U.S. General Services Administration

# Executable EA for GSA's FMLoB: Enabling *Model Based Acquisition*

George Thomas, GSA Enterprise Chief Architect

# This Presentation

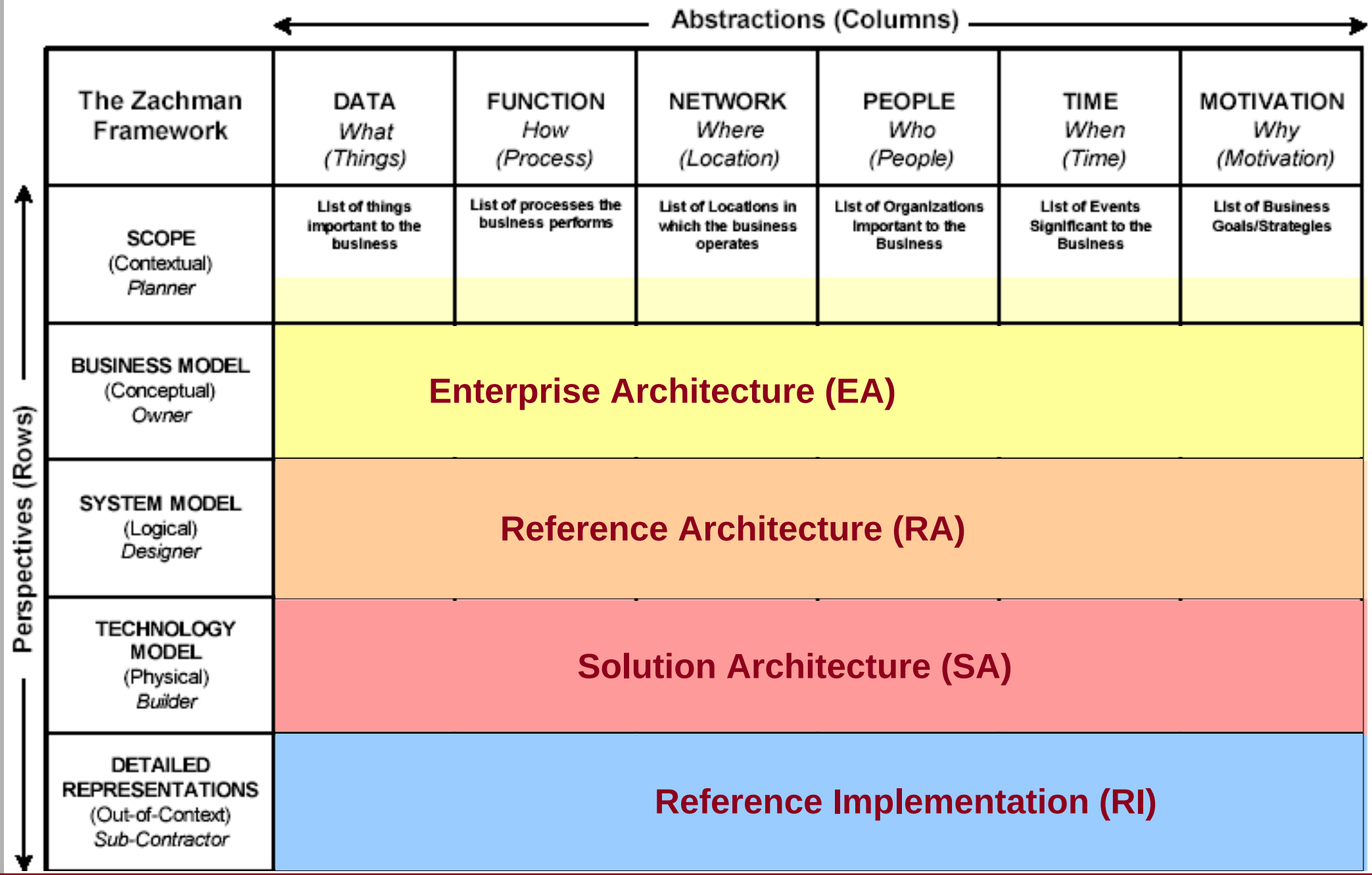
- Executable EA Methodology
  - MDA primer, EDOC as SOA DSL
  - Quick comparison with SCA
  - FEA as Federal Enterprise DSL and CRI ‘aspect’
  - Analytical framework for ITPM, Resource Rationalization
- FMEA – FMLoB Case Study
  - EDOC CIM/PIM conventions
  - ADM Mainframe Analysis
  - UML Information, Transaction, Message, Persistence Models
  - Team and Tools
- OSERA
  - ‘Model to Integrate’
  - Test driven ‘Service Based Procurement’
  - ‘Model Based Acquisition’
  - Semantic Interoperability

# Part 1 - Executable EA

- Slides 3 to 23

- Executable EA Methodology
  - MDA primer, EDOC as SOA DSL
  - Quick comparison with SCA
  - FEA as Federal Enterprise DSL and CRI ‘aspect’
  - Analytical framework for ITPM, Resource Rationalization

# MDA and Zachman 'Perspectives'

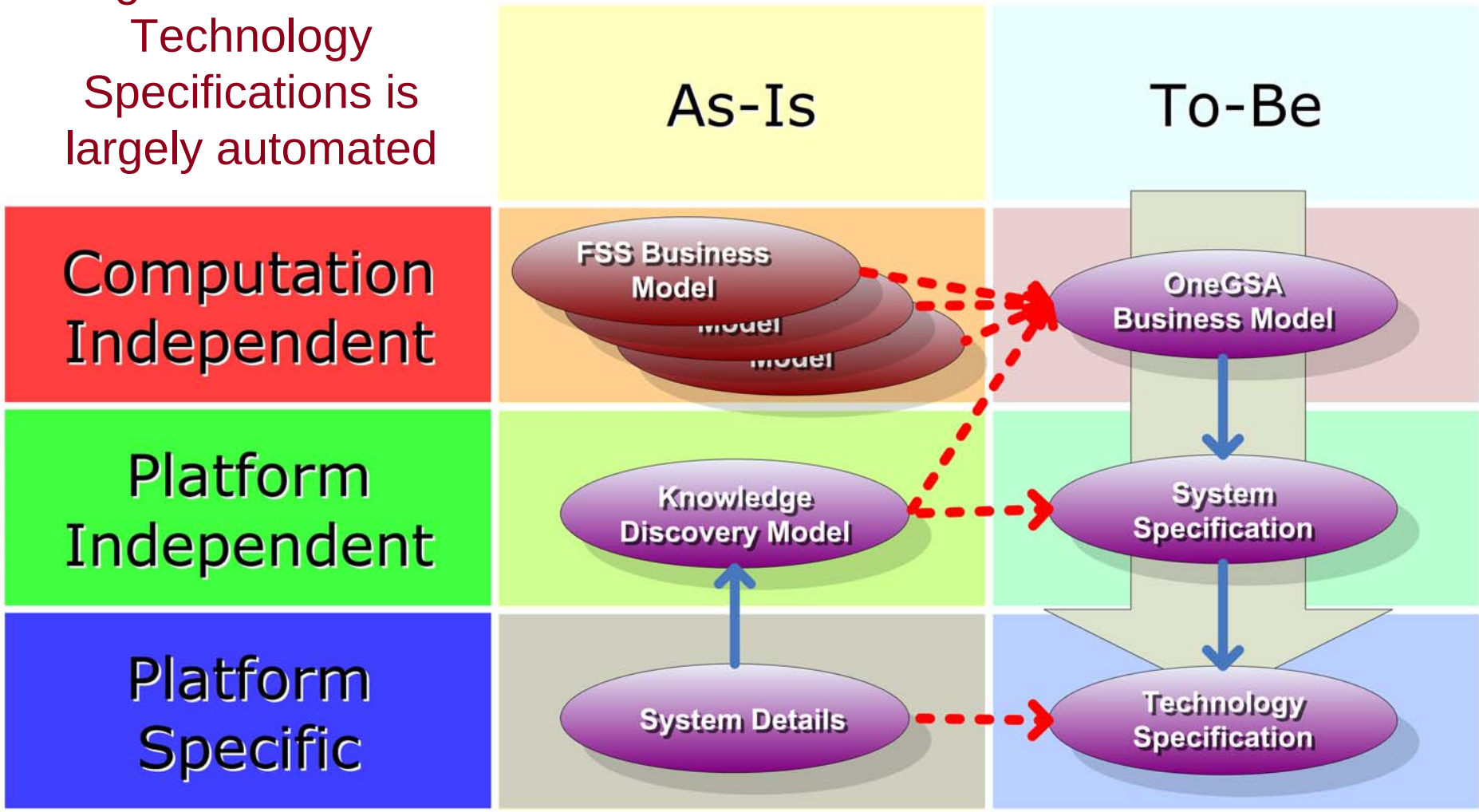


# FMEA: MDA Top Down - ADM Bottom Up

Discovery of System Details and generation of Technology Specifications is largely automated

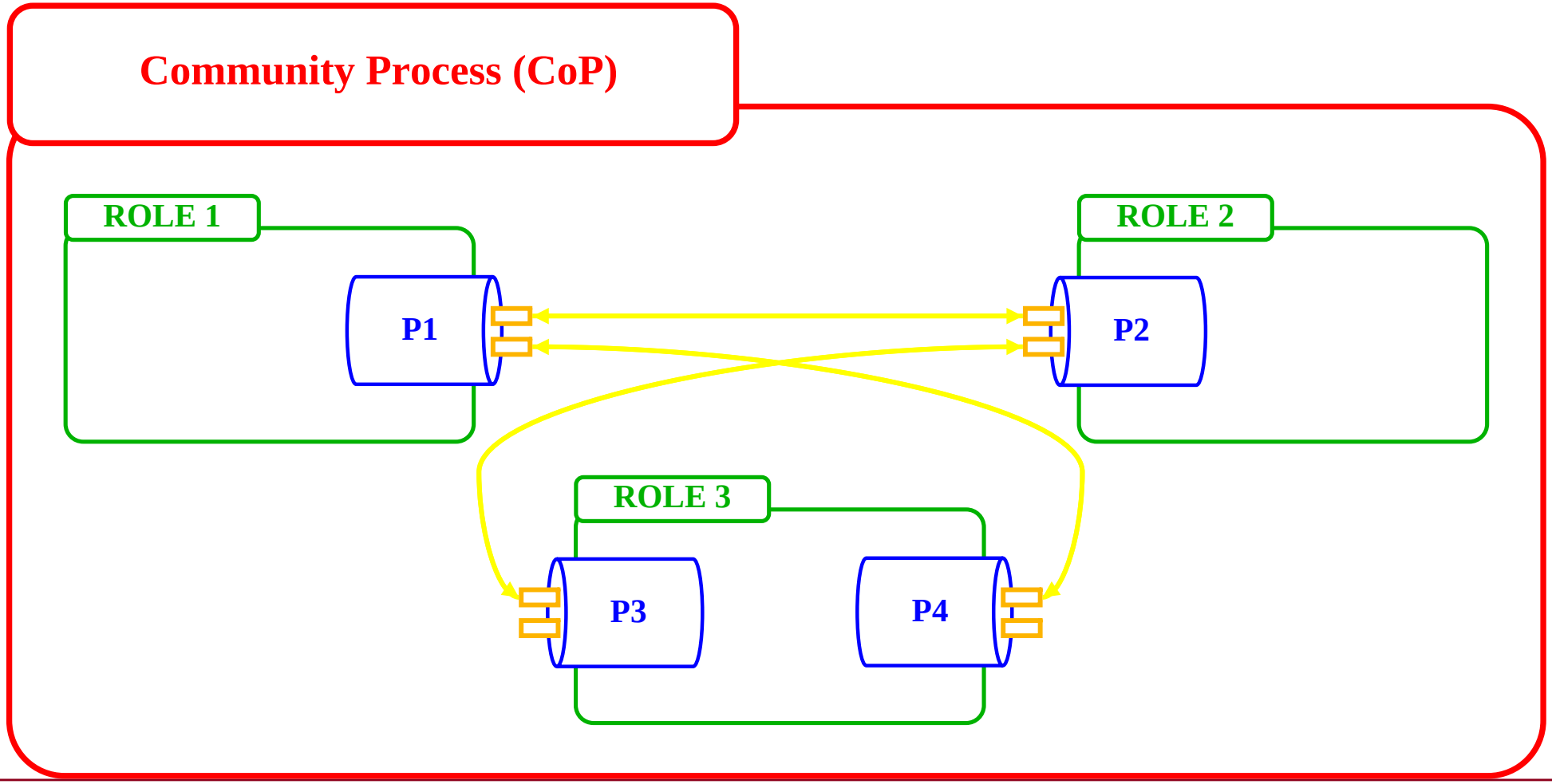
Architecture Driven Modernization (ADM)

Model Driven Architecture (MDA)

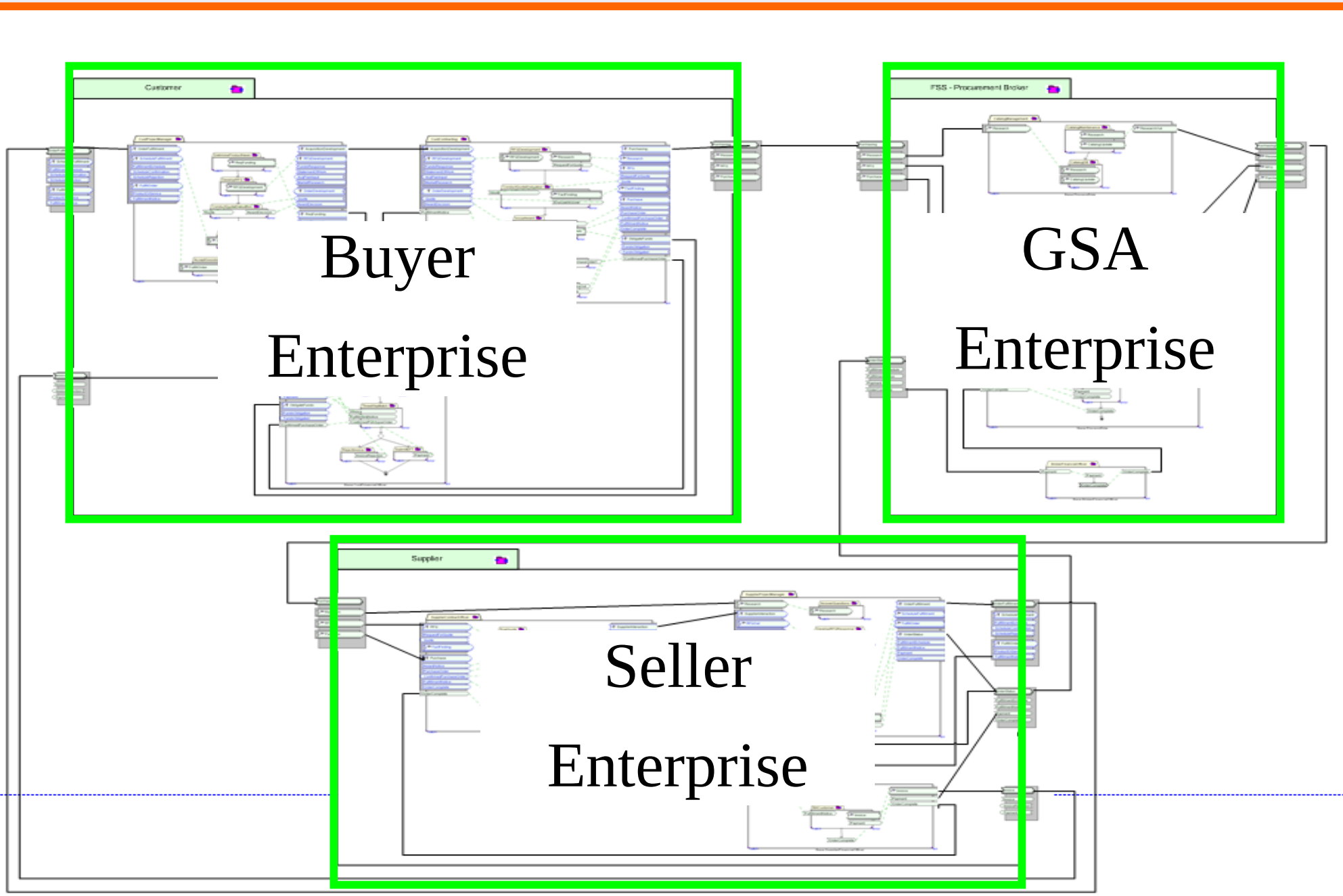


# EDOC/ECA/CCA ***CRI*** Grammar - Standard Graphic Notation

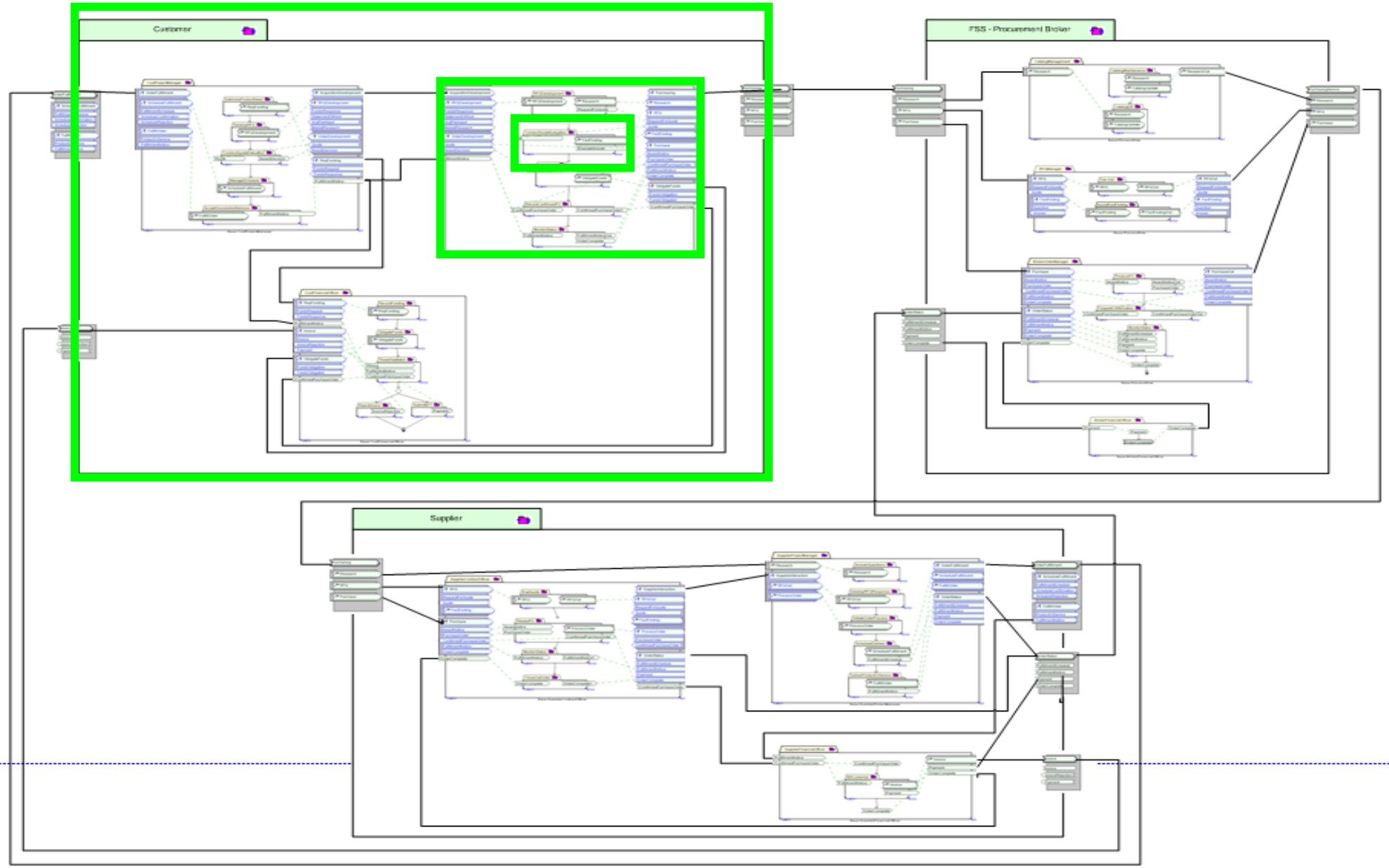
- Recursive decomposition for ‘systems of systems’ modeling
  - Business processes described as a composition of *services*
    - Collaborative Role Interactions (CRI), service choreography
  - Services are realized by (a composition of) components



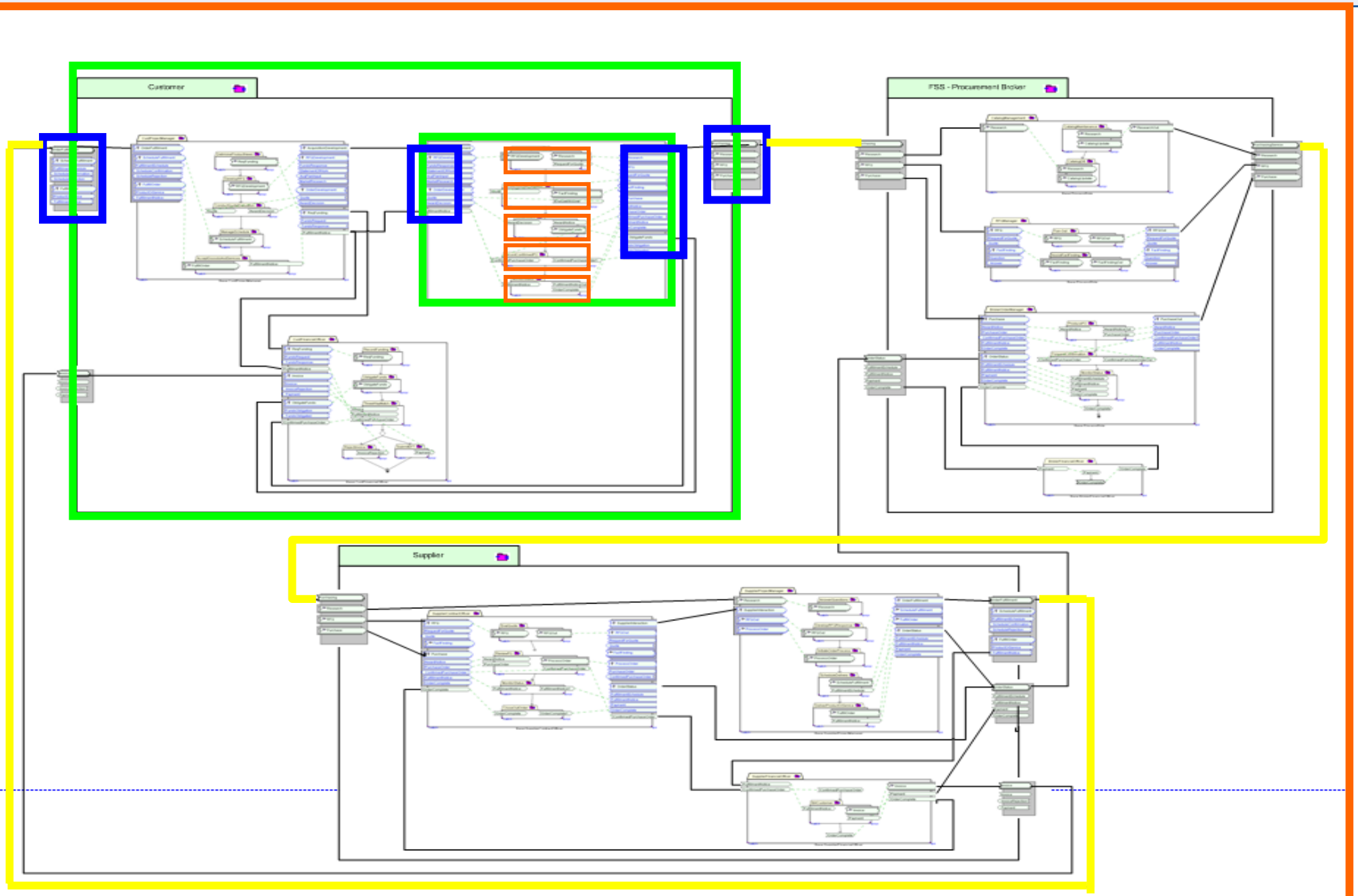
# Collaborations Contextualize Roles = Service Providers



