Dell™ Reference Architectures for Microsoft® Windows® MultiPoint® Server 2011

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Executive Summary

The Dell™ reference architectures for Microsoft® Windows® MultiPoint® Server 2011 (WMS 2011) are designed to meet various numbers of users, types of tasks, and workloads. These configurations are targeted to the needs of classrooms and training facilities, although other businesses, such as libraries, labs, and call centers, may also benefit from these configurations.

The configurations defined in this document include the following component:

- OptiPlex™ 990
- PowerEdge™ T110 II
- Magic Control Technology (MCT) devices (MWS8840, MWS8940 & MWS9940)
- ATI Radeon™ 6670 & 5670 graphic cards
- Nvidia® Quadro® NVS™ 300
- Standard USB hubs and other supported peripherals

By following the proven configurations and best practices provided in this document, customers can quickly deploy Windows MultiPoint Server 2011.

Introduction

Microsoft Windows MultiPoint Server 2011 provides a way to reduce hardware and energy costs while providing a simple-to-use, centrally managed infrastructure that allows computing resources to be shared in a classroom or even for a small business. This document outlines the key decisions the customer needs to make, as well as details some reference systems to use to deploy Microsoft Windows MultiPoint Server 2011.

What is Windows MultiPoint Server?

Microsoft Windows MultiPoint Server (WMS) 2011 is based on Microsoft Windows Server® 2008 R2, SP1 Standard, but unlike the standard server solution, it uses a single system to host multiple, simultaneous and independent user stations (sometimes referred to as "zero" or "thin" clients) that are attached either directly to the system, or by using USB or network cables to increase the distance from the host system. WMS provides a simplified IT solution for school classrooms and other businesses. It is possible to use regular PCs with this solution, but some of the key benefits, such as centralized management and energy savings, are not realized in that scenario.

The clients in a WMS solution consist of a:

- User station/Multifunction hub
- Monitor
- Keyboard
- Mouse

The station hub can be either a standard USB hub (adds more USB ports and extends the distance between the station and the host system), or a multifunction hub, which delivers not only connectivity to the end stations for their display, keyboard, and mouse, but also provides additional functionality,

such as audio (both mic and speakers out or headphones) and additional USB ports to allow a USB flash drive, webcam and other Private devices to be plugged in.

How is hosting client systems with the Windows MultiPoint Server different than a "traditional" server?

1. All processing is done on the host system.

2. Clients are simply terminals, with some extra capabilities, such as USB storage and audio.

3. Management is centralized onto the server, with an easy-to-use MultiPoint Manager console to manage the users and user stations, including specialized functions that are very useful for a classroom environment.

Hardware Requirements

Windows MultiPoint Server 2011 has two editions: Standard and Premium. These editions support a different number of end clients. In addition, the Premium version supports domain joining which can help manage the WMS server in larger and more complex, networked environments. WMS 2011 Premium can also be run inside a VM (Virtual Machine) as a guest OS, but this configuration is outside the scope of this whitepaper.

- Windows MultiPoint Server 2011 Standard - Supports a maximum of 11(10 users + 1 admin) simultaneously connected stations with no domain join supported.

- Windows MultiPoint Server 2011 Premium - Supports a maximum of 21(20 users + 1 admin) simultaneously connected stations with domain join supported.

  Note:

  The following chart, from the Windows MultiPoint Server 2011 Planning Guide*, provides minimum configurations for the listed tasks. It is strongly advised to overbuild your configuration, to ensure you are able to support multiple scenarios, such as video intensive, on selected stations.

