HP OpenVMS on HP Integrity server blades for HP BladeSystem c-Class

30 years' experience meets the next-generation data center

Table of contents

> "OpenVMS system uptimes are often measured in years.…There are clusters out there with uninterrupted service uptimes in excess of 15 years.…OpenVMS is one of the industry's best-kept secrets—those in the know would not consider using anything else for business-critical systems."
> – Colin Butcher, "Hack-proof and crash resistant—have you discovered the OS world's best-kept secret?," *ComputerWeekly.com*

Executive summary

Introduction

The HP OpenVMS operating system has long been known as the "gold standard" for disaster tolerance, and the industry has admired it for its well-documented high availability—up to 100% application uptime—security, and reliability. Over the years, OpenVMS has helped users avert business tragedies by protecting their critical operations and keeping their business processes up and running during disasters—from localized errors to those with farthest-reaching implications.

As OpenVMS celebrates its 30th anniversary, there is something new to celebrate as well: OpenVMS is now available on a modern, highly efficient, ultra-flexible, and easy-to-manage architecture—the HP Integrity server blade deployed in the HP BladeSystem c-Class enclosure. Migrating from legacy OpenVMS architectures to the newest Integrity server blade/BladeSystem c-Class platform will keep businesses powered by OpenVMS operating in a safe, reliable environment.

The innovative BladeSystem c-Class architecture is simply a smarter foundation on which to build an infrastructure to support the vital applications that businesses require. BladeSystem combines the redundancy and robustness that businesses need with greatly reduced facilities and operational costs:

- **Facilities costs** are reduced through the BladeSystem's substantially lower power and cooling requirements—on average 30% less than comparable rack-mounted servers with no sacrifice of performance. A BladeSystem installation can save valuable data center floor space, too, by offering far more computing density than legacy servers.

- **Operational costs** are lower because BladeSystem servers are far less expensive than racked servers to deploy—cabling, for instance, can be reduced by more than 90%—and to maintain: sophisticated management software helps to automate routine tasks, so administrators can effectively manage many more servers.

For companies that have long used OpenVMS, its availability on the Integrity server blade means they can continue to run their safe, powerful, and established OS and applications while gaining the advantages of the most advanced server technology available today. Running OpenVMS on Integrity server blades in the BladeSystem c-Class provides companies with a seamless transition to the latest HP technologies—along with enhanced competitiveness, improved responsiveness, accelerated growth, reduced costs, time savings, and more. And for companies that are just beginning to implement OpenVMS, the Integrity server blade/BladeSystem architecture allows them to leverage the benefits of the new platform's advanced technology right from the start.

Many organizations' IT environments are based on multiple operating systems—such as OpenVMS, Windows®, HP-UX, and Linux—with each OS employed for the processes to which it is best suited. These organizations may find the prospect of moving to a flexible, future-proof architecture that accommodates all these operating systems appealing—and if so, such an environment exists on Integrity server blades. The combination of OpenVMS and Integrity server blades on BladeSystem creates synergistic value by melding all the benefits of the blade infrastructure with the added value of OpenVMS.

Overview

This white paper discusses the well-documented attributes of OpenVMS running on innovative, flexible, future-proof HP Integrity server blades in the HP BladeSystem. It highlights the benefits of OpenVMS on Integrity server blades, including the ability to meet specific business outcomes (such as to accelerate growth, lower costs, and mitigate risks) in a "best-run" infrastructure—meaning one that is cost-savvy, change-ready, energy-thrifty, and time-smart.

The implications of downtime and high infrastructure costs

Across industries, the costs of application downtime—no matter what the source—can reach tens of millions of dollars per minute or more. Lost business and revenue opportunities due to downtime, outages, security breaches, and other catastrophes are nearly incalculable; the extremes of damage can range from a few minutes of inconvenience to the loss of human life. Companies that need to maintain, expand, reconfigure, or upgrade their IT environment while continuing to run applications—without experiencing any downtime—are especially vulnerable. For these organizations, business continuity and high availability are not only essential to profitability and competitiveness, but also critical to their very survival.

At the same time, enterprise-wide growth is causing companies to spend inordinate amounts of time and money building and managing their IT infrastructures. In fact, organizations often spend up to 80% of their budgets running IT—compared to the only 20% they spend innovating it.

