Data Provisioning Using Authoritative Data Sources

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Data Provisioning

- Introduction
- Identify Key Information Classes
- Locate Authoritative Data Sources (ADS)
- Establish Common Ways to Describe Data
- Establish Common Ways to Exchange Data
- Develop Tools and Utilities to Access, Exchange Data
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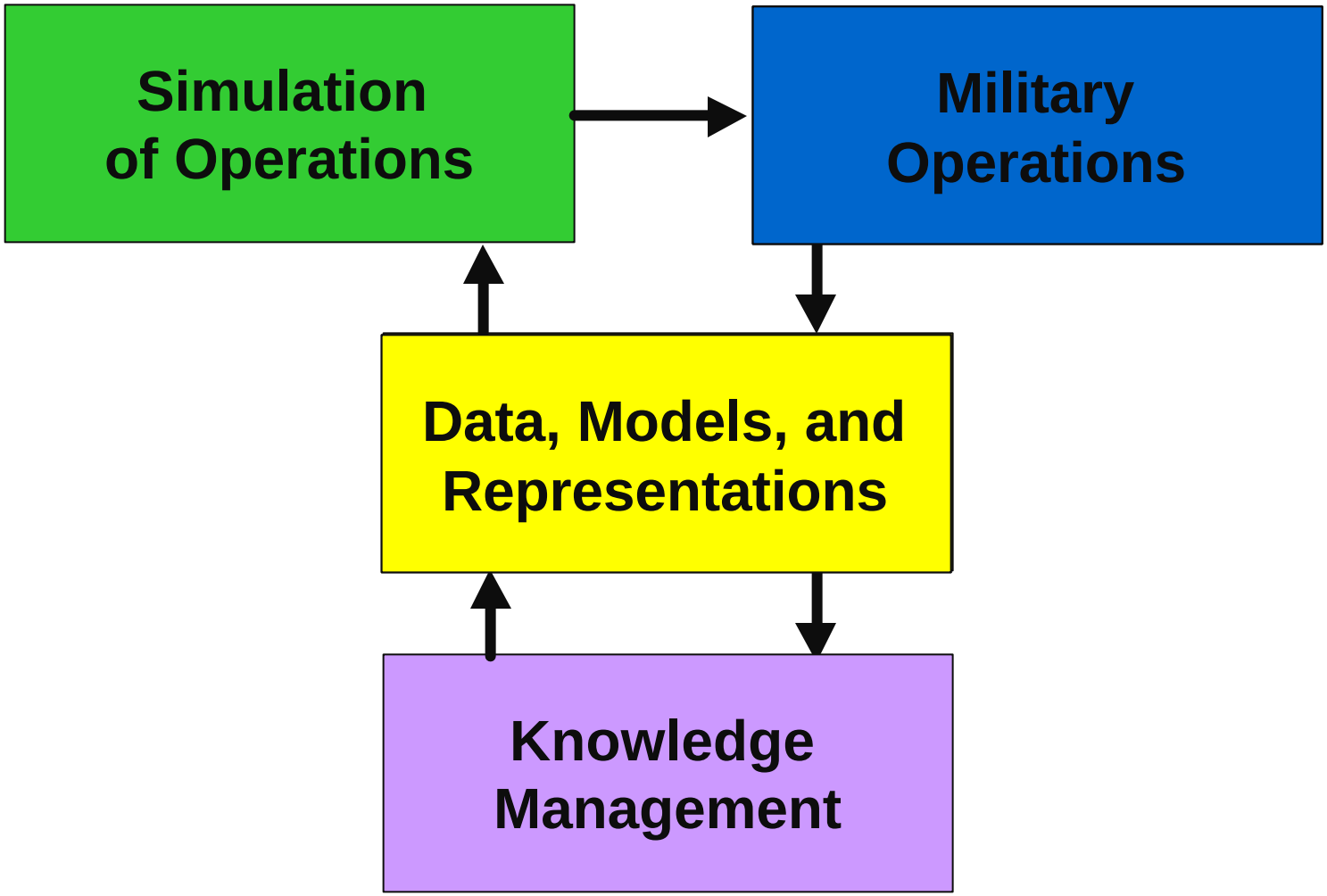
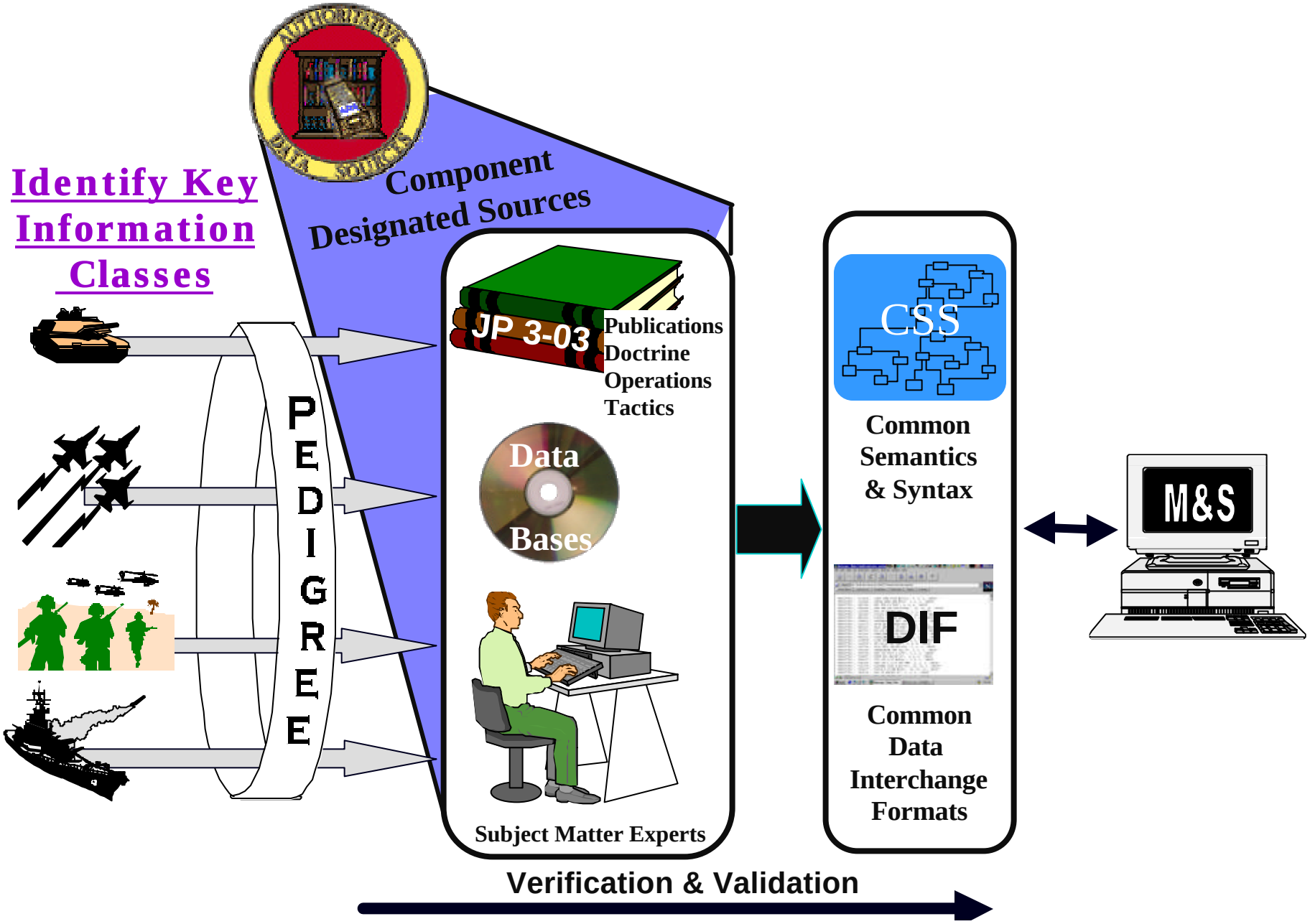
- Address Key Technical, Process, and Policy Issues

Information-Intensive Warfare, Digitization of the Battle blurs distinctions between simulations and operations



