Joint Battlespace Infosphere: Information Management within a C2 Enterprise

Air Force Research Laboratory
Systems & Information Interoperability (IFSE)
Vaughn Combs
Robert Hillman
Michael Muccio
Ryan McKeel

With each of the operations over the past decade, successively more types and larger volumes of information have been made available to the warfighter.

It has become increasingly difficult to get the right information to the right warfighter at the right time.

Compounding this problem is the fact that many of the systems the warfighter currently uses do not readily share information with each other in an intelligent way.

The warfighter is often at the end of a firehose with no way of knowing what information may be useful to the mission at hand.

The Joint Battlespace Infosphere (JBI) Information Management Services is an information management infrastructure which utilizes publish, subscribe, and query services allowing the warfighter to exchange, fuse, and manage information.

JBI and Information Management

- **Information Management**

    – **Universal Access to Information**

    – **Custom Policy and Security Based Access Control**

    – **Orchestrated Information Environment**

    – **Continuous Adaptation and Tuning to the Operating Environment**

    – **Infosphere Generation and Tailoring of Actionable Information**

JBI Objectives

- **Transparently** manages all data types (e.g. Document, imagery, messages)

- **Reduces** information overload through dynamic, multi-level filtering

- **Rapid** system information integration promoting machine-to-machine info exchange

- **Loose coupling** of information publishers and subscribers, no hard system-to-system interfaces required

- **User directed** tailoring transforms information into actionable form via Fuselets

- **Provide** an implementation and technology agnostic information management infrastruscture

- **Utilize** enterprise services provided by NCES

- **Provide** information management mechanism for Net Centric Operations via pub/sub/query within a COI or Enterprise

JBI Information Management Services enable the discovery, transformation, persistence, distribution, and control of *information* for users at all echelons, from the command center to the battlefield.

- **Information structured as Managed Info Objects (MIOs)**

- **Distribution via Publish, Subscribe, and Query services**

- **Implementation independence achieved through Common Client Application Programming Interface (CAPI)**

