



COMPUTER NETWORKS

Sivaraman Eswaran Ph.D.

Department of Computer Science and Engineering

COMPUTER NETWORKS

Application Layer

Sivaraman Eswaran Ph.D.

Department of Computer Science and Engineering

Unit – 2 Application Layer

2.1 Principles of Network Applications

2.2 Web, HTTP and HTTPS

2.3 The Domain Name System

2.4 P2P Applications

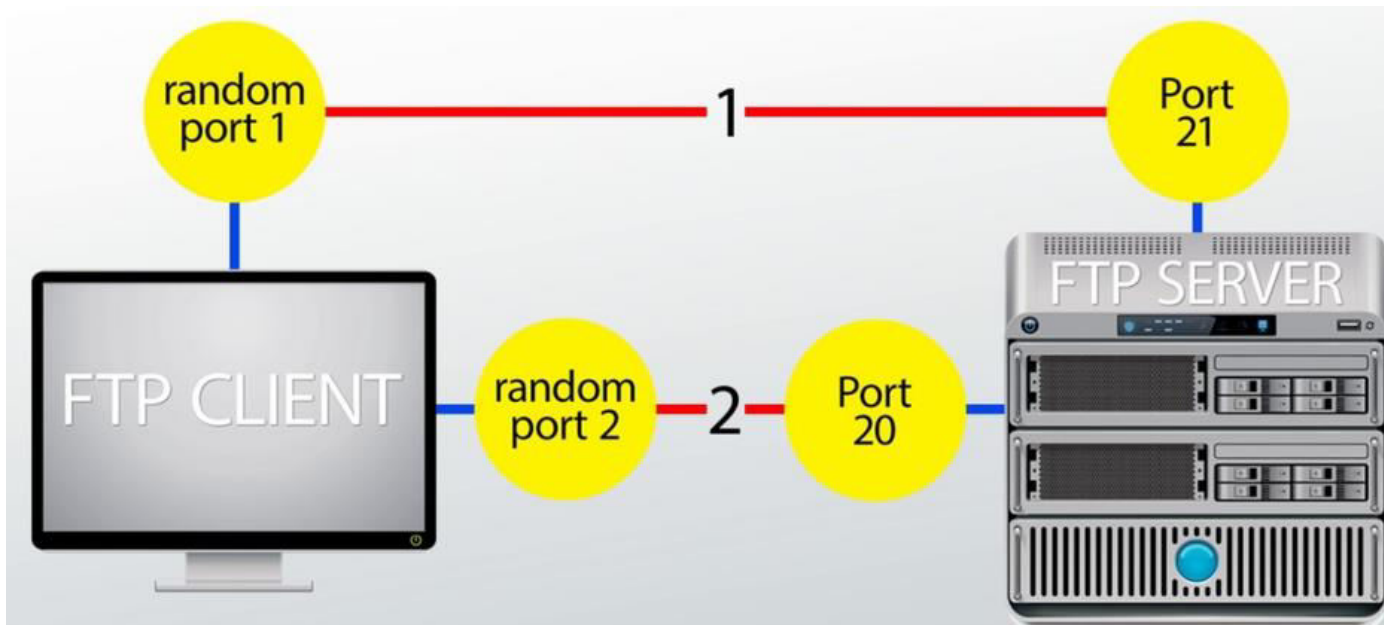
2.5 Socket Programming with TCP & UDP

2.6 Other Application Layer Protocols

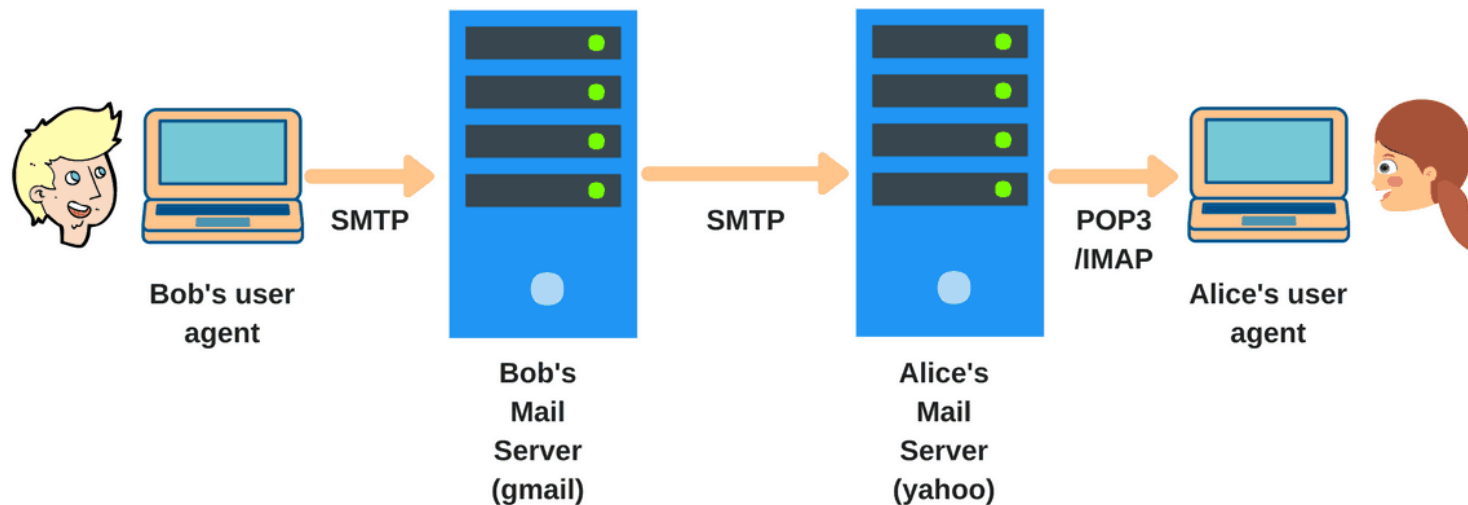
COMPUTER NETWORKS

Other Application Layer Protocols - FTP