  *Windows MultiPoint Server 2011 Planning Guide
  (http://www.microsoft.com/download/en/details.aspx?id=18482)

Application Scenario		Up to 4 Stations	5 to 6 Stations	7 to 10 Stations	11 to 14 Stations	15 to 20 Stations
Productivity-	CPU	2 Cores	2 Cores	4 Cores	4 Cores	4 Cores+MultiThreading or 6 Cores
Office, Web browsing, line-of-business applications	Memory	2GB	4GB	6GB	8GB	8 GB
Mixed-	CPU	2 Cores	2 Cores	4 Cores	4 Cores+MultiThreading or 6 Cores	4 Cores+MultiThreading or 6 Cores
Productivity + Occasional video use by some users	Memory	2GB	4GB	6GB	8GB	8 GB
Video Intensive-	CPU	2 Cores	4 Cores	4 Cores+MultiThreading or 6 Cores	4 Cores+MultiThreading or 6 Cores	4 Cores+MultiThreading or 8 Cores
Productivity + Frequent video use by all users	Memory	2GB	4GB	6GB	8GB	8 GB Thin Client: RemoteFX® USB video not recommended

Table 1.   Windows MultiPoint Server Minimum Configurations

MultiPoint Server Station Deployment Options

In the MultiPoint Server 2011, there are three major types of connections that are supported.

1. Direct Video Connected Stations

2. USB Connected Multifunction Stations

3. LAN Connected Stations (this includes zero-client stations like the MCT 9940, as well as thin-client and regular desktop and notebook systems)

4. Remote LAN-based Client Stations

The Microsoft Windows MultiPoint Planning and Deployment Guides provide excellent material covering most of the current deployment methods. See the links in the Resources section of this white paper to both documents.

Direct Video Connected Stations

This is the preferred implementation for any intensive graphics applications and workloads. Fewer stations can be attached, but the user experience for graphics work is very good, if the server is properly provisioned.

- It is important to note that all Dell testing was done with single graphics cards, in order to remain within the power and cooling envelope of the T110II and OptiPlex 990. This limits the number of direct attached stations. There are video cards in the aftermarket that have multiple DVI ports that may work, but were not tested.

- Note on providing audio for direct-connected configurations—you must obtain a USB audio device as described later in this document

USB Connected Multifunction Stations

This was one of the original deployment options in WMS 2010, and has been improved in WMS 2011 – largely due to the growth of vendors producing zero-client devices. There are many more vendor options to choose from and since these devices have been on the market for a while, some of the initial bugs have been worked out of the technology.

MultiPoint Server with USB-over-LAN stations

This is the newest deployment option for WMS 2011. Below is an illustration of MCT 9940 stations in a 10-station configuration. The advantage of a networked configuration is you avoid the cable-length limits seen in USB. The MCT 9940 (LAN) and MCT 8840 (USB), both use the same driver. The disadvantage may be a somewhat more complex setup/deployment and admin understanding—such as "what's an IP address?" The admin (typically, though not always, a teacher in the class) may have to know some basic networking knowledge — especially if there are issues with the configuration
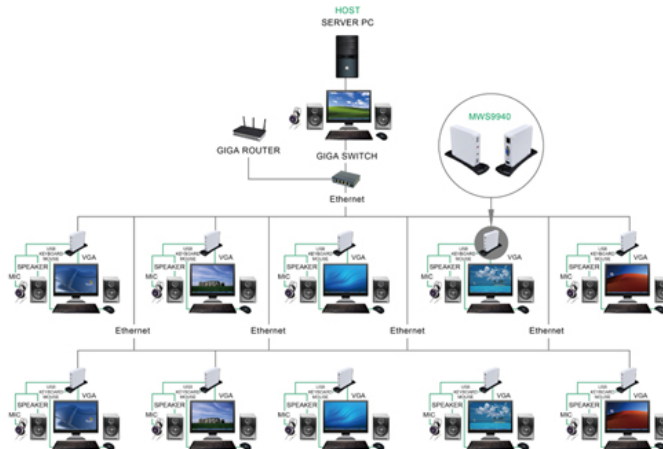
Figure 1.   MCT 9940 Stations in a 10-Station Configuration

Remote LAN-based Client Stations

These are systems (thin-client or standard PC) that connect via Remote Desktop Connection. They appear as remote stations in WMS 2011.

