

MEA Integration Framework

Dinesh Shenoy
Maximo Consultant

Agenda

1. MEA - Brief Introduction
2. Architecture
 - Integration Objects
 - Interfaces
 - External Systems
3. Outbound and Inbound processing
4. Error Management
5. MEA 'Findings' and DW Practices
6. Q&A and general discussion

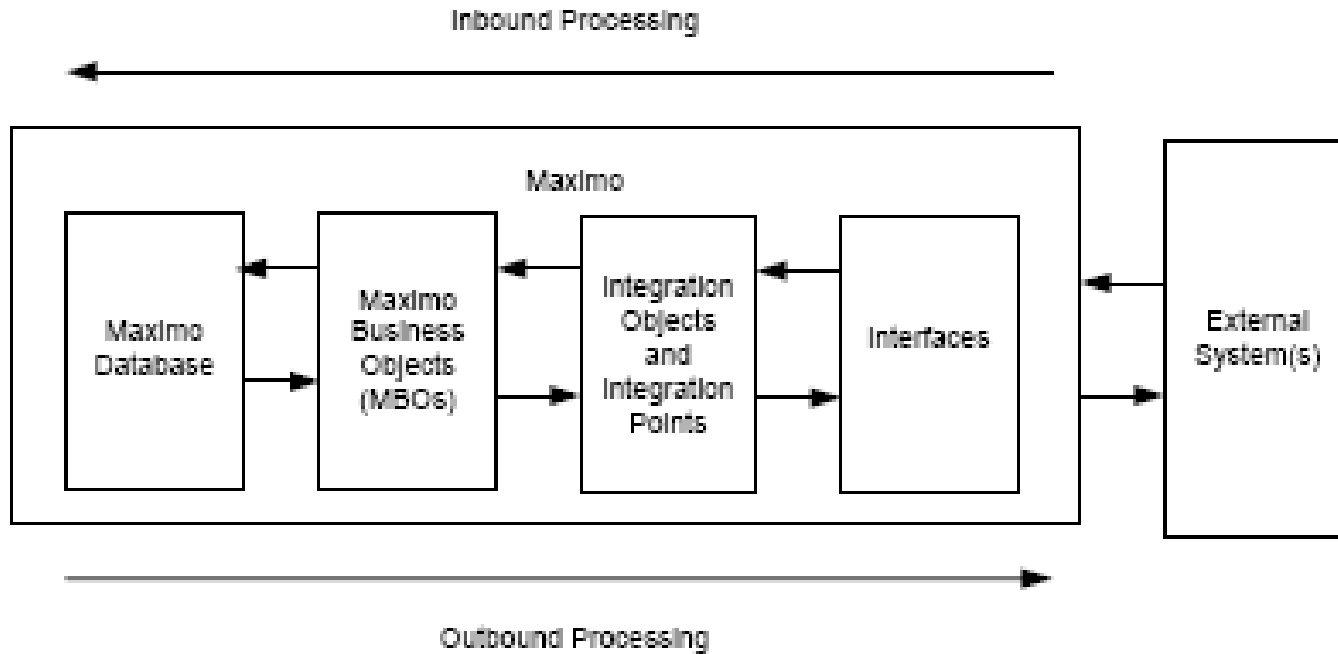
Maximo Enterprise Adapter (MEA)

- The Maximo Enterprise Adapter is a set of applications that help you to integrate Maximo with your enterprise applications and create business flows between Maximo and your other enterprise applications.

Key MEA Features

- Applications to manage integration processing and to create new integration points
- Support for multiple integration models using HTTP, messaging, and database interface tables and flat files
- Real time, batch, and user-initiated processing of outbound and inbound interfaces
- Support for query and data synchronization interfaces
- The ability to perform bulk loading of XML or flat files for inbound interfaces

Integration Overview



Integration Objects

- An integration object consists of one or more sub-records that derive their content from a particular Maximo Business Object.
- Each integration object is built from one or more MBOs that provide the content needed for a specific integration point. Integration points provide a framework for accessing the MBOs in the integration object and any methods defined on the MBOs.

Integration Points

- An integration point provides access to an integration object in a given direction (inbound or outbound). Outbound integration points retrieve data from the MBOs to build the integration object, while inbound integration points create, update, or query MBOs, depending on the operation associated with the point. An integration object can have multiple integration points associated with it, in either direction.

