

HP-UX 11i—a vision for the future of enterprise computing

Building on today's technology leadership to meet tomorrow's business needs



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Solutions for the adaptive enterprise.



HP-UX 11i is a solid platform for innovation, proven to be a highly stable and reliable operating environment. The capabilities of HP-UX 11i enable IT organizations to build an Adaptive Enterprise based on the principles of simplification, standardization, modularity, and integration. In waves of technology, HP is continuing to enhance HP-UX 11i to deliver increasing value for the Adaptive Enterprise over the long term.

Delivering long-term value for the Adaptive Enterprise

As the pace of change continues to accelerate, IT organizations will fall under increasing pressure to align their services more strategically with the dynamic objectives of the business. Therefore, it is essential that the IT infrastructure be architected for low-cost flexibility—with the reliable performance, security, high availability, and scalability to support growing business demands. Bottom line: CIOs are demanding an IT infrastructure that can increase agility, improve performance, mitigate risk, and boost return on investment.

The Adaptive Enterprise is the HP strategy for creating organizations in which business and IT are synchronized to capitalize on change. Following this strategy, people, processes, and technology are integrated across the organization to deliver services at the business, application, and infrastructure levels. The end result is an efficient supply/demand relationship between IT resources and business needs that enables organizations to quickly turn challenge into opportunity.

Building an Adaptive Enterprise requires a rich set of technologies that can deliver power, intelligent flexibility, and efficiency. It requires the capabilities of HP-UX 11i. The fact is, HP-UX 11i is the proven foundation for building an Adaptive Enterprise. It incorporates some of the most advanced capabilities in the industry—including standardization, virtualization, and management—enabling IT professionals to increase agility, optimize resource utilization, and reduce costs. Most important, HP has a demonstrated commitment to building on the strengths of HP-UX 11i to further enhance the value of our customers' investments and help them realize the full power of the Adaptive Enterprise.

HP-UX 11i—investing for leadership today and tomorrow

HP-UX 11i is a solid platform for innovation, proven to be a highly stable and reliable operating environment. The central HP-UX 11i strategy is to deliver outstanding business value, today and in the future, through investments in technology innovation coupled with a robust development process. HP is executing this strategy by delivering waves of technology that enhance HP-UX 11i with additional standardization, virtualization, and management capabilities required to fully enable your Adaptive Enterprise.

HP Adaptive Enterprise strategy

The Adaptive Enterprise is the HP strategy for creating organizations in which business and IT are synchronized to capitalize on change. This strategy takes a holistic approach to enterprise computing, harnessing the power of standardization, virtualization, and management:

- **Standardization**—leveraging standards-based architectures, reusable components, and a consistent implementation to reduce cost and simplify change

- **Virtualization**—pooling and sharing resources to optimize utilization and enable IT supply to automatically meet business demand
- **Management**—automating the dynamic link between business process and IT resources

This holistic approach for your Adaptive Enterprise is based on a set of business realities: getting more return on IT investment; synchronizing business and IT to capitalize on change; and doing more with less while improving IT services.

Standardization

The first wave of technology, which was completed in early 2004, provided HP-UX 11i with industry-leading standardization capabilities, including a common operating system (OS), HP-UX 11i v2, that runs on Itanium®-based HP Integrity servers as well as on RISC-based HP 9000 servers.

Virtualization

The advanced virtualization features built into HP-UX 11i comprise the Virtual Server Environment (VSE)—the first integrated virtualization offering in the industry—which includes workload management, centralized management, availability, partitioning, and utility pricing, all designed to help optimize utilization through shared and pooled resources.

Management

Intelligent management tools provide visual and intuitive ways to automate many administrative functions. By leveraging a strong affinity for Linux®, HP-UX 11i offers unprecedented flexibility in development and deployment to meet diverse business needs.

