
HP 3000 Series 980

Technical Data

HP 3000 Computer Systems

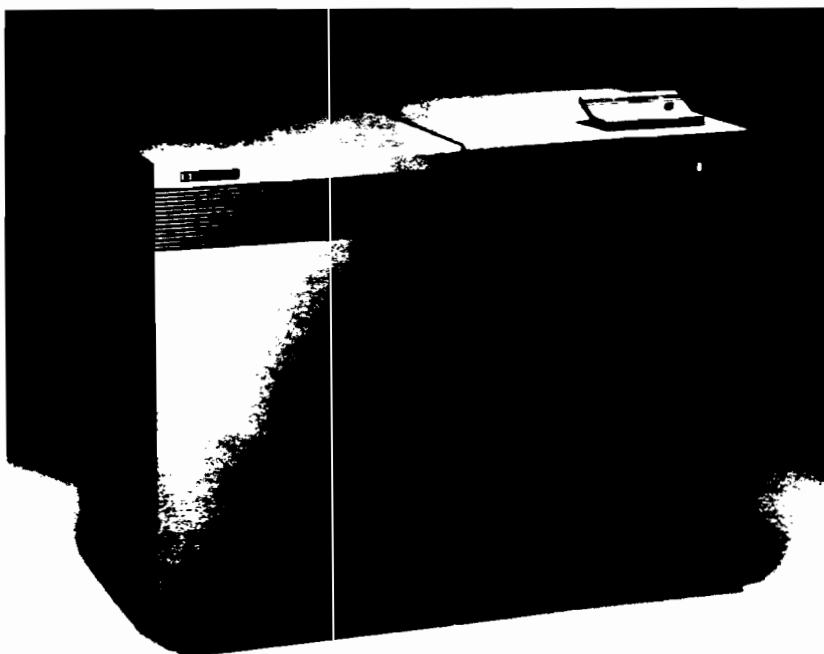
The HP 3000 Series 980 systems are the highest performance members of the broad family of compatible HP 3000 computer systems coupling RISC-based Precision Architecture-RISC (PA-RISC) and an operating system optimized for On-line Transaction Processing (OLTP). Utilizing an advanced implementation of Hewlett-Packard's sub micron CMOS VLSI semiconductor technology, which offers very high performance

and exceptional reliability, the HP 3000 Series 980 systems are impressively implemented with single-chip CPUs and single-board processors. Further, these systems are convenient field upgrades to the S960. The HP 3000 Series 980/100 is a high-capacity system supporting hundreds of users with very large databases, and providing mainframe class performance for very large scale OLTP and batch applications.

The Series 980/200, Series 980/300 and Series 980/400 are fully symmetric multiprocessors comprised of two, three or four Series 980/100 processors respectively, providing significant incremental performance increases.

The HP 3000 operating system complements the high performance Series 980 systems by providing robust functionality while maintaining HP 3000 ease of use. The operating system offers powerful system management utilities, high availability options, tools for performance measurement and monitoring, and built-in features to ensure data integrity. The Series 980 systems are also complemented by a full range of high quality HP peripherals, industry standard networking, a rich set of languages and application development facilities, several high performance database management solutions, and advanced PC integration products.

Figure 1. HP 3000 Series 980



In total, the Series 980 systems provide exceptional performance and functionality to run a wide variety of financial, manufacturing, service industry, inventory, distribution and information management software to meet your data management needs.

Features

- up to 7 times the performance of the Series 947 (Series 980/400)
- up to 3 times performance increase from 980/100 to 980/400
- single-chip VLSI CPU on each single-board processor
- 21-ns system clock cycle
- 64-bit virtual addressing
- large standard/maximum main memory
 - 980/100 192/512 Mbytes
 - 980/200 256 Mbytes/1 C-byte
 - 980/300 320 Mbytes/1 C-byte
 - 980/400 384 Mbytes/1 C-byte
- 512-Kbyte high-speed CPU instruction cache per processor
- 512-Kbyte high-speed, error-correcting CPU data cache per processor
- advanced ultrahigh-performance floating point co-processor standard per processor
- advanced five-stage instruction pipelining per processor
- 8K-entry Translation Lookaside Buffer (TLB) per processor
- 128-entry CPU Translation Lookaside Buffer per processor
- battery backup, auto restart standard
- high performance OLTP operating system

Advanced technologies

HP Precision Architecture

The Series 980 system uses Precision Architecture-RISC (PA-RISC) and a very powerful implementation of HP's advanced CMOS VLSI technology to produce a high performance, highly reliable system at a low cost. PA-RISC builds on reduced instruction set computing (RISC), a design approach that delivers greatly simplified computers that are optimized to provide the highest performance for a given integrated circuit (IC) technology. In addition, the inherent simplicity of PA-RISC means lower cost and higher reliability due to the need for fewer components.

