Introduction to Communication Networks

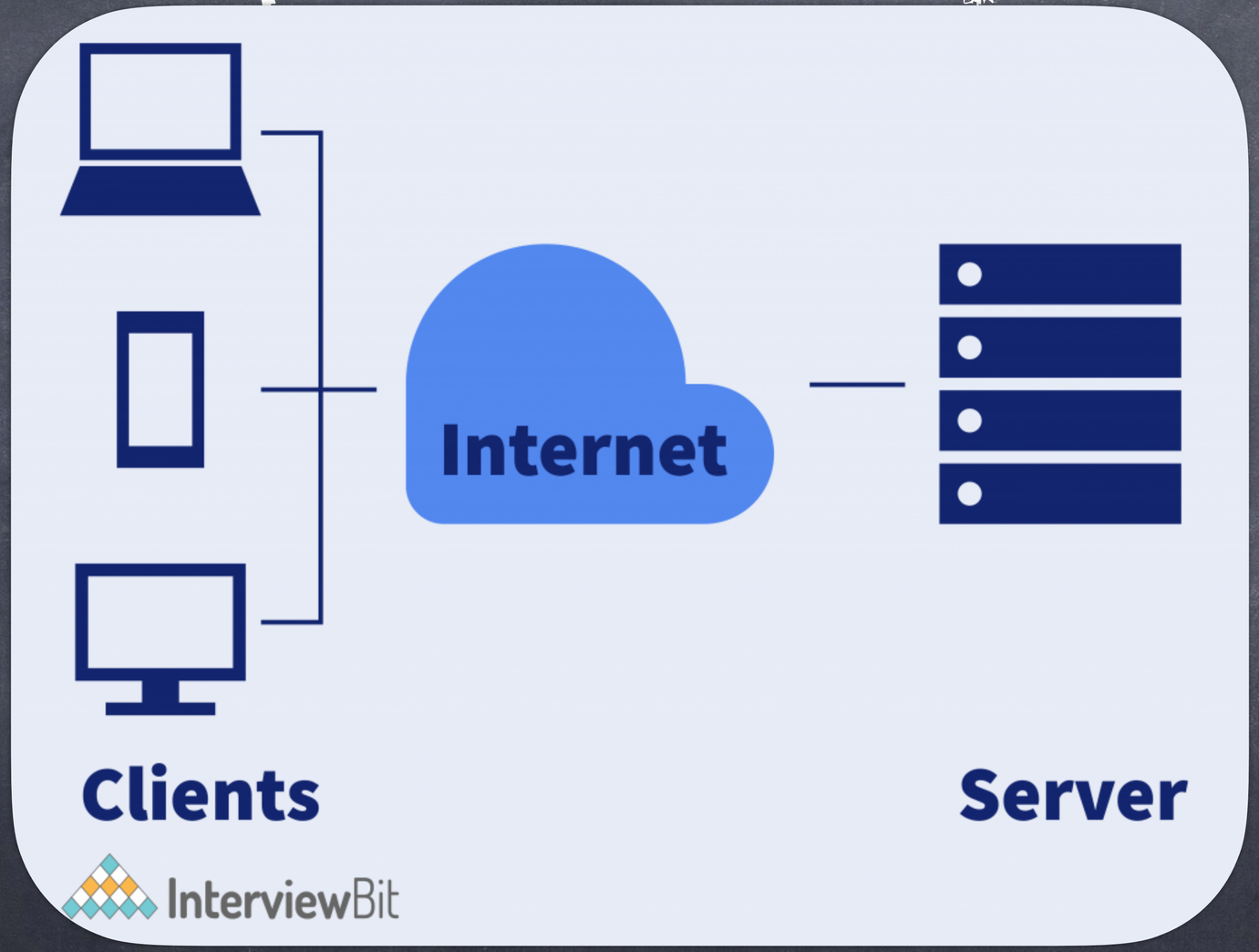
TE 156

APPLICATIONS & LAYERED ARCHITECTURES

Justice Owusu Agyemang, Department of Telecommunications Engineering, KNUST

APPLICATIONS & LAYERED ARCHITECTURES

Examples of Layering



Client-Server Architecture

Examples of Layering

Event	Message content
1. User selects document.	
2. Network software of client locates the server host and establishes a two-way connection.	
3. HTTP client sends message requesting document.	`GET/infocom/index.html HTTP/1.0`
4. HTTP daemon listening on TCP port 80 interprets message.	