Building on these industry-leading capabilities, HP-UX 11i v2 is the cornerstone for creating a fully self-healing and self-adapting virtualized environment. This white paper discusses many key areas of the HP-UX 11i Operating Environment that are being actively enhanced to support this vision. Whether through technology innovation or by partnering with best-of-breed infrastructure providers, HP is focused on delivering the highest value to its customers—with highly robust performance and scalability, a broad range of management tools, very high levels of availability within and across data centers,

virtually fail-safe security that lets customers sleep at night, and a flexible infrastructure that gracefully supports a multi-operating-system environment. By staying true to its clear vision—and following the design principles of simplification, standardization, modularity, and integration—HP has built HP-UX 11i to deliver the dynamic and intelligent capabilities needed to unlock the full benefits of the Adaptive Enterprise: simplicity, agility, and value.

Optimizing resource utilization for a virtualized world

Virtualization is critical to the Adaptive Enterprise. Through virtualization, resources such as servers, storage, and networking can be pooled and shared to optimize utilization and enable IT supply to automatically meet business demand. HP-UX 11i v2 provides some of the most complete, integrated, and advanced virtualization capabilities in the industry today, including server partitioning and dynamic workload allocation. These capabilities have been developed specifically to reduce cost and complexity while increasing IT responsiveness in a dynamic business environment.

As pressure within IT organizations increases to deliver higher strategic value at lower cost, advancements in virtualization techniques will become even more critical—providing the linchpin for higher availability and tighter security as well as enabling more intelligent, automated management.

To support its Adaptive Enterprise, HP is leading the industry in technology development and delivery to reduce costs and complexity, which increases IT responsiveness. A key pillar of the HP Adaptive Enterprise is virtualization.

HP is continuing to develop enhanced virtualization capabilities for HP-UX 11i, building on the HP Virtual Server Environment strategy by integrating virtualization into every corner of the enterprise. The objective is to enable a fully integrated and virtualized enterprise—one that can both optimize resource utilization in real time based on dynamic business needs and exceed service-level requirements.

Near-term steps toward achieving this vision include extending the HP-UX partitioning capabilities with HP-UX 11i v2 and leveraging the industry-leading, high availability capabilities already built into HP-UX 11i within a tightly integrated virtualized environment. Virtual partitions (vPars) will be available on HP-UX 11i v2 for HP Integrity servers in the summer of 2005, and the HP Integrity Virtual Machine (Integrity VM) will be available in the second half of 2005. Integrity VM provides a software abstraction with sub-CPU granularity and shared I/O, presenting all of the interfaces provided by a computer system's hardware. A single HP Integrity server running Integrity VM can support multiple virtual machines, each with its own separate "guest" operating system—HP-UX 11i, as well as Linux, Microsoft® Windows®, and HP OpenVMS. As a result, each virtual machine can host its own application in a fully isolated environment. Virtual machines can be defined as single-CPU servers, or as SMP servers with the ability to host dozens of virtual CPUs on a single physical processor for even greater flexibility and scalability.

Partitioning continuum

Providing a broad, seamless continuum of partitioning technologies that can be easily customized based on the specific requirements of individual enterprises is fundamental to integrated virtualization. HP-UX 11i currently supports hard and soft partitioning, providing the isolation and flexibility customers need while enhancing performance. HP plans to expand these capabilities in future releases of HP-UX 11i, building on the HP Virtual Server Environment to increase the granular control currently provided and to enable sub-CPU granularity for separate OS images with Integrity VM.

HP will also extend the current capabilities of the Virtual Server Environment. Today, CPUs can be moved from one virtual partition to another, and Instant Capacity licenses can be transferred from one hard partition to another. In addition, the goal-based policy engine provided by the HP Global Workload Manager (gWLM) supports large Virtual Server Environments. With these capabilities, server resources are automatically allocated and re-allocated across partitions, servers, and clusters based on predefined service-level objectives. Isolation for greater security is provided by secure resource partitions. The result is intelligent optimization of resource utilization that dynamically and securely manages free pools of resources in real time—increasing business agility while reducing the cost of delivering IT services.

HP-UX 11i gives businesses the ability to do more with less through our tight integration with virtualization, high availability, security, and simplified management.

