



Installation Prerequisites for MetaFrame Presentation Server 3.0

Terms you'll need to understand:

- ✓ Terminal Services Licensing
- ✓ Terminal Services Client Access Licenses (TSCALs)
- ✓ Citrix Connection Licenses
- ✓ Application Server mode
- ✓ Remote Administration mode
- ✓ Remote Desktop
- ✓ Citrix Migration License
- ✓ Citrix Upgrade License

Concepts you'll need to master:

- ✓ Direct access to the Data Store
- ✓ Indirect access to the Data Store
- ✓ Installing Terminal Services in Application Server mode in Windows 2000 Server
- ✓ Installing Terminal Server in Windows Server 2003

As much as we would love to tell you to just place the MetaFrame software in the CD-ROM, install it, and you'll figure out what you need to do as you go—we can't. With complicated systems that host hundreds of users, as is the case with MetaFrame Presentation Server, that approach can quickly turn into a recipe for disaster. Sure, you can install a graphics program and figure it out as you go, but thin client solutions require careful planning and educated design approaches.

In this chapter, we cover the necessary prerequisites that should be met prior to your attempting to install MetaFrame Presentation Server 3.0. In addition to the hardware and software requirements, we cover licensing and the types of licenses involved in this process. Although you probably don't need to know the ins and outs of licensing, you should know what is required for your environment and what can break from not providing proper licenses.

Licensing Requirements

Licensing is easily the most complex subject in a server-based computing environment. The reason is not that the topic is hard to understand but that the vendors are constantly changing the requirements, and with frequent operating system upgrades and application upgrades, figuring out how to stay compliant is always a challenge. In this chapter, we briefly touch on the requirements because going into detail is beyond the scope of this book, which concentrates on the Citrix Certified Administrator exam.

You need to familiarize yourself with two major components: server licenses and client licenses. Let's tackle the server licenses first.

Server Licenses

The first component to license should be the server operating system that will host all the other applications installed on it. It is important to understand what needs to be licensed on a Windows 2000 Server and Windows Server 2003 OS to avoid connection issues later.

Both Windows 2000 Server and Windows Server 2003 have the same licensing requirements with different upgrade paths. It is best to consult your Microsoft representative to ensure you are abiding by the Microsoft guidelines for Terminal Server (TS).

Two types of licenses are required when you are running Terminal Services with Citrix MetaFrame Presentation Server 3.0:

- *Windows 2000/2003 Server License*—This is the core product license, the base Windows server operating system. You need a license to install the operating system.
- *Citrix MetaFrame Presentation Server 3.0 Server license*—A license is required to install the MetaFrame server software. The nice thing about Citrix MetaFrame is you have to buy only one copy of the MetaFrame Presentation Server product. After you own a license, you can install it as many times as you want on as many servers as you like. The catch is that Citrix wants to charge on the connection licenses, which we discuss in the next section, instead of charging every time you install the server product.

Client Licenses

After tackling the server licensing requirements, we arrive at the client licensing requirements. Every client that accesses a Microsoft Terminal Server or a Citrix MetaFrame Presentation Server needs a client license to be able to access the resources on the server. You also need a client license to be able to log in and use the functionality of the MPS server.

The following license requirements should be addressed in any Terminal Server or Citrix MPS environment:

- *Windows 2000/2003 Server Client Access Licenses (CALs)*—You need a CAL to authenticate and use other server resources such as printing or file sharing.
- *Windows 2000/2003 Terminal Server Client Access Licenses (TSCALs)*—In addition to the CALs that are required, a TSCAL is also required. For a user to log in and use the Terminal Services functionality of the server, a TSCAL is necessary. It simply licenses the TS portion of the operating system.
- *Citrix MetaFrame Presentation Server 3.0 Connection Licenses*—These licenses are needed to allow users to log in to the MetaFrame Presentation Server and take advantage of its services.
- *Citrix Migration Licenses*—These licenses are used to migrate to a newer version of MetaFrame. For example, if you are upgrading to MPS 3.0 from MF 1.8 or MetaFrame XP, you can use your existing licenses and migrate them. Consult with your Citrix representative to see whether you qualify for these licenses.

- ▶ *Citrix Upgrade Licenses*—These licenses are used to upgrade the version of MetaFrame within the same family. For example, if you have deployed MPS 3.0 Advanced Edition and you decide you need the features of the Enterprise Edition, you would purchase upgrade licenses from Advanced Edition to Enterprise Edition.
- ▶ *Application Licenses*—These licenses are required for any applications that you install on the MPS server. You should consult with each application's vendor as to how licensing is treated on a Terminal Server.

