



White Paper on

## **Thin Client Benefits**

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## Executive Summary

"Thin-client computing can significantly lower your operating costs, increase the quality of your support and reduce your risk," according to Barrie David of Newburn Consulting.

More than ever, business leaders are focused on growing revenues, containing costs and providing a higher level of customer support, whilst reducing the cost of business support activities, such as IT costs.

One method of achieving these apparently contradictory goals is through the use of thin-client computing. This is certainly a view held by many industry pundits such as Gartner, who are predicting a 50% increase in thin-client device sales in 2002.

The fundamental approach behind thin-client computing is simple. Instead of running all applications locally on PCs with all of the associated challenges and costs, applications run centrally and simply deliver screen updates and inputs to clients. If the concept sounds familiar, that's because it is effectively mainframe computing and dumb terminals on steroids! All the benefits of centralised servers and support staff are realised as are most of the benefits of powerful PCs on desks, including popular Windows applications.

The financial case is clear: thin-client computing can save 30%-70% of your IT costs. Centralising servers and server support staff leads directly to higher utilisation levels. Simplified software deployment radically reduces rollout costs. Longer lifetimes of windows-based terminals reduces capital expenditure. Reduced power consumption directly lowers energy costs, and indirectly lowers cooling requirements.

Thin-client computing is a sound strategic move - mergers and demergers are a fact of life in the current climate, as are decisions to out-source, out-task, in-source, change suppliers. Thin-client computing vastly simplifies this process. Adding a new site involves adding WAN & LAN connectivity and deploying devices, without a prolonged need for on-site support staff. No remote servers, no desktop configuration, no need to redesign and integrate e-mail architectures. In many cases, the end-user can connect the device and be working within minutes, without doing any configuration themselves. Out-sourcing desktop management? Just give remote access into your servers and it's done.

Naturally, it is not a one-size-fits-all solution. Users will generally not have access to floppy and CD drives. Nor will they be able to install applications. Server security and resilience is more important than ever. A server failing will affect everyone connected to that server. It is not suitable for users without a form of network connection or those using highly graphical environments such as CAD. Legacy and bespoke applications may require redesign.

In practice, most companies opting for a thin-client computing model will select a hybrid solution, with the majority of deployments on thin-clients and the remainder on either laptops for mobile workers or local PCs for power-users.

In order to achieve the maximum benefits possible, significant effort should be placed into planning the design. It is essential that companies engage with partners that have practical commercial and technical experience in achieving these successes. Service level agreements, purchasing, user requirements capture, LAN/WAN, telecoms, server, desktop, terminal services and application integration are just some of the skills that you'll be looking to ensure your chosen partner can demonstrate.

## Introduction

Businesses are growing, streamlining, decentralising, centralising, out-sourcing, in-sourcing, merging and de-merging more rapidly than at any time in the past. Central to many of their concerns is, "how do we make our IT work together, cost-effectively? Do we run disparate operating systems with associated costs, or bite the bullet and integrate/replace them for a significant up-front cost? Do we have to go through this again with the next change?". Desktop builds, hardware and software, will almost certainly be different, as will WAN service providers.

One way of reducing the costs associated with these inevitable changes is through thin-client computing. Thin-client computing is not a new concept. However, it has not been widely promoted, since major PC vendors have understandably been reluctant to promote a concept that will impact their highly profitable PC-upgrade spiral. Vendors are now realising that they cannot stop the word spreading and are embracing the technology. Thin-client computing is not the run-from-server installations sometimes used by major Windows applications. That method still installs several files on the local PC and requires significant bandwidth to operate at a useable speed.

Application service provision (ASP) is a high-profile flavour of thin-client computing. The technical solution is very similar, it is the licensing scheme and the out-sourced nature of the provider that it different. ASP has yet to come of age in the UK, primarily owing to software rental licensing agreements. However, this technology looks set to grow. By adopting a thin-client computing solution now, you benefit from the cost savings now, but are in a position to transition to ASP very quickly if desired.

