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Value-Based Acquisition: An Objective, Success-Centric, Evolutionary Approach

Gunderson, Chris; Minton, David; Roth, Rick Hayes

Chris Gunderson
David Minton
Rick Hayes Roth

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Executive Summary

Rather than dwell on well-documented information system acquisition issues, we analyze government success stories. We capture best practice in a suite of tools whose familiar look and feel will resonate with acquisition professionals. We demonstrate how those tools can enable rapid, evolutionary information system development. After all, government policies mandate acquiring information systems rapidly & adaptively. DoD in particular has taken a visionary approach that adopts cutting edge paradigms like Service Oriented Architecture and Open Technology Development. Despite overall slow progress, the government has succeeded impressively in some cases. Success stories include continuous technology refresh of deployed systems; government investment in some COTS markets; inserting true COTS as a quick fix; and consuming state-of-the art COTS hardware. Typical government acquisition behavior contrasts sharply with this best practice. Training and tools can solve that issue. Our strategy is to leverage the enduring value of traditional approaches, the lessons learned from success stories, and the innate innovative tendencies of the best employees. We apply the successful continuous re-capitalization model to govern incremental "development" through a suite of objective measures of effectiveness (MOE) and associated algorithms. These tools are based on the concept of "Quality of Service" but address the higher abstraction "Value of Service." "Value" depends on reliability, speed-to-capability, utility, and cost. The algorithms reward modularity, interoperability, and currency. They include a profoundly new concept for government acquisition – that the front end requirements and procurement activity should be governed with process-level systems engineering MOE. The algorithms provide a framework to optimize choices around bundling options, intellectual property, test & certification, and billable hours. They provide an objective means to enforce policy, and a dashboard to monitor policy impact in near real time. We demonstrate the viability of value-based acquisition in a simple commercial use case, and in context with a real on-going military acquisition. Programs can, may, and should leverage the success of the best of their peers, and begin value-based acquisition immediately. The World Wide Consortium for the Grid (W2COG) Institute (WI) can assist.

Government policies mandate acquiring information systems rapidly & adaptively.

A common perception of government "acquisition" bureaucracy as stogy is at odds with much of the actual policy. In particular the general public might be surprised at the enlightened language in the Federal Acquisition Regulations (FAR) about developing information systems. This policy obviously wants government acquisition professionals to be creative and adaptive. The DOD's vision of "Netcentric Operations" (NCO) enabled by a "Global Information Grid" (GIG)[1] is especially ambitious. DoD has spawned various FAR-compliant directives to implement cutting edge paradigms like Service Oriented Architecture (SOA)[2], Open Technology Development (OTD)[3], and "Agile"[4] methods.

Serious issues notwithstanding, the government has succeeded impressively in some cases.

Nevertheless, myriad GAO reports and media articles document horrendous difficulties delivering large information systems like the GIG[5]. In this paper we take a different tack. We notice that many dedicated innovative government employees, and their industry partners, have in fact achieved great success. We think we can generalize and share their successes. We introduce tools and methods that will resonate with the acquisition community.

If we define "success" of an information-system acquisition as "rapidly deployed, continuously improved, capability that demonstrably delights consumers", then, government information-system success stories tend to follow one of four general patterns. See sidebars for elaboration, but we summarize the successful patterns and their associated takeaways as follows:

1. **Technology refresh of deployed systems.** [6] The best government practitioners do life-cycle maintenance on their operational[a] information systems just like the best commercial "e-businesses". That is, they perform continuous "technology refresh", i.e. "recapitalization." They leverage continuous vendor competition in close partnership with their operational customers.

2. **Government investment in COTS markets.** [7] When it does three things well, government drives Commercial-off-the-Shelf (COTS) markets in directions that address critical government requirements. The three critical activities are:
    a. Investing in research to address COTS technology gaps.
    b. Furnishing the resultant intellectual property to the industrial base
    c. Certifying COTS in ways that provide competitive commercial advantage to vendors of compliant offerings. .

3. **COTS "insertion".**[8] Major acquisition programs, working closely with operational customers, often "buy down" a large percentage of their requirements with true[b] COTS purchases. Program offices deploy the COTS capability before the official system deploys, i.e., before "Initial Operational Capability" (IOC). They field it quickly and at relatively low cost.

