Introduction to the Unified Model Language (UML)
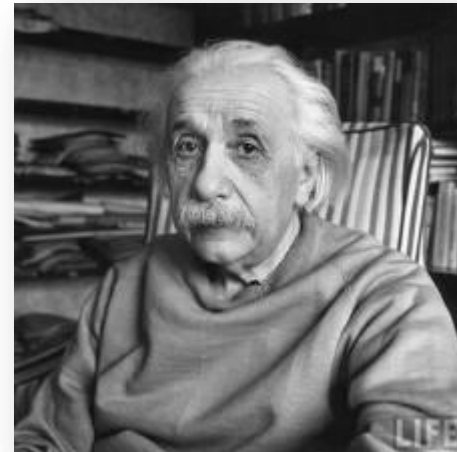
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Curriculum Outline

- **Model Language Background**
- **Terms and Definitions**
- **Use Case Development Process and Tooling**

We cannot solve our problems with the same thinking we used when we created them.
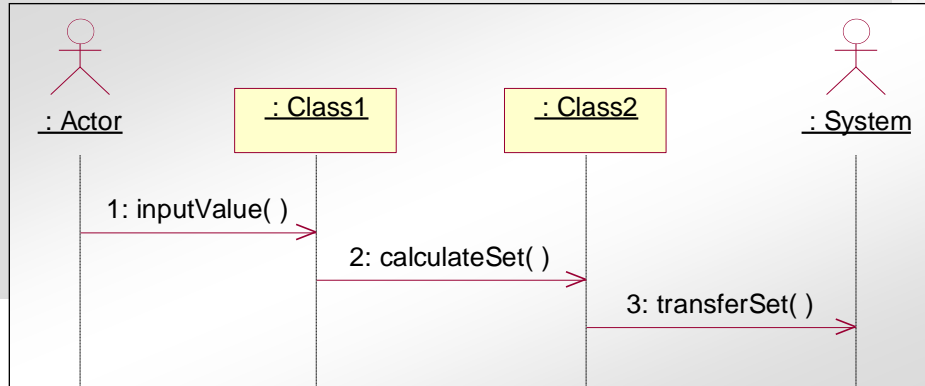
- Albert Einstein

UML Background

▶ **A standardized general-purpose modeling language in the field of object-oriented software engineering**

▶ **Combines best practices from:**
Grady Booch,
Dr. James Rumbaugh, and
Dr. Ivar Jacobson
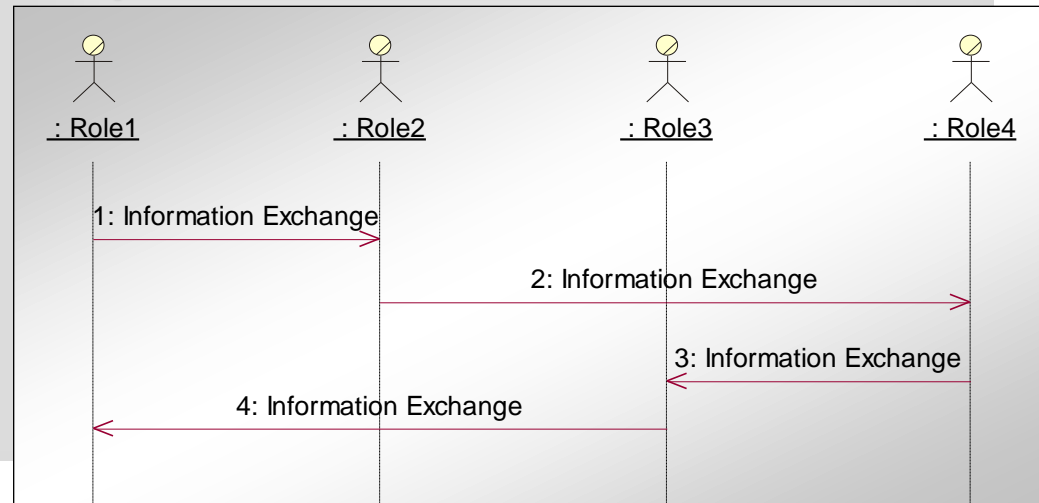**– Referred as the Three Amigos**
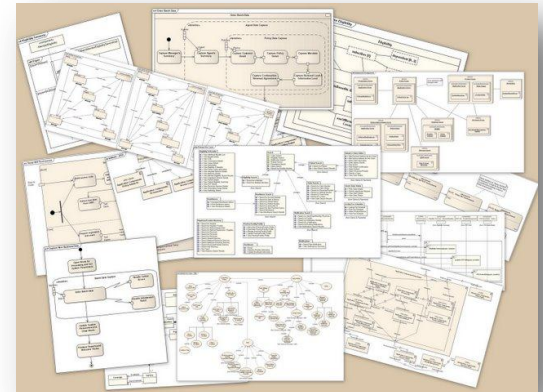
Enterprise Architecture Method is an Abstracted use of UML
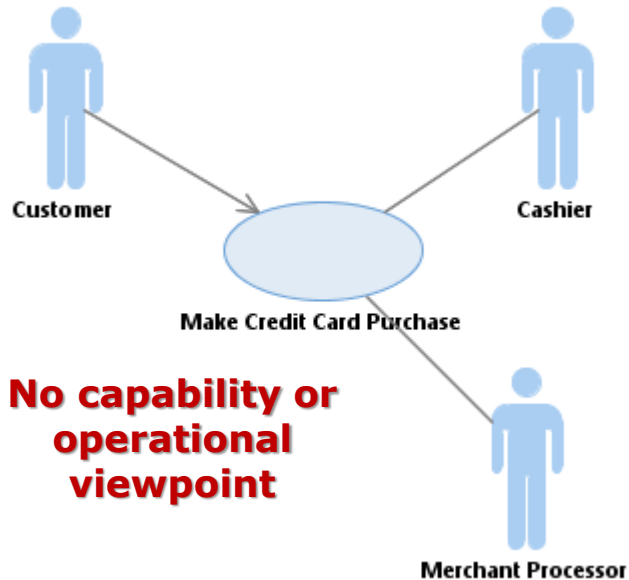
Traditional Design UML

- **The creation of a view that suppresses unnecessary details to focus on a specific set of details of interest**
- **An abstraction defines a boundary relative to the perspective of the viewer**

Enterprise UML

UML Profile-Based Integrated Architecture (UPIA)

Traditional UML Use Case

UML/UPIA Use Case

«Capability Usage»
Make Credit Card Purchase

Customer

Cashier

Make Credit Card Purchase

Merchant Processor

No capability or operational viewpoint

Standardized Stereotypes for better Business Intelligence reporting

«Capability Role»
Capability Role

Customer

Cashier

Make Credit Card Purchase

Merchant Processor
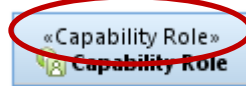
Indicates relationship to capability
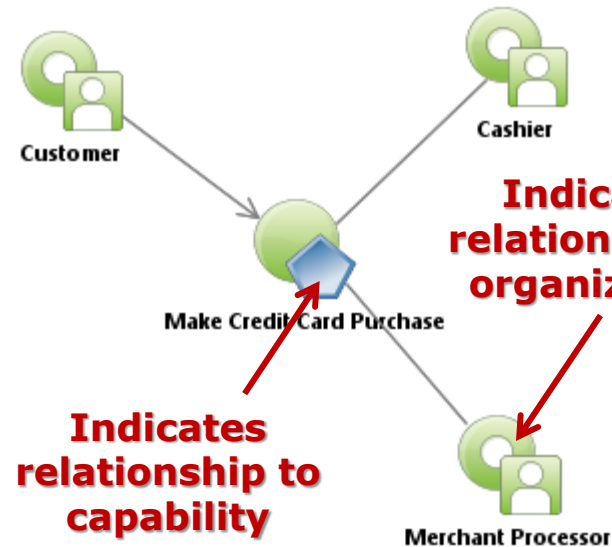
Indicates relationship to organization

