



3rD-LIFE
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Report On Existing Platform Advantages and Disadvantages

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Work Package 3: Platform Development

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EXECUTIVE SUMMARY

This document describes and compares three most relevant 3D virtual world platforms for use in 3rD-LIFE: Open Wonderland, OpenSimulator and Second Life.

Although serving a similar purpose, the platforms show various differences related to licensing, software and hardware architecture, creation of virtual objects, possibilities of customisation and further software development, availability of technical support etc. All these aspects are examined in a detailed comparison.

Most important advantages of Open Wonderland are found to be its open-source Java nature, which implies more freedom in terms of customisation and operating system independence.

On the other hand, both Open Simulator and Second Life provide better scalability and, possibly reliability. The project team would, however, face limitations related to extendibility and customisation.

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1. INTRODUCTION

The main objective of the 3rD-LIFE project is to implement and test an ICT tool which would help elderly individuals to socialise and take part in various activities. The tool in question is a three-dimensional virtual world that a user accesses via a PC-like terminal. In the virtual world each user is represented by a virtual character (avatar), which resides within a virtual environment, i.e. moves around, manipulates virtual objects, has conversations with other users etc. The virtual environment can resemble a real world-like place with floors, walls, furniture and other inventory.

From a technical perspective, virtual worlds along with their features and residents are most commonly run on a server back-end. A key part of the server software solution is a 3-D platform, which produces the virtual environment along with its basic functions such as scene rendering, object creation and manipulation, and avatars. A platform with its basic feature set can be enhanced and customised by adding further virtual spaces, objects and applications that avatars interact with.

The virtual world and its features are the central point of development and user testing within 3rD-LIFE. Therefore it is crucial to make a sound decision which of the available 3-D virtual platforms should be used. Namely, the scope of the project is not to develop a virtual world along with a platform from scratch, but to concentrate on the functionalities that can be added to an existing platform. In this respect it is important to consider how easy or difficult it is to implement various features within a certain platform and what additional functionalities are available. Other relevant criteria are the platform's aesthetic and functional value, user and administrator-friendliness, and reliability of operation.

2. IDENTIFICATION OF RELEVANT SOFTWARE PLATFORMS

From a number of virtual 3-D world platforms that exist today, only a few show relevant advantages that make them potentially useful for 3rD-LIFE. For example, many platforms are used for running multi-player computer games and although these solutions are often advanced and reliable enough, they are not open, i.e. available for further development and custom use.

Platforms that show most potential from the project's perspective were actually developed for a similar purpose, i.e. social networking. These solutions support advanced avatar interaction and building custom virtual objects such as real estate, inventory, avatar wear etc.

In this document, the following platforms are described and compared with respect to the 3rD-LIFE project requirements:

- Open Wonderland
- OpenSimulator
- Second Life

One more virtual world platform was inspected in the research, namely The Sims Online. Although potentially interesting, it was discarded from the comparison due to its discontinuation in 2008. [1]

2.1. OPEN WONDERLAND

Open Wonderland [2] is a Java open source toolkit for creating collaborative 3D virtual worlds. Within those worlds, users can communicate with high-fidelity audio, share live desktop applications, and collaborate in an education, business, or government context. Developers and graphic artists can extend Open Wonderland's functionality to create new worlds and add features to existing worlds.



Figure 1: An example Open Wonderland screenshot [3]

2.2. OPENSIMULATOR

OpenSimulator [4] is an open source server platform for hosting virtual worlds. While it is most recognized for compatibility with Second Life clients, it is also capable of hosting alternative worlds with differing feature sets with multiple protocols. OpenSimulator can be easily expanded through the use of plug-in modules and several modified distributions exist, such as realXtend. Multiple servers can be integrated into a grid which allows larger more complex areas to be simulated.



Figure 2: An example OpenSimulator screenshot [5]

2.3. SECOND LIFE

Second Life [6] is an online virtual world developed by Linden Lab. It is intended for people aged 16 and over, and as of 2011 has about one million active users. A number of free client programs enable Second Life users to interact with each other through avatars. Residents can explore the world, socialize, participate in various activities, and create and trade virtual property and services with one another. Built into the software is a three-dimensional modelling tool based on simple geometric shapes that allows residents to build virtual objects. There is also a procedural scripting language, Linden Scripting Language, which can be used to add interactivity to objects. Sculpted primitives, mesh, textures for clothing or other objects, and animations and gestures can be created using external software and imported. The Second Life Terms of Service provide that users retain copyright for any content they create, and the server and client provide simple digital rights management functions.



Figure 3: An example Second Life screenshot [7]

3. PLATFORM COMPARISON

Open Wonderland, OpenSimulator and Second Life all show the potential to be used as the software platform in 3rD-LIFE. Examining and comparing their most important features in the context of 3rD-LIFE can help in taking the final decision in the process of platform selection.

