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Exploiting Semantic Web Services in an Integrated Satellite Control Network: An Open Standards Approach

**L-3 Communications
CSW-Space and Satellite Control
March 30, 2004**



Terminology

- **Semantic Web Services are designed to support interoperable machine to machine interaction over a network**
- **Semantic Web technologies have been adopted as the way ahead by the DoD Chief Information Officer (CIO)**
- **Resource Description Framework (RDF) is a Joint Technical Architecture (JTA) standard for data interchange**
- **RDF defines a relationship between data or entities**
- **Ontologies define the semantic relationship between the RDF data**



Overview

Evolving Mission Requirements

- **National Security Space: Interoperable access to launch ranges and satellite control networks**
- **Homeland Security: Integration of information and collaboration at all levels down to first responders**
- **Network-Centric Warfare: Interoperability among disparate platforms**
- **Transformational Communications: Integration of information and collaboration for all TC segments**

L-3 Research Objective

- **Evaluate emerging technologies to support evolving mission requirements while recognizing investment in legacy systems**
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Integrated Satellite Control Network

ISCN Objective

- Seamless integration of DoD, NASA, Civil, National, and Commercial Users
- Improve efficiency of operations and reduce O&M costs through increased access to AFSCN, Navy, NASA, and civil entities stovepiped satellite/spacecraft control networks

Problem

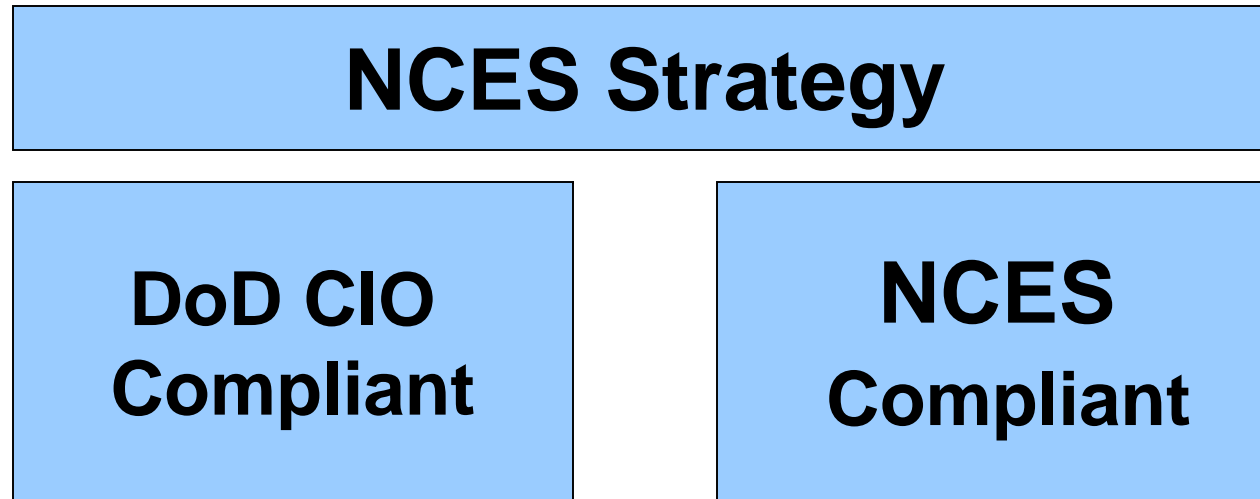
- No semantic data integration between Air Force, Navy, NASA, commercial and other ISCN Users.
- This problem is representative of the issues facing DoD and other government entities (e.g. DHS)

L-3 Research Approach

- Evaluate the potential of Semantic Web Services to solve ISCN integration problem
 - Extensible to Federal and DoD user base
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Network Centric Enterprise Services

- **Two Compliance Levels**
 - **DoD Chief Information Officer (CIO)**
 - **DISA Network Centric Enterprise Services (NCES)**