## Glossary

The industry uses a number of terms to describe thin-client computing, with some of them being apparently, but incorrectly, interchangeable. For the purposes of this paper, I will use the following:

- thin-client computing - running applications from the server and distributing only keyboard, video and mouse (KVM) updates and possibly audio;
- terminal servers - the application servers at the heart of thin-client computing. The software is normally from Microsoft, although other suppliers are making inroads, they are often deployed in conjunction with Citrix or other functionality enhancing products;
- fat-clients - PCs used in a traditional manner, with applications stored on the PC and data stored on servers;
- thin-clients - dedicated, solid-state devices, providing connections into the thin-client computing environment. The only processing done locally is KVM and sound. These are the modern-day 'intelligent' version of dumb terminals;
- tubby-clients - PCs that have an operating system, and possibly some applications, installed on them, but use a locally installed client to connect to the thin-client computing environment for all, or some, of their applications.

## What is thin-client computing?

The fundamental approach behind thin-client computing is very simple. Instead of running applications locally on PCs with all of their associated challenges and costs, applications run centrally with only keyboard, video and mouse (KVM) updates transmitted across the network. Bandwidth usage is minimal compared to traditional PC/server environments, with wireless LAN being ideal for the clients. The server backbone linking the terminal servers, data servers, mail servers, and so on is the only LAN connection that needs high capacity.

In a traditional fat-client environment, applications are stored locally, and data is stored centrally. When a file is opened, the entire file is transferred to the local PC, with the results being saved back across the LAN/WAN to the central storage area. Server/client architecture (such as SQL and Oracle), handle this process slightly differently, but processing still takes place at the local PC. This requires high bandwidth to each PC. If you have downloaded an e-mail attachment over a dial-up connection, you'll be familiar with the issues!

## Why thin-client computing?

Thin-client computing lowers costs and improves the service offering in several key areas.

### Hardware

With more complex software being distributed, desktop hardware upgrades have been accepted as a necessary evil. The currently accepted useful life of a PC is 2 years, although often depreciated over 3 years. As a PC becomes under-powered for a particular need, it is reallocated, often requiring a different software build.

Thin-client computing turns this acceptance on its head. PCs can be used as tubby-clients until they die, although consider the costs associated with their power usage and maintenance of the base operating system before adopting this approach.

### Centralised support

Significant benefits are obtained by centralising the support function, not only in savings, but also in the quality and consistency of the support function. The more diverse the geographical base, the more advantages can be gained.

Many software products provide various forms of remote take-over ability, or shadowing. This ability permits support staff to interact with the users' desktop as they're speaking to them. Performance of these products though is very slow when not on the same physical LAN. With thin-client computing there is no performance drop-off, since all users are running on the same LAN.

Windows 2000 terminal services do not have this capability built-in and add-on products specifically for terminal services will be required. This is expected to change with the .NET range of server products, with Windows XP already having support for remote help built in.

Centralised servers means not having server support staff responding to, or based at, remote sites for server support. Zona Research shows that support costs for 15 PCs in a Windows NT server environment were approximately 500 percent more than in a thin-client computing environment using thin-clients.

## Bandwidth

A Microsoft study conducted by NEC and Groupe Bull shows that the highest bandwidth user is a structured task worker, typically performing the same tasks repetitively, eg claims processing, accounts, customer service. These workers would typically use 20Kbits of bandwidth, making LAN performance over dialup connections a reality.

One real-world installation of a tubby-client environment for a 130-user network showed the following:

	Average bandwidth utilisation	Peak bandwidth utilisation
Fat Client	40%	80%
Tubby Client	0.5%	4%

*Significant bandwidth issues were being encountered during peak periods prior to the thin-client computing deployment. These figures are consistent with the Microsoft study.*

The net effect is that far less bandwidth is required for remote and local sites, further reducing costs in multi-site installations. If your business is in the process of converting older 10Mbps LAN to 100Mbps or even 1Gbps, stop and reconsider.

Have you rejected wireless LAN as being too low bandwidth (currently 11Mbps) and hence too slow for your needs? Reconsider, since this is all you will need on user segments.

Do not upgrade your WAN bandwidth to accommodate increased file transfer needs, particularly e-mail. On the contrary, by switching to a thin-client computing model, you may well be able to downgrade your WAN size, further saving costs.

## Power

Power consumption of a thin-client device is 14% of a PC. To place this in perspective, this is 5%, per year, of the thin-client device purchase price. Since a thin-client device will be expected to have a useful life beyond 5 years, the power savings alone will offset 25% of the cost of those devices.

