COMPAQ

Compaq AlphaServer DS20 Systems

Technical Summary

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Compaq AlphaServer DS20 Systems

The Compaq AlphaServer DS20 system delivers high performance for business, technical, and scientific applications at an affordable price. As a high-capacity database server, high-performance application server, Network File System (NFS) server, or Internet server, the AlphaServer DS20 delivers exceptional value and investment protection.

The 64-bit Alpha RISC architecture, at the heart of DIGITAL AlphaServer products, and now Compaq AlphaServer products, provides fast processing and quick response for today's applications and will run the advanced applications of tomorrow. You can choose from three popular operating environments— DIGITAL UNIX®, Windows NT, and OpenVMS operating systems — as well as thousands of applications. The AlphaServer DS20 system integrates into your current operating environment and anticipates future needs with upgrade capabilities.

More information on Compaq AlphaServer DS20 systems is on the World Wide Web:

http://www.digital.com/alphaserver/products.html.

System Overview

The Compaq AlphaServer DS20 introduces the third-generation Alpha processor, the Alpha 21264, in a pedestal system that offers twice the performance of a comparable speed EV56 Alpha chip. The switch-based system interconnect exploits the full potential of the 21264 chip.

The system is available with one or two processors (500 MHz), each with a 4-MB ECC cache. The pedestal system offers up to 10 internal storage devices, including a floppy diskette drive, a CD-ROM, one additional 5.25-inch removable media device, and seven hot-swap StorageWorks wide disk drives. The system supports up to 128 GB of internal storage using 18.2 GB disks.

The AlphaServer DS20 offers the following high-reliability features: heat sensor, fan status and power supply sensors, and ECC memory. Integrated on the system board are controllers for two SCSI devices, a diskette, two serial ports, one parallel port, and the keyboard and mouse.

Three operating systems are supported: DIGITAL UNIX, OpenVMS, and Microsoft Windows NT Server. Customers can order the system that meets their present application needs; they choose the size of the system disk, two SCSI channels, and an ethernet adapter. Systems can also be configured in a choice of two cabinet enclosures: a 67-inch or 79-inch M-series cabinet.

Features and Benefits

- **Leadership 64-Bit Architecture**

The Alpha 64-bit architecture was introduced with the Alpha 21064 chip in 1992 and now the 21264, builds upon that proven architecture.

- **Performance**

The Alpha 21264 chip when combined with a switch-based interconnect demonstrates its full potential. This switch-based system provides a memory bandwidth of up to 5.2 Gbytes/sec (peak) using two 256-bit memory buses running at 83 MHz.

- **Outstanding Value**

The world's fastest microprocessor is now offered in a low-end server. Use it to validate the performance that can be achieved with the new Alpha 21264.

- **Reliability and Availability**

The AlphaServer DS20 uses the latest technologies to achieve redundancy, error correction, and fault management. The balance between simple error detection and error correction provides high availability at low cost.

Architecture

Driving the design for this system was the objective to maximize the potential of the Alpha 21264 chip. Rather than implementing the traditional bus interconnect, the system designers moved to a switch-based interconnect system. With a bus design, the processors, memory, and I/O modules must share the bus. As the number of bus users increases, the bandwidth is used up. However, with a switch-based system there is no degradation in performance as the number of CPUs, memory, and I/O users increase. Although the users increase, the speed is maintained.

With a switch-based, or point-to-point interconnect, the performance remains constant, even though the number of transactions multiplies. The switched system bus is made possible through the use of a set of complex chips that route the traffic over multiple paths. The chipset consists of one C-chip, two P-chips, and eight D-chips.

- **C-chip.** Provides the interface from the CPUs and main memory. Although there is only one in the system, it allows each CPU to do transactions simultaneously.
- **D-chips.** Provide the data path for the CPUs, main memory, and I/O.
- **P-chips.** Provide the interface to two independent 64-bit PCI buses.

The DS20 system supports up to two CPUs and up to 4 Gbytes memory in 16 DIMM slots. Each memory option contains four DIMMs, so each bank has four DIMMs.

Two 256-bit memory buses support four memory arrays. Transactions are ECC protected. Upon the receipt of data, the receiver checks for data integrity and corrects any errors. Commands and addresses are parity protected.

The system bandwidth is 5.2 Gbytes/sec.

