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A Wolf Slips Into Sheeps' Clothing

By Walter Alan Zintz

Putting the power of Unix along with ubiquitous DOS/Windows (or OS/2) in a single desktop system has long been desirable, but difficult. SPARCard 5 from Opus Systems shows that it can be done with no compromises on either side, and with less trouble and expense than two separate systems would be.

Here's the table of contents for this review:

Here's a 58K JPEG photograph and 58K PostScript diagram of the hardware boards.

Opus Systems makes SPARC-based boards that slip inside standard IBM-architecture PCs. A lot of companies have produced accelerator or co-processor boards for PCs over the years. They're mostly history while Opus is going strong, primarily because the Opus SPARCards are not helpers designed to boost performance of the basic PC; rather they constitute a completely separate SPARC/Unix computer that happens to live inside a PC and share some of its peripheral resources.

The Hardware You Get

Minimum SPARCard 5 hardware consists of two boards. One of them contains a microSPARC II CPU, running at 70, 85 or 92 MHz. (Opus can run these chips at faster clock speeds than Sun does, because every Opus SPARCard 5 has a mini cooling fan on the board, right next to the CPU.) It also has sockets for 60 ns SIMM RAM; 8 to 128 MB of it. RAM is not included with the board.

The other essential board is for I/O. It has the works: Ethernet with internal thicknet cable (10-base5) and external unshielded twisted-pair (10-baseT) connections; synchronous SCSI-2 with internal and external connections; two-slot, 32-bit SBus connector; Centronics-parallel output; two RS232 channels; 8-bit, 8 kHz audio interface; plus a direct-drive connection for an 8-ohm loudspeaker. Not all of these are provided with plug-in connectors. It also has controllers and connections for a 3.5-inch, 1.44 MB floppy drive; a Type 4 keyboard; and a 3-button mouse--for each of these units, the board can be configured to let the SPARCard share the corresponding PC unit or have exclusive use of a separate one.

If the system is to have a monitor (embedded systems often don't), then a PC3i board is also needed. It contains the frame buffer, the video signal generator and a source switch, with screen resolutions up to 1152 x 900 and 256 displayable colors out of a palette of 16.8 million. The SPARCard 5 architecture lets the user choose whether to share the PC monitor or use a separate one for the Unix side. Because sharing is the obvious choice in most cases, this board supports only PC signal generation--using a separate Sun-type monitor requires adding a fourth board. But whichever the user chooses, the GUI that appears when Unix is in use will be familiar X Window System, OpenWindows, or SunView, not MS Windows.

The one essential PC peripheral that SPARCard 5 does not share is the IDE hard disk. This is primarily to avoid throughput bogdown, especially because the PC and the SPARCard may be--and often will be--running separate programs at the same time. No hard disk is automatically supplied with a SPARCard 5--the user must either add a SCSI hard disk or, if the SPARCard will be networked, run as a diskless node.

The Software You'll Need

SPARCard 5 is certified as SCD-compliant by SPARC International, which requires the SunOS operating system and the supporting Solaris user environment. (SunOS is the Unix kernel and other necessities of system operation; Solaris includes all those utilities we've come to think of as an integral part of the Unix environment.) Every SPARCard 5 sale includes a two-user license to run this software, but does not include the software itself. The software does come loaded on every hard disk that Opus sells along with a SPARCard 5; otherwise you must buy it separately from Opus or obtain it through another channel.

To coordinate PC and SPARCard operations, you'll also need a suite of PC TSR programs called Incognito. The first thing they do is let you switch between PC and SPARCard interactive use, if you are sharing the keyboard, mouse and/or monitor between them. You can switch manually just by tapping the right-hand shift key three times in a row. (I know this will be bad news for the few readers who habitually spend their think time nervously tapping that key, but for the rest of us it's a pretty good method.) You can also set up icons on the Windows and/or the Sun GUI that, when clicked on, will move you between the two sides, or launch an application on the other half of the system without otherwise taking you from the environment you were in.

Incognito also handles the peripheral-sharing itself. The PC standard for keyboard and mouse configuration differs significantly from what SunOS and Solaris expect, so Incognito includes a translator module that provides workarounds for most (not all) of the Sun-type functions that are missing from PCs. These are usually common-sense and reasonably convenient--for instance, the user simulates clicking the third button of a Sun-standard mouse by clicking both buttons on a two-button PC mouse simultaneously. The translator table is rumored to be user-modifiable, but I could not find a word about it in the documentation.

Finally, Incognito lets users working on the PC side access files on the Unix disk. It does this by mapping DOS drive names into the user's choice of mount points within the Unix file system, and takes care of format translation on the fly. It doesn't work in the other direction, though: the only way someone working on the Unix side can access files on the PC side is by linking both to a common network with remote file sharing capabilities (or by using the shared floppy drive in a clumsy pipeline kluge).