Integration Point Operation Properties

Operation Properties

Operation	Purpose	Direction
Notify	The integration point performs data synchronization.	Outbound, Inbound
Query	The integration point processes queries.	Inbound only
Response	The integration point provides responses to queries.	Outbound only

DWWOCOMPOSITE Integration Object

The screenshot shows the MAXIMO web interface for configuring the DWWOCOMPOSITE integration object. The browser window title is "MAXIMO - Integration Objects - Windows Internet Explorer provided by Denver Water". The URL is "http://uatmax01:7001/maximo/ui/maximo.jsp?sc=1256139827550&event=loadapp&value=intobject".

The main content area displays the "Integration Object" configuration for "DWWOCOMPOSITE". The description is "Composite WO with Worklog, Asset, AssetSpec". The "User Defined?" checkbox is checked, and "Merged Object?" is unchecked.

Below this, there is a table titled "Source MBOs for DWWOCOMPOSITE" showing the relationships between source MBOs and the integration object. The table has columns for MBO, Parent MBO, Relationship, MBO Order, and User Defined?.

MBO	Parent MBO	Relationship	MBO Order	User Defined?
WORKORDER			1	<input checked="" type="checkbox"/>
MEASUREMENT	WORKORDER	MEASUREMENT	1	<input checked="" type="checkbox"/>
WORKLOG	WORKORDER	MODIFYWORKLOG	2	<input checked="" type="checkbox"/>
ASSET	WORKORDER	WO_ASSET	3	<input checked="" type="checkbox"/>
ASSETSPEC	ASSET	ASSETSPEC	1	<input checked="" type="checkbox"/>

Below the table, there are tabs for "Persistent Fields", "Non-Persistent Fields", and "User Fields". The "Persistent Fields" tab is active, showing a table of fields excluded from the source MBO WORKORDER. The table has columns for Field and Exclude.

Field	Exclude
HASLD	<input checked="" type="checkbox"/>
LANGCODE	<input checked="" type="checkbox"/>
ACTFINISH	<input type="checkbox"/>
ACTLABCOST	<input type="checkbox"/>
ACTLABHRS	<input type="checkbox"/>
ACTMATICOST	<input type="checkbox"/>
ACTSERVCOST	<input type="checkbox"/>
ACTSTART	<input type="checkbox"/>
ACTTOOLCOST	<input type="checkbox"/>
ASSETLOCRIORITY	<input type="checkbox"/>

The bottom of the screenshot shows the Windows taskbar with the Start button, several application icons, and the system tray displaying "Done", "(3) Remote Desktop Connection", "Local intranet", and "100%". The time is 2:27 PM.

DWWOCOMPOSITE Integration Points

The screenshot displays the MAXIMO web application interface for managing integration objects. The browser window title is "MAXIMO - Integration Objects - Windows Internet Explorer provided by Denver Water". The address bar shows the URL: `http://uatmax01:7001/maximo/uj/maximo.jsp?sc=1256139827550&event=loadapp&value=intobject`. The application header includes navigation links such as "Go To", "Reports", "Start Center", "Profile", "Sign Out", and "Help".

The main content area is titled "Integration Objects" and features a search bar and a "Select Action" dropdown. Below this, there are tabs for "List", "Integration Object", and "Integration Point". The "Integration Point" tab is active, showing details for the integration object "DWWOCOMPOSITE" with the description "Composite WO with Worklog, Asset, AssetSpe". The "User Defined?" checkbox is checked, and the "Merged Object?" checkbox is unchecked.

