



# Windows<sup>®</sup> Embedded for Thin Clients

## White Paper

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### Abstract

Microsoft<sup>®</sup> Windows<sup>®</sup> Powered thin clients are purpose-optimized devices that are based on the Windows Embedded family of operating systems, which include Windows CE and Windows XP Embedded. Windows Powered thin clients are key components in server-based computing solutions where line-of-business (LOB) applications are deployed via the Terminal Services functionality in the Windows 2000 Server family or via Web-based services.

Microsoft Windows 2000 Terminal Services is an integral part of Windows 2000 technology that delivers the familiarity and ease-of-use associated with the Windows graphical user interface through a server-based computing mode.

This white paper is written for those business decision makers and IT professionals who are evaluating the deployment of an end-to-end server-based computing solution that incorporates Windows Powered thin clients.

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**Contents**

**Introduction ..... 1**

**Situation..... 2**

**Windows Powered Thin Client Infrastructure ..... 3**

**Windows 2000 Server Family Infrastructure .....10**

**For More Information.....14**

**Appendix: Microsoft RDP and Citrix ICA Comparison .....15**

**Appendix: Windows Powered Thin Client Solutions.....17**

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## Introduction

When Bill Gates and Paul Allen founded Microsoft Corp. in 1975, they had a simple but powerful vision for the new company: a PC on every desk and in every home. In 1999, Bill redefined Microsoft's vision as empowering people through great software — any time, any place *and on any device*. More than simply the evolution of one company's vision for its business, this statement reflects fundamental changes that are creating new challenges — and opportunities — for the entire technology industry as we enter the 21st Century.

Microsoft's investment in devices is very significant. In the spring of 2000, the Embedded and Appliance Platforms Group (EAPG) was created to focus on the embedded device market to provide the software building blocks to create these next generation devices.

The Windows Embedded family of platforms, Windows CE and Windows XP Embedded provide the foundation for Windows Powered devices. These platforms speed time to market by enabling OEMs to pick and chose different components of the operating system - such as Internet Explorer browser software, Remote Desktop Protocol, 802.11 wireless support or HTTP Server - to build a targeted and differentiated Windows Powered devices such as thin clients, PDAs, cellular phones, data collection scanners, retail point of sale (POS) stations, web server and storage appliances, advanced set-top boxes and many other smart devices.

Not only is Microsoft providing the software building blocks to enable our partners, but we as a company are striving to jump-start the marketplace by evangelizing some specific Windows Powered device classes including Pocket PC, "Stinger" (code name for Microsoft's smart phone platform), Car.Net, Microsoft TV, and Ultimate TV® service set top box.

One specific category, the Windows Powered thin client, is the subject of this white paper.

Microsoft Windows Powered thin clients are purpose-optimized devices that are based on the Windows Embedded family of operating systems, which include Windows CE and Windows XP Embedded.

Windows Powered thin clients are key components in server-based computing solutions where line-of-business (LOB) applications are deployed via the Terminal Services functionality in the Windows 2000 Server family or via Web-based services

In this white paper, you will find information relating to Microsoft's strategy around Windows Powered thin clients, their features and benefits as well as an overview of the Microsoft Windows 2000 Terminal Services infrastructure that enables enterprise customers to assemble end to end server-based computing solutions.

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## Situation

### **Windows Powered devices are transforming the way you do business**

The Windows platform enables business computing in enterprises everywhere. For millions of users, the Windows platform has represented the empowerment of employees. Today, in the PC Plus era, the Windows platform goes even further to enable enterprises to extend their IT infrastructure to enable connectivity to customers, better integration with partners and suppliers, and end-to-end business solutions. This shift is being accompanied by an ever-increasing variety of Windows Powered devices. A key Windows Powered device category, and the subject of this white paper, is the Windows Powered thin client.

Today, many businesses are turning to thin client/server-based computing solutions to make their Windows-based environments more productive and efficient than ever before. In a server-based computing model, technology administrators can extend Windows-based applications to clients without physically installing the application on each device. This centralized deployment saves IT administrators significant time and effort, especially in those customer environments that preclude the deployment of Windows PCs.

Microsoft has been delivering server-based computing solutions to enterprise customers since the shipment of Windows NT® Server 4.0 Terminal Server Edition (TSE) and the first Windows-based Terminal Kit in 1998.

TSE enabled customers to deploy productivity and line-of-business (LOB) applications to be deployed on a central multi-user server and then be accessed remotely via PCs or specialized thin client devices.

At the same time, Microsoft introduced platform software for the first instantiation of a Windows Powered thin client, at that time, called a Windows-based Terminal (WBT). This platform was based on Windows CE and Windows Powered thin client products began to be introduced by 1998 by OEM partners such as Wyse Technology (see Appendix for current Windows Powered thin client partners).

### **Explosive enterprise thin client growth forecast**

Since that time, the server-based computing market has matured to the point where enterprise customers are beginning to deploy broadly, as enterprises have now thoroughly evaluated the underlying benefits of the solution.

In fact, according to IDC<sup>1</sup>, the enterprise thin client market is forecast to be a \$3.2B market with 8.7M shipments worldwide by 2005. Windows Powered thin client shipments are a majority of all enterprise thin clients shipping today and are growing at a 64% CAGR.

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<sup>1</sup> IDC, "Thin Is In, Again: Enterprise Thin Client Forecast and Analysis, 2000-2005"

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## Windows Powered Thin Client Infrastructure

### What is a Windows Powered thin client?

A Microsoft Windows Powered thin client is a purpose-optimized device that is based on a Windows Embedded family operating system, including Windows CE and Windows XP Embedded. Windows Powered thin clients are key components in server-based computing solutions where line-of-business (LOB) applications are deployed via Terminal Services or a Web-based services.

One significant advantage of server-based computing is that client devices do not have to be capable of processing sophisticated Windows-based applications to access and use them. Since a powerful central server (or multiple servers organized to work collectively) handles all application execution, processing and data storage, the client device is required to manage only display updates, mouse clicks and keystrokes.

In addition, there may be out-of-band communications ("virtual channels") between client and server to manage interactions and data redirection with local peripherals on the client.

### Server-based Computing Overview

Server-based computing represents an applications deployment methodology. Windows Powered thin clients are ideal client devices for the following server-based computing scenarios:

- Windows applications deployed via Windows 2000 Terminal Services. In this scenario, a Windows Powered thin client leverages Microsoft's Remote Desktop Protocol (RDP) or Citrix' ICA<sup>2</sup> (Independent Computing Architecture) protocol to access applications deployed via Terminal Services.
- Web-based applications deployed via Web server infrastructure. Many Windows Powered thin clients include local Internet Explorer browsers and are ready to access Line of Business (LOB) applications deployed on corporate intranets or as Web-based services.
- Legacy host-based applications via terminal emulation. Windows Powered thin client OEMs frequently bundle terminal emulation software. In this scenario, a Windows Powered thin client provides a compelling migration path from aging "green screen" terminals to richer applications deployed as rich Windows applications or Web-based services.

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<sup>2</sup> Available with Citrix' Metaframe add-on product

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## Windows Powered thin client benefits

Windows Powered thin clients offer the following platform benefits:

- High reliability (no internal fans or spinning media)
- Security for corporate data (for devices designed without local storage)
- Simple setup right out of the box, just like a terminal
- Minimal training costs for users who are already familiar with Windows
- Relatively low capital cost and centralized management model reduces TCO. Gartner Group studies demonstrated that Windows Powered thin clients could reduce TCO by 32% over unmanaged PCs
- Easy transition to new applications platforms (emulation enables the easy replacement of green screen terminals while local Internet Explorer browser and Terminal Services clients enable access to next-generation Windows-based applications)

## What about Windows-based Terminals (WBTs)?

Windows-based Terminals are an example of a Windows Powered thin client, built with Microsoft's Windows Embedded family of platforms such as Windows CE and Windows XP Embedded.

