

ECCS-3631

Networks and Data Communications

Module 1

Internetwork Design

Dr. Ajmal Khan

Introduction

- Syllabus
- Introduction to Canvas,
- Canvas: Activate/Enable Announcement under Accounts → Notifications
- Ensure you are able to access the course Canvas page; if not, contact the Educational Technology department.
- Homework 1 due Tuesday, August 27
- No Lab in the first week. First Lab will be September 5.

What is a Network?

- A group or system of interconnected things.

What is a Computer Network?

➤ A computer network can be described as a system of interconnected devices that can communicate using some common standard (called protocol). These devices communicate to exchange resources (e.g. files and printers) and services.



➤ Here is an example network consisting of two computers connected together:

➤ In this example, the two computers are directly connected using a cable. This small network can be used to exchange data between just these two computers.

What is the Internet?

- The Internet is a computer network that interconnects hundreds of millions of computing devices throughout the world.

Some Pieces of the Internet

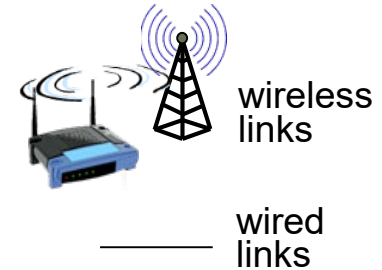
➤ Hosts or End Systems:

These are computing devices; includes desktop PC, laptop, tablet, smartphone, TVs, gaming consoles, web cams, automobiles, environmental sensing devices, picture frames, and home electrical and security systems. Any client computer or server machine is also a host. Network devices including routers and switches are also hosts/end systems.



Some Pieces of the Internet

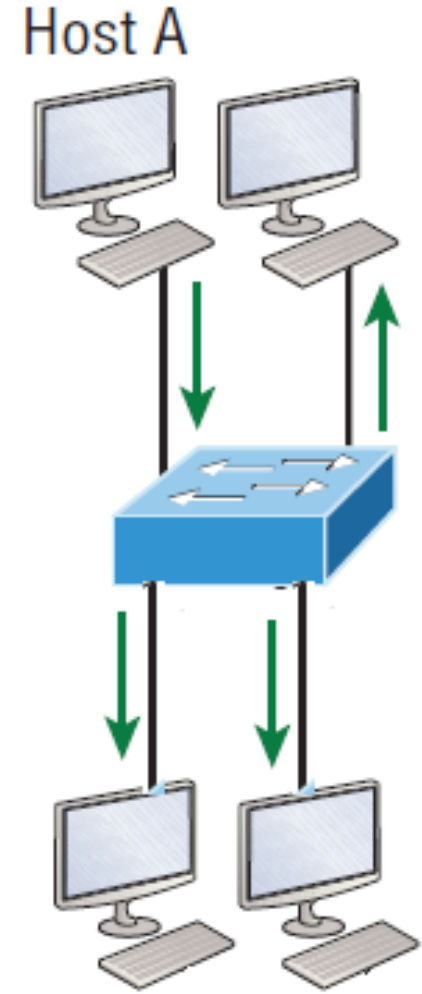
➤ **End systems** are connected together by a network of communication links and switches. Different links can transmit data at different rates, with the transmission rate of a link measured in bits/second.



➤ When one end system has data to send to another end system, the sending end system segments the data and adds header bytes to each segment. The resulting packages of information, known as Packets and are then sent through the network to the destination end system, where they are reassembled into the original data.

