Chapter 1

Living in a Network-Centric World

Communicating in a Network-Centric World

Global Access

- The globalization of the Internet has succeeded faster than anyone could have imagined.
- The manner in which social, commercial, political and personal interactions occur is rapidly changing to keep up with the evolution of this global network.

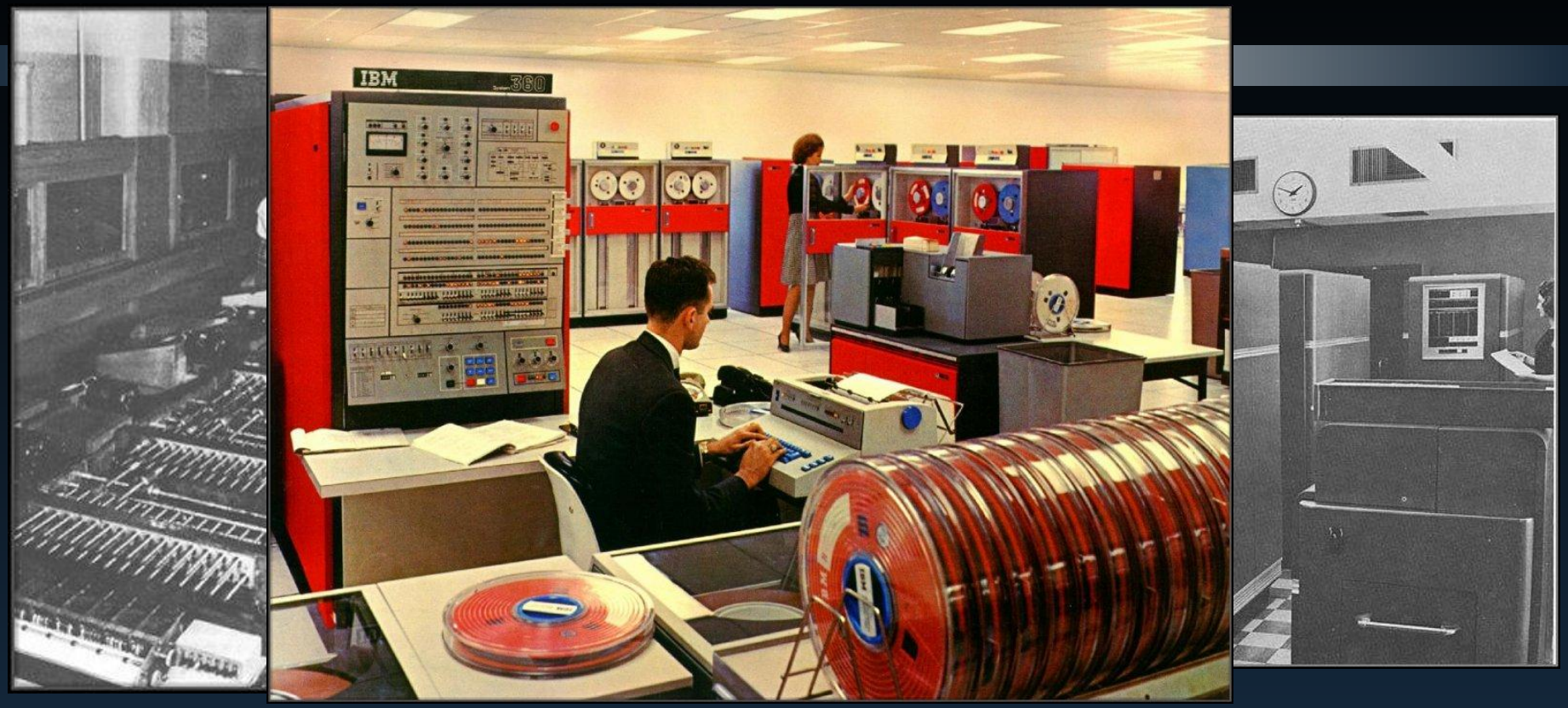
Networks – Behind the Scenes

- Networks are more than just connecting cables.
- They are a complex and sophisticated combination of protocols, software and hardware.
  - Security and Privacy
  - 24 x 7 availability
  - Quality of Service
  - Video on Demand
  - Voice over IP
  - Redundancy and backup
  - Mission critical applications and user expectations
  - Wireless

Networks – The Early Days

- Early communication relied on face-to-face conversations.
- The telephone was used for voice and the post office delivered most of the written communications.
- Video communication was one-way using the television.

Networks – The Early Days

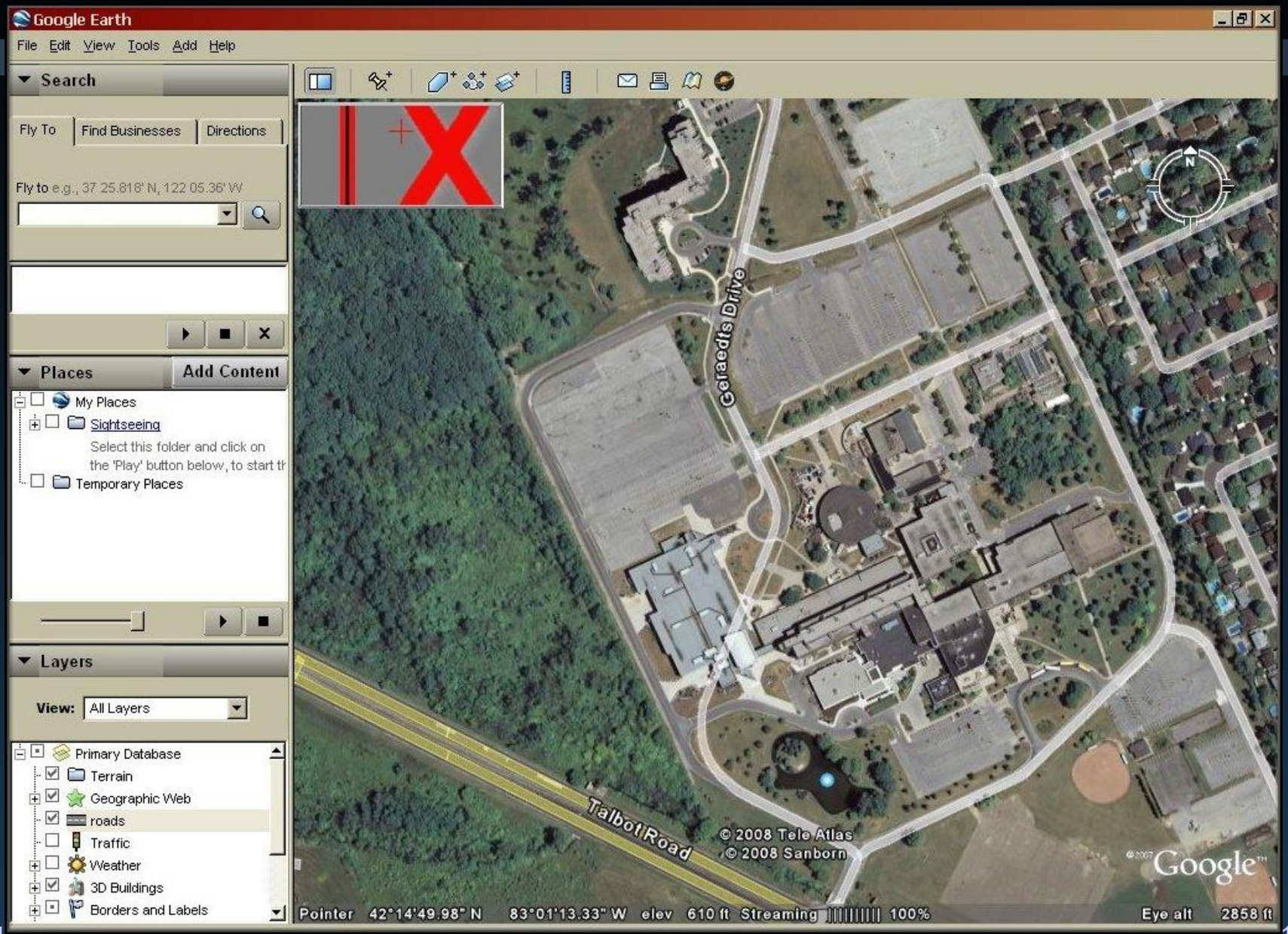


- Early networks were limited to character based information.
- Communications between computers was not easy and required a host (no pun intended) of resources to accomplish the simplest data transfer.

Wind Energy Cell Phone Charger

- Today's [illegible] through many types of devices - *SIMULTANEOUSLY*.
  - Voice, Video, Audio, Text, graphics

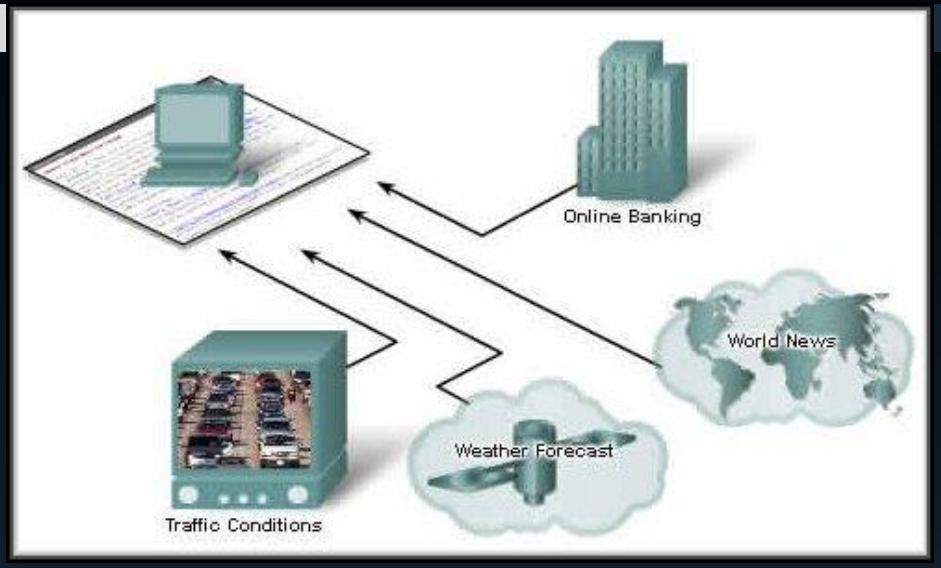
Networks – Today – A Global Community



Networks Supporting The Way We Live

- The Internet has quickly become an integral part of our daily routines.
- Data networks that were once only used to transport business information are now used to improve our quality of life no matter where we live.

Networks Supporting The Way We Live



- In the course of the day, Internet resources can help you.
- IM - Instant Messaging:
  - Internet Relay Chat (IRC)
- Blogs (Weblogs):
  - Personal opinions on any conceivable subject.
- Podcasting:

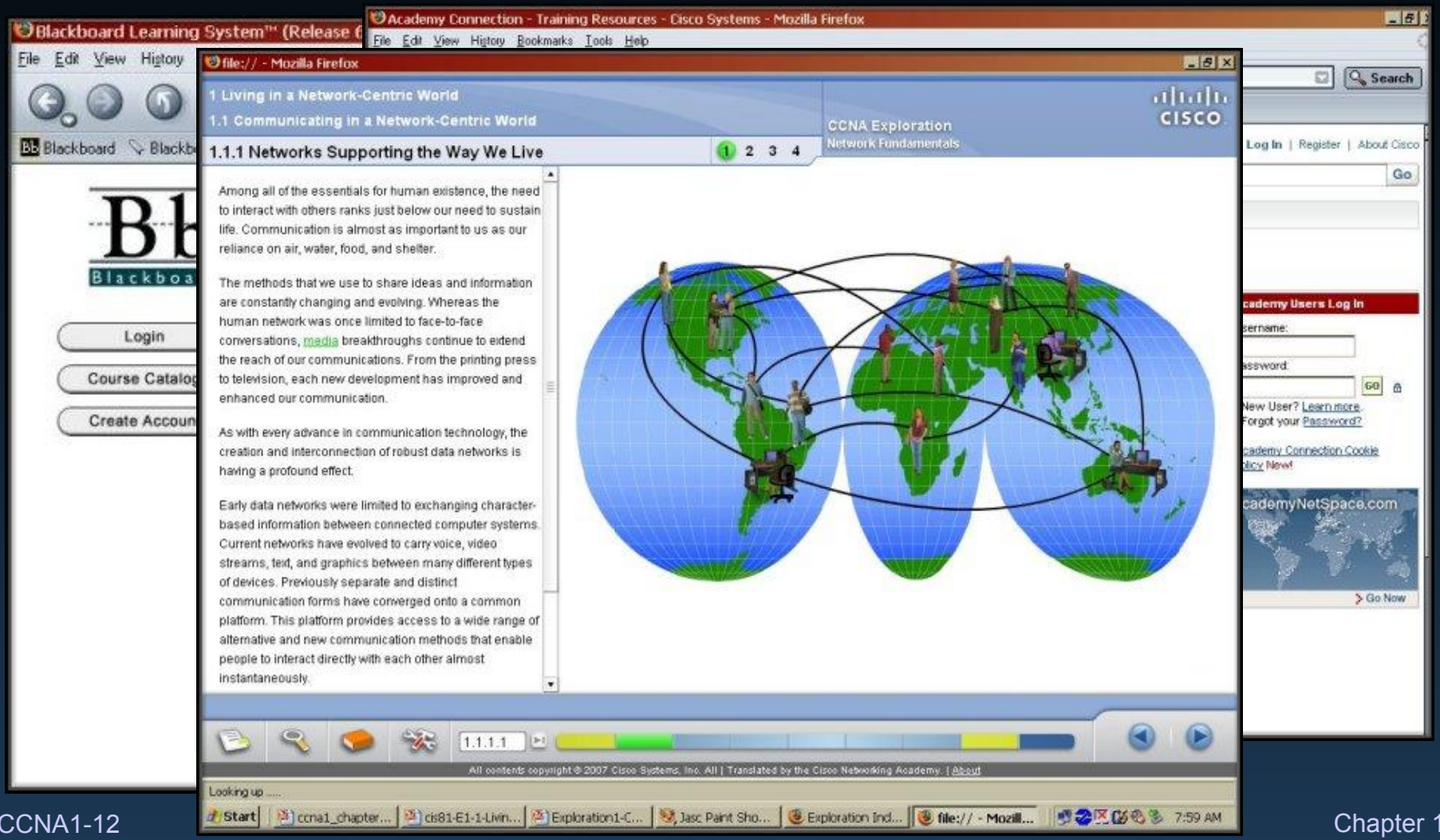
  Sharing recordings with a wide audience (Apple iPods)
- Wikis:
  - A collaboration tool. Gives people the opportunity to work together on shared documents.

