

Matthew Irvine

1001401200

Chapter 4 and 5 review questions

Section 4.1

R1. Let's review some of the terminology used in this textbook. Recall that the name of a transport-layer packet is segmented and that the name of a link-layer packet is frame. What is the name of a network-layer packet? Recall that both routers and link-layer switches are called packet switches. What is the fundamental difference between a router and a link-layer switch? (Marks 4)

Datagram, difference between a router and link-layer switch is that a router specializes in ensuring information is sent to the proper destination while a link-layer switch prioritizes connection speed. Routers are better used for interacting with the internet at large (as they provide services that a link-layer switch doesn't that help protect the router's users) while a link-layer switch is better for inter-device connectivity.

R3. We made a distinction between the forwarding function and the routing function performed in the network layer. What are the key differences between routing and forwarding? (Marks 4)

Routing is about planning how to get information from the source to the destination the fastest, forwarding is about transferring information in a single interchange. Routing is made up of multiple forwarding processes.

Section 4.2

R8. What is meant by destination-based forwarding? How does this differ from generalized forwarding (assuming you've read Section 4.4, which of the two approaches are adopted by Software-Defined Networking)? (Marks 5)

Destination-based forwarding only uses the destination IP address to determine forwarding. Generalized forwarding is based on any set of information provided by header fields. SDN's likely use generalized forwarding.

R10. Three types of switching fabrics are discussed in Section 4.2. List and briefly describe each type. Which, if any, can send multiple packets across the fabric in parallel? (Marks 5)

Memory – uses system memory to store packets, switching under CPU direct control and is limited by bandwidth (2 bus crossing per datagram).

Bus – datagrams come from input port memory and sent to output port memory through a shared bus. Bus bandwidth limits speed.

Interconnection Network – Crossbar nets used to connect processors in multiprocessor. Makes use of parallelism and multistage switches to send multiple packets across the fabric.

Section 4.3

R21. Do routers have IP addresses? If so, how many? (Marks 2)

Yes, 1 for each router interface.

R22. What is the 32-bit binary equivalent of the IP address 223.1.3.27? (Mark 1)

11011111.00000001.00000011.00011011

Section 4.4

R32. How does generalized forwarding differ from destination-based forwarding? (Marks 2)

Destination based only considers the destination address, Generalized forwarding uses sets of header information to determine forwarding.

Problems

P2. Suppose two packets arrive to two different input ports of a router at exactly the same time. Also, suppose there are no other packets anywhere in the router. (Marks 6)

1. a) Suppose the two packets are to be forwarded to two different output ports. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a shared bus?
 1. No, the shared bus can only forward 1 packet at a time.
2. b) Suppose the two packets are to be forwarded to two different output ports. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses switching via memory?
 1. No because memory relies on a system bus which can only transfer 1 packet at a time.
3. c) Suppose the two packets are to be forwarded to the same output port. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a crossbar?
 1. No because they would both be on the same bus which can only support 1 packet at a time.

P8. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also, suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. (Marks 3)

223.1.17.0/26

223.1.17.65/25

223.1.17.156/28

P15. Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes? Explain how you computed your answer. (Marks 4)

3425 datagrams. IP header is 20 bytes and assuming the data is carried via TCP protocol then that adds another 20 bytes header making 40 total non-data bytes.

$$5 * 10^6 / (1500 - 40) = 3424.657534.$$

Cannot have a part of a datagram so round up to the next number: 3425 datagrams.

Section 5.1

R1. What is meant by a control plane that is based on per-router control? In such cases, when we say the network control and data planes are implemented “monolithically,” what do we mean? (Marks 5)

Routing algorithms in every router interact in the control plane. Monolithic routers contain switching hardware, proprietary internet protocols, and a proprietary router OS.

R2. What is meant by a control plane that is based on logically centralized control? In such cases, are the data plane and the control plane implemented within the same device or in separate devices? Explain. (Marks 5)

It means that a remote computer controls and installs forwarding tables in routers. Separate devices.

Section 5.2

R6. Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not? (Marks 2)

No, different intra-AS routing algorithms are designed to do different things. Some are designed for network speed, other may need more security.

Sections 5.3–5.4

R7. Why are different inter-AS and intra-AS protocols used on the Internet? (Marks 4)

Different inter-AS admins want control over how its traffic is routed, intra-AS prefer to focus on performance. Different protocols give different controls and performances.

R10. Define and contrast the following terms: subnet, prefix, and BGP route. (Marks 3)

Subnet – is the IP addresses given to devices on a router that are derived from the router's IP address. Used within a network.

Prefix – is the destination (destination address range) being advertised. Used for BGP routing.

BGP route – is a prefix and the attributes associated and is also a possible advertised path exchanged between BGP routers.

R13. True or false: When a BGP router receives an advertised path from its neighbor, it must add its own identity to the received path and then send that new path on to all of its neighbors.

True.

Explain. (Marks 5)

BGP router must add its own identity to a received path. This allows its neighbors to know of the routers and the path of the autonomous systems that leads to the destination.

Section 5.6–5.7

R19. Names four different types of ICMP messages (Marks 4)

Type	Code	description
3	0	dest. Network unreachable
3	1	dest host unreachable
3	2	dest protocol unreachable

Problems

P1. Looking at the network diagram, enumerate the paths from y to u that do not contain any loops. (Marks 14)

Yxu	yxvu	yxwvu	yxwu
Ywvu	ywxu	ywu	
Yzwvu	yzwu	yzwxu	yzwxvuyzwvxu

P3. Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes.

Show how the algorithm works by completing the following table. (Marks 11)

Step	N'	D(t),p(t)	D(u),p(u)	D(w),p(w)	D(y),p(y)	D(z),p(z)	D(v),p(v)
0	X	∞	∞	6,x	6,x	8,x	3,x
1	Xv	7,v	6,v	6,x	6,x	8,x	
2	Xvu	7,v		6,x	6,x	8,x	
3	Xvu w	7,v			6,x	8,x	
4	Xvuwy	7,v				8,x	
5	Xvuwy t					8,x	
6	xvuwy t z						