Reduced cooling requirements also lower the costs. Steve Greenberg of thinclient.net, a leading design company for Fortune 500 companies in the US, shows in his power-for-the-people whitepaper, the following savings for a *thin-client* computing environment:

Annual £/kWh	Annual Savings (30 Users)	Annual Savings (100 Users)	Annual Savings (1000 Users)	Annual Savings (2500 Users)
£0.67	£457	£2,107	£21,071	£52,680

These savings are based on a real-world study and have been extrapolated for the UK with Greenberg's assistance. They include the cost of the extra servers required and cooling reductions.

## Licensing

Licensing is a major component of IT expenditure. The difficulty of supplying software when needed has led businesses to adopt one of two approaches; deploy software to all PCs and lock users out of those applications that they are not licensed for or purchase licenses for every PC, regardless of whether the application will be used or not.

Both approaches are flawed. The first can lead to prosecution by inadvertently infringing copyright laws, laws not made any simpler to interpret by software manufacturers inability to have a clear and consistent licensing policy. The second approach leads to unnecessary cost. Since software licensing often costs more than the initial PC costs, this approach more than doubles the costs of placing a PC on a desktop.

By centrally installing applications, licensing is simpler to manage. Software need not be installed on a user's PCs 'just in case'. If they need access to it, license availability is easily checked centrally and access granted from the server. No need to visit the PC, or create a package for distribution. There are even products, such as New Moon's Canaveral iQ, that enable much of this process to be automated.

Whilst it is possible to achieve a similar level of licensing control from management systems, such as CA UniCentre and Microsoft SMS, there are additional infrastructure costs associated with these technologies, including higher bandwidth costs, extra distribution servers for remote sites and the staff to support them.

## Security

A concern in a traditional, fat-client environment is the inability to control what is copied and taken elsewhere, possibly into the hands of competitors. Data-loss is rife in this environment, with users often taking a floppy disk home to work on a document and the disk becoming corrupted, so losing the work that they have done.

With thin-clients having no facility for local storage, this concern is all but eliminated in a *thin-client* computing environment. On the contrary, if setup correctly, the security of the network can actually be enhanced by adding levels of encryption to the network data.

Work conducted from outside of the office environment, for example at home, can be done through a dial-up connection. The data remains at the server. There is simply no need for it to ever be taken offsite, other than during controlled backup storage routines.

Unless e-mail security is addressed though, there remains a potential leak for confidential data through this route. This is true of both fat and thin-client environments. This must be addressed as part of the overall IT strategy and it is recommended that you work with partners that provide security expertise for this aspect.

## Backup/restore

In a fat-client environment, data backup is normally conducted at the local storage site. In a distributed WAN, this will normally require file servers at each site, unless WAN bandwidth is substantial. Backups will be conducted locally at each site, resulting in higher upfront costs for the equipment and higher operational costs, both in media costs and management time.



Very often, the physical act of changing and storing tapes at remote sites will be delegated to a non-IT member, who may not show the same care and diligence to this aspect of their function as they do to their core responsibilities. Data integrity, with the associated risks of not being able to restore data if needed, is severely compromised.

With its centralised approach, all data in a *thin-client* computing environment is stored in one place, so removing many of these costs. It is important to note that this does have an element of 'all eggs in one basket', so data backup and off-site archiving becomes more crucial. However, economies of scale generally result in more-efficient backup mediums becoming cost-effective.

### **Viruses**

By not having the ability to introduce data locally, the scope for introducing viruses is greatly reduced. There have been many high profile cases recently where the costs incurred, directly and indirectly, by viruses have been highlighted. Why take the risk?

Admittedly, the floppy and CD drives are often disabled in a managed environment, although any above average user can bypass these controls if they are determined to 'get that file onto the network', not knowing that it may be virus-contaminated. But why pay for a floppy and CD drive, if they're just going to be disabled?

Since the majority of thin-client devices do not physically have floppy and CD drives, this concern is non-existent.

In common with fat-client environments, the servers must still be adequately protected, particularly where e-mail is concerned. The lower-risk and cost benefits come from not exposing the desktops.

### **Devices**

PCs are attractive and a prime target for theft. We've all had it happen to us, even if only on a small scale. Until connected to the correct environment, thin-client devices are worthless and so less attractive. Your insurance company should be able to provide you with reduced premium benefits.

