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Windows 2000 Terminal Services: An Overview

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Executive Summary

Microsoft® Windows® 2000 Terminal Services can provide remote access to a server desktop by means of "thin client" software, operating as a terminal emulator. Terminal Services transmits only the user interface of a program to the client. The client then returns keyboard and mouse clicks to the server for processing. Users log on and see only their individual session, which is managed transparently by the server operating system and is independent of any other client session. Client software can run on a number of client hardware devices, including computers, Windows-based terminals, and handheld devices. Other platforms, such as Macintosh® computers or UNIX-based workstations, can also connect to a terminal server with additional third-party software.

Terminal Services can be deployed on the server in either Application Server or Remote Administration mode. As an Application Server, Terminal Services provides an easy way to distribute Windows programs using a network server. In Application Server mode, Terminal Services delivers the Windows 2000 desktop and the latest Windows applications to computers that might not normally be able to run Windows. When used for remote administration, Terminal Services can provide a means to remotely control your server from virtually anywhere on your network or the Internet.

Remote Administration Mode

Overview

Windows 2000 Terminal Services Remote Administration mode allows any server running Windows 2000 (Windows 2000 Server, Windows 2000 Advanced Server, or Windows 2000 DataCenter) to be administrated remotely with full access to all the built-in graphical user interface-based (GUI) administrative tools, as if the administrator were actually sitting at the console of the server. This permits administrators from virtually anywhere on your network (using a LAN, WAN, Internet, or dial-up connection) to administer the system, eliminating costly training and travel.

License Administration

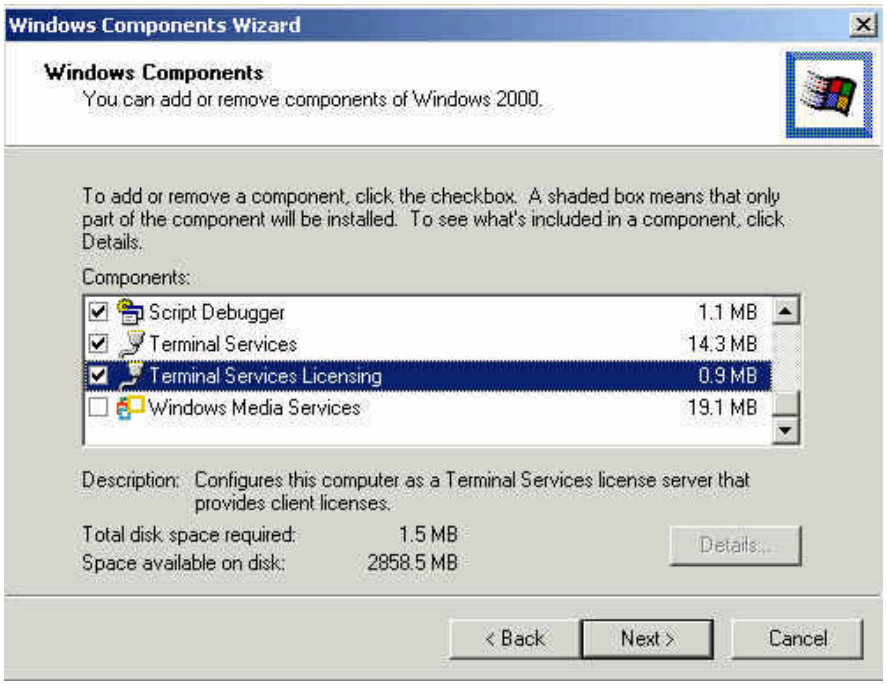
In Remote Administration mode, you do not need to enable Terminal Services Licensing. A maximum of two concurrent connections is automatically allowed on a Terminal server. This can help lower your IT costs by eliminating the purchase of costly additional software, as these two connections are included in the cost of Windows 2000. No Terminal Server Client Access License (CAL) is required to utilize Remote Administration mode.

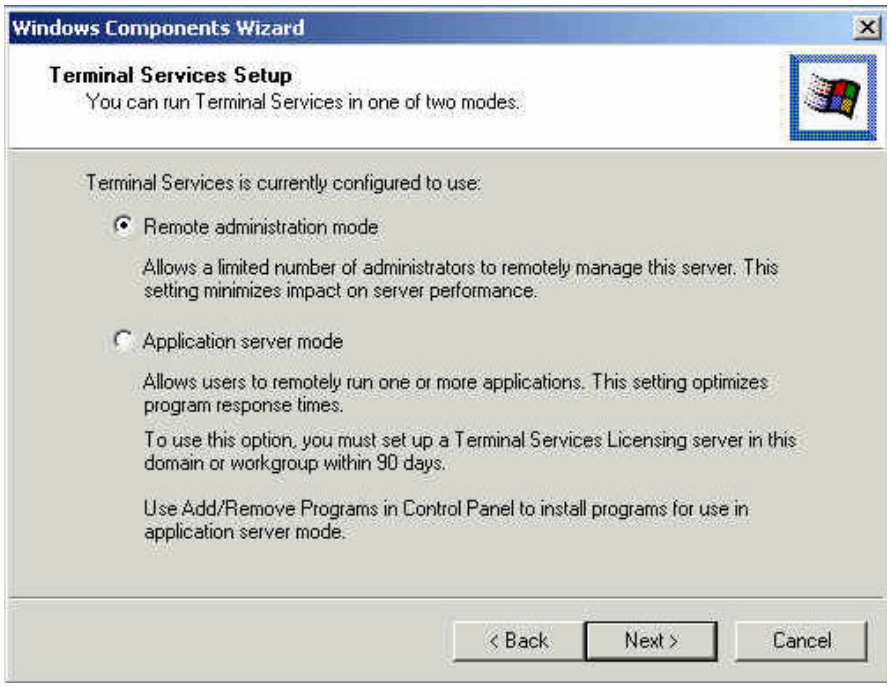
System Resources

Unlike other products, Terminal Services in Remote Administration mode does not require a large amount of resources to be "left on the wire," awaiting a connection from a client. When enabled, Remote Administration consumes no additional disk space on the server because the code is embedded in the Windows 2000 microkernel. Also, it only consumes 85KB of paged, and 185KB of non-paged kernel memory while waiting for a connection, and has little or no impact on processor performance while waiting. When a session is logged in, the performance impact upon the server is similar in cost to the console connection (i.e., someone logged in at the actual machine itself).

