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## EXECUTIVE SUMMARY

# Adding Business Value with Cross-Platform Solutions: Linux Running on IBM Servers

Sponsored by: IBM

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## INTRODUCTION

IBM has focused on a Linux and open source strategy that allows it to leverage the capabilities of its IBM Power Systems (formerly called IBM System i and IBM System p) and IBM System z mainframes. This strategy allows for more efficient cross-platform operations through advanced virtualization and consolidation of Linux workloads running on those systems. Customers have a choice in the way they deploy Linux workloads across the enterprise; some have elected to invest in scalable IT infrastructure platforms, in some cases at an initial cost that is higher than that of Linux solutions that are deployed on volume servers, which are servers that are priced less than $25,000.

This executive summary previews a forthcoming IDC white paper, which is based on preliminary research data that was collected from 12 customer sites in the United States, Canada, and Europe, all with mixed server platforms, to find the technical and business outcomes from deploying cross-platform Linux solutions on IBM servers. This summary presents the key findings of a return on investment (ROI) analysis that was conducted by IDC this year at these customer sites. The white paper will provide additional details about the study's findings, based on data analysis and on in-depth interviews with respondents to capture both capital expenditures (capex) and operational expenditures (opex). The full paper will document customers' decisions regarding hardware, software, and IT staffing, including the ROI that was seen in the year following the initial deployment.

The scalable systems involved in these cross-platform Linux deployments can operate as communicating hubs in a high-bandwidth corporate network of multiple systems, including all types of servers and server blades running Linux. By adopting this cross-platform approach for Linux workloads, IBM is demonstrating the business benefits of workload consolidation, high availability for these scalable servers, and "green IT" by leveraging virtualization software to deploy new "virtual servers," as business requirements change, over time.

To understand the actual costs and benefits of deploying an IBM Linux cross-platform solution, IDC studied 12 IT sites — two-thirds in the United States and one-third in Canada and Europe — all of which have deployed Linux on IBM's Power Systems and IBM System z mainframes. Based on IDC's business value methodology, which is described in this document, the results of this study illustrate the technical and business benefits of running consolidated Linux workloads on these servers.

## ROI Study Highlights

Respondent sites using IBM Power Systems and IBM System z realized the following benefits, based on preliminary data from the ROI analysis and in-depth interviews with respondents:

- Consolidation and virtualization reduced annual IT infrastructure costs by $17,700 per 100 users.
- More efficient server platforms increased the companywide average utilization rate from 36% to 79%, compared with the previous deployment.
- Cross-platform management improved application availability from 99.2% to 99.9%, leveraging high-availability, reliability, and management features that are built into the scalable server systems.
- The use of fewer server footprints, made possible by the use of scalable servers, resulted in overall power/cooling savings of 50%.

In summary, the total annual value of the benefits exceeded $30,000 per 100 users, based on the ROI analysis, and generated a three-year ROI of nearly 500%. The payback period for the investment, including hardware, software, consulting services, training, and IT staff to manage the server platforms, was 6.3 months, following initial purchase and consolidation of Linux and open source workloads on the scalable IBM Power Systems and IBM System z servers. (IDC notes that the payback period is the time from initial deployment to the time when benefits equal the net present value [NPV] divided by the initial investment.) The forthcoming IDC white paper will include data tables and charts based on the details of this ROI analysis. This executive summary provides a synopsis of the key findings from the study.

## Methodology

IDC utilized its standard ROI methodology for this project. This methodology is based on gathering data from current users of the technology as the foundation for the model. Based on these interviews, IDC performs a three-step process to calculate the ROI and payback period:

- Measure the benefits from reduced IT costs (staff, hardware, software, maintenance, and IT support), increased user productivity, and improved revenues over the term of the deployment.
- Ascertain the investment made in deploying the solution and the associated training and support costs.
- Project the costs and savings over a three-year period and calculate the ROI and payback for the deployed solution.

