Comparison of Thin Client Solutions

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Introduction

As your network grows in size, the costs of hardware, maintenance and support become issues that impact your budget and daily operations. A centralized network management strategy offers a means of reducing these costs. Implementing a network management strategy for your clients and servers may reduce the total cost of ownership (TCO) for your network. The thin client solution uses a client/server implementation that uses a server centric architecture to reduce operating costs. Client/server computing relies on a centralized server to perform all its operations. In the non-client/server environment, the client is not dependent on the server unless it requests data or print services. Integrating both kinds of client/server solutions may be the practical approach to reduce your TCO.

Scope

Several types of thin clients will be discussed, comparing their advantages and disadvantages. We will look at two network management solutions for lowering the cost of your network in a Windows networking environment. We will provide a cost analysis for implementing these two systems into a school system environment.

We will not bring mainframes and Unix into this discussion. The IBM mainframe has supported multi-user access from an ASCI terminal, called green screens, for years. The Unix Operating system can perform centralized administration and policy base restrictions as well as push technology using X-Window sessions for free. However the focus here is on the educational system and solutions available using the Microsoft Windows architecture.

Thin Client

Thin client is a generic term for a group of emerging technologies that reduces hardware, maintenance and support costs while also saving bandwidth, reducing down time and improving network security. The technology relies on the ability to manage workstations from a central point, control user access to that station, and automate software installation and updates. It includes Network Computers (NCs), Networked Personal Computers (NetPCs), Windows Terminals (WinTerms) and Direct Connect (or Ultra Thin) clients.

Total Cost of Ownership

The equation for figuring a TCO is not standardized and very customer-specific. It can be defined as the cost of procuring, deploying, managing, maintaining and supporting your information systems and staff. Although the debate continues on what components should be used to calculate this cost, it is agreed that the number is staggering. Industry studies have reported costs ranging from $8,000 to $15,000 a year per computer to maintain a PC LAN environment. A controversial 40% of your cost may be end-user labor costs. This labor cost represents time users spend maintaining their own systems, learning software and hardware, help desk personnel and co-worker support time.

Major TCO Components
- Hardware and software costs
- System, storage and network management
- General operations and maintenance
- Help desk
- Employee (self and peer) support
- Other hidden costs

Network Computers

NCs are low-cost highly scalable GUI devices that support a standard Java-based environment from which users can check e-mail, do word processing or browse the World Wide Web. They can offer stand alone functionality or server centric applications. NCs range from desktop devices to palmtops. An NC may be a computer terminal with a processor, memory and a network card capable of several functions such as browsing the Web, e-mail or word processing.

Examples of NC
- Personal data assistant (PDA)
- ISDN video phone
- Web TV interface device
- E-mail or Web station
- Pagers with e-mail send and receive capabilities
- Citrix WinFrame Java-terminal

NetPCs

A NetPC is a standard workstation that can be implemented as a stand alone (non-client/server) computer or as a server-dependent client in a client/server environment. It permits centralized management using server add on products from Novell called ZEN (Zero Effort Networking) Works, or Microsoft's ZAK (Zero Administration Kit). These products enforce policy-based access to the workstation, remote administration of the workstation, and use push technology to update or install applications automatically over the network or Internet.

Compaq produced the first NetPC with no external drives and a locked computer case (see minimum requirements below). It booted off the network and used server based administration utilities to manage and administer the workstation. This PC was called a diskless workstation.

The main functions of the NetPC are to offer flexibility and scalability. You can use it on your existing network and set up policy-based access by individuals and/or by machines. You can choose to run 100% of your applications on the central server, or just a subset of applications. You can restrict users from changing system settings and deleting files or just deliver selected applications to their desktops. This thin client approach moves the focus of support away from the workstation back to a central server to reduce maintenance costs.

