

# DEVICES AND COMMUNICATION BUSES FOR DEVICES NETWORK—

## **Lesson-24: INTERNET ENABLED SYSTEMS NETWORK PROTOCOLS**

## Internet enabled embedded system

- Communication to other on the Internet.
- Use html (hyper text markup language) or MIME (Multipurpose Internet Mail Extension) type files
- Use TCP (transport control protocol) or UDP (user datagram protocol) as transport layer protocol
- addressed by an IP address
- Use IP (internet protocol) at network layer protocol

# MIME

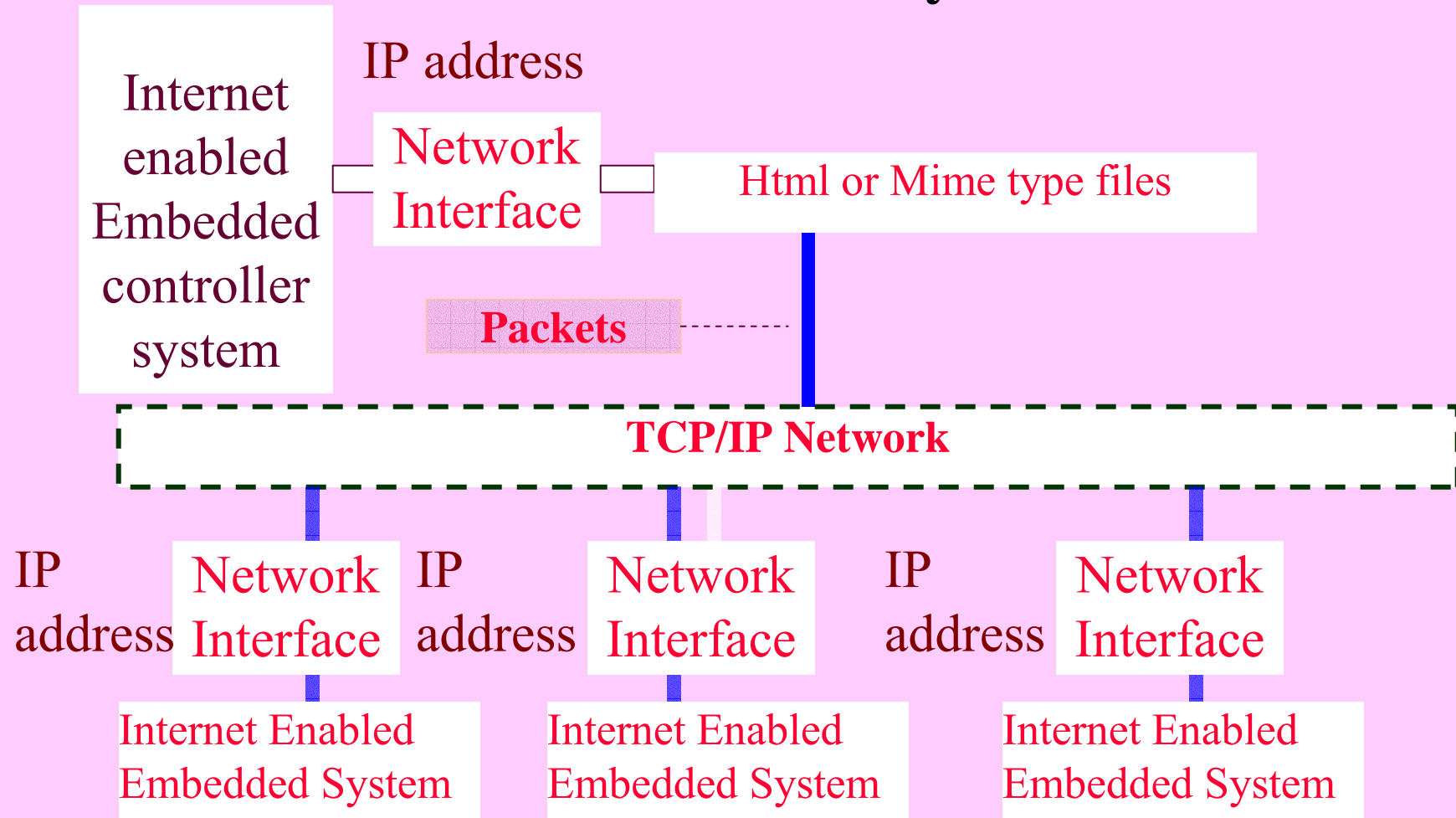
Format to enable attachment of multiple types of files

- txt (text file)
- doc (MSOFFICE Word document file)
- gif (graphic image format file)
- jpg (jpg format image file)
- wav format voice or music file

## A system at one IP address

- Communication with other system at another IP address using the physical connections on the Internet and routers
- Since Internet is global network, the system connects to remotely as well as short range located system.