Citrix Connection Licenses

Citrix Connection Licenses allow users to connect to any resource in the farm and launch as many applications as they want and yet consume just one license. These licenses are the equivalent of Per Seat licensing in Windows 2000 Server or Windows Server 2003. The difference is that this type of license is not permanently attached to the user using it. Licenses are assigned from a pool for a user to use during his or her sessions; after the user logs off, all session connectivity to the farm for the license is released and made available for other users to use.

In other words, if Didi logs on to the server farm and launches Microsoft Word on Server A, then launches JDEdwards One World (a financial software package) on server B, and then launches Report Writer on Server C, she is still consuming just one license yet running three sessions to three different servers in the server farm. After Didi logs out of all three applications, the license assigned to her is put back into the pool.



Given a license scenario, make certain you can identify any missing licenses and provide the proper recommendations to ensure license compliance and avoid outages due to a shortage of available licenses.

Server Software Requirements

Citrix MetaFrame Presentation Server 3.0 can be installed on Microsoft Windows 2000 Server provided that it is at Service Pack 4 or higher. It can also be installed on Windows Server 2003. In addition to installing the server software, you have to enable Terminal Services in both Windows 2000 Server and Windows Server 2003.

In Windows 2000 Server, you have to put the server in Application Server mode before users would be able to log in and before you can install Citrix MPS 3.0. With the introduction of Windows Server 2003, Microsoft shuffled things around a bit. For example, with Windows 2000 Server, you needed to enable Terminal Services in one of two modes: either Remote

Administration, which allows only two simultaneous connections for administrative purposes, or Application Server, which allows multiple users to simultaneously log in to the TS.

Windows Server 2003 has Remote Desktop enabled by default and is no longer a component of Terminal Services. Now when you need to place Terminal Server in what used to be Application Server mode, you need to enable Terminal Server from the Add/Remove Windows Components screen in Add or Remove Programs.



In Windows Server 2003, some Terminal Services components have been renamed. For example, Remote Administration mode has now become Remote Desktop and is installed by default.

You've surely heard the expression "a picture is worth a thousand words." In the exercises to follow, notice the difference between enabling Terminal Services in Windows 2000 Server and Windows Server 2003.

In Windows 2000 Server, do the following:

1. Choose Start, Settings, Control Panel, Add or Remove Programs, Add/Remove Windows Components.
2. Scroll down and check the box next to Terminal Services, as shown in Figure 3.1. Then click Next.

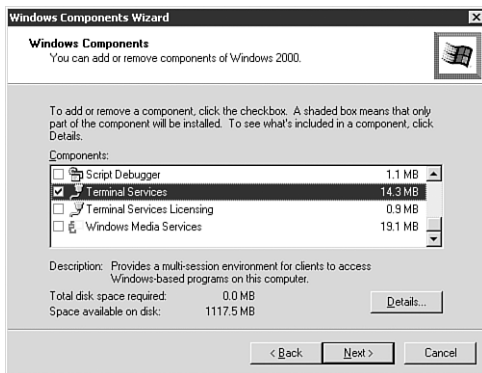


Figure 3.1 Enabling Terminal Services in Windows 2000 Server.

3. The next screen allows you to select between Remote Administration mode or Application Server mode, as shown in Figure 3.2. Choose Application Server mode and click Next.



Figure 3.2 Terminal Server Mode selection screen.

4. You are prompted to make a decision on the default permissions for application compatibility. You can choose between Permissions Compatible with Windows 2000 Users or Permissions Compatible with Terminal Server 4 Users. Unless you have an old application that requires more relaxed Registry permissions, choose the first option, which is Permissions Compatible with Windows 2000 Users.
5. Click Next and then Finish to exit the wizard.



In Windows 2000 Server, the component that allows multiuser access on the server is named Terminal Services, whereas in Windows Server 2003 it is renamed Terminal Server.

