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HP 9000 Series 800 Business Servers Models 865S, 870S/100, 870S/200, 870S/300, 870S/400

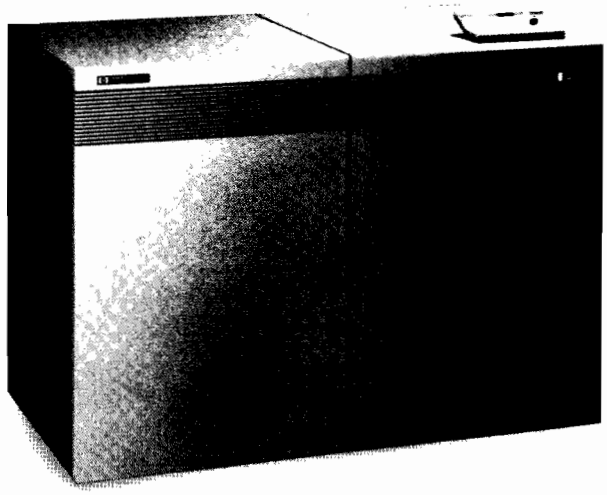
Technical Data

HP 9000 Series 800
High-End Business Servers

The HP 9000 Series 800 Models 865S, 870S/100, 870S/200, 870S/300, and 870S/400 comprise the industry's most expandable and reliable high-end UNIX®-based servers on the market for commercial applications. The combination of HP's Precision Architecture RISC (PA-RISC) technology, symmetrical multiprocessing and commercial software functionality make these systems the leading choice for mission critical UNIX datacenter operations.

Hewlett-Packard's high-performance Very Large Scale Integrated (VLSI) technology is comprised of an impressively small number of parts. Convenient board upgrades between this high-end family of systems deliver incremental growth with a modular approach. Not only can processors be added in a modular fashion, but also memory arrays, I/O channels, and communication links. These features result in substantial price/performance advantages and investment protection.

Figure 1. HP 9000 Series 800 high-end system package



Features

- Broad performance range in the same cabinet
- Single chip VLSI Central Processor Unit (CPU) utilizing PA-RISC
- Large high-speed instruction and data cache
- Three-tiered "mainframe" bus structure optimized for high-performance relational database applications
- 16- or 64-Mbyte ECC memory increments expandable up to 768 Mbytes
- Support for up to 514 Gbytes of disk storage
- High-performance floating-point coprocessor
- Battery backup and auto restart included in all systems
- Support for wide offering of high quality HP disks, tapes, and peripherals

Table 1. HP 9000 Series 800 high-end systems at-a-glance

	865S	870S/100	870S/200	870S/300	870S/400
Number of CPUs	1	1	2	3	4
Relative transaction performance	1.0	1.3	2.0	2.6	3.1
Performance (MIPS relative to VAX 11/780)	56	56	Up to 112	Up to 168	Up to 224
Floating point (DP MFLOPS)**	9.8	9.8	2×9.8*	3×9.8*	4×9.8*
Memory (Mbytes)	64–512	96–768	128–768	160–768	192–768
Aggregate I/O bandwidth (Mbytes/sec)	40	40	40	40	40
Maximum disk storage (Gbytes)	342	342	514	514	514
Cache size (Kbytes)	768	1024	2×1024	3×1024	4×1024
I.C. technology	CMOS	CMOS	CMOS	CMOS	CMOS
Instruction frequency (MHz)	50.0	50.0	50.0	50.0	50.0
Maximum users					
Mux	512	600	600	600	600
DTC	528	768	1200	1632	1968
Total	600	800	1200	1650	2000

*Floating point co-processor capacity available per processor

The HP 9000 Series 800 high-end family primarily consists of five models: the 865S, 870S/100, 870S/200, 870S/300, and 870S/400. In total, the high-end HP 9000 Series 800 Business Servers provide exceptional performance and functionality needed for large multi-user and server environments supporting up to 2000 users.

