Resource Migration from Novell NetWare to a Microsoft Solution

By

Michael Barker and Shawn Garrett

Submitted to
the Faculty of the Information Technology Program
in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science
in Information Technology

University of Cincinnati
College of Engineering and Applied Science

June 2010
Resource Migration from Novell NetWare to a Microsoft Solution

by

Michael Barker and Shawn Garrett

Submitted to
the Faculty of the Information Technology Program
in Partial Fulfillment of the Requirements
for
the Degree of Bachelor of Science
in Information Technology

© Copyright 2010 Michael Barker, Shawn Garrett

The authors grants to the Information Technology Program permission
to reproduce and distribute copies of this document in whole or in part.

Michael Barker  Date

Shawn Garrett  Date

Professor Russ McMahon, Faculty Advisor  Date

Hazem Said, Ph.D. Department Head  Date
Acknowledgements

Michael Barker’s Acknowledgements:

I would like to thank my partner, Shawn Garrett, for his constant focus and calm when it came to this project. I would also like to thank Professor Russ McMahon for all of his advice, as well as keeping us on track with the weekly report meetings. Bryan Newswanger and Bob Elson of UCit also deserve acknowledgement for their assistance to this project. I would especially like to thank my parents for their continued support throughout the years, as well as their support in my decision to transfer to this program.

Shawn Garrett’s Acknowledgements:

I like to thank Michael Barker for accepting to work on this migration project with me, although we had not previously met or worked together, we were able to adapt quickly and form a great team that achieved a lot together. UCit was very helpful in this project especially our main contacts Bryan Newswanger and Bob Elson were a pleasure to work with.
# Table of Contents

Abstract ........................................ VIII
Introduction .................................. 1
Solution Description .......................... 1
User Profiles .................................. 8
  Administrators ............................... 8
  Support ..................................... 8
  Clients (Departmental Users) ............ 8
Design Protocols .............................. 9
  Migrating with Quest NDS Migrator ...... 9
  Migrating with Microsoft Directory Synchronization Service 10
  Migrating with Robocopy ................... 12
  Internet Printing Protocol (IPP) Printing 13
  Active Directory Structure ............... 14
  Hardware .................................. 15
  Software .................................. 16
Testing Plan .................................. 17
Risk Management ............................. 18
Proof of Design ................................ 19
  Migration from NetWare to Windows 2003 using MSDSS 20
  Perform Migration with Robocopy ........ 25
  Administering Permissions to Migrated Folders 28
  Adding Printers To Server ................. 30
  Adding Printers to Clients ............... 34
Project Planning ............................. 36
  Budget .................................... 37
  Timeline ................................... 38
Project Deliverables ........................ 39
Recommendations and Conclusion .......... 41
Appendix A. Migration from NetWare to Windows 2003 .......... 1
Appendix B. Performing Robocopy Migration ........ XIII
Appendix C. Permissions ...................... XVI
  Users ..................................... XVI
  Department/Division ........................ XVI
  OU Configuration ............................ XVII
  Printing .................................. XVIII
  Creating the Base File Structure ......... XVIII
Appendix D. Adding Printers To Servers ........ XXIII
  Adding Printers to Clients ............... XXX
References .................................. XXIV
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>NDS to Server 2K8.</td>
<td>3</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Quest NDS Migrator.</td>
<td>4</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Robocopy.</td>
<td>5</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Design Protocol of Quest NDS Migrator.</td>
<td>9</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Design Protocol of MSDSS Migration.</td>
<td>10</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Design Protocol of MSDSS Migration process from NDS to Server 2003</td>
<td>11</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Design Protocol for Robocopy.</td>
<td>12</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Internet Printing Protocol (IPP) Printing Design Protocol</td>
<td>13</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Current Test Active Directory Structure.</td>
<td>14</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Business object added to Active Directory.</td>
<td>15</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Risk Management.</td>
<td>18</td>
</tr>
<tr>
<td>Figure 12</td>
<td>Netware Icon.</td>
<td>20</td>
</tr>
<tr>
<td>Figure 13</td>
<td>Novell Login.</td>
<td>20</td>
</tr>
<tr>
<td>Figure 14</td>
<td>Novell Connections.</td>
<td>21</td>
</tr>
<tr>
<td>Figure 15</td>
<td>Invalid Mapping File Header</td>
<td>21</td>
</tr>
<tr>
<td>Figure 16</td>
<td>Test Share.</td>
<td>22</td>
</tr>
<tr>
<td>Figure 17</td>
<td>Source and Target.</td>
<td>22</td>
</tr>
<tr>
<td>Figure 18</td>
<td>Migration.</td>
<td>23</td>
</tr>
<tr>
<td>Figure 19</td>
<td>Completed.</td>
<td>23</td>
</tr>
<tr>
<td>Figure 20</td>
<td>Saving Migration.</td>
<td>24</td>
</tr>
<tr>
<td>Figure 21</td>
<td>Command Shell.</td>
<td>25</td>
</tr>
<tr>
<td>Figure 22</td>
<td>The Command.</td>
<td>25</td>
</tr>
<tr>
<td>Figure 23</td>
<td>Finished Migration.</td>
<td>26</td>
</tr>
<tr>
<td>Figure 24</td>
<td>Personal Folders.</td>
<td>26</td>
</tr>
<tr>
<td>Figure 25</td>
<td>Share added.</td>
<td>27</td>
</tr>
<tr>
<td>Figure 26</td>
<td>Initial Permissions.</td>
<td>28</td>
</tr>
<tr>
<td>Figure 27</td>
<td>Base Group.</td>
<td>28</td>
</tr>
<tr>
<td>Figure 28</td>
<td>Shared Folder Properties.</td>
<td>29</td>
</tr>
<tr>
<td>Figure 29</td>
<td>Personal Folder.</td>
<td>29</td>
</tr>
<tr>
<td>Figure 30</td>
<td>Print Management.</td>
<td>30</td>
</tr>
<tr>
<td>Figure 31</td>
<td>Adding A Printer.</td>
<td>31</td>
</tr>
<tr>
<td>Figure 32</td>
<td>Network Printer Installation Wizard.</td>
<td>31</td>
</tr>
<tr>
<td>Figure 33</td>
<td>Printer Name.</td>
<td>32</td>
</tr>
<tr>
<td>Figure 34</td>
<td>Printer Found.</td>
<td>32</td>
</tr>
<tr>
<td>Figure 35</td>
<td>Installation Success.</td>
<td>33</td>
</tr>
<tr>
<td>Figure 36</td>
<td>Updated Printer Management Window.</td>
<td>33</td>
</tr>
<tr>
<td>Figure 37</td>
<td>Printer Web Page.</td>
<td>34</td>
</tr>
<tr>
<td>Figure 38</td>
<td>Printer Information.</td>
<td>34</td>
</tr>
<tr>
<td>Figure 39</td>
<td>Printer Installation.</td>
<td>35</td>
</tr>
<tr>
<td>Figure 40</td>
<td>Installation Complete.</td>
<td>35</td>
</tr>
<tr>
<td>Figure 41</td>
<td>Machines in the ADQA Test Environment.</td>
<td>36</td>
</tr>
<tr>
<td>Figure 42</td>
<td>Budget</td>
<td>37</td>
</tr>
<tr>
<td>Figure 43</td>
<td>Timeline</td>
<td>38</td>
</tr>
<tr>
<td>Figure 44</td>
<td>Netware Icon.</td>
<td>38</td>
</tr>
<tr>
<td>Figure 45</td>
<td>Novell Login.</td>
<td>38</td>
</tr>
</tbody>
</table>
Figure 46. Novell Connections. II
Figure 47. Administrative Tools. II
Figure 48. File Migration Utility Error. III
Figure 49. No File Migration Utility error. III
Figure 50. Mappings Tab. IV
Figure 51. Invalid Mapping File Header. IV
Figure 52. Completed Mapping Tab. V
Figure 53. Test Share. V
Figure 54. Source and Target. VI
Figure 55. Log File Tab. VI
Figure 56. Before System Scan. VII
Figure 57. Scan Complete. VII
Figure 58. Migration Tab. VIII
Figure 59. Warning Prompt. VIII
Figure 60. Pre Migration Errors. IX
Figure 61. Migration. IX
Figure 62. Migration (Cont.). X
Figure 63. Migration Completion. X
Figure 64. Completed Migration Screen. XI
Figure 65. Save Changes Prompt. XI
Figure 66. Saving Migration. XII
Figure 67. Command Shell. XIII
Figure 68. The Command. XIII
Figure 69. Finished Migration. XIV
Figure 70. Personal Folders. XIV
Figure 71. Share added. XV
Figure 72. Initial Permissions. XIX
Figure 73. Block Inheritance. XIX
Figure 74. Base Group. XX
Figure 75. Shared Folder. XXI
Figure 76. Personal Folder. XXII
Figure 77. Block Inheritance Again. XXII
Figure 78. Print Management. XXIII
Figure 79. Print Management. XXIV
Figure 80. Adding A Printer. XXIV
Figure 81. Network Printer Installation Wizard. XXV
Figure 82. Find Printer. XXV
Figure 83. Detecting Printer. XXVI
Figure 84. Printer Name. XXVI
Figure 85. Printer Found. XXVII
Figure 86. Installing Drivers. XXVII
Figure 87. Installation Success. XXVIII
Figure 88. Updated Printer Management Window. XXVIII
Figure 89. Sharing Tab. XXIX
Figure 90. Drivers Window. XXIX
Figure 91. Web Browser. XXX
Figure 92. Credentials. xxx
Figure 93. Printer Web Page. xxxi
Figure 94. Printer Information. xxxi
Figure 95. Add Web Printer Connection. xxxii
Figure 96. Printer Installation. xxxii
Figure 97. Installation Complete. xxxiii
Figure 98. Devices and Printers. xxxiii
Abstract

