NPS SUPPORTS USMC WITH RAPID PRO VIRT

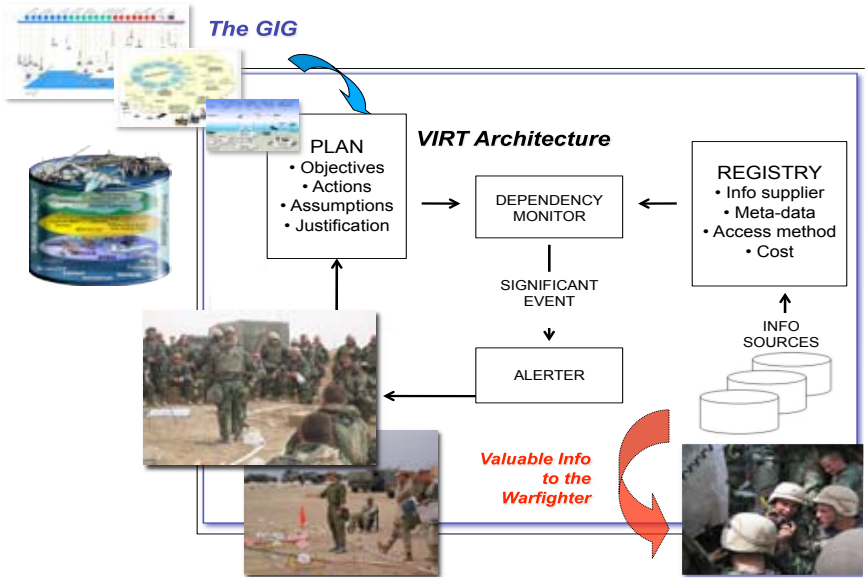
In need of ever-improving systems to find, fix, and target enemies, the Marines have adopted a rapid prototyping approach with five key elements: (1) an architecture for composing capabilities; (2) a set of evolving components; (3) an environment for testing and employing candidate systems; (4) a fitness function to assess candidate performance and guide feedback; and (5) a feedback function that directs investment into successful components and promising candidates. The fitness function must shape successive systems to utilize high-value data and reduce low-productivity activities that involve low-value bits. These problems fall within the scope of VIRT (valued information at the right time) research to be conducted by Professor Rick Hayes-Roth (Information Sciences). VIRT provides a framework and methodology for focusing on events that significantly affect mission performance. VIRT mechanisms filter out trivia and alert personnel to significant factors, thereby assuring that valuable information will receive attention and be available while decision-makers still have the time and resources to act. VIRT is a key aspect of the fitness function that will make the evolutionary approach converge on superior systems. This project supports Marine Corps Systems Command (MARCORSYSCOM) Intelligence Systems in implementing these key objectives and attaining a best-of-breed solution to an elusive intelligence problem.

Rick Hayes-Roth, IS

Rapid changes in environment, missions, and technology make current systems quickly obsolete and render slow, narrowly focused programs mostly irrelevant. An adaptive, evolutionary management of the capability portfolio is called for. Most of these capabilities must be made modular and composable while continually recombinable in ways that exploit new opportunities and allow reinforcement of valuable components. IT applications must be implemented like a population assembled from a tested, selected pool of "genetic" components. Given a small population, set of "genes," and number of generations to control, the basic strategy of natural selection will be applied to IT components. The high rate of change in the environment, missions, and available IT components make an adaptive approach desirable and necessary—desirable because reinforcing and reusing the components that deliver bang for the buck means that existing investments and current capabilities are maximized; necessary because there is neither time nor money to focus on a few mega-systems that follow a five- or ten-year trajectory before arriving on target. Such systems rarely hit the actual targets deemed critical in the future; rarely work; and rarely incorporate best technologies and methods.

As there is no practical alternative in information systems to an adaptable set of composable elements, NPS VIRT is

(cont. p. 5)



BACKGROUND AND CHALLENGES

The defense community recognizes the need to achieve and sustain "information superiority" as a key success factor, not only for 21st-century conventional warfare, but also for military operations other than war (OOTW). Shared data (information) access remains the primary information-dominance "enabler" in this quest. The DoD has issued policy directives over the last decade that mandate network-centric operations (NCO). NCO networks distributed sensors, platforms, weapons, and warriors. The distributed defense network itself is called the global information grid (GIG). Numerous government reports and frequent press coverage indicate that the defense community has achieved little success in fielding a cohesive GIG.

