

IEC CIM architecture for Smart Grid to achieve interoperability International CIM Interop in March 2011

Nada Reinprecht, IBM Global Business Services

E-mail nadarein@au1.ibm.com

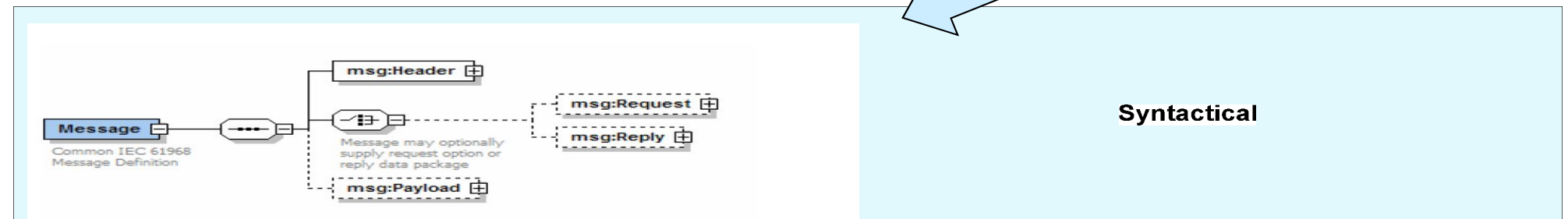
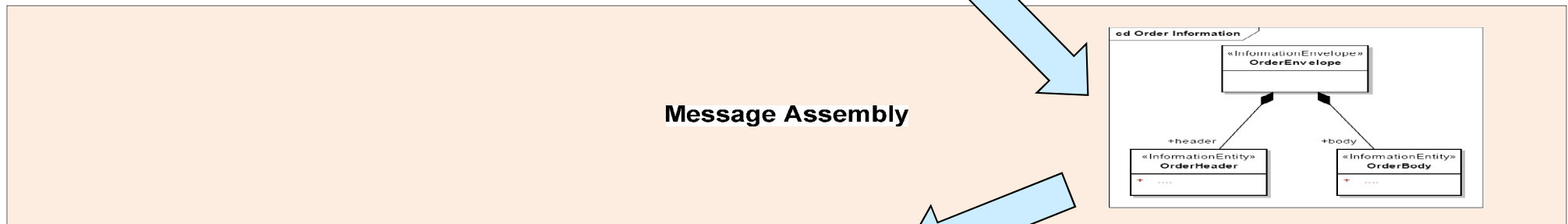
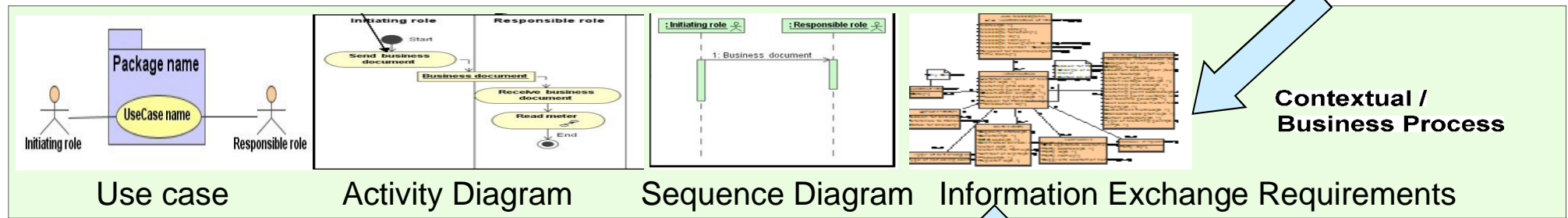
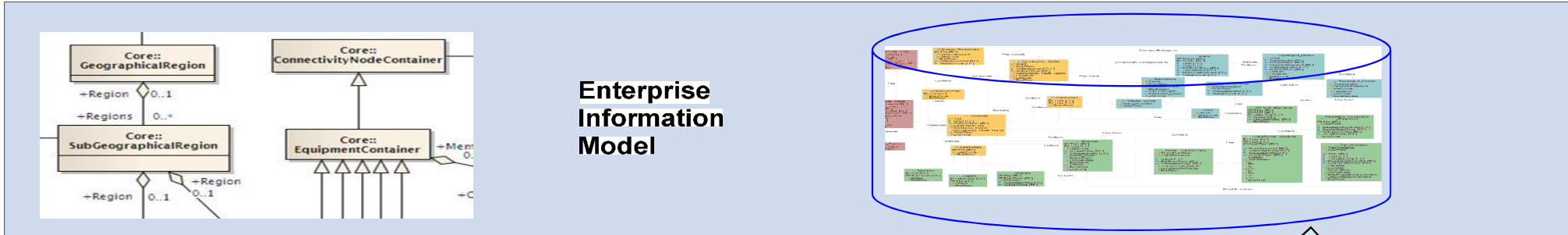
Javier Torres, IBM Software Group

