Ben Smith

REVIEW

Personal Iris: The Dream Maker

The Silicon Graphics Personal Iris Turbo workstation. I created the BYTE logo shown on-screen as a 3-D object. The Iris can set the logo in motion, recalculating and redrawing every polygon in real time.

Personal Iris Model 4D/25 Turbo

Company
Silicon Graphics Computer Systems
2011 North Shoreline Blvd.
P.O. Box 7311
Mountain View, CA 94039
(415) 960-1980

Components
Processor: 20-MHz MIPS R3000 RISC processor; R3010 FPU
Memory: 8-MB RAM; 96K-byte cache
Mass storage: 380-MB SCSI hard disk drive; 150-MB cartridge tape drive
Display: 19-inch, 1280- by 1024-pixel; 16.7 million (24 bits) simultaneously displayable colors
Keyboard: 101-key IBM AT style
I/O interfaces: Two serial ports; one parallel port; SCSI port; Ethernet port; video and audio ports

Software
Irix (Unix System V release 3.2); WorkSpace environment manager; 4-Sight windowing system; X Window System version 11; NeWS graphical environment; Alias QuickModel and QuickPaint; Wavefront Personal Visualizer; a host of 2-D and 3-D graphical demos and source code

Price
System as reviewed: $32,500

Inquiry 856.

Any designer, whether an architect, engineer, planner, or graphic artist, needs to visualize a design while creating it. Rare individuals in this group can generate solid models in their minds. The mental models are so real for these people that they can rotate them, move into them, and investigate the details. But, unfortunately, these imaginings are not easily communicated to others. Wouldn't it be wonderful to display the models on a computer with as much detail and flexibility as in the mind?

That is just what the Silicon Graphics Personal Iris workstations are designed to do, and the new Turbo model does it very fast. It does it so well, in fact, that IBM has selected the same graphics hardware for use in its RISC System/6000 high-end workstations.

Thoughtful Package

Inside its simply designed chocolate-brown case, the Personal Iris Model 4D/25 sports a 20-MHz MIPS R3000 processor with the accompanying FPU. Add to that a 32K-byte data cache and a 64K-byte instruction cache, and you have a serious number cruncher. Feed those numbers into the famous Silicon Graphics specialized display-processing pipeline with the Turbo Graphics option, and you have a machine that can produce real-time animation of solid objects. All this power is contained in a squat tower, with concealment panels to hide the cables in the back and the floppy disk drives and tape drives in the front.

Disk and cartridge tape drives slide in and out of the chassis without tools, so changing system drives is no more difficult than changing tape cartridges. Similarly, changing the electronics assembly requires no expertise or tools: Slide off a plastic panel and remove one screw. The entire circuit cage lifts right out. The system upgrade kits we received included instructions for user installation, all the necessary tools (like a screwdriver for removing that one screw), and grounding straps to protect electronic components while you handle them.

The standard input devices are an AT-style keyboard and an optical mouse. You can add an optional digitizing tablet and a three-dimensional input control called a SpaceBall. The system has two serial ports, a parallel port, an Ethernet port, a SCSI port, and an array of special-purpose connectors for video-recording equipment.

Will It Run DOS?

Despite its size and shape, this machine is far from a PC. It *will* emulate MS-

DOS, but even the most complex DOS program would seem wimpy compared to any native Iris application.

The underlying operating system, Irix, is, as you might guess, an enhanced Unix. All your standard System V release 3.2 utilities and libraries are there, along with some BSD enhancements for interprocess communications and networking. Silicon Graphics has added a rich window manager, along with graphics and window programming libraries. You can also use X Window System, NeWS, and PHIGS graphics. All these window and graphics systems run under the supervision of the Irix window manager. Therefore, if you click on a PostScript file, the Iris creates an appropriate window in which to view it.

Getting It All on Paper

No one can fault Silicon Graphics for failing to adequately document its system and software. There are 21 binders in all, but some of them hold two or three submanuals. Of these, several are devoted to Irix and are mostly reprints of traditional AT&T and Berkeley documentation. Several more cover the graphics extensions and the mountain of demonstration, executable, and source code shipped with the Iris. The overall quality and readability of the documentation is up to normal Unix standards, and the binder labels and section tabs make it somewhat easier to spot your topic of interest from among the thousands of pages.

