LAN SWITCHING

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Motivation

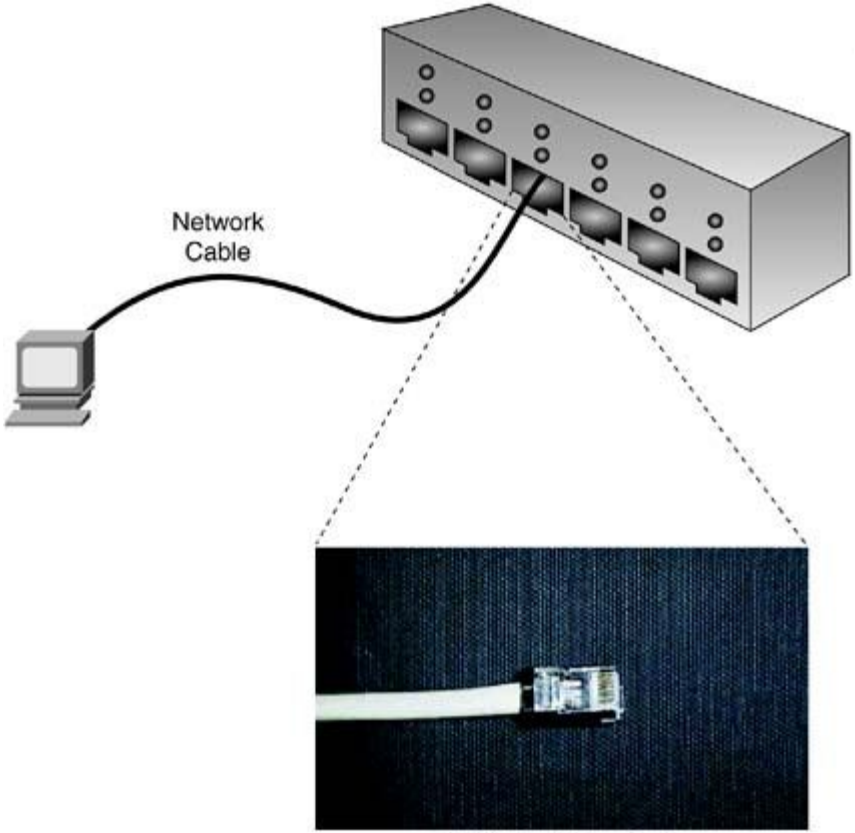
In today's business environment, **businesses need information to survive**. With technology, this has been made possible, the use of new methods of communicating such as the use of voice, video, **data which is transmitted over networks is crucial**.

As such, we **need to design LANs** with these needs in mind.

Physical Switch Platform

switched network is the physical switch itself.

A LAN switch is a device that is made up of many ports connecting LAN segments, such as 100-Mbps Ethernet, and a high-speed port, such as Gigabit Ethernet. The high-speed port, in turn, connects the LAN switch to other devices in the network.



Cable Jack Termination
(Plugs into the NIC and
Switch Ports)

