



***USPTO Enterprise Architecture,  
Solution Architecture  
And Component Based Development  
Approach and Strategic Reuse***

**Daud Santosa**  
*Chief Computer Scientist/CTO  
United States Patent and Trademark Office*



# *Agenda*

- **FEA Reference Model**
- **USPTO Enterprise Architecture (UEA)**
- **UEA Pilot**
- **UEA Component Based Architecture**
- **UEA Strategic Reuse**

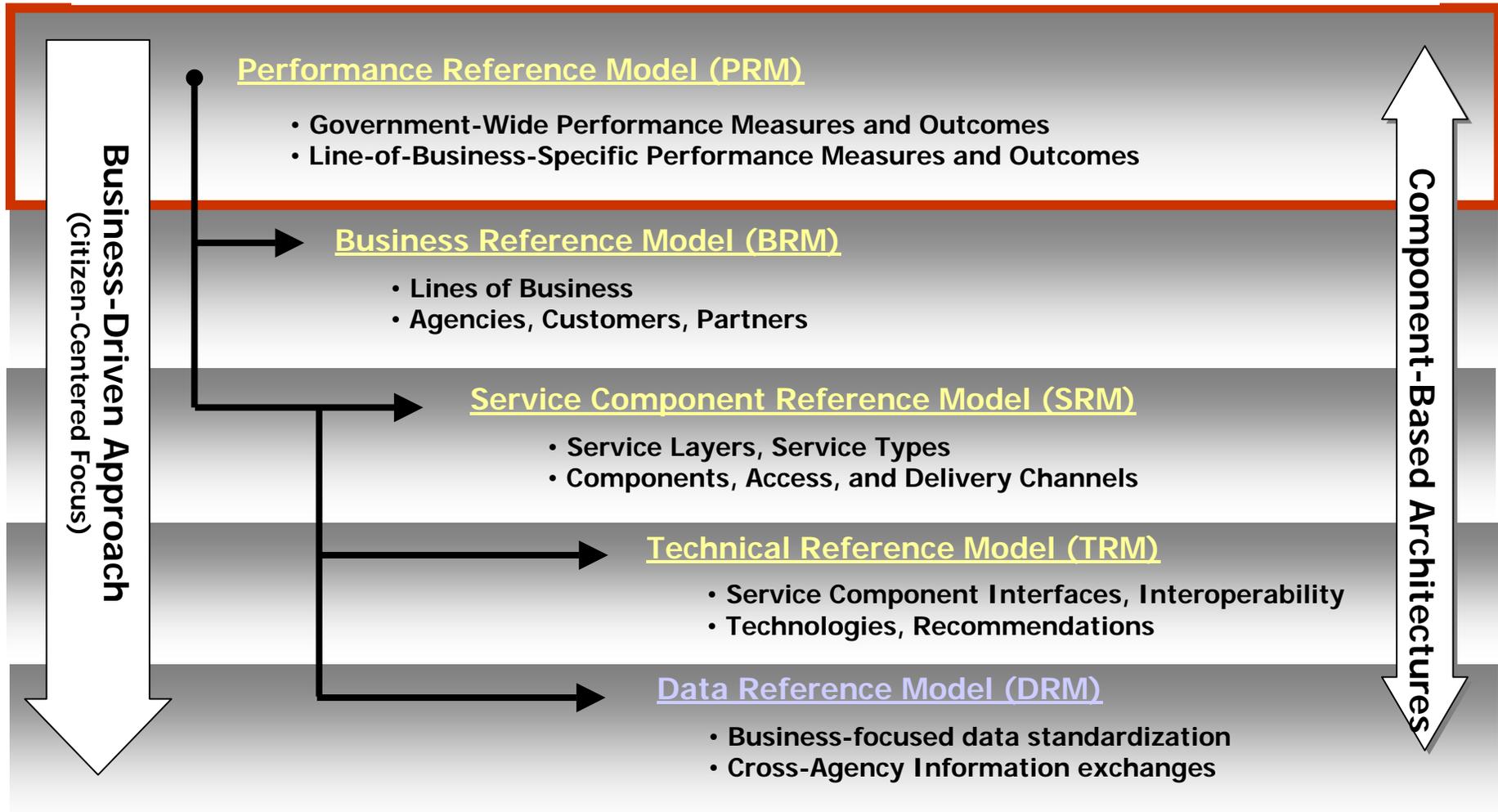


# *Federal Enterprise Architecture Reference Model*



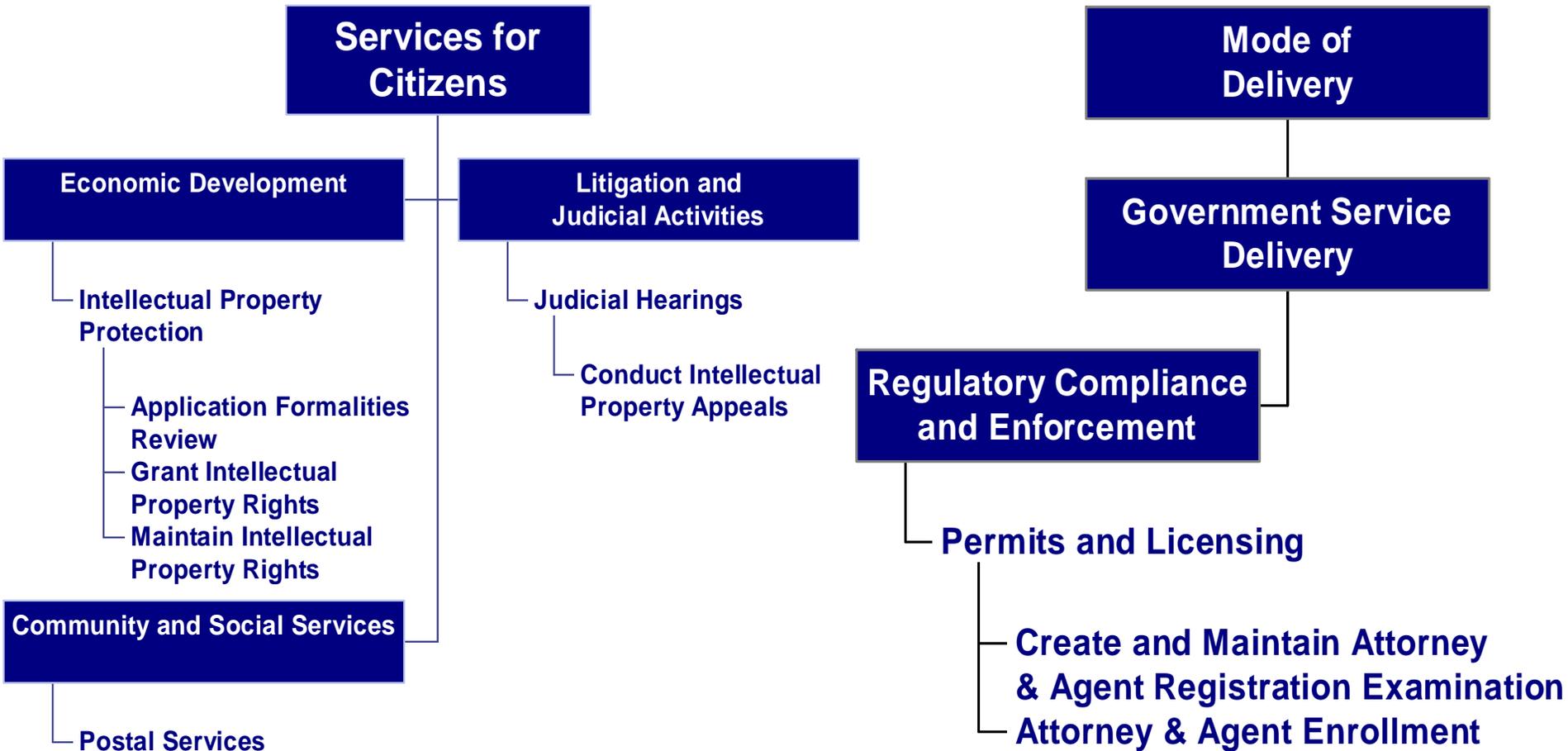
# *The Five FEA Reference Models*

## Federal Enterprise Architecture (FEA) Reference Models



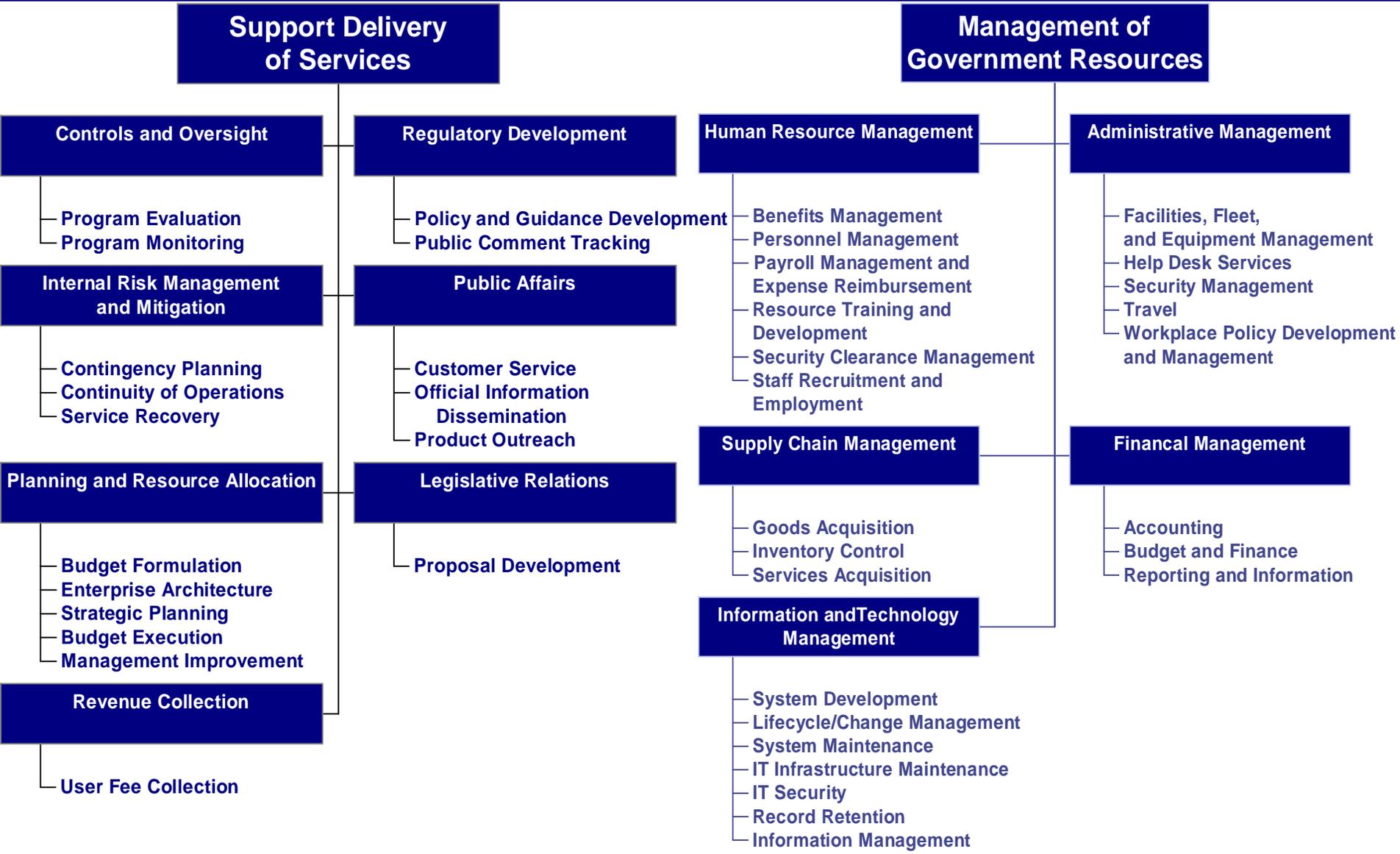


# *Example Decomposition of USPTO Functional Services mapped to BRM*





# Example Decomposition of USPTO Functional Services mapped to BRM - continue



# Example UEA SRM Mapping

## E-Filing Service for Patent Business Area

Description	Service Layer	Service Type	Service Component	Technology	Access Channel	Delivery Channel	
<b>Online Patent Application</b> Electronic Filing System (EFS)							
<ul style="list-style-type: none"> <li>• Electronic Filing System (EFS) provides applicants to file patent applications online with USPTO through Electronic Patent Business Center. EFS supports the <b><u>authoring, preparation, secure submission, receipt, validation, and processing</u></b> of patent applications electronically via Internet. EFS uses <b><u>public key infrastructure</u></b> (PKI) services for secure electronic communications with applicants and their representatives and accepting credit payment via internet.</li> <li>• EFS allows 3<sup>rd</sup> party authoring and submission software adhered to <b><u>WIPO e-filing standard and DTD</u></b>.</li> <li>• <a href="http://www.uspto.gov/ebc/efs/index.html">http://www.uspto.gov/ebc/efs/index.html</a></li> </ul>	<ul style="list-style-type: none"> <li>• Digital Asset Services</li> </ul>	<ul style="list-style-type: none"> <li>• Content Management</li> </ul>	<ul style="list-style-type: none"> <li>• Content Authoring</li> </ul>	<ul style="list-style-type: none"> <li>• TSA XML authoring</li> <li>• i4i (XML conversion tool)</li> <li>• Alterna TIFF Image Format</li> <li>• Xerces (Java code parser)</li> <li>• DynaZIP</li> <li>• Microsoft Word</li> <li>• WordPerfect</li> <li>• Oracle, Digital Liner Tape, EMC Storage</li> <li>• Java Servelet, Java Server Page, Java</li> <li>• IPlanet Web</li> <li>• Entrust Public Key Infrastructure (USPTO Direct)</li> <li>• VFind Security Toolkit</li> <li>• Virtual Vault</li> <li>• Ravline Switch</li> <li>• HP-UX Server</li> </ul>	<ul style="list-style-type: none"> <li>• Web Server -</li> <li>• Internet Explorer 5.x</li> <li>• HP Communicator</li> </ul>	<ul style="list-style-type: none"> <li>• Internet (HTTP)</li> <li>• (HTTPS)</li> </ul>	
		<ul style="list-style-type: none"> <li>• Document Management</li> </ul>	<ul style="list-style-type: none"> <li>• Tagging</li> </ul>				<ul style="list-style-type: none"> <li>• Document Conversion</li> </ul>
		<ul style="list-style-type: none"> <li>• Knowledge Management</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge Capture</li> </ul>				<ul style="list-style-type: none"> <li>• Online Help</li> </ul>
	<ul style="list-style-type: none"> <li>• Customer Services</li> </ul>	<ul style="list-style-type: none"> <li>• Customer Initiated Assistance</li> </ul>	<ul style="list-style-type: none"> <li>• Online Tutorials</li> </ul>				