4. **Rapidly evolving, COTS precludes pre-defining specifications.** Rather than specifying IT architectures years in advance of deploying it, good acquisition professionals now purchase and integrate state-of-the-art true COTS hardware. They negotiate excellent price points, and deploy

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[a] "Operational systems" are associated with programs past "Initial Operating Capability" (IOC). That means they are no longer in "development" but are in a lifecycle maintenance status.

[b] "True COTS" is a vendor offering that is not modified to suit specialized customer requirements. It might ship straight from a catalog order. Shrink wrapped software is an example of true COTS. Contracting with a COTS vendor to develop a specialized capability based on "commercial standards" is not true COTS.

hardware in phase with program fiscal execution. [c] If follows that we can teach them to do the same thing with true COTS software.

Information-system failure stories (per myriad GAO reports[9]) tend to follow just one pattern: legacy monolithic system-centric serial processes applied unsuccessfully to develop next-generation federated information-centric systems-of-systems. The takeaways from the failure pattern, contrasted with points 1-4 above, are as follows:

1. **Long serial development of new system.** Serial development process takes many years to deliver initial capability. Program spends money continuously, but no capability is fielded until "Flag Day".[d] Meanwhile, operational customers spend their maintenance budget fixing broken legacy capability.

2. **Government as an uninformed retail customer of commercial technology.** Typical analysis of alternatives and solicitations take years to process. The basis for competition is white papers, PowerPoint, and "who you know". Winning vendor teams are locked in for years. Customer input is formal and time-late.

3. **Government develops large proprietary systems aimed at 100% of the requirements.** Program managers recognize that government requirements are more stringent than commercial requirements. This is especially true regarding security and interoperability. Programs contract with commercial providers to develop specialized capability based on "commercial standards." Specialized capability is more expensive than true COTS. Cross-program security and interoperability remain elusive.

4. **Government "chases" industry standards.** Programs embrace the concept of "open" commercial standards. Their strategy is to specify a particular "stack" of standards to ensure interoperability. Inevitably standards evolve much faster than bureaucratic process can keep up.

Continuous Recapitalization = Good e-Business

Fielded government information systems require lifecycle maintenance. Typically "maintenance" means fixing broken legacy capability. However, "maintenance" may legally mean "refreshing technology". When it comes to IT, the technical difference between "Research and Development" and "Technology Refresh" is arbitrary. The practical difference is the nature of the funds involved, and the associated time line to spend them. Tech Refresh requires operational funds available in the current year. R&D requires "developmental" funds in "programmed" out years. Savvy managers of operational systems use their operational maintenance budgets to incentivize competition among IT service vendors. They work with their customers to achieve continuous capability improvement, i.e., recapitalization.

The success stories prove that the governing directives, per se, do not absolutely mandate the failure pattern. After all, the government employees engaged in the acquisition activity described in the sidebars have managed to succeed under the auspices of those directives. The issue may simply be that governing directives do not translate best innovative practice into formats familiar to rank-and-file acquisition professionals. Tools and training in their use can solve that issue. However, there are some critical tools absent in the current stack of acquisition policy artifacts. The missing tools are "controls"[e] on the acquisition process itself that are as objective and rigorous as the disciplined controls program managers use to make system-level engineering tradeoffs.

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[c] This assertion is based on personal observation and anecdotal evidence such as proliferation of government-sponsored Indefinite Delivery Indefinite Quantity (IDIQ) contracts with COTS hardware vendors.

[d] "Flag Day" is the date of "Initial Operating Capability" (IOC) of a large system deployed en masse. The Flag Day comes after many years of serial development effort. A flag day contrasts starkly with continuous incremental development and deployment.

[e] In DoD these system-level "controls" are called "Key Performance Parameters" (KPP). KPPS are measures of effectiveness (MOE) computed from algorithms that define engineering trade space.

Government success cases illustrate "best practice".

Government can convert the lessons from success cases into universal "best practice" per the following actions.