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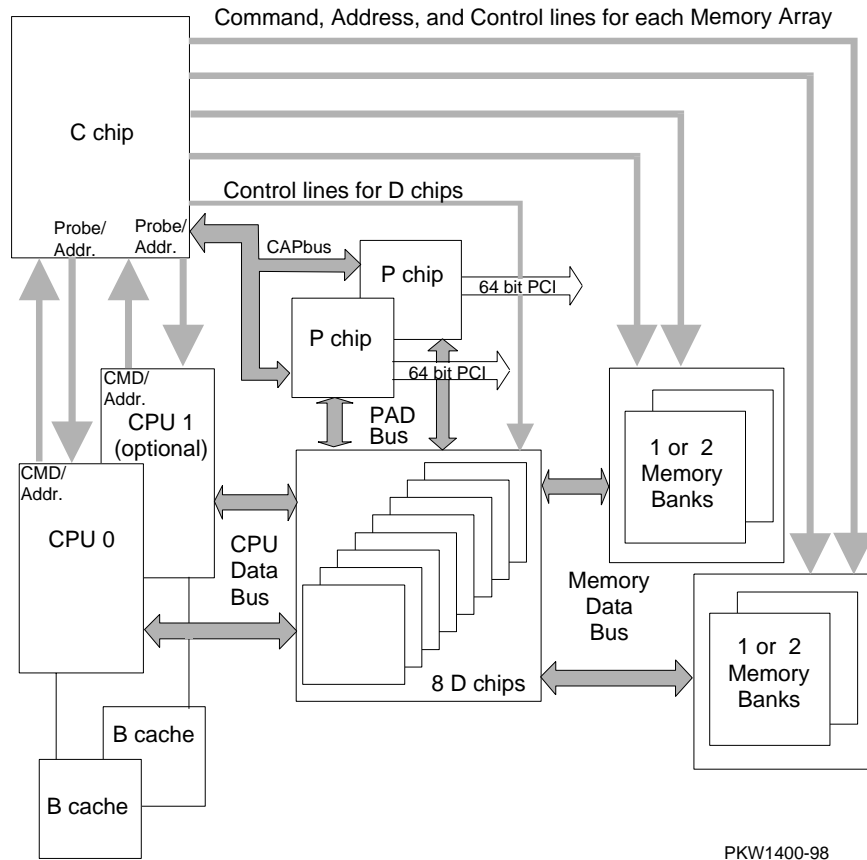
System Block Diagram

System Board

The interconnect switch is implemented on the system board by the chipset consisting of one C-chip, two P-chips, and eight D-chips. This complex chipset provides the data and address path between the CPUs, memory, and the I/O subsystem.

A flash ROM holds the AlphaBIOS console code, the SRM console code, and the NVRAM data.

Integrated into the system board are controllers for the floppy diskette, two serial ports, one parallel port, and keyboard and mouse.

Connectors are provided for the following:
2 CPU modules
16 DIMM memory modules
6 PCI devices
1 ISA device
1 floppy diskette drive
I/O panel for parallel port, COM1 and COM2 ports, keyboard and mouse
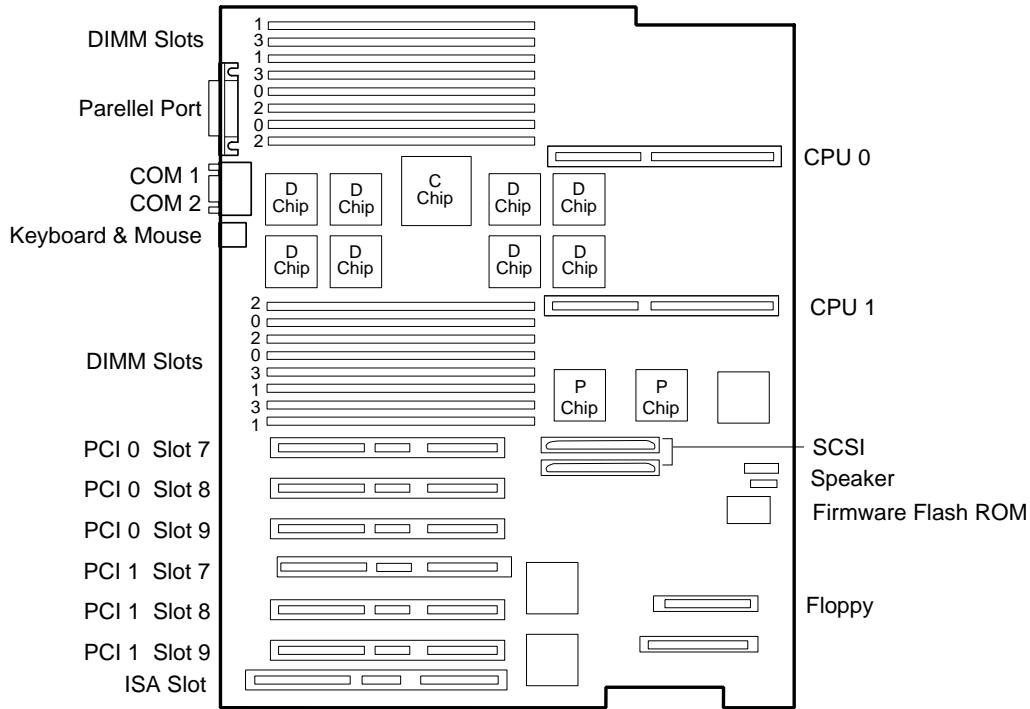
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Component and Connector Locations

Third-Generation Alpha Chip

The Alpha 21264 microprocessor (EV6) is a superscalar superpipelined implementation of the Alpha architecture. The Alpha 21264 chips are manufactured using state of the art CMOS-6 process, using a feature size of 0.35 micron. Over 15.2 million transistors are on one die.

