Memory Management

Part 2

Memory-management resources in MS-DOS 5.0 and DR DOS 6.0 and evaluations of more-efficient add-in memory managers

Last month, we introduced you to the means by which you can move as much of software resources you use into high memory beyond the 1M DOS limit to free up as much memory as possible in the critical lower 640K for running memory-hungry applications. This time around, we conclude with descriptions of the resources available in Microsoft MS-DOS 5.0 and Digital Research DR DOS 6.0 and evaluations of add-in products that take memory management beyond what's possible with these two operating systems.

DOS Memory Services

The more-recent DOS versions have added memory-management services. DOS operating systems from Microsoft and Digital Research now have so many features that they've forced some of the products in this category out of the marketplace.

They also compete with each other on these features. While the most familiar and frequently used DOS commands are shared among DR DOS, MS-DOS and such vendor versions as PC DOS, many of the memory-management commands tend to be more different than similar. The XMA drivers required by certain PS/2 hardware, and available in PC DOS and DR DOS, but not in MS-DOS, are one case making this point.

MS-DOS's DEBUG program has several commands for mapping and allocating expanded memory that are lacking in DR DOS's SID debugger. More frequently used commands—for managing XMS, managing EMS, loading code into the HMA and loading code into UMBs—also differ, as the following examination of the two competing DOS systems shows.

MS DOS 5.0

MS-DOS memory management is divided between two drivers: HIMEM.SYS and EMM386.EXE. HIMEM provides the XMS services, and EMM386 manages EMS and upper memory. Both drivers load from the CONFIG.SYS file, and the division of memory space between XMS and EMS is fixed as the computer starts. A configuration command in DOS can be used to direct the operating system to create the link that joins the upper and conventional areas of memory and loads much of its kernel into the HMA.

The commands DEVICEHIGH and LOADHIGH load TSRs, network redirectors, drivers and basically any resident code into upper memory. Both commands require the presence of EMM386.EXE or an equivalent EMM. DOS can deliver roughly 617K (±4K, depending on machine architecture) of conventional memory by loading processes into as much as 128K of upper memory.

Switches for EMM are limited to a few common functions, such as specifying the location of the page frame and including or excluding memory ranges. HIMEM's switches, likewise, provide few alternatives—principally, XMS through INT 15 and a variety of A20 handlers to accommodate the addressing schemes of different BIOSes. DOS itself can't shadow a BIOS in RAM, but if the feature is provided by a computer's built-in logic, HIMEM.SYS can sometimes recover the memory circuits used by re-mapping them into extended memory.

In addition to its XMS and EMS memory managers, DOS provides one memory utility and a few services, scattered throughout its other commands and facilities, such as those in DEBUG. The DOS MEM command, for example, displays locations of allocated and free memory, as well as loaded programs. It can be run to check the results of a configuration change after rebooting.

Built-in MS-DOS memory managers are among the few that don't support either recovery of video memory or relocation for at least some system resources. DOS has a number of resources that take from small to moderate amounts of memory. Many managers can free additional conventional memory by relocating some of these areas to upper memory. The BUFFERS resource, for instance, requires 528 bytes for each of its sector buffers.

Larger drives may require 40 or more buffers; the DOS User's Guide recommends 50 buffers for drives over 120M. This may explain why BUFFERS is the most peripatetic of resources among managers that move them into upper memory.

Earlier versions of DOS provided a /X switch that moved these buffers into expanded memory. But /X is no longer a part of DOS 5.0. Instead, DOS 5.0 automatically moves this area into the HMA, along with the DOS kernel. The LASTDRIVE resource requires approximately 100 bytes for each drive-table entry it creates, while the FILES and FCBS re-

sources each use about 53 bytes per entry.

Some DOS facilities do have the ability to relocate parts of themselves into extended or expanded memory. The /X parameter moves FASTOPEN's name cache from conventional to expanded memory. The /E and /A switches move the RAM disk created by RAMDRIVE.SYS into extended and expanded memory, respectively. SMARTDRV.SYS normally puts its cache into extended memory, but the /A parameter can be used to put it into expanded memory instead.

The visual MS-DOS interface, DOSSHELL, includes a task switcher that can seemingly fit several applications into memory at one time. DOS can execute only one program at a time, but the shell makes it possible to keep a number of tasks in progress simultaneously by suspending all except the one currently in use. A suspended task can later be resumed at exactly the same point at which it was interrupted. DOSSHELL also has provisions that allow you to specify the minimum conventional- and extended-memory requirements for the applications it juggles in and out of memory.

DR DOS 6.0

DR DOS's MemoryMAX feature is a set of drivers that create EMS, XMS and UBMs; provide access to the HMA; and relocate TSRs and operating-system drivers. A full range of memory-management functions is supported for 386 and 486 systems. XMS is supported for all systems with extended memory if they use any 286 or later processor. If 286 systems have Chips & Technologies NEAT Chip-Set, or an AMD 286LX processor, upper memory is available.

EMS is available for 286 machines if they have an EMS 4.0 or EEMS adapter installed. To maintain compatibility with IBM PS/2s, and PC DOS, EMS 4.0 is also available for the IBM extended-memory adapter (XMA). DR DOS is compatible with *Windows*, and VCPI is also supplied.

On 286 computers, MemoryMAX uses the HIDOS.SYS driver to relocate its kernel to upper memory or HMA, access portions of upper memory on machines with supported chip sets and support UMBs on expanded-memory adapters. EMM386.SYS provides extended- and expanded-memory management for 386 and 486 computers. It can also load the DOS kernel high or into HMA, and it supports *Windows* in all modes. However, upper memory must be disabled to support *Windows* in standard mode. The EMMXMA.SYS driver supports EMS 4.0 for 286-based PS/2s with an XMA card.

MemoryMAX delivers a maximum of 627K without tapping video space. You can add as much as 96K in video addresses to conventional memory for text applications. This memory is configured by the MemoryMAX drivers, but it can be switched on and off by the MEMMAX DOS command. The MEMMAX command also enables and disables both lower conventional and upper memory.

DR DOS manages memory principally from the CONFIG.SYS start-up file. The configuration command, HIDOS, directs the system to load as much of the kernel as possible into upper memory. HIDEVICE and HIBUFFERS load system resources there. HIINSTALL loads TSRs high.

Two more DOS commands are available for memory allocation. HILOAD is the equivalent of the HIINSTALL configuration command, except that it's used from the command line. Similar to the Microsoft version, the DR DOS MEM command displays memory statistics: how much of each type of memory is available and details on the processes using it. It can be run after rebooting to check the results of a new configuration.

