SuperSPARC Premiers in SPARCstation 10

Up to 4 Processors and 512 Mbytes of RAM in "Pizza Box"

By Michael Slater

Shortly after TI's announcement of SuperSPARC (see p. 1), Sun Microsystems announced the SuperSPARC-based SPARCstation 10 family. Starting at $18,495, they establish a new high-end line for Sun. Sun's previous high-end model, the SPARCstation 2, will still be available. While it provides less than half the performance of the SS-10, the SS-2 is $4200 cheaper for the entry-level configuration. (The SPARCstation 10 name, originally SPARCstation 3, was changed to emphasize that this is an entirely new generation, not an evolution from the SPARCstation 1 and 2.)

The new systems are Sun's first workstations to use the MBus architecture and the "reference" MMU, and they are among the first multiprocessor desktop workstations from any vendor. Sun's previous workstations use Sun's older SRAM-based MMU design and do not have a separate memory bus; the DRAM in these systems is interfaced to the SBus. The MBus provides a 64-bit data path and supports multiple processors (see µPR 8/7/91, p. 8). Most importantly, the MBus provides a standard interface for SPARC processor modules, enabling Sun to adopt new processors in the future with no hardware changes. This upgradeability gives users a platform that is likely to last for years.

Configurations

Four configurations have been announced for the SPARCstation 10. The entry-level model 30, priced at $18,495, uses a 36-MHz SuperSPARC processor with no second-level cache. The high-end uniprocessor model 41, priced at $24,995, uses a 40-MHz processor with a 1-Mbyte second-level cache. The 36-MHz version is the result of SuperSPARC's disappointing clock speed; the odd frequency is apparently a compromise between the 40-MHz target and the need for adequate yield to give Sun the volume it needs.

Two- and four-processor models (model numbers 52 and 54) will also be available, using 45-MHz processors, each with a 1-Mbyte second-level cache. The two-processor system starts at $39,995, and the four-processor model is priced at $57,995. The uniprocessor models will be available late this summer, with the dual-processor model to follow by year-end (dependent on the availability of the multiprocessor operating system, not the CPU).

The system includes two MBus connectors, so the dual-processor system can use single-processor modules. The four-processor model requires dual-processor MBus modules, so it will not be available until early next year.

Completing the range of configurations, the SPARCserver 10 line is essentially a "headless" version of the workstation lineup, starting at $16,995. The CPU board alone is also available as the SPARCengine 10 for OEM applications, priced at $11,500 for the 36-MHz version and $18,000 for the 40-MHz, secondary cache model.

The uniprocessor models will run either Solaris 1.1 or 2.0, but the multiprocessor versions require Solaris 2.0, which will be rolled out this fall. The transition to Solaris 2.0 will be painful—all applications must be recompiled—but its symmetric multiprocessor and multithreading capabilities should be worth it.

The uniprocessor systems come standard with 32 Mbytes of RAM and a 424 Mbyte disk; the multiprocessor versions come with 64 Mbytes of RAM and a 1 Gbyte disk. For the first time in a Sun workstation, the memory implements full error correction. The memory bandwidth (using two interleaved 64-bit-wide banks) is 320 Mbytes/s. Using 4-Mbit chips, the system supports up to 128 Mbytes of RAM; with 16-Mbit chips, it will support 512 Mbytes.

Like previous SPARCstations, the system board includes SCSI and Ethernet interfaces. The SCSI performance has been doubled, from 5 to 10 Mbytes/s, although this speed will not be realized with common disk drives. One new feature of the Ethernet interface is support for 10BaseT twisted-pair cabling.

The audio I/O has been upgraded from 8-bit to 16-bit resolution, using the new codec codeveloped by Sun with Crystal Semiconductor and Analog Devices. An external speaker box contains the audio codec, a speaker, and connectors for external audio devices.

The SPARCstation 10 is the first workstation to provide a full-featured ISDN interface on the system board. Using a single-chip interface developed in collaboration with AT&T, it provides dual 64-kbit/s data links and an audio link. Sun's system software supports full network capabilities on the ISDN interface, allowing users at remote locations to have a reasonably fast link to another network without requiring any external modems or interface devices. The ISDN software also provides Group-4 fax, answering-machine, and phone dialing functions. In the near term, however, this fea-

