Moving to a Service Oriented Architecture

Why it’s Different
A Strategy for Managing Development and Certification of Net-Centric Services within the Global Information Grid

Bernal Allen
DISA, GE 4
25 Oct 2005
“(U) Developing Command and Control to Exploit the GIG. The Department must develop a unified command and control capability that can fuse available information and allow decision makers at all levels to act on this information. To help accomplish this, Components will fund the GCCS Family of Systems programs to deliver C2 capabilities specified in their respective requirements documents. Components will plan to transition GCCS to a joint, net-centric C2 capability.”

Task # 21: “(U) Transition GCCS to joint, net-centric capability.”
C4 Transformation: From System-centric to Web Service-centric

Why Change?
Today’s C4 is system-centric

Sensors
- AFATDS - Army Field Artillery Tactical Data System
- GCCS - Global Command and Control System
- TBMCS - Theater Battle Management Core System
- MPQ-53 - C-Band Tracking Radar
- SPY-1 Radar
- Sentinel
- MACCS UPS-3 - D-Band Radar

C2 Networks / Nodes
- FS Section of Grd OPFACs
- JTF OPFACs
- AOC/ TACC
- Patriot ECS / Patriot BCP
- CG AEGIS / DDG AEGIS
- SHORAD Btry / Plt CP
- LAAD Btry / Plt CP

Weapons
- Howitzers
- Aircraft
- Allied Weapons
- PAC-2/GEM, PAC-3
- SM-2 Blk III, IVA
- Stinger Blk II

Information is bound to multiple system of systems

AFATDS – Army Field Artillery Tactical Data System
TBMCS – Theater Battle Management Core System
GCCS – Global Command and Control System
CG / DDG – Guided Missile Cruiser / Guided Missile Destroyer
LAAD – Low Altitude Air Defense

LAV-AD – Light Armored Vehicle Air Defense
MACCS – Marine Air Command and Control System
SM-2 – Land Attack Standard Missile
THAAD – Terminal High-Altitude Area Defense
GCCS-J maintains more than 90 system Interfaces

Maintaining system of systems technical interfaces
GCCS-J has 23 Executive Agents

Maintaining system of systems program baseline synchronization
Joint Mission Threads are derived from C2 Systems of Systems

**Proposed JBMC2 JMT Assessment Schedule**

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Yesterday’s system-based techniques and technologies are too brittle to meet today’s demands for cross system integration.

System of System integration is a long and complex process.
Service Oriented Architecture (SOA)
A set of principles that together define an architecture that is loosely coupled and comprised of service providers and service consumers that interact according to a negotiated contract or interface.

- Can search and find a Service
- Has a need or want that determines context of use
- Not concerned with how service is developed only how it is provided

- Can be found in a registry
- Fulfills a need or want
- Abstracts the details of production
- Can be upgraded or replaced transparently
Service Oriented Architecture
Provides Composable Services
for Just-in-time Capabilities!

Higher-Level Service Composed of Lower-Level
“Fundamental” or “Atomic” Services
Air / Space Operations work flows

The Warfighter Owns and Shapes The Process

Processes

WHAT

Functional Components/Services

ISR collection alerts

Auto plan evaluation

Joint Air & Space Ops Plan

Auto alerting

TCT COA options

Monitor ATO/STO execution

Auto mission reports (MISREPs)

Posted Data & Sources Allow Discovery & Pull

Data & Sources

HOW

Services’ Planning & Targeting Systems

Air Support Requests

Defended asset lists

Plan events, ISR/Target engagement rqmts

Space IR correlation

Resource Allocation

Defensive Deconfliction

ATO, ACP, STO, ACO, ADP

Replanning/Retasking

Auto immediate targeting

Immediate air support rqsts

STRATCOM

JFACC

Joint Air Ops Centers

Space Functional AOCs

Data Centric & Process Oriented: Information flows across multiple, OPFACs, platforms, and sensors
Task: Global Strike Mission Planning

- Global Strike Targeting
  - Operational Context Service
  - Situational Awareness Service
  - COA Services
  - Collaboration

- Blue Force Situational Awareness

- Composed Global Strike

- NCES
  - Enterprise Service Management
  - Security Services
  - Discovery Services
  - Federated Search

- STRATCOM Legacy Targeting Data
- Blue Force Tracking Data
- COCOM Information Dissemination Management Catalogs
- DIA Master Intel Database
- National Geospatial Agency Integrated Product List

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Denotes interface
Task: Global Strike Mission Planning

![CoMotion Web Interface](image)

