IBM's iSeries —
The Open Systems Consolidation Engine for Linux

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Management Summary

In America, we love our automobiles. In fact, we love them so much, we have one for every purpose. We have a family sedan to take the wife and 2.3 children to grandmother's house on Sunday. We have a mini-van when Mom needs to drive a carpool to the soccer match. We even have an SUV for when we want to take the kids into the woods and rough it. And for that mid-life crisis, there is the Chevy Corvette in the driveway to prove that we're not that old, after all. It would be wonderful if we could afford the luxury of having one of everything to put in our 5-car garage. However, very few of us without an NBA contract have the resources for that. As an alternative, we would like to purchase a single vehicle that converts from one style to another, on a common chassis. Unfortunately, that option does not exist, either. We must select the one style, or perhaps two for the suburban family, and make do.

Information Technology (IT) management faces the same problem in the data center, today. Faced with the results of unfettered, often ad hoc, growth in the IT infrastructure, the IT Director is trying to regain control over the plethora of servers that he finds across the enterprise. They exist not only in the data center, but also throughout the enterprise where Directors, and even Managers, have sufficient financial authority to acquire a print server here, a file server there, and, perhaps, a departmental application server over there under that table. The data center staff is not as concerned about the logo on the box as they are about the operating system within. It is one issue to consolidate a network of homogeneous systems all running Microsoft *Windows 2000*, but how do you consolidate a Windows 2000 server with an *NT* server, and then consolidate those with servers running *UNIX* and *Linux*? **It would be great if the data center architecture enabled the consolidation server to run multiple operating systems in series,** i.e., first as a *Windows* server, then as a Linux server, etc., **but the typical environment requires the execution of applications running different operating systems in parallel**. How do you simplify maintain control of the administration of a consolidation server that is running a set of legacy applications and Linux applications at the same time?

IBM would have us believe that the answer to that question has been sitting in the data center all along. Their *eServer iSeries* platform running *OS/400* is more that just a proprietary *AS/400* application server from the 1980's. To see how IBM has evolved the iSeries into an Open Systems consolidation server, please read on.

The Data Center Environment

One of the most important developments in the data center in recent years is the dawning of a new open system era with *Linux* arriving as a significant cog in the e-business-computing engine. An open-source version of *UNIX*, Linux is rapidly becoming the de facto standard for basic e-business infrastructure applications such as Web servers, e-mail, and network security (firewalls). As CIO's everywhere look for ways to consolidate their computing activities and to simplify the operations of their data centers, more and more are looking to Linux as the consolidation vehicle to lower the total cost of operation (TCO) of their Windows infrastructure.

As these enterprises examine the ramifications of evolving their *Windows* infrastructure to Linux, they come away pleased with the opportunity for success, but concerned about embarking on this journey alone. Fortunately, for the IT staff in the data center, they are not alone on an island.

There is a virtual plethora of Linux software available in the open-source market. Multiple varieties of Linux are available from distributions such as Red Hat, SUSE, and Turbolinux. In addition, basic infrastructure applications such as Web services, file and print serving, e-mail servers, and firewalls are available from open source solutions like *Apache* (Web services), *Samba* (file and print), *Sendmail* (e-mail), and *Netfilter* (firewall). These applications can simplify the operation of your data center while taking advantage of the enterprise server through the sharing of processor access and enterprise resources such as disk and tape. This can enable the data center to leverage Linux to provide e-business solutions.

There are also a great many hardware options available for Linux with the operating system running on platforms as diverse as mainframes to desktop workstations. The key to a successful marriage between Linux and the hardware deals with how well the legacy environment integrates with the open environment. The indiscriminate infrastruc-

ture expansion that led to the requirement for consolidation did not account for how well each platform fit within the environment, how easy it is to administer, or how easy it is to upgrade or add resources. IBM tells us that this is not an issue with the *eServer iSeries*.

Based on the *POWER4* architecture that it shares with the *pSeries*, the iSeries is a set of platforms designed to be integrated into a robust, flexible infrastructure, with very high performance and scalability to serve the e-business community. With over 2500 new customers in 2003, the iSeries provides a broad choice in selecting, building and deploying applications, providing on-demand functionality in managing growth and costs, and employs innovative technology in delivering the very high performance and scalability.

The eServer iSeries Platform

Based upon the 64-bit *POWER4* microprocessor and the POWER architecture, the iSeries maintains an economic and technical synergy with the pSeries. Because IBM has been able to share the development expenses for the microprocessor family between these two product lines, they have been able to promote the highest level of microprocessor technology, while at the same time improving upon the basic iSeries platform. The iSeries 8xx product set consists of .a family of scalable servers, from the mono-processor *iSeries 800* to the 32-processor *Model 890* enterprise server at the high end. With *OS/400 V5R2* running in the primary partition, the iSeries can take advantage of the *Logical Partitioning* (LPAR) of the POWER4 architecture to support up to 31 Linux partitions. At the low end, the mono-processor iSeries 800 is limited to nine Linux partitions. With memory support ranging from 8GB at the entry level to 256GB at the high end, the iSeries can support literally thousands of users, delivering enterprise level performance.