Designed for performance, the 21264 achieves this goal by carefully studied and simulated architectural and circuit analysis. The 21264 memory system also enables the high performance levels. On-chip and off-chip caches provide for very low latency data access, which allows for very high bandwidth data access. The large, off-chip cache—4 MB— runs at 200 MHz.

Internal to each chip is a 64-Kbyte instruction cache (I-cache) and a 64-Kbyte data cache (D-cache).
- **I-cache.** 64 Kbytes, two-way set-associative, virtually addressed cache with 64-byte blocks
- **D-cache.** 64 Kbytes, two-way set-associative, virtually indexed, physically tagged, writeback cache with 64-byte blocks

Chip Operation
Several key design choices were made in the EV6 architecture to maximize performance: Four instructions are fetched each cycle, and then how those instructions are handled boosts the speed of execution. Register renaming assigns a unique storage location with each write reference to a register, avoiding register dependencies that can be a potential bottleneck to processor performance.

Out-of-order execution implies that instructions can execute in an order that is differnet from the order that the instructions are fetched. In effect, instructions execute as soon as possible. This allows for faster execution since critical path computations are started and completed as soon as possible.

In addition, the 21264 employs speculative execution to maximize performance. It speculatively fetches and executes instructions even though it may not know immediately whether the instruction will be on the final execution path. This is particularly useful, for instance, when the 21264 predicts branch directions and speculatively executes down the predicted path. The sophisticated branch prediction in the 21264 coupled with the speculative and dynamic execution extracts the most instruction parallelism from applications.

For more information about the chip, see: http://www.compaq.com/alphaserver/technology/ev6chip.pdf.

Alpha 21264 Features
- Out-of-order instruction execution
- Large (64 Kbyte) on-chip data and instruction caches
- Improved branch prediction through intuitive execution
- Register renaming
- Increased bandwidth for high-speed access to second-level cache and system memory
- Motion video instructions
- Square root and divide instructions
- All instructions are 32 bits long and have a regular instruction format
- Floating-point unit, supports DIGITAL and IEEE floating-point data types
- 80 integer registers, 64 bits wide
- 72 floating-point registers, 64 bits wide

Processor Module

An AlphaServer DS20 can have one or two CPU modules. In addition to the Alpha 21264 chip, the CPU module has a 4-Mbyte second-level cache and a 2.2V DC to DC converter with heatsink that provides the required voltage to the Alpha chip. Power-up diagnostics are in a flash ROM on the module.

Cooling of the microprocessor chip is provided by a fan on the chip heatsink, as shown here.
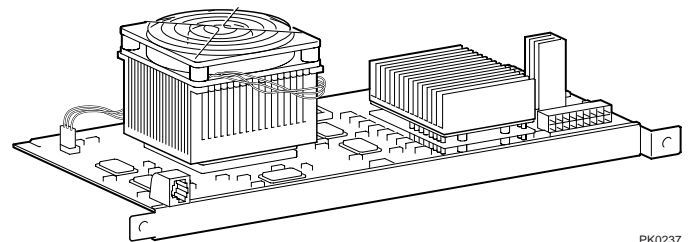
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Processor Configuration Rules
The first CPU module is installed in CPU slot 0. The second CPU is installed in CPU slot 1.

Memory

The switch interconnect can move a large amount of data over two independent memory data buses. Each memory bus is 256 bits wide (32 bytes). The memory bus speed is 83 MHz. This yields 2.67 GB/sec bandwidth per bus (32 x 83 MHz = 2.6 GB/sec). With two CPUs the bandwidth becomes 5.2 GB/sec.

Memory throughput in this system is maximized by the following features:
- Two 256-bit wide memory data buses
- Very low memory latency (120 ns) and high bandwidth with 12 ns clock
- Numerous reliability and availability features, such as ECC memory and command/address parity

Memory Options

Each memory option consists of four 200-pin DIMM modules. The DIMMs are synchronous DRAMs. Each system supports up to four memory options (16 DIMMs) for a total of 4 gigabytes of memory. The options run at a speed of 83 MHz. Memory options are supported in the following sizes:
- 128 Mbytes
- 256 Mbytes
- 512 Mbytes
- 1 Gbyte

Memory Configuration Rules

- A memory option consists of four DIMMs, and all four DIMMs must be the same size.
- Convention places the largest memory option in slots marked 0 on the system board.
- Other memory options can be the same size or smaller than the first memory option.
- Memory options must be installed in slots designated for each bank. The first bank goes into slots marked 0, the second bank into slots marked 1, and so on.

System I/O

There are two 64-bit PCI buses. Industry-standard PCI I/O buses allow you to use inexpensive, widely available I/O options. Both 32-bit and 64-bit PCI options can be used. Six slots can be used for PCI controllers, or five slots for PCI and one slot for an ISA option.

PCI Bus

The industry-standard PCI bus is the number one choice for high-performance I/O options, such as disk storage and high-performance video applications.

