Content Migration between 3D Online Learning Environments

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Abstract: Early adopters are beginning to embrace 3D online educational environments. However, the next level of adoption will require something more than custom solutions geared toward specific applications. The next generation of educational 3D online environments has to support content interoperability and/or content migration. For 3D environments to become mainstream, later adopters will require forms of protection in their content investment. What form this will take is unclear, but a standard or standards for information and content sharing between 3D online educational environments will be appealing to this next level of adoption as a mechanism to reduce anxiety in the technology.

Introduction

Gone are many of the barriers that have hindered the deployment of 3D online learning environments in educational settings (Jones, 2004). For example, over 90% of students at the University of North Texas who use the Created Realities Group’s java-based 3D online learning environment have the necessary computer components (3D graphics adapter, Internet connection, fast computer) for successful first-time use in their course (CRG, 2002; Jones, Morales, & Knezek, in press). Technology issues in the U.S. are no longer a primary concern for the introduction of this type of delivery infrastructure. Early adopters at the departmental and program levels within schools are seeing the value of 3D online learning environments. However, before wide-scale acceptance at the institutional level will be achieved, the barrier of cost as it relates to the creation, maintenance, and reuse of 3D content must be addressed.

Post-secondary schools in the U.S. have realized the real costs associated with the ongoing maintenance of web-based course content (Parks, 2004). With more than 66,000 fully online courses as of April 2003, 90% of which are based in the U.S. or Canada (Paulsen, 2003), post-secondary schools that might be interested in 3D online learning environments are facing ever growing costs to maintain their commitment to existing and growing web-based course content. With the investment in web-based delivery technology, cost-conscience schools examine closely all costs related to new delivery methodologies. While the advantages of 3D online environments have been shown in educational research, a viable case related to cost of implementation and deployment is not as clearly defined. Without the issue of ongoing costs being adequately explained, schools will be hesitant to implement any new course delivery methodology at the institutional level.
While the cost of tools and expertise to build and maintain 3D environments and related scripting/interactions is decreasing each year, the issue of updating or moving existing content between platforms is still very much in flux. When speaking to schools about using 3D online technology, a common question is “What will be the cost of content migration as this technology rapidly changes in the coming years?” This is a question school administrators know how to answer from their experiences with web-based delivery and look for an answer from 3D environments. This paper will examine the issue of content migration at the 3D content and interaction/scripting levels that might be the first answers to these administrators.

3D Content Migration

3D content in the context of this paper, is defined as those objects and resources that make up the physical 3D environment. These objects include geometry, textures, lighting, and other information that make up the environment (i.e. avatars, buildings, benches, lamp posts, etc). 3D content exchange has the easiest path for migration at the object level. Migration can occur at higher orders of grouping, but depends on many different technical and architectural issues of the platform being moved onto. Different technology methods present and group objects in different ways that can hinder migration when working with higher order groups. Depending on the path of migration, a school might be able to move environments easily between systems or might have to reconstitute the environment from lower level object construction. It is recommended by the author that schools beginning 3D content creation keep the original content generated by the development tool (i.e. Maya, StudioMax, TrueSpace, etc) rather than depend on migration from objects and environments imported into the delivery application.

There are three standards now available to help with 3D content migration. They are VRML, X3D, and recently introduced at the ACM SIG-GRAPH 2004 conference, COLLADA. Each provides slightly different functionality. Developers will need to watch carefully X3D and COLLADA to see which of these will be the most widely adopted by industry in the coming years. All three of the standards provide a way to encapsulate 3D information of objects(s) into a common text format for distribution between applications.

