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Secure Implementation of Blogs, Wikis, and Second Life

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ABSTRACT

EMC wants to implement Web 2.0 technologies for use in its business processes, and wants to be aware of the security risks associated with implementing these technologies. We identified business needs to be addressed (improving communication company-wide, reaching out new recruiting channels), investigated how changes could be implemented, assessed the security issues involved, and provided recommendations for EMC to securely adopt wikis, blogs and Second Life.

EXECUTIVE SUMMARY

In *Secure Implementation of Blogs, Wikis and Second Life* we look at how EMC, our sponsoring corporation, can implement emerging Web 2.0 technologies securely within their business. The Global Security Organization (GSO), led by Roland Cloutier, sponsored this project with WPI and project advisor Professor Bengisu Tulu, because of a growing request by other departments in the company to have the GSO allow the use of emerging technologies, specifically blogs, wikis, and Second Life.

Background

A blog, short for web log, is a website that contains periodic, chronologically ordered posts (Marketing Terms). Blogs paired with wikis are increasingly used by businesses as cost-effective solutions for many business processes, such as knowledge management (Gonzalez-Reinhart, 2005), and are comparable to expensive and comprehensive IT solutions. These IT solutions include project management and communication tools. Through the use of these new technologies, team members can share knowledge simply and quickly (Sauer, Bialek et al., 2004).

A wiki is a collaborative website that enables any user with access to it to change its content (American Heritage Dictionary, n.d.). One of the most widely known wikis is Wikipedia, the free online encyclopedia. Since the content of a wiki is maintained by the members of its community, a wiki, such as Wikipedia, relies mostly on the trust and honesty of those who use it to police its content. For example, Wikipedia can be edited by anyone who chooses to make an account with Wikipedia. However, pronounced inaccuracies generally do not last for longer than a day.

Second Life is a fully functional virtual world on the Internet. Users (called “residents”) create their own customizable character (“avatar”) and join the online community by participating in community events, as well as buying and selling things on the internal marketplace. Launched by Linden Research Inc. in 2003, this virtual world is completely interactive with its residents. Residents can create and sell items in the marketplace, which is funded by the “in-world” monetary unit called the Linden Dollar

(L$). This is a unique kind of Internet marketplace because residents that create items hold onto the intellectual property (IP) rights of the items that they create. This allows residents to start businesses selling their wares without any risk of Linden Labs taking their products for any reason. Residents can buy and sell Linden Dollars using real money. A monthly fee of US$9.95 gets a resident a weekly stipend of L$300. A private island can be bought for the sum of US$1625 and a monthly maintenance fee of US$295 (SecondLife.com, 2007).

Objectives

There are security issues that stem from the use of blogs, wikis, and Second Life in any organization. The EMC security team wants to assure that proprietary information is not being posted on a public blog or wiki or exchanged through third-party servers on the Internet. In addition, since Second Life is an application that uses incoming firewalled Internet ports, the EMC security team needs to make sure that any ports opened on the firewall are used only for Second Life network traffic, and not by malicious users who might discover the open ports to gain access into EMC's internal network. These concerns have been identified as road blocks to the implementation and use of blogs, wikis, and Second Life in the organization. Therefore, the business value added by implementing these technologies must be compared to the tradeoffs required to implement them in order to see if it will be feasible for EMC to pursue the new technologies at all.

The objectives of this project were (1) to analyze possible security issues that may appear when implementing blogs, wikis, and Second Life in a corporate setting (2) to weigh those issues against the estimated business value added, and (3) to help the project sponsors determine how to best secure these emerging technologies if the business need is determined to be large enough to implement them. Our goal was to illustrate a comprehensive view of how EMC can make use of blogs, wikis, and Second Life in their company, without compromising enterprise wide security.

Methodology

Our methodology included a qualitative study, a document review, and a technology review. The objective of the qualitative study was to collect categorical data that identifies the business value and security aspects of using wikis, blogs, and Second Life at EMC. The data was collected through semi-structured interviews with nine EMC employees from different departments.

The purpose of our document review was to identify the specific sections in existing security policies that apply directly to the use of wikis, blogs, and Second Life, even if these technologies are not explicitly indicated. For this reason, we reviewed the Information Security Policy and outlined the relevant sections. In our discussions, we used this information to assess any gaps in the policy, particularly in addressing the security issues categories discovered from the qualitative study.

The purpose of our technology review was to evaluate Second Life from two standpoints: at a higher level, to identify the security risks associated with the use of Second Life at EMC, and at a lower technical level, to determine a practical method of implementing the application for use at EMC. To achieve the first goal, we used the Second Life software in order to gain user knowledge and find possible security issues. To achieve the second goal, we conducted an experiment to use Second Life through a Remote Desktop connection. This was all done in an external environment from EMC, on WPI-owned machines within the WPI campus network. For both the first and second goal, we also reviewed technical articles from Second Life.

Findings

We found that wikis and blogs have already been released for corporate use at various degrees of implementation. The product was named EMC ONE and it is a new intranet portal that implements Web 2.0 technologies and provides tools for information exchange and interaction. As of December 2007 when this was first assessed by our team, there was an EMC ONE pilot version in place, which was developed using the ClearSpace application by Jive Software. The pilot version supported up to 2,000 users

and at that time had around 1,100 users. The production version was to be released in Q2 of 2008.

Second Life was found to have business value for EMC. The Human Resources (HR) department has expressed their interest in using Web 2.0 technologies in a recruiting environment. Specifically, HR would like to use Second Life to conduct career fairs and interviews for potential EMC candidates. As of January 2008, HR has conducted two career fairs in Second Life. At the first fair, HR collected roughly 150 resumes. At the second fair, over 300 resumes were collected. HR is very interested in this technology and wants to continue to use it in order to expand the audience that traditional EMC career fairs reach.

Recommendations

According to our research and interviews, the only real way for a wiki or blog system to be successful is for a large number of people to use it. This is especially true for wikis because of their collaborative nature. A wiki depends on its community to keep it up to date and running smoothly, and so a small community hinders the accurate and effective development of such pages. To this end, we suggest that EMC start to expand EMC ONE by encouraging people to use this site as an opportunity to improve the communications and transparency of the company. This could be done by marketing the portal to all employees using EMC's email and internal websites, instead of using the current "organic growth" method of implementation.

Throughout our discussion and analysis of the possible uses of Second Life at EMC, we concluded that presently the only business use that is important, viable, and can directly bring business value to EMC at this time is HR recruiting events. In order to accommodate this need while maintaining the current level of security, we recommend that a virtual lab solution be implemented. We do not recommend an enterprise-wide implementation of Second Life at this time, because the security-related risks outweigh the potential benefits.

Conclusion

Emerging Web 2.0 technologies are arriving on the corporate scene very quickly and corporations will either miss out on the vast benefits they bring by avoiding them, or will learn how to implement them securely and successfully in their companies. EMC has taken good first steps in implementing blogs and wikis with the EMC ONE portal, and also by starting to do some recruiting in the Second Life virtual world. While it may be challenging for the GSO to always be up-to-date with current best practices for securely using these technologies, understanding the underlying business needs will help it better respond to the demand for these technologies. In this project, we communicated the business needs we identified with the GSO and provided suggestions for how to allow Second Life and how to improve the EMC ONE portal. By introducing these new technologies, the GSO will address the current business needs and help EMC stay competitive.

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AUTHORSHIP

This project represents the joint work of Angela L. Burrows, Stephen J. King, and Stefan R. Rashkov. All members of the group participated equally in planning the project, framing the report, conducting interviews, analyzing results, and writing the report.

1 INTRODUCTION

This project explores the possible uses of wikis, blogs, and Second Life, and EMC has chosen to sponsor it in order to understand the full security implications of implementing these technologies on an enterprise scale. Specifically, EMC is interested in how these technologies can be used securely in the corporate environment, and what value they will add to the business. Another important condition is that EMC should always know the risk of proprietary information being exchanged on servers outside of EMC's network. After an introduction to the company and the topics of research (the Web 2.0 technologies of Blogs and Wikis, and the social networking portal called Second Life), we will explain how we used our knowledge and services for the benefit of the sponsoring corporation.

EMC Corporation is a leading developer and provider of information infrastructure technology. The company provides storage platforms, software, services, and integrated solutions to banks and other financial services firms, manufacturers, Internet service providers, retailers, and the public sector (Lower, EMC Corporation Company Overview, 2007). It currently employs approximately 31,000 people around the world (EMC Corporation, 2007). To maintain and improve its leading position, EMC needs to innovate and stay current with new technologies. The company has identified Web 2.0 and Second Life as two areas of interest that could be implemented for internal corporate use to streamline and improve existing business processes. This project identifies the business uses of these technologies and makes recommendations on how to implement them.

