The Electric Sheep Company
25 West 36th Street, 8th Floor, New York, NY 10018

Technology Evaluation for Marketing & Entertainment Virtual Worlds

April 2008

The Electric Sheep Company

ESC Proprietary and Confidential

Contents

ESC Proprietary and Confidential

Introduction

So, you want to build a virtual world? Immediately, a slew of questions arise regarding the target demographic, overall theme, plans for growth, initial funding, competition, and the like. Which of the three general use cases will the virtual world fit into – simulation, collaboration, or marketing/entertainment? Once these questions have been answered, a sea of design and technical questions must be carefully navigated. This paper serves as a starting point and guide for the technical questions surrounding a marketing/entertainment virtual world. While it won't address concerns usually dealt with in a business plan, it will address those usually dealt with in a technical recommendation – it will suggest the right technical questions to ask and point toward possible solutions.

This paper grows out of The Electric Sheep Company's three years of professional experience in the virtual world industry. The Electric Sheep Company is a leading media and technology virtual worlds company. ESC has developed dozens of widely acclaimed projects on behalf of internationally recognized brands such as CBS, NBC, Showtime, Major League Baseball, NBA, MTV, AOL, Reuters, Universal Pictures, Sony BMG, Pontiac, Nissan, Geek Squad, IBM, Sundance Channel, Starwood Hotels, UGS, Gabetti, Bantam Dell, Swisscom, Ben & Jerry's, and Yahoo!, among others. ESC has experience and development capabilities using multiple virtual world platforms and connecting virtual worlds to other technologies, such as corporate intranets, mobile devices, customer databases, and web portals.

THE ELECTRIC SHEEP COMPANY
25 WEST 36TH ST, FL 8
NEW YORK, NY 10018

http://www.electricsheepcompany.com

swords@electricsheepcompany.com

ESC Proprietary and Confidential

Market Trends

Virtual worlds are making the leap from imagination to reality. In so doing, the difference between envisioned virtual world technology and today's commonly used Internet technologies will become a continuous transition. This gradual blurring reflects the market's natural rate of adaptation.

Virtual worlds are making the leap from imagination to reality.

The near-term evolution of virtual worlds will involve the convergence of three present-day industries and their associated domains:

gaming [entertainment] + social networks [social capital] + virtual worlds [presence]

It is only natural for these industries to intertwine, as they all flow from the same wellspring – the desire of people to interact with other people, such as through self-expression or competition.

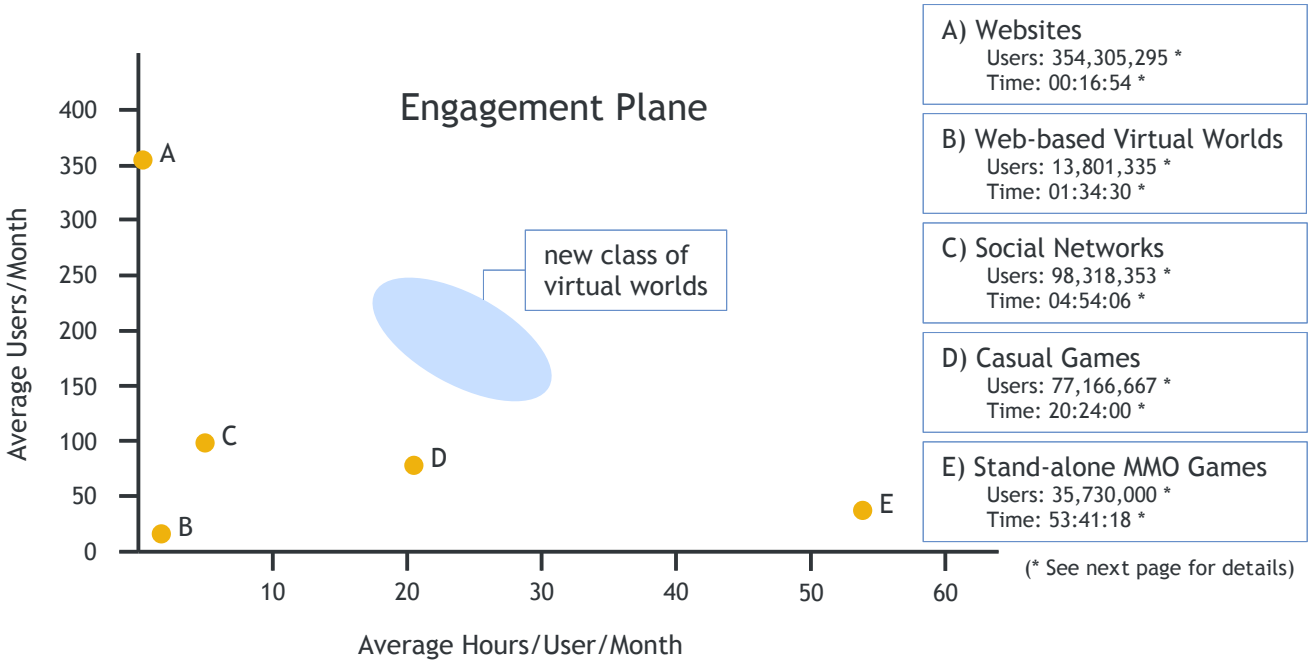
Indeed, the market shows a clear trend toward this convergence. The Electric Sheep Company has seen sharply increased demand for more accessible, tailor-made virtual world solutions that span these three domains. ESC clients routinely demand virtual worlds with innovative new features, while at the same time insisting on the usability and low barriers to entry characteristic of today's mature Internet technologies, such as e-mail and online photo albums.

