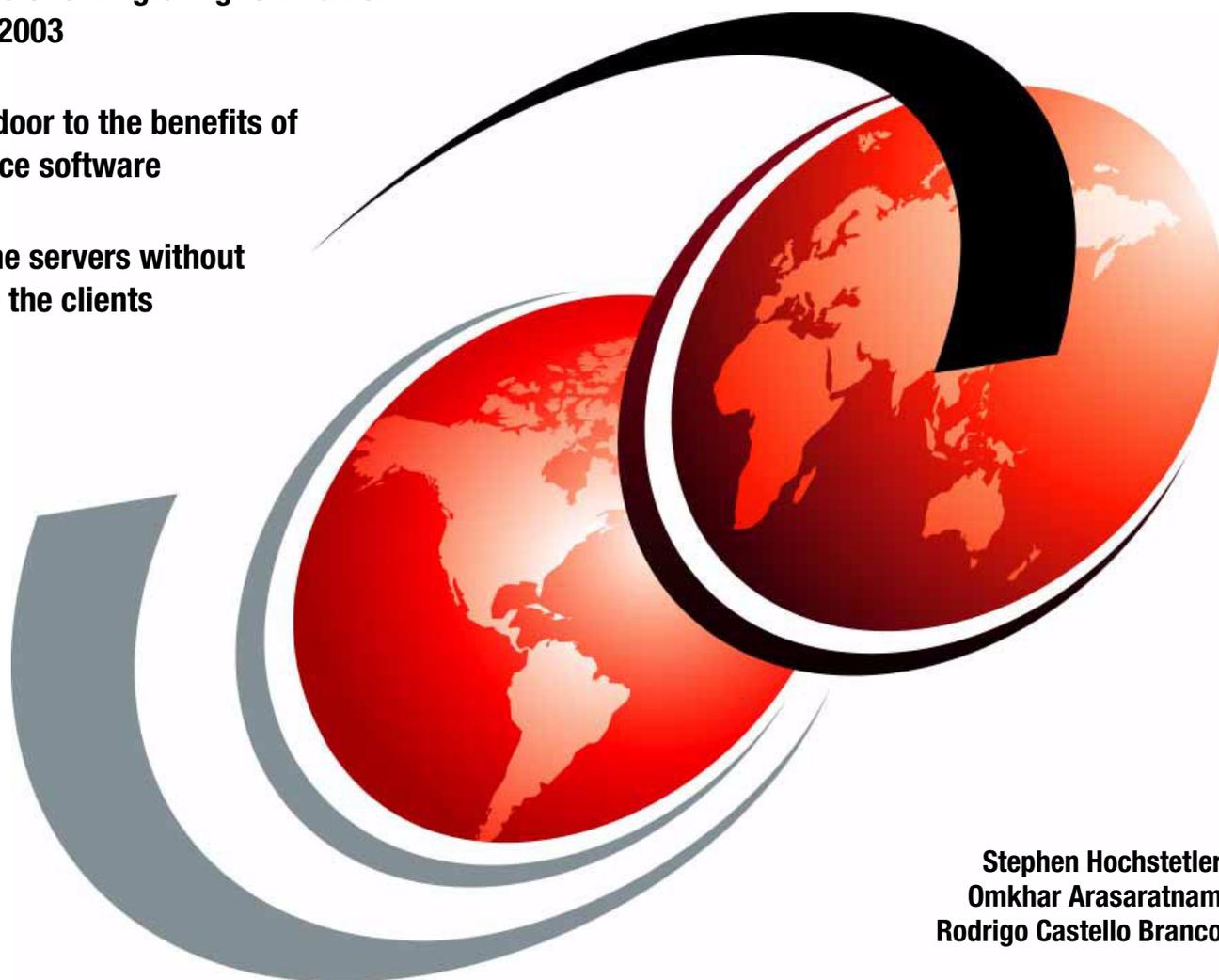IBM

Linux: Why It Should Replace Your Windows NT Domains

Similar costs for migrating to Linux or Windows 2003

Open the door to the benefits of open source software

Migrate the servers without impacting the clients

Stephen Hochstetler
Omkhar Arasaratnam
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Redpaper

IBM

International Technical Support Organization

Linux: Why It Should Replace Your Windows NT Domains

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This edition applies to Samba Version 3 with Red Hat Enterprise Linux ES Version 3, SUSE Linux Enterprise Server 8, and Turbolinux Enterprise Server 8.

