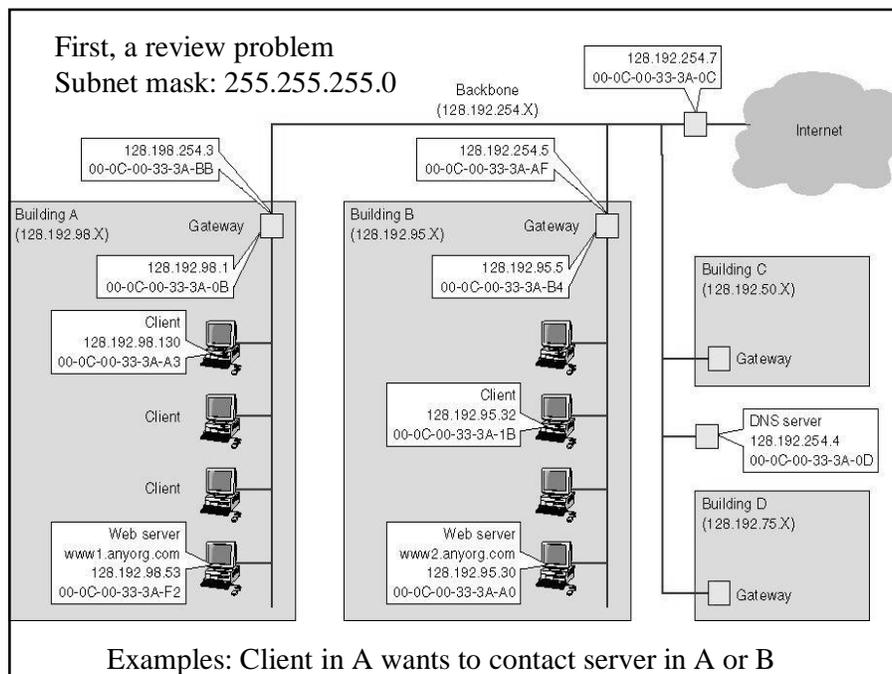


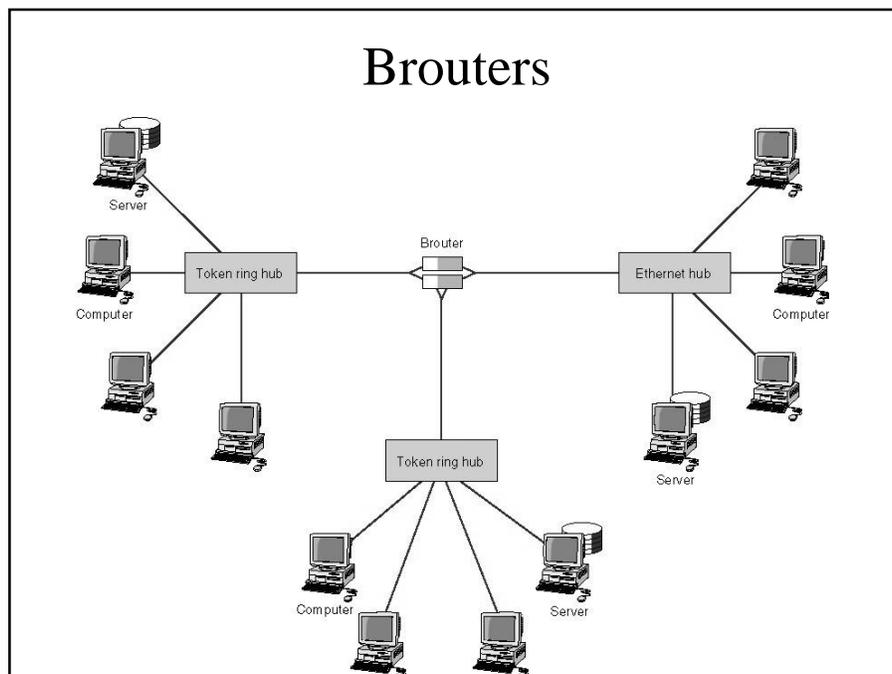
VLANS and Other Hardware

CS442



Other Network Devices

- **Brouters** are devices that combine the functions of both bridges and routers. These operate at both the data link and network layers. A brouter connects both same and different data link type network LAN segments.
- It is as fast as a bridge for same data link type networks, but can also connect different data link type networks.