Basic Hardware Components of the NetPC
➢ CPU: Pentium-II 233MHz (or faster)
➢ 32MB memory
➢ Disk: Internal hard disk as cache or local Operating System
➢ Video: 640x480 pixels at 8 bits/pixel (VGA)
➢ Audio device (type unspecified)
➢ Plug-and-play BIOS support
➢ Network interface card (Ethernet, Token Ring, V.34 modem, ISDN, ATM, T-1)
➢ Keyboard and mouse
➢ Locked/sealed case

Basic Software Components of the NetPC
➢ Microsoft Windows 3.1/95/98/NT

Server Components
➢ Novell 4.11/5.0 or Microsoft NT4.0 Network Operating System
➢ ZEN Works by Novell or ZAK by Microsoft
➢ Standard server components

Windows Terminals

WinTerms are GUI-based terminals developed by Wyse technologies for Citrix WinFrame. The client inter-operates only with a Citrix-Windows NT server and has some limitations for serial based requirements and streaming video. With a minimal amount of hardware, a Boot ROM, CPU, memory and communication port, the client can perform limited applications like e-mail, Web browsing, word processing and spreadsheets. This terminal would be good for a station where one or several limited applications can be used.

Basic Hardware Components of the NC or WinTerm
- Proprietary systems with built-in components
- Windows CE or EPROM containing Operating System
- 8-16 MB memory
- Video: VGA
- Audio device (type unspecified)
- Monitor Grayscale to VGA
- Network interface card
- Keyboard and mouse
- Locked/sealed case

Basic Software Components of the NC or WinTerm
- Java or Windows CE based with bootable EPROMs
- Applications licenses are server-based

Server Components
- Citrix WinFrame or MetaFrame (Windows NT 4.0) server Operating System
- Above standard server components (multiprocessor board up to 4, Gigabyte or greater capable, large amount of SCII Ultra Wide 2 Disk Space, etc.)

Direct Connect or Ultra Thin

Ultra thin clients allow you to attach multiple monitors, keyboards and mice to one PC. Users can share files and run applications from a shared computer. It is supported under Windows 95/98 and Windows NT Hydra. Limitations are dependent on the hardware of the shared PC. The ultra thin client also supports Citrix WinFrame, remote dialup connectivity and stand alone workstations' serial connections. The main uses of direct connect networking are found in small offices with less then 16 devices and with industry using point of sale software.

Comparing the Choices

The basic alternatives are the NC and WinTerms versus the NetPC. The ultra thin client probably does not meet the needs of a school system. The primary distinction between the NetPC compared to the NC and WinTerms terminal is the maintenance and upgrade requirements of the NetPC's hardware components. With the NC or WinTerm costs are moved to the server software and hardware. With NetPC you still focus on the server but since the applications do not run on the server you can spread the cost to the desktop arena.

Client Management

Two management strategies are present in this discussion, Citrix WinFrame versus Novell's ZEN Works and Microsoft's ZAK.

Citrix WinFrame/MetaFrame uses the NC and WinTerms focuses the cost on a big beefy server or fat server. Citrix licensed Microsoft's NT server code and redesigned it to work over its own proprietary ICA protocol supporting a true multitasking server. Citrix will work with all of the above hardware solutions--even Macintosh and DOS 286s machines. The user uses the station like a dumb terminal for Windows. All applications and file sharing happens on the server so the user cannot crash the client. The network should be robust and able to support high traffic volumes. A 100MB-switched network is recommended. Citrix is a good solution for a lab or static environment where people need to run only a few applications like a Web browser, e-mail, word processing or spreadsheet.

The zero management software approaches from Novell and Microsoft are designed to work on existing desktop PCs or the skinny NetPC. Both ZEN Works and ZAK support operating systems from Windows 3.1 to Windows NT4.0. This client workstation integrates with Microsoft's System Policies and either a Novell ZEN Works or Microsoft ZAK System Management Server. The approach is highly scalable: you can lock down a desktop PC so the user cannot make any changes or set policies by group and allow separate groups different access control. You can use remote administration to monitor and control each desktop and use push technology to push new applications and upgrades automatically to the desktop. This strategy works well for lab and individual workstations where you may want to run printing, video or other stand alone applications. There is a learning curve with this product while Citrix is more of a turnkey operation.

