Hewlett-Packard
HP 9000
Multiuser Systems

Product Summary

Editor's Note
Hewlett-Packard significantly enhanced the capabilities of the HP 9000 Series 800 with the introduction of new low end Models 808 and 815 and high end Model 855. Recent price cuts further improve price performance in the HP 9000 product line.

Description
The HP 9000 Series 800 superminicomputer uses the RISC-based HP Precision Architecture and de facto and industry-standard system software facilities and data communications tools. It is oriented toward technical and realtime computing in manufacturing industries and toward general-purpose computing in government and education.

Strengths
The primary advantage of the Series 800 is its adherence to de facto industry standards, including a UNIX operating system based on AT&T's UNIX System V.

Limitations
Connections to IBM mainframes and SNA networks are difficult to implement. Upgrade options for moving from one Series 800 model to another are also somewhat limited.

Competition
The Series 800 finds its toughest competition in Digital Equipment Corporation's VAX 6000 Model 310 and DECsystem 5400 and 5810. Other competition comes from the Unisys Series 5000 and 7000, and the NCR Tower Series computers.

Vendor
Hewlett-Packard Co.
Business Computing Systems
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Cupertino, California 95014
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Price
Ranges from $14,900 to $241,000 for a basic configuration.

GSA Schedule
Yes.

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Analysis

Product Strategy

Since our last report, Hewlett-Packard has en-
hanced the HP 9000 Series 800 superminicom-
puter line with three new offerings: Model 808S,
Model 815S, and Model 855S. These new low- and
high-end models expand the capabilities of the
product line. They make entry into large-scale
computing easier, and provide more room for
growth once an HP 9000 Series 800 model is pur-
chased. The Series 800 family now comprises Mod-
els 808S, 815S, 825S, 835S, 835SE, 850S, and
855S.

New High End

Positioned above the Model 850—the previous top
of the line—the Model 855 is now HP's UNIX,
RISC-architecture Series 800 superminicomputer.
It provides more resources to accommodate heavy
computing demands and larger user communities,
and also effectively meets the growth requirements
of users of the large-scale Model 850 or midrange
Model 835 while preserving compatibility. The
Model 855, which runs at up to 12 MIPS, provides
approximately 1.5 times the performance and ac-
commodates up to 1.3 times more terminal I/O
devices than the Model 850.

A field upgrade for the Model 850 allows cus-
tomers to obtain a Model 855 without buying an
entirely new platform or central system. Included
with the field upgrade is the exchange of CPU
boards.

New Low End

At the low end, Models 808S and 815S are the low-
est priced multiuser systems offered in the
HP 9000 Series 800 line. Both models provide 85
percent of the performance of the former low end
Model 825S at a substantially lower price. A field
upgrade from the Model 815S to the Model 835SE
is available, providing a growth path for expanding
businesses.

Vertical Markets

Hewlett-Packard is busy trying to recapture the
superminicomputer market share it lost to Digital
Equipment Corporation within the manufacturing
automation, engineering, scientific, and process
control and monitoring application areas. At the
same time, Hewlett-Packard is becoming more
forceful within those vertical markets demanding
solutions based on UNIX for their general-purpose
computing requirements.

Hewlett-Packard has created a more attrac-
tive, expanded line of superminicomputers for
technical computing and realtime processing and
for general-purpose UNIX processing within the
private business and public service sectors.

These strategic changes make HP 9000 mul-
tiuser computing more competitive in price, per-
formance, and function cost.

Applications

Hewlett-Packard is marketing the Series 800 for a
variety of applications. Although the Series 800 is
primarily oriented toward technical and realtime
computing, Hewlett-Packard also sells Series 800
units where UNIX systems are required within in-
dustry, government, and educational institutions.
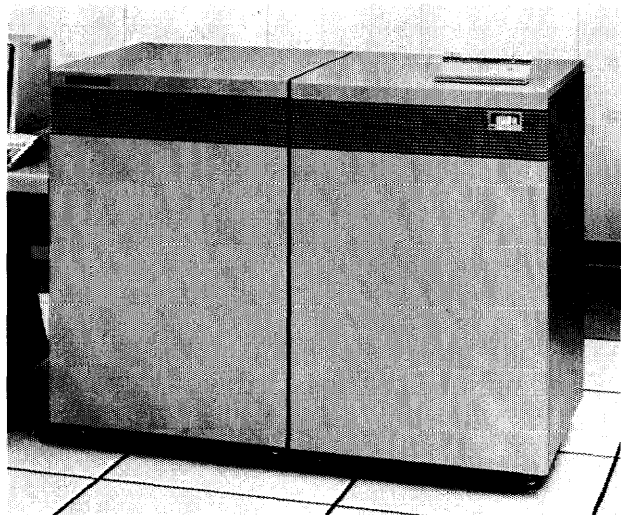
*Since our last report, Hewlett-Packard in-
creased the performance, capacities, and cost-
effectiveness of the Series 800 by introducing
Models 808S, 815S, and 855S. These adjust-
ments are an attempt to meet growing process-
ing requirements and to make the product line
more attractive to potential customers. Pic-
tured here is the HP 9000 Series 800 Model
850, a 7-MIPS system that accommodates up
to 300 local terminal I/O devices.*

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Competitive Position

Although the Series 800 superminicomputer product line has a multitude of competitors, its prime competition comes from the Digital Equipment VAX 6000 Model 310 and DECsystem 5400 and 5810. Digital Equipment has the largest percentage of installations within Hewlett-Packard's primary target market—discrete and process manufacturing industries and research and development facilities. Other competitors include the Unisys Series 5000 and 7000 and the NCR Tower.

The HP 9000 Series 800 models are competitive in price, performance, and capabilities with other systems. Hewlett-Packard cut prices on some Series 800 peripherals by as much as 50 percent to be price-competitive with Digital.

While they compare favorably in price/ performance with the Digital VAX 6000 Models 210/310, the Series 800 models are at a disadvantage in configurability and system expandability. Generally, the VAX 6000 systems offer greater mass storage and terminal I/O device connectivity than the Series 800. For example, the Model 825 accommodates up to 9.1G bytes of mass storage and 64 local terminal I/O devices. In contrast, the VAX 6000 Model 210 accommodates almost 60G bytes of mass storage and 128 local terminal I/O devices.

The other primary competition with the HP 9000 Series 800 systems comes from Unisys Series 5000 and 7000 and NCR's Tower Series microprocessor-based multiuser computers. These vendors are the most active within the UNIX data processing, information system, professional automation, and office automation markets. Generally, when compared to the UNIX offerings from vendors such as Unisys, TI, and NCR, the Series 800 systems remain competitive.

Future Markets

Although the Series 800 superminicomputers offer competitive price/performance and capacities, they are not likely to replace competitors' systems. Customers rarely change vendors or computer architectures because of the high cost of the migration. The Series 800 computers do, however, give Hewlett-Packard a better chance to compete with Digital Equipment, Unisys, and NCR for new corporate accounts or for first-time automation sales.

Sales and Distribution

By focusing on a wide range of target markets, Hewlett-Packard increases the sales potential for Series 800 superminicomputers. Hewlett-Packard is guaranteed sales income from market segments that are automating faster than the marketplace as a whole. Those traditional marketplaces still offer significant sales opportunities.

Applications Software

To compete in its target markets, Hewlett-Packard ensures that applications software for the Series 800 systems is readily available. Independent software developers are the major source.

To attract and retain independent software providers, Hewlett-Packard works at maintaining the marketing, technical, and business aspects of these alliances. The alliances give Series 800 customers access to the services of the independent software vendors (ISVs). After discovering a customer's application need, Hewlett-Packard helps the customer establish contact with the appropriate data system suppliers. In some cases, Hewlett-Packard will provide the customer with third-party packages directly.

Industry Standards

HP's adherence to industry standards is a strong marketing tool being used to sell the new and enhanced HP 9000 multiuser computer systems.

The Series 800 operating environment includes a UNIX operating system based on AT&T's UNIX System V and University of California at Berkeley's 4.2 Berkeley Software Distribution (4.2 BSD) enhancements; standard programming languages; the SQL database language; Graphics Kernel System (GKS) graphics; and IEEE 802.3 and 803.3 Ethernet communications.

Open Computing Environment

By using common operating environment facilities for the Series 800, Hewlett-Packard creates an "open computing environment." Customers want industry-standard solutions to reduce system and applications porting costs when migrating to another hardware platform, increase applications accessibility, standardize computing across the organization, and provide a degree of compatibility between systems in a multivendor or multiple-system-architecture computing environment.

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Table 1. System Comparison

Model	808S/815S	825S	835S/835SE	Model 850S	Model 855S
System Characteristics					
Date of introduction	June 1989	May 1987	April 1988	May 1987	April 1988
Date of first delivery	3rd quarter 1989	3rd quarter 1987	3rd quarter 1988	4th quarter 1987	2nd quarter 1989
Operating system	HP-UX (a superset of UNIX System V.2)	HP-UX (a superset of UNIX System V.2)	HP-UX (a superset of UNIX System V.2)	HP-UX (a superset of UNIX System V.2)	HP-UX (a superset of UNIX System V.2)
Upgradable from	Not applicable	Not applicable	825S/815S, 825S, 835S	Not applicable	850S
Upgradable to	—/835SE	835S, 835SE	835SE/Not applicable	855S	Not applicable
MIPS	—	3	6	7	12
Relative performance (based on a rating of the 825S at 1.0)	0.85	1.0	2.1	2.3	3.5
Memory					
Minimum capacity, bytes	8M	8M	8M/24M	32M	32M
Maximum capacity, bytes	32M/56M	112M	112M	128M	128M
Cache memory, bytes	—	16K	128K	128K	—
Input/Output Control					
Number of channels	—	1 or 2	1/1 or 2	2 to 12	—
Maximum Disk Storage	6.8G bytes	9.1G bytes	9.1G bytes	18.3G bytes	18.3G bytes
Number of Workstations	10/50	64	30/78	300	400
Communications Protocols	IEEE 802 Ethernet, NS/9000 (NFT), TCP/IP, ARPA/Berkeley, NFS, uucp, SNA/3770, SNA/3270, NS/DEC VAX/VMS	IEEE 802 Ethernet, NS/9000 (NFT), TCP/IP, ARPA/Berkeley, NFS, uucp, SNA/3770, SNA/3270, NS/DEC VAX/VMS	IEEE 802 Ethernet, NS/9000 (NFT), TCP/IP, ARPA/Berkeley, NFS, uucp, SNA/3770, SNA/3270, NS/DEC VAX/VMS	IEEE 802 Ethernet, NS/9000 (NFT), TCP/IP, ARPA/Berkeley, NFS, uucp, SNA/3770, SNA/3270, NS/DEC VAX/VMS	IEEE 802 Ethernet, NS/9000 (NFT), TCP/IP, ARPA/Berkeley, NFS, uucp, SNA/3770, SNA/3270, NS/DEC VAX/VMS
Purchase Price (basic)	—/$14,900	$25,500	$45,000/ $101,950	$176,000	241,000

The Series 800 superminicomputers implement an "open network computing" philosophy to attract customers with a multivendor or multiple-architecture computer infrastructure. The scheme provides the openness required in a departmental and distributed processing environment.

