



Linux in Retail & Hospitality

What Every Retailer Should Know

White Paper

Microsoft Corporation
February 2001

Management Summary

Despite popular belief in the retail and hospitality markets, the Linux operating system is not free. The Linux kernel itself may be free, but there are many other costs associated with the total cost of ownership of a system. There are significant costs associated with “retail-hardening” Linux. Even Linux executives admit that Linux isn’t free, but that you just pay in different ways. Linux especially has a long way to go in retail, and someone is going to bear these costs.

When investigating Linux for your retail enterprise, you should investigate and calculate these ten factors into your total cost of ownership (TCO) model:

❶ Limited Device Driver Support

Very few device drivers are available for Linux today, especially those used in retail environments. The JavaPOS standard is still in the early stages and has not been proven like the OPOS standard. In fact, most JavaPOS installations today run on Windows with OPOS and a Java OPOS wrapper. JavaPOS has a long way to go before it can provide the same device driver support as OPOS provides. The cost of developing retail device drivers is a huge consideration in total cost of ownership. Someone is going to have to pay to develop them for retail. The Microsoft platform is years ahead of Linux in meeting the retail industry’s needs and provides an extensive set of device drivers.

❷ Support / Maintenance Costs

Support and maintenance for Linux is not free. Most Linux distributors make their money by selling their services. Support options vary by vendor and can get quite expensive for the enterprise. You will have to pay for support when you need it. However, before you can even receive support, you have to meet certain requirements. Most Linux distributors will only support un-modified versions of their software. Some of them also require you to meet certain hardware requirements before they will support you. Microsoft has a much more advanced support system in place to aid you when you need help.

❸ Numerous Installation Versions

There are over 188 different distributions of Linux available today, with the number growing all the time. You have to first decide which distribution and graphical user interface to use. Next, you have to deal

with the limitations you will be faced with. For example, there is no guarantee that any software you develop on one distribution will run under another distribution. Nor is it guaranteed, or even likely, that an application you develop for one GUI will run under a different GUI, even on the same distribution. You do not have this problem with Microsoft's platform, since there are only a few different versions, all with a common user interface.

④ Lack Of Available Software

Software for the Linux operating system has a long way to go. There are not very many well-known or enterprise-wide software packages available for Linux today, especially for POS. There is also a huge void on the Linux platform in server side software, like database, message queuing services, and transaction servers. The present limitations of software for the front end, middle tier, and server on Linux represent additional costs you need to factor into your TCO model. You do not face this limitation with the Microsoft platform, which has thousands of products available to create a complete end-to-end solution.

⑤ Untested Waters In Retail

Linux has a long way to go in retail and hospitality. Very few retailers run Linux today. POS and other application vendors are going to pass the cost along to you for "retail-hardening" Linux.

⑥ Lack Of Formal Development Schedule, Research, and Standards

With Linux, no formal development schedule or set of standards exists. There are thousands of developers contributing to it from all over the world, with no accountability to the retail industry. Linus Torvalds makes the final decision about what gets included in the latest Linux release, and he has no accountability to the retail industry. There is no formal research and development process with Linux. Microsoft plans to spend over \$4 billion in R&D in 2001 and listens to the retail industry.

⑦ Less Secure

"Open source" means that anyone can get a copy of the source code. Developers can find security weaknesses very easily with Linux. The same is not true with Microsoft Windows.

⑧ Increased Labor Costs

You will have to spend extra money training your staff on a new environment. Store clerks will have to be trained on a new user interface that they are not likely to be familiar with already, and developers will have to be trained in a new development environment. It will be less costly to train staff on the Microsoft Windows user interface and the development environment because so many people are already familiar with them.

⑨ Limited Developer Tools

There are limited developer tools available for Linux. Those that are available are much more difficult to use than Microsoft Visual Studio. Thus, the same application can take much longer to develop for Linux.

⑩ Business Agility in the Future

Businesses must have the agility to quickly adapt to changing market conditions. There is a lot of uncertainty concerning the future of Linux. Microsoft is a stable company offering a reliable long-term solution.

At the point your organization begins to investigate Linux, conduct your own research in the above areas to get a good idea of your total cost of ownership. You will then be in a position to make an educated decision about the best path for your enterprise. You will see that Linux is far from free. You will also see for yourself why the Microsoft platform can actually have a lower total cost of ownership in the long run. And you won't make the mistake of thinking that Linux is free.

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Introduction

The purpose of this paper is to dispel the popular notion that the Linux operating system is free and to arm retailers with the key areas they need to take a serious look at when considering Linux in their enterprise. This paper will also address how the Microsoft^{®1} platform compares with Linux in the retail sector in each of the key areas discussed. After reading this paper, retailers should have a clear understanding that although the Linux base operating system is free, the total cost of ownership is far from free. You simply pay for it in a different way. Throughout this paper, the term “retailers” is intended to include both hoteliers and restaurateurs along with traditional retailers. Similarly, terms such as “retail industry” and “retail sector” are intended to include both the hospitality and food service markets.

Background On Linux And Open Source

Linux began as a concept in the early 1990’s when Linus Torvalds, then a student at the University of Helsinki, began working on the idea of creating a Unix-like operating system, but one that was more efficient, robust, and available as open source. Linux made it possible for Unix developers to continue at home what they did at work. Instead of buying an expensive Unix workstation along with an expensive operating system, developers could simply install Linux on their personal computer.

