Series 10000 Personal Supercomputer

Workstation Systems

The Series 10000 brings supercomputer performance to the office, which means advanced applications like fluid dynamics can now be done on the desktop.

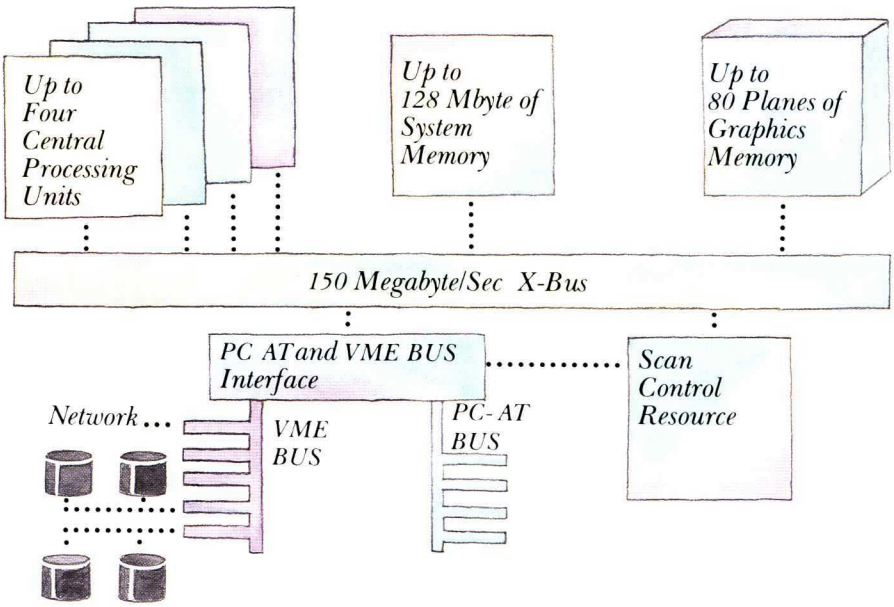
apollo

Description

The Series 10000™ family of Personal Supercomputers™ is based on Apollo's advanced *PRISM* (Parallel Reduced Instruction Set Multiprocessor) architecture. Fully compatible with existing Apollo systems, the Series 10000 puts supercomputer-class power at the fingertips of every user.

The source of the Series 10000's unprecedented power is the multiprocessor *PRISM* architecture, which incorporates today's leading-edge thinking and technology. It features, for example, multiprocessing techniques and 64-bit architecture taken from supercomputer designs. Its groundbreaking compilers incorporate sophisticated data flow techniques from major research institutes. And each of its up to four RISC-based central processing units has a high-speed integer processor *and* an independent floating point processor.

Just as significant as the technology that went into the Series 10000 is the design philosophy behind it. Apollo engineers took a *holistic* approach, which means every component is carefully designed to work with every other component. As a result, not only does the Series 10000 feature the fastest processors, its system architecture, operating system, and compilers have all been developed together, with a great deal of cross-influence, to take full advantage of the local



The Series 10000's well-balanced architecture means all system components are designed to work together to deliver high system performance.

parallelism of its multiprocessor design, and thereby deliver unrivaled *system* performance.

