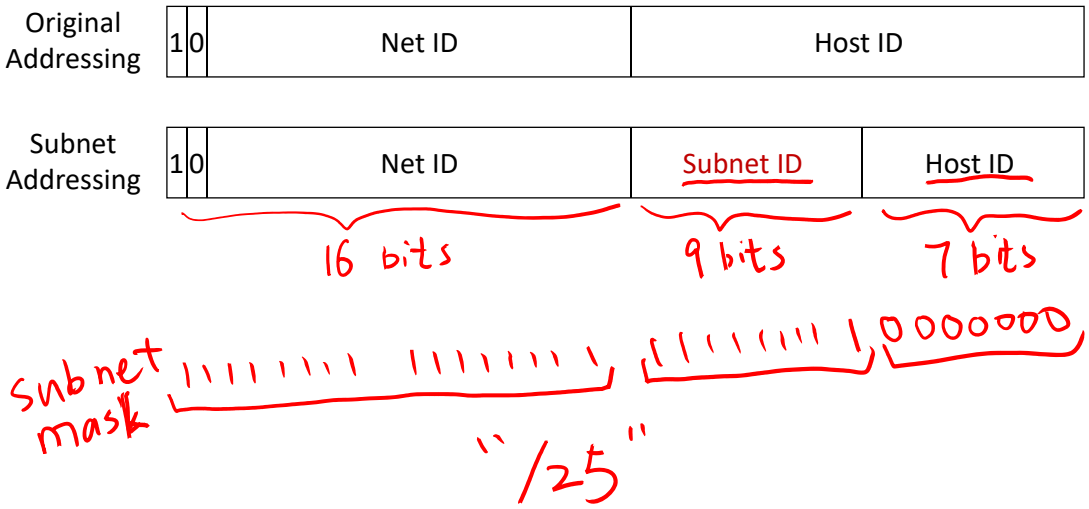
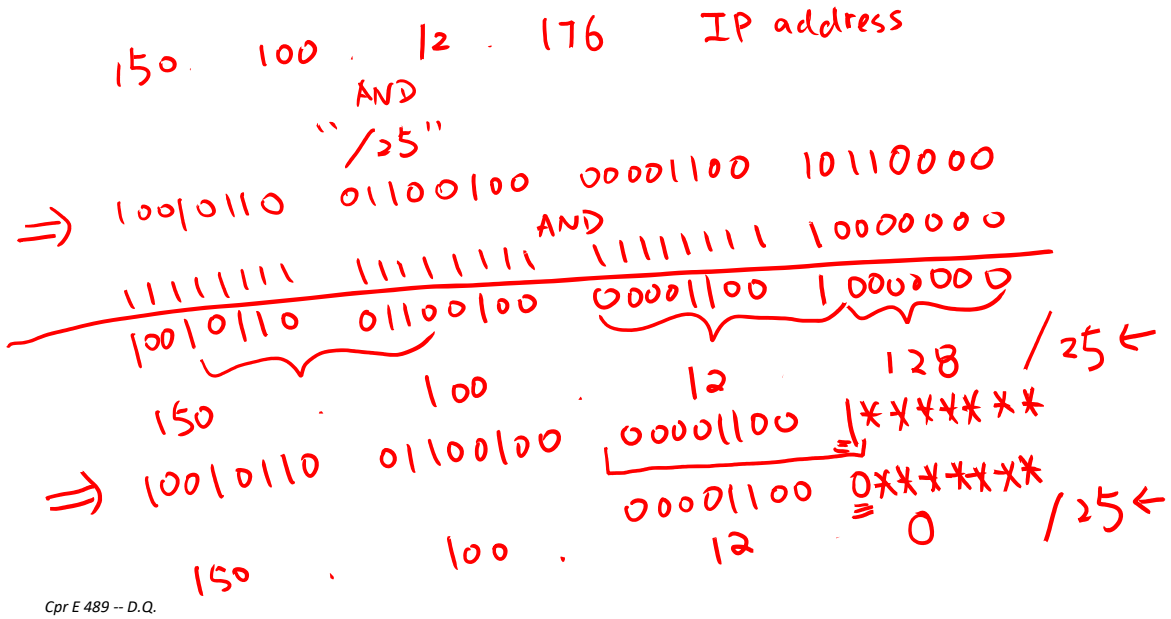
Subnet Addressing

