

MASTER OF SCIENCE IN SOFTWARE ENGINEERING

CONCEPTUAL FRAMEWORK APPROACH FOR SYSTEMS-OF-SYSTEMS SOFTWARE DEVELOPMENTS

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The Department of Defense looks increasingly towards an interoperable and integrated system-of-systems to provide required military capability. Non-essential software complexity of a system-of-systems can have a greater negative impact in system behavior than a single system. Current systems-of-systems tend to require a great deal of software maintenance and to be intolerant of even the most minor changes with respect to negative perturbations in system behavior.

In this thesis, the benefits of developing a conceptual framework as the basis for the system-of-systems development are explored. The application of accepted software engineering practices for single-system developments to the more complex problem of system-of-systems development is examined. Using the Ballistic Missile Defense System as a case study, an abstract framework from which one can reason about the system-of-systems is presented. A conceptual software architecture that represents a logical organization of proposed software modules is developed. The functionality of the system to conceptual software components, with coordination and data exchanges handled by conceptual connectors, is mapped. Finally, the work is assessed to determine the feasibility of applying the conceptual framework techniques described in this thesis to system-of-systems acquisitions with the objective of reducing accidental complexity and controlling essential complexity.

KEYWORDS: Unified Modeling Language, UML, Software Engineering, System-of-systems, Software Complexity, Domain Analysis, Software Architecture

IDENTIFICATION OF COMMERCIAL ITEMS RISK FACTORS

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This thesis examines the critical risk factors and lessons learned associated with integrating commercial items into DOD software programs. It summarizes lessons learned from programs that have made extensive use of commercial items, and provides a risk checklist/questionnaire to assist Project Managers and developers in understanding the risks associated with their developments of a system using commercial items. It implements the questionnaire on current DOD programs incorporating commercial items. Finally, the thesis suggests mitigation strategies, which can be used as guidelines for the risk factors, to consider when adopting commercial components. This thesis provides the starting point for a systematic structure approach to the risk management of commercial items within DOD.

KEYWORDS: Commercial Item, Commercial-Off-The-Shelf, COTS, Nondevelopmental Items, NDI, Risk Management, Risk Factors, Commercial Based Systems, CBS

SOFTWARE ENGINEERING

AN ARCHITECTURE FOR THE SEMANTIC PROCESSING OF NATURAL LANGUAGE INPUT TO A POLICY WORKBENCH

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Formal methods hold significant potential for automating the development, refinement, and implementation of policy. For this potential to be realized, however, improved techniques are required for converting natural-language statements of policy into a computational form. In this paper, an architecture for carrying out this conversion is presented and analyzed. The architecture employs semantic networks to represent both policy statements and objects in the domain of those statements. A case study is presented which illustrates how a system based on this architecture could be developed. The case study consists of an analysis of natural language policy statements, taken from a policy document for web sites at a university, and is carried out with support from a software tool developed which converts text output from a natural language parser into a graphical form.

KEYWORDS: Policy, Natural Language Processing, Semantic Networks, Policy Workbench, Prolog

ENGINEERING SOFTWARE FOR INTEROPERABILITY THROUGH USE OF ENTERPRISE ARCHITECTURE TECHNIQUES

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This thesis proposes a new structured methodology for incorporating the use of enterprise architecture techniques into the DoD software acquisition process, to provide a means by which interoperability requirements can be captured, defined, and levied at the appropriate time in a system's development. It discusses the necessary components of these architectural models, how these models capture interoperability needs, and how these interoperability needs form the basis for meaningful dialogue between the DoD's acquisition and planning communities. While this methodology is applicable to many domains and functional areas, for the purposes of this thesis, the focus will be solely on software systems (including systems with embedded software) within the DoD.

KEYWORDS: Software Architectures, Enterprise Architectures, Software Engineering, Interoperability, System Integration, Software Integration

A GENERIC ARCHITECTURE FOR DECEPTION-BASED INTRUSION DETECTION AND RESPONSE SYSTEM

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Today, intrusion detection systems provide for detecting intrusive patterns of interaction. Although the responses of such systems are typically limited to primitive actions, they can be supplemented with deception-based strategies. This thesis proposes a generic software architecture combining intrusion

detection and deceptive response capabilities in a uniform structure. Detecting and responding to attacks are realized via runtime instrumentation of kernel-based modules. The architecture provides for dynamically adjusting system performance to maintain continuity and integrity of both legitimate services and security activities.

KEYWORDS: Computer Security, Intrusion Detection, Intrusion Response, Deception, Software Architecture, Unified Modeling Language