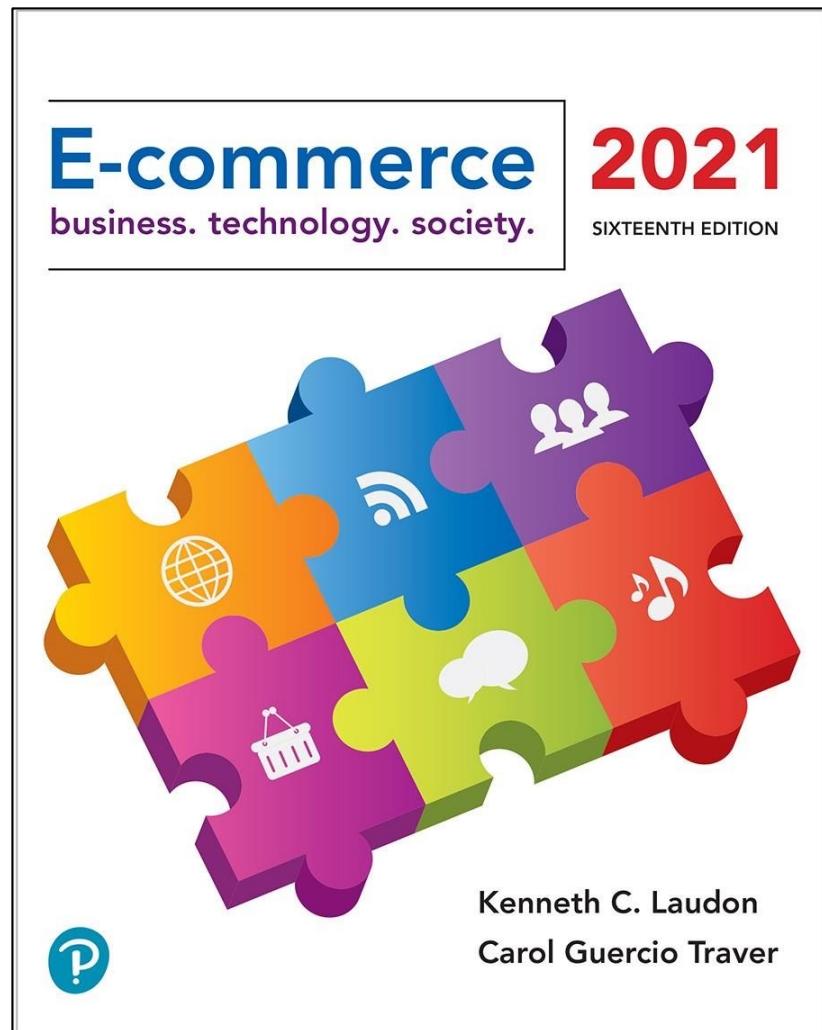


# E-COMMERCE 2021: BUSINESS. TECHNOLOGY. SOCIETY.

Sixteenth Edition



## Chapter 3

E-commerce Infrastructure:  
The Internet, Web, and  
Mobile Platform

# LEARNING OBJECTIVES

1. Discuss the origins of, and the key technology concepts behind, the Internet.
2. Explain the current structure of the Internet.
3. Understand how the Web works.
4. Describe how Internet and web features and services support e-commerce.
5. Understand the impact of mobile applications.



# THE COVID-19 PANDEMIC: WILL THE INTERNET BREAK?

## ■ Class Discussion

- How has your usage of the Internet changed as a result of the pandemic?
- Why are fears that the Internet will break misguided?
- How has the pandemic highlighted the issues raised by the “digital divide”?





## THE INTERNET: TECHNOLOGY BACKGROUND

### Internet

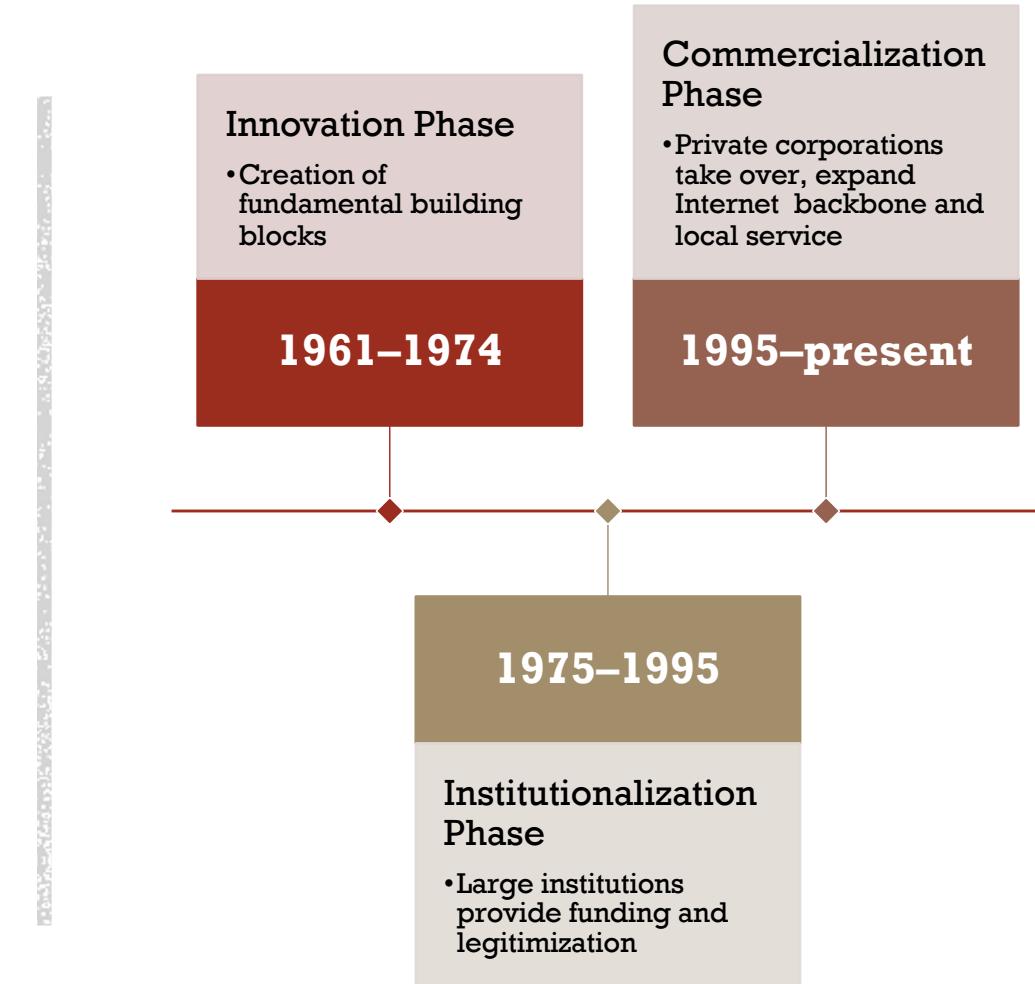
- Interconnected network of thousands of networks and millions of computers
- Links businesses, educational institutions,
- government agencies, and individuals

### World Wide Web (Web)

- One of the Internet's most popular services
- Provides access to billions, possibly trillions, of web pages

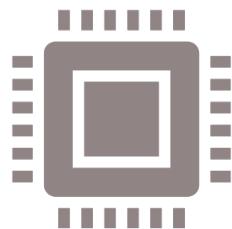
# THE EVOLUTION OF THE INTERNET

1961–PRESENT



# THE INTERNET: KEY TECHNOLOGY CONCEPTS

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**Internet defined as network that:**

- Uses IP addressing
- Supports TCP/IP
- Provides services to users, in manner similar to telephone system

**Three important concepts:**

- Packet switching
- TCP/IP communications protocol
- Client/server computing



# PACKET SWITCHING



Slices digital messages  
into packets



Sends packets along  
different communication  
paths as they become  
available



Reassembles packets  
once they arrive at  
destination



Uses routers



Less expensive, wasteful  
than circuit-switching



## FIGURE 3.3 PACKET SWITCHING

I want to communicate with you.