Four user's manuals—those covering the bundled applications from Alias Research and Wavefront, and Silicon Graphics' own Personal Iris User's Guide—stand apart from the rest. Using them together, you can quickly become familiar with the Iris and its capabilities, without having to open any of the other 20 binders. Each has a "getting started" section, and this group of documents is custom-made for impatient users who can't wait to set their teapots to spinning. On-line manuals round out the set. These include virtually all reference pages, except for demonstration programs and the bundled applications.

Performance

The Iris Model 4D/25 that I reviewed had 8 megabytes of RAM, 96K bytes of cache memory, a 380-MB SCSI hard disk drive, and an internal tape drive. CPU, disk, and floating-point performance, as tested by the BYTE Unix benchmarks, make the system competitive with other workstations in its price range.

continued

Silicon Graphics Personal Iris Turbo

BYTE LAB

HIGH-LEVEL PERFORMANCE

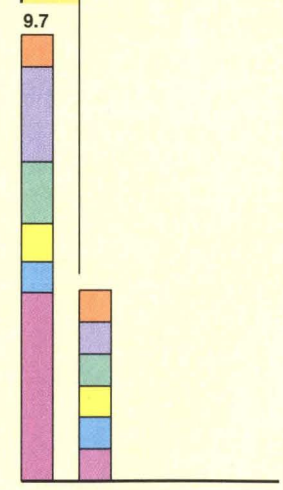
	Iris		Everex
	Time	Index	Time
C Compiler	2.18	0.95	2.08
DC Arithmetic	0.21	3.00	0.63
Tower of Hanoi (17-disk problem)	0.30	1.87	0.56
System Loading[1]			
1 concurrent background process	3.31	1.23	4.06
2 concurrent background processes	4.00	1.45	5.80
4 concurrent background processes	7.19	1.34	9.60
8 concurrent background processes	11.50	1.50	17.30

LOW-LEVEL PERFORMANCE

	Iris		Everex
	Time	Index	Time
Dhrystone 2 (without registers; Dhry./sec.)	13454	0.97	13847
Arithmetic (10,000 iterations)			
Arithmetic overhead	0.20	3.60	0.72
Register	2.90	1.01	2.92
Short	2.92	1.21	3.52
Integer	2.90	1.08	3.12
Long	2.90	1.08	3.12
Floating Point	2.02	5.90	11.92
Double	1.70	7.78	13.22
Throughput			
System call overhead (5 x 4000 calls)	0.62	1.77	1.10
Pipe throughput (read and write 2048- × 512-byte blocks)	0.45	2.04	0.92
Pipe-based context switching (2 × 500 switches)	0.21	3.00	0.63
Process creation (100 forks)	0.55	2.24	1.23
Excel throughput (100 execs)	0.82	4.18	3.43
Filesystem throughput (1600 1024-byte blocks in Kbytes/sec.)			
Read	564		
Write	564		
Copy	330		

Silicon Graphics Personal Iris Turbo 9.7*

Everex Step 386/33 6.0



* Cumulative index is formed by summing the indexed performance results for C Compiler, DC Arithmetic, Tower of Hanoi, System Loading (with eight concurrent background processes), Dhrystone 2, and Floating Point tests.

[1] System loading performed using Bourne shell scripts and Unix utilities.

Note: All results are in seconds, unless otherwise specified. Indexes show relative performance. For all indexes, an Everex Step 386/33 running Xenix 2.3.1 = 1.

For a description of all the benchmarks, see "The BYTE Unix Benchmarks," March BYTE.

The benchmarks don't measure the most impressive aspect of the Personal Iris: its graphics performance. According to Silicon Graphics, the 4D/25 Turbo will manipulate 200,000 3-D vectors in a second, or 20,000 polygons per second. These numbers have little meaning out of context, so consider the model in photo 1. Iris renders this model, with over 1000 3-D polygons, smooth shading, and multiple light sources, so quickly that it simulates smooth motion by redrawing the entire model in a slightly different position several times a second.

Photo 1: *As rendered here, the Silicon Graphics logo contains roughly 1400 polygons. With solid surfaces, remote and local lighting, calculations of spectral characteristics of surface, and full color rendering, this object can rotate and move in real time. The animation is smooth and convincingly real.*

Put On a Simple Face

The Irix operating system comes with its own window manager, icon-based file manager, and editor, as well as several handy graphics applications, including Alias's QuickModel and QuickPaint and a robust renderer from Wavefront, the Personal Visualizer.

