Information Technology Institute

# ITI

## Introduction to Computer Networks & Cyber Security

Prepared By : Mohamed AboSehly

# Part 1 (TCP/IP Protocol Architecture)

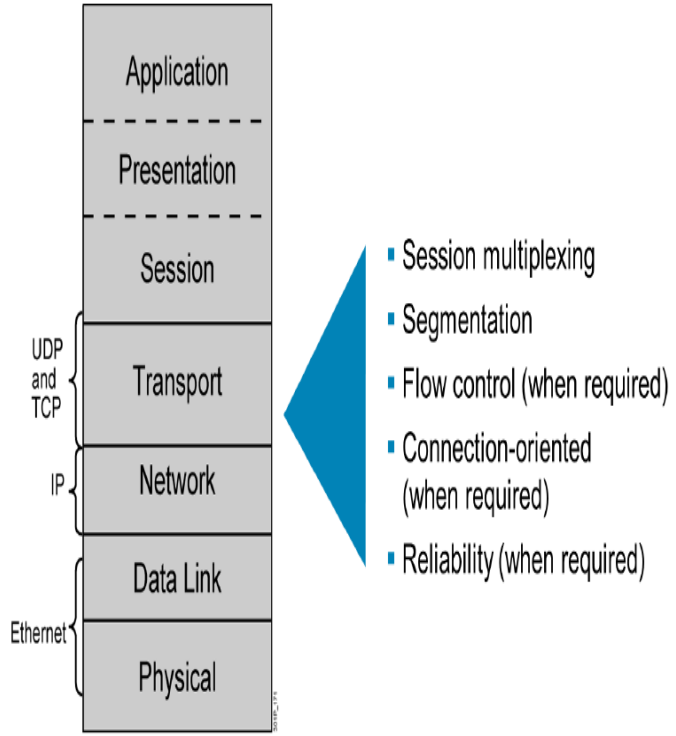
## Transport Layer

# Basic Network Elements (Software)

## Transport Layer

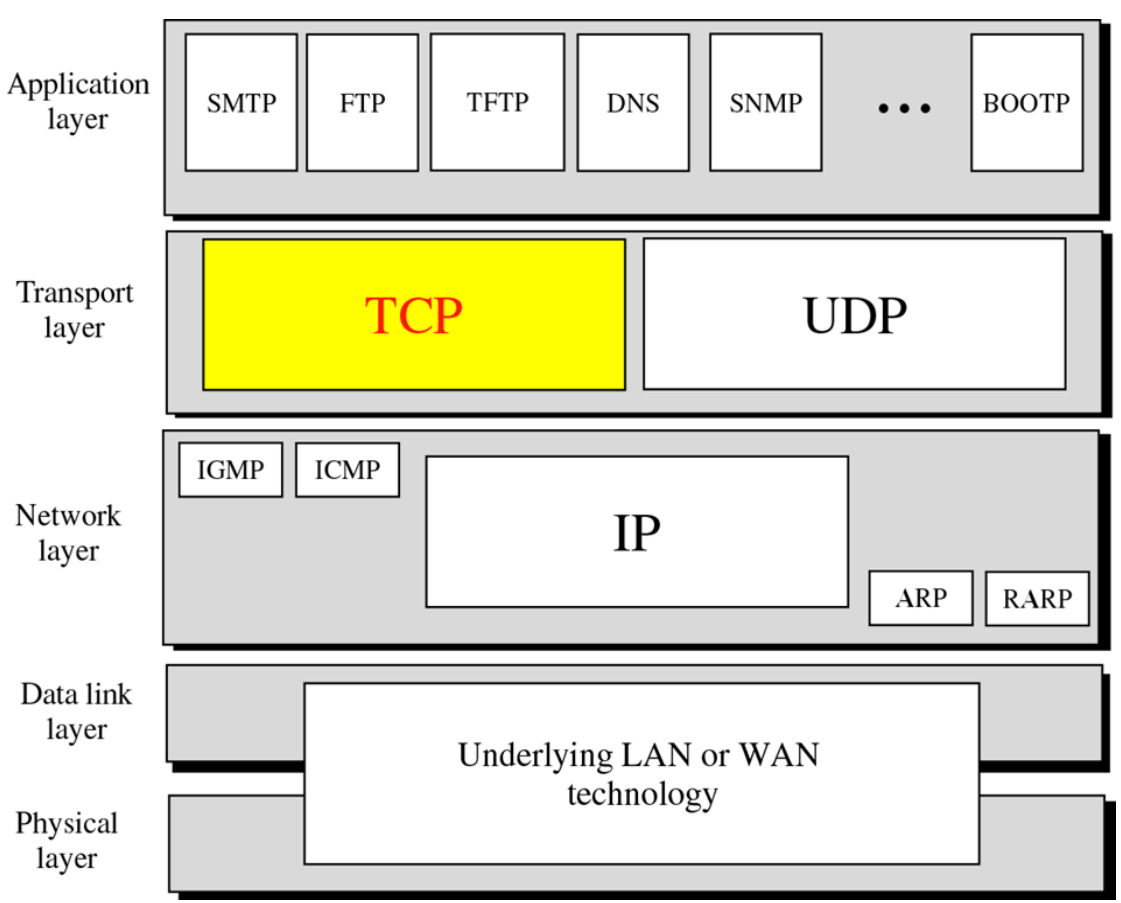
- **Session multiplexing:**
  - open **multiple sessions** using **UDP and TCP**

