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Integration with Oracle Manufacturing Cloud

Release 11

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Executive Overview

Modern manufacturing solutions help organizations streamline shop floor execution by scheduling work orders, recording component and resource consumption and quality management. While many organizations are considering moving their entire manufacturing execution systems to Oracle Cloud, there are situations where companies are looking to have their shop floor systems co-exist with Oracle Manufacturing Cloud. This paper is designed to guide you through adoption choices for manufacturing execution in the cloud with considerations of how to integrate with your existing shop floor execution solutions. With the right integration approach you can successfully deploy Oracle Manufacturing Cloud and achieve the benefits of modern business processes.

Introduction

As part of your Oracle Cloud implementation for manufacturing execution, you need to evaluate how these solutions will work with your existing internal systems and the different integration options available to you. The approach you take will depend on your business requirements, processes, capabilities of your existing systems and configurations. Oracle Cloud provides flexible options for inbound and outbound integration that you can leverage during your implementation.

The first part of this paper discusses how you can leverage the outbound integration capabilities to export different manufacturing master data, work orders and inventory information to your internal systems.

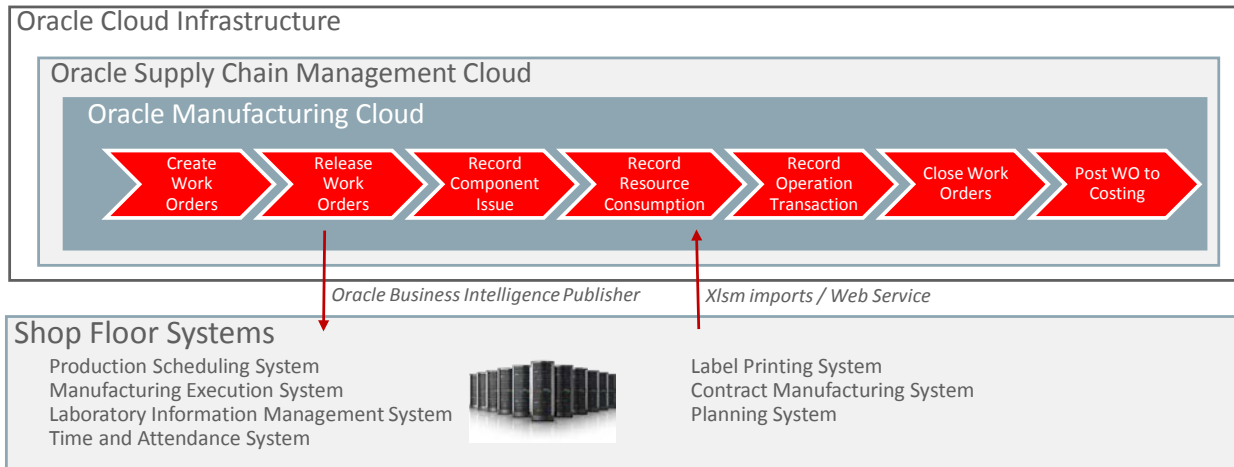
The second part of the paper discusses how you can leverage the inbound integration capabilities to import scheduled work orders, operation, resource and material transactions into the Oracle Manufacturing Cloud from your internal systems.

The rest of this paper provides considerations for each type of internal system, describes the available integration technologies, and refers you to additional sources of information. With a successful co-existence strategy, you can gain the benefits from Oracle Manufacturing Cloud and start building business benefits as quickly as possible.

In this paper we will discuss the following integration scenarios involving Manufacturing Cloud:

- Integration with Production Scheduling Systems
- Integration with Manufacturing Execution Systems

Integrating with Manufacturing Cloud



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Figure 1. Integration between Oracle Manufacturing Cloud to External Systems

Getting Started with Integration

Before embarking on any integration project, you should analyze your business processes and assess the options that make the most sense for your organization. The first step is to evaluate the manufacturing process supported within Oracle Manufacturing Cloud. You should have a compelling need to use your internal system and the need to integrate with Oracle Manufacturing Cloud.

Once the integration need is established, you have to analyze each manufacturing object in Oracle Manufacturing Cloud and the consumption of the object in your internal system. You should also evaluate both the frequency and volume of information needed to be synchronized.