Original text message

10110001001101110001101

Text message digitized into bits

10110001 00110111 0001101

Digital bits broken into packets

0011001 10110001 00110111 0001101

Header information added to each packet indicating destination and other control information, such as how many bits are in the total message and how many packets



# TCP/IP

## Transmission Control Protocol (TCP)

- Establishes connections among sending and receiving Web computers
- Handles assembly of packets at point of transmission,
- and reassembly at receiving end

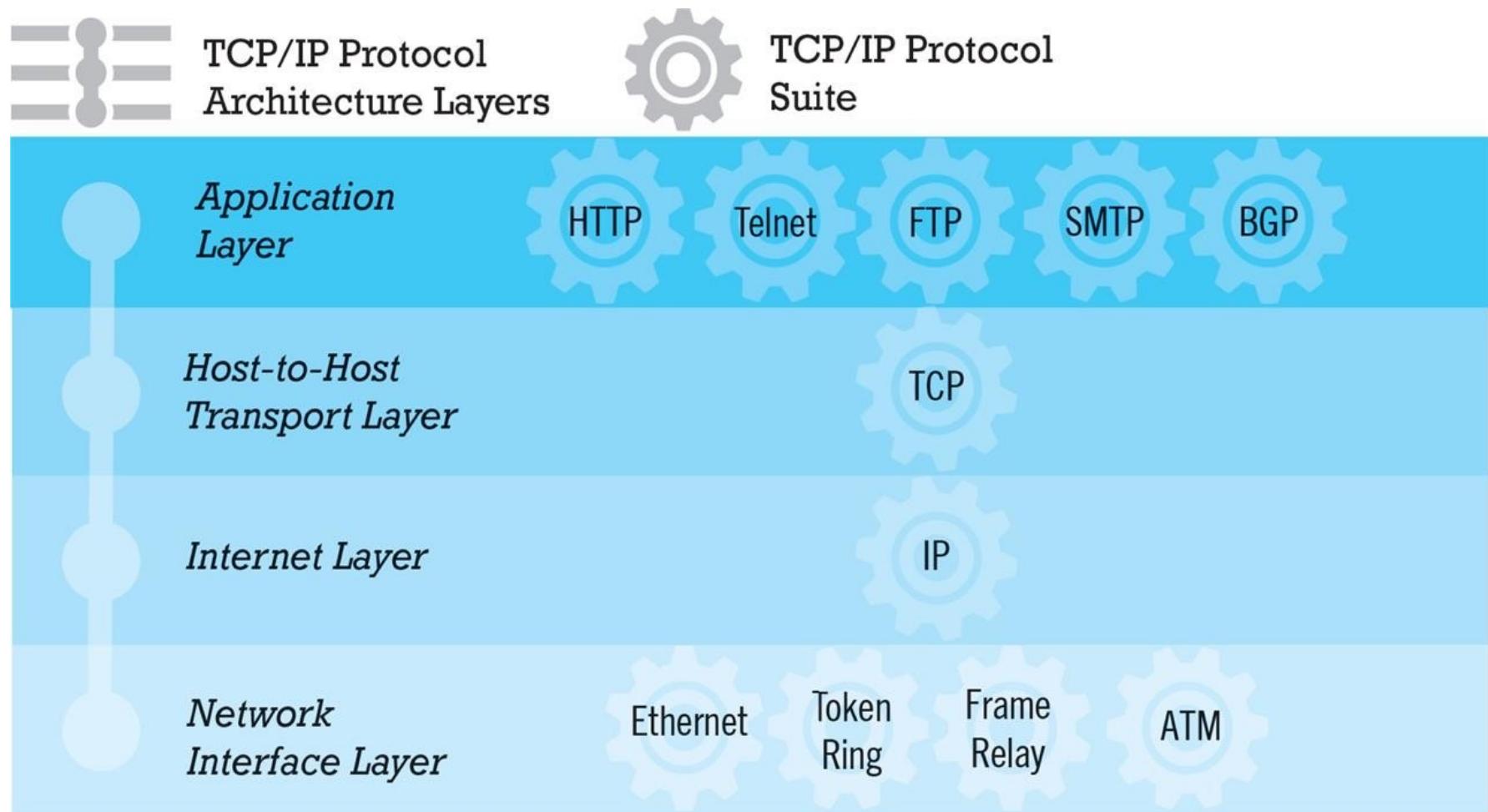
## Internet Protocol (IP)

## Four TCP/IP layers

- Network interface layer
- Internet layer
- Transport layer
- Application layer



# FIGURE 3.4 THE TCP/IP ARCHITECTURE AND PROTOCOL SUITE



# INTERNET (IP) ADDRESSES

## IPv4

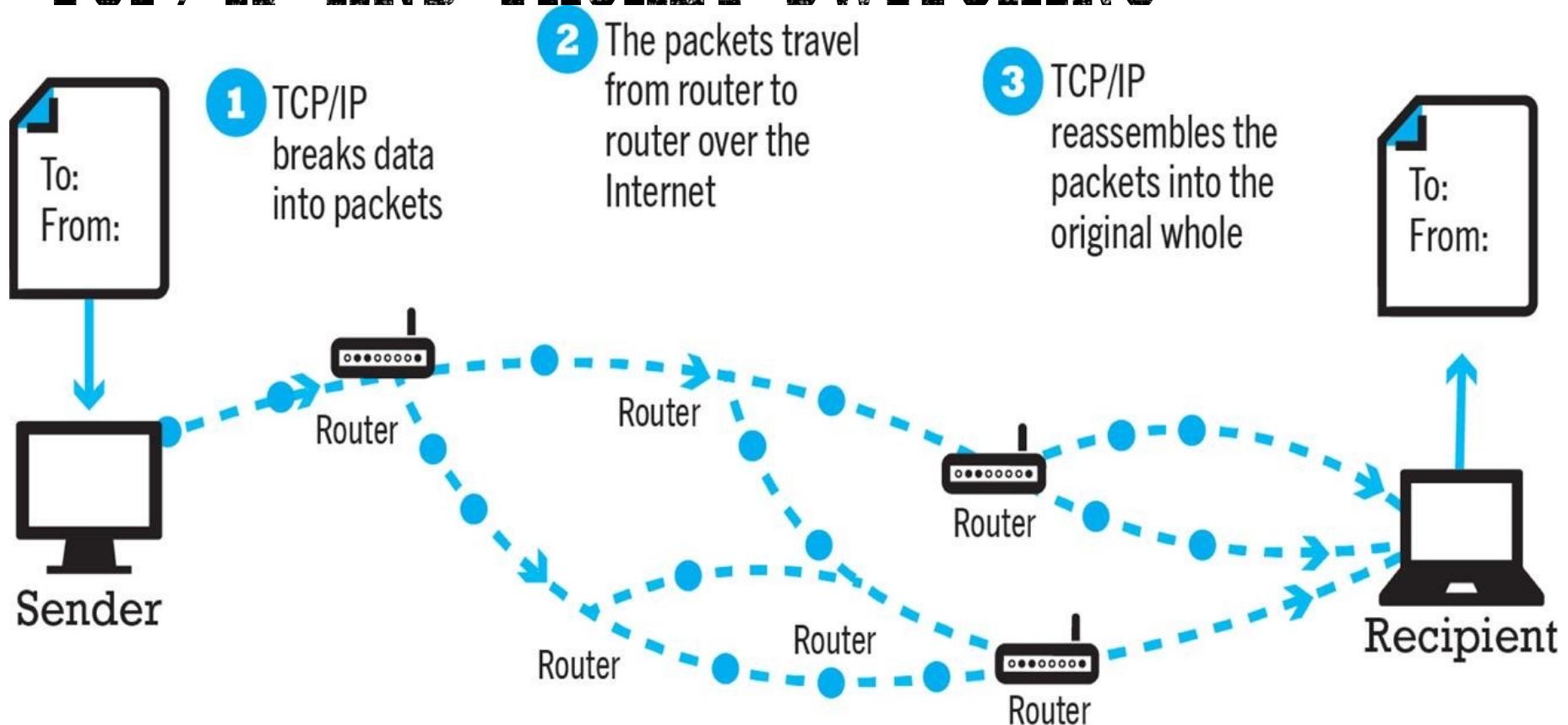
- 32-bit number
- Four sets of numbers marked off by periods: 201.61.186.227
  - Class C address: Network identified by first three sets, computer identified by last set

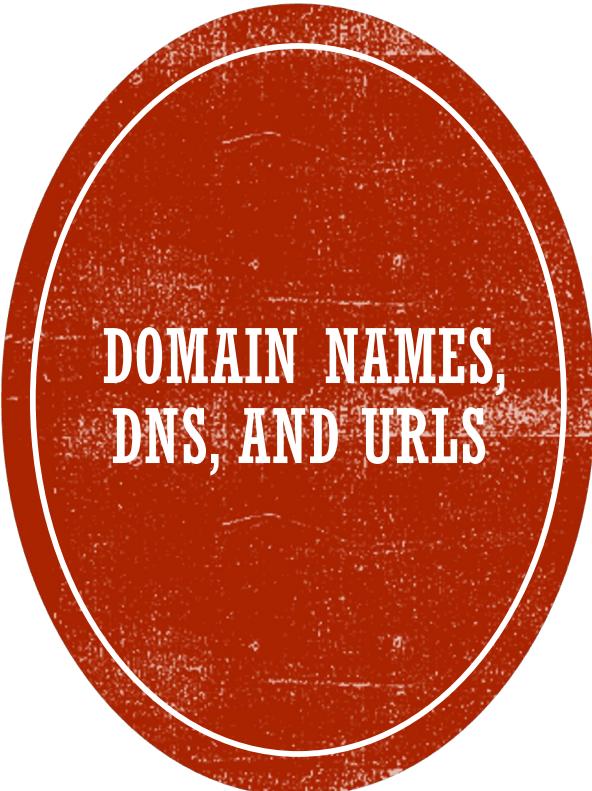
## IPv6

- 128-bit addresses, able to handle up to 1 quadrillion addresses (IPv4 can handle only 4 billion)