Windows Powered thin clients such as Windows-based Terminals leverage an embedded Windows operating system such as Microsoft Windows CE or Microsoft Windows NT Embedded 4.0. These componentized operating systems enable device manufacturers to embed Terminal Server client protocols, Internet Explorer technology, Windows Media™ technologies, terminal emulators and simplified task-oriented user interfaces that deliver a simple, cost-effective complement to fully featured PCs.

## Deployment Scenarios

There are four common usage scenarios driving customer demand for Windows Powered thin clients:

- **Rapid deployment of Windows Line of Business (LOB) applications or Web-based services to task workers.** In this scenario, Windows 2000 Terminal Services provides the server-side infrastructure.
- **Replacement of traditional “green screen” terminals.** Windows Powered thin clients can be implemented with similar form factors (low cost, no-moving parts) to terminals. With built-in terminal emulation

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software these devices provide a compelling migration path from legacy environments to richer Windows and Web-based environments.

- **Internet Kiosks.** For example, customer service kiosks in retail environments and in-room Internet/services access for hotels.
- **Client environments that are too harsh for conventional PCs.** For environments where operating conditions or availability of IT support resources preclude the use of PCs, Windows Powered thin clients offer a robust, secure alternative.

In addition, many enterprise thin clients available today have common design considerations that have traditionally been associated with thin client solutions:

- **No local application processing.** All application processing is performed on the Terminal Server. No local application processing occurs on the thin client, with the exception of a local Internet browser and supporting plug-ins.
- **Optional terminal emulators.** Windows Powered thin client devices frequently include third-party terminal emulation suites.
- **No moving parts, including fans and spinning media.** Many thin client designs seek to improve security for corporate data and reduce TCO through sealed-case designs that eliminate moving parts.
- **Task-oriented user interface/shell.** Windows Powered thin client devices can offer connection-oriented user interfaces which simplify training and deployment in task-oriented environments.

## Windows Powered thin client features

Windows Powered thin clients can incorporate any features and components from the underlying Windows Embedded operating system on which they are based. "Talisker," codename for the next release of Windows CE and Windows XP Embedded have the following differences in terms of core thin client features:

Feature	"Talisker"	Windows XP Embedded
Terminal Services	Microsoft Remote Desktop Protocol and Citrix ICA for Windows CE	Microsoft Remote Desktop Protocol and Citrix ICA
Internet Browser	Internet Explorer 5.5-class browser for Windows CE	Internet Explorer 6.0
Multimedia	MP3, Windows Media 7 for Windows CE	MP3, Windows Media 8
User Interface	Connection Manager and "skinnable" shell	Windows Explorer shell and Windows XP shell
Plug-ins	Flash and Acrobat available from third party	Many plug-ins widely available for Windows XP



Java support	Third party	JVM (JDK 1.1.4) and third party
Local Applications	Windows CE-based applications	Any Win32® application
Processors	X86, ARM, MIPS, PPC, SH	X86
Device manageability	SNMPv2, Telnet, HTTP	SNMPv2, Telnet, HTTP, SMS, WMI, RDP
Terminal Emulation	Supplied by OEM	Supplied by OEM
Device Drivers	Windows CE	All Windows XP drivers
Typical Memory <sup>3</sup>	32 MB RAM	64MB MB RAM
Typical Storage	16 MB Flash memory	48 MB Flash memory
Microsoft .NET Support	MSXML3, SOAP, Common Language Runtime for Windows CE	MSXML3, SOAP, Common Language Runtime
Support for Active Server Pages	Yes	Yes
Remote Boot	Yes	Yes (post RTM)

### How do I choose the right Windows Powered thin client?

Windows Powered thin clients incorporate functionality from the underlying Windows Embedded operating system on which the thin client is based. Windows CE and Windows XP Embedded have different feature sets, even though they are both embedded operating systems:

Platform	Value Proposition
<b>Windows Powered thin clients based on Windows CE</b>	The simple, low-cost Windows Powered solution for replacement of traditional “green screen” terminals and the rapid deployment of Line of Business (LOB) applications to task-oriented workers.

