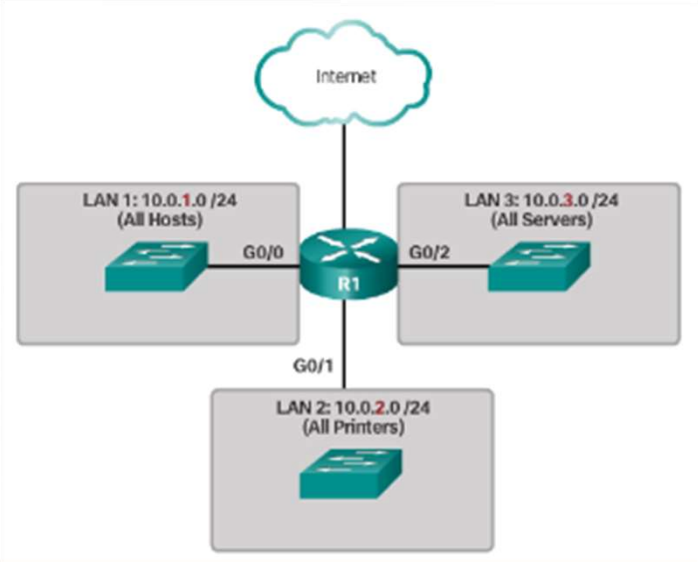
SUBNETTING IP NETWORKS

REDES DE DATOS

SUBNETTING AN IPV4 NETWORK

NETWORK SEGMENTATION

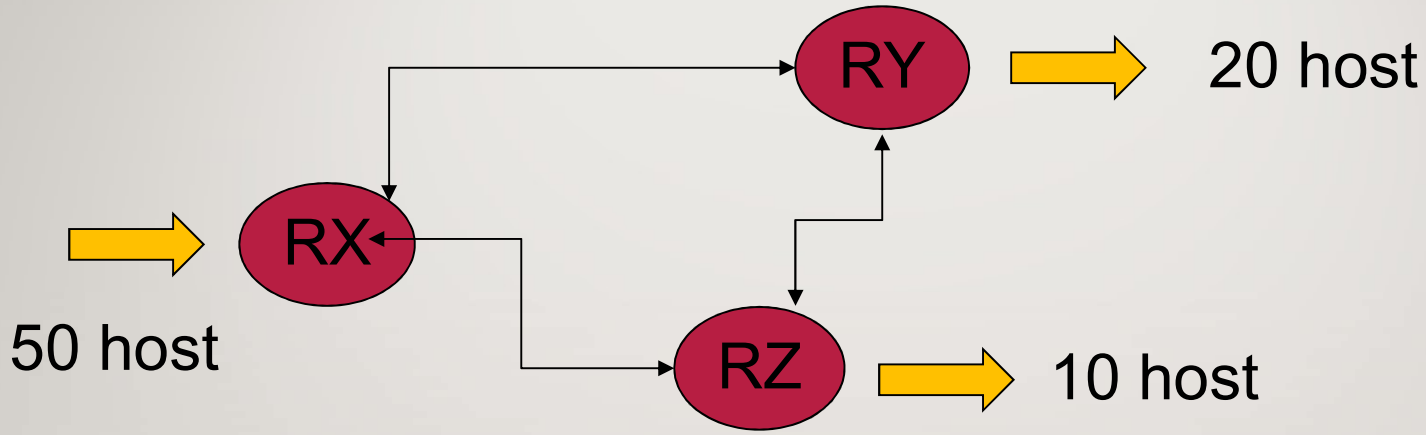
- Broadcast Domains
  - Each router interface connects a broadcast domain.
  - Broadcasts are only propagated within its broadcast domain.
- Problems with Large Broadcast Domains
  - Slow network operations due to the significant amount of broadcast traffic.
  - Slow device operations because a device must accept and process each broadcast packet.
- Reasons for Subnetting
  - Solution: reduce the size of the network to create smaller broadcast domains.
  - Because each broadcast domain connects to a different router interface, each domain needs its own network address space.
  - The process of breaking an address range into smaller address spaces is called subnetting.
  - Network administrators can group devices into subnets that are determined by location, organizational unit or device type.