Because it's an operating system, DR DOS can also provide some memory-related services. For example, it can use memory management to do a single-pass DISKCOPY or DISKCOMP on a computer with only a single floppy drive. Its task switcher preferentially uses available extended or expanded memory over slower disk space. There's also an interactive CONFIG.SYS that allows you to have multiple memory-management configurations. Of course, you can also add this feature to other versions of DOS with add-on utilities like BOOTCON from Modular Software Systems 1-800-438-3930.

This DOS allows both its operating-system kernel and TaskMAX task switcher to run from either UMB or HMA. The DR DOS task switcher further helps exploit memory resources by managing up to 20 tasks from either the command line or a graphical shell. If there's insufficient extended and expanded memory, DOS swaps background programs to a mass-storage device.

Product Reviews

QEMM-386 6.01, $99.95
Quarterdeck
150 Pico Blvd.
Santa Monica, CA 90405
Tel.: 213-392-9851

CIRCLE NO. 107 ON FREE INFORMATION CARD

QEMM provides XMS and EMS services. Both types of memory are shared dynamically from a common pool. Its memory manager replaces both HIMEM.SYS and EMS providers like *Windows'* EMM, EMM386.SYS. It replaces HIMEM.SYS, but it can work with it if necessary. As an example, it can access memory beyond 16M on Compaq computers. (This requires Compaq's version of HIMEM.) It supports all three forms of the XMS: UMB, HMA and EMB.

Quarterdeck's memory manager fills unused regions of upper memory with UMBs for loading TSRs and drivers high. It recovers shadow RAM provided by Chips & Technologies LEAP, NEAT and SCAT ChipSet and equivalent Top Memory (Top384) in Compaq and Compaq compatibles from Micronics, Trillion and others. If upper addresses are unpopulated, *QEMM* shadows BIOS code into mapped memory.

QEMM keeps a library of Microchannel adapters that it uses to configure upper memory in IBM PS/2 machines. It also backfills conventional memory. *QEMM* supports *Windows* in all modes, including standard mode, but you can also disable its built-in EMM and use it with an external substitute like EMM386.SYS—without losing its other features. It also supports applications with VCPI.

Not only does *QEMM* load TSRs and device drivers high, but also most DOS resources: BUFFERS (DOS 4 excepted), FILES, FCBS and LASTDRIVE. Unfortunately, only those drive-table entries used with the DOS SUBST command can be loaded high.

QEMM installation includes a choice between loading upper memory manually or with its OPTIMIZE utility. OPTIMIZE tries to determine what TSRs and drivers can be loaded high and then where it's best to locate them. Installing *QEMM* automatically revises the CONFIG.SYS, AUTOEXEC.BAT and nested files and

optionally creates a separate "response file" that substitutes for direct changes to those files. The response file allows changes to be made for nested batch files that can't be changed directly (public batch files on networks, for example).

The forgoing notwithstanding, this program offers so many alternative configuration scenarios that you many find yourself wanting still more automation.

One of *QEMM*'s options, SQUEEZEF, extends UMBs into the EMS page frame while programs load high. Like the 386MAX FlexFrame and QMAPS Loadextend features, this scheme allows excess code to temporarily load into the EMS page frame during TSR installation.

If you need still more upper memory space, there's STEALTH, a feature newly added in Version 6. Quarterdeck claims that its STEALTH technology can reclaim 20K to 115K of memory address space from the system BIOS area above F0000. Some of this may be in areas that simply contain no code or data, but there are frequently one or more areas that aren't used after a computer boots.

STEALTH comes in two flavors. STEALTH F is closest to the technology in *NETROOM*. An EMS page frame must be present to access the BIOS. Like NETSWAP(4), STEALTH F places a page frame over a memory area and switches between two sections of memory, as required. Since STEALTH F maps the EMS page frame over a BIOS area (the video BIOS at C0000), you have to re-map memory every time an interrupt call occurs. STEALTH F copies the BIOS into the page frame and makes the BIOS visible there. Then it puts EMS back.

The F option is a little faster than the M option, but has more compatibility issues. If it doesn't work, STEALTH tries to use its M mode. STEALTH M leaves the BIOS in place, maps UMBs over it and then uses 386 translation tables to bank switch between the UMBs and BIOS.

With STEALTH, *QEMM* can recover up to 620K of DOS-program area under DOS 5.0. Total upper memory available for TSRs and drivers may reach 211K. Quarterdeck says this configuration can give *Windows* an extra 8K-24K of memory. QEMM can only recover about 570K of conventional memory from DOS 4.0, but it adds the same 211K of upper memory and recovers the 64K of HMA that DOS 5.0 uses.

QEMM can add unused video regions to conventional memory—704K, with the 64K below the VGA/EGA monochrome region, or 736K, with the 96K below the EGA/VGA color-text region. The VIDRAM command provides this memory, depending on monitor type, and only if a VGA or EGA adapter is installed (RAM must occupy the addresses). Once installed, it traps and prevents attempts to change from text to graphics modes. This inhibits crashes, yet still allows you to manually switch modes.

There's an OVERRIDE modifier for VIDRAM that lets you use mapped memory, too. However, while OVERRIDE and its own additional options let you precisely control VIDRAM, they also make it a little more complicated. In addition, *QEMM* allows you to optionally LINK free upper memory to the conventional memory space when needed and UNLINK it when no longer required.

Another utility, EMS2EXT, can switch between expanded and extended memory to provide access to EMS handles for older extended-memory programs like VDISK that can't directly access addresses above real memory. They acquire extended memory logically through BIOS calls to INT 15 (the original cassette I/O interrupt), and the EMS page frame can provide the required access. Programs that use the XMS or VCPI don't need EMS2EXT (for example, *NETROOM* EMS2EXE). *QEMM*'s XMS.COM program can configure the EMS handle "EMS2EXT" on-the-fly for use by EMS2EXT.

Quarterdeck includes three utilities that provide diagnostics: Manifest, QEMM-.COM and LOADHI. They can help you to optimize manual installation of the memory manager and diagnose memory conflicts.

QEMM.COM switches on and off memory manager QEMM.SYS from the command line. However, from either the command line, using option parameters, or from within Manifest, via its easy menu system, it provides a number of reports on the first megabyte of memory. The Summary report includes the status of the memory manager, amount of available EMS and location of the page frame. The Type report lists memory areas and their sizes and uses. The Accessed report indicates regional read and write activity.