High availability uniquely integrated with virtualization

The Virtual Server Environment builds on the industry-leading high availability and disaster tolerance capabilities of HP Serviceguard to provide an integrated solution that includes the virtualization and partitioning technologies built into HP-UX 11i v2. HP-UX 11i has been on the forefront of high-availability solutions, and HP has been working closely with leading partners such as VERITAS to extend high availability beyond traditional bounds—across clustered databases and broad geographies. Leveraging the capabilities of HP Serviceguard, a package within a cluster can be relocated to preserve application availability. Serviceguard Extension for RAC—which supports Oracle® Real Application Clusters (RAC)—extends the clustering capabilities of Serviceguard to provide continuous application and database availability for mission-critical environments. In fact, with Serviceguard Extension for RAC, HP was the first in the industry to achieve sub-five-second failover with Oracle. In addition, Workload Manager helps performance to meet service-level agreements by adjusting the resources assigned to a cluster member, including activation of processing resources under utility pricing. By integrating high availability with its virtualization technologies, HP leads the industry in enabling highly available, agile environments.

HP will continue to enhance HP Serviceguard, integrating additional virtualization and high-availability capabilities into the HP-UX 11i Operating Environment. The objective is to meet or exceed mainframe capabilities—to sustain business continuity, extend disaster tolerance across greater distances, and maintain service levels, even under the most demanding conditions. One way to achieve this objective is through continued integration and simplification of clustered environments, enabling IT organizations to increase application availability while reducing the effort of doing so. Integration of Serviceguard with the VERITAS cluster file system is a major step in this direction. HP Serviceguard Manager also plays a key role in simplifying high availability.

Today, Serviceguard Manager provides a highly visual and intuitive set of monitoring, administration, and configuration tools to maintain high availability across local and geographically distributed clusters for both HP-UX 11i and Linux. Through continued enhancement of Serviceguard Manager, administrators and operators will gain not only big-picture access and control of multiple clusters from a single console, but additional intelligence and policy-based features as well—enabling faster failover; dynamic configuration updates; and automated creation, modification, and deletion of cluster packages, nodes, and clusters.

Building an Adaptive Enterprise requires a rich set of technologies that can deliver powerful, intelligent, flexible, and efficient solutions for your business—HP-UX 11i is the answer.

Serviceguard Manager integrates with HP Systems Insight Manager (SIM), a multi-system management solution. HP SIM provides centralized, secure, role-based monitoring and management of multiple servers and operating systems, with inventory collection and comparison capabilities based on Web-Based Enterprise Management (WBEM) instrumentation. WBEM is an industry standard for management of enterprise computing environments. Tight integration is also planned between Serviceguard Manager, the HP System Management Homepage, and a new Web-based application for volume and file system management. This will give IT administrators the tools to maintain consistency of volume definitions across all cluster members. Additional enhancements further demonstrate the management advantages of the Adaptive Enterprise. These include a set of capabilities that enable a single system view, improving total cost of ownership by enabling system administrators to manage the members of a cluster through a single virtual view. Aspects of management include viewing log files (merged across cluster members), performing management operations across groups of members, and making sure that configurations remain appropriately consistent across the members of a cluster.

With future releases of HP-UX 11i, HP plans to enhance high availability by incorporating dual storage-stack capabilities. These capabilities will include multi-pathing, enabling the operating environment to establish redundant I/O paths to all storage devices—if one path is lost, all operations will automatically fail-over to a working path.

Utility pricing

Flexible capacity and cost management are provided by HP utility pricing solutions, which decrease risk while enhancing business agility. These solutions enable enterprises to handle demand fluctuations without investing in processing resources until those resources are actively needed. There are two solutions: metered capacity, such as Pay per use, and Instant Capacity. In a Virtual Server Environment, when a requirement is recognized by HP-UX 11i Workload Manager, dormant resources can be activated and stylized to ensure that business processes are managed and maintained according to service-level agreements. In the case of metered capacity, all of the CPUs in a system are activated and monitored on a daily basis. A monthly average is derived from the daily CPU utilization metrics, and that average serves as the basis for the monthly price. HP Instant Capacity solutions provide additional flexibility based on the increase of performance over time, while transaction volatility is addressed by metered capacity.

Secure resource partitions combine security isolation with resource management. Enterprises can reduce their total cost of ownership, thanks to lower administrative costs and less unplanned downtime.

