Lab 1: Physical Layer Network Technologies

CNIT 24000-005

Group 12

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Date Submitted: 10/28/2019

Date Due: 10/28/2019

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EXECUTIVE SUMMARY

This lab was all about the configuration of the architecture of the physical layer network of the host computers, switch, and router. The first major phase of this project was to setup the network of the PCs via the TP-link router. The next important phase was about the construction of twisted-pair media cables and troubleshooting the cables if broken and the speed testing of files on different duplex settings to different destinations. The final phase was constructing a laboratory architecture by enabling auto-negotiation and transmitting files through a Procurve switch in default, jumbo frames, and flow control settings enabled for each. Some of the major issues was that one of the host PC had hardware issues which made the process incorrect and inefficient. There was also a network driver problem while configuring the TP-Link router, where the host kept stating that there was a hardware problem. The parts that were not complete were the time server, flow control transmission between hosts, and the WSUS connection. The recommendations for this lab are to complete each step before the next step in order to complete the lab without random errors and to not configure any weird settings on the switch in order to not mess up with the next lab. The business scenario section talks about how this lab's architecture can be used effectively in a real-life situation in an organization and to structure the architecture, the procedure section provides the steps to build the lab architecture chronologically. The results section discusses about the outcome of the lab based on the procedure and the conclusions and recommendations section talks about the warnings and suggestions that people might regret or struggled on during the lab. Finally, appendix A lists the problems encountered during the lab process and appendix B contains the configuration of the Procurve switch.

BUSINESS SCENARIO

The company, named Server242 is a medium-sized server company that acts as a service that transfers large files between clients in the most efficient way. For instance, between large companies or clients who are willing to transfer massive amounts of data files through network without the delay, the use of file transmission through network is the best way to resolve it. This project is very useful for clients who need to transmit their files in the most effective in network processing wise and time wise which can improve both network performance and time. The applications and objects used in this project was Windows 10, ProCurve switch, TP-Link router, and Putty. The network assigned by the ISP is 10.17.12.0/24 and the network used internally is 192.168.12.0/24. The transmissions of files were made between the three host computers through the network using different transmission types such as default, jumbo frames, and flow control. There was no configuration of the pre-lab logical and physical network diagrams, it was a start off from just two PCs without Windows installed. The pre-lab architecture is described in the diagrams below:

Figure 1: Logical and Physical Network Diagram of Pre-Lab

PROCEDURE

This procedure phase is separated by the list of tasks shown chronologically in the check off sheet. The *text entered* are italicized, buttons are underlined, "texts displayed" inside quotation marks, **options** are bolded and menu tree navigation are formatted | in between menus.

Installed Windows 10

1. Turned the computer on by pressing the power button
2. Checked to see if screen, mouse, and keyboard was on the same monitor by clicking on the monitor switch box
3. Pressed F12 to go access boot setup while computer was powering up
4. Selected **Windows Installer** and pressed **Enter**
5. Selected "Install en_windows_10_business_editions_version_1903_x64_dvd_37200948"
6. Pressed Enter
7. Let the computer load while the Windows logo pops up
8. Left the default preferences, Language to Install: English, Time & Currency Format: "English (United States)", Keyboard or input method: "US"
9. Selected **Next**, **Install Now** and **Windows 10 Pro**
10. Accepted the license by clicking the check box next to "I accept the license terms"
11. Selected Custom for Windows installation
12. Selected partitions and deleted each one by clicking the Delete button and pressed Next
13. Waited for installation
14. Selected Restart now
15. After restart, left region at "United States"
16. Selected "US" for keyboard layout
17. Selected Skip for adding a second keyboard layout

18. Selected Personal Use for setting up
19. Skipped step of making or adding an account by selecting We have no internet
20. Selected With Limited Setup

Configured Computer/User Settings for both hosts

1. Selected No for "Doing more across devices with activity history"
2. Selected Decline for "Get help from your digital assistant"
3. Selected Accept when asked "Choose Privacy Settings for your Device"
4. Entered computer information:
    a. Host A
        i. Name: Group12A
        ii. Password: Group12!
    b. Host B
        i. Name: Group12B
        ii. Password: Group12!