Networks Supporting The Way We Learn

- E-Learning

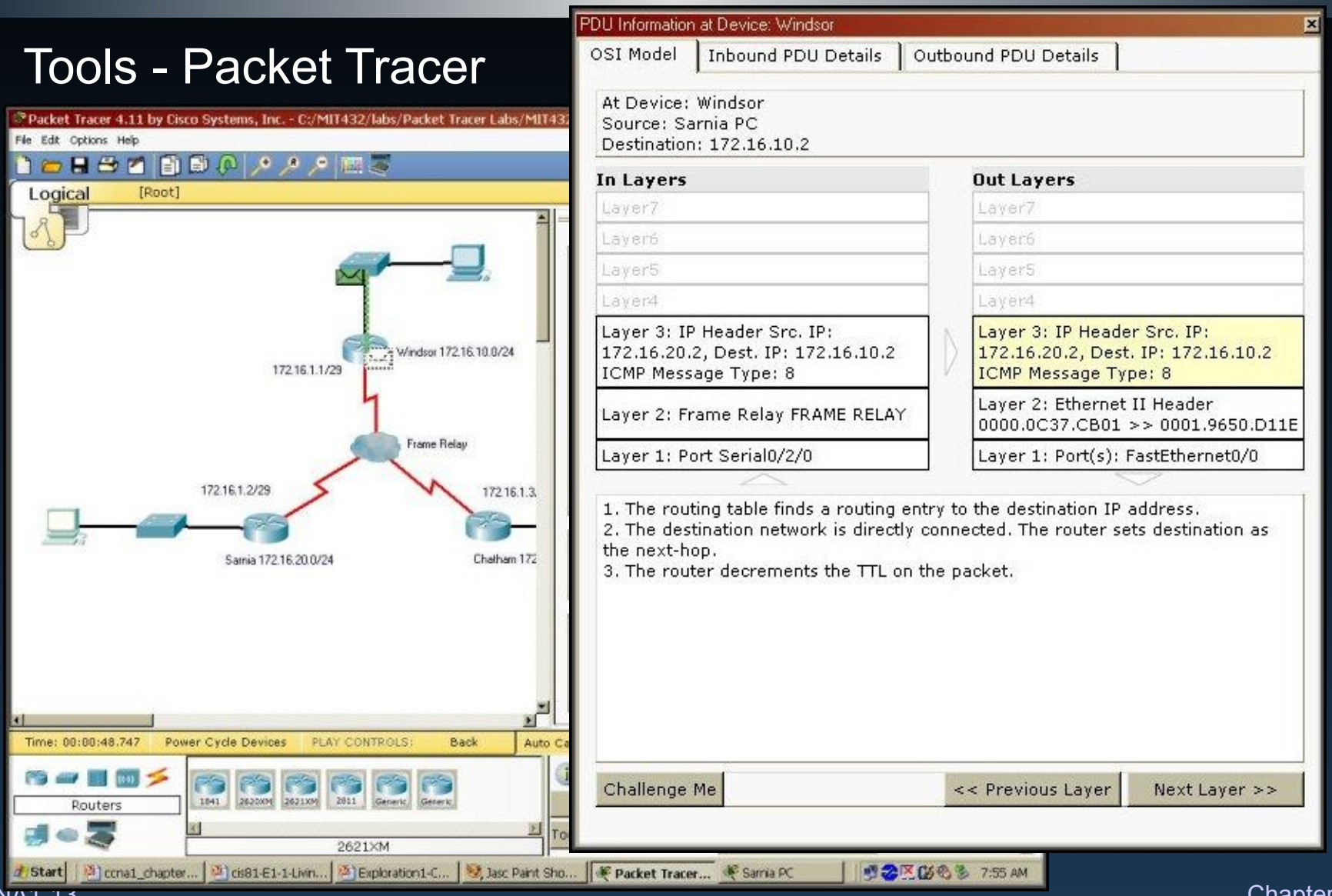
Networks Supporting The Way We Learn

- Online discussions and access to resources.



Networks Supporting The Way We Learn

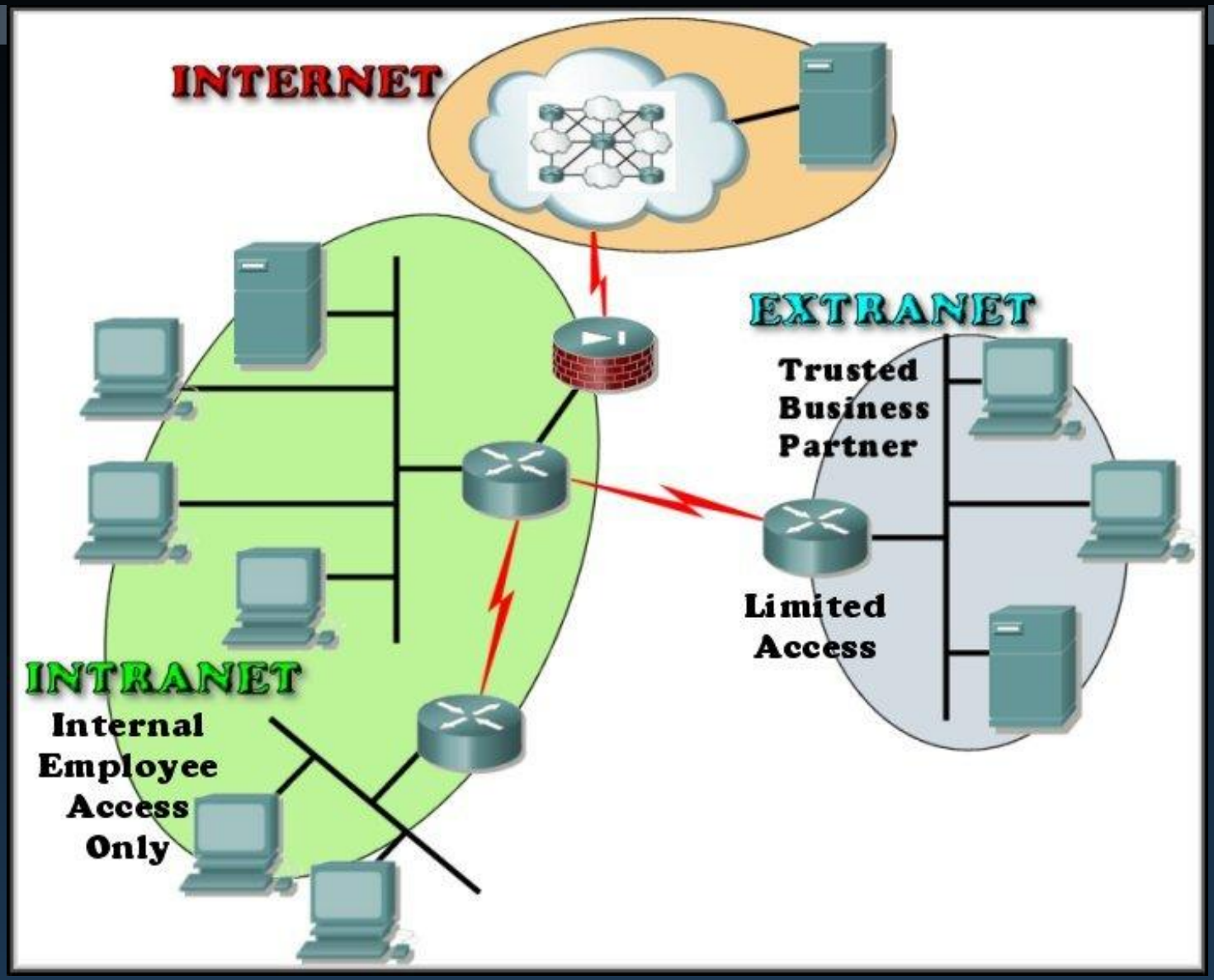
- Tools - Packet Tracer



Networks Supporting The Way We Work

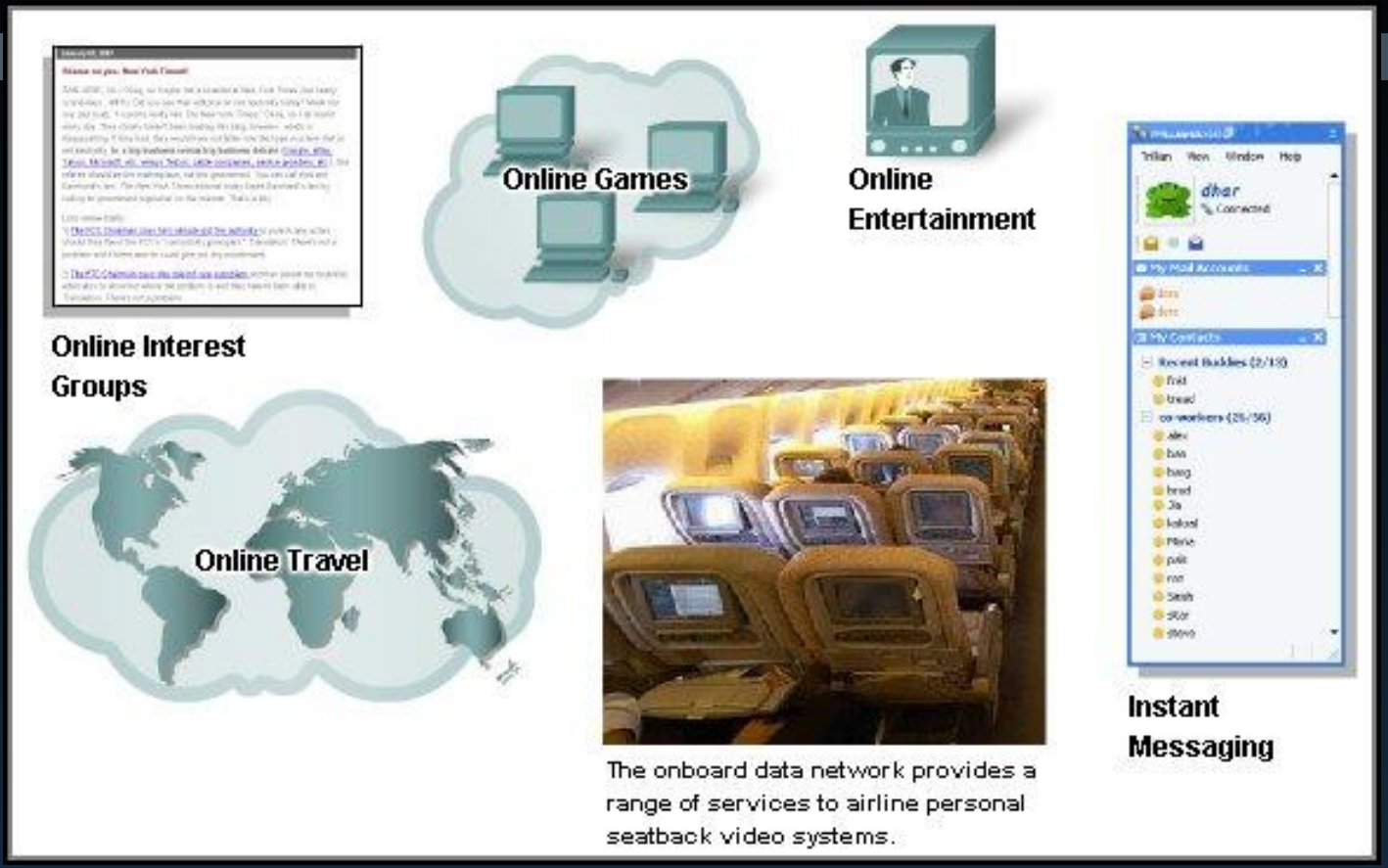
- Business networks evolved to enable the transmission of many different types of information services, including e-mail, video, messaging, and telephony.
- Different companies use different types of networks.

Networks Supporting The Way We Work



Networks Supporting The Way We Work

Networks Supporting The Way We Play



- The entertainment and travel industries have made use of the Internet to provide online gaming, music and movie downloads, online travel bookings, hotel and car reservations and much, much more.

Networks Supporting The Way We Play

- Some of the most innovative developments in network technology have come from the increasing demand for entertainment.

Communications – What is it?

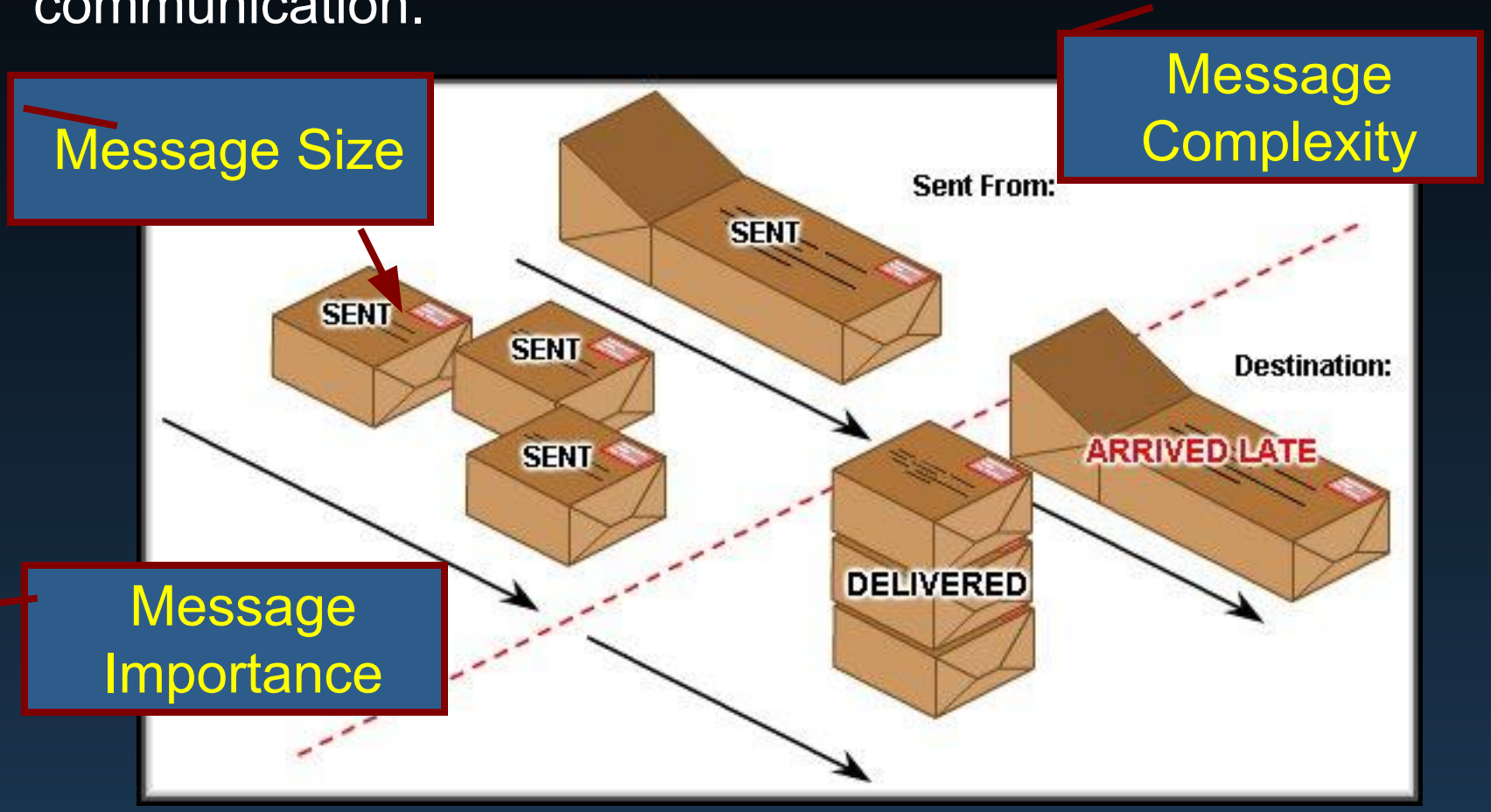
- Communications can take many forms and occurs in many different environments.
- We establish rules, or protocols, for communicating with each other:
  - Identify the sender and receiver.
  - Agree on the method.
  - Common language.
  - Speed and delivery of the message.
  - Confirmation that the message was received.
- Communications between individuals is successful if the meaning of the received message is the same as the meaning of the message that was sent.

Communications - Quality

- For data networks, we use the same basic criteria to judge successful communication.
- However, there are external factors that can affect the message.
  - The quality of the pathway between the sender and the recipient.
  - The number of times the message has to change form or be redirected or re-addressed.
  - The number of other messages being transmitted simultaneously on the communication network.
  - The amount of time allotted for successful communication.

