

APPENDIX 3



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Thin Client Review

v.1.1

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research consulting measurement community news

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- Introduction

- Executive Summary

- Conclusions

- Thin Client Overview

- When To Use Thin Client

- Reference Sites

- Vendor Options

Acronym Key

■ Purpose

- The primary purpose of the workbook report is to review the Thin Client proposals outlined in the IT Strategy Document '**IS Strategies To Be Blueprint Document Final Version 1.0**' and comment on the appropriateness of the approach and recommendations.

- The objectives of the assignment are, as we understand them, to:
 - provide an independent review of the strategic appropriateness of the proposed move to a thin client infrastructure
 - identify the trends for thin client for the next 3 – 5 years
 - highlight the strengths and challenges of a thin client infrastructure
 - provide information on thin client infrastructures currently operating in the UK.



Executive Summary

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- London Borough of Haringey are among a growing number of local authorities who have either implemented or implementing Thin Client technologies. The key reasons for moving to a Thin Client environment are broadly similar to that of the LBoH. The key drivers are as follows:
 - Reduce total cost.
 - Provide the ability to facilitate remote / mobile working.
 - Increase efficiencies.
 - Imminent technical refresh point.
- In an environment where IT users are largely task driven (these are data entry/structured task users and light Office systems users (eMail, Word, and so on) a Thin Client can be very beneficial both in cost savings as well as providing greater operating efficiencies and mobile access. Typically Local Authorities reflect this user profile.

- The key risks to implementing such an environment are:
 - Systems design - this needs to be developed and implemented in partnership with an experienced skills group.
 - Change Management - moving from a traditional 'Thick Client' environment to a 'Thin Client' infrastructure will place enormous demands on the IT organisation for change. The new environment will typically require new support and organisation structures, new skills in-house and insourced, new governance processes and procedures. The ability to manage change in the organisation is a crucial factor for success.

LBoH should assess their readiness for change. New governance procedures and policies will possibly be required to enable the Authority for change.
 - It is important to note that a thin client environment will present change to the user community. For example file storage will be server centric and will no longer be on the hard or floppy drives. This change is typically not onerous and should be addressed through the appropriate communications and training channels setup within the project.
 - Single points of failure - in a poorly designed architecture the Thin Client server centric environment is open to single points of failure which can potentially stop all services to all users. Areas of particular focus for resilience are: Networks & Thin Client server farm



Conclusions

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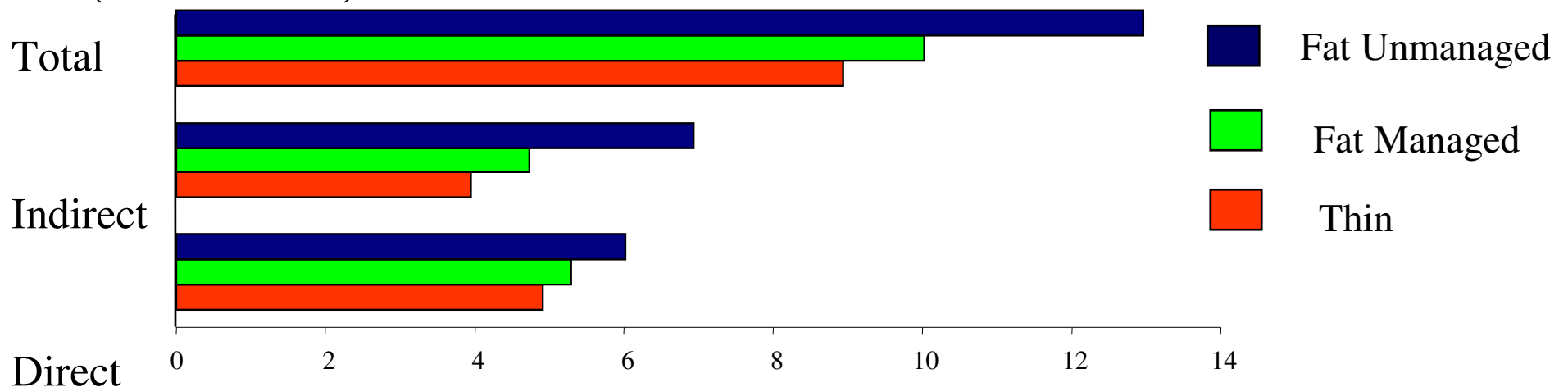
- **The IS Strategies 'To Be' Blue Print identifies the following objectives to be achieved for a Thin Client implementation within the London Borough of Haringey.**
 - Reduced total cost of ownership for application / file server and desktop environments.
 - Provide the ability to facilitate remote working.
 - Increased efficiencies in systems management and support.
 - Deliver an integrated working environment.
 - Robust Business Continuity environment.

