Computer Networks and Network Security: Lab Assignment One

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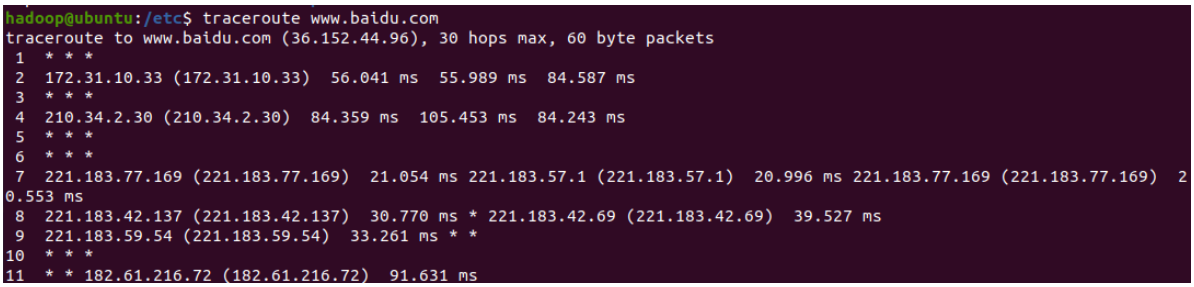
p1.a

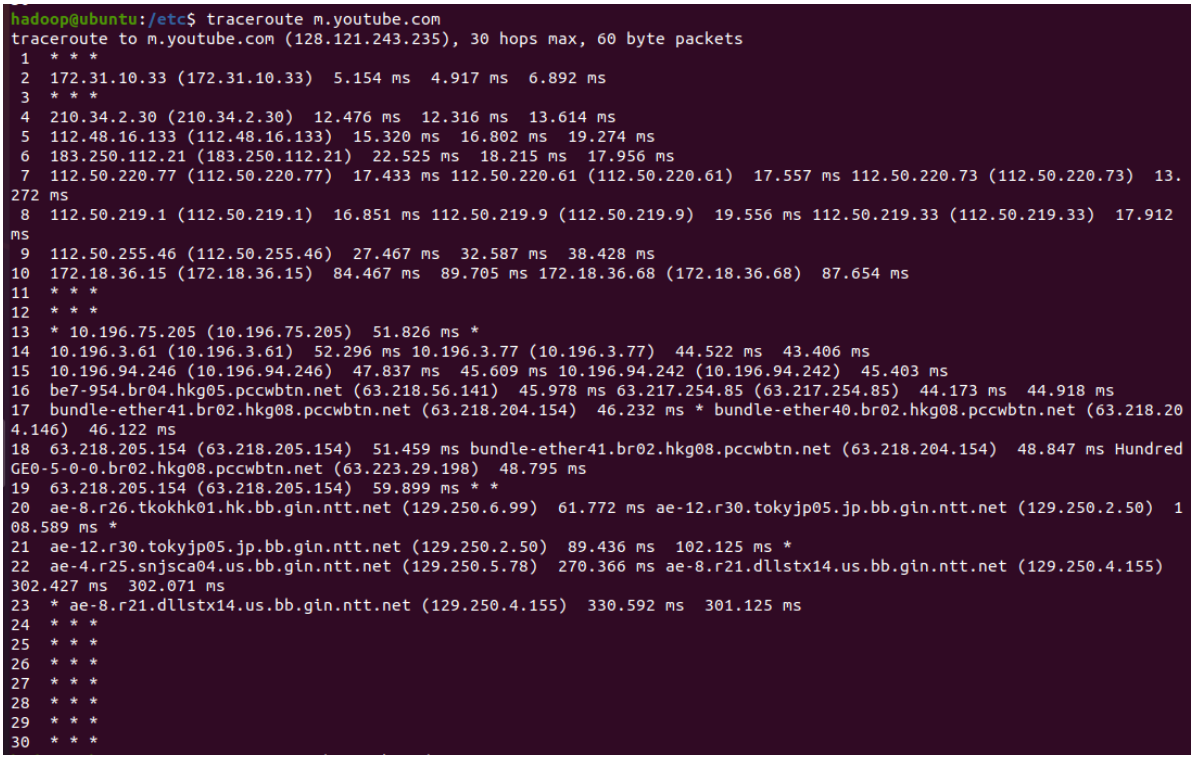
通过traceroute各个网站，观察跳转数量。

①www.baidu.com



```
hadoop@ubuntu:/etc$ traceroute www.baidu.com
traceroute to www.baidu.com (36.152.44.96), 30 hops max, 60 byte packets
 1  * * *
 2  172.31.10.33 (172.31.10.33)  56.041 ms  55.989 ms  84.587 ms
 3  * * *
 4  210.34.2.30 (210.34.2.30)  84.359 ms  105.453 ms  84.243 ms
 5  * * *
 6  * * *
 7  221.183.77.169 (221.183.77.169)  21.054 ms 221.183.57.1 (221.183.57.1)  20.996 ms 221.183.77.169 (221.183.77.169)  2
0.553 ms
 8  221.183.42.137 (221.183.42.137)  30.770 ms * 221.183.42.69 (221.183.42.69)  39.527 ms
 9  221.183.59.54 (221.183.59.54)  33.261 ms * *
10  * * *
11  * * 182.61.216.72 (182.61.216.72)  91.631 ms
```

②m.youtube.com



```
hadoop@ubuntu:/etc$ traceroute m.youtube.com
traceroute to m.youtube.com (128.121.243.235), 30 hops max, 60 byte packets
 1  * * *
 2  172.31.10.33 (172.31.10.33)  5.154 ms  4.917 ms  6.892 ms
 3  * * *
 4  210.34.2.30 (210.34.2.30)  12.476 ms  12.316 ms  13.614 ms
 5  112.48.16.133 (112.48.16.133)  15.320 ms  16.802 ms  19.274 ms
 6  183.250.112.21 (183.250.112.21)  22.525 ms  18.215 ms  17.956 ms
 7  112.50.220.77 (112.50.220.77)  17.433 ms 112.50.220.61 (112.50.220.61)  17.557 ms 112.50.220.73 (112.50.220.73)  13.
272 ms
