Computer Networks

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Unit 5

Application Layer

Contents

- HTTP
- Email: SMTP, MIME, POP3, Webmail, FTP, TELNET
- DHCP
- SNMP

1. HTTP

- **Hypertext Transfer Protocol** is used to transfer files that make up the web pages of the World Wide Web.
- **HTTP: TCP port 80.**
- Was originally developed to publish and retrieve HTML pages.
- used for ***distributed, collaborative information systems.***
- HTTP is used across the world wide web for data transfer and is one of the most used application protocols.
- HTTP specifies a request/response protocol.
- When a client, typically a web browser, sends a request message to a server, the HTTP protocol defines the message types the client uses to request the web page and the message types the server uses to respond.
- The three common message types are:
  - GET
  - POST
  - PUT

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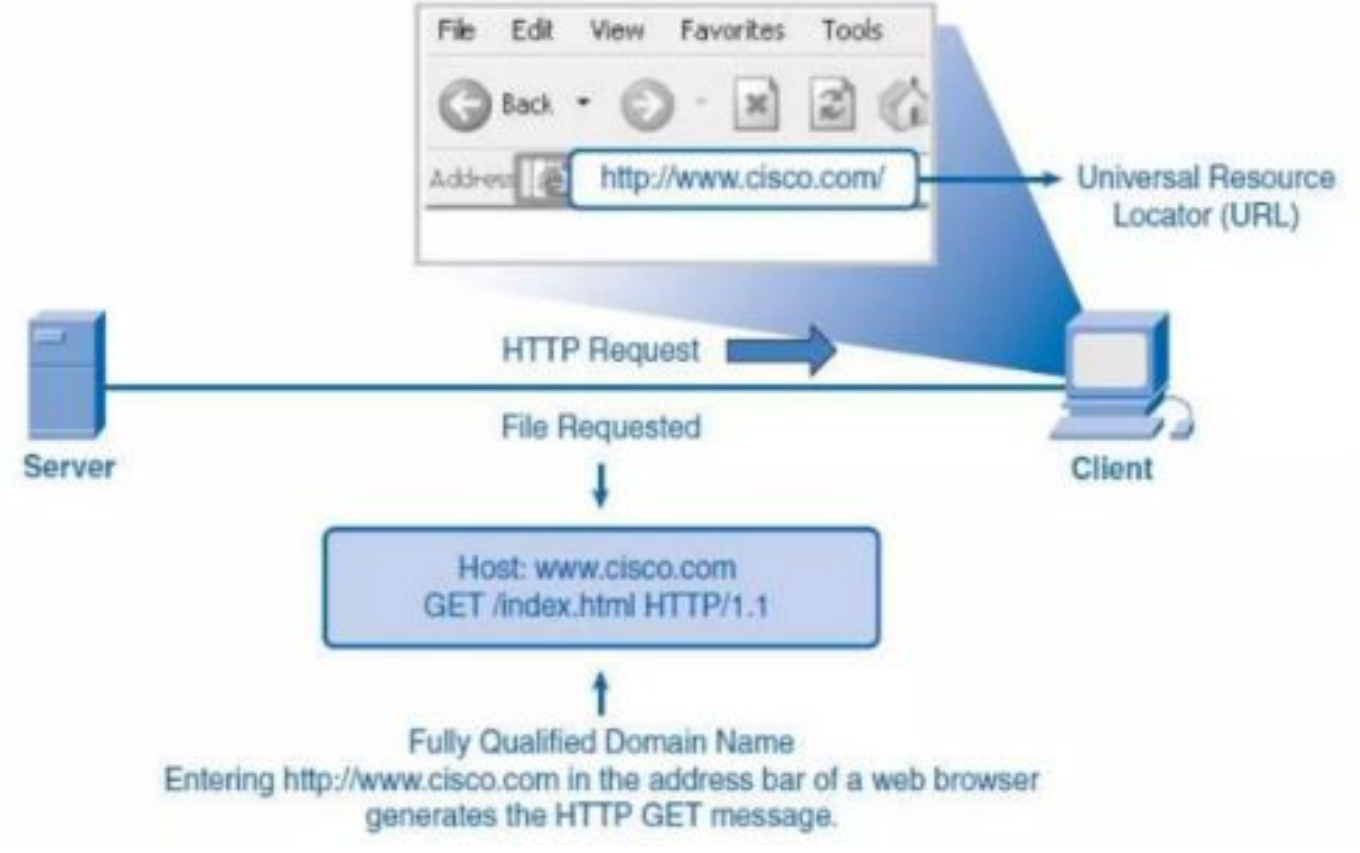
- GET is a client request for data. A web browser sends the GET message to request pages from a web server.
- POST and PUT are used to send messages that upload data to the web server.
- HTTP protocol using GET.



2. DNS

3. FTP

- promote sharing of files.
- encourage indirect use of remote computers.
- shield user from variations in file storage.
- transfer data reliably and efficiently.
- “FTP, although usable directly by a user at a terminal, is designed mainly for use by programs”.
- To successfully transfer files, FTP requires two connections between the client and the server: one for commands and replies, and the other for the actual file transfer.
- The client establishes the first connection to the server on TCP port 21. This connection is used for control traffic, consisting of client commands and server replies.
- The client establishes the second connection to the server over TCP port 20. This connection is for the actual file transfer and is created every time a file is transferred.

