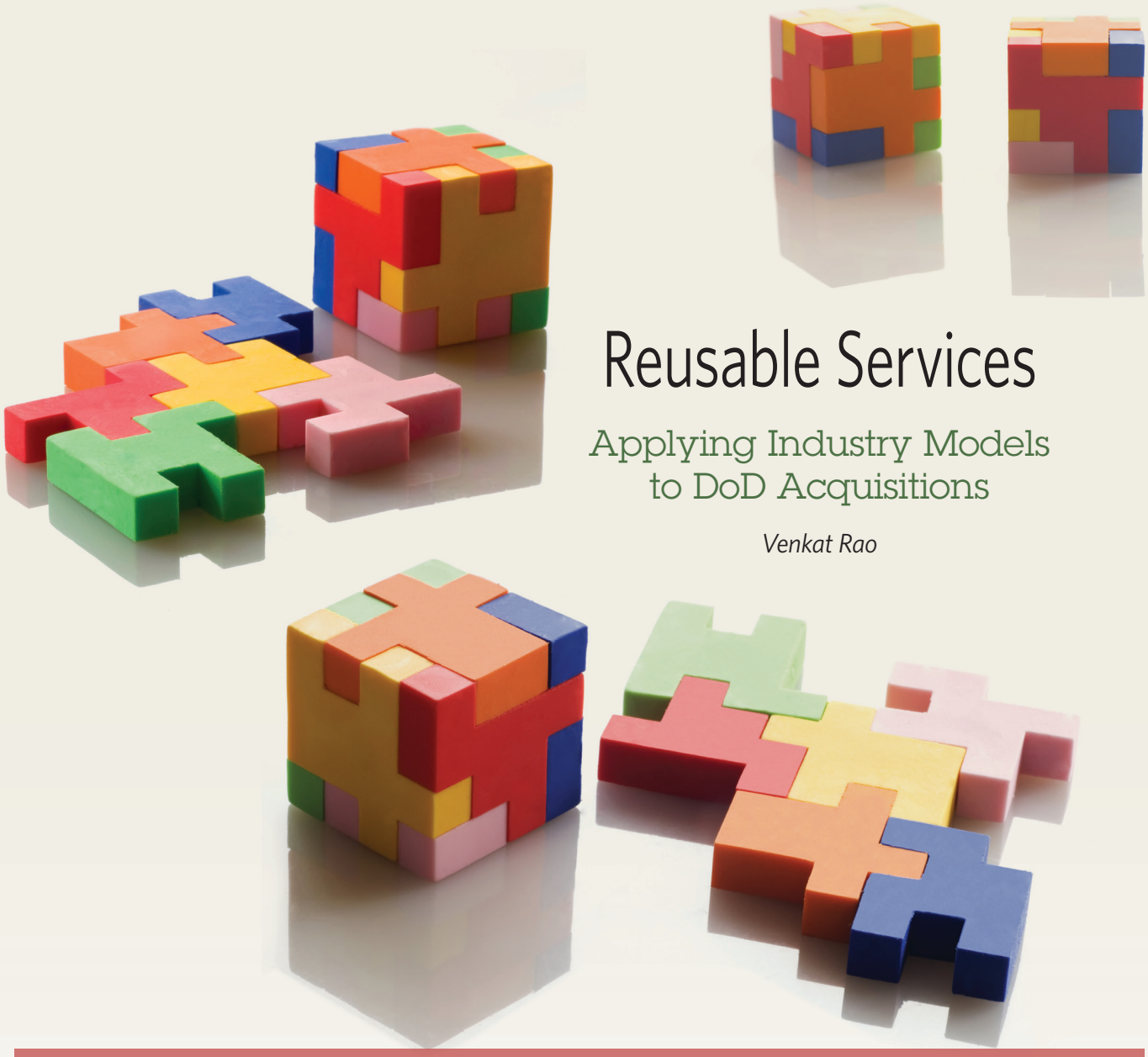

Reusable Services

Applying Industry Models to DoD Acquisitions

Venkat Rao

Software and information technology service providers and Department of Defense acquisition programs face common problems and share common goals. The software and services industry must deliver solutions that meet customer needs cost effectively while providing a profit margin; and DoD programs need software solutions that meet cost, schedule, and performance objectives. The drive to achieve those goals has spurred process and development initiatives in industry and DoD, with each entity leveraging the advances in the other. This continuous search for improvement is as much a journey as a destination, as we examine new opportunities for improving the quality, cost, and timeliness of software capabilities.

Trends in Software Product and Project Development

Software product and project development have always presented challenges for both industry and DoD software acquisition in meeting cost, schedule, and quality objectives. Organizations are in constant search of management systems that address these challenges. One shift industry has made to ensure high quality-product and project

deliverables is to emphasize the importance of the software development process and to rely on capability maturity model integration (CMMI) levels to measure software development organizations. Software development organizations have focused on repeatable processes, continuous improvement, and feedback systems to benchmark and improve their CMMI levels. Software acquisitions in weapons systems programs facing the same issues have leveraged the industry trends and have integrated the use of CMMI measures in software acquisitions and in the selection and evaluation of software development organizations.

A second critical aspect in improving software deliverables is requirements management. Changing requirements have long been recognized as a root cause of programs not meeting cost, schedule, and performance requirements, even as programs bravely attempt to resist requirements creep and struggle to identify valid requirements changes. Industry has responded to this issue by emphasizing robust requirements management with sophisticated tools and implementing rigorous configuration management of requirements. Traceability matrices are used to map software requirements to stakeholder requirements and systems functions. Traceability provides a mechanism of checks and balances to ensure requirements changes are evaluated critically and accepted with a complete analysis of their impact. The process is taken to the next step and extended further when systems development is based on coupling requirements management with the development of business- and system-use cases, again to efficiently and effectively manage the system development process.

