own communications layer, yet another plus for overall efficiency.

One will need to design such a dataserver carefully. One would be wise to utilize the Redundant Array of Inexpensive Disks (RAID) concept to further increase throughput. Indeed, NCR now makes a chip set to implement RAID on a SCSI bus, taking away much of the hard work for the software designer.

Multiprocessing technology under 386 is already mature, whereas multiprocessing hasn't exactly taken off for the Motorola line of CPUs. Intel chips are cheap, and getting cheaper all the time, now that AMD is officially selling 386 CPU clones. A lean, mean, database server engine running on such a multiprocessor box, under Mach, may provide the best cost/performance ratio, as well as the portability and the adherence to standards that Open Systems is all about.

Postscript

No true NeXT tabloid would be complete without mentioning Steve Jobs and his lovely new bride. One of the most eligible bachelors in the computer world, Steve Jobs, 36, married Stanford business school co-ed Laurence Powell, 27, on March 28th, in Yosemite National Park.

Happy April Fool's Day, One And All!

The various vendors of database servers have each devised ways to get around these problems. These methods usually involve side stepping UNIX altogether. Sybase, for example, uses the raw disk device to make sure information is written to disk on each write; it also maintains its own file system, choosing to manage file block allocation and indexing outside of the UNIX file system's intervention.

So as it turns out, database servers under UNIX really make little use of that which is intrinsically UNIX. If achieving maximum throughput is our goal, perhaps it is time to consider other technologies and other operating systems, and not be myopic to one particular solution.

In the old days, the database server used to be tied right into the operating system. The two were inextricably entwined. Pick, for example, is both an operating system, and a database engine. Many of the IBM mainframes were also designed this way. In fact, machines such as the AS/400 are the descendents of highly refined data server hardware and software combinations.

Of course these days it is heretical to utter anything against Open Systems. Face it, people are just not interested in proprietary solutions anymore, or so the media assures us. So it seems one very intriguing design of a highly efficient database server is being totally ignored.

There is now a new generation of 386 multiprocessing machines. Unlike the previous generation, offerings from Sequent and others, these 386 multiprocessor machines are not much more expensive than your plain jane uniprocessor 386. Collorary, a pioneer in multiprocessor 386 UNIX, has recently introduced multiprocessing 486 systems as well, at prices a fraction of the minis that they compete against.

Multiprocessing makes a lot of sense to an efficient database server. The computation load is low, but the number of users high. Adding more processors can give you a very linear increase in transaction processing efficiency -- if you design the software correctly.

Oracle spawns off a child process to handle every user that logs into the database server. Since forking and switching between multiple context is an expensive affair, Oracle tends not to be very nimble. The key to high performance is multi-threading. Instead of spawning off child processes, a lightweight thread of execution handles the requests associated with a given user.

Mach happens to provide excellent facilities for multi-threaded applications. Not only are threads much less resource intensive than processes, they also impose less CPU overhead. They utilize the machine resources at much higher efficiency than do processes. Mach also has the facilities for very quick interprocess communications (IPC). We all benefit from this when we use our NeXT machines; the Display Postscript server talks to each and every application through Mach's lightning fast IPC, so that even high volume traffic such as updating a screen with large bitmaps are quite fast. Mach extends the IPC mechanism across the network automatically, so user programs need not impose their

as the IDE disk subsystem currently in vogue with PCs.

You will have to put NFS on each and every PC workstation. You can get PC NFS software from companies like FTP Software, Wollongong, or Sun Microsystems. Not only do you get an NFS network with considerably more features than any PC based network, but you will also get an excellent Postscript printer sharing facility, a fax modem sharing facility, all free in the bargain. In fact, a NeXT server with a NeXT printer will handily outperform high end models of Postscript printers for the PC, at half the price.

Last but not least, your network will gain a NeXT machine with its excellent set of software and capabilities. You will be able to easily connect a DAT for backing up the network server (see Tao #7 for details), again rendering a cost saving when compared to similar solutions for PCs, because you don't pay for an interface card, or backup software.