E-mail jrtorres@us.ibm.com

Marilza Maia, IBM Software Group

E-mail mmaia@us.ibm.com

- Layered architecture
 - CIM has a layered architecture which ensures implementation of standard methodology at each layer. Both information and context layers are semantic with the defined rules for translation to the implementable physical syntax.
 - Concrete CIM messages tested in the March 2011 CIM IOP were developed following principles of CIM layered architecture; They conform to:
 - CIM information model (Semantic Information Layer)
 - Semantic profile (Business Context Layer)
 - Message structure (Message Assembly Layer)
 - Rules for Translation to XML (Syntactical Layer)
 - SOA web services implementation architecture (Implementation Architecture Layer)

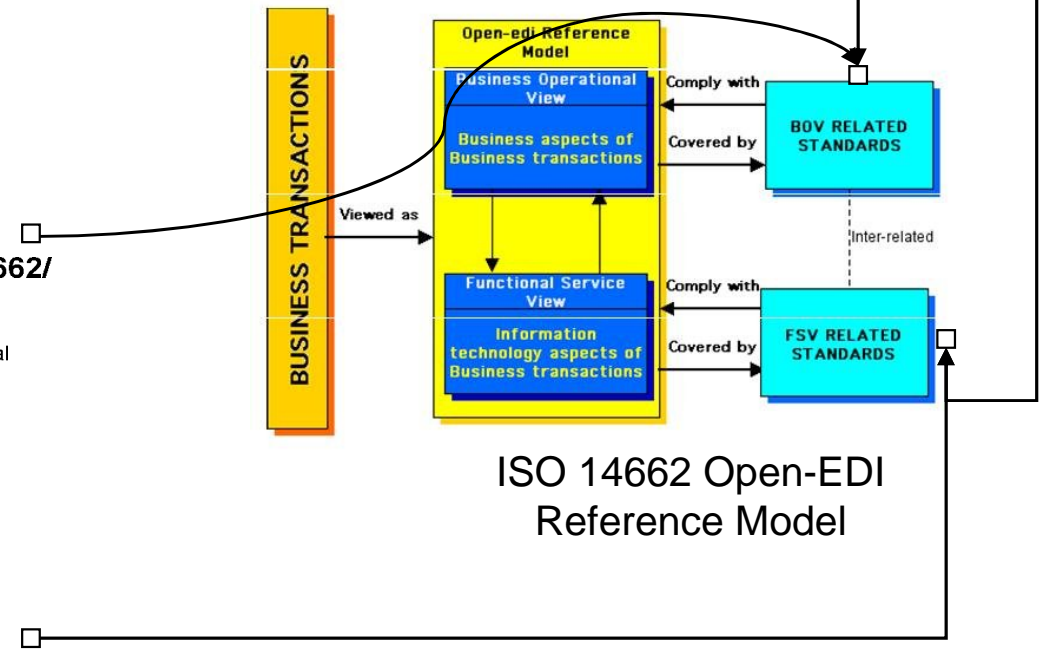
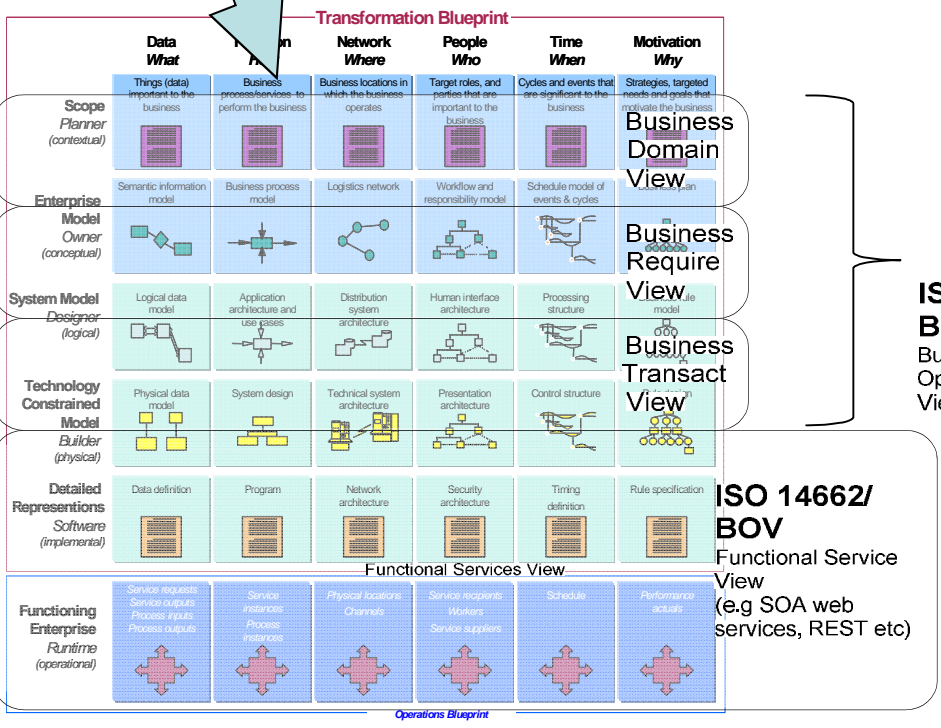
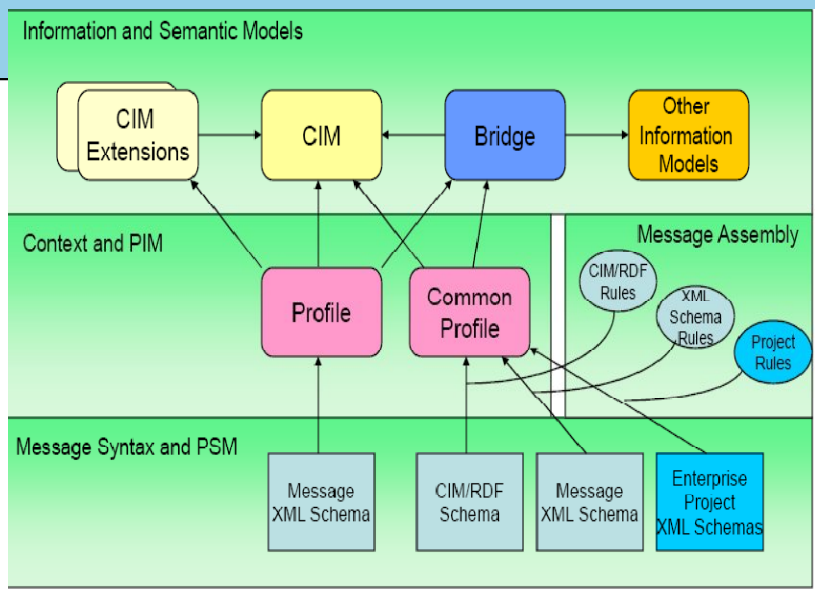


- Loose Coupling
 - Clear semantic definition of an interface which provides for conceptual understanding of exchanged information, allows for loose coupling and enables two or more integrating systems to interoperate without elaborate pre-arrangements.
 - March CIM IOP demonstrated how IOP participants have developed their CIM compliant web services ONLY based on the provided CIM interface specification; There was no need for close collaboration between participants.

