Joint Architecture Federation and Integration Tutorial

Building DoDAF Metamodel Compliant Services

Enterprise Architecture Conference
April 11, 2011
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USJFCOM

Agenda

- What you need to know beforehand
- Definitions of Federation
- Basic Process
- **Use Case Development**
- **Technical Development**
  - Understanding Architecture Tools
  - Data/Mapping to the DoDAF MetaModel (DM2)
  - Infrastructure
  - Web Service Development (SOA Concepts)
  - Configuration Management
  - Information Assurance
  - Validation and Verification (Testing)
- Deployment and Sustainment

What you need to know

- Joint Architecture Federation and Integration Project Documentation
- DoDAF Metamodel
- Database Modeling
- Service Orientated Architecture
- Web Application/Service Development
- XML
- Repository/Architecture Tool Data Schema
- What Data is being exposed?
- What is the purpose?

Federation vs. Integration

- Federated Architecture: A **loosely coupled** collection of information assets that accommodates the uniqueness and specific purpose of disparate architectures which allows for their **autonomy and local governance** while enabling the enterprise to benefit from their content. It provides an approach for **aligning, locating, and linking disparate architectures** and architecture information via **information exchange standards** to deliver a **seamless outward appearance** to users. (Global Information Grid Architecture Federation Strategy, Version 1.2, August 1, 2007).

- Integrated Architecture: An architecture where architectural data elements are **uniquely identified and consistently used** across all products and views within the architecture (DoDAF).

Federation Outline

- Each federated environment maintains autonomy and local governance (Local Sheriff)
- Federated Environment manages overarching governance (*loosely* coupled)
  - State Troopers: i.e. If you want to travel outside your local environment on the highway these are the rules
- Responsible for enforcement of:
  - Data standards/Exchange Standards
  - Configuration Management of the federated environment
  - Web Service/Information exchange Standards
  - Rules for federating information together
  - Federated Portal

Integration Outline

- Everything within the integrated environment is standardized: *Almost "Hard Coded" interoperable*
  - Tightly coupled data and processes. Examples:
    - All architectures built from single catalog of architecture elements
    - Traceability to same library of Authoritative Sources
    - Tightly coupled traceability to other objects across environment
    - Follow same rules and processes for architecture development
  - Level of integration can vary based on internal needs
- One governing body that establishes rules for entire environment

What needs to be decided?

- What needs to be federated and what needs to be integrated?
  - What level of federation?
  - What level of integration?
- Define seams and boundaries for the environment (Security Issues)
- Roles and responsibilities for:
  - Each data repository
  - Information flows between tools (web services or direct data transfers)
  - Configuration Management
    - Required for each aspect of the environment
  - Requirements/Processes/SOPs, etc.
    - Needs to be coordinated and consistent

Two Development Tracks

- **Methodology Development**
  - Use Case Development
    - JMTs
    - IAMD
    - JCIDS Architectures
  - Processes for architecture data Federation and Integration
  - Processes for developing architectures to support federation (DoDAF)
- **Technical Solution Implementation**
  - DoDAF MetaModel web services
  - Integration of NCES services
  - Federation of architectures/data to other authoritative sources of information

Architecture Federation is NOT about building better Architects.

*Enhances the **speed and agility of well-informed decision making** through rapid availability and re-use of architectures/data*

Important Notes!!!

- Don’t rush to a product that cannot be scaled/reused
  - Do it right the first time
  - Solve the right problem correctly
- Much time in the federation project has been spent developing requirements, methodologies, processes to clearly understand what needs to be done

Lessons Learned

- This is not a technical hardware/software problem
  - Most of the work is in process and methodology
- Words are important but do not get in an infinite do loop arguing about semantics i.e. What do you mean by federate, capability, etc…?
  - Requirements provide the definitions
- Architecture environments are not built equally
  - Each presents its own set of unique challenges for federation
  - As issues are overcome, knowledge base expands and process gets easier

Basic Process

Step 1 - Determine Area of Interest: Understand current policy, guidance, standards and Architecture Federation requirement

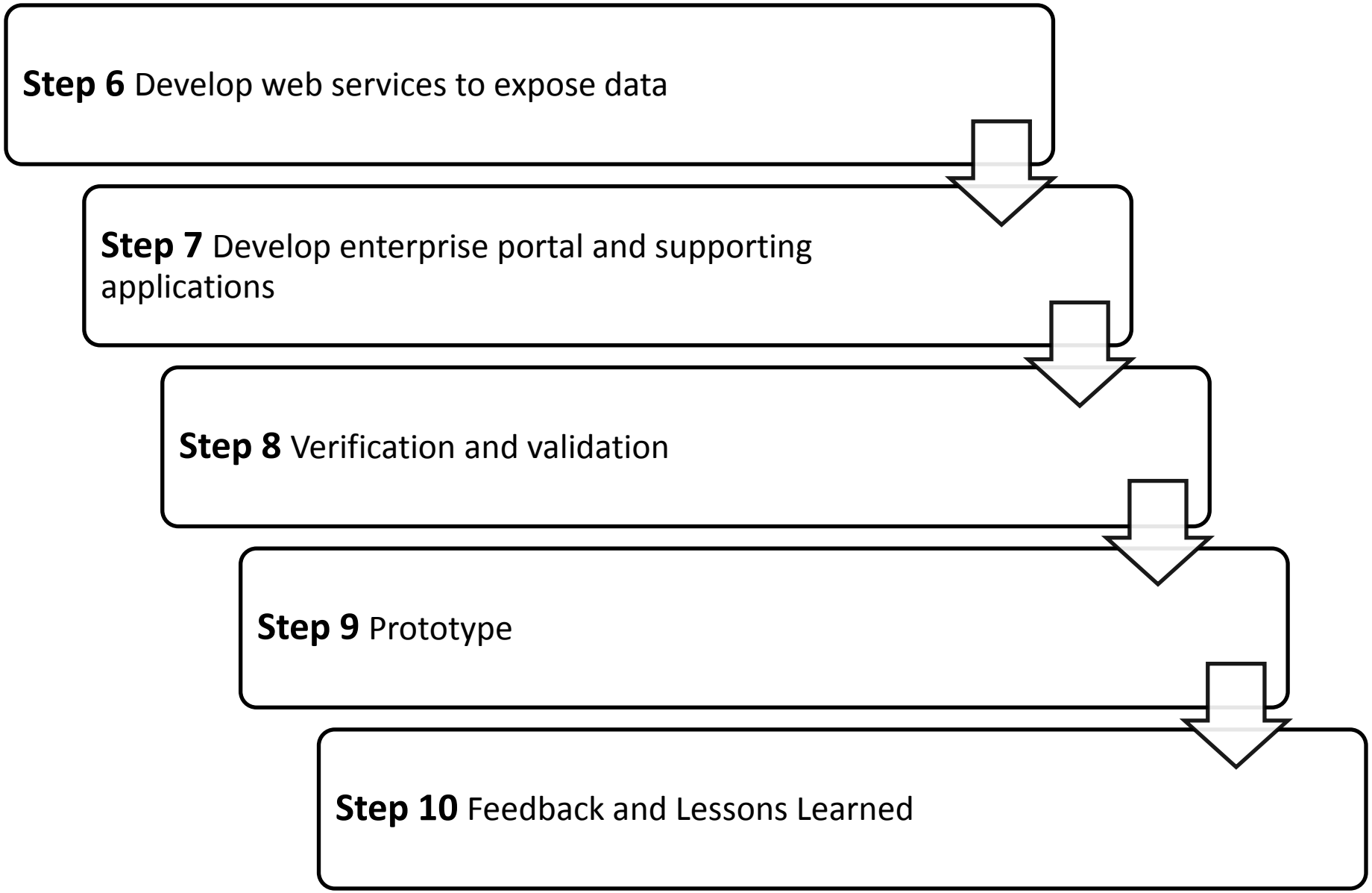
Step 2 - Establish Use Cases: Identify Stakeholders. Solve the right problem.

