Chapter 11

User Datagram Protocol (UDP)

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- USE OF UDP
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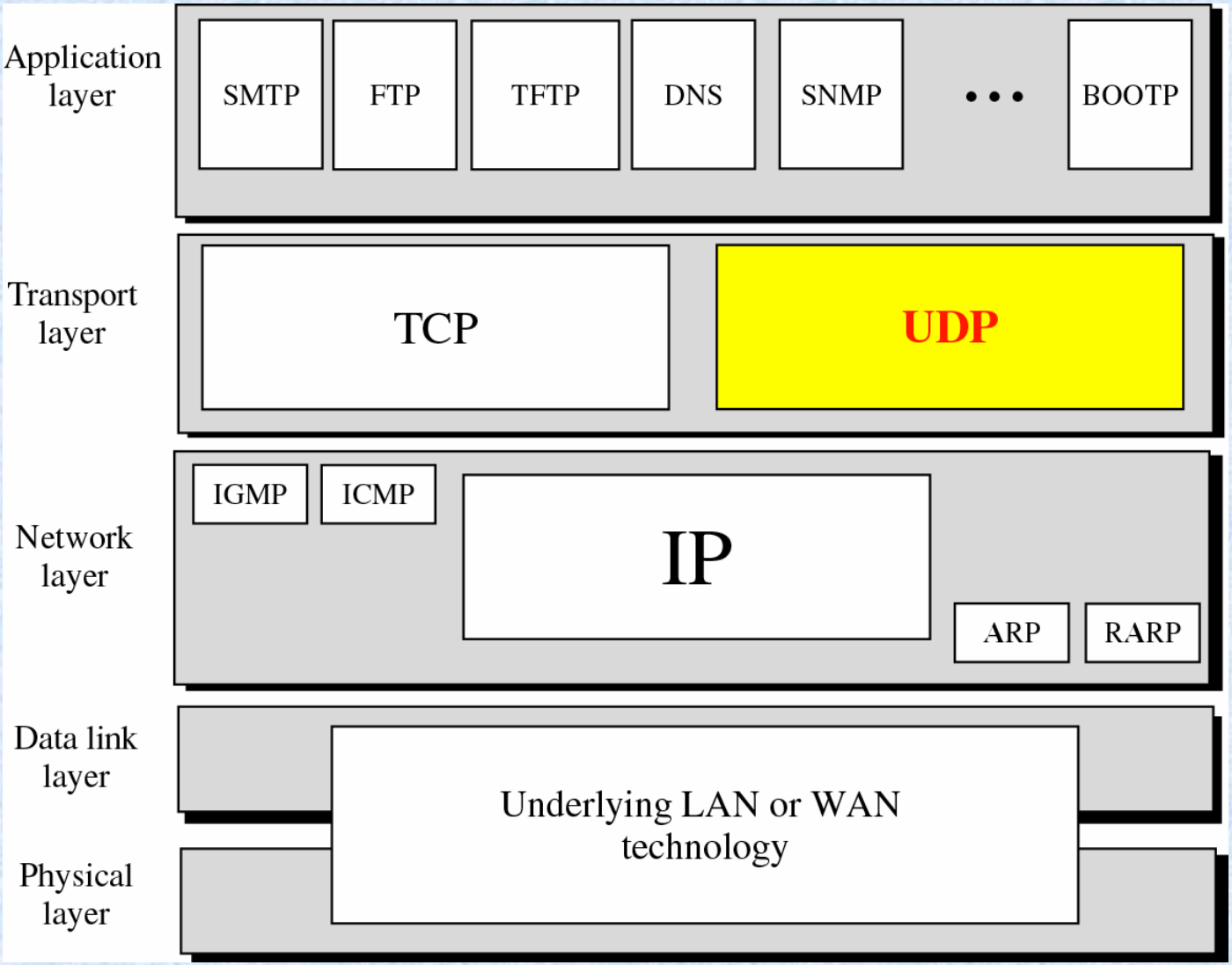
Position of UDP in the TCP/IP protocol suite



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UDP Services

- Process-to-process communication using "Ports."
  Fundamentally, this is the only thing it adds on top of IP.
- Control:
  - No flow control or acknowledgment
  - Minimal error control: simply detect and drop.
- No Segmentation/Reassembly service. Incoming data must fit in a UDP packet.
- Connectionless & Unreliable transport.
- Minimal overhead, compared to TCP

