

HP NonStop S88000, S78000, and S780 servers

Data sheet



Designed to meet the needs of a new generation of media-enhanced electronic commerce and business intelligence applications, HP NonStop S-series servers handle complex transactions and rich data types while maintaining all of the benefits of the NonStop operating system.

Key features and benefits

- Scalable performance and bandwidth
- Continuous system availability
- Easy service and management
- Flexibility in configuration and expansion
- Wide range of networking and connectivity options

NonStop S88000, S78000, and S780 servers deliver improved price/performance while providing the key NonStop server benefits of continuous availability, data integrity, distributed transaction processing and database, open networking, and security.

NonStop S88000, S78000, and S780 servers deliver improved price/performance over the previous-generation servers and are an excellent hardware and software value.

With NonStop S-series servers, you can run your most critical business applications—centralized or distributed—at peak performance. Each server appears as a single entity to applications and users, regardless of the physical distribution of the nodes. Growth within a server or on the network can occur without disrupting your applications.

To protect your investment in existing solutions, NonStop S-series servers are fully application compatible with all NonStop K-series servers, enabling you to move applications among servers with little or no modification.

To minimize operating costs, many components of NonStop S-series servers can be installed and serviced with minimal training. The Open System Management (OSM) interface and remote support make it possible to perform problem analysis and incident reporting and to replace components without disrupting server operation.

Scalable performance and bandwidth

At the heart of NonStop S-series servers is the HP ServerNet interconnect fabric architecture, a technology that provides high-performance interconnection among processors and I/O devices (see figure). It provides excellent growth potential, both in processing performance and in system bandwidth, to handle the increasing demands of the most powerful online transaction processing (OLTP), business intelligence, and electronic commerce applications.

As shown in the figure, to support parallel processing, the NonStop operating system uses multiple ServerNet interconnections and a message system optimized by ServerNet technology to connect two to 16 independent

processors per node. These nodes can be interconnected by a variety of local area and wide area networking technologies to create configurations of up to 4,080 processors.

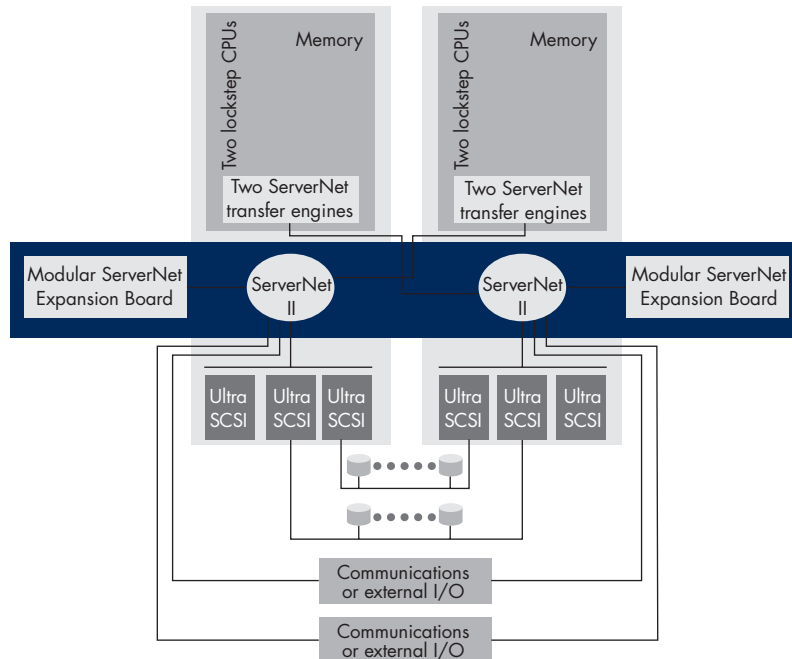
Although the ServerNet architecture can accelerate the performance of current applications, it is designed to support the next generation of data-intensive applications by efficiently moving extraordinary amounts of data within NonStop S-series servers.

