

Innovation in the Software Industry

SENG 403 – Software Development in Teams and Organizations

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Abstract—The software industry has a few cases of a runaway success, and hundreds of dismal failures. Many software businesses have tried and failed to become market leaders in their field, for many reasons. In this report, we are going to present three companies that have succeeded in most of their endeavours, attained incredible popularity, and thus ended up being market leaders in their domains. This report studies the common themes that enabled these companies to achieve, the themes usually focusing company philosophy and work environment. In addition to these, a smaller company that has a good philosophy is also presented; the report will explain why such a company has not had the success of Google, Microsoft and Facebook. Lastly, a company that used to be prosperous is also presented; the report will explain why it has rapidly fallen from being a market leader.

The above five companies will be presented as case studies in the following order: Google, Facebook, Microsoft, Kryos, and Nortel.

I. INTRODUCTION

The software industry has a few cases of a runaway success, and hundreds of dismal failures. Many software businesses have tried and failed to become market leaders in their field, for many reasons. In this report, we are going to present three companies that have succeeded in most of their endeavours, attained incredible popularity, and thus ended up being market leaders in their domains. This report studies

the common themes that enabled these companies to achieve, the themes usually focusing company philosophy and work environment. In addition to these, a smaller company that has a good philosophy is also presented; the report will explain why such a company has not had the success of Google, Microsoft and Facebook. Lastly, a company that used to be prosperous is also presented; the report will explain why it has rapidly fallen from being a market leader.

The above five companies will be presented as case studies in the following order: Google, Facebook, Microsoft, Kryos, and Nortel.

II. CASE STUDY: GOOGLE

A. History

Google started out in January of 1996 as a website called *Backrub*. Cofounders Lawrence Page and Sergey Brin met half a year earlier and decided to collaborate on creating this search engine. A research project for these two computer science grad students, *Backrub* was a search engine running on the Stanford University servers. On campus, its popularity grew by word of mouth. It operated for more than a year before it was taken down as it took up too much bandwidth. Fuelled by the great reviews on their search engine, the two decided to continue their work. On September 15, 1997, Larry and Sergey registered the domain name google.com, a play on the word googol

(Bellis, n.d.; Holden, 2010; Malseed & Vide, 2005). In 1998, even though it was formed of only three employees and it operated out of a garage, Google was already receiving recognition; in August, Danny Sullivan of *The Search Engine Report* mentions that the search engine “is really good and even has a catchy name” (Sullivan, 1998), while in December PC Magazine named Google best search engine of the year (Ziff-Davis, 1998).

Google had a revolutionary search algorithm. Most major search engines back then used a location/frequency method for determining the relevancy of a page. For example, searching for ‘Bill Clinton’ will return web-pages ranked by how often and where the words ‘Bill Clinton’ are mentioned. A page containing ‘Bill Clinton – His time as a president’ would rank higher than a page without his name in the title. Similarly, articles that mention Bill Clinton numerous times would also receive a higher rank than a page that only mentions him once. While naturally not the only factors, location and frequency of the search query tend to be the dominant factors in producing results (Sullivan, 1998).

Mr. Page and Mr. Brin had a different approach. In 1998 they presented their search algorithm at the Seventh International World-Wide Web Conference. In their paper they argue that the most important feature of a search engine is the quality of its results. Google first makes use of the link structure of the web to create a quality ranking, called PageRank, of each web page. PageRank keeps track of hyperlinks, thus creating a graph of all pages. Certain trusted sites such as cnn.com and use.gov automatically have high ranks. If cnn.com has a link to another page, this particular page thus gets a slightly higher rank. In this way, all pages on the Internet get a rank and search queries are most likely to direct to those sites than other more untrusted sites.

Additionally, Google checks the text within links, the location of these links and also where these links point to. Google even looks at page characteristics, such as checking if a font is bold or bigger. Lastly, Google crawled the web itself, thus creating comprehensive results (Brin & Page, 1998). In 1998, over 25 million pages have been indexed with a goal to get up to over 100 million. At the time, AltaVista, the most popular search engine at the time, had an index of about 140 million pages (Bakker, 2001). In 1999, Google received \$25 million in equity funding and on September 21, 1999, it officially removed the beta status from its title. In 2000, the Google Index reached 1 billion web pages, while in December 2001 it was already up to 3 billion (Malseed & Vide, 2005).

Google had gained a lot of popularity by providing very relevant search results. However, their company practices have changed and adapted over the years, as to provide Google with the image of being a fair and great company. Their policies are what makes bright and successful people want to work for Google.

B. Work Environment

Fortune 100 has declared Google to be the top company to work for in 2012, this being the third time Google wins this spot. The magazine mentions that “Employee love [...]was up last year” (CNN Money, 2012). Employees are delighted over the Google mission, their culture and the many perks received, such as bocce courts, cafés with free food, gym rooms, massage rooms, free haircuts, health/dental/vision insurance, and more (Google.com, n.d.a). Google has always been dedicated to providing great benefits, hiring their first massage therapist in 1999. Employees can also attend classes to learn a language, improve their presentation skills or attend a programming course.

The Google environment is geared towards offering workers space for innovation. The workers, called ‘Googlers’ can work as they please, as long as they complete their projects on time. Additionally, each worker can dedicate 20% of their work time to a project they are passionate about (Google.com, n.d.a). Such projects produced Gmail, Google News, and AdSense. Larry Page and Sergey Brin are quite approachable as well, every Friday having a meeting with everyone and answering questions from a microphone (Google.com, n.d.a).

Google is very much open to diversity as well, having employee networks and celebrations for Asians, Hispanics, Blacks, veterans and even gay people. Many groups also perform fitness activities together, Googlers having the ability to join a team sport or attend one of the many fitness classes provided free of charge. Google encourages its people to also join volunteering programs (Google.com, n.d.a).

The Google culture has many inviting benefits, as its workers not only work hard, but also play hard. This characteristic makes Google be the goal-company of many developers. As a result, Google has a large pool of applicants, thus being able to select the most skilled and desirable developers.

C. Philanthropy

Google has produced Google.org, an organization that is committed to developing technologies to help address global challenges, but also to supporting partners through grants and investments. One of this company’s goals is to produce a hybrid electric vehicle that can achieve 100 miles per gallon of gas (Google.com, n.d.b). In addition to giving away money, Larry Page, Sergey Brin and CEO Eric Schmidt have decided not to take much either. Mid-way through 2004, the three Google leaders decided to cut their annual salaries to just \$1 (La Monica, 2006).

Such actions bring Google to be viewed in a positive way by the public. Many supporters might keep them in high regard as a result of their determinism to help the public; many companies depend on help received from Google to continue striving, thus making the world partially have a need for the company to continue existing.

D. Company Philosophy

Google became the leader of search engines not simply by providing good results, but also by being a respectable company. First of all, Google does not sell any placement in their sale results and PageRank cannot be manipulated to provide an advantage to certain sites. While they do have advertising in some of their results, it is always very clearly marked as such, never appears as a pop-up, and is relevant to your search query. If a search query does not have any useful advertisement attached to it, then no advertisements will be shown at all. Google's informal corporate motto is "Don't be evil". Large corporations sometimes do actions against their best public interest for some short term profit (Google.com, 2009). By abiding to the "Don't be evil" philosophy, Google ensures its users that its plan is not to exploit them, but to put them as the number one focus. This mantra has enhanced the trust and the image of the corporation. Additionally, virtually all Google software is available for free. Google gains 95% of its profits through ads (Frommer, 2011); this fosters positive thoughts from users, as Google's world renowned software is freely available to anyone.

Google is always open to experimenting with and creating new products. Employees are encouraged to be creative and explore any programs that could potentially provide profit to the company. With this philosophy, Google has expanded in many areas of computers and technology in general, from creating a mapping tool, an email provider, a translation tool, a documents collaboration tool, blogs, a browser, a news provider, a site where any developer can play with the Google platform, and even their own brand of phones. Additionally, Google has acquired over 100 companies, some being YouTube.com, Motorola Mobility, and Double Click (Wikipedia.org, 2012). By not addressing only the specific niche of search algorithms, Google continually has something to offer to virtually everyone that uses the Internet. Through this constant acquisition, the company is sure to continue being a leader in their industry for years to come.

E. Conclusion

Google had a strong start and it continues to hold a leadership position in today's technological world. They have done this by creating constantly useful products, offering employees a beneficial and stress-less work environment, actively caring for its users and customers and helping the world around them.

III. CASE STUDY: FACEBOOK

A. History

Facebook is a social networking company that owns and operates their website of the same name. The Facebook website was launched on February 4, 2004 under its original

name, "Thefacebook". Thefacebook was a successor to the infamous "FaceMash" website, both of which were created by Mark Zuckerberg. Since then, Facebook has grown to become the world's most popular website, with over 845 million (as of February 1st, 2012) users worldwide (Protalinski, 2012).

1) Facemash

The idea for "FaceMash" was to compare face pictures of two students from Zuckerberg's university, Harvard, next to one another and for users to rate which of the two was "hotter". The inspiration for FaceMash was purely for entertainment value in Zuckerberg's eyes, and the website's popularity quickly exploded. However, student's photos were retrieved illegally by hacking Harvard's student photo book, and complaints against Zuckerberg's actions resulted in the website being shut down (Roeder, 2011).

The main idea, however, of displaying people as they truly are without an Internet alias on a social networking website, was the inspiration for what was to become Facebook. Facebook was initially restricted only to Harvard students, then to other university campuses, and eventually open to everyone. In all cases, eligible users quickly registered to take part in what is now accepted as the norm for a social networking experience.

2) Software Development

The initial production of the Facebook website took Mark Zuckerberg, working alone, about a week to complete and launch. Zuckerberg did not have to research complicated new technologies to sate a desire nobody knew they had. Instead, he was able to create a simple website which appealed to our very human nature – to socially network *as ourselves*.

Since this initial production, Facebook has had to create and implement a growing number of tools to handle the unfathomable loads their servers meet daily.

B. Distinguishing Factors

Internet users currently spend more time on Facebook than on any other website on the planet. This is not likely to happen by chance. This section details some of the distinguishing factors that has brought Facebook much of its success.

1) Unique Social Networking Concept

Facebook's integral concept of social networking is its main attraction. That is, allowing users to customize their own Facebook page with their own details, particularly without using an alias. Users may then more easily learn about others they meet without a mask of anonymity. News feeds, picture uploads, and instant chatting allowed social users to communicate and share profiles with their friends and for more antisocial users to view other's profiles – all with real names attached to real people. Thus, Facebook appeals to all groups of people's interest in their fellow humans in all manners (Pierce, 2011).

2) The Focus is on the User Experience

Using real identities was not the only distinguishing factor Facebook used. Whereas MySpace allowed for users to create custom backgrounds, play music, and alter other features, Facebook opted to give every user the same, easy-to-read profile outline. This allowed visitors to more easily learn information about a person, rather than be hit with a barrage of profile customization.

Facebook also allowed small businesses to more easily flourish through the utilization of their friend networks. This resulted in essentially free advertising for any company, and allows that company to establish its own brand theme on its own page.

Additionally, advertising space is kept to an absolute minimum. There are no advertisements on the Facebook main page, and interior pages keep ads to the side in an unobtrusive position. This is in contrast to MySpace, who pasted large ads on the main page and on every other page of the website.

These features come together to a singular point; Facebook is geared towards the user's experience. Other social networking sites, MySpace primarily, are instead geared more towards making money and focusing on their sponsors (Pierce, 2011).

3) *Initially Practiced Exclusivity*

Facebook initially only allowed users with a Harvard student ID to create a Facebook account. This exclusivity raised the excitement of the experience, and upon having the same reaction at other universities, Facebook was already well-known before it became public (Pierce, 2011).

4) *Facebook is not focused on Money*

Throughout Facebook's history, many bidders have attempted to buy the company for its potential for monetization. However, Zuckerberg is quoted as saying, "We're not really looking to sell the company... We're not looking to [release an initial public offering] anytime soon. It's just not the core focus of the company." The core focus had been to connect people, this focus being born of the culture of the Internet in the 1990s and 2000s pushing for free widespread connectivity (Zuckerberg, 2008).

Inadvertently, this focus fell in line with Google's Paul Buchheit's famous phrase of "Don't be evil". Despite keeping advertising on their website to a surprisingly low level, Facebook has become extremely profitable – even without having to exploit their users or sully their experience in the process.

5) *Open Source software is used*

Facebook handles their software utilization and production according to a similar philosophy. Nearly everything they use, improve, and create is open source. Facebook continually contributes to many open source frameworks such as Linux, Memcached, MySQL, Hadoop, and many others.

Facebook keeps their own engineering projects open source as well, some of which are listed below:

- HipHop – a php to C++ conversion compiler

- Cassandra – a versatile distributed file storage system
- Thrift – a cross-programming-language framework
- Scribe – a flexible logging system.

Rather than keeping technology proprietary, Facebook asserts that giving tools to any developer who wishes to use them allows for the creativity of humanity to flourish. Far from hurting Facebook's profitability, this mindset has raised the opinion others hold of the company and spurs user growth. This is in stark contrast to many companies whose profit-driven motives sometimes result in their customer's collective enmity (Pingdom, 2010).

6) *Creative Work Environment*

Facebook's employees have commented on the good and the bad concerning working at the company. Generally, the employees find themselves genuinely invested in the product, considering it is being used by everyone they know – including themselves. Additionally, employees have the right to work from home as often as they want, which works to accommodate those workers who dislike the open and social workplace.

The biggest differentiator that Facebook's work environment holds in comparison to other larger companies is its lack of interference from management. Allowing employees to work as they please on whatever assignment they want allows their creativity to flow into their work. This environment, however, has also been criticized by some employees as fostering too much competition for excellence. Regardless, it cannot be argued that the approach has not been successful (Carlson, 2009).

This work environment displays an important point about Facebook's philosophy and that of many other successful modern software companies; people are more capable than was once generally believed. They believe that giving employees freedom and control over their work results in higher quality, more creative products.

IV. CASE STUDY: MICROSOFT

A. *Brief History*

Microsoft is a multinational corporation that develops, manufactures, licenses, and supports a wide range of products and services related to computing. These products include operating systems, server applications, business and consumer applications, software development tools, Internet applications, technologies, and customer services (Books, 2010).

Microsoft was established in the United States on April 4, 1975 to develop and sell computer programs for microcomputers, primarily the Altair 8800 – a microcomputer designed in 1975 based on the Intel 8080 CPU (Books, 2010). The article "Microsoft Corporation" explains "Microsoft has succeeded in placing at least one of its products on virtually every personal computer in the

world, setting industry standards and defining markets in the process” (Microsoft, n.d.).

In the mid 1980s Microsoft dominated the home computer operating system market with MS-DOS (Microsoft Disk Operating System) and then a couple of years later the Microsoft Windows line of operating systems (Books, 2010). It also came to dominate the office suite market with Microsoft Office (Books, 2010). In recent years, the company has diversified into the video game industry with the Xbox and its successor as well as into the consumer electronics and digital services market such as Windows Messenger and Windows Phone OS (Books, 2010).

B. Differentiating Factors

Microsoft is one of the largest and most successful companies related to computing in the world. According to Cusumano and Selby, “Microsoft is successful for key strategies and a set of basic principles of operation” (Cusumano & Selby, 1998). One of its key strategies since its inception has been to continuously employ smart people who know the technology and the business and who can take opportunities when they appear (Cusumano & Selby, 1998). Secondly, the company organizes small work teams in order to facilitate the communication and decisions between the members of the group and to ensure that they work on projects at their own pace. This allows them to delve as deep as possible into their own personal projects (Cusumano & Selby, 1998).

1) Emphasis on Creativity

The company places a large focus on creativity. Working in small teams gives every team the opportunity to come up with new ideas. Even though Microsoft organizes work for small teams, the company works in parallel with frequent synchronization by constantly integrating the work of all of the small teams (Cusumano & Selby, 1998). Another very important strategy of the company is that it always tries to improve its products through continuous self-critiquing, including feedback from both the market and the company’s employees (Cusumano & Selby, 1998).

2) Focus on New Ideas

The workplace environment is another key strategy of Microsoft. The company knows that a motivated work force encourage a team to work towards accomplishing their goals. Microsoft not only hires experienced professionals but also talented graduates who the company believes will contribute fresh ideas and innovations (Books, 2010). One of the company’s major objectives is to generate innovative products that would intrigue future minds (Books, 2010).

After hiring their employees, Microsoft makes sure that these employees are always focused and are giving their full potential in research and production in top-of-the-line-products (Cusumano & Selby, 1998). Microsoft tries to offer their employees enjoyable environments, where they feel pleasant and encourage to work with benefits such as financial and health care plans.

3) Four Key Philosophies

Microsoft is committed to develop innovative accessibility solutions with each product they develop (Microsoft, n.d.). In order to accomplish this promise Microsoft concentrates in four key areas:

- Accessibility of products
- Leadership and awareness
- Innovation
- Collaboration

The company has focused on creating products that are accessible to everyone by making them safe, easy to use and designs them so that they can be personalized to meet people’s needs and preferences (Microsoft, n.d.).

As Bill Gates stated on Microsoft’s website, “Our vision is to create innovative technology that is accessible to everyone and that adapts to each person’s needs. Accessible technology eliminates barriers and it enables individuals to take full advantage of their capabilities.” (“Accessibility Mission, Strategy, and Progress”, n.d.). To achieve this Microsoft concentrates on integrating accessibility into its products by implementing it within all of the planning, research, design, development, testing and release stages (“Accessibility Mission, Strategy, and Progress”, n.d.). Microsoft strives to make the products compatible with a wide range of assistive technology products such as screen readers and magnifiers to give the best possible access to these products for computer users with disabilities (“Accessibility Mission, Strategy, and Progress”, n.d.).

Microsoft also leads the industry through research and development projects including large-scale nationwide studies, targeted usability and one-on-one interviews (“Accessibility Mission, Strategy, and Progress”, n.d.). The company studies the market for technology and discovers demand for new products depending on how people recognize the benefits of using currently available products and technology.

4) Emphasis on Customer Support

Another very important quality that distinguishes Microsoft from others companies is that the company has information available worldwide for all possible types of users such as individuals, schools, businesses, and organizations for helping them with the usability of any of the company’s products (“Accessibility Mission, Strategy, and Progress”, n.d.). This information includes demos, tutorials, and guides that are available in 58 regions and 41 languages (“Accessibility Mission, Strategy, and Progress”, n.d.). Additionally, Microsoft also has help centers where experts show the products to the users to help them find the right product and assist them with its usability. These centers are located across the United States.

5) Always Learning and Adapting

Microsoft listens to and learns from individuals, businesses, organizations, governments, and educators who are actively using the products to better understand them and try to improve the products as much as possible to

ensure that they meet user's needs worldwide ("Accessibility Mission, Strategy, and Progress", n.d.). The company came to be one of the most successful companies in the world by encouraging small work teams on enjoyable and inspiring environments where talented employees are able to come up with innovative ideas.

The mission of this company has always been to advance and improve software technology, to make it easier, more cost effective and simply more enjoyable for people to use computers. As Bill Gates explained in an interview with BBC, "Most of our competitors were very poorly run. They did not understand how to bring in people with business experience and people with engineering experience and put them together. They did not think about software in this broad way. They did not think about tools or efficiency. They would therefore do one product, but would not renew it to get it to the next generation." (Pickens, 2008).

V. COMMON FACTORS BETWEEN THESE SUCCESSFUL COMPANIES

The most evident commonality between the three companies mentioned above is that, from their inception to their current state, there has been a primary focus on the creativity of skilled developers. All three companies believe in hiring highly capable employees who are given free reign over what they develop, and thus eliminate superfluous management. They believe their employees are far more creative in this environment, and their success seems to validate that opinion. There is clear evidence from employee testimonials from each company that the freedom to work on interesting projects creates a passion for those projects and employees then foster a desire of their own to see the project succeed. Succinctly, having developers work on what excites them certainly seems to produce favourable results.

Another factor that may seem counter intuitive to some is Google's and Facebook's insistence on serving their customer first with profitability coming as an ulterior benefit. Both Google and Facebook started by simply attempting to expand the Internet; to open the Internet into a freely available connection between all people. They did so in different ways, but their focus was not on the potential for monetary gain. In fact, to this date the advertising from which they accrue the majority of their wealth is kept to a minimum on their products.

Microsoft followed a different approach by having begun at a different time. As a pioneer in their field, a ruthlessly iterative approach for releasing new products brought them success. However, as they age and compete with newer companies, they have begun to step back from their previously monopolistic endeavors and instead favour creating development tools for the betterment of all other software companies' work. The mentality of working together with other developers rather than against an invisible market is similar to Facebook's open source and Google's "Don't Be Evil" philosophies. These practices

garner respect and do greater work towards improving company image and acceptance than against product profitability.

There are other factors, however, that greatly influence the success of a company. The case study below is evidence that the right developmental philosophies will only bring a company so far.

VI. CASE STUDY: KRYOS SYSTEMS LTD.

A. History

Founded in 1995 with headquarters in Calgary and offices in Toronto, Kryos is a small company specializing in digital, web, portal and mobile solutions for enterprises. Kryos is an IBM Premier Partner and a Blackberry Alliance Member focused on providing mobile enterprise strategies, legacy consulting, and improving the development and launch process for enterprise smartphone apps. One of Kryos' innovations is Velocity, the mobile enterprise application development platform for iOS, Android and BlackBerry. Velocity allows all applications to run just like built-in native applications, thus giving the user a greater degree of intuitive use and efficiency ("Kryos Systems: Velocity 1.7 Launch To Offer Blackberry Smartphone 'Super App' Support Including Enhanced Camera Integration", n.d.).

1) Kryos Systems Success Story

The Velocity mobile development platform not only makes developing the apps easier, but faster too. Sykes Assistance Services Corporation, operators of roadside contact centers in Eastern Canada, developed a mobile GPS application to pinpoint the location of a customer during roadside assistance requests. Using Velocity, Sykes was able to develop the app for use with BlackBerry Smartphones, thus allowing Sykes to customize the application according to each auto manufacturer's needs, but with only one back-end application to maintain (Research in Motion Limited, 2011).

B. All Terrain Development

Kryos uses an agile development model they call "All Terrain Development" ("Kryos Systems: Our Story", n.d.). Kryos relates conventional, non-agile, development models to a railroad.

"You knew exactly where everything was coming from and where it was going to, so it was a simple matter of finding the straightest, most level line between A and B, then applying huge amounts of energy and manpower towards constructing the line." ("Kryos Systems: Our Story", n.d.).

The conventional model is slow and inflexible; any changes to the design could cause a project to slow to a crawl. The All Terrain Development model is fast, flexible and adaptive; like other agile methods it allows for the

Kryos development teams to adjust to the client's expectations.

1) *Enterprise Service Strategies*

The work-flow for an enterprise service strategy involves meeting with the clients, followed by several iterations of creating reports, timelines, and analyses of the strategy. After each iteration, the Kryos team meets with the clients again to get more specifics and refine the strategy. Implementation of the strategy varies from customer to customer. Some prefer to do the Implementation internally and retain Kryos for project management, while others hire consultants with specialties in subsections of the strategy (Moriarty, 2012).

2) *Velocity mobile development platform*

The work-flow for a Velocity release is much more involved. Marketing plans the release date to make sure the product will make the biggest splash possible. Management, marketing, sales, and development all meet to identify which features to add and which bugs to fix from previous releases. The list of features and bugs are assigned time estimates based off of previous experience. The bugs and features are also assigned to a developer based on the developer's experience and specialties. Developers have meetings every day or two very similar to the "daily scrum" from the scrum model of agile development. Developers are responsible for testing their own code using Android, Blackberry and iOS simulators. Due to the visual nature of the applications unit testing is not extensively used. Visual inspection of the feature on the simulators is the most efficient way to test the code. To ensure the application works on all appropriate devices each feature is tested by QA on a wide range of devices, operating systems, screen sizes, etc. QA performs these preliminary tests on the code from the nightly builds. QA cannot test every version fully at this stage because the tests require mostly manual inspection to ensure that the application's user interface is rendering properly. Instead QA focuses on testing individual, complete features or bugs. Any bugs found by QA are returned to the developers to fix. Near the deadline QA puts a "freeze" on the code so that more extensive tests can be run. Full tests take several days and are done feature by feature. If bugs are found at this point, they are classified as critical or not critical. Critical bugs are fixed immediately by the development team and then retested by QA. Non-critical bugs are left for the next release of the software, much like the scrum model again (Moriarty, 2012).

The development team usually starts with the most time consuming features and bugs first, leaving the easier tasks for last. The implementation time of each feature or bug is tracked so that implementation time of future bugs and features can be better estimated. If a feature is taking longer than expected to implement then the estimate is revised and sometimes a meeting is setup with the client to see if the priority of the feature should be changed (Moriarty, 2012).

C. *Employees*

Kryos is not a large company, totaling at about 10 employees in Calgary. The development team consists of three people, one lead programmer and two other programmers. One developer is assigned as the QA. To ensure efficient testing, the QA does the testing for the platforms he does not usually develop on, and one of the other developers will do the testing for his platform. The QA is also responsible for writing the documentation for a completed feature or fixed bug. This documentation is added to the original documentation of the developer (Moriarty, 2012).

1) *Work Environments and productivity*

The work environment at Kryos is very relaxed. Working from home is allowed and overtime usually only occurs during major releases or for critical patches to clients. Kryos employees believe that the environment is very important for productivity. Developers need to have quick access to each other so they can assist one another with problems as well as have access to resources such as white boards to better express their ideas. Kryos also ensures that their employees are able to relax when needed and provide sources of entertainment such as a foosball table in their lounge area. Kryos also provides its employees with flex time, the ability to work from home, team lunches, and other benefits packages (Moriarty, 2012).

D. *Comparison*

While considered to be very successful in their field, Kryos is still considered to be relatively unsuccessful compared to larger companies such as Google, Facebook, and Microsoft. Despite sharing commonalities such as agile development techniques and favorable work environments for employees, Kryos' specialized field is preventing them from expanding. Nevertheless, they are on the right track; the addition of iOS and Android to their velocity platform will open up the market over their previous BlackBerry exclusive platform.

