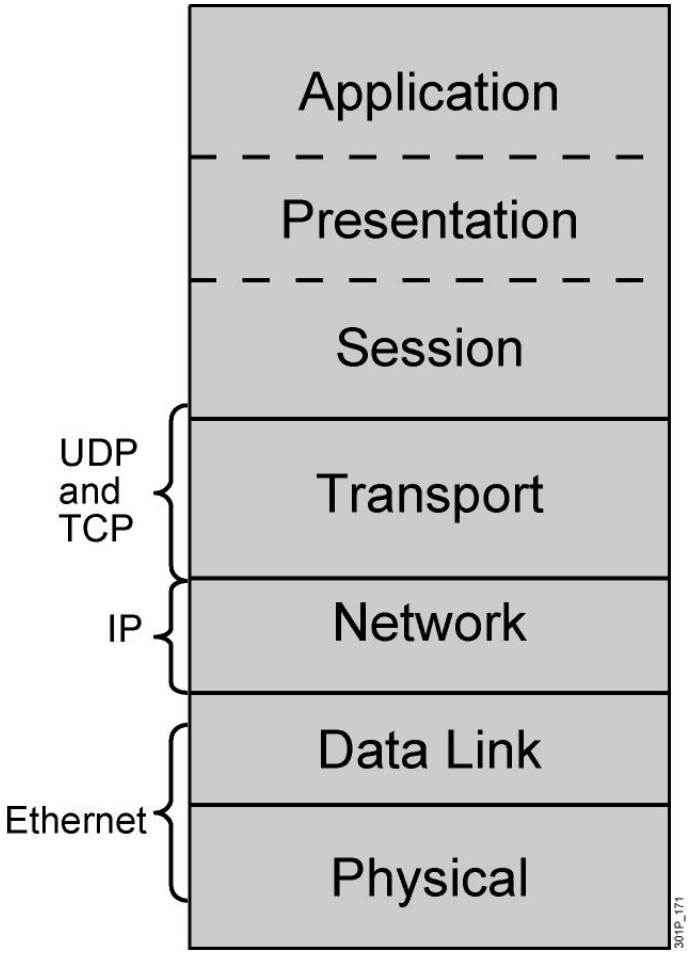
Understanding the TCP/IP Transport Layer

Transport Layer



- Session multiplexing
- Segmentation
- Flow control (when required)
- Connection-oriented (when required)
- Reliability (when required)

Reliable vs. Best-Effort Comparison

	Reliable	Best-Effort
Connection Type	Connection-oriented	Connectionless
Protocol	TCP	UDP
Sequencing	Yes	No
Uses	▪ E-mail ▪ File sharing ▪ Downloading	▪ Voice streaming ▪ Video streaming

