AberdeenGroup

Linux for S/390: A Perspective for IT Executives

An Executive White Paper

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Linux for S/390: A Perspective for IT Executives

Overview

IBM's *Linux for S/390* offering is a product that cuts across two widely differing approaches to computing: the mainframe data center approach with lots of management, security, and process, and the Linux approach, which is open (as in open source), hardware platform-independent, and relatively new to enterprise users. Linux is important because:

- The Linux application portfolio will greatly increase the number of applications available to the S/390 customer;
- All of the flexibility and openness of Linux combined with the qualities of service of S/390 result in an industrial-strength Linux environment;
- S/390 can uniquely provide customers with the ability to consolidate a large number of Linux servers onto a single platform, creating a "Server farm in a box"; and
- Through IBM middleware, customers can blend the data richness of S/390 environments with the Web capability of Linux applications to deliver a highly integrated e-Business solution.

Unix applications are easily ported to Linux and more and more Windows 2000 applications are beginning to appear on Linux. Additionally, IBM's Linux strategy seeks to provide a high degree of application portability across all of IBM's hardware platforms, including the S/390. Linux for S/390 provides the vital link because a substantial amount of customer data resides in IBM mainframe direct access storage devices (DASDs).

Around the world, there are teams of people who have worked solely with mainframes or have worked only with Linux (or Unix or Windows 2000) and underestimate the benefits that can be gained with Linux for S/390. It is Aberdeen's perspective that a market for this product exists within these differing approaches to computing. To IBM's credit, it recognizes that there are workloads for which Linux for S/390 is not the best fit. However, the value propositions for Linux for S/390 indicate that, for many e-Business applications, S/390 adds value to Linux, and Linux adds value to S/390.

This *Executive White Paper* contains Aberdeen's analysis of the Linux for S/390 offering. In this analysis, Aberdeen considers the following elements:

- IBM's Linux strategy and its commitment to Linux and the open source community;
- The positioning of Linux for S/390 with other IBM Linux platforms (e.g., Netfinity, RS/6000, and AS/400);
- Targeted markets/application areas for Linux for S/390;
- Value propositions;
- Independent software vendor (ISV) support and investment;

- Support/services strategy and investment; and
- Licensing structure.

Relevant Background

In December 1999, an IBM laboratory in Boeblingen, Germany, completed the port of Linux to S/390. Shortly thereafter, IBM released the modifications to Linux that enable it to run on S/390 to the open source community. Soon, a complete Linux for S/390 system was available from several Web sites such as the one at Marist College in Poughkeepsie, NY. This was not the first port of Linux to IBM mainframes; however, it was the first port to S/390 hardware. The first mainframe port, referred to as Bigfoot, was completed earlier by Linas Vepstas for the older S/370 machines, but it never reached production status.

More than 2,100 copies of Linux for S/390 have been downloaded since the Web site at Marist College was created (linux390.marist.edu). Users who have downloaded Linux for S/390 have reported that it can be installed in as little as 30 minutes. This Web site also contains a book entitled *Linux for S/390: Installation, Configuration, and Use* (copyrighted by IBM) that includes details for installing Linux on an S/390 in a logical partition (LPAR) or as a Virtual Machine/Enterprise Systems Architecture (VM/ESA) guest.

Linux for S/390 runs as an independent operating system and does not require any other S/390 operating system, such as VM/ESA or OS/390, to be resident. Linux for S/390 can be run in native mode in up to 15 LPARs on an S/390, or hundreds of images can be hosted as guests under VM/ESA. The configuration requirements for LPAR and VM/ESA guest implementations are almost identical. The system administration capabilities, however, can differ depending on whether Linux resides in an LPAR or is hosted as a VM/ESA guest.

IBM's Overall Linux Strategy

IBM's Linux strategy is intertwined with the company's overall Unix strategy. This strategy, combined with IBM's Application Framework for e-Business, is to provide customers with a single de facto standard development platform to build e-Business applications for deployment across IBM's hardware platforms such as Netfinity, RS/6000, AS/400, and S/390. IBM's goal is to use Linux to bring the broad development community and the applications they produce to IBM's server customers and to complement the functionality of its server platforms.