- **Information mediation and transformation enabled by Fuselets**
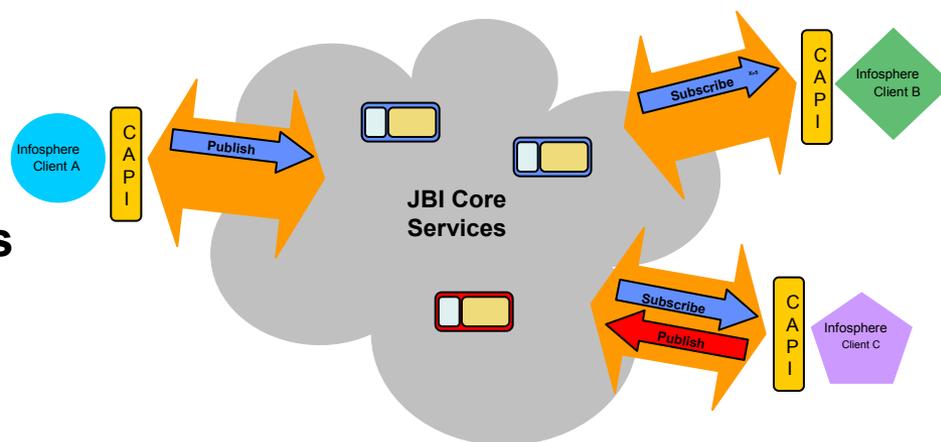
- **Cyber-merge of incoming units via Force Templates**
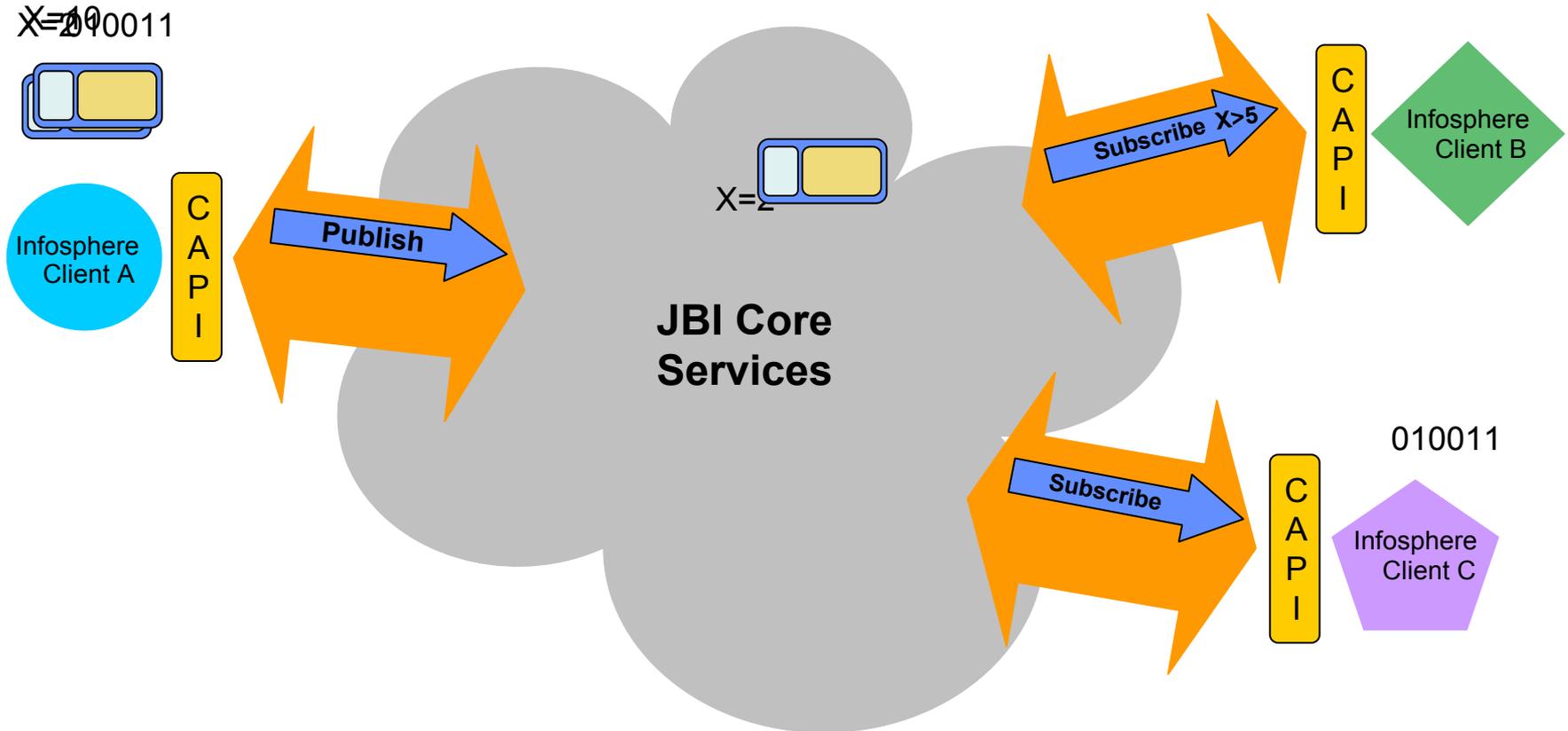
Managed Information Object (MIO)

Metadata

Payload
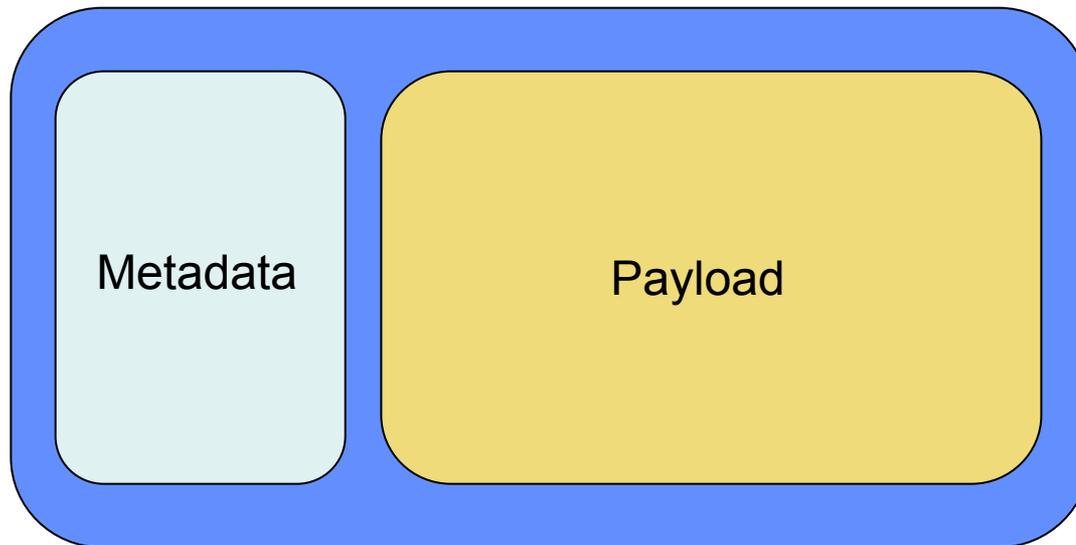
Publish, Subscribe Services

- **Clients publish info objects into Infosphere**

- **Clients subscribe looking forward in time *t* for future info objects**

- **Information has Dynamic Value that decreases as time increases**

- **Common Client Services API (CAPI) is standard interface all clients**

- **Clients need no knowledge of Infosphere implementation (via CAPI)**

- **Clients need no knowledge of existence of other clients (i.e. loose coupling)**