The Defense Department has emphasized the same systems management principles in the systems engineering processes that govern weapons systems development. While DoD does not prescribe a process to external suppliers, weapons systems developers are evaluated on the use of documented industry standard systems engineering processes, with their effectiveness typically reflected in their past performance and deliverables.

The software industry business model was based on requiring a significant investment of research and development dollars in software products with the hope of delivering the same product many times, with minor customization for individual customers. This industry model appears to be restricted to large-infrastructure software capabilities in the realm of databases, enterprise applications, and, perhaps, the social networking platforms of the current era; and is dominated by a few large players. The need for and dream of mass customization of software products continue, however, driven by the mantra "build once and reuse and recombine many times," so as to deliver customized software business solutions that meet individual customers' unique needs.

This need and the mantra are now close to being realized with the third trend in the software industry of developing software as reusable services. The basic concept is to develop services that implement common functionality that can be reused by many software applications. An example is the creation of a service that authenticates users when they sign on to an application using smart cards and user-specific information. This service can be used when authenticating remote users in an application that supports remote access or in an application that supports users when they are present in person—a common service used in two applications. As new customers or new customer needs emerge, existing services can be recombined along with the development of new services to deliver customized solutions. The new services developed in a specific engagement are added to the pool of existing services and reused yet again in the next customer engagement. The advantages are obvious: development of new software on a specific engagement is minimized and limited to any new services required for the engagement. A unique customer solution to address the customer's specific problem is crafted using existing and new services. Thus, we see many software companies becoming services companies and using services to deliver customized solutions, a transformation made possible by this trend.

Over the years, this approach has been used in software development, but the difference this time has been the emergence of the Internet as the driving and governing force of industry standards for services. These standards have supported all aspects of software services development, including the use of communication protocols and the encapsulation of data. The approach is not intended to, and does not, eliminate the development of efficient algorithms or innovation in implementation; instead it allows the software development process to focus on precisely this innovation and the efficient use of technology and less on the rules governing the process.

An Opportunity for DoD

DoD has recognized this trend towards services-oriented architecture and acknowledged it in the DoD Architecture Framework as a key tenet of DoD's Net-Centric Data strategy. A conceptual approach to how DoD can leverage the development and reuse of services not only in weapons systems acquisition but in all automated information systems acquisitions is outlined here. The first step in the process is the identification of required services. This step would involve reviewing the DoD architecture framework, net-ready key performance parameters, and other sources of common software requirements to develop a set of generally accepted software services that have been or will be used in DoD programs. It would also require the development of a common services development framework (CSDF) that would be applicable to DoD software development and software acquisitions. The next step would be to identify software capabilities for which DoD has acquired data rights and to review those capabilities in order to develop a library of services that could be reused for planned software capabilities. The library of services might need to be re-engineered to adhere to the CSDF. The initial set of services could include standard integration services between major information backbone networks currently implemented in DoD. The

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CSDF would be a published framework for software suppliers and industry to use in responding to DoD requirements. Over time, the framework could migrate to be accepted as an industry standard and managed using industry standards groups.

The next step would be to expand the initial library of services with additional or new services required by DoD acquisitions. The process would require that DoD solicitations include the library of services that suppliers could access to develop their responses. This library of services would be made available to suppliers (with limited data rights to protect DoD intellectual property). Suppliers would also have access to the CSDF, and their responses should identify the new services that are included in their proposal. DoD would also acquire data rights to the new services, and those services would be added to the library of services. The logical extension of the model is a robust, growing set of services that could be reused for future acquisitions across the DoD enterprise.

The benefits of the approach described above would be significant. The cost of new software development would be reduced over time as the library of services grew and services were reused. Additional benefits would be gained in reduced test effort as services previously tested required less test effort in future implementations. The quality of the resultant software capability would be higher as the percentage of tested and proven services increased in the delivered capability. A life cycle benefit would be reduced support costs because the system would be built around services currently supported and new development would be minimized. The net result should be a lower-cost, higher-quality capability that meets desired time frames.

Meeting DoD's Unique Requirements

DoD has unique requirements. Foremost are security requirements, and there are several approaches that can be evaluated to ensure DoD systems remain well protected. The specific algorithms and methods to protect data would not be exposed to external suppliers. All of the mechanisms currently in place to protect secure data would continue to be applied in shared services implementations. The library of services provided to suppliers during solicitations would exclude targeted security services; however, those services would be provided to suppliers once they had been selected, and the current strict guidelines that are used to share secure information with external suppliers would continue to be enforced. Another approach could require the development and support of security services to be under the purview of DoD software development organizations. The services could be made available as government-furnished software "black box" modules. External entities would have no access to the content or implementation of those services—integration testing could be restricted to DoD organizations.

Another important aspect of services-based solutions—and even more so in DoD systems—is system performance. Services implementations generally require robust networks and system resources to achieve the required performance; DoD systems are developed with high-performance requirements and around a robust infrastructure. This core competence in high-performance systems positions DoD to take a leadership role in optimizing services implementations for improved performance and transfering the knowledge to industry, thereby continuing the symbiotic relationship between industry and DoD.

The DoD acquisition framework has provided the blueprint for systems development and delivery of high-performance systems that need to be sustained for many years. Driven by market necessities, industry has been agile in improving processes and moving software development technologies forward. The two paths have intersected and leveraged the best practices of both in the search for cost-effective, best-of-breed solutions. The journey continues as services-based implementation opportunities are explored for integration into DoD systems development.

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