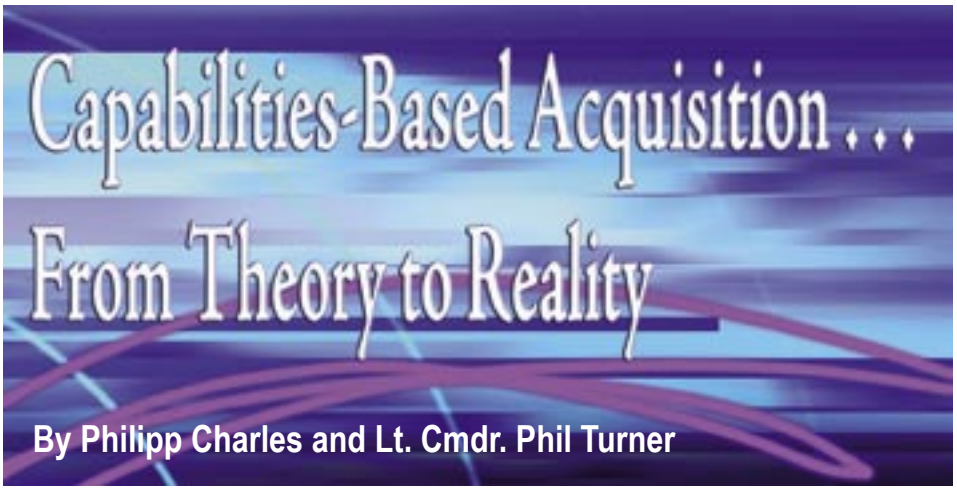

Introduction

The concept of capabilities-based acquisition is fundamentally changing the way we buy and engineer systems in the Department of Defense (DoD). A capability can be defined as the ability to perform a course of action or sequence of activities leading to a desired outcome. The capabilities-based acquisition process requires that we identify these capabilities, their requirements, conditions and metrics, and then acquire the right equipment and information services to support the desired capabilities in an integrated enterprise environment.

In simple terms the concept is this: Instead of buying threat-based, service-specific systems, a mobile target-weapon pairing system, for example, and then identifying how that system can be integrated with other similar threat-based systems, we now identify the warfighting capabilities we want to achieve. Then we start with a "blank sheet of paper" to develop the systems architecture and technical standards necessary to allow seamless interaction using shared data and applications.

For instance, if our objective were to destroy a mobile inland target, we would identify the activities needed to accomplish our objective and the conditions and metrics required. In this case it would be the ability to: (1) detect the target; (2) track the target; (3) identify the target; (4) engage; and (5) assess the engagement, all within the required time line. This capability could be realized with a traditional solution, such as today's connected command and control (C2) systems and a manned strike aircraft.

Capabilities-based acquisition can also provide something less expensive that doesn't put warfighters at risk, such as an autonomous, uninhabited vehicle with weapons launched from offshore. Ultimately, the focus of capabilities-based acquisition is to find a solution that provides the optimum warfighting adaptability, while maximizing combat power and minimizing investment costs.

Capabilities-based acquisition is a new way of doing business that has already significantly affected how DoD defines requirements and acquisition processes. It can give decision makers more power to invest limited resources in the most efficient way possible, improve system interoperability and enhance the operational superiority of our military forces. The Navy's Mission Capability Packages (MCP) analysis and the Joint Capabilities Integration and Development System (JCIDS) are two examples of how this concept is affecting current acquisition efforts.

Engineering Challenges

Implementing capabilities-based acquisition is obviously much more complicated than the previous scenario, especially when considering the requirement to advance netcentric warfare concepts. Now, we face the challenge of not only transitioning from a traditional platform-centric paradigm, so called "stovepipe" acquisition, but also of moving to completely new modes of warfare where sensors and weapons on multiple platforms could serve as resources controlled by a variety of users on a network.

The implications for netcentric warfare on military operations, as well as the overall DoD culture, are immense and naturally beyond the scope of this article. Instead, we will examine how the engineering and architecture communities are working to make this paradigm shift happen, and we will give one example of this approach.

Managing the Transition

To effectively acquire complex systems of systems in a capability-based acquisition environment requires that we increase the use of integrated architectures to identify inter-relationships and resolve issues with system integration and interoperability that impact the operational effectiveness of warriors; platforms; sensors; command and control; networks; and weapons.