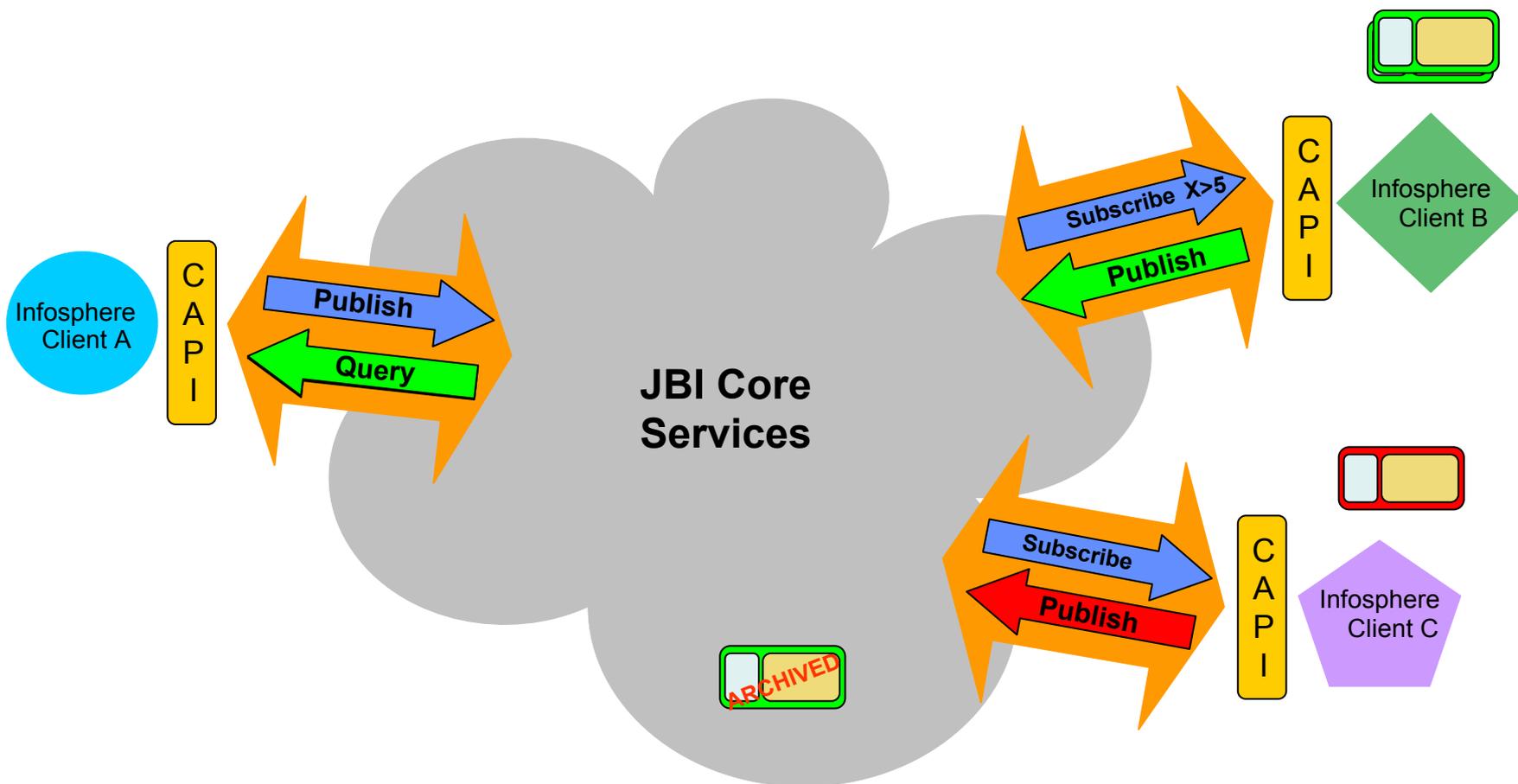- **Pub/sub/query services based on commercial products, industry stds**

Information Transformation Fuselet Services

- **Encapsulated simple decision logic within Infosphere**
  - **Integrate, Aggregate, Correlate, etc**
- **Publishes new info objects resulting from transformation**