IDC uses a standard discounted cash flow methodology to calculate the NPV of the benefits (savings and increased revenue) over three years. IDC notes that NPV is the discounted benefits minus the investment. The ROI value equals the NPV divided by the initial investment. Payback period is the time from initial deployment to the time when benefits equal the initial investment.

IDC uses the following assumptions in its calculations:

- To quantify investment and savings for IT and user labor, IDC multiplies time values by burdened salary (salary + 28% for benefits and overhead).
- IDC uses a 12% discount rate in the ROI analysis to fully account for the average cost of capital and risk and to ensure a conservative analysis.
- Because the full benefits of the solution are not available during the deployment period, IDC prorates the benefits on a monthly basis and subtracts the appropriate amount for the deployment time from the first-year savings.

## SITUATION OVERVIEW

The datacenter is populated by a wide variety of servers that are based on different types of processors and acquired at different times in an enterprise's history. Whether old or new, these servers offer up an important challenge to business managers: How can this range of hardware platforms be tied together more easily? Although there are several paths to accomplish this goal, one way to answer this challenge is to centralize a number of workloads onto fewer server footprints and then to link the servers together via a high-speed network, making it easier to move data and work from one system to another.

In the next wave of computing, this ability to pull together workloads — and to hide the complexity of the underlying IT infrastructure — will become more important than ever. Why? Because a myriad of electronic devices, including PCs, PDAs, and cell phones, will allow universal access to the "back room" of the datacenter, where mission-critical applications and corporate data reside. This access to the datacenter is enabled by high-speed communications networks and by advanced identification and authentication software — both of which were not widely available a decade ago. Further, the move to add cloud computing to the mix will accentuate the importance of being able to scale up workloads, as demand from end users and end customers peaks, based on business conditions, Internet activity, and time-of-day considerations.

IBM has focused on a Linux and open source strategy that allows it to leverage its Power Systems and IBM System z mainframes for more efficient cross-platform operations through their advanced virtualization capabilities and consolidation of Linux workloads running on those systems. Rather than representing islands of automation, these systems can operate as communicating hubs in a high-bandwidth corporate network, spanning the enterprise (including a central site and remote sites) and supporting end-to-end Web-enabled applications. By adopting this approach, IBM is demonstrating the business benefits of workload consolidation, high availability for these scalable servers, and "green IT" by leveraging virtualization software to deploy new "virtual servers," as business requirements change, over time.

## How We Got Here

During the economic downturn of 2001–2003, IT managers began to look to volume servers (servers priced less than $25,000) to support many of the new workloads being deployed, where possible. The vast majority of these volume servers were x86 servers (servers based on x86 processors made by Intel or AMD), while midrange enterprise servers (servers priced $25,000 to $499,999) and high-end enterprise servers (servers priced at $500,000 or more) across all processor architectures (including RISC, EPIC, and CISC) accounted for less than 10% of all units.

System administrators found themselves managing hundreds, if not thousands, of physical servers sold in the volume server space — and individual servers were often underutilized, operating at 10–20% of their capacity. Further, the need to forge a kind of unified management of all of these systems also caused a new kind of complexity in the datacenter — and enhancements in management of the hardware, the operating systems, and the workloads running on them also became necessary.

The trend toward virtualization of x86 servers in recent years, as part of a consolidation cycle that better leveraged server utilization, brought real, bottom-line benefits to customers. To the extent that midrange and high-end systems could host the same workloads, by consolidating workloads that had been running on a larger number of small servers, these scalable servers leveraged built-in virtualization and management capabilities that were designed to support highly available workloads with a high degree of controllability and virtualization-based isolation of important applications — all of which is important to enterprise workloads.

As it turns out, one way to support the same workloads across server types was to adopt Linux and open source software, which was available to run on all server platforms — x86, EPIC (Itanium-based), RISC, and mainframes — and across price categories — volume, midrange enterprise, and high-end enterprise. This approach to Linux and associated software stacks leveraged Linux skill sets across the full range of all servers in the companies studied; it also brought a wide variety of Linux applications and open source software to all platforms present at the customer sites. This allowed the IT staff to leverage capabilities in the RISC server and mainframe systems, with respect to advanced system management and RAS features of those scalable server platforms, which subsequently resulted in improved high availability for applications running on those servers.