- Shallow Integration

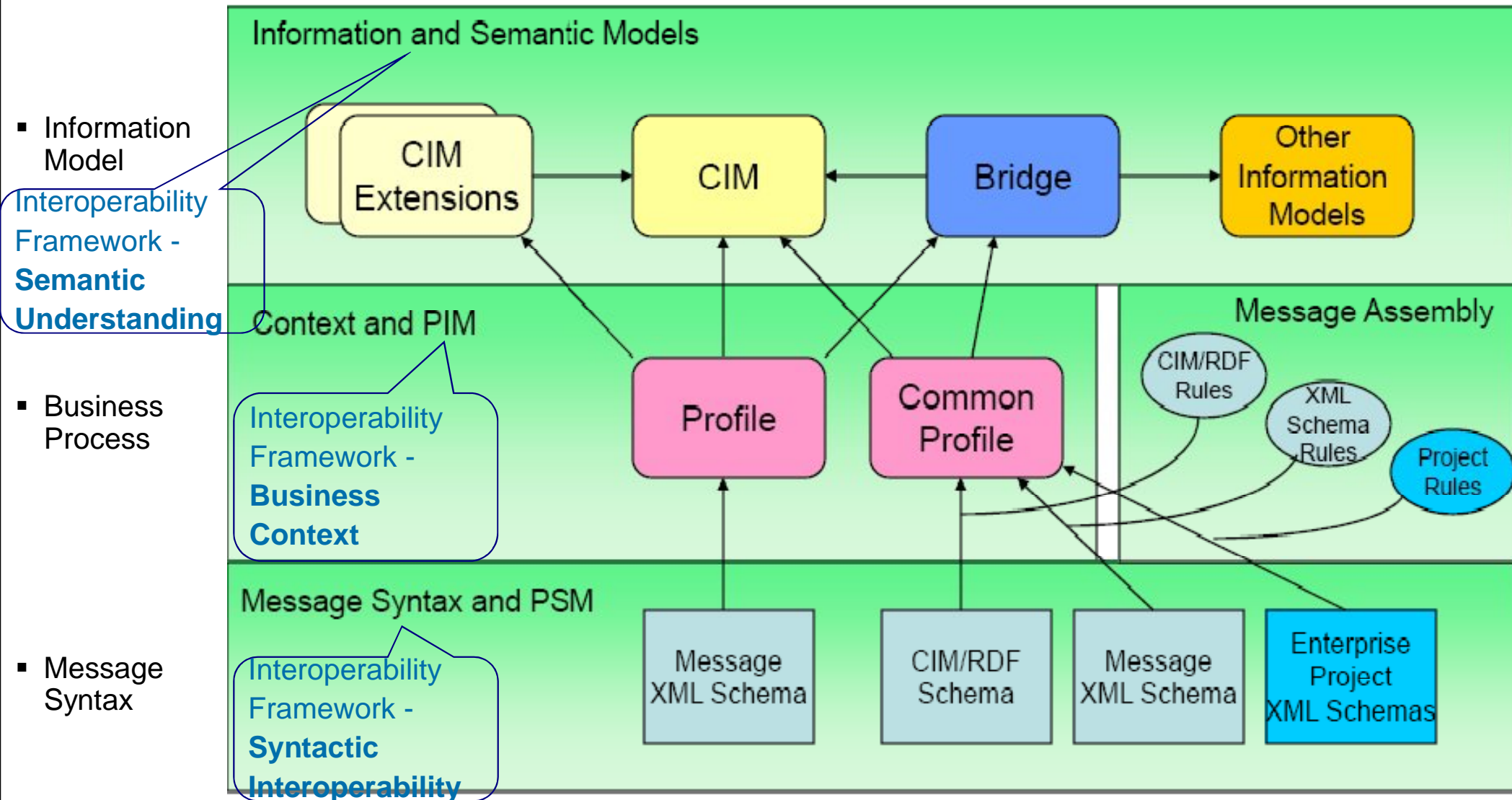
- CIM compliant integration provides for minimum knowledge included in the message (shallow integration) thus enhancing value of composition. Common components of the integration for similar business processes are realized by common messages
- March CIM IOP demonstrated how the WorkRequest interface is used for requesting work from Asset Management System triggered by conditional based maintenance and at the same time for requesting work from the Distribution Management System to repair faulted high voltage transformer

UN Modelling Methodology



ISO 14662 Open-EDI Reference Model

CIM IOP proves that CIM standard provides for both syntactic and semantic interoperability





IBM's Energy and Utility Solution Portfolio

CIM based integration capability tested for Transmission & Distribution Operations: Maximo and WebSphere

Power Generation Optimization (PGO)

- Plant Operations
- Fleet Optimization
- Supply Expansion

Transmission & Distribution Operations

- Mobile Workforce Mgmt
- Asset Lifecycle Mgmt
- Supply Chain Mgmt

Customer Operations Transformation (COT)

- Customer Care
- Customer Management
- Customer Systems

Intelligent Utility Network (IUN)

- Smart Metering & Beyond
- Grid Operations
- Electric Vehicles
- IUN Communications Networks
- IUN Security
- Distributed Energy Resources

