CSC465 – Computer Networks
Spring 2004

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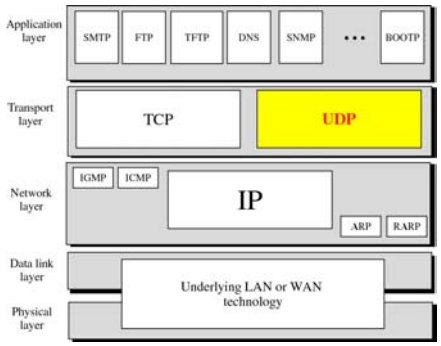
These slides were produced almost entirely from material by Behrouz Forouzan for the text "TCP/IP Protocol Suite (2nd Edition)", McGraw Hill Publisher

Chapter 11

User Datagram Protocol (UDP)

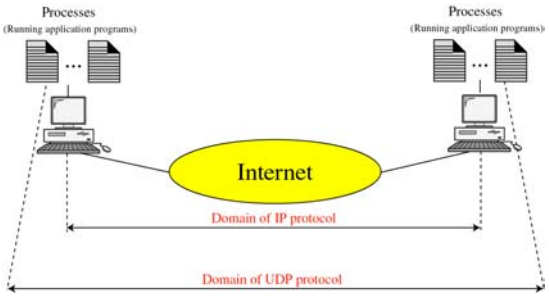
Position of UDP in the TCP/IP protocol suite



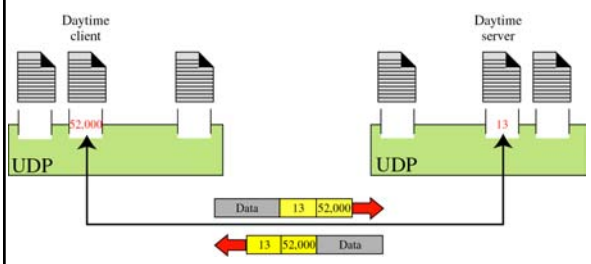
UDP: User Datagram Protocol

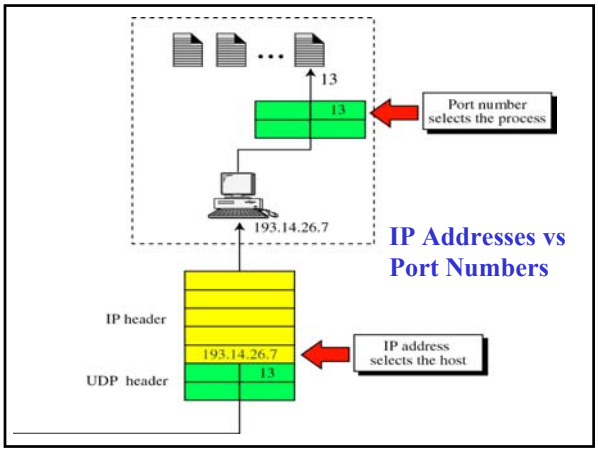
- Connectionless
- Unreliable but minimal overhead
- Adds *process-to-process* communication to IP's *host-to-host*
- Suitable for processes that:
  - requires simple request-response communication (no error/flow control)
  - include ***internal*** error/flow control mechanisms
  - Examples: Broad-/Multi-casting, SNMP, routing

UDP versus IP



Port numbers

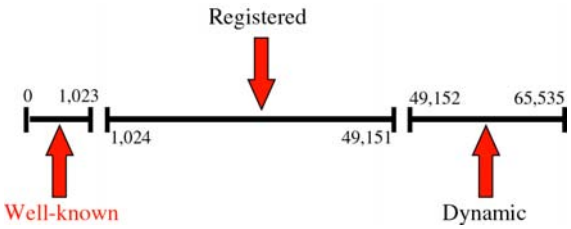




IP Addresses vs Port Numbers

IANA Port Number Ranges

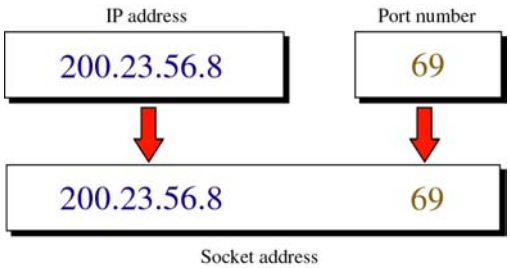
(IANA RFC 1700)



