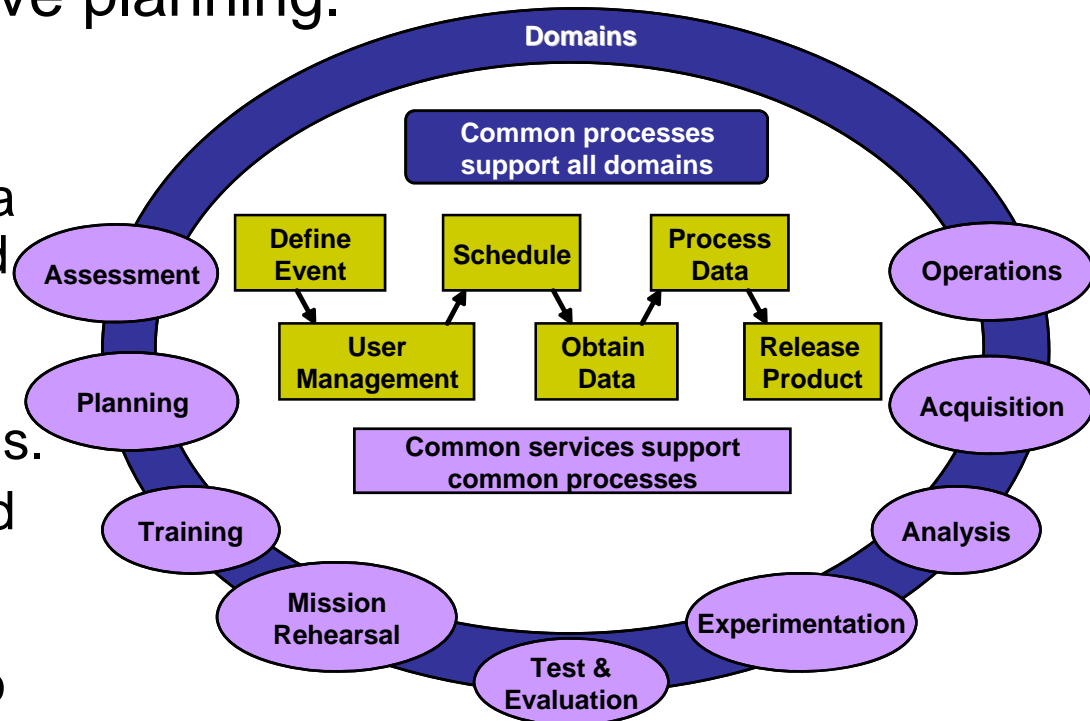# *Joint Rapid Scenario Generation (JRSG)*
Systems Engineering
October 2008

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US Joint Forces Command
Joint Capability Development (J8)
Senior Systems Engineer

JRSG Problem Statement

Generation of scenario data sets do not support operational requirements for near real time mission rehearsal, course of action analysis, and adaptive planning.

- The increasing use of complex M&S applications requires data with greater fidelity with a rapid production time.

- There are common capability gaps that transcend all domains.

- Combined, Joint, Services, and Agencies (C/J/S/A) are developing independent improvements to their scenario generation capabilities.

Domains

Common processes support all domains

| Define Event | Schedule | Process Data |
| User Management | Obtain Data | Release Product |

Common services support common processes

Assessment

Planning

Training

Mission Rehearsal

Test & Evaluation

Experimentation

Analysis

Acquisition

Operations

JRSG Activity Model & Domain Support

No one in is responsible for orchestrating the DoD enterprise solution.

Scenario generation expenses reported in FY07 are **>$400M***

Department of Defense M&S Budget in FY08 is **~$11B****

JRSG Systems Engineering Objective and Constraints

Objective: Integrate existing Combined, Joint, Service, and Agency (C/J/S/A) scenario generation capabilities into an enterprise solution that can rapidly translate authoritative data into a set of initialization products that support mission critical timelines.

Constraints:

- Comply with Net-Centric Data Strategy (NCDS) and Universal Core (UC) data schema

- Utilize Net-Centric Enterprise Services (NCES)

- Synchronize capability development with Net-Enabled Combat Capability (NECC) and the Command and Control (C2) Domain Core data schema

- Evolve best of breed C/J/S/A capabilities

- Adhere to Information Assurance policy

JRSG Systems Engineering Approach

Establish JRSG Community of Interest (COI)

Determine JRSG Demonstration Objectives
- **Integrate existing capabilities as enterprise solution**
- **Determine Combatant Command priority data sharing needs**

Demonstrate JRSG Service Oriented Architecture (SOA)

Geospatial Data Discovery

Map Metadata to GSIP

Build Message Broker

Deploy Agents

Order of Battle Data Discovery/Delivery

Map OOB to JC3IEDM

Build Message Broker

Invoke GFM DI Service

JRSG Community of Interest (COI)

