Plexus
Computers,
Inc.

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November 21, 1984

PLEXUS

Are you using UNIX today? Have you considered a multi-user UNIX system for your application? Are you aware of the high-performance UNIX systems manufactured by Plexus Computers?

In just a few years, since 1980, Plexus Computers has established its reputation by producing high-performance, multi-user UNIX systems. Software developers and commercial application developers have chosen Plexus systems as the best price/performance UNIX systems available today.

Plexus Computers just introduced the P/15 system at the COMDEX Show. Now Plexus offers three system sizes, all with the same UNIX operating systems, utilities, languages, and office automation tools to simplify your application support.

The P/15 system will serve up to 8 terminal users with an entry price of under $11K. The P/35 system serves from 8 to 16 terminal users and sells for $17K. The P/60 system serves from 8 to 40 terminal users and list prices begin at $43K.

Please call and find out why Plexus Computers outperforms other UNIX systems in their price range.

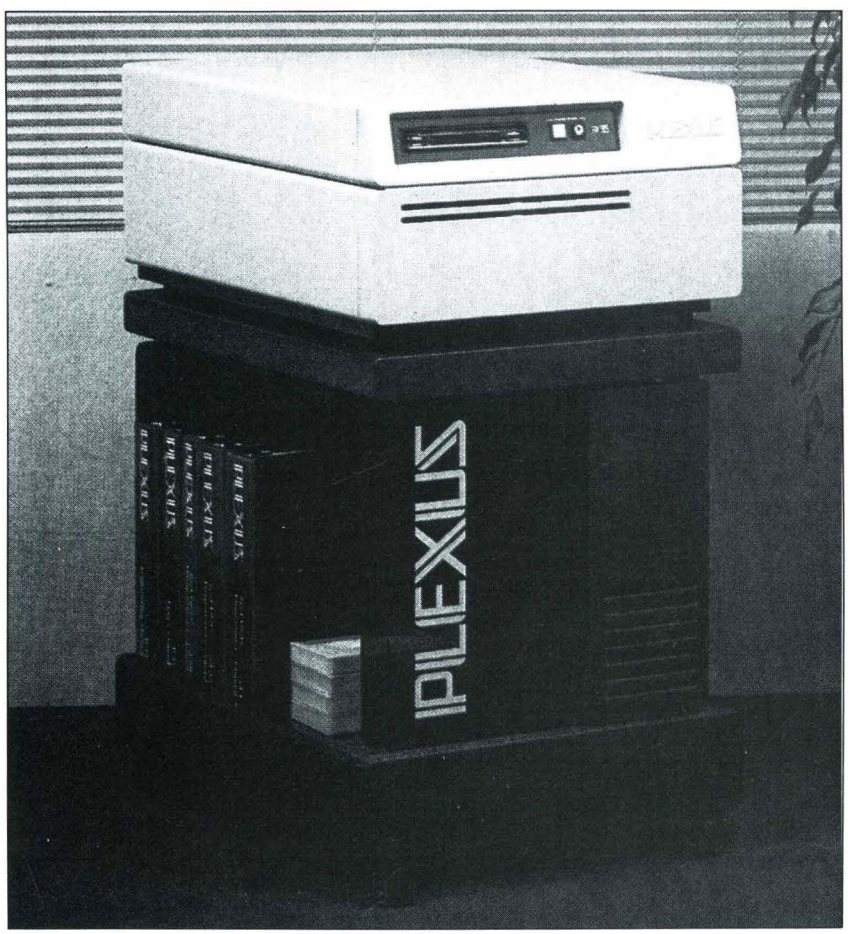
Sincerely,

George T. Workman
District Sales Manager

GTW:jls

enclosures

THE PLEXUS CHALLENGE: REVIEWING THE P/35



This month our crazed reviewer sets out to win himself a watch.

BY BRUCE MACKINLAY

I took the Plexus Challenge—something akin in Unix system benchmarking circles to the Pepsi challenge for colas—and I won, kind of. The only problem is that to do it I had to compare a Plexus P/35 to a machine that costs twice as much. I don't know if the nice guys over at Plexus will count this one, but I thought I'd give it a shot anyway.