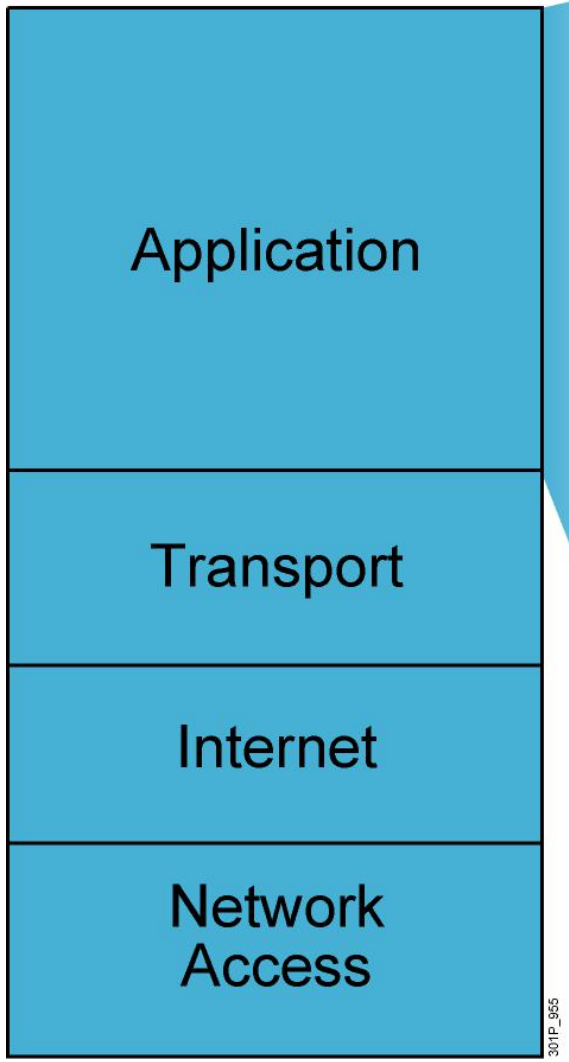
UDP Characteristics

- Operates at transport layer of OSI and TCP/IP models
- Provides applications with access to the network layer without the overhead of reliability mechanisms
- Is a connectionless protocol
- Provides limited error checking
- Provides best-effort delivery
- Has no data-recovery features

TCP Characteristics

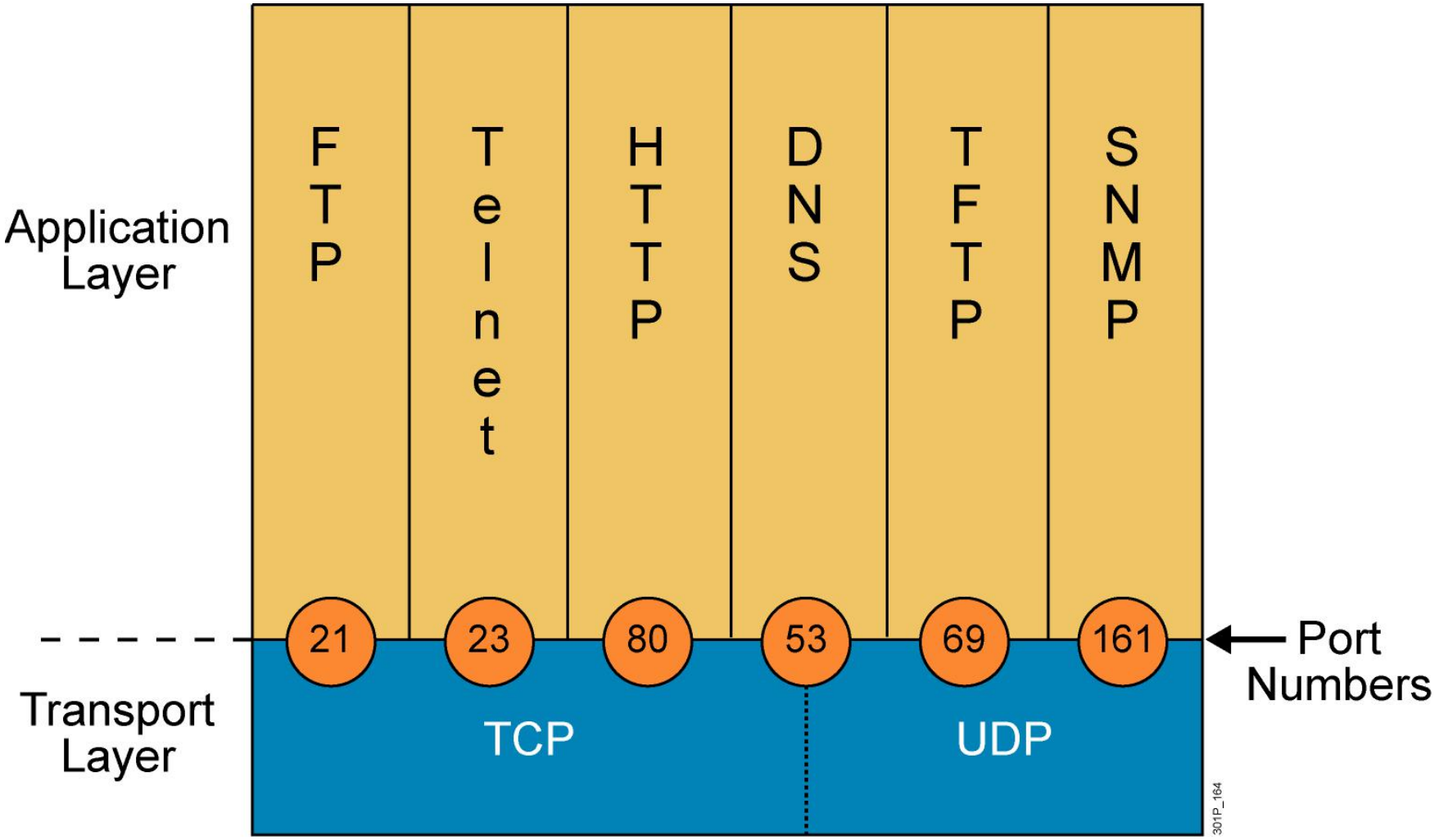
- Transport layer of the TCP/IP stack
- Access to the network layer for applications
- Connection-oriented protocol
- Full-duplex mode operation
- Error checking
- Sequencing of data packets
- Acknowledgement of receipt
- Data-recovery features

