COMPAQ

Compaq AlphaServer DS20E Systems

Technical Summary

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Compaq AlphaServer DS20E Systems

The *Compaq AlphaServer* DS20E 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 DS20E delivers exceptional value and investment protection.

Compaq AlphaServer products use the 64-bit Alpha RISC architecture that supports multiple operating systems: *Tru64 UNIX, OpenVMS,* and Linux.

More information on *Compaq AlphaServer* DS20E systems is on the World Wide Web:

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

System Overview

The *Compaq AlphaServer* DS20E system uses the third-generation Alpha processor, the Alpha 21264, which offers up to 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 as a pedestal or as a rackmount system. The components in both are identical; the rackmount variant is simply rotated to its side. The rackmount system requires 5U space and can be mounted in a 67- or 79-inch M-series cabinet, along with additional disks. In the largest cabinet up to 6 systems and 4 StorageWorks shelves can be installed.

The DS20E system is available with one or two processors (500 MHz), each with a 4-MB ECC cache. The system accommodates four hard disks, a floppy diskette drive, a CD-ROM, and space for one additional 5.25-inch removable media device. The system supports up to 72.8 GB of internal storage using 18.2 GB disks.

There are 6 PCI slots, one of which could be used for an ISA device. Integrated on the system board are controllers for a SCSI device, a diskette, two serial ports, one parallel port, and the keyboard and mouse.

Three operating systems are supported: *Tru64 UNIX, OpenVMS,* and Linux. Customers can order the system that meets their present application needs; they choose the size of the system disk, an Ultra2 SCSI adapter, 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.

- **Reliability and Availability**
The *AlphaServer* DS20E 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. Hot swappable disks, fans, and power supplies allow repairs to be done without shutting the system down.

- **DS20E Workstation**
The pedestal package can also be ordered as a workstation.

Architecture

This system is designed to maximize the potential of the Alpha 21264 chip. The traditional bus interconnect has been replaced by 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 transactions interfere with one another, increasing latency and decreasing aggregate bandwidth. 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 interconnect uses a set of complex chips that route the traffic over multiple paths. The chipset consists of one C-chip, eight D-chips, and two P-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 DS20E 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.
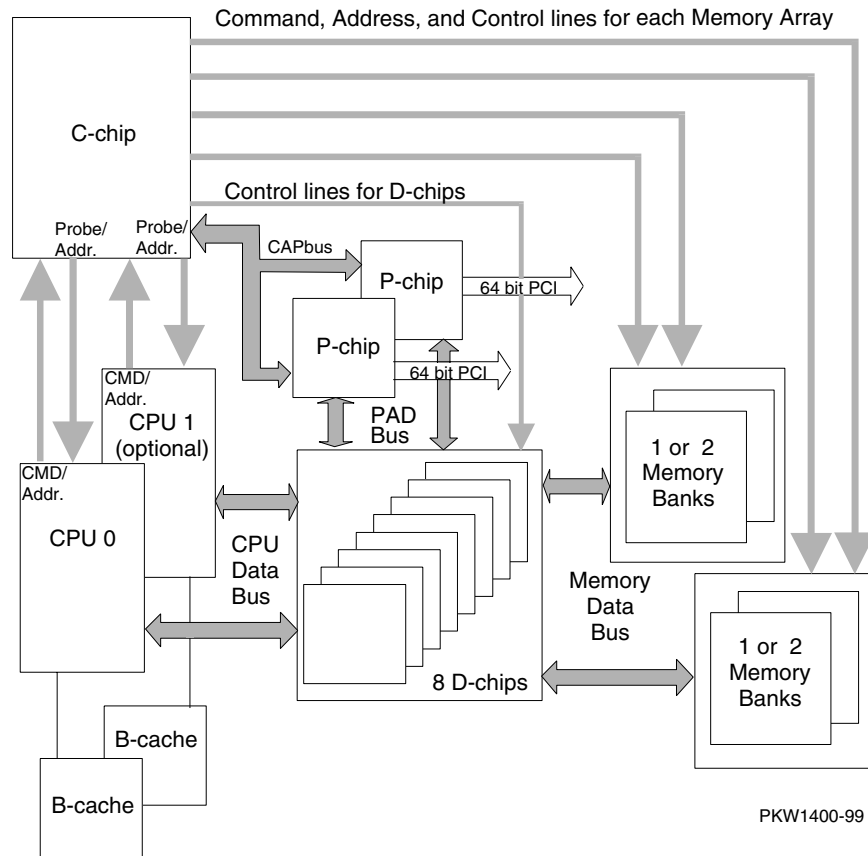
System Block Diagram

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 console code and the NVRAM data.