Step 3 – Leverage!: Identify work already completed that can be leveraged to support project

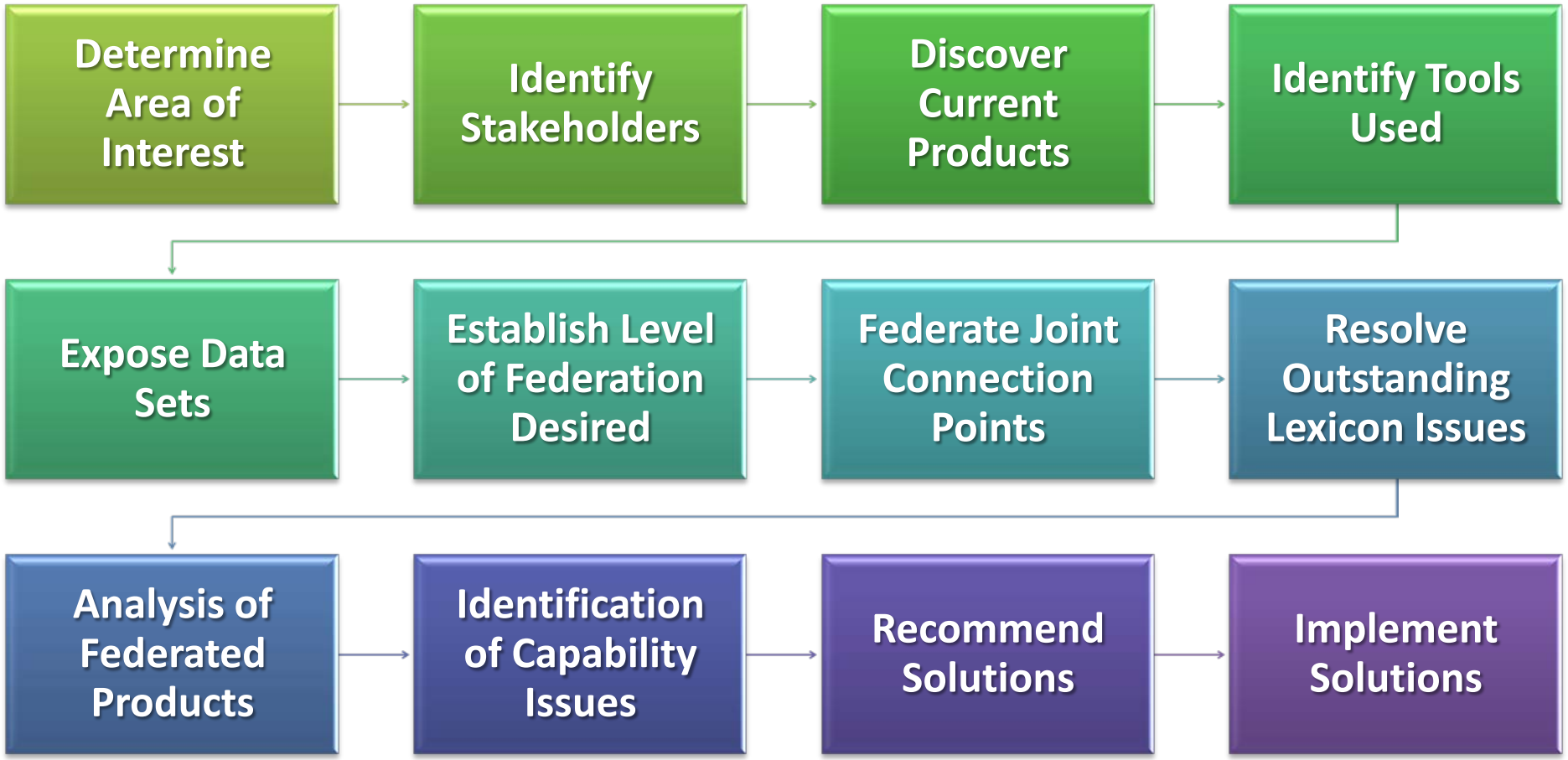
Step 4 Identify data sets to be used for development