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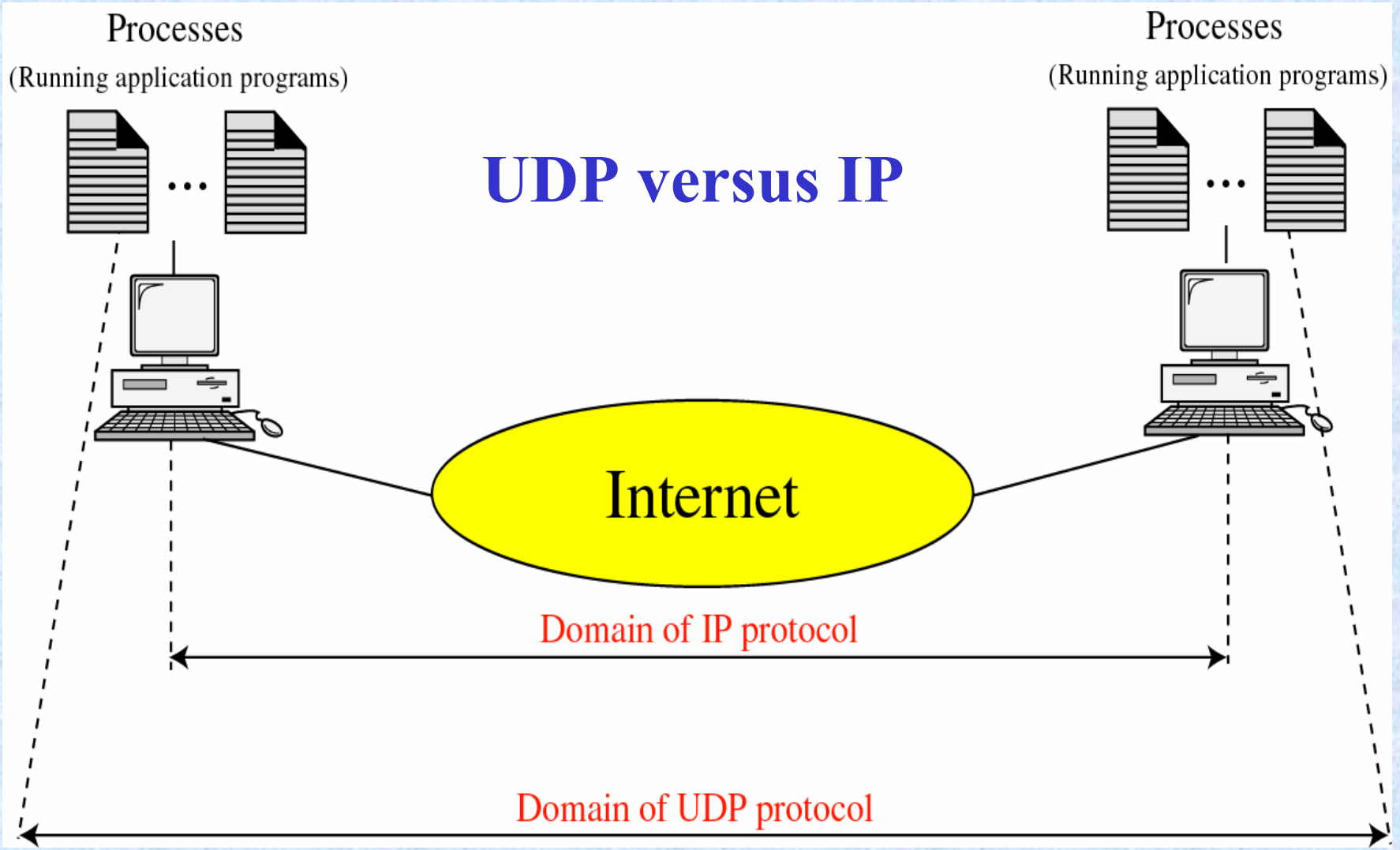
11.1 PROCESS TO PROCESS COMMUNICATION



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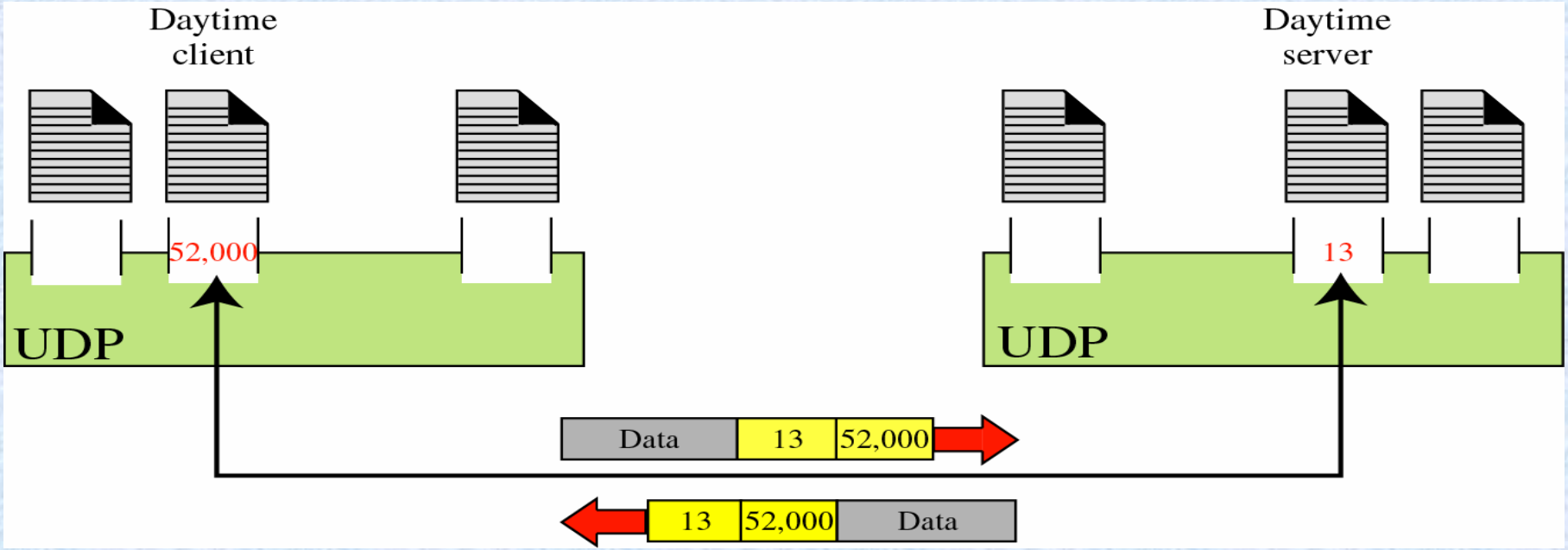
Client-Server Paradigm & Ports

- A *Client* process on a local host sends a request to a *Server* process on a remote host.
- Client process identification:
  - Local host IP
  - *Ephemeral port number* (0-65,535) randomly chosen by UDP
- Server process identification
  - Remote host IP
  - *Well-known* port number