The Irix window system is partly embedded in the operating system instead of built on top of it like Motif. The window manager, 4-Sight, is good compared to what was available a few years ago, but it seems a little archaic when compared to Motif and Open Look. Repositioning overlapping windows, for instance, can turn areas of the screen to mush for several seconds until the window manager cleans things up. Selecting options from cascaded menus requires a delicate hand on the mouse, because there is no way to freeze a menu on the screen while you move to the next level. You must keep the mouse button pressed while you carefully maneuver through the hierarchy of menus.

The icon-based file manager operations are intuitive. As with many other systems, double-clicking on a file icon starts up the application program associated with the icon. Dragging an icon to the dumpster gets the associated file out of the way. Dragging an icon from one directory window (or folder) to another moves the file.

The Irix file manager also manages the WorkSpace, a virtual directory to which you can drag file icons. Instead of moving the file from the directory to the WorkSpace (the action associated with dragging an icon from one directory window to another), the file manager creates a virtual link of the file between the directory and the WorkSpace. I'm familiar with the structure of the Unix file system, and I had trouble understanding how the WorkSpace worked. It may be a gentle approach to file management for those unfamiliar with the subject, but sooner or later they will have to learn the way things are done for real.

The window-based editor, Jot, is probably all that any nonprogrammer will ever need for editing; it is easy to use and has enough features to continue to satisfy users even after they learn its basic capabilities.

QuickModel and QuickPaint are also easy to learn. You can use QuickModel to create 3-D models, and QuickPaint to create 2-D paintings. Then you can use the output from these programs as elements for Wavefront's Personal Visualizer, the full-featured rendering application. QuickModel is an excellent way to become familiar with the 3-D capabilities of the Iris. You can build complex models by creating and manipulating wire frames in three orthographic views and a simultaneous perspective view.

QuickModel gives you basic solid forms—a box, a sphere, and a cone—with which to build. You take each of these shapes as needed and mold them to create your model. You can also generate surfaces by extending and rotating Bézier curves. You can manipulate your perspective viewpoint as you work on the shape. At any point during the design, you can render the model with flat or smooth (Gouraud) shading, color, and local lights, and you can rotate it and zoom in on it for a close inspection (see photo 2).

The documentation provided by Alias and Wavefront for their applications is very good, as far as it goes. These programs are not demos in the conventional sense of the word, but they are running advertisements for higher-level products

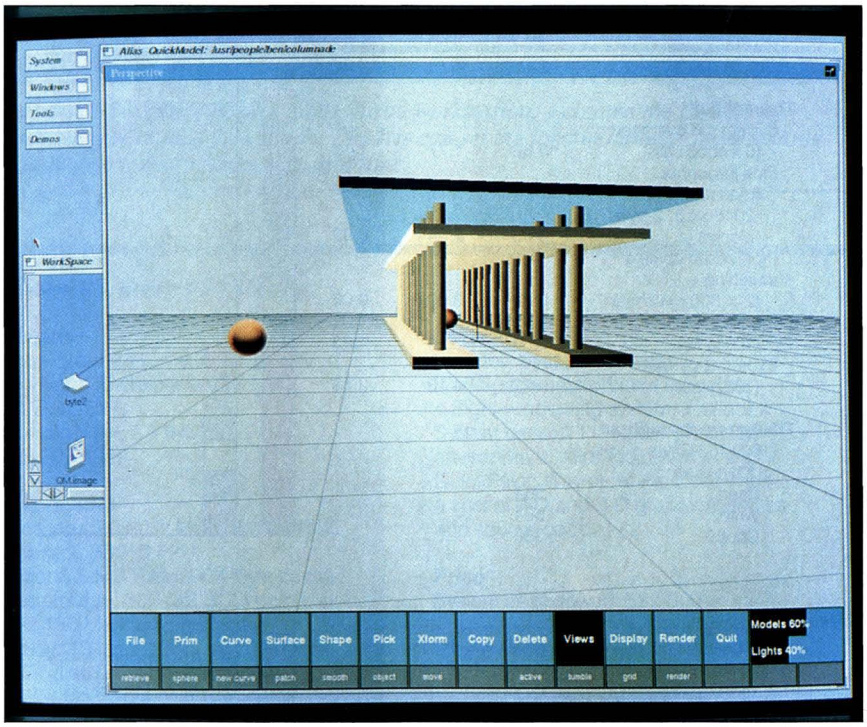


Photo 2: *QuickModel allows you to create models with additive 3-D geometric forms in orthographic views. You can then view them in perspective and export your views to Wavefront's Personal Visualizer, a full rendering program.*

