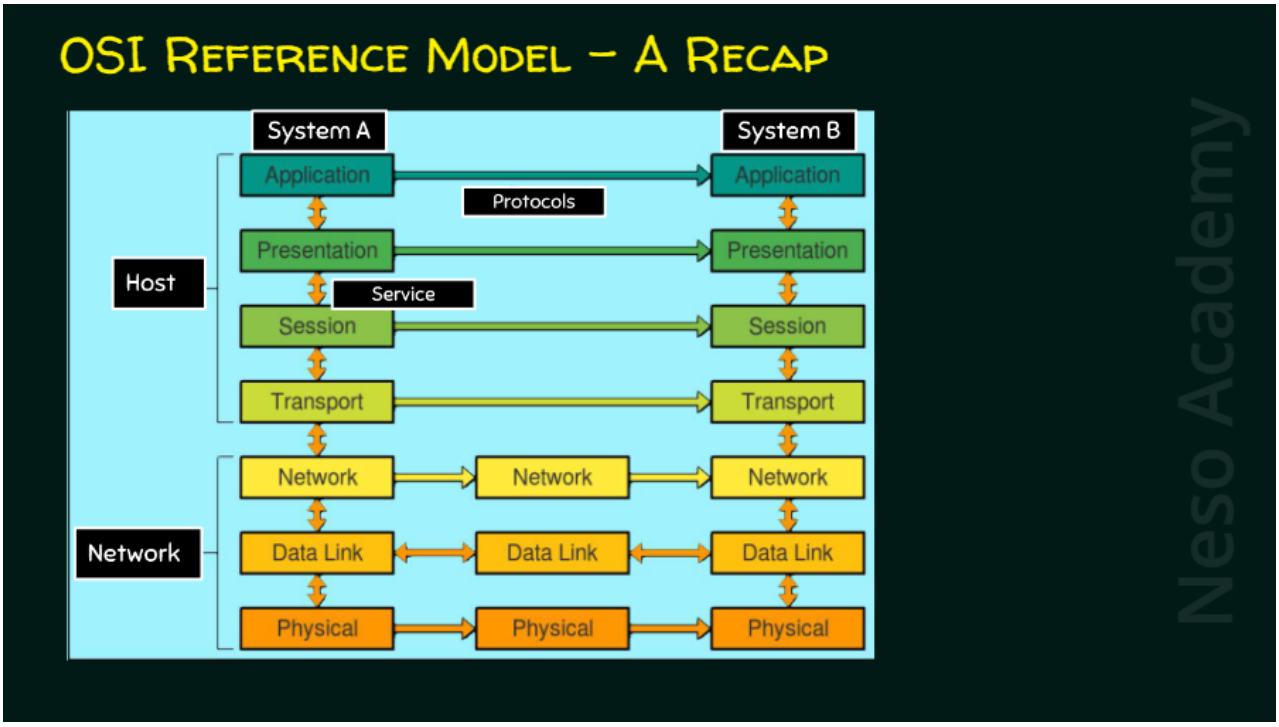
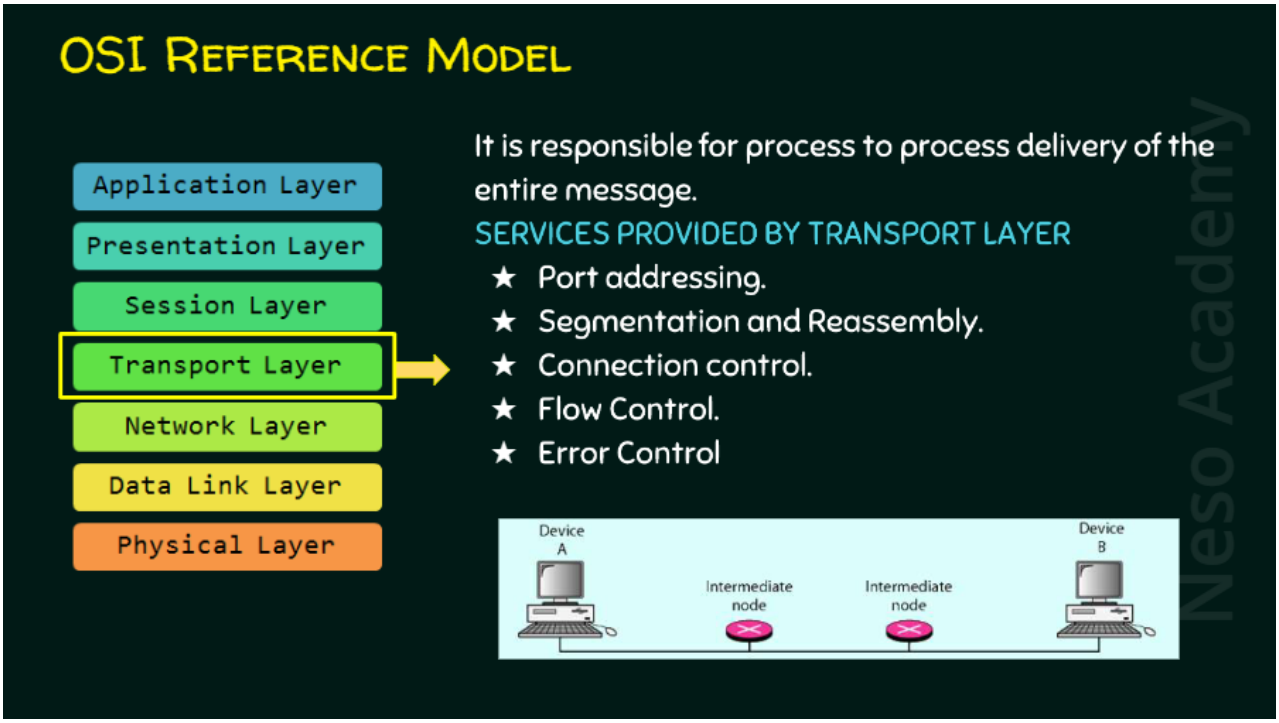
Transport Layer | Neso Academy

