- **Study of Best Practice Methods for Development of Information Technology Systems**
- **In-Progress Review 12 December 2008**
- **Final Report Submitted 11 March 2009**

What DISA Asked NDIA To Do

DISA Operational SOA Test and Evaluation (OT&E)

- **Compare and contrast commercial and DoD methods to design, test and deploy Service Oriented Architecture (SOA)–based, secure IT systems that operate in a networked global enterprise with emphasis upon--**
  - **Testing: Examine how SOA and Web Services (WS) are tested. Review evolutionary testing methods. How to test virtually for/with other IT legacy and evolving systems. How should DISA balance risk management, innovation and testing?**
  - **Speed: Recommend how SOA and WS acquisitions, governance and service level management models ought to adapt more quickly using commercial methods/means.**

The Perceived Problem

With regard to software development, recent studies (2004-2007) conclude that the current Operational Test and Evaluation process in the DoD creates barriers to best practice adoption and use, creates instability by introducing new requirements through the testing process and makes a single all-encompassing large-scale operational test impracticable.

It is hypothesized that these problems may be the result of outdated testing processes and methods within DoD that do not accommodate the modern software development processes used by industry.

Study Approach

- Evaluate commercial and/or DoD best practice methods to design, test, and deploy Service Oriented Architecture –based, secure IT systems that operate in a networked global enterprise via open sources, study team experience, and industry leader points of contact
- Use written industry survey questionnaire to gain insight on how SOA is being accomplished on existing C4ISR systems (done on a non-attribution basis within Boeing and Lockheed Martin)
- Rely on study team experience, literature searches, and interviews as basis for understanding extent DoD is currently adopting the commercial/DoD best practice models

Conclusions

- The innovation gap between Industry and DoD Testing is widening and will continue to increase unless immediate action is taken to close it
- SOA, while widely adopted by DoD, lacks the necessary critical enabling technologies that are clearly prevalent in Industry
- The existing “State of Test” is encumbered by a lengthy bureaucratic approval process
- Lack of immediate action will only increase risk as DoD will not fully understand the evolving Commercial SOA approaches, beneficial solutions and best practices, and corresponding security risks

Recommendations

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- Use Agile software development methodology for software development
- Use TDD (Test Driven Development) within Agile methodology
  - Embed testers into development environments
    - Early experience shows less defect ridden code
- Adopt Acceptance Test Driven Development - develop complex service test artifacts early and exercise them early
- Continuous Testing during run-time a must
  - Possibly the most appropriate method to test SLAs and Governance issues
- Institute these recommendations as a part of the implementation of the DoDI 5000.02 changes, which also include rapid prototyping

Support the enablement of these changes through implementation of a SOA Innovation Capability discussed later

Recommendations (Con't)

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- DISA needs to work with OSD/Services and other stakeholders to streamline the OT&E Test Results Approval process
- DISA needs to work with the appropriate DoD and Industry stakeholders to champion the creation of a SOA Innovation Development/Testing Capability and to put in place a comprehensive set of enabling technologies
- DISA needs to aggressively work with the OT&E community stakeholders to implement these capabilities and to incorporate rapid prototyping, coupled with the a revamped set of OT&E processes and procedures enabled by the new DoDI 5000.02
- DISA needs to ready itself to for the SOA cultural, governance, mission assurance, training, and operational challenges (see next two slides)

Next Step Considerations and Focus Areas

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- **Readiness for cultural changes by adopting commercial business practices**
  - – Recapitalize DISA OT&E business practices into acquisition strategies to place acquisition strategies that support DoD 5000.02 such as requirements for prototyping that support OT&E requirements
- **Readiness for governance challenges by updating policies**
  - – Review/update DISA policies to shed outdated roles to create a more virtual enterprise – thus being more responsive to their customer
  - – Aggressively pursue opportunities to prototype new OT&E solutions as part of new DoD Directive
- **Readiness for OT&E mission assurance challenges by focusing on data**
  - – Focus on the data--The key is data – secure, persistent, accurate, timely, etc data! For example, making security transparent to their customers, without systems performance degradation and complexity, is an enormous challenge but vital to delivering trusted information to the users
  - –Build prototype OT&E test beds

Next Step Considerations and Focus Areas

- **Readiness for technical challenges by focusing on the total workforce**
  - –Training, education and development of the workforce, such as SOA certification
  - –Think "user" first and then DISA/OT&E
    - Assess – Users, regardless of their role, require relevant data and information to be readily available
    - Content – Users will always demand continuously improving information content, from both new and existing information products and services
    - Timeliness – Users demand the information they need, when they need it
- **Readiness for concept of operations challenges by focusing on the end state**
  - –Focus on the end state versus on the intermediate states
    - Help customers understand the end state(s) of the enterprise and begin defining OT&E tests to validate these end states
    - Anticipate mission needs for information by making complete spectrum of sources of information seamlessly fused/available to users
    - Develop mechanisms that allow them to prototype solutions to these challenges

Commercial Solutions Examined

DISA Operational SOA Test and Evaluation (OT&E)

- Microsoft
- Google & YouTube
- Yahoo
- Amazon
- eBay
- PayPal
- IBM
- Sun MicroSystems
- E*Trade
- Travelocity
- Net-Centric Enterprise Services
- AHLTA
- PushToTest
- Defense Acquisition University
- Underwriters' Laboratory
- QOSLabs / Semantic
- WebSearch (Generally)
- Security (Generally)

Subjects Examined

- Development & Integration Approaches
- SOA/Features
- Web Services
- Review Evolutionary Testing Methods
- Innovations
- Future directions

Microsoft

DISA Operational SOA Test and Evaluation (OT&E)

Microsoft: **Possesses a number of complementary strengths that advance a shared vision for helping businesses deliver information worker productivity and improved business results. Microsoft offers worldwide customer reach and an extensive partner network, and is the recognized leader in business productivity.**

Key Products: Server Products, Server Technologies, On-Line Services, Server Operating Systems, Desktop Operating Systems, Embedded Operating Systems (Mobile) Desktop Products & Technologies, Security Products & Technologies, System Center Products, Office Center Products, IT Pro Resources, Archived Resources, and many more.

Service Categories (SOA/Features):

- Operating Systems
- Office Productivity Tools
- Internet Services

Methods:

- Employs methods generally used in software industry: Defect tracking, Test automation, Model based testing, Code reviews and inspections, Customer beta programs, SDL, Customer diagnostics and telemetry
- Using agile - Pairwise, Scrum, etc. in software development
- Scalability and performance requirements: Consistency checks and general health fault injection
- Augmented by Bug bash development unit tests
- Investing in defect prevention: Failure modeling, FMEA Root Cause Analysis

Microsoft Development & Test Approach:

- **New products:** are developed and released in Beta to Microsoft Partners. Older product generations remain in use until they are no longer supported
- **Test Automation –** Use automation frameworks to automate test execution
- **"Quality at the Source":** Involve larger community during software development to prevent errors
- **Defect Prevention:** Integrate with existing methodologies (Six Sigma, Agile, …)
- **Test Effectiveness Improvements**: Use Risk Analysis, Probability and Modeling techniques

Security:

- DOS attacks, identity and authorization, access, spoofing, phishing, malware
- Regular functional testing is important – penetration testing, fuzz testing
- Threat modeling and code inspections as major methods for dealing with this type of vulnerabilities

Recommendations:

- Invest in defect prevention techniques
- Concentrate on “Big Picture”
- Assess risk of missing critical defects

Innovations:

- Stochastic Modeling
- Productivity Games - Google Blog - http://googletesting.blogspot.com/2008/06/productivity-games-using-games-to.html
- Economics / Cost of quality

Future Direction:

- Moving to culture of prevention
- Microsoft is a user services oriented company and sees this as their strategic advantage
- Addressing quality versus cost and User input into Test and Design is a future priority

Google/ YouTube

DISA Operational SOA Test and Evaluation (OT&E)

Google's product development is based on rapid prototyping and continuous innovation with frequent new technology releases. Google labs enables users to test these prototypes and send their comments directly to the Googlers who developed them. Reviewer's Guides provide detailed product features, including screen shots and a PR contact to the journalists interested in reviewing the products. Google Web Toolkit allows developers to quickly build and maintain complex yet highly "performant" JavaScript front-end applications in the Java programming language.

Service Categories (SOA/Features) :

- Search –20 Services
- Ads – 3 Services
- Applications – 21 Services, Including YouTube
- Enterprise – 5 Services
- Mobile – 2 Services

Google Test Approach:

- Products are made available early in their development stages by posting them on Google Labs, at test locations online, or directly on Google.com.
- If users find a product useful, it is promoted to " beta" status for additional testing--Test periods often last a year or more
- Once Google is satisfied that a product is of high quality and utility, the beta label is removed

The Google User Experience team aims to create designs that are: useful, fast, simple, engaging, innovative, universal, profitable, beautiful, trustworthy, and personable.

Software Principles:

- **Installation** -- *Software should not trick you into installing it*
- **Upfront Disclosure** -- *When an application is installed, it should inform you of its principal/significant functions*
- **Simple Removal** -- E*asy to disable or delete an application*
- **Clear Behavior** --*Applications that affect or change user experience should make clear they are the reason*
  Snooping-- *If an application collects or transmits your personal information you should know*
- **Keeping Good Company** -- *Application providers should not allow their products to be bundled with applications that do not meet these guidelines*

Google/ YouTube (Con't)

DISA Operational SOA Test and Evaluation (OT&E)

Innovations:

- **PageRank Technology**: Google's PageRank reflects the importance of web pages by considering more than 500 million variables and 2 billion terms.
- **Hypertext-Matching Analysis**: Google's search engine analyzes page content. Instead of simply scanning for page-based text (which can be manipulated by site publishers through meta-tags)
- Their technology analyzes the full content of a page and factors in fonts, subdivisions and the precise location of each word.
- They also analyze the **content** of neighboring web pages to ensure the results returned are the most relevant to a user's query
- Mobile Apps: Google is developing new mobile applications and services that are more accessible and customizable
- **New Google Search Appliance** can search up to 10 million documents using only a single box, and provides a personalized search experience for end users

Security:

- Google developing security tool code named "Lemon" to Find Cross-site Scripting Vulnerabilities
- Google Security and Product Safety organized around products and security incidents with specific points of contact

Future Direction:

- Google is partnering with industry-leading carriers and device manufacturers to deliver these innovative services globally.
- Goggle is working with many of these industry leaders through the Open Handset Alliance to develop Android, the first complete, open, and free mobile platform, which will offer people a less expensive and better mobile experience

Google shutting down virtual world 'Lively" "It has been a tough decision, but we want to ensure that we prioritize our resources and focus more on our core search, ads and apps business."