The Series 800 systems can also communicate with IBM System/370-architecture mainframe and supermini host systems running MVS or VM operating systems and can directly interface with DECnet-connected Digital Equipment Corporation computers.

Future Enhancements

Hewlett-Packard is committed to enhancing its Series 800 product line to accommodate customers' growing power, functionality, and system expansion requirements. For example, the introduction of Models 808S, 815S, and 855S in 1989 expanded both low- and high-end options.

Furthermore, Hewlett-Packard is planning to introduce multiprocessor versions. Currently, each Series 800 model is configured with only one central processor, but internal bus structures and control schemes can accommodate multiple central processors.

Network of Resellers

Hewlett-Packard increased the size of its direct and indirect sales channels to increase the market visibility of the Series 800. By adding more distributors, dealers, and value-added resellers to its network of existing resellers, Hewlett-Packard gains access to customers it cannot reach through a direct sales force.

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Decision Points

Strengths
One of the primary strengths of the HP 9000 Series 800 line is its adherence to de facto and industry standards.

Communications
The Series 800 communications and networking scheme also provides an advantage. The data communications tools used on the Series 800 provide flexibility in creating networking and distributed processing environments and provide the open connectivity required in departmental processing.

The Network Services/9000 software package links the Series 800 systems to HP 9000 workstations, older HP 9000 Series 500 multiuser computers, HP 1000 computers, HP 3000 Series minicomputers, and Vectra PC microcomputers for bidirectional file transfer and remote file access. The UNIX-to-UNIX Copy (*uucp*), Connect to UNIX (*cu*), and UNIX-to-UNIX Execute (*uux*) commands provide for file transfers, electronic mail, remote logins, and remote command executions between the Series 800 and other computers with UNIX implementations.

ARPA Services/9000 Series 800 provides communications among professional workstations and multiuser computers that implement the Department of Defense Advanced Research Projects Agency (ARPA) or Berkeley 4.2 BSD networking standards—i.e., the Transmission Control Protocol/Internet Protocol (TCP/IP) communications model for data transportation and system interfacing and the FTP, Telenet, and SMTP or *rcp*, *r*login, and *rsh* protocols for file transfer, terminal login access, electronic mail, and remote command execution.

The Network File System Services/9000 Series 800 provides multivendor remote file access to other computers supporting the de facto industry-standard Network File System (NFS) services. The SNA communications tools permit Series 800 superminicomputers to communicate with IBM System/370-architecture mainframe and supermini host systems with MVS or VM operating systems. The DECnet communications facilities permit the Series 800 computers to interact with DECnet-connected Digital Equipment systems with the VAX/VMS operating system.

Common Communications Channel: The most important component of the Series 800's open system approach to networking and distributed processing is the IEEE 802.3 Ethernet local area network. IEEE 802.3 is one of the most popular for interconnecting information systems and workstations—especially at the departmental level. By employing Ethernet, the Series 800 superminicomputers have a common communications channel for interacting with other Hewlett-Packard multiuser computers and workstations and other vendors' supermini-class systems and professional workstations. With IEEE 802.3 Ethernet, costs for system interconnection are reduced and data transfer speeds are increased.

Emulators
The SNA and DECnet emulators are also very important. Such facilities are needed in environments where departmental systems frequently access data, files, and application services residing in IBM MVS or VM environments or Digital Equipment VAX/VMS environments.

Software Applications
Application availability is not a problem with the Series 800. Through HP Plus, Hewlett-Packard's third-party vendor program, customers have access to an abundance of packaged software. The program provides software for both commercial and technical computing, including accounting, manufacturing resource planning, office automation, mechanical engineering, factory floor automation, artificial intelligence, and scientific laboratory automation.

Compatibility
The Series 800 multiuser computers are object-code compatible. Applications developed on one Series 800 multiuser model—such as the Model 825S—can be moved to another Series 800 multiuser model—such as the Model 850S—without being modified or recompiled. Such compatibility preserves software investments, thus prompting system migration and bottom-to-top and top-to-bottom application development.

The Series 800 models remain program, file, and data compatible with the older, conventionally designed HP 9000 Series 500 multiuser computers, despite their RISC-based HP Precision Architecture. The HP-UX operating system, which runs

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Table 2. Mass Storage

Model	HP 7907A	HP 7936FL	HP 7936H	HP 7937FL	HP 7937H
Type	Winchester/ removable	Winchester	Winchester	Winchester	Winchester
Characteristics					
Controller model	Integrated	Integrated	Integrated	Integrated	Integrated
Drives per subsystem/controller	1/controller	1/controller	1/controller	1/controller	1/controller
Formatted capacity per drive (megabytes)	20 fixed, 20 removable	307	307	571	571
Average seek time	30 ms	20.5 ms	20.5 ms	20.5 ms	20.5 ms
Average rotational/relay time	8.5 ms	8.3 ms	8.3 ms	8.3 ms	8.3 ms
Average access time	38.5 ms	28.8 ms	37.3 ms	37.3 ms	25.9 ms
Data transfer rate	1M bytes/second	2.35M bytes/second	2.35M bytes/second	2.35M bytes/second	2.35M bytes/second
Supported by system models	835S, 835SE, 850S	All	All	All	All
Purchase price (basic)	$14,620	$14,800	$14,250	$16,250	$15,700
Comments	Requires an HP-IB interface to communicate with the host.	Requires the HP-FL interface to communicate with the host. Up to 8 drives, each with their own controller, can reside on the HP-FL.	Attaches to the host via HP-IB.	Requires the HP-FL for connectivity and operability.	Communicates with the host via the HP-IB interface.

A dash (—) in a column indicates that the information is unavailable from the vendor.

across the HP 9000 line of conventional and RISC-technology-based superminicomputers, provides protection for software investments and a measure of bottom-to-top software development and execution.

Limitations

Although the Series 800 superminicomputers can access IBM mainframes and SNA networks, the connections are difficult to implement. Missing within the Series 800-to-IBM mainframe communications channel is the popular Advanced Peer-to-Peer Communications (APPC)/LU6.2 protocol. If the Series 800 employed the APPC/LU6.2 protocol and communications interface set, they could establish sessions with applications on IBM mainframes without running the multiple layers of emulation that are now required. Running APPC/LU6.2 reduces the complications and performance degradations caused by file format limitations and emulation overhead.

Compatibility

Programs developed on a Series 500 model cannot run on a Series 800 superminicomputer until the source code has been modified.

The Series 800 multiuser models are compatible with Series 800 superworkstations and conventionally designed HP 9000 workstations for applications development. But applications developed on an HP Precision Architecture-based Series 800 workstation can be moved to the Series 800 superminicomputer without modification, only when the application has been developed to run in a multiuser, multitasking environment. Programs moved between the Series 800 superminicomputers and the conventionally designed HP 9000 Series 200 and Series 300 workstations must be rewritten and recompiled.

Upgrade Options

In-place upgrade options for moving from one Series 800 model to another have been greatly improved, but are still somewhat limited. All but two Models, the 835SE and 855S, come with upgrade options. By simply swapping processors, the 825S can be upgraded to the 835S or 835SE; the 835S can be turned into a 835SE; the 850S can move to an 855S. Moving from other Models requires a reinvestment in the system's main unit; i.e., the system processing unit boxes must be exchanged.

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Table 2. Mass Storage (Continued)

Model	HP 7957B	HP 7958B	HP 7959B	HP 7962B	HP 7963B
Type	Winchester	Winchester	Winchester	Winchester	Winchester
Characteristics					
Controller model	Integrated	Integrated	Integrated	Integrated	Integrated
Drives per subsystem/controller	1/controller	1/controller	1/controller	1/controller	1/controller
Formatted capacity per drive (megabytes)	81	131	304	152	304
Average seek time	29 ms	29 ms	17 ms	17 ms	17 ms
Average rotational/relay time	8.3 ms	8.3 ms	8.9 ms	8.9 ms	8.9 ms
Average access time	37.3 ms	37.3 ms	25.9 ms	28.4 ms	28.4 ms
Data transfer rate	1.25M bytes/ second	1.25M bytes/ second	1.25M bytes/ second	—	1.25M bytes/ second
Supported by system models	835S, 835SE, 840S, 850S	835S, 835SE, 840S, 850S	835S, 835SE, 840S, 850S	835S, 835SE, 840S, 850S	835S, 835SE, 840S, 850S
Purchase price (basic)	$3,575	$4,775	$7,725	$5,275	$8,575
Comments	Has a 5.25-inch form factor. Can be rack-mounted. Requires the HP-IB to communicate with the host.	Has a 5.25-inch form factor. Up to 4 can be connected to a HP-IB.	Has a 5.25-inch form factor. Requires the HP-IB for connectivity.	Has a 5.25-inch form factor. Up to three HP 7962s can reside in one disk drive packaging. Requires the HP-IB for connectivity.	Has a 5.25-inch form factor. Up to three HP 7963s can reside in one disk drive packaging. Requires the HP-IB for connectivity.