To enable Terminal Server in Windows Server 2003, do the following:

1. Choose Start, Settings, Control Panel, Add or Remove Programs, Add/Remove Windows Components.
2. Scroll down and check the box next to Terminal Server, as shown in Figure 3.3. Then click Next.
3. You are presented with a window informing you that you are enabling Terminal Server to allow for multiple simultaneous connections. Click Next to continue.
4. Similar to Windows 2000 Server, you are prompted to choose the application permissions you want to enable on the Terminal Server. You can select between Full Security, which offers the latest security enhancements that Windows Server 2003 offers, or Relaxed Security if you want to allow users more access to the Registry and file system.

Relaxed permissions may be necessary depending on whether your application was designed for Windows Server 2003. Consult your application's vendor and then click Next to continue.

5. Click Next and then Finish to exit the wizard.

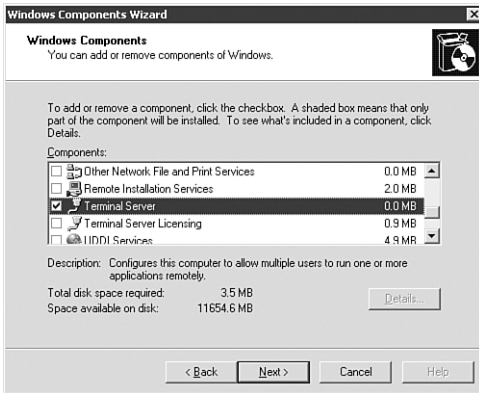


Figure 3.3 Enabling Terminal Server in Windows Server 2003.

Terminal Services Licensing

Whether you are installing Citrix MetaFrame Presentation Server 3.0 on Windows 2000 Server or on Windows Server 2003, you need to install the Terminal Services Licensing component on a server. This server must be accessible to all your TS/MPS servers and should be activated with valid Terminal Services Client Access Licenses. If you don't install any licenses, the Terminal Services Licensing Server will issue temporary licenses that are valid for a period no longer than 90 days. After this period, if no valid license is installed, connections will be refused.

In addition, a TS or MPS server has a grace period of no longer than 120 days to find and contact a Terminal Services Licensing Server. After this period, connections will also be refused.



As of this publication, Windows Server 2003 does not enforce TSCALs when the server is in Per User mode; it relies on the honor system. However, based on previous versions such as Windows 2000 Server, Microsoft is poised to enforce this policy once again. We strongly recommend you install proper TSCALs on your TS Licensing Server so that you avoid any interruptions in the event that a hotfix should be installed to address this issue.

NOTE

Terminal Services Licensing does not have to be installed on a domain controller but is recommended.

Protocols

Both Windows 2000 Server and Windows Server 2003 install TCP/IP by default. If this is the only protocol you will be using on your network, you don't have to worry about doing anything else. However, if you plan to use any other protocols such as IPX, SPX or NetBIOS, it is recommended that you install them prior to installing Citrix MPS 3.0.

Installing these protocols configures Independent Computing Architecture (ICA) to use these protocols properly by creating the necessary connections. In addition, if you plan to use SNMP in your environment to monitor and manage your servers, this would be a good time to install that as well.

NOTE

With Windows Server 2003, the *only* protocol that remote users can use to connect to MPS 3.0 is TCP/IP. Support for IPX/SPX and asynchronous connections has been disregarded.

Server Hardware Sizing

You must consider many factors when sizing your MetaFrame server, but you should start with the basics. Make sure you fulfill the operating system requirements based on vendor recommendations as follows:

- ▶ *Windows 2000 Server and Advanced Server*—Microsoft's minimum recommended hardware for these operating systems includes a 166MHz Pentium with 256MB RAM and a 2GB hard drive with at least 1.5GB of free disk space.
- ▶ *Windows 2000 Datacenter Server*—The vendor recommends eight Pentium III or better processors with at least 256MB RAM and a 2GB hard disk drive with 1.5GB free disk space.
- ▶ *Windows Server 2003 Standard Edition*—A 550MHz Pentium III or better processor is recommended with 256MB RAM and a 1.5GB hard disk drive with 1.5GB free disk space.
- ▶ *Windows Server 2003 Enterprise Edition*—A 733MHz Pentium III with 256MB RAM and a 2GB hard disk drive with 1.5GB free disk space.

- ▶ *Windows Server 2003 Datacenter Edition*—A 733MHz Pentium III with 1GB of RAM and at least 2GB hard disk drive with 1.5GB free disk space.

These recommended hardware requirements are the minimum needed to operate just the operating system. In today's world with fast-changing technology, you probably can't even buy a 166MHz Pentium from a computer vendor.