Contents

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Preface

Microsoft® announced the end of support for Microsoft Windows® NT 4.0 for December 31, 2003. Your company is now facing the migration from Windows NT® to a new platform. Do you realize you have a choice other than migrating to Windows Server 2003? Have you budgeted additional, larger hardware servers to go along with your migration? The operating system that you will be migrating to will affect the size of the hardware to which you migrate.

You have a window of opportunity to make an important business decision at this time. The decision is the server software platform with which you will be replacing Windows NT. If you have looked at a migration plan from Windows NT to Windows 2003, you will see many steps that probably include upgrading hardware and also adding new components such as Active Directory. This paper proposes an alternative path for your business by choosing Linux to replace your Windows NT domain.

Linux opens the door to open source software, while maintaining a great platform for installing IBM® software, such as Lotus® Domino®, DB2®, and Tivoli®, as well as other vendors, such as Oracle, JD Edwards, and SAP. At the same time, GNU software such as Samba provides print, file server, and authentication functions that the Windows NT domain software previously provided. Each day, new functions are released for Linux. One example is software that allows Linux servers to participate in .NET networks. Add to these benefits the efficient use of system resources that allows Linux to run on existing hardware. The security features of Linux makes it even easier to choose Linux over Windows 2003 as the replacement server software.

This paper describes the reasons to choose Linux when replacing your Windows NT 4.0 domains.

The team that wrote this Redpaper

This Redpaper was produced by a team of specialists from around the world working at the International Technical Support Organization, Austin Center.

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Thanks to the following people for their contributions to this project:

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Migrating to Linux

Samba is an open source software package often used with Linux distributions. Replacing Microsoft Windows file and print servers with Samba results in a more stable server environment and can reduce costs, because no client licenses are needed. This paper describes considerations and issues when migrating Microsoft Windows servers to Linux. A simple file serving function using Samba is relatively straightforward. However, duplicating some of the more advanced functions available on Windows servers can be difficult to set up or are simply not supported on Samba at this time.

The purpose of this paper is to help explain some of the advantages of choosing Linux rather than Windows 2003 as a migration path from Windows NT. There are several compelling reasons to choose Linux that we cover in this paper. Various companies and governments have made this choice and have published the migration steps and also decision criteria to make this choice. This is one of several papers from IBM that summarizes the data and also gives you links to additional information so that you too can make an informed decision for your business.

The key topics we cover in this paper are:

► Security
► Total cost of ownership (TCO)
► Open standards

1.1 The business decision

Your business has been relying on Windows NT 4.0 domains for authenticating users, sharing files, and providing access to your networked printers. Why change something that has been working? By ending normal support, your vendor has made the choice for you that you need to change to something different.

Have you been satisfied? Has your office experienced worm and virus attacks? Have you been able to maintain your servers and do timely installs of the critical security updates that are made available? A person looking at the Microsoft Windows download site sees that many new security updates also affect the new Windows 2003 servers. Can your business continue to operate in this environment of attacks and security updates?

Are you ready to migrate from Windows NT 4.0 to a newer operating system? When we upgrade non-operating system software, we are used to putting in a CD and telling the system to do an upgrade with the expectation that it will work without additional effort on our part. As you plan your upgrade from Windows NT 4.0 to Windows Server 2003, you will quickly realize that it is not just an upgrade, but a multistep migration from one operating system to another operating system. At the point of this realization, this paper proposes that you then also consider an attractive alternative, Linux.