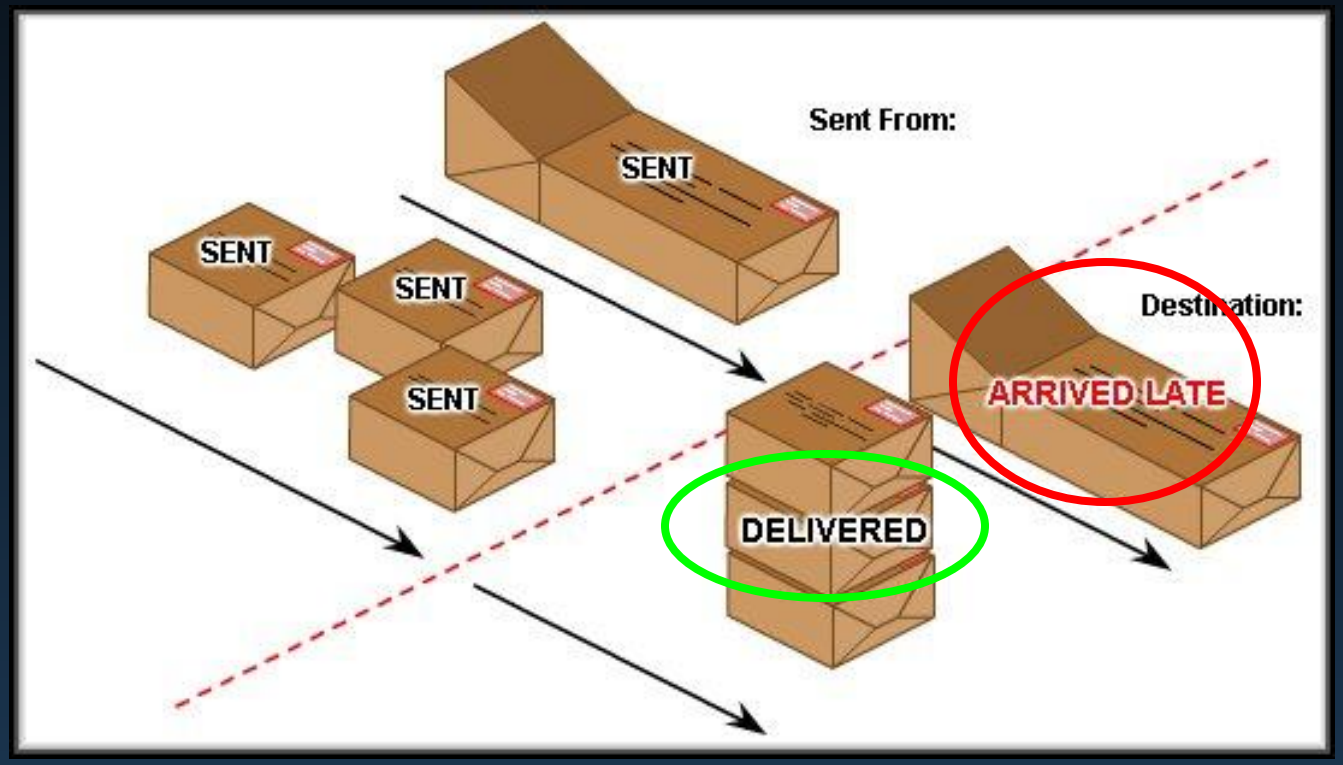
Communications - Quality

- There are also internal factors that can affect successful communication.



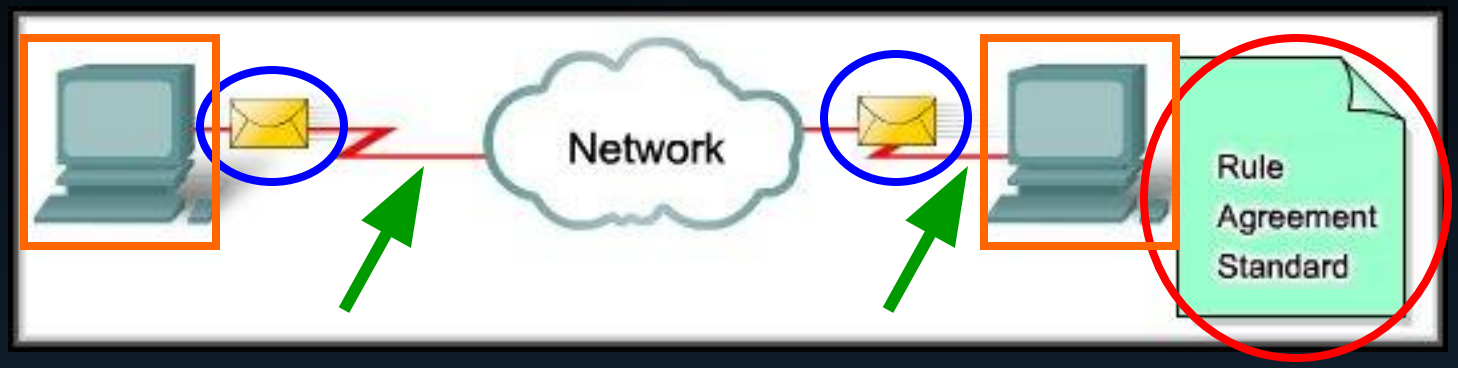
Communications - Quality

- It is also more difficult to deliver a large, bulky package successfully and without damage than it is to deliver several smaller packages.



Network As A Platform

- All networks have **4** basic elements in common:



Rules (protocols) to govern the handling of the message.

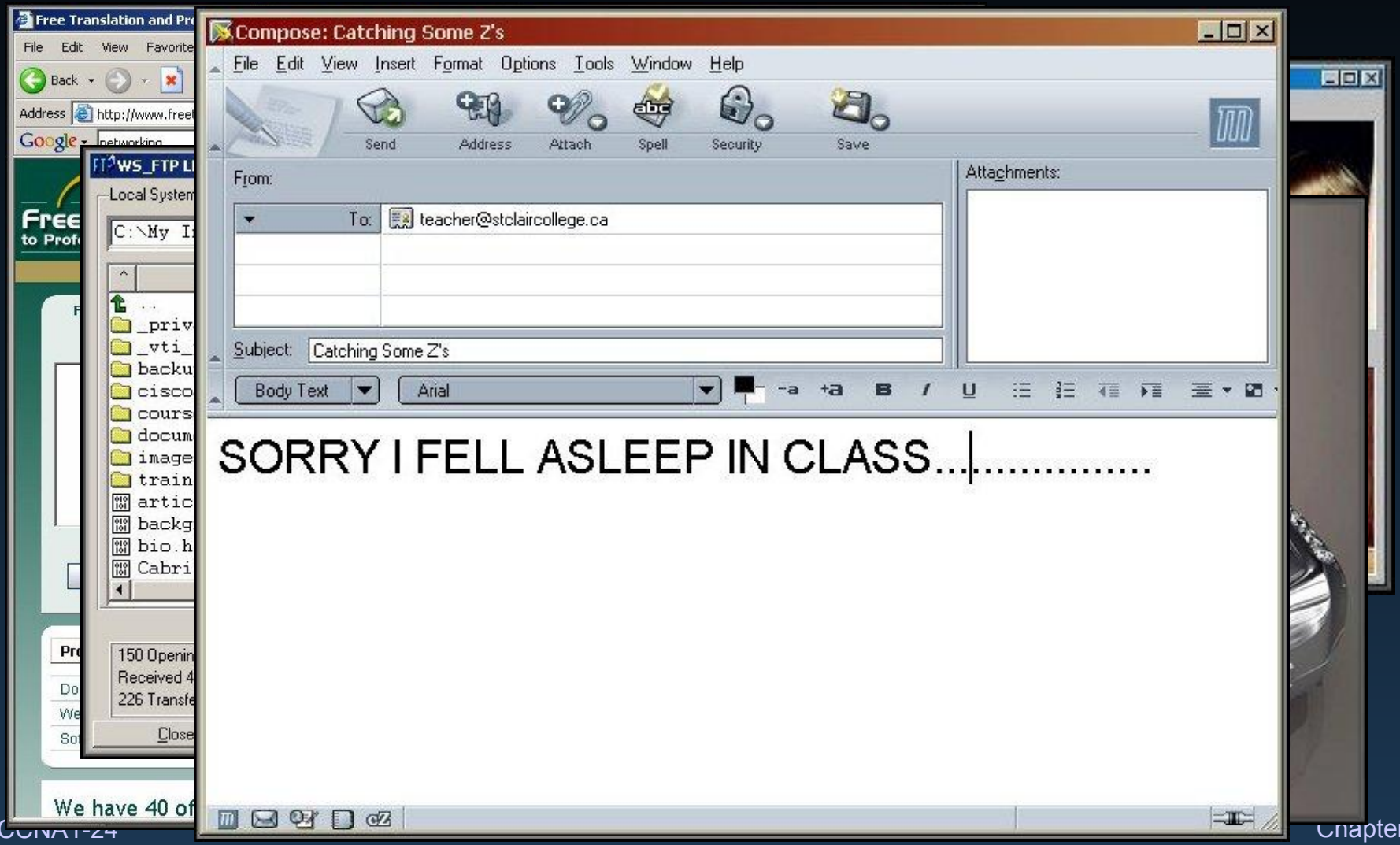
Messages that travel from one device to another.

Medium that is used to interconnect devices and can transport the messages from one device to another.

Devices on the network that exchange messages.

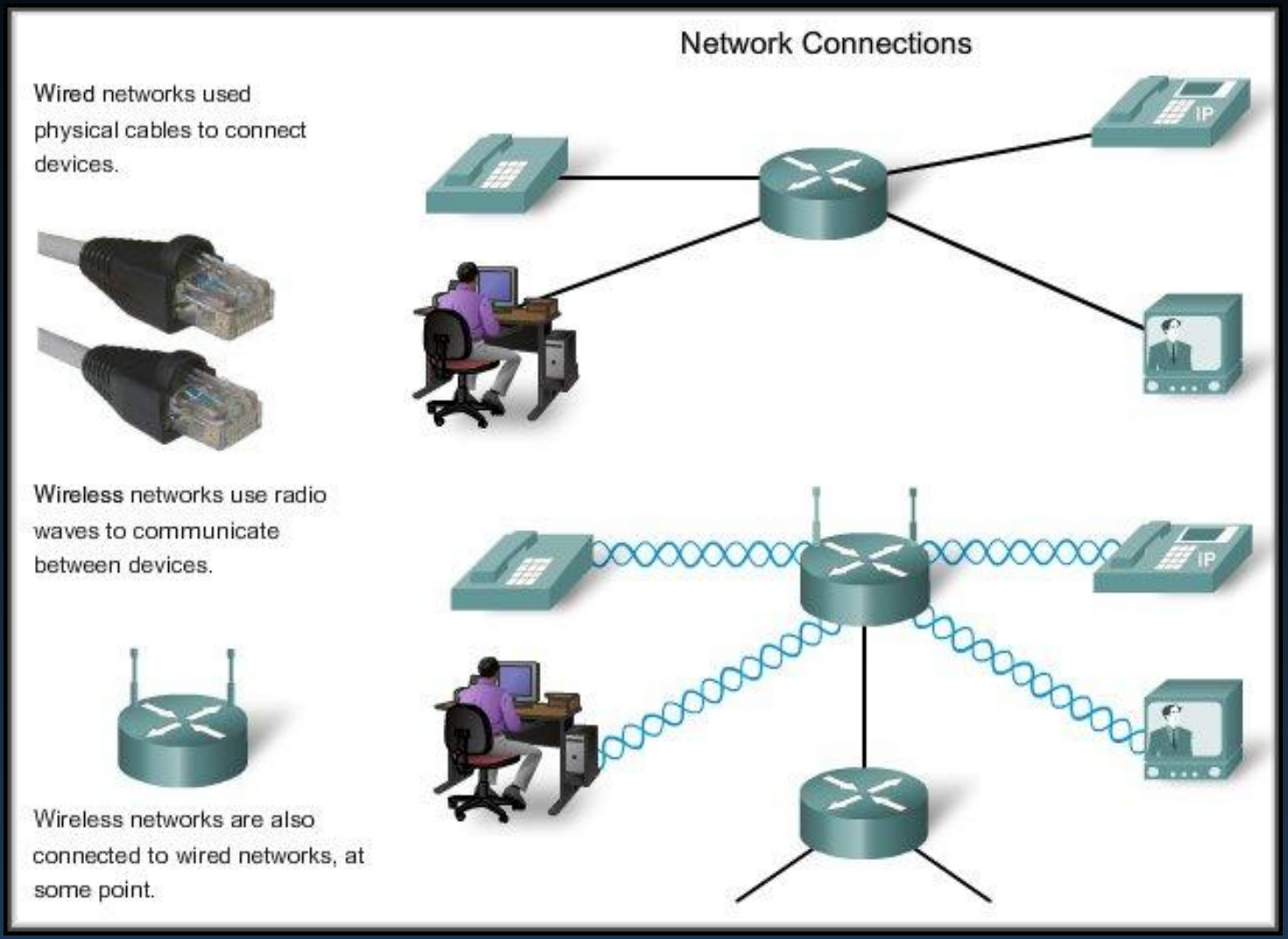
Network As A Platform

Messages take many forms.



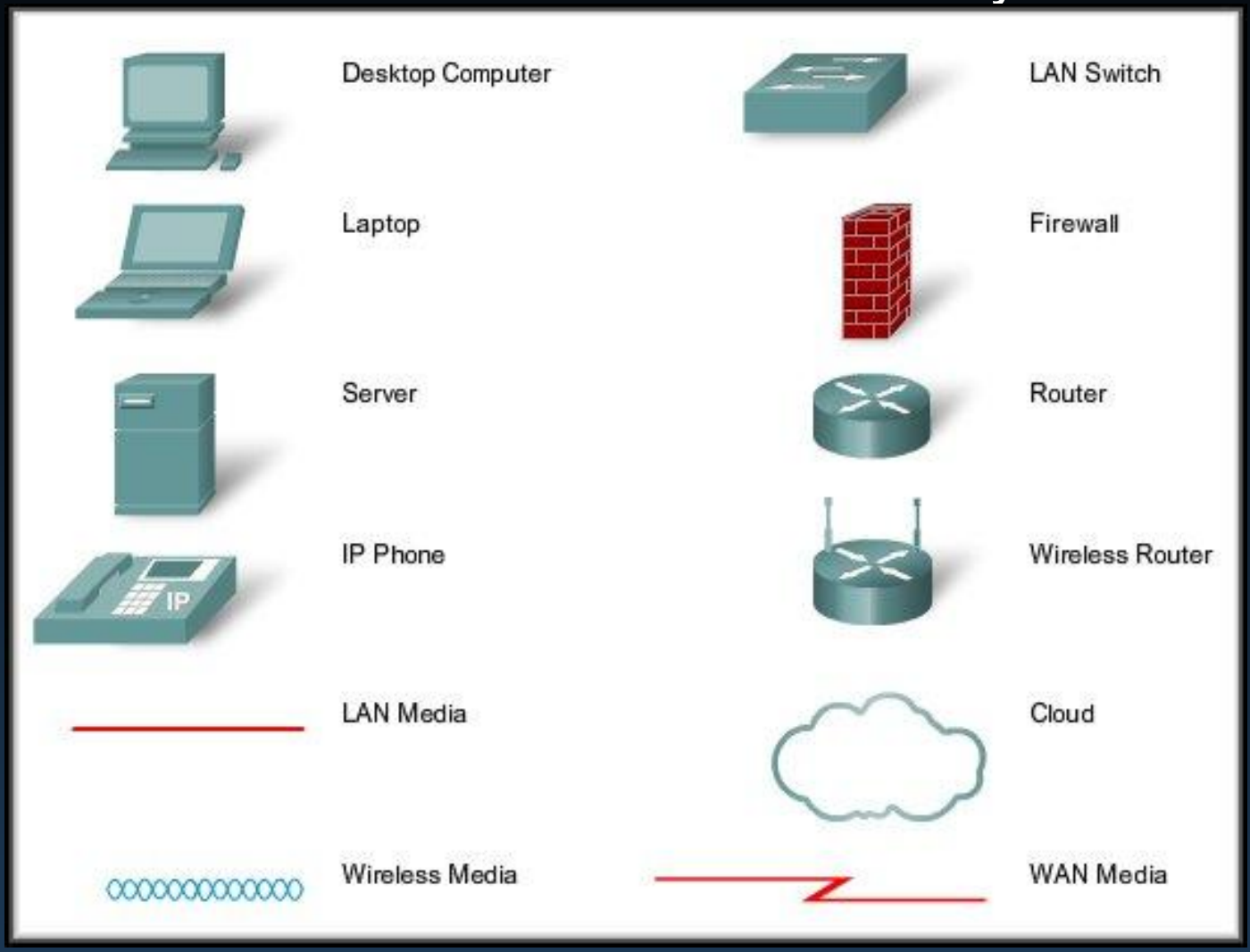
Network As A Platform

Media on a network can be varied.