# FIGURE 3.5 ROUTING INTERNET MESSAGES: TCP/IP AND PACKET SWITCHING





## DOMAIN NAMES, DNS, AND URLs

### Domain name

- IP address expressed in natural language

### Domain name system (DNS)

- Allows numeric IP addresses to be expressed in natural language

### Uniform resource locator (URL)

- Address used by web browser to identify location of content on the Web



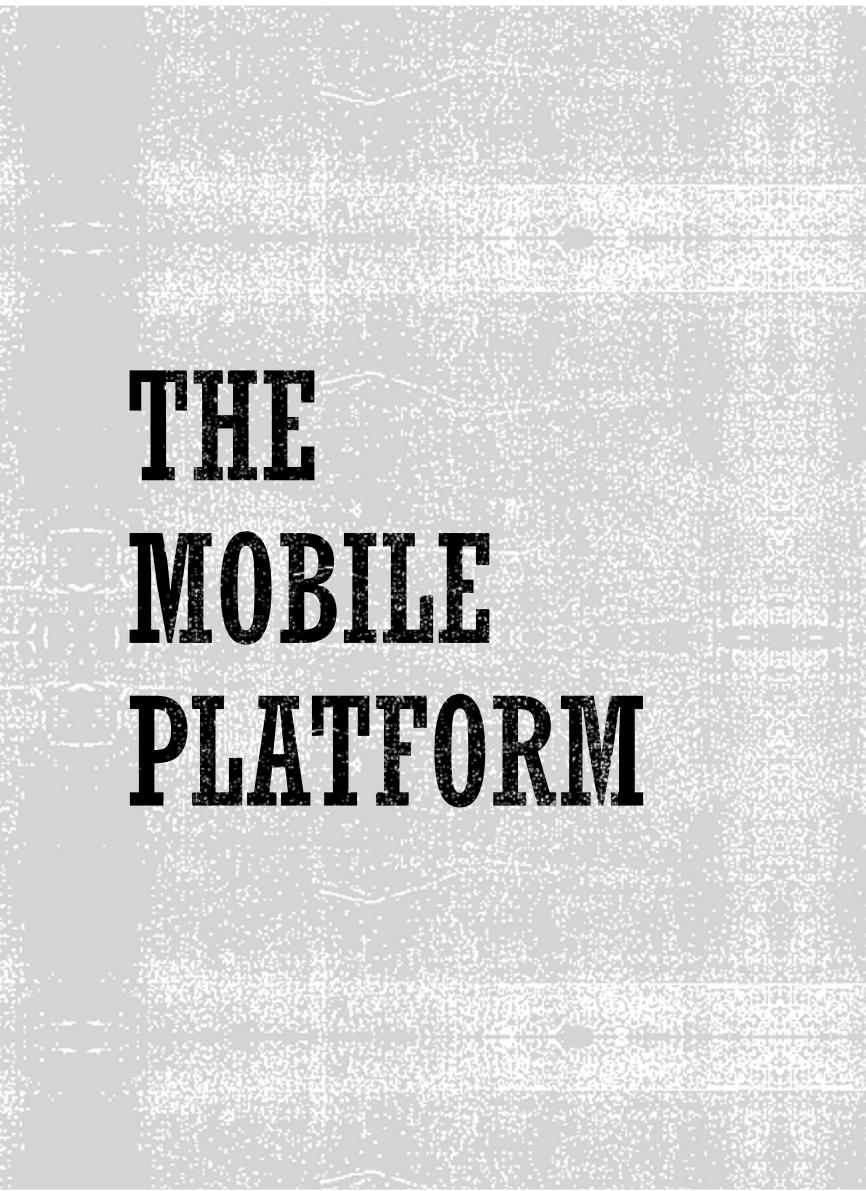
Powerful desktop computers (clients) connected in network with one or more servers

Servers perform common functions for the clients

Storing files

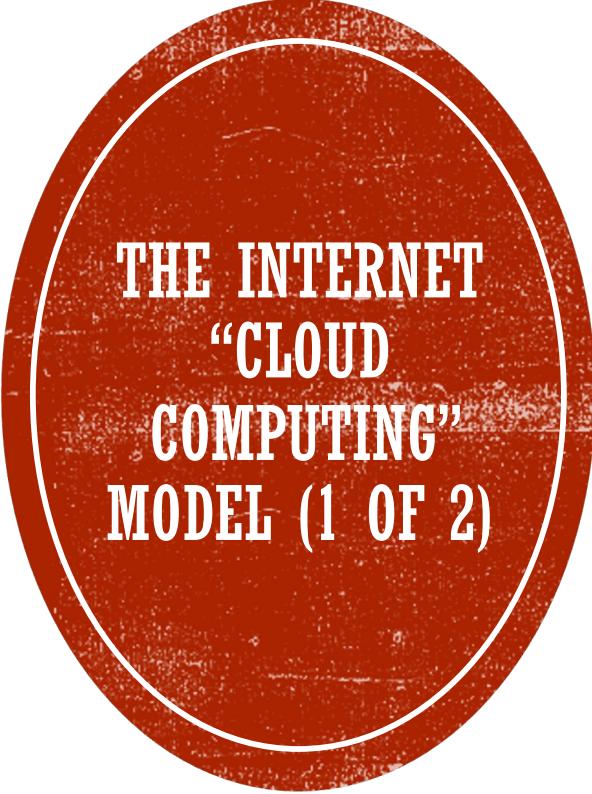
Software applications

Access to printers, and so on



# THE MOBILE PLATFORM

- Primary Internet access is now through smartphones and tablets
- Smartphones are a disruptive technology
  - New processors and operating systems
  - Over 245 million in U.S. access Internet with mobile phone
- Tablets supplement PCs for mobile situations
  - Over 170 million in U.S. use Internet with tablets



## **THE INTERNET “CLOUD COMPUTING” MODEL (1 OF 2)**

- Firms and individuals obtain computing power and software over Internet
- Three types of services
  - Infrastructure as a service (IaaS)
  - Software as a service (SaaS)
  - Platform as a service (PaaS)
- Public, private, and hybrid clouds

# THE INTERNET “CLOUD COMPUTING” MODEL (2 OF 2)

## Drawbacks

- Security risks
- Shifts responsibility for storage and control to providers

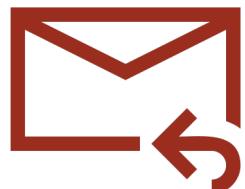
Radically reduces costs of:

- Building and operating websites
- Infrastructure, IT support
- Hardware, software



# OTHER INTERNET PROTOCOLS AND UTILITY PROGRAMS

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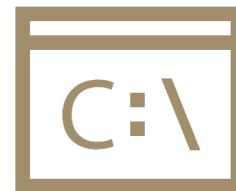