Like all other HP 9000 Series 800 systems, these high-performance Series 800 systems run the standards-based HP-UX operating system, conforming to AT&T's UNIX System V Interface Definition (SVID), IEEE POSIX (1003.1), OSF Level 0, and X/Open™ (XPG3) standard for application portability. HP-UX provides an excellent environment for on-line transaction processing, database management, and manufacturing applications requiring a powerful and flexible standard operating system.

System hardware features

Precision Architecture-RISC

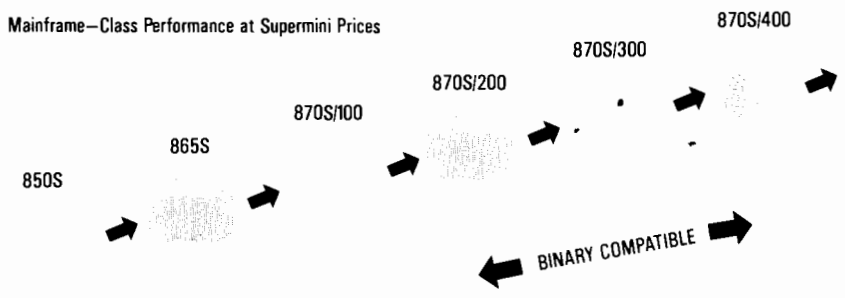
The HP 9000 Series 800 computer systems use HP's Precision Architecture RISC (PA-RISC) technology to provide high performance and reliability at a low cost.

PA-RISC is built upon Reduced Instruction Set Computing (RISC) principles, a design approach that delivers greatly simplified computers that are optimized to provide the highest performance for a given integrated circuit technology. The inherent simplicity of PA-RISC implies that computer systems can be implemented with fewer components to achieve vastly superior reliability when compared to older Complex Instruction Set Computer (CISC) systems.

At the core of PA-RISC is an instruction set containing 140 carefully selected fixed format instructions. This instruction set has been optimized for commercial environments with the inclusion of instructions such as decimal addition.

PA-RISC utilizes a load/store design and register-to-register operations to reduce the number

Figure 2. Superior scalability in a single package



- Over 9X the performance of 850S to 870S/400
- Simple, field installable board upgrades
- Up to 768 Mbytes memory and 514 Gbytes disk storage

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of memory accesses. To further enhance performance, optimizing compilers schedule instructions and manage the instruction pipeline. With hardwired control, a load/store design, and optimizing compilers, instructions can be executed on virtually every clock cycle. Single-cycle instruction accounts for much of the superior performance of PA-RISC.

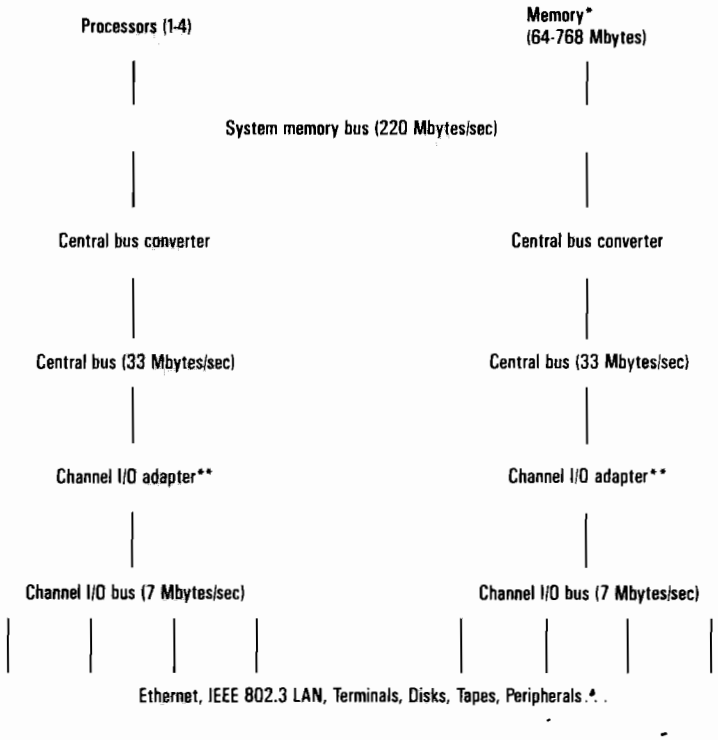
System organization

HP's three-tiered "mainframe" bus structure provides high system throughput and can handle even your heaviest processing and I/O demands. The Central Processor Unit(s) accesses main memory over a 220 Mbytes/second (peak) high-speed memory bus. This 64-bit wide System Memory Bus (SMB) can support sustained data transfer rates in excess of 100 Mbytes/second. This 220 Mbytes/second bus was designed for high performance multiprocessor applications to minimize bus contention, a problem which may occur in other UNIX vendors' multiprocessing platforms.

