MDA & SOA in the Enterprise

VCA
MDA
SOA/ESB

Applying Model Driven Architecture (MDA) to Services Oriented Architecture (SOA) to enable the Executable Enterprise
Introductions

DataAccessTechnologies
Where Business Meets Technology

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Primary author of “CCA” in EDOC
Enterprise MDA

**MDA Viewpoint**

- **The CIM**
  Business Model

- **The PIM**
  Application Component Model

- **The PSM**
  Technology Model

**Model Of**

- **The Business**
  Processes, Information, Requirements, Structure

- **The Information System**
  Application Components Serving Business Needs

- **Technology**
  How specific technologies Will implement application Components

Specifies
Case Study

U.S. General Services Administration (GSA)

Customer: GSA OCIO
Provider: LMI & Data Access Technologies
Tooling: Component-X, Magicdraw UML, OsEra

Sections reproduced with the permission of the GSA – George Thomas
“Sea Change”

- Sea of change
  - Get-it-right (Initiative for better acquisition)
  - Merger of FTS/FSS (Major Internal Organizations)
  - Restructuring to provide a unified face to the customer
  - OMB and Congressional mandates and changes of mission
  - Integrating and modernizing financial management
  - Reduction of redundant processes and systems

- Implications
  - Massive organizational change
  - Massive system changes
  - Retraining staff
  - High cost of change
  - Risky and hard to achieve
  - Change combined with current costs and inefficiencies of redundant stovepipe systems is not practical
“Sea Change” Enablers & Cost Reduction

- **Value Chain Analysis**
  - Analyzing and restructuring business processes based on realized customer value

- **Model Driven Executable Architecture**
  - Executable enterprise architecture to realize business goals with systems and workflow automation

- **Business Service Oriented Architecture / ESB**
  - An enterprise modernization strategy supporting business services, integration, reuse and common components across a system of systems integrated with SOA/ESB

- **Combined effect of more automated processes**

  Being able to realize your business goals – priceless!
Tactical Goals

- Replacement of outdated systems
- Improve business processes
- Position to become a government wide service
- “Get to green” (OMB Requirements for architectural maturity)
One-GSA Initiative

Stovepipes

Un-Architected Solution

One-GSA

Architected Solution

PBS

FSS

FTS

One-GSA Solutions

Buildings

Schedules

I.T.

Telecoms

Auto

Marketing

Finance

H.R.

Supplies
Acquisition Model
Today

Customer Needs

FTS

PBS

FSS

Solution Provider

Finance

Acquisition system

Solution Provider

Finance

Acquisition system

Supplies

IT Services

Space lease

GSA

GSA

Customer Solutions
To Be Acquisition Model

Customer Needs → Solution Provider → Contracting → Solution Provider → Vendor Solution

Finance → Project Management → GSA → GSA
System + Investment cost over 6 years

Business Advantage Savings Not Included

Note: Representative Numbers    Est. NPV Break Even – About 6 Years
Enterprise Service Bus to Enable Target State

- Services driven from the business model
- Reusable Enterprise Services are independent & easily adapted and interconnected
  - Services communicate with each other like humans do with email
- Information systems become a lattice of cooperating services
- CIO to Provide an “Enterprise Service Bus” using commercial standards
  - Industry best practice to avoid developing large monolithic applications
Legacy “Wrapping”

Wrapping allows existing programs and data to work with and work as enterprise components. Legacy systems are wrapped as a set of services.
Enterprise Systems
Modernization Strategy

- Identify components that will offer greatest ROI
  - Create target executable model
    - OneGSA enterprise model is baseline
  - Identify system of systems to consider for target
  - Pick an alternative for each;
    - Evolve one or more current systems to support target processes, take on new capabilities and support One-GSA interfaces and/or
    - Harvest one or more systems to build a replacement and/or
    - Integrate functionality into shared services as common components and/or
    - Replace systems or parts of systems that are no longer suitable.
  - Model driven SOA provides the flexibility to mix and match approaches as required. Commonality where possible – diversity where necessary. Evolving over time from integration to common components.
  - End result – architected system of systems

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Systems to Role Based Service Components
Transition by role, not system

Still Theory
Consolidation into Service Components

- The Good
  - Strategic reduction in operating cost – up to 50%
  - Agile business processes
  - Unification of the enterprise
  - Only way to achieve enterprise transition?

