

Thin Client Networks



Mary logs onto the school server from the Network Computer at the back of the class and goes straight to work on a project that she had started work on the previous day in the computer room. She has exactly the same access to all her files, programmes and Internet as the day before. She finishes off her project and prints it to the central colour laser printer and then goes and collects it.

What is a Thin Client Network?

A thin client network operates by concentrating computing power on a central server, with 'client' machines (i.e., computers connected to the network) doing less computing locally. In fact, the central server performs most of the computing tasks, stores data and hosts all the software applications. This allows low-powered computers and older, outdated desktop machines to run applications that normally would require higher specification computers.

Main Advantages of a Thin Client Network.

- Highly reliable system that delivers dependable computing for schools
- Technical issues are minimised for teachers, as they are centralised on a server(s)
- Limited risk of virus attack– as virus management is centrally controlled on servers(s)
- Standard personal desktop, programmes and data files available from any login point
- Small silent thin client computers that consume less energy and produce less heat

Main Disadvantages of a Thin Client Network.

- As the server(s) is critical to the operation of all computers on the network, there is a higher impact to the school if the server(s) fails. A redundant application server (i.e. a second server) is required in case of failure with the main application server.
- A higher level of planning is required to ensure that all parts of the system work properly together, hardware, software etc.
- Technical expertise is more specialised and as a result may be more expensive.
- All computers need to be connected to a thin Client server in order to operate. Standalone PCs cannot avail of server based learning applications

A thin client network consists of the following four elements:

(1) Server

The central server in a thin client network is often called the 'terminal server'. It is a powerful, high specification machine, capable of handling a large number of logged-in clients. It should:

- Be a multi-processor system (i.e., have two or more processors)
- Possess a minimum of 40MB of memory (RAM) for each client on the system
- Possess an additional 500MB of memory for the operating system
- Have a large storage capacity as all information will be stored on the server
- Be located in a secure locked room and only accessible to the network administrator, as all of the client systems depend on it for their computing power

This means that a typical school server with 35 client computers attached would need about 3GB of memory (RAM) and a twin processor configuration. *Remember, in a thin client network if the server is not fully functional, none of the client machines can operate.*

(2) Client Devices (Clients)

Simply speaking, a client can be defined as a 'user' (in the context of a client/server relationship). There are a number of devices that can function as clients, but from a school's perspective, desktop computers are the most familiar type of device. Client devices can be categorised as follows:

Desktop computers

Ordinary PCs can be connected as clients, but as all of the processing associated with the software programs being run is carried out on the server, much of the PC's power/functionality may not be used to its full potential. Older, 'outdated' PCs can also be used as client devices, as their low-end specifications do not directly affect their ability to run more sophisticated software programs. However older PCs have an inherent higher failure rate due to aging hard drives, power supplies, and older operating systems that are not as stable as current versions. Generally, if these older legacy PCs experience failure, the cost of repair is prohibitive relative to the cost of a new PC.

Devices optimised for thin-client computing

These clients are effectively 'dumb' terminals. Their main function is to act as a means of connecting to the computing power of the server. As the list below indicates, such devices have fewer components than normal PCs.

- Microprocessor
- No hard disk
- No floppy disk or CD drive
- As few moving parts as possible
- Only 256MB to 512MB of RAM.

Portable handheld devices

These devices may be connected to a thin client network using wireless networking technology. This adds a mobile dimension to the network.

(3) Network Infrastructure

Clients are connected to the terminal server via cables. As a general rule, these cables should be capable of transferring data a minimum of 100Mbps (see Advice Sheet 18). A wireless infrastructure for networking the machines is also an option, however fixed networking is recommended.

(4) Software

Windows 2003 and Linux are the two operating systems most commonly deployed on servers. The entire range of application software being used by the school needs to be installed on the server. When in use, software may appear to be running on the desktop or client computer, but it is actually running on the server.

The software installed on the client computer allows it connect to the server. Each client uses a 'protocol' to connect to the server. The two most commonly used protocols are Citrix Metaframe Independent Computing Architecture (ICA) protocol and Remote Desktop Protocol (RDP).

There is another model for thin client computing which involves the use of Java and requires the processing of the data on the client device. However, given the software titles typically used in schools, this model is currently not implemented widely.

Technical Considerations

There are numerous advantages to using thin client networks in schools but the most compelling one has to be the ease with which large numbers of clients can be managed.