Corporate Support Services

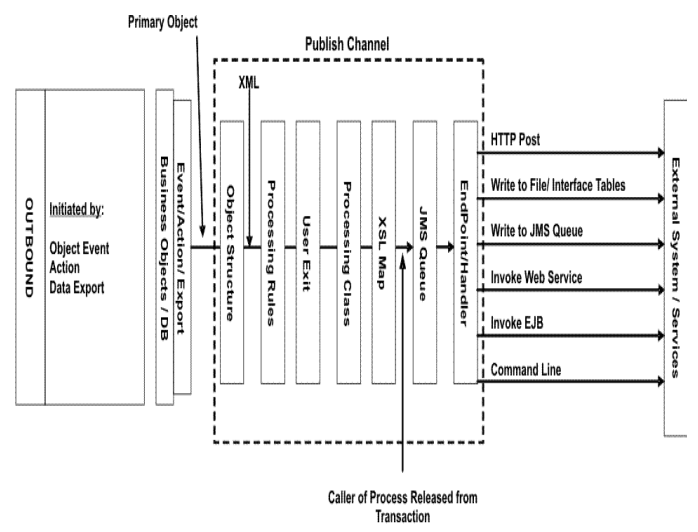
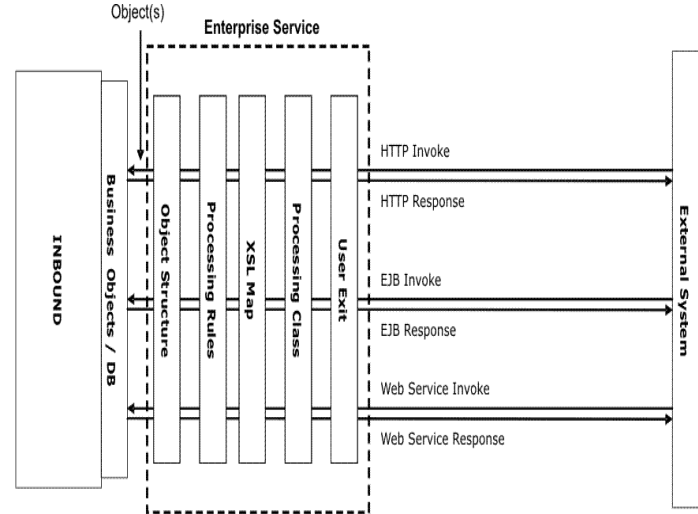
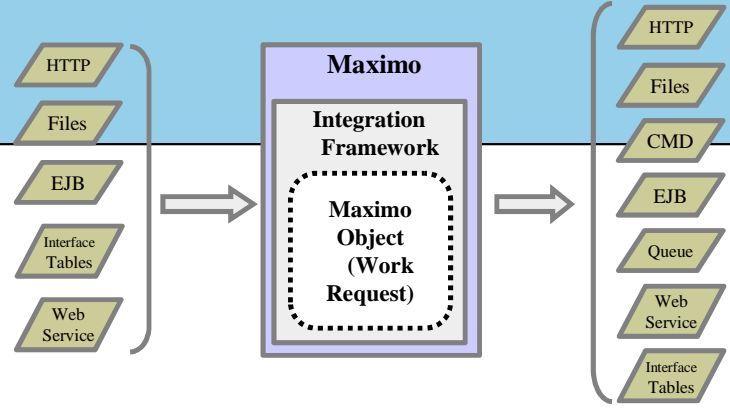
- Human Resources
- Accounting
- Payroll

Delivery Options

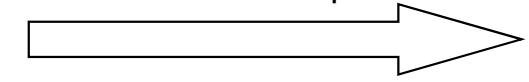
Physical and Cyber Security

Solution Architecture for Energy & Utilities Framework (SAFE)

Infrastructure
Servers, storage, communications networks and equipment and associated services