University of Cincinnati Information Technologies (UCit) has been employing the use of Novell NetWare to handle its file and print services, but is now preparing to move to a Microsoft solution. *Resource Migration from Novell NetWare to a Microsoft Solution* is a project that is going to move the existing file and data structure from the Novell environment to an Active Directory (AD) environment, with the primary goal being the preservation of permissions for two departments, UCit and Business Office, during the migration. The project will also implement the Internet Printing Protocol (IPP) to allow clients to access a Web interface to download print drivers for a specified printer. This project will also provide documentation that will explain the steps taken in performing the migration, as well as documentation that will explain the steps taken in initializing an IPP print server, adding printers to the server, and downloading a specified printer’s drivers from the server to both Windows XP and Windows 7 machines.
Introduction

The University of Cincinnati Information Technologies (UCit) department is presently in the process of migrating away from Novell NetWare. The reason for this was monetary as the department liked the software (16) but can no longer justify the price with more cost-effective options available (16). The department wished to move from NetWare to a solution that not only provided the department with a structure to give permissions to clients but also to allow clients to maintain personal directories as well as a departmental shared directory. In addition, the department wished to move to an Internet-based printing solution that allowed clients to locate printers easily (16).

Solution Description

The migration had three ways of being performed. The first option was with the Microsoft-based utility referred to as the Microsoft Directory Synchronization Services (MSDSS) Tool. The second tool was to purchase software, called Novell Directory Services (NDS) Migrator from Quest. The third option, and the one decided to pursue was Robocopy, a free tool used to replicate a source to a destination. In all instances, there were two separate virtual machines set up - one with Windows Server 2003 and another with Windows Server 2008, all within UCit’s non-production testing domain. UCit’s current domain functional level is that of the 2003 level. It was determined that the Robocopy route was a more valuable solution, therefore the study team went about performing the migration within the Windows Server 2003 machine.

A phased migration will continue beyond the scope of the study team. This allows for a temporary strategy of running both NDS and Active directory based services
simultaneously. This approach was chosen since the migration process will be performed over a long period of time rather than switching all of the department’s users over with a direct migration, which is done over a weekend for example. This conversion will achieve minimal disruption for UCit’s paying clients of the file and printing services provided.