# TCP/IP Network For Internet Enabled Embedded devices/systems



## TCP/IP Network connectivity

- Through the layers— Application, transport, network, data-link and physical
- Application layer protocol also specifies presentation ways.
- Transport layer protocol also specifies provide session establishment and termination ways.
- Each layer has a protocol, which specifies the way in which the data or message from previous layer transfer to next layer

# TCP/IP Network 5 layers

Application HTTP or FTP or Telnet or other
TCP or UDP
internet
Data-link
Physical

# HTTP

- Layer accepts the data, for example, in HTML or text format and puts the header words as per the protocol and sends application header and data to transport layer.
- A port number specifies the application in the header



## Port Number

- A port assigned number supports multiple logical connections using a socket, and a socket has an IP address and port number.
- A registered port number is between 0 and 1023. Registration is done by IANA (Internet Assigned Number Authority).
- Port number 0 means host itself.

# Application Port Numbers

- HTTP (Port 80) enables Internet connectivity by Hyper-Text Transfer Protocol (HTTP).
- FTP (Port 21 for control, 20 for data) enables file transfer connectivity by File Transfer Protocol.
- TFTP (Port 69) for Trivial FTP.
- NFS (Network File System) is used for sharing files on a network.
- TELNET (Port 23) enables remote login to remote terminals by Terminal Access Protocol.
- SMTP (Port 25) enables e-mail transfer, store and forward by Simple Mail Transfer Protocol.

# Application Port Numbers

- PoP3 (Port 110) enables e-mail retrieval.
- NNTP (Port 119) by (Network News Transfer Protocol).
- DNS (Port 53) for Domain Name Service.
- SNMP (Port 161) is Simple Network Management Protocol.
- Bootps and Bootpc (Ports 67 and 68) for Bootstrap Protocol Server and Client, respectively.
- DHCP (Dynamic Host Configuration Protocol) is used for remote booting as well as for configuring a system.

## HTTP (Port 80) features

- standard protocol for requesting for a URL (universal resource locator, for example, <http://www.mcgraw-hill.com>)
- stateless protocol. For HTTP request, the protocol assumes a fresh request. It means there is no session or sequence number field or no field that is retained in the next exchange. This makes a current exchange by an HTTP request independent of the previous exchanges.

## HTTP Features

- A file-transfer like protocol for HTML files. This makes it easy to explore a web site URL. A request (from a client) is sent and reply (response from a server) is received.
- The HTTP protocol is very light (a small format) and thus speedy as compared to other existing protocols. HTTP is able to transfer any type of data to a browser (a client) provided it is capable of handling that data.

# HTTP specific methods

- GET
- POST
- HEAD
- CONNECT
- PUT
- DELETE
- TRACE
- OPTIONS

## HTTP interaction scheme

- A client requests a server directly or through proxy- or gateway
- An HTTP message therefore either a request or a response

## TCP protocol use in transport layer

- Accepts the message from the upper layer (application layer) on a transmission by an application or session layer.
- Accepts a data stream from the network layer at the receiving end.
- Before communicating a message to the next network layer, it may add a *header*.



## TCP message

- The message may communicate in parts or segments or fragments.
- The header generally has the additional bits for the source and destination addresses.
- Also there are bits in it for the sequence and the acknowledge management, flow and error controls, etc.

## TCP feature

- Specifies a format of byte streams at the transport layer of the TCP/IP suite.
- TCP is used for a full duplex acknowledged flow.
- Its format has a TCP header of five plus  $(n-5)$  words for options and padding and data of maximum  $l$  words.

## UDP at transport Layer

- When message is connection less and stateless, then transport layer protocol in TCP/IP suite specifies a protocol called UDP.
- UDP supports the broadcast networking mode. Example — application for communicating a header before a data stream.
- UDP header specifies the bits for the source and destination ports, the total length of message including header and check sum (optional).

## UDP at transport Layer

- During reception, UDP message to the upper layer flows after deleting the header bits from the received transport layer header.
- Header bits added at the transmitting time from the application or session layers are thus strip from the message

## IP for Internet enabled devices communicate

- Transport layer data in TCP or UDP message format transmits on the network after first division into the packets at the network layer, called internet layer.

## IP Packet transmission

- Each packet transmits through a chain of routers on the Internet.
- Packet a minimum unit of data, which transmit on Internet through the routers.
- Several packets from a source can reach a destination using different routes and can have different delays.

# IP packet and routing of packets

- The packet consists of an IP header plus data or an IP header plus a routing protocol with the routing messages. The packet has a maximum of  $2^{16}$  bytes ( $2^{14}$  words, 1 word = 32 bits = 4 bytes).
- The network routing is as per the standard IPv4 (Internet protocol version 4) or IPv6 (Internet protocol version 6).
- IPv6 broadband protocol.

# IP Header

- Version
- Precedence
- service
- QoS (Quality of Service) flags
- checksum



# IP Header

- protocol type
- header length (data-offset)
- Source and Destination addresses
- options
- See Text in the book for explanation

# Summary

## We learnt

- Embedded system Communication to other on the Internet.
- html (hyper text markup language) or MIME (Multipurpose Internet Mail Extension) type files
- TCP (transport control protocol)
- UDP (user datagram protocol)
- Addressed by IP addresses
- IP (internet protocol) at network layer protocol.

# End of Lesson 24 of Chapter 3