1. **Leverage the enduring value of the traditional system-centric approaches.** In particular, traditional "Key Performance Parameters" (KPP) such as "Operational Availability" (A_o)[10] have been very useful to define trade space for program mangers and engineers. A_o is also known as "Reliability". Engineers use the A_o algorithm to objectively calculate the "Quality of Service" (QoS) of a network. Acquisition professionals need abstractions of the A_o concept appropriate for modern system-of-system paradigms such as SOA. Those new abstractions should preserve the following attributes that make A_o a good Measure of Effectiveness (MOE):

    a. Objective, testable, enforceable
    b. Measures critical functionality
    c. Clearly defines options

2. **Leverage lessons learned through early successes in fielding information-centric systems-of-systems.** Analysis of the success stories reveals the following wining behaviors:

    a. Include operational "beta"[f] users in development process
    b. Focus on specific critical transactions per voice-of-the customer
    c. Leverage economy of scale

        i. Incentivize broad competition in the COTS market
        ii. Deliver small increments of improved capability continuously
        iii. Government invests to develop critical shared infrastructure
        iv. COTS products leverage government-furnished infrastructure
        v. Government certification translates to commercial competitive edge

> **Government Investment in COTS**
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> The Internal Revenue Service (IRS) provides its tax algorithms freely to industry. The IRS also "governs" electronic tax return legal and ethical standards. The IRS influenced but did not dictate commercial IT standards associated with e-tax returns. An on-line tax return marketplace, supported by robust SOA, now flourishes. Average tax preparation time, and the time it takes to receive refunds has decreased. Numbers of IRS audits has decreased. Profitability of the e-tax accounting firms endorsed by the IRS has increased. The public image of the IRS has improved.

3. **Leverage the innate innovative tendencies of the best-and-brightest employees.** Every good military leader and industrial executive recognizes that human capital is the most precious resource. The best leaders and executives empower their people to innovate. The following actions empower acquisition professionals:

    a. Provide objective guidelines with real, and clear alternatives
    b. Require risk/benefit analysis
    c. Reward risk management
    d. Punish risk avoidance

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[f] "Beta" refers to the debugging stage of software development. Successful Internet portals use huge numbers of tech-oriented volunteers from their customer communities to help with this process. This approach has proven to be an outstanding way to collect and act on customer input.

Clear, objective, and scalable MOE translate "best practice" into repeatable process.

As Peter Drucker, the quintessential management consultant emphasized "You get what you measure." A critical task for mangers and engineers is to convert desired best practices into measurable and testable parameters. Clearly, the single most compelling "best practice" associated with successful information system is "continuous incremental improvement".[11] Hence, MOE for information systems should consider "continuous incremental improvement" as an essential design specification. This is a profoundly new paradigm for the government! It requires managers to expand the notional information system boundary to include the end-to-end acquisition process. Accordingly, MOE should not only measure run-time system performance. They should also measure "performance" in design-time and build-time.

Per the preceding discussion, the value attributes of an information system are reliability-of-capability, time-to-capability, utility-of-capability, and cost-of-capability. Therefore value-based MOE should define each of those attributes objectively.

Arguably, MOE regarding reliability, time, and cost functions can be universally defined. Different consumers will have different requirements, but they can use the same measurements to make their tradeoffs. However, "utility-of-capability" depends on any given customer's perspective. MOE for "utility-of-capability" must address that need for customization. The customization process will require consumers to define and continuously validate their perceived "utility-of-capability". That feedback loop must span design-time, build-time, and run-time.[12] They may use similar techniques, but the measured parameters may vary considerably.

COTS Buys Down the Total Requirement

Acquisition programs that fall behind schedule will frequently take a strategic pause to address urgent requests from their customers. During this period they purchase true COTS capabilities. The COTS ships quickly and satisfies many, perhaps most, immediate requirements. Since COTS products tend to be easy to use formal training is not a big issue. Customers tend to be delighted…. at least until lack of lifecycle maintenance becomes an issue. Program offices are likewise happy. Not only are their customers happy, but the true COTS is also inevitably cheaper than an equivalent increment of "developed" capability.

