

SAP MII Production Cockpit



Applies to:

SAP MII 12.2 (MDO must be configured)

Summary

The purpose of this document is to explain how the MII based **Production Cockpit** composite application is designed and how it can be adapted to quickly provide a landing page for live production information. The design of this application takes into account the necessity to retrieve data for Metric/KPI calculation from multiple sources and report it efficiently to both PC and Mobile web browsers. The project content to import into your MII environment is downloadable from [here](#).

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Author Bio

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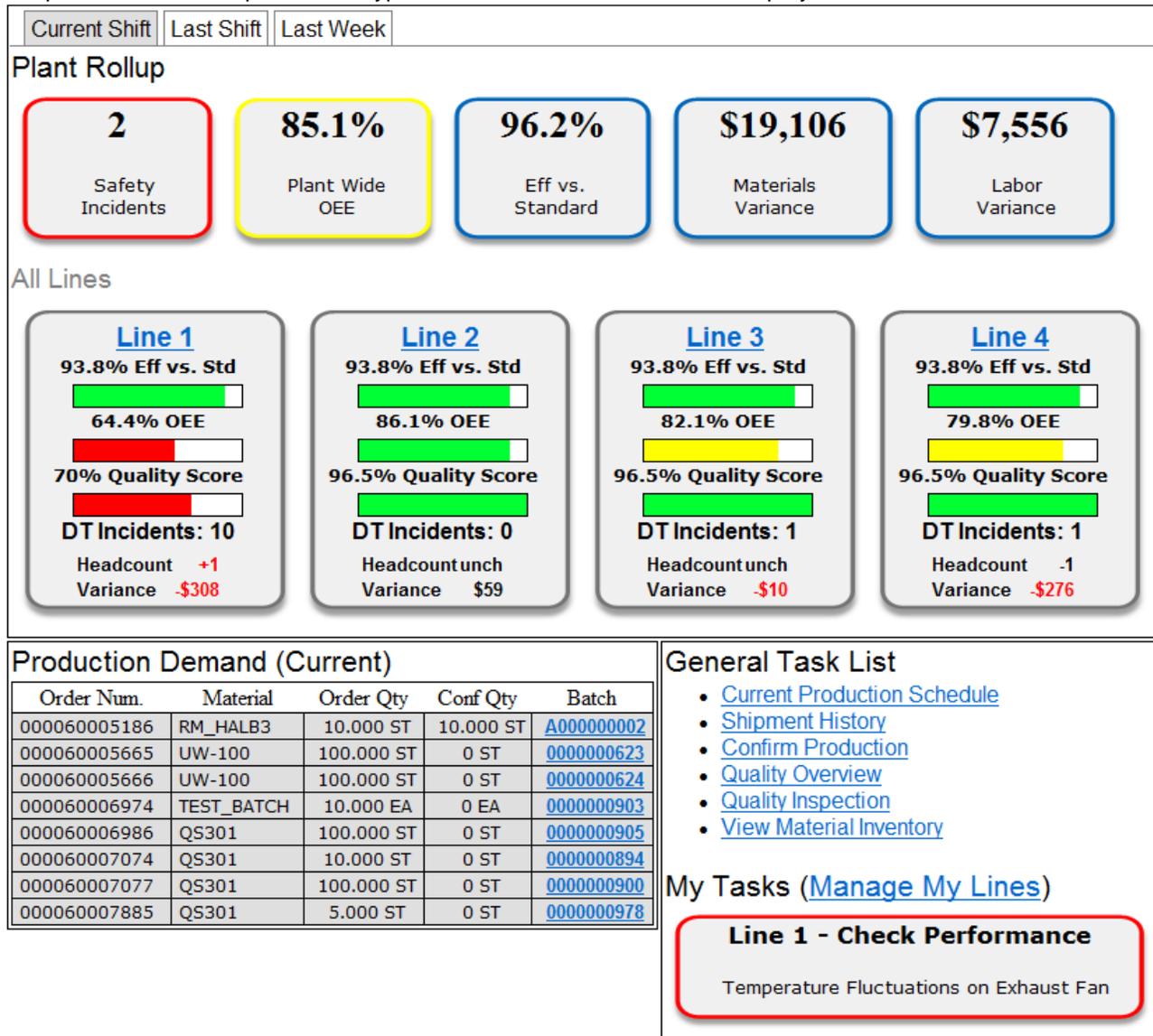
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Overview

The Production Cockpit is a flexibly designed web page for presenting production data to an end user on both standard and mobile device web browsers. It only uses HTML and CSS for presenting data on the front end but relies heavily on the MII integration and calculation pieces behind the scenes. This allows the production cockpit to easily adapt to the needs and requirements of the business.

