

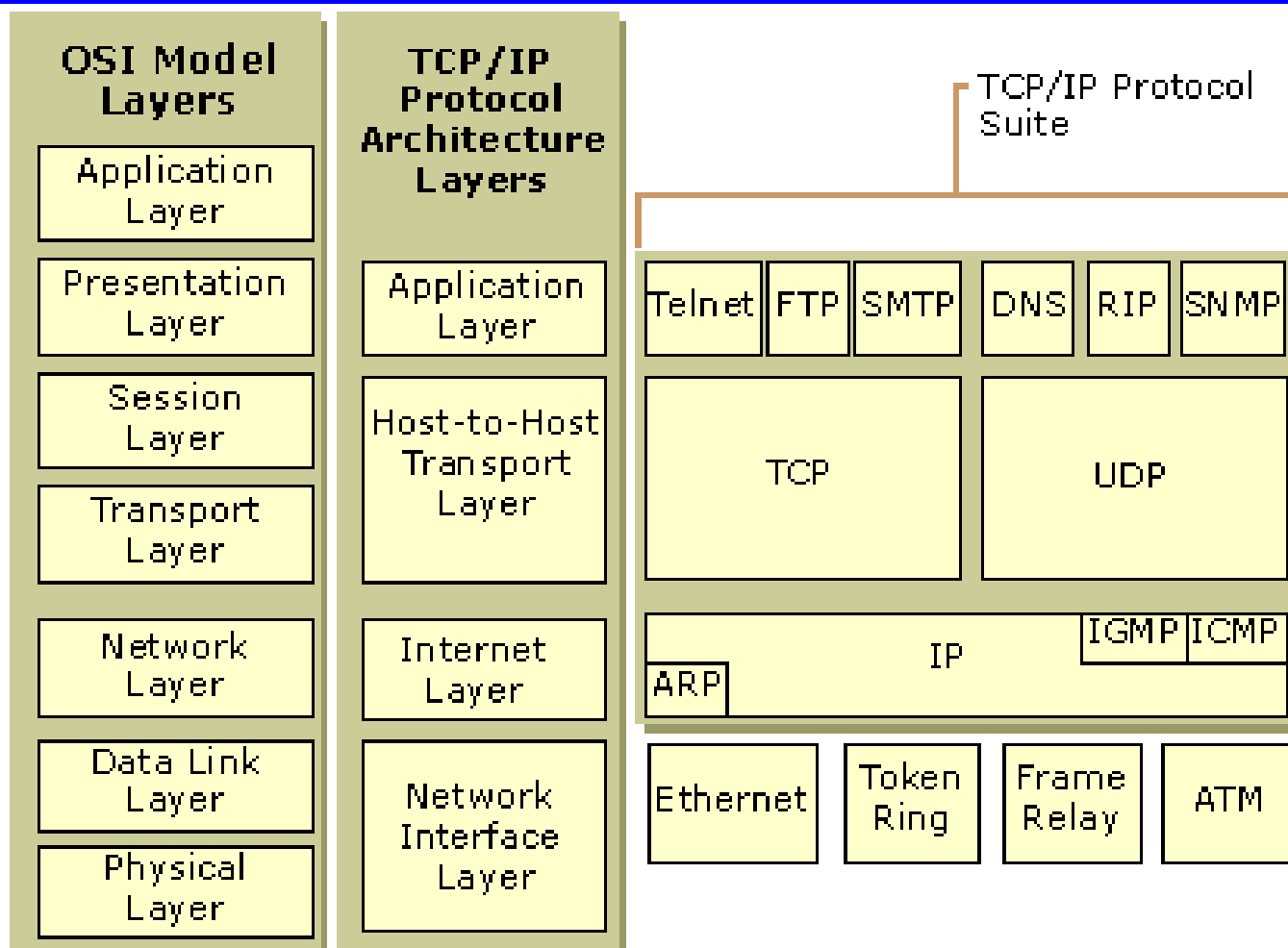
# Redes e Comunicações

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## Transport Protocols

# TCP/IP Architecture

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# Connection Oriented Transport Protocol Mechanisms

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- ⌘ Logical connection
- ⌘ Establishment
- ⌘ Maintenance termination
- ⌘ Reliable
- ⌘ e.g. TCP

# Reliable Sequencing Network Service

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- ⌘ Assume arbitrary length message
- ⌘ Assume virtually 100% reliable delivery by network service
- ⌘ Transport service is end to end protocol between two systems on same network

# TCP & UDP

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## ⌘ Transmission Control Protocol

