MetaFrame XP Training

By Citrix Consulting Services

Citrix Systems, Inc.

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Server Installation

- Insert CD

- Choose Setup

- Read though License Agreement, and Choose I Agree if everything is correct

- Choose Next on Welcome Screen

- Choose Next to begin Data Store Configuration

- To create a new Server Farm:

    o Choose Create a new server farm; Click Next

    o Use a third party database for the data store

    o Uncheck Use Default Zone Name\

    o Enter in new Zone Name; Press Enter

    o Select the SQL Server ODBC driver

        ▪ If on TSE, verify the SQL driver is installed. If not, download MDAC 2.6 from www.microsoft.com. This will install the driver.

        ▪ Click Next

    o Enter in a description and the server which will house the SQL database; Click Next

    o Verify authenticity of the login ID

    o Change Default Database to the SQL database, which will house the DS; Click Next

    o Click Finish

    o Test Data Source

    o Click OK and continue

    o Enter in an administrator and password for database access

    o Enter in new Server Farm Name

    o Verify new Server Farm Name

    o Operate independently in native IMA-only mode

    o Enter in a farm administrator and domain

    o Click Next to establish Network ICA Connections

    o If Modem Setup is not required, Click Next

    o Click Next to configure ICA Session Shadowing

- Click Next to allow shadowing

- Click Next to begin re-mapping of drives

- Choose Re-map server drives if desired; Default is M:

- Change XML port to desired port; Click Next

- Click Next to perform installation

- Choose whether to install Clients or not to

- Enter license and verify product code

- Click Restart to complete installation

- To join an existing server farm

  - Choose Join an existing server farm; Click Next

  - Choose Direct data store connection

  - Uncheck Use Default Zone Name

  - Enter in new Zone Name; Press Enter

  - Select the SQL Server ODBC driver

    - If on TSE, verify the SQL driver is installed. If not, download MDAC 2.6 from www.microsoft.com. This will install the driver. Click Next

  - Enter in a description and the server which will house the SQL database; Click Next

  - Verify authenticity of the login ID

  - Change Default Database to the SQL database, which will house the DS; Click Next

  - Click Finish

  - Test Data Source

  - Click OK and continue

  - Enter in an administrator and password for database access

  - Operate independently in native IMA-only mode

  - Enter in a farm administrator and domain

  - Click Next to establish Network ICA Connections

  - If Modem Setup is not required, Click Next

  - Click Next to configure ICA Session Shadowing

  - Click Next to allow shadowing

  - Click Next to begin re-mapping of drives

  - Choose Re-map server drives if desired; Default is M:

  - Change XML port to desired port; Click Next

  - Click Next to perform installation

  - Choose whether to install Clients or not to

- Enter license and verify product code

- Click Restart to complete installation

Data Store Installation

- Create a new Database within the SQL server

- Create an administrative user within this database

- Assign Database Owner to this user

Installation with a Local Data Store – (Indirect Mode)

- Insert CD

- Choose Setup

- Read though License Agreement, and Choose I Agree if everything is correct

- Choose Next on Welcome Screen

- Choose Next to begin Data Store Configuration

- To create a new Server Farm:

    - Choose Create a new server farm; Click Next

    - Use a local database for the data store

    - Uncheck Use Default Zone Name

    - Enter in new Zone Name; Press Enter

    - Enter in an administrator and password for database access

    - Enter in new Server Farm Name

    - Verify new Server Farm Name

    - Operate independently in native IMA-only mode

    - Enter in a farm administrator and domain

    - Click Next to establish Network ICA Connections

    - If Modem Setup is not required, Click Next

    - Click Next to configure ICA Session Shadowing

    - Click Next to allow shadowing

    - Click Next to begin re-mapping of drives

    - Choose Re-map server drives if desired; Default is M:

    - Change XML port to desired port; Click Next

    - Click Next to perform installation

    - Choose whether to install Clients or not to

    - Enter license and verify product code

        o   Click Restart to complete installation

- To join an existing server farm

  - o Choose Join an existing server farm; Click Next

  - o Choose Indirect data store connection

  - o Uncheck Use Default Zone Name

  - o Enter in new Zone Name; Press Enter

  - o Enter in an administrator and password for database access

  - o Operate independently in native IMA-only mode

  - o Enter in a farm administrator and domain

  - o Click Next to establish Network ICA Connections

  - o If Modem Setup is not required, Click Next

  - o Click Next to configure ICA Session Shadowing

  - o Click Next to allow shadowing

  - o Click Next to begin re-mapping of drives

  - o Choose Re-map server drives if desired; Default is M:

  - o Change XML port to desired port; Click Next

  - o Click Next to perform installation

  - o Choose whether to install Clients or not to

  - o Enter license and verify product code

  - o Click Restart to complete installation

Unattended Install

```
************************************************************
* Sample unattended answer file for Citrix MetaFrame XP 1.0
*
* To run an unattended MetaFrame installation, make a copy
* of this file and customize it for your needs.
*
* If you do not use an answer file, or if you use an
* answer file but do not specify answers to some questions,
* default answers are used for those questions.
*
* The default answers used are the same as the answers
* listed in this sample answer file. However, no licenses
* are added.
*
* Please see the MetaFrame XP Administrator's Guide for
* further installation information.
************************************************************
```

```
**************************************************************
* MetaFrame License Agreement
*
* This section specifies your acceptance of the End-User
* License Agreement. You must set this value to "Yes" to
* indicate your acceptance of the MetaFrame End-User
* License Agreement.
*
* Any value other than "Yes" causes the setup program
* to prompt you with the License Agreement.
**************************************************************

[MetaFrame License Agreement]
AcceptLicense=No

**************************************************************
* Data Store Configuration
*
* This section specifies whether you are creating or joining
* a farm and how to connect to the data store.
*
* Multiple options are available as follows:
*
* 1. To create a farm using an Access database:
*    - Set CreateFarm to Yes
*    - Set DirectConnect to No
*    - Complete the Farm Settings section
*
* 2. To create a farm using an Oracle or SQL database:
*    - Set CreateFarm to Yes
*    - Set DirectConnect to Yes
*    - Complete the Direct Connect Settings section
*    - Complete the Farm Settings section
*
* 3. To join a farm using an Oracle or SQL database:
*    - Set CreateFarm to No
*    - Set DirectConnect to Yes
*    - Complete the Direct Connect Settings section
*
* 4. To join a farm by connecting to an Access database stored
*    on another server (Indirect Connection):
*    - Set CreateFarm to No
*    - Set DirectConnect to No
*    - Complete the Indirect Connect Settings section
*
* Specify the name of the Zone where this server will reside.
* If no Zone name is specified, a default Zone name is
* applied to the first server in a farm. If no Zone name is
* specified for servers joining a farm, the servers are
* added to the Zone where the farm resides.
*
```

```
* If you are using an Oracle or SQL database, manually create
* a .DSN file within the ODBC Data Source Administrator
* "File DSN" option before running the unattend install process.
*
* IMPORTANT: Please read your MetaFrame documentation
* for information regarding data store configuration,
* supported databases, setting up a DSN file, moving
* servers within farms, and renaming Zones.
*************************************************************

[Data Store Configuration]
CreateFarm=Yes
DirectConnect=No
; Leave this blank to use the default zone name
ZoneName=

*************************************************************
* Direct Connect Settings
*
* This section specifies settings for an Oracle or SQL
* database.
*
* This section is used only if the value for DirectConnect
* is Yes in the Data Store Configuration section.
*
* In this section you must specify:
*
* 1. The path to the DSN file for this database.
*     - If you are creating a farm, please see the
*       documentation for details on how to create a DSN
*       file to use here.
*     - If you are joining a farm, you must specify
*       the path to the DSN file created on the server where
*       you created the farm or a copy of it. Please see
*       the documentation for details.
*
* 2. The ODBC user name and password for the authentication
*     account that can be used to access this database. If
*     Windows NT authentication is being used, please include the
*     domain in the user name in the form domain\username.
*************************************************************

[Direct Connect Settings]
DSNFilePath=
UserName=
Password=

*************************************************************
* Indirect Connect Settings
*
* This section specifies settings for connecting indirectly
```

```
* to an Access database on another server.
*
* This section is used only if CreateFarm is No AND
* DirectConnect is No.
*
* In this section you must specify:
*
* 1. The name of the server you want to indirectly connect
*    to and the port number to use.
*
* 2. The user name and password for an account that can be
*    used to access this Citrix Server. This can be either
*    the user designated as Farm Administrator when creating
*    the farm or any other users subsequently designated as
*    farm administrators using the Citrix Management Console.
*    Please include the domain in the user name in the
*    form domain\username.
*
* If you are unsure of any settings, please see the
* MetaFrame documentation for details.
*************************************************************

[Indirect Connect Settings]
IndirectServerName=
IndirectServerPort=2512
UserName=
Password=


*************************************************************
* Farm Settings
*
* This section specifies settings for the entire farm.
*
* This section is used only if CreateFarm is Yes in the
* Data Store Configuration section.
*
* In this section you must specify:
*
* 1. The name of the farm you are creating.
*
* 2. The MetaFrame interoperability mode for this farm. Set
*    it to Yes to operate in mixed mode with MetaFrame 1.8
*    servers. Set it to No to operate independently in
*    native IMA-only mode.
*
* 3. A Windows NT user (username and domain) who will be the
*    administrator of this farm. This user can designate
*    other users as administrators of the farm from the
*    Citrix Management Console later.
*************************************************************
```

```
[Farm Settings]
FarmName=Farm
InteroperabilityMode=No
FarmAdministratorUsername=Administrator
FarmAdministratorDomain=

************************************************************
* ICA Network Protocols
*
* This section specifies if ICA connections are to be
* configured for the specified protocols (TCP/IP, IPX,
* SPX, and NetBIOS).
************************************************************

[ICA Network Protocols]
TCP=Yes
IPX=Yes
SPX=No
NETBIOS=Yes

************************************************************
* Shadowing Restrictions
*
* This section specifies whether shadowing is enabled. If
* shadowing is enabled, it specifies what shadowing
* restrictions are to be placed.
************************************************************

[Shadowing Restrictions]
AllowShadowing=Yes
ProhibitRemoteControl=No
ProhibitNotificationOff=No
ProhibitLoggingOff=No

************************************************************
* Drive Reassignment
*
* This section specifies if the drive letters on the
* MetaFrame server are to be reassigned. If drive letters are
* to be reassigned, specify the new drive letter for
* the server's drive C.
*
* IMPORTANT: Please read your MetaFrame documentation
* for information regarding server drive reassignment
* before choosing this option.
************************************************************

[Drive Reassignment]
ReassignDriveLetters=No
NewDriveLetter=M
```

```
*************************************************************
* Citrix XML Service
*
* This section allows you to specify how you want to add
* XML support.
*
* You can share the default port 80 with IIS (if installed)
* or you can dedicate a port for the XML Service.
*
* If ExtendIIS is set to No, the specified port is used
* for the Citrix XML Service. If ExtendISS is set to Yes,
* DedicatedPortNumber is ignored. If you do set ExtendIIS
* to Yes and IIS is not available, the dedicated port
* number is used.
*
* If you do not use the default port 80, all Citrix
* ICA Clients using TCP/IP with HTTP server location
* and NFuse-enabled Web servers must be configured
* to make requests to the specified port number.
*************************************************************

[Citrix XML Service]
ExtendIIS=No
; This setting applies only if ExtendIIS is No
DedicatedPortNumber=80

*************************************************************
* NFuse
*
* This section is relevant only if you have IIS 4.0 or
* greater installed.
*
* This installs NFuse. The default installs NFuse and
* sets your Web server's default page to point users to the
* NFuse Logon Screen.
*************************************************************

[NFuse]
InstallNFuse=Yes
; This setting applies only if InstallNFuse is Yes
SetDefaultPage=Yes

*************************************************************
* Update ICA Clients
*
* This section specifies ICA Client installation, placing clients
* into the ICA Client Creator and the Client Update Database.
* If clients are installed, it specifies the location of the
* client images.
*
* IMPORTANT: Only typical installations of clients can be done
```

```
* in this way. See the MetaFrame documentation
* for information on installing ICA Clients using custom
* installation options.
*************************************************************


[Update ICA Clients]
UpdateClients=No
ClientPath=

*************************************************************
* License Serial Numbers
*
* This section contains the Citrix MetaFrame license serial
* numbers with an appended equal sign (=). Enter the license
* serial numbers exactly as they appear on the serial number
* sticker provided with your software. You can specify multiple
* licenses in the answer file. The licenses are added in
* the order they are listed in the answer file.
*
* You can leave this section blank if you do not want to
* enter licenses at this time. Licenses can be added at a later
* time from the Citrix Management Console.
*
* NOTE: Licenses consist of five groups of five characters each.
*************************************************************


[License Serial Numbers]
; Enter your license serial numbers in this format:
; Note: you must uncomment the lines first
; XXXXX-XXXXX-XXXXX-XXXXX-XXXXX=
; YYYYY-YYYYY-YYYYY-YYYYY-YYYYY=

*************************************************************
* MetaFrame Product Code
*
* This section contains the Citrix MetaFrame product code.
* Enter the product code exactly as it appears on the
* product code sticker provided with your software.
* If you do not enter a product code, setup will attempt to
* select one for you.

* If you want to change the product code at a later time, you
* can do so from the Citrix Management Console. If a product
* code cannot be selected for you, no product code is
* set and this server will not accept connections until you
* set one using the Citrix Management Console.
*
* NOTE: Product codes consist of two groups of four characters
* each separated by a hyphen.
*************************************************************
```

```
[MetaFrame Product Code]
ProductCode=

************************************************************
* Options
*
* This section contains additional options for unattended
* setup. The reboot option specifies whether MetaFrame
* Setup shuts down and restarts the server after
* setup completes.
*
* If you set this option to No you must manually reboot your
* server before using MetaFrame.
************************************************************


[Options]
RebootOnFinish=Yes

************************************************************
* Upgrade Settings
*
* This section contains options that are applicable only if
* you are migrating to MetaFrame XP from MetaFrame.
*
* If you set MigrateApplications to Yes, setup will check for
* published applications and if any are found, migrate them
* to MetaFrame XP 1.0. If you specify No, you must manually
* recreate your published applications later using the
* Citrix Management Console.
************************************************************


[Upgrade Settings]
MigrateApplications=Yes
```