Data for the Analysis report are collected dynamically by *QEMM* while applications run and actually access memory. It suggests which areas of memory should be placed in INCLUDE and EXCLUDE statements and which are available for use. The Memory report shows how the manager has allocated all of the system's memory to conventional, upper and expanded memory. Except for Summary and Memory, all reports are available as either lists or memory maps.

In addition to *QEMM* reports, Manifest lists conventional and upper memory regions, including the category of program code or system features that reside in each. It also lists specific hardware features, CMOS contents, drivers and memory-management commands that are found in the start-up files.

The LOADHI command (used to load program code high) also produces a report that breaks upper memory into address ranges. It lists the addresses in use, what code is loaded at each and how much memory remains available for loading additional code. It can quickly suggest where to load a program or reveal why something might have failed to load.

QEMM is available by itself, but it also comes bundled with Quarterdeck's *DESQview* operating environment as *DESQview 386*. *DESQview 386* provides virtual-machine abilities similar to those provided by the *Windows* environment.

If options give you a thrill, nothing has more than *QEMM*. There are enough to make you dizzy. It should come as no surprise, then, that QEMM's documentation is good enough to help you understand the competition's products. Exceedingly complete, and almost uniformly clear, perhaps two of its paragraphs demand an inordinate amount of inference. But they're for obscure features of interest principally to programmers who understand them. Of course, compatibility and robustness are also issues. Radical solutions entail more risk. *QEMM*'s broad array of options is important because it gives you many chances to play with the tradeoffs.

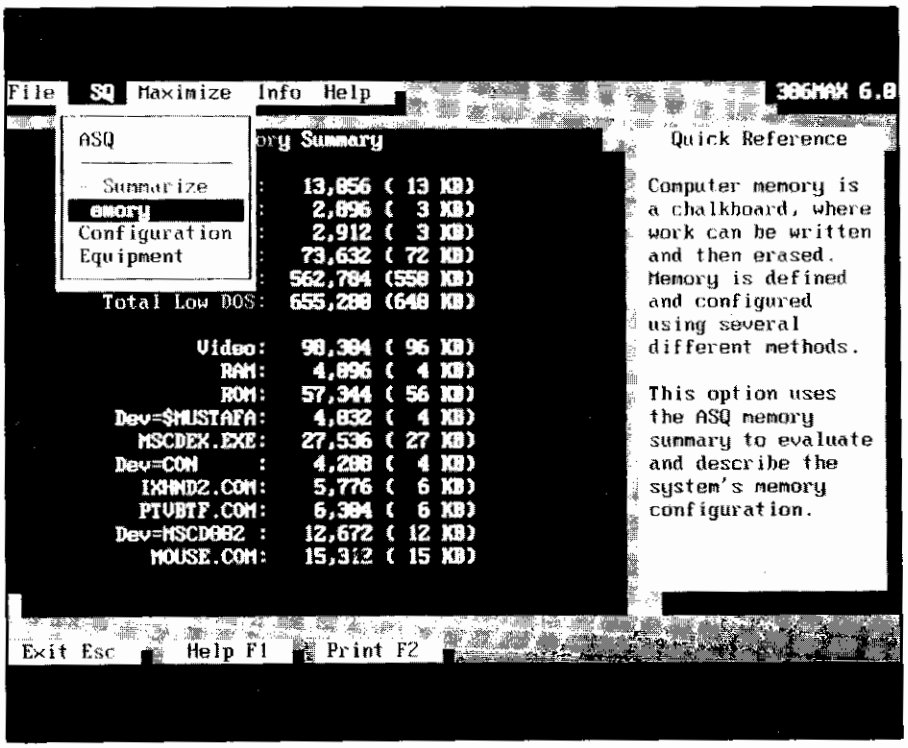
386MAX Version 6.0, $99.95
BlueMAX, $124.95
ASQ 1.3, $5 fee or
On Compuserve: GO PCVENA
Qualitas
7101 Wisconsin Ave., Ste. 1386
Bethesda, MD 20814
Tel.: 800-733-1377 or 301-907-6700

CIRCLE NO. 108 ON FREE INFORMATION CARD

386MAX provides XMS and EMS services, allocating all memory dynamically from a common pool (shared-memory allocation). It can replace HIMEM.SYS, EMM386.EXE (the DOS 5.0 EMM) and EMM386.SYS (the *Windows* EMM); provides UMBs for loading TSRs and drivers high; provides optional instancing; backfills conventional memory; and supports applications with VCPI, DPMI and VDS. The company claims that it's the first utility to provide DPMI host services for DOS applications.

Furthermore, *386MAX* increases the contiguous UMB area by re-mapping a VGA BIOS from C0000 itself, rather than allowing a built-in shadowing feature to move it to E0000. Its backfilling can increase conventional memory to 704K, with the 64K below the monochrome buffer, or to 736K, with the 96K below the CGA buffer. However, it doesn't allow you to switch these for use with monochrome and color-text VGA applications.

It can alternately recover the 32K mono-



Status screen for Qualitas' "386MAX" memory manager.

Facts Box

DR DOS 6.0
Digital Research
Box DRI
70 Garden Ct.
Monterey, CA 93942
Tel.: 408-647-6675

CIRCLE NO. 109 ON FREE INFORMATION CARD

MS-DOS 5.0
Microsoft Corp.
One Microsoft Way
Redmond, WA 98052
Tel.: 800-323-3577 or 206-882-8080

CIRCLE NO. 110 ON FREE INFORMATION CARD

MS-DOS 5 Installation & Optimization Video Course
Microsoft University
10700 Northup Way
Bellevue, WA 98004-1447
Tel.: 206-828-1507

CIRCLE NO. 111 ON FREE INFORMATION CARD

chrome area at B000 for upper memory if the VGA BIOS can be placed elsewhere. It can shadow both system and video BIOS in extended memory. If a computer has Chips & Technologies or Compaq-style top memory shadowing, *386MAX* will optionally recover that RAM for its pool. Another feature, Virtual High DOS, allows you to reuse the same free UMB memory in every *Windows* 3.0 DOS session. Also, *386MAX* automatically locks out instancing of cache programs.

MOVE'EM, Qualitas' 286 memory manager, has been rolled into *386Max* with 6.0. It provides management through Chips & Technologies' ChipSets. Or it works on any PC, including 8086-based systems, with an EMS 4.0 adapter. Owners of *MOVE'EM* (or earlier versions of either MAX can upgrade to the new MAX for under $30.

One of the things that sets *386MAX* apart is its suite of utilities. They're integrated by MAX, the menu-driven shell, and include: an automatic installation program and an update installer; STRIPMGR to undo the work of the installers; 386UTIL for mapping memory; the Qcache upper-memory disk cache; the 386DISK RAM disk; ASQ, a combination system analyzer; Maximize for optimizing installation; and the STEALTH-alternative, ROMSearch, for recovering unused sections of ROMs.