Gartner believe that these objectives are realistic and achievable within a well planned 'Thin Client' infrastructure.

Conclusions (Cont'd)

- **Reduced total cost of ownership for application / file server and desktop environments.**
- The graph shows the annual TCO for thin clients replacing the desktop.
- The analysis is for 2,500 desktops.
- The model includes the server costs to support 2,500 WTs, as well as the Citrix license costs for MetaFrame XPe. TCO mileage will vary greatly depending on each enterprise's environment.
- *Action Item: Enterprises should determine TCO before deciding whether to deploy thin clients for task-oriented users. Decisions to deploy thin or fat clients should not be made based on acquisition cost alone.*

Costs (in Millions)



- Reduced total cost of ownership for application / file server and desktop environments.
- *Action Item: Enterprises should determine TCO before deciding whether to deploy thin clients for task-oriented users. Decisions to deploy thin or fat clients should not be made based on acquisition cost alone.*

Gartner believe that if the London Borough of Haringey plan and develop a Thin Client architecture based on best practice principles that significant cost savings can be achieved over the 3 to 5 year lifecycle period.

■ Provide the ability to facilitate remote working.

- A common situations in which thin client applications are deployed and are very effective are for telecommuters who may have access only to low-bandwidth dial-up connections.
- It provides a efficient method for roaming access users to access the authority from regional offices, hotels, wireless modems and so on.
- Thin client technology is useful for providing remote access of “fat, chatty” applications over low-bandwidth networks, centralised management and for roaming access.

Thin Client will offer a flexible remote working environment to LBoH.

- **Increased efficiencies in systems management and support.**
 - Thin client desktop computing is server-centric. All file and application processing is conducted within a centralised server farm environment.
 - Applications installation and support complexities are greatly reduced. This is because a centrally managed system is relatively straightforward to implement.
 - The difficulties of supporting users is also greatly reduced when compared to that of a disparate non-centrally managed thick client environment.

Thin Client should offer a less complex support environment for the Authority than it maintains in its current environment.

■ Deliver an integrated working environment.

- Gartner understands that the IEG Statement for the LBoH aspires to an integrated computing environment across all platforms. By nature a Thin client computing environment is an integrated computing architecture.
- In a well planned Thin Client environment, integration with other computer platforms should be possible.

Integration with other computing platforms should be possible in a Thin Client computing architecture.

■ Robust Business Continuity environment.

- ❑ One of the greatest areas of risk when implementing a Thin Client environment is in the area of resilience and business continuity. LBoH plans to implement two data centers to enhance resilience.
- ❑ In a computer centric environment such as Thin Client the possibility exists (as with a mainframe system) for one failure to bring down all systems. The Thin Client systems design is crucial to avert such outcomes. Gartner strongly recommend that the systems design is completed and implemented with the aid of proven and experienced partners.
- ❑ Business continuity is not just about technical resilience but includes the ability of the organisation to operate for a period without the normal computing operating systems. In Gartner's experience it is very important that the Authority introduce manual operation systems to address major breakdowns particularly in areas of high public importance i.e. Social Welfare, Security.

LBoH will need to apply the appropriate skills with the necessary experience to design and implement a robust and resilient Thin Client environment.