nesoacademy.org/cs/06-computer-networks/ppts/07-transportlayer

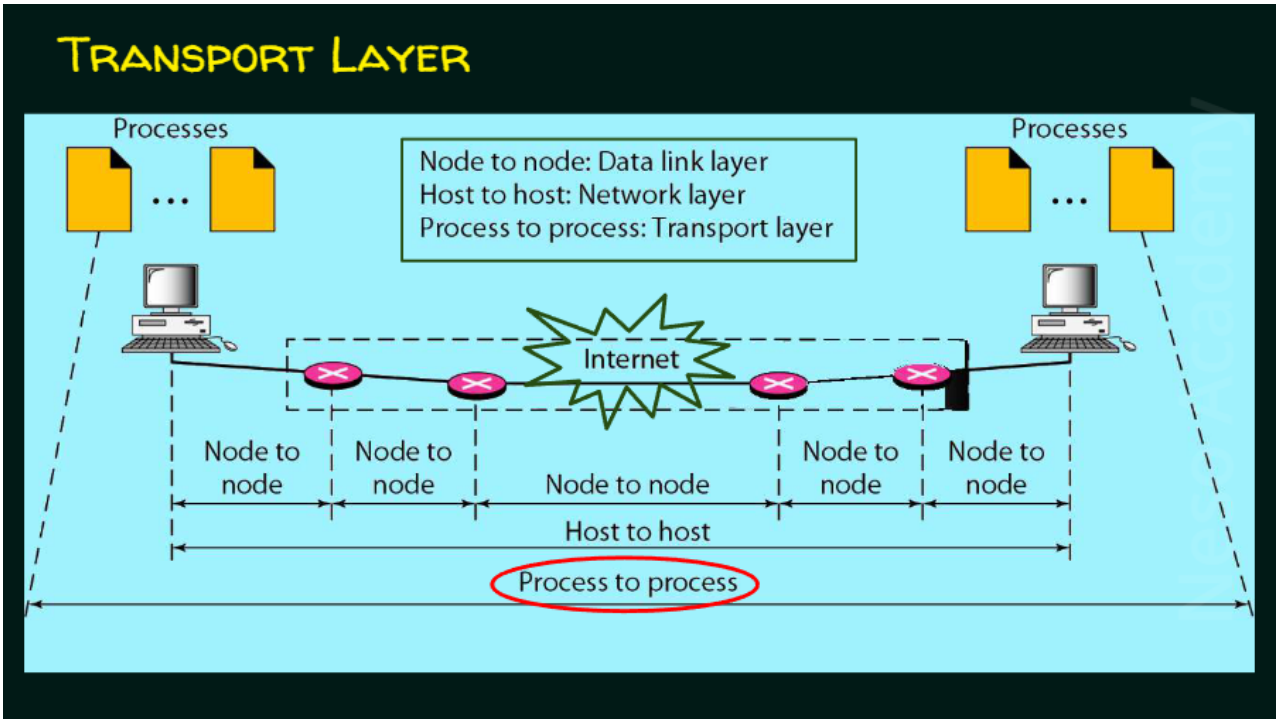
TransportLayerNeso