Regarding printing, Windows Server 2008 provided use of the Internet Printing Protocol (IPP) via its Internet Information Services and its Print Services. By utilizing these services, it was possible to utilize a Web site to host the names of the printers on the network that were connected to a particular server that allowed the client to download the drivers for that printer and enables them to print from it anywhere on the network.
MSDSS – Using the utilities Microsoft developed with the Microsoft Windows Services for NetWare Solutions, one can facilitate directory management and improve data availability by establishing directory interoperability. This tool allowed for the migration of accounts, user files, and other NDS objects to be placed in an Active Directory environment (5).

Figure 1. NDS to Server 2K8. This illustration shows the migration path from Novell NDS to Windows 2008 Active Directory.
**Quest NDS Migrator** – This product was designed to facilitate the transition of various object types and associated files from the NDS environment to Windows 2003/2008 and Active Directory. One of the main reasons the study team considered this tool is for its ability to migrate the Novell Directory Services (NDS) directly to a Windows 2008 target machine. The study team utilized a demo of this software for testing purposes, but according to the Contact Salesman of Quest, the NDS Migrator software’s MSRP value was $7 per migrated user account (19).

![Migrating with Quest NDS Migrator](image)

*Figure 2. Quest NDS Migrator. This illustration shows the migration path utilized by the Quest NDS Migrator.*
**Robocopy** – Robocopy stands for Robust File and Folder Copy, and is a command-line based directory replication tool found within the Windows Resource Kit. By default, it will only copy a file if the source and destination have different time stamps or file sizes.

(6) This tool was initially considered for its ability to easily replicate from the source to the destination, but was put aside to examine the possibility of preserving permissions during the migration from the NDS environment to Active Directory. After it was determined that the MSDSS solution could not see the share volume on the EMC Celerra device, Robocopy was chosen to perform the migration.

![Windows Resource Kits Robocopy](image)

*Figure 3. Robocopy. This illustrates the migration path utilized for Robocopy*
For testing purposes, an isolated Novell Netware data structure was set up within Novell on UCW1 that resembled a similar data structure to that of the live production data within their current Novell environment. There had been a test Organization Unit, two groups, as well as five user accounts that had been created to replicate the existing production environment. For this test structure, a test supervisor account had also been created to use, for migration purposes, ‘Supervisor’ permissions for both user accounts and the file system.

**Organizational Unit (OU)**

Business.UCit.cao.uc

**Groups**

Business.Business.UCit.cao.uc (members get access to ucw1/share:business/everyone

Monthly Reports.Business.UCit.cao.uc (members get access to ucw1/share:business/monthly reports)

**Users**

Five users each with a personal directory (P:) . Each account was active and password = username

- dwarfg.Business.UCit.cao.uc
- dwarfh.Business.UCit.cao.uc
- dwarflu.Business.UCit.cao.uc
- dwarfm.Business.UCit.cao.uc
- dwarfgr.Business.UCit.cao.uc
Personal and Share data

- Personal data: ucw1/users:Business
- Share data: ucw1/share:Business

Supervisor

Username: migratory.uc
**User Profiles**

Administrators, Support, and Clients were the three main groups of users. Each profile had specific needs that required being addressed with the adoption of this new system.

**Administrators**

The Administrators will be responsible for assigning clients to Active Directory (AD) groups that will determine what files they are able to access as well as where they are able to place those files. There will also be a need for clients to have permissions to multiple groups. In addition, they will also be responsible for reviewing disk storage use.

**Support**

Support will be responsible with day-to-day management within AD, such as resetting passwords, client assistance, as well as troubleshooting. Support may also be responsible for relaying concerns between Clients and Administrators.

**Clients (Departmental Users)**

Clients need to be able to access privately mapped folders as well as be able to place files within these folders. In addition to their private folders, each department will have a share to which all members will be able to have read/write permissions. They must also be able to print from printers within their physical location, which is presently defined as the floor on which they reside.
Design Protocols

Migrating with Quest NDS Migrator

The process of migrating with the Quest NDS Migrator can be examined by viewing Figure 4 below. The first step involved mapping all objects within the Novell NetWare structure, and then placing their information within a SQL Database. For this database, SQL Express was utilized, as it was free. Had testing continued with this tool, it would have needed to be installed onto the ADQA Domain Controller, and from there, all objects would have been migrated to the Active Directory domain.

Figure 4. Design Protocol of Quest NDS Migrator. This illustration shows the migration path from Novell NDS to Active Directory
Migrating with Microsoft Directory Synchronization Service

The process of migrating from Novell NetWare to a Windows 2008 environment can be viewed in Figure 5. Through testing, the migration utility would take all of the objects in NetWare, and map them to create a corresponding Active Directory structure in a Server 2003 environment. The original intention was to upgrade the structure to a Server 2008 environment, but after discussions with UCit, it was determined to be above the scope of the project. The resulting Protocol can be examined in Figure 6.

Figure 5. Design Protocol of MSDSS Migration. This illustration shows the migration path from Novell NDS to Windows 2008.
Figure 6. Design Protocol of MSDSS Migration process from NDS to Server 2003. This illustration shows the updated process of migration using MSDSS without requiring an upgrade to Server 2008.
Migrating with Robocopy

When it was discovered that a migration using the MSDSS solution was no longer viable in the live production environment, the decision was made to switch a tool that could view the target location on the EMC Celerra device. Robocopy was able to recognize the volume, and was able to successfully migrate the files from the Novell environment into the Active Directory environment (Figure 7).

Figure 7. Design Protocol for Robocopy. This illustration shows the process of migrating using Robocopy to get to the target share on the EMC Celerra.
Internet Printing Protocol (IPP) Printing

The process of creating a server for maintaining Internet Printing Services can be examined in Figure 8. Printers were attached to the network, and using Windows Server 2008, it was possible to connect to those printers, using Server’s Print Services. By combining those services with Internet Information Services, it was possible to create a print server that clients were able to access via Web page on the server, select the specific printer, and select to install that printer’s drivers onto their machine.

