Citrix MetaFrame XP with Feature Release 1 on Compaq ProLiant Servers Running Microsoft Windows 2000

Abstract: This White Paper provides an overview of Compaq, Citrix and Microsoft Thin Client Server Computing (TCSC) technologies. In particular, the White Paper provides information on the following topics:

- The key benefits of Citrix MetaFrame XP, the powerful application serving platform
- The rich set of enhancements offered by Citrix MetaFrame XP Feature Release 1
- An overview of Windows 2000 Terminal Services, which can deliver the Windows 2000 desktop and the latest Windows-based applications to a wide variety of Thin Client devices
- Scaling data that can help the customer configure a very large enterprise server farm using Compaq ProLiant Density Line servers
- Compaq Remote Insight Lights-Out Edition, a Compaq Intelligent Manageability product that offers browser access to Compaq servers through a hardware-based graphical remote console

In addition, this White Paper provides detailed instructions for installing and licensing Windows 2000 Terminal Services, Citrix MetaFrame XP and Citrix MetaFrame XP Feature Release 1 in a TCSC environment. This installation leverages Compaq SmartStart technology.
Notice

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Citrix MetaFrame XP with Feature Release 1 on Compaq ProLiant Servers Running Microsoft Windows 2000
White Paper prepared by eInfrastructure Business Unit

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Introduction

This White Paper illustrates the leadership position in the Thin Client Server Computing (TCSC) solution marketplace achieved through the unique relationship between Compaq, Citrix and Microsoft team. Solution offerings include TCSC systems design, server sizing, technical consulting and professional services for deploying TCSC technology.

IT managers need more reach to connect with users in any location, on any device, over any network, and more power to manage applications from a single, centralized location. With the server farm capacity improvements provided by MetaFrame XP, larger enterprise TCSC implementations can be accommodated. Scalability tests indicate improvements ranging between 500% and 1000% over previous versions of MetaFrame. Based on proven Citrix technology, MetaFrame XP extends the reach of Windows 2000 operating systems and securely deploys Windows-based applications. It is highly manageable, so the IT manager can easily scale servers as the business grows.

Compaq has worked closely with Microsoft and Citrix to develop the most robust and comprehensive TCSC solutions available. Compaq ProLiant Density Line servers utilizing Citrix MetaFrame XP for Microsoft Windows 2000 Server provide superior performance, scalability, and manageability in large enterprise TCSC environments.

This White Paper

This White Paper includes information on the following topics:

- **Compaq Thin Client Server Computing**
  - Describes the benefits of the enterprise-wide, centralized deployment of applications
  - Shows how to configure a Compaq ProLiant Density Line server farm for a very large enterprise TCSC environment

- **Compaq Remote Insight Lights-Out Edition**
  - Explains Compaq Intelligent Manageability strategy
  - Describes the graphical remote console
  - Describes the remote management features
  - Describes other features
  - Explains how Compaq Remote Insight Lights-Out Edition integrates with other Compaq products
  - Offers installation guidelines

- **MetaFrame XP**
  - Lists key features

- **MetaFrame XP Feature Release 1**
  - Provides an overview
  - Lists key features
• **MetaFrame XP product licensing**
  – Explains the Citrix licensing model
  – Describes options and offers an example

• **Microsoft Windows 2000 Terminal Services**
  – Provides an overview

• **Installing TCSC software**
  Provides detailed instructions for the following activities:
  – Installing Windows 2000 Server (leveraging Compaq SmartStart, if desired)
  – Configuring Terminal Services
  – Installing and licensing MetaFrame XP
  – Installing and licensing MetaFrame XP Feature Release 1

• **Appendix A** – Lists the features and benefits of MetaFrame XP
• **Appendix B** – Lists the features and benefits of MetaFrame XP Feature Release 1
• **Appendix C** – Lists the features of Windows 2000 Terminal Services
• **Appendix D** – Provides an overview of Compaq SmartStart technology

## Compaq Thin Client Server Computing

Thin Client Server Computing (TCSC) solutions allow the centralized deployment of enterprise-wide applications while maintaining the ability to support a variety of client computing devices. Applications run 100% on the server with only mouse clicks, keystrokes and screen updates moving across the network. Client computing devices include handheld computers, notebooks, Windows-based terminals, network-based terminals, desktop PCs, workstations, Macintosh computers, X-terminals, UNIX systems and various data collection devices.

The following sections lists the benefits of deploying a TCSC solution and compare the performance of various Compaq ProLiant DL servers in a large enterprise TCSC environment.

### Benefits

TCSC solutions offer the following benefits:

• Lower cost of application ownership

• Accelerated application deployment

• Extended application availability

• Enhanced security

• Improved data back-up and recovery

• More effective end-user support

• Uniform desktop experience from any network access point
Compaq ProLiant Density Line Servers

Compaq recommends the Compaq ProLiant Density Line of servers for TCSC deployments.

Table 1 compares the performance of various ProLiant DL server configurations in a TCSC environment, providing scaling data that can help the customer configure a Compaq ProLiant Density Line server farm for a very large enterprise TCSC deployment.

Table 1. Performance of Compaq ProLiant Density Line servers in a TCSC environment (with Citrix MetaFrame XP and Windows 2000 Server with Terminal Services enabled)

<table>
<thead>
<tr>
<th>ProLiant Server Type</th>
<th>Processor Type</th>
<th>Quantity</th>
<th>Speed</th>
<th>Memory</th>
<th>Heavy</th>
<th>Medium</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL360</td>
<td>Pentium III (512 KB)</td>
<td>2</td>
<td>1.266GHz</td>
<td>2 GB</td>
<td>91</td>
<td>101</td>
<td>112</td>
</tr>
<tr>
<td>DL380</td>
<td>Pentium III (512 KB)</td>
<td>2</td>
<td>1.266GHz</td>
<td>2 GB</td>
<td>91</td>
<td>101</td>
<td>112</td>
</tr>
<tr>
<td>DL580</td>
<td>Pentium III Xeon (2MB)</td>
<td>2</td>
<td>900MHz</td>
<td>4 GB</td>
<td>65</td>
<td>80</td>
<td>98</td>
</tr>
<tr>
<td>DL580</td>
<td>Pentium III Xeon (2MB)</td>
<td>4</td>
<td>900MHz</td>
<td>4 GB</td>
<td>120</td>
<td>145</td>
<td>175</td>
</tr>
<tr>
<td>DL760</td>
<td>Pentium III Xeon (2MB)</td>
<td>4</td>
<td>900MHz</td>
<td>4 GB</td>
<td>125</td>
<td>152</td>
<td>210</td>
</tr>
<tr>
<td>DL760</td>
<td>Pentium III Xeon (2MB)</td>
<td>8</td>
<td>900MHz</td>
<td>4 GB</td>
<td>170</td>
<td>170</td>
<td>230</td>
</tr>
</tbody>
</table>

Note: Based on server configuration and the customer’s business needs, performance metrics in a production environment may vary from the metrics shown in the table above. The Compaq TCSC online sizer can recommend the configuration and number of servers to meet particular business needs.


1 With the two-processor and four-processor configurations, performance is limited by the capabilities of the processors. However, with the eight-processor configuration, performance is limited by the Windows 2000 System Page Table Entry (PTE) area – which may be improved on the next Microsoft 64-bit operating system. Refer to the Microsoft website for more information on the System PTE area.
Compaq Remote Insight Lights-Out Edition

Today’s IT administrators need an easy, effective way to manage business-critical servers – whether deployed in a data center or at remote sites – from a central location. Compaq Remote Insight Lights-Out Edition offers browser access to Compaq servers through a hardware-based graphical remote console. The client browser can be anywhere in the network.

Remote Insight Lights-Out Edition² is embedded on a PCI board (shown in Figure 1) and includes a dedicated processor, memory and Network Interface Card (NIC), making this solution independent of the host server hardware and operating system. An external power adapter provides continuous power to the board – even when the host server is powered off or there has been a server power failure.

![Figure 1: The Remote Insight Lights-Out Edition board](image)

Compaq Intelligent Manageability

Compaq Intelligent Manageability is a strategy for providing a rich, comprehensive set of offerings that simplify and improve the management of IT resources. These offerings include hardware features, software products, tools, utilities, services and partnerships.

In addition, Compaq Management Integration Solutions integrate the benefits of Compaq Intelligent Manageability into existing management platforms such as Microsoft Systems Management Server, Microsoft Operations Management Server, Tivoli Enterprise and HP OpenView.

Compaq is working with Citrix to integrate MetaFrame XP with Compaq Insight Manager and Remote Insight Lights-Out Edition, leveraging the power of the Internet to offer Web-based systems management. For more information, monitor What’s New on Compaq ActiveAnswers and the Pressroom on the Citrix website.