5. HTTP daemon sends a result code and a description of the information that the client will receive.	`HTTP/1.1 200 OK`
	`Server: Apache/1.2.5 FrontPage 3.0.4`
	`Content-Length: 414`
	`Content-Type: text/html`

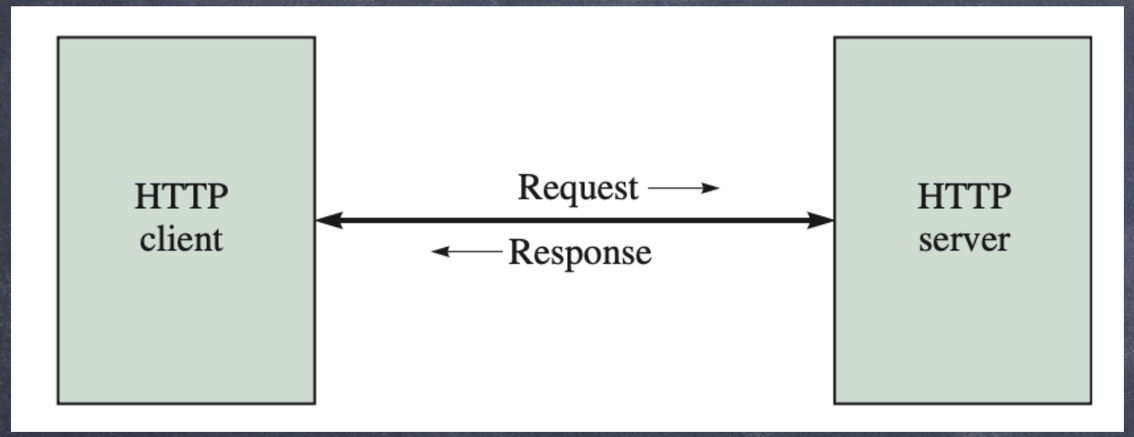
6. HTTP daemon reads the file and sends the requested file through the TCP port.	`<html>`
	`<head>`
	`<title>`
	`IEEE Infocom '99 - The Future is Now...`

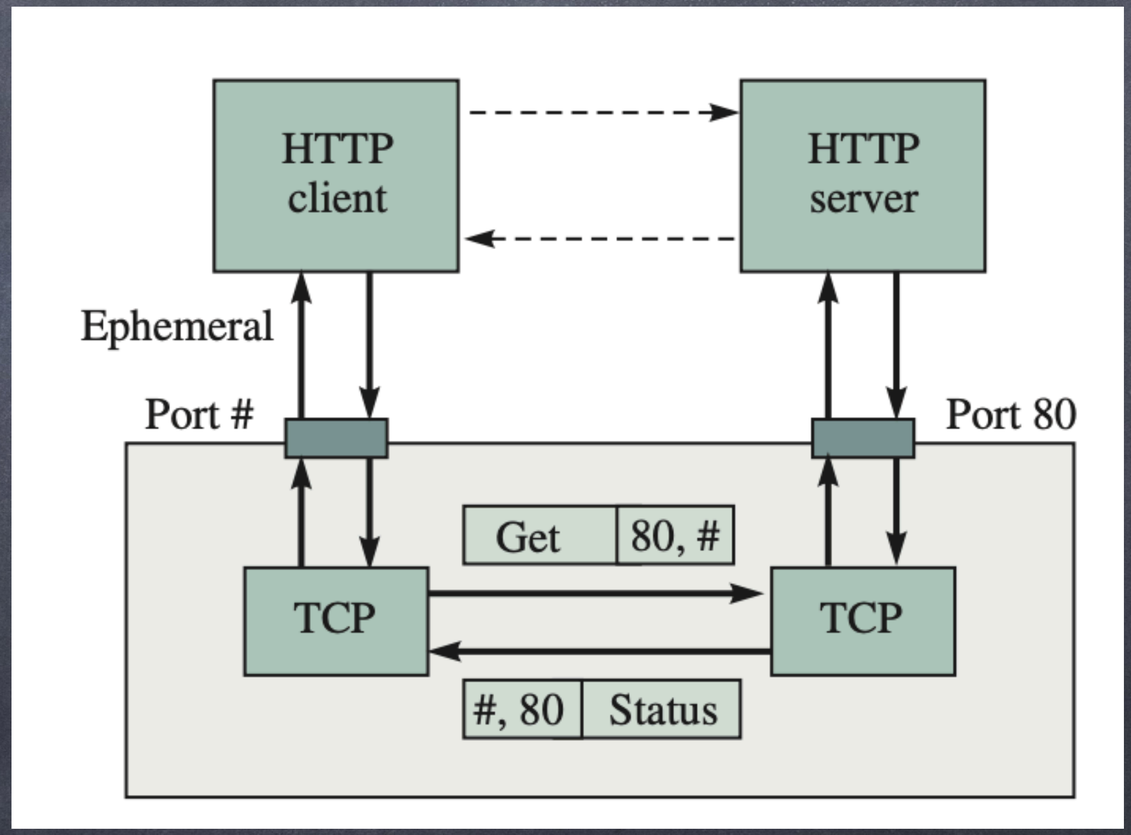
7. HTTP daemon disconnects the connection.	
8. Text is displayed by client browser, which interprets the HTML format.	