Windows MultiPoint Server Recommended Hardware Components

Host System

Dell reference architectures are based on the following two Dell platforms:

- Dell OptiPlex 990 - http://bit.ly/z5jTdM

Figure 2.   Dell OptiPlex 990

- Dell PowerEdge T110II - http://bit.ly/zX3wiE

Figure 3.   Dell PowerEdge T110II

A list of the key features and significant differentiators for each are shown in the matrix on the next page.

Features	OptiPlex 990	PowerEdge T110II	Key Differentiators
Processor type	Intel Core i7 series	Intel® Xeon® processor E3-1200	
	Intel Core i5 series	n/a	
	Intel Core i3 series	Intel® Core™ i3-2100 series	
System chipset	Intel Q67 Express Chipset	Intel C202 Chipset	
Memory speed	Up to 16 GB(4 DIMM slots) - Non–ECC	Up to 32GB (4 DIMM Slots) - ECC only	Greater memory capacity and ECC Memory - **T110II**
Video chipset*	Integrated Intel HD Graphics 2000	Matrox® G200eW w/ 8MB memory; Integrated in iBMC (Nuvoton WPCM450D) - optional add-in cards available via Dell S&P	Supported graphics choices - **Opti 990**
	ATI RADEON HD 6350		
	ATI RADEON HD 6450		
	AMD RADEON HD 6670 (MT only - *suggested graphics solution for Multipoint direct-connected stations*)		
Audio chipset	RealTek ALC269 High Definition Audio	No onboard audio	onboard audio - **Opti 990**
Network controller	Intel® 82579LM GbE Ethernet LAN 10/100/1000	Broadcom BCM5722 Gigabit Ethernet Controller	
Wireless	Internal Dell wireless 1520 802.11 draft-N WiFi		Supported wireless card - **Opti 990**
Drive controllers	Intel SATA 3.0 (2 for HDDs and SSDs)	PERC S100 - onboard software RAID (standard)	Greater drive capacity and also more comprehensive RAID choices and capability; support for SAS as well as SATA - **T110II** Support for SATA 3.0 - **Opti 990**
	Intel SATA 2.0 - 2 connectors	PERC S300	
		PERC H200	
Drive connections and storage capability	2 internal drive bays	Four internal 3.5" drive bays, or six internal 2.5" drive bays	
	Up to 2TB for 2 HDD config(SATA 3.0Gb/s); Hybrid, Opal SED, SSD also available	8TB for 4 HDD config and 12TB will be post RTS in Q3	
Expansion slots	1 full height PCIe x16 1 full height PCIe x16 (wired x 4) 1 full height PCIe x1 1 full height PCI	Two x8 slots (one with x16 connectors); One x4 slot (with x8 connector); One x1 slot	x16 PCIe slot for graphics - **Opti 990**
USB 2.0 support	MT (8 user-accessible ports - 4 back, 4 front)	6 user-accessible ports - 4 back, 2 front	More USB ports - **Opti 990**
Connector differences	Audio		audio and displayport - **Opti 990**
	DisplayPort		
		eSATA	eSATA - **T110II**
System management/security	http://bit.ly/z5jTdM	http://bit.ly/zX3wiE	See links for more information
Chassis	Mini-tower (recommended config for WMS2011)	Only Mini-tower	

Table 2.   OptiPlex 990 and PowerEdge T110II: Key Features and Differentiators

Key Decision Points—Choosing Between OptiPlex 990 and Dell PowerEdge T110II

Reliability – T110II

- Utilizes ECC memory for more reliable performance.

- Has more RAID choices for improved continuous availability of data

Capacity – T110II

- Greater memory capacity to support more workstations

- Greater hard drive capacity to handle increased data requirements

Configurability – OptiPlex 990

- More graphics choices and has a PCIe x16 slot for best graphics card performance—very important for video playback on client systems.

- More USB ports for basic workstation configurations

- Onboard audio to support multi-media requirements

- Optional wireless adapter (NOT to be used for wireless connection of zero-client systems, but to access the server using Remote Desktop from a PC for administrative use only.

What Else Do I Need?