In addition to the base Microsoft hardware requirements for the operating system you are using, you are also required to take into consideration disk space requirements for installing Citrix MetaFrame Presentation Server 3.0 and all the ICA clients as follows:

- ▶ 250MB of disk space for MPS 3.0
- ▶ 150MB for installing all the ICA clients on the MPS server



You are expected to know the basic hardware requirements for both Presentation Server and the underlying Windows operating system.

User Load

Because MetaFrame Presentation Server will support multiple user logins to one server, server resources are needed to adequately service these users. When you are sizing your server hardware, it is very important that you have an idea of how many users will log in to each of your servers and also the types of users who will log in. When we say “types of users,” we are trying to identify what the users will do when logged in to an MPS server. Typically, you can categorize users into two categories:

- ▶ *Typical user*—A typical user is one who logs in, uses one application at a time, and does not copy and paste many items between the ICA session and the ICA client.
- ▶ *Power user*—A power user is one who logs in and typically uses multiple applications at the same time and runs more advanced tasks.

A good rule would be to allocate twice the number of resources to a power user than you would for a typical user. By resources, we mean CPU and memory utilization.



To determine how much CPU and memory utilization a typical user will use, you need to run performance tests. Typically, you would run Performance Monitor while the user is logged in and running the application(s) needed to perform all normal tasks his or her job requires.

Types of Applications

The types of applications installed on the servers have a great impact on the sizing of the servers. Some applications may be poorly written and may bog down an MPS server with as little as 10 users on it. If you are using a mixture of 16-bit and 32-bit applications, you may want to separate them on different servers to improve performance and responsiveness of each application and not allow a faulty application to affect another one.

On the flip side, well-written applications allow you to add more users. Thorough testing of an application using all its functionality is crucial prior to sizing the server's resources.

Network Bandwidth Considerations

A robust, well-configured, and primed network can drastically improve application response and better the user experience. As we discussed in Chapter 2, "MetaFrame Presentation Server Architecture," one of the three components that make up the ICA protocol is the network, which is the transport mechanism by which data is exchanged. For this reason, it is important to avoid bottlenecks. Try the following to ensure higher performance on your network:

- Keep all Citrix MPS servers and Citrix-related servers on the same subnet to localize traffic and improve performance.
- Use Switched Ethernet when possible.
- Set the link speed to Full Duplex on your servers, the switch ports, and your ICA client devices for optimal performance.

Management Console Requirements

The Management Console for MetaFrame Presentation Server 3.0 is the centralized administration tool that allows you to configure all aspects of the farm and administer users, among other tasks. The console is installed by default on every MPS 3.0 server in your farm, but in many cases, you will want to install it on your workstation so you do not have to log in to a server every time you want to run any administrative tasks. The Management Console can be installed from the MPS 3.0 CD on any workstation that meets the following hardware and software requirements:

- Microsoft Windows NT 4.0, Windows 2000, or Windows XP.
- Sun Java Runtime Environment (JRE) 1.4.1 or better. The Management Console is a Java-based application and thus requires the JRE to run.
- 50MB of disk space is required to install the Management Console and the Sun JRE 1.4.1.
- A Pentium class processor is recommended to run the console properly.
- The console requires at least 64MB of RAM for itself to run properly.



When installing the Management Console on a workstation, you do not need to install MPS 3.0. The console runs independently of the server software.

Firewall Configuration

One of the main reasons Citrix MetaFrame is deployed in most organizations is that it provides the capability to access your office applications from anywhere in the world with an Internet connection. This service, however, comes at a cost, as you now have to protect your environment from malicious users who would want nothing more than an opportunity to wreak havoc on your network.

Firewalls are deployed to protect you from potential users who will be using the Internet as their vehicle of penetration into your servers. A firewall governs what type of data is exchanged between the outside and inside networks. For this reason, it is important to know what ports would need to be opened to allow ICA traffic in and out of your network. These ports are also useful because many times organizations even deploy firewalls internally to create layers of security.

The ports used in a Citrix MetaFrame Presentation Server environment are as follows:

- *1494*—An ICA session is established and maintained over this TCP port. Knowing whether clients are connecting from outside the network or inside this port is necessary for ICA traffic between clients and servers.
- *80*—The Citrix XML Service is used by ICA clients to query MPS servers for published applications.
- *2512*—Server-to-server communications are exchanged over TCP port 2512.

