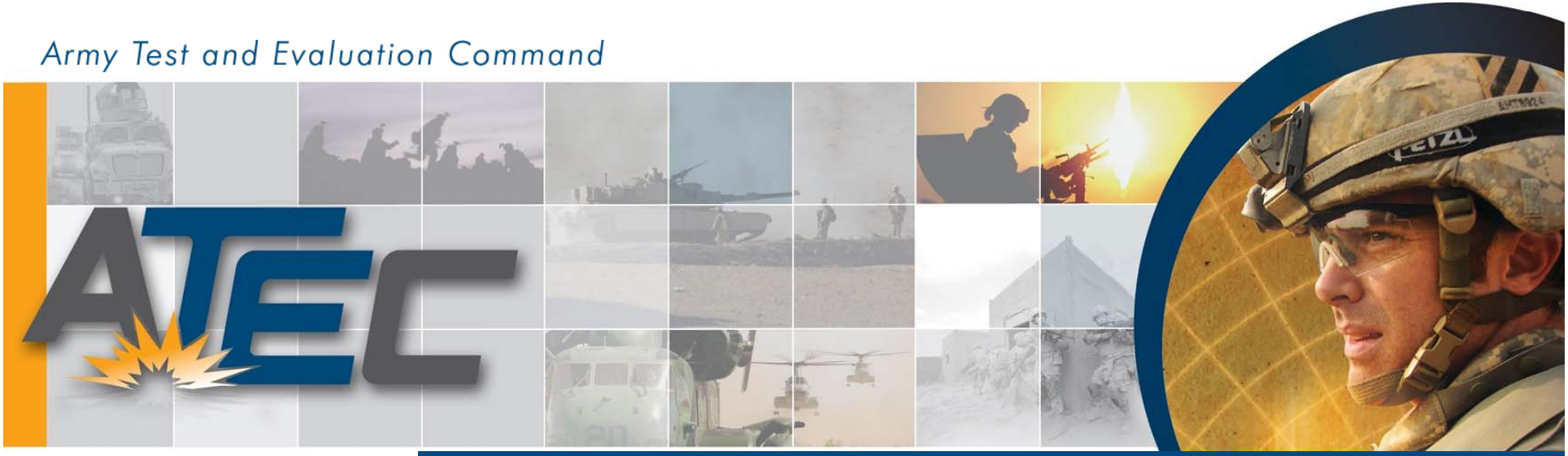
Army Test and Evaluation Command



Highlights of ATEC's Net Centric/Data Centric Architecture

OSD SE Collaborators Information Exchange

Bob Aaron, 1 June 2010

Army Proven Battle Ready

Briefing Outline

- Policy Basics
- Architecture Concepts & DODAF
- Highlights of ATEC's Data Centric Architecture
- Summary & Recommendations

Policies Driving NR KPP

Title X, USC — Operational Effectiveness and Suitability

Clinger-Cohen — Federal IT Acquisition and Management Process

Acquisition Process — *Revised DoD 5000 series*

DODAF — DoD Architecture Framework

IT and NSS Interoperability and Supportability — *DoDD 4630.5*

DoDI 4630.8 — IT and NSS Interoperability and Supportability Procedures

Information Assurance — *DoD 8500.1/2*

DoDI 5200.40 — DOD IT Security Certification & Accreditation Process

Joint Capabilities Integration & Development System — *CJCSI 3170.01*

IT and NSS Interoperability and Supportability — *CJCSI 6212.01*

ATEC Regulation 70-15: Acquisition & Management of Test Technology Assets

Data Layer

- DoD Discovery Metadata Specification (DDMS) (16 July 2008)
  - Core
  - Extensible

- ISO 11179 - Information Technology-Metadata Registries (MDR), 15 September 2004

Briefing Outline

- Policy Basics
- Architecture Concepts & DODAF
- Highlights of ATEC's Data Centric Architecture
- Summary & Recommendations

Integrated Architecture

'DOD Architectural Framework – DODAF'

Version
1.5 vs 2.0

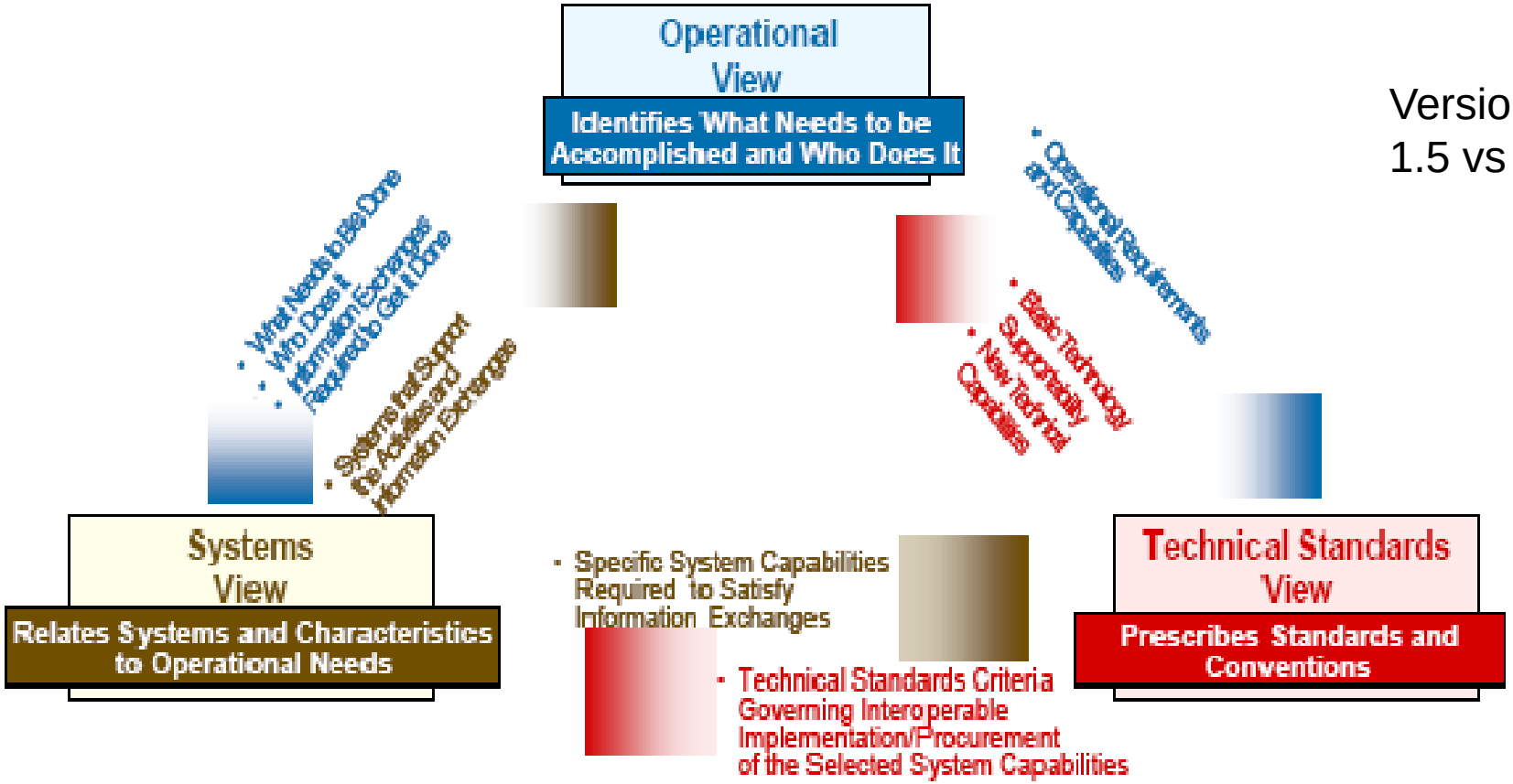


Figure ES-1. Linkages Among Views

Perspectives: Viewpoints That Fit-the-Purpose

- All Viewpoint (AV).
- Capability Viewpoint (CV).
- Data and Information Viewpoint (DIV).
- Operational Viewpoint (OV).
- Project Viewpoint (PV).
- Services Viewpoint (SvcV).
- Standard Viewpoint (StdV).
- Systems Viewpoint (SV).