1.2 The beginnings of Linux

Linux started as a project to improve another UNIX®-like operating system called MINIX. This project was headed by a young University of Helsinki student named Linus Benedict Torvalds.

In 1991, Linus was introduced to the MINIX operating system written by Andrew S. Tanenbaum. Tanenbaum, a professor, wrote MINIX as an open source example to accompany a book he wrote about operating systems. Linus used the MINIX source as a reference and created his own derivative that eventually became known as Linux.

Linux had very humble beginnings; in fact, Linus Torvalds stated the following in a 1991 e-mail to the comp.os.minix newsgroup:

> *I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) clones.*

From Linus Torvalds, August 25, 1991 to the comp.os.minix newsgroup.

Linux has changed significantly since those days. Today, Linux runs on everything from the smallest embedded systems to every IBM @server brand, including zSeries® mainframes running hundreds of LPARs of Linux.

Now, we are reaching a critical point in the IT industry. Windows NT is soon to reach the end of its support life cycle, and companies are looking for an alternate to Windows 2003. Rather than locking themselves into proprietary technology from a single vendor, many companies are looking to open source solutions for maximum flexibility.

1.3 Choose your level of migration

Any company doing a migration cannot accept the cost of employees being unable to perform their daily business during the migration. For this reason, you should have a migration plan that enables you to stage the migrations one layer at a time and that also enables you to verify

that the migrated servers are working as expected before you tackle the next set of servers. With Samba Version 3 with Linux, you can do this. The file servers can exist within your own Windows domain or within an Active Directory structure.

A properly executed migration will be invisible to all employees except for the administrators. To help you see what steps you might need to take, we suggest that you read the *Migration Plan*, available at:

http://www.kbst.bund.de/Anlage303777/pdf_datei.pdf

1.4 Improve your system's security

Security is a major concern within most IT departments. This section explains the key points to look for when considering security. It will help you understand why most security compromises occur and how they are avoided with Linux. It also points out the advantages of implementing and maintaining a secure environment under Linux rather than Windows.

Maintaining a secure environment is one of the most demanding and consuming tasks of an IT department. From patch deployment and outage management to best practices, it is not an easy task to accomplish. Linux eases this burden with a number of methods that we describe in this section.

1.4.1 Security features

There are several features within Linux that make it much easier to secure. One of the methods used to crack into a system, is to exploit a hole in a program and make it crash. This provides the perpetrator a method to execute programs arbitrarily, because they gained remote control of the system by the exploit.

In Linux, this can be prevented by chroot. This is a unique method of running a program in a *sandbox*. This means that the program is allowed a very restricted environment on which to execute. This ensures that if the program is exploited, the malicious cracker's access is limited to a small portion of the system. This prevents the cracker from wreaking havoc on the entire environment. In fact, in an environment properly using chroot, an exploited program would not be an effective means of compromising a server. The privilege that the cracker acquires is also a key to how far the exploit can be taken.

Most programs or services on a Windows server run with system privileges. For the most part, this means unrestricted access to the system resources. When a service is compromised, the attack gains the same privilege level with which the service executed. Therefore, if these services that run with system privileges are compromised, the attacker has complete access to the machine.

On Linux systems, a service is referred to as a daemon, and the system account is synonymous with root. Linux systems typically run most of their daemons with non-root privileges. This means that a compromised program will not gain the user unrestricted access to the system. When combined with chroot, this effectively eliminates the effectiveness of remote exploits.

1.4.2 Open source software peer review

One of the great features of Linux and open source software (OSS) is peer review. With source code readily available, any OSS can be evaluated, reviewed, and improved by the community. The more eyes that see the code, the more mature it becomes.

Closed source solutions cannot benefit from this review, because there is a limited set of people who are allowed to see the code.