Some complexities are unavoidable when implementing systematic integration. For example, apart from the process integration you must also consider error-handling, error recovery, and adaptability to changing or extended data models. The right strategy can mitigate unnecessary investments in building integration and simplify your overall strategy.

Oracle Help Center is an online resource for discovering Oracle Cloud Applications metadata. You can use Oracle Help Center to find information on the integration assets that are available for particular objects and processes across Cloud, including those relating to Oracle Supply Chain Management. This web site will always contain the most recent information on what is available. As time passes, you should consult Oracle Help Center for the most currently available assets (and any new updates) prior to beginning an integration project. Oracle expects that new assets will become available over time.

Examples of the types of assets that you can discover within Oracle Help Center include:

- Web services
- File-based data integrations
- View objects (Tables and Views)
- Interface table definitions
- Sample templates
- Data model diagrams
- Delivered reports for each module

Integration Methods

Cloud applications are built with Oracle’s Application Development Framework (ADF) and provide many methods of integration with other applications including: ADF Services (commonly referred to as Web Services), File Based Data Import, and Reporting Tools.

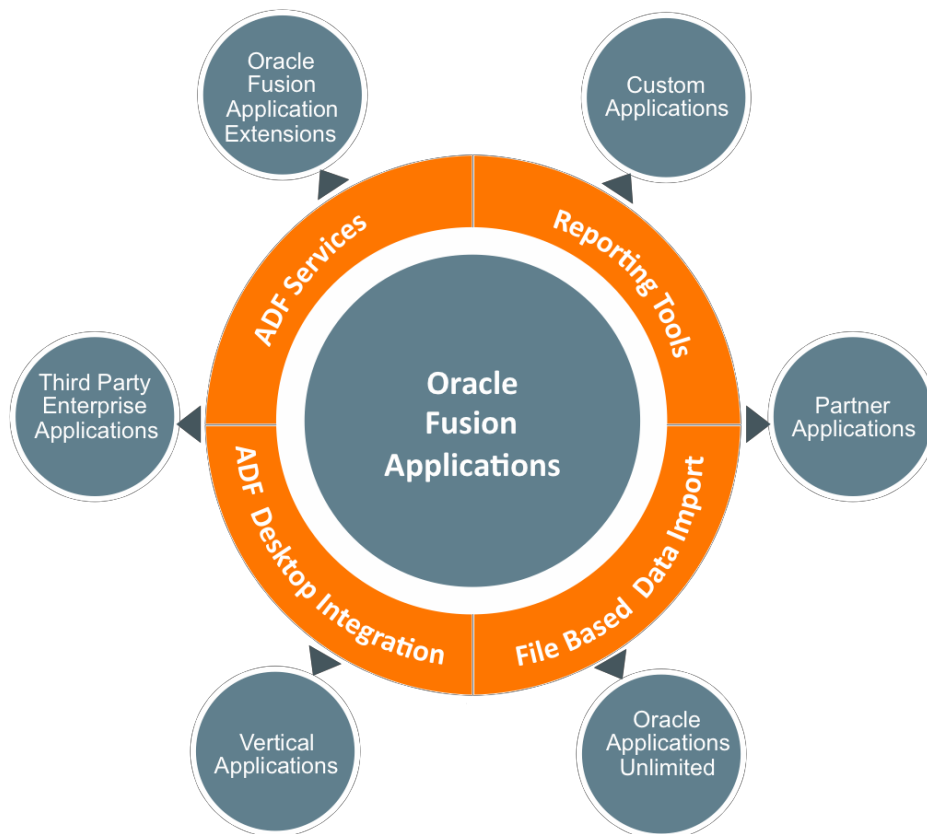


Figure 2. Integration Methods for Oracle Cloud Applications



Web Services

A web service provides a standardized way of integrating two web-based applications. A web service is a program that can be accessed remotely using different XML-based languages. ADF Services simplify integration by enabling XML data exchange between different applications and different platforms. On-premise implementations can access the Enterprise Manager and tailor the available web services for inbound/outbound integration. But for areas where there are no web services currently available, generating OTBI or BI Publisher reports that can be used for integration may suffice depending on what is being integrated.