- **Status:**
  - **Verified Research Concept**
    - **Developed Prototypes as Client Applications**
    - **Run-time Infrastructure**
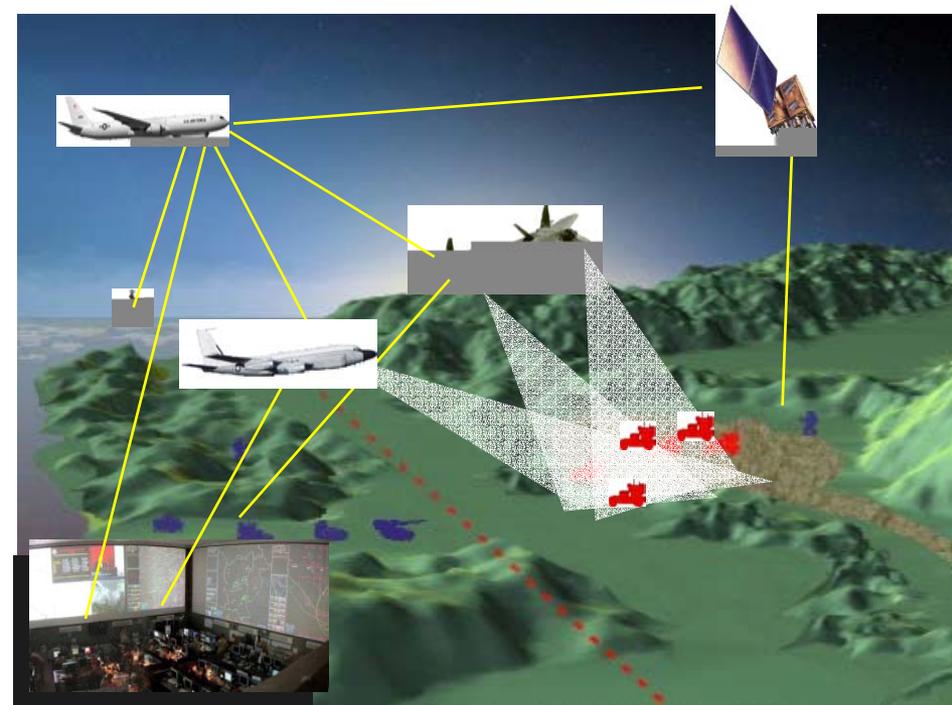 - **Merging Into Infosphere for execution and Control**
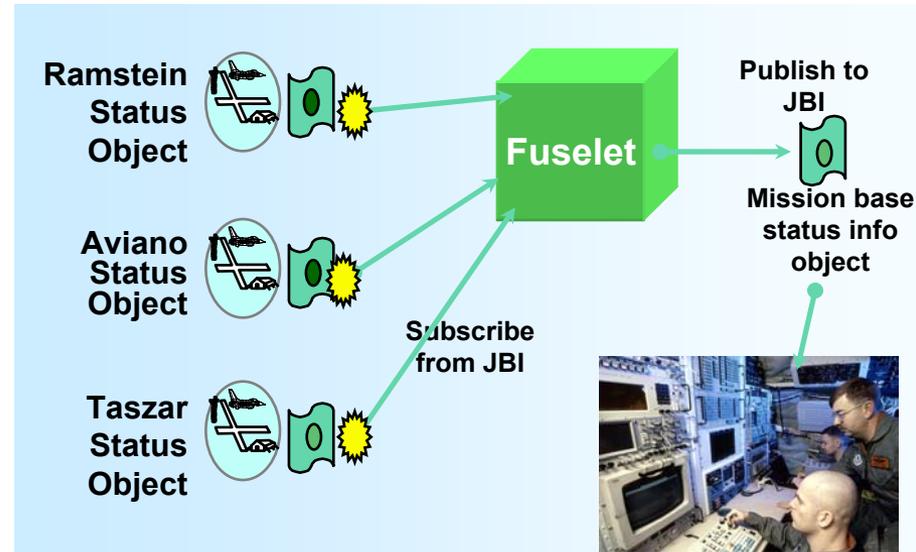
- **Challenges Remaining:**
  - **Validation Fuselet behavior and execution properties**
  - **Invocation Methodology for Orchestration Run-time**
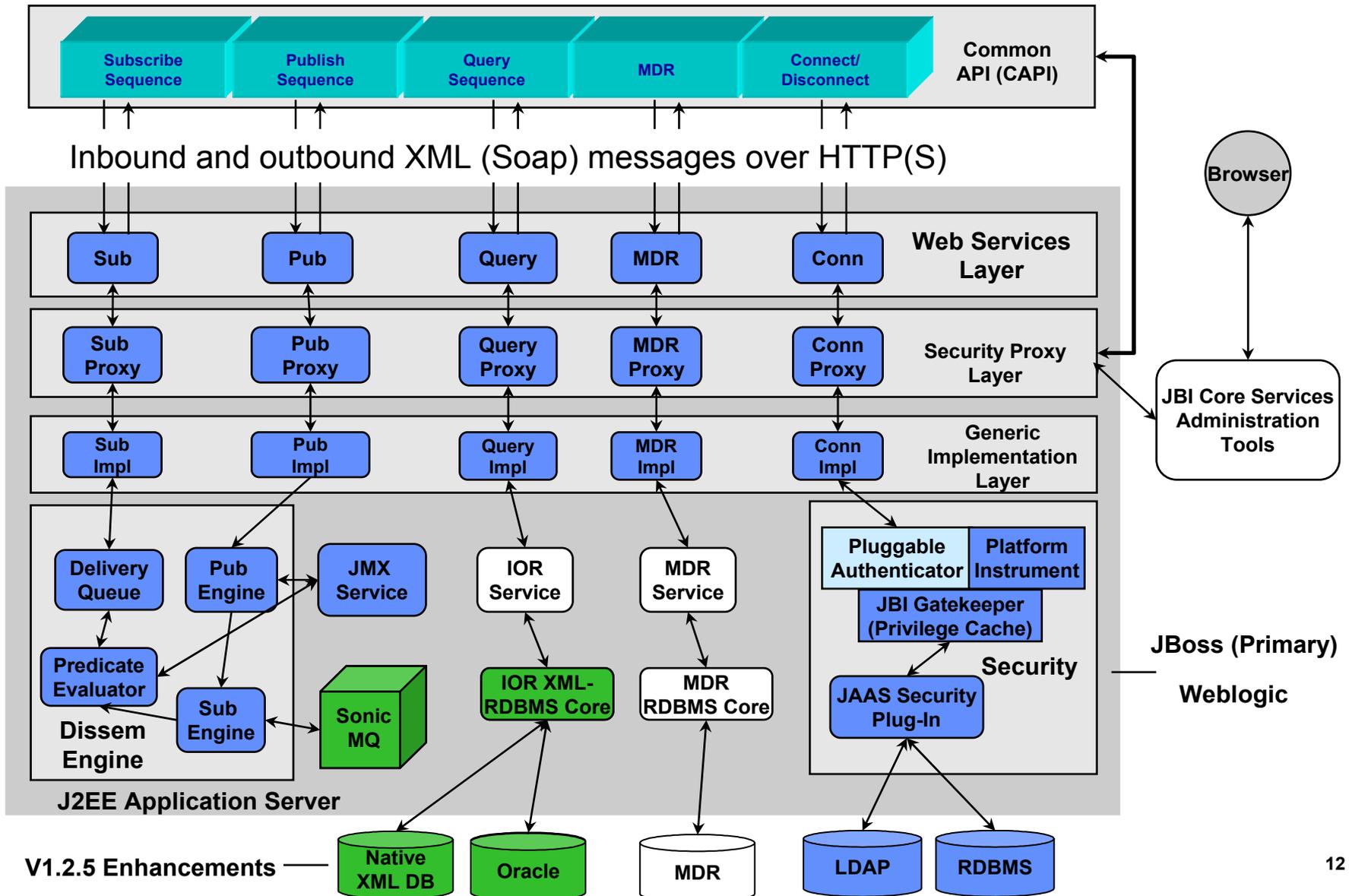 - **Autonomous Monitoring, Operation and Control for IMS**