Web 2.0 is a broad term for new and emerging Internet-based technologies that connect people in more dynamic and interactive ways than in the past. Users in a Web 2.0 environment are not just consumers of information but also co-developers. For example, social-networking sites are online sites that use Web 2.0 technology. On these sites, users create personal profiles and can relate to, and connect with other people in a variety of ways. Another example is Wikipedia, which is a Web 2.0 version

of a paper encyclopedia. It essentially serves the same purpose as an encyclopedia, but is unique in that it is available for free to anyone on the Internet, and that anyone can change any information on it. This dynamic capability of Wikipedia is based on wikis, which are web pages that users can easily create and edit. This allows users to share knowledge about domains that they are strong in, as well as review information that other people post. The functionality of a wiki is provided by content management software typically running on the server side. A similar technology is the web log, or blog, which allows users to post content to the public in a chronological order and allows readers to add comments to every posted item. Web 2.0 technologies such as blogs and wikis, which will be two of the three subjects of this project, have transformed the Internet and are increasingly used by businesses as cost-effective solutions for many business processes, such as knowledge management (Gonzalez-Reinhart, 2005).

Second Life is a three-dimensional online virtual world. Unlike blogs and wikis, which are web-based technologies that can be implemented using software from different vendors, Second Life is a proprietary Internet-enabled client program. In its most basic form, it can be thought of as a social networking site combined with a complex video game. Second Life provides a much more sophisticated environment for interaction than other social networking sites because of the personal feel that people will get interacting in a three dimensional world with another person. An avatar is assigned to every user who logs into the world, and the user can manipulate that avatar and interact with other avatars, which are being manipulated by other real people. The site was started mainly for home consumer use, thus its use for business is only beginning to gain popularity.

1.1 Problem Statement

There are security issues that stem from the use of blogs, wikis, and Second Life (Prentice, 2007) (Lawton, 2007). The EMC security team needs to be confident that proprietary information is not being posted on a public blog or wiki or exchanged through third-party servers on the Internet. In addition, Second Life is an application that uses incoming firewalled Internet ports, and EMC needs to be sure that any ports

opened are used only for Second Life network traffic, and not by malicious users who might discover the open ports to gain access into EMC's internal network. These problems have all been identified as road blocks to the implementation and use of blogs, wikis, and Second Life, and will have to be compared to the business value added by implementing these technologies to see if it will be feasible for EMC to pursue the new technologies at all.

1.2 OBJECTIVES

The objectives of this project were to analyze possible security problems of implementing blogs, wikis, and Second Life in a corporate setting and to estimate the added business value of implementing these technologies. Another objective was to determine the feasibility of implementing the technologies and to provide a recommendation to the Project sponsors for their secure implementation. Our goal was to illustrate a comprehensive view of how EMC can make use of blogs, wikis, and Second Life in their company without compromising enterprise wide security.

Next, we will provide information about EMC, and the relevant technologies that was gathered in our literature review. After that, we will describe the steps that were taken to complete the project. We will discuss our findings in the next chapter and finally offer our conclusions and recommendations.

2 BACKGROUND

2.1 EMC BACKGROUND

2.1.1 HISTORY

EMC was founded in 1979 in Newton, Massachusetts and was originally a manufacturer of memory boards. Later in the company's development, the memory boards were followed by disk drives, and eventually large storage platforms. Today, the company is headquartered in Hopkinton, Massachusetts, and has shifted from being a company centered on hardware to a company that provides complete information infrastructure solutions including hardware, software, and services.

The company grew steadily during the 1980s, when it expanded into data storage. In 1990, the company introduced RAID (redundant array of independent disks) storage. The company has kept growing and expanding its products mainly through numerous acquisitions to include software for information lifecycle management (ILM), security, and virtualization. EMC has successfully competed against companies like HP and IBM by developing new storage technologies, growing its software products, and partnering with companies like Dell and Samsung to increase its market reach.

The company's most recent significant acquisitions focused on expanding the software selection and included the following companies; Documentum (2003), VMware (2004), Rainfinity (2005), Captiva (2005), and RSA Security (2006). Also in 2006 EMC purchased a company which dealt with data protection software development, called Avamar Technologies (Lower, EMC Corporation History, 2007).

2.1.2 PRODUCTS

EMC offers products in four segments: information storage, content management and archiving, RSA information security, and VMWare virtual infrastructure (Yahoo! Finance, 2007). The company's systems, software, and services support the critical business processes of their clients by creating an information infrastructure for storing, managing, and protecting information.

The information storage product segment focuses on networked storage systems for deployment in a SAN (storage area network), NAS (network attached storage), CAS (content addressed storage), or direct-attached storage environment. These systems are designed to support the ILM (information lifecycle management) strategies of the business to meet its requirements for performance, functionality, scalability, data availability, and cost (Reuters, 2007). Products in this category include the Symmetrix, CLARiiON and Celerra storage systems, and the Connectrix family of directors and switches. This product segment also offers a wide array of platform-based software, which controls functions like replication, optimization, and data movement, and multi-platform software designed to store, protect, and optimize data (Yahoo! Finance, 2007). Finally, EMC provides to its customers consulting services, assessment, implementation, integration and operations management services, day-to-day support, maintenance, and training (Reuters, 2007).

The second product segment features content management software, namely EMC's Documentum family of products, which optimizes business processes by streamlining the creation, management, delivery and archival of information. Another product family, called Captiva, offers input management that processes paper-based information and makes it into digital form (Reuters, 2007).

The RSA information security segment offers a number of security products and services, such as enterprise identity and access management, consumer identity and fraud protection, encryption and key management, and tools for collecting, monitoring, analyzing and reporting on the security impact of an event throughout the IT infrastructure (Reuters, 2007).

Lastly, the virtualization software offered by the VMWare virtual infrastructure segment helps enterprises to increase their hardware utilization and reduce cost by allowing them to consolidate and contain servers, provide disaster recovery and business continuity, plan for capacity, and to develop, test, host, and distribute software more efficiently (Reuters, 2007).

2.1.3 Size and Global Presence

According to EMC.com, EMC's sales revenue in 2006 was $11.155 billion, which was 15.4 per cent more than 2005. Today, it employs 31,100 people worldwide, including 8,000 in Massachusetts, and has established a global presence with sales offices in 100 countries and distribution partners in more than 50 countries (EMC Corporation, 2007). EMC products are developed or manufactured in Massachusetts, North Carolina, California, and Ireland. The company runs R&D facilities in Massachusetts, North Carolina, Belgium, China, France, India, Israel, Japan, and Russia and customer support centers in Australia, Massachusetts, Ireland, and Japan (EMC Corporation, 2007).

2.1.4 Internal Communication and Networking

Currently, EMC uses many different technologies to facilitate communication internally. Email, Microsoft LiveMeeting, and eRoom are some technologies used for these purposes. We came across a collection of online communities used internally at EMC during our research called EMC ONE. This is a blog and wiki based site that facilitates easy communication throughout the company. We will elaborate more on this subject in the findings section of this document.

Because EMC is such a large company, all security problems are prevented by a "defense in depth" strategy over the many different layers, including the Demilitarized Zone (DMZ), Network Layer, Application Layer, and Client Layer. Firewalls that block traffic from outside the company are put in place to prevent malicious users from getting into the network at all. Mid-level Security Firewalls, Intrusion Prevention Scanners and Content Scanner and Filters help to prevent attacks from internal users (who may have downloaded a virus at home) or any malicious traffic that has made it into the inner network through the outer firewall. This means that anything coming into EMC's network from the Internet or internally has to be carefully scanned and positively identified as safe and censor approved material before it is allowed to access certain servers or connections.

The level of security in place makes using applications like Second Life nearly impossible. Because of the amount of different ports and protocols that Second Life requires to function, EMC has been forced to deny its use for employees up until this point. A select few employees in the HR department have been able to use it out of the Hopkinton Office, by opening the ports that Second Life uses at the different levels of firewalls and allowing a very risky open connection from the client machine to the external Internet connection.

2.2 BLOGS

New technology can offer improved communication and ease of access to knowledge for any organization. Blogs are no exception. "A weblog is a website which contains periodic, chronologically ordered posts on a common webpage" (Sauer, Bialek, Efimova, Schwartlander, Pless, & Neuhaus, 2004, p. 82). Although it is not their intended use, blogs paired with wikis have the potential to compare to expensive and comprehensive IT solutions in the past. Also according to Sauer, Bialek, et al., these IT solutions include project management and communication tools. Through the use of these new technologies, the team members can share knowledge simply and quickly.

2.2.1 HISTORY

Internet forums, also known as message boards, emerged in the mid-1990s (Preece, Maloney-Krichmar, & Abras, 2003). They had threads of conversation on them that users could start and comment on. A person could have multiple threads on a single message board which user could sample on a main message board page. The modern web log was just like its name suggests. Internet users began to log their activities on the web for others to see. Message boards are still used to discuss various topics, while a blog is usually used by one person to express his or her own feelings about a topic while allowing others to comment on these writings.

It is commonly known that the first blogs surfaced as journals or diaries that people could place online for anyone to see. Soon, they became more focused on

particular subject matter and evolved into a popular forum for people to share their thoughts about the world, politics, and any issue that is important to them.

This term was coined in 1997, when Jorn Barger used the phrase “weblog” at one of his conferences. Two years later, credit is given to Peter Merholz, who broke the word up into “we blog” on his personal webpage (which some would consider a blog, ironically) and thus “Blog” was born. Over the time period between summer ’99 and summer ’04, the Internet saw the number of blogs go from 23 to over 3 million (Information Week, 2006).

Blogs have evolved into different forms including video blogs often found on community video sites, like *YouTube,* or another form of mini-blogging, which encourages shorter quicker stories that more people will read.

In politics, the 2004 election was really the first to see blogging from campaign trails, which vaulted the technology into the main stream of the US. In 2005, Fortune magazine listed 8 individuals famous for blogging that “business men could not ignore”. Finally in 2007, the blogging got popular enough to have a code proposed for its standards. This “Blogger’s Code of Conduct” came from Tim O’Reilly (O'Reilly, 2005). Technorati, a popular blog search tool is “currently tracking 108.5 million blogs and over 250 million pieces of tagged social media” (Technorati, 2007).

2.2.2 Business Uses

Many companies are now using blogs as “effective marketing tools, casual forums for networking and a way to get public feedback” (Robertson, 2006). According to Robertson, certain CEOs of companies (mostly technology-based) are using blogging as a way to break the ice with their employees and to let the customers feel more comfortable by giving the company a personality. As an example, when Jim Estill took over a Canadian company called Synnex Canada Ltd., he began blogging in order to get his over three hundred staff to feel as if they know him better (Robertson, 2006). There are a number of high-profile corporate bloggers in the industry at companies such as Microsoft, Sun Microsystems, Boeing, and GM and many of these bloggers will

argue that the benefits of blogging will outweigh any kind of concerns about confidentiality; they compare blogs to being a “giant water cooler” (Robertson, 2006). Blogs are a place where people can brainstorm for ideas between each other, which usually ends up improving on an idea (Robertson, 2006).

On the other hand, security issues are a reality. A recent survey by the British market research firm YouGov on blogs at the workplace indicates that more than one-third of blogging employees post potentially risky information about their employer, workplace or colleagues on personal blog sites (Pain, 2007). According to the same survey, thirty-nine percent of employees who blog may have posted information that could be considered privileged or confidential.

The situation is comparable to the early days of email, before employees were trained to not send inappropriately worded emails in the heat of tense moments. After emails were considered the same as official correspondence, this problem was lessened. Right now blogs are not considered to be official correspondence, so rude or heat-of-the-moment comments are still commonplace. Until such standards are adopted like those that changed email, blogs will remain a potential risk factor for large corporations. As a result, high-ranking executives currently write nearly all external blogs.

2.3 Wikis

2.3.1 History

According to American Heritage Dictionary, a wiki is a collaborative website that enables any user that has access to it to change its content (wiki). One of the most widely known wikis is Wikipedia, the free online encyclopedia. This is a very simple technology that relies mostly on the trust and honesty of those who use it to police its content. In its simplest form, the wiki is web content that is maintained by the members of its community. For example, Wikipedia can be edited by anyone who chooses to make an account with Wikipedia. In general, pronounced inaccuracies on Wikipedia, perhaps brought about by curious college students, do not last for longer than a day.

The first wiki, called WikiWikiWeb, was created by Ward Cunningham (Cunningham, 2003). It was started in 1994 and installed on a server in 1995. "Wiki" is the Hawaiian word for fast. The term for this collaborative website was inspired by the "Wiki-Wiki bus" a bus in Hawaii that travels between airport terminals.

There are really no predecessors to the wiki. The closest idea would be a mix between a set of articles, and a message board. The wiki combines these two seamlessly as people are allowed to comment on another's addition to the wiki, not through a message board that will need to be moderated before the articles are changed, but by changing the articles and adding comments like "This article needs more justification" and inviting others to improve it.

2.3.2 Business Uses

A wiki is a server-based program that allows people to communicate more effectively by enabling them to make changes and improvements to each other's content. This is especially useful when teams need to collaborate. They can use the wiki to edit each other's work at any time, and maintain a solid tracking system so that edits can be reversed if it is discovered that they do not contain the correct information. This software would interact with users in a web-based environment that is familiar to them and easy to understand.

All wikis have problems with data integrity. Since anyone is allowed to edit the content of these pages, the content can quickly become inaccurate or corrupt in the hands of malicious users. These problems are prevented in large websites such as Wikipedia by bots that can determine when inaccurate or random content was added or large amounts of real content were removed. In order to help prevent data inaccuracies, Wikipedia has set community guidelines and standards that its users should follow and help to enforce. There are also administrators who are volunteers given technical rights to fix the wiki by Wikipedia to patrol the wiki and make sure that inappropriate content is removed and that users are using the wiki effectively (Wikipedia:Administrators). And finally, wiki community members themselves police the website by changing content that is definitely inaccurate and flagging content that is potentially inaccurate.

EMC can use wikis for both internal and external uses. Internally, wikis can be used for team collaboration as well as news sharing and definitions of company-used terms and abbreviations. Also, wikis and blogs can be used to help all employees maintain awareness of what is going on in the rest of the company. Wikis have been shown to increase productivity of novel ideas (Majchrzak, Wagner, & Yates, 2006). A wiki can be whatever its audience and users want it to be. At the very least it can be a reliable and easily updated source of information for members of the community.

Externally, the wiki would act more as a blog to let potential customers or employees write down their experiences with the company, the website, or products that EMC has to offer. It can also offer a kind of technical support site that allows users that have come across problems to post the resolutions so that other customers who might have the same problems can see what other companies are doing. This also would aid EMC in case there is a serious problem with a product. It would be beneficial for EMC to house a forum in which problems encountered can be posted so that if a serious problem occurs, EMC can have advance warning. This would allow EMC to prepare statements faster than if this information is scattered over the Internet.

It is quite common for companies to use wikis elsewhere in industry. The most common ways that other businesses use wikis are: software development, e-learning, project management, posting of general information and knowledge management, user groups, ad-hoc collaboration, technical support, marketing and customer relationship management (CRM), resource management, and research and development. Based on survey research by Majchrzak, et al, wikis make work significantly easier. She found also that benefits are most often found when products of innovation are the primary concern. Users are less likely to find help in a wiki to complete routine tasks. Rather they use the free exchange of ideas and expertise to improve generation of novel ideas (Majchrzak, Wagner, & Yates, 2006). These possibilities show the EMC has many options for using wikis to better the company.

2.4 SECOND LIFE

2.4.1 HISTORY

Second Life is not a video game. It is a fully functional virtual world on the Internet. Residents (users), create their own customizable character (avatar), and join the online community by participating in community events, and buying and selling things on the internal marketplace. Launched by Linden Research Inc. in 2003, this virtual world is completely interactive with its residents. Residents can create and sell items in the marketplace, which is funded by the in-world monetary unit called the Linden Dollar (L$). This is a unique kind of Internet marketplace because residents that create items hold onto the intellectual property (IP) rights of the items that they create. This allows residents to start businesses selling their wares without any risk of Linden Labs taking their products for any reason. Residents can buy and sell Linden Dollars using real money. A monthly fee of US$9.95 gets a resident a weekly stipend of L$300. A private island can be bought for the small sum of US$1625 and a monthly maintenance fee of US$295 (SecondLife.com, 2007).

There are many different kinds of virtual worlds present on the Internet, however Second Life is one of the largest and most diverse worlds. The maintenance of IP rights within the game offers people relatively safe business opportunities that many of the other virtual worlds do not. There is fraud and crime to some degree in Second Life so users need to maintain the level of personal security in-world that they regularly use in the real world.

Second Life is also becoming a forum for academia. There are many different schools present in Second Life ranging from the Australian Film TV and Radio School to Virginia Tech (Second Life: Universities and Private Islands). This platform offers the opportunity for people all over the world to be a part of communities all over the world. The academic islands offer lectures and presentations in-world similar to how they are presented in person. As more people use Second Life the bigger and better it becomes.

Residents can walk, run, or fly around the islands of Second Life. They can participate in online discussions and meetings in places that are designed to facilitate those discussions. Corporate meetings can take place in a virtual conference room that is modeled after the boardroom of that company. The primary form of communication in Second Life is text chat, however the community is fully voice enabled making teleconferenced meetings across multiple countries completely possible(Hall & Nguyen, 2007).There are currently over 12 million residents in Second Life with roughly 487,000 residents logged in within a week (Second Life Economic Statistics).

2.4.2 Business Uses

According to Maddox, 2007, Intel and IBM have both entered the virtual world of Second Life. Intel has created the Intel Dev Zone in Second Life, a developer's community dedicated to improving the multiple core technologies of Intel. IBM uses Second Life as a venue for meetings, training, and recruiting (Maddox, 2007). It has over 230 employees spending time in-world, and owns about half a dozen islands. Other companies, like Deloitte U.S., use virtual worlds like Second Life to test new recruits by placing them in situations that they might be faced with at the company. This way, they can test specific skill sets using specific scenarios for their recruits (Maddox, 2007).

EMC can use Second life for a variety of purposes. Worldwide meetings are easily facilitated in Second Life without much added expense. Recruiting is already on going in Second Life at EMC. Training sessions can be created to aid new employee orientation as well as improving understanding when new systems need to be put in place. Group collaboration is much easier in Second Life, especially when one considers the fact that many groups are spread across continents. It seems to be easier and more fun to interact on Second Life than in regular forms of group communication.

3 METHODOLOGY

For this project, we conducted a qualitative study of the business uses and security issues, a document review and a technology review. This chapter describes the methods we used for each and the rationales behind them.

3.1 QUALITATIVE STUDY

The objective of the qualitative study was to collect categorical data that identify the business and security aspects of using wikis, blogs, and Second Life at EMC. The data were collected through interviews.

3.1.1 SAMPLING METHOD

We interviewed a non-probability sample, which was selected using a combination of the snowball and judgment sampling methods. The judgment sampling strategy is common for qualitative research and involves the active selection of the most useful sample to answer the question (Marshall, 1996). In our case, such a useful sample is known as a "key informant" sample because it includes subjects with special expertise in particular areas. The judgment approach is used to ensure that participants come from a range of backgrounds. The judgment selection criteria were to find candidates from different departments and areas of expertise, and with different levels of familiarity with the technologies in question. Our initial subjects were from the Global Security Office, which sponsors this project. To grow our sample, following the snowball sampling method, we asked our subjects to recommend other potential candidates that would be useful. Eventually, the sample included a total of nine participants from the HR, Marketing, and Technical Sales departments, as well as the Security (GSO), Support (ITSM), and the "Collaborative Tools" Process and Portfolio Management Group (PPMG) units within the Information Technology department, who also had varying levels of familiarity with the technologies in question. This number of subjects sufficiently fulfilled our judgment selection criteria and we determined that this is an appropriate sample size as new categories stopped emerging from the data.

3.1.2 INTERVIEW PROTOCOL

We created two sets of interview questions for technical and non-technical interviews, which can be found in Appendix A. The technical interview questions focused on the security and implementation issues of the studied technologies, specifically relating to methods of authentication, privacy of information, and content filtering. Regarding Second Life, the main focus was on different methods of allowing the use of the application within EMC's network.

The non-technical questions focused primarily on the business needs and the benefits and drawbacks of the studied technologies. It included questions regarding what solutions are currently used to satisfy the existing business needs and whether and how blogs, wikis, and Second Life can bring additional value to the business.

Our interviews were semi-structured. In semi-structured interviews the interview protocol is consistently followed with each subject in the sample, even though the content, length, and complexity of responses to the questions may vary considerably between subjects. The main advantage of this approach, compared to fully structured interviewing, is that it allows interviewers to explore complex issues by asking open-ended questions, while keeping the interviews sufficiently standardized to allow for comparison of the collected data (Carey, Morgan, & Oxtoby, 1996).

The interviews were scheduled by e-mail one to two weeks in advance. A standard invitation letter, found in Appendix B was sent to all subjects. All participants responded to our invitation. The interviews were conducted in person when possible and by phone otherwise and each took between twenty and thirty-five minutes. All group members participated in the interviewing process: Stephen King and Stefan Rashkov were the main interviewers, and Angela Burrows had the task of taking notes and asking additional questions. Each interview was summarized immediately afterwards. All interview summaries can be found in Appendix C.

3.1.3 Data Analysis

The analysis of the interview data we collected included summarizing each interview and identifying the three most important points from that interview. Then, we categorized all the data into different business uses, security issues, and concerns and recommendations. This analysis helped us define the business needs for the technologies, both at the enterprise and the department levels. Secondly, it helped us identify what existing technologies are currently used to meet those needs. Lastly, the analysis helped us determine how wikis, blogs, and Second Life can respond to those needs and what value they bring. On the technical side, we defined the categories of security-related issues for the use of the technologies.

3.2 Document Review

The purpose of our document review was to locate the specific items in existing policies that apply directly to the use of wikis, blogs, and Second Life, even if these technologies are not explicitly indicated. For this reason, we reviewed the Information Security Policy and outlined the relevant sections (EMC Information Security Policy, 2006). In our discussion chapter, we use the results of the document review to assess any gaps in the policy, particularly in addressing the categories of security issues discovered through the qualitative study.

3.3 Technology Review

The purpose of our technology review was to evaluate Second Life from two standpoints: at a higher level, to identify the security risks associated with the use of Second Life at EMC, and at a lower technical level, to determine a practical method of implementing the application for use at EMC. To achieve the first goal, we used the Second Life software in order to gain user knowledge and find possible security issues. To achieve the second goal, we conducted an experiment to use Second Life through a Remote Desktop connection. This was all done in an external environment from EMC, on WPI-owned machines within the WPI campus network. For both the first and second goal, we also reviewed technical articles about Second Life.

We also conducted a technology review of the internal online community portal called EMC ONE. The main purpose was to identify its functionality, what it is currently used for, and what restrictions it has regarding authentication, anonymity, content filtering and other measures to protect the security of information.

The results of the technology review of Second Life and EMC ONE are summarized and discussed in Chapter 4.

4 Discussion of Study Findings

This chapter discusses our findings from the information that we have collected through interviews and the research that we have conducted throughout the project. First, we discuss the different business uses of wikis, blogs, and Second Life at EMC. Next, we describe how wikis, blogs, and Second Life can be implemented at EMC. We note that wikis and blogs have already been released for corporate use at various degrees of implementation, and thus we focus our attention on how they can be improved and expanded to other audiences, such as customers. Then, we describe three alternate solutions for implementing Second Life for business use, comparing their advantages and limitations. Lastly, we present and compare several platforms for creating a privately hosted virtual world, which is one of the three alternate solutions.

4.1 Uses

4.1.1 Collaboration and Information Sharing

Wikis and blogs can significantly enhance the information sharing and collaboration within the organization, because they provide an easy way for regular users to add and edit content, receive updates, and search for information. For collaboration, the company currently uses eRoom as a standard companywide solution. Information sharing is achieved through a number of internal online portals that are typically organized around each department's function and individual needs. As a result, the information is segregated and, for people outside a specific department, it is more difficult to find or update.

4.1.2 Human Resources Recruiting

The Human Resources (HR) department has expressed interest in using Web 2.0 technologies in the recruiting environment. Specifically, HR would like to use Second Life to conduct career fairs and interviews for potential EMC candidates. So far, HR has conducted two career fairs in Second Life. At the first fair, HR collected roughly 150 resumes. At the second fair, over 300 resumes were collected. HR is very

interested in this technology and wants to continue to use it to expand the audience that EMC career fairs reach.

4.1.3 Internal Real-Time Communication and Virtual Meetings

Virtual meetings provide a richer experience than phone calls and allow a much larger number of people to participate in a meeting. EMC currently uses Microsoft Office Live Meeting as its standard tool for virtual meetings. The software can be used for web conferences with up to 250 participants. It is a tool that is also widely used for communicating with vendors.

Another application currently used for real-time communication is Microsoft Office Communicator. It is primarily used for one-on-one communication and features instant messaging, voice, and video conferencing.

Second Life has been proposed as a virtual meeting tool by the Human Resources and Marketing departments. The reason for this proposal is that they believe Second Life creates a different and richer virtual meeting experience than any of the tools currently used. However, two out of nine subjects interviewed were not familiar with Second Life and another two who had heard of it did not see any value in it as a virtual meeting tool. Their main argument was that the software they use already provides excellent functionality for their needs, and they see no value added in switching to an application which "puts off" most people who enter it. Only two out of the nine subjects thought that virtual meetings would be useful, while the remaining two who had experienced Second Life were indifferent about having meetings "in world"

4.2 Implementation - Blogs and Wikis

In response to the opportunities these new technologies present, the Information Technology department has created a new Process and Portfolio Management Group (PPMG) for Collaboration Tools. The PPMG is the link between the developers and the business people in the organization. While other PPMG's are aligned to functions like marketing, sales, or manufacturing, the Collaboration Tools PPMG is enterprise-wide.

The Collaboration Tools section manages the EMC ONE project. EMC ONE is a new intranet portal that implements Web 2.0 technologies and provides tools for information exchange and interaction. As of December 2007, when this was first assessed by our team, there was an EMC ONE pilot version in place that was developed using the ClearSpace application by Jive Software. The pilot version supported up to 2,000 users and at that time had around 1,100 EMC users. The production version was to be released in Q2 of 2008.

The EMC ONE portal features wiki-driven discussion forums, document sharing, and blogging. The portal is organized into "spaces" that users can create themselves with currently over 100 spaces. Each space corresponds to a particular topic or area of interest. One such space is the "EMC Water Cooler" which is a more casual place where members can exchange information of general interest, or ask questions about something they cannot find elsewhere on the portal.

The main advantage of EMC ONE is that it is a unified resource for all EMC employees. It also has features that are not available on other enterprise intranet portals, such as the Power Link knowledge base used by the technical sales group. Such features include user-created polls and user page ratings. Ratings can be particularly useful, because they show what value the readers of a page find in it, especially since this is a website where any visitor can post and edit content. Another useful feature is that content is tagged with keywords, which enables a much more accurate and thorough search functionality.

Authentication is currently achieved through EMC's Active Directory system (the same system that provides computer logins and email addresses), which eliminates the need to create a separate account or password. The sponsors of EMC ONE wanted the portal to be open for any information and opinion from employees, since it is an internal portal. They believe that this will make the company much more transparent, thus helping communication between departments, which would add value to the company as a whole. Two of the project sponsors of this portal, when interviewed, did not consider an abuse of the system to be a potential issue for the security of information.

According to them, the users of EMC ONE cannot misrepresent themselves, and thus anything that they post or blog about will be handled in the same manner as if they sent out an inappropriate email to another employee. In contrast, a participant from Information Security (Subject I) has stated that just as other authentication mechanisms, an Active Directory account does not eliminate the risks of impersonation or abuse. According to the same participant, anyone at EMC who is capable of creating Active Directory accounts can create a false account, sign up for EMC ONE with that account, and abuse the portal. Also according to Subject I it is possible for a hacker to intercept and decrypt login information. This would allow the hacker to not only misrepresent himself, but falsely represent another person inside the company, or outside, if these technologies are implemented externally. One possible way to address the information security concerns is to actively remind users of the information security policy, in an explicit and concise statement located in a visible area of each page, for example next to navigation or submission buttons.

Another drawback of EMC ONE is that, although it has hypothetically limitless room to grow, there is a relatively limited number of users and limited content. As of December 5, 2007, our interviews indicated that there were 1,100 users signed up on EMC ONE (see Appendix C). In February 2008, our interview with Subject H revealed that there are 2,500 users of the portal, which represents less than eight percent of the EMC employees. Just like any other collaborative website where users are also the creators of content, it is critical that a large user base actively reads, updates, and contributes to the portal, to make it useful. The current strategy of the sponsors is to grow the portal organically, i.e. to publicize it by word of mouth rather than require people to use it, because their goal is to create a vibrant online community that behaves and grows like a natural community. Because of this, the current participation in the portal is still comparatively low.

A functional limitation of EMC ONE, identified through interviews with users of the portal, is the inability to include graphics in posts. Graphics, such as pictures,

charts, and diagrams can considerably enrich the user experience, as it makes text content easier to understand and more compelling.

4.3 Implementation - Second Life

Because EMC is such a large company, all security problems have to be prevented by a "defense in depth" strategy over the many different layers, including the Demilitarized Zone (DMZ), Network Layer, Application Layer, and Client Layer. Firewalls that block traffic from outside the company are put in place to prevent malicious users from getting into the network at all. Mid-level Security Firewalls, Intrusion Prevention Scanners and Content Scanner and Filters help to prevent attacks from internal users (who may have downloaded a virus at home) or any malicious traffic that has made it into the inner network through the outer firewall. This means that anything coming into EMC's network from the Internet or internally has to be carefully scanned and positively identified as safe before it is allowed to access certain servers or connections.

This level of security does not currently allow the use of the Second Life application. Since it uses the User Datagram Protocol (UDP), it cannot function properly inside of EMC's network because the UDP packets it uses are stateless, preventing the Network Address Translator (NAT) mechanism from properly directing the packets to their destination computer.

Transmission Control Protocol (TCP) and User Datagram Protocol differ in the fact that TCP packets will always arrive at a destination in the same order as they left their source. This happens because the source will not send another packet until it receives a confirmation that the first packet was received by the destination. UDP works more efficiently, by sending all packets without confirmation of delivery, and then simply resending any that did not make it after the fact (RFC 793 - Transmission Control Protocol; RFC 768 - User Datagram Protocol). Because of this difference, they are manipulated by a NAT differently. The NAT is a protocol that hides the true source of a packet coming from behind a corporate firewall (RFC 1631 - The IP Network Address

Translator (NAT), 1994). The NAT prevents a true end-to-end connection, meaning it intercepts packets from a source, logs the source and destination IP addresses, changes the source destination to a generic IP address, and sends the packet. When the packet returns to the firewall, it needs to check the log for the source IP (which was originally the destination IP) and switch the new destination IP from the generic one to the original one that coincides with the old destination. The problem with this is a TCP address will be for the exact packet that it came from originally, but the UDP packet may be out of order since the protocol sends all the packets in a row, so the translation may get distorted. This results in the packet exchange failing, which causes the original transmission to get a distorted response. In the case of a high resource application (like SL), the distorted transmission will render the network connection useless.

As pointed out in one of our technical interviews, if Second Life used the TCP, this would not have been such an issue. Select employees in the Human Resources department have been allowed to use Second Life inside the network. The current workaround that allows this is to create a static IP address for each user and to write exceptions in the firewall rules for each specific IP address. It is clear that this method could not be used on a large scale because it would require a large number of static IP addresses and would make it more difficult to oversee the traffic that is allowed by the firewall exceptions. Overall, the information security personnel is concerned that by opening the ports used by Second Life at the different levels of firewalls, they would considerably increase the risk for the connection between a client machine inside EMC and the Internet.

Our analysis led to many different possibilities when finding a compromise between the security team and the HR/Marketing team in regards to the usage of Second Life. Each possibility, as described below, has pros and cons and fits the different uses uniquely.

4.3.1 LIVE LAB

A physical computer lab can be set up, perhaps in Hopkinton, to allow users to connect to Second Life for the main goal of providing access to the community for recruiting purposes. This lab would be the only place within the EMC network that would be allowed to bypass the security measures in place that currently prevent Second Life from working correctly through the EMC network. It would consist of 8-10 computers that need to be fast enough to run Second Life. The estimated costs for this would consist of the cost for the room and the cost for the hardware to be installed there (~$700-$800 per computer).

Pros: This is a good option to maintain access for those who currently use Second Life for business purposes.

Cons: This prevents EMC employees from other areas of the world from accessing Second Life on the network. This requires computers with an open connection to the Internet, which might not be desirable for all employees to have access to. Requires additional space in Hopkinton, which may or may not be easily available.

4.3.2 VIRTUAL LAB

Similar to the physical computer lab, EMC could set up a virtual computer lab that employees can remote desktop into to use Second Life. Employees would sit at their own workstations and run a program that would connect them to a server on EMC's network. This server would emulate a computer and allow the employee to run Second Life through the connection. Many different employees could utilize the Second Life application on one server. This server would have the direct connection to the Internet so that the employees' computers would not have to. This would require a dedicated server, preferably running Microsoft Server 2008, but would have to run at least Windows Vista, to provide the power and capabilities to run Second Life over a remote connection. The personal computers of the users of the virtual lab are also going to have to be upgraded to include Microsoft's Terminal Services Client 6.0 (MSTSC),

because of a limitation with older versions of the MSTSC that prevent the Second Life Application from running properly. This upgrade is free through Windows Update.

Pros: Anyone on the EMC network would be able (if they have the permissions) to access Second Life. This would allow meetings to take place, involving employees from all over the world. This option would be much less costly to implement than if every employee in the company was able to access Second Life.

Cons: This would require technical support for the employees that use it. It could increase bandwidth usage or at least increase the internal traffic between the remote desktop server and the client.

4.3.3 Possible Platforms For Privately Hosted Virtual Worlds

Multiverse is a platform option that can be purchased to help in the creation of a virtual world online game (The Multiverse Network, Inc., 2008). The Client possesses 3D rendering technology so that the avatars that are seen in Second Life could be reverse engineered and applied to an EMC private world.

Pros: This client offers “plug-ins” which would allow EMC to purchase already coded functions, which would cut down on development time.

Cons: While the world is private and no other avatars would be able to attend meetings or product launches, it is still hosted on external servers, which still poses some security risks like privileged information being stored externally. There is a possibility of hosting it internally, but that research track ended when we did not hear a response from the Multiverse sales department. Any world built on the Multiverse platform is in the Multiverse Network, and in order to use the Multiverse platform to build a game that is not in the Multiverse Network, a special agreement must be negotiated (The Multiverse Network, Inc.).

Croquet is an open Source solution that may provide some benefit to EMC. Its software allows developers to create virtual worlds where they can develop anything

from avatars to buildings to landscapes. Development would be unavoidable, if this solution were to be implemented in EMC.

Pros: It is free due to its open source nature.

Cons: It would take a great deal of development to construct a world that EMC employees would actually be able to use nullifying the benefit of being free.

Other engines which are difficult to find information about without joining the virtual surrounding communities are GarageGames' Torque Game Engine, Sun's Java-based Project Wonderland, and Forterra System's Olive. These engines can be used to develop worlds inside corporate firewalls (Prentice, 2007). From researching Project Wonderland, we found that they are still very much involved in the planning and developing phases at the time of this report, and thus would recommend reevaluating its value to the company at a later time when it will have been developed more full (CollabNet, Inc.).

4.3.4 Work From Home

This option is currently being used. Employees that need to be on Second Life are using either their home computers or EMC owned laptops and traveling to connect from Wi-Fi hotspots or their home networks.

Pros: No new infrastructure needs to be implemented. Anyone can easily be added to the group of people that needs to be on Second Life. All that is necessary to connect is a laptop and a car.

Cons: No one is supervising the employees that remain on company time in Second Life. Employees have to leave the EMC campus in order to connect. The current set up is inconvenient for employees and the HR department.

5 CONCLUSIONS & RECOMMENDATIONS

The problems that the Security team is facing have to do with the request for access to emerging technologies from other departments of EMC. The security team is having trouble keeping up with the technologies that were being implemented in other parts of the company, and did not know what to do about the desire for Second Life to be opened up to the company's network for general use in meetings, recruiting, and marketing. This section will give the security team specific recommendations, which will help them deal with the issues that emerge from implementing Web 2.0 technologies in EMC, and also what to do about the demand for Second Life from the HR and Marketing Departments.

5.1 RECOMMENDATIONS FOR EMC ONE

EMC ONE is a good way to start the employees on the transition they are going to need to make in order to succeed in the Web 2.0 era. By using this portal, the employees will learn how to be a part of an online community, where they will be able to take on leadership roles, and participate in things that they are passionate about. This "training" will be essential to the future of sites like EMC ONE, which will include external online portals where employees will be expected to interact with customers and competitors.

The portal also provides business value because the wiki function will surpass the functionality of the current knowledge bases in place for the technical support groups. The wiki has a much stronger search engine, which will allow employees to find what they are looking for faster, so that they can fix problems more efficiently.

EMC ONE was implemented in a secure way which will make it difficult for people to misrepresent themselves. While there are technological risks that could lead to misrepresentation, the risks are no greater than the same situation with email accounts, where someone misrepresented could send out inappropriate emails throughout the company.

Overall EMC ONE was a good purchase for EMC. The portal will provide indirect training to employees, will help collaboration between groups, and will hopefully bring the company together. The philosophy will change from a segmented company that has poor across-group communication to a company with much more transparency, which will add a lot more value to EMC than the privacy lost.

We recommend that the following suggestions be implemented to help EMC ONE grow in a way that facilitates the greatest security of proprietary information on that site.

5.1.1 SUGGESTION 1

According to our research and interviews, the only real way for a wiki or blog system to be successful is for a large number of people to use it. This is especially true for wikis because of their collaborative nature. A wiki depends on its community to keep it up to date and running smoothly. Therefore, a small community hinders the development of such pages. To this end, we suggest that EMC start to expand EMC ONE by encouraging people to use this site as an opportunity to improve the communications and transparency in the company. This could be done by marketing the portal to all employees using EMC's email and internal websites, instead of using the current "organic growth" method of implementation.

5.1.2 SUGGESTION 2

Employees at EMC are required to agree to certain policies in the company as a condition of employment. It is imperative that employees understand what is expected of them when using this new technology. We suggest that sections of the IS Policy be shown to employees as they sign up for membership to EMC ONE. The idea is not to discourage people from posting, but to remind them that they all agreed to these policies *(See Sections 5.4.1.2 through 5.4.4.4 of EMC's Information Security Policy)* by being EMC employees and they cannot act in a manner that does not comply with these rules.

5.1.3 SUGGESTION 3

One of the only complaints that we received in our research regarding the functionality of EMC ONE is the lack of pictures and other media for sharing because it feels too "texty". We suggest adding some kind of picture capability to improve users' experience with EMC ONE.

5.1.4 SUGGESTION 4

Our final suggestion has to do with a primary concern of the security department. It is possible to impersonate EMC employees on EMC ONE. While this is a problem because it has the potential to become a scapegoat for users with bad intentions ("I did not do that. It was someone on my account."), we feel this is a similar concern for all levels of EMC technology. The same authentication issues arise when emails are sent out of turn. Since email and EMC ONE use the same password (from Active Directory), there is always potential for impersonation in either of these forums. We suggest that the security department not separate EMC ONE from its technological predecessors, because the risks are very similar to risks that the company has already accepted. We do suggest however that external implementation be treated as if all of the information posted would be visible forever because of the unforgiving nature of the Internet when it comes to hiding mistakes. When the company looks to implement external portals, policing software is going to be needed to ensure the content of the post is safe before it gets posted.

We will once again recommend that users be reminded of the policies in place concerning the use of the portal, but overall the security risk of the portal is low, because the entire world is hosted internally. When the time comes for EMC to begin using these types of portals externally, then more security features will need to be used such as pre-port information scanning and Internet trawlers which scan the posts for proprietary information.

5.2 Recommendations for Implementation of Second Life

Throughout our discussion and analysis of the possible uses of Second Life at EMC, we concluded that the only business use that is important, viable, and can directly bring business value to EMC at this time is Human Resources recruiting. In order to accommodate this need while maintaining the current level of security, we recommend that a virtual lab solution be implemented. We do not recommend an enterprise-wide implementation of Second Life at this time, because the security-related risks outweigh the potential benefits.

There are a number of reasons that the other business uses of Second Life that we explored, namely real-time communication and virtual meetings, did not prove valuable enough to justify the risk, cost, and time it would take to implement a solution. First, there already are web-conferencing applications in use throughout EMC that sufficiently cover the business need of real-time communication. Second, because Second Life does not provide new users with an intuitive, quick and easy way to communicate effectively it may be necessary to budget for training and adoption time. Third, the data exchange through Second Life is remotely hosted at an external location owned by Linden Labs, which poses several significant security risks.

Making exceptions for many different users would be a problem for the security group, because every machine would have to be assigned a static IP address, and exceptions would need to be written for all of those addresses. Our team is proposing that a Remote Access server be setup in one of the corporate offices. This server would have a static IP address assigned to it, so that an exception for only that machine is necessary to allow its UDP traffic through the firewalls seamlessly. With this solution, users can remotely connect to that Remote Access server with their provided username permissions, and use Second Life while still being at work. This prevents users from taking work laptops home and subjecting them to the security risks that Second Life poses. This also prevents the network group from having to create static IP's and exception rules for many individuals. Using this approach the group would only need to give a user permission to sign on to the virtual machine, which is much less effort for the

IT group. While tests at EMC were never completely successful, the problem was identified and should not be a factor in newer Microsoft Operating systems, as described in section 4.2.3.This solution would allow HR\Marketing employees access to Second Life. They will be able to recruit in real time, from anywhere, to anywhere else.

We do not recommend that proprietary and confidential information be shared at meetings that take place in Second Life. There is too much risk in the fact that all Second Life servers are controlled by Linden Labs and not EMC. Although there have been very few attempts at malicious hacking on Second Life's servers, there is no way that EMC could make sure that this type of attack will not happen. If this need increases in time and it becomes necessary for the business in the future, then we recommend that EMC purchase one of the available private virtual worlds that are described in section 4.3.3. Each of these worlds can be hosted internally by EMC ensuring that all traffic and communication on the virtual world stays on EMC's network. This kind of virtual world can also facilitate training and collaboration across continents.

5.3 CONCLUSION

Emerging Web 2.0 technologies are arriving on the corporate scene very quickly, and corporations are either going to have to avoid using them, and lose out on the vast benefits they bring, or learn how to implement them securely and successfully in their companies. EMC has taken good first steps in implementing blogs and wikis with the EMC ONE portal, and also by starting to do some recruiting in the Second Life world. While it may be hard for the security groups to stay up-to-date with current best practices for securely using these technologies, they will now be able to work with the groups that they support, to provide access to some of the new technologies that EMC is going to need to adopt in order to stay competitive in the IT Market. By researching for ways that the GSO can protect against malicious attacks while also being able to use these new application portals, we have provided the company with ways to stay on the leading edge of technology, while being able to maintain their reputation as a security company.

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APPENDIX A: INTERVIEW QUESTIONS

Interview Questions

For interviews with employees in all departments

- How do you see a wiki working on the EMC environment?
- What are your major concerns regarding the possible use of blogs at EMC? Wikis? Second Life?

For interviews with Security Personnel

- What kinds of infrastructure does information have to go through before it gets into or out of the EMC network?
- What kinds of authentication do employees need to gain access to the network?
- How would you overcome the networking problems with Second Life if it was a necessary to implement it?
- How do you ensure that information posted online in blogs is protected?

For interviews with Business Personnel

- Approximately how much money in your budget goes to funding for Second Life?
- What current costs do you see disappearing with company-wide implementation of Second Life?

APPENDIX B: INTERVIEW INVITATION & THANK YOU LETTERS

Interview Invitation Letter

Dear Mr. /Ms. _____,

We are a student group from Worcester Polytechnic Institute that is completing a study for EMC on secure ways to implement Web 2.0 technologies such as wikis, blogs, and Second Life.

We have been made aware that you might be able to help us determine the best way to allow EMC employees use of these technologies securely, from within the EMC campus. We would like to schedule a half hour interview with you to discuss these possibilities. Please let us know of a convenient time for you, preferably on a Wednesday.

Thank you,

Angela Burrows, Stephen King, & Stefan Rashkov

Interview Thank You Letter

Dear Mr. /Ms. _____,

Thank you very much for taking time from your busy schedule to talk with us regarding our project. Your help is truly appreciated.

Thanks again,

Angela Burrows, Stephen King, & Stefan Rashkov

APPENDIX C: INTERVIEW DATA

Subject A – Collaborative Tools Portfolio and Process Management Group (PPMG) – Westborough

Interview Questions

1. Can you tell us about your position and department?
2. What tools do you use for collaboration?
3. Any problems with policing?
4. What authentication and restriction is present on this site?
5. Are you worried about information leaks?
6. Which departments have the users that use this the most often? Can you give us any names of people we might contact for more information regarding one.emc.com?
7. On a 1-10 scale how important is the blogs and wiki software to the business?
8. Was there anything before this tool?
9. How important is the external communication?
10. Second Life – Is it necessary?
    - Cost?
11. Is there anything relevant to our research that we did not ask?

Interview Summary

The Project Team sat down with Subject A on December 5th at 10am. Because of her position, she is one of the EMC employees who had been charged with implementing the one.emc.com site that used blogs and wikis. In her interview we learned that a pilot of the website had already been launched and the blogs and wikis

were already being used by over 1100 users who had signed up for it already. The software to run the page was named ClearSpace and was purchased from a company called Jive. When asked about the policing and moderation of these tools, we found that one of the business requirements was that the tools were to be un-moderated and that all of the tools would be available to all employees. Because of this requirement, there are little to no security risks, as the entire site is completely transparent and no restricted groups of employees can be formed. Thus far there have not been any inappropriate posts anywhere within the site.

To gain access to the site, the software pulls an EMC employee's NT login information from EMC's NT servers. This way there is no way to misrepresent oneself on the site. The Social Media department working under Subject A is researching external communication in the same manner, but no plans to implement anything externally have been put in place yet. As for internal plans, the group planned to make sure that communities could be setup where only authorized users could edit or view posts.

Second Life seems to have no internal business value according to Subject A. She does not see why Live Meeting is not sufficient enough, and wonders what else Second Life could possibly offer that would add business value. Live Meeting already provides the video and audio streams that Second Life promises and Live Meeting is hosted internally so it is safer.

Subject B & Subject C – Security Team, Firewall and Risk Management

Interview Questions:

(This was a very unstructured interview when the team learned a lot of information from these subjects, there were few questions)

- How would you implement Second Life if told to?
- How would you overcome the problems presented by a software like Second Life?

Interview Summary:

The Project Team sat down with Subject B and Subject C on December 5th at 10:30am. Subject B and Subject C both work in the security department, Subject B with the firewalls as a network administrator, and Subject C with the risk management section on the Global Security Office. The conversation was based solely on the feasibility of making Second Life work within their enterprise security solution.

Second Life will not work at EMC currently because of how the EMC network address translators (NATs) and the Checkpoint Firewalls affect the UDP protocol that SL uses. Because UDP is a more efficient protocol that dumps data into a stream and just repeats whatever data did not make it, the symmetric NATs cannot translate the protocol in such a way that will allow SL to make a good connection to the servers that it needs to. If SL used a TCP protocol, which sends one packet at a time in a certain order, then the NATs and Firewalls would not manipulate the translation in such a manner that would render SL useless, like it does over the UDP protocol. Therefore, one viable option is to ask Linden Labs, the developers of Second Life, if they can switch all of their network protocols to be TCP.

If Linden Labs refused to switch its protocol, then other solutions would need to be implemented assuming that Second Life needed to be accessible within EMC. Since

only a few marketing and HR employees would need access to Second Life, a Second Life lab could be setup with static IP addresses that could have exceptions written for them to allow UDP traffic in through the firewalls. To test to see if this setup will work, we are going to have to see if Second Life can still run effectively over a remote desktop connection from a different computer.

Subject D – Executive Management, Human Resources – Hopkinton Office

Interview Questions:

- How do you see this technology working on the EMC environment?
    - Blogs
    - Wikis
    - Second Life
- What are your major concerns about confidentiality of the possible use these at EMC?
- What are your major concerns about brand and reputation risk management of the possible use of these technologies at EMC?
    - Blogs
    - Wikis
    - Second Life
- What are your major concerns about productivity of the possible use of these at EMC?
    - Blogs
    - Wikis
    - Second Life
- What do you want to use these technologies for?
    - On a scale from 1-10, how important is that to your department's business process?

- Have you heard of or dealt with Second Life at EMC before?
    - What current costs do you see disappearing with companywide implementation of Second Life?
- What kinds of benefits, tangible and intangible, do you think can be achieved using
    - Blogs
    - Wikis
    - Second Life
- Do you use EMC's one.emc.com wikis and blogs? If so, why?
- Can you offer a specific situation where you used it for work?
- Can you offer a specific situation where you used it for employee interaction of a non-work related sense?
- What would you like to have in a wiki that would encourage you to use it?
- What effects would allowing anonymous posts have?
- What are the problems/issues with EMC ONE?

Interview Summary:

Subject D has used Second Life and EMC ONE on multiple occasions. She can comment that the HR department has used SL to successfully recruit EMC employees. The first day of the Virtual Career fair, EMC received over 150 resumes for potential employment, and over 300 on the second day. The cost of having a virtual career fair as opposed to a live on is drastically lower, especially considering most of the expenses are one time only (Like purchasing the building).

As far as using SL as a meeting place over Microsoft Live meeting, she believes that anyone who would shoot down SL over Microsoft's Live Meeting has most likely not experienced Second Life. According to Subject D, SL would be a much better meeting room than Live Meeting, because you can see expressions and attitudes on Avatar's

faces, you get the same verbal sound and video that you would have gotten from Live Meeting, and if you leave your computer the Avatar will actually slump like he is asleep. On top of that, you would be able to experience three dimensional data presentations, and the user would have control of what he wanted to look at, as opposed to being shown what to look at like in Live Meeting.

Subject D uses EMC ONE sometimes, but can appreciate its functionality. She does not see any confidentiality issues in the employees, and thinks that proprietary EMC information should be safe there. It is good for sharing information, but is too "texty" as of right now. If the site could introduce picture-posting functionality, she feels it would be improved because often pictures can describe a situation better than explaining it can.

Productivity is an issue when implementing a new technology, because of the learning curve that can waste time at the beginning of the new products life. Subject D says that while it may infringe on schedules, eventually the costs breaks even, and then after that better productivity is enjoyed because of the improved technology. Like any other good investment, it pays off over time.

In conclusion, Subject D is very proactive in implementing new emerging technologies, because they often make processes more efficient, fiscally and time-wise. She does not think that EMC will have any problems with its employees abusing the new technologies, because of the built in traceability, which can allow the company to deal out accountability if anything ever happened.

Subject E – Senior Consulting Program Manager, Human Resources - Hopkinton

Interview Questions:

- How do you see this technology working on the EMC environment?
  - Blogs
  - Wikis
  - Second Life
- What are your major concerns about confidentiality of the possible use these at EMC?
- What are your major concerns about brand and reputation risk management of the possible use of these technologies at EMC?
- What are your major concerns about security problems of opening this stuff up to external users? Specifically employees posting things externally that can hurt the company?
- What are your major concerns about productivity of the possible use of these at EMC?
- Do you have any thoughts on authentication and the use of nicknames or anonymous posts?
- What are your security concerns about Second Life?
- What do you want to use these technologies for?
- Have you heard of or dealt with Second Life at EMC before?
- What kinds of benefits, tangible and intangible, do you think can be achieved using Second Life?

- How did you find the usage of SL on your computer? Jerky movements etc?

- Any closing thoughts that you think we should know?

Interview Summary:

Subject E was one of our best interviews because he had seen many things from both “sides” of the company. He is a Senior Consulting Program Manager in Human Resources. He understood what needed to be done in order for Second Life to work, and he also saw much of the value that Subject D talked about. Subject E had many things to say about the blogs and wikis also, which is why we will break the interview summary up into 2 sections, the blogs and wikis section and the Second Life section.

Subject E is one of the users of the one.emc.com site. He has experienced the blogging and the wikis first hand and has found that it has been extremely useful and has no reservations about it. Some ways that he thought would improve the site would be to allow for the posting of pictures on it, because sometimes with people who do not speak English as their first language, pictures are easier to understand. All in all, the current version is too “texty” and more pictures or graphical designs would make the user experience more enjoyable. As far as external wikis and blogs are concerned, Peter feels that there is no reason not to implement them now. If people are worried about security, they should not be. According to Subject E, if someone wants to post something malicious about EMC, they are going to do it somewhere. There might as well be a page on EMC’s website which logs comments like these and shows them to the outside world. This way EMC knows where the malicious comments are, and can delete them, or respond to them publicly, as opposed to searching through hundreds of blogs on the Internet to find things that they do not yet know exist about them.