Naturally, servers will require a very high level of physical security.

## **Speed of deployment, repair and replacement**

Thin-client computing environments typically enjoy faster deployment times for new software and upgrades. Fewer IT staff are required to track and ensure successful distribution.

In a fat-client managed environment, an application is tested in a lab, packaged, scripted and then advertised to clients for automatic delivery. The clients will pick up the advertisement at an interval predetermined by the administrator with due regard to bandwidth issues. Regardless of the delivery software used, it is unusual for 100% of the clients to be upgraded first time around, with 80% being considered normal.

It takes some time for a package advertisement to start being collected by PCs, with 2 hours being considered a practical minimum, and 4 hours an average. Without manual intervention from IT support staff, remote sites will take even longer. For critical, security or virus related updates, this delay can be unacceptable.

In a thin-client computing environment, the application is again tested in a lab. It is then installed on the terminal server and immediately all authorised clients have access to it. Normally nothing more is required from a client than to logoff and log back on.

Everyone has the upgrade at the same time. No more running with different versions for a few days. IT staff no longer need spend time remotely forcing the application update onto a PC that didn't receive it first time, but needs it now.

## **Why not thin-client computing?**

### **User acceptance**

One of the major challenges to thin-client computing is managing user acceptance, before, during and after deployment. Outside a tightly managed environment, users will have had access to their floppy and CD drives. They may well have had the ability to install software on their own PCs or add screensavers. Whilst this approach is great for employee relations, it is not so great for productivity. When that latest screen-saver causes the PC to crash, who fixes it, and when - during work hours? Add some more IT staff to support this or live with a lower quality support operation.

User acceptance begins at the top and management buy-in to this principle is essential. Problems can also be prevented by using enterprise management tools. As mentioned previously though, they come at a cost in terms of infrastructure and bandwidth.

Whilst tubby-client devices may permit some of this functionality to be retained, in a true thin-client environment, they will not. Experience shows that this is not the problem it is initially perceived to be. If many users need access to particular CDs on a regular basis, a CD tower can be installed alongside the terminal servers. Very few users actually need to use floppy disks, although there are ways to provide access to those that do.

### **High performance environments**

In a thin-client computing environment all processing is done at the server and KVM refreshes are transferred across the network. By their very nature, CAD, terrain modelling and DTP environments have constant screen redraws, which may increase network traffic to an unacceptable degree.

Generally, these applications are not suited to a thin-client computing model, although a hybrid model may be feasible. If Object Linking and Embedding (linking a CAD drawing to a word-processor document or a spreadsheet) is a requirement, even a hybrid model will not be acceptable.

The alternative is to use a traditional fat-client model for these users only. A thin-client computing model can still be considered for these users, although it will only be possible to run a limited number of sessions per server.

## LAN/WAN resilience

Thin-client computing relies on constant connectivity between the server and the client. If that connectivity is broken, clients cannot continue working, although their current session will remain in the state it was in at the time the link was lost.

Therefore, LAN/WAN resilience is vital. In high-availability environments, best-practice recommends that alternate path and supplier routing, particularly for WAN links, exists. This may increase year 1 costs over a fat-client environment, although, since each of these links do not need as much bandwidth as before, year 2 and onwards costs will be lower.

## Legacy applications

With the advent of terminal services, several users will be using the same PC (ie the terminal server) simultaneously to access the same application. Software certified for Windows 2000 will adequately resolve the potential problems associated with this, by tracking registry keys and ensuring that individual user settings do not overwrite system settings. Legacy software generally does not do this tracking and so the scope for conflicts between settings is greatly increased. These conflicts can normally be resolved, but it is crucial that adequate testing and redesign takes place.

Even then, certain applications, particularly those that rely on a unique client IP address, will not work. If an application that your business uses falls in this category, the thin-client computing approach need not be abandoned, but must be adapted for your requirements. Options include:

- considering whether your business is reliant on the application and also whether its use should be continued;
- replacing the application with one that provides the required degree of functionality, yet operates correctly in a thin-client computing environment;
- a hybrid approach, ie using a PC as a stubby device, but with the legacy application stored on the local PC. This option is only possible if data sharing (OLE) between the legacy application and the general productivity suite installed on the terminal server is not required;
- a combination fat and thin-client approach, ie some clients are regular PCs with all applications stored locally and some full thin-clients. Great care and expertise needs to be applied to this situation and the IT issues must not be considered in isolation from the business.