## Internet protocols

HTTP

E-mail: SMTP, POP3, IMAP

FTP, Telnet, SSL/TLS

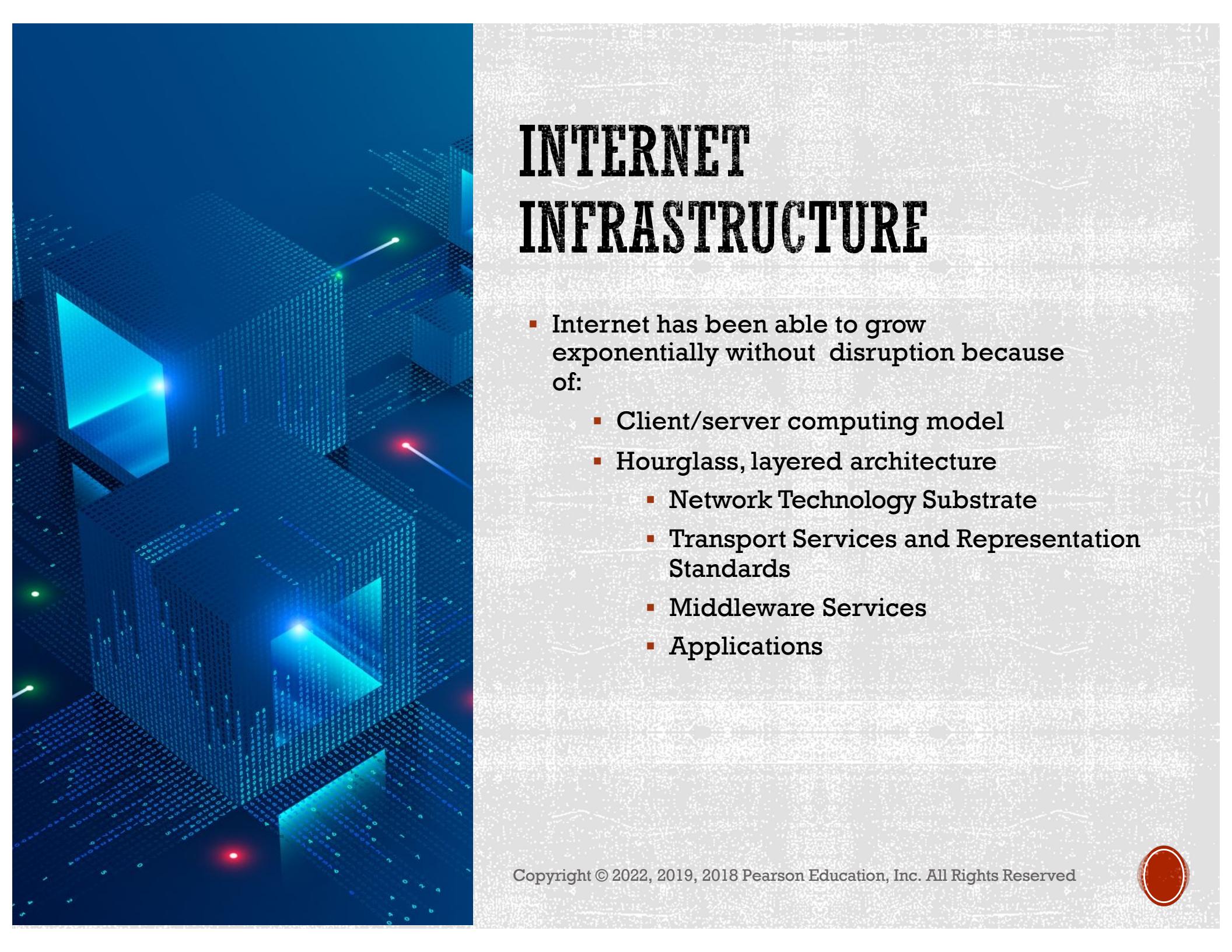


## Utility programs

Ping

Tracert



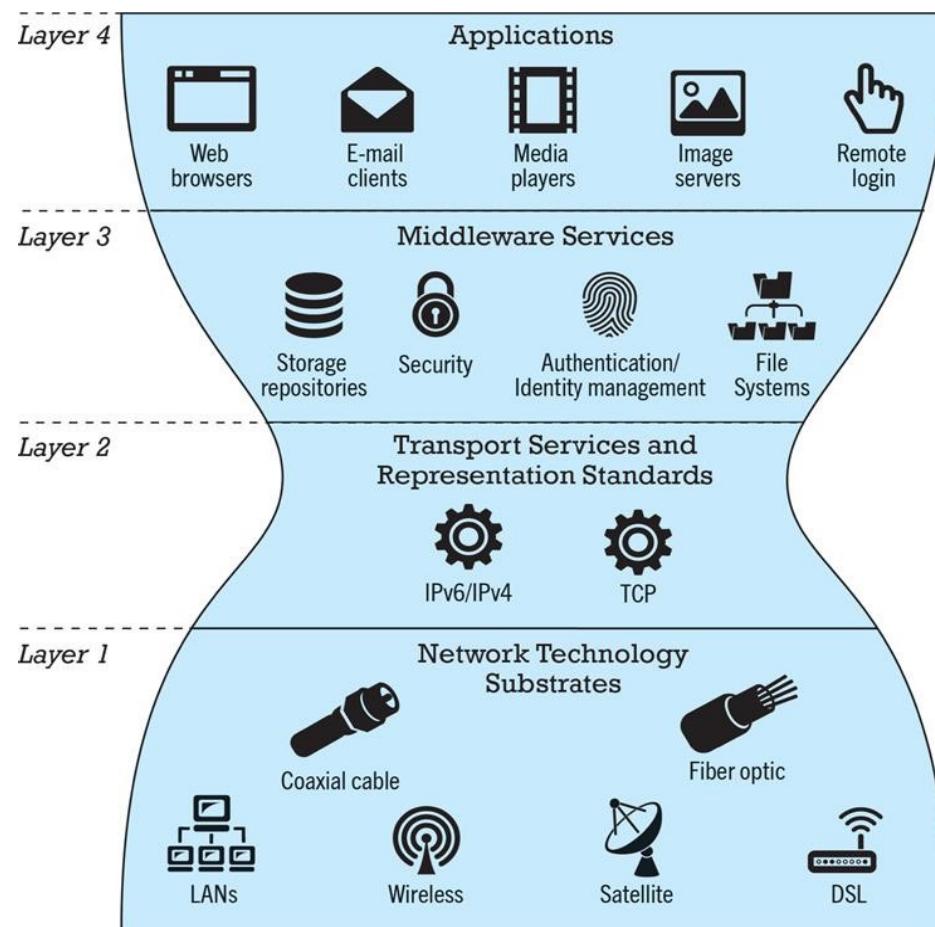
A dark blue abstract background representing a digital network or data flow. It features a grid of glowing blue and white binary digits (0s and 1s) forming a three-dimensional perspective space. Several bright, glowing blue and red arrows point through the grid, suggesting data packets moving along a path. The overall effect is futuristic and represents the complex nature of the Internet's infrastructure.

# INTERNET INFRASTRUCTURE

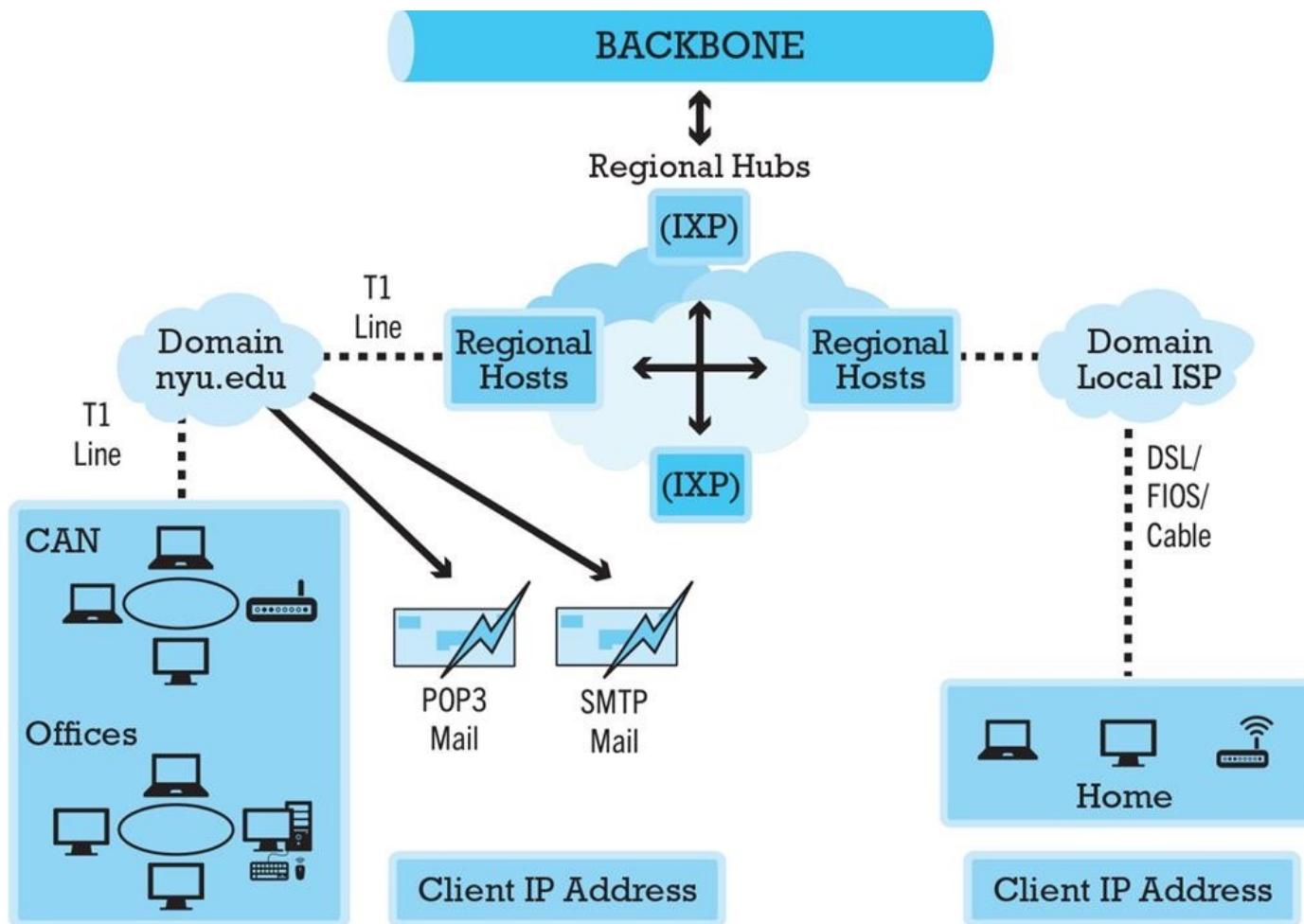
- Internet has been able to grow exponentially without disruption because of:
  - Client/server computing model
  - Hourglass, layered architecture
    - Network Technology Substrate
    - Transport Services and Representation Standards
    - Middleware Services
    - Applications