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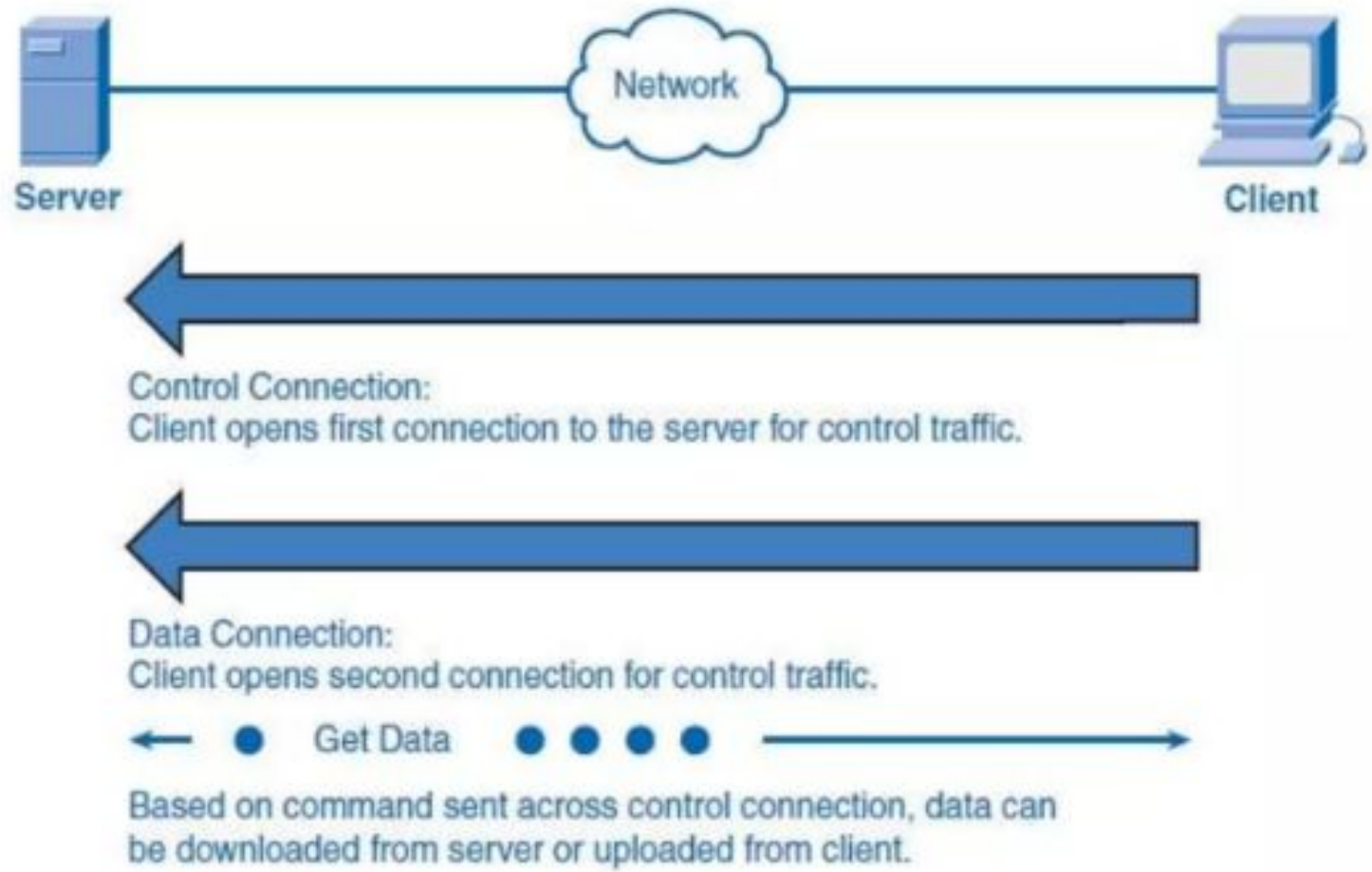
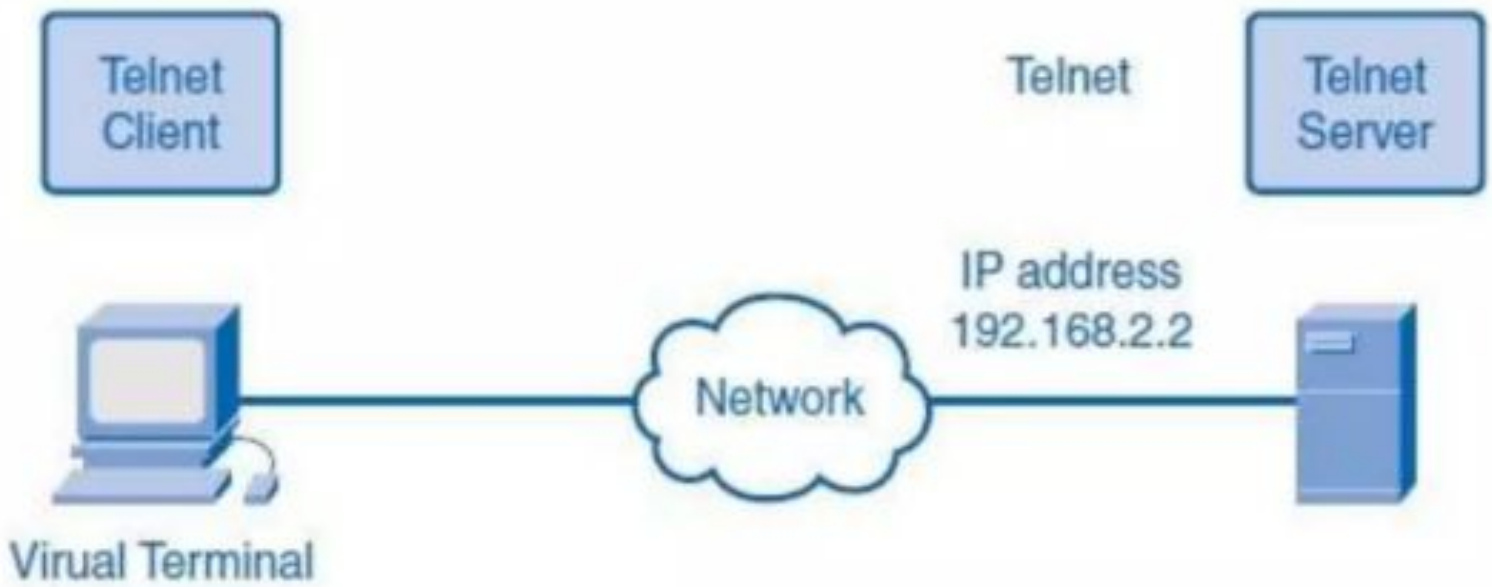
- The client can download (pull) a file from the server or upload (push) a file to the server.
- FTP Process



4. TELNET

- TELNET is a *protocol that provides "a* general, bi-directional, eight-bit byte oriented communications facility".
- telnet is a *program that supports the* TELNET protocol over TCP.
- Many application protocols are built upon the TELNET protocol.
- TELNET service:



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- **The TELNET Protocol**
- TCP connection
- data and control over the same connection.
- Network Virtual Terminal
- negotiated options

