



## Thin client technology and schools

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## 1. Introduction

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Many schools, while recognising the value that IT can bring to both administration and learning, have a patchwork of technology that has been pieced together from many sources over the years. Such a piecemeal approach, though forced out of necessity, requires a greater amount of time and money to be spent supporting it – money that is being diverted from investment in newer technologies.

While it may appear impossible to solve this problem cleanly, the key is to reduce the time and money that is being spent on individual desktop computers by migrating to a shared thin client infrastructure.

This white paper looks at what a thin client environment consists of and examines the benefits that it can bring to schools. We also offer some advice as to the process of implementing a thin client solution.

## 2. What is thin client computing?

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### 2.1 A short history of computing

It is hard to think back now and realise that it was only just over 20 years ago that computers were massive mainframe systems that were affordable by only the largest organisation. The mainframe was usually an enormous box with lots of flashing lights in a climatically controlled environment. All processing was carried out by the mainframe and users worked on dumb terminals via text commands.

This centralised processing environment was easy for the IT manager to administer as, everything was “pulled” off the server, they could control exactly what applications and data the user had access to. This central control meant that mainframe systems communicated over slow networks using proprietary software.

When IBM first released the PC in 1983 distributed computing became the norm. This was computing personalised to the users needs giving them the ability to decide which software they wanted to do their job. This increased flexibility and choice also had a downside with additional costs, as software had to be deployed to every user’s PC and consequently increased the costs of supporting them.

Distributed computing requires a large investment in “fat” client architecture to ensure that users can run the application they want locally. This means not only systems with large processing power, memory and storage but also “fat” network connections to ensure that they can communicate and share information quickly as well.

Thin clients are effectively the best of both the mainframe (centralised) and PC (distributed) worlds, and are the next step in the evolution of computers.

### 2.2 Thin client components

There are 4 basic components in a thin client solution:

- Network infrastructure
- Application server
- Thin client device
- Software

#### Network infrastructure

The connection between the server and the client device needs to be of the right bandwidth to ensure that users are not affected by slow data transmission rates. Unlike fat clients which need to access the network to download programs and data, thin clients only exchange small packets of information (usually keystrokes and display changes). Consequently high speed connections are only necessary between servers. The connection between the thin client devices and the server can be at a greatly reduced speed and accordingly cost.

## Thin client device

Any device connected to the application server via the thin client protocol is called a thin client device. Virtually any new or legacy PC can be connected and run as a thin client as well as being used as a traditional PC for localised work. If you want to give your users access to standard Windows applications, you can do this by running their PC desktop packages centrally on a Windows application server running operating systems such as Microsoft Windows Terminal Server or Citrix MetaFrame. This architecture is currently the dominant way that thin clients are deployed.

However the term thin client is also used to describe a particular type of hardware device that is optimised for use in this environment. In this case a thin client is smaller than a typical desktop PC and contains fewer parts to go wrong (typically it contains a processor, Ethernet network capability, a video subsystem and enough memory to run the software to connect to the server). It does not have any drives and is usually purchased in a sealed case without openings.

Thin client devices like these usually last longer, require less energy to operate and are easier to upgrade. Some also come complete with monitor, keyboard and mouse. They have the added advantage that they can be used to access more than server based Windows applications. These include:

- Web based applications using HTML/XML or Java - Web based computing is where applications are deployed using a form of HTML or Java or a mixture of both. Applications and data are hosted on geographically remote servers and are connected to the Internet. Web browsers can then be used to access the application and data.
- Legacy green screen applications - This form of server based computing refers to older mainframe, mini-computer or UNIX applications running centrally and accessed using ASCII text terminals.

## Software

Most software applications can be accessed by a thin client. It is important that, as part of the implementation process, the compatibility and suitability of applications should be thoroughly tested to ensure that no problems will later occur.

## 3. The benefits to schools of thin client computing

To the end user of the device, a thin client looks and behaves like an ordinary PC, but they are less expensive, faster, more durable and easier to maintain and upgrade. Additionally, they can provide schools with the following benefits:

### 3.1 Increased reliability and consistency of technology

In a school environment where pupils have regular network access, their natural curiosity can lead to inadvertent and sometimes deliberate acts of vandalism to the network, software and hardware. The resultant downtime and network outage leads to disillusionment with the reliability and dependability of the IT infrastructure, for both staff and pupils.