Network As A Platform

Devices on a network – Common Symbols



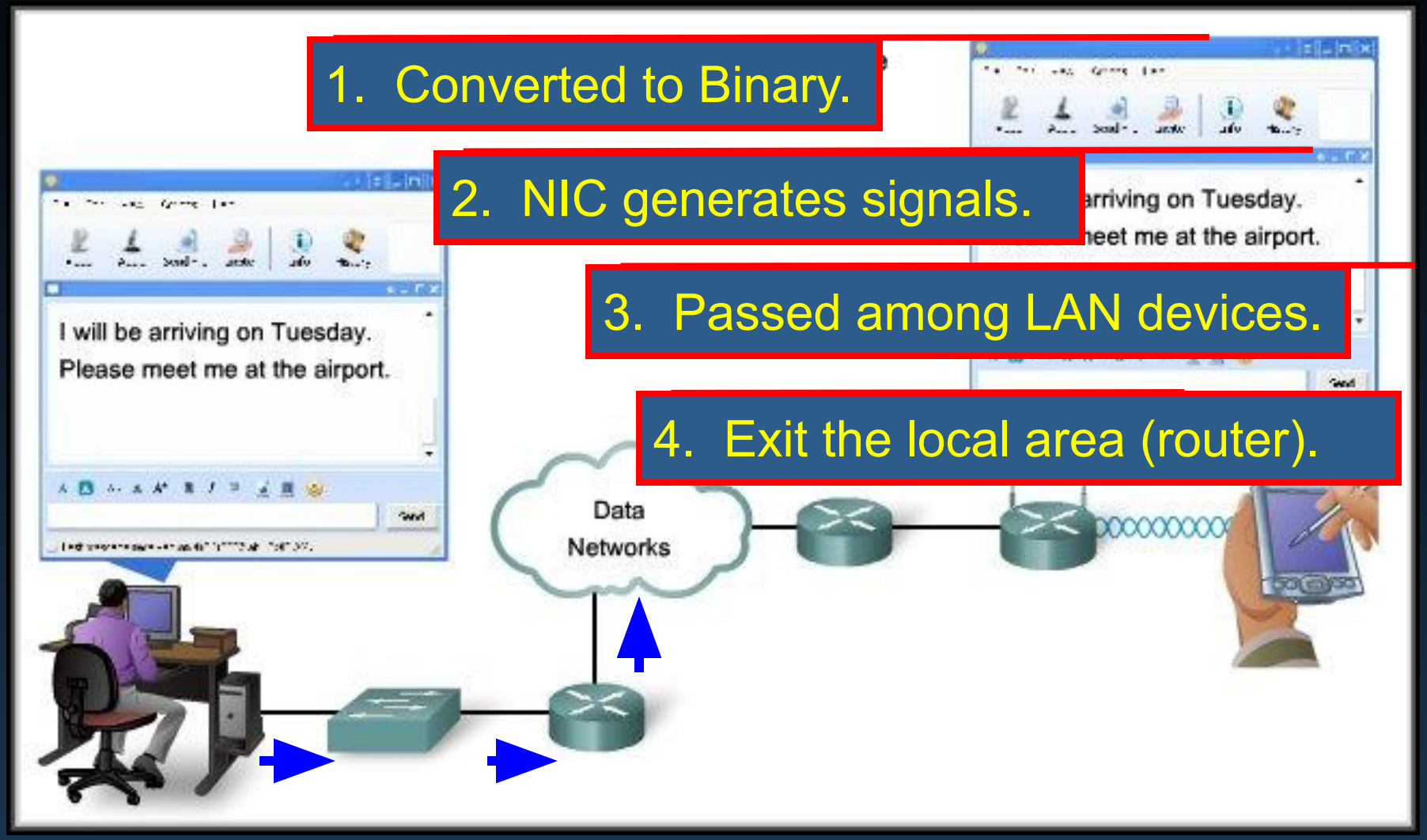
Network As A Platform

Rules on a network seem almost endless – but they're not.

Service	Protocol ("Rule")
World Wide Web (WWW)	HTTP (Hypertext Transport Protocol)
E-mail	SMTP (Simple Mail Transport Protocol) POP (Post Office Protocol)
Instant Message (Jabber; AIM)	XMPP (Extensible Messaging and Presence Protocol) OSCAR (Open System for Communication in Realtime)
IP Telephony	SIP (Session Initiation Protocol)

- Other Application Protocols:
  - DNS, DHCP, FTP
- Some Other Protocols:
  - TCP/IP Protocol Suite, Ethernet, Routing Protocols

Putting It all Together



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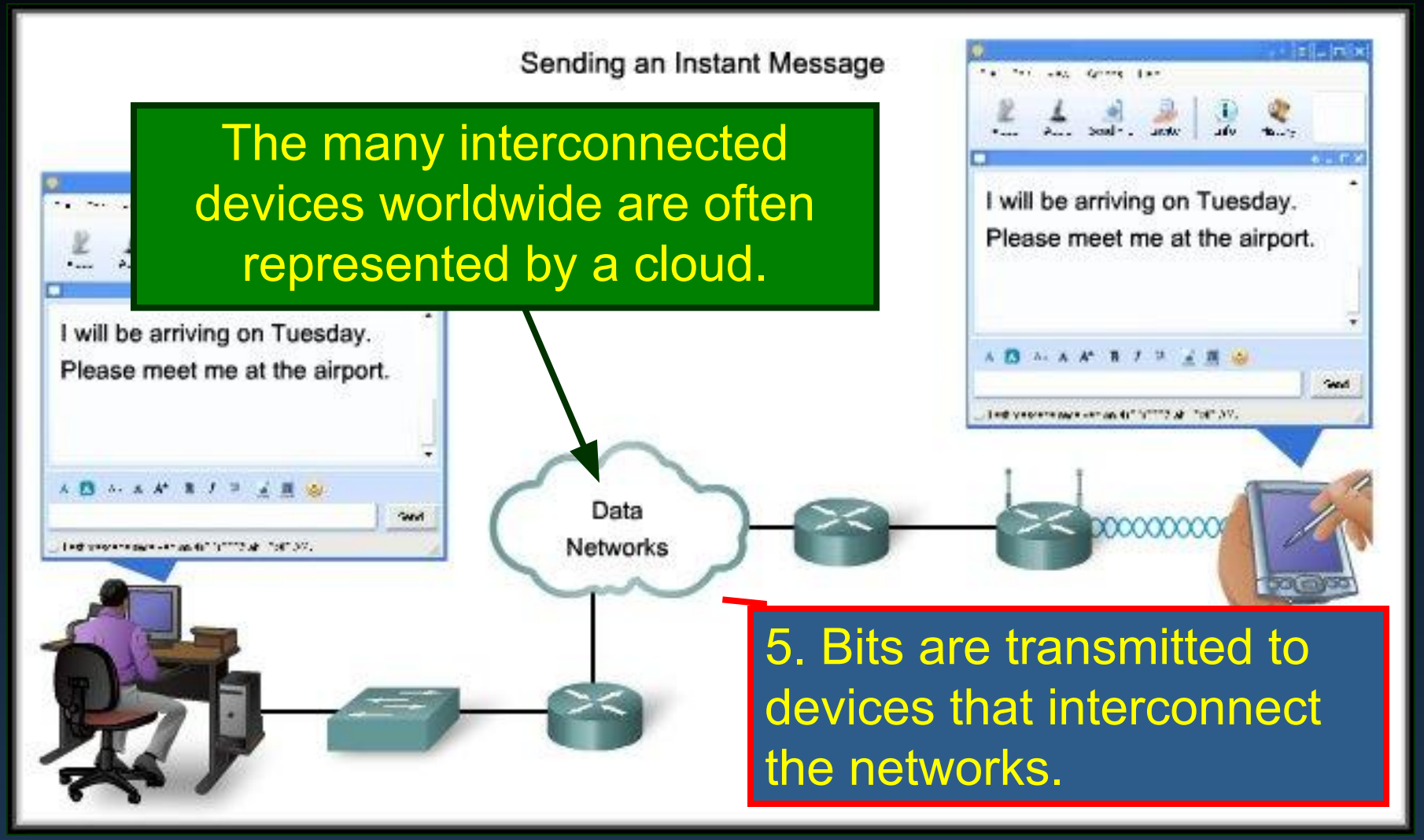

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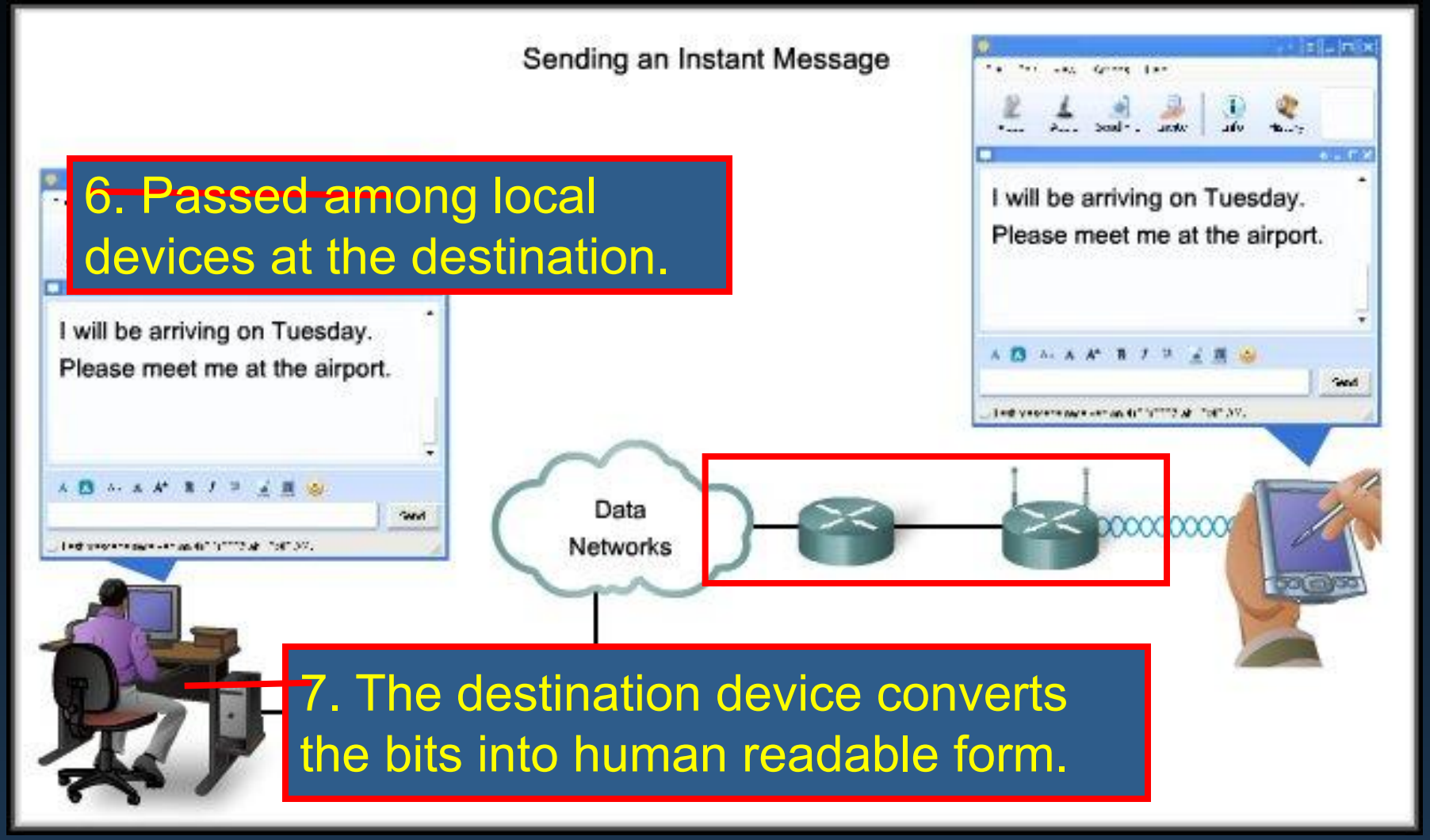
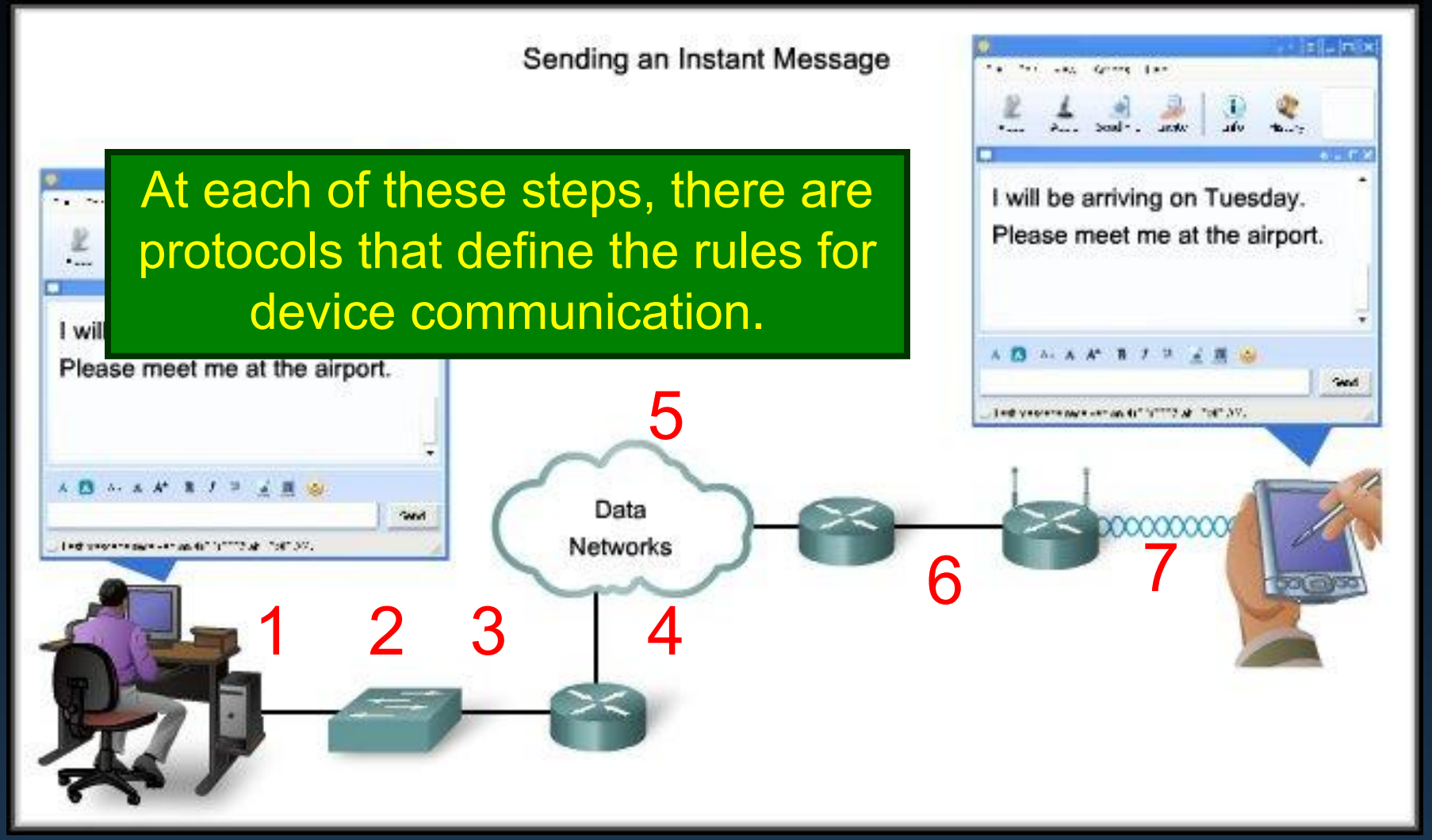


