

Networking A Non-Profit

By

John Grosheim

Submitted to
the Faculty of the Information Engineering Technology Program
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John Grosheim

Date

John Nyland, Faculty Advisor

Date

Patrick C. Kumpf, Ed.D. Interim Department Head

Date

Table of Contents

1. Abstract.....	1
2. Problem Statement.....	2
3. Organizational Needs.....	3
4. Solution.....	4
5. Testing.....	6
6. Deliverables.....	6
7. Proof of Concept.....	7
8. Conclusion & Recommendation.....	8
8.1. Conclusion.....	8
8.2. Recommendation.....	8
Appendix A – Network Diagram.....	10
Appendix B – Timeline.....	11
Appendix C – Budget.....	12
Appendix D – Network Cabling & Power.....	13
Appendix E – Server Documentation.....	14
Appendix F – Server Documentation	15
Appendix G – Server Documentation	16
Appendix H – Windows XP Documentation	17

1. Abstract

There are thousands of non-profit organizations across America who need computers to assist them in completing their mission statements. One such agency here in town is Technology Assisting People In Need (TAPIN). TAPIN had a poorly constructed computer network, which hampered the agencies ability to share information and internet access. Having looked at the networking requirements for TAPIN I solved the networking problem by deploying an active directory network to cover user management, file and print sharing, distribution of internet access and deployment of Ghost Images. The deployment consisted of two Windows 2003 servers, one Windows 2000 Small Business Servers, a Windows XP workstation, three Cisco 2950T-EI switches and a few boxes of category 5e cable. The Internet connection sharing for this network was handled via Microsoft's Internet Security and Acceleration Server (ISA).

2. Problem Statement

Thousands of non-profit organizations across America need computers and other technology to assist with completion of their mission statements. While the goals and scopes of mission statements vary, one thing that remains true for all non-profit agencies is a lack of funds to purchase needed technology. Technology Assisting People In Need (TAPIN), had a poorly constructed network to share information and data. Severe problems with the network hindered the agency's ability to function effectively. TAPIN's most recent problem was a forced to move to a new facility which had mold problems and insufficient power for their needs.

TAPIN's network related problems were numerous and difficult to overcome:

- There was no way to distribute Internet access to the training lab or any other computers. The original mechanism was to swap the patch cable from one jack to another on the patch panel.
- There was no server to maintain a database of equipment in the inventory. Originally, the data was kept on a computer in the office, with the office staff making backup copies on CDs.
- There was no server to share software with the computers in the training lab. When software needs to be installed or updated, somebody had to take a CD to each computer.
- There was no easy way to reinstall or ghost the computers in the training lab. When a machine had to be reinstalled, a volunteer spent most of a day to reformat, reinstall, and reconfigure the system. This method resulted in a huge loss of volunteer time.
- There were no network cables installed in the new location, which made it impossible for the organization to use the training lab.
- There was a lack of power for all the computers, servers, and networking hardware.

3. Organizational Needs

TAPIN had several needs that had to fit within the constraints of time, money, and functionality. Based on my findings, TAPIN needed to have several servers, which had to be assembled and configured for various tasks. The first server to be brought online was to have Windows 2000 Small Business Server. This server is the domain controller, DNS server, DHCP server, and host for ISA, running as a proxy server and firewall. TAPIN also needed a file server running Windows 2003 Server to act as a central repository for all the data generated in the office and day-to-day operations. This server also hosts the inventory tracking software written by Cory Opp to provide inventory management and accountability. The third server they needed was a Windows 2003 Server to act as a CD server and a host for data used in training classes. The fourth and final server needed was as a central repository for Ghost images and a distribution point for multicast images. TAPIN also needed over 2,500 feet of networking cable installed to connect servers to the computers throughout the facility.