TCP/IP Application Layer Overview

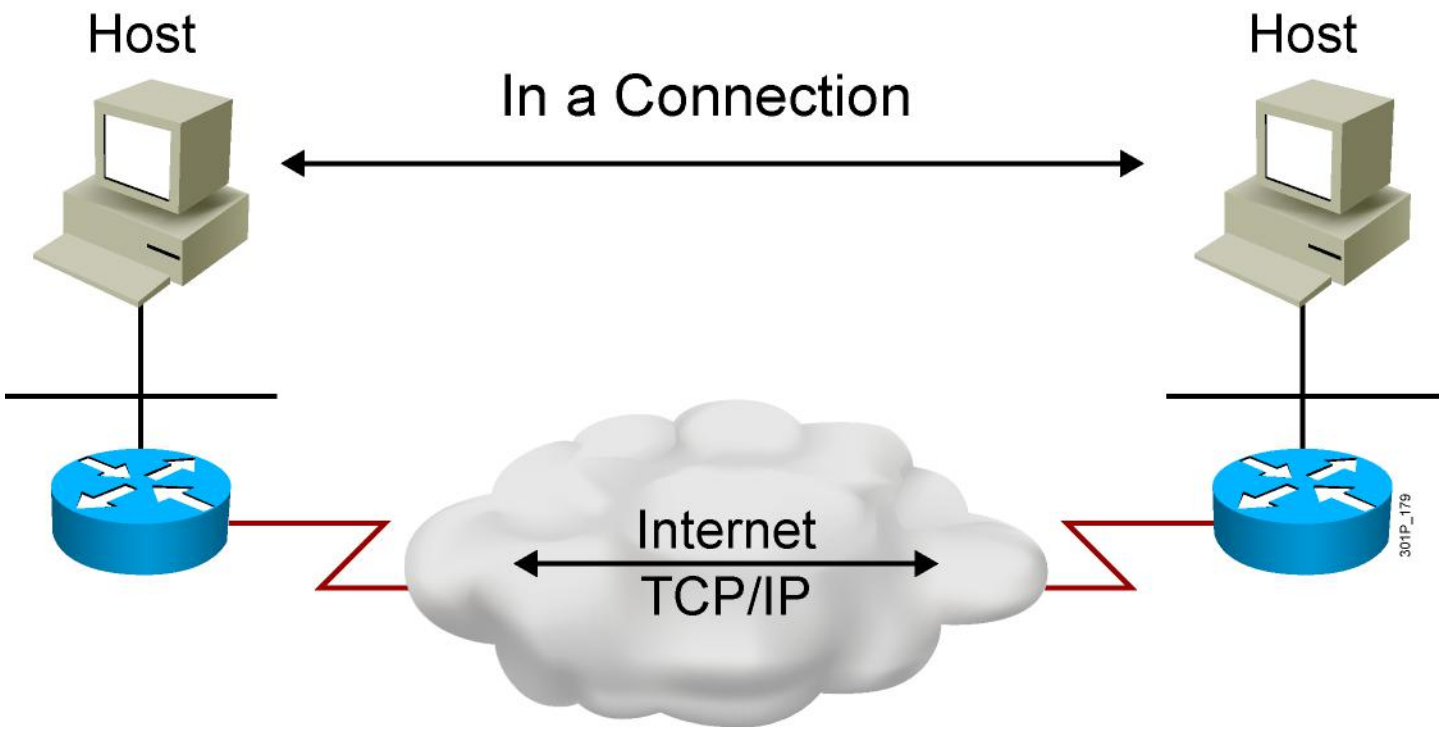


- File transfer
  - FTP
  - TFTP
  - Network File System
- E-mail
  - Simple Mail Transfer Protocol
- Remote login
  - Telnet
  - rlogin
- Network management
  - Simple Network Management Protocol
- Name management
  - Domain Name System