Client-Server HTTP Request-Response Flow

Examples of Layering

Client-Server HTTP Request-Response Flow





Examples of Layering

DNS Request-Response Flow

Event	Message content
1. Application requests name to address translation.	

2. Resolver composes query message.	`Header: OPCODE=SQUERY`
	`Question:`
	`QNAME=tesla.comm.toronto.edu.,`
	`QCLASS=IN, QTYPE=A`

3. Resolver sends UDP datagram encapsulating the query message.	

4. DNS server looks up address and prepares response.	`Header: OPCODE=SQUERY, RESPONSE,`
	`AA`
	`Question: QNAME=`
	`tesla.comm.toronto.edu.,`
	`QCLASS=IN, QTYPE=A`
	`Answer: tesla.comm.toronto.edu.`
	`86400 IN A 128.100.11.56`

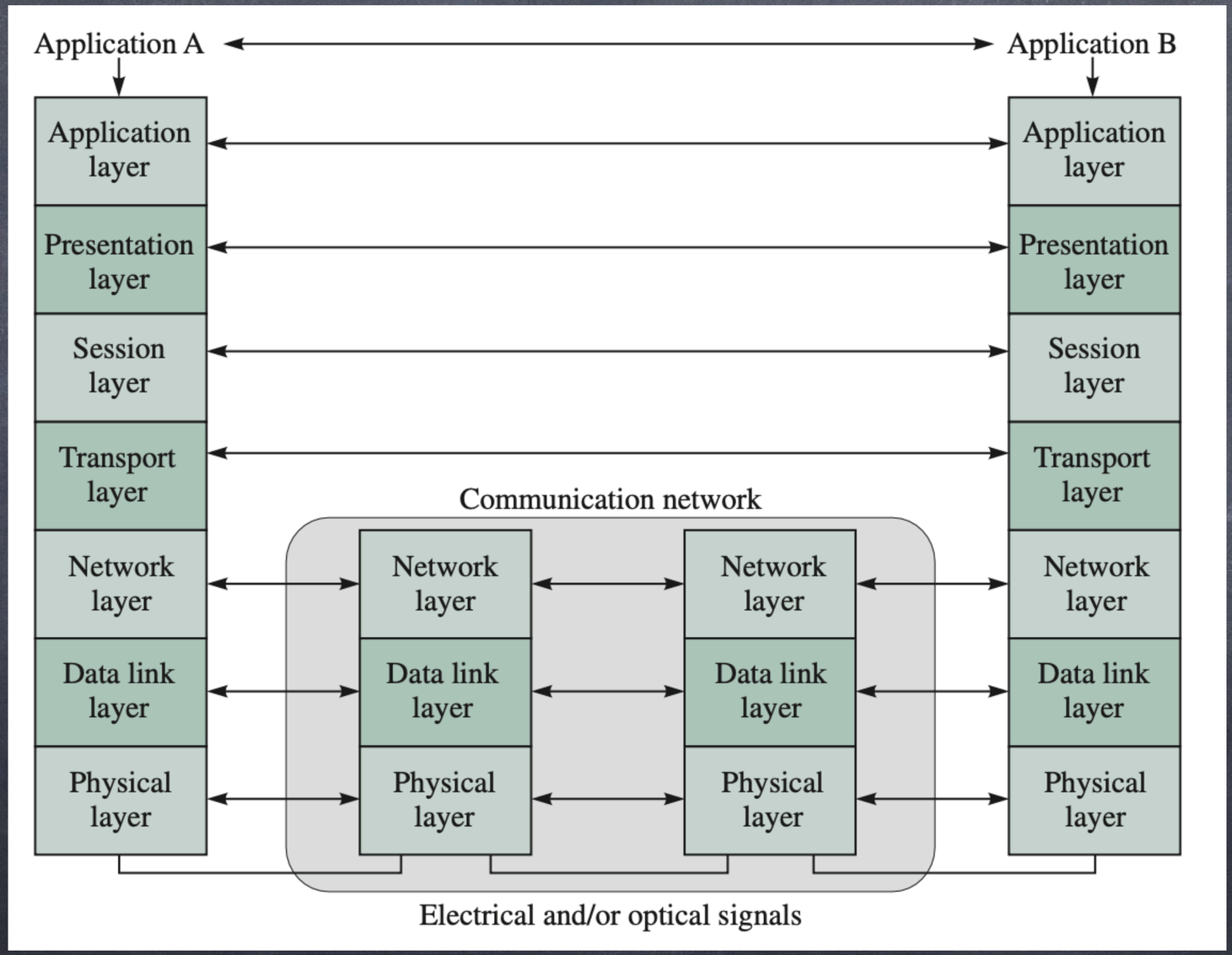
5. DNS sends UDP datagram encapsulating the response message.	

