Enterprise-wide ABC/M:

Oros in the MetaFrame/
NT Server TSE environment

Contents

Executive Summary

Since the advent of commercial ABC/M in the mid-1980's the industry has gone through many evolutionary phases. It has progressed from education, through experimentation, to integration, and into an arena where ABC/M project expansion and enterprise-wide access to the information have become key objectives for organizations. The human dynamics of achieving this are still challenging; however, technology to enable enterprise-wide ABC/M has made great strides. Using the proper technology architecture can enable an organization to get faster buy-in to the concept of ABC/M and to ensure that a critical component of any enterprise-wide ABC/M project – the IT organization- is supportive of the ABC/M efforts.

Three key characteristics of enterprise-wide ABC/M drive technology needs:

1. Multi-site, geographically dispersed ABC/M teams
2. The need for remote access to ABC/M information
3. A drive toward a lower Total Cost of Ownership (TCO)

It is a challenge for organizations to satisfy these requirements without compromising a key dynamic of ABC/M implementations: local control and ownership of each ABC/M model at the site it represents. Historically, organizations that fail to allow for local ownership struggle to obtain broadly based buy-in, oftentimes resulting in project stagnation and program demise.

How can technology enable an organization to achieve enterprise-wide ABC/M while preserving key factors related to project success? The solution lies in a technology architecture that leverages the application server platform of *Citrix MetaFrame™/Microsoft® Windows NT® Server 4.0, Terminal Server Edition* (NT TSE) to deliver analytic applications to the enterprise ABC/M team.

Citrix Systems, Inc. is one of the 20 largest software companies in North America and was also named "America's most dynamic software company" by Forbes magazine. Citrix's leadership in the server-based computing market is ascertained by its presence in over 75% of the Fortune 100. What makes this a powerful solution for enterprise-wide ABC/M?

The MetaFrame/NT TSE platform extends the Windows application architecture to support:
*   Heterogeneous computing environments
*   Enterprise scale management
*   Seamless desktop integration.

Why does ABC Technologies endorse this architecture for enterprise wide ABC/M?

1. Citrix is a proven, industry standard, server-based solution for the enterprise, which reassures the IT organization that the integrity of their managed environment is protected.
2. Over 75% of the Fortune 100 and over 50% of the Fortune 500 have committed to the Citrix application server platform.
3. MetaFrame/NT TSE provides the centralized computing architecture that allows ABC/M teams to leverage all the power of the application server to host and manage applications centrally. This ensures all users of optimal calculation performance.
4. Citrix MetaFrame's *Independent Computing Architecture* (ICA) is a native client-server architecture, which extends the accessibility of Oros applications, including enhanced web-enablement.

5. MetaFrame ICA uses a true *super-thin* client, with 100% of the application executing on the server. This offers the ABC/M team the advantages of local control and ownership of the ABC/M model without imposing local resource management issues on IT organizations.
6. MetaFrame is client platform independent: ICA supports Windows and non-Windows clients (DOS, UNIX, MacOS, Java and OS/2 Warp) on a wide range of hardware platforms. This allows teams around the globe access to Oros applications and data without replacing or modifying client machines.
7. MetaFrame connections leverage standard telephone lines, WAN links, broadband connections, wireless connections, corporate Intranets and the Internet.   This facilitates seamless remote access to ABC/M applications and allows a broader audience to interact painlessly with ABC/M information.
8. The Citrix MetaFrame architecture supports LAN and WAN protocols including TCP/IP, IPX, SPX, NetBIOS etc. This provides users the broadest flexibility in accessing Oros analytic applications hosted on a central application server.
9. IT organizations can manage and balance Oros applications across multiple servers from a single location. This lowers the TCO and supports larger, more dispersed ABC/M teams with fewer resources.

We believe that the Citrix MetaFrame architecture is the most flexible and most proven platform for mission-critical applications such as ABC/M. IT organizations around the world have endorsed this platform as the most robust and flexible application server solution on the marketplace.

Enterprise ABC/M teams need to ensure that IT organizations support the ABC/M program. The Citrix MetaFrame solution is an industry standard platform. With its centralized computing architecture and robust administration features, it decreases IT risk and reduces the TCO for the organization. The MetaFrame platform also allows for local control and ownership of the ABC/M model, which has proven over time to be the critical dynamic driving enterprise-wide ABC/M success.

Infrastructure Challenges

The need to share Oros applications and data among members of the ABC/M team imposes certain technology requirements on organizations that embark on enterprise-wide ABC/M. The MetaFrame/NT TSE native client/server architecture addresses those requirements:

- ABC/M team members are often scattered across multiple LAN's at the same geographical location. Launching programs or loading data over the WAN that connects them can be very slow. But managing Oros frameworks on multiple LAN servers may be impractical or access to multiple servers may be difficult to obtain. **MetaFrame/NT TSE provides access to centrally installed and managed applications with minimal data transfer across the network.**
- Some teams include individuals who work from various locations off-site part of the time and their access to Oros applications and data must be as fluid and responsive as LAN access, regardless of the type of connection. **Access to applications on the MetaFrame/NT TSE server supports multiple network protocols, even over low-bandwidth connections.**
- An enterprise-wide ABC/M project may involve teams in different cities or countries, with a coordinator at a central location. The project coordinator needs to obtain the various models and data extracts, review and revise them as necessary, and send the updated models and data files back. **With Oros applications and data centralized on MetaFrame/NT TSE servers, a project coordinator has direct access to models and other data without transporting files.**