Configured the TP-Link router to provide network connectivity to lab station

1. Took ethernet cables and plugged one end into ports of TP Link and both PCs
    a. Prepared a straight through cable and connected the router to the CIT network
    b. Prepared a straight through cable and connected both PCs to the router
2. Pop-Up asked, "Do you want to allow your PC to be discoverable by other PCs and devices on this network?"
    a. Selected "Yes"
3. Went to *192.168.1.1* on Internet Explorer
    a. Logged in with:

   i. Username: admin
   ii. Password: admin

4. Selected Network | WAN
   a. Set the WAN gateway address of the router to *10.17.12.1*
   b. Set the WAN interface address of the router to *10.17.12.2*
5. Selected Network | LAN
6. Set the LAN addresses of the router to *192.168.12.1 - 192.168.12.254*
7. Clicked Save Settings

Configured Network Connections

1. Went to Start | Control Panel | Network and Internet | Ethernet | Properties
2. Double clicked *Internet Protocol Version 4 (TCP/Pv4)*
3. Toggled "Use the following IP Address:"
4. Inputted following Information
   a. IP Address: 192.168.12.3
   b. Subnet Mask: 255.255.255.0
   c. Default Gateway: 192.168.12.1
   d. DNS Servers: 10.2.1.11 , 10.2.1.12
5. Selected Ok

Enabled virus and threat protection in Windows 10

1. Went to Start | Settings | Update & Security | Windows Security
2. Enabled "Virus and Threat Protection"

Ensured all patches and updates are installed

1. Went to Start | Settings | Update & Security | Check for Updates
2. Waited for updates to install
3. Rebooted computer after updates were ready to install

Proved connectivity between workstations via file sharing

1. Went to Start | Control Panel | Network and Sharing Center | Advanced Sharing Settings |
2. Toggled “Turn on network discovery”
3. Toggled “Turn on file and printer sharing”
4. Clicked Apply
5. Clicked “Save Changes”
6. Right clicked on the file or folder wanted to be shared
7. Clicked **Give access to then**, **Specific People**
8. Went to Start | Settings | Network & Internet | Sharing options
9. Checked off “Automatic setup of network”
10. Selected All Networks menu
11. Turned on “Sharing so anyone with network access can read and write files in the public folders”
12. Turned off “Password protected sharing”
13. Pressed Save Changes

Connected to the world wide web

1. Clicked on Internet Explorer on Windows taskbar
2. Typed *www.google.com* on browser search
3. Checked if Google showed up

Created a printer connection

1. Went to Start | Control Panel | Hardware and Sound | Devices and Printers | Add a Printer
2. Selected The printer that I want isn't listed
3. Toggled "Add a printer using a TCP/IP address or hostname"
4. Entered printer TCP/IP address *10.3.1.204*
5. Selected Generic Printer for printer categories
6. Selected Do not share printer

Constructed a TIA-568B and TIA-568Bspecification straight-through cable

1. Received a non-configured cable from TA
2. TIA-568A and TIA-568B cable specification:
    a. Removed 2 inches of silicone that wraps around the cables to reorder the pins according to:

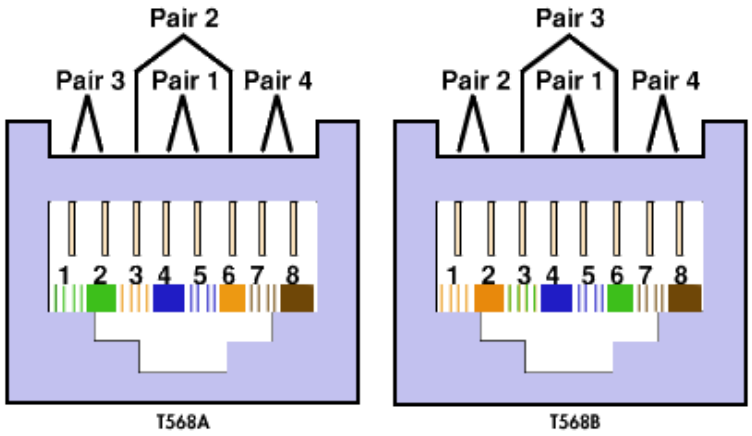

Figure 2: T568A and T568B pin configuration

Changed duplex settings to compare timing and performance

1. Went to Start | Control panel | Administrative Tools | Services

2. Right clicked on Wired AutoConfig and selected Properties
3. Set startup type to “Automatic”
4. Selected **Start** and **Apply** then **Ok**
5. Went to Start | Control panel | Network and Sharing Center
6. Right clicked on Ethernet and selected Properties
7. Selected Configure
8. Selected Advanced and Link Speed & Duplex
9. Created a dummy file 1MB and 100MB in size using the command: *fsutil file createnew FileSize1.txt 1000000* and *fsutil file createnew FileSize1.txt 100000000* respectively
    a. Found the dummy files under: “C:\Users\Group 12”
10. Went to the shared folder under “Network\Shares”
    a. Changed the value to “100 Mbps Full Duplex”
        i. Moved the dummy files under “C:\Users\Group 12” to the shared folder
        ii. Recorded the time it took for the file to complete each transmission
    b. Changed the value to “100 Mbps Half Duplex”
        i. Moved the dummy files under “C:\Users\Group 12” to the shared folder
        ii. Recorded the time it took for the file to complete each transmission
    c. Changed the value to “10 Mbps Full Duplex”
        i. Moved the dummy files under “C:\Users\Group 12” to the shared folder
        ii. Recorded the time it took for the file to complete each transmission
    d. Changed the value to “10 Mbps Half Duplex”
        i. Moved the dummy files under “C:\Users\Group 12” to the shared folder
        ii. Recorded the time it took for the file to complete each transmission
11. Went to Start | File Explorer and typed *\\rtfm.cit.lcl\Pub\CNIT24000\Garbage* on the file explorer address tab
    a. Changed the value to “100 Mbps Full Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Garbage folder

ii. Recorded the time it took for the file to complete each transmission

b. Changed the value to “100 Mbps Half Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Garbage folder

ii. Recorded the time it took for the file to complete each transmission

c. Changed the value to “10 Mbps Full Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Garbage folder

ii. Recorded the time it took for the file to complete each transmission

d. Changed the value to “10 Mbps Half Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Garbage folder

ii. Recorded the time it took for the file to complete each transmission

12. Clicked on Internet Explorer at Windows taskbar and typed *www.google.com* on browser search tab

a. Google searched *Google drive*

b. Logged in with personal Google credentials

c. Created a folder in Google Drive named *240*

d. Changed the value to “100 Mbps Full Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Google Drive folder

ii. Recorded the time it took for the file to complete each transmission

e. Changed the value to “100 Mbps Half Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Google Drive folder

ii. Recorded the time it took for the file to complete each transmission

f. Changed the value to “10 Mbps Full Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Google Drive folder

ii. Recorded the time it took for the file to complete each transmission

g. Changed the value to “10 Mbps Half Duplex”

i. Moved the dummy files under “C:\Users\Group 12” to the Google Drive folder

ii. Recorded the time it took for the file to complete each transmission

Installed Intel NIC and Network Drivers for both PCs

1. Powered PCs off and removed side cover
2. Installed the Intel NIC manually by removing PC parts

1. Booted PCs up and entered credentials for PC
2. Pressed “Ctrl + R”
3. Typed *devmgmt.msc* in the run by pressing Window Key and R
4. Right clicked on the installed network driver and select *Update Driver Software*

Configured speed and duplex settings on each host computers to enable auto-negotiation

1. Went to Start | Control Panel | View network status and tasks | Connections | Ethernet 2 | Properties | Configure | Advanced | Speed & Duplex
2. Ensured “Auto negotiation” was selected under the “Value” pull-down box.

Added HP ProCurve 2900-24G (or Cisco 3750) managed switch to network architecture

1. Plugged in ethernet cables according to the given network architecture
    a. Unplugged the straight through cable connected to the router from both PCs
    b. Plugged in the straight through cable from Host A to Port 1 on ProCurve
    c. Plugged in the straight through cable from Host B to Port 2 on ProCurve
    d. Prepared straight through cable to connect Port 3 on switch to TP-Link router
2. Restored the settings of HP ProCurve to factory settings
    a. Simultaneously pressed on Reset and Clear buttons on the switch with pointed objects
    b. Released the Reset button while pressing the Clear button
    c. Released the Clear button when the Self-Test LED starts to blink