- **Enables rapidly "plug into" Infosphere**
- **Profile for rapid unit assimilation into Infosphere**
- **Base processes to define:**
  - **MIOs needed or provided by entity**
  - **Entity Role, Mission capabilities**

- **Status:**
  - **Developed Initial Concepts of Operation**
  - **Researching Implementation approaches**

Reference Implementation V1.2 Architecture

Common API (CAPI)

Subscribe Sequence	Publish Sequence	Query Sequence	MDR	Connect/ Disconnect

Inbound and outbound XML (Soap) messages over HTTP(S)

Web Services Layer

Sub | Pub | Query | MDR | Conn

Security Proxy Layer

Sub Proxy | Pub Proxy | Query Proxy | MDR Proxy | Conn Proxy

Generic Implementation Layer

Sub Impl | Pub Impl | Query Impl | MDR Impl | Conn Impl

J2EE Application Server

Dissem Engine
- Delivery Queue
- Pub Engine
- JMX Service
- Predicate Evaluator
- Sub Engine

Sonic MQ

IOR Service — IOR XML-RDBMS Core

MDR Service — MDR RDBMS Core

Security
- Pluggable Authenticator
- Platform Instrument
- JBI Gatekeeper (Privilege Cache)
- JAAS Security Plug-In

JBoss (Primary)

Weblogic

Browser

JBI Core Services Administration Tools

V1.2.5 Enhancements

- Native XML DB
- Oracle
- MDR
- LDAP
- RDBMS

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JBI Reference Implementation (Motivation)

- **Establish a research vessel in which to quickly prototype and experiment with JBI concepts & designs**

- **Produce *Reference Implementations* for internal and external consumption**

    - **Modeled after open source projects**

    - **Provides a pluggable, component-based architecture not wedded to any technology**