Step 5 Establish development environment to support effort

Basic Process



Federation Process



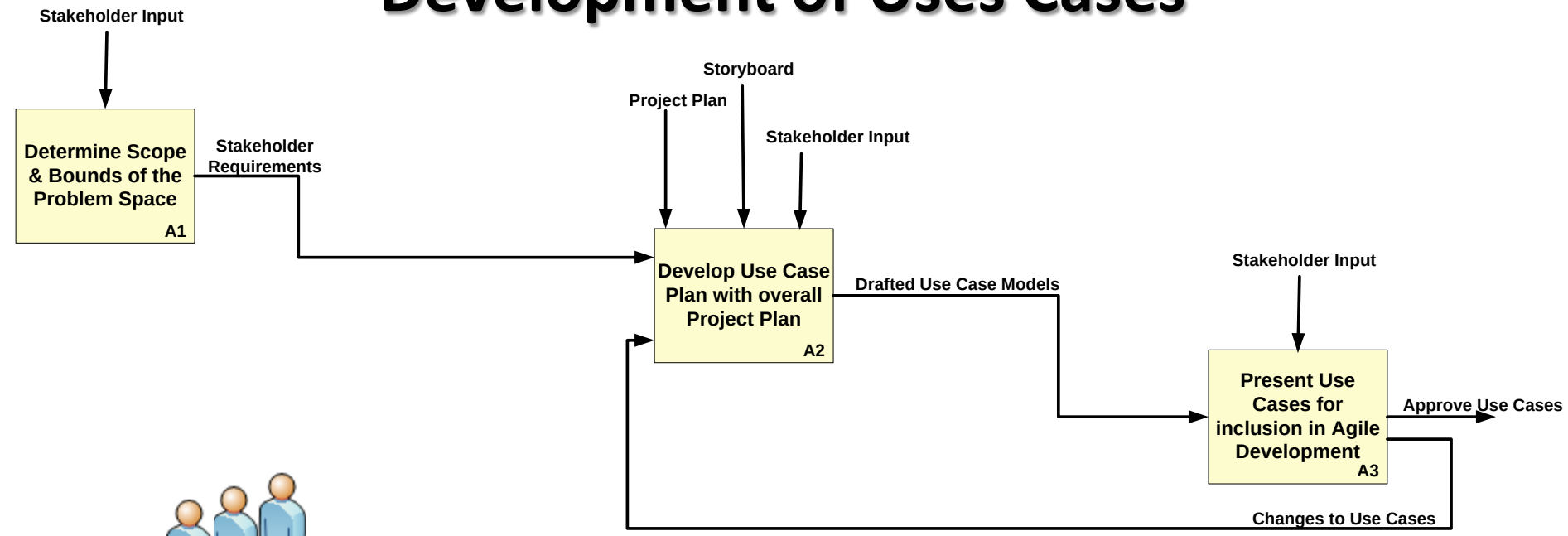
Step 1 – Determine Area of Interest

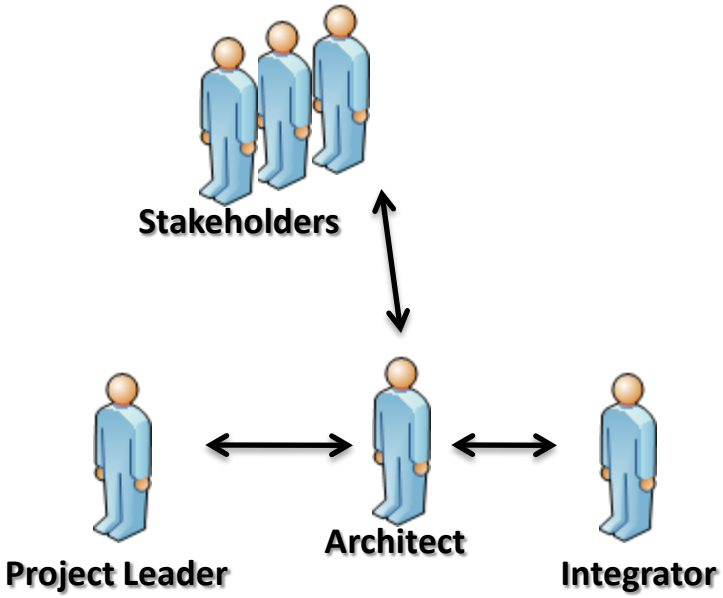
- What are you trying to Federate?
- What is the Purpose?
- Do you understand all the Guidance?
  - DoD and Federal Guidance
  - Information Sharing Strategy
  - Data Strategy
  - Web Service Strategy
  - JAIWG Federation Guidance
    - Federation Project Plan: Mission, Vision, Goals and Objectives
    - Configuration Management
    - DoDAF Metamodel

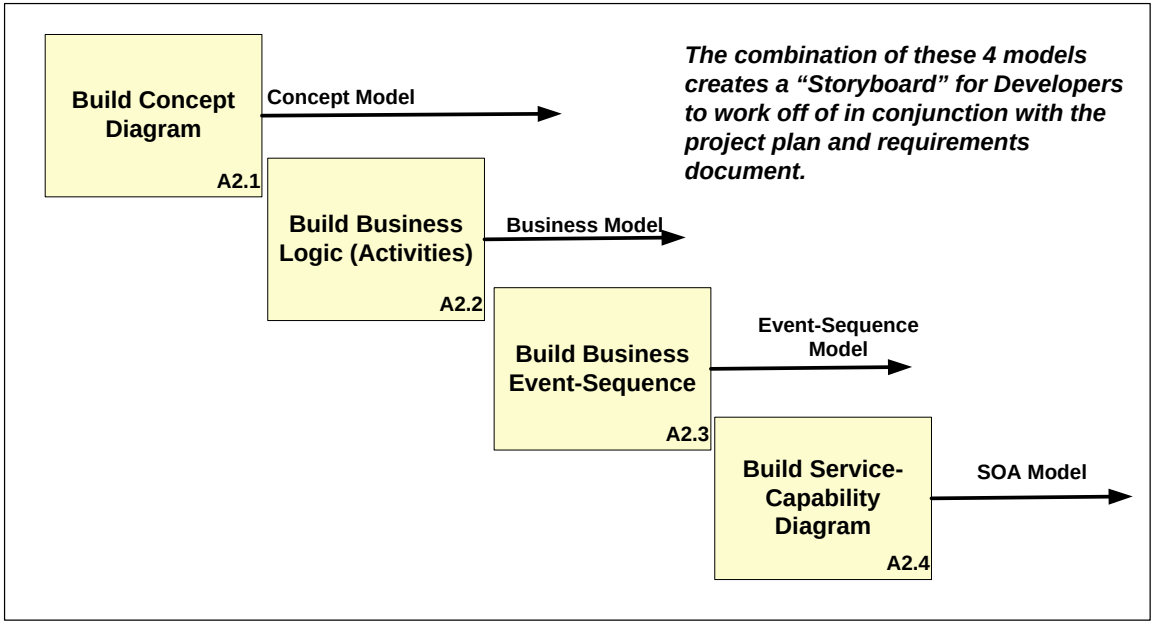
Step 2 – Establish Use Cases

- Who are going to be the customers of your work?
- Build the Use Case
  - Most Critical Piece of Development
  - ***If this is incorrect, the whole process falls down***
- Engage stakeholders early and often
- Ask lots of questions
  - Many stakeholders cannot clearly articulate requirements to a level sufficient for development

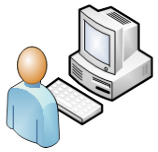
Development of Uses Cases







How Architecture Federation and Integration Helps Decision Makers
(Capability Analysis, Development and Integration)



Warfighter generates a requirement. Organizations need to ask a series of questions

Users

- Acquisition Organizations
- Service SYSCOMS
- Certification and Testing Organizations
- Exercise Planners
- Program Managers
- System Developers/ Engineers

Sample Questions Based on User-Defined Requirements for Federation

- What function descriptions most closely match the requirement?
- Is there a current function that matches or closely matches the requirement description?
- Are there current capabilities, systems or services performing that function?
- What are the differences in functionality between the various capabilities, systems, versions, blocks, etc?
- What other systems/ services does the capability interact with?
- What activities are currently supported by those functions?
- How is that capability currently being used (Operational Context)?
- What are the information exchanges being performed?
- What are the information needs?
- What are the data exchanges being performed?
- Is anyone currently producing the authoritative data required?
- Are data and information exchanges meeting standards?
- Has the capability been tested for Joint Interoperability to a common Joint operational context and measures?