IMA Discussion

Independent Management Architecture

MetaFrame XP incorporates an advanced Citrix server communications and management foundation, the Independent Management Architecture (IMA). IMA is a unified, enterprise-wide platform for installation, management, maintenance, support, and security of server-based computing and application hosting services. It is both an architectural model and a protocol for server-to-server communications. IMA is constructed on a collection of core subsystems that define and control execution of Citrix products including: Data Store (DS), XP or Member Server and Zone Data Collector (ZDC). The figure below depicts the relationships among these core subsystems.
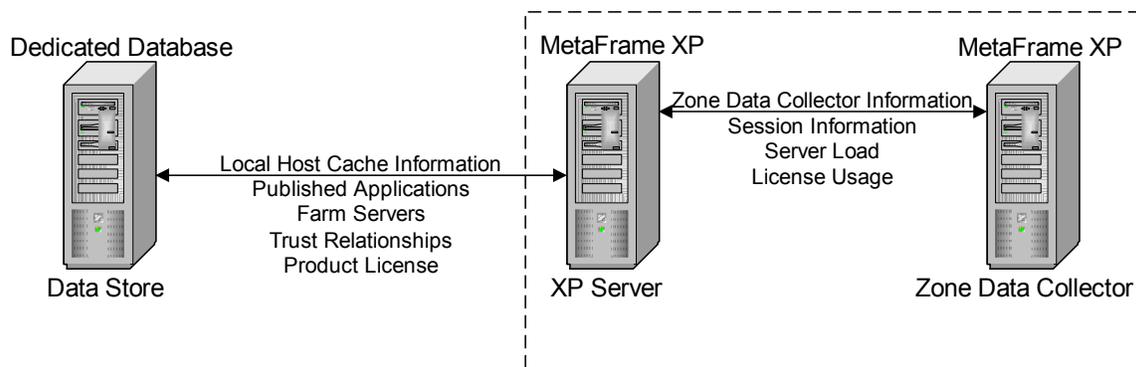

Figure 1 - IMA Core Subsystems

- IMA enables MetaFrame XP servers to be grouped into server farms that do not depend on the physical locations of the servers. IMA allows MetaFrame XP servers on different network subnets to be in a single server farm.

- IMA supports current functionality of all existing ICA Client software from Citrix and will operate with an installed base of ICA Clients. Full client functionality available with MetaFrame XP requires client 6.00 or greater.

- MetaFrame XP installations can scale to multi-site, enterprise-level server-based computing scenarios, with centralized administrative access to all MetaFrame XP servers in a farm.

Data Store

The Data Store (DS) provides a repository of persistent farm information for member servers to reference. The DS stores information that does not change frequently, including: published applications, farm servers, trust relationships, and product licenses. Member servers access the DS for information upon reboot, restart of the IMA service, or the data store poling interval (default of every 10 minutes).[1]

Except for indexes, all information in the DS is stored in an encrypted binary format. Therefore, neither administrators nor users should be allowed access to query or change the DS data. Only IMA-based tools should be used to access the data in the DS.

---

[1] Configuration for the Data Store Poling Interval

- **Data Store Sizing.** The scalability of the DS has been tested in Citrix labs with MS SQL 7.0. Using a dual 600 processor with 1 gig of RAM, Citrix encountered a threshold of 300 servers. The bottleneck in this test was the database's CPU. This should serve as a conservative guideline in scalability planning.

- **Data Store Recovery.** The Data Store updates all MetaFrame XP servers in the server farm (member servers) with farm data on boot. This updates the XP server's Local Host Cache (LHC). There is only one Data Store per farm. If the Data Store fails, member servers have 48 hours before the farm fails. The Data Store contains all license information. XP servers stop accepting connections when they have received no license updates for 48 hours. If the Data Store goes offline and no backup is available, then the entire farm has been placed at severe risk. Only the CMC and initial installs write to the Data Store. Therefore, if the DS cannot be reinstalled using a backup, the server farm needs to be reinstalled.

- **Database Options.** MetaFrame XP supports three databases for the DS:

    o Microsoft Access - a lightweight database that is included with Windows server operating systems. It is most appropriate for smaller server farms of up to 50 servers.

    o Microsoft SQL Server - a client/server database that offers robust and scalable support for multiple-server data access. Database replication is supported. It is suited for use in farms of any size.

    o Oracle - a client/server database that offers robust and scalable support for multiple-server data access. Database replication is supported. It is suited for use in farms of any size.

Zones and Zone Data Collectors

Zones collect data from member servers in a hierarchical structure, and efficiently distribute changes to all servers in the farm. All member servers must belong to a zone. By default the zone name is the subnet on which the member server resides. Each zone is responsible for electing a Zone Data Collector (ZDC). The ZDC is informed when any member server of the zone has dynamic changes such as session information, server loads, or licensing. Periodically, member servers may contact the ZDC to report any changed information.

Each ZDC reports changes in member servers within its own zone to ZDCs of other zones in the farm. This ensures that each ZDC is aware of the server load, licensing, and session information for every server in the farm. To facilitate data transfer, each ZDC maintains an open connection to all other ZDCs in the farm. The formula for calculating the number of inter-zone connections is N * (N-1)/2, where N is the number of zones in the farm.

Factors that determine whether a Zone requires a dedicated ZDC include:

- Number of member servers within the zone – if there are more than 50 member servers in the zone, a dedicated ZDC should be considered.

- Number of zones within the farm (inter-zone communication) – as the number of zones increase, more communication between zones will occur, thereby increasing traffic. Dedicated ZDCs can concentrate on only this traffic.

- Frequency of user logons/app enumerations – ZDCs can handle 70 client resolutions per second. As client resolutions increase, a dedicated ZDC is recommended.

- Frequency of cycle booting on member servers in the zone – As servers are rebooted, the servers advise the ZDC they are online. The more often this occurs, the more traffic is passed within the zone.

- The speed of links between subnets is a major determining factor for Zone selection. If the link speed between subnets is slow, Zones are recommended. Creating two zones between slow linked subnets minimizes network traffic and improves performance of the farm by isolating traffic to communications between ZDCs instead of communications among member servers and a ZDC.

- By default, a single zone supports up to 256 member servers. If a zone contains more than 256 servers, each ZDC must have a registry setting modified to a value greater than the number of servers in the zone. Failure to do so will result in significant performance degradation on the ZDC.