Some of these utilities are obviously intended to aid in installation when automatic installation isn't satisfactory. ASQ 1.3 reports on all types of memory, as well as on how programs are using each. It also reports on the processor, video system and other relevant hardware. It includes a tutorial on memory management, as well as SnapShot, a utility that records instantaneous system information. Incidentally, ASQ is also distributed free by Qualitas. Anyone who wants a copy can obtain it through Compuserve, users groups and bulletin boards or directly from the company (by paying a nominal shipping and handling fee).

Maximize is one feature that you'll use during every installation if you load programs high. It analyzes start-up files; finds TSRs and drivers and the best region to load modules when UMB space is fragmented; determines the optimal for loading modules into upper memory; and modifies the start-up files, including CONFIG.SYS, AUTOEXEC.BAT and nested batch files.

Automatic program re-ordering can increase the number of applications that will fit in UMB space because TSRs can take much more room to initialize themselves than they do to remain resident. For example, FASTOPEN requires approximately 60K to initialize itself but reduces to a resident size of about 2K. If it follows a program that leaves less than 60K, it can't install itself, even though it needs only 2K to run. By installing it before other programs reduce available UMBs below 60K, it may be possible to load as much as 58K of additional TSRs after it.

386MAX further stretches memory while loading programs high with a feature called "FlexFrame." Like the *QMAPS* Loadextend and *QEMM* SQUEEZEF features, FlexFrame gives programs temporary use of the EMS buffer during initialization.

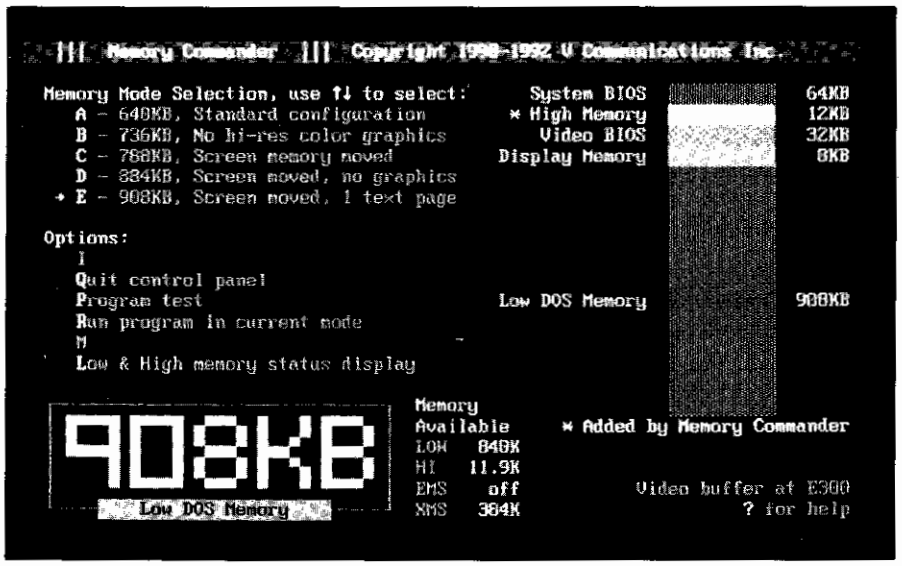
ROMsearch may not work for every system, but like Maximize, you'll want to give it a try. It tests all areas of system ROM, and anything that's not used—-POST, filler, other diagnostics and setup program—is recovered. However, BIOS services aren't re-mapped to areas of extended memory, as they are in some other managers. This is because, Qualitas states, that doing so can cost a 10% or more performance hit. Also, accessing BIOS without going through system interrupts can cause conflicts. Instead, fragments are recovered in-place. This works if Maximize can find the right-size application to fill each hole. The maximum amount of space *386MAX* provides for a VGA-graphics system is 224K of UMB and 640K of conventional.

The bigger advantage of *386MAX* is rock-solid reliability. Qualitas restrained ROMsearch to better serve network environments. As a result, ROMsearch doesn't change the BIOS location, and it may not recover as much BIOS area as some technologies, but its recovery mechanism isn't likely to cause a crash, either. Qualitas also has an unqualified advantage for some developers. If you want memory-management for Borland's protected-mode debugger, the MAX products alone are compatible.

BlueMax has all of the *386MAX* features, including the ability to read IBM's Microchannel Architecture (MCA) Adapter Description Files (ADFs). This information is used to run Adapter Description Programs (ADPs) that configure the PS/2's adapters for optimal exploitation of upper memory.

BlueMAX also takes all the areas you don't need out of the 128K PS/2 BIOS. You're typically left with just 40K of BIOS, and that's compressed to the top of upper memory. The rest is recovered for UMBs. Compatibility is ensured by maintaining a compression file for each version of PS/2 BIOS.

BlueMAX has been optimized for 386 and 486 PS/2s. As a result, it's well-suited to them. Microsoft says you can get a total of 865K real memory on a PS/2 model 70 running DOS 5.0; 621K conventional and 244K UMB. The PS/2 BIOS-compression files in *BlueMAX* are also highly reliable, making *BlueMAX* a good choice for LANs. And *BlueMAX*, like *386MAX*, can be used with Borland's protected-mode debugger without a problem.



Status screen for V Communications' "Memory Commander" memory manager.

Memory Commander 2.11, $99.95
MegaMiser, $99
V Communications
4320 Stevens Creek Blvd., Ste. 275
San Jose, CA 95129
Tel.: 800-648-8266

CIRCLE NO. 112 ON FREE INFORMATION CARD

Like other utilities in this class, *Memory Commander* provides typical EMS and XMS services. It loads TSRs, drivers and pre-DOS 4 DOS BUFFERS into UMB memory; provides optional instancing for TSRs and drivers; supports programs with VCPI and VDS; and provides additional contiguous main memory. It also offers a few of its own extras, some of which have already been mentioned. In addition, it provides shadow RAM from extended memory.

Memory Commander can further boost performance with its own video accelerator. It uses extended memory to backfill main memory to a full 640K if the appropriate low addresses aren't physically filled with RAM. Both its own RAM disk and a replacement for the ANSI.SYS console driver are built-in.

What really makes *Memory Commander* different, though, is the way you use it. Under normal circumstances, *MC* isn't manually configured like other memory-management software, even to customize it. And you never have to edit a CONFIG.SYS or AUTOEXEC.BAT statement to include or exclude regions of memory. The program does this automatically through a special control panel, after installation.

