



BT blueprint
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Case Study: Modeling Enterprise Architectures with UML at HHS

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Agenda

- **Background: Developing Enterprise Architecture for HHS**
- **Benefits of Using UML to Describe Enterprise Architecture**
- **Applying UML to Enterprise Architecture**
 - Establishing Traceability to Business Questions
 - Organizing the EA Metamodel
 - Describing the EA Metamodel
 - Documenting Business Processes
 - Documenting the Data Architecture
 - Describing Enterprise Collaborations
 - Describing EA Transition Planning
- **Limitations of Applying UML to EA**
- **Lessons Learned**
- **Status and Next Steps**
- **Questions**

Background: About HHS



- **U.S. Department of Health and Human Services is the third-largest department of the federal government**
 - \$581B overall budget, \$5B IT budget
 - 66,000 employees
 - 13 operating divisions, including CMS, FDA, NIH, CDC
- **HHS is required by law to develop an enterprise architecture**
 - Clinger-Cohen Act (1996)
 - OMB Circulars A-11 and A-130
 - GAO Enterprise Architecture Maturity Management Framework (EAMMF) Assessment

Background: Challenges

- **Negative previous assessments of HHS EA maturity by Government Accounting Office (GAO)**
- **Previous IT architecture efforts had been largely ignored**
- **Vast, decentralized organization**
- **HHS in process of transitioning between EA repository tools**
 - Formerly using EAMS, Popkin System Architect
 - Currently transitioning to Metis

Strategy

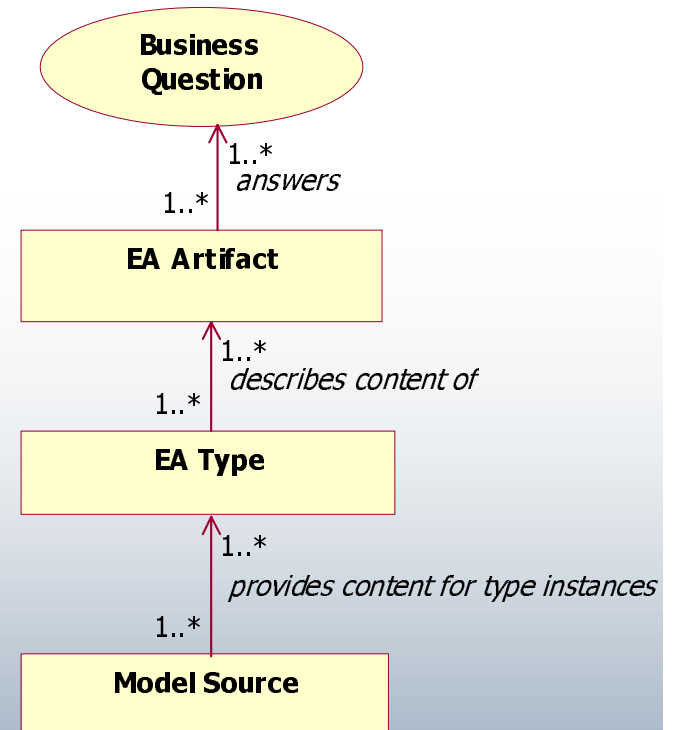
- **Quickly deliver EA content that has a practical impact on strategic decision making**
- **Ensure EA is business-driven**
- **Advance EA maturity (as assessed by GAO/OMB)**
- **Customize generic federal frameworks to meet unique HHS needs**
- **Represent important EA content in a tool-independent manner**
- **Create a hierarchical EA modeling structure to ensure interoperability while enabling specialization for individual business domains**

Benefits of Using UML to Describe EA

- Provides an unambiguous representation of important EA concepts
- Tool independent
- UML profiles provide mechanism for adapting notation to new domains (e.g. enterprise architecture)
- Ideal for describing boundaries between enterprise and application architectures
- UML-based EA models can serve as the basis for enterprise application integration using MDA-based tools