All Viewpoint
Overarching aspects of architecture context that relate to all models

New **Data and Information Viewpoint**
Articulate the data relationships and alignment structures in the architecture content

Renamed **Standards Viewpoint**
Articulate applicable Operational, Business, Technical, and Industry policy, standards, guidance, constraints, and forecasts

New **Capability Viewpoint**
Articulate the capability requirement, delivery timing, and deployed capability

Operational Viewpoint
Articulate operational scenarios, processes, activities & requirements

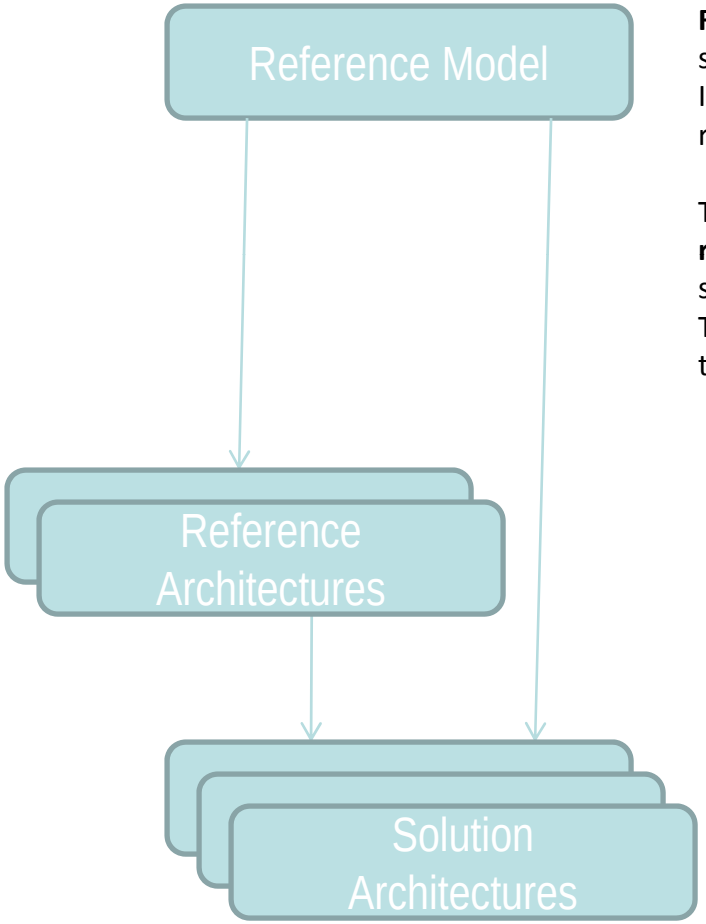
New **Services Viewpoint**
Articulate the performers, activities, services, and their exchanges providing for, or supporting, DoD functions

Systems Viewpoint
Articulate the legacy systems or independent systems, their composition, interconnectivity, and context providing for, or supporting, DoD functions

New **Project Viewpoint**
Describes the relationships between operational and capability requirements and the various projects being implemented; Details dependencies between capability management and the Defense Acquisition System process.

Architecture viewpoints are composed of data that has been organized to facilitate understanding.

Concepts and Definitions



Reference Model: an abstract **framework** for understanding significant relationships among the entities of some environment. It consists of a minimal set of unifying concepts, axioms and relationships within a particular problem domain.

The **Reference Model** is the basis for development of specific **reference architectures** or **solution architectures** using consistent standards or specifications supporting that environment.
The **Reference Model** provides a common vocabulary with which to discuss implementations.

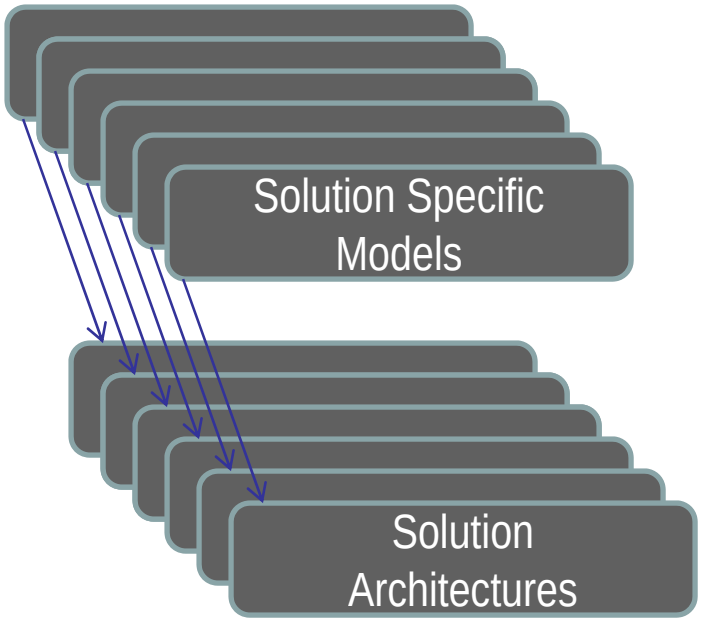
Reference Architecture: a predefined pattern, or set of patterns (templates), partially or completely instantiated, designed, and proven for use in particular business and technical contexts, together with supporting **artifacts** to enable their use.

Solution Architecture:
A specific high-level design used to develop a solution based on a fixed set of requirements.

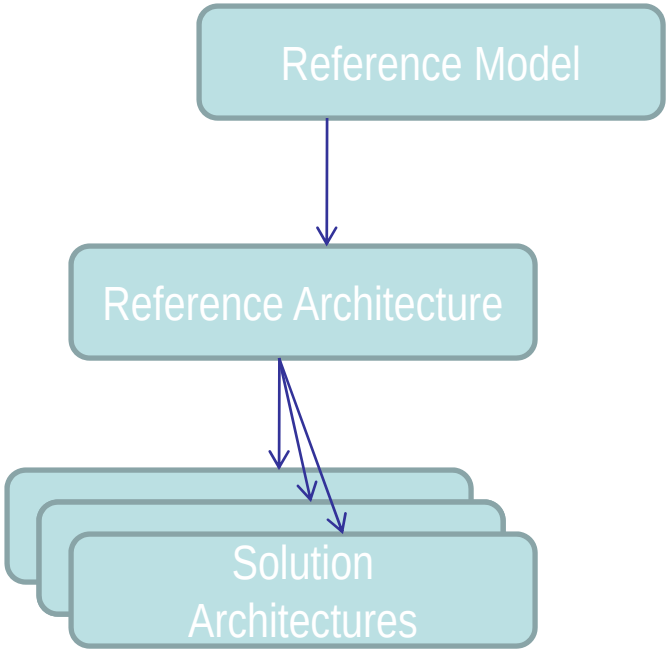
What is the Current State?
What is the Objective State?

Our Architecture/Technology organizations should be designed how?

