SIT202 Computer Networks

Trimester 2, 2016

Problem Solving Report 2

Due Date: 5pm Tuesday August 30th, 2016

This assessment task must be completed individually,
group work and/or collaboration with other students is prohibited.

All work completed/submitted as part of this assessment task must be your own, individual work. Any content drawn from other materials, including unit materials, must be clearly quoted where appropriate, and/or clearly referenced. All students should review and be familiar with the content provided by the University regarding how to reference other materials:

http://www.deakin.edu.au/students/study-support/referencing

And in particular the information provided regarding Academy Integrity:

http://www.deakin.edu.au/students/study-support/referencing/academic-integrity

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Unit Learning Outcomes

As per the Unit Guide, the following Unit Learning Outcomes are relevant to this project:

ULO 2. Differentiate the types of networks, communication and user oriented protocols, and their influence on transmission speed, reliable delivery and security.

You will be required to demonstrate knowledge of concepts and the protocols involved in supporting the delivery of data between devices on a computer network and/or interconnected networks.

ULO 3. Select a local area and design simple protocols for a given environment to track current and future trends in computer networks.

You will be required to design a simple protocol for the delivery of data between devices, and evaluate your protocol to identify strengths and/or weaknesses.

Question 1 (7 + 8 + 10 = 25 marks)

a) In modern switched Ethernet networks, it is not unusual for a router to receive more traffic than it is able to forward due to the relative speeds of the Ethernet network versus the links from the router to other networks or the Internet. In such circumstances, packets would be randomly dropped either by the router or by the interconnecting switch when buffers are filled. Briefly discuss how polling could be used to overcome this problem, and discuss two advantages and two disadvantages of this approach.

b) Prior to the development of full-duplex Ethernet, Token Bus networks provided a means through which communication could be achieved on a shared medium without collisions. Briefly describe how devices transmitted on a network using Token Bus (ignore token management) and discuss the performance token bus as transmission speed increases.

c) Collisions and broadcasts have a negative impact on the throughput of an Ethernet network.

   i) Describe how collisions and broadcasts influence the throughput on an Ethernet network using a bus topology.

   ii) Repeaters, hubs, bridges, and switches are all devices that can be used in the construction of Ethernet networks. Briefly discuss how each of these devices would influence the impact of collisions and broadcasts within a single Ethernet network. *Hint: VLANs divide a network into two or more networks and is irrelevant to this question.*

Question 2 (6 + 6 + 8 + 20 = 40 marks)

a) IPv4 uses a checksum to determine if any errors have occurred in the transmission of a datagram, however this checksum only checks for errors in the IPv4 header. Discuss why only the header is checked by IPv4 for errors, and discuss whether it is necessary to check for errors at all given that Ethernet already checks the entire frame using CRC.

b) Given a subnet mask of 255.255.192.0, demonstrate for an IP address of your choosing the calculation of the range of addresses that are valid from that network (host ID all 0s through to host ID of all 1s).
Note: The IP address you choose must consist of four decimal numbers that are greater than or equal to 101, and must be odd numbers.

c) The fragmentation mechanism provided by IPv4 can contribute to network congestion. Briefly describe how fragmentation works and, given that there is no change to higher-level data, explain how this mechanism could contribute to congestion.

d) Consider implementing a negative acknowledgement mechanism for IPv4 that would alert a source host to a datagram being discarded due to a corruption in the path between the communicating hosts at any router in the path or the destination host.

   i. Briefly describe how your protocol would work.

   ii. Illustrate the operation of your protocol using a time diagram/sequence diagram (see Session 5 Slide 39 for an example), including both successful and unsuccessful delivery of datagrams.

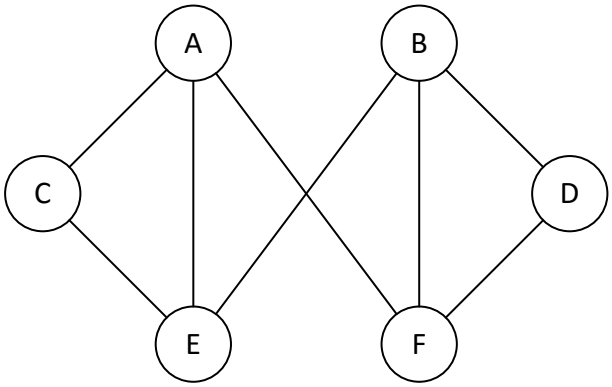
   iii. Discuss two advantages and two disadvantages of your protocol.