## Business Considerations for Consolidation Using Linux Server Solutions

Linux servers play an important role in the worldwide server market; they generated more than $7.5 billion in customer revenue last year and are expected to top $10.5 billion in 2012 (see *Worldwide and Regional Server 2008–2012 Forecast: March 2008*, IDC #211606, April 2008). In terms of factory revenue, Linux server hardware generated $1.8 billion, or nearly 14% of all worldwide server revenue, in 1Q08. While most of the Linux server shipments tracked by IDC are based on x86 architecture, this document focuses on the experiences of IBM server customers who decided to run Linux workloads on server platforms not based on x86 architectures.

The study covered by this document focused on customers who had a mixed server environment, including IBM Power Systems and System z servers, in addition to a large number of small servers, most of them x86 servers (which IDC defines as servers based on microprocessors made by Intel and AMD) running a mix of Windows and Linux. While the mix of these servers varied from site to site, the point of the exercise is that Linux workloads can be deployed on a variety of server platforms, including cross-platform deployments supporting end-to-end applications that span the enterprise — and Web 2.0 workloads for the Internet. At these customer sites, some of the workloads — but not all of them — were moved to Power Systems or System z mainframes to manage Linux workloads that could be consolidated on scalable servers and where they would benefit from central-site management.

Customers' reasons for deploying Linux on Power Systems and IBM System z varied, but several common themes emerged from the research into these IBM server deployments:

- Virtualization on RISC and mainframe platforms is more mature than virtualization on x86 servers, which is developing over time.
- The combination of virtualization and consolidation allowed these customers to deploy Linux workloads efficiently, on fewer server footprints, than would otherwise be possible.
- Unified management available on RISC and mainframe systems improved overall availability and manageability of the Linux computing environment at these sites. IBM has Linux implementations with end-to-end support for line-of-business (LOB) applications running on different types of servers, across multiple IT sites, across an enterprise.

Linux and open source technologies may be selected for technical reasons related to support for multiple workloads and applications; other choices for operating systems are also beneficial, but other operating systems may not be available on all server platforms in the datacenter. Therefore, the business benefits include the ability to run Linux workloads in a cross-platform deployment across server types.

## LINUX AT IBM

### Linux on Power Systems and System z

Linux is an operating system that runs on all major hardware platforms, including x86 (servers based on Intel and AMD processors), RISC, EPIC (servers based on Intel Itanium processors, and CISC (servers based on CMOS processors, including mainframes). This is an important aspect of cross-platform support for IT organizations because Linux applications can be run on two or more server types. This is accomplished in a variety of ways, ranging from running Linux natively on the server processors, to just-in-time translation technologies, to running Linux on top of Java Virtual Machines (JVMs) that run on many types of operating systems and processors.

IBM has embraced Linux as a cross-platform technology that spans all of its server platforms — the Power Systems based on POWER processors (a type of RISC processor), IBM System z mainframes, and IBM System x x86 servers. Many applications have been written for Linux x86 server platforms, and IBM has found a way to bring that wealth of application software — both custom applications and packaged applications — to its Power Systems, using a technology called PowerVM Lx86 that allows Linux x86 applications to run, without change, on the POWER-based systems; this has resulted in thousands of Linux x86 applications being made available for use on Power Systems. IDC notes that Linux can also be run natively, directly on the POWER processors — and that Red Hat and Novell SUSE both run natively on Power Systems.

Importantly, IBM System z mainframes have dedicated Integrated Facility for Linux (IFL) processors that can be used to accelerate performance of Linux as it runs on those servers. Using this approach, Linux performance can be optimized to run faster on the mainframe than would otherwise be the case, and the total number of Linux instances can be increased, compared with running Linux without the feature installed. It is possible to support hundreds of Linux instances on the Integrated Facility for Linux feature, each running a separate workload.