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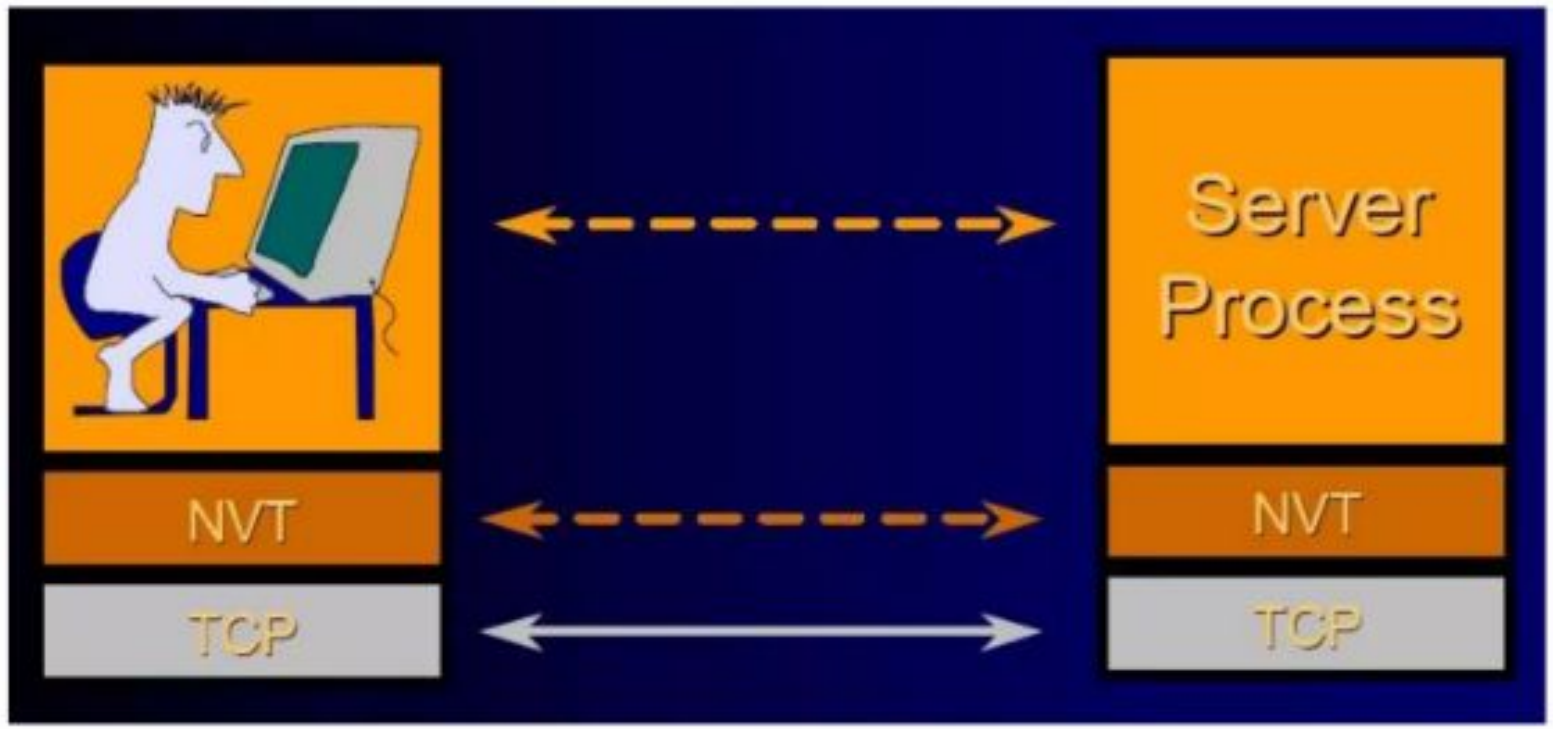
- **Network Virtual Terminal**
  - intermediate representation of a generic terminal.
  - provides a standard language for communication of terminal control functions.



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- **Negotiated Options:**
- All NVTs support a minimal set of capabilities.
- Some terminals have more capabilities than the minimal set.
- The 2 endpoints negotiate a set of mutually acceptable options (character set, echo mode, etc).
- The protocol for requesting optional features is well defined and includes rules for eliminating possible negotiation “loops”.
- The set of options is not part of the TELNET protocol, so that new terminal features can be incorporated without changing the TELNET protocol.

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- **Control Functions:**
- TELNET includes support for a series of control functions commonly supported by servers.
- This provides a uniform mechanism for communication of (the supported) control functions.
- **Interrupt Process (IP)**
  – suspend/abort process.
- **Abort Output (AO)**
  – process can complete, but send no more output to user's terminal.
- **Are You There (AYT)**
  – check to see if system is still running.
- **Erase Character (EC)**
  – delete last character sent
  – typically used to edit keyboard input.
- **Erase Line (EL)**
  – delete all input in current line.

5. DHCP

- DHCP enables clients on a network to obtain IP addresses and other information from a DHCP server.
- DHCP allows a host to obtain an IP address dynamically when it connects to the network.
- The DHCP server is contacted by sending a request, and an IP address is requested.
- The DHCP server chooses an address from a configured range of addresses called a *pool and* assigns it to the host client for a set period.
- different ways of having DHCP servers arranged in next diagram