A dash (—) in a column indicates that the information is unavailable from the vendor.

Such an investment is costly, even though HP offers credits toward upgrades requiring box exchanges. In most cases, replacing the entire main unit requires more effort and expense than performing an upgrade by simply replacing or adding a few circuit boards, as in a file upgrade.

Moving from the Series 500 to a Series 800 is a fairly expensive venture. The move requires the replacement of the main processing cabinet. Only some of the terminals, printers, and magnetic tape units used on the Series 500 can be moved over to the Series 800.

Moving from the aging HP 1000 realtime and compute-intensive timesharing computers to the Series 800 is also very expensive. Besides replacing the basic processing complexes, many peripherals will have to be replaced as well. In addition, much of the software investment is lost. Applications on the HP 1000 will have to be modified to accommodate the HP 9000 Series 800 architecture, because the HP 1000 architecture and HP 9000 Series 800 architecture are incompatible. This is a time-consuming and personnel-intensive task.

To ease application migration efforts during an HP 1000-to-HP 9000 Series 800 move, Hewlett-Packard offers a migration tool called the Port/HP-UX, which allows the migration of existing HP 1000 programs running under the RTE operating system to be upgraded to the HP 9000 running under the HP-UX operating system. This tool reduces the complexity of the migration, thus lowering expenses, not only in the cost of the application porting itself, but in training costs as well.

Cross-Reference

For a detailed description of the Series 800 super-workstations and the conventional HP 9000 workstations, see the CAD/CAM/CAE Systems volume of *Datapro Manufacturing Automation Series*.

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Table 3. Workstations

Model	HP 700/92	HP 700/94	HP 700/41	HP 700/22
Display Parameters				
Screen size	14 inches	14 inches	14 inches	14 inches
Screen format	80 or 132 columns per line	80 or 132 columns per line	80 columns per line	80 or 132 columns per line
Screen type	Monochrome with green, amber, or soft white character phosphor	Monochrome with green, amber, or soft white character phosphor	Monochrome with green or amber character phosphor	Monochrome with green, amber, or soft white character phosphor
Keyboard Parameters				
Style	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY
Terminal Interface	RS-232-C	RS-232-C	RS-232-C	RS-232-C
Purchase Price (basic)	$895	$1,150	$429	$529
Comments	A block-mode alphanumeric display terminal. Has an 8-page display memory.	A high-performance block-mode alphanumeric display terminal.	Features 9 ASCII alphanumeric display terminal compatibility modes.	An alphanumeric display terminal. Features a 4-page display memory.

Characteristics

System Overview

The HP 9000 Series 800 superminicomputer is based on the RISC-based HP Precision Architecture and uses de facto industry-standard system software facilities and data communications tools. It is oriented toward technical and realtime computing in manufacturing industries and towards general-purpose computing in government and education markets.

The Series 800 line comprises Models 808S, 815S, 825S, 835S, 835SE, 850S, and 855S. Memory ranges from 8M to 128M bytes, and disk capacity ranges from 6.8G to 18.3G bytes.

Specifications

Data Formats

Basic Format: 32-bit word.

Fixed-Point Operand: The HP 9000 Series 800 superminicomputers, implementing the HP Precision Architecture, support 16-bit and 32-bit integers, either signed or unsigned. Signed integers are in 2's complement form. To help minimize processor complexity, halfword (16-bit) integers must be aligned at even byte addresses and 32-bit integers must be aligned on a word boundary.

Both packed and unpacked decimal data representations are supported. Packed decimal data is aligned on a word boundary and consists of 7, 15, 23, or 31 Binary Coded Decimal digits.

Floating-Point Operand: The Series 800 computers support single- (32 bit), double- (64 bit), and quadruple- (128 bit) precision arithmetic operations. Single-precision floating-point numbers must be aligned on word boundaries, and double- and quadruple-precision numbers must be aligned on double-word boundaries.

The floating-point instructions can either be executed directly in hardware by a co-processor or emulated in software. A floating-point co-processor performs calculations while the CPU continues to execute in parallel. The Series 800 floating-point format conforms to ANSI/IEEE 754-1985 standard floating-point format.

Instructions: The HP Precision Architecture of the Series 800 defines 140 instructions. Each instruction is 32 bits long and has a fixed format. The instruction set directly implements only simple functions to minimize processor complexity.

Data stored in memory is referenced via Load and Store instructions. This accessing technique, coupled with support for a relatively large number of central processor registers, allows for frequently required operands to be held in the central processor. Minimizing the number of accesses to cache and main memory increases performance.

The arithmetic and logical functions are limited to relatively simple functions with appropriate primitives provided for common operations. More complicated arithmetic and logical functions are implemented by executing a sequence of simple instructions.

Internal Code: ASCII.

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Table 3. Workstations (Continued)

Model	HP 700/43	HP 2393A	HP 2397A	HP 9000 Series 300 Models 310, 320, 330, 350
Display Parameters				
Screen size	14 inches	—	12 inches	—
Screen format	80 or 132 columns per line	80 or 132 columns per line	—	1,024 x 768 or 1,280 x 1,024 pixel matrix screen
Screen type	Monochrome with green, amber, or soft white character phosphor	Monochrome	Color	—
Keyboard Parameters				
Style	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY	Detachable, low-profile, QWERTY
Terminal Interface	RS-232-C	RS-232-C	RS-232-C	RS-232-C, LAN/9000
Purchase Price (basic)	$499	$2,500	$3,925	$5,820 for Model 310; $10,600 for 320; $12,460 for 330; $27,550 for 350
Comments	An alphanumeric display terminal with 12 compatibility modes.	A graphics terminal with bit-mapped and line-drawing graphics. Graphics resolution is 512 x 390 or 640 x 400 pixels.	A graphics terminal with bit-mapped and line drawing graphics.	Technical workstations using HP-UX software.

A dash (—) in a column indicates that the information is unavailable from the vendor.

Main Storage

Capacity: The Series 800 computers are virtual memory machines. Using 48-bit virtual addresses, the HP-Precision Architecture-based computers provide virtual address spaces of significant size. The virtual memory is organized as a set of 65,536 linear spaces. Each space is 4G bytes long. Spaces are further divided into fixed length 2K-byte pages, each of which can hold either code, data, or both. A single data structure can be up to 4G bytes long.

Main storage consists of memory array boards having either 2M, 8M, 16M, or 32M bytes of storage implemented in 256K- or 1M-bit dynamic random access memory (DRAM) chips. Each board also has a memory controller. The Series 800 supports from 8M to 128M bytes of main storage. Table 1 provides the main storage capacities for each model.

Checking: The memory controllers perform bit error detection/correction. Seven bits store a Hamming code, enabling each memory controller to correct all single-bit errors automatically and detect all multibit errors.

Storage Protection: Virtual memory access is protected by the translation lookaside buffer hardware in the central processor. The translation lookaside buffer supports protection mechanisms to ensure that the currently executing process can perform only the code, data, or I/O accesses for which it is authorized. Included in the access checking mechanisms are four privilege levels. Protection parameters are associated with each page, and these parameters define the required privilege level to access that page, as well as what types of accesses are permitted. For each requested access, these privilege parameters are checked against the privilege level of the currently executing process to ensure the user has sufficient authorization to perform a particular access.

Main storage is backed up in such a way that if AC power is lost and restored within 15 minutes, the operating system is automatically restarted and processing can resume without data loss. Batteries power memory only for 15 minutes.

Cache Memory: All the Series 800 computers have a cache. By using a cache, the central processors have high-speed access to frequently used data and instructions. This improves systems performance, because fetching instructions and data from cache memory is faster than accessing instructions and data in main memory. The use of cache memory overcomes the discrepancy between the memory cycle speed and the faster data-access rate of the central processor.

Series 800 computers have up to 256K bytes of cache memory. Separate instruction and data caches (each 64K bytes in size) promote parallel operation.

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Table 4. Printers

Model	HP 2563B	HP 2564B	HP 2566B	HP 2567B
Type	Matrix line	Matrix line	Matrix line	Matrix line
Speed	300 lpm	600 lpm	900 lpm	1,200 lpm
Paper size	3 to 18 in. wide	3 to 18 in. wide	3 to 18 in. wide	3 to 18 in. wide
Character formation	7 of 19 x 18 and 14 of 38 x 18 dot matrix	7 of 19 x 18 and 14 of 38 x 18 dot matrix	7 of 19 x 18 and 14 of 38 x 18 dot matrix	7 of 19 x 18 and 14 of 38 x 18 dot matrix
Horizontal character spacing (char./inch)	5, 10, 12, 13.3, 15, 16.7	5, 10, 12, 13.3, 15, 16.7	5, 10, 12, 13.3, 15, 16.7	5, 10, 12, 13.3, 15, 16.7
Controller/Interface	RS-232-C or HP-IB interface	RS-232-C or HP-IB interface	RS-232-C or HP-IB interface	RS-232-C or HP-IB interface
Graphics capability	Yes	Yes	Yes	Yes
Purchase price (basic)	$7,790	$13,250	$24,950	$32,000
Comments	Prints text and alphanumerics in draft or NLQ mode. Can do OCR and bar code printing. Supports 22 sets of type styles and fonts and 4 types of graphics.	Used as a data center or departmental printer. It prints draft- and NLQ-mode alphanumerics, OCR, bar code, and 4 types of graphics printing.	Used to accommodates high-volume printing at the data center or within the department. Features bar code and OCR printing capabilities.	A heavy-duty printer for high-volume printing. Has OCR and bar code printing capabilities.

Both the instruction cache and the data cache are one-way associative (direct mapped) and are organized as sets of 4,096 cache lines, with 16 bytes per cache line. The instruction cache is read-only. A write-to cache management scheme is used with the data cache.