Yahoo

Yahoo! Developer Network (YDN): Offers Web Services and APIs that make it easy for developers to build applications and Mashups. Yahoo! APIs let developers tap into Yahoo!'s world-class data and infrastructure to help power their businesses and integrate data sources in new ways. Mashup approach encourages public involvement very early in development. http://developer.yahoo.com/blog/yahoo-api-map.zip

Service Categories (SOA/Features) :

- Location APIs
- Media APIs
- Search APIs
- Content APIs
- Commerce APIs
- Communication APIs
- Social APIs
- Tools, Services, resources

Over 60 APIs & Services

Yahoo Test Approach:

- **Web Development Approach** : Relies on HTTP and SOAP tools and techniques. Strong support of W3C
- **labs.yahoo.com**: Used to semantically enrich recommended systems developed via:
  - Rapid prototyping through broad external “alpha” and “beta” test community
  - Profit-reliant; if there is no profit or insufficient financial sponsorship, effort is slowed or stopped
  - Speed is market driven and contributes to success of app or service by beating competition to the market

Security:

- Community-dependent; relies on collaborative approach and “good will” of testing community
- Security Center promotes COTS security solutions and products

Innovations:

- "Mashup" - Web app that integrates data from more than one source in a single area/product
- "Royal Jelly" - a more efficient and flexible way of making online recommendations and connections by studying the patterns of users

Future Direction:

Yahoo is a DATA company and sees this as their strategic advantage. For example, their latest W3C paper speaks of the advantage of metadata for web searches (using their WebMonkey API)

Amazon

DISA Operational SOA Test and Evaluation (OT&E)

Amazon.com Development Centers: All Amazon workers are encouraged to be visionaries, innovators, builders, and owners of ideas. Amazon uses small "2 pizza teams" and stresses stakeholder involvement and end-to-end ownership of development efforts.

Service Categories (SOA/Features) :

- Transactions
- Micro Transactions
- Purchases
- Shipping Network
- Channels/Affiliates
- Marketing
- Reviews
- Data Service

Over 25 APIs & Services

Amazon Test Approach:

- **Web Development Approach**: Uses HTTP, REST, and SOAP protocols. End-to-end development and test.
- **Amazon Development Centers**: In-house, on payroll, off-shore. Develop and perfect Amazon content and methodologies. Locations:
  - India (3 locations)
  - Scotland
  - Ireland
  - Japan
  - South Africa
  - England
  - Romania
  - China

Security:

- Infrastructure is SAS70 Type III (Sarbanes Oxley) and HIPAA certified or capable of being certified at those or similar levels
- Servers are fully encrypted, with SSH and Firewall access
- Data Centers require triple, two-factor authentication to access

Innovations: "Cloud" Internet-Based Development – geography-independent – Offerings:

- Amazon Elastic Compute Cloud (EC2)– Web service provides compute resizable capacity in the cloud
- Simple Storage Service (S3)– designed to make web-scale computing easier for developers
- End-to-End team ownership of innovative ideas (development, testing, production, marketing)
- Small teams, stressing innovation and personal responsibility/credibility for ideas developed/marketed

Future Direction:

Acquisitions: Jan 2008 Audible.com; August 2008 and announced agreement to purchase Victoria, B.C. based Abebooks and Seattle-based Shelfari, a book-based social network site

eBay

Development approach includes: Feedback forum, discussion boards, groups, Answer Center, chat rooms, and an active government relations area ensure eBay development and operations are "well lit" and tightly integrated with providers and developers. 28% of eBay transactions take place via registered applications and sites, registered through the eBay Partner Network. At least 4 different business models are available for developers and advertisers, to help them "drive business" to eBay, and draw financial compensation as a result.

Service Categories (SOA/Features) :

- APIs available:
- Shopping API
- Merchandising API
- Trading API
- Client Alerts API
- Platform Notifications API
- Research API
- Large Merchant Services
- Project Echo (future)

eBay Test Approach:

- eBay Developer Centers, available in a wide variety of languages:
- JavaScript Dev Center (JavaScript, JSON, AJAX)
- Flash Dev Center (ActionScript, Flex)
- PHP Dev Center (PHP, Perl, Python)
- Windows Dev Center (.NET, C#, ASP, VB)
- Java Dev Center (Java, JSP)

Security:

- Infrastructure is SAS70 Type III (Sarbanes Oxley) and HIPAA certified or capable of being certified at those or similar levels
- Servers are fully encrypted, with SSH and Firewall access
- Data Centers require triple, two-factor authentication to access

SOA enabling Technologies: A rich assortment of developer and merchandiser tools including:

code samples, development tools, software development toolkits (SDKs), Code checks and API test tools, link generators, editor's kits, RSS feed generators

eBay (Con't)

Security: Robust, Full-featured Security Center, includes confidence-building information and best practices for buyers, sellers, marketers, and law enforcement personnel

Innovations:

- **eBay Provider Certification** helps members of the eBay community feel more comfortable with hiring providers to grow their eBay businesses
- **Global Law Enforcement Operations Center**, containing data on viruses, identity theft, fraud, spoofs, and other nefarious activities which might have an effect on eBay systems, services, or customers

Future Direction:

Partnership with VUVOX Collage (using Flash and Flex) for presentation, Project Echo (newest API), eBay Desktop 2.0 (using AIR)

PayPal

PayPal development approach:

- Works with partners to develop pre-integrated PayPal solutions that are available for download
- Development & Integrations step call for:
  - Select a product or business
  - Complete PayPal integration (API Integration, Integrating a Gateway, or Integrating a Shopping Cart)
  - Test your integration
  - Update your integration configuration
  - Then “go live”
  - Release to customers
- Provides library of technical documentation, downloadable source code, and training tools
- Promotes “Certified Developer” via online exam that tests your knowledge of PayPal
- Uses PayPal Developer Community portal information to connect developers an promote sharing
- Provides “Integration Training” and offers tools that allow developers to create the HTML code

Service Categories (SOA/Features) :

- Carts -- 100 pre-integrated shopping carts
  - Express Checkout Compatible
  - Website Payments Standard Compatible
  - Website Payments Pro (U.S.) Compatible
  - Website Payments Pro (Canada) Compatible
  - Payflow Compatible
- International Solutions (UK)
- Enterprise Solutions
- Other Pre-integrated Solutions
- Administration and Back-Office

PayPal Test Approach: Uses PayPal Sandbox:

- A testing environment that is a duplicate of the live PayPal site, except that no real money changes hands
- Allows you to test your entire integration before submitting transactions to the live PayPal environment
- Allows tester to create and manage test accounts, and view emails and API credentials for those test accounts
- The IPN Simulator allows you to manually trigger Instant Payment Notifications (IPNs) that are sent to an IPN listener URL you specify

PayPal (Con't)

Security:

- Features a Security Center
- The PayPal Security Key fob gives customers an extra layer of security to protect themselves against online identity theft and account takeover. The PayPal Security Key creates random temporary security codes that help safeguard your PayPal account when you log in. It comes in 2 types, each with different advantages:
  - Security key token: This version is an electronic device – or "token" – designed to be carried on a key ring. It creates a security code for you every 30 seconds.
  - Mobile phone security key: You can get temporary security codes on your mobile phone by text messages (also called SMS)

Innovations:

- Recently launched www.x.com as the showcase site for PayPal Labs to tap the creativity, innovation, and passion among our engineers, product managers, and other employees

Future Direction:

- Expanding PayPal's services around the Globe (leading online payments service to the more than 120 million residents of these three countries)
- Upgraded our service to deliver more relevant information to our customers in 173 countries, making more convenient to use PayPal for our global base of buyers and sellers. Further aligning services with eBay. (PayPal was acquired by e-Bay in 2002)

DISA Operational SOA Test and Evaluation (OT&E)

- Mix of products, software development and hosting services
- Moved from being a product focused to services company
- Supports open source eclipse developer platform to achieve interoperability among software components
- Eclipse lowers software development risks by facilitating software module reuse
- Sells proprietary Rational system as a developer platform to reduce risk associated with building and deploying systems
- Recently released Lotus Software Suite as a Software as Service (SaS), moving to a QoS subscription model versus selling software
- Size means practices vary from group to group, but the one common thread is need to share information both inside and outside the enterprise, believing:
  - People solve their own problems if given access to information (saves time and money)
  - Easier to share information versus trying to understand all the ways people might need access to information

IBM (Con't)

- IBM Service Oriented Architecture Approach-- SOA Center
  - Developer tools
  - Developer, customer sandboxes
  - Training Courses (classroom, virtual, instructor-led virtual)
  - Numerous Certifications (developer, architect, solution provider, manager)
  - Books, white papers, case studies, webcasts, forums, user group communities
  - Acquired Rational Software (Jazz software, Rational Learning Framework)
  - Acquired Telelogic (worldwide best practices, multi-mode reviews, model-driven workflows)
  - International, well-known, proof-of-concept tests
- Key point is to share data as widely as possible

Sun Microsystems

DISA Operational SOA Test and Evaluation (OT&E)

Sun Microsystems is moving from being a hardware based vendor to an open source software subscription service through its support of OSS products such as: Java, OpenSolaris, MySQL and OpenOffice to name a few. Since Sun has adopted the OSS business model they now release and update software much more rapidly. The means: software is continually under test either real world or with simulators, release experimental versions of software, and ensure that software (and by extent knowledge) is openly accessible to developers. Sun also has a test lab available for hardware products.

