

ARM-based Thin Virtual Desktop Client Integrating Electrical Power Control with Monitor

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Abstract— This paper proposes an ARM-based thin virtual desktop client integrating electrical power control with monitor. User can turn on/off both of client and monitor using one monitor power button. This client consists of client power controller and ARM-based virtual desktop client. The client power controller performs integrated power control. The controller detects power-on and power-off events of the monitor and controls power of the client. For power-on event, the client power controller turns on directly the power line of the client. For power-off event, the controller controls both of the power line and power management SW module of the client. The size of the client is compact and mountable to backside of the monitor with VESA mount.

Keywords— Virtual Desktop, Thin Client, Power Control, Monitor

I. INTRODUCTION

Virtual Desktop Infrastructure (VDI) [1] is used to run desktop operating systems and applications inside Virtual Machines (VM) that reside on servers. The desktop operating systems inside the virtual machines are referred as the virtual desktops. Users access the virtual desktops using VDI client through network. Users can use a thin client or a zero client or a PC client. The client receives screen data of VM and displays it to the client display. Keyboard and mouse input of the client are captured and transmitted to the VM.

There are several VDI systems supplied by VMware[2], Citrix[3], Microsoft[4], and KVM[5]. The VDI systems are combination of the hypervisor and the VDI protocol. The representative VDI protocols are PCoIP, ICA/HDX, and RDP/RemoteFX.

There are some types of clients that are a PC client, a thin client, a zero client and a mobile client. All clients except the mobile client require a

monitor to display, which is connected to client using monitor cable. The client and the monitor have its own power cable and the powers are controlled separately by the client and the monitor. Thus, user must turn on and off the client and the monitor using two power buttons.

This paper proposes an ARM-based thin virtual desktop client integrating electrical power control with the monitor. User can turn on and off both of the client and the monitor using one monitor power button. This system doesn't require special monitor and uses off-the-shelf monitor with VESA mount.

II. BACKGROUND WORKS

There are PC-based client, thin client and zero client for the virtual desktop service.

The PC-based client is that OS such as MS-Windows and Linux is mounted on a PC and a virtual desktop client SW is run on the OS. The advantage of the PC-based client is to utilize existing PC. Moreover, old PC with low performance can be used for the virtual desktop client because the virtual desktop service doesn't require high performance PC. VMware, Citrix and Microsoft provide the virtual desktop client SW for PC.

The thin client is special purpose client with CPU and memory, which is optimized for the virtual desktop service. Power consumption of the thin client is 1/10 of the PC-based client and life period is about 8-9 years. The representative clients are from HP, VXC of Cisco.

Zero client is special purpose virtual desktop client without CPU. It has higher security than the

thin client and consumers lower power than the thin client. The representative client is from Teradici[6] that supplies hardware chip for PCoIP protocol. This client is used for the VMware virtual desktop service. Other zero client is G2 zero client[7] of Panologic.

III. ARCHITECTURE OF POWER INTEGRATED VIRTUAL DESKTOP CLIENT

Figure 1 shows architecture of ARM-based thin virtual desktop client controlling electrical power of monitor and virtual desktop client.