- The Bad
  - Investment in change – As high as 25%
  - Legacy and packaged systems are not componentized

- The Ugly
  - Change is expensive and can be disruptive
  - Current boundaries and ownership change – may require centralized authority and budgeting
  - Requires more “enterprise” agreement – very difficult to get consensus
Strategic Migration

- Separate and Non-Interoperable Applications
- Ad Hoc Point to Point Integration of Monolithic Systems
- Standards based integration of Monolithic Systems
- Executable Enterprise Architecture Drives Agile Systems of Systems using Interoperable Components

Target State

• Are you here?
MDA Enhanced Procurement

Current

Order & Requirements

Fund/Contract

Contractor
Design
Implement
Test

Solution

Strategic

Analyze Requirements against or Create BA

MDA Enterprise Architecture

Elaborate Components

Service Component Reuse Library

Generate Adapt Construct

SC Integration Testing

Solution
EA Governance Structure

One GSA
Target EA
Initiative
OMB - 300
Acquisition
Business Drivers

• Guides
• Refines
• Satisfies
“One GSA” EA Strategic Integration

**EA is a STRATEGIC ASSET**

- The “One GSA” EA aligns with:
  - GSA Strategic Plan
  - IT Capital Planning and Investment Control process
  - Human Capital Planning process
  - Performance Management process
  - Competitive Sourcing
  - Governance

The “One GSA” EA repository houses models and artifacts that have been vetted and agreed to.
Enterprise MDA

An approach to realizing executable enterprise architecture with MDA and SOA
Enterprise MDA

- Architecture at the Enterprise Level
  - Systems of systems
  - Collaboration of organizations, systems & people
  - Wide-scale collaborative processes
    - roles and responsibilities
  - Business Service Oriented Architecture
  - Enterprise Components
  - Componentizing functionality – not creating it
  - Executable processes – smooth transition from model to simulation to solution

- Executable Enterprise Architecture
The OMG-Enterprise Collaboration Architecture

➢ ECA is a “profile of UML”, a way to use UML for a specific purpose - it is an OMG standard
   ▲ That purpose is modeling enterprise systems.

➢ You can also think of this as a “modeling framework” for enterprise computing

➢ ECA is part of the “Model Driven Architecture” (MDA) initiative of the OMG
   ▲ Using precise modeling techniques as part of the development lifecycle to speed development and provide technology independence

➢ ECA has been adopted by the OMG as part of the EDOC Profile for UML specification.
Value Focused Target Architecture

One GSA Target EA

- Business Drivers
- Business Models
- Current Processes
- FAR
- Current Environment
- Initiatives
- Trends
- Workflow
- I.T. Systems Specs
- Collaborative Environment
- Documentation & Training
- Projects
- Time Line
- Trends
- Critical Success Factors

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Simulated Model Driven Architecture

Enterprise Architecture Model (CIM)

Domain Architecture

ECA Standard “Meta-Model” & UML Profile

Refine/Iterate

Live Process Simulation

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Automated Model Driven Architecture

- Domain Architecture
  - Meta-Model UML Profile (E.G. ECA)
  - Infrastructure Mapping (E.G. J2EE-WS)
  - Enterprise Architecture Model (CIM)
  - Tools Produce & Integrate (E.G. J2EE-WS)

- Enterprise Components
  - Framework & Infrastructure (E.G. J2EE-WS)
  - PSM

- Mapping is tuned to the infrastructure

Minimize and structure manual implementation

Technical Architecture
Automated Model Driven Architecture

Meta-Model UML Profile (E.G. ECA)
Domain Architecture Framework & Infrastructure (E.G. J2EE--WS)