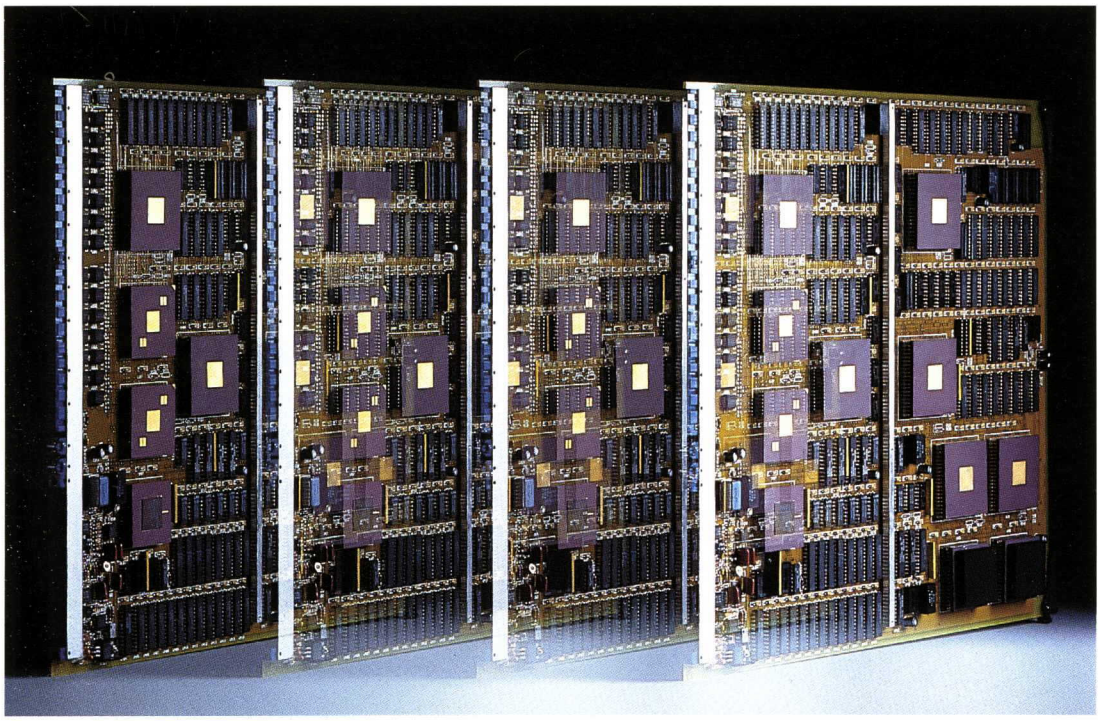
The Series 10000 can easily handle the full gamut of technical applications, whether in traditional areas such as mechanical CAD and electronic design, or in emerging fields like computer-aided molecular design, scientific data visualization, and financial modeling.

As a fully compatible Apollo workstation, Series 10000 family members can be easily integrated into existing network environments, becoming productive within minutes. And for heterogeneous networks, Apollo's Network Computing System™ (NCS) and extensive family of communications tools give users a single-system view of the entire compute environment. NCS is a set of software tools that lets users unite computers and workstations from many different vendors into a single, integrated network. It also allows application developers to convert traditional applications into distributed applications, processing selected parts on the most appropriate network systems and making the most efficient use of the entire network.

The Series 10000 is a superior computational resource for individuals, workgroups, departments, or entire corporations. It is currently available in server and computational workstation configurations.

Highlights

- Symmetrical multiprocessor design, with up to four CPUs, lets users match their application environment to processing performance
- High-performance CPUs incorporate key RISC features to achieve maximum performance from today's most advanced semiconductor technology
- Each CPU includes an independent floating point processor that delivers supercomputer-class performance
- Large dual caches dramatically boost bandwidth by continuously feeding processors to deliver maximum application throughput
- 64-bit data paths and registers minimize machine cycles per instruction and make possible single-cycle execution of double-precision floating point operations
- High-speed 150-megabyte/second system bus delivers sustained throughput for complex applications
- Wide data paths allow parallel execution of up to three operations and increase system response
- Data flow compilers use sophisticated techniques to map execution instructions onto the hardware resulting in multiple instructions per cycle



The Series 10000 supports up to four central processors—each with an independent integer processor, FPU, dual caches, and memory management unit.

- Up to 128-megabyte main memory with 16-way interleaving achieves rapid I/O speeds required by multiprocessor designs
- Shared virtual memory gives programs a common view of memory and allows transparent migration of operations from one processor to another
- Industry-standard VME and IBM PC AT®-compatible buses are supported for links to all standard peripherals
- Up to four 5¼-inch ESDI fast actuator disk drives, with disk striping supported, provide high-performance mass storage

Configurations

Series 10000 family members now available include computational workstation and server configurations. The DSP10000 compute and file server is available with up to four central processors, 3 gigabytes of disk storage, and 128 megabytes of main memory. It can add supercomputer-class performance to any network and is an exceptionally powerful tool for applications like PCB routing, large-scale simulations, and network-wide file storage.

