

Brings the performance and reliability of mainframe virtualization to blade computing

BladeSymphony® is the first true enterprise-class blade system. It introduces Hitachi's Virtage embedded virtualization technology on Intel® Itanium® processor-based server modules, gives you the option of running Intel® Xeon® processor-based server modules, and also delivers centralized management capabilities and powerful, reliable, and scalable system resources. So you can run mission-critical applications with confidence.

VIRTAGE Virtage is the key enabling technology, bringing mainframe-class virtualization to blade computing. Leveraging Hitachi's decades of development work on mainframe virtualization technology, Virtage delivers high-performance, extremely reliable, and transparent virtualization for Intel's Itanium processor platform. It is the world's first Itanium-based embedded server virtualization feature on a highly scalable blade form factor.

Virtage is built-in and requires no separate OS layer or third-party virtualization software, so it safely shares or isolates resources among partitions without the performance hit of traditional software-only virtualization solutions. It is tuned specifically for BladeSymphony and has been extensively tested in enterprise production environments. Virtage has proven to deliver a higher level of stability, manageability, performance, throughput, and reliability than comparable virtualization technology, and it sets a new standard for on-demand infrastructure provisioning.

Virtage leverages Intel's Virtualization Technology (VT) to ensure that processor performance is optimized for the virtual environment, and to provide a stable platform that incorporates virtualization into the hardware layer.

The capabilities of Virtage, combined with Hitachi's Blade SMP interconnect capabilities (which allow multiple blades to be combined to create a single system), create a blade platform that is unsurpassed in flexibility, scalability, and expandability.



Virtage Key Features

- High CPU Performance
 - Hypervisor-type virtualization faster than hosted emulation
 - Leverages Intel VT-i to optimize processor performance
 - Tuned specifically for BladeSymphony
- High Reliability
 - Monitors I/O and memory requests
 - Blocks malfunctions and reports errors
 - Embedded hardware assist feature for Virtage
- High I/O Performance
 - Employs mainframe-style direct execution
 - Fewer "guest unique" problems
- High Compatibility
 - Minimal host intervention
 - Fewer modifications needed from ISVs/IHVs

Hitachi Virtage Embedded Virtualization: Functional Overview

Virtage can partition physical server resources by constructing multiple logical partitions (LPARs) that are isolated, and each of these environments can run independently. A different operating system (called a Guest OS) can run on each LPAR on a single physical server.

The BladeSymphony® Itanium Processor Server Blades can run in basic mode (non-virtualized), or with Virtage. The Virtage feature is embedded within the system and can be activated or de-activated based on customer needs. Each system can support multiple virtualized or non-virtualized environments based on your preferences. A single server module or SMP can be configured up to 16 LPARs at a time.

The diagram below is a visual representation of the Virtage virtualized environment. (See Figure 1.)

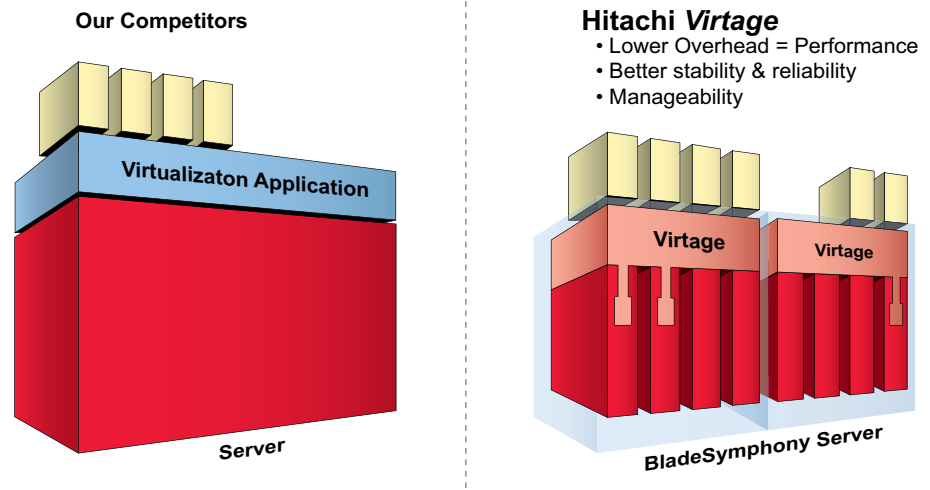
High I/O Performance

Virtage employs “direct execution,” as is used in the mainframe world, leveraging Virtage technology embedded in the Hitachi node controller. The Virtage I/O hardware assist feature passes data through the guest I/O requests with minimum modification, thus does not add an extra layer for guest I/O accesses. Users can use standard I/O device drivers as they are, so they can take advantage of the latest functionality with less overhead. The hardware assist feature simply modifies the memory addresses for the I/O requests.