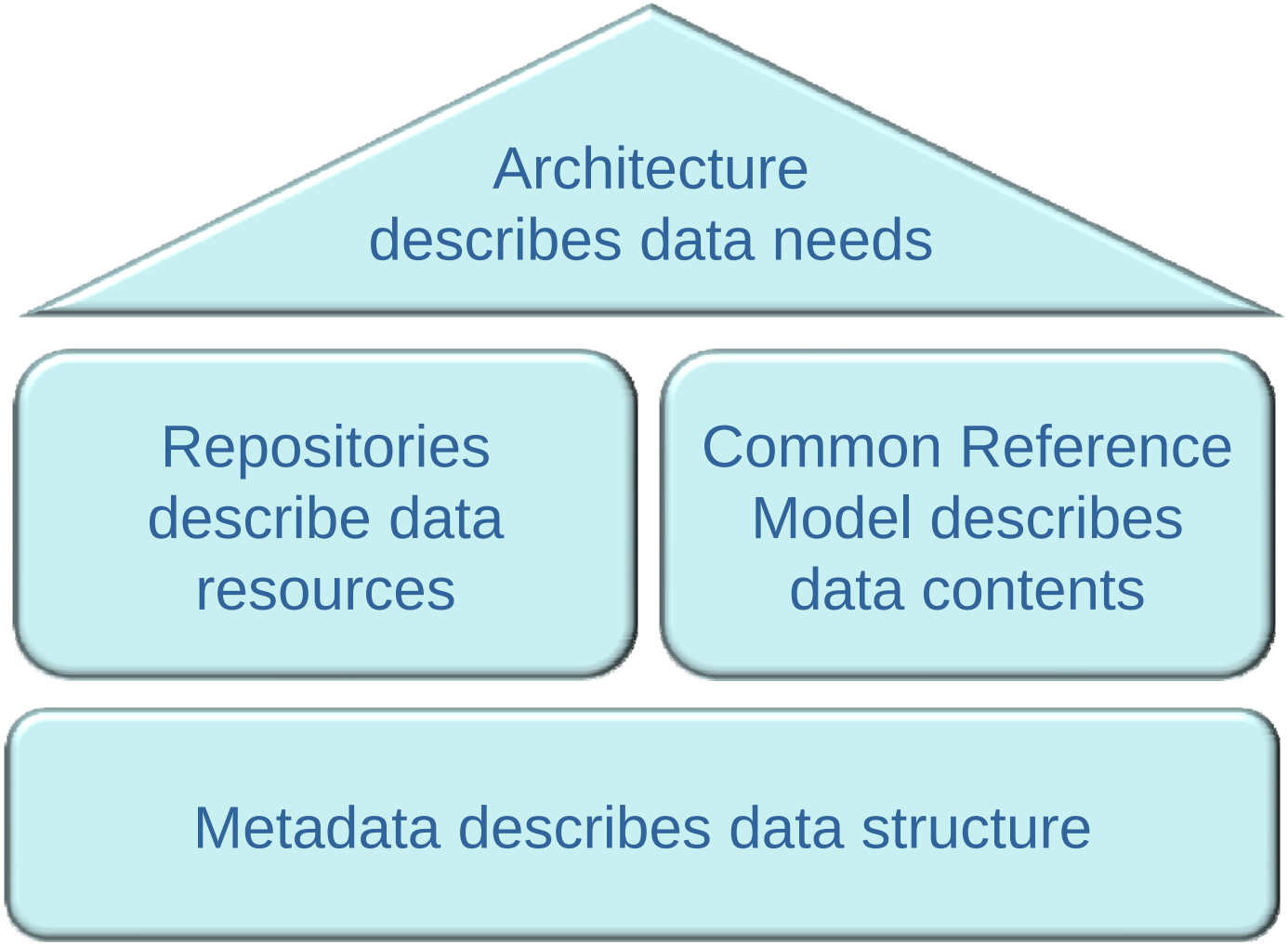
Test Technology Current State



Test Technology Objective State



Data Engineering Components



Linking Data to Processes

(The ATEC TDAP is a sub-process related to the ATEC Test Technology (TT) Investment Process*)

Instrumentation, M&S, Threat, Infrastructure, Test engineer, officer, or Director Inputs* proposed project → Test Center or location reviews and provides priority and validates as required → SCA reviews, clarifies, adjusts, interprets for the ATEC HQ TTD as required → ATEC HQ TTD reviews, clarifies, adjusts, interprets for the POM as required → ATEC HQ TTD uses input as rationale for the POM

Data Required

- TT Domain (Name, attributes, Classifier, **relationships**, Characteristics,...)
- POCs (SCAs, Mfg/Ktr …)

- Test Center (Name,
  - -
  - -
  - - …)
- Priority
- Reviewer

…

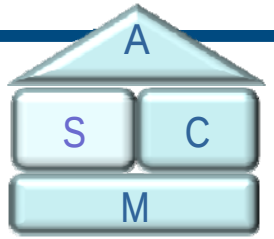
Financials (Name,
- -
- -
- - …)

POM Report Format (Presentation Level)

Result is a Data Model for the process

*In accordance with ATEC Regulation 70-15, Management of Test Technology Assets and TT Annual Guidance.

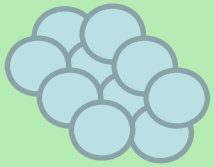
Data Thinking



Examples for M2M: C2, C3, C4, ISR, DSS, MIS

- DDMS

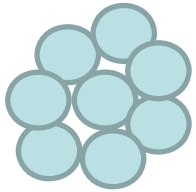
Machine to Machine



POR/COIs

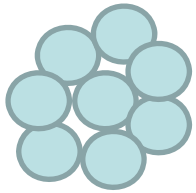
Data Engineering
Data Modeling/ERD
Metadata, Naming Conventions
Syntax, Lexical, Exact Semantics
ISO 11179 – Metadata Registries

Machine to Human



In=Out

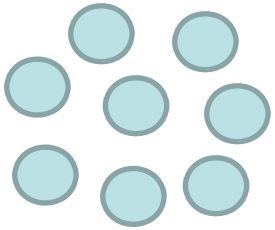
Human to Machine



Extensible

Discovery/Searches
Google/Searches
Metadata
Syntax, Lexical, Semantic …
XML

Human to Human



Ontology
Thesaurus
Semantic
Logical

1 2 3 4 5 6 7 8 9 10

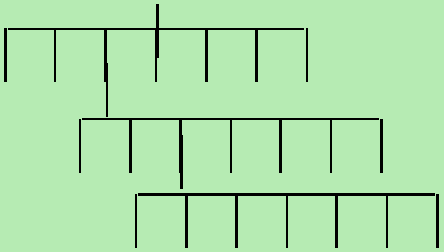
- ADS, Authoritive Data Sources Scale

- Information Flow Speed/Priority

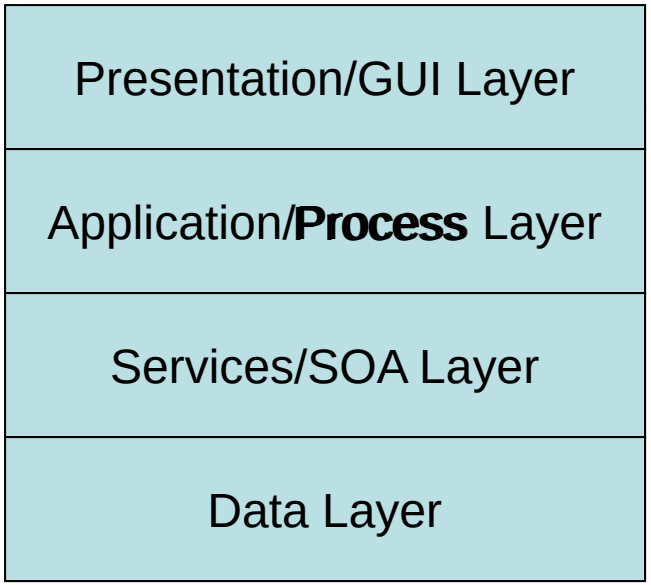
- Participatory/Collaborative Development