	<ul style="list-style-type: none"> <li>• Back Office Services</li> </ul>	<ul style="list-style-type: none"> <li>• Financial Management</li> </ul>	<ul style="list-style-type: none"> <li>• Credit / Charge</li> </ul>				
	<ul style="list-style-type: none"> <li>• Common Services</li> </ul>	<ul style="list-style-type: none"> <li>• Security Management</li> </ul>	<ul style="list-style-type: none"> <li>• Identification</li> <li>• Access Control</li> <li>• Encryption</li> <li>• Verification</li> <li>• Digital Signature</li> <li>• Intrusion Detection</li> <li>• Privilege Management</li> </ul>				



# TRM V7.0 Product Life Cycles

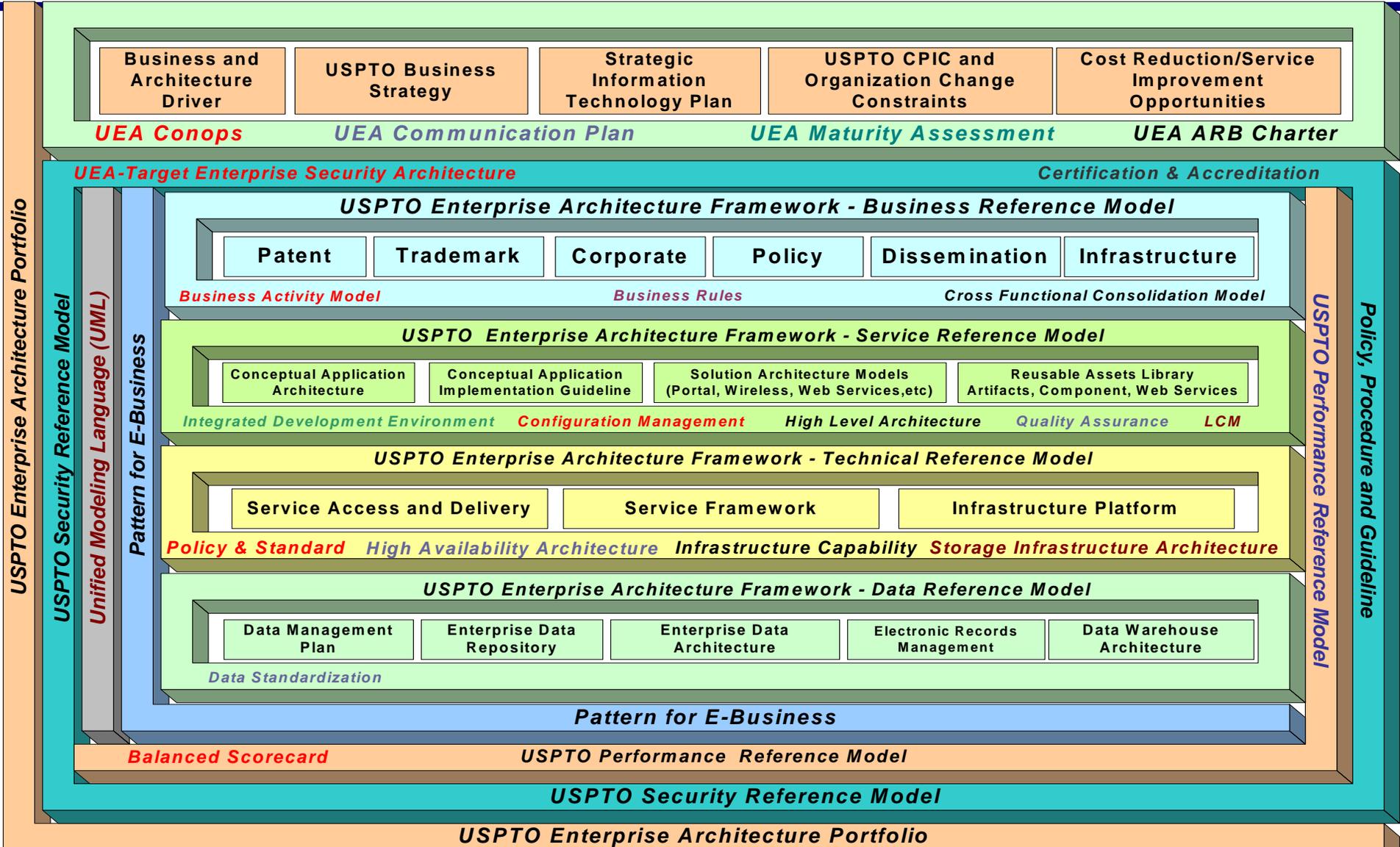
<u>Current Environment</u>	<u>Next 18 Months Near-Term Deployment</u>	<u>Containment Target</u>	<u>Retirement Target</u>
<ul style="list-style-type: none"> <li>Blackberry</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>	<ul style="list-style-type: none"> <li>Blackberry (infringed on patents held by NTP Inc.)</li> </ul>	<ul style="list-style-type: none"> <li>No further procurement</li> </ul>
<ul style="list-style-type: none"> <li>Visual Basic 6</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>
<ul style="list-style-type: none"> <li>Visual Basic 4</li> </ul>	<ul style="list-style-type: none"> <li>Microsoft .NET suite (e.g. Visual Basic .NET; Visual C++ .NET or Visual Studio .NET)</li> <li>Or</li> <li>J2EE Suite (with Java 2 SDK 1.2 or higher)</li> </ul>	<ul style="list-style-type: none"> <li>Visual Basic 4</li> </ul>	<ul style="list-style-type: none"> <li>Visual Basic 4 (Retired by 30-June 2003)</li> </ul>
<ul style="list-style-type: none"> <li>Visual Basic 5</li> </ul>		<ul style="list-style-type: none"> <li>Visual Basic 5</li> </ul>	<ul style="list-style-type: none"> <li>Visual Basic 5 (Retired by 30-June-2003)</li> </ul>
<ul style="list-style-type: none"> <li>Visual C++ 4</li> </ul>		<ul style="list-style-type: none"> <li>Visual C++ 4</li> </ul>	<ul style="list-style-type: none"> <li>Visual C++ 4</li> </ul>
<ul style="list-style-type: none"> <li>Visual C++ 5</li> </ul>		<ul style="list-style-type: none"> <li>Visual C++ 5</li> </ul>	<ul style="list-style-type: none"> <li>Visual C++ 5</li> </ul>
<ul style="list-style-type: none"> <li>Visual C++ 6</li> </ul>		<ul style="list-style-type: none"> <li>Visual C++ 6</li> </ul>	<ul style="list-style-type: none"> <li>Visual C++ 6 (Retired by 30-Sep-2003)</li> </ul>
<ul style="list-style-type: none"> <li>Cold Fusion (IDE)</li> <li>Visual Café (IDE)</li> </ul>	<ul style="list-style-type: none"> <li>Rational Rose (UML)</li> <li>Or</li> <li>Web Sphere Studio Application Developer v4.0</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>
<ul style="list-style-type: none"> <li>COOL:Gen v5.1</li> </ul>	<ul style="list-style-type: none"> <li>Advantage Gen v6.5</li> </ul>	<ul style="list-style-type: none"> <li>COOL:Gen v5.1</li> </ul>	<ul style="list-style-type: none"> <li>COOL:Gen v5.1 (after complete migration)</li> </ul>
<ul style="list-style-type: none"> <li>Crystal Info</li> </ul>	<ul style="list-style-type: none"> <li>Crystal Enterprise</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>HP Netserver with NT 4.0 Operating System</li> </ul>	<ul style="list-style-type: none"> <li>Microsoft will terminate Windows NT support by June 2003. NT servers will migrate to</li> </ul>	<ul style="list-style-type: none"> <li>HP Netserver with NT 4.0 Operating System</li> </ul>	<ul style="list-style-type: none"> <li>HP Netserver with NT 4.0 Operating System will retire after complete migration</li> </ul>



*UEA pilot using Enterprise  
Architecture, Solution  
Architecture and Component  
Based Architecture*

