

Chapter 4 The Internet

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Chapter 4: Networking and the Internet

- 4.1 Network Fundamentals
- 4.2 The Internet
- 4.3 The World Wide Web
- 4.4 Internet Protocols
- 4.5 Security

Big ideas

- What is network?
- How networks are constructed?
- What is Internet?
- What are the application of Internet?
- How messages are transferred through the internet?

Network Classifications

- Scope
 - Local area network (LAN)
 - Small size, campus, building...
 - Metropolitan area (MAN)
 - Intermediate size, local community...
 - Wide area network (WAN)
 - large geographic area, such as connections between cities
- Topology (configuration)
 - Bus (Ethernet)
 - Star (Wireless networks with central Access Point)

Network topologies

a. Bus



Network topologies (continued)

b. Star



Connecting Networks

- **Repeater:** Extends a network
- **Bridge:** Connects two compatible networks
- Switch: Connects several compatible networks
- Router: Connects two incompatible networks

Building a large bus network from smaller ones



a. A repeater or bridge connecting two buses

b. A switch connecting multiple buses

Routers connecting two WiFi networks and an Ethernet network to form an internet



How do processes communicate?

- Client-server
 - One server, many clients
 - Server must execute continuously
 - Client initiates communication (request)
- Peer-to-peer (P2P)
 - Request and receive service from each other
 - Service providing load can be shared



a. Server must be prepared to serve multiple clients at any time.



b. Peers communicate as equals on a one-to-one basis.

The Internet

• The Internet: Worldwide network of networks interconnecting thousands of smaller networks to form large communication infrastructure





So, who owns the Internet?

Well, nobody does.

No single person or company owns the Internet or even controls it entirely. As a wide-area network, it is made up of many smaller networks. These smaller networks are often owned and managed by a person or organization. The Internet, then, is really defined by how connections can be made between these networks.

Internet Architecture

- Internet Service Provider (ISP)
 - Tier-1
 - Tier-2
- Access ISP: Provides connectivity to the Internet
 - Traditional telephone (dial up connection)
 - Cable connections
 - DSL
 - Wireless

Internet Composition



Host & Internet Addressing

"A host is a computer connected directly to the Internet"

- IP address: pattern of 32 or 128 bits often represented in dotted decimal notation
- Mnemonic address:
 - Domain names
 - Top-Level Domains
- Domain name system (DNS)
 - Name servers
 - DNS lookup

Internet Corporation for Assigned Names & Numbers (ICANN)

- Allocates IP addresses to ISPs who then assign those addresses within their regions.
- Oversees the registration of domains and domain names.

Education, some images are from google.com

How To Register A Domain Name?

- Come up a new name
- Get a server and an IP
- 1 administrative contact
- 1 technical contact
- Register the name to an Internet domain registrar
 - <u>www.godaddy.com</u>

Used to be done via email or fax, now all web-based!

What is Wireshark?

- Wireshark is a network packet/protocol analyzer.
- UNIX and Windows.

Internet Applications

- Electronic Mail (email)
- File Transfer Protocol (FTP)
- Telnet and SSH

• Facebook? Google?

World Wide Web

- The World Wide Web (The Web) is only a portion of what makes up the internet, but it is the fastest growing part of the internet.
- Browser gets documents from Web server
- Documents identified by URLs
- Unified resource locator
 - A standard way of specifying the location of a Web page, containing the hostname, "/", and a file

A typical URL



Hypertext Document Format

•Hypertext Markup Language (HTML) The language used to create or build a Web page

•Markup language

A language that uses tags to annotate the information in a document

•Tags

The syntactic element in a markup language that indicates how information should be displayed

Hypertext Document Format

-Appearance

- <h1> to start a level one heading
- to start a new paragraph
- -Links to other documents and content
 -
- –Insert images
 -

A simple Web page

a. The page encoded using HTML.



Education, some images are from

google.com

Package-shipping example



Internet Software Layers

- Application: Constructs message with address
- **Transport:** Chops message into packets
- Network: Handles routing through the Internet
- Link: Handles actual transmission of packets

The Internet software layers



Following a message through the Internet



TCP/IP Protocol Suite

- A family of protocols that makes the Internet works
- Transport Layer
 - TCP
 - UDP
- Network Layer
 IP (IPv4 and IPv6)

Choosing between TCP and UDP

Application layer



Encryption

- HTTPS, SSL, TLS are cryptographic protocols designed to provide communication security over the Internet.
- Public-key Encryption
 - Public key: Used to encrypt messages
 - Private key: Used to decrypt messages

Public-key encryption



Both Alice and Carol can send encrypted messages to Bob.



Carol cannot decrypt Alice's message even though she knows how Alice encrypted it.

Direct questions to rahma2fx

TCP/IP

• TCP stands for **Transmission Control Protocol**

TCP software breaks messages into packets, hands them off to the IP software for delivery, and then orders and reassembles the packets at their destination

• IP stands for **Internet Protocol**

IP software deals with the routing of packets through the maze of interconnected networks to their final destination

Virus, What is it ?

A computer program that is designed to replicate itself by copying itself into the other programs stored in a computer.

It may be benign or have a negative effect, such as causing a program to operate incorrectly or corrupting a computer's memory.

Worms

A malicious program that replicates itself until it fills all of the storage space on a drive or network

Trojan

A Trojan horse is defined as a "malicious, securitybreaking program that is disguised as something benign". For example, you download what appears to be a movie or music file, but when you click on it, you unleash a dangerous program that erases your disk, sends your credit card numbers and passwords to a stranger, or lets that stranger hijack your computer to commit illegal denial of service attacks