Integrated into the system board are controllers for the floppy diskette, the CD-ROM, a SCSI tape drive, 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
1 IDE CD-ROM
I/O panel for parallel port, COM1 and COM2 ports, keyboard and mouse

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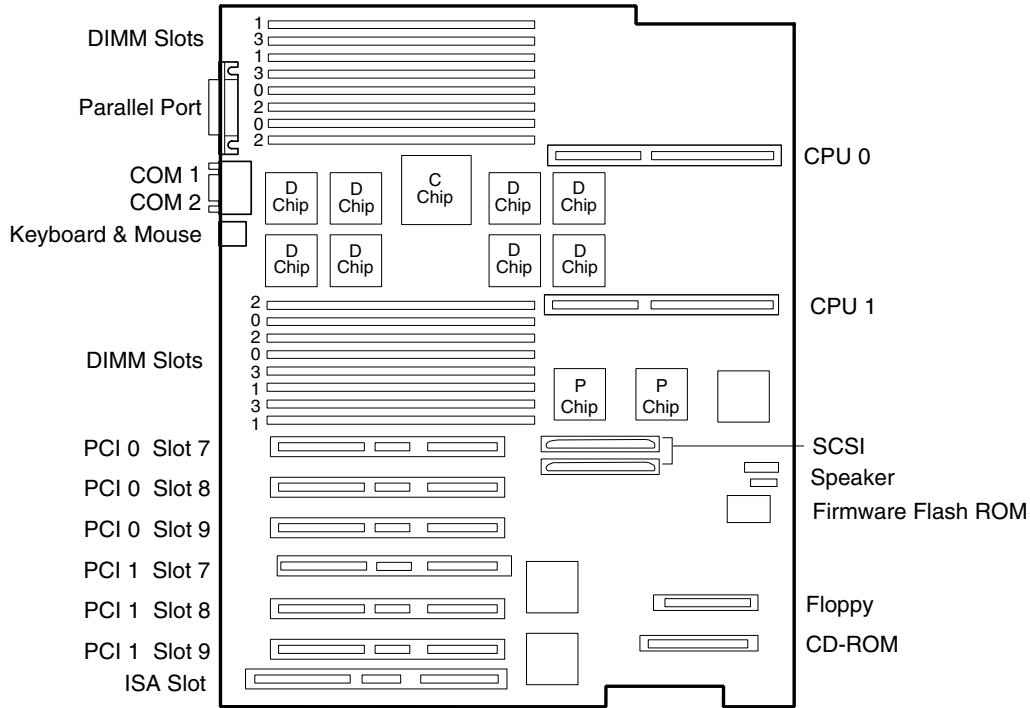
Component and Connector Locations

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 Alpha 21264 achieves this goal by carefully studied and simulated architectural and circuit analysis. The Alpha 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.

Each chip has 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.

Another design feature, out-of-order execution, permits instructions to 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 Alpha 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 Alpha 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 **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* DS20E 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.
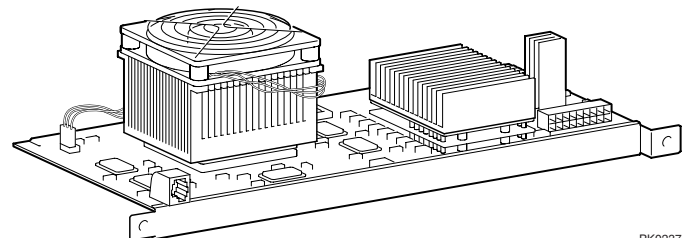
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Processor Configuration Rules
The first CPU module is installed in CPU slot 0. The second CPU is installed in CPU slot 1.

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:
- 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 for support of an internal tape drive.