Examined the MAC address

1. Opened Putty from Host A
2. Went to Device manager | Ports
3. Ensured a USB was connected to a COM #
4. Selected Serial from Putty
5. Typed in the COM# from device manager
6. Set speed to 9600
7. Opened port
8. Typed *show mac-address*
9. Mac-Address Table:

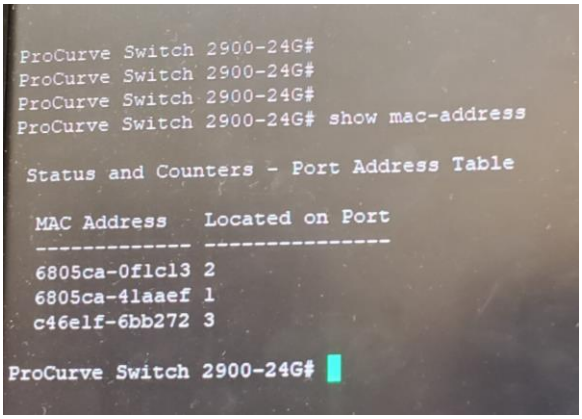

Figure 3: Non-configured Mac Address Table

Reconfigured the MAC address on host to be 00:11:22:33:44:55

1. Opened the Command Prompt by typing *cmd* on Windows Search
2. Typed *ipconfig /all*
3. Ensured the mac address of the PC was under a network adapter
4. Went to Device Manager
5. Selected **Network**
6. Right clicked network adapter that was covering the mac address of the PC “Intel(R) Gigabit CT Desktop Adapter”

7. Selected Properties | Advanced | Locally administered Address
8. Inserted value: *001122334455*
9. Selected Ok
10. Rebooted PC
11. Opened the Command Prompt by typing *cmd* on Windows Search
12. Typed *ipconfig /all*
13. Ensured the mac address of the PC was modified into 00:11:22:33:44:55
14. Went to Putty
    a. Went to Device manager | Ports
    b. Ensured a USB was connected to a COM #
    c. Selected Serial from Putty
    d. Typed in the COM# from device manager
    e. Set speed to 9600
    f. Opened port
15. Typed *show mac-address*
16. Mac-Address Table:

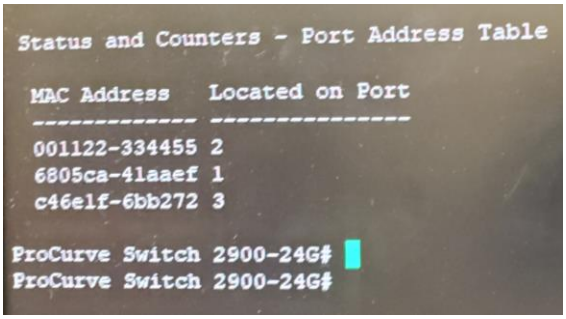

Figure 4: Configured Mac Address Table

Copied a large file (>250 MB) between Host A and Host B

1. Opened the Command Prompt by typing *cmd* on Windows Search

2. Created a dummy file 250MB in size using the command: *fsutil file createnew FileSize250.txt 262144000*
3. Found the dummy file under: “C:\Users\Group 12”
4. Copied the file to the clipboard.
5. Opened computer 1’s desktop by pasting *\\group12A\Users\Group 12\Desktop* into the File Explorer address bar.
6. Pasted the newly created dummy file onto computer 1’s desktop and recorded the amount of time it took for the transfer to occur.
    a. The transfer took an average of 2.29 seconds after multiple transfers.
7. Opened Putty.
    a. Selected Serial
    b. Adjusted the COM port from 1 to 3.
    c. Pressed Open
8. Typed *view interfaces*
9. Repeated the file transfer
10. Typed *view interfaces*
11. Took the difference between the numbers in the “Total Frames” column.

Copied the same large file between Host A and B using Jumbo Frames

1. Opened the Start | Control panel | View network status and tasks | Connections | Ethernet 2 | Properties | Configure | Advanced | Jumbo Packet
2. In the “Value” drop down box, selected 4088 bytes.
3. Typed *config*
    a. Typed *show vlans*
    b. Typed *vlan 1 jumbo*
    c. Typed *show vlans*

4. Ensured that the Jumbo section was changed from “No to Yes”
5. Opened computer 1’s desktop by pasting *\\group12A\Users\Group 12\Desktop* into the File Explorer address bar.
6. Pasted the newly created dummy file onto computer 1’s desktop and recorded the amount of time it took for the transfer to occur
7. Typed *write memory* to save the files and exit the switch
8. Opened Putty.
    a. Selected Serial
    b. Adjusted the COM port from 1 to 3.
    c. Pressed Open
9. Typed *view interfaces*
10. Repeated the file transfer
11. Typed *view interfaces*
12. Took the difference between the numbers in the “Total Frames” column.