From the project point of view, the following aspects need to be considered for each platform:

- License and other user conditions
- Architecture of both server and client software
- Developer and user community
- Process of world building
- Communication features for users
- Hardware requirements
- Online resources
- Examples of best practice

3.1. LICENSE

3.1.1. OPEN WONDERLAND

Open Wonderland is available under the GNU General Public License v2.0 with Classpath Exception. [8]

In the context of the use in the project this means that the platform is available for use at no charge and can be both further developed (extended) and modified. Detailed information on the Classpath Exception is quoted below:

"CLASSPATH" EXCEPTION TO THE GPL VERSION 2

Linking this library statically or dynamically with other modules is making a combined work based on this library. Thus, the terms and conditions of the GNU General Public License Version 2 cover the whole combination.

As a special exception, the copyright holders of this library give you permission to link this library with independent modules to produce an executable, regardless of the license terms of these independent modules, and to copy and distribute the resulting executable under terms of your choice, provided that you also meet, for each linked independent module, the terms and conditions of the license of that module. An independent module is a module which is not derived from or based on this library.

If you modify this library, you may extend this exception to your version of the library, but you are not obligated to do so. If you do not wish to do so, delete this exception statement from your version.

Certain source files distributed by the Open Wonderland Foundation are also subject to the above clarification and special exception to the GPL Version 2, but only where the Open Wonderland Foundation has expressly included in the particular source file's header the words "The Open Wonderland Foundation designates this particular file as subject to the "Classpath" exception as provided by the Open Wonderland Foundation in the License file that accompanied this code."

3.1.2.OPENSIMULATOR

OpenSimulator is provided under a BSD license. [9, 10]

Extensions and modifications of the software is permitted, however redistributions of the code must retain original copyright notices and conditions for use.

Details are quoted below:

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- *Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.*

- *Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.*
- *Neither the name of the OpenSim Project nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.*

3.1.3. SECOND LIFE

Second Life is formulated as a “multi-user virtual world service” and is of commercial nature, i.e. available at a charge. As such, the platform itself cannot be installed, managed and further developed by the project. The project can be viewed as a customer of a virtual world hosting service where customer activity, including development of additional features, is limited to a predefined set of options.

Further information on licensing and pricing is available at the Second Life corporate home page. [11]

3.2. ARCHITECTURE

3.2.1. OPEN WONDERLAND

Open Wonderland’s server platform is a 100% Java toolkit. It is partitioned into several separate projects quoted below: [12]

- *Wonderland contains the main Wonderland code, including the core of the Wonderland client and server, as well as the web administration server. The main Wonderland project also contains a number of “core modules” that provide key functionality including avatars, shared applications, world editing and security.*
- *Wonderland Modules is a repository for Wonderland extension modules. These include stable modules built in to the release, such as the audio recorder and sticky notes. They also include experimental modules provided by the Wonderland core*

team and the community. Many of these modules are also available from the Module Warehouse.

- *The MTGame Graphics Engine is a high-performance graphics engine that extends jMonkeyEngine (see below). MTGame adds multi-threading capabilities for improved graphics performance on today's hardware. Avatars use MTGame to generate realistic-looking 3D characters from Collada files.*
- *jVoiceBridge is a pure-Java audio mixing platform. jVoiceBridge includes a SIP-based audio mixing server and a companion software phone. It supports mixing high-fidelity, stereo audio at up to CD quality. It also supports spatialised 3D audio for in-world positioning.*

As for clients, Open Wonderland worlds can be accessed via a URL. To start, the client uses Java Web Start technology, i.e. all required data is downloaded from server's web page; the client application is then started on the client machine using local Java software.

3.2.2. OPENSIMULATOR

OpenSimulator is written in C#, running both on Windows over the .NET framework and on Linux machines over the Mono framework. Additional software development can be made using various programming languages, and the server side can run in both standalone and grid mode.

More information below: [4]

- *In world scripting OpenSimulator uses a number of different languages, including LSL/OSSL, C#, JScript and VB.NET.*
- *OpenSimulator can operate in one of two modes: standalone or grid mode. In standalone mode, a single process handles the entire simulation. In grid mode, various aspects of the simulation are separated among multiple processes, which can exist on different machines. Standalone mode is simpler to configure, but is limited to a smaller number of users. Grid mode has the potential to scale as the number of users grows.*
- *OpenSimulator utilizes loadable modules for most of its functionality. These loadable modules can be independently developed to add functionality to the server.*

As for clients, one of the available viewers is required to use OpenSimulator. With a browser protocol handler it is possible to launch the viewer by clicking a link on a web page. In order to make use of the full OpenSimulator functionality, the use of a viewer with both grid selector and grid manager is recommended. Viewers in this category include RealXtend [13], Hippo Viewer [14], and PhoenixViewer [15].