To minimize machine cycle time, the I/O subsystems do not interface to the cache. Furthermore, it is the responsibility of the software to update main storage contents with any modified cache contents before launching a direct memory access (DMA) I/O operation.

Central Processor

General: The Series 800 processor implements HP-Precision Architecture, which embodies the basic principles of Reduced Instruction Set Computers (RISC). The Series 800 processor is hardwired and pipelined at the instruction level so that three to five instructions can be processed at the same time. Instructions are executed directly in hardware and typically execute in only one clock cycle. Branch instructions and Load/Store instructions may require more than one cycle, but they are implemented and scheduled to achieve effective execution rates approaching one cycle per instruction.

Instruction execution cycle times (nanoseconds) for the Series 800 Models are as follows: 62.5 for Models 808S and 815S, 80 for Model 825S, 66.7 for Models 835S and 835SE, 73 for Model 850S, and 40 for Model 855S.

The central processor of all Series 800 models includes a CPU with instruction unit and execution unit, cache controller and cache, and the translation lookaside buffer.

Control Storage: The HP 9000 Series 800 does not provide any control storage, as it is not microprogrammed.

Registers: The HP Precision Architecture specifies register-intensive operation. Calculations are performed only between high-speed registers, or between a register and a constant held in the instruction. There are 32 available 32-bit-wide, general-purpose registers for holding operands and results. There are also 32 control and status registers used for interrupt processing, virtual memory access protection, and other system functions. Eight space registers specify up to eight possibly different 4G-byte virtual spaces that can be used for a given operation; these registers can hold 16-bit or 32-bit space identifiers. Five of these space registers can be used directly by application programs. Two registers are used to point to the next instruction to be executed.

Register-intensive operation increases processor performance. Since data is not processed in memory, the number of references to memory are reduced. Memory references require machine cycles. By reducing the number of memory references, the time to execute an instruction is reduced. Furthermore, the circuitry within the register file is faster than the circuitry in memory; data in a register can be processed quicker than in memory, thus promoting faster processor speed.

Addressing: As stated previously, the HP Precision Architecture supports 48-bit virtual addressing. This 48-bit addressing offers 4G bytes of virtual memory for each of the 65,536 linear spaces. The virtual-to-physical address translation is performed by the translation lookaside buffer. The translation lookaside buffer converts the 48-bit virtual address to a 28-bit physical address, to cache recently accessed virtual page translations, and to implement page-level access protection.

In addition to virtual addressing, HP Precision Architecture provides direct access to physical memory

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Table 4. Printers (Continued)

Model	HP 2934A	HP 2235B	HP 2225A	HP 2227A
Type	Matrix serial	Matrix serial	Inkjet	Inkjet
Speed	200 cps	480 cps	150 cps	192 cps
Paper size	2.25 to 15.75 in. wide	Up to 15 in. wide	8.5 x 11 in.	Up to 14 in. wide
Character formation	9 x 12 and 36 x 24 dot matrix	9 x 12 and 36 x 24 dot matrix	11 x 12 dot matrix	19 x 12 and 19 x 24 dot matrix
Horizontal character spacing (char./inch)	5, 10, 16.3	—	6, 10.7, 12, 21.3	5, 6, 10, 10.6, 12, 21.3
Controller/Interface	RS-232-C or HP-IB interface	RS-232-C or HP-IB interface	RS-232-C or HP-IB interface	RS-232-C interface
Graphics capability	Yes; at 90 x 90 dpi	Yes	Yes; at 96 or 192 x 96 or 192 dpi	Yes; at 96 or 192 x 96 or 192 dpi
Purchase price (basic)	$2,595	$1,895	$495	$799
Comments	Used as either a departmental or workstation printer. Features a draft and NLQ mode. Also can do bar coding.	Used as either a departmental or workstation printer. Has a draft and NLQ mode for text and alphanumeric printing.	Used as a workstation printer. Features a draft and NLQ mode.	Used as a workstation printer. Features a draft and NLQ mode.

A dash (—) in a column indicates that the information is unavailable from the vendor.

locations. Low-cost systems have the option of providing only physical addressing if appropriate. The smallest addressable quantity is a byte.

Peripherals

Input/Output Control
The Models 808S and 815S use an HP Precision Bus (HP-PB) for direct I/O connection, while the other Series 800 Models use the channel I/O bus. The HP-PB transfers I/O data at a sustained throughput speed of 21M bytes per second. A backplane interconnects the CPU and I/O card slots.

Both the Model 825S and 835S come with one 16-bit, 5M-byte bandwidth general-purpose channel I/O bus for the connection of peripheral device cards and data communications cards. Up to seven cards can be placed on the channel. Each peripheral device or data communications card consumes one I/O slot.

The channel I/O bus requires a channel I/O adapter, which interfaces the channel I/O bus to the central bus, synchronizing differing speeds and bandwidths. It also manages direct memory access transfers between main storage and channel I/O interfaces with their associated peripherals. The channel I/O adapter accomplishes this function with little central processor intervention, interrupting only to signal completion of DMA transfers. Large blocks of data can be transferred to and from main storage at rates up to 5M bytes per second with negligible central processor overhead.

I/O Extenders
As an option, the Model 825S can be configured with an I/O extender. The I/O extender provides one channel

I/O bus and a channel I/O adapter. Up to seven peripheral or data communications cards can be attached to the channel. The adapter is required to carry DMA communications between the channel I/O bus and central bus.

The Model 835SE comes with two channel I/O adapters. The first adapter supports a channel accommodating up to seven peripheral or data communications cards. The second adapter accommodates an I/O expander that supports a channel with eight I/O slots.

The standard Models 850S and 855S have two channel I/O adapters. Two additional channel I/O adapters can be added to accommodate I/O expansion. Each adapter supports a channel I/O bus with five I/O slots.

The 850S and 855S also can be configured with a channel I/O terminal expander to accommodate terminal I/O configuration growth. The channel I/O terminal expander consists of two add-on cabinets. Each cabinet contains up to two expansion modules. Each module supports one or two channel I/O bus adapters. Each adapter accommodates one channel I/O bus. Each channel I/O bus has eight slots for the multiplexer interfaces used to attach the multiplexers for terminal device connectivity.

Other Peripherals
Disk storage devices, magnetic tape drives, printers, plotters, and instrumentation connect to a channel I/O bus via a Hewlett-Packard Interface Bus (HP-IB). This eight-bit-wide, IEEE-488 standard interface supports up to 14 slow-speed or 4 high-speed devices.

The HP-IB interface is managed by the HP-IB card, which puts peripheral communications onto the

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Table 4. Printers (Continued)

Model	HP 2228A	HP 3630A	HP 33440	HP 2684
Type	Inkjet	Inkjet	Laser	Laser
Speed	192 cps	167 cps	8 ppm	20 ppm
Paper size	8.5 x 11 in.	—	—	—
Character formation	19 x 12 and 19 x 24 dot matrix	—	300 x 300 dpi	300 x 300 dpi
Horizontal character spacing (char./inch)	5, 6, 10, 10.6, 12, 21.3	—	10, 16.7	10, 16.7
Controller/Interface	HP-IB interface	RS-232-C	RS-232-C	RS-232-C
Graphics capability	Yes; at 96 or 192 x 96 or 192 dpi	Yes; at 180 x 180 dpi	Yes; at 300 x 300 dpi	Yes; at 300 x 300 dpi
Purchase price (basic)	$599	$1,395	$2,695	$19,995
Comments	Used as a work-station printer. Features a draft and NLQ mode.	Used as a work-station printer.	Used as a depart-mental printer.	Used for depart-mental printing. Has 34 built-in fonts, 3 font car-tridge slots, and font downloading capabilities.

A dash (—) in a column indicates that the information is unavailable from the vendor.

channel I/O bus and pulls communications from the channel I/O bus. The HP-IB card consumes one I/O slot on the channel I/O bus.

The Hewlett-Packard Fiber Optic Link (HP-FL) provides connectivity for up to eight Winchester disk storage devices. The interface supports transfer rates of 5M bytes per second. Additionally, the HP-FL interface allows Winchester disk storage devices to be placed up to 500 meters away from the host, surpassing the 15-meter capability of the HP-IB interface. The HP-FL interface is supported by the HP-FL card. Each HP-FL card consumes one I/O slot on the channel I/O bus.

Asynchronous six-channel multiplexers connect workstations, modems, serial printers, and other serial devices. Each multiplexer provides six asynchronous ports with full-duplex modem control capability for the connection of RS-232-C devices. Each port supports one device and sends and receives data 19.2K bits per second (bps).

The multiplexers connect to the channel I/O bus via a multiplexer interfaces. Each multiplexer interface requires one I/O slot.

A parallel asynchronous first-in, first-out (FIFO) interface is used to connect factory floor, scientific devices, and automation control devices to the Series 800 host. It provides multipurpose 8- or 16-bit parallel communications capabilities between external devices and the Series 800 host.

The parallel asynchronous FIFO interface card hosts the parallel asynchronous FIFO interface. The interface card requires one I/O slot on the channel I/O bus.

Software

Operating Systems
The Series 800 computers operate under the HP-UX operating system.

HP-UX is a superset of the AT&T UNIX System V.2 operating system. Complying with the AT&T UNIX System V Interface Definition and System V Verification Suite (SVVS) specifications for compatibility, HP-UX includes all the non-hardware-dependent utilities from UNIX System V.2. In addition, the HP-UX operating system contains University of California at Berkeley Release 4.2 Berkeley Software Distribution (BSD) commands and utilities and HP-developed enhancements. Significant Hewlett-Packard enhancements include realtime processing extensions, native-language support, and power failure recovery capabilities.

HP-UX realtime processing tools include the following:

- Realtime process scheduling. The HP-UX process scheduler differentiates between realtime and time-shared processes. The scheduler will always dispatch a process with realtime priority before a process with a time-shared priority.