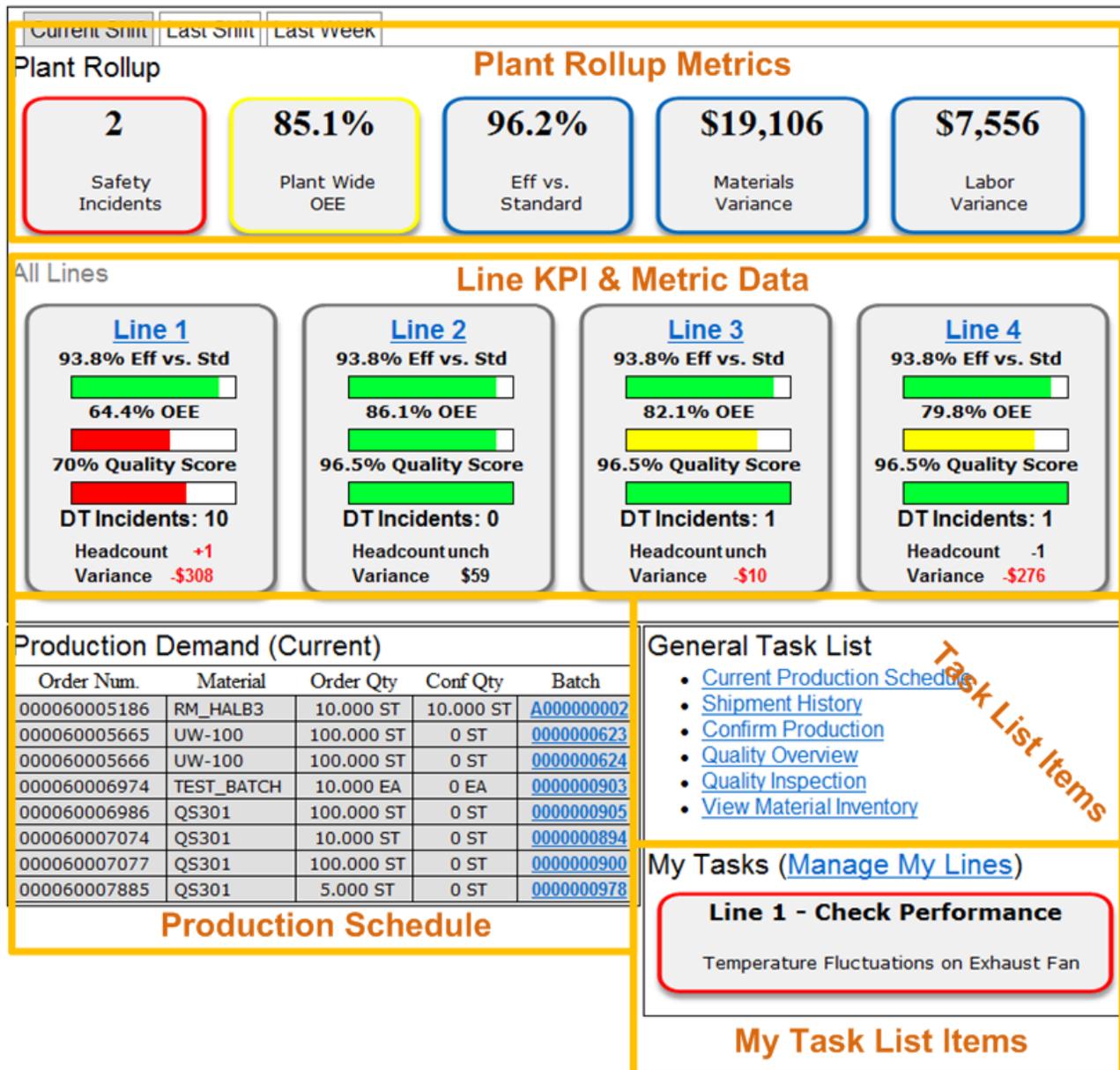
This production cockpit was designed with the idea in mind that it will need to quickly adapt to different business needs and display different operational data to different users. As a result this should be considered a good starting point to developing your actual production cockpit but will reduce the time to realization down to how long it takes to locate the data you wish to present and not developing UI components. An example of what types and formats the data can be displayed in is shown below:



The above data is from a fictional plant and the various metrics and information provided can be modified to fit your production needs without any changes to the UI. The entire production cockpit web page is data driven from generic data stored in Persistent MDO structures.

Description of the Parts

The "Production Cockpit" web page consists of five primary regions for presenting different types of data to the user and they are: Plant Rollup Metrics, Line KPI & Metric Data, Production Schedule, Task List Items, and My Task List Items. Each of these regions is highlighted in the image below:



In order to provide a generic data repository for each of these regions, the data that each presents to the user is stored in corresponding Persistent MDO structures. This approach allows for generic sample data to be delivered, showing how the report should look and also a structure for how your actual production data will be persisted. Additionally, the use of Persistent MDO structures limits the amount of times the data on this production cockpit is calculated before being presented to the user as each structure has its own object lifecycle that can be defined. This allows for control of the frequency of updates for each section on the report and improves data consistency and the speed of the reported data to the Production Cockpit.

Setting It Up For Initial Use

In order to utilize this application with sample data, first download the content referenced on the first page of this document and import the project into your MII 12.2 environment. The project will load content in the following location under the Catalog, Object, and Web tabs (There is no Meta-Inf content delivered with this project):

SAP/Manufacturing/CompositeApplications/ProductionCockpit

Once the content is imported open or refresh your workbench environment and from the Catalog tab navigate to and run the following transaction:

SAP/Manufacturing/CompositeApplications/ProductionCockpit/Configuration/SampleData/LoadAllSampleDataIntoProductionCockpit

This transaction will load the sample data delivered with this project into the four MDO structures so that the production cockpit will appear populated with data. The fifth MDO structure which contains the Production Order Schedule information, requires some configuration of its Data Provider. The Production Order Schedule object is defined in the Object tab here:

SAP/MIIOBJ/Manufacturing/CompositeApplications/ProductionCockpit/ProductionOrderSchedule

The Data Provider for this object is a transaction that is defined in the Catalog tab here:

SAP/Manufacturing/CompositeApplications/ProductionCockpit/ProductionOrderScheduleList

It calls other transactions that make BAPI calls to retrieve production order list and detail information and combines this data into a single result that is stored in the object so that it can be presented to the user without having to query ERP each time the cockpit is loaded. The frequency of this data population into the object is defined in the object Lifecycle. The lifecycle task is called

SAPMFG_PRODUCTIONCOCKPIT_ORDERSCHEDULE_REPLACE

This Lifecycle task needs to be deployed and default inputs need to be configured to retrieve data that is relevant for your ERP instance. It is recommended to test the transaction first with data to ensure that it's working and retrieving the data that you want displayed and then setting the Lifecycle Inputs to match this.

Once you wire in your actual production data and metrics you will no longer need to populate the objects with sample data and should not run this transaction anymore, it is just there to get you started with a working example. Next, from the Workbench select Tools -> "Navigation Editor" or "Project Navigation Editor" and define a navigation link to the production cockpit page along with a couple of URL parameters to initially select the proper time duration tab. The entry in the navigation editor should look like this (Don't forget to add in the URL parameters):

/XMII/CM/SAP/Manufacturing/CompositeApplications/ProductionCockpit/LineMonitorCockpitForMobile.irpt?Time=Current&Tab1=Selected&ProductionHeader=Production Demand (Current)

Save the changes to the navigation and you should see the newly created navigation link the next time you login or press the Refresh link in the top right of the MII main page.