Figure 8. Internet Printing Protocol (IPP) Printing Design Protocol – This illustration provides a logical diagram of printers and machines connected to a Windows 2008 Web server, in addition to the server’s Web site.
Active Directory Structure

**Figure 9** shows the present Active Directory structure in the ADQA test domain. Following the test migration of the Novell objects into the Active Directory, a new object was created within the Test Domain under UCit-OU, called Business (refer to **Figure 10** on next page). This object contained the directory structure of Users, Groups, and other objects migrated from NetWare.

![Current adqa.uc.edu AD Structure](image)

*Figure 9. Current Test Active Directory Structure. This illustration contains the test Active Directory structure for the test ADQA domain.*
Figure 10. Business object added to Active Directory. This illustration provides an example of the migrated object Business into the test ADQA Active Directory structure.

Hardware

The following hardware requirements were determined to be the best choice in the testing and implementation of the Windows Server 2008 solution and Network Attached Storage (NAS).

- Network Attached Storage (NAS) – As UCit wished to use a NAS device to hold its data instead of servers, the study team employed the use of a volume from the department’s EMC Celerra NS-480 device.

- Server – As all the hosts and servers tested were virtual machines via VMWare, a single server was required.
Software

The following software had been used in order to test multiple options for migration from NetWare to Server 2003:

- Windows Server 2003 – Windows Server 2003 was chosen to migrate from Novell Netware.
- Novell NetWare Client – Novell NetWare served as the software from which UCit wished to migrate from in favor of Windows Server 2003.
- VMware – Virtualization software was used to test the migration, as well as used in the final product since the servers are hosted on a VMware ESX Server version 4.0.
- Windows Server 2008 – Windows Server 2008 was chosen to test the migration methods of the Quest NDS Migrator.
- Quest NDS Migrator (trial) – This was a tool used in the migration of accounts from NetWare to Server 2008.
- SQL Server 2005 Express – This was used to create a database with the Quest NDS Migrator that would allow the storage of users as they were transferred from NetWare to Server 2008.
- Microsoft MSDSS and File Migration Utility – This was determined to be the best tool to perform the migration in the test environment, but once the migration of files in production commenced, the File Migration Utility was unable to see the volume on the EMC Celerra device.
- Robocopy – This was the tool that was chosen for the live environment once it became apparent that the MSDSS solution could no longer be used. It was
successfully applied in the migration from the Novell environment to the Active Directory environment.

**Testing Plan**

Testing was key in not only evaluating different migration techniques, but also testing that users were capable of transitioning to the new solution as seamlessly as possible. While testing the migration process with the Quest NDS Migrator, it was important to keep in mind that in this phase it was only trialware, and to move forward with using it in the production environment would incur the cost of $7.00 per profile migrated. Meanwhile, it was imperative to remember that the MSDSS solution would require migration to a 2003 server.

User testing was also imperative. By selecting a user-group to test this system, it became apparent if any changes from the migration would positively or negatively affect users. It was from this first test that determined permissions were preserved, as well as usability of the new system that no longer required the Novell Client. After user testing was concluded, it was determined that the system was efficient for the users, as they no longer had to remember separate Novell credentials in addition to Active Directory credentials, which simplified their logon process.

Testing was also performed for print services. As clients now use the Windows 7 Operating System in addition to Windows XP, testing was performed on both systems to ensure that clients were able to log onto the Web site of the print server and download the drivers of the printers they requested with no conflict.
Risk Management

It was important to examine potential faults that could risk the delay or disruption of this project as it progressed, as well as form mitigation techniques in an effort to lower the possibility of these risks impeding on the success of the project. These risks, as well as their proposed mitigation techniques can be viewed in Figure 11.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Level</th>
<th>Risk Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrupt Virtual Images</td>
<td>Medium</td>
<td>Snapshots are created on the ESX side</td>
</tr>
<tr>
<td>Risk of Adoption Due To Learning Curve</td>
<td>Low</td>
<td>Instructions will be created to walk users though the migration process as it applies past the scope of our project</td>
</tr>
<tr>
<td>Lack of Financial Support</td>
<td>Low</td>
<td>Chances of increases in MSDN licensing could prevent the migration from continuing to be a cost-effective solution</td>
</tr>
<tr>
<td>Falling Behind Timeline</td>
<td>High</td>
<td>Communicate weekly in order to foresee potential implications that could result in delays</td>
</tr>
</tbody>
</table>

Figure 11. Risk Management. This table shows risks as well as the risk level and proposed mitigation technique.
Proof of Design

Prior to the migration, the MSDSS solution was successful in performing the migration from a test source to a test destination (Full process can be examined in Appendix A). In the live environment, this could not be utilized as the tool did not recognize the production destination. Because of this, the decision was made to use Robocopy (Appendix B) to perform the migration, and manually assign permissions after completion (Appendix C). Additionally, adding print servers with internet printing functionality will be demonstrated (Appendix D).
Migration from NetWare to Windows 2003 using MSDSS

First Login to Windows 2003 Server with MSDSS & File Migration Utility installed.

Account used must have Domain Admin privileges for when communicating to AD.

Once logged in, click on the bottom right corner for Novell login. (Figure 12)

![Figure 12. Netware Icon. Right click to access Novell Login.]

Next, enter supervisor login credentials for NDS side. (Figure 13)

![Figure 13. Novell Login. Enter supervisor credentials.]
Right Click on Novell N, in the system tray and go to "Novell Connections" to see the established connection. (Figure 14)

![Novell Connections](image1.png)

Figure 14. Novell Connections. Displays available connections.

Give the utility a blank text file that has the same name and format as one that would be created using the MSDSS utility – in this case, “1-1.txt” will suffice. (Figure 15)

![Invalid Mapping File Header](image2.png)

Figure 15. Invalid Mapping File Header.
The location of the migrated NetWare objects will be in a folder called TestShare. (Figure 16)

Figure 16. Test Share. This illustration shows the test destination folder for the migration.