6. Passed among local devices at the destination.

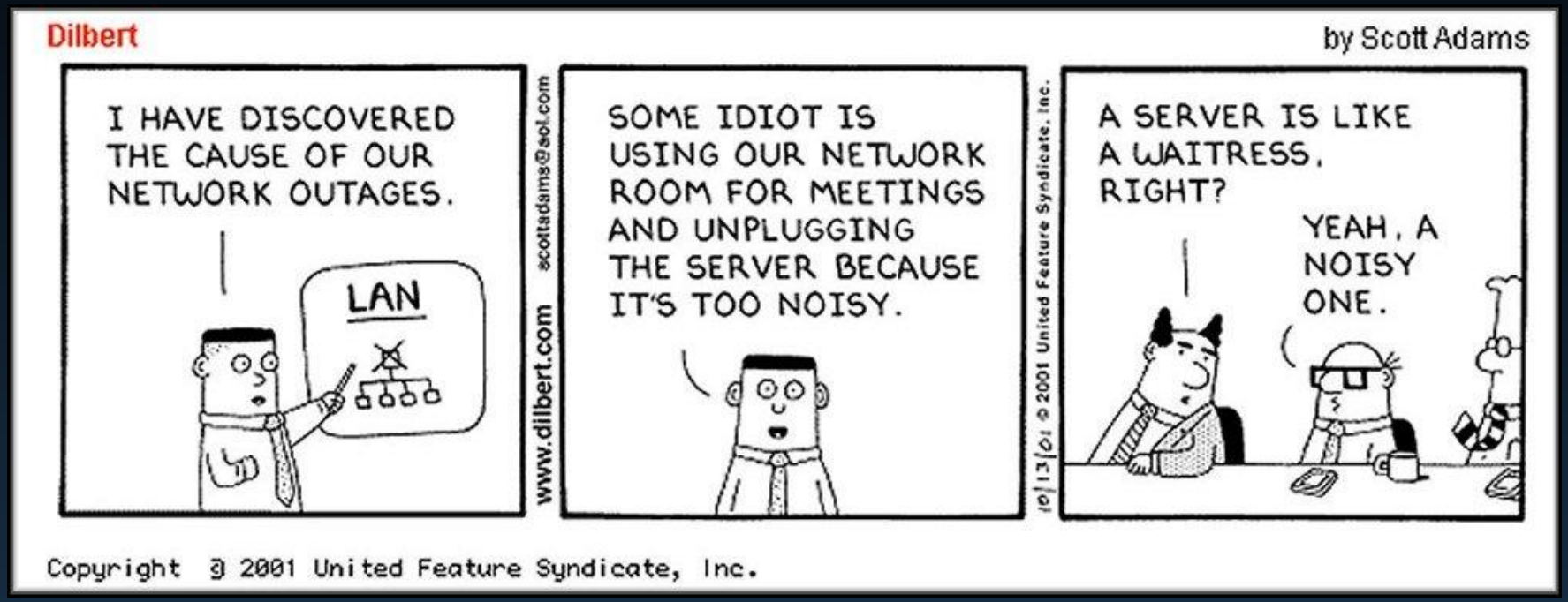
7. The destination device converts the bits into human readable form.

Putting It all Together



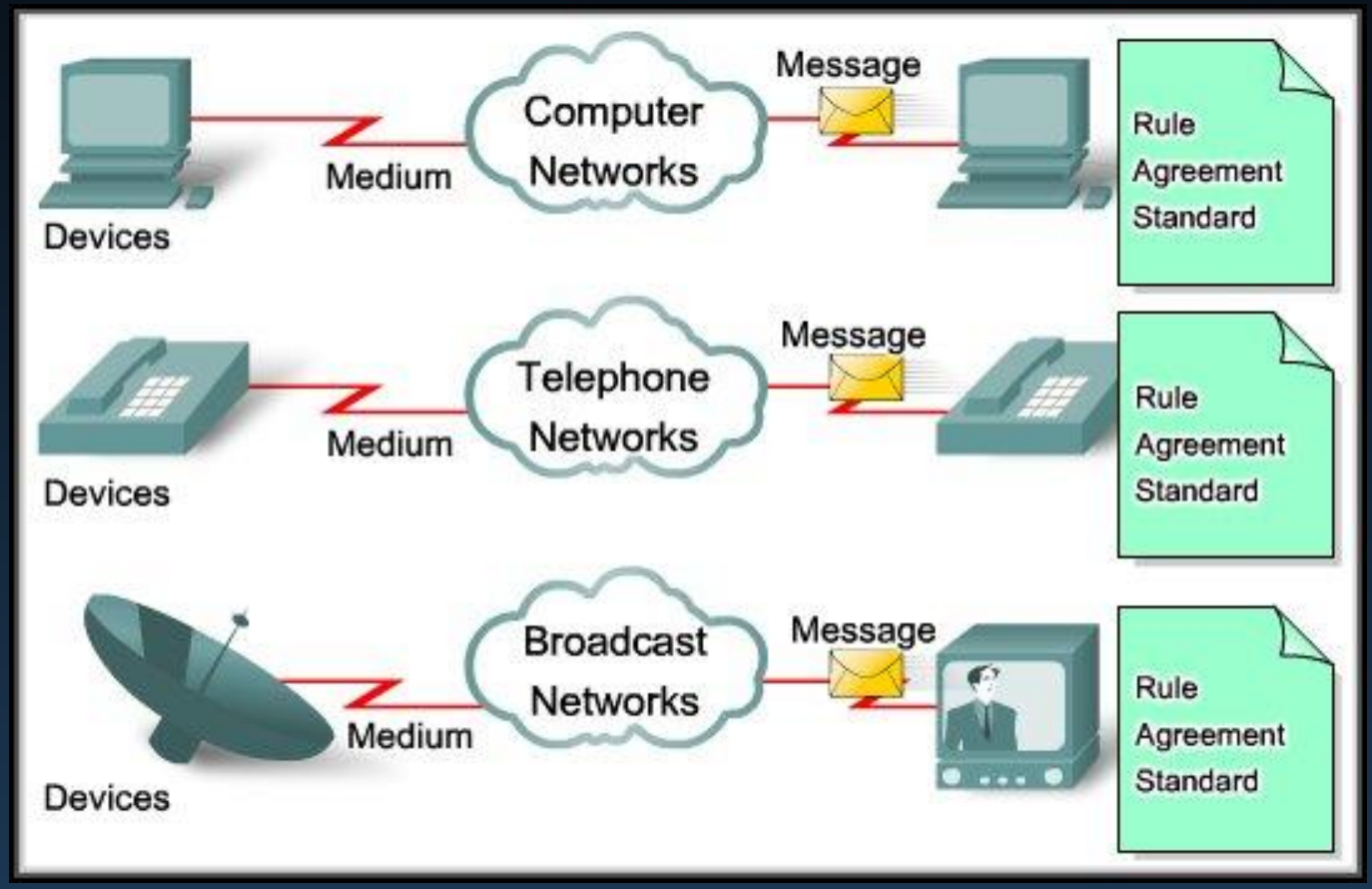
Putting It All Together

- Of course, it always helps to know what you're doing.



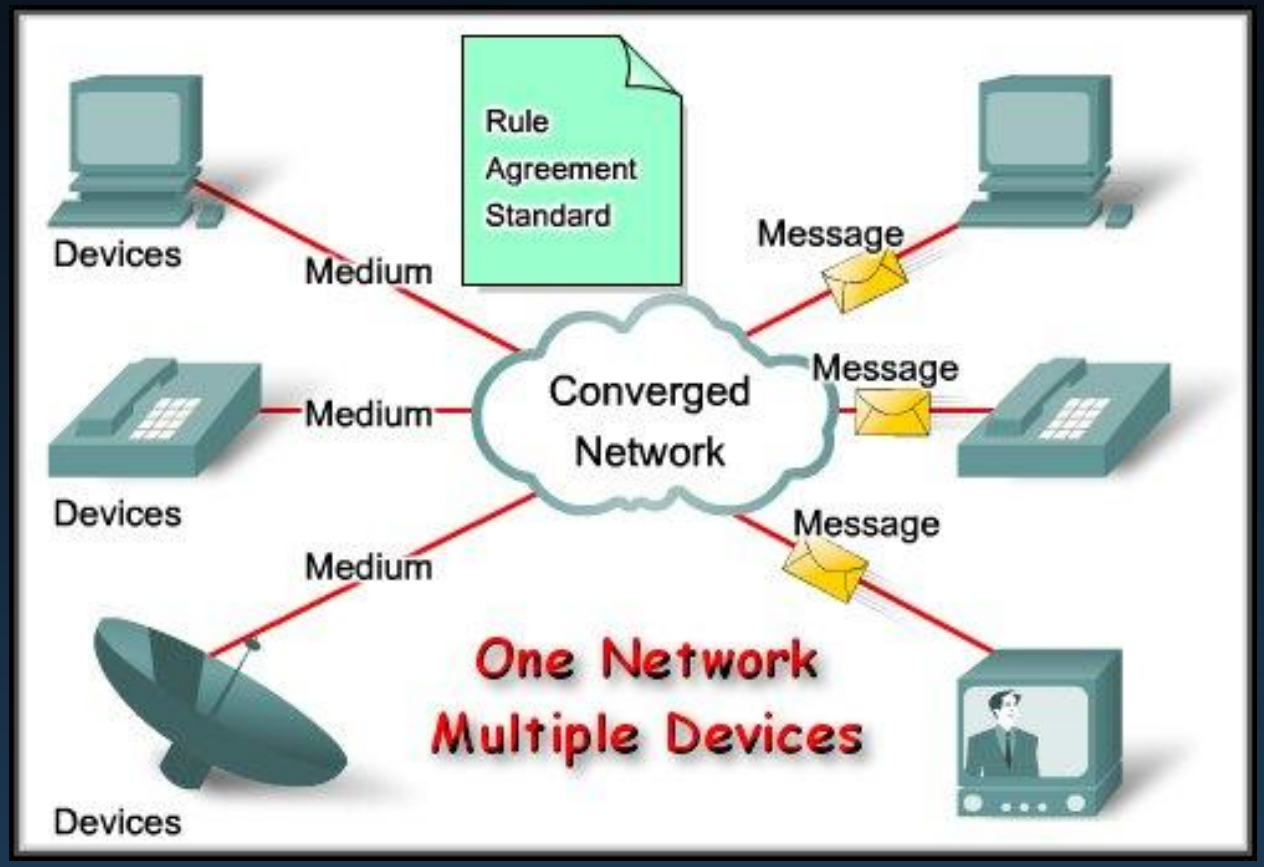
Converged Networks

- Traditional telephone, radio, television, and computer data networks each have their own individual versions of the four basic network elements.

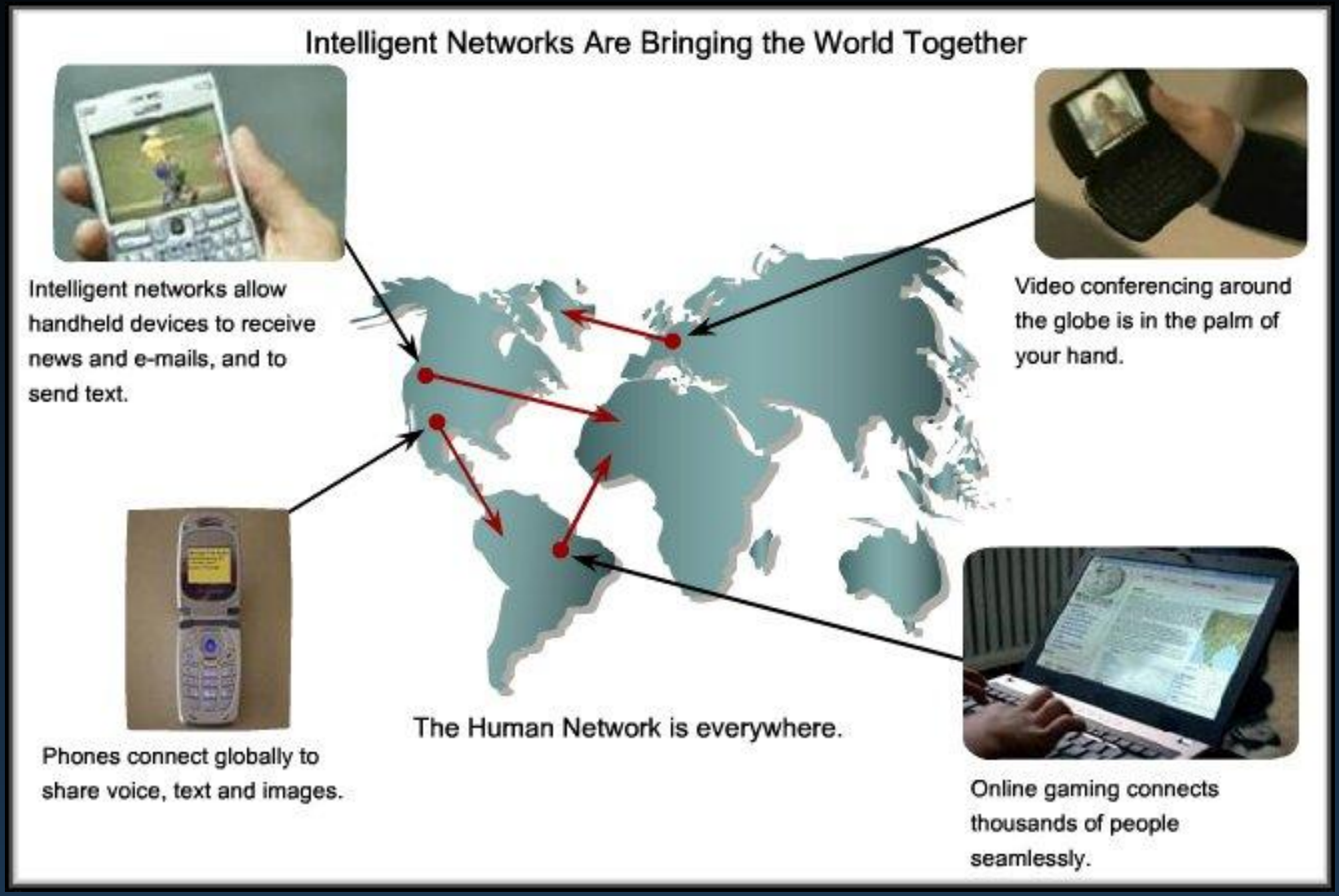


Converged Networks

- Technology advances are enabling us to consolidate these disparate networks onto one platform.
- A platform defined as a converged network.