The Incognito suite is not bundled with the SPARCard 5. In the Opus Systems open style, each of the three modules is licensed separately, so you can buy only what you need.

Getting Set Up

For my 30-day test, Opus supplied me with their mid-level SPARCard 5--the 85 MHz model--with 8 MB of RAM plus a 202 MB hard drive, all in an old 386 PC. (This last was at my request--I wanted to be sure that SPARCard throughput was not dependent on PC speed.) No Sun peripherals were included--the SPARCard was set up to share the PC's keyboard, mouse, monitor and floppy drive. A full suite of Incognito middleware was installed on the PC's hard disk, and the SPARCard's disk contained SunOS 5.4 and Solaris 2.4.

But everything was assembled, loaded, configured and ready to run when Opus turned the system over to me. That's not what a normal customer would receive, of course, but no one at Opus was enthused about taking it all apart again so I could put it together myself, and I did not press the point, so most of what I can tell you about setting things up is what I learned from the manuals.

(I did take the boards out of the bus, separate them, and then restore them. At close inspection they looked to be high quality in materials and workmanship, and the removal and reinstallation were trouble-free.)

According to the manuals, anyone who knows which end of a screwdriver to hold onto should be able to make a routine installation of the boards and the SCSI drive, in about an hour. There's a special ''Quickstart'' manual in the documentation slipcase that will easily guide users through the straightforward process. Installations that require installing the SIMM RAM, making substantial changes to the myriad DIP switches and jumpers on the boards, loading SunOS and Solaris onto the hard disk, and the like, should be done by someone who understands system setup. In these cases, the job will be complicated, but not tricky.

Setting up the PC side will often be a ten-minute job. The Incognito programs install and configure from a simple guide. Usually, the one hardware change required is installing a video jumper cable. The only likely complication occurs when the user wants to share Unix files from the DOS/Windows side. Selecting optimum access points into the Unix file system is harder than DOS/Windows people would imagine.

How good is the documentation? It varies, and (oddly enough) the less the reader knows technically, the more satisfactory s/he is likely to find it. The basics of a routine installation and simple system use are explained with admirable clarity and completeness, primarily in two ''Quick Start Guide'' manuals. Technically-challenged people who wouldn't think of going beyond this minimal level will easily find almost everything they want to know. Technicians who must do complex set-ups, and advanced users who want to utilize the full power of the system, will find explanations for a large part of what they need to know, but not always in enough depth. Systems engineers working for OEMs and integrators are left woefully short of the technical details they will need.

All this documentation covers only what Opus produces. The PC should come with its own documentation, of course, and Opus add-ins such as SCSI disks may come with their own instruction sheets for all I know. But it is regrettable that their is nary a word about using and maintaining SunOS and Solaris--not even instructions for accessing online manual (''man'') pages.

A Thirty-Day Test Drive

This system's dual personality is not in the Dr. Jekyll and Mr. Hyde style. The feeling is more like owning Aladdin's magic lamp. Cautious users might prefer to work entirely on one side, setting up icons to launch applications on the other system without immersing the user in the alien environment. But it's much more fun to tap the shift key three times and let the genie whisk the PC out of sight and instantly replace it with a SPARC workstation. Or vice versa. Tap-tap-tap and you're miraculously transported to the magic land of full Unix with SPARC power. Tap-tap-tap again and back you go to the everyday world of DOS on a 386. It happens instantly and completely, with the new vista looking as though it has been there all the time.

Which it has, of course. Experience showed that these really are two independent computers that happen to share a few peripherals. Both run simultaneously, and jobs will run on one even while you're connected to the other, without any need for backgrounding them. When I was on the PC side I was working with a standard--as far as I could tell--DOS and Windows PC, running at what seemed to be a normal speed for its 386 CPU.

Actually, though, there is one major difference in operating the PC after a SPARCard 5 has been installed, and it's an absolutely vital one. PC users generally stop their PCs just by turning the power off. That's pretty harmless to the PC itself. But because the SPARCard gets its power from the PC's bus, a user who cuts the power without first halting SunOS causes a Unix system crash, with potential for serious file trashing. Sadly, the Opus documentation, usually exemplary on the basics, mentions this only in passing, toward the back of the manuals. Were I running Opus Systems, I'd prominently display a warning about this in the early pages of the manuals, and I'd also put the warning on vivid peel-and-stick labels for keyboards and monitors, to be shipped with every SPARCard.

