

CS 594 IP Assignment 1

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1) The application is mostly suited for packet switching network over circuit switching. In packet switching resources are used as needed, so packets can be sent whenever they are needed and energy can be conserved. In this case data can be bursty which can be easily sent over packet switching.

Since the packet switching is fault tolerant, it ensures more reliability. Packet switching is cost efficient and it ensures that most of the bandwidth is used. Since there is no physical link between the source and the destination, the physical cost of setting up the route is reduced.

2) The top level goal of the DARPA architecture was to develop the internet using interconnected networks. The positive artifact was that the alternative to circuit switching, packet switching was developed and since then packet switching is being considered as a fundamental component in internet architecture. Another positive artifact is that store and forward technique where the data is stored in the intermediate device and errors are checked and they are sent to the destination at a later time.

Negative artifact is that the internet communication must always continue despite the loss of networks or gateway, this is not always true. Sometimes there are internet blackouts where the internet communication is lost. One way to preserve the data stored from being lost during the blackout is to backup the data in the secondary or tertiary servers such that the data is not lost. Another negative artifact is that the internet must be cost effective. This might not be the case all the time. Sometimes setting up the internet involves huge capital and even the implementation of new protocols also requires a large budget which most big companies do not agree easily. One of the drawbacks is that datagrams have not solved the resource accountability problems which can be solved by using the End-to-End principle.

3) a) 1000.5 s

b) 1000.26 s. The calculations are attached in the screenshot below.

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3a) $T_{\text{transmission}} = 32 \text{ Kbps} = R$
 $\text{distance} = 200 \times 10^6 \text{ km} = d$
 $\text{Speed} = 2 \times 10^8 \text{ m/s} = s$
 $\text{Packet size} = 2000 \text{ byte} = L$
 $T = \frac{L}{R} = \frac{2000 \times 8}{32 \times 10^3} = \frac{1}{2} = 0.5 \text{ s}$
 $\text{Delay} = d/s = \frac{200 \times 10^6 \times 10^3}{2 \times 10^8} = 1000 \text{ s}$
 $\text{Total time} = T + d = 1000.5 \text{ s}$

3b) $d_1 = 400$; $d_2 = 200 \times 10^6$ $R_1 = 2 \text{ Mbps}$
 $L_1 = 2000$; $L_2 = 2000$ $R_2 = 64 \text{ Kbps}$

$$T = \left(\frac{L_1}{R_1} + \frac{L_2}{R_2} \right) + \left(\frac{d_1}{s} + \frac{d_2}{s} \right)$$

$$= \left(\frac{2000 \times 8}{2 \times 10^6} + \frac{2000 \times 8}{64 \times 10^3} \right) + \left(\frac{400 \times 10^3}{2 \times 10^8} + \frac{200 \times 10^6 \times 10^3}{2 \times 10^8} \right)$$

$$= 0.008 + 0.25 + 0.002 + 1000$$

$$= 1000.26$$

4) Traceroute Program.

- a) The `traceroute` program when executed with the address “sdmcet.ac.in” (An Indian web page) the command has around 12 hops and rest of the hops are “* * *” till the 64 hops until it times out. The command is tested with different web addresses outside the US and it reaches some hops and times out.

From the screenshot attached below the trace route passes from local isp i.e. 10.0.0.1 and hops to beaverton then further hops to amsterdam and the request timed out.

```
MacBook-Pro:~ shrikishnabhat$ traceroute https://sdmcet.ac.in
traceroute: unknown host https://sdmcet.ac.in
MacBook-Pro:~ shrikishnabhat$ traceroute www.sdmcet.ac.in
traceroute to sdmcet.ac.in (92.119.150.250), 64 hops max, 52 byte packets
 1  10.0.0.1 (10.0.0.1)  6.258 ms  5.271 ms  4.996 ms
 2  96.120.60.85 (96.120.60.85)  13.995 ms  36.544 ms  13.815 ms
 3  68.87.219.181 (68.87.219.181)  13.833 ms  54.895 ms  15.423 ms
 4  ae2-2-rtr02.beaverton.or.beaverton.comcast.net (68.85.243.154)  13.962 ms  13.567 ms  44.304 ms
 5  96.216.60.245 (96.216.60.245)  13.414 ms  178.099 ms  42.582 ms
 6  68.85.243.197 (68.85.243.197)  21.886 ms  17.535 ms  16.716 ms
 7  4.68.37.245 (4.68.37.245)  39.729 ms  17.434 ms  15.567 ms
 8  ae2-280a.edge7.amsterdam1.level3.net (4.69.162.181)  313.361 ms  166.226 ms  291.454 ms
 9  worldstream.edge7.amsterdam1.level3.net (213.19.194.174)  162.959 ms  168.953 ms
10  189.236.95.185 (189.236.95.185)  224.131 ms
11  189.236.95.183 (189.236.95.183)  161.877 ms
12  189.236.95.181 (189.236.95.181)  223.492 ms
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
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60  * * *
61  * * *
62  * * *
63  * * *
64  * * *
```

- b) When the `traceroute` program is executed with address ‘www.google.com’ it finishes with 10-11 hops.