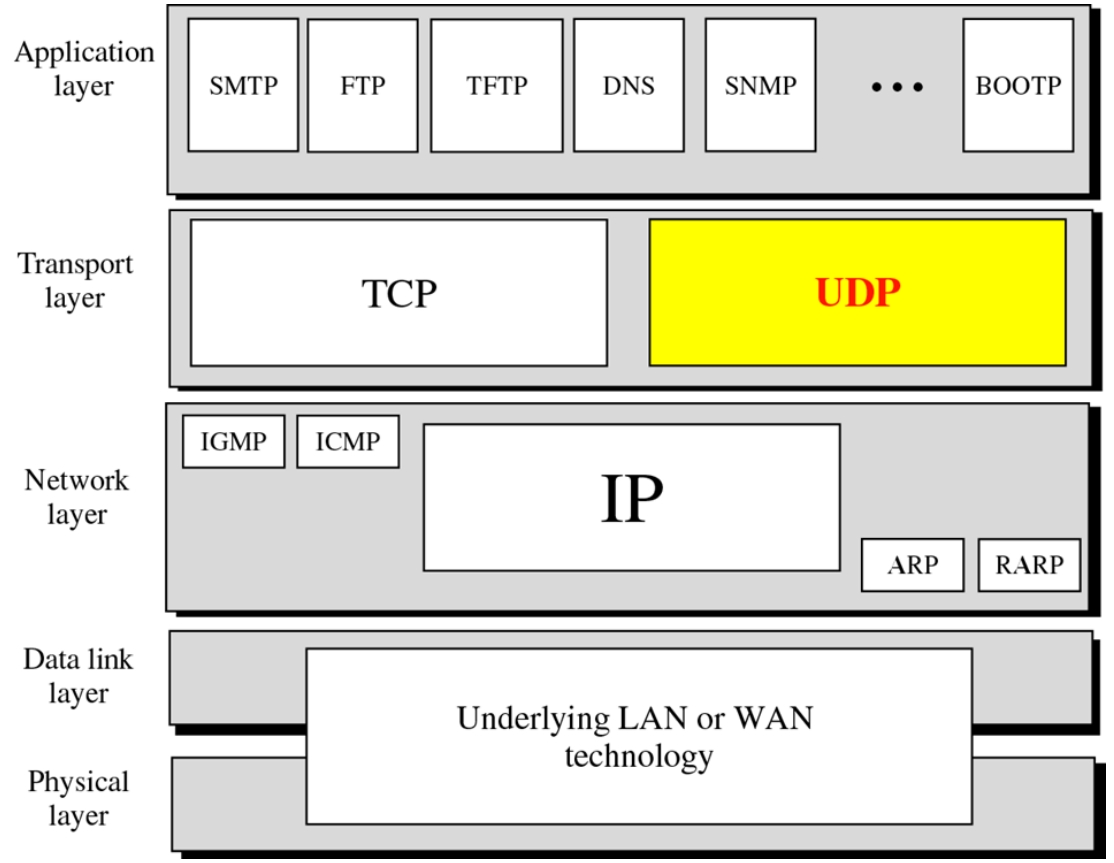
  Example : open **cisco.com & open facebook.com** you are the source using **port 49001** and another **port 49002** on the same machine (session multiplexing).
- **Segmentation:**
  - divided the data up to **multiple segments** to be easier in handling (the maximum performance 1518 byte)
- **Connection Oriented:**
  - To maintain the session with **acknowledgements** that the data are sent to the receiver then terminate the session
- **Reliability:**
  - **Data corrections** and **avoid** the **duplicate data** out of order and data arrangement.



# Part 1 (TCP/IP Protocol Architecture)

## TCP/IP Protocol Architecture



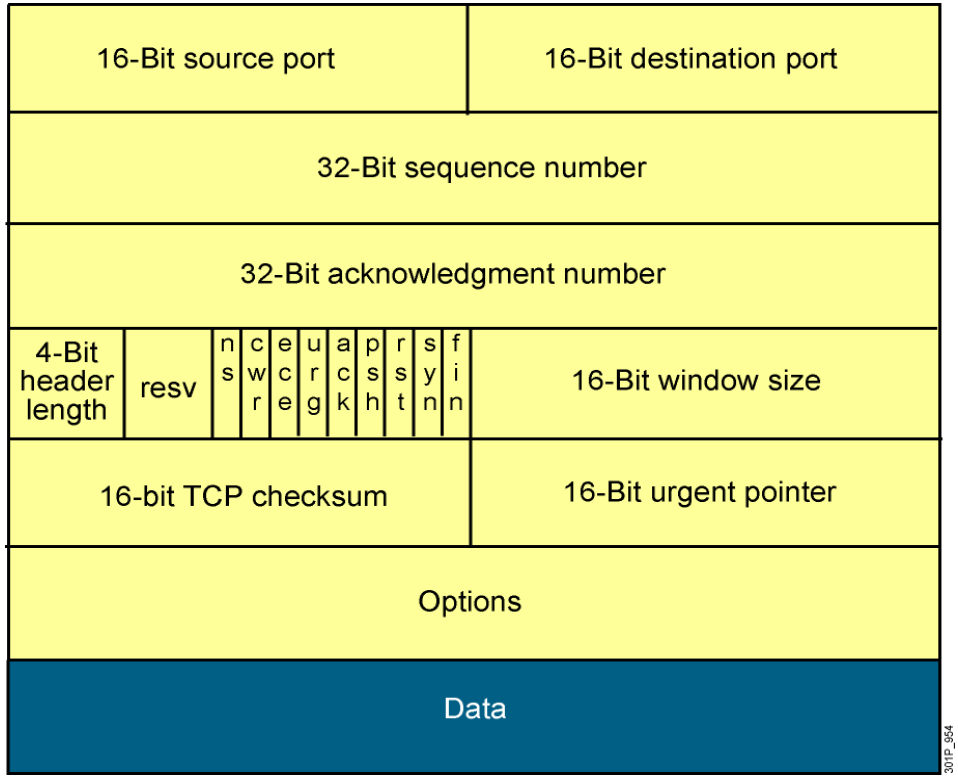
# Part 1 (TCP/IP Protocol Architecture)

## TCP Characteristics

- Transmission Control Protocol
- Transport layer protocol
- Use port numbers
- Reliable (Acknowledgement of receipt)
- **Connection oriented(**synchronization)
- **Full duplex**
- Error control(Error checking(checksum )
- **Flow control**
  - Data-recovery features
  - Sequencing of data packets