- Kernel preemption. In traditional UNIX systems, a process executing in its own "user" code can be preempted immediately, but if the kernel is executing in behalf of a process, such as when the user process makes a system call, that process surrenders the central processor only voluntarily. Thus, the kernel can execute for a significant period of time before giving the central processor another process. This period of time is called "preemption latency" and is unacceptable in a realtime system. Hewlett-Packard, therefore, placed facilities within HP-UX that allow a realtime process to preempt the kernel.

- Process locking. This feature prevents paging or swapping of a process, so it can be guaranteed immediate execution when it becomes runnable.

- File locking. A region of a file or the entire file can be locked.

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Table 5. Magnetic Tape Equipment

Model	HP 7979A	HP 7980A	HP 9144A	HP 35401A
Type	0.5-inch reel-to-reel	0.5-inch reel-to-reel	0.25-inch cartridge	0.25-inch cartridge auto changer
Format				
Number of tracks	—	—	16	16
Recording density, bits per inch	1600	1600/6250	—	—
Recording mode	PE	PE/GCR	DC 600 HC	DC 600 HC
Characteristics				
Controller model	Integrated	Integrated	Integrated	Integrated
Storage capacity, bytes	40M	40M/140M	67.1M	67.1M (on each cartridge)
Tape speed, inches per second	125	125	60	60
Data transfer rate, units per second	200K bytes	781K bytes	35K bits	35K bits
Streaming technology	Yes	Yes	Yes	Yes
Start/stop mode speed, inches per second	—	—	—	—
Supported by system models	All	All	All	All
Purchase Price (basic)	$13,400	$23,200	$2,600	$8,150
Comments	Requires an HP-IB for connectivity.	Requires an HP-IB for connectivity.	Requires an HP-IB for connectivity.	Has an auto changer that accesses up to 8 cartridges from a removable magazine. An HP-IB interface is required to communicate with the host.

A dash (—) in a column indicates that the information is unavailable from the vendor.

- File space preallocation. In standard UNIX systems, file system blocks are allocated dynamically for every write operation. HP-UX can preallocate file system space for realtime applications to avoid this overhead during activities such as high-speed continuous data collection.

Other HP-UX Features: The native-language support feature provides for localization—the process of adapting a software application for use in different countries. The native-language support tools permit installations to develop applications that are localizable with software modification.

The power failure recovery feature ensures transaction and data integrity when power is lost. When HP-UX detects a power failure, the central processor state and cache data are flushed out to battery backed-up memory. If power is restored within 15 minutes, I/O devices are reset, I/O transactions going on at the time of failure are restored, and a signal is sent to every process informing it of the power failure.

Concurrent Processing: With HP-UX, over 500 user processes can run concurrently. To support this capability, HP-UX implements UNIX System V's "pipes," FIFO files, and System V IPC (messages, semaphores, and shared memory). The pipes and FIFO features allow interprocess communications, in which data can be passed asynchronously between two tasks using a high-level language's read and write commands. IPC

facilities allow interprocess communications and synchronization using system calls unique to each IPC subsystem. In addition, HP-UX intrinsics permit synchronization to control the initiation and resumption of task execution.

Memory: HP-UX virtual memory consists of 4G byte spaces which are divided into 2K-byte pages. Pages can hold code, data, or a combination of both. Codes can span spaces and a single data structure can be up to 4G bytes in length. Using HP-UX' demand loading feature, the user can choose between having an entire program loaded into memory before execution and loading program segments only when they are required for execution.

File System: HP-UX implements the UNIX hierarchical file system, which allows users to organize files in a logical fashion. Permission for each file to read, write, and execute can be assigned on an individual, group, or community basis.

Utilities: To exchange data with other HP computers, HP-UX supports utilities that selectively convert and copy HP-UX files to Logical Interchange Format (LIF), a vehicle for transporting ASCII files on removable mass storage media. Standard UNIX commands are supported to transport files between HP-UX and other UNIX systems.

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Database Management System

Database management is provided by *Allbase/HP-UX*, a database management system (DBMS). Allbase/HP-UX offers data independence so that changes can be made to the database structure without affecting application programs. Concurrent access allows multiple users to access data simultaneously. Automatic locking and automatic (rollback) recovery ensure data integrity.

Both a relational and a network data model interface are offered with Allbase/HP-UX. HP SQL is selected when the application requires a relational model interface, and HP IMAGE is chosen when a network model interface is needed. HP SQL maintains compatibility with IBM's Structured Query Language (SQL) product. HP-IMAGE is upwardly compatible with existing Image/9000 databases—the databases running on HP 9000 technical workstations and the defunct 500 multiuser computers.

HP Visor/HP-UX is available to users of the HP-SQL interface in Allbase/HP-UX. It gives HP SQL users menu-driven tools to perform ad hoc queries and generate customized reports.

Languages

HP-UX supports the following high-level programming languages: Fortran 77, Pascal, C, and Cobol. These languages are provided with optimization and full symbolic support. They can be linked at the object level. Programs written in any of HP-UX supported languages can access all HP-UX system intrinsics and other libraries.

Communications

Low-level networking is performed by LAN/9000 Series 800 Link software and software for X.25 network connectivity. Application-level networking is performed by packages such as Network Services/9000 Series 800, ARPA Services/9000 Series 800, Network File System Services/9000 Series 800, and Network Services/DEC VAX/VMS (NS/DEC VAX/VMS).

The *LAN/9000 Series 800 Link software* provides IEEE 802.2 and 802.3 Ethernet link control and media access control functions and contains the transport and interface programs required to connect a Series 800 to a IEEE 802.2 or 802.3 Ethernet network. It corresponds to layers 1 through 5 of the International Organization for Standardization's (ISO's) Open Systems Interconnection (OSI) networking model. The transport-level protocols are based on the de facto industry-standard Transmission Control Protocol/Internet Protocol (TCP/IP) communications set. The set of node management programs provide for online configuration, diagnostics, and logging.

A *X.25 host packet assembler/disassembler software package* allows the Series 800 computers to communicate over a X.25 packet-switching public or private data network (PDN). Its primary functions are to provide login functions for terminals connected to the Series 800 and to allow protocols to run across the network.

The *Network Services/9000 Series 800* enables the Series 800 to transfer files to and from HP 9000, HP 1000, HP 3000, and HP Vectra (IBM PC-compatible)

computers using the Network File Transfer (NFT) protocol. It also provides for remote file access between HP 9000 computers using the Remote File Access (RFA) protocol and network interprocess communications among Series 800 computers using the Network Interprocess Communication (NET IPC) protocol.

ARPA Services/9000 Series 800 allows communications among professional workstations and multiuser computers that implement the Department of Defense Advanced Research Projects Agency (ARPA) and Berkeley 4.2 BSD networking standards. The ARPA services include FTP for file transfer, Telnet for terminal login access, and SMTP for electronic mail. The Berkeley 4.2 BSD networking services include *RCP* for file transfer, *rlogin* for terminal login access, and *RSH* for remote command execution.

Network File System Services/9000 Series 800 provides multivendor remote file access to other computers supporting the standard Network File System (NFS) services. It also provides NFS-specific Remote Procedure Call (RPC) and Yellow Pages (YP) network administration services.

Network Services/DEC VAX/VMS (NS/DEC VAX/VMS) integrates Digital Equipment's VAX/VMS computers into the Series 800 environment. It permits files to be transferred between Series 800 and Digital Equipment VAX/VMS computers and allows bidirectional virtual services between Series 800 and VAX/VMS computers.

The *UNIX UUCP, UUX, CU, and mail commands* within HP-UX are useful when communicating with other UNIX or HP-UX-based systems. The *UUCP* command performs file transfers and works in conjunction with the mail command to allow electronic mail to be sent to a user on another computer. The *UUX* command allows remote command execution, and the *CU* command permits terminal emulation.

IBM communications are supported via the *HP-UX Gateway SNA/3270 for HP 9000 Series 800* and the *HP-UX Gateway SNA/3770 for HP 9000 Series 800* communications packages. These packages allow for interactive and batch communications between a Series 800 and an IBM System/370-compatible mainframe using SNA 3270 and SNA 3770 protocols.

Both HP-UX Gateway SNA/3270 for HP 9000 Series 800 and the HP-UX Gateway SNA/3770 for HP 9000 Series 800 run on a LAN 9000-attached HP 9000 Model 300 workstation. The workstation functions as a gateway server, providing a cluster of Series 800 computers with access to IBM 3270 and 3770 communications—interactive access, remote command execution, and file transfer.

Utilities

As stated previously, HP-UX contains UNIX System V.2 utilities for programming, professional support, and system administration. Included are the following:

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- The Documenter's Workbench. This provides a full set of text processing, formatting, and typesetting facilities and controls for document and publication creation.

- The Source Code Control System (SCCS). This system provides a means for controlling changes to a program's source code or text file, and it documents the progress of a project as versions are created and modified throughout the development process. It stores, updates, and retrieves source code modules; allows modules to be manipulated by version number or date; keeps track of the changes; protects versions from unauthorized changes; and allows generations to be combined, modified, and compared.

- The Resource Accounting System. This system collects resource use data to record user connect time and monitor CPU disk use for the purpose of charging fees to individual users and fine-tuning the system.

- Interactive and noninteractive graphics facilities and editors for the construction of data plots, pie charts, bar charts, and histograms and free-form graphics images.

- Electronic mail.

- Professional support tools including an electronic systems news service, automatic reminder services, and a desk calculator.

In addition, a number of add-on system-level applications are available for applications development and support.

The *Port/HP-UX* package is a collection of tools and utilities for migrating applications from the HP 1000 computers running the RTE-6/VM and RTE-A operating systems to the HP 9000 Series 800 with its HP-UX operating system. In addition to emulating most RTE calls on HP-UX, Port/HP-UX provides tools to analyze applications to determine what program statements need to be modified, as well as providing instructions on the type of modification.

HPtoday/HP-UX is used to develop data or transaction processing applications. HPtoday applications, created without traditional programming methods, are written using formatted screens with menu selections and fill-in-the-blank forms. Programmers need not code reams of instructions.

