

# CURRENT REALITY AND FUTURE VISION **OPEN VIRTUAL WORLDS**

Sun<sup>SM</sup> Services  
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## **Abstract**

This white paper examines the current state of 3D virtual worlds and provides insight into Sun's vision for the future of virtual worlds as they evolve with open standards and interconnected communities. The paper also provides an overview of Sun's value proposition in this domain and describes the progress that is already being made toward open virtual worlds.

## Table of Contents

<b>A New World of Opportunities</b> .....	<b>1</b>
What virtual worlds have in common .....	1
Several purposes and types of virtual worlds .....	2
Key facts .....	2
<b>The Future of Virtual Worlds</b> .....	<b>3</b>
<b>The Open Road to Virtual Worlds</b> .....	<b>4</b>
Open standards .....	4
Open source .....	5
Enterprise-grade platforms .....	5
<b>Carving a Bright Future</b> .....	<b>6</b>
Open source .....	6
Open standards .....	6
Enterprise-grade platforms .....	7
End-to-end services .....	8
<b>Learn More</b> .....	<b>9</b>

## A New World of Opportunities

Virtual worlds such as Second Life, There.com, and Club Penguin offer a new way for groups of people to interact, exchange information, and conduct business over the Web. These environments also create new business opportunities, providing a place for customers to socialize, collaborate, play, train, and purchase goods.

The convergence of broadband, wireless, computing, video, and sound technologies has matured, making multiplayer, immersive environments more practical and usable. 3D Web is readily available to a large audience, and an increasing number of people are exploring the potential of virtual worlds for a variety of applications.

Today's virtual worlds represent the first phase of 3D Web. Dedicated servers running their own virtual worlds are to 3D Web what MySpace is to today's Web. In the future, 3D Web will be a network of virtual worlds that are owned by various entities. The success of virtual worlds will depend on factors such as openness, enterprise-strength platforms, vibrant communities, and a portfolio of services.

From entrepreneurs to large multinational enterprises, interest in virtual worlds is growing fast, attracting a wide range of participants who have established virtual stores online. Virtual worlds support buying and selling, communications, multimedia, and perhaps most importantly, the ability to construct unique environments that offer visitors an emotional connection to the people and things within the environment.

## What virtual worlds have in common

A virtual world is a computer-based simulated environment that is accessible by multiple users and enables interaction via avatars through an online interface. The emergence of virtual worlds is leading to 3D Web enhancements, and visual extensions to the participatory Web technologies are sweeping the online world.

There are different types of virtual worlds, and most have some of the following features in common:

- **Shared space, allowing multiple users to participate simultaneously** – The Internet is shifting from a text-based environment to a visually oriented 3D world. Interacting with an avatar in a 3D environment, as opposed to a screen name or a flat image, offers a richer user experience.
- **Users interact with one another and the environment** – Objects or contents can be created or moved through a graphical user interface (GUI) and may enable a 3D immersive user experience.
- **Persistence** – The virtual world continues to exist regardless of whether users are connected.
- **Immediacy of the interactions** – Everything takes place in real time.
- **Similarities to the real world** – The virtual world emulates gravity, topography, locomotion, actions, and communication (VoIP is now available on top of text) to enable life-like interactions, giving users the feeling of being there in person.

## Several purposes and types of virtual worlds

Virtual worlds have been created for many different purposes and offer a wide variety of content. Some examples of different types of virtual worlds include:

- **Gaming** – Massively Multiplayer Online Role-Playing Games (MMORPGs) are the largest and most common type of virtual world and include games such as World of Warcraft, EverQuest, and Lineage.
- **Social networking and online communities** – These sites usually offer an open-ended experience and go beyond traditional text-based chat rooms to create a more compelling user experience.
- **Immersive education** – Traditionally promoted by academic institutions, these environments are beginning to be sponsored and used by corporations. Immersive education offers meeting spaces for online courses, virtual libraries, conferencing, student recruitment, and collaborative learning.
- **Corporate collaboration** – Virtual worlds offer an inexpensive, useful, and immersive way to hold meetings, train, collaborate, and share information.
- **Business-oriented virtual worlds** – These virtual worlds support a wide range of activities including electronic commerce, virtual events, marketing and branding, advertising and promotion, customer service and interaction, talent recruitment and discovery, and product demonstration. They can be used to help build customer loyalty and enable rich customer feedback.
- **Focus groups** – These sites target specific groups of people with interest in topics such as music and entertainment, politics, military training, prototyping, or experimentation.