AcademyCHAPTER - 7



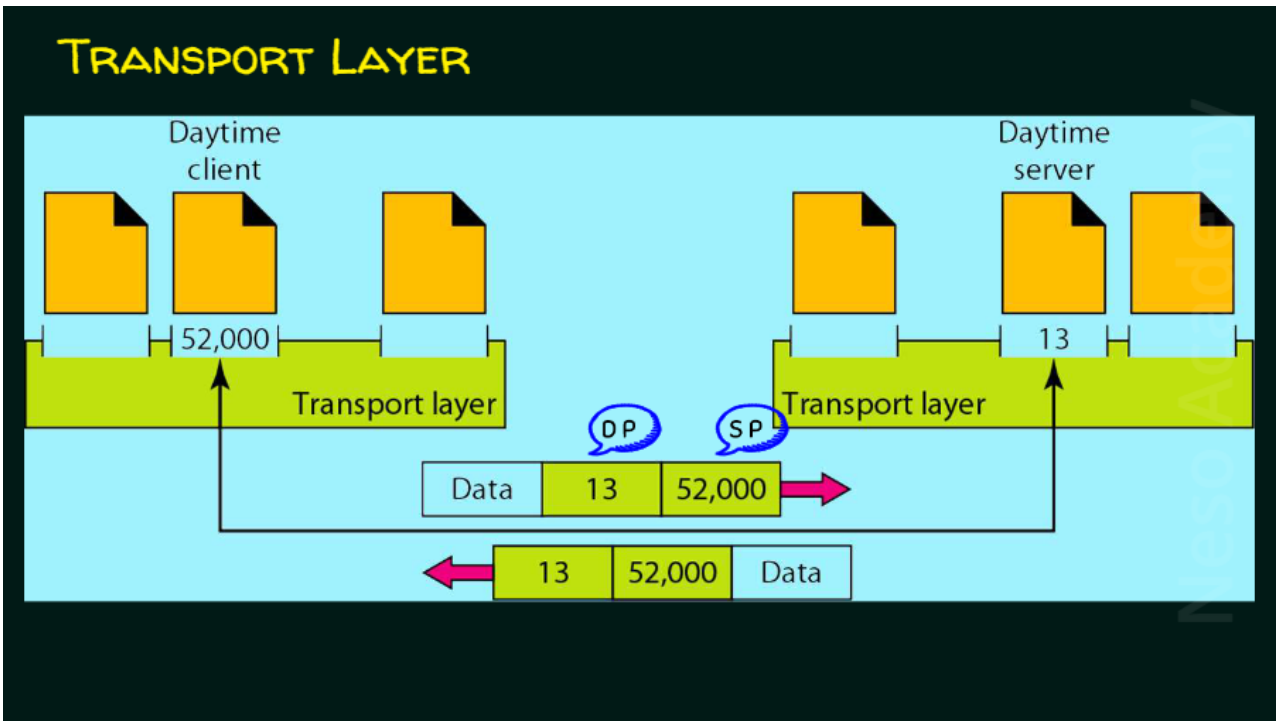
OSI Reference Model -A RecapNeso Academy