When the experiment is repeated at 3 different times of the day, each time the route goes to 3 different ip addresses.

The ip addresses are : 142.250.69.196, 142.251.33.100, 172.217.14.228 respectively.

```

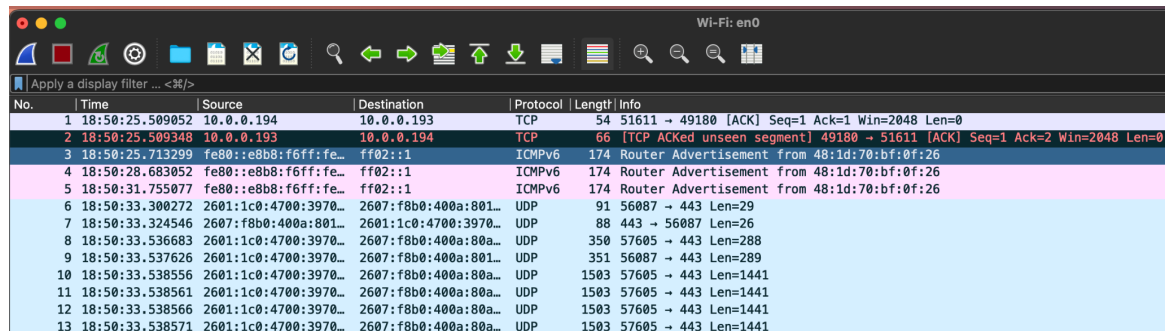
Last login: Fri Sep 30 10:23:35 on ttys002

The default interactive shell is now zsh.
To update your account to use zsh, please run 'chsh -s /bin/zsh'.
For more details, please visit https://support.apple.com/kb/HT208050.
MacBook-Pro:~ shrikishnabhat$ traceroute www.google.com
traceroute to www.google.com (142.251.33.100), 64 hops max, 52 byte packets
 1 10.0.0.1 (10.0.0.1) 7.839 ms 4.799 ms 5.008 ms
 2 96.120.60.85 (96.120.60.85) 15.495 ms 14.161 ms 31.250 ms
 3 68.87.219.181 (68.87.219.181) 16.702 ms 15.258 ms 13.983 ms
 4 ae-2-rur02.beaverton.or.bvorton.comcast.net (68.85.243.154) 14.015 ms 38.598 ms 14.864 ms
 5 96.216.60.245 (96.216.60.245) 14.547 ms 17.289 ms 15.439 ms
 6 68.85.243.197 (68.85.243.197) 38.764 ms 15.007 ms 16.098 ms
 7 be-36221-cs03.seattle.wa.ibone.comcast.net (68.86.93.57) 23.199 ms
  be-36221-cs02.seattle.wa.ibone.comcast.net (68.86.93.53) 29.058 ms
  be-36241-cs04.seattle.wa.ibone.comcast.net (68.86.93.61) 163.013 ms
 8 be-2312-pe12.seattle.wa.ibone.comcast.net (96.110.34.138) 19.560 ms
  be-2311-pe11.seattle.wa.ibone.comcast.net (96.110.32.234) 39.679 ms
  be-2411-pe11.seattle.wa.ibone.comcast.net (96.110.32.238) 23.745 ms
 9 66.208.228.170 (66.208.228.170) 21.490 ms 21.379 ms
 10 58.248.118.134 (58.248.118.134) 18.898 ms
 11 209.85.254.236 (209.85.254.236) 40.521 ms
 12 142.251.33.100 (142.251.33.100) 19.898 ms
 13 142.251.55.202 (142.251.55.202) 44.187 ms
MacBook-Pro:~ shrikishnabhat$

```

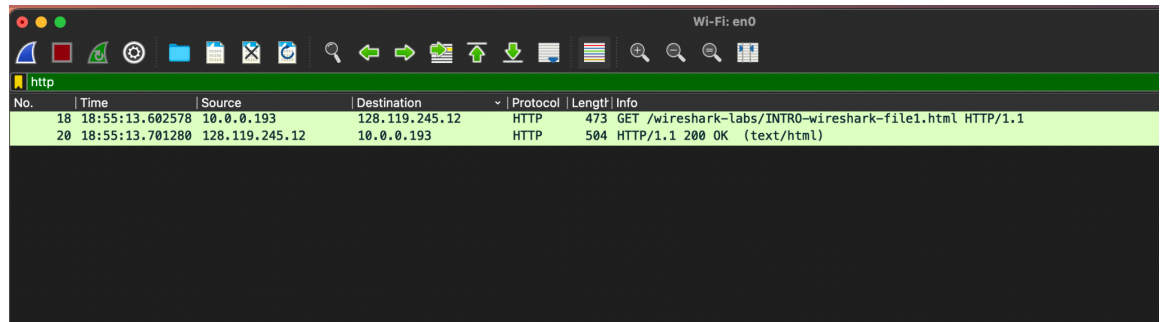
5) Wireshark labs

- a) The 3 protocols from running the wireshark labs are : TCP, ICMPv6 and UDP.