US Special Operations Command

Joint Chiefs Of Staff

US Joint Forces Command

National Geospatial Intelligence Agency

DISA
Defense Information Systems Agency
Department of Defense

Simulation to C4I Interoperability

US Army

US Navy

National Simulation Center

US Air Force

US Marine Corps

Topographic Engineering Center

Program Executive Office Simulation Training, Instrumentation

Synthetic Environment Core

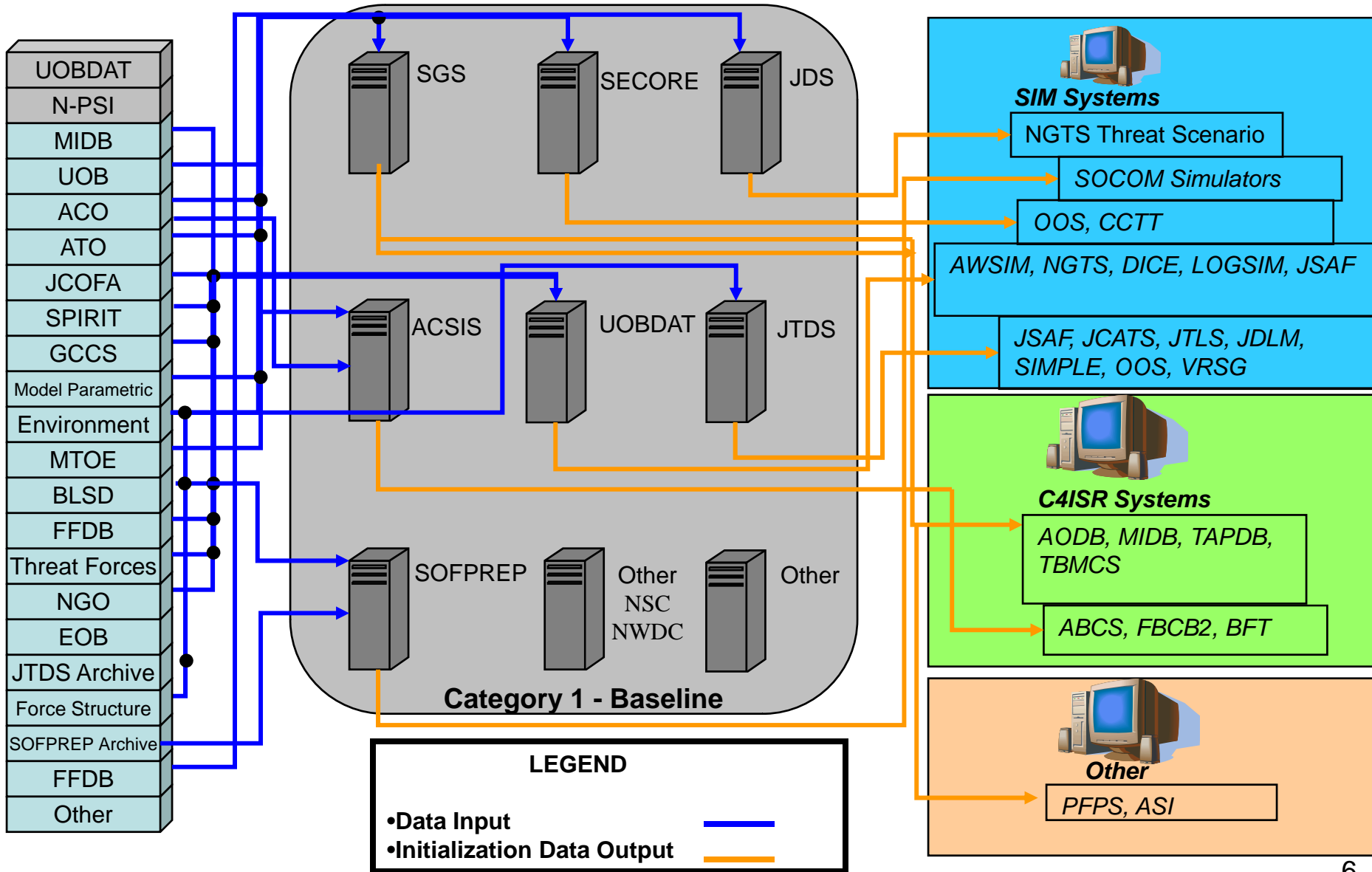Air Force Research Lab

Air Force Agency For Modeling & Simulation

Naval Aviation System Master Plan

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Notional "As-Is" Baseline Capability

Source Data

UOBDAT
N-PSI
MIDB
UOB
ACO
ATO
JCOFA
SPIRIT
GCCS
Model Parametric
Environment
MTOE
BLSD
FFDB
Threat Forces
NGO
EOB
JTDS Archive
Force Structure
SOFPREP Archive
FFDB
Other

Scenario Build Process

SGS

SECORE

JDS

ACSIS

UOBDAT

JTDS

SOFPREP

Other
NSC
NWDC

Other

Category 1 - Baseline

LEGEND

• Data Input

• Initialization Data Output

Target Systems

SIM Systems

NGTS Threat Scenario

SOCOM Simulators

OOS, CCTT

AWSIM, NGTS, DICE, LOGSIM, JSAF

JSAF, JCATS, JTLS, JDLM, SIMPLE, OOS, VRSG

C4ISR Systems

AODB, MIDB, TAPDB, TBMCS

ABCS, FBCB2, BFT

Other

PFPS, ASI
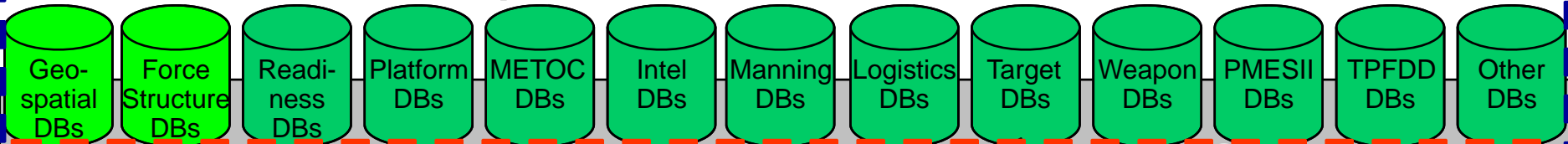
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Conceptual JRSG "To Be" Architecture
FOCUSED ON PROVIDING LVC FUTURE IMMERSIVE TRAINING ENVIRONMENT

Required / Potential Data Sources

| Geo-spatial DBs | Force Structure DBs | Readiness DBs | Platform DBs | METOC DBs | Intel DBs | Manning DBs | Logistics DBs | Target DBs | Weapon DBs | PMESII DBs | TPFDD DBs | Other DBs |

Data Strategy

GIG **NCES**

Distribution

Hosting

Discovery and Delivery

Collaboration

Portal

SOA Foundation

JRSG Services

- Define Event
- Schedule
- Process Data
- User Management
- Obtain Data
- Release Product
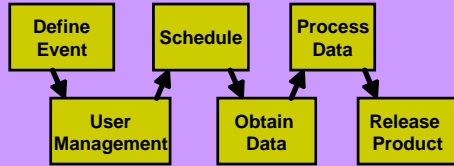
Common Scenario Definition