- File Transfer Protocol (FTP) - used to exchange large files on the internet TCP
- Invoked from the command prompt or some GUI.
- Allows to update (delete, rename, move, and copy) files at a server.
- Data connection (Port No. 20) & Control connection (Port No. 21)



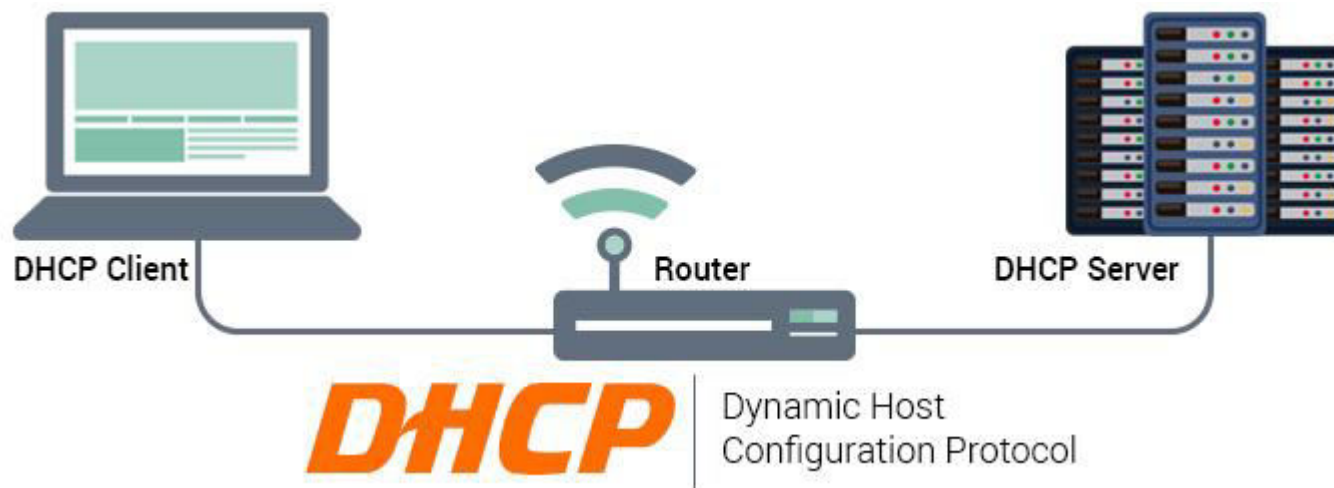
- **Simple Mail Transfer Protocol** - an internet standard for e-mail Transmission.
- Connections are secured with SSL (Secure Socket Layer).
- Messages are stored and then forwarded to the destination (relay).
- SMTP uses a port number 25 of TCP.