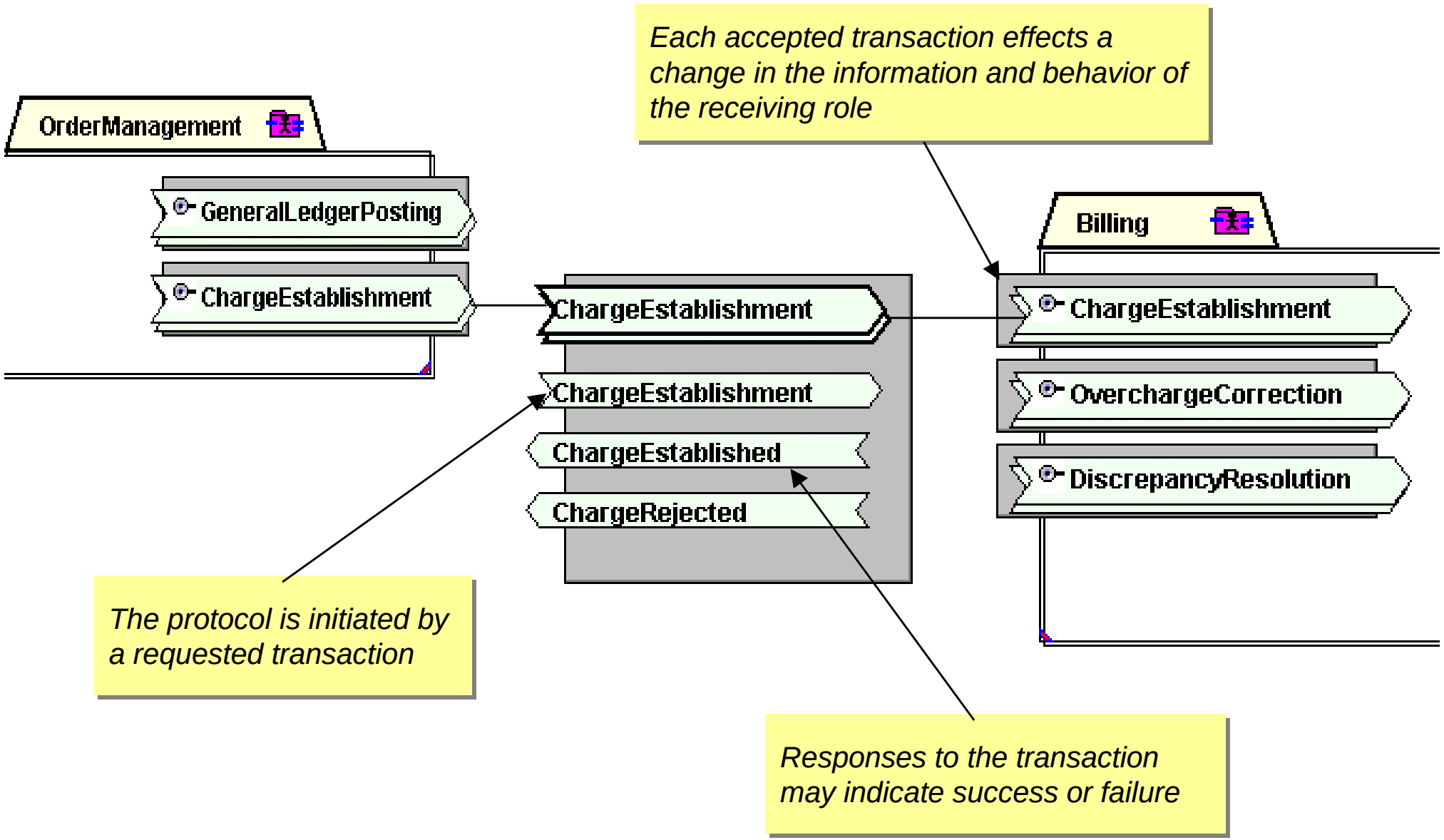
# Roles Compose Inner Roles = Service Granularity



# Protocols Organize Conversations Choreographed by Roles



# CCA Protocol = Interface Specification



# Protocol WSDL Representation (PSM/SA, TRM)

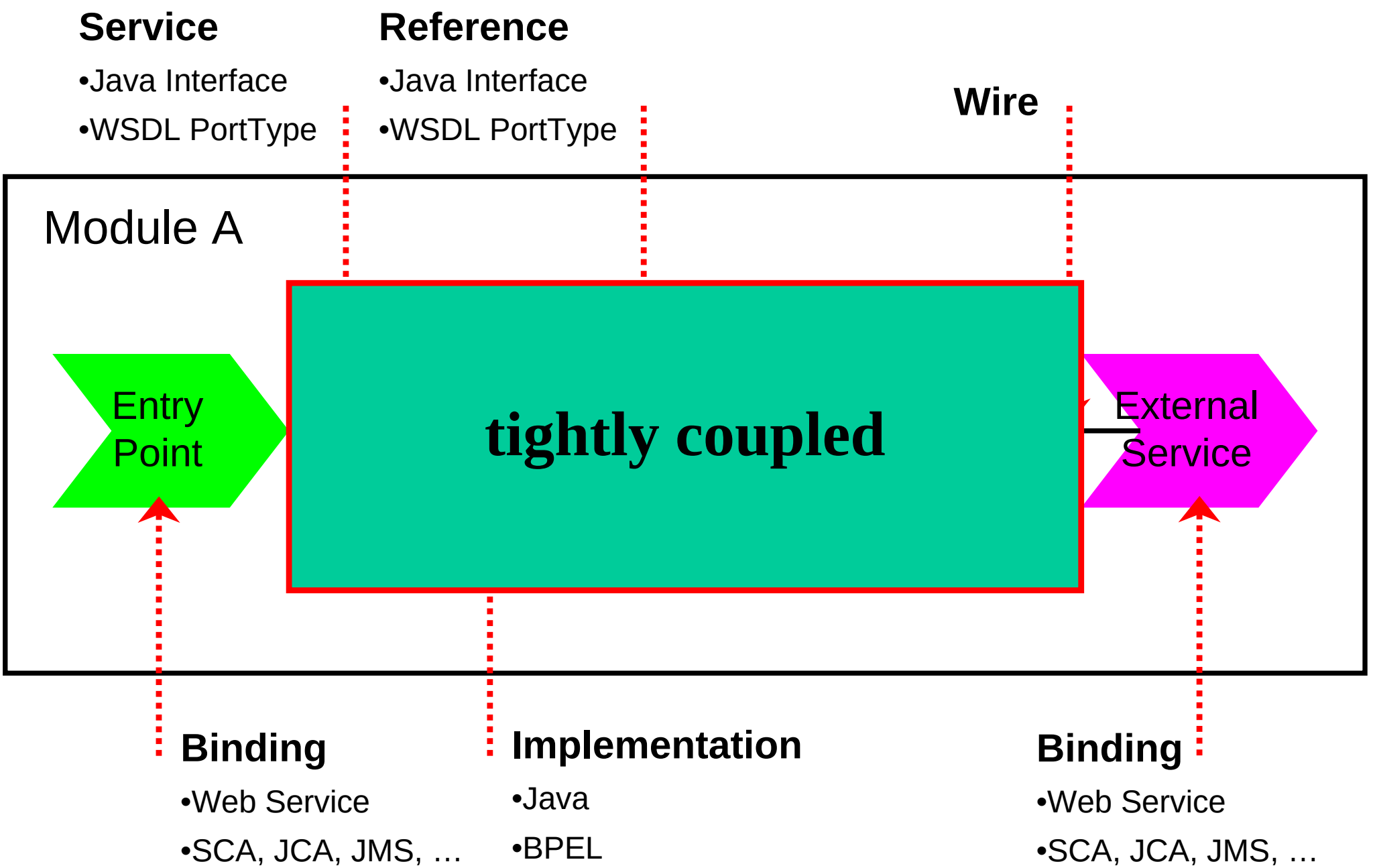
```
<portType name="ChargeEstablishmentRequestInterface">
      <operation name="sendChargeEstablishment">
          <input name="ChargeEstablishment"
            message="tns:ChargeEstablishment" />
      </operation>
</portType>

<portType name="ChargeEstablishmentResponseInterface">
      <operation name="sendChargeEstablished">
          <input name="ChargeEstablished"
            message="tns:ChargeEstablished" />
      </operation>
      <operation name="sendChargeRejected">
          <input name="ChargeRejected"
            message="tns:ChargeRejected" />
      </operation>
</portType>
```

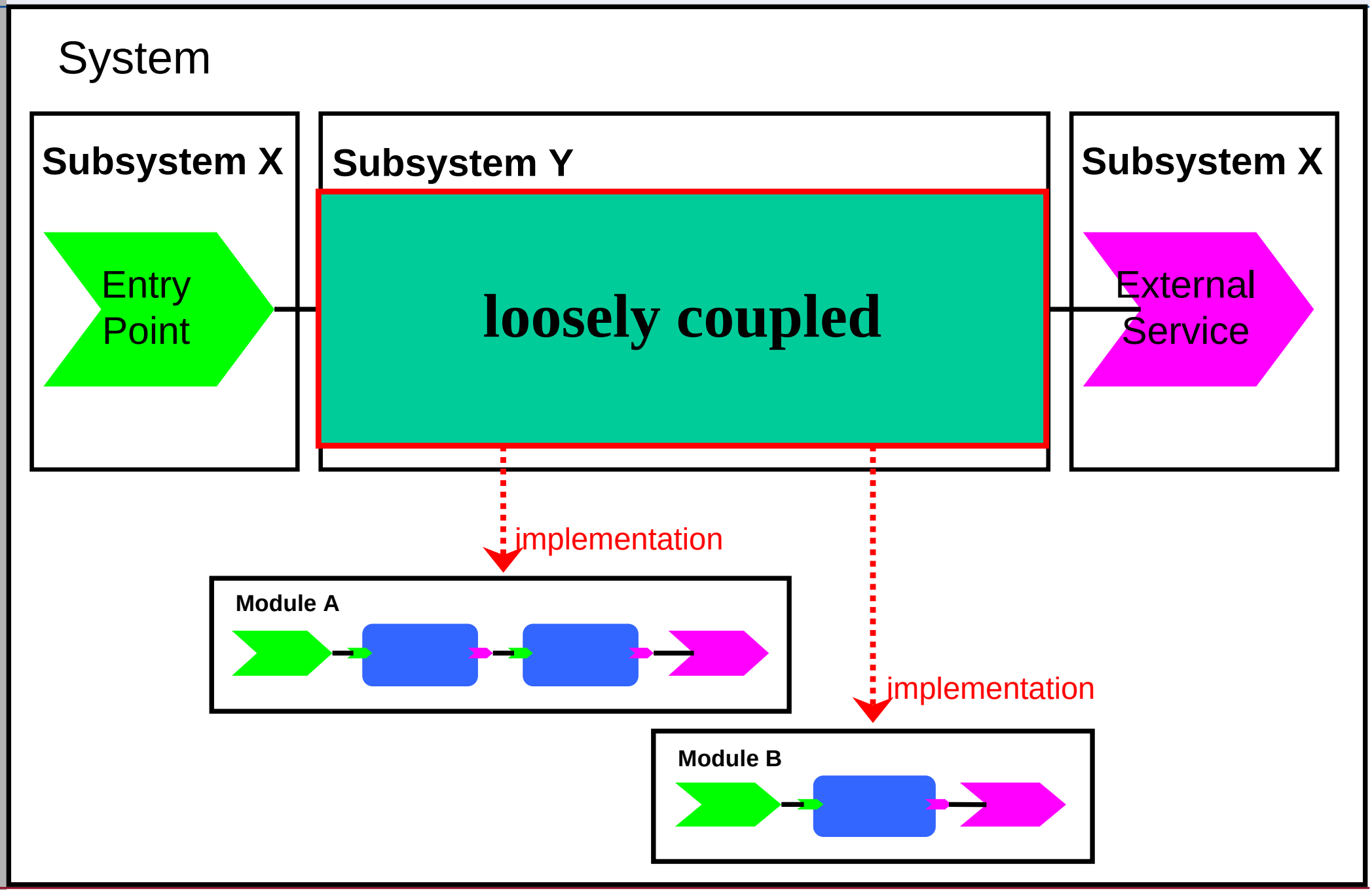
# Service Component Architecture (SCA)

- IBM, BEA, Oracle, SAP, IONA, Siebel, Sybase, Interface21
  - ‘SOA is a composition model that connects the functional units of an application, called services, through well-defined interfaces and contracts between these services’
  - ‘SCA is a set of specifications which describe a model for building applications and systems using a Service-Oriented Architecture’
  - ‘SCA divides up the steps in building a service-oriented application into two major parts:
    - The **implementation** of components which provide services and consume other services
    - The **assembly** of sets of components to build business applications, through the **wiring** of service references to services’
- Another example of a SOA DSL
  - Nov ’05 v0.9 specs describe an SCA runtime platform

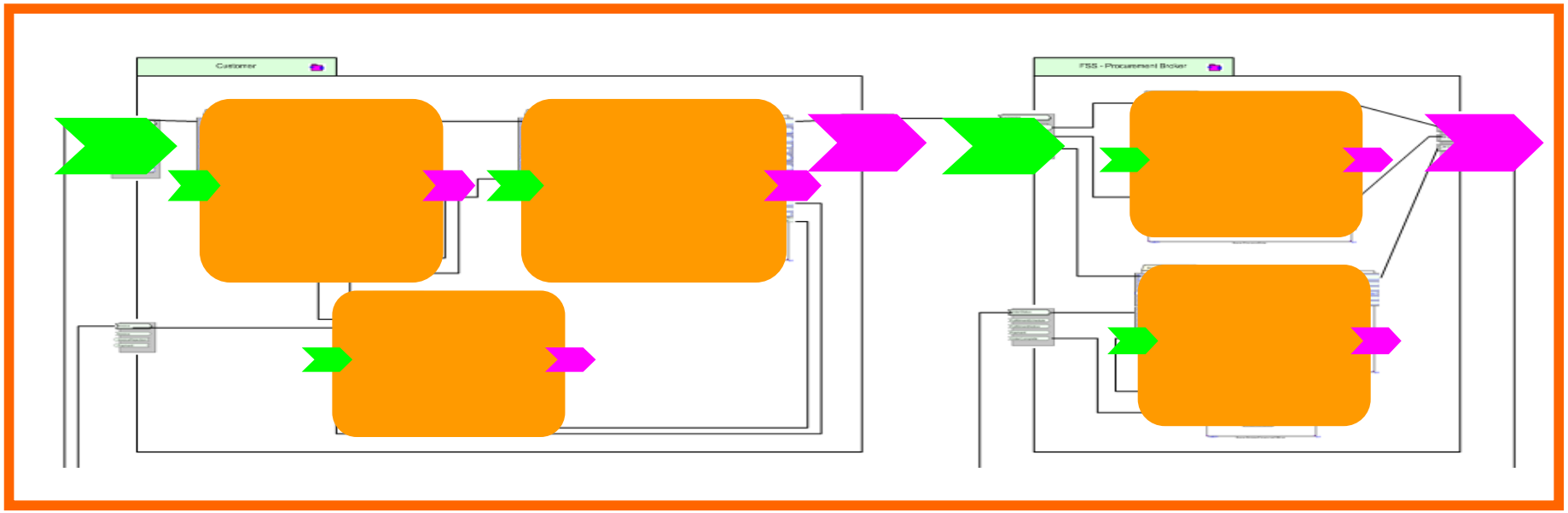
# SCA - Module Assembly Diagram

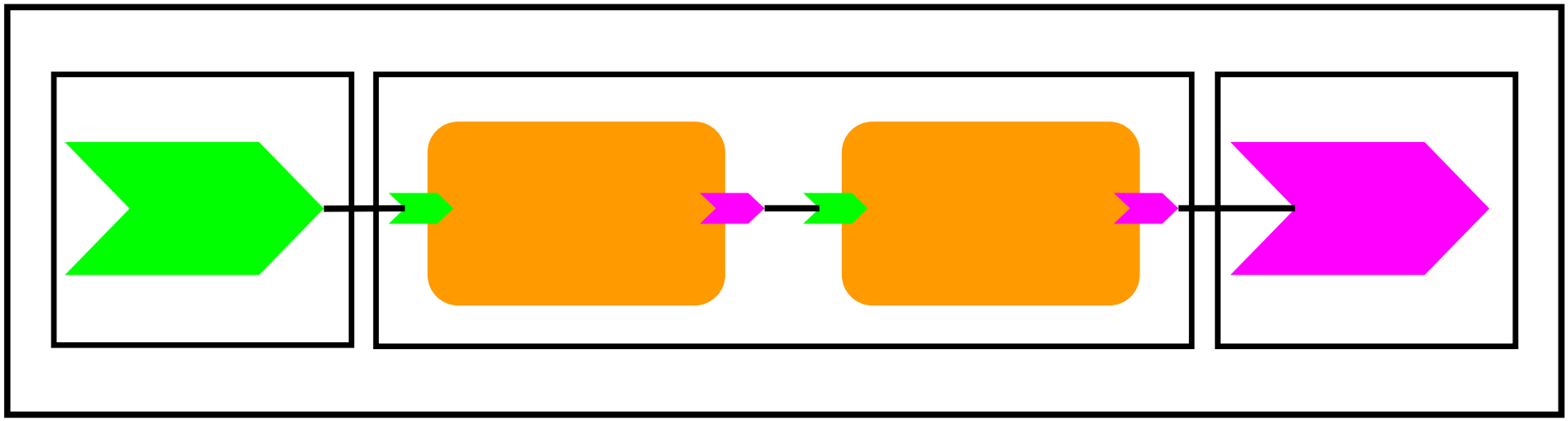


# SCA - System Assembly Diagram



# eGov SOA System of Systems, Quick CCA-SCA Comparison



# FEA as CCA Aspect = PRM Line of Sight

FEA Aspects of PRM Metrics, BRM/SRM classifications, and DRM schema definitions are associated with and applied directly to ***Business*** model elements

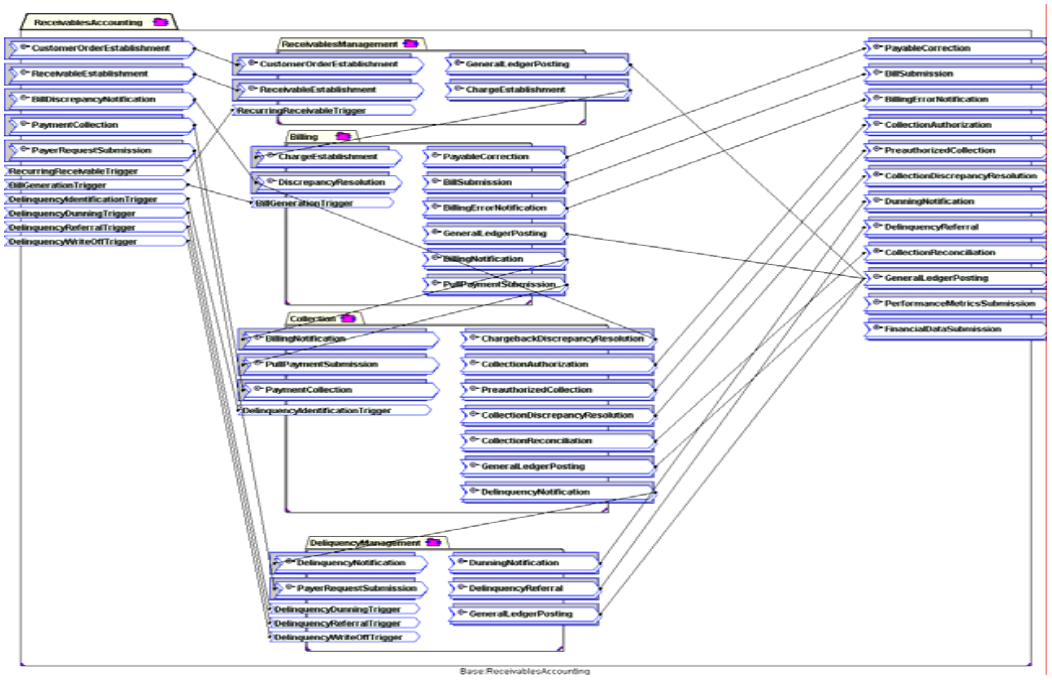
**PRM**

Elaborated ***Platform*** model elements inherit these annotations, adding further PRM and TRM annotations as a model is transformed and deployed to a J2EE Server