Besides the host system, we outline the additional components needed to put a solution together. There are several ways to attach to the WMS 2011 host:

1. USB hub – especially important in increasing distance from the server (powered hubs only), but also used in direct-connected video configurations.

    a. An additional component for direct-connected stations is USB audio devices, such as those outlined later in this white paper.

2. Network zero-client—these use a network to attach to the WMS server. They act the same as the Multifunction USB-attached devices, but offer greater range from the server.

3. Network Remote Desktop Protocol (RDP)—regular PCs, laptops, and Thin Clients (more powerful than "zero" clients that we document in this white paper – no Thin Client systems were tested) can connect to the WMS 2011 server, but the user experience is different than a zero-client system (can implement RemoteFX).

4. Multifunction Hubs

There are several hardware vendors manufacturing WMS-compliant multifunction hubs.

Magic Control Technologies zero-client stations were the devices tested for this reference architecture document, but there are other vendor products that offer similar functionality, and are specifically designed for Windows MultiPoint Server 2011, as the MCT products are.

- Provides VGA/DVI Port support up to 1600 x 1200

- Two USB 2.0 ports for Keyboard and Mouse

- Speaker out & Microphone in ports
- Some models have additional USB ports for use with private devices such as USB storage & Webcams

  Note:

  Mixing different brand multifunction hubs is not recommended on the same WMS 2011 host due to potential driver conflicts. But if you are mixing multifunction hubs and the USB over LAN hubs from the same vendor, then make sure that the drivers support both these devices.

MWS 8820

This is an older device that was used in tests for WMS 2010. It was reused here, but the focus of the testing was on the 8840 and 8940 devices.

MWS 8840/8940 Features

MWS 8840/8940 features include:

- 1 VGA port – 4 USB 2.0 Ports
- Stereo Audio Output (Speaker/Headphone) and Mono audio input (Mic)
- USB 2.0 compliant
- Plug-and-Play compliant
- Up to 10 MWS 8840s or 10 MWS 8940s can be used with WMS 2011.

Figure 4.   MWS 8840/8940

MWS 9940 Features

MWS 9940 features include:

- Simple plug and play setup
- Simplified administration
- Up to 10 WorkStations per Server PC
- 1 VGA Port;
- 1 Gigabit Ethernet Port
- Stereo Audio Output (Speaker/Headphone) and Mono audio input (Mic)
- 2 USB 2.0 Ports for Keyboard and Mouse / Plug-and-Play compliant

Figure 5.   MWS 9940

Graphics Cards (Host System)

The OptiPlex 990 can support the ATI Radeon 6670—this is the preferred graphics solution for WMS 2011, with the highest performance of the available tested cards in that system. It is important to note that graphics cards can, in some cases, take a lot of power and require a separate power connector. It is possible to exceed the power and/or cooling envelope of a system if you are not careful. It is recommended to use the tested cards for the OptiPlex 990, but there are some low-power (no need for supplemental power) multi-port cards, such as the following:

- http://dell.to/wr7uJt

The disadvantage is that the cost of the card is high, but, if high quality graphics is paramount to the set of applications and usage, this may be far cheaper than deploying individual work stations.

RemoteFX and the T110II

The PowerEdge T110 II server has an integrated video controller (Matrox) that is not supported with Windows MultiPoint Server 2011 RemoteFX, nor do the Magic Control Technology devices tested work with the onboard Matrox graphics controller. This means you must add a third-party graphics card to the PowerEdge T110II. The Nvidia NVS 300 and the ATI 5670 were tested on this server to verify compatibility with third-party graphics cards in the platform. On the T110, if an add-in graphics card is used, the onboard controller MUST be disabled in the BIOS after the new card is installed.

The onboard controller is disabled in system setup, under Integrated Devices. Look for the Embedded Video Controller field. This field can be disabled only if an add-in video card is present. If this field is disabled, remote access features such as virtual KVM are not available. Consult your user manual for further instructions.