The control panel lets you add each TSR or driver to a built-in database that specifies the location where code is to be loaded and other requirements, such as *Windows* instancing, for example. If you must make a rare change for something like a network driver, it's made using the control panel's menus.

Because it's installed before you configure it, *MC* is able to walk you through trial-and-error tests that determine the optimal mode for running each application you use. Once you make a selection, based on those test results, and put it into the database, *MC* automatically allocates one of five memory models to the application whenever it runs. You don't need to run a utility before or after an application, and you get the greatest amount of memory possible for each.

Memory Commander's five operating modes provide from 640K to 920K of conventional memory for a VGA system. For a VGA-graphics application, V Communications asserts, you can generally improve conventional memory to 700K and still have 100K of UMB space. *Memory Commander*'s best case is 896K for VGA and 928K for CGA. If you're only running text mode, it adds another 24K to either of those figures giving *MC*'s largest model. This is a whopping 952K of main memory —more than any other memory manager! However, if an application writes directly to the video buffer, some modes have a performance penalty. Obtaining optimum performance may require switching to 640K of conventional memory.

The next version of *MC*, 3.0, is expected to add a feature similar to Quarterdeck's STEALTH, called "virtual ROM" (V-ROM). Both technologies hide almost all of the BIOS. Whenever the BIOS is required, either switches to the ROMs or to shadow RAM in extended memory, if implemented. There's a significant difference in how the code is accessed, though. V-ROM uses protected mode to directly access the moved BIOS code. You don't need to tie up 64K for the EMS page frame. If you don't require EMS, you're free to use the area for more TSRs, drivers or conventional memory.

V Communications is also preparing to ship a hardware memory-management product for the 286. At $99, the *MegaMizer* can compete against motherboard upgrades for a range of machines.

Memory Commander benefits have a good fit at both ends of the user spectrum. Due to its menus, standard memory models, simple trial-and-error tests, bootless memory reallocation and excellent documentation, *MC* is among the better choices for novice users. Program development is another noteworthy application for it.

Since compilers are text-based applications and tend to use DOS services and BIOS calls, they can benefit from the huge conventional-memory models this utility provides and still give full performance. In some cases, developers may have no alternative for acquiring needed space.

NETROOM 2.1, $99
HEADROOM, $129.95
Helix Software Co.
4709 30 St.
Long Island City, NY 11101
Tel.: 718-392-3100

CIRCLE NO. 113 ON FREE INFORMATION CARD

NETROOM has just about as much control over memory as you can get. It replaces HIMEM.SYS for XMS and HMA memory. It also provides both UMB and EMS memory. TSRs, drivers, DOS BUFFERS, DOS FILES and COMMAND.COM can be loaded high using revisions to the CONFIG.SYS and/or AUTOEXEC.BAT files.

The program runs on 386 and 486 machines, 286 computers with a Chips & Technologies NEAT ChipSet and any machine with EMS hardware, including old EMS 3.2 boards. (Not all features are supported for EMS 3.2 hardware. The CUSTOMIZE function and creation of UMBs both require EMS 4.0 or built-in support from a processor or ChipSet.) *NETROOM*'s RAM-MAN/386 utility provides EMS services on any 386 and 486 and any 286 with the Chips & Technologies NEAT ChipSet.

You can also load drivers and some TSRs with NETSWAP4. Helix says that "loading out" (that is, using NETSWAP4), combined with loading high, can give you a total of at least 704K for TSRs and drivers (776K with BIOS compression, 800K with compression and monochrome video).

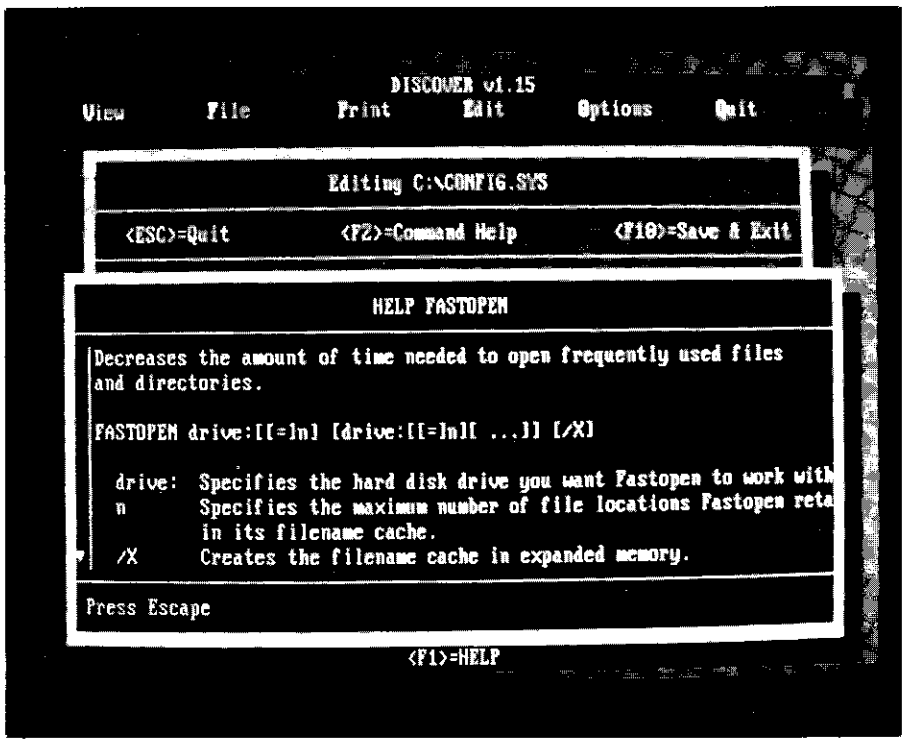
Does this mean you can have more than 1M of DOS-addressable real memory? Surprisingly, if you're willing to pay a performance penalty, the answer is yes. You could run PC Tools, NetWare and a CD-ROM drive without using any conventional space.

The virtual machine created by NETSWAP4 (or NETSWAP, a 64K version for EMS 3.2) also gives *NETROOM* the ability to load drivers high from the command line instead of from the CONFIG.SYS file eliminates the need to reboot when adding to a configuration.

