Lab 1: Network Fundamentals and Cloud Service Measurement

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1. Objectives

- Master the network measurement tool: WireShark (Get Wireshark)
- Understand Internet traffic characteristics
- Understand the operations of a typical cloud-based storage service: Dropbox & Google Drive
- Compare Dropbox and Google Drive

2. Equipment Needs

- Computers
- Internet access

3. Experiments

3.1 Campus network traffic measurement

1) Download WireShark and study how to use it to capture packets, in particular, how to set filters to capture certain traffic or use built-in functions to display certain packets.
2) Go to NYU-Tandon cafeteria to capture packets in a wireless environment. Repeat the measurement in the morning, noon, and afternoon. For each time, capture the packets continuously for 10 minutes. (If you cannot make it to the NYU-Tandon campus, you can choose other public places with wifi access and decent amount of wifi users)
3) Analyze each measurement result and provide the following statistics.

Table 1 Campus Network Traffic Measurement

	Morning	Noon	Afternoon
Total number of packets captured	3784	17453	826965
Total number of bytes captured	1910896	12805909	861688382
Percentage of broadcast packets in packet numbers	0.4%	0.3%	0.0%(148)

Percentage of broadcast packets in bytes	0.1%	0.0%(2760)	0.0%(13629)
Percentage of packets with transmission errors in packet numbers	6.4%	13.4%	2.6%
Question 1: How do you count the number of broadcast packets?			
Answer 1: Filter: eth.addr == ff:ff:ff:ff:ff:ff			
Question 2: How do you decide if a packet belongs to a transmission error?			
Answer 2: Filter: tcp.analysis.flags			

3.2 Dropbox traffic measurement

1) Create a Dropbox account, and install the client software
2) Use Wireshark to capture the packets between the Dropbox client software and the cloud during the synchronization process (i.e., sync a file to dropbox), and understand the steps that the Dropbox client software takes to exchange data with the cloud.
3) Based on your measurement, fill out the following table to list ALL the servers the Dropbox client software interacted with. The order must be the same as what you observed.

Table 2 Dropbox-Cloud Interactions

Server domain name	Server IP address	Server's function	Amount of Traffic Exchanged
Client.dropbox-dns.com	162.125.4.3	Authentication of dropbox meta data	19KB
Bock-edge.dropbox.com	162.125.4.4	Dropbox Download	492KB
	172.16.47.255	Dropbox LAN Sync	352Bytes
Questions 1: How do you make sure the above servers/IPs are used for Dropbox but not other applications on your computer?			
Answer 1: In wireshark info column, we observe standard query in dns before the data transferred, which is contained three way handshake format.			
Questions 2: How do you decide the function of each server contacted?			
Answer 2: There are more tls process and traffic amount in download than authentication process/wireshark info column.			

3.3 Comparison between Dropbox and Google drive

1) Place a computer A in one subnet and place computer B in a different subnet, both computers should have the DropBox client software.
2) Create a shared Dropbox folder between computer A and computer B
3) Create a file in the shared folder on computer A, Dropbox should upload it to the Dropbox cloud, and mark the time to start upload as T1. Then wait for the file to be automatically downloaded to computer B, and mark the time the download is complete as T2. The time consumed for this process is then (T2-T1)

4) Try different files with different sizes with Dropbox and repeat the same for Google drive, and fill out the following table. (Highly recommended to use text files)

Table 3 Comparison 1: Dropbox and GDrive

	Using Dropbox		Using Google drive	
Files	Time Consumed	Bytes Uploaded	Time Consumed	Bytes Uploaded
File-a: 1 MB	59.814124 s	0.04825 MB	66.488856 s	0.72238 MB
File-b: 10 MB	63.217887 s	4.57768 MB	80.826297 s	4.34419 MB
File-c: 100 MB	105.016065 s	43.28153 MB	201.010152 s	106.65449 MB
Question: How do you measure T1 and T2 to reach high accuracy?	Answer: Both of us synched local computer time.			
Question: Is there any difference between number of bytes uploaded for Dropbox and Google Drive? If so, why?	Answer: Dropbox is better at compressing files than Google. And Dropbox sends files more quickly than Google.			

4) Now copy a file, File-C in the above table, to create a duplicate file. It will be uploaded to dropbox. Repeat the operation and let it be uploaded to Google drive. Measure the number of bytes being uploaded in each operation. Fill out the following table.

Table 4 Comparison 2: Dropbox and GDrive

# of bytes uploaded to Dropbox	19KB
# of bytes uploaded to Google drive	101MB
Is there any difference in number of uploaded bytes between DropBox and GoogleDrive? Is so, why is there a difference between the above two numbers?	Answer: Once we copy a 100MB .txt file that Dropbox already has in the Cloud, it syncs only the change, not the entire file. Google Drive has to upload the entire 100MB file all over again.

4. Link for wireshark capture files from each table:

https://drive.google.com/drive/folders/1O04SX23mG4lMhA5TW-vqqknnzvUylMAU?usp=sharing