Web Enabling HLA Compliant Simulations to Support Network Centric Applications

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ABSTRACT: The Extensible Modeling and Simulation Framework (XMSF) is defined as a modeling-&-simulation-tailored set of self-consistent standards, processes and practices employing a set of web-based technologies and services to enable a new generation of Internet-distributed applications to emerge, develop and interoperate. One of the earliest XMSF uses web services to web enable the Defense Modeling & Simulation Office (DMSO)/SAIC High Level Architecture (HLA) Runtime Infrastructure (RTI) enabling communication between federates in an existing federation. As a result, existing federates and federations can be web enabled rapidly, in some cases just by relinking the federate with the Web Enabled RTI libraries instead of the standard RTI libraries. The resulting federate connects to a web server over the Internet, communicating with a federation that is unaware that the federate is not local. The Web Enabled RTI is an excellent example of the application of web technologies to the problem of making modeling and simulation capabilities available in a network centric environment, supporting the operational warfighter with network centric modeling and simulation tools.

We formatted the required RTI calls via the Simple Object Access Protocol (SOAP) employing the Blocks Extensible Exchange Protocol (BEEP) communication layer to enable bi-directional calls and call backs via the DMSO/SAIC RTI. This approach encapsulates non-reentrant RTI libraries, permitting multiple instances of the federate Web Service to run in the same server. It also overcomes http’s shortcoming of requiring unidirectional service initiation, a shortcoming that makes it unsuitable for supporting simulation communication patterns. This approach enables existing HLA compliant federates to be integrated easily over the Internet, including through most firewalls with minimal reconfiguration, significantly enabling composability of repository-based simulations.

The Web Enabled RTI has already been applied in three federations:

- The Defense Threat Reduction Agency’s (DTRA) existing Weapons of Mass Destruction Operational Analysis federation
- An integrated HLA-Advanced Distributed Learning (ADL) circuit design training application
- The XMSF Distributed Continuous Experimentation Environment (DCEE) Viewer that participated in JFCOM J9’s initial DCEE integration event

As has been demonstrated in the past, each of these federations can be run on a LAN. However, the implications of running these and other federations via web services are enormous. A legacy simulation may be made available without moving its dedicated hardware or trying to create a new installation on potentially rare hardware, both very expensive propositions. The simulation can stay home based with its technical support and configuration management. There’s no switching between supporting different federations at different times. The positive impact on lifecycle costs and availability can be significant.

To date we have implemented all of the HLA services in the Web Enabled RTI. This effort demonstrated that the current specification is not perfectly suited to web enabling, especially the Data Distribution Management (DDM) services. However, we have demonstrated that all the services are implementable with little or no support from the RTI.
In this paper we describe the web technology standards, data standards, and process used to produce the web enabled RTI, and our successes with employing it in federations. We also describe our ongoing efforts to add security mechanisms to the Web Enabled RTI. Security mechanisms were not an original feature of the HLA, although significant analysis of the problem was performed. Our current work with the Web Enabled RTI includes the addition of identification and authentication mechanisms based on web standard technology. Integration of these mechanisms will allow users to connect to unclassified federations over the Internet via a web browser or lightweight client.