



Implementing RDM in a Wide Area Network

A White Paper

May 10, 2006

Notes:

Visit www.ibm.com/pc/safecomputing periodically for the latest information on safe and effective computing.

Warranty Information: For a copy of applicable product warranties, write to: Warranty Information, P.O. Box 12195, RTP, NC 27709, Attn: Dept. JDJA/B203. IBM makes no representation or warranty regarding third-party products or services.

Before using this information and the product it supports, read the general information in "Notices," on page 36.

© Copyright International Business Machines Corporation 2005, 2006. All rights reserved.

U.S. Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Table of contents

1. PREFACE	5
1.1 WHO SHOULD READ THIS WHITE PAPER	5
1.2 ASSUMPTIONS	5
1.3 FURTHER REFERENCE	5
1.3.1 <i>Guides</i>	5
1.3.2 <i>White Papers</i>	6
1.3.3 <i>Online help</i>	6
1.3.4 <i>Links</i>	6
1.4 CHANGE HISTORY	6
2. OVERVIEW	7
3. RDM CONCEPTS	9
3.1 COMPONENTS	9
3.1.1 <i>RDM Server</i>	9
3.1.2 <i>RDM Deployment Server</i>	9
3.1.3 <i>RDM Console</i>	9
3.1.4 <i>Target systems</i>	9
3.2 SAMPLE ENVIRONMENT	9
3.3 NETWORK PROTOCOLS	11
3.3.1 <i>RDM Console – RDM Server</i>	11
3.3.2 <i>RDM Server – RDM D-Server</i>	11
3.3.3 <i>RDM D-Server – Target Systems</i>	11
3.4 NETWORK PORTS	12
3.5 NETWORK-CONFIGURATION PREREQUISITES	12
3.5.1 <i>DHCP Server</i>	12
3.5.2 <i>Link speed and duplex settings</i>	14
3.5.3 <i>Router/switch/firewall settings</i>	14
3.6 RDM REPOSITORY	16
3.6.1 <i>What is a repository?</i>	16
3.6.2 <i>Master repository</i>	16
3.6.3 <i>Remote repository</i>	16
3.6.4 <i>Directory structure</i>	16
3.7 FILE REPLICATION	17
3.7.1 <i>What is replication?</i>	17
3.7.2 <i>How to replicate</i>	17
3.7.3 <i>Controlling when replication occurs via the network</i>	22
4. INSTALLING AND CONFIGURING RDM	25
4.1 INSTALLING THE DIRECTOR SERVER	25
4.2 INSTALLING THE RDM SERVER	25
4.3 CONFIGURING THE RDM SERVER	25
4.4 INSTALLING A DIRECTOR CONSOLE	28
4.5 INSTALLING AN RDM CONSOLE	28
4.6 INSTALLING A REMOTE RDM D-SERVER	28
4.7 CONFIGURING THE REMOTE RDM D-SERVER	28
5. TESTING YOUR RDM INSTALLATIONS	31
5.1 TESTING THE RDM SERVER	31
5.1.1 <i>RDM Server's subnet</i>	31
5.1.2 <i>Other local subnets</i>	34
5.2 TESTING THE RDM CONSOLE	35
5.3 TESTING THE REMOTE RDM D-SERVER	35
5.3.1 <i>RDM D-Server's subnet</i>	35

5.3.2	<i>Other local subnets</i>	35
6.	NOTICES	36
6.1	EDITION NOTICE	36
6.2	TRADEMARKS	36
7.	GLOSSARY	39

1. Preface

This White Paper explains how to install and use IBM® Remote Deployment Manager (RDM) in a Wide Area Network (WAN). It applies to RDM 4.30, and later releases.

The procedures described in this paper accomplish their desired functions in a variety of ways. There are alternate techniques available for doing most or all of these functions. The intent is to illustrate various methods as well as to describe a way to implement these particular functions. To use these procedures in your own environment will probably require some extrapolation on your part.

You can use this White Paper to learn how to do the following:

- Install an RDM server.
- Install an RDM remote deployment server (D-Server).
- Configure RDM.
- Understand the RDM repository.
- Understand RDM file replication.

1.1 Who should read this White Paper

This paper is intended to help skilled RDM administrators to create deployment procedures and to understand the concepts involved. To effectively use this paper, you should already have an extensive knowledge of your Network environment, your RDM environment, DOS batch files, and standard installation techniques for Windows applications.

1.2 Assumptions

This paper assumes that you have installed RDM, on Windows, in its default location: C:\Program Files\IBM\RDM. If you have installed RDM in a different location or on Linux, you will have to make the necessary adjustments to the file paths.

1.3 Further reference

In addition to this paper, there are various other sources of information that you can consult for RDM and for RDM Custom tasks.

1.3.1 Guides

The following product documentation is available for RDM:

- *Remote Deployment Manager 4.30 Users Reference* – The main reference manual for RDM
- *Remote Deployment Manager 4.30 Installation and Configuration Guide* – Describes the complete installation process of RDM
- *Remote Deployment Manager 4.30 Compatibility Guide* – Lists RDM-supported hardware and software

Check the IBM Web site at <http://www-307.ibm.com/pc/support/site.wss/document.do?Indocid=MIGR-56662> to get the current versions of the above documents.

1.3.2 *White Papers*

The various RDM white papers are available on the IBM Web site at <http://www-307.ibm.com/pc/support/site.wss/document.do?Indocid=MIGR-53487>.

1.3.3 *Online help*

In general, every window has online help available (except for some message windows or other windows where no help is applicable), either using a **Help** menu or a **Help** button.

1.3.4 *Links*

The following links are available for further information:

- Support is available for supported systems (IBM and non-IBM) through e-mail or fee-based telephone support. Telephone support is not available in all countries. For more information about the fee-based telephone support, go to <http://www.ibm.com/support> or <http://service.software.ibm.com/supportline.html>. For more information about e-mail support, refer to the RDM home page.

Important: Before using RDM, check the compatibility test results and browse the rest of the RDM Web site for additional information and tips concerning the installation and use of RDM.

1.4 **Change history**

- May 10, 2006 – Replaced pictures with RDM 4.30 versions. Updated the network ports table. Other minor modifications.

2. Overview

RDM is an effective tool for deployment in a WAN. This environment was a key design point for RDM. The idea is to initiate deployment work from your office, even though the target systems may be in several remote locations (e.g., in different cities).

The basic environment is:

- A main site, which contains the data bases, the master repository, the deployment processing logic, and a console.
- Remote sites, which contain a distributed repository (a subset of the master repository) that allows the remote systems to access the RDM images on their local LAN.
- Remote consoles, from which you will manage deployment for your enterprise. That is, you will manage deployment from a computer in your office, which can be anywhere in your network.

Implementing RDM effectively in this kind of environment requires several work items:

1. Education – You need to understand several concepts, including RDM general concepts, RDM's external structure, how RDM deploys systems across a WAN, RDM's repository, and RDM's replication function.
2. Planning and design – You must figure out your deployment strategy, how many servers to use, whether you need to make network configuration changes and how to do them, all of your deployment procedures, and your procedures for installing the RDM components.
3. Design validation – You should install RDM in a pilot environment (which could be a subset of your production environment) to validate your design.
4. Implementation – You then install RDM in your production WAN environment.
5. Test – Run the required tests to validate that your production environment is working as desired.

The chapters below describe how to do the above work items.

3. RDM Concepts

Some of the topics in this white paper are complex. In order to establish a knowledge base, we briefly describe a few significant concepts in this chapter.

3.1 Components

There are 4 basic components to any RDM environment:

3.1.1 *RDM Server*

The RDM Server is an IBM Director Server on which RDM server software is installed. It controls all RDM processing, and it monitors status communication from the target systems.

3.1.2 *RDM Deployment Server*

The RDM Deployment Server (D-Server) is RDM's file server. It delivers all programs and data files to the target systems. It also handles all communication between the RDM server and the target systems.

There is always a Master D-Server, which is located on the RDM Server. It contains the entire RDM repository.

You can optionally have Remote D-Servers. They are typically located at different sites and are connected to the RDM Server over a WAN. A Remote D-Server contains a subset of the RDM repository.

3.1.3 *RDM Console*

The RDM Console is an IBM Director Console on which RDM console software is installed. It is the primary user interface into RDM.

There is always at least one RDM Console, which is located on the RDM Server. You can optionally have other RDM Consoles. It is a best practice to have RDM consoles on your own desktop and laptop computers.

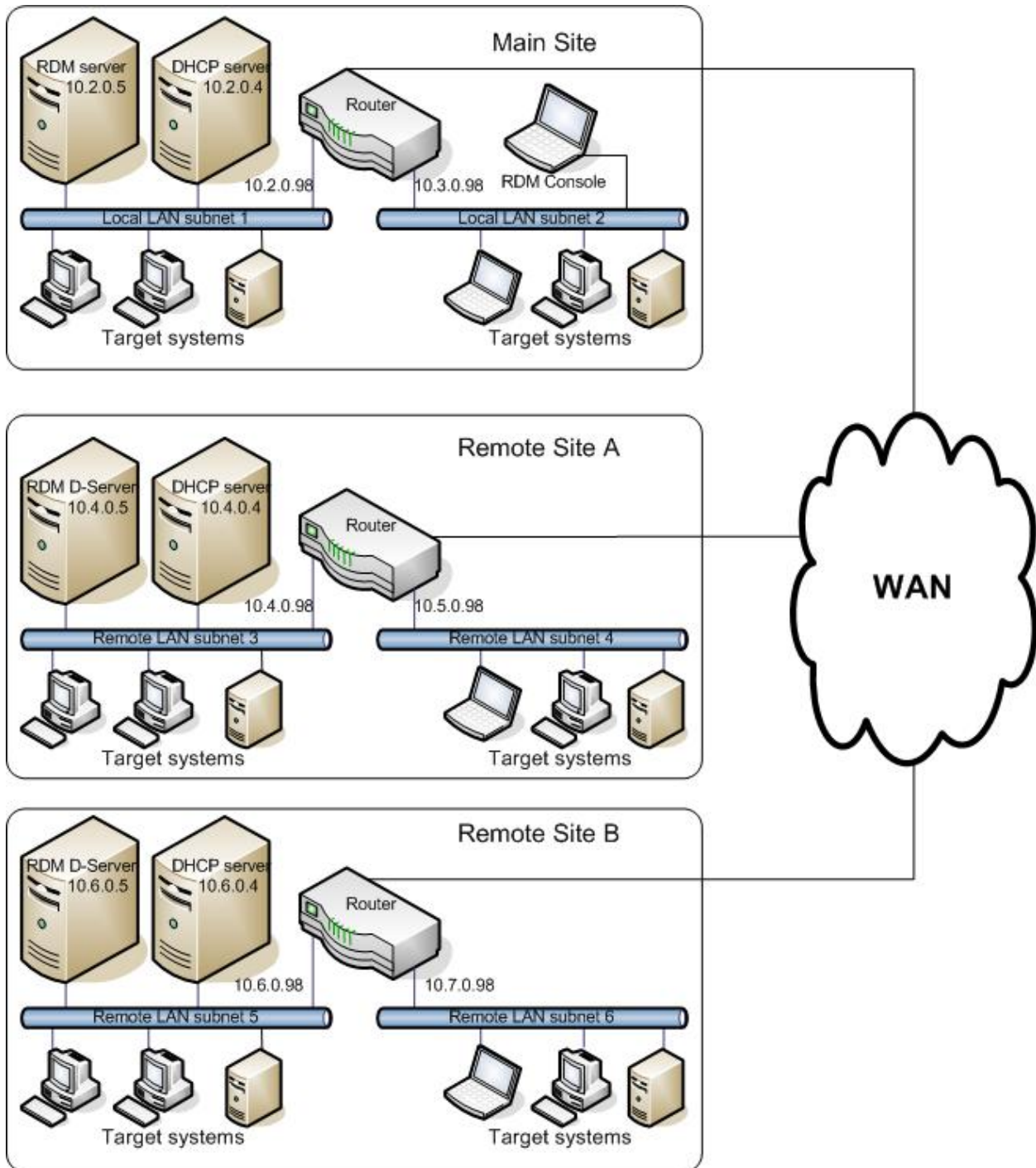
3.1.4 *Target systems*

The target systems are the systems that RDM deploys.

