

Introduction to Computer Networks

Week 1

Module : Computer Networks

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Networks: Live, Work, Play

- Networks are no longer only used to connect computers.
- Networks are a vital part of our every day lives.
- Networks are involved in the way we live, work and play.



Networking Today

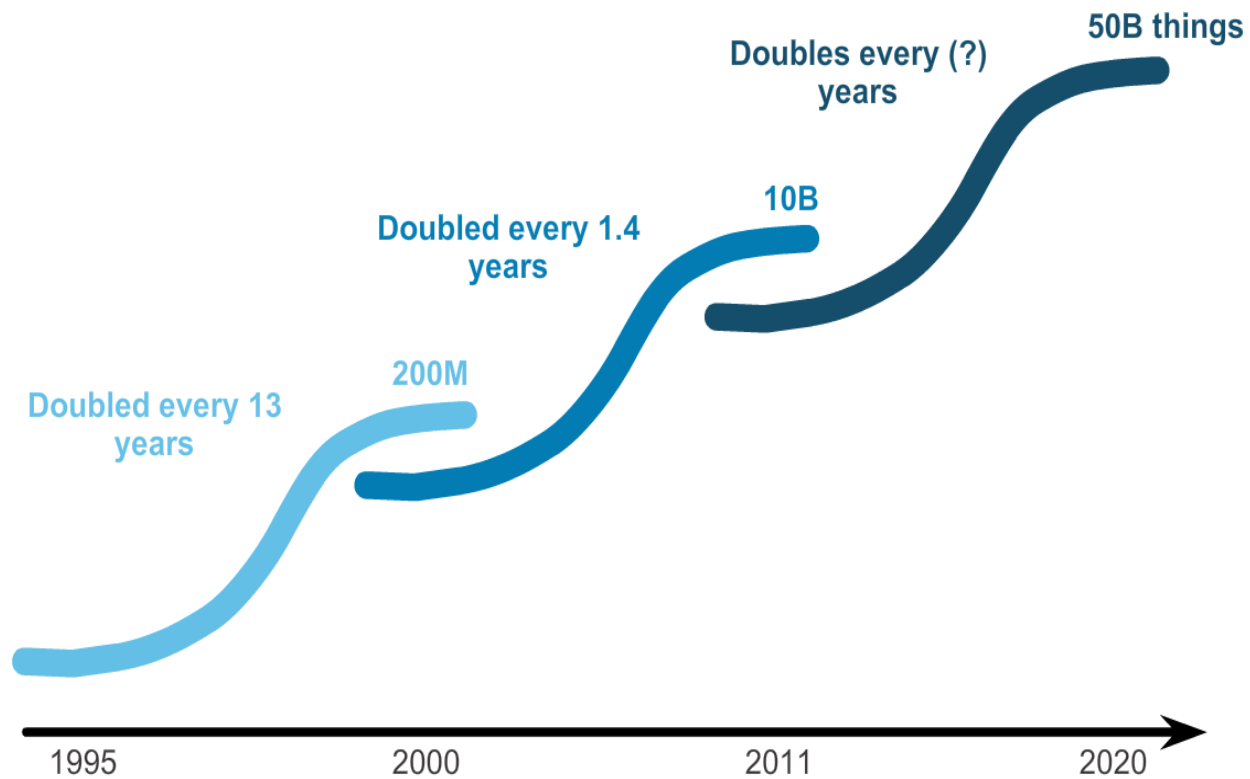
Networks in Our Past and Daily Lives

"Fixed" Computing
(You go to the device)

Mobility/BYOD
(The device goes with you)

