

Steam XML Case Study



Application: Rapid Modeling and Simulation

Radar Resource Manager – Teledyne Brown Engineering

Teledyne Brown Engineering (TBE), the company that created one of the most widely used military simulations in the world, the Extended Air Defense Simulation Model (EADSIM), set out to provide a framework for analyzing and understanding some of the complex modules involved in the E-10A radar system using simulation and modeling.

The U.S. Air Force E-10A Multi-Sensor Command and Control Aircraft (MC2A) will bring together an unprecedented fusion of comprehensive intelligence data with an integrated mission execution capability. In their analysis, TBE specifically concentrated on the E-10A radar resource scheduling requirements.

Opportunity And Challenge Of Advanced Radar Capabilities

Advanced radar capabilities, such as those associated with the E-10A, significantly expand the type and number of sensor tasks that can be successfully completed within a given timeframe. Typical radar tasks can include synthetic aperture (SAR) for ground targets and wide-area search (WAS) and sector search modes for both ground and air targets.

The challenge posed by expanded radar capabilities is to optimize the utilization of available radar resources through finely tuned algorithms so that as many tasks as possible can be completed in the time available. Allocation of resources drives the type, quality and quantity of battlespace information that a sensor can collect and directly impacts the radar system's ability to complete operational tasks. Whereas in the past, humans would freely interact with radar task scheduling, task prioritization must now take place at speeds that make human intervention problematic.

TBE developed the Radar Resource Management (RRM) Model to better understand trade-offs involved in prioritizing and optimizing radar tasks. The RRM allows implementation of varied scheduling schemes and can capture key performance metrics for evaluation. The model helps test overall radar capabilities under various concepts of operations (CONOPS) and evaluates scheduling algorithm efficiency and effectiveness.

Complicating Factors In The Simulation

Simulation of MC2A radar systems can be especially complex because of the range of complicated sensor tasks, the number and variety of targets and the number of different sensor and target timelines. The RRM must handle all these complex factors and still return a prioritized set of radar functions that can be executed before any of the targeted objects, which the radar is observing, reach their destinations.

Radar Resource Manager Model Implementation

The RRM was developed using a combination of C++ and Steam XML. The Extended Air Defense Simulation Model (EADSIM) is used to provide the theater-wide scenarios of terrain, targets and assets. Unconstrained sensor and truth target data is fed over a High Level Architecture (HLA) link into the EADSIM C++ Federate, which converts the unconstrained data into the data that would more typically be observed in the battle environment as constrained by battlefield equipment, intervening terrain and practical time limits. The results of the RRM simulations were fed back into EADSIM to dynamically develop the scenarios.

The Benefits Of Steam XML In The RRM

The use of Steam XML enabled rapid implementation of the RRM scheduling algorithm. The TBE team initially built subsets of the algorithms, which could be rapidly tested and enhanced. Because Steam XML is based on Water, an interpreted language, it was simple and quick to make changes to the algorithm based on the results of early simulations. The outputs could be verified and validated as the effort progressed, rather than waiting until the final implementation was complete

The built-in XML and Web services capabilities of Steam XML made it easy to implement the algorithm simulation as a Web service. This provided a flexible means to integrate the algorithm simulator into the overall model as well as make it available to other models.

As the RRM simulations grew more complicated, it was easy to build a framework to simulate the processing of the radar tasks with Steam XML. Even the Steam XML IDE itself was easily customized and extended to provide a domain-specific environment for the RRM simulator