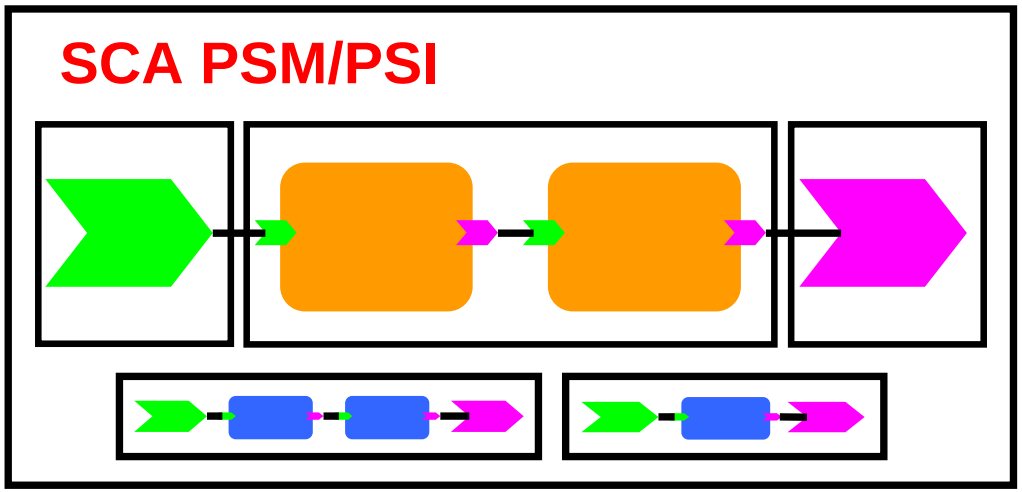
**BRM**

**SRM**

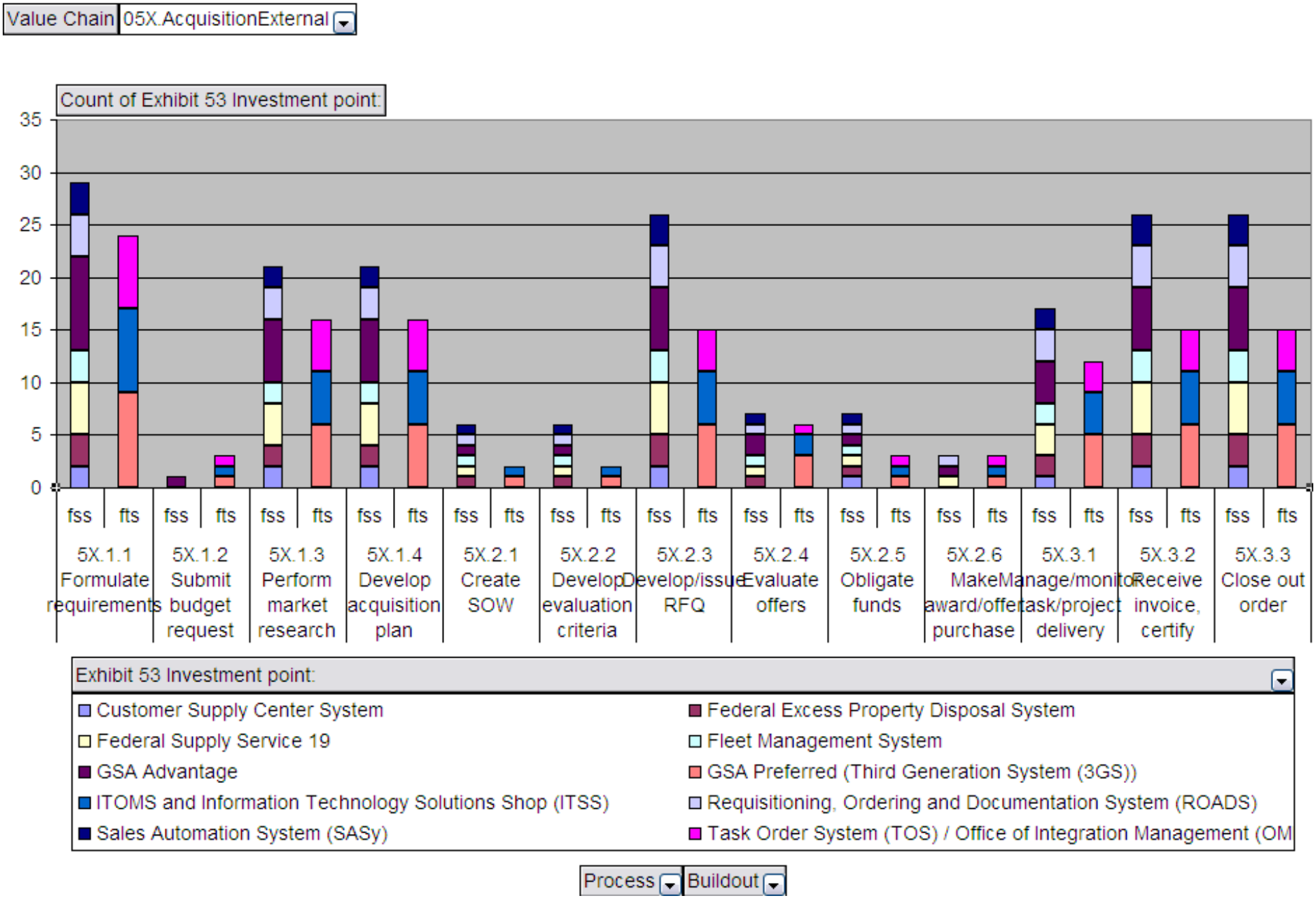
**DRM**




**TRM**

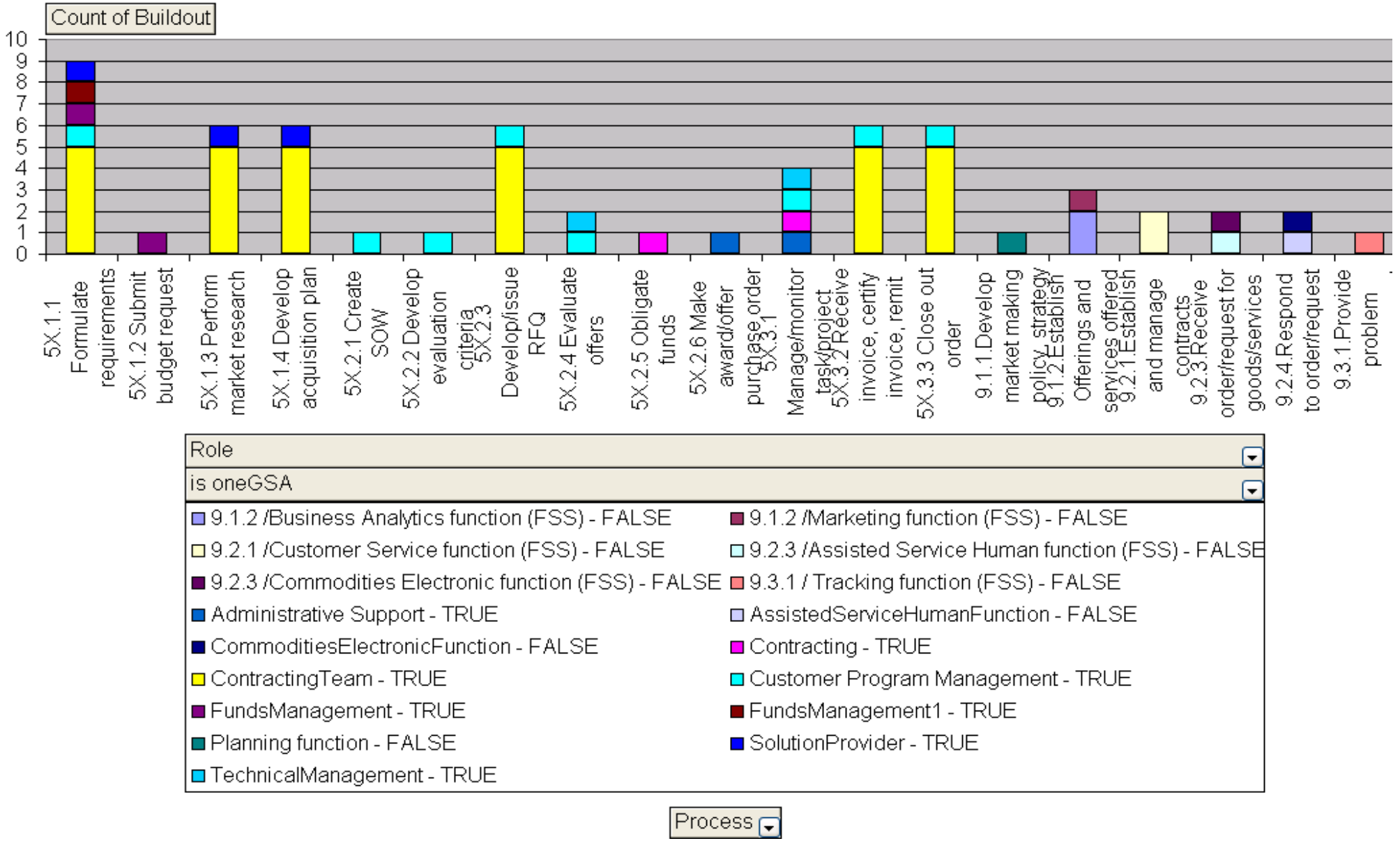


# ITPM - Business Process, FSS/FTS, Exhibit 53

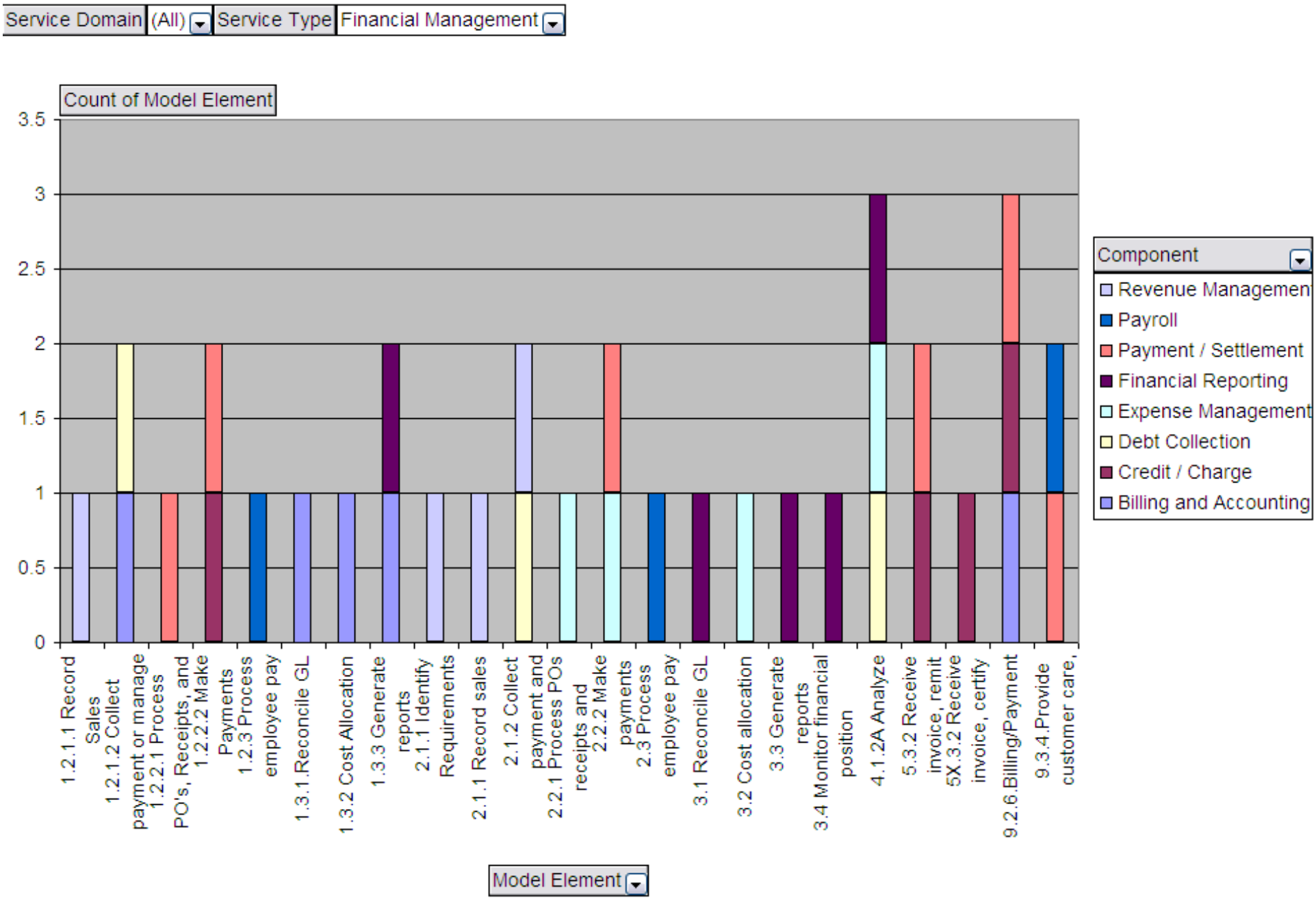


# ITPM - GSA Advantage, Business Processes, Roles

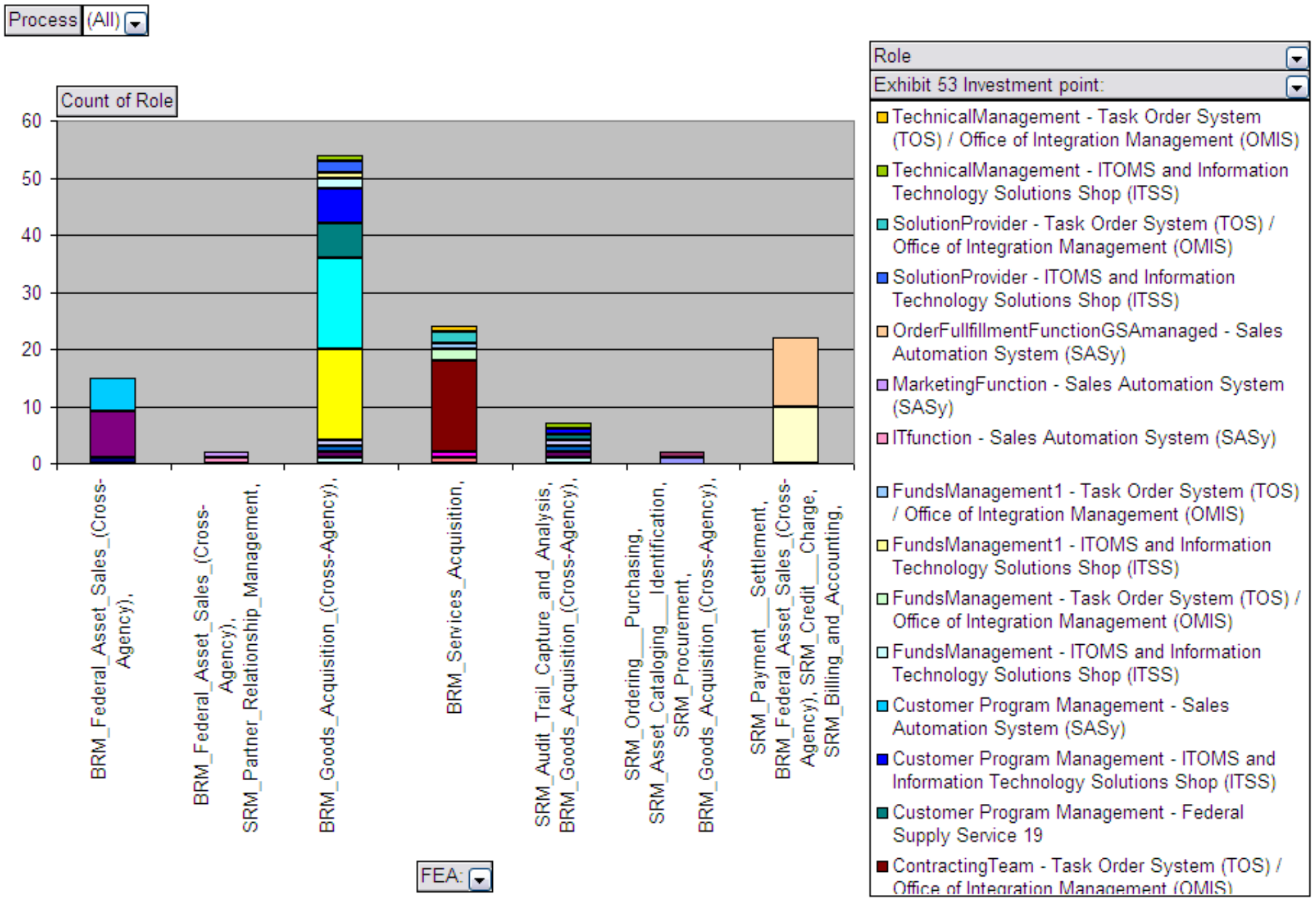
Exhibit 53 Investment point: GSA Advantage



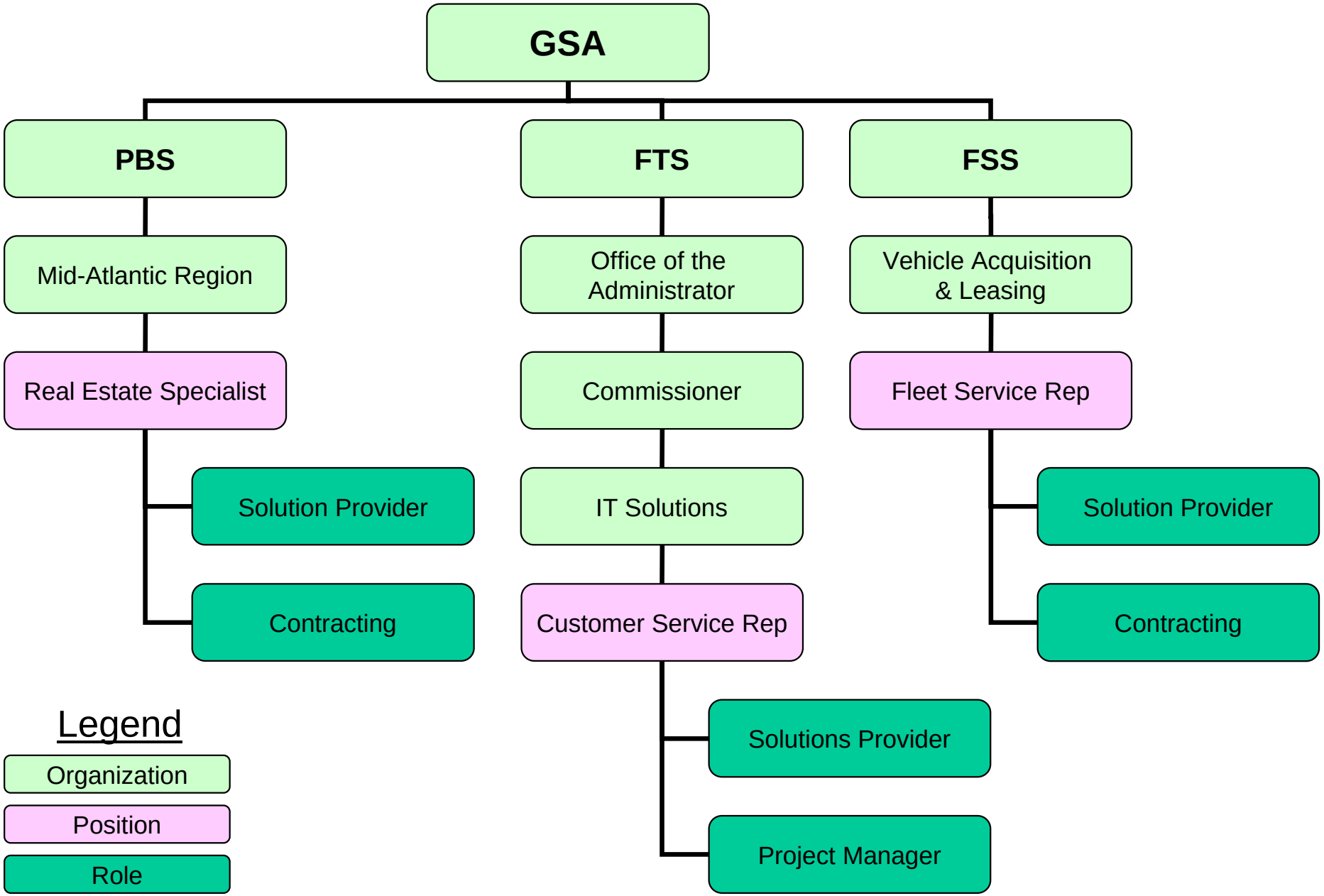
# ITPM - SRM Financial Management, Business Processes



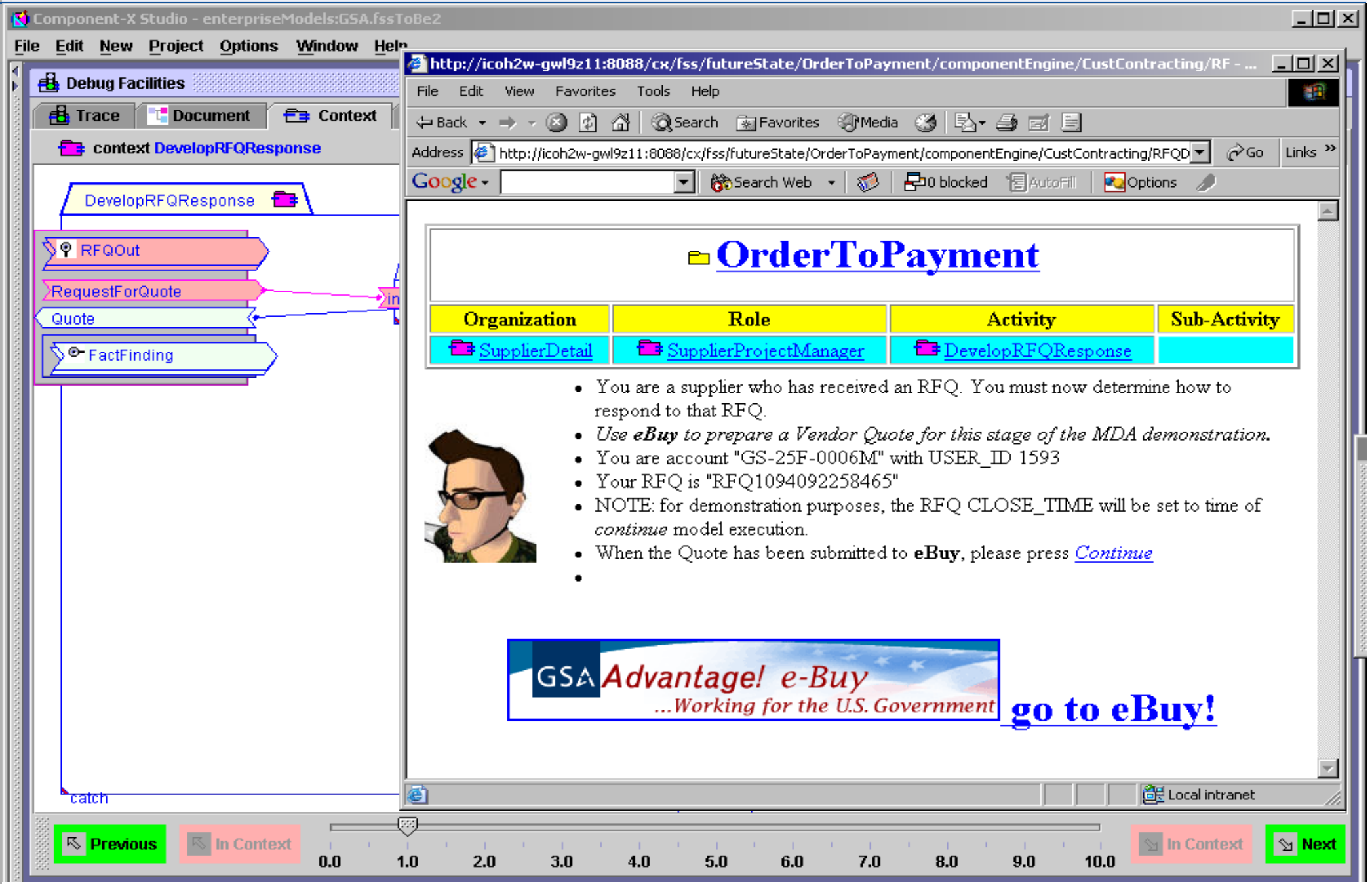
# ITPM - Business Process, Roles, Exhibit 53, FEA (all)