Two tables are displayed, both showing "1 - 1 of 1" records:

- Outbound Integration Points for DWWOCOMPOSITE:**

Integration Point	Description	Operation	Processing Class
DWWOCOMPO		Notify	
- Inbound Integration Points for DWWOCOMPOSITE:**

Integration Point	Description	Operation	Processing Class
DWWOCMPIN		Notify	

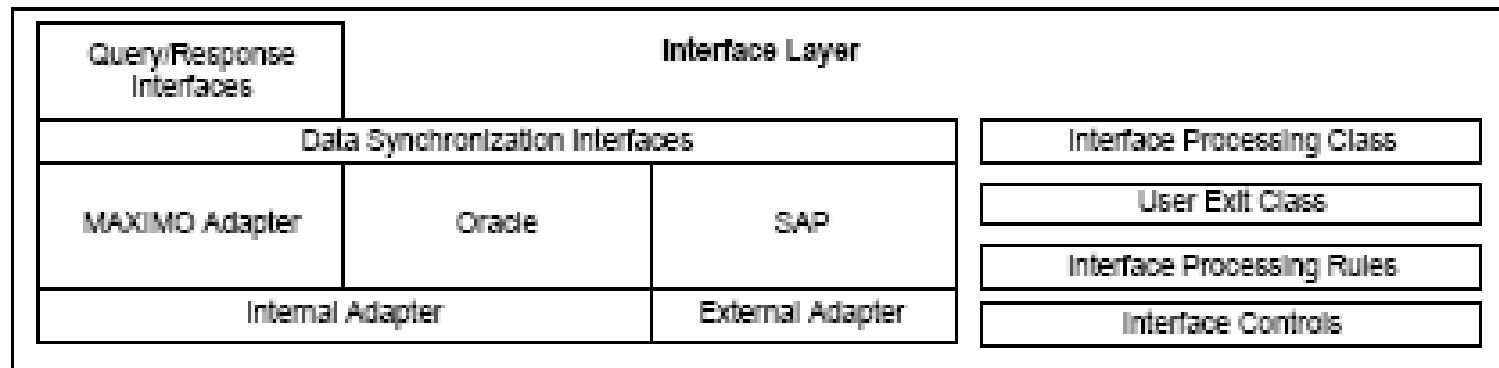
The Windows taskbar at the bottom shows the system tray with the time "2:28 PM" and the text "Local intranet".

Interfaces

- Maximo uses interfaces to transform data from Maximo format to an external format, and vice versa. Interfaces implement one or more integration points in either direction (outbound or inbound) and each interface-integration point combination can have processing rules associated with it.

Interface Layer

Maximo Enterprise Adapter Interface Layer



DWWOCOMPOSITEInterface

The screenshot displays the MAXIMO Integration Interfaces web application in a Windows Internet Explorer browser. The browser's address bar shows the URL: `http://dwmax04:7001/maximo/ui/maximo.jsp?sc=1256159090253&event=loadapp&value=interface`. The application's title bar reads "MAXIMO - Integration Interfaces - Windows Internet Explorer provided by Denver Water".

The main content area is titled "Integration Interfaces" and features a navigation menu with tabs for "List", "Interface", "Outbound Processing Rules", and "Inbound Processing Rules". The "Interface" tab is active, showing the configuration for the "DWWOCOMPOSITEInterface".

The configuration details are as follows:

- Interface:** DWWOCOMPInt (selected), DW Work Order Composite Interface
- Operation:** Notify
- Integration Object:** DWWOCOMPO
- Adapter:** MAXIMO
- Reply Interface:** (empty)
- User Defined?:**
- Web Service Deployed?:**
- Interface Table:** DWWOCOMPO

Below the configuration, there are tabs for "Outbound Integration Points" and "Inbound Integration Points". The "Outbound Integration Points" tab is active, showing a table with the following columns: "Integration Point", "Interface Processing Class", and "Interface User Exit Class".

Integration Point	Interface Processing Class	Interface User Exit Class
DWWOCOMPO		

A "New Row" button is located at the bottom right of the table. The browser's status bar at the bottom shows "Done", "Local intranet", and "100%". The Windows taskbar at the very bottom displays the Start button, several application icons, and the system clock showing "3:26 PM".

Interface Processing Rules

- Interface processing rules let users change the behavior of any interface without having to write Java classes. Processing rules can access and evaluate values in XML and MBO fields, MBO sets, and controls; and they can change the values in XML and MBO fields, or stop or skip processing of all or part of a transaction.

Sample Processing Rules

The screenshot displays the MAXIMO Integration Interfaces web application. The browser window title is "MAXIMO - Integration Interfaces - Windows Internet Explorer provided by Denver Water". The URL is <http://dwmax04:7001/maximo/ui/maximo.jsp?sc=1256159090253&event=render&targetid=interface&value=rerender>. The application shows the "Outbound Processing Rules" for the "DWWOCOMP" interface. The interface is named "DWWOCOMP" and the adapter is "MAXIMO". The user defined flag is checked.