Collaborative Data Workspace

Data Correlation

Data Configuration Management

Scenario Data Archive

Translation for Export

Interoperability & Data Standards

| Mission Planning Apps | Experiment Apps | Acquisition Apps | Test & Eval Apps | Training Apps | Mission Rehearsal Apps | Force Planning Apps | Adaptive Planning Apps | Mobility Analysis Apps | Decision Support Apps | Other Apps |

M&S Enabled Applications

GIG: Global Information Grid

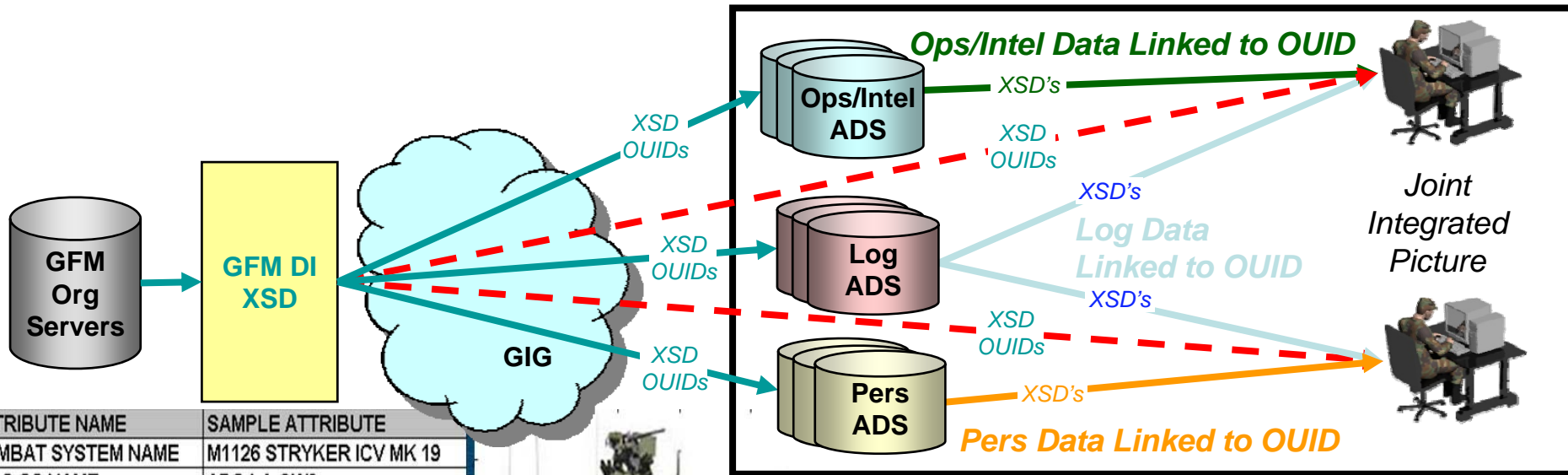**NCES: Net-Centric Enterprise Services**

JRSG COI Geospatial Metadata Mapping
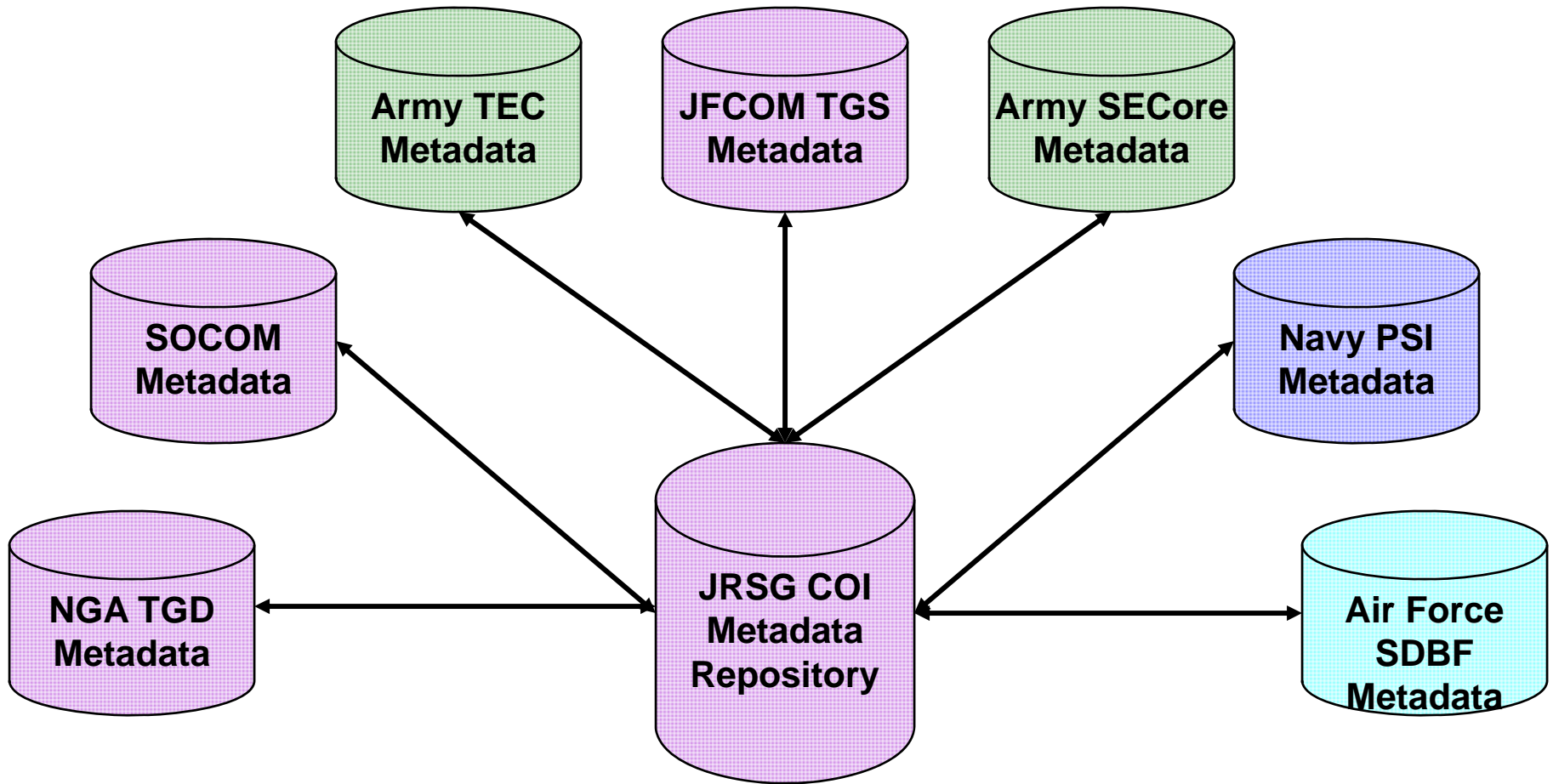
All JRSG COI geospatial discovery metadata mapped to GEOINT Structure Implementation Profile (GSIP) standard metadata exchange model.
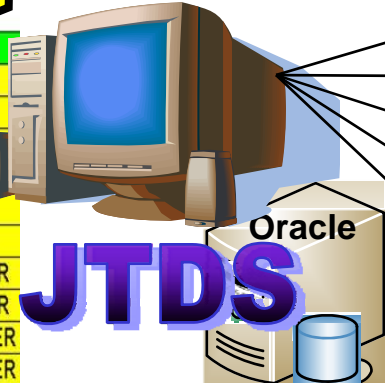
Order of Battle Scenario Generation Data