The PCI bus implementation has the following characteristics:
- Fully compliant with the PCI Version 2.1 Specification
- Operates at 33 MHz, delivering a peak bandwidth of 500 MB/sec; over 250 Mbytes/sec for each PCI bus
- Supports 6 option slots
- Supports peer-to-peer I/O operations
- Supports three address spaces: PCI I/O, PCI memory, and PCI configuration space
- Supports byte/word, tri-byte, and longword operations
- Exists in noncached address space only

The Adaptec 7895 chip provides the bridge from PCI to SCSI, providing two separate devices to the PCI bus. (Today only Windows NT can use the integral SCSI adapters.) Two ports that support UltraSCSI devices are offered.

ISA Bus

The ISA bus provides system support functions and the use of peripheral devices. An ISA connector is available for devices that provide functions not offered in a PCI implementation.

The Cypress SIO chip, which provides the bridge between the PCI bus and the ISA bus, incorporates the logic for the following:
- ISA interrupt controller
- Speaker driver
- Decoding and control for utility bus peripheral devices
- IDE interface

This system does not support IDE devices.

I/O Configuration Rules

A graphics adapter, if present in the system, must be installed in PCI 0.

I/O Implementation

Two separate 64-bit PCI buses are provided, each with three slots. As can be seen in the block diagram, the C-chip controls both PCI control chips.

PCI 0 offers the following:
- Slots for three PCI devices or two PCI devices and one ISA device
- Integrated control for system functions and bulkhead ports
- Integrated control for two IDE ports and a universal serial bus

PCI 1 offers three PCI slots.

At the rear of the system are connectors offering access to two serial communications ports, one parallel port, and ports for the keyboard and mouse. Two breakouts are also on the back panel.

PCI Bus 0
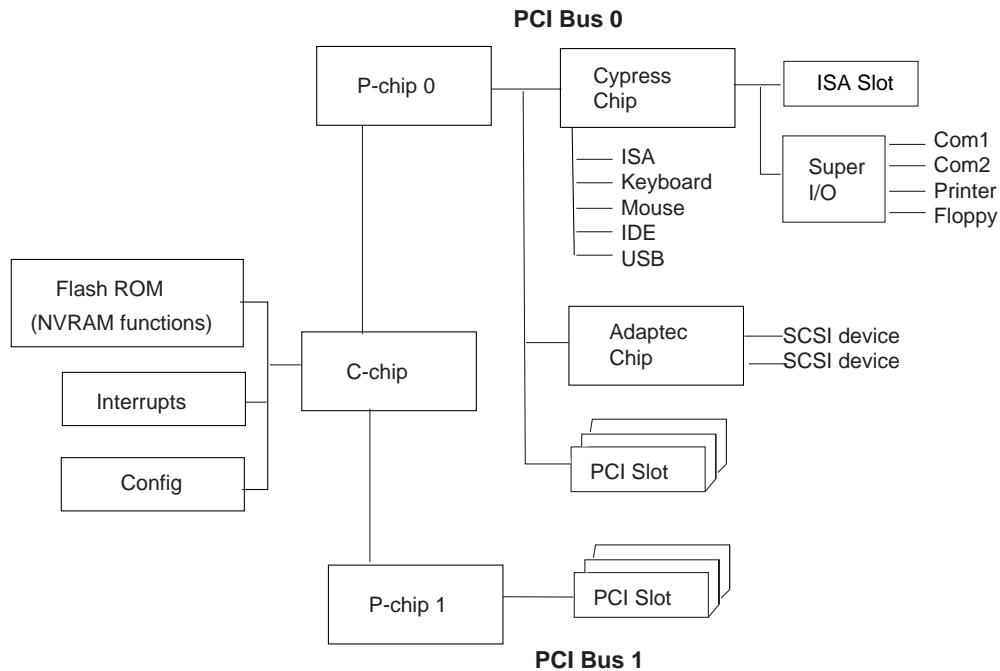
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Block Diagram of I/O Control

System Control

The server feature card is located in the compartment to the right of the system board. This module provides for the following:
- Remote server management
- Environmental monitoring
- Power system event data collection

Storage

The AlphaServer DS20 system offers up to 10 internal storage devices including a CD-ROM drive, floppy diskette drive, one additional 5.25-inch removable media device, and seven hot-swap StorageWorks disk drives. The system supports up to 128 Gbytes of internal storage (using 18.2 GB disks). The StorageWorks shelf is 16-bit (wide) UltraSCSI.

RAID (Redundant Array of Independent Disks)

The system can be configured with optional PCI RAID controllers to organize disk data cost-effectively, improve performance, and provide high levels of storage integrity.

The optional RAID controllers have the following features:
- Support for hot-swap drives
- Automatic rebuild after hot swap
- Console support for booting system from RAID
- RAID levels 0, 1, 0+1, 5
- Optional write cache
- Optional read cache
- Support for command queuing

Split Bus StorageWorks Shelf

The StorageWorks shelf can be reconfigured as two SCSI buses by installing a second repeater card. The card is part of the UltraSCSI Bus Splitter Kit (H8253-AA).