VRML

The Virtual Reality Modeling Language (VRML) is a file format for describing interactive 3D objects and worlds (VRML, 1997). VRML was established in 1994 as a way to transport 3D visuals across the web. In 1997, VRML version 2 was introduced and became an IEEE standard. VRML exporters and importers can be found in just about every design tool used today. However, the early promise of VRML has waned. Justin Couch, an early participant in the VRML development process, states the following in a message posted to the VRML list “… VRML is [has become] a static geometry format. It gets loaded into a 3D application and the 3D code is custom written. We're not using VRML for the VR part. To us, and to most others it might as well be a 3D geometry markup language like ChromeEffects (Couch, 1998).” While VRML is still widely used, the focus has moved on to newer standards of X3D and COLLADA.
X3D

In 2001, the Web3D Consortium launched the X3D (Extensible 3D) open standard as a successor to VRML (Daly, 2002). X3D is a powerful and extensible open file format standard for 3D visual effects, behavioral modeling and interaction (Web3D Consortium, 2004b). It moved beyond VRML 1 and 2 to provide an XML-encoded scene graph and a language-neutral scene authoring interface (SAI). Both of these features provide more advanced capabilities than were provided for in either VRML 1 or 2. One feature that is missing in VRML and X3D is the ability to support a binary format. XML provides several attractive features, but the process of textually encoding information for transmission is inherently slow and can generate considerable overhead, especially for large data transmissions (Pelegri-Llopart, 2004). There has been much discussion in various groups about creating a binary form of XML over the past few years, with the Web3D Consortium and Sun Microsystems recently announcing that they have created a X3D binary format working group to develop an encoding process for X3D to enable advanced compression of 3D data (Web3D Consortium, 2004a). It will be interesting to see how this working group progresses in the coming years. As an example of the importance of this issue, Created Realities Group uses XML formats to store information within the client and server contexts, but does not use text-based XML in the transmission stream because of the need to maintain the minimum amount of bandwidth to users. X3D does have the advantage over COLLADA of working toward standardizing the information interchange at the transmission level.

COLLADA

During the 2004 ACM SIG-GRAHP conference, Alias, Discreet, Softimage, and Sony Computer Entertainment introduced a new interchange file format for interactive 3D applications (Sony, 2004). COLLAborative Design Activity (COLLADA) brings industry leading companies together supporting a new standard. Several solutions exist to transport data from one Digital Content Creation (DCC) tool to another, but none of them have been widely adopted. For example, most studios and game design houses develop their own tools to support internal content exchange between applications and platforms. The industry participants see there is a need for a standard format to provide information interchange between their applications. It is hoped that COLLADA will better streamline the content pipeline. As is pointed out by the developers of COLLADA, the standard provides “a neutral zone where it becomes possible for competitors to work together in the design of an interchange file format. This creates a new paradigm in which the format is supported directly by the DCC vendors. Each of them writes and supports their implementation of COLLADA importer and exporter from their tools (Sony, 2004).” Unlike X3D, COLLADA is focused on moving information between applications. What makes COLLADA possibly a more powerful standard are the participants involved in its creation.

Interactions and Scripting Migration

A more complicated issue to be resolved is the migration of interactions and scripting. Creating a 3D online environment consists of modeling the environment (objects, textures, relationships) and then specifying interactions and behaviors of elements within the environment. These programmed interactions take a static 3D environment and make it a dynamic system that can support situated learning and simulations. The programming also represents an additional
investment in development that takes the 3D content and makes it into something much more than atmosphere that helps with immersion. The difficulty with migration of this programming between platforms is due in most part to the custom nature of the current generation of 3D online environment. Each 3D online environment has developed procedures that control these interactions and is most times closely tied to the concept and technology implementation of the application.

Migration of the programmed interactions will become less of a problem as commercial engines and middleware approaches gradually replace custom development. With more standardized tools will come the emergence of agreed upon authoring tools that will allow novices the same ability as experts to specify interaction in these 3D online environments (Hendricks, Marsden, & Blake, 2003). This emergence of future authoring tools will resolve the issue of migrating interactions and at the same time reduce the cost of 3D environment content development and maintenance.

Conclusion

While there are now several standards for 3D data content interchange, there is still a lack of information exchange for interactions and scripting. This last migration issue will be solved as the 3D online environment market grows beyond entertainment into education, training, and commerce. The growth of the technology into new markets will expand the demand for tools that at the same time will reduce the cost of content creation and maintenance. This will see common authoring tools emerge that will streamline the content creation process for 3D online environments. In the end, there will be a simple and obvious answer to the administrator and concerning questions on cost of content creation and maintenance. For now, the question is more difficult to answer, and as a result, 3D online environments will be primarily adopted schools that see the true advantages of the technology and are willing to live with the pain of content migration as early adopters.
References: