



**Hewlett Packard
Enterprise**



When Compared to UNIX, is Linux ‘Stable’ enough?

Contents

The concern expressed by customers.....	2
What makes a mission-critical environment stable?	2
Industry supports Linux	5
Linux runs in the world’s top companies and industries.....	8
Internet.....	9
Finance.....	9
Insurance.....	9
Healthcare.....	9
Other industries	9
More about Linux and its support.....	10
Why consider Linux?	10
Linux is one of the fastest-growing server operating systems.....	10
Platform flexibility	10
Support	10
Patch updates.....	11
Staffing.....	11
Security.....	11
More innovative—features and applications, delivered faster.....	11
Massive industry support—Linux powers mobile devices, desktops, servers	11
Applications on AIX and Linux	11
Should I choose AIX or Linux?.....	12
Conclusion.....	12
Next steps.....	13
References and further research.....	13
Appendix.....	13

The concern expressed by customers

Is Linux® truly stable enough to support mission-critical applications in an enterprise, just as IBM AIX has done for many years? Will the OS run applications 24x7 and in an uninterrupted manner in a mission-critical environment? How would frequent patch updates work?

The question “is Linux stable enough?” may need to be further clarified by understanding, “what makes a mission-critical environment stable?” and “is it stable enough with Linux as the operating system?”

To answer this, let’s look at:

- What we mean by stability: The ability of a business-processing environment to run continuously and not be affected by planned or unplanned downtime. The environment should be reliable and dependable, as well as provide a predictable level of service to users.
- Various factors affect stability in an environment, including each component of a solution. It also affects the support and administration provided to the environment during a variety of situations, such as planning, normal operations, maintenance, and when things go wrong. The components comprise:
 - The application, middleware (for example, high-availability software), operating system, and hardware (reliability, availability, and serviceability [RAS] of the hardware and software is important to stability). Disaster recovery may also be included here.
 - The support, including break/fix, proactive updates, and upgrades provided by the software and hardware vendors is key in maintaining the stability of the environment.
 - Human capability that includes quality, expertise, training, and experience of operations, development, and administration staff. These resources create, monitor, and manage the environment.
 - Effective operational processes that manage planned downtime, unplanned events, or disasters, along with processes to manage and monitor service levels as well as respond to any degradation in the service levels expected by the business.
- The following are the data points regarding Linux and its commercial success:

What makes a mission-critical environment stable?

Component stability

As the overall stability is proportional to that of each of the components, the questions to ask are—during normal and stressful conditions how reliable, dependable, and effective are the:

- Hardware (RAS) including servers, storage, and infrastructure
- System software (high availability and disaster recovery for servers and storage)
- Application
- Support
- Staff expertise, planning, tools, and resources
- Operational processes to manage service delivery

To better understand what kind of stability IBM Power customers expect, let’s review examples of customer experiences of replacing stable IBM Power Systems-based infrastructures with Linux on Hewlett Packard Enterprise.



Financial services example

An insurance company had been running its mission-critical Oracle database and applications on IBM Power 595. However, the Power System did not provide the scalability and flexibility the company needed to support ongoing business growth. The aging Power System also had frequent outages, which raised customer concerns for availability.

After evaluating HPE Superdome X against IBM Power System E880, the company chose to replace the Power 595 with HPE Superdome X running Red Hat® Enterprise Linux for mission-critical Oracle Database 12c and applications. The solution includes two HPE Superdome X systems with Oracle Real Application Clusters (RAC) for high availability. The company also deployed HPE ProLiant DL580, HPE ProLiant DL380, and HPE ProLiant DL160 servers for application development. HPE StoreOnce 4500 Backup provides data protection.

Hewlett Packard Enterprise offered greater platform flexibility with the open, standards-based HPE Superdome X, and superior TCO compared to IBM AIX. Hewlett Packard Enterprise also offered greater room for cost-effective infrastructure growth in an environment that is easier to operate and manage.

The software running on Hewlett Packard Enterprise included—Red Hat Enterprise Linux, Red Hat KVM, Oracle Database 12c RAC, and Oracle ASM.

Automotive manufacturing example

A business unit of a European automaker traditionally relied on IBM Power 6, 7, and 8 systems with IBM AIX to run its SAP® applications. The company wanted to migrate from Oracle to SAP HANA® to improve performance and functionality but IBM Power with AIX did not support HANA.

Hewlett Packard Enterprise displaced IBM Power with five HPE Superdome X servers running Linux to support SAP HANA and SAP Business Warehouse. The solution also included HPE ProLiant DL580 and HPE ProLiant DL380 servers to run SAP Solution Manager, SAP Enterprise Data Warehouse, and dozens of ancillary applications. In addition, the company replaced Hitachi with HPE XP7 Storage and eliminated IBM HCMP, Veritas, Solaris, and Red Hat high-availability solutions by deploying HPE Serviceguard for Linux to achieve high availability and disaster recovery.