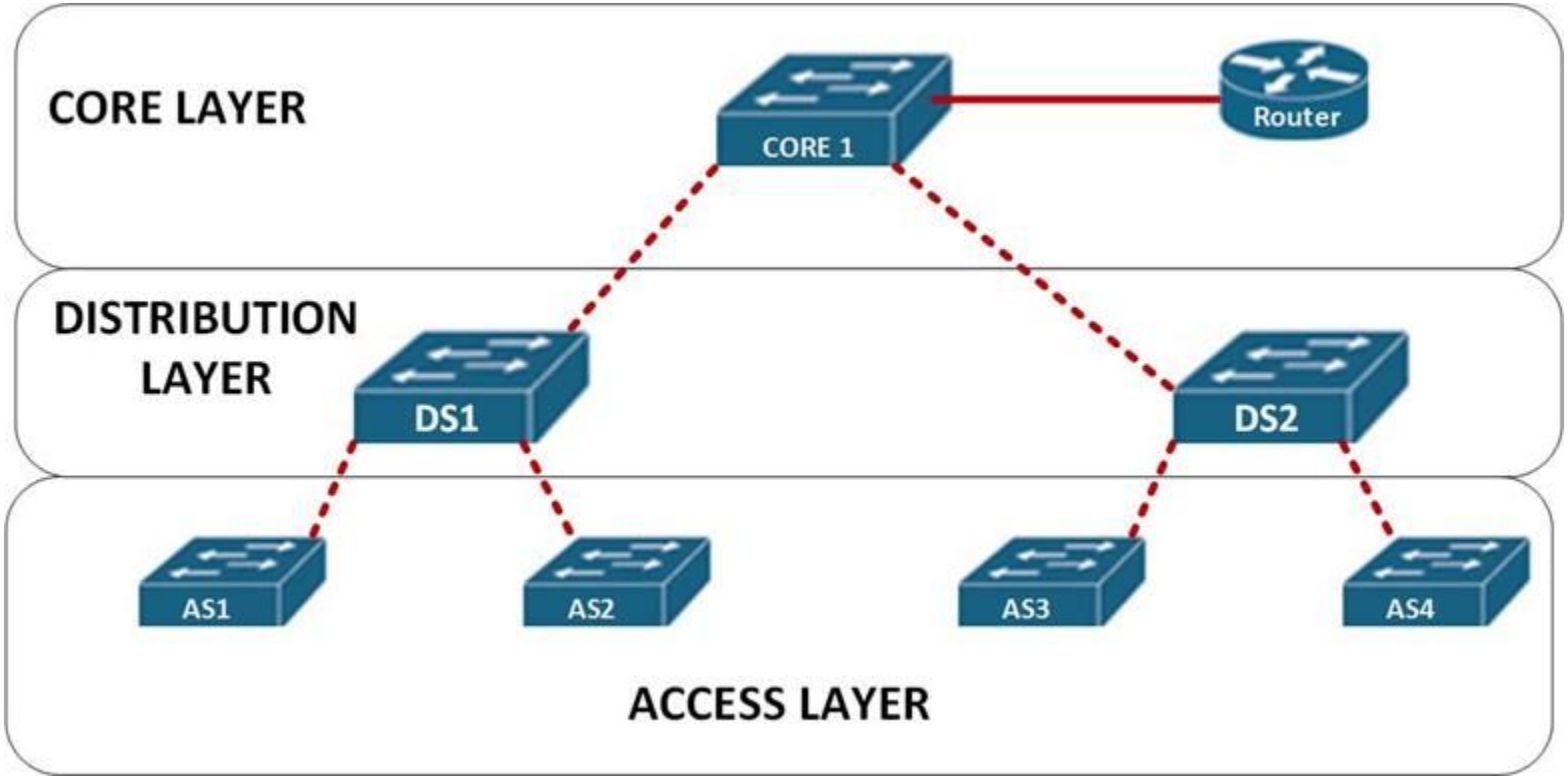
Lan design concept

- Network segmentation and broadcast traffic management – this is mainly through the **use of VLANs**
- Security
- Easy configuration and management of the switches
- Redundancy

Hierarchical layered model in LAN design

The design of a LAN network is critical to communication within the enterprise, when using the hierarchical model as recommended by CISCO, there are three layers that we should implement depending on the size of the organization.

- Core layer
- Distribution layer
- Access layer.



Hierarchical Layer model in LAN design (The figure below shows how the implementation of this hierarchy can be achieved.)

Illustrating each Layers

Access Layer : This is the layer that connects to end user devices such as PCs, printers, IP phones among others.

Distribution layer, is meant to aggregate the data from the access layer. This layer controls the traffic in the lower levels and prioritizes traffic based on organizational policies that have been implemented during configuration of the switches. Typically, this level should be redundant and made up of faster switches than the access layer.

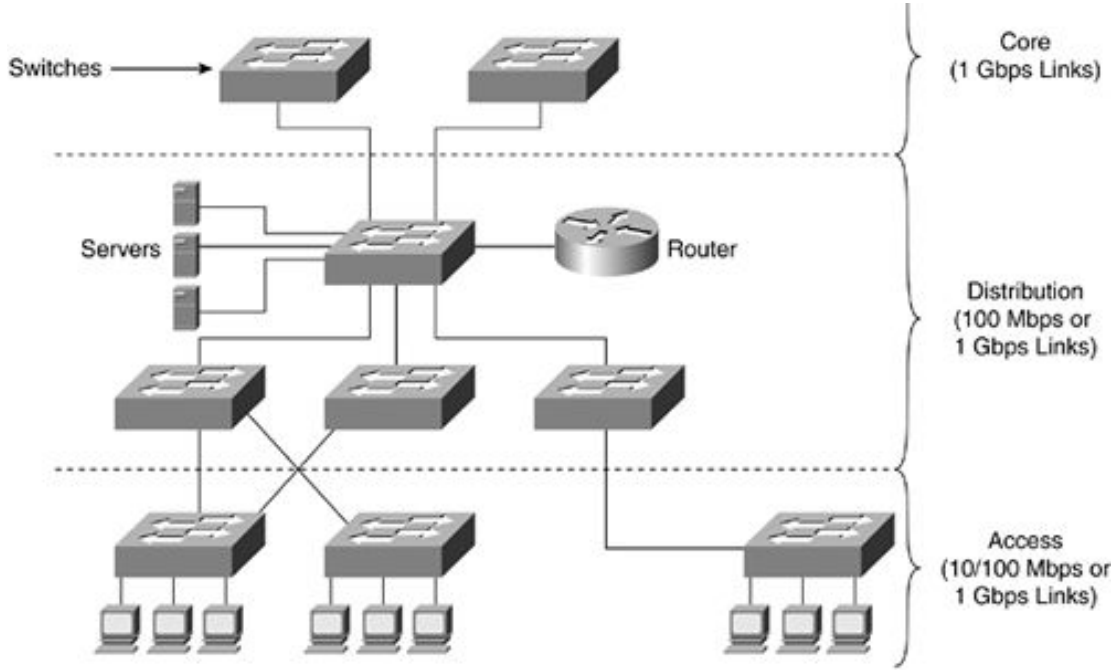
Core layer, is responsible for high-speed switching in the network. Typically, this layer should consist of the fastest switches in the network and offer the highest bandwidth since communication to other networks from the lower levels is forwarded through these switches.

Network designs are evolving with the deployment of switching from the user desktop to the network backbone.

Three topologies have emerged as generic, switched campus network designs.

- Scalable switching
- Large switching/minimal routing
- Distributed routing/switching

NOTE : When VLANs are used, end users in one VLAN cannot communicate with end users in another VLAN unless routers are deployed within the network to enable this inter-VLAN communication.