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 for CD-ROM (no other IDE devices are supported)

I/O Configuration Rules

A graphics adapter, if present in the system, must be installed in PCI 0.
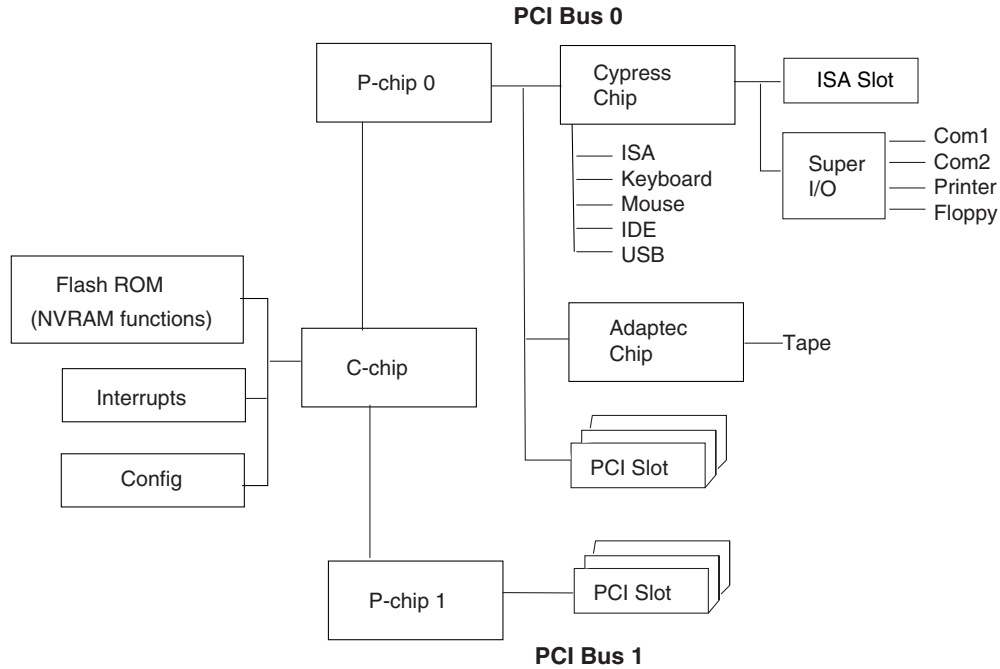
I/O Implementation

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, universal serial bus port, and ports for the keyboard and mouse. Six breakouts are also on the back panel.

