

## Operation of TCP/IP

- ✍ Two levels of addressing are needed:
  - » Each host on a subnet must have a unique global internet address
  - » Each process with a host must have a unique address within the host (port)
- ✍ Host address on a network
- ✍ IP deals only with host addresses = Subnet + Host #
- ✍ Application messages are broken into TCP segments

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## Operation of TCP/IP (Cont. )

- ✍ **TCP Header**
  - » Source port (16 bits)
  - » Destination port (16 bits)
  - » Uses segment sequence number (32 bits) for ordering and lost segment detection
  - » Uses checksum for error detection
  - » Passes the segment to IP with instructions to deliver it to the destination host
  - » Delivers the data to appropriate port in the destination host

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## IP Operation

### ✍ IP Protocol

- » Deals only with host addresses

### ✍ Services:

- » Send: user to IP
- » Deliver: IP to user
- » Error (optional): IP to user

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## IP Operation

### ✍ IP Header

- » Source host address (32 bits)
- » Destination host address (16 bits)
- » Type of service ( reliability, precedence, priority)
- » Time-to-live (TTL)
- » Uses checksum for error detection

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## IP Address

✍ Class A: 16,774,214	0	Network	Local	
✍ Class B: 65,534	1	7	24	bits
✍ Class C: 254	10	Network	Local	
✍ Class D:	2	14	16	bits
✍ Local : Subnet + Host	110	Network	Local	
✍ Example 1:	3	21	8	bits
150.215.17.9	4	Host group (multicasting)		
10010110.11010111.00010001.00001001		28		bits
✍ Example 2:				
150.215.255.255 (broadcasting)				5

## IP Address

- ✍ Class A - supports 16 million hosts on each of 127 networks
- ✍ Class B - supports 65,000 hosts on each of 16,000 networks
- ✍ Class C - supports 254 hosts on each of 2 million networks

## IP Address

- ✍ **1 and 126** it is a **Class A** address.
- ✍ **128 and 191** it is a **Class B** address
- ✍ **192 and 223** it is a **Class C** address
- ✍ **224 and 239** it is a **Class D** address
- ✍ **240 and 255** it is a **Class E** address

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## IP Address Assignment

- ✍ Each network address prefix used within a given TCP/IP internet must be UNIQUE.
- ✍ Private internet can assign address prefixes without considering the assignments of other organizations
- ✍ A central authority exists to ensure the uniqueness of global IP assignments
- ✍ *Internet Corporation For Assigned Names and Numbers (ICANN)*
- ✍ Internet Service provider (ISP)

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## IP Address Assignment

- ✍ Each host on a specific network is assigned a *host number* or *host address* that is unique *within that network*
- ✍ Assignment of network numbers must be coordinated globally; assignment of host addresses can be managed locally

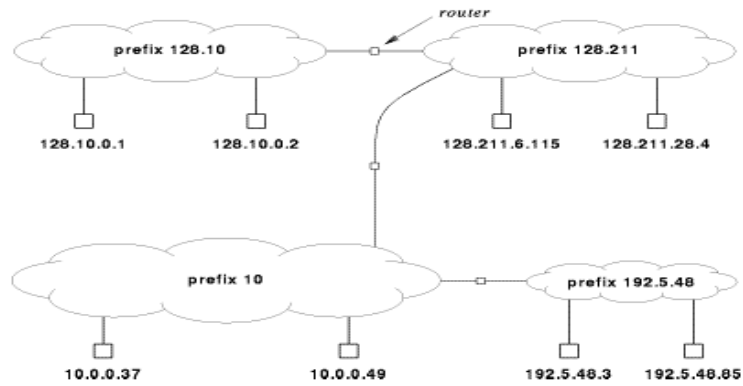
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## Example: IP Address Assignment

- ✍ Select address class for each network depending on expected number of hosts
- ✍ Assign network numbers from appropriate classes
- ✍ Assign host suffixes to form internet addresses for all hosts

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## Example: IP Address Assignment