Is there any capability, service, or system that can meet the warfighter requirement?

What is the DOTMLPF-P way ahead to meet the warfighter requirement?

Portal

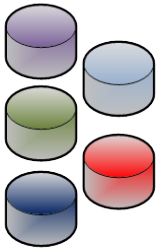
Joint Architecture Federation Environment

DoDAF MetaModel enabled Web Services provide the ability to query multiple federated architecture repositories and authoritative sources of information

NCES Services to provide discoverability, security, etc

Standardized portal interface allows users to access data in reusable formats

Repositories



Federated Architecture Repositories

JCIDS Document Repositories (CDTM/E-ISP)

Other DoD Repositories of Information

Architecture Products and Data Examples

Functions	Functions and Capabilities	Systems and Services	Functions to Activities	Operational Activities, Performers	Operational Resource Flows	System/ Service Resource Flows	Standards	Joint Operational Mission Context
SV-4 SvcV-4	SV-4 SvcV-4 CV-7	SV-1* SvcV-1	SV-5 SvcV-5	OV-5b* OV-6c CV-6	OV-2* OV-3	SV/SvcV-2 SV-6 SvcV-6	StdV-1	JMTs (*Tier 1 JMT Data)
JCSFL	JCA's			UJTL, Service Task Lists			C2-Core UCore	Certification Results
	JCIDS Documents CDTM/KMDS					E-ISP		
Requirements sources (NRID, IPLs, JUONs)						ADS-Registry	DISR DITPR	Test and Evaluation Tools

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Joint Architecture Federation and Integration Project

Step 3 – Identify work for Reuse

- Discover what data and architectures are out there that support your work
- What are the data sets?
- What are the tools used to create the data?
- Is the data accessible via services?
- Traceability to Authoritative Sources
  - Official Documents
  - Joint Approved Architectures (JSAP/JROC)
  - Component Approved Architectures
- Configuration Management (Version Control)

Step 4 – Identify Data

- Need to have a clear understanding of data to be exposed and structure
- Does root data have necessary properties to support DM2 exchange
  - Classification Markings on all objects
  - Configuration Management attributes
  - Relationship structures properly developed in architectures (DoDAF 1.5 or 2.0)

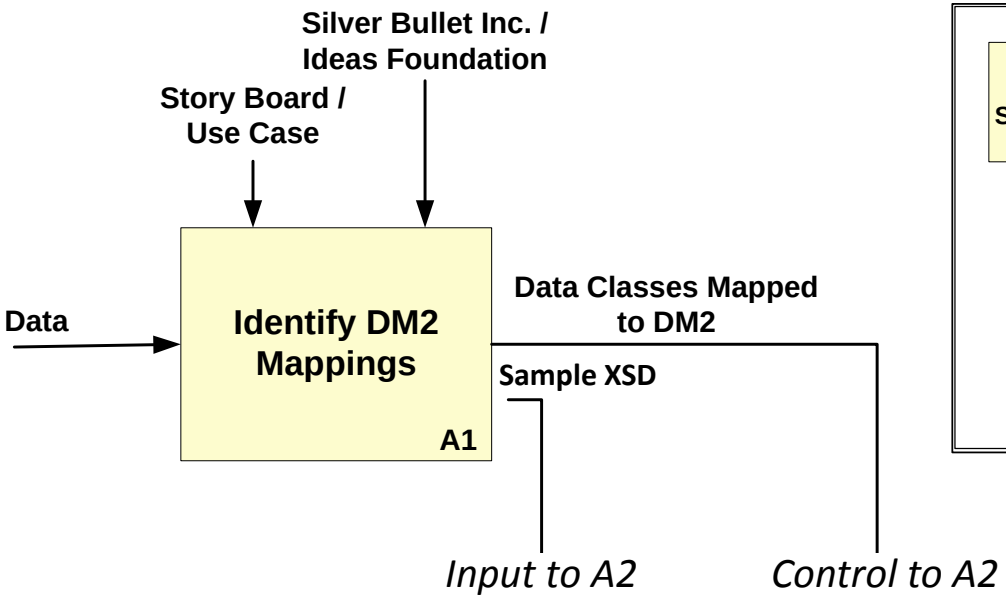
Step 5 – Development Environment

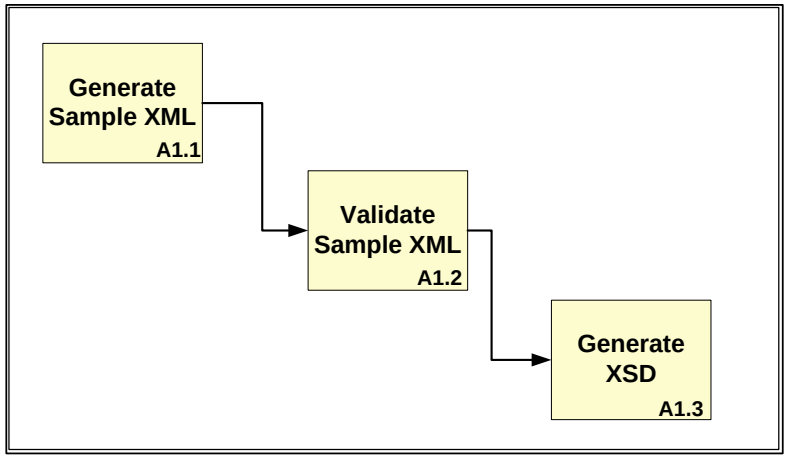
- Two Parts:
  - What tools were used to build the data sets?
  - What tools are going to be used to expose the data sets and federated the data?
- Majority of architects use a couple of tools
  - There is a large variety of tools for specialized purposes
- Need to understand the capabilities and limitations of the tools
  - Schema
  - License Agreement Details
- Tools may support DoDAF 2.0 views, but do they support the DM2??