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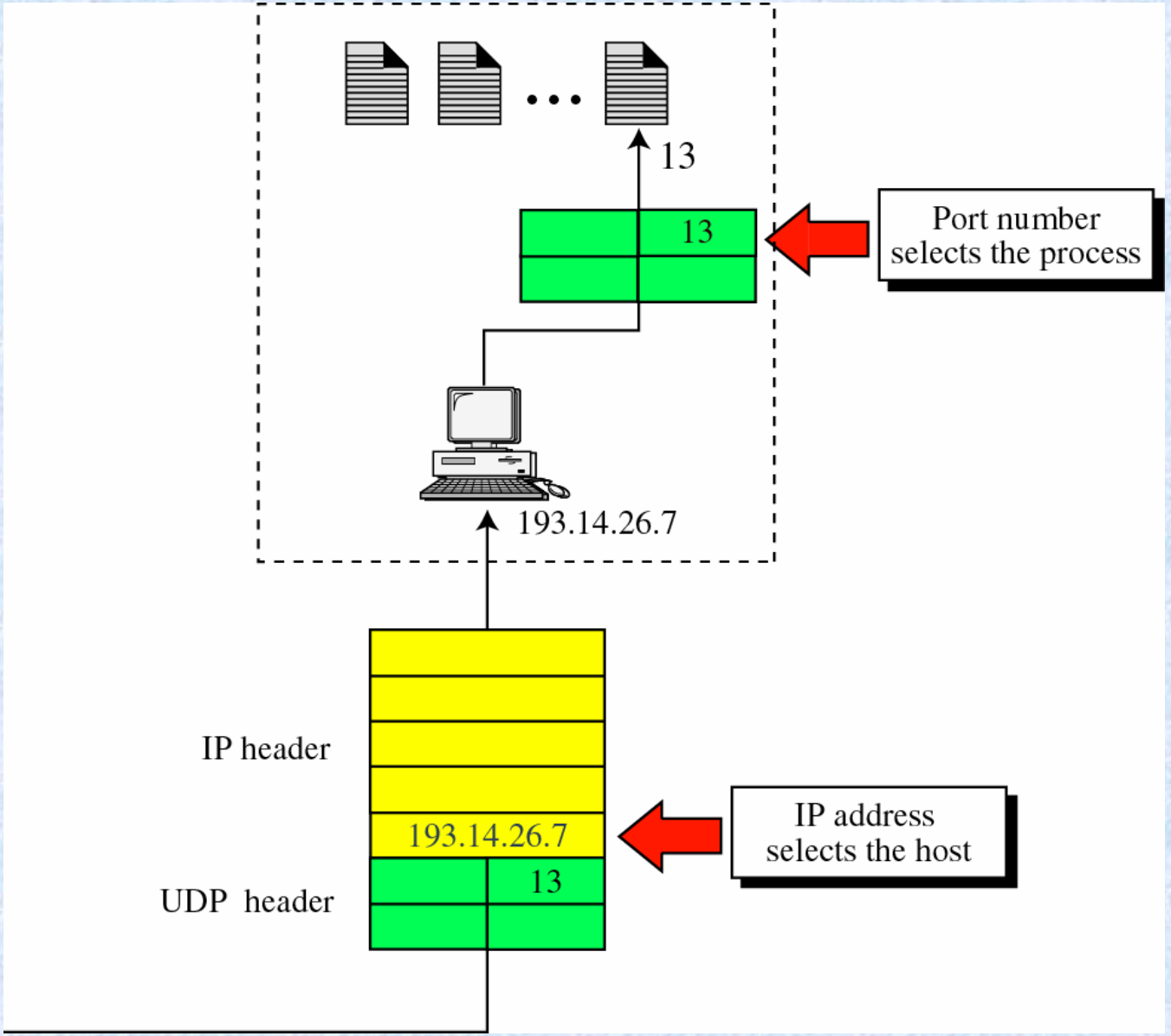
Role of IP addresses vs. Port numbers



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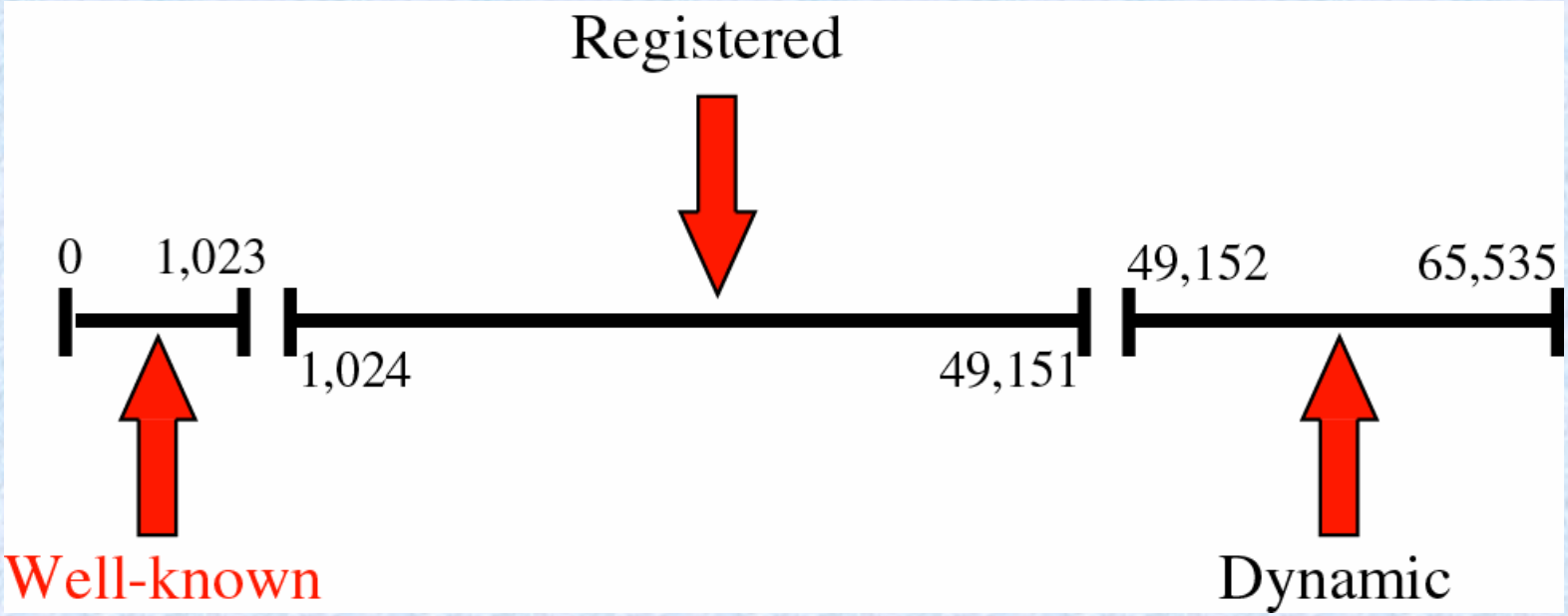
IANA Port Number Ranges



Port	Protocol	Description
7	Echo	Echoes a received datagram back to sender
13	Daytime	Returns the date and time
111	RPC	Remote procedure call
123	NTP	Network Time Protocol
161	SNMP	Simple Network Management Protocol