Integration into Windows 2000

Terminal Services code is now embedded in the operating system microkernel, making it a core part of Windows 2000. No additional software needs to be purchased or installed on the system, possibly consuming valuable resources. Terminal Services is installed just like any other Windows 2000 core application, by clicking the Add/Remove Programs program located in the Control Panel, and then clicking Add/Remove Windows Components.





When installed, Terminal Services runs as a service on the system, providing the ability to start, stop, pause, or resume the service at any time. As well, if the service fails, it can either be restarted automatically by Windows 2000, or run a file or a batch command notifying the administrator of the failure, or the system itself can be rebooted. This applies both to Remote Administration and Application Server modes.

For unattended setup, Terminal Services can be enabled by using the *TSEnable* key in the *Components* section of the unattend (.sif) file. By providing the unattend file, Terminal Services in Remote Administration mode can automatically be enabled at installation, permitting remote access upon the first boot of the system. This capability enables the administrator to complete the installation from a remote location.

Client Access

Clients are available to perform Remote Administration mode for both 16-bit Windows (Windows for Workgroups 3.11 with TCP/IP), 32-bit Windows (Windows 95 / Windows 98 / Windows NT® 4.0 / Windows 2000) and Windows CE 2.11 systems. As well, future access is expected via Internet Explorer utilizing an ActiveX plugin. This feature enables the adminstrator to use virtually any system on the to control the system. The entire 32-bit client application is stored on only two diskettes (the 16-bit version requires four) and requires only 8MB of memory (16MB for Windows NT 4.0 and Windows 2000) and 1.5MB of disk space. By default, the client software is installed in the *%systemroot%*\system32\clients\tsclient directory upon installation. However, this default setting can be disabled in large server environments.

Developer Benefits

Windows 2000 Terminal Services in Remote Administration mode can be a great benefit in deploying and troubleshooting applications. In Remote Administration mode, you are directly controlling Windows 2000 as if you were physically sitting at the console. In this mode, all graphical tools available in the console environment are at your disposal.

At any time during a remote session, the system can be shut down or rebooted. By default, Terminal Services is automatically set to restart upon boot. This means that you can install or reconfigure your application, and if a reboot is required, reboot the system and reconnect once the system has been restarted. If any problem arises (e.g., an impending power failure) requiring the server to be shut down, Remote Administration allows you to do this as well. While Remote Administration mirrors the console session in the tasks that can be performed, it does not affect any console session that may be in progress on the system. Although the user at the console cannot see what the remote session is doing, use of the Terminal Services administration tools or command line interface enables detection of a remote user who is logged on. This feature permits simultaneous access of the system by multiple administrators, allowing them to perform their job without visually affecting the other users. During remote administration, care must be exercised to avoid making changes that could affect another remote user.

Another benefit is the use of Roaming Disconnect, which is enabled by default. This feature is useful if the administrator is disconnected for any reason. The session will, upon reconnection, resume exactly where it was before the disconnect. The administrator does not need to be sitting at the same client; he or she can move to another system (e.g., nearer to any materials that may be needed), reconnect, and continue working as if the move never took place.

By default, all Terminal Services sessions connect using medium (56-bit cypher) encryption. However, this can be changed (in North America) to high encryption, providing bi-directional security using a 128-bit cypher. By utilizing high encryption, you can be certain that any sensitive information that may be transmitted is secure, greatly easing the worries of administering the server outside a firewall.

As can be expected, applications can be installed and executed using Remote Administration. By use of sharing, your local drive can be connected to the server (via the client session) to permit applications to be installed on the server without physically being at the system. Applications as well as any needed fixes or patches can be rapidly deployed. Customers can be served more quickly, and applications can be kept up to date without the need to send CDs or diskette packages, or require a customer to connect to a Web or an FTP site to download the fix and install it successfully. This is especially convenient for help desk personnel who need to correct errors or update systems. If needed, domain controllers can be promoted or demoted within the client session, providing backup is case of a system failure.

Like Terminal Services in Application Server mode, a server in Remote Administration mode has full access to the Remote Desktop Protocol (RDP) feature set, including local printing, clipboard mapping (cut, copy, and paste), and support for any RDP virtual channel applications such as local drive mapping (available in the Windows 2000 Resource Kit).

Application Server Mode

Overview

Windows 2000 Terminal Services running in Application Server mode enables the deployment of the latest Windows-based applications in a fully server-centric mode, running everything entirely on the server. This time-saving feature permits the deployment and management of applications from one central location so that all users receive the same version of an application. Deployment and development time, as well as time spent on maintenance and upgrades is reduced. Once deployed, anyone utilizing the Terminal Services client can connect to the server and run the application as if sitting at the console.

Single Install

With Terminal Services, applications are installed on the server, and then rapidly deployed to all clients at the same time. Clients all receive the same version of the software, reducing support costs for different versions of the same application. To install an application, the server is placed in “Install Mode” using the Add / Remove Programs applet from the Control Panel. If the application is already “multiuser-aware,” nothing else needs to be done; the application is ready for the clients to use. Microsoft also supplies numerous command scripts that can be used to modify an application to make it multiuser-aware. Command scripts are available for many of today’s most popular applications, such as Microsoft Office and Lotus® SmartSuite. Developers can also write application command scripts, allowing virtually any application to run properly utilizing Terminal Services.