Hewlett Packard Enterprise has deep knowledge and expertise in SAP, as well as the most references for SAP HANA. Immediately upon learning the customer's migration plans, Hewlett Packard Enterprise started educating the customer on HANA and HPE solutions, which earned the customer's trust and confidence that we have superior knowledge and expertise in SAP HANA compared to IBM.

The software running on Hewlett Packard Enterprise included: Red Hat Enterprise Linux, HPE Serviceguard for Linux, VMware® ESX®, SAP HANA, SAP Business Warehouse, SAP Solution Manager, and SAP Enterprise Data Warehouse.

Food and beverage example

A large, global food and beverage company needed to improve performance to meet business growth projections in its Asia-Oceania-Africa region. The company also wanted to reduce the high cost of Oracle licenses and improve overall business flexibility.

The company consolidated its landscape of IBM P-Series servers running IBM AIX on to HPE ConvergedSystem 500 and HPE ConvergedSystem 900 platforms running Linux. HPE Serviceguard for Linux provides high availability and automated failover from production to a disaster recovery site to ensure business continuity. The company also migrated from Oracle to SAP HANA for mission-critical SAP ERP.

Hewlett Packard Enterprise offered an open architecture with a more certain x86 roadmap than the IBM P-Series and provided a complete portfolio of infrastructure technology and services certified for SAP HANA.

The software running on Hewlett Packard Enterprise included—Red Hat Enterprise Linux, HPE Serviceguard for Linux, VMware ESX, SAP ERP, and SAP HANA.

U.S. government tax agency example

A large U.S. government tax agency was experiencing 56% annual growth in new business services, resulting in data growth of 30% per year, which drove up infrastructure resource consumption by 15% annually. The agency's legacy IBM P-Series and IBM Mainframes—z Systems was too costly to maintain at this level of growth. In addition, the agency's IBM P-Series servers were not meeting the Big Data needs of its SAP Sybase IQ environment.

The tax agency migrated all core and non-core applications from the IBM Mainframes—z Systems to approximately 250 HPE ProLiant BL460c Gen9 Server Blades running SUSE Linux. Now, the agency plans to consolidate Microsoft® SQL Server and file/print services from its branch locations onto the HPE blade infrastructure. In addition, the agency migrated its SAP Sybase IQ environment from IBM P-Series servers to four HPE ProLiant DL580 Gen9 Servers. In the future, the agency plans to replace SAP Sybase IQ with HPE Vertica for SQL on Hadoop. HPE Datacenter Care will support this infrastructure.

The agency's CIO recognized a huge opportunity to reduce TCO by moving off IBM to an open standards-based platform. The ability to automate operations with HPE OneView was a critical success factor in choosing Hewlett Packard Enterprise because the customer does not have a team skilled in open systems management. What's more, the customer gained trust and confidence in us because HPE Datacenter Care would streamline the transition from IBM to Hewlett Packard Enterprise, and provide on-site administration assistance, knowledge transfer, and training.

The software running on Hewlett Packard Enterprise included—SUSE Linux, VMware ESX, and HPE OneView.

Telecom service provider example

A South Asian business unit of a leading global telecom service provider serves nearly 200 million customers with mobile voice and data services. The company wanted to replace its outdated Amdocs CRM with the latest Siebel CRM to unify it across its primary lines of business. Its legacy IBM Power server and storage environment lacked the performance and scalability to meet the company's growth objectives.

The company replaced its IBM P-Series servers with HPE Superdome X for the Oracle database tier along with a mix of HPE ProLiant BL460c Gen9 Server Blades, HPE ProLiant DL380, and HPE ProLiant DL580 servers for the application tier, as well as HPE ProLiant SL4500 servers for data archive. The company also replaced IBM storage with HPE 3PAR StoreServ all-flash arrays and deployed HPE 5900 switches for the IP network. For secure data protection, the company deployed HPE StoreOnce 6500 with off-site replication and HPE StoreEver MSL6480 and HPE StoreEver MSL4048 tape backup with encryption.

Hewlett Packard Enterprise offered an open architecture with a comprehensive portfolio of infrastructure technology and system integration expertise to deliver a complete solution for the customer with a single point of accountability. We also met the customer's requirements for performance, availability, security, and scalability with the services and skills to deliver operations management along with mission-critical support.