Scalable switching

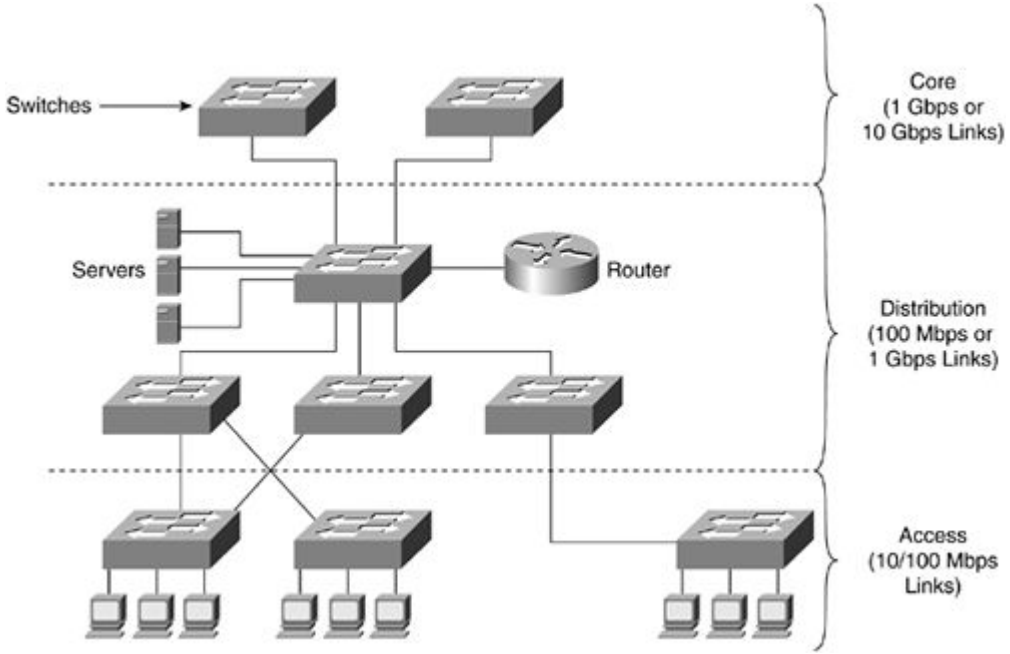
Scalable switch

A scalable switch network design is a **low-cost** and **easy-to-install** solution for a **small campus network**. This design does not require knowledge of network address structure, is easy to manage, and enables all users to communicate with one another.

However, you do need to remember that a scalable switch network makes up a **single broadcast domain, which can lead to network congestion if the amount of broadcasts increases**, such as with additional users being added to the network. If a scaled switched network needs to grow beyond the broadcast domain, then VLANs should be used to create multiple smaller broadcast domains.

Large Switched/Minimal Routing

The large switched/minimal routing design deploys switching at the access, distribution, and core layers of the network,



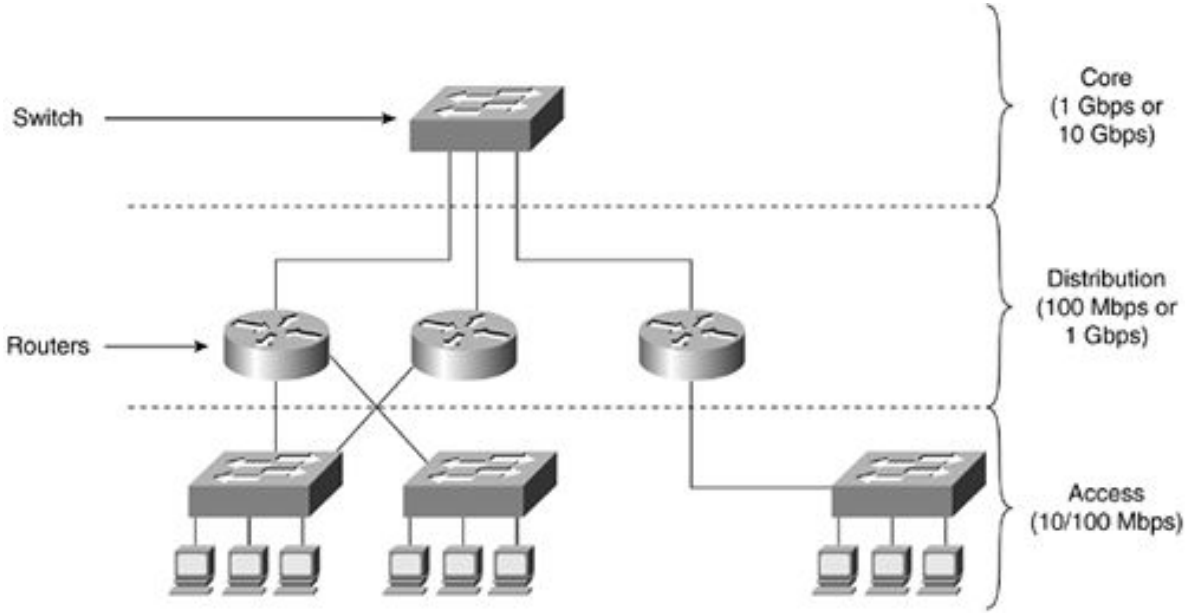
In the case of LAN switching in the distribution layer, the following issues need to be considered when designing your network:

- Support for VLAN trunking technology in each enterprise-class LAN switch you use in the network. (Remember, some low-end switches do not support VLAN trunking.)