- The system administrator updates and maintains the clients by managing the server and its resources. This eliminates the need to install software on individual clients as they are added to the network. Simply connect it and give it the appropriate rights.
- One of the main advantages of a thin client network for teachers is the uniformity of desktop and the increase in system "uptime". If one client is working they generally all are working.
- New applications and upgrades only need to be loaded onto the server once. They then become instantly available on all client devices, regardless of age, platform or hardware configuration.
- Not all software for schools is designed for use in a network situation and some will absolutely require that it is run on a stand alone PC. Check out the software by actually testing it first before you purchase licences for your school.

- Thin clients use less bandwidth than other networks as there is much less data travelling across the network in this arrangement. In fact, keystrokes, mouse clicks and screen images make up the bulk of the data being transferred.
- Because the server handles all application processing and memory demands, legacy computers can function as a thin client and still run up-to-date software, however technical support costs on older PCs are higher due to higher failure rates.
- Devices specifically designed for thin client networking or 'native' thin-client hardware devices offer particular advantages. They are more reliable and require less technical support, troubleshooting and set up time, thereby leaving more time for teaching and learning.

Purchasing Considerations

Setting up a thin client network with 30 client computers is generally no more expensive than setting up a standard PC network of comparable size. However depending of the exact implementation, capacity required, level of redundancy of servers, level of technical support etc costs will vary. However, the total cost of ownership¹ can be lower than for standard networks. Thin clients reduce maintenance and support costs at the desktop level, as technical support costs are generally centralised. Thin Client PC failure rates are generally much lower than standard network computers.

Other issues to consider include:

- Graphic-intensive programs do not work very smoothly due to the restricted bandwidth – test such programs prior to purchasing them. Flash animation running in a web browser is usually fine.
- Thin clients will not replace stand-alone PCs for multimedia creation, video-editing, large file photo editing or viewing large video clips. In nearly all schools running thin client networks you will find high spec PCs connected to the network as well. This type of mixed network is the ideal for handling all the needs of an average school.
- There is a huge learning curve involved in the use of Windows 2003 server, or Linux, particularly if the teacher acting as the network administrator has no previous experience of these systems. An external support contract with a proven supplier is both essential and recommended.
- Response times will suffer if there is inadequate computing power. Also, what one user is doing on the server will impact upon the performance experienced by another user if there is only one server involved in the system. Ideally, you would require at least 3 servers for the optimum performance in a school scenario with say 30 to 50 clients logging in. A server acting as *domain controller*, a server configured to handle *file and print* operations and lastly an application server. With a system such as this you could add application servers as your number of clients increase. At least 2 application servers operating in a redundant load sharing mode is recommended.
- The licensing costs for the Citrix protocol software for connecting the thin clients to the server is expensive for schools and has an annual fee if you wish to avail of the upgrades.
- Linux Terminal Server Project (LTSP) is an add-on package for Linux that allows many people to simultaneously use the same computer. There are many resources available on the web for helping to set up a system such as this. However, if the school loses the Guru teacher who sets up such an Open Source thin client network then it may find it very hard to find an external IT company willing or able to support their system.

¹ The total cost of ownership (TCO) is the sum all the costs (including time) spent on technology integration from purchase to disposal, including maintenance, support, downtime, user administration costs, upgrades, updates and other costs.

Relevant Web Sites

The Thin Planet

www.thinplanet.com

Thin Planet, a resource centre for Thin Client and server-based technologies. Their aim is to accelerate the broad acceptance of thin client and server-based computing technologies.

The LemonLink Project

www.lgsd.k12.ca.us/lemonlink

A major schools based, thin client project based in California. They have developed a unique infrastructure that connects a large number of schools to a central server farm via various technologies.

The Hermes Project

www.hermesnet.ie

An NCTE/DES project that connects 9 primary schools in the north County Dublin area, via a WAN, to a central server farm using broadband wireless links. Over 300 network computers and 100 PCs are in use in the 9 schools.

Linux Thin Client Project for schools

<http://k12ltsp.org/contents.html>

K12LTSP is based on RedHat Fedora Linux and the LTSP terminal server packages. It's easy to install and configure. It's distributed under the GNU General Public License. That means it's free and it's based on Open Source software.

Wikipedia

http://en.wikipedia.org/wiki/Thin_client

Reference material on thin clients, A good overview of Thin Client technology and the range of issues involved.

Note: While the advice sheets aim to act as a guide, the inclusion of any products and company names does not imply approval by the NCTE, nor does the exclusion imply the reverse. The NCTE does not accept responsibility for any opinions, advice or recommendations on external web sites linked to the NCTE site.

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