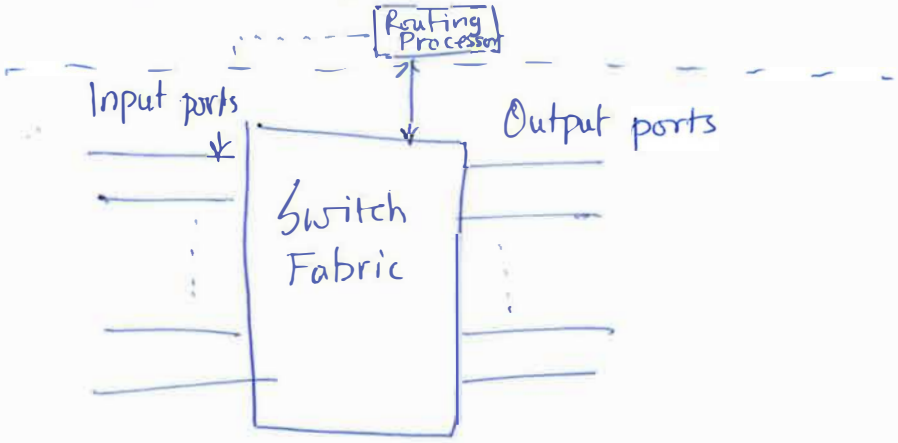
ELEC 3500

Tutorial - 7

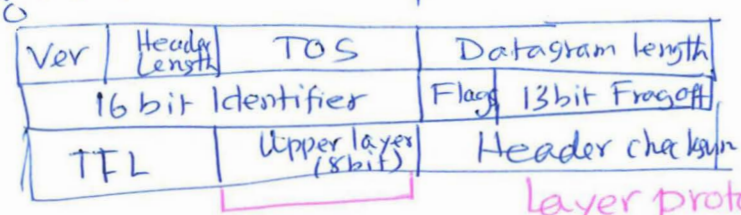
Solution

7.0 The main differences between routing and forwardi techniques is that the forwarding action is router's local task which ensures that packets from its input interfaces are transferred to output interfaces. Forwarding takes place at very short time scale (typicall few ns) and thus typically implemented hardware. Routing refers to the network-wide process that determines the end-to-end paths that packets take from sources to destinations. Routing takes place on much longer timescales (typically seconds) and is often implemented in software.



7-1. The service model of the internet's network layer is best-effort service. With this service model, there is no guarantee that packets will be received in the order in which they are sent, no gurantee on of the end-to-end delay, and no minimal bandwidth guarantee.

7-2. IPV4 header



The upper layer field (8 bit) contains information about which transport layer protocol the destination host should pass the segment to.

7-3 i) For IPv4: It is the Time To Live (TTL) field which generally calculate the path length in terms of number of hops.

For IPv6: Hop Limit, this field is decrement every time it pass a router.

In both cases when the field value is 0 the datagram is discarded.

(ii) For IPv4: Type of Service (TOS): 4 bit field this field distinguishes different types of IP datagram

For IPv6: Traffic class, The 8 bit field can be used to give priority to certain datagrams within a flow or a datagram.

7-4 The reassembly of fragments of an IP datagram is done in the destination host.

7-5 Maximum size of data field in the segment $L_D = 500 - 20 = 480$ bytes

The number of required fragment $N_f = \left\lfloor \frac{1600 - 20}{480} \right\rfloor$

$\Rightarrow N_f = \lfloor 3.29 \rfloor = 4$

Fragment 1: ID: 291, Flag MF: 1 Fragment offset: 0, Length 480

Fragment 2: ID: 291, MF = 1, FO = 60, Length: 480

Frg ment 3: ID: 291, MF = 1, FO = 120, Length: 480

Fragment 4: ID: 291, MF = 0 FO = 180, Length: 160

Fragment offset is represented by group of 8 bytes.
FO also represent where the fragment will join.