- The switches in the distribution layer must run the Spanning Tree Protocol (STP) to prevent network loops. Running STP means that some connections will be blocked and load sharing will not be available for you to use in your network. However, you can load balance by having some VLANs block on one port and other VLANs block on the other port when using trunking.

Distributed Routing/Switching

The distributed routing/switching design uses switching in the access layer, routing in the distribution layer, and high-speed switching in the core layer



The distributed routing/switching design follows the classic hierarchical network model in both physical and logical fashions.

Because this design provides high bandwidth for access to routing functionality, the distributed routing and switching design scales very well.

Benefits of a hierarchical model

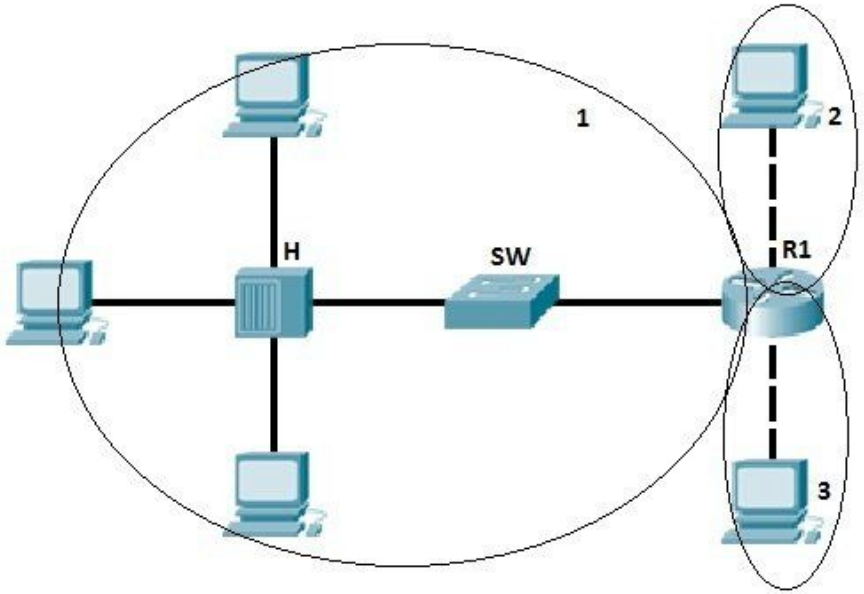
- **Scalability** – when you implement a network a hierarchical network model, expansion is simplified since all the roles are well defined. For example, if you have 5 access layer switches, connected to 2 distribution layer switches, you can add the access layer switches until all the ports on the distribution switches are filled up.
- **Redundancy** – this is achieved when the switches in each layer are connected to two or more devices at another level. If one device at the higher level in the hierarchy fails, the lower level switch automatically fails over to the other switch. Redundancy is achieved at the distribution and core layers.

Cont.

- **Performance** – it is recommended that core layer switches should have very fast switching abilities. The distribution switches should also be very fast and redundant. The result of using very fast core and distribution layer switches would guarantee very fast networks.
- **Security** – the security of the network is enhanced since at each layer of the model, there are several security measures that can be put in place; for example switch ports at the access layer can be configured with port security, segmentation of the distribution layer using VLANs is also another security feature.
- **Manageability** is the ability to make configuration changes in the network, the use of the hierarchical model eases management of the switches. For example, making changes on one layer would be simplified since we can assume that the role of switches in that layer all perform similar functions, further, the modular design means that management does not mean that the network is down due to maintenance due to redundancy.

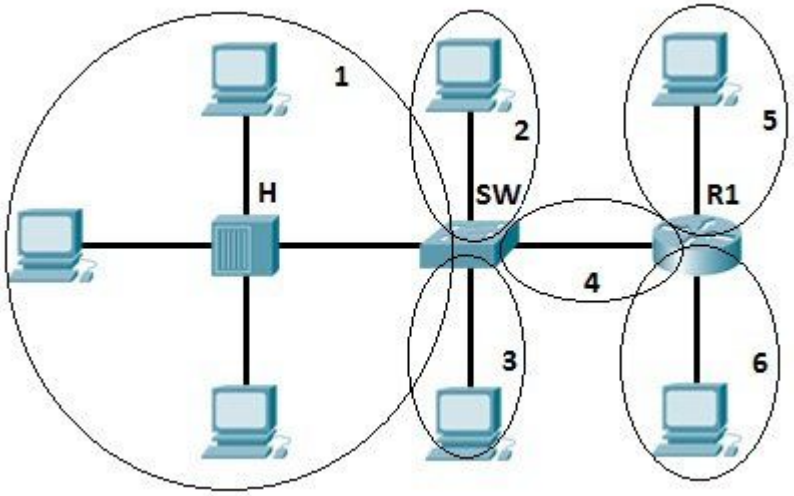
Broadcast domain

A broadcast domain is the **domain in which a broadcast is forwarded**. A broadcast domain contains all devices that can reach each other at the data link layer (OSI layer 2) by using broadcast. All ports on a hub or a switch are by default in the same broadcast domain. All ports on a router are in the different broadcast domains and routers don’t forward broadcasts from one broadcast domain to another.