When I switched over to the Unix side, my first impression was completeness. The screen looked, and the whole system acted, just like a Sun workstation. I never came to a place where something was missing, and except for the PC keyboard and two-button mouse I would quickly have forgotten that I was not on a Sun at all.

Next I noticed heartwarming speed. This system ran about as fast as a Sun SPARCstation 20/50, in my estimation. I was expecting noticeable degradation from operations that were funneled through an AT bus, a 386 CPU, and middleware running under DOS, but I definitely did not find that.

My last major impression was solidity. I pushed the Unix side pretty hard at times, and never crashed it. Even the few hiccups were invariably traceable to Sun's software. (Yes, there are some flaws in Sun's highly-touted SunOS and Solaris, especially in the code they imported from Berkeley distributions. I'm not sure why a company with sales in the billions can't take the trouble to clean up the free code they're selling so widely.

Opus Trumps the Ace

While I was reviewing this system, Opus people were getting first shipments on a new microSPARC chip that they were able to run at an impressive 120 MHz, thanks to their on-board fan. They offered to let me try this new chip in the review system, I gladly accepted, and a few days later a marketing person--not an engineer--came by to make the exchange.

Opus has designed its SPARCards to be readily upgradable, with separate boards for different function areas, plus DIP switches and jumpers galore to make most anything you can think of adjustable in the field. It took two screwdrivers and about eight minutes to remove the CPU/memory board, move its RAM to the new board, put the new board in place, and close everything up again. As he was working, this marketeer mentioned that the old CPU board could have been retained, just by adjusting switches and jumpers, had he felt qualified to pull and replace the SPARC chip.

And what a difference the faster CPU made! With the first CPU the system had been a long way from slow, but now I had to get used to getting the prompt back before I finished lifting my finger off the RETURN key. I used my homebrew benchmarks on the SPARCard with both CPUs (see results below), and found that the speed improvement was closely proportional to the new chip's increased clock speed. That put an end to any suspicion that the SPARC CPU was being held back by delays in the PC's support operations, or by I/O bottlenecks, or by any other external factor.

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BENCHMARK TIMES: SPARCARD 5 WITH DIFFERENT CPUS
:::::::::::::::::::::::::::::::::::::::::::::::

                                           85 MHz    120 MHz
                                           ------    -------
Character and file-block handling test
      user time, seconds                     92.3       64.9
      system time, seconds                   54.4       37.2

Integer arithmetic test
      user time, seconds                     64.9       45.9
      system time, seconds                    2.2        1.3
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A Few Rivals

The marketplace offers several other approaches to putting Unix and DOS/Windows on a single machine. A brief look at them will show why they're all in niche markets while the mainstream belongs to dual mainboard solutions such as SPARCard 5.

A partioned hard disk carrying both DOS/Windows and Unix on an X86 PC.

This is just fine on the DOS/Windows side, although switching between the two environments requires a shutdown and reboot. But Unix on PC hardware doesn't begin to rival the power of Unix on a true workstation, and the usual Unix-for-Intel implementations don't have all the most powerful technical applications available; the apps that are ported to them are mainly small programs that are also available for PCs, and which run just fine there. This combination is sensible only where the users do just occasional work on the Unix side, limited to a few applications that are all known to be available for one particular Unix-on- Intel implementation.

Linux with its built-in DOS emulator.

You're still facing low CPU power, plus a dire shortage of commercial applications for native Linux. You do get a close linkage between the pseudo-Unix and pseudo-DOS sides, but you have to put up with the none-too-robust nature of Linux, which was not designed for commercial use.

Unix-like utilities that run on top of DOS/Windows.

Here the power of Unix is even more restricted, by the limitations of the underlying DOS operating system. And there are hardly any commercial Unix applications that are ready to run in such an environment. The only place for this approach is where the applications are entirely DOS/Windows, but diehard Unix-buff users insist they can't live without Unix-style utilities handy.

Software DOS/Windows emulation on a Unix workstation.

In this case it's the DOS/Windows applications that run unbearably slowly. This seems to be universal, perhaps it's a fundamental incompatibility between the convoluted Intel CPU architecture and that of workstation CPUs. Go this route only if your DOS/Windows workload is minimal.

PCs networked to Unix servers with remote login.

Back to timesharing. PCs and technical workstations both became popular as antidotes to this situation, rival jobs from rival users endlessly scrapping for scarce machine resources.

Compared to these alternatives, the position of the SPARCard 5 is pretty clear. It costs more than any of the alternatives sketched above--quite a bit more than some of them--but it avoids all their limitations. It's as powerful a solution as having a PC and a high-powered technical workstation sitting side by side, but at a lower cost, using half the desktop real estate, and without the bother of physically switching back and forth.