Legacy Clients

The Terminal Services client requires only 8MB of memory (16MB on Windows NT) and 1.5MB of disk space, permiting the use of legacy clients. The latest applications can be deployed on older hardware that may not be able to run the application locally, reducing the work of upgrading all clients hardware by using Terminal Services, saving dollars and resources. The Terminal Services client runs on Windows 95, Windows 98, Windows NT 3.51, Windows NT 4.0, and Windows 2000. Also, by using Citrix MetaFrame, you can create clients for DOS, Macintosh, and UNIX, and Java. Virtually any machine on the network can be a Terminal Services client.

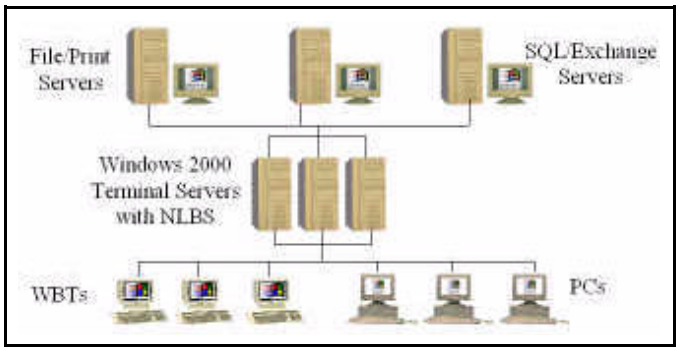
Front End / Back End Setup

By utilizing Terminal Services in Application Server mode, you can create a three-tier environment for your users. In this scenario, only the Terminal services client is located on the

client computers. The client applications are stored on the Terminal Server, and middleware applications (e.g., SQL Server, Exchange, Lotus Domino) can be stored on a third layer of servers. This means that your clients directly connect only to those servers running Terminal Server, and not the application (middleware) servers. In a network environment, this can be used for such things as setting up a high-speed dedicated link between application servers and Terminal servers, freeing network bandwidth to gain optimal performance for your application servers, while eliminating client traffic along the same paths.

Network Load Balancing

Windows 2000 Advanced Server also comes with Network Load Balancing Services (NLBS). This service performs load distribution of client connections, and can provide high availability of your Terminal servers. Up to 32 nodes can be managed using NLBS, providing a robust environment for your clients. DNS round-robin can be used to distribute user connections, as well as third-party applications from such vendors as Citrix, Cubix and NCD.



Developer Benefits

Terminal Services in Application Server mode can provide support for several different environments. First, it can be used as a development tool. During the development of a software application, beta testers can log on via Terminal Services to test the product, instead of requiring installation at the client workstation. This ensures that all testers will be using the same revision level, testing the same code without the long process of requiring everyone to perform manual updates for every new release.

Terminal Services can also add value to your application. You can write your application for Windows 2000 today, and market it to those who are currently running another version of Windows. Utilizing Terminal Services, the users can connect and access the product using their older operating system software, and when their systems are upgraded, they can install the application on their local client. This can speed deployment of an application, and also simplify the deployment process: Applications can be deployed today without having to upgrade the client at the same time, saving money and time.

Licensing is made easier by Terminal Services. All code is on the server, and usage can be tracked with the Terminal Services License tool. This can curb needless software expense and guarantee that the organization is always in compliance with licensing. Restricted products can be accessed by Terminal Services only, ensuring that code is not released to the general public. Using profiles and default applications, Terminal Services can be restricted to the application level, wherein only one application can be run from the session with no direct interaction with the file system on the server.

Client Configuration

Overview

User accounts can be created on a Windows 2000 Server by:

- Using the server (created and managed using Local Users and Groups)
- Using Active Directory on a domain controller (using Active Directory Users and Computers)

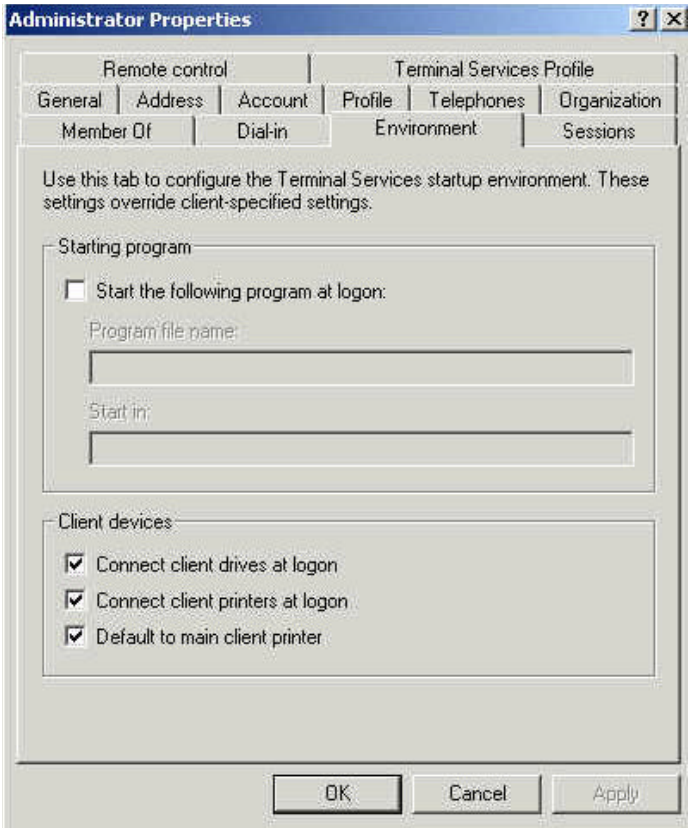
Whichever way accounts are created and stored, the parameters given to manage that user account are the same.

If the server is running in Remote Administration mode, no licensed server is necessary. If the server is running in Server Application mode, a licensed server must be running somewhere in the site (note that licensing is done at the site level and utilizes your site topology). A licensed server stores all Terminal Services licenses that have been installed in the organization. This may or may not map to your domain or Active Directory topology. Each client that connects to your Terminal server must have a valid Terminal Server Client Access License (CAL). By default, all users in the domain are eligible to utilize Terminal Services unless specifically denied the right to log on.

