CHAPTER 22

PRACTICE SET

Questions

Q22-1. The IP header is included because it contains the IP address of the original source. The first 8 bytes of the data are included because they contain the first section of the TCP or UDP header which contains information about the port numbers (TCP and UDP) and sequence number (TCP). This information allows the source to direct the ICMP message to the correct application.

Q22-2. We still needs the *next header* field; it defines the type of data encapsulated in the datagram.

Q22-3. A compatible address is an address of 96 bits of 0s followed by 32 bits of an IPv4 address. A mapped address is an address of 80 bits of 0s followed by 16 bits of 1s and followed by 32 bits of an IPv4 address. A compatible address is used when a computer using IPv6 wants to send a packet to another computer using IPv6. A mapped address is used when a computer using IPv6 wants to send a packet to a computer still using IPv4.

Q22-4. The prefix length is 8, which means the size of the block is

$N = 2^{128-8} = 2^{120}$ A very large block

Q22-5. The prefix length is 7, which means the size of the block is

$N = 2^{128-7} = 2^{121}$ A very large block

Q22-6. We need to have both IPv4 and IPv6 packets in *header translation* strategy.

Q22-7. The prefix length is 3, which means the size of the block is

$N = 2^{128-3} = 2^{125}$ A very large block

Q22-8. The prefix length is 8, which means the size of the block is

$$N = 2^{128-8} = 2^{120} \qquad \text{A very large block}$$

Q22-9. We can say (1) larger address space, (2) better header format, (3) new options, (4) allowance for extension, (5) support for resource allocation, and (6) support for more security.

Q22-10. The three protocols IGMP, ICMP, and ARP in IPv4 have been combined into a single protocol, ICMPv6.

Q22-11. *Autoconfiguration* allows the DHCP to automatically allocate an IP address to a host when the host joins the network.

Q22-12. Renumbering allows a site to have two prefixes during a transition from an ISP to another. This will be possible if the DNS protocol also changes.

Q22-13.

a. The *neighbor-solicitation* message in ICMPv6 replaces the ARP request message in version 4.

b. The *neighbor-advertisement* message in ICMPv6 replaces the ARP response message in version 4.

Q22-14. The address should be in the global unicast block, which means the leftmost three bits are 001.

Q22-15. We need to encapsulate IPv6 packets in IPv4 packets in the *tunneling* strategy.

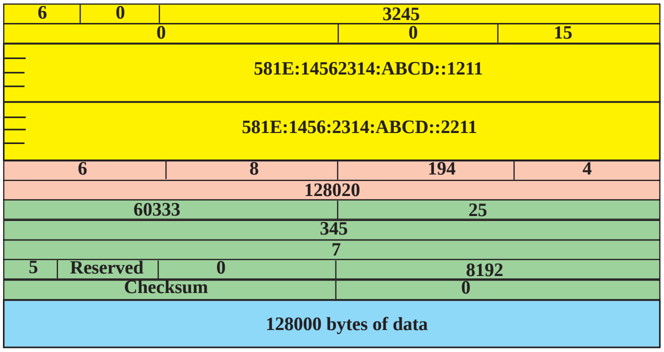
Q22-16. The membership-query and membership-report messages in ICMPv6 replace the IGMP messages in version 4.

Q22-17. The *next header* field is responsible for multiplexing and demultiplexing in IPv6. It is similar to the protocol field in IPv4.

Q22-18. The flow field can be used in several ways. It allows IPv6 to be used as a connection-oriented protocol. It also allows IPv6 to give priority to different payloads, such as giving high priority to real-time multimedia applications.

Problems

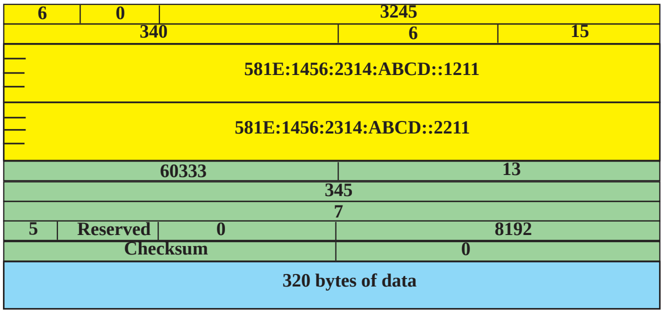
P22-1. See the following figure.



P22-2. The address is **::1111:129.6.12.34/128**.

P22-3. Here we mean unique local unicast address (see the errata). The prefix in this case is FC00/7. After adding the suffix (0::123/48), we can get the *unique local unique address* as FC::123/48.

P22-4. See the following figure.



P22-5.

a. `0000:0000:0000:0000:0000:0000:0000:0002`

b. `0000:0023:0000:0000:0000:0000:0000:0000`

c. `0000:000A:0000:0000:0000:0000:0000:0003`

P22-6. We can easily find the block by looking at the prefix length.

a. Link local

b. Unique local unicast

c. Global unicast

P22-7. The error-reporting messages in ICMPv4 and ICMPv6 are similar except that some messages have been totally deleted in version 6 or has been inserted in other categories. The following table shows a comparison.