The core of PA-RISC is an instruction set containing 140 carefully selected, fixed-format instructions tuned to support commercial applications. Because the instruction set is simple, instructions can be hardwired directly in the central processing unit (CPU), eliminating the need for microcode and the necessity to decode complex instructions.

PA-RISC utilizes a Load/Store design to reduce the number of relatively slow memory accesses, as most operations are performed register-to-register. To further enhance performance, optimizing compilers are used to schedule instructions and manage the instruction pipeline. With hardwired control, a Load/Store design, and optimizing compilers, one instruction is executed with virtually every clock cycle. Single-cycle execution provides much of the performance benefit of PA-RISC over traditional architectures.

PA-RISC goes beyond RISC to incorporate other features that greatly enhance its performance and functionality. For example:

- support for co-processors (floating-point)
- extended addressing
- Memory-mapped I/O subsystem
- COBOL primitives

Symmetric multiprocessing

PA-RISC has been optimized for tightly coupled symmetric multiprocessors. Multiprocessors share the same memory and I/O busses and I/O devices. The Series 980/200, Series 980/300 and Series 980/400 are fully symmetric multiprocessors that provide significant incremental performance increases for OLTP and multi-batch environments with no changes to software. The HP 3000 operating system distributes the workload between the processors to provide a single system image to applications, Data Processing staff, and end users.

Symmetric multiprocessing allows a significant increase in the number of individual transactions and jobs that can be completed in a given period of time. In addition, each successive processor provides protection against downtime due to CPU failure. If one of the processors should fail, the operating system will deconfigure the failed processor during reboot and continue to boot the system without the failed processor, allowing operations to continue until repair.

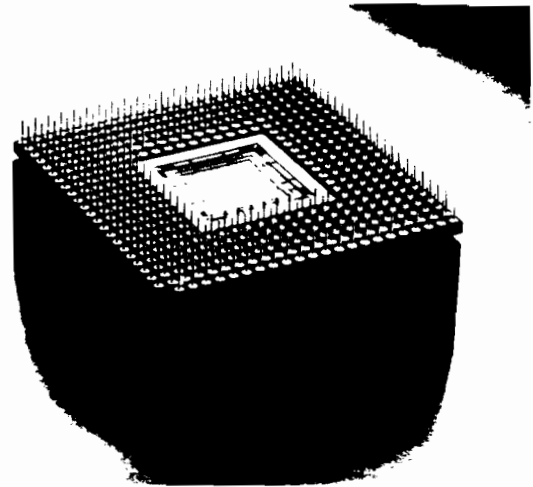


Figure 2. Single-chip VLSI CPU

VLSI technology

The Series 980 system is implemented using a powerful design in HP's advanced submicron CMOS VLSI technology. CMOS is a very effective CPU technology, allowing for denser, more cost-effective implementations than bipolar technologies. CMOS is also more reliable and requires less stringent environmental conditions. HP's CMOS VLSI technology allows the entire Series 980 CPU to exist on a single 1.4 cm die, comprising approximately 475,000 transistors and packaged in a 408-pin pin-grid-array (PGA).

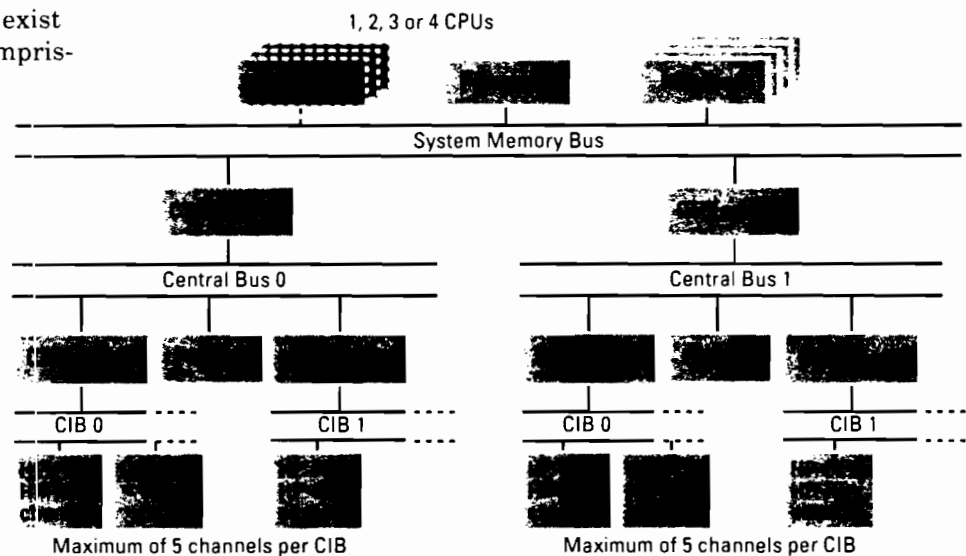
The 408-pin PGA allows separate paths for data and instructions from the cache to memory and enables single-cycle execution for every 21-ns clock cycle.