It is only natural for these industries to intertwine.

In response, The Electric Sheep Company has investigated and evaluated many candidate technologies, ranging from well-known standbys to entirely new breakthroughs. This document takes a class of virtual worlds – custom, branded, web-based virtual worlds – and provides an overview of a few prominent technologies for publishing such a virtual world.

Convergence

Three present-day technologies – virtual worlds, games, and social networks – are converging toward custom, web-based spaces that draw upon the strengths of all three. This new class of virtual worlds will fill a currently unoccupied portion of the "engagement plane," as indicated by the blue oval in the graph below. Also plotted on this graph are five present-day classes of Internet marketing and entertainment technologies, indicated by yellow circles. The vertical axis of the graph is the total number of users of a technology per month. For example, in any given month, approximately 350 million people view websites in general. The horizontal axis of the graph is the average time per month a user spends engaged with a particular example of a technology. For example, a user spends on average approximately 17 minutes over the course of a month at each website she visits.



Within the engagement plane, the most desirable area is the upper right quadrant, which corresponds to having a large user base that spends a lot of time engaged with the product. At present, this quadrant is essentially vacant with the notable exception of television (not shown). The least desirable area is the lower left quadrant, which corresponds to having a small user base that spends little time engaged with the product. This quadrant is typically occupied by new technologies that are just gaining traction or failing technologies on the verge of extinction. Social networks, casual games, and web-based virtual worlds all started in this quadrant, as shown, but are quickly moving out as they grow and succeed. The upper left quadrant is occupied by classes of products that command a large user base but little time from each user, as exemplified by websites. The lower right quadrant is occupied by classes of products that command a small user base but a lot of time from each user, as exemplified by massively multiplayer online games.

ESC Proprietary and Confidential

In essence, the technologies highlighted in this paper are evaluated according to their potential to bring together web-based virtual worlds, games, and social networks into the new class of virtual worlds depicted in the engagement plane graph.

However, although the engagement plane tells a compelling story, it is not telling the entire story, for two reasons. First, there are many important metrics aside from user base and engagement time, such as revenue and volatility. Second, the data used to generate the graph is not entirely uniform – a best effort was made to compare apples to apples, but occasionally there's an unavoidable orange to contend with due to scarcity of data. Regarding this second point, the table below details how exactly the graph on the previous page was generated.

A) Websites
Nielsen//NetRatings Global Index Chart for the month of February 2008
http://www.netratings.com/resources.jsp?section=pr_netv&nav=1
Users: 354,305,295
= Active Digital Media Universe
Time: 00:16:54
= (Web Pages per Person per Month)*(Duration of a Web Page Viewed)/(Domains Visited per Person per Month)

B) Web-based Virtual Worlds
http://www.compete.com
February 2008 data for clubpenguin.com, gaiaonline.com, habbo.com, neopets.com, webkinz.com
Users: 13,801,335
= sum of unique users per month for each website
Time: 01:34:30
= weighted average of (average visit length)*(visits per month)/(unique users per month)