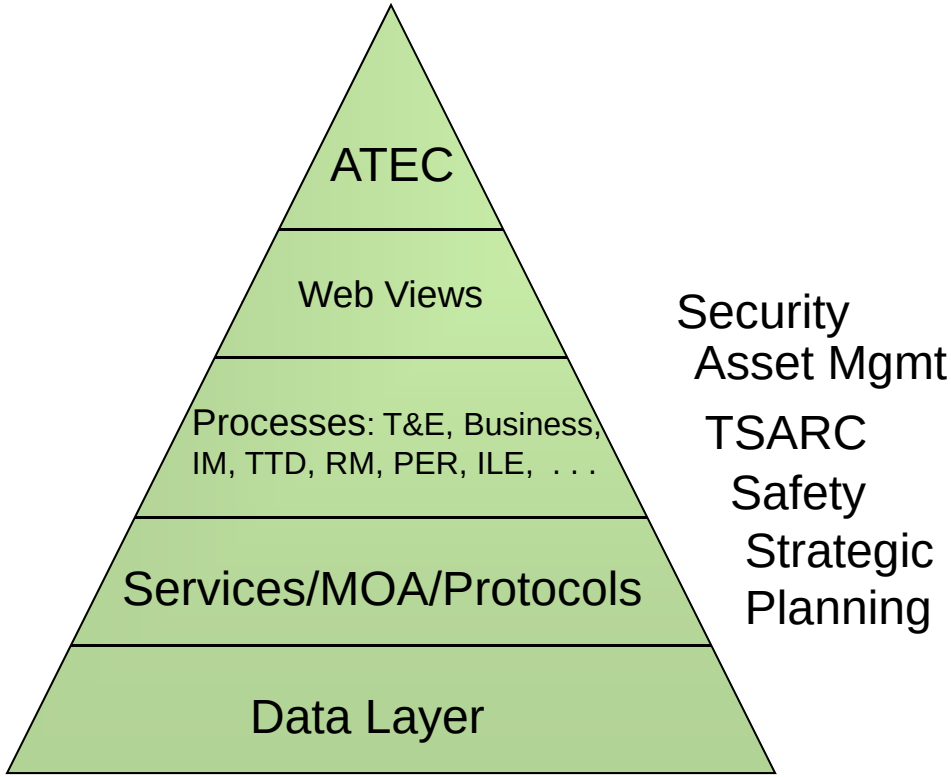
- Capability Sets

JCA



Architecture Congruency to the Organization - Basic View & Concepts – ATEC OV-1



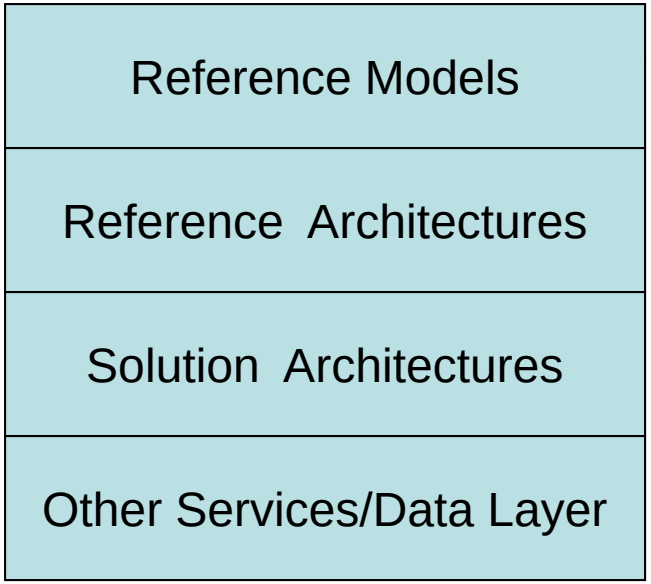


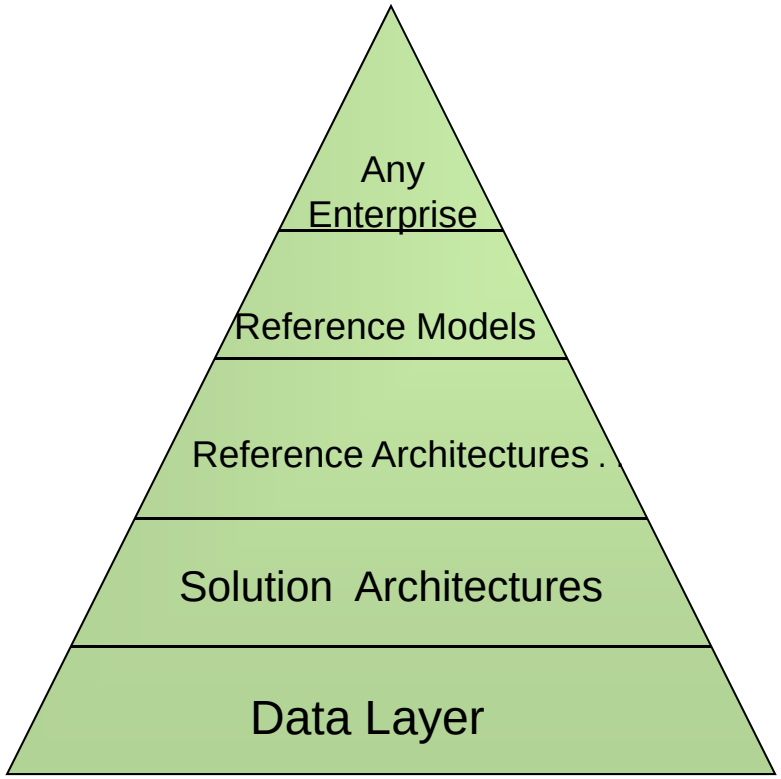
PLAN – CONDUCT - REPORT

FOCUS ON MBDE ----- Data Modeling, Data Engineering, Data Specification, Common [Data] Reference Models, ERD (Entity Relationship Diagrams) Ontology's, Semantics

Architecture Congruency to the Organization - Basic View & Concepts – OV-1

- From Information Technology to Enterprise Technology

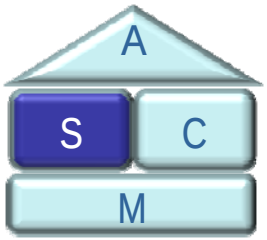




DoDAF 2.0 Data Products

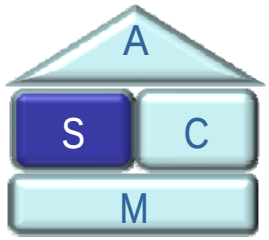
- DIV-1: Conceptual Data Model
- DIV-2: Logical Data Model
  - Based upon the information exchanges identified in the activity model (OV-5) and information exchange matrix (OV-3)
- Related artifacts
  - OV-2: Operational Node Connectivity
  - OV-3: Information Exchange Matrix
  - OV-5: Operational Activity Model
  - OV-6: Operational Activity Sequence and Timing Descriptions
- DIV-3: Physical Data Model
  - The data specifications, formats, and relationships, derived from the Logical Data Model, as physically implemented in and exchanged among the systems
- Related
  - Becomes basis for SV-6: Systems Data Exchange Matrix

DDMS Overview



- The DoD Discovery Metadata Specification (DDMS) defines discovery metadata elements for Resources posted to community and organizational shared spaces
  - The DDMS specifies a set of information fields that are to be used to describe any data or service asset that is made known to the Enterprise
  - It serves as a reference for developers, architects, and engineers by laying a foundation for Discovery Services.
  - The DDMS will be employed consistently across the Department's disciplines, domains and data formats.
- Current version: DDMS 2.0 (16 July 2008)
- Website: http://metadata.dod.mil/mdr/irs/DDMS/

DDMS Primary Category Sets



Core Layer

- **Security Category Set**
- **Resource Category Set**
- **Summary Content Category Set**
- **Format Category Set**