# FIGURE 3.10 THE HOURGLASS MODEL OF THE INTERNET



# FIGURE 3.11 INTERNET NETWORK ARCHITECTURE

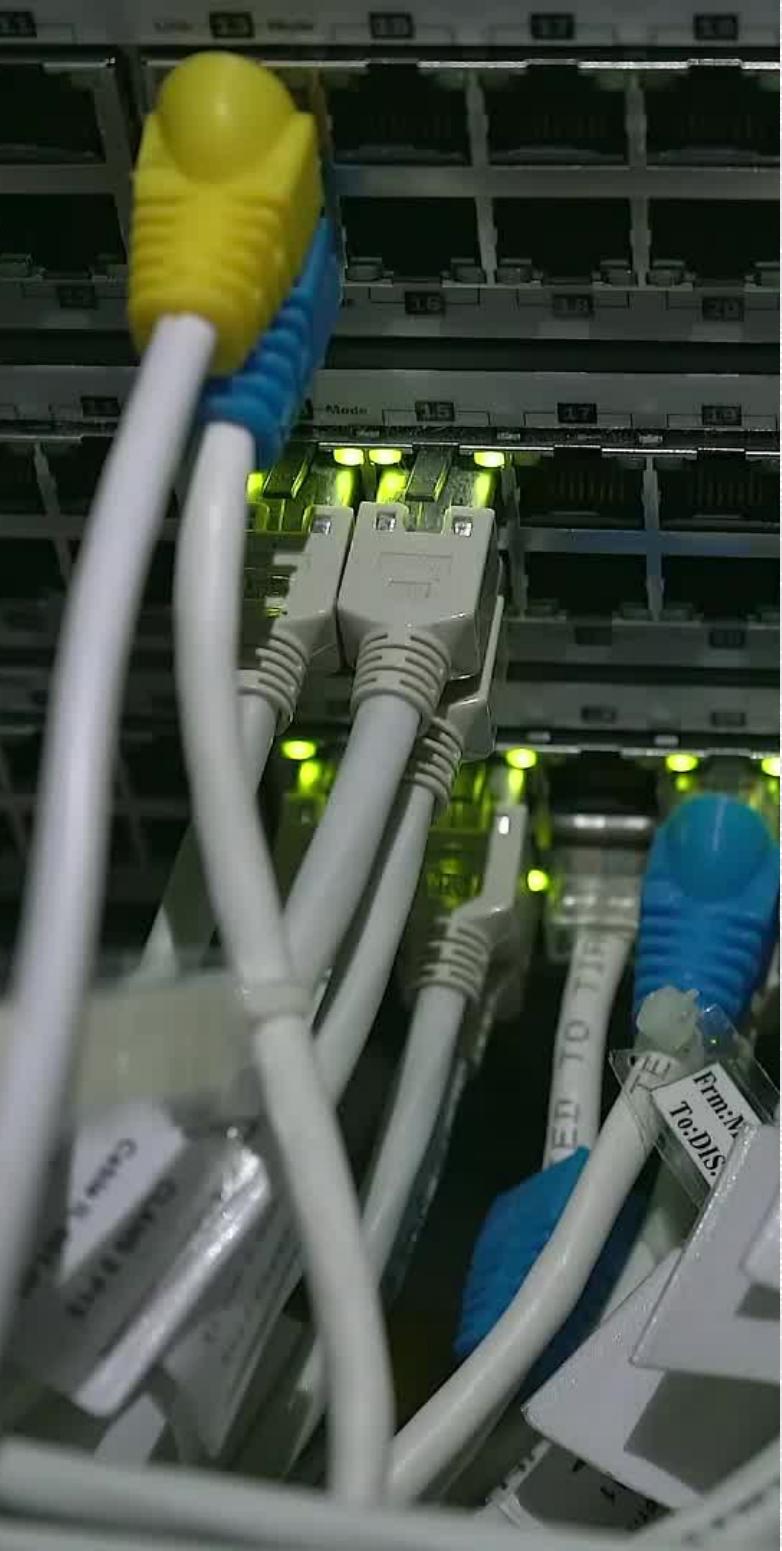




# THE INTERNET BACKBONE

- Comprised of fiber-optic cable: hundreds of glass strands that use light to transmit data
  - Faster speeds and greater bandwidth
  - Thinner, lighter cables
  - Less interference
  - Better data security
- Tier 1 Internet Service Providers (Tier 1 ISPs) or transit ISPs
- Numerous private networks physically connected to each other
- Undersea fiber optics, satellite links





# INTERNET EXCHANGE POINTS (IXPS)

- Regional hubs where Tier 1 ISPs physically connect with one another and with regional Tier 2 ISPs.
- Tier 2 ISPs provide Tier 3 ISPs with Internet access.
- Originally called Network Access Points (NAPs) or Metropolitan Area Exchanges (MAEs).



# TIER 3 INTERNET SERVICE PROVIDERS

## Retail providers

- Lease Internet access to homeowners, small businesses
- Large providers: Comcast, Charter Spectrum, AT&T,
- Verizon, Altice (Optimum)
- Smaller local providers

## Services

- Narrowband
- Broadband
- Digital subscriber line (DSL)
- Cable Internet
- Satellite Internet



# **CAMPUS/CORPORATE AREA NETWORKS**

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**Local area networks operating  
within single organization, such  
as NYU or Microsoft Corporation**

---

**Lease Internet access directly  
from regional and national  
carriers**





# MOBILE INTERNET ACCESS

- Two basic types of wireless Internet access:
  - Telephone-based (mobile phones, smartphones)
  - Computer network-based (wireless local area network-based)
- Telephone-based wireless Internet access
  - Currently based on 3G and 4G technologies
  - 5G will provide higher bandwidth with speeds
  - reaching 10 Gbps or more



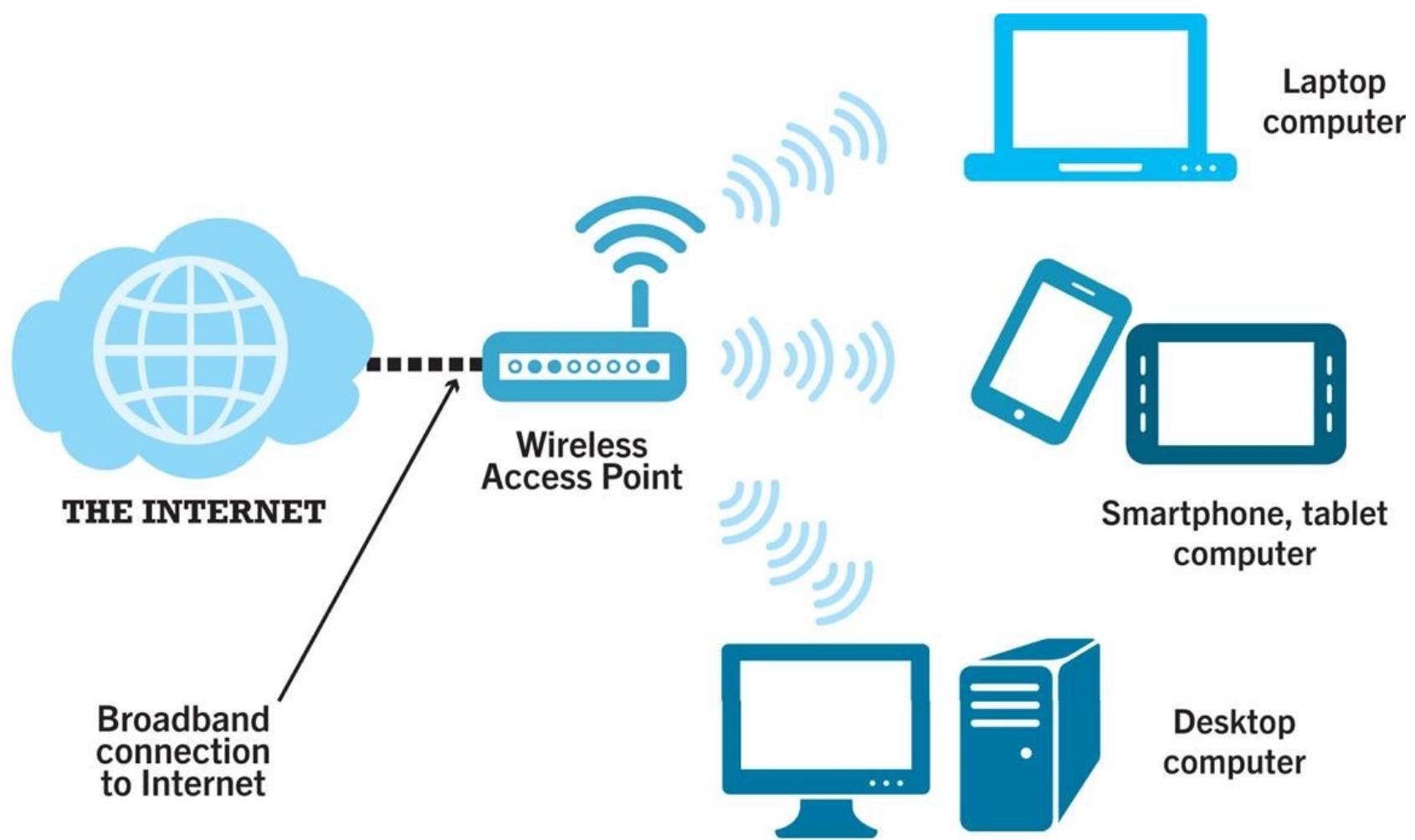


# WIRELESS LOCAL AREA NETWORK (WLAN) - BASED INTERNET ACCESS

- Wi-Fi (various 802.11 standards)
  - High-speed, fixed broadband wireless LAN (WLAN)
  - Wireless access point ("hot spots")
  - Limited range but inexpensive
- WiMax
- Bluetooth