² The Remote Insight Lights-Out Edition kit (Part Number 157866-001) includes the following items: a Remote Insight Lights-Out Edition PCI board; a PCI extender; a keyboard/mouse adapter cable; a virtual power button cable; an AC power adapter; a luggage tag with pre-configured DNS name, user name and password; an installation overview card with other system documentation; and support software CD-ROMs.
This Section

This section provides information on the following topics:

- **Graphical Remote Console**
- **Other features** of Remote Insight Lights-Out Edition
- **Integration with other Compaq products**
- **Installation guidelines**
- **Solution certification**

Graphical Remote Console

Remote Insight Lights-Out Edition provides embedded graphical remote console capabilities that can turn a standard Web browser into a virtual desktop. The administrator uses the Web browser to gain full control over the host server’s keyboard and mouse and over text and graphics displayed on the host server’s monitor.

The remote console is independent of the operating system.

The next section details the remote server management capabilities of Remote Insight Lights-Out Edition.

Remote Server Management Features

The graphical remote console allows the administrator to perform many remote server management activities, including the following:

- **Using a virtual power button** to power up or power down the host server

**Note:** The virtual power button feature requires a cable (supplied) to be connected between the Remote Insight Lights-Out Edition board and the host server’s power button.

- **Using a virtual floppy drive** for the following activities:
  - Performing a cold reboot to bring an unresponsive host server back online
  - Running diagnostic tests
  - Performing a disaster recovery
  - Deploying an operating system
  - Applying a Compaq ROMPaq upgrade

**Note:** The administrator can use any physical floppy drive in the network, eliminating the need to visit a remote host server just to insert a diskette.

- Sending alerts regardless of the state of the host server
- Using the advanced troubleshooting features of Remote Insight Lights-Out Edition
• Accessing Compaq Management Agents deployed on the host server
• Using Simple Network Management Protocol (SNMP) and Compaq Insight Manager to troubleshoot the host server from a Web browser

The next section details other features of Remote Insight Lights-Out Edition.

Other Features

Table 2 lists other features of Remote Insight Lights-Out Edition.

Table 2. Other Features of Remote Insight Lights-Out Edition

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN connectivity</td>
<td>A 10/100MB Ethernet chip on the Remote Insight Lights-Out Edition board offers a dedicated network connection with auto-selected speeds between 10MB – 100MB.</td>
</tr>
<tr>
<td></td>
<td>The board provides in-band SNMP notification of server problems in real-time with no need for separate telephone connections or modem-sharing devices.</td>
</tr>
<tr>
<td>Dial-up support</td>
<td>Remote Insight Lights-Out Edition provides dial-up access to the host server through Remote Access Service (RAS).</td>
</tr>
<tr>
<td>Web browser support</td>
<td>Remote Insight Lights-Out Edition supports the following Web browsers:</td>
</tr>
<tr>
<td></td>
<td>• Microsoft Internet Explorer 4.01 or later</td>
</tr>
<tr>
<td></td>
<td>• Netscape Navigator 4.05 or later</td>
</tr>
<tr>
<td></td>
<td>• Any other Java 1.1-compliant device</td>
</tr>
<tr>
<td></td>
<td>This support gives administrators full control of the host server’s display, keyboard and mouse – regardless of the state of the host server or operating system. Using a familiar Web browser interface, administrators can easily perform all remote management tasks.</td>
</tr>
<tr>
<td>Remote firmware update</td>
<td>A remote firmware update feature uses the Web browser to make sure that Remote Insight Lights-Out Edition always runs the latest firmware available from Compaq.</td>
</tr>
<tr>
<td>User administration</td>
<td>Remote Insight Lights-Out Edition supports up to 12 users with customizable login names, advanced password encryption (see below), access rights and client IP address restrictions.</td>
</tr>
<tr>
<td></td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td>• A user with supervisory status may create, modify or delete other users.</td>
</tr>
<tr>
<td></td>
<td>• A user with non-supervisory status may be denied access to the Remote Insight Lights-Out Edition login, the host server’s remote console, and the remote reboot feature of Remote Insight Lights-Out Edition.</td>
</tr>
<tr>
<td>Security</td>
<td>Remote Insight Lights-Out Edition offers secure password encryption, tracking all login attempts and recording login failures.</td>
</tr>
<tr>
<td></td>
<td>When a login attempt fails, the board can send an alert to a remote management PC running Insight Manager.</td>
</tr>
</tbody>
</table>

The next section describes how Remote Insight Lights-Out Edition can integrate with other Compaq products.
Integration with other Compaq Products

Table 3 describes how Remote Insight Lights-Out Edition integrates with other Compaq products to provide remote management capabilities.

Table 3. Integration with other Compaq Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaq Insight Manager</td>
<td>In key operating environments, Remote Insight Lights-Out Edition provides full integration with Insight Manager or Insight Manager 7 to offer the following capabilities:</td>
</tr>
<tr>
<td></td>
<td>• Providing access to Management Agents and to diagnostics for Remote Insight Lights-Out Edition</td>
</tr>
<tr>
<td></td>
<td>• Supporting full in-band SNMP management</td>
</tr>
<tr>
<td></td>
<td>• Supporting SNMP trap delivery to an Insight Manager console</td>
</tr>
<tr>
<td>Compaq Management Agents</td>
<td>Management Agents allow fault, performance, and configuration management, and reduce down time by providing predictive fault management.</td>
</tr>
<tr>
<td></td>
<td>Remote Insight Lights-Out Edition integrates with Management Agents to provide remote access to system management information through the board’s Web browser interface.</td>
</tr>
<tr>
<td>Compaq Survey Utility</td>
<td>Compaq Survey Utility is an online agent that captures critical hardware and operating system configuration information on Compaq servers without interrupting server operation. Using a standard Web browser you can access this configuration information to help diagnose server problems.</td>
</tr>
<tr>
<td>Integrated Management Log</td>
<td>A server’s Integrated Management Log (IML) provides a historical log of recent system events – such as memory errors or Power-On Self-Test (POST) errors – for diagnostic purposes. With Remote Insight Lights-Out Edition, you can use a single Web browser to view and manage system events on local and remote systems.</td>
</tr>
<tr>
<td>Compaq SmartStart</td>
<td>You can fully configure Remote Insight Lights-Out Edition using SmartStart.</td>
</tr>
<tr>
<td>Compaq System Configuration Utility</td>
<td>The System Configuration Utility is a versatile ROM-based configuration utility that allows fast, easy setup of Remote Insight Lights-Out Edition.</td>
</tr>
</tbody>
</table>

The next section provides guidelines for installing Remote Insight Lights-Out Edition.
Installation Guidelines

**IMPORTANT:** This section provides guidelines for installing Remote Insight Lights-Out Edition. For specific instructions and warnings, refer to the documentation that shipped with the kit.

This section provides guidelines for the following activities:

- Installing the hardware components
- Configuring the board
- Installing the software required for remote management of the host server

### Installing the Hardware Components

Use the following guidelines when installing Remote Insight Lights-Out Edition hardware:

1. Remove and set aside the “luggage tag” label from the board.

   **Note:** The luggage tag contains information required to configure Remote Insight Lights-Out Edition.

2. Install the Remote Insight Lights-Out Edition board in a vacant PCI slot on the primary bus of your Compaq server.

3. Connect the keyboard/mouse adapter cable provided with the kit to the Remote Insight Lights-Out Edition board, the server’s keyboard and mouse connectors and the keyboard and mouse.

   **Note:** A headless server has neither keyboard nor mouse.

4. Connect the existing cable from the monitor to the video connector on the Remote Insight Lights-Out Edition board.

   **Note:** A headless server has no monitor.

5. Connect the Remote Insight Lights-Out Edition board to the LAN.


You are now ready to start the server and configure the board.
Configuring the Board

Remote Insight Lights-Out Edition must be configured with the appropriate Domain Name Service (DNS) name, user name and password.

**IMPORTANT:** For networks that do not use DNS/Domain Host Configuration Protocol (DHCP), Remote Insight Lights-Out Edition supports static Internet Protocol (IP) addressing.

Remote Insight Lights-Out Edition ships ready-to-deploy with the following default configuration values (recorded on the luggage tag attached to the board):

<table>
<thead>
<tr>
<th>User name</th>
<th>Administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Password</td>
<td>nnnn</td>
</tr>
<tr>
<td>DNS name</td>
<td>RIBmmmmmmmmmmmm</td>
</tr>
</tbody>
</table>

where “nnnn” represents the last four characters of the board’s serial number

where “mmmmmmmmmmmm” represents the board’s twelve-characters Medium Access Control (MAC) address

**Note:** The user name, password and DNS name are case-sensitive.

Table 4 lists options for configuring Remote Insight Lights-Out Edition.

**Table 4. Configuration Options**

<table>
<thead>
<tr>
<th>Method</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the board’s ROM-based Configuration Utility</td>
<td>1) While the host server is starting, press F8.</td>
</tr>
<tr>
<td></td>
<td>2) Follow the on-screen instructions to configure the board’s NIC and user accounts.</td>
</tr>
<tr>
<td>Using the System Configuration Utility</td>
<td>1) While the host server is starting, press F10.</td>
</tr>
<tr>
<td></td>
<td>2) Follow the on-screen instructions to configure the board’s NIC and user accounts.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> Compaq SmartStart 5.20 or above is required.</td>
</tr>
<tr>
<td>Using a Web browser</td>
<td>1) Start the Web browser.</td>
</tr>
<tr>
<td></td>
<td>2) In the Web browser’s Address or URL box, type the board’s default DNS name.</td>
</tr>
<tr>
<td></td>
<td>3) When prompted, enter the default user name and password.</td>
</tr>
<tr>
<td></td>
<td>4) Use Remote Insight Lights-Out Edition’s browser interface to reconfigure these default values.</td>
</tr>
</tbody>
</table>

The next section lists the software required for remote server management.