Note:

PowerEdge T110 II does not have a separate power connector to provide power to the graphics cards. This limits graphics card selections to cards that do not require supplemental power. The PowerEdge T110II also does not have PCIe x16 functionality to use for the highest quality graphics, however, it does have a PCIe x16 SLOT (this will accept a x16 graphics card, but will operate more slowly via the PCIe x8 capability the T110II provides).

Other Peripherals

In addition to the key components illustrated above for deploying a WMS 2011 solution, other peripherals such as the following are also required.

USB Hub

The USB hub plays two roles in the WMS implementation:

Station Hub

One is to serve as the station hub between the station and the host system in a direct-connected setup. It provides the USB connectivity to the keyboard and mouse for the end station.

WMS 2011 requires all direct-connected stations, including the admin station, to have the keyboard and mouse connected using a Station hub to the host, vs. directly attached to any onboard USB ports. The station's monitor can be directly connected to the host system (the main usage for this scenario is to run high definition videos, since video is running off the graphics card vs over USB or LAN).

> ### Note:
>
> *Some USB hubs have a hidden integrated USB hub which generates two different USB hub layers. Some ports on that physical hub are at one layer and others are at a different one. When serving as a station hub, the keyboard and mouse must be connected to ports on the same layer, otherwise, the mouse or keyboard may not be mapped correctly for that station. (In general, the USB ports on the same side of a hub are at the same USB hub layer.)*

Intermediate Hub

Another role for the USB hub is to serve as the intermediate hub between the station hub and the host system. When serving as an intermediate hub, the USB hub needs to have an external power supply.

The intermediate hub both increases the number of USB ports and also extends the distance between the station and the host—this allows WMS 2011 to be deployed over a larger area.

> ### Note:
>
> *The distance between the host and station is limited to 15 meters recommended by Microsoft, so some care needs to be taken to accurately calculate the over length of the USB cable run.*

Monitors

Depending upon the capabilities of the graphic card or the multifunction hub, both digital (DVI) and analog (VGA) monitors can be used as display for the station. The selection of screen resolution depends on the station capabilities (see MCT 8840 and 9940 video capabilities later), the number of stations, and the types of applications on the stations. As mentioned in the previous section, it is cost-efficient to use a monitor with an integrated USB hub. It can also free up table space and cut down on configuration complexity because of the elimination of external USB hubs.

Keyboard and Mouse

Multifunction hubs provide the USB connections for the keyboard and mouse. A few also have PS/2 connectors, though those were not evaluated by Dell.

> ### *Note:*
>
> *Some USB keyboards have built-in USB hub, primarily to provide a port for the mouse. As previously noted, the keyboard and mouse must be on the same USB layer, or one or the other may not work (we did see this in Dell testing with a keyboard with a USB hub embedded) These keyboards add an additional USB hub layer and the maximum level of USB hubs is limited to 5, so be very careful about keyboards that have integrated hubs. In general, it is preferred to have the USB ports in the multifunction or station hub, with no additional ports in the keyboard itself to prevent any issues.*

USB-to-Audio Adapter—options for audio, if direct-attached to graphics and only have a USB hub vs a multifunction hub

When using a multi-port graphic card to deploy the WMS 2011 as a Direct video connected setup, a USB-to-audio adapter is needed if audio playback is also expected at the station. Connect the USB-to-audio adapter to the USB station hub to provide the audio connectivity to the station user.

Here are two examples of devices Dell offers:

- StarTech.com Virtual 7.1 USB stereo Audio Adapter External Sound Card (Dell Part #: A3000641)
- StarTech.com USB to Stereo Audio Adapter Converter (Dell Part #: A1261025)

Monitors, Keyboards and Mice

A variety of Dell-branded monitors, USB keyboards, and USB mice have successfully been tested with Windows MultiPoint Server 2011. Keyboards with a built-in USB hub is the only device that presented any issues. The other item to watch out for is buying LCD monitors that do not match, or exceed, the video output capabilities of the zero-client stations. Many different LCD monitors were tested, but it is best to avoid exceeding the zero-client graphics output capabilities, or you may see the monitor run at a less-than-optimal resolution.