- Note: Modify the following registry setting on each ZDC or Potential ZDC to be a value greater than the number of member servers in the zone. Default value is 256 (100h):

    - HKLM\Software\Citrix\IMA\Runtime\MaxHostAddressCacheEntries

- There are no known limitations to the number of zones in a farm. However, careful consideration must be made when planning the deployment of zones. Each zone is responsible for keeping information on **all** servers in the server farm. Because of this, planning must include consideration of the bandwidth/connectivity between all zones within a farm, as illustrated in the following diagram:
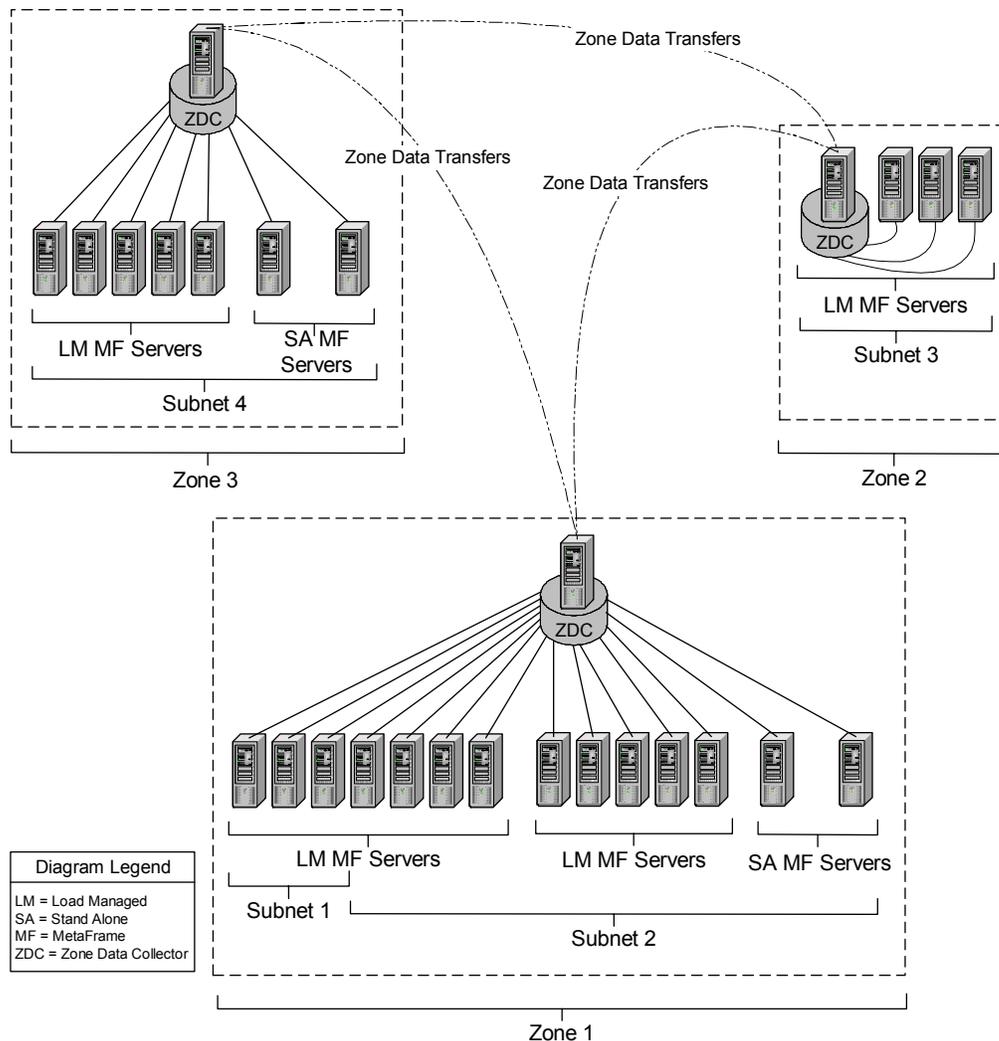

Figure 2 - MetaFrame XP Zones

ZDC Configuration & Redundancy

Zone Data Collectors (ZDC) should be configured as the authentication source (XML Server) for any NFuse web server that have been integrated into an XP environment. Selection of a member server would result in a request to the ZDC for authentication information. By configuring the ZDC as the authentication source, network traffic is minimized and time to process is improved.

ZDCs are configured with one of four settings:

- Most Preferred

- Preferred

- Default Preference

- Not Preferred

In a zone where there will be a dedicated ZDC, the server that will take on the ZDC responsibilities will be set with "Most Preferred." Additionally, configuring a dedicated or shared backup ZDC for a sizeable zone is a good practice. Backup ZDCs will be configured with the "Preferred" setting. During a ZDC election, the server with the "Most Preferred" setting will win and become the dedicated ZDC for the zone. If that server fails, an election will occur and the server with the "Preferred" setting will take over the role.

If the zone is large enough to warrant a dedicated ZDC, a dedicated backup ZDC is also in order. If the primary ZDC fails, the backup will take over the roles of a ZDC as well as its previous role of serving applications to users. If the zone is too large, these two processes will severely hinder the backup ZDC from performing any functions.

In an NFuse/Web scenario, each web server should be configured for a primary source and multiple backup sources. In a multi-zone configuration, the backup sources will be the ZDCs of the other zones. In the event that the preferred ZDC fails, the Web server will use the backup ZDC specified in its backup server list. Specifying the ZDCs of other zones will continue to keep the network traffic minimized for user authentication.

Local Host Cache

Each MetaFrame XP server has a subset of the DS called the Local Host Cache (LHC). The LHC performs two primary functions:

- It permits the server to function in the absence of a connection to the DS.

- It improves performance by caching some of the most used client information.

Types of information found within the LHC include:

- All servers in the farm with some common information

- All applications published within the farm and their properties

- All trust relationships (NT Domain) within the farm

- All information specific to itself (Product code, SNMP settings, etc)

If the DS is unreachable, the LHC contains enough information about the farm to continue to function for 48 hours. During this "grace" period, the member servers will continue normal functions normally and the IMA service attempts to connect to the DS. After 48 hours, if the DS is unreachable the server will stop taking incoming connections because licensing fails.

Load Management

When a user requests a published application that is load balanced, Load Manager determines the server with the lightest load for the published application based on server load levels. Load balancing uses load evaluators to calculate server load. Load Evaluators are comprised of rules that can be added individually or in any combination. An administrator creates Load Evaluators from the Citrix Management Console (CMC). Instructions are provided in the configuration section of this document.

Load Evaluators

Load Evaluators are groupings of rules such as CPU, Memory, Page Faults, etc. that combine to create a single rule that can be evaluated by the load management routines. This means that multiple Load Evaluators can be created, each contributing a percentage of an overall load number that is used by the load management routines. As an example, assume the Load Management routines for a set of servers are set to allow a maximum load number of 10,000. This means, that when all Load Evaluators are applied, if the server load is greater than 10,000, then access to that server will be denied and the session request will cascade to other servers.   Load Evaluators (LE) can be associated with servers or published applications. Loads for each server or application are calculated using the following rules:

1. Establish the maximum server load value

2. If a server's load is greater than the maximum value, based on the combination of all applicable Load Evaluators, then new sessions will be routed to a server with load figures less than the maximum value. If no qualified servers are available, then the connection request will be denied.