- ▶ *2513*—The Management Console uses this TCP port to plug into the IMA.
- ▶ *1604*—UDP is usually enabled if the MPS server is used in interoperability mode or mixed mode, which means there are MetaFrame 1.8 servers in the farm. It is used by ICA clients to broadcast a query to find the Master ICA Browser.
- ▶ *443*—Secure Sockets Layer (SSL) Relay is used to secure communications between the Web Interface server (formerly NFuse) and MPS servers.
- ▶ *139, 1433, 443*—MPS servers use these ports to communicate with Microsoft SQL or Oracle databases hosting the Data Store.

MetaFrame Data Store Requirements

Because the IMA Data Store is the central repository for storing all the farm settings for the MetaFrame Presentation Servers, careful planning and database software consideration are necessary. The IMA Data Store supports the following database software:

- ▶ *Microsoft Access*—This database software is intended for use by organizations that have up to 50 MetaFrame servers in their farms. It is provided to you free with the MPS operating system and is installed automatically if you choose to deploy the Data Store as an Access database. It is also ideal in organizations in which experienced database administrators are not available.
- ▶ *Microsoft SQL Server Desktop Engine (MSDE)*—MSDE, database software based on Microsoft SQL server, is a lightweight database installed on the first MPS server prior to installing MetaFrame. MSDE is geared toward small to medium-size businesses and is much more robust than Microsoft Access. It can be administered using standard Microsoft SQL Server tools.
- ▶ *Microsoft SQL Server*—This complete database software is recommended for any size organization. It can be costly in terms of price, so if cost is a major factor and the company is small to medium sized, other options such as Access or MSDE would be more appropriate. SQL is very robust and scalable.

- *Oracle*—Similar to Microsoft SQL Server, Oracle is recommended for any size organization, but because of price considerations and the expertise needed for installation and administration, it is recommended for medium to large organizations. It is a very robust and scalable database system.
- *IBM DB/2*—Another enterprise class database software similar to Oracle and Microsoft SQL, IBM DB/2 is suited for medium to large organizations. It is very scalable and robust. It also requires extensive expertise to install and maintain.

When you use Microsoft Access or Microsoft MSDE as the Data Store database, they should be installed on the first MetaFrame server in the farm.

Direct and Indirect Data Store Connection

A MetaFrame Presentation Server can connect to the IMA Data Store in two ways. Depending on the type of database software you decide to use, MPS servers make either a *direct connection* or an *indirect connection*.

A direct connection to the IMA Data Store means that the database software resides on a dedicated server and all the MetaFrame servers connect directly to this dedicated database server and plug into the IMA Data Store. This type of connection is associated with Microsoft SQL Server, Oracle, and IBM DB/2 databases.

An indirect connection to the IMA Data Store means that the first MetaFrame server you install in the farm hosts the Data Store, which is in the format of a Microsoft Access or an MSDE database. All MPS servers added thereafter will connect to the first MPS server, which hosts the IMA Data Store and will then connect to the Data Store, thereby making an indirect connection. The MPS servers can't connect directly to the Data Store database but first have to connect to the MPS server and then to the Data Store it hosts.



When in indirect mode, all the servers explicitly rely on the first MPS server in the farm because it holds the IMA Data Store. This renders the first server very critical, and thus it should be properly backed up and maintained to avoid any potential issues from the loss of the database it hosts in the event of a disaster.



You are expected to clearly understand the differences between a direct and an indirect Data Store connection. Given a farm configuration, you should be able to determine whether the Data Store is directly or indirectly available to Presentation Servers in the farm.

Server Farm Distribution and Availability

One of the major strengths that attracts companies of any size to deploy Citrix MetaFrame Presentation Server is that it is more redundant and more available than any other system. For example, suppose you have 10 MetaFrame servers in the farm serving users. If one server fails or goes down for any reason, the users connected to that server will lose their connection, as well as any unsaved work they were working on. However, they can immediately connect back and will be directed to another server in the farm that supports the same application, enabling them to keep working.

Ideally, you would want all your MPS servers to be in one geographical location, which is what server-based computing or centralized computing is all about. However, in many cases and mostly in larger organizations, you may find groups of servers located in different regions serving different users. For these types of scenarios, you should investigate clustering the IMA Data Store and distributed databases.

Clustering, Distributed Databases, and Multiple Farms

In large, enterprise-class organizations where numerous servers may be located in different geographical locations, you should rethink the way you design your IMA Data Store for performance reasons and for failover or disaster recovery reasons.

