CR-TA-92-08

CRH SSD
APRIL 1992

CENTRAL REGION TECHNICAL ATTACHMENT 92-08[1]

DOS COMPATIBILITY UNDER OS/2

National Weather Service Western Region
Scientific Services Division
Salt Lake City, Utah

A DOS compatibility feature is included in OS/2 version 1.21 which was implemented on MicroSWIS. Many sites have found that this feature does not properly run many DOS programs and, in some cases, can even crash the system. This Technical Attachment examines the technical issues surrounding DOS compatibility under OS/2; how it works, and why it doesn't always work.

The 80286 Modes of Operation

OS/2 Version 1.x is written for an Intel 80286 processor. The 80286 processor has two modes of operation: real mode and protected mode. These processing modes can be thought of as two different computers packaged into one chip. The real mode computer assumes that one program is controlling the entire system and that no other programs exist. Thus, real mode programs are concerned only with their task and assume that the computer is entirely theirs to accomplish this task; a single task machine. Conceptually, the real mode of operation is any PC running a DOS program.

The protected mode of operation was developed by Intel to execute multiple tasks. As the protected mode name implies, each task or program is isolated (protected) from every other program running on the system. Thus, if one program crashes, all other programs can continue executing with no ill effects. The operating system must implement these features of the 80286 chip. OS/2 Version 1.x implements the full 80286 capabilities. (DOS provides a minimal implementation of protected mode with extended memory (above 1 MB) addressing.)

The concept that real mode and protected mode are two distinct computer systems reflects the actual design philosophy behind the 80286 chip. Intel carried this philosophy to the point that when switching from protected mode to real mode, the 80286 microprocessor actually reboots itself. This reboot action is similar to the procedure which occurs when you hit the reset button, or turn the power off and on.

---

[1] Originally published as Western Region Technical Attachment No. 92-11, March 17, 1992.

Reasons for DOS Compatibility Crashes

Given the fact that two modes of operation exist in the microprocessor, a person can correctly assume that DOS programs running in the DOS compatibility box on MicroSWIS execute in real mode, and the actual OS/2 MicroSWIS software executes in protected mode. This situation can lead to system instability in several areas:

Performance Loss from Mode Switching

While running an OS/2 program on the screen, any DOS program which was executing is frozen. While executing a DOS program on the screen, the operating system continues executing the OS/2 programs. The overhead from switching between a DOS program and OS/2 programs is significant. For host MicroSWIS sites which have a tremendous CPU load associated with ingesting imagery, just the increased overhead of switching to real mode (the DOS program) can crash the system. The microprocessor cannot perform all the processing that is requested of it.

Remote MicroSWIS sites which receive imagery data from AFOS have a much lower cpu load. Thus, the performance loss associated with mode switching is less critical and usually not enough to immediately crash the system.

Lack of System Integrity in Real Mode

When OS/2 Version 1.x executes a program in the DOS compatibility box, the microprocessor is switched into real mode to provide the best emulation possible for the DOS program. The DOS program has access to the lower 1 MB of memory on the computer, the same as any PC which is running DOS. OS/2 tries to maintain the operation of the other OS/2 programs while executing the DOS program; thus, critical OS/2 resources must be located in this lower 1 MB of memory. If the DOS program inadvertently affects these critical areas of memory, the system will likely crash. Additionally, since the DOS program is running in real mode, if it crashes the health of the entire system is affected. Whenever the processor is switched into real mode, most of the security and stability characteristics of protected mode are compromised. Hence, extreme care should be taken when trying to run any DOS program in the compatibility box, because a DOS program was developed under the basic assumption that it is the only program running on the PC. Under OS/2, this basic assumption is always violated.

Device Contention

A DOS program can access any device on the PC (e.g., the video, serial ports, keyboard, etc.), since it is assuming it has control of the entire machine. If the DOS program accesses a device while an OS/2 program is using it, the device will likely be left in an unknown state which could eventually crash the system.

The device contention problem area arises frequently when internal NWS PC programs are run on MicroSWIS. The normal sequence of operations for a DOS program in the NWS is: (1) request a product from AFOS, (2) process this product into a new product and (3) display this new product on the screen. Since the OS/2 AFOS Request/Reply and AFOS Monitor programs continuously use the serial port, a DOS program following the above sequence will immediately cause a conflict. Only one program can access the serial port at a time. Since the serial port is likely left in an unknown state, the system must be rebooted to resume normal operations.

Solutions to the DOS Compatibility Problem

The DOS compatibility problem and solution are affected by two factors: the microprocessor hardware and the operating system. The actual programs which constitute MicroSWIS do not greatly affect whether DOS programs run or not.

During the development of the 80386 chip, Intel realized that running DOS programs (real mode) and protected mode programs as separate entities was not going to work. Hence, Intel developed a superset of the protected mode which is called the Virtual 86 (V86) mode in the 80386 processor. This new mode of operation was designed specifically to execute multiple DOS programs in a secure and isolated environment. In V86 mode, if a DOS program crashes, the system integrity cannot be compromised. Only the individual DOS program is affected.

Since MicroSWIS has an 80386 processor, half of the solution to the DOS compatibility problem already exists. The 80386 processor contains specific hardware features to implement fast mode switching between V86 mode and protected mode, ensure system integrity when in V86 mode, and ensure resource (device) mitigation and resolution when conflicts arise.

Unfortunately, OS/2 Version 1.x does not implement these features which exist in the 80386 hardware. OS/2 Version 2.0 provides a full implementation of these features and will solve most DOS compatibility issues. Some minor MicroSWIS software modifications

will be required to take full advantage of the new OS/2 2.0 features. No plans currently exist to upgrade MicroSWIS to OS/2 Version 2.0, although this upgrade is a possibility at some point in time.

Conclusion

DOS compatibility on MicroSWIS will not improve in the near future. Stations need to use caution when running any DOS program, since crash frequency rises dramatically when any DOS program is executing.