- In some carefully managed network environments, IT departments may require central installation and administration of all application software, even when ABC/M team members work at different sites. **The MetaFrame/NT TSE application server platform offers IT the flexibility to locate applications and data files for efficient management and use of resources, reducing TCO.**
- Central storage of data files – models, source data, queries, reports and so on – is required to make them readily available to all members of the ABC/M team; yet there must be no consequent performance bottlenecks when loading data over a busy network. **Access to data stored on a MetaFrame/NT TSE server avoids the requirement to transfer files, providing quick response even over the busiest network.**
- Some individuals who should participate in the ABC/M project are using older PC's, an older (16-bit) version of Windows, or non-PC hardware (e.g., Macintosh, Sun workstations), but require the same fluid access to Oros applications and data as users of the latest Windows-based workstations. **With broad support for heterogeneous computing environments, Citrix MetaFrame brings the same Oros applications to the widest possible range of Windows and non-Windows desktops, laptops, even palmtops.**

The key to all of these challenges lies in shifting the task of running applications from the user's workstation to a server at the same location where the applications are installed. Users, connected to the server across a WAN, or via a remote connection control the operation of applications from their workstations and see results displayed on their own screens. Since program files and data are both stored on the same local network as the machine whose processor and memory are used to run the applications, data files load much faster than they could across the highest-speed WAN, or remote connection.

So, how does an organization achieve such an architecture?

Overcoming Infrastructure Challenges: Microsoft® Windows NT Server® TSE and Citrix MetaFrame™

The secret to overcoming the obstacles of physical distance, limited access and constrained bandwidth is choosing the right server platform. MetaFrame/NT TSE transfers the task of running Oros processes from the user's workstation to a server, local to where Oros is installed and shared data is stored. The connection to the server no longer carries application files and data from the server to the user's computer for local processing. Instead, the MetaFrame ICA connection carries keyboard and mouse commands from the user to the server and returns screen updates to the user. Oros programs use only the server's processor, memory, and disk resources to perform their work. The user's processor, memory, and disk space only support the super-thin ICA client program that handles communication with the server.

Teaming Oros with the MetaFrame/ NT TSE server platform gives remote users abilities previously enjoyed only by those with local Oros installations. Even a dial-up connection offers crisp program response - WAN users may forget that the programs they are using are running on a machine in a different location. This approach to supporting Oros analytic applications lets IT departments retain control of server-based resources, when that is the key issue. Of course, there is still no substitute for giving ABC/M teams the flexibility of local application installations, so a local (or regional) MetaFrame/NT TSE server is an ideal solution whenever possible. Yet for those cases where a local Oros installation is impractical, the MetaFrame/ NT TSE application server lets ABC/M teams overcome infrastructure obstacles of limited server availability, slow remote connections, and network bottlenecks.
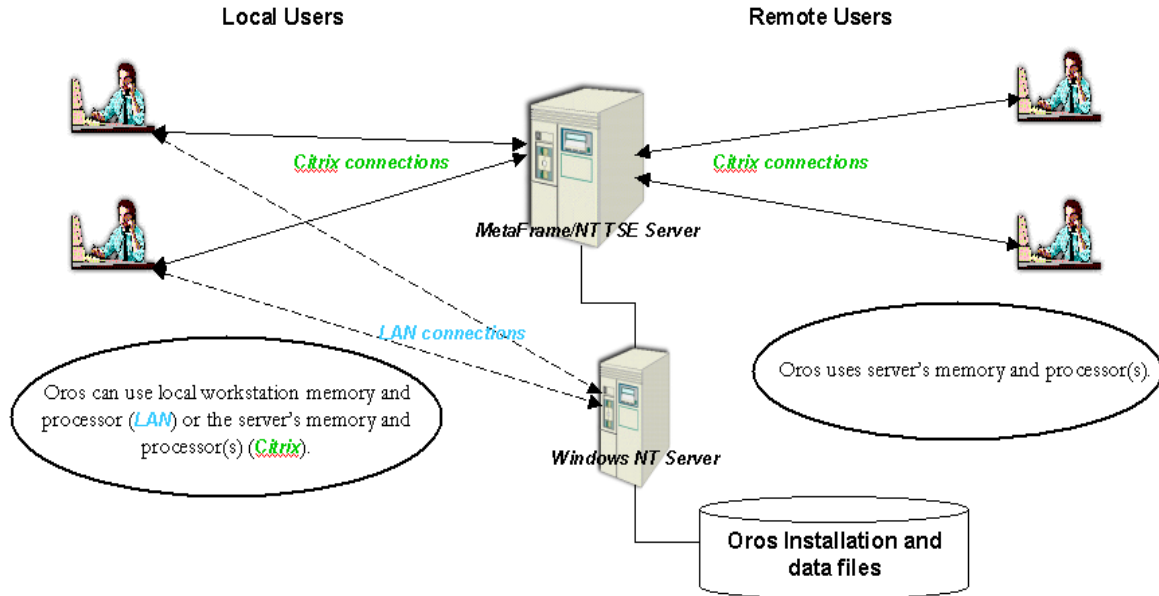
Figure 1
Local and remote Oros users share applications and data on the MetaFrame/NT TSE platform.

Figure 1 illustrates how team members with direct LAN connections to a local Windows NT TSE application server can still use the server only for file and print services. They can set up Oros applications to execute in the workstation's Windows environment, using the workstation's processor and memory. Oros users not on the same LAN launch a client program on their workstations to connect to the server and begin a separate session of the Windows NT operating system, from which they can launch application programs.