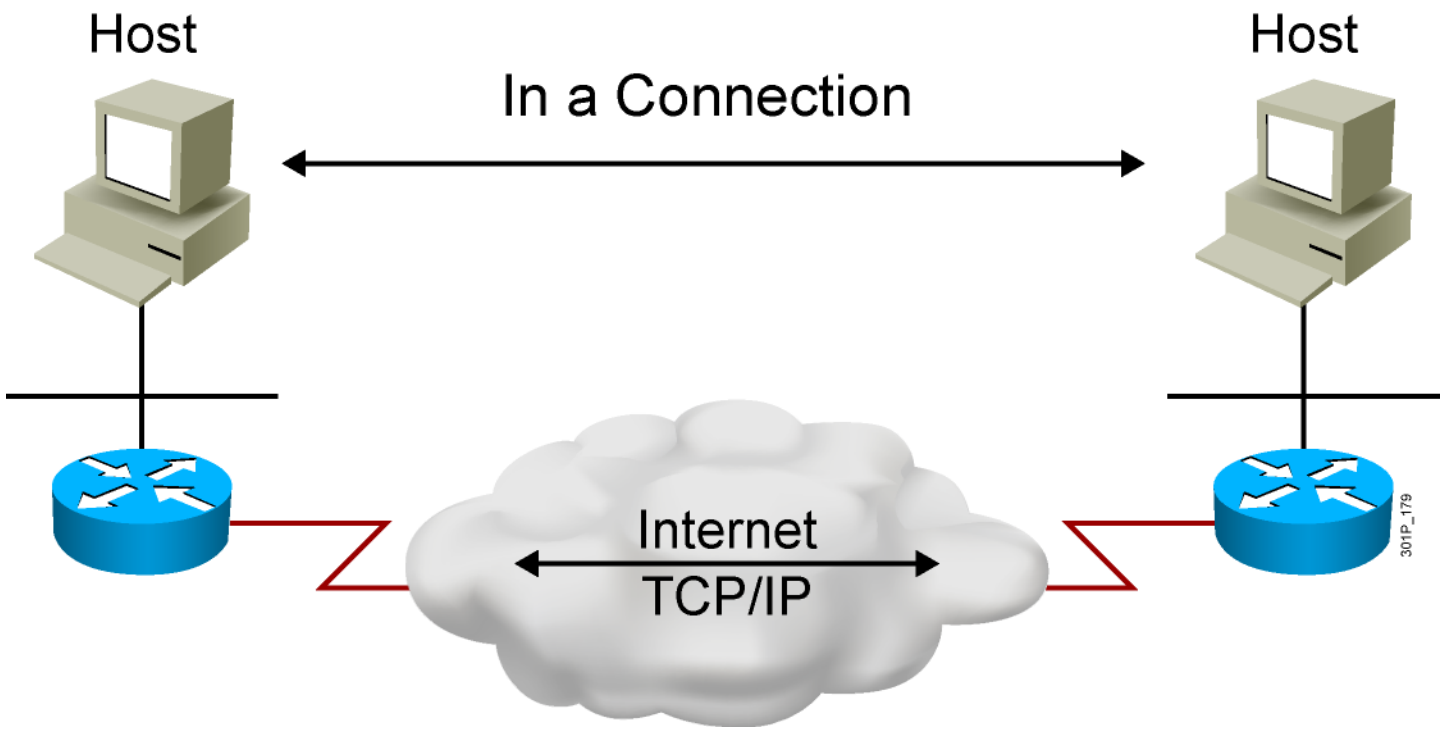
No internet

## TCP Header



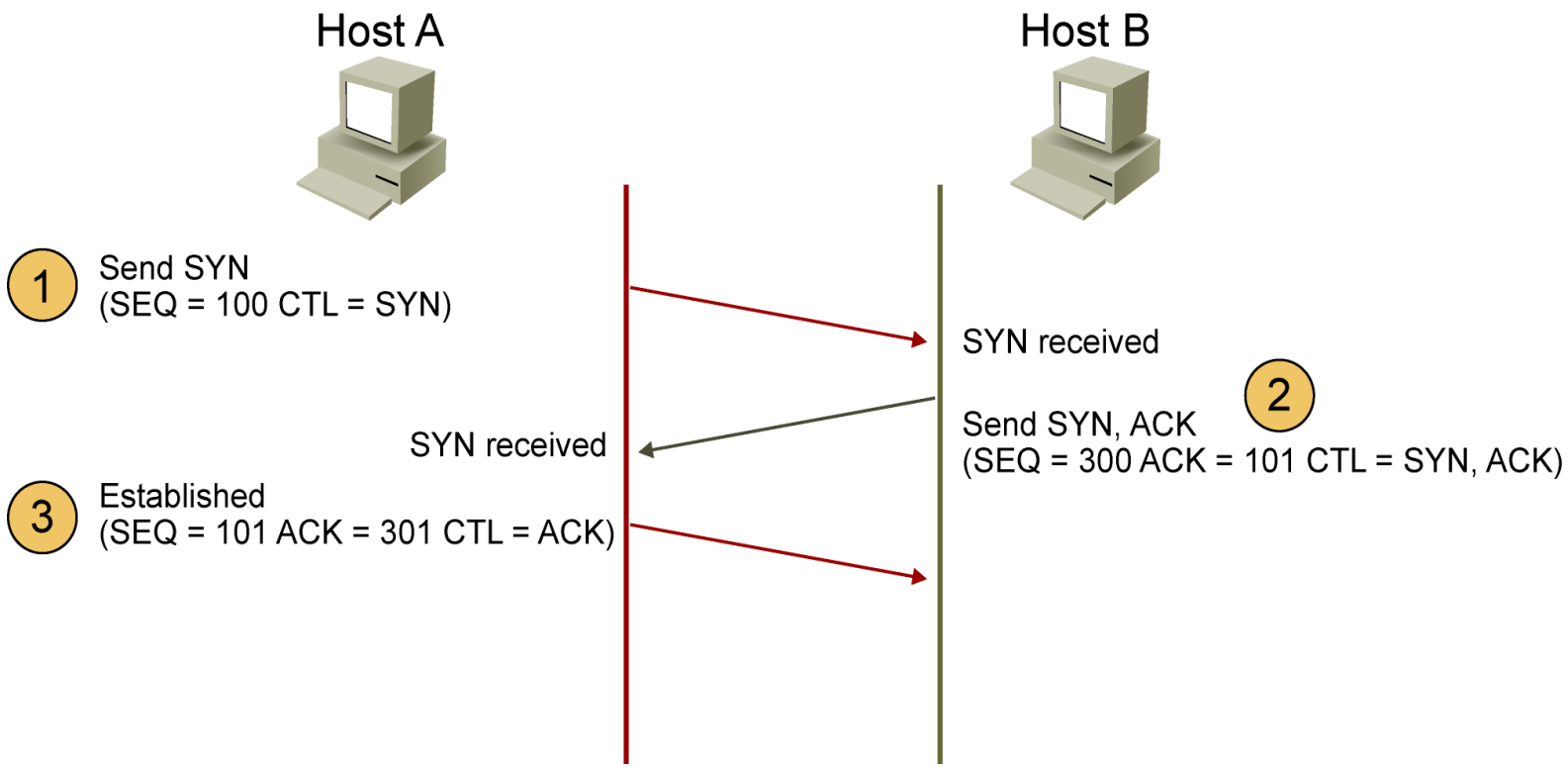
# Part 1 (TCP/IP Protocol Architecture)