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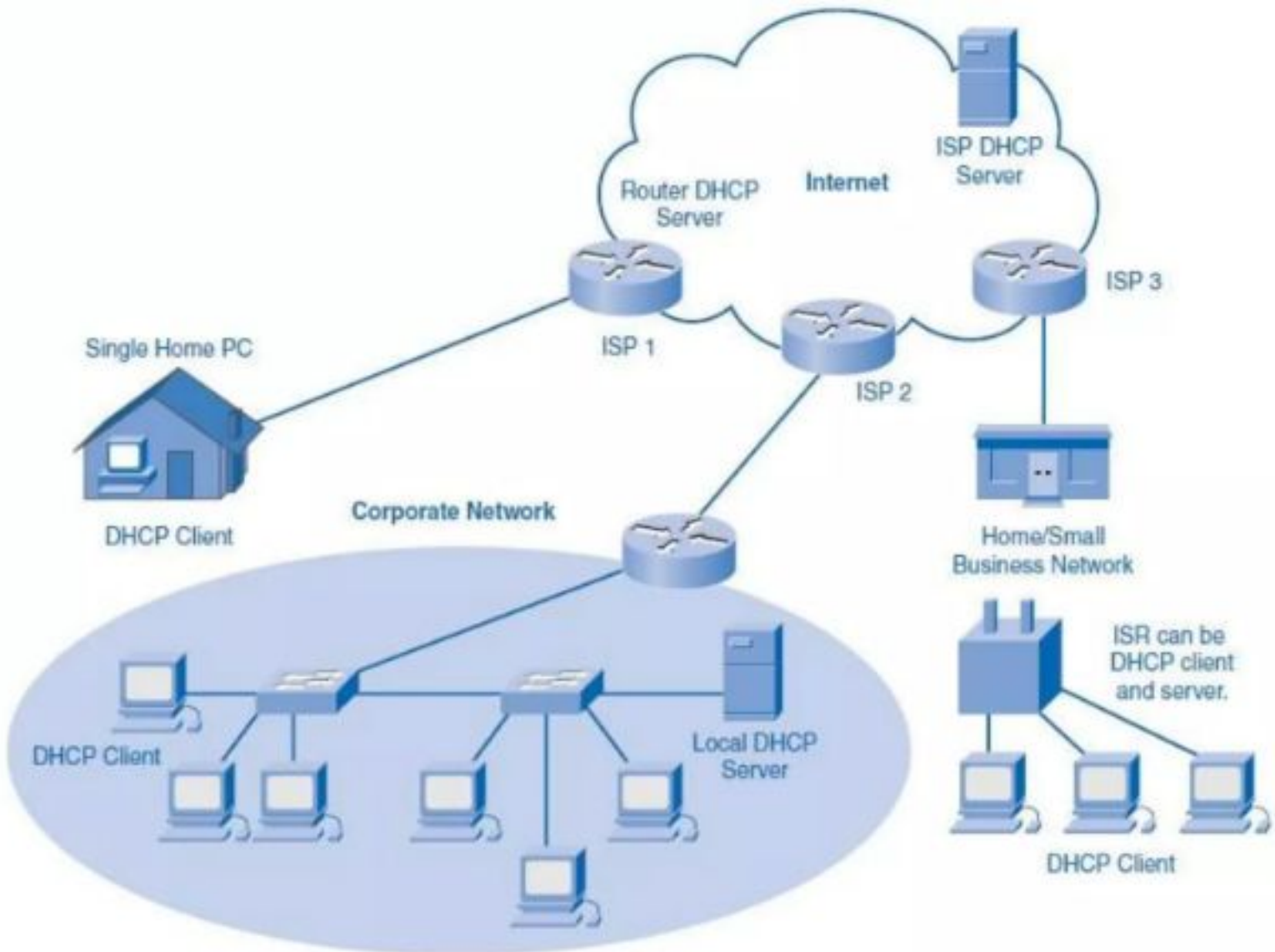
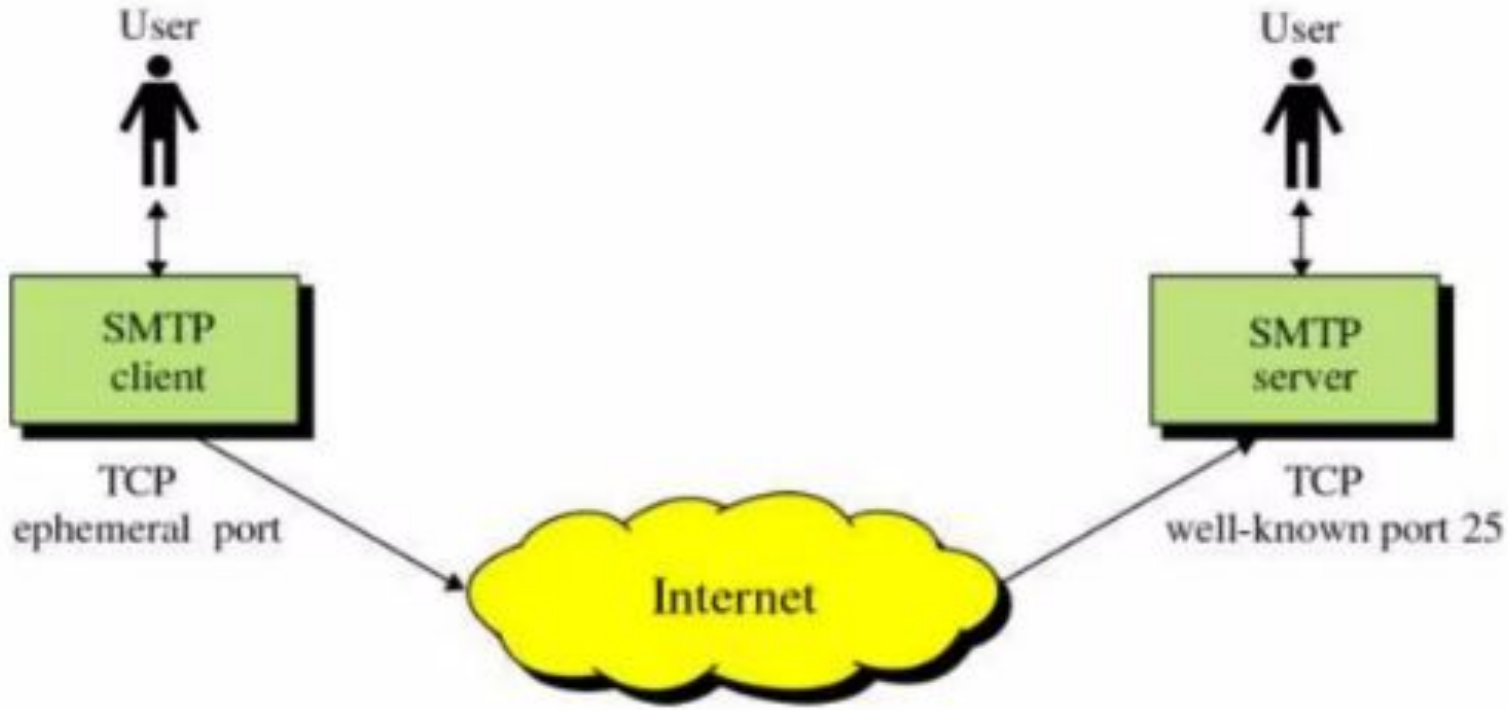

Router DHCP Server
Internet
ISP DHCP Server
ISP 1
ISP 2
ISP 3
Single Home PC
DHCP Client
Corporate Network
Home/Small Business Network
ISR can be DHCP client and server.
DHCP Client
Local DHCP Server
DHCP Client

7. SMTP

- Protocol originated in 1982 (RFC821, Jon Postel)
- Standard message format (RFC822,2822, D. Crocker)
- Goal: To transfer mail reliably and efficiently