<sup>3</sup> Device footprint (RAM+Flash) for a typical Windows Powered thin client with RDP.

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**Windows Powered thin clients based on Windows XP Embedded**

The high-end Windows Powered thin client solution that delivers no-compromise functionality including full Internet Explorer 6 browser, device driver availability, local Win32 application support and the highest levels of robust performance

## How to choose between a Windows Powered thin client and a Windows XP Professional PC

Windows XP Professional, the desktop operating system for business PCs, supports a broad range of applications and peripherals, enabling businesses to maximize the flexibility and functionality of their PCs.

How do you choose between deploying a Windows XP Professional PC versus a Windows Powered thin client? The following table outlines some platform recommendations based on usage scenario:

Usage Scenario	Client Platform Recommendation
Knowledge workers who need rich Windows productivity applications such as the Microsoft Office suite	Windows XP Professional PC
Server-based computing environment where all applications are deployed via Terminal Services	Windows XP Embedded or Windows CE thin clients
Access to Web-based services that require fully featured Internet Explorer browser	Windows XP Professional PC or Windows XP Embedded thin client
Access to Web-based services or corporate Intranets where content is managed to lowest-common denominator formats	Windows CE thin client
Requirement for rich multimedia	Windows XP Professional PC
Environments that are too harsh for PCs (heat, dust, noise, etc.)	Windows Powered thin client
Replacement of an existing traditional "green screen" terminal	Windows CE thin client
Content creation (versus access)	Windows XP Professional PC
Kiosks (Internet or otherwise)	Windows Powered thin clients

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## **Licensing Implications for Windows Powered thin clients and Windows 2000 Terminal Services solutions**

Microsoft® Windows® 2000 Terminal Services provides access to Windows-based applications from a variety of client hardware devices. Applications are installed on the server and accessed by clients via Terminal Services software.

If you are accessing applications deployed via Windows 2000 Terminal Services then there are 3 product licenses that will be associated with this solution:

- Windows 2000 Server is required for hosting Terminal Services sessions.
- A Windows 2000 CAL or a BackOffice® CAL is required to access Windows 2000 Terminal Services and other basic network/application services in the Windows 2000 operating system.
- A Windows 2000 Terminal Services CAL is required to run applications on a Windows 2000 Server via Terminal Services.

Additionally, you are required to ensure that the applications you are running on the terminal server are properly licensed. For instance, Microsoft Office applications are licensed per-device. Each device that runs Office via a terminal server must have a license for Microsoft Office.

## **Windows Powered thin client roadmap**

At the time of their original introduction in 1998, the core business and technology drivers for Windows Powered thin client solutions were

- The desire to run the business within the context of financial constraints.
- The realization that a one-size-fits-all model for desktop client computing doesn't necessarily make sense for task workers versus knowledge workers.
- The desire to deploy devices and applications rapidly, especially in the context of replacing old terminal infrastructure to make way for the next generation of Windows applications.

Today, these drivers are still active, especially with respect to reducing TCO in a difficult economy. However, we can now add the desire to be prepared for the coming transition to distributed computing where PCs and smart devices access next generation applications that have been deployed as Web-based services. This shift is the basis for Microsoft's focus on Microsoft .NET.

To accommodate this shift, Windows Powered thin clients are migrating from their "Windows-based Terminal" roots to include more sophisticated technologies incorporating Internet standards.

Historically, Windows Powered thin clients were licensed via a special Windows-based Terminal (WBT) OEM platform kit, which included all the Microsoft components for thin clients as well as documentation and build instructions. This platform kit included a Windows-based Terminal design specification as well as a certification process where WBT designs had to validate their design versus the specification prior to commercial availability.

Over time, OEMs asked Microsoft to provide a more seamless linkage between Windows Powered thin client functionality and the underlying Windows Embedded OS distribution vehicles (Windows CE, Windows XP Embedded) and to simplify the process of building a thin client configuration.