If you're a little lost right now, let me take a second to explain. The challenge of Plexus' recent advertisement was simply too much for me. Plexus promised a fancy new $485 Heuer Chronograph to anyone who could find an equivalent Unix system-based supermicro that beat one of its own. I just can't resist a dare. I said to myself that there must be another supermicro in the market that is faster than the Plexus. And if I can find one, I can win a free watch. For its part, Plexus was so confident that it couldn't be beat that it loaned me a P/35 to make the tests.

For those remaining few of you out there who don't know Plexus, it was one of the first companies to

enter the supermicro market, back in 1980. In the last few years, the firm has earned quite a reputation for producing machines with a good price/performance ratio, good support, and excellent networking. On top of all that, because it was one of the first and because its machines have been so good, a large selection of software is available on the Plexus.

The P/35 is an M68000-based supermicro built around the Multibus communications bus. The machine I benchmarked had 1 Mbyte of memory and a 36-Mbyte hard disk. What makes the machine so fast is the use of memory caching and a separate input/output (I/O) processor. The processor runs at 12.5 MHz and uses a 4K-byte cache. Standard on the P/35 is a 45-Mbyte streaming tape cartridge for system backup. The base system starts at $17,000, and the machine I benchmarked is currently priced around $22,500.

THE HARDWARE

There are a number of different types of I/O processors on the P/35: one to handle all serial (terminal) I/O, another that handles block (disk and tape) I/O, and another to handle local-area network (LAN) I/O. The Unix system is known to be very I/O intensive, and on many Unix systems the main central processing unit (CPU) spends most of its time handling I/O and very little time doing "useful" work (that is, processing data).

The heavy use of I/O coprocessors on the P/35 keeps it from degrading in Unix system environments when many others' response times bog down. Both the serial and block I/O processors use the Z8000 with local and shared memory. The serial I/O processor handles up to eight terminals and parallel printers. The maximum data rate for terminals is 19.2K baud, or 1920 characters per second.

The P-35 also supports both synchronous and asynchronous I/O, allowing the Plexus to support remote job entry (RJE) and HASP protocols, which are important in large IBM-dominated companies. The block I/O processor handles both the SMD disk drive and the tape. The basic P/35 comes with a 22-Mbyte NEC hard disk and a streamer cassette tape for backup. You can add a second drive or upgrade to a number of larger disks, including a 145-Mbyte Fujitsu (pronounced very fast) hard disk.

Other machines in the Plexus hardware family include the P/15 and other models up through the P/60. Two older machines, the P/25 and P/40, use the Z8000 for the CPU, while all the rest use the M68000 (or M68010). Plexus still supports and sells these older Z8000 units, but these machines do not have as low a price/performance ratio as do the M68000-based machines. I expect Plexus to retire the P/25 and P/40 one day, but the company makes a big deal about the fact that it will support them forever.

The big difference between the P/35 and the P/60 is expandability. The P/35 currently supports up to