3.2 Sample environment

Consider the following (simplified) picture. It contains 3 sites. Each site contains a campus LAN (that is, each site contains several subnets). We assume that the deployment department is located at the main site.

We will use this example throughout this white paper.



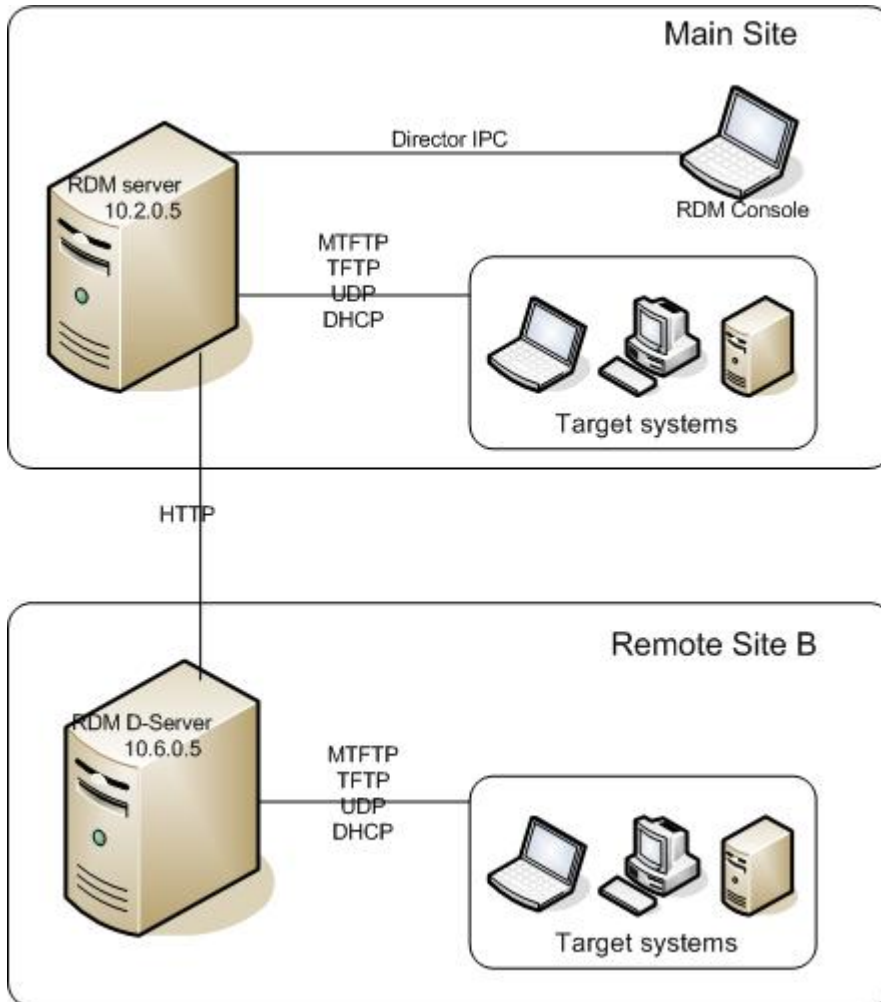
The objective is to be able to run deployment tasks on any of the target systems in the picture, and to initiate that deployment work from someone's office.

Note: There is no restriction on where the office is located. The initiation of deployment tasks may actually be done from any RDM console at any location within the WAN.

This white paper is intended to describe WAN configurations with many (1 or more) remote sites. Our example uses 2 remote sites. Assume that our example uses subnet masks 255.255.240.0 or 255.255.255.0, depending on subnet.

3.3 Network protocols

Consider the following (simplified) picture. It shows the communication protocols used by RDM.



There are several significant points:

3.3.1 RDM Console – RDM Server

Communication between the RDM Console and the RDM Server uses IBM Director's proprietary IPC protocol. This is actually a TCP session.

An RDM Console can be located anywhere in your network, as long as your routers and firewalls are configured to allow the IPC protocol. See the appropriate *IBM Director Installation and Configuration Guide* for information on this network configuration.

3.3.2 RDM Server – RDM D-Server

Communication between the RDM Server and any remote D-Server uses HTTP protocol.

This communication typically consists of small messages. However, if RDM Replication (see below) is enabled, then large amounts of data can go over this path.

3.3.3 RDM D-Server – Target Systems

All communication with the target systems goes through a D-Server. This means that all data entering or leaving a target system travels over your LAN (and not necessarily over your WAN).

3.4 Network ports

See the appropriate *IBM Director Installation and Configuration Guide* for information on the network ports used by IBM Director.

The following table lists the RDM ports used in an RDM environment.

Category	Connection	Default	Permissible	Comments
UDP	D-Server	69	69	MTFTP server for unicast listen/send.
UDP	D-Server	1759	1759	MTFTP server for multicast listen.
UDP	D-Server	4016 – 6016	4016 – 65535	MTFTP server listen/send.
UDP	D-Server	67	67	Proxy DHCP server listen/send, if not on D-Server.
UDP	D-Server	4011	4011	PXE server listen/send.
UDP	D-Server	4012	4012	UDP server listen.
UDP	D-Server	5011	5011	PXE server update listen.
TCP	D-Server	1234	1024 – 65535	HTTP server listen.
UDP	Target system	1758	70 – 65535	Multicast TFTP client listen/send.
UDP	Target system	4015	4015	Unicast TFTP client listen/send.
UDP	Target system	68	68	PXE client listen/send.
UDP	Target system	2070 ~	NIC dependent	PXE TFTP client listen/send.

3.5 Network-configuration prerequisites

RDM places a few requirements on your network configuration. Consult the latest *RDM Installation and Configuration Guide* for details. If the network is improperly configured, then RDM may work very slowly, or it may not work at all. Although these requirements are conceptually straightforward, they can occasionally be difficult to get right. Therefore, we will describe them here, too.

3.5.1 DHCP Server

3.5.1.1 Requirement

RDM requires that a DHCP server (i.e., one or more) be present. The DHCP servers collectively must serve every subnet on which you will have target systems. That is, they must have a scope of IP addresses for each of those subnets.

3.5.1.2 Installing RDM

Whenever you install an RDM D-Server, the RDM installation program displays a D-Server Configuration dialog. That dialog contains 2 check boxes related to your DHCP configuration:

- DHCP Server is local – Check this box if you are installing the RDM D-Server on the same computer as your DHCP Server. RDM needs to know this information, because it affects the port numbers that RDM will use during the PXE boot.
- Microsoft DHCP Installed – If your DHCP Server is local and is also the one included with Microsoft Windows, then check this box, too. This will cause the install program to run this RDM batch file to configure DHCP option 60: C:\Program Files\IBM\RDM\bin\PXEDHCP.BAT.

If you already installed RDM and got this part wrong, you can fix it by the following procedure:

1. Edit file `c:\Program Files\IBM\RDM\local\DSERVER.INI`, and change the `LocalDhcpServer` value to the appropriate value (*no* or *yes*).
2. Restart the IBM RDM D-Server service.

You can also run `C:\Program Files\IBM\RDM\bin\PXEDHCP.BAT` manually, if appropriate.

In our example, because none of our DHCP servers is installed on an RDM D-Server, we checked neither of these boxes during RDM installation.

3.5.1.3 DHCP options required by RDM

If you already had DHCP installed and working before you installed RDM, you probably will not have to change the DHCP configuration in order to use RDM. This section describes all of RDM's DHCP requirements.

3.5.1.3.1 Option 3

If there is a router in your configuration (as in our example), then each DHCP scope must have Option 3 configured with the value of its subnet's gateway IP address.

Subnet	DHCP Options	Value
10.2.0.x	3	10.2.0.98
10.3.0.x	3	10.3.0.98
10.4.0.x	3	10.4.0.98
10.5.0.x	3	10.5.0.98
10.6.0.x	3	10.6.0.98
10.7.0.x	3	10.7.0.98

If there is no router in your configuration, then your DHCP scope should not have Option 3 configured.

3.5.1.3.2 Option 60

If the DHCP server is installed on the same computer as an RDM D-Server, then each DHCP scope must have Option 60 (PXEOption, its value is PXEClient) configured. This would be an unusual configuration (most users will have DHCP separate from RDM), but it can be done this way. If you configure this option incorrectly, then your RDM target system's PXE boot may fail with error *PXE-E53 No boot filename received* or some other error.

If the DHCP server is not installed on the same computer as an RDM D-Server, then all DHCP scopes must not have Option 60 configured. This is the most common configuration. If you configure this option incorrectly, then your RDM target system's PXE boot may fail with error *PXE-E53 No boot filename received* or some other error.

Note: The RDM D-Server install program may be able to configure Option 60 for you. It runs the RDM batch file `C:\Program Files\IBM\RDM\bin\PXEDHCP.BAT`, which can set this option on the Microsoft DHCP server that is part of a Windows 2000 or 2003 server operating system.

3.5.1.3.3 Other options

You may also have other DHCP options configured, but they are not RDM related. Examples include Option 6 (DNS Servers), Option 15 (DNS Domain Name), Option 44 (WINS/NBNS Servers), and Option 46 (WINS NBT Node Type).

Note: You should **not** be using Option 66 or Option 67.

3.5.1.4 Conflict detection attempts

If you have a Microsoft Windows DHCP Server, it has a configuration parameter called *Conflict detection attempts*. We recommend that you set its value to 0, the default value. If you want to use another value, then set it to 1. If you set it to a higher value, then an RDM target system's PXE boot will probably time out, perhaps intermittently, making your RDM tasks fail indiscriminately.

Note: If you are experiencing duplicate IP addresses on your network, we recommend that you change your business procedures to avoid that problem. Using this parameter as a workaround is not recommended.

3.5.2 Link speed and duplex settings

You must configure these settings to *Autonegotiate* (or equivalent, depending on the brand of hardware or software). Do this on the following:

- Switch ports
- Network adapters (NICs)

That is, let the NIC and switch negotiate the appropriate setting.

If you configure a different setting, the likely result is a performance degradation of up to 500%, or worse.

Note: If you have set this to an explicit value because of another application that does not work with *Autonegotiate*, then we recommend that you fix that other application. Circumventing one problem by introducing another problem is the wrong tactic.

3.5.3 Router/switch/firewall settings

These are the settings that occasionally are difficult to get right. It's pretty easy on a simple network, but in today's environments, the network configurations are often quite complex. The complexity offers greater performance and security, but it can make it hard to find all the places that you might need to change.