The DN10000-E computational workstation configuration comes with one to four CPUs and an 8-bits-per-pixel graphics display with 1024 x 800 resolution that can simultaneously represent 256 colors from a palette of 16.7 million. This workstation is ideal for users who require a high-powered compute resource with a high-resolution, multiwindow graphics screen for displaying results. It's particularly well-suited for non-graphics-intensive applications like artificial intelligence, computer-aided software engineering, and financial modeling.

Multiprocessing

The Series 10000 features a highly efficient multiprocessor architecture which supports up to four independent CPUs and is ideal for process-rich applications. Each CPU has its own integer unit, floating point processor, cache memory, and memory management unit. And each CPU is entirely independent, executing processes either independently on one CPU, or together with other CPUs, without user intervention. This makes it easy for existing applications to immediately exploit the multiprocessor architecture.

In the typical multitasking operating system environment, tasks are continuously waiting for CPU processing time. The Series 10000 solves this problem by speeding up each process with creative and fast CPU design, and by applying multiple CPUs to increase overall

system throughput. Actual multiprocessor task management is handled by the operating system. Shared operating system code ensures that each free processor selects the next-highest priority process from a common ready-process queue.

Balanced CPU Power

The heart of the Series 10000 is its extremely powerful and uniquely designed central processing unit which incorporates a high degree of local parallelism as well as advanced RISC concepts.

The RISC instruction set is implemented directly in hardware as opposed to the microcode used in traditional CISC (Complex Instruction Set Computer) computers. This eliminates a level of interpretation and reduces overhead per instruction, so execution is faster. It also makes possible parallelism through pipelining and the simultaneous execution of serial instructions.

Among the RISC concepts the system implements is *fixed length instructions,* which is a simplified instruction format that boosts pipeline flow. *Delayed branching,* which executes instructions after a branch until the branch target is fetched, eliminates delays caused by waiting for pipeline refilling. And *single-cycle execution,* which ensures virtually all instructions are executed in one machine cycle.

Even more significant and unlike traditional approaches, the system combines both an integer processing unit (IP) and floating point unit (FPU) in every central processing unit. Although the two are independent of each other, they're tightly integrated and designed to work in unison to reduce set-up time and improve response.

In essence, the floating point unit is a peer of the integer processor, and because of this the traditional overhead problems associated with floating point coprocessors have been eliminated.

Low-latency Floating Point

In place of the traditional co-processor approach, the Series 10000 has tightly integrated, low-latency, high-performance floating point processors. As the FPU is a logical equivalent of the IP, floating point instructions can be dispatched in parallel with integer operations, doubling the throughput compared to conventional techniques. In addition, the floating point unit has both ALU and multiplier, which can operate in parallel using compound instructions.

This local parallelism lets each CPU execute up to three operations in a single cycle. For example, an integer operation plus a floating point multiply and add. This means a more efficient use of both system and cache memory, and unprecedented performance from a single CPU. When multiple processors are added to the system, the result is supercomputer-class performance from a workstation.

Data Flow Compilers

Everyone recognizes that a new computer design is in reality only as strong as its compiler. In building the Series 10000 compilers, not only have Apollo engineers rewritten the object code generator, a requirement for RISC-based architectures, but they have also incorporated sophisticated data flow concepts developed at some of the nation's leading research institutes. These improvements have been included in all the standard Apollo compilers.

By paying careful attention to compiler technology and using data flow techniques to map and schedule instruction processing, our engineers have developed advanced compilers that fully harness the latent power of the Series 10000.

High-bandwidth Main Memory

Apollo's holistic approach means that, unlike other vendors, our engineers have paid just as much attention to the memory, mass storage, and

The interior of the Series 10000 reflects its highly efficient design and easy accessibility.

datapaths as to the CPUs. As a result, the Series 10000 solves one of the key problems in multiprocessor systems: the capacity of the memory bandwidth to handle massive information flow. That's why Apollo engineers made sure the Series 10000 could easily meet the demands of today's high-throughput applications.

