Agile Integration of Complex Systems

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Outline

- Background and Problem
- Service Oriented Architecture (SOA) in DoD
- Baseline SOA
- Baseline SOA: Foundation (SOAF)
- Changes for Agile Integration
- Graphically enabled approach
  - SOAF vs. Graphically Enabled Discovery
  - SOAF vs. Graphically Enabled Messaging
  - SOAF vs. Graphically Enabled Mediation
- Summary
Background and Problem

- SOA is fundamental to DoD’s Net-Centric Vision
- SOA provides a powerful infrastructure for integrating disparate systems and technologies through services
- Current practice relies heavily on human intervention for such integration that leaves little flexibility to the edge user

Human intervention limits SOA flexibility for edge users
This presentation describes a graphically enabled method for reducing and simplifying the human intervention:

- Allows edge user to quickly identify non-organic systems and technologies of interest
  - Netted sensors
  - Netted effectors
  - C2
- Provides agility during mission execution
SOA in DoD

- DoD has mandated that all systems support the Network-Centric Environment and SOA is fundamental to realizing DoD’s Net-Centric Vision (DoDAF 1.5, volume 2, p. xiv and DoDAF 2.0, volume 1, p. 2)

- SOA is mandated by multiple policies, reference architectures and models, and the acquisition process (see notes view)
Baseline SOA

- DISA NCES CDD*
  - Provides a baseline and taxonomy that are architecture-, technology-, and vendor-neutral
  - Describes Core Enterprise Services
  - Describes SOA Foundation Services within the Core
- Agile Integration is based on graphical enablement of three of the Foundation Services

Baseline SOA: Foundation (SOAF)

- Discovery
- Machine to Machine Messaging (Messaging)
- Mediation
- Enterprise Service Management
- IA/Security

Foundation services provide net-centric infrastructure
Changes for Agile Integration

- **SOAF Service Discovery Service**
  - Change how provider registers
  - Change how consumer finds and binds

- **SOAF Messaging Service**
  - Change subscription flow
  - Change alert flow
  - Change notification flow

- **SOAF Mediation Service**
  - Create workflow during mission execution
  - Preprovision
    - Adaptors
    - Translators

**Changed three SOAF services**
SOAF Service Discovery Service

- Registries
- Consumers
- Providers
- Publish
- Find
- Bind (assign)

Discovery needed to link decoupled providers and consumers
SOAF Service Discovery – Provider

- Publish endpoints and metadata
  - Obtain certification to publish to registry
  - Use general registries
    - Service
    - Metadata
  - Publicize locations
    - Locations widely distributed
    - Available through internet searches
    - Open to large populations
    - Consumer not known in advance
    - Time of access not known in advance

Large open registries with unanticipated users
SOAF Service Discovery – Consumer

- **Design time**
  - Search registries manually
  - Find required services
  - Assign endpoints in code and compile (bind)
  - Human intervention

- **Runtime**
  - Find services dynamically (service)
  - Latency
  - Uncertainty

Human intervention or latency, uncertainty
Graphically Enabled Discovery

- Functions reduced to enabling selection of displayed services
  - General purpose registries not used
  - Based on Community of Action (CoA) registry (slide 16)
- Whatever is placed on the edge-user’s display is available for the mission
- Edge user finds a service by selecting a displayed icon
- Edge user binds the service by dragging it and dropping it on an orchestrate icon (slide 22)

**Discovery simplified and made visual**
SOAF Messaging Service

- Transport
- Receive, route, queue, and deliver messages
- Create new topics and/or channels
- Transmit new content
- Process subscriptions
  - New
  - Results
  - Alerts
  - Notices

Messaging is more than a data bus
SOAF Messaging – Provider

- Respond to new publications
  – Create new topic or channel
  – Send new content from publishers

Registries and repositories

Send content
Send notice
Create topic
Send alert

Provider-service

Messaging is in background
SOAF Messaging – Consumer

- Respond to new subscriptions
  - Topic or channel
  - Interests or preferences for content

- Send alerts for topics or channels

- Send notifications for interests or preferences (content available)

Registries and repositories

Receive notice

Receive alert

Subscription request

Consumer

Messaging is in background
Graphically Enabled Messaging

- Registry based on CoA
  - Providers and services
  - Consumers and interests
  - Details for mediation

- Consumer entry effectively subscribes consumer to all of the services included with the consumer interests

Mission CoA would collaborate with subgroups within CoIs

Mission-limited registry
Graphically Enabled Messaging

- **Sensor Services**: Event service responds to new entries in CoA registry.
- **C2 Services**: Alert provided when display service displays icon for new service on all CoA displays.
- **Communications Services**: Consumers implicitly subscribe to services when they register in CoA registry.
- **Effecter Services**: Messaging is in foreground.
SOAF Mediation Service

- Transformation
- Adaptation
- Orchestration

Mediation enables integration of services from disparate systems
SOAF Mediation – Transformation

- Respond to requests for format translation for content
- Find transformation, e.g., relevant schemas
- Translate content, e.g., from one XML schema to another for consumer

Transformation explicitly requested
SOAF Mediation – Adaptation

- Respond to requests for protocol adaptor
- Find adaptor
- Return adaptor to consumer

Adaptation explicitly requested
SOAF Mediation – Orchestration

- Create and register workflow script
- Retrieve workflow script (for same or different consumer)
- Execute workflow script (services from one or more providers)

-May require service discovery for endpoints

Orchestrate at design and plan time
Graphically Enabled Mediation

Sensor Services

Edge user determines orchestration during mission execution

Orchestrate

Orchestration
• Dragging and dropping a service icon to the orchestrate icon provides interface and other information to rules engine
• Rules engine parses information
• Rules engine connects services to complete the orchestration

Communications Services

C2 Services

Adaptation and transformation
Rules engine applies preprovisioned adaptors and transformations

Effecter Services

Orchestrate during mission execution
Summary

- Four fundamental differences run across all three graphically enabled services
  - Graphically displayed registry
  - Mission-limited registry
  - Consumers register, but don’t subscribe explicitly
  - Registry-driven

- Agile Integration provides the edge-user increased flexibility during mission execution

- Agile integration combines aspects of corresponding SOAF services as part of specializing them
Summary

- There are extensions to what was demonstrated that would be worth investigating and potentially developing
  - Creating contingency pools for resources through real-time resource management
  - Including interfaces between resource management and the CoA registry

- There are implications for doctrine and training to maximize the agility and related benefits
Acronyms

- BPEL: Business Process Execution Language
- CDD: Capability Development Document
- CoA: Community of Action
- CoI: Community of Interest
- CoP: Community of Practice
- DoDAF: DoD Architecture Framework
- ESB: Enterprise Service Bus
- ESM: Enterprise Service Management
- IA: Information Assurance
- JCIDS: Joint Capabilities Development System
- NCES: Net-Centric Enterprise Services
- SOA: Service Oriented Architecture
- SOAF: SOA Foundation
- UDDI: Universal Description, Discovery, and Integration Services
- WSDL: Web Service Definition Language
- XML: eXtensible Markup Language