In a Gartner survey of 25 enterprises using or piloting thin client devices, several benefits stood out:

- fast application delivery (e.g., upgrading 1,800 users from Office 97 to Office 2000 in one afternoon),
- reduced staffing requirements (e.g., the survey respondents believed strongly that it takes more than five times as many people to support PCs as thin clients),
- improved “PC application” access for roaming users (i.e., end-user access from anywhere on the network and groups of users accessing group profiles) and increased company productivity (e.g., one respondent reported a 50 percent improvement in customer responsiveness).

Not all experiences were positive, however. Respondents also cited:

- high server infrastructure requirements (additional server purchases and server staffing requirements),
- additional license fee costs for Microsoft Terminal Server Client Access Licenses and Citrix MetaFrame,
- lack of flexibility (e.g., no offline use, unsuitability for heavy-duty office application use, no streaming video).



Thin Client Overview

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What is Thin Client?

- Thin Client computing is a method of delivering software to the desktop which differs from what the LBoH now think of as being the conventional model of PC based or Fat Client computing. In a Thin client model, all the processing is done on large centralised servers, often joined together in farms. Using specially devised code, the servers send only the screen refreshes, keyboard strokes and mouse moves across the network. The client or user end of the transaction is therefore Thin. In the traditional PC model all the processing occurs locally on the PC itself and this is therefore a Fat client.

A thin client is a software architecture where the applications reside on servers and the graphical user interface is remoted to users.

Positives:

- + Remote access over low-bandwidth
- + Centralized management
- + For roaming access
- + **Data security**
- + **Data reliability**
- + **Disaster recovery**
- + **Rapid application deployment**

Limitations:

- No offline work
- Heavy office use
- End-user perception
- **Server costs**

- IS organisations deploying thin client technology must work with line of business managers and end users during the early planning and pilot stages.
- IS directors should carefully select which applications, environments and end user classes to target.
- An enterprise should determine if the deployment is centralised or decentralised, LAN-based or WAN-based.
- You will need to use load balancing and replication tools for managing users, applications and server resources in the server farm.
- Do you want to publish your applications to the Internet? What security do you need?
- Finally, think ahead. What is your application development strategy, and how will your thin client environment evolve?

Action Item: Enterprises using best practices when deploying thin clients will achieve at least twice the ROI.

- Customer and end-user driven
- Targeted applications and environments
- Number of active users
- Centralised vs. decentralised?
- Network infrastructure?
- Server requirements
- Server management
- Deploy to the Internet?
- Security
- Is MetaFrame needed?
- Terminal emulation and browsers: client-based vs. server-based?
- Which thin client desktop?
- Test! Test! Test!
- Thin client direction?



When To Use Thin Client

What are the benefits?