## Key facts

Some key facts about today's virtual worlds include:

- Increased network bandwidth and widespread Internet access have made virtual environments with multiuser interactivity more practical and widely available, increasing use in recent years.
- Virtual worlds targeted at children and teenagers, such as Club Penguin, Webkinz, and Habbo Hotel, are becoming very popular.
- Corporations are not generally using virtual worlds for business activities such as advertising and marketing.
- So far, the virtual world industry has focused primarily on content providers, some of which created virtual worlds platforms incidentally because they needed them to deliver content.
- Because media streaming is attractive and feasible, broadcasters are launching spaces in virtual worlds.

## The Future of Virtual Worlds

Several new virtual worlds will likely launch in 2008, some of which will be in direct competition with Second Life and other established sites. Others will be brand-focused or private virtual worlds (the equivalent of an intranet). Among the platform vendors, a visionary company similar to Google or Facebook may emerge and leverage virtual worlds in an entirely new way. Users will visit speciality worlds that are most closely associated with their lifestyles and interests, creating an opportunity for marketers to build whole worlds around products or customize an environment within a speciality virtual world.

Corporate use of virtual worlds will grow for activities such as meetings and staff training, which could significantly improve business productivity and save money, time, and resources. Companies can use virtual worlds to generate revenue through marketing, branding, and advertising. This will lead to new and innovative forms of interactive advertising and perhaps lessen the use of real-world types of posters, billboards, and conventional pods, such as those seen today on Second Life. Virtual worlds will also be useful as a next-generation, virtual-team collaboration platform with flexible application sharing.

Interoperability is of great importance to the continued expansion of 3D Web. Virtual worlds will use common tools and shared contents that will be served through a standard browser interface. Some characteristics that Sun expects to see in future open virtual worlds include:

- Diversity of platforms
- Universal registered names and avatars to enable the transport of virtual identities and virtual assets between virtual worlds
- Common and portable identities such as Open ID (interoperable identities)
- Standards-based security for transactions involving digital assets
- Better-defined protocols and file formats such as X3D, the ISO standard for real-time 3D computer graphics
- Universal client, including standard 2D and 3D browsers on various types of devices (including mobiles clients) with the ability to bookmark virtual worlds
- Integration with existing business applications

As the 3D Web and applications continue to develop, the common communications blueprint between various virtual worlds will be based on open standards, creating a more competitive marketplace for virtual worlds. In the future, users will interact in 3D Web using a virtual replica of themselves. Thus the new Internet may look like a galaxy of connected virtual worlds.

GUIs are getting friendlier, making virtual worlds easier to use and more intuitive. For instance, a user experience similar to that of Nintendo Wii may become common for Internet users. And graphical realism will vary depending on the purpose and focus of the virtual world.

Hybrid types of virtual worlds are also likely to emerge for gaming, social networking, immersive education, corporate collaboration, business activities, and focus groups. Another possible trend is the convergence of traditional online social networking tools such as Facebook and MySpace. While virtual worlds will not replace physical interactions, they can enhance real-world meetings or 2D Internet.

The market is moving toward a reduction in the vertical integration of virtual world services, creating an ecosystem of ancillary businesses for social networking, gaming, training, commerce, and events. All of these major areas of use will be facilitated by better performance, scalability, and stability of the virtual world platforms.

People may spend a lot more time in virtual spaces in the future, using virtual worlds to complement and enhance real life through technologies that support social, educational, and business activities.

Governments will also get involved in virtual worlds. In addition to using them, governments will likely enact legislation that regulates access and content. They may also promote collaboration and training for virtual worlds.

## The Open Road to Virtual Worlds

Trends listed in the previous chapter could materialize sooner or later. However, for this to happen there are a number of requirements such as those described below.

Open standards provide the following benefits:

- Enable integration across disparate contexts and systems
- Can be implemented and deployed on a variety of environments
- Improve the market ecosystem by driving both commoditization and innovation and mitigating adoption risks
- Enable and enhance interoperability
- Drive prices down by allowing competing implementations
- Enable greater substitutability among the products that adhere to them
- Provide a level of protection against economic and legal uncertainty, as the process by which they're developed is clear about intellectual property rights

### Open standards

Due to major technical differences between virtual world platforms, open standards are needed in this domain.