JRSG SOA Pilot Operational Nodes

JFCOM JTDS

SOCOM SOFPREP

Army TEC

AFAMS/SGS

JRSG SOA

Enterprise Service Bus (ESB)

Complex Subscription Broker (CSB)

SIPRNet

NGA Geospatial Web Services

Federation

JCS GFM DI Authorized Force Structure

Federation

JRSG SOA

Enterprise Service Bus (ESB)

Complex Subscription Broker (CSB)

NIPRNet

JFCOM JTDS

Navy PSI

Army SE Core

Air Force/DMOC

EDCSS (ASNE-Weather) Web Services

Federation

Cross Domain Guard - TBD

● Agent   ) CSB Plug-In   ⬌ Federation SOA Federation

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USJFCOM – IBM
Cooperative Research and Development Agreement
Joint Force Operations
Service Oriented Architecture (SOA)

Applying SOA
9 October 2008

Paul Giangarra
IBM Distinguished Engineer
Office of the CTO, IBM Federal

The Path to Integrated Systems

Silos

Systems of Systems

Integrated Systems

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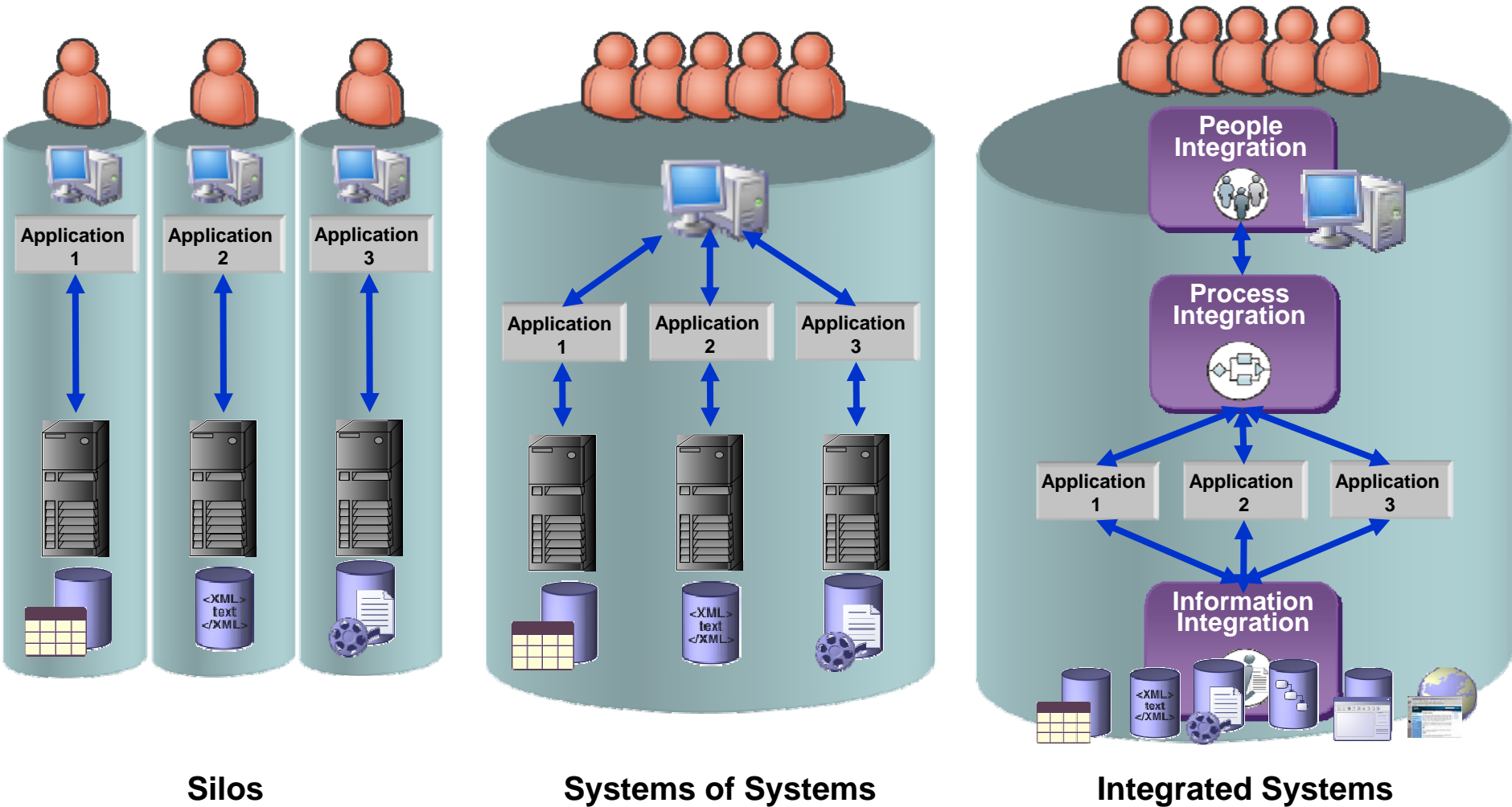
What is (and isn't) SOA?