As far as confidentiality within the company, Subject E sees no need for it. He does not understand why departments are hiding their policies from each other. Everything useful in EMC needs to be found through a “go to guy”, or someone that “knows who to go to, to ask about something”. If all of the company’s knowledge was

logged online and was searchable for the employees, finding information would be easier.

Subject E also found that collaboration with third party vendors would be very useful and is not currently permitted by EMC.

Subject E also thought there should be some kind of anonymous thread where the employees would give positive or negative feedback while maintaining their amnesty. This would be useful for the management who has already implemented similar processes.

Second Life is an application that Subject E finds extremely useful. He thinks that it has a great value added to the business because the recruiting open house was the best ones they've ever seen. As far as representing EMC externally through Second Life, Subject E thinks that it is absolutely necessary. The work around that EMC currently uses is allowing employees to go online from home or from WIFI hotspots to enter this world and meet potential employees and customers. For these purposes, he considers the product extremely valuable to the business, and recommends that they be given access to it ASAP so that they may continue to use it more effectively as they learn with it.

Subject E also feels that internal use of Second Life would be a great business value added simply because Microsoft's Live Meeting is boring. He wants an environment tha is fun, so that employees will show up to a meeting excited and wanting to work. He thinks that because SL is less structured that Live Meeting, a brainstorming session could take place in Second Life, with three dimensional charts and graphs which people could walk around, and depending on which information they are looking for, could have it presented to them in different ways. Subject E used a 4 year old laptop on Second Life and his experience was fine because the less processing power a computer has, the less detailed the world is. Thus, the speed of the world does not suffer.

In conclusion, Subject E felt that the company needs to be more transparent in general, and should not worry about security issues that already exist outside of the company anyway. Second Life will be a big money maker for EMC and anything that can be done to allow for employee meetings in virtual worlds would be a big morale booster also.

Subject F–Technical Sales – Franklin Office

Interview Questions:

- Do you use EMC's one.emc.com wikis and blogs? If so, why?
- Can you offer a specific situation where you used it for work?
- Can you offer a specific situation where you used it for employee interaction of a non-work related sense?
- What would you like to have in a wiki that would encourage you to use it?
- What effects would allowing anonymous posts have?
- What are the problems/issues with it?

Interview Summary:

Subject F uses EMC ONE every day for many of the technical support issues that he comes across. The Power link knowledge base that is setup for their team to use is incomplete and has poor search features. Subject F likes to use EMC ONE because it has powerful searching features and it allows everyone to post to a topic as opposed to having to wait for the owners of the knowledge base to edit the content.

EMC ONE seems to be a superior product that Subject F would like to see more widely implemented to go so far as to replace all of the knowledge bases. This way all of the company's combined knowledge would be found in one place for efficient information searches. Subject F Likes the "water cooler" features, and while he would not check it every day, email alerts to when posts are added or answered do interest him.

As far as possible anonymous postings or amnesty threads are concerned, he feels like there is no value added and would just cause problems.

Subject G–ITSM Westborough Office

Interview Questions:

- Do you use EMC's one.emc.com wikis and blogs? If so, why?
- Can you offer a specific situation where you used it for work?
- Can you offer a specific situation where you used it for employee interaction of a non-work related sense?
- What would you like to have in a wiki that would encourage you to use it?
- What effects would allowing anonymous posts have?
- What are the problems/issues with it?
- Are you familiar with Second Life?

Interview Summary:

Subject G has had limited personal interaction with the EMC ONE page. He has had to support the software in the past. His group is in charge of using and updating the Peregrine IT Knowledge base, and so has to let the IT support staff know what to do for certain problems involving the new web portal. During the interview, Subject G became more familiar with how he might personally use the portal, and began to get excited about the functionality it had. By the end of the interview, Subject G had found information that his own group had posted on it which was useful to him. He was interested in getting back to his group to find who used the new EMC ONE portal to post information that was supposed to be kept in their group.

Because of the content that the ITSM group is responsible for, Subject G feels like it should not be posted for all EMC employees to see it. If a technical employee is preparing a solution for another technical employee, he might include high level fixes, like registry edits. Normal users, who try to edit their registry because they saw how to

do it in a wiki, have often deleted the wrong registry keys, which usually require their computer to be reformatted. This is a large waste of company resources, and should be avoided. Subject G would like to see some discretion as to who can see which posts, but other than that loves the idea of having a central information depository.

The “Water Cooler” pages were unknown to Subject G, and when he saw them, he began to read them with interest. Because of this we can conclude that Subject G will have some use for the more social aspects of the Portal.

Subject G has no experience with Second Life.

Subject H – Executive Management - Social Media

Interview Questions:

- What features do you use the most on EMC ONE?
    - His Own Blog.
- Can you offer a specific example where you used it for work?
    - Every day for everything
- Can you offer a specific situation where you used it for employee interaction of a non work related sense?
    - He writes to the Water Cooler Posts
- What is the effect of allowing anonymous posts?
    - Absolutely no need for Anonymous posts, destroys the idea of transparency which is why EMC ONE was created.
- What problems or issues do you see in the site?
    - People taking time for learning curve, there is a generic fear of participation
    - It is hard to make a community because there are no resources to learn how to build one
- Where do you see room for improvement on EMC ONE?
    - (One suggestion from a user was to allow posting picture files to make it more visual)
    - That would be fine, do not see too many other improvements until more people are using it.
- When will the full version of the website be launched?

- It has been the full version for almost 3 months now, there was no clear cut launch date.

- Why did you chose ClearSpace to build the website?
  - It was easy and seemed to be the most affordable, We knew we were not going to develop our own.

- Are you familiar with Second Life?
  - Yes, he feels there is no business value that can be added through it. It is off putting to most non-technical people and he does not like it at all.

- On a scale from 1-10, how important is the use of Second Life to your department's business process?
  - 0

- What are the main benefits, tangible and intangible, that you think Second Life brings?
  - Anything that it could bring would be more beneficial with other products like Cisco's Telepresence

- Do you think that allowing an enterprise-wide use would be beneficial? How?
  - Not at all, once again there is no business value for adding second life to the business processes at EMC, Maybe for the HR department, but not for anything that Subject H is involved with.

Interview Summary:

Subject H almost immediately went into the larger problems that he was trying to solve at EMC by implementing the EMC ONE portal .The company, in his opinion, was "stovepiped", in that there was no inter-group communication and no transparency in any business processes. He wanted to help the employee "find each other" and so by setting up a social atmosphere on the computer, he believed that people would get to

meet each other more easily and thus work more efficiently together. In the future, the point of the technology will be to interact with customers and that interaction will need to happen by the employees, who will hopefully be good virtual world citizens by that point because of what they are able to experience with EMC ONE. He feels that the portal is easy to get into, because the login is the same as the current email system, and it is easy to learn how to use because of its simplistic design.

Subject H had a very poor opinion of Second Life. He felt that it was extremely off-putting to non-technical persons. Subject H then started to speak about how implementing new technologies should only take place to fix a business problem or satisfy a business need. Second life is not the best solution to solve any business problem that he faces right now. If the company needed a better solution to enable remote meetings, Cisco's telepresence is a better product to use, which is even cheaper than implementing an internal virtual world at EMC. He finished by saying that if the HR department finds that it is saving money on Job Fairs, then tha is fine, but as far as using the application for company meetings, it is not the best option and should not be used.

Subject I – Security Team, Westborough

Interview Questions:

Have you ever had experience with EMC ONE?

Interview Summary:

Subject I had not heard about EMC ONE, because of this we avoided the rest of the EMC ONE questions, as the Interviewee started a long conversation with us about the capabilities of the portal and asked us what we knew about its implementation.

Subject I wanted to know what EMC ONE was and how long it had been up and running. We spoke about how the implementation had no launch date, because the pilot test went so well that they just left the pilot test turn right into the final product. We then discussed the user authentication and the interviewee found some problems with this. He said there was still an opportunity to misrepresent oneself by creating a false active directory account, or by grabbing and figuring out another user's logon information through hacking techniques that he was aware of. Basically, the Interviewee was surprised and alarmed that such a product as the EMC ONE portal was implemented without the Global Security Office's knowledge. He can only guess that either a protocol was circumvented or the GSO was not represented at the implementation meetings. Either way, he was going to go back to his group to evaluate the product further, and see if there were any other security risks that he could think of.

As for Second Life, we reported to the interviewee about our progress in finding a remote solution for it and he offered that if the remote desktop solutions did not work, we could try a Citrix solution, and then provided the WPI group with the contacts to see about that solution.

As a follow up, the Citrix Solution was not going to be plausible for our intents purposes in this project.