While open standards can be an important catalyst for driving new business and innovation, they are often overlooked and sometimes even taken for granted. In virtual worlds, open standards will enable the exchange of information, virtual goods, currency, and avatars throughout the metaverse, or universe of virtual worlds. Additionally, standardization of the file format for entities would improve the ability to interchange and interoperate between virtual worlds. One possible standard is X3D from the Web3D Consortium.

## Open source

The open source model offers liberties to users and developers and encourages genuine collaborative innovation.

Open source software will lower access barriers to virtual worlds, creating more value through increased participation and competition. In open source environments, developers can build on the contributions of others, thus reducing the cost and time to market for new solutions. Advantages for enterprises could include:

- Cutting-edge innovation
- High quality and value
- No lock-in, meaning that investments are protected
- Greater certainty about rights to use a product

## Enterprise-grade platforms

Enterprise-grade platforms are necessary for virtual worlds to be used extensively across diverse industries and environments. Sun envisions a need for platforms with the following characteristics:

- **Scalability and distribution** – Platforms should enable scalability at all levels of the solution, including applications, operating systems, and hardware (both systems and storage). They should also support a true distributed computing paradigm.
- **Reliability and security** – Because virtual worlds need high availability at all levels, they require platforms that are highly reliable and secure, including a strong authentication capability to help prevent intrusions.
- **Flexibility for both public and private uses** – Platforms should support public (Internet), private (intranet), and B2B (extranet) versions of virtual worlds.
- **Services availability** – The platform ecosystem should also provide assistance to developers, support production environments, deliver community support, provide hosting services, and enable 3D art development.
- **Cutting-edge features and services** – Since virtual worlds are pushing the boundaries of computing, the platform must also provide access to cutting-edge features and services such as immersive real-life audio for communications and flexible Artificial Intelligence (AI) tools.

## Carving a Bright Future

Progress has been made in each of the major requirement areas, and the future of open virtual worlds looks bright.

### Open source

Through Project Darkstar and Project Wonderland, Sun promotes open source technologies that give developers more freedom, flexibility, and control. Because Sun's approach keeps customers from being locked into proprietary systems, developers can mix and match alternative operating systems, middleware, and applications on industry-standard hardware. No long-term commitment is required, and open source software removes many development barriers, such as cost and risk.

Sun takes a three-step approach to free and open source software:

- Build software as a foundation
- Grow developer and customer communities
- Improve product quality for enterprise solutions

In Sun's view, open source is the ideal development and business model for today's massively connected economy. Virtual worlds are a major component of the connected economy and will benefit from the open source movement.

### Open standards

Sun believes that open IT standards are key to keeping the Internet open and accessible to all. By promoting a definition of open IT standards that can support economic goals and social policies, Sun is helping to bridge the digital divide.

Sun dedicates significant resources to hundreds of standards efforts that address numerous technical and industry-specific issues, and Sun's vast experience in network computing enables Sun to contribute to efforts across all computing domains. Sun believes that collective knowledge and action are much more important to the future of the IT industry than solutions developed by a few vendors. Open standards are central to Sun's long-term, strategic business objectives, and Sun was integral to the development of technologies such as OpenOffice.org™, Lightweight Directory Access Protocol (LDAP), Transmission Control Protocol/Internet Protocol (TCP/IP), the Java™ platform, Network File System (NFS), and Extensible Markup Language (XML).

The Project Darkstar platform is also client agnostic, providing open Application Programming Interfaces (APIs) for C++, Java 2 Platform, Standard Edition, and Java 2 Platform, Micro Edition. The connection API is also developer extensible, making it possible to add unique clients and connection strategies. Code can be written using tools that generate byte code, including NetBeans™ and Sun Java Studio Creator software.

Files formats of virtual world solutions are flexible as well. The Project Wonderland platform supports the importation of art from open source 3D content creation tools as well as professional 3D modeling and animation applications. The X3D standard is supported, and open source tools such as Blender are suggested. Commercial tools such as Maya can be used as well.

Operating system support for these virtual worlds is also diverse and includes Linux, Windows XP, Solaris™ for x86, and Mac OS X. Management of the platform (such as for billing and monitoring) can be implemented using standard OSS through Java™ (OSS/J) components.

Collaboration applications including all of today's X11 applications are also supported and features can be added using Java Rule Engine API or other software.