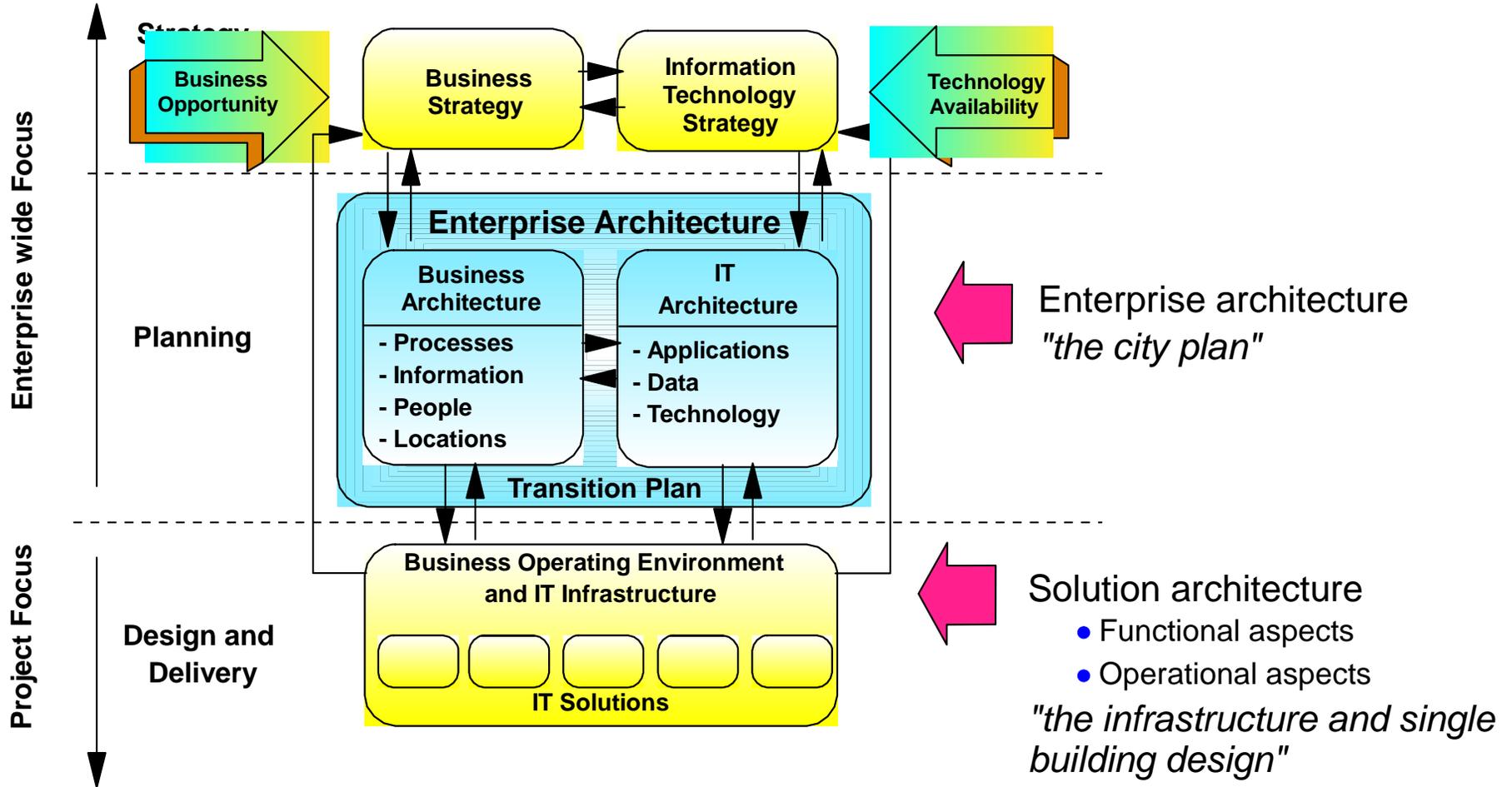


# USPTO EA Reference Model



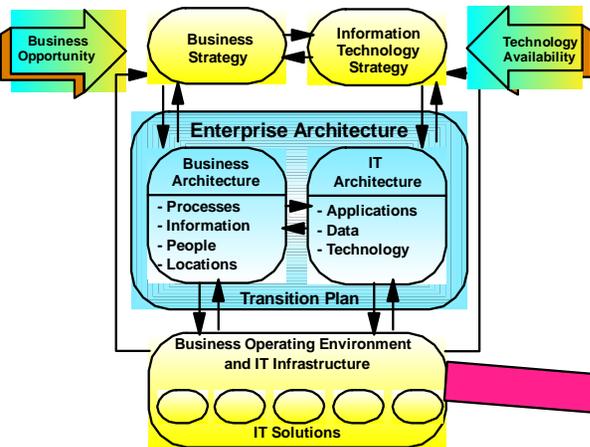


# Enterprise Architecture vs. Solution Architecture





# Enterprise Architecture vs. Solution Architecture - continue



## Enterprise architecture

### Characteristics

- An Enterprise Architecture (EA) is an enterprise-wide framework to guide investment and design decisions
- An EA defines an infrastructure that will meet the current and future needs of a diverse user population and will adapt to changing business requirements and technology.

### Typically performed by

- IT strategy consultants with EA specialization

## Solution architecture

### Characteristics

- Defines the structure of an IT solution (IT infrastructure or single system) to specific system requirements
- Defines functional and operational aspects of the solution
- Applies the latest technology to the EA framework, based on current financial constraints

### Typically performed by

- IT architects with skills in various disciplines and/or solution areas



# High-Level of Business Functions That Provide the Business Services



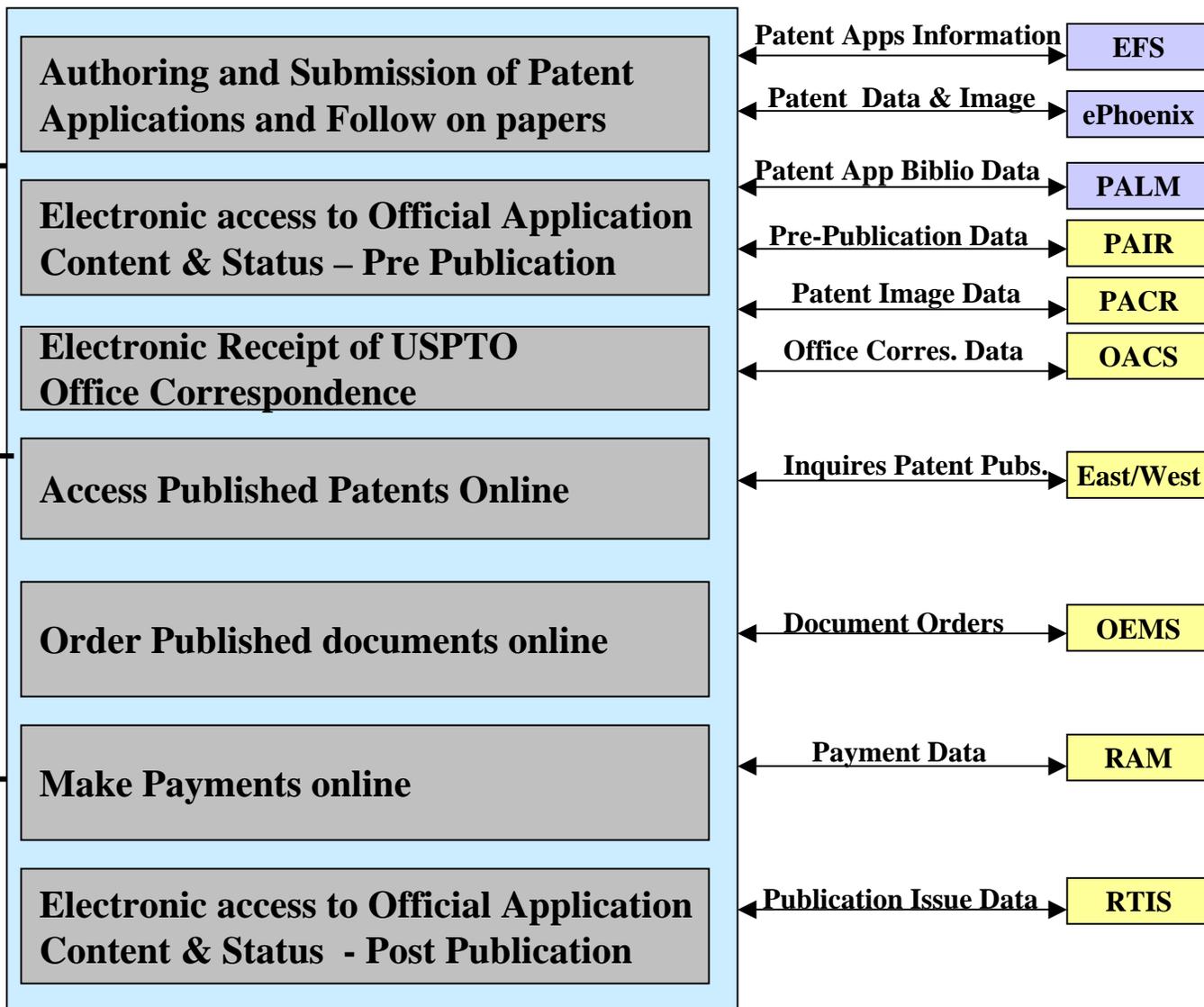
**USPTO Staff**  
*Patent Examiners*



**Business Partner**



**Patent Practitioners,  
Applicants, &  
General Public**





# High-Level View of Business Services for e-Gov Initiatives

**Users**                      **Access & Delivery Channels**                      **Application Services Component**                      **Resources**



**USPTO Staff**  
*Patent & Trademark Examiners*



**Business Partner**



**Patent Practitioners, Applicants, & General Public**

**Internet/ Intranet Browser**

**E-Book**

**Pervasive/ Wireless Devices**

**Filing Services**

**Payment Services**

**Update Services**

**Inquiry Services**

**Authentication and Authorization Services**

**Messaging & Collaboration Services**

**Reporting Services**

**Administration Services**

**Pre-Exam Services**

**Exam Services**

**Post-Exam Services**

**Scanning Services**

**Directory Services**

**AIS Applications**

**System Monitoring**

**Customer Relationship Management**

**Internal Enterprise Systems**

**External Enterprise Systems**

External Customer Services  
Common Services for both external and internal  
Internal Customer Services



# Patterns for E-Business Enable Reusability

**Customer Requirements**

**Business Patterns:**

- Establish the primary business purpose for the solution
- Identify the high-level participants who interact with the solution
- Describes the nature of interaction among participants
- Business pattern types: **Self-Service, Collaboration, Information Aggregation, Extended Enterprise**

**Business Patterns**

**Integration Patterns**

**Composite Patterns**

**Composite Patterns:**

- Involve several applications
- Express the complexities of real systems

**Integration Patterns:**

- Used within a business pattern to integrate apps and databases
- Links individual business patterns to deliver a complete solution
- Types: **Access Integration** and **Application Integration**

**Application Patterns**

**Application Patterns:**

- Provide an architectural view of how the presentation, application, and data layers interact
- Refine the business patterns so they can be implemented
- Partition application logic and data and define interaction between logic tiers