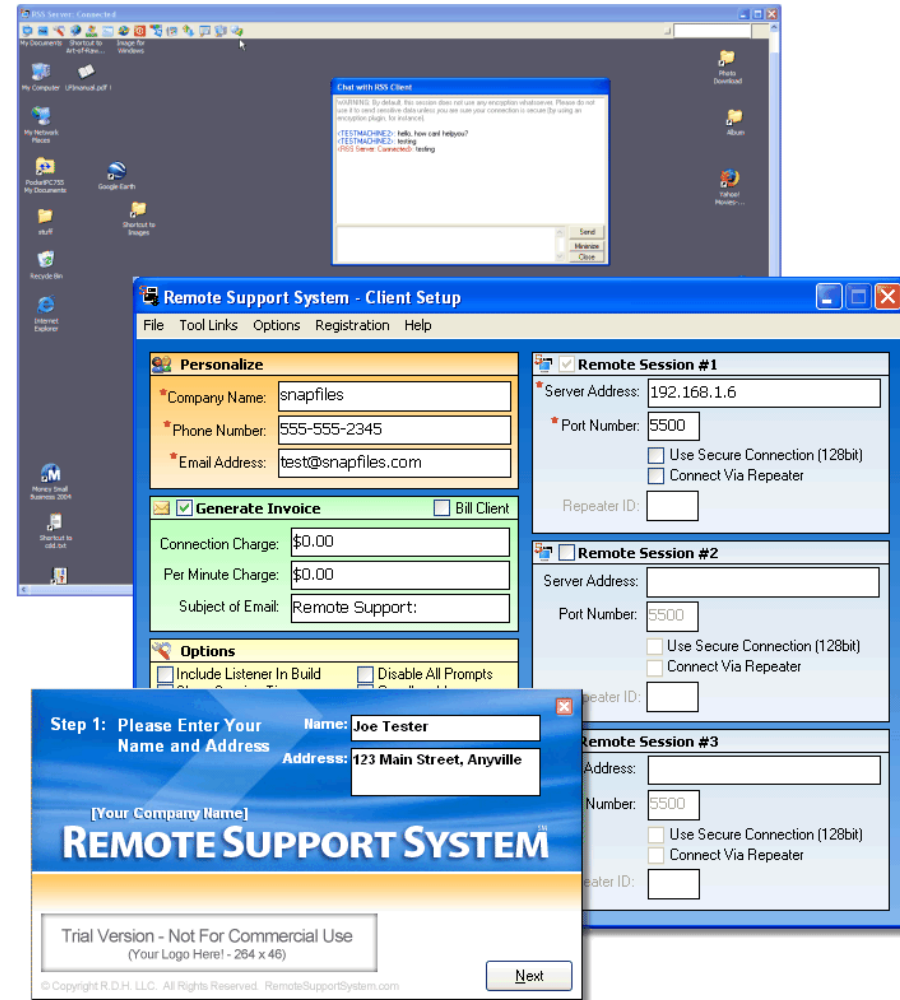
Internet of Things
(Age of Devices)

Internet of Everything
(People, Process, Data, Things)