Examples of Layering

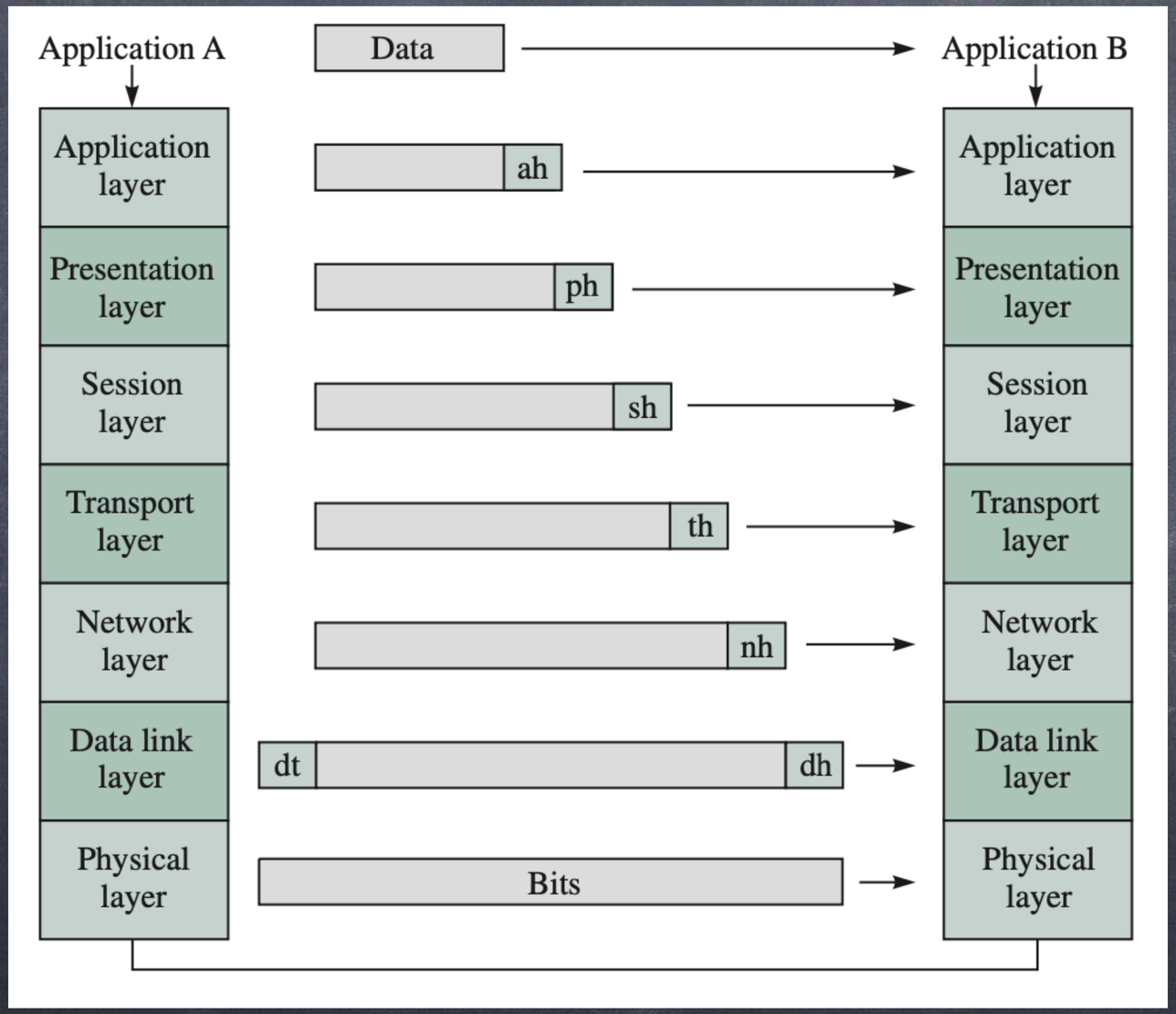
SMTP (Email) Request-Response Flow

	Event	Message content
1.	The mail application establishes a TCP connection (port 25) to its local SMTP server.	
2.	SMTP daemon issues the following message to the client, indicating that it is ready to receive mail.	`220 tesla.comm.toronto.edu ESMTP Sendmail 8.9.0/8.9.0; Thu, 2 Jul 1998 05:07:59 -0400 (EDT)`
3.	Client sends a HELO message and identifies itself.	`HELO bhaskara.comm.utoronto.ca`
4.	SMTP daemon issues a 250 message, indicating the client may proceed.	`250 tesla.comm.toronto.edu Hello bhaskara.comm [128.100.10.9], pleased to meet you`
5.	Client sends sender's address.	`MAIL FROM: <banerjea@comm.utoronto.ca>`
6.	If successful, SMTP daemon replies with a 250 message.	`250 <banerjea@comm.utoronto.ca>... Sender ok`
7.	Client sends recipient's address.	`RCPT TO: <alg@nal.utoronto.ca>`
8.	A 250 message is returned.	`250 <alg@nal.utoronto.ca>... Recipient ok`
9.	Client sends a DATA message requesting permission to send the mail message.	`DATA`
10.	The daemon sends a message giving the client permission to send.	`354 Enter mail, end with ''.'' on a line by itself`
11.	Client sends the actual text.	`Hi Al,` `This section on email sure needs a lot of work...`
12.	Daemon indicates that the message is accepted for delivery. A message ID is returned.	`250 FAA00803 Message accepted for delivery`
13.	Client indicates that the mail session is over.	`QUIT`
14.	Daemon confirms the end of the session.	`221 tesla.comm.toronto.edu closing connection`