With Windows CE and Windows XP Embedded, we will offer a Windows Powered thin client configuration within the Platform Builder and Target Designer development tools respectively.

This will enable OEMs to quickly create highly differentiated offerings by adding additional technology components to the base thin client configurations provided by these development tools.

In addition, Microsoft is eliminating the WBT specification and the certification process that accompanied it to enable our OEMs to more rapidly respond to customer and market requirements as opposed to focusing on products that serve a specific "WBT" instantiation of a Windows Powered thin client.

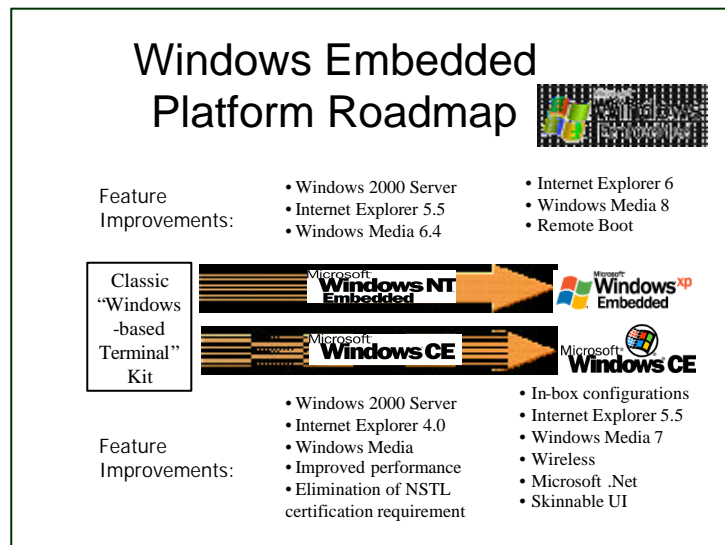


Figure 1: Windows Embedded thin client platform roadmap

## **Windows 2000 Terminal Services**

The Terminal Services component of the Microsoft Windows 2000 Server operating system can deliver the Windows 2000 desktop, as well as the latest Windows-based applications, to virtually any desktop computing device, including those that cannot run Windows. This lets more people in an organization take advantage of the resources provided by a distributed computing environment. Terminal Services can also be used to remotely administer a Windows 2000-based server.

Terminal Services client software is available for a wide variety of different client hardware devices, including Windows PCs and Windows Powered thin clients. Support for non Windows-based devices such as the Apple Macintosh or UNIX workstations is available via middleware from Citrix.

Terminal Services lets enterprises more easily and cost-efficiently accomplish the following goals:

- **Centrally deploy and manage Windows-based applications to virtually any type of client and over virtually any type of network connection.**

Organizations can use Terminal Services in Application Server mode to deliver Windows-based applications to heterogeneous desktop environments, over local area network (LAN), wide area network (WAN) and dial-up connections. This is a cost-effective way to deploy line-of-business applications that are frequently updated, hard to install, or need to be accessed over low-bandwidth connections.

Using Terminal Services, companies can ensure that all clients are using current versions of an application because the software is installed once on a server, rather than on every desktop throughout the company. This model reduces the costs and challenge of updating desktop machines, especially for remotely located desktops or branch office environments. In addition, Terminal Services features such as Remote Control can simplify application support.

- **Phased hardware upgrades.** By letting users access current applications on hardware that might otherwise be of little use, Terminal Services can help companies that are gradually replacing older machines.
- **Remote administration of Windows 2000-based servers.** Using Terminal Services can give administrators greater flexibility and mobility. Administrators can securely manage their Windows 2000-based servers over any network connection from any device using the Terminal Services Client software. The client device does not need to be running Windows 2000 Professional. This lets an administrator perform tasks such as directory maintenance, virus scans, backups, reboots and even promote a server to be a domain controller—all from a remote location.