Data Provisioning Strategy



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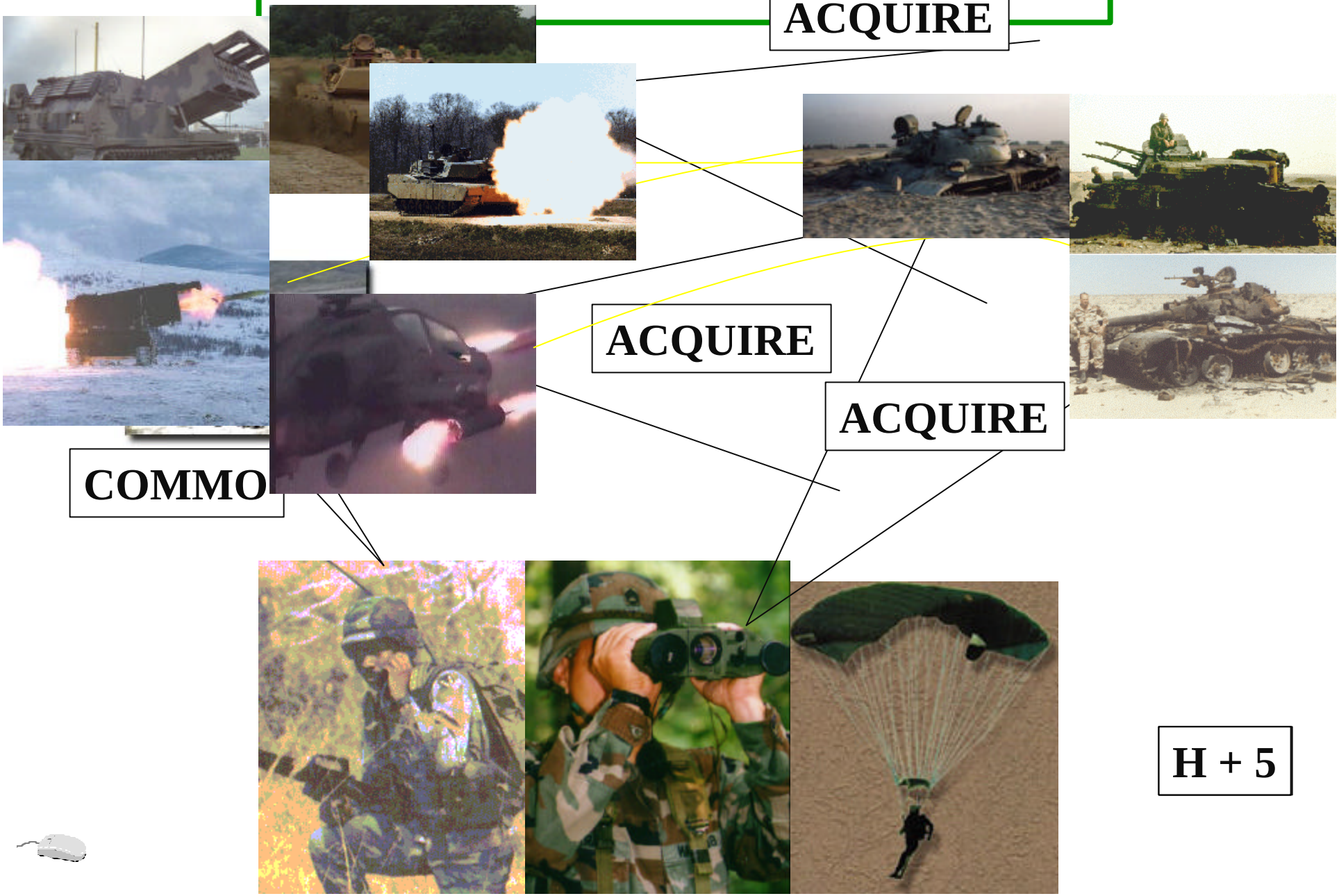
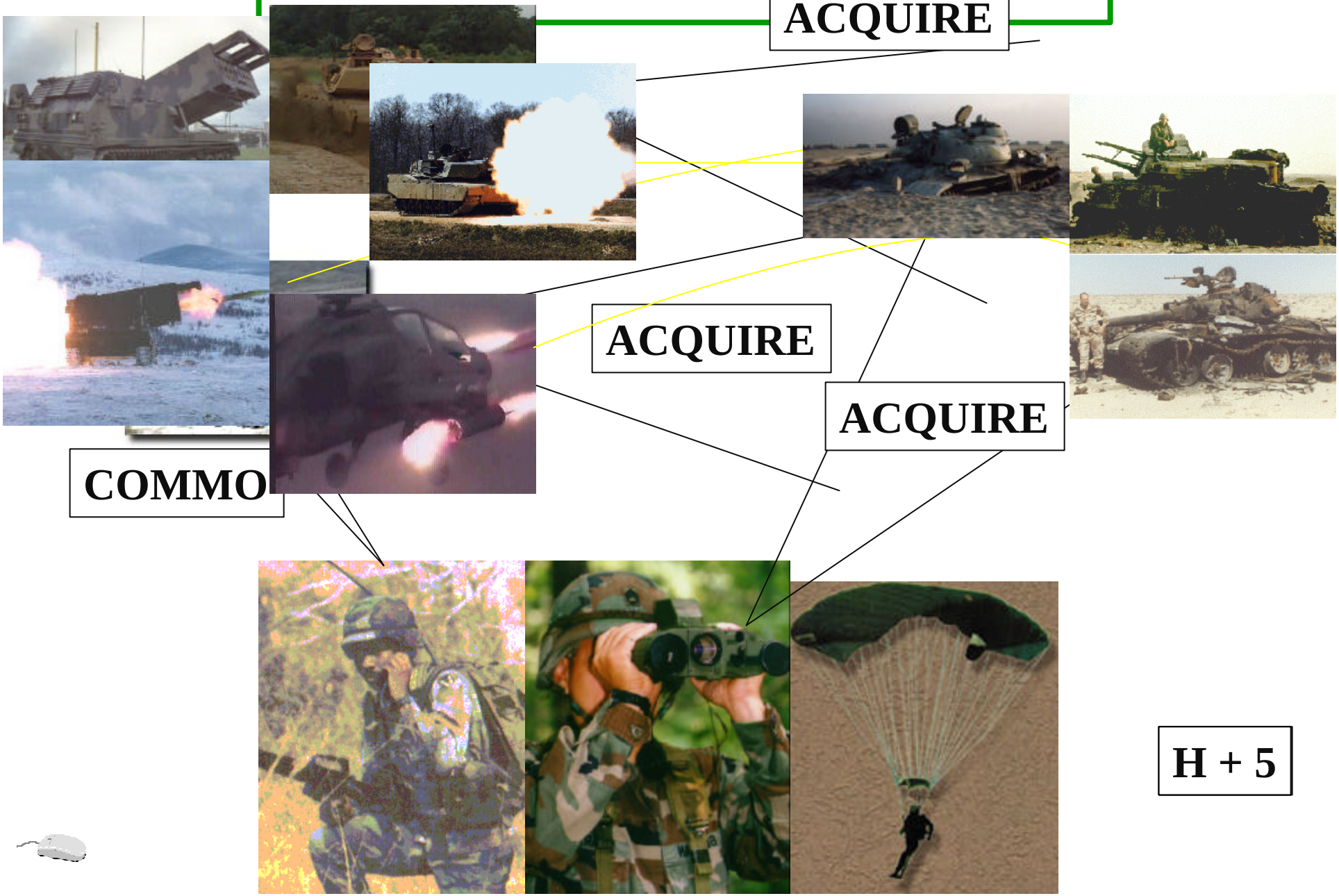
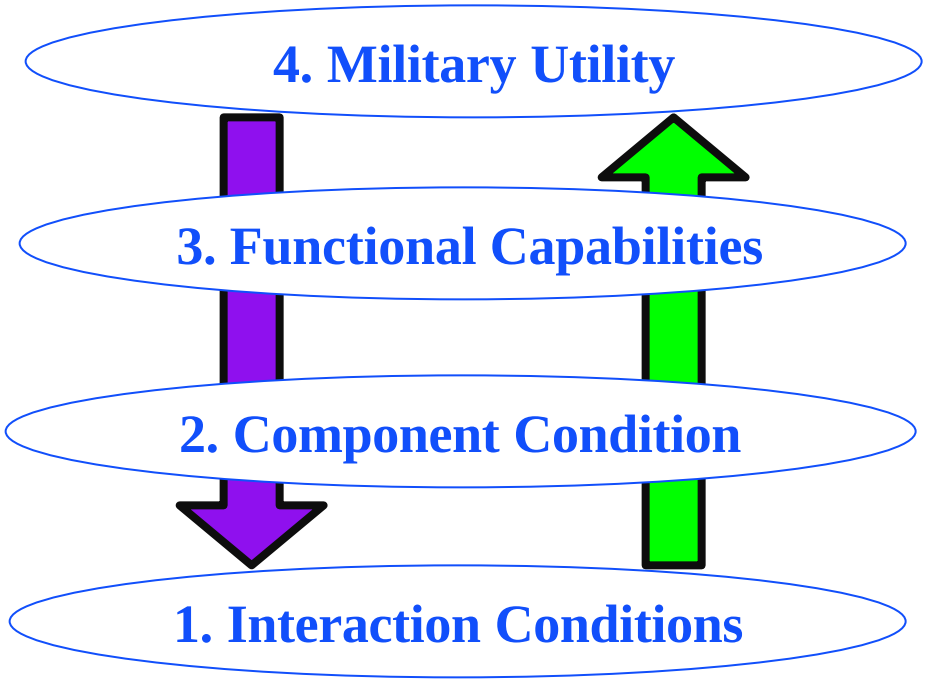
Combined Arms Representation



Combined Arms Representation



Top-Down Decompositional Framework

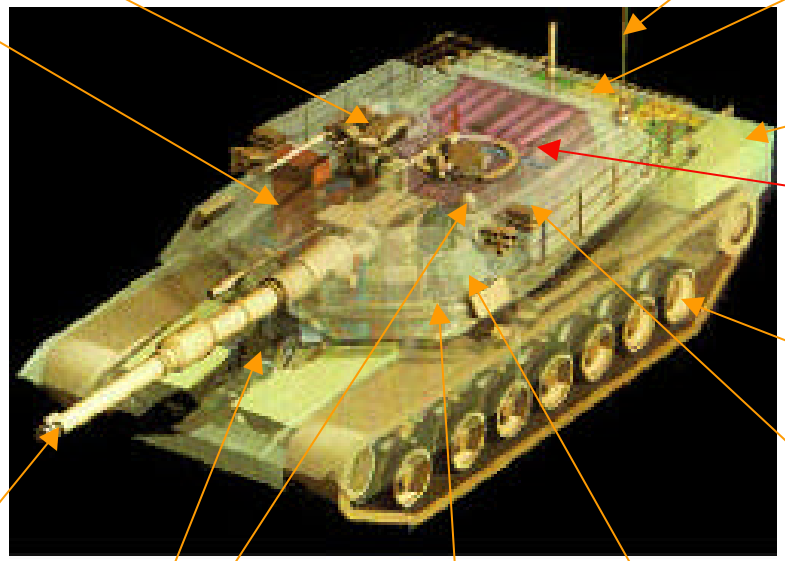


Bottom-Up Analysis Framework

Bottom-up process follows causal (*i.e.*, time-forward) behavior

Example: Platform Configuration

Level 2]



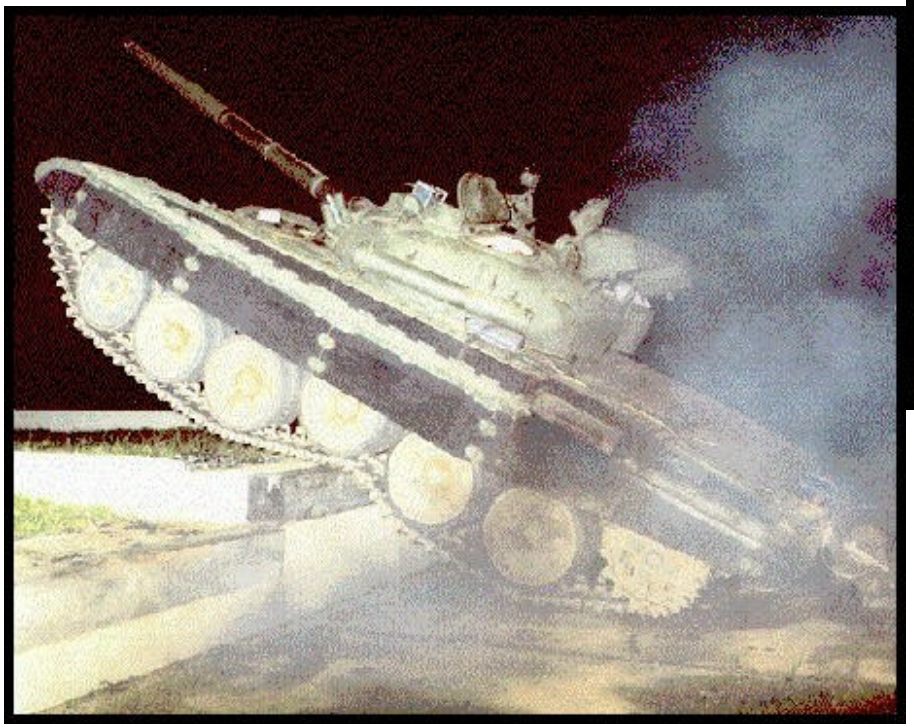
Testing for Platform Capabilities

Level 3]

Move

Communicate

Sense



Engage

Replenish

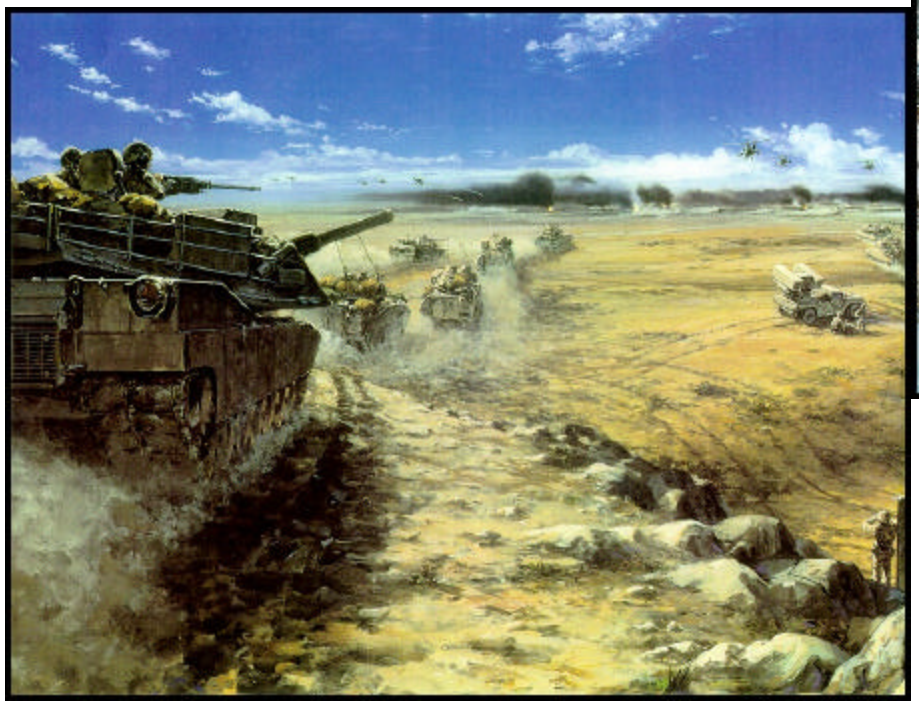
Mission Utility from Capabilities

Level 4]

Effectiveness?