Torvalds decided to distribute Linux under the General Public License (GPL), because it allowed free source code distribution. The GPL ensures that any additions or changes made to Linux also have free source code distribution. Thus, this gives only one licensing possibility for the Linux kernel. However, proprietary material can still be developed to run on the Linux operating system. Such applications are not subject to the GPL and do not have to offer their source code. Only changes to the Linux kernel itself are subject to the GPL.

¹ Microsoft is a registered trademark of Microsoft Corporation in the United States and/or other countries.

Several companies such as Red Hat, TurboLinux, SuSE, VA Linux Systems, and Caldera have taken the free Linux kernel, added features such as automated installation programs, window managers, and graphical user interfaces (GUI's) and sell their packages for less than \$100 typically. Thus, it is only the Linux kernel itself that is actually free. If you want a version other than the kernel, you pay one of the distributors for their particular version. Although any distributor can charge you a fee for their version, such distributions are still subject to the General Public License. This means that they must allow you to have the source code behind their version.

With Linux, as well as Unix, the operating system is a separate layer from the graphical user interface. KDE and Gnome are the two most popular GUI's for Linux. KDE is referred to as the most closely related to a Microsoft Windows^{®2} look and feel. The Linux community has chosen not to standardize on one GUI but instead to allow developers and users to choose an existing GUI or create their own.

Top 10 Reasons Why Linux Is Not Free

Retailers typically stay with their POS systems for years because of the costs that can be involved in upgrading thousands of terminal devices to a new environment. Since the retail and hospitality markets have a general perception that Linux is free, Linux has been receiving a lot of attention lately by the industry. At first glance, it seems like it might be a cost effective way to upgrade thousands of terminal devices. However, this can be very misleading. Even though the Linux kernel itself is free, the total cost of ownership of Linux is far from free. You are just paying for it in a different way. Even Linux executives agree that it isn't really free and that you just pay in different ways than before. For example, in a February 7, 2001 LinuxGram article about Linux-distributor SuSE's layoffs, author Maureen O'Gara quoted SuSE's US president, Volker Wiegand, as saying that customers have effectively been duped into believing that they would be getting something for nothing when, in fact, they would just be paying for it differently.

In this section of the paper, we will take a look at ten cost factors that will show you first hand why Linux is by no means free. There is an extensive amount of time and money that will have to be expended before Linux will meet the needs of the retail industry. Someone is going to have to bear the costs of "retail-hardening" Linux. These costs must be factored into your total cost of ownership. In the process of analyzing these costs, you will see why the total cost of ownership of Linux can be greater than operating systems such as Microsoft Windows that are not open source products.

² Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.

The top ten cost factors are shown below. Each of these will be discussed in greater detail in the sections that follow.

- ❶ Limited Device Driver Support
- ❷ Support / Maintenance Costs
- ❸ Numerous Installation Versions
- ❹ Lack Of Available Software
- ❺ Untested Waters In Retail
- ❻ Lack Of Formal Development Schedule, Research, and Standards
- ❼ Less Secure
- ❽ Increased Labor Costs
- ❾ Limited Developer Tools
- ❿ Business Agility in the Future

Reason 1: Limited Device Driver Support

Cash registers in retail stores, hotels, and restaurants have a large number of hardware devices attached to them, such as printers for receipts, bar-code readers, touch screens, credit-card processors, keypads, and cash drawers. Linux has very limited driver support for these devices. What this means for retailers, hoteliers, and restaurateurs is that they have to write the drivers and other functionality themselves, wait for someone else, like the POS vendors, to write them, or pay an outside vendor to develop them.

The POS vendors are only just now beginning to add Linux support for their retail devices. IBM, for example, has only two Linux device drivers available today. The IBM web site listed a device driver available for the Red Hat distribution of Linux to support an IBM SureMark Printer, Model T13 or T14 that is attached by RS-232 to a Linux system. That means that they only presently support one device, a printer device, for the "Red Hat" distribution of Linux. What about support for all the other basic retail hardware like scanners, customer displays, credit-card processors, etc? What about support for other Linux distributions beyond Red Hat? That printer driver could not even be downloaded from their site, unlike all the non-Linux POS drivers that could be downloaded. Instead of going to the download page, you go to a page describing the drivers and what IBM plans to develop in the future. That is pretty limited Linux POS driver support from IBM at this point, especially for a company that has hundreds of device drivers for POS peripherals on other platforms.

Wincor Nixdorf is similar to IBM in the fact that they presently offer very few drivers for Linux. On their web site, they list a handful of drivers that they have available for Linux. For example, they presently support Wincor

Nixdorf scanners, two printers, cash drawers, and a few other devices. These are two good examples to show that there are still a lot of essential device drivers not yet available for the retail industry on the Linux platform.

Suppose that vendors like IBM and Wincor Nixdorf jump in and quickly develop these drivers for Linux. Will those drivers run on other devices, or will IBM's drivers only run on IBM's hardware? IBM would likely develop the drivers for only their platform so they can get some return on their investment. That would be an understandable business decision for them to make. Suppose Wincor Nixdorf creates the drivers. Will their device drivers run on devices other than the ones they were developed on? What about running their drivers under different Linux distributions?

Another important question to be addressed is what standard they are going to develop these drivers under. The JavaPOS effort is presently underway, but has still has not been time tested like the OPOS standard has been. The OPOS standard is a worldwide industry standard that provides for language-neutral and operating system-independent POS drivers. JavaPOS, on the other hand, is a standard for driving retail peripherals in a Java environment. JavaPOS is still in the early stages of development and does not presently provide the necessary device driver functionality that retailers require. In fact, it is interesting to note that most of the JavaPOS installations today are running on Windows, using OPOS and a Java OPOS wrapper. This is not making life any easier for retailers.