Results

Through this lab, all hosts were able to download Windows 10 and successfully connect to the world wide web, printer, and other host via file sharing. To create this, there was the configuration of the WAN and LAN interface of the TP-Link router and the configuration of the host PCs in network and Windows patch and update wise. Next, to understand how twisted pair media works there was the creation of the TIA-568A and TIA-568B cables and troubleshooting them when broken. There were also network performance testing depending on the duplex settings and different destinations, such as host to host transmission and online transmission. The specific instructions were written down in the procedures. Finally, the installation of a new NIC driver and an addon of a Procurve switch was made in the network architecture. Using this novel architecture, there were successful transmission between host PCs through the switch by utilizing various ethernet options such as jumbo frames and flow control. The outcome for WSUS, flow control traffic, and time server was not met successfully throughout the procedure and this lab. Thus, this creates a network architecture that makes hosts not only connect to each other but also connects to the CIT network and online sources. As said, Figure 5 depicts what the logical diagram looks like when doing file sharing between provided computers and a personal laptop. All the hosts are considered equal and there is no hierarchy between each host. As for the physical diagram, the diagram depicts the setup for the computer system. The diagram looks the way it does because the TP-Link, which is the network's connection to the main server, CIT-NET, is what all the computers are connected to. But in between the hosts and the TP-Link is the ProCurve 2900, which is a switch that allows the hosts to be connected to each other and allow internet. Both diagrams are very important to understand how the systems and network work.