If your organization requires zero downtime or very minimal downtime and is willing to spend the money, you should consider clustering the IMA Data Store to avoid the single point of failure scenario. You can use a number of different clustering methods, but most notable here is the Microsoft Clustering service. The topic is beyond the scope of this exam, but as an administrator, you should be aware of the different options available to you.

Another method you should be aware of is the distributed databases method, which is useful for organizations that have groups of servers in different geographical locations. Because the servers do many reads to the IMA Data Store to query it for data, if these servers are located far away from the Data Store and must travel the WAN to query it, performance is affected for all servers in the farm. For this reason, you should consider using distributed databases, which means you will add a database server at every location

where the number of servers warrants a database server. This database server would be an exact replicated copy of the original Data Store and would be used to serve these servers in the remote locations. Again, this topic is beyond the scope of the CCA exam but is mentioned here because, as an administrator, you should be aware of it.

Organizations usually consider creating a second farm when servers are located in geographically dispersed areas and separation of communication is critical. For example, an organization that has a presence in the United States and also in Europe with servers in every continent should consider having separate farms for each region, which would improve performance and reliance on each other. This would mean separate Data Store databases for each farm, which in this scenario is required and recommended.

Redundant Hardware

The quest of building the “ultimate” environment where no component will ever go down is the dream of every techie in the industry. Many of us dream of a server with so much redundancy that it can never go down. Even though that dream is far from being realized, components in the server can be redundant, which means you have two or more of the same component, and in the event that one of them goes down, the other picks up automatically without any interruption of service.

Today, you can order servers with redundant hard drives that are built on RAID technology, so if a hard drive fails, the server continues to function properly, and all you need to do is exchange the bad hard drive with a new one.

You can also have redundant network interface cards (NIC) and redundant power supplies so if one goes down, power is picked up from the other one without affecting the server’s uptime.

Even if you spend thousands on redundant components, in our opinion, you can never ensure that a server will never go down. For example, what if the motherboard goes bad? All the other redundant components will not help.

A much better solution would be to spend the money on an additional server, rather than on redundant components. More servers improve performance, and they do not cost that much more than the redundant components. This is, of course, the advice we give for MPS servers. For database servers, we recommend some redundant components such as power supplies and hard drives, but we strongly recommend clustering in environments where extended downtime is not tolerated.

Load Balancing

Citrix MetaFrame Presentation Server Advanced Edition and Enterprise Edition have the capability of automatically load balancing MPS servers either based on user load or based on a more advanced set of calculations. We discuss load balancing in more detail in Chapter 8, “Citrix Load Management.” Load balancing is an automated method of spreading user load to the least busy server in the farm. You should be careful, though, as load balancing is not fault tolerant, which means in the event that an MPS server goes down, the users connected to that server will lose their connection. They will not be automatically routed to another server, but they will have to initiate a new ICA session and then be directed to a new server.

A circular icon with a scalloped border containing the word "NOTE" in a bold, serif font.

NOTE

Citrix MetaFrame Presentation Server Standard Edition does not come with load balancing; therefore, MPS Standard Edition cannot direct users to the least busy server, as is the case with the Advanced and Enterprise Editions.

Exam Prep Questions

1. On which of the following operating systems can MetaFrame Presentation Server 3.0 be installed? (Choose all that apply.)

- A. Microsoft Windows NT 4.0 TSE
- B. Microsoft Windows 2000 Advanced Server SP2
- C. Microsoft Windows 2000 Server SP4
- D. Microsoft Windows Server 2003 Datacenter

Answers C and D are correct. Answer C is correct because all flavors of Windows 2000 Server are supported provided that they are at SP4. Answer D is correct because all flavors of Windows Server 2003 are supported. Answer A is incorrect because MPS 3.0 does not support Windows NT 4.0 TSE. Answer B is incorrect because Windows 2000 should be at Service Pack 4 or later; because it is at SP2, it is not supported.

2. When installing MetaFrame Presentation Server 3.0 on Windows Server 2003 Standard Edition, what is the minimum recommended amount of RAM required for the operating system?

- A. 128MB
- B. 256MB
- C. 512MB
- D. 1GB

Answer B is correct. Answers A, C, and D are incorrect because Microsoft's minimum RAM requirement for Windows Server 2003 is 256MB RAM.