Collision domain :

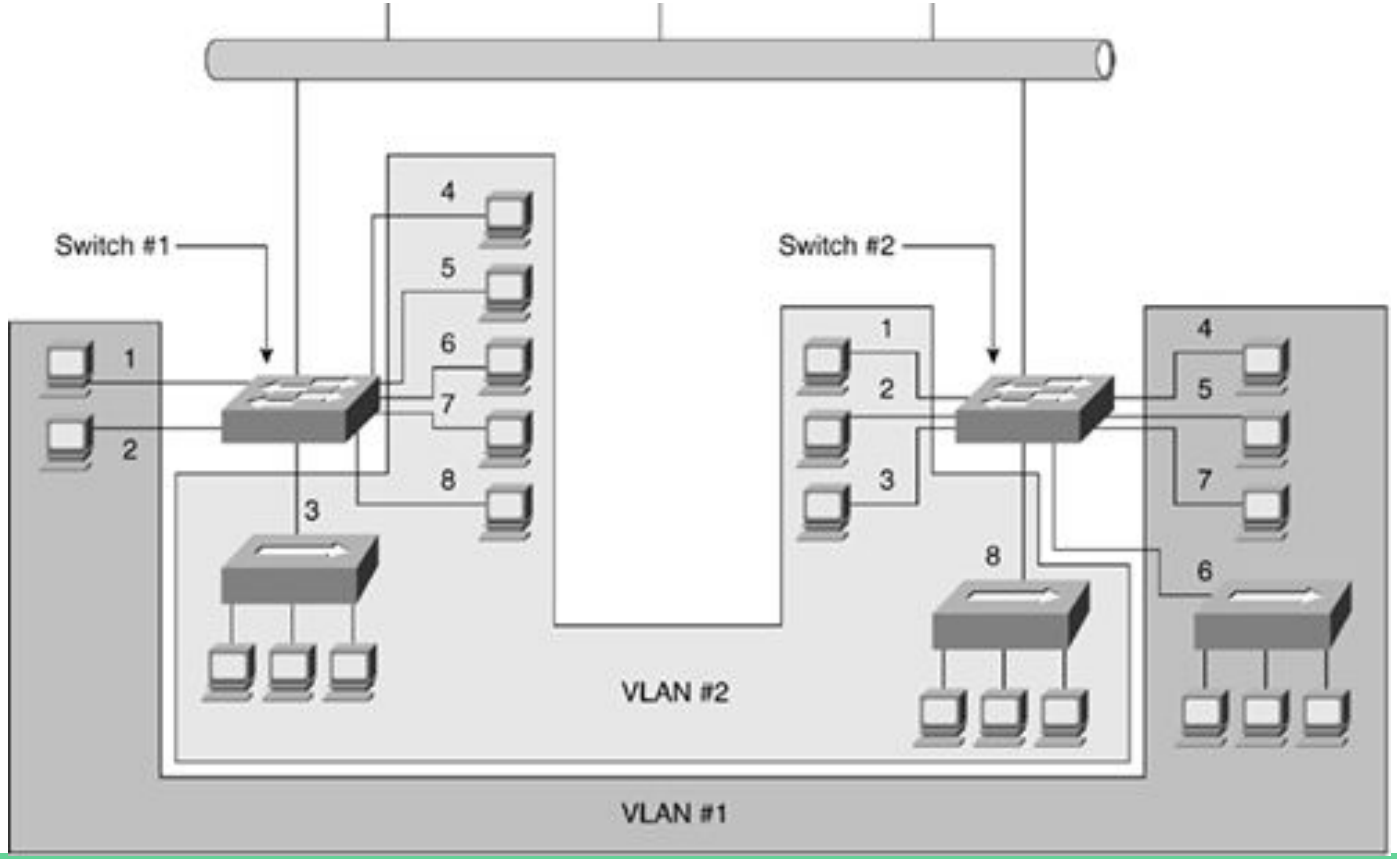
A collision domain is, as the name implies, **the part of a network where packet collisions can occur.** A collision occurs when two devices send a packet at the same time on the shared network segment. The packets collide and both devices must send the packets again, which reduces network efficiency. Collisions are often in a hub environment, because each port on a hub is in the same collision domain. By contrast, each port on a bridge, a switch or a router is in a separate collision domain.