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4 Remote Insight Lights-Out Edition includes a DHCP client that leases an IP address from the network’s DHCP server.
Installing Remote Management Software

Table 5 lists the software required to support SNMP management of the host server through Remote Insight Lights-Out Edition.

Table 5. Management Software Requirements

<table>
<thead>
<tr>
<th>Machine</th>
<th>Required Management Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host server</td>
<td>• Software driver for Remote Insight Lights-Out Edition</td>
</tr>
<tr>
<td></td>
<td>• Compaq Management Agents</td>
</tr>
<tr>
<td>Management client (running the Web browser)</td>
<td>• Compaq Insight Manager (to access SNMP information from Remote Insight Lights-Out Edition)</td>
</tr>
</tbody>
</table>

You can install the software from the appropriate server support CD-ROM or from a network-share. The latest versions of Insight Manager and Management Agents are available on the Compaq website.

The next section details configurations certified by Compaq for a Remote Insight Lights-Out Edition deployment.

Certified Configurations

Configurations certified by Compaq to deploy Remote Insight Lights-Out Edition feature the following components:

- The Compaq ProLiant DL server line
- Compaq SmartStart 5.20 or above
- Microsoft Windows 2000 server
- Citrix MetaFrame XP 1.0

More Information

More information on Remote Insight Lights-Out Edition is available on the Compaq website.

The next section lists the key benefits of MetaFrame XP, a powerful application-serving platform.
MetaFrame XP

MetaFrame XP offers a more predictable, cost-effective computing experience for all users. Single-point control over applications, servers and server farms, licenses and resources results in better utilization of limited IT resources.

Citrix customized the MetaFrame XP family into the following three solutions that accommodate a wide spectrum of customer requirements for functionality and scale:

- **MetaFrame XPs** delivers the level of control that departmental workgroups require to extend the reach of Windows 2000 servers to multiple devices.
- **MetaFrame XPa** maximizes the availability of applications across the network for growing organizations.
- **MetaFrame XPe** offers extensive scalability and manageability, as well as rapid application deployment, for global enterprises in a Windows 2000 server-based environment.

The MetaFrame XP family has a highly scalable communications and management foundation that provides the capability to manage and deploy applications across the enterprise. It delivers much more than application support, giving IT managers the ability and confidence to maintain a fast, predictable and efficient application-serving network.

Key Benefits

MetaFrame XP offers the following key benefits:

- **Unparalleled manageability and scalability for systems, applications and users**
  MetaFrame XP provides the power to manage servers and server farms anywhere across an enterprise with robust system management capabilities that can be integrated with third-party network management solutions. IT managers can centrally configure and manage software distribution to multiple servers in numerous locations in just minutes, as well as monitor and control application usage, resource utilization and user activity. With these capabilities, IT managers can proactively predict system requirements and maximize availability and performance across the network.

- **Total Net leverage – integration, personalization and control**
  The adoption of the Internet is the driving force behind the Citrix concept of a universal Net – the seamless integration of LANs, WANs, the Internet, intranets and extranets —that enables organizations to optimize their communications. Citrix NFuse gives businesses the ability to deliver any application to a single portal view without rewriting code. This is the fastest way to provide single-point access to applications and content information through any device that supports a standard Web browser – improving productivity and delivering true user mobility.
• **Ultimate flexibility — any application, any device, over any Net connection**  
MetaFrame XP provides the power to deploy any application to any device via any Net connection – quickly and with reduced total cost of ownership. By shifting application processing to the server, administrators ensure the rapid, user-friendly deployment of business-critical applications with a higher level of performance predictability. The flexibility of seamless application access from PCs, Macintosh computers, UNIX and Linux workstations, laptops, wireless devices and other network appliances means fewer hardware roadblocks and far less technology churn. MetaFrame XP offers a consistent user experience across the enterprise, complete freedom and mobility, unparalleled speed, and simplified management. MetaFrame XP is the powerful, behind-the-scenes framework that makes it all happen.

**More Information**

Refer to [Appendix A](#) for more information on the features and benefits of MetaFrame XP.

The next section discusses the rich set of enhancements offered by Citrix MetaFrame XP Feature Release 1.

**MetaFrame XP Feature Release 1**

Citrix has recently improved MetaFrame XP, the world’s most powerful application serving platform. Feature Release 1 (FR-1) for MetaFrame XP for Windows offers a rich set of enhancements to the already robust MetaFrame XP family. Citrix continues their mission to extend the virtual workplace while saving the customer both time and money.

With FR-1, Citrix MetaFrame XP offers a new dimension for deploying applications and content with unparalleled manageability and scale, total Net leverage and ultimate flexibility. FR-1 adds value to the customer’s existing Citrix investment by streamlining business processes, improving operational efficiencies, increasing competitiveness and reducing time-to-market. This release underscores the Citrix commitment to continuously respond to the customer’s changing needs and to effectively extend the reach of Windows applications to users in any location, at any time, using reliable, secure and scalable technology.

FR-1 includes the following new features and enhancements to MetaFrame XP functionality:

• **Auto client reconnect**  
With auto client reconnect, the Independent Computing Architecture (ICA) client for the Windows 32-bit platform automatically reconnects to a session when it detects a dropped connection. Users continue to work without reconnecting manually, re-entering credentials and restarting applications.

In embedded mode, the ICA client for Java supports basic automatic reconnection without credential caching. Users must re-enter their credentials to re-connect.

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5 If caused by a network problem unrelated to MetaFrame XP
• **Content publishing**
  The content publishing feature allows the user to publish document files, media files, Web URLs, and any other type of file from any network location.

  Icons for published content appear in **Program Neighborhood** on the user’s desktop and in NFuse. Users double-click published content icons to access content in the same way as accessing published applications.

• **Connection control**
  The connection control feature gives the administrator the following capabilities:
  – Limiting the total number of concurrent connections to a server
  – Limiting the total number of concurrent connections to specified published applications
  – Preventing users from launching more than one instance of the same published application

• **CPU prioritization**
  The CPU prioritization feature allows the administrator to assign each published application in the server farm a priority level for CPU access. This feature can be used to ensure that CPU-intensive applications do not degrade performance of other applications. For example, the administrator can assign a higher CPU priority to mission-critical published applications and a lower CPU priority to less-important applications.

• **Universal print driver**
  The administrator can install the new Citrix universal print driver in the server farm to be used as the driver for all print jobs submitted by users. The universal print driver eliminates the need to install many individual printer drivers for diverse printing environments.

• **Novell Directory Services support**
  Support for Novell Directory Services (NDS) allows users in a Novell network environment to log on using NDS credentials to access applications and content published in a MetaFrame XP server farm.

• **SSL encryption**
  The Secure Socket Layer (SSL) encryption feature allows the use of SSL protocol to secure communications between MetaFrame XP servers and supported ICA. SSL provides server authentication, data stream encryption, and message integrity verifications. After configuring the Citrix SSL relay, the administrator can specify the use of SSL when publishing applications.

• **Citrix Web console**
  Using the Citrix Web console, the administrator can monitor MetaFrame XP server farms from any workstation with a supported Web browser. The Citrix Web console allows the administrator to view information about the server farm, published applications, servers, and active sessions, and lets the administrator to reset, disconnect, and shadow ICA sessions and send messages to users. The new Citrix Web console can be deployed on MetaFrame XP servers with Microsoft Internet Information Server 5.0 or later installed.
• **MetaFrame XPe components**
  FR-1 includes enhancements to Citrix Resource Manager, Citrix Installation Manager and Citrix Network Manager, which are part of MetaFrame XPe. For feature descriptions and configuration information, refer to the documentation in the “Doc” directory of the FR-1 Service Pack 1 CD-ROM.

• **ICA session monitoring**
  New ICA performance counters allow the administrator to use Windows Performance Monitor to monitor ICA communications, providing valuable information on network bandwidth utilization and helping to determine if a bottleneck exists. Session characteristics that can be monitored by the administrator include the following:
  – Bandwidth and compression for sessions, servers, and individual virtual channels
  – Latency in ICA sessions

• **Management console improvements**
  More detailed information about servers and licensing now appears in Citrix Management Console. For example, the Licensing Summary tab now shows the name of feature releases installed, the number of servers set up to use feature releases, and the feature release licenses that are installed in the server farm.

  For more information on these new options, refer to the console’s online help feature.

• **Extended parameter passing**
  FR-1 allows the user to associate a file type on an ICA client with an application published on a MetaFrame server. When the user double-clicks a local file, the client passes the file path as a parameter to the server, which retrieves the file, then opens it with the associated application in an ICA session.

• **Program Neighborhood Agent**
  Citrix Program Neighborhood Agent leverages NFuse to deliver published applications directly to the user’s desktop, allowing the user to access links to published applications – whether or not the user has a Web browser.

  With the Program Neighborhood Agent, links to NFuse-enabled published applications appear in the Start menu on the Windows desktop or in the Windows System Tray. Remote applications are integrated into the desktop and appear to the user as local applications.

  Refer to **Appendix B** for more information on the features and benefits of Feature Release 1.

The next section describes MetaFrame XP licensing.
MetaFrame XP Product Licensing

The licensing model for MetaFrame XP is based on the following criteria:

- The total number of user connections, not the number and configuration of MetaFrame XP servers
- The MetaFrame XP family member – XPs, XPa or XPe

The following sections discuss the advantages of connection-based licensing and offer an example of licensing options.

Advantages of Connection-based Licensing

The advantages of a connection-based licensing model over a server-based model include the following:

- **Simplicity for the customer**  
The connection-based licensing model is simple and easy to understand. Customers need only know the cost per connection of the XP family member they are purchasing (with or without subscription), then multiply the cost per connection by the total number of connections to determine the cost of the solution.

- **Flexibility in configuring the best solution**  
With the connection-based licensing model, customers have the freedom and flexibility to determine the optimal number of MetaFrame XP servers in a given server farm without impacting their overall costs. Customers can install MetaFrame XP on as many servers as needed to support a growing user base; there is no charge for installing the software on additional MetaFrame XP servers.

- **Cost-effective and easier IT budgeting**  
Since all connection licenses are priced equally within a given MetaFrame XP solution, the linear pricing model makes it easier for customers to forecast IT expenditures and determine optimal usage of their IT budgets.

- **Easier to manage licenses**  
Since the Citrix connection-based licensing model does not provide for MetaFrame XP “base” licenses, it is no longer necessary to re-enter and re-activate licenses when changing the configuration of MetaFrame XP servers.

**IMPORTANT:** All MetaFrame XP software installations, including those associated with software migrations and/or upgrades, must abide by the terms of the software license agreement that is provided with each product.
Licensing Options

The MetaFrame XP licensing model offers options for licensing user connections. For example, the customer has the following options for licensing connections to a MetaFrame XPe 1.0 server:

- Purchase a MetaFrame XPe 1.0 license for the appropriate number of connections
- Combine WinFrame/MetaFrame 1.X and MetaFrame XPe 1.0 Migration licenses
- Combine MetaFrame XPs 1.0 and MetaFrame XPs 1.0 to XPe 1.0 Upgrade licenses
- Combine MetaFrame XPa 1.0 and MetaFrame XPa 1.0 to XPe 1.0 Upgrade licenses

The next section discusses Windows 2000 Terminal Services, which can deliver the Windows 2000 desktop and the latest Windows-based applications to a wide variety of Thin Client devices.

Microsoft Windows 2000 Terminal Services

The Terminal Services component of the Windows 2000 Server operating system delivers the Windows 2000 Professional desktop and the latest Windows-based applications to a wide variety of Thin Client devices.

Terminal Services client software is available for a wide variety of Thin Client devices, including PCs, Windows-based terminals, and even non-Windows-based platforms such as a Macintosh or UNIX workstation.

Note: Non-Windows-based platforms require additional third-party software such as Citrix MetaFrame XP.

For organizations needing more flexibility when deploying applications and more control over desktop management costs, Terminal Services offers important improvements over the traditional two- or three-tier client-server architecture.

Refer to Appendix C for more information on the features and benefits of Terminal Services.

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 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 to the client’s terminal emulation software.

Each user logs on and sees only an individual session, which is managed transparently by the server and is independent of any other user session.

In addition, Terminal Services includes a remote administration mode that can be used to administer any Windows-based server remotely.

---

6 Including domain controllers, member servers and BackOffice servers
Bridge to Windows 2000


The customer can deploy hard-to-install or frequently updated line-of-business applications on a Windows 2000 Server. Terminal Services client software allows the user to access only the desired application rather than the entire desktop. This can be beneficial for any desktop, including the latest Windows 2000 Professional desktop – especially if the organization wishes to improve performance by placing the application execution logic as close as possible to back-end data.

Client Licensing Requirements

Terminal Services\(^7\) has the following client licensing requirements:

- **To access the Terminal Server**\(^8\)
  A Windows 2000 Server Client Access License (CAL) or BackOffice 2000 CAL is required to access the Windows 2000 server.

- **To run the desktop and applications**
  A Windows 2000 Terminal Services CAL or a license for Windows 2000 Professional is required to run a Windows-based desktop and applications from a Windows 2000 server, regardless of the protocol or software used to interact with applications running on the server.

  The Windows 2000 Server End User License Agreement defines "Terminal Services\(^7\) as follows:
  - Using the Terminal Services feature of the server software to enable devices to use software residing on the server, or
  - Using other software in conjunction with the server software to provide similar services

- **To run applications**
  Appropriate application licenses are required from each independent software vendor (ISV). Microsoft Office, for example, is licensed on a per-device basis; each client device that accesses an Office application on the Windows 2000 server requires a license.

---

**IMPORTANT:** Terminal Services is licensed on a per-device basis and is not available on a per-server or concurrent basis. Each client device, whether it connects directly to the Terminal Server, or indirectly via another server, requires the appropriate licenses to be assigned to it.

If appropriate, a Citrix MetaFrame XP license is also required.

More information on licensing Terminal Services is available on the [Microsoft website](https://microsoft.com). The next section discusses installing TCSC software components and licenses.

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\(^7\) If enabled in "Application Server" mode
\(^8\) A Windows 2000 Server with Terminal Services enabled
Installing TCSC Software

This section provides the following instructions for installing TCSC software:

- **Installing Windows 2000 Server**
  - Using Compaq SmartStart
  - Without using Compaq SmartStart
- **Configuring Terminal Services**
- **Installing MetaFrame XP**, with additional instructions for:
  - Creating a Microsoft SQL Server data store
  - Creating an Oracle data store
  - Continuing the MetaFrame XP installation
  - Installing the ICA Client
  - Adding MetaFrame XP licenses
- **Installing FR-1**, with additional instructions for
  - Updating the ICA Client
  - Adding the FR-1 license

Installing Windows 2000 Server

If desired, you can take advantage of Compaq SmartStart, an easy-to-use, wizard-based utility, to facilitate the Windows 2000 Server installation. However, this section provides instructions for installing Windows 2000 Server with or without SmartStart.

**With SmartStart**

The following procedure uses SmartStart 4.80 (or higher) to install Windows 2000 Server:

1. Insert the SmartStart CD-ROM into the server’s CD-ROM drive.
2. Boot the server.
3. At the Utilities screen, run the System Erase utility.
4. At the Desired SmartStart Path screen, select Manual Configuration.
5. At the Operating System screen, open the Microsoft folder.
7. After SmartStart loads the System Configuration utility, highlight Review or Modify System.
8. Press Enter.
9. Select View or Edit Details.
10. Press Enter.
Note: The system defaults to Internet Packet Exchange (IPX) and Ethernet 802.3 settings. If these settings are not appropriate for your system, select the desired settings.

11. After entering all information, press **F10**.
12. Select **Save** and **Exit** (option five).
13. At the shutdown prompt, select **Save Configuration**.

**IMPORTANT:** Do not close the *SmartStart* window.

14. Restart the server.
15. Use the **Array Configuration** utility to configure the array.
16. Follow the procedures outlined on the screen; insert the Windows 2000 Server CD-ROM when requested.

This completes the installation and configuration of the Windows 2000 Server operating system. You are now ready to **configure** Terminal Services.

**Without SmartStart**

Use the following procedure to install Windows 2000 Server without taking advantage of the capabilities of *SmartStart*:

1. Insert the Windows 2000 CD-ROM into the server’s CD-ROM drive.
2. Boot the server.
3. When the license agreement is displayed, press **F8** to accept the terms of the agreement and continue the installation process.
4. Select the partition in which you want the installation to place system files.
5. After selecting a partition, you must specify your file system – either Windows NT File System (NTFS) or File Allocation Table (FAT).

**Note:** For security reasons, Compaq recommends the NTFS system.

6. When prompted, remove your CD-ROM and restart the computer.

This completes the installation and configuration of the Windows 2000 Server operating system. The next section provides instructions for configuring Terminal Services.

**Configuring Terminal Services**

After installing the Windows 2000 Server operating system, you can configure Terminal Services. Use the following procedure:

1. After the server has restarted, place the Windows 2000 CD-ROM in the CD-ROM drive.
2. The next few screens prompt you for information to set up a unique identity for the server. Enter the appropriate information.
3. When prompted, enter an administrator account password.
4. On the **Server Components** screen, select **Terminal Services**.
5. At the **Terminal Services Set Up** screen, select **Application Server** mode.
6. Choose **Native Mode** or **Mixed Mode**.
7. At the **Network Settings** screen, select the appropriate protocols.
8. At the prompt, select an existing workgroup or domain.
9. Confirm the settings for **Date**, **Time**, and **Video Display**.
10. When **Setup** has finished, remove the Windows 2000 CD-ROM.
11. Restart the server.

Installation and configuration are now complete.

### Installing MetaFrame XP

This section provides instructions for installing MetaFrame XP.

**Prerequisite**

Before installing Citrix MetaFrame XP, the administrators should read “Administrator’s Guide, Citrix MetaFrame XP Server for Windows,” which is available on the Citrix MetaFrame XP CD-ROM. This document includes information on the following topics:

- Planning a MetaFrame XP deployment
- Installing MetaFrame XP
- Configuring MetaFrame XP servers and farms
- Licensing MetaFrame XP
- Configuring Citrix Independent Computing Architecture (ICA) client connections
- Deploying ICA clients to users
- Publishing applications
- Managing users and ICA sessions
- Managing printers for ICA clients

After familiarizing yourself with the Administrator’s Guide, you are ready to begin the MetaFrame XP installation.

### Installing MetaFrame XP

Use the following procedure to install MetaFrame XP:

1. After the server has restarted, place the MetaFrame XP CD-ROM in the server’s CD-ROM drive.

   **IMPORTANT:** If the CD-ROM drive has auto-run capability, the installation process starts automatically. Skip to Step 6.

2. Select the **Start** menu on your desktop.

3. Click **Run**.

4. Select setup executable `\W2k\MF\Setup.exe` from the CD-ROM drive (either by typing the path or browsing the drive’s root directory).
5. Either click OK in the Run dialog box or press Enter.
6. Click MetaFrame Setup.
7. Click I agree to accept the MetaFrame XP license agreement.
8. At the Welcome screen (shown in Figure 2), click Next.

![Figure 2: The MetaFrame XP setup program’s Welcome screen](image)

9. At the Data Store Configuration screen (shown in Figure 3), click Next.

![Figure 3: The Data Store Configuration screen](image)
10. The **Server Farm Selection** screen (shown in Figure 4) requires you to select one of the following two options:

- Create a new server farm, or
- Join an existing server farm

Make the appropriate selection, then click **Next**.

![Server Farm Selection](image)

**Figure 4: Selecting the option to create a new server farm**

11. The **Data Store Configuration** screen (shown in Figure 5) requires you to select one of the following two options:

- Use a local database for the data store, or
- Use a third-party database for the data store

Make the appropriate selection, then click **Next**.

**Note:** If accepting the local database, refer to “Continuing the MetaFrame XP Installation” for additional MetaFrame XP installation instructions.

If using a third-party database, refer to either “Creating a Microsoft SQL Server Database” or “Creating an Oracle Database.”
Creating a Microsoft SQL Server Database

To create an optional third-party database with Microsoft SQL Server, use the following procedure:

a. Run SQL Enterprise Manager on your SQL server by selecting Start>Programs>Microsoft SQL Server 7.0>Enterprise Manager.

b. Browse to the Enterprise Manager’s Database folder.

c. Select b.

d. A dialog box appears. In the Name box, enter a name; click OK.

e. Expand the Security folder.

f. Right-click Logins.

g. Click New Login.

h. A dialog box appears with General tab displayed. In the Name box, enter a name.

**IMPORTANT:** You will use this name later in the MetaFrame XP installation procedure.

i. In the Authentication section of the General tab, click SQL server authentication.

j. Enter a password.

**IMPORTANT:** You will use this password later in the MetaFrame XP installation procedure.

k. In the Defaults area of General tab, change the name of the Database to the name specified in Step d.

l. Click the Database Access tab.

m. In the Database list, select the database name specified in Step d.

n. In the Database Roles list, select DB_Owner.
Note: Do not uncheck any pre-selected roles.

   o. Click OK.

   p. Confirm your password.

This completes the procedure for creating a Microsoft SQL Server data store. Refer to “Continuing the MetaFrame XP Installation” for additional MetaFrame XP installation instructions.

The next section provides instructions for creating an Oracle database.

Creating an Oracle Database

To create an optional third-party database with Oracle, use the following procedure:

   a. Run the Oracle Database Configuration Assistant.

   b. In the first screen that appears, select Create a database; click Next.

   c. In the next screen, select Typical; click Next

   d. After verifying that the Oracle CD-ROM is in the server’s CD-ROM drive, select Copy existing database files from the CD; click Next.

   e. Enter a Global Database Name for the new database; click Finish.

   f. After creating the database, run Net8 Easy Configuration on each server on which you are installing MetaFrame XP. This utility allows you to create a service name that points to the Global Database Name of the data store that you have just created.

This completes the procedure for creating an Oracle data store. Refer to “Continuing the MetaFrame XP Installation” for additional MetaFrame XP installation instructions.
Continuing the MetaFrame XP Installation

After accepting the local database (or creating a third-party database), continue the MetaFrame XP installation procedure.

1. The **Zone Name** screen (shown in Figure 6) allows you to enter a name for the Interactive Multimedia Association (IMA) zone or accept the default. Make the appropriate selection, click Next.

![Zone Name](Image)

**Figure 6: Accepting the default IMA zone name**

2. The **Enter Server Farm** screen (shown in Figure 7) requires you to name the server farm. Enter the name, then click Next.

![Enter Server Farm](Image)

**Figure 7: Entering a server farm name**
3. The **Confirm Server Farm** screen (shown in Figure 8) requires you to confirm the server farm name that you entered in the previous step. Confirm the name, then click **Next**.

![Confirm Server Farm](image)

Figure 8: Confirming the server farm name

4. The **MetaFrame Interoperability** screen (shown in Figure 9) requires you to select whether or not you wish your MetaFrame XP server farm to operate independently of existing MetaFrame 1.8 server farms. Select one of the following two options:

- Operate independently in native IMA-only mode
- Operate in mixed mode with MetaFrame 1.8 servers

Click **Next**.

![MetaFrame Interoperability](image)

Figure 9: Selecting the option to create a MetaFrame XP-only server farm
5. The **Farm Administrator** screen (shown in Figure 10) requires you to identify the administrator of the farm. Enter the user name and domain, then click **Next**.

At the follow-on screen (not shown), confirm your selection.

![Figure 10: Naming the server farm administrator](image)

6. The **Network ICA Connections** screen (shown in Figure 11) allows you to create ICA connections for various network types (TCP/IP, IPX, SPX, and NetBIOS). Either accept TCP/IP only (the default) or specify the desired protocol(s); click **Next**.

**Note:** Basic Terminal Services features support TCP/IP protocol only; MetaFrame XP extends protocol support to IPX, SPX and NetBIOS.

If desired, you can select additional protocols after the MetaFrame XP setup is complete. Use the Windows Control Panel to install the appropriate components, then enable the ICA connections using Citrix Connection Configuration.
7. The **TAPI Modem Setup** screen (shown in Figure 12) allows you to add TAPI modems to give remote users access to your server. If desired, click **Add Modems**.

**Note:** You can also add TAPI modems after the MetaFrame XP setup is complete. Use the **Phone and Modems** applet in the control panel.

Click **Next**.

**Figure 12: Adding TAPI modems, if desired.**
8. The ICA Session Shadowing screen (shown in Figure 13) provides information on ICA session shadowing. After reading this information, click Next.

![ICA Session Shadowing](image)

Figure 13: The ICA Session Shadowing information screen

9. The Shadowing Setup screen (shown in Figure 14) requires you to specify if you wish to allow session shadowing. Select one of the following two options:

- **Allow shadowing of ICA sessions on this server** (and, if desired, prohibit remote control of ICA sessions, prohibit shadow connections without notification, or prohibit shadow connections without logging)

- **Do not allow shadowing of ICA sessions on this server**

**IMPORTANT:** Make sure that your selections are correct before clicking Next. You cannot change the shadowing setup later.

After verifying your selection(s), click Next.
10. The Drive Mapping screen (shown in Figure 15) provides information on drive letter mapping. After reading this information, click Next.
11. The **Server Drive Reassignment** screen (shown in Figure 16) allows you to reassign server drive letters. If desired, check the **Remap the server drives** box, then select a new letter for current drive C. Click **Next**.

![Server Drive Reassignment](image)

**Figure 16: Reassigning server drive letters, if desired**

12. The **Citrix XML Service** screen (shown in Figure 17) requires you to specify one of the following two options for the port to be used by Citrix XML Service:

- **Share default TCP/IP port with Internet Information Service**, or
- **Use a separate port for XML support**

**Note:** To specify a separate port, enter the port number in the **TCP/IP Port** box. If the selected port is already in use, you receive notification.

After making your selection, click **Next**.
13. The NFuse Setup screen (shown in Figure 18) allows you install NFuse. If desired, accept the default – Install NFuse Technology – then click Next.

IMPORTANT: NFuse is required to access Thin Client devices over the Internet.
14. The **Perform Installation** screen (shown in Figure 19) advises you that the setup program is ready to begin the installation. Click **Next**.

![Perform Installation Screen]

Figure 19: Allowing Setup to copy files and make changes to the system

15. The **Perform Installation** screen (shown in Figure 20) displays the status of the installation. **WARNING:** Do not click **Next** before the MetaFrame XP installation is complete.

![Perform Installation Screen]

Figure 20: Monitoring the progress of the installation

The MetaFrame XP installation is complete. You are now ready to install the ICA Client, if desired. Click **Next**.
Installing the ICA Client

After the MetaFrame XP installation is complete, a wizard allows you to install ICA Client on the server. Follow this procedure:

1. The **Citrix ICA Client Distribution Wizard** (shown in Figure 21) allows you to install ICA Client, if necessary.
   - If you wish to install ICA Client, click **Next**.
   - If the latest version of ICA Client is already installed, click **Cancel**.

![Figure 21: Choosing to install ICA Client](image-url)
2. The Citrix ICA Client Distribution Wizard (shown in Figure 22) allows you to install the ICA Client from either a CD-ROM or a network-share. Make the desired selection, then click Next.

![Figure 22: Selecting the source for the ICA client setup files](image)

3. The Citrix ICA Client Distribution Wizard (shown in Figure 23) allows you to select either a Typical or Custom installation. Make the desired selection, then click Next.

![Figure 23: Selecting the ICA client installation type](image)
4. The **Citrix ICA Client Distribution Wizard** (shown in Figure 24) displays the progress of the installation.

**WARNING:** Do not click **Next** before the ICA Client installation is complete.

![Citrix ICA Client Distribution Wizard](image)

Figure 24: Monitoring the progress of the ICA client installation

When the ICA Client installation is complete, you are ready to add your MetaFrame XP licenses. Click **Next**.

**Adding MetaFrame XP Licenses**

After the ICA Client installation is complete, a series of Setup screens allows you to add your MetaFrame XP licenses. Follow this procedure:

1. The **MetaFrame XP 1.0 Licensing** screen (shown in Figure 25) requires you to enter the serial numbers of your MetaFrame XP licenses.
   a. Enter the serial number of your first license in the **License Serial Number** box.
   b. Click **Next**.
   c. Repeat for the remaining serial numbers.
   d. Click **Next** to go to the next screen.

**Note:** If desired, you can enter the licenses later using Citrix Management Console.
2. The **MetaFrame XP Product Code** screen (shown in Figure 26) requires you to specify your eight-character MetaFrame XP product code. The following options are available:
   - Using the product code suggested by Citrix, which is based on the licenses already entered on the server, or
   - Entering the product code from your MetaFrame XP license sticker

**IMPORTANT:** You must use the product code from your license sticker if this code differs from the suggested code.

After specifying the product code, click **Next**.
3. The **System Restart** screen (shown in Figure 27) advises you that the system will be restarted. Click **Restart**.

![System Restart screen](image)

**Figure 27: Restarting the server**

4. Start **Citrix Management Console** so that you can activate the MetaFrame XP license.
5. Log in to the server farm.
6. When the **Administrator** screen (shown in Figure 28) is displayed, right-click **Licenses** to display a drop-down menu.

![Figure 28: Right-clicking Licenses to display a drop-down menu](image)

7. Click **Add License**.

8. After you receive a notice (shown in Figure 29) advising you that the license has been added, click **Yes** to activate the license.

![Figure 29: Notice indicating that the license was added successfully](image)
9. The **Activate License** dialog box (shown in Figure 30) requires you to enter the appropriate activation code, which is available through the [Citrix Activation System](http://www.citrix.com/activate). **Note**: Log in to CAS using the ID and password provided with your license.

![Activate License dialog box](activate-license.png)

Figure 30: Activating your FR-1 license

You have successfully added and activated the MetaFrame XP license. This completes the installation of MetaFrame XP; you are now ready to install MetaFrame XP FR-1.

**Installing MetaFrame XP FR-1**

Following the successful installation of MetaFrame XP, you can install MetaFrame XP FR-1. **Important**: Make sure that no other applications are running on your server.

Use the following procedure:

1. Replace the MetaFrame XP CD in the server’s CD-ROM drive with the MetaFrame XP FR-1 CD. **Important**: If the CD-ROM drive has auto-run capability, the installation process starts automatically. Skip to Step 6.

2. Select the **Start** menu on your desktop.

3. Click **Run**.

4. Select setup executable `\imdeployfr1.exe` from the CD-ROM drive (either by typing the path or browsing the drive’s root directory).

5. Either click **OK** in the **Run** dialog box or press **Enter**.
6. The Feature Release 1 screen (shown in Figure 31) allows you to select from a number of installation options. Select Feature Release 1.

![Figure 31: Selecting the option to install FR-1](image)

7. In the follow-on License dialog box, select I Accept.

8. The Welcome screen (shown in Figure 32) advises you to exit any other programs. If no other programs are running, click Next.

![Figure 32: The FR-1 Welcome screen](image)
9. The **Perform Installation** screen (shown in Figure 33) offers you the option to cancel the installation, if desired. To continue the FR-1 installation procedure, click **Next**.

![Perform Installation screen](image)

**Figure 33: Selecting the option to install the FR-1 software**

10. The **Perform Installation** screen (shown in Figure 34) displays the status of the FR-1 installation.

**WARNING:** Do not click **Next** before the installation is complete.

When the installation is complete, click **Next**.

![Perform Installation screen](image)

**Figure 34: Monitoring the progress of the installation**
11. The **Finish** screen (shown in Figure 35) indicates that the FR-1 installation is complete. You are now ready to update the ICA Client.

Verify that the **Run the Client Distribution Wizard** box is checked, then click **Next**.

![Figure 35: Invoking the Client Distribution Wizard](image)

**Updating the ICA Client**

After the FR-1 installation is complete, a wizard allows you to update the ICA client. Follow this procedure:

1. The **Citrix ICA Client Distribution Wizard** (shown in Figure 36) allows you to update the ICA client, if desired.
   - If you wish to update the ICA client, click **Next**.
   - If the latest ICA Client is already installed, click **Cancel**.
2. The **Citrix ICA Client Distribution Wizard** (shown in Figure 37) allows you to update the clients from either a CD-ROM or the network. Make the desired selection, then click **Next**.

![Citrix ICA Client Distribution Wizard](image)

**Figure 36: Specifying that you wish to update the ICA Client**

**Figure 37: Selecting the source for the ICA client setup files**
3. The **Citrix ICA Client Distribution Wizard** (shown in Figure 38) advises you that it is looking for ICA Client software. After the appropriate software has been located, click **Next**.

![Figure 38: Waiting while the wizard locates the ICA Client software](image)

4. The **Citrix ICA Client Distribution Wizard** (shown in Figure 39) allows you to select either a **Typical** or **Custom** installation for the update. Make the desired selection, then click **Next**.

![Figure 39: Selecting the ICA client update type](image)
5. The **Citrix ICA Client Distribution Wizard** (shown in Figure 40) displays the progress of the update.

**WARNING:** Do not click **Next** before the FR-1 licensing notice (shown in Figure 41) appears.

![Citrix ICA Client Distribution Wizard](image)

**Figure 40:** Monitoring the progress of the ICA client update

6. The wizard issues a notice (shown in Figure 41) advising you that you must add and activate FR-1 product and connection licenses immediately. Click **OK**.

![Feature Release 1 for MetaFrame XP 1.0 Setup](image)

**Figure 41:** Receiving a notification that immediate FR-1 license activation is required

**IMPORTANT:** If you do not activate the licenses, you receive a warning notice (shown in Figure 42) after re-starting the server.

![Citrix ICA Warranty Notice](image)

**Figure 42:** Showing the warning notice you receive later if you do not immediately activate the FR-1 licenses

The ICA Client update is complete. You are now ready to use Citrix Management Console to add and activate the FR-1 license.
Adding the FR-1 License

To add and activate the FR-1 license, use the following procedure:

1. Start Citrix Management Console so that you can add the FR-1 license.
2. Log in to the server farm.
3. When the Administrator screen (shown in Figure 43) is displayed, right-click Licenses to display a drop-down menu.

4. Click Add License.
5. After you receive a notice (shown in Figure 44) advising you that the license has been added, click Yes to activate the license.

Figure 43: Right-clicking Licenses to display a drop-down menu

Figure 44: Notice indicating that the license was added successfully
6. The **Activate License** dialog box (shown in Figure 45) requires you to enter the appropriate activation code, which is available through the **Citrix Activation System** (CAS).

**Note:** Log in to CAS using the ID and password provided with your license.

![Activate License dialog box](image)

**Figure 45: Activating your FR-1 license**

This concludes the instructions for installing TCSC software.

**Summary**

Compaq **ProLiant** servers utilizing Citrix MetaFrame XP and Microsoft Windows 2000 Terminal Services provide superior performance, scalability, and manageability in large enterprise TCSC environments.