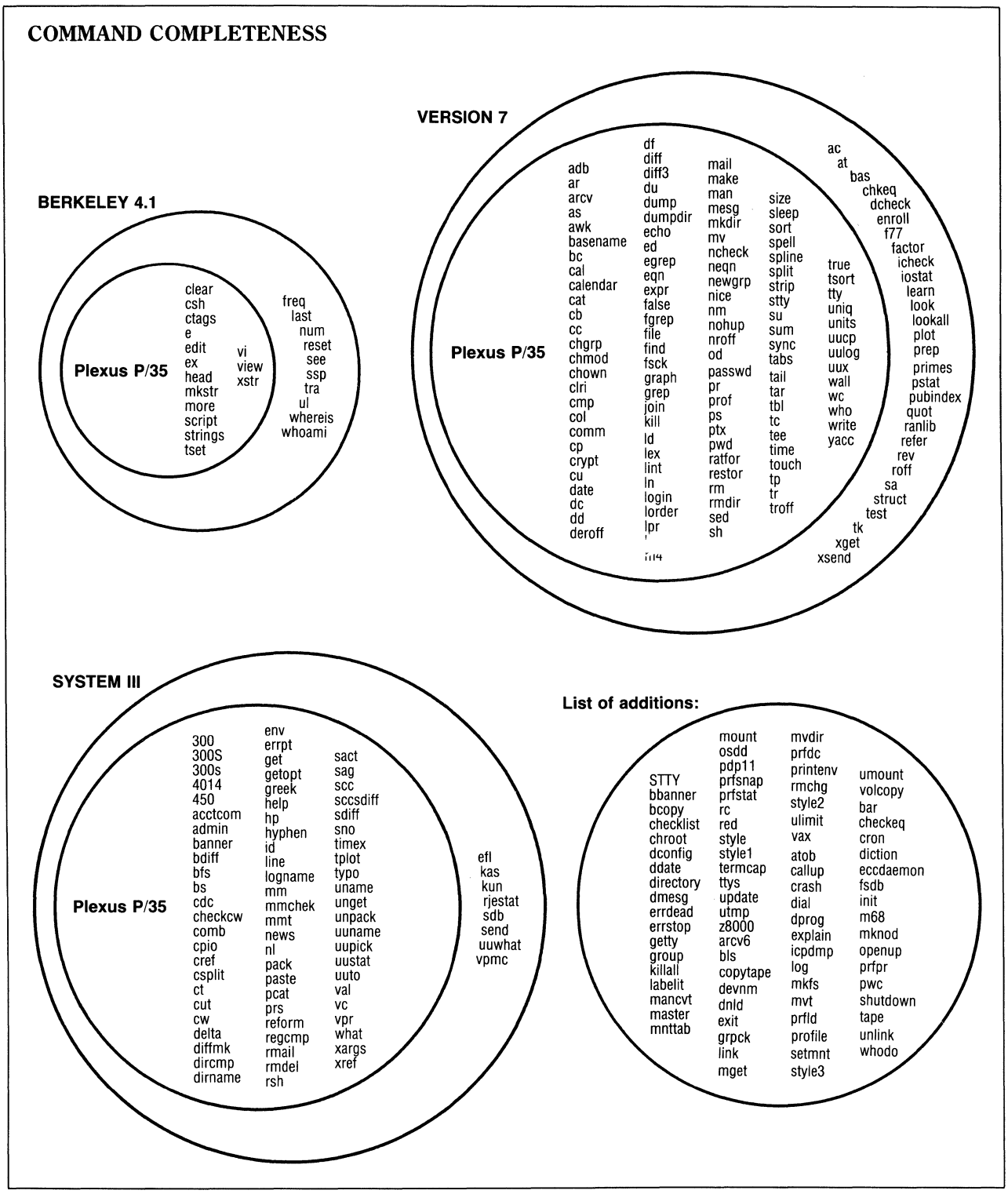
COMPANY OVERVIEW

Company name:	**Plexus Computers Inc.**
Public/private:	**Private**
In business since:	**November 1980**
Headquarters:	**3833 N. First St. San Jose, CA 95134 408/943-9433 TWX/TELE 910 338 2223**
CEO:	**Paul Klein**
VP Marketing:	**Kip Myers**
General sales contact:	**Ed McCurtain, VP sales Plexus Computers Inc. 3833 N. First St. San Jose, CA 95134**

	This Year	Last Year
Gross revenue	**N/A**	**N/A**
Net income:	**N/A**	**N/A**
Employees:	**200**	**150**
% of total expense spent on R&D:	**N/A**	**N/A**

Units shipped:	**1500+**
Major support centers:	**San Jose, Calif., Washington, D.C., Swindon, U.K.**
Major funding if private:	**venture capital**

COMMAND COMPLETENESS



BENCHMARK MEASUREMENTS

Aim Technology Suite II: Plexus P/35 Benchmark Results

Plexus P/35

Arithmetic Instruction Times (microseconds per op.)

	short	*long*	*float*	*double*
+ Add	2	905ns	343	229
+ Multiply	28	38	560	424
/ Divide	49	52	400	297