There are 3 distinct communication situations that you must consider:

- Between a remote RDM Console and the RDM Server.
- Between the RDM Server and a remote RDM D-Server.
- Between an RDM D-Server and the target systems.

We will consider each in the sections below.

3.5.3.1 RDM Console ↔ RDM Server

The only requirement is that you enable TCP protocol on the appropriate ports. See the appropriate *IBM Director Installation and Configuration Guide* for information on the network ports used by IBM Director.

3.5.3.2 RDM Server ↔ RDM D-Server

There are 2 requirements:

- Enable HTTP protocol on port 1234 (or on whatever port you entered when you installed RDM).
- Disable Spanning Tree Protocol on all ports to which a computer is connected.

Important: Do not disable Spanning Tree Protocol on ports to which a router or switch is connected.

Note: A somewhat equivalent setting, for Cisco switches, is to enable both Spanning Tree Protocol and Port Fast.

3.5.3.3 RDM D-Server ↔ target systems

There are 5 requirements:

- Enable subnet-directed broadcast to all subnets that the D-Server serves. This is what enables RDM's Wake-on-LAN (WoL) capability to power on the target systems when it starts running a task.

In our example, RDM will send its WoL Magic Packet to one of the following subnet-directed broadcast addresses (depending on which subnet the target system is located): 10.2.0.255, 10.3.0.255, 10.4.0.255, 10.5.0.255, 10.6.0.255, and 10.7.0.255. There will never be a problem with systems on the 10.2.0.x, 10.4.0.x, and 10.6.0.x subnets, because their D-Server is on the same subnet. But if you don't enable subnet-directed broadcast to the 10.3.0.x, 10.5.0.x, and 10.7.0.x subnets, RDM will not be able to power on any system in those subnets.

Important: Do not enable all broadcast forwarding. Just enable subnet-directed broadcast forwarding to your specific target subnets.

- Enable BOOTP/DHCP forwarding to the RDM D-Server. During a PXE boot, there are (at least) 2 DHCP servers that respond:
 - The DHCP server will offer an IP address.
 - The RDM Proxy DHCP server will offer the path, name, and location of a boot file.

If DHCP is already working in your routed environment, then you have already enabled BOOTP/DHCP forwarding to the DHCP server. You also must enable BOOTP/DHCP forwarding to the RDM D-Server (in a similar way).

For example, for Cisco switches, this parameter is called an *IP Helper Address*.

In our example, we already had helper addresses of 10.2.0.4, 10.4.0.4, and 10.6.0.4 on our respective switches (to enable the DHCP server to serve the 10.3.0.x, 10.5.0.x, and 10.7.0.x subnets, respectively). We had to add helper addresses of 10.2.0.5, 10.4.0.5, and 10.6.0.5 on our respective switches (to enable the RDM D-Server's Proxy DHCP server to serve the 10.3.0.x, 10.5.0.x, and 10.7.0.x subnets, respectively).

- Enable Proxy ARP forwarding.

RDM uses a DOS network stack that uses ARP. ARP is a broadcast-based protocol, so cannot cross routers. Proxy ARP, by allowing the router to act as a surrogate host, allows ARP resolution across a router, so that communication can exist between the RDM target systems and the RDM D-Server (across a router).

If your router provides another method, you can use it. Most routers use a built-in Proxy ARP agent anyway. Most enable it by default; some do not let you disable it; some do. On many modern routers, a default gateway on client TCP/IP stacks is sufficient to overcome ARP across a router, as the router simply ignores Proxy ARP settings, and treats the packet on the basis of its arrival at the default gateway (the router).

- Enable Multicast (IGMP/ICMP) forwarding. RDM uses a multicast TFTP protocol in its Windows, Linux, and VMware native install tasks. It substantially reduces the network load when deploying one of these tasks concurrently to multiple systems.

Use of multicast in RDM is optional. If you prefer not to use it, you can just disable it by unchecking the *Enable Multicast* box when you install the RDM D-Server. You can, instead, disable it later, by unchecking the *Multicast Enabled* boxes in the RDM Console's *Deployment Server Management Options* window.

- Disable Spanning Tree Protocol on all ports to which a computer is connected.

Important: Do not disable Spanning Tree Protocol on ports to which a router or switch is connected.

Note: A somewhat equivalent setting, for Cisco switches, is to enable both Spanning Tree Protocol and Port Fast.

Spanning Tree Protocol (STP) is an inter-switch protocol, **not** understood by computers, and hence of no consequence to computers **directly** connected to the port. STP is to stay enabled on ports that are connected to other switches or routers.

To read more, here is a URL: http://www.cicprep.com/WebHelp/ccna/ccna_obj_58.htm. You will see that it clearly talks about bridges communicating. Nothing is said about computers. (For more information, you can do a web search on "Spanning Tree Protocol").

In any case, DOS predates STP by quite a few years, and STP was not made compatible with DOS computers, not the least reason being that all ports with STP are shut down while the tree is being updated. If a DOS computer tries to connect at that time, it will not be able to find a route and will indicate a failure of the network connection.

There is a clear choice here. Disable a protocol that is of no use, and get the benefit of RDM; or make a decision not to use RDM because one prefers to use something that is of no benefit, anyway.

3.6 RDM repository

In this section, we define the term *repository* as it is used in RDM.

3.6.1 What is a repository?

An RDM repository is a set of directories, on an RDM D-Server, that contains all of the files that RDM needs to run its tasks. It is the C:\Program Files\IBM\RDM\repository directory.

3.6.2 Master repository

The master repository is the one in the D-Server that is installed as part of the RDM Server.

3.6.3 Remote repository

Each D-Server that is installed on a different server from the RDM Server contains a remote repository. Its content is a subset of the master repository.

3.6.4 Directory structure

The following table is a subset and modification of the table shown in Appendix C of the *RDM User's Reference*. All of the directories in the table are in C:\Program Files\IBM\RDM\repository.

Directory	Contents
drivers	The RDM device-driver repository for the <i>Windows Native Install</i> template. It is a set of ZIP files and a batch file.
environment	Bootstrap loader programs, DOS and Linux system environments.
environment\dos	Programs that run in DOS, including a ZIP file of commonly used DOS programs.
environment\etc	Programs that run in Linux.
environment\win32	Programs that run in 32-bit Windows.
image	RDM images. These are all typically created with the <i>RDM Image Management</i> function. An image can be 1 file, 2 files, or a directory that

	contains several files.
template	A directory for each RDM template. Note that a remote repository may contain a subset of the directories and files in this folder tree.
template \<n>	A directory for template <n>. Each of these contains a directory that contains the template files, plus a directory for each task.
template \<n>\<m>	A directory for task <m> under template <n>. It contains the task files. The <m> directory with the lowest value contains the template files.
winpe	Windows PE for use by the <i>Windows Native Install</i> task for 64-bit Windows.
wnihal	Files related to the Windows Hardware Access Layer for certain IBM systems. These are used by the <i>Windows Native Install</i> task.
wnihives	Files that are used to modify the Microsoft hivesft files in the Windows registry. These are used by the <i>Windows Native Install</i> task.

Note: For security reasons, the RDM MTFTP.EXE program is configured to read files only from the repository directory tree. That program can, in general, write files only to the C:\Program Files\BM\RDM\temp directory. If the file extension is LOG, RDM will always write that file to the C:\Program Files\BM\RDM\log directory.

3.7 File replication

In this section, we define the term *replication* as it is used in RDM.

3.7.1 What is replication?

Replication is copying files from the master repository to the remote repositories.

3.7.2 How to replicate

3.7.2.1 Automatic replication

This is an on-demand replication. The first time a task running on a system at a remote site requests a file that is not in the remote repository, RDM automatically downloads it from the master repository to the remote repository.

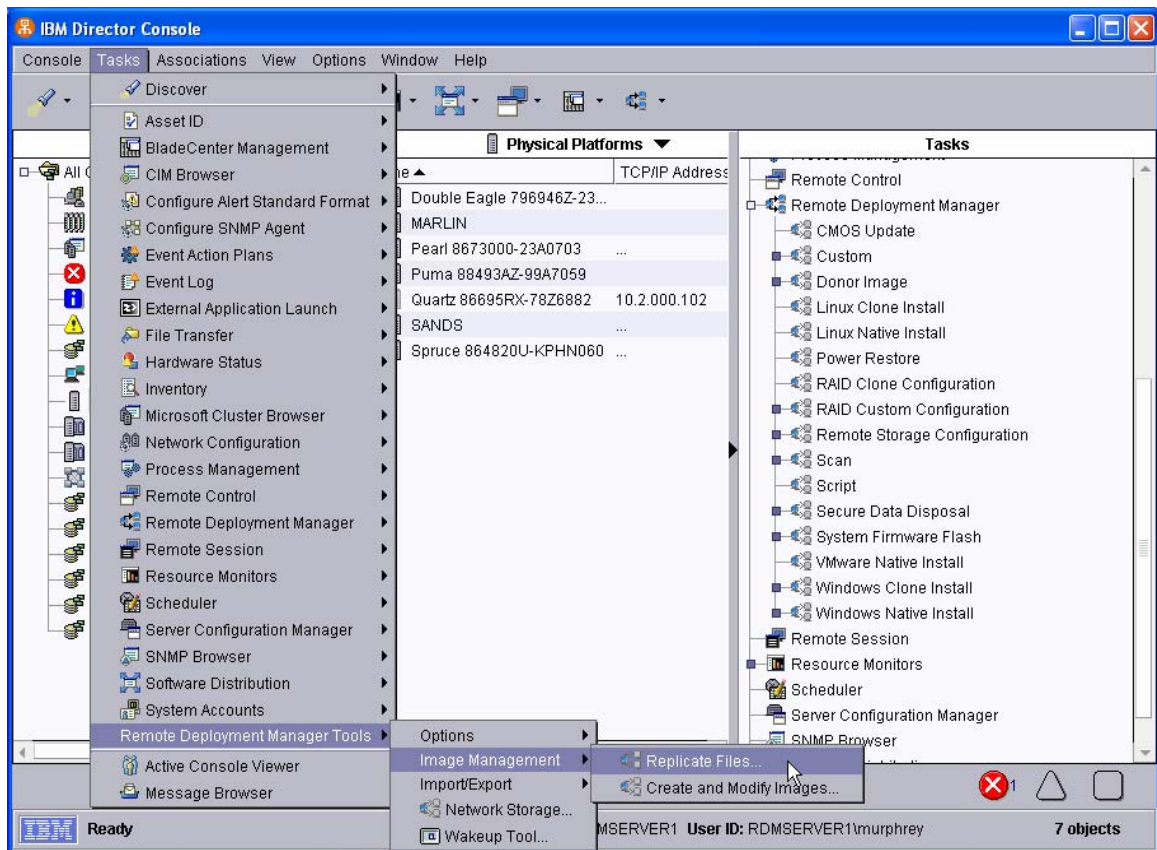
The task pauses during that download. It polls the remote D-Server at regular intervals to see if the file is in the remote repository. Once it gets an affirmative answer to its polling, the task resumes and downloads and uses the file. To minimize network traffic, this polling is currently set to 1-minute intervals. Therefore, even a small file takes at least 1 minute to replicate.

To use automatic replication, check the Replication Enabled box in the *Deployment Server Management Options* window (see screen picture in section 3.7.3 below).

