



Executive Overview

Employing SOA to Achieve Information Dominance

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THE PROBLEM: CURRENT PRACTICE DOES NOT MEET NAVY REQUIREMENTS

Globally-oriented, service-oriented systems and infrastructures will form the backbones of a new generation of information networks. These systems are being implemented throughout the business world. Yet, much remains to be done to realize the Navy's objective of deploying capable, reliable, and affordable service-oriented systems afloat and at operational staffs. Our current DOD-centric ability to implement systems based on service-oriented architecture (SOA) technologies falls short, as we cannot yet meet requirements for systems that are highly secure to protect classified content in the face of malicious attacks, readily configurable to allow for multiple deployment choices, highly adaptable to changes in the environment, and reliable and precise in mission-critical contexts.

HOW SEI RESEARCH WILL CLOSE THE GAPS

To close the gaps in these areas, research is needed in SOA security, semantic SOA, context-aware applications, and real-time SOA.

SOA Security

Threat modeling is a technique widely used in software assurance to assess and document a system's security risks, but its use in SOA environments involves new techniques and risks. We propose to synthesize existing threat model work, such as Microsoft STRIDE, with the attack surface model, which consists of the data, methods, and channels that an attacker can leverage to exploit a system. This combination will reflect the permutations that result from the selected security countermeasures. This will provide a new approach to enable SOA implementations to apply state of the practice security approaches where today they have primarily been using ad hoc and inconsistent solutions.

Semantic SOA

To achieve highly configurable service-oriented systems, we must develop a standard for semantics that enables us to describe services unambiguously in terms of data, functionality, and behavior. A significant area of work and research in semantic SOA is that of semantic web services (SWS), which uses a markup language that is descriptive enough for a computer to obtain the information it needs to discover, compose, and invoke web services without human intervention, and to perform at runtime the tasks that developers currently perform at design time when developing service-oriented

systems. The SEI can provide a unique contribution to this effort by identifying best practices for designing components that support semantic interoperability, proposing alternate solutions for fully dynamic binding among service providers and consumers, identifying end-user programming technologies that enable system users with very little technical knowledge to obtain necessary information, and identifying approaches for developing service registries and repositories that contain service consumer code that can be embedded into pre-defined configurable user interfaces.

Context-Aware Applications

Service-oriented systems are not highly adaptable because there currently is no agreement on how to represent context so that services can be selected and adapted every time, according to each user's performance, reliability, and security characteristics, as well as the user's language, time zone, and invocation environment. SEI research would address the questions that must be answered in order to support context awareness in SOA environments: What is context? How can context best be modeled and represented? How can semantic descriptions of services be used to facilitate context-aware discovery? And what are the SOA infrastructure requirements in a context-aware service provision environment?

Real-Time SOA

SOA technologies are increasingly targeted for use in high-performance and real-time systems, for which the current loosely-coupled approaches promoted by service-orientation are not adequate. SEI research in this area would focus on performance models for real-time service-oriented systems that help determine whether the SOA paradigm is appropriate for a particular system; design patterns for real-time service-oriented systems that could include infrastructure usage, proper service interface definition, and architectural styles for real-time support in service-oriented systems.

THE IMPACT OF SEI RESEARCH ON NAVY INFORMATION DOMINANCE

Navy information dominance objectives place requirements on systems that are still not met by current SOA implementation technologies. The SEI will propose solutions to fill the gaps between the state of research and the Navy's objectives and conduct contextual experimentation to analyze the feasibility of our solutions.

This work will enable the Navy to develop systems that address information dominance priority requirements while maintaining the loosely-coupled, stateless, standards-based nature of the relationship between service consumers and service providers in service-oriented systems that have made SOA a worthwhile technology to adopt.