Loosely coupled shared-nothing architecture

The processing performance of NonStop S-series servers scales in a linear fashion through a loosely coupled shared-nothing architecture, which uses ServerNet technology to connect processors to each other and to I/O devices. This architecture alleviates performance bottlenecks caused by conflicts with shared resources.

Each processor has its own instruction unit, memory, memory access, cache, and router connections. As your applications expand, this unique, loosely coupled architecture delivers linear performance improvement. As each processor is added, a full processor's worth of performance is delivered to the application.

A separate copy of the operating system runs inside each NonStop S-series processor. This distributed operating system eliminates the physical boundaries between processors by making it possible for an operation running in any processor to transparently access system resources in any other processor. Processors operate independently but in a cooperative manner, with control of processes distributed throughout the server.



High-performance routers

Taking advantage of ServerNet technology, the architecture of NonStop S-series servers employs high-performance routers to rapidly route packets of data between devices in the system. Each ServerNet II router delivers 1.5 gigabytes per second of bandwidth, with each of the 12 router paths having a 125-megabyte, full-duplex data-transfer path. The ServerNet architecture is a wormhole-routed, full-duplex, packet-switched, point-to-point network optimized for high bandwidth and low latency.

Point-to-point connections

Using high-speed, point-to-point data paths, I/O devices connect directly to processors, communications devices, and other I/O devices in the NonStop S-series server, which allows data transfer directly from one system resource to another, minimizing needless transfers. This capability streamlines data transfers and frees processors for other important application tasks.

With the addition of each ServerNet router, the aggregate system bandwidth capacity grows. Optional disk and communications adapters, each connected via additional ServerNet routers, can be added cost-effectively to NonStop S-series servers. I/O capacity

scales independently from processor scaling and allows virtually unlimited device connectivity.

Wormhole routing for lowest-latency switching

ServerNet technology optimizes communications with latency of only 300 nanoseconds in each router. To reduce network latency, ServerNet technology uses a technique known as *wormhole routing*. With this technique, a packet does not need to be completely received before being sent to its next destination (as with store-and-forward architectures). Wormhole routing allows the router to decode the header of the packet as it is received, then locate the port on which the packet will exit by using the header's destination address and the internal routing table. This one-time operation allows the packet to be directed through the router while the router is still receiving the remainder of the packet. As a result, the header information is routed and forwarded well before the end of the packet has been received. Wormhole routing reduces the latency to lower levels than a store-and-forward architecture would require. It provides high performance, even if the server is configured with multiple router hops.



Continuous system availability

NonStop S-series servers are designed to minimize both planned and unplanned downtime. Running the NonStop operating system, the servers detect, isolate, and recover from component failures without applications being affected. No modifications to applications are required to enable this transparent recovery.

To meet your specific needs, NonStop S-series servers can be reconfigured online. As application demands change, enclosures can be either added or deleted, minimizing planned downtime. Adapters, disk drives, and other components can also be added or removed from the system, providing a uniquely flexible environment to meet changing application needs.

Fault-tolerant processor and memory architecture

NonStop S-series servers provide comprehensive fault detection and isolation as well as the industry's highest level of data integrity. Self-checking processors and ServerNet routers use data replication and comparison logic to ensure that faults are detected and that faulty components are taken offline so error propagation does not occur. ServerNet technology prevents adapters and controllers from corrupting memory and ensures that data and addresses are correctly transmitted.

Two central processing units (CPUs) with comparison logic, two copies of Level 2 cache, and main memory reside on the processor multifunction (PMF) unit. PMF units have dual-ported access to the ServerNet adapters. Running in lockstep, the CPUs on a PMF unit execute the same instruction stream out of local cache. The output of each CPU is compared continuously to that of the other CPU. If the outputs disagree, the operating system immediately shuts down the processor, thus preventing

any corruption of data. The operating system records the failure in the system event log, and sophisticated diagnostic software analyzes the problem.