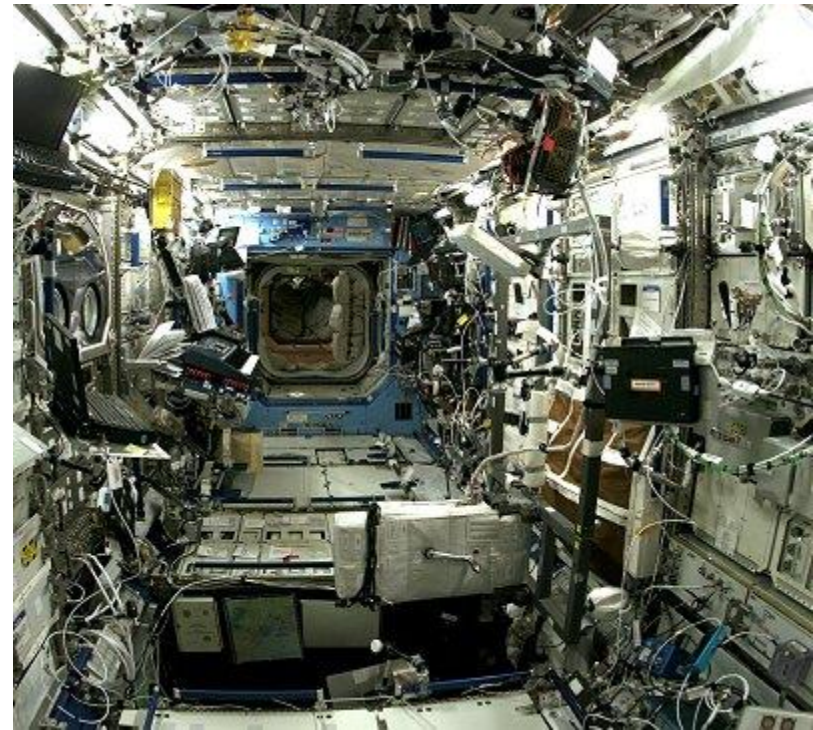
Example: Allowing Remote Access Support

- Remote Access Support
 - Increases availability and productivity.
 - Competitors are using it.
- IT issues may be:
 - Access
 - Security
 - QoS
- It's not a user problem, but an IT problem.
- Networking is a dynamic area where the needs and expectations of the organization change as quickly as the technology.



Networks – Behind the scenes

- More than just connecting cables... (that's the easy part)
- Today's networks are complex and sophisticated combination of protocols, software, hardware, algorithms, configurations, policies, ...
- Security
- Privacy
- 24 x 7 availability and access
- Quality of Service
- Video on Demand
- Voice over IP (over the Internet)
- Redundancy and backup
- Mission critical applications
- Productivity and user expectations
- Wireless



Inside the International Space Station

- Networks Impact Daily Life through popular communication media such as, IM, Wikis , Blogs, Podcasting, and Collaboration Tools