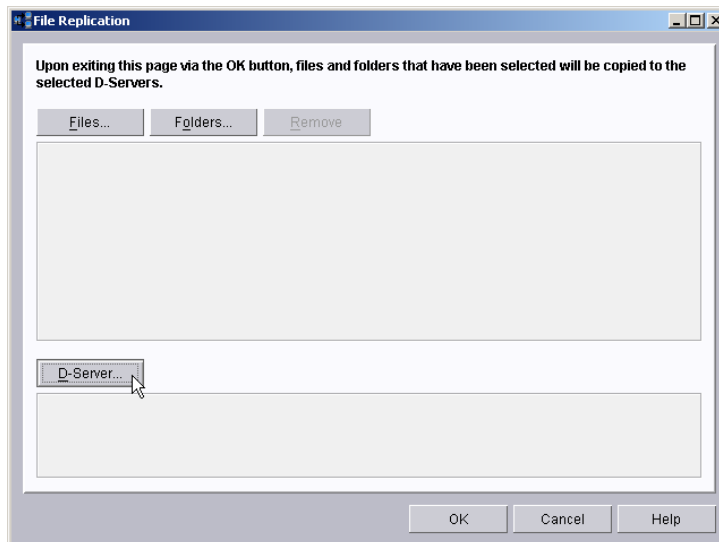
3.7.2.2 Replication via Image Management

You can explicitly replicate files using the RDM *Image Management* tool.

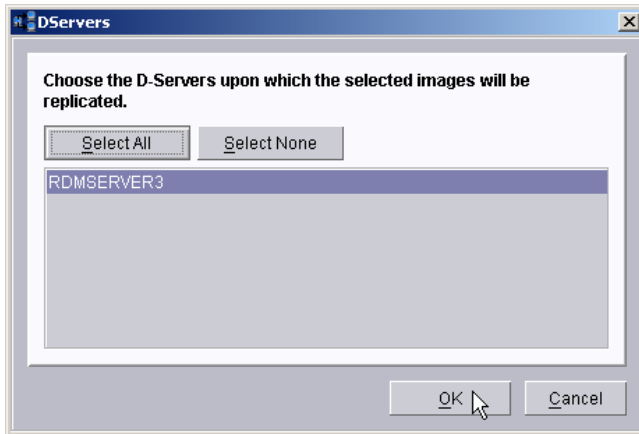
1. Use the menus shown in the picture below to open the *File Replication* dialog.



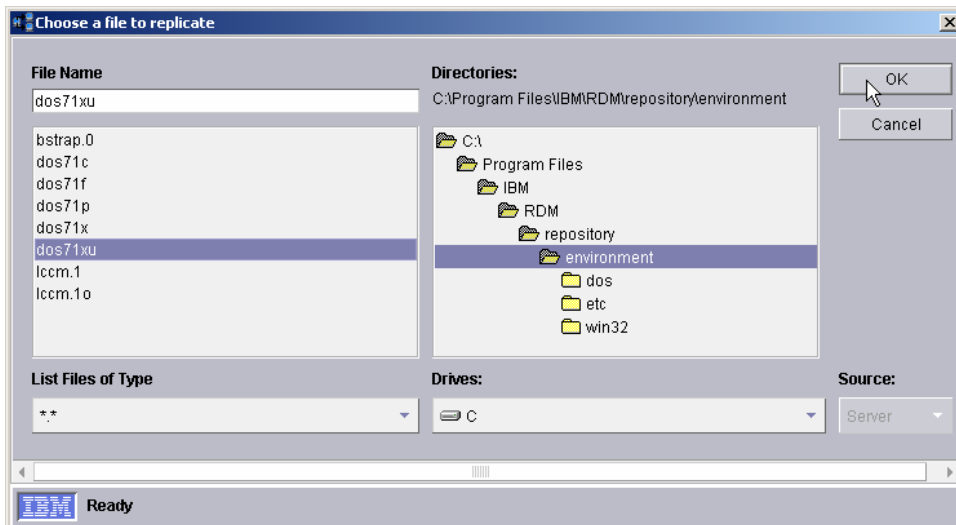
2. In this dialog, you must select which D-Servers are the targets of your replication. Select the *D-Server...* button.



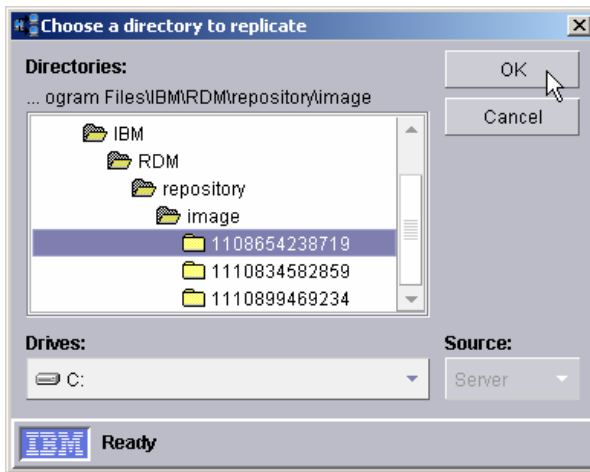
3. This displays the *DServers* dialog.



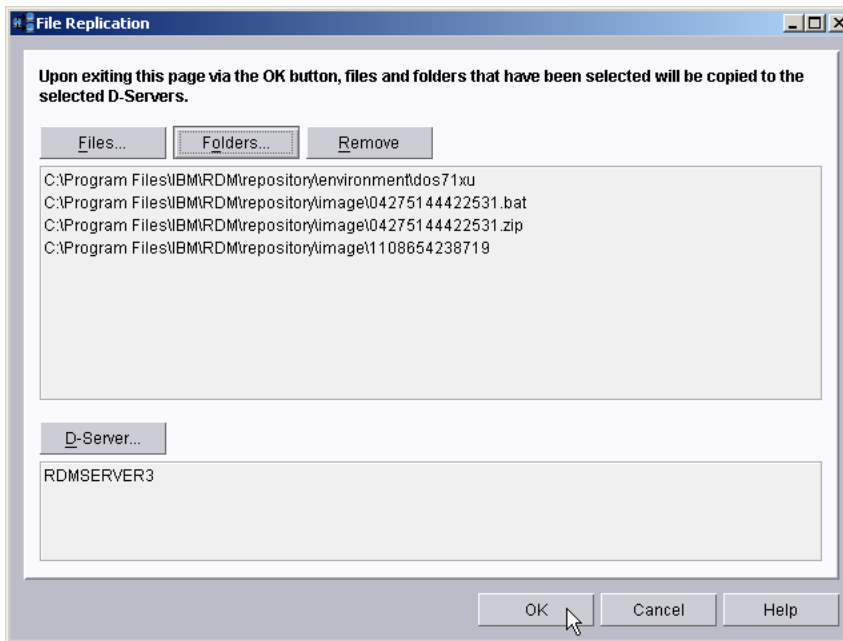
4. Select the appropriate D-Servers from the list, and then select the *OK* button.
5. Then select the *Files...* button on the *File Replication* dialog.
6. This displays the file dialog, named *Choose a file to replicate*. Navigate to the file you want to replicate. Then press the *OK* button.



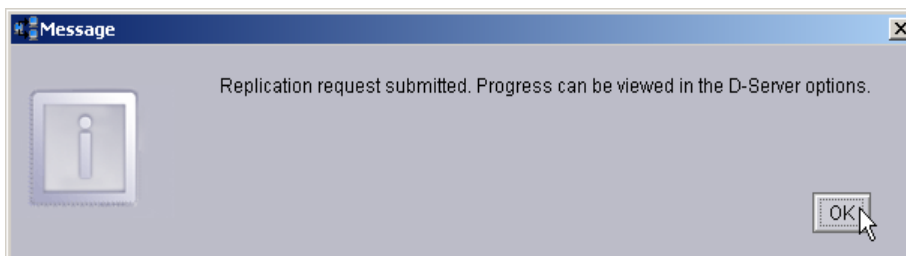
7. Repeat the last 2 steps for each file that you want to replicate.
8. Then select the *Folders...* button on the *File Replication* dialog.
9. This displays the file dialog, named *Choose a directory to replicate*. Navigate to the directory you want to replicate. Then press the *OK* button.



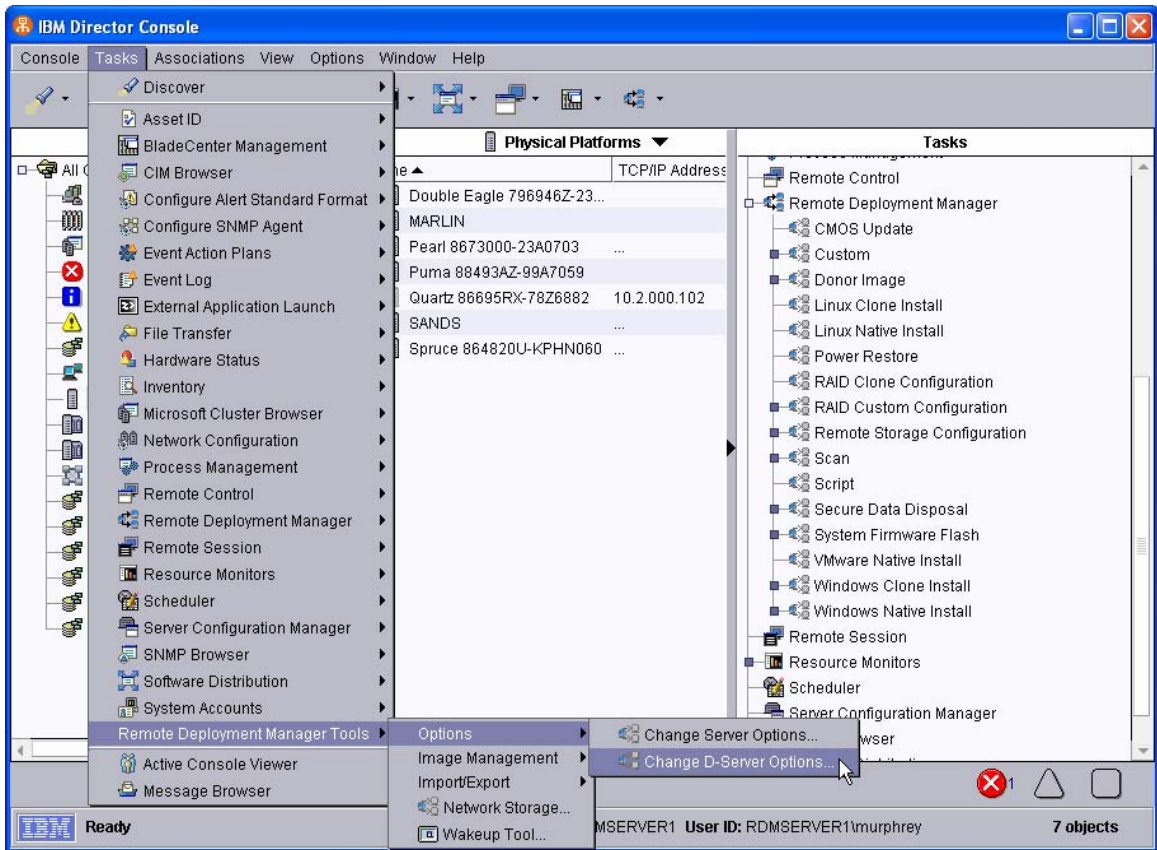
10. Repeat the last 2 steps for each directory that you want to replicate. Now the File Replication dialog will contain all of the files, directories, and D-Servers that you selected.