Inbound XSLT sample

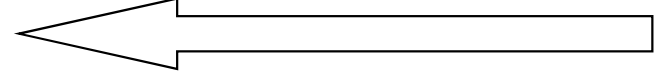


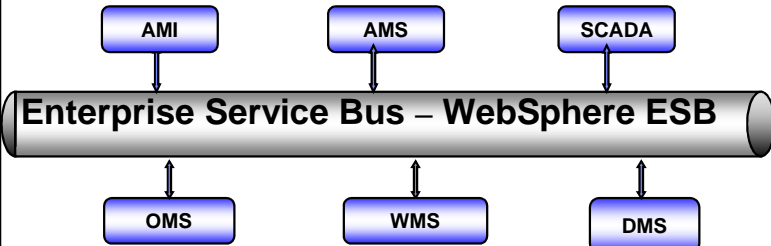
```

<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet xmlns:m1="http://www.iec.ch/TC57/2010/schema/message" xmlns:m="http://www.ibm.com/maximo" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:xs="http://www.w3.org/2001/XMLSchema-instance" >
  <xsl:output omit-xml-declaration="no" method="xml"/>
  <xsl:strip-space elements="*" />
  <xsl:template match="/">
    <xsl:if test="max:PublishPLUSDWO">
      <xsl:element name="m:ChangedWorkRequest">
        <xsl:element name="m:Header">
          <xsl:element name="m1:Noun">WorkRequest</xsl:element>
          <xsl:element name="m1:Source">Maximo</xsl:element>
          <xsl:element name="m1:MessageID">
            <xsl:value-of select="max:PublishPLUSDWO/@messageID"/>
          </xsl:element>
        </xsl:element>
        <xsl:element name="m:Payload">
          <xsl:if test="max:PublishPLUSDWO/max:PLUSDWOSet/max:WORKORDER">
            <xsl:for-each select="max:PublishPLUSDWO/max:PLUSDWOSet/max:WORKORDER">
              <xsl:apply-templates select="."/>
            </xsl:for-each>
          </xsl:if>
        </xsl:element>
      </xsl:element>
    </xsl:if>
  </xsl:template match="max:WORKORDER">
    <xsl:element name="p:WorkRequest">
      <xsl:element name="p:Organisation">
        <xsl:element name="p:mRID">
          <xsl:value-of select="max:SITEID"/>
        </xsl:element>
      </xsl:element>
      <xsl:element name="p:Work">
        <xsl:element name="p:mRID">
          <xsl:value-of select="max:WONUM"/>
        </xsl:element>
      </xsl:element>
      <xsl:element name="p:kind">
        <xsl:value-of select="max:WORKTYPE"/>
      </xsl:element>
    </xsl:element>
  </xsl:template>
  <xsl:template name="WORKTYPE">
    <xsl:attribute name="changed">false</xsl:attribute>
    <xsl:value-of select="p:Work/p:kind"/>
  </xsl:template>
  <xsl:template name="WOPRIORITY">
    <xsl:attribute name="changed">true</xsl:attribute>
    <xsl:value-of select="p:Work/p:priority"/>
  </xsl:template>
  <xsl:choose>
    <xsl:when test="p:Work/p:TimeSchedules/p:kind = 'estimate'">
      <xsl:element name="SCHESTART">
        <xsl:attribute name="changed">true</xsl:attribute>
        <xsl:value-of select="p:Work/p:TimeSchedules/p:scheduleInterval/p:start"/>
      </xsl:element>
      <xsl:element name="SCHEFINISH">
        <xsl:attribute name="changed">true</xsl:attribute>
        <xsl:value-of select="p:Work/p:TimeSchedules/p:scheduleInterval/p:end"/>
      </xsl:element>
    </xsl:when>
    <xsl:when test="p:Work/p:TimeSchedules/p:kind = 'request'">
      <xsl:element name="TARGSTARTDATE">
        <xsl:attribute name="changed">true</xsl:attribute>
        <xsl:value-of select="p:Work/p:TimeSchedules/p:scheduleInterval/p:start"/>
      </xsl:element>
      <xsl:element name="TARGCOMPDATE">
        <xsl:attribute name="changed">true</xsl:attribute>
        <xsl:value-of select="p:Work/p:TimeSchedules/p:scheduleInterval/p:end"/>
      </xsl:element>
    </xsl:when>
  </xsl:choose>
  </xsl:template>
</xsl:stylesheet>

```

Outbound XSLT sample





CIM IOP Test Topology

WebSphere Integration Developer

WebSphere ESB

Mediation Support
(transformation, validation, routing, lookup, enrich, splitting, aggregation, synchronization, logging, etc., custom)

Format Support
(TRANSFORMS from any to any)

Protocol Bindings
(CONVERTS from any to any)