Gateways

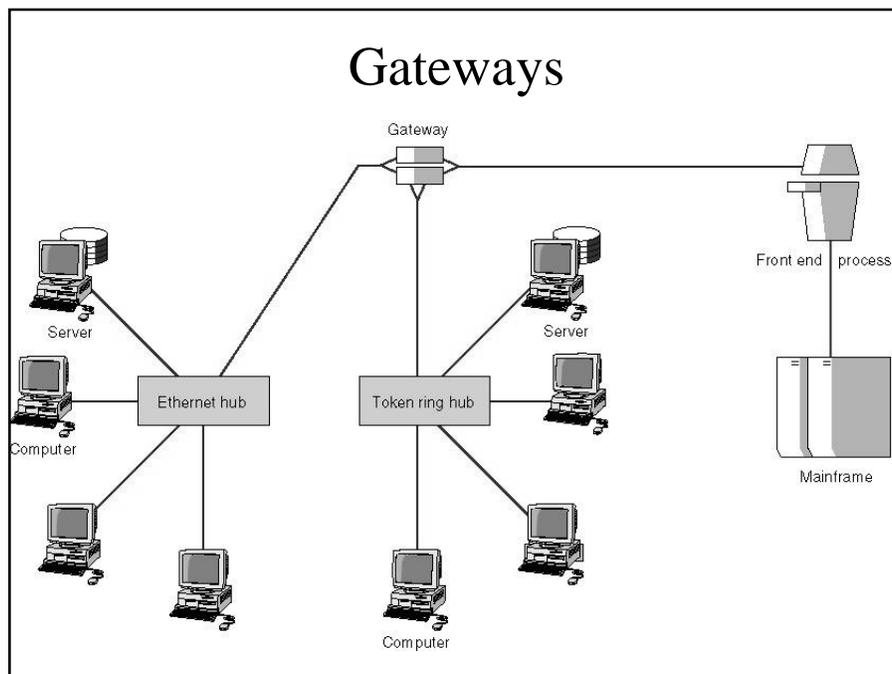
- Gateways operate at the network or application layer and use network layer addresses in processing messages.
- Gateways connect two or more LANs that use the same or different (usually different) data link and network protocols. They may connect the same or different kinds of cable.
- Gateways process only those messages explicitly addressed to them.

Gateways

- Gateways translate one network protocol into another, translate data formats, and open sessions between application programs, thus overcoming both hardware and software incompatibilities.
- A gateway may be a stand-alone microcomputer with several NICs and special software, a Front End Processor (FEP) connected to a mainframe computer, or even a special circuit card in the network server.

Gateways

- One example for a gateway is to enable LANs that use TCP/IP and ethernet to communicate with IBM mainframes that use SNA.
- The gateway provides both the basic system interconnection and the necessary translation between the protocols in both directions.
- Another common setup is for a gateway to also act as a proxy server, firewall, or email translator.
 - More on this later