3. When an MPS server connects to a Microsoft SQL MSDE IMA Data Store database, the connection is known as

- A. Host Mode
- B. Direct Mode
- C. Straight Mode
- D. Indirect Mode

Answer D is correct. When an MPS server connects to a Microsoft SQL MSDE or Microsoft Access IMA Data Store database, it is connecting to this database via another MPS server that is hosting the database; therefore, this is known as Indirect mode because it indirectly access the database. Answer A is incorrect because no such mode exists. Answer B is incorrect because a Direct mode is not supported with Microsoft SQL MSDE; it is supported with Microsoft SQL, Oracle, or IBM DB/2. Answer C is incorrect because no such mode exists.

4. What is the minimum recommended RAM size when installing Windows Server 2003 Datacenter server?

- A. 2GB
- B. 1.5GB
- C. 1GB
- D. 256MB

Answer C is correct. The recommended size of RAM when installing Microsoft Windows Server 2003 Datacenter server is 1GB. Answers A, B, and D are incorrect because they are not the minimum recommended size.

5. What is the minimum recommended size of free disk space necessary when you are planning to install Windows Server 2003 Standard Edition in preparation for an MPS 3.0 install?

- A. 2GB
- B. 1.5GB
- C. 1GB
- D. 512MB

Answer B is correct. The minimum recommended free disk space required for a Windows Server 2003 Standard Edition install is 1.5GB. Answers A, C, and D are incorrect because they are not the minimum recommended free disk space size on a Windows Server 2003 Standard Edition.

6. A Terminal Server Licensing Server must be installed on a domain controller when using Windows 2000 or Windows Server 2003 domains?

- A. True
- B. False

Answer B is correct. TS Licensing Server does not have to be installed on a domain controller in either Windows 2000 or Windows Server 2003. It is recommended for more reliable querying but is not mandatory and can run on other servers.

7. Which of the following licenses are not required in an MPS 3.0 environment? (Choose two.)

- A. Microsoft Windows 2000/2003 Server License
- B. Microsoft Windows 2000/2003 CALs
- C. Microsoft Windows 2000/2003 TSCALs
- D. Citrix MPS 3.0 Server License
- E. Citrix Connection License
- F. Citrix Load Balancing License
- G. Citrix ICA Client device License

Answers F and G are correct. You do not need a specific Citrix load balancing license. Depending on the edition of MPS you purchase, you will either get this feature or not. The Standard Edition of MPS 3.0 does not include load balancing, but the Advanced and Enterprise Editions do. Citrix load balancing was licensed separately in the MF 1.8 days. There is no such thing as the Citrix ICA Client Device License. Answers A through E are incorrect because they are all requirements.

8. Which of the following ports is used to establish and maintain an ICA session?
- A. 2512
 - B. 2523
 - C. 1604
 - D. 1494

Answer D is correct. TCP port 1494 is used to establish and maintain an ICA session. Answers A and B are incorrect because 2512 and 2513 are used for MPS server-to-server communication and server-to-IMA communications. Answer C is incorrect because 1604 is a UDP port used for client broadcast.

9. Your Citrix MPS 3.0 farm is composed of 25 servers supporting the accounting package in your organization. On a daily basis, you have 30 users on each server. Servers 10 and 11 have just failed with hardware problems. What happens to the users who were actively connected to these two servers?
- A. Users are rerouted automatically to another server, but they lose any unsaved data they were working on.
 - B. Users are automatically rerouted and spread over to the other servers in the farm. Users do not lose the data they were working on, and the operation is seamless to the user.
 - C. Users are disconnected from the server and have to reconnect, but they do not lose any data and can pick up where they left off before the servers went down.
 - D. Users are kicked off the servers; they need to reconnect, and any unsaved data is lost.

Answer D is correct. Load balancing is not fault tolerance. In the event of a server failure for any reason, users connected to that server lose their connection, thereby needing to reconnect, and any unsaved data is lost. Answers A, B, and C are incorrect because they are incorrect statements.

10. What is the grace period for an MPS server to find and communicate with a terminal Server Licensing server before it starts to refuse connections?
- A. 120 days
 - B. 90 days
 - C. 60 days
 - D. 30 days

Answer A is correct. An MPS 3.0 server has 120 days to locate and communicate with a TS Licensing server; otherwise, it will start refusing connections. Answers B, C, and D are incorrect because they do not provide the correct grace period value.