With a thin client environment, all data and applications are held securely on the central server and only keystrokes, mouse clicks and screen images travel across the network. When students log in, the server automatically provides them with their preconfigured desktop configuration: they only see the applications and data they use and access to system controls and other applications and data is prevented.

#### Case Study

Kirbie Kendal High school, in Cumbria, had over 1300 users accessing an insecure network via a variety of desktop operating systems. This allowed students to easily bypass the existing security arrangements and access or create inappropriate files as well as vandalise workstation operating systems.

As a result of constant system crashes and server reboots work was often lost and the confidence of both staff and students in the network was low. This led to little use being made of the IT investment by staff, and students were obtaining poor results in subjects that required the use of IT.

Novus Networks implemented a thin client solution to provide a single, integrated and consistent access infrastructure with the result that the school now has a highly resilient and secure network that greatly benefits staff and students enabling them to fully integrate IT into their learning.

### 3.2 Reduced cost of technology

The true cost of technology is not just the initial costs of hardware and software, but also the cost of supporting the IT infrastructure over time. Many schools fall into the trap of not budgeting for these support costs and as a result they tend to be hidden, even though they can be as high as the initial purchase costs.

When a school recognises these true costs, it can take control over its budget by modifying its computing environment to enable it to reduce total costs over time. In a thin client environment, services are centralised on a server rather than distributed on desktops throughout the school. This means that the time and cost need to maintain, support and upgrade the thin clients is dramatically less than for a traditional computing environment.

In addition the reduced requirement for processing power and memory at the client means that either lower cost dedicated thin clients or older, lower specification PC's can be utilised.

## Case Study

Reddish Vale school, in Cheshire, was able to extend the life span of their PC's from 3 to 7 years (3 years as a fat client and 4 years as a thin client) by implementing a thin client solution from Novus Networks. This enabled valuable IT budget to be spent on peripherals such as Interactive white boards and VLE.

In addition second hand equipment can now be utilised to replace failed PCs, it has been calculated that this equates to an annual saving of £16,000

### 3.3 Increased security

By concentrating data, applications and processing power onto a central server(s), the thin client model reduces the security risks of data loss and equipment theft. It also reduces the backup requirement of the school as there will only be a need to backup the critical server(s), rather than many desktops, to ensure that rapid recovery from a catastrophic situation can be achieved.

In addition by only allowing students access to the data and applications they need, the chances of deliberate or accidental damage to network resources is greatly reduced, leading to reduced support costs and increased resource uptime.

### 3.4 Enriched learning experience

The low resource requirement of thin client solutions and the fact that the same desktop environment is presented to users irrespective of where they login means that pupils and staff can access their applications and data from any Web enabled device from home or any location they choose.

This enables them to personalise their learning by working at times and locations that are convenient to them. This in turn will increase motivation and the desire to complete work on time.

Thin client solutions are now capable of supporting rich multimedia applications enabling learning to be carried out away from the classroom.

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## 4. How thin clients can be used in schools

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Thin clients can provide schools with a reliable and secure solution to increasing IT ownership costs. They optimise network utilisation, provide access to new applications from older PC's, keep data secure and provide IT support staff with more control.

In addition there are a number of unique features that help to enhance the educational environment:

### 4.1 Shadowing

Shadowing allows a teacher to access a student's desktop in real time, enabling them to solve a problem without having to go to the student's workstation. This feature is particularly useful in distance learning.

Shadowing can also be used for staff development and mentoring, allowing a trainer to access the desktop remotely and show the teacher how to solve a problem.

Although a number of applications provide similar features, it is only the thin client solution that performs this function at the server, rather than the desktop, reducing the computing and network resources required.

### 4.2 Machine independence

With a thin client solution the desktop configuration that the user is presented with when they logon is the same, irrespective of the device or physical location they login at. Consequently a student will see the same icons and buttons and have access to the same applications and data whether they login in the IT suite, their classroom or from home.