SOA is…

- Service Oriented Architecture
- A way of thinking
- A means of aligning Business with Information Technology
- An architectural style for the design of business applications in terms of flexible, reusable, loosely coupled service assets

SOA is <u>not</u>…

- A standard
- A specification
- A programming model
- A platform

The SOA Journey

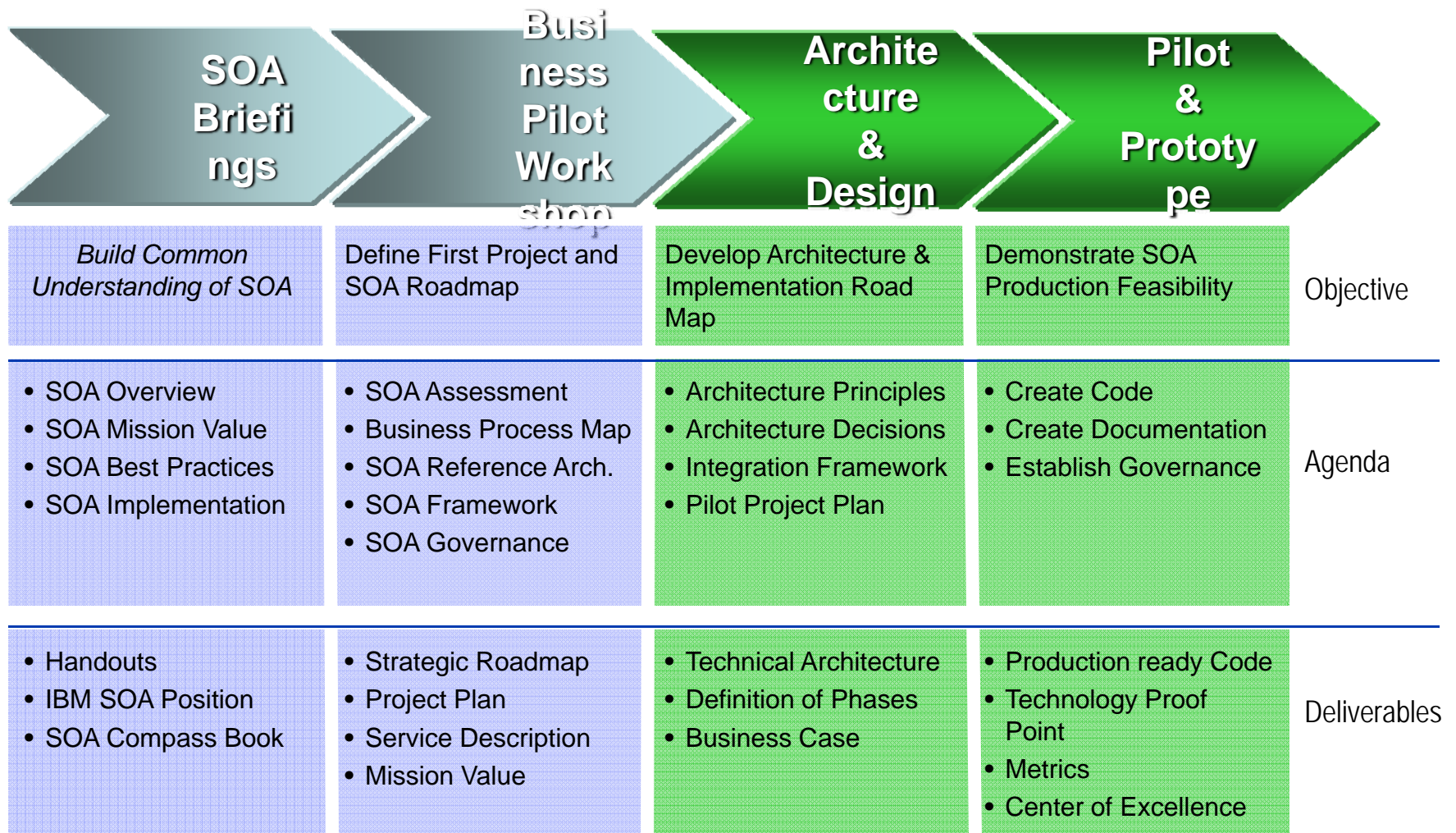| SOA Briefings	Business Pilot Workshop	Architecture & Design	Pilot & Prototype	
Build Common Understanding of SOA	Define First Project and SOA Roadmap	Develop Architecture & Implementation Road Map	Demonstrate SOA Production Feasibility	Objective
• SOA Overview • SOA Mission Value • SOA Best Practices • SOA Implementation	• SOA Assessment • Business Process Map • SOA Reference Arch. • SOA Framework • SOA Governance	• Architecture Principles • Architecture Decisions • Integration Framework • Pilot Project Plan	• Create Code • Create Documentation • Establish Governance	Agenda
• Handouts • IBM SOA Position • SOA Compass Book	• Strategic Roadmap • Project Plan • Service Description • Mission Value	• Technical Architecture • Definition of Phases • Business Case	• Production ready Code • Technology Proof Point • Metrics • Center of Excellence	Deliverables

Joint Rapid Scenario Generation SOA Reference Architecture

Target SYSTEMS

JRSG Processes

JRSG Common Databases (Geospatial, Weather, etc)

JFCOM Data Catalog

Event Database

Portal/User Interface

Business Innovation & Optimization Services
Provide for better decision-making with real-time mission information

Development Services

Interaction Services
Enables collaboration between people, processes & information