Advantages and Disadvantages of NetPC Systems using ZEN or ZAK/SMS

Advantages of NetPC (Systems)
- Standardized hardware
- Standardized Operating Systems
- Scalability for video or serial devices
- GUI interface
- Low cost devices available
- Distributed computing or server centric manageable
- User flexibility for most applications
- High Productivity Applications

Disadvantages of NetPC (Systems)
- Desktop devices cost 50% more than Windows Terminal
- Centralized backup may be a factor
- Hardware maintenance more costly (more moving parts)
- Security management must be implemented
- Hardware upgrades must be done locally
- Learning curve requires training

Advantages and Disadvantages of NCs or WinTerms

Advantages of WinTerm
- Less hardware (moving parts) to support
- All applications run on a centralized server
- Good fault tolerance
- GUI interface (Windows CE)
- Lower cost devices than desktop system
- Centralized backup
- Maintenance and hardware upgrade costs focus on a fat server
- Support most Windows' application suites (like Microsoft Office)
- Good security (all services run on the server and the ICA protocol from Citrix uses encryption)
- Takes up less room
- Less chance of theft
- Almost a turnkey installation and operation (company service contract recommended)

Disadvantages of NC or WinTerms
- Proprietary hardware
- Not scalable for video or serial devices
- Cost is not much less than a desktop system
- Not able to do distributed computing

Market Scan for Cost of NetPC and Citrix NC/WinTerm

NC/WinTerm
- Web Browsing
- E-mail
- Word processing
- Spreadsheets
- Audio
- Video streaming (not yet)

NetPC/workstation
- Web browsing
- E-mail
- Word processing
- Spreadsheets
- Audio
- Video Conferencing
- Web based learning
- Video Streaming

ZEN Works or ZAK Zero Management
- Client can be a stripped down PC, Windows operating system required
- Client can be standard PC, Windows operating system required
- Client can run applications on or off the server
- Client has increased hardware maintenance and upgrade
- Zero management is supported on existing Novell and NT servers
- Existing network architecture supported
- Client security dependent on network security design (server must be secure)
- Implementation has lower start up costs

Citrix Management Implementation
- NC/WinTerm Client dependent on server to operate
- Client can be NC/WinTerm/workstation/NetPC/MAC
- Clients security is safe using ICA protocol (server must be secure)
- Existing network requires switched 100MB LAN
- WinTerm/NC require less maintenance
- Fat server required to support clients
- Large up front cost to implement
- Legacy PC (even 286) CPUs can operate as a Windows Terminal

COST for 100 PC Network

ZEN Works/ZAK Zero Management	ZEN Works	ZAK/SMS
Workstations P-II 233, 32MB, 14" monitor, sound, 2.3GB HD $699x100	$ 69,000	$ 69,000
Internetworking (VLAN switches, inside wiring, router not included)	$ 32,000	$ 32,000
Server (Netware-1 Server) (NT-2 Servers)	$ 8,000	$ 16,000
NT 4.0 Server O ($750-10 user + $225-20 user client)		$ 1,875
ZAK System Management server software ($211.50/5 user)		$ 4,250
Netware 5.0 Server OS (250 user license)	$ 999	
ZEN Works Management software ($25/station)	$ 2,500	
TOTAL	$112,499	**$123,125**

Citrix MetaFrame	
WinTerm/NC ($999x100)	$ 99,000
Internetworking (VLAN switches, inside wiring, router not included)	$ 32,000
Server (Data General) 2 servers $10,000 each	$ 20,000
Citrix MetaFrame server software (SRP 5995 for 15 user + (5-, 10-, 20- or 50-concurrent users for $995, $1,995, $3,990 or $9,975)	$ 17,955
Windows NT OS-Terminal Server OS	$ 1,499
Load balancing secure ICA services ($2,495/server)	$ 4,990
Server maintenance contract not included--costs vary	
TOTAL	$175,444

References

"Desktop clients: A Cost of Ownership Study," Anzer Business Systems.
   http://www.anzer.com/tcscwyco.htm

" Network Computer Technical Standard", The Open Group.
   http://www.opengroup.org/onlinepubs/9627999/toc.htm,

"Study Shows Systems Management Server Dramatically Reduces Cost of Ownership,"
Northeast Consulting Resources, Inc.
   http://www.microsoft.com/smsmgmt/exec/ncriexecsum.asp

"Thin World Technology," StamiNet, Inc.
   http://206.96.42.32/technology/technology.htm

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