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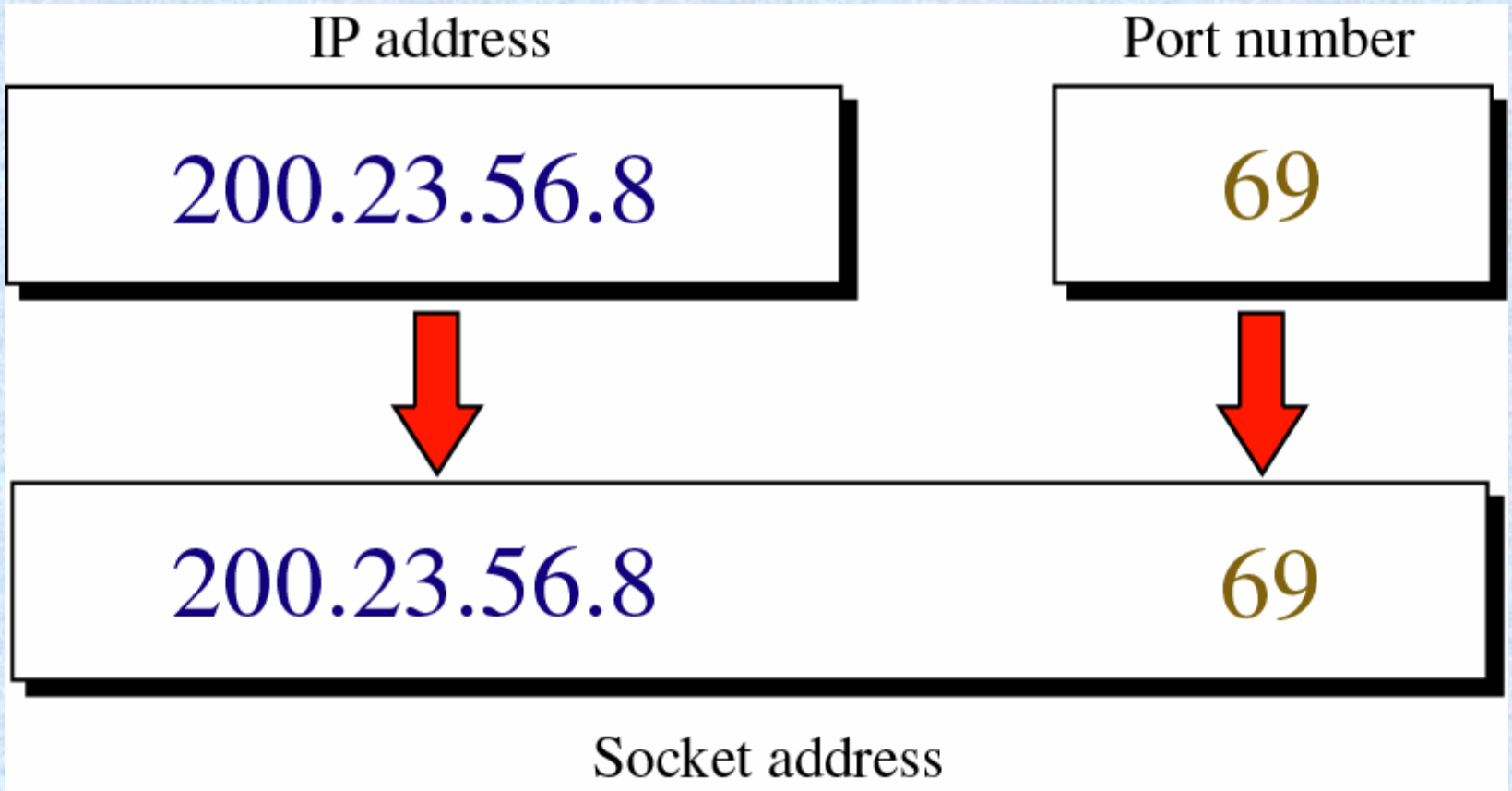
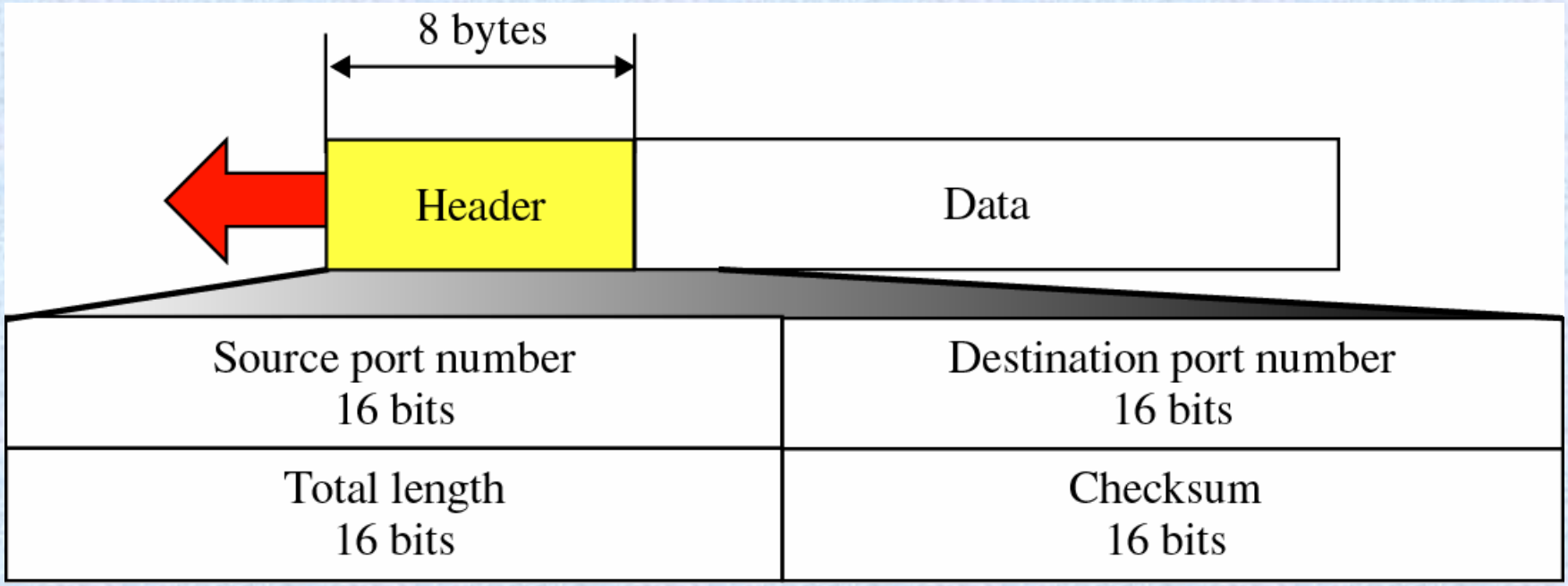
Socket addresses



11.2 UDP Packets or *User Datagram*



Max UDP Data length

= 65535 - UDP Header (8) - Smallest IP header(20)

= 65,507

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11.3 Checksum

- Checksum covers three sections:
  1. Pseudoheader *(which does not physically exist as part of the user datagram)*
  2. UDP header
  3. Data coming from Application Layer whose length must be an even number of Bytes. Padding may be added to help compute the checksum, then eliminated be.