Server Management

The AlphaServer products support important operational and platform management requirements.

Operational Management

Server/Network Management. ServerWORKS Manager software is included with each system. This software utilizes the Simple Network Management Protocol (SNMP) environment to assist the network or server administrator by constantly monitoring the network for problems, thus avoiding expensive downtime. The software monitors vital server information, such as CPU and file system utilization, as well as the condition of the network supported by the management console.

Remote Server Management. An integral remote console manager (RCM) lets the administrator perform several tasks from a serial console: monitor the system power, temperature, and fans, and reset, halt, and power the system on or off, regardless of the operating system or hardware state.

These systems support all the management tools and features provided by the operating systems to manipulate and monitor system resources such as disks, printers, networks, and back-ups.

Platform Management

The AlphaServer DS20 systems support platform management tasks such as manipulating and monitoring hardware performance, configuration, and errors. For example, the operating systems provide a number of tools to characterize system performance and display errors logged in the system error log file.

In addition, system console firmware provides hardware configuration tools and diagnostics to facilitate quick hardware installation and troubleshooting. The system operator can use simple console commands to show the system configuration, devices, boot and operational flags, and recorded errors. Also, the console aids in inventory support by giving access to serial numbers and revisions of hardware and firmware.

Error Reporting

Compaq Analyze, a diagnostic tool used to determine the cause of hardware failures, is installed with the operating systems. It provides automatic background analysis, as it constantly views and reads the error log file. It analyzes both single error/fault events and multiple events. When an error condition is detected, it collects the error information and sends it and an analysis to the user. The tool requires a graphics monitor for its output display.

Reliability and Availability Features

The AlphaServer DS20 system achieves an unparalleled level of reliability and availability through the careful application of technologies that balance redundancy, error correction, and fault management. Reliability and availability features are built into the CPU, memory, and I/O, and implemented at the system level.

Processor Features

- CPU data cache provides error correction code (ECC) protection.
- Parity protection on CPU cache tag store.
- Multi-tiered power-up diagnostics to verify the functionality of the hardware.

With two processors, when you power up or reset the system, each CPU, in parallel, runs a set of diagnostic tests. If any tests fail, the failing CPU is configured out of the system. Responsibility for initializing memory and booting the console firmware is transferred to the other CPU, and the boot process continues. This feature ensures that a system can still power up and boot the operating system in case of a CPU failure. Messages on the operator control panel power-up/diagnostic display indicate the test status. and component failure information.

Memory Features

- The memory ECC scheme is designed to provide maximum protection for user data. The memory scheme corrects single-bit errors and detects double-bit errors and total DRAM failure. It also detects RAM address errors.
- Memory failover. The power-up diagnostics are designed to provide the largest amount of usable memory, configuring around errors.

I/O Features

- ECC protection on the switch interconnect and parity protection on the PCI and SCSI buses.
- Extensive error correction built into disk drives.
- Optional internal RAID improves reliability and data security.
- Disk hot swap on systems configured with RAID.

System Features

Auto reboot. On systems running DIGITAL UNIX or OpenVMS, a firmware environment variable lets you set the default action the system takes on power-up, reset, or after an operating system crash. For maximum system availability, the variable can be set to cause the system to automatically reboot the operating system after most system failures. Windows NT auto reboots by default, but lets you specify a countdown value so you can stop the system from booting if you need to carry out other tasks from the console firmware.

Software installation. The operating systems are factory installed. Factory installed software (FIS) allows you to boot and use your system in a shorter time than if you install the software from a distribution kit.

Diagnostics. During the power-up process, diagnostics are run to achieve several goals:

- Provide a robust hardware platform for the operating system by ensuring that any faulty hardware does not participate in the operating system session. This maximizes system uptime by reducing the risk of system failure.
- Enable efficient, timely repair.

The system has a built-in firmware update utility (LFU) that provides update capability for console and PCI I/O adapter firmware. A fail-safe loader provides a means of reloading the console in the event of corrupted firmware.

Thermal management. The air temperature and fan operation are monitored to protect against overheating and possible hardware destruction. Two fans in the front of the enclosure cool the system box, and additional cooling is provided in the rear to cool the StorageWorks disks. In addition, each processor has its own fan on the chip heatsink. If a processor fan or fan in the front of the box fails, the system will shut down.

Error handling. Parity and other error conditions are detected on the PCI and ISA buses. The memory checking scheme corrects single-bit errors and detects double-bit errors. Multiple ECC corrections to single-bit errors detected by the operating systems help in determining where in the system the error originated. Errors are logged for failure analysis.

Disk hot swap. The hardware is designed to enable hot swap of disks. Hot swap is the removal of a disk or disks from any of the storage compartments while the rest of the system remains powered on and continues to operate. This feature contributes significantly to system availability. Since many disk problems can be fixed without shutting down the entire system, users lose access only to the disks that are removed.

N+1 power redundancy A second power supply can be added to provide redundant power to the system box.