Performance?

Lethality ?

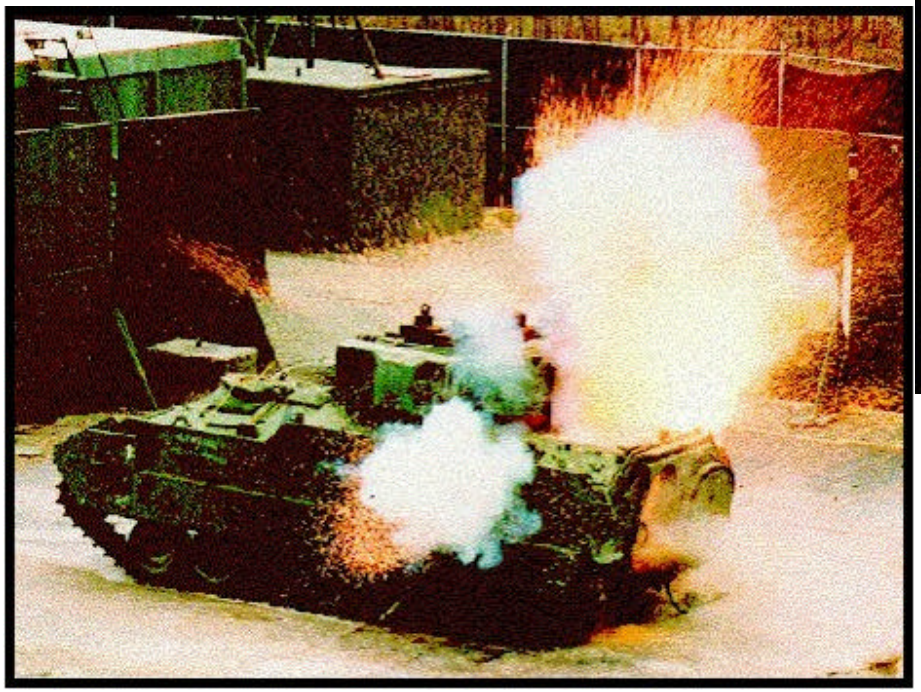


Survivability ?

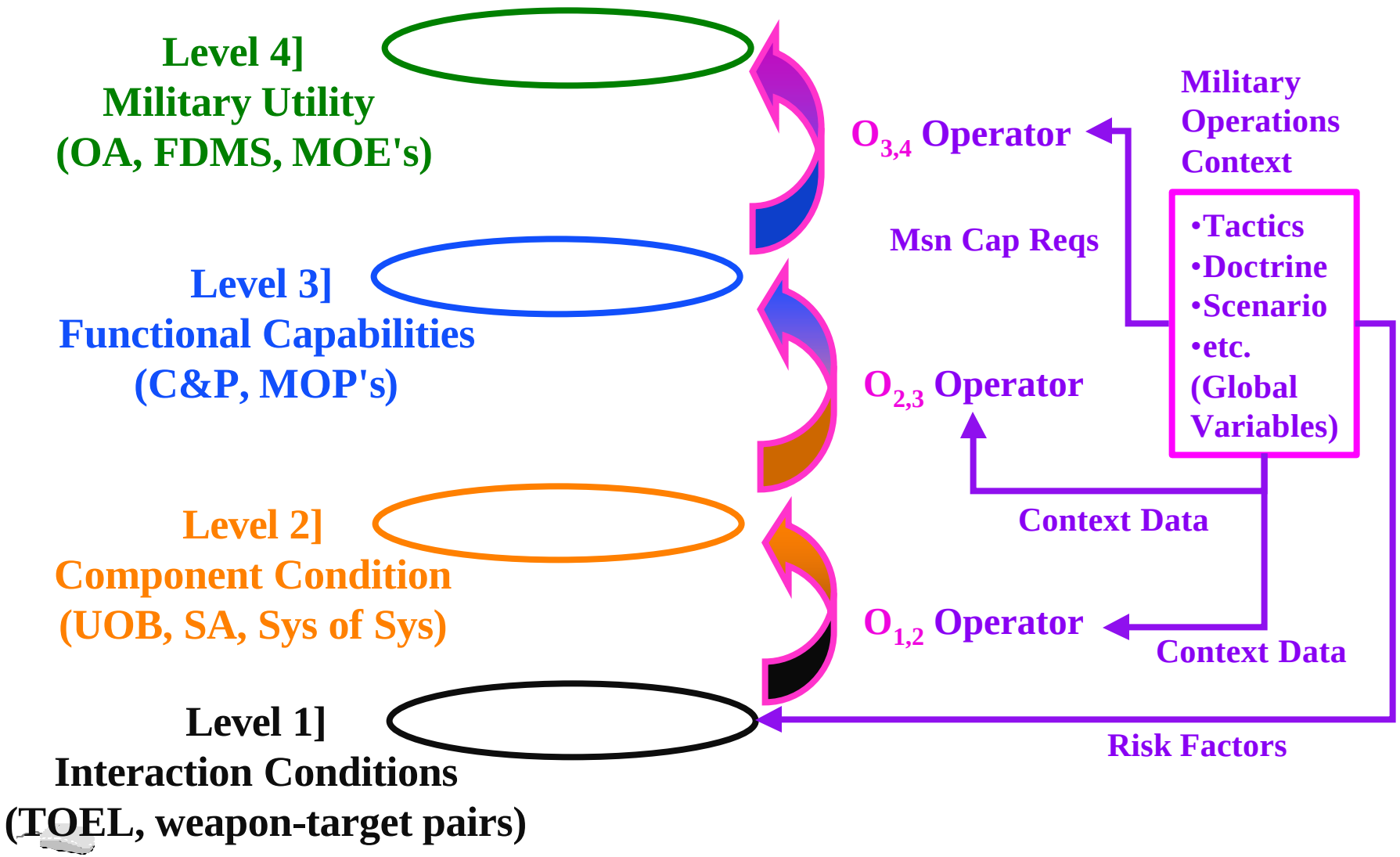
Loss/Exchange ?

Readiness ?

Physical Analogues for the $O_{1,2}$ Operator



V/L Taxonomy


Level 4]
Military Utility
(OA, FDMS, MOE's)
Level 3]
Functional Capabilities
(C&P, MOP's)
Level 2]
Component Condition
(UOB, SA, Sys of Sys)
Level 1]
Interaction Conditions
(TOEL, weapon-target pairs)
$O_{3,4}$ Operator
Msn Cap Reqs
$O_{2,3}$ Operator
Context Data
$O_{1,2}$ Operator
Context Data
Risk Factors
Military
Operations
Context
•Tactics
•Doctrine
•Scenario
•etc.
(Global
Variables)

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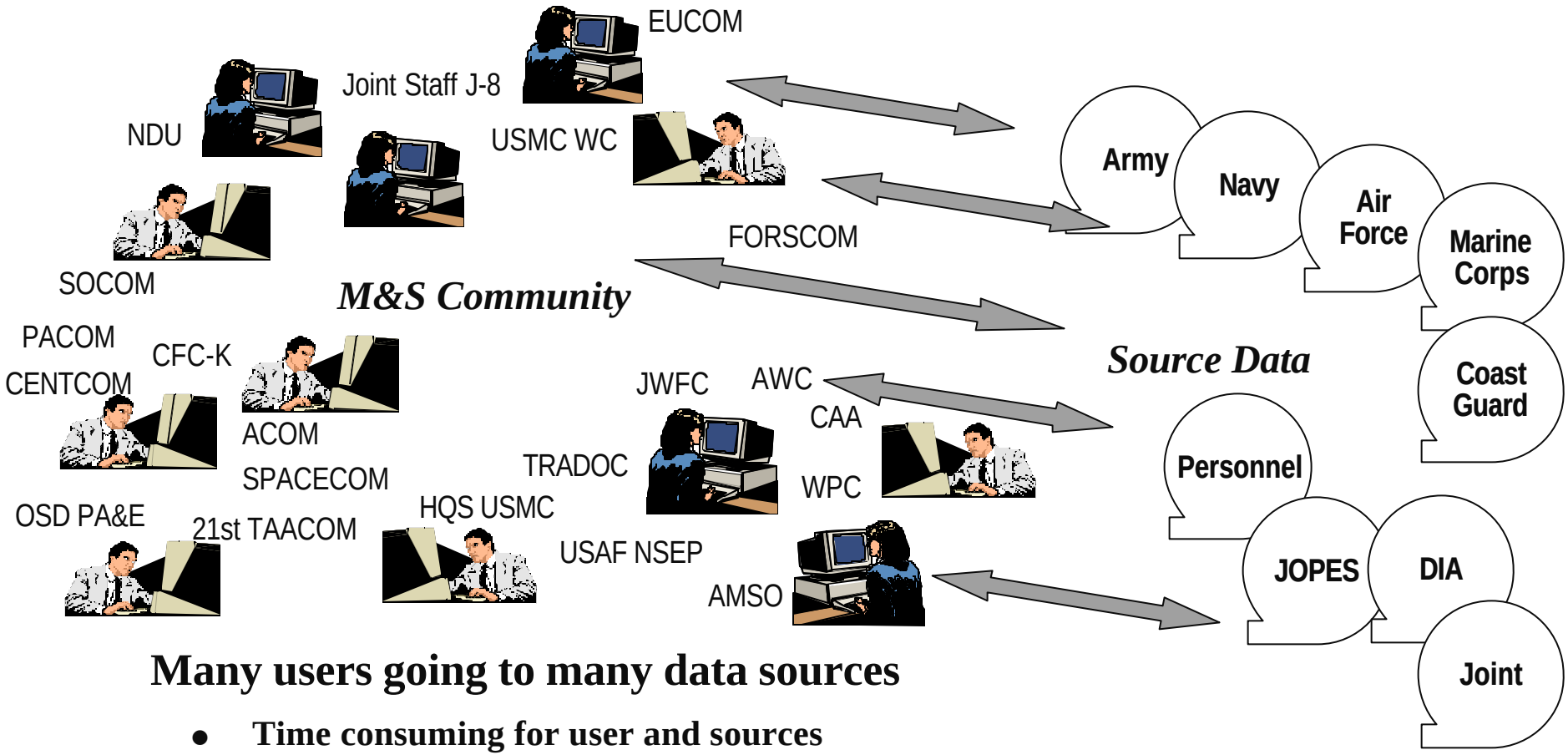
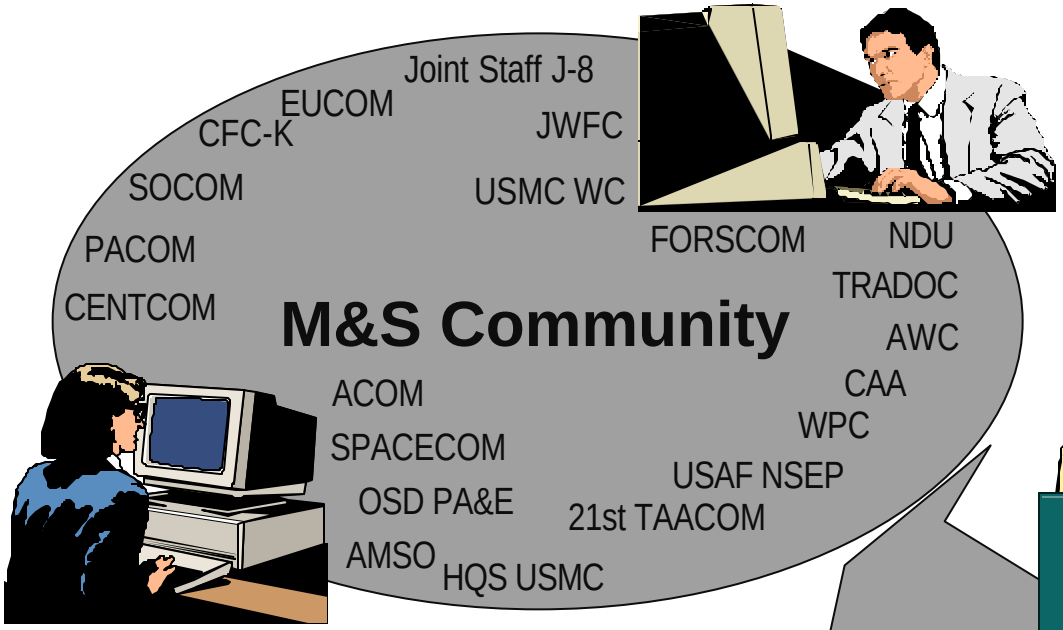
Identifying Source Data without ADS