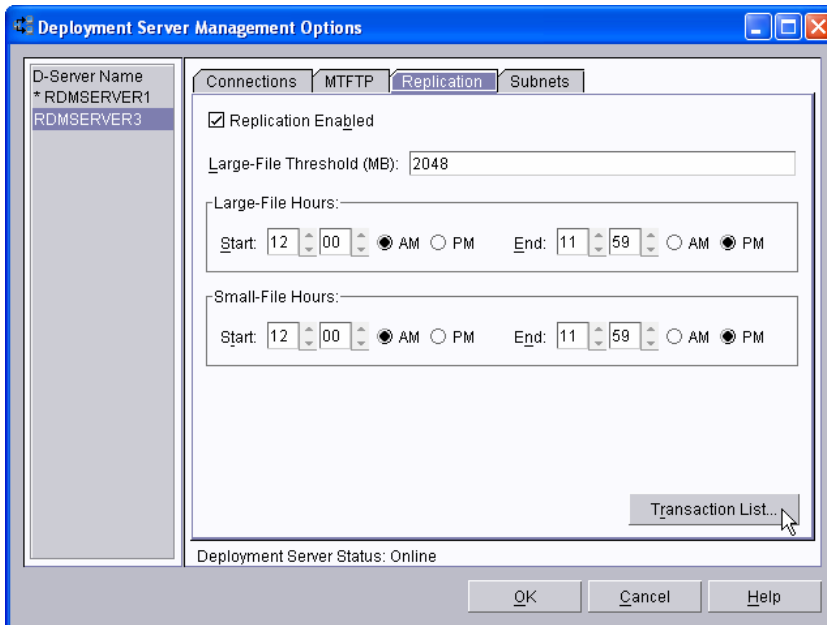
11. Select the *OK* button to initiate the file replication. You will see the following message.



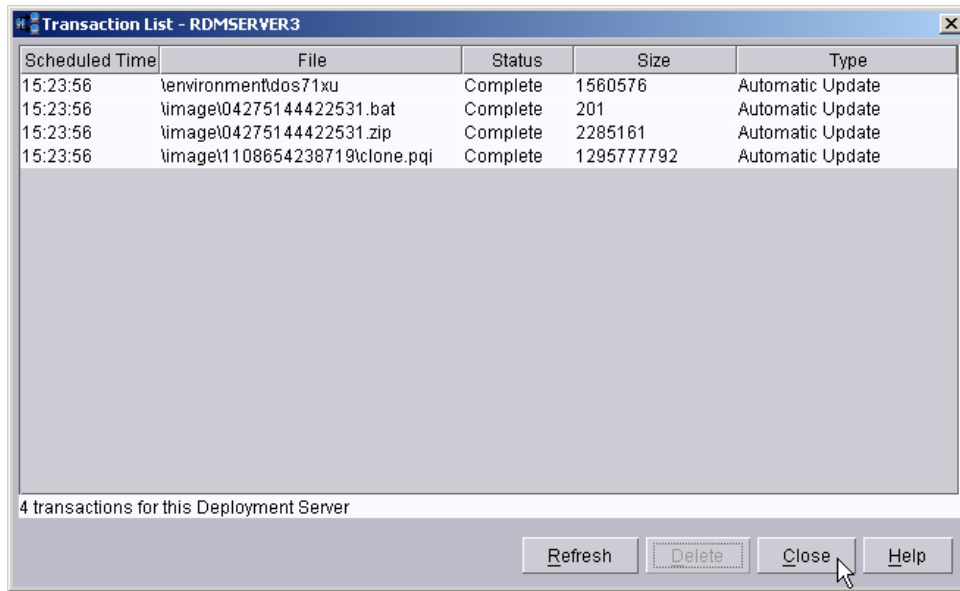
12. Press the *OK* button on the message to close its window, and press the *OK* button on the *File Replication* dialog to close it.
13. If you want to view the replication progress, use the menus shown in the picture below to open the *Deployment Server Management Options* dialog.



14. Select the appropriate D-Server, and then select the *Replication* page.



15. Select the *Transaction List...* button to display the list of files that are being replicated.



Scheduled Time	File	Status	Size	Type
15:23:56	\\environment\dos71xu	Complete	1560576	Automatic Update
15:23:56	\\image\04275144422531.bat	Complete	201	Automatic Update
15:23:56	\\image\04275144422531.zip	Complete	2285161	Automatic Update
15:23:56	\\image\1108654238719\clone.pqi	Complete	129577792	Automatic Update

4 transactions for this Deployment Server

Refresh Delete Close Help

16. You can delete entries from the list (after their status is *Complete*) by selecting the transaction and then selecting the *Delete* button.
17. Select the *Close* button to close the transaction list, and select the *OK* button to close the options window.

3.7.2.3 Manual replication

One way to replicate files is to copy them from the master repository. For example, you could create a set of CDs that contain some of the files in the master repository, mail the CDs to the remote site, and copy the files from the CDs into their identical directories in the remote repository.

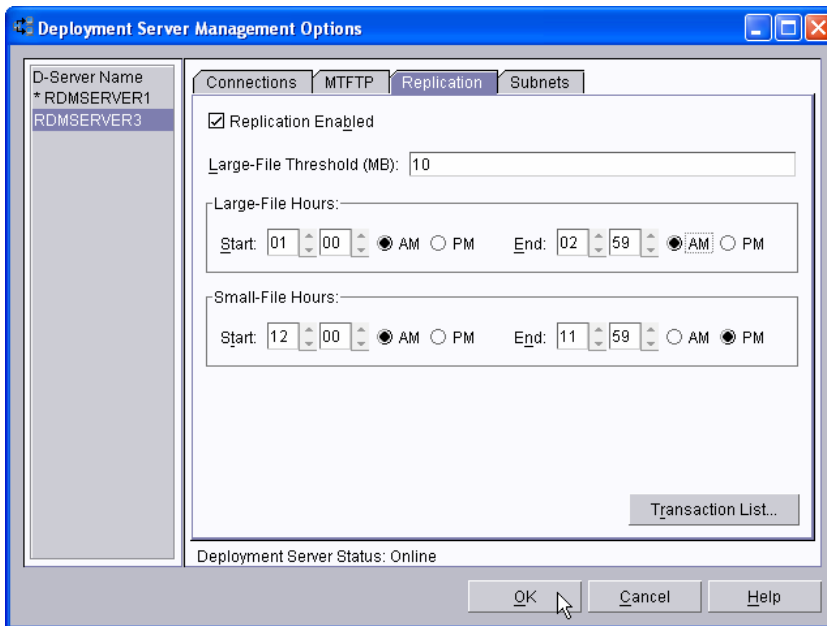
You might use this method if your WAN bandwidth is too small to copy the large files over the network.

To use manual replication, uncheck the Replication Enabled box in the *Deployment Server Management Options* window (see screen picture in section 3.7.3 below).

3.7.3 Controlling when replication occurs via the network

RDM gives you the option of using file size to control when replication occurs. You can set 2 time ranges within which replication occurs.

Use the *Deployment Server Management Options* window to define the ranges.



1. Enter a threshold to distinguish between “large” and “small” files. We chose 10 MB.
2. Enter a time range for each file size. We chose to allow small-file replication at any time, and to allow large-file replication only for a couple of hours late at night (presumably when there is enough bandwidth on the WAN to download large files).
3. Press the OK button to save the new settings.

Note that our example uses overlapping time ranges. This is the typical way to use this function.

4. Installing and Configuring RDM

In this section, we will outline the procedure for installing RDM in our example environment. The overall procedure is the following:

1. Install IBM Director Server on 10.2.0.5 (our future RDM Server, located at our Main Site).
2. Install RDM Server on 10.2.0.5.
3. Configure the RDM Server.
4. Install IBM Director Console on the IBM ThinkPad computer that will be our remote RDM Console (located at our Main Site in our example, but can actually be anywhere in our network).
5. Install RDM Console on the IBM ThinkPad computer.
6. Install RDM D-Server on 10.4.0.5 (our future RDM D-Server located at Remote Site A).
7. Configure the RDM D-Server.
8. Repeat steps 6 and 7 for each remote D-Server.

In the sections below, we describe the steps relevant to the Wide Area Network, in detail.

4.1 Installing the Director Server

Consult the IBM Director documentation for detailed installation instructions.

You may also want to download and install the ServeRAID Manager optional component.

4.2 Installing the RDM Server

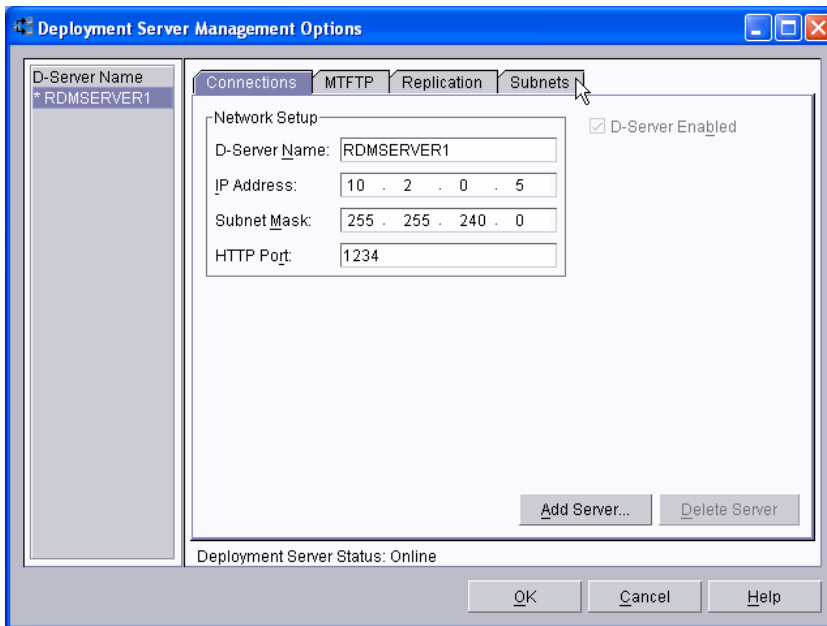
Consult the *RDM Installation Guide* for detailed installation instructions. Visit the IBM web site and look for an RDM update. If one exists, download and install it, too.