    - **Quickly swap in new or better components**

    - **Government-owned, no restrictions on use**

- **Foster innovation within context of disciplined release process**

- **Apply lessons learned in preparation for Mercury, Gemini and Apollo acquisitions**

- **Helps chart the course for overall JBI Program**

Reference Implementation

- **Version 1.2 Available Now**

  - **Pub/Sub/Query/Persistence/IMS Toolkit/RBAC Security**

  - **Full suite of client applications and utilities**

  - **Over 80 copies distributed to government, academia and industry**

    - **https://cmweb.deepthought.rl.af.mil/pls/new_user/new_request.cmdb**

- **Compatible with Web Services (WS)**

  - **CAPI available as fully functional WS applications**

  - **Potential to augment WS with Persistence and Access Control**

- **Commercial Standards**

  - **Enterprise Integration: J2EE, JMS, XML Schemas, XPath/*XQuery***

  - **SOA and WS: WSDL, *UDDI,* and emerging *NCES Standards***

  - **Security: Sun One Directory and Identity Servers, Role-Based Access Control, and *Policy Representation***

  - **Databases: Oracle, MySQL, TigerLogic, Berkeley XML DB**

Instrumentation Services
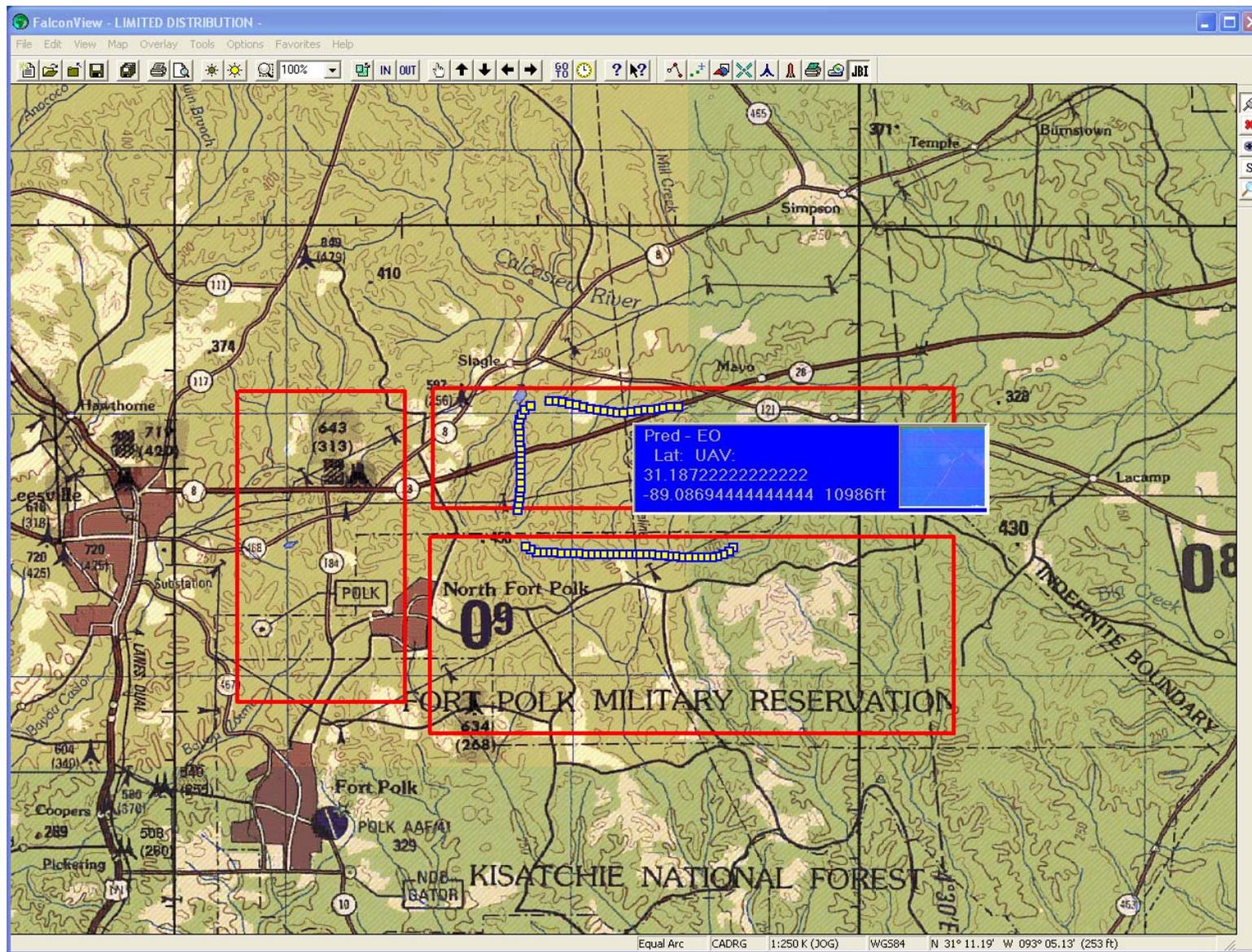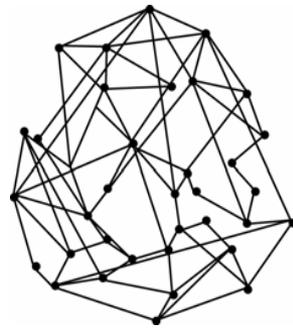
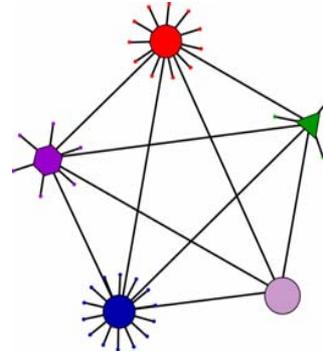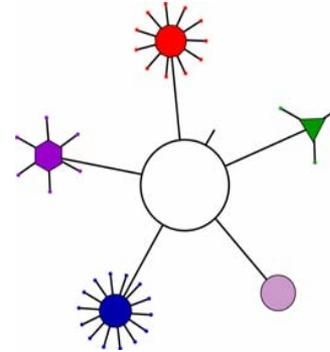| Architecture Characterization:	Pair-wise Integration of Systems	Pair-wise Integration of Domains	Federated Architecture	Unified Architecture
Retrofit integration cost scaling law:	N^2	$N+P^2$	$N+P+1$	$N+1$
Relative integration cost to add a new system:	N	P	1	1
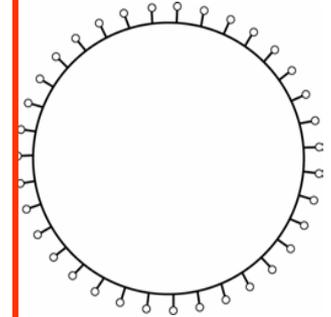
Net-centricity

