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

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Smart Grid Architectural principles and CIM

• 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)
CIM layered architecture to achieve interoperability
• 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
CIM and Other Standards

UN Modelling Methodology

ISO 14662 Open-EDI Reference Model

ISO 14662/BOV Business Operational View

Business Domain View

Business Require View

Business Transact View

ISO 14662/BOV Functional Service View

Functional Services View
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

- Corporate Support Services
  - Human Resources
  - Accounting
  - Payroll

Intelligent Utility Network (IUN)
- Smart Metering & Beyond
  - Grid Operations
  - Electric Vehicles

- IUN Communications Networks
  - IUN Security
  - Distributed Energy Resources

Physical and Cyber Security

Solution Architecture for Energy & Utilities Framework (SAFE)

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

#GridInterop Phoenix, AZ, Dec 5-8, 2011
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CIM IOP – Maximo

- <complexType name="WorkRequest">
  - <complexContent>
    - <extension base="WorkflowStage">
      - <attribute name="SimpleContacts" type="xsd:boolean"/>
      - <attribute name="Scheduling" type="xsd:boolean"/>
      - <attribute name="RevisedSchedule" type="xsd:boolean"/>
      - <attribute name="Complete" type="xsd:boolean"/>
      - <attribute name="SchedulingError" type="xsd:boolean"/>
      - <attribute name="ApprovalRevised" type="xsd:boolean"/>
      - <attribute name="ContactsRevised" type="xsd:boolean"/>
      - <attribute name="ApprovalError" type="xsd:boolean"/>
      - <attribute name="ContactsError" type="xsd:boolean"/>
      - <attribute name="ApprovalStage" type="xsd:string"/>
      - <attribute name="ContactsStage" type="xsd:string"/>
      - <attribute name="ApprovalComment" type="xsd:string"/>
      - <attribute name="ContactsComment" type="xsd:string"/>
    </extension>
  </complexContent>
</complexType>

HTTP
- <complexType name="HTTP">
  - <complexContent>
    - <extension base="MaximoObject">
      - <attribute name="HTTPInvoke" type="xsd:boolean"/>
      - <attribute name="HTTPResponse" type="xsd:boolean"/>
      - <attribute name="EJBInvoke" type="xsd:boolean"/>
      - <attribute name="EJBResponse" type="xsd:boolean"/>
      - <attribute name="WebServiceInvoke" type="xsd:boolean"/>
      - <attribute name="WebServiceResponse" type="xsd:boolean"/>
    </extension>
  </complexContent>
</complexType>

Maximo Integration Framework

Maximo Object (Work Request)

- <complexType name="Command">
  - <complexContent>
    - <extension base="WorkRequest">
      - <attribute name="CommandType" type="xsd:string"/>
      - <attribute name="CommandStage" type="xsd:string"/>
      - <attribute name="CommandComment" type="xsd:string"/>
    </extension>
  </complexContent>
</complexType>

- <complexType name="Task">
  - <complexContent>
    - <extension base="WorkRequest">
      - <attribute name="TaskType" type="xsd:string"/>
      - <attribute name="TaskStage" type="xsd:string"/>
      - <attribute name="TaskComment" type="xsd:string"/>
    </extension>
  </complexContent>
</complexType>

Inbound XSLT sample

Outbound XSLT sample
CIM IOP Test Topology

IBM WebSphere Enterprise Service Bus

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 (Transactions, Security, Scalability, Availability, etc.)
- WebSphere Integration Developer
- WebSphere Integration Registry & Repository

WebSphere ESB
- XML Schema
- CSV
- COBOL
- C Struct
- Non-XML
- Custom
- XML
- SOAP
- Fixed Width
- Delimited
- Atom
- JSON
- SOAP
- HTTP
- WS-*)
- WebSphere AD
- Custom code
- Web Service standards
- Adapters
- Messaging: SAP, J2EE, WebSphere MQ, IBM DB2, IBM DB2, Oracle, etc.
- Visual, and pattern-based, Mediation Authoring in WID for deployment in WAS
- Wide Range of Supplied Mediation Functions
- System Health, Service Traffic, Mediation Policies and Service Enforce
- 2.0 UI

OMS
WMS
DMS
AMI
AMS
SCADA

CIM IOP - WebSphere

Header
Payload
MessageID & CorrelationID
Location

Number of events: 50

CIM IOP Test Topology

IBM WebSphere Enterprise Service Bus

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