Setup [page 17]</a>
You want to install R packages for data science services of SAP Predictive Maintenance and Service, on-premise edition for the first time.	<a href="#">Installing R Packages for Data Science Services [page 58]</a>
You have already installed SAP Predictive Maintenance and Service, on-premise edition and want to upgrade to a new patch.	<a href="#">Installing Patches for SAP Predictive Maintenance and Service, on-premise 1.0 FP02 [page 75]</a>



## 2.1 Preparing to Install SAP Predictive Maintenance and Service, on-premise edition

Before installing SAP Predictive Maintenance and Service, on-premise edition, complete the following preparation steps.

### Prerequisites

You have made yourself familiar with the system landscapes described in the chapter [System Landscape \[page 12\]](#).

### Context

To prepare the installation of the platform, proceed as follows:

### Procedure

1. Download the documentation set for SAP HANA Platform 1.0 SPS 12 from the SAP Help Portal: [SAP HANA Platform 1.0 SPS 12](#)

SAP Predictive Maintenance and Service, on-premise edition is based on SAP HANA 1.0 SPS 12. You might therefore need to access the corresponding documentation.

2. Install SAP HANA SPS12 Database Maintenance Revision 122.05 or higher along with SAP HANA XS Advanced Model 1.0.34 (XS RUNTIME 1 Patch Collection 24 (build 1.0.34) / PL 34).

#### **i** Note

The installation of SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 is **not** supported on an SAP HANA system that uses multitenant database containers (MDC).

To download the SAP HANA SPS12 Database Maintenance Revision 122.05 or higher along with SAP HANA XS Advanced Model 1.0.34., go to <https://launchpad.support.sap.com/#/softwarecenter>, and search for **SAP HANA DATABASE 1.00** and **SAP EXTENDED APP SERVICES 1**. To install **SAP EXTENDED APP SERVICES 1**, choose patch level 34.

For more information about how to install SAP HANA Platform Edition 1.0 SPS12 containing SAP HANA XS advanced runtime, see the [SAP HANA Server Installation and Update Guide](#).

3. Install the XSA standard applications for administration and job scheduling.

To download the XSA standard applications for administration and job scheduling, go to <https://launchpad.support.sap.com/#/softwarecenter>, and search for **XS SERVICES 1** and **XS MONITORING 1**. Choose the latest SP for both software components.

For more information about how to install SAP HANA Platform Edition 1.0 SPS12 containing SAP HANA XS advanced runtime, see the [SAP HANA Server Installation and Update Guide](#).

4. Install the XS command-line tools.

For more information about how to install XS Advanced command-line tools, see SAP Note [2242468](#).

5. Import the XS Advanced SSL certificate.

For more information about how to import the XS Advanced SSL certificate, see SAP Note [2243019](#).

6. Check that the XS Advanced monitoring tools are installed.

- a. In the `xs` command-line interface, use the command `xs version` and check whether `xsa-admin` is available under *Registered Services*.
- b. If `xsa-admin` is not available, download the `XSACMONITORING02_0-70001258.ZIP` file from <https://launchpad.support.sap.com/#/softwarecenter>: **Support Packages & Patches** > **By Alphabetical Index (A-Z)** > **H** > **SAP HANA PLATFORM EDITION** > **SAP HANA PLATFORM EDIT. 1.0** > **Entry by Component** > **XS Advanced Monitoring** > **XS Monitoring 1**.

7. **Mandatory for using data science services:** Install R 3.2.3 or higher.

For more information, see <http://cran.us.r-project.org/>.

8. **Optional for running the insight provider *Derived Signals*:** Install the SAP HANA Rules Framework from the <https://launchpad.support.sap.com/#/softwarecenter>. Search for **HANA RULES FRAMEWORK 1.0** and choose **HANA RULES FRAMEWORK 1.0**, SP08 or higher.

The installation of SAP HANA Rules Framework is required, if you **do not** have your own rule engine. You can integrate SAP HANA Rules Framework with the insight provider for derived signals to write your own rule evaluation jobs.

#### ➔ Tip

If you have your own rule engine and events coming from your assets, you can skip the installation of SAP HANA Rules Framework. However, it is recommended to install SAP HANA Rules Framework if you would like your rule engine to generate additional custom events.

#### i Note

SAP HANA Rules Framework has to be installed using SAP HANA Application Lifecycle Management. For more information, see *Installing and Updating SAP HANA Products and Software Components* in the *SAP HANA Administration Guide*.

SAP HANA Rules Framework is an add-on component for the SAP HANA platform required by the insight provider for derived signals. For more information about this insight provider, see the *Application Help for SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02*.

9. Optional: Install an external data source if you need to work with high volumes of data.

An external data source can be SAP IQ, for example. To download SAP IQ, go to <https://launchpad.support.sap.com/#/softwarecenter> and search for **SYBASE IQ SERVER 16.0**. For more information about how to install and configure SAP IQ, see <https://help.sap.com/iq16>: **SAP IQ** > **Information on installing, configuring, and optimizing SAP IQ** > **<Your SP>** > **Installation and Upgrade Information**.

### Note

If you want to use SAP IQ as external data source, the minimum version SAP IQ 16.0 SP10 PLO3 is required.

- Optional: Install and configure SAP HANA Smart Data Access if you are working with an external data source other than SAP HANA.

To download SAP HANA Smart Data Access, go to <https://launchpad.support.sap.com/#/softwarecenter> and search for **SAP HANA SMART DATA ACCESS 1.0**. For more information about SAP HANA Smart Data Access, see the *SAP HANA Administration Guide*.

If data is stored in a separate storage location and can be moved to SAP HANA using SAP HANA Smart Data Access, SAP HANA needs the required libraries for the connection. For more information about where to extract these libraries so that SAP HANA can reach them, see *Setting Up Database Drivers* in the *SAP HANA Administration Guide*.

- Optional: Create a remote source in SAP HANA studio using the following SQL command:

### Note

The following code is a sample.

### Sample Code

```
DROP REMOTE SOURCE <IQ_SDA>;
CREATE REMOTE SOURCE <IQ_SDA> ADAPTER IQODBC CONFIGURATION
'Driver=libdbodbc16_r.so;
ServerName=<release>;
CommLinks=tcPIP(host=<hostname>;port=<port>);DatabaseName=<database name>'
WITH CREDENTIAL TYPE 'PASSWORD' USING 'user=<database user>;
password=<password of database user>';
CREATE SCHEMA <IQ_SDA>;
```

## Results

You have prepared for the installation of the platform of SAP Predictive Maintenance and Service, on-premise edition, and can continue with the next steps: [Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#)

## Related Information

[SAP Help Portal: SAP HANA Platform \(Core\)](#)

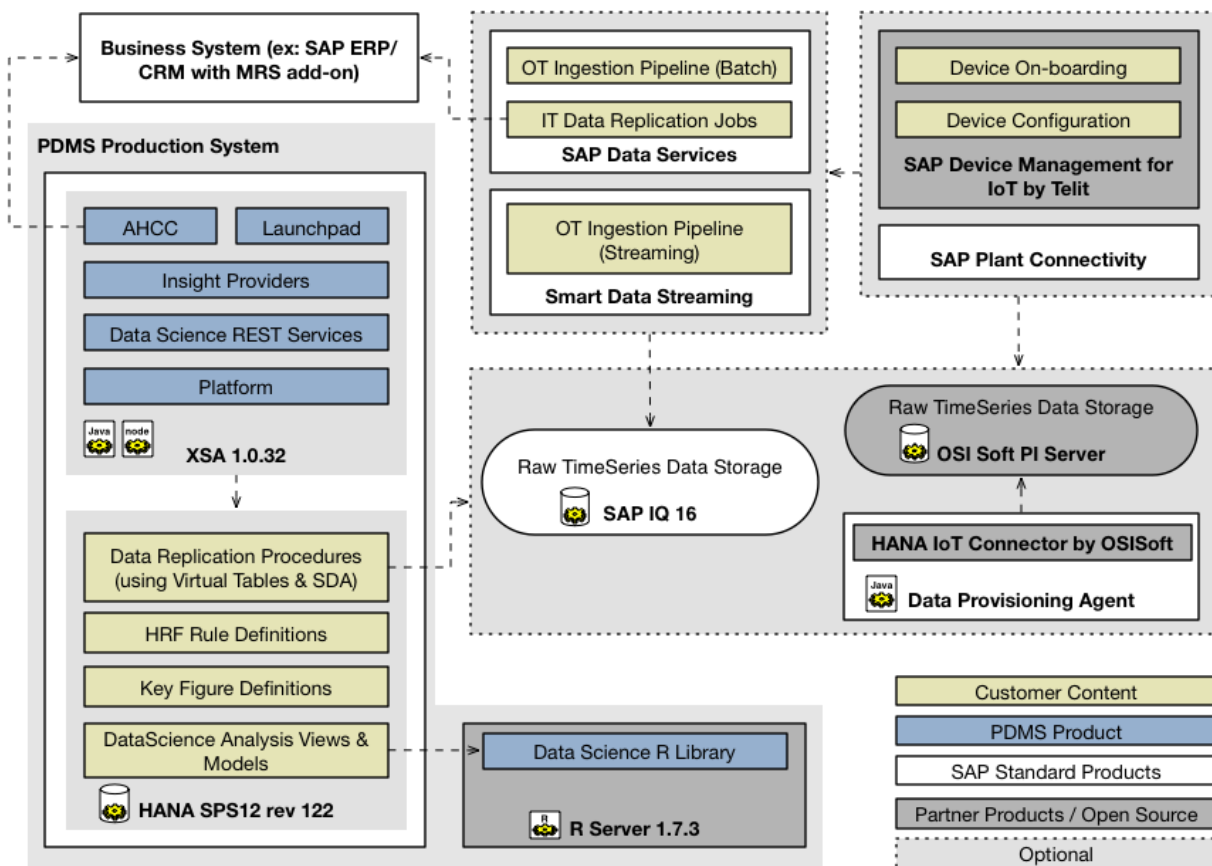
[SAP Help Portal: SAP IQ 16.0](#)

## 2.1.1 System Landscape

### Minimal System Landscape

The minimal system landscape is depicted in the following figure. The two **mandatory** physical or logical hosts, **host 1 with SAP HANA and XSA** and **host 2 with the R runtime**, are depicted with solid blocks.

The **optional** systems in the landscape for device connectivity, OT data ingestion (sensor data), and time series storage vary from customer to customer are shown in dotted blocks.