Meanwhile, the fundamental goals of business never change: To remain competitive, companies must strengthen customer relationships, lower costs, and accelerate business growth while mitigating risks. But the focus today is shifting from how technology performs to what technology can deliver to the business in the form of *actual* business results—also known as *business outcomes*.

Businesses that use technology most effectively often spend far less on infrastructure than their competitors. These are the leaders with "best-run" environments that are effective in delivering IT service to match business needs, with high levels of productivity and flexibility at low operational costs. A best-run infrastructure is measured in metrics such as cost, change, energy, and time. The most successful, best-run infrastructures are tightly integrated with business outcomes.

Mitigating risks with high availability, clustering, and security

High availability and clustering capabilities

Because business risks and IT risks are now irrevocably codependent, enhanced security not only contributes to protecting data and operations, but it also directly impacts the bottom line. It does so by mitigating the potential costs of downtime due to security breaches, as well as by significantly reducing the need for additional software and management expenditures. Mitigating risks while reducing the business impact and costs of outages is a constant concern for both IT and business executives. Business continuity—the ability to continue operations at predetermined levels regardless of adverse internal or external events—is essential to profitability and competitiveness. And in many cases, it is vital to an organization's actual survival. Only a few seconds of system downtime can cause damage ranging from inconvenience to bankruptcy or even the loss of human life.

High availability and disaster tolerance are the IT elements that contribute to business continuity. While high availability is focused on maintaining local operations in the face of application failures or system-level problems, disaster tolerance protects against large-scale outages such as catastrophic data center failures. Disaster recovery, which organizations can achieve through replication at one or more remote locations, is mainly focused on preserving data.

Companies can achieve high availability through clustering, which OpenVMS first introduced in 1985. Clustering helps achieve up to 100% application availability by enabling interruption-free maintenance and upgrades—even when new servers are being added to the cluster—as well as by mitigating the risk of system failure. OpenVMS clusters can provide full functionality even when cluster nodes are physically separated up to 500 miles—further under certain conditions. Scalable to full 96-node capability, an OpenVMS cluster functions as a single system, sharing everything—yet still being able to address a failure in one node without adversely affecting any of the others or limiting the application's ability to function. Furthermore, OpenVMS data replication and protection capabilities are qualified for distances as great as 60,000 miles.

As a result of these unique clustering capabilities, a company can relocate its entire OpenVMS environment to new a geographic location without any downtime or loss of transactions, functionality, or data. Furthermore, OpenVMS customers can transition their applications from HP AlphaServer or VAX systems to Integrity servers or Integrity server blades without causing disruptions to operations. In fact, new systems can be added to the cluster as the previous ones are being removed.

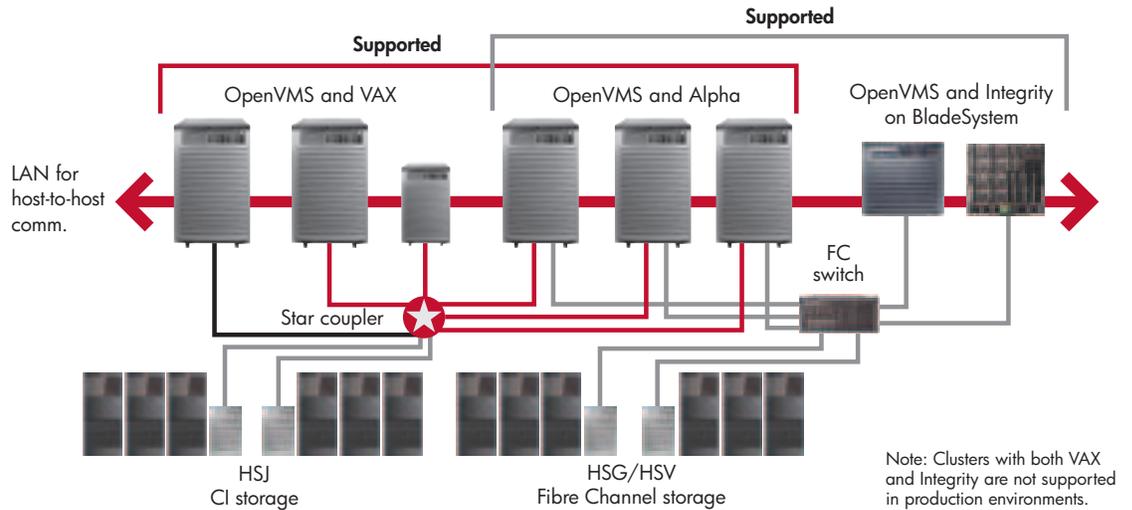**Mitigating risks with built-in security**