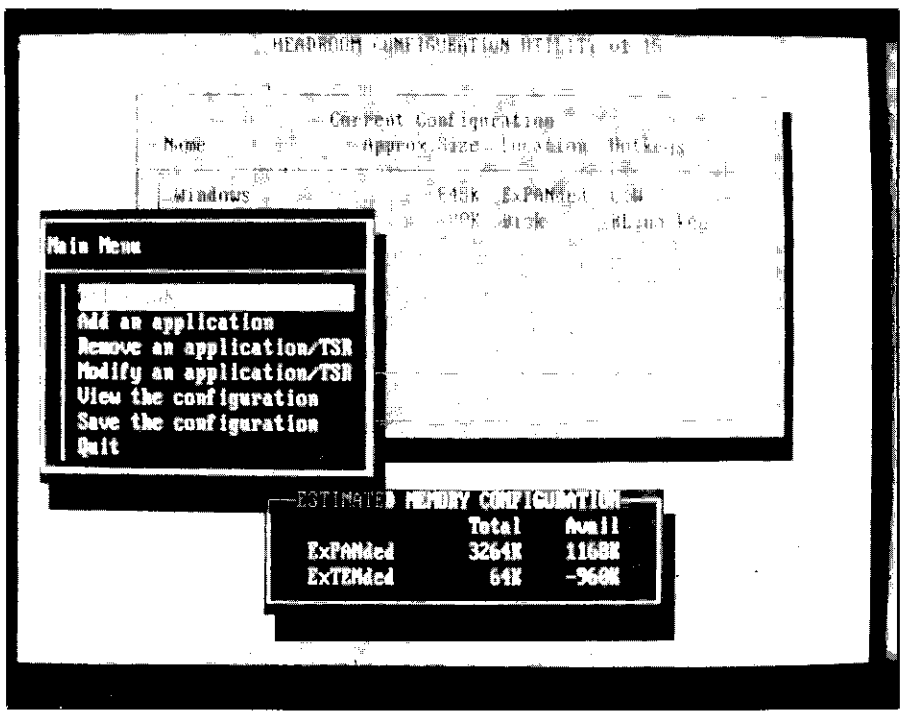
NETROOM can be installed automatically, and it normally allocates all memory from a shared pool. But a vast array of parameters alternately allows you scalpel-like precision in controlling memory resources. Sometimes that's necessary. For example, *NETROOM*'s RAM-MAN/386 retains some control over UMBs in *Windows*' enhanced mode. As a result, it's recommended that XMS, not EMS, be used to load high when running enhanced mode. Its tools permit you to do this. It's fortunate that, although *NETROOM* is a very technical product, its documentation is, largely, quite readable.

Automatic installation is rather sophisticated. *NETROOM* ferrets out not just the TSRs and drivers in AUTOEXEC.BAT, but also those in nested batch files. Its DISCOVER module provides both a memory map and an editor for modifying CONFIG and AUTOEXEC files. You can use it to find available memory regions and add them to UMBs in XMS or EMS memory. If a computer has an EMS 4.0 card or hardware shadow RAM, DISCOVER can recover those memories, too. *NETROOM* claims to be more clever than most EMMs at excluding such areas as hard-to-detect token ring cards.

EMS frames are automatically created



Helix Software's "Netroom" memory-manager Discover screen.



Helix's "Headroom" Configuration Utility screen.

for RAM-MAN/386 by the CUSTOMIZE routine. CUSTOMIZE automatically finds the optimum fit for loading TSRs and drivers high and places the required commands into the AUTOEXEC.BAT and CONFIG.SYS files. It also exercises the system BIOS and finds areas that can be recovered for UMBs. As a result, *NETROOM* frequently compresses the BIOS down to 32K. Under DOS 3.x or 4.x, it then moves the system BIOS, together with the 32K of video BIOS, into HMA. This gives you an additional 96K of UMB.

You have a choice with DOS 5.0, since it can also be loaded into HMA, and HMA can hold only one program. Of course, you want to conserve as much memory as possible. Therefore, load the larger program into the HMA and the smaller high. On systems without VGA BIOS, DOS 5.0 is bigger; so the system BIOS is automatically moved into UMBs. If DOS 5.0 is smaller than the combined system and VGA firmware, move DOS into upper memory.

As a third option, *NETROOM* will place other drivers, such as bus-mastering drivers that can't operate in upper memory, into the HMA. Either load strategy leaves only 32 bytes (not K bytes, just bytes) of reserved upper memory for the DOS reset vector.

QEMM and *MC* also leave the jump table in addition to the reset vector. But Helix avows it's never encountered a complaint about a program failing because modern programs use interrupts instead of the jump table. Helix even does it on PS/2s, but the software turns off BASICA automatically, unless you override it. (IBM's built-in BASICA is the principal jump-table user.) Helix has named this compression-and-relocation technology "Quantum."

For 286 machines that don't have appropriate chip sets, *NETROOM* includes an EMS2XMS utility that creates UMBs for DOS 5.0 by using an EMS adapter. EMS2XMS is required with such a hardware configuration only if you want to use the DOS LOADHIGH and DEVICEHIGH commands, but not if you want to use *NETROOM*'s XLOAD.

Conventional memory can be backfilled to 704K for monochrome or 736K for CGA, but only on systems using these adapters. This curb on adapters is imposed by one of *NETROOM*'s few handicaps. This is the lack of a utility to restore memory to the video buffer when switching applications between text and graphics modes on an EGA or VGA adapter. The program can also move a 32K VGA BIOS, usually at C0000, to B0000. Such a move can interfere with some super-VGA graphics, it but won't cause the system to bomb. *NETROOM* prevents this by marking the memory-translation tables as read-only.

NETROOM has been designed with networks in mind—literally. As a result, it's a good choice for workstations. It provides roughly the same conventional memory as most other managers. In addition, it can provide a huge amount of EMS memory for relocating even the largest network redirector into its virtual mind. This means more conventional memory is actually free for application software.

Its smaller VM can sometimes run the relocated code with no performance degradation, despite providing a second upper-memory space. (There isn't a performance loss if programs and drivers in UMBs don't communicate directly with the network driver or other drivers in the VM.) There are other options for networks and plenty of advice, including a special appendix.

Maximizer 3.3, $49.95
Max8, $149
Softnet Communications
15 Hillcrest Dr.
Great Neck, NY 11021
Tel.: 516-829-2977

CIRCLE NO. 114 ON FREE INFORMATION CARD

Maximizer provides UMB management that can load TSRs and drivers into upper memory and provide optional instancing of them. It can also load the DOS BUFFERS high. It doesn't provide EMS services, however. Nor does it replace HIMEM.SYS; rather, it works in conjunction with it to actually map XMS into UMBs.

Maximizer also reclaims unused video buffer area as main memory: 64K video for monochrome, 96K for CGA and color text. It can shadow BIOS ROMs in extended RAM, too. Lastly, *Maximizer* maps out unused ROM code and replaces it with RAM. Individual maximums are 736K of conventional memory and 256K of UMB. (Note that these maximums aren't available simultaneously; maximizing conventional memory takes 96K from upper memory.)