Because you also get UNIX free in the bargain, the server can now act as a uucp dialup, or even an Internet node (with some work).

Finally, your network can now tap the full power of Sybase, not just any also-ran SQL server without the integrity and speed features of Sybase.

MACH 386 and Data Server Engineering

One interesting trend in the last ten years has been the shift from dedicated database machines, to general purpose machines that also host database servers, coinciding with the shift from heavily centralized mainframes, to a network of independent machines which talk to a file server.

Today the prevalent practise is to put a database server on a UNIX machine. This arrangement can easily satisfy a small network of, say, less than twenty users, but it is hardly adequate for true OLTP (On-line Transaction Processing), where thousands of users need real time information.

OLTP has been the exclusive domain of high end proprietary machines. Recently, many companies have promised OLTP on their UNIX database servers (Sybase, Oracle, Informix, Ingres, and others). But if the truth be known, UNIX really isn't a very hospitable environment for OLTP requirements.

UNIX's file system is geared toward a large number of small files. A database server needs to quickly access a small number of usually very large files. UNIX's process scheduler is optimized for user responsiveness, whereas a database server may need to balance processes based on maximum transactions per second throughput. UNIX's standard block device caches all the writes, so the database server is never guaranteed that information it has written is, in fact, committed to disk.

Sybase Saga, Continued

The version of Sybase, updated for System 2.0, has a new feature that nobody seems to be talking about. The new server, which can be ordered from NeXT for $100, will now work on the network for all clients, not just NeXT clients.

This is interesting news. For those of you who think $995 is a lot of money to pay for software, Sybase has the following list price for their SQL Server

SparcStation 1+, 2-4 users	$7,920
SparcStation 1+, Unlimited users	$23,760
SparcServer 490, Unlimited users	$76,320
VAX 6220, 6320, 6420	$113,760
VAX 9420, 9430, 9440	$360,000

If we accept the ’040 NeXT as having the same level of processing power as the Sparc, it seems the NeXT becomes an awfully good alternative to the Sparc as a database server for up to six users. As reported in Tao #1, Sybase accepts up to **six** users, not five, as documented.

This new capability only matters to people who wish to have a Sybase server for a network of non-NeXT machines. For the NeXT purist, such a scenario borders on the unthinkable. But the reality is a PC and Mac dominated business world, who are at the moment paying exorbitant sums of money for SQL server capability on their Novell or LAN Manager or AppleTalk network.

NeXT: The New Network Alternative

If you were thinking to connect your department’s PCs into a network, most people will immediately think "Novell". Some may think "Microsoft LAN Manager", and still others may think "OS/2". Now suppose you want to put a database server on the network, so all your five PC’s can access your company’s information system.

Under Novell, LAN Manager, or OS/2, this is the agenda: first, buy a 386 class server with at least 4M RAM, and a high performance ethernet card. Ignoring for the moment the cost of hard disk, it will cost you about $3,000. Now you must consider your options: buying Novell, LAN Manager, or OS/2 will cost about $2,000 just to start. To get a SQL server on it will be another $5,000 or so. Altogether, a total bill of $10,000 for the server, before buying the hard disk subsystem.

Consider now the alternative. Buy a NextStation, outfit it with say 32M RAM. The total cost there is about $6,500. If you qualify for discounts of one sort or another, developer, education, corporate or otherwise, and if you shop around for memory prudently, you may get away with as little as $4,500. The SCSI disk subsystem will cost about as much

Snake is reaching press, and information about its performance is no longer a matter of non-disclosure, I can say a bit more about this muscle bound, fire breathing CPU.

HP makes both a 50 Mhz and a 66Mhz version of this CMOS RISC chip. The 50 Mhz unit performs at 57 MIPS, 15 MFLOPS, and is rated at 55.5 SpecMarks. HP plans to sell the base unit, complete with all the typical workstation trimmings and a 19" monitor, for a mere $12,000. The 66Mhz version is even more spirited at 76 MIPS, and 72 Specmarks.