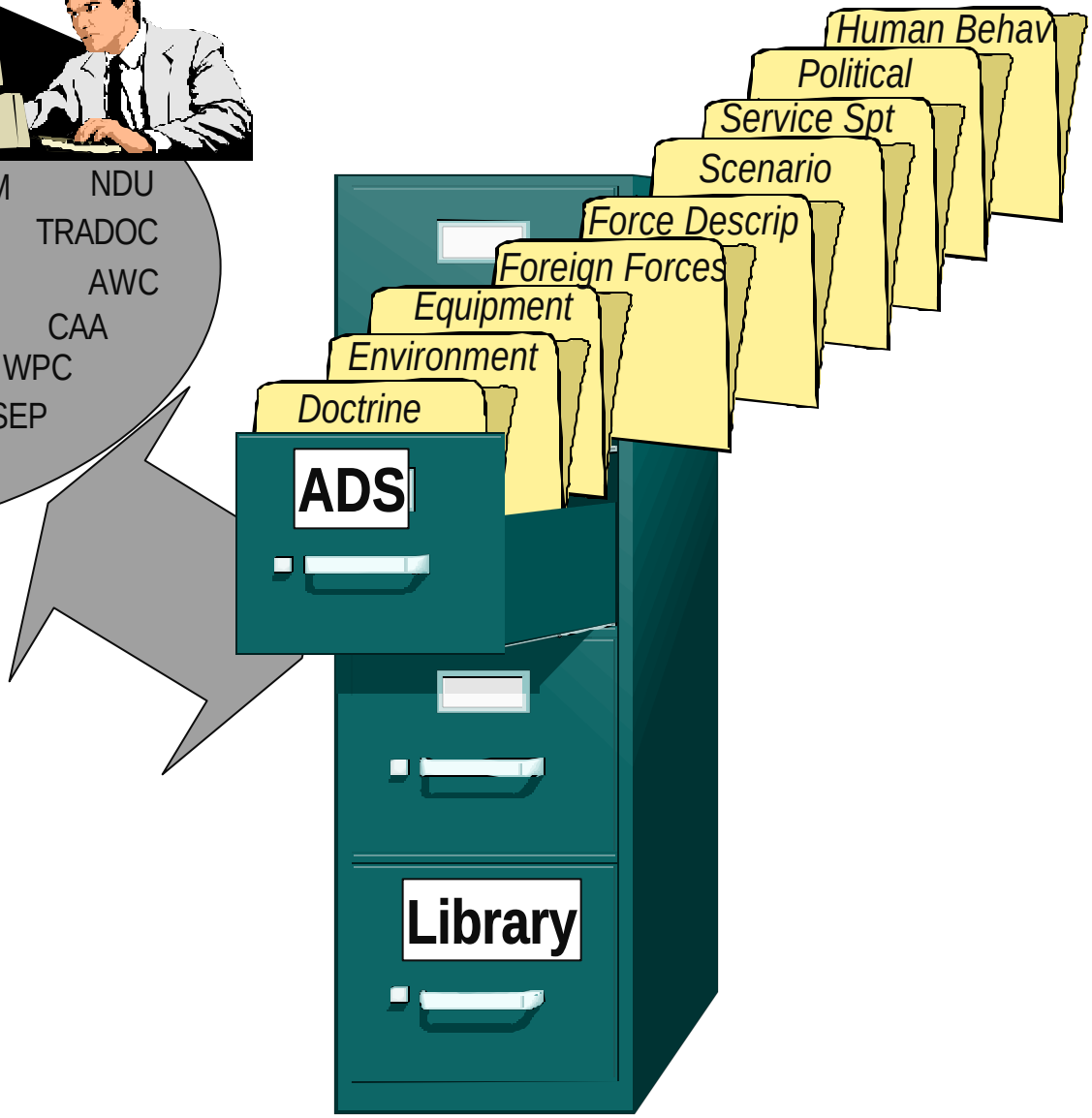


Many users going to many data sources

- **Time consuming for user and sources**
- **Requires many months and many people**
- **Pedigree & V&V unknown or ambiguous**
- **Difficult & expensive for Components to maintain**

Identifying Source Data with ADS





- Reduce knowledge acquisition time
  - representation development
  - representation employment.
- Identification of “best” initial data product
- Intended purpose of data clearly described
- Indication of pedigree and data quality
- Metadata configuration management

Authoritative Data Source (ADS) Working Group

DMSO Initiated - DOD MSWG Sanctioned - ADSWG Coordinates

ADSWG - Co-Chaired by DMSO and AF-XOC
Members include DMSO, Service M&S Offices, M&SEA, DIA, Others

Purpose: ADS is to provide the DoD Modeling and Simulation Community with a Knowledge Acquisition Tool that identifies data/informational sources, helps the user make a first level decision as to which might be best for his use, and then assists in acquiring the data.

Authoritative Data Source Library

What is it? ADS is a web accessed (http://ads.msrr.dmso.mil) set of libraries (DMSO, Army, Navy, Air Force, MEL) of metadata on M&S data and knowledge source. It provides general description, quality, and access information for each source. [DMSO 1039, AF 690, Army 755, Navy 1164]

Advantages: Provides single points of entry to all libraries, uses standard definitions and structure across libraries for ease of use and designates recognized authoritativeness.

Status: Library source data collection FY96-99, Transferring Service records to respective Service FY00-01, DMSO Library Maintenance FY00-01, Transitioning Library to MSRR hosting FY01.

Authoritative Data Sources Summary:

- **A simulation is <u>only</u> as good as the data which drives it.**
- **If you need help figuring out where to begin, MSIAC is a good place to start.**
  - **Navigate to the DMSO home page – link to MSIAC home page.**
- **If you have a solid notion of what you need, but don't know where to find it, the ADS Working Group is a good way to get pointed to the best starter data:**
  - **Navigate to the DMSO home page – link to the appropriate ADS-WG member: AMSO, AF/XOCP, M&S Environmental EA's, etc.**
  - **Or navigate directly to the appropriate Service/Component ADS Library.**
- **If you have access to an established data provisioning community:**
  - **Joint Data System for QDP,**
  - **Virtual Data Center for BMDO,**
  - **Joint Integrated Data Preparation Center for JFCOM**

  Then work through your designated representative to reach the above groups.
- **If you still need help, contact one of the ADS Working Group co-chairs:**
  - **Mike Hopkins, DMSO (mhopkins@dmso.mil) or**
  - **Lt Col Katherine Rowe, AF/XOCP (roweka@af.pentagon.mil)**

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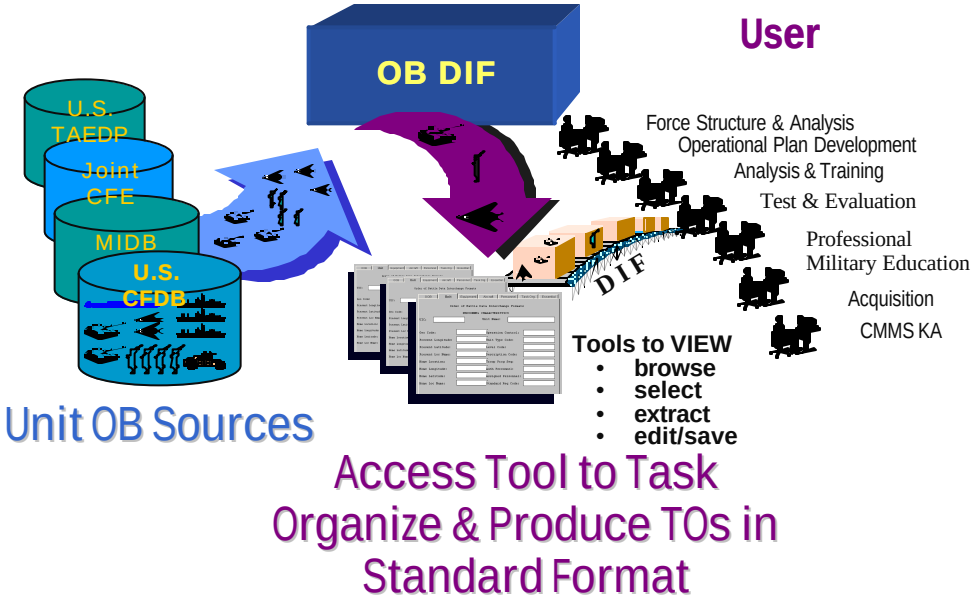
UOB DAT's Three Major Components