Spreadsheet Integration

Spreadsheet integration through ADFi or other methods enables the use of familiar spreadsheet tools such as Excel. ADF Desktop Integration (ADFdi) is part of the ADF framework and enables desktop integration with MS Excel spreadsheets to manage large volume data uploads into Cloud Applications. The integration provided with ADFdi includes interactivity that enables web picker to search for valid values, perform validation during data entry, display error messages, and immediately submit transactions directly from Microsoft Excel.

File Based Data Import

File Based Data Import (FBDI) is another option for getting information into Cloud applications. For applications deployed in the public cloud, in the absence of a delivered web service, the currently available option is file based integration to transfer files to a location that the source system can consume. The process of using FBDI is quite simple: download an excel template that identifies all of the fields, populate the spreadsheet with data from the external system, save the file as a .csv file type, upload the file, and run processes to transfer the data to the interface tables and import into the various applications. All of the data is validated during import to insure its integrity. External data can be extracted and formatted into a source file for transfer and import into Oracle Cloud applications.

Reporting Tools

Reporting tools can be used to extract data from Cloud applications for further analysis and import data into external systems via XML, Excel or other file types. Oracle Transactional Business Intelligence (OTBI) Reporting can be used to extract data for import into your external systems. Oracle Transactional Business Intelligence provides the ability to build custom queries on transactional data, and the output can be downloaded to Excel. You can configure an Oracle Business Transaction Intelligence (OTBI) report or BI Publisher report and generate it based on your organization's specific requirements.

Outbound Integration to Manufacturing Cloud

Oracle Manufacturing Cloud has a repository of all the master data objects for manufacturing execution and your internal systems can leverage these master data objects. As part of the process integration, you can also export documents like work orders, material transactions, operation transactions and resource transactions.

You can choose to implement Oracle Business Intelligence Cloud Service to export data out of the Manufacturing Cloud. You need to build a data model to extract the master data from Oracle Manufacturing Cloud into a spreadsheet and import it into your internal system.

You can refer the following web site for documents related to Oracle Business Intelligence Cloud Service here:

http://docs.oracle.com/cloud/latest/reportingcs_use/index.html

You have to evaluate between two options – extract all the data every time and do a complete overwrite of the data into your internal system v/s synchronize only the changes. Your decision depends on the volume of the data and frequency of changes.

TABLE 1. DATA BASE TABLES FOR EXPORTING MASTER DATA FROM MANUFACTURING CLOUD

MASTER DATA OBJECT	DB TABLE	NOTES
Plant	RCS_MFG_PARAMETERS_V	<i>This table has the plant attributes.</i>
Items	EGP_SYSTEM_ITEMS	<i>This table has the item specific attributes.</i>
Subinventory	INV_SECONDARY_INVENTORIES	<i>This table has the subinventory attributes.</i>
Locators	INV_ITEM_LOCATIONS	<i>This table has the locators attributes.</i>
Inventory Transaction Types	INV_TRANSACTION_TYPES	<i>This table has definition of the inventory transaction types.</i>
Work Areas	WIS_WORK_AREAS_B	<i>This table has definition of the work areas.</i>
Work Centers	WIS_WORK_CENTERS_B	<i>This table has definition of the work centers.</i>
Resources	WIS_RESOURCES_B	<i>This table has definition of the resources.</i>
Resource assignment to Work Center	WIS_WC_RESOURCES	<i>This table has details of assignment of resources to work center.</i>
Shifts of a Resource assigned to a Work Center	WIS_WC_RESOURCE_SHIFTS	<i>This table has details of shifts of the resources assigned to a work center.</i>
Work Definition Header	WIS_WORK_DEFINITIONS	<i>This table has the work definition header details.</i>
Work Definition Versions	WIS_WD_VERSIONS_V	<i>This table has the work definition version details.</i>
Work Definition Operations	WIS_WD_OPERATIONS_V	<i>This table has the work definition operation details.</i>
Work Definition Operation Materials	WIS_WD_OPERATION_MATERIALS_V	<i>This table has the work definition operation material details.</i>

Work Definition Operation Resources	WIS_WD_OPERATION_RESOURCES_V	<i>This table has the details of work definition operation resources.</i>
Current Shifts	FUSION.WIE_CURRENT_SHIFTS_V	<i>This table has the details of the shifts.</i>

For process integration, you have to synchronize transaction documents between Oracle Manufacturing Cloud and your internal systems. You have to decide the master system that owns the document and evaluate the options to export the transaction data into the target system. If Oracle Manufacturing Cloud is the master system, then you have to export data using Oracle BIP. Table 2 helps you to export the transaction documents.