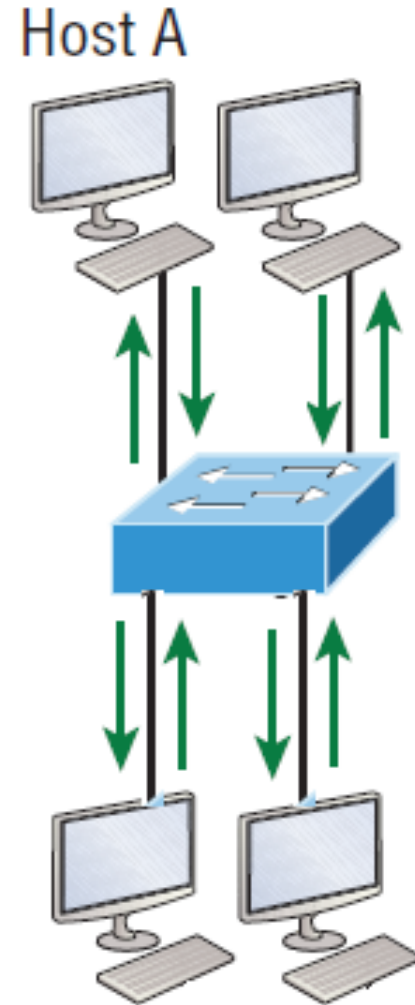
Broadcast Domain

- A broadcast domain is a domain in which a broadcast is forwarded.
- A broadcast domain contains all devices that can reach each other at the data link layer by using broadcast.



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.

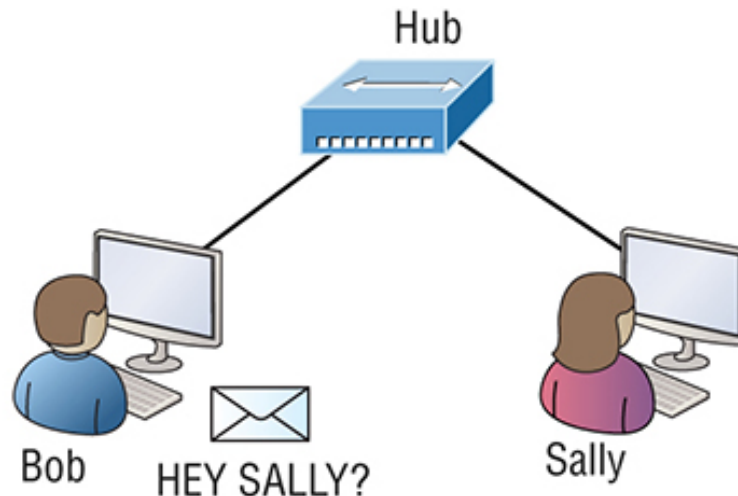


Network Components

➤ Hub

Hub connects two or more end systems together. Such network is called as Local Area Network. Hub is typically used in Small Office Home Office (SOHO) network.

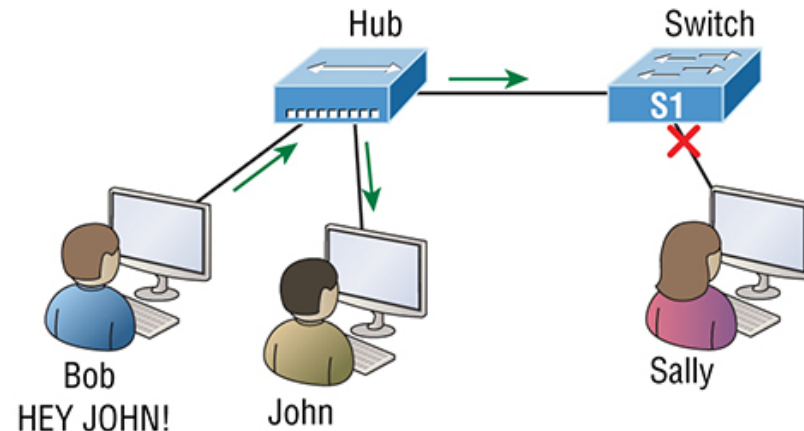
Keep in mind that a simple SOHO network like this is a *one collision domain* and *one broadcast domain*.



Network Components

➤ Switch:

- A switch takes a packet arriving on one of its incoming communication links and forwards that packet on one of its outgoing communication links.
- A Switch breaks up collision domains.
- This network is still just one, *single broadcast domain*., however, each link (port) is *a collision domain*.