 8  112.50.219.1 (112.50.219.1)  16.851 ms 112.50.219.9 (112.50.219.9)  19.556 ms 112.50.219.33 (112.50.219.33)  17.912
ms
 9  112.50.255.46 (112.50.255.46)  27.467 ms  32.587 ms  38.428 ms
10  172.18.36.15 (172.18.36.15)  84.467 ms  89.705 ms 172.18.36.68 (172.18.36.68)  87.654 ms
11  * * *
12  * * *
13  * 10.196.75.205 (10.196.75.205)  51.826 ms *
14  10.196.3.61 (10.196.3.61)  52.296 ms 10.196.3.77 (10.196.3.77)  44.522 ms  43.406 ms
15  10.196.94.246 (10.196.94.246)  47.837 ms  45.609 ms 10.196.94.242 (10.196.94.242)  45.403 ms
16  be7-954.br04.hkg05.pccwbtn.net (63.218.56.141)  45.978 ms 63.217.254.85 (63.217.254.85)  44.173 ms  44.918 ms
17  bundle-ether41.br02.hkg08.pccwbtn.net (63.218.204.154)  46.232 ms * bundle-ether40.br02.hkg08.pccwbtn.net (63.218.20
4.146)  46.122 ms
18  63.218.205.154 (63.218.205.154)  51.459 ms bundle-ether41.br02.hkg08.pccwbtn.net (63.218.204.154)  48.847 ms Hundred
GE0-5-0-0.br02.hkg08.pccwbtn.net (63.223.29.198)  48.795 ms
19  63.218.205.154 (63.218.205.154)  59.899 ms * *
20  ae-8.r26.tkokhk01.hk.bb.gin.ntt.net (129.250.6.99)  61.772 ms ae-12.r30.tokyjp05.jp.bb.gin.ntt.net (129.250.2.50)  1
08.589 ms *
21  ae-12.r30.tokyjp05.jp.bb.gin.ntt.net (129.250.2.50)  89.436 ms  102.125 ms *
22  ae-4.r25.snjsca04.us.bb.gin.ntt.net (129.250.5.78)  270.366 ms ae-8.r21.dllstx14.us.bb.gin.ntt.net (129.250.4.155)
302.427 ms  302.071 ms
23  * ae-8.r21.dllstx14.us.bb.gin.ntt.net (129.250.4.155)  330.592 ms  301.125 ms
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

③zh.m.wikipedia.org