TABLE 2. DATA BASE TABLES FOR EXPORTING TRANSACTION TABLES FROM MANUFACTURING TABLES

MASTER DATA OBJECT	DB TABLE	NOTES
Work Order Header	WIE_WORK_ORDERS_V	<i>This table contains the details of the work order header.</i>
Work Order Operations	WIE_WO_OPERATIONS_V	<i>This table contains the details of the work order operations.</i>
Work Order Operation Materials	WIE_WO_OPERATION_MATERIALS_V	<i>This table contains the details of the work order operation materials.</i>
Work Order Operation Resources	WIE_WO_OPERATION_RESOURCES_V	<i>This table contains the details of the work order operation resources.</i>
Work Order Serials	INV_SERIAL_NUMBERS	<i>This table contains the details of the work order serials.</i>
Dispatch List	WIE_WO_DISPATCH_LISTS_V	<i>This table contains the details of the dispatch list.</i>

You may also need to export operation, material and resource transactions from Oracle Manufacturing Cloud. You can use below SQL script as a reference script to export the data.

Implementation of the Outbound Integration

Outbound integration using Oracle Business Intelligence Cloud Service is simple. You need to develop the integration scenario in a Development pod in the cloud, test the report and archive the report to be deployed into the Production pod. Next, you deploy the report in the production pod and configure the source and target systems.

Implementation of the integration solution involves the following steps:

- In SCM Cloud – Development pod:
 - Login using a user id having both BI Administrator role and BI Publisher Data Model Developer role
 - Create a data model as per the integration scenario using SQL. Create a report to output the data into a XML file.
 - Archive the report and model definitions to a local file

- In SCM Cloud – Production pod:
 - Login using a user id having BI Author role, BI Consumer role and BI Publisher Data Model Developer role
 - Unarchive the local file to production pod
 - User exports data using the report
 - User downloads the XML file to a client device
- Transform the data and import the data into your target system

Inbound Integrations

You may have to import work orders, operation, resource and material transactions from your internal system to Manufacturing Cloud. You have two options to import the data into Manufacturing Cloud:

- Develop an adapter in Oracle Integration cloud services (ICS) that can populate the interface tables
- Use File-Based Data Import
- Use web services (only for material, resource and operation transactions)


Using Oracle Integration Cloud Services (ICS)

You can use Oracle Integration Cloud Services (ICS) to import data from your internal system into Manufacturing Cloud. Oracle ICS provides infrastructure to develop an adapter and you can automate the inbound integration process.

This adapter in ICS will insert records into appropriate Manufacturing Cloud tables. Table 3 summarizes the interface tables in Manufacturing Cloud.

TABLE 3. INTERFACE TABLES IN MANUFACTURING CLOUD

ENTITY	INTERFACE TABLE	NOTES
Work Order Header	<i>WIE_WORK_ORDERS_INT</i>	This is the interface table for the work order header. It would contain details about the work definition on which the work order is created, the work order type the assembly quantities etc.
Work Order Details	<i>WIE_WORK_ORDER_DETAILS_INT</i>	This is the child interface table that carries the operations, operation resource and operation material of the work order.
Material Transaction	<i>WIE_MATERIAL_TRANSACTIONS_INT</i>	This table will be the interface from Manufacturing for all the material transactions
Resource Transaction	<i>WIE_RESOURCE_TRANSACTIONS_INT</i>	This is the interface table for the charging of resources to record the actual usage of the labor, equipment and tooling type of resources.
Operation Transaction	<i>WIE_OPERATION_TRANSACTIONS_INT</i>	This is the interface table for the work order operation level transactions.
Transaction Lots	<i>WIE_TRANSACTION_LOTS_INT</i>	This table stores the lot number information that is being interfaced to manufacturing. A record in this table is either the child of the material transactions interface or the operation transactions interface.
Transaction Serials	<i>WIE_TRANSACTION_SERIALS_INT</i>	This table stores the serial number information for the transaction interfaced as part of a transactional interface to manufacturing.