The next step requires the selection of the Source NDS objects, as well as the destination Active Directory Target. After selection, click Next. (Figure 17)

Figure 17. Source and Target. Select the Source NDS objects and Destination Active Directory objects.
The migration has begun. **(Figure 18)**

![File Migration Utility](image1.png)

**Figure 18.** Migration. The migration has commenced.

With the success of the migration, the maps selected for migration will be created in the TargetShare folder. **(Figure 19)**

![Completing Migration with File Migration Utility](image2.png)

**Figure 19.** Completed Migration Screen. This shows the objects that were successfully migrated.
The session was saved as “First Test Migration.” (Figure 20)

Figure 20. Saving Migration. Name and save the migration file.
Perform Migration with Robocopy

The prerequisite for this was to have downloaded Windows Resource Kits.

The first step was to open the command shell and navigate to
C:\Program Files\Windows Resource Kits\Tools (Figure 21)

![Figure 21. Command Shell. The location needed to access the tool Robocopy.](image)

The command for performing the migration reads as

```
robocopy \source \destination /MIR
```

In this example, the command read as

```
robocopy \ucw1\USERS\Business \ucdvtiw10\TargetShare\Business /MIR (Figure 22)
```

![Figure 22. The Command. The command used to migrate from source to destination.](image)
The files have been migrated from the source to the destination. (Figure 23)

Figure 23. Finished Migration. The files have been successfully migrated.

A look at the user personal folders migrated. (Figure 24)

Figure 24. Personal Folders. The personal folders for the users have been migrated.
Repeat the process with the group’s share to place it within the business folder. (Figure 25)

Figure 25. Share added. The Business Shared folder has been added.
Administering Permissions to Migrated Folders

The first step is to block inheritance and ensure that "Everyone" is removed. (Figure 26)

![Advanced Security Settings for Department](image)

Figure 26. Initial Permissions. First, block inheritance and remove "everyone" from the security settings.

Ensure that the base group only has the ability to “Traverse Folder/Execute File” (Figure 27)

![Permission Entry for Department](image)

Figure 27. Base Group. Allows the group to traverse the folder and execute the file.
For the share folder, allow inheritance and select the base group to have “full control” (Figure 28).

![Share Folder Properties](image1)

**Figure 28.** Shared Folder Properties. Let the group have full access of the shared folder.

For the personal folders, block inheritance, add the user and grant “full control,” and remove the base group. Also ensure that VOL1 Administrators and SYSTEM have full access to the folder and sub-folders. (Figure 29)

![Advanced Security Settings for Department](image2)

**Figure 29.** Personal Folder. Ensure that the personal folder is available to only those who require it.
Adding Printers To Server

The prerequisite for this was that Print Services and Internet Information Services (IIS) must be installed (22).

The first step is to select Administrative Tools, and then Print Management. (Figure 30)

Figure 30. Print Management. This is accessed from Administrative Tools.
Right click on Printers, and then select Add Printer. (Figure 31)

As the printer will be attached from the network, select Add a TCP/IP or Web Services Printer by IP address or Hostname. Click Next to continue. (Figure 32)

Figure 31. Adding A Printer. Right click on Printers to add a printer.

Figure 32. Network Printer Installation Wizard. Select to add a TCP/IP printer by IP address.
Once the printer is located, it will be displayed. The location and comment fields display “Test Location” and “Test Printer” respectively. Click Next. (Figure 33)

This screen confirms the printer has been added. Select Next. (Figure 34)
After the drivers are installed, you can print a test page, repeat the process, or click Finish. (Figure 35)

Figure 35. Installation Success. The Drivers have successfully been installed.

The Print Management window now displays the newly added printer. (Figure 36)

Figure 36. Updated Printer Management Window. This window now displays the newly-added printer.
Adding Printers to Clients

The prerequisite for this test is that the client must be on the network, and have access to a Web browser.

Start the Web browser, and head to the Internet Printer’s Web site. In the case of this project, that site is http://ucfseiw2.adqa.uc.edu/printers. A prompt for credentials will appear. Enter those, then click OK to access the server’s site. (Figure 37)

![Figure 37. Printer Web Page. This page displays available printers on the accessed server.](image)

Once on this screen, click Connect under Printer Actions. (Figure 38)

![Figure 38. Printer Information. This shows all of the actions and options available for the specified printer.](image)
The server will begin to push the drivers for the specified printer to your client. It may take a few moments. (Figure 39)

Figure 39. Printer Installation. The server will begin installing print drivers to the client machine.

The printer has been installed. You can either exit the browser, or click the link in the middle of the page to view your available printers. (Figure 40)

Figure 40. Installation Complete. The printer has successfully been installed to the client machine.
Project Planning

Two clients of type Windows 7 and XP were used for testing group policies and effective permissions of the groups that were migrated over. Two servers stood as test servers, one being of Windows Server 2003, and one being Server 2008. Windows Server 2003 stood as the Domain Controller for the ADQA Test Domain. A Novell server also existed providing Novell Directory Services.

<table>
<thead>
<tr>
<th>Server Name</th>
<th>Server Description</th>
<th>OS Version</th>
<th>IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>ucdvtiw10.adqa.uc.edu</td>
<td>MSDSS Solution</td>
<td>Windows 2k3 Server SP2</td>
<td>10.23.12.179</td>
</tr>
<tr>
<td>ucfseiw2.adqa.uc.edu</td>
<td>NDS Migrator Solution</td>
<td>Windows 2k8 Server SP</td>
<td>10.23.12.100</td>
</tr>
<tr>
<td>ucw1.msbb.uc.edu</td>
<td>Novell Directory Services</td>
<td>Novell Netware 5.1 SP8</td>
<td>10.23.1.216</td>
</tr>
<tr>
<td>Qaaddomaintestw.adqa.uc.edu</td>
<td>Win 7 Test Client</td>
<td>Windows 7 Professional</td>
<td>10.169.4.97</td>
</tr>
<tr>
<td>Domaintestxp.adqa.uc.edu</td>
<td>Win XP Test Client</td>
<td>Windows XP SP3</td>
<td>10.191.8.110</td>
</tr>
<tr>
<td>ucede qi w1.adqa.uc.edu</td>
<td>Domain Controller</td>
<td>Windows 2k3 Server Enterprise</td>
<td>10.191.8.214</td>
</tr>
</tbody>
</table>