OpenVMS is the most secure general-purpose commercial operating system in the market. In fact, OpenVMS was declared "cool and unhackable" at the DefCon9 hacker convention.[1] While all operating-system environments employ some level of security, they typically do so by adding features on top of the OS. Conversely, OpenVMS is secure by design, meaning that security is built in—from the innermost elements of the kernel out to all individual users—not added on afterwards. Every layer requires unique privileges, and every action is tested, authorized, monitored, and recorded.

High-availability requirements span industries

HP OpenVMS working in the HP BladeSystem infrastructure provides virtually impenetrable security and up to 100% application availability for the most demanding IT environments. Because of these attributes, OpenVMS is employed across industries where the utmost in availability, disaster tolerance, and security are required, including:

- **Hospitals**—for their critical patient information systems, diagnostic departments such as radiology and labs, and pharmacies
- **Government**—in defense, operations, education, and numerous critical military and security programs throughout the government sector
- **Financial services**—with a large presence in enterprises ranging from exchanges and insurance to funds transfer activities
- **Transportation**—across vital operations such as tracking, ticketing, scheduling, baggage handling, shipping, and traffic control

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[1] http://groups.google.com/group/comp.org.decus/msg/ccf63376f8cb26d1

4

Supported

Supported

OpenVMS and VAX

OpenVMS and Alpha

OpenVMS and Integrity on BladeSystem

LAN for host-to-host comm.

FC switch

Star coupler

HSJ
CI storage

HSG/HSV
Fibre Channel storage

Note: Clusters with both VAX and Integrity are not supported in production environments.

- **Telecommunications**—supporting more than two-thirds worldwide SMS transactions, and driving billing systems and business operations
- **Media and entertainment**—for operations such as satellite and radio, as well as electronic gaming enterprises and automated lottery systems
- **Manufacturing**—over 90% of the world's microprocessors are manufactured by fabrication systems based on OpenVMS

Accelerating growth with capacity utilization and scalability

Going beyond failover with capacity utilization

OpenVMS running on Integrity server blades in BladeSystem c-Class enclosures enables users to analyze current capacity utilization and adjust it appropriately to meet specific business needs and service-level agreements, such as reducing response times, increasing performance, and accelerating growth. Unique clustering capabilities and load balancing/sharing features facilitate the ability to increase, upgrade, or expand capacity. Unlike many products that boast clustering capabilities today, OpenVMS goes beyond enabling failover from one node to another by allowing all the systems in a cluster to operate and actively process workloads. This in turn lets organizations run the same application—and perform load balancing/sharing—across multiple nodes simultaneously. This mode of operation not only delivers up to 100% application uptime, but it also allows for system nodes to be upgraded, maintained, and added to or removed from the cluster without interrupting application, data, or transaction flows.

OpenVMS also helps accelerate growth with scalability and virtualization—an approach to IT that pools and shares resources to optimize utilization and enable supply to meet demand automatically. Multi-architecture, cross-generational clustering facilitates scalability and helps organizations protect investments.

Scaling up and out for enhanced flexibility

OpenVMS scales up by adding processors to a single system, and it scales out using clusters. Scaling up is the ability to move to a larger server when needing extra capacity and power; scaling out is the ability to increase IT capacity by simply adding systems to the existing cluster. In the BladeSystem c-Class architecture, scaling out and scaling up share the same enclosure. The HP BladeSystem c7000 enclosure can accommodate one to 16 blades of all kinds—including storage, PC, and workstation as well as server blades—across various models. In November 2007, the HP BladeSystem c3000 enclosure will be added—able to accommodate one to eight blades across a range of types and models.

The diagram above demonstrates the supported evolution of OpenVMS clusters, from OpenVMS VAX systems to HP Integrity server blades.