Reference Wikipedia Use Case Description

UPIA Normalizes Defined Parts

Classes = Types of Things

Traditional UML

UML with UPIA

Class
| attribute |
| Operation () |
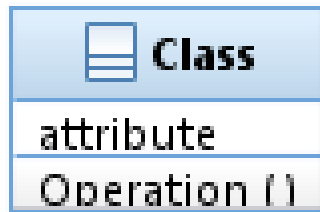
Stereotyped class

«Information Element»
Information Element
| attribute |

Visually rendered based on stereotype

UML with UPIA

«Capability»
Benefits Administration

«Exercises Capability»
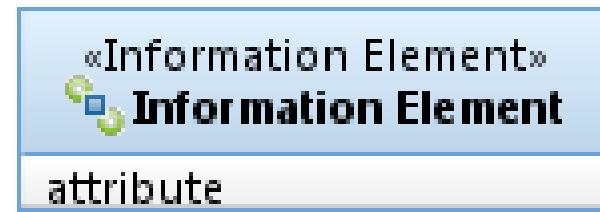
Perform Open Enrollment

Attributes and operations turned off

Standardized relationship stereotype

Use Case Used for Concept Development

Capability

Core Human Resources Management Systems

«Capability» Benefits Administration

«Capability» Employee Self Services

«Capability» Manager Self Services

«Capability» Payroll

«Capability» Personnel Administration

Use Case

Trace to capability
(part of strategic viewpoint)

«Exercises Capability»

Perform Op... ...ment

Employe...

Media Specialist

«Realizes Usage»

Perform Open Enrollment

Participating Roles

open enrollment dates

Employee Benefits Division Manager

Benefits Vendor

...ltant

Employee Benefits Division Specialist

Open Enrollment Coordinator

Department Director

Website Manager

Enrollee

Third Party Administrator

Retiree

Department Personnel

Scope: Prepares and executes a five-week enrollment period that allows employees and retirees to make benefit changes without a qualifying event. This would include adding and dropping dependents to coverage, changing or adding medical, dental, vision, life, disability, and legal coverage.

Defines scope

Ensures "results of value" ROV

Identifies reponsible roles

UML Capitalizes on Human Collaboration Factors – i.e., Teams Working Together

▶ **EA should be included early!**

▶ **Builds collective knowledge – individually, we're smart – together, we're genius**

▶ **Teams should be limited to 5 - 9 people. If larger, this significantly reduces effective team knowledge**

▶ **The Use Case Model establishes the audience/stakeholder on the boundary of the problem and the scope of discussion**

▶ **During model development, the end state is clear preventing wondering concepts outside the discussion boundary - leads to quicker results**

Provides tool for Critical Mass of Understanding!

IBM Rational Software Architect Tool
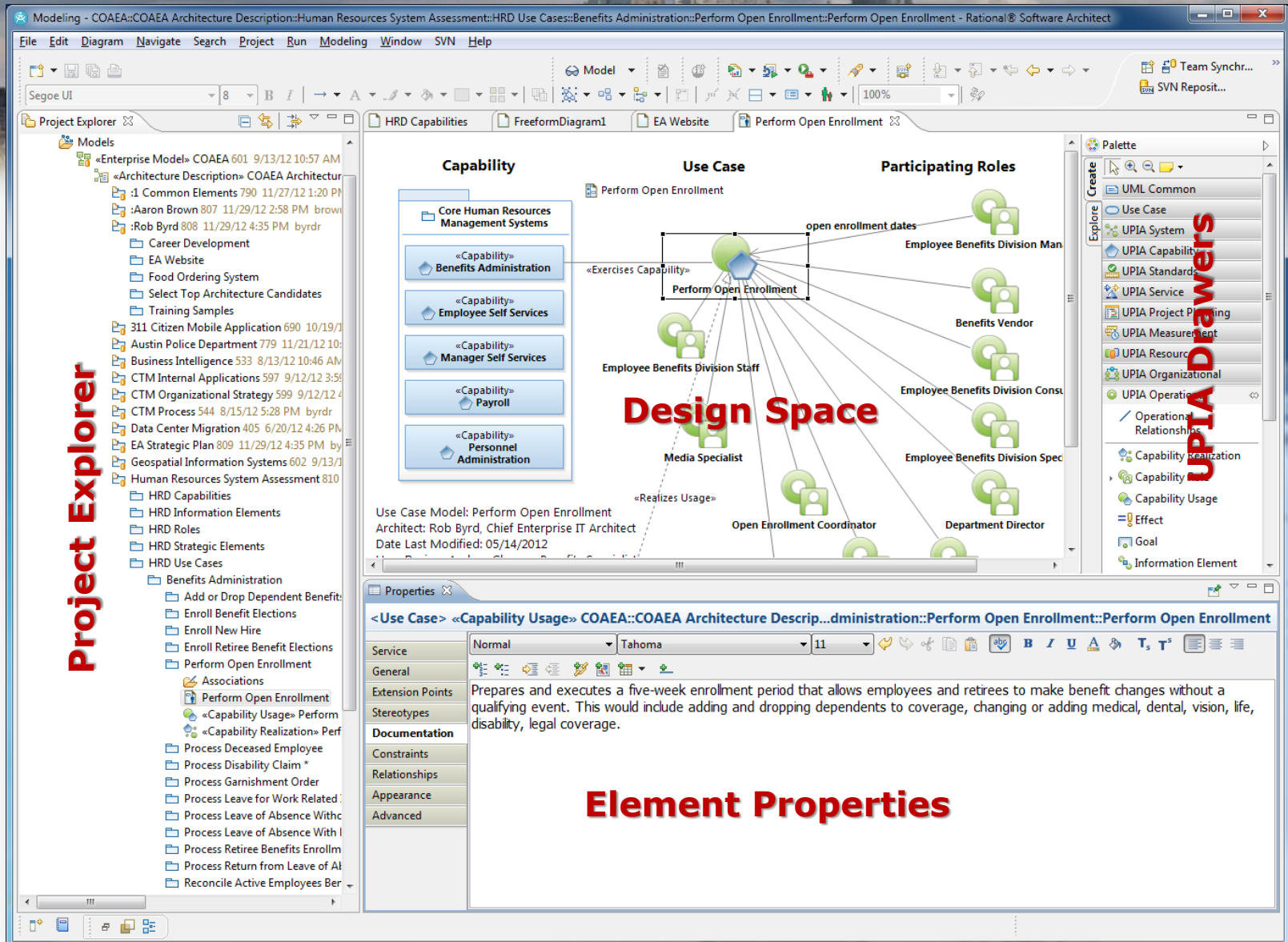
Model Structure