C) Social Networks
http://www.compete.com
February 2008 data for bebo.com, facebook.com, myspace.com, orkut.com
Users: 98,318,353
= sum of unique users per month for each website
Time: 04:54:06
= weighted average of (average visit length)*(visits per month)/(unique users per month)

D) Casual Games
Interpret 2007 new media study
http://www.next-gen.biz/index.php?option=com_content&task=view&id=9400&Itemid=2
Users: 77,166,667
= (71 million weekly players) + (remaining yearly players)*(1 year/12 months)
Time: 20:24:00
= (fourth quarter average time per week)*(4 weeks/1 month)

E) Stand-alone MMO Games
MMOGData: Charts
http://mmogdata.voig.com/
Users: 35,730,000
= Total Active Subscriptions for October 2007 for over 100 tracked MMO Games, including WoW, EVE, SL, There
Linden Lab February 2008 Second Life statistics
http://static.secondlife.com/economy/stats_200802.ods
Time: 53:41:18
= (total hours logged in month)/(unique active users in month)

ESC Proprietary and Confidential

The Electric Sheep Company
25 West 36th Street, 8th Floor, New York, NY 10018

Costs of Building a Virtual World

Costs inherent in running any virtual world can be categorized as:

Infrastructure & Software Development:
- Creating, testing, and deploying the viewer and server technology.
- Maximizing the number of users per server.
- Determining the number of required servers.
- Providing server fail-over, redundancy, and replication.
- Hosting all the servers.
- Licensing or purchasing the necessary software libraries and tools.

Art Production & World Creation:
- Conceiving and creating the 2D, 3D, audio, video, and text art assets.
- Combining the art assets into a unified world.
- Experience design.
- Licensing or purchasing the necessary software and tools.

Operation & Upkeep:
- Managing user registration and accounts.
- Billing.
- Upgrading and patching the viewer and server.
- Moderating user forums.
- Triaging and fulfilling customer support requests.
- Moderating and enforcing a user marketplace.

Distribution & Marketing:
- Defining and managing business partnerships.
- Defining and promoting the paths of user adoption, such as:
  - license technology to other companies to create a common platform
  - give early adopters the power to promote the platform
  - convert audiences from other media, such as television
  - seed social networking sites with viral advertisements

The remainder of this paper overviews and evaluates a sampling of platforms and technologies according to the Infrastructure & Software Development portion of the above costs. The other costs are important, but less related to the technology underlying the virtual world than the business plan.

ESC Proprietary and Confidential

Example Design Tradeoffs

Every virtual world makes certain tradeoffs between mutually exclusive features that define the character of the world. These decisions, in turn, affect the technical requirements of the virtual world. Example design tradeoffs include:

Perspective: The visual presentation of the virtual world to the user. Options include 2D (no depth perception, single viewing angle), 2.5D (limited depth perception, simple viewing angles), and 3D (full depth perception, realistic viewing angles). The tradeoff is between the realism and flexibility of 3D and the simplicity and accessibility of 2D.

Content Creation: The source of the things to do and see in the virtual world. The developer, the users, or some combination of the two can create content that appears in the world. User generated content (UGC) gives users a sense of ownership and investment and can serve as a free resource for other users to enjoy, whereas developer generated content can more finely control the look, feel, and standards of the world. The challenge of UGC is building and maintaining the tools users need for content creation, whereas the challenge of developer created content is keeping up with the constant demand for new content.

User-to-User Interaction: The methods by which users communicate, influence, and express themselves to other users. Live local text chat, instant messaging, e-mail, avatar customization, audio, customization of the virtual environment, and friends lists, among others, are all proven ways for users to interact. Leveraging existing online social networking tools can expand the reach of the virtual world. The deeper the level of user-to-user interaction, the more invested users will be in the world, but the more potential there is for "griefing" – when one user harasses another.

Geography: The way in which various virtual world spaces are interconnected. This can range from a direct mimicry of the real world to completely arbitrary and dynamic topologies that would be impossible in the real world. The tradeoff here is between giving something users are familiar and comfortable with and giving them the flexibility to connect their world as they please.

Goal Structure: The level of direction users are given with respect to how they spend time in the virtual world. Some users might want to spend their time completing well-specified quests, while other users might be more attuned to free-form exploration of the virtual world. The amount of direction is especially important when a user first enters a virtual world, whereas experienced users may want more freedom or even the option of providing new users with the support they need.