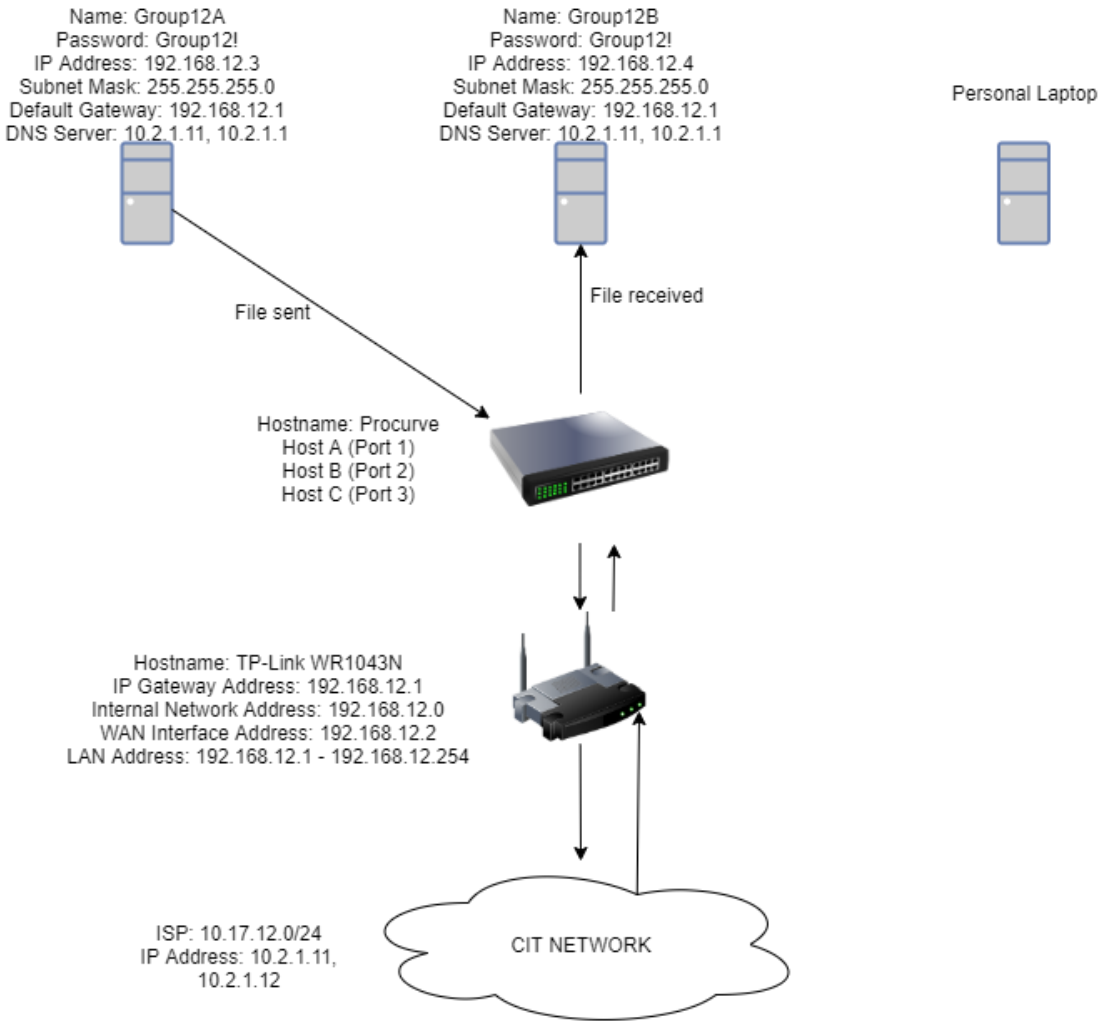

Figure 5: Logical Network diagram of current lab (ping 192.168.12.4)