Understanding How It Works

There are many features of the MII 12.2 product being used here in order to provide the most flexible application with the least amount of changes required to realize the solution. The following technologies were used in order to accomplish this PC and Mobile device compatible cockpit: HTML, CSS, Servlets & XSLT, MDO, Queries, and Transactions. There are no applets used in this application on purpose as they are not compatible with mobile device web browsers, so as a substitute the MII Servlet interface is used to retrieve query data and XSLTs are applied to generate the HTML & CSS content. Each of the five previously mentioned regions on the production cockpit is generated using this technique. This area assumes that you have basic knowledge of the MII content development environment and can reverse engineer how the various content pieces work together once you understand the basic concepts used to build the UI.

MIl Servlet Definitions

Since the MII Servlet interface plays a major role in this composite application it is necessary to provide a basic level of understanding of the technology and how the interface works. The HTML Servlet tag has been around as a standard in HTML for a long time and the MII product can take advantage of this through the use of what is referred to as a Report.

To define a Servlet call on your web page, use the following syntax:

```
<ervlet name="Illuminator">
  <param name="QueryTemplate" value="Full Path to MII Query Template">
  <param name="Stylesheet" value="Full Path to XSLT">
  <param name="Param.1" value="Parameter value to pass to the Query Template">
  <param name="Content-Type" value="text/xml">
</ervlet>
```

The above definition consists of two main parts the data retrieval part which is defined by the query template parameter and how to format the data returned which is the Stylesheet parameter. This interface supports all of the same parameters as the applets do, with the exception of the DisplayTemplate parameter. The XML data returned from the query template is fed into the XSLT and the output of the XSLT is written onto the web page and sent to the client (yes, the processing is done on the server). For details on how XSLTs work there are lots of examples available on the web but it's very common to find yourself looking at this page for basic examples; www.w3schools.com/xsl. There aren't any really great XSLT editors out there but with a little due diligence they are the best way to present dynamic HTML content.