For the Magic Control devices:

- 8840 - Resolutions up to 1680x1050 (1600x1200 recommended)
- 8940/9940 - Resolutions up to 1600 x 1200 (1600 x 900 recommended)

Choose LCD monitors that have their resolutions in the Supported Display Resolutions at the Magic Control web site. LCD monitors offer the clearest picture when the pixel width/height matches one of the resolutions offered by the client device:

- MWS 8840 and 8940 - http://www.mct-us.com/MWS8840.html
- MWS 9940 - http://www.mct-us.com/MWS9940.html

Windows MultiPoint Server 2011 – Provisioning and Deployment Considerations

There are several key questions to answer to determine the best solution for deploying WMS 2011 in your environment.

- Provisioning your WMS server

- Provisioning your workstation hardware

- What features are important in the station?

- What software will you deploy?

1. **Provisioning your WMS server—how do you plan to use the workstations?** The chart provided earlier in this document breaks down usage into three simple categories, but do not limit yourself to these—if there are different ways you wish to use WMS 2011, be sure you cover this in your analysis—it may require some testing to verify your applications and usage model:

- **Productivity**

    Office, Web browsing, line-of-business applications (word processing, spreadsheet, PowerPoint, etc.)

- **Mixed**

    Productivity plus: Occasional video use by some users

- **Video Intensive**

    Productivity plus: Frequent video use by all users

These general guidelines can help you determine the server configuration you should plan to buy. As also stated earlier, it is important to properly size your server to meet not just the needs today, but also what they might look like in the future. The general trend towards heavier use of the internet to display video content (as well as increasing use of video in the classroom) suggests provisioning for video intensive use. In addition, with WMS, you no longer need a PC-per-user, so the idea of one rich config for 4-20 students still makes economic sense and ensures a good user experience for each station.

2. Provisioning your station hardware—Physical layout, workstation features, and ease of connecting and deploying workstations.

- It is imperative that you do an actual layout of the classroom, with desk locations and planned locations of the stations, with accurate measurements!

- Consider cable routing and accurately measure the potential cable runs (around door frames, along baseboards, avoiding tripping hazards, etc.).

- Location of power jacks, network jacks may constrain the ideal layout.

    The output from this exercise will allow you to make decisions on the type of end-user stations to use:

- o USB –
    - No more than 15 meters to station hub and no more than one intermediate hub between station hubs (see Deployment Guide - http://www.microsoft.com/download/en/details.aspx?id=18482)
    - Used for direct-attached stations via USB Hub.
- o LAN –
    - Much greater cabling flexibility and length allowed.
    - Also allows use of RDP and RemoteFX with the proper configuration. But, with RDP-connected clients, some loss of overall end station control.

What features are important in the station?

- The basics—keyboard, mouse, monitor—these are essential.

- Additional USB ports—some examples for use include USB storage—so a student can save their work created in class to their USB key)

- Audio—the multifunction USB devices generally have built-in USB audio—both output for headphones and input for a mic. For direct-connected stations, attached via USB hubs, you need a separate USB audio device as described earlier.

Outside of these hardware decisions, USB is the simplest to deploy and to manage. This is likely the better choice if you expect the teacher to connect/disconnect/deploy new stations. There are some devices on the market that include both USB and network connections on the same device. This means you can buy a single device to cover all scenarios, simplifying spares management and increasing flexibility in deployment, if you plan on a multi-room deployment of WMS 2011. Multipoint Manager can monitor and administer all of the zero-client stations.

3. What software will you deploy? This is not covered in depth in this document, but there are several key issues to be aware of:

- Licensing requirements for the software you wish to deploy—contact your software vendor for more information.

- Compatibility with WMS 2011—again, the software vendor would have the best insight into this.

- Number of users of the software—if, for example, you plan to use a software package to allow students to edit video, you need to plan for video-intensive use on the number of stations that will need access.

Conclusion—this is a product that was developed for the education market, so it's no surprise that there is "some homework" involved! WMS 2011 Premium is a solution that requires the customer or installer to conduct a thorough planning session to accurately assess the server and station hardware needed, as well as the connectivity between them.