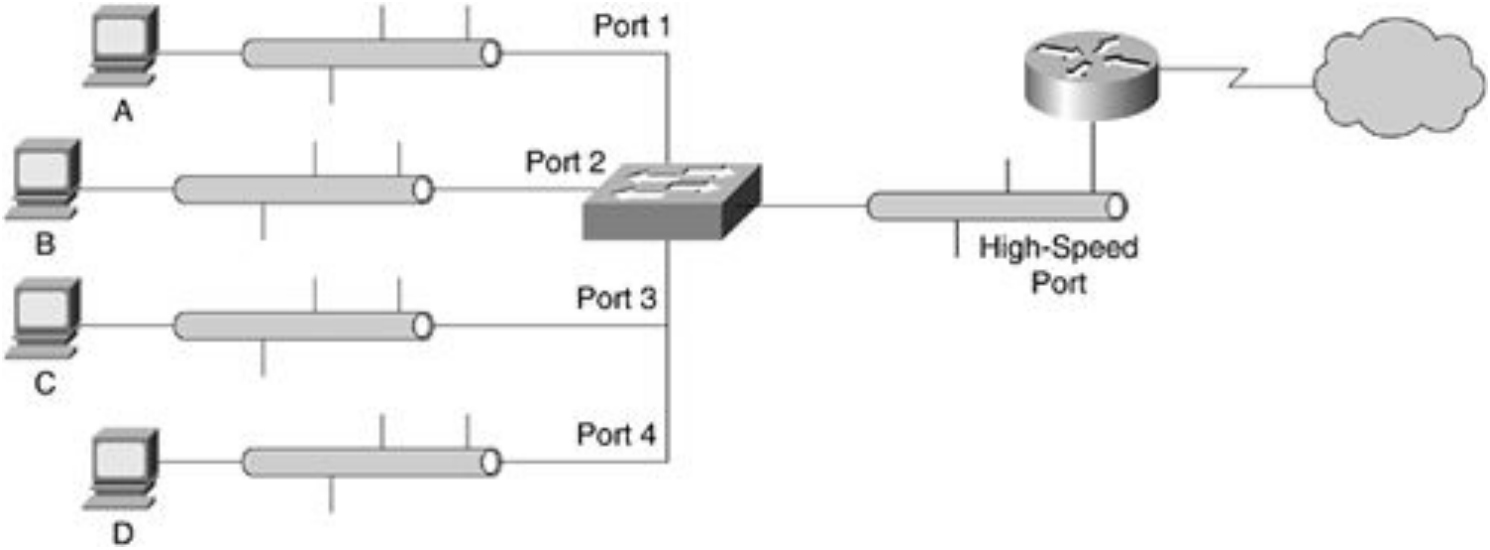
Few additional examples of LAN designs ...

VLAN Infrastructure

Without a router, hosts in one VLAN cannot communicate with hosts in another VLAN.

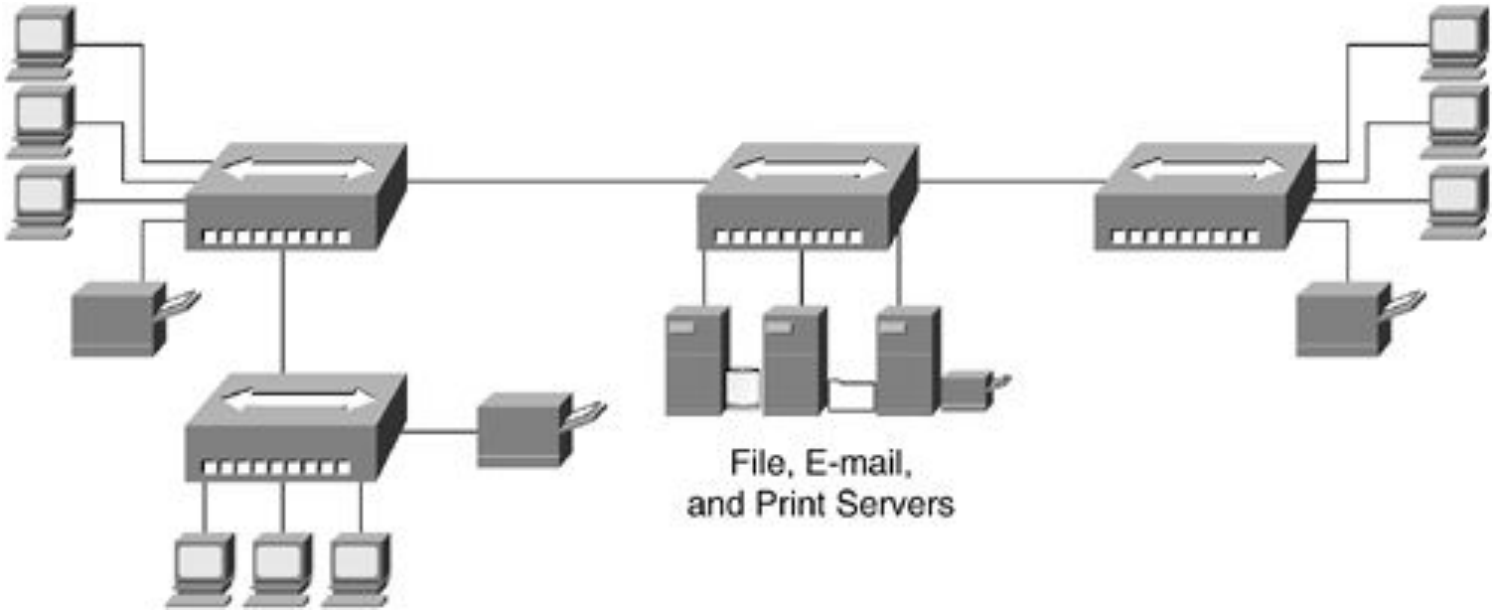


A LAN switch has dedicated bandwidth per port, and each port represents a different segment. For best performance, network designers often assign just one host to a port, giving that host dedicated bandwidth of 100 Mbps.

