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1 Getting Started

You use the Master Guide to get an overview of SAP MII, its software units and scenarios from a technical perspective. The Master Guide is a planning tool that helps you to design your system landscape. It refers you to the required detailed documentation, mainly the following:

- Installation guides for single software units
- SAP Notes
- Configuration documentation

For a general overview of the available SAP documentation, see *The Main SAP Documentation Types*.

The Master Guide consists of the following main sections:

- **SAP MII Overview**, including an overview of the **OEE_MII** and **OEE_ERP** components
  - A short introduction to SAP MII
  - A description of the software units for SAP MII, OEE_MII, and OEE_ERP
  - The software component matrix that provides the information on which components are used in the business scenarios and if the corresponding component is mandatory or optional
  - Minimal system landscape information
  - The overall implementation sequence for SAP MII
- Information about the business scenarios

**Constraints**

The business scenarios that are presented here serve as an example of how you can use SAP software in your company. The business scenarios are only intended as a model and do not necessarily run the way they are described here in your customer-specific system landscape. Ensure to check your requirements and systems to determine whether the scenarios can be used productively at your site. Furthermore, we recommend that you test the scenarios thoroughly in your test systems to ensure they are complete and free of errors before going live.

This Master Guide primarily discusses the overall technical implementation of SAP MII, rather than its subordinate components. This means that additional software dependencies might exist without being mentioned explicitly in this document. You can find more information on component-specific software dependencies in the corresponding installation guides.

**Related Master Guides**

This Master Guide is based on Master Guides for cross-industry solutions. You can find more information about the relevant solutions in the following:

*SAP NetWeaver 7.5 Master Guide*

*Master Guide of SAP ERP 6.0*
Important SAP Notes

You must read applicable SAP Notes before you start the installation. These SAP Notes contain the most recent information about the installation, as well as corrections to the installation documentation.

Ensure you have the up-to-date version of each SAP Note.

<table>
<thead>
<tr>
<th>SAP Note Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1759717</td>
<td>Transactions in PENDING state for long duration</td>
</tr>
</tbody>
</table>

Naming Conventions

In this document, apply the following:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW 750</td>
<td>NetWeaver Java Application Server</td>
</tr>
</tbody>
</table>

Example

Log on as user `<SAPSID>adm`.

If your SAP system ID is `C11`, log on as user `C11adm`. 
SAP MII Overview

SAP MII 15.4 allows you to integrate your plant and enterprise systems and display integrated data to your employees using SAP NetWeaver. You can use SAP MII to view, measure, and compare the performance of plants and assets with different automation system infrastructures. SAP MII reduces the cost of synchronizing plant and enterprise business processes by using the following:

- Plant system connectors
- Business logic services
- Integration scenarios

You can also use SAP MII to analyze plant activity using OEE_MII and OEE_ERP. OEE is a manufacturing standard term to allow users to analyze plant activity both in real time and historically to measure, analyze, and adjust manufacturing performance. OEE utilizes the most common and important sources of manufacturing data and distils them into metrics that provide a gauge for measuring the availability and performance of equipment and the quality of goods that the equipment produces.

By assessing equipment performance, plant managers can gain insight into the efficiency and effectiveness of the manufacturing processes running in their plant. OEE metrics can help them pinpoint problems and gauge their impact on the overall manufacturing process; it provides a method for assessing progress as problems are corrected; it can be implemented quickly and easily. However, OEE is only part of the picture when it comes to achieving overall operational excellence. To be fully effective, OEE must be evaluated within the larger picture of the entire plant floor, and gaining that perspective is more involved.

The most efficient way of getting an overall view of plant operations is to integrate your enterprise software with the plant floor and share the overall manufacturing view to stations throughout the plant floor in real time. This empowers production personnel to make decisions concerning equipment based not only on the OEE metrics they can see for the equipment they operate, but on the current operating status of the entire production.

OEE is comprised of industry and manufacturing standard KPIs and calculations. OEE is in itself an overall percentage KPI of plant performance made up of three components for Quality, Performance, and Availability, which are themselves percentage KPIs based on other component KPIs. The Quality KPI is comprised of component KPIs and calculations for measuring the quality of the parts or product produced, that is good parts versus bad parts. The Availability KPI is comprised of component KPIs and calculations for measuring the available time of equipment versus the actual time equipment was utilized. Finally, the Performance KPI is comprised of component KPIs and calculations for measuring the amount of product produced given the amount of time equipment was available.