At some point, more retail device drivers will be available for Linux, whether by the JavaPOS effort or otherwise. Different entities will pay to develop the drivers, as they need them. If you need them before someone else develops them, you will be the one paying for them. But if someone else developed them, there is a chance you may not be able to use them on your Linux platform or version unless strict standards in the industry are followed.

Another interesting consideration is whether companies like Red Hat will support drivers created by other entities. It will most likely be the retailers and the retail vendors who create the drivers. So does that mean that Red Hat or the other Linux distributors will not support them and offer assistance?

There are presently a lot of unknowns in the area of Linux device drivers for retail stores. Given the lack of such drivers presently available for POS systems and the early stage of JavaPOS efforts, driver-related costs could be significant. These device driver costs are the first set of costs that you have to take into consideration in calculating total cost of ownership.

Microsoft, in contrast to Linux, has an extensive set of device drivers available for their platform and always continues to provide those drivers with new operating system releases. You don't have to incur all those development costs for new device drivers when you purchase a Microsoft operating system. In addition, Microsoft was a key contributor to the OPOS standard that is time tested as the industry standard for language-

neutral and operating system-independent POS drivers. The standard itself is based on Microsoft's Component Object Model (COM), ActiveX, and OLE technologies and provides a standard programming interface definition for POS hardware devices. The OPOS standard is years ahead of the JavaPOS standard. Unless JavaPOS or another standard succeeds on Linux, device drivers will not run across the wide number of Linux distributions today.

Reason 2: Support / Maintenance Costs

The majority of vendors providing the different distributions of Linux make their way by selling their services. They charge you a limited amount, if anything, for their version of the operating system, but if you need their support, that costs extra. Many of them do offer a limited time frame, such as 30 days, during which they will help with installation support for free. When they say that they will give free installation support, they mean exactly that. If you call with a non-installation question, like development or other such questions, those are not covered under the free support and you have to pay for the service.

Support options vary by vendor and can get quite expensive for the enterprise. Red Hat Linux, the leading distributor of Linux has a variety of support options, such as Installation Assistance, Advanced Configuration Support, Developer Incident Support, Platinum Support, and Per Seat support, to name a few. For many of the pricing options, you have to call to get a quote. However, here is an example of some prices listed on their web site. If you purchased their Embedded Developer Kit so that your developers can create programs to run on embedded devices, such as your POS systems, here are two of the support options you can choose:

- EDK – Platinum Support – The basic 10-seat Platinum package costs \$40,000 per year. The services of a Technical Account Owner (TAO) are an additional \$25,000 per year. This program is designed for development projects that require the highest level of support.
- EDK - Developer Incident Support – The cost for a 5-incident package is \$12,500 and the cost for a 10-incident package is \$20,000. This program is designed to cover tools and embedded operating system software problems not usually covered under installation support. Red Hat will provide priority response on any submitted bug and on EDK usage questions. The support is limited to one solution per incident.

Red Hat also offers incident support for home users and small business, which run anywhere from \$325 for a single incident to \$1799 for a pack of 10 incidents. Next, let's take a look at some support costs from TurboLinux, another popular distributor. Here are a few of their support services program offerings from their web site:

- TL 10-Incident Pack CS Lite - \$1500 per year – allows 10 calls for 1 node

- TL 3-Incident Pack 3 CS - \$1200 per year – allows 3 calls for 1 node
- TL Extended Support 24X7 CS - \$80,000 per year – allows unlimited calls for 1 site

So, if you want 24X7 extended support for TurboLinux running in your retail enterprise, you would have to pay \$80,000 per year, per site. If you have 10 different sites that need support, that would total \$800,000 annually. If you are running Linux for critical systems in your enterprise, such as your POS systems, you cannot afford to have large amounts of downtime. Thus, you would most likely consider extended support options such as those previously mentioned. Posting your problem to a Linux News Group in such situations and waiting for an answer is not a viable solution. Thus, you are going to have to pay for the level of support you need.

It is important to mention that many Linux distributors have further requirements that you have to follow before they will even offer support to you. First of all, most of them will only support un-modified versions of their software. Thus, if you modified their version to add additional features to best meet the needs of your retail organization, they will not offer you assistance under many of their packages. The Red Hat World Wide Technical Support Guidelines and Definitions document, for example, states that they will not support any modifications made to their distribution of Linux that are not approved or recommended by them.

Linux distributor SuSE has a similar provision in their Technical Support Agreement, which states that they will only provide support for un-modified versions of their distribution. Thus, you take a big risk of not qualifying for the support for all of your operating system code any time you start modifying it. The whole point of open source is to allow you to modify the code if you need to, but that benefit isn't very useful if you lose your support options.

Secondly, some distributors have hardware requirements that you must meet before qualifying for support. Red Hat is an example. Their World Wide Technical Support Guidelines and Definitions document further states that for an X86-based target system, you must have an Intel Pentium II board with 8 meg of memory, and the following devices for connecting to the host system: 1) Ethernet card 2) Floppy drive for testing and using the Etherboot software 3) Video card to set up the BIOS 4) Cables to enable using the host operating system's keyboard 5) Video monitor and mouse 6) Ribbon cable for connecting the floppy drive to the target 7) Keyboard and mouse may be required for the target's BIOS to boot. Red Hat will not provide support for customer installations that do not meet these requirements.