Enterprise Architecture Model (CIM)
Tools Produce & Integrate
Infrastructure Mapping (E.G. .NET-WS)

Mapping is tuned to the infrastructure

Multiple and Changing Technology Support

J2EE-WS Enterprise Components
Framework & Infrastructure (E.G. -J2EE-WS) PSM

Simulated Enterprise Components
Simulation Infrastructure

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The Connected Enterprise
Content and Communication

- Digital Map
- Census Data
- Police Records
- House Drawings
- Aerial Photos

Police Dispatcher Role
Multiple roles in a collaboration
Travel Expense Example

1. travelPermissionRequest
2. travelPermission
3. expenseReport
4. authorizedExpenseReport
5. paymentRequest
Diagram
Travel Expense Model

Objects --> ClassifierRoles
Collaboration Diagram

- Traveler
- Authorizer
- Book Keeper
- Paymaster
Where are the services?

Mechanics Are Us
Buyer

Web Service

Order
Conformation
Shipped

GetItThere Freight Shipper

Web Service

Ship Req
Shipped
Delivered

Acme Industries Seller

Web Service

Physical Delivery

Status
Inside the Seller

Order Processing

Shipping

Event

Receivables

Order

Conformation

Shipped

Ship Req

Shipped

Delivered

Web Service

Web Service

Web Service

Web Service

Web Service

Web Service
Roles to Systems

Role

Collaboration

Framework, Middleware & Container

Interaction Path

Interaction (With Information)

Implementation

Net

Hardware

Operating System

Component in Role

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Model to Integrate

From business needs to executing solutions
Value Chains

Mission-Critical Value Chain

Support Services Value Chains
- Development of Government-wide Policy
  - Marketing
  - Acquisition

Shared Services Value Chains
- Financial Management Services
- I.T. Services
- Human Capital Services
Disciplines – Areas of Responsibility

- Financial Management
- Acquisition
- Solutions
- Property Management
- Policy
- Business Intelligence
- Human Resources
- Marketing

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Collaborative Process Model

**Enterprise Role.** A major area of functional responsibility within the discipline of financial management.

**Work Role.** A role responsible for a specific functional area within an enterprise role, such as might be assigned to a single worker or supported by an IT system.

**Activity.** A specification of a business function in carried out in the context of a work role.

**Subactivity.** A specification of a subfunction within necessary to carry out an activity.

**Protocol.** A defined conversation between two roles that may be extended over time. One role initiates and the other responds to the protocol, but information may flow both ways across the protocol.

**Information Flow.** An individual flow of information across a protocol or into or out of an activity.
Receivables Management Example

Related to Customer Orders

Related to Receivables
A term in the vocabulary represents a **class** of things to be described.

Entities may be described as having a **unique identity**.

A relation between terms is described by an **association** between classes.

**Attributes** specify descriptive information having simple types.

A class may be **specialized** into sub-classifications.

---

This means "zero or more" association.

This indicates a compositional (as opposed to referential) association.

This means "one or more" association.

This is a constraint that defines the sub-classification.

An un-shaded class is further detailed on a different diagram.
Business (CIM) view - Collaborating Roles with Processes
“Upper” PIM (system) View - Enterprise Component

People, organizations
And/or enterprise components
play roles in Business Processes.
The “Enterprise Digital Assistant”

People, Organizations And systems play roles

Components frequently help people play these roles

People, organizations and systems components work together to realize roles

Components are the peoples Automated assistant

Enterprise components help people and organizations play roles by automating and monitoring The business process

From the system perspective. People and organizations become part of the implementation Of the role
People, Components & Organizations Collaborating

Enterprise Component

Enterprise Component

Enterprise Component
“Lower” PIM View - Enterprise Component Internals

UI Client Tier
UI Server Tier
Business Logic
Enterprise Component
Enterprise Component
Enterprise Component
[Web] Service
[Web] Service

DBMS
Data Managers
Containers
Legacy Systems
UI Framework
Browser

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Each Work Component in the PIM implements a Work Role from the CIM.