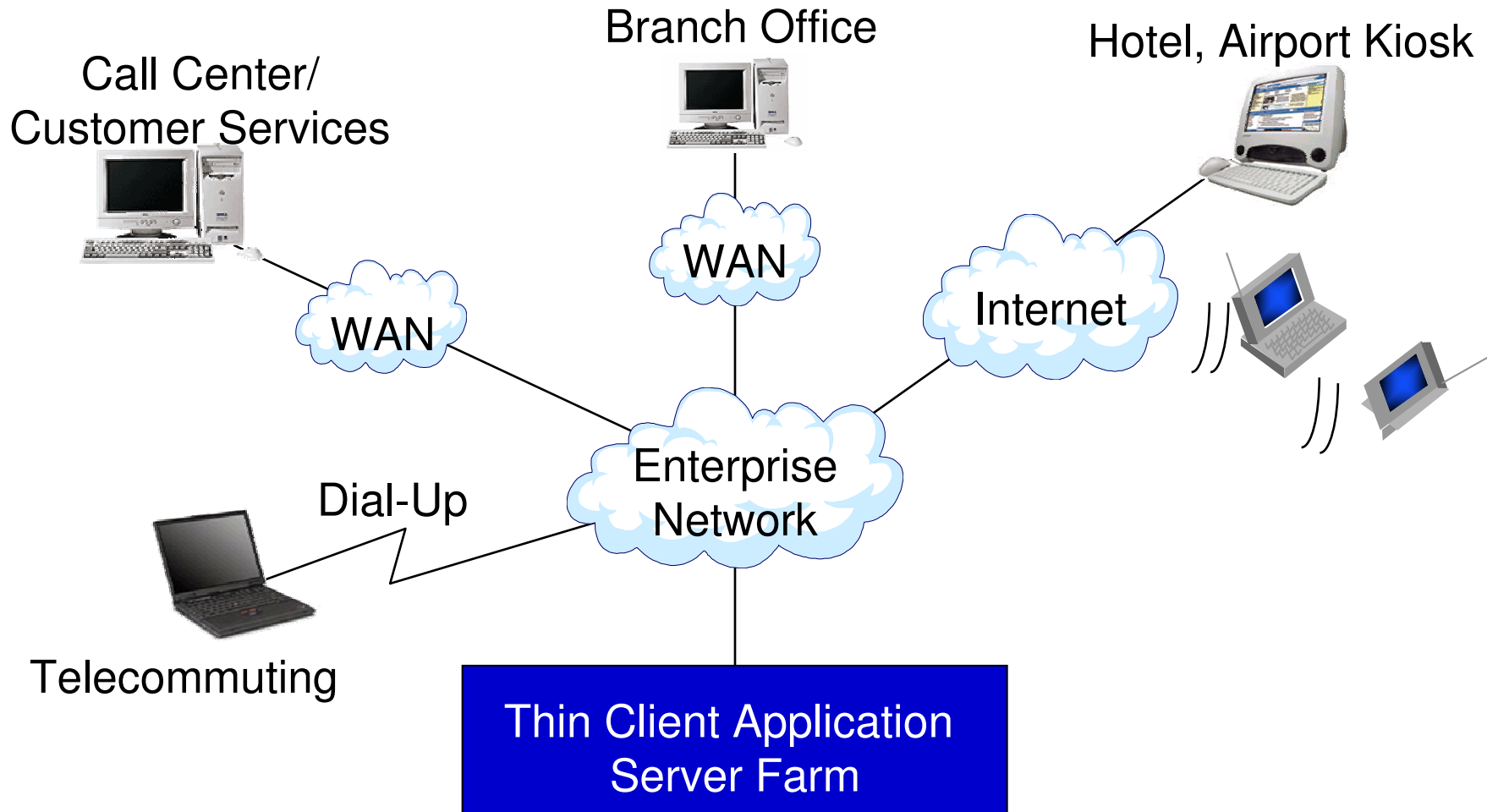
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Where Thin Is In



Despite the confusion about what a thin client is, Gartner estimates that 90 percent of enterprises that have deployed or plan to deploy thin client applications have done so in vertical application environments, like customer service centers. These are far more than “green screen” production environments (e.g., data entry) and often include light use of Microsoft Office, e-mail and Internet access, as well as client/server business applications.

The environment's key characteristic is that computer use is not related to creative activities (engineering CAD design for example). These are data entry/structured task users, not knowledge workers or high-performance users. In this type of environment, thin client technology works well and the enterprise meets less end-user resistance to thin client deployment. This is the typical environment of a local authority.

Other common situations in which thin client applications are deployed are for telecommuters (who may have access only to low-bandwidth dial-up connections) and for roaming access. Once thin client applications are successfully deployed in a vertical application environment, enterprises tend to deploy them elsewhere to targeted users in general horizontal office environments.

The most appropriate Thin Client user reflects the majority of the typical local authority user.



