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“Engineering and Acquiring C4ISR Systems Based on SOA”

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Goals for this Paper

- Better understand the migration from traditional “stove pipe” systems to systems based purely on services
- Understand the significant changes to how we specify, acquire, integrate, test and field systems as we move to services-based systems
- Discuss potential solutions for many of these challenges, using real world examples where possible

Within the Context of the Defense Department

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The Evolution of C4ISR Systems

(1) Stove-piped System

- *Provides all if it's own functionality*
- *1-to-1 external interfaces*
- *Hosted on own hardware*

(2) Initial Net-Centric System

- *Provides all if it's own functionality*
- *Uses web services & XML to decrease # of unique interfaces*
- *Hosted on own hardware*

(3) Stove-piped SOA System

- *Provides all of own functionality as collection of services*
- *Hosted on own hardware*

(4) SOA System

- *Functionality through combination of own and shared services*
- *Hosted on hardware provided by variety of systems*

(5) Collection of Services

- *No longer fielding systems—fielding collection of services from multiple providers to meet mission thread requirements*
- *Hosted on virtualized hardware provided by variety of systems*

(6) Cloud Services

- *SOA Services hosted in shared data centers on cloud infrastructure*

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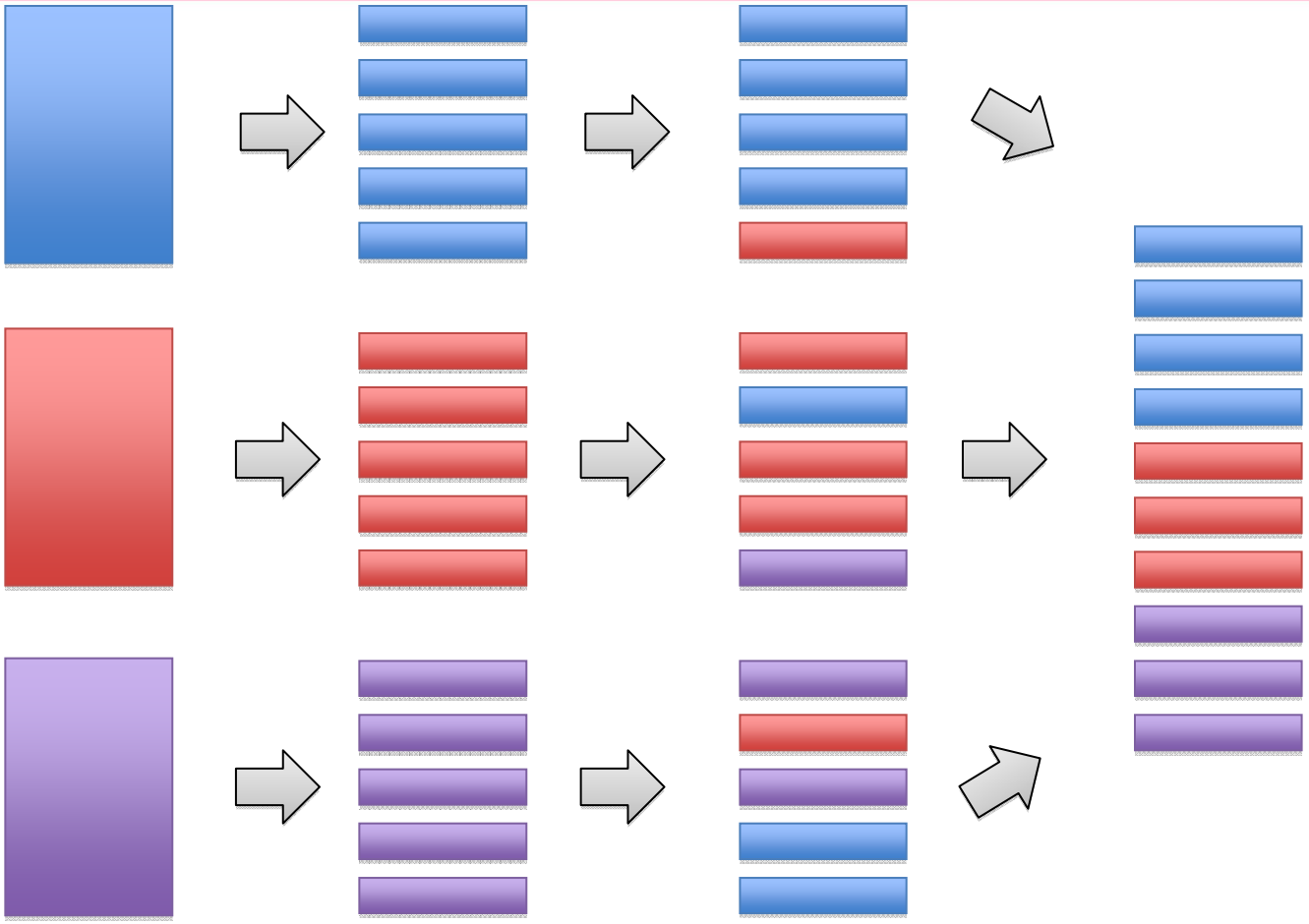
Decomposing Systems Into Services