In general, OpenSimulator clients are compatible with the Second Life platform.

3.2.3. SECOND LIFE

Linden Lab provides official viewers for Windows, Mac and Linux client machines. The viewer renders 3D graphics using OpenGL technology. Since the viewer is open source, users may recompile it to create their custom viewers; modified viewer software is available from third parties.

There are a handful of mobile clients which allow users to login to various virtual worlds, including Second Life. While these applications do not provide a 3D virtual view of the world, residents are able to view their contacts, chat in IM or local and teleport to other locations.

Regions in the Second Life grid run on a multi-core server, running proprietary software on Debian Linux. The server side is hosted by Linden Lab Inc. [16]

In future, both client and server are expected to be released as free and open source software.

3.3. COMMUNITY

3.3.1. OPEN WONDERLAND

Open Wonderland started as a project within Sun Microsystems Inc. After discontinuation of the project within Sun (now Oracle), activities continued as an open source initiative. All software legacy along with the developer and user communities were retained.

The Open Wonderland community is active and can be reached via various information channels: [17]

- Documentation wiki

- Forum
- IRC channel

Daily “nightbuilds” of the core project are published and discussed on a regular basis.

3.3.2.OPENSIMULATOR

Due to their close relation, most Second Life documentation can be used for resolving Open Simulator issues as well.

Open Simulator community is available through: [18]

- Documentation wiki
- Two separate mailing lists
 - For users
 - For developers
- IRC channel

3.3.3.SECOND LIFE

Second Life has the largest community among 3D virtual world platforms. Its communication channels are:

- Second Life wiki [19]
- Forums
- In-world meetings
- Documentation
- Mailing lists

3.4. WORLD BUILDING

3.4.1.OPEN WONDERLAND

Open Wonderland supports the use of most open source and commercial 3D modelling tools that can export to the Collada (.kmz/Google Earth) format. [20]

Google SketchUp [21] is one of the most popular and easiest to use free tools that works well with Wonderland. Blender [22] is another free tool which is more complex, but allows creation of higher-fidelity 3D models that take greater advantage of Wonderland's graphics rendering capabilities. Commercial modelling tools such as Autodesk's Maya [23] and 3D Studio Max [24] can also be used.

Object within the virtual environment can be arranged, e.g. moved, resized, using in-world tools. Creation and in-world use of objects based on following file formats is supported:

- Images (.gif, .png., .jpg)
- Documents (.pdf, .svg)
- Multi-media (.mp4, .mov, .wmv, .ogg)
- 3D models (.kmz, .dae)
- Avatars (.evm)

3.4.2. OPENSIMULATOR

An integrated world builder is available for Open Simulator. It supports import of models created by external 3D modelling programs such as Maya, 3D Studio Max and Google SketchUp.

3.4.3. SECOND LIFE

LSL (Linden Scripting Language) is a scripting language that gives behaviour to Second Life primitives, objects, and avatars. [25]

Second Life provides an integrated 3D building environment with behaviour and animation support. Graphics files are added textures and HavokTM-powered physics so they respond to gravity, inertia, propulsion and wind from the in-world weather system.

Unlike dedicated professional software for computer graphic design, the building environment within Second Life was designed to support less skilled developers as well.

3.5. COMMUNICATIONS

3.5.1. OPEN WONDERLAND

Open Wonderland features tight integration interactive high-fidelity stereo audio. Using a piece of open source voice software (jVoiceBridge [26]), in-world communication and audio playback are both available at CD-quality. The software adapts to allow remote users with lower bandwidth connections to use lower audio fidelities, including telephone-quality.

In an in-world conversation, the high-fidelity users can hear other users' voices coming from the appropriate directions, as they would in the real world. This way multiple, simultaneous conversations within the same virtual space are made possible.

A wide range of audio-related modules can be created. For example, an in-world virtual telephone allows users without access to a computer to dial into meeting within Open Wonderland. Virtual microphones, audio recorders, and a cone-of-silence for private voice chat are other examples of audio-related modules. In addition, recorded audio can be associated with objects in the world, including simulated characters.

Open Wonderland voice software can be extended to support the Session Initiation Protocol (SIP) for communication with real-world voice terminals.

3.5.2. OPENSIMULATOR

A software module named FreeSWITCH [27] enables voice in OpenSimulator. FreeSWITCH is a scalable open source cross-platform telephony solution designed to route and interconnect popular communication protocols using audio, video, text or any other form of media.

Various communication technologies such as Skype, SIP, H.323 and GoogleTalk are supported. [28]

3.5.3. SECOND LIFE

Voice in Second Life uses software solutions developed by Vivox Inc. [29] The technology behind them is based on RTP, SIP, OpenAL, TinyXPath, OpenSSL, and libcurl. These

technologies are contained in external daemon software controlled by the Second Life Viewer.

