MASTER OF SCIENCE
IN
SOFTWARE ENGINEERING

VALIDATION OF A QUALITY MANAGEMENT METRIC

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The quality of software management in a development program is a major factor in determining the success of a program. The four main areas where a software program manager can affect the outcome of a program are requirements management, estimation/planning management, people management, and risk management. In this thesis a quality management metric (QMM) was used to measure the performance of ten software managers on Department of Defense (DoD) software development programs. Informal verification and validation of the metric compared the QMM score to an overall program success score for the entire program and yielded positive correlation. The results of applying the QMM can be used to characterize the quality of software management and can serve as a template to improve software management performance. Future work includes further refining the QMM, applying the QMM scores to provide feedback and appropriate training to program managers, and using the QMM scores as an input to program cost and schedule estimation methodologies to provide better program estimates.

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: Software Management, Requirements Management, Estimation/Planning Management, Risk Management, People Management, Quality Management Metric (QMM)

EVALUATION OF THE EXTENSIBLE MARKUP LANGUAGE (XML) AS A MEANS FOR ESTABLISHING INTEROPERABILITY BETWEEN HOMOGENEOUS DEPARTMENT OF DEFENSE (DOD) DATABASES

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This thesis evaluates the application of current Extensible Markup Language (XML) tools and technologies toward solving data interoperability issues between legacy data repositories. Past efforts to address these issues have largely failed. XML has the capability to address many of the past problems, but this can only be accomplished when the supporting COTS tools and technologies are available.

The thesis first establishes the underlying issues that need to be addressed. It then evaluates the current state of technologies and COTS products and describes the advantages and disadvantages of each. Finally, it focuses in on the schema for a specific relational database, demonstrates a process by which data exchange can be implemented, and outlines the issues remaining to be solved.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Extensible Markup Language, Interoperability, Database Management, COTS, Database Interoperability

COMMERCIAL-OFF-THE-SHELF (COTS)/LEGACY SYSTEMS INTEGRATION ARCHITECTURAL DESIGN AND ANALYSIS

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The nature of COTS products often falls short of achieving the unique requirements of the Department of Defense (DoD). The focus of this thesis is on the use of distributed component middleware technology within the framework of integrating COTS/Legacy system architecture. One of the main problems facing distributed computing is software component integration. There is no single, standardized framework for achieving component integration. However, technologies such as Common Object Request Broker Architecture (CORBA) and Microsoft's Component Object Model (COM) are emerging as solutions to component integration. These methodologies provide a sort of software communications bus for components, supporting platform and language independency. A case study developed within the Navy Integrated Tactical Environmental System I (NITES I) architecture was used to show the integration and communication of COTS/Legacy software components using distributed component technology. This resulted in a distributed object architecture supporting location, platform, and programming language transparencies.

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: Commercial-off-the-shelf (COTS), Legacy System, Distributed Components, Middleware, Heterogeneous System Integration

A FORMAL MODEL FOR RISK ASSESSMENT IN SOFTWARE PROJECTS

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The current state of the art techniques of risk assessment rely on checklists and human expertise. This constitutes a weak approach because different people could arrive at different conclusions form the same scenario. The difficulty of estimating the duration of projects applying evolutionary software processes adds intricacy to the risk assessment problem. This thesis introduces a formal method to assess the risk and the duration of software projects automatically, based on measurements that can be obtained early in the development process. The method has been designed according to the characteristics of evolutionary software processes, such as efficiency, requirement volatility and complexity. The formal model based on these three indicators estimates the duration and risk of evolutionary software processes. The approach introduces benefits in two fields: a) automation of risk assessment and, b) early estimation methods for evolutionary software processes.

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: Risk Assessment, Formal Models, Software Estimation Models, Software Metrics, Project Management

INTEROPERABILITY AND SECURITY SUPPORT FOR HETEROGENEOUS COTS/GOTS/LEGACY COMPONENT-BASED ARCHITECTURE

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There is a need for Commercial-off-the-shelf (COTS), Government-off-the-shelf (GOTS) and legacy components to interoperate in a secure distributed computing environment in order to facilitate the development of evolving applications.

This thesis researches existing open standards solutions to the distributed component integration problem and proposes an application framework that supports application wrappers and a uniform security policy external to the components. This application framework adopts an Object Request Broker (ORB) standard based on Microsoft Distributed Component Object Model (DCOM). Application wrapper architectures are used to make components conform to the ORB standard. The application framework is shown to operate in a common network architecture.

A portion of the Naval Integrated Tactical Environmental System I (NITES I) is used as a case study to demonstrate the utility of this distributed component integration methodology (DCIM).

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: COTS, GOTS, Application Wrapper, Security Model, Network Architecture, Component Interface, Open Standards

THE SHARP EVOLUTION: DEVELOPMENT OF THE SIERRA HOTEL AVIATION REPORTING PROGRAM FROM THE DECK PLATES

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Due to constant changes in the military environment, operations tempo, resource limitations, and leadership directives, the fashion in which the military computes its training and readiness is constantly in flux. Previous readiness calculations were accomplished from simple two-dimensional models of qualifications by dates. With the increase of more sophisticated requirements, a new six-dimensional model of training and readiness was invented to compute and even predict future readiness levels, for aviation as outlined in the Training and Readiness (T&R) Manual CNAP INST/CNAL INST 3500 Series.

Due to the complex requirements of the new T&R Manual, a software tool was required to track post-flight data and compute aviation combat readiness. The T&R Manual is revised at irregular intervals by independent type wings, resulting in a constant requirement to re-develop existing readiness models and tracking programs. To fulfill this requirement, a team of Naval Aviators with a combination of software engineering expertise, military operations, and project management experience was created to develop a modular based rapid prototype application.

This thesis will review the unique software development models utilized in rapid military application development, contrasting with existing application development models, and the utilization of non-traditional techniques to meet defense readiness requirements. This thesis will also review other readiness tracking systems to compare and contrast the ability to meet the diverse needs of fleet readiness models through efficient software development.

DoD KEY TECHNOLOGY AREAS: Command, Control, and Communications, Computing and Software, Manpower, Personnel, and Training

KEYWORDS: Software Engineering, Combat Readiness, Software Management, COTS, Software Evolution Model