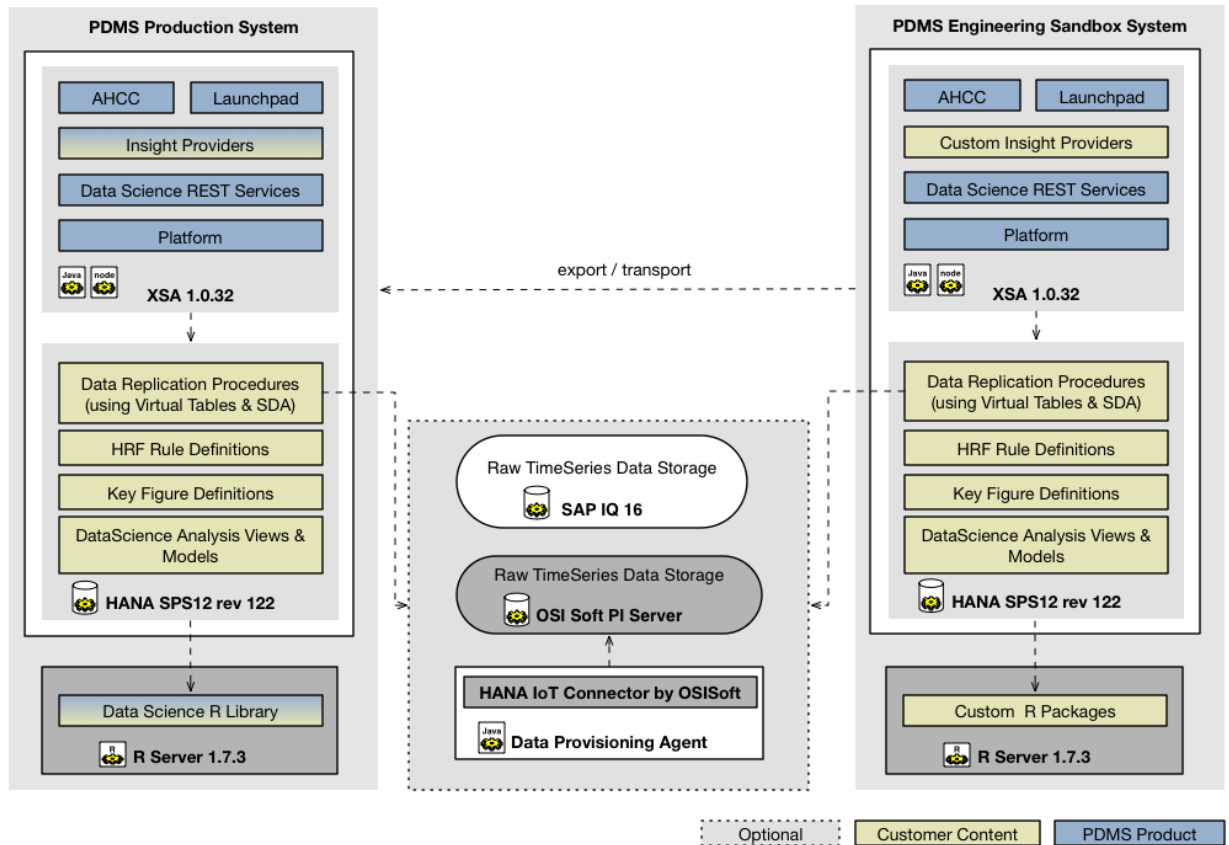
### Typical System Landscape

The typical system landscape comprises of a **production system** and an **engineering system**.

The **production system** is typically configured for high availability and disaster recovery (with hot standbys) for individual components of the landscape.

The **engineering system** is a copy of the production system configured as a sandbox without high availability. The engineering system is connected to the productive data lake and is used by domain experts and data scientists to

explore the raw timeseries data, define data replication procedures, rules, key figures, predictive modelling, and implement custom R packages for new algorithms. Once the content is finalized, it is transported to the production system and made active. Typically, the engineering system also doubles up as the test system for testing custom insight providers.



## Related Information

[Installation of SAP Predictive Maintenance and Service, on-premise edition \[page 8\]](#)

## 2.2 Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02

Start the installation of the platform of SAP Predictive Maintenance and Service, on-premise edition.

### Prerequisites

Make sure that the prerequisites explained in section [Preparing to Install SAP Predictive Maintenance and Service, on-premise edition \[page 9\]](#) are met.

You have made yourself familiar with the recommended deployment setup: [Recommended Deployment Setup \[page 17\]](#)

### Context

To start the installation of the platform of SAP Predictive Maintenance and Service, on-premise edition, proceed as follows:

### Procedure

#### Download SAP Predictive Maintenance and Service, on-premise edition 1.0 from SAP Service Marketplace:

1. Go to the [SAP Software Download Center: SAP PDMS ON-PREMISE 1.0](#).
2. Download the ZIP file `SAPPDMSONPR02P_3-71002247.ZIP`.

#### Log on to SAP HANA XS Advanced:

3. Connect to the host where you installed SAP HANA and SAP HANA XS Advanced.

You can use an ssh client to connect to the host, for example.

4. Log on to the SAP HANA XS Advanced host with the following logon credentials:

- `<XS ADMIN User>`
- `<XS ADMIN User Password>`

#### **i** Note

You need to specify the path to the `default.root.crt.pem` file when you log on to XS Advanced for the first time.

For information about how to log on to SAP HANA XS Advanced and how to get the `default.root.crt.pem` file, watch the short YouTube video *SAP HANA Academy - XS Advanced: Connect to Server Runtime* linked below.

For information about SAP HANA XS Advanced logon credentials, see SAP Note [2303772](#).

### Note

To connect using SSL, download the `default.root.crt.pem` file from the directory `/hana/shared/ANA/xs/controller_data/controller/ssl-pub/router/` on the SAP HANA host.

#### Create an XS user space:

5. In the `xs` command-line interface, list all XS user spaces by using the command `xs spaces`, and choose the user space `pdms-op`.

If this user space does not exist, create it by using the command `xs create-space pdms-op` and switch to the user space `pdms-op` by using the command `xs target -s pdms-op`.

For more information about XS spaces, see [http://help.sap.com/hana\\_platform/](http://help.sap.com/hana_platform/): [Development and Modeling](#) [SAP HANA Developer Guide for SAP HANA XS Advanced Model](#).

6. Download or create the following extension files, which contain details of the user-provided service:

### Note

You can download the extension files you need from the [Attachments](#) section in SAP Note [2283623](#):

- `ahcc.mtaext`
- `derived-signals.mtaext`
- `pdms-router.mtaext`
- `work-activity.mtaext`

Alternatively, you can create the `.mtaext` files yourself as described in the following sections:

- [Extension File for pdms-router \[page 18\]](#)
- [Extension File for Asset Health Control Center \[page 20\]](#)
- [Extension File for Insight Provider for Derived Signals \[page 20\]](#)
- [Extension File for Insight Provider for Work Activities \[page 21\]](#)

7. Create the necessary users with the relevant passwords as required in the `.mtaext` files that you just created.

To create the required users, you can execute the following SQL script in SAP HANA studio:

### Sample Code

```
CREATE USER <user name> PASSWORD "<password>" NO FORCE_FIRST_PASSWORD_CHANGE;
```

We recommend creating the following users:

- `<PDMS_EXECUTOR>`  
This user is a technical user. The credentials of this user are required by the XSA Job Scheduler service to call back to the Executor Service app.
- `<PDMS_TECH_USER>`  
This user is needed to have access to the configuration UIs to configure insight providers, and to the Executor Service app used to load data.
- `<PDMS_DS_ADMIN>`  
This user is needed to have access to the configuration UIs to create, score, and train models, and to extend data science services.

### **i** Note

The <PDMS\_DS\_ADMIN> user needs to have grantable CREATE R SCRIPT system privileges.

- o <PDMS\_APP\_USER>

This user is needed to have access to the Asset Health Control Center containing the Asset Health Fact Sheet.

### **i** Note

For an overview of required users, roles, and privileges, see the chapter [Overview of Users, Roles, and Privileges \[page 27\]](#).

8. Create the schemas required for the installation of the relevant software components.

To create the required schemas, you can execute the following SQL script in SAP HANA studio:

#### Sample Code

```
CREATE SCHEMA "SAP_PDMS_REPLICATION_DATA" OWNED BY <PDMS_TECH_USER>;
CREATE SCHEMA "SAP_PDMS_DATA_KEY_FIGURES" OWNED BY <PDMS_TECH_USER>;
CREATE SCHEMA "SAP_PDMS_DSS_FUSION_SCHEMA" OWNED BY <PDMS_DS_ADMIN>;
```

9. Install the **product instance 1** by executing the following command in the xs command-line tool:

#### Sample Code

```
xs install <PRODUCT_ARCHIVE_ZIP> -i 1 -e <pdms-
router.mtaext>,<ahcc.mtaext>,<derived-signals.mtaext>,<work-activity.mtaext>
```

This creates all the necessary XSA roles for creating a role collection.

10. Create the necessary role collections and assign them to users as explained in the section [Maintaining Role Collections and Users in SAP HANA \[page 22\]](#).
11. Install the remaining product instances by executing the following command in the xs command-line tool:

#### Sample Code

```
xs install <PRODUCT_ARCHIVE_ZIP> -e <pdms-
router.mtaext>,<ahcc.mtaext>,<derived-signals.mtaext>,<work-activity.mtaext> -
o ALLOW_SC_SAME_VERSION
```

## Results

You have completed the first steps for installing SAP Predictive Maintenance and Service, on-premise edition, and can continue with the next steps:

- Install the R packages required to work with data science services as explained in the section [Installing R Packages for Data Science Services \[page 58\]](#).



- Configure the insight providers as explained in the guide .

## Related Information

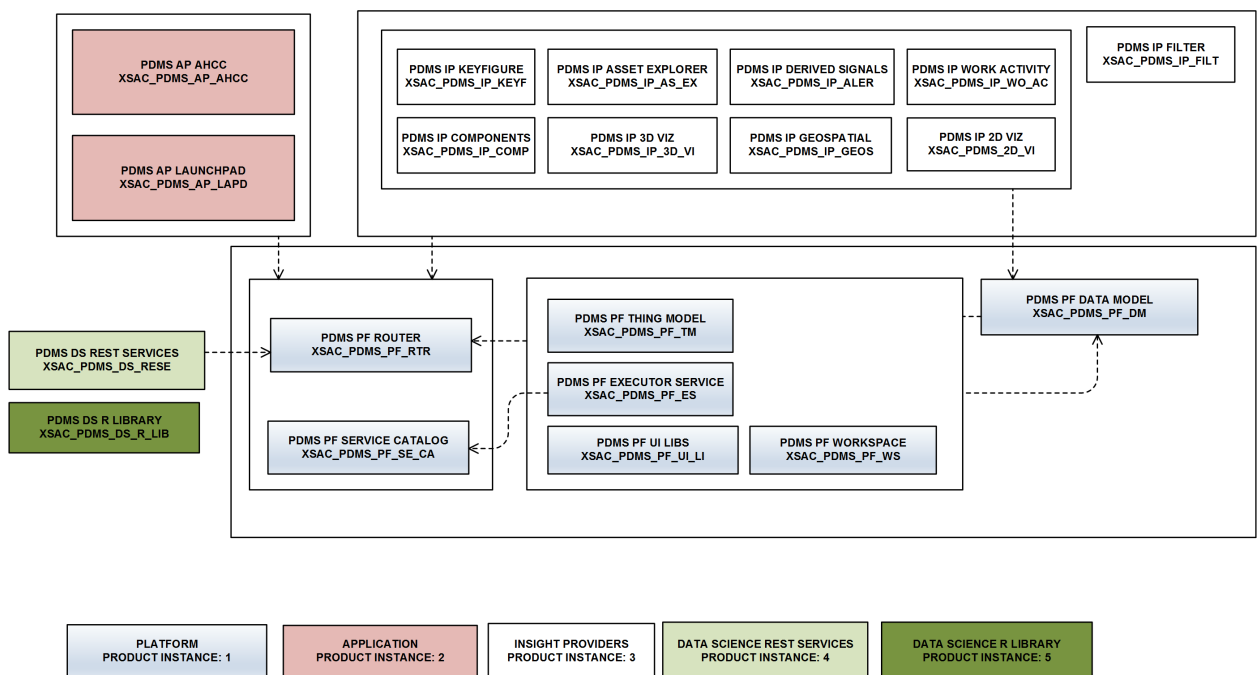
[SAP Help Portal: SAP HANA Platform \(Core\)](#)

[SAP Help Portal: SAP IQ 16.0](#)

[YouTube: SAP HANA Academy - XS Advanced: Connect to Server Runtime](#)

### 2.2.1 Recommended Deployment Setup

The following image depicts the recommended deployment setup for SAP Predictive Maintenance and Service, on-premise edition:



- **Platform (product instance 1):** This consists of all the base components responsible for data definition and data storage, cross-application generic functionality such as routing, service entries, and UI libraries. The following seven components belong to the platform: a router, UI libraries, the Insight Provider Catalog, a thing model, an executor service, workspace management, and a data model.
- **Application (product instance 2):** This consists of the applications that the user can access. The two applications currently available are the Asset Health Control Center (AHCC) and the administration launchpad. The administration launchpad is an entry point for all applications and also contains the user interfaces for configuring insight providers and platform components, and for managing data science services.
- **Insight providers (product instance 3):** This consists of all insight providers, which are specialized microservices with a UI and underlying business logic coupled to perform specialized functions. There are currently nine insight providers: the Asset Explorer, a components list, a filter, a map, a 3D chart, a 2D chart, a list of derived signals, a list of work activities, and key figures.