N = number of systems to be integrated
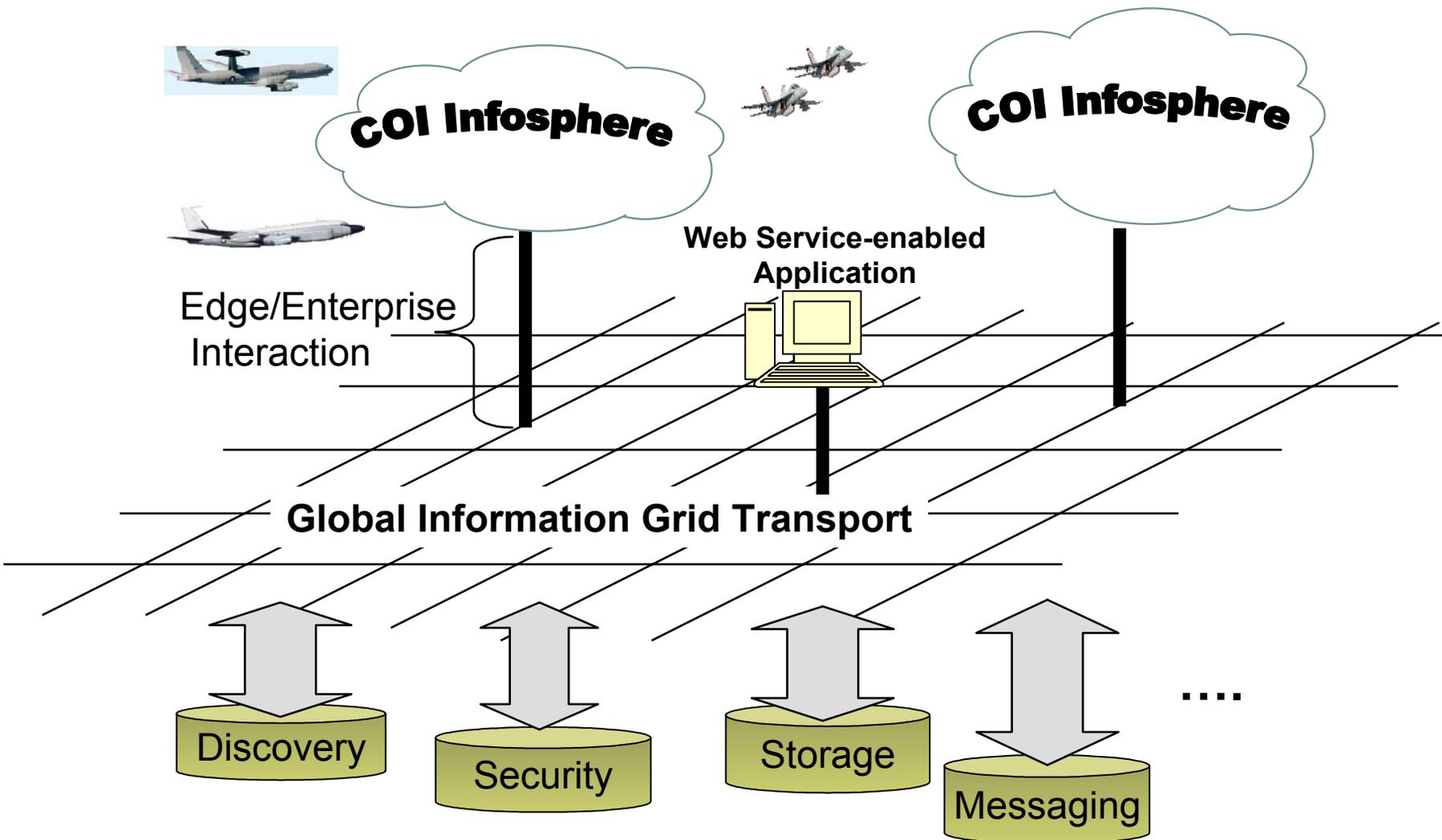
P = number of pre-existing domain-specific architectures currently implemented among the N systems

