XMSF Position Paper

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Background

Vcom3D, Inc., develops technologies, products, and solutions for simulation-based training. In this role, we operate in several domains governed by multiple standards organizations. Our background may be different than that of others attending the XMSF Workgroup, in that the majority of our projects have been developed for non-military applications, including K-12, law enforcement, and corporate training. Our content is Web-based, and conforms to the Advanced Distributed Learning (ADL) Shareable Content Object Reference Model (SCORM) suite of specifications. The SCORM, which is supported by scores of e-Learning technology and content providers, specifies requirements for Shareable Content Objects (SCOs) that use a common Learning Management System (LMS) interface, as well as standard XML metadata, and an aggregation model.

More recently, Vcom3D has been involved in the development of simulation-based training for military, homeland defense, and law enforcement training. Our approach has been to repurpose simulation data, especially synthetic environments, for integration into SCORM-conformant courses. Our thoughts on what constitute the opportunities and issues for XMSF are driven in large part by these experiences.

Simulation-based Training Example

A recent Proof-of-Concept demonstration that we developed under a Small Business Innovation Research (SBIR) contract to the US Army STRICOM serves to illustrate how we view Opportunities, Current State of the Art, and Open Problems related to Web-based training simulations. For this demonstration, Vcom3D integrated standards from several domains:

- Using OpenWorlds' ™ **Extensible 3D (X3D)** Simulation Engine, new nodes were added to incorporate behaviors and visual attributes commonly found in Modeling and Simulation environments, but not built into Web3D standards.

- We converted complex Synthetic Environments and Models, originally developed for such applications as Close Combat Tactics Training (CCTT) and Military Operations in Urban Terrain (MOUT), from **Synthetic Environment Data Representation and Interchange Specifications (SEDRIS)** transmittals to the extended X3D representation.

- Using the converted Synthetic Environments and models, as well as several, interchangeable **Humanoid Animation (H-Anim)** characters as 3D components, we composed a simple training scenario.

- Using **Speech Application Programmer's Interface XML (SAPI-XML) Markup**, as well as our own XML-based character animation markup, we authored interchangeable behaviors for the H-Anim characters.

- Using the **ADL Shareable Content Object Reference Model (SCORM)** API and Metadata, we developed a reusable Learning Object, with environments, vehicle, and human models embedded into a training simulation that could be hosted by any SCORM-conformant Learning Management System.

Overall, this prototype development was very successful. X3D's XML syntax and extensibility allowed us to leverage the infrastructure of commercial e-Learning platforms to create highly reusable and modifiable simulations that run in pervasive Web environments. On the other hand, in order to achieve this, we had to perform numerous conversions; and, although we were able to create content that performed well in the Web environment, the Web standards we used (X3D, SCORM, and H-Anim) were not sufficiently specific so as to enforce reusability at the constituent modeling and simulation (M&S) component level.

Key Opportunities for Web-based Modeling and Simulation

A recent study by Sam Adkins for Brandon-Hall [Adkins 2002] indicates that the market for Simulation-based Learning is poised to grow at a staggering rate over the next decade: from $300 million in 2002 to $6.1 billion in 2006 and $37 billion in 2011. According to this and other reports, corporate training and other commercial applications will grow to dominate the market. Although some of the applications, such as "call center simulations", will be far removed from the requirements of military modeling and simulation, many will not. Simulations will include interactive, 3D visualizations of products, processes, environments, and virtual humans. The growth of this segment of the training market will spur the development of new commercial tools for authoring, managing, and delivering this training content.

Corporate, civil government, military, and academic e-learning have all embraced the standards of the Web and of the ADL initiative. Scores of companies offer SCORM-conformant Authoring Tools, Learning Management Systems, Content Management Systems, and instructional content. As the ADL standards grow to cover the requirements for reusing simulation-based training, there is an opportunity for the modeling and simulation community to benefit from these reusability standards, as well as the commercial tools and technologies that are developed to support them. The risk is that this opportunity will be allowed to slip by, and the modeling and simulation community will not be able to benefit from the commercial tools being developed to serve this market.

Key Open Problems

As a commercial organization providing Web-based learning, we tend to focus on the current shortcomings of the standards on which our own technology is built: ADL SCORM, X3D, and H-Anim.

Standards for Reusable, Web-based Simulation Components

We have demonstrated that X3D can be readily integrated into SCORM-conformant e-Learning. However, by themselves, the current X3D profiles do not enforce many of the requirements needed to build repositories of reusable simulation components. Additional requirements include:

- Standards for 3D component metadata: description, available behaviors, usage restrictions, and methods for aggregation. This is imperative in order to support the development of commercial and government repositories of reusable content. (The SCORM resource metadata provides a good starting point for this, but does not consider the specific needs of simulation components.)

- Standards for aggregating 3D components, including both geometry and behavior, into larger simulations. (The X3D PROTO provides a starting point for this.)

- An X3D profile that includes the most common elements of M&S synthetic environments as standardized, built-in nodes. (Layering and advanced texturing are examples of content that can be readily interchanged in SEDRIS, but cannot be rendered using built-in X3D nodes.)

- Standards for interchanging higher-level behaviors. For example, in human animation, there is a need for common descriptions of higher-level behaviors (e.g., "point at", "walk to", "look at") than are currently defined by the H-Anim standard.

Specific Recommendations

Our initial recommendations focus on establishing groups to develop exemplar scenarios, and to provide liaisons between the several standards organizations driving reuse and interoperability in the Web-based modeling and simulation community. These include:

Joint Industry/Government/Academic Working Group(s) to Develop Exemplar Scenarios

The best way to work out the requirements of a Web-based, Extensible Modeling and Simulation Framework is through the development of exemplar scenarios, involving technologies provided by collaborating organizations. Within the scope of our funding and resources, we will be glad to participate in such collaborations. Capabilities we can offer include developmental authoring tools, conversion tools, and our X3D Simulation Engine.

__Liaisons and/or Working Groups Spanning Multiple Standards Organizations__

Examples of liaisons or cross-standards working groups that can further the aims of XMSF include:

- Advanced Distributed Learning / Web 3D Consortium: Develop Metadata Standards for Reuse and Aggregation of 3D Components

- Modeling and Simulation / Web 3D Consortium: Develop components, or possibly an "M&S profile" of the X3D specification that serve the needs of high-performance modeling and simulation.

Due to its breadth, the XMSF initiative may find that an effective way to establish standards necessary for interoperability is to use a model similar to that of the ADL initiative… Rather than develop a new body of specifications, ADL works closely with other groups, including IEEE, IMS, and AICC, to define a collection of specifications that together insure interoperability of ADL learning objects.

References

[Adkins 2002] Sam S. Adkins, The 2002 U.S. Market for E-Learning Simluation: The Shape of the Next Generation E-Learning Market, Brandon-Hall, 2002.