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Computer Networks Homework set I

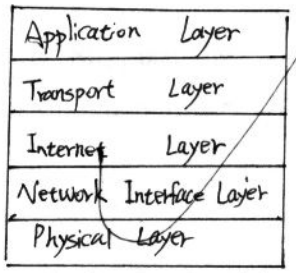
Due date: Mar. 19, 2012

99+1

1. Give the full name of the following acronyms. (12%)
   (a) ISP : Internet Service Provider
   (b) P2P : Peer 2 Peer
   (c) NIC : Network Interface Card

2. What are the five layers in the Internet protocol stack?

2.



▲ Network Layering model.

3. Please briefly described the main functions of the following command:
   (a) ipconfig : Displays all the local TCP/IP configuration values.
   (b) tracert : Shows all the routers on the path, and measuring transit delays.
   (c) ping : Send 4 little packets to the host, and check that it will respond or not.
   (d) netstat : Displays network connections and other network interface statics.

4.
① Transmission Delay : the amount of time required to push all of the packet's bits into the wire, which is related to the bandwidth.
② Propagation Delay : the amount it takes for the head of the signal to travel to the other end of the wire.
③ Processing Delay : the time it takes routers to process the packet header.
④ Queuing Delay : the time a packet waits in a queue of a router.

4. Consider sending a packet from a sending host to a receiving host over a fixed route. List the delay components in the end-to-end delay.

5. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates $R_1 = 500kbps$, $R_2 = 2Mbps$, and $R_3 = 1Mbps$. Suppose the file is 4 million bytes. Roughly, how long will it take to transfer the file to Host B using message switching?

5.
Length of a file : $4\times10^6\times8$ bits

$$\text{Time} = \frac{32\times10^6}{500\times10^3} + \frac{32\times10^6}{2\times10^6} + \frac{32\times10^6}{1\times10^6}$$

$$= 64 + 16 + 32 = 112 \text{ sec}$$

A: 112 sec

6. What is packet-switching, and why is packet switching relevant to the Internet?

6A. Packet-switching tear the file into pieces by fixed length while transport through Internet

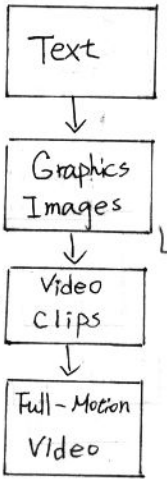
Benefit: ① Since the packets are short, it requires a small amount of time to send each packet, the packets belonging to others may be sent between packets, therefore every user can fairly share the resource.

② By packet switching, it can gain efficiency through "pipelining", that means every packet can effectively use all the segments of the path.

③ If an error occurs during the process of transmission, they can simply re-send few packets instead of the whole file.

7. List the steps in the transition in graphics presentation from the early Internet to the current Internet.

7.



8. Suppose two hosts, A and B, are separated by 10,000 kilometers and are connected by a direct link of $R = 1$ Mbps. Suppose the propagation speed over the link is 2.5×10^8 meters/sec.

   (a) Calculate the "bandwidth-delay product," $R \cdot t_{prop}$.

   (b) Consider sending a file of 400,000 bits from host A to host B. Suppose the file is sent continuously as one big message. What is the maximum number of bits that will be in the link at any given time.

   (c) Provide an interpretation of the bandwidth-delay product.

   (d) What is the width (in meters) of a bit in the link? Is it longer than a football field?

   (e) Derive a general expression for the width of a bit in terms of the propagation speed s, the bandwidth R, and the length of the link m.

a.

$R = 1\text{Mbps}$, $t_{prop} = \frac{10000 \times 10^3}{2.5 \times 10^8} = 4 \times 10^{-2}$

$R \cdot t_{prop} = 1 \times 10^6 (\text{bit/sec}) \times 4 \times 10^{-2} (\text{sec})$

A: 40000 bits.

b.

Let the L = the length of the file = 4×10^5 (bits)

R = bandwidth = 10^6 (bit/sec)

d = the length of link = 10^7 (m)

s = the speed that signal travels in the link = 2.5×10^8 (m/sec)

$$\Rightarrow \frac{\frac{d}{s}}{\frac{L}{R}} \cdot L = \frac{\frac{10^7}{2.5 \times 10^8}}{\frac{4 \times 10^5}{10^6}} \times 4 \times 10^5 = 40000 \text{ (bits)}$$

A: 40000 bits.

c.