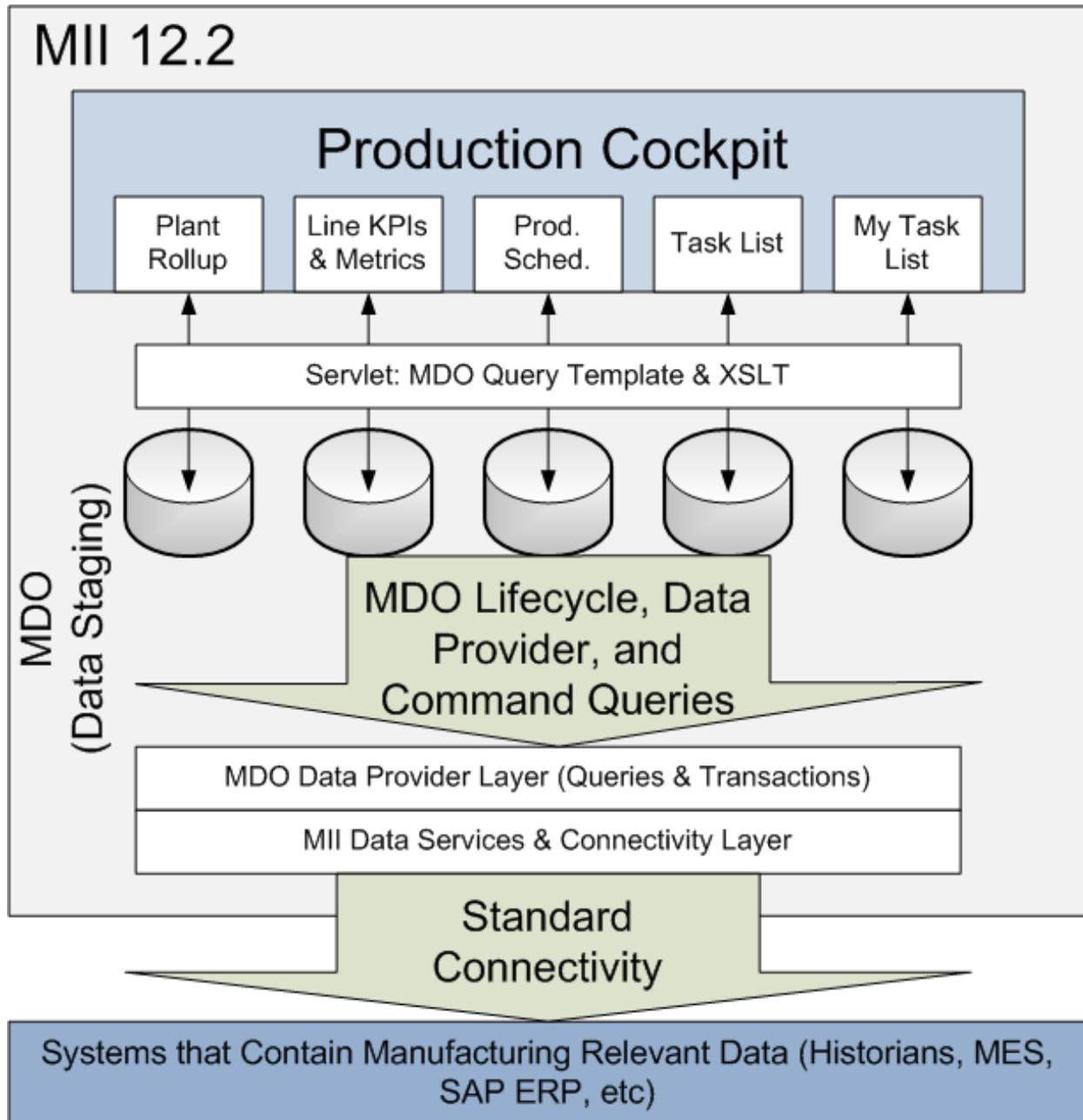
MIl Persistent MDO

The basic concept behind Persistent MDOs in MII is to provide a temporary data staging area for presenting information to a UI screen (More information can be found here: [Examples 12.2 project](#)). The object definitions in this project represent the data expected by the Servlet calls in order to populate data on the cockpit report. When you run the transaction in the "Setup for Initial Use" section:

SAP/Manufacturing/CompositeApplications/ProductionCockpit/Configuration/SampleData/LoadAllSampleDataIntoProductionCockpit

This transaction clears each of the objects and writes sample data into the objects in the format that is expected by the web page. For those of you familiar with programming, MDOs are very similar to defining an Interface for a class. Each object that is defined for this project defines the structure that the corresponding XSLT is expecting. Enabling this type of disconnected web page creation is key to the methodology of centrally creating MII content that can be rolled out to multiple plants. From here all that needs to be done is to "wire" in the plant data to the objects and the UI is ready to go and has a consistent look and feel from plant to plant.

This concept may be a bit difficult to grasp so to dive into more detail about it, here is the architecture of this solution:

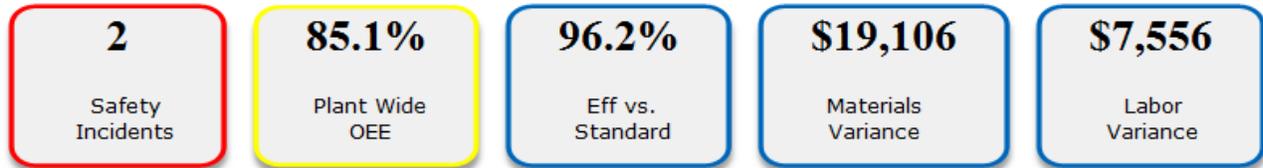


The above graphic illustrates how the Production Cockpit UI is abstracted from the actual manufacturing systems and the calculations required for populating the MDOs with data. This provides a modifiable/editable caching or data staging layer for providing Metric and KPI calculated values to a standard UI without knowing the underlying systems or calculations involved or having to determine their values each time the page is requested. For more information about how the individual MDOs work please see the MII 12.2 Help documentation and review the MII Examples 12.2 project on the MII SDN Wiki.

