21.3: Software Managed Displays – Not Just an OSD Replacement

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Abstract: *This session will explore recent advances in display controllers and LCD manufacturers to implement low cost and highly reliable hardware to control and manage the display via software. With the upcoming release of Microsoft's Longhorn [Vista], all computer displays will need to have a basic functionality in their firmware to take advantage of software controls that will be integrated into the OS. However, today's display vendors have tremendous opportunities prior to the release of Longhorn [Vista] to compete for little or no cost with feature-rich display management software enhancements. This session will identify specific enhancements and benefits including color management, asset management, theft deterrence, auto rotation, zoning, and PIP.*

Keywords: DDC/CI; MCCS; OSD; Vista

Introduction

Computer users are accustomed to using software control panel solutions to setup and manage their computer's peripherals. The monitor is the lone exception.

This is because each display manufacturer creates a unique On-Screen Display (OSD), often employing a user interface that severely compromises the user experience. Monitor adjustments and menu hierarchy are vastly inconsistent from display to display, creating customer support problems and user dissatisfaction. In addition, the OSD is often unintuitive with no explanation of the controls which exacerbates to the user's frustration. The new result is the user incorrectly adjusting the display and adversely affecting the visual quality.

Control panel OSD replacements provide an elegant alternative to the crude hardware OSD while also offering the manufacturer the ability to promote the company's brand. But the ability to manage the display does not stop at simple display adjustments and software controls of OSD functions. The control panel should offer a superset of features not found in the OSD.

The biggest obstacle in creating a solution for a software managed display is implementing bi-directional communications from the host to the peripheral. The host must be able to send commands to the display and receive information back in real time. In the past, this required the addition of USB, Ethernet, Firewire, or other bi-directional circuitry which was a cost adder to the BOM. A more elegant solution would be to use the display's analog or digital cable as means to communicate bi-directionally.

The VESA DDC/CI standard does just that. The standard defines the bi-directional pipeline to control the display directly from the mouse or keyboard through the standard analog or DVI cable. This solution requires that the graphics card driver support I^2C communication and that an API is available to communicate from the host to the display.

In addition, the display firmware must have the proper hooks in place to accept commands written from the host. VESA has defined a universal set of Virtual Control Panel (VCP) codes in the Monitor Control Command Set (MCCS) Standard. These codes, when embedded in the firmware of the display, allow the host application to read and write commands to control the screen settings of the display. The cost adder for DDC/CI enabled displays is negligible as all mainstream scalers have affordable solutions that are currently shipping into the market.

With the upcoming release of Microsoft's Vista, all computer displays will be required to have basic functionality in their firmware to take advantage of software controls that will be integrated into the Vista operating system. The list of Vista required VCP codes for the display technology can be found in Microsoft's document titled "Windows Longhorn Logo Program System and Device Requirements".

Fortunately, display manufacturers do not have to wait until the introduction of Vista to be more competitive and feature-rich in today's market. Features such as color management, asset management, theft deterrence, auto rotation, zoning, and PIP are just a few enhancements that can be added to today's displays for little or no cost while positioning the displays for the next major OS release.

Color Management

Accurate Windows color reproduction on a display device requires conformity to the sRGB standard. To achieve this conformity the tonal response of the monitor must generally follow a gamma 2.2 curve. CRTs in their native state come very close to approximating this curve and simple adjustments can bring them into very good calibration. But LCDs typically vary a great deal from this ideal response curve and most suffer from severe color crossover effects as well. Software targets can be used to correct critical points along the tone curve. User adjustments with respect to these targets establish the variance in the LCD's tonal response to an ideal gamma 2.2 response curve. Based on this point data, software can calculate the overall video signal compensation necessary to cause the display to exhibit a gamma 2.2 behavior along the entire tone curve. Software then uses an intelligent agent to apply the calculated compensation at all times, achieving the desired sRGB results.

Asset Management

In any large computing environment, the importance of managing the client's hardware and software (assets) is instrumental in the Total Cost of Ownership (TCO). Displays are viewed as an investment to the overall computing solution, and require the same attention and management as all other capital assets. IT managers need the ability to view the asset and control it. Both are imperative in successfully controlling expenses and asset allocation.

However, traditional asset control implementations fell short by not controlling the display remotely over the network. Only with the introduction of bi-directional communication did asset management software finally provide the necessary control to track the display and control all functions supported within the firmware. For example, industry-standard DDC/CI bi-directional communication allows the standard monitor cable to communicate between the client's computer and display while the server can access the display directly through the client. There no longer is any need for USB or other proprietary cabling schemes that can introduce complications into the network environment. Asset management solutions not only support vertical markets such as call centers or trading floors which have specialized requirements, but can also be applied to horizontal markets, where it can be used in both small and large domain solutions. IT managers can experience a seamless integration of mixed manufacturer's displays into existing network configurations without having to update cabling or other special hardware considerations.

With remote control of the display the IT manager can send various VCP commands to the client to control and adjust the display. These controls can be sent to an individual client or a work group to adjust white point, geometry, factory default settings, or presets for display consistency. In addition, the commands can be sequenced to be sent during non-business hours for maintenance updates.