**Runtime Patterns**

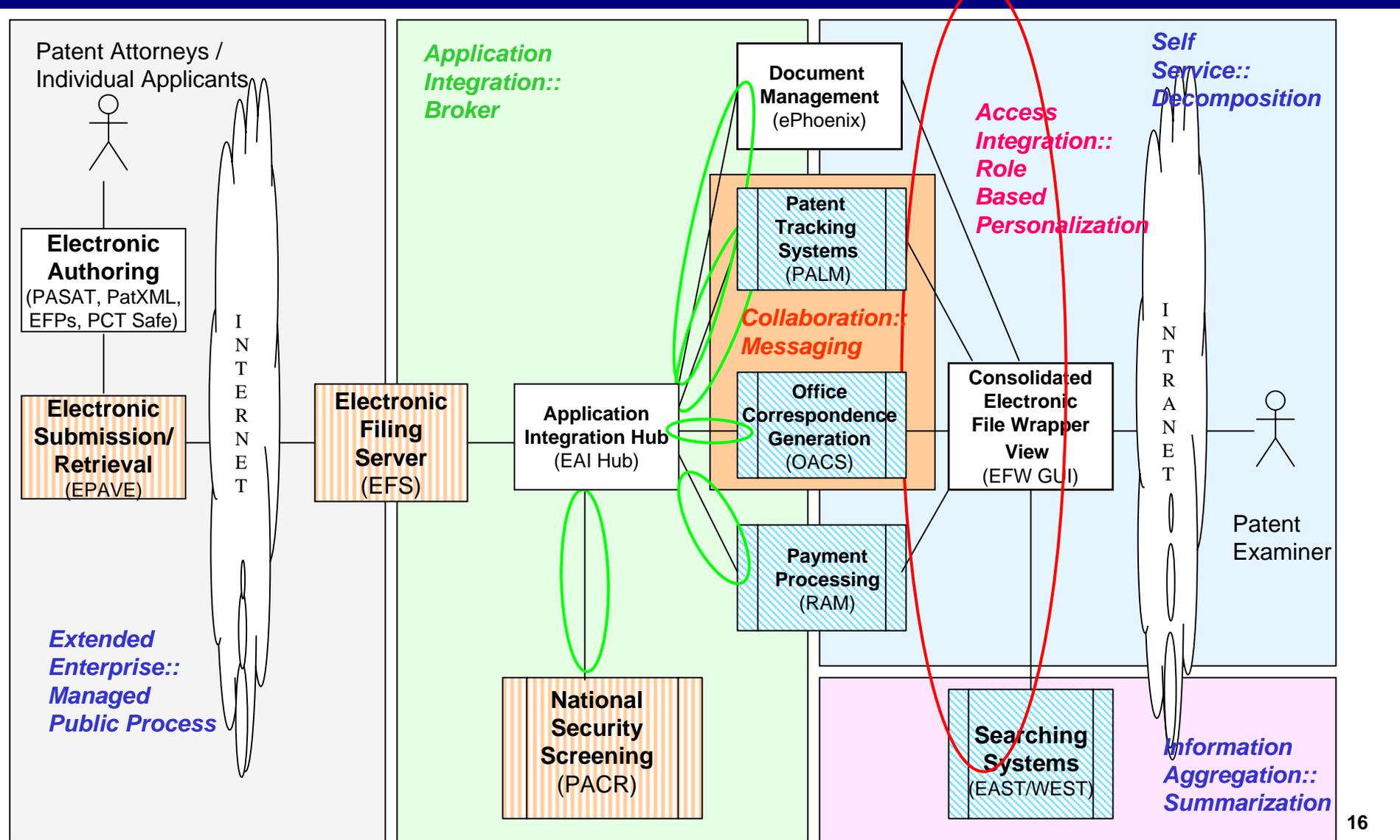
**Runtime Patterns:**

- Detail the logical middleware architectures needed within a solution
- Specify the runtime technologies (not products) needed to make the application patterns work
- Technology types (not products) are specified at this stage

**Runtime Product Mappings**

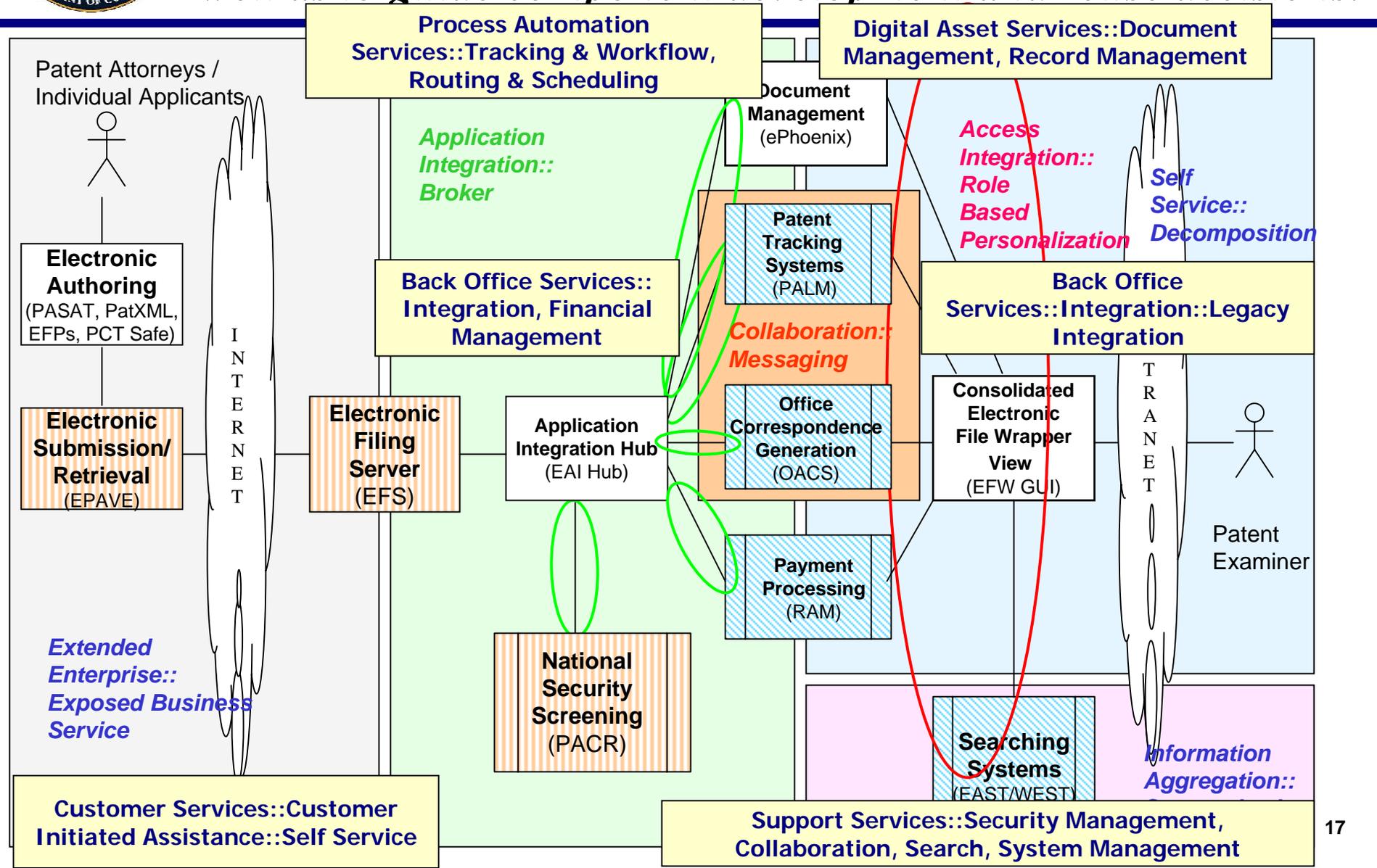


# *This Solution Overview Diagram for the Patents Electronic Government strategic initiative consists of a composite set of reusable architecture patterns.*



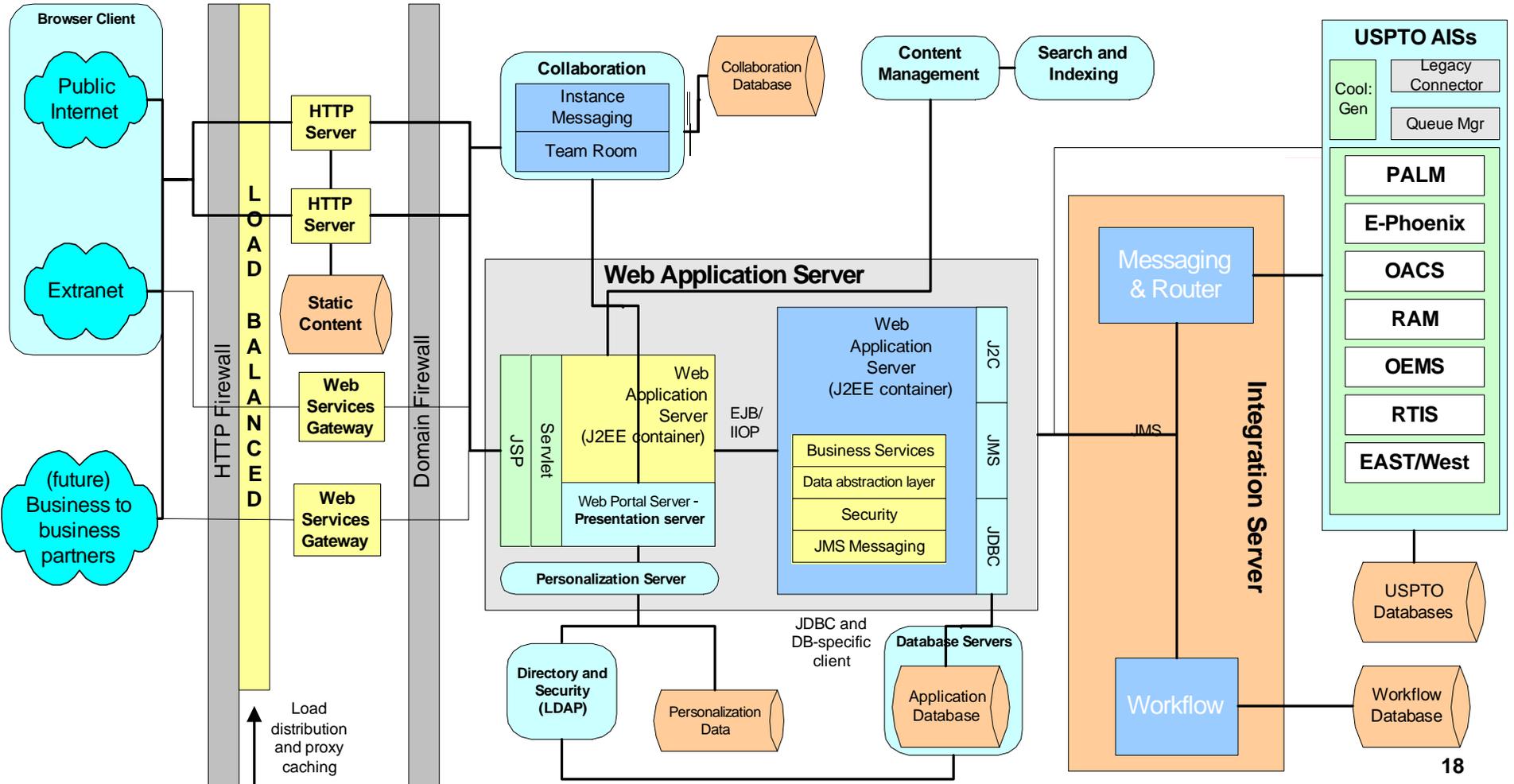


*The reusable architecture patterns can be mapped back to the FEA SRM to indicate clear alignment and integration as well as to guide component development and reuse decisions.*