Types of Workers:

Data Entry/ Structured Task

- Data entry clerks
- Customer service
- Factory workers
- Telemarketers
- Service workers

Knowledge

- Middle managers
- Secretaries
- Marketing staff
- Direct salespeople
- Professional support staff

High-Performance

- Financial analysts
- Programmers
- Engineers
- Accountants
- Graphic Artists

Opportunity for Thin Client Success:

Easiest



Most Difficult

Positives

Negatives

Reduced TCO

- + Reduced staffing
- + Reduced hardware maintenance
- + Reduced software maintenance
- + Instant on




- Server cost
- Scalability
- Software license cost
- Shift in staffing to server and network




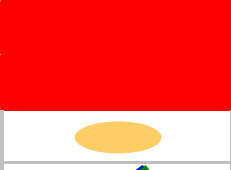

















Increased Productivity

- + Fast solutions delivery
- + Client reliability
- + Roaming access

- No offline use
- Multimedia
- Heavy-duty office use

Fat vs. Slim/Thin

-  Decided advantage
-  Feature may exist,, but not a strength
-  Major weakness

	Fat	Slim	Thin (WTS/Citrix)	Thin (HTML-only)
Low TCO				
Zero Footprint				
Manageability				
Security				
Rich User Interface				
Power Users				
Remote Access				
Offline Work				
Online Only				
Intermittant (some offline capability)				

Thin/Slim Benefits:

- Low TCO
- RAD
- B2B, B2C
- Continuous operation
- Consolidation of M/A
- Data security
- Central virus control

Thin/Slim Limitations

- Not always appropriate
- End-user perception
- HTML-based applications

Fat vs. Slim/Thin (Cont'd)

This comparison shows where each client application deployment style is most appropriate. Deploying applications using a thin-client protocol (such as Citrix ICA) does not require software installation (“zero footprint”), and offers secure remote access with central management. However, it does not support offline capability and is not appropriate for power users.

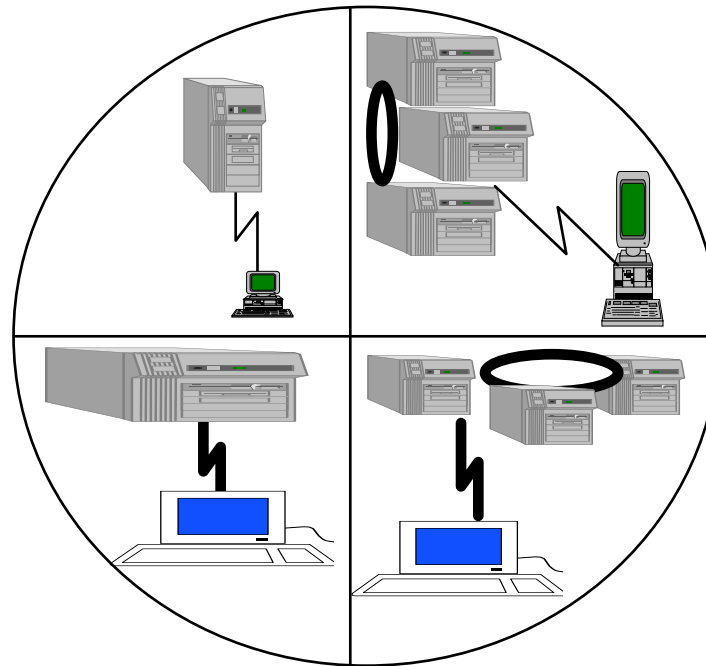
HTML-only thin-client applications typically have poor performance (weak for remote access) and have a weak user interface. Slim clients, like thin clients, also have zero footprint, and also offer occasional offline capability for simple tasks in the event of loss of connection; however, there may be limitations concerning security, remote access and the user interface, depending on the application design.

Fat applications offer full offline capability with a rich user interface, but there may be issues regarding remote access, security and manageability. Thin clients (using a thin protocol such as Citrix) and slim clients offer similar benefits: low TCO, rapid application deployment (RAD), data security, central virus control, continuous end-user operations, ease of consolidating mergers/acquisitions, and quick deployment of B2B and B2C applications. However, thin/slim is not appropriate for every user.