- **R libraries (product instance 4):** This consists of all R libraries that are delivered with SAP Predictive Maintenance and Service, on-premise edition. One software component is delivered for this product instance. Only this product instance is non-XSA content and should be installed directly on the R server.
- **Data science REST services (product instance 5):** This contains the REST services delivered for data science services.




## Related Information

[Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#)

### 2.2.2 Extension File for pdms-router

Save the following coding to an `.mtaext` file and make sure that the file contains valid `YAML`. Replace the entries in `<>` in the `.mtaext` file with your system details. **Read the explanations below the coding snippet before you actually save the extension file.**

#### Note

You can alternatively download the already prepared `.mtaext` file from SAP Note [2283623](#):  [Attachments](#)  
 [pdms-router.mtaext](#) .

#### Note

The value of the parameter `SESSION_TIMEOUT` is defined in minutes.

#### Sample Code

```
_schema-version: "2.1.0"
ID: com.sap.pdms.router.ext
extends: com.sap.pdms.router
modules:
  - name: pdms-router
    properties:
      SESSION_TIMEOUT: 30
    parameters:
      port: <PORT_ON_WHICH_PDMS_ROUTER_SHOULD_RUN>
resources:
  - name: data-access-ups
    parameters:
      config:
        host: "<HANA_host>"
        port: "<HANA_SQL_PORT>"
        user: "<PDMS_TECH_USER>"
        password: "<password for PDMS_TECH_USER>"
        tags: ["hana"]
  - name: service-catalog-ups
    parameters:
      config:
        url: <URL of the pdms router>/platform/service-catalog
```

```

    username: "<PDMS_TECH_USER>"
    password: "<password for PDMS_TECH_USER>"
- name: datascience-ups
  parameters:
    config:
      host: "<HANA_host>"
      port: "<HANA_SQL_PORT>"
      user: "<PDMS_DS_ADMIN>"
      password: "<password for PDMS_DS_ADMIN>"
      tags: ["hana"]
- name: executor-service-ups
  parameters:
    config:
      user: "<PDMS_EXECUTOR>"
      password: "<password for PDMS_EXECUTOR>"

```

## Port-Based Routing

If you use XSA installed as port-based routing, the host of the pdms router is the XSA domain, and the port of the pdms router is the port on which the pdms router is run.

### ➔ Tip

It is recommended to specify a port for the pdms-router in the extension file when you use port-based routing.

The `<URL of the pdms router>` that you need to specify for the `service-catalog-ups` can be replaced with the following:

### Code Syntax

```

${protocol}://${default-domain}:<Port_on_which_pdms_router_runs>

```

To get information about on which domain the pdms-router is run, execute the command `xs domains` in the command line tool.

## Host-Based Routing

If you use XSA installed as host-based routing, remove the `<port>` parameter from the pdms-router section in the extension file. For more information about host-based routing, see SAP Note [2245631](#).

The `<URL of the pdms router>` that you need to specify for the `service-catalog-ups` can be replaced with the following:

### Code Syntax

```

${protocol}://${org}-${space}-pdms-router.${default-domain}:<xsa_platform_router_port>

```

To find the correct `<xsa_platform_router_port>`, go to your SAP HANA configuration under `xscontroller.ini` `> communication > router_port`.

## Related Information

[Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#)

## 2.2.3 Extension File for Asset Health Control Center

Save the following coding to an `.mtaext` file and make sure that the file contains valid `YAML`. Replace the entries in `<>` in the `.mtaext` file with your system details.

### Note

You can alternatively download the already prepared `.mtaext` file from SAP Note [2283623](#): `Attachments` `> ahcc.mtaext`.

### Sample Code

```
schema-version: "2.1.0"
ID: com.sap.pdms.ahcc.ext
extends: com.sap.pdms.app.ahcc
modules:
  - name: ahcc-app
    parameters:
      scheduleMaintenanceUrl: "https://<host>:<port>/sap/bc/webdynpro/mrss/
wd_sgx_lean_plb?sap-client=<client number>&sap-language=<language code>"
```

The parameter `scheduleMaintenanceUrl` contains the API end point that points to a maintenance planning application UI such as SAP Multiresource Scheduling (MRS).


## Related Information

[Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#)

## 2.2.4 Extension File for Insight Provider for Derived Signals

Save the following coding to an `.mtaext` file and make sure that the file contains valid `YAML`.

### Note

You can alternatively download the already prepared `.mtaext` file from SAP Note [2283623](#):  [Attachments](#)  
[> derived-signals.mtaext >](#)

### Sample Code

```
_schema-version: "2.1.0"
ID: com.sap.pdms.ipro.derived-signals.ext
extends: com.sap.pdms.ipro.derived-signals
modules:
  - name: derived-signals-ipro-config-db
  - name: derived-signals-ipro-db
  parameters:
    TARGET_CONTAINER: derived-signals-ipro-hdi
  - name: derived-signals-ipro-backend
  - name: derived-signals-ipro-ui
resources:
  - name: derived-signals-ipro-hdi-service-alias
  parameters:
    service-name: derived-signals-ipro-hdi
```


## Related Information

[Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#)

## 2.2.5 Extension File for Insight Provider for Work Activities

Save the following coding to an `.mtaext` file and make sure that the file contains valid `YAML`. Replace the entries in `<>` in the `.mtaext` file with your system details.

### Note

You can alternatively download the already prepared `.mtaext` file from SAP Note [2283623](#):  [Attachments](#)  
[> work-activity.mtaext >](#)

### Sample Code

```
_schema-version: "2.1.0"
ID: com.sap.pdms.ipro.work-activity.ext
extends: com.sap.pdms.ipro.work-activity
modules:
  - name: work-activity-ipro-config-db
  - name: work-activity-ipro-db
  parameters:
    TARGET_CONTAINER: work-activity-ipro-hdi
  - name: work-activity-ipro-app
  parameters:
```

```
ODATA_HANA_SERVICE_NAME: work-activity-ipro-hdi
resources:
- name: work-activity-ipro-hdi-service-alias
  parameters:
    service-name: work-activity-ipro-hdi
```

## Related Information

[Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#)

## 2.2.6 Maintaining Role Collections and Users in SAP HANA

### Context

To maintain role collections and users required for SAP Predictive Maintenance and Service, on-premise edition, follow the procedure described below.

### Procedure

1. Go to the Application Role Builder tool by executing the following steps:
  - a. Open the command line tool and log on to XS Advanced, to space `SAP`, with your `<XSA_ADMIN>` user.

#### Sample Code

```
xs login -u <XSA_ADMIN> -p <Password> -s SAP
```

- b. In the command line tool, execute the `xs apps` command.  
You get an application overview list.
- c. In the application overview, look for `xsa-admin` and copy the corresponding URL to your browser.

#### Tip

We recommend using Google Chrome.

- d. Log on with your `<XSA_ADMIN>` user.
- e. Open the Application Role Builder tool.

For more information about how to use the Application Role Builder tool and the required XSA roles, see

[http://help.sap.com/hana\\_platform/](http://help.sap.com/hana_platform/):  [System Administration](#) > [SAP HANA Administration Guide](#) .

2. In the Application Role Builder tool, create a new role collection.
3. Add the required application role templates to the role collection you have created.

For more information about the role templates and scopes that are delivered with SAP Predictive Maintenance and Service, on-premise edition, see [Role Templates for SAP Predictive Maintenance and Service, on-premise edition \[page 24\]](#).

This is a sample configuration of required role collections.

### **i** Note

If you create a role collection for a user who is supposed to work with the launchpad, you need to add the role templates `ConfigUser` or `AHCCUser` to the role collection.

Table 3: Sample Role Collections

Role Collection	Role Templates
<pdms-tech>	ConfigUser, ThingModeler, ThingReader, ThingWriter
<pdms-executor-role>	ExecutorUser
<pdms-datascience-role>	DataScienceUser, ThingReader, ConfigUser
<ahcc-user-role>	AHCCUser, ThingReader

4. In the SAP HANA cockpit, use the SAP HANA `SYSTEM` user to assign the role collections to your users.
  - a. Open the user to which you want to assign role collections, and go to the [Application Role Collections](#) tab.
  - b. Select the relevant role collections and assign them to the user.

Table 4: Sample Role Collection Assignments

User	Required Role Collection	Additional Privileges
<PDMS_TECH_USER>	<pdms-tech>	System privilege CREATE SCHEMA
<PDMS_EXECUTOR>	<pdms-executor-role>	-
<PDMS_DS_ADMIN>	<pdms-datascience-role>	System privilege: <ul style="list-style-type: none"> <li>○ Grantable CREATE R SCRIPT</li> <li>○ CREATE SCHEMA</li> </ul>
<PDMS_APP_USER>	<ahcc-user-role>	-

For more information about how to use the SAP HANA cockpit, see [http://help.sap.com/hana\\_platform/](http://help.sap.com/hana_platform/): [System Administration](#) > [SAP HANA Administration Guide](#).

## Related Information

[SAP Help Portal: SAP HANA Platform](#)

[Role Templates for SAP Predictive Maintenance and Service, on-premise edition \[page 24\]](#)

## 2.2.7 Role Templates for SAP Predictive Maintenance and Service, on-premise edition

The table below shows the XS Advanced roles that are delivered with SAP Predictive Maintenance and Service, on-premise edition.




Table 5: XS Advanced Role Templates

Application Name (in Application Role Builder tool)	Role Template Name (in Application Role Builder tool)	Description
pdms	ConfigUser	<p>Role template used to configure insight providers and access the Asset Health Control Center</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"><li>• <code>ConfigAccess</code>: Scope that gives permission to configure insight providers and the Insight Provider Catalog</li><li>• <code>AppAccess</code>: Scope that gives permission to read the configuration of insight providers and the Insight Provider Catalog, and to read and write to insight providers and application data</li></ul>
pdms	ExecutorUser	<p>Role template to schedule tasks for data replication</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"><li>• <code>ExecutorAccess</code>: Scope that gives permission to schedule tasks for data replication</li></ul>



Application Name (in Application Role Builder tool)	Role Template Name (in Application Role Builder tool)	Description
pdms	ThingModeler	<p>Role template to maintain IoT application services: Configuration services and Thing services</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"> <li>• <code>ThingModelAccess</code>: Scope that gives permission to read and write to IoT application services</li> </ul>
pdms	ThingReader	<p>Role template to read Thing instances from the Thing model</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"> <li>• <code>ThingRead</code>: Scope that gives permission to read Thing instances of IoT application services</li> </ul>
pdms	ThingWriter	<p>Role template to read Thing instances from the Thing model</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"> <li>• <code>ThingWrite</code>: Scope that gives permission to write to Thing instances of IoT application services</li> </ul>
pdms	AHCCUser	<p>Role template to access the Asset Health Control Center application</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"> <li>• <code>AppAccess</code>: Scope that gives permission to read the configuration of insight providers and the Insight Provider Catalog, and to read and write to insight providers and application data</li> <li>• <code>AHCCAccess</code>: Scope that gives permission to access the Asset Health Control Center application</li> </ul>

Application Name (in Application Role Builder tool)	Role Template Name (in Application Role Builder tool)	Description
pdms	DataScienceUser	<p>Role template to access data science models and algorithms</p> <p>Consists of the following scopes:</p> <ul style="list-style-type: none"> <li>• <code>DataScienceAccess</code>: Scope that gives permission to read and write to data science models and algorithms</li> </ul>

For more information about how to use the Application Role Builder tool and the required XSA roles, see [http://help.sap.com/hana\\_platform/](http://help.sap.com/hana_platform/) :  *System Administration*  *SAP HANA Administration Guide* .