As an example, if your business has two call-centres, with half of all clients fitting into this category and half not, consider whether it might be better to relocate all of your thin-clients to one site and move all of your fat-clients to the other site which is collocated with your support staff (move your support staff also if need be). There are numerous other factors to be considered with this approach and the assistance of commercially aware partners in this decision is invaluable.

The alternative would be to have fat-clients spread across two sites and so not achieve the maximum benefits in cost savings.

## Local device support

Without the addition of add-on software, many local devices and ports will not work in a thin-client computing environment. This is not to say that the thin-client computing model should be abandoned, just that current practices should be audited and if necessary re-evaluated.

Add-on software can enable COM and LPT ports to be used. The imminent release of Windows CE.NET is rumoured to have USB support native to the operating system. Since many dedicated thin-clients are already based on the CE operating system, this is good news. You need to consider whether all users need to have the ability to connect local devices, or only a few select users. What are the impacts for your scanning systems, local printers, and so on?

Why are printers local, should they not be networked? How about a central scanning area, with more powerful scanners? Do all Personal Digital Assistant (PDA) users need their own connection, or could they update daily from a few strategically placed shared PCs? These are just some of the questions that need answering.

## Sample fat and thin-client environment

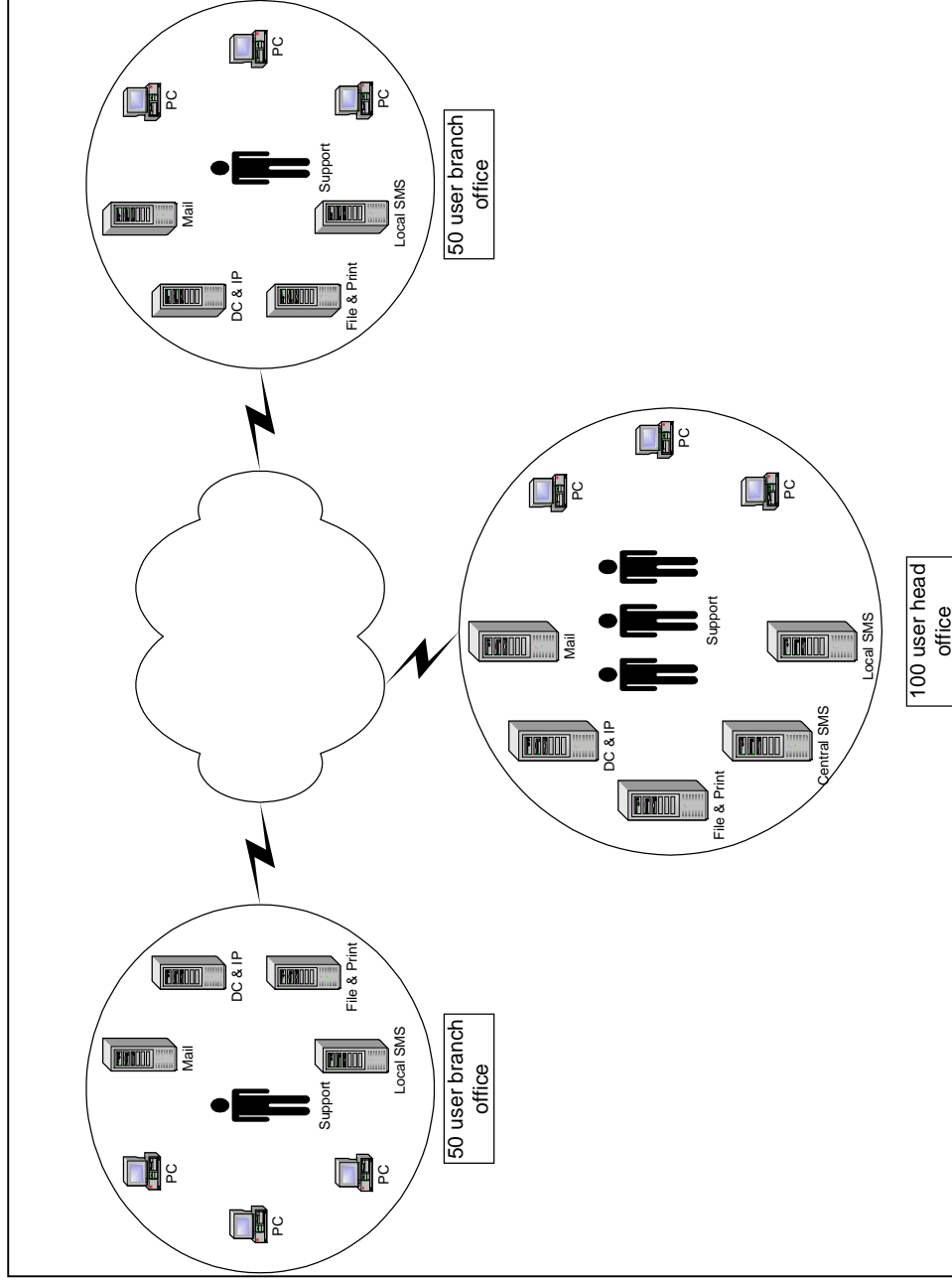
The following diagrams show a sample environment, in both fat and thin-client mode. Clearly demonstrated is the reduction at outlying sites of both server hardware and server support staff. One of the support staff has been relocated to the central site. If we were to keep the service levels the same, there is actually no need to increase the support staff at the main site. We have however taken the opportunity to increase the service offering.