Figure 41. Machines in the ADQA Test Environment. A list of all machines available for the project.
### Budget

<table>
<thead>
<tr>
<th>Expense</th>
<th>Description</th>
<th>Retail Cost</th>
<th>Cost Incurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Server 2008</td>
<td>Provided by MSDNAA</td>
<td>$1,029 (14)</td>
<td>$0</td>
</tr>
<tr>
<td>Windows XP single</td>
<td>Provided by MSDNAA</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>license</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows 7 single</td>
<td>Provided by MSDNAA</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>license</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAS Device</td>
<td>Purchased</td>
<td>15,000</td>
<td>0</td>
</tr>
<tr>
<td>Server</td>
<td>Provided by UCit</td>
<td>2,266 (5)</td>
<td>0</td>
</tr>
<tr>
<td>Novell NetWare</td>
<td>Provided by UCit</td>
<td>1,445 (17)</td>
<td>0</td>
</tr>
<tr>
<td>VMWare Workstation</td>
<td>Provided by UCit</td>
<td>189 (7)</td>
<td>0</td>
</tr>
<tr>
<td>Labor</td>
<td>Est. cost of work*</td>
<td>9,000</td>
<td>0</td>
</tr>
<tr>
<td>Quest NDS Migrator</td>
<td>Trial</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SQL Server 2005 Free</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Express</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows Server 2003</td>
<td>Provided by MSDNAA</td>
<td>999</td>
<td>0</td>
</tr>
<tr>
<td>Folder Sizes</td>
<td>Purchased</td>
<td>50 (8)</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td><strong>$30,578</strong></td>
<td><strong>$50</strong></td>
</tr>
</tbody>
</table>

*Cost of work estimated at 150 hours with a rate of $30/hour for two people*

---

Figure 42. Budget
Timeline

Below is the timeline of the project over the three-quarter course (Figure 43). Two of the key dates have already been met, the Proposal presentation and Design Freeze presentation. Two important dates remain – Tech Expo on May 4, and the final presentation on May 24.

Figure 43. Timeline
Project Deliverables

The following is a list of project deliverables:

- Migration of two departments from Netware to Windows server
  - UCit.
  - Business Office.
  - Install Active Directory Services.
  - Approximately 30 AD user accounts.
  - Approximately 30 machines. (clients consisting of Windows XP and some Win7)

- Migrated Print services from Netware to Windows Server 2K8
  - Install IPP Print Services.
  - Approximately 10 printers. (all the printers on the 4th floor of University Hall)
  - Recommend a number of print servers to UCit to use for them to finish the migration beyond the scope of the Senior Design Project.
  - Implementation of print services
  - Server allows the creation of a Web interface page that can implement Internet Protocol Printing.

- File Migration
  - User files will be moved from the server itself to the EMC storage solution.
  - Maintain the effective permissions.
  - Create a prompt notifying clients of current disk usage.
Create Work Instructions

- The process of Migrating a user.
- Files
- Printers
- Create a migration checklist.
- Create a prompt notifying clients of current disk usage.
Recommendations and Conclusion

The team responsible for the foundation of UCit’s migration from Novell NetWare to a Windows environment has recommended that while three tools have been thoroughly tested, to continue the migration utilizing Robocopy. The justification for this was that there is no cost associated with use of the tool (as opposed to Quest), and it was able to view the shared volume on the EMC Celerra device (as opposed to MSDSS). Robocopy has proven itself capable of successfully migrating the data that was stored in the Novell environment to the Windows environment. After the migration, procedures were created to establish permissions to control access to the file system.

As it stands, UCit Business Office has been successfully migrated from Novell to the Microsoft Windows environment. In addition, internet printing services have been successfully utilized outside of the Novell environment, allowing clients to connect to printers via the internet print server’s interface. Utilizing the Internet Printing Protocol, clients are now able to log onto a website to install and use printers. Scripting now enables personal and shared folders to be mapped at logon via Group Policy, in addition to default printers for their specified group. Documentation instructions have been submitted to show the process of how this was accomplished, allowing UCit to continue with the migration in the absence of the team.
Appendix A.

Test Migration from NetWare to Windows 2003

First Login to Windows 2003 Server with MSDSS & File Migration Utility installed.

Account used must have Domain Admin privileges for when communicating to AD.

Once logged in, click on the bottom right corner for Novell login. (Figure 44)

![Netware Icon. Right click to access Novell Login.](image1)

Next, enter supervisor login credentials for NDS side. (Figure 45)

![Novell Login. Enter supervisor credentials.](image2)
Right Click on Novell N, in the system tray and go to "Novell Connections" to see the established connection.

(Figure 46)

![Novell Connections](image1)

Figure 46. Novell Connections. Displays available connections.

Next, select the File Migration Utility in Administrative Tools. (Figure 47)

![Administrative Tools](image2)

Figure 47. Administrative Tools. Select File Migration Utility to start the migration service.
If an error occurs that you are not a Domain Administrator, request to be added to that group if you are allowed to be, and restart the File Migration Utility. Otherwise, Continue. (Figure 48)

Figure 48. File Migration Utility Error. If this occurs, ensure proper privileges are applied to the account in charge of migration.

If no error occurs, then all tests performed have passed with no disturbances. (Figure 49)

Figure 49. No File Migration Utility error. All tests have passed to continue with migration.
The utility requires a migration log. (Figure 50)

![Figure 50. Mappings Tab. Enter the path to the migration log to be used.]

Give the utility a blank text file that has the same name and format as one that would be created using the MSDSS utility – in this case, “1-1.txt” will suffice. (Figure 51)

![Figure 51. Invalid Mapping File Header.]
Click Next to continue. (Figure 52)

Figure 52. Completed Mapping Tab. Migration log is selected.

The test location of the migrated NetWare objects will be in a folder called TestShare. (Figure 53)

Figure 53. Test Share. This illustration shows the test destination folder for the migration.
The next step requires the selection of the Source NDS objects, as well as the destination Active Directory Target. After selection, click Next. (Figure 54)

Enable Logging, with date and time stamp, and set the log level to “High.” Click Next. (Figure 55)
At this point, it will scan to ensure that the source and target can be verified for migration.

