

Sirindhorn International Institute of Technology Thammasat University

Final Examination: Semester 2/2007

Course Title : ITS 413 Internet Technologies and Applications

Instructor : Dr Steven Gordon

Date/Time : Thursday 6 March 2008, 13:30 – 16:30

Instructions:

- ③ This examination paper has 18 pages (including this page).
- ③ Condition of Examination
Closed book (No dictionary, No calculator allowed)
- ③ Students are not allowed to be out of the exam room during examination. Going to the restroom may result in score deduction.
- ③ Turn off all communication devices (mobile phone etc.) and leave them under your seat.
- ③ Write your name, student ID, section, and seat number clearly on the answer sheet.
- ③ The space on the back of each page can be used if necessary.

Part A – Multiple Choice Questions [15 marks]

Select the most accurate answer (only select one answer). Each correct answer is worth 1.5 marks. You receive 0 marks for an incorrect answer or no answer.

1. The advantages of a peer-to-peer system (versus a client/server architecture) include:
 - a. Load-sharing, controlling access to resources, and simple algorithms
 - b. Load-sharing, fault-tolerance, and scalability
 - c. Load-sharing, scalability, and controlling access to resources
 - d. Controlling access to resources, scalability, and fault-tolerance
 - e. Controlling access to resources, simple algorithms, and fault-tolerance
 - f. Scalability, simple algorithms and fault-tolerance

2. The following protocol/system uses a client/server architecture for storing the entire resource index, but a peer-to-peer architecture when peers access resources:
 - a. Gnutella
 - b. Chord
 - c. Jabber/XMPP
 - d. AOL Instant Messenger
 - e. Fasttrack
 - f. Yahoo Messenger
 - g. Napster

3. What is the approximate per-user throughput for an IEEE 802.11g wireless LAN which contains 9 clients communicating via a single access point (select the closest answer):
 - a. 540Mb/s
 - b. 54Mb/s
 - c. 5.4Mb/s
 - d. 250Mb/s
 - e. 25Mb/s
 - f. 2.5Mb/s
 - g. 250kb/s

4. The following system is designed to support the network layer handover of a group of nodes at the same time.
 - a. NEMO
 - b. Mobile IP
 - c. Wireless LAN
 - d. MANET
 - e. None of the above

5. If IPsec in transport mode is used to encrypt a message from a Computer A to a Computer B, then:
 - a. An intermediate router that receives a packet from A to B can view the contents of the message.
 - b. Intermediate routers that receive a packet from A to B cannot view the contents of the message.
 - c. The local router that Computer A is connected to can view the contents of the message.
 - d. The local router that Computer B is connected to can view the contents of the message.
 - e. An intermediate router that receives a packet from A to B cannot determine that A is communicating with B.

6. The main aim of TOR is to:
 - a. Hide the contents of the messages between a source and destination user
 - b. Hide the identity of the source and destination from other users
 - c. Hide the identity of the source from the destination
 - d. Hide the identity of the destination from the source
 - e. Provide a Virtual Private Network between users
 - f. None of the above

7. Which instant messaging protocols use asymmetric servers:
 - a. Jabber
 - b. AIM and MSN
 - c. Yahoo Messenger and Jabber
 - d. AIM
 - e. Yahoo Messenger
 - f. XMPP and Jabber
 - g. XMPP and MSN

8. What delivery method is best suited to Video on Demand delivery in IPTV networks:
 - a. Routing
 - b. Broadcast
 - c. Multicast
 - d. Unicast
 - e. File-based
 - f. Non-real-time

9. What scheme can be used to reduce the impact of hidden terminals in a wireless LAN:
 - a. DCF
 - b. PCF
 - c. RTS/CTS
 - d. Basic Access
 - e. Decreasing the Contention Window
 - f. None of the above