The software running on Hewlett Packard Enterprise include—Red Hat Enterprise Linux, VMware ESX, Siebel CRM, Oracle database, and HPE OneView.

In these examples, the new HPE environment supported mission-critical business objectives by providing a reliable hardware, system software, operating system (Linux), application, and support infrastructure.

“Is it stable enough with Linux as the operating system?”

— what others think.

Let's look at what IBM and a few companies think about Linux:

IBM, Oracle, and SAP users

- ibmsystemsmag.com/aix/administrator/performance/AIX-v-Linux/
- [Linux OS on IBM z Systems](#): “See what is possible with a fast, reliable, and secure platform for the Linux operating system.”
- [IBM-sponsored IDC Analyst Paper: “IBM Pushes z Systems Head-On into the Open Source Arena of DevOps, PaaS, Application Development, and APIs.”](#)
- [Gaining a fast and stable development platform](#)

With a number of clients keen to move their Allone trading systems to a stable and reliable platform, the company, wanted to port its applications to run on IBM z Systems. By working with SUSE and IBM to adopt SUSE Linux Enterprise Server for z Systems, Allone was able to port its existing software rapidly to Linux on the mainframe.

“With our trading applications running on SUSE Linux Enterprise Server for System z, we can offer our clients an extremely stable platform that is also highly scalable”

-Marco Mak, Regional Director, Allone IT Co., Ltd.

- Even the latest IBM mainframes run Linux.
- IBM BladeCenter, Linux, and open source are a blueprint for e-business on demand launched by IBM International Technical Support Organization.
- Putting Linux reliability to the test: IBM-published article by developerWorks ibm.com/developerWorks/

The Linux Technology Center evaluated the long-term reliability of Linux and found that “the tests demonstrate that the Linux kernel and other core OS components are reliable and stable over 30, 60, and 90 days, and can provide a robust, enterprise-level environment for customers over long periods of time.”

They also stated in their conclusions that “the tests demonstrate that the Linux system is reliable and stable over long durations and can provide a robust, enterprise-level environment.”

- Linux is Oracle’s operating system of choice to run their relational database.¹
- x86 and Linux is SAP’s platform of choice for developing new releases
- 2008 Server OS Reliability Survey (iaps.com/2008-server-reliability-survey.html)
- Regarding Linux on IBM Mainframes, IDC states, “IDC believes that with Linux on IBM z and its various capabilities for next-generation application development, IBM has put a platform on the market that marries two worlds that needed to be joined for enterprises to succeed: the world of massive, highly secure, high-volume data transactions and processing with the world of app development for analytics, mobile and the cloud using open source solutions, frameworks, containers, microservices, and popular development languages.”

Industry supports Linux

The top contributors to Linux

The kernel, which forms the core of the Linux system, contains the work of over 1,400 developers representing over 200 corporations and individuals. Since 2005, about 12000 individual developers from nearly 1,200 different companies have contributed to the kernel. The Linux kernel is a common resource developed on a massive scale by companies, which are competitors in other areas. It is the result of one of the largest cooperative software projects in history.

Several major companies are the biggest corporate sponsors of Linux, who market it directly to enterprises, and are included in the following list of the top contributors:²

1. Intel®
2. Red Hat
3. Linaro (founded by IBM, Samsung, and ARM® to improve Linux performance on Android devices)
4. Samsung
5. IBM

¹ Find reference to factoid including Windows® vs. Linux Oracle RDBMS test done 9i on Windows 2000

² Data sourced from Jon Corbet, Linux Weekly News. They concluded that 80% of the contributions coming to the Linux kernel are from developers paid by a company to do the work on Linux.

6. SUSE
7. TI
8. Vision Engraving Systems
9. Google™
10. Renesas Electronics

Note:

IBM is a Red Hat partner and it has contributed significantly to the Linux kernel. IBM has also helped write Linux solutions for its z Systems. IDC says, “with Linux on IBM z, IBM has fully embraced this shift.”

Some of Oracle’s contributions include:

- Oracle created its own “Unbreakable Linux” support program and Enterprise Linux (derived from Red Hat) as a robust environment to run the Oracle database and other Oracle software. Oracle says that “Linux can help reduce cost and complexity” and that Oracle Linux is helping organizations to:
 - Reduce TCO and lower management costs
 - Increase security with zero-downtime kernel patching
 - Decrease complexity with included management, clustering, and more

Google’s contributions have been most visible recently in the form of Android—their Linux-based OS for mobile devices—and Chrome OS—a stripped-down Linux system that runs Google’s-own Chrome browser. Both these offerings have been the source of various kernel-level contributions.

