

# IP Addressing

MAC address (layer 2)

IP address (layer 3)

IPv4. 32 bits  $\rightarrow 2^{32}$

$\rightarrow$  NAT Network Address Translation  
(to reuse IP addresses)

IPv6: 128 bits



$\downarrow$   
write as decimal

Ex: 255.255.255.255  $\rightarrow$  all 1's  
 $\rightarrow$  reserved for broadcast

10. \* . \* . \*  $\rightarrow$  anything } private IP  
192. \* . \* . \*

should be unique  
in the internet

$\downarrow$   
only one host must  
use that IP address

$\leftarrow$  public IP

## IP header

### IPv4 header

Time to live  
(decremented at each  
IP router)  
 $\rightarrow 0 \Rightarrow$  drop packet  
Next layer protocol  
6: TCP  
17: UDP  
1: ICMP

0		4	8	16	31
VERSION		TOS		LENGTH	
Identifier			Flag/Fragment offset		
TTL		Protocol		CHECKSUM	
SOURCE IP					
DEST IP					
IP options					
DATA					

$\rightarrow$  length of  
IP packet

20 bytes

$\rightarrow$  optional

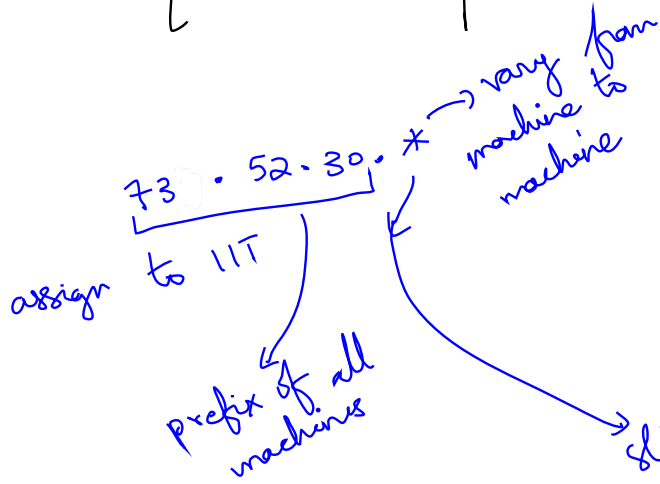
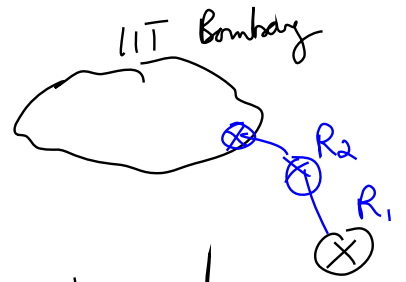
$\rightarrow$  higher layer  
data

# Routing table

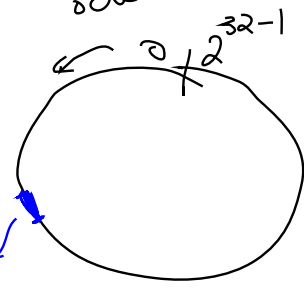
Destination	Next hop
73.52.30.* IP Prefix	R2