Algorithms that calculate MOE should enforce acquisition policy. That is, they should pragmatically parameterize policy objectives such the following:

> "…use common sense and sound business process," "…avoid imposing government-unique restrictions", "…include performance-based specification", "…monitor and assess Modular Open Systems Approach… that emphasizes modularity and use of commercially supported practices, products, performance specifications, and performance-based standards," "…Ensure access to the latest technologies" [13]; "…provide for full and open competition", "…a trade off process is appropriate", "… all evaluation factors and their relative importance should be clearly stated", "… Address complex information technology objectives incrementally," "…Facilitate acquisition of subsequent increments", "…comply with commercially acceptable standards," "….Reduce risk by avoiding custom designed components," *"… release long-range acquisition estimates."* [14]

The algorithms should also provide a framework to optimize choices with respect to program priorities, resource allocation, technologies, architectures, bundling options, intellectual property rights (IPR), testing, and certification. That is, algorithms should help program managers manage continuing competition in ways that minimize emergent risk to specific program priorities.

Modularity, interoperability and portability enable re-usability of valued components. Re-useable, interchangeable components contribute to rapid continuous improvement. Hence historic policies have mandated "compliance" with a particular group of "open" industrial standards. Those policies have not delivered the desired interoperability or re-usability.[g] Value-based MOE approach the issue by treating interoperability and modularity as means to an end. Value-based MOE, measure the end, not the means. If a component is rapidly deployed at low cost, is reliable, and delivers valued information at the right time, it will earn a high score. In that case, the component must have been sufficiently modular and interoperable. Developers are thereby self-incentivized to re-use these "certified successful" artifacts.

Consume State-of-the-Art COTS as a Commodity

Two decades ago, despite a robust COTS market, DoD programs still developed IT hardware per Military Specification Standards (MILSPEC). Until recently, even after adopting COTS hardware, DoD program offices specified the details for future builds (e.g. processor speed, RAM, external storage formats, etc) according to current standards. When it came time to execute the build, the specified hardware was already obsolete. Obviously obsolete equipment is difficult to obtain, expensive to maintain, and suboptimal in any case. Consequently, many government programs have learned to integrate state-of-the-art COTS hardware in phase with actual fiscal execution.

Consider some objective value-based MOE.

The Joint Interoperability Test Command (JITC) has sponsored a World Wide Consortium for the Grid (W2COG) research initiative to study netcentric development, test, and certification issues. As a result, W2COG has developed a suite of algorithms based on traditional KPPs, but expanded per the discussion below.

"Operational Availability" (A_o) [15] serves as our model for a suite of MOE formulated to address various levels of abstraction. Recall that A_o is a system-level MOE equivalent to "reliability." The A_o algorithm objectively calculates the QoS of network data flow.

The A_o algorithm divides "up time" by "total time" in various formulations. In engineering terms, A_o is the level of assurance that data bits will flow at a particular place at any given time." Very reliable systems will achieve QoS scores that approach 1.000.

"Total time" includes trades pace around inherent system reliability, typical repair times, and typical logistics delay times. For example, if a system in a remote location tends to break frequently, investment in on-sight technicians and plenty of spares might bolster A_o to its specified value. Conversely, investments to develop more inherent reliability might decrease over all cost by obviating the need for spares and on-site technicians.

"Information Value Availability" (A_{iv}) is a system-level MOE. It is analogous to A_o, but at a higher level of abstraction. Netcentric engineering paradigms like SOA aim to abstract the need to understand technical details away from busy operators. Hence engineers fielding netcentric systems-of-systems need appropriately abstract MOE. Consider A_{iv} as the "reliability" that valued information will be available at the right time. The A_{iv} algorithm calculates the "Value of Service" (VoS) of a network data flow objectively. The concept of VoS recognizes that not all data, data sources, and data streams are equal in the eyes of any particular consumer. In that sense, A_{iv} is literally a design specification for avoiding "information overload". Hence, VoS is a function of the QoS of a particular data stream, but also a function of the perceived utility of that data stream. Utility depends on factors like security, relevance, timeliness, criticality, functionality, preference, etc. Individual consumers can determine utility subjectively or objectively, but perceived utility will certainly vary across different consumers. Only expert operators

[g] The various communication devices used by first responders to disasters like Katrina and 911 were all built to commercial standards. Clearly that did not enable them to talk to each other. Meanwhile commercial standards evolve so quickly it is impossible for any administrative process to keep up to date.

can define the military “utility” of any particular data flow. Hence expert operators, acting as a “beta” community, analyze critical information transactions in context with realistic mission models. They will assign higher utility scores to data flows that enable desired mission outcomes. The more objective the process, the better it is.