Converged Networks

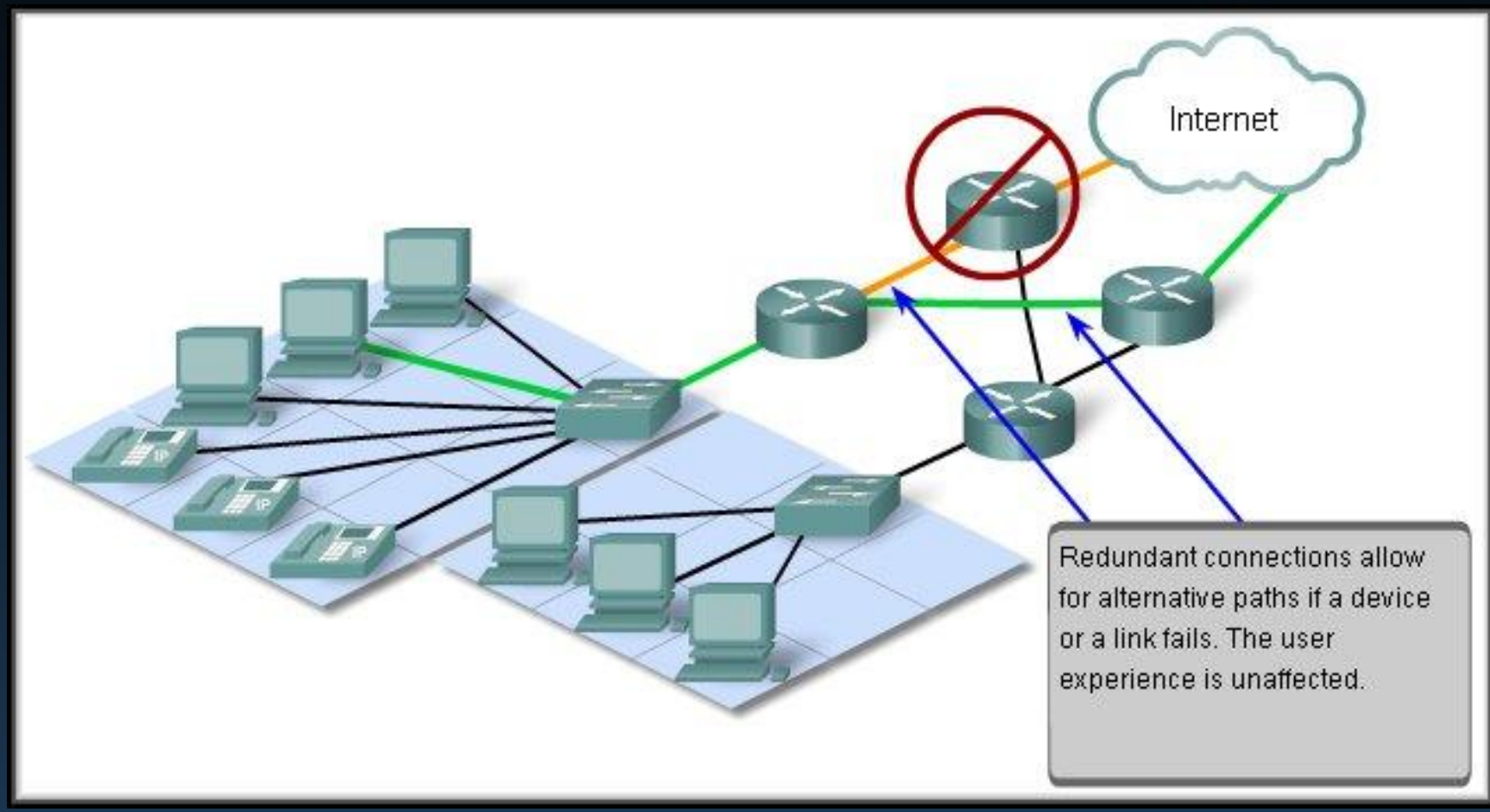


The Architecture of the Internet

- The term Network Architecture:
  - Technologies that support the infrastructure
  - 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
  - Scalability
  - Quality of Service (QoS)
  - Security

The Architecture of the Internet

Fault Tolerance

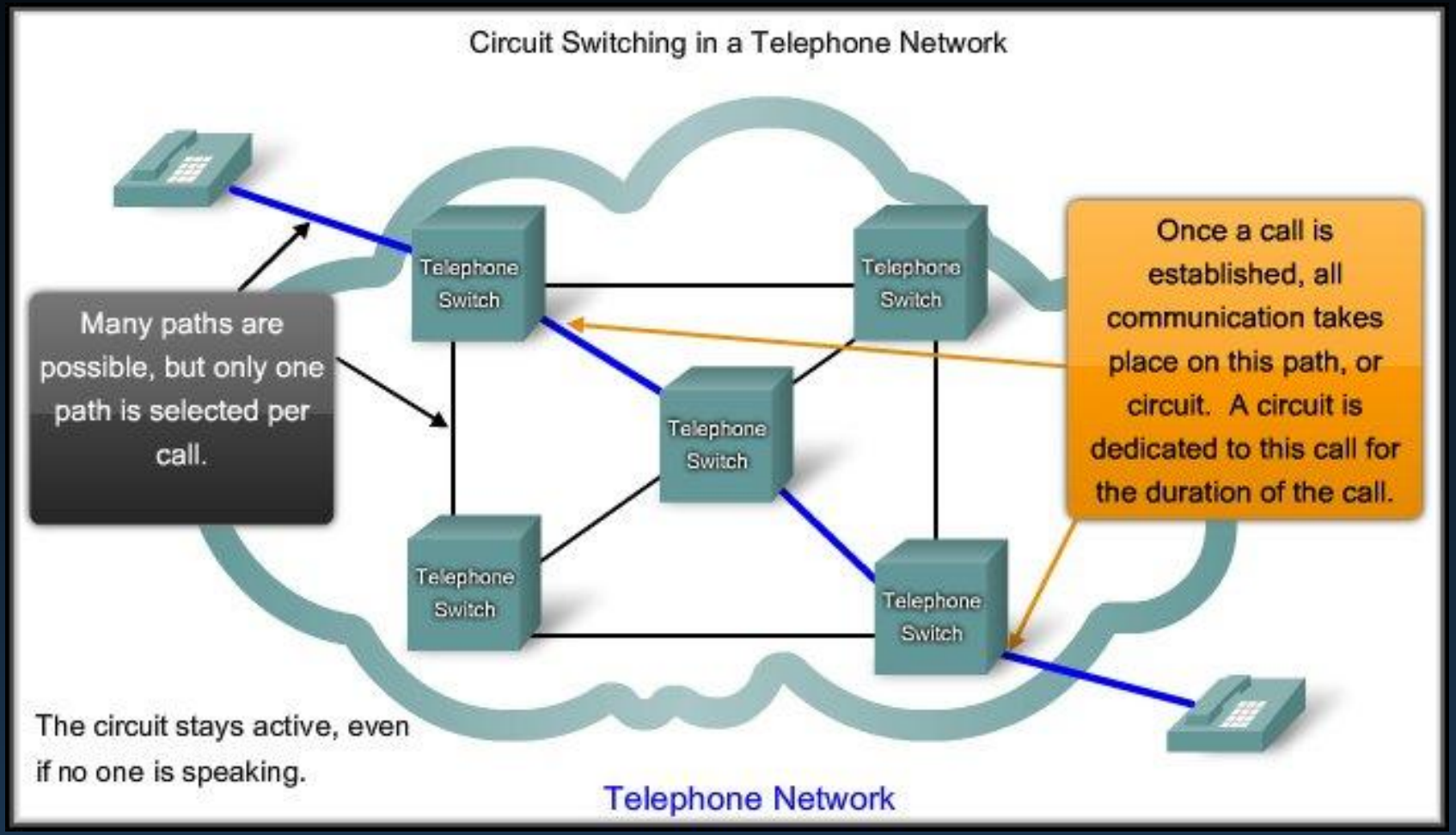


The Architecture of the Internet

- Fault Tolerance:
  - The Internet, in its early inception, was the result of research funded by the United States Department of Defense (DoD).
  - Fault tolerance was the focus of the initial internetwork design.
  - Early network researchers looked at the existing communication networks, which were primarily for the transmission of voice traffic, to determine what could be done to improve the fault tolerance level.

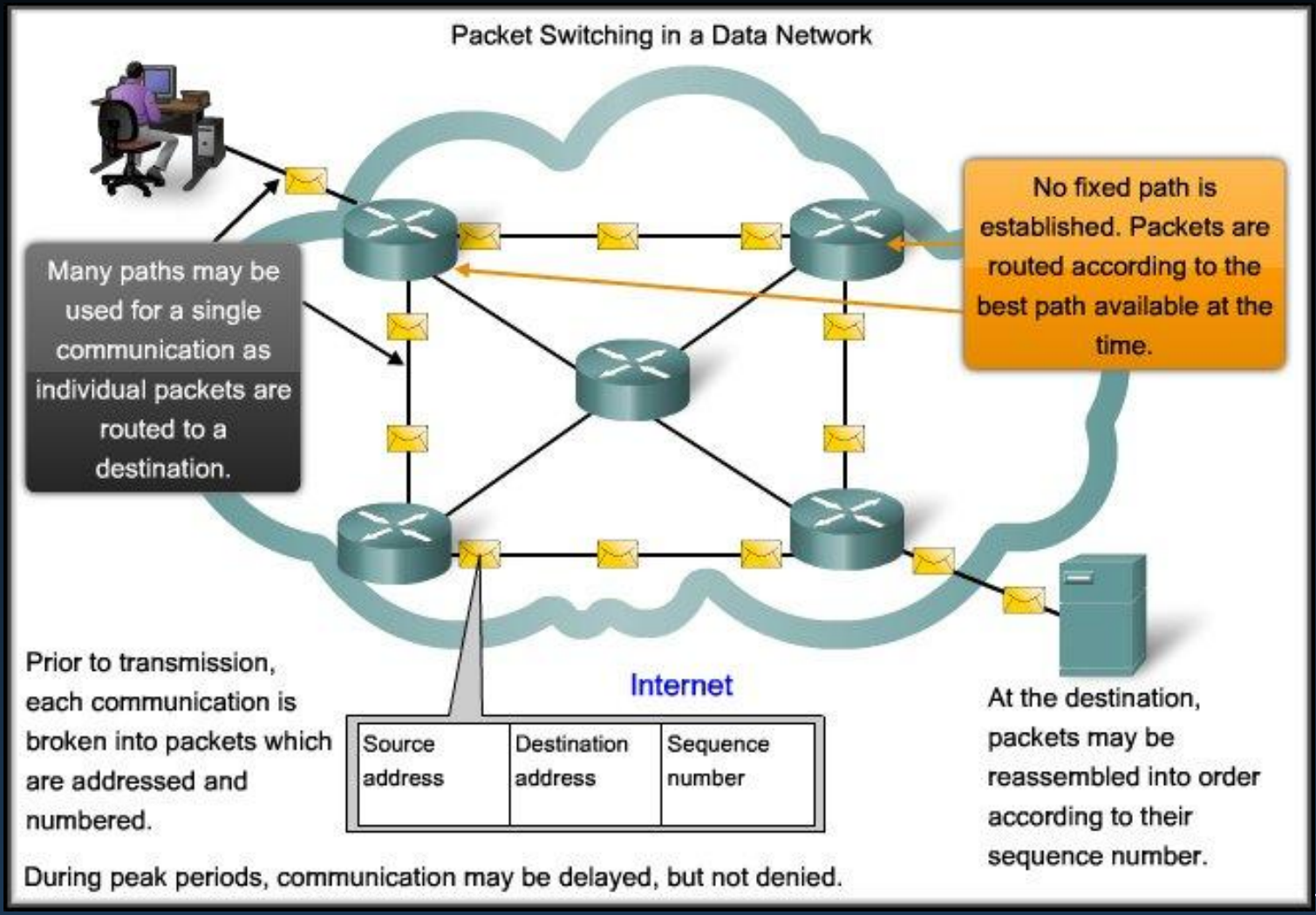
The Architecture of the Internet

Circuit Switched – Connection-Oriented Networks



The Architecture of the Internet

Packet Switched – Connectionless Networks

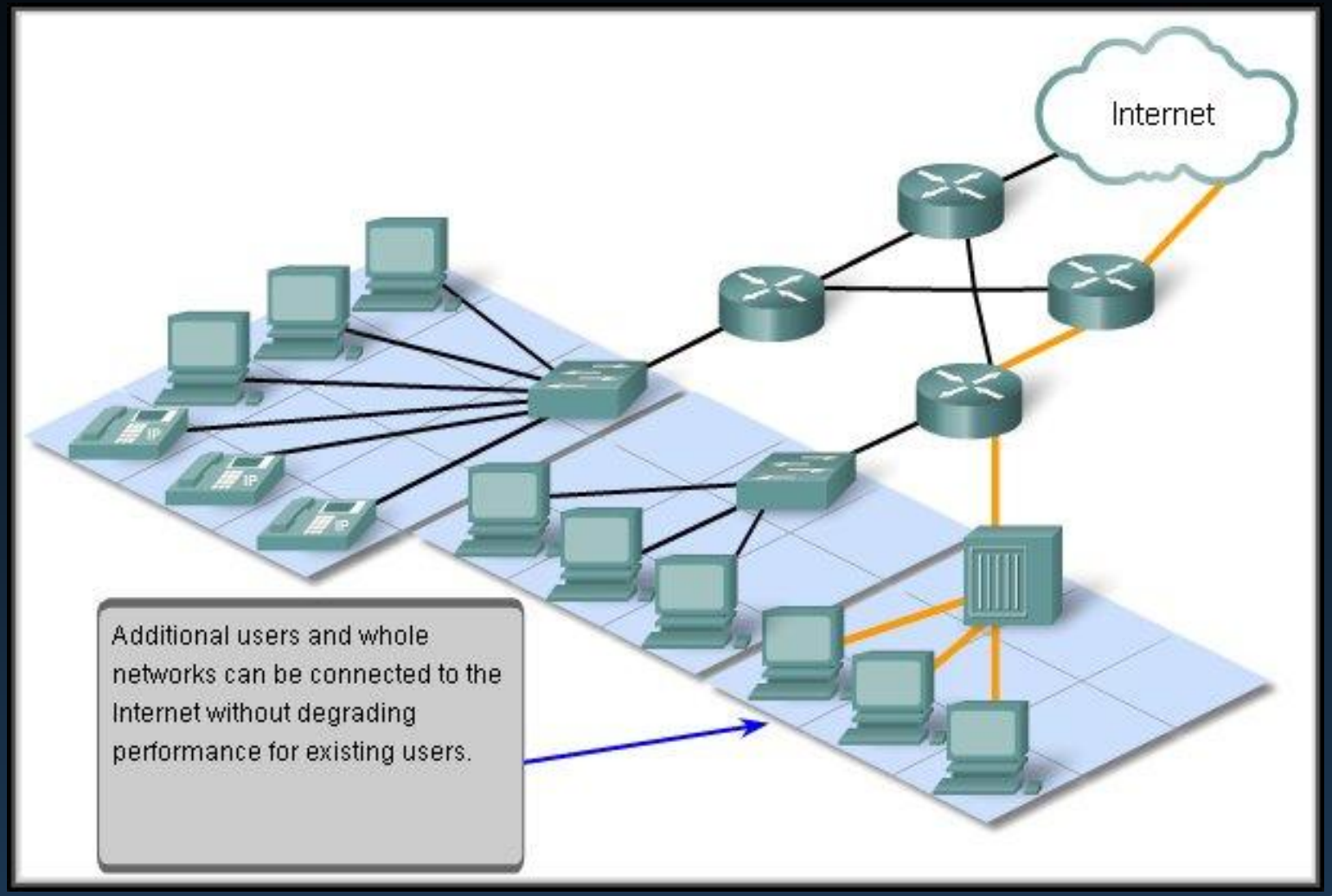


The Architecture of the Internet

Circuit Switched	Packet Switched
Connection-oriented	Connectionless
Dedicated Circuit	Shared Circuit
Guaranteed level of service (Bandwidth, QoS)	Messages divided into packets
Inefficient use of Medium	Efficient use of Medium
Single path, no redundancy	Fault Tolerant, multiple possible paths

