

The use of multiple monitor and KVM (keyboard, video, and mouse) technologies in an educational setting

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Abstract

Having more than one screen of usable space can enhance productivity, both inside and outside of the classroom. So can using one keyboard, screen, and mouse with multiple computers. This paper (and session) will cover the author's use of multiple monitor and KVM (keyboard, video, and mouse) technologies both inside and outside the classroom, with particular emphasis on setup, configuration, troubleshooting, and use of these technologies. In addition, a practical way is presented for moving a laptop on a cart, that uses these technologies, between office and classroom with minimal effort.

Introduction

This paper (and session) will cover the author's use of multiple monitor and KVM (keyboard, video, and mouse) technologies both inside and outside the classroom, with particular emphasis on setup, configuration, troubleshooting, and use of these technologies.

In most cases, the exact method for installing and/or configuring the features depends on the version of the operating system used, the hardware used, etc. This being the case, some specific examples are given, but the reader is urged to do a relevant Internet search to find specific instructions for his or her own computer configuration.

Multiple monitors

At some point in using a computer, a user may increasingly spend more and more time moving windows on the screen, not being able to see enough. This is especially true for programming tasks, where a programmer needs to see code, debugging windows, object browsers, the executing program being developed, documentation about the program, email, etc. Often, getting a bigger monitor can be an expensive proposition, although prices keep falling. Traditionally, CRT monitors took up lots of space and used lots of power (warming up the local area in which they are used). LCD monitors are compact, use little power, and prices have dropped steadily in the past few years. Yet, larger monitors can cost significantly more than smaller monitors.

One solution to this problem is to add additional monitors. Microsoft Windows supports multiple monitors (as does Linux), except for Windows XP Home Edition, which supports only one monitor. Windows calls this feature MultiMon. However, in addition, the hardware and software drivers must be present. For a desktop, a multiple-monitor compatible video card must be used. Most

laptops in the past few years support multiple monitors, but one should check before buying one to be sure. The author has used Toshiba laptops for many years, and has had no problems using multiple monitors.

For most laptops, selecting simultaneous video mode displays the same image on the laptop monitor and the external monitor. However, if the video driver and operating system support it, the "Settings" tab of the "Display" Control Panel applet can be used to make the external monitor different than the built-in monitor (i.e., laptop screen).

The following command can make it easier to automatically invoke the "Settings" tab of the Monitor Control Panel applet.

```
C:\WINDOWS\rundll32.exe shell32.dll,Control_RunDLL desk.cpl,@0,3
```

This (Windows Me compatible) command can be assigned to a shortcut, run from a batch file, etc.

The monitors on the "Settings" tab can be moved as desired to conform to the physical arrangement of the monitors. To add another (existing) monitor, select the desired monitor. Windows asks if you want to activate this monitor. To remove the monitor (i.e., to go back to simultaneous mode), select the monitor and uncheck the option for "Extend my Windows desktop onto this monitor".

Most laptops will support an additional monitor in this manner.

Since the summer of 2001, the author has used three monitors at home and in the office. In 2002, the author started using two monitors in the classroom. In 2004, the author started using three monitors in the classroom.

The author uses the Margi Systems Display-to-Go PCMCIA/PC card to add a third monitor to the laptop. This requires an available PCMCIA/PC card slot in the laptop. Some newer laptops only provide one such slot. The Display-to-Go provides software (that conveniently appears in the tray, with the clock, etc.) to make it easy to check the status of video drivers, monitors, etc. It also provides a way to save the Desktop layout of shortcuts as Windows has an annoying habit, especially in the presence of multiple monitors, of forgetting the Desktop layout.

Most LCD monitors will work very well as long as the hardware resolution of the monitor is matched with the video card. That is, if the LCD monitor is 1023x768, then the laptop resolution should be the same. Otherwise, the image can appear fuzzy. At home, the author uses two Philips Brilliance 150P LCD monitors, at 1023x768 resolution. One is connected via a digital connection. One is connected via an analog connection. Both appear to provide the same quality image.

Not all software supports multiple monitors. In PowerPoint, for example, one can select "Slide Show", "Set Up Show", and, under "Show on:", select "Monitor 2 Default Monitor" to select the monitor where the show will be displayed. In this mode, one can see presenter notes on one monitor while displaying the full presentation on another monitor.

In class, the author uses a small computer cart/desk that has a laptop screen (i.e., the primary monitor), the second monitor connected to the classroom projection system, and the third monitor on the cart (a smaller 14-inch LCD monitor that fits nicely on the cart). This allows the author to manage classroom administration tasks, etc., on screens such that the students are not distracted. The author lets the students know that multiple monitors are being used, and that, occasionally, the mouse will be lost on one of the three screens (i.e., for a few seconds). To show the Desktop, task bar, etc., on the classroom screen, the task bar can be moved to the desired monitor.

When software is used that does not fully support multiple monitors (e.g., Equation Editor in Microsoft Word), then the author switches to simultaneous mode on the laptop while that software is being used in class.

A useful web resource for multiple monitors is the VideoSaver site at <http://www.realtimesoft.com/multimon/> [as of Tue, Apr 20, 2004]. There are programming links, usage tips, etc. Their feature software is UltraMon. The UltraMon software system can be used to get more out of a multiple monitor system. As their web site states, *UltraMon is a utility for multi-monitor systems, designed to increase productivity and unlock the full potential of multiple monitors. 1. Efficiently move windows and maximize windows across the desktop. 2. Manage more applications with the Smart Taskbar. 3. Control application positioning with UltraMon Shortcuts. 4. Multi-monitor support for desktop wallpapers and screen savers. 5. Mirror your main monitor to secondary monitors for a presentation.* The price for one copy of UltraMon is \$40 [as of Tue, Apr 20, 2004]. A trial version is available.

Another web resource is <http://www.multiplemonitors.org/> [as of Tue, Apr 20, 2004].

Keyboard and layouts

Most people use the QWERTY keyboard layout. The design of this layout, going back to the second half of the 1800's, was designed without consideration for ergonomic factors. In fact, it appears that the design of the layout was done to avoid jamming the keys. The story goes that the letters on the top row allowed the salesperson to type the word "typewriter" without leaving that row, most likely to help make the sale by impressing the user with the speed with which such a long word could be typed.

In the 1930's, Dvorak developed the Dvorak keyboard layout. The placement of the keys was designed to make typing easier. The vowels are in the middle row of the left hand. The most used letters in the middle row of the right hand. More common letters are on the top row. The least used letters are in the lower row. The placement was adjusted to make it easier to type common combinations of letters. Here is the (most common) Dvorak layout for upper-case letters.

PYFGCRL
AOEUIDHTNS
QJKXBMWVZ

Here is the Dvorak layout for lower-case letters.

```
pyfgcrl  
aoeuidhtns  
qjkbmwmvz
```

A standard Windows (or Linux) keyboard can be converted to the Dvorak keyboard layout. The following command can make it easier to automatically invoke the "Language" tab of the Keyboard Control Panel applet.

```
C:\WINDOWS\rundll32.exe shell32.dll,Control_RunDLL main.cpl,@1,1
```

This (Windows Me compatible) command can be assigned to a shortcut, run from a batch file, etc.

However, it is nice to have labels on the keycaps. Hardware Dvorak keyboards are expensive. Keycap labels seem to cost more than they should. The author designed a Dvorak keyboard layout PostScript/PDF file/page that can be printed onto Avery standard address labels, cut, and pasted onto a keyboard.