In the client window, the user sees a Windows NT desktop from which they can run all Oros components, along with the other Windows applications they need. Behind the scenes, MetaFrame/NT TSE balances the terminal server's resources among user sessions, separating and protecting each session's processes and data from those in other sessions. With models, imports, exports and other files stored on another local server, reading and writing data is not hampered by performance bottlenecks remote users typically experience. Given adequate processor power and memory for the number of users and the processes running in their sessions, users can expect to see performance comparable to (and sometimes better than) loading the same Oros applications on their own workstations.

The Server Platform

NT TSE - Based on technology developed by both Microsoft and Citrix, the NT TSE server operating system supports multiple Oros users by providing an independent Windows NT 4.0 environment for each user session. A session and its processes are maintained in a separate memory space from all other sessions. Transparent to the user, NT TSE manages access to shared operating system and program files; any files to which multiple sessions must be able to write are mapped to different physical pages of memory. This ensures that each user session is insulated from the data and events in every other session. NT TSE manages the competition for memory and processor time among sessions, as the needs of the processes running within each session increase or decrease. The server communicates with Microsoft's client software on the user's workstation by means of *Remote Desktop Protocol* (RDP), which is based on the T.120

teleconferencing protocol used in such products as Microsoft NetMeeting™. For more information, visit Microsoft's website at *http://www.microsoft.com/ntserver/terminalserver/* and download documents from the Executive Overview and Technical Details sections.

MetaFrame - While NT TSE has the basic capabilities to support server-based deployment of Oros analytic applications, some organizations need more capability. Citrix MetaFrame augments the server platform considerably. Among the improvements in usability and versatility offered by MetaFrame's Independent Computing Architecture:

- Expanded user and server management tools
- Support for IPX, SPX, NetBEUI, and direct asynchronous connections in addition to TCP/IP
- Client software provided for MS-DOS, Macintosh, UNIX, and Java client platforms
- Access from most popular Web browsers
- Ability to publish server applications to client Windows desktops
- Compatibility with Citrix NFuse™ portal technology for application integration

To ensure maximum productivity of the ABC/M team, Citrix MetaFrame is strongly recommended as a supplement to NT TSE. For more detailed information about the capabilities and advantages that MetaFrame adds to the NT TSE environment, visit the Citrix website at *http://www.citrix.com*.

Client Software

Both Microsoft and Citrix provide super-thin client software that consumes very little system resources to allow its use on the widest possible range of client hardware. Microsoft includes client software on the NT TSE installation CD-ROM. Citrix supplies ICA client software for most platforms on the MetaFrame installation CD and makes all their latest versions available for download from http://download.citrix.com.

Client Platforms Supported	Microsoft	Citrix
32-bit Windows (95, 98, NT, 2000)	👌	👌
16-bit Windows (3.x, WFW 3.x)	👌	👌
Windows CE 2.x devices	👎	👌
MS-DOS	👎	👌
Macintosh	👎	👌
UNIX (Sun, DEC, HP, IBM, SGI, SCO, Linux)	👎	👌
Java (JDK 1.0 or 1.1)	👎	👌
Microsoft Internet Explorer (ActiveX)	👎	👌
Netscape Navigator/Communicator (16-bit and 32-bit plug-ins)	👎	👌

Currently the Microsoft client software only supports TCP/IP connections to the server. Among the advantages of the Citrix ICA clients, the Windows, DOS, ActiveX and Netscape plug-in clients all support *client drive mapping*. This makes the disk drives on the user's workstation visible as mapped drives in the server session. Files can be loaded or saved locally

from applications running on the server. The Windows and DOS clients are also able to redirect audio and COM port activity to the local devices. Windows clients also support cut-and-paste between server session windows and any local application windows. All Citrix ICA clients allow mapping the workstation printer to server sessions to allow remote sessions to generate hard copy locally.

Server Hardware Requirements

The table below lists the requirements to support

Processor	Pentium-equivalent or higher; multiple processors recommended. **Oros applications will not run on Compaq/DEC Alpha processors.** (see **Processor** section below)
Memory	Minimum of 32MB + 8MB per user (see **Memory** section below)
Disk space	Minimum of 128MB free (see **Disk space** section below)
Miscellaneous	CD-ROM and 3.5" diskette drive

Processor - Considering that all sessions running on a server are competing for processor time, the more powerful the processor, the better the server will handle heavy use. Remember, NT TSE 4.0 supports up to four processors; for the long-term, select a server that can accommodate multiple processors even if only one will be installed to start. **Important:** Once NT TSE is installed for a single processor, enabling multiple processor support requires reinstallation.
Memory – Microsoft states a minimum memory requirement of 32MB plus 4 to 8 MB for each anticipated user. However, these values only take into consideration rather modest application requirements. Certain operations in some Oros applications are much more complex and require considerably more memory than the actions commonly performed in word processors, spreadsheets and other familiar desktop applications. Since all simultaneous Terminal Server sessions must share the server's total memory, assess the heaviest likely load and to equip the server to handle it. For example, assume that a certain process in a large, complex model consumes 100MB of total memory (peak consumption), and more routine processes (queries, reports, etc.) likely to be running at the same time consume up to 10MB each. If only one person at a time runs the largest process and up to four others run the smaller processes, physical memory should exceed Microsoft's recommendation by 140MB (1*100+4*10).
Disk space – The stated minimum disk space in Microsoft's documentation is 128MB free on the partition that houses NT TSE. Depending on the amount of physical RAM and the server's configuration, more may be needed. Disk space requirements for the storage of models and other user files vary widely. Server systems with high performance I/O bus, fast/wide SCSI hard disk drives, and high speed network interface yield the best performance overall.