It’s important to note that due to the dominance of Android on smartphones, Linux has the largest installed base of all general-purpose operating systems. Linux is also the leading operating system on servers and other big iron systems such as mainframe computers and virtually all the fastest supercomputers but is used on fewer than 5% of desktop computers.³

³ IBM’s newest mainframe is all Linux, Computerworld, December 2009
computerworld.com/s/article/9142007/IBMs_newest_mainframe_is_all_Linux (Archived from the original on November 11, 2016. Retrieved February 22, 2009.)

Table 1. The world's top supercomputers all run on Linux⁴

Top 10 positions of the 48th TOP500 in November 2016

Rank	Rmax Rpeak (PFLOPS)	Name	Model	Processor	Interconnect	Vendor	Site country, year	Operating system
1	93.015 125.436	Sunway TaihuLight	Sunway MPP	SW26010	Sunway	NRCPC	National Supercomputing Center in Wuxi China, 2016	Linux (Raise)
2	33.863 54.902	Tianhe-2	TH-IVB-FEP	Xeon E5-2692, Xeon Phi 3151P	TH Express-2	NUDT	National Supercomputing Center in Guangzhou China, 2013	Linux (Kylin)
3	17.590 27.113	Titan	Cray XK7	Opteron 6274, Tesla K20X	Gemini	Cray	Oak Ridge National Laboratory United States, 2012	Linux (CLE, SLES based)
4	17.173 20.133	Sequoia	Blue Gene/Q	A2	Custom	IBM	Lawrence Livermore National Laboratory United States, 2013	Linux (RHEL and CNK)
5	14.015 27.881	Cori	Cray XC40	Xeon Phi 7250	Aries	Cray	National Energy Research Scientific Computing Center United States, 2016	Linux (CLE)
6	13.555 24.914	Oakforest-PACS	Fujitsu	Xeon Phi 7250	Intel Omni-Path	Fujitsu	Joint Center for Advanced High Performance Computing, Kashiwa Japan, 2016	Linux
7	10.510 11.280	K computer	Fujitsu	SPARC64-VIIIfx	Tofu	Fujitsu	Riken Advanced Institute for Computational Science (AICS) Japan, 2011	Linux
8	9.779 15.988	Piz Daint	Cray XC50	Xeon E5-2690v3, Tesla P100	Aries	Cray	Swiss National Supercomputing Centre Switzerland, 2016	Linux (CLE)
9	8.587 10.066	Mira	Blue Gene/Q	A2	Custom	IBM	Argonne National Laboratory United States, 2012	Linux (CNK)
10	8.101 11.079	Trinity	Cray XC40	Xeon E5-2698v3	Aries	Cray	Los Alamos National Laboratory United States, 2015	Linux (CLE)

⁴ TOP500 Supercomputer Sites, June 2016—top500.org/lists/2016/06/

ISVs

Some of the top ISVs such as SAP with HANA and Oracle are leading the pack for mission-critical x86 Linux use. For instance, Oracle believes that “as companies shift away from supporting a wide array of Linux and UNIX® variants and consolidate, Oracle Linux offers greater value at less cost than other commercial Linux releases.” And that “Oracle Linux is the proven enterprise Linux choice.”

Oracle Linux is backed by 24x7 support in 145 countries and deployed by thousands of customers worldwide. It is the Linux development standard at Oracle, running on over 175,000 virtual and physical servers that power Oracle’s engineering, business, and customer-facing cloud operations.

What makes Oracle Linux the best platform for Oracle Database 12c?

A recent survey shows 78 percent of companies run part or all of their operations on open source software. Indeed, open source continues to gain market traction as more companies adopt open technology to speed innovation, disrupt industries, and improve overall productivity.

Those who remain hesitant about adopting open source are in danger of being left behind. Open source architecture lends itself to updates that are more frequent and its openness provides the freedom to innovate and mature in the way that enterprises need.

One of the reasons why CIOs should consider using open source software is security:

In light of recent revelations about the NSA spying on Internet traffic through firmware modification and BIOS exploits,⁵ organizations can remain immune to this type of intrusive monitoring by using open source where the community would quickly detect any code tampering. With open source, there are many professionals and corporations overseeing code integrity. The benefit is being able to maintain full control of a software stack as well as actively monitoring for security vulnerabilities.

Tools

Enterprise Linux supports standard tools for data center management and the rich management environment to which enterprise IT departments are already accustomed. Enterprises can leverage existing knowledge and skills, as well as maintain their proven management practices and processes consistently. Linux is supported by major suppliers of data center management tools, from disaster recovery to backups, configuration, and provisioning support such as:

- HPE Business Technology Optimization (BTO) formerly called HPE OpenView
- IBM Tivoli
- Symantec NetBackup
- CA
- BMC: Business Service Management (BSM)
- EMC: a wide variety of storage management and data center operations tools
- NetApp

Linux runs in the world’s top companies and industries

It is no longer 1995. If an enterprise used massive symmetric multiprocessing systems, or systems with more than eight CPUs, they had to run UNIX since it was far more capable than Linux in handling all the processes more effectively.