Question 3 (11 + 8 + 16 = 35 marks)

a) Both RIPv2 and OSPFv2 routing protocols receive updated information about the state of the network from their neighbours. However it can be said that the decisions made by vector-distance routing protocols (such as RIPV2) are based on "second hand" information, whilst the decisions made by link state routing protocols (OSPFv2) is based on "first hand" information. Briefly describe what information is contained in the updated information routers receive, where the information comes from, and why it is considered "second hand" or "first hand".

b) Given the following Link State Database and network topology:

	A	B	C	D	E	F
A	-	-	1	-	4	1
B	-	-	-	3	1	6
C	1	-	-	-	2	-
D	-	3	-	-	-	2
E	4	1	2	-	-	-
F	1	6	-	2	-	-



Demonstrate the working of the Shortest Path First algorithm and final routing table. Your answer must indicate the paths and costs that will be taken by all datagrams through the network.

c) For each of the fields listed below appearing in the IPv4 and IPv6 headers, briefly describe the purpose of those fields, explain how they are related, and explain why a change has been made:

i. IPv4 defines both header length (HLEN) and total length fields, whilst IPv6 defines only a payload length.

ii. IPv4 defines a protocol field, whilst IPv6 defines a next header field.

iii. IPv4 defines a time to live (TTL) field, whilst IPv6 defines a hop limit field.

Submission Requirements

Please note the following requirements when submitting your answers:

- Your answers must be submitted to the correct Assignment box provided in CloudDeakin, submissions will not be accepted outside of this assignment box, e.g., email submissions will not be accepted.
- Answers must be submitted in a format which can be read by the plagiarism detection system. It is your responsibility to ensure your answers in a correct format.
    - Acceptable formats include: Word (.doc/.docx), Excel (.xls/.xlsx), PowerPoint (.ppt/.pptx), OpenOffice Text (.odt), Rich Text Format (.rtf), HTML (.html/.htm), Acrobat (.pdf), and Text (.txt)
    - Unacceptable formats include: ZIP/RAR/7z or any other type of archive, submissions linked from the Portfolio (download the document from the portfolio and upload it separately).
    - Note that any diagrams you prepare as part of this Problem Solving Report can be submitted either embedded in your document or separately using common image formats
- Late submissions are penalised as per Faculty regulations, which is based on the due date of the submission. *Note that the indication of lateness by CloudDeakin is often misleading and not considered*. For example, for a due date of 5pm Tuesday:
    - Submission before Tuesday 5pm – no penalty.
    - Submission after Tuesday 5pm but before Wednesday 5pm – 10% penalty
    - Submission after Wednesday 5pm but before Thursday 5pm – 20% penalty
    - Submission after Thursday 5pm but before Friday 5pm – 30% penalty
    - Submission after Friday 5pm – not accepted.
- Applications for extensions can only be considered by the unit chair. In general, applications must be submitted before the due date (unless it is not possible to do so), and must satisfy the rules for special consideration, i.e., reasons must fall into categories for medical, compassionate, or hardship, and evidence must be provided. If you have to wait to receive evidence (such as documentation from a practitioner/professional), or if the due date has passed, you should still contact the unit chair for advice as soon as possible.

Marking Scheme

Question 1 *(7 + 8 + 10 = 25 marks)*

- Part (a)
  - (3 marks) Discussion of how polling could be used.
  - (2 marks) Discussion of advantages.
  - (2 marks) Discussion of disadvantages
- Part (b)
  - (3 marks) Description of transmission using token bus.
  - (5 marks) Discussion of performance of token bus.
- Part (c)(i)
  - (2 marks) Description of how collisions influence throughput.
  - (2 marks) Description of how broadcasts influence throughput.
- Part (c)(ii)
  - (3 marks) Discussion of influence of repeaters and hubs.
  - (3 marks) Discussion of influence of bridges and switches.

Question 2 *(6 + 6 + 8 + 20 = 40 marks)*

- Part (a)
  - (3 marks) Discussion of why only the header checked.
  - (3 marks) Discussion of why check needed given Ethernet CRC.
- Part (b)
  - (2 marks) Correct conversion of IP address and subnet mask to binary.
  - (2 marks) Correct application of binary AND.
  - (2 marks) Correct identification of first and last addresses.
- Part (c)
  - (3 marks) Description of how fragmentation works.
  - (5 marks) Discussion of how fragmentation can contribute to congestion.
- Part (d)
  - (3 marks) Description of how protocol works.
  - (2 marks) Illustration shows successful delivery of datagram.
  - (3 marks) Illustration shows unsuccessful delivery of datagram.
  - (6 marks) Discussion of two advantages.
  - (6 marks) Discussion of two disadvantages.

Question 3 *(11 + 8 + 16 = 35 marks)*

- Part (a)
  - (3 marks) Explanation of information contained in RIPv2 updates.
  - (3 marks) Explanation of information contained in OSPFv2 updates.
  - (2 marks) Correctly identifies source of information.
  - (3 marks) Explanation of why information is second/first hand.
- Part (b)
  - (5 marks) Correctly indicates paths and cost for all destinations.
  - (3 marks) Correct working.
- Part (c)(i)
  - (3 marks) Description of fields.
  - (3 marks) Explanation of relationship and changes.
- Part (c)(ii)
  - (2 marks) Description of fields.
  - (3 marks) Explanation of relationship and changes.
- Part (c)(ii)
  - (2 marks) Description of fields.
  - (3 marks) Explanation of relationship and changes.