```
hadoop@ubuntu:/etc$ traceroute zh.m.wikipedia.org
traceroute to zh.m.wikipedia.org (54.89.135.129), 30 hops max, 60 byte packets
 1  * * *
 2  172.31.10.29 (172.31.10.29)  64.748 ms  71.083 ms  104.642 ms
 3  * * *
 4  210.34.2.26 (210.34.2.26)  104.289 ms  127.945 ms  127.875 ms
 5  * * *
 6  183.250.112.21 (183.250.112.21)  114.152 ms  50.358 ms  43.979 ms
 7  * 112.50.220.77 (112.50.220.77)  20.900 ms *
 8  112.50.219.5 (112.50.219.5)  22.543 ms 112.50.219.21 (112.50.219.21)  25.534 ms 112.50.219.17 (112.50.219.17)  14.24
3 ms
 9  111.24.11.33 (111.24.11.33)  13.592 ms  41.224 ms  36.704 ms
10  111.24.4.149 (111.24.4.149)  60.234 ms  59.520 ms  63.048 ms
11  111.24.4.246 (111.24.4.246)  46.056 ms 111.24.4.250 (111.24.4.250)  44.233 ms 111.24.5.2 (111.24.5.2)  42.145 ms
12  221.183.68.141 (221.183.68.141)  40.273 ms 221.176.18.110 (221.176.18.110)  39.440 ms 221.176.22.106 (221.176.22.106
)  36.152 ms
13  221.183.52.86 (221.183.52.86)  40.560 ms  42.563 ms *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