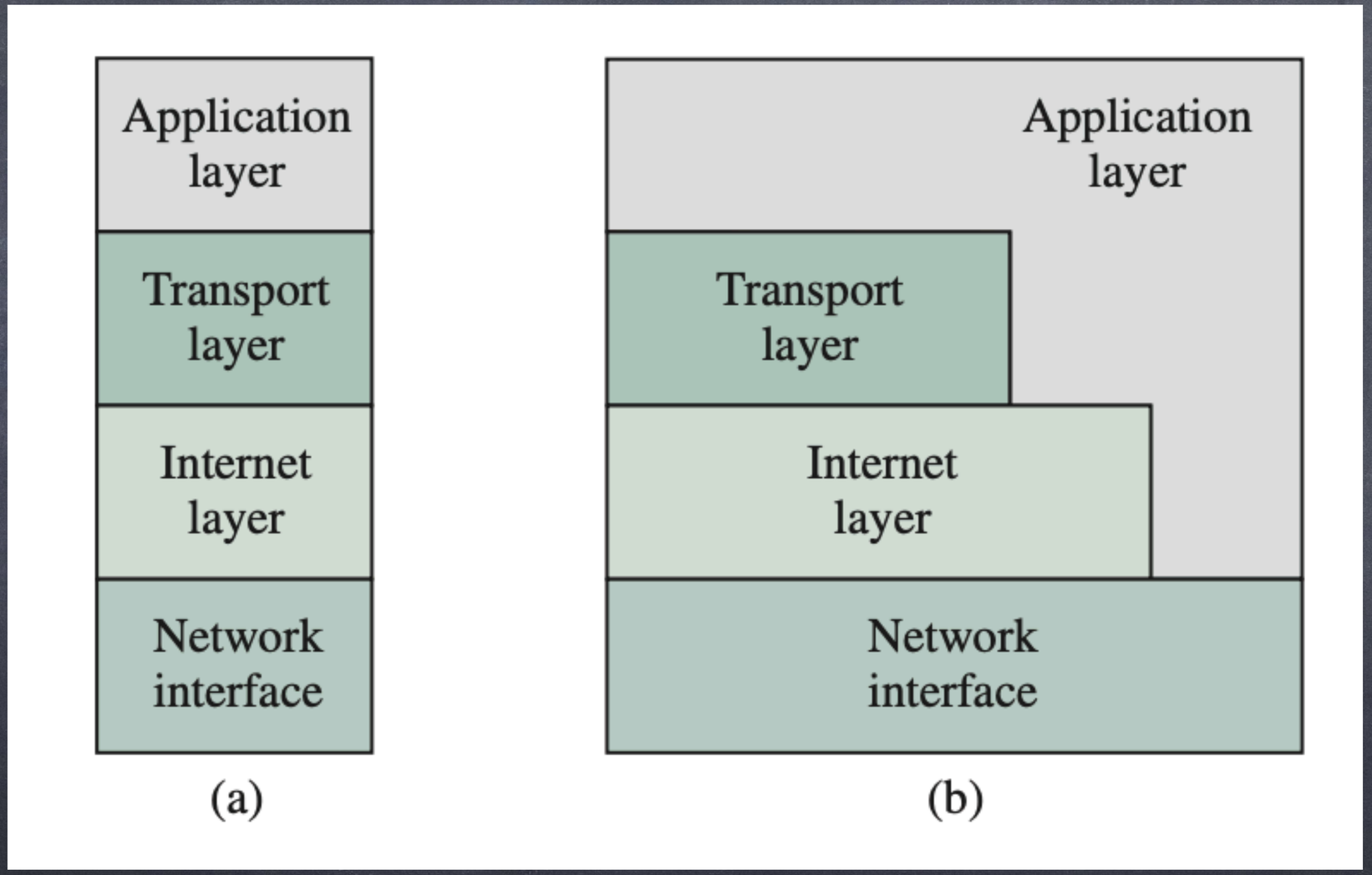
OSI REFERENCE MODEL



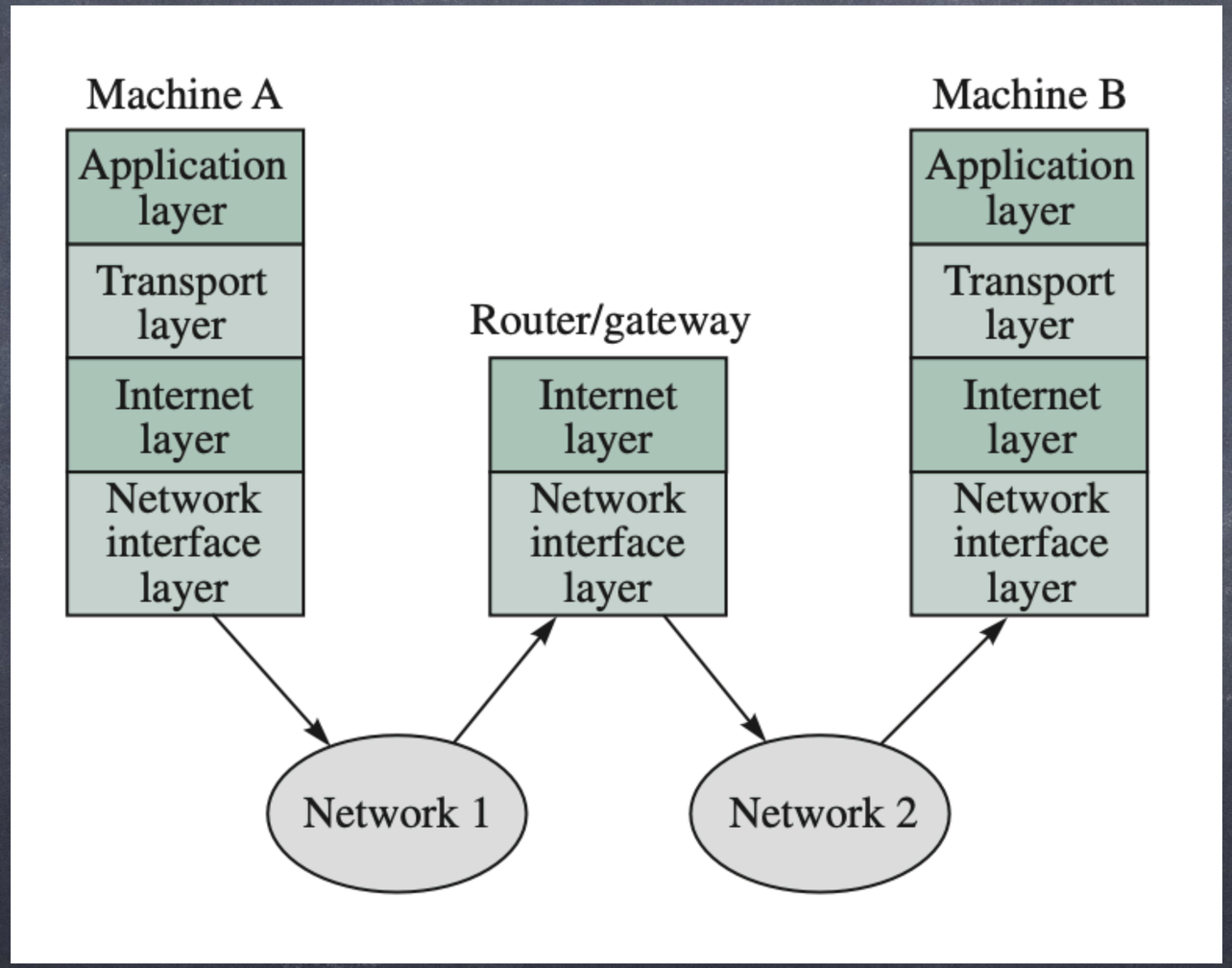
OSI REFERENCE MODEL



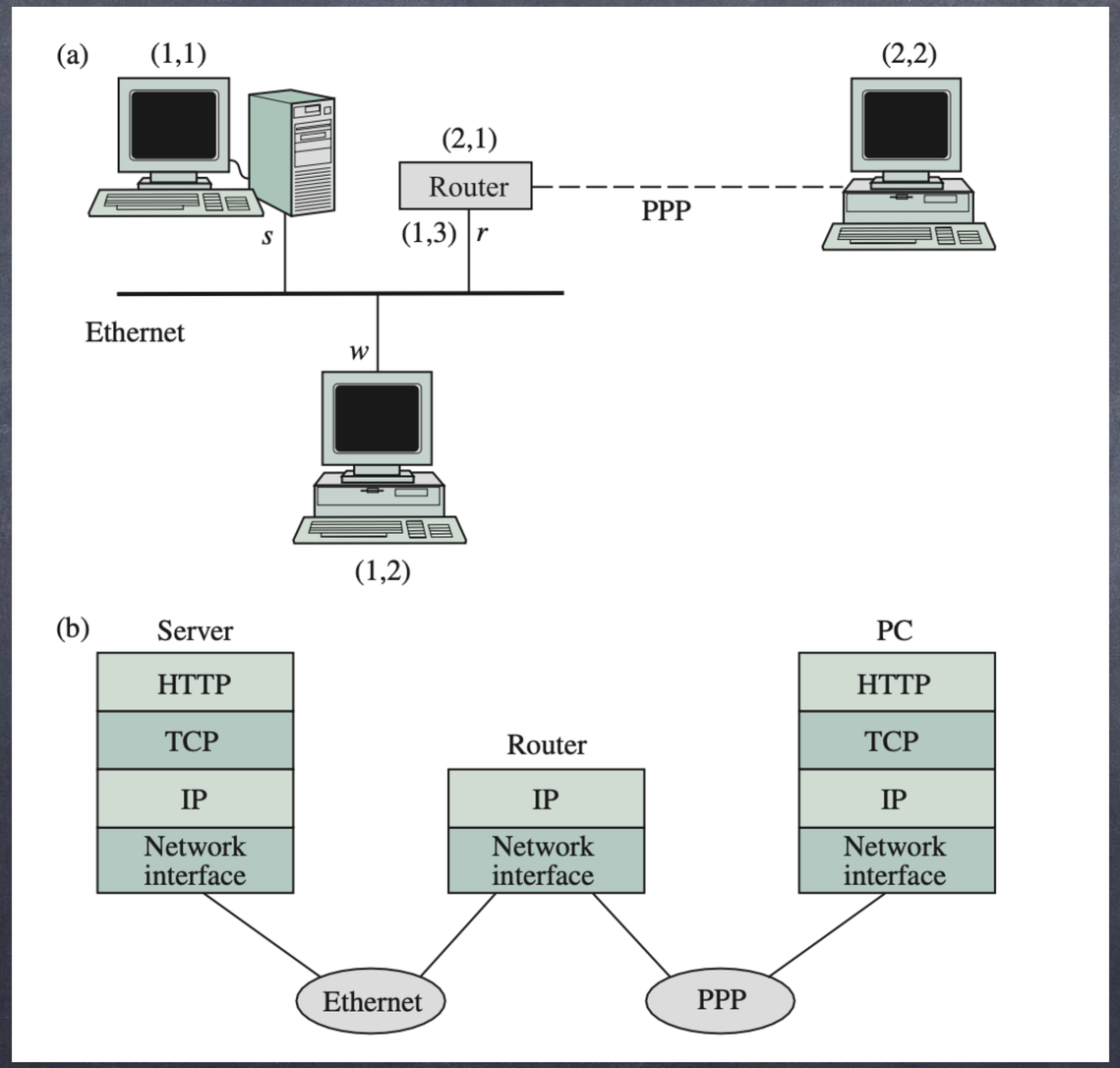
OVERVIEW OF TCP/IP ARCHITECTURE



THE INTERNET LAYER AND THE NETWORK INTERFACE LAYER



THE INTERNET LAYER AND THE NETWORK INTERFACE LAYER



APPLICATION PROTOCOLS AND TCP/IP UTILITIES

TELNET

Telnet is a TCP/IP protocol that provides a standardized means of accessing resources on a remote machine where the initiating machine is treated as local to the remote host. In many implementations Telnet can be used to connect to the port number of other servers and to interact with them using a command line.