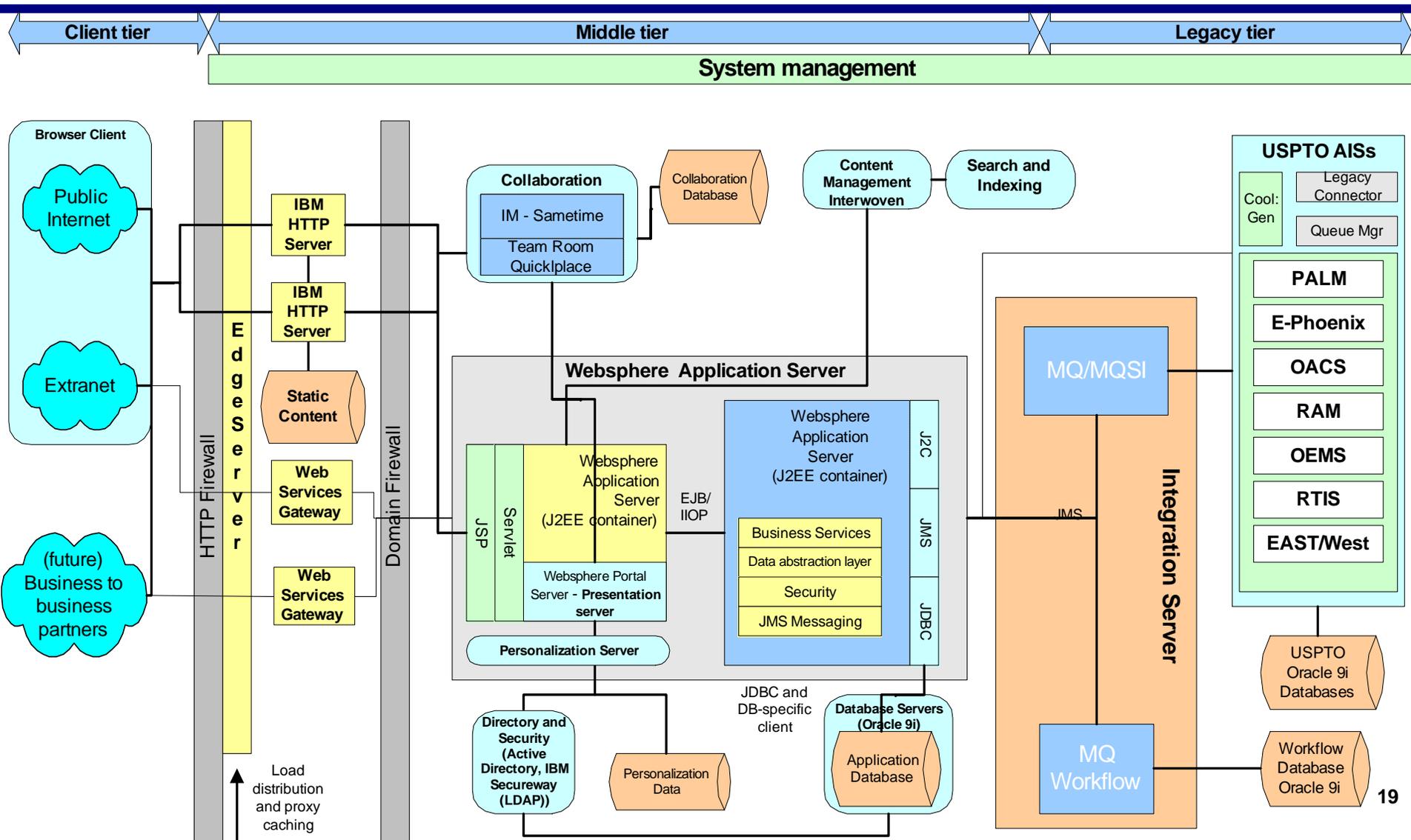


*This view depicts the logical run-time topology, which provides a complete solution architecture that adheres to the composite patterns.*





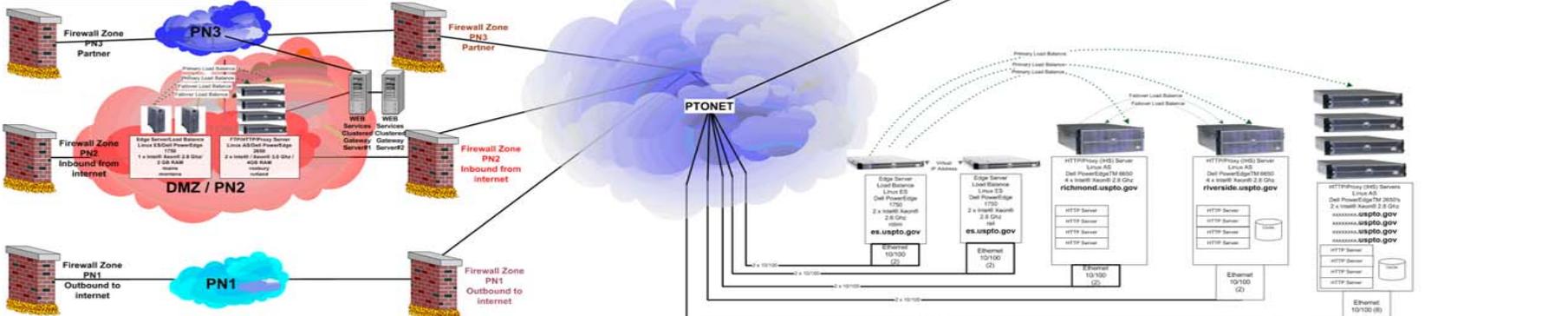
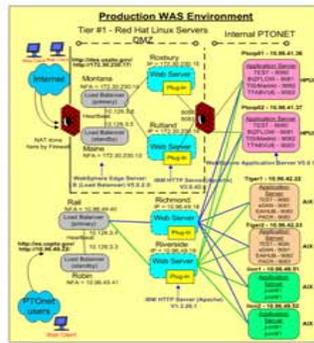
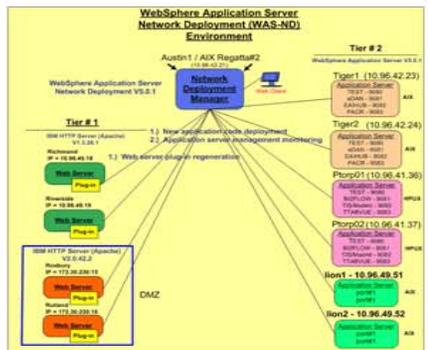
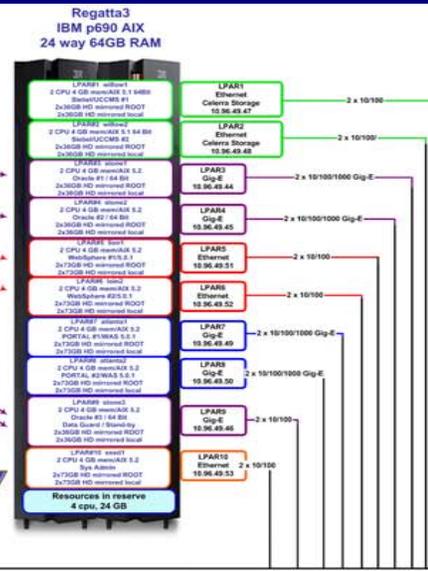
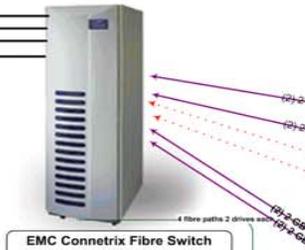
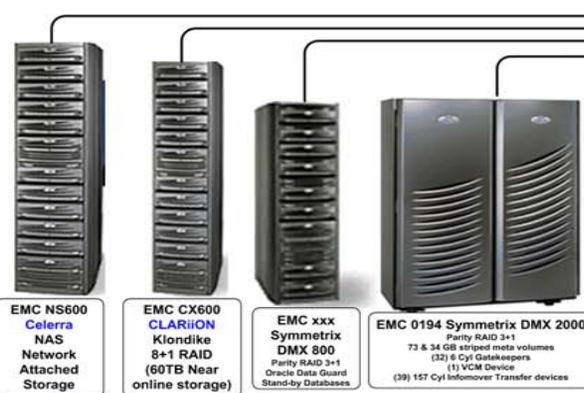
*This view depicts the solution architecture mapped to the specific products and standards from the USPTO TRM.*





# This view depicts the solution architecture mapped to the Infrastructure Architecture.

UNITED STATES PATENT AND TRADEMARK OFFICE  
**PORTAL / CORPORATE**  
**Production**  
**Infrastructure Environment**  
Wednesday, November 19, 2003





*USPTO Component Based  
Development Approach &  
Strategic Reuse*



# *Component Based Development Approach*

Federal Enterprise Architecture Reference Model

Software Architecture Development Life Cycle

Understand –  
apply patterns

Provision

Assemble

Implement

Business  
Model

Component  
Architecture

Acquire

Subscribe

Modify

Wrap

Build

Application  
/Component  
Assembly

Execution

Deployment

Inventory Management

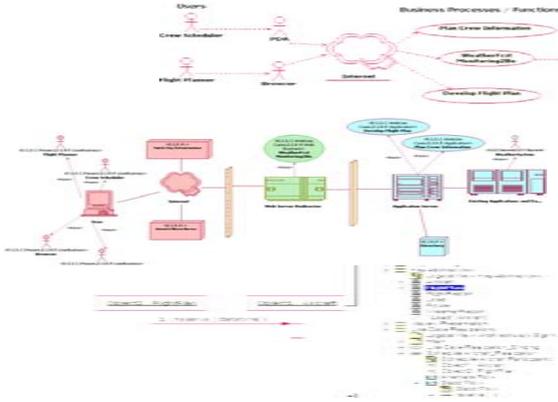
Process Management

Manage





# Component Based Development Approach - continue



1. Business Process Modeling

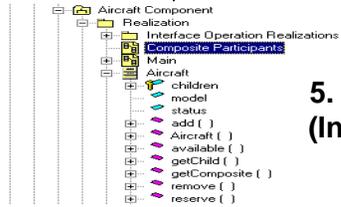
2a. Business Process / Solution Architecture Mapping  
2b. Operational Model

3. Application Use - Case Modeling

4. Application Behavioral Modeling

Acquire component

Make component

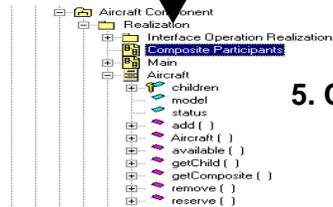


5. Component Specification  
(Integration Specification)

6. Component Design  
(none for acquired components)  
7. Component Creation  
(none for acquired components)

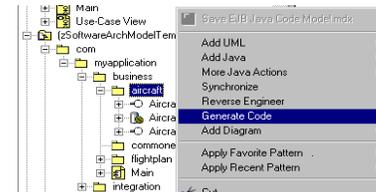
8. Code Generation  
(none for acquired Components)

```
package com.organization.business.aircraft;
import java.util.Date;
public class Aircraft {
    // ...
    public java.lang.String model;
    // ...
    public java.lang.String status;
    // ...
    public java.util.ArrayList children;
    // ...
    public java.lang.String add();
    public java.lang.String available();
    public java.lang.String getChild();
    public java.lang.String getComposite();
    public java.lang.String remove();
    public java.lang.String reserve();
}
```