+

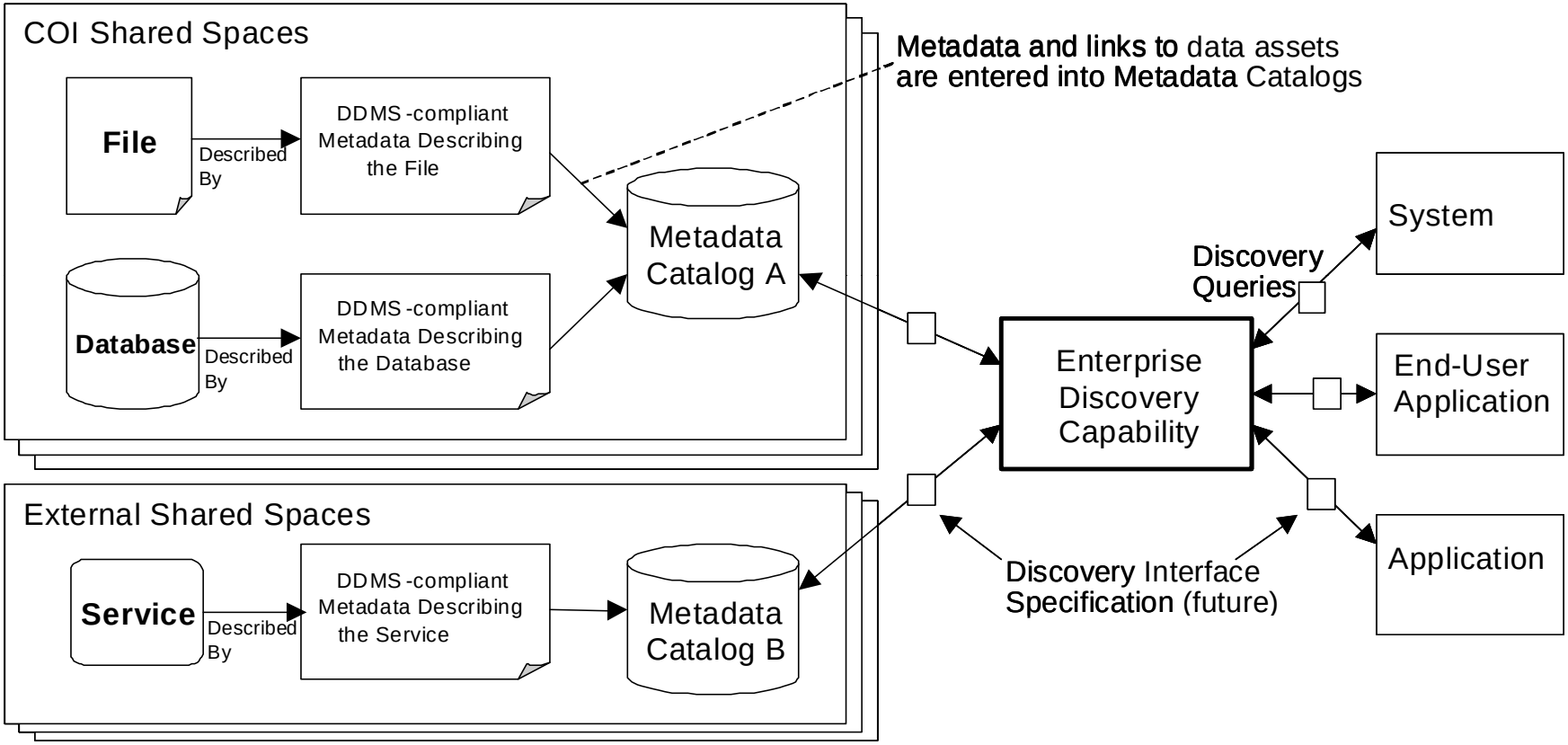
Extensible Layer

COI/Domain Specific Categories

Provides ability to define specific metadata elements

Can extend any of the core sets, as needed.

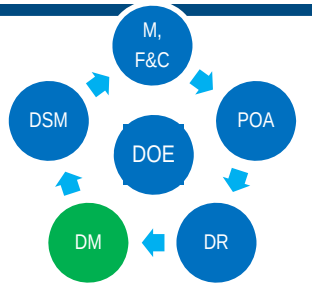
DDMS Usage Concept



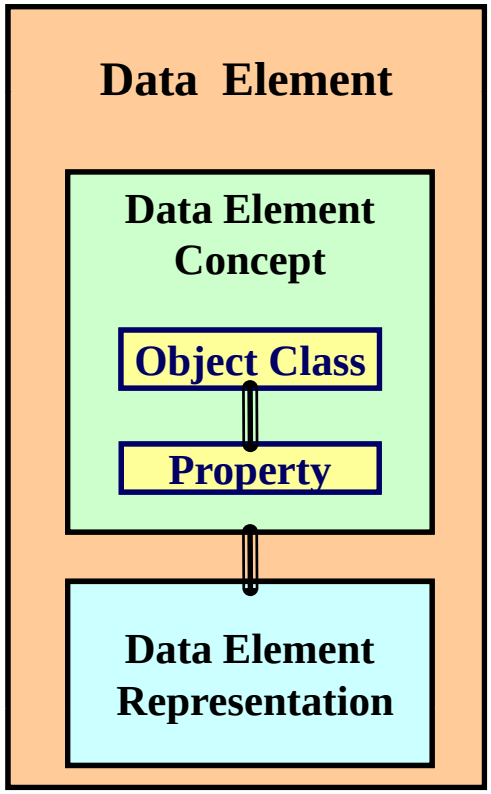
Assets are 'advertised' by describing themselves in terms of DDMS metadata elements…

…assets are 'discovered' by the Enterprise Discovery capability that performs searches against DDMS metadata catalog entries

ISO 11179 Part 5: Naming a Data Element Example



Need to identify semantic, syntactical, lexical, and uniqueness principles to name things

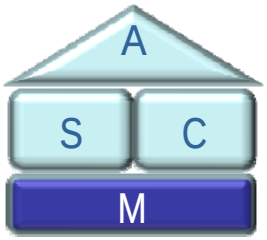


Object Qualifier (optional)	Object Class	Property Qualifier (optional)	Property Term	Representation Class
Ground	Platform	Body	Length	Value[1]: Meters; Format: Float:

The *Logical* Data Element Name is: "Ground_Platform_Body_Length_Value"

[1]"Value" is an example of a naming convention that represents a class; another example is "Name."

ISO/IEC 11179 Documents



Part 1 – Framework:

Overview of the standard and basic concepts

Part 2 – Classification:

How to manage a classification scheme in an MDR

Part 3 – Registry Metamodel and Basic Attributes

Provides the basic conceptual model, attributes, and relationships for an MDR

Part 4 – Formulation of Data Definitions

Rules and guidelines for defining data elements and their components

Part 5 – Naming and Identification Principles

How to form naming conventions for data elements and their components

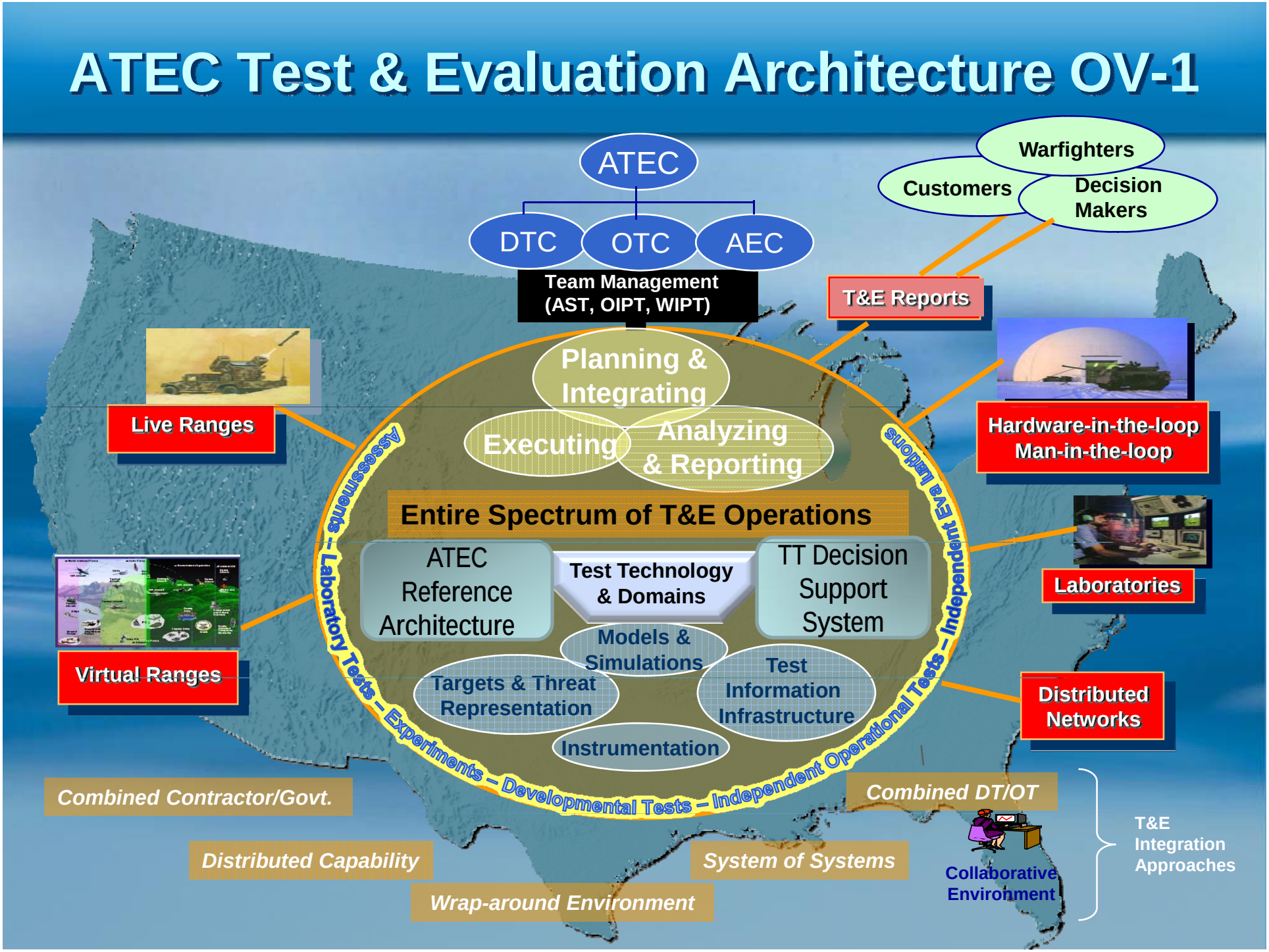
Part 6 – Registration

Roles and requirements for the metadata registration

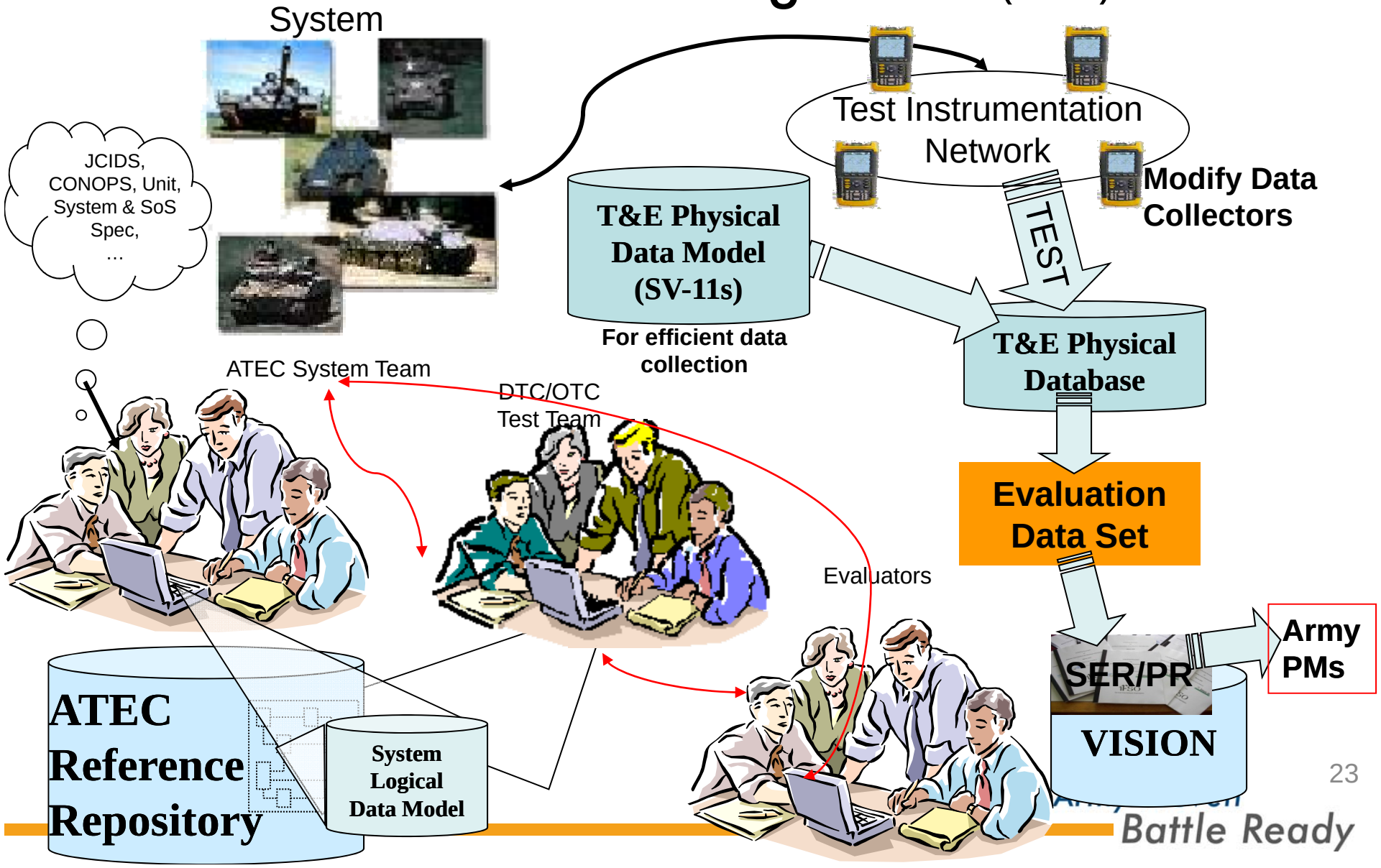
Briefing Outline

- Policy Basics
- Architecture Concepts & DODAF
- Highlights of ATEC's Data Centric Architecture
- Summary & Recommendations

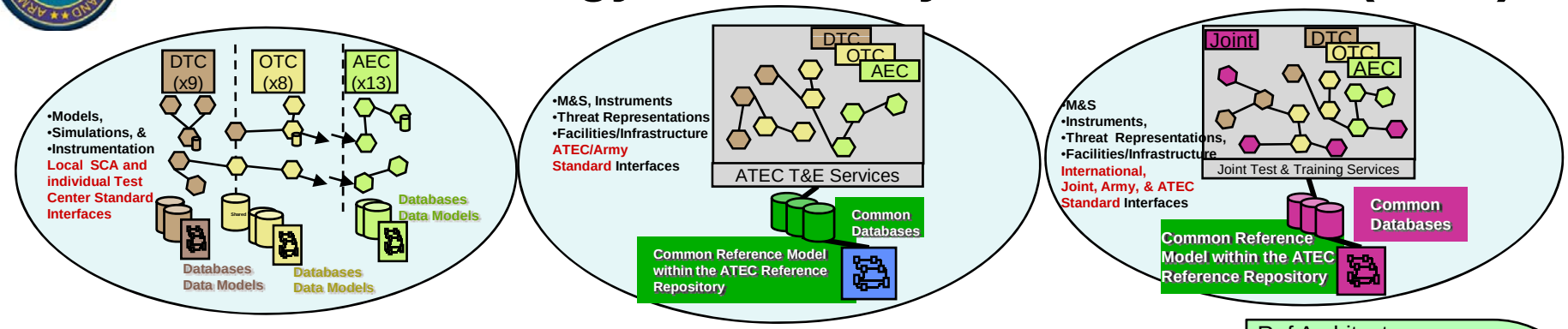
ATEC Test & Evaluation Architecture OV-1



Integration of ATEC T&E Data Management (OV-1)



Test Technology "To-Be" System Evolution (SV-8)



CY08

- Initial Ref Architecture for TTD Review
- Initial Reference Repository with:
  - First AEC data models
  - Search, Submit, & Download Functions

FY09

- Initial Ref Architecture for Community Input
- Functioning Reference Repository with:
  - Initial CRM containing the following data models:
    - AEC T&E Reference Model & other available data models
    - TENA TSPI
    - Engineering Units DB

FY10

- Ref Architecture
  - Community involved in evolution
  - Initial Automation Support
- Operational Reference Repository with:
  - Initial Visualization functionality for data model comparison
  - Enhanced CRM that includes Planning metadata
  - Additional & Evolved data models

FY11

- Ref Architecture
  - Community Active in Evolution
  - Improved Automation Support
- Operational Reference Repository with:
  - Improved Visualization, Aggregation, Disaggregation functionality for data models
  - Evolved CRM that includes Execution metadata
  - Additional & Evolved data models
- Initial TT Investment Decision Support System