No.	Time	Source	Destination	Protocol	Length	Info
1	18:50:25.509052	10.0.0.194	10.0.0.193	TCP	54	51611 → 49180 [ACK] Seq=1 Ack=1 Win=2048 Len=0
2	18:50:25.509348	10.0.0.193	10.0.0.194	TCP	66	[TCP ACKed unseen segment] 49180 → 51611 [ACK] Seq=1 Ack=2 Win=2048 Len=0
3	18:50:25.713299	fe80::e8b8:f6ff:fe...	ff02::1	ICMPv6	174	Router Advertisement from 48:1d:70:bf:0f:26
4	18:50:28.683052	fe80::e8b8:f6ff:fe...	ff02::1	ICMPv6	174	Router Advertisement from 48:1d:70:bf:0f:26
5	18:50:31.755077	fe80::e8b8:f6ff:fe...	ff02::1	ICMPv6	174	Router Advertisement from 48:1d:70:bf:0f:26
6	18:50:33.300272	2601:1c0:4700:3970...	2607:f8b0:400a:801...	UDP	91	56087 → 443 Len=29
7	18:50:33.324546	2607:f8b0:400a:801...	2601:1c0:4700:3970...	UDP	88	443 → 56087 Len=26
8	18:50:33.536683	2601:1c0:4700:3970...	2607:f8b0:400a:80a...	UDP	350	57605 → 443 Len=288
9	18:50:33.537626	2601:1c0:4700:3970...	2607:f8b0:400a:801...	UDP	351	56087 → 443 Len=289
10	18:50:33.538556	2601:1c0:4700:3970...	2607:f8b0:400a:80a...	UDP	1503	57605 → 443 Len=1441
11	18:50:33.538561	2601:1c0:4700:3970...	2607:f8b0:400a:80a...	UDP	1503	57605 → 443 Len=1441
12	18:50:33.538566	2601:1c0:4700:3970...	2607:f8b0:400a:80a...	UDP	1503	57605 → 443 Len=1441
13	18:50:33.538571	2601:1c0:4700:3970...	2607:f8b0:400a:80a...	UDP	1503	57605 → 443 Len=1441

- b) It took 100.598 ms to get the OK reply from the HTTP sent.



No.	Time	Source	Destination	Protocol	Length	Info
18	18:55:13.602578	10.0.0.193	128.119.245.12	HTTP	473	GET /wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1
20	18:55:13.701280	128.119.245.12	10.0.0.193	HTTP	504	HTTP/1.1 200 OK (text/html)

- c) The internet address of the gaia.cs.umass.edu is : 128.119.245.12
The internet address of my computer is 10.0.0.193

- d) Printed messages GET and OK as below

/var/folders/39/1xdz5x5x2qncrm54skztyj_w0000gn/T/wireshark_Wi-Fi153LT1.pcapng 75 total packets, 2 shown

No.	Time	Source	Destination	Protocol	Length	Info
12	19:08:26.547309	10.0.0.193	128.119.245.12	HTTP	473	GET / wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1

Frame 12: 473 bytes on wire (3784 bits), 473 bytes captured (3784 bits) on interface en0, id 0
Ethernet II, Src: Apple_e3:53:09 (c8:89:f3:e3:53:09), Dst: CiscoSPV_bf:0f:26 (48:1d:70:bf:0f:26)
Internet Protocol Version 4, Src: 10.0.0.193, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 53272, Dst Port: 80, Seq: 1, Ack: 1, Len: 407
Hypertext Transfer Protocol

No.	Time	Source	Destination	Protocol	Length	Info
14	19:08:26.647907	128.119.245.12	10.0.0.193	HTTP	504	HTTP/1.1 200 OK (text/html)

Frame 14: 504 bytes on wire (4032 bits), 504 bytes captured (4032 bits) on interface en0, id 0
Ethernet II, Src: CiscoSPV_bf:0f:26 (48:1d:70:bf:0f:26), Dst: Apple_e3:53:09 (c8:89:f3:e3:53:09)
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.0.0.193
Transmission Control Protocol, Src Port: 80, Dst Port: 53272, Seq: 1, Ack: 408, Len: 438
Hypertext Transfer Protocol
Line-based text data: text/html (3 lines)