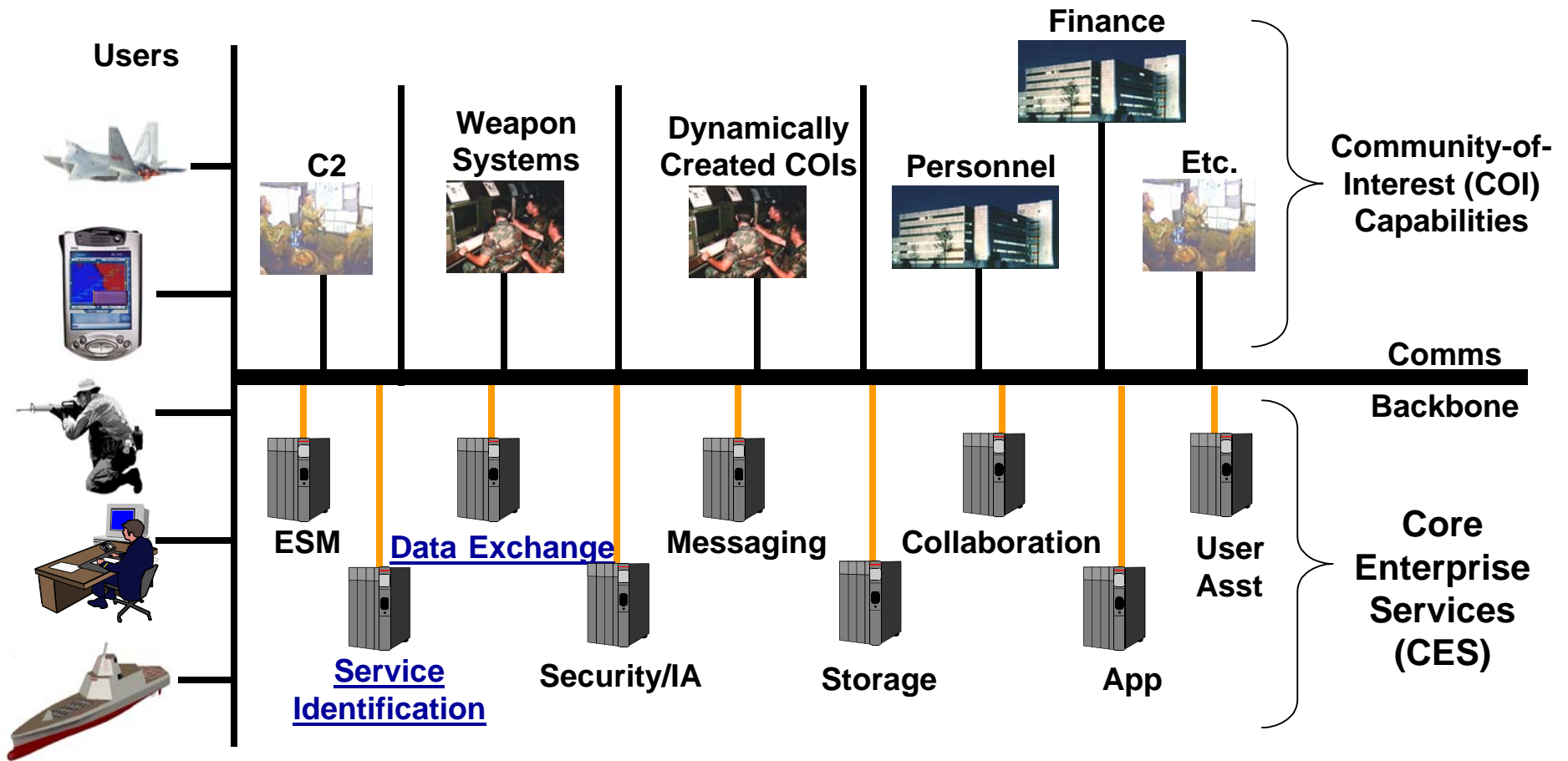


Semantic Web Services are compliant and preferred

Network-Centric Enterprise Services



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Features and Benefits

Features	Benefits
Automated machine to machine interaction	<ul style="list-style-type: none">• Interoperability on the cheap• Reduced O&M• Data stores may be distributed
Integrates disparate data sources	<ul style="list-style-type: none">• Data aggregation
DII COE Level 7/8	<ul style="list-style-type: none">• Semantic mapping to XML Registry data
Seamless integration with existing networks	<ul style="list-style-type: none">• Does not disturb underlying architectures