Small in number

#IPs  $\approx 2^{32}$

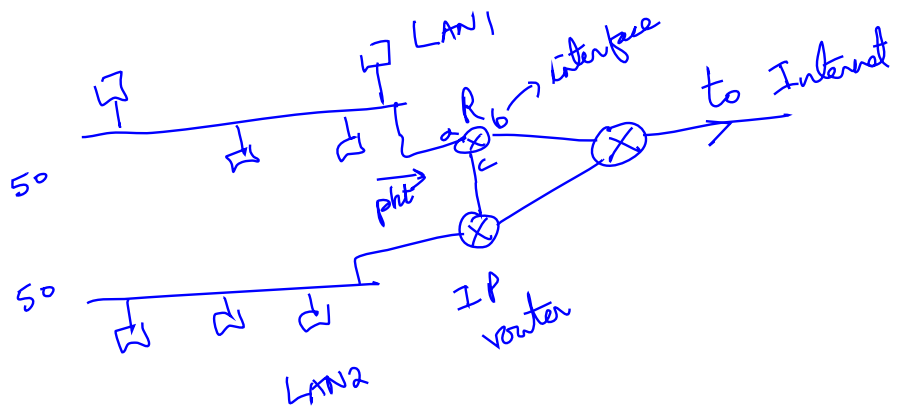


a.b.c.d  
octet

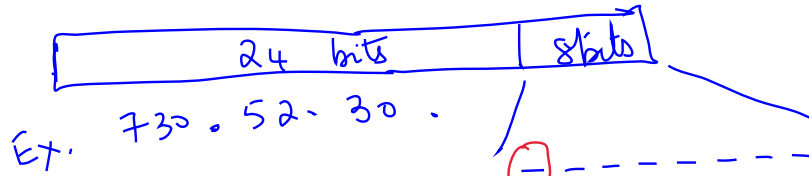


- Class A:
- 8 bits Network (common)
  - 24 bits host  $\rightarrow \approx 2^{24}$  hosts
- B:
- 16 bits network
  - 16 bits host
- C:
- 24 bits network
  - 8 bits host

SUBNETTING: Given a slice of IP addresses how to divide among LANs, setup/config. internal router

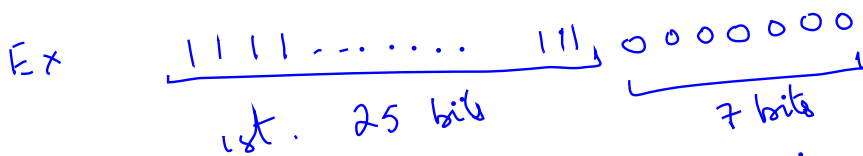


class C:



indicate which LAN  
 $0 \Rightarrow \text{LAN 1}$   
 $1 \Rightarrow \text{LAN 2}$

SUBNET MASK: Says which bits  
 in IP address to use to  
 decide which LAN to route to



Subnet address:  $S_1$  for LAN1 ( $M_1$  is mask)  
 $S_2$  for LAN2 ( $M_2$  is mask for LAN2)

Router R: Suppose dest. IP is 'D' (pkt on interface 'a')  
 $[S_1 = 730.52.30.0]$

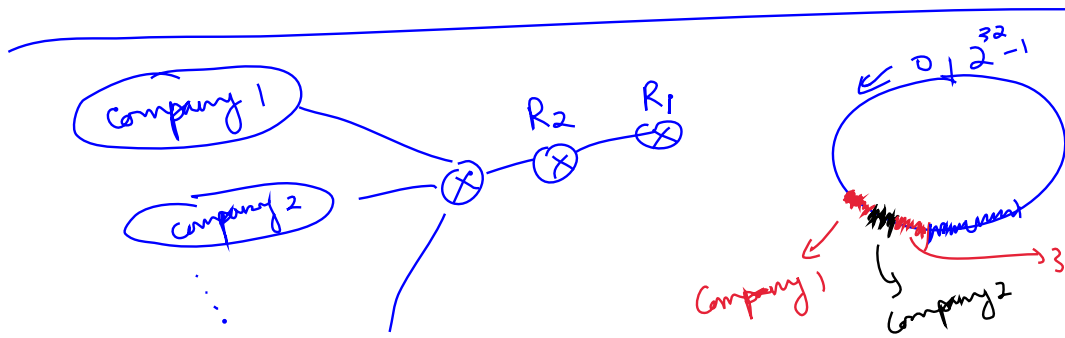
Is  $(D \text{ AND } M_1) == S_1$ ?