- ☑ Connection oriented

- ☑ RFC 793

## ⌘ User Datagram Protocol (UDP)

- ☑ Connectionless

- ☑ RFC 768

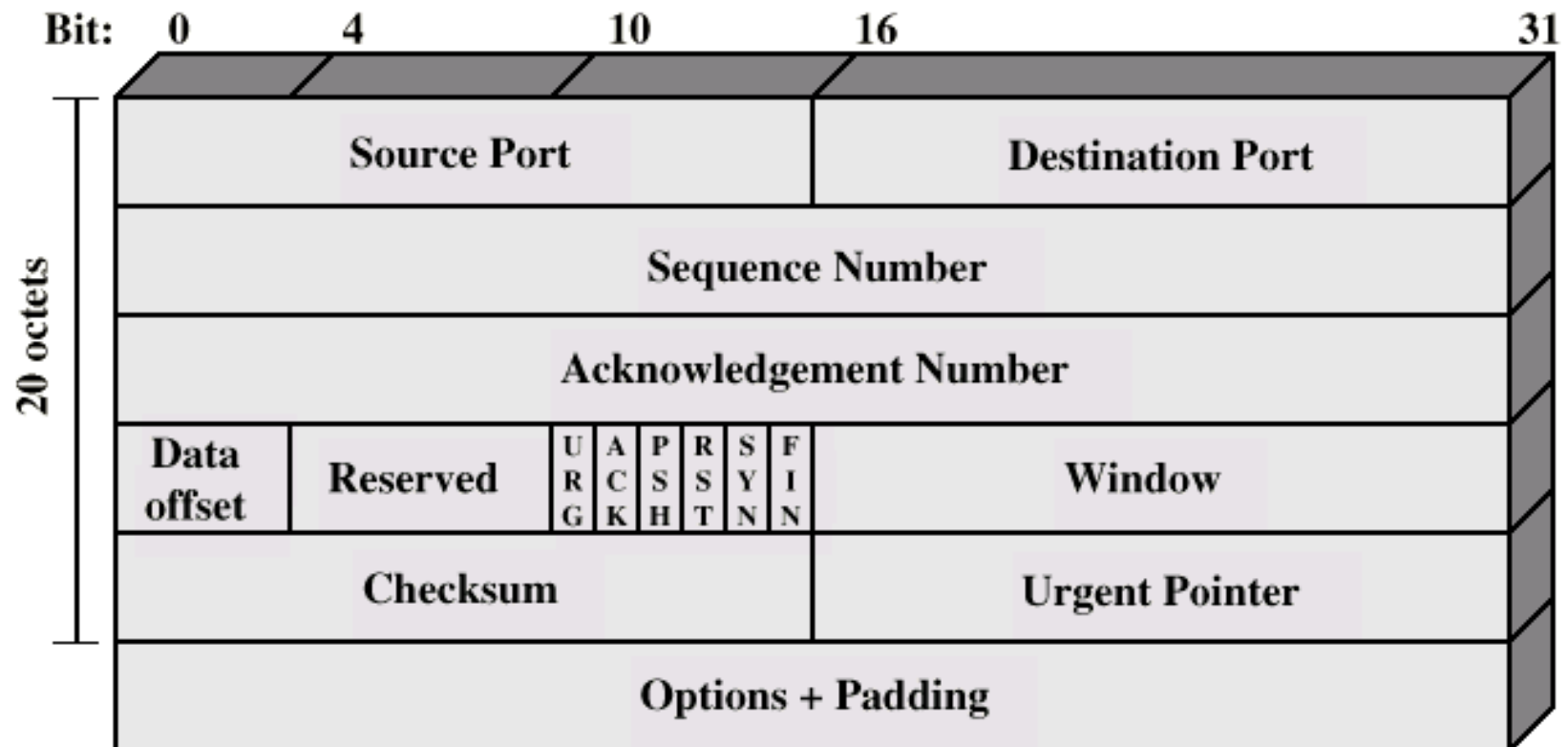
# TCP Services

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- ⌘ Reliable communication between pairs of processes
- ⌘ Across variety of reliable and unreliable networks and internets
- ⌘ Two labeling facilities
  - ⌘ Data stream push
    - ⌘ TCP user can require transmission of all data
    - ⌘ Receiver will deliver in same manner
    - ⌘ Avoids waiting for full buffers
  - ⌘ Urgent data signal
    - ⌘ Indicates urgent data is upcoming in stream
    - ⌘ User decides how to handle it

# TCP Header

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# TCP Mechanisms (1)

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## ⌘ Connection establishment

- ☑ Between pairs of ports
- ☑ One port can connect to multiple destinations



# TCP Mechanisms (2)

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## ⌘ Data transfer

- ☑ Logical stream of octets
- ☑ Octets numbered modulo  $2^{23}$
- ☑ Flow control by credit allocation of number of octets
- ☑ Data buffered at transmitter and receiver

# TCP Mechanisms (3)

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## ⌘ Connection termination

- ☑ Graceful close
- ☑ TCP users issues CLOSE primitive
- ☑ Transport entity sets FIN flag on last segment sent
- ☑ Abrupt termination by ABORT primitive
  - ☒ Entity abandons all attempts to send or receive data
  - ☒ RST segment transmitted

# Implementation Policy Options

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- ⌘ Send
- ⌘ Deliver
- ⌘ Accept
- ⌘ Retransmit
- ⌘ Acknowledge

# Send

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- ⌘ If no push or close TCP entity transmits at its own convenience
- ⌘ Data buffered at transmit buffer
- ⌘ May construct segment per data batch
- ⌘ May wait for certain amount of data

# Deliver

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- ⌘ In absence of push, deliver data at own convenience
- ⌘ May deliver as each in order segment received
- ⌘ May buffer data from more than one segment

# Accept

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- ⌘ Segments may arrive out of order

- ⌘ In order

  - ☑ Only accept segments in order

  - ☑ Discard out of order segments

- ⌘ In windows

  - ☑ Accept all segments within receive window

# Retransmit

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- ⌘ TCP maintains queue of segments transmitted but not acknowledged
- ⌘ TCP will retransmit if not ACKed in given time
  - ☑ First only
  - ☑ Batch
  - ☑ Individual

# Acknowledgement

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⌘ Immediate

⌘ Cumulative



# UDP

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- ⌘ User datagram protocol
- ⌘ RFC 768
- ⌘ Connectionless service for application level procedures
  - ☑ Unreliable
  - ☑ Delivery and duplication control not guaranteed
- ⌘ Reduced overhead
- ⌘ e.g. network management

# UDP Uses

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- ⌘ Inward data collection
- ⌘ Outward data dissemination
- ⌘ Request-Response
- ⌘ Real time application

# UDP Header

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