Memory Loop Access Times (nanoseconds per byte)

	read	*write*	*copy*
Char type	866ns	2	1
Short type	438ns	827ns	613ns
Long type	312ns	440ns	487ns

Input/Output Rates (bytes/sec)

	read	*write*	*copy*
Disk	34K	28K	19K (NEC 22-Mbyte Disk)
	184K	52K	33K (Fujitsu 72-Mbyte Disk)
	145K	64K	39K (Fujitsu 145-Mbyte Disk)
Pipe			123K
TTY 1		615	
TTY 1+2		1K	
RAM 1-byte			823K
RAM 4-byte			2059K

Array Subscript References (microseconds)

short[ ]	long[ ]
4	4

Function References (microseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
7	13	18

Process Forks

(49K bytes)
19 per second

System Kernel Calls
(calls-per-second and microseconds per call)

`getpid()` calls:	4 kcalls/sec or	236 microseconds/call
`sbrk(0)` calls:	210 calls/sec or	4762 microseconds/call
`create/close` calls:	129 pairs/sec or	7752 microseconds/pair
`umask(0)` calls:	3 kcalls/sec or	303 microseconds/call

16 terminals and 2 Mbytes of random-access memory (RAM), while the P/60 supports up to 40 terminals and 8 Mbytes of RAM. A nine-track cypher tape drive is standard on the P/60, and there are more slots on the backplane.

The most recent addition to Plexus' product line, the P/15, is a low-priced machine intended to compete with the AT&T 3B2 and IBM PC/AT. Of course, AT&T and IBM have a great name advantage, but the Plexus P/15 should perform circles around these brand-name computers. Moreover, the P/15 starts at $11,000 and will easily support eight users.

NETWORKING AND SUPPORT

One of the most exciting things about the Plexus line of computers is its use of local-area networking and extensive communications. Of course, Plexus supports the Unix-to-Unix Copy (`uucp`) facility, but it also supports its own remote job entry (RJE) system. RJE is used heavily on IBM mainframes to share resources (and to hide the fact that IBM operating systems are slow). The Plexus RJE facility uses the standard HASP (read IBM) protocol, which allows the Plexus supermicro to be a front-end RJE station on your IBM mainframe.

The real jewel of Plexus' communications options, however, is its local-area network (LAN), which is Ethernet based and which uses the Excelan Ethernet Multibus card. This card supports full 10-Mbit machine-to-machine data rates. On top of this hardware, Plexus has developed what it calls the Network Operating System (NOS). NOS is really just an extension of Unix System III to support networking.

First, here are the good things about NOS. It is a very complete LAN; it even supports a distributed

file system. Of the big players, none currently has a Unix system-compatible distributed file system. Distributed file systems are important because you can build a LAN without worrying too much about where the hardware is. This means that a user on machine A could use files and devices on machine B transparently and efficiently.

The problem with NOS is that it is not a standard LAN. The base hardware is standard (ISO level 1 and 2), but the rest is nonstandard. This means that you will have a hard time using Plexus equipment in other, more conventional ISO standard networks. While no real standard in local-area networks exists, there are some strong contenders. One is the ICP/TP protocol developed for the Unix system at UC Berkeley. A number of manufacturers (including Digital) have picked up ICP/TP, and it is the protocol of choice in the Unix system research community.

The other contending protocol is X.25. This seems to be the protocol that AT&T will embrace, and it has a very wide following, especially in Europe. I should not discount IBM and its SNA protocol. IBM could still make its terrible protocol the standard (but I hope not). Unfortunately, Plexus' NOS doesn't work with either the X.25 or SNA protocols, and it seems unlikely that IBM or AT&T will adopt NOS as a standard.

One of the nicest things about the Plexus computer is the support. While many other small supermicro companies provide poor support, Plexus saw that supermicros are a lot like minicomputers and thus require the same type of support. Plexus offers a number of good support plans, including a field maintenance support program under which Plexus will send a field engineer within four hours of your call.

If you are willing to wing it, Plexus will repair your machine on a time-and-parts basis, or you can ship your machine back to factory for repairs. Plexus will also train your personnel to identify, isolate, and repair Plexus problems, and the firm will provide exchange parts upon demand. There is also a software support contract under which subscribing customers are provided with automatic updates, bug reports, enhancements, and a toll-free "software consulting" service.