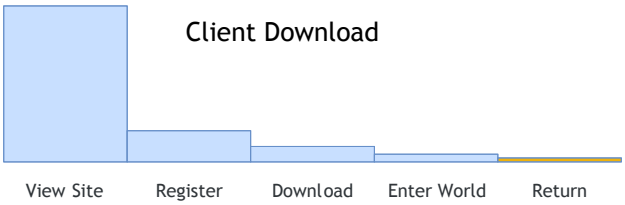
ESC Proprietary and Confidential

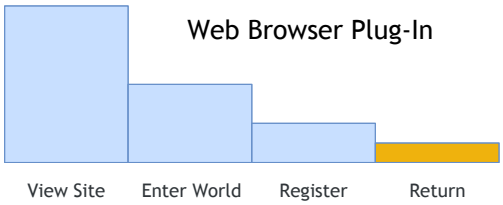
Example Technical Tradeoffs

In addition to the design tradeoffs mentioned on the previous page, there are also tradeoffs that must be made due to technical limitations. Here, the decision is not one of pure aesthetics, but more one of choosing between the lesser of various technical evils, such as:

Graphics Quality: The fidelity with which the visual presentation of the virtual world is rendered. While potentially more immersive, extreme levels of visual detail can be distracting to the user or impossible for many computers to properly process. There are significant differences in the capabilities of integrated graphics chips found on most computers and a dedicated graphics cards used for gaming, although both are quickly improving. Furthermore, high graphics quality often requires correspondingly complex and expensive artwork.

Viewer Installation: The process by which a new user joins the virtual world for the first time. The primary choice to be made is between requiring the user to download a stand-alone application and relying on web browser plug-ins which the user may or may not have installed. The low barrier to entry of a web browser plug-in is offset by correspondingly less flexible underlying technology. The graphs below show how user retention rate depends largely on the method of viewer installation and the number and order of steps in the installation process. In particular, the graphs were generated assuming a 50% drop off rate for each step in the registration and installation other than registering without first trying the virtual world, which is assumed to incur an 80% drop off. These assumptions are in line with ESC's anecdotal evidence. The result is a predicted five-times increase in user retention for virtual worlds embedded in a web browser.





Art Pipeline: The tools an artist uses to create assets (images, 3D models, animations, lighting effects, etc.) and the process by which they are integrated into the virtual world for scripting and placement. Some platforms have limited built-in tools for creating, placing, and programming objects. Other platforms rely exclusively on outside tools, such as Photoshop, for art asset creation. A smooth art pipeline will lower ongoing production costs, but may increase initial production costs due to higher upfront development costs or licensing fees.

External Media: The display within the virtual world of digital content originating from outside the virtual world. The ability to display live and recorded audio and video, web pages, and the like can add both utility and complexity to a virtual world.

ESC Proprietary and Confidential

Feature Criteria

Architecture

Client: A software program that runs on the user's computer and allows the user to interact with the virtual world. Is it a download or is it embedded in a web browser? What user interface features does it support?

Server: A software program that runs on a service provider's computer and coordinates the virtual world between many Clients. How many users can a single Server support? Can multiple Servers be connected to create a large world?

Network: The set of protocols, bandwidth, and software that allows the Client to communicate with a Server. What kind of network connection do users employ? What information needs to be coordinated and how quickly?

Rendering

Graphics: The visual representation of the virtual world, as displayed within the Client. Is the world 2D, 2.5D, or 3D? How capable is the user's computer?

Physics: The set of rules governing how objects interact within the virtual world. Is there gravity and can users bump into each other? Does the viewer or server perform physics computations?

Information Services

Account Management: The system for registering new users and keeping track of their preferences and personal information.

Billing: The system for invoicing and collecting revenue. Is revenue collected from users or from advertisers? Are there tie-ins with existing products?

Search: The system for users to find and categorize people, places, and things within the virtual world. What parts of the world are indexed automatically and what parts manually? How often is the index updated?

Marketplace: The system supporting the virtual world economy, including currency and secure transactions between users. Can virtual currency be exchanged for real money? How is the marketplace policed for fraud and other illegal activity?

Social Groups: The system for users to track and manage their social connections and friends. Do these social networking tools extend beyond the virtual world? What levels of privacy are appropriate?

Analytics: The system for logging statistics and metrics of the virtual world so as to diagnose problems and proactively meet demand. What level of detail needs to be recorded?