Each PMF unit contains a memory subsystem that is protected by error correcting code (ECC), which detects and corrects single-bit errors. If a double-bit error is detected, the operating system recognizes the hard memory failure and takes the failed PMF offline until memory can be replaced. The NonStop S-series server continues running—without impact to applications—using a second PMF unit, which contains a backup process. In a NonStop S-series server configured with two or more processors, backup processes can run in any PMF unit in the server. This allows the workload from a failed processor to be distributed across the other processors. These backup processes retain the context of the original process so that processing continues without disruption.

The unique process of end-to-end checksums provides additional data integrity checking at other levels in the operating system. This and other powerful functions transparently boost data integrity to levels unmatched in the industry.

Comprehensive system interconnect architecture

ServerNet technology ensures fault tolerance by providing multiple paths to all elements of the server.

All processors, I/O devices, and communications adapters are monitored by the service management subsystem, which can detect and isolate any failure within the server, allowing a failed component to be taken offline quickly, diagnosed, and replaced. If any component fails, data is routed via a different path to the same destination. Each processor has two independent paths to other processors or ServerNet adapters.

NonStop S-series servers are designed to minimize planned and unplanned downtime and, with the NonStop operating system, recover from component failures without affecting applications.

Data integrity is ensured by cyclic redundancy checking of packets (header, data, and address), which validates all data transferred between ServerNet adapters and memory. Access validation tables ensure that adapters do not contaminate memory. Command link integrity isolates single-bit errors on all high-speed data paths, and hardware protocol acknowledgments ensure end-to-end reliable data transfer.

Disk mirroring

NonStop S-series servers support disk mirroring to ensure continuous access to data stored on disks. If a disk drive fails, the server continues to operate using the mirrored copy. When the faulty disk is replaced, the mirrored data is copied to the new disk while the server remains online and operational. Reintegration of the repaired disk is automatically performed online while the system remains operational.

Power-failure protection

Power-failure detection hardware, system software, and battery modules allow NonStop S-series servers to shut down gracefully if a power outage occurs, eliminating the risk of losing critical data.

A fault-tolerant battery backup system keeps servers running (for up to 30 seconds) during transient AC power failures. This programmable ride-through capability ensures availability during most power outages. In the case of extended AC power loss, the battery backup retains data in memory for up to one hour.

NonStop systems also employ other unique software features that allow the systems to recover quickly after power failures.

Easy service and management

The management and service features of NonStop S-series servers maximize system availability and minimize operating costs. Special diagnostic and maintenance software automatically isolates faults, tests and restarts components, and reports any needed action. For ease of manageability, NonStop S-series servers incorporate the NonStop System Console (NSC) suite, which includes the OSM interface. (The NSC suite is packaged with a console processor; one such processor is required per system.) The OSM subsystem includes the following components:

- OSM workstation, which provides a graphical, object-oriented interface for maintenance and administration
- OSM workstation applications, which perform basic operations and service tasks
- OSM open service applications, which run under the NonStop operating system
- Service processor, which resides in each PMF module and which works in conjunction with other subsystem components to perform operations and service functions

While providing sophisticated service management, the OSM subsystem coexists with other operations management software and with major third-party software products.

Service management subsystem

The OSM subsystem comprises hardware and software that take over maintenance and test functions as soon as the server is powered up. Monitoring conditions within the server, the service management subsystem detects and isolates failures, performs analysis, and allows recovery while the server continues running. The service management subsystem logs events, notifies the system administrator of needed actions, and makes it possible to perform service action tasks.

If a component needs to be replaced, a NonStop S-series server can be configured to dial out to the Global Customer Support Center (GCSC), which will dispatch a replacement part. When a component is replaced, the service processor manages the reintegration process.

The service management subsystem includes software to test the hardware modules in NonStop S-series servers and to check and control the operating state of each module.

