

# TCP/IP 通訊協定及應用

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<http://wmlab.csie.ncu.edu.tw/course/tcp>

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# Chapter 17 TCP: Transmission Control Protocol

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## Introduction

- ♦ The original specification for TCP is RFC 793, although some errors in that RFC are corrected in the Host Requirements RFC.

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## TCP Service

- ♦ TCP provides:
  - Connection-oriented: establish a TCP connection with each other before they can exchange data.
  - Reliability:
    - ♦ the application data is broken into what TCP considers the best sized chunks to send.
    - ♦ Acknowledge and retransmit: a timer for each TCP segment.
    - ♦ This acknowledgment is not sent immediately, but normally delayed a fraction of a second.
    - ♦ TCP maintains an end-to-end checksum on its header and data.
    - ♦ Re-sequencing: TCP segments can arrive out of order.
    - ♦ A receiver must discard duplicate data.
    - ♦ TCP also provides flow control.

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- Byte stream service
  - ♦ There are no record markers automatically inserted by TCP.
  - ♦ TCP does not interpret the contents of the bytes at all.

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## TCP Header

- ♦ TCP data is encapsulated in an IP datagram

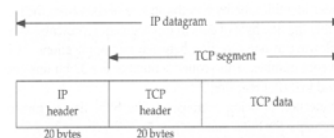


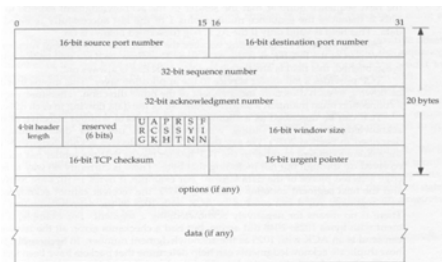
Figure 17.1 Encapsulation of TCP data in an IP datagram.

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## TCP Header (Cont.)

- ◆ The format of TCP header



## TCP Header (Cont.)

- **port number**: to identify the sending and receiving application.
- **Socket**: the combination of an IP address and a port number.
- **Socket pair**: the 4-tuple consisting of the client IP address, client port number, server IP address, and server port number.
- **sequence number**: identifies the byte in the stream of data from the sending TCP to the receiving TCP that the first byte of data in this segment represents.
  - ◆ TCP numbers each byte with a sequence number.
- **ISN**: initial sequence number (seq# of the 1st data byte = ISN+1)
- **acknowledgment number**: contains the next sequence number that the sender of the acknowledgment expects to receive.
- **header length**: this is required because the length of the option field is variable.

## TCP Header (Cont.)

- The six flag in the TCP header:
  - ◆ **URG** The urgent pointer is valid.
  - ◆ **ACK** The acknowledgment number is valid.
  - ◆ **PSH** The server should pass this data to the application as soon as possible.
  - ◆ **RST** Reset the connection.
  - ◆ **SYN** Synchronize sequence numbers to initiate a connection.
  - ◆ **FIN** The sender is finished sending data.
- **window size**: TCP flow control (up to 65535 bytes)
- **checksum**: calculated and stored by the sender and then verified by the receiver
- **urgent pointer**: valid only if the URG flag is set. This pointer is a positive offset. TCP's urgent mode is a way for the sender to transmit emergency data to the other end.
- **option**: MSS (maximum segment size)

## Summary

- ◆ TCP provides a reliable, connection-oriented, byte stream, full-duplex, transport layer service.
- ◆ TCP packetizes the user data into segments, sets a timeout any time it sends data, acknowledges data received by the other end, records out-of-order data, discards duplicate data, provides end-to-end flow control, and calculates and verifies a mandatory end-to-end checksum.
- ◆ TCP is used by many of the popular applications, such as Telnet, Rlogin, FTP, and electronic mail (SMTP).