10. A problem with (or disadvantage of) Mobile IP is:
 - a. Mobile nodes must change their IP addresses, causing TCP connections to break
 - b. Normal Internet routing will not work when a mobile node changes networks
 - c. A foreign network cannot support visiting mobile nodes that have different Home Agents
 - d. A mobile node must inform the Home Agent of all possible Foreign Agents it will visit before Mobile IP will work
 - e. Some packets must be sent on a sub-optimal route via the Home Agent
 - f. None of the above

Part B – General Questions [85 marks]

Question 1 [6 marks]

- a) Explain the purpose of a robot exclusion file and how it works (including where the file is and what information the file contains, and how it controls robots – but *you do not have to give the format of the file*). [3 marks]
- b) Is a robot exclusion file suitable for protecting (that is, restricting access to) content on a web site? Explain your answer [3 marks]

Question 2 [21 marks]

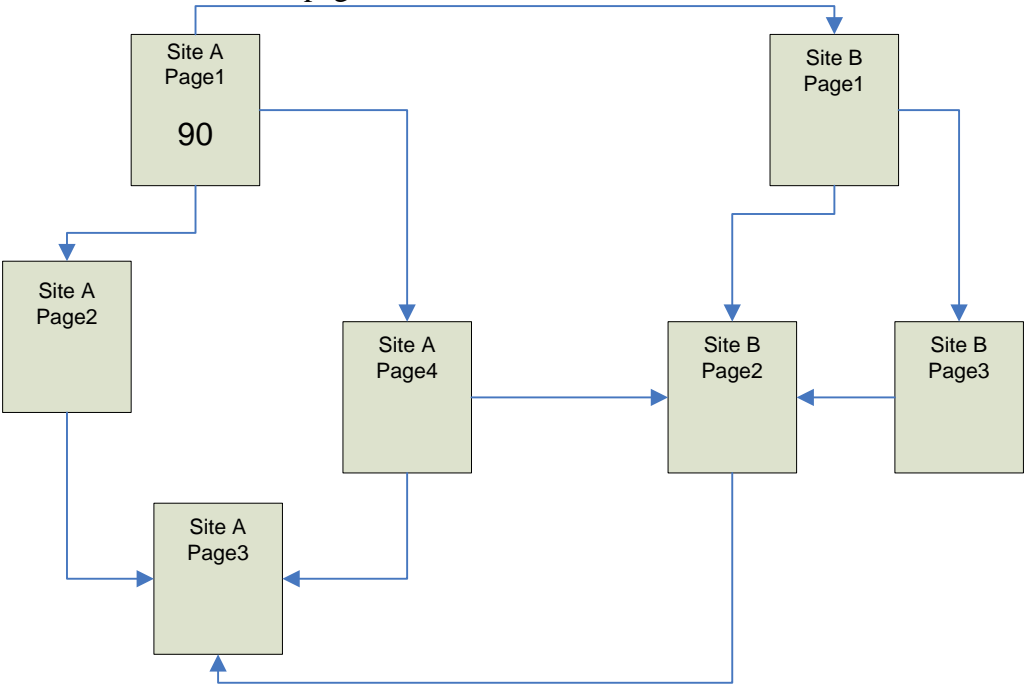
- a) Draw the architecture of a typical search engine. Make sure you label each component and show the connectivity between components. [6 marks]

- b) Explain how a search engine crawler works. [4 marks]

c) A search engine crawler picks a URL from a “To be crawled” list. Why is the picking algorithm important? [2 marks]

d) Explain the difference between query dependant and query independent ranking algorithms. Give an example set of criteria for each and also give an advantage of each approach (compared to the other approach). [4 marks]

e) Calculate the Google PageRank for each page in the diagram below. Write the PageRank value inside the page. [3 marks]