System organization

The processor communicates with main memory via the System Memory Bus (SMB). The SMB is a very high speed bus that provides a 64-bit data path and can support sustained data transfer rates of 100 Mbytes/second.

The SMB connects to two Central Buses (CTBs) through separate CTB adapters. Each CTB supports two channel I/O buses (CIBs) via separate CIB adapters. The CIBs support I/O interfaces to peripheral devices and Local Area Network (LAN) links.

Figure 3. I/O System Structure



Floating point co-processor

Single precision and double precision floating point calculations are performed by the floating point co-processor. The co-processor is designed using advanced ultrahigh-performance bipolar chips, and significantly decreases the time required to perform floating point calculations. The floating point co-processor and the CPU can operate in parallel, allowing for increased performance in applications that use floating point.

Virtual memory management

Virtual addresses on the Series 980 are 64 bits in length. This greatly extended address space provides tremendous expandability for large applications. Virtual memory is divided into a set of 4 billion spaces, with each space 4 Gbytes in length. Spaces are further divided into fixed-length, 2 Kbyte pages, with a given page holding data, code, or both. A single data structure can be up to either 1 Gbyte or 4 Gbytes in length (compiler dependent), and code can span multiple spaces.

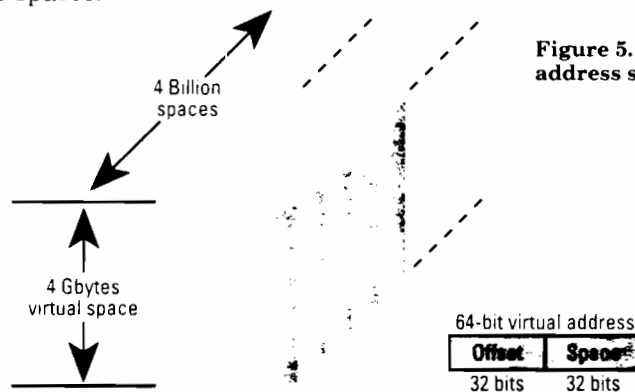


Figure 5. Virtual address space

Virtual address translation

Virtual-to-physical address translation is done by Translation Lookaside Buffers (TLBs) that cache recently accessed virtual page translations and convert the 64-bit virtual address into a 32-bit physical address. The Series 980 implements a two-level TLB scheme. A 64-entry data and a 64-entry instruction split TLB resides on the CPU chip, and high speed SRAMs are used to implement an external TLB that holds translations for 8,192 virtual pages, and is split into a 4,096-entry instruction TLB and a 4,096-entry data TLB. Page level access protection is provided on the Series 980, and 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.

Memory subsystem

HP 3000 Series 980 memory sizes are listed under "Features" on page 2. Memory can be expanded with either system in both 16 and 64-Mbyte increments. The memory subsystem uses 1-Mbit, nibble-mode dynamic RAMs for the 16-Mbyte modules and 4-Mbit, nibble-mode dynamic RAMs for the 64-Mbyte modules. Main memory has battery backup to ensure that information is maintained for a minimum of 15 minutes in the event of an interruption in AC power. This allows the operating system to be automatically restarted and processing to continue without data loss upon resumption of power.

The internal memory word size is 72-bits, with 64-data bits of two 32-bit words, plus 8-bits for error detection and correction. Single bit memory errors are automatically corrected, with automatic detection of all double-bit errors.