3. If a single rule is added to a LE, that rule's load number will be used as the Load Evaluators load.

4. If any combination of rules is added to a LE, then the rule that currently has the highest usage/load value will be used as the LE's load figure.

5. If a published application resides on a server where both the application and the server have LEs, the LE with the higher load is used to determine where the next published application will be sent.

Two load evaluators are created by Default: Advanced and Default.

- **Advanced.** Calculates load using a combination of three rules: CPU Utilization, Memory Usage, and Page Swap. The server's load is based on the higher load of the three rules.

- **Default.** Calculates load using the Server User Load Rule. Each user who logs into a particular server will add to the load of this rule. Max Server User Load is set at 100 and cannot be changed. Each session adds 100 to the rule's load (10,000/100 = 100). By default, this means that no more than 100 connections will be allowed before the server disallows additional connections.

Rules

When a server is first established as a load-managed server, the LE is set to the Default LE. The following list comprises the complete set of available LE rules:

1.	Application User Load	7.	License Threshold
2.	CPU Utilization	8.	Memory Utilization
3.	Context Switches	9.	Page Faults
4.	Disk Data I/O	10.	Page Swap
5.	Disk Operations	11.	Server User Load
6.	IP Range	12.	Scheduling

Application User Load. Calculates load using the number of concurrent users connected to a server. Each session's load is determined by dividing 10,000 by the number entered in Max App Load, i.e., Max App Load = 100, each session adds 100 to the rule's load.

CPU Utilization. Calculates load based on CPU utilization. This rule uses performance monitor. There are two parameters, which the administrator must enter, upper threshold and lower threshold. If the value is between the two thresholds, the load is based upon the CPU Utilization percentage * Max Load (10,000), i.e., CPU Utilization = 20%, load is 2000. When the CPU utilization exceeds the upper threshold, Load Manager reports full load. When the CPU utilization is less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 100.

Context Switches. Calculates load based on CPU context switches. A context switch occurs every time the operating system switches from one executing process to another. This rule uses performance monitor. There are two parameters, which the administrator must enter, upper threshold and lower threshold. When the CPU context switches are within the lower and upper thresholds, Load Manager reports a load percentage based on the upper threshold value and 0. When the CPU context switches exceed the upper threshold, Load Manager reports full load. When the CPU context switches are less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 2,147,483,647 or (2^{31}-1).

Disk Data I/O. Calculates load based on the disk I/O throughput in kilobytes. This load uses performance monitor. There are two parameters, which the administrator must enter, upper threshold and lower threshold. When the disk I/O throughput is within the lower and upper thresholds, Load Manager reports a load percentage based on the upper threshold value and 0. When the disk I/O throughput exceeds the upper threshold, Load Manager reports full load. When the disk I/O throughput is less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 2,147,483,647 or (2^{31}-1).

Disk Operations. Calculates load based on the number of disk operations per second. There are two parameters, which the administrator must enter, upper threshold and lower threshold. When the number of disk operations per second is within the upper and lower thresholds, Load Manager reports a load percentage based on the upper threshold value and 0. When the Disk Operations per second exceeds the upper threshold, Load Manager reports full load. When the Disk Operations per second is less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 2,147,483,647 or $(2^{31}-1)$.

IP Range. Allows the load evaluator to enable or disable access to a server or published application based upon whether or not the IP addresses of the ICA clients are within the specified IP address ranges. The formula for matching clients with specified ranges is: If the IP address of the ICA client is greater than or equal to the specified [Starting IP Address] AND the IP address of the ICA client is less than or equal to the specified [Ending IP Address], then the client is considered to be a part of the specified range and action is taken depending on the inclusion or exclusion mode. This rule must be used in conjunction with another rule. This rule cannot load balance connections itself.

License Threshold. Calculates load based on the number of assigned or pooled connection licenses used on each server. When the number of connection licenses in use is less than or equal to the thresholds, Load Manager reports a load percentage based on the threshold values. When the number of connection licenses in use exceeds the upper threshold, Load Manager reports full load. To indicate that a license type, assigned or pooled, is to be ignored, enter zero for the license type. You can enter zero for only one license type. The valid range for the upper threshold is 0 to 9999.

Memory Utilization. Calculates load based on memory utilization. Memory Utilization includes both virtual and physical memory. This rule uses performance monitor. There are two parameters, which the administrator must enter, upper threshold and lower threshold. If the value is between the two thresholds, the load is based upon the memory utilization * Max Load (10,000), i.e., memory usage = 20%, load is 2000. When the memory utilization exceeds the upper threshold, Load Manager reports full load. When the memory utilization is less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 100.

Page Faults. Calculates load based on the number of page faults per second. A page fault occurs every time the operating system accesses physical memory that has been flushed to disk. This rule uses performance monitor. There are two parameters, which the administrator must enter, upper threshold and lower threshold. When the number of page faults per second is within the lower and upper thresholds, Load Manager reports a load percentage based on the upper threshold value and 0. When the number of page faults per second exceeds the upper threshold, Load Manager reports full load. When the number of page faults per second is less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 2,147,483,647 or $(2^{31}-1)$.

Page Swap. Calculates load based on the number of page swaps per second. A page swap occurs every time the operating system swaps physical memory to virtual memory on disk. This rule uses performance monitor. There are two parameters, which the administrator must enter, upper threshold and lower threshold. When the number of page swaps per second is within the upper and lower thresholds, Load Manager reports a load percentage based on the upper threshold value and 0. When the number of page swaps per second exceeds the upper threshold, Load Manager reports full load. When the number of page swaps per second is less than the lower threshold, Load Manager reports no load. The valid range for the upper and lower thresholds is 0 to 2,147,483,647 or $(2^{31}-1)$.

Server User Load. Calculates load based on the number of users on an attached server. When the number of users is less than or equal to the upper threshold, Load Manager reports a load percentage based on the threshold value. When the number of users exceeds the upper threshold, Load Manager reports full load. The valid range for the upper threshold is 1 to 10,000.

Scheduling. Allows the load evaluator to enable and disable availability of a server or published application during certain days of the week and certain hours of the day. The load evaluator displays a schedule as a block of squares. The squares are indicated in half hour time blocks. Filled squares are enabled and white squares are disabled. When the time and day of the week is within the specified time, Load Manager reports no load. When the time and day of the week is outside the specified time, Load Manager reports full load. This rule must be used in conjunction with another rule. This rule cannot load balance connections itself.

MetaFrame XP Best Practices

Data Store Migration

The DSMAINT command must be used to migrate a MetaFrame farm to a different Data Store. The DSMAINT command can be used to both migrate farm data between databases (DSMAINT MIGRATE) and reconfigure servers to use the new database (DSMAINT CONFIG).