Human Resources System Assessment 997 1/15/13 4:54 PM browna
- HRD Capabilities
- HRD Information Elements
- HRD Roles
- HRD Strategic Elements
- HRD Use Cases
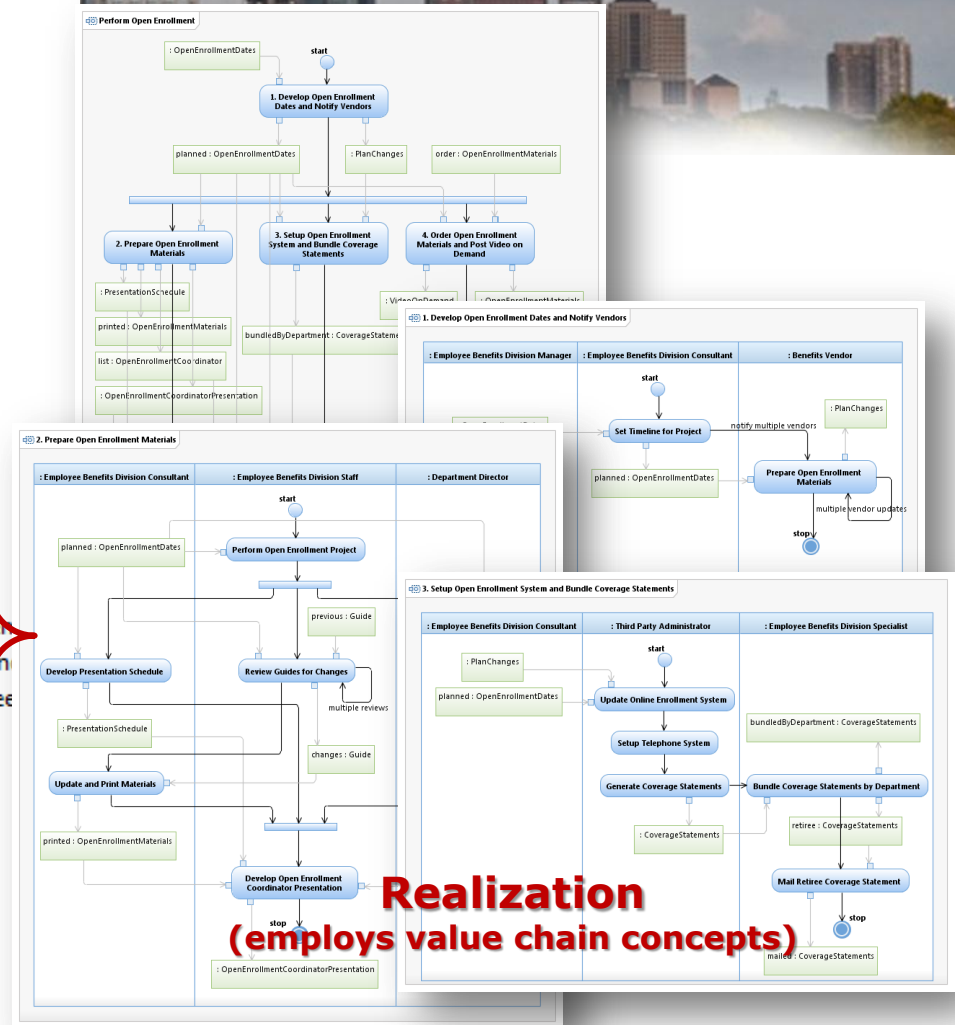 - Benefits Administration
    - Add or Drop Dependent Benefits
    - Enroll Benefit Elections
    - Enroll New Hire
    - Enroll Retiree Benefit Elections
    - Perform Open Enrollment
      - Associations
      - «Capability Usage» Perform Open Enrollment
        - Perform Open Enrollment   ← **Diagram**
        - «documentation»
      - «Capability Realization» Perform Open Enrollment
        - 1. Develop Open Enrollment Dates and Notify Vendors
        - 2. Prepare Open Enrollment Materials
        - 3. Setup Open Enrollment System and Bundle Coverage Statements
        - 4. Order Open Enrollment Materials and Post Video on Demand
        - 5. Collect Coordinator Presentation Schedule and Material Needs
        - 6. Elect Benefits
        - Perform Open Enrollment
        - «Realizes Usage» (Perform Open Enrollment)
    - Process Deceased Employee
    - Process Disability Claim *
    - Process Garnishment Order
    - Process Leave for Work Related Injury or Illness *
    - Process Retiree Benefits Enrollment Form *
    - Process Unemployment Claim
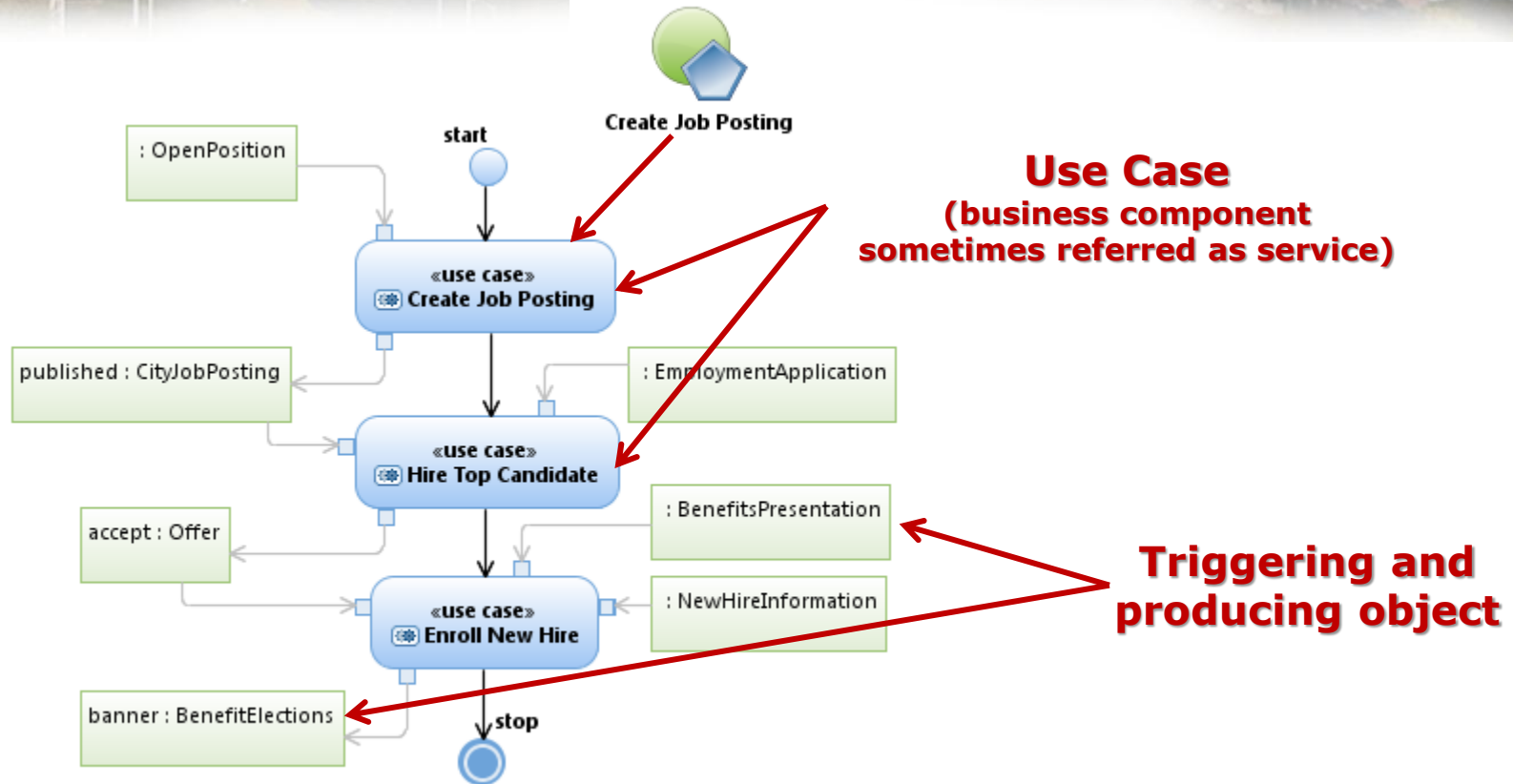   - Reconcile Active Employees Benefits