4.3 Configuring the RDM Server

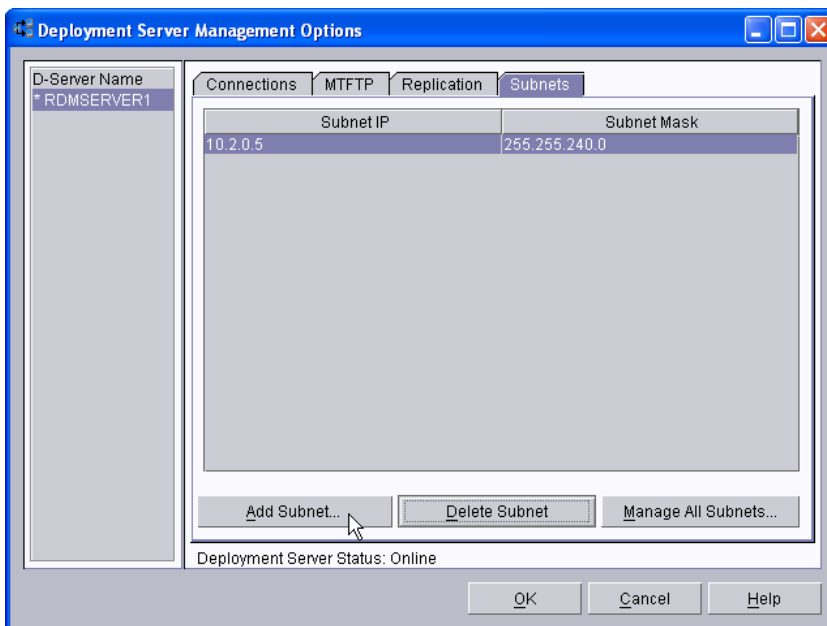
Once you have installed the RDM Server, it will be configured (by default) to deploy target systems that are on the same subnet as the RDM Server. Because most users will have multiple subnets, it is usually required that you do some further configuration. Here are the steps to take:

1. Open the *Deployment Server Management Options* dialog, using the menus (see step 13 on page 20).

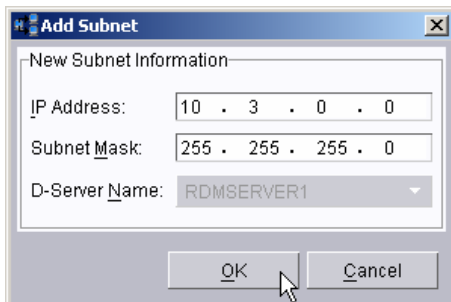
You should not change anything on this page.



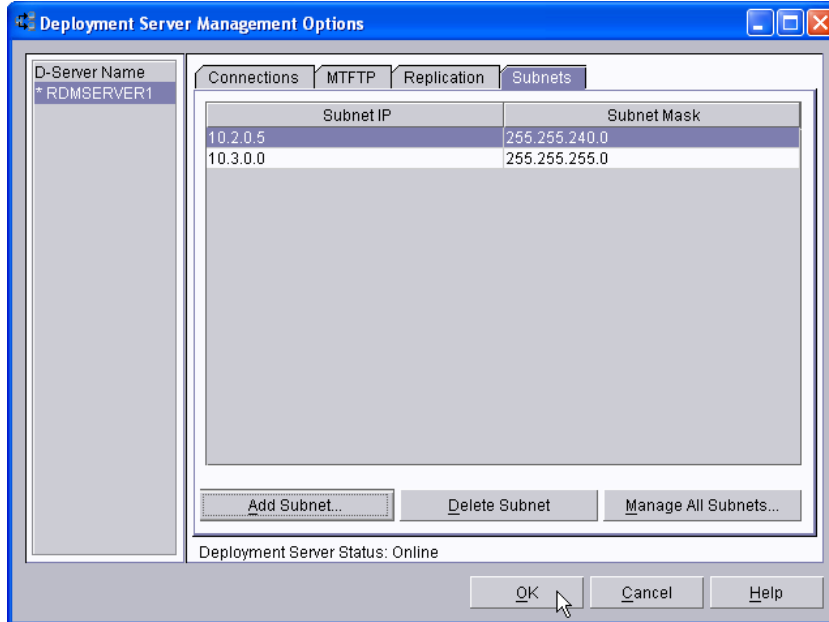
2. Select the *Subnets* page. This page lists all of the subnets that the D-Server that is selected in the left panel can serve.



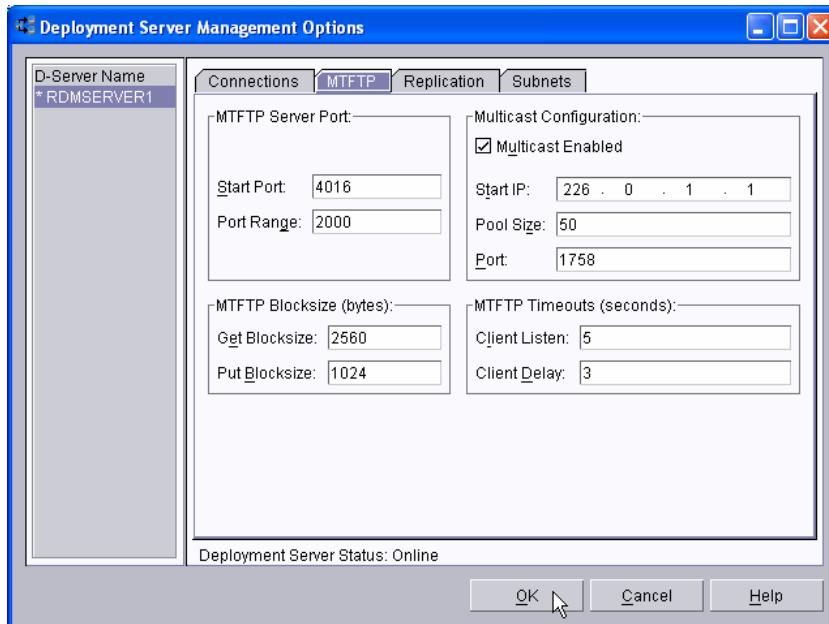
3. You are going to add each subnet that will contain target systems. To do that, select the *Add Subnet...* button.



- Then fill in the *IP Address* (this is any IP address that is on the subnet you are adding) and *Subnet Mask* fields with appropriate values, and select the OK button. This will add the subnet to the list on the Subnets page.



- Continue adding subnets, as needed.
- Select the *MTFTP* page. You may need to change some of the settings on this page.



- If you will deploy large numbers of systems concurrently, you may need to increase the *Port Range* value.
- Note that replication is not applicable for the Master D-Server (the one that is part of the RDM Server). So we will skip that page. Select the OK button to close the window and save our settings.

4.4 Installing a Director Console

Consult the IBM Director documentation for detailed installation instructions.

4.5 Installing an RDM Console

Consult the *RDM Installation Guide* for detailed installation instructions. Visit the IBM web site and look for an RDM update. If one exists, download and install it, too.

4.6 Installing a remote RDM D-Server

Consult the *RDM Installation Guide* for detailed installation instructions. Visit the IBM web site and look for an RDM update. If one exists, download and install it, too.

1. In the D-Server Configuration window, enter the IP address of the RDM Server.
2. You may change other settings in this window, if appropriate.

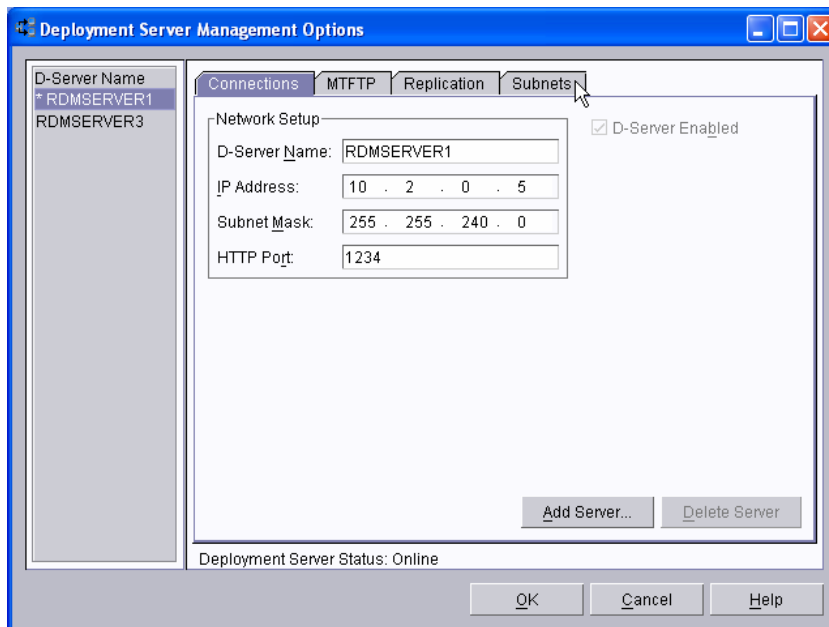
4.7 Configuring the remote RDM D-Server

Once you have installed an RDM D-Server, it will be configured to deploy target systems that are on the same subnet as the RDM D-Server. Because most users will have multiple subnets in the remote location, it is usually required that you do some further configuration.

In particular, you have to add subnets using the procedure described in section 4.3 above.

1. Open the *Deployment Server Management Options* dialog, using the menus (see step 13 on page 20).

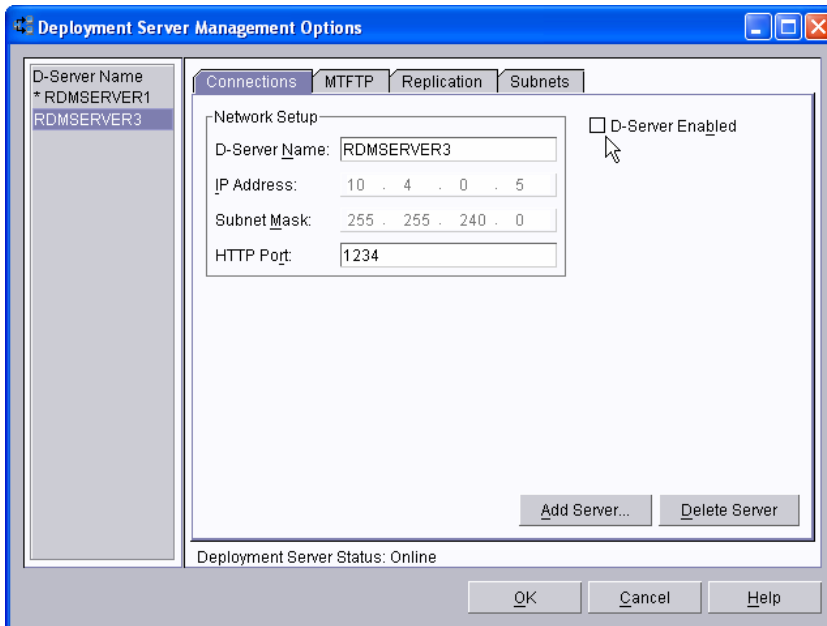
You should not change anything on this page.



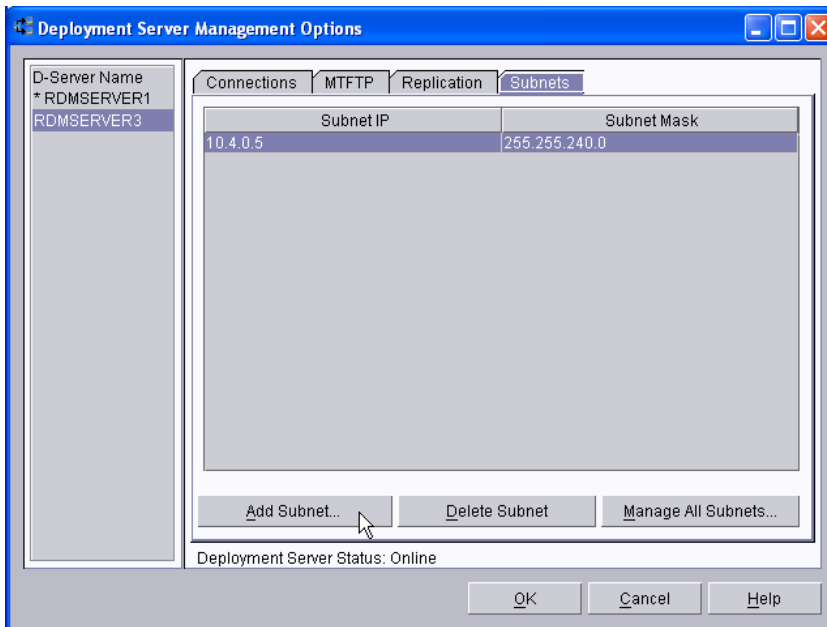
Notice that the remote D-Server installed as in section 4.6 above (RDMSERVER3) now appears in the list of D-Servers in the left panel. (If your new remote D-Server is not in the list, it means that the RDM install program could not communicate with the RDM server. In this case, you will have to add the D-Server manually, using the *Add Server...* button, and you will also have to fix the communication problem that occurred during your D-Server install.)