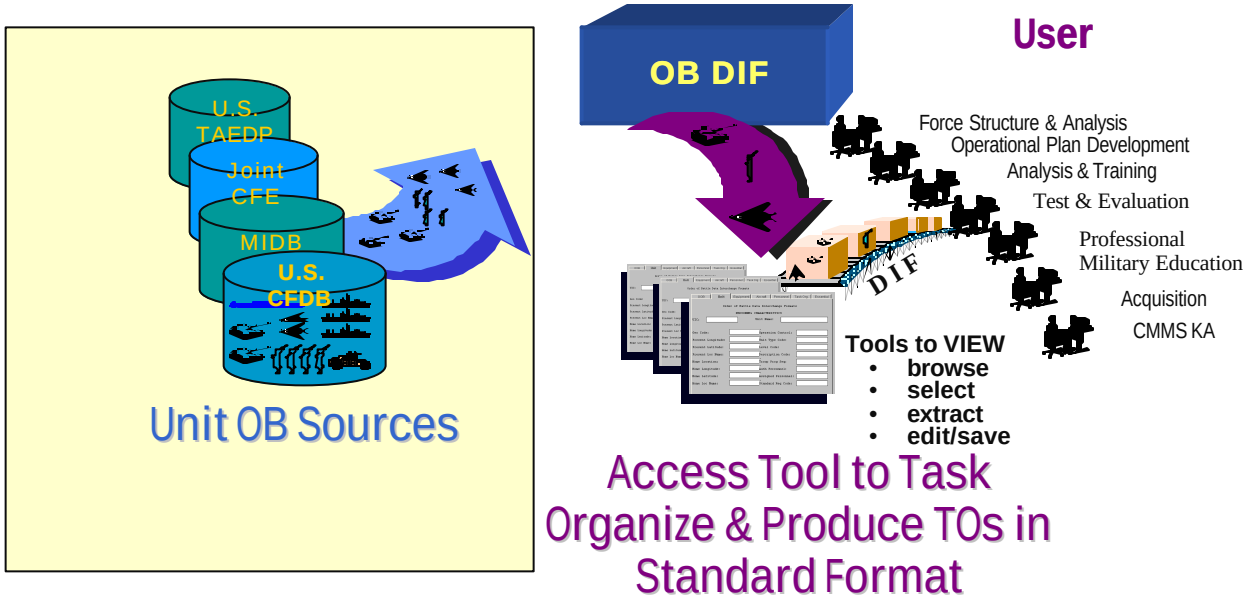


1. **Authoritative UOB Data Sources**

2. **UOB Data Access Tool (DAT)**

3. **UOB Data Interchange Format (DIF)**

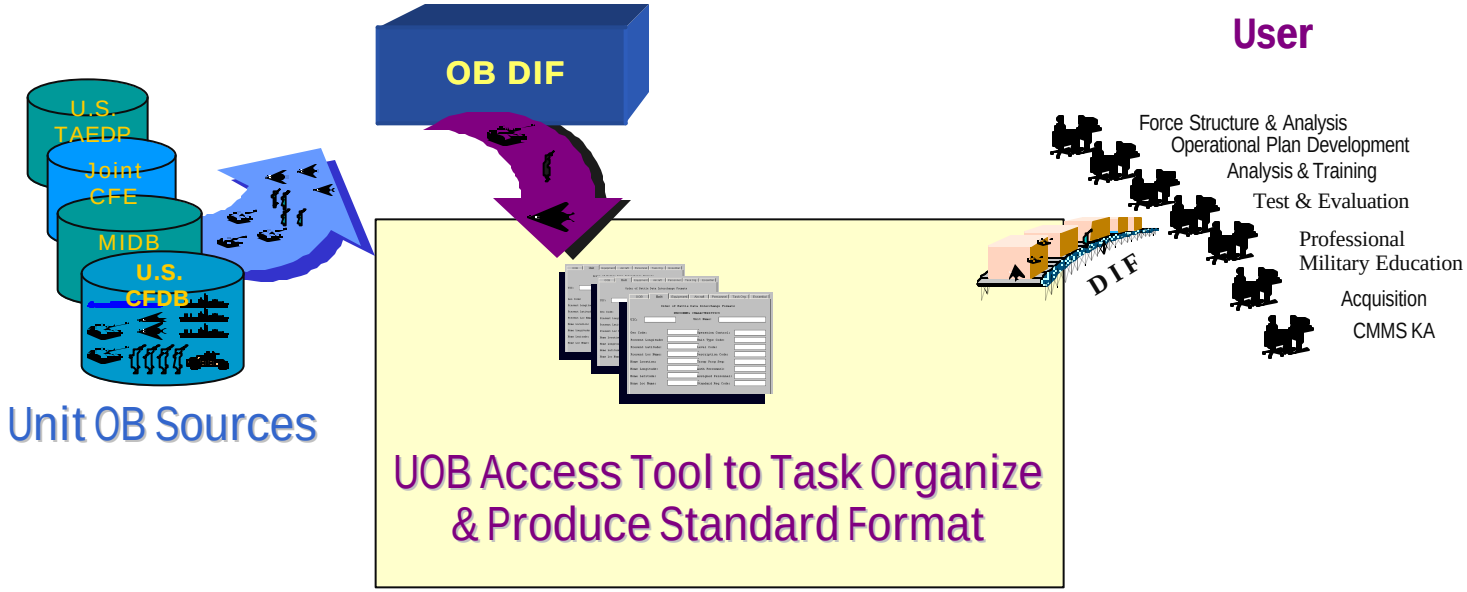
UOB DAT's Three Major Components



1. Authoritative (UOB) Data Sources

- **Library of Classified & Unclassified Authoritative UOB Sources**
- **US and OPFOR**
- **Current and Future data**
- **Stored and Maintained by Sources**

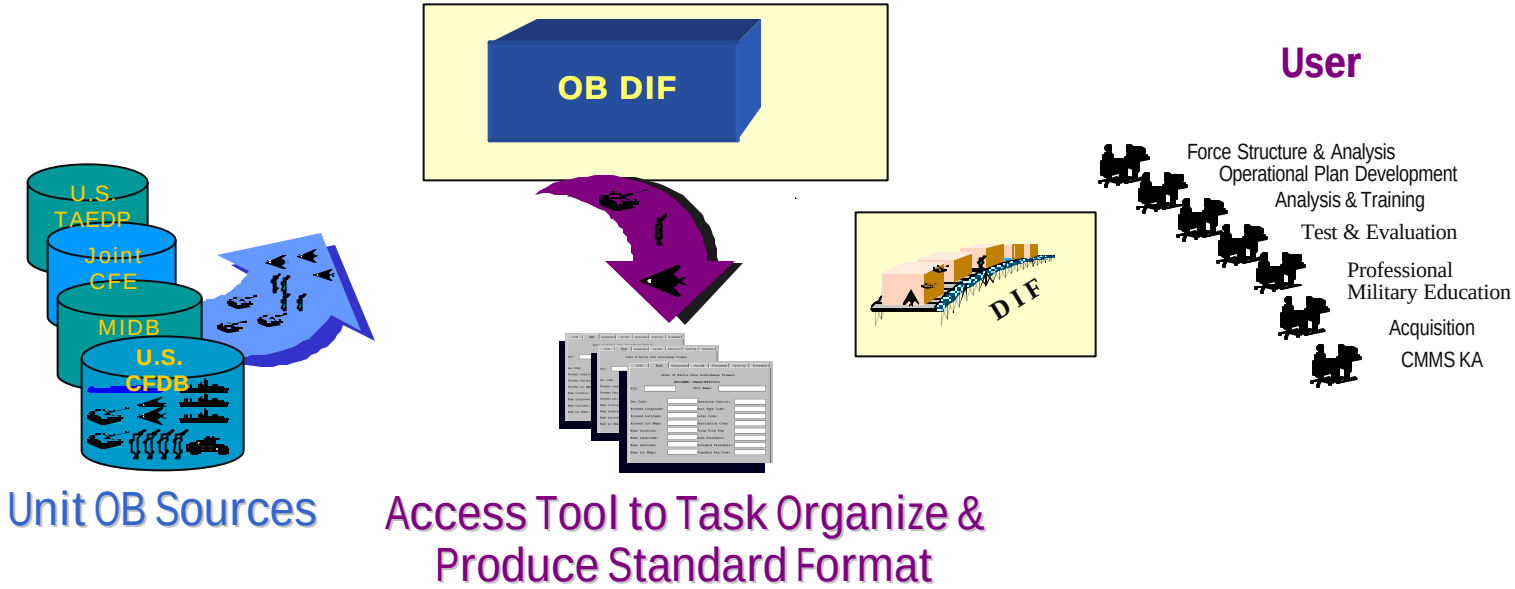
UOB DAT's Three Major Components



2. UOB Data Access Tool (DAT)

- Sources accessed via Internet & SIPRnet
- Select only forces required for task
- View & Edit TOE data
- Build Task Organizations to accomplish specific mission
- Produce DIF

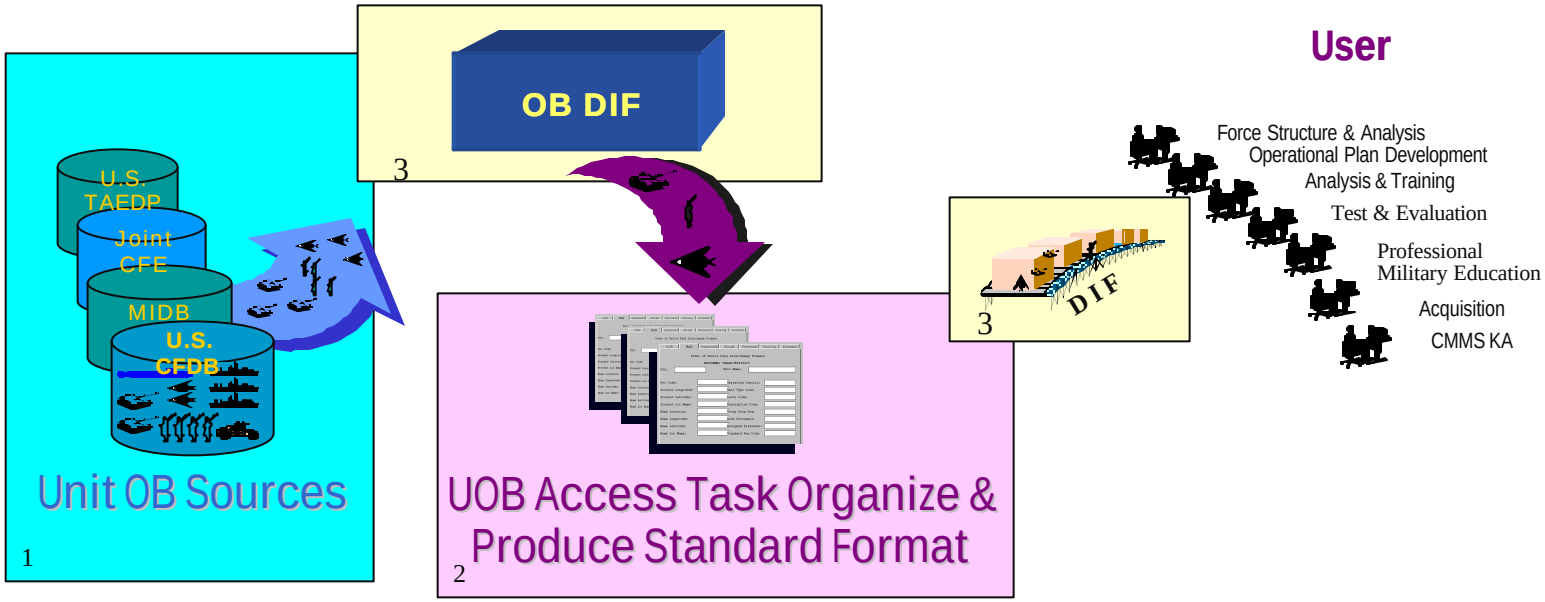
UOB DAT's Three Major Components



3. Data Interchange Format (DIF)

- Common Syntax and Semantics
- Based on standard DoD Data Elements
- Stable standard UOB Format
- Four standard files - units, equipment, aircraft, personnel (Fixed width or comma delimited ASCII text)
- COE compliant