This example alone shows where savings are to be made. Expanding this to include smaller sites, where there is currently no network offering, would show a major improvement in service levels, data sharing, and so on for minimal extra cost - literally the cost of adding a low-cost LAN/WAN connection and a few thin-client devices!

Enterprise solutions that could not previously be implemented owing to this limitations at smaller sites are suddenly available in a thin-client environment. Centralised order processing, CRM, HR functions can now be made available company wide, instead of only at the larger sites.

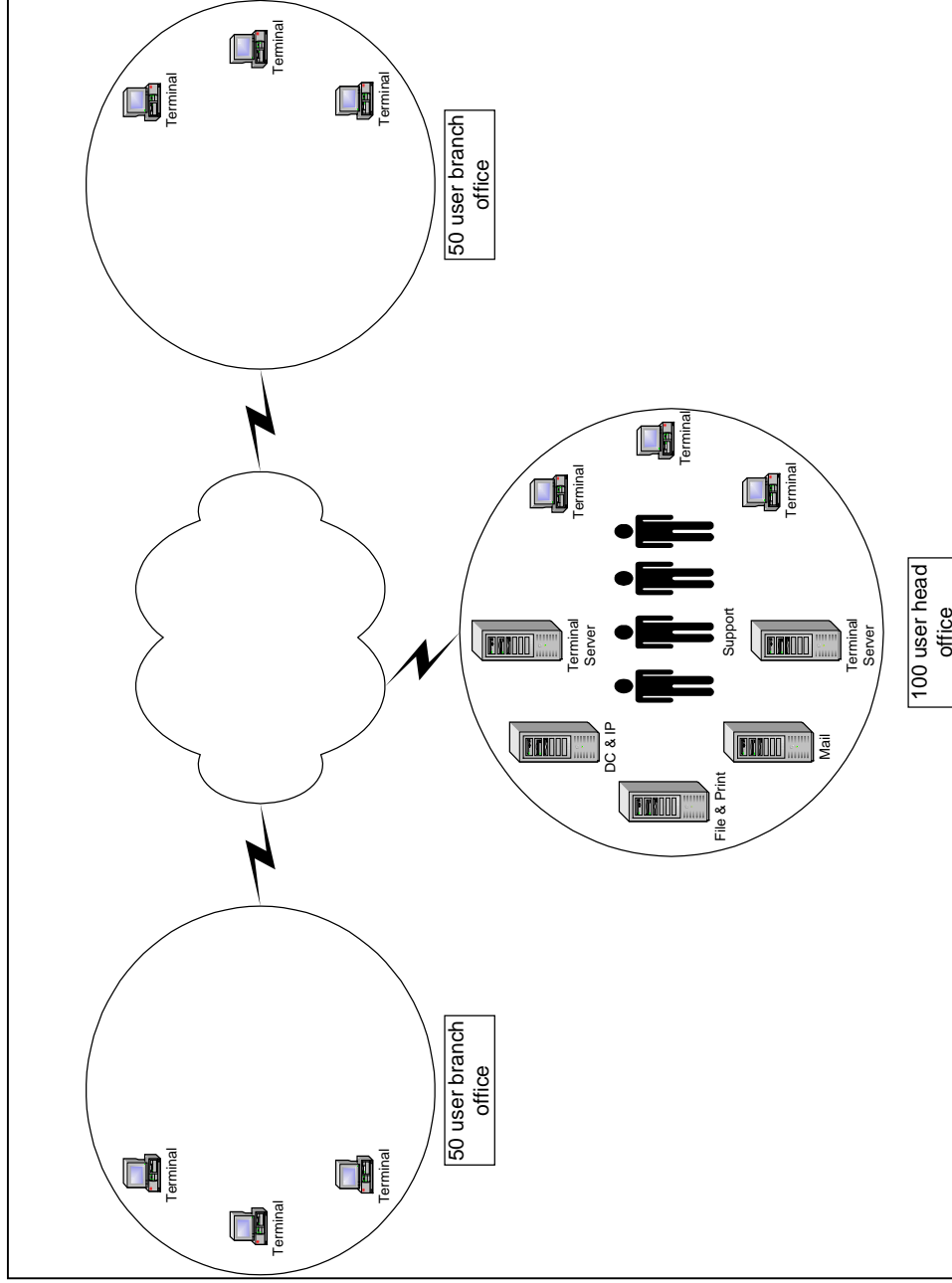
Businesses, such as travel agencies, that consist mainly of many small outlets can take advantage of these technologies to improve their service offering whilst containing their costs.

