

The Future of Virtual Worlds and NASA's Role

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On Tuesday, August 7th, NASA CoLab coordinated an on-line, in-world discussion about the future of virtual environments, and the role NASA could play in it. We discussed high level visions of where virtual environments are going, features, and architecture, and then how this specifically applied to NASA and space exploration.

The discussion focused mostly on high level architectural issues, but contained various specific feature requests as well. These are of note more because they are becoming fairly standard than because they are new or unheard of. There was a strong sentiment that more sophisticated content creation ability was needed, both through existing tools and in-world, while maintaining the collaborative nature of virtual environments. Platforms robust and flexible enough to support large numbers of people with varying types of hardware was highlighted. Beyond that, the discussion really highlighted a need for virtual environments not to re-invent what was already out there, but to work with those technologies and seamlessly integrate them. Secure environments, multimedia support, geo-referenced information, messaging, and good search tools were all mentioned.

<Architecture>

The strongest messages that came out of the discussions was the absolute requirement for an underlying architecture for virtual environments and immersive 3D experiences that is independent of the content or browser technology used. This would underpin all 3D content on the web, and allow it to seamlessly integrate with online technologies that exist today.

The second message was that we require the capability to access that architecture is a variety of customized ways-- from "light" or "mini" world experiences to full blown standalone applications and games. An analog can be made with the current 2D web of today. We have an underlying architecture that is common to the entire Internet, and yet our uses and methods of accessing that architecture vary from mobile devices with limited content types, to full blown browser experiences, and everything in between.

In order to achieve a full spectrum of ways to access virtual content and environments, the concept of 'plugins' and the utility of flexible content definition types such as XML were noted. Leveraging microformat specifications to ease the integration and usability of 3D content on the existing web was highlighted as well. Together with plugin-type browsing experiences and extensions to existing web browsers, these technologies could allow a spectrum of virtual environment experiences to be made available to the broad public more quickly (because they are smaller and simpler to implement), while putting existing standards and frameworks to the test in manageable, discrete scenarios, and thus helping to push the envelope of what the standards and frameworks are capable of.

Working on so-called "lighter" virtual world experiences would help NASA to achieve short term wins in the area of virtual environments, demonstrating their value in concrete ways while catalyzing innovation

partially as a result of multiple implementations. Short-term wins are always important to organizations with large constituents and fluid funding. This kind of activity could also contribute to the eventual unification of these experiences into a single coherent architecture, with tested and refined components.

Today, virtual environments are typically standalone applications, and sit in the application layer (Second Life is an example of this). They are generally developed by a company or organization and, for the most part, users connect via the Internet to resources on a remote server and interact using capabilities unique to that application. Because these applications are standalone environments, there isn't the same kind of incentive to develop interoperability with existing languages and specifications as we might otherwise see. There will always be a place for standalone applications, but integrated virtual content is of particular relevance to NASA because of its strong interest in short-term value demonstration, and the desire to build application-agnostic toolsets and processes, ensuring NASA content has a place in all virtual environments of the future.

Thus, a major difference with these light or plugin-type virtual world experiences is that they could build on and be a part of the existing Internet, rather than be a layer that sits on top of the Internet. This would allow virtual environments to take advantage of and ensure smooth interoperability with existing web technologies.

<Trends>

Important trends surrounding the rise of rich content mobile devices, the miniaturization of sensors, and the mashup of physical and virtual worlds were pointed out as particularly relevant to virtual environments, as well as NASA's work. For example, as sensors get smaller, lighter, and cheaper, they will be deployed more frequently in our physical environment, and receivers for the information they convey will be integrated into small devices of all kinds-- of which mobile phone are simply the most widely and heavily used example. Those same sensors will be able to support increasingly fine grained data collection on other planets, and with all variety of devices ready to receive that information on Earth, the potential for outreach, science, transparency, and training grows exponentially.

Imagine the ability to integrate 3D content into multi-purpose, Internet-enabled applications in much the same way you could create a table or a bulleted list with HTML. This scenario highlights another important and relevant trend in online technologies-- that of microformats. The microformat movement is working to define a variety of types of atomic pieces of content, so that it is more easily identified in either machine or human form. It can then be integrated, re-mixed, or simply recognized and used appropriately in applications beyond the ones they were initially deployed in. Microformats support a move to a network experience less defined by the application you are running or page you are viewing, and more defined by the content itself. And they give all the more reason to integrate virtual content into existing web experiences, since when defined properly that content will still be "lossless-ly" reusable across the spectrum.

<Priorities>

As the one of the largest generators of data in the world, NASA also has a unique opportunity to bridge the worlds of standards development with implementation. Important work is happening on the standards front with respect to 3D content rendering, geographic data formats, and browser features; however, no one seems to have yet taken the specifications on offer and applied them to large amounts of data in an application agnostic way. Applications like Google Earth and NASA World Wind are making important strides in this direction, but neither are really a virtual world per se.

There was a broad sense that in order to support these activities, open and common network standards, languages, and interoperability practices need to be identified, implemented, actively supported, and evolved. It was pointed out that, correspondingly, an open architecture is likely an optimal framework for pursuing these goals, as well as for building a strong community of developers around a common platform, keeping efforts unified, and minimizing dependence of said efforts on any one single entity.

Consequently, the discussion suggested that NASA's priorities should lie in developing a) generic tools for content generation and visualization, and b) streamlined processes for getting massive quantities of that content into virtual environments. In the process, innovation is guaranteed to occur at the margins, which can in turn feed back into the standards process and help to advance state of the art in this area.

The immediate step recommended in support of this direction was to do a survey of existing virtual environments' features, architectures, and implementations. NASA should compile an assessment of these features along with a more detailed analysis of desired future virtual world architecture and feature sets, how they relate to where we are today, and an implementation path to support the desired outcome. By better understanding the state of the art today, NASA can assess the possibility space for next steps and optimize its contributions.

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