–Instant messaging

- Real time communication between 2 or more people based on typed text

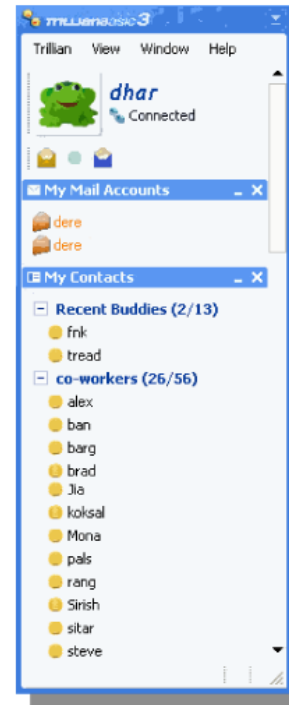
– Blogs

- Web pages created by an individual

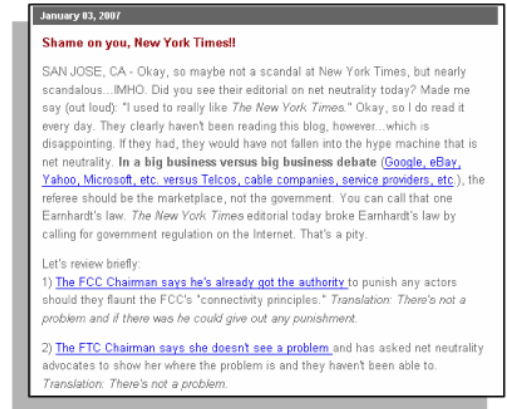
–Podcasting

- Website that contains audio files available for downloading

Instant Messaging



Weblog



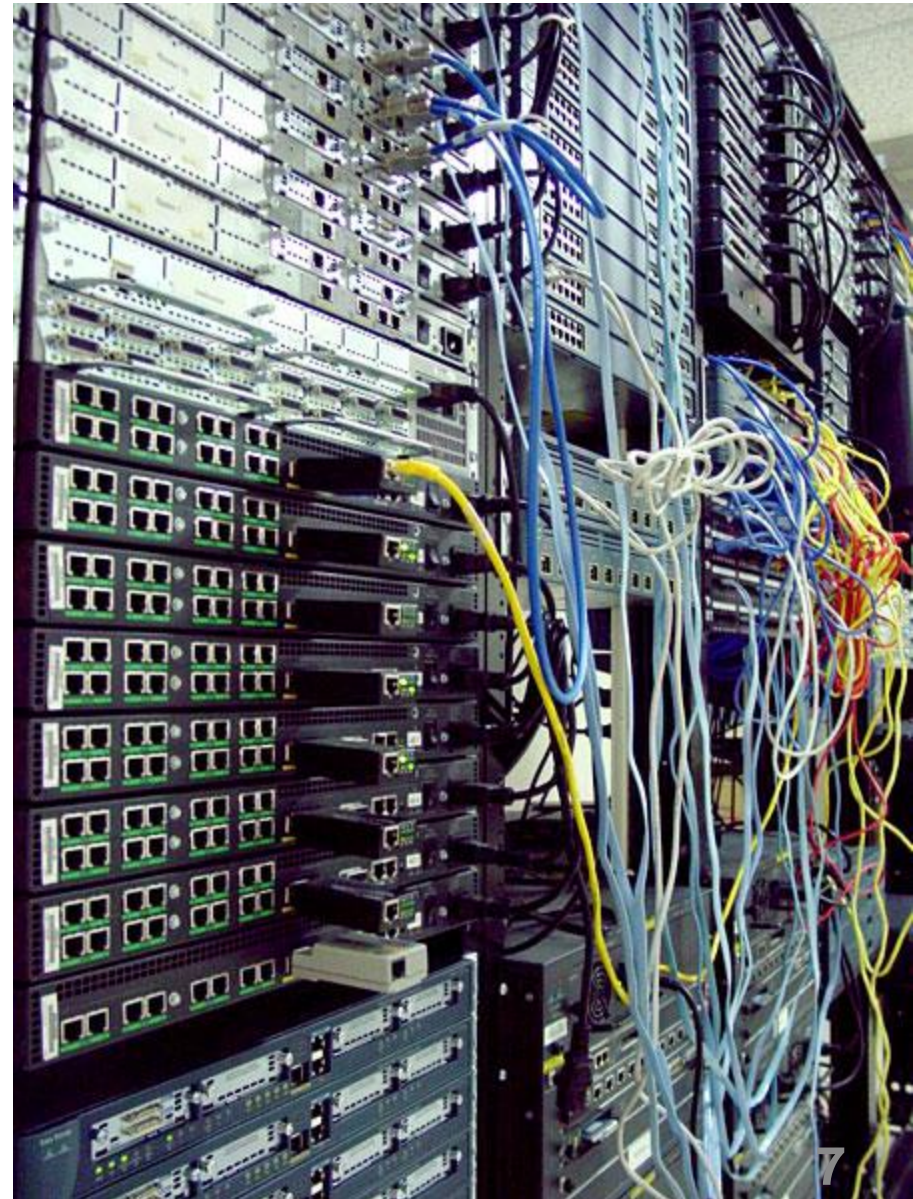
Podcasting



What is Networking?

Networking - the interconnection of workstations, peripherals, terminals and other devices.

Whatis.com: “In information technology, networking is the construction, design, and use of network, including the physical (cabling, bridge, switch, router, and so forth), the selection and use of telecommunication protocol and computer software for using and managing the network, and the establishment of operation policies and procedures related to the network.”