Software Units

The following software units are required for SAP MII 15.4:

- SAP NetWeaver Java Application Server
- Java Runtime Environment (JRE) 1.6, on your client machines, and JDK 1.6 on your server
- OEE_MII and OEE_ERP (optional software units)
# Software Component Matrix

This section provides an overview of the software units used in the SAP MII business scenarios. For the latest component version and patch level requirements, see the SAP Support Portal.

<table>
<thead>
<tr>
<th>Software Component</th>
<th>Mandatory or Optional Software Units</th>
<th>Other Components</th>
<th>Optional Components</th>
<th>Clients</th>
</tr>
</thead>
</table>
| Integrating Shop Floor with Enterprise Resource Planning (ERP) System | • SAP NW AS  
• Java  
• XMII  
• MII_ADMIN | • SAP ECC  
• Plant Connectivity (PCo) | Data Historians like Aspentech IP21 or OSI-Soft PI | |
| Plant Information Catalog | • SAP NW AS  
• Java  
• XMII  
• MII_ADMIN | Plant Connectivity (Pco) | Data Historians like Aspentech IP21 or OSI-Soft PI | |
| Developing MII content using Manufacturing Data Objects, KPI Framework, Alert Framework, Query, and Display Templates | • SAP NW AS  
• Java  
• XMII  
• MII_ADMIN | | | |
| MII Content using Business Objects Crystal Reports | • SAP NW AS  
• Java  
• XMII  
• MII_ADMIN | Crystal Enterprise Server | Crystal Reports | |
| Change Management of MII Configurations using Solution Manager | • SAP NW AS  
• Java  
• XMII  
• MII_ADMIN | | Solution Manager | |
| Transport MII Configurations using Change and Transport System (CTS) | • SAP NW AS  
• Java  
• XMII  
• MII_ADMIN | | ABAP CTS System | |
OEE Management

- OEE_ERP 15.0
- OEE_MII 15.4

For OEE Management with HANA, the additional components required are:

- HCO_HBA_OEE 1.0
- HCO_HBA_APPS_OEE 1.0

SAP MII 15.1 SP01 onwards OEE is compatible SAP S/4 HANA on-premise edition 1511.

For more information, see the SAP OEE section in 2268304.

SAP Lumira

Minimal System Landscape

The minimal system landscape for SAP NetWeaver Java Application Server applies to SAP MII 15.3. For more information, see the Master Guide for the SAP NetWeaver Java Application Server.

Installation Options with SAP NetWeaver 7.5 (for Java Hubs)

For SAP Business Suite applications as of SAP Business Suite 7 that are based on an Application Server Java and on hub systems, you can install these applications on SAP NetWeaver 7.5. You can also change from your current release to SAP NetWeaver 7.5. Changing means upgrading or updating. The following approaches for system landscapes for SAP NetWeaver 7.5 are possible:

- Upgrading to SAP NetWeaver 7.50 works for hub systems.
- Embedded deployment continues to work only for SAP NetWeaver 7.0x releases and their enhancement packages (this means, for example, for SAP NetWeaver 7.00, SAP NetWeaver 7.01, and SAP NetWeaver 7.02).

For more information about the technical background, see SAP Note 1874939.

**i Note**

If you want to install Business Suite Java applications, we strongly recommend that you use SAP NetWeaver 7.5 as the platform for your hub systems.

**Caution**

We strongly recommend that you use a minimal system landscape for test and demo purposes only. For performance, scalability, high availability, and security reasons, do **not** use a minimal system landscape as your production landscape.
Overall Implementation Sequence

The following table describes the overall installation sequence for SAP MII. This table contains all available software units. However, to run a specific scenario, you only need a subset of available software units. Some are required only for special processes.

For the latest component version and patch level requirements, see the SAP Support Portal at SAP Support Package Stacks.

For documentation listed in the following table, see References.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>[Required Documentation]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Install SAP NetWeaver Java Application Server.</td>
<td></td>
</tr>
</tbody>
</table>
| 2    | Install SAP MII 15.4  
       | [SAP MII 15.4 Installation Guide] |
| 3    | Install SAP OEE Management  
       | 1. OEE_ERP 15.0  
       | 2. OEE_MII 15.4  
       | [SAP MII 15.4 Installation Guide]  
       | To install OEE with HANA, additionally install:  
       | 1. HCO_HBA_OEE 1.0 SP06  
       | 2. HCO_HBA_APPS_OEE 1.0 SP06 |

System Landscape

The minimal system landscape for SAP NetWeaver Java Application Server applies to SAP MII 15.4. For more information, see the Installation & Implementation Documentation Center for SAP NetWeaver Java Application Server.