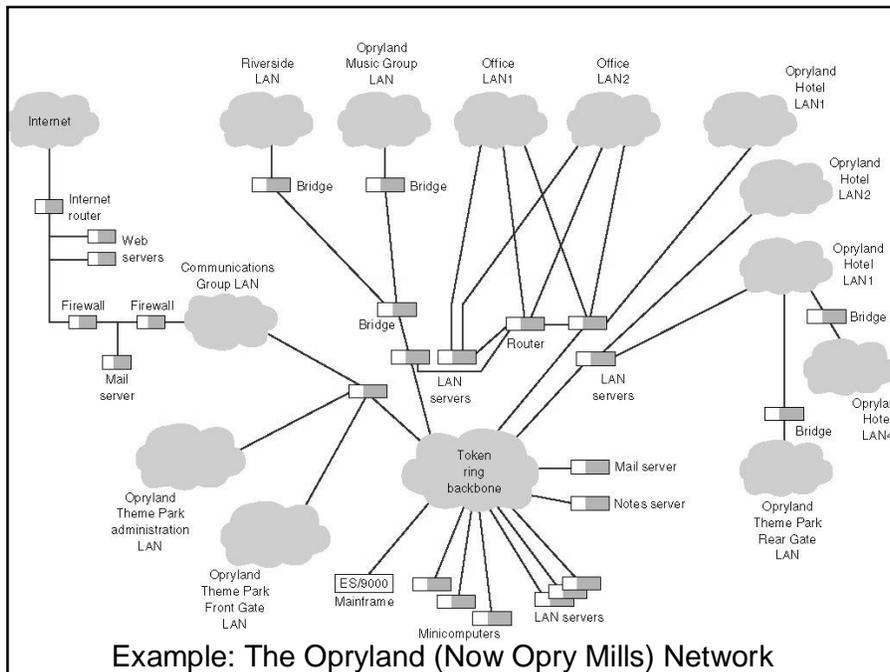
Network Devices

Device	Operates at	Messages	Physical Data Link Network		
			Layer	Layer	Layer
Hub	Physical	All transferred	S/D	Same	Same
Bridge	Data link	Filtered using data link layer addr.	S/D	Same	Same
Switch	Data link	Switched using data link layer addr.	S/D	Same	Same
Router	Network	Routed using network layer addr.	S/D	S/D	Same
Brouter	Data link & Network	Filtered & routed	S/D	S/D	Same
Gateway	Network & Application	Routed using network layer addr.	S/D	S/D	S/D

A Caveat

The terminology used in the marketplace may differ substantially. One vendor's bridge may provide the functions of a router.

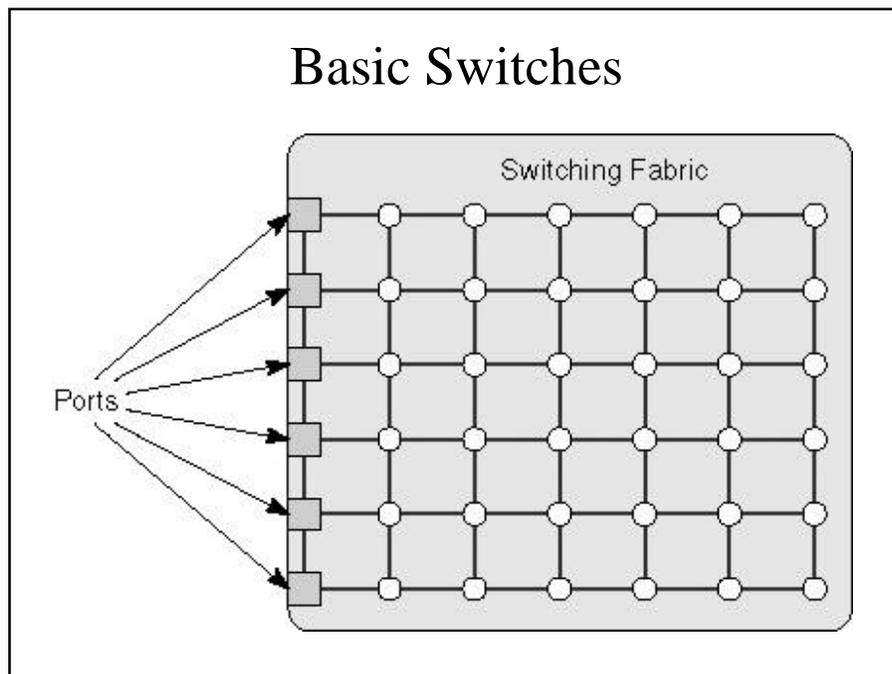
- Multiprotocol bridges - translate between different data link layer protocols.
- Multiprotocol routers - can understand several different network layer protocols.
- Protocol filtering bridges - multiprotocol bridges that forward only packets of a certain type.
- Encapsulating bridges - connect networks with different data link protocols.
- Layer-3 switches (IP switches) - can also switch messages base on their network layer address.



Virtual LAN Design

- Switches also have enabled the creation of Virtual LANs (VLANs). VLANs provide greater opportunities to manage the flow of traffic on the LAN and reduce broadcast traffic between segments.
- VLANs are groups of computers in an intelligent switched network.
- Before getting into VLANs let's revisit switches...

Basic Switches



Intelligent Switches

- Intelligent switches support larger networks than the basic switch's 8- or 16- port LANs.
- As well as being able to support far more computers or network connections, the key advantage is in the modularity of intelligent switches (might add an ATM, Fiber module).
- These switches often can support several hundred ports spread over a dozen or more different modules.