Message	*v4*	*v6*	*Explanation*
Destination unreachable	√	√	
Source quench	√		Deleted from ICMPv6; rarely used
Time exceeded	√	√	
Parameter problem	√	√	
Redirection	√		Moved to neighbor-discovery category
Packet too big		√	Added in v6 to prevent big-packet size

P22-8.

a. `0000:0000:0000:0000:5555:5555:5555:5555`

b. `0000:0000:0000:0000:AAAA:AAAA:AAAA:AAAA`

c. `5555:5555:5555:5555:5555:5555:5555:5555`

d. `7777:7777:7777:7777:7777:7777:7777:7777`

P22-9. The address is **::129.6.12.34/128**.

P22-10. Two informational messages in ICMPv4 is kept in ICMPv6, but the other two have been deleted. The following table shows a comparison.

Message	*v4*	*v6*	*Explanation*
Echo Request/Response	√	√	
Timestamp request/ response	√		Deleted from ICMPv6; rarely used

P22-11. The neighbor-discovery category is new in ICMPv6. In ICMPv4, one of these messages belonged to another category; the duties of others were covered by other protocols, The following table shows a comparison.

Message	*v4*	*v6*	*Explanation*
Router solicitation		√	Version 4 uses DHCP for this purpose
Router advertisement		√	Version 4 uses DHCP for this purpose
Neighbor solicitation		√	Version 4 uses ARP request packet
Neighbor advertisement		√	Version 4 uses ARP reply packet
Redirection		√	Included in error-reporting group in v4

P22-12. These message are new in Version 6. Version 4 was using RARP protocol, but it is now deprecated.The following table shows a comparison.

Message	*v4*	*v6*	*Explanation*
Inverse neighbor solicitation		√	Version 4 used RARP request message
Inverse neighbor advertisement		√	Version 4 used RARP reply message

P22-13.

a. `0:FFFF:FFFF::`

b. `1234:2346:3456::FFFF`

c. `0:1::FFFF:1200:1000`

d. `::FFFF:FFFF:`**24.123.12.6**

P22-14. We assume the subnet identifiers start from $(0001)_{16}$, but they can also start from $(0000)_{16}$.

a. The block for the third subnet is **2000:1110:1287:0003/64**.

b. We change the IEEE address to EUI address: F7A9:23FF:FE14:7AD2.

c. We add the interface to the block prefix to get the IPv6 address of the station as **2000:1110:1287:0003:F7A9:23FF:FE14:7AD2**.

P22-15. Both subnets keep the given *global routing prefix*. Each subnet adds a 16-bit subnet identifier. We assume the subnet identifiers start from $(0001)_{16}$, but they can also start from $(0000)_{16}$.

a. The first subnet block is 2000:1234:1423:0001**/64**.

b. The second subnet block is 2000:1234:1423:0002**/64**.

P22-16. Error-reporting messages contain part of the IP datagram for which the error message has be created. This is needed to let the sender of the datagram to identifier which datagram has been discarded due to the error.

P22-17. The following table shows the comparison:

Field	*IPv4*	*IPv6*
VER	√	√
HLEN	√	
Service (or traffic class)	√	√
Flow label		√
Total length	√	
Payload length		√
Identification	√	
Flags	√	
Flag offset	√	
TTL (or hop limit)	√	√
Protocol	√	
Checksum	√	
Source Address	√	√
Destination Address	√	√

P22-18.

a. `0000:0000:0000:0000:0000:0000:0000:2222`

b. `1111:0000:0000:0000:0000:0000:0000:0000`

c. `000B:000A:00CC:0000:0000:0000:1234:000A`

P22-19. The address is **::01/128**.

P22-20. The prefix is FE80::/10. After adding the suffix (0::123/48), we can get the *link local address* as FE80::123/48.

P22-21. We change the seventh bits from 0 to 1 (F5 is changed to F7) and insert four extra hexadecimal digits (FF-FE) after the sixth digits:

F5	-	A9	-	23	-	12	-	7A	-	B2				
F7	**-**	**A9**	**-**	**23**	**-**	**FF**	**-**	**FE**	**-**	**12**	**-**	**7A**	**-**	**B2**

The resulting preface address in IPv6 is **F7A9:23FF:FE12:7AB2**.

P22-22. We change the seventh bits from 0 to 1 (F5 is changed to F7):

F5	-	A9	-	23	-	AA	-	07	-	14	-	7A	-	23
F7	**-**	**A9**	**-**	**23**	**-**	**AA**	**-**	**07**	**-**	**14**	**-**	**7A**	**-**	**23**

The resulting preface address in IPv6 is **F7A9:23AA:0714:7A23**.

P22-23. Group membership messages are new in Version 6. Version 4 is using IGMP protocol for this purpose. The following table shows a comparison.

Message	*v4*	*v6*	*Explanation*
Membership query		√	It was part of IGMP protocol in v4.
Membership report		√	It was part of IGMP protocol in v4.