Notice also that the entry for the master D-Server (RDMSERVER1) contains an asterisk (*) to help identify it.

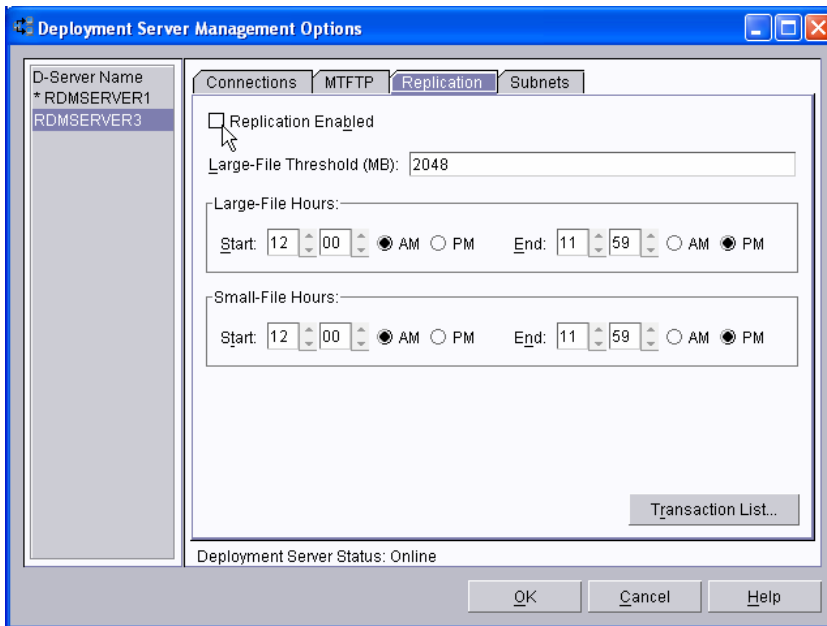
2. Select your remote D-Server in the left panel.
Then check the *D-Server Enabled* box.



3. Select the *Subnets* page. This page lists all of the subnets that the D-Server that is selected in the left panel can serve.



4. Then add subnets, as necessary, as you did in section 4.3 above.
5. Select the *Replication* page.



6. Then, if your network bandwidth will support replicating files (i.e., to keep the D-Server in synch with the Server), check the *Replication Enabled* box.
7. You may want to change the *Large-File Threshold* and the corresponding time ranges, if appropriate. Note that the default setting is for all files of any size (because 2048 MB is RDM's maximum file size of 2 gigabytes) to be replicated at any time.
8. If you want to change multicast settings for this D-Server, select the *Multicast* page and make your changes.
9. Select the *OK* button to save your settings.

5. Testing your RDM installations

After doing any RDM installation, you should run a few basic tests to validate that RDM is working properly and that your network is configured in a way that will support remote deployment. We will summarize the kinds of things to test in each case.

In general, if you can run one RDM task successfully, with no errors, it means that your RDM installation is working properly. But you need to test a target system on each subnet to validate that your network is configured in a way that will support remote deployment.

5.1 Testing the RDM Server

You should do this immediately after configuring your RDM Server (section 4.3 above). Use the *RDM Troubleshooting Guide* white paper to help resolve any errors.

5.1.1 RDM Server's subnet

5.1.1.1 RDM discovery

The first test is to see if RDM can discover a target system that is on the same subnet as the RDM server. (In our example environment, the target system would be on the 10.2.0.x subnet.)

1. Open the Director console. Its middle panel will probably be empty.
2. Power on the target system manually (e.g., with its white button).
3. When the target system's monitor displays a message (in the lower left corner) about pressing F12 to force a network boot (or to show a list of boot options), press the F12 key.
4. If you are presented with a list of options, select the one that will do a network boot.

5.1.1.2 Troubleshooting discovery

The test in section 5.1.1.1 above should cause RDM to run its default scan task on the target system and then power off the target system. Here is what happens, in detail, if the system is not already known to RDM:

1. The target system's network adapter (NIC) broadcasts its DHCPDiscover message.
2. The DHCP server responds with an IP address (10.2.0.123 in the screen picture below).

If you get an error message at this point, the likely cause is improper DHCP server configuration or failure to set up DHCP/BOOTP forwarding to the RDM D-Server. Or it could be that the *IBM RDM D-Server* service is not started.

3. The RDM D-Server (the one on the RDM Server, in this case) responds with the location (IP address of the D-Server – 10.2.0.4 in this case), path, and filename of a bootstrap loader program.

At this point, you can see on the system's monitor (screen picture below) the IP address of the D-Server that is responding, the IP address and gateway address that the system will use, and some other stuff.

4. The target system's NIC sends a TFTP GET request to download the bootstrap loader program.
5. The target system's NIC runs the bootstrap loader program.

You will see some RDM text about the bootstrap loader on the system's monitor (screen picture below).

If you get an error message, it could be that your RDM D-Server is not properly configured (perhaps it is configured with the wrong IP address).

6. The bootstrap loader program contacts the RDM D-Server (who then contacts the RDM Server) to find out what to do next.
7. The RDM Server finds that this system is not in the console. So it sends the RDM D-Server (who then sends it to the system) the first command from the default scan task. This command contains the location, path, and filename of a DOS system environment (environment\dos71x in our example).

At this point, you will see an entry, in the form of a 12-digit MAC address (00025547ffb7 in our example), appear in the RDM console.

8. The bootstrap loader program sends a TFTP GET request to download the DOS system environment.
9. Bootstrap loader program creates a virtual A: drive in memory, loads DOS on that drive, and boots DOS. (At the end of the screen picture below, DOS is about to start booting.)
10. The DOS AUTOEXEC.BAT file contains a loop that continually contacts the RDM D-Server (who then contacts the RDM Server) to find out what command to run next.
11. Eventually, one of these commands runs SCAN.BAT, which runs SCAN.EXE, which creates 2 text files.

If you get an error message on the system's monitor, and SCAN.BAT never runs, it could be that your RDM Server and D-Server are not up-to-date (i.e., they are an older version).

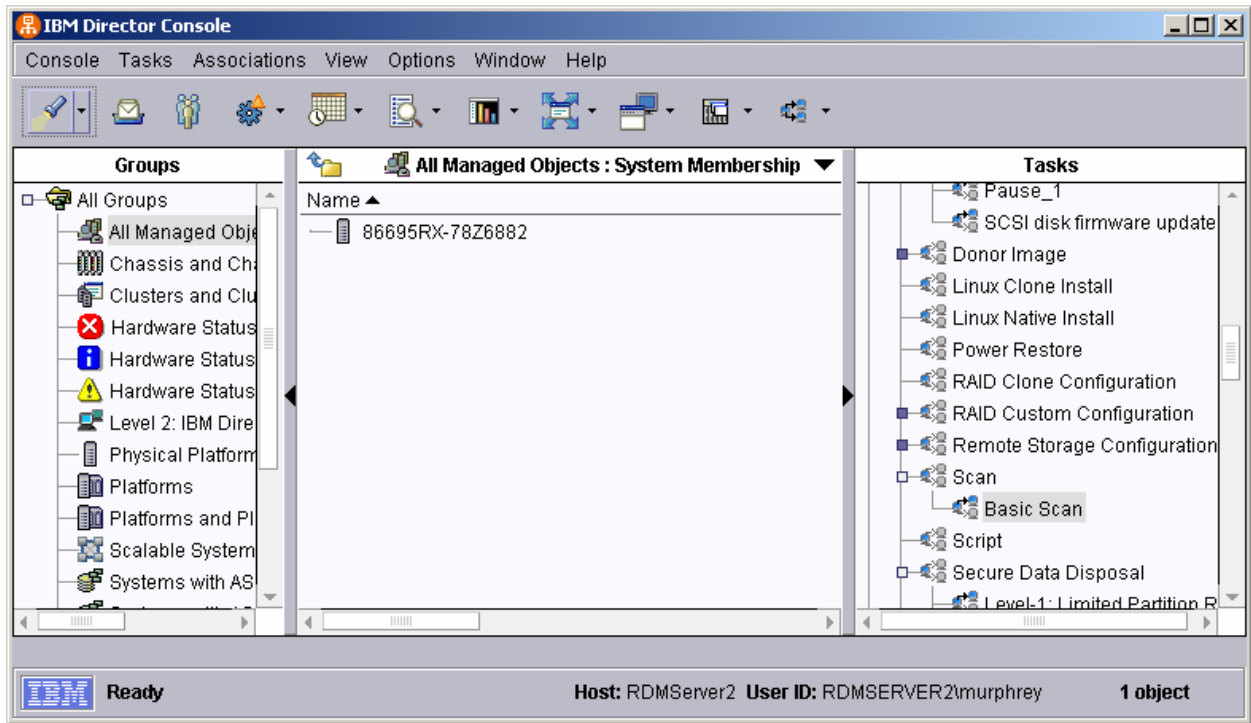
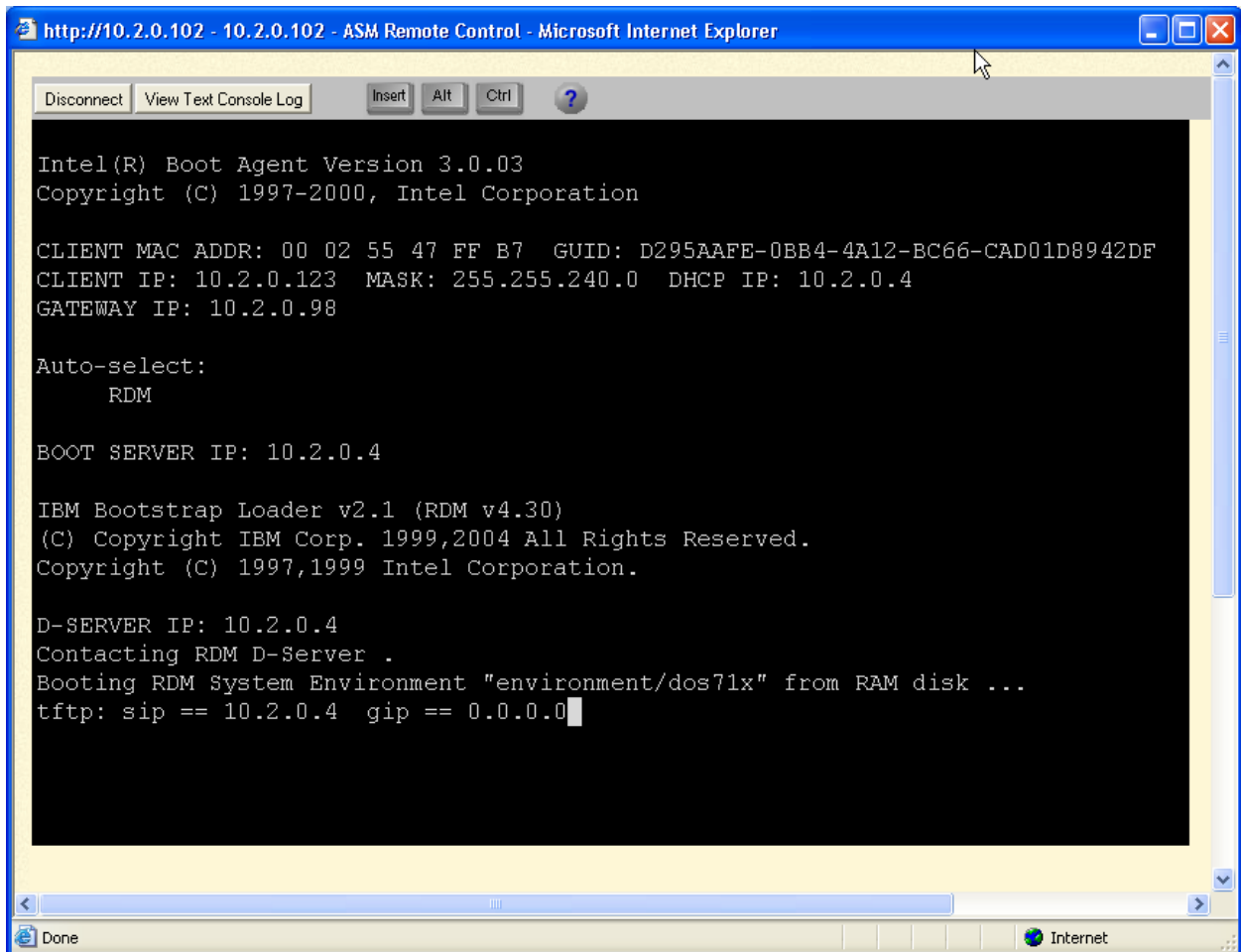
12. Other commands will TFTP those files to the D-Server (who then sends them to the RDM Server via HTTP).