### **i** Note

For more information about how to create and assign role collections, see the chapter *Maintaining Role Collections and Users in SAP HANA* in the guide *Installation of SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02*.

## Related Information

[SAP Help Portal: SAP HANA Platform](#)

## 2.2.8 Overview of Users, Roles, and Privileges

### User: PDMS\_TECH\_USER

Table 6:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
pdms-tech	<ul style="list-style-type: none"> <li>• ConfigUser</li> <li>• ThingModeler</li> <li>• ThingReader</li> <li>• ThingWriter</li> </ul>	<ul style="list-style-type: none"> <li>• com.sap.pdms.sdm::DATA.Provider# with grantable to others option</li> <li>• com.sap.pdms.sdm::DATA.Consumer# with grantable to others option</li> </ul>	<ul style="list-style-type: none"> <li>• CATALOG READ</li> <li>• CREATE SCHEMA</li> </ul>	<ul style="list-style-type: none"> <li>• SAP_PDM_S_REPLICATION_DATA               <ul style="list-style-type: none"> <li>◦ CREATE ANY with grantable to others option</li> <li>◦ DELETE with grantable to others option</li> <li>◦ EXECUTE with grantable</li> </ul> </li> </ul>	-	-	-

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
				<ul style="list-style-type: none"> <li>to others option</li> <li>○ INSERT with grantable to others option</li> <li>○ SELECT with grantable to others option</li> <li>○ UPDATE with grantable to others option</li> <li>● SAP_PDM_S_DATA_KEY_FIGURES</li> </ul>			

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
				<ul style="list-style-type: none"> <li>○ CREATE ANY with grantable to others option</li> <li>○ EXECUTE with grantable to others option</li> <li>○ SELECT with grantable to others option</li> <li>● SAP_PDM_S_DATA_EXTENSION               <ul style="list-style-type: none"> <li>○ CREATE ANY</li> </ul> </li> </ul>			

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
				with grantable to others option			

## User: Performing HRF Tasks

### **i** Note

For the user that is performing HRF tasks, these are the roles and privileges. This user can be either the `<PDMS_TECH_USER>` or an `<HRF_TECH_USER>`.

Table 7:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
-	-	<ul style="list-style-type: none"> <li>• sap.hrf.role.model::HRF_TECH_ROLE</li> <li>• sap.hrf.role.mrfAdmin</li> <li>• sap.hrf.role.mrfPublicAliasEditor</li> <li>• sap.hrf.role.mrfRuleConsumer</li> <li>• sap.hrf.role.mrfRuleEditor</li> <li>• sap.hrf.role.mrfServiceEditor</li> <li>• sap.hrf.role.mrfRuleViewer</li> </ul>	-	<ul style="list-style-type: none"> <li>• SAP_PDM_S_REPLICATION_DATA               <ul style="list-style-type: none"> <li>◦ EXECUTE with grantable to others option</li> <li>◦ SELECT with grantable to others option</li> </ul> </li> </ul>	-	<ul style="list-style-type: none"> <li>• &lt;Package where rule services will be created / stored&gt; such as HRF_Rule_Services               <ul style="list-style-type: none"> <li>◦ REPO.READ</li> <li>◦ REPO.EDIT_NATIVE_OBJECTS</li> <li>◦ REPO.MAIN_TAIN_NATIVE_VE_</li> </ul> </li> </ul>	sap.hrf::AllPrivilegesForTechnicalUser

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
						PAC KAG ES <ul style="list-style-type: none"> <li>• &lt;Package where rules will be created / stored&gt; such as HRF_Rules               <ul style="list-style-type: none"> <li>◦ REP O.R EAD</li> <li>◦ REP O.E DIT _NA TIV E_O BJE CTS</li> <li>◦ REP O.A CTI VAT E_N ATI VE_ OBJ ECT S</li> <li>◦ REP O.M AIN TAI N_N ATI VE_</li> </ul> </li> </ul>	



Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
						<ul style="list-style-type: none"> <li>PAC</li> <li>KAG</li> <li>ES</li> <li>• Root package               <ul style="list-style-type: none"> <li>◦ REP</li> <li>◦ O.R</li> <li>◦ EAD</li> <li>◦ REP</li> <li>◦ O.M</li> <li>◦ AIN</li> <li>◦ TAI</li> <li>◦ N_N</li> <li>◦ ATI</li> <li>◦ VE_</li> <li>◦ PAC</li> <li>◦ KAG</li> <li>◦ ES</li> </ul> </li> <li>• &lt;Package where you create vocabulary and HRF repository artifacts&gt; such as the SAP_PDM_S_REPLICATION_DATA package               <ul style="list-style-type: none"> <li>◦ REP</li> <li>◦ O.R</li> <li>◦ EAD</li> <li>◦ REP</li> <li>◦ O.E</li> <li>◦ DIT</li> </ul> </li> </ul>	

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
						_NA TIV E_O BJE CTS ◦ REP O.A CTI VAT E_N ATI VE_ OBJ ECT S ◦ REP O.M AIN TAI N_N ATI VE_ PAC KAG ES	

## User: PDMS\_DS\_ADMIN

Table 8:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
pdms-datascience-role	<ul style="list-style-type: none"> <li>DataScienceUser</li> <li>ThingReader</li> <li>ConfigUser</li> </ul>	<ul style="list-style-type: none"> <li>com.sap.pdms.dm::DATA.Consumer#</li> </ul>	<ul style="list-style-type: none"> <li>CREATE R SCRIPT with grantable to others option</li> <li>CREATE SCHEMA</li> </ul>	<ul style="list-style-type: none"> <li>SAP_PDM_S_DSS_FUSION_SCHEMA               <ul style="list-style-type: none"> <li>◦ CREATE ANY</li> <li>◦ CREATE TEMPORARY TABLE</li> <li>◦ DELETE</li> <li>◦ DROP</li> <li>◦ EXECUTE with grantable to others option</li> <li>◦ INSERT with grantable to oth-</li> </ul> </li> </ul>	-	-	-

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
				<ul style="list-style-type: none"> <li>ers option</li> <li>◦ SELECT with grantable to others option</li> <li>◦ UPDATE with grantable to others option</li> </ul>			

## User: PDMS\_EXECUTOR

Table 9:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
<ul style="list-style-type: none"> <li>• pdms-executor-role</li> <li>• pdms-jobscheduler-role</li> </ul>	<ul style="list-style-type: none"> <li>• ExecutorUser</li> </ul>	-	-	-	-	-	-

## User: PDMS\_APP\_USER

Table 10:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
<ul style="list-style-type: none"><li>ahcc-user-role</li></ul>	<ul style="list-style-type: none"><li>AHCCUser</li><li>ThingReader</li></ul>	-	-	-	-	-	-

## User: PDMS\_CONFIG\_USER

Table 11:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
<ul style="list-style-type: none"><li>pdms-config-role</li></ul>	<ul style="list-style-type: none"><li>ConfigUser</li><li>AHCCUser</li><li>ThingModeler</li><li>ThingReader</li><li>ThingWriter</li></ul>	-	-	-	-	-	-

## User: \_SYS\_REPO

Table 12:

Application Role Collection	Role Templates	Granted Roles	System Privileges	Object Privileges	Analytic Privileges	Package Privileges	Application Privileges
-	-	-	-	<ul style="list-style-type: none"> <li>• SAP_PDM_S_REPLICATION_DATA               <ul style="list-style-type: none"> <li>◦ SELECT</li> </ul> </li> <li>• &lt;Virtual source table from which data is loaded&gt; @ SAP_PDM_S_REPLICATION_DATA               <ul style="list-style-type: none"> <li>◦ SELECT</li> </ul> </li> <li>• &lt;Target table to which data is loaded&gt; @ SAP_PDM_S_REPLICATION_DATA               <ul style="list-style-type: none"> <li>◦ INSERT</li> <li>◦ UPDATE</li> <li>◦ DELETE</li> </ul> </li> </ul>	-	-	-

## 2.3 Data Model

With the installation of SAP Predictive Maintenance and Service, on-premise edition 1.0 a set of views and tables is created.

- [Views for Metadata \[page 39\]](#)
- [Views for Data \[page 51\]](#)

The Thing model is described in the *Configuration Guide* of SAP Predictive Maintenance and Service, on-premise edition 1.0 FPO2.

### 2.3.1 Views for Metadata

#### META

The CDS context `META` contains meta data about things backed by the thing model, and the hierarchy of things.

#### Hierarchy

This view represents an entire hierarchy which could be structure of function location or components of an asset. Currently there are two types of hierarchies defined:

- `com.sap.pdms.ComponentHierarchy`: The component hierarchy is used to represent the component structure of an asset. In this hierarchy, the asset is at root level. In the Asset Explorer insight provider, when an asset is clicked to understand the information about its components, the component hierarchy is used to provide relevant hierarchical information of the asset components. The component hierarchy is also used in the Components insight provider to showcase the components of an asset.
- `com.sap.pdms.AssetHierarchy`: The asset hierarchy, which is the function location hierarchy, is used to represent the function location structure where an asset is always at the leaf level. The asset hierarchy is used in the hierarchical filter tab of the Asset Explorer insight provider. The hierarchical filter tab shows n-1 levels of an n-level asset hierarchy. The nth leaf level for assets is shown as a list on the right hand pane of the insight provider.

These hierarchies are used by the Asset Explorer and components insight provider.

Table 13: Hierarchy

Key	Column	Type	Description
x	ID	String (32)	Uniquely identifies an hierarchy consisting of a set of <code>HierarchyNodeS</code>

Key	Column	Type	Description
-	Tenant	String (36)	Not used
-	Name	String (60)	A name for this hierarchy
-	Type	String (60)	Type that identifies hierarchies, for example <code>com.sap.pdms.ComponentHierarchy</code>
-	ExternalID	String (255)	External ID to connect to the hierarchy maintained in an external system

## HierarchyDescription

This view contains translatable descriptions for hierarchies.

Table 14: HierarchyDescription

Key	Column	Type	Description
x	ID	String (32)	Identifies the hierarchy in the hierarchy table
x	LanguageIsoCode	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
-	Description	String (60)	Translated text describing the <code>Hierarchy</code>

## HierarchyNode

This view models the parent-child relationship within a hierarchy. A `HierarchyNode` may represent a position in a train, which can be assigned to a coach or locomotive, for example. It may also represent a position in an asset into which a component (thing) can be placed.

Table 15: HierarchyNode

Key	Column	Type	Description
x	ID	String (32)	Uniquely identifies a node



Key	Column	Type	Description
-	ParentID	String (32)	ID of the parent <code>HierarchyNode</code> . May be null for the root node.
-	HierarchyID	String (32)	ID of the <code>Hierarchy</code> to which this node belongs.
-	NodeSemantic	String (60)	Semantics of this node such as <code>IsPartOf</code> or <code>IsConnectedTo</code>

## HierarchyNodeDescription

This view contains translatable descriptions for `HierarchyNodes`.

Table 16: HierarchyNodeDescription

Key	Column	Type	Description
x	ID	String (32)	Identifies the <code>HierarchyNode</code>
x	LanguageIsoCode	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
-	Description	String (60)	Translated text describing the <code>HierarchyNode</code> , for example <b>Front Bogie</b> , or <b>Rear Bogie</b>

## HierarchyAssignment

This view contains time-dependent assignments of things to hierarchy nodes. For the component hierarchy of the type `com.sap.pdms.ComponentHierarchy`, the root node is assigned to an asset and other nodes are assigned to components of the asset. Both an asset and its components are things of different thing types. For the asset hierarchy of the type `com.sap.pdms.AssetHierarchy`, the leaf node is assigned to an asset and other nodes including the root are assigned to different things of the functional location hierarchical structure like stations and trainsets. All objects like stations and trainsets in the functional location hierarchy are things of different thing types.