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## Terminal Services Architecture

Terminal Services extends the model of distributed computing by allowing PCs to operate in a server-based computing environment. With Terminal Services running on a Windows 2000-based server, all client application execution, data processing, and data storage occur on the server. Applications and user desktops are transmitted over the network and displayed via terminal emulation software. Similarly, print streams, keyboard input, and mouse clicks are also transmitted over the network between the server and the terminal emulation software. Each user logs on and sees only their individual session, which is managed transparently by the server operating system and is independent of any other client session.

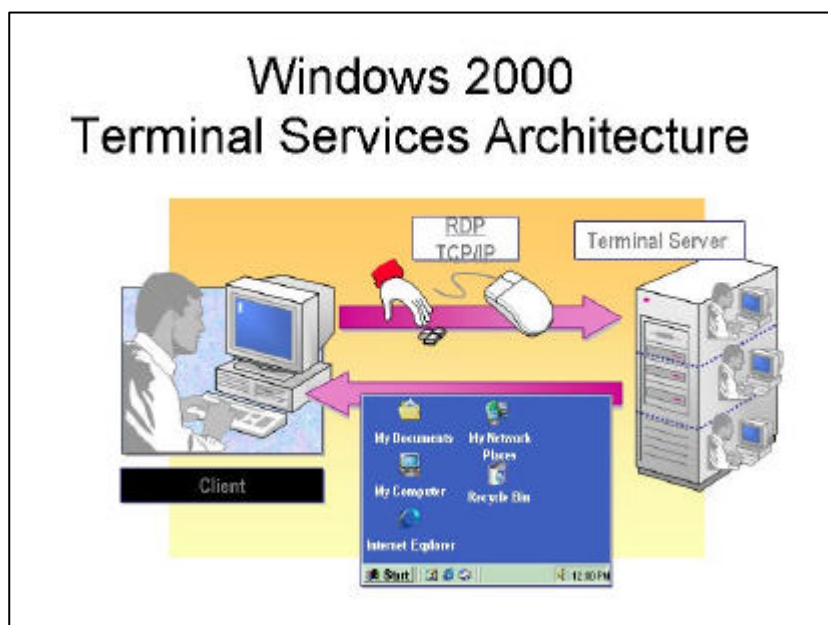


Figure 2: Windows 2000 Terminal Services

## Terminal Services Components

Windows 2000 Terminal Services consists of five components: the Windows 2000 Server multi-user kernel, the Remote Display Protocol, the Terminal Services Client software, the Terminal Services Licensing service, and Terminal Services system administration tools. Specifically:

- **Multi-user kernel.** The multi-user kernel extensions, originally developed for Windows NT Server 4.0, Terminal Server Edition, have been enhanced and fully integrated as a standard part of the Windows 2000 Server family kernel.
- **Remote Desktop Protocol.** A key component of Windows 2000 Terminal Services is the protocol that allows a client to communicate

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with the Terminal server over a network. This protocol is based on International Telecommunications Union's (ITU) T.120, an international standard, multiple-channel protocol used first in Microsoft NetMeeting® conferencing software. It is a Unicode-compatible protocol tunable for any environment that allows for network localization, automatic disconnection, and remote configuration. It supports three levels of encryption. It also supports different bandwidth allocations by allowing client-side bitmap caching and optional compression for low-bandwidth connections.

- **Terminal Services Client.** The client software that displays the familiar 32-bit Windows user interface on a client machine. The client software is a very small software application that establishes and maintains the connection between a client and a server running Terminal Services. It transmits all input from the user to the server, such as keystrokes and mouse movements, and all output from the server such as application display information and print streams. In addition, there may be out-of-band communications ("virtual channels") between client and server to manage interactions and data redirection with local peripherals on the client.
- **Terminal Services Licensing service.** This service is required whenever Terminal Services is enabled for application serving. The service allows Terminal Services to obtain and manage its Terminal Services Client Access Licenses (CALs) for connecting devices. It can manage unlicensed, pre-licensed; temporarily licensed, and CAL licensed clients, and supports both ordinary CAL and Internet Connector Licensing for Terminal Services. The Remote Administration mode does not use the Terminal Services Licensing service. Terminal Services Licensing is a component service of Windows 2000 Server, Advanced Server, and Datacenter Server.
- **Terminal Services Administration Tools.** The Administration Tools consist of software that manages Terminal Services. These include Terminal Services License Manager, Terminal Services Client Creator, Terminal Services Client Configuration, and Terminal Services Manager.

## Assembling an End-to-End Solution

Windows Powered thin clients are a key element of an end-to-end server-based computing solution. However, a complete solution will include some or all of the following components:

- Server hardware and network infrastructure to support the desired number of users

- Microsoft Windows 2000 Servers and Microsoft .Net Enterprise servers such as Microsoft SQL Server 2000 or Microsoft Exchange Server 2000
- Line of Business (LOB) and/or productivity applications such as Microsoft Office XP or Microsoft Great Plains Business Solutions

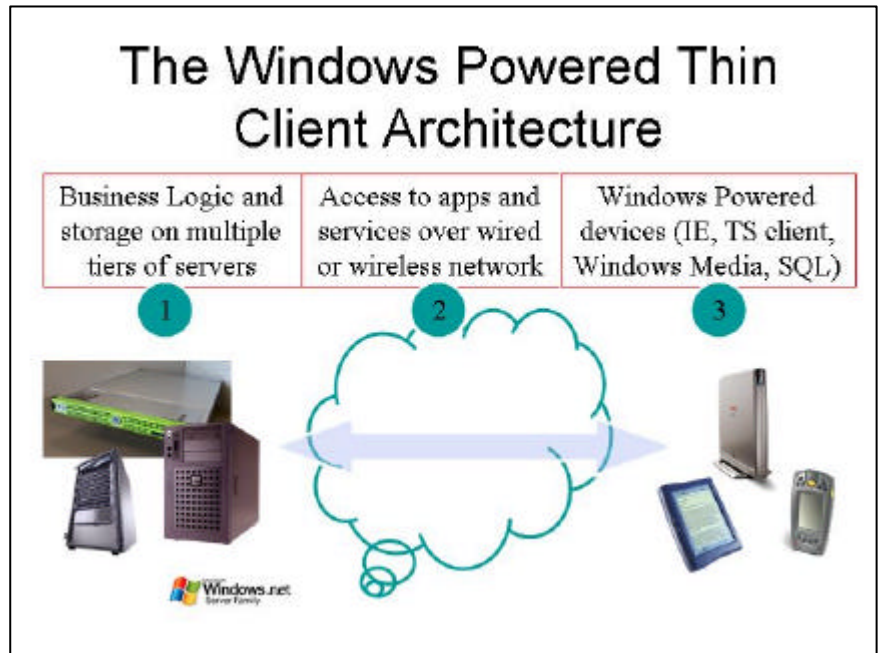


Figure 3: Typical Server-based Computing Architecture

### Windows Powered thin clients and Microsoft .NET

Microsoft .NET is Microsoft's platform for building, deploying and running Web Services and applications. It's all about enabling software as a service and enabling the transition of applications to XML Web-based services.

Moving into the Internet-connected future, enterprises, their customers and partners will also find significant benefits from the technologies behind Microsoft's .NET initiative. The Microsoft codename "Hailstorm" services, such as authentication, authorization, and "MyWallet" services, are designed to help solve common problems facing consumer commerce in a dynamically interconnected world.

Windows Powered thin clients, being built on Windows CE and Windows XP Embedded, will be ready to participate in Microsoft .Net services as the underlying Windows Embedded family platforms include support for key Internet standards as well as Microsoft .NET technologies: Internet Explorer, XML, SOAP, .NET Framework, Common Language Runtime and Active Server Pages.