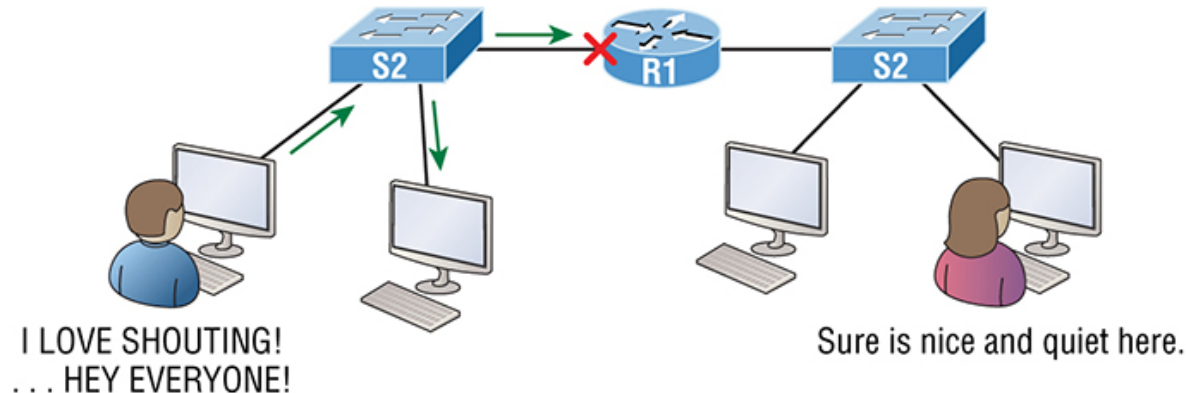


- The result is that John received the data from Bob but, happily, Sally did not, which is good because Bob intended to talk with John directly. If he had needed to send a broadcast instead, everyone, including Sally, would have received it, causing unnecessary congestion.

Network Components

➤ Router

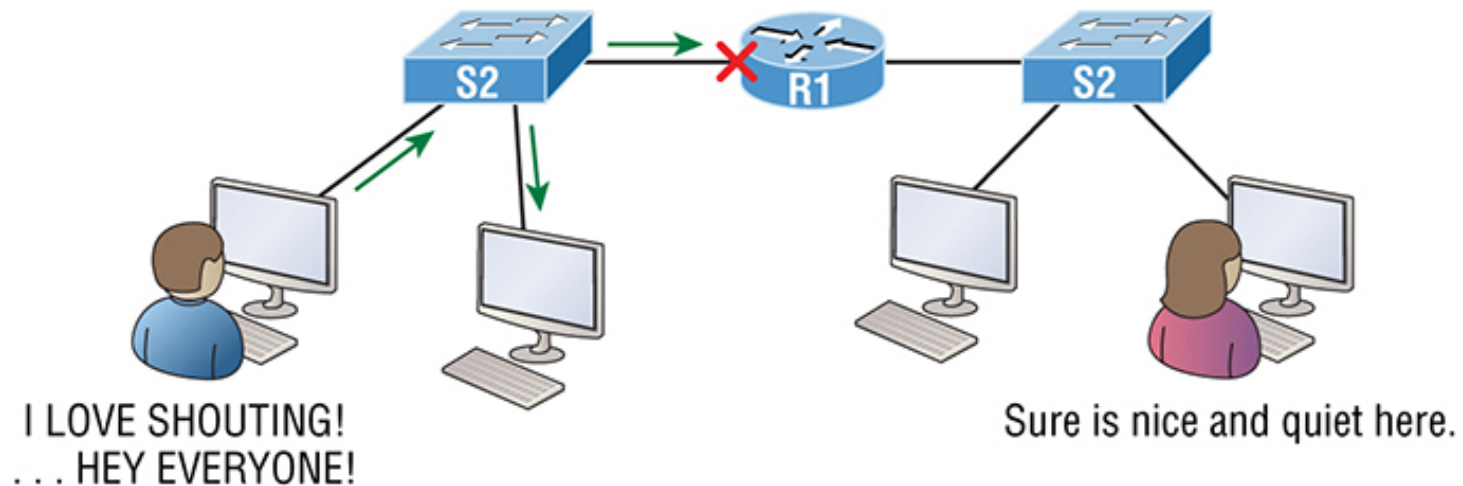
- Common causes of LAN traffic congestion:
 - Broadcast storms
 - Too much multicast traffic
 - Low bandwidth
 - Adding hubs for connectivity to the network
 - A bunch of ARP broadcasts
- Routers do not forward broadcasts by default, i.e. break up the broadcast domain
- Routers filter the network based on layer 3 information such as IP address
- Router finds the best routing path or route to forward a packet to the destination network.