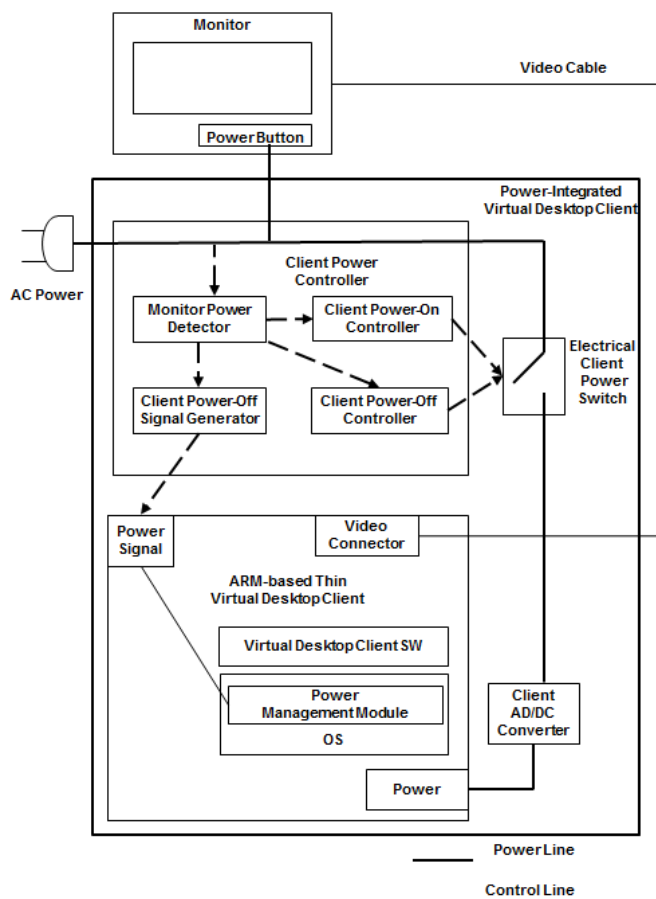


Figure 1. Power Integrated Virtual Desktop Client Architecture

The power-integrated virtual desktop client is connected to monitor with power and monitor cable. The power cable for the monitor is provided by the power-integrated virtual desktop client.

The power-integrated virtual desktop client includes client power controller, ARM-based thin virtual desktop client, electrical client power switch and AD/DC converter. The client power controller consists of monitor power detector, client power-on

controller, client power-off controller and client power-off signal generator. The client power controller controls both of the client and the monitor.

The virtual desktop client is based on ARM embedded system and a virtual desktop client SW is run on Linux of the ARM embedded system.

IV. POWER CONTROL MECHANISM

A. Power On Process

Figure 2 shows the power-on process of the virtual desktop client. If the monitor power button is on, electrical current flows through the power line to the monitor. The monitor power detector, which watches the power line to the monitor, knows this event and makes the client power-on controller to turn on the electrical client power switch. Then, the client AD/DC converter is activated and the electrical power is provided to the ARM-based thin virtual desktop client through the AD/DC converter.

The virtual desktop client starts boot-up process. When the boot-up process finishes, the virtual desktop client SW is launched automatically.

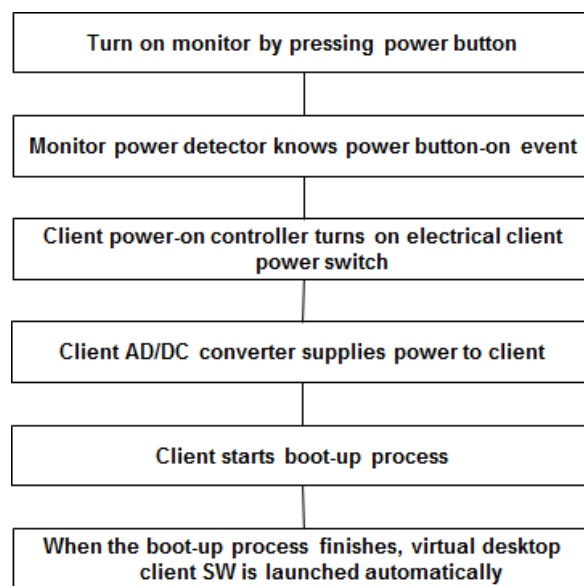


Figure 2. Power-On Porcess of Virtual Desktop Client

B. Power Off Process

Figure 3 shows the power-off process of the virtual desktop client. When the monitor power button is off, the monitor power detector knows this event and makes the client power-off signal generator to send power-off signal to the client. The

power management module of Linux in the client receives this signal and forces the client to go to power-off state. The power-off process of the client takes about 10 seconds and the power of the client should be provided for this time period. The monitor power detector waits for the power-off process time and makes the client power-off controller to cut off the power of the client by controlling the electrical client power switch.

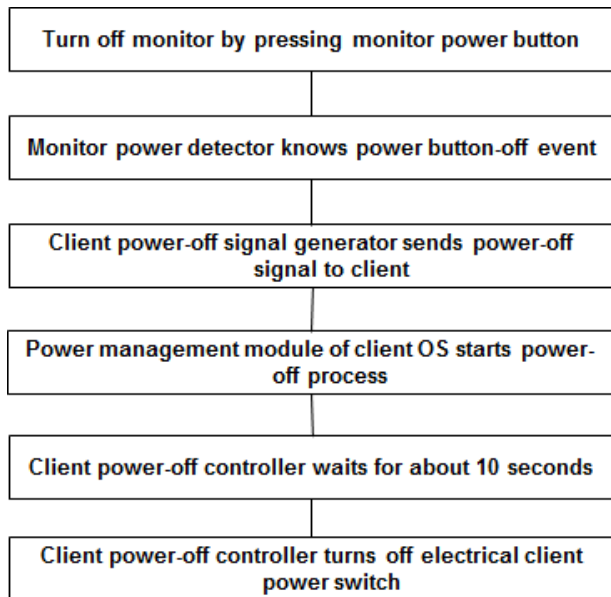


Figure 3. Power-Off Porcess of Virtual Desktop Client

V. ARM-BASED THIN VIRTUAL DESKTOP CLIENT

The virtual desktop client of this paper is based on ARM-based embedded system. The specification of the client is shows in Table 1. Virtual desktop client SW is run on this client hardware.