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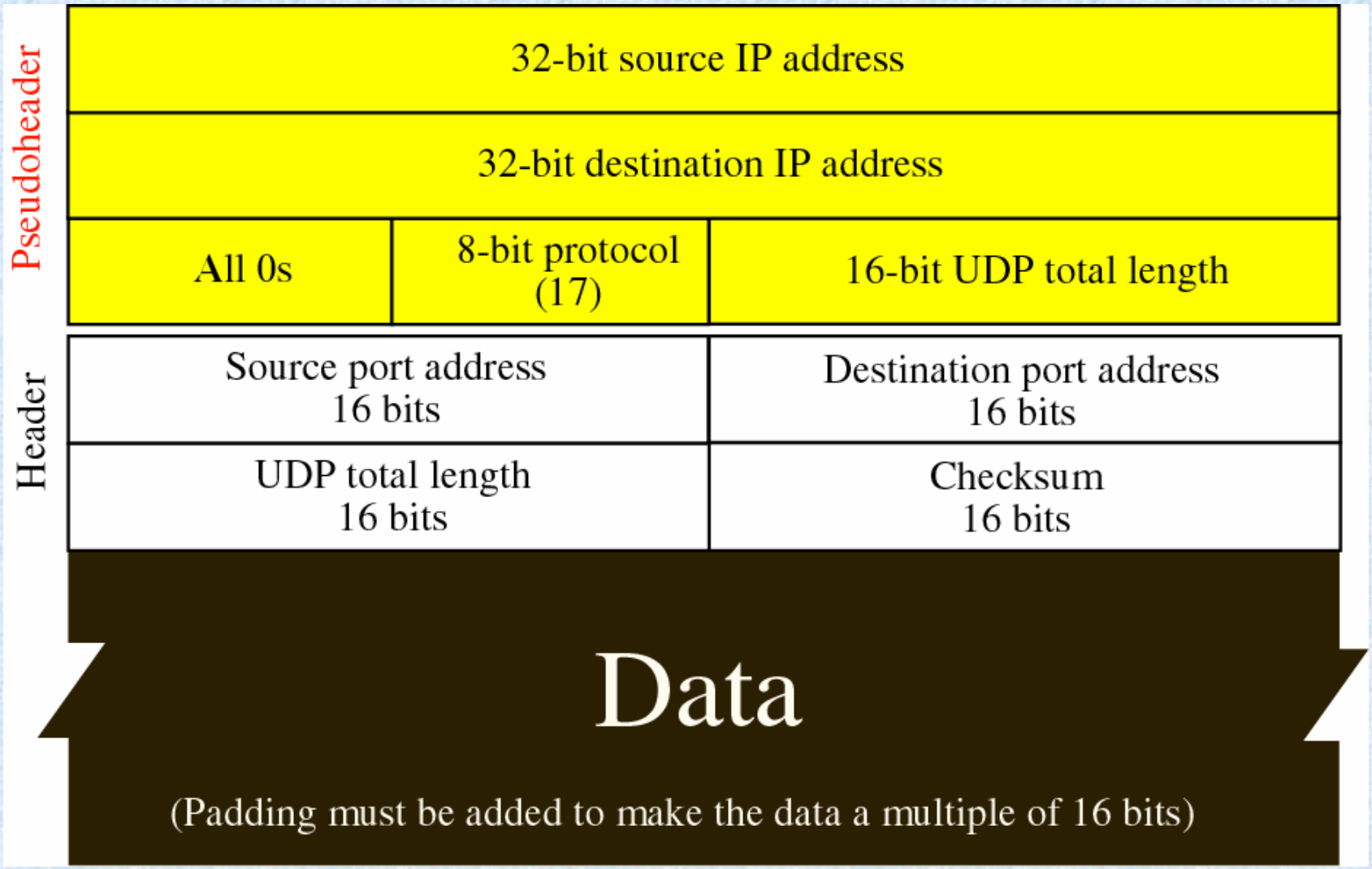
Pseudoheader added to the UDP datagram