Service Managers implement as system services the business services defined in the CIM.
Information Model

Note; Not expecting anyone
To really read this

Business Transaction

Business Entity
Messaging
Note; Not expecting anyone
To really read this
Association indicates a reference to an entity persisted elsewhere.
Enterprise Service Bus to Enable Target State

- Services driven from the business model
- Reusable Enterprise Services are independent & easily adapted and interconnected
  - Services communicate with each other like humans do with email
- Information systems become a lattice of cooperating components providing services
- SOA/Enterprise Service Bus using commercial standards
  - Industry best practice to avoid developing large monolithic applications
Example of XML provisioned from model

Note; Don’t have to really read this either!

```xml
<CustomerOrderEstablishment>
  <Inter-Work-RoleTransaction>
    <inter-work-roleTransactionID> ...
  </Inter-Work-RoleTransaction>
  <newOrder>
    <orderingCustomer>
      <customerID> ...
    </orderingCustomer>
    <controllingSalesInstrument>
      <salesInstrumentId> ...
    </controllingSalesInstrument>
    <customerOrderAmount> ...
    <lineItems>
      ...
    </lineItems>
  </newOrder>
</CustomerOrderEstablishment>
```
Enterprise Service Bus

Logical SOA Tiers and Components

<table>
<thead>
<tr>
<th>Client</th>
<th>Presentation</th>
<th>Business</th>
<th>Intermediary</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Apps</td>
<td>Portlet or Web Container</td>
<td>EJB, POJO, or Servlet Container</td>
<td>JBI Container</td>
<td>Heritage Systems</td>
</tr>
<tr>
<td>Java Apps</td>
<td></td>
<td></td>
<td></td>
<td>RDBMS</td>
</tr>
<tr>
<td>Mobile Device</td>
<td>Domain Objects</td>
<td>Domain Objects</td>
<td>Domain Objects</td>
<td></td>
</tr>
<tr>
<td>B2B Gateway</td>
<td></td>
<td></td>
<td></td>
<td>BPM Repository, Rules Repository</td>
</tr>
</tbody>
</table>

*Complements of jBoss*
Many BPEL Processes support the CIM
Common Environment for Intellectual Capital

- Value Chain Modeling
- UML Modeling
- Workflow Tools
- Business Modeling
- Collaboration Modeling

MDA Environment
- MOF
  - Models define the system

Integration of infrastructure
Net Effect of Enterprise MDA

- Clear path from needs to running technology
- Integrate business driven solutions with capital planning & the FEA
- Interoperable component architecture based on SOA
- Integrate legacy, COTS, GOTS and new development into a coherent solution
- Strategic evolution
- Reduced time, costs & risk
Business Model (CIM) Terminology

*Role*
- A specification of the responsibility to perform specific functions in the context of a business process.
- Work roles may be nested in organizing enterprise roles.

*Activity*
- A specification of a business function in the context of a role.
- Activities may be decomposed into subactivities.

*Protocol*
- A defined conversation between two roles that may be extended over time (i.e., responses of one party to the other may not be immediate).
- One role *initiates* and the other *responds* to the protocol, but information may flow *both ways* across the protocol.

*Flow*
- An atomic flow of information across a protocol or into or out of an activity.
Financial Management Discipline

Enterprise Role

- PayablesAccounting
  - PaymentPreparation
  - ReceivingNotification
  - InvoiceSubmission
  - OffsetInitiation
  - PerformanceMonitoring

- ReceivablesAccounting
  - SalesAgreement
  - ReceivingNotification
  - OverchargeCorrection
  - DiscrepancyNotification
  - CollectionReception
  - PerformanceMonitoring

- FundsManagement
  - Funding
  - ObligationReclassification
  - AcquisitionFunding
  - PerformanceMonitoring