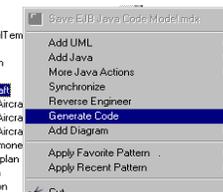


5. Component Specification

6. Component Design  
7. Component Creation

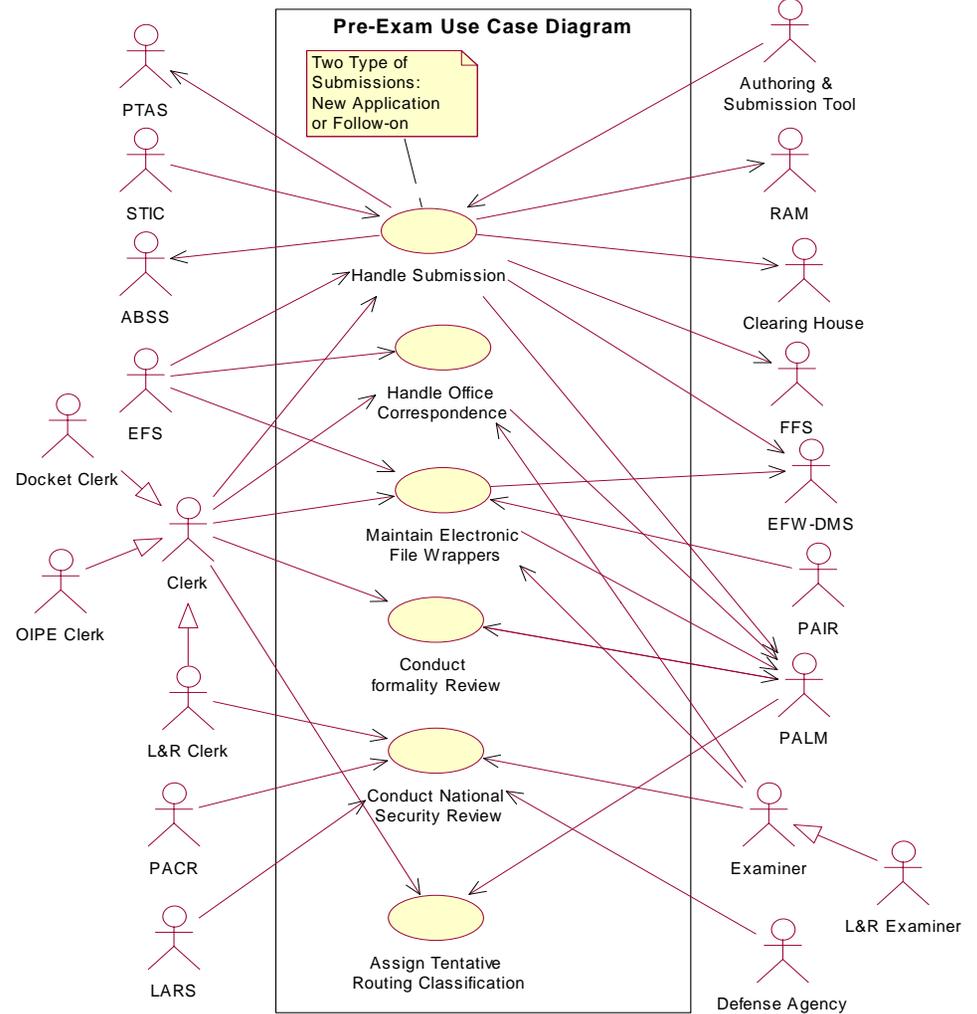
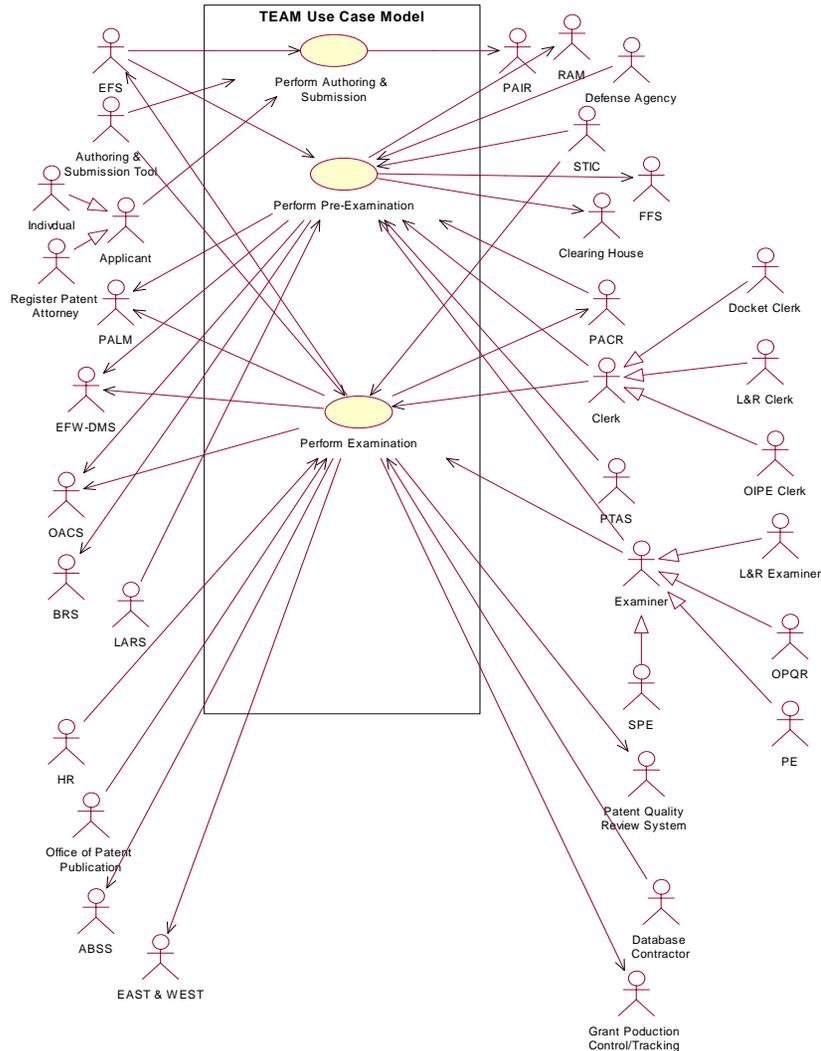