Obviously HP plans to go head to head against IBM’s RS/6000 line. NeXT may be a beneficiary of the fantastic price performance of the PA-RISC by licensing this technology for itself. Such a prospect is given some credence by eye witness accounts of NextStep running on a prototype Snake workstation.

The key factor in a successful RISC offering from NeXT is smooth upgrade path. To go ahead with a RISC machine will put NeXT in the same position that Sun was in, several years ago, when caught between its 680x0 line and the new Sparc offerings. Sun managed the transition with generous upgrade offers. NeXT can do the same, and be in an even better position to finess the switch, since the NeXT install base is smaller than Sun’s, when Sun made the transition.

The HP PA-RISC chip is ideal for intensive math processing operations. High end imaging, CAD, animation, fluid dynamics, and other such engineering related jobs come immediately to mind. NeXT is still woefully inadequate in most of these areas; the only thing that can immediately tap all that FPU muscle is Mathematica. NeXT needs to encourage developers to migrate their CAD packages into NextStep, to round out the application software base.

Color for All

NeXT will be offering color upgrades to existing users of the NextStation. Dealers will be authorized to swap the motherboard in monochrome NextStations to color logic boards, along with a color monitor swap. There has been no words on how Cube users will get color, except by spending big bucks and getting NextDimension.

Either third party, or NeXT itself, may service the need with a 16 bit color expansion board. There is a need for a mid-end solution that will not require the money and the prestige of 32 bit colors, especially for the casual business user, whose main interest is in good looking Improv bar charts.

On the other hand, the news for NextDimension is not so good. The problem appears to be the C-Cube chip. The word has it the deficient C-Cube chip is making a lot of people very upset at NeXT. The product’s release has been delayed, and we may very well see either another company’s compression chip, or perhaps even a second i860 dedicated to performing compression tasks.

Tao #8
April 4, 1991

Steve Jobs, billionaire and entrepreneur extraordinaire, was ousted from Apple, a company that he himself founded. It seems that Steve will have the last laugh after all. Financed by IBM, who put in 50% of the money, Steve Jobs will be returning to Apple as its CEO in an unfriendly take-over. Insiders to the deal say Steve Jobs will not be firing Sculley outright. Some speculate that this is so Sculley will not be able to invoke his golden parachute, which Steve himself put in place for John Sculley, back in the better days of their association.

It should be interesting to speculate what will happen to the Macintosh line of machines. Will there be a merging between NeXT machines and Macintoshes? This appears unlikely. However, it is almost for certain that many of the advance technologies found in NeXT will migrate its way to the Mac. Perhaps Display Postscript will be the first to unite the imaging techology between the two lines, with a gradual conversion of AU/X into something resembling NeXT's OS.

NeXT's RISC Strategy

The news is now leaking out about the difficulty engineers have been experiencing with making the 68040 work in a multiprocessor environment. The problem has to do with Motorola's promise of the multiprocessor version for 68040, and the all-important copy-back cache. According to hardware engineers, the actual delievered goods did not have the copy-back cache feature, as according to spec.

The copy-back cache is important in a multiprocessor design to minimize conflict of CPU over memory, coordinating the integrity of consistent data across all CPUs without draining the bus bandwidth.

Doubtlessly NeXT engineers must be shaking their heads in consternation over this. Rumor has it that Motorola is in fact considering dropping the copy-back cache altogether, though publically Motorola has denied all accusations of faulty design. This may give NeXT the impetus to drop the Motorola line altogether, and move agressively to RISC.

As mentioned in Tao #7, two possible candidates for a NeXT RISC implementation are the MIPS chip, and HP's Precision Architecture RISC (PA-RISC).

Microsoft recently aligned itself with Compaq and MIPS to push for OS/2 3.0, the "Portable OS/2", as the operating system of choice for Compaq RISC boxes based on MIPS CPU. The political clime makes it unlikely, in my humble opinion, for NeXT to go with MIPS.

How good is HP's PA-RISC? Damn good. Now that news of the HP-9000 Series 700