- Subnet addressing introduces another hierarchical level
  - Part of original "Host ID" becomes "Subnet ID"



Subnet Addressing

- Subnet addressing introduces another hierarchical level
  - subnet address = IP address AND subnet mask



Subnet Addressing

① Subnets are specified by subnet address and subnetmask
② Subnets may have different sizes.
③ Subnets shall not overlap, if assigned to diff parties

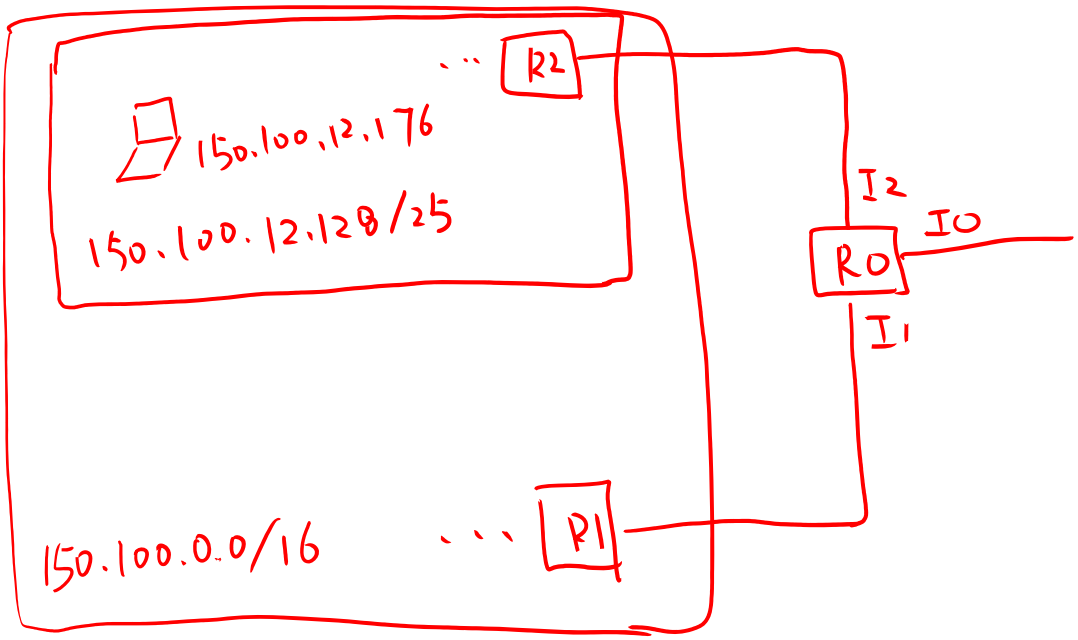
150 . 100 . 12 . 128 /25 ⇒ subset of

10010110 01100100 00001100 10000000
netid subnet id

150 . 100 . 12 . 0 /24

10010110 01100100 00001100 00000000
8 bits 8 bits

Subnet Addressing



Subnet Addressing

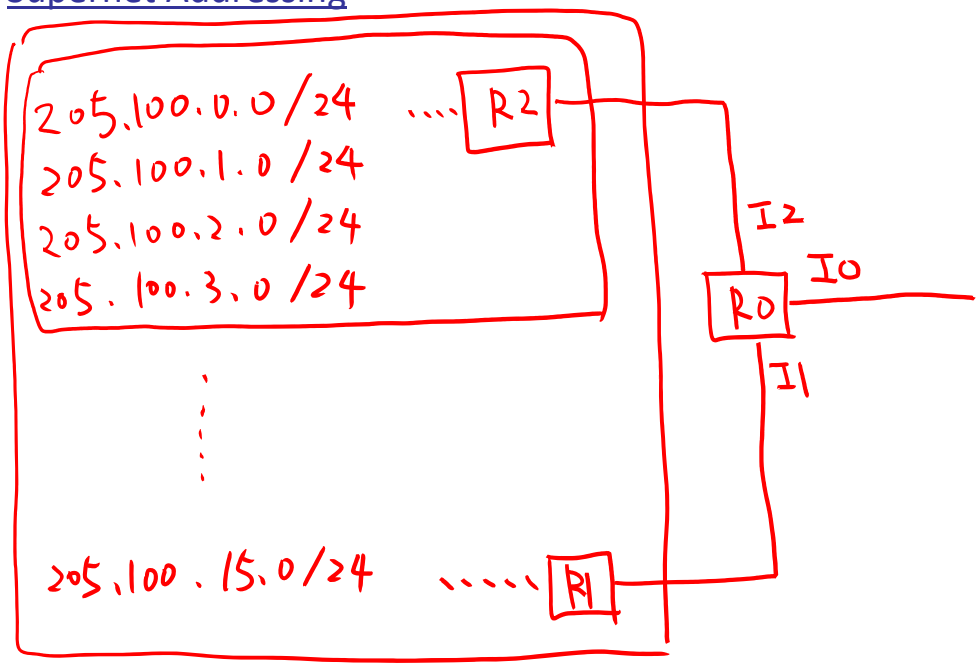
Routing Table @ R0:

Dest	Mask	Next-Hop	Interface
150.100.0.0	/16	R1	I1
150.100.12.128	/25	R2	I2

150.100.12.176

Longest Prefix First

Supernet Addressing



Supernet Addressing

Routing Table @ R0

Dest	Mask	Next-hop	Int
205.100.0.0	/24	R1	I1
205.100.1.0	/24	R1	I1
205.100.2.0	/24	R1	I1
205.100.3.0	/24	R1	I1
⋮			
205.100.15.0	/24	R1	I1

Supernet Addressing

common prefix of 22 bits 205.100.0.0/22

205.100.0.0	11001101	01100100	00000000	00000000
1.0	11001101	01100100	00000001	00000000
2.0	11001101	01100100	00000010	00000000
3.0	11001101	01100100	00000011	00000000
⋮				
15.0	11001101	01100100	00001111	00000000

Common prefix of 20 bits

Supernet Example

- Example:
  - A supernet contains 16 Class C blocks:
    - From 11001101 01100100 00000000 00000000 (205.100.0.0)
    - Up to 11001101 01100100 00001111 00000000 (205.100.15.0)
  - The common network prefix is 11001101 01100100 0000
  - supernet address = 11001101 01100100 00000000 00000000
  - network mask = 11111111 11111111 11110000 00000000
  - supernet address = IP address AND network mask