## ESTABLISHING A CONNECTION



# Part 1 (TCP/IP Protocol Architecture)

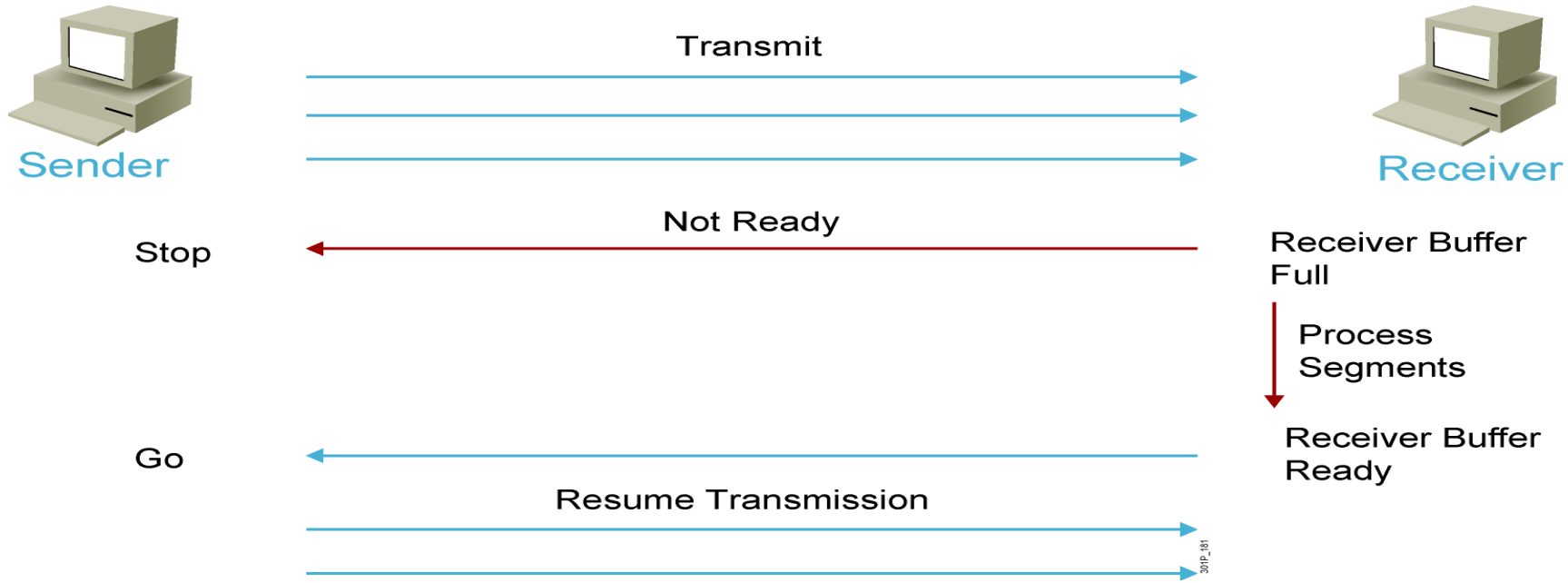
## THREE-WAY HANDSHAKE




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

# Part 1 (TCP/IP Protocol Architecture)

## Flow Control

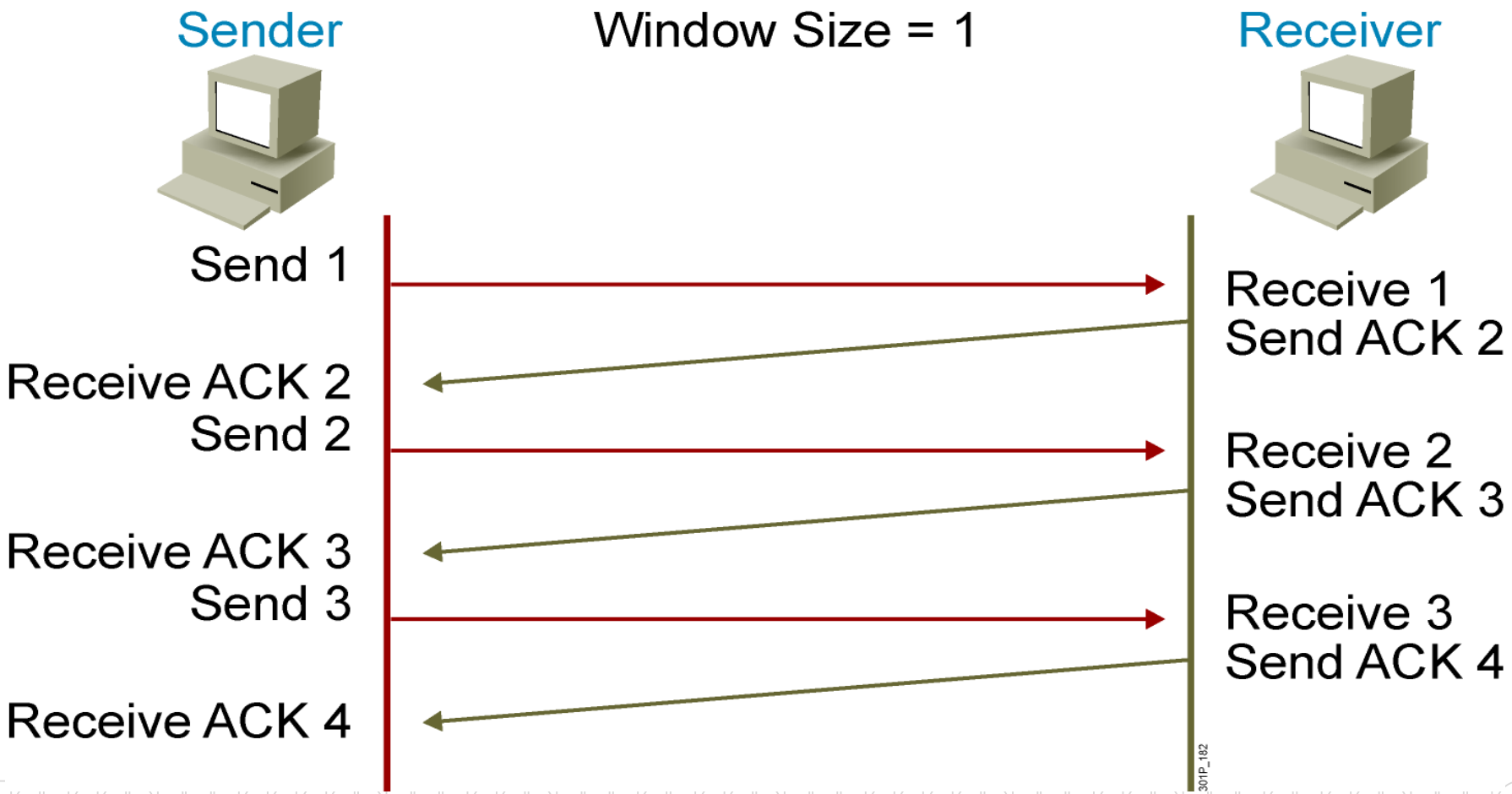