ESC Proprietary and Confidential

Performance Criteria

This list of broad criteria guides the evaluation of technologies with potential to satisfy our particular use case, that of a custom, branded, web-based virtual world. Some criteria apply to all involved technologies, some only to pieces used in the viewer, and some only to pieces used in the server. Appendix A lists a more fine-grained set of criteria to consider.

General

Extensible

- How customizable is the solution?
- Will the solution meet market demand in the future?

Low licensing costs

- Licensing and maintenance costs, not development time.

Short time to market

- Contract negotiation and development time.

Client

Large crowds

- How many users can appear in a single virtual space?

Low-spec PC

- Will an integrated graphics card suffice?
- How much memory and bandwidth is required?

On the Web

- How easy is the browser plug-in installation?
- What percentage of the market has the plug-in installed?

Server

Scalable

- How many users can be handled by a single machine?

In addition to the above list of performance criteria, each of the technologies considered is also evaluated for feature completeness according to some of the technical components listed on the previous page, namely: graphics, physics, account management, billing, search, marketplace, social groups, and analytics. In general, a less complete technology will require extra expense and time to fill in the feature gaps. A given technology may perform well but be incomplete, or vice versa – both sets of criteria deserve careful consideration.

ESC Proprietary and Confidential

Considered Technologies

This paper compares a limited set of technologies potentially capable of fulfilling the requirements of a custom, branded, web-based virtual world. Many more technologies beyond those considered here may be just as appropriate. Appendix B provides a more extensive list of technologies. Of particular note are technologies too new to review in time for this publication, such as Adobe's Director 11.

All-in-one

Metaplace

- A web-based 2D platform for interconnected worlds.

Multiverse

- A 2D/3D platform for interconnecting many worlds.

OpenSim

- An open-source effort modeled after Second Life.

Second Life

- A popular 3D world that is entirely user-created.

Wonderland

- A 3D world developed by Sun for business collaboration.

Client

Flash

- A popular 2D graphics plug-in for web browsers.

Java

- A general language with good graphics and web support.

Papervision

- A non-accelerated 3D library for Flash.

Unity 3D

- A 3D graphics browser plug-in and game development tool.

Server

Darkstar

- Sun's server technology behind Wonderland.

ElectroServer

- A proprietary server targeted toward Flash-based clients.

Ogoglio

- An open-source Java-based virtual world server.