## IBM Software on Linux

A full complement of system software and middleware is supported on IBM servers running Linux. In part, this is due to IBM's support for all levels of the software stack running on Linux distributions (e.g., Red Hat Enterprise Linux [RHEL], Novell SUSE Linux Enterprise Server [SLES], and several other distributions worldwide). Examples include IBM Tivoli for system management, workload provisioning, and orchestration; IBM WebSphere for application serving and transaction processing in end-to-end applications; IBM Lotus/Domino for collaborative software and support of Web portals; and IBM DB2, the relational database that runs on a wide variety of servers, including IBM Power Systems and IBM System z mainframes.

This ability to host Linux across all server models made by IBM illustrates the business value of hosting Linux on all IBM models — the IBM Power Systems, the IBM System z mainframe, and the IBM System x x86 servers, including scalable models. This means that customers who have adopted Linux and open source software, and have invested in Linux skill sets, can see the applicability of these skill sets across all IBM server models.

## IBM Server Product Services for Linux

IBM provides support services and professional services for Linux server solutions on a worldwide basis. Services range from break-fix support to services that are aimed at optimizing and deploying Linux servers at the customer site. Specific services offerings include implementation services for high-availability clusters or high-performance computing (HPC) clusters; consolidation of Linux workloads onto scalable servers, including IBM Power Systems and IBM System z mainframes; migration services to move workloads to Linux server configurations; and services that help customers to plan for installing Linux distributions in their IT computing environment by identifying gaps in Linux-specific skill sets and addressing them.

In general, Linux deployments often require Linux-specific skill sets for programming, system administration, and optimization so that service offerings that can add to existing skills within an organization can speed time to deployment, reducing IT staff costs. Because consolidation of workloads can yield high returns, in the form of reduced operational expenses, adding resources that aid in consolidation projects can reduce the time it takes to prepare for a Linux project or to provision Linux workloads onto new servers. While customers will likely continue to have mixed architectures and mixed operating environments within their IT infrastructure (due to customer preferences and familiarity with a variety of operating environments), the ability to identify those applications that will benefit most from workload consolidation has the potential to reduce IT costs, to increase system utilization, and to reduce power/cooling costs. For end-to-end applications spanning the enterprise, services that aid in planning, application development for Web 2.0 and SOA applications, and the ability to deploy on a variety of cross-platform server platforms can also tap Linux services for additional staffing "bandwidth" to complete projects more quickly.

### *Benefits of Linux Workload Consolidation*

IDC's in-depth study of 12 sites using IBM Power Systems and IBM System z mainframes in the United States, Canada, and Europe showed that customers had deployed Linux in a cross-platform strategy for the datacenter that, in their opinion, had produced tangible savings in the form of operational efficiencies. Based on respondent data, IDC will provide tabulated data in the forthcoming white paper.

Table 1 shows a summary of the ROI analysis in aggregate for the 12 organizations in the study. IDC notes that all ROI analysis results in this summary table are shown per 100 users. For example, the average investment (discounted) per 100 users, was $12,333; for a 500-user organization, the average annual investment would be $61,665.

**TABLE 1**

Three-Year ROI Analysis per 100 Users

| Category | Value |
|---|---|
| Average benefit (discounted) | $72,079 |
| Average investment (discounted) | $12,333 |
| Net present value | $59,746 |
| Discount rate | 12% |
| Return on investment | 484% |
| Payback period | 6.3 months |

Source: IDC, 2008

Table 1 shows that the companies in the study saw an ROI of nearly 5 to 1 in a 6.3-month payback period for Linux deployments on IBM Power Systems and IBM System z platforms. The bottom line is that the business benefits of the solution, as seen in operational cost savings, paid for the initial investment in just over a half year after deployment.

Overall, both technical and business benefits were seen when Linux workloads were deployed with virtualization and consolidation on these IBM scalable servers, supporting more workloads on fewer server footprints. This combination of virtualization and consolidation enabled the companies to reduce their IT infrastructure spending on hardware, software, and networking and to reduce IT staffing costs. Virtualization on the larger platforms reduced datacenter footprints by as much as 85%, not only lowering space costs but also lowering power and cooling costs significantly and producing a "green IT" aspect to the workload consolidation project. "What is the competitive advantage?" asked one respondent who had consolidated Linux workloads on IBM Power Systems. "Just the cost savings … The goal is to maximize what we can return to the business. And I'd say that we've done pretty well there."