VII. CASE STUDY: NORTEL

A. *Brief History*

Nortel Networks Corporation originated in 1882 as a department within Bell Telephone Company of Canada, charged with manufacturing telephone equipment. The department was incorporated as a company in 1895 with the name Northern Electric and Manufacturing Company (Nortel, 2012).

By 1980, Nortel was providing networking hardware and software to North American, European, and Chinese markets. At its height in 2000, it employed over 94,000 people worldwide and accounted for over a third of the total valuation of all companies listed on the Toronto Stock Exchange, being the world's largest supplier of telecommunications equipment (Gorman, 2012).

Nortel's demise began in the late 2000. By August 2002, Nortel's stock price was down to \$0.47 from \$124 – a 26,000% drop. After going through multiple leadership changes and laying off two-thirds of its employees, Nortel filed for bankruptcy on January 14, 2009 (Gorman, 2012).

B. Reasons for Failure

While there were many reasons behind Nortel's failure, one major contributor was not discovered until 2004. As it turned out, the company's intranet was compromised by hackers, who had full access to company's documents from as early as year 2000. A report produced by Nortel's security team claimed that hackers had access to the entirety of Nortel's network infrastructure for almost a decade by using seven different stolen employee passwords, including one from a former CEO. The leader of the team behind the report, Brian Shield, said that he "has no doubt that extensive cyberattacks on the technology company contributed to its downfall." (CBC News, 2012).

1) Poor Internal Security

While Nortel had some protection from outside intrusions into their corporate network, little attention was paid to internal security. The poor security of Nortel's internal structure allowed hackers to have unrestricted access to the company's system from just a few compromised computers. According to Mr. Shield, "Once you were on the inside of the network, it was soft and goeey".

This inattention to network security is particularly surprising, as Nortel specialized in networking software and hardware. They had plenty of talented people with the knowledge to properly secure their own infrastructure, but no efforts were seemingly made towards this goal.

2) Inexperienced Management

One of Nortel's problems stemmed from a lack of technical experience in the higher ranks of management. Nortel was a case where specific telecom experience was especially important, but the board of directors has been criticized for lacking sufficient industry expertise.

This lack of technical expertise manifested not only in poor company leadership, but also an inability to take appropriate action with regards to the security breach. Despite the security report and repeated warnings from Mr. Shields, Nortel ignored the problem. Nortel leadership dismissed the breach as unimportant, and hackers had access to private company documents until 2009. Many infected machines were even sold to other companies, potentially introducing security issues to their networks as well. (McFarland, 2012; Gorman, 2012).

3) Financial Malpractices

Nortel had a 3-year history of financial mismanagement, which hurt their reputation, decreased stock prices, and wasted millions on financial audits. In 2000, Former CEO Frank Dunn, CFO Douglas Beatty and controller Michael Gollogly received a total of over \$12 million in bonuses for

allegedly returning Nortel to profitability. The unexpected and suspicious news prompted the board of directors to hire a law firm to confirm the financial statements. After an external audit in 2003 showed the financial statements for the last three years to be off by billions of dollars, Dunn, Beatty and Gollogly were fired for financial mismanagement and charged with fraud by the RCMP (Wahl, 2009).

VIII. CONCLUSION

In this report, we have studied five companies that work in the software development industry. The three most wildly successful companies described were Google, Facebook, and Microsoft. As discussed, there are many common themes as to why these companies were successful: they put the user first, they gave creative freedom to their developers, and they helped out the general public through philanthropic activities. While Kryos tried to follow within the same footsteps, they lacked a product with a large enough market to allow them to expand as quickly as Google, Facebook, or Microsoft. Putting effort into a product that does not visibly fill a human desire and thus must be specifically advertised tends to create a barrier between a company and runaway success.

Lastly, Nortel is a clear example of how an extremely successful company can fail because of poor organizational practices and software security faults. This shows that success must be maintained, and organizations cannot become complacent once they have achieved it. Poor practices can sink a prosperous company just as easily as they can prevent a company from becoming prosperous in the first place.

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