General Performance Recommendations, Guidelines and Configurations

In this last section, we will cover what Dell tested configurations and results:

Notes:

- *Microsoft recommends at least one direct-connected station, so boot screens and hardware configuration options can be accessed*

- *The MCT devices are not compatible with the onboard graphics controller on the PowerEdge T110II, so a discrete graphics card must be added.*

- OptiPlex 990 - Tested Configuration

    o CPU – Intel® Core™ i7 2600 / 3.40GHz, 8M, VT-x, VT-d, TXT(vPro™), 95W

    o Memory – 8GB1 DDR3, 1333MHz, (2 DIMM)HDD – 2x250GB1 SATA 7200 RPM HDD – RAID 0 (performance configuration)

    o Graphics - 1GB AMD RADEON HD 6670 with DP, DVI and VGA

    - Maximum stations tested – 17

        o 10 USB-connected stations (MWS 8820 and 8840)

        o 4 LAN-connected zero-client stations (MWS 9940)

        o 3 standard systems – 2 notebooks and one desktop, connected via LAN and using RDP to connect

- PowerEdge T110 II – Tested Configuration

    o CPU – Intel Xeon E3-1220 3.5 Ghz CPU(4 Cores)

    o Memory – 8GB DDR3, 1333MHz(2 x 4 GB DIMMS)

    o HDD - 2 x 500GB SATA HDD

    o Storage Controller – Dell H200 in Raid 0

    o Graphics – 512MB Nvidia NVS 300 & 1GB ATI Radeon 5670 with DVI, HDMI and VGA

    - Maximum Stations tested - 15

        o 2 Directly connected stations

        o 4 USB Connected Multifunction stations using MWS 8940

        o 4 USB Over LAN connected zero clients stations(MWS 9940)

        o RDP connections from 5 systems running Windows 7 client OS

Dell testing was designed to truly stress the platform and to find the outer boundaries for acceptable performance. Even though Microsoft supports a maximum of 21 stations for WMS 2011 Premium, testing showed that a server supporting less than the maximum workstations utilized about 85%+ CPU. Memory use approached the full 8 GB with all stations watching high definition videos (this is why we suggest you over-provision your server!).

How to Support the Maximum number of Workstations

WMS 2011 supports 20 stations, plus one management station. How do you accomplish this? The answer is simple, but the setup becomes more complex. You must adopt a hybrid approach for your stations. This entails a mix of:

- USB and/or LAN connected zero-client stations (MCT does not support more than 10 stations of a single type, though in some of our tests, we exceeded 10 stations using a multitude of types (LAN, RDP, USB)

- Direct-connected stations (would require multi-port graphics adapters not tested in our tests)

- LAN-connected thin client or regular systems that would access using RDP (Remote Desktop Protocol)

Using all the various methods for attaching to WMS 2011 will allow you to get 20 stations connected.

In addition, if you wish to run video on all of the stations, you may have to adopt a video strategy, such as using a maximum resolution of 360p video running in a native resolution window, i.e. not full screen or scaled to any other sizes. Running all the videos in a window and using a lower resolution lowers the overall burden on the WMS 2011 server and allows acceptable frame rates and viewing. To recap, the one caveat is performance and expected user workloads—be cautious in adding workstations, to avoid overload and poor performance, or adopt a specific usage model as mentioned above.

Network connections—The OptiPlex 990 has both a single 1 Gb wired network port and wireless capability (wireless is an optional add-in card that is available). Of particular interest is the wireless card. Wireless (Dell wireless 1520 PCIE WLAN card) provides an extra option for accessing the server, but there are some definite limitations to wireless use in the OptiPlex 990 and WMS 2011. Wireless access was not tested on the PowerEdge T110II, but these observations can be presumed to be the same in that system.