A COMPARISON OF THE SUN-120 AND THE PLEXUS P/35

(The fields that are full are the amount that the Sun-120 is faster than the Plexus P/35, based on the Aim benchmarks.)

Arithmetic Instruction Times

	short	*long*	*float*	*double*
+ Add	+	+	1.5043	1.8031
+ Multiply	1.2173	1.3571	1.7210	2.3186
/ Divide	3.4285	1.6250	+	+

Memory Loop Access Times

	read	*write*	*copy*
Char type	+	+	+
Short type	+	+	+
Long type	+	+	+

Input/Output Rates

	read	*write*	*copy*
Disk	6.8529	10.2857	3.6315 (Using NEC disk)
	1.2663	3.6154	2.0910 (Using Fujitsu 72-Mbyte disk)
	1.6069	2.9375	1.6410 (Using Fujitsu 145-Mbyte disk)
Pipe			1.3902
TTY 1			++
TTY 1+2			++
RAM 1-byte			+
RAM 4-byte			+

Array Subscript References

short[ ]	long[ ]
+	+

Function References

0-parameters	1-parameters	2-parameters
funct()	funct(i)	funct(i,i)
1.8571	1.4615	1.3333

Process Forks
+++

+	Plexus P/35 is faster or identical
++	Not comparable
+++	Numbers not available

Aim Technology Suite II: Plexus P/60 Benchmark Results

Arithmetic Instruction Times (microseconds per op)

	short	*long*	*float*	*double*
+ Add	2	1	367	231
+ Multiply	29	30	514	377
/ Divide	49	52	448	334

Memory Loop Access Times (nanoseconds per byte)

	read	*write*	*copy*
Char type	978ns	2	1
Short type	439ns	827ns	613ns
Long type	317ns	456ns	500ns

Input/Output Rates (bytes/sec)

	read	*write*	*copy*
Disk	145K	64K	39K
Pipe			115K
TTY 1		0	
TTY 1+2		0	
RAM 1-byte			784K
RAM 4-byte			2000K

Array Subscript References (microseconds)

short[ ]	long[ ]
4	5

Function References (microseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
7	14	20

Process Forks

(50K bytes)
17 per second

System Kernel Calls
(calls-per-second and microseconds per call)

`getpid()` calls:	119 Kcalls/sec or	8 microseconds/call
`sbrk(0)` calls:	206 calls/sec or	4854 microseconds/call
`create/close` calls:	119 pairs/sec or	8403 microseconds/pair
`umask(0)` calls:	3 Kcalls/sec or	394 microseconds/call

BENCHMARKS AND COMPARISONS

Finding a machine that is faster than the Plexus is easy: Try the Amdahl V7 IBM-compatible mainframe. Finding a machine that is both faster *and* that fulfills the requirements of the ad is another problem.

The ad clearly states that the machine must be a "supermicro." Well, that's easy. How about the Apollo; its arithmetic instruction times are from 2 to 40 times faster than the P/35. The problem with the Apollo is that it is not a "Unix system-based" supermicro. If you apply this requirement, you eliminate a number of machines that would otherwise contend with the Plexus, including the Charles River Data Systems machine. This machine runs UNOS, which is a "Unix-like" operating system, but it is not strictly a Unix system supermicro.

So after you throw out the mainframes, minicomputers, and non-Unix (not pure Unix) system supermicros, you are left with a lot of slower machines (including the NCR Tower, the IBM PC/AT, and the AT&T 3B2/300). Of the machines I have benchmarked, only one, the Sun-120, is faster, and even then only on some of its benchmarks. This is a little unfair because the Sun-120 is about twice as expensive and is marketed as a single-user professional workstation.

More specifically, the Sun is faster in some respects (for the benchmarks, see Vol. 1, No. 5), but not in all respects. It is faster in most of the arithmetic operations, the disk is faster, and the operating system is faster; but the Plexus P/35 is faster in the rest of the arithmetic instructions and in all memory I/O.