FY12

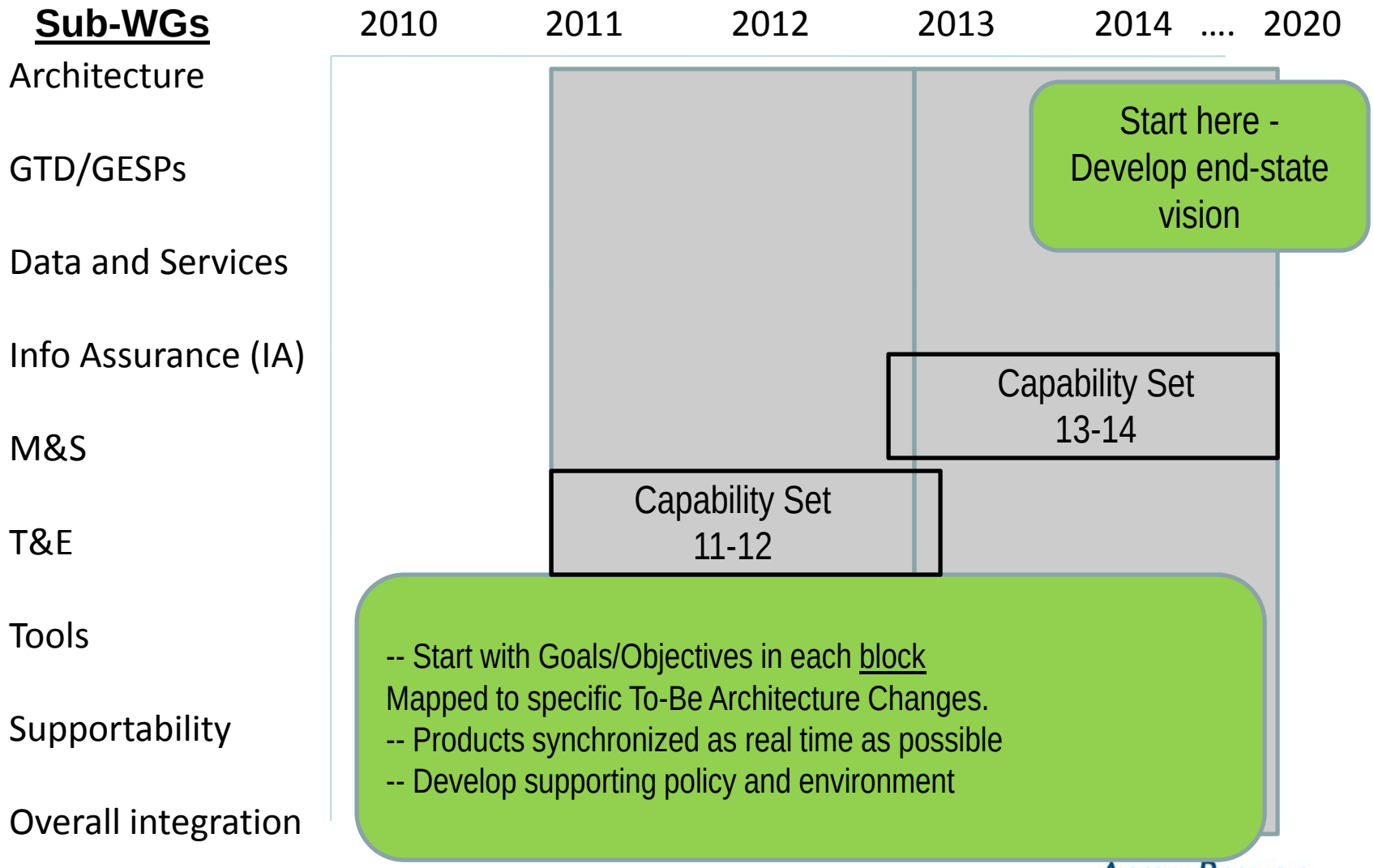
- Ref Architecture
  - Community Driven
  - Full Automation Support
- Reference Repository
  - Sophisticated Visualization, Aggregation, Disaggregation functionality for data models
  - Evolved CRM that includes metadata for all T&E phases
  - Additional & Evolved data models
- Improved TT Investment Decision Support System

More Automation - Less Manual Effort, Greater Accuracy, & Less Time
Increasing Community Involvement, Modeling and Governance –
Greater Interoperability & Less Ambiguity
Growing Architectural Cohesion Enabling Informed Decision Making

Summary & Recommendations

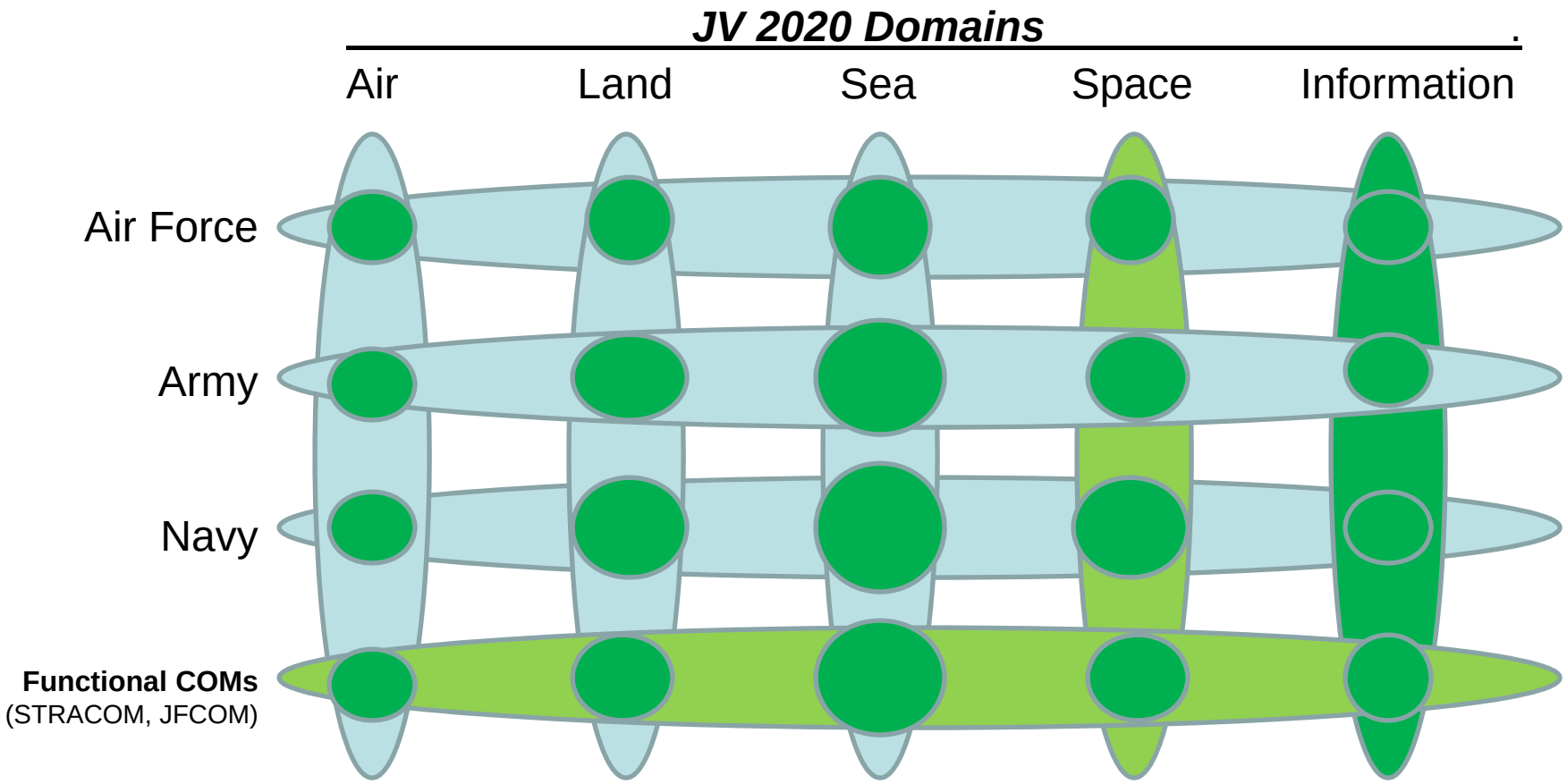
- DODAF 2.0 relates more layers of the architecture with business/investment goals
  - Should be in dynamic, real time environment
  - Six Step Process (ref DODAF Definitions and Guidelines)
- We need common architecture lexicon
- Greater emphasis on DDMS, 'data reference models for SOS'
- Congruence/Alignment between organizations & IT, & SOS
- DOD Architecture products should consider overall architecture integrating air, land, sea, and information domains/architectures (with the goal of full spectrum dominance IAW JV2020)
- M&S engineering and development environment
  - Integrated Development Environment (MS Foundation tools)
- Technology Roadmap (and SV-8)

Synchronization of NR KPP Sub-WGs



Architecture Opportunities for Data Sharing
OV-1, NR KPP Data & Services WG
(DODAF 2.0: CRM and DIV-1, DIV-2, & DIV-3)