Securing valuable information assets for protection and agility

As highly virtualized and networked environments expand, the requirements for security will be greater than ever. HP-UX 11i already incorporates leading features that enable highly secure connectivity to meet the needs of today's networked and mobile business environments. The HP-UX 11i network technologies team has been working very closely with HP customers on the development and deployment of wireless TCP technologies, and the standards-based HP-UX 11i networking stack has been extended to allow seamless roaming of an Internet connection throughout the enterprise, using the same IP address. HP is continuing to invest in secure mobile technologies—and, as the demands of a dynamic and virtualized business environment evolve, additional security capabilities are planned for HP-UX 11i.

HP-UX 11i incorporates and supports a broad set of products and technologies, ranging from standard communication security protocols to advanced intrusion detection and protection functionality. New trends, such as server consolidation within a single operating-system image, demand additional measures to protect data integrity—stronger isolation, for example. In addition, the threat of increasingly sophisticated attacks mandates that the operating system protect itself and other applications against such attacks by limiting application privileges and by isolating potentially vulnerable applications.

In its first wave of technology, HP introduced role-based access control into the HP-UX 11i Operating Environment. This important enhancement, implemented with the existing HP-UX privilege model, is designed to integrate with future fine-grained privilege models. By splitting the root account into a set of administrative roles, HP-UX 11i now reduces administrative costs by providing administrators with role-based access rather than requiring that tasks be funneled to central administration. In addition, risk is reduced because accountability can be traced through role assignments and access delegation. Secure resource partitions combine security isolation with resource management. And enterprises can reduce their total cost of ownership, thanks to lower administrative costs and less unplanned downtime.

Upcoming waves of technology will build on these capabilities with continued investment in HP-UX 11i security, including advanced identity management, policy enforcement, access control, and isolation—all integral parts of the operating environment for maximum business value.

Identity management and provisioning

When management of user identities and access rights is centralized onto a single set of servers, user information can be updated in a single place, and security policy changes can be implemented with a single command. HP is working to integrate an identity management solution, such as HP OpenView Select Access, into HP-UX 11i to support the following enhanced capabilities:

- **Simplified administration and provisioning**—Future HP-UX 11i enhancements are planned to simplify the process of managing access privileges by enabling HP-UX 11i to “hook in” to existing access control solutions.

- **Centralized policy enforcement**—Integrating HP-UX 11i with an identity management solution will make it possible to change access control policy by simply changing the reporting structure, making it easy and efficient to adapt the enterprise to changing market forces without compromising security.
- **Granular access control**—With the simplified management provided by identity management solutions, it will also be possible to break down the access control provided by HP-UX 11i into much finer-grained authorizations, with privileges assigned to users based on security policy.

Isolation and virtualization

By incorporating compartment isolation and virtualization into future releases of HP-UX 11i, HP is planning to provide enterprises with the following capabilities:

- **Secure resource partitioning**—Enhancing the resource partitioning capabilities of HP-UX 11i with compartmentalization will make it possible to consolidate the functionality provided in many physical servers into a single server, while maintaining security isolation.
- **Application firewalling**—Compartmentalizing servers and limiting their communication to other services on the system will enable isolation of potentially vulnerable services from confidential information, thus mitigating the risk of damage from an intrusion.

In addition, to support growth in IP networking, HP plans to enhance the current security and scalability capabilities of HP-UX 11i with additional technologies that will enable HP customers to build a cost-effective, easy-to-manage, and secure IP telephony infrastructure. Finally, looking beyond the current multimedia protocols for HP-UX 11i, HP is investing in technologies that are expected to make HP-UX 11i the operating environment of choice for multimedia applications.

As these and other mobile, networked capabilities propagate across the extended enterprise, HP is planning to continue to provide, in HP-UX 11i, a stronghold of security to protect valuable information assets from attack and misuse. For our customers, that means protection and agility in a mobile IT environment—the best of all worlds!

Driving higher performance and more flexible scalability

HP-UX 11i is well established as a leader in performance and scalability. Today, the operating environment is producing record-breaking benchmark results on standards-based HP Integrity servers, with unprecedented and sustained performance leadership across multiple servers and diverse workloads. HP is planning to enhance HP-UX 11i with new capabilities for even greater performance and scalability—achieving mainframe functionality in an integrated, virtualized environment.