The "Integration Point" is "DWWOCOMP". The "Integration Object Sub-Records" are listed as follows:

MBQ	Parent MBQ	Processing Order
WORKORDER		1
MEASUREMENT	WORKORDER	2
WORKLOG	WORKORDER	3
ASSET	WORKORDER	4
ASSETSPEC	ASSET	5

The "Processing Rules for Sub-Record WORKORDER" are listed in the following table:

Rule	Description	Sequence	Action	Enabled?	User Defined?
SKIPTASK	Skip TASKs on WOs	1	SKIP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SKIPWAPPR	Skip WAPPR WOs	2	SKIP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SKIPREVIEWED	Skip REVIEWED WOs	3	SKIP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SKIPFINALREV	Skip FINALREV WOs	4	SKIP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SKIPHOLD	Skip HOLD WOs	5	SKIP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

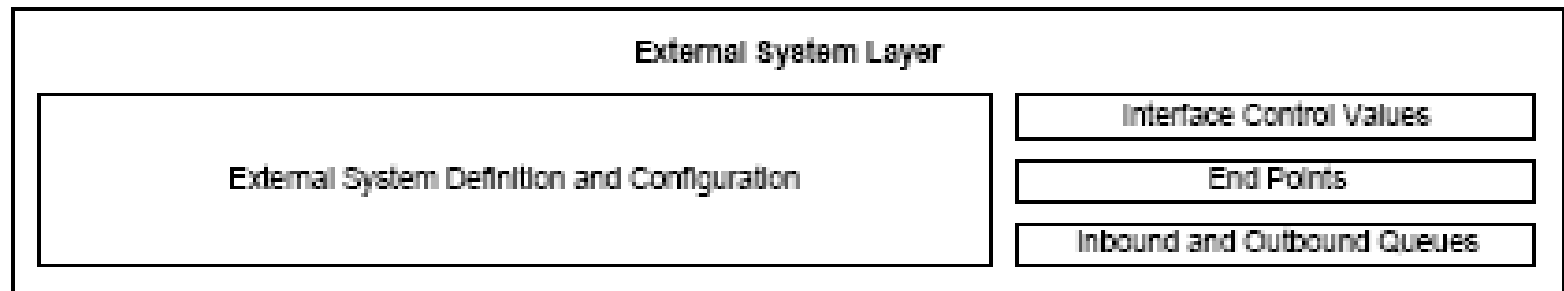
Buttons at the bottom of the table include "Sub-Record Fields", "Add/Modify Conditions", and "New Row".

External Systems

- An external system interacts with Maximo, either as an end point (location) to which Maximo sends outbound data, or as a source from which Maximo receives inbound data. Any business application that sends data to Maximo or receives data from Maximo is considered to be an external system.

External System Layer

Maximo Enterprise Adapter External System Layer



End Points

- An end point is a location to which an outbound queue sends data.

Sample End Point

The screenshot displays a web browser window titled "MAXIMO - External Systems - Windows Internet Explorer provided by Denver Water". The address bar shows the URL: `http://dwmax04:7001/maximo/ui/maximo.jsp?sc=1256159090253&event=loadapp&value=extsystem`. The browser tabs include "Hydrant Inspection Round 6", "MAXIMO - External Systems", and "WebLogic Server Console".

The main content area is titled "External Systems" and features a navigation bar with "Go To", "Reports", "Start Center", "Profile", "Sign Out", and "Help". Below this is a search bar and a "Select Action" dropdown. The "System" tab is active, showing configuration details for "ESB Integration".

Configuration fields include:

- System: ESBINT
- Adapter: MAXIMO
- End Point: DWWOOUTBO
- Enabled?:
- Outbound Sequential Queue: `jms/mro/int/queues/sqout`
- Inbound Sequential Queue: `jms/mro/int/queues/sqin`
- Inbound Continuous Queue: `jms/mro/int/queues/cqin`

Below the configuration fields is a table titled "Properties for End Point DWWOOUTBOUND" (1 - 8 of 8). The table has columns for "Property", "Value", and "Encrypted Value".