The following are sample DSMAINT commands and should be typed as one continuous string from the command prompt:

DSMAINT MIGRATE /SRCDSN:" C:\Program Files\Citrix\Independent Management Architecture\MF20.DSN" /SRCUSER:*citrix* /SRCPWD:*citrix* /DSTDSN: "C:\Program Files\Citrix\Independent Management Architecture*MFSQL.DSN*" /DSTUSER:*sa* /DSTPWD:*sa*

DSMAINT CONFIG /User:*sa* /PWD:*sa* /DSN:"C:\Program Files\Citrix\Independent Management Architecture*MFSQL.DSN*"

The MetaFrame XP database should be backed up whenever a change is made using the Citrix Management Console. Scheduling a daily backup should be sufficient in most cases.

MS SQL Server 7.0 & 2000

The practices outlined in this section are intended to aid with the optimal implementations of the MS SQL Server data store. This is not intended to be a substitute for MS SQL Server documentation. Please read all of the MS SQL Server documentation available with the product prior to the installation of MS SQL Server. Some suggestions:

- Approximately 20 MB of disk space for each 100 servers in the farm. The space used may increase if there is a large number of published apps, assigned printers, or imported drivers in the farm.

- Verify that enough disk space exists on the server to support the growth of the temp database, the farm database, and associated log files.

- Microsoft Terminal Server 4.0 requires that you install the Microsoft Data Access Components version 2.5 or later, MDAC 2.6 is recommended. However, with MDAC 2.6, the JET engine is no longer installed automatically and should be installed separately.

- The log files for the database should be placed on a different set of drives than the databases.

- The log files should be placed on mirrored drive sets, which will provide better access for the serial reads/writes normal to a log file.

- If incremental backups are to be supported, ensure that a DUMP TRAN runs at the end of each backup to clear the log of old transactions.

- If incremental backups are not going to be supported, set the database to 'truncate log on checkpoint.' This will impact database performance.

Tip: Make sure you stop the MS Terminal Services Licensing service before installing MDAC. Also be sure to reboot the server, before beginning MetaFrame XP installation. For more information see the Windows_Metaframe_MetaFrame XP_Guide pg. 40.

- MS SQL Server supports both NT and MS SQL Server Authentication. Consult your MS SQL Server documentation for configuring NT authentication support.

- For high security environments, Citrix recommends using NT Authentication only.

- The account used for the Data Store connection should have DBO rights on the database that is being used for the Data Store.

Note: If tighter security is required, after the initial install of the database as DBO, the user permissions may be modified to be read/write only. However, this practice may prevent future Service Packs or Feature Releases from being installed correctly. Always change permissions back to DBO during the initial install of a SP or FR.

- When using MS SQL Server in a replicated environment, be sure to use the same user account on each SQL Server for the Data Store Database.

- Each MetaFrame XP farm requires a dedicated database. However, you may run multiple databases on a single SQL server.

  Note: The MetaFrame XP farm should not be installed in a database that is shared with any other client server application.

- If you are installing more than 256 servers into a farm with a SQL Data Store, you must increase the number of worker threads available for the database. To do this:

  o Launch the SQL Server Enterprise Manager

  o Left click on the server name and select properties

  o Click on the Processor tab

  o Change the Maximum worker thread count from 256 to a number greater than the number of servers in your server farm.

- Follow Microsoft's recommendations for configuring database and transaction logs for recovery.

- The MetaFrame XP database should be backed up whenever a change is made using the Citrix Management Console.

- **Caution**: If the MetaFrame XP database is lost, the farm must be recreated from scratch. This will require running CHGFARM on all farm servers, then republishing all applications, etc. There is no way to "auto-build" the database from an existing farm.

Dedicating a XP Server as a ZDC

- Select properties of the farm

- Choose the Zones Tab

- Select the zone to be configured

- Select the server within the zone to be configured

- Choose Set Preference Option

- Choose Most Preferred

Creating New Zones

There will be times when scaling requirements will dictate that a new zone needs to be created. When this occurs, follow the procedures below:

- Select properties of the farm

- Choose the Zones Tab

- Choose New Zone

- Enter name of the Zone

- Move selected servers into the new Zone

  o Select Server to be moved

  o Select Move Servers Option

o   Select Target Destination

o   Select OK

Minimize Contention to the Data Store

- Contention to the database should be minimized.

- Farms should use a cycled reboot; limit reboots to one hundred servers at a time.

- Using clustered or replicated databases will allow more data to be handled throughout the farms without contention to the database.

- When using MS SQL Server in a replicated environment be sure to use the same user account on each SQL Server for the Data Store Database

- MetaFrame XP supports distributed databases. Distributed databases are useful when the data store begins to bottleneck due to too many read requests. In order to distribute the load of reads, distributed database can be used. MetaFrame XP needs to be assured of data coherency across multiple databases. Because of this, a two-phase commit algorithm must be used for writes to the database.

- When configuring MS SQL Server for a two-phase commit, Citrix recommends using the "Immediate Updating Subscriber" model. See Microsoft SQL Server documentation on how to setup replication with the immediate updating subscriber model.

Troubleshooting the Data Store

- To keep log space controlled, databases should have the "Truncate log on Checkpoint" option set.

- If you are installing more than 256 servers into a farm with a SQL Data Store, you must increase the number of worker threads available for the database. To do this:

  1. Launch the SQL Server Enterprise Manager

  2. Left click on the server name and select properties

  3. Click on the Processor tab

  4. Change the Maximum worker thread count from 256 to a number greater than the number of servers in your server farm.

- Follow Microsoft's recommendations for configuring database and transaction logs for recovery.

- The MetaFrame XP database should be backed up whenever a change is made using the Citrix Management Console.

Caution: If the MetaFrame XP database is lost, the farm must be recreated from scratch. This will require running CHGFARM on all farm servers, then republishing all applications, etc. There is no way to "auto-build" the database from an existing farm.

Troubleshooting a Zone

- If users experience slow connection time, consider dedicating a MetaFrame XP server for the ZDC.

- Monitor the CPU on the ZDC for performance degradations. In the event that the ZDC is overwhelmed with enumeration/resolution requests and/or regular reporting, subdivide the current zone into two zones to lessen the load on the ZDC.

Local Host Cache Troubleshooting

Sometimes servers or published applications are not properly displayed in the CMC. Incorrect data could be from a timing issue or from a corrupt LHC. Refreshing or recreating the LHC will remedy this situation.

Refreshing the LHC

If the IMA Service is currently running, but information in the Citrix Management Console (CMC) appears to be incorrect, you may attempt to force a manual refresh of the LHC using the DSMAINT command. From a command prompt on the server execute **DSMAINT REFRESHLHC**. If this fails to solve the problem, attempt to recreate the LHC.

Note: Refreshing the LHC only works if the IMA Service can be started. If the IMA Service cannot be started, try recreating the LHC as outlined in the next section.

Recreating the LHC

If the LHC appears to be corrupt and the IMA Service is running, attempt to refresh the LHC first. If this fails, or if the IMA Service will not start, attempt to recreate the database using the steps outlined below:

- Stop the IMA Service on the MetaFrame server.