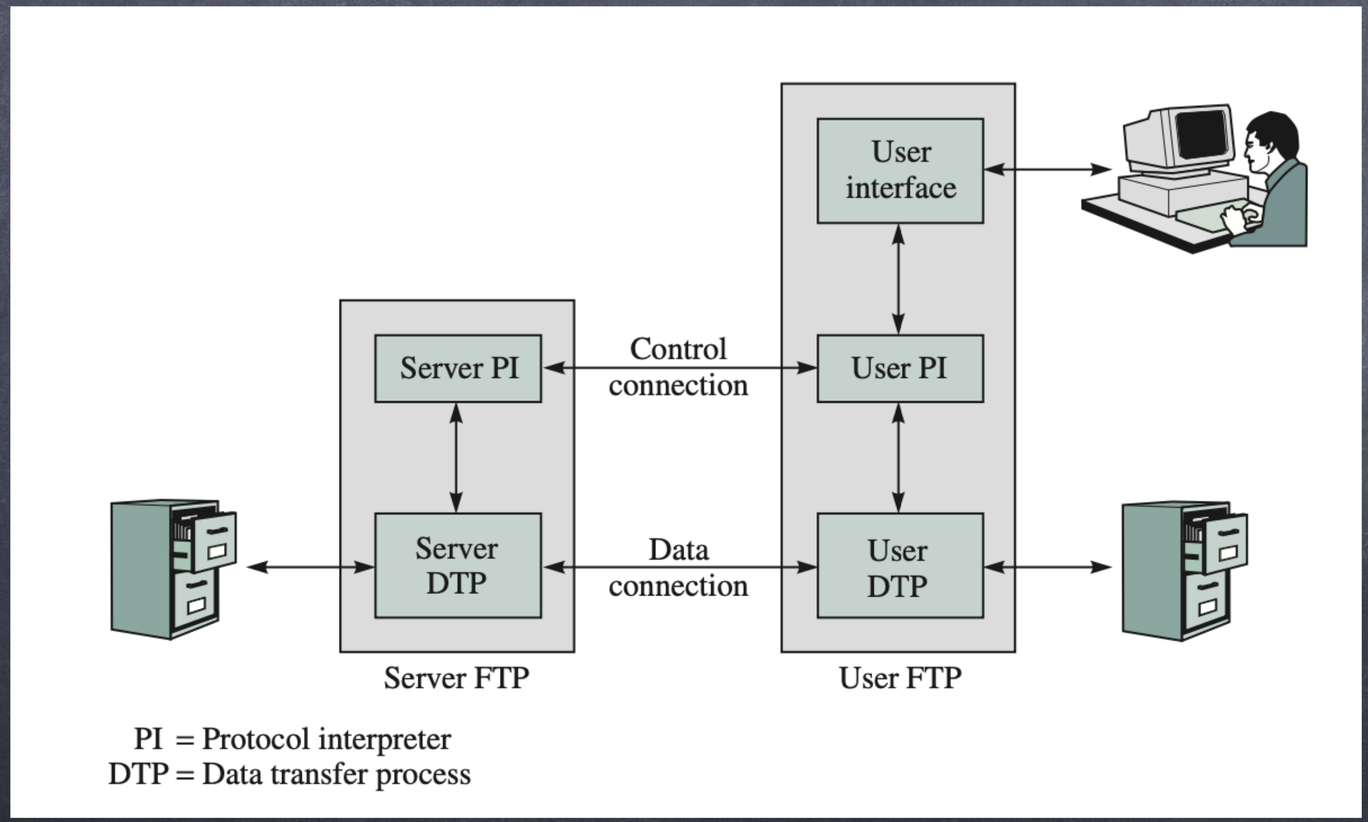
APPLICATION PROTOCOLS AND TCP/IP UTILITIES

FILE TRANSFER PROTOCOL

File Transfer Protocol (FTP) is another commonly used application protocol. FTP provides for the transfer of a file from one machine to another. Like Telnet, FTP is intended to operate across different hosts, even when they are running different operating systems or have different file structures.

APPLICATION PROTOCOLS AND TCP/IP UTILITIES

FILE TRANSFER PROTOCOL



APPLICATION PROTOCOLS AND TCP/IP UTILITIES

IP UTILITIES

1. PING
2. TRACEROUTE
3. NETSTAT
4. TCPDUMP

Next ...

CELLULAR NETWORKS