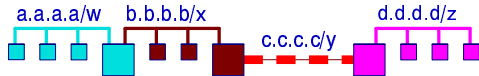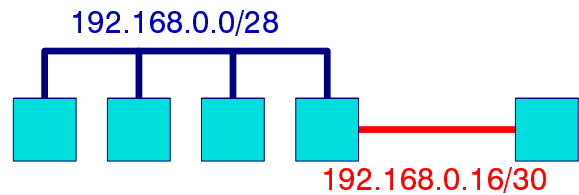## Allocating IP numbers on an Internetwork

- Easy: follow the Golden Rules!
    1. Give each network its own prefix
    2. Give each machine an IP number using this prefix plus a host number
    3. Don't use the first and last host numbers (all 0's and all 1's)

a.a.a.a/w   b.b.b.b/x   d.d.d.d/z

c.c.c.c/y

1

IP allocation example

- Allocate IP numbers to the following devices

192.168.0.0/28

192.168.0.16/30

Subdividing prefixes

- Every network must have its own network number (prefix)
    - See the Golden Rules
- You will most likely only get one prefix from your provider
- So if you have more than one network, you have to divide a large prefix into several smaller ones

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Subdividing prefixes: example

- You have been allocated 195.176.112.0/25
- How many IP numbers is this?

- What is the smallest IP number available? The largest IP number available?

Example (contd)

- We have decided we need 8 separate networks, linked by routers
- Each network needs its own prefix
- So we need *more* prefixes but each with *fewer* IP numbers available

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Example (contd)

- Prefix we have been given

195.176.112.0/25

11000011 10110000 01110100 0hhhhhhh

195.176.112.0 to 195.176.112.127

(195.176.112.1 to 195.176.112.126 usable)

Example (contd)

- Now let's make the prefix longer

  11000011 10110000 01110100 0nnn<u>hhhh</u>

- What is the new prefix length?

- Now we have 3 more bits of network number and 3 less bits of host number
- How many combinations of nnn are there?

Example (contd)

- We have created these new prefixes

  11000011 10110000 01110100 0000<u>hhhh</u>
  11000011 10110000 01110100 0001<u>hhhh</u>
  11000011 10110000 01110100 0010<u>hhhh</u>
  11000011 10110000 01110100 0011<u>hhhh</u>
  11000011 10110000 01110100 0100<u>hhhh</u>
  11000011 10110000 01110100 0101<u>hhhh</u>
  11000011 10110000 01110100 0110<u>hhhh</u>
  11000011 10110000 01110100 0111<u>hhhh</u>

Example (contd)

- How many hosts can each network have?
- What are the network numbers we have created?
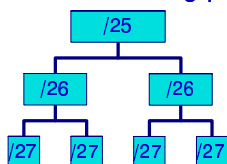
Dividing Prefixes - class example

- Here is a prefix:

  192.168.34.0/24

- What is the smallest and largest IP number in this range?
- Turn this into two /25 prefixes
- What are the smallest and largest IP numbers in each of the new ranges?

Aggregation Tree
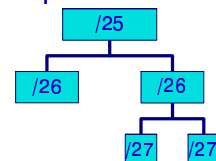
- A useful tool for dividing prefixes

- "Aggregation" is the process of combining smaller prefixes into larger ones - the reverse of what we have been doing

Aggregation Tree (contd)

- You don't have to divide your space into equal sized prefixes

This is OK: one /26 network and two /27 networks

- But check your work - work out the ranges of IP numbers and see that they don't overlap