## Sample fat-client design



A sample 200 user network, across three sites, managed by Microsoft SMS.

## Sample thin-client design



The same 200 user network with all client devices as thin-client terminals.

## Who are the technology players?

### Microsoft

<http://www.microsoft.com>

The major provider of terminal server software. Windows 2000 has significant advantages over Windows NT4 Terminal Server Edition, both in terms of stability and functionality. Windows 2000 in terminal services application mode can be deployed in a NT4 environment, although full benefits will not be obtained this way. Maximum benefits will be enjoyed in a Windows 2000 domain, incorporating best-of-breed products in the server architecture.

Windows 2000 also has a remote administration mode. This mode permits up to 2 concurrent administrators access to the server for remote administration purposes, removing the need for add-on products such as PCAnywhere. There is absolutely no reason to deploy any Windows 2000 server without the remote administration mode enabled.

The .NET range of server software is set to further enhance the offerings, particularly as licensing agreements between Microsoft and Citrix are due for renewal.

### Linux Terminal Server Project

<http://www.ltsp.org>

Linux has provided an alternative to Microsoft for server and desktop operating systems for some time. Recently released is Linux Terminal Server Project (LTSP). This provides terminal services and runs most Microsoft applications, or even the excellent StarOffice. Linux itself is very low cost, with often the only charge being made for the distribution medium. However, it suffers from being perceived as a 'techie' product with little take-up by enterprises over concerns about ongoing support. Consider support issues before going the Linux route.

### Citrix

<http://www.citrix.com>

Citrix is the most instantly recognisable name in the thin-client software enhancement market. They provide a range of increased functionality, from enhanced load-balancing, true-colour support, two-way sound, session shadowing for support staff, application publishing. However, Citrix licensing is expensive. Consider whether the enhancements are actually needed.

### New Moon

<http://www.newmoon.com>

A new addition to the thin-client sector is the introduction of New Moon's flagship product, Canaveral iQ. This permits software metering or software-as-a-service. New Moon is targeting itself as a "more cost effective, easier to use alternative to Citrix MetaFrame". This may well be the case. However the software metering aspect of Canaveral iQ looks to have far more benefit than a head-to-head with Citrix is likely to achieve, at least for them in the medium term.

Look for interesting developments as New Moon seek to gain market share from Citrix and Citrix respond with new offerings or lower costs.

## Wyse

<http://www.wyse.co.uk>

Providing thin-client terminal devices and management software, Wyse has a proven track record in this area. Their expertise dates back to mainframes and computer bureaux. The holders of the single largest market share, at 41%, Wyse is committed to R&D and local UK support.