Installation Options with SAP NetWeaver 7.5 (for Java Hubs)

For SAP Business Suite applications as of SAP Business Suite 7 that are based on an Application Server Java and on hub systems, you can install these applications on SAP NetWeaver 7.5. You can also change from your current release to SAP NetWeaver 7.5. Changing means upgrading or updating. The following approaches for system landscapes for SAP NetWeaver 7.5 are possible:

Upgrading to SAP NetWeaver 7.5 works for hub systems

Embedded deployment continues to work only for SAP NetWeaver 7.0x releases and their enhancement packages (this means, for example, for SAP NetWeaver 7.00, SAP NetWeaver 7.01, and SAP NetWeaver 7.02).
For more information about the technical background, see SAP Note 1468349. There you can find a list of all the Java hubs that you can install on SAP NetWeaver 7.5.

If you want to install Business Suite Java applications, we strongly recommend that you use SAP NetWeaver 7.5 as the platform for your hub systems.

We strongly recommend that you use a minimal system landscape for test and demo purposes only. For performance, scalability, high availability, and security reasons, do not use a minimal system landscape as your production landscape.
System Landscape for OEE Management

OEE System Landscape

iNote

The above diagram shows one SAP MII system per plant. It is also possible that you have one SAP MII system per SAP ERP system. In that case consider appropriate sizing for the SAP MII server. Similarly it is possible to have one central SAP HANA for multiple SAP ERP systems. In that case consider proper sizing of the SAP HANA box.
Technical System Landscape for OEE Management

For high performance, scalability and availability, consider the master guides of respective dependent components for example, SAP NetWeaver ABAP, SAP NetWeaver Java, SAP HANA, and Plant Connectivity (PCo).
3 SAP MII Business Scenarios

SAP MII 15.4 includes the following business scenarios:

- Shop Floor Production Integration
- Shop Floor Quality Integration
- Content Versioning
- Ad Hoc Reporting
- Transactions for BAPI Consumption
- Trend Chart Visualization
- KPI and Alerts
- Plant Information Catalog
- Energy Monitoring and Analysis
- Business Objects Integration (Crystal Reports)
- Joined MDO, Join mode on MDO Queries
- OData Services
- Self Service Composition Environment
- OEE Management with HANA
- OEE Management without HANA

Technical System Landscape

SAP MII 15.4 is powered by SAP NetWeaver Java Application Server.

Integrating Shop Floor with Enterprise Resource Planning (ERP) System

SAP MII is primarily used to integrate top floor systems (ERP systems like SAP ECC) with shop floor (MES/Historians/SCADA) systems. Some examples of shop floor systems include Manufacturing Execution Systems (MES), Data Historians and SCADA Systems. Data such as Bill of Materials (BOM) Routing, Production Orders are downloaded from SAP ERP systems and sent to MES systems using SAP MII. Production Confirmations and Goods Movement information are sent from MES to SAP MII and then uploaded to ERP systems to close the loop.

To provide integration to SAP ERP system, SAP MII provides connectors like Java Connector (JCo), Java Resource Adapters (JRA) and web services for SAP Enterprise Services. You use these connectors to send and receive data from SAP ERP (Push from ERP and Pull from SAP MII). The same connectors can also be used for ABAP systems like SCM, SRM, CRM and so on.

For shop floor system integration, you use the SAP Plant Connectivity (PCo) which connects to historians, SCADA and tag based systems. MES systems can either use PCo, HTTP, or web services to connect to SAP MII. Using the connectors you can build a complete scenario to download information from ERP, send to a Shop Floor system, read information from Shop Floor Systems, and send to SAP ERP.
Plant Information Catalog

For all releases until SAP MII 12.0, you could not create a unified view of the assets and tags in a plant. You have to create PCo or tag queries to use a tag based system in SAP MII and use the tag data. Each PCo or tag query allows access to only one tag based system with no integration to multiple tag based systems existing in a single manufacturing plant. Additionally, the tag based systems contains technical names of tags which is tedious for the user in the organization.