### Enterprise-grade platforms

Sun is already well known for its enterprise-grade hardware and operating system—Project Wonderland and Project Darkstar platforms are enterprise-grade as well. Some key features of these enterprise-grade virtual world platforms include:

- **A simple development model** – Despite possible multinode, multithreaded environments, developers can write code as if it were going to run on a single machine in a single thread.
- **Zoneless and shardless** – Environments can be designed with zones and shards if desired, but these are no longer required for scalability.
- **Fail-over capable** – If one server fails, another one takes over, enabling 99.999 percent availability for games and virtual worlds.
- **Massive scalability** – Scaling problems have doomed otherwise promising games. Project Darkstar has been designed, from the bottom up, to be more scalable than other server solutions. Dynamic load balancing is one of the key features that enables massive scalability.
- **Horizontally scaled server** – Easily move from a few to millions of players. There is no tie between geography and architecture and no limit to the number of users in a virtual world. The same cluster can support many worlds.
- **Completely persistent** – Everything in the world is automatically and transparently persistent, which frees the developer from database work and allows worlds to evolve and change.
- **Dupe bug and rollback proof** – Project Darkstar's transactional nature makes breaks in referential integrity virtually impossible, helping prevent dupe bugs. And because Project Darkstar continuously streams completed transactions out to long-term storage, data isn't lost if an application fails.
- **Disaster proof** – Because Project Darkstar is based on an integrated, enterprise-level transactional data storage system, the entire back-end can go down and be recovered—so that at most one or two seconds may be lost.

- **High-fidelity audio** – The environment supports tight integration of high-fidelity stereo audio, so users can listen to both live and recorded audio in stereo at CD quality. When users are having a conversation, the high-fidelity audio allows them to hear voices coming from the appropriate direction, just as in the real world. Since voices or other sounds become softer when farther away, it easily supports multiple, simultaneous conversations within the same virtual space.
- **Interaction with the real world (mixed-reality)** – Collaboration can bridge the virtual and physical worlds. Those participating in the real world see a view into a virtual conference room or other virtual space. A Porta-Person, which supports stereo audio input and stereo output, provides high-quality audio communication between the real and virtual worlds.
- **World editing tools** – Tools for editing the virtual world will soon be available.

### End-to-end services

Together with partners and communities, Sun offers a range of services that support the components of a virtual world framework:

- Professional services
- Support services such as Sun™ Developer Expert Assistance service
- Managed services
- Grid services
- Training and education consulting

Sun provides an integrated, broad portfolio of services that encompasses the full lifecycle of virtual world projects, from evaluation, architecture, and integration to management. Sun Services not only span the entire project lifecycle, but also address each of the four disciplines of people, process, practice, and platform.

## Learn More

For more information about open virtual worlds and the technologies that support them, visit:

- **Mixed Reality Teaching and Learning Environment (MiRTLE) Project**  
[chimera69.essex.ac.uk/User:Gardnemr/Mixed\\_Reality\\_Teaching\\_and\\_Learning\\_Environment](http://chimera69.essex.ac.uk/User:Gardnemr/Mixed_Reality_Teaching_and_Learning_Environment)
- **Media Grid's Immersive Education Initiative**  
[immersiveducation.org/](http://immersiveducation.org/)
- **Virtual Northstar**  
[virtualnorthstar.org/](http://virtualnorthstar.org/)
- **MPK20 – Sun's Virtual Workplace**  
[research.sun.com/projects/mc/mpk20.html?cid=921781](http://research.sun.com/projects/mc/mpk20.html?cid=921781)
- **Project Darkstar**  
[projectdarkstar.com](http://projectdarkstar.com)
- **Project Wonderland**  
[wonderland.dev.java.net/](http://wonderland.dev.java.net/)
- **Sun's Immersion Wiki**  
[wikis.sun.com/display/IESIG/Home](http://wikis.sun.com/display/IESIG/Home)
- **Sun Immersion Special Interest Group**  
[sun-isig.org/](http://sun-isig.org/)
- **Sun's Immersive Education Platform**  
[sun.com/emrkt/educonnection/newsletter/1007eduinsight.html?cid=921781](http://sun.com/emrkt/educonnection/newsletter/1007eduinsight.html?cid=921781)
- **Metaverse Roadmap**  
[metaverseroadmap.org/](http://metaverseroadmap.org/)