Similarly teachers are presented with their same desktop configuration whether they are checking e-mail in the staffroom or planning lessons from home.

### 4.3 User groups based on needs

A thin client solution allows a school to setup user groups on their IT system with privileges and application access defined by the IT support staff. These user groups can be easily focused around specific subjects or curriculum making new resources and applications quickly available to all members of the group.

## 5. Implementing a thin client solution

Although many commercial organisations have implemented thin client solutions, the concept is still relatively new to schools. It is important that any school implementing a thin client solution develops a fully costed plan before they commence, otherwise costly mistakes may be made.

### 5.1 Analyse the existing IT infrastructure

The first decision is to determine which parts of the current network to migrate to thin clients based on the school's strategic goals, budget and availability of software. At this point it is necessary to review and test the existing network to ensure that it matches the current documentation, to identify any weaknesses and set performance benchmarks.

From this analysis it will be possible to decide which parts of the current network (servers and workstations) can be integrated into the new system and which need to be replaced.

### 5.2 Determine needs

The actual equipment requirement will be dependent on who uses the network and how. Firstly it will be necessary to define the needs and requirements of the primary user groups (students, teachers, administrators etc). This will then allow estimates to be made for bandwidth requirements based on factors such as:

- The number of applications users will run concurrently
- The number of concurrent users logged in at any one time
- The maximum and minimum for these numbers

### 5.3 Determine equipment needs and budget

With the organisational and user needs mapped against the current IT infrastructure, it is now possible to ascertain what the new equipment requirements will be and assess this against the available budget.

It will then be possible to develop a full project plan with timescales, deliverables and hardware and software requirements. The plan should consider:

- ∑ Facilities upgrade (electrical, Ethernet wiring etc)
- ∑ Network upgrades
- ∑ Server testing and configuration
- ∑ Application testing, installation and configuration
- ∑ Thin client installation

## 5.4 Application testing

It is important that all applications that are intended to be run on the thin clients are rigorously tested beforehand. The graphic-rich applications used by many schools need particular attention to ensure that they can perform satisfactorily in a thin client environment.

In addition older applications, such as those written for DOS and Windows 3.1 environments need thorough testing to ensure they will run satisfactorily.

## 5.5 Server configuration and testing

Servers should be configured and tested on a non-critical part of the network, with a number of the required user groups set up probably at generic level. Further detail can be added to the user groups as testing continues.

## 5.6 Client testing

All the applications and system settings are determined at the server. This should mean that installing the clients is just a case of plugging them in and switching them on. But problems like slow response and application view issues will require network or server adjustments.

It is usually a good idea to start with a small pilot to ensure that problems will be quickly identified and solved before the whole project goes live. This will also help to prevent demotivation of users during the "bedding-in" period when things will go wrong.

## 5.7 Full installation

Once the servers and clients have been tested and problems solved, it will be then be possible to move to a full installation across the school. During this time all applications should be tested by simulating classroom activities and constant checks made for bandwidth utilisation and application performance.

Full training should also be given to the relevant system administration staff together with the necessary system documentation to enable the rapid troubleshooting of common problems.

## 5.8 On-going review

Once the system is up and running it will be necessary to carefully monitor factors such as application and bandwidth utilisation to ensure that any fine-tuning that needs to be carried out to maintain peak system performance is dealt with promptly.

Regular diagnostics should be run and service levels set for performance. This will also help to identify thresholds for future project reviews and upgrades.

## 6. Conclusion

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The idea behind thin client computing is simple: centralise computing power, storage, applications and data on centrally based servers and provide users with less expensive client devices that are easier to install and cheaper to support.

Many schools that are faced with an ageing IT infrastructure cannot adopt the “rip and replace” strategy of commercial organisations. A thin client infrastructure removes the need to do this and allows older and cheaper PC’s to be used for longer, while at the same time releasing funds to provide the latest software and other technology.

The thin client model offers schools a realistic and cost effective way to acquire and effectively manage new technology and make it freely available to staff and students.