Project Explorer
- **Solely for storing parts**
- **Design captured by diagrams**
- **Caution: Do not design in structure!**

Realization Documents the Process

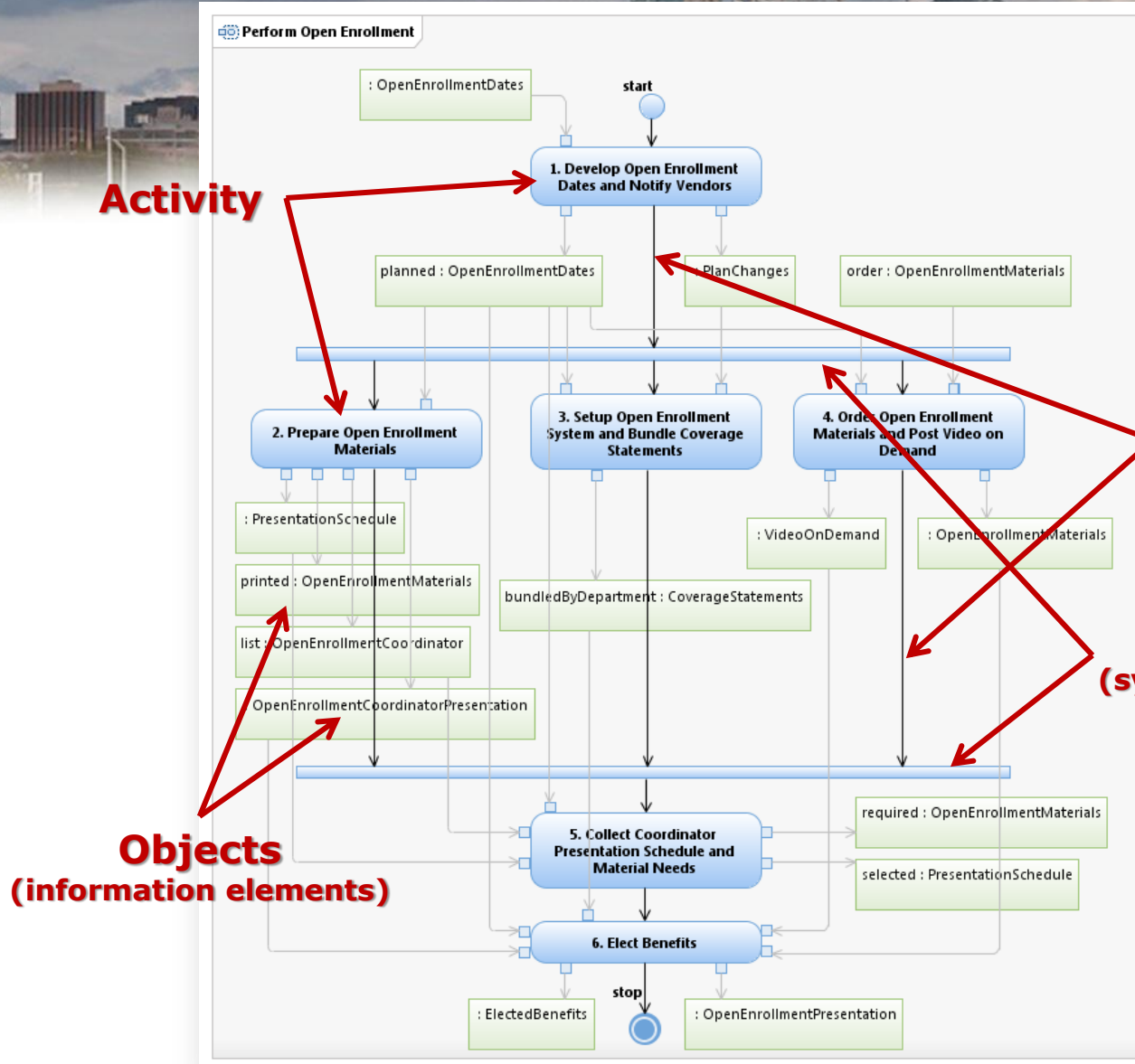Human Resources System Assessment 997 1/15/13 4:54 PM browna
- ▷ 📁 HRD Capabilities
- ▷ 📁 HRD Information Elements
- ▷ 📁 HRD Roles
- ▷ 📁 HRD Strategic Elements
- ▲ 📁 HRD Use Cases
  - ▲ 📁 Benefits Administration
    - ▷ 📁 Add or Drop Dependent Benefits
    - ▷ 📁 Enroll Benefit Elections
    - ▷ 📁 Enroll New Hire
    - ▷ 📁 Enroll Retiree Benefit Elections
    - ▲ 📁 Perform Open Enrollment
      - ▷ 📝 Associations
      - ▲ 🌐 «Capability Usage» Perform Open Enrollment
        - 📄 Perform Open Enrollment
        - 📄 «documentation»
      - ▲ 🌐 «Capability Realization» Perform Open Enrollment
        - ▷ ⚙ 1. Develop Open Enrollment Dates and Notify Vendors
        - ▷ ⚙ 2. Prepare Open Enrollment Materials
        - ▷ ⚙ 3. Setup Open Enrollment System and Bundle Coverage State...
        - ▷ ⚙ 4. Order Open Enrollment Materials and Post Video on Dema...
        - ▷ ⚙ 5. Collect Coordinator Presentation Schedule and Material Nee...
        - ▷ ⚙ 6. Elect Benefits
        - ▷ ⚙ Perform Open Enrollment
        - ↗ «Realizes Usage» (Perform Open Enrollment)
    - ▷ 📁 Process Deceased Employee
    - ▷ 📁 Process Disability Claim *
    - ▷ 📁 Process Garnishment Order
    - ▷ 📁 Process Leave for Work Related Injury or Illness *
    - ▷ 📁 Process Retiree Benefits Enrollment Form *
    - ▷ 📁 Process Unemployment Claim
    - ▷ 📁 Reconcile Active Employees Benefits

Realization
(employs value chain concepts)

Business Component Value Chain

Create Job Posting

start

: OpenPosition

«use case»
⊛ Create Job Posting

published : CityJobPosting

: EmploymentApplication

«use case»
⊛ Hire Top Candidate

accept : Offer

: BenefitsPresentation

«use case»
⊛ Enroll New Hire

: NewHireInformation

banner : BenefitElections

stop

Use Case
(business component
sometimes referred as service)

Triggering and
producing object

Interaction Overview – Activity Model

The value chain

Activity

Process Flow
(flow of control)

Forks / Joins
(synchronizes activities)

Objects
(information elements)