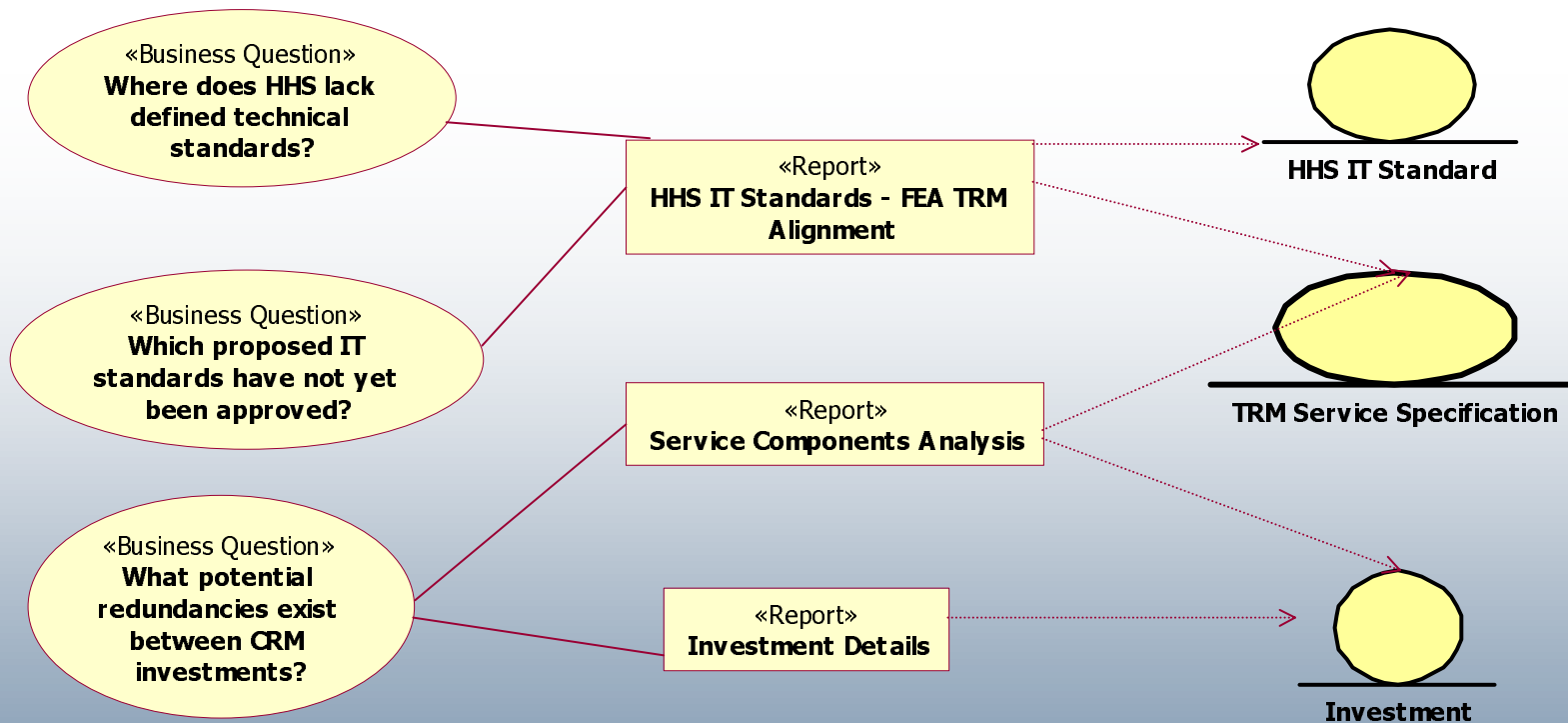
Establishing Traceability to Business Questions