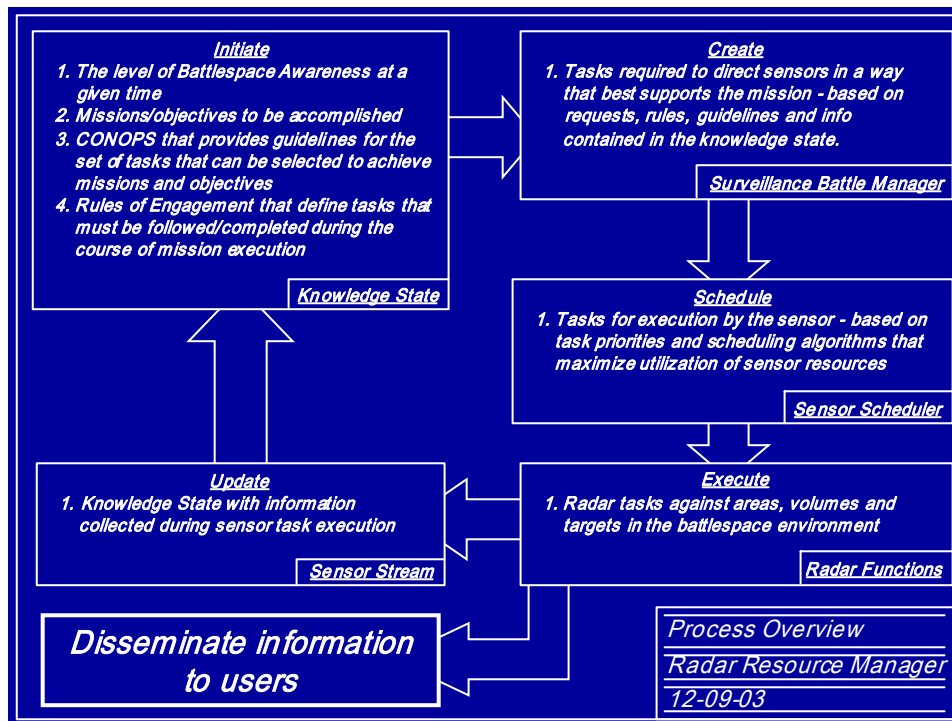


Figure 1 Functional diagram of the Radar Resource Manager

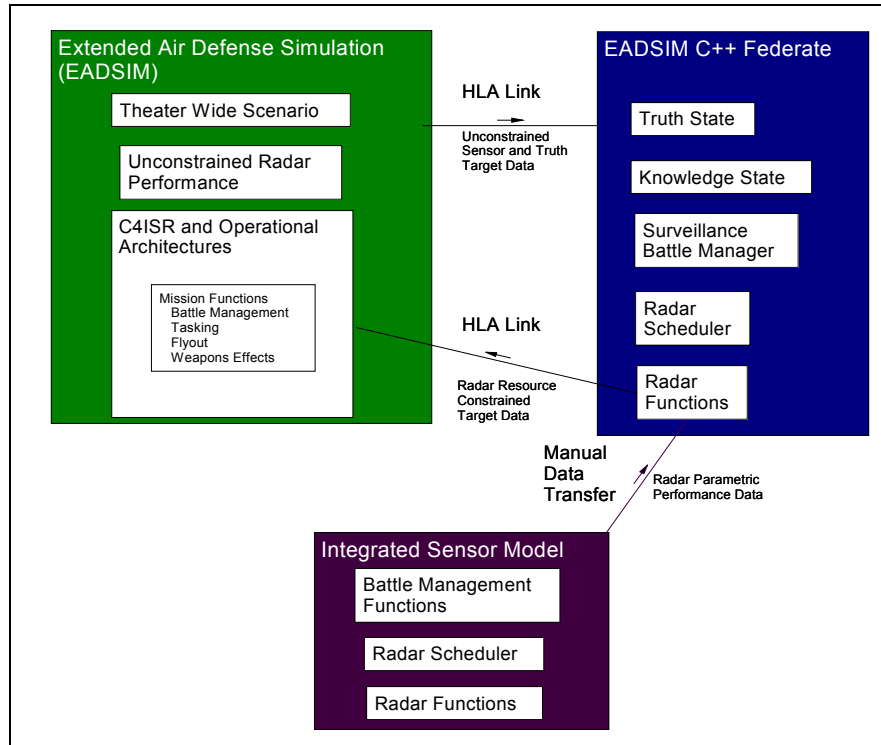


Figure 2 Present Radar Resource Manager Model implementation

Future RRM Plans

The design of the RRM is flexible enough to be used for testing other sensor platforms, beyond the E-10A. Other factors can be easily introduced, such as the effects of scheduling for a constellation of sensor platforms. Scheduling algorithms are modularized, so new algorithms can be rapidly brought into the model and tested. Finally, the software has been designed to be system platform independent. Therefore, as the simulation grows and requires more computing power, it can be run on higher performance hardware that becomes available.