Perform Open Enrollment

: OpenEnrollmentDates

start

1. Develop Open Enrollment Dates and Notify Vendors

planned : OpenEnrollmentDates

: PlanChanges

order : OpenEnrollmentMaterials

2. Prepare Open Enrollment Materials

3. Setup Open Enrollment System and Bundle Coverage Statements

4. Order Open Enrollment Materials and Post Video on Demand

: PresentationSchedule

: VideoOnDemand

: OpenEnrollmentMaterials

printed : OpenEnrollmentMaterials

bundledByDepartment : CoverageStatements

list : OpenEnrollmentCoordinator

OpenEnrollmentCoordinatorPresentation

5. Collect Coordinator Presentation Schedule and Material Needs

required : OpenEnrollmentMaterials

selected : PresentationSchedule

6. Elect Benefits

stop

: ElectedBenefits

: OpenEnrollmentPresentation

Swim-lane Activity Model

Interaction Overview

5. Collect Coordinator Presentation Schedule and Material Needs

| : Employee Benefits Division Consultant | CTM : Website Manager | : Employee Benefits Division Specialist | : Open Enrollment Coordinator |

Merge Point

Decision Point
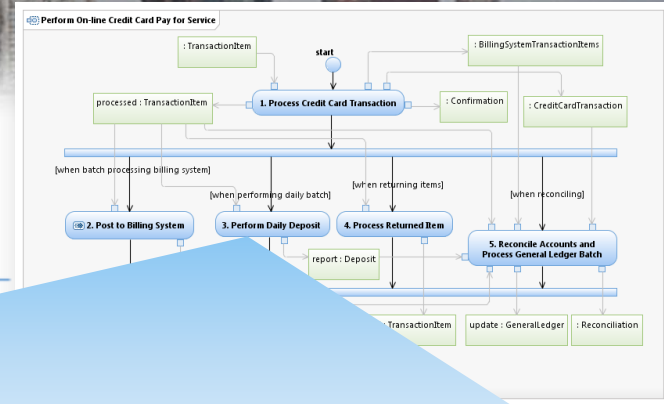
Never Yes/No!

Sequence Diagram

Interaction Overview

«Realizes Usage»

Perform On-line Credit Card Pay for Service

Perform On-line Credit Card Pay for Service

Object

Combined fragment

Lifeline

:Online Payment Service

:Merchant Processor

:Bank

loop

[0,*],[when daily batch processing for each organization code]

batchCreditCardTransactions (: DateTimeRange, : OrganizationCode, : MerchantID, : TransactionItem) : PaymentTransaction

processDailyBatchBasedOnMerchantID (: PaymentTransaction) : Confirmation

makeDeposit (: PaymentTransaction) : Deposit
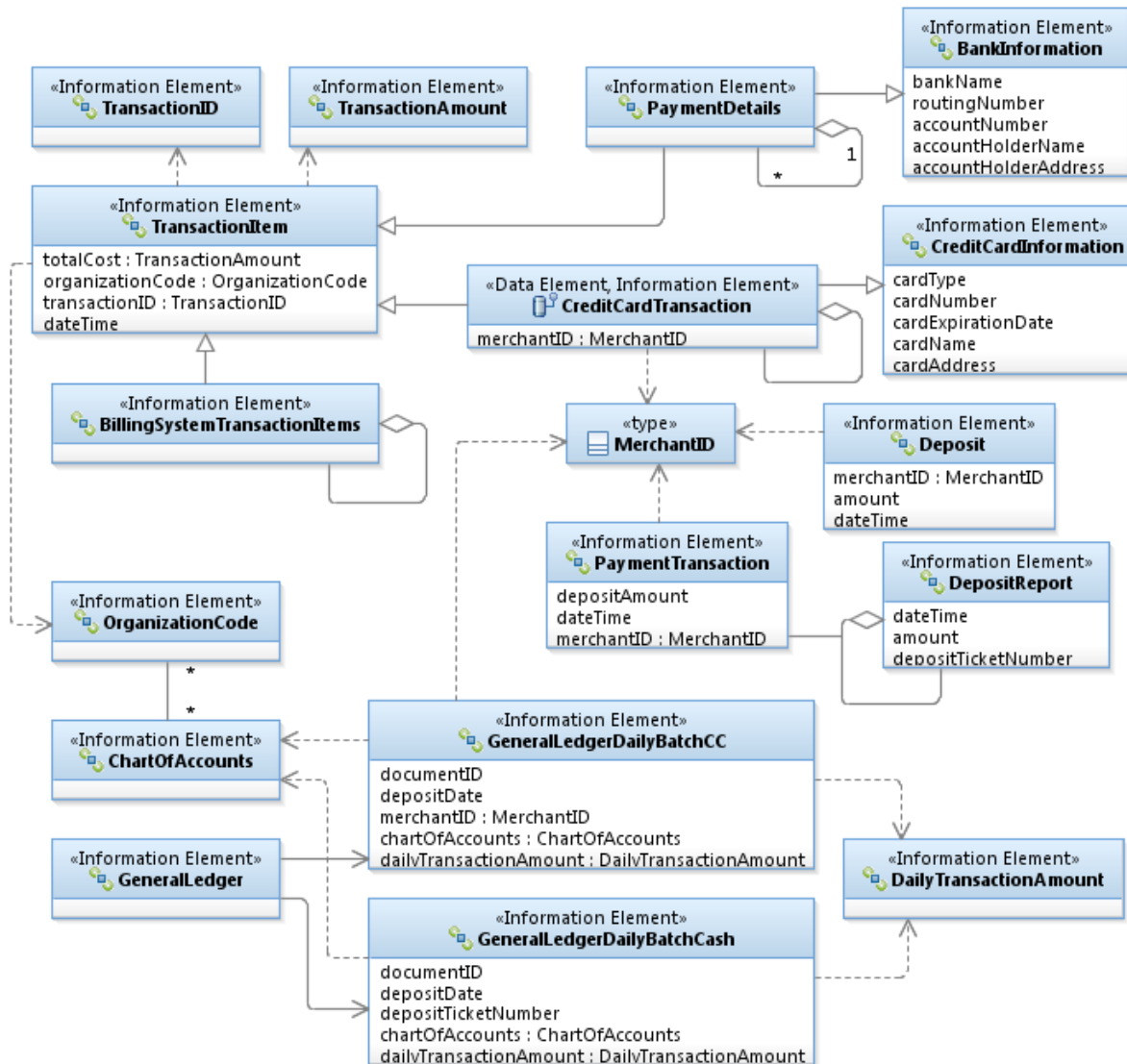
Message

Signature

Focus of control

Class Relationships
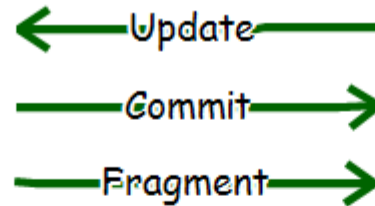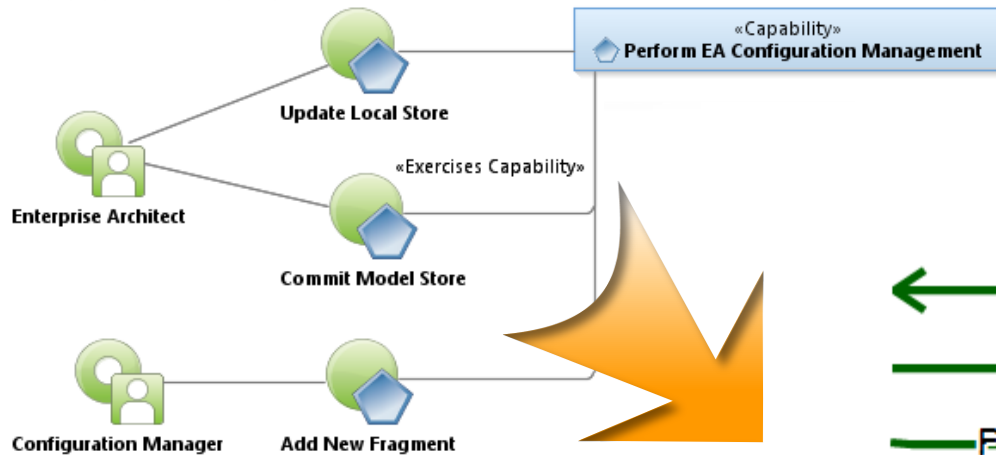
Logical Data Model