The SMB Bus also connects two Central Buses (CTB) through Central Bus converters. The CTB Bus provides a 32-bit wide data path that can support peak data transfer rates of 33 Mbytes/second and sustained rates of 20 Mbytes/second. With two CTB Buses, aggregate sustained system I/O throughput exceeds 40 Mbytes/second. Each CTB Bus supports two Channel I/O (CIO) Adapters internally and, with optional expansion modules, can support up to four more (a total of 12). Each CIO Adapter drives a CIO Bus that supports I/O interfaces to peripheral devices and data communications links. Each CIO Bus, which supports a sustained I/O data transfer rate of 5 Mbytes/second (7 Mbytes/second peak), can support up to five device adaptors.

This robust three-tiered bus structure reduces I/O bottlenecks and provides you with assurance that high system throughput can be obtained for large numbers of users.

Figure 3. HP 9000 Series 800 high-end system organization



*Up to 16 slots are available
**Up to 6 channel I/O adapters per central bus.

Processors

The processor for the HP 9000 Series 800 Models 865S and 870S resides entirely on one printed circuit board. The 865S and 870S processor modules contain eight custom VLSI chips. The processor module also contains a first level on-chip TLB, which provides virtual memory capability, and the cache, which reduces bus overhead by minimizing the need to access system memory.

Single-board processors facilitate simple, modular growth with the original Series 800 high-end system cabinet. This means that you can size your system according to your current needs and be assured that your future needs will be met with a system in the original cabinet.

Symmetric multiprocessing

With HP-UX release 8.06, the Model 870S system supports tightly coupled, symmetrical multiprocessing of up to four 870S processors. Multiprocessing (MP) allows economical, modular growth of processing power as system performance requirements increase. In addition, MP provides increased system availability because, upon failure of one processor, the system can be immediately restarted using the remaining available processor(s).

HP's multiprocessing implementation available with the 870S is a truly balanced MP implementation. HP's tightly coupled MP systems use shared memory to allow communication between processors. Tightly coupled MP systems provide superior performance over loosely coupled MP systems. In addition, by combining extremely fast CPUs (as opposed to slow commodity microprocessors) and multiprocessing, HP is the only high-end UNIX server vendor to offer both superior on-line transaction processing performance and excellent batch throughput in the same cabinet.

HP's symmetrical MP implementation means that any CPU has the ability to execute any kernel and user processes. Symmetric MP systems allow different processes to execute in the HP-UX operating system kernel at the same time while keeping system tables correct at all times. Symmetrical MP systems provide the best possible performance improvement when additional CPUs are added.

Finally, multiprocessing in HP-UX is entirely transparent to the application. This means that existing applications can benefit from the increased MP system performance without any modifications. Multiprocessing is only supported with 870S processors.

Cache

The use of cache memory enhances system performance by minimizing CPU requests for instructions or data stored in main or system memory. By storing frequently used instructions and data in a high-speed cache memory instead of relying on system memory, the CPU can execute instructions or process data without overloading the System Memory Bus. This is particularly important for multiprocessor systems. UNIX multiprocessing systems which do not provide adequate cache can suffer from very poor performance as the number of installed CPUs increases.

The Model 865S uses a 256-Kbyte instruction cache and a 512-Kbyte data cache. Each Model 870S processor board uses a 512-Kbyte instruction cache and a 512-Kbyte data cache.