Plant Rollup Metrics Section

The first section of the Production Cockpit is the high-level metric values shown at the top and these metrics are intended to reflect the overall state of the manufacturing facility. On the Production Cockpit page the metrics for the selected time frame determine the color and values shown to the user. The sample data for the “Current” time interval looks like this:

Plant Rollup



The MDO that persists these calculated values has a generic structure where any metric name and value pairs can be presented to the user. This is accomplished using the structure shown below:

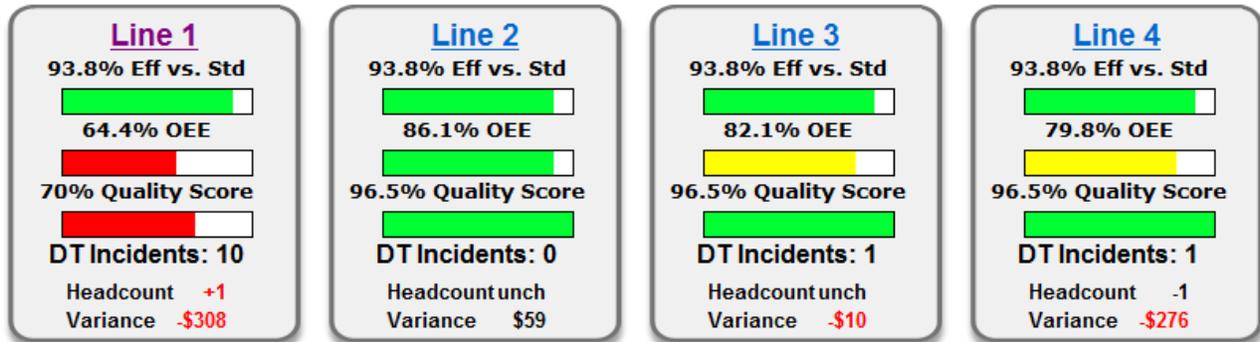
METRIC_DURATION	METRIC_NAME	METRIC_VALUE	METRIC_UOM_PREFIX	METRIC_UOM_POSTFIX	COLOR
Current	Safety Incidents	2			Red
Current	Plant Wide OEE	85.1		%	Yellow
Current	Eff vs. Standard	96.2		%	Blue
Current	Materials Variance	19,106	\$		Blue
Current	Labor Variance	7,556	\$		Blue
LastShift	Safety Incidents	1			Yellow
LastShift	Plant Wide OEE	89.1		%	Yellow
LastShift	Eff vs. Standard	96.2		%	Blue
LastShift	Materials Variance	19,106	\$		Blue
LastShift	Labor Variance	7,556	\$		Blue
LastWeek	Safety Incidents	0			Blue
LastWeek	Plant Wide OEE	95.1		%	Blue
LastWeek	Eff vs. Standard	96.2		%	Blue
LastWeek	Materials Variance	19,106	\$		Blue
LastWeek	Labor Variance	7,556	\$		Blue

The intent of this design is to allow the actual implementation and metrics that the manufacturing facility cares about can be quickly loaded and calculated behind the scenes and then displayed on the Production Cockpit. In order to wire this MDO into your environment you can define the object lifecycle which will populate and manage the persisted data. Since this object does not have a “Data Provider” and it consists of only “Custom Attributes” it allows for insert and update commands to be performed on it for maintaining updated values and adding new metrics.

Line KPI and Metric Data Section

The second section of the Production Cockpit provides an overview of the production lines that exist in the plant. The purpose is to break apart the overall picture of the plant to identify which production lines are lagging as compared to each other. In the image below the sample data provided with the cockpit is shown in order to provide an example of how this section could be used.

All Lines



This section follows a very similar design as the previous section of Plant Rollup Metrics does in that any metric can be presented here to the user. The design of the MDO structure allows for a flexible interface and this structure is shown below:

METRIC_DURATION	LINE	METRIC_NAME	METRIC_VALUE	METRIC_PREFIX	METRIC_POSTFIX	DISPLAY_TYPE	COLOR
Current	1	CurrentState	Running			DisplayColor	Green
Current	1	Eff vs. Std	93.8		%	ProgressBar	Green
Current	1	Headcount	1	+		Text	Red
Current	1	LineDetailsPage	/XMI/ICM/SAP/Manufacturing/D...				
Current	1	OEE	64.4		%	ProgressBar	Red
Current	1	Quality Score	70		%	ProgressBar	Red
Current	1	Top Issue	DT Incidents: 10			Headline	Black
Current	1	Variance	308	-\$		Text	Red
Current	2	CurrentState	Running			DisplayColor	Green
Current	2	Eff vs. Std	93.8		%	ProgressBar	Green
Current	2	Headcount	unch			Text	Black
Current	2	LineDetailsPage	/XMI/ICM/SAP/Manufacturing/D...				
Current	2	OEE	86.1		%	ProgressBar	Green
Current	2	Quality Score	96.5		%	ProgressBar	Green
Current	2	Top Issue	DT Incidents: 0			Headline	Black
Current	2	Variance	59	\$		Text	Black

It is important to note that this interface has multiple slices that the metric values are broken down by and this is by time, line name, and metric name. Also, each metric has a display type that the XSLT uses to define how the metric value is presented to the user and which coloring is used.