**Flow Control:**

If the transmitter is sending data faster than the receiver so the receiver will drop the data and the retransmitting will waste time and network resources. The Round trip time will be very slow so we used **TCP windowing**

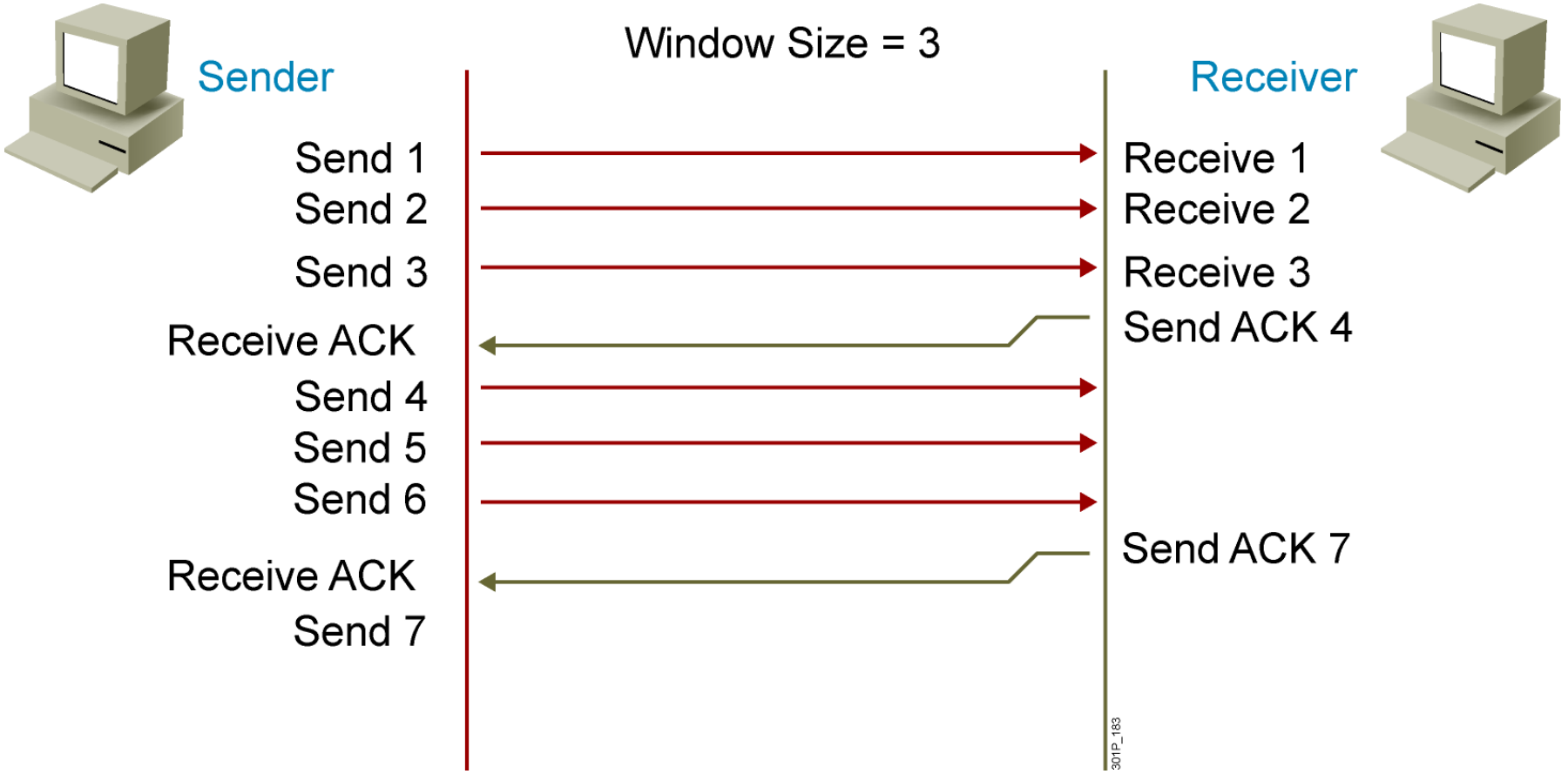
# Part 1 (TCP/IP Protocol Architecture)