The UML expert can read this diagram like a book – associations define the relationships between the information elements

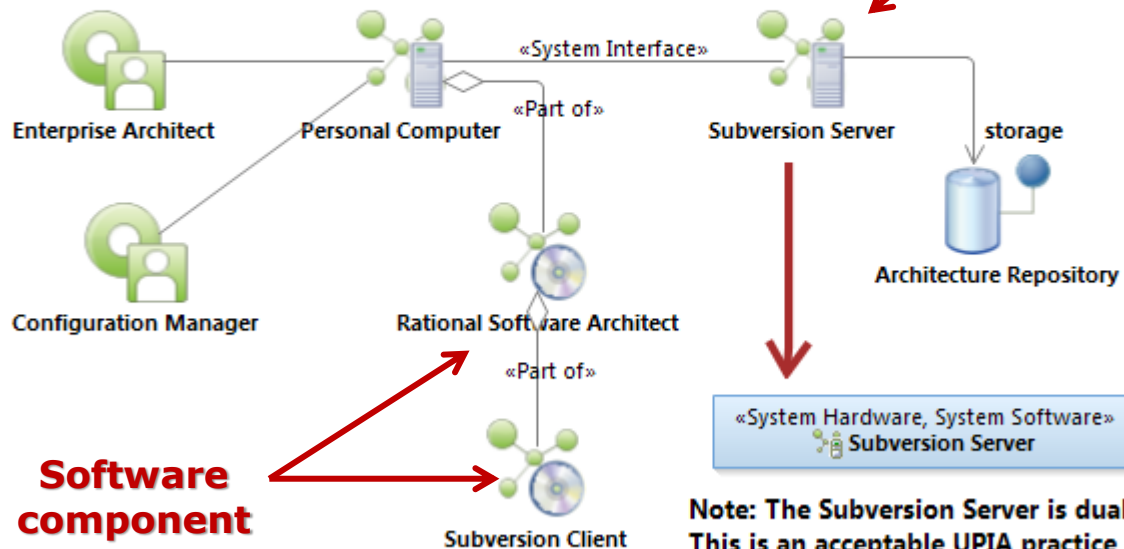The enterprise architect makes the associations based on the use case model

Any qualified IT developer knows how to read these diagrams – hence the UML bridges the gap between the user and the developer because the user identified them in the use case
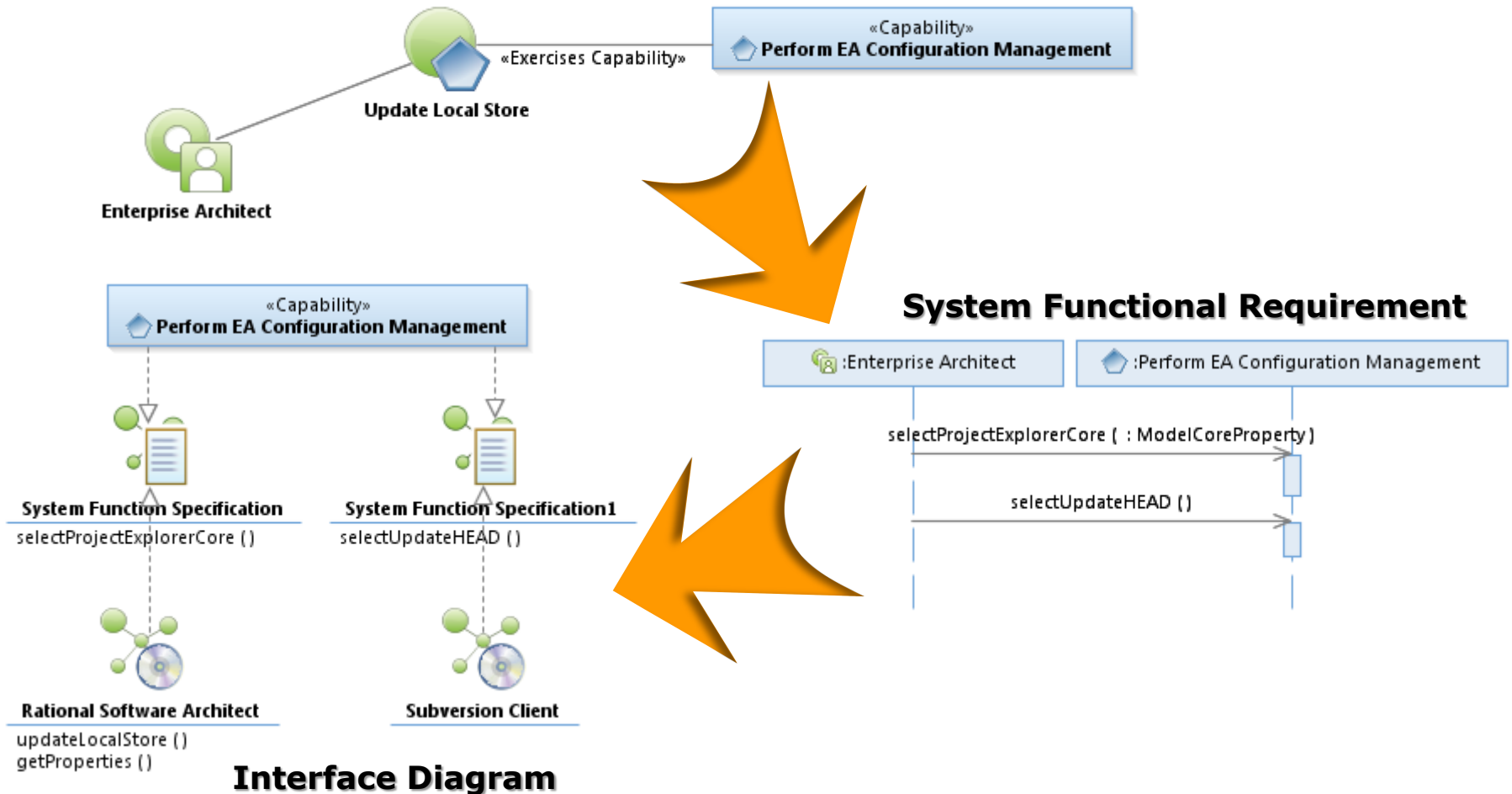
System Context Diagram

Use Case Model

Perform EA Configuration Management «Capability»

Enterprise Architect — Update Local Store — «Exercises Capability» — Commit Model Store

Configuration Manager — Add New Fragment

Update ← Commit → Fragment →

Enterprise Architect — Personal Computer — «System Interface» — Subversion Server — storage — Architecture Repository

Configuration Manager — «Part of» — Rational Software Architect — «Part of» — Subversion Client