Service Categories (SOA/Features):

- Open source SOA
- Java. One of the largest software knowledge repositories in the world, widely open and available to anyone. Used on a majority of cell phones
- OSS Databases (small, large and distributed)

Sun Test/Development Approach:

- Products are made available early in their development stages by posting them on their open source developer website
- Actively solicit input from users and accept code as well (trust but verify)
- Default to using only open source software

Test Principles:

- Testing is everyone's job
- Share, share and share information and make widely available
- Make test suites easily accessible

E*Trade

DISA Operational SOA Test and Evaluation (OT&E)

E*Trade has devoted itself to moving to an all open source software (OSS) platform. E*Trade's competitive advantage is speed of trading, you cannot outsource your competitive advantage, they MUST know how the E*Trade system works

"If you can sustain change faster than somebody else, you're going to survive, and the person who can't sustain the change is not going to evolve, and they're going to die off." - VP of Architecture, Lee Thompson, of E-Trade

- During big drops, they handled traffic at about the same pace while everyone else was slammed with degraded performance (E*TRADE ~5 sec vs. ~60 sec for competitors)
  - Transaction speed has decreased from 8-9 seconds to 4-5 seconds , about 3 now as they move from proprietary to all OSS Also have saved $16 million dollars going all OSS
- E*TRADE has become such a complex environment that testing in the traditional way (scheduling time in the center) became too hard
- Uses Maven and control tier for lifecycle management each developer has **a test environment** on their laptop of the entire E*TRADE system, so they can simulate and fully test new ideas:
  - Distributed testing, since the environment is fully scalable, uses Selenium as the testing backplane, http://www.openqa.org/selenium/
- Roughly 50 million lines of code
- Won Keynote awards: banking and brokerage tech.
- E*Trade internal dev matched to OSS dev cycles

E*TRADE Test Approach:

- Prepare the system for failure
- Constant monitoring at all places through out the technology stack
- Testing constantly and provide test tools to all developers
- Encourage experimentation

Travelocity

- In 2002, Travelocity lost revenue and market share to competition
- Travelocity and Sabre collaborated to develop the enterprise network model (ENM)
- ENM combines discrete choice customer modeling with simulation and large-scale optimization to improve Travelocity's management supplier agreements, customer marketing, and product pricing
- Travelocity become a more effective retailer
- ENM is a good example of how to reinvent supplier-customer relationships through Customer Data Modeling, Supply Model Applications, and Marketing and Pricing Models

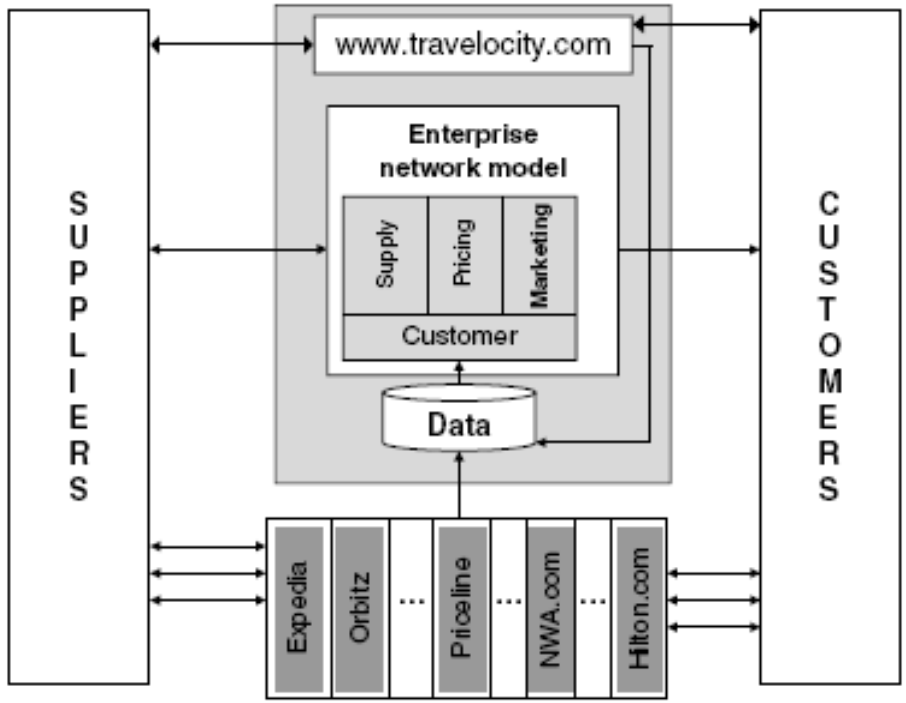


Figure 1: Travelocity's business is to connect the suppliers of travel products and customers on its Web site, www.travelocity.com. The enterprise network model (ENM) improves Travelocity profitability by optimizing what travel products to display and price. The ENM combines a variety of customer-choice, simulation, and optimization models.

Source: **Smith, Darrow, Elieson, Guenther, Rao, and Zouaoui:** *Travelocity Becomes a Travel Retailer*
Interfaces 37(1), pp. 68–81, © 2007 INFORMS

Net-Centric Enterprise Services (NCES)

DISA Operational SOA Test and Evaluation (OT&E)

Department of Defense (DoD) Net-Centric Enterprise Services (NCES) enables information sharing by connecting people and systems that have information (data and services) with those who need information. DISA offers services that are designed to assist NCES developers.

Service Categories (SOA/Features):

- Services:
  - Storage
  - Mediation
  - User Assist
  - IA (Information Assurance)
  - ESM (Enterprise Service Mgt.)
  - Messaging
  - Discovery & Delivery
  - Application
  - Collaboration
- Product Line:
  - Collaboration
  - Content Discovery & Delivery
  - User Access (Portal)
  - Service-oriented Arch. Foundation

Approach:

Adopt before Buy: Buy before Create (A, B, C)

- NCES services are being acquired via Managed Service Providers, which includes DoD organizations for the Adopt, IBM & Carahsoft and Computer Sciences Corp. for the Buy, and DISA for the Create.
- Early User Testing (EUT) & Limited Operational Availability (LOA) Decisions deployed capabilities during the System Development & Demonstration (SDD) Phase
- Unbundled capabilities for accelerated delivery timelines
- Multiple Operational Availability Decisions (OADs) combined with a single Full Deployment Decision Review (FDDR) supported by a Technology Readiness Assessment (TRA) and T&E Risk Assessment shaped the post-Milestone C Limited Deployments
- Continuous Monitoring of deployed capabilities to assist in validating Service Level Agreements (SLAs)

Test & Evaluation Strategy:

- Combined Dev. Testing w/ Operational Assessments
- Post Milestone C: *Revised Test & Evaluation Strategy*
  - OTAs conducted T&E Risk Assessment for each capability to determine maturity and value of additional testing
  - Utilizes continuous monitoring to collect Reliability, Availability, and Maintainability data and obtain user feedback

AHLTA Electronic Health Records

(Armed Forces Health Longitudinal Technology Application)

DISA Operational SOA Test and Evaluation (OT&E)

AHLTA is the military medical and dental clinical information system that will generate and maintain a comprehensive, life-long, computer-based patient record for each Military Health System (MHS) beneficiary. AHLTA provides a secure, comprehensive, interoperable, standards-based, enterprise-wide medical and dental clinical information system that generates, maintains, and provides round-the-clock access to longitudinal electronic health records of active duty military, their family members and others entitled to DoD health care in fixed medical/dental facilities, on board ships, and in Theaters of Operations.

Service Categories (SOA/Features):

- On-Demand Healthcare Record
  - Interoperability (combines medical/ dental/ optical/ pharmacy records into a single system)
  - Secure, worldwide accessibility by healthcare providers
  - Windows-based client platform
- Data on beneficiaries' conditions, prescriptions, diagnostic tests & information essential to providing quality care.

AHLTA Developer Approach:

- Requirements Engineering
- Requirements derivation via reverse engineering
- "Spiral development"
- Staged and evolutionary delivery
- Joint Application Development (JAD) facilitation
- Function Point Analysis
- Recording and Tracking requirements

Testing Approach:

- Uses Certification Commission for Healthcare Information Technology (CCHIT)
- AHLTA has been tested and passed inspection of 100 percent of a set of criteria for:
  - functionality (ability to create and manage electronic records for all patients, as well as automating workflow in a physician's office),
  - interoperability (a first step in the ability to receive and send electronic data to other entities such as laboratories), and
  - security (ability to keep patients' information safe)

AHLTA Electronic Health Records

(Armed Forces Health Longitudinal Technology Application)

DISA Operational SOA Test and Evaluation (OT&E)

Certification Commission for Healthcare Information Technology Provides:

- Certification "how to"
- Repository of CCHIT Certified Ambulatory EHR Products
- Case studies of CCHIT Certified EHRs in practice
- A physicians/practice managers guide for understand certified CCHIT EHR product benefits
- Participation:
  - CCHIT Jurors:
    - (1) Physician Jurors, (2) Provider Jurors, and (3) Security Inspectors
    - Qualified experts who undergo further orientation and a trial observation before they serve in this role
    - Conduct the rigorous, structured testing process by which vendor products become CCHIT CertifiedSM
- Work Groups: CCHIT volunteer Work Groups develop criteria and inspection processes for each domain includes: assessing the market environment and available standards, drafting and finalizing certification requirements, publishing a future roadmap of certification

Innovations:

DoD entered into a CRADA with Microsoft to develop a prototype medical data warehouse and the analytical tools required to allow easy access and maximize use of military patient health data and records currently stored in the AHLTA clinical data repository (CDR)

Future Directions:

- Dept of Veterans Affairs providers can now access the DoD's MHS through the VA's VistA system, and vice versa
- Full interoperability with VistA and the National Health Information Network is expected by 2011.