Production Order Schedule Section

This section follows a different design pattern than the other sections on web page, since the object uses a "Data Provider" and a Lifecycle Replace task to populate its data from a Transaction result-set. The transaction that is defined as the Data Provider for this object makes synchronous BAPI requests to an ERP system. You will have to configure this to point to your ERP instance and to identify the proper material and order range information. Once you're done with this the presentation of this data looks like this:

Production Demand (Current)

Order Num.	Material	Order Qty	Conf Qty	Batch
000060005186	RM_HALB3	10.000 ST	10.000 ST	A000000002
000060005665	UW-100	100.000 ST	0 ST	0000000623
000060005666	UW-100	100.000 ST	0 ST	0000000624
000060006974	TEST_BATCH	10.000 EA	0 EA	0000000903
000060006986	QS301	100.000 ST	0 ST	0000000905
000060007074	QS301	10.000 ST	0 ST	0000000894
000060007077	QS301	100.000 ST	0 ST	0000000900
000060007885	QS301	5.000 ST	0 ST	0000000978

The object itself has a structure that contains lots of other information about the production order that can be presented and this is shown below and the actual data returned is even more detailed than this:

ProductionOrder	Material	Batch	OrderQuantity	ConfirmedQuantity	UOM	OrderScrap	Status
000060005186	RM_HALB3	A000000002	10.000	10.000	ST	0	REL CNF DLV PRC BASC BCRQ GMPS MACM*
000060005665	UW-100	0000000623	100.000	0	ST	0	REL PCNF PRC BASC BCRQ DEF ERTR GMPS*
000060005666	UW-100	0000000624	100.000	0	ST	0	REL CNF DLV PRC BASC BCRQ DEF ERTR*
000060006974	TEST_BATCH	0000000903	10.000	0	EA	0	REL PRC BASC BCRQ MANC OPGN SETC
000060006986	QS301	0000000905	100.000	0	ST	0	REL PRC BASC BCRQ ILAS MANC MSCP SETC
000060007074	QS301	0000000894	10.000	0	ST	0	REL CNF PRC BASC BCRQ GMPS ILAS MANC*
000060007077	QS301	0000000900	100.000	0	ST	0	REL CNF PRC BASC BCRQ GMPS ILAS MANC*
000060007885	QS301	0000000978	5.000	0	ST	0	REL PCNF PRC BASC BCRQ DEF ILAS MANC*

It is possible to include additional columns in the MDO Query response but keep in mind that you don't want to clutter the cockpit and you can reuse this same object with additional queried detail on a separate page dedicated to production order information.

Task List Items Section

The Task List Items section of the Production Cockpit supports a generic list of name and hyperlink values for linking in references to other content that has been built that a user of this page will typically interact with. The idea is to add references to other commonly used content that has already been built to leverage it in a flexible manner and reduce overhead for the operator when trying to navigate between screens. The section with the provided sample data looks like this:

General Task List

- [Current Production Schedule](#)
- [Shipment History](#)
- [Confirm Production](#)
- [Quality Overview](#)
- [Quality Inspection](#)
- [View Material Inventory](#)

The object structure behind the scenes is just a name and value pair of data with the visible text and the URL link that is defined for it that points to a page that already exists in your MII environment.