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## For More Information

## For More Information

For the latest information on the Microsoft Windows 2000 Server family and Terminal Services, visit:

<http://www.microsoft.com/windows2000/technologies/terminal/default.asp>

For more information about Microsoft Windows 2000 Server family and Terminal Services licensing, including special situations such as access via Application Service Providers (ASPs), visit:

<http://www.microsoft.com/windows2000/server/howtobuy/pricing/default.asp>

For the latest information on Windows Powered thin clients, visit:

<http://www.microsoft.com/windows/embedded/wbt>

For the latest information on the Windows Embedded family of operating systems, including Windows CE and Windows XP Embedded, visit:

<http://www.microsoft.com/windows/embedded/>

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## Appendix: Microsoft RDP and Citrix ICA Comparison

### What is the difference between Microsoft's Remote Desktop (RDP) Protocol and Citrix Independent Computing Architecture (ICA)?

Windows NT® Server 4.0, Terminal Server Edition, (Terminal Server) and Windows® 2000 Terminal Services support both the native Microsoft Remote Desktop Protocol (RDP) as well as the Citrix Independent Computing Architecture (ICA) protocol (via the Citrix MetaFrame add-on). The following table provides an overview of the features available with each of these protocols:

Feature	Description	RDP 5.1	ICA
<b>Clients</b>	Windows CE-based thin client	?	?
	Windows XP Embedded-based thin client	?	?
	ActiveX Control	?	?
<b>Transport</b>	TCP/IP	?	?
	SPX, IPX, NetBEUI		?
	WAN connection	?	?
	Dial-up, VPN, xDSL	?	?
<b>Audio</b>	Direct dial-up (non-RAS)		?
	System beeps	?	?
	Stereo Windows audio		?
<b>Local Printing</b>	Printing to a local printer attached to a thin client	?	?
<b>Local Drive Mapping</b>	Local drives accessible from server-based applications	?	?
<b>Local Port Redirection</b>	Redirection of server ports (LPT/COM) to local client ports	?	?
<b>Cut and Paste</b>	Cut and paste of text and graphics between client and server	?	?
<b>User-centric session access</b>	Client remembers previous user's logon name for each connection	?	
	Connect to an active or disconnected session using a different screen resolution	?	

	Connect directly to an application rather than to an entire desktop	?	?
<b>Application Publishing</b>	Server-based applications resize and minimize similar to local applications		?
	Advertise server-based applications directly to client desktops		?
<b>Resolution</b>	16-bit color depth	?	?
<b>Load Balancing</b>	Pooling of servers behind a single server address and for increased availability	? <sup>1</sup>	?
<b>Remote Control</b>	Viewing and interaction with other client sessions (aka "Shadowing")	?	?
<b>Bitmap Caching</b>	Optionally cache display bitmaps in memory for improved performance	?	?
	Optionally cache display bitmaps to disk for improved performance	?	?
<b>Encryption</b>	Multiple-level encryption for security of client communications	?	?
	Multiple-level encryption on Windows CE thin clients	?	
<b>Automatic client update</b>	Administrative means for updating client connection software from the server	? <sup>2</sup>	?
<b>Pre-configured client</b>	Predefined client with published applications, IP addresses, server names and connections options	?	?

<sup>1</sup> Requires Windows 2000 Advanced Server or Datacenter Server

<sup>2</sup> Not available on Windows CE thin clients

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## Appendix: Windows Powered Thin Client Solutions



Windows Powered thin client solutions are currently available from the following OEMs and Systems Integrators:

- Acer  
<http://global.acer.com>
- Annasoft Systems  
<http://www.annasoft.com>
- BSquare  
<http://www.bsquare.com>
- Compaq Computer Corporation  
<http://www.compaq.com>
- Eizo Nanao Corporation  
<http://www.eizo.com/products/wbt/index.html>
- IBM Corporation  
<http://www.ibm.com>
- National Semiconductor  
<http://www.national.com>
- Neoware Systems, Inc.  
<http://www.neoware.com>
- Network Computing Devices, Inc.  
<http://www.ncd.com>
- PRAIM, Inc.  
<http://www.praim.com>
- Takaoka Electric Mfg  
<http://www.takaoka.jp>
- TeleVideo, Inc.  
<http://televideo.com>
- VenturCom, Inc.  
<http://www.vci.com>
- VXL Instruments Limited  
<http://www.vxl.net>
- Wyse Technology  
<http://www.wyse.com>