Conceptually, the A_{iv} algorithm divides “Available Valued Bits” by “Total Bits Processed”. In engineering terms, A_{iv} is the level of assurance that useful data bits will be preferentially available over less useful data bits. Systems that deliver very reliable, very useful, data streams will achieve scores that approach 1.0000.

“Total Bits Processed” includes trade space around security policies, “discovery” tools, data strategies, and circuit discipline. For example user-defined spam filters can decrease the over-all “Total Bits Processed”. “Pop-up” alert messages based on pre-defined critical conditions of interest can increase the “Available Valued Bits”. Monolithic security policy might preclude “Availability of Valued Bits” to a coalition partner. Dynamic “Need-to-Share” authorization services might enable “Availability of Valued Bits” to a critical coalition partner. Geospatial services might provide context for determining a bit’s “value”. Search engines may enhance “Availability of Valued Bits”, but will also introduce “expensive” overhead in “Total Bits Processed”.

“Net-Ready Availability” (A_{nr}) is a *process-level* MOE. A_{nr} treats continuous improvement, i.e. recapitalization, as part of the “specification”[h] of an acquisition. In other words, it treats the targeted acquisition method as part of the engineered system. Accordingly, A_{nr} is the “reliability” that the acquisition process will continuously deliver valued enhancements to the information system of interest. As previously discussed, this is a new paradigm for the government. [16] The A_{nr} algorithms calculate the “Value of Enhancement” (VoE) objectively. Goals include increased speed-to-capability, and decreased cost-of-capability. One means to those ends is to reward re-use of pre-existing, pre-certified components. Another is to deploy small increments of new capability within regular maintenance cycles. Cycle times vary per level-of-effort of the maintenance action of interest, e.g. software patching vs. upgraded architecture. Modularity, interoperability, and portability all contribute to re-usability. The A_{nr} algorithm includes optional weighting functions to reward value-added attributes. “Value added” might be up-to-date COTS standards[i], use of a favored architecture, greater security, etc.

The A_{nr} algorithm normalizes a comparison of “Maintenance Cycle Time” to “Capability Deployment Time”. In engineering terms A_{nr} is the level of assurance that an increment of useful capability will be delivered on cost on schedule. Providers who develop and re-use modular off-the-shelf components to deliver capability seamlessly within routine maintenance cycles will achieve scores that exceed 0.5000 and approach 1.0000.[j]

Optimizing “Capability Deployment Time” requires careful consideration of myriad choices around intellectual property rights (IPR)[k], bundling options[l], billable hours, testing options, certification options, etc. For example, bundling pre-tested and certified services developed by another program adds value and increases speed-to-capability. Contracts to develop and maintain “portable” certified security

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[h] A “specification” is a formal description of the desired outcome of an acquisition. Good specifications identify test criteria upfront.

[i] COTS software in government systems is almost inevitably out of date. This issue illustrates the need for process-level MOE. Disciplined acquisition process can force interception of better new architectures and shedding the legacy.

[j] If a program manager needs to invent a new capability the development time investment will decrease $A_{ec.}$ If projected values of Aec decrease below 0.5000 the PM knows he’s taken on too large an increment. Reusing existing capability takes very little development time and hence enables higher values of A_{ec}.

[k] Intellectual Property Rights issues include, e.g., consideration of expensive enterprise license vs. low cost seat license, and open source vs. COTS vs. Government-off-the-Shelf (GOTs.)

[l] Bundling options include, e.g., network services vs. “thick client” applications, managed services vs. owned capability, and life cycle support options.

components under open source licenses can accelerate accreditation. Expensive enterprise licenses might be cost-effective if amortized beyond the scope of a particular program. Re-allocating billable hours from one capability to another, from one maintenance cycle to the next, mitigates risk of "busting" a critical specification.

"Measured Value" can guide evolutionary acquisition from end to end.

In a value-based acquisition, providers and consumers, together, define both critical mission requirements, and measurable verification and validation (V&V) criteria. The A_{iv} algorithm catalyzes this function by providing a clear objective framework. The A_{nr} algorithm takes input from Aiv to objectively calculate the customer-defined "value" of any particular proposal. Hence A_{nr} provides objective source selection criteria.