As of November 2016, the [TOP500 List](#) shows 498 out of 500 of the speediest computers on the planet are running [Linux](#). According to ZDNet, “Linux owns supercomputing. 497 of the TOP500 run Linux. Only three supercomputers, all running UNIX, aren't using Linux. The fastest of these came in at 281st place.”

Since June 2016, Linux powers most of the top 10 (from TOP500) supercomputers.⁶ Many global companies are using Linux such as Toyota, EDF, Deutsche Bank, Boeing, Alcatel, IBM, Hewlett Packard Enterprise, France Telecom, AT&T, British Telecom, Pixar, Oracle, Avis, and others.

⁵ wired.com/2015/02/nsa-firmware-hacking/

⁶ TOP500 Supercomputer Sites, June 2016
top500.org/lists/2016/06/

Internet

Major players such as Amazon, Google, and Netflix all rely on Linux for delivering services. A Linux system administrator at Netflix or another company who uses Amazon Web Services would probably use [Amazon Linux AMI](#). Facebook and Twitter use a Linux variant that has been tweaked in-house. For such organizations, open source Linux distributions deliver a lower cost of ownership than even the lowest-priced proprietary cloud options because of the many servers needed to offer software as a service on a global scale.

Finance

Wall Street has been a good place for job seekers to apply for openings in Linux system administration. Several markets, including the [NYSE Euronext](#), [London Stock Exchange](#), and [Chicago Mercantile Exchange](#) trade by using solutions built on a Linux stack. Financial exchanges and Internet companies both rely on Linux because the communications architecture is stable when handling many simultaneous, roundtrip messages quickly.

Insurance

Large insurance companies also build operating environments on Linux. AIG, for example, uses Red Hat and SUSE variants in its architecture. Health insurer, Cigna, was named “[Innovator of the Year](#)” in 2013 in the Red Hat Innovation Awards. Scalability and tight security top the list of reasons some insurers are choosing Linux today.

Healthcare

Red Hat skills come in handy for Linux system administration jobs at healthcare organizations such as Beth Israel Deaconess Medical Center. Many Debian “[pure blends](#)”—subsets of the Debian GNU/Linux distribution—address the specific needs of healthcare providers and researchers by packaging the kernel with [drug databases](#) or [electronic medical record systems](#).

Other industries

Government, education, and military are other sectors increasing their reliance on Linux system administration. Innovative companies such as Tesla are using Linux systems to support graphics and advances in autonomous vehicles, [wearable devices](#), and other “smart” combinations of hardware and software. The trend toward increased use of Linux in the enterprise is good news for technology professionals with Linux skills and especially those with a background in Linux system administration.

TechWeek Europe: [Study: Big Businesses Increase Linux Investment](#)

Linux is already running mission-critical environments

With the release of the latest kernel, Linux continues its journey to be the leader in arenas that were the stronghold of UNIX alone, a decade ago. Linux is considered stable and is used for mission-critical applications by many companies. Some Linux-based workloads have been running continuously for years and Hewlett Packard Enterprise has scores of customers that have been running mission-critical workloads on Linux using HPE Superdome X.

Some examples of Linux supporting mission-critical data/processing are:

- [W.B. Mason transforms its SQL Server-driven business with HPE Superdome X \(external case study\)](#)
- [Regional European financial institution transforms core banking with Superdome X \(external case study\)](#)
- [Financial institution migrates core banking from IBM Power Systems to HPE Superdome X \(external migration paper\)](#)
- [Air handling manufacturer drives greater efficiency and productivity with Superdome X \(external case study\)](#)
- [Egyptian pharmaceutical distributor modernizes business with HPE solution for SAP HANA \(external case study\)](#)
- [RI-Solution modernizes its SAP environment and improves response times by up to 33% \(external case study\)](#)
- [NTUC Fair Price builds ideal shopping experience around data insight \(external case study\)](#)
- [MAGLITE® manufacturer modernizes mission-critical ERP system with HPE \(external case study\)](#)
- [Pella increases infrastructure performance and scalability \(external case study\)](#)
- [Statens Innkrevingsentral increases server and storage performance 10X \(external case study\)](#)
- [MTS migrates business-critical applications to HPE x86 architecture \(external case study\)](#)
- [RI-Solution creates an open and flexible platform for SAP HANA \(external case study\)](#)

Linux kernel is running mobile

Android uses the Linux kernel under the hood. Because Linux is open source, Google's Android developers were able to modify the Linux kernel to fit their needs. Linux gives the Android developers a pre-built, already maintained operating system kernel to start with so they don't have to write their own kernel.