## FIGURE 3.13 WI-FI NETWORKS



# OTHER INNOVATIVE INTERNET ACCESS TECHNOLOGIES: DRONES, BALLOONS, AND WHITE SPACE

- Google: Project Loon
- Facebook: Facebook Connectivity Lab/Aquila drone
- Microsoft: Airband Initiative (white spaces)





# THE INTERNET OF THINGS (IOT)

- Objects connected via sensors/RFID to the Internet
- “Smart things”
- Interoperability issues and standards
- Security and privacy concerns



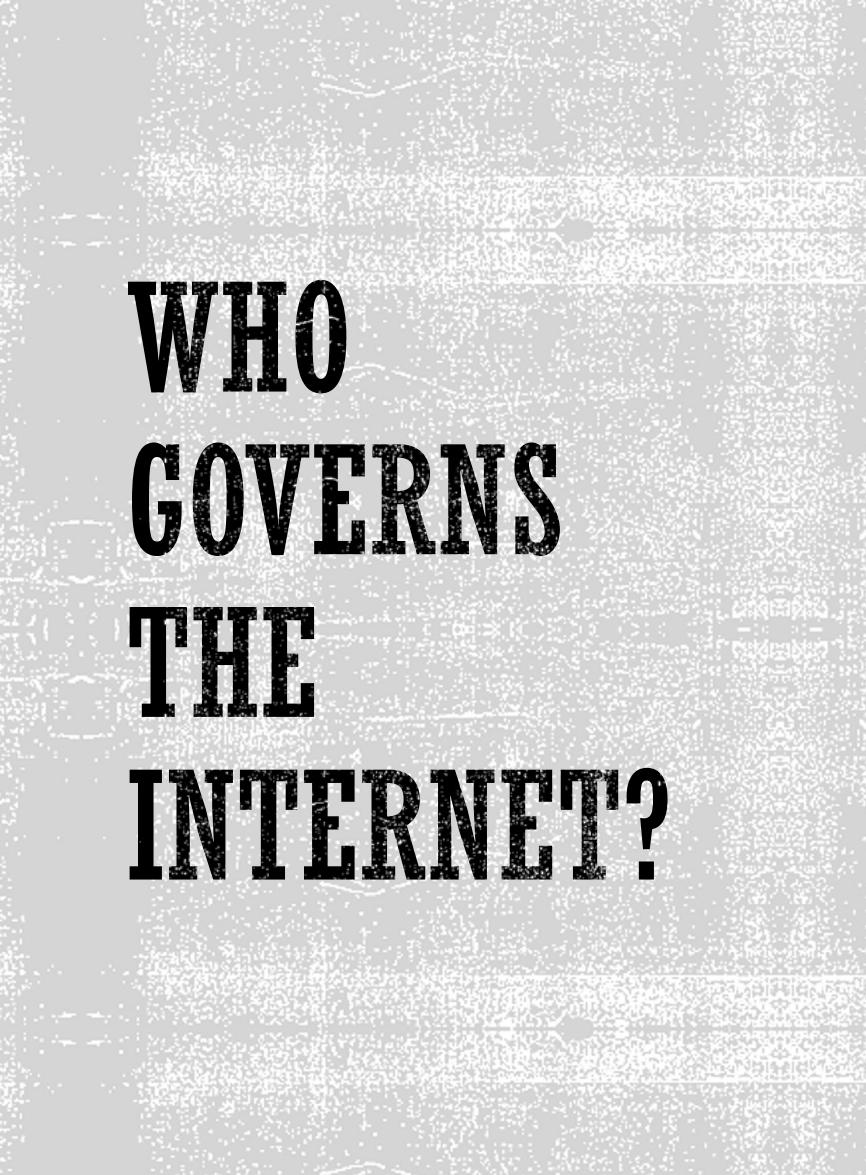


# INSIGHT ON BUSINESS: THE APPLE WATCH: BRINGING THE INTERNET OF THINGS TO YOUR WRIST

- Class Discussion

- Are you or anyone you know using the Apple Watch? If not, why not? If so, what apps do you use most?
- What are the potential benefits of wearable technology? Are there any disadvantages?
- What effects will features like the Apple Pay button and Taptic Engine have?
- Are there any privacy issues raised by wearable technology?





# WHO GOVERNS THE INTERNET?

- Organizations that influence the Internet and monitor its operations include:
  - Internet Corporation for Assigned Names and Numbers (ICANN)
  - Internet Engineering Task Force (IETF)
  - Internet Research Task Force (IRTF)
  - Internet Engineering Steering Group (IESG)
  - Internet Architecture Board (IAB)
  - Internet Society (ISOC)
  - Internet Governance Forum (IGF)
  - World Wide Web Consortium (W3C)
  - Internet Network Operators Groups (NOGs)

# **INSIGHT ON SOCIETY: GOVERNMENT REGULATION AND SURVEILLANCE OF THE INTERNET**

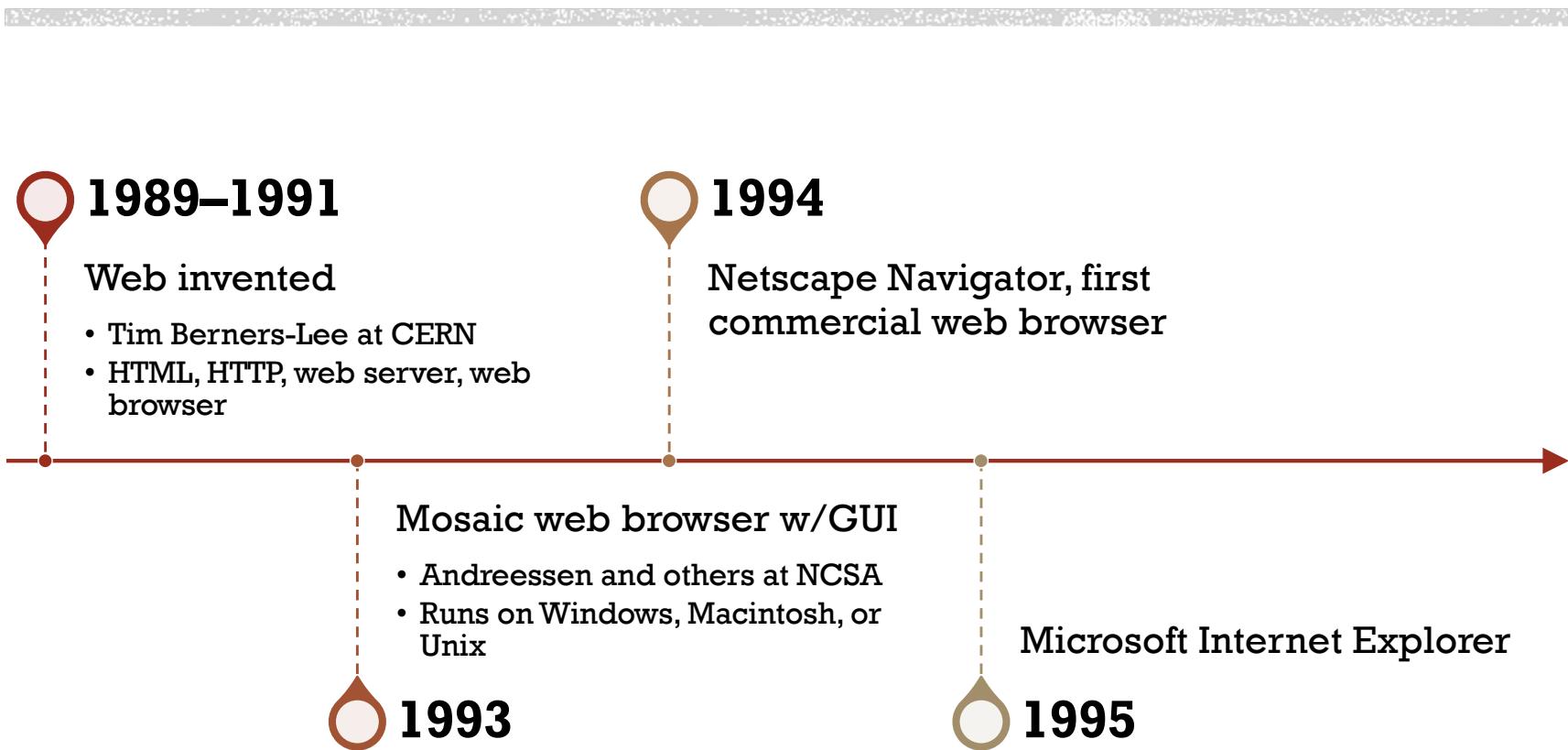
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## **Class discussion:**

- How is it possible for any government to “control” or censor the Web?
- Does the Chinese government, or the U.S. government, have the right to censor online content?
- How should U.S. companies deal with governments that want to censor content?
- What would happen to e-commerce if the existing Web split into a different Web for each country?



