

HP-UX 11i Roadmap Optimization:

Strengthening Virtualization Solutions by Unifying Clustering and Virtualization Management Environment



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Overview

Businesses are dynamic – they must respond constantly to market challenges and maximize opportunities as they arise. At the same time, there is constant pressure to reduce costs and increase operational efficiency. Today's computing environment is too complex to be easily managed and responsive to change, and requires the ability to manage, integrate and utilize different resources from different platforms and operating systems. Customers have requested standardized methodologies to help them more readily manage their dynamic computing resources and applications.

The Adaptive Enterprise is HP's vision of an organization where business and IT are synchronized to capitalize on change. An Adaptive Enterprise with integrated and shared computing resources reduces operational costs by simplifying management tasks and optimizing resource utilization. An essential step to become an Adaptive Enterprise is to virtualize your IT resources. Virtualization is an approach to IT that pools and shares your IT resources to optimize utilization and match supply to demand automatically.

According to IDC, 49% of companies are likely to implement a virtualization project in the next 12 months.¹ By 2008, according to Gartner, enterprises that do not leverage virtualization technologies will spend 25% more annually for hardware, software, labor and space for Intel servers and 15% more for RISC servers.²

Through virtualization, "scale-up" and "scale-out" environments can be used together and be optimized as part of a shared resource pool that spans servers and storage resources. Therefore, to deliver this capability sooner to our UNIX customers, HP has accelerated its HP-UX 11i roadmap to unify the clustering and virtualization management environment. HP is accomplishing this by:

1. Strengthening the HP Virtual Server Environment with common management for scale-up and scale-out
2. Delivering cluster file system and enhanced file system capabilities sooner on HP-UX 11i v2 via an enhanced partnership with VERITAS
 - Replacing the integration of Advanced File System (AdvFS) and TruCluster in the HP-UX 11i roadmap with the integration of VERITAS Storage Foundation technologies into HP-UX 11i and Serviceguard
3. Providing easy upgrades to these new technologies for HP-UX 11i customers through file system and Serviceguard continuity

This document is organized into the following sections:

1. HP Virtual Server Environment (VSE)
2. HP-UX 11i File Systems and Volume Management
3. Serviceguard Integrated with VERITAS Storage Foundation Including a Cluster File System
4. Oracle Database Applications and Serviceguard Clusters
5. Conclusions

¹ IDC's 2003 Black Book

² Gartner, "Predicts 2004: Server Virtualization Evolves Rapidly" by Tom Bittman, November 14, 2003

1. HP Virtual Server Environment (VSE)

HP has always recognized the importance of scale-up and scale-out environments. Both environments address key demands in the IT infrastructure, and the choice is typically driven through the specific application structure and application workload. As such, HP has invested in delivering both environments to our customers. Through virtualization (an approach to IT that pools and shares your IT resources to optimize utilization), scale-up and scale-out environments can be used together, be optimized as part of a shared resource pool that spans servers and storage resources, and managed under common management as part of HP's virtualization offering.

HP Virtual Server Environment (VSE), an integrated solution for both HP 9000 and HP Integrity server platforms, allows enterprises to achieve a greater return on their IT investments by optimizing server resource utilization on a real-time basis according to business priorities. Within a VSE, virtual servers automatically grow and shrink based on the service-level objectives (SLOs) set for each application they host. The design goal for HP VSE is to:

- Double resource utilization by dynamically allocating resources
- Maintain continuous service levels by combining simple policy management and high availability
- Pay only for what you use by integrating with HP's utility pricing portfolio

Today's focus for VSE is to optimize utilization in a scale-up environment, for example, by dynamically moving resources from one partition to another. Today, VSE supports scale-out capability mainly from a high availability perspective – whenever an application is re-directed by Serviceguard to another system or partition, resources are automatically adjusted in accordance with the business priorities and SLOs of all the applications running at that time on that system or partition.

HP's goal is to offer common management for scale-up and scale-out capabilities – to manage all virtualized resources in the same way, whether they are partitions, nodes in a cluster, or multiple clusters. These improvements will be integrated with HP Systems Insight Manager and related plug-ins to deliver one unified multi-OS platform management solution.