5

> "*Supercomputing Online*'s readers jumped behind the HP BladeSystem c-Class server blades and easily propelled it into first place in our annual Product of the Year competition…. The great strength associated with HP's ability to innovate and integrate new technologies will drive increasing levels of performance and value to help the world's supercomputing professionals overcome the challenges they face."
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> — "HP BladeSystem c-Class Server Blades Win Readers' Choice Award," *Supercomputing Online*, February 28, 2007.[2]

Delivering a best-run infrastructure

An Integrity server blade running OpenVMS in a BladeSystem c-Class enclosure delivers a best-run IT infrastructure out of the box—unifying server, storage, network, power, cooling, and management capabilities to create unlimited possibilities for IT and business. The OpenVMS/Integrity server blade/ BladeSystem c-Class combination is:

- **Cost-savvy**—The consolidated design is more affordable and efficient than conventional IT.

- **Change-ready**—HP Virtual Connect and a modular system approach help to eliminate barriers to change.

- **Energy-thrifty**—HP Thermal Logic technology optimizes efficiency by managing power and cooling as a resource.

- **Time-smart**—HP Insight Control helps manage a pre-integrated, automated infrastructure to save valuable time.

Lowering costs with a consolidated design

The typical data center's rising acquisition and operating costs result from every new addition, upgrade, or change that occurs, as well as from low productivity and downtime. In traditional rack-mounted server architectures, enterprises typically incur extra costs by having to purchase additional hardware, power components, connections, and external networking components. Enterprises are constrained in their ability to lower these costs by the very design of conventional, rack-mounted infrastructures as well as the processes required to manage them.

OpenVMS running on Integrity server blades in the BladeSystem c-Class helps lower costs and reduce time with a cost-savvy blade architecture that is consolidated from the start, with compute, storage, network, power/cooling, and management. The BladeSystem c-Class infrastructure enhances the bottom line by:

- Internally integrating the essential elements of the data center, including network, power/cooling, and management

- Reducing space by up to 60% vs. 1U servers, using less power and cooling, and reducing the time required to build and maintain the environment

- Facilitating configuration of up to 64 servers in 15 minutes—locally or remotely—with HP Onboard Administrator

- Reducing cables by up to 95% with a broad range of HP Virtual Connect modules, switches, and interconnect options

- Reducing LAN and SAN connectivity costs by up to 50% and simplifying overall system administration

- Reducing acquisition costs and increasing utilization by pooling and sharing power, cooling, and network components—and eliminating the need for other components

- Offering built-in redundancy with proactive monitoring and automated failover, and with features such as dual VLAN switches, storage and storage interconnects, cooling fans, and hot-swappable server blade replacement

- Lowering total cost of ownership (TCO) and streamlining operations with cost-effective, single-install, single licensing of HP Insight Control management software

- Leveraging built-in management capabilities of HP Onboard Administrator with easy-to-use, wizard-driven interfaces

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[2] The survey had more than 750 respondents, with the HP BladeSystem c-Class receiving more than 25 percent of the total votes among 12 nominated products. The annual awards identify significant new technologies of the past year that promise to make the greatest impact on IT strategies and honor the products that exemplify the best implementation of those technologies.

Responding rapidly to changes and demands

Today's complex IT environments and infrastructures are affecting the ability to respond rapidly and effectively to ever-increasing business demands. In the typical data center, a leading barrier to change is the manual coordination required across multiple groups—including server, LAN, and SAN administrators—to synchronize internal processes. And businesses often spend far too much time patching, monitoring, configuring, and deploying instead of creating and innovating.

The BladeSystem c-Class loaded with Integrity server blades running OpenVMS offers a change-ready environment that takes advantage of modular components and virtualization, enabling companies to share all resources and connections by:

- Providing up to five terabits of aggregated bandwidth and eight interconnect ports for redundancy using HP Virtual Connect architecture

- Creating virtual SAN and LAN connections to servers, allowing rapid configuration changes without impacting other domains, and enabling users to preconfigure and wire the infrastructure once with HP Virtual Connect modules

- Tapping into shared or networked storage consisting of HP StorageWorks storage blades to add drive capacity to servers

- Enabling management and movement across and between physical and virtual environments using HP Virtual Server Environment capabilities

- Easily adding or removing blade servers, storage, and other modular components without having to power down

- Identifying performance bottlenecks and rapidly scaling resources to meet business demand

- Recovering quickly from system failures through health monitoring and alerting combined with policy-based automation