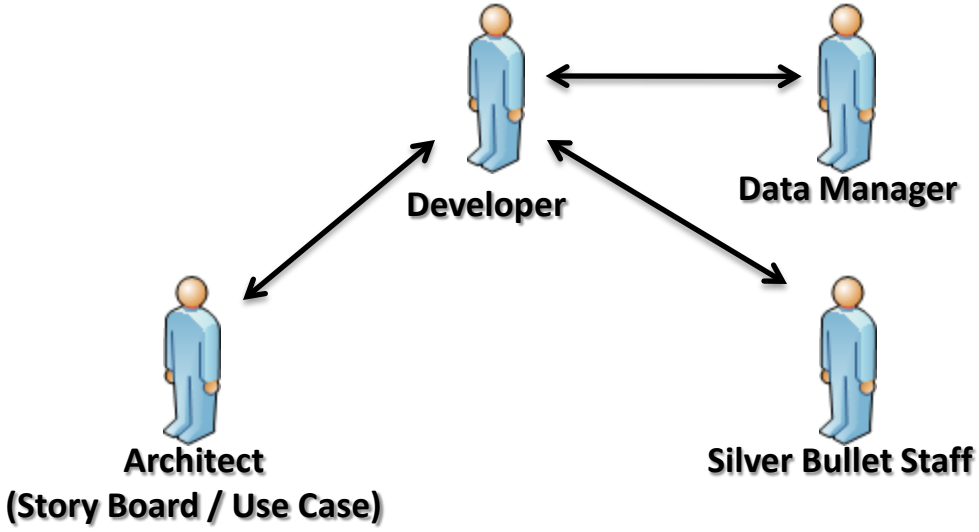
Step 6 – Build the Web Services

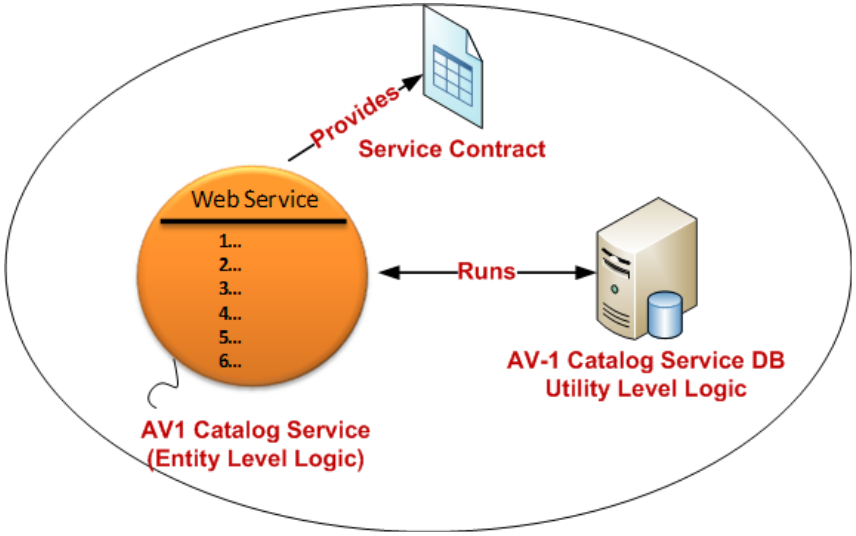
- Your own data needs to be normalized
  - Under version control: Critical that data is configuration managed!!!
- DM2 Web Service Development
- Programming Languages WCF, REST, JAVA

Step 1: Mapping Your Data to the DM2









Step 6 (cont)- Level of Federation

- Three clearly identified types of federation
  - Aliases
  - Hierarchal
  - Information/data flow
- All three relationships are described in the DM2

Aliases

- Two types that have different names but directly refer to the same type of “object”
- Federation is possible by:
  - Creating a master list then mapping the two distinct objects directly to the master
  - Creating a “like” relationship
- Most complicated of all relationships when semantic alignment is necessary
- Most simplistic relationship when naming and definitions are identical (i.e. system names)

Hierarchal

- Objects are part of a hierarchal relationship
  - i.e. UJTs - Service Tasks, JCSFL – Service Functions, Joint Activities – Service Activities
- Very straightforward. Many relationships of these types are vetted and approved.

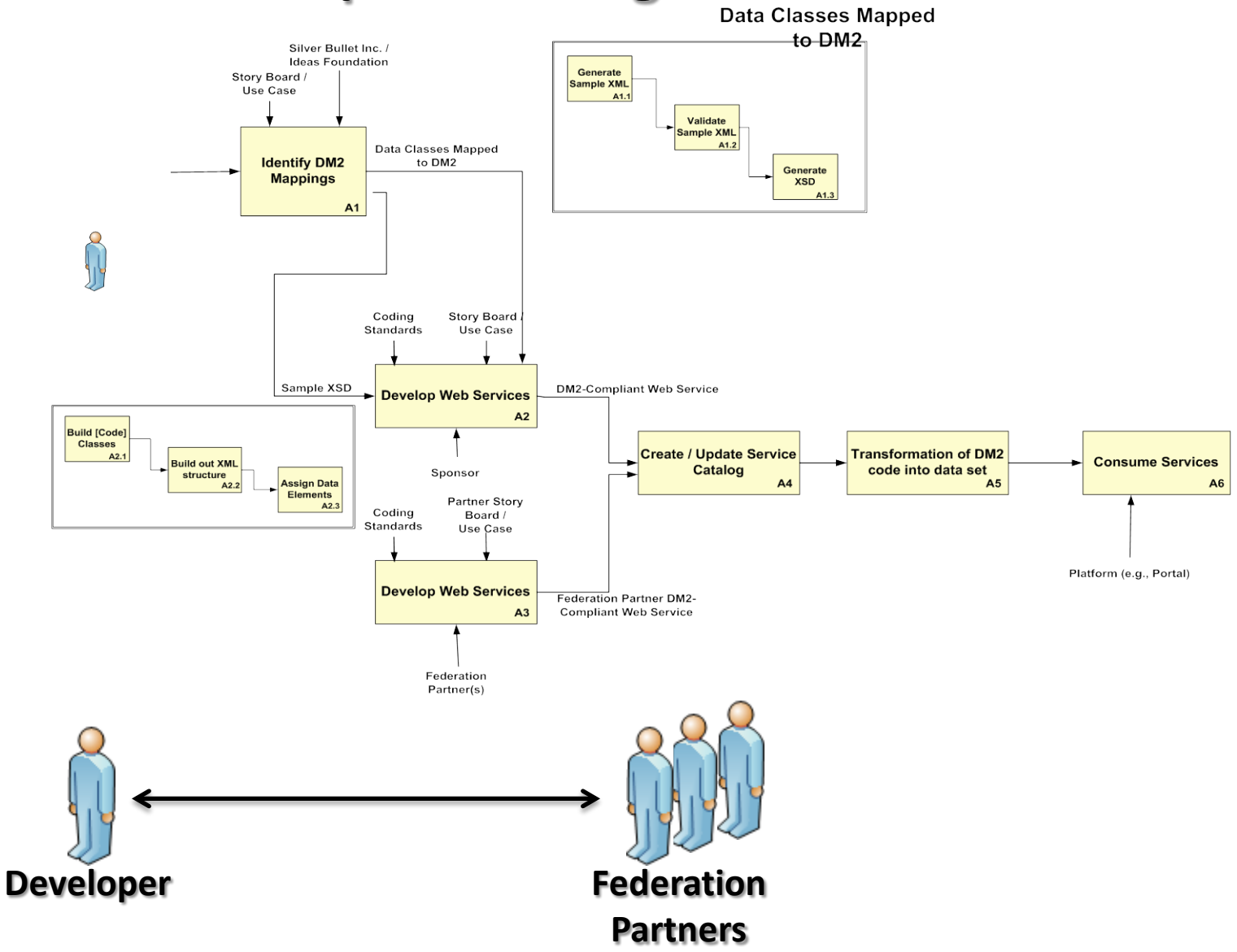
Hierarchal -Federate to Logical Connection Points