Table 17: HierarchyAssignment

Key	Column	Type	Description
x	NodeID	String (32)	Uniquely identifies the <code>HierarchyNode</code>
x	ObjectID	String (200)	Identifies the <code>Thing</code> which is assigned
x	ObjectType	String (200)	Fixed to <code>com.sap.Thing</code>
x	StartDateTime	UTCTimestamp	Point in time from which the assignment is valid
-	EndDateTime	UTCTimestamp	Point in time until which the assignment is valid

## Thing

This view contains instances of `ThingTypes`.

Table 18: Thing

Key	Column	Type	Description
x	Thing	String (32) not null	Unique identifier to be used in other tables of the data model
-	ExternalID	String (255)	An external ID to link this <code>Thing</code> to a representation in an external system
-	Name	String (255)	A readable name of the <code>Thing</code>
-	Tenant	String (36)	not used

## ThingTypes

This view contains assignments of `ThingTypes` to `Things`.

Table 19: ThingTypes

Key	Column	Type	Description
x	Thing	String (32) not null	Identifies the <code>Thing</code>

Key	Column	Type	Description
x	ThingType	String (81) not null	Identifies the ThingType assigned to the Thing
x	ValidityEndDateTime not null	UTCTimestamp	Point in time from which the assignment is valid
-	ValidityStartDateTime not null	UTCTimestamp	Point in time until which the assignment is valid

## ThingDescription

This view contains translatable descriptions for Things.

Table 20: ThingDescription

Key	Column	Type	Description
x	Thing	String (32)	Identifies the Thing
x	Language	String (2)	Defines the language, for example de, or en
-	Description	String (60)	Translated text describing the Thing

## ThingType

This view contains ThingTypes known to the system.

Table 21: ThingType

Key	Column	Type	Description
x	ThingType	String (81)	Identifies the ThingType  The ThingType must be prefixed with the Package name, for example <code>com.sap.test:ABC2Series</code> .

Key	Column	Type	Description
x	Version	Integer	The version of the <code>ThingType</code> . Newer versions must have a higher version number. <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.
-	extendedThingType	String (81)	Not used
-	Package	String (50)	The package to which the <code>ThingType</code> belongs, for example <code>com.sap.test</code>

## ThingTypeAll

This view contains all versions of `ThingTypes` known to the system. **This view can be updated.**

Table 22: ThingType

Key	Column	Type	Description
x	ThingType	String (81)	Identifies the <code>ThingType</code> . The <code>ThingType</code> must be prefixed with the <code>Package</code> name, for example <code>com.sap.test:ABC2Series</code> .
x	Version	Integer	The version of the <code>ThingType</code> . Newer versions must have a higher version number. <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.
-	extendedThingType	String (81)	Not used
-	Package	String (50)	The package to which the <code>ThingType</code> belongs, for example <code>com.sap.test</code>

## ThingTypeDescription

This view contains translatable descriptions for `ThingTypes`.

Table 23: ThingTypeDescription

Key	Column	Type	Description
x	ThingType	String (81)	Identifies the <code>ThingType</code>  The <code>ThingType</code> must be prefixed with the <code>Package</code> name, for example <code>com.sap.test:ABC2Series</code> .
x	Version	Integer	The version of the <code>ThingType</code>  <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.
x	Language	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
-	Description	String (60)	Translated text describing the <code>ThingType</code>

## ThingTypePropertyType

This view contains the usage of `PropertySetTypes` as properties of `ThingTypes`.

Table 24: ThingTypePropertyType

Key	Column	Type	Description
x	ThingType	String (81)	Identifies the <code>ThingType</code>  The <code>ThingType</code> must be prefixed with the <code>Package</code> name, for example <code>com.sap.test:ABC2Series</code> .
x	Version	BigInt	The version of the <code>ThingType</code>  <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.

Key	Column	Type	Description
x	Position	Integer	The position of the property within the ThingType
-	ID	String (30)	The name of the property which has to be unique within a ThingType
-	PST	String (81)	The PropertySetType of the property.  This value corresponds to the column PropertySetType in the table PropertySetType.
-	Package	String (50)	The package to which the ThingType belongs, for example com.sap.test

## PropertySetType

This view contains the PropertySetTypes known to the system.

PropertySetType is a set of properties with some semantic affinity.

Table 25: PropertySetType

Key	Column	Type	Description
x	PropertySetType	String (81)	Identifies the PropertySetType
x	Version	BigInt	The version of the PropertySetType  Version always has to be part of a join with other tables that also have a Version column.
-	TimeDepResolution	String (30)	Always set to Timestamp

Key	Column	Type	Description
-	DataCategory	String (30)	The category to which the <code>PropertySetType</code> belongs  When set to <code>TimeSeriesData</code> , the corresponding data has to be stored in the table <code>DATA.READINGS</code> or <code>DATA.LOCATIONS</code> .  When set to <code>MasterData</code> , the corresponding data has to be stored in the table <code>DATA.MASTERDATA</code> .
-	Package	String (50)	The package to which the <code>PropertySetType</code> belongs, for example <code>com.sap.test</code>

## PropertySetTypeAll

This view contains all versions of `PropertySetTypes` known to the system. **This view can be updated**

`PropertySetType` is a set of properties with some semantic affinity.

Table 26: `PropertySetType`

Key	Column	Type	Description
x	<code>PropertySetType</code>	String (81)	Identifies the <code>PropertySetType</code>
x	<code>Version</code>	<code>BigInt</code>	The version of the <code>PropertySetType</code>  <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.
-	<code>TimeDepResolution</code>	String (30)	Always set to <code>Timestamp</code>

Key	Column	Type	Description
-	DataCategory	String (30)	The category to which the <code>PropertySetType</code> belongs  When set to <code>TimeSeriesData</code> , the corresponding data has to be stored in the table <code>DATA.READINGS</code> or <code>DATA.LOCATIONS</code> .  When set to <code>MasterData</code> , the corresponding data has to be stored in the table <code>DATA.MASTERDATA</code> .
-	Package	String (50)	The package to which the <code>PropertySetType</code> belongs, for example <code>com.sap.test</code>

## PropertySetTypeDescription

This view contains translatable descriptions for `PropertySetTypeDescriptions`.

Table 27: `PropertySetTypeDescription`

Key	Column	Type	Description
x	<code>PropertySetType</code>	String (81)	Identifies the <code>PropertySetType</code>
x	<code>Version</code>	Integer	The version of the <code>PropertySetType</code>  <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.
x	<code>Language</code>	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
-	<code>Description</code>	String (60)	Translated text describing the <code>PropertySetType</code>



## PropertySetTypePropertyType

This view contains the `PropertyTypes` that belong to a `PropertySetType`.

Table 28: PropertySetTypePropertyType

Key	Column	Type	Description
x	PropertySetType	String (81)	Identifies the <code>PropertySetType</code>
x	Version	BigInt	The version of the <code>PropertySetType</code> <code>Version</code> always has to be part of a join with other tables that also have a <code>Version</code> column.
x	Position	Integer	The position of the property within the <code>PropertySetType</code>
-	ID	String (30)	The name of the property which has to be unique within a <code>PropertySetType</code>
-	ValueDataType	String (30)	Data type of the value If set to <code>GeoLocation</code> , the correspond values must be found in the table <code>DATA.LOCATIONS</code> .
-	Value.UnitOfMeasure	String (30)	The unit of measure for this property such as $^{\circ}\text{C}$ , or <b>km/h</b>

## ObjectDescription

This view contains the translatable descriptions for `ThingType` properties and `PropertySetType` properties.

Table 29: ObjectDescription

Key	Column	Type	Description
x	Language	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
x	ObjectID	String(200)	Identifies the <code>ThingType</code> or <code>PropertySetType</code>

Key	Column	Type	Description
x	SubObjectID	String(100)	The name of the property as per column ID in the table ThingTypePropertyType Or PropertySetTypePropertyType
x	Version	BigInt	The version of the PropertySetType Version always has to be part of a join with other tables that also have a Version column.
-	Description	String (60)	The translated description
-	ObjectType	String (100)	If Objectid identifies a ThingType, com.sap.ThingTypePropertySetType  If Objectid identifies a PropertySetType, com.sap.PropertySetTypePropertyType

## AssetThingTypes

This view contains a list of ThingTypes to be considered assets **rather than components**.

Table 30: AssetThingTypes

Key	Column	Type	Description
x	ThingType	String(81) not null	Defines the the <b>ThingType</b> that is to be considered an asset.

## 2.3.2 Views for Data

### READINGS / READINGS\_T

This view is a tall skinny table to store all readings related to `Things`. This view holds values of properties of property set types marked with `DataCategory = TimeSeriesData`.

#### **i** Note

The view has no keys as keys have a negative effect on compression.

Table 31: TimeSeriesData

Key	Column	Type	Description
-	Thing	String (32)	Identifies the <code>Thing</code>
-	Timestamp	UTCTimestamp	The time at which the measurement was taken
-	ThingType	String (81)	Identifies the <code>ThingType</code> This value is <b>mandatory</b> .
-	PropertySetTypeId	String (30)	The property within the <code>ThingType</code> used to refer to a <code>PropertySetType</code> This value corresponds to the column <code>ID</code> in The view <code>ThingTypePropertyType</code> .
-	PropertyId	String (30)	The property within the <code>PropertySetType</code> This value corresponds to the column <code>ID</code> in The view <code>PropertySetTypePropertyType</code> .
-	PropertyValue	BinaryFloat	The actual value assigned to the property

The columns `ThingType`, `PropertySetTypeId`, and `PropertyId` together are equivalent to "Metric ID" (measurements).

#### **i** Note

Localization to different languages is supported only for `PropertyId` values. Values for `ThingType` and `PropertySetTypeId` are **not** localized.

### **i** Note

READINGS\_T is the underlying series table, which in fact is a view. Inserting data is only possible for READINGS\_T. The underlying table is a series table with series key (Thing, ThingType, PropertySetTypeId, PropertyId) that is equidistant piecewise. This view is not partitioned. If large amounts of data need to be stored in This view, a partitioning scheme needs to be set up. For more information, see the [SAP HANA Administration Guide](#).

## LOCATIONS / LOCATIONS\_T

This view contains geolocation data.

### **i** Note

The view has no keys as keys have a negative effect on compression.

Table 32: LOCATIONS / LOCATIONS\_T

Key	Column	Type	Description
-	Thing	String (32)	Identifies the Thing
-	Timestamp	UTCTimestamp	The time at which the measurement was taken
-	ThingType	String (81)	Identifies the ThingType  This values is needed because a Thing can have multiple ThingTypes.
-	PropertySetTypeId	String (30)	The property within the ThingType used to refer to a PropertySetType  This value corresponds to the column ID in The view ThingTypePropertyType.
-	PropertyId	String (30)	The property within the PropertySetType  This value corresponds to the column ID in The view PropertySetTypePropertyType.

Key	Column	Type	Description
-	Location	hana.ST_GEOMETRY(4326)	Defines the geolocation  For more information about ST_GEOMETRY, see the <a href="#">SAP HANA Spatial Reference</a> .
-	GeoLayerName	String (30)	
-	GeoLayerLevel	Integer	
-	IndicatorType	String (30)	
-	IndicatorValue	BinaryFloat	

The columns ThingType, PropertySetTypeId, and PropertyId together are equivalent to "Metric ID" (measurements).

#### **i** Note

Localization to different languages is supported only for PropertyId values. Values for ThingType and PropertySetTypeId are **not** localized.