This project had several difficult constraints, which included time, money, labor, and hardware. The major constraint was money; there was no money available for this project. The organization had everything I need donated, or purchased via grants, so there was no room for other options. The servers that I used were donated machines, and at the time I started, most of them did not work. There was no money to buy new machines, so I had to piece together several machines with spare parts. Second was the lack of manpower; all of the new networking installations require a large number of hours to install and most of the time I was the only person working on this project. I did

manage to get assistance from a commercial electrician and a few other volunteers at TAPIN to assist me with this task. A third constraint was the facility; because TAPIN just moved into an old warehouse, there is no network cabling and inadequate power. During the course of this project, TAPIN and I had to deal with permits, inspections, and negotiating with the city and fire department to get approval for all of the electrical changes needed for the organization to function. The final constraint was the hardware; because none of this hardware was tested or known to work, I dealt with several intermittent devices. Most of this hardware was disposed of by Corporate America, so it was presumed to be bad. I had to test all of the machines to determine which ones were repairable, and then I chose which ones would be used. This proved especially troublesome in that the computers tended to be underpowered for the required usages.

4. Solution

Having spent time talking with the Managing Director of the agency, I formulated a plan that solved all the current network related problems for the agency. The solution took a systematic approach to alleviating the problems. My solution was a multi-step process that addressed all the problems of the agency, while addressing and hopefully mitigating most of the future problems. The structure for the network is shown in Appendix A. Since this project was for a non-profit organization the cost had to be kept to a minimum as the organization did not have any money budgeted for this project. The budget for this project showing the manufacturers suggested retail price and the price the agency paid are in Appendix C.

The list below documents what steps were taken to increase the organizations functionally and address the networking problems.

1. Replaced the old main breaker panel, ran new circuits, and modified existing electrical circuits to allow the organization to use the computers effectively, as well as incorporated an area for servers to be centrally located. See Appendix D for a diagram of the premises and the network cable/power installation.
2. Ran over 2,500 feet of Category 5e network cable to allow the organization to connect all of the computers to the centralized servers. See Appendix D for a diagram of the premises and the network cable/power installation.
3. Found and tested four servers, and repaired hardware problems as was needed by scavenging parts from other computers. By segmenting the work onto four separate servers, network traffic and maintenance was optimized.
4. Installed, configured, and tested the Windows Small Business Server. Part of the configuration on this server was to set it up as an Active Directory controller, firewall, router, DNS server, DHCP server, and proxy server. The specifications for this server are documented in Appendix E.
5. Installed, configured, and tested the Windows 2003 Server for use as a database server. The configuration on this server consisted of making it ready for use with an inventory control application, which is being written, as well as setting up secure file shares. These shares are used by the office staff as a place to keep all agency related data, which helps centralize the data and simplifies data backup. The specifications for this server are documented in Appendix F.
6. Configured a CD sharing server using a second copy of Windows 2003 Server for the training lab. This computer allows the computers in the training lab access to the media and training materials. This should assist in the process of updating, patching, and installing new packages onto the computers. This server has shares, which can be used for training classes to keep their projects, in addition to a place for the instructor to keep sample files for the learners. The specifications for this server are documented in Appendix G.
7. Configured and installed Windows XP Professional and Symantec Ghost Multicast Server to allow backup and deployment of images to all the computers in the lab. This server also takes backup information from other servers. This computer is on an internal network that exists only

within the server room. When the server is needed to image computers in the lab, it is equipped with a second network card which can be connected for the duration of the multicast session. This other network was set up to keep the data off the user accessible network for both bandwidth and security reasons. The specifications for this server are documented in Appendix H.

8. Installed, configured, and troubleshot three Cisco 2950-T-EI switches connecting all the computers on the network. These switches were installed and configured to allow all the computers to connect to both the servers and the Internet (through the proxy).

5. Testing

To test a network of this complexity requires a great deal of planning and care. This network was tested first in pieces, and then tested as a functional whole. The first tests were done as each section was completed (i.e., testing cable after punching down the ends). Once each piece was tested, they were tested as a completely functional unit. This unit testing was where I tested all the functionality of a server to make sure that it performed as expected. Finally, there was user acceptance testing, where the Managing Director of TAPIN used various computers to make sure the functionality matched what was expected. I have also committed to assist the organization with networking issues after the completion of this project.

