Week 7 – Network Layer Contd

Internet Technologies
COMP90007

Addressing

- *Routing tables needs addresses* to work/route
- IP addresses are used for this purpose on the Internet
- They are **hierarchical**
- There is *a network portion*
- And also *a host portion*
- The network portion is same for all hosts on a network
- This portion grabs a continuous block of addresses and is called the prefix

Addressing

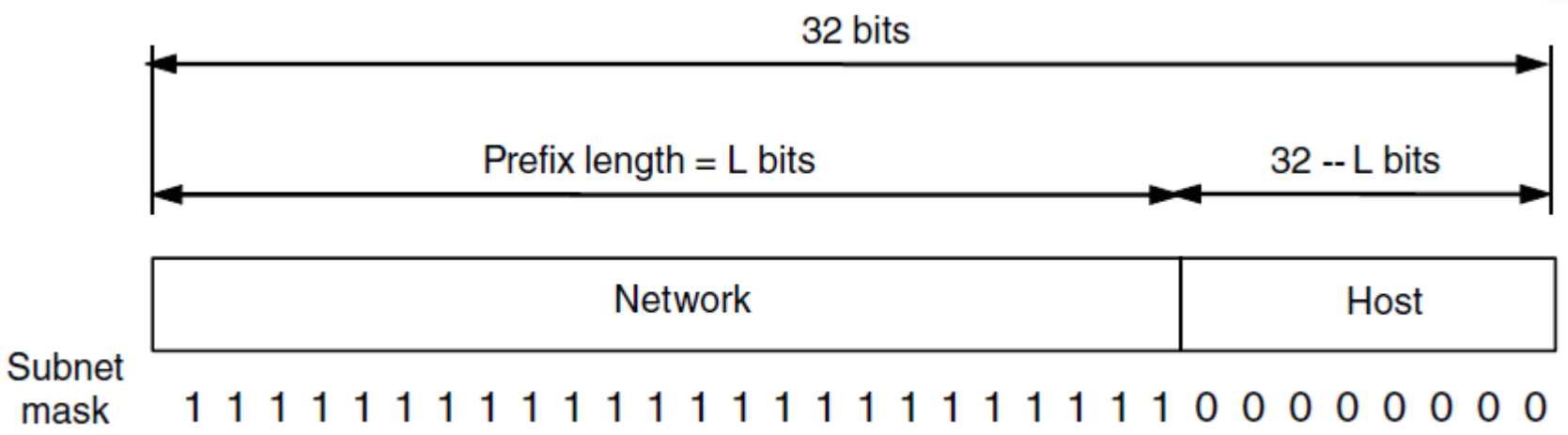
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
0	0	0	1	0	0	1	0

- IP Addresses are allocated in prefixes
  - Prefix is determined by a LAN for example
  - IP addresses are written in dotted decimals
  - For example W.X.Y.Z
  - 4 bytes >> 8 x 4 = 32 bit addresses
  - Given as lowest address+length, e.g., 18.0.31.0/24
  - /24 states the length of the network part in bits, so here 8 bits are left for hosts in this example

- Overall IP allocation is responsibility of Internet Corporation for Assigned Names and Numbers (ICANN) by delegation to Internet Assigned Numbers Authority (IANA) and Regional Internet Registries (RIR's)

