

NRAC Report: Future Naval Use of COTS

Networking Infrastructure

Executive Summary

This study was conducted by the Naval Research Advisory Committee under the sponsorship of the Deputy Chief of Naval Operations for Communication Networks (N6). It explores the future of commercial networking architectures and the ways in which these architectures might be adapted to Naval use, based on the current pace and direction of their development. Today, the Navy and Marine Corps incorporate commercial networking architectures and this will continue into the future. In fact, the impact of developing proprietary networking architectures – on capital, maintenance, and training expenses – would be cost prohibitive. The fundamental question to be answered by this study is, “How can the Navy and Marine Corps leverage emerging commercial networking architectures to improve operational effectiveness while keeping the cost in an affordable range?”

The report is divided broadly into four sections. The first establishes the reasons why the study matters to the Navy. It sets the stage with an example from the Bechtel Corporation, a large company that deploys task units into remote areas where bandwidth is limited and connectivity is intermittent, i.e., conditions that resemble those in many Naval operating areas. The second section addresses the evolution of networking architectures from the original productivity-focused computing systems in the mid-1970s to the latest next-generation networking architectures. It begins with the centralized architectures (circa 1970-1985), moves through the era of the client-server architectures introduced in the mid-1980’s and still the dominant networking architecture today, and shows the current transition to the new architectures that are characterized by virtual execution and central management. It then focuses on the evolution of resource sharing, illustrating the advances of the newer architectures over the current, and introduces the concept and definition of Cloud Computing. While Cloud Computing is developing in many variations – including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), among others – the overall concept of shared resources across accessible, virtual, scalable systems is common to all. The

second section ends with the impact that Cloud architectures are having on the way digital information and communications are handled today.

The third section provides a transition from the discussion of the technical aspects of Cloud Computing, as it is being implemented in the commercial sector, to the technical gaps between the priorities of the commercial development and Naval requirements. The identified technical gaps were developed by comparing the priorities of the commercial developers to the requirements of the Naval Networking Environment goals and features. Also, operational requirements were derived from meetings with the Commander Third Fleet N6 staff and a review of recent after action reports from deployed strike groups. The gaps are grouped under two headings: 1) security in the Cloud and 2) bandwidth and connectivity in the Cloud. These are clearly the dominant gaps that must be addressed by science and technology before the Navy and Marine Corps can embrace Cloud Computing as their operational standard.

The final section contains the Panel's findings and recommendations. The "take-away" points are what the Panel considers the most important. They are:

- Cloud Computing is here to stay,
- Engage the Cloud community to ensure Naval needs are incorporated into evolving standards,
- Establish Cloud pilot project(s) for non-combat services,
- Focus research and development efforts on:
 - Securing the virtualization layer,
 - Developing data links that enable Cloud architectures,
 - Developing Cloud performance models to simulate network performance in various conditions.

A cautionary note for readers of this report: studies in IT offer a great opportunity to explore the leading edge – and to become outdated in the process. The pace of IT development is well beyond one's ability to maintain complete knowledge of ongoing developments. As an example – since the first draft of this report on July 1, 2009 – the commercial sector has begun to address at least one (and probably many more) of the issues the Panel noted as a gap to Naval applications: the problem of time delays in communication or information links, i.e., latency.