SUBNETTING AN IPV4 NETWORK

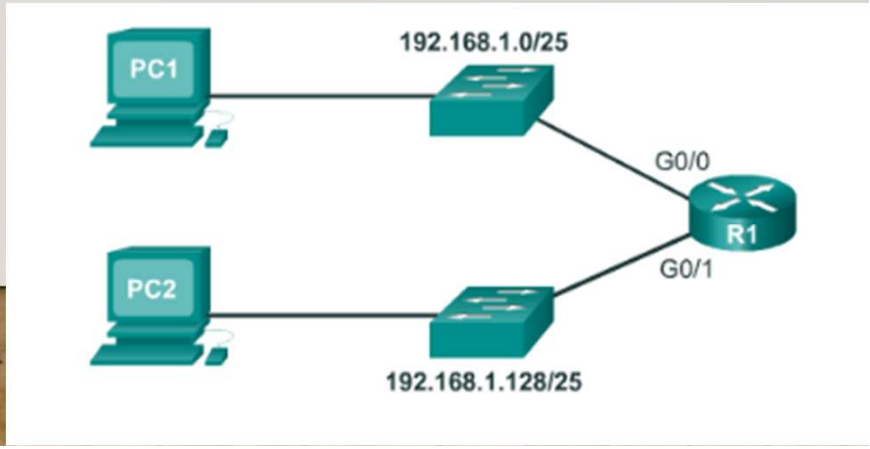
- Octet Boundaries
  - Subnets can be created based on octet boundaries. (/8, /16 or /24)
- Subnetting on the Octet Boundary
  - Also known as IPv4 Classes.
  - Uses the octet boundaries to separate network from hosts.
- Classless Subnetting
  - Uses address bits to separate network from hosts.
  - Allows for much more flexibility.
- Classless Subnetting Example

Prefix Length	Subnet Mask	Subnet Mask in Binary (n = network, h = host)	# of subnets	# of hosts
/25	255.255.255.128	nnnnnnnn.nnnnnnnn.nnnnnnnn.nhhhhhhh 11111111.11111111.11111111.10000000	2	126


RY
20 host
RX
50 host
RZ
10 host

SUBNETTING AN IPV4 NETWORK

- Creating 2 Subnets
  - A subnet mask of /25 applied to 192.168.10.0, creates two equal subnets, each one with 126 hosts.
- Subnetting Formulas
  - Use 2^n, to calculate the **number of subnets**.
  - Use 2^h-2 to calculate the **number of hosts.**
  - *n* is the number allocated to the network portion of the address.
  - *h* is the number allocated to the host portion of the address.
- Creating 4 Subnets
  - A subnet mask of /26 applied to 192.168.10.0, creates four equal subnets, each one with 62 hosts.
  - *n* = 2 and therefore $2^2 = 4$.
  - *h* = 6 and therefore 2^6-2 = 62.



SUBNETTING A /16 AND /8 PREFIX

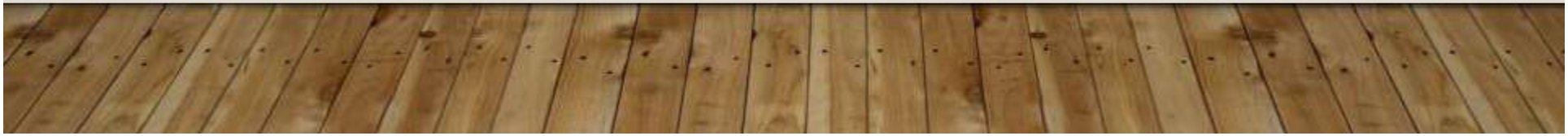
- Creating Subnets with a /16 Prefix
  - A subnet mask of /16 applied to 172.16.32.0, creates a network with 65534 hosts.
  - A subnet mask of /18 applied to 172.16.32.0, creates 4 networks with 16382 hosts in each network.
  - A subnet mask of /22 applied to 172.16.32.0, creates 64 networks with 1022 hosts in each network.
- Creating 100 Subnets with a /16 Prefix
  - A subnet mask of /23 applied to 172.16.32.0, creates 128 networks with 510 hosts in each network
- Calculating the Hosts
  - Use 2^h-2 to calculate the number of hosts.
  - *h* is the number allocated to the host portion of the address.
- Creating 1000 Subnets with a /8 Prefix
  - A subnet mask of /18 applied to 20.0.0.0, creates 1024 networks with 16382 hosts in each network