Architecture	SPARC			MIPS		PA-RISC		POWER		486
Processor	Super-SPARC	Super-SPARC	7C601	R4000	R4000	Snakes	Snakes	RIOS	RIOS	486DX
System	Sun SS-10/30	Sun SS-10/41	Sun SS-2	MIPS Magnum	SGI Crimson	HP 710	HP 750	IBM 340	IBM 560	Intel Xpress
Clock Rate	36	40	40	50/100	50/100	50	66	33	50	50
Cache (S+P)	0 + 36K	1M + 36K	0 + 64K	0 + 16K	1M + 16K	0 + 96K	0 + 512K	0 + 40K	0 + 72K	256K + 8K
espresso	41.3	48.5	21.5	40.6	54.5	40.8	58.5	27.3	41.7	25.8
li	50.7	61.1	21.6	48.1	67.8	36.2	50.6	28.6	43.5	40.2
eqntott	57.6	68.8	22.8	43.7	78.7	37.5	54.5	34.6	53.1	25.2
compress	28.7	35.6	17.3	22.7	69.3	25.8	45.9	26.1	40.2	24.0
sc	52.3	60.6	28.1	49.3	67.1	25.2	39.1	25.9	39.2	44.6
gcc	41.0	47.9	20.9	26.1	40.7	27.7	42.9	24.8	36.4	26.6
SPECint92	44.2	52.6	21.8	36.8	61.7	31.6	48.1	27.7	42.0	30.1
spice2g6	31.3	38.4	17.4	24.4	44.5	33.0	60.5	34.1	57.2	18.6
doduc	46.4	58.7	18.8	35.0	51.8	44.7	68.9	39.0	60.6	12.8
mdljdp2	59.4	69.9	27.4	64.6	88.3	68.3	96.3	58.9	90.5	12.7
wave5	34.8	45.5	15.6	24.2	40.7	18.1	49.3	32.5	50.3	9.0
tomcatv	65.6	66.8	24.8	37.8	68.1	64.5	84.1	100.4	160.6	15.0
ora	106.8	120.7	44.9	70.6	73.9	109.3	144.4	54.0	81.2	17.0
alvinn	108.0	129.0	34.1	52.0	76.1	67.3	87.6	89.8	139.1	22.9
ear	70.1	75.9	26.9	80.7	89.6	63.7	84.6	83.9	126.5	21.8
mdljsp2	29.5	33.5	15.9	40.3	46.3	32.3	44.0	25.4	39.0	6.8
swm256	41.3	38.3	13.8	32.4	38.5	34.9	46.0	24.8	37.8	8.5
su2cor	54.9	92.3	29.3	31.1	75.4	58.6	96.8	54.5	158.5	17.1
hydro2d	44.5	59.5	20.1	39.6	77.5	44.4	79.3	55.5	91.4	13.6
nasa7	51.4	73.8	25.5	36.1	74.3	44.6	65.6	81.9	155.3	15.5
fpppp	55.4	76.9	21.7	31.3	77.5	42.3	98.6	63.2	93.7	14.8
SPECfp92	52.9	64.7	22.8	40.0	63.4	47.6	75.0	51.9	85.6	14.0

Table 1. SPEC92 benchmark results for the SPARCstation 10, compared with other mid-range and high-end workstations. Some high-end models are deskside, server-configured machines. All results are measured, not simulated, as reported by the vendors.

ture will be of no use to most users, at least in the U.S., since ISDN connections are relatively rare.

When used in the single-chip (no external cache) configuration, the SuperSPARC processor runs synchronously with the MBus clock. The system board includes two crystals, 36 and 40 MHz, that are jumper-selected. This allows a 36-MHz system to be upgraded to a 40-MHz system.

There is no reason why Sun could not offer a 40-MHz version without a second-level cache, but for now it has no plans to do so. Likewise, there are no current plans for a 45-MHz uniprocessor model. Since the MBus is limited to 40 MHz, systems operating at higher clock rates must use the second-level cache to allow the processor to operate asynchronously.

As in previous SPARCstations, the display controller is implemented on an SBus card. The base system comes with a GX accelerated graphics controller; it is not offered with a non-accelerated frame buffer. (The server and OEM board configurations do not include any display controller.) There are four SBus connectors, instead of three as in previous SPARCstations, increasing the amount of available I/O expansion. To make room for the additional SBus connector and the two MBus connectors, they are stacked in two rows at different heights, so cards plugged into one set of connectors sit above those plugged into the other set.

Performance

As Table 1 shows, the uniprocessor system performance fails to meet the "three times SPARCstation 2" levels originally promised for SuperSPARC, but it is comfortably twice as fast even in the low-end configuration. When the 50-MHz clock rate is reached, the three-times goal should be met.

Figures 1 and 2 show SPEC92 performance for the systems listed in Table 1, sorted by integer and floating-point ratings. The SPARCstation 10 provides top integer performance, outpaced only by SGI's R4000-based, deskside IRIS Crimson machine, and even the entry-level SPARCstation 10 configuration beats a top-of-the-line RS/6000 system on integer performance. Sun's floating-point performance still lags behind HP and IBM, but it compares more favorably if systems in the

same price range are compared (the high-end HP and IBM systems shown in our chart are much more expensive).

While SuperSPARC has allowed Sun to roughly catch up with HP and IBM, Sun seems doomed to fall further behind in uniprocessor floating-point performance. HP's floating-point performance should be boosted dramatically later this year when PA-7100-based systems begin shipping, and IBM is readying a next-generation version of its two-year-old chip set, while Sun's performance will increase very gradually as the SuperSPARC clock rate is increased to 45 and then 50 MHz.