offered by both companies. I'm always pleased when a hardware vendor includes free software of any kind, and Silicon Graphics distinguishes itself by providing tons of it.

The BYTE Logo Project

To better understand the graphics hardware and the software libraries that facilitate its use, I wrote a C program to generate the solid-form BYTE logo shown in the photo on page 174. You can rotate or translate the object or your viewpoint using the mouse. You can even send the model into a tumbling spin.

The logo model is generated from four tables of 2-D data points. Each table describes the edges of a single letter in the word "BYTE." Two rather lengthy and boring functions use these tables differently to describe the polygons that make the faces of the logo and the polygons that make the edges.

The largest part of the time needed for the project was spent in mathematically describing the model, roughly 230 polygons (I did it by hand, without any CAD tools—not recommended). When I was working on the solid model, the power of the Personal Iris became supremely obvious. But the level of the Irix graphics libraries requires you to know your 3-D analytic geometry. You must describe each polygon *and* its unit normal vector for the Iris to properly calculate the lighting of the polygon's surface. This is a nontrivial problem and remains the responsibility of the programmer. But once you have solved it, the Iris will do all the work of rendering as you rotate and move your viewpoint. Adding mouse control and menus was simple, but again, I had to write all the high-level work of turning mouse and menu operations into program-flow changes and 3-D motion.

During the course of the project, I found that the Irix window-based symbolic debugger, `edge`, was easy to use and that the Silicon Graphics technical-support people are friendly, knowledgeable, and responsive.

The BYTE logo project took about 40 hours of study and programming. Mind you, most of this time was spent at the low end of the learning curve. To finish another similar project would take only about 10 hours. All in all, I enjoyed programming the Iris, but I would have liked a few more convenience routines to handle more common functions.

Most people will find that there really isn't a need to do any programming for the Iris, since there are plenty of application programs. According to the Silicon Graphics directory of software products, more than 400 commercial applications are available for its machines.

There are 21 different professional animation packages that run on these machines, making the Iris the machine of choice for that kind of work. There are seven packages for building design; dozens for mechanical engineering, aerodynamics and fluid dynamics, and automation; and a host of applications for graphics modeling. The list also includes an assortment of databases, spreadsheets, and editors.

Who Will Buy

Silicon Graphics workstations are already established as the most cost-effective, production-quality, computer-animation workstations. They are also very affordable for applications such as visualization of data from medical scanning equipment (e.g., CAT scans).

Without question, anyone who wants to do 3-D rendering could profit from a Silicon Graphics Personal Iris Turbo system, but, clearly, not everyone can afford one. A minimal Personal Iris 12.5-MHz system with a 14-inch (1024- by 768-pixel) monitor costs $13,500. This configuration will display only 256 colors out of a palette of 16.7 million. The minimum configuration does not include a hard disk drive; $2000 buys you a 200-MB drive. The drive includes the operating system and all the graphics utilities.

The machine I reviewed had the minimum 8 MB of system memory (out of a possible 32 MB), but it had the 20-MHz processor, the full Super Graphics options that deliver 24-color bit planes (16.7 million colors), 24 z-buffer planes, and eight system planes (see "3-D Graphics: From Alpha to Z-Buffer" on page 271). It also had a 380-MB hard disk drive and a 150-MB quarter-inch SCSI tape drive. The total value of the review system is $32,500. For graphics options, this is the top of the Personal Iris line but the low end of the Silicon Graphics family. Slip the disk drive from the review machine into a $13,000 model, and you can do the same things, but without the same performance or range of colors.

The Personal Iris 4D/25 places real graphics power in the hands of the people who need it most. Designers, engineers, artists, and other dreamers will find this system a willing bridge between the drawings of the mind and the finished product. ■

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