A strength that open source development has over a standard commercial software development process is the number of people doing peer reviews. While no process is perfect, it is likely that security holes caused by buffer overflow errors found in commercial software during the past 24 months would have been exposed before shipment if it had been open source development. We can state that even this process of open source peer reviews is not perfect with the announcement late in 2003 of an overflow in the Linux kernel that was found and patched. However, the number of security updates that have been released this year for Linux is dramatically less than the number of security updates for commercial software for your file and print servers. Although the good news is that Microsoft is releasing patches as problems are found, the number of patches can strain the support and administration teams that maintain these servers.

Ask a programmer to explain this example to you if you are not a programmer yourself. The following example is simply to show you the simplicity of the correct programming practices that commercial software companies and open source programmers should be using. It is not a complex problem to fix, nor a complex problem to resolve before it happens on your computers. Consider the following simple coding in Example 1-1 and Example 1-2. We see that with one line of change and one additional line of code that a buffer overflow will not happen. The message here is simple, you should not accept any excuses from vendors that have security problems because of buffer overflows. But what is a buffer overflow? This means that the programmer who wrote this particular application did not ensure that they were transferring the correct amount of data from one place to another. Proper programming etiquette dictates that before transferring data from one place to another its size should be checked, and appropriate action should be taken if the data is not the expected length.

Example 1-1   Simple buffer overflow

```
void overFlowMe(char *str)
{
    char buffer[10];
    strcpy(buffer,str)
    /* Overflow will occur above */
}

int main (void)
{
    char *str = "This is beyond 10 characters by far"
    overFlowMe(str);
    return 0;
}
```

Example 1-2   Avoiding an overflow

```
void noOverflow(char *str)
{
    char buffer[10];
    strncpy(buffer,str,(sizeof(buffer)-1));
    buffer[(sizeof(buffer)-1)]=0;
    /* Avoiding buffer flow with the above two lines */
}

int main (void)
{
    char *str = "This is beyond 10 characters by far"
    noOverflow(str);
    return 0;
}
```

Although a line-by-line explanation is beyond the scope of this paper, you can see how buffer overflows can easily be avoided by using proper programming style. When the logic of the program ensure that a buffer overflow is not possible, more secure and robust code is produced.

1.4.3 Patch release frequency

Microsoft recently announced that they would be moving to a monthly patch release schedule, barring a large security exposure, in which case, the patch would be released immediately. In addition to this, many Microsoft security patches to date have required a reboot of the operating system. This results in a disruption of service and an unpleasant experience to end users who are not able to access the server while it is being recycled. This requirement has remained the same through all incarnations of Windows, from Windows NT to 2003.

Linux distributions release their patches in a timely manner. All major vendors usually have patches for vulnerabilities within one to three days of the exploit being discovered. Even if the vendors do not have packages immediately available, the maintainers of the software will usually release a source code patch. This patch can be applied against the source, compiled, and distributed to servers as appropriate if quicker action is required. Most importantly, most patches do not require reboots. The one exception is kernel updates. These are released about once a quarter for enterprise distributions such as Redhat Enterprise Linux or SuSE Linux Enterprise. The less reboots that occur, the less scheduled or emergency outages occur on the system. This results in users being more productive due to the increased uptime.

Another concern in a Windows environment is the amount of patches that are released for Internet Explorer alone. Due to the browser's tight integration to the operating system, it is critical that the Internet Explorer patches are given the same attention as the operating system patches. Linux is quite different. Most Linux servers do not even have a GUI installed. In security, being able to install only the function required on the server with Linux reduces the amount of function that needs to be secured.

1.5 Lowering total cost of ownership

Total cost of ownership, or TCO, is used to account for all the costs involved in implementing a solution. From hardware purchase to training and system maintenance, TCO accounts for the complete cost of a system. This section describes some of the key points that make Linux a good choice when lowering the TCO of IT.

1.5.1 Linux is more secure

How much money does a company lose when a server goes down? That is a very hard number to find, but it is not a bill any company is willing to pay for. Linux can be configured to be more stable by being a virus-free environment and more reliable when holding up against malicious hacker attacks.