#### **i** Note

LOCATIONS\_T is the underlying series table, which in fact is a view. Inserting data is only possible for LOCATIONS\_T. The underlying table is a series table with series key (Thing, ThingType, PropertySetTypeId, PropertyId) that is equidistant piecewise. This view is not partitioned. If large amounts of data need to be stored in This view, a partitioning scheme needs to be set up. For more information, see the [SAP HANA Administration Guide](#).

## MASTER\_DATA

This view contains master data of things. Values of properties of property set types marked with DataCategory = MasterData are stored in this view.

Table 33: MASTER\_DATA

Key	Column	Type	Description
x	Thing	String (32)	Identifies the Thing
x	ThingType	String (81)	Identifies the ThingType  This values is needed because a Thing can have multiple ThingTypes.

Key	Column	Type	Description
x	PropertySetTypeId	String (30)	The property within the <code>ThingType</code> used to refer to a <code>PropertySetType</code>  This value corresponds to the column ID in The view <code>ThingTypePropertyType</code> .
x	PropertyId	String (30)	The property within the <code>PropertySetType</code>  This value corresponds to the column ID in The view <code>PropertySetTypePropertyType</code> .
-	PropertyValue	String (256)	The actual value assigned to the property

## EVENTS

This view contains events.

Table 34: EVENTS

Key	Column	Type	Description
x	Event not null	String (32)	Uniquely identifies the <code>Event</code>
-	Timestamp not null	UTCTimestamp	The time at which the event occurred
-	ExternalId	String (255)	An external ID to link the <code>Event</code> to a representation in an external system
-	BusinessTimestamp	UTCTimestamp	
-	Status	String (50)	
-	Type	String (81)	
-	Severity	Integer	
-	Code	String (5)	
-	Source	String (100)	

Key	Column	Type	Description
-	ThingId	String (32)	The Thing to which the Event relates to
-	Property	String (255)	The Property of the ThingType of the Thing to which the Event relates, for example com.sap.MyThingType/ myProperty
-	Tenant	String (36)	
-	Description	String (200)	A description of what the Event is about, for example <b>Engine temperature above critical threshold</b>

## WORKACTIVITY

This view contains data related to work activities.

Table 35: WORKACTIVITY

Key	Column	Type	Description
x	ID	String (20)	Uniquely identifies the work activity
-	Name	String (38)	A free-text, <b>nontranslatable</b> short description of the work activity
-	TypeCode	String (20)	The TypeCode of the work activity (see table WORKACTIVITY_TYPE_CODE_DESCRIPTION)
-	Priority	String (20)	The Priority of the work activity (see table WORKACTIVITY_PRIORITY_DESCRIPTION )

Key	Column	Type	Description
-	Status	String (20)	The <code>Status</code> of the work activity (see table <code>WORKACTIVITY_STATUS_DESCRIPTION</code> )
-	StartTS	UTCTimestamp	
-	EndTS	UTCTimestamp	
-	AssignedTo	String (50)	
-	PlannerGroup	String (3)	
-	WorkCenter	String (8)	
-	Description	String (200)	A free-text, <b>nontranslatable</b> description of the work activity
-	ComponentThingId	String (32)	The component <code>Thing</code> to which the work activity relates (see table <code>Thing</code> in <a href="#">Views for Metadata [page 39]</a> )
-	AssetThingId	String (32)	The asset <code>Thing</code> to which the work activity relates (see table <code>Thing</code> in <a href="#">Views for Metadata [page 39]</a> )
-	ReportedBy	String (50)	
-	ReportedTS	UTCTimestamp	

## WORKACTIVITY\_PRIORITY\_DESCRIPTION

This view contains translatable descriptions of priorities of work activities.

Table 36: WORKACTIVITY\_PRIORITY\_DESCRIPTION

Key	Column	Type	Description
x	ID	String (20)	Uniquely identifies the priority of work activities
x	Language	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>



Key	Column	Type	Description
-	Description	String (60)	Translated text describing the priority

## WORKACTIVITY\_STATUS\_DESCRIPTION

This view contains translatable descriptions of statuses of work activities.

Table 37: WORKACTIVITY\_STATUS\_DESCRIPTION

Key	Column	Type	Description
x	ID	String (20)	Uniquely identifies the status of work activities
x	Language	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
-	Description	String (60)	Translated text describing the status

## WORKACTIVITY\_TYPE\_CODE\_DESCRIPTION

This view contains translatable descriptions of type codes of work activities.

Table 38: WORKACTIVITY\_TYPE\_CODE\_DESCRIPTION

Key	Column	Type	Description
x	ID	String (20)	Uniquely identifies the type code of work activities
x	Language	String (2)	Defines the language, for example <code>de</code> , or <code>en</code>
-	Description	String (60)	Translated text describing the type code

## 2.4 Installing R Packages for Data Science Services

### Context

You install R packages on the R server that you use for data science services. To get an overview of where to find the data science services provided with SAP Predictive Maintenance and Service, on-premise edition, see [Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#). Follow the instructions below to install the R packages that are required to work with data science services.

### Procedure

1. Create a data fusion view schema as explained in the section [Creating the Data Fusion View Schema \[page 59\]](#).

This schema is needed to combine OT data (asset sensor data) and IT data (business data).

2. Integrate R into SAP HANA, proceed as described in the following guide: [http://help.sap.com/hana\\_platform](http://help.sap.com/hana_platform): ► [References](#) ► [R Integration Guide](#) ►.

To use data science services for SAP Predictive Maintenance and Service, on-premise edition, you use R packages on RServe. To use R and process R code in the context of the SAP HANA database, you first need to integrate R into SAP HANA.

3. Check that Java 8 is installed on your RServe by executing the command `Java -version`.

If Java 8 is **not** installed on your RServe, install it and make sure that the environment variables point to it correctly.

4. On RServe, install dependent R packages as explained in [Installing Dependent R Packages on RServe \[page 61\]](#).
5. On RServe, install R packages for data science services as explained in [Installing R Packages for Data Science Services on RServe \[page 62\]](#).
6. Test the installation of data science services as explained in [Testing the Installation of Data Science Services \[page 64\]](#).

### Related Information

[http://help.sap.com/hana\\_platform](http://help.sap.com/hana_platform)

[Download R on r-project webpage](#) ➔

[Uninstalling R Packages for Data Science Services on RServe \[page 65\]](#)

---

## 2.4.1 Creating the Data Fusion View Schema

### Context

The technical user `<PDMS_DS_ADMIN>` is required who owns a data fusion view created in a schema.

### Procedure

1. Open the SAP HANA SQL console.
2. To create the schema for the data fusion view `SAP_PDMS_DSS_FUSION_SCHEMA`, execute the following command using the `SYSTEM` user in SAP HANA studio:

```
CREATE SCHEMA SAP_PDMS_DSS_FUSION_SCHEMA OWNED BY <PDMS_DS_ADMIN>;
```

## 2.4.2 Creating Data Fusion Views for Data Science Services

### Prerequisites

You have created the schema `SAP_PDMS_DSS_FUSION_SCHEMA` as explained in the chapter [Creating the Data Fusion View Schema \[page 59\]](#).

### Context

Before you can train and score models using algorithms, you have to create views in the SAP HANA system that you use for the data science services of SAP Predictive Maintenance and Service, on-premise edition. These views combine OT data from different metrics in the metrics storage with IT data.

### Procedure

To create a data fusion view, execute the following command in the SAP HANA SQL console:

## Sample Code

```
CREATE VIEW "SAP_PDMS_DSS_FUSION_SCHEMA"."<DATA_FUSION_VIEW_NAME>" (  
  "Thing",  
  "ThingType",  
  "Timestamp",  
  "<TABLE_FIELD_1>",  
  "<TABLE_FIELD_2>",  
  "<TABLE_FIELD_n>") AS SELECT  
  "Thing",  
  "ThingType",  
  "Timestamp",  
  "<TABLE_FIELD_1>",  
  "<TABLE_FIELD_2>",  
  "<TABLE_FIELD_n>"  
FROM  
  "SAP_PDMS_DSS_FUSION_SCHEMA"."<TABLE_WHERE_DATA_NEEDED_FOR_DATA_FUSION_ARE_LOCATED>";
```

### **i** Note

The fields `Thing`, `ThingType`, and `Timestamp` are mandatory. The `Thing` column contains the asset IDs.

Add the columns `<TABLE_FIELD_<x>` to your data fusion view according to the algorithm that you want to use. The algorithms and your specific business case determine which columns you need in the data fusion view.

Some algorithms have additional requirements:

- PCA  
Expects data columns that are not used in the `group.by` or `order.by` argument to be numeric. These columns typically contain readings from sensors.

### **i** Note

Make sure that training data and scoring data do not contain any `NULL` values.

Besides these columns, you also need to specify the columns that contain data that you want to use in the algorithm training and scoring. These columns typically contain readings from sensors.

#### **Mandatory fields:**

- A field for grouping sensor readings (used by parameter `group.by` in the model configuration)
- A field for sorting sensor readings (used by parameter `order.by` in the model configuration)
- EMD  
Expects data columns that are not used in the `group.by` argument to be numeric. Besides these columns, you also need to specify the columns that contain data that you want to use in the algorithm training and scoring. These columns typically contain readings from sensors.

### **i** Note

Make sure that training data and scoring data do not contain any `NULL` values.

#### **Mandatory fields:**

- A field for grouping sensor readings (used by parameter `group.by` in the model configuration)
- Weibull

Expects a numeric column that typically denotes the age of an asset. Additionally, it expects a status column containing the values 0 or 1, where 1 typically means that a failure has occurred on a component and 0 means that no failure has occurred yet.

**Mandatory fields:**

- A field for input data containing the age information (used by parameter `nameAgeColumn` in the model configuration)
- A field for input data containing the failure information (used by parameter `nameFailureColumn` in the model configuration)

## 2.4.3 Installing Dependent R Packages on RServe

### Prerequisites

- R and RServe are correctly integrated into SAP HANA as described in the following guide: [http://help.sap.com/hana\\_platform:References > R Integration Guide](http://help.sap.com/hana_platform:References>R Integration Guide).
- R is set up correctly and you can open an R console by typing `R` in the command line tool.

### Context

Before you install the R packages that are required to work with the data science services provided by SAP Predictive Maintenance and Service, on-premise edition 1.0, you need to install dependent R packages as explained in the following steps.

### Procedure

1. In the command line tool, execute the command `R` with root privilege to open the R console.
2. To download dependent R packages from the Comprehensive R Archive Network (CRAN), execute the following command:


**i Note**

To download dependent R packages from CRAN directly, you need to have Internet access on your RServe.

```
install.packages("dplyr")
install.packages("magrittr")
install.packages("survival")
install.packages("data.table")
install.packages("emdist")
```

---

3. **If you cannot automatically download dependent R packages from CRAN**, you need to manually download and install the dependent R packages.

- a. Go to <https://cran.r-project.org/> .
- b. Download the dependent R packages to your local client.
- c. Transfer the dependent R packages to your RServe.
- d. To install the dependent R packages, execute the following command:

```
setwd("PATH/TO/PACKAGES/")
install.packages("dplyr_{version}.tar.gz", repos = NULL, type="source")
install.packages("magrittr_{version}.tar.gz", repos = NULL, type="source")
install.packages("survival_{version}.tar.gz", repos = NULL, type="source")
install.packages("data.table_{version}.tar.gz", repos = NULL, type="source")
install.packages("emdist_{version}.tar.gz", repos = NULL, type="source")
```

## Next Steps

[Installing R Packages for Data Science Services on RServe \[page 62\]](#)

## Related Information

[SAP HANA R Integration Guide](#)

[The Comprehensive R Archive Network](#) 

## 2.4.4 Installing R Packages for Data Science Services on RServe

### Prerequisites

- You have correctly downloaded and installed dependent R packages from the Comprehensive R Archive Network (CRAN).