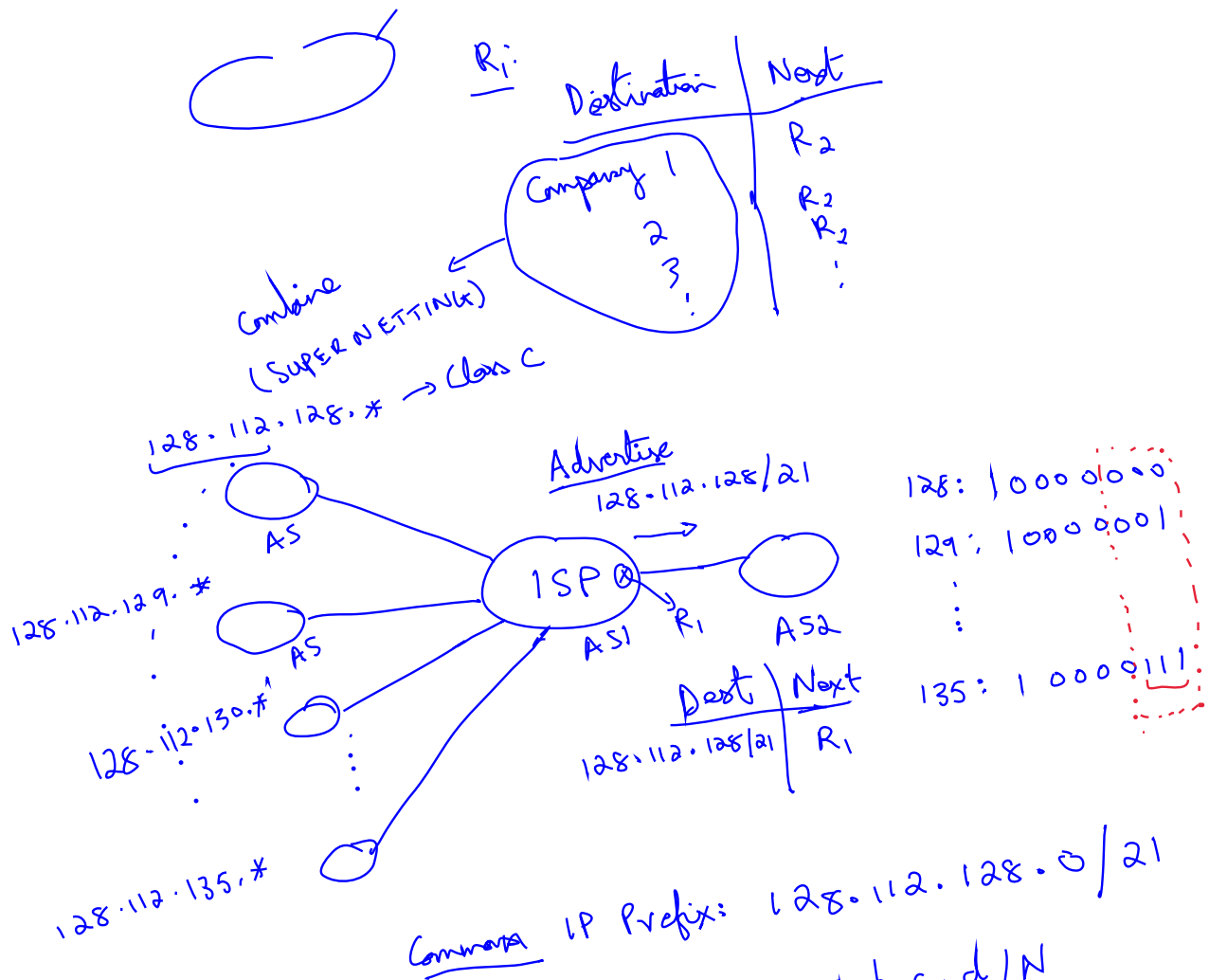
YES  $\rightarrow$  do nothing  
 NO  $\rightarrow$

Is  $(D \text{ AND } M_2) == S_2$ ?  
 YES  $\rightarrow$  Fwd To interface 'c'  
 NO  $\rightarrow$  send to 'b'

[Ex:  $M_1 = M_2$ ]  
 $[S_2 = 730.52.30.128]$

1 in the leading bit





If given dest. IP address 'D'

If first N bits of D match with the first N bits of a.b.c.d, then D belongs to that prefix

**CIDR: Classless Inter Domain Routing**  
 ↳ specify any prefix length (N)

a.b.c.d/N  
 ↓  
 consider N leading bits to get the IP prefix