## TCP Acknowledgment



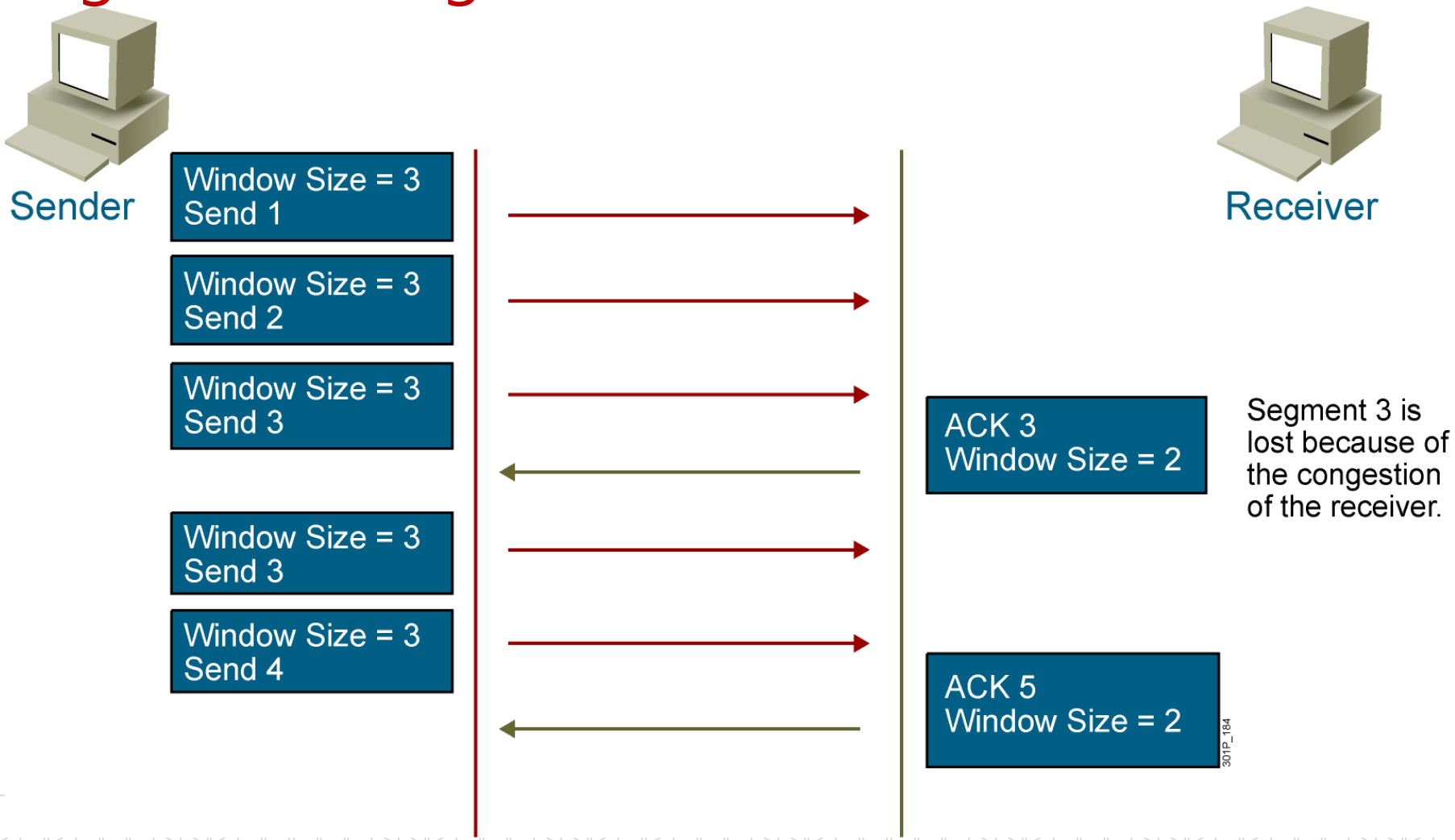
# Part 1 (TCP/IP Protocol Architecture)