For more information, see [Installing Dependent R Packages on RServe \[page 61\]](#).

## Context

To install the R packages for data science services that contain data science functions, abstraction layers, and algorithms, proceed as follows:

## Procedure

1. Extract the `XSACPMSDSLIB<VERSION>.ZIP` file to the host where you have set up R.
2. Unzip the above mentioned file again to get the four `.tar.gz` files.

These are the delivered R packages that can be installed directly on the R:

- `com.sap.pdms.datascience.tar.gz`
- `com.sap.pdms.datascience.pca.tar.gz`
- `com.sap.pdms.datascience.dbfa.emd.tar.gz`
- `com.sap.pdms.datascience.rul.weibull.tar.gz`

3. In the command line tool, execute the command `R` with root privileges to open the R console.
4. To install the R packages for data science services of SAP Predictive Maintenance and Service, on-premise edition, execute the following command:

```
setwd("PATH/TO/PACKAGES/")
install.packages("com.sap.pdms.datascience.tar.gz",
                 repos = NULL, type="source")
install.packages("com.sap.pdms.datascience.pca.tar.gz",
                 repos = NULL, type="source")
install.packages("com.sap.pdms.datascience.dbfa.emd.tar.gz",
                 repos = NULL, type="source")
install.packages("com.sap.pdms.datascience.rul.weibull.tar.gz",
                 repos = NULL, type="source")
```

## Next Steps

[Testing the Installation of Data Science Services \[page 64\]](#)

## Related Information

[Uninstalling R Packages for Data Science Services on RServe \[page 65\]](#)

## 2.4.5 Testing the Installation of Data Science Services

### Context

After you have installed the REST APIs for data science services, you can test the installation of data science services by using REST calls.

### Procedure

- Use the following REST API to test the installation of data science services: `https://<host>:<port>/datascience/api/v1/info`.

### Results

You can check if all packages are installed by validating their versions:

#### Sample Code

```
{
  "rServerPlatform": "x86_64-pc-linux-gnu",
  "rVersion": "R version 3.3.0 beta (2016-03-30 r70404)",
  "rNickname": "Supposedly Educational",
  "pdmsRVersion": "1.2.0",
  "packageStatuses": [
    {
      "namespace": "com.sap.pdms.datascience",
      "dataScienceService": "PCA",
      "rPackageVersion": "com.sap.pdms.datascience.pca 1.2.0",
      "rTrainFunction": "FOUND PCAttrain",
      "rScoreFunction": "FOUND PCAscore"
    },
    {
      "namespace": "com.sap.pdms.datascience",
      "dataScienceService": "RUL",
      "rPackageVersion": "com.sap.pdms.datascience.rul.weibull 1.2.0",
      "rTrainFunction": "FOUND Weibulltrain",
      "rScoreFunction": "FOUND Weibullscore"
    }
  ]
}
```

If the response of the REST call is `Failed`, please repeat the installation of the data science services.



---

## 2.4.6 Uninstalling R Packages for Data Science Services on RServe

### Context

If you want to uninstall the R packages delivered with SAP Predictive Maintenance and Service, on-premise edition 1.0, proceed as follows:

### Procedure

1. In the command line tool, execute the command `R` to open the R console.
2. To uninstall the R packages for data science services of SAP Predictive Maintenance and Service, on-premise edition, execute the following command:

```
setwd("PATH/TO/PACKAGES/")  
remove.packages("<package name without extension .tar.gz>").
```

### Related Information

[Installing R Packages for Data Science Services on RServe \[page 62\]](#)

## 2.5 SAP IQ

### 2.5.1 Data Model Variants

To model your SAP IQ database tables, you can choose between horizontal table layouts and vertical table layouts.

When you create your readings table in SAP IQ, you can decide which table layout best suits your use case. The following topics give you an overview of different table layouts with examples, and pros and cons for each table layout.

If you need to store sensor readings with one time stamp for several metrics, for example, you might prefer a horizontal table layout. For more information, see the section [Horizontal Table Layout \[page 66\]](#).

If you need to store sensor readings with several time stamps for several metrics, for example, you might prefer a vertical table layout. For more information, see the section [Vertical Table Layout \[page 68\]](#).

## 2.5.1.1 Horizontal Table Layout

You can choose between single horizontal tables and multiple horizontal tables.

In a horizontal table, each sensor or feature has one column. Columns do thus **not** correspond to properties.

Table 39:

Timestamp	AssetId	Property1	Property2	...	PropertyN
12345	A1	42	27	...	12
13456	A2	23	19	...	14

### Example

A train has 2 bogies with 2 axes and 2 disk brakes each. Let's assume we are measuring the disk-brake temperature: There is one column per disk brake in the horizontal table. If another disk-brake temperature sensor is added, a new column is added.

Table 40:

Timestamp	AssetId	Disk-brake1 temp	Disk-brake2 temp	...
1	T1	42	37	...
1	T2	38	25	...

To deal with non-synchronized time stamps, different measures can be combined under the same time stamp, and their original time stamps can be stored as additional columns.

Table 41:

Timestamp	AssetId	Temperature_TS	Temperature_Value	Pressure_TS	Pressure_Value
10	T1	11	42.7	13	23.2

In the previous example, the time stamp is rounded to increments of 10. The columns `Temperature_TS` and `Pressure_TS` are the original time stamps.

### Pros and Cons

Table 42:

Pros	Cons
A table consists of relatively few rows. If you have, for example, 100 properties recorded every second for 1,000 assets, this would generate ~86.4 million rows a day.	All properties must be measured at the same time, otherwise the table will be sparse.

Pros	Cons
Storage efficiency is good because only one time stamp, asset ID, and properties ID are stored for all properties.	SAP IQ supports up to 45K columns. However, performance can be impaired if there are more than 10K columns. For more information, see <a href="#">SAP IQ: Physical Limitations</a> .
Tables with this format are particularly efficient for business intelligence (BI) and data scientists.	

`SELECT *` queries should be avoided. Instead, only the relevant columns should be selected, to take full advantage of column-based storage of SAP IQ.

## Multiple Horizontal Tables (Hybrid Approach)

To counter the problems that arise with a very large number of columns, you can split one big table into several smaller tables. This combines the horizontal and the vertical approach. You can split up a table into different tables containing sensor readings based on certain asset IDs, for example. You could define that sensor readings from assets 1 to 10 are to be stored in the table TABLE\_1, sensor readings from assets 11 to 20 in the table TABLE\_2, and so on. You can also create landing tables. Incoming sensor readings would be stored in a landing table, which is open for write access at the moment the sensor readings are recorded. In this case, it is not predefined which sensor readings are stored in which table. You can also use partitioning to split up tables. For more information on partitioning, see the following example.

### Example

You have sensor readings for different assets. In the single horizontal table layout, all readings for all assets are collected in one table. You can, however, split up the table according to asset IDs. You would then get a database table for each asset, which could look like this:

Table 43: Table Name: <AssetId>

Timestamp	Temperature_TS	Temperature_Value	Pressure_TS	Pressure_Value
10	11	42.7	13	23.2

## Pros and Cons

Table 44:

Pros	Cons
You can perform as many data manipulations (such as <code>LOAD</code> commands) as you have separate database tables. If you use, for example, 10 tables separated by partitioning, data can be uploaded to these 10 tables in parallel.	Time stamps across property IDs need to be synchronized to avoid a sparse table.
A table consists of relatively few rows. If you have, for example, 100 properties recorded every second for 1,000 assets, this would generate ~86.4 million rows a day.	

Pros	Cons
The physical limitations of SAP IQ can be handled more easily. For more information about the physical limitations of SAP IQ, see <a href="#">SAP IQ: Physical Limitations</a>	
This table format provides room for adding columns when new property IDs are added, or when new property information consisting of key-value pairs is added to a property ID.	

## 2.5.1.2 Vertical Table Layout

You can choose between single vertical tables and multiple vertical tables.

### Single Vertical Table Layout

In a vertical table, each property for each asset has its own row.

Table 45:

Timestamp	AssetId	PropertyId	Value
12345	A1	Property1	42
13456	A1	Property2	27

If further property information consisting of key-value pairs is added to the table, new columns or rows can be added.

### Pros and Cons

Table 46:

Pros	Cons
This table layout is suitable for sparse time series because properties do not need to be measured at the same time.	A table consists of a relatively high number of rows. If you have, for example, 100 properties recorded every second for 1,000 assets, this would generate ~8.64 billion rows a day.
	Performance is hard to predict if there are more than 8 billion rows in a single table.
	The same time stamps and asset IDs are repeated for every metric, which results in a less efficient storage approach. Compression might alleviate this problem to some extent.

Pros	Cons
	<p>Analysis of readings may require temporal joins of several properties, which is time-consuming. There is a limit of 16 joins in SAP IQ. If time stamps are not synchronized, simple SQL equi joins do not suffice. Time stamps need to be rounded off, and values need to be interpolated or aggregated. If time stamps are missing, a complete time series (table similar to the SAP HANA function <code>SERIES_GENERATE_TIME</code>) is required.</p> <p>For more information on the SAP HANA function, see <a href="#">SERIES_GENERATE</a>.</p>
	<p>This table layout is difficult to use with business intelligence (BI) because self-joins are required for analysis.</p>
	<p>Adding additional metric information consisting of key-value pairs for a specific metric may result in additional sparse columns or sparse rows. The number of &lt;key, value&gt; pairs is limited by the number of columns in the table.</p>

## Multiple Vertical Table Layout

You could define tables for each property ID, for example. A table following this layout approach is shown below.

### Example

You have sensor readings for different assets. In the single horizontal table layout, all readings for all assets are collected in one table. You can, however, split up the table according to asset IDs. You would then have a database table for each asset, which could look like this:

Table 47: Table Name: <PropertyId>

Timestamp	AssetId	Temperature_TS	Temperature_Value	Pressure_TS	Pressure_Value
10	T1	11	42.7	13	23.2

### Pros and Cons

Table 48:

Pros	Cons
Properties can be measured at different times.	The same time stamps and asset IDs are repeated for every metric, which is less efficient. Compression might alleviate this problem to some extent.

Pros	Cons
A table consists of relatively few rows. If you have, for example, 100 properties recorded every second for 1,000 assets, this would generate ~86.4 million rows a day.	Analysis of readings may require temporal joins of several properties, which is time-consuming. There is a limit of 16 joins in SAP IQ. If time stamps are not synchronized, simple SQL equi joins do not suffice. Time stamps need to be rounded off, and values need to be interpolated or aggregated. If time stamps are missing, a complete time series (table similar to the SAP HANA function <code>SERIES_GENERATE_TIME</code> ) is required.  For more information on the SAP HANA function, see <a href="#">SERIES_GENERATE</a> .
Property IDs do not need to be repeated in each row, as this is denoted implicitly (for example, by using <code>propertyId</code> as the table name).	There is a table limit in SAP IQ of approximately 4 million indexes.  For more information about the physical limitations of SAP IQ, see <a href="#">SAP IQ: Physical Limitations</a>
Different loaders (clients that execute SQL LOAD commands) can load data to SAP IQ at the same time.	The overall load performance is worse than when using a horizontal table layout.

## 2.5.2 Data Import to SAP IQ

This topic relevant to you if you use SAP IQ as external data source.

Importing data into SAP IQ highly depends upon factors outlined below:

- Hardware Setup (Simplex/Multiplex Setup, hardware resources of each node, etc.)
- Underlying data structure (Horizontal vs Vertical format, Partitioning, etc.)
- SQL statement used (`INSERT` vs. `LOAD`)
- Parallelization (Landing Tables, Load Balancing, etc.)

