Computer Networks and Network Security: Lab Assignment One 王垚

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P1. a. 通过指定-m参数调节数据包的ttl值使其能再网络中的生存周期延长来发现更多的跳转，多次实验发现cemtos官网的跳转数较多为23跳

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tqym@ubuntu:~$ traceroute centos.org
traceroute to centos.org (81.171.33.202), 30 hops max, 60 byte packets
 1  _gateway (192.168.1.1)  4.371 ms  4.257 ms  4.201 ms
 2  100.100.0.1 (100.100.0.1)  5.564 ms  5.495 ms  5.449 ms
 3  112.5.175.53 (112.5.175.53)  11.129 ms  5.353 ms  11.032 ms
 4  112.50.220.65 (112.50.220.65)  9.813 ms *  6.401 ms
 5  111.24.11.61 (111.24.11.61)  9.651 ms  9.606 ms  9.555 ms
 6  221.183.98.70 (221.183.98.70)  21.935 ms 111.24.5.89 (111.24.5.89)  31.047 ms 221.183.98.66 (221.183.98.66)  30.948
 ms
 7  111.24.5.194 (111.24.5.194)  37.841 ms 111.24.5.182 (111.24.5.182)  27.491 ms 111.24.14.150 (111.24.14.150)  27.177
 ms
 8  221.176.22.158 (221.176.22.158)  48.679 ms 221.183.68.145 (221.183.68.145)  26.705 ms 221.176.24.6 (221.176.24.6)
26.415 ms
 9  221.176.19.42 (221.176.19.42)  35.127 ms 221.176.20.2 (221.176.20.2)  25.953 ms 221.183.25.117 (221.183.25.117)  34
.671 ms
10  221.183.55.81 (221.183.55.81)  47.169 ms 221.183.55.57 (221.183.55.57)  197.350 ms 221.183.55.53 (221.183.55.53)  4
6.692 ms
11  223.120.15.109 (223.120.15.109)  261.888 ms 223.120.15.101 (223.120.15.101)  262.394 ms 223.120.15.57 (223.120.15.5
7)  250.160 ms
12  223.120.10.198 (223.120.10.198)  254.830 ms  242.380 ms  248.459 ms
13  149.14.199.193 (149.14.199.193)  341.483 ms  341.410 ms *
14  be3672.ccr52.lhr01.atlas.cogentco.com (130.117.48.145)  348.646 ms * be3671.ccr51.lhr01.atlas.cogentco.com (130.117
.48.137)  354.149 ms
15  be3488.ccr42.lon13.atlas.cogentco.com (154.54.60.13)  341.138 ms  341.090 ms be3487.ccr41.lon13.atlas.cogentco.com
(154.54.60.5)  341.036 ms
16  be2870.ccr22.lon01.atlas.cogentco.com (154.54.58.174)  329.902 ms be2868.ccr21.lon01.atlas.cogentco.com (154.54.57.
154)  325.038 ms be2871.ccr21.lon01.atlas.cogentco.com (154.54.58.186)  324.612 ms
17  151.139.40.3 (151.139.40.3)  291.300 ms 151.139.40.9 (151.139.40.9)  279.656 ms  282.181 ms
18  151.139.40.69 (151.139.40.69)  280.204 ms 151.139.40.67 (151.139.40.67)  274.183 ms 151.139.40.69 (151.139.40.69)
281.260 ms
19  * * *
20  151.139.80.3 (151.139.80.3)  279.399 ms  279.345 ms 151.139.80.6 (151.139.80.6)  279.282 ms
21  151.139.82.7 (151.139.82.7)  279.989 ms  284.387 ms 151.139.82.9 (151.139.82.9)  283.592 ms
22  * * *
23  ip-81.171.33.202.centos.org (81.171.33.202)  285.672 ms !X  280.118 ms !X  282.120 ms !X
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b.通过尝试不同的服务器，从本地到116.203.240.158主机所经过的ISP最多，为5个