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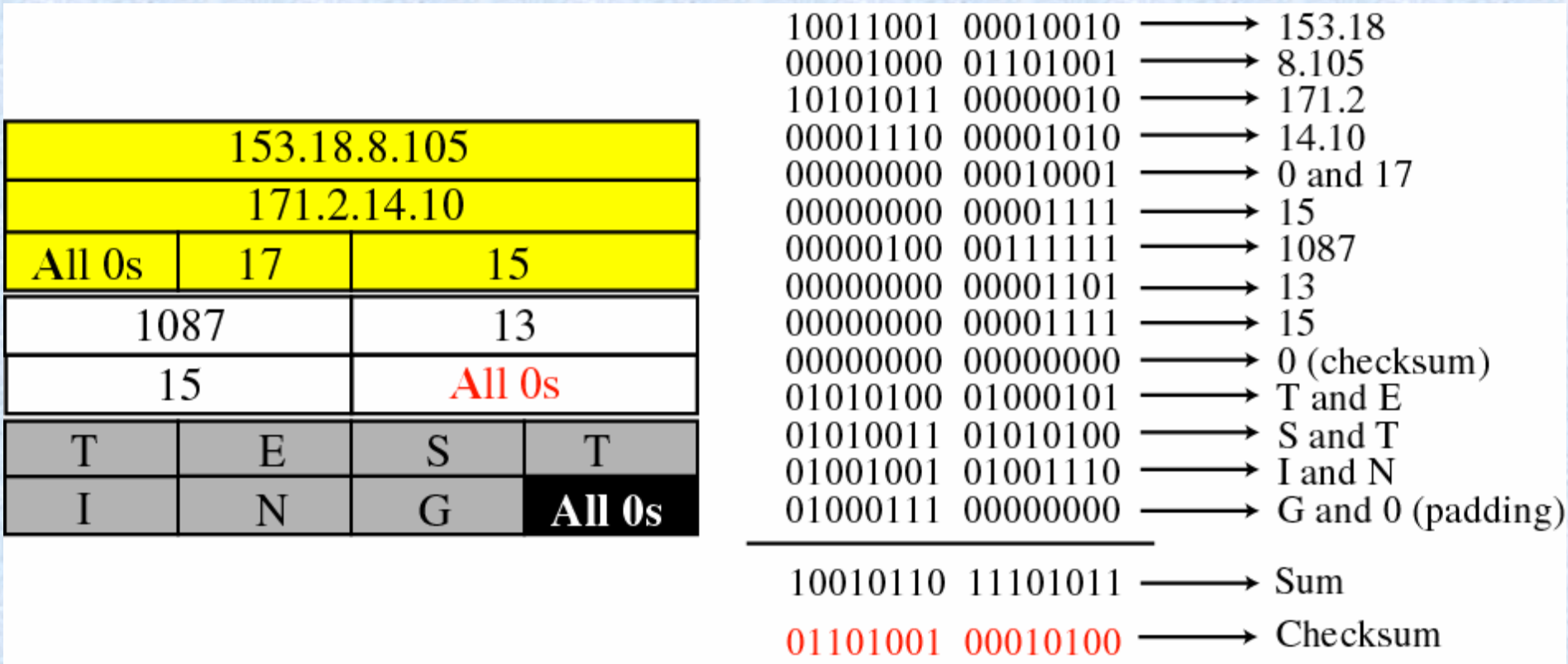
Checksum calculation of a simple UDP user datagram



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11.4 UDP Operation

- Its Connectionless:
  - Independent user datagrams, even if from same source socket to same destination socket. No streaming is supported.
  - Data must be small enough to fit in one user datagram.
- No flow or error control
  - If checksum fail, destination silently drops the datagram.
  - Source gets no idea whether the user datagram has arrived.

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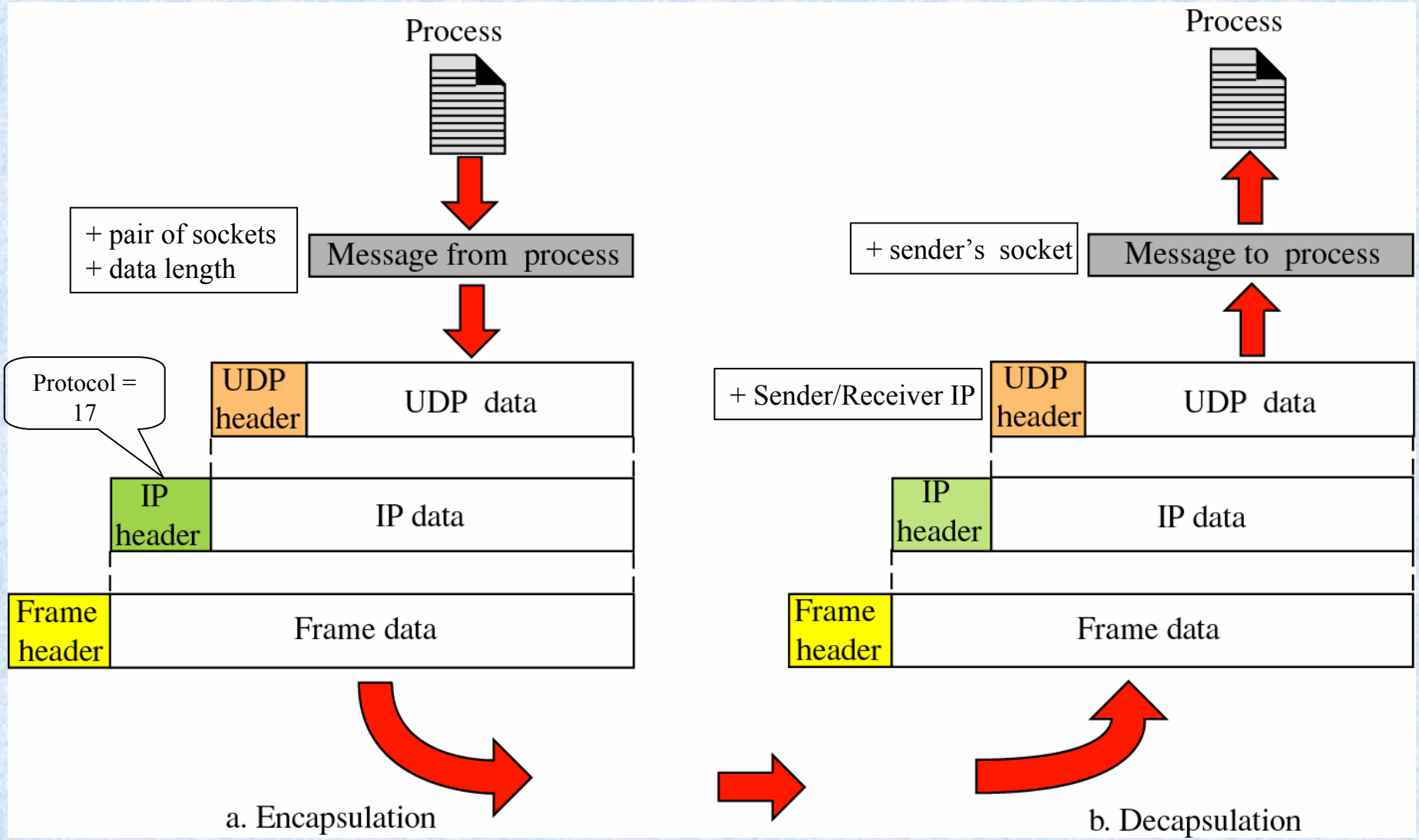
Encapsulation and decapsulation