Designed to run in a mixed workload environment, the iSeries also supports the *On/Off Capacity Upgrade on Demand*

Exhibit 1 – Infrastructure Simplification
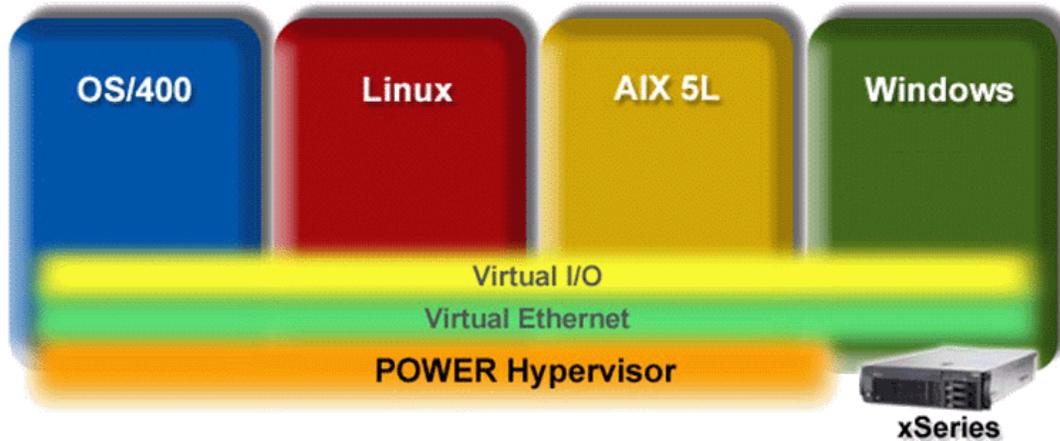
IBM's statement of direction is to support AIX in a logical partition on iSeries in the future.
This chart contains information about IBM's plans and directions. Such plans are subject to change without notice.

Source: IBM

(CUoD) capability. This enables the temporary or permanent activation of standby CPUs in order to meet the dynamic workload requirements of the enterprise in any high performance computing or On-Line Transaction Processing environment. With the flexibility of the POWER4 CPU at its core, the iSeries can support multiple operating systems concurrently, including OS/400, Linux, and Windows (See Exhibit 1, above.). The iSeries will support AIX 5L by the end of 2004.

There are two solutions for support of Windows within the iSeries. The first is provided via an integrated xSeries PCI Server board with a 2.0GHz Xeon processor, Intel memory and a built-in 10/100 Mbps Ethernet adapter. The server leverages the systems management, communication and storage resources of the iSeries. As many as 48 discrete, Windows servers can be installed within a single iSeries server. The second solution is provided by an integrated xSeries Adapter. This adapter is a PCI-based interface card that mounts inside of the xSeries server. It provides a 1GB/sec *High-Speed Link (HSL)* to an iSeries Server. This permits the use of centralized iSeries storage, along with integrated operations and systems management for up to 60 xSeries servers. (See Exhibit 2, on the next page.)

A single iSeries server can host multiple Linux applications instead of adding one or more dedicated IA86 server(s) to the data center. **With hundreds of thousands of OS/400 servers installed in data centers around the world, IBM has the base necessary to create the ideal synergy for the merging of these two environments within a consolidated server**.

Linux on iSeries

The iSeries under OS/400 V5R2 supports the three leading versions of open-source Linux – Red Hat, SuSE and Turbolinux – in a 64-bit environment. Behind these competing implementations are thousands of ISVs developing e-business and high performance computing applications for Linux. Since the iSeries uses PowerPC processors, distributions that use the PowerPC Linux kernel are required to run in iSeries partitions. Linux applications compiled for PowerPC will run on iSeries, pSeries, and other *PowerPC* platforms, gaining synergy for these implementations within the development community based upon the total number of these platforms installed across every enterprise.

The data center can configure the Linux environment with less than one processor,