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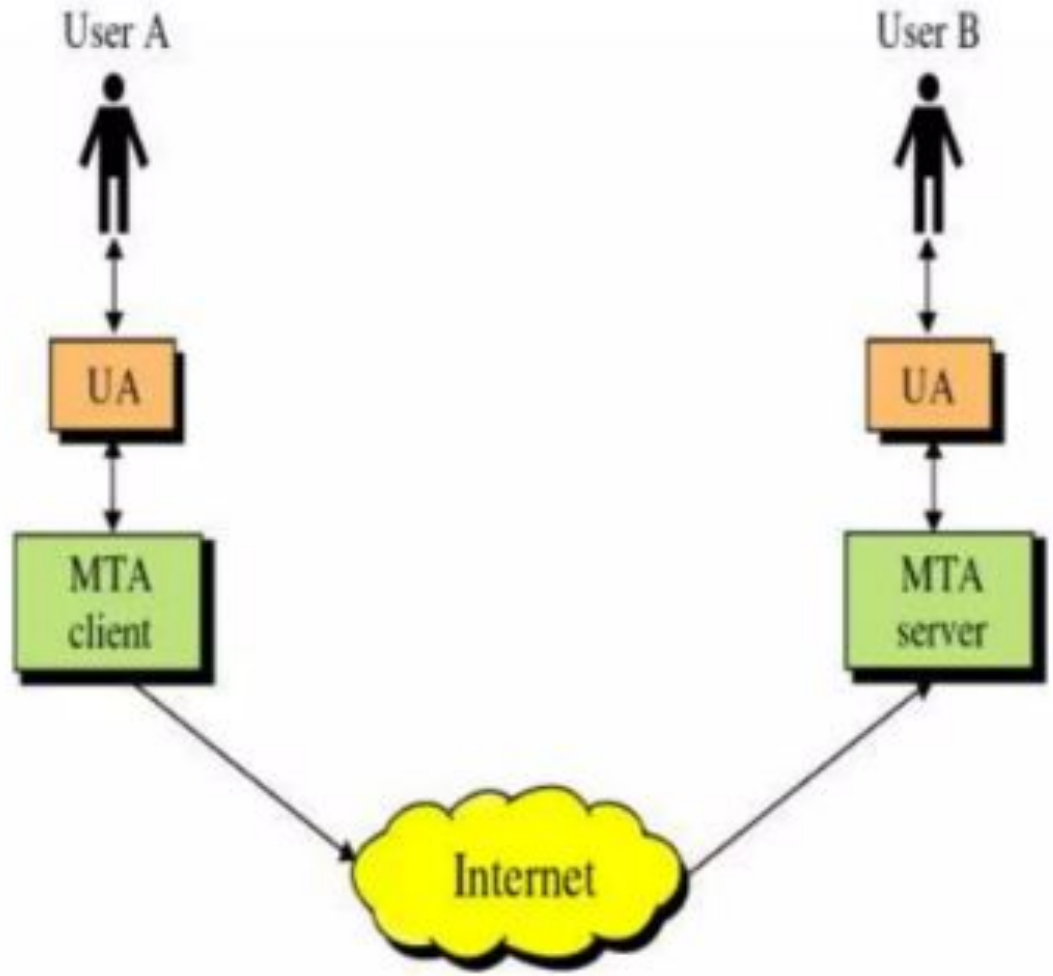
- SMTP clients and servers have two main components:
  - User Agents – Prepares the message, encloses it in an envelope. (ex. Thunderbird, Eudora)
  - Mail Transfer Agent – Transfers the mail across the internet (ex. Sendmail, Exim)
  - Analogous to the postal system in many ways



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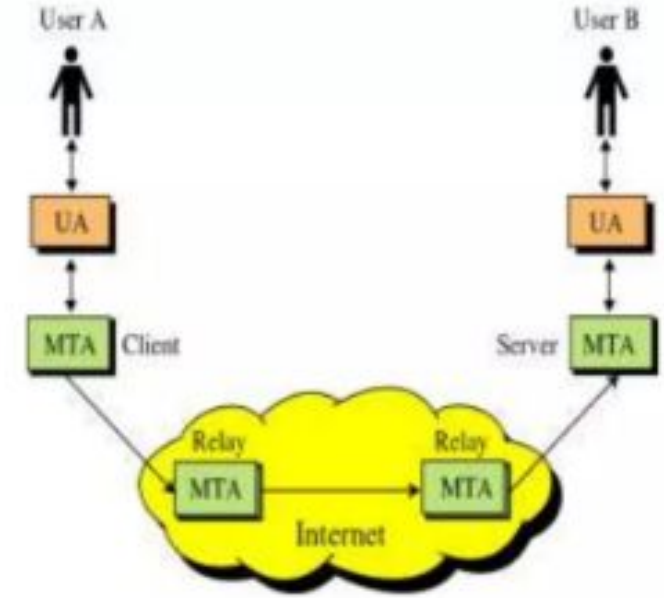
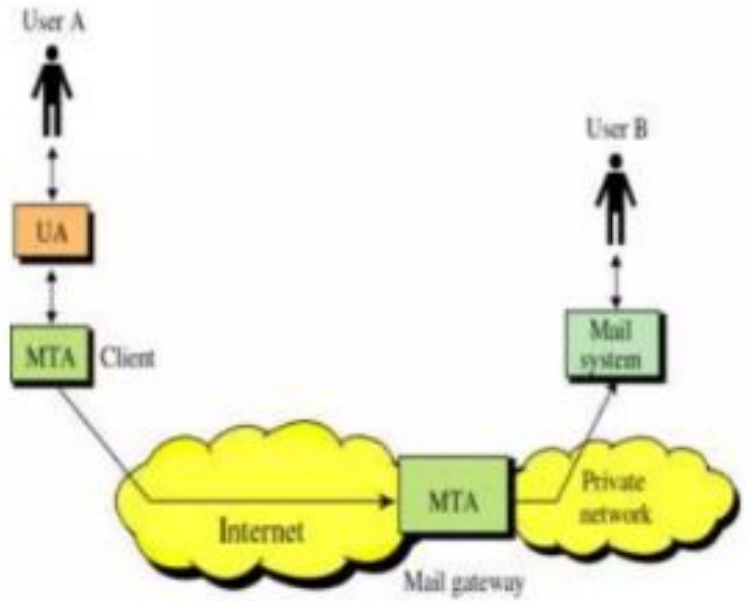
- SMTP also allows the use of Relays allowing other MTAs to relay the mail.



- Mail Gateways are used to relay mail prepared by a protocol other than SMTP and convert it to SMTP.