HP will deliver a single virtual view (SVV) functionality to increase ease of management and visualization. This virtual view is applicable to Serviceguard high availability clusters, Cluster File System or High Performance Technical Computing environments, as well as any group(s) of servers or partitions (hard partitions, virtual partitions, virtual machines, resource partitions). HP's single virtual view includes the following new functionality for cluster management:

- Auto synchronization
- Flexible simultaneous task execution across nodes in a cluster
- Centralized cluster management
- Auto-discovery of Single Points of Failure

These new cluster management capabilities integrate into the System Management Homepage (next generation System Administration Manager (SAM)), HP's out-of-the-box system management solution.

In addition, these new capabilities integrate into HP System Insight Manager (SIM) to support multiple clusters through the same management solution, allowing multiple groupings and variable levels of synchronization. This functionality is planned for both HP-UX 11i and Linux.

In addition to the new cluster management capabilities, single virtual view (SVV) will contain enhancements to visualization and configuration. System administrators can see pictures of their physical complexes, as well as how partitioning and clustering technologies are used within and across complexes. System administrators are able to easily view the relationships between workloads and resources. This management ease is obtained by having a single tool to visualize the complete virtual server environment, configure the various VSE technologies and set SLOs for the applications.

Single virtual view (SVV) functionality is being designed into existing management tools for the HP Virtual Server Environment (VSE). This ensures a common look and feel as well as data sharing for seamless integration. This functionality will be part of the following tools: Serviceguard Manager, System Management Homepage and next generation Partition Manager. It complements server deployment tools such as Ignite-UX and Software Distributor (SD-UX). These tools are all integrated into HP Systems Insight Manager, letting customers take advantage of this functionality and employ HP SIM as the central point of administration for complete resource life-cycle management. In addition, HP will ensure consistent tools across HP-UX 11i and Linux, where applicable. For example, Serviceguard Manager, System Management Homepage (including key management applications like HP's new Disk and File System management utility, fsweb), and HP SIM will be the same tools across HP-UX 11i and Linux, providing consistency and ease of use.

System Management Homepage is the next generation SAM product that supports the out-of-the-box system management applications. SM Homepage will provide a web-based GUI and tighter integration of existing SAM functionality and event management capabilities. Most system management applications that integrate into the SM Homepage support a single OS image, cluster or complex. The SM Homepage framework is the same across HP-UX 11i, Microsoft Windows Server, and Linux, enabling the same system management application to support multiple operating systems. All system management applications available from the SM Homepage are also integrated into HP SIM. Some key features of SM Homepage and the new suite of web-based system management applications include:

- Command preview
- Status information for all system components (including the cluster)
- Integration between events and system configuration applications
- Greatly improved start-up and screen-to-screen performance

For HP-UX 11i v2 customers will have both SAM (currently available on v2) and System Management Homepage along with web-based system management applications such as pdweb (peripheral and device management) and kcweb (kernel configuration management).

Single virtual view management enhancements for HP-UX 11i v2:

1. **Auto-synchronization:** Currently HP SIM provides a basic snapshot comparison capability in which the user can compare basic configuration information among multiple servers. SVV complements HP SIM's inventory capabilities by providing a configuration file management utility with the following features:
 - Compare the content of an HP recommended set of files across nodes and flag differences
 - Execute comparisons at regular intervals via the UNIX scheduler
 - Resynchronize the server configuration by pushing a new file, merging in changed content or executing commands/scripts to modify the configuration automatically
 - Provide extensibility so system administrators can specify additional files for comparison
 - Execute synchronized operations on a down node when the node reboots
 - Report file differences or errors to the system administrator

There are specific instances (like LDAP for user definition/attribute consistency) where auto-synchronization capabilities already exist. This feature will complement existing capabilities by handling additional types of configuration information.

2. Flexible simultaneous task execution across nodes in a cluster: One of the cluster management challenges is ensuring that tasks are executed across all members of the cluster (even when some of the members are down for preventative maintenance). HP SIM provides a distributed task facility for executing tasks across multiple systems from a central management server. SVV will enhance HP's solution by providing system administrators the ability to:

- Execute tasks from any cluster member to all cluster member nodes
- Execute tasks on a down node when the node reboots
- Use a command line interface (CLI) and/or web-based GUI – available on all systems and from SIM

3. Centralized cluster management:

Cluster log viewer: One of the existing complexities in cluster management involves trying to view and manually “consolidate” the contents of member-specific log files. The cluster log viewer provides both log file consolidation and log file viewing capabilities. Key log files supported include syslog and Serviceguard package logs. Both a web-based GUI and CLI will be provided.