Intelligent Switches

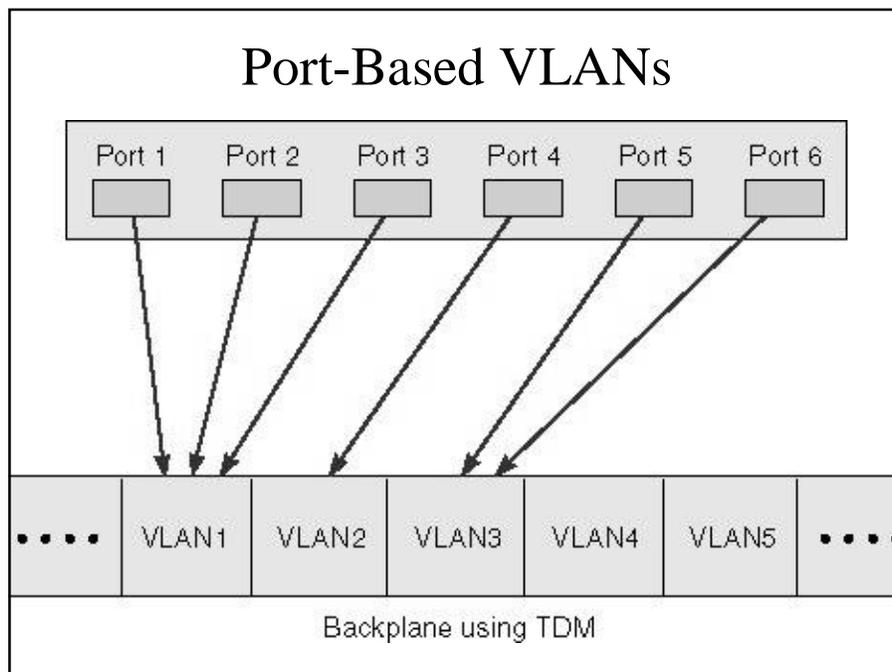
- For most switches there is not enough capacity in the switching fabric / backplane to support all ports if they become active so the switch forms **groups of connections** and assigns capacity using time division multiplexing.
- This means that the switch no longer guarantees simultaneous transmission on all ports, but will accept simultaneous input and will switch incoming data to outgoing ports as fast as possible.
- The groups are called VLANs

VLANs

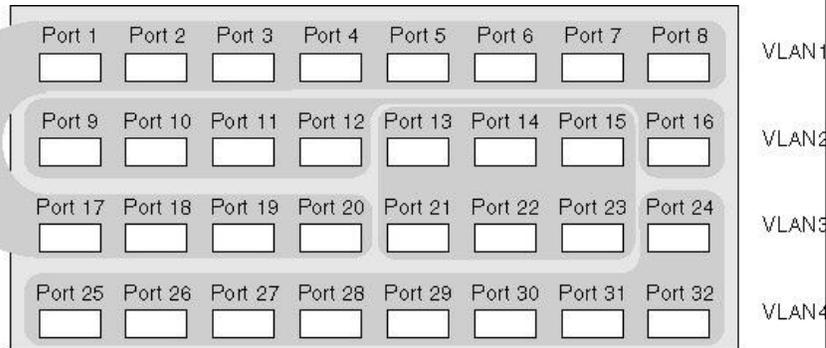
- VLANs can be seen as analogous to a group of end-stations, perhaps on multiple physical LAN segments, that are not constrained by their physical location and can communicate as if they were on a common LAN
- **Big wins**
 - Broadcast traffic is limited to the VLAN
 - Consider a big network across an entire campus on 1 switch, there would be too much broadcast traffic!
 - VLANs can be assigned and managed dynamically without physical limitations
 - VLAN can be used to balance bandwidth allotment per group

Port-Based VLANs (Layer-1 VLANs)

- Port-based VLANs use the physical port address to form the groups for the VLAN.
- It is logical to connect computers that are physically close together on the LAN into ports that are physically close together on the switch, and to assign ports that are physically close together into the same VLAN.
- This is the approach used in traditional LAN design: physical location determines the LAN, but is not always the most effective approach.



VLAN Example



VLANs used to balance capacity against network traffic

MAC-Based VLANs Layer-2 VLANs

- MAC-based VLANs use the same data link layer addresses to form the VLAN groups.
- The advantage is that they are simpler to manage when computers are moved.

IP-Based VLANs

Layer-3 VLANs

- IP-based VLANs use the network layer address (i.e. TCP/IP address) to form the VLAN groups. Layer-3 VLANs reduce the time spent reconfiguring the network when a computer is moved as well.
- Some layer-3 VLANs can also use the network layer protocol to create VLAN groups. This flexibility enables manager even greater precision in the allocation of network capacity.

Application-Based VLANs

Layer-4 VLANs

- Application-based VLANs use the application layer protocol in combination with the data link layer and network layer addresses to form the VLAN groups.
- The advantage is a very precise allocation of network capacity.