How much money can a company lose if their credit card numbers database is compromised? That is even worse, because it does not lose the actual costumers, but the bad marketing it represents prevents the company from getting new costumers. Therefore, if security has a cost for your company, it should be considered in a TCO study.

1.5.2 License cost

Proprietary software licenses are usually expensive and also include the additional cost of the client access licenses (CALs) licenses that are needed by authenticated users to access the server in Microsoft environments for example. You can calculate the time that it will take to get a return on the investment implementing a Linux solution, which will be recovered by the price of renewing the licenses that you would not have to do with Linux.

1.5.3 Windows down time applying security patches

Every time a patch for an operational system has to be applied or the registry needs to be updated by an installed application, the Windows servers need to be rebooted. Down time can be added as a factor that impacts the TCO rate. And with certain regularity, Windows servers have to be booted in order to maintain updates as Microsoft recommends.

1.5.4 Less IT specialists managing more servers

At first, moving UNIX administrators to Linux increases the TCO, until these specialists get familiarized with the environment; this takes about a month or two. After that, a Linux administrator can manage several servers at a time. After a period of time when the administrator develops administrative scripts focused on the servers tasks and use, the system is almost self managed, and the administrator just needs to monitor, and occasionally adjust, processes. Depending on the number of servers and the server' use, this characteristic can be fundamental in drastically lowering TCO and justifying the migration to Linux.

1.5.5 Linux firewalls, proxies, Web servers, and databases

Many of the packages shipped with Linux have recognized quality and functionality that are taken today as standards by IT specialist, such as Iptables, Bind, Squid, and Apache. Therefore, it is not necessary to buy third-party solutions. These packages are recognized as good quality software even when compared with proprietary ones.

1.5.6 Use UNIX infrastructure

If your company already has a UNIX infrastructure, it is cheaper to implement a Linux solution than to bring in a new Windows 2003 server solution. It is possible to use UNIX backup solutions through NFS and use authentication UNIX solution such as NIS or LDAP.

You have a choice of running Linux on many of your UNIX servers or to reuse your Windows servers as Linux servers. This gives you a chance to expand your UNIX-compatible environment, while also extending that environment to be Windows compatible by deploying a Samba solution.

1.5.7 Lower application development costs

Development in open source is usually faster and therefore cheaper. This is because there is several code repositories with tested and ready code that can be freely used by open source developers.

1.5.8 Server consolidation on zSeries

Domino on zSeries has a special TCO rate, because you can replace hundreds of Intel®-based servers with one zSeries server. That means some of the infrastructure costs

will be cut out. Network cabling, routers, and providing physical space in the server site to host all the machines is expensive. With a zSeries, you don't have to worry about having a big network infrastructure and fast connection speed between the servers. Even the costs of electricity and air conditioning should be analyzed, because the amount saved each month is considerable. The hardware maintenance contract for one machine could be much more affordable than hundreds of machines.

1.6 Benefits of open source software

This section describes the benefits of an open source environment. It also covers how companies can take advantage of open source and standards as a philosophy during software development. In addition, we make suggestions as to how an open source strategy can address the dynamic requirements of an enterprise.

Open source software means different things to different people. For most, open source software means flexibility: the ability to choose the best software or hardware for your particular need.

1.6.1 Freedom to change

Some closed source products have strict licensing agreements that can severely limit the functionality of a product. With a closed source solution, you are tied to the framework of your provider. You are bound by the restrictions imposed within the framework, because the source code is not available to modify. If there is a bug that needs to be fixed or a feature to be added, you must wait for a fix or upgrade to be released.

With open source software, this is never an issue. Source code is always available. If the development team doesn't like how a certain portion works, it can be rewritten. If a feature needs to be added, it can be. Most open source licenses allow the modification of the original source as long a some simple rules are followed. These rules usually ensure that the software remains open source and that recognition is given to the contributors.

Open source not only describes a software distribution method, but also an ideology. Open source developers pride themselves in pedantically adhering to standards, such as Request for Comments (RFCs), in order to ensure interoperability.