- GeneralLedgerPosting
  - AssetOwnershipEstablishment
  - AssetRecordEstablishment
  - AssetValuationNotification
  - AssetTransferNotification
  - AssetDisposalNotification
  - PerformanceMonitoring

- PerformanceMonitoring
- GeneralLedger
- CostAllocation
- CashManagement
Example: Receivables Accounting Work Roles

Protocol initiated outside Receivables Accounting

Protocol used internally within Receivables Accounting

Protocol responded to outside Receivables Accounting

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Example: Billing Work Role
Example: Establish Billing Activity
Typical Simple Protocol

The protocol is initiated by a requested transaction.

Each accepted transaction effects a change in the information and behavior of the receiving role.

Responses to the transaction may indicate success or failure.
Sample Billing Service Interfaces

Provided Interfaces

- ChargeEstablishment
- OverchargeCorrection
- DiscrepancyResolution

Required Interfaces

- BillSubmission
- OffsetInitiation
- GeneralLedgerPosting
- BillingNotification

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One-GSA Methodology

A simple methodology for creating collaborative business processes
Basic Steps

- Define business goals using Value Chain Analysis
- Refine to high-level activities
- Identify roles and organize roles into collaborations
- Define collaboration documents
- Create basic business transactions
- Organize into protocols and events
- Use protocols to define ports on roles
- Drill-down into role detail
- Use model as basis for acquisition
- Acquire/Implement roles
- Configure implementations for deployment with technology specifics
- Deploy
Order to Payment Process
Informal Diagram

Order to Payment (Future State) - Involves only Purchases via Schedules
Order to Payment Process Diagram

Order to Payment (Future State) - Involves only Purchases via Schedules

Customer: Project Manager

- Determine project need for products and services
- Coordinate Acquisition Planning
- Receive purchase request data from PM
- Assign contract specialist
- Conduct research using e-Library/eBuy
- Evaluate vendor responses
- Request review of responses

Contacting

- Combine Project requirements
- Funding validated

Customer: Financial Officer

- Record funding

Supplier: Contract Officer

- Assign contract specialist
- Receive RFQ
- Evaluate RFQ

Supplier: Manager

- Review RFQ
- Answer

Evaluate

- Build RFQ
- Issue RFQ
- Final fact finding with suppliers
- Responses via eBuy
- Answer questions/
- provide input
Finding the Roles and Inner Roles

“Swim Lanes”

- Customer Project Manager
- Customer Contracting
- Customer Financial Officer
- Supplier Financial Officer
- Supplier Project Manager
- Supplier Contracting Officer
- FSS: Order Manager
- FSS: Financial Officer

Roles in a Collaboration

Order to Payment

- Customer
  - Project Manager
  - Contracting Officer
  - Financial Officer

- Procurement Broker
  - Catalog Manager
  - RFQ Manager
  - Order Manager

- Supplier
  - Project Manager
  - Contracting Officer
  - Financial Officer

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Enterprise Context

Simplified View - Level of detail is optional
Drilling Down into Customer Detail

Customer

- Project Manager
- Contracting Officer
- Financial Officer

Diagram showing the relationship between customer and project manager, contracting officer, and financial officer, with various processes involving acquisition, development, fulfillment, and purchasing.
Choreography of Process
Protocols group Role Interactions into Conversations
Create Business Transactions
Organize into protocols
Inner Protocols

- Protocols represent conversations between roles.
- Conversations frequently have sub-conversations, detail about a specific subject.
- These sub-conversations are inner protocols.
- Inner protocols can also be reused in other protocols or even as top-level protocols.
- Protocols can “nest” to any level of detail.
Operations & Business Transactions

- The highest level of interaction detail is specified as the flow of documents - business information.
- This can be as events or “business transactions”
- Business transactions are a “request/reply” that usually results in creating or satisfying some business commitment - it may take place over an extended time
- We specify abstract document types to represent the information that flows.