Beyond support costs, there are also maintenance costs to take into consideration. Assuming that you do modify the base Linux operating system, you will have a maintenance cost to synchronize your changes when the new Linux kernel is released. As new releases of the base operating system come out, you have to spend the time, money, and

effort to incorporate any custom changes that you made to the prior operating system into the new release if you want to upgrade. You then have to go through the effort of testing your custom code changes to the operating system all over again to make sure that it will work with the latest release the same way it did before. For every release that comes out, this cycle repeats. If you plan to make modifications to the operating system, then maintenance costs must be factored in with the other support costs.

Microsoft, like most of the Linux distributors, offers a number of support options to its customers. What distinguishes Microsoft's support options from Linux support options is the extensive support process that Microsoft has refined over the years. Microsoft has massive amounts of helpful information on its public knowledge bases and other web sites. In many cases, a quick search in the knowledge base can reveal the solution to a problem without having to contact Microsoft. In the event that you do need assistance from Microsoft, you have numerous options available. For example, you can call Microsoft's Product Support Services (PSS) Organization and receive detailed support from someone experienced in the area you're having problems with. One way to pay for this assistance is on a per incident basis. For example, a single incident for IT Professional or Developer Support costs \$195 for a web submission or \$245 for a phone submission. Premier support for developers, enterprise agreements, and volume discounts are also available for retail organizations with greater support needs.

Unlike some of the Linux distributors, Microsoft doesn't require that you meet specific hardware requirements before they will support you. If you are running a Microsoft product, then you can receive support from Microsoft. The extensive support infrastructure that Microsoft makes available to its customers is far more advanced than anything available with Linux today.

Reason 3: Numerous Installation Versions

There are over 188 versions of Linux distributions presently available, according to a February 1, 2001 TechWeb article entitled "188 Linux Distributions...and Counting." The article mentions that according to Elizabeth Coolbaugh, executive editor of Linux Weekly News, they are tracking 188 distributions presently and are generally adding one or two per week. The article goes on to discuss that the leading offerings of Linux distributions are Red Hat, SuSE, TurboLinux, Caldera, Debian GNU/Linux, Slackware, and Mandrake.

From the 188 total distributions, 28 are derived from the popular Red Hat Linux. So Red Hat is derived from the Linux kernel and then those 28 are derived from Red Hat. Nine of the 188 are derived from Debian. Where does this stop? This is starting to sound like we're headed back in time to the 1980's and 1990's era where retailers were locked into a single vendor's innovation. For example, with so many different distributions available, there are bound to be proprietaries introduced beyond the free operating system to allow vendors to distinguish themselves. There is a

great possibility that Linux, like Unix before it, will split into vendor-specific variants. The whole point of the progress that's been made in the retail industry in the past 20 years was to avoid going back to that model.

The next logical question to consider is whether a Linux POS application that is created on one distribution will work on another distribution. Also, will it run under the different Graphical User Interfaces (GUI's) available for Linux? GNU, KDE, and GNOME are the most popular, but there are others available too. KDE is typically touted as the closest resemblance to the Windows GUI. Chances are slim that a POS application designed for the KDE user interface will run under the GNU user interface. So if you change your mind and want to use GNU instead of KDE, any money you spent on designing the application for the KDE interface was likely wasted. If you try to run your application on a different distribution of Linux, but under the same GUI, you still have a similar problem.

Retailers really have a lot of decisions to make. With such a vast amount of distributions available, how do you choose one? Do you go with the latest and greatest one that sprouted up during the week? Do you go with the oldest or the most popular? Once you choose the distribution, which GUI do you choose? Do the retail device drivers you need run on that distribution? Numerous complications exist as a result of having so many Linux distributions. The costs of dealing with these complications should be included in determining total cost of ownership.

Microsoft, unlike Linux, has one standard graphical user interface across its limited number of operating systems. Of Microsoft's operating systems, Windows NT³ Embedded, Windows CE, and Windows 2000 are best suited for the retail industry. With Microsoft's platform, you don't face the challenge of trying to choose which distribution to use or which GUI to use. Imagine how confusing it would be if Microsoft released 188 versions of Windows and multiple versions of the GUI, each with a slightly different functionality? Wouldn't that be confusing? Wouldn't it be extremely difficult to run an enterprise solution with confidence about your future and return on investment in Microsoft products? That is the exact scenario that Linux is presently in by having so many distributions.

Reason 4: Lack of Available Software

The software selection for the Linux Operating System has a long way to go. There are not very many well-known or enterprise-wide software packages for Linux available today. There are a growing number of Linux freeware and commercial software packages available, but we're just now starting to hear about major vendors migrating their popular software packages to Linux. Corel, for example, has migrated its popular WordPerfect Office 2000 suite to Linux.

³ Windows NT is a registered trademark of Microsoft Corporation in the United States and/or other countries.

If you investigate on Linux software sites, you will see some other word processing and spreadsheet programs, some utilities, and other software. However, you will not see very many financial software, project planning, desktop publishing, and other related software packages, if you see any at all. Better yet, try finding Linux POS applications when you're doing your research. Good luck. You will probably be able to count the number of POS applications available for Linux on one hand. Even Linux software makers, distributors, and advocates admit that Linux has a long way to go on the software side before it can become a valuable player in the enterprise.