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Because the majority of HP-UX 11i kernel parameters are dynamic, performance can be optimized by tuning the operating environment while running; there is no need to reboot for the changes to take effect. The long-range vision is to further enhance performance by enabling HP-UX 11i to adapt automatically as CPUs, I/O cards, storage, and other resources are added on the fly. Future releases of HP-UX 11i are planned to include additional enhancements such as these:

- Increased instrumentation and dynamic tuning capabilities built on standards, such as WBEM, for all HP management solutions
- Improved automation in responding to events
- Support for next-generation compiler technology
- The ability to support more than 128 CPUs in a single image

Managing information growth by enhancing the HP-UX 11i storage subsystem

As information grows, the demands on file systems and storage will grow accordingly. Therefore, HP is planning to enhance the HP-UX 11i storage subsystem by enabling greater information lifecycle management (ILM), so enterprises can manage information more efficiently based on its business value over time. While many vendors offer ILM products, HP is one of the few to deliver an end-to-end solution focused on business needs. The storage and file management capabilities of HP-UX 11i are designed to support ILM—and to maintain data access at all times of the day and night.

To support increased storage and file-system demands, HP-UX 11i employs a file-system strategy that includes partnering with VERITAS to continue delivering OnlineJFS (VxFS). OnlineJFS is currently available on HP-UX 11i. In addition, HP and VERITAS have strengthened their relationship to include the VERITAS cluster file system technology integrated with Serviceguard for HP-UX 11i. HP-UX 11i file systems are tightly integrated with HP storage technology, enabling intelligent data management solutions to recognize and respond to file-system and volume changes. HP also partners with other best-of-breed solutions for file-system management, such as the ADIC StorNext product.

File systems provide enhanced features and intelligence to enable increased file-system performance, greater system administrator efficiency, and, ultimately, improved business productivity. These highly reliable, available, and scalable file systems provide the full breadth of capabilities needed to support large, mission-critical applications, offering these key enhancements:

- **Reliability and protection**—HP-UX 11i file systems will support a wide range of policy-based, self-managing functions with the goal of providing a fully automated, adaptive storage domain that offers the highest level of security—built into HP-UX 11i.
- **Performance**—HP-UX 11i will support increased performance by incorporating the VERITAS Quick I/O capability into Serviceguard, which is designed to deliver the equivalent of raw device read/write performance for individual servers and across all members in a cluster running database applications.

- **Scalability**—HP-UX 11i is architected to support files and file systems of up to eight exabytes. This results in larger, but fewer, file systems to manage, thus reducing management overhead significantly.

The rules-based intelligent management provided by HP-UX 11i, combined with the “agility” computing enabled by integrated virtualization technologies, will take HP-UX 11i to a whole new level of performance and scalability—delivering what IT managers require to act on new business demands in real time. What’s more, these capabilities provide the building blocks for creating a completely virtualized and dynamic infrastructure—one that offers higher return on IT investments, increased asset utilization, reduced operational and administrative costs, enhanced quality of IT service, and significantly improved agility to manage unforeseen business changes.

Simplifying management with greater intelligence and automation

Manageability is a critical factor in maintaining application service levels and reducing IT operating costs, but it is largely dependent on how effectively an administrator can inventory and monitor the state of systems and how efficiently those systems can be configured. HP-UX 11i offers manageability features that extend from the OS kernel design to instrumentation, the storage stack, command syntax, graphical user interfaces, and integration with enterprise management tools.

Sophisticated management capabilities for HP-UX 11i include HP SIM as a unified management solution, along with tools such as Serviceguard Manager and System Administration Manager (SAM) as well as various Web-based applications such as kcweb (for kernel configuration) and pdweb (for peripherals and device management). HP is continuing to enhance the operating environment with increased WBEM instrumentation and improved event-handling automation capabilities. Planned enhancements to both the command line and the graphical user interfaces will provide a richer display of information so that administrators can more quickly understand and control their systems.

HP also plans to extend the capabilities of SAM for HP-UX 11i beyond the current Functional Area Launcher and plug-in capabilities. In addition to tool launch, HP will provide at-a-glance visualization of server health through the System Management Homepage and via additional Web-based management applications for areas such as Logical Volume Management, file systems, users, groups, networking, security, and eventually printers, plotters, and trusted systems. Web-based tools provide the ability to color-code health elements and provide graphs (e.g., bar graphs or pie charts) of resource utilization. Additional enhancements are planned for Partition Manager, which provides a rich, graphical representation of all cell-based resources and their relationships.

