Federated Service Oriented Architecture for Effects-Based Operations

Intelligence and Information Systems

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Topics

- Effects-Based Operations (EBO)
- Service Oriented Architectures (SOA)
- Federated SOA
- Characteristics of a Federated SOA that enable EBO
  - Shared data and services across Communities of Interest
  - Simplified Integration of legacy capabilities
  - Leverages existing standards and standards implementations
  - Maintains interoperability of Vendor tools
- Conclusions
AFDD-2 Principles of EBO

- Effects-based operations:
  - seek to integrate planning, execution, and assessment.
  - should focus upon the objectives and the end state.
  - are about creating effects, not about platforms, weapons, or methods.
  - approach should consider all possible types of effects.
  - should seek to achieve objectives most effectively, then to the degree possible, most efficiently.
  - cut across all dimensions, disciplines, and levels of war.
  - focus on behavior, not just physical changes.
  - recognize that comprehensive knowledge of all actors and the operational environment are important to success, but come at a price.
EBO Requires a Net-Centric Enterprise

- Traditional siloed systems do not support EBO well
  - Need capability to easily share large amounts of data across organizational boundaries

  - Timeliness of data and decisions is critical to EBO

  - Need access to modeling and sim, and other service like capabilities across the Enterprise

  - Limited visibility across the Enterprise

  - Efficient asset usage to gain data for EBO decision making

Federated Service Oriented Architecture Provides a Net-Centric Infrastructure to Support EBO
Service Oriented Architectures

“Service oriented architecture is an IT strategy that organizes the discrete functions contained in enterprise applications into interoperable, standards-based services that can be combined and reused quickly to meet business needs.” – BEA

- **SOA COTS**
  - Multiple vendors provide each layer
    - Vendor products often blur the layers
    - Vendor standards compliance lacking
SOA Topologies in a Net-centric Environment

**Global:** one shared SR (Service Registry)

**Directly Connected:** two+ completely synchronized SRs

**Brokered:** two+ SRs selectively synchronized

**Federated:** three+ SRs selectively synchronized (including 1 master)
Federated SOA
Characteristics of a Federated SOA Infrastructure that enable EBO

- Shared data and services across Communities of Interest
- Simplified Integration of legacy capabilities
- Leverages existing standards and standards implementations
- Maintains interoperability of Vendor tools

Federated Service Oriented Architecture Design Pattern is a Key Architectural Decision
Leveraging Core Services to Integrate Legacy Capabilities
The WS-* set of standards is overwhelming. Some of the standards are not implemented. So, for real interoperability, it’s safest to stick to the WS-I Basic Profile:

- SOAP 1.2
- MTOM
- HTTP 1.1
- WS-Addressing 1.0
- XML 1.0
- WSDL 1.1
- XML Schema
- UDDI 2.0
- TLS 1.0 / SSL 3.0
- X.509 v2/v3
Vendor Agnosticism is Key to Success

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CES Test Bed Incorporates The Best Industry COTS Software
Vendor Interoperability Lessons Learned

Discovery
- UDDI v3 enabled multi-vendor replication
- Service discovery was practical and useful
- Two way replication wasn’t possible due to vendor limitations

Security
- Replication using the same identity manager product worked well
- WS-Security between management points was relatively easy
- Tools to help implement 1st mile and last mile WS-Security necessary
- WS-Trust not implemented by vendors

Management
- Policy Enforcement at multiple governance zones could impact performance
- Policy enforcement at each zone specific to vendor
- Lack of standards limits interoperability (WS-Policy)

Mediation
- Different vendor implementation of WSDLs caused difficulty in orchestration
- Including edge appliance in architecture increased required adaptation
- Requiring no changes of applications required additional mediation

Messaging
- Centralized messaging service required special security code via policy enforcement
- Broadcast via topics was better solution than point to point, even though security was more difficult

Raytheon Reduces Vendor Interoperability Risk due to Web Service Standards Implementation
Conclusions

- A Net-Centric environment is necessary to enable Effects-Based Operations.
- A Federated Service Oriented Architecture approach to providing federated interoperability, including federated modeling and simulation, can help achieve Effects-Based Operations.
- The federated governance design pattern that is used is a key architectural decision in the development process.
  - It is important to choose a design pattern that allows multiple vendor tools to be used across the enterprise while maintaining interoperability.
- Leveraging federated SOA and core service capabilities allows existing capabilities to be included in the Effects-Based Operations process.
- Understanding current standards and how vendors implement these standards is an important element in achieving success.

Federated Service Oriented Architecture Enables EBO