With support for Linux across the complete range of the company's servers, customers will be able to deploy Linux solutions on the platforms of their choice. The largest Linux opportunity, from a volume point of view, is Netfinity, as Linux primarily runs on Intel processors. The Trillian Project, a community effort focused on porting Linux to Intel's IA-64 microprocessor, will be important in the near future. Trillian members have completed the initial Linux port, and soon

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IBM's IA-64 platforms will benefit from the cooperative effort. IBM's Linux for RS/6000 strategy is to selectively target market segments in which Linux on PowerPC offerings have compelling value propositions. As a result, Linux is available on some, but not all, RS/6000-based hardware models. IBM's initial focus for Linux on the AS/400 is to provide excellent interoperability with Linux systems.

On the software front, IBM has ported key Application Framework for e-Business middleware to Linux including DB2 Universal Database (UDB), MQSeries, WebSphere Application Server, Lotus Domino, VisualAge for Java, the Tivoli Management Applications, and IBM's Java virtual machine for Linux — all shipping today on Intel-based Linux platforms. In addition, IBM has announced that it plans to support key software on Linux for S/390, such as connectors for DB2, IMS, CICS, MQSeries, WebSphere Application Server Advanced Edition with Java2 support, DB2 UDB, and Tivoli Storage Manager client software.

IBM's Commitment to the Linux and Open Source Communities

IBM is donating technology, code, and skills to the Linux community. In addition to contributing technology to various open source projects, IBM is focused on ensuring that Linux becomes a viable enterprise operating system platform capable of running applications that require high availability and scalability. Presently, IBM has more software engineers (over 50) engaged with Linux kernel projects than most, if not all, of the Linux distributors. An important by-product of IBM's focus on Linux and the development of Linux for S/390 is the depth of the pool of software engineers able to contribute in areas of scalability, reliability, availability, and serviceability.

IBM's key open source contributions to date include:

- Journaling file system;
- Internationalization technology (founding member of Linux project);
- Kernel performance work in the form of tools, kernel patches, and contributions to the SGI lockmeter project;
- Kernel scalability contributions to the SGI NUMA project;
- RAS (reliability, availability, and scalability) and debug tools;
- IA-64 port assistance via the Trillian Project;
- Device drivers for networking, RAID, Token Ring, and PCI LanStreamer;
- Cluster install management software;
- File and print (contributions to Samba and other projects);
- TCP/IP;
- Application development; and
- The code for enabling Linux to run on PowerPC and S/390.

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IBM is currently involved in several other open source projects, such as Apache, Jakarta, PHP, Jikes, and Mozilla. They have also published source code for SOAP, Extensible Markup Language/Extensible Stylesheet Language (XML/XSL) parsers, and internationalization class libraries. Project descriptions are available at ibm.com/developerworks/opensource. In the future, IBM expects to contribute more of its industry-leading Advanced Interactive Executive (AIX) technology, such as cluster management software, Logical Volume Manager, and single point of control.

Why Linux for S/390?

S/390 customers will benefit from the Linux application portfolio now available. In addition, the superb flexibility and openness of Linux combined with the qualities of service of S/390 provide S/390 customers with an industrial-strength environment in which to run their existing Linux applications. The S/390 platform is unique because customers have the ability to consolidate a large number of servers on a single platform easily, like a "Server farm in a box." Through the power and flexibility of IBM middleware, S/390 customers can now blend the data richness of the S/390 environments with the Web capability of Linux applications to deliver a highly integrated e-Business solution.

Linux for S/390 Marketing Strategy

Customers use Linux to run workloads such as Web serving, e-mail serving, file and print serving, firewalls, database serving, edge serving, scientific/technical computing, network connections, and applications servers — including some e-Business applications. The number of applications being ported to Linux and being developed specifically for Linux is increasing very quickly.

