Towards a Universal Computer Laboratory

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The Scenario

In 1989, when I first joined AUT (ATI at that time), one of the modules taught was the installation and administration of the Novell Netware 2 operating system. At that time we had the use of three computer labs with IBM compatible XT machines, booted to the network via boot diskettes. The sole networking class of 15 students was provided, in one of these labs, with 10 megabyte hard disk drives fitted to some of the computers. Because the students' server was booted from special diskettes and not from the hard disk, the students could reasonably expect to find their server software intact from one session to the next.

With the move to new premises in 1992, and increases in student numbers, the number of hard disk drives was increased, but as other users still booted from the network, the hard disks remained reasonably secure. Later, cradles for removable drives were installed, enabling students to share server hardware. We then introduced courses in other operating systems such as Linux, simply by providing additional removable drives. At that time, hard drives in the networked machines were rare.

The Problem

Upgrades to NetWare 3.12 and then 4.11 brought their own problems, but the situation changed dramatically with the introduction of Windows NT onto the workstations. This meant that every workstation booted NT from a local disk and then attached to the network. At the same time, another module was introduced requiring the installation of Windows NT Server on removable drives. To support the needs of the majority of students, the machines must boot from the fixed hard drive, while the Netware, Linux and Windows NT students needed to boot from their removable drives, without the risk of corrupting - or even accessing certain parts of – the fixed disks.

Possible Solutions

Possible solutions investigated were:

1 Allowing access to the setup program on the computers to change the boot device. This was considered too complex and error-prone, and also raised other technical problems with detection of the hard drive parameters and building of the device table.
2 Transferring the fixed internal drive into a carrier to be replaced by the networking drive. This raised disk security worries, and exchange between workstations, introducing address problems.
3 Building a circuit to be installed in the workstations to switch the interface cables from the fixed drive to the removable. Such a circuit was published recently in an electronics journal. This was considered too expensive; we had around 80 machines to modify.

The Answer

Investigation of the standard IDE interface proved interesting. We found that although there are two power supplies, and some 40 other connections involved in the interface, removal of the 5volt supply alone causes all the other connections to 'float', i.e. disconnect from the external circuitry. All we had to do was disconnect the 5volt supply from the internal drive when the removable drive was inserted in the carrier. The carrier IDE interface is connected to the same channel as that of the fixed drive, and the 5volt supply disconnected from the fixed drive by a micro-switch installed in the carrier. The setup on the computer is permanently set to Autodetect, so that any size removable drive will be detected and configured on boot-up. Apart from the extra IDE socket on the existing cable there is no internal modification of the computer required. The cost of the solution? Given a friendly technician, around $30 per unit, plus the $35 or so for the cradle and carrier if needed.

The Future?

Since configuring three of our computer laboratories with these units, we have discovered other uses for the solution.

1 Alternate use of other operating systems on workstations, e.g. supporting video capture under Windows 98 in our Multimedia labs.
2 Testing of software and other operating systems on staff machines without disturbing the installed O/S or software.

We believe that this system, along with a network isolation solution under development, is a move towards inexpensively equipping computer labs for greater flexibility and more efficient use.