- Many approved **authoritative** lexicons currently exist
  - JCAs UJTs, JCSFs, Service Tasks, Service Functions, Joint Pubs
- New authoritative lexicons are being created
  - i.e. Joint Mission Threads
- These authoritative Joint Lexicons provide the core for initial federation work
- Using DM2 relationships built into web services, this provides immediate horizontal and vertical traceability

Information/Data Flow

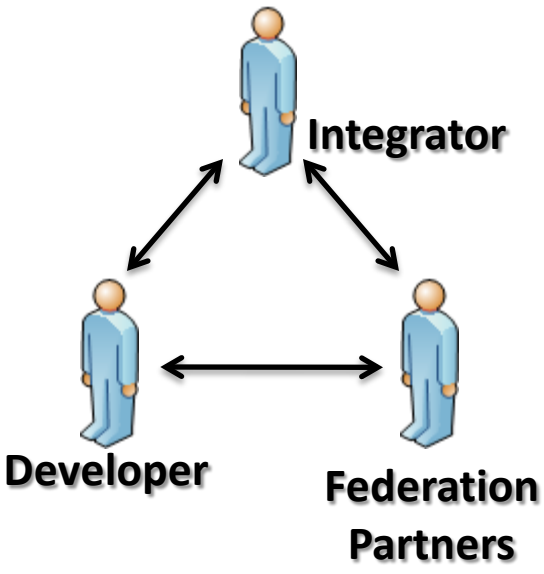
- Information/Data flows from one architecture to another
- Architectures do not overlap but connect together
- Could be phased (timing) and/or input-output
- “Ideal” of where federation needs to get to