  - Slash notation for this supernet is 205.100.0.0/20

Supernet Example

Dest	Mask	Next-hop	Int
205.100.0.0	/20	R1	I1
205.100.0.0	/22	R2	I2

205.100.0.1

Effect of Supernet Addressing on Routing

- With supernet addressing, routing is according to the supernet address (or, the network prefix) of an IP address, not its class
  - This is known as CIDR (Classless Inter-Domain Routing)
    - CIDR collapses a block of contiguous Class C address blocks into a single entry in the routing table
  - Example: 205.100.0.0/20
    - Pre-CIDR: destination network with 16 contiguous Class C address blocks requires 16 entries in the routing table
    - Post-CIDR: destination network with 16 contiguous Class C address blocks only requires 1 entry in the routing table

Longest Prefix Match

- With CIDR, multiple routing table entries may match a given IP destination address
- Example: routing table may contain
  - 205.100.0.0/20 corresponds to a given supernet
  - 205.100.0.0/22 corresponds to another supernet resulted from aggregation of a smaller number of addresses
  - Longest Prefix Match
    - Packet must be routed using the most specific route
      → routing table entry corresponding to the smallest supernet
      → longest prefix match
  - Several fast longest-prefix matching algorithms are available

Supernet Addressing

- Supernet Addressing allows the addresses assigned to a single organization to span multiple classed address blocks
  - Classless Addressing

- Why was classless addressing adopted?
  - Class B is too large for most organizations
    - At the rate Class B numbers were being assigned, Class B prefixes would be exhausted quickly
  - Class C is too small

  - Supernet Addressing is short-term solution
  - Long-term solution: IPv6 with much bigger address space