Exhibit 2. – iSeries Integration

Source: IBM
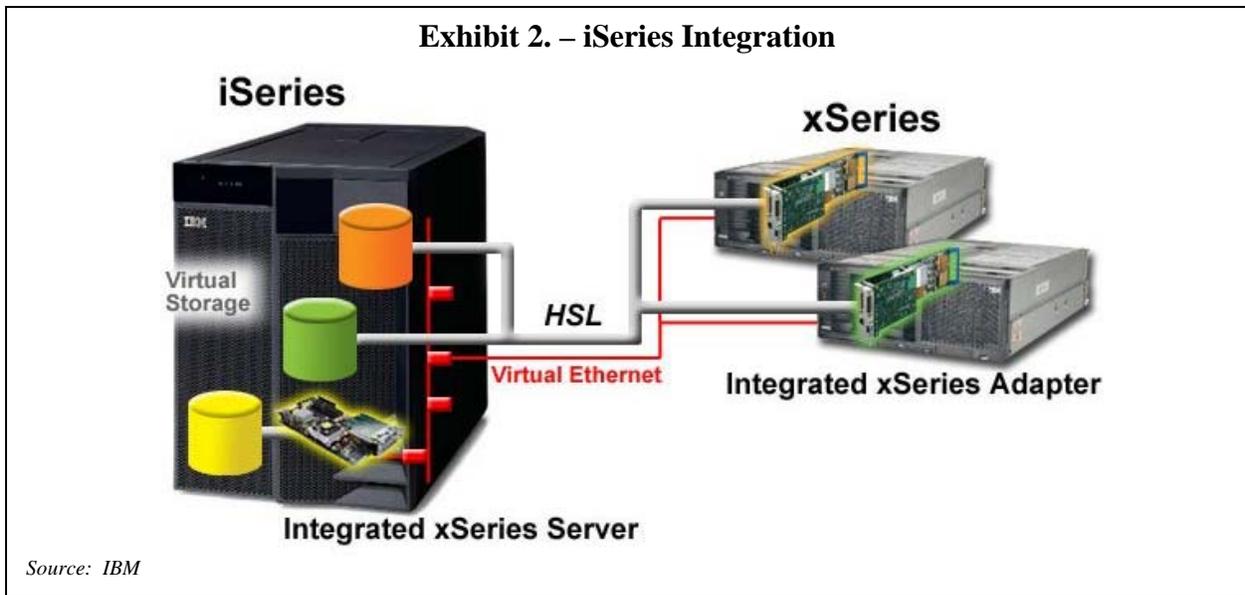
some memory, and disk resources. This makes LPAR an essential facilitator enabling Linux on the iSeries. Each POWER4 processor can consist of multiple partitions, with initial increment of at least 10%. For example, in a mono-processor i800, OS/400 runs in a primary partition consuming at least 10% of the processing power of the POWER4. Each Linux application can then run in a separate partition representing at least 10% of the CPU. Each partition contains at least 64MB of memory. If there are three Linux applications in place, such as Samba, Apache, and Netfilter, each could evolve into a partition representing 30% of the processing capability of the CPU. Through LPAR, each partition can dynamically expand its CPU consumption in increments of 1%, while expanding its memory use in increments of 1MB. By adding these Linux partitions, the data center can ensure better utilization of the CPU and memory resources, some of which may have been idle, previously. A mono-processor configuration can be segmented into ten partitions, nine of which may be dedicated to Linux, while a dual-CPU can support up to 19 Linux partitions, and a quad-processor iSeries server can utilize a maximum of 31 Linux partitions.

iSeries CUoD complements LPARs by providing standby processors, ready to be activated on a permanent basis when

additional Linux applications or users are consolidated onto the server or when seasonal demand requires a temporary increase in processing capacity. Applications can communicate between the partitions via the 1GB Ethernet LAN using the iSeries high-speed bus.

Within the iSeries, Linux applications have two highways through which to access storage facilities. They can leverage iSeries resources through virtual I/O under OS/400 control or they can access resources dedicated to the Linux environment directly. By using virtual I/O, the data center can implement new applications while minimizing any new investments and accessing OS/400 recovery services. IBM has also enhanced OS/400 NetServer with Samba to support the exchange of files between OS/400 and Linux partitions.

Linux applications can gain access to OS/400 data, files, and applications enriching the OS/400 environment with open source solutions, protecting the investment that enterprises have made in iSeries products. Data centers can now maximize their existing infrastructures to scale for expansion.

Because IBM has chosen the iSeries as the platform for the propagation of Linux applications, the enterprise receives the added bonus of a comprehensive set of

technical services in place for the iSeries. These include the availability of service consultants to assess, design and implement the consolidation of Linux workloads, education and consulting services for Linux installation, an IBM Support Line from Global Services.

Conclusion

IBM has solved the cost equation by integrating Linux with OS/400 on the iSeries to allow you the time to manage your enterprise, not your technology. Linux is the vehicle chosen to leverage a virtual worldwide development team to bring open source applications to the data center on the iSeries. To paraphrase the popular vernacular, we can summarize by looking at the "Top Ten" reasons why the iSeries may be the answer to your operations dilemma:

1. **The iSeries as the ideal consolidation server** for the enterprise with OS/400, Linux, AIX, and Windows applications.

2. **Logical Partitioning** enables the enterprise to achieve 100% CPU utilization through shared processor support.

3. **Dynamic resource allocation** enables the administrator to direct additional resources to any partition on the fly.

4. **Capacity Upgrade on Demand** enables the dynamic assignment of standby processors to any mission-critical application.

5. **Storage virtualization** enables the sharing of iSeries devices by Linux applications eliminating the need to purchase additional storage.

6. **High-speed intercommunication** between partitions through the iSeries virtual Ethernet.

7. **Application integration** extending the availability of open

source applications to the OS/400 environment.

8. **Common administration** of microprocessor and storage facilities.

9. **Enterprise-level reliability** through the POWER architecture.

10. **Data protection** through OS/400 disaster recovery services.

Whether you have an iSeries server installed in your data center already, or not, **the integration of Linux with OS/400 simplifies the implementation of your e-business infrastructure and high-performance computing requirements. This solution would appear to be a winner for infrastructure simplification.**

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