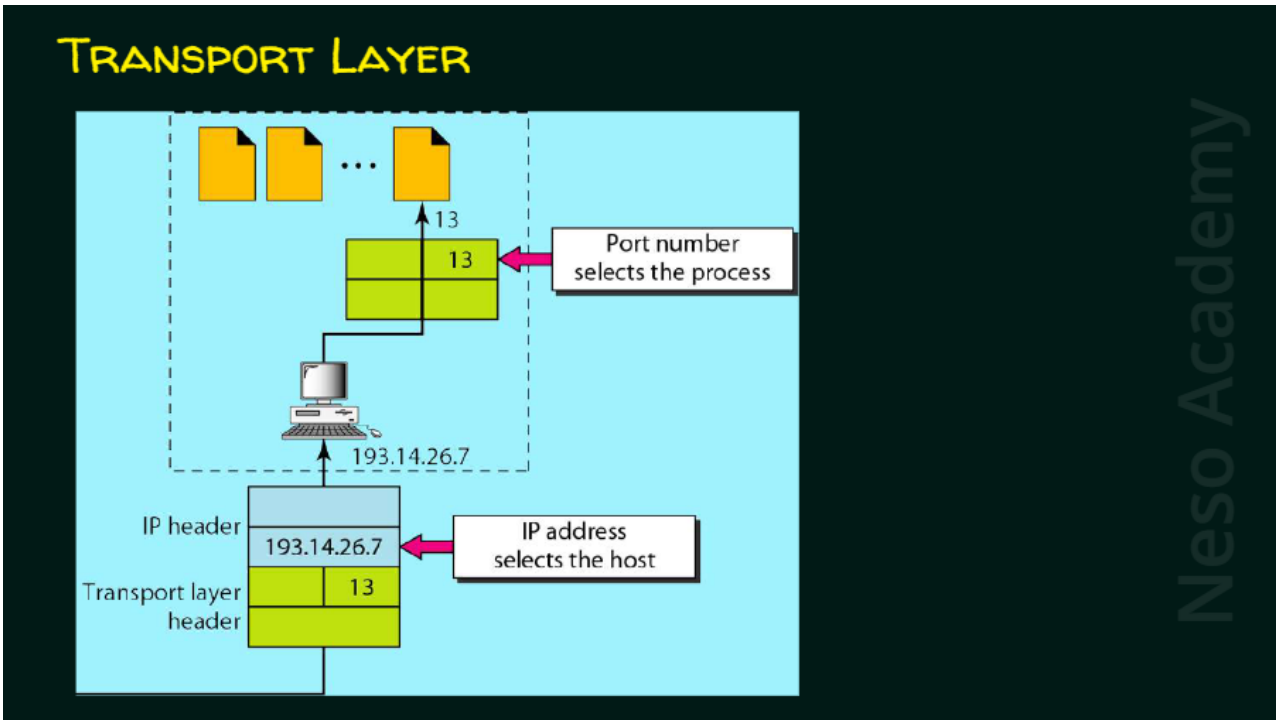
★★★★★OSI Reference ModelNeso Academy



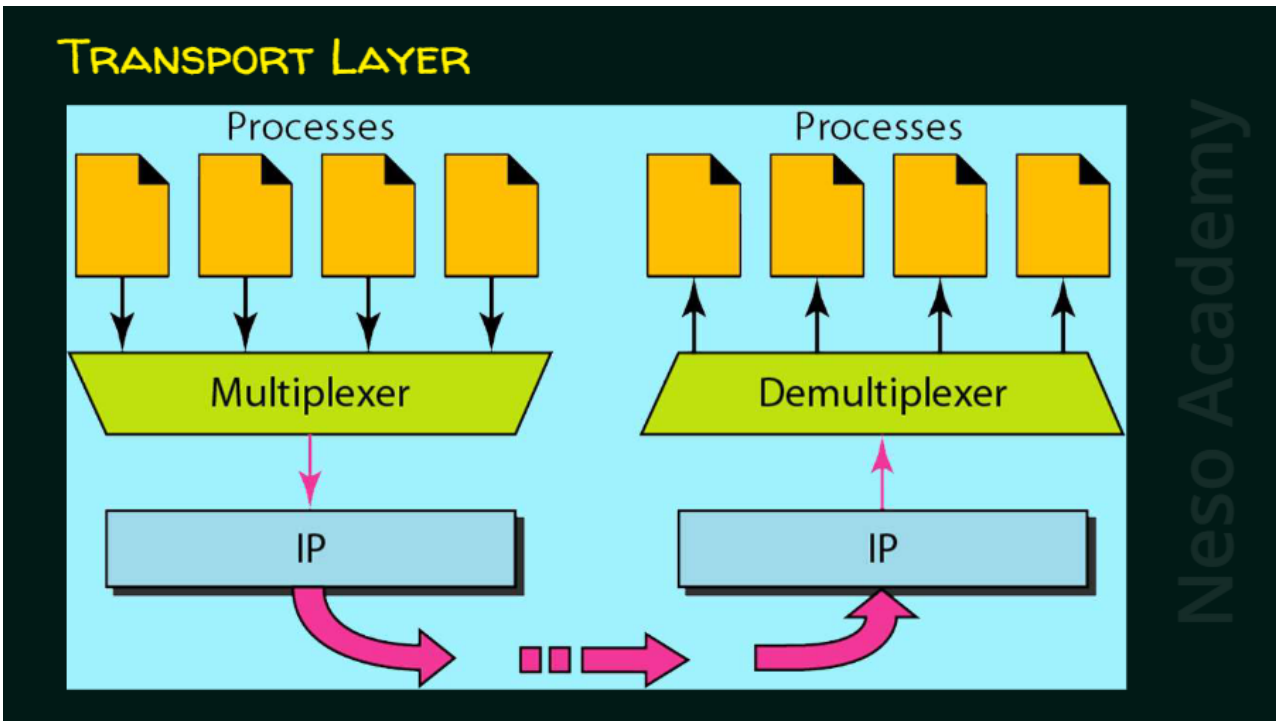