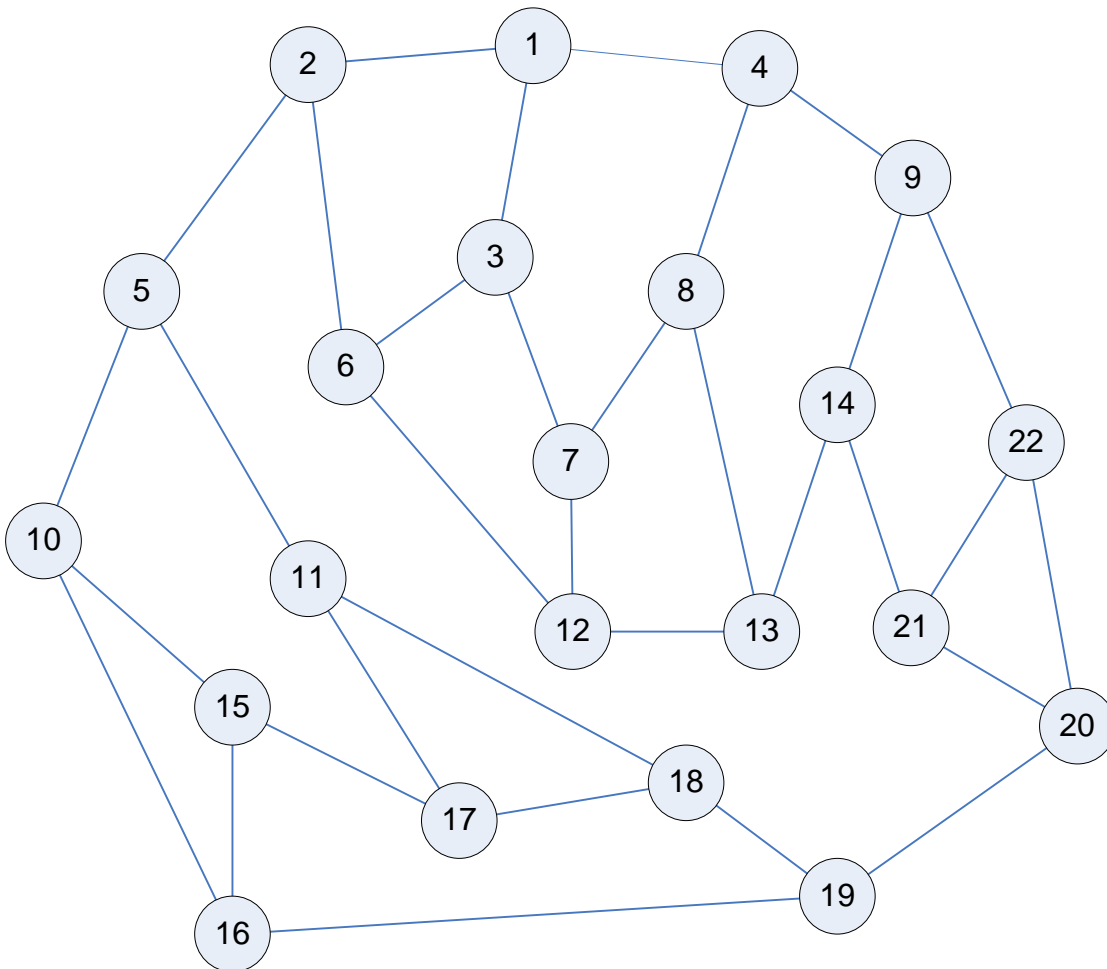
f) Explain a limitation of the Google PageRank algorithm. [2 marks]

Question 3 [12 marks]

- a) Explain how the Gnutella Peer-to-Peer protocol works, including:
- How do nodes join the network
 - How does a node search the network for a resource

You *do not* have to give details of the protocol, a brief textual description is sufficient. [4 marks]

- b) Using the diagram below (which shows a set of nodes and their $C=3$ permanent peers), answer the following questions (assume the nodes have already joined the network and a node forwarding a message counts as one transmission). In all parts you must explain any additional assumptions you make.