Preparing the Server

NT TSE: The installation of Microsoft Windows NT Server 4.0, Terminal Server Edition is not significantly different from the installation of other editions of Windows NT Server 4.0 and most administrative issues will be identical. Before beginning a new implementation:

- Visit Microsoft's website at *http://www.microsoft.com/ntserver/terminalserver/* and download the deployment kit along with other informative documents available there. Even IT professionals who have experience with NT TSE may benefit from a review of these resources.
- Obtain a Windows NT Server Client Access License (or Back Office CAL) and a MetaFrame user license for each user.
- If MetaFrame will not be installed, provide a Terminal Server Client Access for each user not running Windows NT Workstation 4.0 on their computer.

MetaFrame: Once NT TSE is installed:

1. Insert the MetaFrame CD into the server's CD-ROM drive and an installation shell should auto-run. If the shell does not run automatically, click Start, Run, browse to the CD's I386 directory and select Autorun.exe.
2. Click MetaFrame Setup to begin.
3. Follow the onscreen instructions; enter any additional license packs, activate any relevant network protocols and TAPI devices.
4. **Important:** Carefully review the section of the MetaFrame manual concerning drive mapping and understand it fully before making any changes in the default mappings, either during or after the installation process. The results of an erroneous selection are not easily reversed. Restart the server when prompted.

Installing the Clients

The MetaFrame installation CD contains ICA client software for 32-bit Windows; 16-bit Windows; MS-DOS; Macintosh; several versions of UNIX, Java (JDK 1.0 and JDK 1.1); and access from popular web browsers. Alternatively, copy the client installation files directly from the CD to diskettes for installation on systems without CD-ROM drives. You can also make installation diskettes for MS-DOS, Windows and Java clients from the server by launching the ICA Client Creator application. Clients for Linux and Windows CE devices, as well as the latest updates of the all the other ICA clients, are available to download at *http://download.citrix.com/*. The following instructions assume that the necessary network protocols are in place to make the connection the ICA client will use.

To install the ICA client for 32-bit Windows:

1. Close all other applications running on the workstation before beginning installation of the ICA client. An installation shell will auto-run on Windows 95, Windows 98 and NT 4.0 workstation and the installation will launch with a single mouse click. Alternatively, launch Setup manually from ICACLIENT\Ica32\Disk1 on the CD. If the installation files are on diskette, insert the first diskette and use File Manager, Windows Explorer or the Run command to launch Setup.
2. If you have obtained updated client software from the Citrix download website, copy the file to the workstation hard disk and open a command (MS-DOS) window.
3. Change directories to the location of the downloaded file and type the filename followed by a space and the path where you want the resulting files to be written.
4. Follow the same steps to extract each resulting file to a separate diskette.
5. Run Setup from the first disk and insert the second.

6. Follow the instructions on screen. The installation creates a program group and adds Citrix ICA Client to the Start, Programs menu.

To install the ICA client for 16-bit Windows:
1. Run Setup from ICACLIENT\Ica32\Disk1 on the CD or copy the files to diskette and run Setup from diskette 1.
2. When prompted, select an appropriate installation path or accept the default path.
3. Follow the on-screen instructions.

To install the ICA client for MS-DOS:
1. Copy the installation files from the MetaFrame CD to diskettes or use the ICA Client Creator to make installation diskettes for the ICA client for MS-DOS.
2. Run Install from Disk 1.

To install the ICA client for Macintosh:
1. Copy the file MACICA_SEA.HQX from the MetaFrame CD (or download it from Citrix's website) to the Macintosh hard disk.
2. Drag the file onto the Stuff-It Expander (or a similar application) icon to extract the files.
3. Once the files are extracted, double-click the Installer icon to begin installation.
4. Follow the instructions on screen.

To install the ICA client for UNIX:
Copy the installation files to the workstation hard disk and run the script setupwfc to begin installation. The default location for installation is usr/lib/ICAClient (you can change this during the installation process).

To install the ICA client for Windows CE:
Consult the instructions provided with the software.

To set up ICA client access from a Web browser:
Prerequisites: In order to enable ICA client access from a Web browser, a Web server is required; it can be the MetaFrame/NT TSE server (using IIS) or another server. To register MetaFrame's ICA files as a MIME type (also required):
1. Edit the Web server's registry.
2. Add the REG_SZ key HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\InetInfo\Parameters \MimeMap\application/x-ica, ica,,5.
3. Leave the key's string value blank.

To set up the Internet Explorer ActiveX control or the Netscape plug-in for use on the client workstations:
1. Use the Client Creator to make installation disks for Web clients or download the latest version and follow the instructions provided.
2. Run the installation program:
   - For Internet Explorer, run Wfica32.exe /setup.
   - For Netscape Navigator under 16-bit Windows, run Nsplugin\Wfplug16.exe from the installation disk.
   - For Netscape Navigator under 32-bit Windows, run Nsplugin\Wfplug32.exe from the installation disk.