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tqym@ubuntu:~$ traceroute 116.203.240.158 -A
traceroute to 116.203.240.158 (116.203.240.158), 30 hops max, 60 byte packets
 1  _gateway (192.168.0.1) [*]  37.741 ms  37.610 ms  37.545 ms
 2  1.176.30.117.broad.xm.fj.dynamic.163data.com.cn (117.30.176.1) [AS140330]  37.490 ms  37.433 ms  37.356 ms
 3  117.30.25.41 (117.30.25.41) [AS140330]  40.220 ms 117.30.25.45 (117.30.25.45) [AS140330]  37.239 ms  37.227 ms
 4  117.30.26.117 (117.30.26.117) [AS140330]  37.128 ms 61.154.236.9 (61.154.236.9) [AS140330]  39.996 ms  39.941 ms
 5  202.97.103.9 (202.97.103.9) [AS4134]  43.144 ms 202.97.40.165 (202.97.40.165) [AS4134]  43.090 ms *
 6  202.97.24.254 (202.97.24.254) [AS4134]  42.980 ms * 202.97.57.145 (202.97.57.145) [AS4134]  28.013 ms
 7  202.97.94.114 (202.97.94.114) [AS4134]  27.927 ms 202.97.94.98 (202.97.94.98) [AS4134]  27.845 ms 202.97.83.62 (202.97.83.62) [AS4134]  43.989 ms
 8  202.97.13.26 (202.97.13.26) [AS4134]  228.360 ms 202.97.89.110 (202.97.89.110) [AS4134]  228.285 ms 202.97.95.206 (202.97.95.206) [AS4134]  217.460 ms
 9  ae77.edge3.London15.Level3.net (195.50.126.217) [AS9057/AS3356]  269.608 ms  329.576 ms *
10  * ae-2-3204.edge7.Amsterdam1.Level3.net (4.69.162.181) [AS3356]  248.082 ms *
11  AS33891-NET.edge7.Amsterdam1.Level3.net (212.72.41.234) [AS9057/AS3356]  227.828 ms  227.768 ms  225.277 ms
12  ae6-2011.nbg40.core-backbone.com (80.255.14.246) [AS201011/AS33891]  215.266 ms  215.215 ms  225.111 ms
13  core-backbone.hetzner.com (5.56.20.254) [AS33891]  234.984 ms  205.714 ms core-backbone.hetzner.com (81.95.15.6) [AS33891]  244.702 ms
14  213-239-245-73.clients.your-server.de (213.239.245.73) [AS24940]  234.819 ms core12.nbg1.hetzner.com (213.239.229.165) [AS24940]  244.573 ms  233.765 ms
15  static.85-10-228-86.clients.your-server.de (85.10.228.86) [AS24940]  243.401 ms  243.145 ms spine1.cloud1.nbg1.hetzner.com (85.10.250.210) [AS24940]  253.428 ms
16  * * *
17  12546.your-cloud.host (88.99.159.151) [AS24940]  222.290 ms  222.232 ms  229.099 ms
18  static.158.240.203.116.clients.your-server.de (116.203.240.158) [AS24940]  209.025 ms  222.027 ms  221.970 ms
tqym@ubuntu:~$
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P2 XMU平均每分钟访问速度 $\lambda = \frac{60000}{24\times60} = \frac{1000}{24} = \frac{125}{3}$ /min

平均处理速度 $\mu = \frac{1}{3}$ /min ∴ $\frac{\lambda}{\mu} = 125 = \rho$

假设需要k个电话，其阻塞率

$P_k = \frac{\frac{1}{(k+1)!}\rho^k}{1+\frac{1}{1!}\rho+\cdots+\frac{1}{k!}\rho^k} = 1\%$

∴当 $k \geq 144$ 时，$P_k < 1\%$ ∴需要144条外部电话线

P3

单核处理速度 $v = \frac{1}{200ms} = 5/s$

四核处理速度 $\mu = 4 \times v = 20/s$

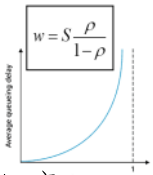
web请求速度 $\lambda = 15/s$

$\therefore \rho = \frac{\lambda}{\mu} = \frac{3}{4}$. $S = \frac{1}{\mu} = \frac{1}{20}$