An external UPS can be used to support critical customer configurations. Because power is maintained for the entire system (CPU, memory, and I/O), power interruptions are completely transparent to users.

Installation and Maintenance

The systems are designed for easy hardware, software, and option installation. Options ordered with a system are preinstalled and tested at the factory. The operating systems are also installed at the factory.

Installation of the pedestal system is relatively simple, and may take only 30 minutes.

Security Features

- A key lock controls access to the StorageWorks disk area, and when locked, the panels covering the system cannot be removed.
- A security loop on the rear of the system allows the system to be secured in place.
- An interlock sensor switch shuts down power if the top cover is removed while power is on.

Clustering

A cluster is a loosely coupled set of systems that behaves (is addressed and managed) like a single system, but provides high levels of availability through redundant CPUs, storage, and data paths. Clusters are also highly scalable, meaning that CPU, I/O, storage, and application resources can be added incrementally to efficiently grow capacity. For customers, this translates to reliable access to system resources and data, and investment protection of both hardware and software.

Clustering allows multiple computer systems to communicate over a common interface, share disks, and spread the computing load across multiple CPUs. Clustering is implemented using our traditional interconnects and using the newest technology.

PCI to Memory Channel Interconnect

Under DIGITAL UNIX and OpenVMS, you can build high-availability clusters using the PCI to Memory Channel interconnect. The Memory Channel interconnect is a high-bandwidth, low-latency PCI-based communications interconnect for up to eight AlphaServer systems. Data written to one computer's memory is shared by other computers on the Memory Channel bus.

The PCI CCMAB adapter is the interface between a PCI and a Memory Channel bus. This bus is a memory-to-memory computer system interconnect that permits I/O space writes in one computing node to be replicated into the memories of all other nodes on the Memory Channel bus. A write performed by any CPU to its reflected address region will result in automatic hardware updates to memory regions in other nodes. One node's write is "reflected" to other nodes as a direct side effect of the local write. This provides a memory region with properties similar to a high-performance shared memory across a group of nodes.

Operating System Support

For clustered UNIX systems, TruCluster Software solutions allow users access to network services and provide further failover recovery from server, network, or I/O failures. UNIX cluster systems use the SCSI bus and/or PCI to Memory Channel interconnect bus between disks and systems.

OpenVMS cluster systems use the CI, SCSI, Ethernet, FDDI, DSSI, and Memory Channel as the interconnect between disks and systems. OpenVMS systems can be configured into DSSI clusters using the following two options:
- The KFPSA DSSI adapter, which gives the system the capability of creating DSSI clusters.
- The HSD family of storage controllers.

Windows NT cluster systems use SCSI buses and Ethernet.

The primary means of clustering AlphaServer DS20 systems depends on the operating system.
- CI clusters, OpenVMS only
- Memory Channel, DIGITAL UNIX and OpenVMS
- SCSI clusters, DIGITAL UNIX, OpenVMS, and Windows NT
- DSSI clusters, OpenVMS only

Performance

COMPAQ has an ongoing program of performance engineering, using industry-standard benchmarks that allow comparisons across major vendors' systems. These benchmarks against competitive systems are based on comparable CPU performance, coupled with comparable memory and disk expandability.

See Table 1 for the record-breaking performance numbers of the AlphaServer DS20 systems. For example:

- SPECweb96 Internet Server — 6,065 operations per second, using an AlphaServer DS20 UNIX system with two processors, and 4,092 ops/sec with a single processor.

The SPECweb96 benchmark focuses on server performance for static Web pages, measuring the ability of the server to service HTTP requests or "gets." One or more clients are used by SPECweb96 to send the HTTP requests to the Web server. The software then measures the response time for each request. At the end of the benchmark run, SPECweb96 calculates a metric based on overall throughput, measured as maximum benchmark operations per second.

System performance, however, is highly dependent upon application characteristics. Thus, benchmark information is one helpful "data point" to be used in conjunction with other purchase criteria such as features, service, and price.

Sources of Performance Information

Performance information is available on the internet, and you can have it delivered directly to your fax machine.

- *InstaFACTS.* The InstaFACTS fax service delivers information directly to your fax machine. Call 1-800-DIGITAL (via a touch-tone phone in the U.S.A. and Canada) and 908-885-6426 (outside the U.S.A. and Canada). A catalog of documents is available from which you can order an abbreviated table of performance information, including performance briefs and flashes, TPC results, AIM results, and graphics results.
- *FTP.* Access performance documents from ftp://gatekeeper.dec.com/index.html. The directory is pub/DEC/DECinfo/performance/sys.
- *World Wide Web.* The document URL is http://www.digital.com/info/performance.html.

Information for COMPAQ Partners

COMPAQ and its partners and customers can register with DIGITAL Business Link to access information needed to purchase and sell COMPAQ products and services; including access to pricing, product, sales, and marketing information. http://www.businesslink.digital.com/.

Also see the Alliances and Partners Web site located at http://www.digital.com/other-servers.html.