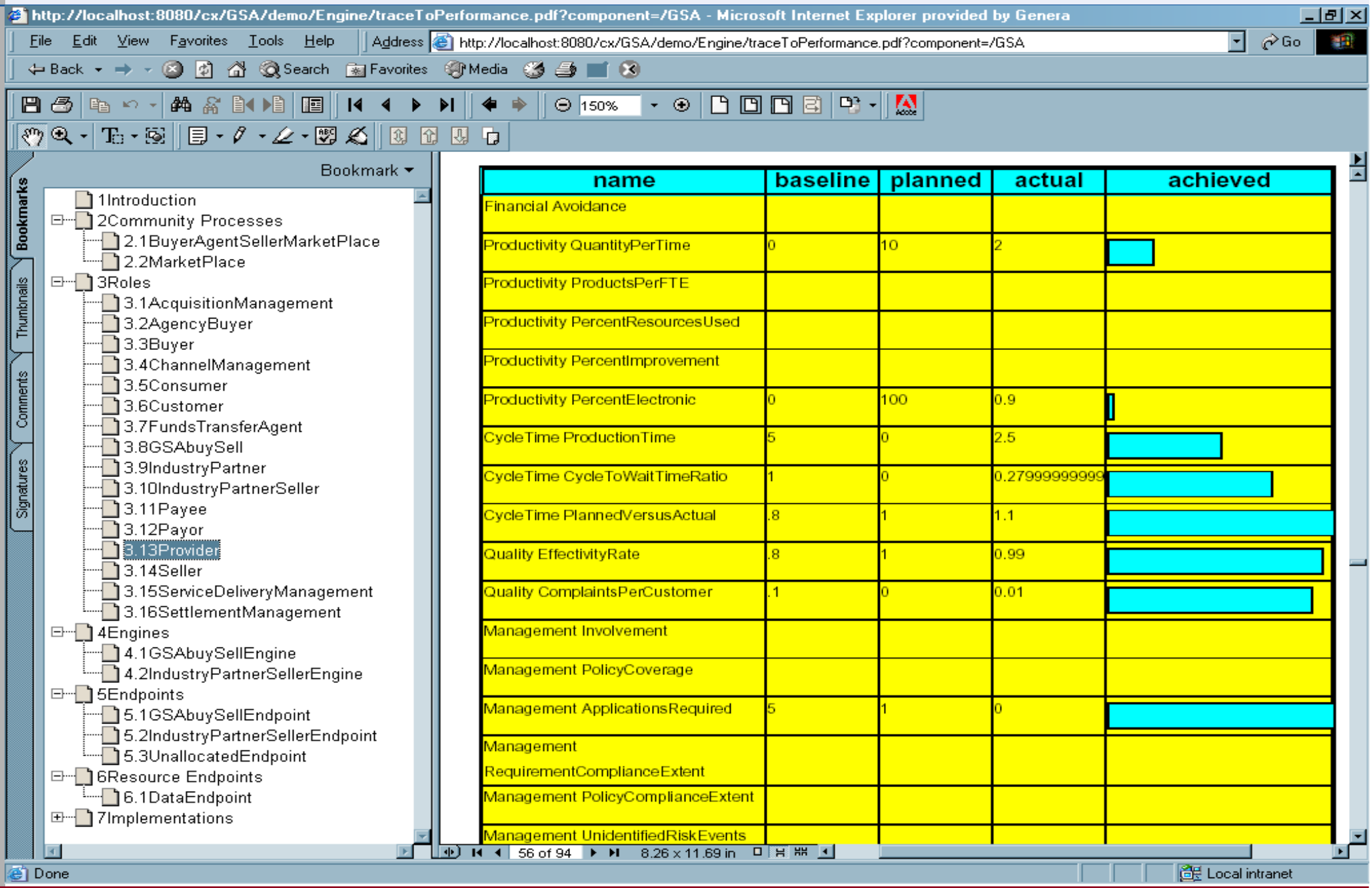
# Org Design – Flexible Role/Service Composition and Reuse



# To-Be BP Interoperates with As-Is Service Component



# PRM Line of Sight for Activity Based Costing



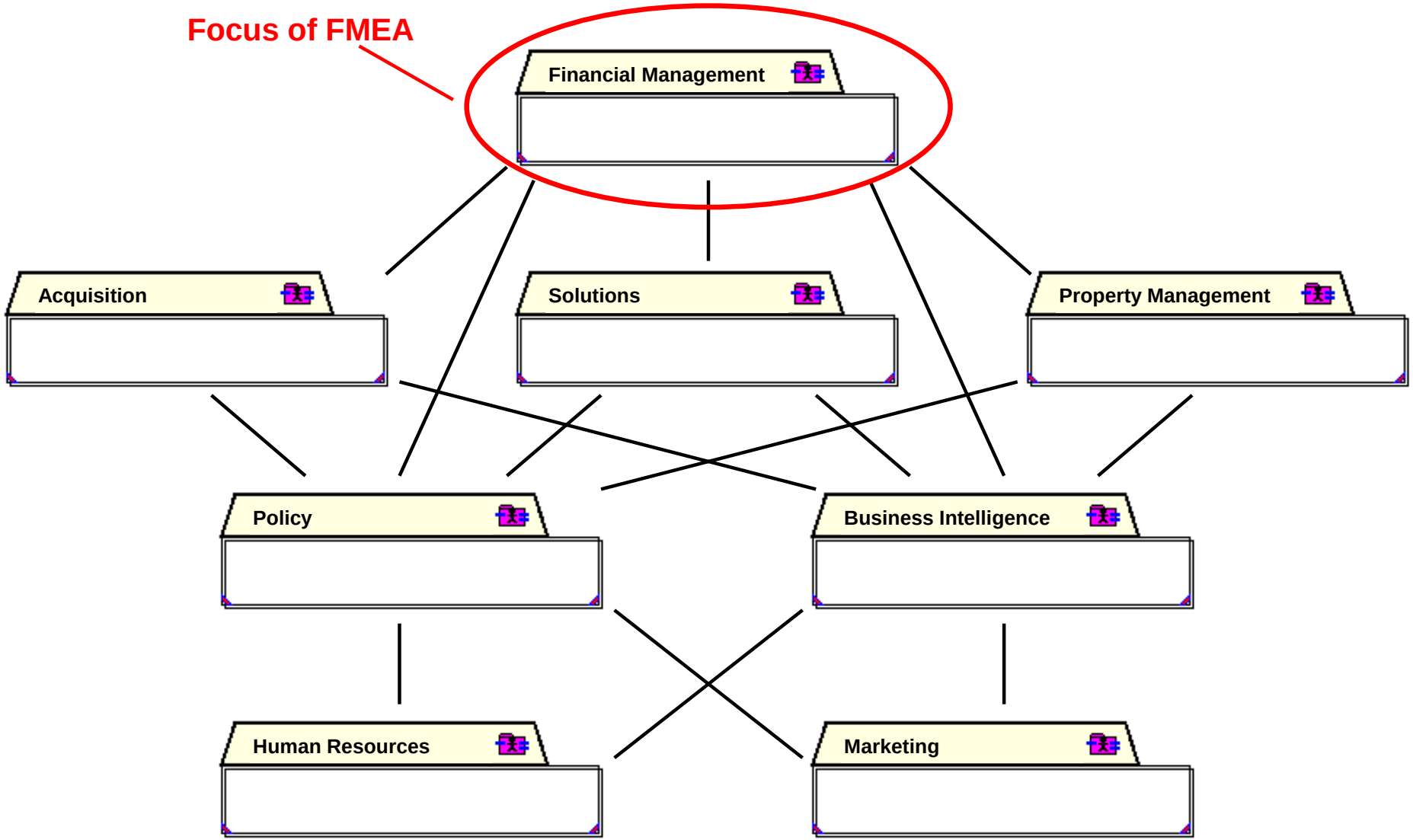

| name | baseline | planned | actual | achieved |
|---|---|---|---|---|
| Financial Avoidance | | | | |
| Productivity QuantityPerTime | 0 | 10 | 2 | |
| Productivity ProductsPerFTE | | | | |
| Productivity PercentResourcesUsed | | | | |
| Productivity PercentImprovement | | | | |
| Productivity PercentElectronic | 0 | 100 | 0.9 | |
| CycleTime ProductionTime | 5 | 0 | 2.5 | |
| CycleTime CycleToWaitTimeRatio | 1 | 0 | 0.27999999999 | |
| CycleTime PlannedVersusActual | .8 | 1 | 1.1 | |
| Quality EffectivityRate | .8 | 1 | 0.99 | |
| Quality ComplaintsPerCustomer | .1 | 0 | 0.01 | |
| Management Involvement | | | | |
| Management PolicyCoverage | | | | |
| Management ApplicationsRequired | 5 | 1 | 0 | |
| Management RequirementComplianceExtent | | | | |
| Management PolicyComplianceExtent | | | | |
| Management UnidentifiedRiskEvents | | | | |

# Part 2 - FMLoB

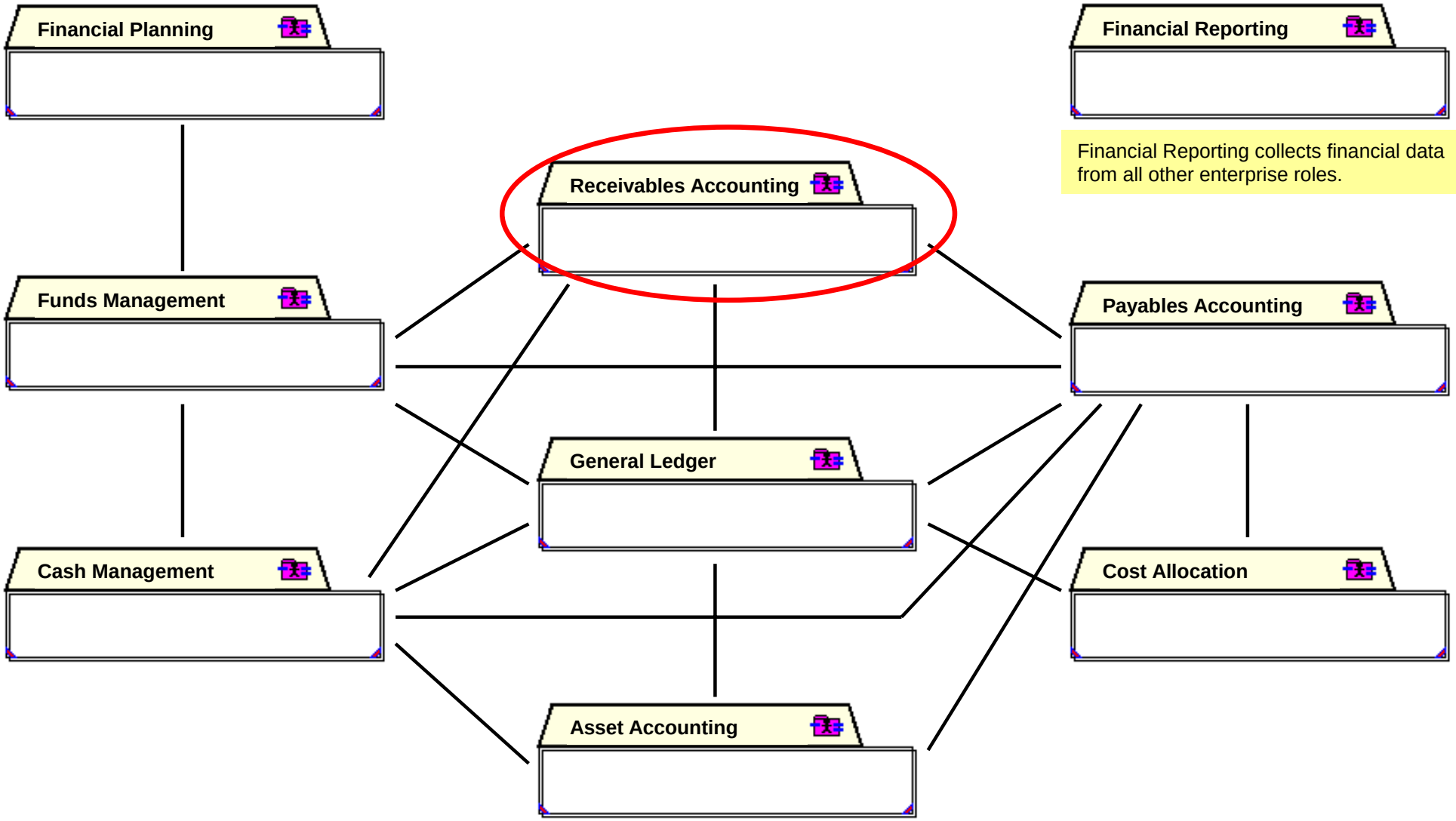
- Slides 24 to 45

- FMEA – FMLoB Case Study
  - EDOC CIM/PIM conventions
  - ADM Mainframe Analysis
  - UML Information, Transaction, Message, Persistence Models
  - Team and Tools

# CIM: “One GSA” Disciplines



# CIM: Financial Management Enterprise Roles



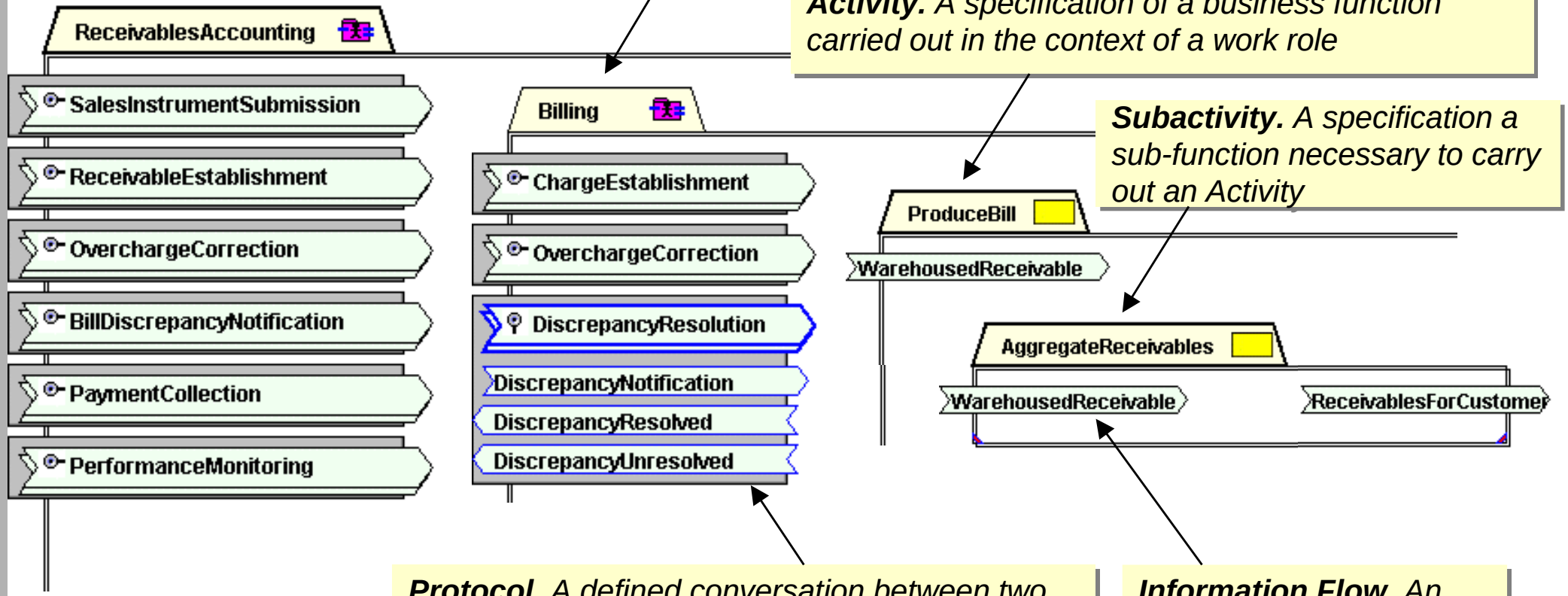
# GSA's FMLoB: CIM Decomposition Conventions

***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 and supported by an IT system*

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

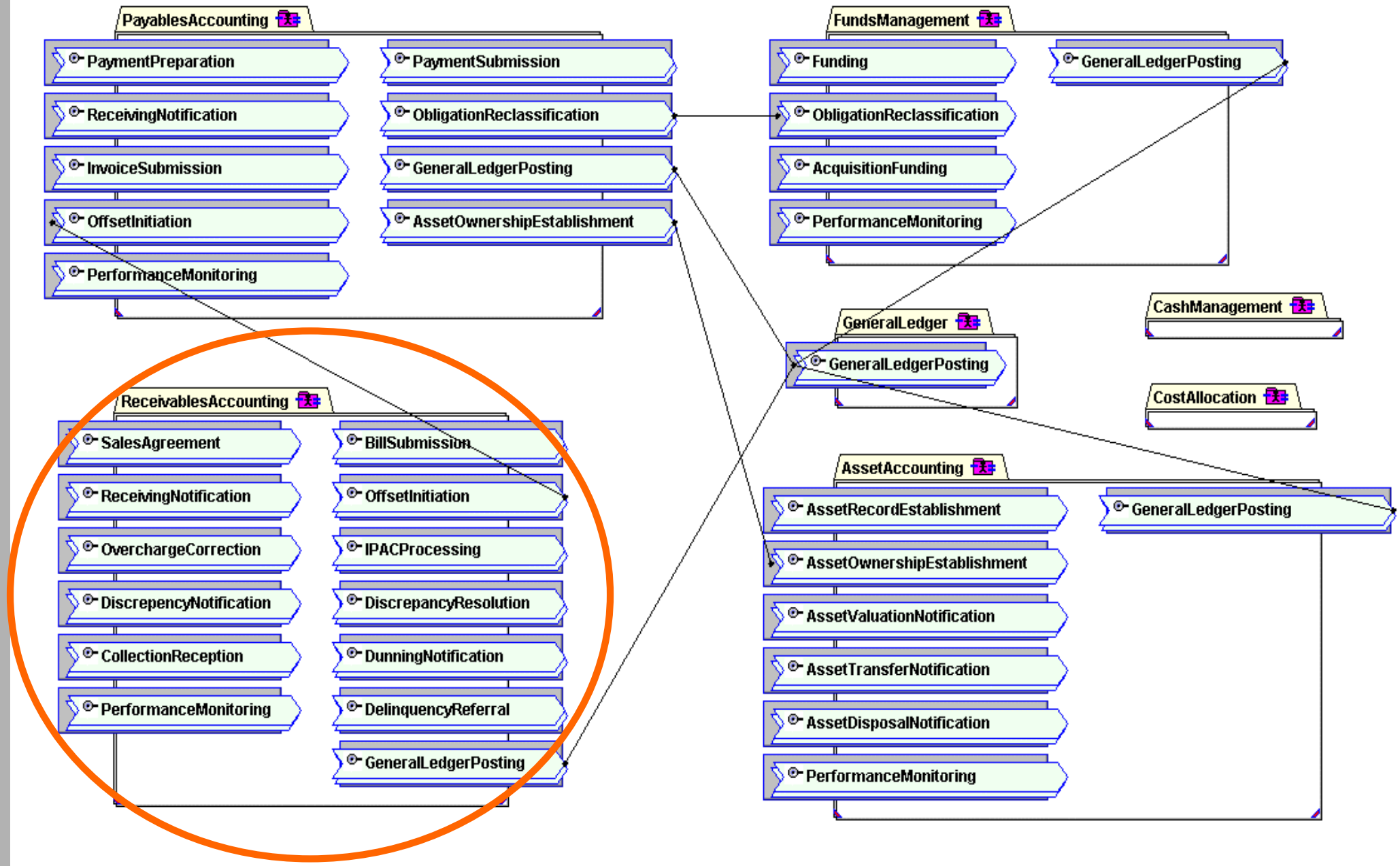
***Subactivity.*** *A specification a sub-function necessary to carry out an Activity*



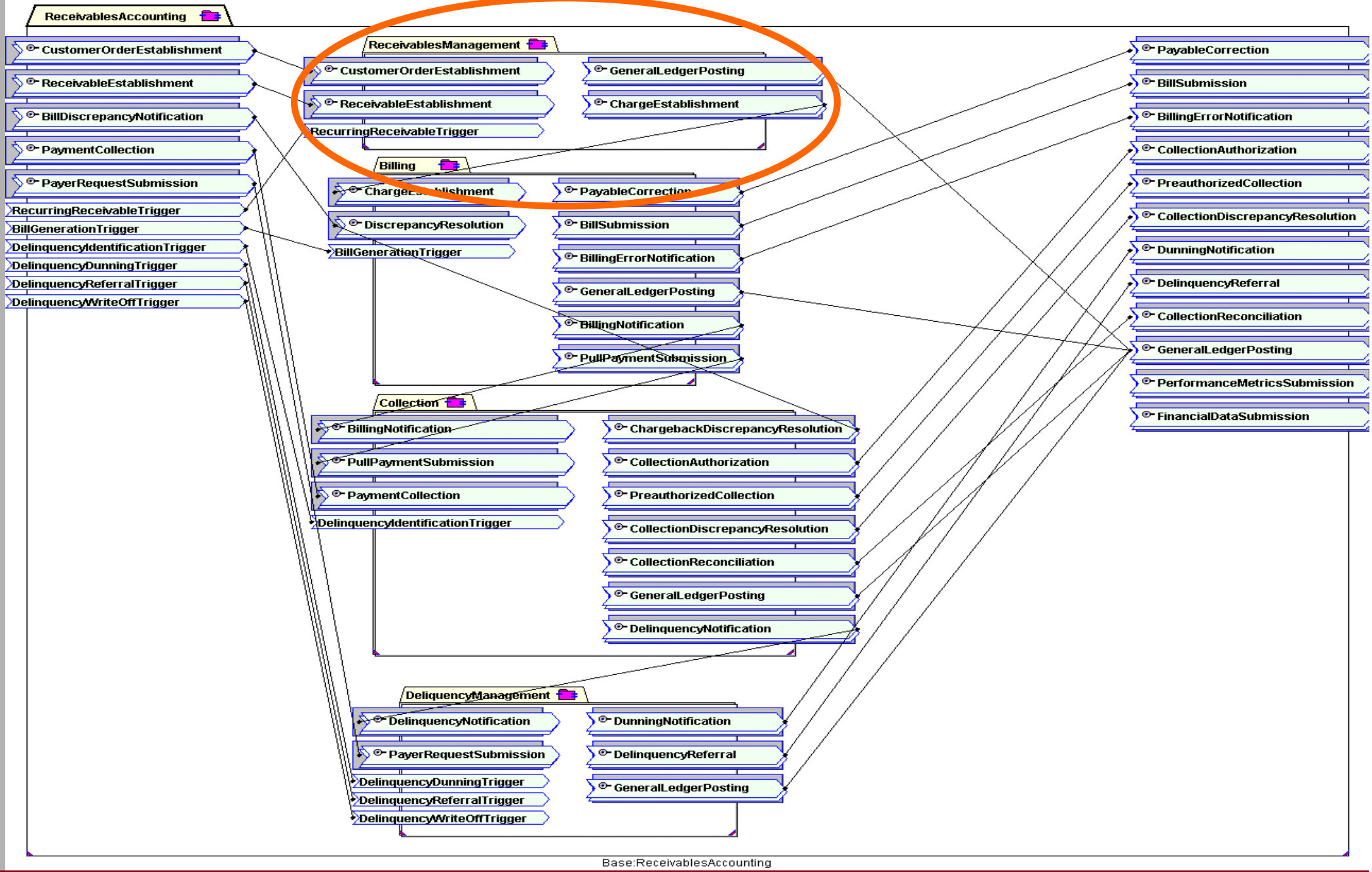

***Protocol.*** *A defined conversation between two roles that may be extended over time. One role initiates and the other responds to the protocol, but information may flow both ways across the protocol*

***Information Flow.*** *An individual flow of information across a protocol or into or out of an Activity or Subactivity*