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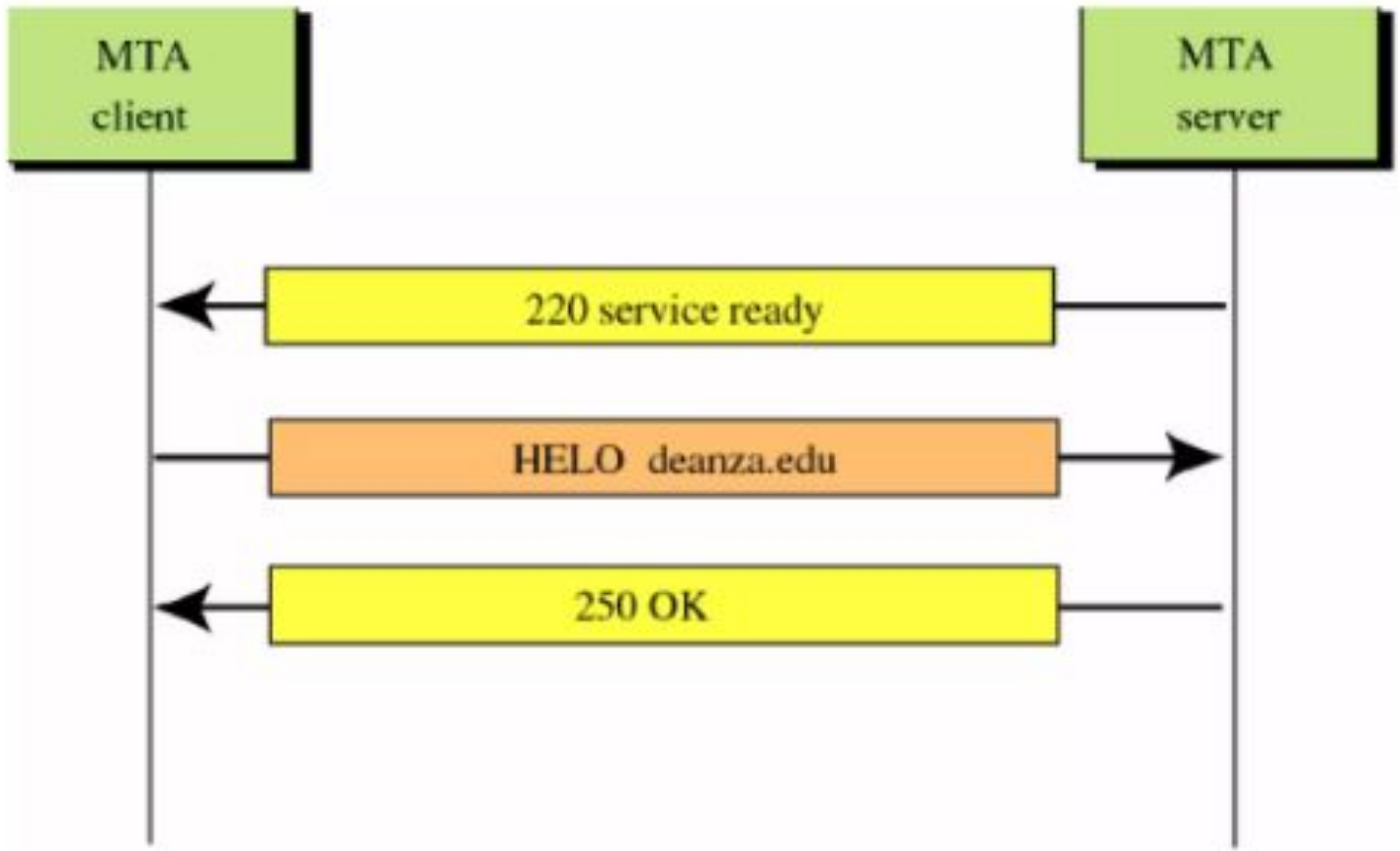
- Connection establishment:



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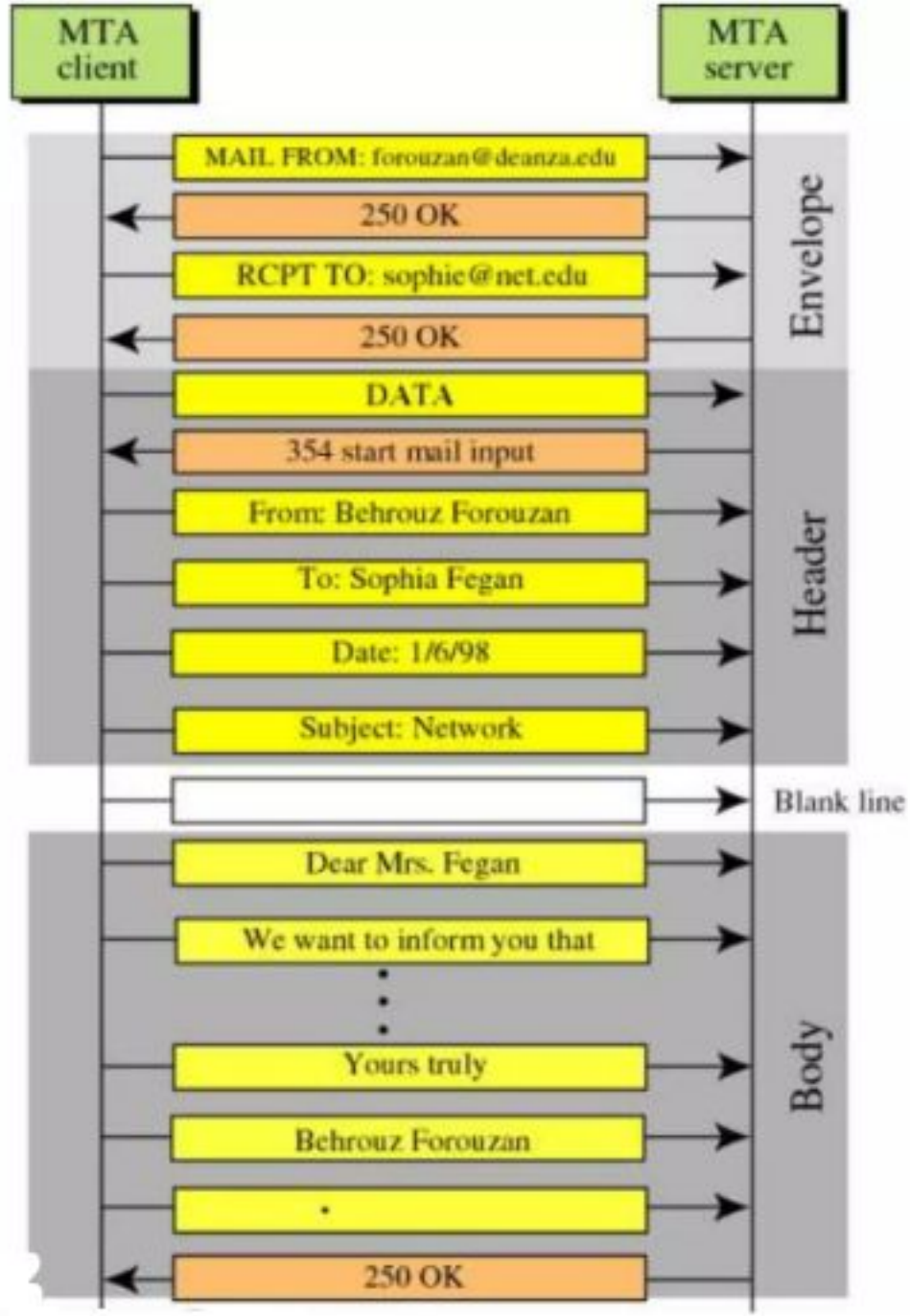
- Message Progress:



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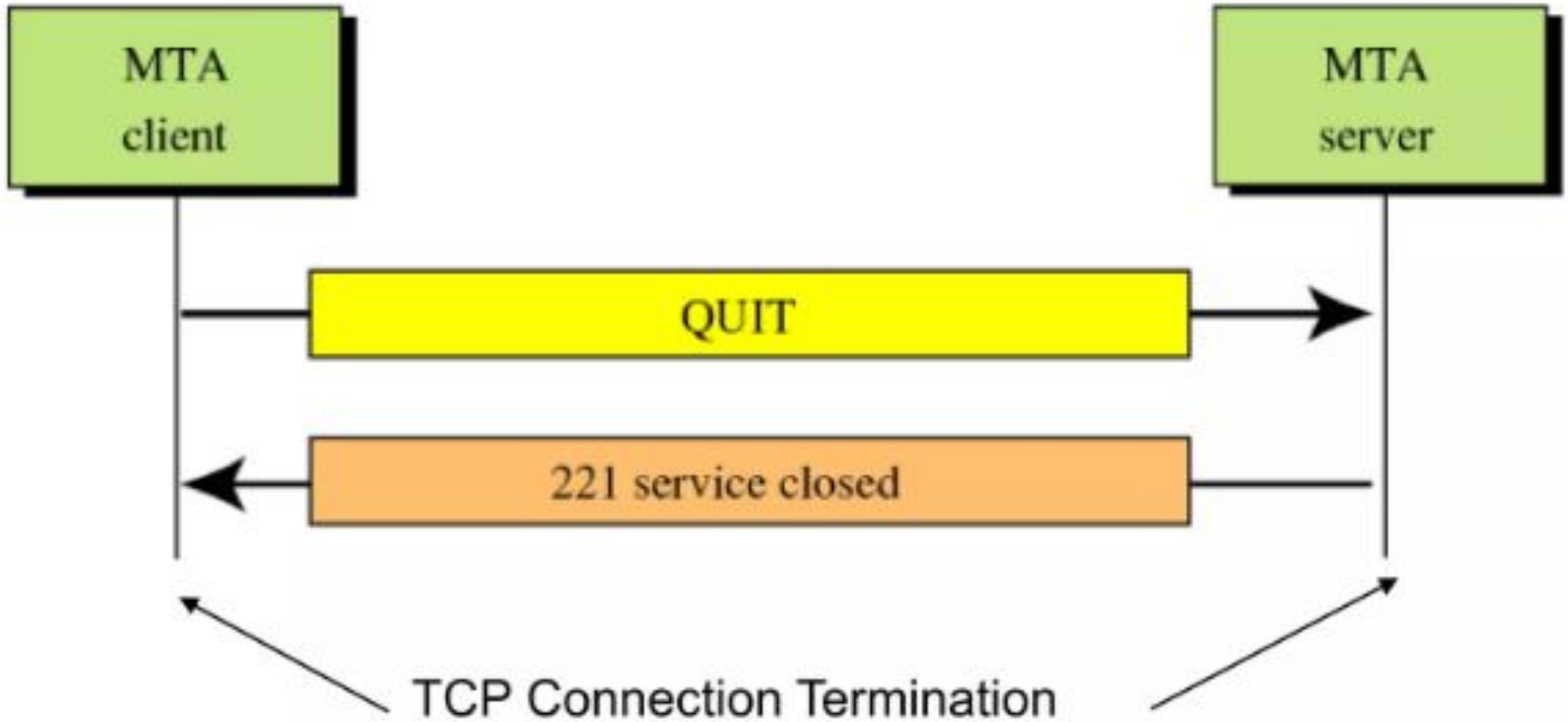
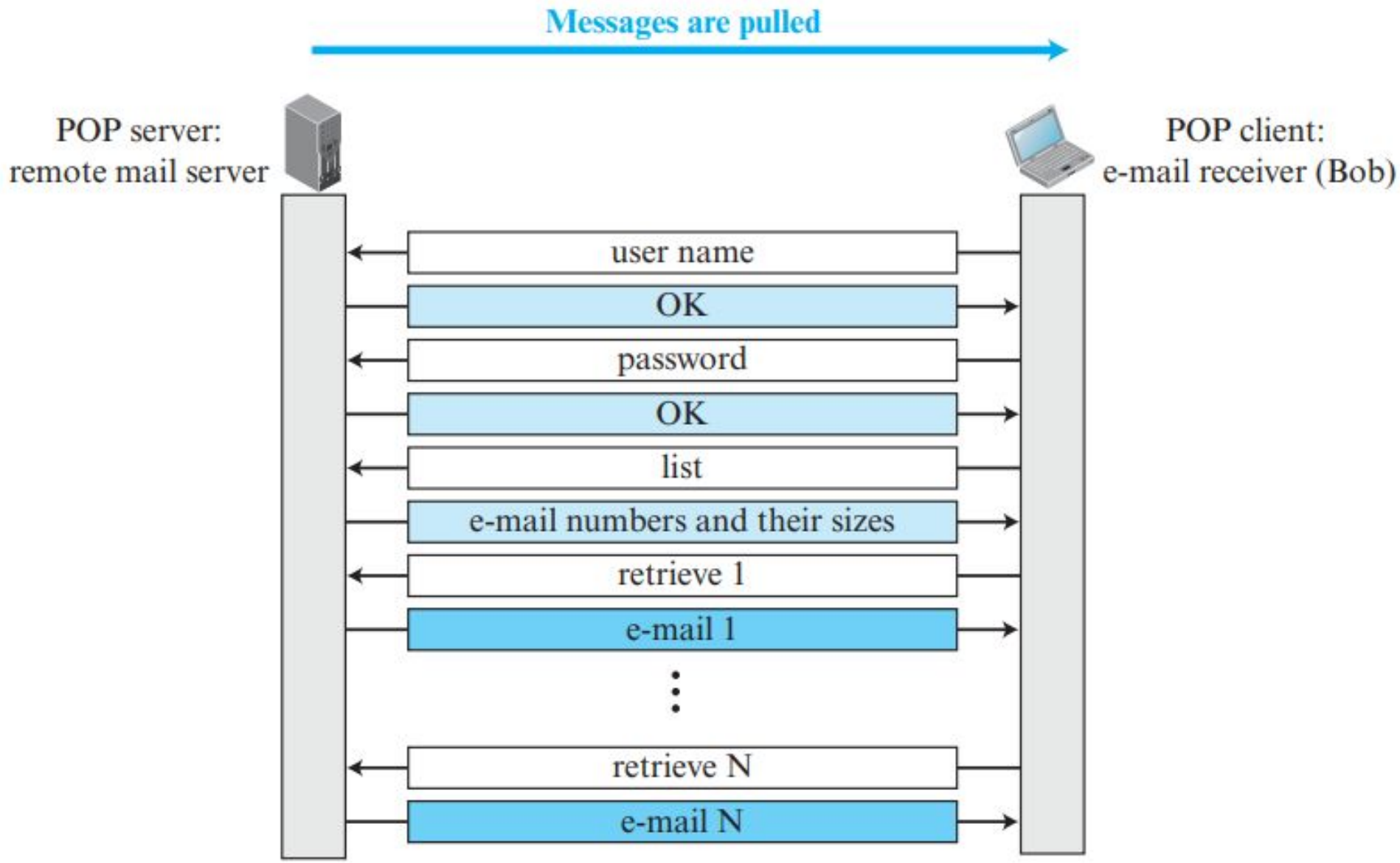
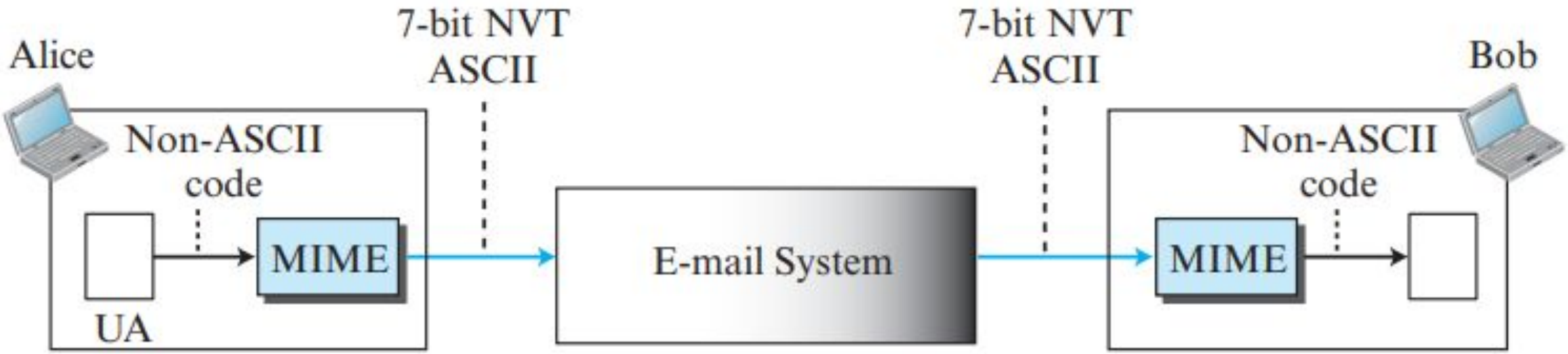
- Connection Termination:



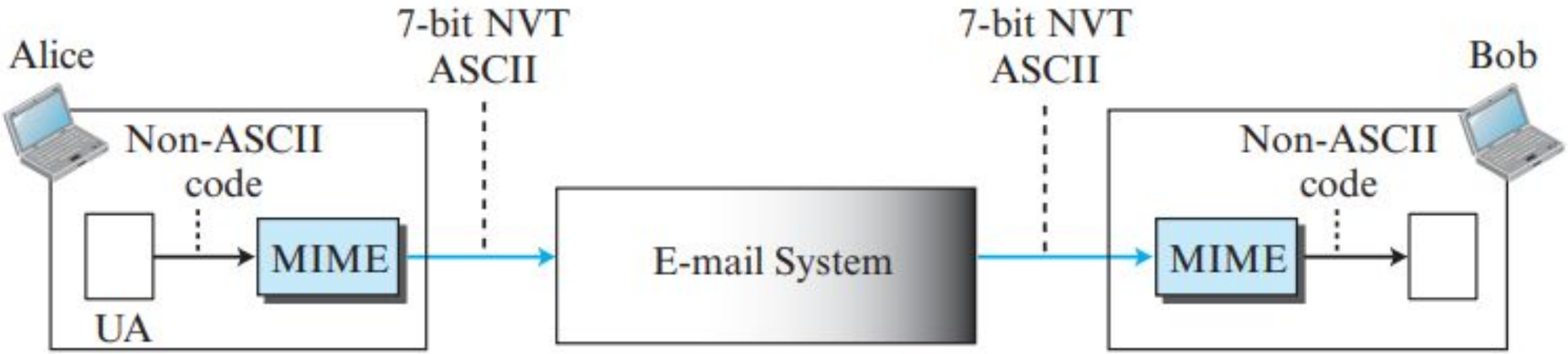
8. POP3


Messages are pulled
POP server:
remote mail server
POP client:
e-mail receiver (Bob)
user name
OK
password
OK
list
e-mail numbers and their sizes
retrieve 1
e-mail 1
retrieve N
e-mail N

9. MIME


Alice
7-bit NVT ASCII
7-bit NVT ASCII
Bob
Non-ASCII code
MIME
UA
E-mail System
MIME
Non-ASCII code

10. MIME


Alice
7-bit NVT ASCII
7-bit NVT ASCII
Bob
Non-ASCII code
MIME
UA
E-mail System
MIME
Non-ASCII code

Thank you