Process Services
Orchestrate and automate business processes

Information Services
Manages diverse data and content in a unified manner

IT Service Management

Model Design Implement Test

ESB — *Enable inter-connectivity between services*

Manage and secure services, applications & resources

Partner Services
Connect with mission partners

Business App Services
Build on a robust, scaleable, and secure services environment

Access Services
Facilitate interactions with existing information and application assets

Apps & Info Assets

Joint Organization Server (GFM DI)

Infrastructure Services
Optimizes throughput, availability and performance

Customer (Requests and Product Delivery)

Source Data Provider (e.g., NGA, Air Force, Army, Navy, COCOMs, TEC …)

Import Customer Data

Package Training Product

Catalog New Data

Future Services (e.g., Locate Source Data)

Information Lifecycle: The "Problem" Space

Collection (task/post)

Analyze (process)

Disseminate (use)

Satellite

Newsfeeds

Radar

UAV

Weather

…

Complex image analysis

Add some meta data

**GPS metadata, target analysis**

GPS metadata

GPS metadata

… Generically steps:

- Cleanse, transform, resolve, combine (federation), structure, tag, index
- Choreograph the analysis process
- Requires deterministic E2E responsiveness

Complex Subscription Broker fits here

Decouple UI from final information "fusion" and filtering

Community based pub/sub

Example communities: jet fighters, bomber pilots, AWACs, AOC (various roles), ….
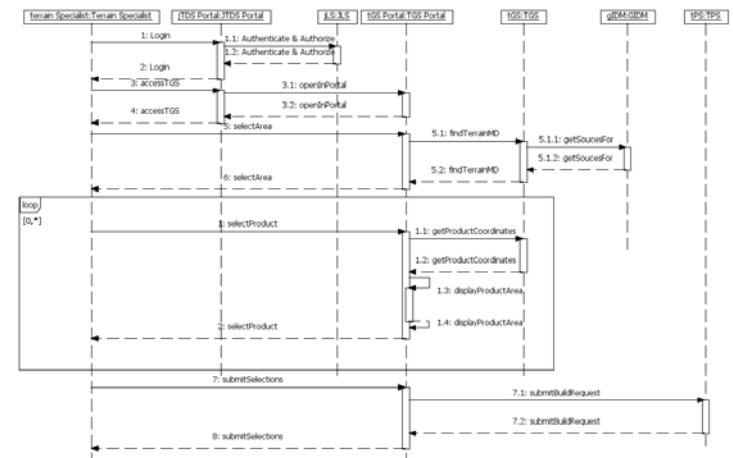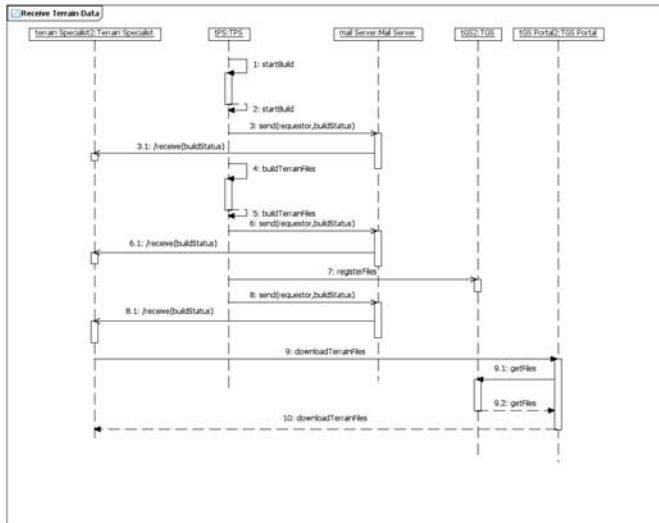
Key Architectural Decision