- i. How many times are messages sent in the network using the normal Gnutella protocol if node 1 searches for a resource that is located on nodes 11 and 18 (assume $TTL=7$)? [2 marks]

ii. How long does it take for node 1 to receive a reply from part (i) (assume the hop time is 100 milliseconds)? [2 marks]

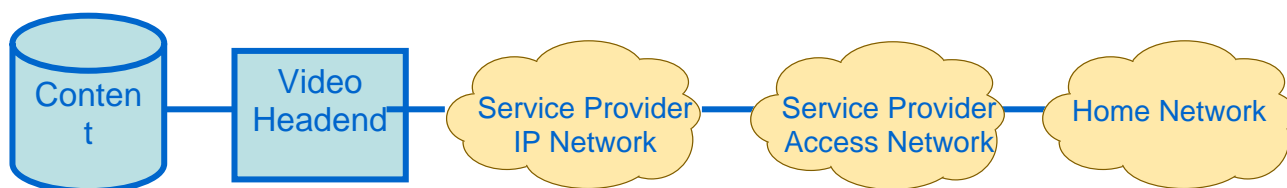
iii. How many replies are received by node 1? Explain your answer. [2 marks]

c) How does the Time To Live (TTL) assist, with respect to broadcast overhead, in Gnutella? [2 marks]

Question 4 [15 marks]

- a) Explain the difference between IPTV, File-based TV distribution and Internet (or Net) TV. You should also mention the network (or type of network) that each are delivered over. [2 marks]

- b) The figure below shows a typical structure of an IPTV network.



- i. Which portion of the network is the performance bottleneck? [1 mark]

- ii. List two network technologies that may be suitable for delivering IPTV into a home (that is, the technology used to connect your home to a larger service provider network). You must give accurate names of standards/protocols, referring to versions if necessary. [2 marks]
- iii. Fibre-to-the-X may be used to refer to a range of different fibre-based technologies, where X can have different names.
- List two possible Fibre-to-the-X technologies for IPTV [1 mark],
 - Describe briefly the two technologies [2 marks], and
 - Explain the trade-offs (advantages and disadvantages) between the two technologies [3 marks]

- iv. For the delivery of HDTV channels to users over the Service Provider IP Network, the bandwidth requirement of the network may be measured in terms of number of channels delivered. However, for the delivery of Video on Demand to users, the bandwidth requirement of the Service Provider IP Network may be measured in terms of number of VoD subscribers. Explain why the bandwidth requirement is measured with different metrics for the different services (TV versus VoD). [4 marks]

Question 5 [10 marks]

An average performance comparison of the Napster, Fasttrack and Chord P2P systems is given below:

	Latency (delay) in search	Messages to be sent for search	Update Cost	Storage Required
Napster	1	1	1	1
Gnutella	$\log(n)$	n	1	1
Fasttrack	$\log(C)$	C	1	1
Chord	$\log(n)$	$\log(n)$	$\log(n)$	$\log(n)$

where C is the number of super-peers and n is the number of nodes in the network. Note that the values represent an “order of magnitude” – they don’t represent absolute values.

Assume a P2P network last year had 10,000 nodes. However, rapid growth in the popularity of the network saw the size grow to 1,000,000 nodes. (In the cases where super-peers are used, assume C is 1% of the total number of nodes). Answer the following questions. You may use this example network to help explain your answers.

a) Explain why the “Messages to be sent” for Gnutella is in the order of n . [2.5 marks]

b) Explain why the “Update cost” for Napster is in the order of 1 . [2.5 marks]

c) With respect to only the performance criteria shown in the table, which P2P system is the best for the example network. Explain your answer. [2.5 marks].

d) Considering the performance criteria in the table AND the advantage of fault-tolerance, which P2P system is the best for the example network. Explain your answer. [2.5 marks]

Question 6 [21 marks]

Chord is a protocol that uses Distributed Hash Tables for peer-to-peer applications.

- a) Draw a diagram of an example Chord network that has 8 nodes (and can support no more than 8 nodes) [2 marks]

- b) Using your example network where necessary, explain:
 - i. How are nodes given identifiers that represent their position in the Chord network? [2 marks]

ii. What is the relationship between keys and resources in Chord? [1 mark]

iii. What is the relationship between keys and nodes? [2 marks]

iv. What other nodes does a node maintain routes to? [2 marks]

v. In addition to the addresses of other nodes, the routing information maintained by a node should also contain what? [2 mark]