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<thead>
<tr>
<th>Rank</th>
<th>1 B-2</th>
<th>1 B-52: 12xAGM</th>
<th>1 B-52: 8xAGM</th>
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<tr>
<td>a. Type</td>
<td>Stealth</td>
<td>Heavy Bomber</td>
<td>Cruise Missile</td>
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<td>b. All Weather</td>
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<td>Y</td>
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<td>c. Civilians At Risk</td>
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<td>MEDIUM</td>
<td>MEDIUM</td>
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<td>d. Collateral Damage</td>
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<td>VERY LOW</td>
<td>VERY LOW</td>
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<td>g. Force Package</td>
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<td>k. Recover Notes</td>
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Total Table

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C4 Capability Development with Service Oriented Architectures

How it’s Different
Taking a Chapter from the Commercial World

eBay.com

- WWW-based E-Commerce Leader *
  - $8 Billion quarterly sales
  - 1.7 Billion dynamic content page views per day
  - 50 million active traders / user
  - Localized to 27 countries

- eBay Infrastructure *
  - 25 million items listed at any given time
  - Over 2,000 application servers
  - Over 100 Oracle database
  - 3+ Terabytes of storage

- KEY POINT:
  - 40% of all business transactions conducted via eBay’s Web Service Platform *

* Source: “Web Service in Action: Integrating with the eBay Marketplace”, O’Reilly, June 2004
eBay’s Core Entities
(a very terse architecture!)

**Item**
sellable on eBay.

**Listing**
(noun) An entry on eBay with one or more items; (verb) The action of creating such a listing. An auction is a type of listing that enables competitive bidding.

**Categories**
A hierarchical set of groups on eBay in which items of a similar nature are listed.

**User**
Someone who has registered with eBay. There are [user roles] such as bidder, buyer, seller, store owner and application developer.

**Transaction**
The data for the purchase of one or more items by one buyer from one listing. Some listings enable a seller to offer multiple items in the same listing; thus there could be multiple buyers purchasing items from the same listing and therefore multiple transactions for the same listing.

**Feedback**
An eBay mechanism or system by which one user may rate another user, enabling other users to know how well or how poorly a transaction went.
All eBay Web Service are available for Partner Developers.

Technical on-line documentation available for all eBay web services, including sample code on how to use them in an contextual example.
eBay’s Development/Production Environment

A web accessible development environment available to all partners
eBay’s Development Environment & Support

- Key Elements for Take Away:
  - Simple and understandable architecture
    - Seven nouns and verbs
  - Development Web Site (http://developer.ebay.com)
    - Extensive documentation available on web service
      - API Specifications, Code Samples, How-to-docs
    - Software Development Kit (SDK) available
      - .NET, JAVA, and other programming language support
    - Forums and Technical Support available on-line
  - Development Sandbox
    - Area to test applications against sample data sets
    - Area to field new eBay APIs and conduct alpha testing
    - Certificate process to validate user access
    - Process in place to help developers determine simple functionality and performance characteristics
    - Module certification program to provide some assurance before developer roles capability into production

eBay started with a federated development mindset!
“The Strategy”

- Establish a Federated Development & Certification Environment (FDCE) as a distributed and collaborative environment addressing the challenges associated with concurrent and distributed Service Management.
- Its purpose is to establish the Infrastructure, Processes, and Policies so that Services can be progressively Developed, Tested, Refined, and Certified with increasing rigor leading to operational deployment.
Proposed JC2 Federated Development and Certification

**Development Environment**
- Candidate ECM Development
- Developer CM
- Developer Test
- Initial security certification

**Developmental Piloting Environment**
- ECM Integration
- Gov't CM
- Performance Testing
- NetOps validation including security and Management
- ECM DT&E
- Early Mil Utility Assessment
- Others

**Operational Piloting Environment**
- Operational Demonstration
- Gov't CM
- ECM OT&E
- NetOps Validation add scalability and SLA maintainability
- Others

- JC2 Operational Baseline
- Operations, Maintenance & evaluation for improvements

**Evaluation Capability Module (ECM)**
**Operational Capability Module (OCM)**

**Federated Development and Certification Environment**

**NetOps for Operational Services**
# Notional Certification Requirements

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<th>Operational Piloting Tier</th>
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<td>Response Time Guarantees</td>
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<td>Reliability/Surv Guarantees</td>
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<td>On-Line Help</td>
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<td>Life Cycle Commitments</td>
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FDCE pilot as part of FY04-05 NCCP initiative

- http://fdce.net
- 57 participants representing all Components
- 34 web services registered and undergoing initial certification

* As of 12 Aug 05
Cultural Change
And
Next Steps
Becoming Net-Centric means ....

Participating as a part of a continuously evolving ecosystem of people, devices, information and services; interconnected by a communications network to achieve optimal benefit of resources and better synchronization of events and their consequences.

This is about Culture Change...
COI Services will be derived from multiple heterogeneous capabilities. Issue: program synchronization.

Test, cert and accreditation needs to be focused on small modules of capability. Issue: loss of E2E perspective.

Workflows can be very dynamically composed. Issue: JMT may be only locally authoritative.

edge users QoS may be dynamically Prioritized. Issue: NetOps