# THE WEB



# HYPERTEXT

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Text formatted with embedded links

- Links connect documents to one another, and to other objects such as sound, video, or animation files

Uses Hypertext Transfer Protocol (HTTP) and URLs to locate resources on the Web

- Example URL:  
<http://megacorp.com/content/features/082602.html>



# MARKUP LANGUAGES

- Hypertext Markup Language (HTML)
  - Fixed set of pre-defined markup “tags” used to format text
  - Controls look and feel of web pages
  - Used in conjunction with CSS (Cascading Style Sheets)
  - HTML5 the newest version
- eXtensible Markup Language (XML)
  - Designed to describe data and information
  - Tags used are defined by user

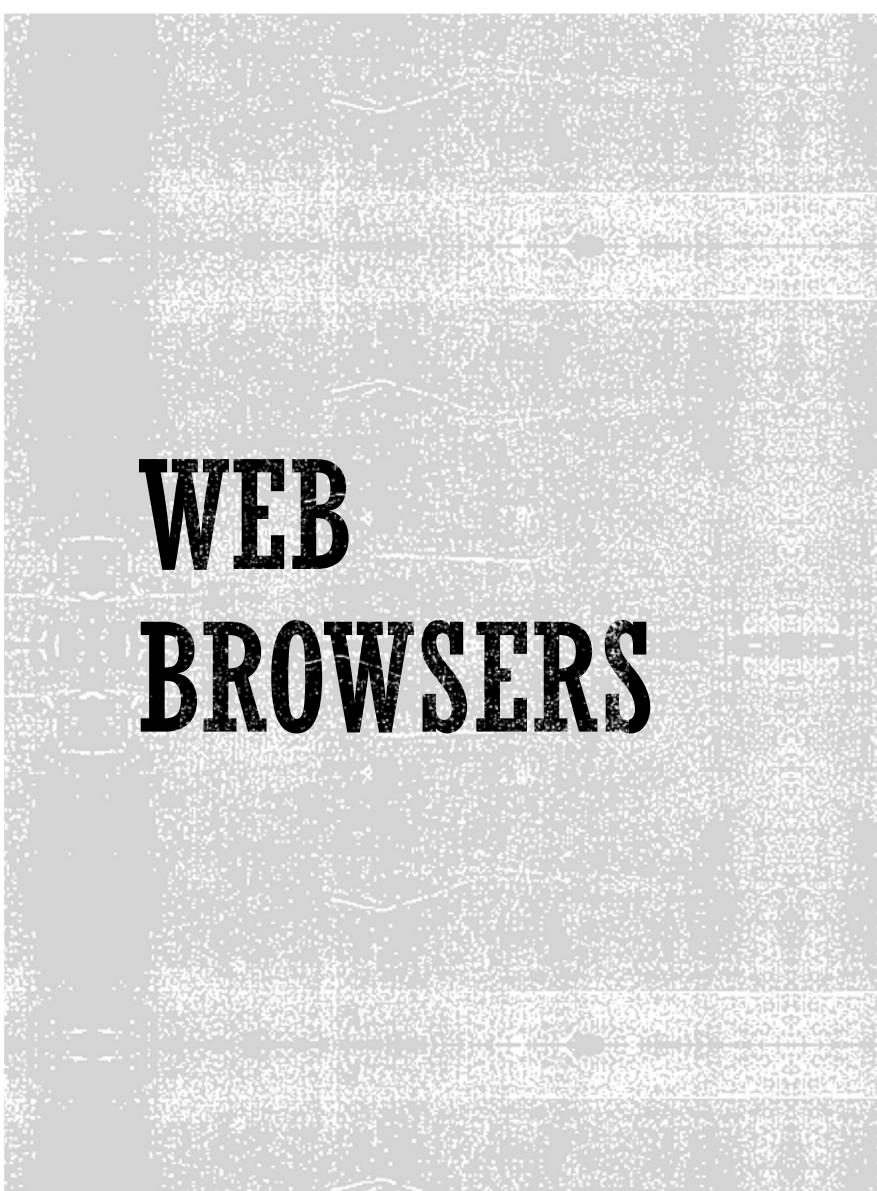




# WEB SERVERS AND WEB CLIENTS

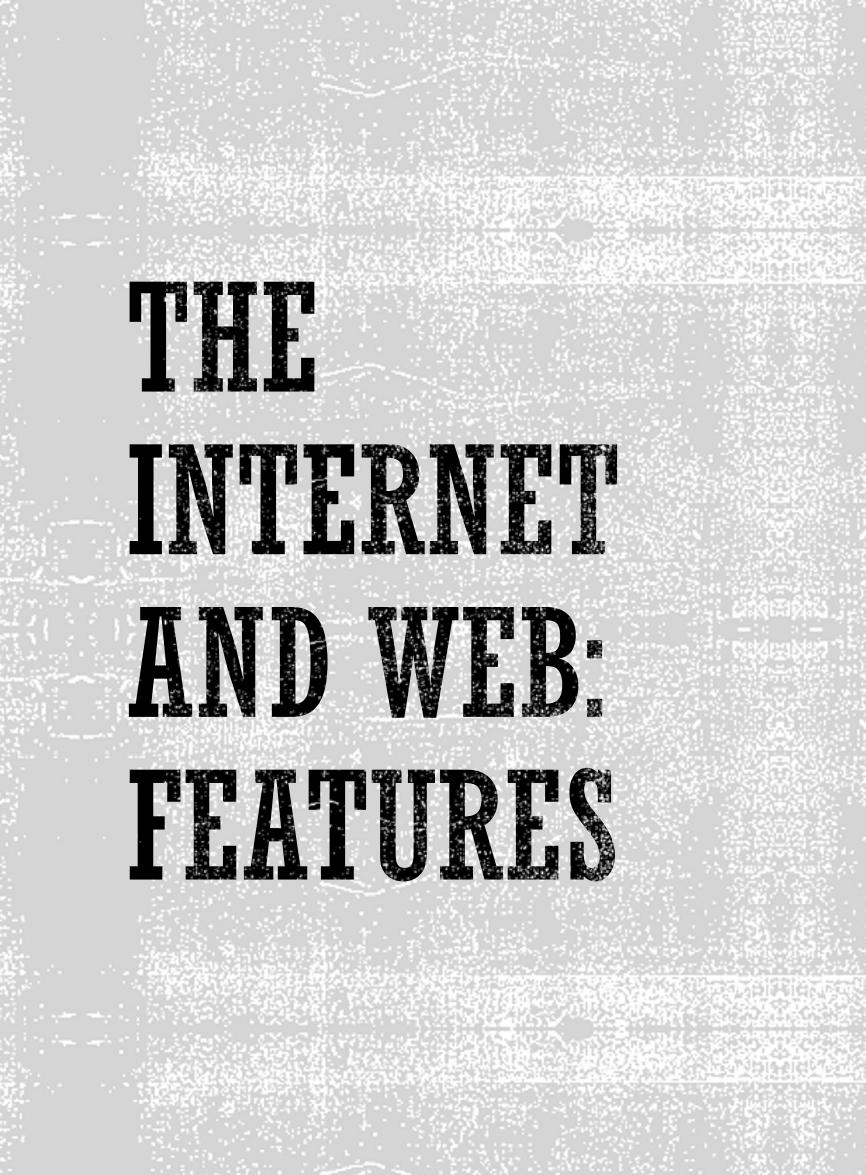
- **Web server software**
  - Enables a computer to deliver web pages to clients on a network that request this service by sending an HTTP request
  - Basic capabilities: Security services, FTP, search engine, data capture
- **Web server**
  - May refer to either web server software or physical server
  - Specialized servers: Database servers, ad servers, and so on
- **Web client**
  - Any computing device attached to the Internet that is capable of making HTTP requests and displaying HTML pages