SmartFoxServer

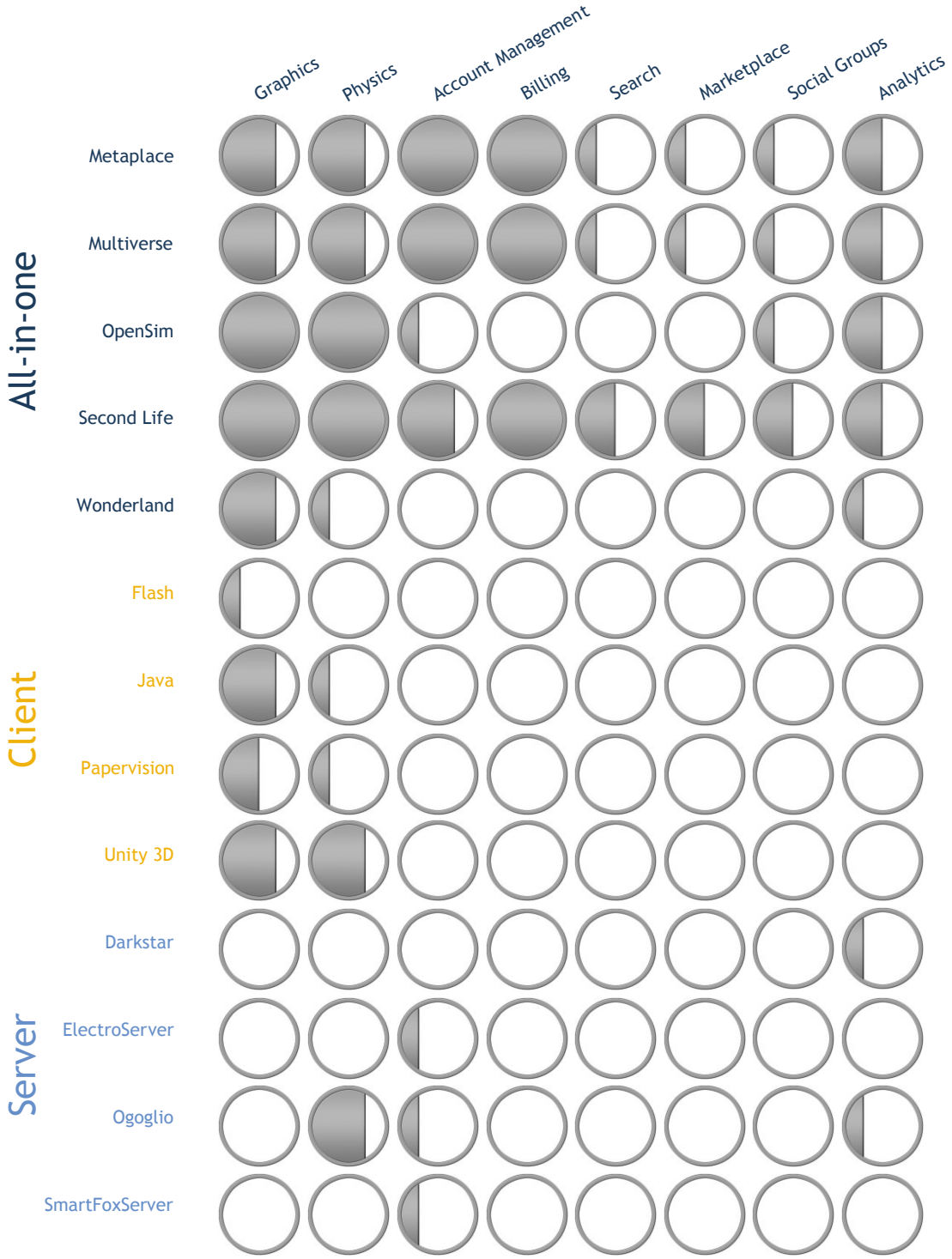
- A proprietary server targeted toward Flash-based clients.