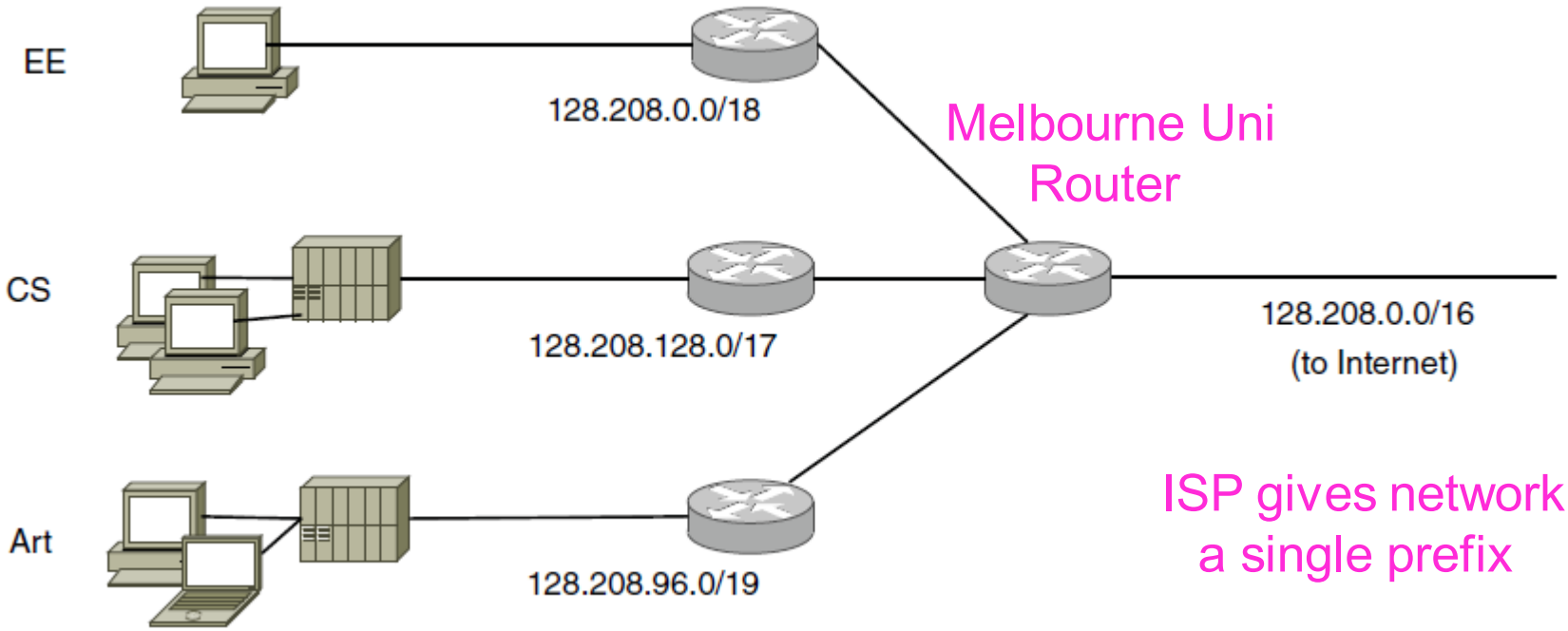
Addressing

- 18.0.31.0/24
  - /24 states the length of the network part in bits, so here 8 bits are left for hosts



Subnetting

- Subnetting allows networks to be split into several parts for internal uses whilst acting like a single network for external use
  - Looks like a single prefix outside the network



Network divides it into subnets internally

IP Addresses and Routing Tables

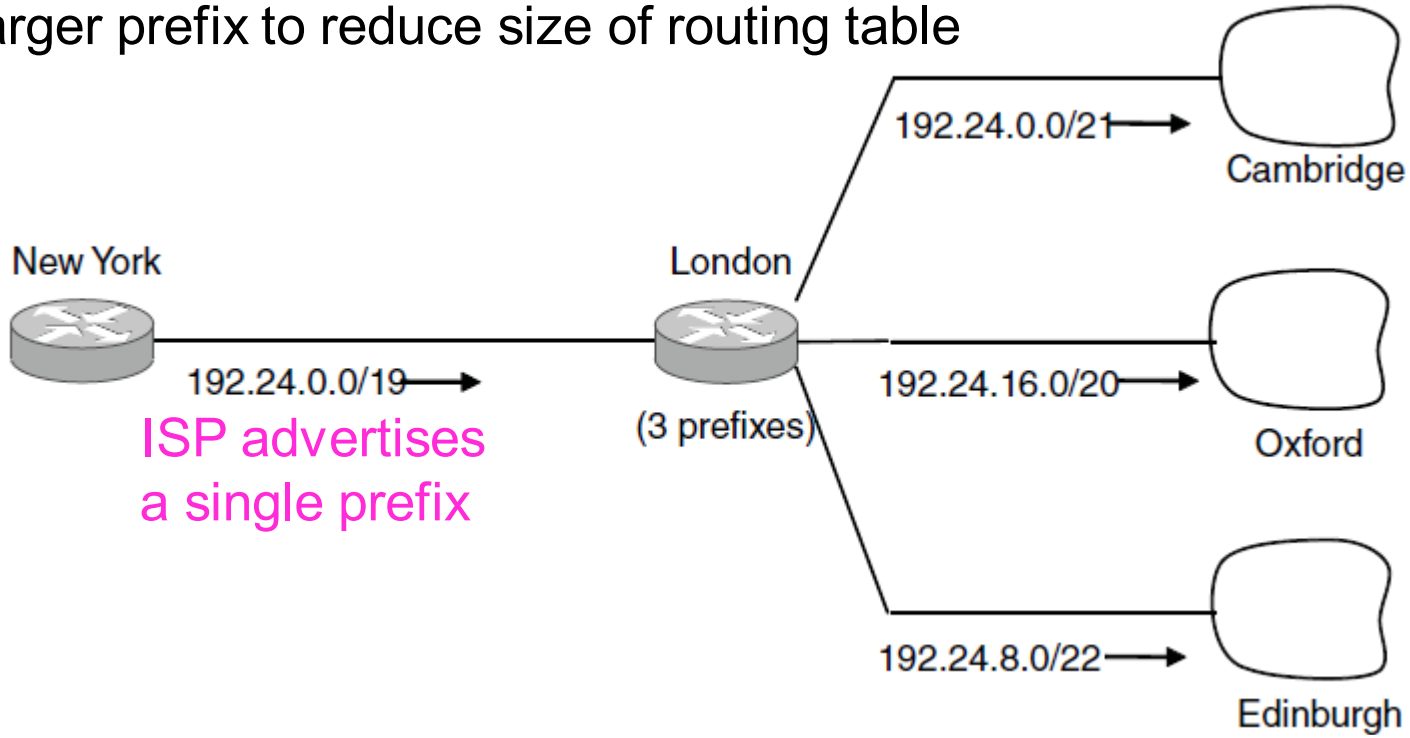
- Routing tables are typically based around a triplet:
  - Address
  - Subnet Mask
  - Outgoing Line (physical or virtual)
- Eg: A row of a routing table:

Prefix addr	Subnet Mask	Interface
203.32.8.0	255.255.255.0	Eth 0

The process is simple for routing, for a given packet check address by AND operation with Subnet Masks and find the matching prefix to forward

Aggregation of IP addresses

- Backbone routers are connecting a large no of networks around the world → e.g., 300k networks
- *So we search each line for each incoming packet with 300k entries?*
- Aggregation – Process of joining multiple IP prefixes into a single larger prefix to reduce size of routing table



ISP advertises a single prefix

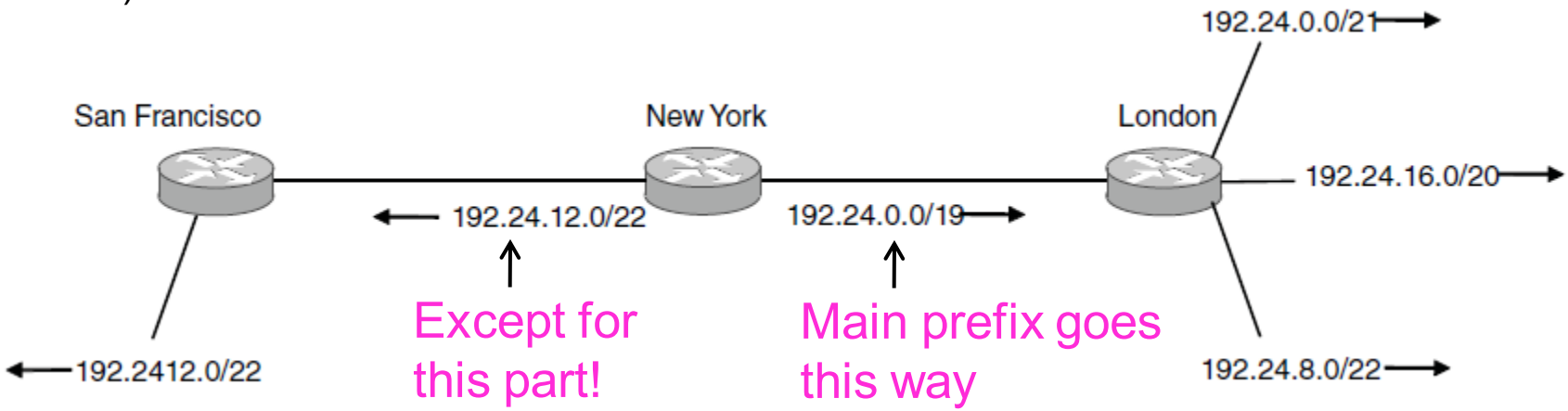
ISP customers have different prefixes

Longest Matching Prefix

- Packets are forwarded to the entry with the longest matching prefix or smallest address block
  - Complicates forwarding but adds flexibility