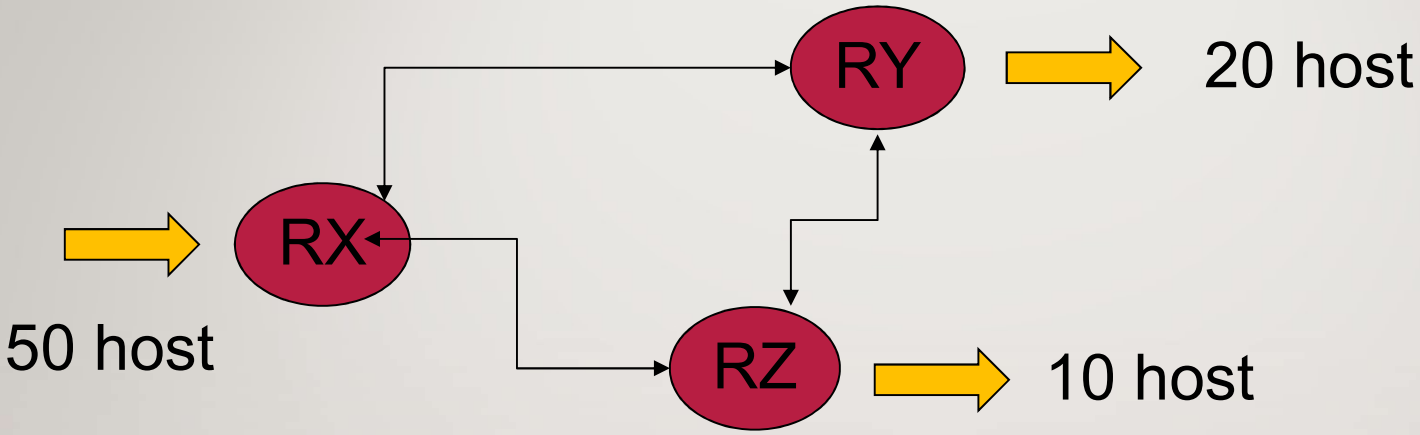
SUBNETTING TO MEET REQUIREMENTS

- Subnetting Based on Host Requirements
  - Two considerations when planning subnets:
    - The number of host addresses required for each network.
    - The number of individual subnets needed.
- Subnetting Based on Network Requirements
  - Administrators may be asked to subnet an IP range to accommodate a specific number of networks.
  - Think of a company with 7 departments where each department must have its own subnetwork.
  - The number of hosts per subnet, while secondary, is also important.
- Network Requirement Example
  - Assume the range 200.42.98.0/24 was given to the administrator.
  - 7 subnets must be created.
  - Each department will have no more than 29 hosts.
  - A subnet mask of /27 applied to 200.42.98.0/24, creates 8 networks with 30 hosts in each network.

BENEFITS OF VARIABLE LENGTH SUBNET MASKING

- Traditional Subnetting Wastes Addresses
  - Subnetting based on classes is not very flexible.
  - Results in wasted addresses.
- Variable Length Subnet Masks
  - By varying the mask, an administrator has more control.
  - Less waste.
- Basic VLSM
  - A subnet mask of /30 applied to 200.42.98.0, creates a network with 2 hosts in each network.
  - The network 200.42.98.0/30 would be a perfect match for a serial link.
- VLSM in Practice
  - Consider two routers connected by a Serial link:
  - RouterA would be 200.42.98.1/30 and RouterB would be 200.42.98.2/30.
  - 200.42.98.0/30 is the network address and 200.42.98.3/30 is the broadcast address.




RY
20 host
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ADDRESSING SCHEMES

STRUCTURED DESIGN

- Network Address Planning
  - Planning requires decisions on each subnet in terms of size, the number of hosts per subnet and how host addresses will be assigned.
- Planning to Address the Network
  - The Primary Planning Considerations are:
    - Prevent Duplication of Addresses
    - Monitor Security and Performance
    - Provide and Control Access
- Assigning Addresses to Devices
  - Different devices needs may also impact the addressing scheme.
  - Common devices are:
    - End user devices, servers, printers, network devices and gateways

ADDRESSING SCHEMES

STRUCTURED DESIGN

- The IPv6 Global Unicast Address
  - The IPv6 global unicast address normally consists of a /48 global routing prefix, a 16 bit subnet ID, and a 64 bit interface ID.
- Subnetting Using Subnet ID
  - The subnet ID provides plenty subnets and host support in one subnet.
  - The subnet ID alone allows for creating up to 65,536 /64 subnets.
- IPv6 Subnet Allocation
  - Address waste is not a concern in IPv6.
  - Administrators can concentrate on designing a logical scheme to address the network.