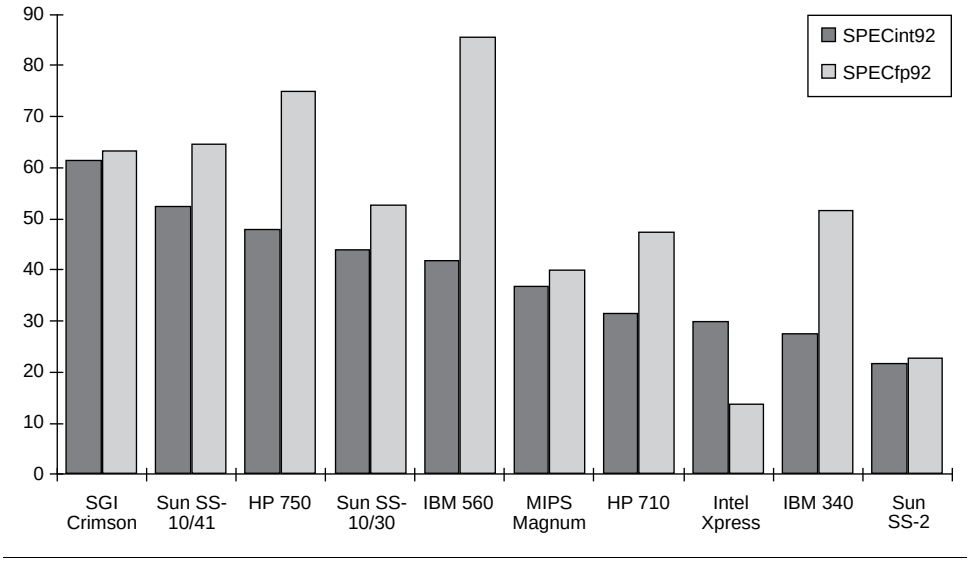

Figure 1. SPEC92 performance sorted by integer performance.

Sun is betting on multiprocessor systems as their way to performance leadership. So far, relatively little software has been available that can make good use of multiple processors in a single-user machine. Solaris 2.0 will provide the infrastructure to efficiently exploit multiple processors. Eventually, mainstream applications will be written to use multiple threads, allowing a single application to be divided among processors.

Even without such applications, however, many users will recognize a performance gain from a multiprocessor system whenever they are running multiple tasks. In the simplest case, the operating system and network software might run on one processor, while user tasks run on the other. Alternatively, one processor could be dedicated as a sort of personal compute server, running a simulation or database task in the background while the other processor remains available for interactive use.

A multiprocessor system will not, however, provide a linear increase in performance with the number of processors. The increased communication overhead, inefficiencies of workload partitioning, and contention for memory and bus bandwidth all reduce the actual performance, which is highly dependent on the mix of applications and the working style of the user. The only benchmarks Sun has provided for its multiprocessor systems is SPECthruput89 (109 for the two-processor system and 218 for the four-processor model). SPECthruput is essentially the SPEC89 performance multiplied by the number of processors—an optimistic rating at best. Generating meaningful multiprocessor benchmarks for comparing uniprocessor and multiprocessor workstation will be difficult.

For users whose primary need is maximum floating-point performance, HP and IBM will continue to have an edge. For commercial users, however, or for technical users who can exploit the system's multiprocessor capability, the SPARCstation 10 appears to be an outstanding machine. Its biggest drawback is the relatively high price, which will keep it out of the highest-volume segments of the market. ♦

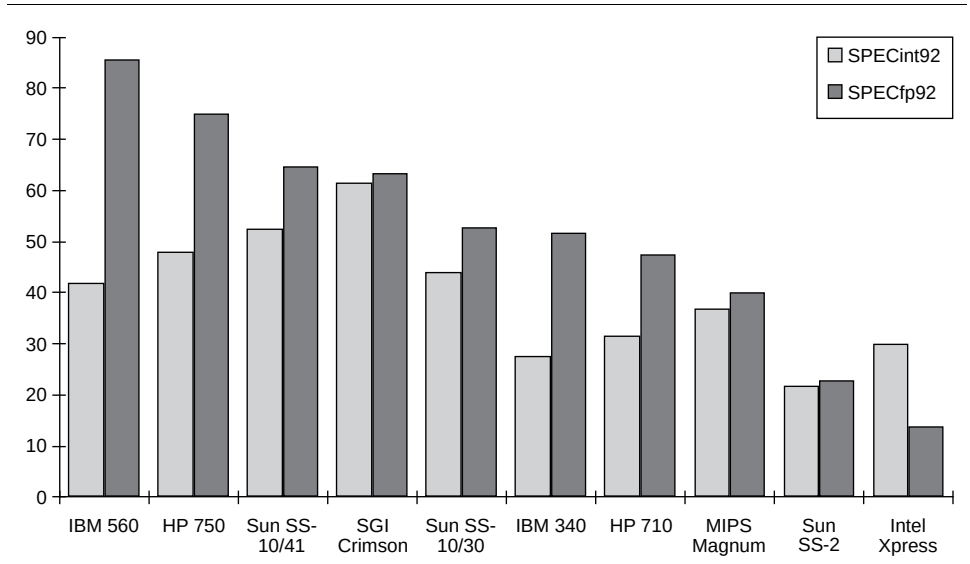

Figure 2. SPEC92 performance sorted by floating-point performance.