(Figure 56)

![Figure 56. Before System Scan. Click scan to begin verification of source and target destination.]

If the source and target can be verified, and the scan is completed successfully, select Next to continue to migration. (Figure 57)

![Figure 57. Scan Complete. The scan has been completed.]
At this point, it is now time to Migrate. (Figure 58)

Figure 58. Migration Tab. Click Migrate to begin.

If a warning appears that no migration log was loaded, you can continue, but no privileges are preserved. This is a side-effect of not having the MSDSS installed on a Domain Controller. For this test, select Yes to continue. (Figure 59)

Figure 59. Warning Prompt. This will appear if no migration log was loaded from the Domain Controller.
As a result of not having MSDSS on a Domain Controller, it cannot log permissions, resulting in these pre-migration errors. For test purpose, please select Continue Migration. (Figure 60)

Figure 60. Pre Migration Errors. If no fatal errors occur, continue.

The migration has begun. (Figure 61)

Figure 61. Migration. The migration has commenced.
The migration is approximately halfway complete. (Figure 62)

Figure 62. Migration (Cont.). The migration is half-completed.

Once the migration is complete, you can click Next. (Figure 63)

Figure 63. Migration Completion. This migration has been completed.
With the success of the migration, the maps selected for migration will be created in the TargetShare folder. (Figure 64)

Figure 64. Completed Migration Screen. This shows the objects that were successfully migrated.

If saving changes to the migration project is a priority, select Yes. Otherwise, select No. (Figure 65)

Figure 65. Save Changes Prompt. Inquires if the migration project wants to be saved.
The session was saved as “First Test Migration.” (Figure 66)

Figure 66. Saving Migration. Name and save the migration file.
Appendix B.

Performing Robocopy Migration

The prerequisite for this was to have downloaded Windows Resource Kits.

The first step was to open the command shell and navigate to

C:\Program Files\Windows Resource Kits\Tools (Figure 67)

Figure 67. Command Shell. The location needed to access the tool Robocopy.

The command for performing the migration reads as

“robocopy \source \destination /MIR”. In this example, the command read as

“robocopy \ucw1\USERS\Business \ucdvtiw10\TargetShare\Business /MIR (Figure 68)

Figure 68. The Command. The command used to migrate from source to destination.
The files have been migrated from the source to the destination. (Figure 69)

![Figure 69. Finished Migration. The files have been successfully migrated.](image)

A look at the user personal folders migrated. (Figure 70)

![Figure 70. Personal Folders. The personal folders for the users have been migrated.](image)
Repeat the process with the group’s share to place it within the business folder. (Figure 71)

Figure 71. Share added. The Business Shared folder has been added.
Appendix C.

Permissions

The following is a guideline for creating objects in the ucfseiw1 file share.

Users

General Info

- Unless otherwise approved, all users will have their own accounts.
- Generic accounts are permitted but will be charged the same as other accounts.
- There is no charge for printing services.
  - However, the department/users are responsible for the maintenance.

User Account Standards

- All accounts will have the following
  - User directory
    - Located in `\ucfseiw1\department_name\username`
    - Physical location:
      `ucfseiw1\vol1\department_name\username`
  - Password Restrictions
    - Password policies defined by Default Domain Group Policy
    - All non generic accounts must be verified in the Seam_Views sixplustwo database.

Department/Division

- All departments will be given a shared folder. `Ucfseiw1\department_name\share`
• Typically there will be one subdirectory for the entire division/department with full access rights. Rights may be restricted as required for special needs or applications.

OU Configuration

The following should be performed when setting up a new OU for departmental use.

- Create the OU
- Base Group for Security permissions
  - Create a group with the same name as the parent OU. This will be used to grant global permissions to all users in said OU. This group should be granted “full control” to the share folder and access to printers used by the department.
    
    Example: Parent OU: OU=CAS,dc=ad,dc=uc,dc=edu
    
    Group Name: CAS

- Local Admin Group
  - Create a group in the Admins OU. The group name should be named after the OU with “_Administrators” appended.
    
    Example: ou = CAS
    
    Group name: CAS_Administrators
  - This group should be delegated Full Permissions to the OU and all child objects.
  - All departmental system administrators (user objects) are added to this group.
  - Add this group as a “member of” Group Policy Creator Owners”, and “Computer Manager” groups.

Base Group Policy

- Create the base group policy leaving ALL default settings.
- Name: ou_name_GPO
  - Modify the vbs logon script to be applied to this GPO
    - departmentName-Offices-UCit OU.vbs
  - Set Default Printers to be applied in the logon script
  - Modify the “Case” statement to match the “base group” name
    - Change the “objNetwork.MapNetworkDrive” lines for both S & P drives to reflect the path of the Department’s respective folders.
  - Delegate permissions and change ownership, for this policy, to the “Local Admin Group” previously created.

Printing
- All Printing objects associated with a specific area will be configured as Controlled Access Printers and be placed in their “home” context.
- Exceptions can be made for legacy devices.

Creating the Base File Structure
- Go to the root of the file system
  \Ucfseiwl.ad.uc.edu\c$\ucseiwl
- Create the base folder for the new OU or Department and Edit properties of the folder created
  - Security tab | Advanced
  - In the “Permissions” tab, perform the following in order listed.
    - Block Inheritance and copy current permissions; (Figures 72 & 73)
Figure 72. Initial Permissions. First, block inheritance and remove "everyone" from the security settings.

Figure 73. Block Inheritance. Confirm the removal of inheritance.

- Remove “Everyone”

- Add the “Base Group” for Security permissions created in the OU Configuration granting ONLY “Traverse Folder / Execute File” permissions Apply onto “This folder, subfolder and files” as shown below. (Figure 74 on next page)
Ensure the following has “Full Control” to “This folder, subfolder and files”

Vol1 Administrators

SYSTEM

- Share Folders (one share folder per department)
  - Create a folder called “share” directly under the base folder previously created.
    - For example; Ucfseiw1\department_name\share
  - Edit “properties” of this folder, then “Security” tab and set the following permissions.
    - DO NOT block inheritance
    - Select the Base Group for Security permissions then check the box marked for Allow “Full Control” permissions. (Figure 75 on next page)
Figure 75. Shared Folder. Ensure the group has full control over the folder.