Service and Support

COMPAQ provides a comprehensive set of services that range from migration, consulting, and training, to direct support of Alpha systems, software, and applications. For information on COMPAQ Services, point your Web browser to http://www.service.digital.com/.

Hardware Warranty

The AlphaServer DS20 system and components, including CPU, memory, PCI controllers, and power supplies, have a 3-year onsite, 5-day per week, 9-hour per day hardware warranty with next-day response time.

StorageWorks components contained in the pedestal or cabinet systems are supported by the comprehensive StorageWorks warranty: five years for disks, three years for controllers, two years for tape devices, and one year for other components. The first year includes onsite next-day response time. Network products in the pedestal or cabinet systems carry the network products warranty.

Users can upgrade to higher levels of service through a variety of hardware supplemental services.

Software Warranty

The warranty for DIGITAL UNIX and OpenVMS is conformance to SPD with advisory telephone support for a period of 90 days. The warranty for Windows NT is conformance to the written material accompanying the software. Users can upgrade to higher levels of service through a variety of software supplemental services.

AlphaServer DS20 System Diagrams
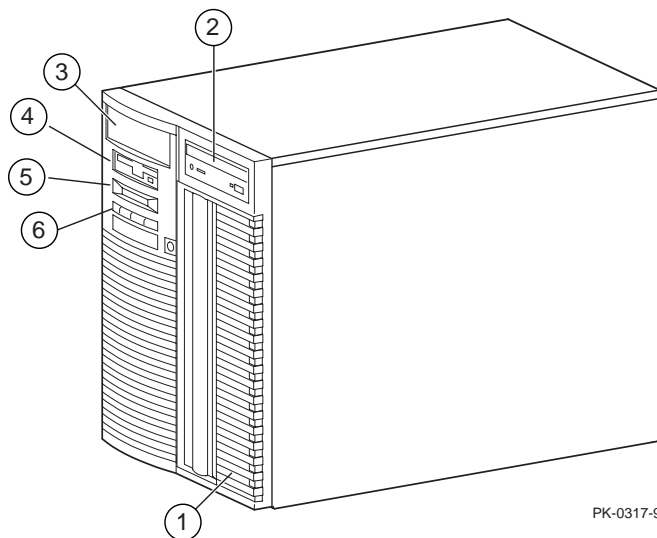
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1. StorageWorks shelf for hard disk drives
2. SCSI CD-ROM drive
3. Optional removable media drive bay

4. Floppy diskette drive
5. Control panel display
6. Control panel switches
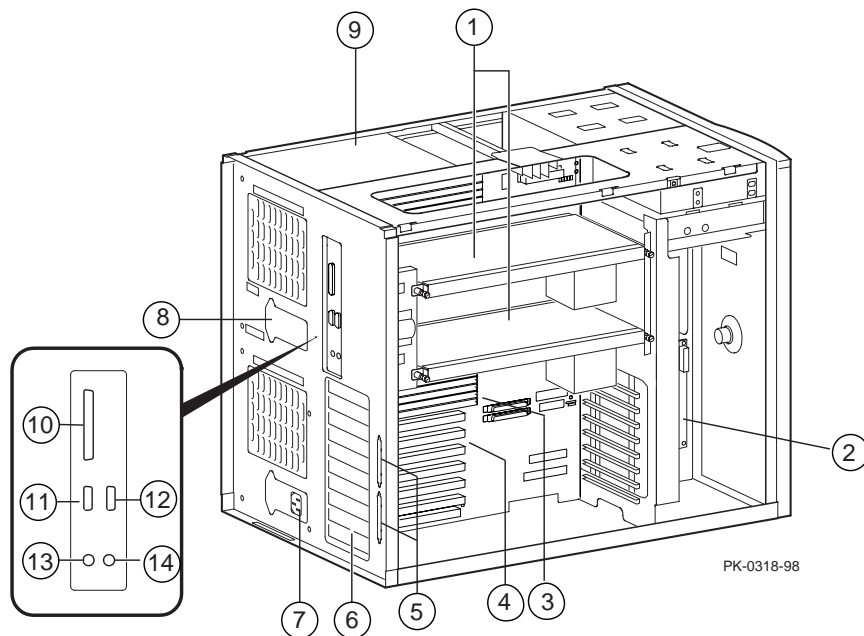
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1. CPU modules
2. Server feature card
3. Memory DIMMs
4. PCI slots
5. SCSI breakouts

6. PCI/ISA bulkhead ports
7. Power inlet and power supply
8. Optional power inlet
9. Fan or optional power supply

10. Parallel port
11. Serial port (COM2)
12. Serial port (COM1)
13. Keyboard port
14. Mouse port

System Features at a Glance

Table 1 provides a quick reference to features of the Compaq AlphaServer DS20 systems.

