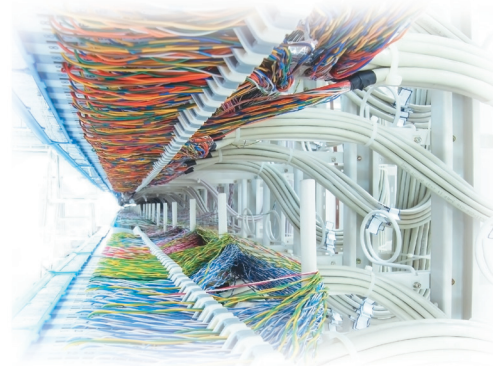


Is 3D Finally Ready for the Web?

➔ Sixto Ortiz Jr.



3D content still is not widely found on the Web. Now, though, several new technologies may widen 3D's presence on the Web by transforming browsers into computing platforms powerful enough to play the content.

From its humble beginnings as a point-and-click environment, today's Web is a dazzling collection of pages filled with all types of applications for both entertainment and productivity.

Users can accomplish many tasks on today's Web, from purchasing products to interacting in real-time with users throughout the world.

However, one key element has yet to make its mark on the Web: 3D.

Today, 3D is primarily used online in applications such as games and virtual worlds, which are rendered using powerful computers and specialized software.

However, businesses, engineering firms, and other users also want the realism and additional detail that 3D adds, noted D.J. Edgerton, CEO and cofounder of Zemoga, a graphics design and marketing firm.

Users want their browser-based experiences to be more like those they have on a PC.

Consumers are becoming more accustomed to 3D content because of the use of the technology in movies, videogames, and other types of entertainment, said David Laubner, director of product marketing at Dassault Systèmes' 3DVIA, a vendor of 3D development tools.

There is thus demand for more and easier-to-access 3D content on the Web, said Antonio Collier, founder and CEO of Vzillion, which designs virtual environments.

And the better the browser experience, the more potential revenue that online content could generate for providers and others.

However, 3D on the Web remains primitive today because the complex technology has been difficult to use with typical PCs and browsers, said David Gardner, founder and CEO of the Venue Network, which developed the VenueGen 3D Web-based conferencing application.

In fact, browsers generally cannot natively run complex 3D content or offer either high frame rates or full-screen graphics, noted Joshua Smith, chief technology officer and cofounder of Kaon Interactive, a company that creates and develops interactive 3D product models.

Including 3D in real-time collaboration programs and other applications complicates already complex development processes, he added.

Now, though, several organizations are working on technologies that may finally widen 3D's presence on the Web by transforming browsers into more powerful computing platforms

that can deliver a PC-like experience, including the playing of 3D content.

This would enable applications such as product modeling, presentation, and configuration; 3D online meetings and worker collaboration; the simulation of processes such as surgery or mechanical procedures; virtual tours; and augmented reality.

Nonetheless, 3D on the Web will have to clear some obstacles before the technology can become reliable and mainstream.

3D on the web

The early Web ran without graphics, but that changed when the US National Center for Supercomputing Applications released Mosaic—the first browser able to display images along with text—in 1993.

There have been several technologies for 3D on the Web that basically work the same but use different file formats.

VRML and X3D

3D on the Web began when the VRML Consortium released the Virtual Reality Markup Language in 1994.

However, VRML never really caught on because it let developers write only 3D content, said Kaon's Smith.

To create full, compelling applications, he explained, developers must be able to write 3D, 2D, video, and audio content together.

Also, VRML appeared well before processors and software could support the graphics that the technology enabled, noted Eric Brown, president of Saugus.net, a website design firm, and a Boston University lecturer.

And, 3DVIA's Laubner added, VRML was "too slow and incapable of rendering complex, high-fidelity models and scenes."

In 1997, the Web3D Consortium released X3D—an XML-based file format for representing 3D graphics that includes VRML extensions. Like VRML, Smith said, X3D has not really caught on.

According to Laubner, the gaming and interactive-3D developer communities have largely ignored X3D, which is supported by few commercial tools.

Other approaches

The 3D Industry Forum's Universal 3D technology, released in 2003, is a compressed file format for 3D graphics. However, proponents have promoted Universal 3D as a file format that will be used primarily in applications such as manufacturing and construction.

The open source 3D Markup Language for Web is an XML-based file-format for creating 3D and 2D content on the Web. 3DMLW, which 3D Technologies R&D released last year, works with most popular Web browsers via plug-ins.

TECHNICAL DEVELOPMENTS

Today's hardware is better able to produce 3D content than in the past. For example, faster CPUs, graphics processors, and video cards, as well as more pervasive 3D graphics accelerators, are contributing to the emergence of 3D on the Web.

JavaScript and HTML 5.0

Performance improvements in browser engines that process Java-

Script, the language that developers use to write many Web-based applications, have helped bring 3D to the Web.

For example, the engine in Internet Explorer 9 will be able to use the host system's graphics processor to perform graphics-related tasks quickly.

Also, Mozilla's enhancements to Firefox's JavaScript engine used a technique called tracing—which optimizes the way code is run—to improve performance.

And JavaScript's ability to access HTML 5.0's many capabilities lets developers combine video, audio, 3D, and 2D into one seamless application.

scenes from simple elements, called *primitives*, such as lines and polygons. OpenGL ES (embedded systems) works in small devices such as smart phones.

However, these capabilities cannot be implemented in a browser without plug-ins.

Many users prefer not to use plug-ins, finding them inconvenient to install, troubleshoot, and manage, said Vladimir Vukicevic, Mozilla's principal engineer for the Firefox browser.