Accordingly, value-based solicitations are simply published descriptions of the value-based MOE together with discussion of the procurement budget and schedule. Value-based budgets and schedules include continuing vendor competitive opportunities throughout the acquisition lifecycle. Either the government directly, or a prime contractor, will manage the continuing competition. Government furnished equipment (GFE) includes mission-based test and validation cases. GFE also includes any relevant GOTS components.

Responses to value-based solicitations must include documented working products or prototypes. They may include proposed mission-based validation cases. Responses will not include white papers or PowerPoint slides. Vendors demonstrate their prototypes in accredited laboratories against operator-verified, digitally modeled, use cases. Demonstration cycles are continuous with drops at quarterly or greater frequency. Certification and accreditation authorities, together with beta community users, will validate demonstrated artifacts per value-based MOE

Value-based Work Breakout Structures (WBS)[m] and Statements of Work (SoW)[17] describe this rapid evolutionary process specifically in context with the acquisition of interest. Program manager make source selection decisions based on cost/benefit tradeoffs. Value-based MOE define "benefits" objectively. The same MOE define performance targets in contract incentive clauses. These value-based contracts include frequent review periods. Value-based contracts also include requirements for continuing, documented feedback from the operational beta community.

Throughout this process authorities place certified off-the-shelf components on pre-approved products lists. Contracting authorities award Indefinite Cost Indefinite Quantity (IDIQ) contracts to vendors of pre-approved network components. Multiple programs conduct value-based acquisitions in parallel. Many programs will have similar requirements. Pooled resources enhance economy of scale. In this way government investment fuels a "marketplace" of off-the-shelf net-enabling components.

The broadband services marketplace validates value-based acquisition.

As a conceptual proof of concept, consider an information system composed of household broadband services. In particular, consider how value-based MOE can quantify the value propositions associated with various bundling options for television, Internet, and telephone.

Options for television might include cable and satellite. Say both are immediately available and basic service costs are the same for each. QoS for cable is higher because the satellite signal suffers in strong wind and rain. On the other hand, satellite offers a sports package not available on cable. A sports fan might perceive the utility of a sports package "data stream" to be very high compared to other

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[m] A Work Breakout Structure (WBS) is a traditional approach to modularizing development responsibility in appropriate functionality "bins". Modern paradigms like SOA can map to a WBS.

entertainment channel data streams. The sports fan might willingly pay more and suffer some QoS degradation in order to consume the valued data stream.

Potential "capability enhancements" might include a second antenna for the satellite system. That off-the-shelf component might boost QoS to some assured higher level for a specified additional cost. On the other hand, suppose the cable provider invests in a major infrastructure upgrade like laying optical fiber in your neighborhood. The cable provider might bundle Internet and telephone services together with the television package at some relatively small incremental cost increase. By divesting of your "legacy" Internet and telephone services, you can upgrade service and decreased cost. How important is that sports package really?

Value-based MOE quantify all these potential enhancements and bound the tradeoffs. One takeaway is that a providers' sunk cost need not hold a consumer captive. Another is that continuing competition among vendors and technologies inevitably present either an opportunity or an opportunity cost to consumers. Agility is the key to capitalizing on opportunities. *Value-based MOE parameterize agility*.

Value-based acquisition also works for real DoD C2 systems.

JITC's W2COG research initiative has demonstrated value-based acquisition in context with real world military requirements. The venue was Coalition Warrior Interoperability Demonstration 2008 (CWID 08) "Interoperability Trial" 5.64.[18] At the request of Rear Admiral Hight, Deputy Director DISA, the W2COG engaged the Multi-National Information Sharing (MNIS) program office. The MNIS mission is to consolidate and enhance multinational information sharing capability. Program requirements boil down to three objectives.