# WEB BROWSERS

- Primary purpose is to display web page, but may include added features
  - Google's Chrome: almost 70% of desktop market and about 65% of mobile market
    - Open source
  - Mozilla Firefox: 8% desktop, >1% mobile
    - Open source
  - Microsoft Edge: 7% desktop
  - Internet Explorer: 6% desktop
  - Apple's Safari: 4% desktop, 27% mobile



# THE INTERNET AND WEB: FEATURES

- Features on which the foundations of e-commerce are built:
  - Communication tools
  - Search engines
  - Downloadable and streaming media
  - Web 2.0 applications and services
  - Virtual reality and augmented reality
  - Intelligent digital assistants

# COMMUNICATION TOOLS



**E-mail**

Most used application of the Internet



**Messaging Applications**

Instant messaging



**Online message boards**



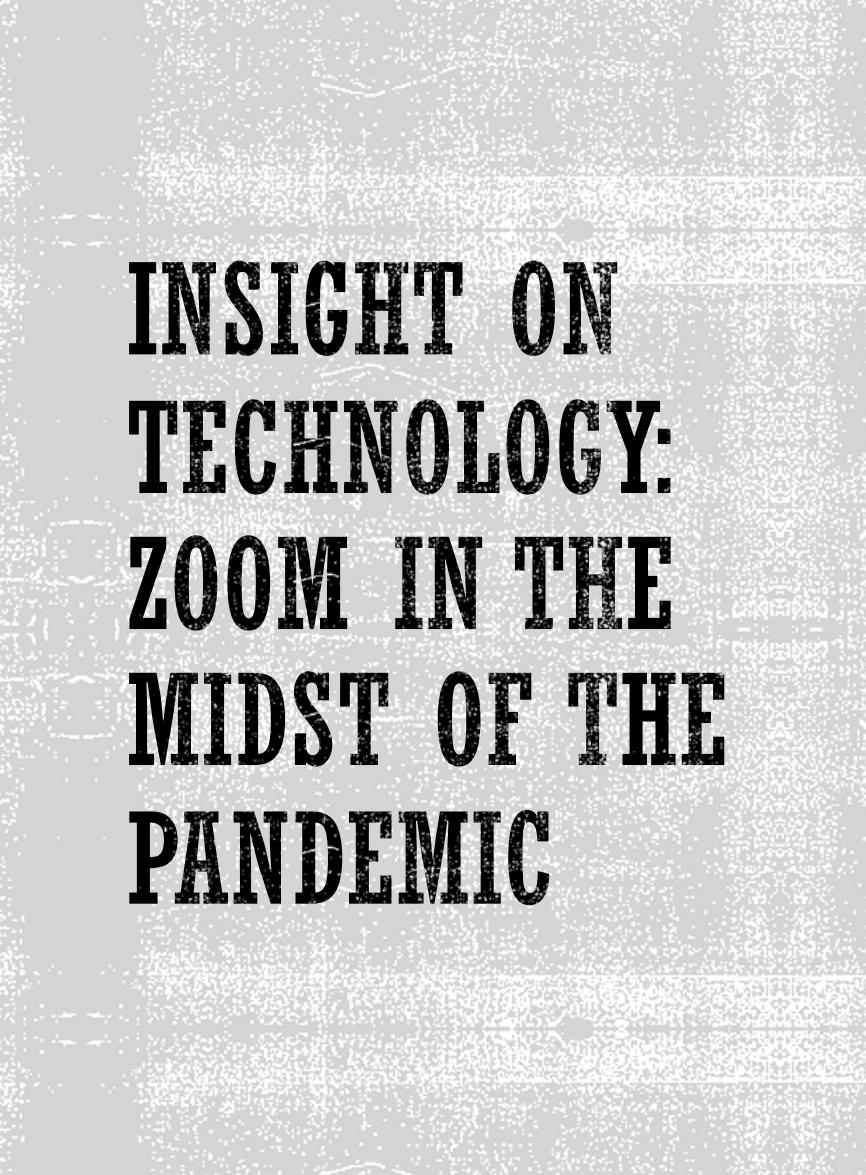
**Internet telephony**

VOIP



**Videoconferencing, video chatting, telepresence**





# **INSIGHT ON TECHNOLOGY: ZOOM IN THE MIDST OF THE PANDEMIC**

- **Class Discussion**
  - What has your experience using Zoom and other videoconferencing services during the pandemic been like?
  - What challenges does Zoom face?
  - How has Zoom responded to those challenges?

# SEARCH ENGINES

1

Identify web pages  
that match queries  
based on one or  
more techniques

- Keyword indexes
- Page ranking

2

Also serve as:

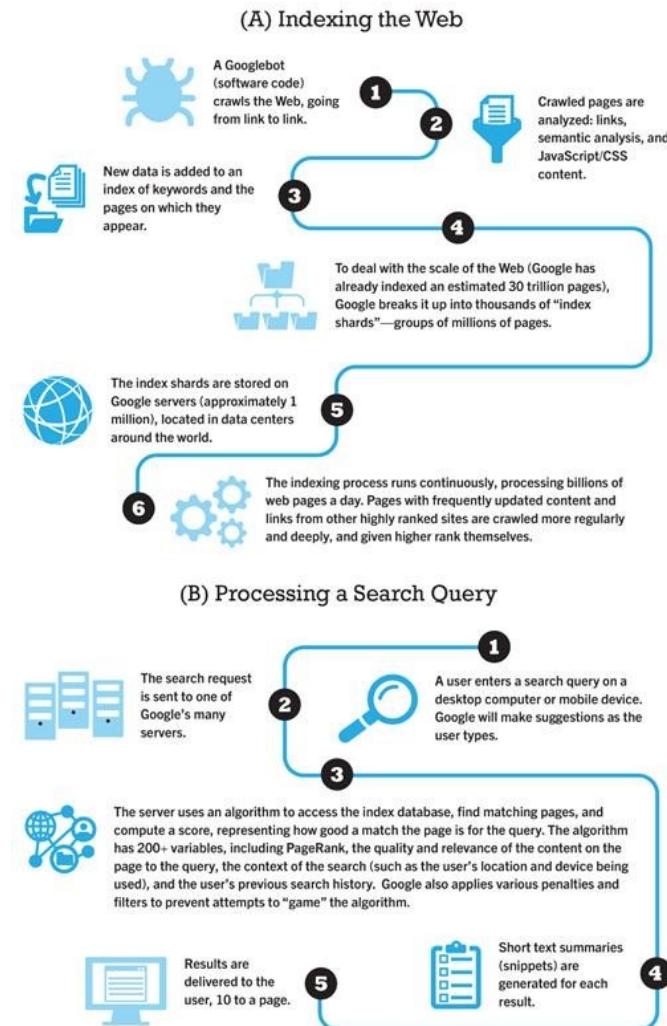
- Shopping tools
- Advertising vehicles  
(search engine marketing)
- Tool within e-commerce  
sites

3

Top three providers:  
Google, Microsoft's  
Bing, Verizon Media  
(Yahoo)



# FIGURE 3.17 HOW GOOGLE WORKS



# DOWNLOADABLE AND STREAMING MEDIA

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## Downloads:

- Growth in broadband connections enables large media file downloads

## Streaming technologies

- Enables music, video, and other large files to be sent to users in chunks so that the file can play uninterrupted

Podcasting

Explosion in online  
video viewing



# **WEB 2.0 FEATURES AND SERVICES**

Online Social Networks	Blogs	Wikis
<ul style="list-style-type: none"><li>• Services that support communication among networks of friends, peers</li></ul>	<ul style="list-style-type: none"><li>• Personal web page of chronological entries</li><li>• Enables web page publishing with no knowledge of HTML</li></ul>	<ul style="list-style-type: none"><li>• Enables documents to be written collectively and collaboratively</li><li>• E.g., Wikipedia</li></ul>

# VIRTUAL REALITY AND AUGMENTED REALITY

## Virtual reality (VR)

- Immersing users within virtual world
- Typically uses head-mounted display (HMD)
- Oculus Rift, Vive, PlayStation VR

## Augmented reality (AR)

- Overlaying virtual objects over the real world, via mobile devices or HMDs
- Pokémon GO

## Mixed reality (AR)

- Enhanced version of AR



# INTELLIGENT DIGITAL ASSISTANTS

Computer search engine using:

- Natural language
- Conversational interface, verbal commands
- Situational awareness

Can handle requests for appointments, flights, routes, event scheduling, and more.

- Examples:
  - Apple's Siri
  - Google Now/Google Assistant
  - Amazon Alexa



# MOBILE APPS

- Use of mobile apps has exploded
  - Most popular entertainment media, over TV
  - Always present shopping tool
  - Almost all top 100 brands have an app
- Platforms
  - iPhone/iPad (iOS), Android
- App marketplaces
  - Google Play, Apple's App Store, Amazon's Appstore



# **ASSIGNMENT**

- (1)How does 5G differ from 4G?
- (2) What is podcasting?
- (3)What are the implications of the app ecosystem for e-commerce?