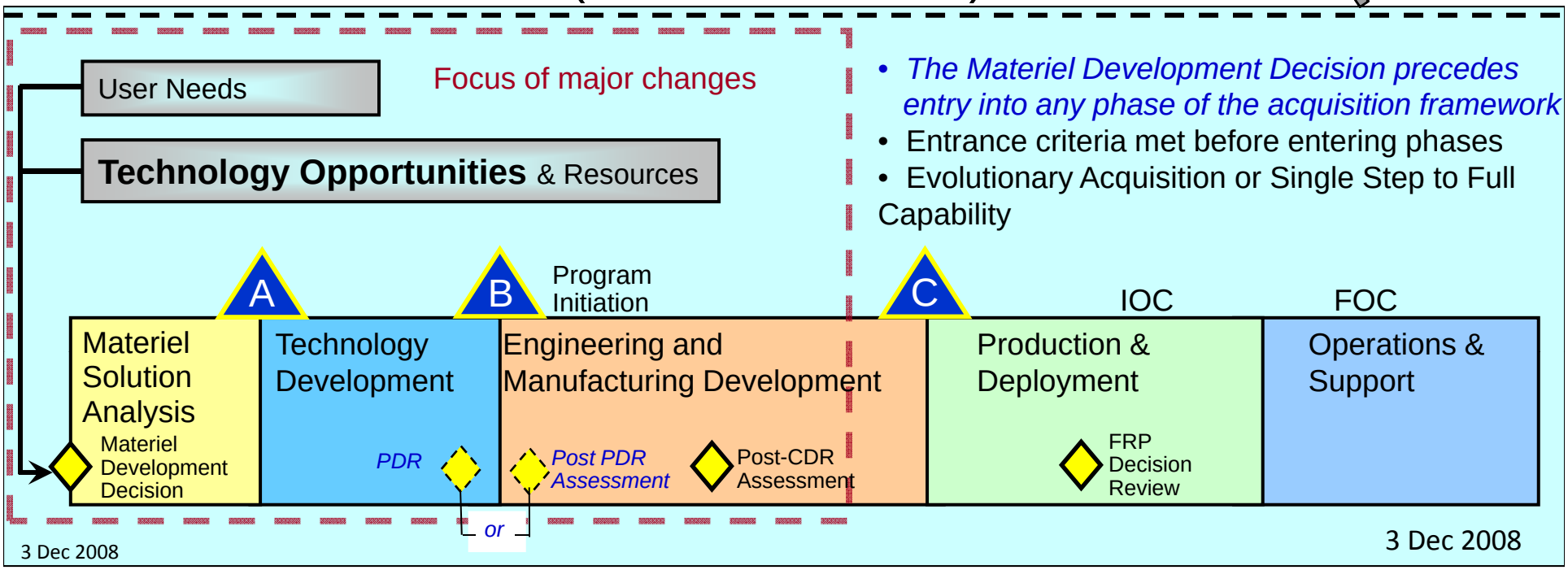
TO-BE

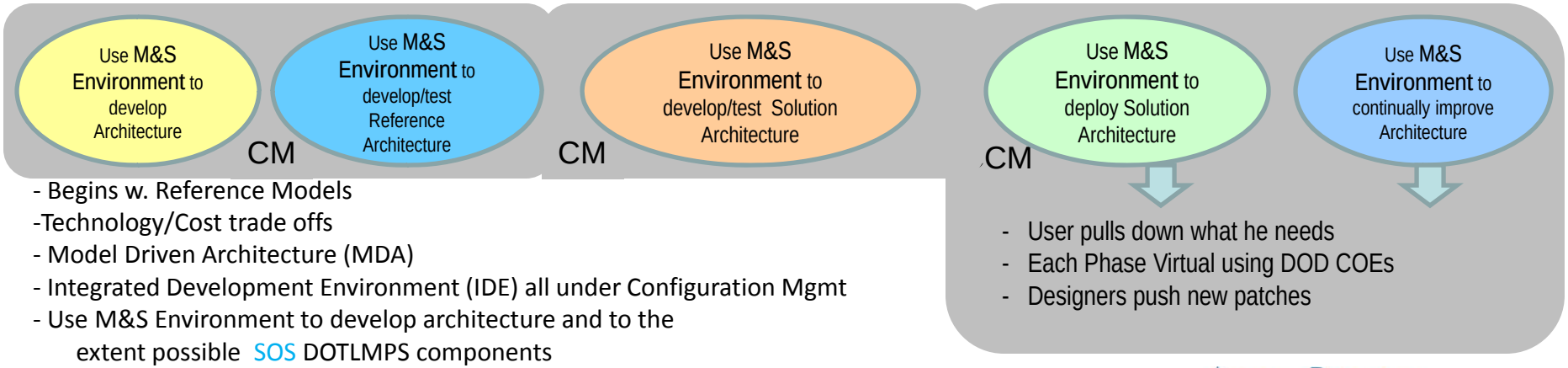


Creating the Environment for NR KPP – OV-1

(NR KPP WG - Draft)

TO-BE





- Begins w. Reference Models
- Technology/Cost trade offs
- Model Driven Architecture (MDA)
- Integrated Development Environment (IDE) all under Configuration Mgmt
- Use M&S Environment to develop architecture and to the extent possible SOS DOTLMPS components
- Common/interoperable tools and tool kits for this acquisition domain

QUESTIONS

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703-681-2744

Activities

- NR KPP Working Group (WG), Lead of Net Centric Data and Services sub-WG (1 of 8)
  - Other sub-WGs: GTDs/GESPs, T&E, M&S, IA, Tools, Supportability, Integration
- G-6 Data Board
- JFCOM Joint Systems Integration Center (JSIC) Training Cross Domain Information Systems (CDIS)
  - Sub-WGs discussed: Architecture, M&S, T&E, IA, Tools, GTPs
- ATEC Data Centric Architecture Repository/GUI
- Analytical Community

DOD/DISA (1 of 2)

- Net Ready Key Performance Parameter (NR-KPP) for DOD IT and National Security Systems (NSS)
  - DODD/I 4630 – Policy/Procedures for IT and NSS
  - Chairman Joint Chief of Staff Instruction (CJCSI) 6212- Policy/Procedures for IT and NSS
  - DOD Architecture Framework (DODAF) (V1.5 & 2.0), UPDM (Unified Profile for DODAF/MODAF)
  - DODD 8320, DoD Directive 8320.2, "Data Sharing in a Net-Centric Department of Defense," April 23, 2007
  - DOD CIO Net-Centric Data Strategy
  - Data Discovery Metadata Specification (DDMS), Joint Product
  - JACAE- Joint C2 Architectures and Capability Assessment Enterprise- a capability mapping and analysis tool. https://www.us.army.mil/suite/page/474703
  - JCPAT – Joint C4I Programs Assessment Tool - Repository for program DODAF views

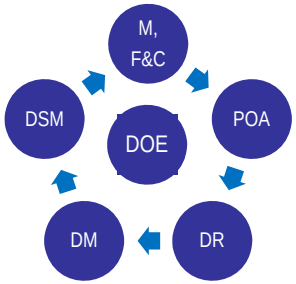
DOD/DISA (2 of 2)

- Defense Information Systems Agency (DISA)
  - DoD IT Standards Registry (DISR On-line) – DoD and PM Standards and Governance information
  - Defense Information Enterprise Architecture – www.defenselink.mil/cio-nii/sites/diea
  - DOD Architecture Registry System (DARS)- https://dars1.army.mil
  - CM for KIPs/GESP- GIG Technical Guidance (GTG) Configuration Management (CM) Board -https://www.intelink.gov/wiki/Global_Information_Grid_Technical_Guidance_%28GTG%29
  - DM2 DODAF Metadata Model – "EA/ITA, M&S tools," analysis software, Authoritive Data sources, etc. Extends existing data models
  - CADM – Core Architecture Data Model – Data mgmt/mapping to DODAF views
  - CORE –
  - ELS- Enterprise Lexicon Services
- Bottom line: Net-centricity concepts are dual use – Mission (Acquisition) and Internal IT Biz systems

Data Modeling for T&E Briefing Outline

- Architecture Framework: From AV-2, to OV-1, to OV-7, to SV-11
- Evaluation Fundamentals

- System Capability/Requirements Analysis
- Integrating Data Modeling into the Iterative Analytical Process



- ATEC Reference Repository (Part B)