Using File-Based Data Import

Manufacturing Cloud also provides xlsx template for Work Orders, Operation, Material and Resource transactions to import data. You can find these templates at

http://docs.oracle.com/cloud/latest/scmcs_gs/OEFSC/toc.htm

Implementation of the outbound integration

Implementation of the integration solution involves the following steps:

1. In SCM Cloud – Development pod:
 - a. Login using a user id having both BI Administrator role and BI Publisher Data Model Developer role
 - b. Create a data model as per the integration scenario using SQL. Create a report to output the data into a XML file.
 - c. Archive the report and model definitions to a local file
2. In SCM Cloud – Production pod:
 - a. Login using a user id having BI Author role, BI Consumer role and BI Publisher Data Model Developer role
 - b. Unarchive the local file to production pod
 - c. User exports data using the report
 - d. User downloads the XML file to a client device
3. Transform the data and import the data into your target system

Integration Scenario 1: Work Order Scheduling in External System

Oracle Manufacturing Cloud uses unconstrained scheduling engine in the background to schedule work orders during create and certain update actions. However, you may want to leverage external system for scheduling the work orders.

Integration with External Production Scheduling Systems

Production scheduling systems typically employ constraint based scheduling algorithms to schedule the work orders. These algorithms attempt to find a feasible schedule by optimizing a performance metric (often called as an objective function) given a set of manufacturing activities that have precedence constraints and that require a set of resources having finite capacity.

For example, the feasible solution may be splitting an operation into two or more quantities where each quantity is worked on different start and end dates. Another feasible solution could be to use work definition A for certain quantity and work definition B for the remaining quantity.

In this approach, Oracle Planning Central System creates the work order. Oracle Planning Central system sends the work order header data containing the work definition. Oracle Manufacturing Cloud then explodes the work definition to create detailed operations, operation items and schedules the work order. You can now export the work order data from Oracle Cloud Manufacturing.

Oracle Manufacturing assumes that the resources have infinite capacity and schedules the work orders without considering the load profile of the resources. If you need constraint based scheduling, then you have to integrate Oracle Manufacturing Cloud with your Production Scheduling System. Figure 3 below shows the high-level flow between the two systems.

