

Minding Your DMA's and IRQ's

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The most difficult aspect of configuring an AT-compatible PC to run NEXTSTEP for Intel is resolving device conflicts. It is the intent of this Radical Solution (TM) technical note to provide assistance with resolving IRQ, DMA, and Base I/O Address conflicts.

The first step to take is to inventory all of the IRQ's, DMA's, and Base I/O Addresses used by the system and by any additional user installed devices. Use Configure.app, read the device manuals and examine the devices themselves to obtain this information. Include every device whether it is intended for use by NEXTSTEP or not.

The following table illustrates the resources utilized by a standard AT-compatible system:

IRQ	DMA	Base I/O	Device
0			System Timer
1		060-067	Keyboard
2*			Cascade for interrupts 8-15
3		2F8-2FF	Serial Port COM2
4		3F8-3FF	Serial Port COM1
5		278-27A	Parallel Port LPT2
6	2	3F0-3F7	Floppy Disk Controller
7		378-37A	Parallel Port LPT1
8			Realtime Clock
9*			Redirected IRQ2
10			(available)
11			(available)
12			(available)
13			Math Coprocessor
14		1F0-1F8	Hard Disk Controller (IDE)
15			(available)

*IRQ2 and IRQ9 are equivalent and are treated as a single interrupt. Depending on the motherboard and BIOS, various combinations arise. IRQ2/IRQ9 may be mapped to IRQ2 or IRQ9 or both. Some systems only work with the device set to IRQ2 with the interrupt reporting as IRQ9 or vice versa. A side effect of the IRQ cascading worth noting is that the IRQ's have the following priorities:

High 0 1 2/9 10 11 12 13 14 15 3 4 5 6 7 8 Low.

The following table shows the default resources utilized by some common user installed devices:

IRQ	DMA	Base I/O	Device
		200-207	Game Port
2		330-338	PAS 16 MPU-401 Emulation
2		2E8-2EF	Some Video Adapters - Most Don't
3		2E8-2EF	Serial Port COM4
3		300-30F	Intel EtherExpress 16 Ethernet Adapter
4		3E8-3EF	Serial Port COM3
5/7		278-27A	Parallel Port LPT3
5	1	220-22F	Sound Blaster Sound Adapter
5	1	220-22F	PAS 16 Sound Blaster Emulation
7	3	388	Pro Audio Spectrum 16 Sound Adapter
7	5	330-333	Adaptec 154X SCSI Adapter

Some other possible areas of contention are with the BIOS and memory mapped address spaces used by some devices. This is generally not a problem but should be taken into consideration.

The following table lists the default BIOS and memory mapped address space utilized by some standard and common devices:

Address Space	Device
A000-C7FF	Video Adapter BIOS
DC00-DFFF	Adaptec 154X SCSI Adapter BIOS
F000-FFFF	System BIOS
80000000-9FFFFFFF	Video Adapter Memory Mapped

The next step to take is to note the device resource conflicts. Carefully observe the first two tables above and note some of the potential conflicts between IRQ's, DMA's, and Base I/O Adresses. Left to their own doing, devices will conflict with one another.

Once the conflicts are discovered, the final step is to resolve them. This is easier said than done. First try and reconfigure one of the conflicting devices to another available setting. If the resolution of the conflict is not obvious from the inventory taken, try to reconfigure all of the devices as suggested for NEXTSTEP. Another possibility is to configure the devices to match another working system. The remaining option is to experiment, which can become a very long and frustrating process.

The following table summarizes the resources utilized by a system that has been running NEXTSTEP for Intel without incident:

IRQ	DMA	Base I/O	Device
0			System Timer
1		060-067	Keyboard
2			(see IRQ9)
3		2F8-2FF	Serial Port COM2
4		3F8-3FF	Serial Port COM1
5			(available)
6	2	3F0-3F7	Floppy Disk Controller
7		378-37F	Parallel Port LPT1
8			Realtime Clock
9			(available)
10		300-30F	Intel EtherExpress 16 Ethernet Adapter
11	5	334-338	Adaptec 1542CF SCSI Adapter
12	7	388	Pro Audio 16 Basic Sound Adapter
13			Math Coprocessor
14		1F0-1F8	Hard Disk Controller (IDE)
15			(available)

Another possibility to consider is that the conflict may not be with another device but with the system itself. Try the devices in various slots. Make sure that the device is in the correct type of slot. There may be 8-bit ISA, 16-bit ISA, 32-bit EISA, 32-bit VLB, 32-bit PCI, or 64-bit PCI slots on a motherboard. Also try different combinations of IRQ's and DMA's for the devices. Note that DMA's 0-3 are for 8-bit transfers and 4-7 are for 16-bit transfers. In general, IRQ's 0-7 are for 8-bit devices and 8-15 are for 16-bit devices. Also check that the system BIOS is configured properly. Some systems with more than 16MB of RAM misbehave when ROM shadowing is enabled.

If all else fails, give up! Not every device will work with every other device or motherboard. That's one of the facts of life when working with AT-compatible PC systems.

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