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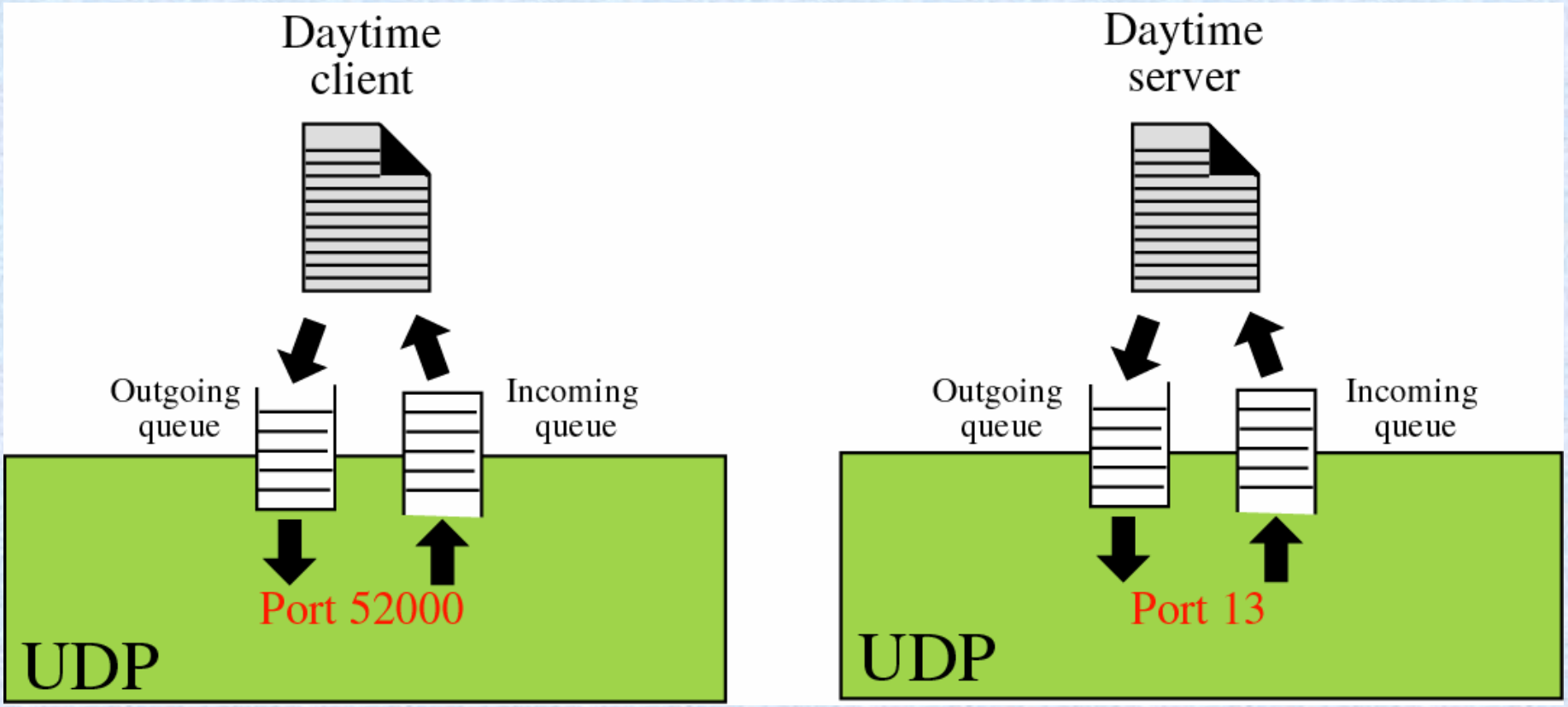
Queues in UDP



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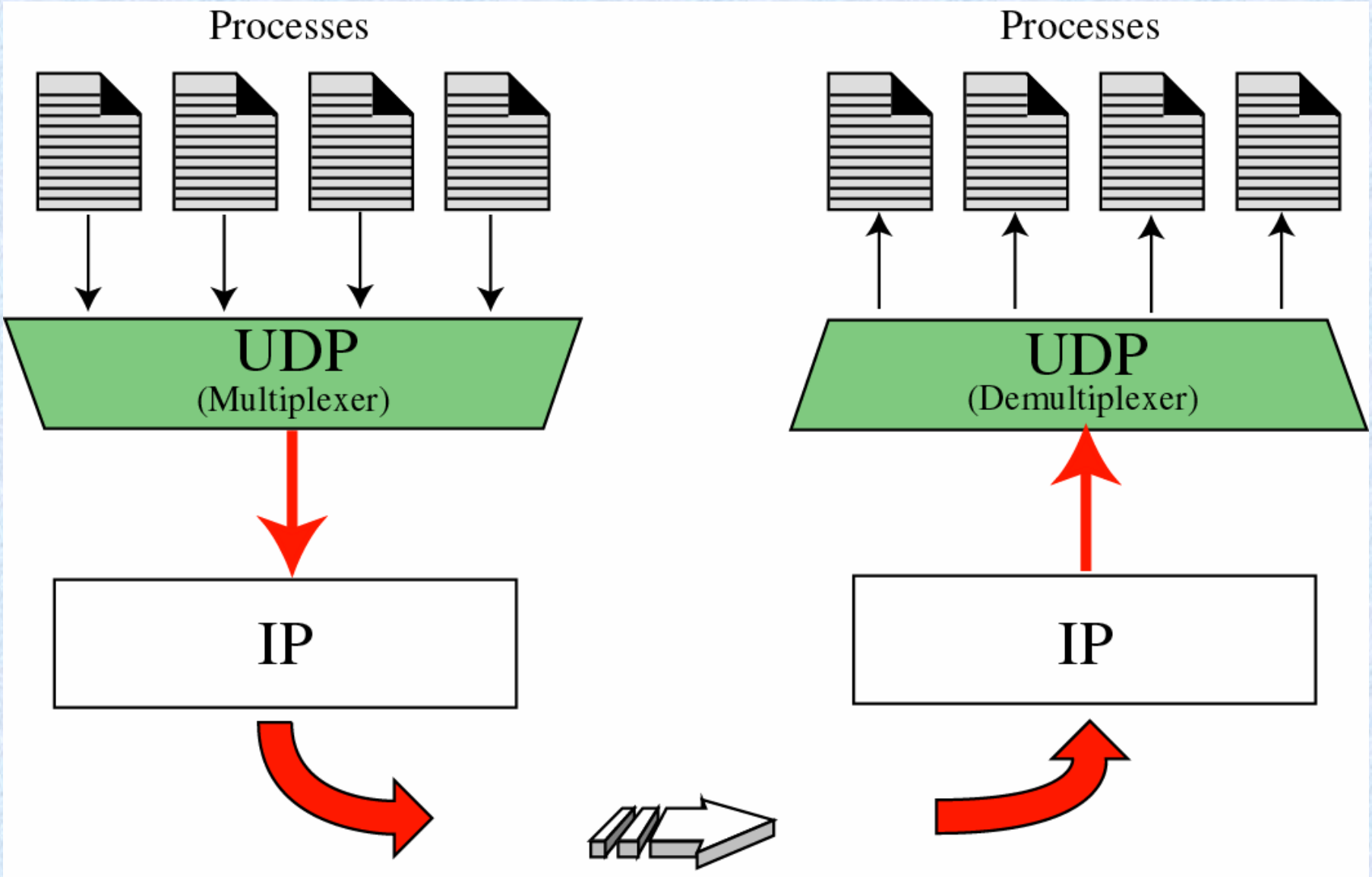
Multiplexing and demultiplexing