TABLE 1. SPECIFICATION OF VIRTUAL DESKTOP CLIENT

Specification	Descriptions
CPU	ARM CortexA9 Quad-Cord 1.6GHz
Memory	2GB
Storage	8GB uSD Card
Video	1920x1080p with HDMI cable
Audio	Standard 3.5mm headphone jack HDMI Digital
LAN	10/100Mbps Ethernet
Power	5V 2A

VI.IMPLEMENTATIONS

We implemented the power-integrated virtual desktop client as shown in Figure 4. In the photo, there are AC power cable, power line to monitor, USB/LAN port of the virtual desktop client, video connector, client SW upgrade port and VESA mount hall. The top side of the client, that is invisible in this photo, has video and audio connectors. This client is mountable to backside of the monitor with VESA mount.

The AC power cable is connected to AC power outlet and the power line to monitor is connected to power connector of monitor. Client SW upgrade port is used for the virtual desktop client SW upgrade.

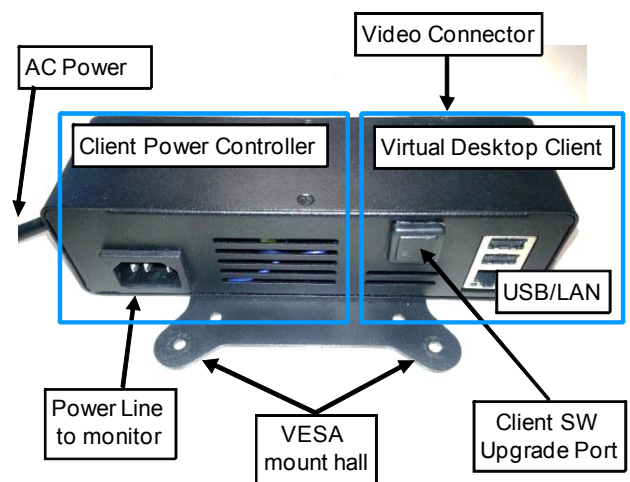


Figure 4. Photo of Power-Integrated Virtual Desktop Client

If the monitor power button is pressed, the virtual desktop client SW is finally launched as shown in Figure 5. This is the login screen of the virtual desktop client.



Figure 5. Login of Virtual Desktop Client SW

When the login process successes, a virtual desktop is delivered to the client as shown in Figure

6. This figure shows the client screen of the virtual desktop service that plays a movie. The virtual desktop client SW is run in window mode over Linux OS background.



Figure 6. Screen Capture of Virtual Desktop Client SW

VII. CONCLUSIONS

This paper proposed the ARM-based thin virtual desktop client integrating electrical power control with monitor. User can turn on/off both of client and monitor using one monitor power button. The client consists of the client power controller and the ARM-based virtual desktop client. The client power controller performs integrated power control. The size of the client is compact and mountable to backside of the monitor with VESA mount.

VIII. ACKNOWLEDGEMENT

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REFERENCES

- [1] D.-A. Dasilva, L. Liu, N. Bessis, and Y. Zhan, "Enabling Green IT through Building a Virtual Desktop Infrastructure", 2012 Eighth International Conference on Knowledge and Grids (SKG), Beijing, Oct. 2012, pp. 32-38.
- [2] J. Langone and A. Leibovici, "Chapter5. The PCoIP Protocol", VMware View 5 Desktop Virtualization Solutions, Jun. 2012, pp. 77-87.
- [3] G. R. James, "Chapter 5. Desktop Delivery Controller", Citrix XenDesktop Implementation, 2010, pp. 113-127.
- [4] T. Cerling, J. Buller, C. Enstall, and R. Ruiz, "Chapter 15. Deploying Microsoft VDI", Mastering Microsoft Virtualization, Nov. 2011, pp. 443-476.
- [5] I. Habib, "Virtualization with KVM", Linux Journal, Volume 2008, Issue 166, Feb. 2008. Article No. 8.
- [6] "Simplify and Save with PCoIP Zero Clients: Down Size the End Point", <http://www.teradici.com/products-and-solutions/pcoip-products/zero-clients>, [retrieved:October, 2014].
- [7] "Pano G2 Zero Client", <http://www.propalms.com/pano-g2>, [retrieved: October, 2014].