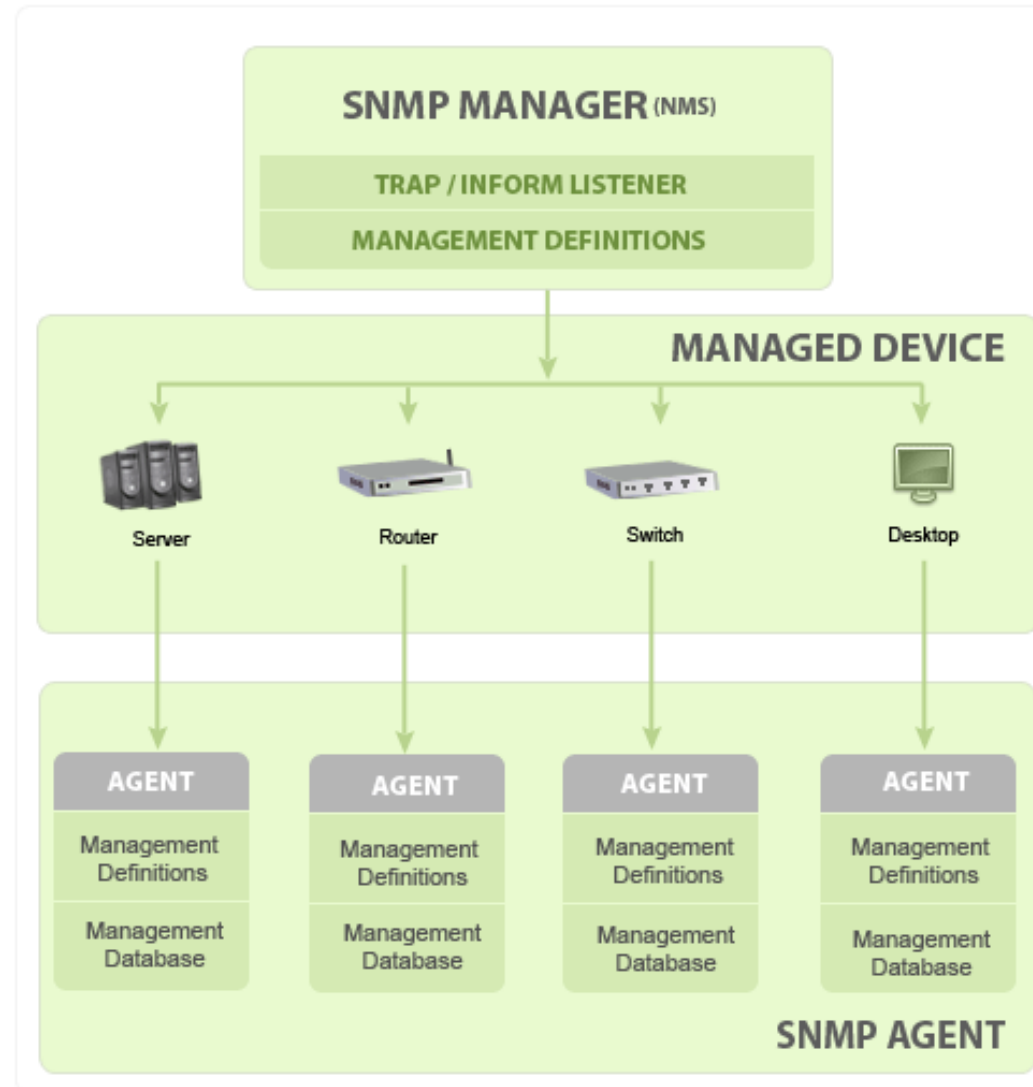
COMPUTER NETWORKS

Other Application Layer Protocols - DHCP

- **Dynamic Host Configuration Protocol** - assign IP addresses to computers in a network dynamically.
- IP addresses may change even when computer is in network (DHCP leases).
- DHCP port number for server is 67 and for the client is 68.
- A client-server model & based on **discovery, offer, request, and ACK**.
- Includes subnet mask, DNS server address, default gateway