3. Once the client is installed, launch Start, Programs, MetaFrame Tools (Common), Application Configuration on the MetaFrame/NT TSE server.
4. Create a new application, making the appropriate selections on each dialog box. Generally, an ICA application for Oros users should not specify a particular program file.
5. Select the MetaFrame/NT TSE server(s) on which Oros applications will be installed.
6. Once the application configuration is complete, highlight the application and click the ICA button on the toolbar.
7. Choose the level of assistance you need and respond to each subsequent dialog box.
8. Set the desired window size, color depth, and encryption level.
9. Then, enter the name of the new ICA file and indicate the path on the Web server where it is to be written.
10. Use Internet Services Manager to set up a virtual directory for the location of the ICA file.
11. A user can then open a session on the server by starting the browser and navigating to the ICA files location on the server or selecting a link that points to it.

To run the ICA Java client in a Web browser as a Java applet, without installing client software to the user's workstation:
1. With the browser on the Web server, open Download.htm from the CD's ICACLIENTS\Icajava directory and use it to copy Setup.class to the Web server's hard disk. Download.htm also contains information about installing the ICA Java client files on various platforms.
2. Use the Web server's Java Virtual Machine (JVM) to run Setup.class. For example, if the web server is the MetaFrame/NT TSE server or another NT 4.0 server, start a command session (Start, Run, then enter Command).
3. Change directories to the location of the file Setup.class.
4. Type the command string *C:\Winpath\Jview setup*, where C is the drive letter and Winpath is the system root directory.
5. When prompted, select the installation path – it may be simplest to specify the same location as the ICA file. Setup.class installs three signed archive files used by various Web browsers, a directory of help files in HTML format, as well as other files. The archive files are used as follows:

Browser and platform	Supported archives
Netscape Communicator 4.05 with AWT 1.1 support or Netscape Communicator 4.06+ for Windows 95, Windows NT 4.0, Macintosh, and Solaris 2.6	JICAEngN.jar
Internet Explorer 4.0x for Windows 95 and Windows NT 4.0	JICAEngM.cab
HotJava Browser 1.1 for Windows 95, Windows NT, JavaOS for Business, and Solaris 2.6	JICAEngJ.jar
HotJava Views for Sun JavaOS	JICAEngJ.jar

6. Open Index.htm and locate the section titled *Using the ICA Java Client as an Applet*.
7. Modify one of the sample HTML files to support each of the browsers users will employ to launch the ICA Java client. For example, if the browser is Internet Explorer, the following would start a session at 800 by 600 resolution on the server whose name or IP address is specified in place of ServerVal:

```
<html>
<body>
<applet code=com.citrix.JICA.class
archive=JICAEngN.jar
width=800 height=600>
<param name=address value=ServerVal>
</applet>
</body>
</html>
```

Note that the Java client lacks the ability to specify a full-screen session and can only *embed* an ICA application rather than being able to *launch* it. Review the *Citrix MetaFrame Administrator's Guide* and other MetaFrame documentation for more information about Application Launching and Embedding. For information about options and modes of operation not discussed here, read the help files installed with the ICA Java client and the *Citrix ICA Web Clients Administrator Guide*, available from the Citrix website.

Installing Oros in the MetaFrame/NT TSE environment

Because of the multi-user nature of the NT TSE operating system, there are two special system modes for installing applications. The mode used to install applications that can run in any user's session is technically called *user global mode* but is referred to in Microsoft's NT TSE documentation as *install mode*. While the system is in install mode, Windows registry entries and other system configuration updates for the current user are recorded and made global to all users. When the system is in this mode, do not run any user programs or allow any connections to the server. The other mode, used to install applications that will only be accessible to particular users, is *user local mode* or *execute mode*. Changes made to the system configuration while in this mode are only applied to the user in whose session they occurred.

To change between install mode and execute:

- When applications are installed through Add/Remove programs in the Control Panel, one of the screens asks whether all users should receive the same initial settings. Selecting *All users begin with common application settings* changes the system to install mode. At the end of the installation process the Add/Remove Programs wizard returns the system to execute mode.
- The other way to change modes is to start a command session (Start, Programs, Command Prompt or Start, Run and enter Command). At the command line type *change user /install* to enter install mode or *change user /execute* to switch back to execute mode.

Before installing any applications, consult the section entitled *Preparing to Install Applications* in the Microsoft document *Deploying Microsoft Windows NT 4.0, Terminal Server Edition: A Service and Planning Guide* (Terminal Server Service Guide.doc), included with the NT TSE deployment kit.

A word about compatibility scripts

Since relatively few applications were designed specifically for a multi-user application server environment, programs often require some accommodation to their unique needs. In the NT TSE operating system, this is accomplished through *application compatibility scripts*, which make any necessary changes to the server environment. Microsoft includes compatibility scripts for widely used applications with the NT TSE installation, as well as some generic scripts that address many common situations.

Before installing Oros applications on a MetaFrame/ NT TSE server:
1. Be sure to change to install mode.
2. Run *CheckRoot.cmd* (found in the Application Compatibility Scripts directory under the system root), which then calls *RootDrv2.cmd*.
3. When prompted, enter a drive letter that does not conflict with any existing or anticipated workstation drive mappings.

When a user logs onto the MetaFrame/NT TSE server, *RootDrv2.cmd* maps their home directory to the root of that drive letter. This ensures that the Oros workstation setup works properly and that Oros applications behave as expected. For more information about application compatibility scripts, read the Microsoft document *Using and Developing Application Compatibility Scripts with Windows NT Server 4.0, Terminal Server Edition*, available at *http://msdn.microsoft.com/library/techart/appcompsc.htm*.

It is also advisable to specify a home directory for each user in User Manager for Domains on the MetaFrame/NT TSE server. Otherwise, Oros user files default to the user's Profiles directory.