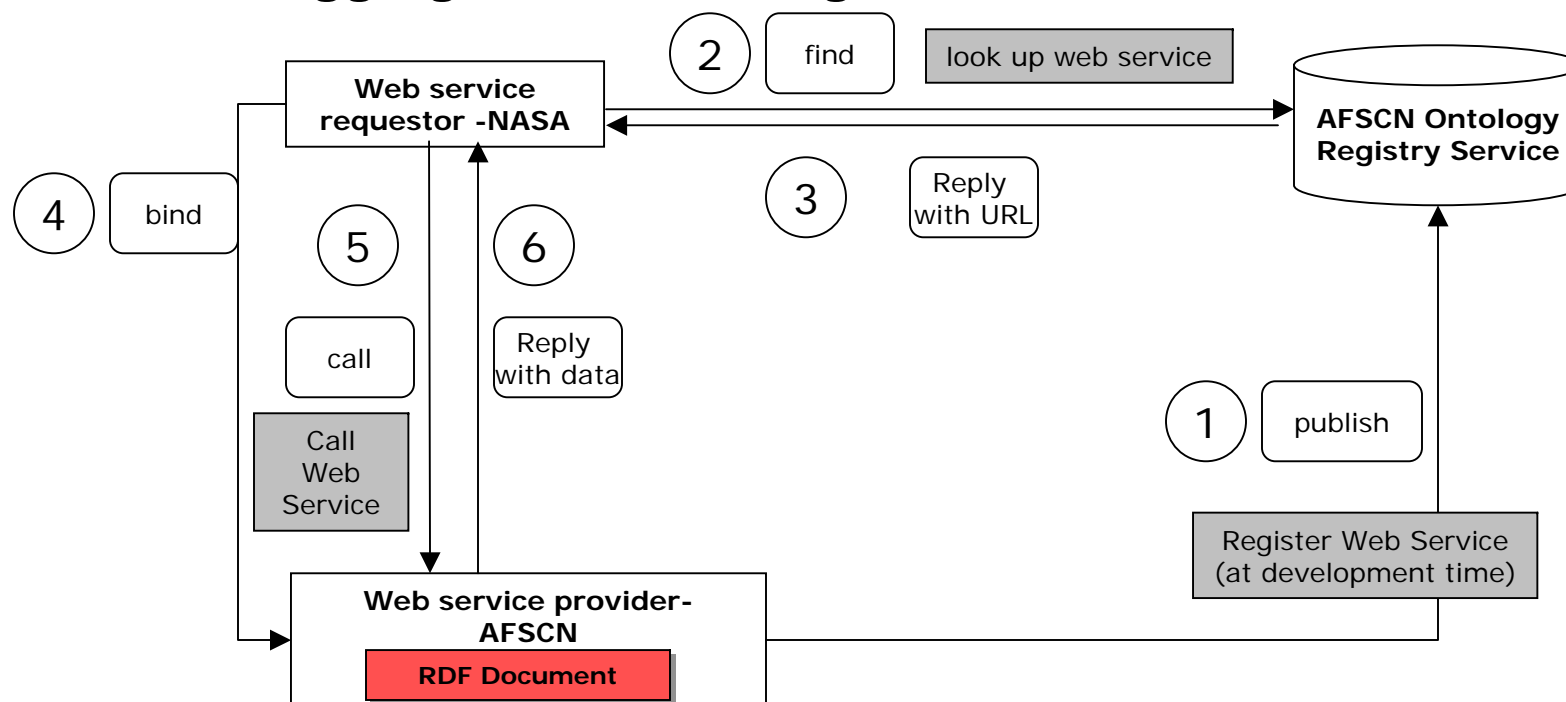


L-3 Technical Approach

- **Team surveyed available RDF-based products**
 - **Cost**
 - **Capability/Sustainability**
 - **Ease of Use**
 - **ISCN integration problem identified as a candidate for evaluation of the technology**
 - **Formulated a preliminary ISCN data interchange strategy**
 - **Developed two rapid prototypes to evaluate technical feasibility in L-3 Software Development Lab**
 - **Microsoft based RDF tool**
 - **Java based RDF tool**
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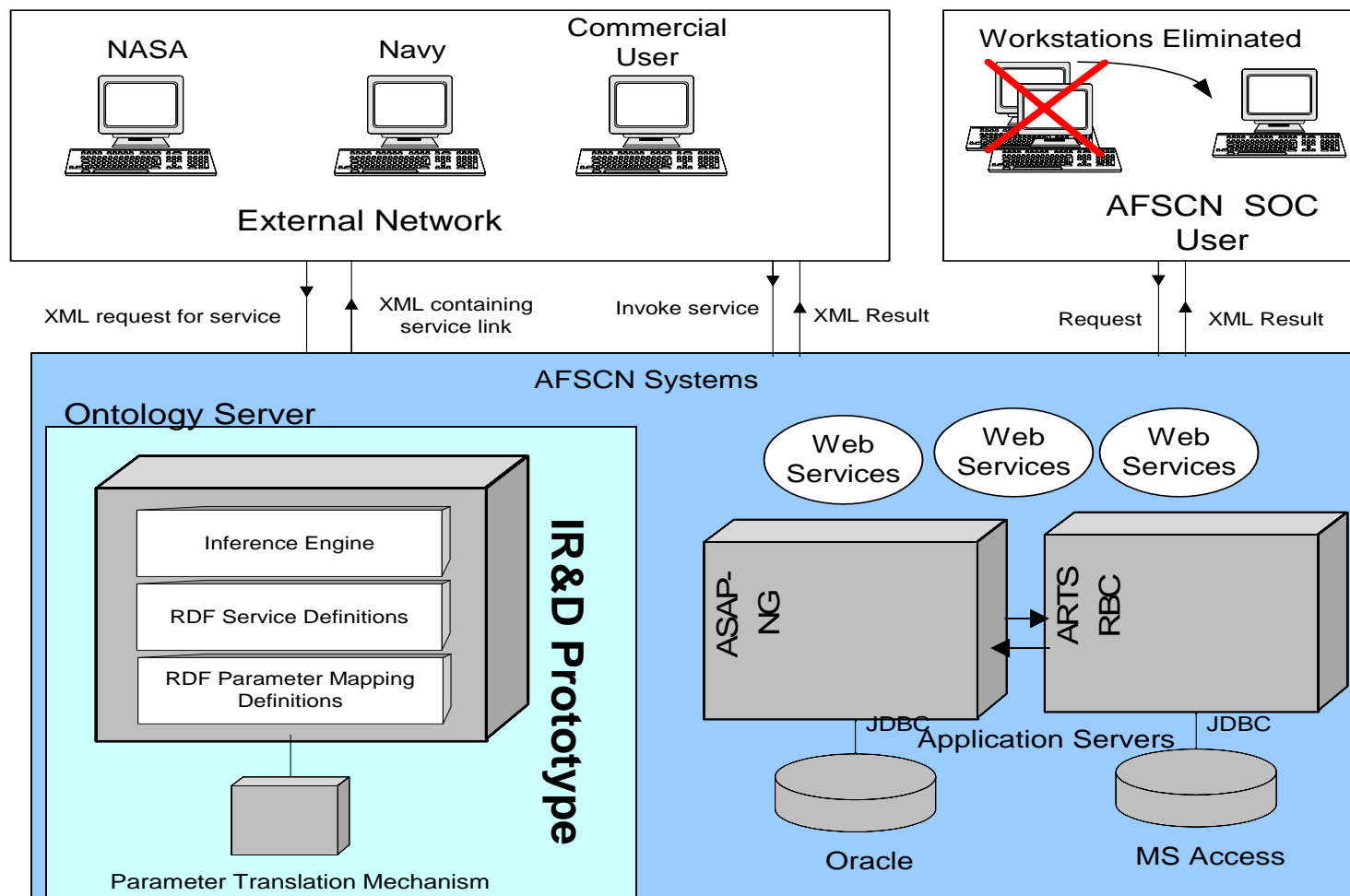
Semantic Web Services

- RDF provides seamless integration of data and services
- Allows users to access disparate databases
- Provides aggregation to leverage information in custom clients





RDF-based AFSCN Integration





Summary

- **Semantic Web Services allow:**
 - Data integration to comply with DISA XML Registry
 - Load balancing to eliminate a single point of failure
 - Avoidance of JMS compatibility issues found in other solutions
 - External users to access network resources without imposing additional architectural components
- **Demonstrates ability to integrate legacy applications, support evolving mission requirements, recognize investment in legacy systems, and is *extensible to additional problem sets***
- **Recommendation: Include Semantic Web Services as part of the ISCN Integration solution**

RDF supports transformation of AFSCN to ISCN