## Internetworking

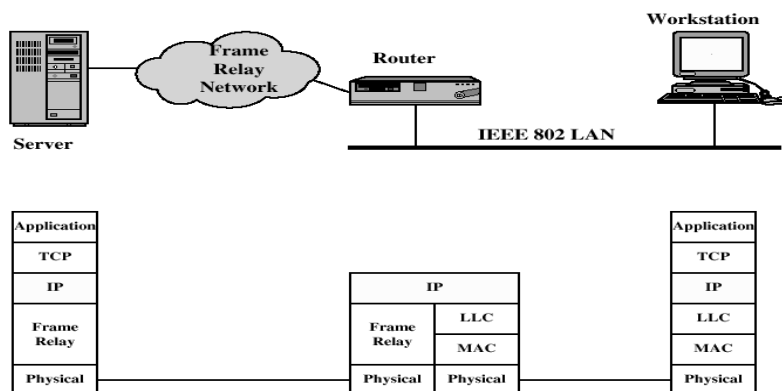
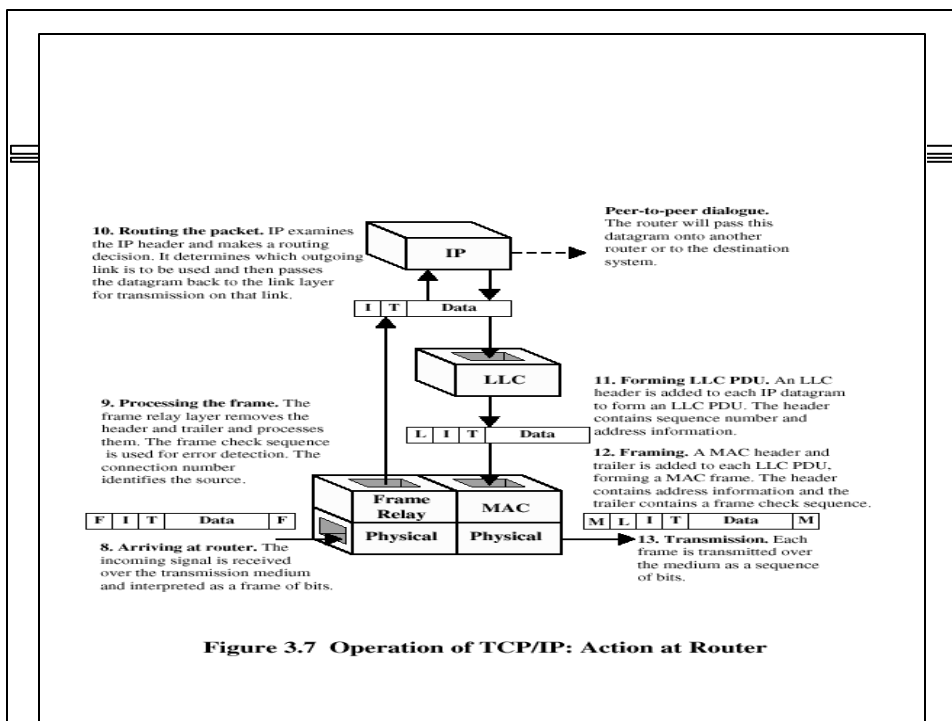
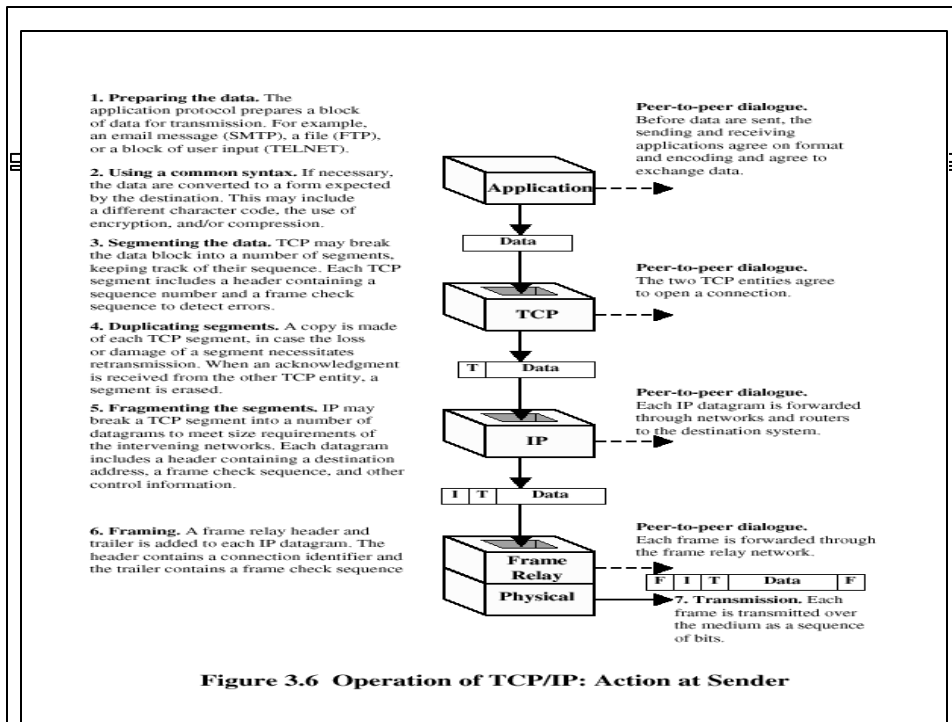
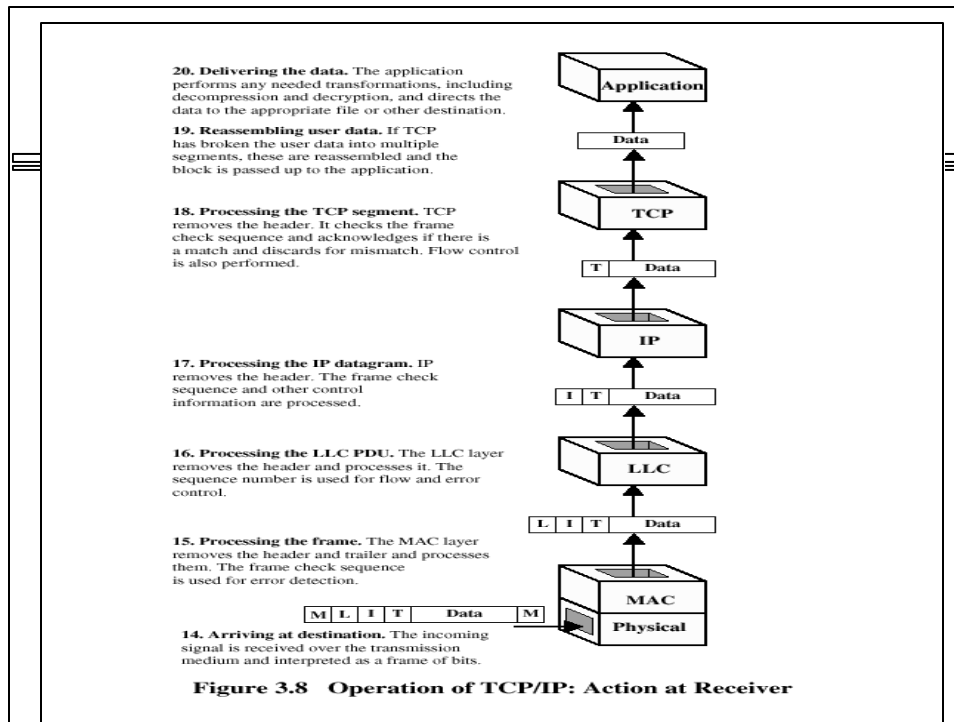


Figure 3.5 Configuration for TCP/IP Example





## Important Concepts

### 📌 Circuit Switching

- » A dedicated communication path between two stations
  - a path is a sequence links between nodes
- » Circuit switching connection phases:
  - Circuit Establishment (TDM or FDM)
  - Data transfer
  - Circuit disconnect
- » Channel capacity is dedicated for the duration of a connection
- » Fixed data (digital or analog) transfer rate (streaming)
- » No delay other than Call establishment delay and propagation delay
- » **Main Application: Telephone networks**



## Important Concepts

### ✎ **Circuit Switching Drawbacks:**

- » Low channel utilization
- » The interconnecting devices must receive and transmit at the same rate

### ✎ **Packet Switching**

- » Data is transmitted in blocks, called packets
- » Each packet has two main components:
  - data (payload)
  - header (control information)

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## Important Concepts

### ✎ **How Network handles the Packet Streams:**

- » Datagram Approach
- » Virtual Circuit Approach

### ✎ **Datagram Approach**

- » Each packet is treated independently
- » Packets may not follow the same route and therefore arrive out of sequence

### ✎ **Virtual Circuit Approach**

- » A logical connection is established before sending any packets (A fixed route is preplanned)
- » Each packet contains a virtual circuit identifier and data

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