Network Components

➤ Router

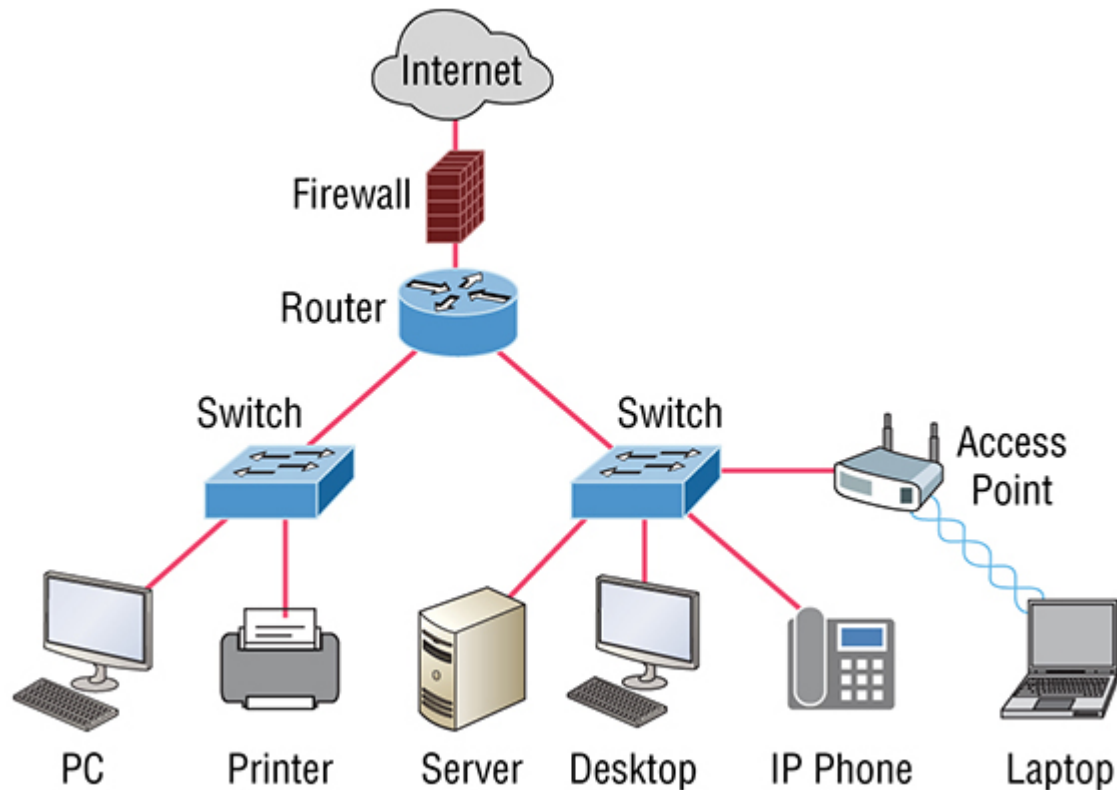
In this Figure, each host is connected to its own collision domain because of the switch, and the router has created two broadcast domains. So now Sally is happily living in peace in a completely different neighborhood, no longer subjected to Bob's incessant shouting! If Bob wants to talk with Sally, he has to send a packet with a destination address using her IP address—he cannot broadcast for her!