6. Deliverables

I spent quite a bit of time considering all of the available solutions, worked with TAPIN to determine what was needed, consulted with professionals and came to the following list of solutions that should alleviate the problems of the agency, while allowing them to deal with future problems. Appendix B shows a timeline of when steps were completed.

1. Replaced main electrical service panel to the building and add about 200 Amps worth of new electrical circuits to several locations around the building.
2. Pulled over 2,500 feet of Category 5e network cabling to several locations around the building.
3. Found four server class computers and repaired them to bring them up to working order.
4. Installed, configured, and tested Windows Small Business Server and configure it as a firewall, router, DHCP server, and proxy server.
5. Installed, configured, and tested a Windows 2003 Server for use as a database server.
6. Installed, configured, and tested a Windows 2003 Server for the training lab, as a file server with CD shares.
7. Installed, configured, and tested a Windows XP Professional with Symantec Ghost Multicast Server.
8. Installed, configured, and tested three Cisco 2950-T-EI switches.

7. Proof of Design

Due to the fact that this project is a deployment of a network, there is no textual proof of design. The physical network has been shown to my Technical Advisor. Professor John Nyland has seen the functionality of the network deployed. Cory Opp has installed and tested the application he wrote as an inventory tracking package. Other proof of the design can be viewed by contacting Technology Assisting People In Need at 513-924-9111 to schedule a time to take a tour of the facilities.

8. Conclusions & Recommendations

8.1 Conclusion

In conclusion, this project has been an interesting experience that has forced me to learn and grow both personally and professionally. There was a considerable amount of time spent to determine the needs of the organization. The largest problem encountered during this project was the need for the organization to move during the second quarter of this project. The entirety of my project was thrown into boxes, crates, and pallets, and this pushed my entire project behind schedule by two months. The delay affected all the deadlines for the rest of the project.

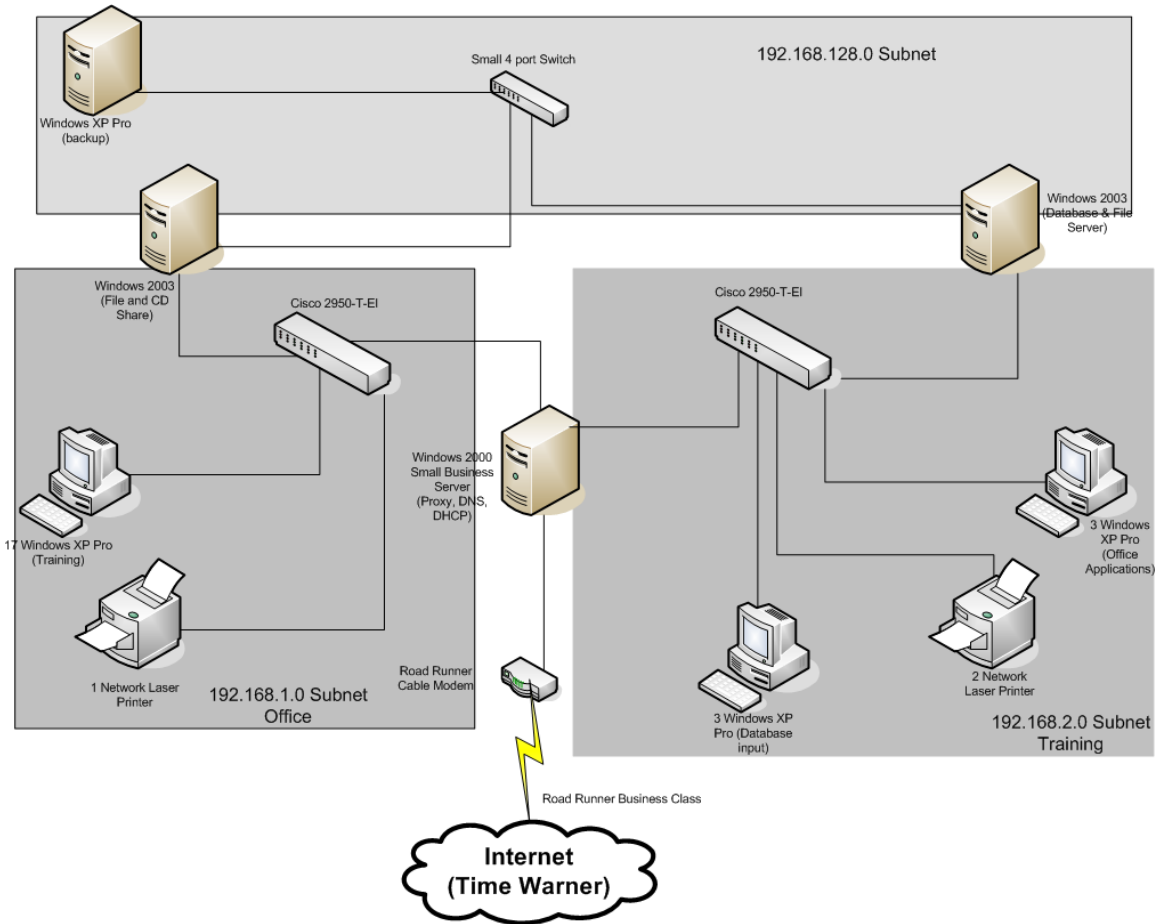
While this made for a hectic few weeks toward the end of the project, there were things that turned out very well for the organization. In hindsight, I should have taken more time to find some of the software prior to the move. I spent several weeks and over a hundred man hours with a few friends to find the server software once it arrived at the new facility.