8. Code Generation



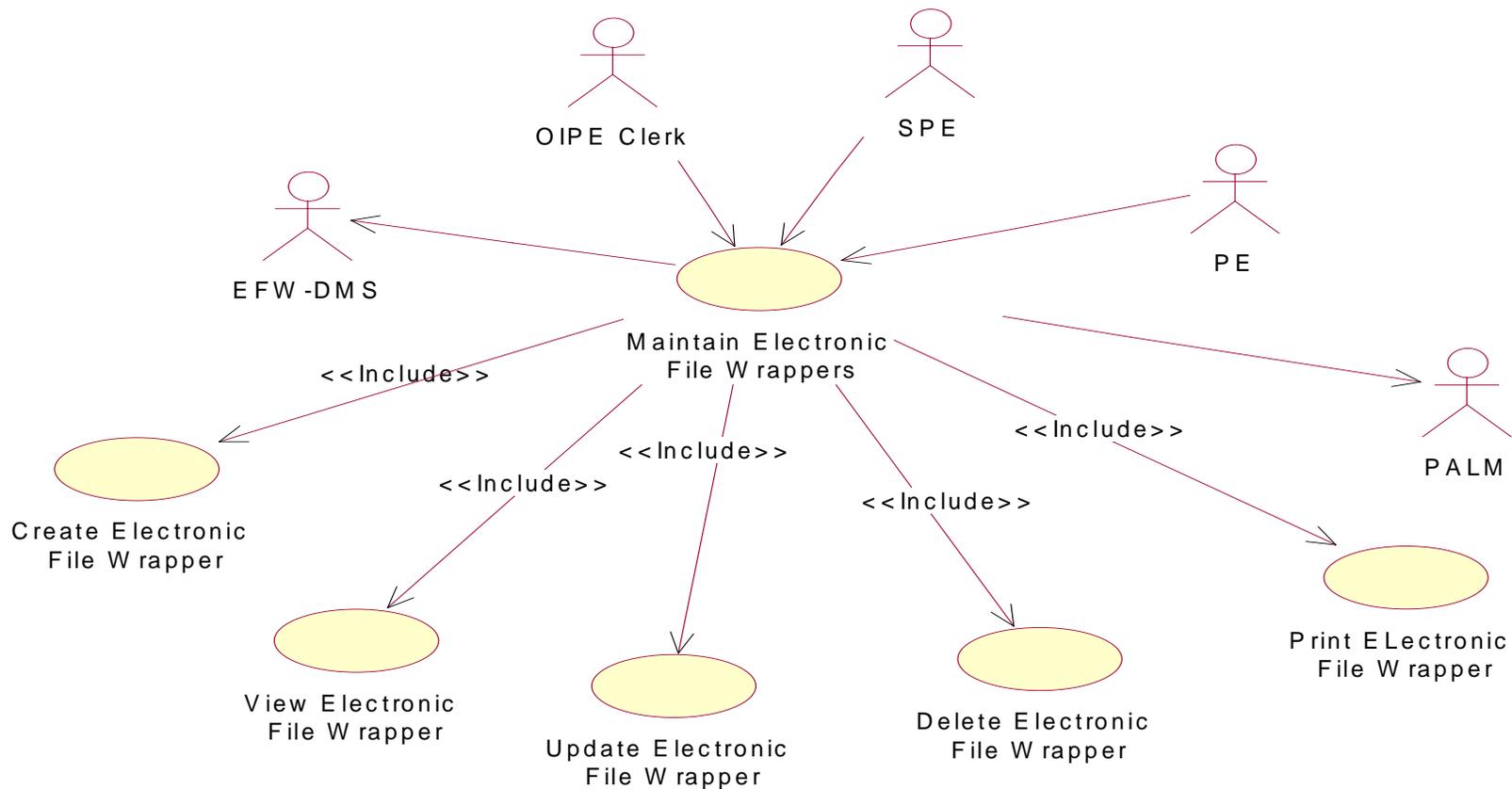


# Patent High Level Use Cases





# Maintain Electronic File Wrapper Use Cases

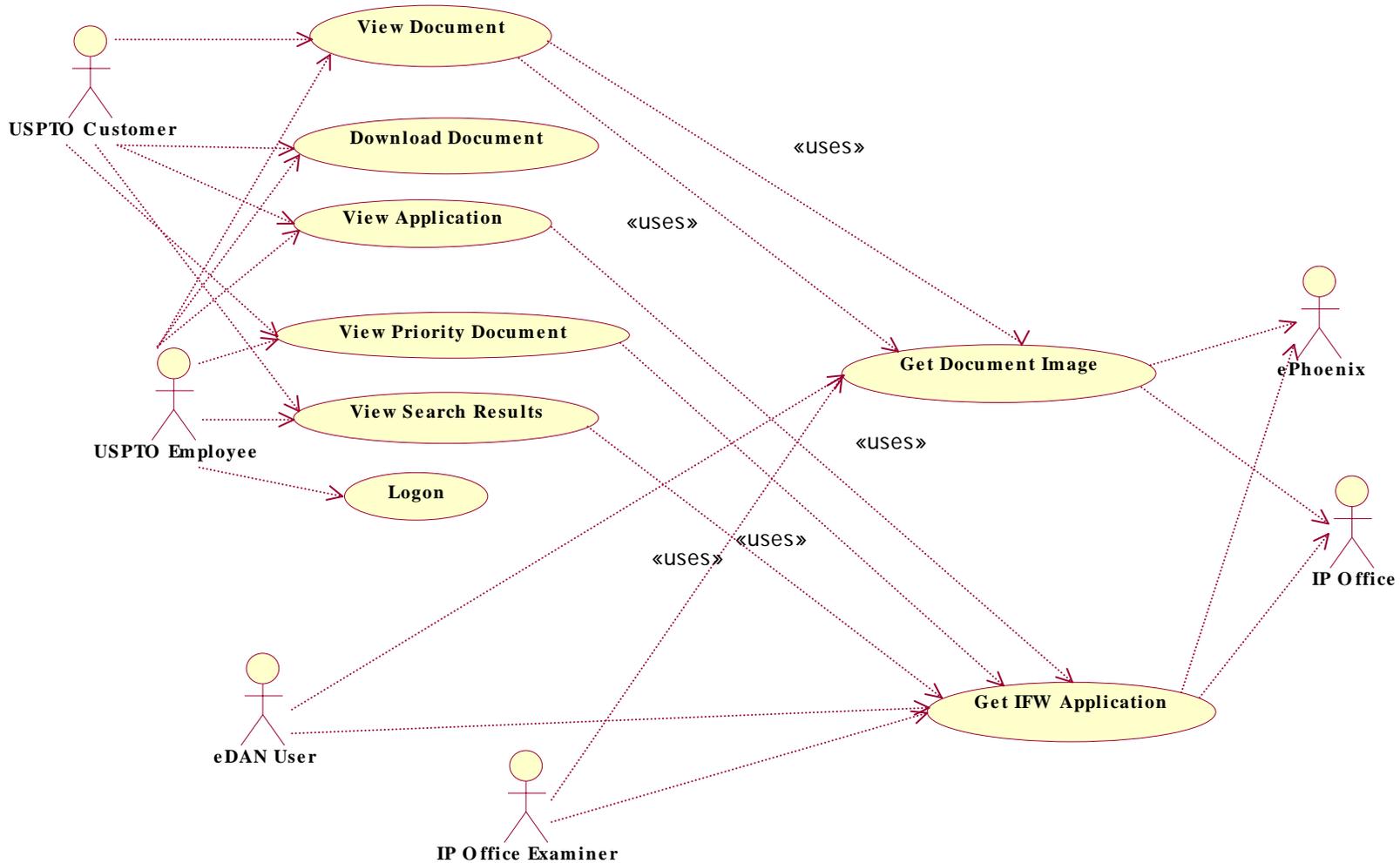


Maintain Electronic File Wrappers Use Case Diagram



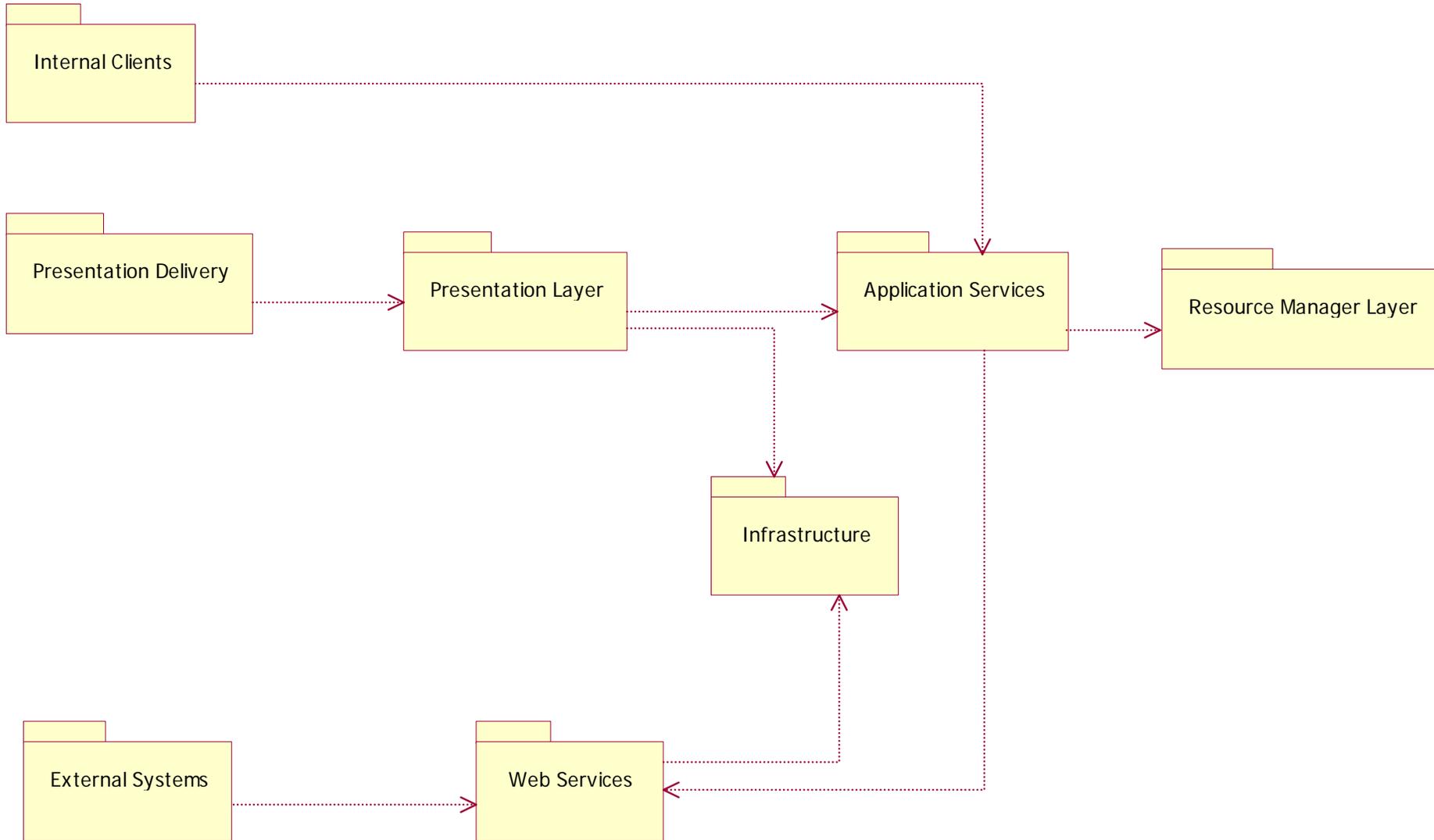
# Use Cases for Viewing Electronic File Wrapper (IFW)

File Inspection - Access IFW Content





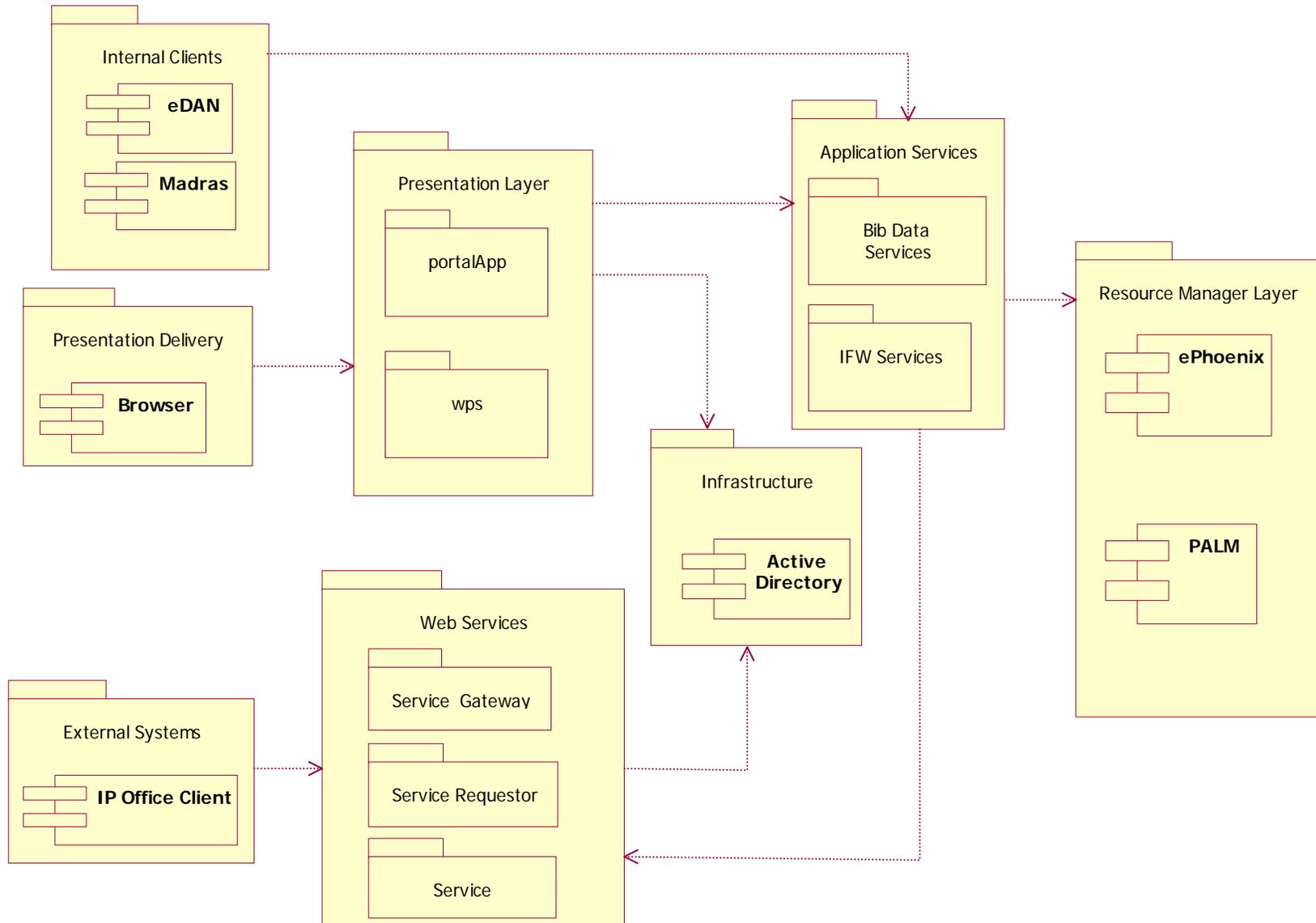
# *Component Interaction Diagram*





# Component Interaction Diagram

## - continue





# User Experience Patent Examiner Browser

Focus of these links are on the administrative areas of the organization such as the Director's area, CIO, Corporate Planning, Finance, and so forth.

The navigation links focus on the user's access to career, health and money options as an employee of the U.S. Patent Office.

Core navigation links to essential technical services as well as information, training, and other technical support.

Key administrative service links to procurement, repairs, facilities management, security, and other administrative core content areas.

The screenshot shows the USPTO Intranet Examiner Browser interface. At the top left is the USPTO Intranet logo. A yellow box labeled 'Portal subnavigation' points to a vertical menu of blue buttons: HOME, About USPTO, You and USPTO, Technical Support, Administrative Services, and USPTO Internet. Below this is a section for 'USPTO Links' with links for Director, HR Home, IT Services, and Trademark Office. Another section for 'Most Used Links' includes Payroll (with an EDIT button), HR Forms, and MPEP. A 'My Links' section (with an EDIT button) contains links for Employee Express, TC 1600, Art Room Locations, Select US Classes by Number and Title, Fitness Center, and WEST. At the top right, a yellow box labeled 'Global Portal Tools' points to a navigation bar with links for Firewall, Site Map, Help, Contact Us, Search, and Log Out. Below this is a row of portlets: Patent Examiner Home, Examiner Reference, Tech Centers, Patent News, and Patent Offices. A 'Welcome First, Last Name' message is displayed. The main content area features four portlets: 'Resources' (with EDIT, -, and + buttons), 'News' (with EDIT, -, and X buttons), 'Technical Resources' (with EDIT, -, and + buttons), and 'Human Resources News' (with EDIT, -, and + buttons). Each portlet contains a list of links. On the right side, there is an 'EMPLOYEE LOCATOR' form with a search box and a GO button. Below it is a 'SEARCH' section with radio buttons for 'USPTO intranet' and 'USPTO internet', a search box, and a GO button. At the bottom right is an 'Alerts and Notices' section with a 'SECURITY ALERT' about fire alarm testing on August 12, 2003, and other notices. A yellow box labeled 'Edit Page Layout' points to the 'Edit Layout' link in the top right. Another yellow box labeled 'Users can Edit, Maximize, Minimize, or Close each portlet according to USPTO business rules on a portlet-by-portal basis.' points to the control buttons in the portlets.

Edit Page Layout

EMPLOYEE LOCATOR  
Last Name or first 4 letters of name

SEARCH  
 USPTO intranet  
 USPTO internet  
GO  
Advanced

Alerts and Notices  
**SECURITY ALERT**  
Building XXX, fire alarm testing.  
10am, August 12, 2003  
-----  
[Rules Changes to Patent Process](#)  
August 31, 2003  
[Tech Center 1700 Announcement](#)  
July 17, 2003

Users can Edit, Maximize, Minimize, or Close each portlet according to USPTO business rules on a portlet-by-portal basis.