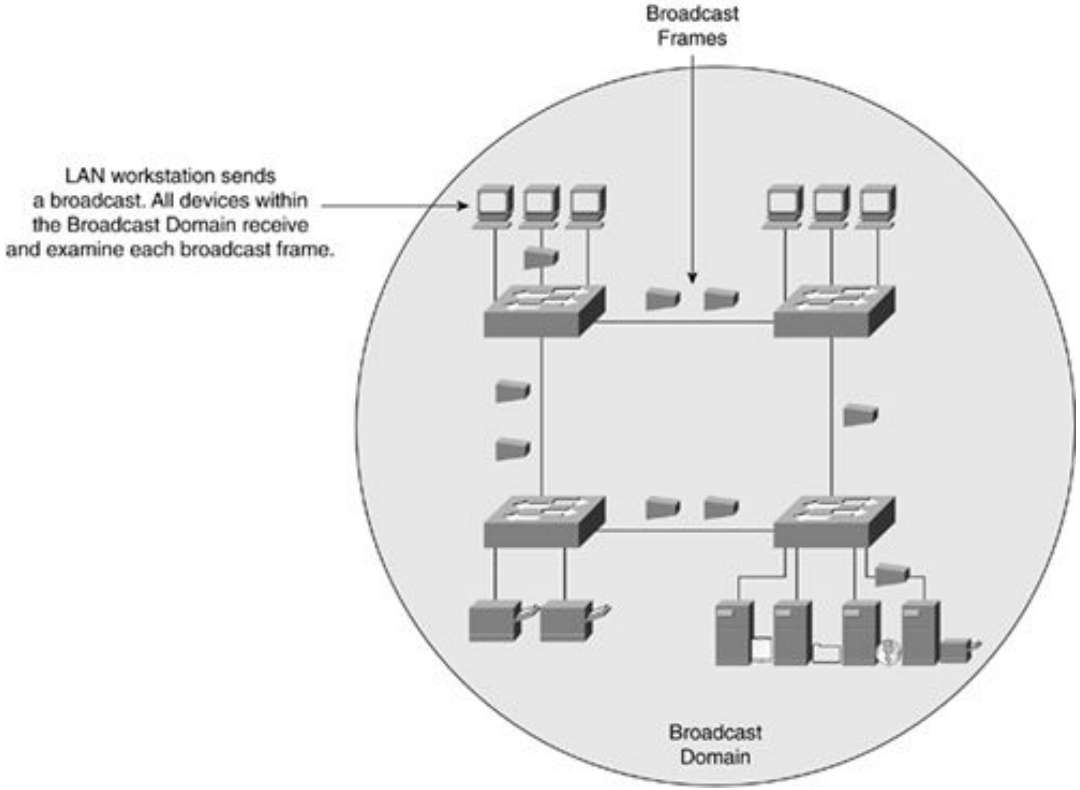


Flat Network Topology

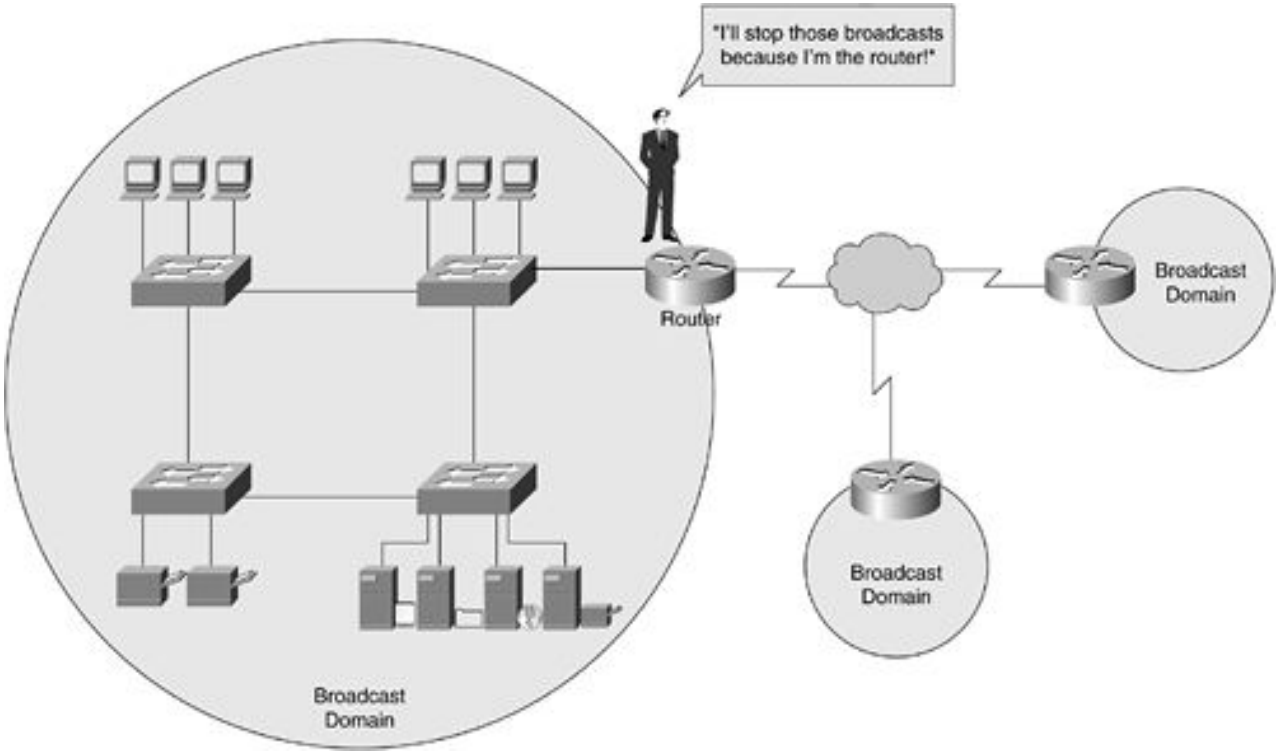
The typical architecture for a small LAN is workstations, printers, and servers attached to one or more hubs or to a small switch in a flat topology