8.2 Recommendations

During the course of this project I discovered several things that should be considered before attempting this project in the future. First and foremost, no matter how hectic things get always know where all of your essential parts, pieces and software is at all times. Second, never depend on a third party company to deliver services on time, always leave some leeway. Third, research all installation and security settings prior to attempting a software installation. Following a step by step guide can result in some

unexpected problems. Finally, put your project on a time line linearly but be prepared to be working on several pieces at once when there is a time crunch.

Appendix A Network Diagram

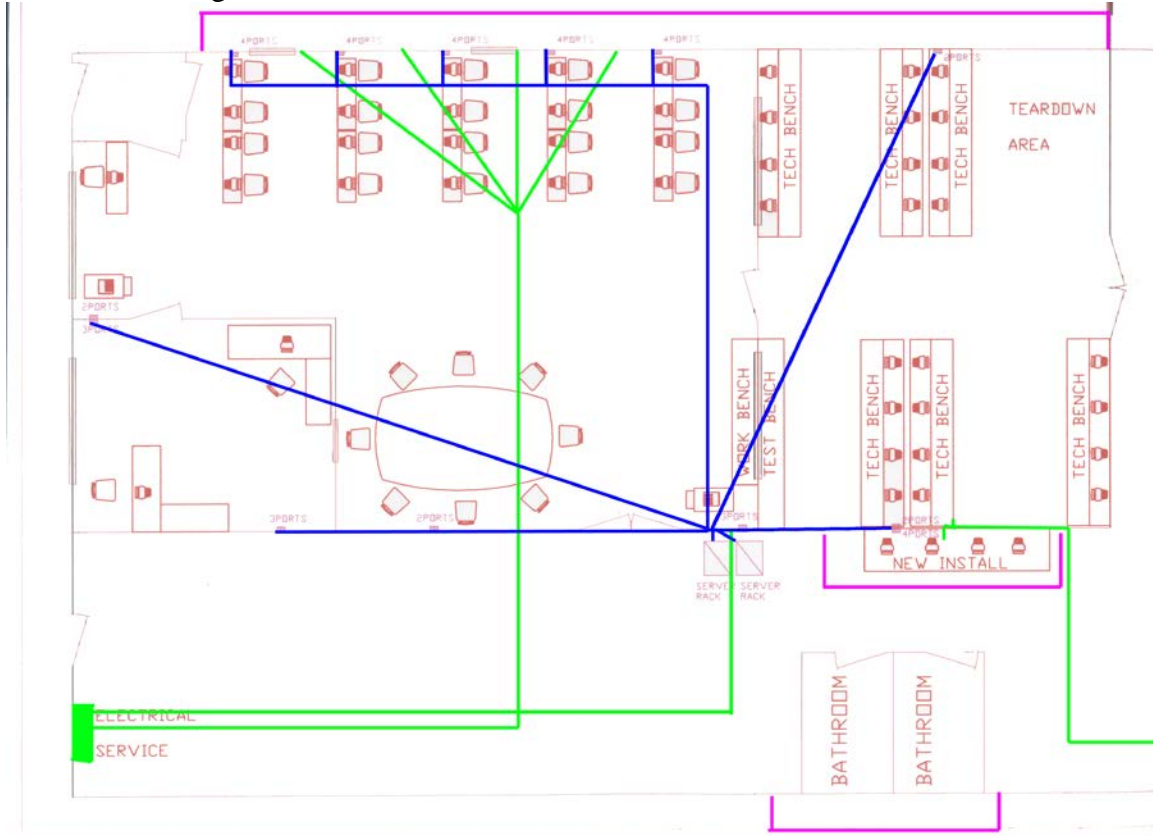


In each of the subnets listed above, all addresses from X.X.X.200 to X.X.X.225 are reserved as static addresses.

Appendix C Budget

Windows 2003 Server	2	\$1,015.00	\$2,030.00	\$30.00	\$60.00	Own
CAL's for 2003 Server (5CAL's ea.)	18	\$325.00	\$5,850.00	\$5.00	\$90.00	Own
Windows Small Business Server	1	\$509.00	\$509.00	\$45.00	\$45.00	Own
CAL's for Small Business Server (5 Cal's ea.)	9	\$300.00	\$2,700.00	\$1.50	\$13.50	Own
Windows XP Pro	30	\$270.00	\$8,100.00	\$6.00	\$180.00	Own
Office XP Pro	30	\$250.00	\$7,500.00	\$24.00	\$720.00	Own
Spool Cat 5e Cable (1000')	1	\$125.00	\$125.00	\$125.00	\$125.00	Donated
Bulk RJ45 connectors (100 Ea.)	1	\$50.00	\$50.00	\$50.00	\$50.00	Donated
Cisco 2950-T-EI	2	\$688.00	\$1,376.00	\$60.00	\$120.00	Own
New 200 AMP electrical Service Pannel	1	\$190.00	\$190.00	\$175.00	\$175.00	Purchase
Spool Electrical Wireing	4	\$200.00	\$800.00	\$200.00	\$800.00	Purchase