HPtoday/HP-UX consists of two parts. HPtoday/HP-UX Developer Kit builds and modifies applications. The HPtoday/HP-UX Run-Time Environment software package supports the execution of developed HPtoday applications.

The Series 800 computers support several graphics libraries for the development and support of applications.

The *Starbase/HP-UX Graphics Library* is a 2-dimensional (2-D) and 3-dimensional (3-D) graphics library based on the American National Standards Institute's (ANSI's) Computer Graphics Interface (CGI)

standard. It is compatible with the current implementations of Starbase on the HP 9000 Series 300 workstations and Series 500 multiuser computers, allowing a graphics application written on a Series 300 or 500 to be moved to a Series 800 and vice versa.

The *Starbase/HP-UX Display List* supports hierarchical display lists for modeling of graphics data. The HP GKS/HP-UX package provides de facto industry-standard Graphics Kernel System (GKS) graphics. The GKS graphics system, an implementation of the two-dimensional graphics standard approved by the ISO, provides programmers with a framework for designing graphics application software. It consists of a software library of subroutines with specific calling sequences which, when loaded with a user program and executed, produce defined actions. GKS runs with programs written in Fortran, Cobol, and Pascal. GKS constructs images from any number of input devices and generates output to any output device.

The *DGL/AGP/HP-UX Graphics Library* provides the routines for executing applications based on Device-independent Graphics Library (DGL) and Advanced Graphics Library graphics. It serves as a migration tool for moving the DGL and AGP graphics applications residing on the HP 1000 computers and older, existing HP 9000 workstations and multiuser computers to the Series 800 computers.

Computer Graphics Metafile (CGM) provides users with the ability to run capture and display picture files.

The *X Window System* provides a platform for building window-based applications and user interfaces. It features the MIT-developed, industry-supported X Windows System for defining how multiple, local applications and tasks are to be displayed on the screen simultaneously and for defining how multiple remote computing sessions are to be displayed on the screen with local applications or with other remote computing sessions.

Office Automation

Alis/HP-UX provides a set of professional services. Included within Alis/HP-UX is a document composer, a graphics editor, spreadsheet analysis, a personal database, electronic mail, and calendar and personal time management.

Applications

There are large number of applications solutions available for the Series 800 superminicomputers. These solutions are provided by both Hewlett-Packard and independent vendors that have established business relationships with Hewlett-Packard through the HP Plus program.

Applications sold and supported through the HP-Plus third-party program run the gamut of established business and technical processing markets. Applications cover areas such as:

- Accounting and business administration

- Education institute administration

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- Medical/health care organization patient care
- Financial security trading
- Office automation
- MRP and production control
- Industrial engineering
- Process monitoring
- Computer-aided testing
- Electronic/electrical and mechanical engineering
- Architectural and civil engineering
- Earth sciences engineering
- Artificial intelligence
- Software engineering

Communications

Communications Control

The Series 800 computers communicate with each other, with other Hewlett-Packard computers, and with other vendors' systems via the Hewlett-Packard LAN/9000 local area network. The LAN/9000 is an Ethernet LAN supporting IEEE 802.2- or IEEE 802.3-recommended media and protocols. It has a bandwidth of 10M bps and allows file transfer, remote file access, process start and terminate, and communications between processes running anywhere on the network.

The Series 800 systems are connected to the network through an intelligent controller known as the *LAN/9000 Series 800 Link*. The LAN/9000 Series 800 Link contains the hardware and transport and interface software required to connect a Series 800 computer to an IEEE 802.2 or IEEE 802.3 cable. Hardware components of the LAN/9000 Series 800 Link include the following:

- Local Area Network Interface Controller (LANIC)—a microprocessor-based communications controller that plugs into the Series 800 backplane. It handles buffering, IEEE 802.2 and 802.3 protocols, and error checking; it also tracks network statistics.

- Attachment Unit Interface (AUI) Cable—the interface cable plus a 2-meter internal LANIC cable connect the LANIC to the Medium Attachment Unit (MAU).

- Medium Attachment Unit (MAU)—provides the physical and electrical connection by connecting the AUI cabling to the network coaxial cable. The MAU is powered by the LANIC through the AUI cable. The MAU receives signals from, and sends signals to, the coax cable; it also detects collisions resulting from two nodes transmitting simultaneously.

LAN/9000 Series 800 Link software is described in the "Communications" subsection of the "SOFTWARE" section.

The Series 800 systems can also communicate with other computer systems using one or more multiplexer channels and hardwired modem links. The asynchronous six-channel multiplexer accommodates up to six communications links for remote communications using RS-232-C communications lines. The X.25 multiplexer provides for attachment to a X.25 packet-switching network.

IBM communications are supported via SNA 3270 and 3370 products using a LAN-attached HP 9000 Series 300 workstation as a nondedicated gateway. The gateway allows a cluster of Series 800 computers to have access to resources on an IBM System/370-compatible mainframe running under MVS or VM operating systems.

Operating Environment

Specifications
The following tables highlight the physical and environmental specifications of the HP 9000 Series 800 computers.

Physical Specifications				
Model	Height	Width	Depth	Weight
815S	12.2″	12.9″	16.3″	45 lb.
825S	9.2″	12.8″	19.7″	—
835S	18.4″	12.8″	19.7″	—
835SE	18.4″	12.8″	19.7″	—
850S	39.4″	51.2″	27.9″	880 lb.
855S	39.4″	51.2″	27.9″	880 lb.

Environmental Specifications			
Model	Operating Temp. (°F)	Operating Humidity (%)	Heat Dissipation (Btus/Hr.)
815S	32-131	15-95	—
825S	32-131	15-95	200
835S	32-131	15-95	2,050
835SE	32-131	15-95	2,050
850S	41-104	15-80	15,000
855S	41-104	15-80	15,000

Configuration Rules
The standard Series 800 Model 808S comes bundled as follows:

- SPU (with 8M bytes of main storage, one 8-channel multiplexer, and one HP-IB interface)
- One 152M-byte disk drive
- One 67M-byte tape drive
- Three available I/O slots
- An 8-user HP-UX configuration

The standard Series 800 Model 815S comes with an SPU containing the following:

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- One central processor with 64K bytes of cache memory
- 8M bytes of main storage
- Two 8-channel serial multiplexers
- One HP-IB interface

The standard Series 800 Model 825S comes with an SPU containing the following:

- One central processor with 16K bytes of cache memory and a floating-point co-processor
- 8M bytes of main storage
- One asynchronous six-channel multiplexer
- One HP-IB interface

The basic Series 800 Model 835S comes with an SPU containing the following:

- One central processor with 128K bytes of cache memory and a floating-point co-processor
- 8M bytes of main storage
- One asynchronous six-channel multiplexer
- One HP-IB interface

The standard Series 800 Model 835SE comes with an SPU containing the following:

- One central processor with 128K bytes of cache memory and a floating-point co-processor
- 24M bytes of main storage
- One asynchronous six-channel multiplexer
- One HP-IB interface

The standard Series 800 Model 850S comes with an SPU containing the following:

- One central processor with 128K bytes of cache memory and a floating-point co-processor
- 32M bytes of main storage
- One asynchronous six-channel multiplexer
- One HP-IB interface

The standard Series 800 Model 855S comes with an SPU containing the following:

- One central processor with 256K bytes of cache memory and a floating-point co-processor
- 32M bytes of main storage
- One asynchronous six-channel multiplexer
- One HP-IB interface

See Table 1 for a comparison of system characteristics for the HP 9000 Series 800 Models.

Mass Storage
A variety of disk storage devices can be configured on a Series 800. The HP 7907 has 20M bytes of Winchester

(nonremovable) disk storage and 20M bytes of removable disk storage. The HP 7957B and HP 7958B provide 81M and 131M bytes of Winchester disk storage, respectively. For installations requiring high-performance, high-capacity Winchester disk drives, HP 7936FL, HP 7936H, HP 7937FL, HP 7937H, HP 7959B, and HP 7963B are available; these Winchesters offer either 304M, 307M, 404M, or 571M bytes of online storage.

Each disk storage device contains its own controller. The controller communicates with the host processor over the HP-IB interface, which interfaces to the central bus. Up to four Winchester disk drives can be supported on an HP-IB interface.
See Table 2 for specifications on mass storage equipment.

Workstations
The Series 800 computers accommodate alphanumeric terminals, graphics terminals, data entry terminals, technical workstations, and personal computers. The technical workstations and personal computers must be configured with the appropriate asynchronous terminal emulation equipment to access the applications running on the Series 800.

The Series 800 workstations connect to the Series 800 host processor via the asynchronous six-channel multiplexers, which interface with a channel I/O bus. The six-channel multiplexers support six interactive terminals running at 19.2K bps.

See Table 3 for specifications on workstations for the HP 9000 Series 800.

Printers
The Series 800 computers support an assortment of printers. The matrix line printers handle text, numerics, OCR, bar code, and graphics character sets and offer maximum print speeds ranging 300 to 1,200 lines per minute (lpm). The matrix serial printers run at maximum speeds ranging from 200 to 480 characters per second (cps). The ink jet printers provide nonimpact matrix printing at maximum speeds ranging from 150 to 192 cps. The laser printers output documents, images, and graphics at up to 20 pages per minute (ppm).

The matrix line printers and page printers are used at the data center or on a departmental processor. The matrix serial and ink jet printers address printing requirements on the departmental processor and at the individual workstation. All Series 800 printers connect to a Series 800 host processor or Series 800 workstation using an RS-232-C or HP-IB interface.
See Table 4 for printer specifications.

Magnetic Tape
The Series 800 computers use the HP 7979A, HP 7980A, HP 9144A, and HP 35401A magnetic tape drives for online storage backup, archival storage, data exchange, and software distribution. The HP 7979A, and HP 7980A are reel-to-reel tape drives that use 0.5-inch media and read and write in 800, 1600, or 6250 bit-per-inch (bpi) mode at 75, 100, or 125 inches per

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second (ips). The HP 9144A and HP 35401A are cartridge tape drives that store up to 67.1M bytes of data. The HP-IB interface attaches the HP 7979A, HP 7980A, HP 9144A, and HP 35401A to the host processor.