Finally, enhancements to the HP-UX 11i Operating Environment itself are planned to support more online maintenance so that administration tasks will not interrupt services.

HP-UX 11i currently has solutions for patch management, security lock-down capabilities, and install-time security capabilities. Other system-management tool enhancements are planned that will extend HP-UX 11i's security management capabilities to include management of security-related product updates. Beyond these capabilities, future releases of HP-UX 11i are also planned to support the following enhancements:

- **Increased deployment flexibility**—In future releases of HP-UX 11i, HP plans to simplify and automate the deployment of operating systems and software, including the increasingly modular HP-UX 11i Operating Environment bundles. HP also plans deployment enhancements that will support finer-grained software selections and updates while reducing unplanned downtime.
- **Greater integration with multiple-system-management environments**—Future enhancements to HP-UX 11i are planned to enable simultaneous script execution across a group of systems as well as multi-system installation and analysis.

As HP-UX 11i continues to evolve over the long term, additional management capabilities will be added to streamline administrative functions, employing an increasing level of intelligence and automation to boost administrator efficiency and reduce the cost of managing IT.

Investing in the future

An investment in HP-UX 11i is an investment in the future of enterprise computing, enabling the Adaptive Enterprise. With decades of experience, technology innovations, and global resources, HP is well positioned to extend the leadership of HP-UX 11i for decades to come. HP is committed to innovation that delivers the highest customer value for mission-critical business requirements.

With an unwavering focus on meeting customer needs, HP recognizes that to provide the highest return on investment, HP-UX 11i must operate as part of a broad ecosystem of applications and middleware within a standards-based heterogeneous environment. That's why compatibility with Linux is built into HP-UX 11i. In fact, by integrating the entire Linux library into HP-UX 11i, HP provides enterprises with the ability to develop on Linux and deploy on HP-UX 11i—and, what's more, to add Linux within the same server and IT environment as HP-UX 11i without any changes. As the operating environment continues to evolve, HP will continue to strengthen the affinity between HP-UX 11i and Linux in future releases, providing more flexible computing options that increase total value.

In addition, HP is continually building strong relationships with best-of-breed partners, testing and supporting HP-UX 11i with a wide range of applications and open standards-based tools. As we look to the future, HP will also provide expanded integration and support of open source software on HP-UX 11i to extend its multi-OS compatibility and make system administration still more efficient.

Another added value of working with a global leader like HP is that we provide reference architectures and verified configurations for HP-UX 11i, and we will continue to offer solutions that simplify installation and testing. HP customers can also take advantage of our global solution centers to test customized applications prior to deployment.

From every perspective, HP is focused on making HP-UX 11i the operating system of choice for mission-critical applications—today and in the future—by providing our customers with top business value and superior return on investment.

Conclusion

With its leadership in virtualization, high availability, performance and scalability, security, and intelligent management, HP-UX 11i is the proven foundation for the Adaptive Enterprise. And HP innovation will continue to strengthen this position.

Our long-term vision is to continue enhancing HP-UX 11i through waves of technology that will provide more integrated virtualization and scalability across the enterprise, while simplifying the management of large, virtualized environments. Ultimately, HP-UX 11i will incorporate the features and capabilities to enable full utility computing, with automated intelligence and enhanced self-healing that can be managed from end to end through a single global view.

By enabling greater virtualization throughout the data center and by building additional intelligence, automation, and self-healing into HP-UX 11i, HP will deliver on the full promise of the Adaptive Enterprise—providing an environment that strategically aligns IT with the dynamic requirements of the business. HP has the breadth of capabilities and technology assets to make the Adaptive Enterprise a reality, offering the industry's most complete and compelling solutions built on HP-UX 11i, including servers, storage, networking, clients, services, and strategic partnerships.

It is a formula for delivering strong business value today—and well into the future.

For additional information on HP-UX 11i, please contact your HP representative or reseller today, or visit: www.hp.com/go/hpux11irocks/

To learn more, visit www.hp.com

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