- Many EA initiatives turn into “paperware”
 - Models not used for enterprise decision-making
- A useful EA must answer important business questions to enterprise stakeholders
 - These represent the requirements of the EA
 - Can be modeled as stereotyped use cases
- Business questions determine the artifacts (reports, queries,, etc.) of the EA model
 - Can be represented as stereotyped classes
- Artifacts are generated from a model defined by EA types
- EA types are instantiated by populating the model with content from identified sources



Traceability Example

- This diagram shows a small subset of traceabilities between business questions, reports and model entity types



Organizing the EA Metamodel

«EA Layer»
Strategy

«EA Layer»
Stakeholder

«EA Layer»
Business

«EA Layer»
Application

«EA Layer»
Data

«EA Layer»
Technology

«EA Layer»
Workforce

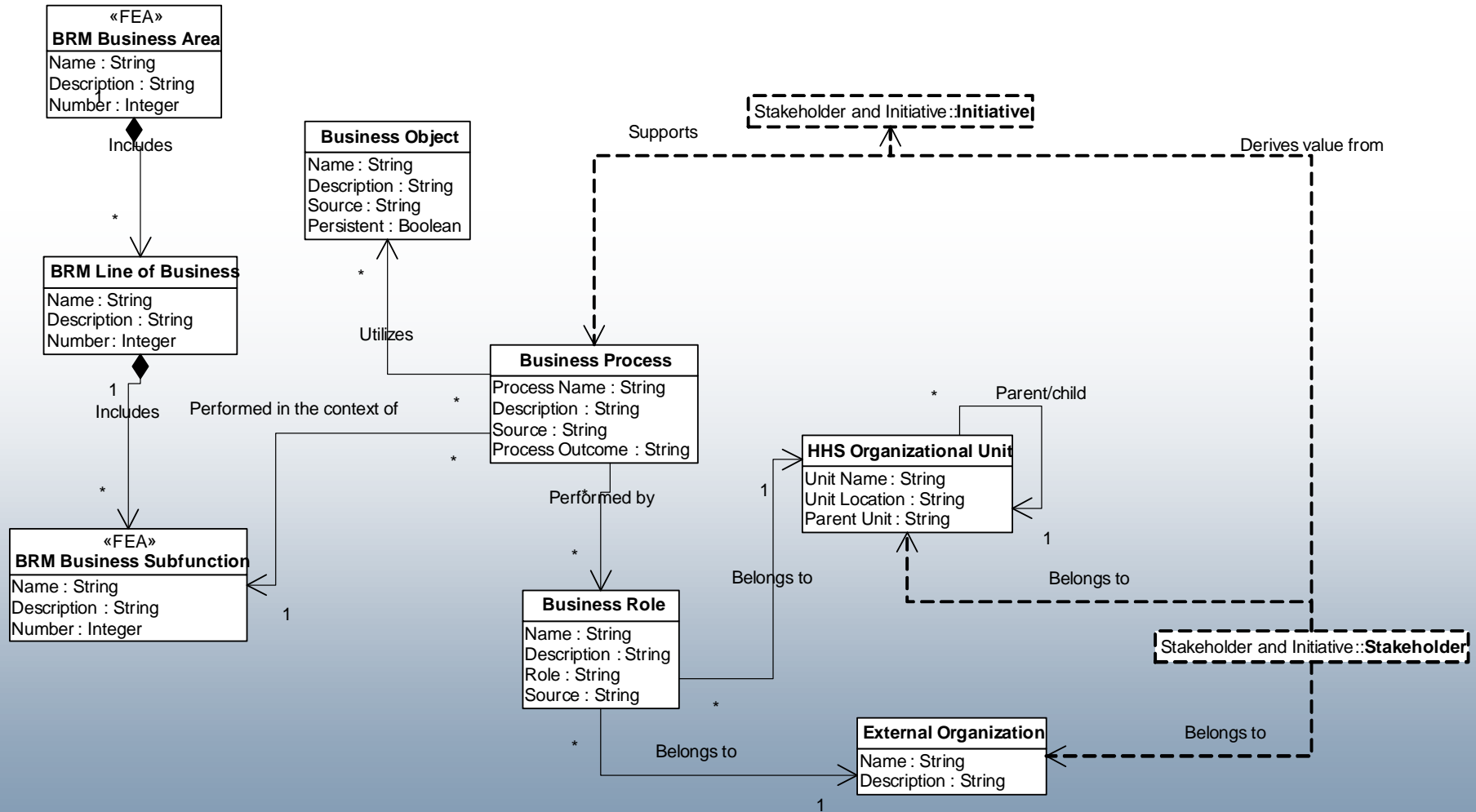
«EA Layer»
Facility

- **HHS had already developed an eight-layered framework for EA**
 - Not an exact match to existing popular frameworks (FEA/FEAF, Zachman)
- **As in OO modeling, layers can be represented as stereotyped UML packages**
- **As in OO, layers still serve as a grouping mechanism for related types (classes)**
- **In EA modeling, however, value of layers is more on classifying levels of abstraction and communities of interest, and less on managing dependencies**

Describing the EA Metamodel