4. Visualization

System administrators can better visualize the physical and virtual resources in their environment:

- Expanded inventory and health information
- Relationships of resources (clusters, partitions, and workloads)

5. Auto-discovery of single points of failure:

Single virtual view includes a utility for analyzing a cluster or group of systems for single points of failure. Key checks supported include fans/power supplies, high availability connectivity of I/O, failover capabilities and other high availability attributes.

Single virtual view management enhancements for HP-UX 11i v3:

Centralized cluster management - fsweb:

This new application replaces the SAM Disk and File Systems functional area. Like the SAM Disk and File Systems area, fsweb provides the ability to view and configure the various disks and file systems including Logical Volume Manager (LVM) configuration. Some key features of fsweb include:

- Improved visualization of file system status
- Improved visualization of LVM components (LV/VG relationships and cluster usage)
- Access to disk array configuration tools
- Improved disk and file system commands, particularly for tracking disk usage
- More device and file system information
- Launch VxVM and VxFS management tools
- Improved LVM cluster configuration capabilities in a Serviceguard environment

For more information on the HP Virtual Server Environment for HP-UX 11i, visit:

<http://www.hp.com/go/vse>

If you would like to learn more about Virtualizing IT in an Adaptive Enterprise, visit:

<http://h71028.www7.hp.com/enterprise/cache/8886-0-0-225-121.aspx>

For information about HP Systems Management, including products like HP SIM, visit:

<http://h71028.www7.hp.com/enterprise/cache/4225-0-0-0-121.aspx>

2. HP-UX 11i File Systems and Volume Management

2.1. File Systems

The recent changes to the HP-UX 11i roadmap described above will not change the file system strategy for existing standalone HP-UX 11i customers. Although AdvFS is no longer on the roadmap, the majority of the functionality that AdvFS was planned to provide in HP-UX 11i v3 exists in the VERITAS File System™ V4 (VxFS), which will be available to HP-UX 11i customers in Q2CY2005. Both file systems are based on 64-bit architectures and offer scalability, stability, journaling, direct I/O, online resizing, de-fragmentation and multi-volume file systems as well as many other industry leading capabilities. VxFS V4 also offers additional functionality that makes it the superior choice for enterprise customers. These features include Data Management API (DMAPI) support, small file performance, and heterogeneous platform support. Currently HP-UX 11i v2 update 2 provides customers with 32 TB support in OnlineJFS. If customers were planning on taking advantage of the larger file system and file sizes offered by AdvFS, they will want to consider the option of purchasing one of the integrated VERITAS Storage Foundation V4 bundles. These packages provide additional functionality beyond the base VERITAS File System and VERITAS Volume Manager components that are delivered with the HP-UX 11i operating system, including the ability to create file systems larger than 32TB, file change logging, Cross Platform Data Sharing (CDS), Quality of Storage Service, and Storage Checkpoints.

You can continue to use HP JFS (VxFS free subset), the default file system for HP-UX 11i environments that is included with the HP-UX 11i Foundation Operating Environment (OE), and OnlineJFS included in the Enterprise and Mission Critical Operating Environments. OnlineJFS provides additional availability features such as online resizing, online backups, and online de-fragmentation, and is functionally equivalent to the full VERITAS VxFS product.

HP will continue to provide on-going file system enhancements and adopt future releases of the VERITAS File System™. The current release of JFS is based on VxFS 3.5 (disk layout version 5). The V4 release of VxFS (disk layout version 6) provides additional enhancements that make it functionally equivalent to the AdvFS version that was planned to be provided with HP-UX 11i v3. HP-UX 11i customers will retain an easy upgrade path to VxFS V4 and future V4 releases as they become available. Changes to V4 will not impact customer data as VERITAS VxFS V4 supports disk layout versions 4, 5 and 6, providing the flexibility to customers to not have to upgrade specific file systems immediately. When a customer chooses to change the format of a VxFS 3.3 (disk layout version 4) or VxFS 3.5 file system to a VxFS V4 file system to take advantage of the new functionality, VERITAS supplies the *vxupgrade* utility to perform the upgrade quickly and easily. If there is sufficient free space available, a file system may remain online during the conversion process. In cases where there is not enough free space for a file system targeted for conversion, an offline process will be required. For VxFS V4, file system conversion from disk layout versions 1, 2 and 3 must be performed via offline upgrade only.