Elements that make up a network

–Devices

- These are used to communicate with one another

–Medium

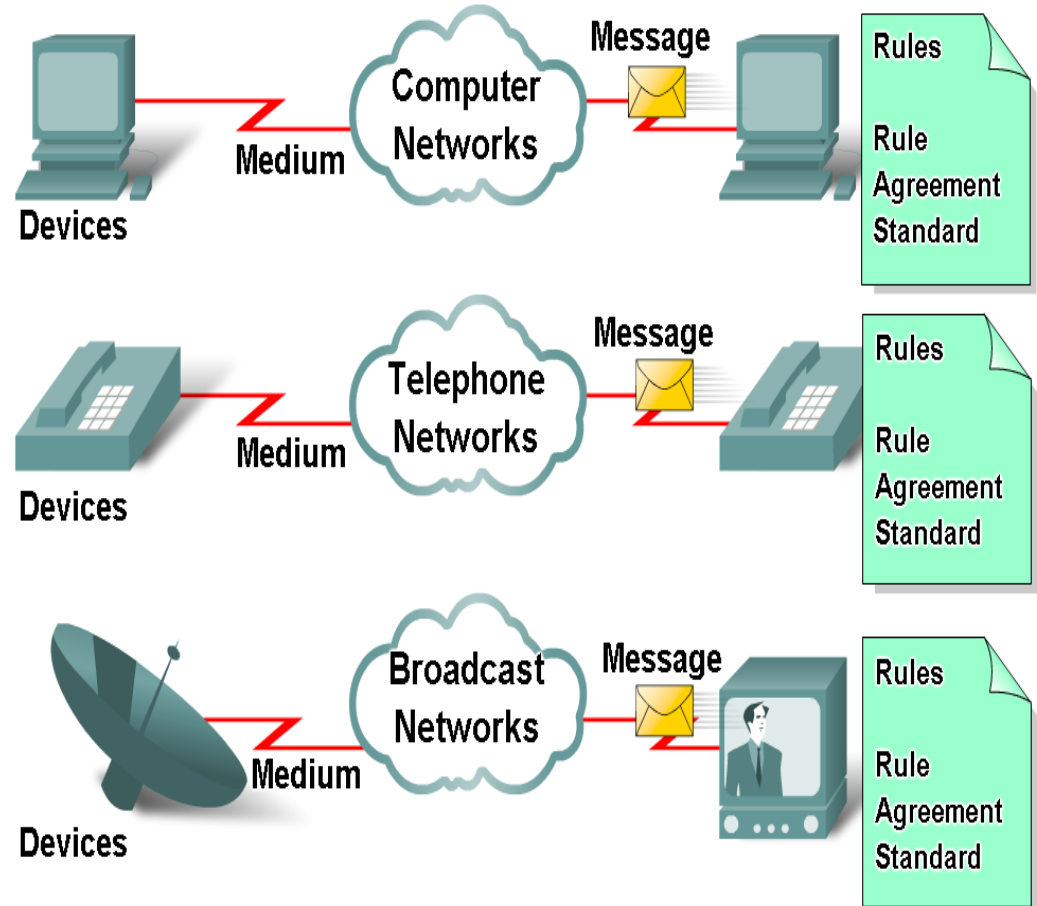
- This is how the devices are connected together

–Messages

- Information that travels over the medium

–Rules

- Governs how messages flow across network



End Devices

Some examples of end devices are:

- Computers (work stations, laptops, file servers, web servers)
- Network printers
- VoIP phones
- TelePresence endpoint
- Security cameras
- Mobile handheld devices (such as smartphones, tablets, PDAs, and wireless debit / credit card readers and barcode scanners)

Network Infrastructure Devices

Examples of intermediary network devices are:

- Network Access Devices (switches, and wireless access points)
- Internetworking Devices (routers)
- Security Devices (firewalls)