- Launch the ODBC Data Source Administrator.

- Select the file DSN tab.

- Open the file in "c:\program files\citrix\independent management architecture\imalhc.dsn."

- Once that file is selected, click on create from the ODBC Setup screen.

- Enter any name except IMALHC for the new LHC Database.

- Exit the ODBC Data Source Administrator.

- In the registry change the value of \\HKLM\SOFTWARE\Citrix\IMA\RUNTIME\PSRequired from 0 to 1.

- Restart the IMA Service.

Note: The Data Store server must be available for this procedure to work. If the DS is not available, IMA Service will fail to start until the DS is available.

Field Issues

First Issue: MF XP unattended installation failed with an error message about 'not able to communicate with the Data Store (DS)' if the DS resides on a clustered SQL 2000 Server or if it is using a port OTHER THAN the default port 1433.   Manual installation in those scenarios was successful.

	SQL Port	Stand-alone SQL 2000 Server	Clustered SQL 2000 Server
Manual Install	1433	Success	Success
	1111	Success	Success
Unattended Install	1433	Success	Failure
	1111	Failure	Failure

The resolution is to change the server entry (from hostname to IP Address) in the ODBC DSN file used during XP installation.

Second Issue: MF XP installation failed with an error message about the 'IMA server failing to start' when using the NT Authentication method for MS SQL.

The NT account used for SQL access is APPSVCS\aptclustersvc.   The account was added to the local administrators group of the MetaFrame server and the XP installation still failed when logged in as that account. The resolution was to:

1. Add the appsvcs\aptclustersvc to the local administrators group of the MetaFrame server.

2. Modify the XP unattend.txt file to use appsvcs\aptclustersvc under the [Direct Connect Settings] section.

3. Run the MF XP installation as the local Administrator user account of the MetaFrame server.

"Hands on" MetaFrame XP

Citrix Management Console – CMC

"Ad hoc" lab work to publish applications, load manage applications and servers, add and activate licenses, add administrators, and explore functionality within the CMC.

Admin Functionality

Exploratory testing

Printer Management

Backend Printing

The backend printing method employs TCP/IP printing and network attached printers using print servers with print shares. Each MetaFrame user is mapped to their specific print shares.

Using the Backend Printing Model allows one to implement some of the new features of MetaFrame XP. MetaFrame XP allows the administrator, from the Citrix Management Console, to import printers from a multitude of print servers in the environment. The administrator can assign these network printers to the appropriate Active Directory users and groups. Only printers which the user has rights are visible from the user's MetaFrame sessions.

The figure below describes the path a print job takes when the Backend Printing method is implemented.
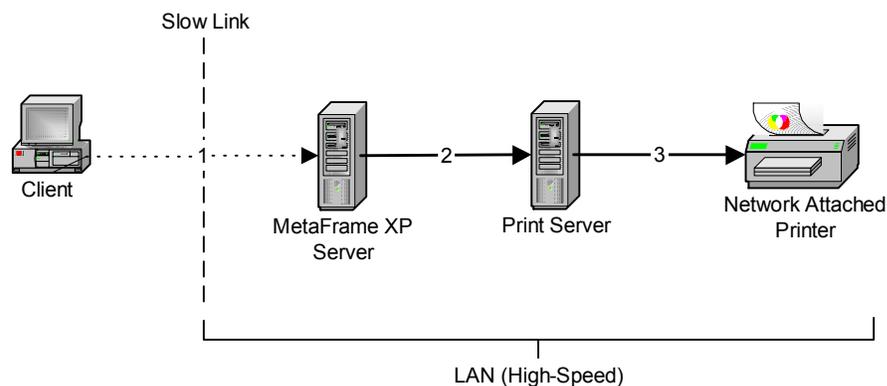

Figure 3

The following steps explain the above diagram.

1. The client clicks the print button from the application being used on the MetaFrame XP server. Mouse clicks are sent from the client workstation to the MetaFrame XP server.

2. The server responds to the print request by creating a spool file and sending it to the print server for printing. The spooled file can range in size from a few hundred Kilobytes to well over a few Megabytes.

3. The network print server sends the spooled file to the network-attached printer. The print job then prints.

Advantages:

- Network traffic is minimized because all print traffic is between the MetaFrame XP server, the print server, and the network-attached printer as opposed to the traffic traveling back to the client.

- Administration with this method is easier compared to the increased management effort required for the printer auto-creation method identified later in this document.

Disadvantages:

- This method does not support users with locally attached printers.

Printer Auto-Creation

Printer Auto-Creation allows for client access to locally attached printers as well as network-mapped printers. Using this method, as each user logs on, MetaFrame attempts to create new printer shares that map to their current Windows environment printers. During this process the MetaFrame server sends API calls to the client looking for printer specific information such as which port the printer is connected to, what network printers are mapped, what drivers are being used, and what properties have been set for these printers.

For example, when a Windows 98 user with an HP LaserJet 4 logs on, MetaFrame determines if it can create a printer share for this type of computer.   To do this, it attempts to match the Win98 user's printer driver name with:

- An exact match of the printer driver that is installed on the MetaFrame server,

- Or a "translation" of the printer driver name to a compatible driver. The list of compatible drivers is stored in the wtsuprn.inf file in the System32 directory.

If a match cannot be found, the print share will not be created.

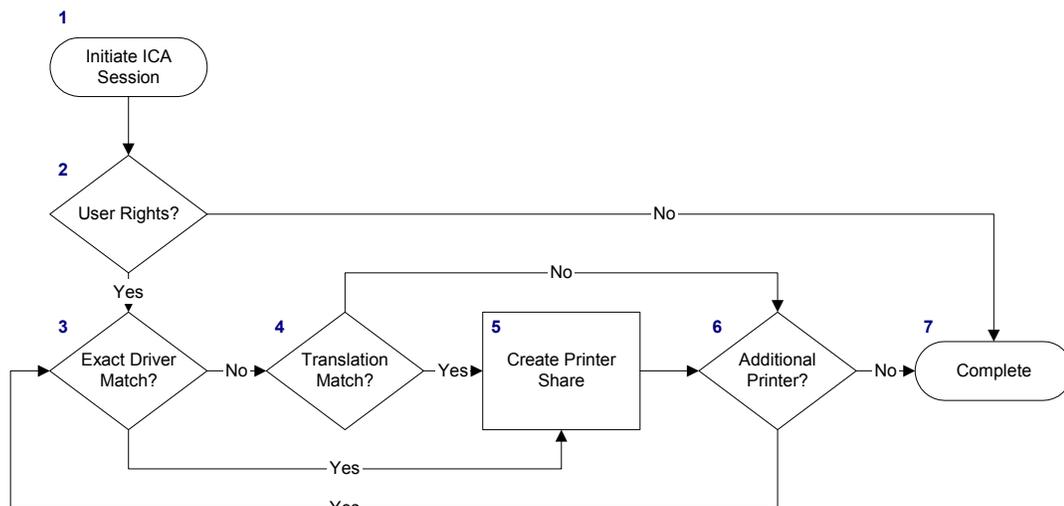The following flowchart shows the high-level steps involved during auto-creation of printers.