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11.5 Use of UDP

- Simple request-response communication (no bulk data)
- Processes with Internal flow and error-control mechanisms (e.g. Trivial FTP).
- Multicasting and Broadcasting
- Management processes (e.g. SNMP)
- Routing Information Protocol (RIP) for route updating.

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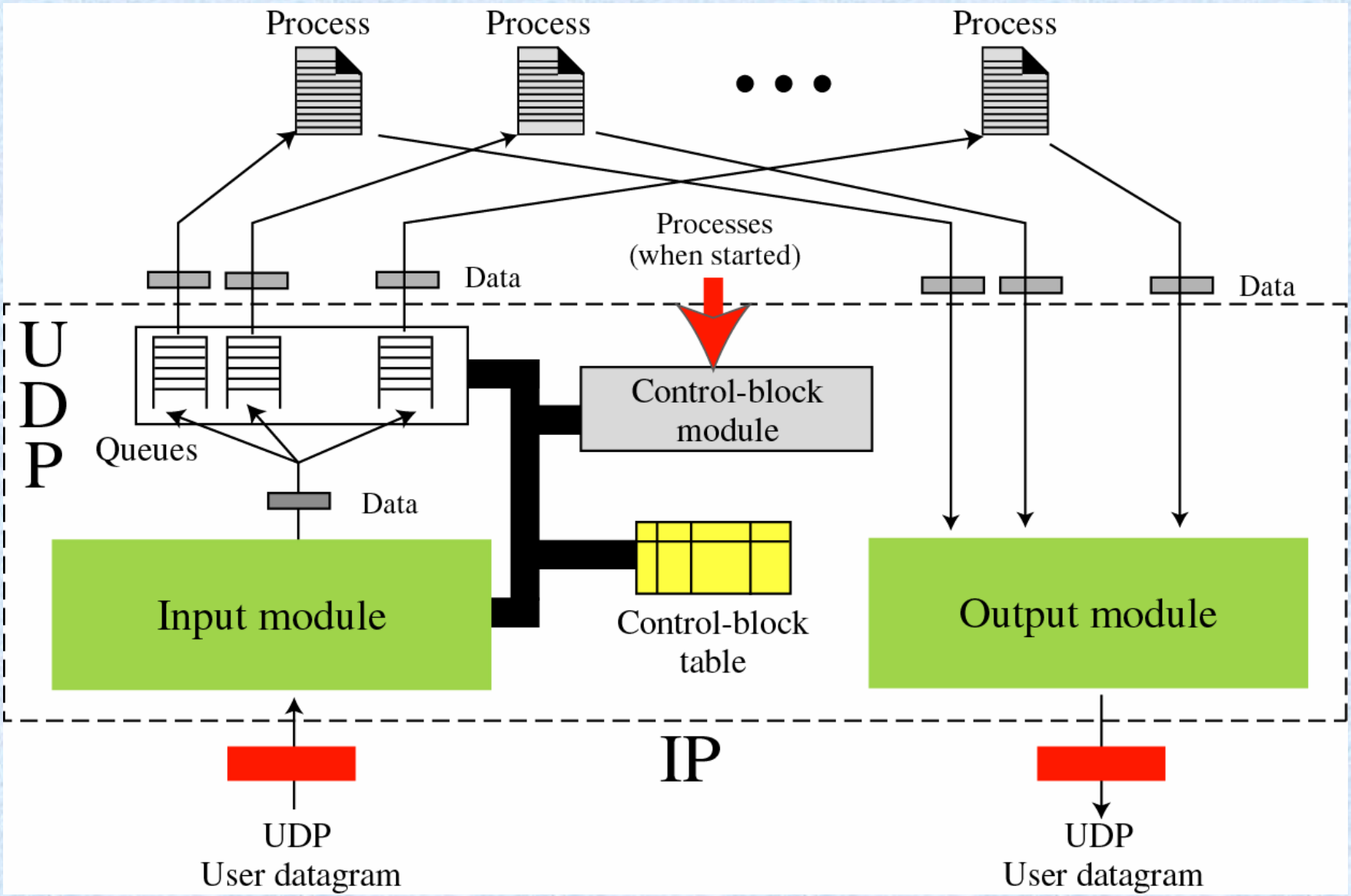
11.6 UDP Package



Examples
Control-block table at the beginning

State	Process ID	Port Number	Queue Number
IN-USE	2,345	52,010	34
IN-USE	3,422	52,011	
FREE			
IN-USE	4,652	52,012	38
FREE			

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Example 1

The first activity is the arrival of a user

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Example 2

After a few seconds, a process starts. It asks

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Modified table after Example 2

State	Process ID	Port Number	Queue Number
IN-USE	2,345	52,010	34
IN-USE	3,422	52,011	
IN-USE	4,978	52,014	
IN-USE	4,652	52,012	38
FREE			

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Example 3

A user datagram now arrives for port 52,011.

Modified table after Example 3

State	Process ID	Port Number	Queue Number
IN-USE	2,345	52,010	34
IN-USE	3,422	52,011	43
IN-USE	4,978	52,014	
IN-USE	4,652	52,012	38
FREE			

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Example 4

After a few seconds, a user datagram arrives for port 52,222. The input module checks the table and cannot find the entry for this destination. The user datagram is dropped and a request is made to ICMP to send an "unreachable port" message to the source.

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Example 5

After a few seconds, a process needs to send a user datagram. It delivers the data to the output module which adds the UDP header and sends it.

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