The DoD intelligence, surveillance, and reconnaissance (ISR)-integration road map does not:

- Identify (ID) future requirements (and how DoD plans to achieve them)
- ID requirements already filled or "saturated"
- ID critical gaps
- ID funding priorities
- Measure progress (quantitative, qualitative)
- Define requirements for global persistent surveillance ....or how to use current assets to attain it
- ID enterprise-level architecture of what the ISR enterprise should be
- Show how ISR (existing and future) will fit into a vision for common architecture to efficiently meet priority ISR requirements or provide a basis for making trade-offs among competing programs
- Provide a basis for determining 'best value' mix of present and future capabilities that would necessarily collaboratively support improved fusion and analysis through an ISR architecture

The DoD's approach limits its ability to optimize the use of available assets, as follows:

- Lacks visibility of all ISR assets (theater, tactical)
- Lacks metrics and feedback to evaluate impact of ISR assets.
- Causes delays in delivering new systems, leading to unplanned investments to keep legacy systems relevant

(VIRT, cont. from p. 4)
concerned with ensuring that significant bits low to accelerate adaptive behavior and improve mission outcomes. By incorporating VIRT as an essential system property, the evolutionary approach will lead to superior systems.

Marines deserve more than a map and a compass in the high-tech, digital age.

RapidPro VIRT conserves human bandwidth by pushing valuable information only.

OPPORTUNITY AND APPROACH

USMC goals are as follows:

- Dynamic, scalable organizations capable of faster, tighter decision spirals from operational-level "planners" to tactical-level "executors."
- A process to plan, train and equip along these lines.
- A rapid-prototyping team (RPT) capable of dynamically responding to emergent requirements that balance intelligence "ownership" vs. "stewardship." The RPT seeks material and non-material solutions that serve a traditional [doctrinal] intelligence cycle while delivering VIRT time to achieve the 'effects' that equip warfighters with knowledge at the point of action.

RPT requires disciplined systems architecture, i.e. repeatable best practices and resultant structures, to support this mission. NPS VIRT research envisions such an architecture.

Relevant VIRT thesis are presented below.

VALUED INFORMATION AT THE RIGHT TIME AND THE NAVY'S COOPERATIVE-ENGAGEMENT CAPABILITY: A WIN/WIN PROPOSITION

Rafael A. Acevedo, Lieutenant Commander, USN
MS, Information Technology Management–March 2006
Advisor: Rick Hayes-Roth, Information Sciences
Co-advisor: Curtis Blais, MOVES Institute

In this thesis I examine the theory of valued information at the right time (VIRT) and the benefits it can provide to the Navy's best example of accurate information-sharing, the cooperative-engagement capability (CEC). The primary premise of VIRT is that only information that has some value to the user and could impact mission accomplishment should be allowed to flow from a source to the user. If information has little or no value to the individual it is destined for, it must simply be regarded as overhead and should not be sent/received. Using a simple simulation I show in this thesis that VIRT has the potential to provide benefits of orders of magnitude versus a non-VIRT implementation. The Navy's CEC program represents a premier air track data sharing mechanism. It enables ships augmented with this capability and residing on the network to share fire control quality information on the individual parameters of air tracks such as location, course, speed, and altitude. There is a place for VIRT implementation within CEC. Such an implementation can prove beneficial both to CEC as an internal user of information and also as a supplier to external entities of its valuable track information. Finally, I provide a notional VIRT-enabled product-line architecture for a coalition information-sharing system. If both the concept of VIRT and CEC are to have a place in the future of information-sharing, the issue of providing timely and valuable information to our coalition partners must be addressed.

RAPID, VALUE-BASED, EVOLUTIONARY ACQUISITION AND ITS APPLICATION TO A USMC TACTICAL, SERVICE-ORIENTED ARCHITECTURE

Tyrone H. Ferrel–Major, USMC
MS, Information Technology Management–June 2009
Advisor: Rick Hayes-Roth, Information Sciences
Second Reader: Carl Oros, Information Sciences

Acquisition project success or failure is defined from the perspective of the system operator, or the warfighter for DoD tactical systems. Causes of project failure are analyzed in terms of the system itself and of the timeliness of the acquisition process, citing the value of a rapid process. This analysis serves to introduce rapid, value-based, evolutionary acquisition, or RVEA RVEA focuses on rapidly and iteratively providing valued products to warfighters, while concentrating on how the acquisition-action officer can improve the next product and the process itself. This thesis applies RVEA principles to a system of direct interest to the Marine Corps, a tactical, service-oriented architecture, anticipating increasing the chances of its successful acquisition.

INFORMATION MANAGEMENT UTILIZING VALUED INFORMATION AT THE RIGHT TIME AS APPLIED TO A JOINT TERMINAL ATTACK CONTROLLER MISSION

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MS, Information Technology Management–June 2009
Advisor: Rick Hayes-Roth, Information Sciences
Second reader: Curtis Blais, MOVES Institute

This research utilizes the JTAC mission and applies the VIRT concept of smartpush information delivery. Current efforts within DoD focus on achieving a virtual world where all information becomes available through the GIG. This pull approach to information delivery does not adequately address the value of information and the absolute requirement to deliver it to the lowest levels when and where needed. The current DoD enterprise-wide mentality of IT implementation does not focus on where best to leverage IT in order to achieve an immediate increase in capability. VIRT, as demonstrated in this research, provides an excellent place to start and a great opportunity to utilize technology in an effective way without taking a decade for implementation.