Table 1 AlphaServer DS20 Features

CPU Features		
Symmetric multiprocessing	1–2 processors	
Processor	Alpha 21264	
CPU clock speed	500 MHz	
Cache on chip	64 KB I-cache	
	64 KB D-cache	
On-board cache	4 MB	
Upgradable in pedestal and cabinet	CPU, memory, I/O, storage	
Memory (maximum)	4 GB	
Performance	**1 CPU**	**2 CPUs**
SPECint95	27.7	–
SPECfp95	58.7	76.1
SPECint_rate95	249	494
SPECfp_rate95	528	947
SPECweb96	4,092	6,065
TPC-C	–	11,616 tpmC @ $50.58
Standard Features	1.44 MB diskette drive, CD-ROM drive, Ethernet controller, SCSI controller, 2 serial ports, 1 parallel port, keyboard and mouse, integral remote system console, operating system license and customer documentation, Internet software	
Internal Storage		
Removable media	CD-ROM, floppy diskette, one additional 5.25-inch removable media bay	
Maximum internal storage	7 hot swap disks (126 GB)	
Total storage	128 (18.2 GB each)	
I/O slots	6 PCI slots (5 PCI and 1 PCI/ISA)	
Maximum PCI throughput	Over 500 MB/sec with two 256 MB/sec buses	
Availability Features		
System	System auto reboot, thermal management, remote system management, RAID 0, 1, 0+1, 5, disk hot swap, memory failover, ECC memory, ECC cache, N+1 power supply, SMP CPU failover, error logging, optional uninterruptible power supply	
OpenVMS clusters	CI, Ethernet, DSSI, SCSI, FDDI, PCI to Memory Channel Interconnect	
UNIX TruClusters Solutions	SCSI, PCI to Memory Channel Interconnect	
Windows NT cluster	Ethernet, FDDI, SCSI	
Operating Systems	DIGITAL UNIX, OpenVMS, Microsoft Windows NT Server	
Warranty		
Hardware	3-year, on-site	
Software	90-day telephone advisory support for OpenVMS and DIGITAL UNIX	

Physical Characteristics

Table 2 details basic physical characteristics of the system.

Table 2 AlphaServer DS20 Physical Characteristics

Shipping Dimension		
Height	60 cm (23.8 in.)	
Width	43 cm (16.9 in)	
Depth	65 cm (25.6 in)	
Weight	43 kg (95 lb) typical; 71 kg (156 lb) maximum	
Installed Dimensions		
Height	46 cm (18.1 in.)	
Width	35.8 cm (14.1 in.)	
Depth	58.6 cm (23.1 in.)	
Weight	39 kg (86 lb) typical; 51 kg (113 lb) maximum	
Clearances	**Operating**	**Service**
Front	75 cm (29.5 in.)	75 cm (29.5 in.)
Rear	15 cm (6 in.)	75 cm (29.5 in.)
Sides	None	75 cm (29.5 in.)
Environmental		
Temperature	Operating*	10–40° C (50–104° F)
	Rate of change	11° C/hr (20° F/hr)
	Nonoperating	-40–66° C (-40–151° F)
	Storage (60 days)	-40–66° C (-40–151° F)
	Rate of change	20° C/hr (36° F/hr)
Relative humidity	Operating	10–90%
	Nonoperating	10–95%
	Storage (60 days)	10–95%
	Rate of change	20%/hr
Maximum wet bulb temperature	Operating	28° C (82° F)
	Storage (60 days)	46° C (115°F)
Minimum dew point temperature	Operating	2° C (36° F)
	Storage (60 days)	Not tested
Maximum heat dissipation	Current	
Single supply	2390 Btu/hr	
Dual supply	4097 Btu/hr	
Airflow and quality	Intake location	Front
	Exhaust location	Rear
	Particle size	N/A
	Concentration	N/A
Altitude	Operating[†]	3048 m (10,000 ft)
	Nonoperating	12192 m (40,000 ft)
Mechanical shock	Operating	10 G 10 ms
	Nonoperating	20 G peak 30 ms
Vibration	Operating	10-500 Hz .1 G peak
	Nonoperating	1.03 Grms 5-300Hz
Acoustics		Average Declared
	Operating	5.7 L^{wA}, B 38 L^pA^m, dba
	Idle	5.6 L^{wA}, B 37 L^pA^m, dba
Electrical—Power supplies are universal 120/240 Vac		
Nominal ac voltage	100-120 Vac	220-240 Vac
Operating Voltage range	90-128 Vac	180-256 Vac
Power source phase	Single	Single
Nominal frequency	60 Hz	50 Hz
Frequency range	59-61 Hz	49-51 Hz
Maximum inrush current	50 Amps	50 Amps
RMS current at nominal voltage (steady state)		
Single power supply	8.0 Amps	4.0 Amps
Dual power supply	4.6 Amps each supply	2.2 Amps each supply
Power cord	Type	IEC 320 C13
	Length	190 cm (75 in.)
	U.S. plug	NEMA 5-15

* Maximum operating temperature at Sea Level. Reduce by 1 C (1.8 F) for each 600 m (2000 ft) above Sea Level.

[†] Higher altitudes are possible if maximum operating temperature is reduced (see Temperature, above); other restrictions may apply, such as maximum permissible altitude for hard drives.

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Features may differ among operating environments. Performance may vary depending on configuration, application, and operating environment.

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