Terminals, Thin-Client Computing and Network Impact

Host /Terminal

Deterministic traffic (no bursting):
Proprietary policy controls in the architecture



Windows Terminal

Deterministic traffic (little bursting):
Simple policy and prioritization required to protect performance

Traditional Client/Server

Business during execution:
Best effort networking — no policy in the network

Internet Terminal (dynamically deployed applets)

Bursts at applet download and execution:
Sophisticated policy mechanisms needed

Terminals, Thin-Client Computing and Network Impact

Enterprises deploying thin-client desktops must consider network latency and bandwidth. Thin clients, like phones, are sensitive to delays in the network. A phone call doesn't take a lot of bandwidth, but if there is a delay, performance appears to be poor. Similarly, for WTs, Citrix ICA may require only about 20K of bandwidth, but delays in the network make performance appear to be slow. Simple policies and procedures must be implemented to prioritize the network for ICA sessions to meet response time requirements. More-sophisticated policies and procedures must be implemented for Internet terminals where applications from Web pages to client/server applications will be accessed via HTTP. Network bandwidth can be an issue where thin clients are deployed in branches to access servers over WAN links. For example, WTs with ICA can only support a maximum of six active users (assuming 20 Kbps required per ICA session) over a 128K WAN link. Increased bandwidth per active-user will be needed to support Internet terminals. Sufficient bandwidth is needed to support the active number of users required over the WAN link to the backbone network. Third parties such as Packeteer and Sitara offer quality of service (QOS) platforms to optimize ICA on service provider networks.

Action Item: Enterprises deploying thin clients should ensure adequate bandwidth exists on WAN links to support the desired number of active users, and use policy and traffic prioritization techniques in the network to ensure that response time requirements are met.

Thin Client With Browser

Server-Based Browser

Pros

- Performance
- High availability
- Local multimedia

- Manageability
- Lower TCO

Cons

- Increased complexity
- Desktop replacement of Windows terminals
- Increased TCO
- Higher acquisition cost

- Performance
- Flexibility
- Increased server costs



Reference Sites

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The following is a list of some of the UK authorities have implemented or are implementing Citrix technologies. Some authorities have implemented Citrix to provide all desktop services where other have implemented Citrix to provide services for selected applications only.

- 5,000 to 10,000 users
 - Hampshire
- 1,000 to 5,000 users
 - Dundee City Council
 - City of York Council
- up to 1,000 users
 - Tees Valley Borough Council
 - Knowsley Borough Council
 - Lambeth Borough Council
- *Other local Government users include Coventry City Council, Nottinghamshire County Council, Lambeth Borough Council, Woking, Seven Oaks, West Dorset, North Tyneside, Sefton Borough and Dundee City Council.*



Vendor Options

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Through 2002, more than 75 percent of WTS deployments with more than 200 active users will use Citrix MetaFrame (0.8 probability).

Through 2006, more than 70 percent of enterprises with more than 1,000 active users and 100 applications will use WTS with Citrix MetaFrame, but only 50 percent with fewer than 1,000 active users and less than 50 applications will use Citrix MetaFrame with WTS (0.7 probability).

- Gartner has noted over the past 12 to 18 months, with the improvements it has made to RDP's performance, Microsoft's WTS (without MetaFrame) is good enough for most deployments over low-bandwidth networks with fewer than 200 active users, assuming there are only a few applications and no requirement for a particular feature supported by ICA but not by RDP.
- More recently, some enterprises with larger deployment plans have begun actively pursuing alternatives to Citrix because of the perceived high license costs of MetaFrame XP and the license cost of migrating from MetaFrame 1.8 to MetaFrame XP. The migration is relatively trivial, but the license costs for MetaFrame XP are causing some Citrix customers to hesitate.

Gartner recommend that LBoH conduct a vendor assessment which analyses the authority's requirements against the functionality offerings of vendors other than Citrix. This exercise may present a more cost effective Thin Client solution to LBoH.