For those exceptional programs that know how to use them, *Maximizer* also supports memory control blocks (MCBs) that are basically UBMs that DOS maintains in a linked list. MCB-aware applications software like *FoxBase+* can use them as additional data space.

This utility does everything from the AUTOEXEC.BAT file, not CONFIG.SYS like most of the competition. As a result, you don't have to restart the system to change a memory configuration. Unfortunately, there's no method of unloading. It doesn't have automatic installation but does have an interactive menu that allows you to experiment and on-line help. Once configured, you set it permanently.

Maximizer also works on 286 systems with a Chips & Technologies NEAT or SCAT ChipSet to provide high loading into physical memory at UMB addresses. Systems without these logic chips can use SoftNet's proprietary Max8 board ($149 with software). The current version of *Maximizer* doesn't support either VCPI or DPMI and, thus, can't coexist with programs like Lotus *1-2-3* Version 3.1. However, DPMI Version 0.9 will be included in *Maximizer*, beginning with Release 3.0.

Maximizer's low overhead of just 47K is a big advantage on small-minded machines. All but 500 bytes is loaded into extended memory. Its documentation is quite clear and includes a number of examples for network users. Finally, its lack of an EMM (and ability to work with HIMEM.SYS and EMS386.SYS) actually offers a compatibility advantage with *Windows*.

QMAPS, 2.0, $99.95; net license, $99%
UMB Pro, $79.95
Quadtel Corp.
3190-J Airport Loop
Costa Mesa, CA 92626
Tel.: 714-754-4422

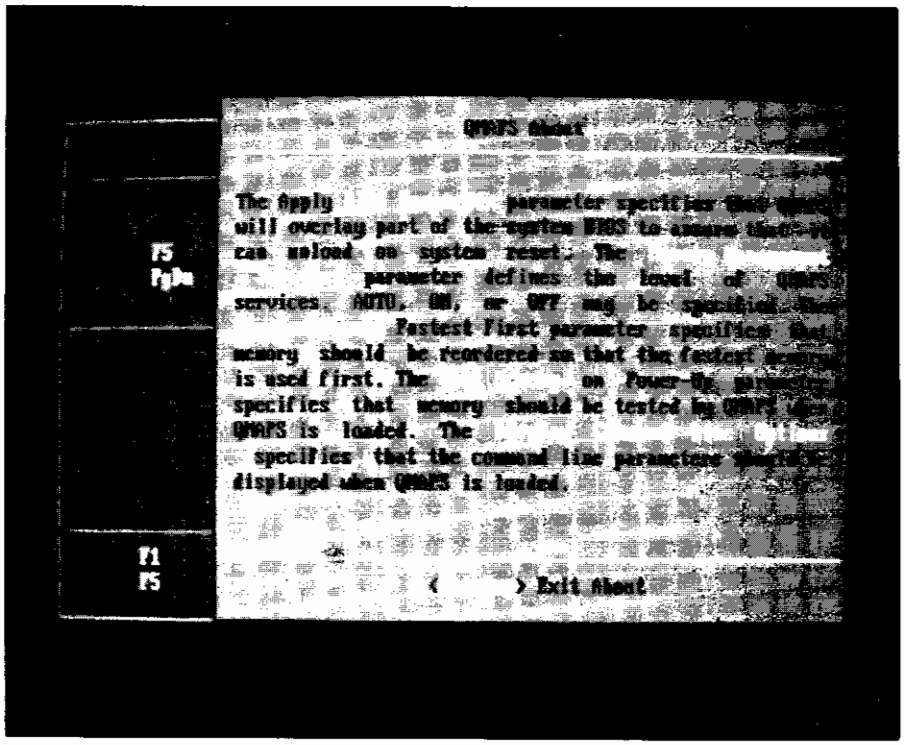
CIRCLE NO. 115 ON FREE INFORMATION CARD

QMAPS gives full EMS and XMS services with some choices. You can have either a shared pool from which both types of memory are allocated automatically or individual memory resources for each. It can completely replace HIMEM.SYS or defer to it, as you prefer. The utility's principal memory functions let you load TSRs and drivers into UMBs. It can also provide shadow RAM in extended memory, if required—not only for video and system BIOS, but for any adapter-card BIOS that isn't bridled by its timing.

Both VCPI and VDS are supported. *QMAPS* supports shared-memory allocation, which is compatible with *Windows*' enhanced mode, but it isn't compatible with *Windows*' standard mode. (Many EMM programs, including the EMM386.EXE shipped with DOS 5.0, aren't fully compatible with *Windows* in this mode.) In *Windows*' real mode, it supports only large-frame EMS.

Unused video-buffer areas can be moved to conventional memory by *QMAPS* to provide 704K (monochrome) or 736K (CGA or color text). Or the buffers can be used to provide additional UMB areas: 32K for either monochrome or color monitors attached to EGA or VGA adapters. The QMAPS.EXE control program moves video buffers when the video mode changes, provides a map of memory and controls EMS support and other features.

QMAPS has a few other long jumps on its flowchart. For example, you can run a SMARTMOVE utility after the installation program to do an analysis that deter-



Information screen for Quadtel's "QMAPS" memory manager.

mines what's in conventional memory and find the best fit for loading TSRs and drivers high. Then it puts QLH (Qadtel Load High) commands into CONFIG-.SYS, AUTOEXEC.BAT and AUTOEXEC's embedded batch files. You can also load programs high from the command line with QLH, or use it without parameters to display the memory map of a configuration.

The Loadextend feature, like the *386MAX* FlexFrame and *QEMM* SQUEEZEF features, extends UMBs into the EMS page frame while programs load high. This lets a program load into memory that's just large enough for its resident size, so long as its excess code fits into the 64K of an EMS buffer during initialization.

Quadtel is a relatively recent entrant in utility software, but it has long been building the EMS drivers that end up in computers from Tandy, Hewlett Packard, Phillips, Dell, AST, ALR, Wang, IBM and others. It's the number-one supplier of hardware EMS memory managers in the world, and its code is in system-logic chip sets from Chips & Technologies, Western Digital, Headland, TI, VLSI and National Semiconductor. This is the reason *QMAPS* can automatically recover fallow ranges from physical memory used for a computer's built-in shadow RAM. Furthermore, the company claims that its inside information gives it a performance advantage and that *QMAPS* lets programs that make extensive use of EMS functions run faster.