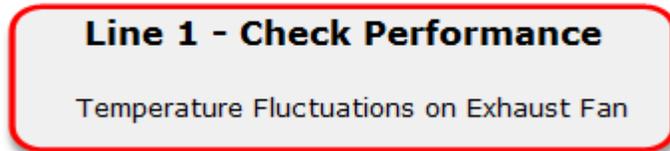
TASK_ITEM	TASK_REFERENCE
Current Production Schedule	/XMI/CM/MIIDemo/ManufacturingAnalytics/CorrelatedViews/Wip_Lots.htm
Shipment History	/XMI/CM/SAP/Manufacturing/Demo/OperationsDashboard/ShipmentHistory.irpt
Confirm Production	/XMI/CM/SAP/Manufacturing/ERP/Process/SupplyChainManagement/ConfirmProductionAgainstOrder.irpt?Material=Ethylene Glycol&PlantID=0001&ProcOrder=&...
Quality Overview	/XMI/CM/MIIDemo/WorkProcessManagement/SimplifiedUI/QCInspectionPareto.htm
Quality Inspection	/XMI/CM/QM_eSOA/QualityInspection.html
View Material Inventory	/XMI/CM/SAP/ModuleLibraries/MM/UI/MaterialInventory.irpt?material=CPH_3002&plant=0001

This task list is supposed to contain a short “quick links” list of common tasks that are shared by all of the users of this cockpit screen.

My Task List Items Section

The My Task List Items section of the Production Cockpit is a basic attempt to include user/role specific content to the logged in user or for a role that they belong to. It's a starting point that demonstrates how the roles and user information can be pulled from the session and passed into a query to retrieve specific information. The section looks like this in the cockpit:

My Tasks ([Manage My Line](#))



The role/user specific delivery of information further helps to enhance the user experience of not having to sift through a list of issues that may or may not pertain to them and their job. The way this is achieved is that the username and role information is pulled from the session through the use of Session properties on the Cockpit page. The Servlet definition that contains these properties looks like this:

```
<servlet name="Illuminator">
<param name="QueryTemplate"
value="SAP/Manufacturing/CompositeApplications/ProductionCockpit/UMETaskListItemMDOQuery">
<param name="Stylesheet"
value="/XMII/CM/SAP/Manufacturing/CompositeApplications/ProductionCockpit/XSLT/SAPRiseMyTaskList.xml">
<param name="Content-Type" value="text/xml">
<param name="Param.1" value="{IllumLoginRoles}">
<param name="Param.2" value="{IllumLoginName}">
</servlet>
```

In the definition above you'll notice that for the Param.1 and Param.2 properties with the names that are defined in curly braces. This is a specific feature of the MII product to replace the text with the session property values whose name matches the name defined in curly braces. For a complete list of session properties use the following url:

<http://<server>/XMII/PropertyAccessServlet?Mode=List>

The login name and role information is passed to an MDO query which filters out entries stored in the MDO structure so that only relevant entries are shown. The structure of the MDO data is shown below:

ROLE_NAME	USER_NAME	TASK_ITEM	TASK_DESCRIPTION	COLOR
ALL	ALL	Line 1 - Check Performance	Temperature Fluctuations on Exhaust Fan	Red

This is a very basic design and may not apply to your environment but it's a starting point to user specific notifications and therefore relevant for this cockpit.

Ideas for Improvement & Customization

With any application there is always room for improvement and this composite application is no exception. There are areas where additional configuration screens and content can be developed and provided as part of this project. A couple of thoughts and ideas behind this area for improvement are as follows:

- Instead of using a Synchronous BAPI call to populate the Production Schedule the messaging services can be setup to receive IDocs from the SAP ERP or PI systems.
- Additional content around the Task List Items could be provided as standardized UI screens for basic tasks, currently you define your own pages for these links
- The My Tasks List section could be tied into a system like SAP BPM for retrieving User Task information
- The My Task List section could provide an interface for managing items in this list (pass along to another role/user, confirm the item is complete, traceability of who did what.
- The cockpit could include a section that integrates with the ERP 6.0 Shift Notes features for support of cross-shift sharing of information.

Related Content

SAP MII & PCo SDN Forum: <https://www.sdn.sap.com/irj/sdn/forum?forumID=237>

SAP MII & PCo SDN Wiki: <https://wiki.sdn.sap.com/wiki/display/xMII>

SAP ME, MII & PCo Help Documentation: <http://help.sap.com> -> SAP Business Suite -> SAP Manufacturing

SAP Manufacturing Downloads: <http://www.sdn.sap.com/irj/scn/manufacturing-tools>

SAP MES Integration Package for ERP:

<http://wiki.sdn.sap.com/wiki/display/ESpackages/Integration+of+Manufacturing+Execution+Systems>

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