SOA Domains:

- Ambulatory
- Behavioral Health
- Cardiovascular Medicine
- Child Health
- Emergency Dept.
- Inpatient
- Interoperability
- Network|
- Personal Health Records
- Privacy & Compliance
- Security

PushToTest (OSS SOA Test Community)

DISA Operational SOA Test and Evaluation (OT&E)

- PushToTest (Established in 2001) is a profitable professional software publisher with more than 160,000 users and thousands of enterprises:
  - Open-source software publisher of test automation tools, methodology, and training to medium and large sized enterprises, including: The Jackson Laboratory, General Motors, & TIBCO
  - Aim is to provide flexible open-source test automation solutions that encourage reuse and sharing among software architects, developers, QA testers, and IT Managers
- Solutions integrate into modern software development environments and leverage agile, test-first, and unit testing expertise into functional tests, performance and load tests, and business service monitoring:
  - Designed its technology for Service Oriented Architecture (SOA), Ajax, Web applications, Web services, and REST applications.
  - Is an extensible framework that is easily extended to handle new protocols, message formats, encoding styles, and test operations
  - Is a distributed architecture where tests scale vertically and horizontally
  - Solutions have 6 years of development, 5th generation, active development community, and a 3-year product roadmap
- Solutions cost a fraction of competing commercial tools Software Principles:
  - Make knowledge openly accessible Installation
  - Build great tools for/with the community
  - Ensure that the testing tools are easily utilized and able to be on continuously
  - Actively manage community

Software Principles:

  - Make knowledge openly accessible Installation
  - Build great tools for/with the community
  - Ensure that the testing tools are easily utilized and able to be on continuously
  - Actively manage community

Defense Acquisition University

DISA Operational SOA Test and Evaluation (OT&E)

The Defense Acquisition University supports the Acquisition, Technology, and Logistics Workforce via a system of systems consisting of an approach that blends the evolution and integration of existing GOTS and COTS systems; interaction during the development phases between leadership, instructional system designers, the development team, SMEs, and the customer base; and continuous innovation to explore and integrate a mix of proven and promising new technologies.

(SOA/Features):

- Knowledge Repositories
- Communities of Practice
- Performance Learning Tools
- Knowledge Gateways
- Best Practices Clearinghouse
- Web-Enabled Guidebooks
- Enterprise Search
- Portal Services

DAU's Development and Test Approach:

- Development begins with requirements passed to an instructional systems designer for concept refinement upfront
- Products are exposed to the support team and potential users throughout the development process
- Close interaction between DAU, the CSC support contractor, and the respective product vendors to improve COTS products
- Formal usability testing

The DAU team aims to create designs that are: useful, fast, simple, innovative, and that integrate into the DAU Performance Learning Model

Software Principles:

Installation – Must be server based
Upfront Disclosure – Must comply with DoD Policy on information collection (e.g., no client based cookies, no user behavior tracking, etc.
Simple Removal – N/A
Clear Behavior – Sites evolve vs change to the degree possible; but when radical change is necessary every effort is made to guide and educate users in advance; maximum emphasis placed on screen recordings as primary tutorial resources

Defense Acquisition University (Con't)

DISA Operational SOA Test and Evaluation (OT&E)

Innovations:

- DAU is SOA model of excellence
- Makes extensive you of Instructional System Design Engineers and Use Cases at the beginning of the system development cycle to ensure desired system functionality is actually achieved
- Knowledge Sharing services
- Media Services
- Best Practice Clearing House Services
- ACQuire Search Services
- Living Library
- Ask-a-Professor
- Electronic Defense Acquisition Guide Book
- Integrated Navigation Framework Chart
- ACQuipedia
- Hosts other Organizations in manner that promotes knowledge sharing
- Community of Practice Implementation Guide

Security:

- All systems deployed at DAU are subjected to close DoD security scans prior to launch and must meet all DoD requirements related to network certification

Future Direction:

- Web 3.0
- Focus for all current and future development efforts are on a services architecture both for internal designs and to make content available to external DoD, support contractor, and other appropriate portals

Underwriters' Laboratory

DISA Operational SOA Test and Evaluation (OT&E)

Independent, Non-profit safety certification organization. UL evaluates nearly 20,000 types of products, components, materials and systems annually. There are 126 UL inspection centers, 62 laboratories, and certification and testing facilities worldwide. Active Participation/Support in the code community, regulatory authorities in the electrical inspection community, environmental and public health regulatory community, those responding to fire and security hazards, and refrigerants and the refrigeration/air conditioning industry.

Service Categories (SOA/Features) :

- Promote Safe Living and Working Environments
- Comprehensive (>1,000) Standards Library, available online or in print
- Apply "Safety Science" and "Safety Hazard Based Engineering"
- Work to advance the industry through research and investigation

Approach:

- Published Standards
- Certification Channel
- Public Safety Awareness Campaigns
- ISO/IEC Standards for Evaluation and Test criteria
- "UL University", promoting industry awareness, security conformance

Innovations/Future Direction:

Massively scalable, allowing rapid evaluation, testing, and certification on a near-global basis. Will accept product test results from other labs, including private industry, if they meet ISO/IEC test criteria

QOSLabs / Semantic

DISA Operational SOA Test and Evaluation (OT&E)

QoS Labs: deliver services to organizations who act as digital service integrators based on its service-oriented multi-disciplinary experience and extensive knowledge-base acquired through years of R&D and an active presence in the SOA market, delivering early-adopter integration and outsourcing projects. QoS Labs' Semantic SOA platform facilitates the use of valuable knowledge resources by modeling them into a virtual space and allowing customers to refine their own solution based on their own specific requirements and by using their own domain-specific language.

Service Categories (SOA/Features) :

- Facilitate integration with internal ICT infrastructures and third-party web resources
- Vertical XML standards and best practices allow for better guidelines to solve industry-specific interoperability problems
- Controlled vocabularies
- Common reference architecture to model the solution
- Create virtual services, reducing service creation time

QOSLabs Test Approach:

- All projects at the lab work under a 360-degree vision of service orientation which makes a much wider scope of how SOA is typically understood in the market.
- Testing through real use cases
- Nearly 60 Test & Integration partners (including IBM, Microsoft, Oracle, SAP, Cisco)

Security:

- Lab security was foundational (layer 1) in formation of virtual lab design.

Innovations:

"SarbOx Accelerator" - development platform for documenting and automating processes, integrating with existing applications, identifying users and participants, and managing the publishing of restricted information. In addition, it continuously generates, manages and monitors the auditing traces required by the Sarbanes-Oxley regulation

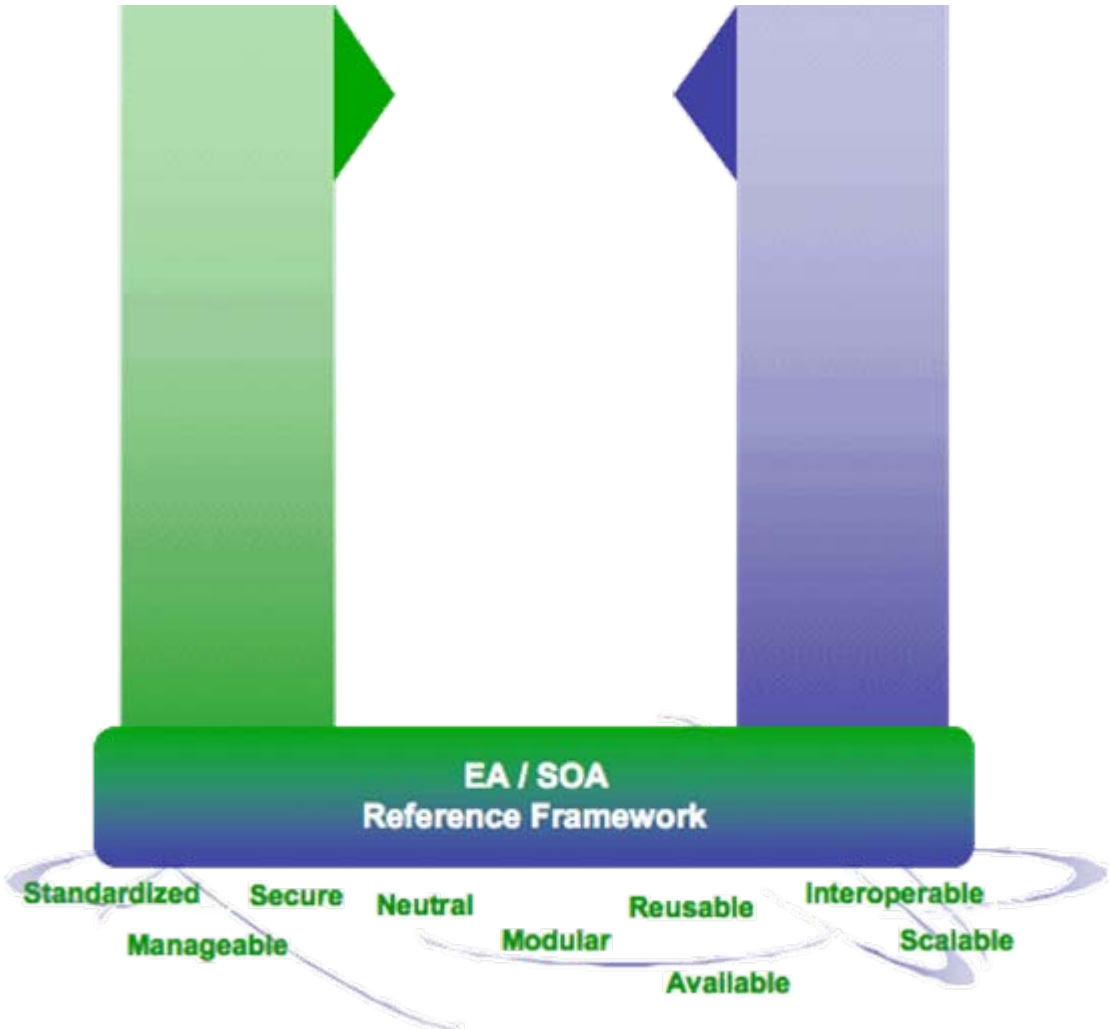
Employee Life Cycle Management (ELCM) - business solution to the problem of "provisioning" and "de-provisioning" employees who have access to applications, digital services and infrastructure