There are several varying sets of potential customers for Linux for S/390. These customer sets range from existing S/390 customers to customers who have little, if any, knowledge of S/390 and its operating systems. The following three sets of customers should find Linux for S/390 particularly appealing:

1. Internet service providers (ISPs) moving upstream by adding applications to the set of services they provide — in effect, becoming application service providers (ASPs);
2. Customers interested in consolidating many Intel-based Linux servers onto a single hardware platform, leveraging the S/390 qualities of service and central system management — in effect, building a "Server farm in a box"; and
3. Enterprises wishing to optimize the communication path between the Web portion of their e-Business application with the data/transaction portion, leveraging the near-memory communication speeds available within the S/390 — in effect, building an equivalent network within a single machine.

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These customers may not represent the end-points of the continuum of potential customers for Linux for S/390, but they demonstrate the range of applications and the varying sets of requirements and customer support that IBM is willing to address.

Customers who currently own S/390 hardware represent the first opportunity of Linux for S/390. Other potential adopters, such as Web hosting companies that utilize large server farms of relatively small servers to operate customer Web sites, are more likely to take a take a wait-and-see attitude with respect to the flexibility of operation and cost effectiveness. Aberdeen notes, however, that Web hosting companies, and other companies with similar computer usage characteristics, may find that managing workloads under a single S/390 is a cost-effective alternative to managing hundreds of individual servers. This is especially true in situations in which many of the small servers are running at much less than 100% capacity, or individual servers are required for workload isolation issues.

Value Propositions: Determining the Value

IBM delivers value in six areas:

1. Server consolidation;
2. Faster access or reduced latency to enterprise data;
3. Alternative application platform for S/390 users;
4. S/390 value additions;
5. Web hosting capabilities; and
6. Multi-tiered application consolidation.

Each of these value propositions, except the third, is directly related to server consolidation. (The value propositions are immediately relevant for those S/390 installations that have unused processor capacity; in other cases, additional S/390 engines or processors might have to be purchased.)

Server Consolidation

The underlying assumption for server consolidation is that the S/390 is a more desirable platform from a manageability/scalability point of view. Server consolidation can occur in at least two ways:

1. Removing Windows 2000, Unix, and possibly even Linux front-end servers and consolidating their workloads onto an S/390 running multiple instances of Linux for S/390.
2. Suspending the purchase of new Windows 2000 and/or Unix front-end servers and implementing these additional workloads on Linux for S/390.

These two approaches to server consolidation assume that applications running on Windows 2000 servers have already been, or will be, ported to Linux. The most

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likely workloads to be moved to Linux for S/390 in the short term are Web serving (Apache) and file and print (Samba). Apache is the most widely implemented Web server on the Internet, with about 60% of the Web sites running it, and Samba is a popular suite of programs that turns a Linux or Unix server into a file and print server for Windows network clients.

Faster Access to Enterprise Data

Today, a large percentage of enterprise data resides on S/390 servers. In Internet and client-server environments, front-end Unix servers often access enterprise data on an S/390. Linux for S/390 permits high input/output (I/O) rates between front-end applications and back-end applications running on OS/390, VM/ESA, and Virtual Storage Extended/ESA (VSE/ESA). Connections between Linux for S/390 servers inside an S/390 and back-end data under OS/390, VM/ESA, and VSE/ESA provide higher data transfer rates and more security than network connections between front-end servers and S/390 machines. The technology used in this case is high-speed TCP/IP connections enabled by IBM's channel-to-channel adapter (CTCA) support and Inter-User Communication Vehicle (IUCV).

Alternative Application Platform for S/390

Linux for S/390 provides an alternative application platform for S/390 users. Linux also offers a growing set of server and middleware products and open source applications — and, in all likelihood, will host the next generation of e-Business applications. S/390 customers will be able to readily share in new technologies as they are developed for Linux.

S/390 Value-Add

Linux for S/390 running as a guest under VM/ESA can transparently take advantage of VM/ESA support for S/390 hardware and RAS features. In addition, VM/ESA provides support for diverse workloads and resource sharing among processors, memory, and storage devices as well as extensive system administration/ monitoring capabilities.

In LPAR mode, Linux for S/390 can run in up to 15 LPARs and inherits the "generic" qualities of service provided by the hardware (chip sparing, CPU sparing, "phone home," and so on). For applications that consistently utilize high levels of resources (processors and I/O), it may be preferable to run Linux in an LPAR rather than as a guest under VM/ESA.