Online expansion and servicing with minimal training

Servicing and system upgrades of NonStop S-series servers are quick and easy. With minimal training, a user can replace major system components—including system processing units, memory, Modular ServerNet Expansion Boards (MSEBs), ServerNet adapters, disk drives, fans, power supplies, and battery modules—without special tools and without disrupting application processing. User serviceability helps keep maintenance costs low.

To meet your specific needs, HP offers a variety of service and support options. These programs are complemented by the server features that support remote access for diagnostics and repair, which maximize system availability and minimize operating costs.

Efficient system monitoring and control

System management products from HP and its partners give customers flexibility and choice to tailor specific NonStop server system management environments to individual business needs. In addition, NonStop servers integrate easily with HP OpenView products. Operators can manage the NonStop server using OpenView products as part of the enterprisewide service management adaptive infrastructure.

Flexibility in configuration and expansion

NonStop S-series servers let you configure and expand the system to match the needs of your business. The premium high-end NonStop S88000 server is based on the MIPS R16000 microprocessor with 8 megabytes of secondary cache. The high-end NonStop S78000 server is based on the MIPS R14000 microprocessor with 8 megabytes of secondary cache.

The NonStop S780 server is an entry-level server in the NonStop product line. It is available only in a two-processor configuration using the NonStop S78000 processor. All of the entry-level NonStop servers are intended as low-cost entry points for distributed branch applications that require continuous availability and data integrity, but not scalability. If a NonStop S780 server needs to be scaled for more than two processors, it must be converted to a NonStop S7800, S78000, or S88000 server, with the appropriate license fee changes applied.

As applications grow, any of the servers can be expanded in increments of two processors at a time, up to 16 processors in a single node. For high-end servers, you can attach up to 36 additional I/O enclosures, each supporting 16 internal disk drives and four dual-ported ServerNet adapters.

The NonStop S-series S88000 server has a minimum of two PMF units and accommodates 2 gigabytes, 4 gigabytes, 8 gigabytes, or 16 gigabytes of main memory per processor. The NonStop S-series S78000 server has a minimum of two PMF units and accommodates 2 gigabytes, 4 gigabytes, or 8 gigabytes of main memory per processor. Each processor in the server configuration can have a different memory size to optimize cost-effectiveness for varying application environments.

A NonStop S-series server—with a compact system design that minimizes floor space requirements—can operate in a non-computer room environment. A four-processor NonStop S-series server fits into an industry-standard, 19-inch rack that occupies only 5 square feet. For more information about standard configurations, see the *HP NonStop S-series Servers Ordering and Configuration Guide*.

Multifunction I/O board

A comprehensive set of capabilities is included with each processor. The NonStop S88000, S78000, and S780 server PMF units have a multifunction I/O board that includes the following components:

- ServerNet router, which provides connections between the two processors, the MSEBs in the system enclosure, and storage connections (such as the SCSI ports) within an I/O or system enclosure



- Three SCSI ports, including one differential Ultra SCSI port for attaching external tape subsystems and two Ultra SCSI ports to control internal disk drives
- Ethernet controller, which supports the system console
- Service processor, which provides the hardware component of the server's maintenance and diagnostic functions

High-performance disk drives

The 18-gigabyte (15,000 rpm) 4619 disk drive addresses the key requirements of the OLTP market segment: low price and high performance. The aim is to deploy multiple access arms (disk drives) cost-effectively to support massively parallel high-volume OLTP applications.

Later in 2004, the 36-gigabyte (15,000 rpm) 4638 disk drive is planned to supersede the 4619 disk drive. The industry-leading rotational speed and low seek time of these disk drives make a significant contribution to OLTP performance.

HP also offers the 72-gigabyte (15,000 rpm) 4672 disk drive to address the needs of customers that require large databases. Later in 2004, the 144-gigabyte (15,000 rpm) 46144 disk drive is planned to supersede the 4672 drive. Both of these devices offer the lowest cost per megabyte of disk storage on NonStop servers.