Total			\$29,230.00		\$2,378.50	

Appendix D Network Cabling & Power



Blue denotes network cables added.

Green denotes electrical service that was added or changed.

Purple denotes walls that were demolished during the course of this project.

Appendix E

Windows Server Installation Documentation

Basic Information

Operating System	Windows 2000 Small Business Server		
Server Name	TAPINSBS	NetBios Name	TAPINSBS
Product Version	Build 2195	Installation Date	4/18/2006
Time Zone	(GMT-05:00) Eastern time (US & Canada)		
Organization	TAPIN	Company	TAPIN

Physical Section

Memory	256 MB		
Physical Disk (1) Capacity	32 GB	Physical Disk (2) Capacity	32 GB
RAID Configuration	<input checked="" type="checkbox"/> RAID 0 <input type="checkbox"/> RAID 1 <input type="checkbox"/> RAID 5 <input type="checkbox"/> RAID 0+1 <input type="checkbox"/> Other:		
Network Interface Card (1)	Intel Pro/100 VE		
Network Interface Card (2)	Intel Pro/100+		
Network Interface Card (3)	3Com Etherlink XL 10/100 PCI		

Windows Configuration

Server Role(s)	DNS, DHCP, ISA Proxy Server		
Domain/Workgroup Name	Tapin.org		
Protocol[s]	TCP/IP		
Server TCP/IP Address (1)	192.168.1.254	Subnet	255.255.255.0
Server TCP/IP Address (2)	192.168.2.254	Subnet	255.255.255.0
Server TCP/IP Address (3)	192.168.42.104 (DHCP)	Subnet	255.255.255.0
DNS Server No 1	24.29.1.218	DNS Server No 2	24.29.1.219
DNS Server No 3	65.24.0.168	DNS Server No 4	65.24.0.159
DHCP Configuration	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gateway Address	192.168.42.1
Administrative Accounts	Emergency & DomAd	Password	18char complex & 10char w/ High LVL Ascii
Automatic Updates	Daily		