More about Linux and its support

The open source community develops the Linux kernel with developers from major corporations such as Intel, Hewlett Packard Enterprise, IBM, Oracle, and SAP. It is then integrated into various distributions sold by Linux vendors such as Red Hat, SUSE, and Ubuntu.

The degree of Linux kernel testing nowadays is comprehensive:

1. A massive community is continually testing to ensure the quality of the kernel.org top-of-tree (ToT). This includes many automated tests to discover any functional problems and regressions.
2. The ToT feeds into backports to the stable kernels that provide another level of testing.
3. The distros such as Red Hat and SUSE take the ToT and stable kernel changes to backport into the commercial distros with their own rigorous testing.
4. Hewlett Packard Enterprise also carries out distro certification and qualification tests.

So, that's four levels of testing for quality and performance that go into the Linux distros that ride on mission-critical servers from Hewlett Packard Enterprise. This adds more to the quality and stability for Linux environments on the HPE platforms.

Linux is kept very stable via continuous regression testing, functional verification, and system testing. There are very stable kernel points to which the distros (such as Red Hat, SUSE) add further stabilization.

Hewlett Packard Enterprise then performs more testing to further stabilize Linux versions and ensure they are well coupled to our mission-critical servers, storage, and high-availability offerings. Linux is tested with the latest version of HPE Serviceguard for Linux to ensure 99.999% availability can be delivered reliably with the latest release.⁷

Why consider Linux?

Linux is one of the fastest-growing server operating systems⁸

This is important because the larger the market, the more products will be available and the more people will be there to support your environment. Linux enjoys a broad and committed commercial ISV support with access to more engineers and administrators that are far less expensive on Linux than on AIX.

Platform flexibility

Linux is available on x86, as well as virtually all types of hardware, including IBM Mainframes. With AIX, you're married to Power Systems hardware as AIX is tightly integrated with the hardware. Even Microsoft Windows will only run on PC Intel-type architectures, while Linux no longer has that constraint and can even run on IBM Power with dynamic logical partitioning and virtualization.

Support

As an AIX or HP-UX user, you are accustomed to round-the-clock support from your hardware vendor. With Linux, if you are running on x86 HPE platforms, you will still receive mission-critical one-stop 24x7x365 enterprise-class support that will include hardware, OS, and application-level support in some cases. With bare Linux on non-HPE x86 or white boxes, you might need to be more self-sufficient. Of course, RHEL and SUSE both provide dedicated support as do all the major commercial ISVs on Linux.

⁷ h20195.www2.hp.com/V2/getdocument.aspx?docname=4AA5-5765ENW

⁸ Market Share Analysis: Server Operating Systems, Worldwide, 2015, Gartner, May 2016

Patch updates

SUSE has live patching and roll back. RHEL also has live patching and patches are rolled up into 6-month batches except for necessary security updates. These patching approaches allow fewer upgrades and planned downtime akin to AIX.

Staffing

Good Linux admins are much easier to find than AIX system admins. Your staff costs will likely be higher and of potentially limited quality if you're not based somewhere with a large pool of qualified admins. And even with enterprise-class support for IBM Power and AIX, there's no substitute for a great admin in the trenches, on the front line when challenges occur. **These are the hidden costs of choosing AIX.**

Security

Both AIX and Linux are susceptible to bugs but Linux potentially finds bugs faster and is potentially more responsive in dealing with the threats:

1. Linux took many of the same security threat management functions found in UNIX and built further capabilities upon this foundation. For example, UNIX and Linux both enable a password system that can be encrypted and/or located remotely; the segmentation of the user domain in a multi-user environment; the isolation of tasks in a multi-tasking environment.
2. As Linux is an open system OS, the bugs can be reported by anyone in the user or developers forum and within days can be fixed. For UNIX or AIX, this is not the case, and users may not find the bugs as frequently and may have to wait longer to address it with the best fixing patch. The open source community is large and can find and fix bugs more rapidly as it need not be constrained by the slower processes and multiple development cycles applicable to commercial-based operating systems.

To understand how Red Hat delivers strong security with Linux, review:

[How Red Hat delivers a secure enterprise platform for next-generation datacenters](#)

More innovative—features and applications, delivered faster

Unlike AIX, Linux, as an open source operating system, is supported by tens of thousands of developers worldwide. This promotes better innovation and quicker to market new features when compared to AIX.