S/390 mainframes rarely go down because they have multiple redundant power supplies, I/O channels, disks, memory buses, memory subsystems, and processor subsystems. If one of these resources goes down, then it can be "hot swapped" with a replacement without affecting the operation of the system — other than a

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slight slowdown during the hot swapping. It is not uncommon to hear users talk about having only one or two hardware failures every six or seven years.

Web Hosting Capabilities, or "Server Farm in a Box"
First-generation Web hosting architectures typically utilize large farms of relatively small servers to host Web sites for businesses, with Linux being the dominant operating system. These providers now have the option of consolidating a massive amount of servers onto a Linux for S/390 platform, and the providers gain all of the administrative advantages, flexibility, security, and reliability associated with the S/390.

Multi-Tiered Application Consolidation
Through IBM middleware capability (such as DB2 Connect, IMS Connect, CICS Transaction Gateway, and so on) multi-tiered applications split across two or more machines or servers can take advantage of the benefits normally associated with functional partitioning while running on the same physical machine. The entire application can run in two or more instances of Linux for S/390 and receive the same benefits. For example, firewall, Web server, and ORB components can run in three instances of Linux for S/390. This type of consolidation means there is only a single hardware environment to manage and maintain.

ISV Enthusiasm
ISV enthusiasm for Linux for S/390 is a by-product of the ongoing ISV enthusiasm for Linux itself. An ISV that has built an application to run on Linux (on an IA-32 microprocessor) may find certifying it on Linux for S/390 as simple as "compile and test." IBM has an active program for encouraging and supporting ISV business partners, called PartnerWorld. The S/390 PartnerWorld team will actively promote Linux for S/390.

Services and Support
IBM Global Services provides the same level of support for Linux as it does for its other operating systems and will deliver the level of service S/390 customers expect. This support includes consulting, planning, implementation services, and remote technical support for Linux as well as for Linux for S/390. IBM consultants are available to help customers evaluate their Linux for S/390 requirements and to assist in implementing and optimizing their Linux for S/390 solutions. Key services that will be available include:

- Consulting and planning;
- Implementation;
- Infrastructure design;
- Application enablement; and
- Database enablement.

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Licensing

Currently, IBM licenses its operating systems software on a monthly basis, and the rental cost is based on the number of installed processors that a customer has. The cost of hardware is a relatively small part of the total cost of running an S/390. Licensing for Linux for S/390 is determined by a variety of Linux distribution partners.

Aberdeen Conclusions

IBM's enterprise server strategy is to create a higher degree of application portability across its server products than has been available in the past. The company believes that Linux, in combination with its Application Framework for e-Business middleware, is the key to providing this portability. A by-product of this strategy is the freedom for users to choose the platform best suited to host their e-Business applications. Aberdeen research suggests that Linux for S/390 can potentially open the S/390 to new e-Business applications, especially if predictions that Linux will host the next generation of e-Business applications come true.

Existing S/390 customers will find the following four areas very appealing: increased application availability; the flexibility and openness of Linux combined with the legendary S/390 qualities of service; the potential to consolidate existing racks of Intel-based Linux servers to form a "Server farm in a box"; and the ability, through IBM middleware, to leverage high-speed access to enterprise data running under S/390 operating systems. Together, these factors add up to a very compelling value proposition — the ability to deliver tightly integrated, high-performance, high-availability, and scalable e-Business solutions.

Further, IBM is creating a compelling proposition among users who do not currently deploy S/390 hardware. For example, an ASP bringing a new customer on a new server can take days, while adding another Linux for S/390 instance could take as little as 45 seconds. The same S/390 features that have attracted the installed base for many years intrigue these companies. It is Aberdeen's perspective, however, that these customers will take a wait-and-see attitude with respect to flexibility and cost-effectiveness.

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Aberdeen Group is a computer and communications research and consulting organization closely monitoring enterprise-user needs, technological changes and market developments.

Based on a comprehensive analytical framework, Aberdeen provides fresh insights into the future of computing and networking and the implications for users and the industry.

Aberdeen Group performs specific projects for a select group of domestic and international clients requiring strategic and tactical advice and hard answers on how to manage computer and communications technology.