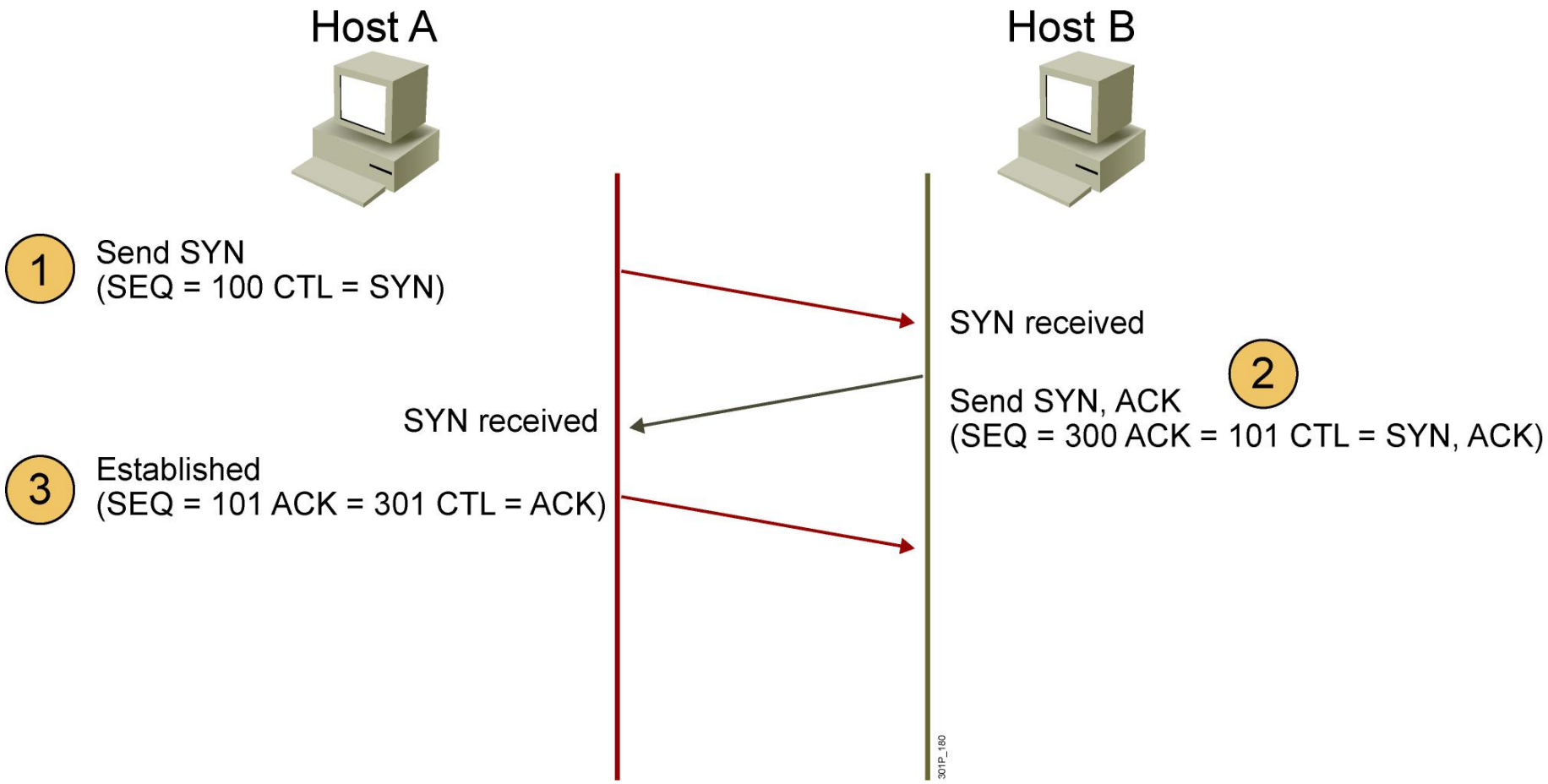
Mapping Layer 4 to Applications



Establishing a Connection