7 Echo

69 TFTP

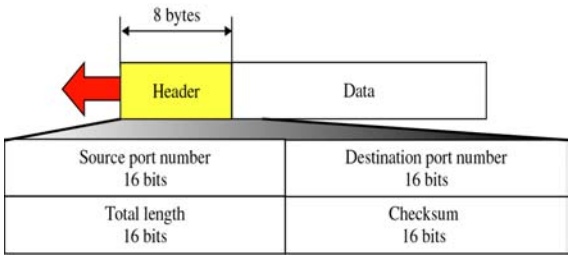
Socket addresses



11.2

USER DATAGRAM

User datagram format



Note

UDP length = IP length – IP header's length

11.3

CHECKSUM

Pseudoheader added to the UDP datagram

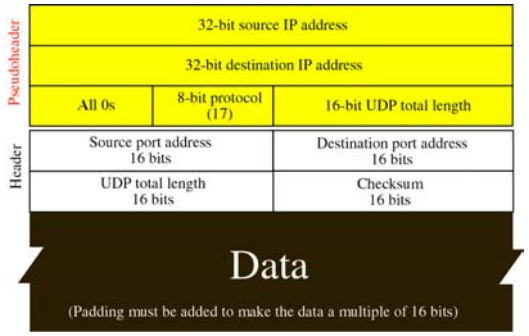
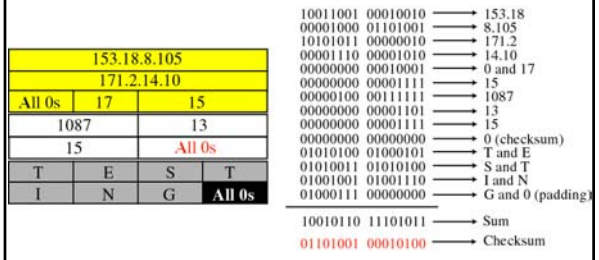


Figure 11-9

Checksum calculation of a simple UDP user datagram



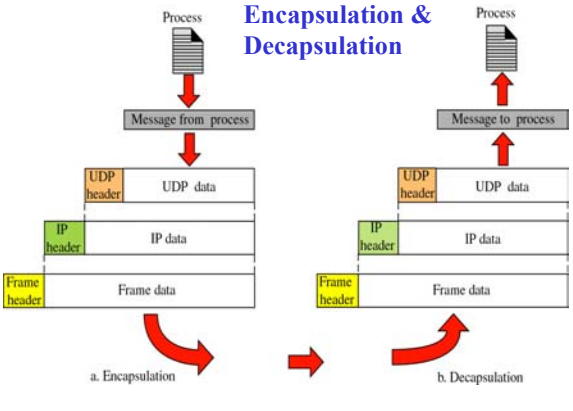
11.4

UDP OPERATION

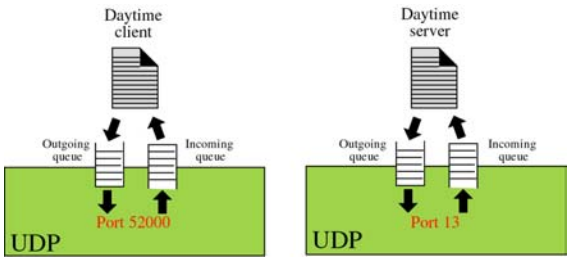
Connectionless Service

- Each UDP datagram independent
- No relationship assumed, even if datagrams are coming from the same source process & going to same destination program; not numbered
- No connection establishment / termination
  - Each datagram can travel on different path
- Process cannot send stream of data to UDP and expect UDP to partition into different related user datagrams
- request must be small enough to fit into one datagram

Encapsulation & Decapsulation

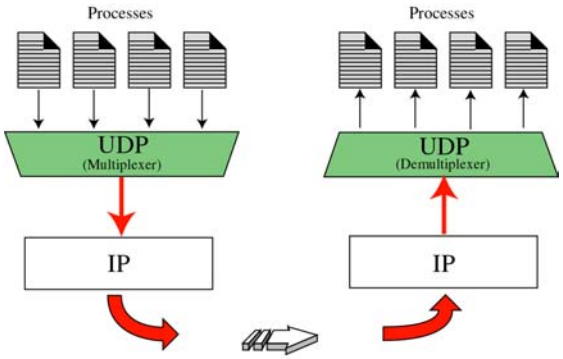


Queues in UDP

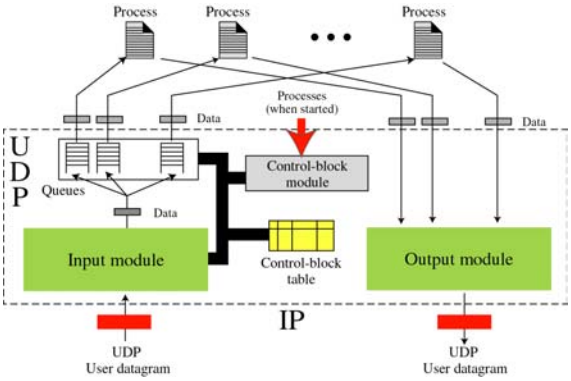


ICMP "port unreachable" message

Multiplexing and demultiplexing



UDP package



UDP Package: Control-Block Module

- Process requests port # from OS
- OS assigns well-known port to server or ephemeral port to clients
- Process passes process ID and port # to *control-block* module to create an entry in table
- CB Module does not create the queue

UDP Package: Input Module

- Receives user datagram from IP
- Checks for entry in control-block table
- If found, allocate queue if necessary then, enqueue the data in the corresponding queue
- If not found, instruct ICMP to send "unreachable port" message and discard datagram

Output Module

- Create and Send UDP datagram

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			

Example 1

The first activity is the arrival of a user datagram with destination port number 52,012. The input module searches for this port number and finds it. Queue number 38 has been assigned to this port, which means that the port has been previously used. The input module sends the data to queue 38. The control-block table does not change.

Example 2

After a few seconds, a process starts. It asks the operating system for a port number and is granted port number 52,014. Now the process sends its ID (4,978) and the port number to the control-block module to create an entry in the table. The module does not allocate a queue at this moment because no user datagrams have arrived for this destination

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			

Example 3

A user datagram now arrives for port 52,011. The input module checks the table and finds that no queue has been allocated for this destination since this is the first time a user datagram has arrived for this destination. The module creates a queue and gives it a number (43).

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			

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.

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.