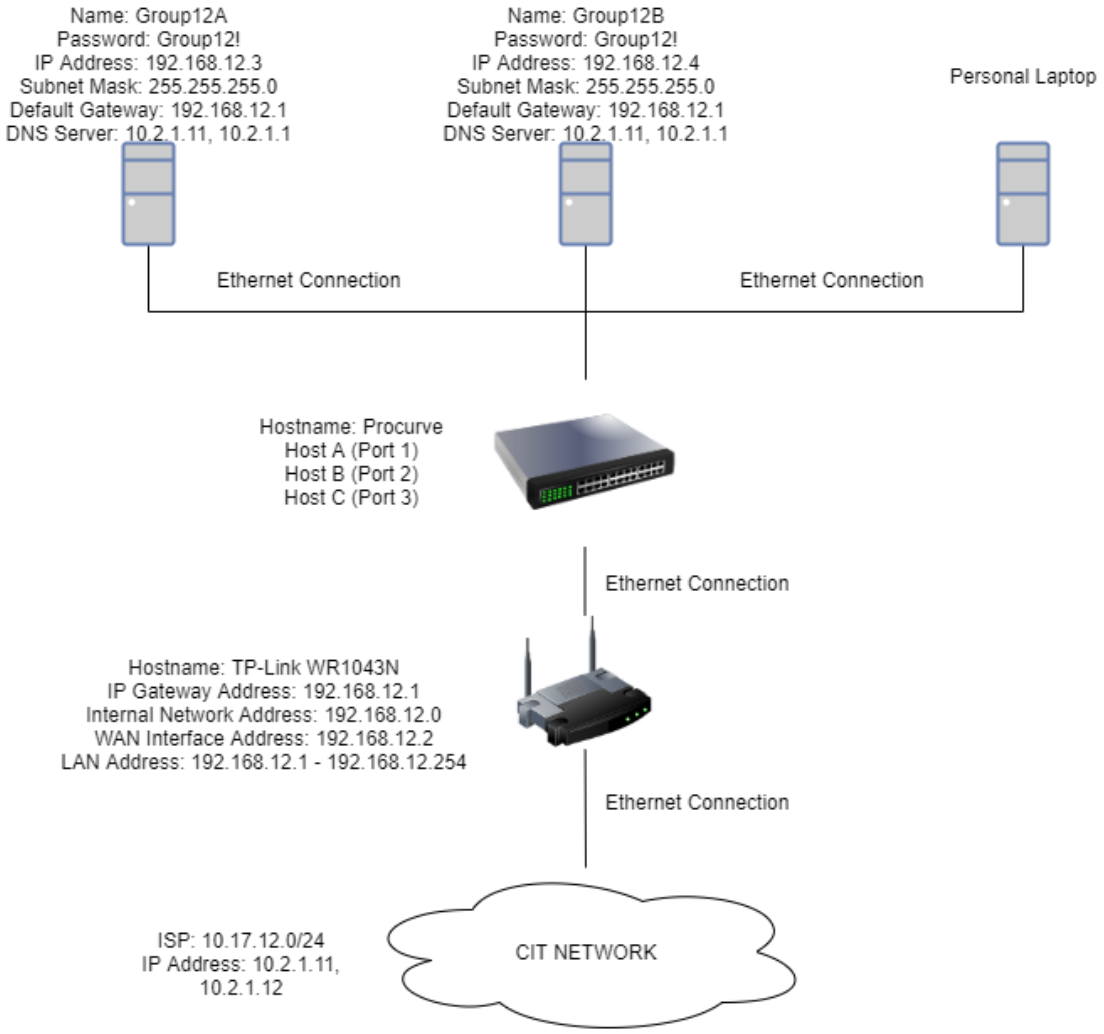

Figure 6: Physical Network diagram of current lab

Conclusions and Recommendations

In conclusion, this project did meet most of the requirements that was mentioned in the business scenario. This main purpose of the company Server242 was to transfer large files in the most efficient way in network performance wise and time wise. This lab did produce a solution to this by demonstrating the usage of duplex configurations and ethernet option configurations (jumbo frames) on large files and checking which transmission method results most efficiently. As shown in the procedure there were successful steps on duplex speed configurations and jumbo frames configurations through the switch. However, a few limitations in this lab is that the uncompleted demonstration of flow control transmission and PC configuration such as WSUS and time servers.

Recommendations

Recommendation 1: When monitoring the traffic of the switch, there must be no other browsers open or other network connections when transferring files between hosts or moving files to a shared folder. There might be interference in between the file transmission which might delay the performance than usual that affects the result of the lab.

Recommendation 2: When setting the password for the two hosts or any other machines that need passwords configured, the passwords should be uniform within a lab. If the password is not uniform it may cause confusion between members which might be time consuming when logging in.

Recommendation 3: When reconfiguring the pins of the TIA-568A and TIA-568B cables, double checking if the replacement of the pins is accurate is critical to the lab because once messed up it is complex to go back and check which cable has issues.

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APPENDIX A: Problem Solving

Problem 1: Broken Computer

Problem Description: Before starting the lab, one of the computers used was broken in which it would not turn on.

Problem Solution: The possible solutions to resolve this issue was to restart host computers or to ask the lab instructor and the professor could help because students fixing the PC might contain high risks.

Solution Attempted: The attempted solution was to ask the professor why the computer was not working properly.

Final Solution: Professor Yang asked someone else to help, and they removed the RAM and put it back into the computer which allowed the computer to start working. One major recommendation to prevent this issue might be to resolve this problem before starting on any lab steps because if this was a major issue the steps must be redone.

Problem 2: Network Connection Error

Problem Description: While trying to get the network connection to configure the TP-Link, the computer kept stating that there was a driver or hardware problem.

Problem Solution: The potential solutions for this issue was to restart the PC, disconnecting and reconnecting TP-Link and computer, and shutting off network and connections and turning it back on.

Solution Attempted: The solution attempted for this issue was to reconnect to TP-Link and computer by unplugging all ethernet cables.

Final Solution: The attempted solution did not work, and the TA suggested that deleting Windows and restarting the PC would be the fastest way to resolve this issue. One major step to prevent this problem

might be to check the device manager before starting to work on other lab instructions. Another major step might be to try to restart the TP-Link router instead of the PC.

Problem 3: Flow Control Setting

Problem Description: When enabling flow control, the jumbo frames setting could not be disabled for a systematic error.

Problem Solution: The possible solutions for this problem was repeating the disable jumbo frame command or to ask the TA for help or to reset the switch to factory defaults

Solution Attempted: The solutions attempted for this issue was repeating the disable jumbo frame command.

Final Solution: The jumbo frame command did not work on the switch which made us fail to complete this task due to time constraints. One of the major suggestions to prevent this issue is to try to discuss with the lab instructor for machine errors because it might also be a problem for future lab work.

Appendix B: Router and Switch Configurations

ProCurve Switch

show mac-address

!

view interfaces

!

config

show vlans

vlan 1 jumbo

show vlans

!

exit