Enterprise QOS

Cluster Administration **Powered by WAS ND**

Visual, and pattern-based, Mediation Authoring in WID for deployment to WESB

Wide Range of Supplied Mediation Function

System Health, Service Traffic, Mediation Policies and Service Reuse

XML Schema | CSV | COBOL | C Struct | Non-XML | Custom

XML | SOAP | Fixed Width | Delimited | Atom | JSON

Synchronous, native, and asynchronous invocations:

Messaging: JMS 1.1, WS, WebSphere MQ, HTTP

Web Service standards: SOAP/JMS, SOAP/HTTP

Adapters: SAP, PeopleSoft, Siebel, JDE, Oracle, Email, FTP, FlatFile, Domino, System i, ECOM, IMS, CICS, Java, EJB, SCA

WebSphere Service Registry & Repository

IBM WebSphere Enterprise Service Bus

WebSphere software
Common Base Event Browser

Get Events | Logout | Help

Event Views	Event ID	Event Name	Location
All Events	2011-03-29T12:25:09.046Z	IEC61968-6_EventEmitter_Request	10 rhel5u5x64Node01Cell\rhel5u5x64Node01
User Data Events	2011-03-29T12:25:15.057Z	IEC61968-6_EventEmitter_Response	10 rhel5u5x64Node01Cell\rhel5u5x64Node01
Server Events			

Number of events: 520

```

    <me:CreateWorkRequest>
      <me:Header>
        <me_1:Verb> create</me_1:Verb>
        <me_1:Noun> workrequest</me_1:Noun>
        <me_1:Revision> rev1</me_1:Revision>
        <me_1:Context> TESTING</me_1:Context>
        <me_1:Timestamp> 2011-03-29T18:29:02Z</me_1:Timestamp>
        <me_1:Source> EMS</me_1:Source>
        <me_1:AsyncReplyFlag> false</me_1:AsyncReplyFlag>
        <me_1:ReplyAddress> ReplyAddress</me_1:ReplyAddress>
        <me_1:AckRequired> true</me_1:AckRequired>
        <me_1:MessageID> 432143214321</me_1:MessageID>
        <me_1:CorrelationID> 123412341234</me_1:CorrelationID>
        <me_1:Comment> Message created manually</me_1:Comment>
      </me:Header>
      <me:Payload>
        <re_1:WorkRequest>
          <re_1:Organisation>
            <re_1:mRID> PROD</re_1:mRID>
          </re_1:Organisation>
          <re_1:Work>
            <re_1:kind> CM</re_1:kind>
            <re_1:lastModifiedDateTime> 2011-03-29T18:29:02Z</re_1:lastModifiedDateTime>
            <re_1:priority> 1</re_1:priority>
            <re_1:requestDateTime> 2011-03-30T09:00:00Z</re_1:requestDateTime>
            <re_1:type> maintenance</re_1:type>
          </re_1:Work>
          <re_1:ActivityRecords>
            <re_1:createdDateTime> 2011-03-29T18:29:02Z</re_1:createdDateTime>
            <re_1:reason> gas in oil ppm reach alarm level</re_1:reason>
            <re_1:type> maintenance</re_1:type>
          </re_1:ActivityRecords>
          <re_1:TimeSchedules>
            <re_1:kind> request</re_1:kind>
            <re_1:scheduleInterval>
              <re_1:end> 2011-03-30T18:00:00Z</re_1:end>
              <re_1:start> 2011-03-30T09:00:00Z</re_1:start>
            </re_1:scheduleInterval>
          </re_1:TimeSchedules>
          <re_1:WorkTasks>
            <re_1:mRID>
            <re_1:description> gas in oil ppm reach alarm level</re_1:description>
            <re_1:priority> 1</re_1:priority>
            <re_1:subject> BUCHHOLTZ alarm displayed in habitat</re_1:subject>
            <re_1:type> maintenance</re_1:type>
          </re_1:WorkTasks>
          <re_1:Assets>
            <re_1:mRID>
            <re_1:critical> false</re_1:critical>
            <re_1:subNumber>
          </re_1:Assets>
        </re_1:WorkRequest>
      </me:Payload>
    </me:CreateWorkRequest>
  
```

Location <re_1:mRID> CEYLON.XFMR.T1</re_1:mRID>
</re_1:Location>