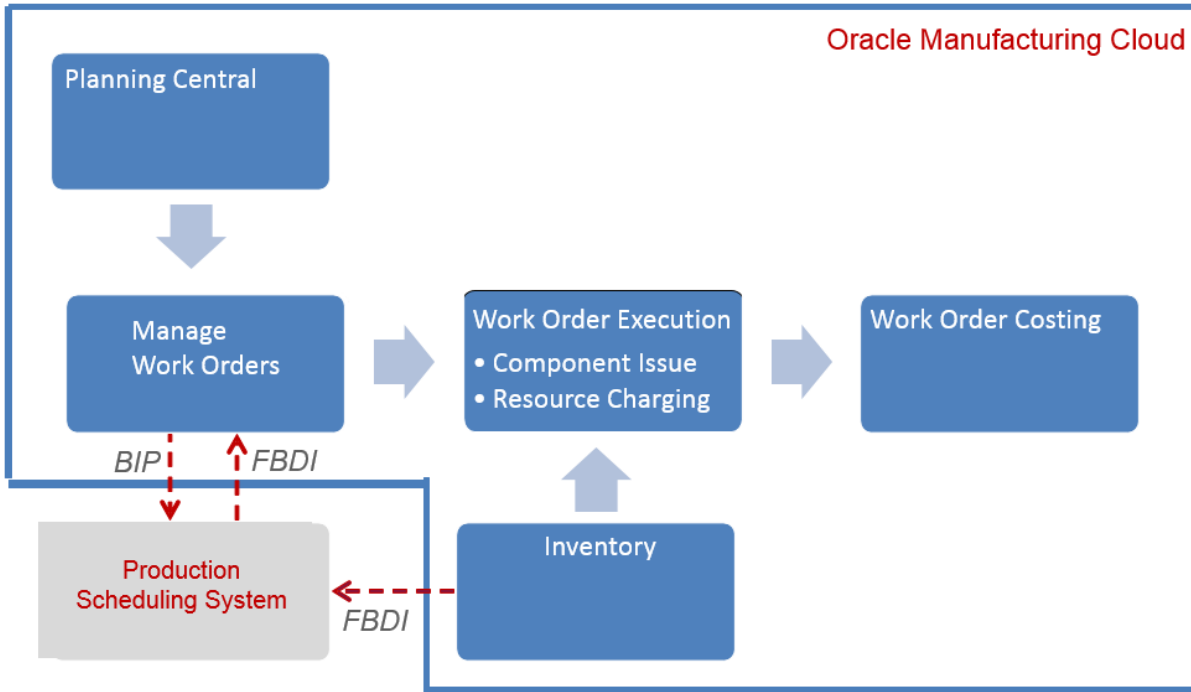


Figure 3. Integration between Oracle Manufacturing Cloud to External Scheduling System

Following master data objects in Manufacturing Cloud may need to be exported to Production Scheduling System:

- Item
- Production Calendar
- Shifts
- Resource
- Work Centers
- Assignment of Resources to Work Center
- Work Definition

Following transaction objects in Manufacturing Cloud may need to be exported to Production Scheduling System:

- Work Orders
- Inventory On Hand
- Projected Inventory

From Production Scheduling System, you will import scheduled work orders into Oracle Manufacturing Cloud.



Outbound Integration Considerations

In Release 11, you have to use Oracle BI Publisher to export the master and transactional data from Oracle Manufacturing Cloud in a csv file. Later, this data in csv file can be imported into your Production Scheduling Systems.

You have to export the master data whenever there is an update in Manufacturing Cloud. Depending upon your Production Scheduling Systems, you can decide to do a full extract of the master data or only an extract of the updates. You may also have to refresh periodically the Production Calendars and availability of the resources for each work center.

Work Orders except that are in 'Completed' and 'Closed' status have to be exported to your Production Scheduling System. Apart from the Work Orders, you may also have to export 'Inventory-on-Hand' and 'Projected Inventory' to know the availability of the components.

Inbound Integration Considerations

After scheduling the work orders in the Production Scheduling Systems, you can import these work orders into Manufacturing Cloud. You can download the scheduled work orders into the specified work order xls/m format and upload them into work order interface tables in Manufacturing Cloud.

To prevent re-scheduling of the work order in Manufacturing Cloud, you have to set the scheduling method as 'No_Scheduling'. Oracle Manufacturing does not re-schedule the work orders if the scheduling method is 'No_Scheduling' and the operation start and end dates in the interface tables are not changed.

Integration Scenario 2: Integrating with Manufacturing Execution Systems

You may want to use your Manufacturing Execution Systems (MES) for shop floor control. This MES system will import the work orders from Oracle Manufacturing Cloud and will execute them. MES will monitor the flow of material and records operating conditions of the manufacturing execution. It also records material and resource consumption for each operation. MES also records operation completion and product completions.

Following master data objects in Manufacturing Cloud may need to be exported to MES System:

- Item
- Production Calendar
- Shifts
- Resource
- Work Centers
- Assignment of Resources to Work Center
- Work Definition

Following transaction objects in Manufacturing Cloud may need to be exported to MES System:

- Work Orders
- Inventory On Hand
- Projected Inventory

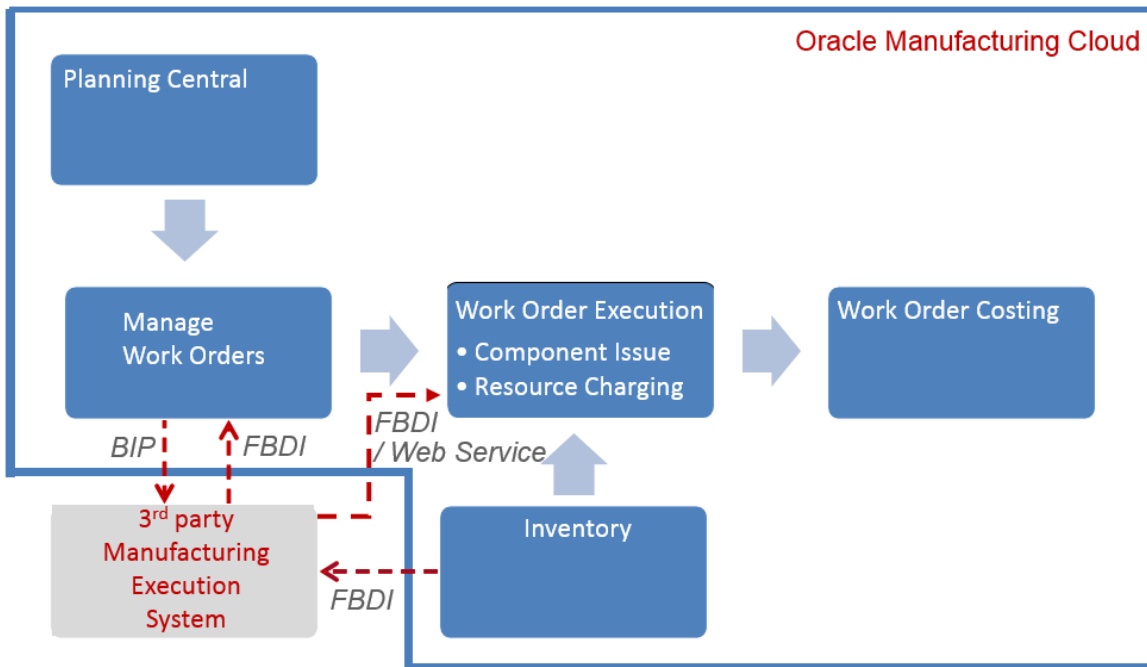


Figure 4. Integration between Oracle Manufacturing Cloud to External MES

Outbound Integration Considerations

In Release 11, you have to use Oracle BI Publisher to export the master and transactional data from Oracle Manufacturing Cloud in a csv file. Later, this data in csv file can be imported into your MES.

Work Orders except that are in 'Completed' and 'Closed' status have to be exported to your MES system. Apart from the Work Orders, you may also have to export 'Inventory-on-Hand' and 'Projected Inventory' to know the availability of the components.

Inbound Integration Considerations

MES records material and resource consumptions apart from recording operation and product completions. You can either use FBDI or web service to import data into Oracle Manufacturing Cloud. If you want to capture the operating conditions, then you have to configure Descriptive Flexfields (DFF) for operation transaction.

If you are using DFF in operation, material and resource transactions, then it is recommended to use FBDI approach for integration. Currently, support for DFF in web service is available only for resource transaction.

Conclusion

This paper provides recommendations based on technologies available at the time of publication. Please consult <https://docs.oracle.com/en/> for the latest available web services, import/export processes, and other integration assets.

Additional Resources

Oracle provides many resources to help with integration options. Please reference the resources below for additional information.

TABLE 6. ADDITIONAL RESOURCES

Title	TYPE	Description
External Data Integration Options for Oracle Cloud	White Paper	Describes how to load data from external sources into Oracle Fusion Applications. My Oracle Support: Doc ID 1474204.1
Oracle Help Center	Web Site	Use the Oracle Help Center for technical information about integrating with other applications, including services, operations, composites, events, and integration tables. This includes diagrams, schematics, and links to other technical documentation. https://docs.oracle.com/en/
Tables and Views of Oracle Supply Chain Management Cloud	Web Site	Use the Oracle Help Center for technical information about data base details of Oracle Manufacturing Cloud. This includes diagrams, schematics, and links to other technical documentation. http://docs.oracle.com/cloud/latest/scmcs_gs/OEDSC/toc .
Oracle Business Intelligence Cloud Service	Web Site	Find all the documents related to Oracle Business Intelligence Cloud Service here: http://docs.oracle.com/cloud/latest/reportingcs_use/index.html
File-Based Data Import for Oracle Supply Chain Management Cloud	Web Site	Use the Oracle Help Center for technical information about file-based data import for Oracle Supply Chain Management Cloud. http://docs.oracle.com/cloud/latest/scmcs_gs/OEFSC/toc.htm
SOAP Web Services for Oracle Supply Chain Management Cloud	Web Site	Use the Oracle Help Center for technical information about SOAP web services for Oracle Supply Chain Management Cloud. http://docs.oracle.com/cloud/latest/scmcs_gs/OESSC/About_Oracle_Applications_Cloud_Web_Services.htm#About_OracleApplicationsCloudWebServ-CAF00B9F



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Oracle Cloud Procure-to-Pay Co-existence and Integration Options
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