### Hardware Setup

SAP IQ highly relies on # of Cores and ratio of IO Bandwidth / # of Cores. For more information about hardware sizing for SAP IQ, see the [Hardware Sizing Guide](#). A few general rules are the following:

- Increase in # of Cores increases data load performance (capped by IO Bandwidth and Storage speeds).
- Each core needs an IO Bandwidth in the range of 20 - 40 MB/s.
- Having less memory could hurt a lot. The chapter *Sizing Memory* in the [Hardware Sizing Guide](#) provides an overview of percentages of RAM to be allocated for various caches.

---

## Cluster Setup

SAP IQ offers two modes of operation: **Simplex** and **Multiplex**. In the former, a single physical node is used which acts as both **WRITER** and **READER**. In the latter case, multiple physical nodes are used with one being a coordinator node. For more information about roles of a coordinator node and suggestions in general, see the chapter *Multiplex Best Practices* in the [Best Practices Guide](#).

## SQL Statements

SAP IQ primarily supports two ways to store data into database: using the `INSERT` statement or the `LOAD` statement.

### INSERT Statement

This statement inserts a single row or a selection of rows, from elsewhere in the current database, into the table. This command can also insert a selection of rows from another database into the table. For more information, see [INSERT Statement](#).

As used by numerous databases, the `INSERT` statement is a trivial SQL command for inserting single rows into a database table.

Advantages over the `LOAD` command:

- Less overhead for preparing an SQL statement.
- Suits for use where data does not arrive continuously, but at irregular intervals and small chunks (few rows).

### Batching

To allow multiple `INSERT` statements to be executed at once (sent as a single network request to the SAP IQ server), the SAP IQ driver supports batching using `PreparedStatement` objects. This allows to `INSERT` multiple rows in a table and has a limit of 65,535 `INSERTS`/batch. If more number of rows are added to the batch, the batch is split into multiples of 65,535.

### LOAD Statement

For more information about using SQL statements to imports data into a database table from an external file, see [LOAD TABLE Statement](#).

The `LOAD` statement is particularly designed for uploading huge data files in less time. A `LOAD` command can only run on single table.

Advantages over the `INSERT` command

- Data can be directly loaded from files.
- Speed of data ingestion improves with larger files, however, is based on physical hardware and might start degrading after a certain point.

### Batching

The `LOAD` statement also supports loading multiple files in a single statement. Files are loaded sequentially though. In addition to multiple files, a compressed file can also be provided which is then uncompressed by SAP IQ and finally loaded. However, usage of this compressed file should be evaluated against the overhead of compression and uncompression.

## Input Files

- **Physical files on disk:** files stored on a disk. Ideal would be to have a networked storage where SAP IQ databases are also locally stored. This allows SAP IQ to read files locally and load into database. Note the networked storage part, this allows local IO to be routed over different network links thus maintaining high IO throughput.
- **UNIX-named Pipes:** using this shared memory approach, data can be directly streamed without storing onto disk thus reducing latency.

## Parallel LOADs

A `LOAD` statement acquires a lock on the table into which data is loaded. This prevents users from running more than one parallel `LOAD` statements on the same table. To circumvent this problem, a mechanism using **landing tables (LT)** can be employed.

### Landing Tables (LT)

An LT is a physical table residing in a database which represents a part of the main table. Thus, multiple `LOAD` commands can be run simultaneously against different physical LTs. Salient features of this approach:

- Number of LTs depends on the parallelization factor of the `LOAD` command.
- More than one LTs can be employed, however, their amount depends on various factors.
- One of the criteria for creating LTs would be a round-robin scheme with fixed number of LTs, for example 5.
- A `UNION ALL` SQL View on all LTs abstracts away implementation details.

### Selecting the Number of LTs

Consider the following when selecting the number of LTs:

- Experiment with the number of threads a physical node is able to handle. If you know the number of threads required for a `LOAD` command, you can approximately calculate how many parallel `LOAD` commands can be executed.
- Experiment with available IO bandwidth and storage speeds.
- # of Cores and memory size in a physical machine are a limiting factor.

### Choosing between INSERT and LOAD Statement

The `INSERT` statement is better in cases of irregular and short chunks of data.

The `LOAD` statement provides higher performance for bigger files.

Hence, for a scenario to load readings data comprising of various measurements recorded at particular intervals, a `LOAD` command would prove to be performant. This is regardless of whether reading data is timestamp-aligned for all measurements, or if each measurement has a different timestamp.

However, in a scenario where data could arrive virtually at any time, for instance, events, an `INSERT` statement along with batching would provide better throughput. Events are tuples consisting of data collected during an incident. Events are generally unplanned entities which are recorded due to a trigger. As events are recorded asynchronously, there could be a case where they are not timestamp-aligned. Consequently, event data should be preferably stored in a tall format table. Here, as batching is also employed, it ensures that all event data is transmitted in chunks of 65,536 thus reducing several network requests being sent to and from.



---

## Multiplex Setup

The cluster mode of SAP IQ is known as Multiplex. For more information about setting up and using a Multiplex, see the [Hardware Sizing Guide](#) and the [Best Practices Guide](#). This setup also enables fine tuning for dedicated operations and balancing as outlined below.

### Roles

Nodes in a Multiplex setup could be assigned specific roles for performing fixed operations, for instance, **READ** or **WRITE** operations. This allows dedicated nodes to only load data and others for only serving. All operations are coordinated through a coordinator node which is able to execute both **READ** and **WRITE** operations.

### Load Balancing

All requests need to be load-balanced by the client. This can be done using a simple round-robin-request-sending strategy or complex approach as follows:

- The client responsible for sending SQL commands to SAP IQ maintains a list of all nodes in Multiplex.
- The client maintains separate lists for **READ** and **WRITE** nodes.
- For each **WRITE** request, the client first executes a `sp_iqstatistics()` procedure on a node.
  - If, the node has enough resources available, the client executes data loading on this node.
  - Else, the client selects next the node (perhaps with a round-robin strategy) and repeats the process.
- For each **READ** request, the client follows similar procedure as outlined above.

## 2.6 Uninstalling Components of SAP Predictive Maintenance and Service, on-premise edition

### Prerequisites

- You are logged on to SAP HANA XS Advanced in the space where the components you want to undeploy are located.

## Context

If you no longer need components of SAP Predictive Maintenance and Service, on-premise edition or the product itself anymore, you can uninstall the respective files using the command line tool.

## Procedure

### Uninstalling components

1. In the command line tool, display the components of SAP Predictive Maintenance and Service, on-premise edition, that are available to you by executing the following command:

```
xs lc
```

You receive a list of software components that are available in the space concerned.

2. Copy the *software component* name of the component you want to uninstall.
3. To uninstall this component, execute the following command:

```
xs uninstall <software component you want to uninstall>
```

You have uninstalled the respective component of SAP Predictive Maintenance and Service, on-premise edition from your system.

4. To delete the component entry from the Insight Provider Catalog, proceed as described in the chapter *Delete an Insight Provider Entry* in the guide [Configuration of SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02](#).

### Note

The `CSRF` token needs to be provided in the header. For information about how to retrieve a `CSRF` token, see the chapter *Retrieve a CSRF Token* in the guide [Configuration of SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02](#).

### Uninstalling the product (if required)

5. In the command line tool, display the products that are available to you by executing the following command:

```
xs pc
```

You receive a list of products that are available in the space concerned.

6. Copy the product *name* `SAP_PDMS_ON-PREMISE` that you want to uninstall.
7. To uninstall the product, execute the following command:

```
xs uninstall "SAP_PDMS_ON-PREMISE" -pv
```

You have uninstalled SAP Predictive Maintenance and Service, on-premise edition from your system.

# 3 Installing Patches for SAP Predictive Maintenance and Service, on-premise 1.0 FP02

## Prerequisites

You have installed SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 as described in the chapter [Installing SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 \[page 14\]](#).

## Context

You want a new patch delivered for SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02. Proceed as described in the following steps:

## Procedure

1. To download the patch, go to the [SAP Software Download Center: SAP PDMS ON-PREMISE 1.0](#) and download the `<Patch Filename>.ZIP` file.

Table 49: Patches

Patch	Filename
02	SAPPDMSONPRO2P_2-71002247.ZIP
03	SAPPDMSONPRO2P_3-71002247.ZIP

2. Log on to XSA to the space where SAP Predictive Maintenance and Service, on-premise edition 1.0 FP02 is installed.
3. To install the patch, run the following command:

### Sample Code

```
xs install <Patch Filename>.ZIP -e <pdms-router.mtaext>,<ahcc.mtaext>,<derived-signals.mtaext>,<work-activity.mtaext>
```

## **i** Note

Use the same extension files (.mtaext) that were initially used for the installation of SAP Predictive Maintenance and Service, on-premise edition 1.0 FPO2.

For more information about the extension files, see the following chapters:

- [Extension File for pdms-router \[page 18\]](#)
- [Extension File for Asset Health Control Center \[page 20\]](#)
- [Extension File for Insight Provider for Derived Signals \[page 20\]](#)
- [Extension File for Insight Provider for Work Activities \[page 21\]](#)

## **Related Information**

[Installation of SAP Predictive Maintenance and Service, on-premise edition \[page 8\]](#)

[SAP Note 2404329](#) 

---

# Important Disclaimers and Legal Information

## Coding Samples

Any software coding and/or code lines / strings ("Code") included in this documentation are only examples and are not intended to be used in a productive system environment. The Code is only intended to better explain and visualize the syntax and phrasing rules of certain coding. SAP does not warrant the correctness and completeness of the Code given herein, and SAP shall not be liable for errors or damages caused by the usage of the Code, unless damages were caused by SAP intentionally or by SAP's gross negligence.

## Accessibility

The information contained in the SAP documentation represents SAP's current view of accessibility criteria as of the date of publication; it is in no way intended to be a binding guideline on how to ensure accessibility of software products. SAP in particular disclaims any liability in relation to this document. This disclaimer, however, does not apply in cases of willful misconduct or gross negligence of SAP. Furthermore, this document does not result in any direct or indirect contractual obligations of SAP.

## Gender-Neutral Language

As far as possible, SAP documentation is gender neutral. Depending on the context, the reader is addressed directly with "you", or a gender-neutral noun (such as "sales person" or "working days") is used. If when referring to members of both sexes, however, the third-person singular cannot be avoided or a gender-neutral noun does not exist, SAP reserves the right to use the masculine form of the noun and pronoun. This is to ensure that the documentation remains comprehensible.

## Internet Hyperlinks

The SAP documentation may contain hyperlinks to the Internet. These hyperlinks are intended to serve as a hint about where to find related information. SAP does not warrant the availability and correctness of this related information or the ability of this information to serve a particular purpose. SAP shall not be liable for any damages caused by the use of related information unless damages have been caused by SAP's gross negligence or willful misconduct. All links are categorized for transparency (see: <http://help.sap.com/disclaimer>).

**go.sap.com/registration/  
contact.html**

© 2017 SAP SE or an SAP affiliate company. All rights reserved.  
No part of this publication may be reproduced or transmitted in any form or for any purpose without the express permission of SAP SE or an SAP affiliate company. The information contained herein may be changed without prior notice.  
Some software products marketed by SAP SE and its distributors contain proprietary software components of other software vendors. National product specifications may vary.  
These materials are provided by SAP SE or an SAP affiliate company for informational purposes only, without representation or warranty of any kind, and SAP or its affiliated companies shall not be liable for errors or omissions with respect to the materials. The only warranties for SAP or SAP affiliate company products and services are those that are set forth in the express warranty statements accompanying such products and services, if any. Nothing herein should be construed as constituting an additional warranty.  
SAP and other SAP products and services mentioned herein as well as their respective logos are trademarks or registered trademarks of SAP SE (or an SAP affiliate company) in Germany and other countries. All other product and service names mentioned are the trademarks of their respective companies.  
Please see <http://www.sap.com/corporate-en/legal/copyright/index.epx> for additional trademark information and notices.