Legacy Program of Record

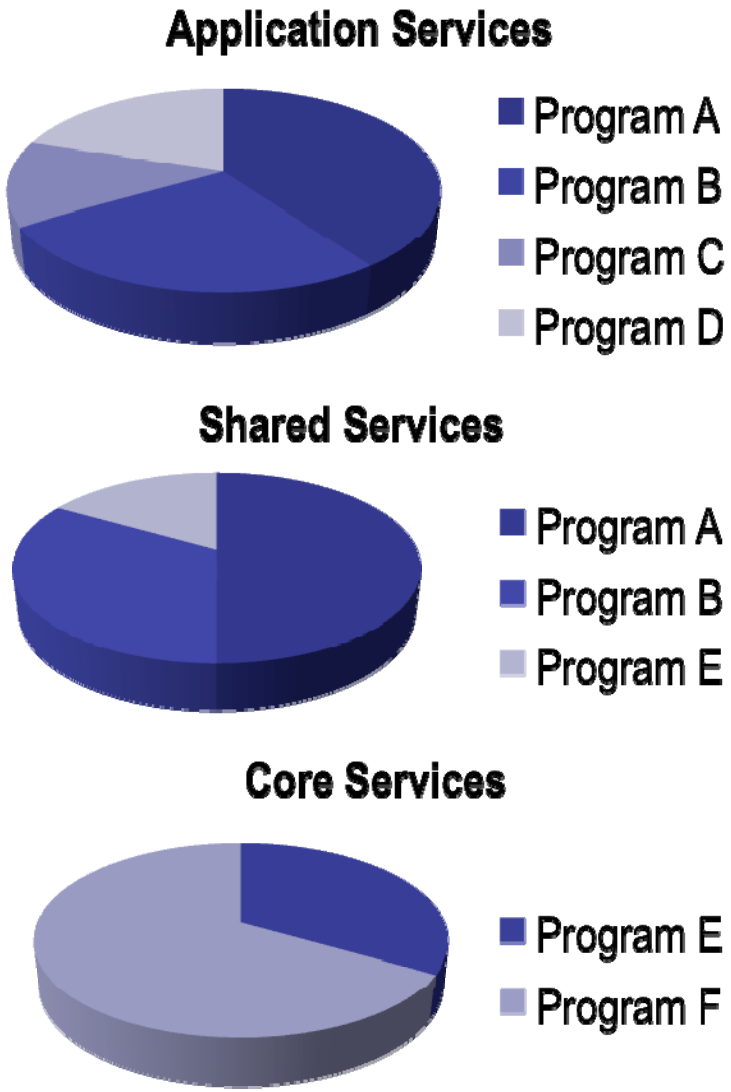
Decomposed Into Services

Starting to Use Other's Services

Collection of Services

Requirements Allocation

- Shift from system level to mission threads
- Partition solution(s) between core services, shared services and unique application services
- Importance of Service Level Agreements (SLA)
- Shared risk
- Dynamic composeability?
- How allocate funding?