1. "Flatten" coalition networks
2. Enable data and service "discovery" via semantic interoperability
3. Decrease life cycle costs by leveraging COTS

"Flatten" means to use the same physical infrastructure to support private coalition network enclaves. "Discovery" means dynamically selecting critical bits of information from the huge pool of data available on the network. Flattening networks and enabling discovery requires balancing the "need-to-share" and the "need-to-protect" information. Hence, the demonstration assumed a basic requirement to establish multiple secure coalition enclaves on the same physical network. Central Intelligence Agency (CIA) policy[19] requires "Protection Level 4" (PL4)[n] certification for virtual separation paradigms like this one. Access to any particular enclave depended on need-to-know. Need-to-know changed dynamically per emergent events in the scenario. The scenario included a realistic mission thread around coalition Maritime Interdiction Operations (MIO) and Maritime Domain Awareness (MDA).

The government furnished PL4 GOTS security software components to a group of COTS vendors. The vendors' task was to bundle their capabilities as off-the-shelf offerings with GFE security "inside." Their hypothetical target market was a ~$10M COTS procurement in FY09. The "Utility-of-Capability" requirements were as follows:

1. Geospatial context
2. Relevant data streams
3. Alerts of pre-defined critical conditions of interest

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[n] "Protection Level" PL is a graduated assurance scale managed by the National Security Agency. It loosely correlates to the Common Criteria Engineering Assurance Levels. Achieving a PL4 certification is expensive and typically takes years.

4. Dynamic authorization per emergent need-to-protect vs. need-to-share posture

The vendors' prototype included GOTS, COTS, and open source software bundled on a LINUX blade server. CWID watch standers invoked the capability as network services via Firefox or Internet Explorer browsers and point and click menus. Services included, GOTS "Single Sign On", GOTS authorization service, COTS ship tracks, COTS Unmanned Aerial Vehicle sensor data, GOTS environmental information, open source geospatial rendering, and COTS intelligent agents[o]. The government spent approximately one tenth of a man year for the prototype and documentation. Vendors can deliver "shrink wrapped" versions of the demonstrated capability within six months of a funded solicitation.

Post-CWID analysis of objectively quantified the value of this COTS/GOTS service stack. Using notional but realistic user inputs, and value-based MOE, we calculated that this capability enhancement increases the value over the current capability by at least 60% and perhaps as much as two orders of magnitude. The context of the analysis includes policy compliance, and program-specific tradeoffs.

Programs can, may, and should begin value-based acquisition immediately.

Value-based acquisition process and MOE follow from analysis of government and industry successes. Value-based acquisition not only complies with government policy, it provides the measurable means to enforce policy usefully. Further it provides an objective "dash board" for policy makers to monitor success and adjust policy accordingly. Value-based acquisition is agnostic of program owner or size. It is equally applicable at all phases of a program's lifecycle. It does not attempt to identify universal one-size-fits-all specifications. It does identify universally useful tools and methods to quantify value as perceived by any particular consumer. Value-based acquisition applied to simple commercial use cases passes the sanity check. Value-based acquisition applied to an actual DoD information system program, unlike traditional government acquisition practice, also passes the sanity check. Value-based acquisition lacks only adoption by courageous pioneers who agree with Einstein that "The same thinking that created a problem won't solve it!" Acquisition professionals, who agree with Einstein, can break the failure-cycle by taking the following action:

1. **Partner with forward leaning authorities and experts.** There are passionate individuals and offices at, e.g., JITC, NSA, DISA, and Director, Operational Test &Evaluation who are motivated to streamline and improve the C&A, T&E, and V&V processes. There are forward leaning experts in, e.g., open source software, SOA, Agile software development, industry standards, semantic technology, modeling and simulation, policy, contracting, and IA in both government and industry. No one organization or individual is expert in all requisite areas! The not-for-profit W2COG Institute (WI) exists to find forward leaning government and industry experts and to remove the barriers to effective collaborative engineering among them. Engage the WI to find partners who will help objectively define "useful", "secure", "certified", "open", "modular" architecture in your mission context, and to manage the myriad options to field it.

2. **Learn by doing.** The WI "GIGlite"[20] project has identified existing infrastructure and process aligned with value-based acquisition as described above. Use this existing GIGlite capability as "training wheels" to ramp up your own capability, or to find an appropriate outsourced provider. Target a certified value-based testing-as-a-service capability as a first value-based delivered article!

[o] Watch standers program intelligent agents with critical conditions of interest. When agents detect those conditions they send pop-up alert messages to watch stander browsers.