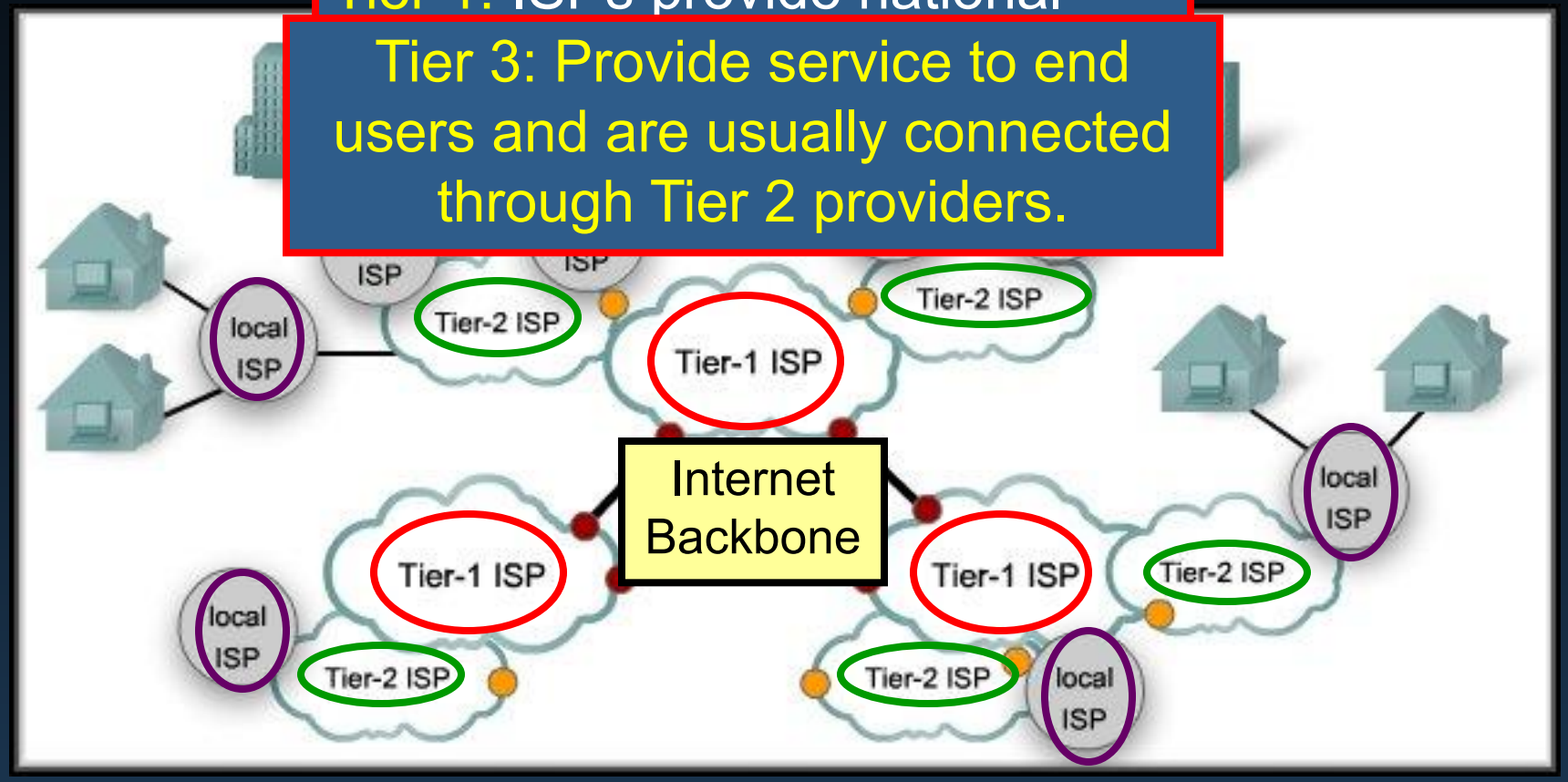
The Architecture of the Internet

Scalability



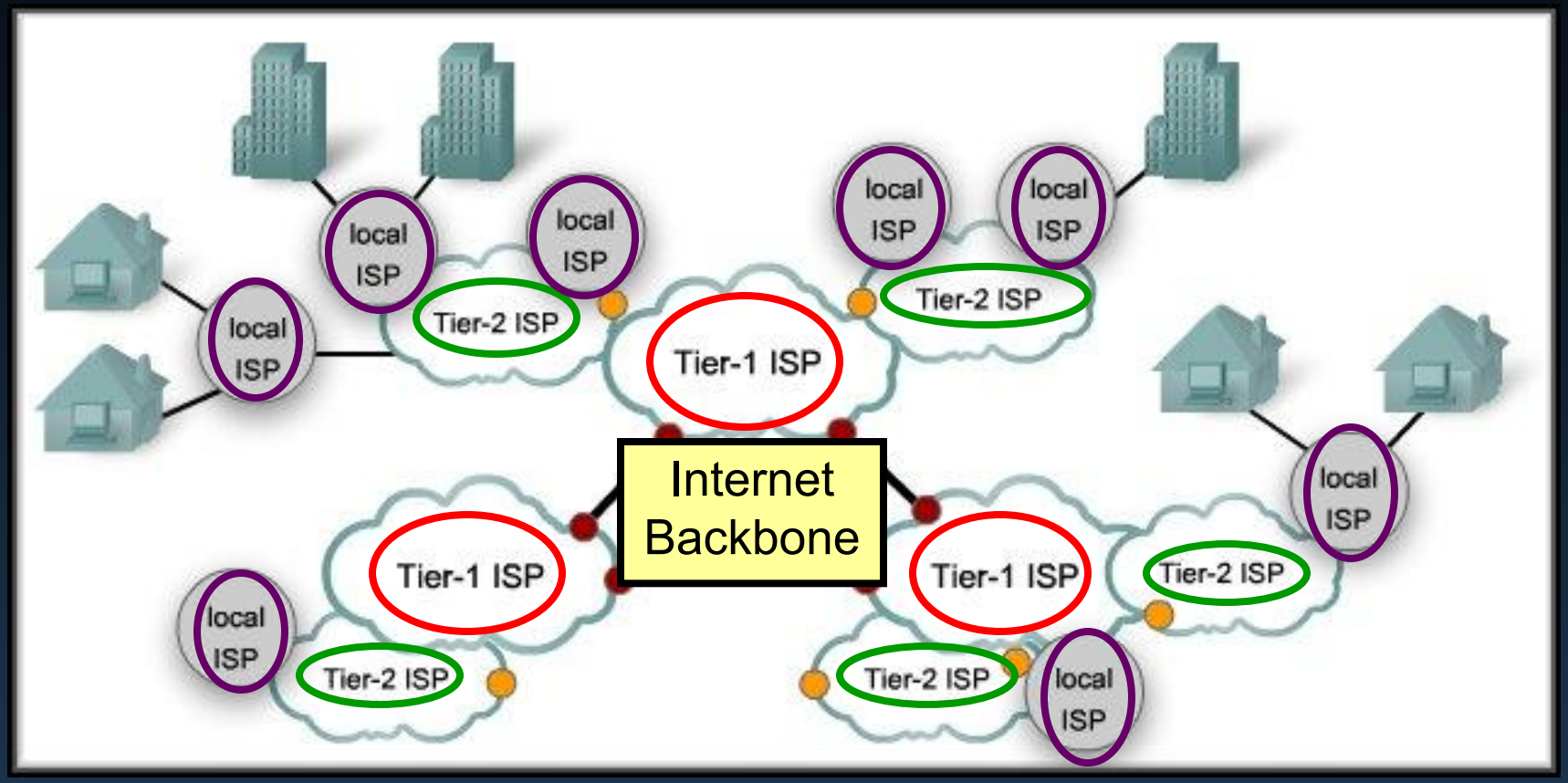
The Architecture of the Internet

- A good example of scalability is the Tier architecture of the Internet.



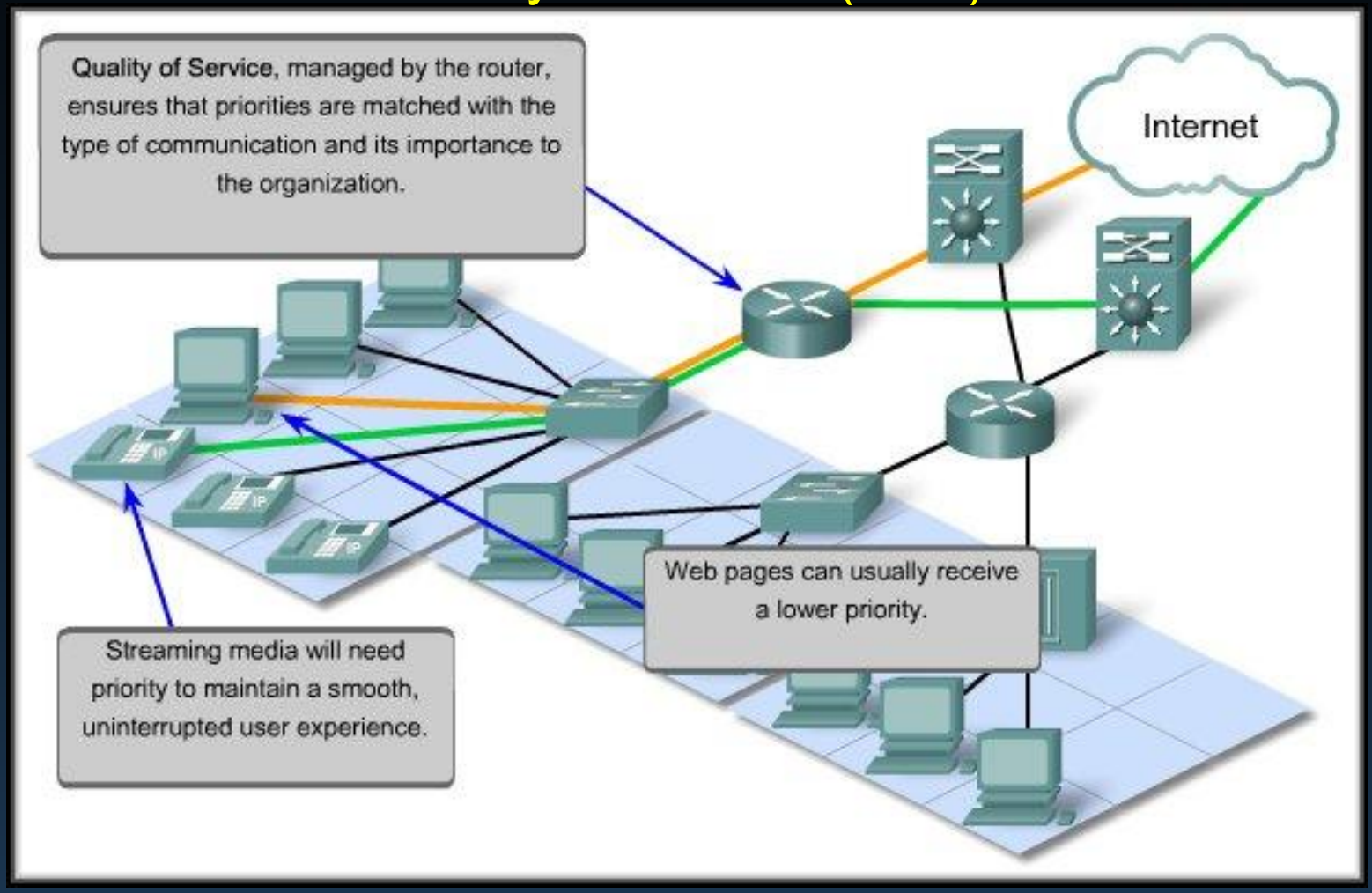
The Architecture of the Internet

- Additional providers can be added relatively easily with no disruption of current services. *THAT is scalability!*



The Architecture of the Internet

Quality of Service (QoS)



The Architecture of the Internet

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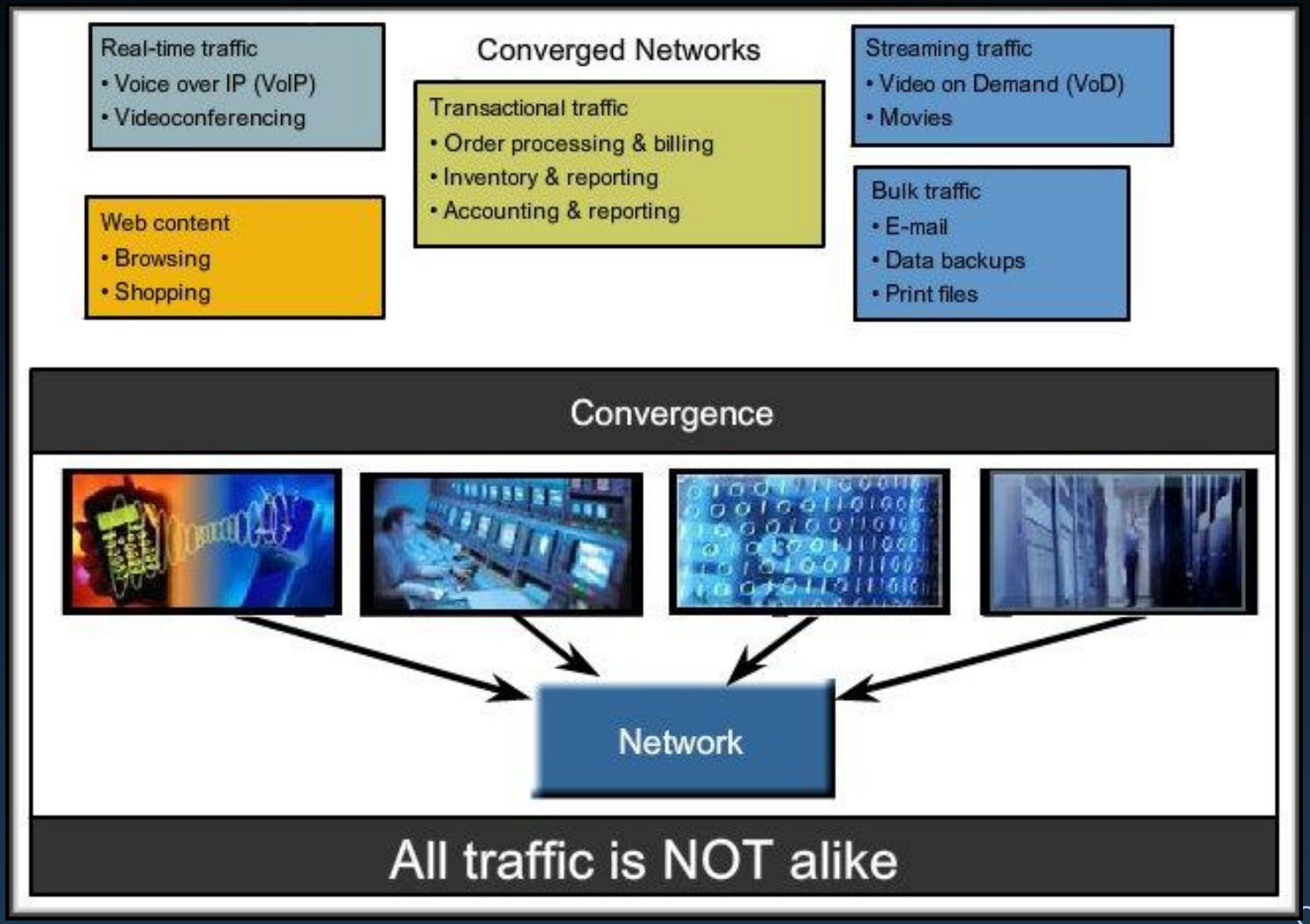
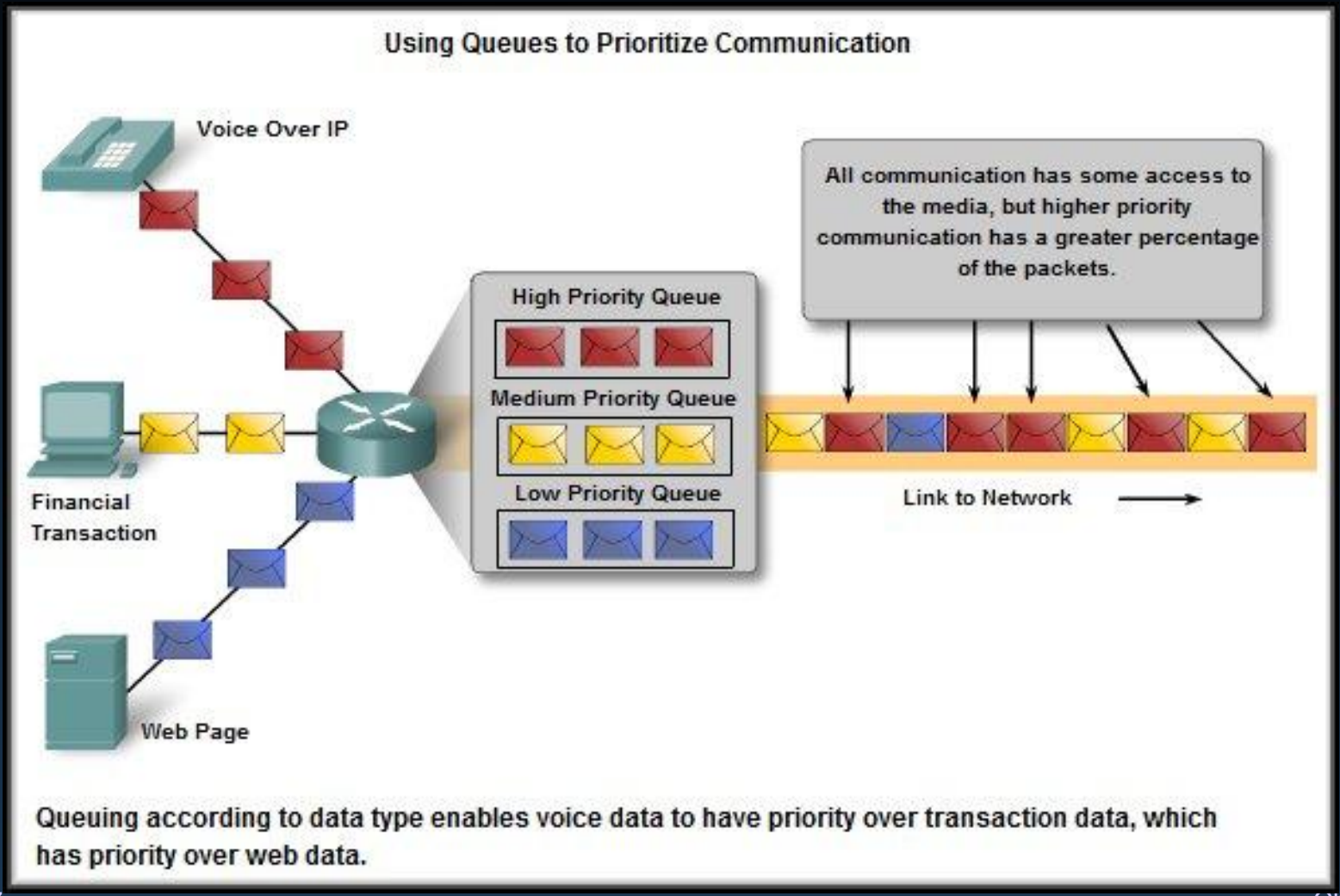