From a business point of view, it turns out that once someone has learned a keyboard layout (e.g., the QWERTY layout), it is not cost-effective to retrain that person (i.e., the payoff is not that great). However, if one wishes to self-absorb the cost of retraining, it can be done in about 40 hours. The first 10 or so hours can be very frustrating, so if you are about to try it, plan ahead. The author tried switching over to the Dvorak layout in 1984, but switching between QWERTY on the mainframe and Dvorak on a personal CP/M computer was too inconvenient. After laser eye surgery in 2002 (which went very well), the author decided to give it another try while recovering and adjusting. After 10 days, the author was sufficiently converted to not consider switching back. The only frustrating part was (and sometimes still is) that once fingers have "learned" certain patterns, those patterns can be hard to unlearn. The author has now used the Dvorak layout for more than two years, and is not planning on going back to Qwerty. This can make it inconvenient for students to use the author's keyboard (e.g., during an in-class Power-Point presentation), but does seem to make typing easier for the author. A future area of investigation is the promising area of voice recognition software that can, hopefully, reduce the amount of typing that must be done.

KVM's

Although one computer is enough for most users, there are times when one might need to use, or control, more than one computer. This is especially common in situations where network, web, and/or database servers are being controlled. Space and convenience are often issues. There is never seems to be enough space to put everything and there never seems to be enough time to do what needs to be done.

For example, three computers can take a lot of space if three keyboards, video monitors, and mice are needed. And, anyone who has tried to use more than one keyboard and/or mouse can tell you that it is not uncommon in such situations to start typing on one keyboard while looking

at a screen for another computer. While this is inconvenient, it can sometimes create problems if the right command is issued to the wrong computer.

This is a situation where one or more KVM's might be useful. A KVM is a device that allows one keyboard, video monitor, and mouse to be used with multiple computers. Thus, the name KVM.

The author has been using LinkSys KVM's for several years now and the descriptions here reflect that usage. There are larger more expensive KVM's, but most personal uses can be satisfied with either 2-port or 4-port KVM's. Both types are small boxes. Some have a button that is used to switch the computer to which keyboard and mouse signals are sent. Most recognize special keyboard signals to switch between options. If the KVM has no button, then keyboard signals must be used.

The LinkSys KVM's with buttons recognize the "Ctrl" key quickly pressed twice in succession as the signal to switch to the next computer. The LinkSys all-in-one 2-port KVM uses the "Scroll Lock" key quickly pressed twice in succession to switch computers.

A typical price for a LinkSys 4-port KVM is \$80, without cables. Cables are extra and can range from \$6 to \$20 depending on brand, length, quality, etc. The LinkSys 2-port KVM, with a button, bundled with cables, is about \$60. A LinkSys Proconnect Integrated (i.e., all-in-one) 2-port KVM switch, without a button, but with cables, is \$35.

The more expensive KVM's have their own power supply (another cable and power brick) while the smaller ones get their power from the computer's keyboard port and default to the port that is providing power.

One annoying feature is that when DOS window sessions are used (not full screen sessions), the video signal is occasionally interrupted (Windows seems to do this) on task switching and the KVM may revert to another computer. This can be annoying but does not happen very often.

Another annoying shortcoming feature of Windows is that a PS/2 mouse, once lost or disconnected, requires a reboot of the computer to re-recognize it. This can happen with a KVM if a switch is made where the mouse is not connected. To avoid this problem, the author has a spare USB mouse on the web server so that the web server does not need to be rebooted just to re-recognize the mouse.

Iogear has a several USB KVM switches that add audio support, but the author has not had the opportunity to try these systems.

Integration

Years ago, while director of Academic Computing, the author noted that the computer capability on the office desktop should match the computer capability in the classroom. [1] If the office has more capability than the classroom, the teacher will be frustrated. If the classroom has more capability than the office, the additional capability will seldom, if ever, be used. Since that time,

the author has reconciled this dilemma by putting a computer on a cart and then moving the cart between office and classroom.

The cart is comfortable enough to be used in the office. The current configuration of the cart is now described.

A UPS, uninterruptible power supply, is used to condition the power, and extend the life of the laptop battery when moving between office and classroom.