UOB DAT's Three Major Components



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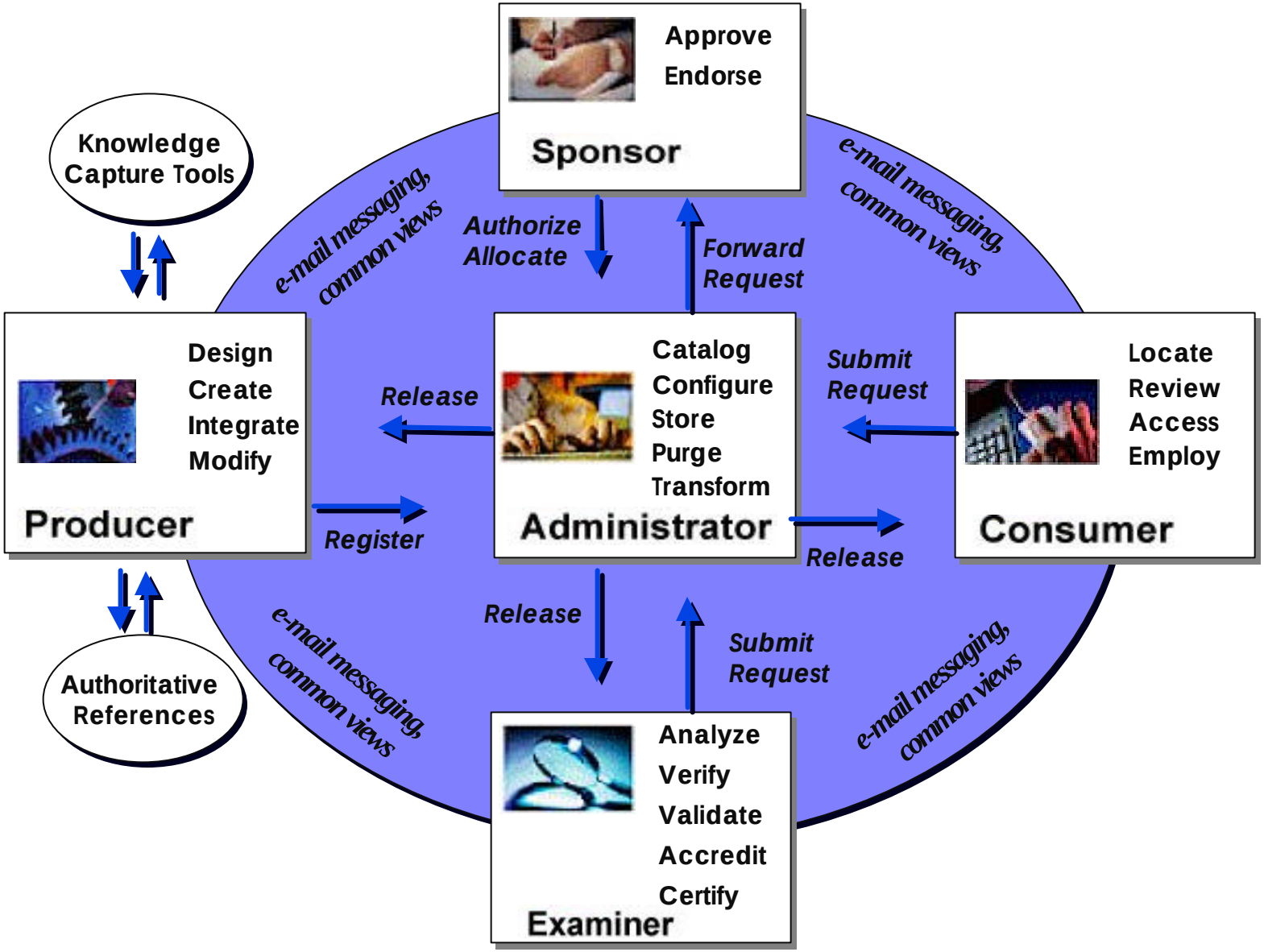
Data Engineering Process



Implemented in the FDMS Model Library

Key Concepts

- **It's Content that Counts**
  - **Enforcing and administering access control drives everything else**
- **Formal Collaborations**
  - **Partners: shared funding, shared decision making**
  - **Associates: shared products**
  - **Observers: shared discussion**
- **Focus on Content Exchange**
  - **Common semantics for logical structure and meaning**
  - **Neutral formats for data exchange**
- **Use before Re-use**
  - **"Fill it and they will come…"**
  - **"Add value for the original requirement and they will stay…"**
  - **"Focus on the food label, not the diet"**
  - **"Do the hardest one early, the easy ones will follow"**

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Data Provisioning Problem Summary

- A simulation is only as credible as its data
- "Overloading" formats with new/alternative content is a common "in-door sport" in modeling and simulation
- Substantial investment in legacy systems must be retained
- The "quality and utility" of data cannot be separated from the "purpose and intent" of its usage

Key Problems:

- Authoritative data is not readily available
- Data that is available is incomplete or ambiguous
- Valuable data sets are not retained for future use

Key Information Classes Summary:

- **The Warfighter's Perspective (missions, operations, tasks) is the Central Organizing Principle. The Systems, Platform, Equipment Perspective plays as supporting role defined by the Warfighter's Perspective.**
- **Key Information Classes include are subdivided into:**
  - **Entities, Processes, and Environment.**
- **Entity-focused information classes include:**
  - **Force Structure (order of battle: unit, electronic, logistics load-out, etc)**
  - **System C&P (to move, sense, communicate, engage, replenish)**
  - **Targets and Facilities (both static and mobile)**
  - **Weapons Effects (damage, attrition, suppression, etc.)**
- **Process-focused information classes include:**
  - **Missions, Operations, Tasks**
  - **Tactics, Techniques, Procedures**
  - **C4ISR, Logistics**
  - **Human and Organizational Behavior**
- **Environment-focused information classes include:**
  - **Integrated Natural Environment (Terrain, Ocean, Air & Space)**
  - **Civil and Political Environment**

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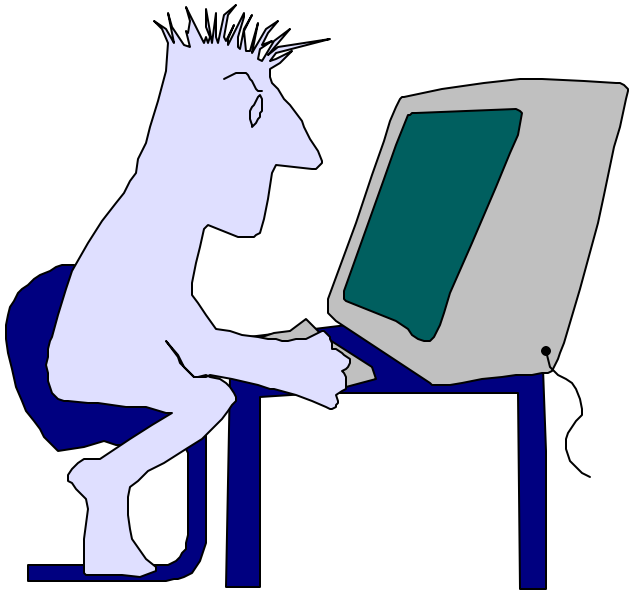
Ambiguity is an Issue

FO calls in mission.
FA Btty fires it.



Is he calling the priest to warn him that he's going to set the mission on fire?

But why is the church burning?

Common Semantics and Syntax

SYNTAX:

the symbols and structures which may be used in a representation and the ways that those symbols may be arranged with the allowed structures.

SEMANTICS:

the content or meaning embodied in the symbols and symbol arrangements defined in the syntax.

COMMON SEMANTICS and SYNTAX:

the implementation-independent logical representation of structure and content (meaning) of a particular model or data element within the specified scope and context of a recognized standard.

CSS is composed of:

- **Common Lexicon**
- **Representation Templates**
- **Style Guide**

Examples:

- **Entity, Task, Class names**
- **JSIMS FDP, C4ISR-AF ver 2.1**
- **UML guide for FDMS**