The following lists the capabilities of file system products that are available on HP-UX 11i:

- a) JFS (Journaled File System): The base VxFS kit journaling file system from VERITAS bundled in the Foundation Operating Environment of HP-UX 11i; also known as the VxFS free subset. It can support Asynchronous I/O via the POSIX AIO facility, but does not support Direct IO, or Oracle Asynchronous I/O. To learn more about JFS and how it can be tuned for your environment today, please refer to:

http://docs.hp.com/hpux/onlinedocs/5576/JFS_Tuning.pdf

- b) OnlineJFS (Online Journaled File System): The enhanced journaled file system provided with the HP-UX 11i Enterprise and Mission Critical Operating Environments, also known as the Full VxFS (VERITAS File System). OnlineJFS can also be added by ordering it as an optional HP Product. It supports POSIX AIO, Direct I/O through extended mount options, but not Oracle Asynchronous I/O (planned in the future). It may be used to house database data files, but supports only Synchronous I/O. VERITAS offers I/O acceleration and database tools as components of their *VERITAS Storage Foundation for Database V4* bundles which support Direct I/O and also utilize

kernel asynchronous I/O to avoid kernel write locks and enhance performance. These offerings will be integrated with Serviceguard and delivered in Q3CY2005 as part of the new agreement with VERITAS. (See Table 2) For more information on OnlineJFS, visit:

<http://www.hp.com/products1/unix/operating/onlinejfs.pdf>

- c) VERITAS CFS (VERITAS Cluster File System): VERITAS CFS provides for file system sharing across clustered nodes and is functionally comparable to that of Tru64 UNIX CFS. VERITAS CFS can support shared file system access across cluster members if they are mounted globally. VERITAS CFS capabilities are primarily different from those of Tru64 UNIX CFS in that it does not provide a shared root (/) file system, but does have other application capabilities, like direct access cached read/write operations, byte-range locking granularity and DMAPI support. This functionality will be integrated with Serviceguard in the following options – *Serviceguard extension for RAC integrated with VERITAS Storage Foundation for Oracle RAC V4, Serviceguard integrated with VERITAS Storage Foundation V4, Serviceguard integrated with VERITAS Storage Foundation for Oracle V4, and Serviceguard integrated with VERITAS Storage Foundation for CFS V4.*

The initial release of HP-UX 11i v2 officially supported file system sizes up to 8 TB and file sizes up to 2 TB. With HP-UX 11i v2 Update 2 (also called the September 2004 release), file system sizes have been tested up to 32 TB. When VxFS V4 is integrated into 11i v2, files will be supported up to 16 TB and file systems will go beyond 32 TB. For more information on the HP-UX 11i v2 Update 2, visit:

<http://www.hp.com/go/hpux11irocks>

2.2. Volume Management

Volume management plans for HP-UX 11i users will not be impacted by the updated roadmap and new direction HP is taking. HP will continue to support all of the volume managers that are currently supported: LVM, SLVM, VxVM and VERITAS CVM. Customers can choose any of these volume managers in their HP-UX 11i environment depending on their high availability needs.

For reference, the following lists the capabilities of these volume management products that are available on HP-UX 11i:

- a) VERITAS VxVM (VERITAS Volume Manager): A storage management software sub-system that provides capabilities for configuring physical disk storage as logical volumes for use on an individual node. Base VxVM is bundled into HP-UX 11i, and can be upgraded to the full version of VxVM with a simple license key upgrade which is ordered as an optional product from HP. VxVM provides additional functionality, especially in the area of online configuration capability, over and above the base HP LVM product bundled with HP-UX 11i. On HP-UX 11i, VxVM is used in conjunction with the VxFS file system and now has the ability to manage boot disks for HP-UX 11i releases, removing the need to use LVM if customers desire to standardize on VERITAS products throughout their enterprise. VxVM can be used in non-clustered environments as well as with Serviceguard. For information on the VERITAS Volume Manager, please refer to the release notes:

<http://docs.hp.com/hpux/onlinedocs/5187-1373/5187-1373.html>

- b) HP LVM (Logical Volume Manager): LVM, HP's default volume manager, along with MirrorDisk/UX, will continue to be available under HP-UX 11i and is not impacted by this decision. HP will continue to enhance LVM capabilities and integrate it into various management tools for HP-UX 11i. LVM can be used for non-clustered environments as well as with Serviceguard. When Serviceguard is installed on the system, several LVM features are enabled such as exclusive volume group activation. There are no plans at this time to integrate LVM with the VERITAS Cluster File System. For more information on HP's LVM, please refer to:

<http://docs.hp.com/hpux/onlinedocs/B2355-60103/00/42/4255-con.html>

- c) HP SLVM (Shared Logical Volume Manager): SLVM is enabled during the installation of the Serviceguard Extension for RAC (SGeRAC) product and provides concurrent read/write access from multiple nodes in the cluster. This feature is used only for Oracle's RAC product, and works on raw LVM-managed logical volumes only. There are no plans to integrate SLVM with the VERITAS Cluster File System.
- d) VERITAS Cluster Volume Manager (CVM): VERITAS CVM is an extension to VERITAS Volume Manager (VxVM) and provides concurrent read/write access from multiple nodes in the cluster. This feature is used with Oracle's RAC product and user-written applications that are written to coordinate the concurrent reads and writes. VERITAS CVM is typically used with SGeRAC for Oracle RAC environments. Those customers who wish to implement a cluster file system instead of using raw logical volumes must use VERITAS CVM together with VERITAS CFS (see the next section). The Base VERITAS CVM version comes with the Mission Critical OE. The Full VERITAS CVM version can be purchased from HP as an optional product. The full version of VERITAS CVM requires the full version of VxVM.

3. Serviceguard Integrated with VERITAS Storage Foundation Including a Cluster File System

The VERITAS Storage Foundation products including a Cluster File System is the foundation technology for the HP-UX 11i cluster file system supporting both commercial and technical market requirements, and replacing TruCluster CFS in the HP-UX 11i roadmap. In Q3CY2005, HP will integrate the VERITAS Storage Foundation products including a cluster file system with Serviceguard.

Serviceguard is integrated today with all of the VERITAS Foundation technologies (VxVM, VxFS and VERITAS CVM) except for VERITAS CFS. Once VERITAS CFS is integrated with Serviceguard (Q3CY2005) it will become the high availability cluster solution of choice for customers who desire a cluster file system. The new integrated product bundle, known as *Serviceguard integrated with VERITAS Storage Foundation for CFS V4*, will allow globally mounted user files and applications to be accessible to all cluster members. This is also good news to current HP-UX 11i customers, as they will have no need to plan to convert file systems to AdvFS in order to take advantage of an integrated Serviceguard cluster file system solution. For information about Serviceguard HA and DT solutions for HP-UX 11i and Linux, visit:

<http://h71028.www7.hp.com/enterprise/cache/6469-0-0-225-121.aspx>

Table 1 -- High availability option plans for HP-UX:

Cluster Software	HP Serviceguard	HP Serviceguard	HP Serviceguard
Bundle		Integrated with VERITAS Storage Foundation V4	Integrated with VERITAS Storage Foundation for CFS V4
File System	Raw or OnlineJFS (VxFS)	VxFS	VERITAS CFS
Volume Manager	LVM or VxVM	VxVM	VERITAS CVM
High Availability - Failover (Single instance application on one node, with failover capability)			
a) Physically shared connection to storage device with no concurrent shared I/O access	Available today HP 9000 PA-RISC & Integrity	Works today on HP 9000 & HP Integrity. New bundle will be available in Q3CY2005 HP 9000 PA-RISC & Integrity	
b) Application and File System data simultaneously shared between nodes			Q3CY2005 HP 9000 PA-RISC & Integrity

Note: Bundle names subject to change

4. Oracle Database Applications and Serviceguard Clusters

Customers running Oracle database applications on either HP 9000 or HP Integrity will benefit from the changes in the HP-UX 11i roadmap recently announced. HP will still be providing a cluster file system for HP-UX 11i. However it will now be available one year sooner than originally planned and be based on the VERITAS Cluster File System™. Serviceguard is already tightly integrated with all of the other components of the standard VERITAS Storage Foundation suite and now HP is working on Serviceguard integration with the VERITAS CFS product as well. HP plans to deliver this technology in Q3CY2005 in the form of two new, enhanced integrated product bundles for Oracle: *Serviceguard integrated with VERITAS Storage Foundation for Oracle V4*, and *Serviceguard Extension for RAC integrated with VERITAS Storage Foundation for Oracle RAC V4*, which may be used for global file access across cluster members for all file systems except the root file system. HP recommends this solution for customers who need a cluster file system for use with Oracle applications, deployed on flexible, highly available clustering solutions.