In result, the bandwidth - delay product is equal to the maxium amount of bits that will be in the link.

d.

$\frac{10^7 (m)}{4 \times 10^4 (\text{bits})} = 250 (m/\text{bit})$, and the width of a footboall field is 49 meter (and the length is 110 m.

thanks a lot, wikipedia!)

A: Yes.

e.

width of a bit in the Link = $\frac{m}{\text{Bandwidth-delay product}} = \frac{m}{R \cdot m/s} = \frac{s}{R}$

A: $\frac{s}{R}$

Computer Networks Homework II

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1. Give the full name of the following acronyms:

Ans: (a) FTP : File Transfer Protocol

(b) HTTP: Hyper Text Transfer Protocol

(c) SMTP : Simple Mail Transfer Protocol

(d) DNS : Domain Name Service

(e) POP3 : Post Office Protocol - Version 3

2. What is the overall purpose of the Domain Name System ?

Ans:

DNS can automatically convert the domain name into IP address, creats a bridge between human-readable text and machine-identifiable number.

3. List two types of protocols used with email, and describe each.

Ans: (a) SMTP: The technology used to send out email messages, which uses TCP port 25.

(b) POP3: A standard protocol used by e-mail clients to retrieve e-mail from server over TCP port 110.

4. (a) List the major functions of a proxy server.

Ans:

While surfing the Internet through proxy, the proxy serves as an intermediate. The client sends a request to the proxy server, and after the proxy server gets the data that client requires, it will send back the data with a copy stored in proxy cache.

(b) What advantage does a proxy server have?

Ans: 1. Caching: The caching in proxy can reduce loading times and save bandwidth.

2. Content Filtering: Proxy server allows net manager to setup a blacklist to block out some website.

3. Anonymity: By using proxy server, users need not access to the Internet directly, so they can hide their IP, and retrieve data without some limits.

4. Security: The proxy server can encrypt the data before passing it into Internet, protect the users' privacy.

5. What are the advantages that the HTTP uses cookies?

Ans: 1. Cookies are like ID cards. if user visit website in a short period of time, servers can identify the user by cookies.

2. Cookies can store some message like the site you visit recently, the server can gather those information to provide better service.

6. How does the DNS perform iterative query?

Ans: When the local DNS server gets the request and doesn't have the exact IP address for the domain name, it will then visit DNS of the upper level, if it doesn't have the exact IP address either, it send back the other DNS that is more likely to have the right address to the local DNS server, local DNS server will repeat those step iteratively until it gets the right answer.

IP

Ver	head len	type of service	length
4	5	00	003D
16-bit identifier		flags	fragment offset
6D33		0	000
time to live	upper layer	Internet checksum	
1E	06	F394	
32 bit source IP address			
8C71 1188			
32 bit destination IP address			
8C71 1189			
options (if any)			
data (variable length, typically a TCP or UDP segment)			

③

TCP

source port #		destination port #	
0442		1770	
sequence number			
6B28 9E06			
acknowledgement number			
5AAC E406			
head len	not used	U A P R S F	recieve window
5	0	1 8	1000
checksum			urg data pater
226D			0000
options (variable length)			
application data (variable length)			

1. Source IP address 為何？
2. Destination IP address 為何？
3. IP header 中的 check sum 為何？
4. 這個 checksum 正確嗎？
5. Source port number 為何？
6. Destination port number 為何？

Computer Networks

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1. Explain the store and forward paradigm.

Ans. When a packet arrives in a switch, the switch will place the packet in a memory, and this operation is called "store". When other packets in the queue is cleared, the packet will then be forwarded to its destination, so the process of "store and forward" can be done.

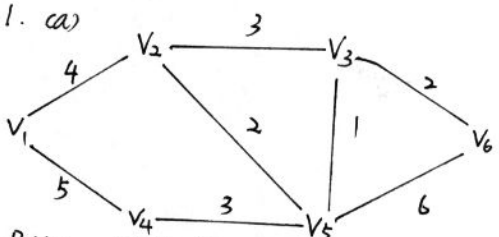
2. If an ISP assigned you a /28 address block, how many computers could you assign an address?

Ans.

$$2^{32-28} - 2 = 14$$

3. Consider the network in figure 1 ca), Please use Dijkstra's shortest-path algorithm to compute the shortest path from V_1 to all network nodes.