Note: the drawing detail (N=35 and P=5) is illustrative only

COI Infosphere

COI Infosphere

Web Service-enabled Application

Edge/Enterprise Interaction

Global Information Grid Transport

Discovery

Security

Storage

Messaging

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Net-Centric Enterprise Services (NCES)

Domain Application

Operational Task Supported	Interested Organizations/ Target Domain
Dynamic Mission Re-Planning	Air Operations Center
Multi-Int Fusion	STRATCOM/NEC, AF/XOIR, NRO
Joint Dynamic Target Folders	Air Operations Center
Target Assessment/Cursor on Target	CJSOTF
Mission updates for tactical assets via Link-16	Air Operations Center
Force Protection	Air Base Emergency Responders
Blue Force Tracking	Air Operations Center
Airspace/Mission Planning And Utilization	Tactical Airlift Control Center
Open Source Intelligence	HLS, First Responders
Common Mission Ground Segment (CMGS)	AFSPC

Collaborations and Tech Exchange

- NWDC/SPAWAR/ONR - Joint Experimentation with Extensible Tactical C4ISR Framework (XTCF) project, Sea Trial '04 Experiment, JRAPTOR Exp, JBI SW installed
- ESC/MITRE – Installed JBI SW in ACAT Laboratory for C2C
- AFC2ISRC – Joint JBI Clients BAA, JBI SW at TC
- DARPA - JBI services integrated with CoABS Grid, JBI used as OASIS Dem/Val system
- Oracle, Texar, IBM - Collaborative Efforts, Beta projects, influence commercial products
- AMC - JBI experimentation with Mobility Forces, JBI Arch Migration Study
- AF Academy – Installed JBI SW in Institute for IT Applications Lab
- AFCA – Common API into iTRM AF Stds database
- Boeing: Total Domain and Xinfosphere
- General Dynamics: Mercury & BAA   Army/CECOM: Publish and Subscribe Sys (PASS)

Summary

- JBI's Unique Approach

  - Cast data as managed information using Metadata tagging for discovery

  - Share Information using publish/subscribe (push vs. pull)

  - Ensure data are visible, available, and usable when and where needed

  - Information Persistence (actual or *referenced* content)

  - Collaboration using shared information in a distributed environment

  - Extracting legacy business logic as lightweight *fuselets*

  - Dynamic Interoperability of incoming entities via *Force Templates*

  - IM Staff acting on behalf of commander dynamically controls the information space

  - Interoperability within and among communities of interest

Questions?