Compaq has worked closely with Microsoft and Citrix to develop the most robust and comprehensive TCSC solutions available. Compaq **ProLiant** DL servers utilizing Citrix MetaFrame XP for Microsoft Windows 2000 Server provide superior performance, scalability, and manageability in large enterprise TCSC environments. This White Paper compares the performance of various **ProLiant** DL server configurations in a TCSC environment, providing scaling data that can help the customer configure a **ProLiant** Density Line server farm for a very large enterprise TCSC deployment. In addition, this White Paper provides information on Compaq Remote Insight Lights-Out Edition, a Compaq Intelligent Manageability product that offer today’s IT managers an easy, effective way to manage business-critical servers – whether deployed in a data center or at remote sites – from a central location.

The MetaFrame XP family has a highly scalable communications and management foundation that provides the capability to manage and deploy applications across the enterprise. It delivers much more than application support, giving IT managers the ability and confidence to maintain a fast, predictable and efficient application-serving network. Citrix has released Feature Release 1 (FR-1) for MetaFrame XP, offering a rich set of enhancements to the already robust MetaFrame XP family. Citrix continues their mission to extend the virtual workplace while saving the customer both time and money.
For IT managers needing more flexibility when deploying applications and more control over desktop management costs, the Terminal Services component of Microsoft Windows 2000 offers important improvements over the traditional two- or three-tier client-server architecture. Terminal Services delivers the Windows 2000 Professional desktop and the latest Windows-based applications to a wide variety of Thin Client devices.

Terminal Services client software is available for a wide variety of Thin Client devices, including PCs, Windows-based terminals, and even non-Windows-based platforms such as a Macintosh or UNIX workstation.

The detailed instructions offered by this White Paper can facilitate the installation of a TCSC solution that allows the centralized deployment of enterprise-wide applications while supporting a wide variety of client computing devices.
## Appendix A – Features and Benefits of MetaFrame XP

Unparalleled manageability and scale — systems, applications and users

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrix Management Console (CMC)</td>
<td>Use a single, comprehensive interface to manage the entire server farm — including servers, applications, licenses, printers and users — from any location</td>
</tr>
<tr>
<td>Application packaging and delivery (MetaFrame XPe only)</td>
<td>Take advantage of installation enhancements such as support for unattended installs, customizable project details, packager rollback, scheduled package delivery, server reboot and MSI support, delivery verification, and package inventory</td>
</tr>
<tr>
<td>System monitoring and analysis (MetaFrame XPe only)</td>
<td>Monitor and manage the server farm centrally using capacity planning, user-access tracking, real-time graphing and alerting, user-definable metrics, and reporting</td>
</tr>
<tr>
<td>Advanced load management (MetaFrame XPa and XPe only)</td>
<td>Customize load-balancing rules to maximize server resources based on any application and user environment; schedule taking applications off-line for maintenance.</td>
</tr>
<tr>
<td>Network management (MetaFrame XPe only)</td>
<td>Administer a server farm through the native console of leading network-management solutions</td>
</tr>
<tr>
<td>Centralized printer management</td>
<td>Replicate printer drivers across the server farm; designate printer drivers for particular uses; limit the bandwidth used by print data streams</td>
</tr>
<tr>
<td>Centralized license management</td>
<td>Manage all Citrix product and user licenses, including entry and activation — from a single point</td>
</tr>
<tr>
<td>Application publishing</td>
<td>Deploy applications across the MetaFrame XP server farm — on any server to any user — with a single click</td>
</tr>
<tr>
<td>Enterprise-class scalability</td>
<td>Install, manage and expand easily as business requirements demand</td>
</tr>
<tr>
<td></td>
<td>Support complex network configurations, including multiple network segments and firewalls</td>
</tr>
</tbody>
</table>

*continued*
Active Directory support | Publish applications to Active Directory users and groups; share and manage information on network resources and users | Saves time and simplifies server logon with the user’s full Active Directory-based username and password
---|---|---
TCP–based browsing | Allow clients to browse for published applications and desktops without relying on User Datagram Protocol (UDP) broadcasts | Eases deployment through firewalls and other secured network links by supporting standard protocols
Program Neighborhood | Push native Windows icons down to the desktop through the Program Neighborhood client, the central location for browsing the network | Allows total administrative control of applications by providing users with dynamic access to published applications
Advanced shadowing | Allow the administrator to take control of user’s ICA sessions, log shadowing instances and provide an on-screen shadowing indicator | Makes it easy for administrators to remotely troubleshoot application problems and record shadowing instances for precise auditing purposes
Pass-through authentication | Pass the user’s desktop password to the server, eliminating the need for multiple system and application authentication | Enhances the seamless integration of ICA clients by minimizing the number of authentication tasks performed by the user

**Total Net leverage – integration, personalization and control**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrix NFuse</td>
<td>Integrate existing and customized applications into a standard Web browser without rewriting a single line of code; deliver personalized content and access to specified applications</td>
</tr>
<tr>
<td>Support for corporate portals</td>
<td>Add published interactive applications to enterprise Web portals, rounding out the array of Web-based resources with business-critical solutions</td>
</tr>
<tr>
<td>Web-based client installation</td>
<td>Identify the platform a user is on; offer the opportunity to automatically download the appropriate client</td>
</tr>
<tr>
<td>ICA client object for Windows</td>
<td>Provide a programmable interface for integrating ICA clients into portals; support major Web browsers and ActiveX &quot;containers&quot;</td>
</tr>
<tr>
<td>Application filtering and caching</td>
<td>Enumerate application access by group for caching on the Web server so that, when several users from the same group log onto the site, their applications can be displayed from the Web server’s cache</td>
</tr>
<tr>
<td>MetaFrame XP server rollover</td>
<td>Contact backup servers automatically if the designated MetaFrame XP server fails to capture the NFuse log on request.</td>
</tr>
<tr>
<td>SSL encryption</td>
<td>Use the inherent 128-bit encryption of Citrix’s Secure Sockets Layer (SSL) so that credentials are not passed from the MetaFrame XP server to the Web server</td>
</tr>
</tbody>
</table>
## Ultimate flexibility – any application, any device, over any Net connection

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Universal client access          | Provide support for over 20 native ICA clients for Windows and non-Windows platforms  
|                                  | Allows application deployment across the enterprise to almost any device. |
| Seamless Windows                 | Provide user access to multiple applications and keyboard controls       
|                                  | Integrates local and remote applications into a local Windows desktop, offering a true, seamless user experience. |
| High-color depth and resolution  | Allow users to choose between local and remote applications on the task bar; support high-color (65,000) and true-color (16 million) sessions with screen resolutions up to 64,000 by 64,000 pixels  
|                                  | Enables ICA user sessions to run rich, high-resolution applications with the look and feel of a local desktop |
| Access to local system resources | Automate access to all local drives and devices attached to communication ports; play 16-bit sound files.  
|                                  | Enables organizations to leverage all their local resources such as printers, personal digital assistants and other devices; offering a seamless user experience. |
| Client time-zone support         | Enable applications operating on a MetaFrame XP server to run in the context of each user’s local time-zone  
|                                  | Enables users to set the correct time-zone according their physical location, allowing accurate timestamps to be recorded for e-mail and other personal manager applications |
| Panning and scaling              | Pan the ICA session window around the full session desktop and scale to view more of the ICA session at one time  
|                                  | Eliminates panning by shrinking the perceived size of the ICA session so that users can view large images on small device screens |
| Speed Screen 3                   | Immediate echo of mouse movements and keystrokes with text-entry prediction and instant mouse-click feedback; reduce the transmission of frequently repainted screens  
|                                  | Provides significant performance improvements on restricted bandwidth connections for a consistent user experience |

## More Information

Refer to the [Citrix website](https://www.citrix.com) for more information on the features of MetaFrame XP.
Appendix B – Features and Benefits of Feature Release 1