4.1. Oracle Single-Instance (standalone)

For I/O intensive applications that must reside on file systems, customers can currently use the VERITAS Database Edition for Oracle product running under HP-UX 11i on HP 9000 servers. This product is an enhanced integration of the VxFS file system and related add-on products that provide improved I/O performance and management for Oracle database data files. It supports both Direct I/O and Oracle Asynchronous I/O, in the form of a Quick I/O file component. Designed and developed for Oracle database file system use on a single node, it is currently only available on HP-UX 11i v1 HP 9000 (PA-RISC) systems. However, it will become available on HP Integrity servers in Q3CY2005 as a new, enhanced integrated product bundle, *Serviceguard integrated with VERITAS Storage Foundation for Oracle V4*. The Serviceguard component of the bundle does not have to be used in a standalone environment. *Please refer to Table 2.*

4.2. Oracle Single-Instance with High Availability (HA)

HP-UX 11i customers who are implementing a high availability Oracle solution and need data access from only one node at a time with failover capabilities for a specific Oracle instance may design a solution using HP-UX 11i v2, OnlineJFS (VxFS) or raw devices, Serviceguard and either LVM or VxVM as a volume manager. This solution is currently available on both the HP 9000 (PA-RISC) and HP Integrity platforms today. Each node in the Serviceguard cluster may be active, running different respective Oracle instances and still act as a standby node for failover when necessary. As a future choice, the VERITAS Storage Foundation for Oracle V4 product, mentioned in the previous section, will be integrated with Serviceguard and released on both HP 9000 and HP Integrity servers in Q3CY2005 as a new product bundle, *Serviceguard integrated with VERITAS Storage Foundation for Oracle V4*. *Please refer to Table 2.*

4.3. Oracle RAC

a. Raw device-based data files

Today and in the future, customers can use Serviceguard Extension for RAC (SGeRAC) on HP Integrity Server and HP 9000 platforms and install their databases on raw device based logical volumes which may be shared concurrently across cluster nodes. Raw database I/O is efficient in that no file system buffering is required. Both synchronous and kernel asynchronous I/O modes are supported. In the case of raw devices, HP-UX 11i offers a kernel Oracle asynchronous I/O driver which may be used to optimize I/O performance. SGeRAC integrates with Oracle RAC to provide continuous application availability and protects against loss of transactions, while dramatically improving resource utilization across partitions, servers, data centers and continents.

b. Cluster file system based data files

For HP 9000 customers currently using file systems to implement Oracle RAC, HP recommends you continue with your current solution, VERITAS Database Edition/ Advanced Cluster. Serviceguard extension for RAC (SGeRAC) will be integrated with VERITAS Storage Foundation for Oracle RAC V4 for a multi-node cluster environment. It is a stack of software that includes Oracle9i RAC enhancements along with Serviceguard, Database Accelerator (quick I/O), VERITAS CFS, VxFS, CVM, VxVM and DB tools combined to create a total clustering solution for Oracle9i RAC. HP plans to offer the bundle, *Serviceguard extension for RAC Integrated with VERITAS Storage Foundation for Oracle RAC V4*, providing comparable capabilities, on the Integrity Server platform in Q3CY2005. This solution bundle will provide simplified cluster file system technology and integrated single system view management using the VERITAS Cluster File System component rather than the AdvFS product. *Please refer to Table 2.*

This will be the best choice for Oracle RAC customers desiring a range of highly available, disaster tolerant clustering solutions based on a cluster file system. Additional enhancements to Serviceguard are planned in the areas of failover, management, virtualization integration and disaster tolerance, for availability on HP Integrity and HP 9000 servers in Q3CY2005.

Table 2 -- Database and clustering option plans for HP-UX platforms.