With SAP MII 14.0, Plant Information Catalog, you can create asset hierarchy by choosing and grouping tags from multiple data sources like historians and SCADA systems. The groups can be functional locations, equipments in ERP or non existent entities created for general naming purpose. It is also possible to create properties used often for these entities in the Plant Information Catalog using property sets and properties.

The Plant Information Catalog can also be viewed and used in other plants or at corporate level using an catalog query template. This template allows querying Plant Information Catalog from multiple plants and aggregating the results in a single query, thus providing a view spanning across multiple systems.

With SAP MII 14.0 SP04, you can configure SAP ERP system to view production planning and plant maintenance hierarchy in SAP MII. You can add or map the production planning and plant maintenance objects to plant information catalog groups and tags.

Technical System Landscape

For details, see the section SAP MII Overview System Landscape.
**Energy Monitoring and Analysis**

Data collection is never an end in itself but a means to identifying issues and then resolving issues. Energy Monitoring and Analysis helps you achieve these purposes. By defining production events, you build a bridge between business data and energy consumption data. You not only become aware of the energy consumption of each piece of equipment, but also get to know which production order consumes the most energy using which piece of equipment. Based on this analysis, you can make better decisions to improve your energy use. In addition, the possibility to maintain KPI values manually enables you to fill up data gaps that could have impacted your data analysis.

**Develop MII Content using Manufacturing Data Objects, KPI Framework, Alert Framework, Query and Display Templates**

SAP MII provides a host of actions blocks (to be used in BLS transactions), query and display templates to build MII applications. Some of these blocks are described below:

**Manufacturing Data Objects**

SAP MII is primarily used to download planning information from ERP systems such as BOM, Routing, Production Orders and so on. Often, you create your own persistency layer and use custom SAP MII business logic transaction leading to a high number of support cases than required. Manufacturing Data Objects aims at supporting common customer use case by providing a framework that allows easy integration of necessary data from an ERP system into MII. Business Object Models as defined by the interfaces of BAPIs or Enterprise Services in SAP ERP can be downloaded into SAP MII. SAP MII allows you to create a partial view on the Business Object (BO) that are needed for shop floor purposes. Furthermore, additional fields can be added to the SAP MII view on the BO. For example, status fields for shop floor execution tracking. Data stored in MDOs can be retrieved using MDO query templates.

**KPI Framework**

Key Performance Indicators (KPIs) are used extensively today in manufacturing and other areas of a company to measure the performance of an organization. In Manufacturing, the main KPIs include Availability, Performance, Quality, Overall Equipment Effectiveness and so on. Currently, you have to build such KPIs using the tools available in SAP MII which requires considerable effort in development and maintenance.

With KPI framework in SAP MII, you can create various KPIs relevant to manufacturing in your organization. It is possible to define a KPI by providing the dimensions, and measure (the field that contains the KPI value) for the KPI. Also, you can calculate the KPI using several fields of the data provider for the KPI. A data provider is usually a MII BLS transaction or a MII query template which details the KPI framework the location to get the data for KPI.

KPI definition includes aggregation logic (AVG/MIN/MAX), threshold limits and so on which lets the framework decide the KPI out of range. Using the Alert Framework (see below) the KPI framework can also raise alerts when a KPI is beyond its threshold limits.
Alert Framework

A lot of effort today goes in knowing exceptional events at real time in the manufacturing space. SAP PCo is often used to capture such automated equipment down events and send the information to SAP MII. This information is usually stored in SAP MII and also sent to ERP to create Maintenance Notifications and Work Orders.

By using Alert Framework in SAP MII, you can provide details of the events to the management through email, alert monitor, other channels such as SMS and the necessary actions. This ensures a quick response and smooth production. Alerts can be raised using Alert action blocks, BLS transactions, and by KPI framework. You can use the definition of the alert and alert details can be configured at runtime when an alert is raised.