Figure 4 - Printer Auto-Creation

Step	Description
1. Initiate ICA Session	When a user logs in, a series of programs are run, including: ✓ Login Scripts ✓ Client Drive Mapping ✓ Printer Auto-creation ✓ Application Compatibility Scripts This flowchart details the steps associated with Printer Auto-creation.
2. User Rights?	MetaFrame determines if the user has the rights to "auto-create" a printer. These rights are set in the following places: ✓ Citrix Connection Configuration – Connection Client Settings: Do not Disable Windows Client Printer Mapping. ✓ W2K Active Directory Users and Computers – User Properties – Environment Tab: Do Connect Client Drives at Logon and Default to Main Client Printer. If the current user does not have the above rights, then no client printers will be mapped.
3. Exact Driver Match?	Each user's printers' drivers are matched against the printer drivers that are installed on the MetaFrame server. If an <u>exact</u> match for the driver description is found, then the client printer is mapped. Note that additional spaces and other subtle differences in driver description would cause this check to fail. These differences can occur between the same printer driver on different operating systems.
4. Translation Match?	Printer driver descriptions are then matched against the wtsuprn.inf file found in the System32 directory, if it exists. The file contains mappings between client printer driver descriptions and printer drivers that are installed on the MetaFrame server.

Step	Description
5. Create Printer Share.	The printer share for locally attached printers is created with the format of: #clientname/printername Network attached printers are created with the format of: #clientname\\PrintServer\ShareName
6. Additional Printer?	Steps 3 – 5 are repeated for each client printer.
7. Complete	Printer Auto-creation is complete and the remainder of the session initiation tasks begin.

The figure below describes the path a print job takes when the printer auto-creation method is implemented for locally attached printers.
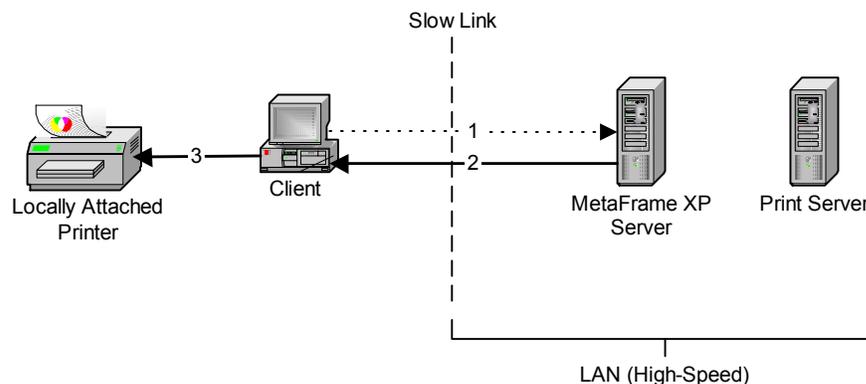

Figure 5 - Print Job Path for Locally Attached Auto-created Printers

The following steps explain the above diagram:

1. User indicates to the application being used on the MetaFrame XP server that they wish to print by clicking File, Print, and Enter. These user interactive steps involve mouse clicks and typing, which are sent through ICA to the MetaFrame XP server. The display response to the user is sent back through ICA to the Client Session.

2. The server responds to the print request by creating a spool file and sending it to the auto-created printer name on the MetaFrame XP server thereby sending it to the Citrix client running on the client computer for printing. The print job is sent through ICA using the Printer Virtual Channel. This data travels over the slow network link to reach the client. The spooled file can range in size from a few 100Kilobytes to well over a few Megabytes.

3. The Citrix client then sends the received spooled file to the locally attached printer and the print job prints.

The figure below describes the path a print job takes when the printer auto-creation method is implemented for locally mapped network printers.
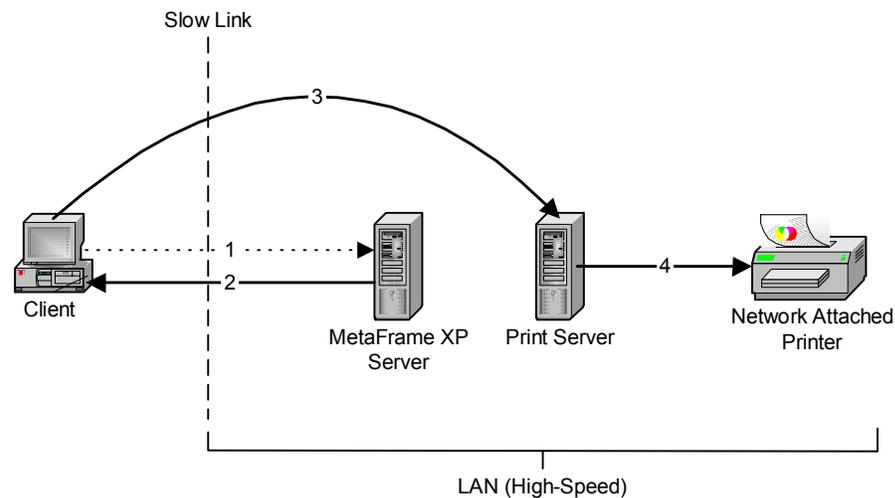
Figure 6 - Print Job Path for Locally Mapped Network Printers

The following steps explain the diagram above:

1. User indicates to the application being used on the MetaFrame XP server that they wish to print by clicking File, Print, and Enter. These user interactive steps involve mouse clicks and typing, which are sent through ICA to the MetaFrame XP server. The display response to the user is sent back through ICA to the Client Session.

2. The server responds to the print request by creating a spool file and sending it to the auto-created printer name on the MetaFrame XP server thereby sending it to the Citrix client running on the client computer for printing. The print job is sent through ICA using the Printer Virtual Channel. This data travels over the slow network link to reach the client. The spooled file can range in size from a few 100 Kilobytes to well over a few Megabytes.

3. The client printer is a network printer from a print server. The client must send the spool file to the network print server.

4. The network print server sends the spooled file to the network-attached printer that then prints the job.

The two-hop count on this scenario might not sound overwhelming, but large print jobs will make the process take an eternity in the client's eyes. This configuration is aimed at systems where printing is not constant or the size of print jobs is fairly small.

This type of architecture should only be used in environments where Remote Printing and Backend Printing do not fit. This model provides for the slowest print throughput of the three models.

Advantages:

- Locally attached printers or mapped network printers are automatically created.

Disadvantages:

- When clients connect over slow network links or dial-up print jobs have to make one slow network hop for locally attached printers or two slow network hops for locally mapped network printers. Given this print jobs will be slower than the back-end method, which may be viewed as a negative from the client's perspective.

- Large print jobs could negatively impact the network connection between the client and server.

- The process of supporting users' expectations of broad printer compatibility can be time-consuming

Questions and Comments

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