## Fixed Windowing



# Part 1 (TCP/IP Protocol Architecture)

## TCP Sliding Windowing

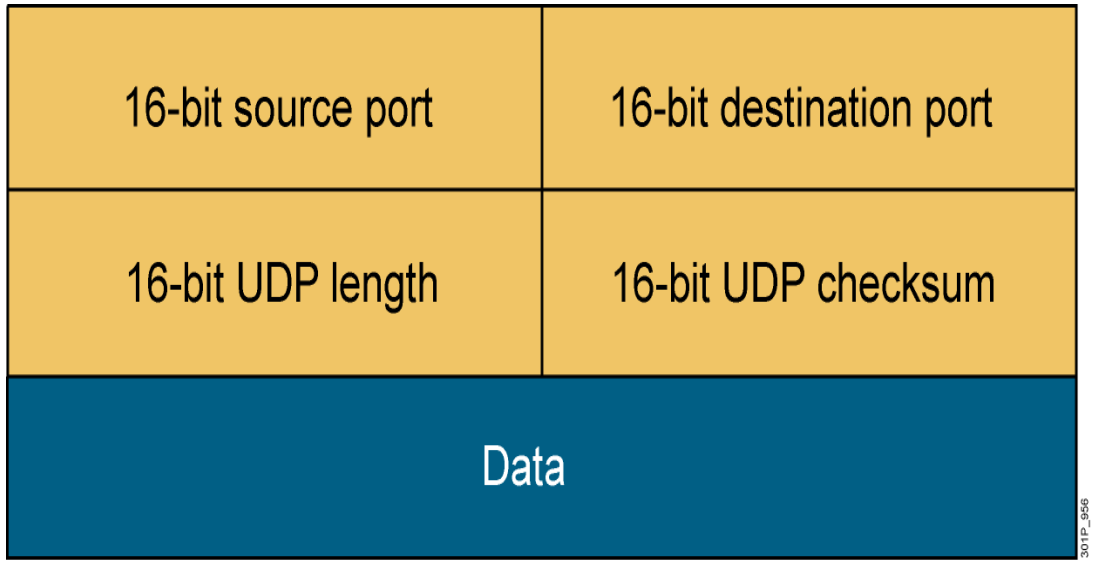


# Part 1 (TCP/IP Protocol Architecture)

## UDP Characteristics

- User Datagram Protocol / Transport layer protocol
- Process to process communication
  - Use port numbers
- **Connectionless** (no notification)
- Unreliable
- **Perform very limited error checking**
- Very simple using a minimum of overhead
- Provides best-effort delivery
    - The data may be dropped due to:
        - Routing Error,
        - Duplicate data due to redundancy
        - Data loss in its way due to TTL.
- **Has no data-recovery features**

## UDP Header



# Part 1 (TCP/IP Protocol Architecture)

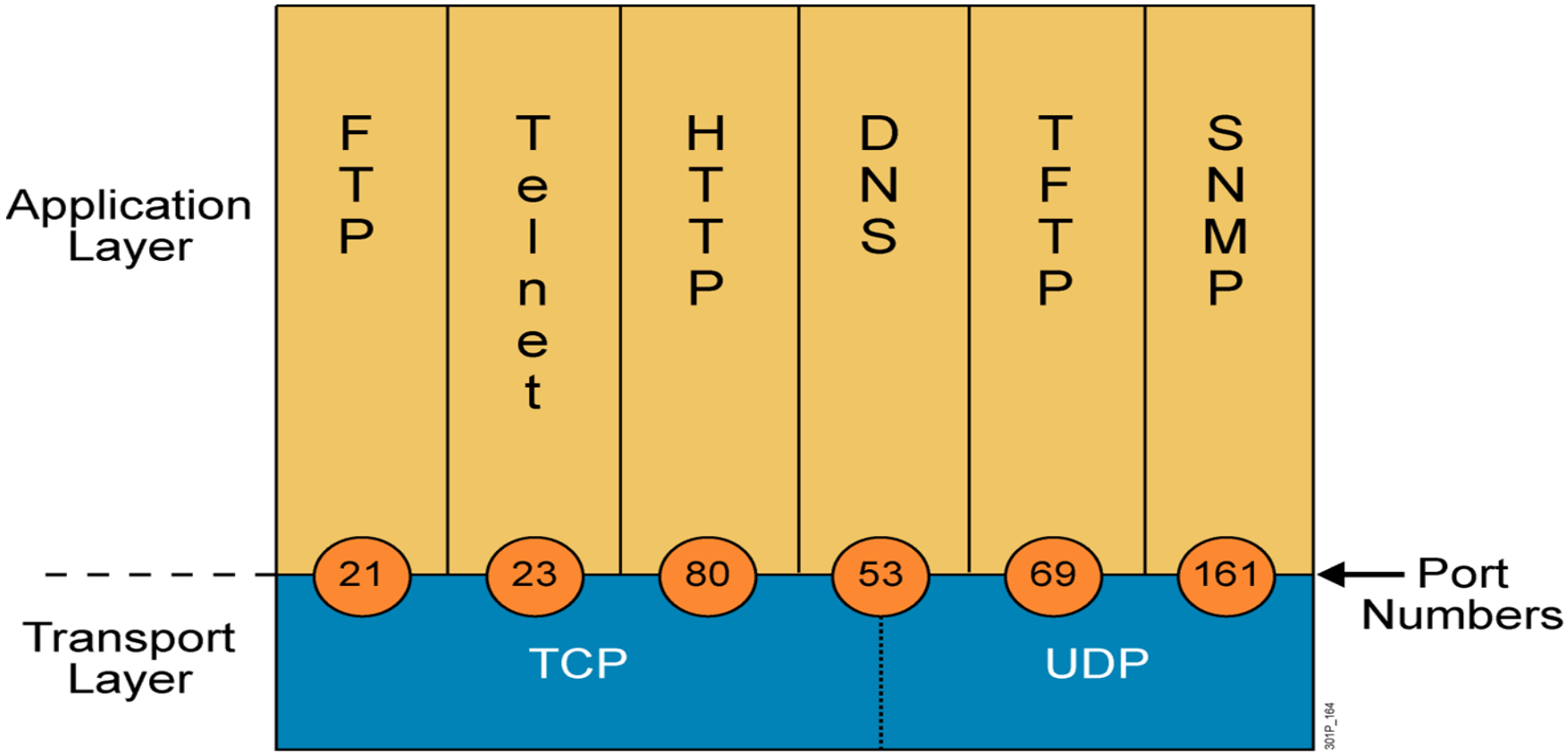
## TCP (Reliable) vs. UDP (Best-Effort Comparison)