# *USPTO Strategic Reuse*



# Example of Reuse Vision and Mission Statement

- US DoD – “The vision of the DoD Software Reuse Initiative is to drive the DoD software community from its current ‘re-invent the software’ cycle to a process-driven, domain-specific, architecture-centric, library-based way of constructing software. The strategy to realize this vision is based on systematic reuse: where opportunities are predefined and a process for capitalizing on those opportunities is specified.” (J.Piper, “DoD Software Reuse Vision and Strategy 1992”.)

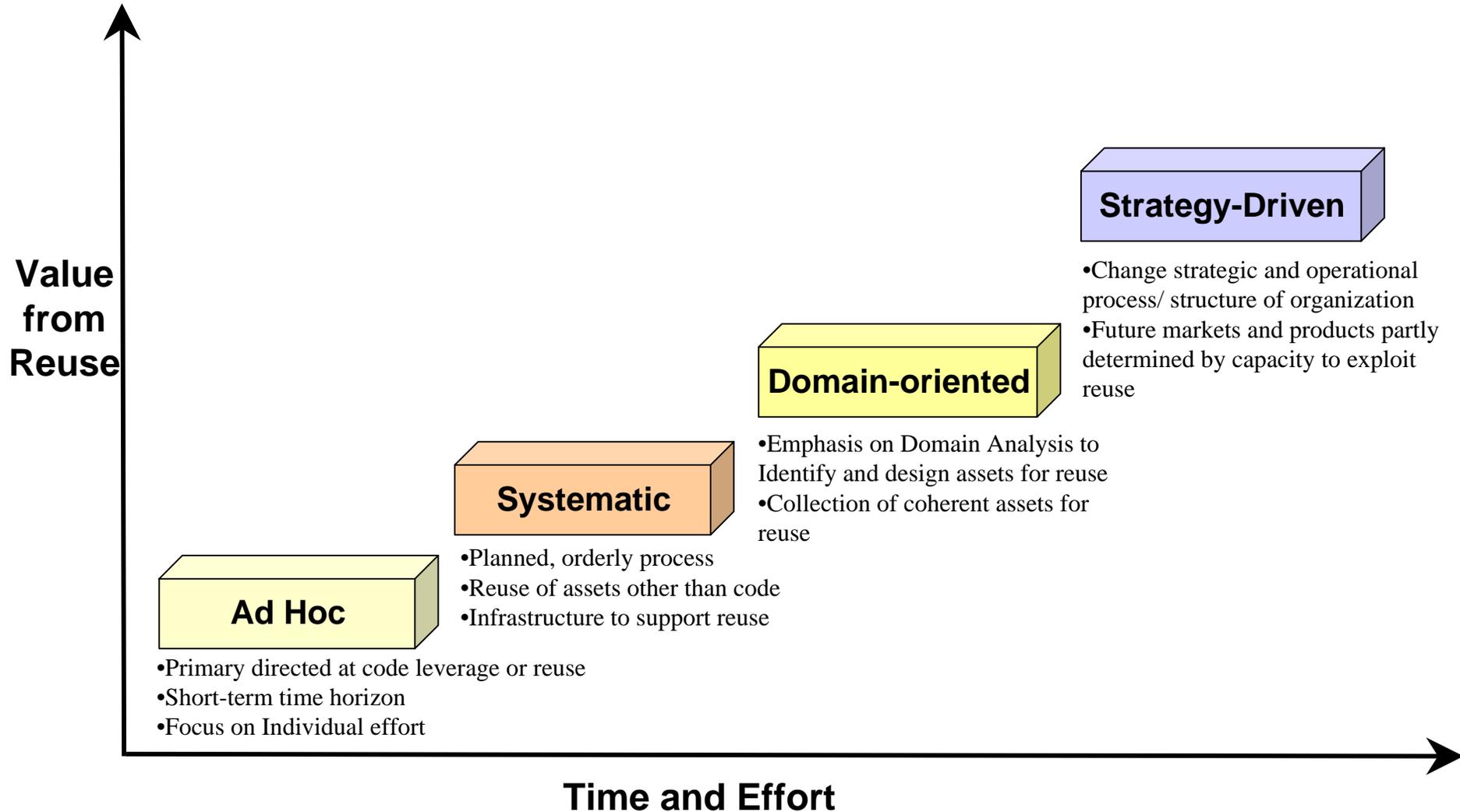


# Example of Reuse Vision and Mission Statement

- IBM – “To be the industry leader in providing and applying reuse technology and methodologies by developing tools, processes and parts for internal use with market potential” (IBM Reuse Program Poster, 1992)
- US Army Reuse Center – “The mission of the Army reuse Center is to develop, implement, maintain, and administer a total reuse program that will support the entire software development life Cycle” (Army Reuse Center Literature, 1993)



# UEA Level of Reuse





# UEA Asset Based Development Framework

## UEA Reference Model

- Business reference model
- Service component reference model
- Technical reference model
- Data reference model
- Security reference model

### Business Solution Architecture Workflow



1. **Primary:** SIRA, BA; **Assistants:** SA  
 2. **Primary:** SA; **Assistants:** SIRA, BA



Solution Architecture

### Application Family Architecture Workflow (optional)



3-8. **Primary:** AFA; **Assistants:** SIRA, SA  
 (scope is cross-application)



Application Family Architecture

### Application Architecture Workflow



3-8. **Primary:** AA; **Assistants:** SIRA, SA, AFA  
 (optional), SDM  
 (scope is application-specific)



Application Architecture

### Application Development Workflow



6-8. **Primary:** AD; **Assistants:** SIRA, AA, SDM



Application

Core Asset Development Workflow

Core Assets



CAP, AR, RC



Asset Certification Workflow

AR, RC



AL

## Asset Management



Enterprise Asset Repository



Application Asset Repository



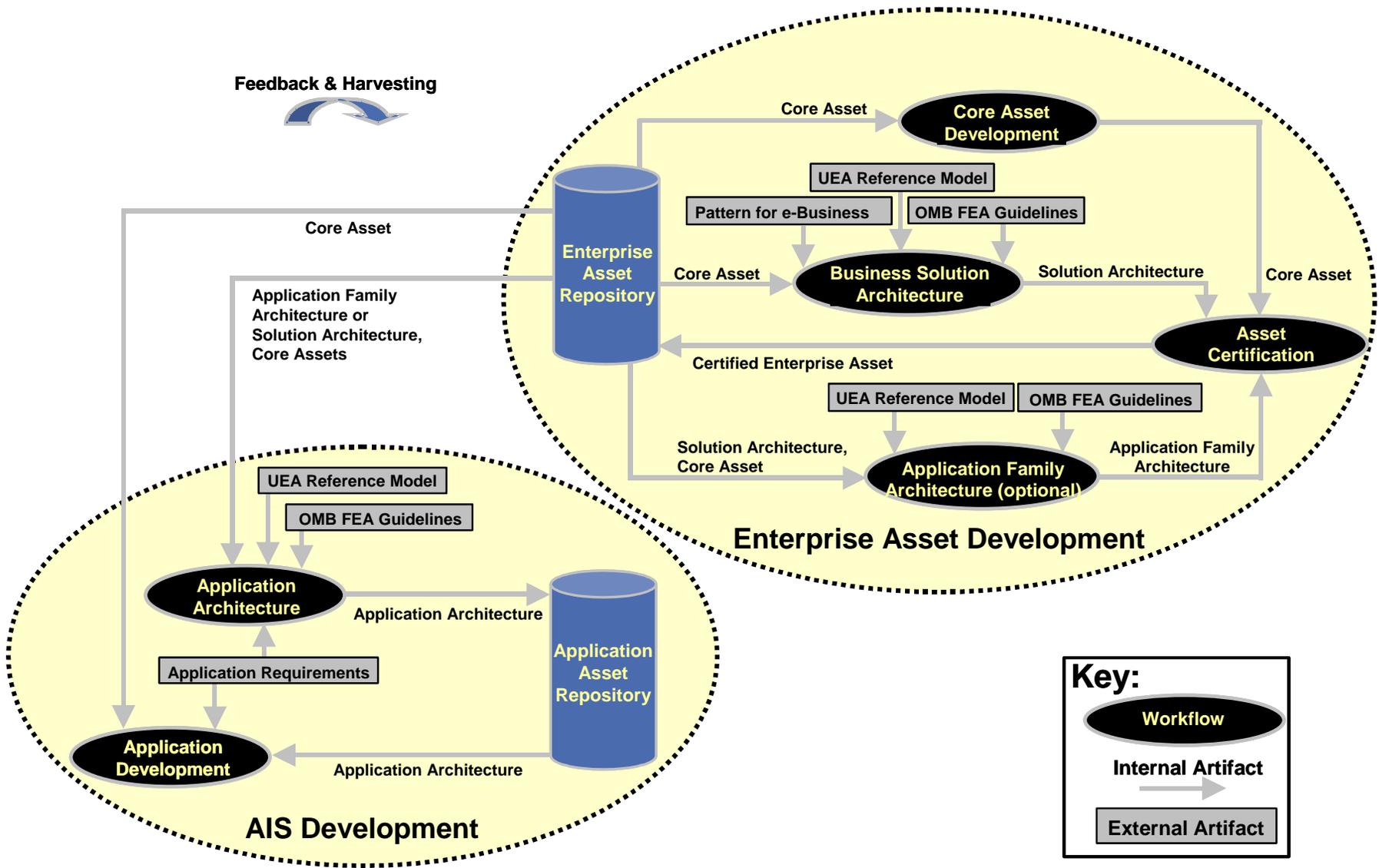
RC

## Reuse Management

Policies / Procedures / Guidelines



# UEA Artifact Centric Views of the ABD workflow





# Description of it's workflow

- *The Application Architecture workflow* takes the OMB's FEA guidelines, the UEA Reference Model, any existing AIS requirements, the Application Family Architecture (if it exists), or the Solution Architecture, and supporting Core Assets from the Enterprise Asset Repository, and produces the architecture for a specific Automated Information System (AIS). Any assets that are produced as part of the Application Architecture workflow, including the Application Architecture, are maintained in the Application Asset Repository. Certification is not required for application assets.
- *The Application Development workflow* takes any existing AIS requirements, the Application Architecture from the Application Assets Repository, and any supporting Core Assets from the Enterprise Asset Repository, and produces an Automated Information System (AIS). Any assets that are produced as part of the Application Development workflow are maintained in the Application Asset Repository. Certification is not required for application assets.



# Description of it's workflow - continue

- *The Core Asset Development workflow* produces in Core Assets that are certified in the Asset Certification workflow and then published in the Enterprise Asset Repository.
- *The Business Solution Architecture workflow* takes the current practices and requirements from the OMB's FEA guidelines and UEA Reference Model, applies the Pattern for e-Business, assembles some Core Assets from the Enterprise Asset Repository, and produces a Solution Architecture that is certified in the Asset Certification workflow and then published in the Enterprise Asset Repository.



# Description of it's workflow - continue

- *The Application Family Architecture workflow* takes the current practices and requirements from the OMB's FEA guidelines and UEA Reference Model and the Solution Architecture and Core Assets from the Enterprise Asset Repository, and produces an Application Family Architecture that is certified in the Asset Certification workflow and then published in the Enterprise Asset Repository.

Note: The Application Family Architecture Workflow is optional which means that an Application Family may not be created. An Application Architecture may be instantiated directly from a Solution Architecture. Even if Application Family Architectures are created, they may not be created up front, but instead may be harvested from a set of Application Architectures for which some commonality has been identified.



# *Questions?*

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**Daud.Santosa@USPTO.gov**