- **EA metamodel describes the types (classes) that can be instantiated into objects within the EA model repository**
- **Can be represented as a UML Class diagram**
- **Similarities to OO class diagrams:**
 - Stereotype classifiers
 - Attributes, including attribute types and default values
 - Relationships include multiplicity and semantics, including association classes
 - Simple association and containment relationships both supported
 - Generalization important for hierarchical EA models
- **Differences from OO class diagrams:**
 - Operations are less common and typically repository tool-dependent
 - Relationships do not usually include dependencies or navigability

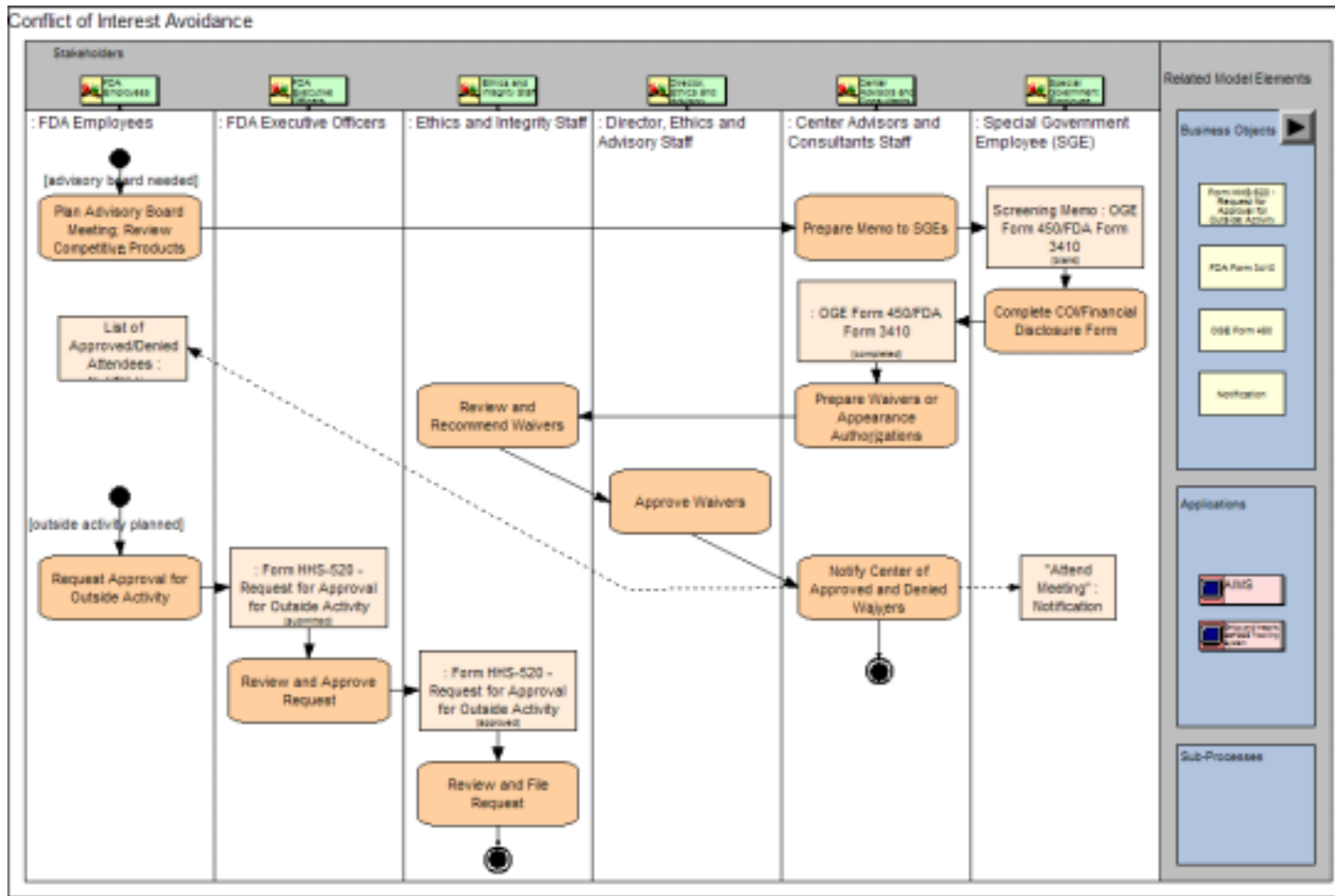
EA Metamodel Example: Business Layer of HHS EA