3. **Collect feedback & continually improve.** Actively recruit innovative, tech-savvy members of your operational customer community to serve as a beta developers. Include regular customer visits as a required condition of all contracts. Use those visits to objectively audit performance per agreed MOE, teach new functionality, explore the art-of-the-possible, and collect new use cases. Feed lessons learned into your continuing value- delivery process.

[1] (Joint Chiefs of Staff, 2001)
[2] (Federal CIO's Council, 2008)
[3] (Scott, Mark, & Herz, 2006)
[4] (Fruhling & Tarrell, 2008)
[5] (Government Accounting Office (GAO), 2006)
[6] (Haines, 2001)
[7] (Internal Revenue Service (IRS))
[8] (Boudreau, 2006)
[9] (Government Accounting Office (GAO), 2006)
[10] (Wikipedia)
[11] (Denning, Gunderson, & Hayes-Roth, 2008)
[12] (Meyerricks, Davis, Pipher, & Guthrie, 2008)
[13] (Defense Acquistion University)Defense Acquisition Guide
[14] (Code)FAR
[15] (Wikipedia)
[16] (Govenment Accounting Office (GAO), 2006)
[17] (DoD, 1996)
[18] (CWID JMO, 2008)
[19] (Director Central Intelligence, 2000)
[20] (W2COG Institute)

Boudreau, M. (2006). *Acoustic Rapid COTS Insertion: A Case Study in Spiral Development.* Monterey CA: Naval Postgraduate School.
Code, U. T. (n.d.). *Federal Acquisiton Regulations (FAR)*. Retrieved December 12, 2008, from Acquisition Central : http://www.acqnet.gov/Far
CWID JMO. (2008). *Coalition Warrior Interoperability Demonstration (CWID) 2008 Final Report.* Hampton VA: CWID Joint Management Office (JMO).
Defense Acquistion University. (n.d.). *Defense Acquisiton Guidebook*. Retrieved December 12, 2008, from Defense Acquisition Guidbook: http://akss.dau.mil
Denning, P. J., Gunderson, C., & Hayes-Roth, R. (2008, December). Evolutionary System Development. *Communications of the ACM* , p. 29.
Director Central Intelligence. (2000). *Protecting Sensitive Compartmented Information within Infomation System (DCID 6/3) Manual.* Washington DC: CIA.
DoD. (1996). *Handbook for Preparation of Statement of Work (SOW).* Washington DC: DoD.
Federal CIO's Council. (2008). *Practical Guide to Federal SOA (PGFSOA).* Washington, DC: http://smw.osera.gov/pgfsoa/index.php/Welcome.
Fruhling, A. L., & Tarrell, A. E. (2008). *Best Practices fro Implementing Agile Methods: A Guide for Department of Defense Software Developers.* IBM.
Govenment Accounting Office (GAO). (2006). *Best Practices: Stronger Practices Needed to Improve DoD Technology Transition Process.* Washington, DC: GAO.
Government Accounting Office (GAO). (2006). *Defense Acquisitions DoD Management Approach and Processes not well Suited to Support Development of Global Information Grid.* Washington DC: GAO.
Haines, L. (2001, March/April). Technology Refreshment Within DoD. *Defense ATL Magazine* , pp. 22-27.
Internal Revenue Service (IRS). (n.d.). *Information for e-file providers*. Retrieved November 25, 2008, from Internal Revenue Service: http://www.irs.gov/taxpros/providers/index.html
John Scott.

Joint Chiefs of Staff. (2001). *Global Information Grid (GIG) Capstone Requirements Document.* Washington DC: JROCM.

Meyerricks, D., Davis, S., Pipher, J., & Guthrie, P. (2008). *Independent Assessment Team Report on C2 Data.* Alexandria, VA: Institute for Defense Analysis.

Scott, J., Mark, & Herz, J. (2006). *Open Technolgoy Development Roadmap.* Washiington DC: Deputy Undersecretary of Defense Advanced Systems and Concepts.

W2COG Institute. (n.d.). *About Us/Product Offerings*. Retrieved December 10, 2008, from World Wide Consortium for the Grid: http://www.w2cog.org

Wikipedia. (n.d.). *Availability*. Retrieved November 25, 2008, from Wikipedia: http://en.wikipedia.org/wiki/Availability