Loosely couple the "Front End" (Human or Machine Interface) from the "Information Broker", from the Information Source(s) using a Complex Subscription Broker
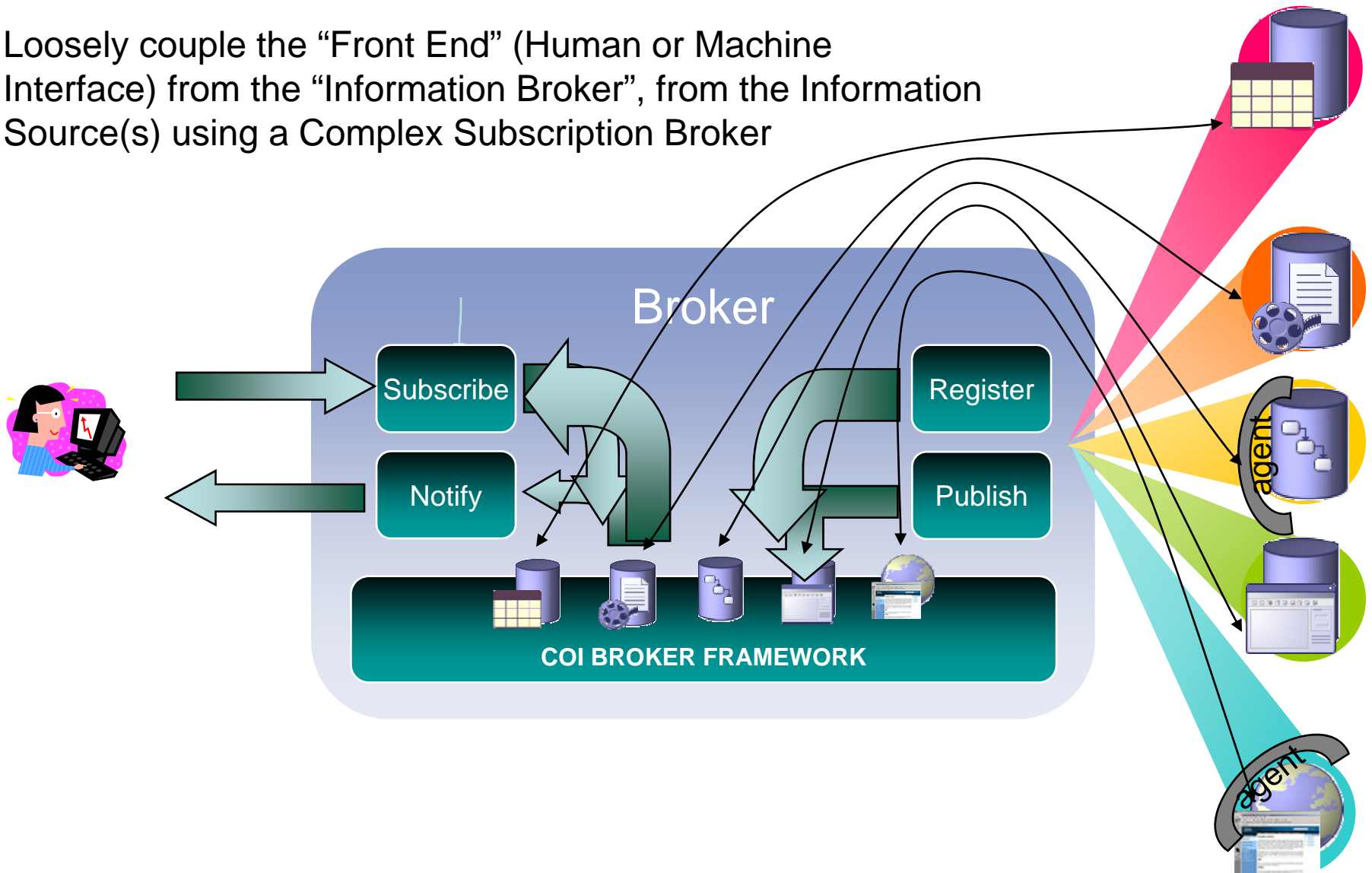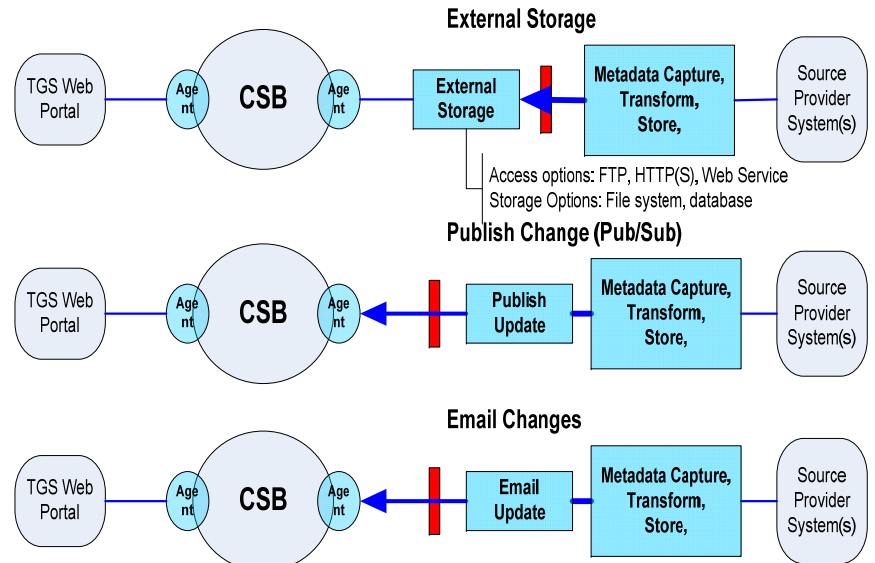
Use Cases to Validate Design Assertions

- Publish Terrain Metadata
- Search for and Request Terrain Data
- Receive Terrain Data

(Sample) Sequence Diagrams Created to document the use cases:

To Push or Pull: Architectural Alternatives

External Storage

TGS Web Portal — Agent — CSB — Agent — External Storage ← Metadata Capture, Transform, Store, ← Source Provider System(s)

Access options: FTP, HTTP(S), Web Service
Storage Options: File system, database

Publish Change (Pub/Sub)

TGS Web Portal — Agent — CSB — Agent ← Publish Update ← Metadata Capture, Transform, Store, — Source Provider System(s)

Email Changes

TGS Web Portal — Agent — CSB — Agent ← Email Update ← Metadata Capture, Transform, Store, — Source Provider System(s)

Push Options: Source Provider pushes the metadata outside the firewall(s).
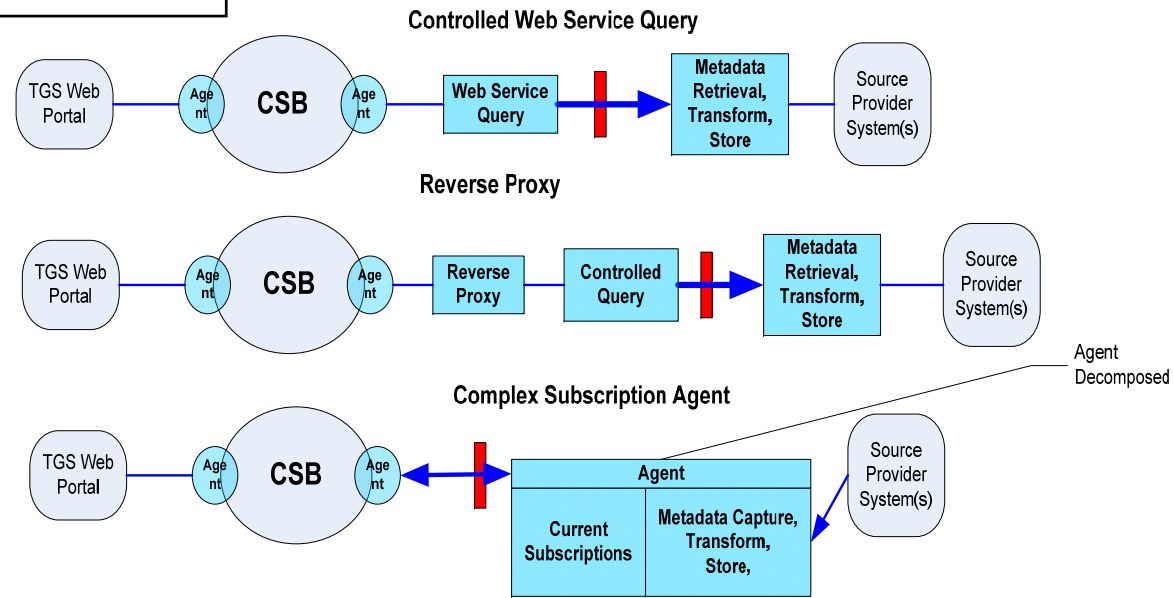
Functional Requirements