See Table 5 for specifications on magnetic tape equipment.

Other
Several types of plotters can be attached to the Series 800 computers. the HP 7550A is an eight-pen plotter supporting A- and B-size media. The HP 7570 is an eight-pen plotter that uses C- and D-sized media. The HP 7595 and HP 7596 are eight-pen plotters that accommodate A- and E-size media.

Pricing and Support

Policy
The Series 800s are sold primarily through Hewlett-Packard's direct sales force and are available on a purchase-only basis. Series 800s are offered as preconfigured systems; the HP-UX operating system, device I/O libraries, the C programming language, a symbolic debugger, and an assembler are included as part of the basic system.

Documentation

CD-ROM Subscription Service
HP LaserROM, a new information service, speeds referencing and simplifies technical publication use. LaserROM uses compact disk read-only memory (CD-ROM) technology coupled with information retrieval software to deliver manuals, bulletins, catalogs, and other technical publications. Each HP LaserROM disk contains up to 200,000 pages of support information. The full-text retrieval software instantly pinpoints requested information. Customers have direct access to information and do not need numerous physical manuals and publications.

Service/Support

Hardware Support
Several types of monthly maintenance contracts are available for the computer systems hardware. The Basic Monthly Maintenance hardware support agreement provides on-site servicing with next-day response. Under the agreement, service is available from 8 a.m. to 5 p.m., or up to 24 hours a day, five days a week. The Standard Monthly Maintenance hardware support agreement provides on-site servicing with a four-hour response time. The coverage period is from 8 a.m. to 9 p.m., or up to 24 hours a day, five to seven days a week. Customers who prefer to employ Hewlett-Packard service on a time-and-materials basis can take

advantage of the Per-Call service. A Hewlett-Packard representative can tailor a maintenance plan to meet their needs.

New Support Program: On January 1, 1990, Hewlett-Packard instituted a new hardware service program called SuccessLine. SuccessLine features four levels of support, an expansion of the previous two levels.

Priority Plus Support offers maximum coverage 24 hours a day for critical applications.

Priority Support offers maximum coverage during normal business hours.

Next Day Support offers next-day response during normal business hours.

Scheduled Support is the lowest cost support level and offers scheduled weekly visits to your location.

For additional information on the SuccessLine services, contact your HP representative.

Software Support
HP increased the level of software service and support for the HP 9000 Series 800 superminicomputers with the release of its HP TeamLine, HP ResponseLine, and HP BasicLine. These new software support services effectively replace existing support services, adding more problem resolution, software maintenance, and usage assistance.

HP TeamLine
This service provides premium software consulting and a comprehensive set of software maintenance services. Customers have access to a team of HP engineers which examines a customer's business goals, operating environment and applications, and recommends methods to improve system use. Consultations cover system performance, application design, operating procedures, and system administration. In addition, customers can receive assistance from HP consultants for system growth planning, personnel development, and implementing software updates.

As the highest level of HP's software support services, HP TeamLine gives customers an account-assigned consultant to ensure they have access to all the standard and contractual services needed to support their computer infrastructure. In addition, HP TeamLine provides all of the software maintenance and support services included within HP ResponseLine and HP BasicLine. These services include unlimited telephone access to the remote support center, on-line access to an electronic database of HP product and support information, and on-site assistance for critical situations.

HP ResponseLine
This service provides problem resolution, user assistance, and software maintenance out of HP's 32 worldwide response centers (remote support centers). Based on HP's proven telephone assistance and remote diagnostics systems, it includes extensions to existing problem resolution, user assistance, and software maintenance offerings.

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Telephone consulting and remote diagnostics for software troubleshooting and user assistance are available 24 hours a day, 365 days a year to all customers with account management or HP Response Level support. This availability is extremely beneficial to customers who need assistance outside of HP's normal business hours.

HP ResponseLine also provides all of the maintenance and support of HP BasicLine, including software updates, documentation updates, subscription services, and on-line access to a database of HP product and support information.

HP BasicLine
This basic service is aimed at customers who opt to support their own systems and provides the following:

- Right to use software updates

- Documentation and related updates to reference information

- Product bulletins, newsletters, and periodicals

- On-line access to HP SupportLine electronic database

HP SupportLine
HP SupportLine is a remote, on-line information service that customers access via terminals and modems. Through this electronic service, customers can rapidly and easily access up-to-date information on product developments, get usage assistance, and resolve problems.

Training
On-site and off-site customer training is available. Training covers general system overviews as well as detailed instruction for system administration and programming.

Equipment Prices

		Purchase Price ($)	BMM Charge ($)	SMM Charge ($)
Series 800 Base Systems				
A1071A	Model 815S system bundle including: a system processor containing an HP-PA CPU, 8MB of main storage, 2 serial ports, and a 12-slot box; a 16-user HP-UX; an HP-IB, 2 8-channel serial multiplexers, a 304M Byte disk, 67M byte 1/4" tape drive, battery backup unit, and Design Plus Cabinet	29,500	—	—
A1410A	Model 815S system with a system processing unit containing an HP-PA CPU, 8M bytes of main storage, 2 serial ports, a 12-slot box, and a 16-user HP-UX	14,900	—	—
A1004A	Model 825S system with a system processor containing a floating-point co-processor, 8M bytes of main storage, a channel I/O bus, an HP-IB, and a six-channel multiplexer; a system processor cabinet; a 16-user HP-UX; a C compiler; a symbolic debugger; an assembler; and a I/O device library	25,500	163	204
A1035A	Model 835S system with a system processor containing a floating-point co-processor, 8M bytes of main storage, a channel I/O bus, an HP-IB, and a six-channel multiplexer; a system processor cabinet; a 16-user HP-UX; a C compiler; a symbolic debugger; an assembler; and an I/O device library	45,000	203	276
A1040A	Model 835SE system with a system processor containing a floating-point co-processor, 24M bytes of main storage, 2 channel I/O buses, an I/O extender, an HP-IB, a 6-channel multiplexer; a system processor cabinet; a 64-user HP-UX, a C compiler and debugger; an assembler; and an I/O library HP-UX, a C compiler and debugger; an assembler; and an I/O device library	101,950	321	426
9742A	Model 850S system with a system processor containing a floating-point co-processor, 32M bytes of main storage, 2 channel I/O buses, an HP-IB, and a 6-channel multiplexer; a system processor cabinet; a 64-user HP-UX; a C compiler; a symbolic debugger; an assembler; and an I/O device library	176,000	548	685
A1114A	Model 855S system with a system processor containing a floating-point co-processor, 32M bytes of main storage, 2 channel I/O buses, an HP-IB, and a 6-channel multiplexer; a system processor cabinet; a 64-user HP-UX; a C compiler; a symbolic debugger; an assembler; and a I/O device library	241,000	649	811

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		Purchase Price ($)	BMM Charge ($)	SMM Charge ($)
Field Upgrades				
—	Model 815S-to-835SE central processor upgrade package	—	NA	NA
A1036A	Model 825S-to-835S/SE central processor upgrade package	19,500	NA	NA
A1038A	Model 825S-to-835SE multiuser computer system upgrade package; includes central processor upgrade, I/O extender and additional I/O channel adapter, 16M bytes of main storage, powerfail battery backup system, and 16-to-64 user HP-UX upgrade	75,700	NA	NA
A1039A	Model 835S-to-835SE multiuser computer system upgrade; includes an additional I/O channel adapter and I/O extender, 16M bytes of main storage, a powerfail battery backup system, and a 16-to-64-user HP-UX upgrade	59,200	NA	NA
A1118A	Model 850S-to-855S central processor upgrade package	120,000	NA	NA
Series 800 Accessories				
A1404A	8M byte error correcting memory for Model 815S	8,000	NC	NC
A1009A	2M-byte memory board for Models 825, 835S, and 835SE	4,000	NC	NC
A1010A	8M-byte memory board for Models 825, 835S, and 835SE	10,000	NC	NC
A1037A	16M-byte memory board for Models 825, 835S, and 835SE	20,000	NC	NC
A1104A	16M-byte memory board for Models 850S/855S	23,900	NC	NC
A1013A	I/O expander with channel I/O adapter for Model 835SE	16,000	17	21
A1101A	Channel I/O adapter for Models 850S/855S	15,750	—	—
A1122A	Channel I/O terminal expander for Models 850S/855S	26,250	47	37
A1123A	Expansion kit for A1122A	21,000	34	43
A1124A	Add-on expander for A1122A	24,375	37	47
27110B	HP-IB interface	1,630	3	4
27114A	A parallel asynchronous FIFO interface	1,780	2	3
98196A	Asynchronous 6-channel CIO multiplexer	2,675	5	6
A1014A	A powerfail battery backup system	5,000	—	—
Mass Storage				
7907A	Mass storage subsystem with 20M bytes of Winchester disk storage and 20M bytes of removable disk storage	14,620	—	—
7936FL	307M-byte Winchester disk drive with integral controller and HP-FL interface	14,800	—	—
7936H	307M-byte Winchester disk drive with integral controller and HP-IB interface	14,250	—	—
7937FL	571M-byte Winchester disk drive with integral controller and HP-FL interface	16,250	—	—
7937H	571M-byte Winchester disk drive with integral controller and HP-IB interface	15,700	40	50
7957B	81M-byte Winchester disk drive with integral controller and HP-IB interface	3,575	—	—
7958B	131M-byte Winchester disk drive with integral controller and HP-IB interface	4,775	—	—
7959B	304M byte Winchester disk drive with integral controller and HP-IB interface	7,725		
7962B	Winchester disk drive package containing one 152M byte Winchester disk drive with an integral controller and HP-IB interface and room for two more 152M byte Winchester disk drives with their controllers and HP-IB interfaces	5,275	—	—
7963B	Winchester disk drive package containing one 304M-byte Winchester disk drive with an integral controller and HP-IB interface and room for two more 304M-byte Winchester disk drives with their controllers and HP-IB interfaces	8,575	—	—
Magnetic Tape Equipment				
7979A	Magnetic tape drive with a 1600 bpi read/write mode and a tape speed of 125 ips	13,400	35	44
7980A	Magnetic tape drive with a 1600/6250 bpi read/write mode and a tape speed of 125 ips	23,200	35	44
9144A	Cartridge tape drive capable of storing 67M bytes of data on tape cartridges	2,600	13	16
35401A	Cartridge tape drive with an auto changer that accommodates 8 tape cartridges	8,150	35	42