Low-cost, high-capacity tape drive

HP StorageWorks DAT 72 tape drives are based on the Digital Data Storage (DDS) format, the most successful tape backup format of all time, with an installed base of more than 9 million drives. DDS technology has led the tape market for many years because of the capacity, reliability, and low cost of the tape drives that use this

format. DAT 72 tape drives for NonStop servers have backward compatibility with two previous DDS generations, providing excellent media investment protection. The low cost of DDS media contributes to the DAT 72 disk drive's extraordinarily low cost of ownership.

The StorageWorks DAT 72 tape drive is available in two configurations for use with NonStop S-series servers: a single-cartridge manual-load tape drive, and a model equipped with a six-media automatic cartridge loader (ACL), both designed for table-top use.

The DAT 72 tape drives have added value in the form of an enhanced and expanded user interface, which provides valuable information essential to effective use and maintenance of the DAT 72 tape drive. Information available at the push of a front-panel button includes drive identification, firmware revision level, transfer rate, current operational mode, compression on/off, compression ratio, and remaining cartridge capacity. Making this information easily available enables tape operations to run more efficiently and with reduced operator error.

For more information about tape drives, see the *HP NonStop S-series Servers Ordering and Configuration Guide*.

Wide range of networking and connectivity options

NonStop S-series servers support open networking standards, including TCP/IP versions 4 and 6 (IPv4 and IPv6), Internet Packet Exchange (IPX)/Sequenced Packet Exchange (SPX), NetBIOS, SNA, and OSI. They also support protocols that enable you to integrate a wide variety of standard and nonstandard devices into your information system.

High-performance adapters

NonStop S-series servers can be configured with the following options:

- One-port Gigabit Ethernet ServerNet adapter, or GESA (product ID 3865, copper, and multimode fiber models)
- Four-port ServerNet/4E adapter (E4SA, product ID 3861) for 10-megabit-per-second Ethernet LANs
- One-port Fast Ethernet ServerNet adapter (FESA, product ID 3863), for 10-/100-megabit-per-second Ethernet LANs
- One-port ServerNet ATM adapter (ATM3SA, product ID 3860), for 155-megabit-per-second Asynchronous Transfer Mode (ATM) networks
- One-port 10-/16-megabit-per-second Token Ring ServerNet adapter (TRSA, product ID 3862), providing connection to a wide range of workstations, other servers, and/or wide area networks (WANs) using either ServerNet Wide Area Network (SWAN) or SWAN 2 concentrators (product ID 3880 or 3881) or Asynchronous Wide Area Network (AWAN) concentrators (product ID 3886-xx)

These high-performance adapters are designed for the demands of peak-load, low-latency client/server use. To support more users, you can add adapters, one at a time or in pairs (for fault tolerance). NonStop S-series servers can be configured with any combination of communications adapters without limitations.

You can also use HP Expand software to connect NonStop S-series servers to other NonStop servers. The NonStop ServerNet Cluster product provides high-performance, low-latency connections between NonStop S-series servers. This is the best performing medium (that is, the physical layer on which data is transmitted) available for Expand connections. ServerNet/FX adapters also enable you to connect NonStop S-series servers to K-series servers that use the HP TorusNet or FOX ring connections. These adapters provide a connection between the ServerNet architecture and the FOX fiber.

To preserve your investment in peripherals, HP ServerNet/DA technology lets you attach external storage devices (used with NonStop K-series servers) to NonStop S-series servers.

Technical specifications

For specifications of NonStop S-series servers, refer to the *HP NonStop S-series Servers Ordering and Configuration Guide*. Compatibility or configuration restrictions and limitations are also included in that document.

Ordering information

For ordering information of NonStop S-series servers, refer to the *HP NonStop S-series Servers Ordering and Configuration Guide*.

For more information

For more information about NonStop S-series servers, visit www.hp.com/go/nonstop.

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