Future Direction:

Thought Leadership: Proponents of "Next Generation SOA Infrastructure"

QOSLabs / Semantic (Con't)

DISA Operational SOA Test and Evaluation (OT&E)



Source: http://www.qoslabs.com/wb3/wb/qos/qos_services

QOSLabs / Semantic

Examples of SOA Enabling Technologies:

- **Service portals** (personalization, Model-View-Controller pattern, portlets, JSR-168, JSR-286, AJAX, content aggregation, semantic portals)
- **e-Business** (ERP, CRM, BPM, e-Commerce engine, e-payment, personalization, profiling, analytics, e-Business vocabularies and XML schema, ebXML, UBL)
- **Document and content management** (publishing workflow, content repositories, JSR-170, JSR-283, WebDav, DARWIN, knowledge management systems)
- **Integration middleware** (EAI, Web Services, UDDI, workflow, BPEL, Java API's, ESB, JBI)
- **SOA security management** (AAA, cryptography, privacy, intrusion detection, VPN security, security gateways, Web Services Security, Web Services Policy, digital certificates)
- **Directory Management** (LDAP, Active Directory, RACF, meta-directories)
- **Access Management** (password/fingerprint/biometric/digital certificate/MAC authentication mechanisms, RBAC, single-sign-on)
- **Network Identity** (identity federation, SAML, Liberty, automated user provisioning, identity auditing, Passport, Infocard, Identity 2.0,)
- **SOA accounting management** (IP traffic flows, NetFlow, RTFM, IPFIX, IPDR, portal/web site access, server process queues, logging, virtual accounting services)
- **SOA fault management** (OSS, OSS/J, SNMP, VPN management , WBEM/CIM, SDM, JMX, element management interoperability, data & event correlation, fault root cause analysis, Web Services Management, Microsoft MoM)
- **SOA performance Management** (Service Level Management, SLA, IP bandwidth management, process queue management)
- **SOA configuration management** (virtual private environments, ICT inventory auto-discovery, TMN, TMF, WBEM/CIM, virtual CMDB)
- **SOA management dashboard** (infrastructure & business processes, multiple-source data correlation, business indicators, OLAP, BAM, Balanced Score Card)
- **Development & Provisioning** (object-oriented modeling, semantic modeling, O/RM, PMI, SCRUM, ISO 9000, CMM, ITIL, infrastructure auto-provisioning, user provisioning, IT continuity, mobility)
- **IT Governance** (ITIL, SarbOx, HIPAA, IT auditing, policy standards, semantic constraints, rules, RuleML, OWL)

Source: http://www.qoslabs.com/wb3/wb/qos/qos_enabling_technologies

WebSearch Industry Dynamics

Search Engine Leaders (Oct. 2008; source: Nielsen)

- Google (61.2%)
- Yahoo (16.9%)
- MSN / Windows Live Search (11.4%) – On April 24, 2008, Microsoft acquired FAST, which is now known as FAST, A Microsoft® Subsidiary
- All others (10.5%)
- Leading internal search engines include: Google, Fast, Endeca, Autonomy, Siderean, and Dieselpoint

What's at stake?

- Internet Traffic – Development is revenue-driven, and revenue comes from ad/referral revenue

What's their approach?

- Develop "Killer App"; Breakthrough Solutions to increase market share
- Hire High-Priced Experts (Nov 08: Microsoft hires top Yahoo Search Engineer)
- Strategic Acquisitions and Partnerships

How will industry acquisitions/design strategy affect WS products?

- WebSearch product fundamental/pervasive across every aspect of the DoD GIG
- Dwindling field of providers means fewer possible approaches
- Apps may not be thoroughly appropriate/applicable to DoD need (see "revenue-driven" bullet above)

What are the implications for DoD?

- DoD becomes just another client, with less influence in the final shape, function of the technology
- DoD will then either have to shop around for useful commercial solutions, or contract for expensive in-house development, which will then incur expensive O&M tails, expensive replacement paths, etc.

What can DoD do?

- Stay an industry stakeholder; attend/host conferences, encourage DoD/industry "cross-pollination"
- Form partnerships, provide forums, insert "DoD perspective" early in development efforts

Commercial Service Level Agreements

Wide Range of SLAs

- Casual/Free user - no written SLA, enforced by market forces
- Paying advertiser - written agreement might not even address up-time because the fee is only paid if the ad is actually “clicked on”
- Premium users , Listing for Sale – written agreement, but not very stringent, for example:
  - Credits if availability falls below 99.9%, but downtime only counts if it is longer than 10 minutes
  - Credits associated fee if title search (soft) outage is more than one hour AND the customers listing was scheduled to end during the outage or during the hour following the outage
  - Credits all fees for a hard outage of more than one hour, but less than two hours, if the
    - Listing scheduled to end during the outage, or
    - Listing scheduled to end in the hour after the end of the outage
  - Service credit might seem rather minor compared to the service that is lost – 25% credit if availability is less than 99% in a month – that’s over 7 hours of downtime

Commercial Service Level Agreements

What's typically covered (or not)

- Usually just covers system up-time
- Usually measured by the vendor; not the customer
- Lots of room for "finger pointing" between the service provider, the network provider and the customer's equipment/facility
- Usually does not cover Quality of Service related issues

Limited Direct Applicability to DoD Mission Areas

- SLAs can be used where services are not considered critical or mission essential

Commercial SLA Gaps to DoD

- GIG is a Federated Architecture that spans from the warfighter to the service provider
  - Commercial SLAs cover edge to edge within the service providers infrastructure
- Financial compensation is not appropriate for potential loss of life due to service outage

Conclusion for DoD

- In the majority of applications, DoD cannot adopt Commercial Industry's approach to SLAs because the goals and objectives with respect to SLAs are so different

Service Level Agreements – Stockmarkets and Trading

DISA Operational SOA Test and Evaluation (OT&E)

Week starting 2 February 2009

Rank by Speed (seconds)			
Rank	Target	Response Time (seconds)	Rank Last Week
1	Scottrade	3.57	1
2	TD Ameritrade	4.39	2
3	Etrade	4.75	3
4	Fidelity	5.09	4
5	Firstrade	6.43	5
	KBT Index	**8.99**	
6	OptionsXpress	8.99	6
7	Schwab	11.30	7
8	ShareBuilder	13.04	8
9	Bank of America	17.41	9
10	TRowe Price	19.49	10
11	Wells Fargo	21.50	11

Rank by Success Rate (percentage)				
Rank	Target	Success rate (%)	Outage Hours	Rank Last Week
1	Firstrade	100.00	0	5
1	Scottrade	100.00	0	1
3	Fidelity	99.93	0	1
3	Schwab	99.93	0	3
3	ShareBuilder	99.93	0	3
6	Etrade	99.86	0	6
7	Bank of America	99.57	0	7
8	Wells Fargo	99.38	0	10
	KBT Index	**99.20**	**0**	
9	TD Ameritrade	99.16	0	8
10	TRowe Price	97.78	1	9
11	OptionsXpress	95.31	0	11

Stockmarket Key Points

- **SLA levels actively probed and posted**
- **Competition & Options**
- **Penalties for non-performance, both direct (loss of money) and indirect (loss of reputation and customers)**

Brokerage Generate Order Benchmark

January 31, 2009 - February 13, 2009/9:00 - 16:00 EST, Monday through Friday

Response Time Rating

Rank	Site	Response (sec)
1	Scottrade	3.95
2	TD Ameritrade	4.54
3	Fidelity	4.63
4	E*Trade	4.88
5	TradeKing	6.85
6	Options Xpress	7.84
7	FirstTrade	8.01
8	WallStreet E	8.72
9	Banc of America Investment Services, Inc	8.76
	Average	**9.11**
10	Muriel Siebert	10.25
11	Wells Fargo Brokerage	15.42
12	Charles Schwab	16.19
13	Vanguard	18.37

Availability Rating

Rank	Site	Availability (%)
1	E*Trade	100.00
2	TD Ameritrade	99.94
3	Fidelity	99.88
4	Charles Schwab	99.81
5	TradeKing	99.76
	WallStreet E	99.76
7	Muriel Siebert	99.75
8	Scottrade	99.57
	Vanguard	99.57
	Average	**99.56**
10	Wells Fargo Brokerage	99.51
11	FirstTrade	99.06
12	Options Xpress	98.96
13	Banc of America Investment Services, Inc	98.76

Consistency Rating

Rank	Site	Consistency (sec)
1	TD Ameritrade	1.81
2	Fidelity	2.59
3	FirstTrade	3.12
4	Banc of America Investment Services, Inc	3.46
5	Scottrade	3.53
6	Wells Fargo Brokerage	3.76
7	Options Xpress	4.06
	Average	**4.75**
8	E*Trade	5.19
9	TradeKing	5.58
10	WallStreet E	6.04
11	Charles Schwab	7.06
12	Muriel Siebert	7.58
13	Vanguard	8.01

-- Denotes Gomez Data Unavailable

Security Features/Approaches

- Open Source Security Releases (Google Ratproxy passive security monitor, KeyCzar cryptographic toolkit, Webmaster Tools for Security fixes, OAth for cross-site secure data transfers)
- Security-Enhancing Methods (Google SSL GMail using HTTPS, GoogleOnlineSecurity blog, host-based client browser version/patch analysis, Yahoo! “Sign-In Seal”/PayPal Iconix mail identity verification)
- Teaming (Yahoo!, E*Trade with Symantec)
- Secure Platforms (Amazon Web Services)
- Multi-factor authentication (E*Trade Security Tokens, PayPal Security Key)
- Industry-level Accreditation (E*Trade/PayPal FDIC-insured deposits or pass-through)

General Industry Findings

DISA Operational SOA Test and Evaluation (OT&E)