PCI Bus 0

```
                      PCI Bus 0

   ┌──────────┐    ┌──────────┐    ┌──────────┐
   │ P-chip 0 │────│ Cypress  │────│ ISA Slot │
   └──────────┘    │ Chip     │    └──────────┘
                   └──────────┘
                      ── ISA       ┌──────────┐    Com1
                      ── Keyboard  │ Super    │    Com2
                      ── Mouse     │ I/O      │    Printer
                      ── IDE       └──────────┘    Floppy
                      ── USB

┌──────────────────┐
│ Flash ROM        │
│ (NVRAM functions)│──┐            ┌──────────┐
└──────────────────┘  │            │ Adaptec  │── Tape
                      ├─┌────────┐  │ Chip     │
┌──────────────────┐  │ │ C-chip │  └──────────┘
│ Interrupts       │──┤ └────────┘
└──────────────────┘  │            ┌──────────┐
                      │            │ PCI Slot │
┌──────────────────┐  │            └──────────┘
│ Config           │──┘
└──────────────────┘
                   ┌──────────┐    ┌──────────┐
                   │ P-chip 1 │────│ PCI Slot │
                   └──────────┘    └──────────┘

                      PCI Bus 1
                                    PK-0319A-99
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Block Diagram of I/O Control

System Control

The system features module provides for the following:
- Remote server management
- Environmental monitoring
- Power system event data collection

The module is located at the top rear of the system.

Storage

The *AlphaServer* DS20E system offers up to seven internal storage devices including a CD-ROM drive, floppy diskette drive, one additional 5.25-inch removable media device, and four hot-swap disk drives. The system supports up to 72.8 Gbytes of internal storage (using 18.2 GB disks).
The disk cage supports up to four Ultra2 SCSI disk drives (9.1 or 18.2 GB). The Ultra2 SCSI drives are 1.6-inch 10,000 RPM.

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

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 integrated remote management console (RMC) lets the operator 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. The monitoring can be done locally or remotely through a modem.

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 backups.

Platform Management

The *AlphaServer* DS20E 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, Availability, and Maintainability

The *AlphaServer* DS20E 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. LEDs on the control panel indicate 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.

System Features

Auto reboot. On systems running *Tru64 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.

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 rear of the enclosure cool the system box; if one system fan fails, the second one speeds up to provide additional cooling. Also, each power supply has two fans, and each processor has its own fan on the chip heatsink. The system shuts down if a processor fan fails or if the temperature reaches a threshold. The system fans are hot swappable.

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 third 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 system is relatively simple and may take only 30 minutes.

Some maintenance tasks can be performed while the system is running. Systems are designed so that system fans, power supplies, and disks can be replaced without shutting down the system.

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; that is, CPU, I/O, storage, and application resources can be added incrementally to efficiently increase 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.

PCI to Memory Channel Interconnect

Under T*ru64 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 results 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. *Tru64 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.

The primary means of clustering *AlphaServer* DS20E systems depends on the operating system.
- Ethernet, *OpenVMS*
- CI clusters, *OpenVMS* only
- Memory Channel, *Tru64 UNIX* and *OpenVMS*
- SCSI clusters, *Tru64 UNIX* and *OpenVMS*
- 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 perform-ance, coupled with comparable memory and disk expandability. See Table 1 for the performance numbers of the *AlphaServer* DS20E systems. For example:

- SPECweb96 Internet Server — 6,065 operations per second, using an *AlphaServer* DS20E 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.
- *World Wide Web*
  http://www.digital.com/alphaserver/products/perform3.html
- *FTP*. Access performance documents from
  ftp://gatekeeper.dec.com/index.html.
  The directory is pub/DEC/DECinfo/performance/sys.

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

and the Compaq Partner Network (CPN):
http://CPN.compaq.com

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* DS20E system and components, including CPU, memory, PCI controllers, and power supplies, have a 3-year on-site, 5-day per week, 9-hour per day hardware warranty with next-day response time.

Network products 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 *Tru64 UNIX* and *OpenVMS* is conformance to SPD with advisory telephone support for a period of 90 days. Users can upgrade to higher levels of service through a variety of software supplemental services.
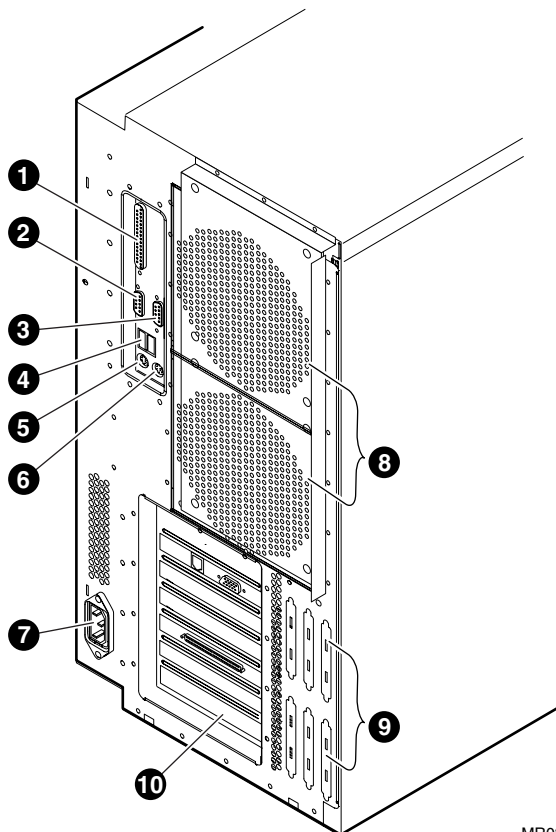
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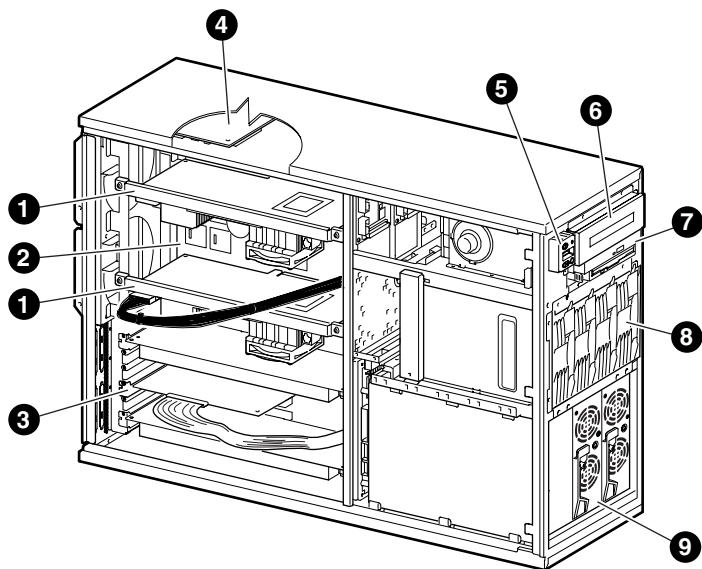
1. CPUs
2. System board
3. PCI slots
4. System features module
5. Control panel
6. Removable media bay
7. CD-ROM / floppy diskette drive
8. Storage drive bays
9. Power supplies (2 minimum)

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1. Parallel port
2. Serial port (COM2)
3. Serial port (COM1)
4. Universal serial bus
5. Keyboard port
6. Mouse port
7. AC power inlet
8. System fans
9. SCSI breakouts
10. PCI/ISA bulkhead ports

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System Features at a Glance

Table 1 provides a quick reference to features of *Compaq AlphaServer* DS20E systems.

Table 1 AlphaServer DS20E 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, 2 serial ports, 1 parallel port, keyboard and mouse, integrated remote system management 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	
Hard disks	72.8 GB (4 hot swap disks, 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, hot swap of disks, power supplies, and fans, 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	
Operating Systems	*Tru64 UNIX, OpenVMS,* Linux	
Warranty		
Hardware	3-year, on-site	
Software	90-day telephone advisory support for *OpenVMS* and *Tru64 UNIX*	

Physical Characteristics

Table 2 details basic physical characteristics of the system.

Table 2 AlphaServer DS20E Physical Characteristics

Dimensions	Pedestal	Rackmount
Height	47.0 cm (18.5 in.)	22.2 cm (8.75 in.)
Width	22.5 cm (8.85 in.)	44.5 cm (17.5 in.)
Depth	69.9 cm (27.5 in.)	66.0 cm (26 in.)
Weight	36 kg (80 lbs) typical; 40 kg (88 lbs) maximum	36 kg (80 lbs) nominal; 39 kg (86 lbs) maximum With brackets, slides, & cables 38 kg (84 lbs) nominal; 40 kg (88 lbs) maximum

Environmental		
Temperature	Operating	10–35° C (50–95° F)
	Storage (60 days)	-40–66° C (-40–151° F)
	Rate of change	11° C/hr (20° F/hr)
Relative humidity	Operating	20–80%
	Nonoperating	20–80%
	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)
Maximum heat dissipation	Nominal	550 watts, 1,878 Btu/hr
	Maximum	780 watts, 2,664 Btu/hr
Airflow	Intake location	Front
	Exhaust location	Rear
Altitude	Operating	3,037 m (10,000 ft)
	Nonoperating	12,192 m (40,000 ft)
Vibration	Operating	10–500 Hz .1 G peak
Mechanical shock	Operating	
	Pedestal	7.5 G, 10+/–3ms
	M-series cabinet	5.0 G, 10+/–3ms
Acoustics		Average	Declared
	Idle	5.8 L^{wA}, B	44 $L^{P}A^{m}$, dba
	Operating	6.3 L^{wA}, B	49 $L^{P}A^{m}$, dba

Electrical (Power supplies are universal, PFC, auto ranging, 100/240 Vac)

Nominal voltage (Vac)	100	120	200–240
Voltage range (Vac) temporary condition	90–100	110–128	180–250
Power source phase	Single	Single	Single
Nominal frequency (Hz)	50/60	50/60	50/60
Frequency range (Hz)	49–51 / 59–61	49–51 / 59–61	49–51 / 59–61
RMS current (maximum steady state)			
Pedestal and rackmount			
Single power cord	6.6 A	5.5 A	3.0 A
Maximum VA	780	765	730
M-series cabinet (configuration dependent)			
Nominal voltage (Vac)	100	120	220–240
Each power cord	24 A	24 A	16 A

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

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