Also, because BladeSymphony has physical PCI slots, I/O is assigned by the slot to any given partition. Therefore, any partition can be assigned any amount slots available to the SMP environment and each partition can be mounted with any standard PCI interface cards. Since the PCI slots are assigned to the partition, each environment can support a unique PCI interface card. (See Figure 2.)

Embedded Virtualization: A Closer Look

Figure 1



Hitachi Advantages

Security

Hitachi's exclusive chipset supporting MLPF assures security between partitions

Chipset Features

- Memory Address Offset
- Access Prevention Logic
- Event Trace Monitoring

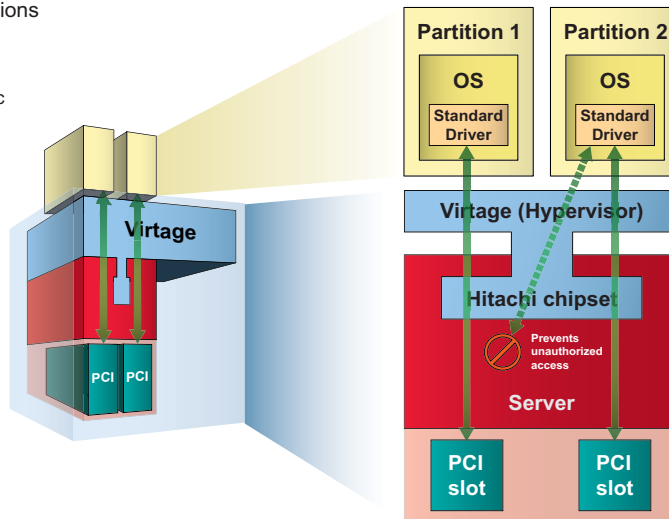


Figure 2

The system also monitors CPU utilization rates and allows processor CPU utilization changes dynamically for partitions operating in CPU shared mode.

The BladeSymphony Management Suite provides centralized system management and control of all your server, network, and storage resources.

Strong Relationship with Intel for Early Access to Enhancements

Intel and Hitachi have worked closely together to develop hardware VM assist features for a number of years. Hitachi's early development platform facilitated Intel's VT-i firmware development. The close cooperation between the two companies brings users early access to the latest hardware features in the IA64 architecture.

Fiber Channel Virtualization

Hitachi also offers Fibre Channel I/O virtualization for Virtage. This allows multiple logical partitions to access a storage device through a single Fiber Channel card, allowing fewer physical connections between server and storage and increasing the utilization rates of the storage connections. This is exclusive to the 4GB Hitachi FC card.

Shared/Virtual NIC Functions

Virtage also provides a virtual NIC (vNIC) function, which constructs a virtual network between LPARs and enables communication between LPARs without a physical NIC. There are two types of virtual NIC functions: one that only supports the communication between LPARs, which has no connection with external networks; the other is a part of the shared NIC function that realizes connection to the external physical network through the shared physical NIC.

Virtage enables multiple vNICs assigned to LPARs to share a physical NIC. This function takes full advantage of the connections between vNICs and external physical networks. The physical NIC shared between vNICs is called a shared physical NIC in the virtualization feature.

Integrated System Management

Hitachi provides secure and integrated system management capabilities to reduce the total cost of ownership (TCO) of BladeSymphony with Virtage.

Hitachi offers integrated system management functionality with Virtage virtualization. Administrators can access the integrated remote console via IP to manage and configure the virtualized environments remotely. Virtual partitions can be created, re-configured, and deleted through an integrated console screen that is remotely accessible. An integrated shell console lets users access the guest operating system directly from the console screen for ease of use.