Property	Value	Encrypted Value
ENDPOINTURL	<code>http://hpdapp02:8087/Services/MaximoWorkOrderPublisher/MaximoWorkOrderPublisher.serviceagent/MaximoWorkOrder</code>	
ONEWAYWS		
PASSWORD		
SERVICENAME	MaximoWorkOrderPublisher	
SOAPACTION	<code>/Services/MaximoWorkOrderPublisher/MaximoWorkOrderPublisher.serviceagent/MaximoWorkOrderPortTypeEndpoint1/processDocument</code>	
TARGETNAMESPACE	<code>http://xmlns.example.com/1238602159627</code>	
USERID		
WSEXIT		

The bottom of the browser window shows the status bar with "Done" and "Local intranet". The Windows taskbar at the very bottom displays the Start button, several application icons, and the system tray showing the time as 3:42 PM.

Inbound and Outbound queues

- A queue is what Maximo uses as a staging area during the exchange of messages between Maximo and external systems. Maximo uses one sequential queue for outbound processing and two – sequential and continuous for inbound processing.

Outbound Integration Processing

Maximo performs two types of outbound integration processing:

- Real time, initiated via data entry in Maximo
- Batch, initiated via the Data Export feature of Maximo

Sample 'Data Export'

The screenshot displays the MAXIMO External Systems web application in Internet Explorer. The browser address bar shows the URL: `http://dwmax04:7001/maximo/ui/maximo.jsp?sc=1256159090253&event=loadapp&value=extsystem`. The application interface includes a navigation menu with 'Outbound Interfaces' selected. A 'Data Export' dialog box is open, showing the following configuration:

- Interface: MXINTFACEInt
- Integration Point: MXINTFACEOU
- Export Condition: ifacename = 'DWWOCOMPOSITEInterface'

The background table lists various interfaces with their descriptions and enabled status:

Interface	Description	Enabled?
MXACTIONInter	MAXIMO ACT	<input checked="" type="checkbox"/>
MXCTEMPLATE	MAXIMO COI	<input checked="" type="checkbox"/>
MXDOMAINInter	MAXIMO DOI	<input checked="" type="checkbox"/>
MXENDPOINTInt	MAXIMO END	<input checked="" type="checkbox"/>
MXEXTSYSInte	MAXIMO EXT	<input checked="" type="checkbox"/>
MXINTFACEInt	MAXIMO INTEGRATION INTERFACE	<input checked="" type="checkbox"/>
MXINTOBJInter	MAXIMO INTEGRATION OBJECT	<input checked="" type="checkbox"/>
MXINTYPEInte	MAXIMO INTERFACE TYPE	<input checked="" type="checkbox"/>
MXMAXROLEIn	MAXIMO ROLES	<input checked="" type="checkbox"/>
MXMESSAGEIn	MAXIMO MESSAGES	<input checked="" type="checkbox"/>

At the bottom of the application, there are buttons for 'Data Export' and 'New Row'. The Windows taskbar at the bottom shows the system time as 4:06 PM and the network as 'Local intranet'.

Inbound Integration Processing

- Queue-based
- Synchronous, initiated via WebServices

How to monitor queues

- Login to the WebLogic Console and navigate to mxesdomain> JMS Servers> mxintsqoutserver> JMS Destinations> mxintsqout> Active JMS Destinations and click on 'Monitor all Active JMS Destinations...'

Monitoring Outbound queue

WebLogic Server Console - Windows Internet Explorer provided by Denver Water

http://dwmax04:7001/console/actions/mbean/MBeanFramesetAction?bodyFrameId=wl_console_frame_1256159101127&isNew=false&frameId=wl_console_frame_12561591011

File Edit View Favorites Tools Help

Hydrant Inspection Round 6 MAXIMO - External Systems WebLogic Server Console

mxesdomain> JMS Servers> mxintsqoutserver> JMS Destinations> mxintsqout> Active JMS Destinations

Connected to : dwmax04 :7001 | You are logged in as : weblogic | Logout

A JMS destination identifies a queue (Point-To-Point) or a topic (Pub/Sub) for a JMS server.

This Active JMS Destinations page displays statistics about the active JMS destinations currently running on your JMS server.