1) Check address whether matches the longest prefix → /22

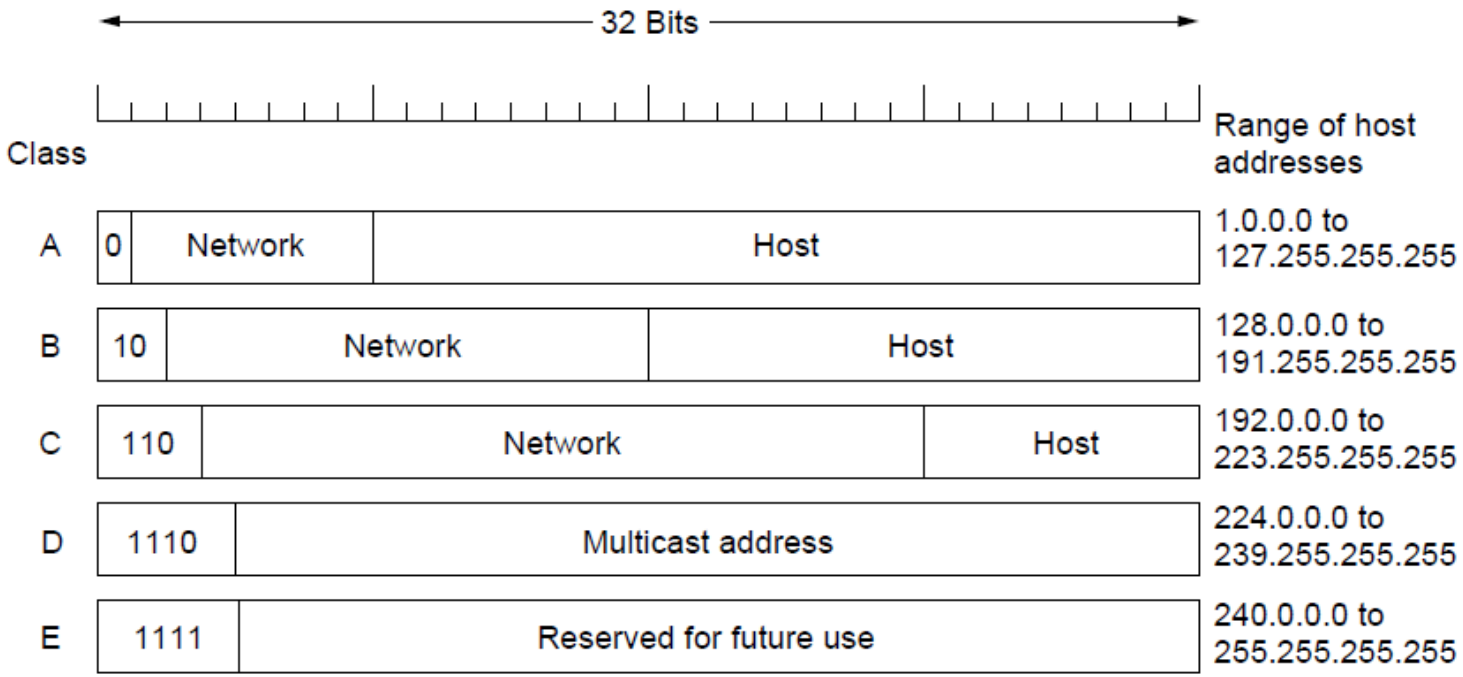
2) If not the see if it matches /19



Prefix addr	Subnet Mask	Interface
192.24.12.0	255.255.252.0	Eth 0
192.24.0.0	255.255.224.0	Eth 1

Classful Addresing

- To appreciate Classless InterDomain Routing (CIDR) one needs to see old ways
- Part of history now-old addresses came in blocks of fixed size (A, B, C)
  - Carries size as part of address, but lacks flexibility



Private IP Ranges

- Range of IP addresses that CANNOT appear in the Internet
- Only for private networks
- 10.0.0.0/8 (16,777,216 hosts)
- 172.16.0.0/12 (1,048,576 hosts)
- 192.168.0.0 /16 (65,536 hosts)

Network Address Translation (NAT)

- NAT box maps one external IP address to many internal IP addresses
  - Uses TCP/UDP port to tell connections apart
  - Violates layering; still very common in homes, etc.