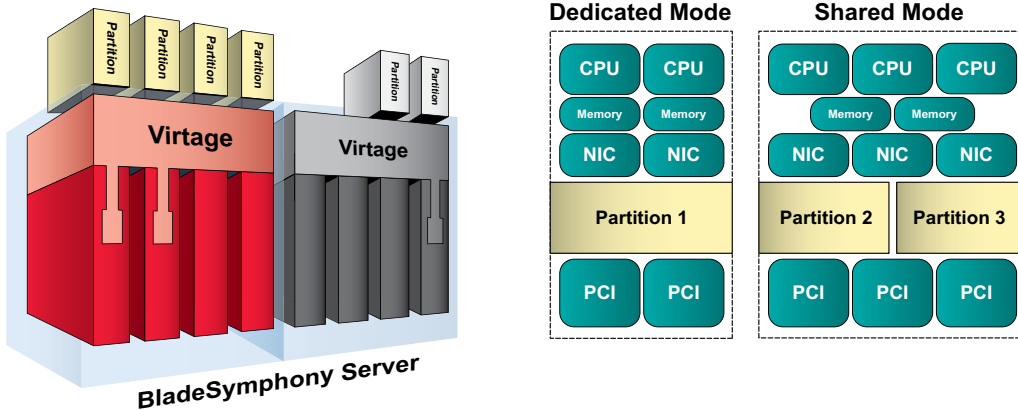
In addition, Hitachi's VM implementation is relatively simple and involves no emulation, and each host processes are isolated from other host operations. Thus new hardware features can be quickly implemented in the future.

Hitachi Advantages

Flexibility of CPU and I/O Assignment

Figure 3

Share or Isolate CPU and I/O resources to any partition in the same environment



High CPU Performance and Features

Virtage is Hypervisor-type virtualization, and therefore has a natural performance advantage over host-emulation virtualization offerings because guest operation systems can be simply and directly executed on virtualized environment without host intervention.

Virtage fully utilizes the Hypervisor mode created by leveraging Hitachi's node controller and Intel's new VT-i technology, which is embedded in the Itanium processor. Therefore, Virtage can capture any guest operation requiring host intervention with minimal performance impact to normal operations. And the host intervention code is tuned for the latest Itanium 2 hardware features, minimizing

the performance impact to guests. Virtage offers two modes in which processor resources can be distributed amongst the different logical partitions: Dedicated mode and Shared mode. Please refer to table below for details. (See Figure 3.)

Mode	Description
Dedicated mode	Individual processor cores can be assigned to a specific logical partition. Dedicating the core to an LPAR ensures that no other partition can take CPU resources away from the assigned partition. This method is highly recommended for environments that require CPU processing exclusivity such as databases or real time applications.
Shared mode	A single processor core or groups of cores can be assigned to multiple logical partitions, which in turn can share the assigned processing resources. This allows multiple partitions to share one or multiple CPU cores to increase utilization. Each partition is assigned a service rate of the processor. Another advantage is the ability to dynamically change the services ratio for any given partition. The system monitors the activity of a partition, and if one partition is idle while the other is using 100% of its share, the system will temporarily increase the service rate until CPU resources are required by the other partition.

Specifications

#	Item		Virtage
1	Supported Platform		IPF Server Module (Montecito)
2	Supported Guest Operating Systems		Red Hat Enterprise Linux 4
			SUSE Linux 10
			Windows Server 2003
3	Maximum number of logical partitions per SMP		16
4	Maximum number of logical processors ^(*) per SMP		32
5	Partition Granularity	CPU	Cores or Threads
6		Memory	256MB
7		PCI device	Slot
10	Dedicated CPU mode		Supported
11	Shared CPU mode	Variable Service Ratio	1% unit
12		CPU Performance Capping	1% unit
13	Dedicated PCI device mode		Supported
14	Shared PCI device mode	NIC	Supported
15		FC adapter	Supported
16	N+M cold standby feature (Host to Host)		Supported
17	Management Console	Virtage console (Character Screen i/f)	All functions
18		BSMS (GUI)	Basic functions
19	Hardware Assist	CPU assist	Intel VT
20		Dedicated I/O assist	Virtage H/W assist
21		Shared I/O assist	Hitachi FC-HBA
22		Hypervisor installation assist	SVP
23		RAS assist	SVP

(*1) The number of processors that is recognized by an OS in a LPAR
 On the Dual-Core Intel® Itanium® processor "Montecito," two processor cores per physical CPU socket are mounted, and each processor core can be used as two processors by HyperThread technology. Therefore, an 8-CPU-socket SMP in BladeSymphony can configure either core-based 16-way SMP or thread-based 32-way SMP in the basic mode.

For More Information

Virtage embedded virtualization technology brings the performance and reliability of mainframe-class virtualization to blade computing, enabling Hitachi to offer the world's first true enterprise-class blade server. For additional details about BladeSymphony or Virtage, visit www.bladesymphony.com or call 1-866-Hitachi.

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