Figure 1. ca)

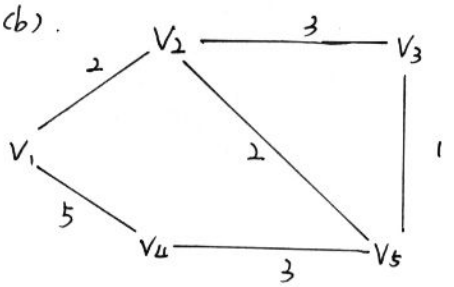


Ans.

N	D(V1) P(V1)	D(V2) P(V2)	D(V3) P(V3)	D(V4) P(V4)	D(V5) P(V5)	D(V6) P(V6)
V_1	—	4, V_1	∞	5, V_1	∞	∞
V_1V_2	—	4, V_1	7, V_2	5, V_1	6, V_2	∞
$V_1V_2V_4$	—	4, V_1	7, V_2	5, V_1	6, V_2	∞
$V_1V_2V_4V_5$	—	4, V_1	7, V_2	5, V_1	6, V_2	12, V_5
$V_1V_2V_4V_5V_3$	—	4, V_1	7, V_2	5, V_1	6, V_2	9, V_3

4. Consider the network shown in Figure 1 cb), and assume that each node initially knows the costs to each of its neighbors. Consider the distance vector algorithm and show the distance tables for every node in each iteration step.

Figure 1 cb).



(背面尚有)

ns :

1.

8C71 1188 => 8C . 71 . 11 . 88

=> 16×8 + 12 . 16×7+1 . 16×1+1 . 16×8+8

= 140 . 113 . 17 . 136

A: 140.113.17.136

2.

8C71 1189 => 8C . 71 . 11 . 89

=> 16×8+12 . 16×7+1 . 16×1+1 . 16×8+9

= 140 . 113 . 17 . 137

A: 140.113.17.137

3.

A: F394

4.

```
  4500
+ 003D
+ 6D33
+ 0000
+ 1E06
+ 8C71
+ 1188
+ 8C71
+ 1189
------
 20C69
```

=>

```
  0C69
+    2
------
  0C6B
```

=> 1'補數 = F394

A: 正確

5.

A: 0442

6.

A: 177o

Ans.

D^{V_1}	V_2	V_4
V_2	②	∞
V_3	∞	∞
V_4	∞	⑤
V_5	∞	∞

D^{V_2}	V_1	V_3	V_5
V_1	②	∞	∞
V_3	∞	③	∞
V_4	∞	∞	∞
V_5	∞	∞	②

D^{V_3}	V_2	V_5
V_1	∞	∞
V_2	③	∞
V_4	∞	∞
V_5	∞	①

D^{V_4}	V_1	V_5
V_1	⑤	∞
V_2	∞	∞
V_3	∞	∞
V_5	∞	③

D^{V_5}	V_2	V_3	V_4
V_1	∞	∞	∞
V_2	②	∞	∞
V_3	∞	①	∞
V_4	∞	∞	③

D^{V_1}	V_2	V_4
V_2	2	∞
V_3	⑤	∞
V_4	∞	5
V_5	④	8

D^{V_2}	V_1	V_3	V_5
V_1	2	∞	∞
V_3	∞	3	3
V_4	7	∞	⑤
V_5	∞	4	2

D^{V_3}	V_2	V_5
V_1	⑤	∞
V_2	3	3
V_4	∞	④
V_5	5	1

D^{V_4}	V_1	V_5
V_1	5	∞
V_2	7	⑤
V_3	∞	④
V_5	∞	3

D^{V_5}	V_2	V_3	V_4
V_1	④	∞	8
V_2	2	4	∞
V_3	5	1	∞
V_4	∞	∞	3

D^{V_1}	V_2	V_4
V_2	②	10
V_3	⑤	9
V_4	7	⑤
V_5	④	8

D^{V_2}	V_1	V_3	V_5
V_1	②	8	6
V_3	7	③	3
V_4	7	7	⑤
V_5	6	4	②

D^{V_3}	V_2	V_5
V_1	⑤	5
V_2	③	3
V_4	8	④
V_5	5	①

D^{V_4}	V_1	V_5
V_1	⑤	7
V_2	7	⑤
V_3	10	④
V_5	9	③

D^{V_5}	V_2	V_3	V_4
V_1	④	6	8
V_2	②	4	8
V_3	5	①	7
V_4	7	5	③