WebGL lets browsers render 3D content without a plug-in. The technology extends OpenGL by providing

New technologies may promote 3D on the Web by improving browser capabilities.

The introduction of the *canvas* element to HTML 5.0 will also enable 3D on the Web, predicted Tim Johansson, Opera Software's core developer for the company's browser.

This element lets browsers, via their JavaScript engines, natively and dynamically render bitmap images, which makes it easier to display 3D content without plug-ins.

WebGL

The Mozilla Foundation—a group that creates and supports open source applications—and the Khronos Group—an industry consortium that designs standards for parallel computing, graphics, and dynamic media—are developing WebGL.

The technology brings hardware-accelerated 3D graphics to the Web without plug-ins. WebGL will work in any browser that supports Khronos' OpenGL (originally the Open Graphics Library) or OpenGL ES specification.

The cross-language, cross-platform OpenGL defines an API for writing applications that produce 2D and 3D computer graphics.

The specification provides programming tools for drawing 3D

an API that lets software programmatically access a PC's 3D-rendering hardware.

In essence, WebGL allows communication between JavaScript applications and the OpenGL software libraries, which access the host system's graphics processor. This enables use of the hardware's full capabilities to render 3D content.

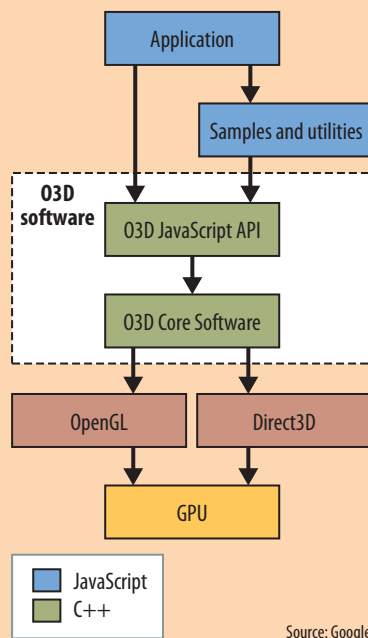
Khronos has established a WebGL Working Group, which is slated to deliver the technology's first public release in the first half of this year.

But programmers are already building WebGL into developer versions of Firefox and the WebKit open source browser engine, used with both Apple's Safari and Google's Chrome.

O3D

Google, which participates in the WebGL Working Group, has developed a 3D graphics technology for browsers called O3D, which Figure 1 shows.

O3D is a plug-in for the Internet Explorer, Firefox, Safari, and Chrome browsers. Google is now building the technology into Chrome and hopes it



Source: Google

Figure 1. A JavaScript application can run via O3D plug-in software, which includes a JavaScript API and the Core Software. The Core Software taps directly into a host computer's graphics hardware—for better performance—via the OpenGL or Microsoft's Direct3D graphics API. JavaScript utilities provide sample code to help with common tasks.

eventually will be built directly into other browsers, too.

O3D—which works with Windows, the Mac OS, and Linux—is an open source JavaScript API for developing interactive 3D graphics applications—such as games, advertisements, and virtual product tours—that run within a browser.

The API provides an interface for JavaScript-based programs. It lets a JavaScript application talk to the O3D Core Software, contained in the O3D plug-in, to tap directly into a computer's graphics hardware.

Google spokesperson Eitan Bencuya said O3D is a retained-mode technology, which sets up a scene once, then draws only the changes necessary for each frame.

Unlike immediate-mode technologies such as WebGL, O3D doesn't redraw the entire scene every time.

This provides better performance but less developer control, Bencuya noted.

Adobe Flash

Adobe is adding better 3D capabilities to its proprietary Flash browser plug-in.

Adobe introduced 3D capabilities with the release of Flash Player 10 in 2008.

This technology incorporated support for 3D effects via the addition of new classes and methods—particularly the ability to specify an object's position in three dimensions—to the ActionScript programming language for Flash, said Tom Barclay, Adobe's senior manager for the Flash Player.

With this approach, developers without much 3D experience can author 3D content by designing objects in 2D and modifying them via the new classes and methods, he explained.

Flash Player 10.1, now in beta, will bring 3D effects to smart phones and other mobile devices, he added.

STANDING IN THE WAY

Before the 3D Web can truly flower, it must overcome numerous hurdles.

For example, plug-ins, used in some approaches, occasionally cause browser crashes and other problems.

Vzillion's Collier said the need for browsers to natively render 3D content and the current inability of 3D technology in general to work with all browsers, operating systems, and application types are challenges.

The lack of standardization is also an issue, he added.

If standardization doesn't occur, said independent 3D designer Lane Force, the Web will wind up with numerous incompatible formats and technologies, forcing developers to create multiple versions of content to run on different browsers.

Also, 3D on the Web entails long authoring times, and relatively few developers are familiar with the approach.

The upsurge in the use of netbooks and smart phones, which have slower processors, means more people are using devices that can't run 3D content, noted Kaon's Smith.

Added Zemoga's Edgerton, even though hardware capabilities and network bandwidth have increased significantly, they're still not enough for presenting highly complex 3D models.

And proponents aren't designing online 3D technology for the average user, which is the same mistake that occurred with VRML, said William Hurley, founder of whurleyvision LLC, an augmented-reality consultancy.

WebGL is the most interesting development for 3D on the Web because it doesn't require plug-ins, according to Opera's Johansson.

Once WebGL is released, he said, "We will see a large increase in the amount of 3D content on the Web."

3D won't really take off for about 10 years, though, until the increasingly popular netbooks and smart phones gain the processing power to play the data-intensive content, said Kaon's Smith.

Eventually, though, he predicted, 3D on the Web will do as well as video on the Web has done. **■**

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