Another big drawback to Linux presently is the lack of server side software, like database, message queuing services, transaction servers, etc. From the transaction server side, there is no Linux software that provides functionality such as Microsoft Transaction Server (MTS) or Microsoft BizTalk™⁴ Server. The few messaging systems for Linux that exist are either really expensive, like the IBM MQSeries software, or they are proprietary, such as the Wincor Nixdorf version.

The present limitations of software for the front end, middle tier, and server on Linux could represent additional costs to any retailer presently considering Linux for their enterprise. Retail organizations today cannot effectively integrate their core business applications and databases together on Linux given the current shortage of enterprise software. For example, under Linux, how can you integrate your office suite with your financial systems? It is very difficult to do so.

Unlike Linux, the Microsoft Windows platform supports thousands of products for a complete end-to-end solution. You can purchase Microsoft software or software from thousands of third parties for nearly anything you could ever want to run on a Microsoft Windows operating system. Microsoft also offers volume licensing on its products for the enterprise to make it more cost effective. The Microsoft platform has been tried and tested as an enterprise solution but the Linux platform has a long way to go. Almost every organization in existence has Windows running somewhere in their enterprise. When considering Linux, you just need to account for the extra cost associated with the limited software and limited integration available. You will either have to develop the software yourself, or wait for someone else to do so.

Reason 5: Untested Waters In Retail

Even though Linux has made great strides in other industries, it is far from being a mature, tested platform in retail and hospitality. There are very few retailers running Linux today, although many are investigating it presently. In order to develop the device drivers for POS and other retail

⁴ Biztalk is either a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.

software for Linux, someone is going to pay for it. If the ISV's sell you a solution to run on Linux, they are going to pass the cost along to you for the effort they have to put into "retail-hardening" the solution for Linux. A well-known POS vendor mentioned that his company factors in research and development costs that are required to support any new operating system when they decide to take on a project.

Another well-known POS vendor indicated that any additional development and support costs would be divided by the number of Linux POS units to be sold. That divided cost would then be added to the software or solution price for each of their customers or each POS system. A third vendor commented that Linux is never cheap, if support and maintenance costs are taken into consideration, although the cost of the initial operating system is cheaper than Windows and other such platforms. What these retail vendors are saying is that when you consider Linux, you have to consider the costs you will be paying to retail-enable it.

The Microsoft platform, on the other hand, has been tested time and time again. The OPOS standard offers the majority of device drivers that retailers need. The thousands of client, middleware, and backoffice solutions available for the retail enterprise on the Microsoft Windows platform have proven themselves. In addition, Microsoft is leading the way in the retail industry for the Windows platform. From the OPOS standard to XML and Microsoft Biztalk and beyond, Microsoft is leading the advancement of systems for the retail industry. Who is leading the way in the retail industry for Linux? No one is. All in all, the Microsoft platform is a stable, scalable, and reliable platform for all ends of the retail enterprise. When you invest in Microsoft's platform for your retail enterprise, you don't have to pay to re-invent the wheel. The same is not true when you invest in Linux.

Several case studies are described later in this paper showing real examples of what several retailers who either investigated or implemented Linux found out and why they switched or stayed with Windows.

Reason 6: Lack Of Formal Development Schedule, Research, and Standards

One of the biggest criticisms you hear of Linux is the lack of a formal development schedule and standards. In this section we will discuss why that criticism has a lot of merit and will show you the impact it can have on total cost of ownership.

Let's first take a look at the lack of formal development schedule and standards with Linux. Since Linux is open source, thousands of developers and companies from all over the world can make suggestions to be included in the next release. Under the general public license, they can change the source code and try to make it better. They must agree to submit their changes for all to benefit from. The best ideas then get included in future releases. There is really no formal development process or set of standards with Linux development. At the present time, it is totally up to Linux father and guardian, Linus Torvalds himself. Torvalds

works full-time as an engineer at Transmeta Corporation, a chip maker. A January 26, 2001 TechWeb article entitled "Is Linus Killing Linux?" discusses how in the Linux world, the buck stops with Linus Torvalds. The article goes on to discuss how Torvalds lacks formal accountability for Linux and with his full time job at Transmeta Corporation, he has considerable distractions outside his open-source activities.

With everything being in Torvalds' hands, he is in total control over where the future of Linux goes. If he doesn't want a new retail feature to be included in the core operating system, it will not be included. Additionally, he doesn't have any accountability to the industry when the releases are delayed, if they do not work well, etc.

In a January 28, 2001 TechWeb Q&A interview with Torvalds, he commented that the worst part for him is to herd the developers and get them to do the right thing and to make sure they don't get too upset with him when he says no to something they want to do. If Torvalds has to coerce the developers to do the right thing and if the developers of the world have no accountability to Torvalds or the industry in general, how can you be sure that your best interests will always be listened to?

To further illustrate the risks associated with Open Source software, it is best to quote Red Hat, number one distributor of Linux. The excerpt below is from Red Hat's November 1999 Securities and Exchange Commission Form 10-Q filing document:

"WE MAY NOT BE ABLE TO EFFECTIVELY ASSEMBLE AND TEST OUR SOFTWARE BECAUSE IT CONSISTS LARGELY OF CODE DEVELOPED BY INDEPENDENT THIRD PARTIES OVER WHOM WE EXERCISE NO CONTROL, WHICH COULD RESULT IN UNRELIABLE PRODUCTS AND DAMAGE TO OUR REPUTATION"

The filing document further goes on to say that, "Red Hat Linux, in compressed form, consists of approximately 546 megabytes of code. Of that total, approximately 500 megabytes have been developed by independent third parties, including approximately 10 megabytes of code contained in the Linux kernel. Included within the 546 megabytes of code are over 700 distinct software components developed by thousands of individual programmers which we must assemble and test before we can release a new version of Red Hat Linux. If these components are not reliable, Red Hat Linux could fail, resulting in serious damage to our reputation and potential litigation. Although we attempt to assemble only the best available components, we cannot be sure that we will be able to identify the highest quality and most reliable components or to successfully assemble and test them. In addition, if these components were no longer available, we would have to develop them ourselves, which would significantly increase our development expenses."