# CIM: FMLoB Enterprise Roles

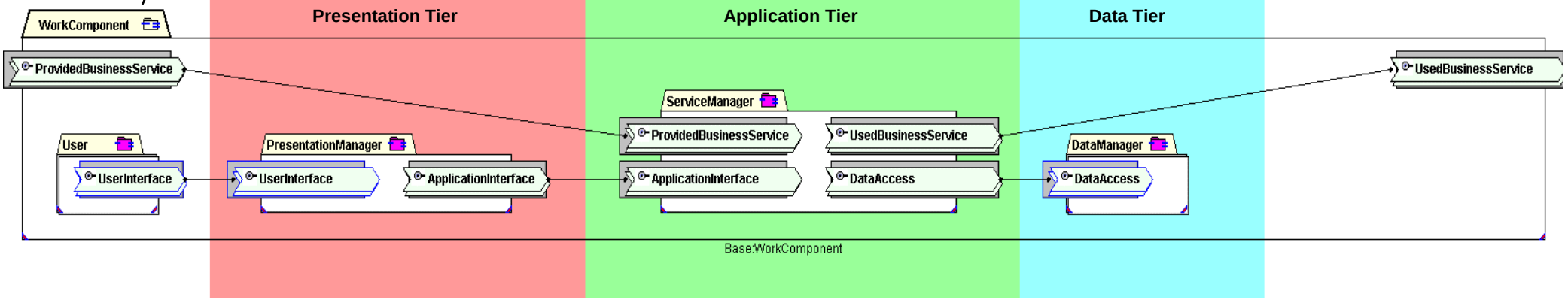


# CIM: Enterprise Role Composes Work Roles



# PIM/PSM: Service-Oriented Component Architecture

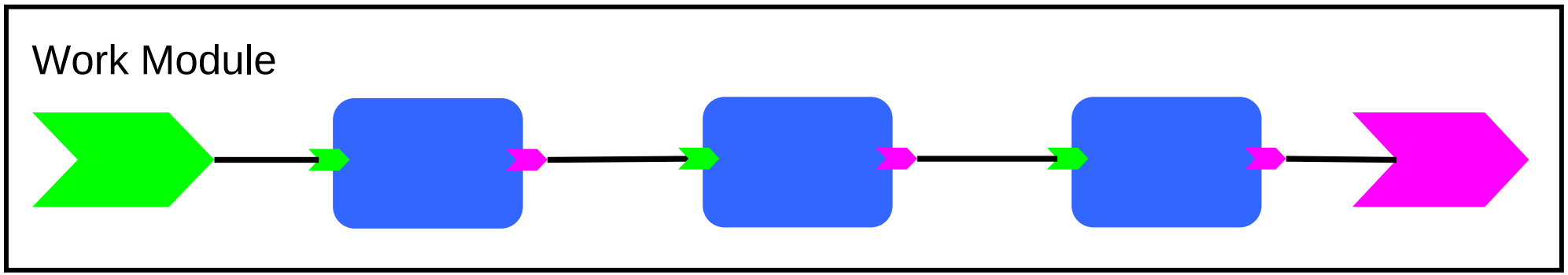
***Each Work Component in the PIM implements a Work Role from the CIM***




***Presentation Manager components provide user access to application services***

***Service Manager components provide transactional implementation of application services defined in the CIM***

***Data Manager components persist data between application transactions***



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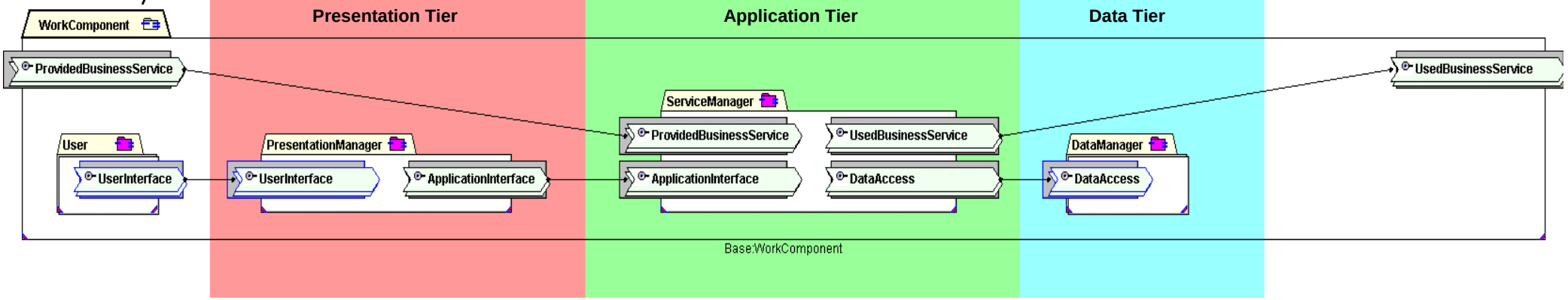


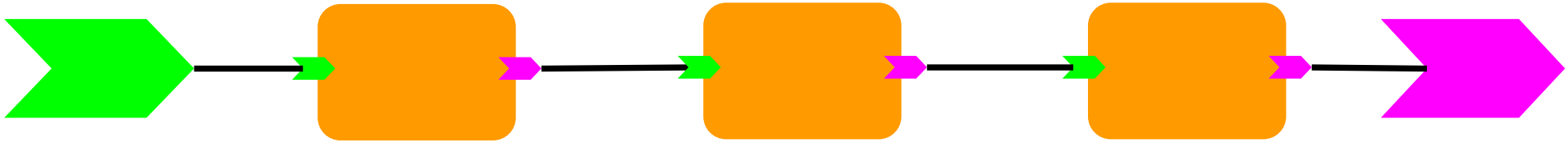

***Presentation Manager components provide user access to application services***

***Service Manager components provide transactional implementation of application services defined in the CIM***

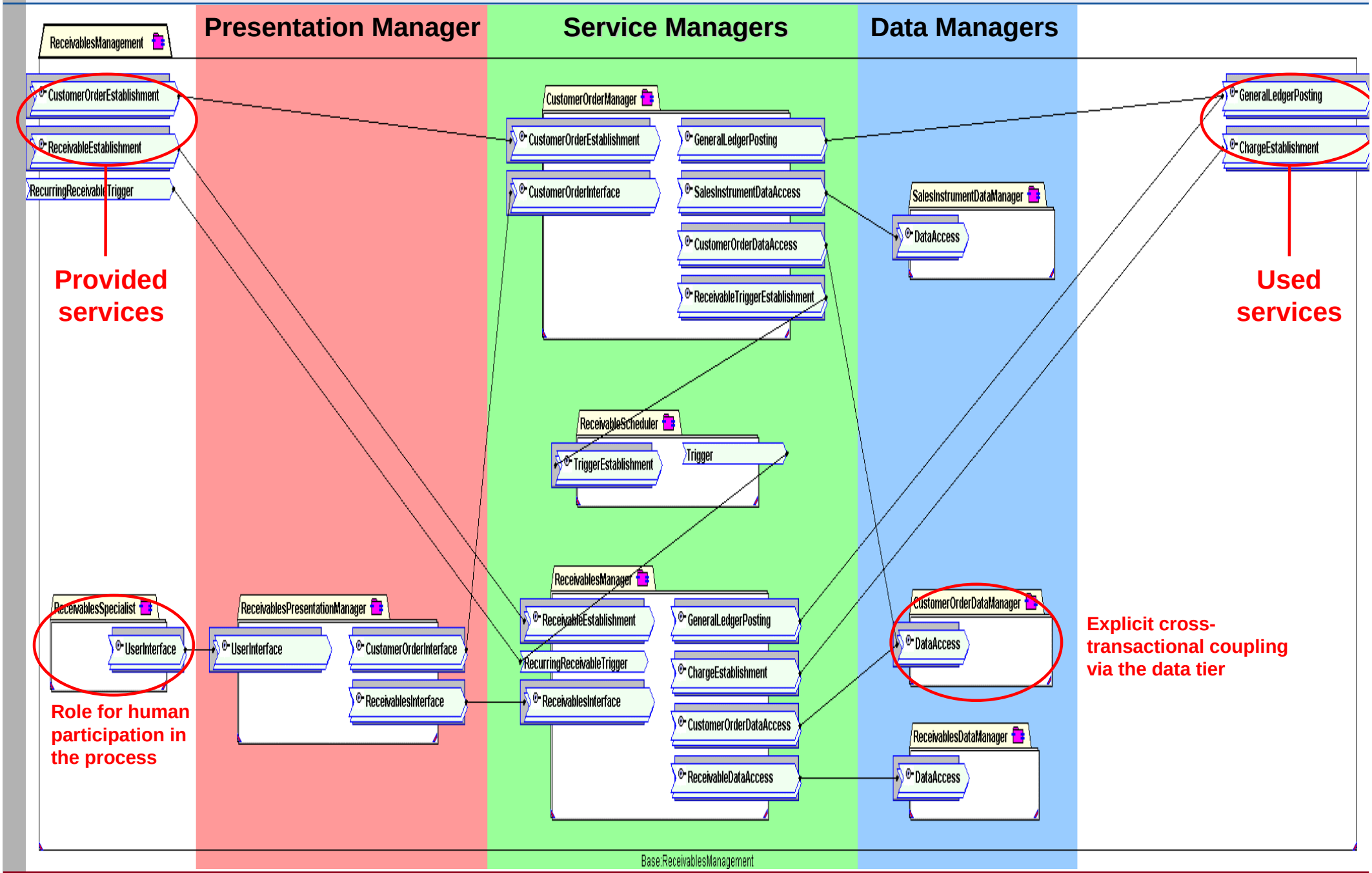
***Data Manager components persist data between application transactions***

## System Assembly

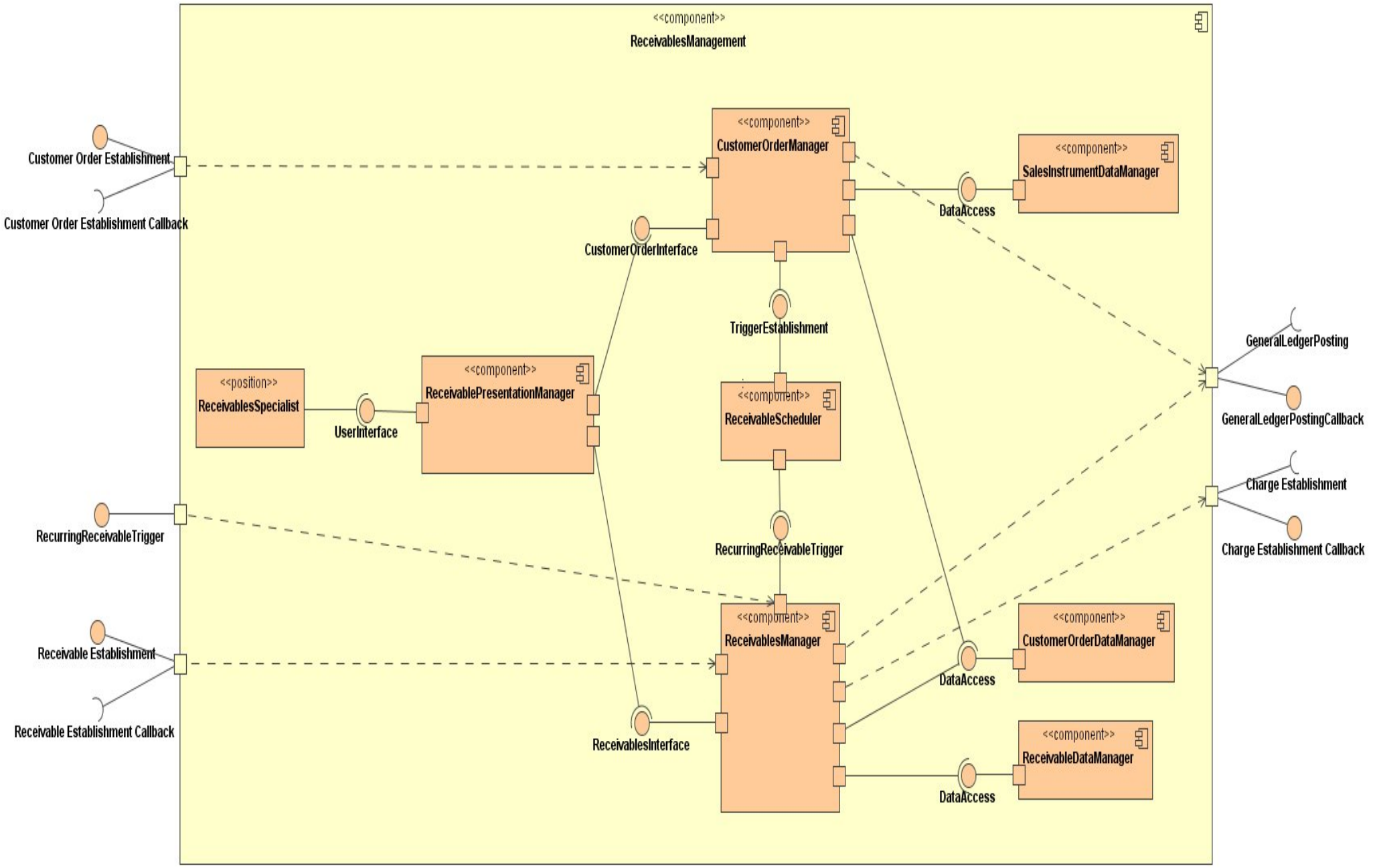
Subsystem



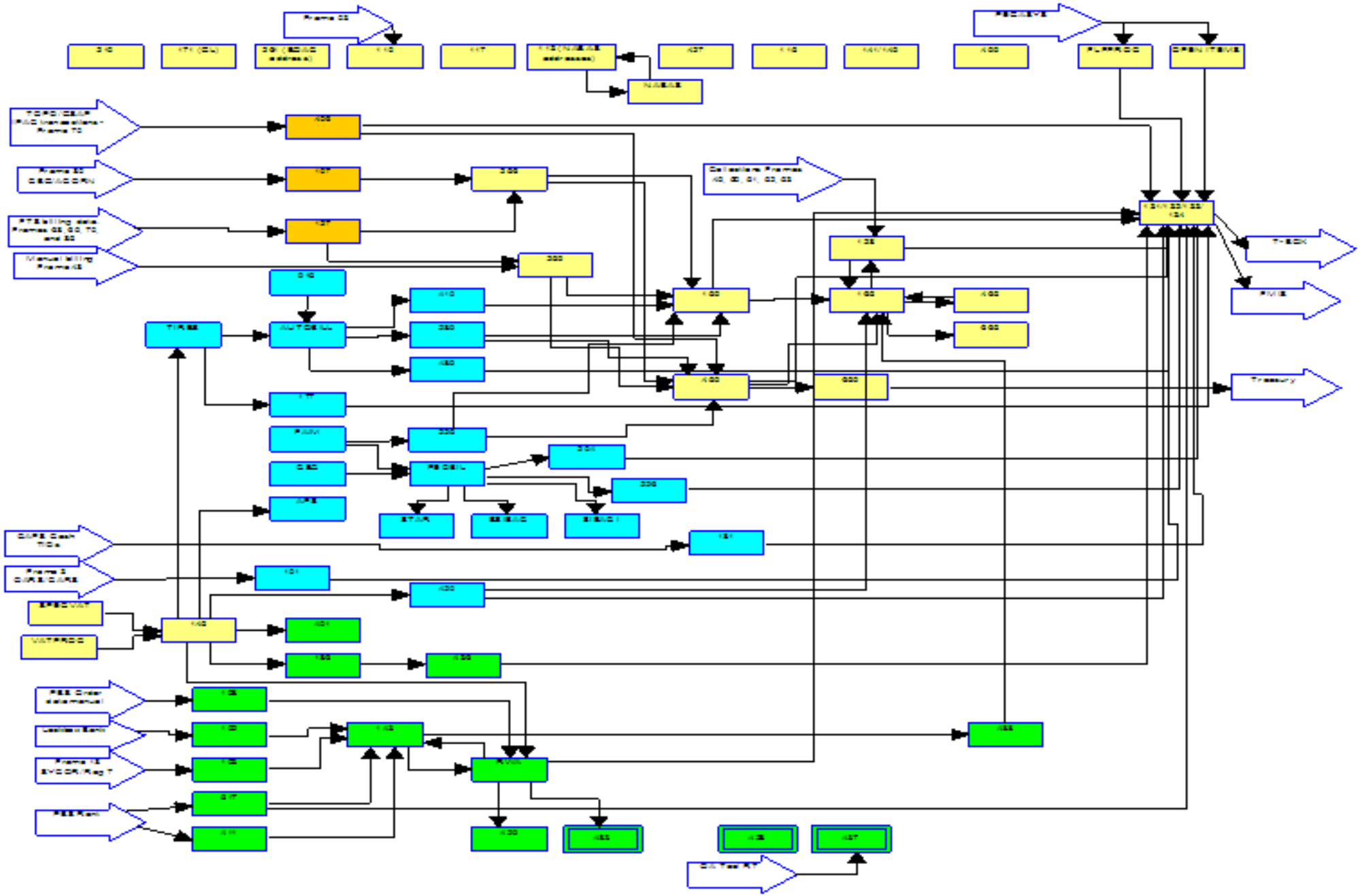
# PIM: Receivables Management Work Role



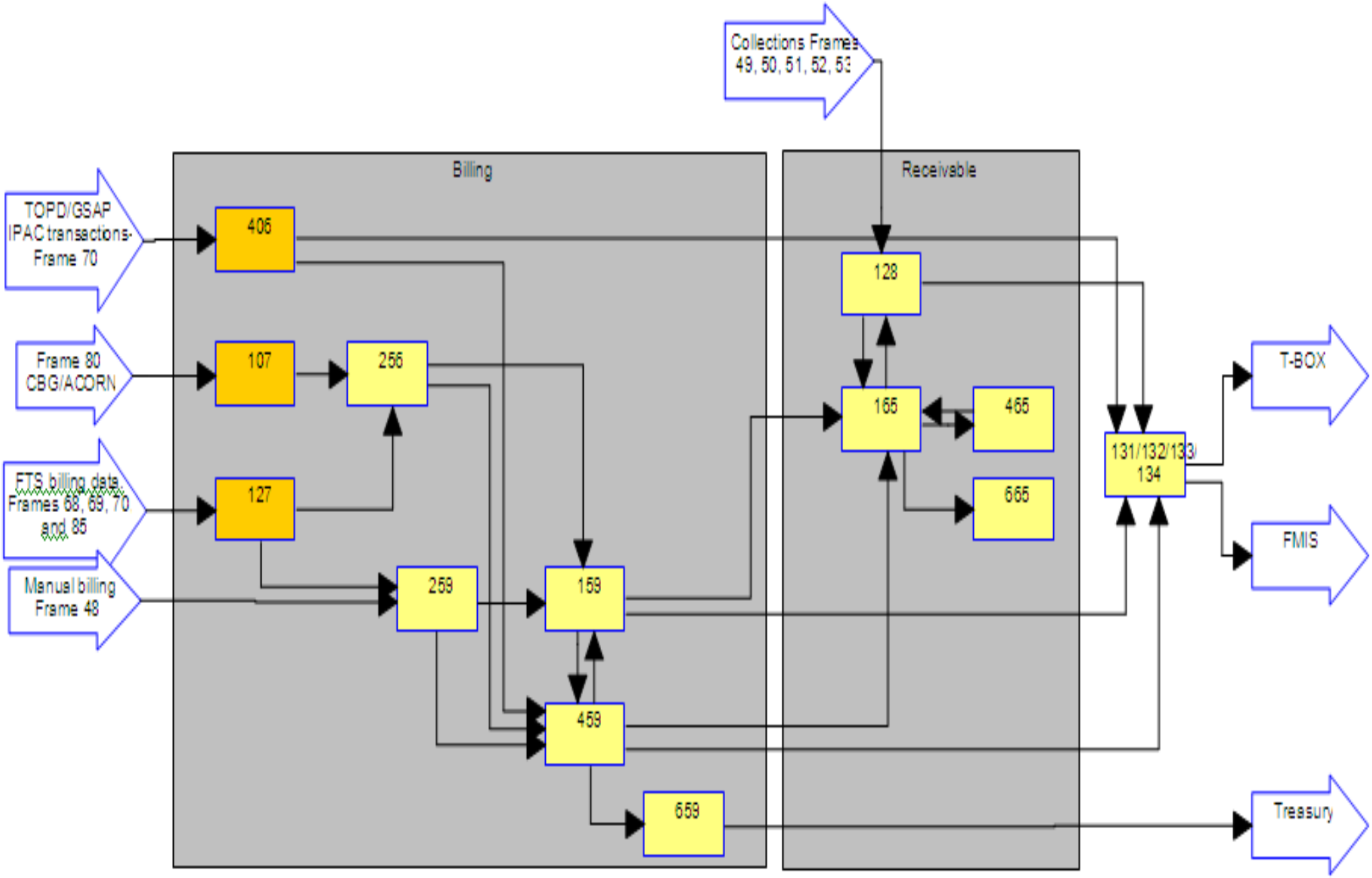
# UML2 Receivables Management Composite Component