Vendors - Citrix MetaFrame XP

- Add-on for Windows 2000, Terminal Services
- Supports all desktop OSs, browsers, handhelds via ICA
- ICA optimization
- Secure access of Windows applications from the Internet
- Integrated with portals
- Terminal Server management tools
 - Application-based load balancing
 - Resource management
 - Installation management

Vendors - Citrix (Cont'd)

- Citrix faces growth challenges in extending MetaFrame (MF) within its installed base, to new markets, and in delivering new capabilities beyond MF.
- However, Citrix is stable, viable and is the proven leader in the thin client market with over eight million Citrix ICA licenses installed. At least 85 percent of Microsoft Windows thin client deployments use Citrix MF. MF XP runs on top of Windows 2000 Terminal Services, as well as on Windows .NET Server, Terminal Services (when Microsoft releases the new server OS later in 2002).
- MF supports application-based load balancing, session shadowing, local driver mapping (including printing, serial devices and audio) and application publishing with Web-based access to Windows applications (NFuse). Citrix ICA supports Windows and non-Windows devices, including handhelds. ICA (with SSL support) allows secure (128-bit SSL) remote access over the Internet.
- MF XP supports central management of applications, users and configuration data, and is interfaced with Active Directory and Novell eDirectory. MF XP is packaged with three offerings: XPs, XPa and XPe. Enterprises moving to Windows 2000, with new deployments of Windows Terminal Server of under 100 active users, will probably not need MF XPs. Microsoft Windows 2000 Terminal Services should suffice in most cases.

Vendors - Citrix (Cont'd)

- Further improvements expected with Windows Terminal Services, and competitive alternatives, will encroach on Citrix's current sweet spot of departmental deployments from 200 to 2,000 active users. For large deployments, the XPe's management capabilities, or those offered by Novell OnDemand Services, will be necessary. Citrix is not offering any future enhancements to MF 1.8 but continues to support 1.8. Enterprises with MF 1.8 should plan to migrate from 1.8 no later than year-end 2003.
- ***Action Item: Enterprises with new deployments of Windows 2000 Terminal Services with over 200 active users should use MF XPa or Xpe, or Novell OnDemand Services.***

Microsoft Windows 2000 Terminal Services

- Integrated with kernel for all three versions of the server
- Over LANs, wireless LANs, WANs and remote dial-up
- Windows clients only via RDP
- Support for RDP and ICA
- RDP 5 also supports sessions shadowing (1:1), local printing,
- 128-bit encryption
- Network load balancing with advanced and data center servers
- Browser access through Terminal Services
- Advanced Client (TSAC) with RDP 5

- Microsoft currently has no other way to deliver Windows applications over slower-speed network connections (e.g., Internet connections, application service providers for consumer use and wireless devices).
- Microsoft's WTS, which includes Windows 2000 Terminal Services and NT 4.0, Terminal Server Edition (TSE), is the dominant choice for thin client deployments in 2002. Microsoft's WTS supports both Microsoft's RDP and Citrix ICA thin client display protocols. Terminal Services is bundled with all three versions of Windows 2000 Server, and there are no longer separate service packs (as was the case with TSE).
- Terminal Services with RDP can use the network-based load balancing service of Advanced and Data Center Servers for Windows 2000. RDP 5.1, which will only be available with Windows .NET Server, Terminal Services, and will only supported for Windows XP and CE.NET clients, supports one-to-one session shadowing, local printers, audio-in, smart cards, 16-bit color and 128-bit-only encryption (not SSL but RSA-level security). RDP 5, which lacks the enhancements offered by RDP 5.1, is supported for Windows 9.x, NT and Windows 2000 Professional clients. RDP supports only Windows-based desktops, but Microsoft licenses RDP to Tarantella, which runs RDP on its Web server.

■ Terminal Services Advanced Client (TSAC), a feature with RDP v.5, is a Win32-based ActiveX control (COM object) that can be used to run RDP sessions within Microsoft IE. Scalability is limited by the memory constraints of the 32-bit OS, which has a maximum 2GB of memory for terminal services (using RDP or ICA).