There are closed source vendors who claim to follow RFCs. In reality, some of these vendors make subtle changes while implementing these RFCs in order to make interoperability difficult. This leads to great frustration when attempting to have two vendors' implementations work with each other.

1.6.2 Variety of platforms

Linux is one of the most heterogeneous operating systems in the world. It runs on everything from the largest zSeries mainframe down to embedded systems such as routers. Because of strict adheration to standards such as the Linux Standards Base (LSB) project, many Linux distributions are considered *source compatible*. This means that the source code of a program can be taken from one system, recompiled, and run on another LSB-compatible system.

If you want to run a program on a zSeries server that is only available on Intel hardware, simply recompile. In one simple step, your software will gain all the advantages of running on big iron hardware, with minimal cost and almost no cross-development time.

Part of this flexibility of open source is owed to the GCC compiler. This compiler is responsible for building almost all the software currently available for Linux. Its maintainers currently support over 50 platforms and targets. This ensures that you can always find the best hardware and software combinations.

Having several platforms of development is very helpful, because you can choose the one that best fits the needs of your applications. This means that companies don't have to spend money buying technology that is not actually being used or time adapting a proprietary solution to fit your company's needs.

1.6.3 Cost effectiveness and longevity

Much of the open source software out there is available free of charge. Most open source software can be used and modified in a royalty-free manner. Major vendors charge a significant fee for the custom consulting work required to adapt a generic software package for the specific needs of a company. With open source, your company can leverage its existing talent pool to tailor applications at a cheaper rate. If you don't have that talent pool in house, you will still need to pay someone to configure the software for you. With the source for the program available to that person, it might be easier for them to meet your requirements. With less cost and effort spent on customizing applications and other sundry details, you can focus efforts on the business at hand. Because the source is available, you can choose to set the limit on the support life of a particular product. You might still need to pay someone to maintain the code for you, but if a bug is discovered, it can be resolved and the software recompiled.

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this Redpaper.

IBM Redbooks

For information about ordering these publications, see "How to get IBM Redbooks" on page 10. Note that some of the documents referenced here may be available in softcopy only.

► *Lotus Domino 6 for Linux*, SG24-6835

► *Migrate Exchange 5.5 to Domino on Linux*, REDP-3777

► *Migrating from Microsoft Exchange 5.5 to Lotus Notes and Domino* 6, SG24-6955

► *Open Your Windows with Samba on Linux*, REDP-3780

Other publications

These publications are also relevant as further information sources:

► *Migration Guide: A guide to migrating the basic software components on server and workstation computers*, KBSt Publication Series, Volume 57, July 2003, ISSN 0179-7263, available at:

http://www.kbst.bund.de/Anlage303777/pdf_datei.pdf

► Terpstra, John H., and Jelmer R. Vernooij, *The Official Samba-3 HOWTO and Reference Guide*, Prentice Hall PTR, 2003, ISBN 0131453556

Online resources

These Web sites and URLs are also relevant as further information sources:

► MacIsaac, M., *Migrating Windows Servers to Samba*

http://linuxvm.org/Present/misc/SambaMig.pdf

► The European Commission Interchange of Data between Administration (IDA) Open Source Migration Guidelines

http://europa.eu.int/ISPO/ida/jsps/index.jsp?fuseAction=showDocument&parent=news&documentID=1647
http://europa.eu.int/ISPO/ida/export/files/en/1618.pdf

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You have a window of opportunity to make an important business decision at this time. The decision is the server software platform with which you will be replacing Windows NT. If you have looked at a migration plan from Windows NT to Windows 2003, you will see many steps that probably include upgrading hardware and also adding new components such as Active Directory. This paper proposes an alternative path for your business by choosing Linux to replace your Windows NT domain.

This paper also includes links to publicly available migration documents used by government agencies to analyze the costs of the migration choices and determine the total cost of ownership, providing them with a short-term and long-term analysis on which to base their business decision of choosing to migrate to Linux.