Hardware component

Software component

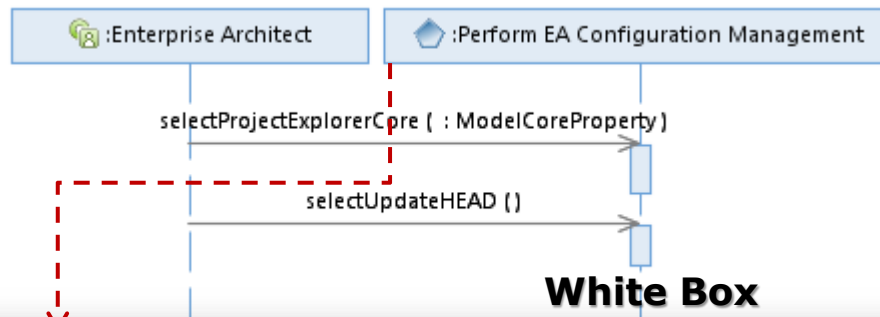«System Hardware, System Software» Subversion Server

Note: The Subversion Server is dual stereotyped. This is an acceptable UPIA practice and provides many advantages
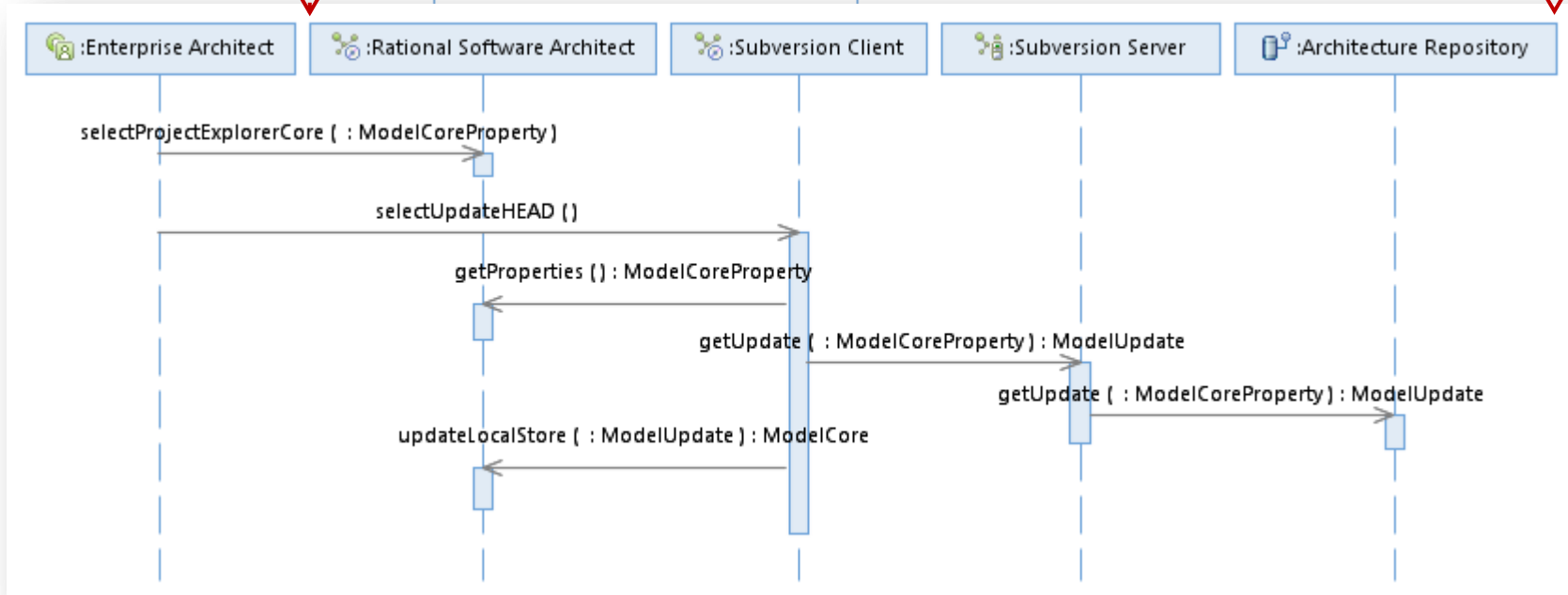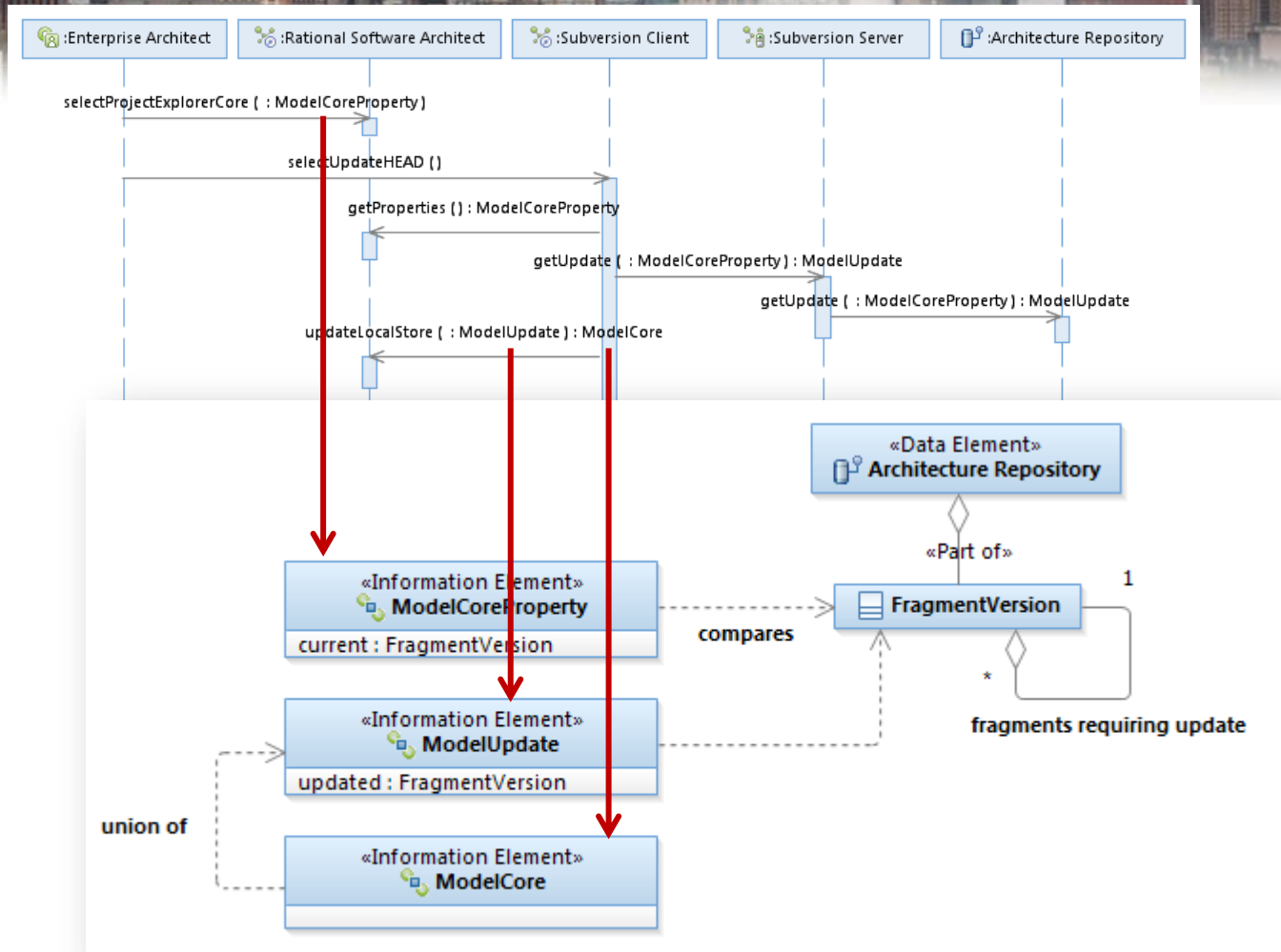
System Functional Requirements