The Oros installation itself consists of two procedures:

I. Server setup installs the Oros applications, creating the Oros directory tree with the executable files and libraries necessary to run Oros applications. Once the MetaFrame/NT TSE platform is prepared, install Oros software from the CD to a separate Windows NT server (**not** Terminal Server Edition) and add the appropriate user licenses.
1. At the non-NT TSE server's console, run Setup.exe from the Oros CD.
2. When prompted for product serial number and authorization code, enter the values for one Oros product and click Next.
3. To enter the serial number for other Oros products, click Yes when prompted for additional serial numbers.
4. After the last Oros product, click Yes again to enter user license serial numbers and authorization codes. Click No after the last serial number has been entered.
5. Select the appropriate path on the server's hard disk and click Finish.

Before anyone can use Oros applications, you must launch the Oros Administrator from the Oros program group, create users, and assign them licenses as described in the Oros Administrator online documentation.
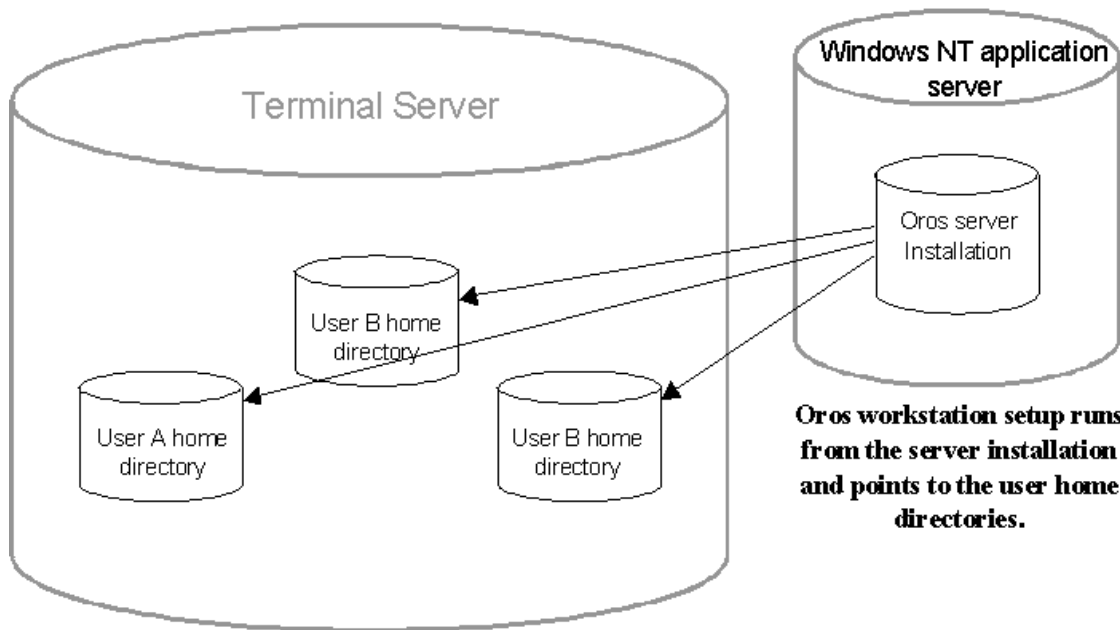
Figure 2
Running workstation setup to physically separate user directories preserves individual named views and query preferences. Housing the Oros installation on a separate Windows NT server from the terminal server is a standard practice among MetaFrame/NT TSE implementation specialists and allows the use of multiple server *farms*. Windows NT is required to support the Oros Multi-User CMA product.

II. Workstation setup runs on the MetaFrame/NT TSE server from the server installation and should be run once by the server administrator in install mode. It then needs to be run in execute mode, once under each user logon. It sets up the files where each user's Oros Modeler named views and Oros Links ForEach preferences are stored, as well as sample models, queries and so on (Figure 2).

1. Change the MetaFrame/NT TSE server's console session to install mode.
2. Run Setup.exe (from Oros\Bin\Setup on the non-NT TSE server) in the MetaFrame/NT TSE server's console session. The precise destination path is unimportant.
3. Change the MetaFrame/NT TSE server's console session back to execute mode.
4. Launch a Citrix ICA client session under each user's login in turn, and rerun Setup.exe (as in step 2 above) in execute mode once for each user.
5. When prompted for a destination, enter a path under the user's home directory root. For example, if RootDrv2.cmd maps the user's home directory to drive letter P, point each user's workstation setup to P:\Oroswork. The exact path chosen is not critical but it must be identical for all users. Because the home root is mapped to a unique home directory for each user, the files that contain individual lists of named views (Oros Modeler) and ForEach Preferences (Oros Links) are kept separate.

As stated previously, users who are physically local to the MetaFrame/NT TSE server can use an alternate workstation setup procedure:

1. Launch Setup from the user's local Windows desktop rather than in a session on the server.
2. Map the network share on the non-TSE server where the Oros server installation resides to a drive in the user's local Windows, or use a UNC path.
3. Enter a destination path on the user's local hard disk drive rather than on a MetaFrame/NT TSE server home root.

This is essentially the same workstation setup procedure covered in the Oros Setup online help, *Performing the installation, Installing Oros, To install Oros on workstations*.

Configuring a Connection

The steps outlined in this section represent the ICA client for 32-bit Windows, version 4.20. Although the procedures vary for other client platforms, the essential concepts and most of the options are applicable. For specific details, refer to the appropriate quick reference card included in the Citrix MetaFrame package and review the online documentation installed with the client software. If an earlier version of the Windows client is installed, refer to the accompanying user and administrator guides.