Memory interleaving

The symmetric multiprocessing versions of the HP 3000 Series 980 use the memory subsystem to implement cache-line interleaving. This improves performance by increasing aggregate bandwidth for usable memory. Consecutive cache-lines are fetched from alternate memory modules to improve the effective data return rate, while allowing parallel access to cache-lines on the same page from all processors.

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I/O subsystem

I/O buses

Channel I/O Buses (CIBs) support up to five cards each for interfacing peripheral devices and providing for local area networking. Each CIB adapter provides DMA functions and has a data throughput capacity of up to 5-Mbytes/second. Two CIB adapters directly connect to each Central Bus (CTB). Each of the two CTBs run synchronously with a 9-MHz clock and can support data transfer rates of up to 20-Mbytes/second.

Memory-mapped I/O

Input/output operations are initiated and controlled via a memory-mapped I/O scheme, such that the processor only needs to access reserved virtual or physical memory locations to control I/O operations. Memory mapped I/O allows for streamlined I/O operations and thus increases system performance in I/O-intensive applications.

Peripheral connection

Disk drives are connected via HP Fiber-Optic Link interfaces (HP-FL), each supporting up to 8 disk drives. Each HP-FL can support a data transfer rate of up to 5 Mbytes/second. Fiber optics offer exceptional immunity to noise and HP-FL allows disk drives to be located up to 500 meters from the SPU.

Tapes and printers (as well as disk drives) are connected via the 8-bit wide, IEEE-488 standard Hewlett-Packard interface bus (HP-IB).

Workstation and serial printer connection

Connections for workstations, serial printers, and other serial devices are provided via Data-communications and Terminal Controllers (DTCs) that are distributed over an IEEE 802.3 standard local area network (LAN). This flexible connection scheme allows DTCs to be

situated in the department that they service, saving the cost and effort of running cables from each workstation back to the processor. Each DTC can support up to 48 direct connect ports, or 36 modem ports, or a combination of the two. Both RS-232C and RS-422C interfaces are supported.

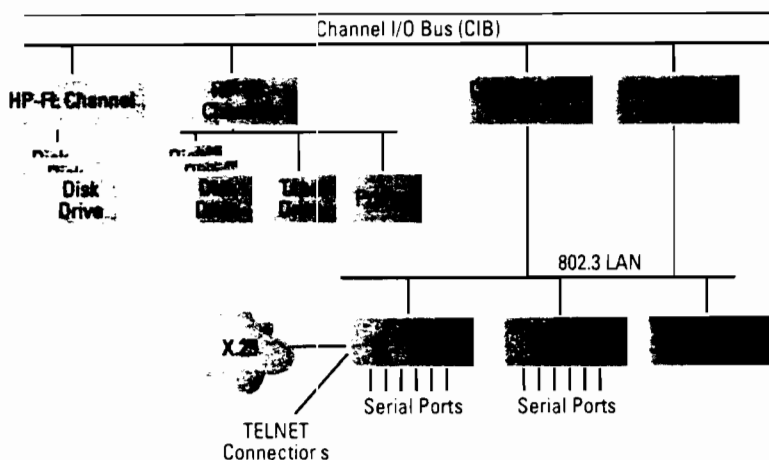
PCs can also be connected to the HP 3000 through Novell's NetWare, HP OfficeShare and LAN Manager LANs. Physical connections can be made through an IEEE 802.3 LAN using coaxial and unshielded twisted pair cabling.

Both workstations connected via a DTC and PCs connected via a LAN can switch between multiple HP 3000 systems and servers connected over the same LAN.

Open Systems Functionality

The HP 3000 900 Series systems provide OLTP performance and functionality while supporting industry and de facto standards. The HP 3000 supports X/Open's open systems definition by providing interoperable networking (ARPA, OSI and IBM SNA services) and application portability through application programming interfaces (APIs). In addition, the HP 3000 supports de facto market standards such as Microsoft's LAN Manager and Novell's NetWare for PC Integration, as well as SQL Access for interoperable relational databases.

Figure 6. Peripheral connection



System-to-system datacommunications

HP NS XL Network Services provide virtual terminal, network file transfer, remote file and data base access, network interprocess communication, and remote process management between HP 3000s on an IEEE 802.3 Local Area Network using HP LAN Link/XL; or over wide areas using the HP DTC X.25 Network Link or the HP NS Point-to-Point Link.

