

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 2

Academic Year: 2006-2007

Date: March 2, 2007

Time: 09:00 – 12:00

Subject Number: 240-362

Room: R200

Subject Title: Internet Engineering

Exam Duration: 3 hours

This paper has 8 pages (including this page).

- Write answers in the answer book provided.
- There are 175 marks total for this exam.
This will contribute 35% of the course total.

Authorised Materials:

- Anything the student can carry (except mobile/cell phones.)

Instructions to Students:

- Attempt all 14 questions.
- **Clearly Number** the answers. It is **not** required that questions be answered in order.
- Anything illegible is incorrect.
- Answer briefly where possible, essays are **not** required.
- The marks allocated for each question are shown next to that question. There are 175 marks total for this examination.
- *Answer questions in English.* Good English is **not** required.

Question 1.*(5 marks)*

Which items are true, which are false?

- A) The DNS uses only UDP as its transport layer protocol.
- B) In the DNS, a domain can have only one name.
- C) The answer section in the DNS reply message must have only one resource record.
- D) If we know the IP address of a computer, we cannot ask the DNS for the domain name of that computer.
- E) The two domain names, “santichai.coe.psu.ac.th” and “SANTICHA1.coe.psu.ac.th” are the same name in DNS.

Question 2.*(10 marks)*

There are 4 sections of resource records (RR) in each DNS message. They are the **question**, **answer**, **authority** and **additional** sections. When a resolver would like to send a DNS query message to a DNS server, it can add only one RR in the question section. This is one of DNS limitations.

Explain why the resolver cannot put more than one RR in the question section of a DNS query message.

Question 3.*(15 marks)*

Zone transfer is the process used by the secondary DNS server to update its copy of zone data from the primary DNS server. Answer the following questions about the query process of zone transfer.

- A) What is the difference between the query for a zone transfer and a general query for an IPv4 address?
[5 marks]
- B) How does the secondary server know that its copy of zone data is out of date?
[5 marks]
- C) How does the secondary server know that when it should send a query to update the zone data again?
[5 marks]

Question 4.*(15 marks)*

There are 4 methods for browsing a web page that we have discussed in this course. They are Non-Persistent Connection (Simple), Persistent Connection, Parallel Connection and Pipeline. Answer the following questions about this issue.

- A) There is a header field in the HTTP response message, **Content-Length**, which tells the number of bytes of data in the body of message. Which browsing methods require this header field and which do not? Why?

[10 marks]

- B) At the end of each HTTP request message, there is a blank line, which is a line with only <CR><LF> characters. Explain why the Pipeline method requires this blank line.

[5 marks]

Question 5.*(10 marks)*

In HTTP version 1.1, the request message requires not only the request line (command), but a header field, **Host**, is also required. Explain when and why this header field is needed.

Question 6.*(25 marks)*

Encryption techniques can be separated into two schemes, symmetric key encryption and public key encryption. In the case of a secure web page, these two techniques are also used. Answer the following questions about this topic.

- A) Explain the difference between symmetric key encryption and public key encryption. [5 marks]
- B) The following items give the security steps that a web browser uses to communicate with a web server in order to provide secure transmission of data from the web browser. Explain the **security processes** that the browser or server do in each of steps 2, 4 and 5. [20 marks]

Step 1: Client sends request to browser for a page, the page is returned, signed, together with a certificate containing the public key, with the certificate signed by a certificate authority.

Step 2: */* The web browser does something here */*

Step 3: The user fills in a form in the secure page, often containing sensitive data (a password or credit card number, or similar) and presses a button to submit the form data.

Step 4: */* The web browser does something here */*

Step 5: */* The web server does something here */*

Question 7.*(20 marks)*

Reverse Path Forwarding is a technique used to protect the network from looping multicast packets. Answer the following questions.

- A) Explain how Reverse Path Forwarding works. [10 marks]
- B) What is the difference in the use of the IP header in routing multicast packets (with Reverse Path Forwarding) compared with routing simple unicast packets? [5 marks]
- C) What is the advantage of adding the **flood and prune** technique to the reverse path forwarding method? [5 marks]

Question 8.*(10 marks)*

Explain why E-Mail needs (in general) to all be encoded for transmission as 7 bit ASCII text, even where some other language (German, Thai, or Japanese) is being transmitted, and even when the e-mail contains content that is not text at all, such as a photograph.

Question 9.*(12 marks)*

Explain, using time-line diagrams, exactly when responsibility for a e-mail message passes from one MTA to another (when the client releases its responsibility, and when the server becomes responsible) relating this to the sequence of steps (commands) used during the SMTP transaction.

Show what happens if the TCP connection should be broken (for any reason) at various times during the SMTP message transaction.

Explain why the concept of ownership of responsibility for the message is important, and what might occur if this concept did not exist.

Question 10.*(6 marks)*

Explain how a playout buffer can help reduce the effects of jitter upon a real time application.

Indicate what is the cost (in terms of application or network performance, or apparent performance) of using a playout buffer.