Network Media

Copper



Fiber Optic



Wireless



Network Representations

End Devices



Desktop Computer



Laptop



Printer



IP Phone



Wireless Tablet



TelePresence Endpoint

Intermediary Devices



Wireless Router



LAN Switch



Router



Multilayer Switch



Firewall Appliance

Network Media



Wireless Media



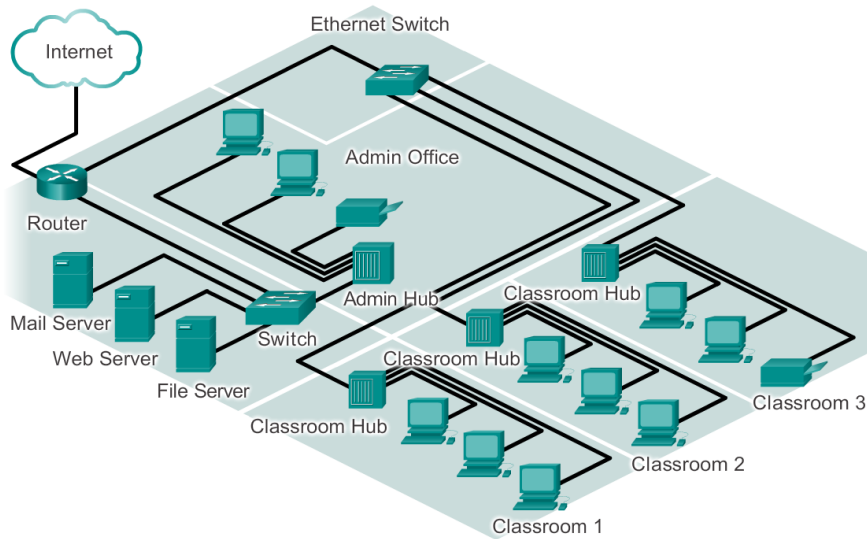
LAN Media



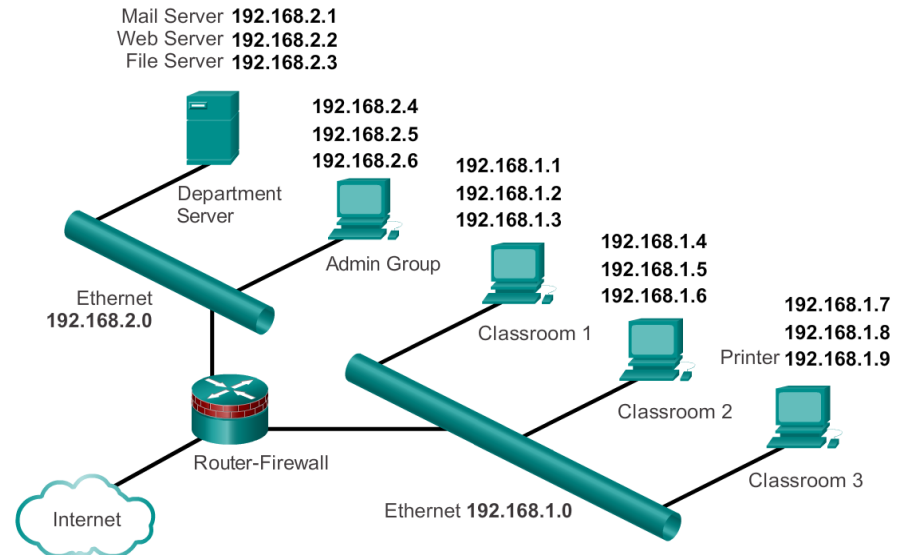
WAN Media

Topology Diagrams

Physical Topology



Logical Topology



Communicating The Messages

- Data is divided into smaller parts during transmission
 - Segmentation
- The benefits of doing so:
 - Many different conversations can be interleaved on the network. The process used to interleave the pieces of separate conversations together on the network is called multiplexing.
 - Increase the reliability of network communications. The separate pieces of each message need not travel the same pathway across the network from source to destination

- **Downside of segmentation and multiplexing**
 - level of complexity is added (process of addressing, labeling, sending, receiving and etc are time consuming)
- Each segment of the message must go through a similar process to ensure that it gets to the correct destination and can be reassembled into the content of the original message
- Various types of devices throughout the network participate in ensuring that the pieces of the message arrive reliably at their destination

Communication – Establishing Rules

- Before beginning to communicate with each other, we establish rules or agreements to govern the conversation. These rules, or **protocols**, must be followed in order for the message to be successfully delivered and understood. Among the protocols that govern successful human communication are:
 - An identified sender and receiver
 - Agreed upon method of communicating (face-to-face, telephone, letter, photograph)
 - Common language and grammar
 - Speed and timing of delivery
 - Confirmation or acknowledgement requirements

What's a protocol

human protocols:

- “what’s the time?”
- “I have a question”
- introductions

... specific msgs sent

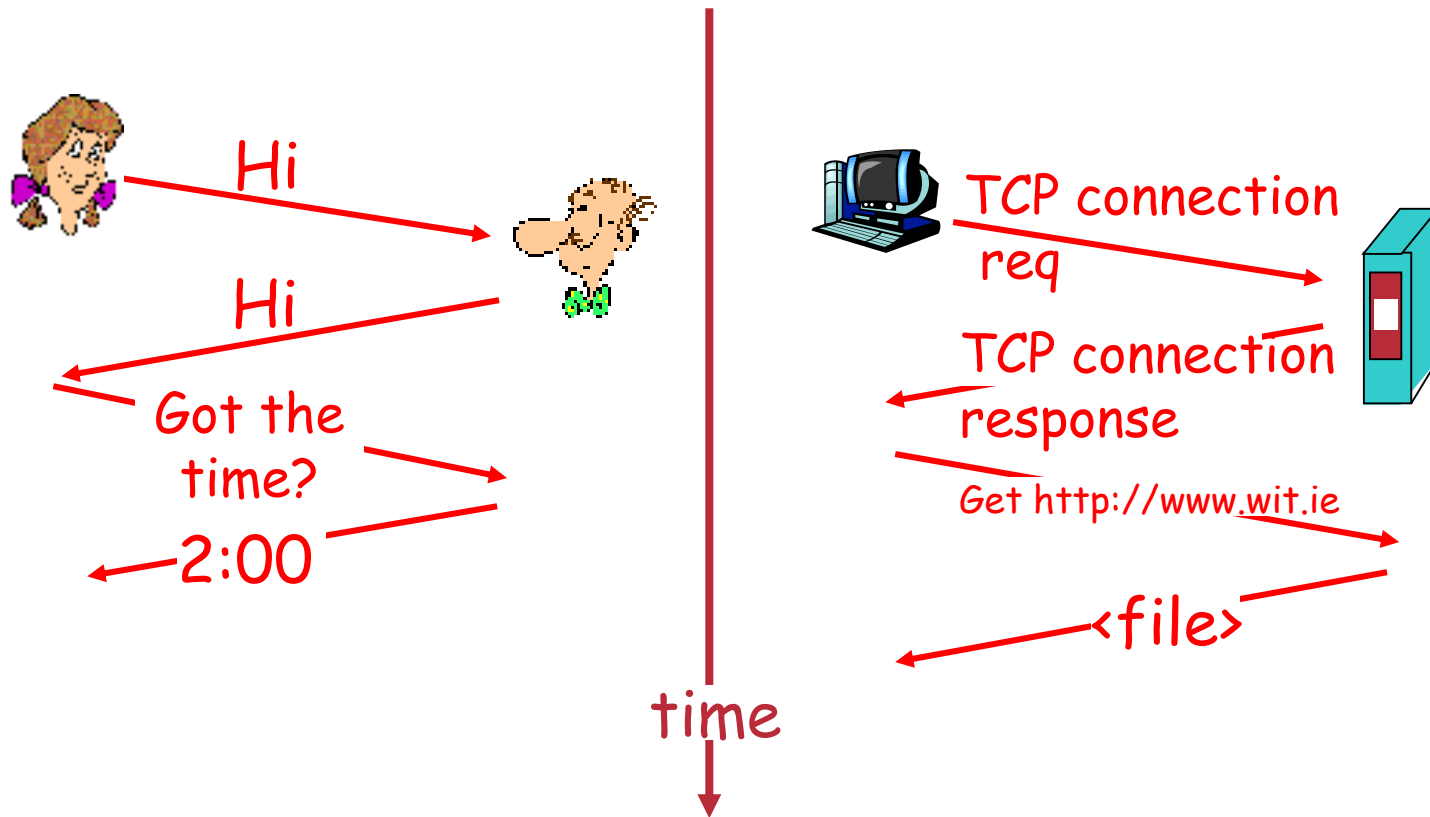
... specific actions taken
when msgs received, or
other events

network protocols:

- machines rather than humans
- all communication activity in Internet governed by protocols

protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt

A human protocol and a computer network protocol:



• Converged networks in communications

–Converged network

- A type of network that can carry voice, video & data over the same network



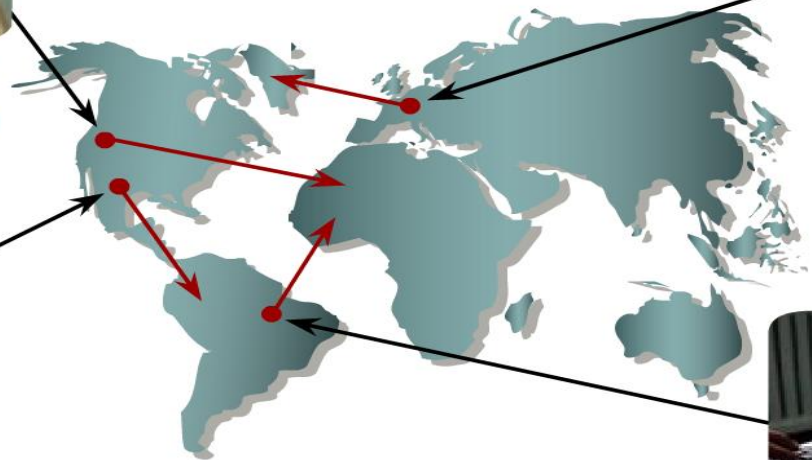
Intelligent Networks allow handheld devices to receive news, Emails, and to send text.