The complete text of that filing document can be found on the SEC's web site at: <http://www.sec.gov/Archives/edgar/data/1087423/0000912057-00-001361.txt>

Let's take a closer look at their comments. They are admitting that they may not be able to effectively test and assemble their software because Linux is created by third parties that they have no control over. Those are

the same parties that Torvalds has no control over either. They also admit that if the code from those parties should prove unreliable, that their Linux software could fail. With the largest Linux distributor in the world noting such problems, it just further highlights the riskiness of the Linux open source business model.

Distributors like Red Hat typically make most of their money from their services, not the software. So, if the Red Hat distribution of Linux should happen to fail, what would happen to all of the entities out there that purchased it? They wouldn't likely get help from the other distributors for Red Hat's code. As noted before, each distributor has different rules and regulations about what they will support, with the most common theme being that they will only support their own un-modified versions. In the event that one of the distributions ceases to exist, their customers can truly be left hanging in the support arena.

Other Linux executives admit there are problems with the business model. In the same SuSE article mentioned earlier, SuSE's US president Volker Wiegand was quoted as saying that Linux as a business isn't working out, calling it a victim of hype and irrational expectations. Wiegand compared Linux to a "fallen angel", and claimed that it had actually "fallen more than it had climbed." Under the new economy, he said, "expectations were greater than the deliverables...expectations are now below zero". The article discusses that he made those statements after having to layoff many SuSE employees in the United States. Other articles in early February cited further layoffs in the Linux industry, such as at Linuxcare and TurboLinux.

If the Linux distributors themselves are having doubts about the business model and are laying off employees, and if Linus Torvalds and the rest of the contributors to Linux have no accountability, then these are serious risks that you have to take into consideration in calculating your total cost of ownership for a platform.

Microsoft, in contrast to Linux, has a formal development process and is accountable to the industry. If Microsoft doesn't perform to customer expectations, retailers won't buy Microsoft's software. Microsoft has listened to the retail industry in the past, with OPOS and Active Store, as examples. Microsoft also has a formal research and development process and plans to invest over \$4 billion in R&D in 2001. Microsoft invested over \$3 billion in R&D in 2000. They invest huge amounts of money like this in R&D every single year. Linux has no comparison. Different entities invest money in Linux but the money they publicize often includes their marketing costs and other costs that are not truly just research and product development to better the product for the industry. The bottom line is that the criticism of the Linux business model has merit and should definitely be included in your total cost of ownership calculation.

Reason 7: Less Secure

The nature of open source is that you can get a copy of the source code and look at it, make changes to it, etc. Whatever distribution you choose,

you can get a copy of that exact source code. Because of this open nature, developers can much more easily identify security weaknesses and prey upon them with viruses and by hacking into systems.

Recent examples of the security problems with Linux were discussed in the media. According to a January 17, 2001 CNET News.com article entitled "Internet Worm Squirms into Linux Servers", the Ramen worm has been squirming into Linux servers worldwide. The article discusses how lax security is to blame for the problem and how the worm exploits many of the well-known flaws of the Linux operating system based on a default installation of Red Hat's 6.2 and 7.0 distributions of the software.

The problem of open source is that when new security fixes are incorporated into the Linux kernel, developers will be able to see them as well. It is sad to say, but there are people out there who get a big kick out of the challenge of finding flaws in systems. And when they can get their hands on the source code itself that makes it even easier for them.

If your business goes down because of a security breach, then you lose money during the downtime. How quickly you can recover is a key question. Microsoft Windows has better security than Linux out of the box. Microsoft is also driving better security with its customers than Linux is doing. In addition, you don't have to worry about the source code to the latest security fix being exposed to developers around the world, only for them to use the code to find new weaknesses. By protecting the source code and by working closely with customers to drive better security, Microsoft is able to provide stronger security than Linux.

Reason 8: Increased Labor Costs

Another cost to consider in total cost of ownership is labor. Any time you introduce something new and unfamiliar to your staff, you have to train them. This is not a new concept. In the case of Linux, if your staff has not worked with Unix before, then they would have to be trained on how to use Linux.

For example, if you install a Linux-based POS system in your retail stores, then you will have to train the clerks how to use that user interface on Linux. The chances are slim that the clerks have worked with Linux at home. This means that the training costs will be higher than if you implement a graphical interface they are likely to be familiar with, such as Microsoft Windows, for example.

It isn't just the store clerks who will need training, either. It will be just as important, if not even more so, to provide adequate training to your in-house development staff. Since there are not large numbers of developers familiar with Linux development already, you will have to spend some extra money getting them the training they need. Contrast this with the number of developers readily available and knowledgeable about the Microsoft platform. You might have to invest more money in labor to hire, retain, and train Linux developers than with Microsoft developers. It could also be even more difficult to find the developers you need for your Linux

applications. The main reason is because the more you customize your application and the operating system, the more proprietary it becomes. This ends up making it even harder for you to find expertise in that particular area.