Question 11.*(5 marks)*

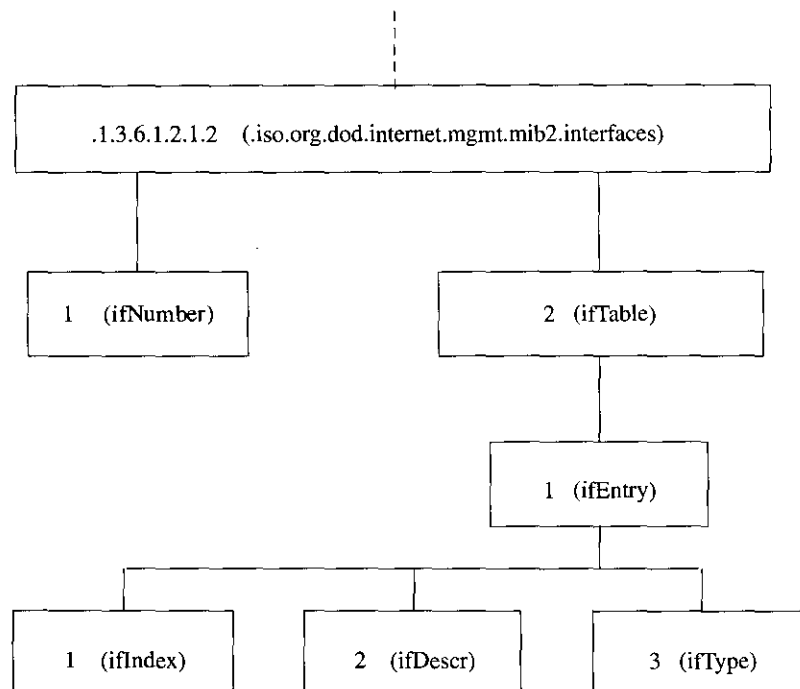
Which of the following can be accomplished using SNMP (the Simple Network Management Protocol) and some appropriate MIB (Management Information Base) at a suitable agent, and which cannot?

- A) Adding a new entry to a router's forwarding table.
- B) Counting bytes sent to a particular host.
- C) Configuring a network interface with IP address (etc.)
- D) Discovering bottlenecks (over-congested links) in a network.
- E) Determining the mapping between a network address (IPv4 or IPv6) and a link level (Ethernet, or other) address.

Question 12.*(25 marks)*

Use the MIB fragment shown below to answer the following questions.

Note, that while this is a fragment of the actual Internet MIB-2, only a part of the interfaces table is shown. For the purposes of this question, you should assume that the part shown is the entire interfaces table. That is, for this question, there are no more child nodes of **ifEntry** than those shown in the diagram. The other leaf variables that would normally exist (interface status, statistics, etc.) are all absent. The entire sub-tree under **interfaces** is shown here.



- A) If an SNMP manager were to send an SNMP **GetNext** request to an agent implementing the MIB fragment shown, with the request containing the single variable binding OID

.1.3.6.1.2.1.2

What would the OID be in the response from the agent?

There is no need to show the value for the variable returned, just its OID.

You may use numeric (.1.3.6...) or symbolic (.iso.org.dod...) form for your answer.

[5 marks]

- B) Assume that there are an unknown number of interfaces, and that the

interface table is the last MIB entry implemented by this agent (*i.e.*: there are no later MIB variables after the *ifType* for the last interface.)

Show the sequence of steps that the manager (software) would take to obtain the interface descriptions (*ifDescr*) and interface types (*ifType*) for all interfaces existing at the agent.

There is no need to show (or invent) values for the various interface descriptions and types, simply show which OIDs are requested by what kinds of SNMP commands, and which OIDs are returned with their unknown values by the agent in response to each request.

You may use numeric (.1.3.6...) or symbolic (.iso.org.dod...) form for your answer.

If your answer involves a loop, or other repetitive task, you should clearly state what the termination conditions are that the manager would use, and show an example of the actual termination that would occur in this case.

You may assume for your example where you show termination, that the interface index (*ifIndex*) for the last interface present in the system is 11. You must not assume that the manager knows this value in advance, merely that this happens to be the case when the agent returns its values. Note: this does not mean that there are 11 (or 10 or 12) interfaces present (some *ifIndex* values may be missing.)

[20 marks]

Question 13.

(5 marks)

Which of TCP, UDP, SNMP or Quality of Service (QoS) is best suited to provide for each of the following:

- A) Lower packet delay.
- B) Ordered packet delivery.
- C) Less variation in the intervals between packet arrival times (that is, less jitter).
- D) Quick small transactions over mostly reliable links.
- E) Reliable data transfer.

Question 14.*(12 marks)*

Which of the following statements do you agree with, and which do you disagree with? In each case, indicate whether you agree or disagree, and give reasons for your decision. Without reasons, your opinion is worthless, and will be marked that way!

You may expand upon the statements below (add more detail) if that will help your answer.

- A) Quality of Service cannot be achieved over the Internet.
- B) A Certificate Authority can be automated, issuing certificates to anyone who submits a request.
- C) E-mail security is rarely used in practice as most users do not need their e-mail to be secure.
- D) Network management is the most important application run over the network, as without it, the network might stop working, and no-one would know.