Well-defined architectures are an essential part of engineering assessments. They allow decision makers to look for the mix of assets that best optimizes the balance between cost and capability. The acquisition community determined that decision makers need the ability to perform detailed technical analysis, while maintaining traceability and repeatability. To support this need, the Space and Naval Warfare Systems Center, Charleston, S.C., spent four years developing and evolving the Global Engineering Methods Initiative for Integration and Interoperability (GEMINII).

GEMINII enables decision makers to understand the impact of their acquisition decisions. It captures capability-based analytical data, which helps to manage complexity in an almost ad hoc development environment. GEMINII meets the need for traceability and repeatability. It is both a process and a toolset based on achieving desired capabilities through activity decomposition, integrated architectures and semiautomated analysis of inter-system dependencies.

GEMINII development led to key lessons learned. Effective analysis must include information from the warfighter's perspective on capability definition, conditions, metrics, prioritization and impact on the Concept of Operations (CONOPS) and Tactics, Techniques and Procedures (TTPs).

Analysis requires information from an

acquisition perspective to analyze integrated architectures, which are candidates to meet the capability requirements. This includes dependencies on system milestones, migration plans and evolution strategies. Integrated architectures are also used to evaluate compliance with DoD and Naval architecture guidance.

The GEMINII process is only one example of how an enterprise environment can be developed. In this environment, it is critical to incorporate all of these authoritative sources wherever possible to facilitate the collection of complex information and minimize data calls.

Well-defined architectures are an essential part of engineering assessments. They allow decision makers to look for the mix of assets that best optimizes the balance between cost and capability.

If done properly, this process can produce a large quantity of information about complex systems of systems that can help guide programmatic decisions. Ultimately, the goal for this type of analysis is to help advance our understanding of both capabilities-based acquisition and netcentric warfare in engineering terms.

While the underlying philosophy of simultaneously tackling capabilities-based acquisition and netcentric warfare appears to go hand-in-hand, connecting the dots with analytic rigor can be extremely complex. The concept of netcentric warfare is centered on the ability of a warfighter to assemble services and information as needed, when needed. Services could be whatever warfighting capabilities are required by the user at any given time.

Making it Real: *a solution space*

Tools themselves can not provide capabilities-based acquisition. But when tools are combined with an integrated process to build a knowledge base, the results can be revolutionary. *Knowledge* emerges when the tools and process are combined. This knowledge can be applied effectively to yield a true capabilities-based acquisition paradigm.

The significant challenge from a knowledge discovery and management perspective; however, is to ensure that the process is automated (for quick turnaround time), repeatable (for stability of results and applicability to multiple suites of capabilities) and traceable (results mapped back to authoritative data sources).

The work being done by the SPAWAR Chief Engineer, SPAWAR Systems Center Charleston, and others, for implementing capability-based acquisition, focuses on increasing the speed and automation of engineering assessments of end-to-end warfighter capabilities, mapping capability to integrated architectures and portfolio management.

The ultimate goal for capabilities-based architectures is to provide a cost-effective analysis of alternative capabilities, system configurations and option characteristics (schedule, performance and costs) at any level of detail desired by a decision maker, structured so that all analysis and current issues are traceable.

This analysis process begins by breaking down warfighter capabilities into end-to-end mission descriptions by activity, information, platforms, systems and components. A static assessment is performed at this point to identify known interoperability issues based on authoritative databases of lessons-learned and technical problems.

Once the end-to-end mission capability descriptions are complete, the enterprise analysis environment can implement those components using a variety of modeling tools, such as Network Warfare Simulation (NETWARS) or the JUDY Theater Surveillance and Strike Simulation Model, to assess technical performance. Selection of the specific modeling tool is based on the appropriate validated model by determining which tool offers the best fidelity for the specific question.

Just because systems are interoperable and comply with network-centric warfare concepts does not necessarily mean that they will improve force effectiveness. To track improvements in warfighting, the GEMINII process incorporates campaign-level modeling tools such as the Joint Warfare System (JWARS) or the Naval Simulation System (NSS) to assess architectural decisions, component choices and acquisition assumptions against operational results and outcomes. Ultimately, this process can provide increased automation of system technical assessments, offering a rapid, cost-effective decision support environment.

The Way Ahead

In summary, the optimal decision support environment created by the integration of tools and an analytical capability is necessary to make informed decisions regarding Navy and joint capability acquisition.

The engineering and architecture communities are working together to provide the analytic tools needed to make capabilities-based acquisition a reality. And, they are evolving the process to support acquisition leadership by merging warfighter capabilities with integrated architectures. This proven process has already provided an effective framework for integrating all the factors required to rapidly deliver end-to-end capability to the warfighter.

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