Massive industry support—Linux powers mobile devices, desktops, servers

The Linux kernel is developed by the open source community including developers at major corporations such as Intel, Hewlett Packard Enterprise, IBM, Oracle, Google, Samsung, Fujitsu, Texas Instruments, Qualcomm®, ARM. Google and Samsung have become two of the top 10 companies sponsoring the open source kernel that powers operating systems from mobile devices to desktops and servers.

Applications on AIX and Linux

Many customers are deciding whether to use AIX or Linux due to factors such as cost, application availability, access to industry-standard technologies in virtualization and cloud automation, and staffing costs in retaining and hiring.

Let's review some examples of application availability with respect to time to market for new versions, updates, optimization, and support:

1. IBM software such as WebSphere Application Server, MQSERVER, Message Broker, and Content Manager has been optimized on IBM Power and AIX. Such applications may be better supported with net higher performance on IBM AIX, albeit at a higher price.
2. There are commercial ISVs such as SAP with S/4HANA that have decided to develop on x86 first and with partners such as Hewlett Packard Enterprise, they offer fast, enterprise-class support to customers worldwide. Hewlett Packard Enterprise is a market leader in SAP to SAP HANA migrations, with almost half of the worldwide market share for SAP S/4HANA on x86 with over 7000 installations.⁹ Such applications that are already running in mission-critical environments are better supported on Linux and they produce performance results with better prices.
3. Another prime example is Temenos, a financial application that many users have re-platformed from AIX to Linux on Hewlett Packard Enterprise. It provides mission-critical functionality with better price performance on HPE Superdome X.

⁹ Migrate your mission-critical SAP applications from IBM Power AIX to HPE
[h20195.www2.hpe.com/v2/GetDocument.aspx?docname=4aa6-8873enw](https://www2.hpe.com/v2/GetDocument.aspx?docname=4aa6-8873enw)

Should I choose AIX or Linux?

If you are truly debating IBM Power vs. say x86 then the question is not one of Linux' stability but you need to compare both ecosystems for your specific workloads, people, processes, and needs.

Your choice of either AIX or Linux should take into account ecosystem-level criteria such as performance, existing knowledge base, OS support, service-level agreements, application support, reliability and availability, along with functionality and features.

AIX and HP-UX both work great in mission-critical environments where one needs optimum reliability and scalability and vendor support. Unlike most x86 platform vendors, Hewlett Packard Enterprise also offers 99.999% availability (via HPE Serviceguard for Linux) and 24x7x365 enterprise-class support (akin to that offered for HP-UX), for its most scalable, flexible, and powerful x86 platforms such as HPE Superdome X.

So Hewlett Packard Enterprise and Linux (RHEL and SUSE) have closed the gap in the mission-critical server market, primarily because of its platform-level reliability, scalability, and quality that is proven in hundreds of installations. Some articles that illustrate this:

[HP brings mission-critical computing to x86 architecture ARN](#)

[HP launches servers with two times faster computing power](#)

[HP adds Xeon-based systems to mission-critical Superdome and NonStop lines](#)

[HP brings HP Integrity Superdome X and HP Integrity NonStop X to x86 servers](#)

It's also worth noting that AIX is developed and supported by IBM but Linux is a unique operating system environment that benefits from a huge industry effort from many large corporations as well as many individual developers. The kernel from Linux has achieved a level of performance, capability, broad acceptance, and innovative potential that is excellent.

Conclusion

The stability of an environment depends on so much more than just the operating system. It is affected by factors such as the hardware RAS capability, the stability of the overall infrastructure including system software, and associated high-availability software. This stability also depends on quality and alacrity of the support offered by the platform provider, application vendors, and most of all, the stability of the applications themselves.

But often overlooked factors affecting stability include the people and the processes an IT organization employs. The IT team's capabilities in planning and operations, the tools and resources they have at their disposal, along with proven operational processes that effectively and reliably deliver the service levels expected by the business.

For several years now, Hewlett Packard Enterprise customers have been successfully delivering the expected service levels to their businesses utilizing Linux on HPE ProLiant DL580, HPE Integrity MC990 X, and HPE Superdome X to run mission-critical workloads. Proven x86-based servers such as HPE Superdome X is 20X more reliable¹⁰ than other x86 platforms. We also deliver 24x7x365 enterprise-class mission-critical support for OS, hardware, and applications, along with 99.999% assured availability from proven high-availability software, which provides a UNIX-like level of RAS and stability.

Though it's more than just Linux that needs to be stable to deliver such results, according to one of HPE x86 platform system architects, "Usually we say its cost effective and high performance but we should also add that Linux is pretty dang stable."