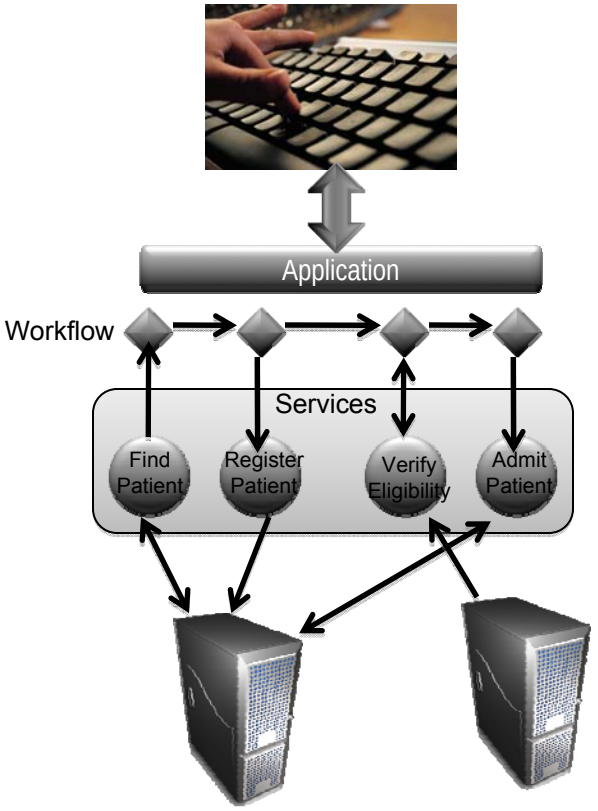


Development: What is needed?

Access to other services

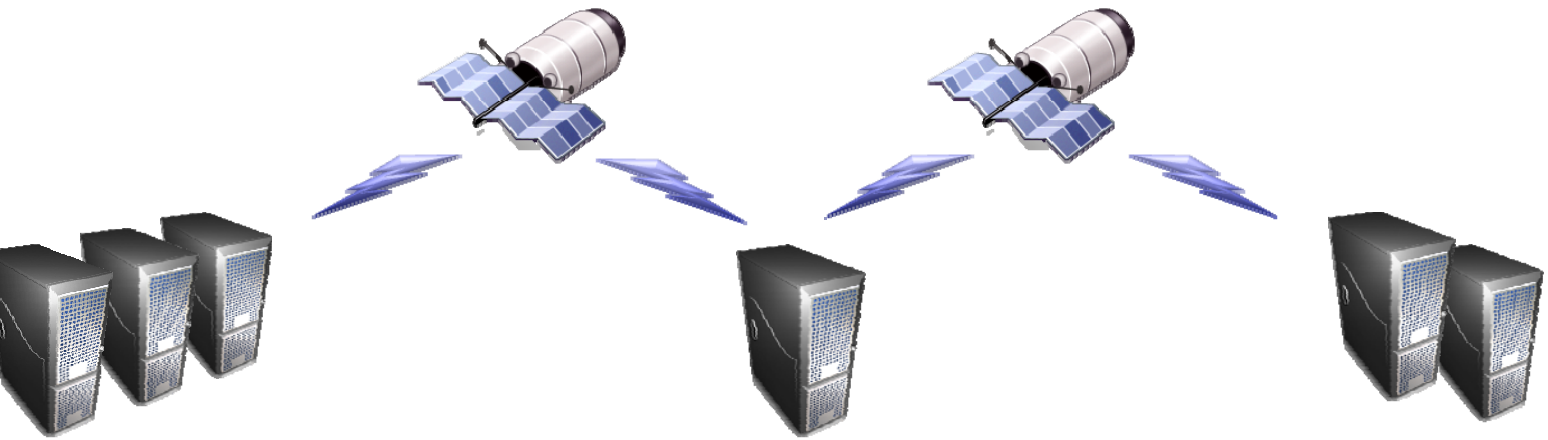
Interoperability standards

System-of-systems engineering



Testing: Concerns & Questions

- Can't test all combinations of services
- Need multiple mission threads to exercise all services - breadth and complexity of test environment
- Service vs. thread level metrics
- Baselines vs. individual service



Accreditation

Cloud based SOA system breaks almost every key tenet of current processes

- Logical system boundary
- Physical system boundary
- Crosses multiple organizations