Regarding the deployment of Linux on the IFL feature of the IBM System z mainframe, one respondent described the ability to move Linux applications to the mainframe through a recompile of the source code. "The System z helps us consolidate our workloads and scale up," the respondent said. "That's the engine that we've been talking about. We can run [Linux code] without change on IFL systems. The only thing that needs to happen is a recompile … that's valuable to us."

Further, management of workloads was eased by a more integrated management environment that conferred granular controllability to Linux applications that could be isolated within hardware-defined and software-defined partitions. This management software moved workloads, as needed, to alternate resources as business requirements changed over time. This was another factor in improving the high availability of applications.

In addition to reducing costs, the managed environment on the scalable servers hosting consolidated Linux workloads resulted in reliable and consistent utilization, based on the data collected from these sites. IT resources were allocated to handle peak times for processing without outages, which was important given that the respondents were running 78% of their mission-critical and business-critical applications in the Linux environment running on the IBM Power Systems and IBM System z servers. The data also shows that the unplanned downtime (e.g., downtime that is caused by power outages, network outages, the failure of a hardware component, natural disasters or man-made causes), as reported by respondents, was reduced by 88% and availability increased to 99.9%, compared with operations prior to the deployment on IBM Power Systems and IBM System z servers.

### *ROI Analysis*

IDC documented the IT sites' experience in deploying Linux workloads, on a cross-platform basis, on the IBM Power Systems and IBM System z server solutions. This analysis took into consideration the hardware and software costs, consulting costs, power and cooling costs, space requirements, and bandwidth requirements associated with the deployment. IT staffing costs associated with system setup and configuration, as well as with application migration, were fully accounted for in this analysis. IDC then conducted a discounted cash-flow analysis of the benefits and investment over a period of three years to quantify the ROI for the Linux cross-platform solution deployed.

## CHALLENGES/OPPORTUNITIES

IBM has provided a number of paths to IT managers who want to run Linux: All of IBM's server products — including the IBM Power Systems, based on IBM POWER RISC processors, IBM System z mainframes, and IBM System x servers, which are x86 servers — support this operating environment. This allows customers to run Linux applications across computing tiers on a variety of server form factors and system architectures. One challenge for IBM is that many potential customers are unaware of the Power Systems and System z offerings, often due to a broader familiarity with scale-out volume server deployments, many of them based on x86 server platforms.

IBM has worked to meet this challenge in several ways: First, it found a way to bring Linux x86 server applications to the Power Systems platforms, without change, through just-in-time translation technology from Transitive. It is also possible to recompile Linux source code for use on the IBM System z mainframe's IFL feature. In addition, IBM has encouraged independent software vendors (ISVs) to port their applications to the Power Systems platform and to System z, allowing a range of Web-enabled workloads to run on these IBM server systems. Another way to encourage cross-platform use of Linux would be to deploy prepackaged, preconfigured software appliances that could run on the full range of IBM server systems, without any changes at the application or hardware levels of the technology stack.

## CONCLUSION

IDC has conducted a study of IBM customer sites deploying Linux workloads on scalable IBM Power Systems or IBM System z mainframes, collecting capital costs and operational costs, to determine the ROI after acquiring these systems. Key to the study's results was the consolidation of Linux workloads that had been running on a large number of small servers at the same sites. Some of these workloads were rehosted on the Power Systems and System z systems as part of a virtualization and consolidation process aimed at improving operational results.

As is often the case in consolidation work, most of the sites reported operational efficiencies associated with running large amounts of workloads on fewer server

footprints. Other efficiencies were associated with IT staff costs because IT skill sets could be leveraged across multiple server platforms, including x86, RISC, and mainframe processor servers.

IDC will publish a full white paper with detailed data summaries. This executive summary describes the study and presents key findings.