Wireless Observations

Wireless testing on the OptiPlex 990 yielded the following observations:

- We tested a high-speed wireless N router, connected to the MCT LAN devices (these devices were connected using a cable to the wireless router), which were then connected to the Dell wireless 1520 card. We could not successfully get a zero-client station to work via a wireless connection. The same LAN stations worked perfectly when connected using cable, so using wireless-connected zero-client workstations is not recommended or supported (at least in our tests). Microsoft does not have any documented or supported methods for wireless connectivity of zero-client stations to WMS 2011 due to bandwidth issues with wireless, as well as overall reliability of wireless connections at this time.

- Using wireless to RDP from a thin-client or PC to WMS 2011 is also not recommended (as above, it's fine to access the server for management purposes). In testing high-definition video performance over wireless RDP (Remote Desktop Protocol), there were some quality/performance issues that make it less than desirable for this use. The wireless connected laptops and desktops, even with a single wireless RDP session, did not perform well. In a typical wireless environment, the performance would likely be worse, with multiple users accessing the same router or access point. In addition, this would likely impact all the users of that access point as bandwidth was used to support a high-definition video stream.

- Accessing the server using wireless to run administrative tasks works fine, so this is a viable use for either the IT department or teacher to access the WMS 2011 server.

Conclusions — zero-client stations should always be attached using a cabled connection (either USB or network). Wireless connections are best suited to accessing the server to run administrative tasks. Do NOT try to run zero-client stations over wireless unless this is explicitly supported by the hardware vendor and Microsoft.

Using RemoteFX

RemoteFX is a new feature in WMS 2011. Using this feature provides much better graphics with systems attached with RDP, to allow high-definition video display with LAN-connected thin-client or rich-client systems with much lower network bandwidth. The best way to check if remote FX is working on WMS is to look for the following events in the event log. To enable, you turn on "Analytic and Debug" logs (Select View and check Analytic and Debug logs). Look for the following.

```
Application and Service logs\Microsoft\windows\RemoteDesktopServices-
RemoteDesktopSessionManager
```

```
RDSH event: Microsoft RemoteFX for Remote Desktop Session Host is enabled and
a session was created
```

```
        i. Level = Information

        ii. String = "Microsoft RemoteFX for Remote Desktop Session Host is
        enabled and a session was created"

        iii. RDSH_REMOTEFX_MODE
```

```
Event ID: 1000
```

This is detailed in the following TechNet web page: http://technet.microsoft.com/en-us/library/ff817580(WS.10).aspx

Other Observations

In some tests, running video, there was a noticeable mouse lag. There is a Microsoft patch that may resolve some of these issues: http://support.microsoft.com/kb/2530453

1. When WMS 2011 is put into the maintenance mode, clients that are connected using RDP do not disconnect/logoff but they remain connected. This is a known behavior, only local stations, including direct video and USB video connected stations, will be disconnected.

2. We noticed jerky video playback when playing video from video streaming sites when played in full screen mode. Playing the video in its native screen mode will allow the video to play more smoothly (results will vary depending on number of stations watching video).

3. On a mixed setup using Direct attached stations, USB Multifunction Hubs and LAN based hubs, when the WMS 2011 system is started the Direct connected and the USB connected Multifunction stations will show the logon screen as soon as WMS 2011 boot, but the LAN based stations will take around 30 sec to get the logon screen. This is because network services must load on the server and only after the stations receive the IP address do they get a display.

4. Make sure all driver installations, including the MCT drivers on the WMS 2011 server is performed in the Maintenance mode, if done in the normal mode the stations will not be identified and a reboot will be needed to detect the stations.

5. When using Windows Media Player and playing HD video, jerky video play back may be seen on stations that are directly connected to the WMS system. To fix this issue, connect or use the USB audio adapter. Low resolution video or Flash-based video should not have this issue.

Reference

- Magic Control Technology Web Site: http://www.mct.com.tw/

- Main Microsoft MultiPoint Server 2011 Web Site - http://www.microsoft.com/windows/multipoint/

- Windows MultiPoint Server 2011 Planning Guide - http://www.microsoft.com/download/en/details.aspx?id=18482

- Windows MultiPoint Server 2011 Deployment Guide - http://www.microsoft.com/download/en/details.aspx?id=18482