The Second Life Viewer handles configuration, control, and display functions, but the voice streams (from the microphone and from the Vivox voice server) do not enter the Viewer. The source code for the external SLVoice daemon is currently not available due to contractual obligations between Linden Lab and Vivox. [30]

3.6. HARDWARE REQUIREMENTS

3.6.1. OPEN WONDERLAND

The hardware requirements for running the Open Wonderland client are given below:

- Computer processor: at least 1.5 GHz
- Computer memory: at least 1 GB
- Graphic card: 256 MB of video memory or more

Additional remarks:

- Hardware-accelerated OpenGL drivers should be installed.
- For Solaris and Linux Nvidia cards/drivers are recommended.
- An accelerated graphics card, typically geared towards running 3D games, is recommended.
- With a recommended configuration, the simulation runs with up to 25 fps.
- A broadband data connection is required.

3.6.2. OPENSIMULATOR

Hardware requirements for OpenSimulator and Second Life are practically the same. See next subchapter for details.

3.6.3. SECOND LIFE

The hardware requirements for running the Second Life client are given below:

- Computer processor: at least 1.5 GHz
- Computer memory: at least 1 GB
- Screen resolution: at least 1024x768 pixels
- Graphic card: 256 MB of video memory or more
- A broadband data connection is required.

Additional details for use of Mac OS X and Linux operating systems are available online. [31]

3.7. ONLINE RESOURCES

3.7.1. OPEN WONDERLAND

Various Open Wonderland applications are hosted online in the “Module Warehouse”. [32]

Java-based application support is available.

3.7.2. OPENSIMULATOR

OpenSimulator-specific applications are hosted on the project’s forge. [33]

OpenSimulator supports in-world scripting and is compatible with Second Life scripts. [34]

3.7.3. SECOND LIFE

A community of developers of all skill levels along with documentation can be reached online. [25]

3.8. EXAMPLES OF BEST PRACTICE

3.8.1. OPEN WONDERLAND

A video presentation of Open Wonderland’s capabilities is available here: [35]

A locally installed virtual world used for preliminary tests within 3rD-LIFE: [36]

3.8.2.OPENSIMULATOR

A video example of platform's capabilities: [37]

An example of a functional virtual world: [38]

3.8.3.SECOND LIFE

A presentation video of one of the worlds (grid islands): [39]

Access to Second Life virtual world: [6]

4. CONCLUSION

In this document, a comparison among three possible platforms for use in the project was made. Based on this, a platform for 3rD-LIFE can be chosen.

The comparison revealed important differences among generally similar platforms. The main conclusions that can be derived in this respect are following:

- Commercial vs. non-commercial
 - Second Life is a commercial product, and although it offers certain extension mechanisms, their use is limited. The commercial license may also prevent the project team from adding non-standard elements (like specific avatars, gestures and/or user interfaces - i.e. kinetic interfaces).
 - The commercial nature of Second Life does incur additional costs related to service fees. However, the projected figures are seen as acceptable in terms of the project budget.
- Platform architecture
 - Open Wonderland is a pure Java solution. This is why the platform may be run on nearly any hardware configuration that supports Java (Windows, Mac, Linux etc.).
 - On the other hand, OpenSimulator is based on .Net architecture which is not a free standard and is related to the Microsoft Corporation. It can be run on Linux with Mono Framework, however it should be taken into consideration that .Net is a standard managed by the company that supports only one operation system - Windows.
- Scalability of the server-side configuration
 - Server-side architecture of OpenSimulator is based on a similar pattern as in the case of Second Life. It offers possibility to work in standalone and grid configuration.

- Open Wonderland's architecture presumes a standard client-server configuration.
- Virtual object editing and editors
 - Both OpenSimulator and Second Life offer built-in editors.
 - Open Wonderland relies heavily on external development tools.
 - All tools offer support from external editors and tools.
- Platform maturity
 - Open Simulator and especially Second Life offer good general reliability of the software platform. This impacts several aspects of use, e.g. ease of system installation, administration and maintenance, efficiency of additional software development and lower occurrence of problems for end-users (e.g. denial of service).
 - On the other hand, Open Wonderland is a product of an open source initiative. As such, problems related to platform reliability are more likely to occur. Due to the non-commercial nature of the Open Wonderland community collaboration, potential problems can take time to get resolved, leaving the project team without any sort of formal (contractual) leverage to demand immediate support or claim reimbursement.

To summarise, the project team is faced with a choice between two options:

1. A Second Life compatible environment (with Open Simulator as an open source replacement).
2. A pure open source platform Open Wonderland.

The first option provides better scalability and access to grid infrastructure. On the other hand it may limit the project team in adding non-Second Life-standard elements to the user interface.

The second option offers better extendibility, but its scalability may be limited to the front-end, i.e. user interface. Developer- and user-friendliness may be more questionable.

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