HP SNA/SDLC Link/XL and HP BSC Link/XL are provided for HP-to-IBM system communication in SNA and Bisync environments respectively. Network services over these links include HP SNA IMF/XL for SNA 3270 emulation; HP SNA NRJE/XL for SNA remote job entry; HP LU 6.2 API/XL, an LU 6.2 program-to-program application interface; HP SNA Distributed Host Command Facility/XL (HP SNA DHCF/XL) for IBM 3270/PC access to the HP 3000; and BSC RJE/XL for Bisync remote job entry.

Application software

A wide range of solutions are available for the HP 3000 systems, including application areas such as manufacturing, financial, inventory, distribution, and information management. Additionally available are solutions that are targeted for wholesale distribution, retail, legal services, and state and local government. Your local HP sales representative can provide more information that is specific to your needs.

Availability

In organizations that increasingly rely on on-line transaction processing (OLTP) — whether, it's business, industry or government — the need for greater system uptime goes in one direction: up. The HP 3000 provides a range of solutions to meet these needs. Mirrored Disk/XL eliminates vulnerability to disk drive failure by providing redundant or mirrored disk drives for user-selected critical application data. SPU Switchover/XL automatically detects system failures and allows operator initiated switchover of data between a pair of System Processing Units (SPUs); additionally, full data integrity is ensured at the point of failure. AutoRestart/XL minimizes downtime due to critical software failures by immediately saving the system state and initiating system restart. TurboSTORE/XL II eliminates downtime due to system backup requirements; data is concurrently backed up while production processing against the data continues.

System Management

The increasing IS challenge: Do more with less! Increase system availability! Improve performance! Boost productivity! While at the same time manage more users with increasing requirements. The HP 3000 offers a broad set of systems management solutions to address these needs. Solutions encompass performance, administration, security, availability, operations and storage management. The solutions are aimed at meeting the needs of large system environments while improving productivity, service quality, and control and management of the systems. Your local HP sales representative can provide more information that is specific to your needs.

Information management

The HP 3000 has two complementary database management products for information storage. HP ALLBASE SQL is HP's strategic relational database management system (RDMS) for 900 Series HP 3000 systems. This database is based on the industry standard, SQL. HP TurboIMAGE is a networked database management system that provides the best DBMS performance on HP 3000 systems. Software developers are provided with a rich selection of programming languages and tools that support both of these databases. Reporting and presentation tools are available that allow access to the stored data without programming. A common data dictionary provides the integration necessary to tie the system into a unified whole.

System software and supported peripherals

For a list of supported system software and peripherals, refer to the "900 Series HP 3000 Supported Products Listing."

Support services

A wide range of hardware and software support services are available worldwide for all HP 3000 products. Contact your HP sales representative for details on available support services.

For more information, call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

United States:

Hewlett-Packard Company
4 Choke Cherry Road
Rockville, MD 20850
(301) 670-4300

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Rolling Meadows, IL 60008
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Hewlett-Packard Company
5161 Lankershim Blvd.
No. Hollywood, CA 91601
(818) 505-5600

Hewlett-Packard Company
2015 South Park Place
Atlanta, GA 30339
(404) 955-1500

Canada:

Hewlett-Packard Ltd.
6877 Goreway Drive
Mississauga, Ontario L4V 1M8
(416) 678-9430

Japan:

Yokogawa-Hewlett-Packard Ltd.
15-7, Nishi Shinjuku 4 Chome
Shinjuku-ku
Tokyo 160, Japan
(03) 5371 1351

Latin America:

Hewlett-Packard
Latin American Region Headquarters
Monte Pelvoux No. 111
Lomas de Chapultepec
11000 Mexico, D.F., Mexico
(525) 202-0155

Australia/New Zealand:

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Melbourne, Australia
(03) 895 2895

Far East:

Hewlett-Packard Asia Ltd.
22/F Bond Centre, West Tower
89 Queensway
Central, Hong Kong
8487777

In Europe, please call your local HP sales office or representative:

Austria, East Central Europe, and Yugoslavia:
(0222) 2500 0

Belgium and Luxembourg:
Customer Information Center
(02) 761 34 00

Denmark:
(02) 81 66 40

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(022) 780 41 11 (Suisse Romande)
(046) 05 15 05 (Customer Information Center)

South Africa:
HiPerformance Systems
(011) 802 5111

Turkey:
175 29 70

UK:
(0344) 369 369

Middle East and Africa:
Geneva, Switzerland
41/22 780 7111

European Headquarters:
Hewlett-Packard S.A.
150, Route du Nant d'Avril
1217 Meyrin 2
Geneva, Switzerland
41/22 780 8111

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