1. Start the Citrix Program Neighborhood from Start, Programs, Citrix ICA Client. If no connections have been defined, the Program Neighborhood prompts the user to create one.
2. If not prompted, double-click the Add ICA Connection icon to start the Add New ICA Connection wizard.
3. Choose the appropriate type of connection for the method you will use to access the server:
    - **Local Area Network –** Use this type of connection if the workstation is on the same LAN as the MetaFrame/NT TSE server.
    - **Wide Area Network –** Select this type of connection if the MetaFrame/NT TSE server is accessible over a WAN connection. This is also the appropriate selection if a dial-in connection to the LAN/WAN or the Internet Service Provider will be established separate from, and prior to, initiating a MetaFrame/NT TSE server session.
    - **Dial-up Networking –** This connection type allows the ICA connection to use a Windows Dial-up Networking connection to dial into the network or Internet Service Provider and then initiate the server session. If the appropriate dial-up connection exists, choose it from the list provided. If it has not yet been defined, click Configure to start the Make New Connection wizard for Windows Dial-up Networking.
    - **ICA Dial-in –** This selection supports direct serial connections to the server.
4. On the next screen of the wizard, enter a description that will serve as a label for the connection. The description should make it easy to distinguish between connections to different locations or servers, connections with different properties (screen size, color depth), and connections tied to specific server applications.
5. Select the network protocol to be used and identify the server or the ICA published application. The server designation can be either an IP address or a server name. If the workstation is already connected to the same network as the MetaFrame/NT TSE, the server or application name may already appear on the drop-down list provided. For more information on publishing applications, see the *Citrix MetaFrame Administrator's Guide*.
6. Next, the wizard offers the option to send the user name, password and domain to log on to the MetaFrame/NT TSE server transparently when the connection is made. For laptops or remote workstations in unsecured locations, this may be inadvisable from a network security standpoint.
7. Select the color depth for the session - to edit the value, first deselect Use Default. For Oros applications, the16 color setting is adequate and it is a better choice for lower bandwidth connections.
8. Set the window size for the session - to edit the value, first deselect Use Default. For users unaccustomed to working with server-based software, set the size to Full Screen. If necessary, edit the properties of the local Windows taskbar to enable Auto hide. When a Full screen connection is launched, it appears to take over the Windows desktop while still allowing the user to toggle between local application windows and the server session. This may be less confusing than seeing two Windows desktops at the same time. For more experienced users, set Window Size large enough to accommodate the user's preferred Oros window size with minimal scrolling.

9. If users need to launch various Oros applications from the Windows desktop, leave application and Working Directory values on the next screen blank. For users who only work with a particular Oros program, enter the path to the corresponding program file in Application and the default path for the application's data in Working Directory.
10. Once a connection has been defined, create a desktop shortcut or add it to a shortcut bar for greater convenience.

Controlling the Session: Connect, Disconnect, Logon, Logoff

When a user launches an ICA client connection to the MetaFrame/NT TSE server, the ICA client locates the server. If it does not use an existing network connection, the client initiates Dial-up Networking or whatever means was specified to contact the server. If the connection does not include user name and password (or if transparent logon is not allowed), the user enters them to log on to the server. The client window then displays a Windows NT 4.0 desktop (or the specified application) for that session.

The first time a user connects to the server, the NT TSE operating system creates a new session for that user. The session is an instance of Windows NT that NT TSE keeps separate from all other instances running on the server. Each session has its own SessionID, which is tagged with the user name. A user can run more than one session at a time; and each one has its own unique ID but all are marked as belonging to that user.

Closing an ICA client window on the user workstation does not end the session but merely *disconnects* it. Processes continue to run in a disconnected session, although the server administrator can limit the length of time a disconnected session is allowed to continue. If the user subsequently launches an ICA client connection to the same server, the client automatically reconnects to that user's session already running on the server. If there are multiple disconnected sessions for that user, the server presents a list of sessions, with time and date stamps, from which the user must select. The client window displays the reconnected session in progress.

To end a session, close all applications running in that session and click the Start button. Select Logoff and click Yes on the resulting message box. NT TSE ends that session and its memory is made available for use by other sessions.

If two connections are defined with different screen sizes (e.g., one is set to 640 x 480 and the other to 800 x 600) and a session is started with one, disconnected and reconnected with the other, the session displays in its original screen size. However, if two connections have different color depths (e.g., the first is set to 16 colors and the second is set to 256 colors), the second connection is not able to reconnect to the existing session; a new session is opened.

Running Oros Applications in a Session

Once the NT desktop is displayed, the user can run Oros applications just as though they were local. They can be launched from the Start menu (Start, Programs, Oros) or from shortcuts placed on the desktop or in a shortcut bar. Remember, other than the workstation disk drives re-mapped by MetaFrame, all other file paths are from the perspective of the server, not the user's workstation.

Also remember that all applications running in all sessions are competing for memory and processor time. When users forget to log off to discontinue their sessions, the server administrator should use the MetaFrame administrator to terminate abandoned sessions and free up server resources.