Documenting Business Processes

- **Well-documented business processes represent the heart of a business-driven enterprise architecture model**
- **UML Activity diagrams can be adapted to model business processes at the enterprise level**
 - Swimlanes represent actors/stakeholders who participate in the business process
 - Activity states represent coarse-granularity steps that often serve as the basis for more detailed use-case level analysis later
 - May not involve systems at all
- **Value comes from linking processes to key enterprise data abstractions and systems**
 - Mechanism for identifying redundancies and inefficiencies

Business Process Example: Food & Drug Administration



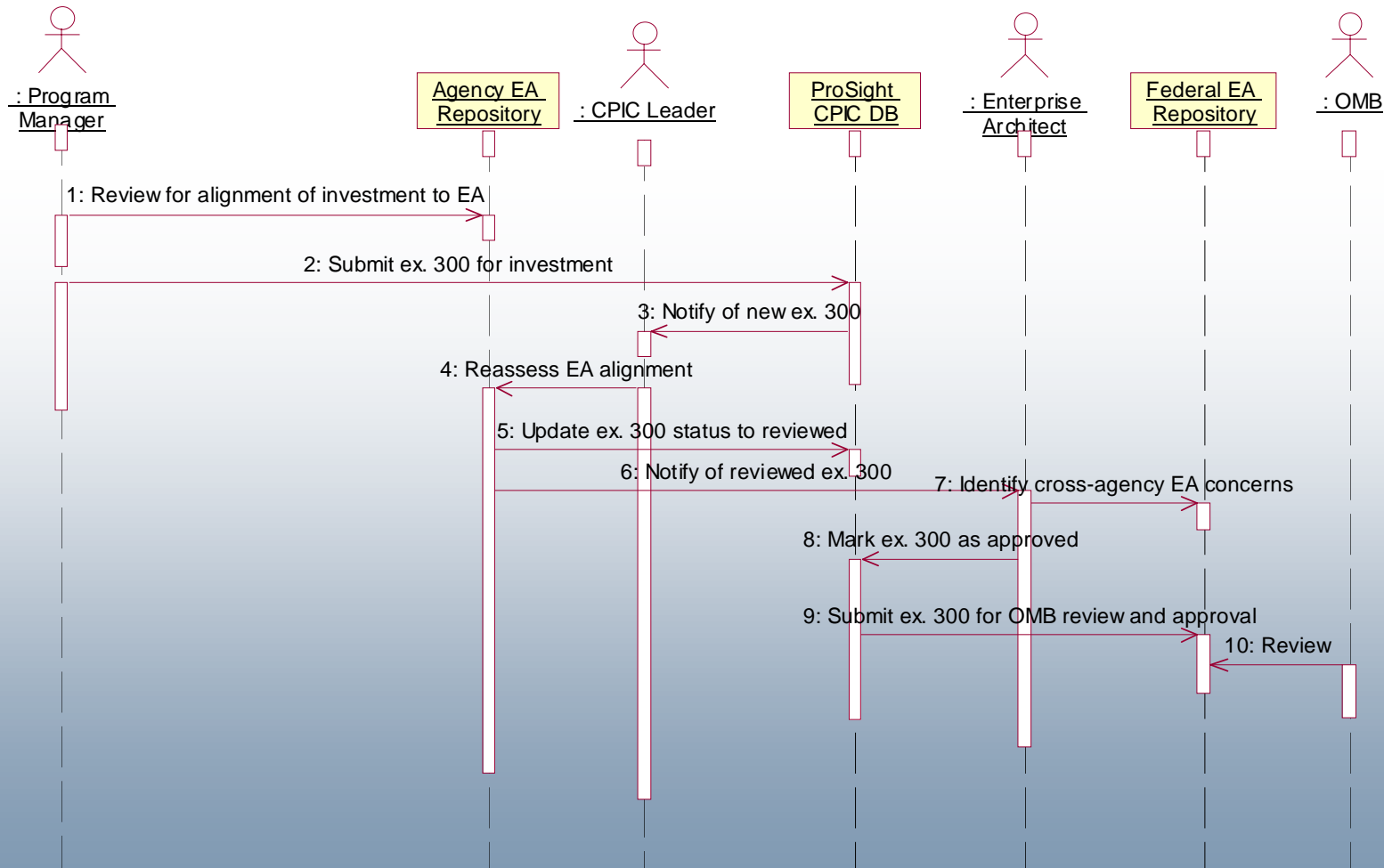
Shows how stakeholders (swimlanes), business processes (round rectangles) and enterprise data (square rectangles) interact for one business process

Describing Enterprise Collaborations

- **In enterprise architectures, collaborations are typically modeled at a higher level of interaction than in application architectures**
- **Focus is on interactions across multiple systems and stakeholders**
 - Common to see human intermediaries mediate the interactions between systems, especially across multiple business units and legacy systems
 - Identifying these baseline inefficiencies often serves as a good basis for prioritizing EAI initiatives and moving the organization towards service-oriented architecture
 - Excellent mechanism for identifying enterprise dependencies that must be considered when developing transition plans
 - Constrains ability to replace or retire existing systems if they are the focus of multiple enterprise-scope interactions

Enterprise Collaboration Example

- This example shows the collaborations between key actors and systems in the HHS IT investment review process