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Modeling Collaboration Documents

- Fill in details of the documents
- Focus on business information - not technology
- Collaboration - Not an information model
- May be derived from existing sources
- Helps in creating technology mappings - E.G. Web Services
- Includes
  - Composition
  - Type
  - Cardinality
Attach Protocols to Roles as “Ports”

Group transitions together into logical units
Detailed Information Flows

- Inside the activities we can drill down to inner activities or detailed document flows - sending and receiving information.

- This is used for the simulation, to validate the model is correct and ultimately to test the implemented components.
Drill-down
Information Model

Note; Not expecting anyone
To really read this
Messaging

Note: Not expecting anyone
To really read this
Persistence Model

Association indicates a reference to an entity persisted elsewhere.
Adding Data Managers

- Entities are added to manage entity data
- Entity Roles are managers that provide a view of the same identity in another context
- The Entities have ports for managing and accessing the entities
- Non-entities which are owned by (aggregate into) an entity are managed by the entity
Simulating the Process

-validation & Buy-in
  - Business stakeholders
  - SMEs
  - Systems Implementers
Initiating Activity
Activity interacting externally

[Diagram of process flow with various nodes and connections labeled with activities like OrderFulfillment, ReqFunding, RFQDevelopment, AcquirePlan, OrderDevelopment, Quote, AwardDecision, and ManageSchedule.]
... With financial officer
Who records the funding?
And the process returns to the PM.
Add implementation

- As component compositions
- In a programming language
- By using an external service
- By Wrapping legacy systems
Enterprise Service Bus

- Application Server (jBoss)
- BPEL Engine
- Web Services
- Schema
- J2EE
Add technology specifics for deployment
Dealing with Variation
Multiple Implementations of a Role

The “Inside” can change as long as the external “contract” is satisfied
Architecture becomes part of Acquisition
ECA/CCA Implementation at GSA

Data Access Technologies
- MDA experts, developers of ComponentX, One GSA EA support
  - enterprise-component.com
- Creators/contributors to OMG EDOC/ECA/CCA open standards

ComponentX
- Implements ECA/CCA, used by GSA EAPMO to create collaborative role interaction models
- Supports ‘model to integrate’, combining design-time and run-time tools, with an extensible ‘component palette’
- Supports FEA Line of Sight via aspect orientation
- Supports ‘just in time’ model driven generated documentation

ComponentX is a J2EE application
- The models are executable – they’re java programs!
- Web enabled simulations integrate with existing IT systems

Widely used EA tools (Mettis, Popkin, MS-Office) don’t compare!
Federal Enterprise Architecture

Support for the FEA as a view of the enterprise architecture
FEA (from reference)
FEA/ComponentX

Community Process

Roles, processes, activities

Reference model associations via aspect/properties
<table>
<thead>
<tr>
<th>name</th>
<th>baseline</th>
<th>planned</th>
<th>actual</th>
<th>achieved</th>
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<tbody>
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<td>Financial Avoidance</td>
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<td>Productivity QuantityPerTime</td>
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<td>Productivity ProductsPerFTE</td>
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<td>1.1</td>
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<td>Management PolicyComplianceExtent</td>
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<td>Management UnidentifiedRiskEvents</td>
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</tbody>
</table>
Iterative Development

Business Model Design

Automation

Infrastructure Development

Build Build Build Build Build

Release Build

Deploy
Generating Web Services & BPEL
Mapping of a WSDL Engine

- `<definitions xmlns="http://schemas.xmlsoap.org/wsd`
- `xmlns:soap="http://schemas.xmlsoap.org/wsd/soap`
- `xmlns:mime="http://schemas.xmlsoap.org/wsd/mime`
- `xmlns:http="http://schemas.xmlsoap.org/soap/http`,
- `ENC="http://schemas.xmlsoap.org/soap/encoding`
- `xmlns:xs2000="http://www.w3.org/1999/XMLSchema`
- `xmlns:xs2001="http://www.w3.org/2001/XMLSchema`,
- `targetNamespace="urn:SellerServer" xmlns:tns="urn:S`
- `xmlns:CoreTypes="urn:CoreTypes" xmlns:Ordering="uri`
- `- <!-- definitions obtained from component /BuySell/Deployment/Sellei`
Mapping of an Enterprise Component