Network Components

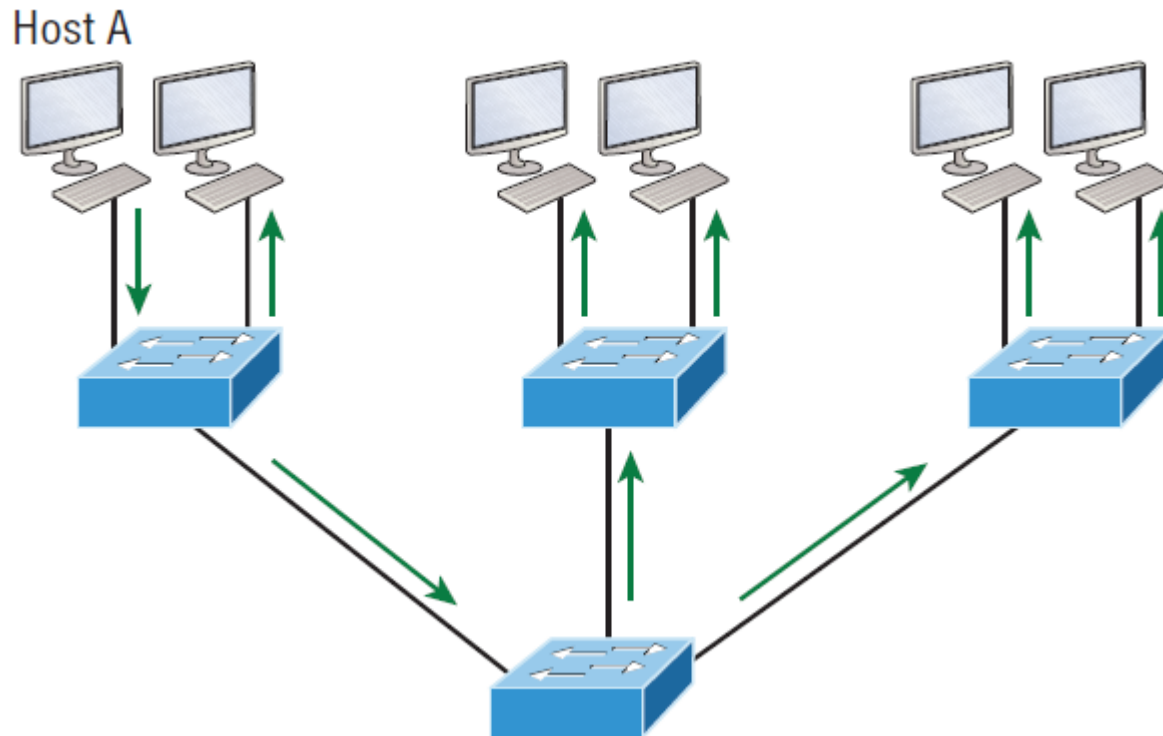
➤ Firewall

- Block unwanted or malicious connections to the computer
- Placed between the computer and the network or the entrance of the LAN
- Can be hardware or software



Practice Questions

- How many Broadcast domains are in this network?
- How many Collision domains are in this network?



Practice Questions

Question 1

How many collision domains are created when you segment a network with a 12-port switch?

- A. 1
- B. 2
- C. 5
- D. 12

Network Topology Architecture

- Large networks are extremely complicated.
- Design the network in a hierarchical manner
- Hierarchy helps in simplifying the complexity of the network; such as protocols, broadcast traffic, routing, redundancy, etc.

Wide Area Network (WAN)

➤ A major distinction between a WAN and a LAN is that while you generally own a LAN infrastructure, you usually lease a WAN infrastructure from a service provider.

Major characteristics of WANs:

➤ WANs generally connect devices that are separated by a broader geographic area than a LAN can serve.

➤ WANs use the services of carriers like telcos, cable companies, satellite systems, and network providers.

➤ WANs use serial connections of various types to provide access to bandwidth over large geographic areas.

Internetwork