Note: Simultaneous Read/Write access to an Oros model by multiple users requires the Oros Multi-user CMA product.
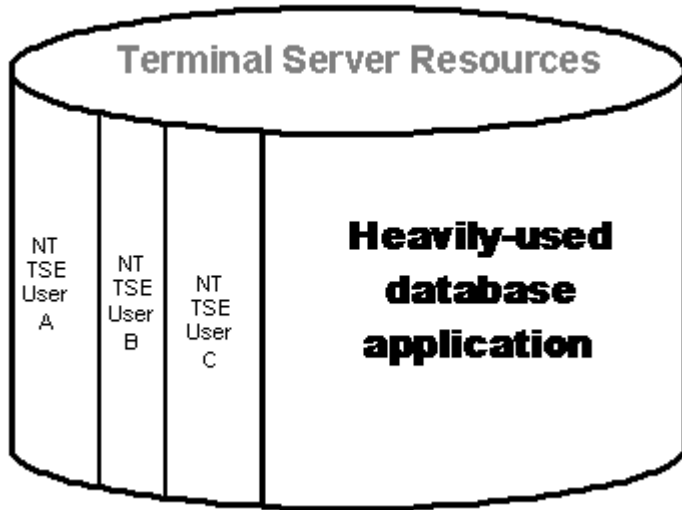

Figure 3
Large, server-based applications running on the Terminal Server can severely curtail the resources available to user sessions, eroding their performance.

Evaluating Performance

Since all sessions and their applications compete for processor time, memory, disk space and I/O bandwidth, it is generally inadvisable to run Oros applications on the same NT TSE server with large and demanding server applications, like heavily-used databases and OLAP engines (Figure 3). Even if Oros applications have the server all to themselves, some operations (e.g., generating very large dimensional views) can consume a great deal of memory and processor time, adversely affecting the performance of other sessions. To ensure maximum productivity, the server administrator should use the Performance Monitor to evaluate the resource needs of processes that execute regularly on the MetaFrame/NT TSE server and install additional memory or processors if that is indicated (Figure 4).
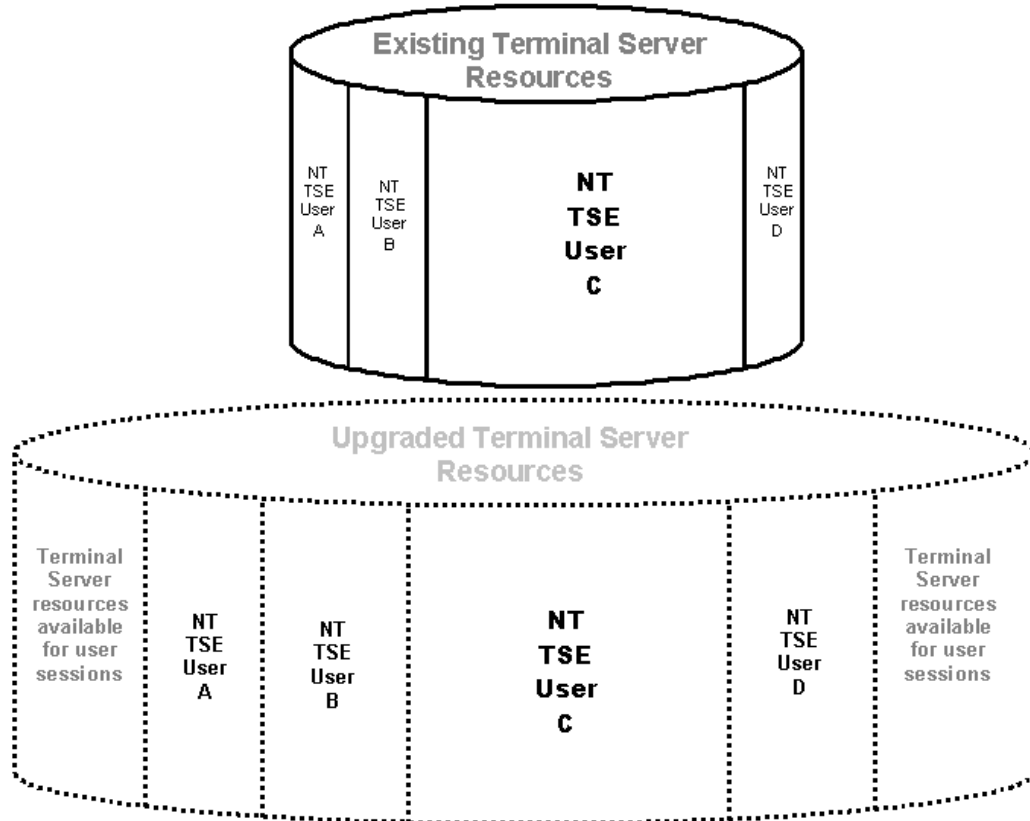
Figure 4
To maintain productivity, consider upgrading memory, adding processors and/or increasing server storage capacity when competing sessions frequently exhaust available server resources.

Keep in mind that some factors, such as unusually low connection bandwidth, high connection latency (passing through multiple switches, routers, etc. with their cumulative delays) and increased graphical content in an ICA client session can temporarily cause the session window to update more slowly. Screen response does not equate to session performance and a user with a very poor dial-up connection may see sluggish screen response when the session on the server is performing very well indeed.

Conclusion

Microsoft® Windows NT Server® 4.0, Terminal Server Edition with Citrix MetaFrame™ is the ideal operating system platform for providing Oros applications to ABC/M teams faced with geographical challenges or limited local access to server resources. MetaFrame adds vital support for heterogeneous networks, and enhanced system and application management tools. MetaFrame's super-thin ICA clients place server-based tools within reach of the broadest possible range of local and remote users. The powerful combination of Oros with MetaFrame/NT TSE is the key to overcoming the infrastructure challenges that can hamper the deployment of ABC/M analytic applications throughout the enterprise.