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

301P_957

# Part 1 (TCP/IP Protocol Architecture)

## Mapping Layer 4 to Applications



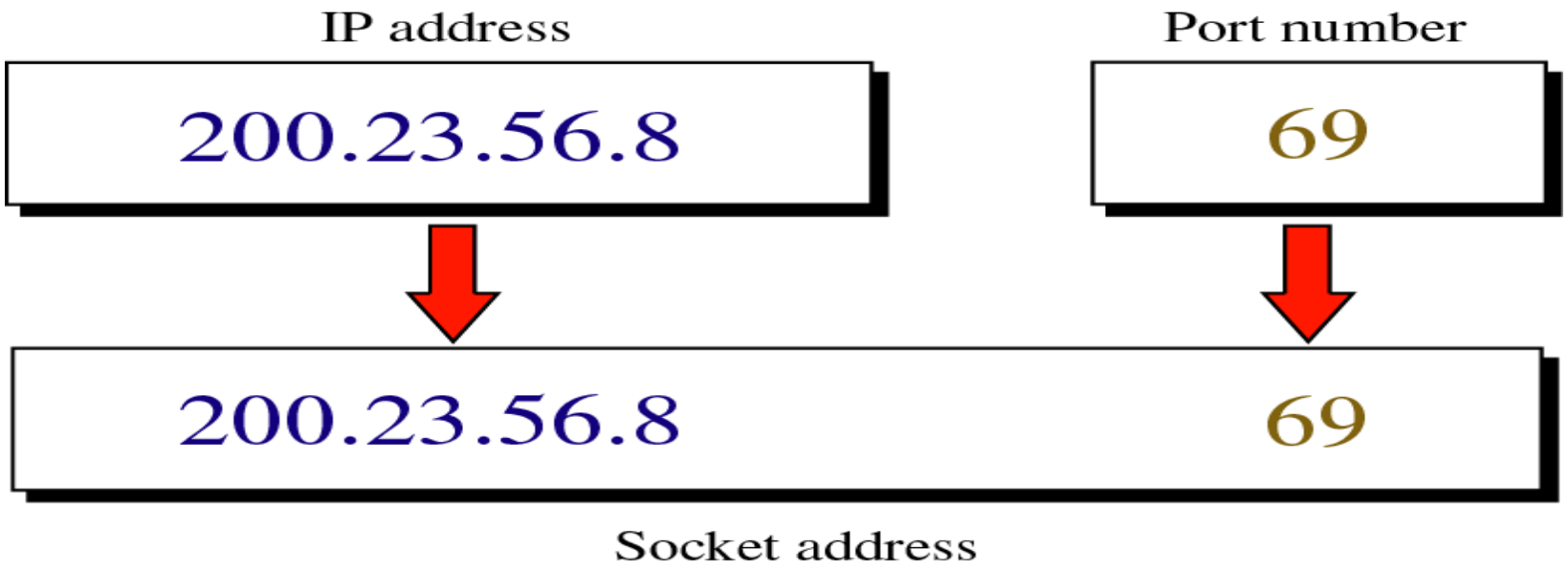
# Part 1 (TCP/IP Protocol Architecture)

## Port Numbers

- **Well Known ports**
  - Range from 0 to 1,023 are assigned and controlled by ICANN
- **Registered ports**
  - Range from 1,024 to 49,151 not assigned or controlled by ICANN but can be registered at ICANN to avoid duplication
- **Dynamic ports**
  - Range from 49,152 to 65,535 are neither controlled nor registered

- https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers

## Socket Address



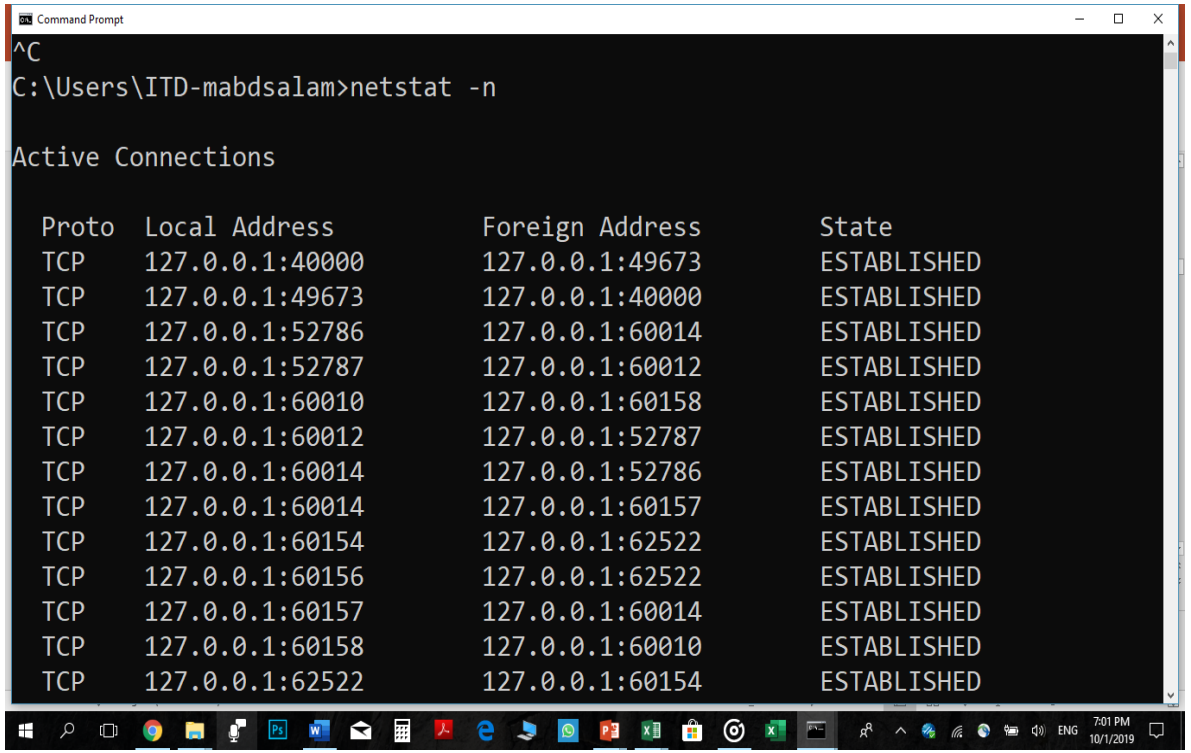
# Part 1 (TCP/IP Protocol Architecture)-

❖ NETSTATE

netstat –n

netstat -a

To know session and ports on your device



# Thank You