Video conferencing around the globe is in the palm of your hand.



Phones connect globally to share voice, text and images.



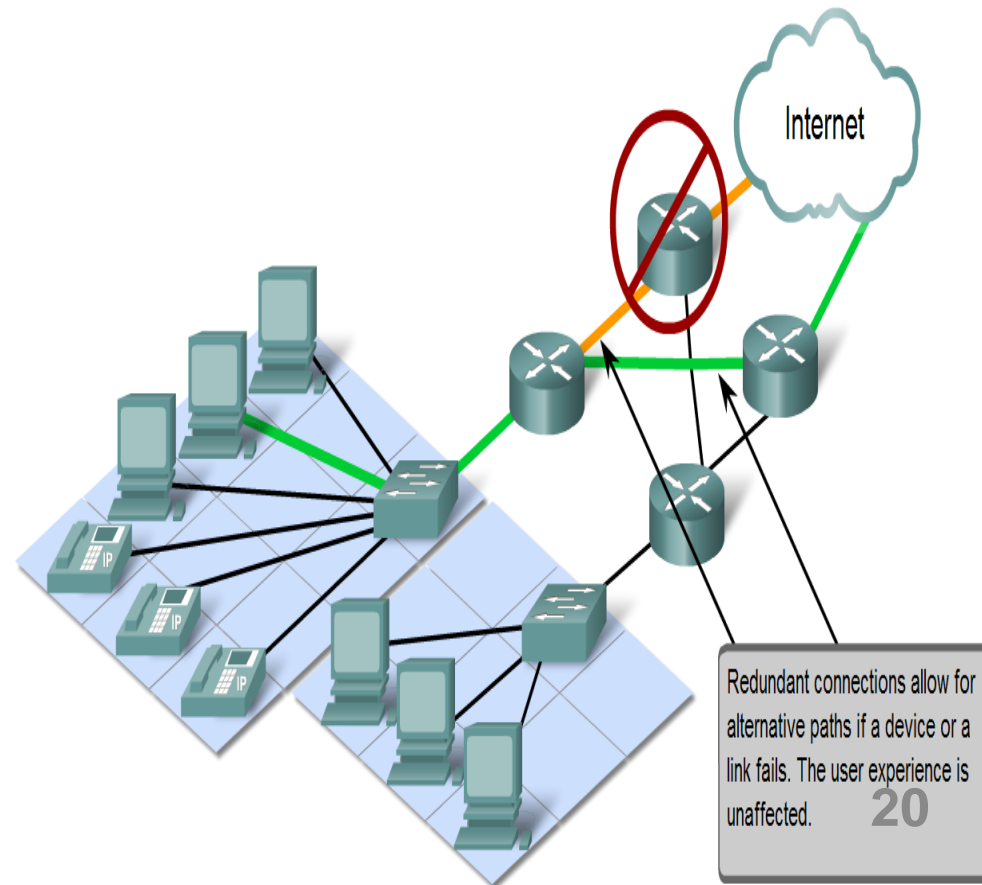
The Human Network is everywhere.



Online gaming connects thousands of people seamlessly.

Some Network Architecture Characteristics

- The term network architecture, refers to both the technologies that support the infrastructure and the programmed services and protocols that move the messages across that infrastructure
- There are **4 basic characteristics** for networks in general to meet user expectations:
 - Fault tolerance,
 - eg: consistent quality of video
 - Scalability,
 - Quality of service (QoS)
 - Security



Key takeaways so far....

- Networks are everywhere
- 4 components of all networks
 - Device
 - Medium – Copper, Fiber, Wireless
 - Protocols
 - Message (data)
- Physical v Logical Topology
- Rules are needed to manage communications (i.e. Protocols)
- Converged Network – Data/Voice/Video
- Some Characteristics of a network.....