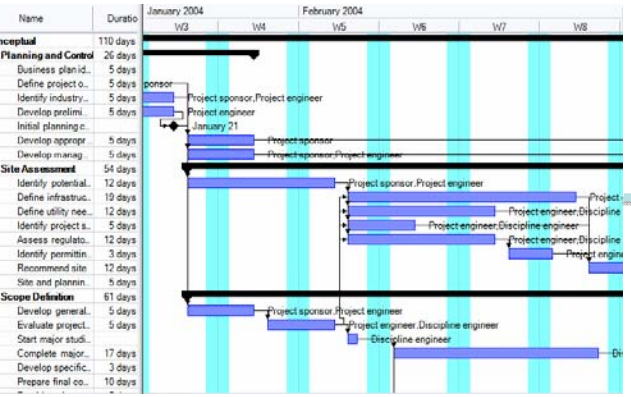
Selected Accreditation Best Practices

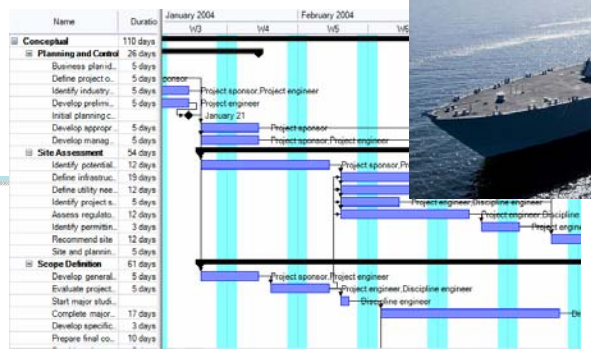
- Policy and Doctrine harmonization
- Upfront planning and architecture to identify friction points
- Better mechanisms to quickly adjudicate issues

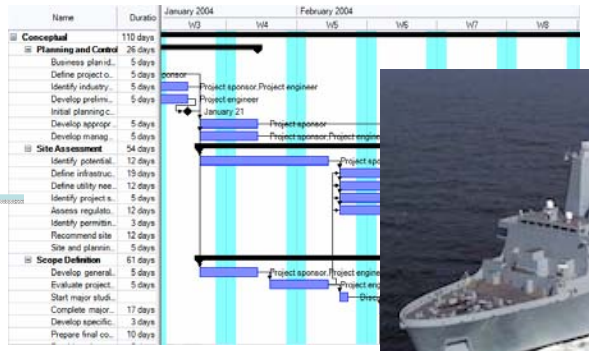
Fielding

Baseline or individual service?

Schedule alignment among services







Net-Enabled Command Capability (NECC)

Approach:

- Centralized funding and requirements, flow down to stakeholders
- Innovative test process

Pros:

- Well documented, consistent architecture, governance

Cons:

- Significant up front costs before see operational results
- Perceived loss of control by Services

Outcome:

- Program cancellation

Global Command and Control System – Integrated Imagery and Intelligence (GCCS-I3)

Approach:

- Component programs retained funding
- Common fielding schedule & hardware
- Rigid interoperability standards
- Shared user environment

Pros:

- Parallel development by small teams
- Legacy programs evolve at own pace

Cons:

- Effort to align multiple component programs

Outcome:

- Success!

Consolidated Afloat Networks and Enterprise Services (CANES)

Approach:

- Centralized Funding for hardware, decentralized funding for software
- Cross-POR governance - common services, development cycle, testing, hardware allocation

Pros:

- Evolve legacy PORs in parallel with emphasis on shared services
- Savings from common, virtualized compute infrastructure

Cons:

- Some Loss of POR autonomy

Outcome:

- TBD

Summary

Must develop acquisition and engineering processes that allow us to:

- Define requirements in terms of mission threads and services
- Allocate requirements across multiple organizations for implementation of services
- Allocate resources for sustainment of services
- Test complex collections of services
- Accredit “systems” composed of collections of services
- Field and sustain “systems’ composed of interdependent services

Way Ahead

- Continue to develop and capture best practices from efforts like GCCS-I3, CANES, C2 RPC, NECC follow-on,…
- Leverage SPAWAR Enterprise Engineering and Certification (E2C) lab environment to develop engineering, test and fielding approaches for services-based systems
- Participate in efforts to reform Defense Acquisition such as Section 804 of the U.S. DoD Defense Authorization Act, U.S. Federal Cloud Computing initiative, UCORE, …

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