Cluster Software	HP Serviceguard	HP Serviceguard	HP Serviceguard Extensions for RAC (SGeRAC)	HP Serviceguard Extensions for RAC (SGeRAC)
Bundle		Integrated with VERITAS Storage Foundation for Oracle V4		Integrated with VERITAS Storage Foundation for Oracle RAC V4
File System	Raw or OnlineJFS (VxFS)	VxFS	Raw Devices	VERITAS CFS
Volume Manager	LVM or VxVM	VxVM	SLVM or VxVM	VERITAS CVM
High Availability Failover (Single instance application on one node, with failover capability)				
Physically shared connection to storage device with no concurrent shared I/O access	Available Today HP 9000 PA-RISC & Integrity	New bundle including I/O Accelerators and DB tools will be available in Q3CY2005 HP 9000 PA-RISC & Integrity		
Applications executing concurrently on multiple nodes, including failover capability (Multi-instance application)				
a) Application data resides on raw devices and is simultaneously shared between nodes			Available Today HP 9000 PA-RISC & Integrity	
b) Application and File System data simultaneously shared between nodes				Q3CY2005 HP 9000 PA-RISC & Integrity

Note: Bundle names subject to change

5. Conclusions

HP strengthens its position as the leader in virtualization solutions and provides our customers the flexibility and agility they need to ensure their continued success in today's challenging business environment. Through virtualization, "scale-up" and "scale-out" can be used together and be optimized as part of a shared resource pool that spans server and storage resources. Therefore, to deliver this capability sooner to our UNIX customers, HP has accelerated its HP-UX 11i roadmap to unify the clustering and virtualization management environment.

Our goal is to offer common management for scale up and scale out – to manage all virtualized resources in the same way, whether they are partitions, nodes in a cluster, or multiple clusters. For HP-UX 11i customers we will offer file system continuity and support VERITAS File System™ V4 (VxFS) building on the default file system HP JFS (VxFS subset). VxFS V4 will be available to HP-UX 11i customers in Q2CY2005. For HP-UX 11i Serviceguard users we will offer VERITAS Cluster File System (CFS) integrated with Serviceguard on HP-UX 11i v2 in a number of packaged options. This means an earlier and smoother path to take advantage of CFS in a Serviceguard environment. This accelerated roadmap eases the adoption of virtualization and clustering technologies.

Appendix A: References

The following URLs are those listed in the body of this paper. They have been included here for the convenience of the reader.

- **Strengthening the HP Virtual Server Environment with scale-out capabilities under one management solution**
 - HP Virtual Server environment for HP-UX
<http://www.hp.com/go/vse>
 - Virtualizing IT in an Adaptive Enterprise
<http://h71028.www7.hp.com/enterprise/cache/8886-0-0-225-121.aspx>
 - HP System Management for HP-UX 11i
<http://h71028.www7.hp.com/enterprise/cache/4225-0-0-0-121.aspx>
- **HP-UX File Systems and Volume Management**
 - JFS Tuning and Performance
http://docs.hp.com/hpux/onlinedocs/5576/JFS_Tuning.pdf
 - OnlineJFS information
<http://www.hp.com/products1/unix/operating/onlinejfs.pdf>
 - HP-UX 11i V2 Update 2 Release
<http://www.hp.com/go/hpux11irocks>
 - VERITAS Volume Manager release notes
<http://docs.hp.com/hpux/onlinedocs/5187-1373/5187-1373.html>
 - HP's LVM
<http://docs.hp.com/hpux/onlinedocs/B2355-60103/00/42/4255-con.html>
- **Oracle Database Applications and Serviceguard Clusters**
 - Serviceguard HA and DTS solutions for HP-UX 11i and Linux
<http://h71028.www7.hp.com/enterprise/cache/6469-0-0-225-121.aspx>

For More Information

- For information on HP-UX 11i, the proven foundation for the Adaptive Enterprise
 - HP-UX 11i Operating Environment
<http://www.hp.com/products1/unix/operating/index.html>
- For training information on HP-UX 11i and VERITAS Volume Manager and File System
 - HP-UX 11i Education Program
<http://www.hp.com/education/sections/hpux.html>
 - VERITAS Volume Manager and File System Administration
<http://www.hp.com/education/courses/u4204s.html>
 - VERITAS Volume Manager for HP-UX 11i
<http://www.hp.com/education/courses/h7085s.htm>

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