There will also be increased labor costs due to lowered productivity. If the Linux interface is less intuitive for the store clerks to use, then they will not be able to produce as much during the same time they did in the past. Thus, they will have to work more hours to accomplish the same thing. The same idea holds true for developers. The less familiar they are with the development environment, the more hours it will take them to do their work.

Microsoft, in contrast to Linux, has an extensive developer base available. In fact, it is fair to say that Microsoft probably has the largest developer base among all the platforms today. There is also more standardization across projects running on the Microsoft platform, so developers are able to be productive in a new environment much more quickly than they can in Linux environments. These labor costs are a significant factor to consider in total cost of ownership for a platform.

Reason 9: Limited Developer Tools

The bad news is that you will not only have to pay more money for developer training, but also, once trained, your developers may not be as productive as they are on the Microsoft Windows platform. This is because of the limited developer tools available on Linux. Limited does not mean quantity. There are plenty of developer tools available for free or for purchase. For example, you can use C, Java, Perl, and many other languages to develop in Linux. The most popular languages used to develop software for Linux are probably C++ and Java. There are very few good GUI developer tools on Linux. The majority of them are non-gui based like C++. Several developers and POS Vendors have indicated that both GUI and non-GUI Linux development tools are extremely difficult to use when compared to the Microsoft Visual Studio⁵ development environment.

In addition to lowered developer productivity because of more difficult developer tools, there are also additional costs for the Linux development tools themselves. The better development tools are not free. There is a wide range in cost, from a few dollars to several thousands of dollars. The embedded developer tools tend to be the most expensive to purchase. The cost for development tools is yet another cost you have to include in your total cost of ownership model.

⁵ Visual Studio is a registered trademark of Microsoft Corporation in the United States and/or other countries.

Microsoft, in contrast to Linux, has excellent developer tools available. The Microsoft Visual Studio development environment is the preferred choice among most developers today. Microsoft Visual Studio allows developers to be extremely productive and create powerful, robust applications in much less time than the same functionality could be created on Linux.

Reason 10: Business Agility in the Future

Businesses must have the agility to quickly adapt to changing market conditions. It can be very costly to invest in a solution today that will not grow with your business needs. Applying band-aids or complete re-writes to your store systems can get very expensive indeed. Thus, if the platform you choose doesn't allow you to quickly adapt to changing conditions, then you will have extra costs that must be taken into consideration in calculating your total cost of ownership.

With Linux, there are some key areas that haven't yet been proven. For example, how will Linux handle future connectivity among multiple devices in the store? How will Linux handle integration with other systems? How will Linux scale across the enterprise? Will end-to-end software solutions for the whole enterprise be developed for Linux? Will the drivers needed by the retail industry be supported in my version of Linux? Will I have to develop all of them myself? It is going to be very costly for someone to define the answers to these questions and will be even more costly for businesses that switch to Linux and then find it doesn't work out for them.

There is a lot of uncertainty around Linux. That is why a lot of companies are holding back, just waiting and watching from the sidelines to see how it works out. Microsoft offers a much more stable alternative. Microsoft has been around for a very long time and will be around for a lot longer. Microsoft has the talent, resources, and funding to continue developing products that customers want. Microsoft's products have been proven time and time again in the enterprise and are getting better every day. Microsoft also has accountability to the industry to do what the industry wants and has provided the industry with a clear migration path from one Microsoft platform to the next. Microsoft provides your organization with the ability to move on a dime. The same is not true with Linux.

Case Studies

In this section, we will take a look at some case studies of companies who either switched to Linux or had considered switching to Linux but decided that the Microsoft platform would better serve their company's needs.

General Growth Properties

General Growth Properties (GGP) is a leading owner/operator of regional malls in the United States. GGP owns or operates more than 140 shopping malls in 38 states, with some 16,000 retail tenants. As an aggregator of tenant services, technology has become GGP's latest amenity, since they have installed a Broadband infrastructure across all their malls. Retailers access the network via a portal solution. The GGP retail portal is a partnership of Microsoft, USi, and Plumtree. The solution is now operational with 5,000 users running Exchange Server 2000, Windows[®] 2000, SQL Server[™] 2000, Internet Explorer 5.5, and Active Directory^{™6}.

Delivering applications that satisfy retailers' requirements is GGP's objective. Current uses include email and content personalization, e-Learning, video marketing distributing, digital music, accounting, four human resources programs and many more services. The networking infrastructure also supports hi-tech video displays and interactive kiosks in the common areas of the mall.

Due to volume discounts and preferred licensing arrangements by Microsoft and their vendor partners, GGP is providing a cost effective way for retail tenants to access business-building technology. GGP's solutions allow retailers to focus their limited IT resources by delivering an end-to-end technology implementation and at a significant cost savings. The future is truly unlimited on where GGP will expand.

When trying to determine what platforms and technologies to implement, GGP investigated a number of infrastructure options, including Microsoft and Linux. In a phone interview with Guy Denney, Senior Director of GGP Networking Services, he revealed some insight into how GGP made the decision to go with Microsoft's platform.

According to Denney, GGP felt it was very risky to base the future of the enterprise on something that was not predictable. He said, "compatibility is critical to achieving retail adoption and ultimate success...The whole world is Microsoft compatible...Linux would limit our opportunities." Denney further noted that retail stores face a challenge created by geographic diversity...having multiple locations utilizing the same platform could provide scalability...that security of data was essential. GGP's research showed that Windows 2000 was the best solution for them. Denney also commented that it is much easier to find developers for the Windows platform than Linux. "The Internet developers of the world don't know Linux; they know IE and Netscape," Denney noted.