- Creating a stable set of APIs/Products is foundation of solution strategy
- Several Mature SOA-based development and testing frameworks exist within the large companies
- Repeating themes are Interoperability, Open Source, Modularity/Re-use, Rapid prototyping
- Industry Leaders promote customer involvement throughout the T&E and Integration Processes
- Operational testing is done once the APIs/Products reach a mature state and are actually being used within the larger system context -- lessons learned through this testing are used to modify and enhance the APIs/Products
- The NCES testing approach appears to be a more complex approach than Industry's and places more emphasize on operational testing and interoperability somewhat divorced of the actual system(s) they are designed for
- Strong developer support (Service Desk , toolkits, automated testing capability, multi-language APIs)
- Virtual (Labs) sandbox or API-based access
- No direct access to development or production systems
- Multi-layer security, multi-factor authentication
- Training & Certifications offered as an incentive to customers and partners
- In the majority of applications, DoD cannot adopt Commercial Industry's approach to SLAs because the goals and objectives with respect to SLAs are so different

C4ISR Survey Questionnaire Results

DISA Operational SOA Test and Evaluation (OT&E)

General:

- Modern software-based Systems Development
  - SOA acceptance and initial implementations across the board
  - Predominant experience gained is in Infrastructure and at Granular Services Level
  - Broad Adoption of COTS and Open Source
- Testing Experiences
  - Recognition of Inadequacy of Traditional Test Methods by all software developers as well as integrators
  - Test methodology to adjust to SOA-based Systems is currently very much in flux

Issues:

- Modern (SOA-based) software systems need more than interoperability to operate successfully
  - Security models, Policy, Data models, Metadata, SLAs, Governance policies are all issues that need to be transparently defined prior to testing
  - Backward compatibility strategies (e.g. DISA backward compatibility) needs to be defined and made available prior to testing
  - Lack of definition of failover approach when a service is unavailable is an impediment to successful test completions
  - Different implementations of same specifications (WSDL e.g.) by different toolsets a frequent issue

C4ISR Survey Questionnaire Results (Con't)

Suggested Mitigation:

- This is an Industry in flux – Recommendations currently take form of experimental methods only
  - Supply Surrogate test applications along with implementations to exercise interoperability at service and infrastructure level
  - Supply Governance documents, service specifications and SLAs to testers
  - Develop 2 levels of Testing for SOA services
    - Low level granular services
    - Integration services testing
  - Rebalance / Refocus from Conformance and Scenario tests to Business Service Logic Tests
  - Establish clear unambiguous security profiles COTS products and SOA architectures should meet

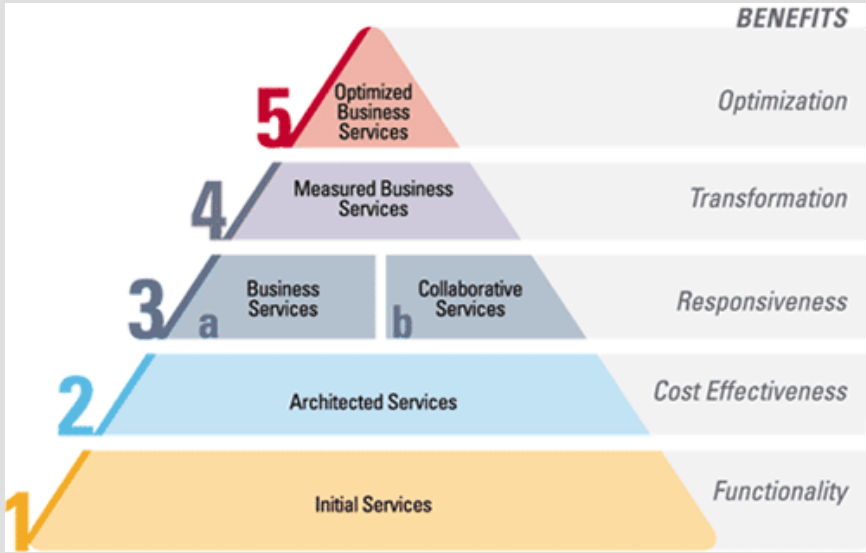
Major Implications:

- Test Driven Development, Acceptance-Test Driven Development and Continuous Testing Methods Modify the Traditional V-process for Systems Engineering
  - The above three Test verticals are now embedded in the V-process moving from left to right
- Potentially modifies the SE process artifacts
  - Substitution of graphical description specifications (sequence diagrams, etc.) by test scenarios
- Test Designers need to be proficient in design & coding languages
- This Test methodology integrates architects, developers, testers and Data Analysts early

Conclusions

DISA Operational SOA Test and Evaluation (OT&E)

- SOA based software systems are widely under development within the DoD community
- Novel Test Methodologies are being experimented and initial positive results exist but no industry consensus exists as far as best approach
- An intermediary such as FFRDC, with complete transparency in SOA, Failover, Security, Backward compatibility and Migration strategies and implementations may be necessary to bring systems with complex and distributed business logic together
- Existing SOA enabling capabilities appear fragmented and in many cases nonexistent when viewed from a DoD perspective
- Large contractors are evolving their own in-house SOA enabling technologies, but they cannot do it alone if sharing and reuse are the goal
- OT&E needs to become more relevant earlier in the acquisition cycle given the new emphasis on test – especially prototyping brought about by new DoDI 5000.02

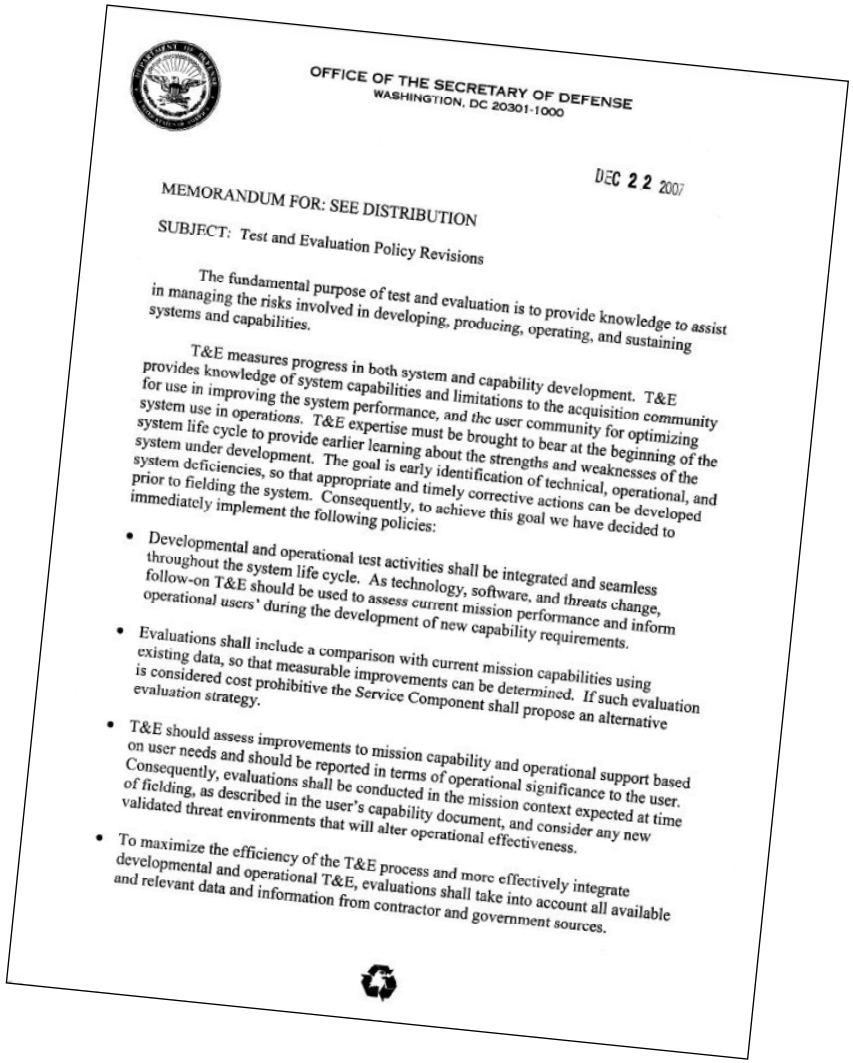


***How do DoD's SOA capabilities measure up against the Sonic* SOA Maturity Model?**

Incorporate Rapid Prototyping in conjunction w/ DoDI 5000.2 Changes

DISA Operational SOA Test and Evaluation (OT&E)

- Integrated DT&E / OT&E activities
- Evaluations include comparison with current capability
- Evaluations conducted in the expected “mission context”
- Emphasis time corrective actions
- DoDI 5000.02, December 2, 2008 provides the T&E community with new upfront opportunities!
- Upfront prototyping
- More test information required before Milestone B



OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, DC 20301-1000

DEC 22 2007

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Test and Evaluation Policy Revisions