The remaining question is whether the Sun-120 is a super-

micro. I believe that it is: It is based upon the M68000, a very large scale integration (VLSI) CPU. This is the traditional mark of a micro, and it supports multiple users, also the mark of a supermicro.

In analyzing the benchmarks, I have concluded that the P/35 has faster overall hardware (with the exception of the disk controller) and that the Sun has faster software. This makes sense when you consider history. The Plexus software is derived from AT&T System III code, which is known to be a little slow, while the Sun software is derived from Berkeley 4.2 code. UC Berkeley put a lot of research and energy into making 4.2 Unix fast, and it paid off.

The disk was the one area where the P/35 showed poor performance. The P/35 I reviewed used the NEC 36-Mbyte hard disk. This disk is not as fast as the Fujitsu disk in the Sun, but it is not slow. The NEC is rated (by the manufacturer) at 38.8 msec. average access time, while the Fujitsu disk is rated at 28.1 msec. average access time.

After benchmarking the slower 36-Mbyte machine, I went over to Plexus' headquarters in San Jose and tested a number of other machines. Although the disks on these machines were faster than that of the P/35, they were still slower than the Sun-120's. The difference is more than the disk speeds. The explanation must be in the choice of controller hardware and operating system overhead. Choosing the correct controller can make or break disk performance. This is the area where Plexus must make improvements because a lot of applications are disk intensive. In fact, I understand that Plexus has recently announced a faster controller for the P/60, a move apparently intended to address this very problem.

PRICE/PERFORMANCE AND POPULARITY

Plexus' early entry into the Unix supermicro market has resulted in one of largest lists of third-party application packages. In fact, many of the most popular Unix system-based applications on the market today were developed on the Plexus, a fact that may also account for the long list of software ported to this family of machines.

This point was clearly driven home at the Fall 1983 Comdex show. At that show I made an informal survey of Unix system application software on the floor. Almost all of the software vendors on the floor were demonstrating their software on the Plexus, and many had developed their software on the Plexus. I think I found so many Plexus machines at Comdex because it is a small, fast, and reliable machine.

Plexus prints a software catalog that contains over 200 products, including a large number of vertical applications. Other machines might come close to the Plexus in performance, but very few have software libraries that can rival that from Plexus.

THE UNIX SYSTEM AND PLEXUS

The Unix system on the P/35 is very complete. The code started out as System III, but there have been so many Berkeley and Version 7 programs added that I find it very satisfactory. Included are the important (at least for me) `csh` and `vi`.

One problem I have had on other Unix systems is the very primitive tape drive controller. The Plexus commands `tape`, `copytape`, and `volcopy`, added to the Unix system commands `cpio`, `tar`, `dump`, `dumpdir`, and `restor`, gave me a great deal more control over the tape.

Most Unix systems have a hard time reading and writing multifile tapes, but this has been solved on the Plexus. The `bls` command is really the Berkeley version of `ls`. Plexus wrote an `openup` daemon that keeps key files and directories open. Not only does this result in faster access, but it also solves a System III problem with the line printer. On many System III Unix machines, the line printer speed reverts to the default speed every time the printing stops. Plexus' `openup` command keeps the device open and preserves the `stty` settings.

Surprising additions are the programs `style` and `diction`, commands usually part of Writer's Workbench. You can find them on Berkeley Unix system releases, but not on Bell-derived Unix system code unless you purchase them separately (as part of Writer's Workbench).

The Plexus P/35 has been around for a number of years; it is an oldie-but-goody that has captured a significant market share because it is a real performer. It is not the fastest supermicro in the world (and I will get my watch to prove it), but to find a faster machine, I had to compare the Plexus P/35 to a machine costing twice as much.

Another plus is that Plexus is marketing and supporting this machine like a minicomputer. I predict that Plexus' outstanding support and its large software library will keep the company going strong, even after AT&T and IBM have killed off much of the rest of the supermicro bunch. □

Bruce Mackinlay, a frequent UNIX/WORLD contributor, is currently working for WMZ/Novatech, a computer consulting firm located in Concord, Calif.