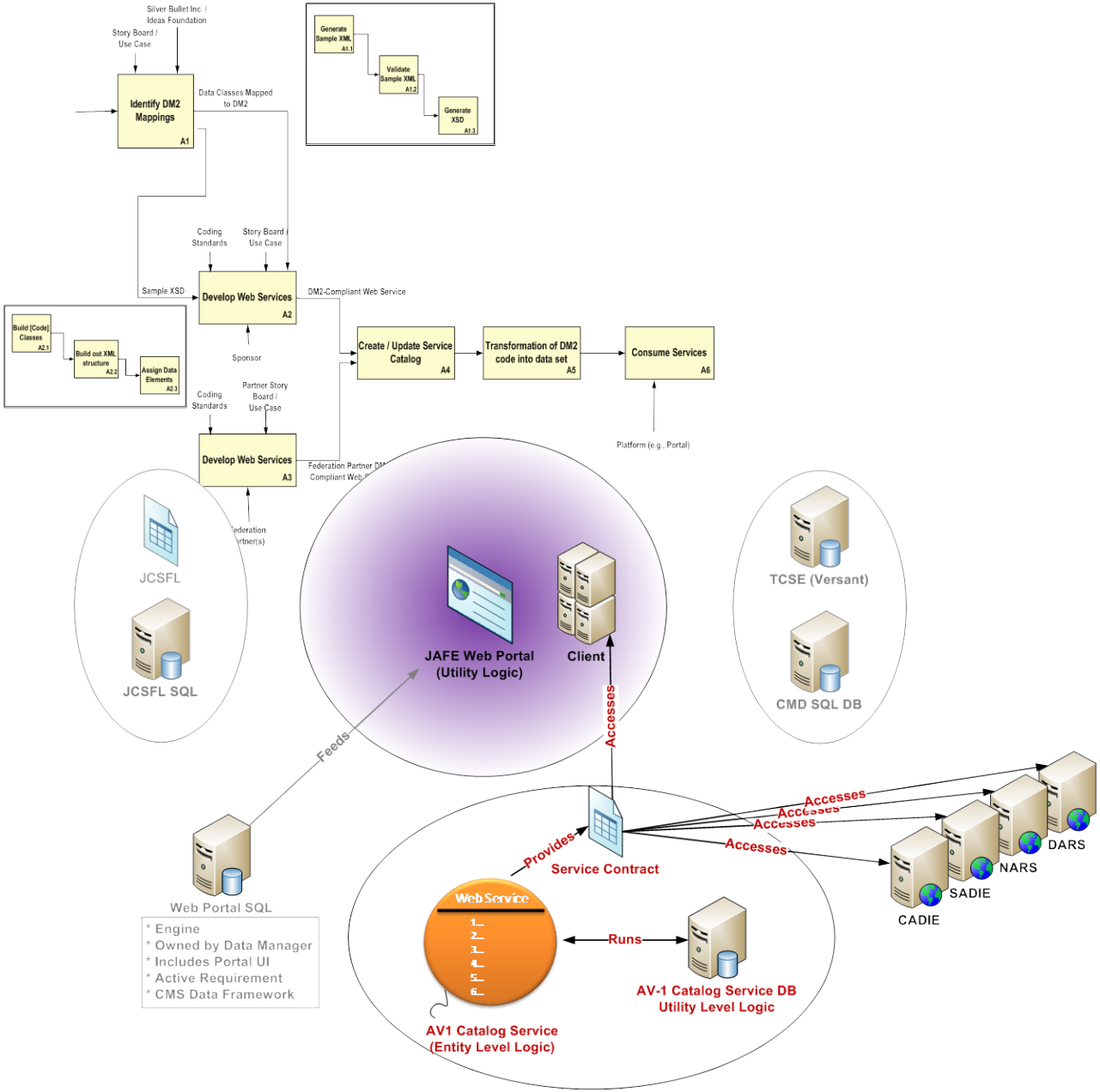
Step 2: Working With Your Partners



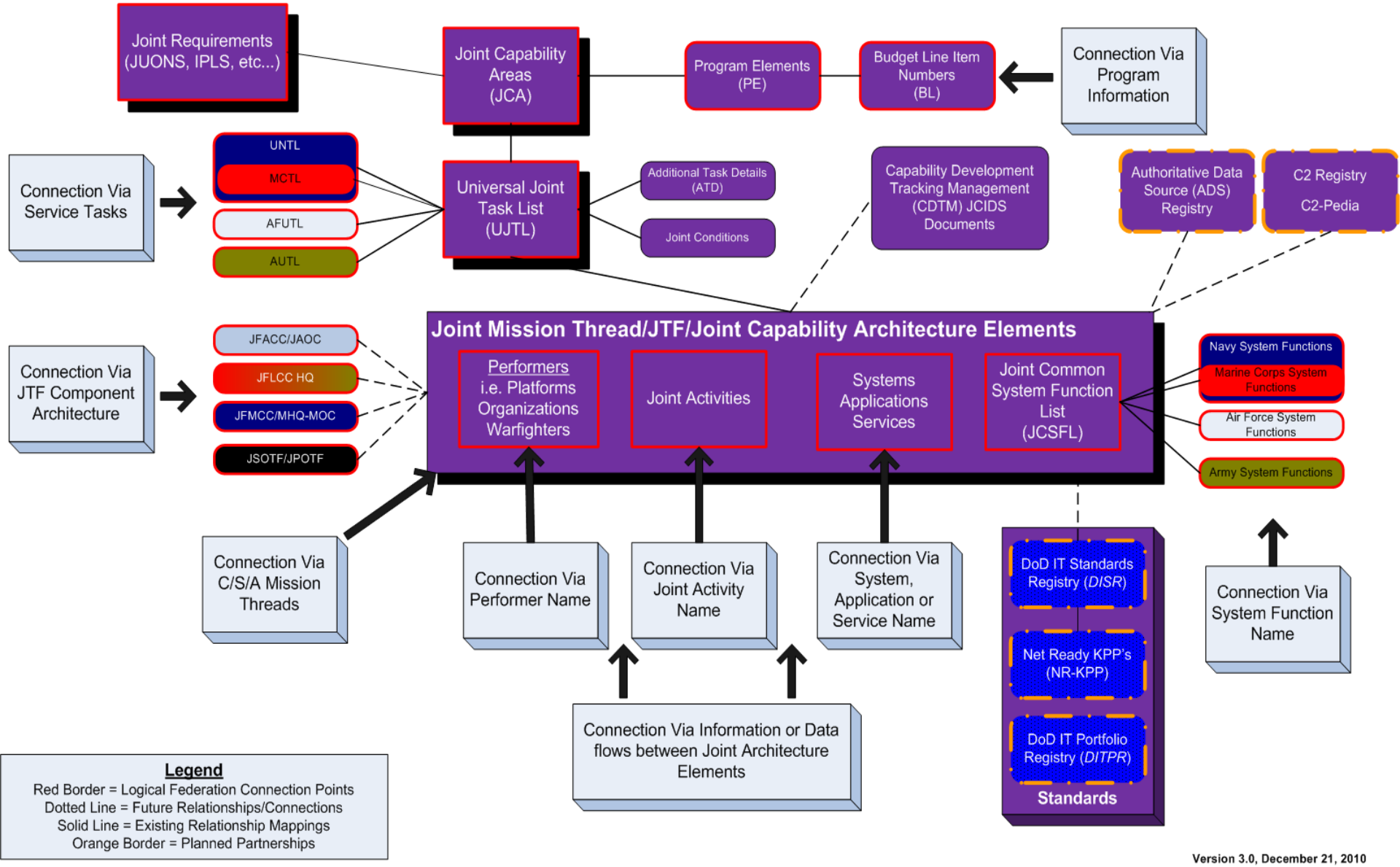
Input to A5

Step 3: Catalog, Integration, Consumption





Architecture Federation to the Joint Environment



Step 7 – Standardized Interface

- Customers have a requirement to use a standard interface for accessing information
- How you present the information is critical
- Do NOT recreate already existing capabilities
  - Automated links to where architectures reside in component repositories
- NOTE: Component Repositories need to ensure that they meet DoD guidance for Information Sharing

Joint Architecture Federation and Integration Project (JAFIP) Site

- Joint Mission Threads
- Architecture Projects
- JCIDS Reviews
- Joint Common System Function List
- Joint Architecture Development
- Joint Command and Control (C2) Objective Architecture
- Joint Architecture Federation and Integration Project

The Department of Defense (DoD) has embraced architectures as a rigorous means to analyze complex organizational relationships to support capability area assessments used by senior leadership to make decisions and recommendations. Complete understanding of a process, its required information flow, supporting systems, and communications capabilities ensures more accurate assessments of associated dependencies, shortfalls and overlaps. In this way, both material and non-material recommendations can be analyzed before they are instituted, and their impacts across the entire enterprise evaluated before they are enacted. The DoD Architecture Framework (DoDAF) provides guidance for architecture development.

As USJFCOM's Chief Architect, the J89 Division has the responsibility to plan, coordinate and implement joint integrated architecture efforts as directed by the Department of Defense. In order to accomplish this, the Joint Architecture Integrated Working Group (JAIWG) was established and is chaired by the J89 Division.

The JAIWG provides the forum to address the integration and management of relevant architectures across all Military Services and the DoD. Membership includes operational, systems, and technical architecture leadership and action officer representatives from the C/S/As, Joint Staff, Office of the Secretary of Defense, other DoD organizations, and the Business Transformation Agency. The JAIWG membership examines issues important to all DoD architecture developments and identifies best practices to promulgate as guidance to the community.

Point of Contact:

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News and Updates

Upgrade in Progress

Version 0.5 of our portal is now deployed. This includes a DM2 compliant web service to feed our catalog of Joint Mission Threads and Architecture Projects. We continue to work to expand the capability to assist our customers. Any feedback or questions about site design should be directed to the project lead, William Piazza at william.piazza@jfcom.mil

Step 8 – Validation and Verification

- In some cases, there is no direct means to federate
  - Different Lexicons, Different levels of decomposition, etc…
- In these cases work needs to be done to map data to a common framework
  - Sometimes the framework needs to be built (JMTs, Reference Architectures)
  - Takes time and effort
- More important to build with federation in mind (reuse of existing data)

Step 9 - Prototype

- Is the federated output meeting the needs of the stakeholders?
- Does the output answer the stakeholders questions?
- Federation can show gaps, overlaps, and inconsistencies in architectures
- What are the critical issues and gaps that need to be worked to better answer stakeholder questions?