■ ***Action Item: Enterprises with small thin-client deployments of under 200 active users should consider using Windows 2000 Terminal Services with Microsoft's RDP protocol.***

- Provides workflow provisioning and usage tracking to thin and fat applications
- Adds value to Microsoft Terminal Services
 - Works with Citrix ICA or Microsoft RDP, and ZENworks
- Browser-based
 - Via Internet Explorer or Netscape
- Integrated with Novell Directory Services (NDS eDirectory)
- Runs on Microsoft WTS (NT 4.0 and Windows 2000)
- Supports load balancing

Strengths

- + Supports thin and fat clients
- + Includes load balancing
- + Supports both RDP and ICA
- + Low license cost
- + Browser-based
- + Usage tracking

Challenges

- Requires NDS eDirectory
- Requires RDP or ICA for thin client-side features

- Novell's OnDemand Services is integrated with NDS eDirectory; it consists of the DirCommerce Engine (interfaces to credit card authentication and billing services), the OnDemand Web application (manages user authentication and provides a browser-based application publishing environment) and the Novetrix DeFrame solution (provides a thin client solution for Windows applications).
- Novell acquired Novetrix in March 2001 and integrated DeFrame with ODS v.1.5, which requires Microsoft NT 4.0 TSE or Windows 2000 Terminal Services. The Novell Client 32 must also be installed on WTS. The client provides access to the WTS applications through a browser plug-in (either IE v.5.0+ or Netscape v.4.5+, and for ICA or RDP). Resource-based load balancing services are included to manage the WTS server farm. ODS also provides support for fat client Windows applications through Novell ZENworks. ODS requires ICA or RDP for thin-client-side features (local printer and device support, audio support, support for non-Windows devices). Users with NDS could, for example, use Citrix MetaFrame for ICA features and ODS for load balancing, user authentication, and mixed thin and fat deployment. For enterprises with NDS eDirectory, ODS is an attractive alternative to Citrix MetaFrame.
- ***Through 2006, up to 10 percent of Windows Terminal Services deployments will use Novell's OnDemand Services (0.7 probability).***

Other Thin-Client Choices



Novell. ZENworks Synergy

Sun Ray™ Integrated Solutions

Simplicity at the Desktop



Bridging Windows to Linux

Netilla® Service Platform



- For thin-client deployments focused on Windows, the main alternatives to using Citrix MetaFrame are using Microsoft WTS with RDP alone, WTS with RDP and Canaveral iQ software from New Moon Systems, or Novell ODS with Microsoft's RDP or Citrix ICA. For thin-client deployments in heterogeneous environments (requiring access to Unix x-Windows, mainframe 3270, AS/400 5250 and Windows applications), we recommend that enterprises consider Tarantella's platform. New Moon is primarily targeting deployments of up to 500 active users, but it has won several customers with plans for deployments of up to 2,000 to 3,000 active users. Citrix MetaFrame has more features than Canaveral iQ, such as application installation and management (across the server farms) and better security (with SSL for ICA), but Canaveral iQ is a simple, cost-effective alternative to MetaFrame XPa for many small to midsize deployments. Novell ODS is a Web-based provisioning tool for WTS or Citrix MetaFrame (which can be used with ICA and RDP server-based applications). Novell's ZENworks Synergy is the integration of ZENworks 4.0 (which includes ODS) with Novell's Portal Services. Enterprises can deploy server-based or desktop applications with a common user interface and a unified management infrastructure. Architected independently from server-based legacy applications, including WTS, Tarantella runs on a separate server to provide remote access to legacy applications through a browser (without making any changes to them), as well as poor-performing, Web-based applications, with remote and secure access through a browser.

Acronym Key

CSG	Citrix Secure Gateway
FR2	MetaFrame XP Release 2
ICA	Independent Computing Architecture
ODS	Novell's OnDemand Services
RDP	Remote Desktop Protocol
SSL	Secure Sockets Layer
UPD	Universal print driver
WTS	Windows Terminal Server