$\therefore$ 排队延迟 $w = S\frac{\rho}{1-\rho} = \frac{3}{20}s$

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

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



当核心数为2时, $\mu = 2v = 10/s$

$\rho = \frac{\lambda}{\mu} = 1.5/s$, 可知平均排队延迟将无穷大

P4

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

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

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

d. Just left host A

e. the single link between A and B

f. Host B

g. let $\frac{m}{s} = \frac{L}{R} \Rightarrow m = \frac{L}{R} \cdot S = \frac{120}{56 \times 1000} \times 2.5 \times 10^8 = 5.357 \times 10^5$ m

P5

a. $R \cdot d_{prop} = 2 \times 1000^2 \times \frac{20000 \times 10^3}{2.5 \times 10^8} = 1.6 \times 10^5$ bits

b. propagation delay $= \frac{20000 \times 10^3}{2.5 \times 10^8} = 0.08s$

transmission delay $= \frac{800000}{2 \times 1000^2} = 0.4s$

so the maximum number of bits is

$R \cdot d_{prop} = 1.6 \times 10^5$ bits

c. the bandwith-delay product is a measurement of how many bits can fill up a network link

d. the width is $\frac{m}{R \cdot \frac{m}{s}} = \frac{s}{R} = \frac{2.5 \times 10^8}{2 \times 1000^2} = 125$ m

it is longer than a football field (105m)

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

P6

the processing delay $d_{proc} = \frac{56 \times 8}{64 \times 1000} = 7$ ms

the transmission delay $d_{trans} = \frac{L}{R} = \frac{56 \times 8}{2 \times 1000^2} = 0.224$ ms

the propagation delay $d_{prop} = 10$ ms

the whole time is 17.224ms

P7

The required transmission delay is $d_{trans} = \frac{40 \times 1000^4 \times 8}{100 \times 1000^2} = 3.2 \times 10^6 s \approx 37$ days

(use standard SI prefixes)

so using FedEx over-night delivery is faster. choose FedEx

P8

a. A circuit-switch network is more appropriate for this application.

Because it will continue running for a relatively long period of time and sending data at a steady rate. Circuit-switch can make the transmission quick, efficient and steady. Relatively speaking, packet loss and blocking will occur in packet-switch network.

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

P9

a. $\frac{3 \text{ Mbps}}{150 \text{ kbps}} = 20$

P9

a. $\frac{3\,mbps}{150\,kbps} = 20$

b. 10%

c. $C_{120}^{n} p^{n}(1-p)^{120-n}$, $p = 0.1$

$C_{120}^{n} 0.1^{n} \times 0.9^{120-n}$

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

P10

a. The time required for the first packet switch is $\frac{L}{R} = \frac{8\times10^{4}}{2\times10^{6}} = 4s$

total time is $4\times3 = 12s$

b. The time required for the first packet switch is $\frac{10000}{2\times10^{6}} = 5ms$

After $2\times5 = 10ms$, the first switch fully receives the second packet.

c. When the first packet arrives at destination, the time spent is $5\times3 = 15ms$

After that, a packet will be received every 5 seconds. So the total time is

$15ms + 799\times5ms = 4.01s$, which is faster than sending without message segmentation.

d. Facilitate error detection and retransmission;

Non-segmented large packets are easy to make the router cache insufficient, resulting in packet loss.

e. Sorting is required for message segmentation

The header needs to be added

P11

The number of groups is $\frac{F}{S}$

The transmission delay is $\frac{S+80}{R}$ each link

The delay of transmitting the first packet to host B is $3\times\frac{S+80}{R}$. After that a packet will be receive every $\frac{S+80}{R}$ seconds,

So the total delay is:

$$d_{delay} = (S+80)\times3 + (S+80)\times(\frac{F}{S}-1) = (S+80)\times(\frac{F}{S}+2)$$

Derived from the above:

$$\frac{d}{dS} d_{delay} = 0$$

The solution is $S = \sqrt{40F}$

P12

电路交换电话网络和互联网两个网络在"网关"处连接在一起。当一个"Skype"用户(连接到互联网的)打一个电话给普通用户时,通过电路交换网络,在电话用户和网关之间建立了电路。由多个组构成的"Skype"的语音通过互联网发送到网关。在网关那里,语音信号被重整处理,然后发送到电话交换网络。另一方面,语音信号通过电路交换网络发送到网关,网关对语音信号进行分组化处理,再发送给"Skype"用户。