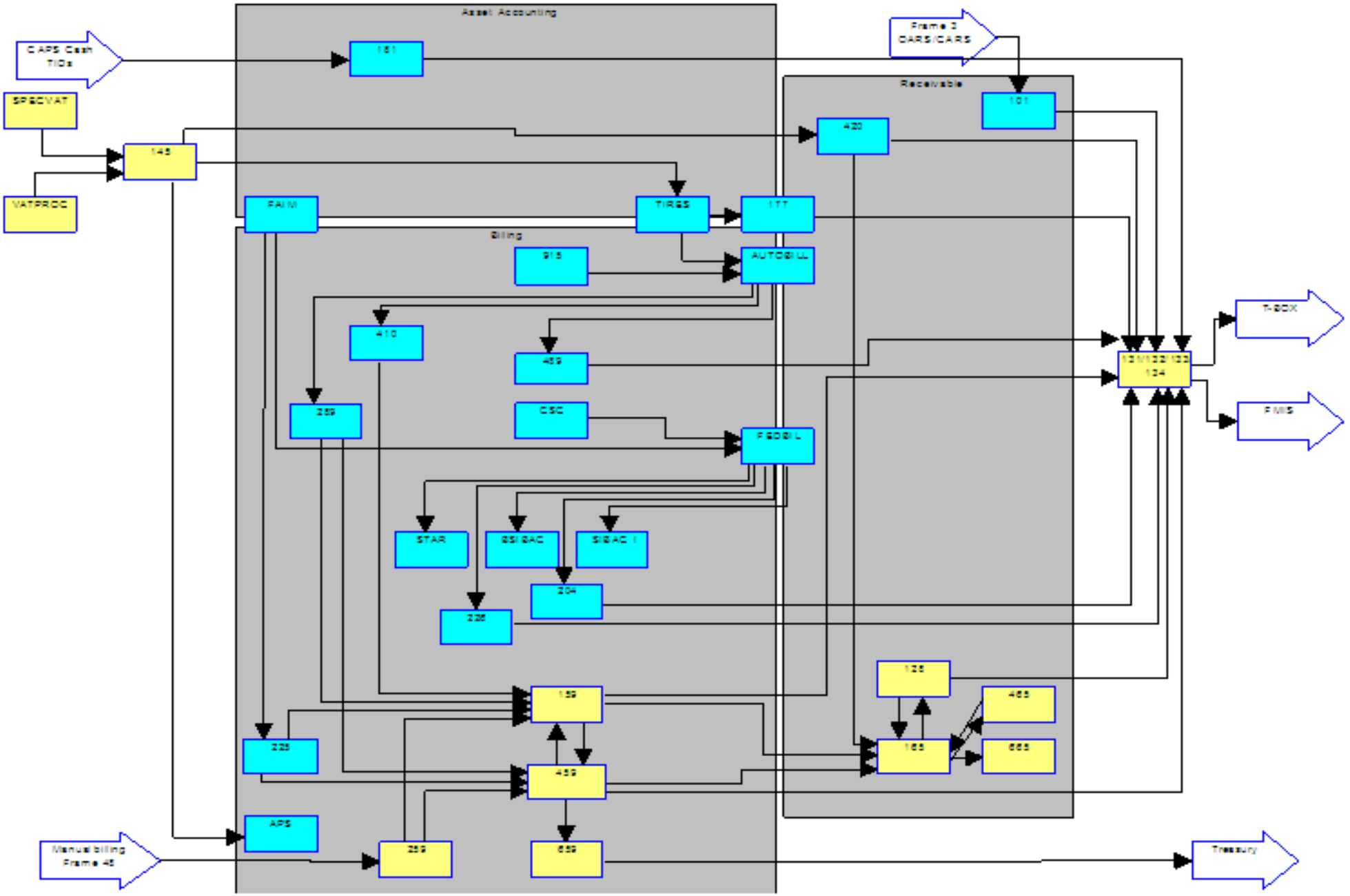
# ADM - Flow of NEAR Modules



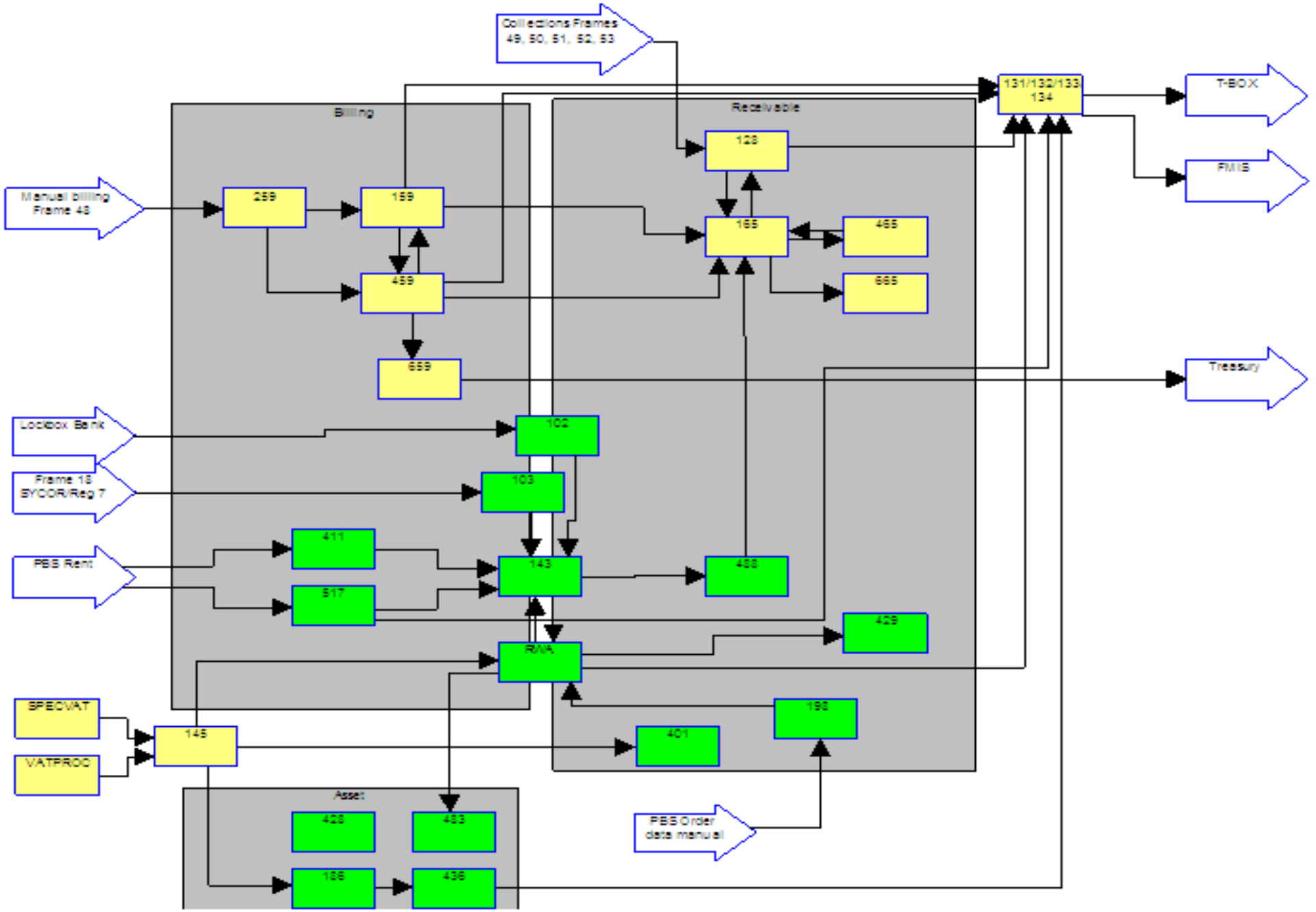
# ADM - FTS Module Flows, with Process Mapping



# ADM - FSS Module Flows, with Process Mapping



# ADM - PBS Module Flows, with Process Mapping



# Record Unfilled Customer Order - Requirements

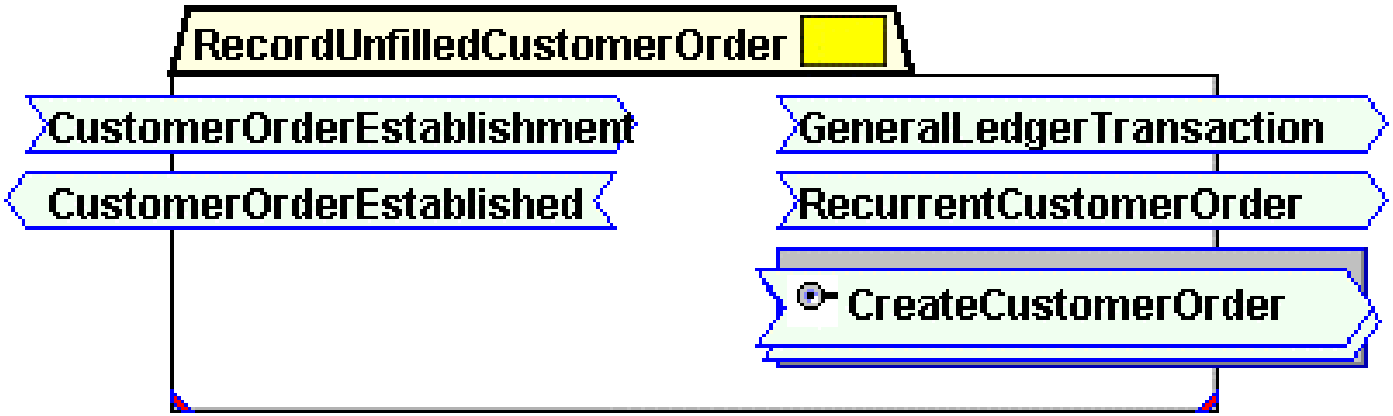
- ADM enabled identification and analysis of 86 modules, 728 programs and 342 copybooks (735,000 loc)
- Tools offer query, reporting, sorting capabilities useful for extracting business rules
  - ~3 FTE person months - 636 business rules extracted
  - Only used this analysis technique on a COBOL mainframe slated for deprecation, other parsers available

Description: Record a new unfilled customer order, as established via a specific sales instrument.
Generate general ledger transactions to increase Unfilled Customer Orders and decrease Anticipated Reimbursements.

Requirement

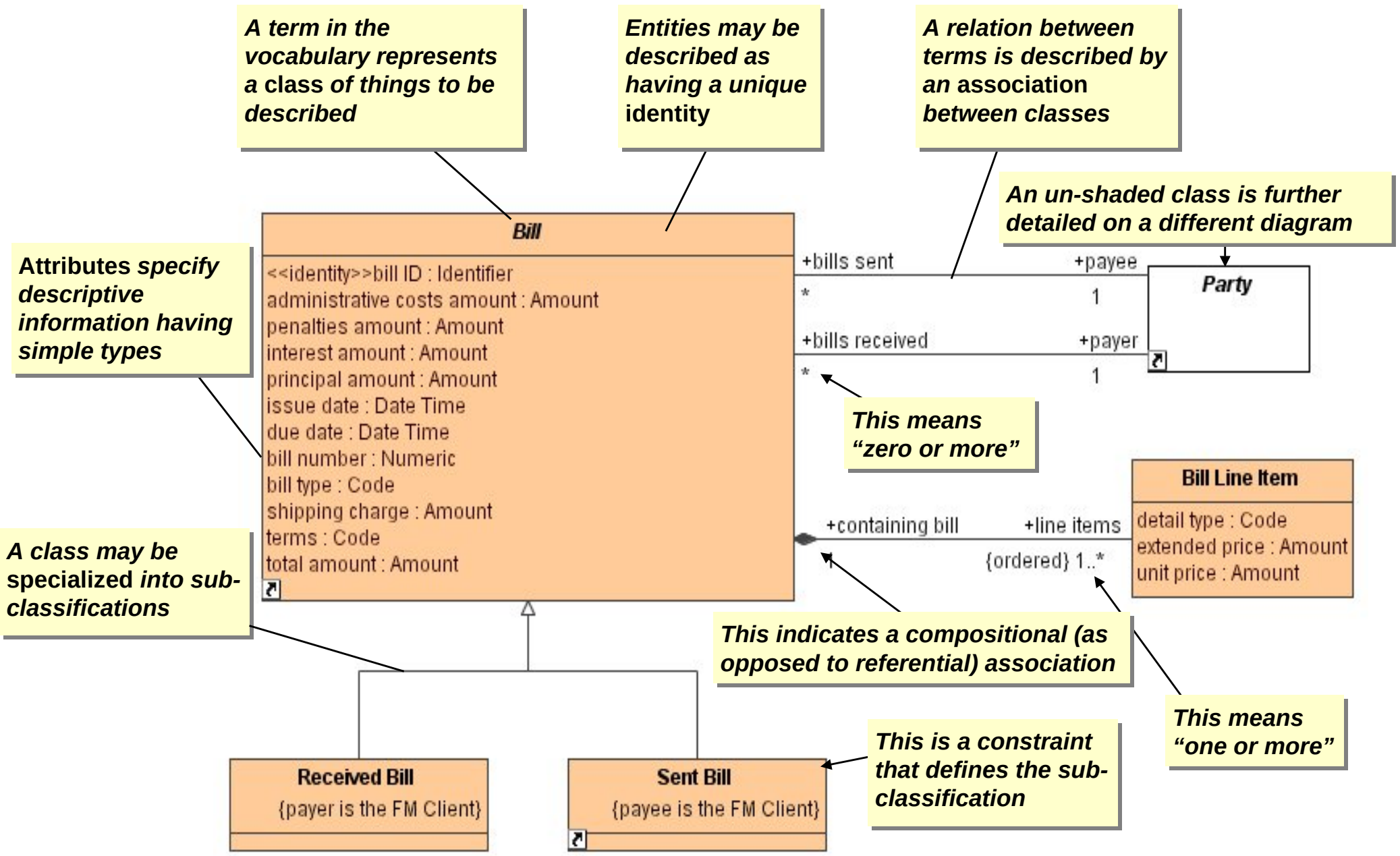
| | | |
|---|---|---|
| RMA-03 | Reimbursable agreement information. Capture and accumulate reimbursable agreement information that includes the following:<br>* Billing limit<br>* Billing terms<br>* Customer order amount<br>* Amount obligated<br>* Amount expended<br>* Advances collected<br>* Advances applied to earned revenue<br>* Remaining balance on advances<br>* Amount earned<br>* Amount billed<br>* Accounts receivable<br>* Collections on receivables.<br>Enable access to reimbursable agreement information by customer ID number, reimbursable agreement number, project, or fund. | JFMIP Core Requirements 2005 |

# Record Unfilled Customer Order - Functional Spec

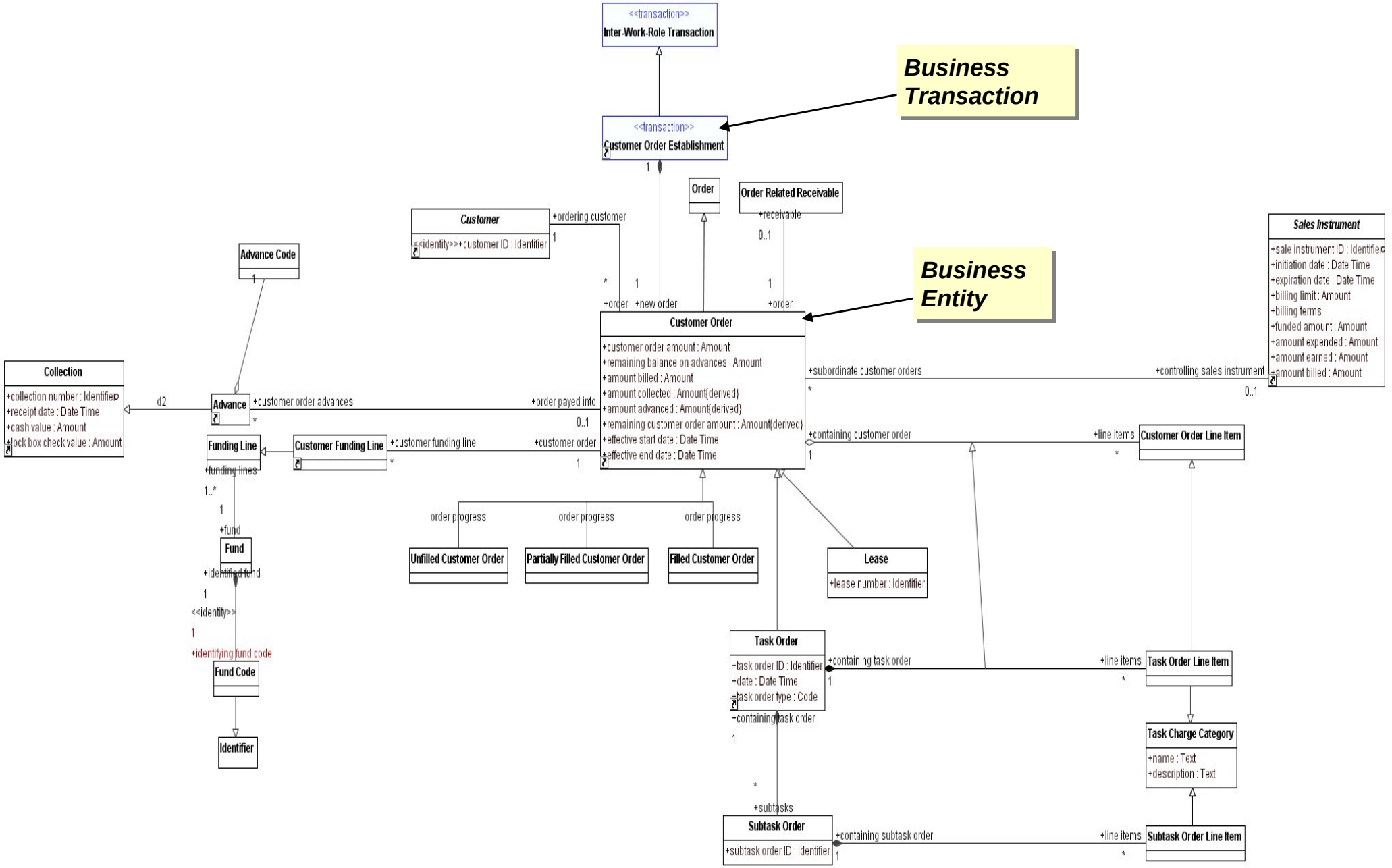



1. **Receive** CustomerOrderEstablishment
2. **Let** newOrder = CreateCustomerOrder(CustomerOrderEstablishment.newOrder).data
3. **Send** GeneralLedgerTransaction to increase Unfilled Customer Orders and decrease Anticipated Reimbursements
4. **Send** newOrder as RecurrentCustomerOrder
   (**Note**: EstablishRecurringReceivables will check if there are actually any creation triggers.)
5. **Send** CustomerOrderEstablished

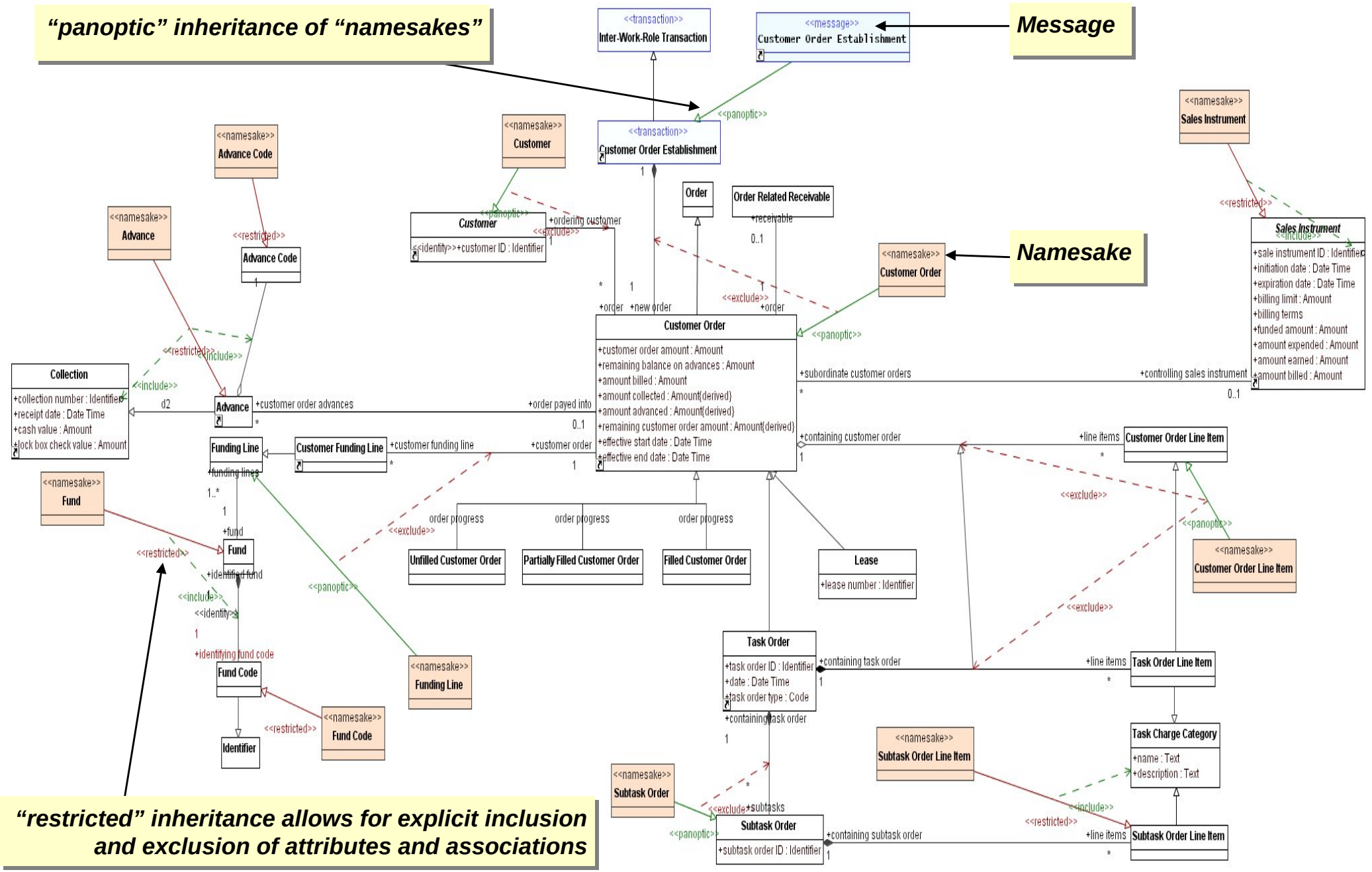
# Information Model Example - UML Primer



# Business Information, Business Transaction Model



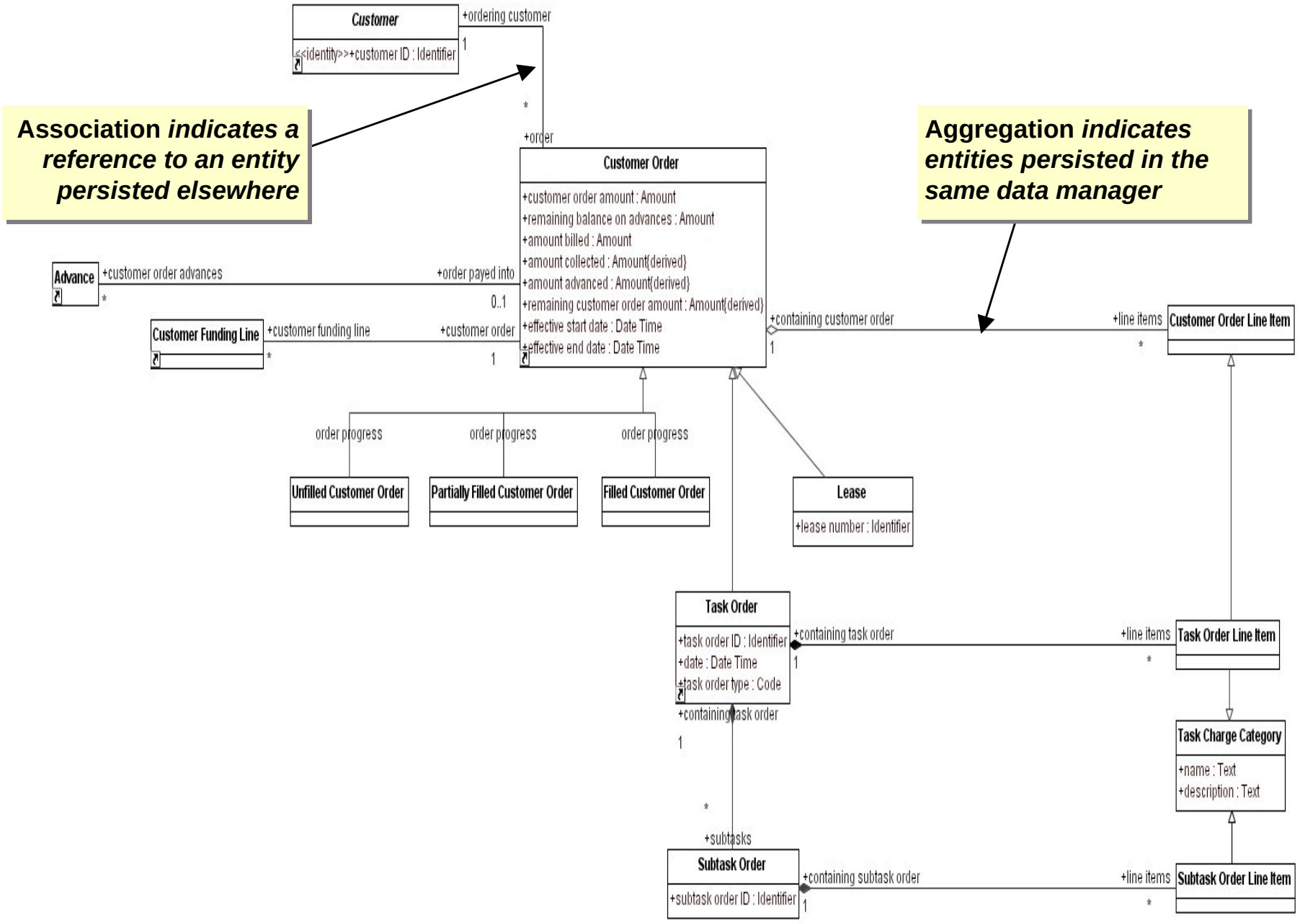
# Business Transaction Message Model



# Business Transaction Message in XML for CIM/CRI

```
<CustomerOrderEstablishment>
    <Inter-Work-RoleTransaction>
        <inter-work-roleTransactionID> … </inter-work-
  roleTransactionID>
        …
    </Inter-Work-RoleTransaction>
    <newOrder>
        <orderingCustomer>
            <customerID> … </customerID>
        </orderingCustomer>
        <controllingSalesInstrument>
            <salesInstrumentId> … </salesInstrumentId>
        </controllingSalesInstrument>
        <customerOrderAmount> … </customerOrderAmount>
        …
        <lineItems>
            …
        </lineItems>
    </newOrder>
</CustomerOrderEstablishment>
```