7-6 Datagram size $L_D = 40 + 20 + 20 = 80$ Bytes

(TCP Header, IP Header.)

$$\% \text{ OH} = \frac{40}{80} \times 100 = 50\%$$

7-7 A private network address of a device in a network refers to a network address that is meaningful to those devices within the network. A datagram within a private network address should never be present in the larger public internet, because the private network address is potentially used by many network devices within their own private networks.

7-8 (a) Data destined to host H3 is forwarded through the interface 3.

Table entry:

Destination	—	Interface
H3	—	3

(b) No, because the forwarding rule is only based on destination address.

7-9

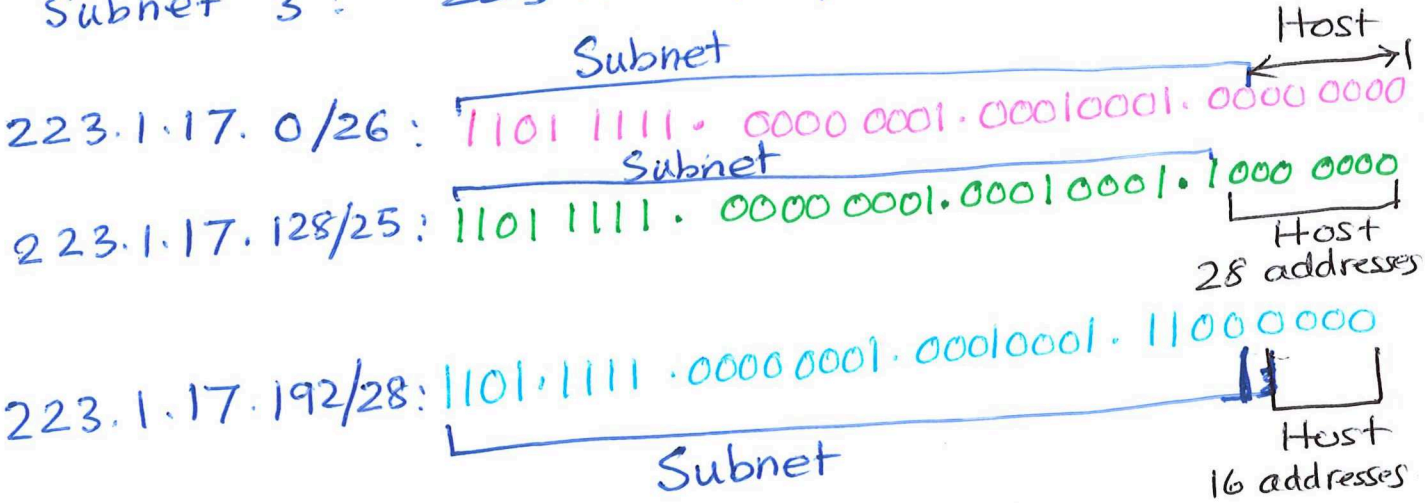
Destination Address Range		Link Interface
1100 0000 — 1111 1111 (64 addresses)		0
1010 0000 } 1011 1111 } (32 addresses)		1
1000 0000 } 1001 1111 } (32 addresses)		2
0000 0000 } 0111 1111 } (128 addresses)		3.

7-10 Subnets are required to have the prefix:

223.1.17/24

Possible addresses:

Subnet 1 : 223.1.17.0/26
Subnet 2 : 223.1.17.128/25
Subnet 3 : 223.1.17.192/28



7-11 Number of datagram

$$N_D = \left\lfloor \frac{5 \times 1024 \times 1024}{[1500 - (20+20)]} \right\rfloor = \left\lfloor \frac{5242880}{1460} \right\rfloor$$

$$= \lfloor 3591.01 \rfloor = 3592$$

Last ~~dag~~ datagram Size

$$N_{D,last} = \lfloor 0.0137 \times 1460 \rfloor = \lfloor 20.002 \rfloor + 40$$

$$= 21 + 40 = 61 \text{ byte.}$$

40 ↓ TCP/IP header