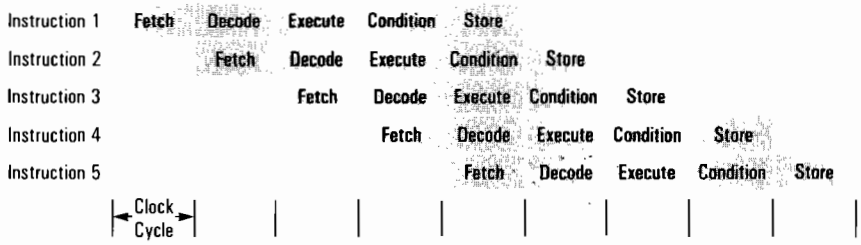
The cache operates in a write-back mode. Write-back means that the cache writes modified data to system memory only when: the processor needs the cache location for other data, the operating system flushes the cache location due to a direct memory access operation, or there is a power failure. This efficient cache operation provides maximum system throughput. Parity checking protects the cache, and a parity error triggers a recovery algorithm that resolves cache failures.

Instruction pipelining

Instruction pipelining is a technique that overlaps instruction processing so that one instruction can begin to execute before the previous one has finished. The net effect is that one instruction completes with essentially every instruction clock cycle. The efficient use of pipelining greatly increases system performance.

The Models 865S and 870S use five-stage pipelines. With a fast CMOS technology, one new instruction is completed approximately every 20 nanoseconds.

Figure 4. Instruction pipelining



Floating-point coprocessor

Single and double precision floating point calculations are performed by the floating-point coprocessor (FPC). The coprocessor significantly decreases the time required to perform floating-point calculations. The FPC unit allows floating-point operations to overlap with CPU operations, as long as there is no interlocking data. This ability to operate in parallel allows for increased performance in applications which are compute-intensive. The floating-point coprocessor is standard on the Model 865S and all Model 870S systems.

Virtual memory

Virtual addresses are 64 bits in length, ensuring ample expandability to meet growing software needs. Virtual memory is divided into 65,535 spaces with each space 4 gigabytes in length. Spaces are further divided into fixed-length 2-Kbyte pages, with a page holding code or data. A single data structure can be up to 1 Gbyte in length. The virtual memory scheme can accommodate memory of more than 260,000 Gbytes.

The Translation Lookaside Buffer (TLB) performs translations from virtual addresses to physical addresses. The TLB stores recently accessed virtual page translations and converts the 64-bit virtual address into a 32-bit physical address. For example, the TLB of the Models 865S and 870S hold translations for 8192 virtual pages. The memory for the virtual pages is split into two parts, half for an instruction TLB and half for a data TLB. There are two levels of TLB on the 865S and 870S systems. A first-level TLB of split instructions and data of 64 entries each is on the CPU chip. A second-level TLB of 4K entries each is located on the processor board.

All Series 800 high-end systems provide page-level access protection. The TLB hardware supports protection mechanisms to ensure that the currently executing process has sufficient authorization to perform the requested data, code, or I/O access. The TLB also uses parity checking which signals the CPU when errors are detected.

Memory subsystem

The Model 865S, 870S/100, 870S/200, 870S/300, and 870S/400 come standard with 64 Mbytes, 96 Mbytes, 128 Mbytes, 160 Mbytes, and 192 Mbytes, respectively. Memory for the Models 865S and 870S systems are expandable in 16 Mbyte and/or 64 Mbyte increments up to 512 Mbytes and 768 Mbytes, respectively. Advanced memory interleaving is supported for increased system throughput on the 870S multiprocessor systems.

The internal memory word size is 72 bits, with 64 bits for data and 8 bits for error detection and correction. Rare double bit errors are automatically detected causing an interrupt or a high-priority machine check. Single bit errors are automatically corrected. This unique ECC memory implementation assures high memory performance and high reliability.

In the event of a power loss, the powerfail battery backup protects the system. If AC power is lost, the state of the processor is secured in memory for at least 15 minutes. Maximum storage time depends on the amount of memory in the system. If power is restored within this limit, the system restores itself and resumes processing with no loss of data.