Detect change in Metadata
Retrieve updated metadata (can be entire catalog at first)
Transform local metadata structure to a common format
Store common format metadata (if needed)
Expose metadata to search

Nonfunctional Requirements (will vary by site)

Requires minimal work to install, configure and manage on the source provider's part
Adheres to IA constraints
 IA: Transparency of exposed metadata
 IA: Controlled queries
 IA: Controlled ports/protocols
Satisfy agreed to SLAs
Sources are geographically distributed
Source provider systems may not always be accessible
Extensible / flexible
Open Architecture, Standards Based

Controlled Web Service Query

TGS Web Portal — Agent — CSB — Agent — Web Service Query → Metadata Retrieval, Transform, Store — Source Provider System(s)

Reverse Proxy

TGS Web Portal — Agent — CSB — Agent — Reverse Proxy — Controlled Query → Metadata Retrieval, Transform, Store — Source Provider System(s)

Complex Subscription Agent

TGS Web Portal — Agent — CSB — Agent ↔ Agent (Current Subscriptions | Metadata Capture, Transform, Store,) — Source Provider System(s)

Agent Decomposed

Pull Options: Source responds to metadata requests

Logical (Network & Product) Architecture
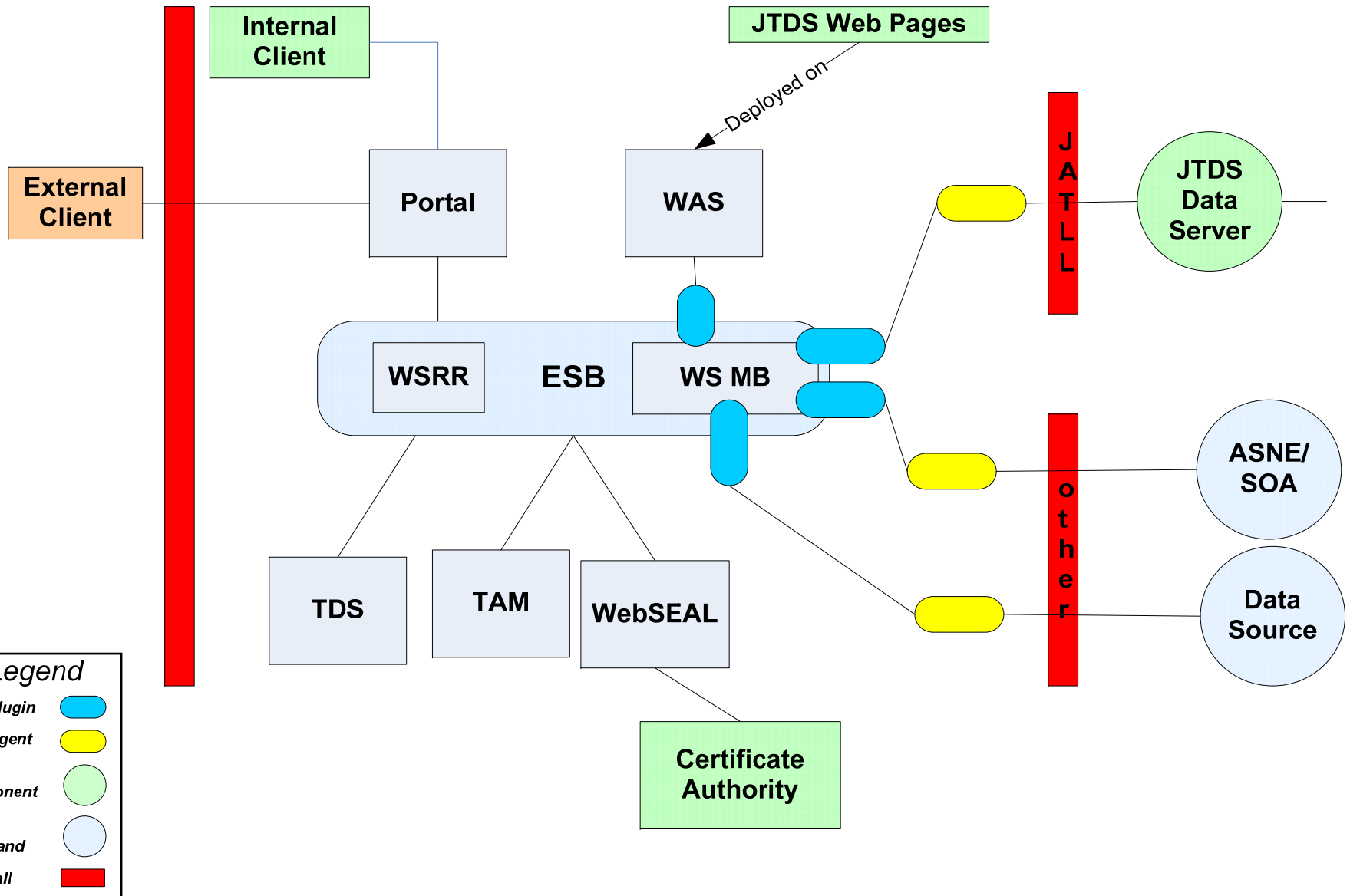
Examples of What is Coming Next

- Finalize Security Model & Design
- Finalize the Data Model
- Design, Develop, Test & Deploy the Components and Infrastructure
- Governance
- Possibly Look at Alternative Interface Options

- Demonstrate the Results
- Determine the Next Steps/Spirals

- Document What We Learned

QUESTIONS?????