

Raytheon Enterprise Management System Reference Architecture

Abstract

Raytheon/Aurora Space Systems has investigated how the development of these various and diverse Enterprise Management Systems could be coalesced into a flexible set of architectures that could be used to efficiently design future systems. The result of this investigation is the Raytheon EMS Reference Architecture (REMSRA). The REMSRA provides technical descriptions, COTS implementation options, and cost estimation information that can be directly inserted into proposals, engineering change proposals (ECP) and rough order of magnitude (ROM) estimates. The REMSRA describes 16 primary functional capabilities generally required by diverse customer systems including command & control systems, mission planning systems, e-business systems, and others. From these functional definitions, three architectures were developed addressing basic, intermediate, and advanced system needs.

The REMSRA approach has been applied to the Enterprise Management (EM) components of several large commercial and government projects. These projects include Command, Control, and Mission Management of multiple satellite systems and ground stations. The EM subsystem provides system and segment level status to operators at their Mission Management Operation Centers. The EM subsystems utilize the REMSRA during the proposal phase to create technical descriptions, cost estimates, architecture suggestions, trade study data, and basic EMS functional information. The EM subsystem provides a consolidated console for depicting applications status, control, and reporting – in addition to trending of critical services, interfaces, and equipment. The EM subsystem is implemented in varying levels. At the lowest level, EM performs the role of monitoring hardware, operating system, and application status of each critical computational system in the entire project. At the segment level, the EM subsystem logs all activity to disk and generates periodic reports as well as supports ad-hoc queries for performance and failure anomaly resolution. At the system level, EM displays end-to-end processing of the stored mission data and status of the communications network. In addition, The EM subsystem provides integration with a work request system and various web services.

Introduction

- Implemented as a Suite of Standards-Based COTS Products
 - Flexible and Extensible
 - Component Based Development
 - Components are easily upgraded or replaced to provide incremental improvements in capability
 - Allows infusion of new technology when proven
 - Custom Code / "Glueware" minimized
- Enterprise Management Architecture can be distributed to support management oversight of multiple locations
- Multi-layer information displays provide increasing levels of detail to satisfy specific user needs
- Alarm / Event notification provides the capability for proactive vs reactive management of the data processing environment

Methods

The approach taken in developing the Raytheon Enterprise Management System Reference Architecture:

1. Determine source programs / projects / proposals to be considered for defining required EMS functionality
2. Assemble available Functional Requirement Specifications (FRS) and Concept of Operations (CONOPS) documents
3. Determine combined list of functions / services for EMS model from the source projects
4. Identify Commercial-Off-The-Shelf (COTS) / Government-Off-The-Shelf (GOTS) / Custom tools available for each function / service area
5. Develop one or more overall architectures from the "piece parts" (Functional and physical)
6. Develop cost model including Other Direct Charges (ODC) and Labor (Development, Deployment, and Operations & Maintenance (O&M))
7. Document / summarize results
8. Apply / integrate architecture into program design & development phases.

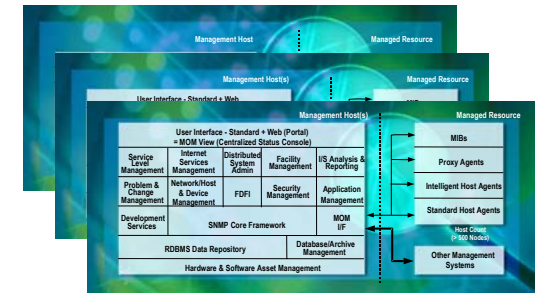
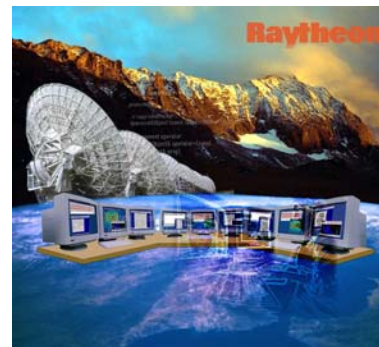
S. Norton, S.J. Smith
Raytheon Company/Aurora Space Systems, Aurora, CO

Results

Raytheon Enterprise Management System Reference Architecture Artifacts:

1. **Functions & Definitions:** Functions can be divided into two primary categories: On-line and Off-line. On-line functions provide near-real-time management of specific operational resources. Off-line functions support planning, analysis, and support functions that are less time critical.
2. **Functional Architectures:** Three functional architectures are available. Basic EMS provides infrastructure monitoring. Intermediate EMS provides monitoring and management functionality. Advanced EMS provides end-to-end monitoring and management functionality.
3. **Commercial Off The Shelf (COTS) Products:** The Enterprise Management product marketplace was surveyed for the latest COTS technology that could be used to satisfy the functionality required for a complete Enterprise Management system solution. In addition, current Raytheon program areas were surveyed to determine the products currently in use and the level of satisfaction with these products within Raytheon program areas.
4. **Cost Model:** Two types of labor models are available for EMS: 1) Development / Implementation Labor Model and 2) O&M Model. The generation of these models is based on the Engineering Computing (EC) Cost Models. These cost models are based on actual hours from numerous programs and use COTS product count, host count, and

network connection count as independent variables.



Conclusions

The Raytheon Enterprise Management System (EMS) Reference Architecture defines and documents the artifacts for all stages of a project – from the proposal phase through the development phase.

Various Raytheon proposals and programs have implemented this architecture and have experienced the following benefits:

1. Knowledge gained from legacy and current efforts in a common repository
2. Functional and Physical architecture diagrams for multiple degrees / levels of Enterprise Management functionality
3. Basis Of Estimates – products, prices, labor charges, & documentation that can be easily input into proposals and Engineering Change Proposals