The setting tabs listed below can be used to administer and manage a user account on a per-user basis. If you wish to manage all users, see the section on server configuration and tools.

Environment Settings

All settings related to creating the client's environment are located on the Environment Tab.



The Starting Program parameter can be used to set the application that the user is permitted to run under Terminal Services. If an application is placed here, it is the only application that the user is allowed to run. Closing the application disconnects the user from the session. This can be used to limit the applications that can be run by the user, such as in a kiosk setup (for such applications as conference registration or information signup). This field can be set to invoke one and only one application. However, if that application starts up other applications, then those application will still be permitted to run. If you do not wish to set this parameter for each user, you can set it systemwide by using the Terminal Services Configuration tool. Note that using the configuration tool will override any information that may be located in the environment tab.

The Client Devices can be set to automatically connect local printers upon logon. When the client connects to the Terminal server, the server will automatically detect the local printer (i.e., the printer at the client workstation), install the proper printer driver, and make this printer the default printer for the session. This greatly increases mobility, allowing the user to print locally from any system on the network without either standardizing on one printer or installing all of the printer drivers on the client. Drivers are installed only when printers are detected. This feature can be used via automatic printer redirection (for all 32-bit clients included in Windows 2000) or by manual printer redirection (for 16-bit clients, Windows-based terminals, or printers whose drivers were not shipped with Windows 2000 Server).

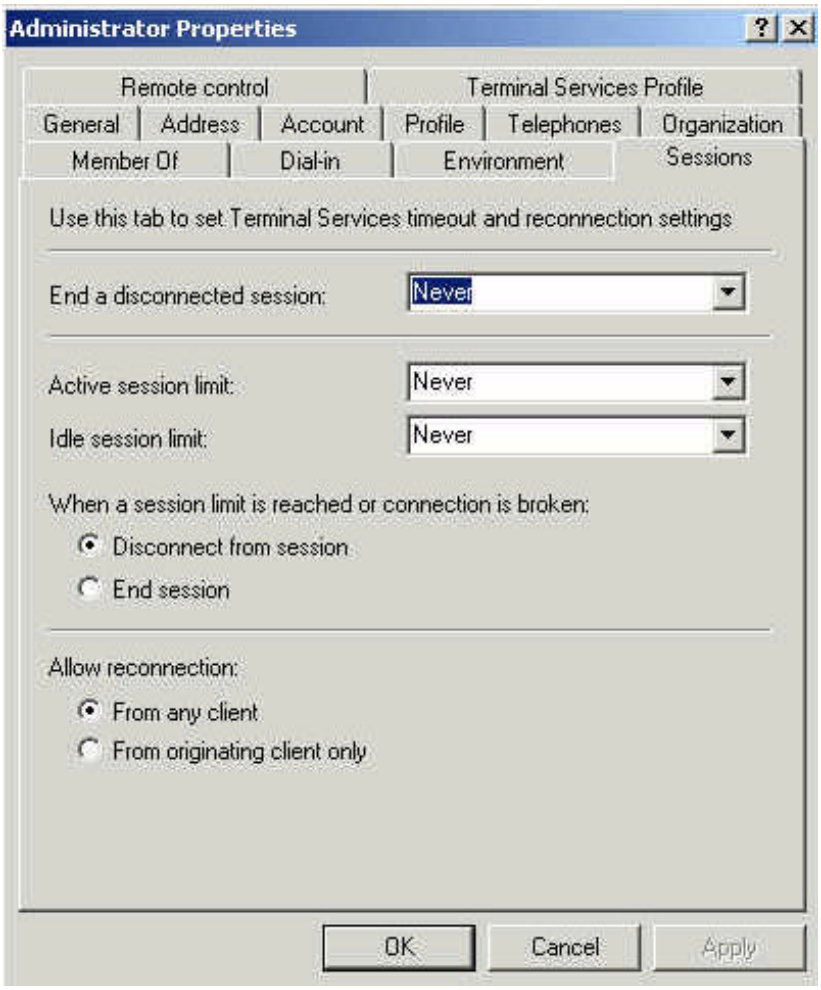
For automatic printer redirection, Terminal Services detects any local printers attached to the LPT, COM, or USB port on the client machine at logon. The printer driver is installed and a local queue is created on the server. When the client disconnects, this printer queue is deleted, and

any pending or incomplete jobs are deleted, saving space on the server. However, this printer information is stored on the client computer so that subsequent logons by any user will use this stored information to restore the printer connection. For manual redirection, administrator assistance is required during initial installation. However, after the initial setup, printers are automatically redirected during subsequent logons. Printer redirection does not work with bi-directional printers.

Note that only by using Citrix clients (running the ICA protocol) can client drives be automatically connected at logon.

Sessions Settings

The Sessions Tab lets individual users have their session set to restrict the duration of a session based upon its current state.



By default, all disconnected Terminal Server sessions are retained upon disconnect. The length of time the session is retained can be set from 1 minute to never (disabling the timer). Once the time limit is reached, the session is reset by the computer and cannot be restored to its disconnected state. This frees system resources for additional sessions, while also allowing time for users to reconnect after network outages or possible client system problems.

The session itself can be restricted by use of the Active Session Limit setting, which determines how long the session can be active on the Terminal Server until it is disconnected automatically. This feature is valuable when a user accidentally leaves a session open, or when you want to restrict usage due to limited server or network bandwidth.

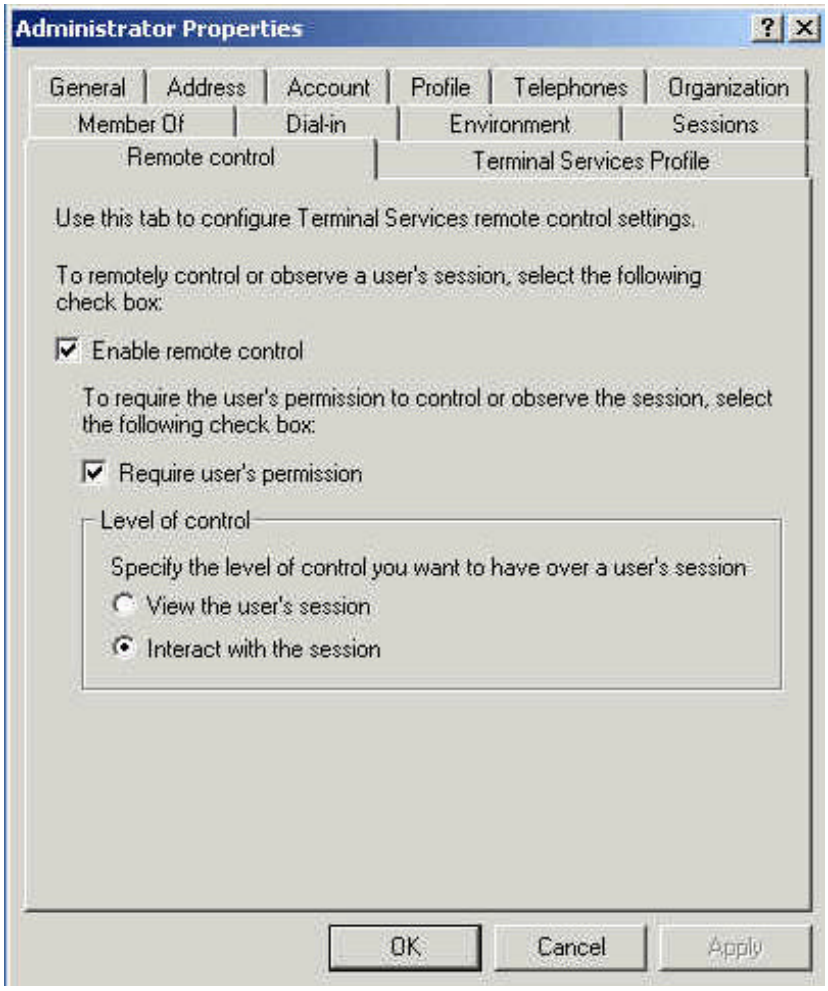
Finally, you can adjust the Maximum Idle Time (denoted as time without connection activity) allowed before a session is reset. This is adjusted via the Idle Session Limit parameter. Again, this can permit resources to be freed by disconnecting users who have been idle for any length of time (from 1 minute to never, disabling the timer).

A fourth parameter permits you to determine where a session can be reconnected from upon disconnect. By default, any disconnected session can be reconnected to any computer, allowing

you to resume where you left off from a different computer. This is invaluable for users who need to roam between systems, and who do not what to have to restart their session from the beginning every time they switch computers. However, this parameter can be turned off as well, specifying that only the computer that the user initially connected to can be used to reconnect to. This feature is only available to Citrix ICA clients that can supply a serial number, and is not available to the clients shipped with Windows 2000.

Remote Control Settings

By default, an administrator can control all client sessions remotely (via another terminal session). However, these settings can be adjusted with the Remote Control Settings tab. The checkbox Enable Remote Control is used to both enable and disable remote control for that user. If this feature is enabled you have two choices concerning both the visibility of the administrator and whether or not permission is needed to remotely administer or view the client session.



The first choice is whether or not the administrator has the ability to manage the session, or just observe (or shadow) the client session. By default, this parameter is set to take control of the session, permiting such people as help desk personnel to actively manage a user's desktop, change any parameters in the session that may need adjusting, or deliver education to users by showing them what needs to be done in a particular application or session.

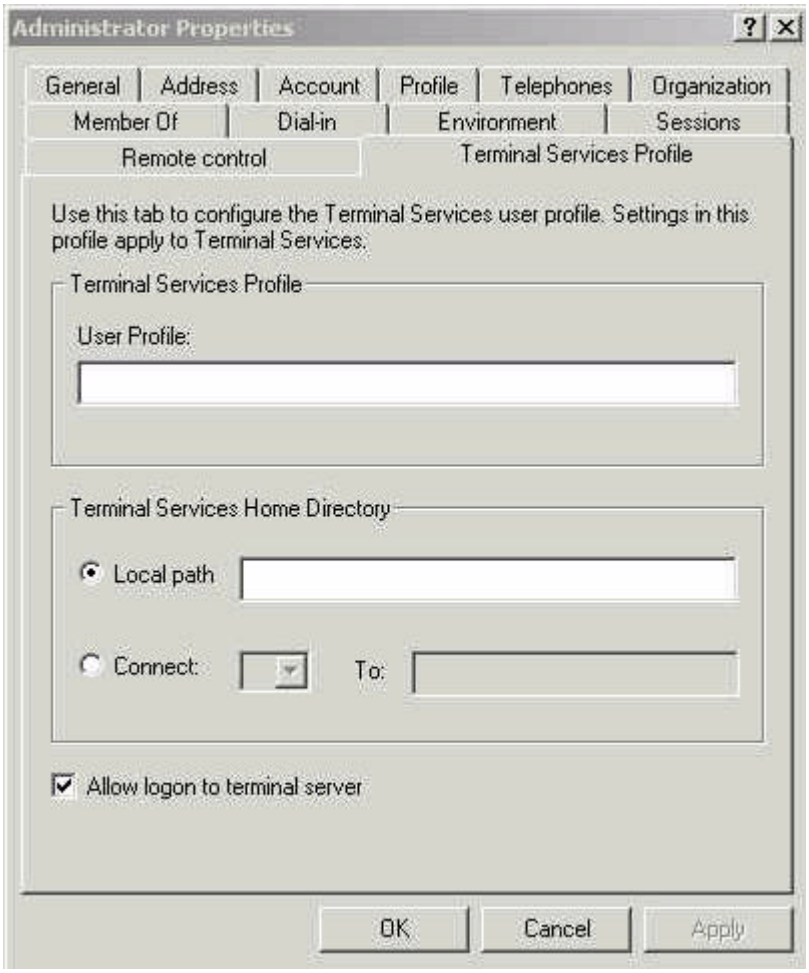
Prior to shadowing or actively managing a session, the administrator can choose whether the client session will be notified, or ask permission to monitor or control the session. By default, the user is notified and permission must be granted to view or control the client session. This feature can be disabled, but that is not recommended except in special circumstances.

Remember that a system console cannot control or view a client session, nor can a client session view a system console. Both users (the client and the administrator) must be running a Terminal Services session for shadowing or remote control to occur. The active session (the one seeking control or shadowing) must be able to support the display resolution of the client machine, or the operation will fail.

Terminal Services Profile Settings

This final tab permits you to adjust three settings for your Terminal Server users:

- Create a specific profile to apply to Terminal sessions.
- Specify the home directory for Terminal sessions.
- Allow logon to Terminal Services.



Terminal Services provides the option of using an alternate profile, which can be used to restrict the applications a user can execute in the Terminal Server environment or to disable desktop wallpaper and screen savers, conserving system utilization and network bandwidth. This profile

is separate from the normal user profile (the one invoked at logon to a console), so access to features can be enabled in one environment and disabled in another. Administrators can use this profile to create and store connections to resources such as printers and network shares to be used only during a user session.

The home directory for Terminal sessions can be set to either be the same or different for a Terminal session as opposed to a console session. Or, the directory can be disabled altogether, preventing the Terminal session user from saving any information to either the client or server disk storage.

This tab permits the overall access to Terminal Services via the Allow Logon to Terminal Services checkbox. If this box is left unchecked, the user will have no access to logon to any Terminal server in the organization.

Server Configuration and Tools

Overview

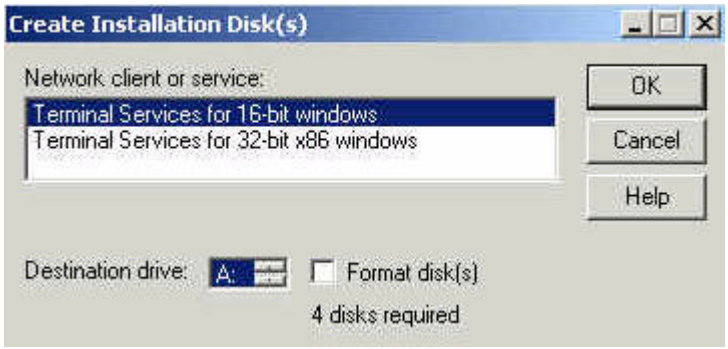
While the settings tabs for each user can be used to customize your Windows 2000 Terminal Services setup, it is recommended that, for large changes, you use the server configuration tools included with Windows 2000. Five different applications are provided:Terminal Services Client Creator

- Terminal Services Licensing
- Terminal Services Configuration
- Terminal Services Manager
- Command Line Tools

Each tool is discussed in the following sections.Note that these tools define global settings for all users connecting to the server, and will override settings in the individual users settings. By default, all applications can be located by going to Start > Programs > Administrative Tools

Terminal Services Client Creator

The Terminal Services Client Creator application assists in the creation of floppy disks to be used in the installation of the Terminal Services Client on a client computer.

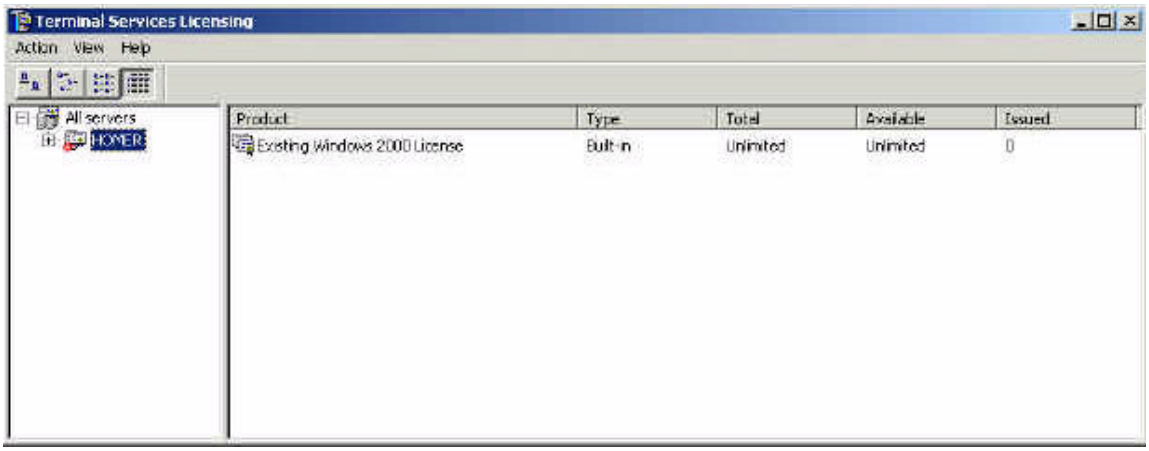


By default, a copy of the client installation files is located on the server at \\%systemroot%\System32\Clients\Tsclient\Net. This drive can be shared so that diskettes do not have to be manually created and distributed.

A connection file can also be created. This is not done directly with the Terminal Services Client Creator application, but instead with the Client Connection Manager application installed when installing Terminal Services on the client. By using the Client Connection Manager, default connections can be created for each user and then exported to a .cns file. This .cns file can then be copied to the client installation disks, or it can be located in the folder that the client installation files are shared / installed from. This will allow the connections you want your users to have by default to be present at installation.

Terminal Services Licensing

Terminal Services Licensing is a separate component and is required for the server to be running in Application Server mode. For Windows 2000 domains, licensing must be enabled on a domain controller. Terminal Services licensing allows you to either provide licensing for your entire Active
Directory forest, or you can maintain a separate license server for each domain.



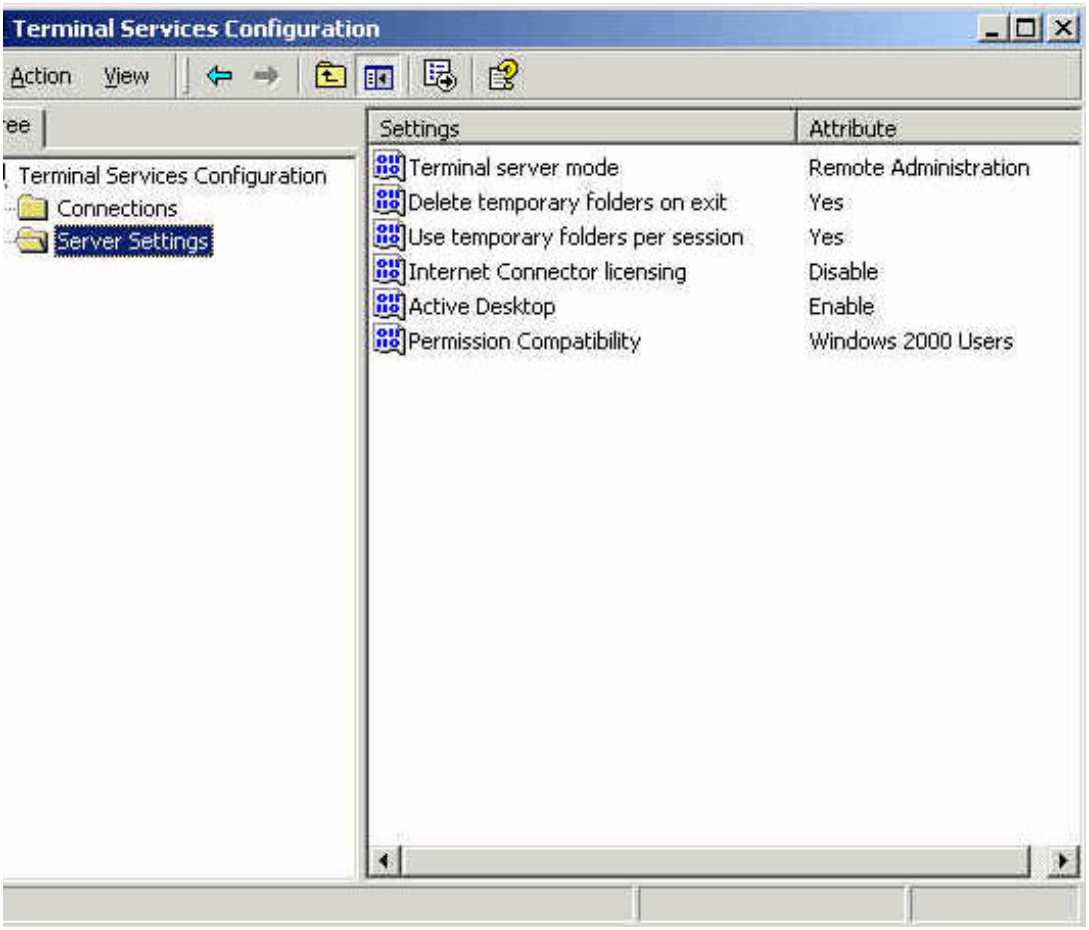
You must have a valid license server running in your domain / enterprise to enable Terminal Services Licensing. Terminal Services has it own method for licensing clients, separate from Windows 2000 client licensing. Terminal Services Licensing allows you to activate license servers, install client key packs, and track license usage. The following tasks can be performed using the Terminal Services Licensing application:

- Activate a license server.
- Install client licenses.
- Reactivate / deactivate a license server.
- Change license wizard properties.
- View the number of available and issued licenses.
- View the date and name of the computer each license was issued to.

Windows 2000 Terminal Services allows unlicensed clients to access the server for 90 days, after which, Terminal Services will not allow any clients to connect until it locates a license server to issue client licenses.

Terminal Services Configuration

The Terminal Services Configuration application permits you to view and modify the links clients will use to logon to a session on the server. By default, a single TCP/IP connection (called the RDP-TCP connection) is created and enabled on the Windows 2000 server. You can use Terminal Services Configuration to change the default properties of this connection, or create new connections.



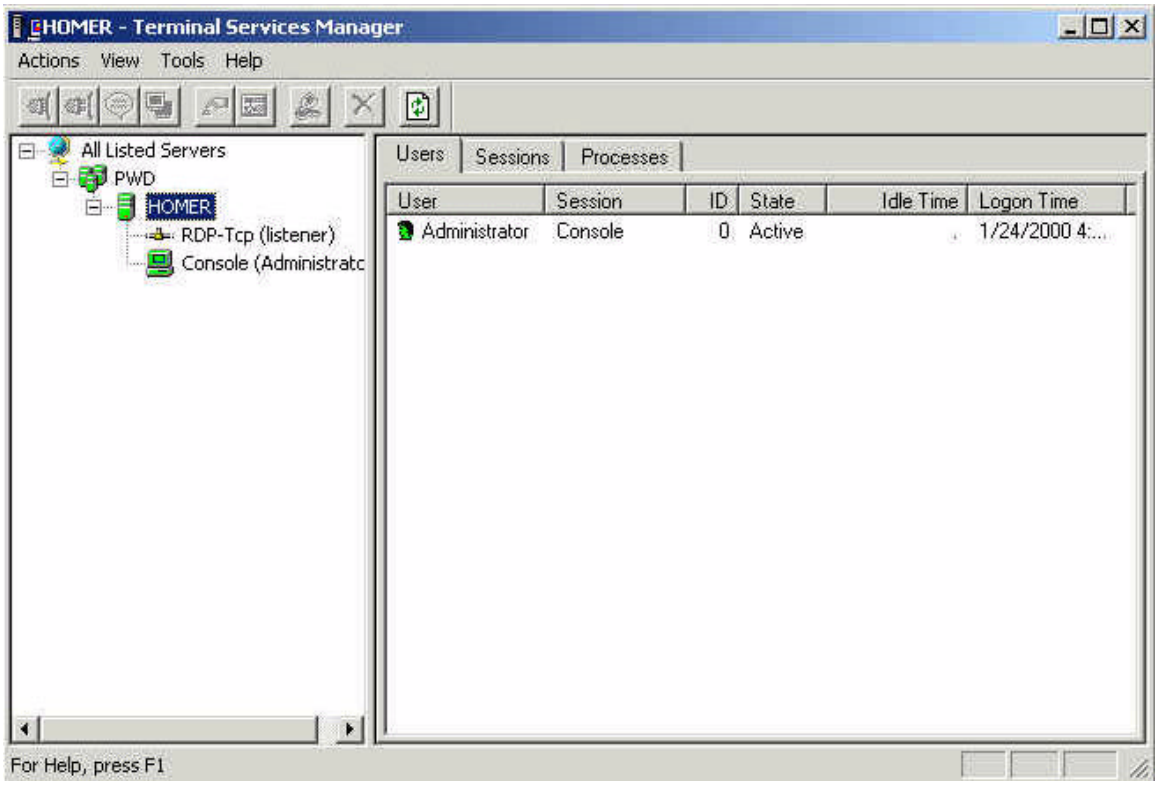
The default connection is typically the only connection needed. However, if you have multiple adapters in the system, you can configure an additional RDP connection for each network adapter installed.

You can also configure the properties of the connection using the Terminal Services Configuration utility. These parameters include the amount of time the client session can remain active on the server, the encryption level to be used for the connection, and the permission you want users and groups to have. These parameters are set on a per-connection basis, and will override any settings configured on the local user properties. This means, for example, tha if you set a time limit on a per-connection basis, this time limit will be applied to all users who use that connection.

Terminal Services Configuration can also be used to configure settings that apply to the server, such as settings for temporary folders, default connection security, and enabling or disabling Internet Connector licensing. Also if Citrix ICA clients are being utilized, their connections can be configured here as well.

Terminal Services Manager

The Terminal Services Manager application allows the administrator to monitor users, applications, and sessions on any server in the domain / forest. It also permits the management of the server.



By default, the first connection seen is the System Console session. This is the session for the computer running Terminal Server. Using the console session, you can logon to the Terminal server just as you would from a client session. However, all administrative tasks except for sending messages are disabled.

You will also see at least one listener session, which is set up to listen and accept new RDP client connections, at which time a new user session will be created. For each connection created using Terminal Services Configuration, you will have an associated listener session. Using the Terminal Services Manager, this session can be reset. However, this is not recommended because it will reset all current connections on the server using that connection, possibly resulting in the loss of data.

To assist in performance, two idle sessions, which are automatically created and initialized on the server, are available at all times for clients to connect to. By having idle sessions, all programs are running in an idle state on the system, ready to be used during client connection, speeding up logon time for the client.

Terminal Services Manger, using the Actions bar, also allows the administrator to perform tasks such as:

- Sending a message to a user in a remote session.
- Logging off a user.

- Ending a process running in the user session.
- Showing the status of the users, as well as the incoming and outgoing bytes and frame for that session.
- Observe or remotely controlling a user session. This is dependent on the parameters set for the user profile .
- Connecting and disconnecting to a session.

Terminal Services Command Line Utilities

Using the command line utilities, an administrator can monitor and control the Terminal server without using any of the GUI utilities above. A list of the commands available is provided below. This information can also be found in the Windows 2000 Help.

- Change Logon - Allows you to temporarily disable logon to the Terminal server.
- Change port - Changes COM port mapping to enable compatibility with MS-DOS applications.
- Change user - Changes .ini file mapping for the current user.
- Cprofile - Removes all user-specific file associates from a user profile.
- Dbgtrace - Enables or disables debug tracing (for advanced administrators only)
- Flattemp - Enables or disables flat temporary directories.
- Logoff - Logs off a user from a session and deletes the session from the server. Useful if you have run out of sessions and need to make one available.
- Msg - Send a message to a user or a group of users (or all users on the Terminal server).
- Query process - Queries a process running on the Terminal server.
- Query session - Returns information about sessions on the Terminal server.
- Query termserver - Displays a list of all Terminal servers on the network.
- Query users - Displays a list of all users on the Terminal server.
- Register - Allows applications to be registered to execute in a multiuser-aware state.
- Reset session - Resets a session.
- Shadow - Allows viewing or monitoring of another session.
- Tscon - Connects to an existing session
- Tsdiscon - Disconnects from an existing session.
- Tskill - Ends a process.
- Tsprof - Copies user information from one user to another.
- Tsshutdn - Shuts down a Terminal Server.

Additional Information

For more information on IBM Netfinity direction, products and services, refer to the following white papers, available from our Web site at www.ibm.com/netfinity.

Management

Integrating IBM Netfinity Manager with Microsoft Systems Management Server
Integrating IBM Netfinity Manager with Intel LANDesk Server Manager
IBM Netfinity Manager 5.2
IBM Netfinity Advanced Systems Management
IBM Netfinity Advanced Systems Management for Servers
IBM ServerGuide for Netfinity and PC Server Systems

Other Topics

IBM Netfinity 3500 M10 Exchange 5.5 MAPI Messaging Benchmark (MMB) Performance Result
IBM Netfinity 3000 Exchange 5.5 MAPI Messaging Benchmark (MMB) Performance Result
Capacity Planning for Netfinity on Windows Terminal Server
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Fibre Channel Solutions for Enterprise Storage
IBM Chipkill Memory
IBM Netfinity X-architecture
IBM ClusterProven Program on Netfinity
IBM Netfinity Predictive Failure Analysis
IBM Netfinity Cluster Directions
IBM Netfinity Web Server Accelerator
Implementing Microsoft IIS on Netfinity 5500 M10
IBM Netfinity Availability Extensions for Microsoft Cluster Server
IBM Netfinity ESCON Adapter
IBM Netfinity Hot-Plug Solutions
IBM Netfinity Storage Management Solutions Using Tape Subsystems
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