Teledyne Brown Engineering and the Extended Air Defense Simulation Model (EADSIM)

The Extended Air Defense Simulation Model (EADSIM) designed by Teledyne Brown Engineering simulates complex air, missile, and space warfare. Written in C, it was first deployed in 1989. It is the most mature and widely used force-on-force model, with over 400 user agencies worldwide. EADSIM provides analysis, training, and operational planning to the warfighter in one package.

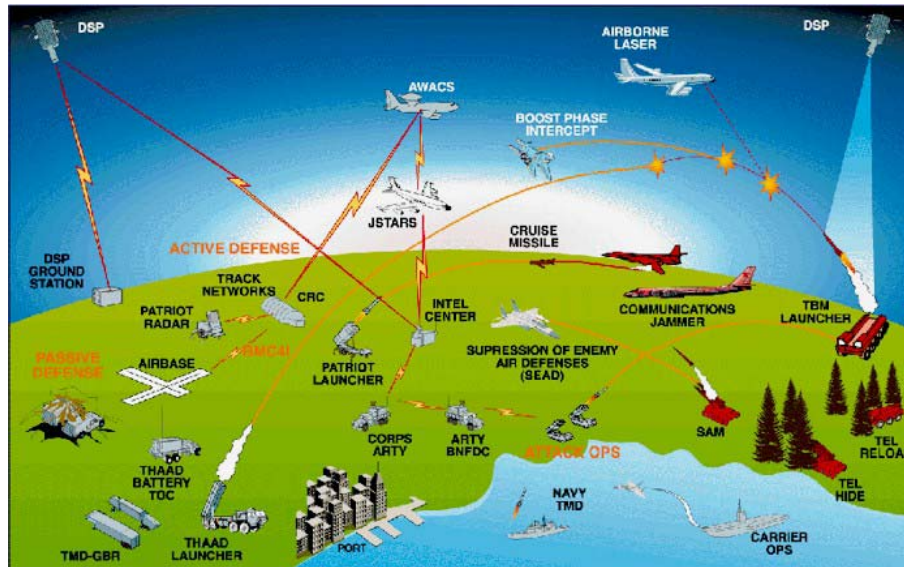


Figure 3 EADSIM Combat Model

Teledyne Brown's capabilities are currently being applied to future launch vehicles, microgravity science, international WMD threat reduction, cyber security software, and control of space. Their efforts to assist the Homeland Security Agency include designing an Emergency Response Vehicle with a WaterSabre™ fluid cutting system, software for the congressionally-mandated Consequence Management system, and a mobile detonation chamber for safely depositing of explosives.

Clear Methods Steam XML

The Steam XML IDE™ is an interactive development environment that includes a comprehensive toolset for the Steam XML platform. It provides an environment to write, run, and debug Water language programs. The Steam XML IDE expression stepper provides much greater programmer guidance than the typical line-by-line steppers of other IDEs. The Steam XML IDE Professional Edition also provides a customizable menu for inserting common patterns, a one-click test case generator, integrated documentation tools, a powerful object inspector, and an online reference manual. The resulting high productivity environment caters to the Extreme Programming style with its rapid edit, run, and debug cycles.

About Clear Methods

Clear Methods provides enterprises and independent software vendors with an advanced Web services platform that dramatically speeds the creation of flexible business software. The Clear Methods Steam XML product is a pure Web services environment that enables the use of XML throughout the software lifecycle. Steam XML provides a compact, uniform, standards-based commercial product set for the open Water language.

Founded in 2001, Clear Methods is headquartered in Cambridge, Massachusetts. Customers include Teledyne Brown Engineering, General Dynamics, MIT, Pratt and Whitney, Northrop Grumman, MITRE, and the US Air Force. Steam XML applications include simplified XML Web services, system and network modeling and simulation, and rapid prototyping.

Contacts

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