ESC Proprietary and Confidential

The Electric Sheep Company
25 West 36th Street, 8th Floor, New York, NY 10018

Feature Evaluation

= completely = mostly = partially = minimally = not at all



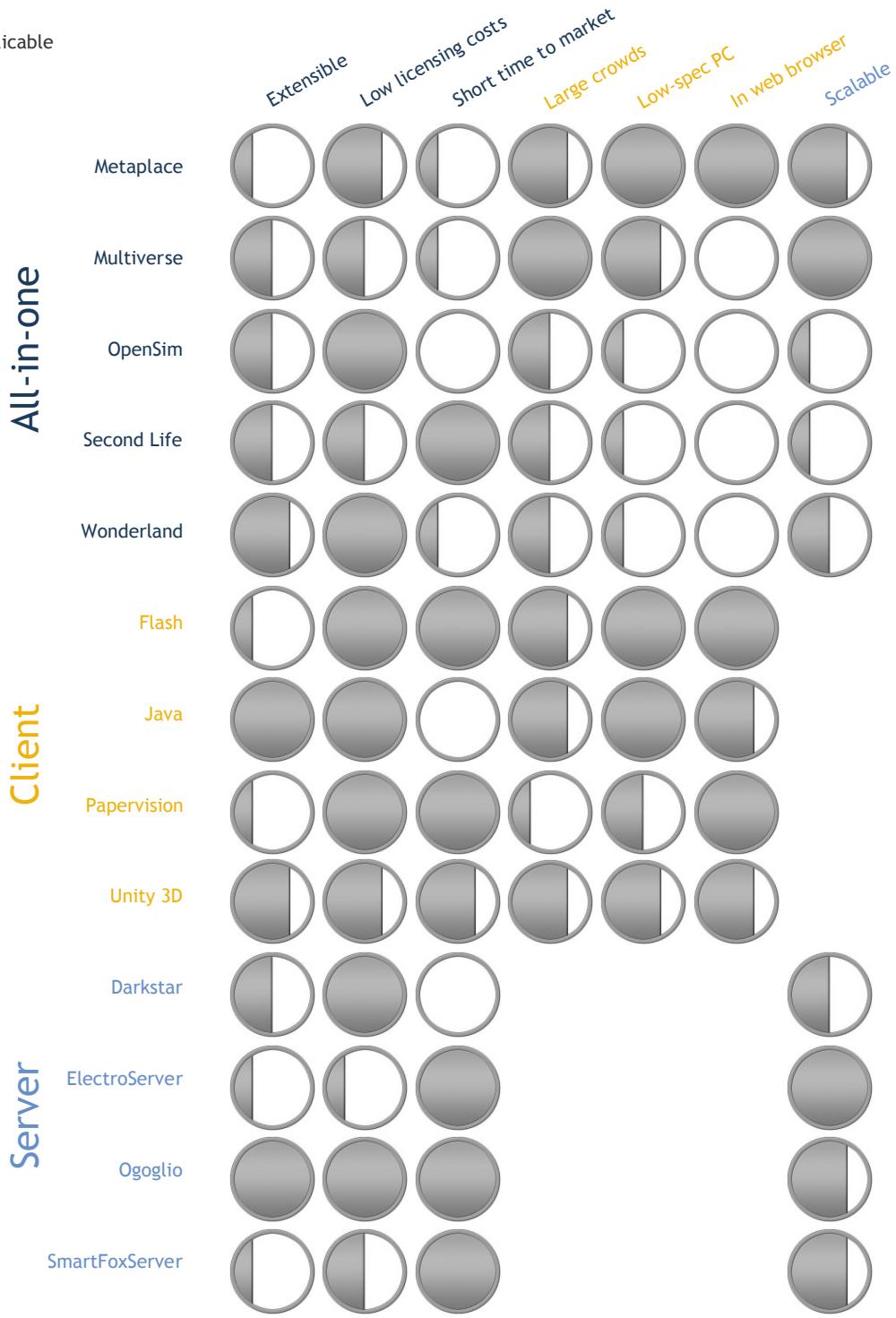
ESC Proprietary and Confidential

The Electric Sheep Company
25 West 36th Street, 8th Floor, New York, NY 10018

Performance Evaluation

= completely = mostly = partially = minimally = not at all

<blank> = not applicable



ESC Proprietary and Confidential

Conclusion

The virtual worlds market is entering a new phase that embraces the immediacy of the web. These new worlds will combine the strengths of today's virtual worlds with those of social networks and games. A wide variety of technologies are emerging to meet the demands of these new experiences.

Choosing the right technology stack is a crucial first step toward creating a successful virtual world. Any innovative new virtual world will require some combination of proven technologies and custom development of new technologies fitted to specific needs. The technology evaluations presented here are a launching point for a more comprehensive evaluation that fully takes into account the unique requirements of a particular virtual world.

ESC Proprietary and Confidential

Appendix A: Other Criteria

Commerce
- Currency
- Listing
- Delivery
- Search

Communication
- Text
- Voice

Development
- Server open source
- Ability to host servers
- Client open source
- Client customizable
- Programmable avatars
- Programmable place
- License
- Programming language(s)
- Streaming content
- Library dependencies

Environment
- **2D / 2.5D / 3D**
- **Topology/map**
- **User access to land**

Graphics
- Hardware Acceleration
- Max polygon count
- Supported file formats
- Supported network formats

Identities and Accounts
- Registration management system
- End users billed to use world
- Inventory system -- built-in
- Profiles
- Groups
- Friends
- Avatar appearance
- Avatar customization

Installation
- **File size (download and install)**
- **Mobile support**
- **OS Support**
- **Minimum system requirements**
- **Update path (new download, patch, etc)**

Media
- **Streaming video**
- **Streaming audio**
- **Embedded web**

Simulation
- Physics engine (client or server-side?)
- Adjustable physics detail

Security
- Land and objects permissions
- Identity verification

Support
- End-user support
- Developer support

User Content Creation
- Scriptable objects
- Script access to viewer and PC
- Art creation -- tools, import process
- Avatar animation
- Collaborative development environment
- Network interface for scripting language

ESC Proprietary and Confidential

Appendix B: Other Technologies

Programming Languages

Director 10
Director 11
Processing
Silverlight

Development Tools

Croquet
Forterra Olive
Instant Action/Torque
OpenViewer
Qwaq
Virtools

All-in-one Worlds

Activeworlds
Barbie Girls
Chapatiz
Club Penguin
Gaia
Habbo
HangOut
HiPiHi
IMVU
Kaneva
Neopets
QQ
Sony Home
Stardoll
There
vMTV
Webkinz
Whyville