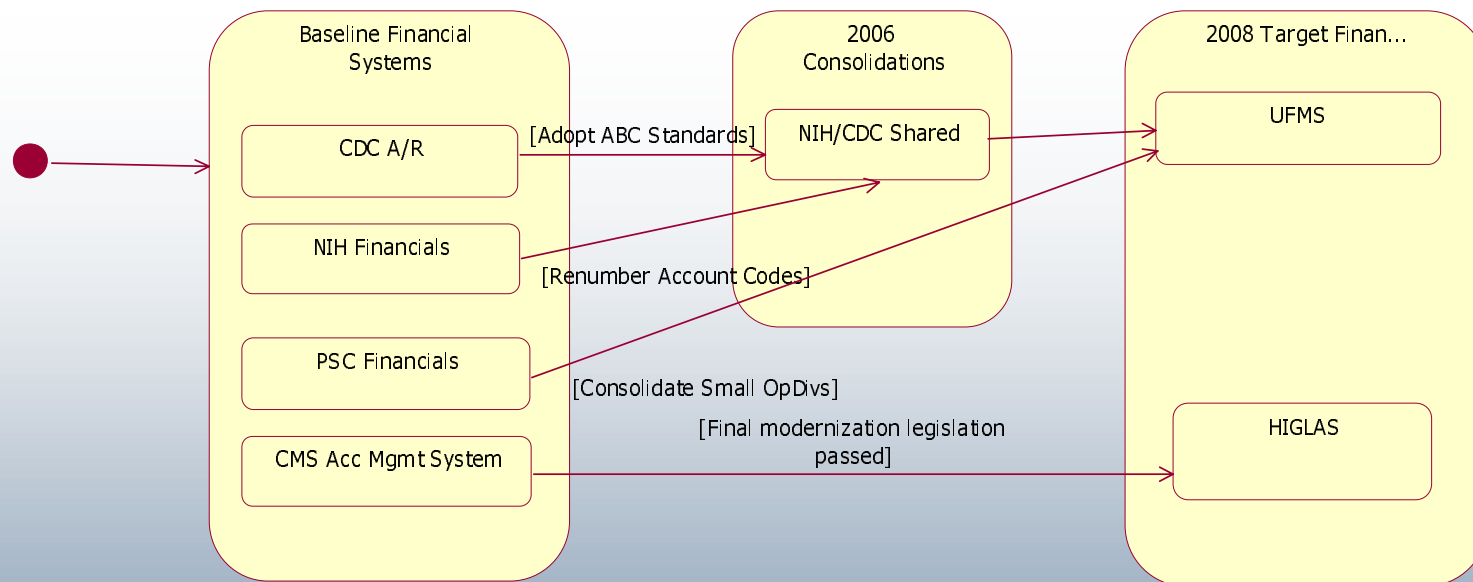


Describing EA Transition Planning

- **One of the critical deliverables of an EA initiative is a transition plan (sometimes called migration or sequencing plan)**
- **Describes the discrete states required for a given aspect of the EA to transition from the current (baseline) architecture to the future (target) architecture**
 - Examples might include business processes, enterprise data, applications and/or technologies
 - Transition activities may include replacement, enhancement, and consolidation activities among others
 - Transition typically occurs over multiple years (planning periods) and often involves dependencies and preconditions
- **Transition plans can be described as state transition diagrams**

Transition Planning Example

- This diagram is a small subsection of a proposed modernization blueprint for financial systems



Limitations of UML in EA

- **UML metamodel exists at a different level of abstraction than EA metamodels**
- **UML modeling tools tend to lack important features of EA repositories**
 - Ad hoc searching and reporting
 - Object data value entry
 - Many UML modeling features (like codegen) may be less useful in an EA context
 - Dynamic context switching (zoom in/out)

Lessons Learned

- **Develop model in collaboration with stakeholders**
 - Establish working group(s)
 - Provide UML 101 training where necessary
- **Many SDLC best practices still apply**
 - Manage requirements (business questions)
 - Develop iteratively
 - Model visually
- **Use UML where it fits**
- **Automate where possible**
 - We have developed a tool to reverse engineer an EA metamodel in UML/Rose from a Metis model

Status and Next Steps

- Initiative began in September 2003
- Current model has over 2500 objects, 6000+ relationships
- Metamodel is being actively refined to incorporate new entity types and relationships
- We are developing/modeling a presentation architecture that rests atop the EA repository/modeling environment
- Federating the EA models at multiple levels of the organization (department, agency/operating division, bureau/office) is one of the most significant activities in the next few months
- Data collection and policy development tend to be the biggest brakes on model development, not tool or framework issues
- Business process modeling migrating to BPMN



QUESTIONS



Thank You

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