You will be able to see the files appear (for a few seconds) on the RDM Server, in the ..\RDM\temp directory.

13. The RDM server will process those files, erase them, and create the Physical Platform Managed Object.

On the console, you will see the name of the object change from the MAC address to a name like <MachineType><Model>-<SerialNumber> (86695RX-78Z6882 in the console screen picture below).

14. The last command will be !SHUTDOWN, which will power off the system and complete the task.)



5.1.1.3 Run an RDM task from the console

The next test is to see if you can run an RDM task on the system.

1. Drag the *Basic Scan* task and drop it onto the object for the new system.
2. Select *Run systems....*
3. Select *Execute now* to run the task immediately.

RDM should power on the system, run the task, and power the system off. You will also see a task execution history on the RDM console.

5.1.1.4 Troubleshooting running a task

If you wait several minutes and the target system does not power on, it is probably caused by having Wake on LAN disabled in the BIOS settings. Another possible cause is if you had previously powered the system off irregularly.

5.1.1.5 Multicast

Do the following steps to validate that multicast is working properly:

1. Create an RDM *Windows Native Install* image from a Windows CD.
2. Create an RDM *Windows Native Install* task that uses that image.
3. Run the *Windows Native Install* task on a target system.

The task, which will take 30 to 60 minutes to complete, should power on the system, use several reboots to install and configure Windows, and power off the system.

5.1.1.6 Troubleshooting multicast

You should observe the second boot on the target system's monitor. During the download of the operating-system image, you should see an incrementing percent-complete number, plus a spinning cursor. If you see no spinning cursor, it means that the file transfer is using unicast, not multicast. That means that either you have multicast disabled in the RDM D-Server options or your Ethernet switch has multicast disabled.

5.1.2 Other local subnets

After you get the above tasks working correctly, you are ready to test your other subnets.

Run both tests described in section 5.1.1 above using a target system in a different local subnet. (In our example environment, the target system would be on the 10.3.0.x subnet.) Do this for each local subnet.

5.1.2.1 Troubleshooting discovery

If the system does not get an IP address, it is probably due to a DHCP configuration error.

If the system does not get the RDM bootstrap loader program, it could be that you forgot to add the subnet to the RDM D-Server configuration.

5.1.2.2 Troubleshooting running a task

If you wait several minutes and the target system does not power on, and none of the causes from section 5.1.1.4 above is present, it is probably caused by failing to set up your routers to forward subnet-directed broadcast to the target system's subnet.

5.2 Testing the RDM Console

You should do this immediately after installing your RDM Console (section 4.5 above).

Open the Director console that you installed on your laptop or desktop computer. It should display exactly like the console on the RDM Server that you used in section 5.1.1 above. You can have any number of Director consoles open concurrently. Run a test as in section 5.1.1.3 above.

5.3 Testing the remote RDM D-Server

You should do this immediately after configuring your remote RDM D-Server (section 4.7 above). Use the *RDM Troubleshooting Guide* white paper to help resolve any errors.

5.3.1 RDM D-Server's subnet

5.3.1.1 RDM Discovery

Run the test described in section 5.1.1.1 above using a target system in each remote D-Server's subnet. (In our example environment, the target systems would be on the 10.4.0.x and 10.6.0.x subnets.)

5.3.1.2 Run an RDM task from the console

Run the test described in section 5.1.1.3 above using a target system in each remote D-Server's subnet. (In our example environment, the target systems would be on the 10.4.0.x and 10.6.0.x subnets.)

5.3.1.3 Multicast

Run the test described in section 5.1.1.5 above using a target system in each remote D-Server's subnet. (In our example environment, the target systems would be on the 10.4.0.x and 10.6.0.x subnets.)

5.3.1.4 Replication

Do the following steps to validate that replication is working properly:

1. Create an RDM *System Firmware Flash* image for BIOS firmware update.
2. Run the built-in *Deploy latest system firmware* task on a target system.

While watching the target system's monitor, you should observe the task pause while the replication takes place. Then the task should finish in the normal manner.

3. Replicate the *Windows Native Install* image (that you created in section 5.1.1.5 above) using the *Image Management* window.
4. Run the *Windows Native Install* task (that you created in section 5.1.1.5 above) on a target system.

The task should run in a similar way as it does on systems at the main site, except that it may pause while replicating some small task-related files.

5.3.2 Other local subnets

Run the first 3 tests described in section 5.3.1 above using a target system in each of the other local subnets that are served by the remote D-Server. (In our example environment, the target systems would be on the 10.5.0.x and 10.7.0.x subnets.)

6. Notices

This information was developed for products and services offered in the U.S.A.

IBM might not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service might be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right might be used instead. However, it is the user responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM might have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

*IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.*

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement might not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM might make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product, and use of those Web sites is at your own risk.

IBM might use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Some software might differ from its retail version (if available) and might not include all user manuals or all program functionality.

IBM makes no representations or warranties regarding third-party products or services.

6.1 Edition notice

© COPYRIGHT INTERNATIONAL BUSINESS MACHINES CORPORATION 2005, 2006. All rights reserved.

Note to U.S. Government Users Restricted Rights — Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

6.2 Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

IBM

IBM (logo)

Asset ID

IntelliStation

LANClient Control Manager

Netfinity

ServeRAID

ThinkPad

Wake on LAN

xSeries

Adaptec is a trademark of Adaptec Inc. in the United States, other countries, or both.

Broadcom is a trademark of Broadcom Corporation in the United States, other countries, or both.

Microsoft, Windows, and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

Other company, product, or service names might be trademarks or service marks of others.

7. Glossary

BAT file. A file that contains a batch program (that is, a set of commands).

bind. Associating one or more systems to a task. This causes all information to be verified (by one of the STC modules) and a resulting job to be scheduled to run.

console, or RDM Console. The group of programs that make up the user interface to RDM. RDM is client/server in nature so that the Console might run on any computer and not necessarily be running on the same computer as the RDM server or other RDM components. The RDM Console is actually an IBM Director Console on which the RDM Console component is installed.

image. An image is the software stored on a deployment server that is downloaded to a system during an operation. Images vary in size and in the type of software they provide to the system. The purpose and content of each image depends on the task to be accomplished, as well as the method used to download the image from the deployment server to the system. A *native* image is built off a product installation CD. A *clone* image is copied from a donor system.

job. An object managed by the scheduler and created by STC. A job is a binding of one task and one or more systems. A job can be scheduled to run once or to recur. Sometimes a job is called by a different name (Scheduled Task, Running Task), to emphasize some aspect of the job.

managed system. The IBM Director term for its system. Mentioned here only for clarity; the term *system* is preferred when referring to an RDM system.

preboot DOS agent. The preboot DOS agent is a DOS operating system with a communications stack that is booted from the network by the bootstrap agent. The preboot DOS agent performs actions on a system as directed by the RDM server.

Preboot Execution Environment (PXE). PXE is an industry standard client/server interface that allows networked computers that are not yet loaded with an operating system to be configured and booted remotely. PXE is based on Dynamic Host Configuration Protocol (DHCP). Using the PXE protocol, clients can request configuration parameter values and startable images from the server.

The PXE process consists of the system initiating the protocol by broadcasting a DHCPREQUEST containing an extension that identifies the request as coming from a client that uses PXE. The server sends the client a list of boot servers that contain the operating systems available. The client then selects and discovers a boot server and receives the name of the executable file on the chosen boot server. The client downloads the file using Trivial File Transfer Protocol (TFTP) and executes it, which loads the operating system.

Redundant Array of Independent Disks (RAID). RAID is way of storing the same data in different places (thus, redundantly) on multiple hard disks. By placing data on multiple disks, I/O operations can overlap in a balanced way, improving performance. Multiple disks increase the mean time between failure (MTBF) and storing data redundantly increases fault-tolerance.

system. An individual, target system being deployed or managed by RDM. In IBM Director terminology, an RDM system is always a platform managed object. These can represent any of the supported-by-RDM systems. They cannot represent an IBM Director object that RDM does not process, such as a chassis or an SNMP object.

system environment. This is the RDM term for a preboot operating system, one that contains a communications stack and is booted from the network by the bootstrap loader program.

task. An already defined and configured unit of work that is available to be applied to a system or a group (of systems). You create a task by clicking on the applicable task template from the RDM main

console. RDM is installed with predefined tasks, such as data disposal and scan.

task template. A prototype of a specific kind of RDM task. This is a term used to describe the different kinds of tasks shown on the task pane in the main window of the RDM console. Each task template has its own characteristics and attributes. RDM comes with a set of task templates.

Wake on LAN. Technology developed by IBM that allows LAN administrators to remotely power up systems. The following components are essential for the Wake on LAN setup:

- Wake on LAN-enabled network interface card (NIC).
- Power supply that is Wake on LAN-enabled.
- Cable which connects NIC and power supply.
- Software that can send a magic packet to the system.

If the system has the first three of the previous components, the system is called a Wake on LAN-enabled system. Even though a system might be powered off, the NIC keeps receiving power from the system power supply to keep it alive. A network administrator sends a magic packet to the system through some software, for example, RDM or Netfinity IBM Director. The NIC on the system detects the magic packet and sends a signal to the power supply to turn it on. This process is also called *waking up the system*. Using RDM, this process can be scheduled for individual systems. The Wake on LAN feature and RDM together make it very easy for you to deploy software on individual systems on a scheduled basis.