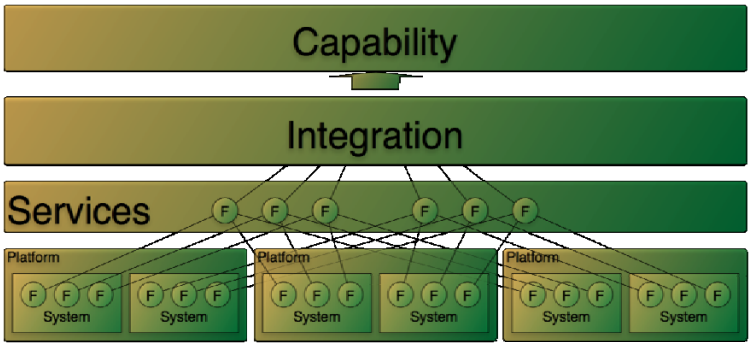
Network Enabled Capability: System Integration for the Military

Network Enabled Capability Through Innovative Systems Engineering

Introduction

The NECTISE project is jointly funded by the EPSRC and BAE Systems. It involves ten universities and is addressing the question of how BAE Systems delivers NEC to the UK MoD, taking account of the aims summarised in the 2005 Defence Industrial Strategy. To tackle this NECTISE contains four topic groups, with challenges centred on:

- **Through-Life Systems Management** - provision of military capability: acquisition, service and support
- **Architectures** - for network enabled capability: service-oriented, evolvable architectures for military capability and support organisations
- **Decision Support** - within a capability-based acquisition environment: decision support tools and collaborative environments
- **Control and Monitoring** - for systems of systems: health monitoring, reconfiguration and prognosis.



Capability Provided by Integrating System Services
Similar functions from different systems across platforms can be integrated to provide Capability

Network Enabled Capability

The Armed Forces need to be flexible, ready and rapidly deployable, with the application of controlled and precise force, to achieve realisable effects. To be successful in achieving this goal, NEC requires system integration of independent components that can evolve, operate in a dependable manner, managing system and component changes, cost effectively and connecting industrial, defence and pan-defence environments. NEC requires Network Enabling by connectivity, information sharing and networking people, assets, and procedures; and Capability requires identification of networks of people, assets and procedures to fulfil mission objectives.

In the future NEC battlefield, the architecture can provide the means to integrate systems of systems using service descriptions that include functional description and the Quality of Service (QoS) attributes, such as availability, accessibility, integrity, reliability, security, maintainability and resilience to name a few of the characteristics. These QoS attributes are important measures that need to be monitored in use, but also need to be known for mission planning and acquisition. The challenge for architectures in NEC is to express known characteristics alongside unknown or variable attributes, using monitoring to evaluate an architecture through its lifetime in unknown and variable situations. However, in these situations, using structured closed-world systems and making assumptions about total system behaviour can no longer meet requirements.

Systems Architecture

The topic group addressing Systems Architecture is led by School of Computing, University of Leeds and includes Cranfield Defence College of Management and Technology, Cranfield University.

The Systems Architecture topic group is investigating:

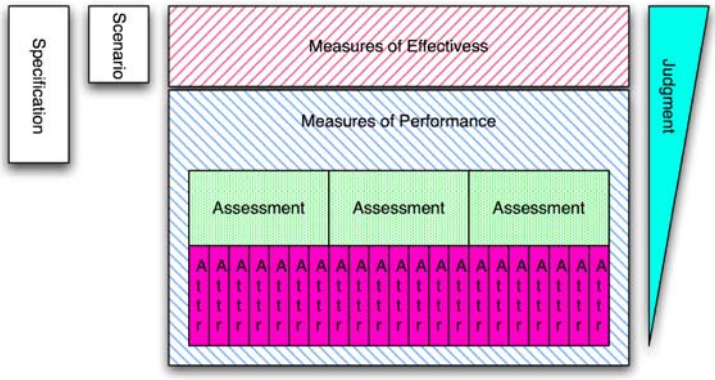
- Service-oriented architecture for the integration of systems in a dynamic military environment and in the delivery of network enabled capability
- Architecture frameworks to capture and

describe systems integration for through-life capability, in design, acquisition and mission planning

- Evolution of architectures, in the design of dependable evolution and managing changes during service
- Evaluation of architectures, researching methods of evaluation towards a framework for evaluating capability during design, acquisition and in-service use for dynamic integration.

Capability

Military capability is the ability to achieve a specified 'wartime' objective and includes network, information and people [1]. Examples of different levels of capability are: defend UK, capture and defend hilltop, and deliver and administer medical treatment. Continuous delivery of defence capability requires management of precision, speed, agility, deployability and sustainability. The NECTISE capability architectural model attempts to illustrate that capability can be defined at an abstract level, but to achieve NEC, networking is required to combine assets in a flexible and controlled manner.



Architecture Evaluation Framework
System attributes are combined by assessment to give measure of performance and effectiveness in delivering capability

Service Oriented Architecture

Service Oriented Architecture (SOA) provides one means to facilitate the matching of assets to capabilities. In SOA, assets are described by the service they provide. Services are combined to provide further functions that can be offered as services and further integration of services provides functional capabilities. This integration of services can be seen to be similar to the conceptual model of capability, where a capability is formed by the integration of responsibilities. The description of responsibility is similar to a service described by its function and quality of service attributes.

In SOA, an asset described as a service (by its function) can be generalised such that different types of asset may also provide a similar service. This can be used to match system solutions to domain problems, at different points through the life of the system and the capabilities they are employed in. The loose coupling of systems through service interfaces supports the dynamic nature of military environments during system and service integration, service discovery, reconfiguration and evolution.

Evaluation of Architecture

The evaluation of architectures is required in order to match system solutions to the problems. In military capabilities the evaluation needs to include:

- Dependability (including security, reliability and integrity)
- Cost
- Risk

The evaluation framework, shown left, combines low-level system attributes (derived from quality of service metrics) with an assessment. Using rule-based evaluation and judgement then measure of performance and measures of effectiveness are calculated.

The evaluation framework is working towards providing assessment of capability in support of:

- Design and engineering of systems to meet capability and service requirements
- Support of acquisition of systems to meet capability objectives
- In-service support of systems and services in mission planning and continuous capability delivery

Reference

[1] UK Mod, 2005, "JSP777 Network Enabled Capability", Edn 1, Jan 2005

Further Information

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