Its advanced memory architecture features a parallel design that easily supports heavy I/O traffic over Apollo's high-bandwidth X-bus, as well as quick simultaneous access from each of the multiple processors feeding the bus. The parallel design eliminates the bottlenecks long associated with traditional memory architectures. In addition, the main memory incorporates unique intelligence for managing *write* buffers and for increasing bandwidth by using static column RAMs. The benefit of all this is uninterrupted high-speed data flow to and from the main CPUs.

High-speed Disk Striping

The Series 10000 uses sophisticated disk striping to provide the large bandwidth required by a well-balanced system. Disk striping enables files to span multiple drives, allowing high-bandwidth access to a file via multiple controllers. It's supported by new high-speed ESDI fast actuator drives with 15-megabit/second transfer rates.

Series 10000 users can stripe two or four drives, with the total data transfer rate depending on how many disks are striped. For example, two striped disks double the data transfer rate of disk-bound applications. Users select how many and which disks are to be striped at initialization. This way disk-intensive files can be put on striped drives and the remaining drives can be used for general-purpose applications.

Scan Path Technology

To ensure an extremely high degree of reliability in the Series 10000, Apollo has incorporated *scan path technology* throughout the system. Pioneered by IBM in the 1970s for mainframes, scan path technology provides a built-in system for testing dense VLSI arrays.

With up to 256 pins and 40,000 gates per VSLI chip, each Series 10000 gate array presents a formidable verification problem. Scan path technology makes it possible to "look" inside each VSLI chip. By shifting the input through the chip,

applying an input function, and then shifting to the output, testers can determine its state and functionality.

Because all of the Series 10000's semicustom chips have scan path capability, they can be linked together in series to form a single shift chain. This allows built-in test circuitry to analyze functionality with a nearly 100% level of confidence.

Advanced Ergonomics

In addition to performance, what makes the Series 10000 unique is Apollo's ability to put its power and speed into a package that could fit conveniently and comfortably in an office environment. That meant paying particular attention to the things that many vendors might consider unimportant, but which can make a significant difference to the user.

To begin with, the dimensions of the Series 10000 are 24½ inches x 20 inches x 29 inches. So not only does it easily fit into the office, it can slide under the standard office table for added convenience. And along with its streamlined dimensions, the Series 10000 is designed so that it can be directly abutted to a wall.

Packaging Specifications

Series 10000 Operating Environment

Heat Dissipation – 5934 BTUs (fully configured)
Noise Output – 55dba (fully configured @ 30°C)
Temperature – 15°C to 32°C (59°F to 90°F)
Humidity – 20% to 80% Relative (non-condensing)
Wet Bulb – 25°C max (77°F)
Ceiling – 8000 feet (2438 meters)
Vibration – 5-22Hz, 0.25 G Peak
Shock – 5G Peak, 10msec ½ sinewave

Network Independence

The Series 10000 can dramatically increase the available power of virtually any network. Because, as a fully compatible member of Apollo's Domain® family, it can be linked to a wide variety of media – including Apollo Token Ring and Ethernet.® And as new standards and technologies develop, such as FDDI (Fiber Optics Digital Data Interconnect), they are being added to Apollo's networking capabilities.

Apollo's layered network architecture and communications products make it quick and easy to link the Series 10000 and other Apollo systems, as well as entire Domain networks, to each other and to other networks. These products make it possible for existing networks to take full advantage of the Series 10000.

Apollo Computer Inc.

Apollo Computer is a full-service company that designs, manufactures, markets, and supports integrated hardware software systems for high-level engineering, scientific, and technical applications.

Apollo provides the resources and power of 32-bit workstations dedicated to the individual professional, and combines these with a high-speed LAN, integrated graphics, and an open architecture environment of data, storage, and communications network capabilities.

Apollo applies advanced workstation technology to improve the productivity of professionals and their organizations by providing the ultimate in processing, graphics, and network computing performance.

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