A safe bet, the only difficulty will be deciding which model to choose.

## Neoware

<http://www.neoware.com>

Provide thin-client terminal devices and management software. The second largest supplier in the UK market, Neoware do not have an extensive a range as Wyse. Their local port enablement software - Citrix Device Services - is available free of license charge from Citrix, although very few enterprises use it owing to its limited functionality and high management overhead.

## NCD

<http://www.ncd.co.uk>

Provide thin-client terminal devices and management software. Also provide application software that competes with Citrix at a lower cost. Not as diverse. Two years ago, NCD were a major player in the thin-client market, but have lost significant market share in the UK over the last year. NCD look set to relaunch themselves as a thin-client and tubby-client software management provider.

## Others

There are several other thin-client device manufacturers. When evaluating them, consider the availability of management software for them, ie the ability to remotely change home server settings and IP scopes. If they don't have it, which many of them don't, don't consider them.



## Conclusion

Thin-client computing is an important option to consider in any organisation's strategy. Implemented correctly, it can significantly lower your operating costs, increase the quality of your support and reduce your risk. The key is assessing and planning your deployment correctly.

Very few businesses will have the in-house skills to audit, plan, install and deploy the technology optimally, always maintaining due regard to the business needs and commercial requirements. In order to avoid actually increasing your support costs, it is vital that you obtain relevant assistance from independent partners. The costs associated with this will often be offset by the significant savings achieved.

As a quick checklist on the applicability of thin-client computing for you, consider the following:

Definitely yes to thin-client computing, if any of the following are true:

- you are using standard applications, particularly if they are Windows 2000 certified;
- you are not currently running a managed environment;
- your enterprise is very distributed, with many WAN links;
- your LAN requires upgrading;
- your client devices are nearing replacement date.

Possibly no to thin-client computing, if any of the following are true:

- your workforce consists mainly of mobile or high performance users;
- you are currently running a fully managed environment;
- you have many legacy or bespoke applications.

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## The author

Barrie David, the author of this paper, is a senior consultant for Newburn Consulting. Specialising in infrastructure management, Barrie has project managed several successful implementations of thin-client environments and managed fat-client environments. He is well-placed to evaluate the correct path for you. If you would like further information, please contact Barrie at [bdavid@newburn.co.uk](mailto:bdavid@newburn.co.uk).

Newburn Consulting is an independent IT and management consultancy. We offer multi-disciplined, impartial advice to create business oriented solutions. Our commitment is simple: to add value to your business - by reducing costs, helping to improve the service to your customers and minimising your exposure to risk.

In our experience, IT issues can make or break commercial and service initiatives. Organisations are under relentless pressure to improve from competitors, customers, regulators and shareholders. Newburn bridges the gaps between management and technology issues to create practical, effective solutions and achieve co-ordinated decision making.

We focus on the effective management of technological issues, operating in three key areas:

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- management consultancy;
- IT outsourcing.

We are acknowledged to be one of the top IT management and outsourcing consultancies in the UK, with a blue-chip client base across a range of market sectors.

Our partners are business strategists who have held senior management positions in leading multinational firms. Our consultants apply their commercial experience, intellectual rigour and technical expertise to a wide range of management and IT issues. We offer multi-disciplined, impartial advice to create business oriented solutions for our clients.

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Selecting and installing the right technology is only part of the solution. Making it an effective catalyst which improves business operations and processes is what delivers the return on investment.

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## References and further information

### Microsoft

<http://www.microsoft.com>

"Windows 2000 Terminal Services Capacity and Scaling"

### Gartner

<http://www.gartner.com>

Peter Lowber: 17 December 2001 - Note number: COM-15-0003

"Thin-client predictions for 2002"

### Zona Research

<http://www.sageza.com>

"Desktop clients - a cost of ownership study"

Zona Research has transitioned to The Sageza Group, Inc.

### Tolly Group

<http://www.tolly.com>

"Total Cost of Application Ownership"

### Thin Client Computing

<http://www.thinclient.net>

Stephen Greenberg, Christa Anderson, Jennifer Mitchell Jackson

"Power to the people: comparing power usage for PCs and thin-clients in an office network"