The need to control the power of the display is beneficial in effectively managing the life span of the display's lamp. The IT manager can set the power mode for the display to accommodate vacation time, unexpected sick leave, schedule holidays, and non-business operation hours.

Another benefit of this remote control is being able to limit user access to the OSD. The biggest problem with monitor support calls is caused by "pilot error". Remote access allows the display to be reset and lock out the client's access to the OSD from future tampering. All remote controls and actions can be sent to individual(s) or entire group with a single point and click.

Theft Deterrence

LCDs are very susceptible to theft due to their high price-tag and ease in "lifting" them from the host computer. Software applications can be written to minimize theft or unauthorized relocation of the display. Theft deterrence does not prevent the display from being stolen, but hinders the operation of the display once it is removed from the "theft deterrence enabled" host.

There are two possible configurations for the theft deterrence: enterprise and individual. For individual users, software can be used to create a PIN that is locked to the host computer. For enterprise configurations, PINs can be set remotely for individual clients or work groups.

To activate theft deterrence, the user must completely shut down the power by unplugging the power cord of the display AND removing the video cable from either the display or host (Note: some LCD controllers will only require power disruption to initiate theft deterrence). The assumption is that if there is theft or unauthorized relocation, then all display cables must be disconnected so the display can be removed from its current location. Once these two conditions are met, the theft deterrence logic residing in the display firmware is initiated the next time the LCD is powered up and a user-definable clock value stored in the display begins a countdown sequence. During the countdown sequence, the user must enter a valid PIN to over ride theft deterrence. Failure to enter a valid PIN before the completion of the countdown places the display into either an unfavorable or inoperable viewing mode.

Unfavorable view still provides some level of functionality for the display. This would allow the user to move the display to another system and still use the display after the theft timer value reaches zero. The display's image will be put into a mode that is less desirable, such as inverting the color ramps or placing the display into gray scale only. This allows a minimal level of visual performance after temporarily moving the display from the host.

Inoperable view makes the display unusable. Examples of inoperable view are powering down the display or setting the contrast to zero. Rendering the display inoperable lends itself to electronic signage where the owner wants the display to have no use or minimal resale value if it is stolen.

Auto Rotation

A common feature found on most flat panel displays is the ability to rotate the display into 90°/270° portrait or 180° presentation mode. The rotation is accomplished through a pivoting hardware hinge in the monitor stand or a VESA compliant arm or wall mount. The user can lift the display and rotate it into portrait mode for full page viewing or flip the display over to allow a viewer sitting across from the display to see the contents. However, the contents of the display must also be rotated, either through the graphics driver or through Pivot® software. This software control requires the user to send a command to rotate the contents either through the keyboard or mouse.

With bi-directional communications, a sensor can be designed into the display that relays the current orientation to the firmware. The host can continuously poll the display firmware to determine the orientation and then automatically rotate the contents to the current operating mode. There is no need for user intervention as the mechanism to rotate the desktop contents is handled transparently through software.

Zoning

Zoning is a hardware function that allows a region within the desktop to be selected and controlled independently of the entire desktop. Common adjustments such as brightness, contrast, and color settings can be applied to a user-definable zone without impacting the overall settings of the display. The zone can be moved or resized while maintaining its unique characteristics. Zoning allows for application tuning, where an application's window can display settings that are most desirable for the content. For example, text applications can be displayed in high contrast/brightness ratio while video can be shown in high color saturation. The display characteristics of the content can be applied whenever the application is launched.

Zoning isn't a new feature. However, trying to set the X:Y coordinates of a window from a conventional OSD is cumbersome and unintuitive. Using bi-directional communication, the control and maintenance of the zoned window can be controlled from the keyboard and mouse, thus bypassing the need to navigate through a sequence of OSD buttons and menus. The number of active zones which can be displayed and controlled is dependent on the scaler. Some scalers offer up to seven unique zones which can be defined and controlled.

Picture-In-Picture (PIP)

Multi-function displays are becoming more and more popular. These displays allow for a separate video input source such as S-Video, composite, component and/or USB to be added to the display. Traditional OSD hardware allows users to select, open and view the video source. However, the problem with most traditional OSD hardware is that the PIP window can be difficult to manage. In many cases, the PIP window is confined to a certain size and to one of four quadrants on the screen. With users accustomed to moving and controlling a software window within the desktop, bi-directional communication allows a software control panel to be designed to let users bypass the limited functionality and control of traditional OSD hardware buttons. This software control panel would provide an easy-to-use and intuitive way to select on/off, video source, visual settings , and window location and size.

Conclusion

In today's world, display hardware capabilities and end users should not be subjected to the potential limitations of a traditional OSD control. The display is an investment and its visual quality paramount to the user's computing experience. The value proposition for software control of both the common display adjustments, as well as new exciting features, will assist in the user's purchasing decision. And with Vista on the horizon, now is the time to design the necessary commands for tomorrow's operating system while adding compelling features that address today's markets.

References

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