# Persistence Model



# FMEA - FMLoB Thanks

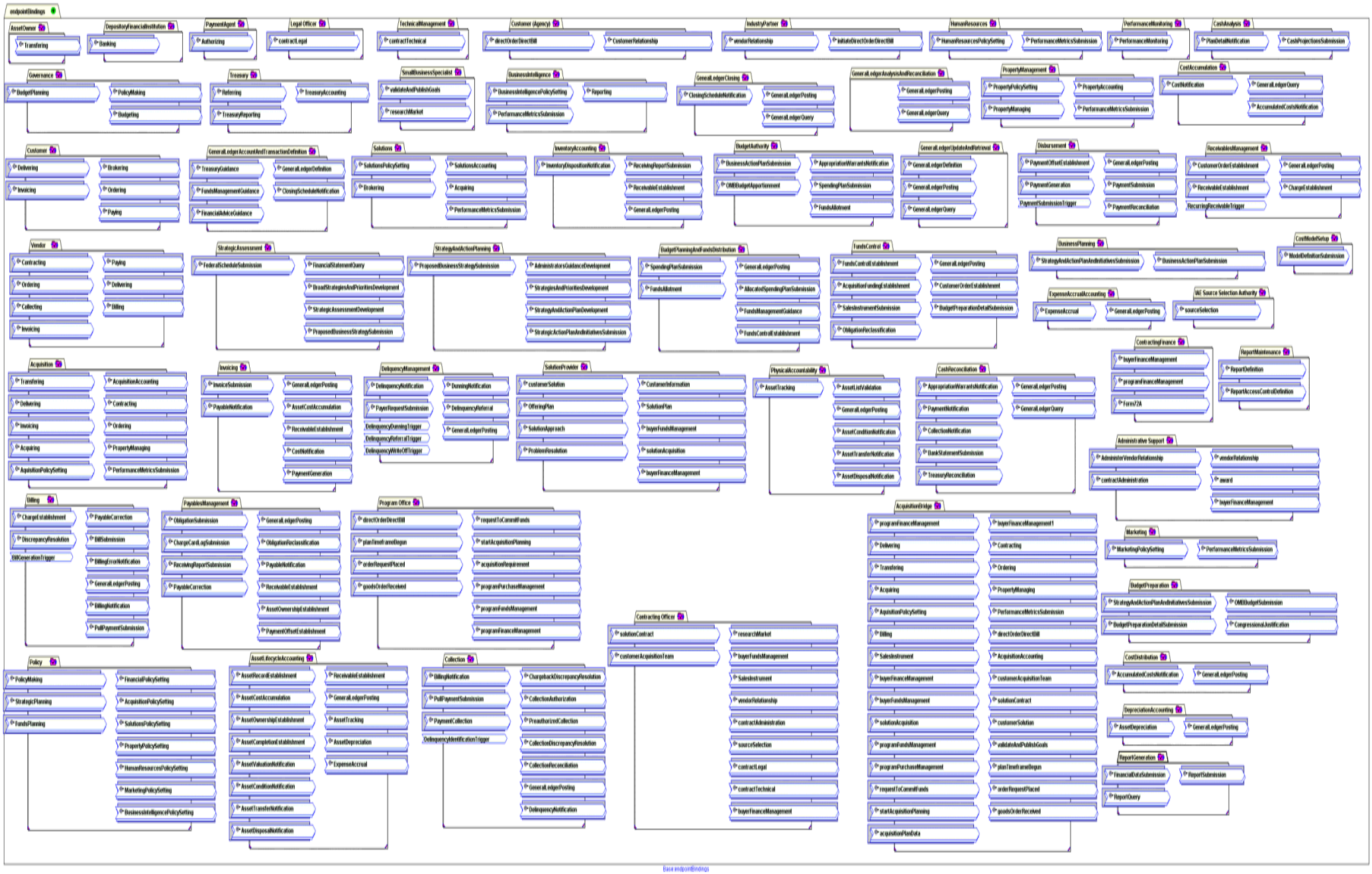
- GSA OCFO
  - Driving GSA toward shared services
- LMI
  - Task Lead
  - FM domain (JFMIP-FSIO) specialists
- Data Access Technologies
  - Tech Lead
  - MDA (EDOC, UML) specialists
  - One GSA EA and ComponentX specialists
- Tactical Strategy Group
  - ADM Transformation specialists
- ASG
  - Becubic and additional support!

# Part 3 - OSERA

- Slides 46 to 60

- OSERA
  - ‘Model to Integrate’
  - Test driven ‘Service Based Procurement’
  - ‘Model Based Acquisition’
  - Semantic Interoperability

# OSERA - BPEL Work Roles for Acquisition and FMLoB



# FMEA PSM: Generated BPEL/WSDL/XSD

```
<wsdl:portType name="ReceivableEstablishment.ReceivableEstablishment">
  <wsdl:operation name="ReceivableEstablishment">
      <wsdl:input name="ReceivableEstablishment“ message="tns:ReceivableEstablishmentPanopticInheritanceCluster">
</wsdl:input>
  </wsdl:operation>
</wsdl:portType>
```

```
<wsdl:message name="ReceivableEstablishmentPanopticInheritanceCluster">
  <wsdl:part name="ReceivableEstablishmentPanopticInheritanceCluster"
type="Receivable_Establishment:ReceivableEstablishmentPanopticInheritanceClusterType">
  </wsdl:part> <wsdl:part name="correlationId" type="xsd:string"/>
</wsdl:message>
```

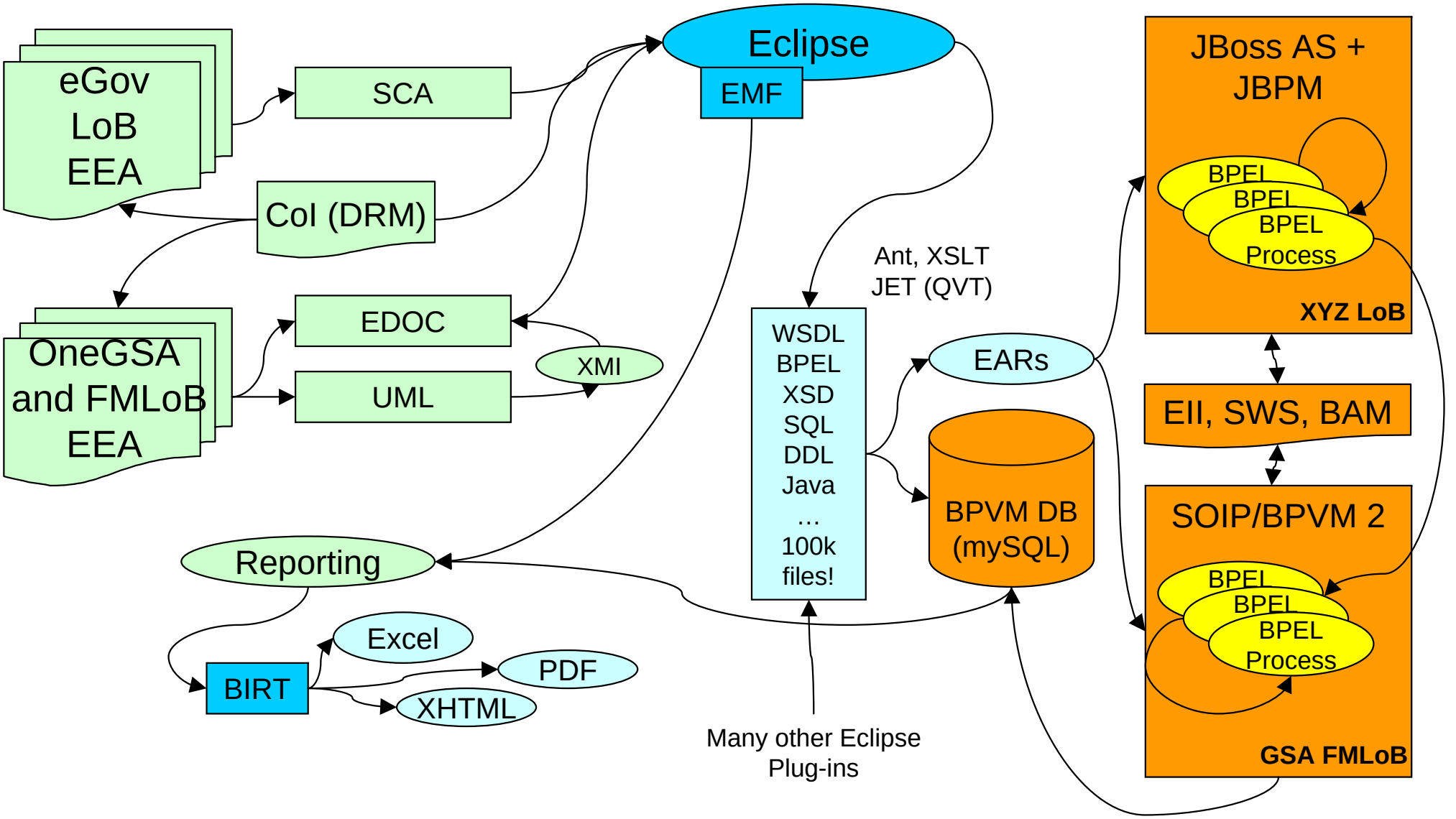
```
<plt:partnerLinkType name="ReceivableEstablishment">
  <plt:role name="PayablesManagement" portType="tns:ReceivableEstablishment.ReceivableEstablishmentCallback"/>
  <plt:role name="ReceivablesManagement“ portType="tns:ReceivableEstablishment.ReceivableEstablishment"/>
</plt:partnerLinkType>
```

```
<wsdl:types>
  <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
targetNamespace="platform:/resource/fmea.process/model/Receivable_Establishment.xsd“
xmlns="http://www.w3.org/2001/XMLSchema">
      <xsd:include schemaLocation="Receivable_Establishment.xsd"/>
  </xsd:schema>
</wsdl:types>
```

```
<xsd:complexType name="ReceivableEstablishmentType">
  <xsd:sequence> {…}
    <xsd:element minOccurs="1" maxOccurs="1" name="Inter-Work-RoleTransaction"
      type="BusinessTransactions:Inter-Work-RoleTransactionType"/>
    <xsd:element minOccurs="1" maxOccurs="1" name="Inter-Enterprise-RoleTransaction"
      type="FinancialManagement:Inter-Enterprise-RoleTransactionType"/> {…}
  </xsd:sequence>
</xsd:complexType>
```

# EEA Models, IME/MDM, Code, SOIP/BPVM, Reports/Alerts

- OSERA generates, deploys and executes EEA models



# OSERA Managed Platform: EEA Tools and Techniques

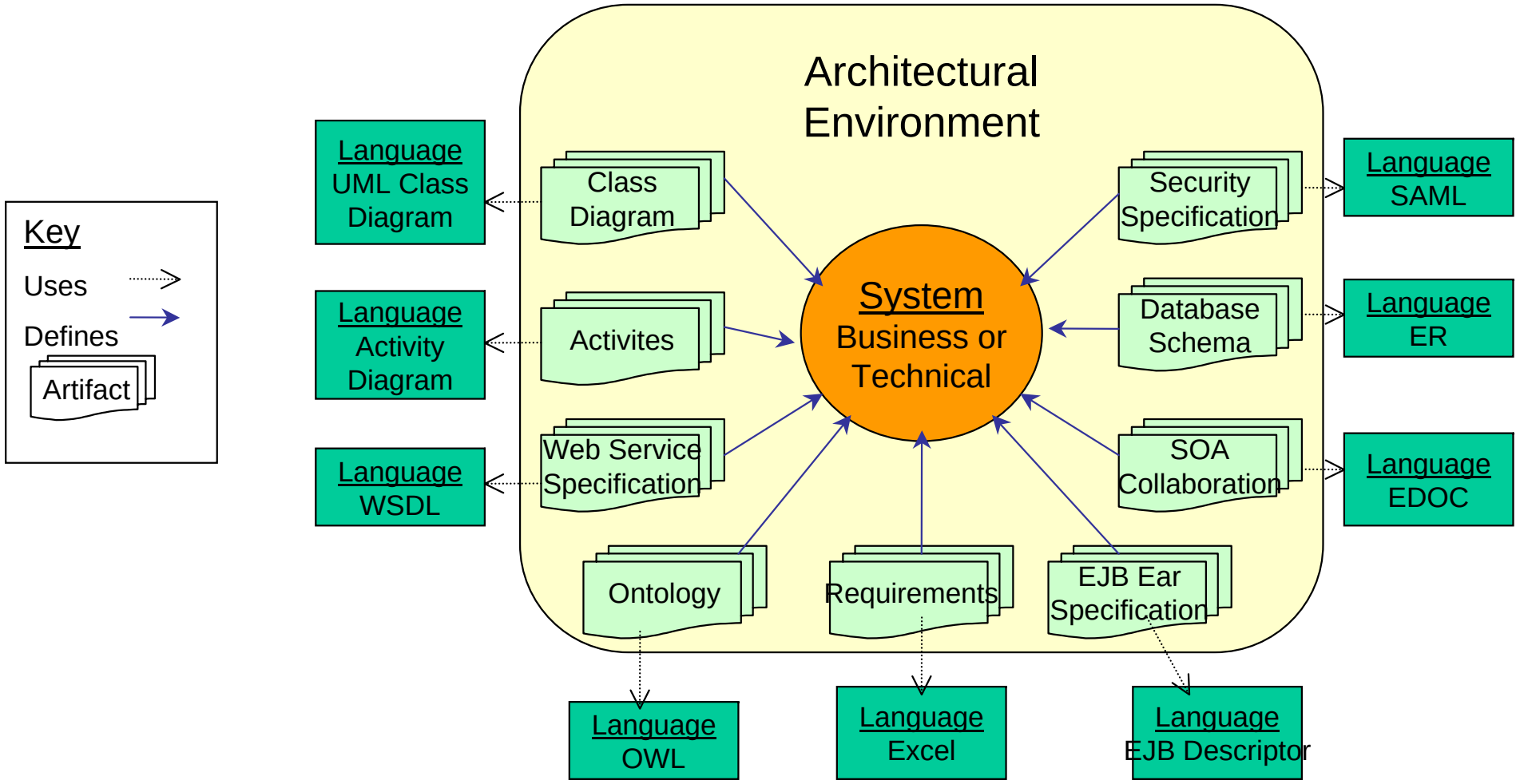
- Aggregating, enhancing and integrating existing FOSS for EA
  - Eclipse, JBoss
  - NetBeans, GlassFish
  - Platform and tool agnostic
    - Fusion, .NET
- Model to Integrate, ‘collapse CPIC and SDLC’
  - IME, MDM, SOIP, BPVM, ESB
  - Integrated design and runtime tools
  - EDOC to BPEL example
- Semantic Interoperability, ‘end modeling fatigue’
  - Integrating structured and knowledge representations
  - MDA (MOF, EDOC, BPDM, SBVR, UML2, KDM, GASTM, …)
  - RDF/S, OWL-DL (others)
- Infrastructure Services
  - UDDI/ebXML Registry/Repository
  - Semantic stores and services, Policy Engine
  - Portal, Content Mgmt, SCM, Project Tracking, Listserves, Wiki

# OSERA Managed Program: Model Based Acquisition

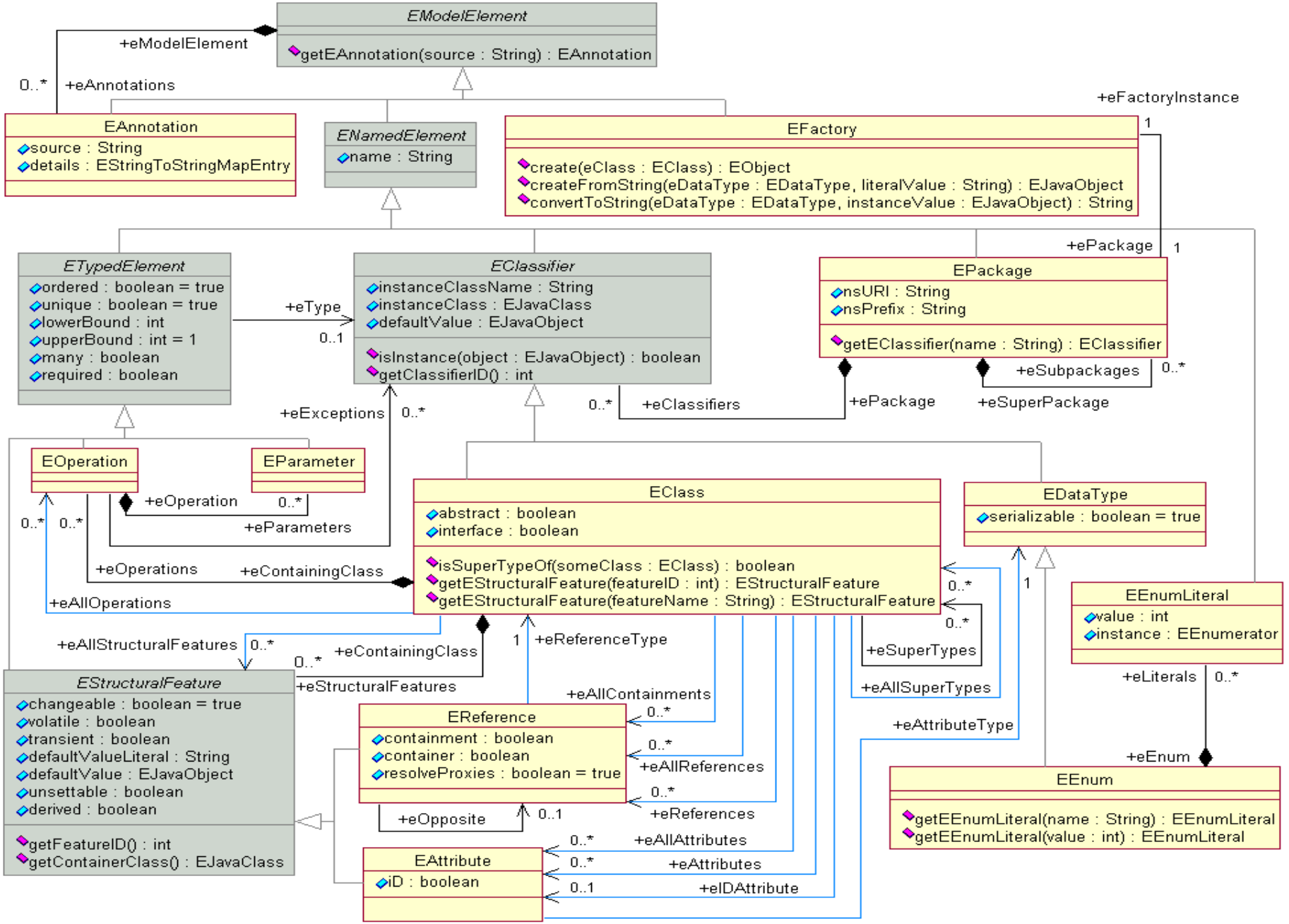
- Test driven service based procurement
  - CIOC AIC/IAC ‘SCBA’ whitepaper, v3.5
  - Service and component interaction testing (DoD NCES JITC)
- Federal-wide ITPM, ‘Resource Rationalization’
  - Combined LoB domain models are ‘RA authoritative sources’
  - Horizontal and vertical government alignment using OS-RA’s
- OSERA as ‘eGov Factory’
  - A RI for designing and *executing* LoB (OS-RA) interoperability
    - ‘TCK’ for standards (WS-I, OASIS, OMG, NIST, other) compliance
  - EEA enables FTA sequencing
- Federal Target Architecture
  - Persistent SOA/ESB enables *progression* testing
  - LoB scenarios as DBC and UAT proof
  - Leading indicators of citizen-centrism, PRM LoS
    - To-be procured service interacts with as-is services
  - Resource rationalization moves from cathedral to bazaar

# Semantic Interoperability – Solving 'Modeling Fatigue'

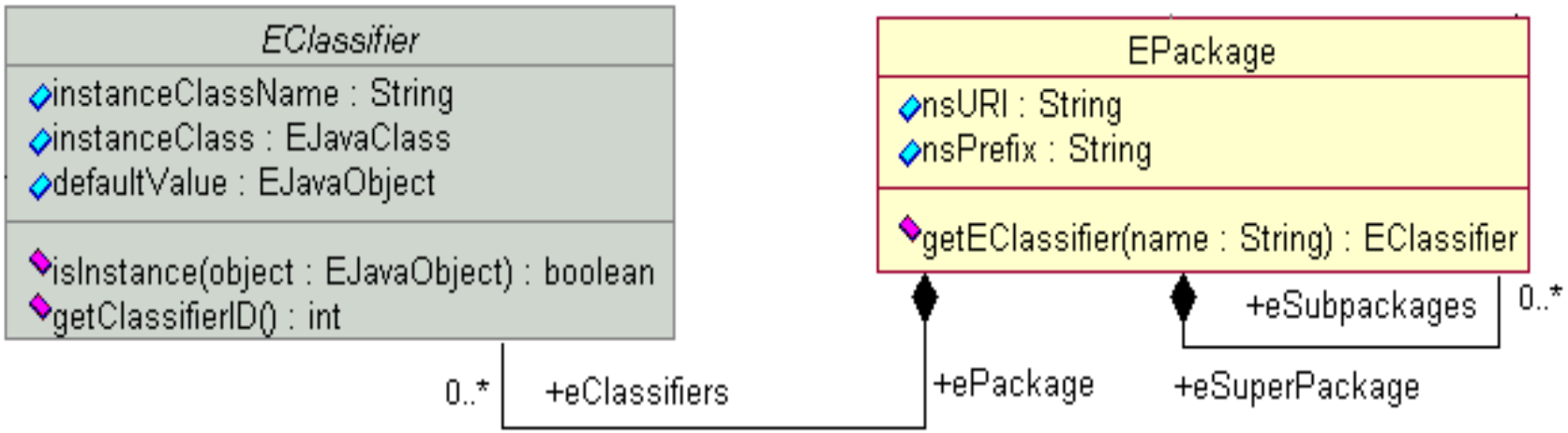
- Problem: too many ways to talk about the same thing, redundant and conflicting semantics
- Solution: integrate structured and knowledge representation disciplines