To monitor the active durable subscribers running on the JMS server, click the [Monitor All Durable Subscribers...](#) link.

[Customize this view...](#)

Name	Consumers	Consumers High	Consumers Total	Messages	Messages Pending	Messages High	Messages Received	Messages Threshold Time	Bytes	Bytes Pending	Bytes Received	Bytes Threshold Time
mxintsqout	1	1	1	0	0	1	1	0	0	0	4483	0

Applet navapplet started

Local intranet 100%

start 4 M... 5 I... 4 R... Orac... 4 M... Rule... Orac... Mic... unttl... 4:00 PM

Error Management

- Outbound errors are typically due to a communication failure between the queue and external system or, if writing to interface tables or files, a problem with table or file space.
- Inbound are typically due to business rule validations in the MBOs or in the inbound processing of Maximo.

Error Management

Error Management Folders

Folder	Contents	Owner
error	Messages in which integration processing encountered an error	Maximo
retry	Corrected messages, to be reprocessed by Maximo	User
delete	Messages to be deleted	User
deleted history	Log of deleted messages	Maximo

Error Management

- Outbound errors go to
D:\mea_globaldir\error\jms.mro.int.queues.s
qout\ folder
- Inbound errors go to
D:\mea_globaldir\error\jms.mro.int.queues.s
qin\ folder

Error Management

- With sequential queues, inbound or outbound, once you encounter an error, subsequent messages in the queue are not processed until the message in error has been resolved. As a result, only one error at a time can exist in a sequential queue.
- When an error is encountered in the continuous queue, the error management mechanism is initiated and the message is flagged as having an error. However, Maximo continues to process subsequent messages in the queue. As a result, multiple errors can exist in a continuous queue.

Sample Error File

```
<?xml version="1.0" encoding="UTF-8"?>
<ERROR>
<ERRORMESSAGE>Error occurred while processing IR record
CHARTOFACCOUNTS at number 1. Error is:
Not a valid GL Account. The COST CENTER component value is not
valid.</ERRORMESSAGE>
<ER>
<MXCOAInterface xmlns="http://www.mro.com/mx/integration"
language="en">
<Header operation="Notify" event="1">
...
</Header>
<Content>
<MXCOA>
<CHARTOFACCOUNTS action="Add">
...
</CHARTOFACCOUNTS>
</MXCOA>
</Content>
</MXCOAInterface>
</ER>
<IR>
<MXCOA>
<CHARTOFACCOUNTS action="Add">
...
</CHARTOFACCOUNTS>
</MXCOA>
</IR>
</ERROR>
```

MEA Gotchas

- MEA assumes defaults for any Action that involves manual intervention.
Ex : If a Location is being DECOMMISSIONED, it takes the default of NOT taking it out of Routes. If a GLComponent is being Activated, it takes the default of Activating all GLAccounts that contain that GLComponent.

MEA Gotchas

- MEA doesn't exactly follow all standard MBO processing rules.
Ex : You can charge time against a CLOSEd WO if the LABTRANS transaction is created via MEA !

DW Practices

- Use MXINTOBJInterface and MXINTIFACEInterface to migrate newly-defined interfaces from one environment to another.
- Use Outbound interfaces to generate an XML file that can in turn be used to test Inbound interfaces.

DW Practices

- To avoid sending emails (escalations, workflow, etc) from a non-production environment, after every database overlay, we run the following SQL

```
DELETE FROM Email;
```

- To avoid sending interface messages from non-production environments to the production middleware machine, we deactivate the key External Systems (ESB%) and all Outbound interfaces by running the following SQL

```
UPDATE MaxExtIFaceOut SET Enabled = 0 WHERE ExtSysName LIKE 'ESB%';
```

```
UPDATE MaxEndPointDTL SET Value = NULL WHERE EndPointName LIKE '%OUTBOUND%' AND Property = 'ENDPOINTURL';
```

Deleting entire In/Out queues

- At times certain sequential transactions could get 'stuck' in the queue, and one way to delete the entire queue (if moving the error file to delete folder does not work), is to stop the MX Server, clear out D:/bea/jmsstore folder and restart the server. This should be done in non-production environments only !

Q&A

and

General Discussion