Uses for Common Semantics & Syntax

COMMUNICATION

between

people and organizations

INTER-OPERABILITY

between systems

Specification

Reliability

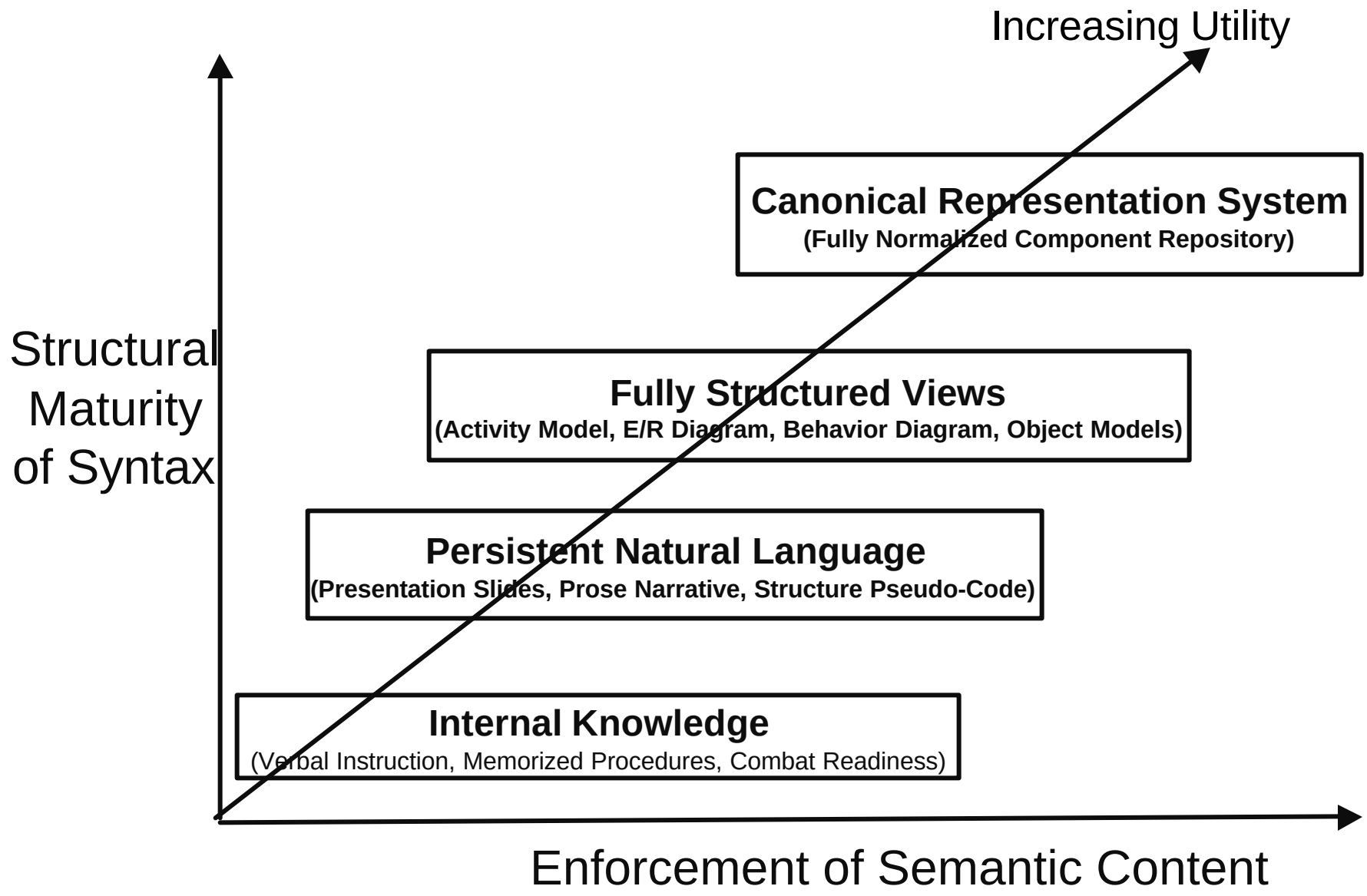
Reusable Components

Knowledge Acquisition

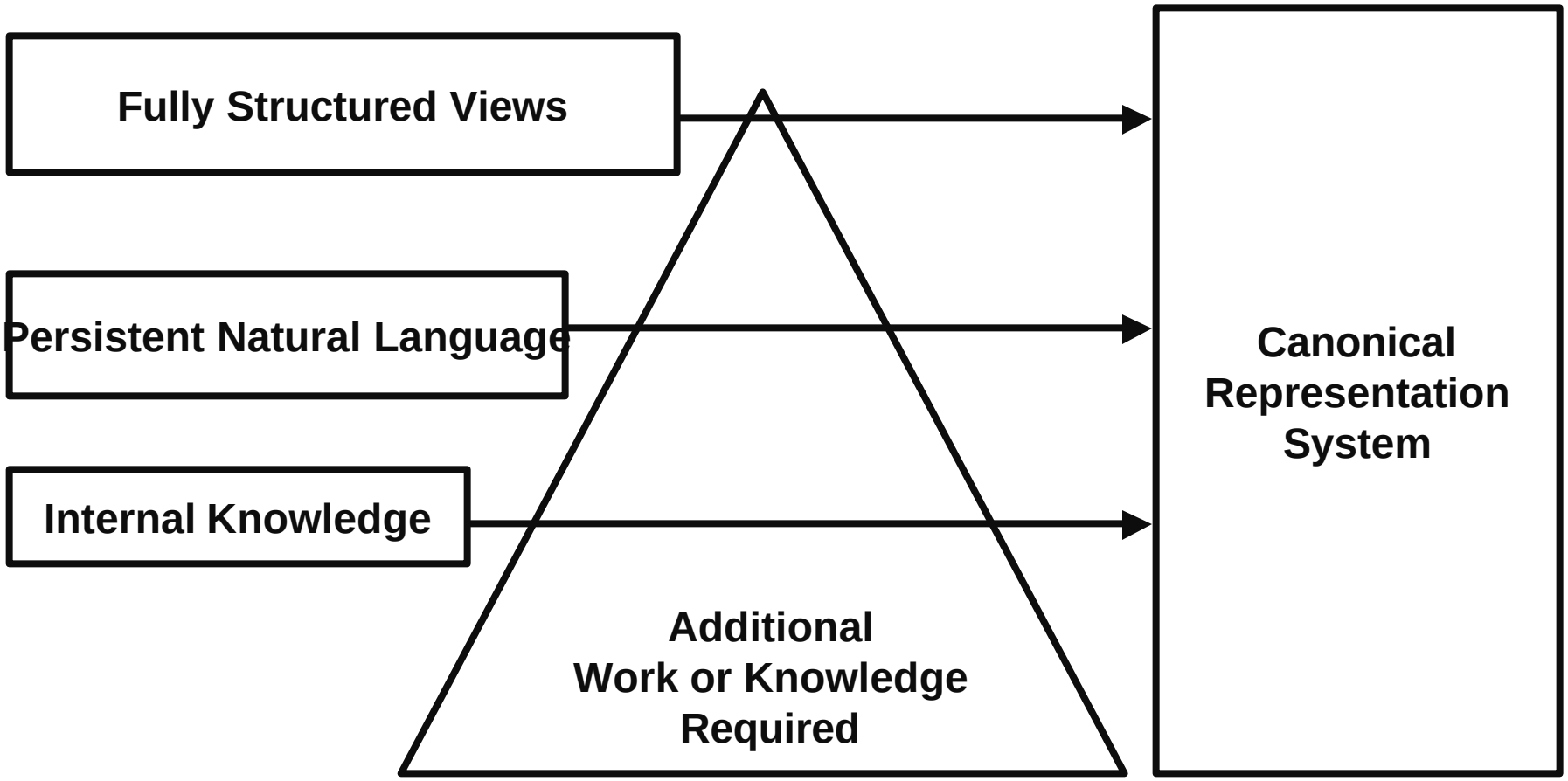
SYSTEMS ENGINEERING

Adapted from Mike Uschold, 1996

Representation Dimensions



Migrating Knowledge
at Multiple Levels of Structural Maturity



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Data Interchange Format

FORMAT:

the set of symbols and structures which define the physical implementation of data (BNF, SQL, bits & bytes) conforming to a specified semantics and syntax.

DATA INTERCHANGE FORMAT:

an intermediate format required to convert data from a set of input formats which share a common semantics and syntax to a set of output formats without loss or distortion of content.

DATA INTERCHANGE MECHANISM:

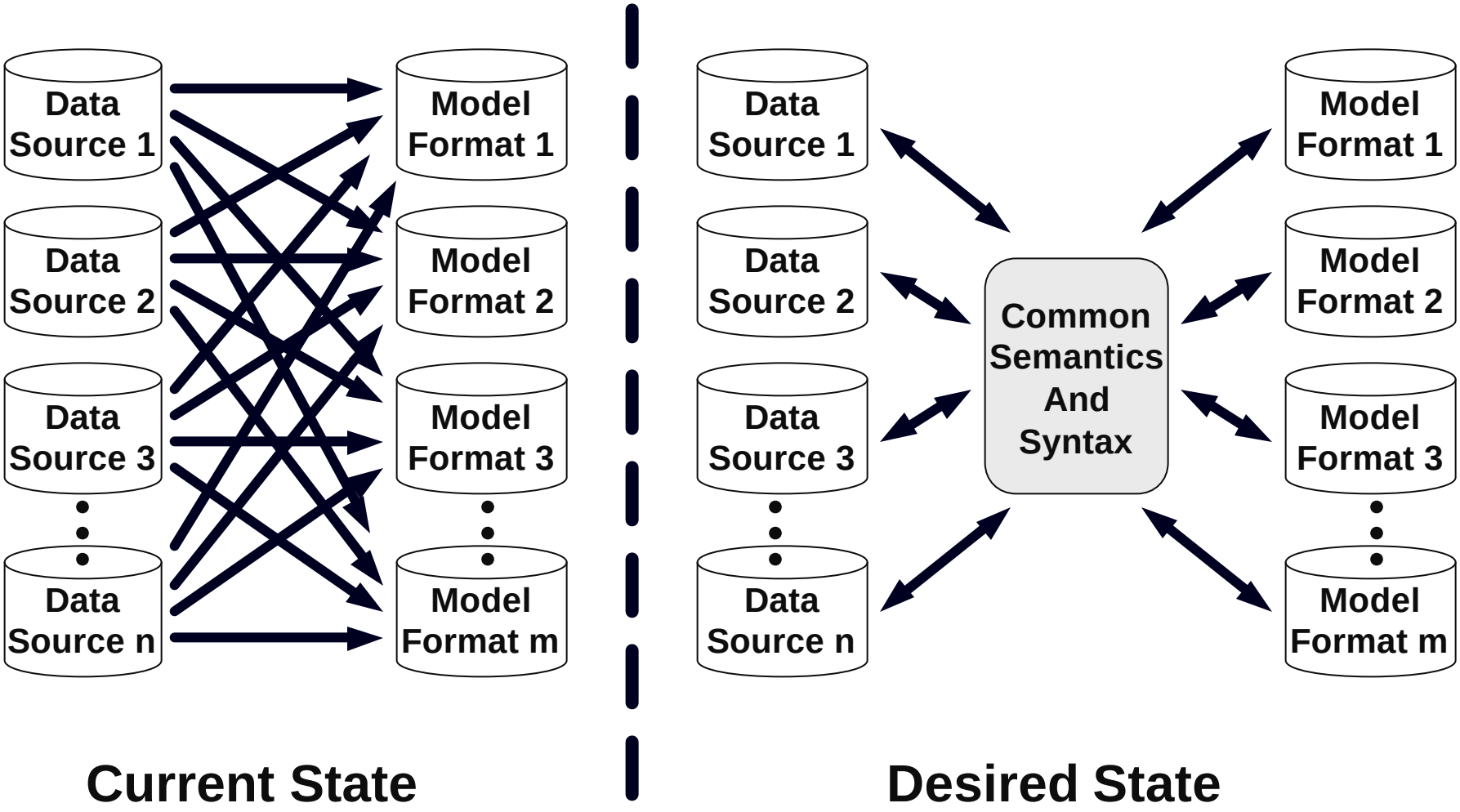
a set of tools, utilities, or application programming interfaces which perform the conversion into and/or out of a data interchange format

DIF is composed of:

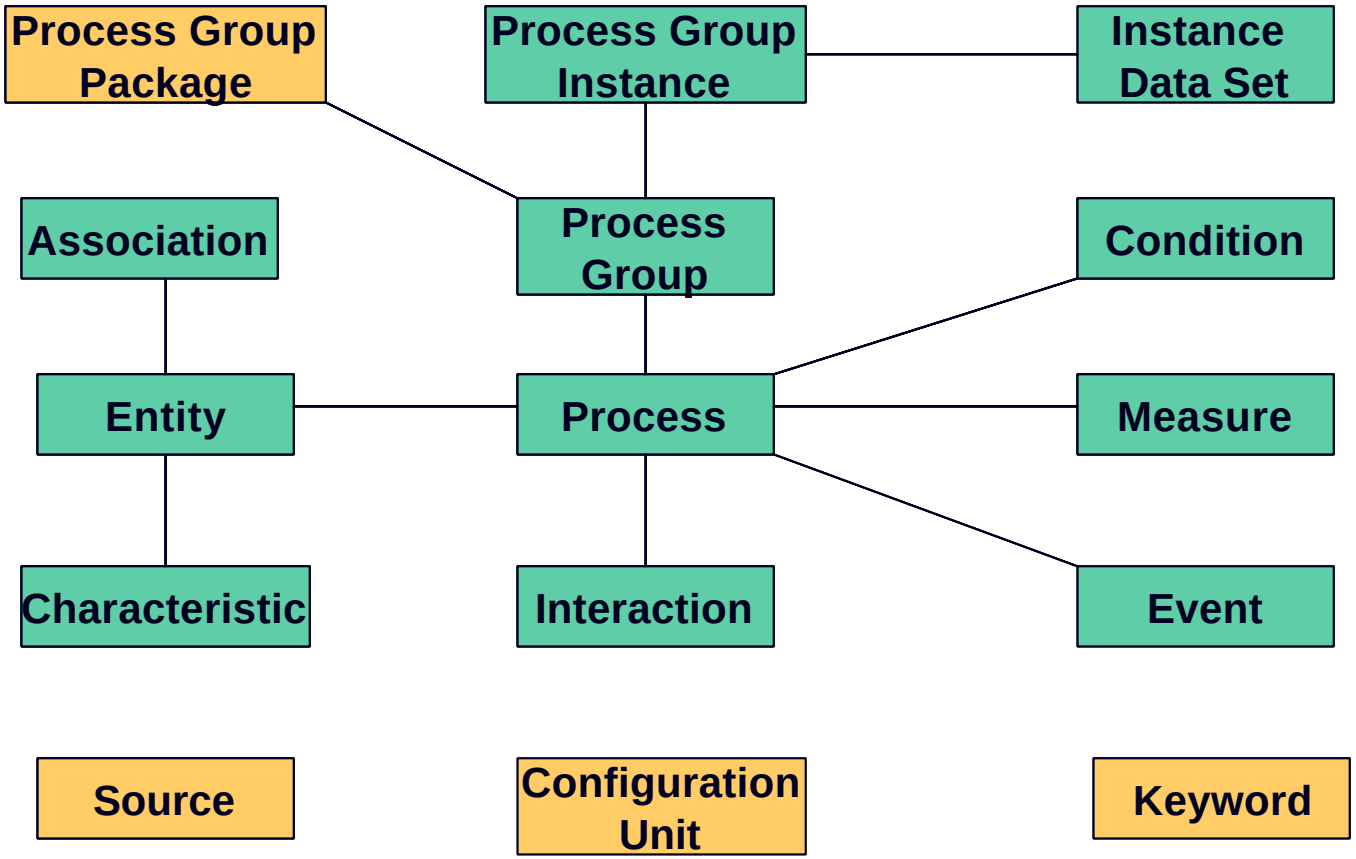
- a CS&S
- a physical format

Examples:

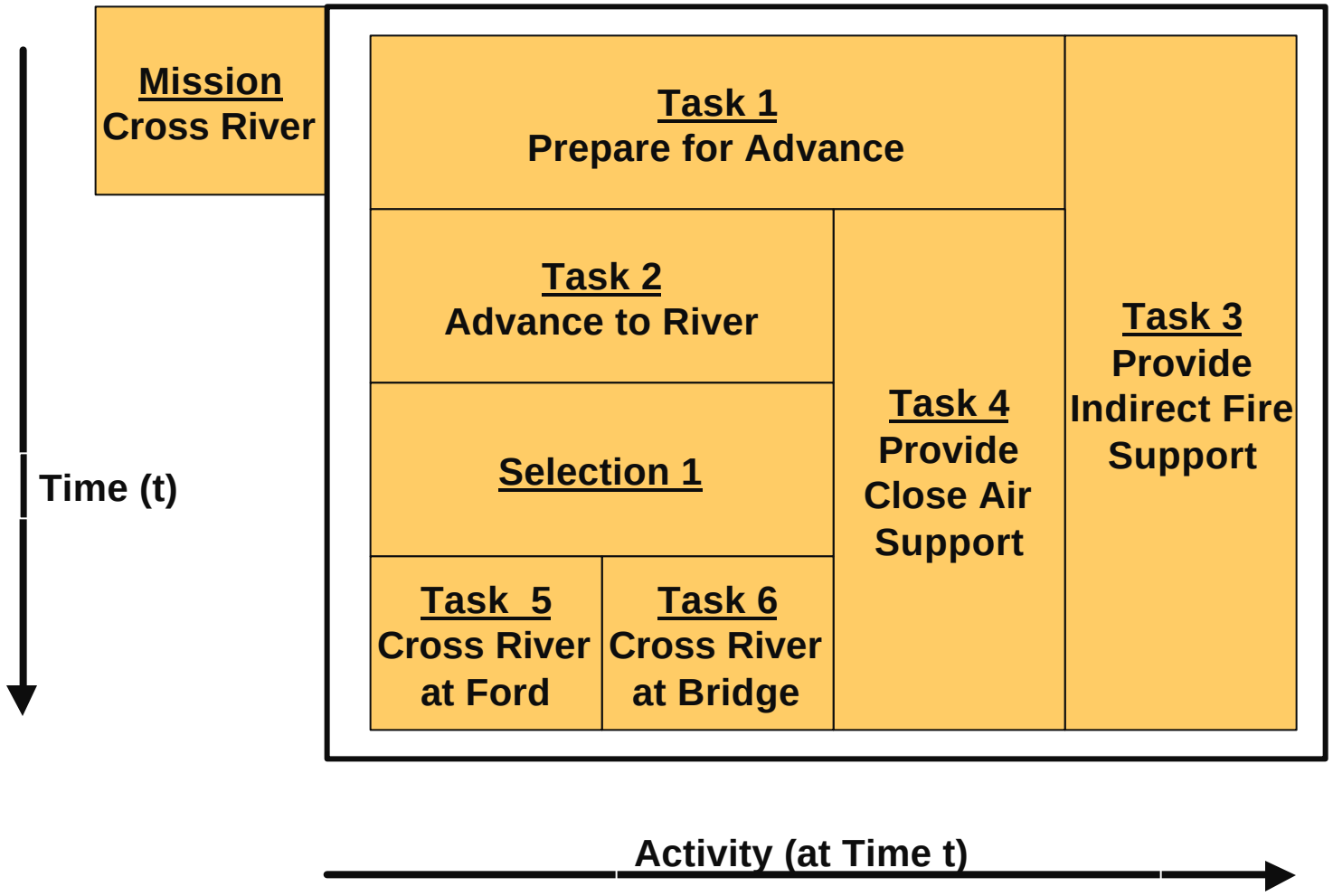
- HLA-OMT, SEDRIS Data Representation
- HLA-OMT-DIF, SEDRIS Transmittal, UOB-DIF, FDMS-DIF


Data Source 1
Data Source 2
Data Source 3
Data Source n
Model Format 1
Model Format 2
Model Format 3
Model Format m
Current State
Data Source 1
Data Source 2
Data Source 3
Data Source n
Common Semantics And Syntax
Model Format 1
Model Format 2
Model Format 3
Model Format m
Desired State

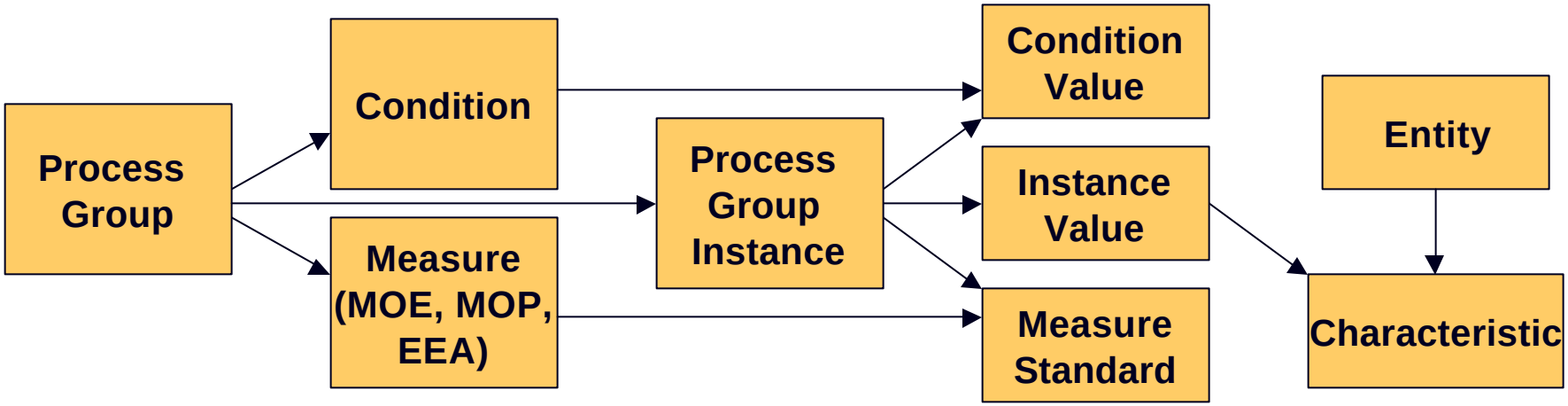
FDMS Data Interchange Format



The Operational View

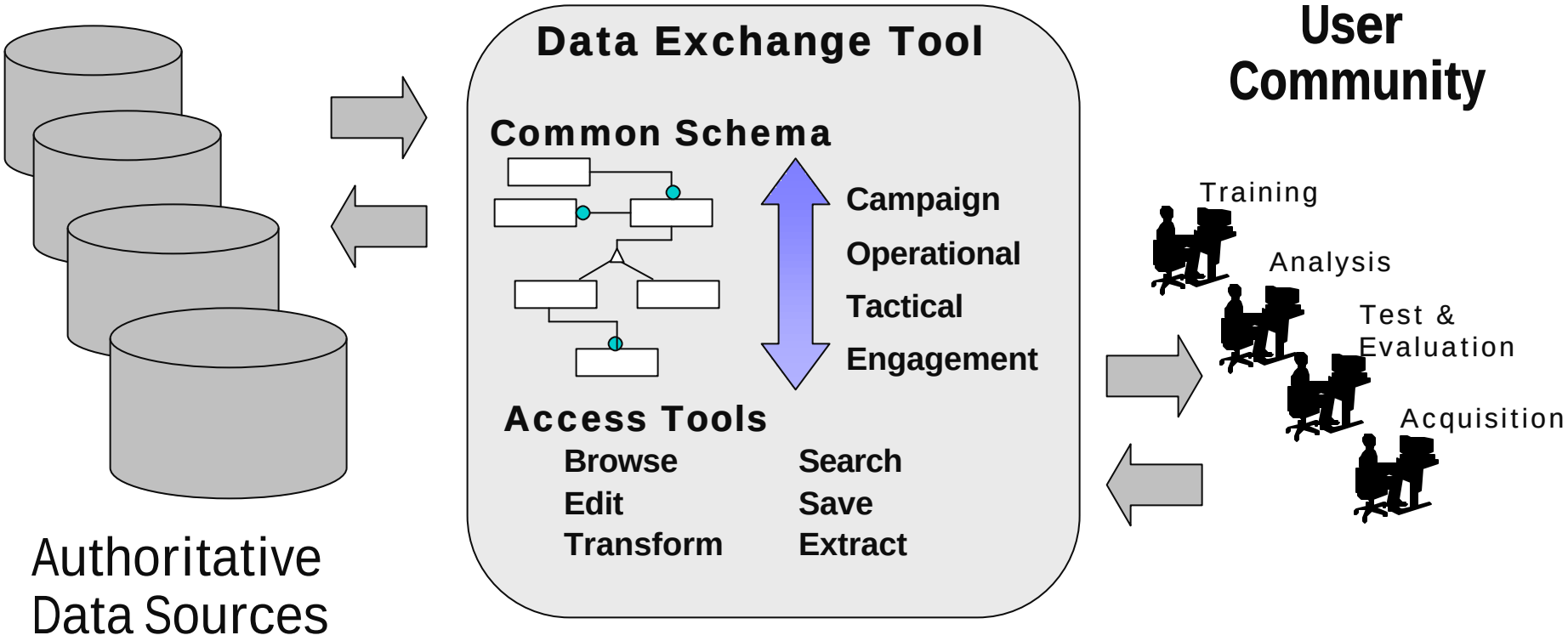


An Engineering Requirements View



Data Exchange Summary:

- **Enforce the Exchange Standard <u>between</u> major applications; encourage PM's to make pragmatic choices about where and when to embrace the Exchange Standard <u>inside</u> the application.**
- **If you need help with Data Exchange Standards, contact the:**
  - **Appropriate Service Standards Category Coordinator (Army in the lead, Navy and AF making excellent strides) via their respective M&S management offices.**
  - **The M&S Executive Agents for Intell and Environment (Terrain, Ocean, Air & Space) via DMSO.**
  - **The M&S Functional Data Administrator (Roy Scrudder, DMSO (ARL:UT), scrudder@arlut.utexas.edu)**


Data Exchange Tool
Common Schema
Campaign
Operational
Tactical
Engagement
Access Tools
Browse
Search
Edit
Save
Transform
Extract
User Community
Training
Analysis
Test & Evaluation
Acquisition
Authoritative Data Sources