⁶ Active Directory, SQL Server, and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

General Growth Properties is very happy about their decision to invest in the Microsoft platform and are very excited about the endless possibilities the Windows 2000 infrastructure can provide for them and their retailers.

Wyse

Wyse Technology, a maker of general purpose terminals, went through a round of using thin clients on Sun Microsystems' Java software and then the Linux operating system, and has now settled on Windows CE for their Winterm 3000 series of thin clients. Wyse introduced a Linux-based thin client in 1999 but has been phasing out that machine because Linux didn't have adequate support from vendors that made scanners, printers, bar-code readers, and other hardware peripherals.

Wyse technology chose Microsoft Windows CE for its Windows-based terminal product because of Windows CE's native connectivity to Windows NT Server 4.0, Terminal Server Edition through the Remote Desktop Protocol. With Windows CE, Wyse was able to control the size of the RAM by selecting only the operating system components they needed. According to Randy Buswell, Product Development Manager for the Winterm 3000 Series at Wyse Technology, "Together, Microsoft and Wyse are delivering an end-to-end solution for enterprises that reduces their total-cost-of-ownership for workstations of task-based workers."

Any retail organization considering thin clients for their organization will benefit from taking a look at the complete Wyse case study, which can be found on the Microsoft web site at:

<http://www.microsoft.com/windows/embedded/ce/guide/casestudies/wyse.asp>. In addition, the information about Wyse switching from Linux as part of that effort can be found in the CNET News.com March 31, 2000 article entitled "Wyse wants to put thin clients in the home" by Stephen Shankland at: <http://news.cnet.com/news/0-1006-200-1619553.html?tag=st.ne.1002.bgif.1006-200-1619553>

GoInvest.com

GoInvest.com is a Santa Monica based business-to-business provider of private label online financial data, content, and technical analysis tools. GoInvest.com solutions allow clients to affordably and quickly integrate financial content into their own web sites. They have standardized on Windows 2000 and have found it to be everything they are looking for.

According to Jeff Fenley, GoInvest.com president, "It's the answer to everything we've been looking for." "With Linux", he further commented, "we had to restart our servers on an average of once every week or two." Fenley stated that they have not had to restart their Windows 2000 servers for several months and that the problems with computers freezing up have been eliminated.

From an administration perspective, GoInvest.com is finding that the Windows environment is easier and more user-friendly for them to administer than Linux. Fenley said, "The GUI is more intuitive and

standardized.” GoInvest.com has also had great results with the remote administration offered by Terminal Services component of Windows 2000. Fenley also noted that Windows 2000 platform has made their ability to attract and retain developers much easier.

A complete copy of this case study can be found on Microsoft’s web site at: <http://www.microsoft.com/windows2000/guide/server/profiles/goinvest.asp>

Hoeft & Wessel

Hoeft & Wessel, of Hannover, Germany, is well known all over Europe for their sleek electronic digital devices. They are a leader in information terminals for retail, logistics, ticketing, and other industries. Hoeft & Wessel wanted to design a portable, wireless internet access device. They needed an embedded operating system that was universal, open and familiar to developers around the world.

They considered Microsoft Windows CE and Linux. According to Thomas Wolf, Director Business Unit Ticketing and Information at Hoeft & Wessel, “Only Windows CE offered the professional support and international familiarity that we needed,” Wolf explained. “Our industrial customers want a very high level of technical support, and Microsoft does a great job of this.”

Hoeft & Wessel knew that many customers would want to do their own development around the product, so they wanted to tap into the immense base of Windows tools, applications and talent. They knew that the operating system needed to support many graphical resources, including browsers and found it would be too much work to create them in-house if they went with Linux. Since Hoeft & Wessel developers were already familiar with the Windows programming model, this was a much better choice for them.

Thanks to the Windows CE operating system, the Webpanel had a large library of applications able to run on it the day it hit the market. Pocket versions of Microsoft applications such as Pocket Word, Pocket Excel, Pocket Outlook, and Pocket Internet Explorer run right out of the box. “The open architecture and Windows installed base give us an instant advantage and an instant boost in developer acceptance,” Wolf says.

A complete copy of this case study can be found on Microsoft’s web site at: <http://www.microsoft.com/windows/embedded/ce/guide/casestudies/hoeft-wessel.asp>

Research Organization TÜViT GmbH’s Report

An independent study was conducted by Research Organization TÜViT GmbH to show a cross-comparison of Windows 2000 and Linux. The title of the report is “Comparative Test of Microsoft Windows 2000 and Linux as Network Operating Systems”.

The report compared Windows 2000 with SuSE Linux 6.4 / Red Hat Linux 6.2 and concluded that Windows 2000 was better suited for corporate use as a network operating system. The Windows 2000 network essentially worked "out of the box", while the Linux system required extensive effort in terms of configuration, programming and testing before it was possible to create an equivalent network in terms of functionality. The study also found that Windows 2000 is less expensive than Linux and gives a better return on investment.

The report does an excellent job comparing the different hardware investments, software costs, installation requirements, training, operating costs, stability, etc. Before considering Linux in your retail enterprise, this is an excellent report to take a look at. It will give you a lot of great information to consider in making the best decision for your organization.

The complete text of the management report can be found in English at: <http://www.microsoft.com/europe/industry/retail/news/2501.htm> or in German at: <http://www.tuvit.de/de/download/Windows2000-Linux/>

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