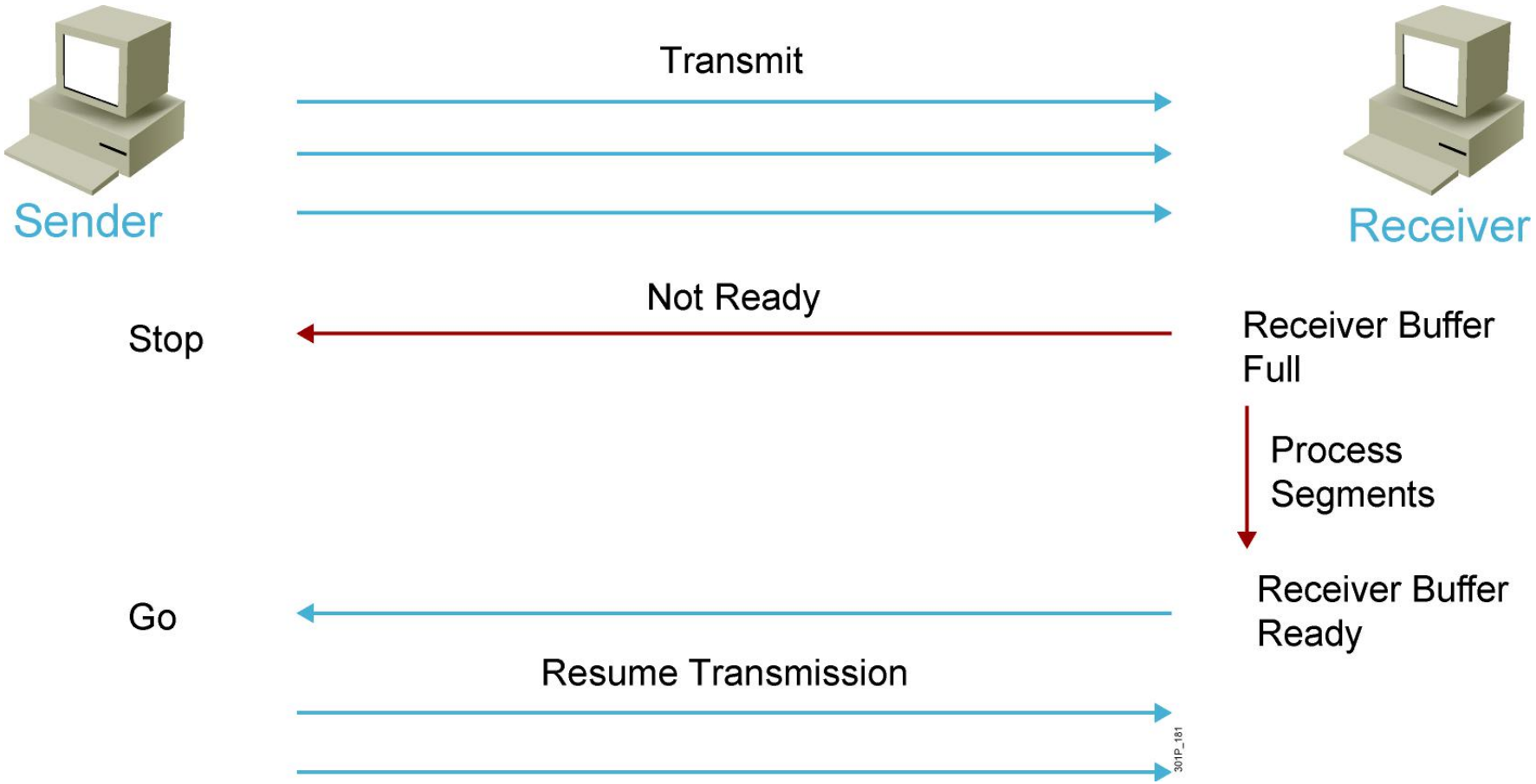


Three-Way Handshake

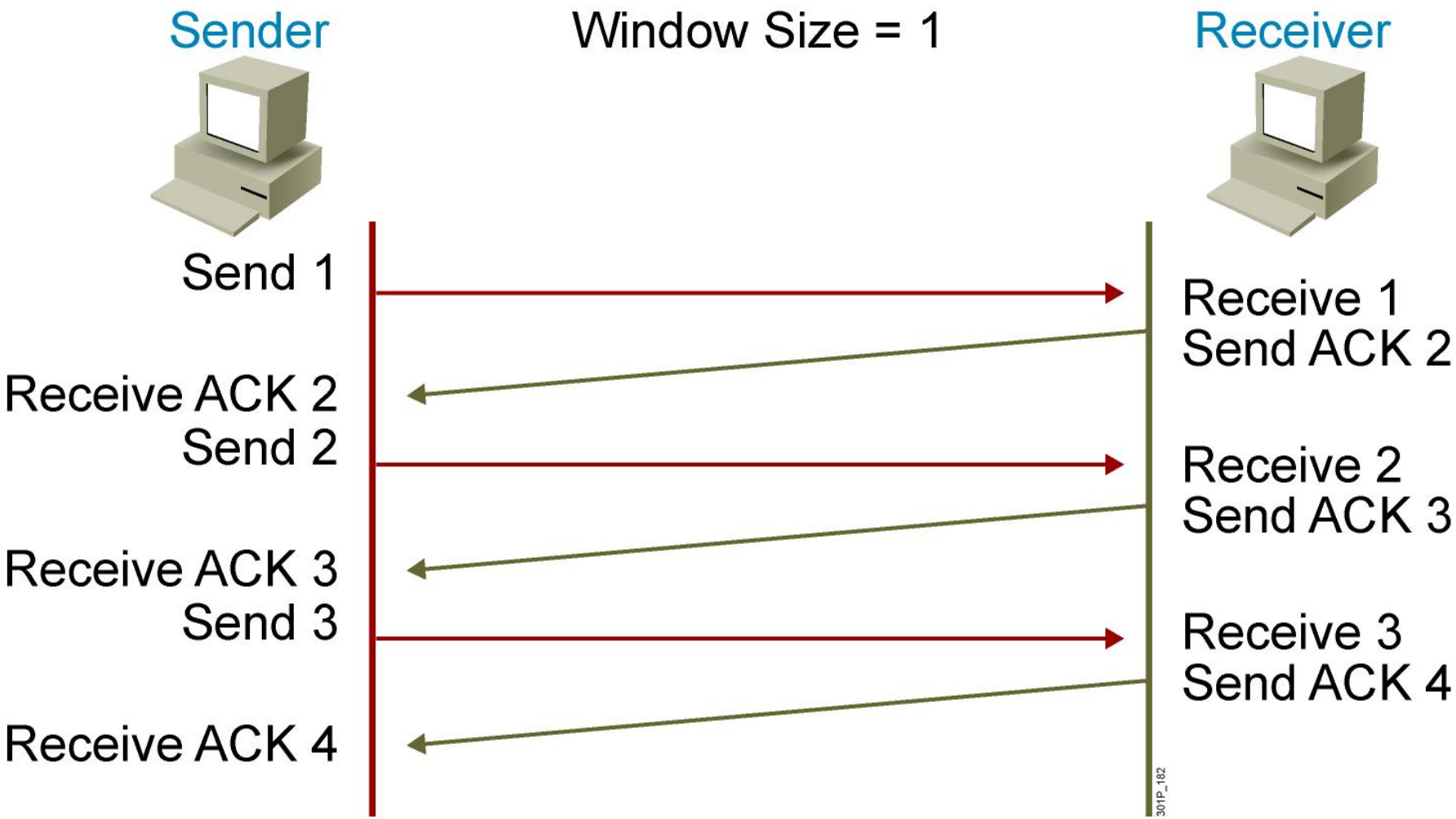