System Functional Requirement

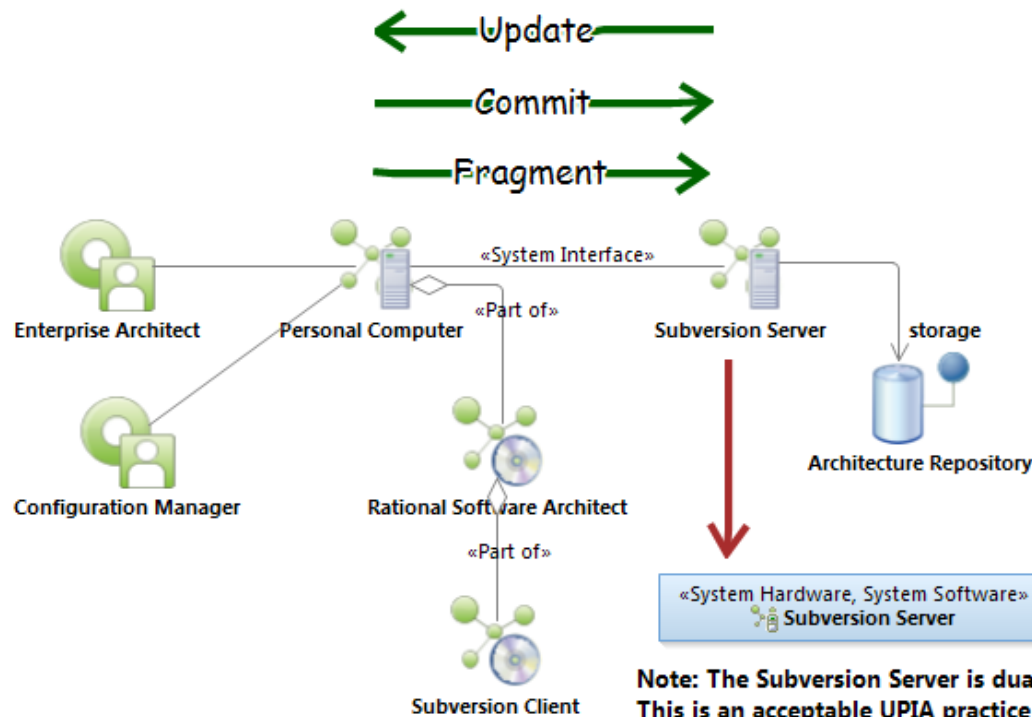**Interface Diagram**

System Sequence Diagram
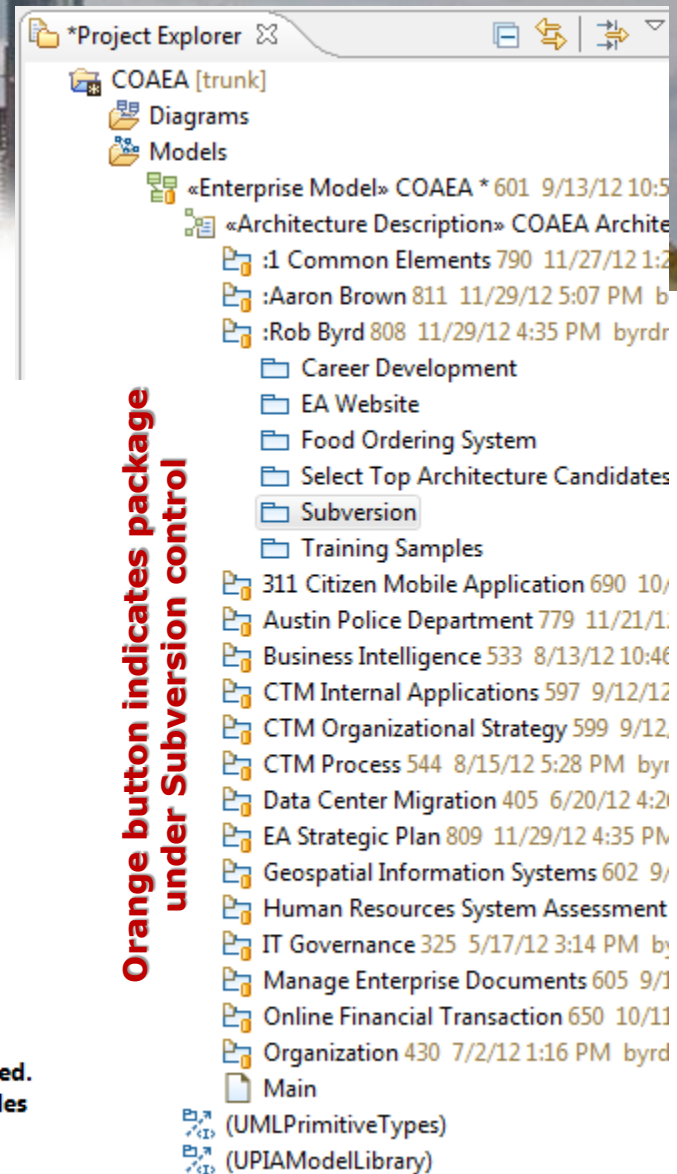
Black Box

White Box

Logical Data Elements

Configuration Management

UML System Context Diagram

Orange button indicates package under Subversion control

Project Explorer

- COAEA [trunk]
  - Diagrams
  - Models
    - «Enterprise Model» COAEA * 601 9/13/12 10:5
      - «Architecture Description» COAEA Archite
        - :1 Common Elements 790 11/27/12 1:2
        - :Aaron Brown 811 11/29/12 5:07 PM b
        - :Rob Byrd 808 11/29/12 4:35 PM byrdr
          - Career Development
          - EA Website
          - Food Ordering System
          - Select Top Architecture Candidates
          - Subversion
          - Training Samples
        - 311 Citizen Mobile Application 690 10/
        - Austin Police Department 779 11/21/1:
        - Business Intelligence 533 8/13/12 10:46
        - CTM Internal Applications 597 9/12/12
        - CTM Organizational Strategy 599 9/12,
        - CTM Process 544 8/15/12 5:28 PM by
        - Data Center Migration 405 6/20/12 4:2(
        - EA Strategic Plan 809 11/29/12 4:35 PM
        - Geospatial Information Systems 602 9/
        - Human Resources System Assessment
        - IT Governance 325 5/17/12 3:14 PM by
        - Manage Enterprise Documents 605 9/1
        - Online Financial Transaction 650 10/1
        - Organization 430 7/2/12 1:16 PM byrd
        - Main
    - (UMLPrimitiveTypes)
    - (UPIAModelLibrary)

Summary

▶ **UML is an open standard general purpose language for object-oriented analysis and design created by the Three Amigos**

▶ **UPIA extends the UML to standardize classes and their associations – it normalizes defined parts**

▶ **The use case is the primary instrument for collaboration, concept development, business process analysis and value chain understanding – the use case always results in the same value**

▶ **Logical data models define the data requirements used by the use case**

▶ **System diagrams show systems and their interfaces**

▶ **Configuration management allows teams to work collaboratively in "one" model**