# ECORE Meta-Meta Model (M3)



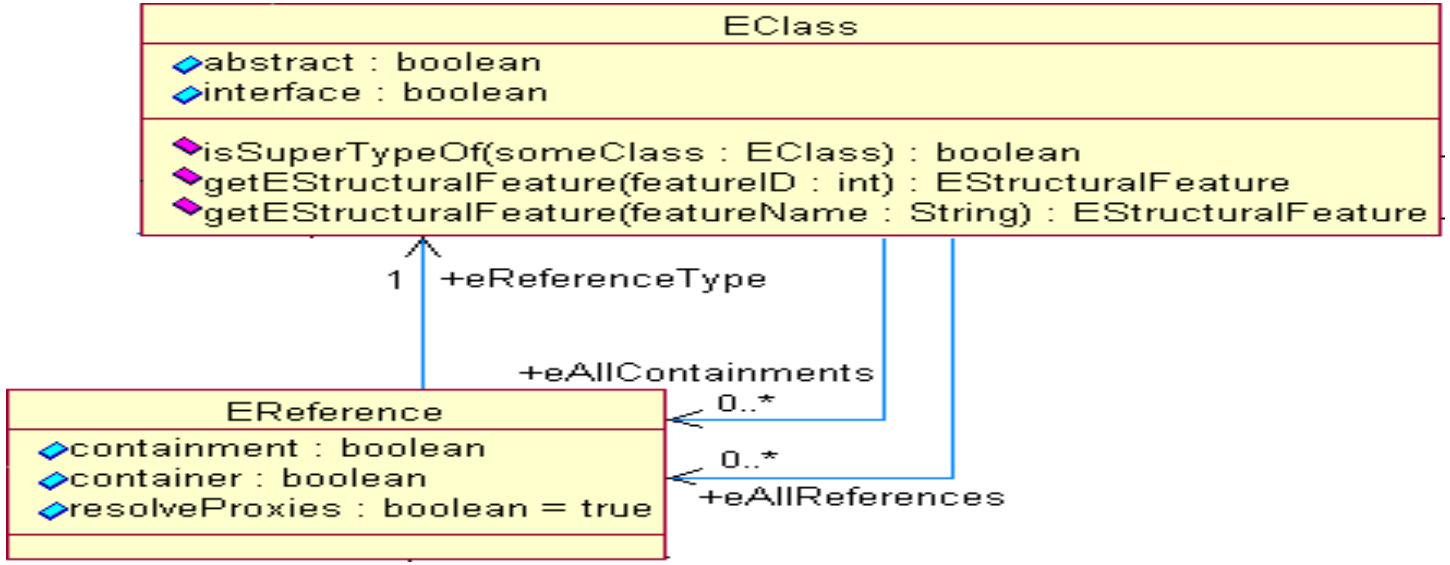
# ECORE and RDFS/OWL - Composition Example




```
<owl:ObjectProperty rdf:about="&EPackage;eClassifiers">
  <rdfs:domain rdf:resource="&EMF;EPackage"/>
  <rdfs:range rdf:resource="&EMF;EClassifier"/>
  <owl:inverseOf rdf:resource="&EClassifier;ePackage"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:about="&EClassifier;ePackage">
  <rdfs:domain rdf:resource="&EMF;EClassifier"/>
  <rdfs:range rdf:resource="&EMF;EPackage"/>
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <owl:inverseOf rdf:resource="&EPackage;eClassifiers"/>
</owl:ObjectProperty>
```

# ECORE and RDFS/OWL - Association Example




```
<owl:ObjectProperty rdf:about="&EClass;eAllContainments">
  <rdfs:domain rdf:resource="&EMF;EClass"/>
  <rdfs:range rdf:resource="&EMF;EReference"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:about="&EClass;eAllReferences">
  <rdfs:domain rdf:resource="&EMF;EClass"/>
  <rdfs:range rdf:resource="&EMF;EReference"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:about="&EReference;eReferenceType">
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  <rdfs:range rdf:resource="&EMF;EClass"/>
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
</owl:ObjectProperty>
```
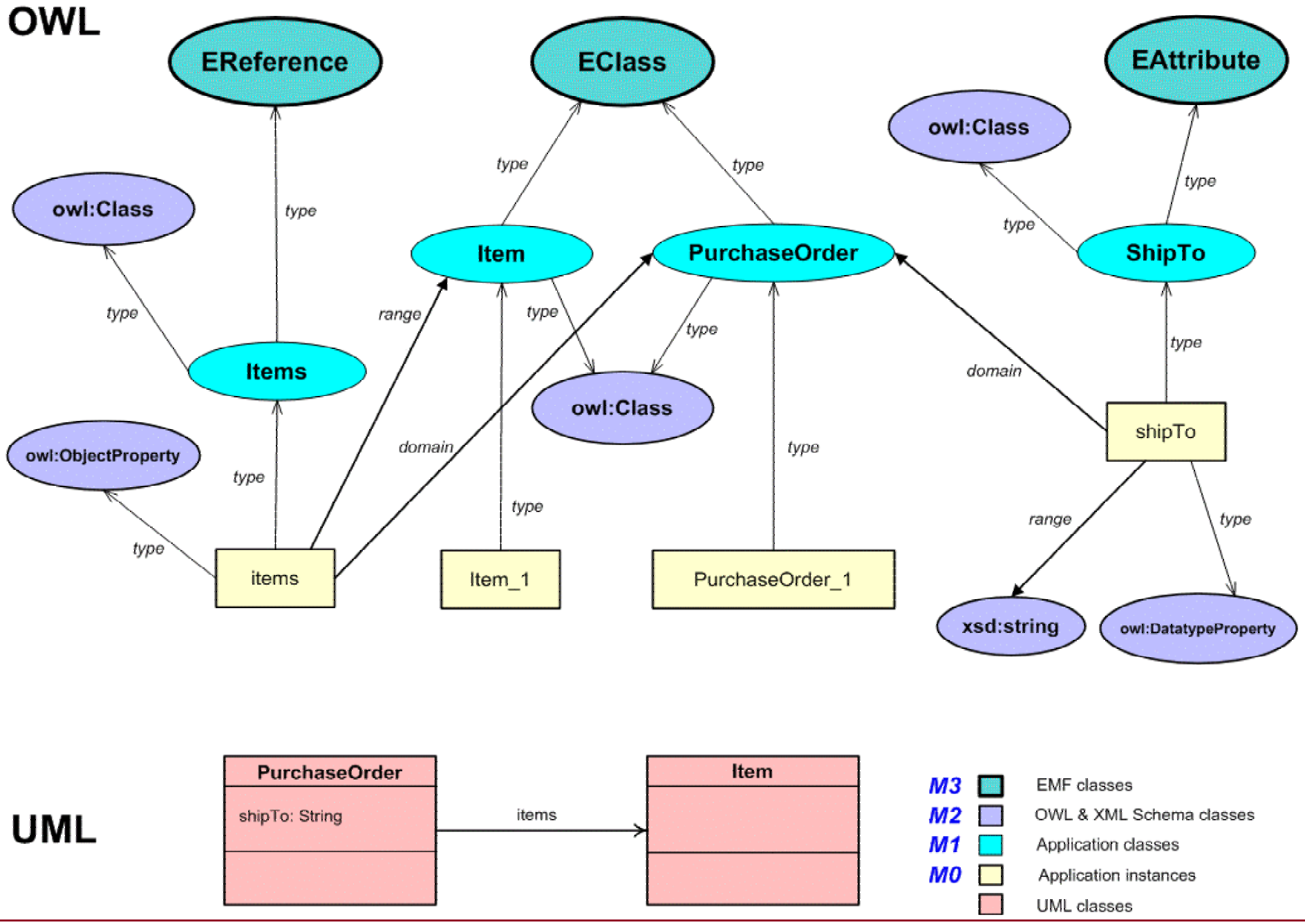
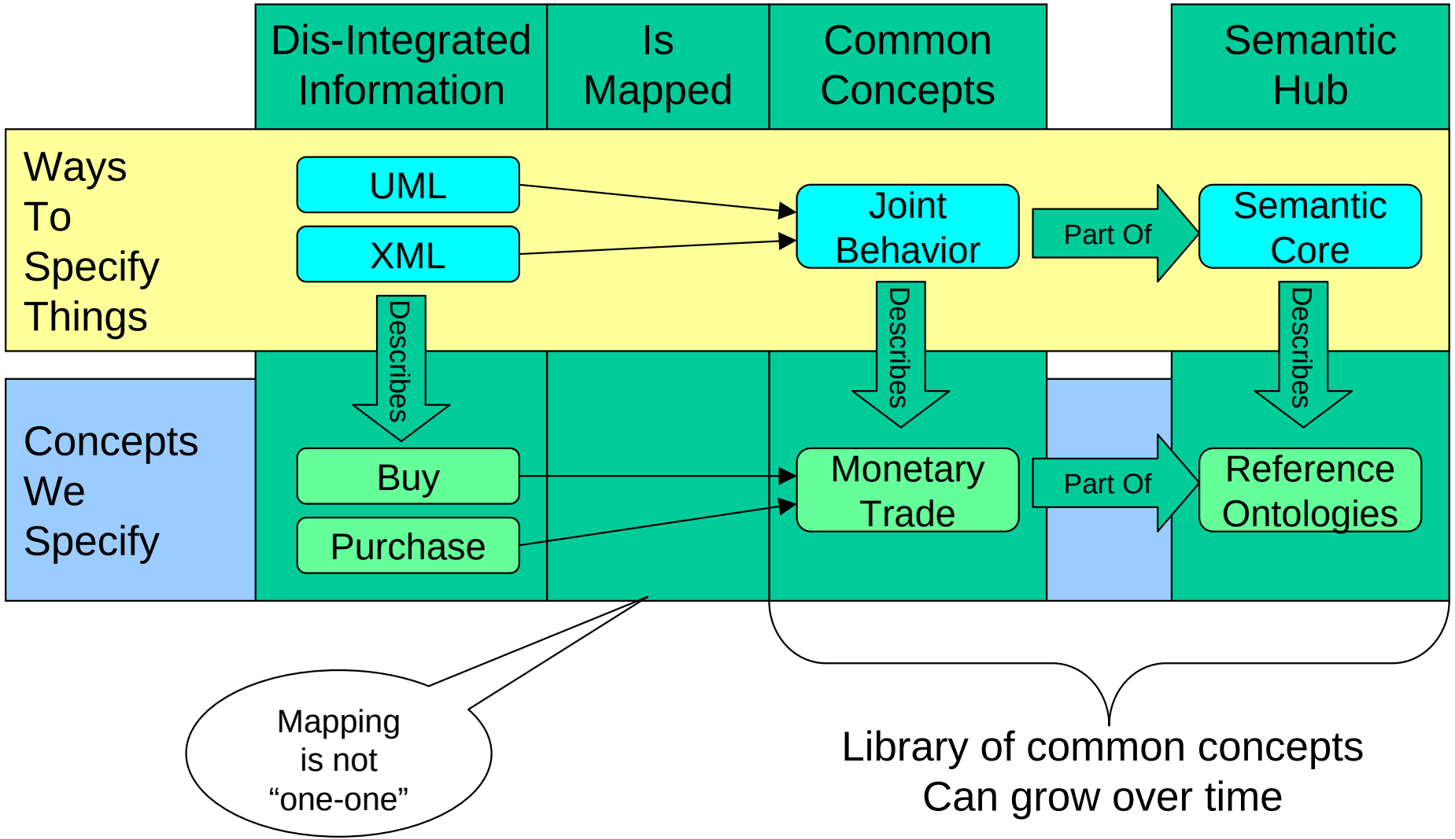

# A Complete Example



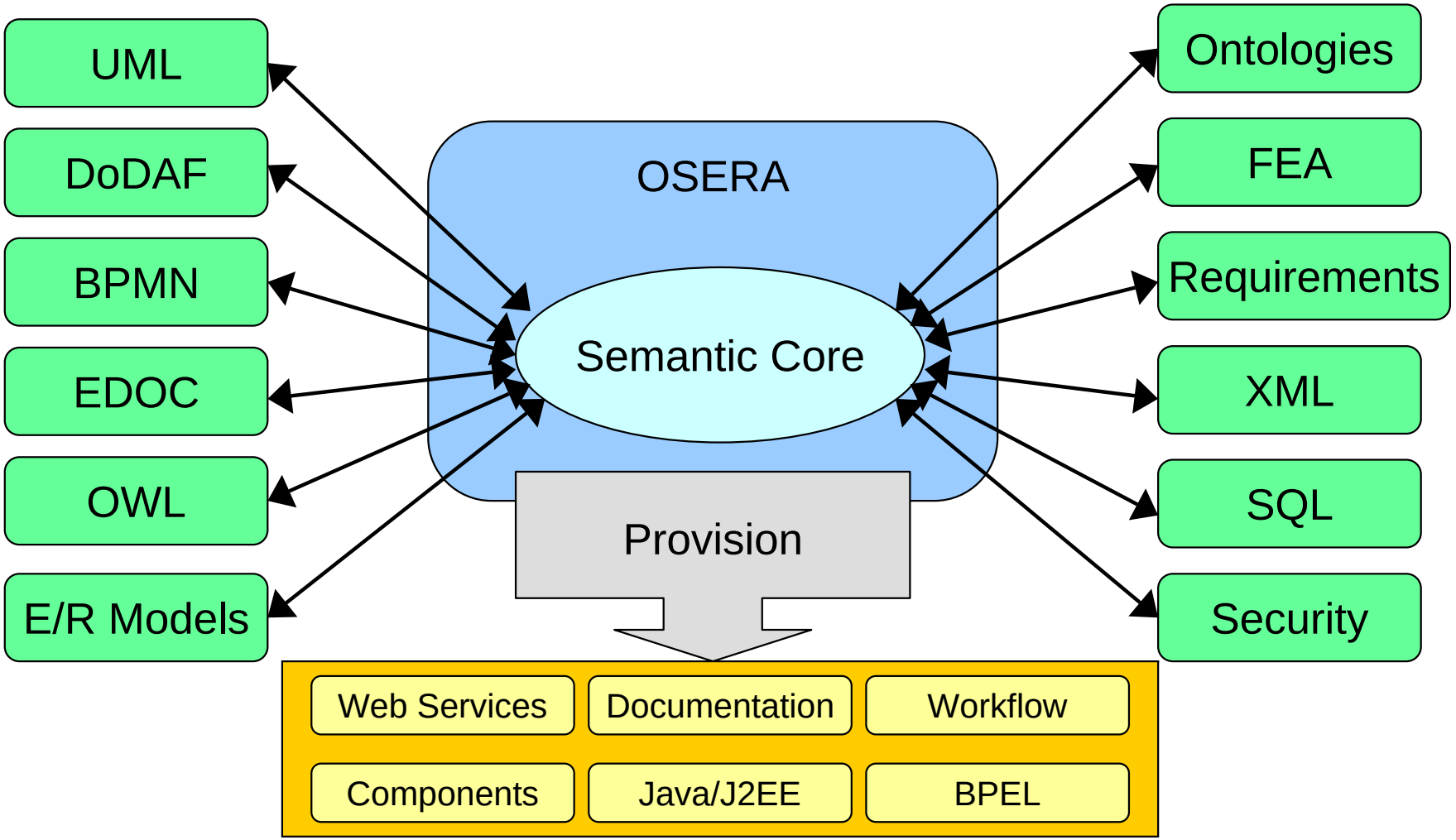
# Normalize Locally, Harmonize Globally

- Integrate architecture concepts expressed in multiple languages
- Hubs can be connected across CoI/CoP's

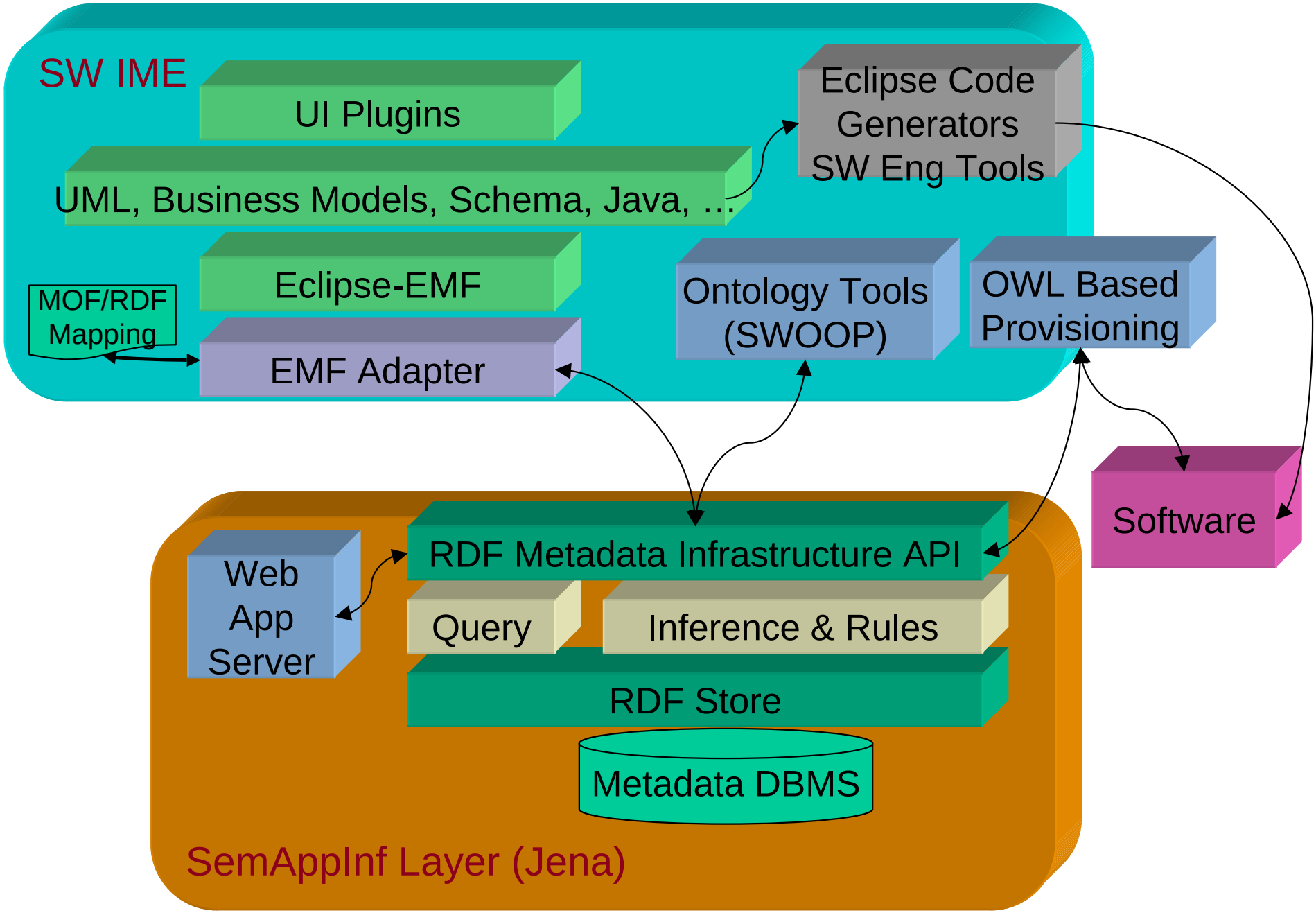


# ‘Views’ of Integrated Information

- semanticcore.org - mid-level ontology/metamodel of architecture
- Normalize terms and concepts in a domain of discourse

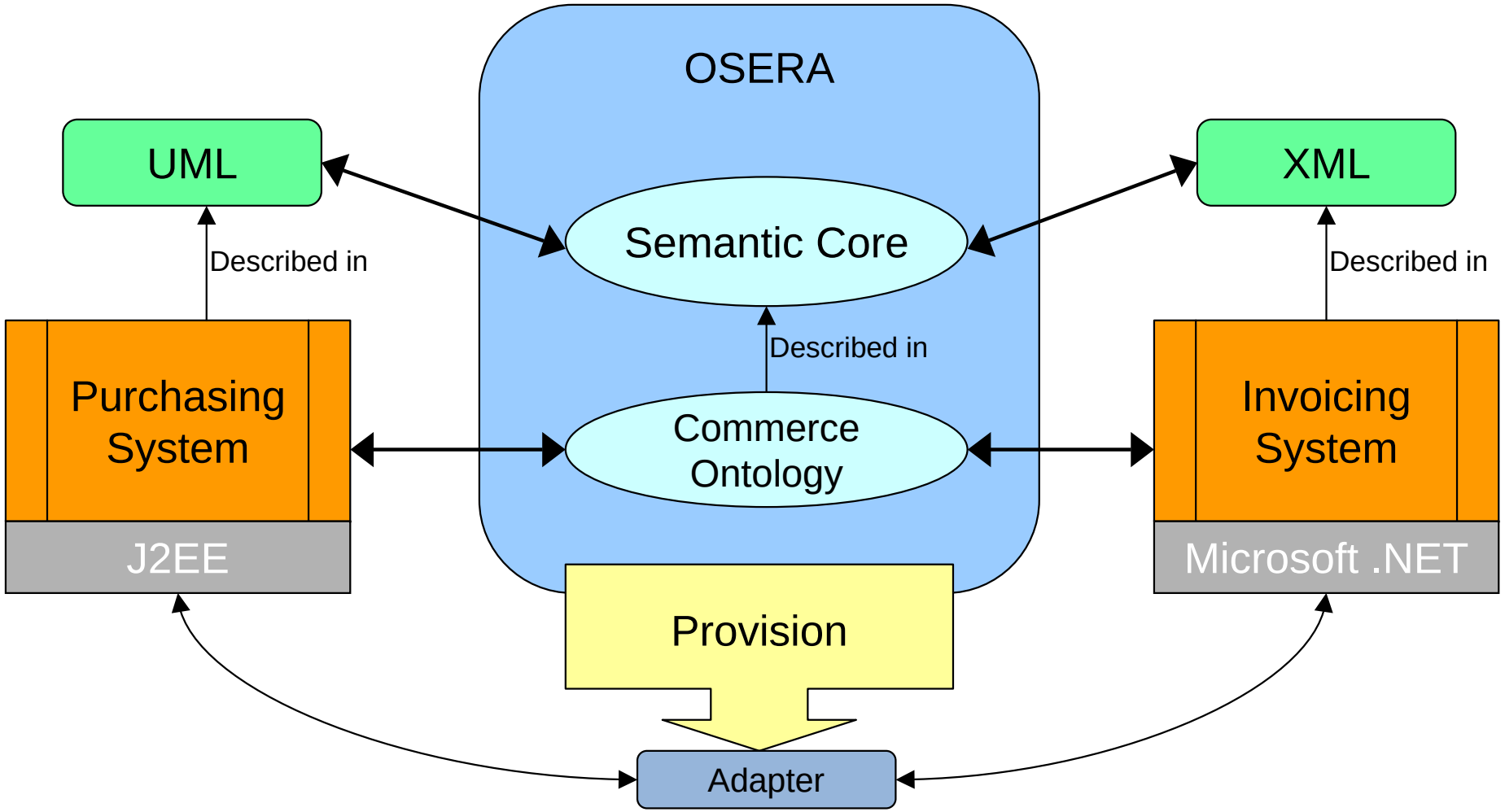


# OSERA KM and BAM Tools



# Adapting Systems with OSERA

- Design time, or run time?
- Architecture integration and semantic web services
- Autonomic configuration



# Summary

- Executable EA
  - GSA shared service target using MDA standards as SOA DSL
  - Consistent with Industry direction
  - Open standards based model simulations drive SME validation and stakeholder consensus
  - FEA Reference Model integration
  - ITPM framework, IT and Organizational Resource Rationalization
- FMEA and FMLoB
  - MDA (EDOC/UML) modeling conventions
  - ADM enables target traceability for mainframe sunset
  - XML Message assembly of business transactions
- OSERA
  - FMLoB ‘Model to Integrate’ from EA to Web Services
  - Platform goals and objectives for ‘Model Based Acquisition’
  - Semantic Interoperability for intellectual capital unification and systems adaptations across trading partner communities

# Thank You

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