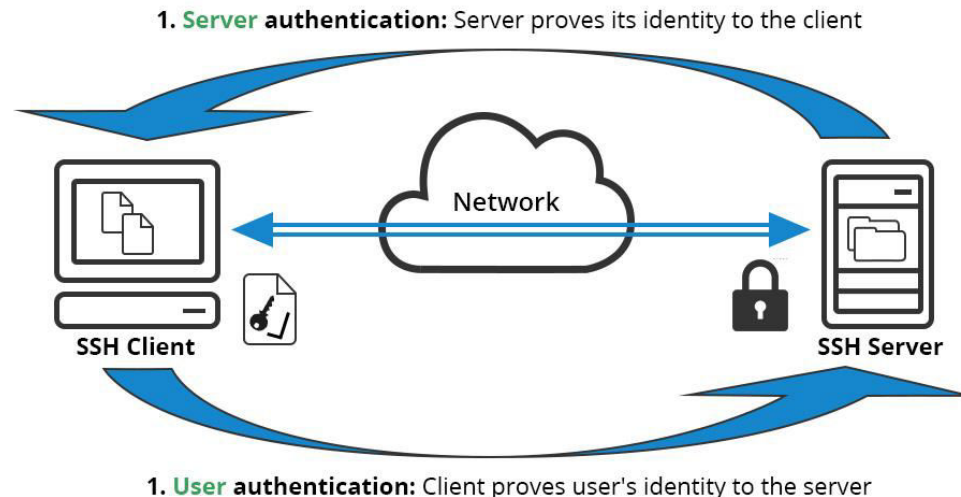
- **Simple Network Management Protocol** - exchange management information between network devices.
- **Basic components & functionalities**
 - SNMP Manager
 - Managed Devices
 - SNMP Agents
 - MIB (Management Information Base)



COMPUTER NETWORKS

Other Application Layer Protocols – Telnet & SSH

- Allows a user to communicate with a remote device.
- Used mostly by network admin to remotely access and manage devices.
- Telnet client and server installed – uses TCP port no. 23
- SSH – uses public key **encryption** & TCP port 22 by default.



COMPUTER NETWORKS

Summary of Application Layer Protocols

Port #	Application Layer Protocol	Type	Description
20	FTP	TCP	File Transfer Protocol - data
21	FTP	TCP	File Transfer Protocol - control
22	SSH	TCP/UDP	Secure Shell for secure login
23	Telnet	TCP	Unencrypted login
25	SMTP	TCP	Simple Mail Transfer Protocol
53	DNS	TCP/UDP	Domain Name Server
67/68	DHCP	UDP	Dynamic Host
80	HTTP	TCP	HyperText Transfer Protocol
123	NTP	UDP	Network Time Protocol
161,162	SNMP	TCP/UDP	Simple Network Management Protocol
389	LDAP	TCP/UDP	Lightweight Directory Authentication Protocol
443	HTTPS	TCP/UDP	HTTP with Secure Socket Layer

our study of network application layer is now complete!

- application architectures
 - client-server
 - P2P
- application service requirements:
 - reliability, bandwidth, delay
- Internet transport service model
 - connection-oriented, reliable: TCP
 - unreliable, datagrams: UDP
- specific protocols:
 - HTTP
 - DNS
 - P2P: BitTorrent
- socket programming:
TCP, UDP sockets

Most importantly: learned about *protocols*!

- typical request/reply message exchange:
 - client requests info or service
 - server responds with data, status code
- message formats:
 - *headers*: fields giving info about data
 - *data*: info(payload) being communicated

important themes:

- centralized vs. decentralized
- stateless vs. stateful
- scalability
- reliable vs. unreliable message transfer
- “complexity at network edge”



THANK YOU

Sivaraman Eswaran Ph.D.

Department of Computer Science and Engineering

sivaramane@pes.edu

+91 80 6666 3333 Extn 834