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		Purchase Price ($)	BMM Charge ($)	SMM Charge ($)
Printers and Plotters				
2563B	Matrix line printer that runs at up to 300 lpm	7,790	49	62
2564B	600-lpm matrix line printer	13,250	79	99
2566B	900-lpm matrix line printer	24,950	184	230
2567B	1,200-lpm matrix line printer	32,000	195	245
2934A	200 cps dot matrix impact printer	2,595	26	30
2235B	RuggedWriter matrix serial printer running at up to 480 cps	1,895	NA	22
2225A	A 150 cps inkjet printer	495	4	7
2227A	A 192 cps inkjet printer that accommodates paper with a width ranging up to 14 inches	799	NA	7
2228A	A 192 cps inkjet printer that accommodates 8.5-by-11 inch paper	599	NA	7
3630A	Inkjet printer running at up to 167 cps	1,395	5	10
33440A	8-ppm laser printer	2,695	30	54
2684A	20-ppm laser printer	19,995	318	398
7550A	A- and B-size, 8-pen plotter with sheet feeder	3,995	22	39
7570A	C- and D-size, 8-pen plotter	3,995	NA	18
7595A	8-pen plotter with A- and E-size media	8,495	NA	NA
7596A	8-pen roll-feed plotter with A- and E-sized media	10,995	—	—
Terminals and Workstations				
C1001A	HP 700/92 alphanumeric display terminal	895	4	7
C1002A	HP 700/94 alphanumeric display terminal	1,150	NA	7
C1003A	HP 700/41 alphanumeric display terminal	429	NA	7
C1004A	HP 700/22 alphanumeric display terminal	529	NA	7
C1006A	HP 700/43 alphanumeric display terminal	499	NA	7
2393A	HP 2393A graphics terminal	2,500	6	11
2397A	HP 2397A color graphics terminal	3,925	7	14
98561A	HP 9000 Series 300 Model 310 workstation, basic configuration	5,820	15	16
98561B	HP 9000 Series 300 Model 320 workstation, basic configuration	10,600	13	23
98562A	HP 9000 Series 300 Model 330 workstation, basic configuration	12,460	11	20
98562B	HP 9000 Series 300 Model 350 workstation, basic configuration	27,550	24	43
Data Communications				
2334A	X.25 multiplexer	2,560	18	22
98196A	LAN/9000 Series 800 Link hardware for Models 825S, 835S, and 835SE	See Note 1.	13	18
98196A	LAN/9000 Series 800 Link for Models 825S, 835S, and 835SE; includes the LAN controller, media link, and link control, interface, and transport software	4,120	13	18
98196A	LAN/9000 Series 800 Link for Model 840S; includes the LAN controller, media link, and link control, interface, and transport software	5,660	13	18
98196A	LAN/9000 Series 800 Link for Model 850S; includes the LAN controller, media link, and link control, interface, and transport software	5,600	13	18

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Software Prices

		License Fee ($)
Operating System		
92452A	1-to-16 user version of HP-UX Operating System	5,250
92453A	1-to-32 user version of HP-UX Operating System	10,500
92454A	1-to-64 user version of HP-UX Operating System	18,375
92455A	HP-UX unlimited license	34,125
Programming and Application Development Tools		
92626A	Development pack for Model 815S; includes Fortran-77, Pascal, Starbase Graphics Library, and DGL/AGP Graphics Library	5,430
92627A	Fortran-77 compiler for Model 815S	2,500
92628A	Pascal for Model 815S	2,125
92629A	Cobol development package for Model 815S; includes a Cobol compiler, a debuggig tool, and a screen generator	5,0500
92630A	Cobol compiler for Model 815S	3,500
92631A	Cobol Run-time system for Model 815S	—
92447A	Development Pack for Models 825S, 835S, and 835SE; includes Fortran-77, Pascal, Starbase Graphics Library, and DGL/AGP Graphics Library	10,300
92443A	Fortran-77 compiler for Models 825S, 835S, and 835SE	4,775
92444A	Pascal for Models 825S, 835S, and 835SE	4,775
35328A	Cobol development package for Models 825S, 835S, and 835SE; includes a Cobol compiler, a debugging tool, and a screen generator	10,750
35335A	Cobol compiler for Models 825S, 835S, and 835SE	6,600
35329A	Run-time system for Cobol programs; runs on Models 825, 835S, and 835SE	1,085
92465A	Development pack for Models 850S and 855S; includes Fortran-77, Pascal, Starbase Graphics Library, and DGL/AGP Graphics Library	22,200
92461A	Fortran-77 compiler for Models 850S and 855S	10,300
92462A	Pascal for Models 850S and 855S	10,300
35330A	Cobol development package for Models 850S and 855S; includes a Cobol, a debugging tool, and a screen generator	23,100
35329A	Cobol compiler for Models 850S and 855S	13,750
35331A	Run-time system for Cobol programs; runs on Models 850S and 855S	2,325
Graphics Libraries		
92445A	Starbase/HP-UX Graphics Library for Models 825S, 835S, and 835SE	2,600
92522A	Starbase/HP-UX Display List for Models 825S, 835S, and 835SE	1,000
92446A	DGL/AGP/HP-UX Graphics Library for Models 825S, 835S, and 835SE	3,750
92521A	GKS/HP-UX for Models 825S, 835S, and 835SE	2,000
92524A	X Window System Version 10.4 for Models 825S, 835S, and 835SE	2,100
92463A	Starbase/HP-UX Graphics Library for Models 850S and 855S	5,600
92464A	DGL/AGP/HP-UX Graphics Library for Models 850S and 855S	8,050
92529A	GKS/HP-UX for Models 850S and 855S	4,620
92532A	X Window System Version 10.4 for Models 850S and 855S	4,500

*These prices do not reflect the new SuccessLine support services.
Contact your local HP representative for pricing information.
NC—No charge.
NA—Not applicable.
Notes:
Monthly BMMC Fee is the monthly charge for the Basic Monthly Maintenance support service.
Monthly SMM Fee is the monthly charge for the Standard Monthly Maintenance support service.
Footnotes:
LAN/900 Series 800 Link software is bundled with LAN/9000 Series 800 Link hardware. The purchase price for the LAN/9000 Series 800 Link listing in the "Data Communications" subsection of the "EQUIPMENT PRICES" section includes the price of both hardware and software. The hardware and software for the LAN/9000 Series 800 Link are priced separately for maintenance.

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		License Fee ($)
Productivity Tools and Data Management Software		
92632A	HP ALLBASE/SQL/$GL/QUERY Developer Pack for Model 815S	14,200
92636A	HP ALLBASE for Model 815S	5,000
92635A	HP ALLBASE/QUERY for Model 815S	3,300
92633A	HP ALLBASE/4GL (formerly HPtoday/HP-UX) for Model 815S	1,690
92637A	HP SQL RunTime for Model 815S	2,750
36362A	HP ALLBASE/SQL/$GL/QUERY Developer Pack for Models 825S, 835S, and 835SE	35,100
92460A	HP ALLBASE for Models 825S, 835S, and 835SE	17,050
92533A	HP ALLBASE/QUERY for Models 825S, 835S, and 835SE	6,830
35306A	HP ALLBASE/4GL (formerly HPtoday/HP-UX) for Models 825S, 835S, and 835SE	3,450
92601A	HP SQL RunTime for Models 825S, 835S, and 835SE	9,400
36361A	HP ALLBASE/SQL/$GL/QUERY Developer Pack for Models 850S and 855S	81,100
92469A	HP ALLBASE for Models 850S and 855S	36,750
92535A	HP ALLBASE/QUERY for Models 850S and 855S	14,700
35308A	HP ALLBASE/4GL (formerly HPtoday/HP-UX) for Models 850S and 855S	8,800
92603A	HP SQL RunTime for Models 850S and 855S	20,200
Data Communications/Networking Tools		
98189A	LAN/9000 Series 800 Link (software) for Model 815	3,000
B1015A	NS/9000 for Model 815	950
B1016A	ARPA Services/800 for Model 815	800
B1017A	NFS Services/800 for Model 815	650
36949A	HP-UX Gateway SNA/3270 for Model 815	1,200
98177A	HP-UX Gateway SNA/3770 for Model 815	1,200
50950A	NS/DEC VAX/VMS for Series 800 Models	6,680
91786B	LAN/9000 Series 800 Link (software) for Models 825S, 835S, and 835SE	4,365
91787A	NS/9000 for Models 825S, 835S, and 835SE	2,120
50981A	ARPA Services/800 for Models 825S, 835S, and 835SE	2,205
50970A	NFS Services/800 for Models 825S, 835S, and 835SE	1,440
36918A	HP-UX Gateway SNA/3270 for Models 825S, 835S, and 835SE	3,280
98185A	HP-UX Gateway SNA/3770 for Models 825S, 835S, and 835SE	3,185
50950A	NS/DEC VAX/VMS for Series 800 Models	6,680
91788B	LAN/9000 Series 800 Link (software) for Models 850S and 855S	8,190
91789A	NS/9000 for Models 850S and 855S	6,360
50982A	ARPA Services/800 for Models 850S and 855S	7,720
50972A	NFS Services/800 for Models 850S and 855S	6,690
36919A	HP-UX Gateway SNA/3270 for Models 850S and 855S	10,900
98187A	HP-UX Gateway SNA/3770 for Models 850S and 855S	10,600
50950A	NS/DEC VAX/VMS for Series 800 Models	6,680

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