I/O subsystem

All systems can support up to 12 general-purpose Channel I/O (CIO) buses with the addition of Channel I/O Adapters. The 16-bit, 5-Mbyte/second bandwidth CIO buses connect peripheral and data communication cards. All systems come standard with two CIO Adapters, each providing five I/O slots. Three of the 10 standard slots contain a peripheral interface (HP-IB), a six-channel multiplexer, and an access port card interface for remote diagnostics. Two additional CIO Adapters can be added to each cabinet for a total of 20 slots.

In addition, I/O Terminal Expander units provide for modular expansion of all systems. The I/O Terminal Expander consists of up to two add-on cabinets. Each cabinet contains up to two expansion modules which in turn support up to two CIO Adapters each.

With the I/O Terminal Expander system, each CIO Adapter supports a CIO bus with eight slots for multiplexer interfaces. Serial devices can be connected to the Series 800 high-end systems with direct-connect multiplexers or LAN-connected Distributed Terminal Controllers (DTCs).

Each CIO Adapter manages I/O traffic by interfacing the Central Bus (CTB) with the CIO bus, synchronizing the different speeds and bandwidths. CIO Adapters also manage Direct Memory Access (DMA) transfers between system memory and CIO interfaces with their associated peripherals. The CIO Adapter accomplishes this function with minimal CPU intervention, interrupting only to signal completion of DMA transfers. This allows large blocks of data to be transferred to and from system memory at rates up to 7 Mbytes per second per channel.

Peripheral connections

Disk drives, backup units, printers, and plotters connect to all systems via an HP-IB card which supports the 8-bit wide, IEEE-488 standard. Each HP-IB card interfaces with up to 4 high-speed devices or 14 low-speed devices.

Certain disk drive and backup units can also be connected using a CIO SCSI host adapter. Each host adapter can interface to up to 7 SCSI devices.

Certain disk drives can be connected via the Hewlett-Packard-Fiber Link (HP-FL) technology, which is a high-speed fiber-optic disk controller. Each HP-FL channel can support eight disk drives at up to 7 Mbytes per second per channel. Hewlett-Packard was the first minicomputer vendor to offer fiber-optic disk controller technology. HP-FL disk controllers also support dual-porting to increase system availability.

RS-232 six-channel and 16-channel multiplexers are available to connect PCs, workstations, terminals, modems, serial printers, and other serial devices. Local Area Network (LAN) and Wide Area Network (WAN) interfaces allow connections to other systems, as well as support for Distributed Terminal Controllers (DTCs). DTCs, which are distributed over an IEEE 802.3 standard LAN, can support up to

Table 2. Peripherals supported on HP 9000 Series 800 high-end systems

Terminals	Disk drives	Backup units	Printers	Printers
HP C1001A/G/W	HP 7936H	HP 7979A	HP 2225D	HP C1602A
HP C1002A/G/W	HP 7936FL	HP 7980A	HP 2227A	HP 2235A/B/C/0
HP C1003A/G	HP 7937H	HP 7980XC	HP 2228A	HP 2932A
HP C1004A/G/W	HP 7937FL	HP 9144A	HP 2276A	HP 2686A/D
HP C1006A/G/W	HP 7958B	HP 9145A	HP 2277A	HP 2562C
HP C1007A/G/W	HP 7959B	HP C1511A	HP 2563B	HP 2563C
HP C1017A/G/W	HP 9122C	HP C1700A	HP 2564B	HP 2564C
HP 2397A	HP 9153C	HP C1701A	HP 2566B	HP 2566C
HP 3082B	HP C2200A	HP C1512A	HP 2567B	HP 2567C
HP 2393A	HP C2201A	HP C2292A	HP 2684A/D/P	HP 41063
HP 2394A	HP C2203A	HP C7980S	HP 2934A/D/P	HP C120DA
HP C2301A	HP C2204A	HP C7980SX	HP 33440A	HP C1202A
HP C23D2A	HP C2212A	HP C1501A	HP 33447A	HP 33438P
HP C2303A	HP C2213A	HP C1502A	HP 3630A	HP 33449A
HP C2304A	HP C2251A			HP 33459A
HP 9666A	HP C2252B			HP 33471A
HP C1010	HP C2254B			HP C2106A
	HP C2252HA			
	HP C2254HA			