- Detecting potential security vulnerabilities and quickly correcting them with HP vulnerability and patch management

Reducing costs, heat, and power usage

Data center electricity bills are soaring; it's estimated that it costs USD$5.9 million annually to run a 100,000-square-foot data center. Costs associated with powering and cooling servers, storage, and networks threaten to exceed their acquisition costs. At the same time, faster high-performance processors and high-density servers draw more power, produce more heat, and require more air conditioning and power to cool. Having multiple racks exposes many legacy data centers to exponential demands for power—demands that most will not be able to meet. Today, power and cooling are more limited resources than processing capacity, which raises IT costs and jeopardizes uptime.

Running OpenVMS on Integrity server blades in a BladeSystem c-Class enclosure helps companies leverage the benefits of an energy-thrifty environment that uses shared resources such as power cooling and cabling. This helps organizations save watts and eliminate excess BTUs by managing and adapting power and cooling as a resource, and by:

- Seeing and understanding power usage, thermal impact, heat output, and cooling capacity using a graphical "thermal dashboard"

- Tracking and analyzing specific data through customized reports to keep the IT environment up and running

- Monitoring the infrastructure, advising about repairs, and warning of impending power and cooling issues with built-in management features of HP Onboard Administrator

- Dissipating heat quickly in any configuration with redundant, scalable HP PARSEC cooling architecture

- Automatically delivering required cooling to match changing demands and environmental conditions at significantly reduced power levels with jet-inspired, patented HP Active Cool fans

- Tripling the cooling capacity of a standard rack without increasing the data center's heat load with the water-cooled rack technology of the HP Modular Cooling System

- Automatically shifting power load for maximum power supply efficiency and reliability with Dynamic Power Saver

Increasing productivity and saving time

The daily, time-consuming tasks associated with running a data center often impede productivity, contribute to downtime, and hamper efficiency. This, in turn, results not only in lost time and squandered resources, but also in potential lost revenue and business opportunities. To enhance productivity and increase competitiveness, companies need the ability to control resources—from anywhere, at any time—while preparing for the unexpected.

The OpenVMS/Integrity server blade/BladeSystem c-Class infrastructure is a time-smart environment that enables simplified provisioning and change management with built-in intelligence and control features. This pre-integrated, automated infrastructure helps administrators enhance productivity and save valuable time by:

- Delivering system health and performance monitoring, automated server provisioning and recovery, and vulnerability scanning through HP Insight Control software

- Identifying the physical location, status, and configuration of every component within the enclosure through a photorealistic graphical interface

- Allowing the quick installation and configuration of HP BladeSystem hardware and software—and the safe updating of firmware in minutes—with a user-friendly provisioning system

- Making it possible to transition from traditional rack-mount servers to the BladeSystem infrastructure in minutes with HP Insight Control management software

- Seamlessly moving server resources between and within physical and virtual environments with virtual machine transparency

- Consolidating devices, management, power, and cooling, enabling IT staff to manage more infrastructure with the same or even fewer resources

- Monitoring, controlling, and managing remote sites by centralizing IT talent

Conclusion

HP OpenVMS has provided up to 100% application availability, security, and reliability for millions of users worldwide. Widely adapted by those seeking space-, power-, and cost-saving capabilities, HP Integrity server blades—with their high-density design and facilitated clustering capacity—continue to serve enterprises. The unique clustering features of OpenVMS can help a company relocate its entire data center to a new geographic location without any application downtime. Together, OpenVMS, the Integrity server blade, and the BladeSystem c-Class enclosure leverage the infrastructure expertise and proven history of innovation from HP to deliver the next generation of data centers. This innovative solution helps companies bring about specific business outcomes such as mitigating risks and accelerating growth in a best-run infrastructure—one that is cost-savvy, change-ready, energy-thrifty, and time-smart. The combination of the HP OpenVMS operating system, the HP Integrity server blade, and the HP BladeSystem c-Class enclosure helps unify server, storage, network, power, cooling, and management capabilities to create unlimited possibilities for IT and business, now and in the future.

For more information

For more information about OpenVMS for HP Integrity server blades, please visit

www.hp.com/go/openvms or

www.hp.com/go/integrity,

or call your local sales representative.

To learn more, visit www.hp.com

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