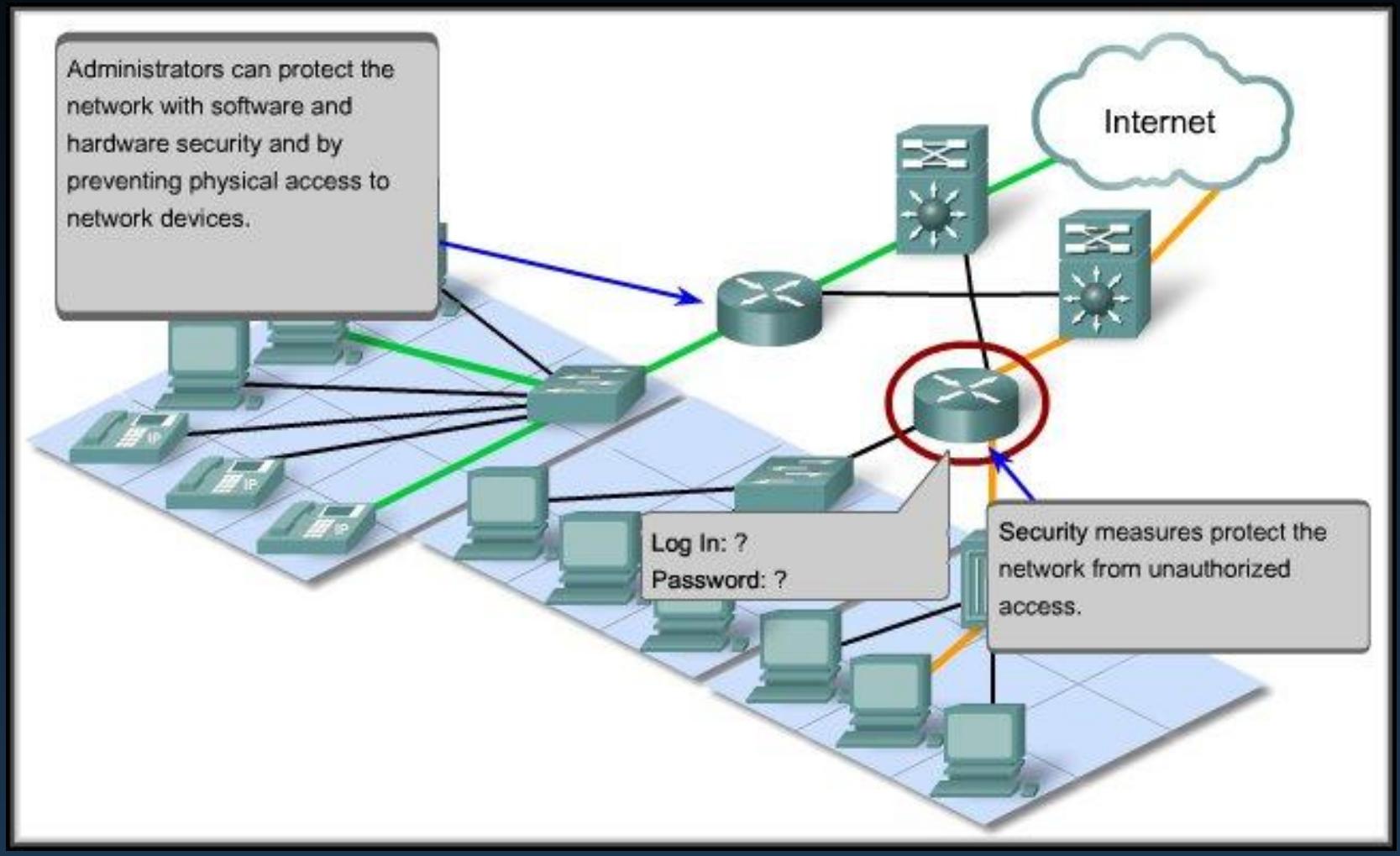
The Architecture of the Internet

Quality of Service (QoS)



The Architecture of the Internet

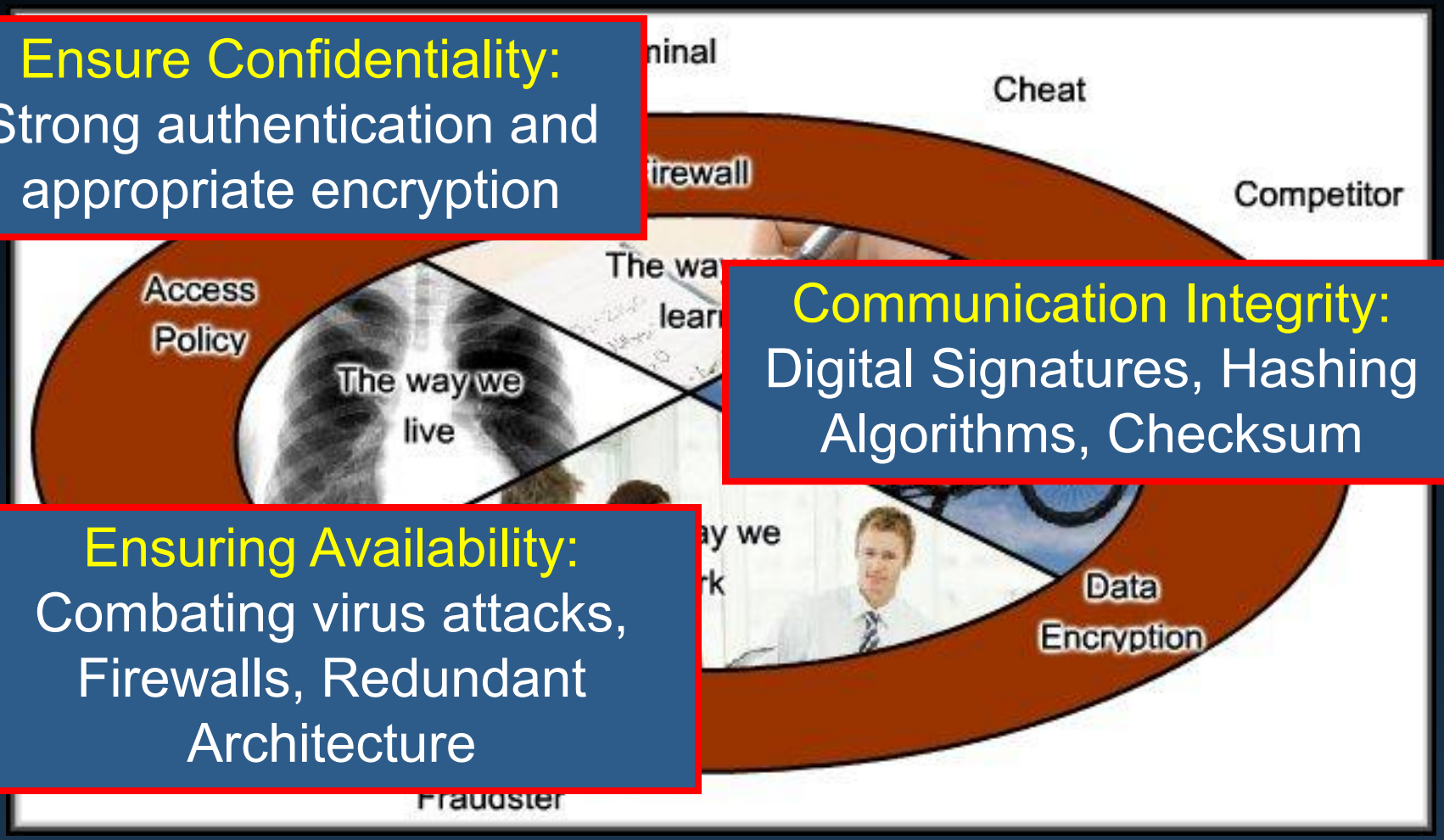
Security



The Architecture of the Internet

Security

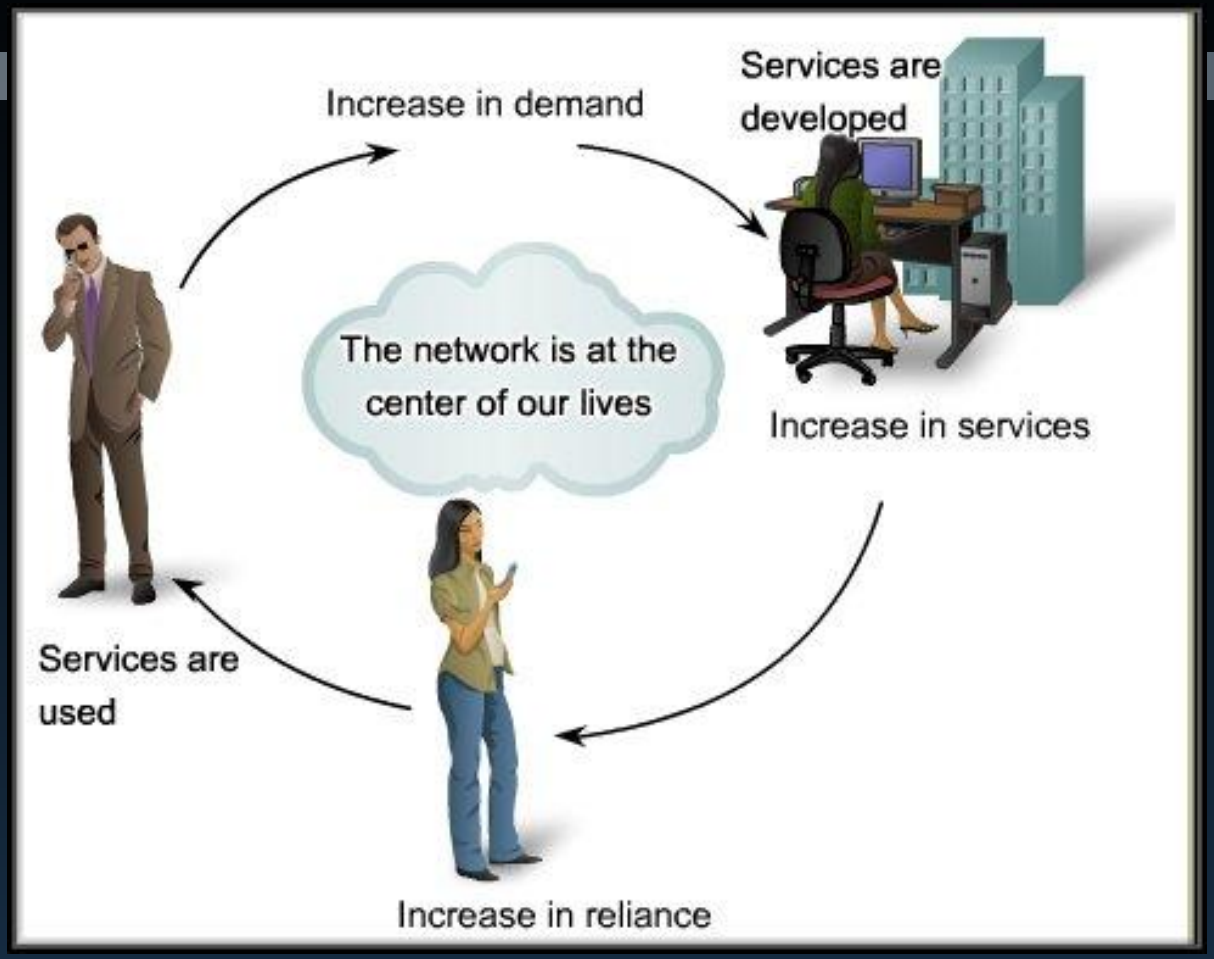
Ensure Confidentiality:
Strong authentication and appropriate encryption



Communication Integrity:
Digital Signatures, Hashing Algorithms, Checksum

Ensuring Availability:
Combating virus attacks, Firewalls, Redundant Architecture

Trends in Networking



- Increasing number of mobile users
- Proliferation of network capable devices
- Expanding range of services

Careers

- Information Technology and networking careers are growing and evolving as fast as the underlying technologies and services. As networks increase in sophistication, the demand for people with networking skills will continue to grow.

“IT” is not the Network – it IS the users.

- The IT (Information Technology) department is not the network.
- The network is the users and their:
  - Needs
  - Expectations
  - Requirements
  - Uses

If IT doesn’t find a way, the users will!

A Shift in Attitude

- Old school IT doesn't work any more.
  - We don't support MACs.
  - We can't allow that application on our network.
  - We can't give them access on our network.
  - We have too much to do already.
  - We don't support that.
  - You don't know about networks, so we can't do that.
  - That would breach our security

Technical and Soft Skills

- Networking professionals need more knowledge and skills today than ever before.
- Tomorrow's IT professionals will need even more.
- Just as important, and sometimes even more important, are the soft skills:
  - Attitude
  - Enthusiasm
  - Communications skills
  - Professionalism and Ethics