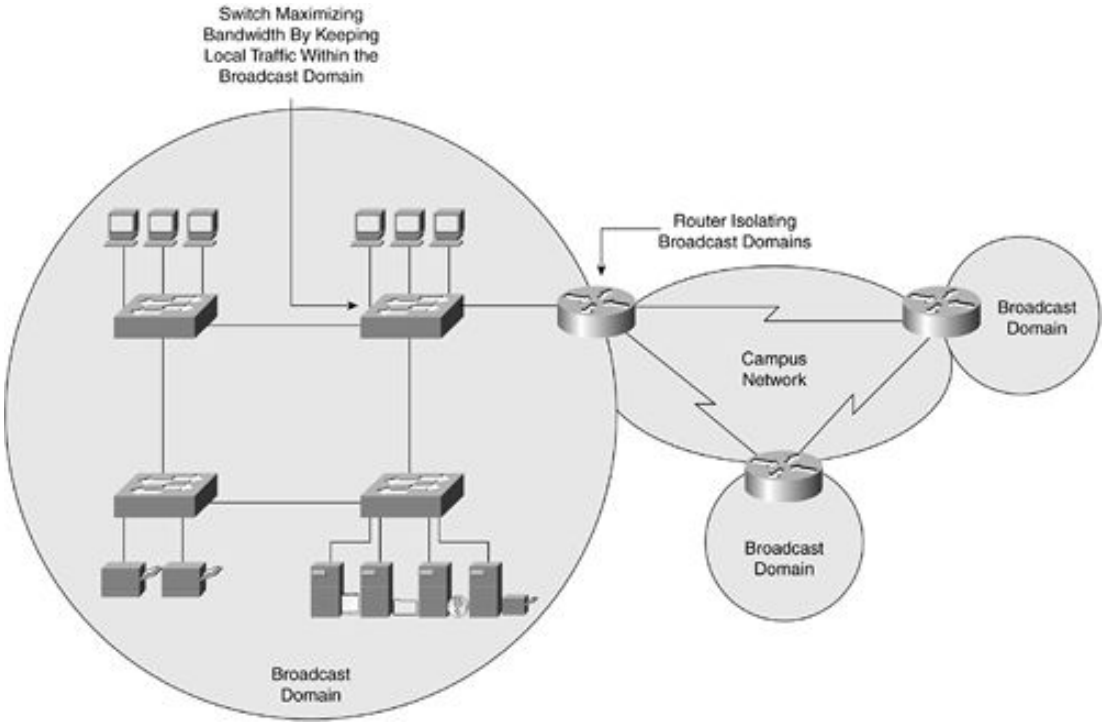
Flat Network in a Single Broadcast Domain



Routers Separate Broadcast Domains



Hierarchical Design with Campus-Area Network Core



PORTS

Ports:

1. 10/100 Ports : These use RJ-45 Connectors and twisted-pair cabling and they can be connected to 10BASE-T-compatible devices, such as workstations and hubs, or 100BASE-TX-compatible devices, such as high-speed workstations, servers, hubs, routers, and other switches. The 10/100 ports can be explicitly set to operate in any combination of half duplex, full duplex, 10Mbps, or 100Mbps.

2. 100BASE-FX Ports : The 100BASE-FX Ports use 50/125- or 62.5/125-micron multimode fiber-optic cabling. These ports only operate at 100Mbps in full-duplex mode.

You can connect a 100BASE-FX port to an SC or ST port on a target device by using one of the MT-RJ fiber-optic patch cables

3. 10/100/1000 Ports : The 10/100/1000 ports on Catalyst 2950T-24 switches use RJ-45 connectors and twisted-pair cabling. The ports can connect to10BASE-T-compatible devices, such as workstations and hubs or 100BASE-TX-compatible devices, such as high-speed workstations, servers, hubs, routers, and other switches or 1000BASE-T-compatible devices, such as high-speed workstations, servers, hubs, routers, and other switches.

Difference between Circuit Switching and Packet Switching

CIRCUIT SWITCHING	PACKET SWITCHING
In circuit switching there are 3 phases: i) Connection Establishment. ii) Data Transfer. iii) Connection Released.	In Packet switching directly data transfer takes place .
In circuit switching, each data unit know the entire path address which is provided by the source.	In Packet switching, each data unit just know the final destination address intermediate path is decided by the routers.
In Circuit switching, data is processed at source system only	In Packet switching, data is processed at all intermediate node including source system.
Delay between data units in circuit switching is uniform.	Delay between data units in packet switching is not uniform.

switching is uniform.	packet switching is not uniform.
Resource reservation is the feature of circuit switching because path is fixed for data transmission.	There is no resource reservation because bandwidth is shared among users.
Circuit switching is more reliable.	Packet switching is less reliable.
Wastage of resources are more in Circuit Switching	Less wastage of resources as compared to Circuit Switching
It is not a store and forward technique.	It is a store and forward technique.
Transmission of the data is done by the source.	Transmission of the data is done not only by the source, but also by the intermediate routers.
Congestion can occur during connection establishment time, there might be a case will requesting for channel the channel is already occupied.	Congestion can occur during data transfer phase, large number of packets comes in no time.