Installed Utilities, Service Packs, and Applications

Spybot	Adaware	Microsoft Defender
Microsoft ISA Server	Norton Antivirus	

Appendix F

Windows Server Installation Documentation

Basic Information

Operating System	Windows 2003 Server		
Server Name	TAPINOffice1	NetBios Name	TAPINOffice1
Product Version	Build 3790	Installation Date	4/22/2006
Time Zone	(GMT-05:00) Eastern time (US & Canada)		
Organization	TAPIN	Company	TAPIN

Physical Section

Memory	256 MB		
Physical Disk (1) Capacity	40 GB	Physical Disk (2) Capacity	N/A
RAID Configuration	<input type="checkbox"/> RAID 0 <input type="checkbox"/> RAID 1 <input type="checkbox"/> RAID 5 <input type="checkbox"/> RAID 0+1 <input type="checkbox"/> Other:		
Network Interface Card (1)	3Com SC920 Integrated Fast Ethernet Controller		
Network Interface Card (2)	3Com Etherlink XL 10/100 PCI		
Network Interface Card (3)	N/A		

Windows Configuration

Server Role(s)	File Server		
Domain/Workgroup Name	Tapin.org		
Protocol[s]	TCP/IP		
Server TCP/IP Address (1)	192.168.1.200	Subnet	255.255.255.0
Server TCP/IP Address (2)	192.168.128.3	Subnet	255.255.255.0
DNS Server No 1	192.168.1.254	DNS Server No 2	192.168.2.254
DNS Server No 3	N/A	DNS Server No 4	N/A
DHCP Configuration	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gateway Address	192.168.1.254
Administrative Accounts	Emergency & DomAd	Password	18char complex & 10char w/ High LVL Ascii
Automatic Updates	Daily		

Installed Utilities, Service Packs, and Applications

Spybot	Adaware	Microsoft Defender
Norton Antivirus		

Appendix H Microsoft Windows XP Installation Documentation

Basic Information

Operating System	Windows XP Professional		
Computer Name	TAPINGHOST	NetBios Name	TAPINGHOST
Product Version	Build 2600	Installation Date	4/22/2006
User Name	Domain Authenticated	Organization	TAPIN

Physical Section

Memory	256 MB		
Physical Disk (1) Capacity	10 GB		
RAID Configuration	<input type="checkbox"/> RAID 0 <input type="checkbox"/> RAID 1 <input type="checkbox"/> RAID 5 <input type="checkbox"/> RAID 0+1 <input type="checkbox"/> Other:		
Logical Disks Capacity	10 GB		
Network Interface Card (1)	Realtek RTL8139 Family PCI Fast Ethernet NIC		
Network Interface Card (2)	3Com Etherlink XL 10/100 PCI		

Windows Configuration

Product Key	Genuine Microsoft		Time Zone	(GMT-05:00) Eastern time (US & Canada)		
Country or Region	United States of America		Area Code	513		
Regional Settings	English (United States)		Language Group	Western Europe and United States		
Display Colors	Use Windows Default	Display Screen Area	Use Windows Default	Display Refresh Frequency	Use Windows Default	
Domain/Workgroup Name	TAPINGHOST.TAPIN.ORG					
Protocol(s)	TCP/IP					
Computer TCP/IP Address (1)	192.168.128.2	Subnet		Computer TCP/IP Address (2)	192.168.1.201	Subnet
DNS Server #1	192.168.1.254	DNS Server #2	192.168.2.254			
DHCP Configuration	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gateway Address	192.168.2.254			
Automatic Updates	<input checked="" type="checkbox"/> Enabled: Daily /3:00 AM		<input type="checkbox"/> Download Only	<input type="checkbox"/> Notify Only	<input checked="" type="checkbox"/> Disabled	

Installed Utilities, Service Packs, and Applications

Spybot	Adaware	Microsoft Defender
Norton Antivirus	Norton Ghost 8.0	