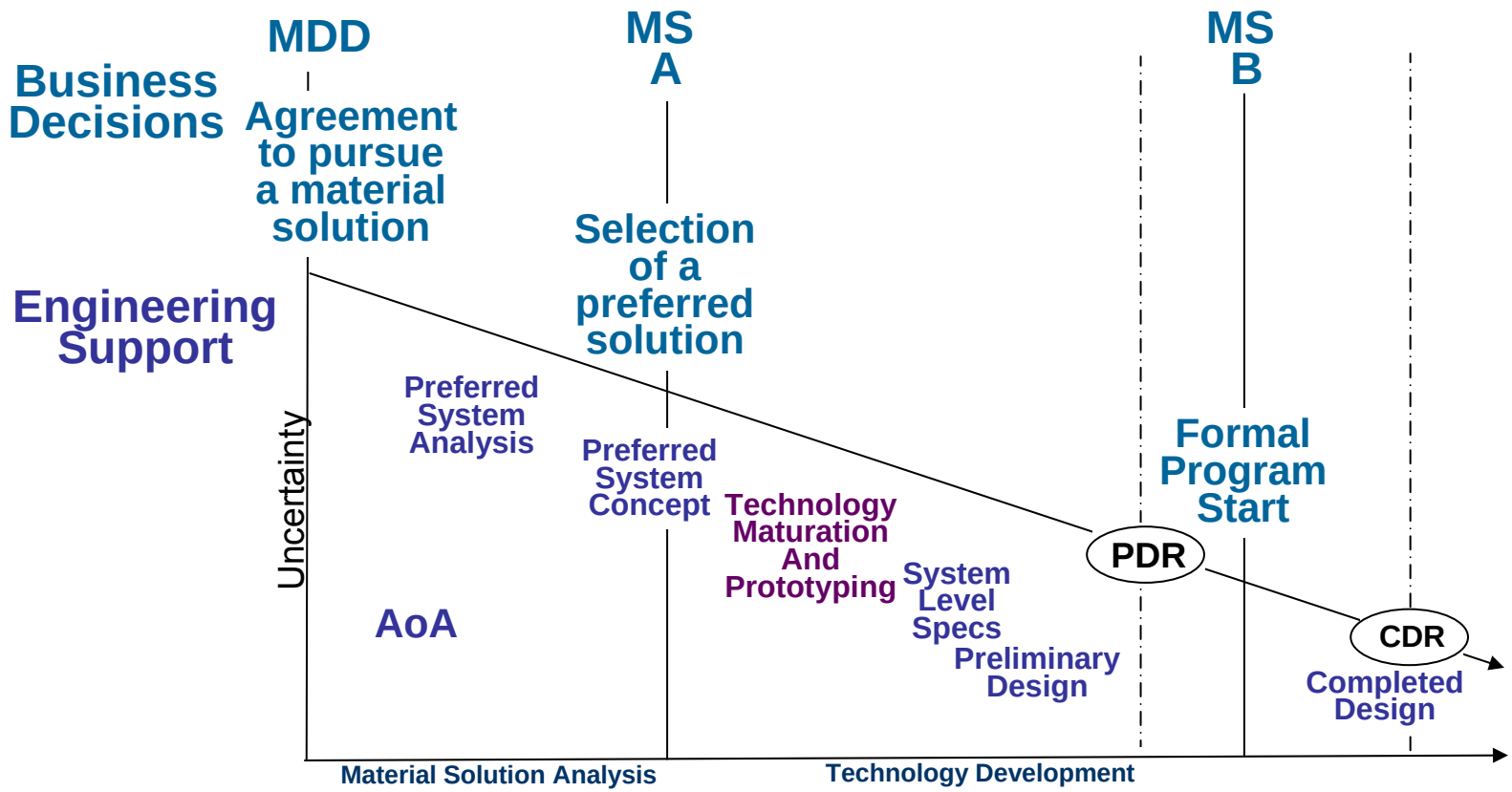
The fundamental purpose of test and evaluation is to provide knowledge to assist in managing the risks involved in developing, producing, operating, and sustaining systems and capabilities.

T&E measures progress in both system and capability development. T&E provides knowledge of system capabilities and limitations to the acquisition community for use in improving the system performance, and the user community for optimizing system use in operations. T&E expertise must be brought to bear at the beginning of the system life cycle to provide earlier learning about the strengths and weaknesses of the system under development. The goal is early identification of technical, operational, and system deficiencies, so that appropriate and timely corrective actions can be developed prior to fielding the system. Consequently, to achieve this goal we have decided to immediately implement the following policies:

- Developmental and operational test activities shall be integrated and seamless throughout the system life cycle. As technology, software, and threats change, follow-on T&E should be used to assess current mission performance and inform operational users' during the development of new capability requirements.
- Evaluations shall include a comparison with current mission capabilities using existing data, so that measurable improvements can be determined. If such evaluation is considered cost prohibitive the Service Component shall propose an alternative evaluation strategy.
- T&E should assess improvements to mission capability and operational support based on user needs and should be reported in terms of operational significance to the user. Consequently, evaluations shall be conducted in the mission context expected at time of fielding, as described in the user's capability document, and consider any new validated threat environments that will alter operational effectiveness.
- To maximize the efficiency of the T&E process and more effectively integrate developmental and operational T&E, evaluations shall take into account all available and relevant data and information from contractor and government sources.

Incorporating Rapid Prototyping in conjunction w/ DoDI 5000.2 Changes

Changes to DoDI 5000.02, December 2, 2008



T&E is effective in reducing uncertainty when it timely informs!

How to test virtually IT legacy & evolving systems?

DISA Operational SOA Test and Evaluation (OT&E)

- Commercial applications, such as PayPal, provides tools that facilitate the integration process
- Products like Java 2 Platform Enterprise Edition (J2EE) provide a means for enterprises to encapsulate legacy applications running in low-concurrency client/server environments in order to integrate them into massive-concurrency, multi-tiered Internet environments
- Metadata tagging can be used to update the legacy systems as a by-product of using the newer internet generated transactions
- DoD's heavy reliance on legacy systems means its developers must become experts at using encapsulating legacy applications as a part of the design process
- A virtual test environment with working versions of DoD legacy systems (dummy transactions), combined with key SOA reuse library software system modules and documentation must exist to facilitate this process
- Building this capability onto DISA's Rapid Access Computing Environment (RACE) is a logical starting point

This problem is best dealt with as a part of the SOA enablement process and could still be done on a Fee-for-Service basis

DoD Commercial-off-the-Shelf Clearing House

DISA Operational SOA Test and Evaluation (OT&E)

- Many currently fielded systems have operationally COTS gear that have been thoroughly tested
  - Collect data on equipment that has already been tested and approved for fielding
    - Not every piece of equipment is unique to every system
    - Consolidate data and make it available to everyone
    - No need to test the same “widget” on system B that was tested on system A last year
- Central location for archived data
  - Results/Deficiencies
  - Testing environment/caveats
- Establish organization to collect and conduct “fill the gap” testing of COTS equipment
  - Detailed analysis of factory testing and needed additional testing to bring it up the DoD data standard

DoD Commercial-off-the-Shelf Clearing House

DISA Operational SOA Test and Evaluation (OT&E)

- Establish a database of COTS equipment that has been tested to OT standards
- Influence industry to give OTAs and DT organizations visibility into testing methodologies
- Track changes to COTS equipment and determine risk impact to implementation of new equipment
  - Determine necessity to “re-test”
- CONOPS:
  - System A is going to test. Test director takes list of equipment and looks up components in “Clearing House” database. Assess testing that was previously completed results, scenario, and operators. Compares test environment and function of System A and determines if additional testing is required.
  - All results must be traceable back to tests

This problem is best dealt with as a part of the SOA enablement process

The State of OT&E

DISA Operational SOA Test and Evaluation (OT&E)

Current Situation:

- There is a current need to test systems more rapidly to keep pace with technology
- Provide capability to the warfighter in a more efficient manner
- Reduce cost of testing and occurrence of redundant testing

Where can we save the most time?

- Program office needs to interact with many outside agencies for document approval
  - Operational Test Agencies (OTAs), Developmental Test Agencies, DISA, JITC, Services etc.
  - Each outside agency has its own review process for approval
  - For major acquisition programs final approval of documents will be staffed to the FO/GO level for signature

Timeline:

- For most major Joint acquisition documents, timeline is 90 days to get final signature
- It's possible to produce a document in 3 to 4 weeks
- Staffing timeline on average will take 8 weeks to receive and adjudicate all levels of comments
  - This is looking at a Joint program requiring FO/GO signature by all services

No matter how fast documents are produced internal to the program, outside review and approval will take the most time!

The State of OT&E (Con't)

Review Process:

- Typically three levels of review prior to FO/GO level signature
- Action Officer Level Review
  - Lowest level of comments provided by AO and are incorporated into the document
- O-6 Level Review
  - Next level up from AO level, AO comments have already been adjudicated prior to routing to the O-6
- Flag and General Officer Approval
  - Typically there is no FO/GO level review, only approval
  - Document must have adjudicated O-6 level comments incorporated

Delegate signature to lower levels of command

- Re-evaluate which documents need higher approval
- Need to get all agencies to agree or a bottleneck will result
- Need to convince OTAs that this will not cause a loss of "independence"

Who will be accountable for unsatisfactory results?

The State of OT&E (Con't)

Redundant Testing

- To eliminated Redundant testing there needs to be a transparency between test agencies, program offices, and engineers
- Data must be "Valid" to be carried forward
- Valid data for OTAs consists of
  - Operationally representative user/warfighter
  - Operationally/Production representative system/software
  - Operationally realistic environment/scenario
- Test community involvement during all stages of development – Building Trust
  - There has to be a willingness of the program office to have outside observers present during early phases of the program
  - The program office must get over the fear of "Looking Bad" at early stages of development
  - The outside Observers/Testers must not run every deficiency "Up the Chain" during the early stages of development
- Use the observations as Risk Reductions and to reduce the scope of later testing
- Make every attempt to make all data "Valid"

Recommendations for Streamlining OT&E Results Approval Process

- Free Flow of information is crucial to the approval process
- Levels of trust within organizations need to be clearly established consistently across all involved
  - Determine a scale of approval authority
    - *Not everything needs to go to the General*
  - The agency receiving the results must be willing to assume the risk if a lower level of approval is desired
  - The agency receiving the results must also NOT overstate the significance of the results if only a low level of approval is provided
- Approval authority should be delegated down as much as possible and be identical from one organization to another
  - i.e. Action officer level approval at JFCOM should mean the same thing at AFOTEC and MCOTEA
- Standardization of expectations between organizations in terms of documents, reviews, and ability to proceed forward
- Each organization, at every level should appoint delegates that have approval authority in the absence of the primary
- Realistic timelines
  - Look at realities of organizational structures and take into account internal differences
    - *Not every organization will be willing to "bend over backwards" to meet your schedule every time*

Balancing Risk, Innovation & Testing

DISA Operational SOA Test and Evaluation (OT&E)

Closing the Innovation Gap

Success and scale threaten innovation

- It is easier to stifle innovation than allow it to grow, it must be nurtured
- Rigid processes, metrics and policies discourage questions and openness

We have a national innovation deficit!