CTL = Which control bits in the TCP header are set to 1

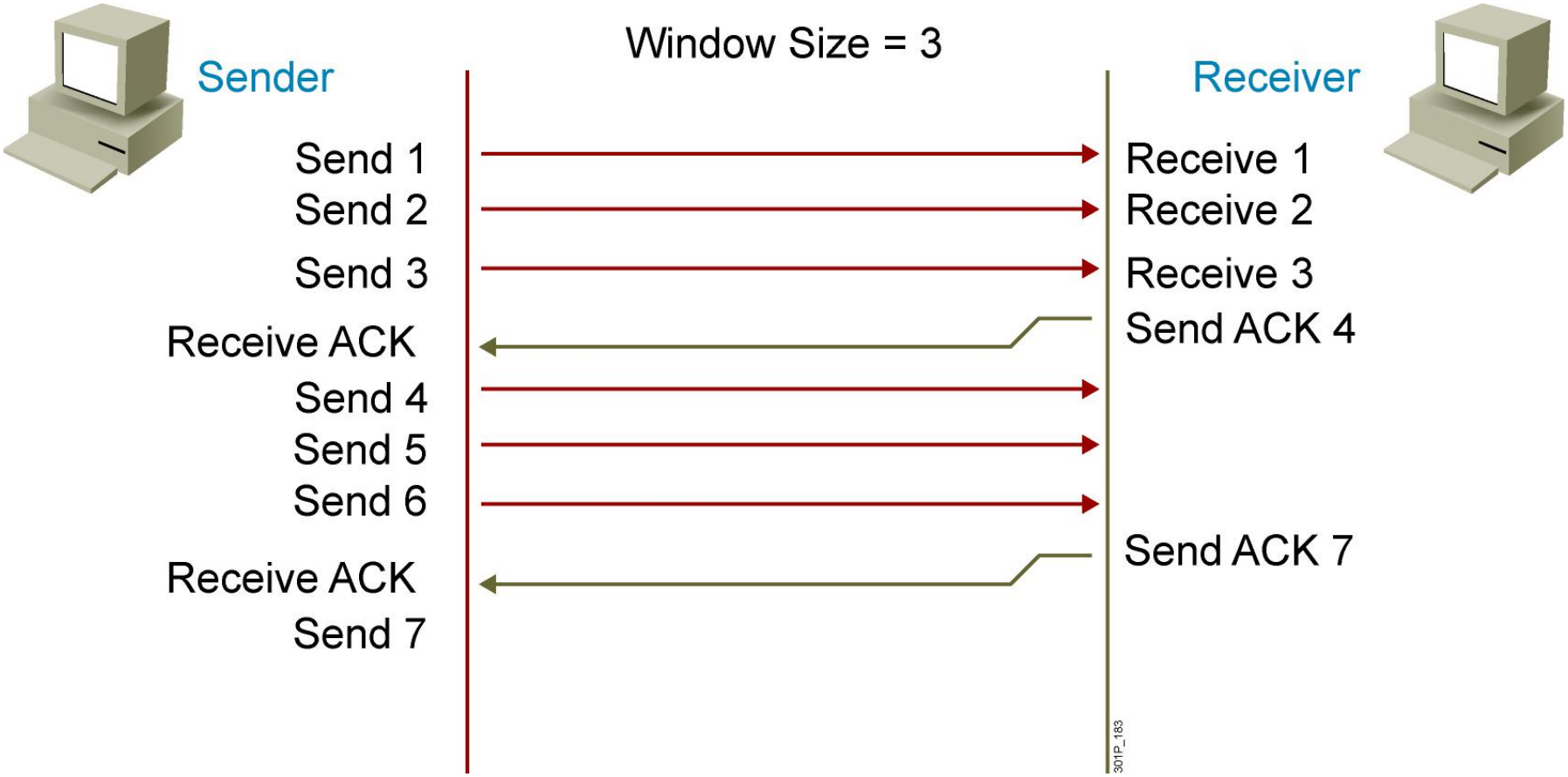
Flow Control



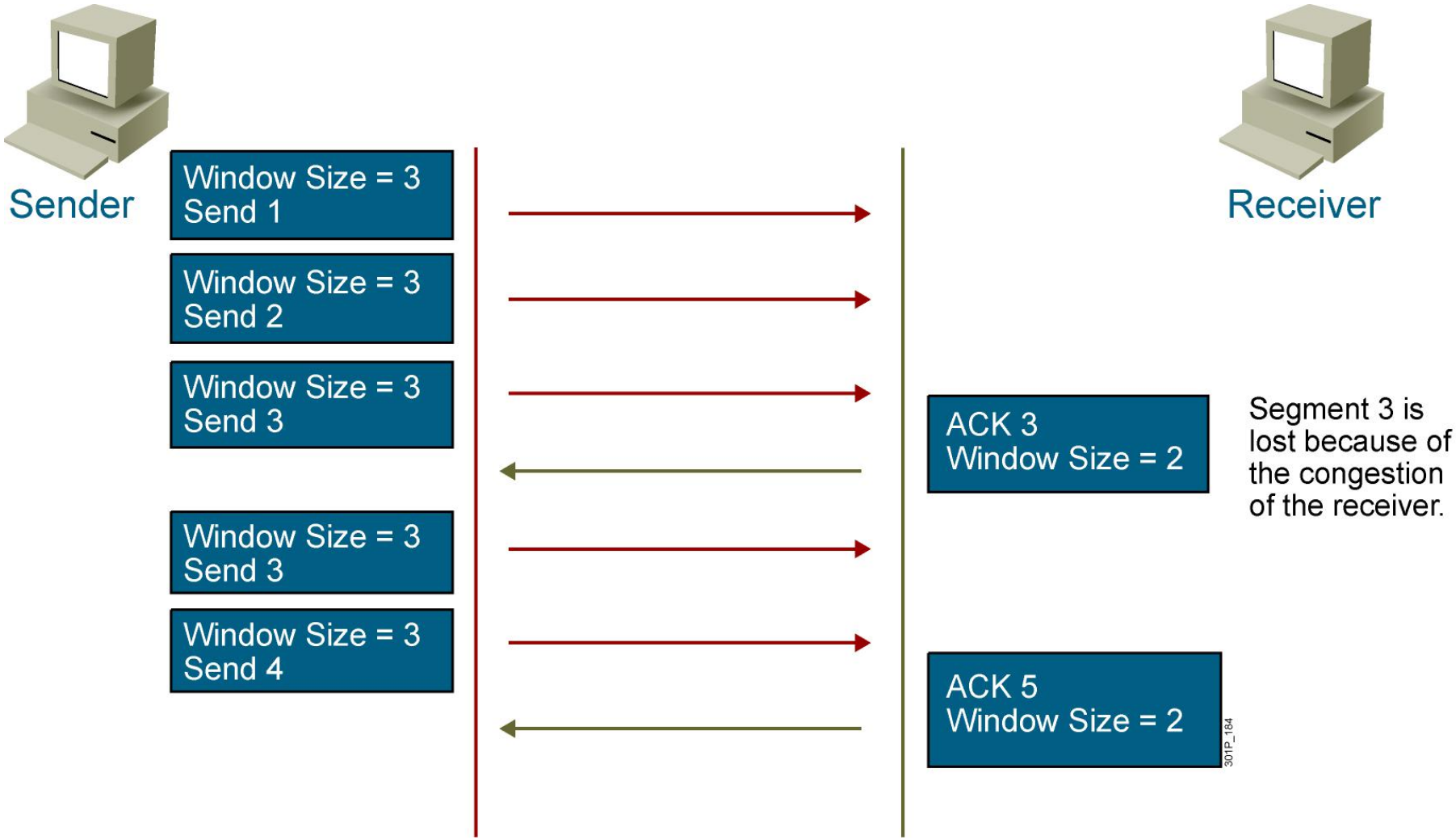
TCP Acknowledgment



Fixed Windowing



TCP Sliding Windowing



TCP Sequence and Acknowledgment Numbers