Real-World Applications

The Opus SPARCard series has already established itself in a number of markets. Here are some that Opus' Vice President of Sales, Solomon S. ''Sam'' Pelc, tells me are going well for SPARCards:

Software development for the PC arena.

With SPARCard systems, programmers get the speed of a SPARC system and the power of Solaris-based development tools. But as soon as code is cross-compiled it's ready to be tested on the PC side, straight off the Unix disk. No network or sneaker-net transfers, no problem with keeping the two systems' versions synchronized, and the programmer has full desktop control of both systems.

Scientific instrumentation.

Instrumentation control packages have traditionally been written for PCs, but serious data-analysis software runs primarily on Unix systems. With SPARCard systems, the underlying PC can control the tests and write the data directly to the Unix hard disk, ready for immediate analysis. Aside from speeding up the overall process, this puts experimenting scientists and engineers outside the grasp of computing centers and backbone networks.

Financial analysis.

Do-it-yourself computing for financial professionals grew up around the non-threatening IBM PC; even today, most everyday applications for financial people are PC-based. But as they lusted for more capabilities, these people found that more advanced statistical and analysis packages run on Unix or mainframes, not PCs. Adding SPARCards to their PCs lets financial wizards compute away, without a second--and to them--alien-looking box on the desk.

Industrial OEMs.

Designers who must put real computing power in embedded systems, or separately out on the shop floor, can buy embeddable or rugged-environment technical workstations at high prices (they're not common enough to be production-line items). Or they can buy embeddable or rugged-environment PCs, both commodity items, and slip in SPARCards.

To jog your imagination, here are a few likely applications of my own for the SPARCard 5:

''We're saddled with these PCs, but we really need technical workstations.''

SPARCards can be the everybody-wins answer. Users don't have to face a sudden, complete environment change; management doesn't have to hear about scrapping a large investment; yet SPARCard has the power of a freestanding SPARC workstation, not just a souped- up PC.

‘‘No PC system has enough power to run our applications at acceptable speeds.’’

Often the resource-hog applications are also available in Unix versions, just because they do call for more than PC power. With those offloaded to a SPARCard, the PC side should be equal to running everything else.

‘‘We're outgrowing PCs, but our users refuse to leave that familiar environment.’’

Adding SPARCards will let them make the move gradually. And unlike most training-wheels products, SPARCard-equipped PCs will not be obsolete when the transition is complete.

‘‘We serve a transient user population, with a constantly-changing proportion of PC to Unix workstation users.’’

One SPARCard-equipped PC is a lot cheaper than a PC plus a technical workstation plus the labor and storage space needed to constantly move units in and out.

Buying Decisions

If your need is for one or a few systems, the business aspects are fairly simple. Opus' list pricing for the three-board set I originally tested, with an 85 MHz CPU and empty memory slots, is $3995, including the usual 90 day at-factory warranty. The same boardset plus 32 MB of RAM and a gigabyte SCSI-2 hard disk with SunOS and Solaris loaded costs $8995. The three middleware modules list for: Incognito/Launch for application access, $95; Incognito/FS for file sharing, $195; Incognito/Share for peripheral sharing, $245. Compare that to alternative solutions and make your choice.

But a prospective OEM or high-volume user wants to know how stable a vendor is before negotiations start. Well, Opus Systems was founded in 1983 (same year as Sun!), and has sold better than 20,000 systems since then. They've specialized in Unix on a card for PCs since the start. Although Opus is a very small company, they've taken a substantial role in the SPARC arena: the technology Opus co-developed with LSI Logic for producing Sun SPARCstation clones has been licensed to very large players--including Tatung, Hyundai and Goldstar among others--as the basis for their entry into the SPARCstation clone market.

Vendor Information

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Minimum PC Specifications

HARDWARE: 100% IBM compatible, with a 286 or higher CPU, at least 640 KB of RAM, and a non-interlaced VGA or SVGA monitor offering 640 x 480, 800 x 600, 1024 x 768 or 1152 x 900 resolution (if the PC monitor is to be used by SPARCard 5). The internal bus must be ISA or EISA standard--since this bus is the only direct connection between the PC and the SPARCard, the PC does not need either an Ethernet or a SCSI port. There must be two adjacent full-length slots available on the bus, and up to 1 MB of available space will be needed on the hard disk for the Incognito middleware.

SOFTWARE: Either MS-DOS Release 5.X or higher, or OS/2 Release 2.1 or higher. If MS Windows is to be used, it must be Release 3.X or higher. At present, the Incognito modules run on Windows 95 as DOS programs; Opus says that porting the suite to run in Windows 95's 32-bit native mode is nearly complete [as of 8/1/95].

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