On the other hand, an engineering focus may also be why the manual is so tersely technical that many users are bound to have a tough time with it.

The current *QMAPS* method for recovering unused address ranges from BIOS memory space is the primitive trial-and-error use of an INCLUDE command in the CONFIG.SYS file. While *QMAPS* currently doesn't have a feature similar to *QEMM*'s STEALTH, Quadtel president Scott Daniels says, "We definitely have an answer to STEALTH," and "It is well in the works."

QMAPS comes bundled with three utilities collectively known as QUADTOOLS. They include a disk cache, RAM disk and print spooler. They have the advantage of being configurable from within the *QMAPS* installation program. Consequently, command-line parameters aren't required.

QMAPS provides fairly complete and precise control over memory resources and includes some powerful features. However, using special features or modifying its automatic configurations, requires both a degree of expertise and the ability to make a number of inferences from its documentation and text files. It also isn't a complete replacement for EMM386.EXE or EMM386.SYS, since *Windows* won't run in standard mode with the *QMAPS* memory manager loaded.

UBM Pro supports both 286 and 386 computer architectures, but it provides only UMB and XMS support (including HMA). If a system already has EMS memory, *Pro* can use it for UMBs and doesn't interfere with the operation of *Windows*. Both large-frame and small-frame EMS can be supported by it.

The principal advantage of *Pro* is that it saves 275K over QMAPSD, using a mere 2K to 4K of main memory. Like *QMAPS*, it has both the SMARTMOVE and Loadextend features as, well as QUADTOOLS. As a replacement for HIMEM.SYS, Quadtel believes its move-block XMS function to be slightly faster at copying data between conventional, or UBM, and extended memory. It also supports the fast-gate-A20 function, found on some systems, that can speed transitions to extended memory by circumventing the keyboard controller.

UMB Pro can't convert extended memory into UMB, as can *QMAPS*. It must obtain memory from shadow RAM, EMS provided by a chip set or an EMS adapter. Both shadow RAM and EMS provided by chip sets are supported by physical upper memory. It's this memory that *UMB Pro* must use if an EMS adapter isn't present.

Fortunately, Quadtel's experience in providing original-equipment manufacturers (OEMs) with EMS firmware allows it to recognize the memory capabilities of 22 different chip sets, including all C & T ChipSets, Headland's HT12 and many others. "We're a BIOS company; so we work with a lot more chips than the competition," says its company president. It's a significant advantage on 286 systems. However, you must first provide a hardware-type parameter garnered from a table located on your software distribution disk or *Pro*'s CHIPSET utility.

UMB Pro's manual configuration parameters let you make precise allocations of memory. While it's a technical product, its familiarity with a wide assortment of logic chips improves the likelihood it will support a 286 machine.

Turbo EMS 6.0, $99.95
InfoSpotter, $79.95
Remote RX, $129.95
RenaSonce Group., Inc.
5173 Waring Rd., Ste. 115
San Diego, CA 92120
Tel.: 619-287-3348

CIRCLE NO. 116 ON FREE INFORMATION CARD

Turbo EMS provides expanded memory and access to upper memory on any AT-type system, including 286 machines with Chips & Technologies ChipSets and any PC with an EMS 4.0 or EEMS board installed. It also works with EMS 3.2 boards if they have an EMS 4.0 driver.

Turbo even provides reduced services on a PC that doesn't have a board or chip set by using emulation. Only EMS services can

be emulated, however. It simply isn't possible to relocate code into UMBs without a board or a chipset that implicitly has shadow RAM. Physical memory has to come from somewhere other than conventional memory. (There would be no advantage if UMBs used conventional memory.)

Many common services are provided. Among them are: TSRs and drivers that can be relocated to UMBs; ROM that can be shadowed; VCPI support; expansion of conventional memory to 736K for color-text applications (by recovering part of the video buffer); and adding to UMB any unused chunk of upper memory—including areas of the BIOS.

Turbo EMS also has some extensions. It provides menu-driven installation and configuration for 386 and 486 processors. It can optimize the fit when loading programs high. And it can run on really small machines, even old laptops that have just a pair of floppies. It requires only 256K of main memory and DOS 2.0 or later to run, and it can page EMS from any type of disk drive instead of extended memory. (As you can imagine, replacing RAM with a floppy drive provides considerably reduced performance.)

RenaSonce is still selling *Turbo EMS*, but probably not for long, according to partner Pat Bryan. "We're still developing the product as long as there's a demand for it, but we think that DOS is going to replace this category," says Bryan, who serves as VP and general manager. Most of the company's development effort is going into a new diagnostic product line that includes *InfoSpotter*, a system-diagnostic program, and *Remote RX*, a diagnostic with built-in remote communications.

Diagnostics

Infospotter, Remote RX, QAPlus, System Sleuth, Kickstart and like programs are all designed to diagnose troubled hardware. They include diagnostics that show you the memory installed in a computer and often the adapters and controllers at upper-memory addresses. Access to the latter information can be especially critical when installing memory-management software.

Some of these utilities also provide a list of the programs in memory and drivers and other processes installed in upper memory. They can be very useful when troubleshooting difficult installations and become indispensable if you configure systems for others where documentation isn't handy.

Conclusion

Despite the note of pessimism at RenaSonce, most EMM developers are going to continue evolving their products for the foreseeable future. Quarterdeck, for one, can't do without *QEMM* for *DesqVIEW 386*. (And it's about to assume additional importance with support for *X Windows* on commodity personal computers.) As for the rest, market opportunities haven't dried up yet. For one thing, memory on the next generation of personal computers will increase dramatically.

Workstations are already moving to 256M configurations. When it becomes common, much of those huge memories (by today's standards) will begin to migrate to the desktop personal computer. Advanced processors will also be on the scene. To remain a viable competitor against alternatives like OS/2, Unix, *New Technology (NT)*, the forthcoming Pink, and others, new techniques will have to be developed for DOS. So far, as you can see, reports of its impending death have been premature.

If DOS vendors adopt more radical tools for their own arsenals, the competition will get hotter for third-party utilities. Leading developers are already working hard to stay ahead, as the current crop of products shows, and they display an encouraging breadth of creative approaches. This is always good news for users who can depend on advances in technology to produce additional features, increased reliability, more compatibility and, perhaps, even lower prices.

On the other hand, if OS/2, *NT* or some other system comes along to replace DOS tomorrow, it's a sure bet that the memory sophisticate still stands to benefit from knowledge that helps to configure memory. You have only to look at all the memory-management options that Microsoft *Windows* provides for DOS applications and ask yourself if those thousands of applications are going to go away anytime soon to determine the odds.

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