在经过对多个网站traceroute之后，发现m.youtube.com的跃点最多，近似认为为23个

p1.b

通过尝试不同的服务器，可得到从本地到116.200.250.150经过了5个ISP

```
hadoop@ubuntu:/etc$ traceroute 116.200.250.150 -A
traceroute to 116.200.250.150 (116.200.250.150), 30 hops max, 60 byte packets
 1  * * *
 2  172.31.10.33 (172.31.10.33) [*]  1163.381 ms  1170.041 ms  1178.602 ms
 3  * * *
 4  210.34.2.30 (210.34.2.30) [AS4538]  1248.433 ms  1252.781 ms  1267.579 ms
 5  * * *
 6  183.250.112.21 (183.250.112.21) [AS9808]  1280.206 ms  1088.976 ms  1084.948 ms
 7  112.50.220.69 (112.50.220.69) [AS9808]  1076.317 ms 112.50.220.73 (112.50.220.73) [AS9808]  1010.886 ms 112.50.220.69 (112.50.220.69) [AS9808]  1007.027 ms
 8  111.24.11.61 (111.24.11.61) [AS9808]  996.007 ms  991.033 ms  2018.296 ms
 9  * * *
10  111.24.5.186 (111.24.5.186) [AS9808]  2244.665 ms 111.24.5.170 (111.24.5.170) [AS9808]  2248.087 ms 111.24.5.194 (111.24.5.194) [AS9808]  2249.184 ms
11  221.176.22.158 (221.176.22.158) [AS9808/AS9394]  1843.053 ms  1616.322 ms 221.183.68.145 (221.183.68.145) [AS9808/AS9394]  1613.203 ms
12  221.183.25.117 (221.183.25.117) [AS9808/AS9394]  1608.352 ms 221.176.19.210 (221.176.19.210) [AS9808/AS9394]  854.644 ms 221.176.19.214 (221.176.19.214) [A
S9808/AS9394]  854.289 ms
13  221.183.55.53 (221.183.55.53) [AS9808/AS9394]  1032.921 ms  1032.601 ms  1032.300 ms
14  223.120.2.237 (223.120.2.237) [AS58453]  906.393 ms 223.120.2.181 (223.120.2.181) [AS58453]  902.673 ms 223.120.2.177 (223.120.2.177) [AS58453]  905.676 ms
15  223.120.2.190 (223.120.2.190) [AS58453]  904.539 ms  1490.467 ms 223.120.2.246 (223.120.2.246) [AS58453]  1490.193 ms
16  223.121.2.42 (223.121.2.42) [AS58453]  1489.968 ms  1491.550 ms  1497.095 ms
17  112.174.89.89 (112.174.89.89) [AS4766]  1507.152 ms 112.174.80.113 (112.174.80.113) [AS4766]  1503.845 ms 112.174.80.109 (112.174.80.109) [AS4766]  990.731
 ms
18  112.174.86.93 (112.174.86.93) [AS4766]  1004.385 ms 112.190.29.169 (112.190.29.169) [AS4766]  1012.977 ms 112.190.29.177 (112.190.29.177) [AS4766]  1020.57
9 ms
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

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P_2. 平均每分钟 $\lambda = \frac{60000}{24\times60} = \frac{1000}{24} = \frac{125}{3}$ /min

$\mu = \frac{1}{3}$ /min $\therefore \rho = \frac{\lambda}{\mu} = 125$

假设有 k 个线，阻塞率 $P_k = \frac{1}{(k+1)!}\rho^k \frac{1}{1+\frac{1}{1!}\rho+\cdots+\frac{1}{k!}\rho^k} = 1\%$

P_3 $\lambda = 15/s$ $\mu = \frac{1}{200ms} = 5/s$ 四核 $\mu' = 20/s$

$\rho = \frac{\lambda}{\mu'} = \frac{3}{4}$ $s = \frac{1}{\mu'} = \frac{1}{20}$

$\therefore$ 排队延迟 $W = s\frac{\rho}{1-\rho} = \frac{1}{20}\times\frac{\frac{3}{4}}{\frac{1}{4}} = \frac{3}{20}s$

传输延迟 $s = \frac{1}{\mu} = 0.2s = \frac{1}{20}$

$\therefore$ 总服务时间为 $W+s = \frac{4}{20} = \frac{1}{5} = 0.2s$

当核心为 2 时 $\mu'' = 10/s$ $\rho' = \frac{\lambda}{\mu''} = \frac{15}{10} = \frac{3}{2} > 1$

可知平均排队延迟 $\to \infty$

P_4. a. $d_{prop} = \frac{m}{s}$

b. $d_{trans} = \frac{L}{R}$

c. end-to-end ed delay $= d_{prop} + d_{trans} = \frac{m}{s} + \frac{L}{R}$

d. it just left the host A

e. the first bit is in the single link between A and B

f. the first bit has arrived at the host B

g. let $\frac{m}{s} = \frac{L}{R}$ so $m = \frac{L}{R}s = \frac{120}{56\times1000}\times2.5\times10^8 = 5.357\times10^5$

P5 a. $R \cdot d_{prop} = 2\times10^3 \times \frac{20000\times10^3}{2.5\times10^8} = 1.6\times10^5$

b. $d_{trans} = \frac{L}{R} = \frac{500\,000}{2\times(10^3)^2} = 0.4s$

c. the bandwith-delay product is to show how many bits the link can contain.

d. the width is $\frac{m}{R\cdot d_{prop}} = \frac{s}{R} = \frac{2.5\times10^8}{2\times1000^2} = 125m$

It's longer than a football field.

e. the width of a bit is $\frac{m}{R\cdot d_{prop}} = \frac{s}{R}$

P6 ~~$d_{trans} = \frac{64\times10^3}{56\times8}$~~ $l_1 =$

$d_{proc} = \frac{56\times8}{64\times10^3} = 7ms$ $d_{prop}^{trans} = \frac{64\times10^3}{2\times(10^3)^2} = \frac{32}{10^3} = 32ms$

$d_{prop} = 10ms$

so the whole time is $49ms$

P7 if we use the link, it will take $t = \frac{40\times(1000)^4\times8}{100\times(1000)^2} = 3.2\times10^6 s$

≈ 37 days.

So, chose FedEx ~~may~~ may be a good choice.

P8. a. circuit-switched network may be more appropriate for this application because when the app is starts, it will continue running for a long period of time and the app will start in a small rate, It will cause packet loss and congestion if we use packet switch network

b. No, because the sum of the application data rates is less than the capacities of each and every link.

P9. a. $\frac{3\times(10^3)^2}{150\times10^3} = 20$

b. 10%

c. $C_{120}^{n}\,0.1^{n}\,0.9^{1-n}$

d. ~~$P=1-C_{120}^{20}\,0.1^{20}\,0.9^{20}=$~~ $P=1-\sum_{n=0}^{20} C_{120}^{n}\,0.1^{n}\,0.9^{1-n}$

P10. a. the total time is $3\times\frac{8\times10^6}{2\times(10^3)^2} = 12s$

b. the first packet use $\frac{10000}{2\times(10^3)^2} = 5ms$

the second packet use $2\times5 = 10ms$

c. the total time is $5\times3+799\times5 = 4.01s < 12s$

it's faster than sending without message segmentation

d. it will do better in error detection and no much cache is needed

e. we should take another time to do message segmentation and recovery

P11. $n=\frac{F}{S}$ $d_{trans}=\frac{S+60}{R}$ ∴ $t=\frac{3(S+80)}{R}+\frac{(S+80)}{R}\times(\frac{F}{S}-1)$

$$=\frac{S+80}{R}(\frac{F}{S}+2)$$

$$=\frac{F}{R}+\frac{160}{R}+\frac{80F}{RS}+\frac{25}{R}$$

$\geq \frac{F}{R}+\frac{160}{R}$ ∎

when $\frac{80F}{RS}=\frac{25}{R}$ $\Rightarrow S=\sqrt{40F}$, we can find the value

P12. 当一个 skype 用户打一个电话给普通用户时，Internet 电话网关将语音编码、压缩、打包，经路由器在IP网络中传输。接收方路由器接到数据包后，根据IP地址将数据传给接收方网关，该网关将数据拆包、解码、解压缩随后传给普通电话，向电话向 skype 用户传输过程亦是如此.