Table 3. Technical specifications

Power requirements		
	865S/870S	
	MIN	MAX
Current (Amps) at:		
280V	3.2	7.8
380V	1.6	3.9
415V	1.5	3.6
Power Consumption (Watts)	1048	2569
Heat Dissipation (BTU/Hr)	3578	8768
Voltage tolerance	±10%	
Frequency tolerance	±2%	
Environmental characteristics		
Temperature	Operating: +5° to +40°C Recommended operating: 20° to 30°C Non-operating: –40° to +70°C	
Humidity	Operating: 15% to 80% RH at 40°C, non-condensing Recommended operating: 40 to 60% RH	
Maximum altitude	Operating: 4570m (15,000 ft) Non-operating: 15,240m (50,000 ft)	
Acoustics	7.3 Bels (A) Sound Power	
Ventilation	Forced air cooling; air flows from top to bottom	
Regulatory compliance		
Electromagnetic interference	Complies with FCC Rules and Regulations, Part 15, Subpart J, as Class A computing device FTZ 1046/1984 (Manufacturer's Declaration) VCCI Class 1 Registered	
Safety	UL listed; CSA certified Complies with IEC 380 and IEC 435 (IEC 950/EN60950 Pending)	
Datacom licenses	Germany: A301307U Belgium: 30192A–RTT87D1055, 27140A–RTT86D1128, 30263A–RTT89D1118	
Immunity	Radiated immunity: 3v/m 14KHz–1GHz	
Electrostatic discharge	0 to 15 kV–No effect 15 to 25 kV–Nondestructive (possible system interruption)	
Physical characteristics		
Dimensions	Height: 100 cm (39.4 in) Width: 130 cm (51.2 in) Depth: 71 cm (27.9 in)	
Weight	400 kg (880 lbs)	

16 or 48 directly connected ports, or 36 modem ports, or a combination of the two. Both RS-232 and RS-422 interfaces are supported.

The Series 800 products support a wide variety of industry standard networking links and services. HP is the recognized leader in OSI networking and IBM connectivity. Please contact your local sales representative for a complete list of currently supported networking products.

Supported peripherals

Table 2 contains peripherals supported by the Model 865S and 870S systems at the time of publication. The list of supported peripherals changes as new peripherals are introduced and others are discontinued. Contact your local HP Sales Representative for more information on currently supported peripherals.

System software features

All HP 9000 Series 800 computers are based on the standards-based multiuser, multitasking HP-UX. HP-UX provides object code compatibility among these computers and the HP 9000 Series 700 workstations. The operating system is based on AT&T's UNIX System V Release 3.0, and passes AT&T's System V Interface Definition (SVID 2). It also incorporates selected features from U.C. Berkeley Software Distribution 4.3 (BSD). In addition, HP-UX conforms to X/Open's Portability Guide Issue 3 (XPG3), the IEEE's POSIX 1003.1, and the Federal Processing Specification (FIPS) 151-1. HP-UX is also X/Open Branded for XPG3. Compliance with these standards facilitates portability of applications developed on other standards-based operating systems.

HP-UX meets the growing need for highly available, high-performance commercial servers by supporting a suite of high availability and system management products, such as disk mirroring and performance monitoring tools. HP-UX also contains features intended to fulfill the Department of Defense C2 Trusted System Requirements. Finally, HP-UX supports all the popular programming languages and a rich assortment of products for Information Management, Computer Aided Software Engineering (CASE), Office Automation, and graphics. For detailed information on the HP-UX operating system, please see the HP-UX Technical Data Sheet.

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Application software

Over 3000 application software packages are available on the HP-UX operating system. Contact your HP Sales Representative for information regarding specific applications.

Support services

A wide range of hardware and software support services is available worldwide for all HP 9000 products. Contact your local HP Sales Representative for details on available support services.

Warranty information

The warranty covering your specific system is determined by the HP WARRANTY AND INSTALLATION TERMS in effect at the time of purchase. These terms are specified in HP publication No. 5954-1617D for the United States and in similar documents for other countries.

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