- Sustainable innovation requires a balance of planting and harvesting
- We have become shortsighted - valuing short term results over investing for future generations
- Natural ecosystems require balance to sustain life, our national *Innovation Ecosystem* is out of balance due to neglect.

Fundamentals of Innovation

- We need all types of innovation - breakthrough, incremental and orthogonal
- Innovation is iterative (and messy)
- You need to be willing to invest without knowing the outcome
- Innovation builds on innovation - increases with sharing
- Culture must embody core values that enable a *capacity for change*
- Talent is key

Source: Judy Estrin Closing the Innovation Gap--DoD Mini Highlands Forum September 2008

Balancing Risk, Innovation & Testing (Con't)

DISA Operational SOA Test and Evaluation (OT&E)

- Like many organizations DISA is facing an "innovation gap"
- SOA, Cloud Technologies, and Virtual Worlds are innovation drivers
- Mastering these change forces requires not only innovation, but major cultural change
- Putting in place a strong innovation capability coupled with education is the key to success in industry
- Innovation in the form of SOA and rapid prototyping is leading to new testing approaches and massive reuse
- Reuse of thoroughly tested SOA products and services is viewed as a way to mitigate risk
- Putting too much emphasize on testing and not enough on innovation actually increases risks associated with Global Complexity

DISA 2008 "Possibilities" Panel

John Garing, DISA CIO and Director of Strategic Planning, moderated a panel discussion themed "Possibilities," featuring experts from the federal government and the private sector, discussing innovations in information technology and what the future holds.

Panelists:

Dr. Werner Vogels, vice president and chief security officer, Amazon.com

David Mihelcic, DISA CTO and principal director, Global Information Grid Enterprise Services-Engineering

Evan G. Burfield, chairman and CEO, Synteractive

Alfred Rivera, director, DISA computing services

Mihelcic said that DISA needs a platform for innovation. "We don't need IT networks, we don't need computing centers, we don't need operating systems, we don't need command-and-control stats," he said. "We need a platform for innovation to allow the department to do what Amazon has been doing—move to bringing capabilities to the network in small packages that leverage everything that has been built before. We need to streamline testing and development and certification."

http://www.disa.mil/news/grid/june2008/poss_panel.html

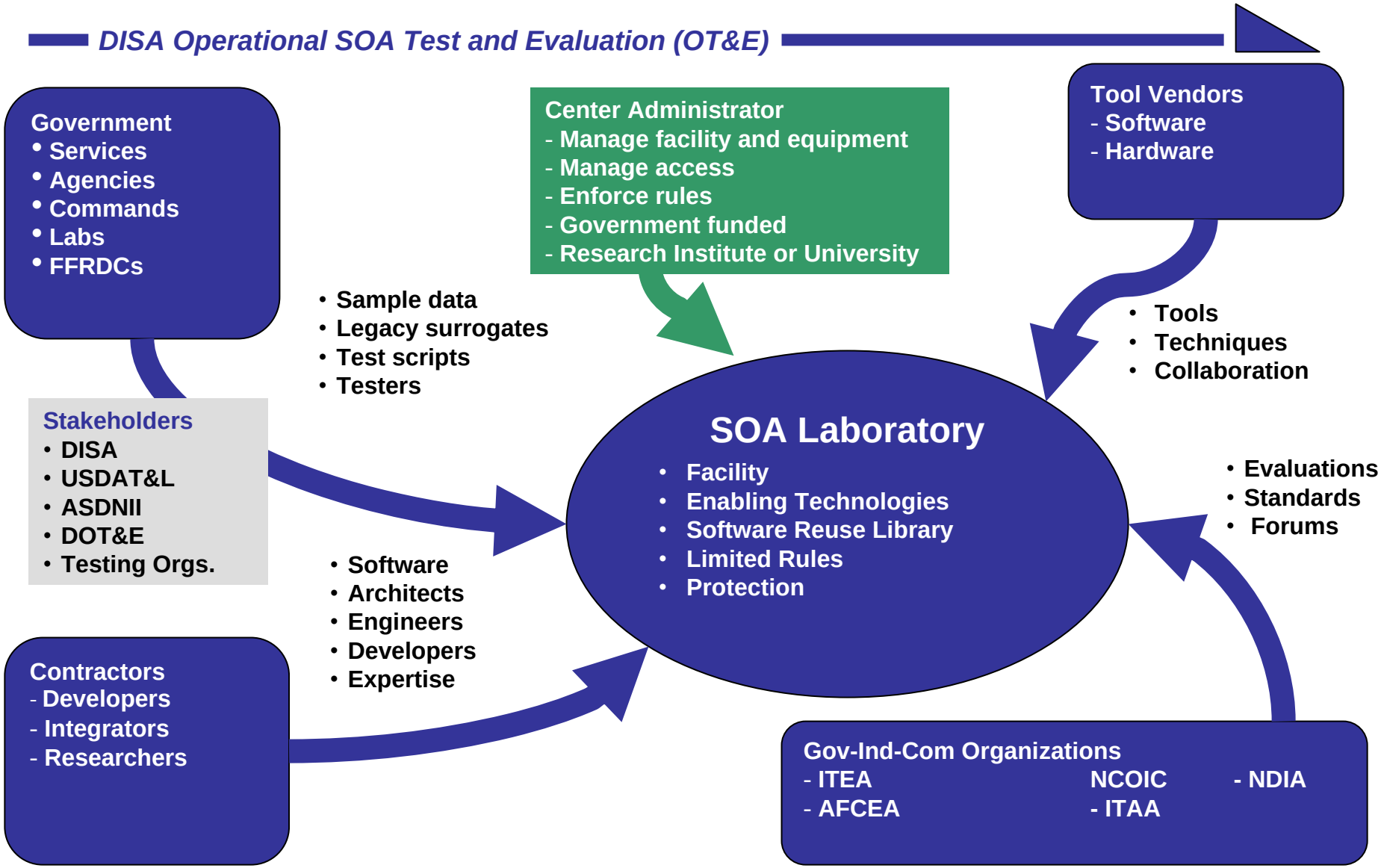
Global Innovation/Risk Drivers

- Complexity
  - Less predictable
  - Global market, profit driven
  - Numerous systems interfaces
- Cloud Technology
  - Location independent
- Virtual Machines
  - Hardware independent

Gartner's SOA Recommendations

- Treat SOA as a strategic initiative
- Start small, and invest in organization and training before committing in new, SOA-dedicated technologies
- Use a systematic approach and a governed process for the design of services
- Pick a multichannel application to prove the concept of SOA
- Advance gradually through the stages of SOA maturity
- Learn EDA to fully understand SOA
- Recognize that, although all application logic is suitable for modularity, not all is suitable for SOA. Continue to justify any SOA-style conversions and new developments.
- Implement an SOA center of excellence or integration competency center to coordinate the SOA and integration activities of diverse business units
- Strive to achieve the long-term benefits of SOA, including:
  - A clearer, more manageable software architecture
  - Higher affinity between business modeling an business software design
  - Increased software reuse
  - Increase agility in software, IT services and the enterprise's core business

SOA Innovation Capability Concept



Strategies for Creating SOA Innovation Capability

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- Work with DoD/agency/supplier stakeholders to formulate new OT&E acquisition strategy for the new acquisition life cycle process – new processes, methods & tools
- Include an assessment of test bed(s) and innovation capabilities needed to accommodate the prototyping
- Conduct a survey and inventory of all existing SOA enabling capabilities (PEO EIS and Army have extensive capabilities)
- Build SOA Innovation Capability from existing capabilities wherever possible
- Work with industry partners to create SOA facility to showcase tools & technologies
- Employ small staff (3-5) augmented by working groups and FFRDCs
- The SOA Innovation Lab services should:
  - Design SOA Innovation Capability services aimed at facilitating prototyping/reducing risk
  - Focus on creating and fostering strong communities of interest (COIs) and on involving them during software development to prevent errors.
  - Create a “sandbox environment” replete with tools – access should be controlled through registration, but be free of charge
  - Be tightly coupled with learning intuitions – DAU and SEI should be a major players: Define skill sets, Training Curriculum, and Certification requirements
  - Establish a library of reusable fully tested software (especially COTS)
  - Develop and release Beta versions to DoD "partner community" for evaluation
  - Integrate with existing methodologies (Six Sigma, Agile, …) to prevent defects. “Quality at the Source”
  - Test Effectiveness Improvements through Risk Analysis, Probability & Modeling techniques
- Work with key stakeholders (AT&L, DOT&E, and ASDNII) to create small innovation fund to finance services like the sandbox and reuse library

Strategy for Streamlining DISA O&TE

DISA Operational SOA Test and Evaluation (OT&E)

- Readiness for cultural changes adopt commercial business practices
  - Recapitalize DISA OT&E business practices into acquisition strategies to place acquisition strategies that support DoD 5000.02 such as requirements for prototyping that support OT&E requirements
- Readiness for governance challenges
  - Review/update DISA policies to shed outdated roles to create a more virtual enterprise – thus being more responsive to their customer
  - Aggressively pursue opportunities to prototype new OT&E solutions as part of new DoD Directive
- Readiness for OT&E mission assurance challenges.
  - Focus on the data. The key is data – secure, persistent, accurate, timely, etc data! For example, making security transparent to their customers, without systems performance degradation and complexity, is an enormous challenge but vital to delivering trusted information to the users.
  - Build prototype OT&E test beds
- Readiness for technical challenges
  - Training, education and development of the workforce, such as SOA certification
  - Think “user” first and then DISA/OT&E
    - Assess – Users, regardless of their role, require relevant data and information to be readily available.
    - Content – Users will always demand continuously improving information content, from both new and existing information products and services
    - Timeliness – Users demand the information they need, when they need it.
- Readiness for concept of operations challenges.
  - Focus on the end state versus on the intermediate states
    - Help customers understand the end state(s) of the enterprise and begin defining OT&E tests to validate these end states
    - Anticipate mission needs for information by making complete spectrum of sources of information seamlessly fused/available to users
    - Develop mechanisms that allow them to prototype solutions to these challenges