SAP MII Business Logic Transaction Editor

SAP MII Business Logic Transaction Editor is the core part of the MII Workbench. You can create business logics by combining MII action blocks in a graphical editor. An MII action block is a chunk of JAVA coding having a defined inbound and outbound XML Interface. The outbound interface of the preceding action block can be linked/mapped to the inbound interface of the following action block in sequence. MII Business Logic Transactions are invoked by submitting input parameters and can return output parameters. Some standard action blocks of MII are as follows:

- **Data I/O**
  Read/Write files to/from MII database, FTP input/output, database operations through query templates, send/receive e-mails, read/write data from/to SAP systems, read/write access to document received by MII message listeners, web service calls, creation of PDF documents

- **Dynamic Graphics**
  Used to create SVG graphics dynamically on the fly that can be persisted in the MII database and used in MII content web applications.

- **Flow logic**
  A set of typical flow logic action blocks that is available in any programming language like assignment, conditional statements, loops, switches, branching, pausing, and termination of a transaction.

- **XML manipulation**
  Statistical functions, adding calculated columns, value extractors, normalize, joiner, totalizer, XSL transformations. Using the custom action block API delivered together with MII, the portfolio of action blocks can be enhanced according to special needs.

SAP MII Query Template Editor

The query template editor, a part of MII Workbench, functions as a configuration utility for queries into the different data sources that are connected to MII (For example, relational databases, MII transactions, XML files, manufacturing systems). MII query template can be used either in MII transactions for data retrieval, update purposes, or in conjunction with MII display templates as data sources for MII applets. For more details, see the illustration in the Technical Landscape section.
SAP MII Display Template

MII display templates are used to define the style and behavior of the MII applets. Different varieties of display templates like grids, charts, browsers, and tickers are available with SAP MII. MII applets are operated based on a query template (defines 'what to display') and a display template (defines 'how to display').

SAP MII 14.0 SP04 display templates supports HTML5 based charts.

Technical Landscape

The following diagram illustrates the system landscape for MII applets:

![System Landscape for SAP MII Applets](image)

Develop Visualization using Business Objects Crystal Reports

SAP Business Objects Crystal Report is a tool to create easy simple and specialized reports, and visualize the data pictorially using colorful and sophisticated charts. The crystal report charts are comprehensive than MII grid applets.
You can create a crystal report using MII query templates. You can also filter or sort the records based on required parameters. These reports can be integrated into MII, JSP, and IRPT pages. Optionally, you can host these reports on SAP Business Objects Crystal Reports Server.

To use Business Objects Crystal Reports, do the following:

2. Import the MII Connector.

**Technical Landscape**

**Change Management of MII Configurations using Solution Manager**

Analyzing the configuration issues is a major hurdle in the MII system. Sometimes, MII configuration changes are reflected on the quality system but not on the production system. In SAP MII 14.0, you can use SAP Solution Manager to perform change analysis either on a system between two dates/time periods to view the configuration changes. You can also compare two systems, Quality and Production systems to view the missing or wrong configurations.
Transport MII Configurations using Enhanced Change and Transport System (CTS+)

In the previous MII releases, you can import and export MII configurations between SAP MII systems manually which is usually error-prone. With SAP MII 14.0, you can use ABAP CTS transport along with Java CTS+ to transport MII configurations between different systems. To do so, install CTS+ and transport the configurations from the source SAP MII system. Import the transport request to the target system from the CTS+.

Self Service Composition Environment

SAP MII has modelling capabilities for data acquisition from different sources and bind the same data with a set of visualization objects such as charts, grids and so on. User can create plant performance dashboard by using different visualization objects to monitor the real time data in their respective plants. SAP MII Self Service Composition Environment is a simplified HTML5 based design tool for plant supervisor/manager and developers to create plant performance dashboard by moving different MII objects (such as display templates, query template, MDO, KPI, resource files, and tags from plant information catalog) to the selected cells, and display the static or real time data. Users can also create form based reporting dashboard by moving different UI elements to the selected cells of the dashboard.

OEE Management with SAP HANA

OEE Management with SAP HANA has the full capabilities of the software which comprises of the following:

1. Ability to download OEE related SAP ERP configuration and master data to OEE MII.
2. Ability to download production/process orders and other related master data from SAP ERP to OEE MII.
3. Collect shop floor data manually or automatically through machine interface.
4. Send order confirmation and maintenance notifications to SAP ERP.
5. Perform Good Issue and Goods Receipt integration with SAP EWM.
6. Ability to replicate data from SAP ERP and OEE_ERP shop floor system to SAP HANA and visualize the KPI values in an analytic report application.

OEE Management without SAP HANA has all the capabilities of the software except the SAP HANA reporting part.
OEE Management with HANA - High Level Overview
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