- Personal Folders

Each user should have a personal folder created using their logon name.

- Create a folder, matching the users’ login name, directly under the base folder previously created.
  - For example; Ucfseiw\department_name\username

- Edit “properties” of this folder, then “Security” tab and select “Advanced”.

- In the “Permissions” tab, perform the following in order listed.
  - Block Inheritance by unchecking the box below and then “copy” current permissions; (Figures 76 & 77 on next page)
Figure 76. Personal Folder. Ensure the user, vol1 Administrators, and SYSTEM have access to the personal folder.

- Add the User and grant them “Full Control” Permissions to their personal folder.
- Remove the “Base Department Group” so other members of the department cannot access the user’s personal folder.
- Ensure the following has “Full Control” to “This folder, subfolder and files”
  - Vol1 Administrators
  - SYSTEM
Appendix D.

Adding Printers To Server

The prerequisite for this Proof-of Concept is that Print Services and Internet Information Services (IIS) must be installed.

The first step is to select Administrative Tools, and then Print Management. (Figure 78)

Figure 78. Print Management. This is accessed from Administrative Tools.
In the left pane, there will be an item for Printers. (Figure 79)

![Figure 79. Print Management. This window displays printers attached to server.](image)

Right click on Printers, and then select Add Printer. (Figure 80)

![Figure 80. Adding A Printer. Right click on Printers to add a printer.](image)
As the printer will be attached from the network, select Add a TCP/IP or Web Services Printer by IP address or Hostname. Click Next to continue. (Figure 81)

Figure 81. Network Printer Installation Wizard. Select to add a TCP/IP printer by IP address.

Enter the Printer Name or IP address. The port name will be added automatically. Click Next to continue. (Figure 82)

Figure 82. Find Printer. Enter the printers IP address to search for it.
The wizard will detect the specified printer. (Figure 83)

Figure 83. Detecting Printer. The server is attempting to connect to the printer.

Once the printer is located, it will be displayed. For testing purposes, the location and comment fields display “Test Location” and “Test Printer” respectively. Click Next. (Figure 84)

Figure 84. Printer Name. Enter a printer name, location, and comments.
This screen confirms the printer has been added. Select Next. (Figure 85)

Figure 85. Printer Found. Displays printer information.

Now the Wizard will attempt to install drivers. (Figure 86)

Figure 86. Installing Drivers. The server searches for drivers to install.
After the drivers are installed, you can print a test page, repeat the process, or click Finish.  

(Figure 87)

![Network Printer Installation Wizard](image)

Figure 87. Installation Success. The Drivers have successfully been installed.

The Print Management window now displays the newly added printer.  

(Figure 88)

![Print Management Window](image)

Figure 88. Updated Printer Management Window. This window now displays the newly-added printer.
If additional drivers are necessary, right-click the printer, select properties, select the sharing tab, and then click additional drivers. *(Figure 89)*

![Sharing Tab](image)

**Figure 89.** Sharing Tab. This tab shows share information, as well as the ability to download additional drivers.

Drivers for x86 and x64 bit systems have been installed. *(Figure 90)*

![Drivers Window](image)

**Figure 90.** Drivers Window. This window shows that drivers have been installed for x86 and x64 systems.
Adding Printers to Clients

The prerequisite for this test is that the client must be on the network, and have access to a Web browser.

Start the Web browser, and head to the Internet Printer’s Web site. In the case of this project, that site is http://ucfseiw2.adqa.uc.edu/printers. (Figure 91)

![Figure 91. Web Browser. This shows a client attempting to reach the Web page of the print server.](image)

A prompt for credentials will appear. Enter client domain\username and password and click OK. (Figure 92)

![Figure 92. Credentials. The client must enter their domain credentials to access the printers.](image)
A Web site with the listed available printers appears. Click the printer name to be added.

(Figure 93)

![Printer Web Page](image)

Figure 93. Printer Web Page. This page displays available printers on the accessed server.

Once on this screen, click Connect under Printer Actions. (Figure 94)

![Printer Information](image)

Figure 94. Printer Information. This shows all of the actions and options available for the specified printer.
A prompt will appear asking if you want to add the selected printer. Click Yes. (Figure 95)

Figure 95. Add Web Printer Connection. This prompt asks if the client wants to connect to the specified printer.

The server will begin to push the drivers for the specified printer to your client. It may take a few moments. (Figure 96)

Figure 96. Printer Installation. The server will begin installing print drivers to the client machine.
The printer has been installed. You can either exit the browser, or click the link in the middle of the page to view your available printers. (Figure 97)

![Installation Complete](image1)

Figure 97. Installation Complete. The printer has successfully been installed to the client machine.

By clicking the link in the middle of the Web page, you are taken to your Devices and Objects window, which shows the newly-added printer. You can now print to it. (Figure 98)

![Devices and Printers](image2)

Figure 98. Devices and Printers. The newly-installed printer is now available for use.
References


<http://books.google.com/books?id=KRcEAAAAMBAJ&pg=PA30&dq=Migrating+from+NetWare+to+Windows+NT.&ei=tcPdStebDoy4No_iwNkP#v=onepage&q=Migrating%20from%20NetWare%20to%20Windows%20NT.&f=false>.


19. "Quest Software - NDS Migrator." Message to the author. 8 Feb. 2010. E-mail. MSRP for NDS Migrator is $7 per migrated user.


<http://www.visualbasicscript.com/m1510.aspx>. VBS imports a txt file as an array.

23. Robertson, Bruce. "Microsoft Gets You From NetWare To NT -." *Network Computing.*  


<http://www.vbsedit.com/scripts/ad/groups/scr_33.asp>. List All the Members of a Group, LDAP

<http://social.technet.microsoft.com/forums/en-US/winserverprint/thread/a8145628-01e5-4c85-b3dd-f65c67738c09/>. IIS with IPP printing