¹⁰ hpe.com/us/en/servers/mission-critical.html
hpe.com/us/en/servers/superdome.html
h20195.www2.hp.com/V2/getdocument.aspx?docname=4AA5-5765ENW

Next steps

1. It's certainly not 1995 anymore and Linux is now running many business-critical applications across enterprises. However, when IBM AIX providers start sowing fear, uncertainty, and doubt in IBM customers by saying that "Linux is not as stable or capable of mission critical as AIX," IBM customers should ask IBM to bring their IBM Linux experts to the conversation and answer the same questions. Remember, IBM has championed Linux and spent a billion dollars on it. Linux not only runs on HPE x86 servers but also on IBM Mainframes and IBM Power servers.
2. If you are an AIX user then, as they say, the proof is in the pudding. Since Linux is essentially "free," and your IBM Power hardware can be partitioned, you could trivially install one AIX partition, one Linux partition, and run your own benchmarks with your own specific workloads.
3. Have Hewlett Packard Enterprise or an HPE business partner run the same workload on your IBM AIX server and your HPE server? HPE business partners have access to the HPE ProLiant DL580 or HPE Integrity MC990 X or HPE Superdome X servers, where they can run benchmarks for you and show you the performance and stability data for your specific workloads over weeks or months.

References and further research

For more information on AIX vs. Linux and Linux running mission-critical workloads, review the following:

ibmsystemsmag.com/aix/administrator/performance/AIX-v-Linux/

IDC believes Linux runs mission-critical workloads:

- intel.com/content/dam/www/public/us/en/documents/white-papers/mission-critical-idc-running-workloads-linux-x86-white-paper.pdf
- [IDC White paper: HPE's Superdome X: The Mission-Critical Scale-Up x86 Platform for SAP, Oracle, and SQL Server white paper](#)
- [IDC Executive Brief: Modernize and Consolidate Your Database Servers on x86 with HPE's Mission-Critical Superdome X and ConvergedSystem 300 for Microsoft APS](#)
- [The Changing Face of Mission-Critical IT in an Always-on World](#)

Appendix

Other organizations and efforts using Linux include:

1. Google, Twitter, Facebook, Amazon, IBM, McDonalds, and more.
2. The submarines in the United States Navy are controlled by Linux.
3. National Aeronautical and Space Administration (NASA) widely uses Linux in many programs.
4. Linux powers mobile phones, tablets, and Kindle. Android uses the Linux kernel.
5. Though a little late, Linux is now widely used in schools and academics as well as in government offices.
6. New York Stock Exchange relies on Linux.
7. In many countries, the road traffic or air traffic control is run on Linux.
8. Bullet trains in Japan run at 240–320 km/hr and all train tracking, maintenance, scheduling, and controlling are Linux based.
9. The world's fastest supercomputer—China's Tianhe-2, which is capable of performing 33.86 petaflops operations per second, is running Kylinos—a Linux-based operating system.
10. Wikipedia, Pizza Hut, aviation industries, parliaments of countries such as France use Linux.
11. The U.S. Postal Service uses Linux.
12. Schools, colleges, and universities in Russia, Germany, Philippines, Georgia, Switzerland, Italy, and India are using Linux even for basic computer education.
13. The availability of specific Linux distro for every task makes Linux the most sought after platform. Ubuntu is a distro specially developed for computer labs from an educational point of view.
14. Oscar winning movies Titanic and Avatar were edited and graphics were created using Linux. Many new video cameras run a Linux core.
15. Cisco uses Linux-based real-time communication and integration solutions.

Learn more at

hpe.com/info/smartchoice

hpe.com/info/riscmigration



Sign up for updates

© Copyright 2017 Hewlett Packard Enterprise Development LP. The information contained herein is subject to change without notice. The only warranties for Hewlett Packard Enterprise products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. Hewlett Packard Enterprise shall not be liable for technical or editorial errors or omissions contained herein.

ARM is a registered trademark of ARM Limited. Google is a registered trademark of Google Inc. Intel is a trademark of Intel Corporation in the U.S. and other countries. Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. Oracle is a registered trademark of Oracle and/or its affiliates. Red Hat is a registered trademark of Red Hat, Inc. in the United States and other countries. SAP and SAP HANA are trademarks or registered trademarks of SAP SE in Germany and in several other countries. UNIX is a registered trademark of The Open Group. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries. VMware ESX is a registered trademark or trademark of VMware, Inc. in the United States and/or other jurisdictions. Qualcomm is a trademark of Qualcomm Incorporated registered in the United States and other countries used with permission. All other third-party trademark(s) is/are property of their respective owner(s).

a00000186ENW, January 2017