An inexpensive DSL/Cable router is used to connect to the Internet. Currently, fixed IP addresses are used in the classroom, so the router is assigned the fixed IP address, and the laptop uses DHCP to dynamically connect to the Internet. Thus, the laptop uses DHCP at home, at the office, and in the classroom. The author tried a wireless router and PC Card, but encountered problems. The current situation allows students with laptops, but no wireless card, to connect to the Internet during class (if they sit near the front and bring their own network cable).

A Gyration cordless mouse and keyboard, with USB connection of the relay to the computer, are used to move away from the cart during classroom presentations. In particular, the multimedia keys of the keyboard are useful, as they can be programmed to do certain actions (slide forward, slide reverse, etc.) when pressed. The author has actually hooked the keyboard in author-written software to do specialized tasks for classroom presentation. Here are the multimedia keys, in Delphi Pascal notation.

```
const
    VK_BROWSER_BACK           = $A6; // Browser Back key
    VK_BROWSER_FORWARD        = $A7; // Browser Forward key
    VK_BROWSER_REFRESH        = $A8; // Browser Refresh key
    VK_BROWSER_STOP           = $A9; // Browser Stop key
    VK_BROWSER_SEARCH         = $AA; // Browser Search key
    VK_BROWSER_FAVORITES      = $AB; // Browser Favorites key
    VK_BROWSER_HOME           = $AC; // Browser Start and Home key
    VK_VOLUME_MUTE            = $AD; // Volume Mute key
    VK_VOLUME_DOWN            = $AE; // Volume Down key
    VK_VOLUME_UP              = $AF; // Volume Up key
    VK_MEDIA_NEXT_TRACK       = $B0; // Next Track key
    VK_MEDIA_PREV_TRACK       = $B1; // Prev Track key
    VK_MEDIA_STOP             = $B2; // Stop Media key
    VK_MEDIA_PLAY_PAUSE       = $B3; // Play/Pause Media key
    VK_LAUNCH_MAIL            = $B4; // Start Mail key
    VK_LAUNCH_MEDIA_SELECT    = $B5; // Select Media key
    VK_LAUNCH_APP1            = $B6; // Start Application 1 key
    VK_LAUNCH_APP2            = $B7; // Start Application 2 key
```

The 30 foot range of the wireless keyboard allows freedom of movement, though sometimes the signal is lost, due to a bad connection, weak batteries, etc. Without a wrist support, however, the remote keyboard is not of great use for typing (from the author's point of view).

A zip drive and USB CD-RW drive are used for backup purposes.

A 14-inch LCD monitor provides the third monitor and is attached to the cart with multipurpose ties to keep it from falling off during movement.

A security cable is used to provide a minimal level of security for the laptop while on the cart (e.g., while in the office, left unattended for a short period of time, etc.).

When entering the classroom, three cables must be configured: the power cable, the network cable, and the video cable. The power cable is plugged into the power outlet. The network cable is plugged into the network outlet. Since the instructor classroom computer is on that line, the author added a short cable with a connector that makes it easy to disconnect the instructor classroom computer and connect the router on the cart. Likewise, a video extension cable makes it easy to disconnect the instructor classroom computer and connect the laptop. A 2-port KVM (with a button) on the cart makes it easy to do this.

At the end of class, the reverse is done. In the office, a 4-port KVM is used. Since KVM's can be cascaded (i.e., hooked together), the KVM cable on the cart is connected to the KVM in the office, allowing the keyboard and mouse on the cart to control the web server in the office.

Summary

This paper has described the author's use of multiple monitor and KVM (keyboard, video, and mouse) technologies both inside and outside the classroom, with particular emphasis on setup, configuration, troubleshooting, and use of these technologies.

References

- [1] Snyder, R. (1994). An institutional multimedia system for instructional support. Proceedings of the 8th Annual Computers on Campus Conference. Myrtle Beach, SC.
- [2] Snyder, R. (1996). A personal multimedia system for instructional support. Proceedings of the 29th Annual Conference of the Association of Small Computer Users in Education. Myrtle Beach, SC.