Implement

- Agile development cycle
- Sprints to meet specific development goals
- Architecture Federation is a large effort touching many data sources
  - Cannot be done overnight
  - Need to lay the critical groundwork to be scalable and reusable

Step 10 – Feedback and Lessons

- Working with stakeholders identify areas and provide recommendations on where to improve
- Feedback from stakeholders is critical to improve the process

Federation Rules of the Road

- Not a technical hardware/software problem
- Configuration Management of data critical
  - Version Numbers and Dates
  - Traceability to Authoritative Sources
- Security versus Information Sharing
  - Need to clearly understand the information needs of the stakeholders and balance against security
- Need to participate
  - Meetings DCO/Telcon
  - Virtual Teaming
    - SoftwareForge https://software.forge.mil/sf/sfmain/do/viewProject/projects.joint_architecture_integration_w
    - DCO Chat
    - Sandbox that allows for virtual collaboration SADIE Development Environments

What Needs to be Done

- “Mapping” of various repository data sets to DM2
  - Lots of reuse!!
- Expose important legacy products and make available for reuse
- Continued development and expansion of use cases
- Architectures need to be built with clear understanding of the architectures they need to interact/be interoperable with
- “Fit for Federation” needs to be better defined

Challenges Ahead

- Guidance is Inconsistent
  - De-confliction/consistency required
- Security: NIPRNET versus SIPRNET
- Leadership Support in Resource Constrained environment
  - Priorities/Efficiencies
- Great architecture data/information exists in many repositories
  - Just need to get it exposed to the federated environment
- Resources
  - Virtual Teaming and DoD-wide collaboration tools are essential
- Expectation Management
  - Solutions are available, implementation requires dedicated resources

Web Service Example

DM2 Compliant AV-1 Catalog Service

- Fundamental piece of DM2 web service development
  - Where do architectures reside?
  - What architectures contain the objects?
  - What architecture views use the objects?
- Key Tenet: Do not recreate data that already resides in exposed repositories!!!

Provide a Common Framework

- Need to have a common middle ground.
- Most repositories share a common set of attributes
- Some core information is necessary to meet basic information sharing requirements

Data Element Name	Definition	DM2 Mapping	Ideas Foundation	JAR	JACAE	DARS	NARS	CADIE
AV-1 Details								
Architecture Name	Identifies the name or title of the Architecture	Project	Individual	X	x	x	x	x
Architecture Description	Describes an overview and summary of the architecture similar to an executive summary	Architectural Description	IndividualType	X	x	x	x	x
Architecture Type	Identifies the category type of Architecture (i.e. JMT Tier 1, Enterprise Architecture, JCIDs, etc.)	ProjectType	IndividualType	X			x	
Version_Number	Number assignment associated with the versioned document	Name NamedBy	IndividualType	X	x		x	x
Version_Date	Date of the version	Measure MeasureTypeUnitsOfMeasure	IndividualType	X	x			
Version_Type	Identifies the category type of the version (i.e Draft, Final, etc.)	Name	IndividualType	X	x	x		x
Architecture Sponsor Name	The Name of the Government Representative sponsoring the Architecture Project	PersonRoleType IndividualPersonRole	IndividualType Individual	X	x	x	x	x
Architecture Sponsor Organization	The Organization of the Governement Representative sponsoring the Architecture Project	OrganizationType Organization	IndividualType Individual	X	x	x	x	x
Architecture Sponsor Phone Number	The phone number of the Governement Representative sponsoring the Architecture Project	Address	IndividualType	X	x	x	x	
Architecture Sponsor Email Address	The email address of the Government Representative sponsoring the Architecture Project	Address	IndividualType	X	x	x	x	
Architecture Approval Authority	Name of organization(s) approving the architecture	OrganizationType Organization	IndividualType Individual	X	x	x		x
Approval Date	Date of approval	Measure MeasureTypeUnitsOfMeasure	IndividualType	X	x	x		x
Architecture Classfication	Identifies the overall Classfication level of the Architecture	ism:classification		X	x	x		x
Architecture Classification Dissemination	Identifies the authorized Dissemination control portion mark for the Architecture	ism:disseminationControls		X	x			
Architecture Classfication Releasability	Identifies the authorized tri-graphic code of the countries to which the Architecture content can be released	ism:releasableTo		X	x			
AV-1 Document Location	Location of the AV-1 document soft copy (URL)	LocationType Location	IndividualType Individual	X			x	x

Create XML

- Translate to meet standard .xsd

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<Address exemplar="**Sponsor Email**" id="Address5.2"
ns1:FoundationCategory="IndividualType">
<ns1:Name exemplarText="**lee.meador@jfcom.mi**l" id="Name25.2" />
</Address>
<OrganizationType id="OrgType1.2" ns1:FoundationCategory="IndividualType">
<ns1:Name exemplarText="**Sponsoring Organization**" id="Name22.2" />
</OrganizationType>
<Organization id="Organization1.2" ns1:FoundationCategory="Individual">
<ns1:Name exemplarText="**Joint Personnel Recovery Agency, US Joint Forces Command**," id="Name23.2" />
</Organization>
<typeInstance tuplePlace1="OrgType1.2" tuplePlace2="Organization1.2"
ns1:FoundationCategory="typeInstance" />
<OrganizationType id="OrgType2.2" ns1:FoundationCategory="IndividualType">
<ns1:Name exemplarText="**Approval Authority**" id="Name26.2" />
</OrganizationType>
<Organization id="Organization2.2" ns1:FoundationCategory="Individual">
<ns1:Name exemplarText="" id="Name27.2" />
</Organization>
<typeInstance id="TypeInst8.2" tuplePlace1="OrgType2.2" tuplePlace2="Organization2.2"
ns1:FoundationCategory="typeInstance" />
<Measure id="Measure3.2" numericValue="" ns1:FoundationCategory="IndividualType">
<ns1:Name exemplarText="**Approval Date**" id="Name29.2" />
</Measure>

<typeInstance id="TypeInst9.2" tuplePlace1="MTUOM1.2" tuplePlace2="Measure3.2" />
<Name exemplar="**Unclassified**" id="Name30.2" ns1:FoundationCategory="IndividualType" />
<namedBy id="NamedBy6.2" tuplePlace1="Project1.2" tuplePlace2="Name30.2" ns1:FoundationCategory="namedBy" />
</IdeasData>
</IdeasEnvelope>

Expose Service

- Services can use any technology REST, SOAP, WCF, as long as the data uses a common .xsd

Consume Service (Federate/Integrate)

- JAFIP provides the hub for bringing the information together in an integrated portal
- O.H.I.O. (Only Handle Information Once)

JMT Example

15 Minutes

Summary

- Basic Knowledge Necessary prior to start
- 12 Step Process
- Use Cases
- Technology
- Virtual Collaboration
- Lots of work available for reuse

More Information

- **Joint Architecture Federation NIPR Portal**
  - https://sadie.nmci.navy.mil/jafe
- **Joint Architecture Federation SIPR Portal**
  - https://jacae.jfcom.smil.mil/sjafe
- JAIWG JKO Portal
  - https://www.us.army.mil/suite/page/512915
- JAIWG Federation Working Group JKO Portal
  - https://www.us.army.mil/suite/page/596533
- IAMD Use Case Description
  - https://www.kc.army.mil/wiki/JAIWG_Architecture_Federation_and_Integration_Project_%28JAFIP%29/Integrated_Air_and_Missile_Defense_Use_Case
- **SoftwareForge.mil Technical Development Environment**
  - https://software.forge.mil/sf/sfmain/do/viewProject/projects.joint_architecture_integration_w

Back-ups