- <service name="MySeller">
  - <!-- implemented service role
  /BuySell/Deployment/SellerServer/MySeller -->
  <documentation>
    <p> </p>
  </documentation>
  - <port name="BuySellProtocol" binding="tns:BuySellProtocol">
    - <!-- original service port was
    /BuySell/Deployment/SellerServer/MySeller/BuySellProtocol (extending Component
    &lt;/BuySell/SellerImplementation/MySeller/BuySellProtocol&gt;) -->
  </port>
</service>

Aspects
WSDL
WSDL-SOAP
Mapping of a protocol binding

- `<binding name="BuySellProtocol" type="tns:BuySellProtocol">`
  - `<soap:binding transport="http://schemas.xmlsoap.org/soap/http" style="rpc" />
  - `<operation name="Order">
      - `<soap:operation soapAction="urn:/BuySell/Community/BuySellProtocol/Order" style="rpc" />
        - `<input name="Order">
          - `<soap:body use="encoded" namespace="urn:SellerService" encodingStyle="http://schemas.xmlsoap.org/soap/encoding/" />

Mapping of a protocol

- `<portType name="BuySellProtocol">
  - <!-- original cx operation = /BuySell/Community/BuySellProtocol/Order -->
  - `<operation name="Order">
    - <!-- original cx flow port = /BuySell/Community/BuySellProtocol/Order/Order -->
      <input name="Order" message="tns:Order" />
      <output name="OrderConfirmation" message="tns:OrderConfirmation" />
      <fault name="OrderDenied" message="tns:OrderDenied" />
    </operation>
  </portType>`
Mapping of message types

```xml
  <message name="Order">
    <part name="Order" type="Ordering:Order">
      <message name="OrderConfirmation">
        <part name="OrderConfirmation" type="Ordering:OrderConfirmation" />
      </message>
    </message>
  </message>

  <message name="OrderDenied">
    <part name="OrderDenied" type="Ordering:OrderDenied" />
  </message>
```
Mapping of data types

```xml
<xs2001:complexType name="Order">
  <xs2001:sequence>
    <xs2001:element minOccurs="1" maxOccurs="1" name="CompanyID" type="CoreTypes:CompanyID" />
    <xs2001:element minOccurs="1" maxOccurs="1" name="OrderID" type="Ordering:OrderID" />
    <xs2001:element minOccurs="0" maxOccurs="unbounded" name="Item" type="Ordering:Item" />
  </xs2001:sequence>
</xs2001:complexType>
```
High level tooling & infrastructure

- MUST BE SIMPLE!
  - We must be able to create better applications faster
  - We must separate the technology and business concerns, enable the user

- Tooling + Infrastructure
  - Executable models are source code
  - Tooling must be technology aware
  - Infrastructure must support tooling, not manual techniques

- Model based component architectures
High level tooling & infrastructure

MUST BE SIMPLE!

- We must be able to create better applications faster
- We must separate the technology and business concerns, enable the user

Executable Models

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Net effect

- Using these open standards and automated techniques we can:
  - 80% Reduction in complexity (Conservative)
  - Achieve the strategic advantage of an open and flexible enterprise
  - Produce and/or integrate these systems FASTER and CHEAPER than could be done with legacy techniques
  - Provide a lasting software asset that will outlive the technology of the day
Sample Applications

- Financial Management Enterprise Architecture, and
- One-GSA Executable Enterprise Architecture for the General Services Administration
- Enterprise Component Architecture for U.S. Army PEO-STRI
- Intelligence application for Raytheon & DARPA
- Collaboration Architecture for Kaiser Permanente
Contact

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