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novell NDS support</td>
<td>Publish applications and content to Novell NDS users and groups; support seamless NDS authentication. Administrators no longer have to create Microsoft domain or Active Directory users or groups. Novell NDS users no longer have to authenticate twice when connecting to MetaFrame XP.</td>
</tr>
<tr>
<td>SSL encryption</td>
<td>Pass ICA and XML content through the firewall using the HTTPS port; leverage the inherent 128-bit encryption of Internet-standard SSL technology. Brings added security and peace of mind to administrators and users.</td>
</tr>
<tr>
<td>CPU prioritization (MetaFrame XPa &amp; XPe)</td>
<td>Assign higher CPU priority to more strategic applications. Ensures top performance for mission-critical applications running on Windows 2000 Servers.</td>
</tr>
<tr>
<td>Auto client reconnect</td>
<td>Automate the ICA client’s efforts to reconnect to a temporarily disconnected but still active user session. Saves the user time and effort when attempting to reconnect to a disconnected ICA session.</td>
</tr>
<tr>
<td>Program Neighborhood Agent</td>
<td>Push application icons down to the Windows client’s Start menu and desktop – optimized for those users not requiring ICA client configuration changes. Prevents users from making configuration changes to the ICA Client while making it easier than ever for users to connect to server-based applications and content.</td>
</tr>
<tr>
<td>Content publishing</td>
<td>Extend the application-publishing model to accommodate local applications and internal/external content, such as audio, video, Web pages and files. Saves time by accessing dispersed applications and content through a convenient Web portal.</td>
</tr>
<tr>
<td>Citrix Web Console</td>
<td>Combine many of the most frequently used MetaFrame XP administration functions into an easy-to-use Web interface. Gives Citrix administrators a convenient, new way to access basic MetaFrame XP administration functions.</td>
</tr>
<tr>
<td>Citrix Universal Print Driver</td>
<td>Consolidate print driver requirements into a single, universal print driver. Significantly reduces print driver administration while also reducing printing time for many desktop printers.</td>
</tr>
<tr>
<td>Improved printing performance</td>
<td>Use ICA to reduce print time by up to 50% over low bandwidth, high-latency links. Users can now print from MetaFrame XP sessions more quickly than ever, even without the Citrix Universal Print Driver.</td>
</tr>
<tr>
<td>ThinWire performance enhancements</td>
<td>Leverage advances in ThinWire ICA technology to reduce per-connection bandwidth requirements by up to 50% when using 24-bit color over low bandwidth connections. Further reduces bandwidth costs while increasing application performance across the enterprise.</td>
</tr>
<tr>
<td>Connection control (MetaFrame XPa and XPe)</td>
<td>Limit the number of concurrent user and/or application connections. Preserves valuable server resources; ensures that maximum application license usage is not exceeded.</td>
</tr>
<tr>
<td>ICA session monitoring (MetaFrame XPe)</td>
<td>Monitor ICA network traffic – down to the virtual channel. Ensures appropriate bandwidth allocation to remote users and offices by providing network usage data.</td>
</tr>
</tbody>
</table>
Enhanced application packaging and delivery (MetaFrame XPe) | Group servers by OS-type and/or departmental function; take advantage of additional tools for managing application packages for distribution | Makes it easier to create and replicate applications, service packs and files across the entire server farm

CA Unicenter TNG plug-in (MetaFrame XPe) | Use MetaFrame XPe’s Network Management capability to provide support for CA Unicenter TNG | Allows enterprises to leverage their CA Unicenter TNG investment to help monitor and manage the MetaFrame XPe server farm

Enhanced Citrix Management Console (CMC) | Take advantage of the enhanced CMC user interface to monitor MetaFrame XP connection licenses and identify MetaFrame XP server properties | Offers Citrix administrators more information – at their fingertips

Support for NFuse 1.6 | Provide support for NFuse 1.6 | Allows MetaFrame XP administrators and users to take full advantage of the newest functionality found within NFuse 1.6

More Information

Refer to the Citrix website for more information on the features of MetaFrame XP FR-1.
## Appendix C – Features of Windows 2000 Terminal Services

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated local printer support</td>
<td>Windows 2000 Server Terminal Services can add and automatically reconnect printers attached to Terminal Services clients.</td>
</tr>
<tr>
<td>Clipboard redirection</td>
<td>Users can cut and paste between applications running on the local machine and those running on the Terminal Server.</td>
</tr>
<tr>
<td>Performance enhancements</td>
<td>Enhancements to caching (including persistent caching, packet utilization and frame size) provide significant performance improvements.</td>
</tr>
<tr>
<td>Roaming disconnect support</td>
<td>Users can disconnect from a session without logging off or allow a session to remain active while disconnected and then reconnect to the existing session from another machine or at a later time. The Windows 2000 Server security model requires logon to reconnect, so sessions remain secure at all times.</td>
</tr>
<tr>
<td>Multiple logon support</td>
<td>A user can have multiple simultaneous logon sessions from one or more desktops. Users can log on to multiple computers running Windows 2000 Server with the same logon name or they can log on to a single server multiple times (again using the same logon name) to perform several tasks or run multiple unique desktop sessions.</td>
</tr>
<tr>
<td>Remote administration mode</td>
<td>Remote administration mode allows Terminal Services to be enabled on any computer running Windows 2000 Server for graphical remote administration – with no impact to server performance or application compatibility. Up to two concurrent remote sessions are permitted.</td>
</tr>
<tr>
<td>Remote control</td>
<td>Helpdesk staff can view or control another Terminal Services session. Keyboard input, mouse movements, and display graphics are shared between two Terminal Services sessions, allowing the support person to diagnose and resolve configuration problems, as well as train the user remotely. This feature is especially useful for organizations with branch offices.</td>
</tr>
<tr>
<td>Integration with Windows 2000 Server features</td>
<td>Terminal Services supports and extends all Windows 2000 Server features, such as Active Directory services and the Microsoft Management Console.</td>
</tr>
<tr>
<td>Network load balancing</td>
<td>Network load balancing, available in Windows 2000 Advanced Server and Datacenter Server, allows Terminal Services clients to connect to a pool of servers running Terminal Services, eliminating a single point-of-failure.</td>
</tr>
<tr>
<td>Windows Thin Clients</td>
<td>Windows Thin Clients (formerly known as Windows-based Terminals) are devices that integrate with and complement Windows 2000 Terminal Services and Citrix MetaFrame via Microsoft's Remote Desktop Protocol (RDP) and Citrix ICA.</td>
</tr>
<tr>
<td></td>
<td>Windows Thin Clients are available today from Compaq, Wyse Technology, Network Computing Devices, Boundless Technologies, Neoware Systems and others. Information on configuring a Windows Thin Client is available on the Microsoft website.</td>
</tr>
<tr>
<td>Client Connection Manager</td>
<td>Users can set up pre-defined connections to one or more servers for a single application or full desktop access. Client Connection Manager creates an icon on the client desktop for single-click connectivity to one or more computers running Terminal Services. This way, administrators wanting to provide a single line-of-business application across the computing environment can create a connection, export it, and distribute that connection along with the Terminal Services Client software to the PC desktops. The connection is automatically made available when the client software is installed.</td>
</tr>
</tbody>
</table>

*continued*
License Manager | The Terminal Services License Manager helps system administrators and purchasing offices track clients and associated licenses.
---|---
Distributed File System (Dfs) Support | Support for Dfs allows users to connect to a Dfs-share and allows administrators to host Dfs-shares from a Terminal Server.
Terminal Services Manager | Administrators can use the Terminal Services Manager tool to query and manage Terminal Services sessions, users, and processes on computers running Windows 2000.
System policies components allow desktop lockdown | Terminal Services-based clients have additional components on the Windows desktop and Start menu: Disconnect, Logoff, and Windows 2000 Server Security. Administrators can disable these components if not needed.
Terminal Services Configuration | Terminal Services Configuration is used to manage connection protocol settings and server settings, including permissions, encryption strength, and the licensing mode.
Integration with Windows 2000 Server User Management | Administrators create user accounts for Terminal Services users in the same way they create accounts for Windows 2000 Server users. Extra fields exist for specifying Terminal Services specific information, such as the Terminal Services Profile Path and Home Directory.
Integration with Windows 2000 Server Performance Monitor | Integration with Windows 2000 Server Performance Monitor allows system administrators to easily monitor Terminal Services system performance, including tracking processor use, memory allocation, and paged memory usage and swapping per user session.
Messaging support | Administrators can alert users to system shutdowns and upgrades or to new application postings.
Configurable inactivity timeout | Administrators can configure when to time out sessions due to inactivity, reducing server workload.
Limit logon attempts and connection time | Administrators can limit the number of user logon attempts to prevent hackers from attacking a server, as well as the connection time of any individual user or groups of users.
RDP encryption | The built-in RDP encryption feature lets administrators encrypt some or all RDP data transmitted between the Windows 2000 Server and Terminal Services clients. The default encryption level is medium, which provides bi-directional encryption between the server and the client using RSA Security's RC4 encryption algorithm, using a 56-bit key (or a 40-bit key, if using a Terminal Server 4.0 client).
Manage user security | Administrators can set up security restrictions for individual users or an entire server. This includes limiting the ability to redirect to local devices.

**More Information**

Refer to the [Microsoft website](https://microsoft.com) for more information on the features of Terminal Services.
Appendix D – Overview of Compaq SmartStart

Compaq SmartStart is a reliable system configuration utility that offers the following benefits:

- Minimal setup time to reduce costs and allow a quicker response to changing business needs
- Assurance of software compatibility
- Consistency – helping to minimize the number of servers requiring configuration by creating a replication diskette

Compaq ProLiant servers feature Compaq SmartStart, a software integration tool that can help administrators configure complex server platforms. Compaq conducted extensive testing with different hardware platforms and software applications to ensure the reliability of system configurations created using SmartStart.

The next section describes the key capabilities of SmartStart.

Capabilities

SmartStart is an easy-to-use, wizard-based utility that allows administrators to set up consistent configurations for each new server installed. SmartStart includes the following capabilities:

- Facilitating and streamlining system configuration
- Automatically installing drivers that are optimized to perform with Compaq hardware
- Assisting with the installation of leading server operating systems, including Microsoft Windows 2000, SCO UnixWare, Novell intraNetWare, and Novell NetWare
- Installing and optimizing leading Internet applications such as Microsoft Internet Information Server, Netscape Server, and Raptor EagleNT firewall software
- Using the Replicated Server feature to duplicate selected configurations among multiple identical servers

More Information

Refer to the Compaq website for more information on SmartStart.