Transport LayerNeso Academy



Transport LayerNeso Academy

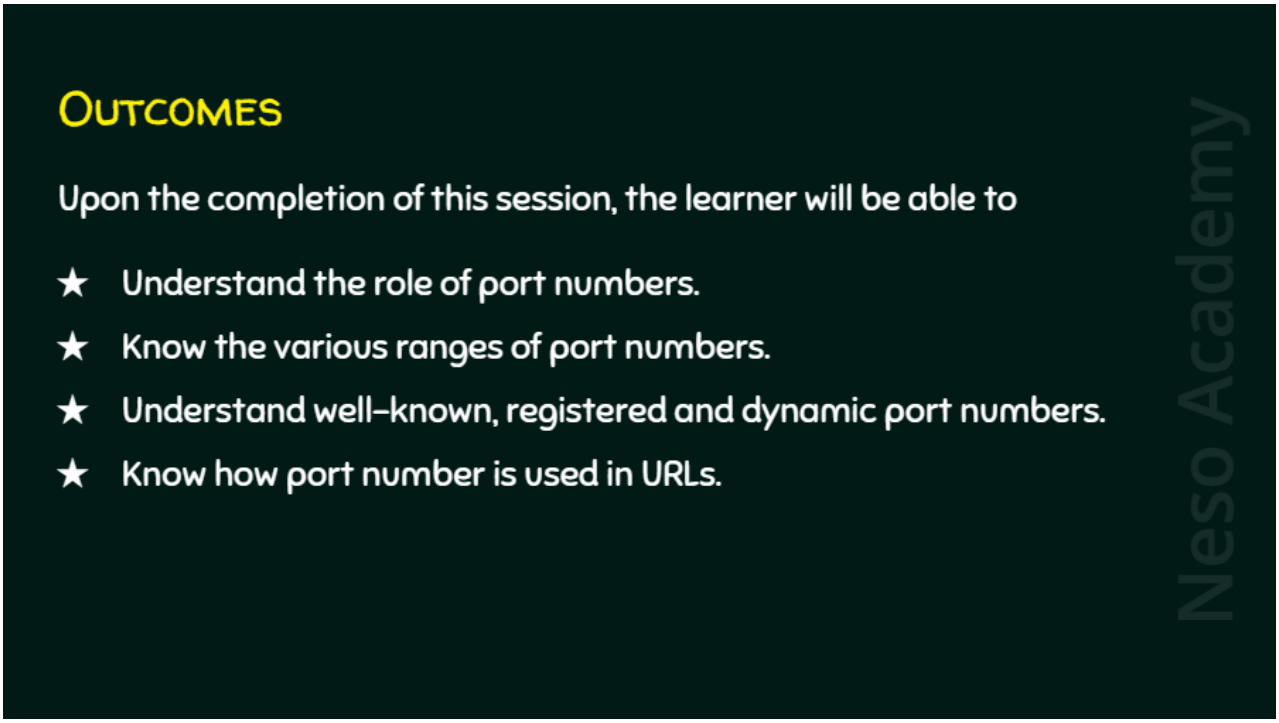


Transport LayerNeso Academy

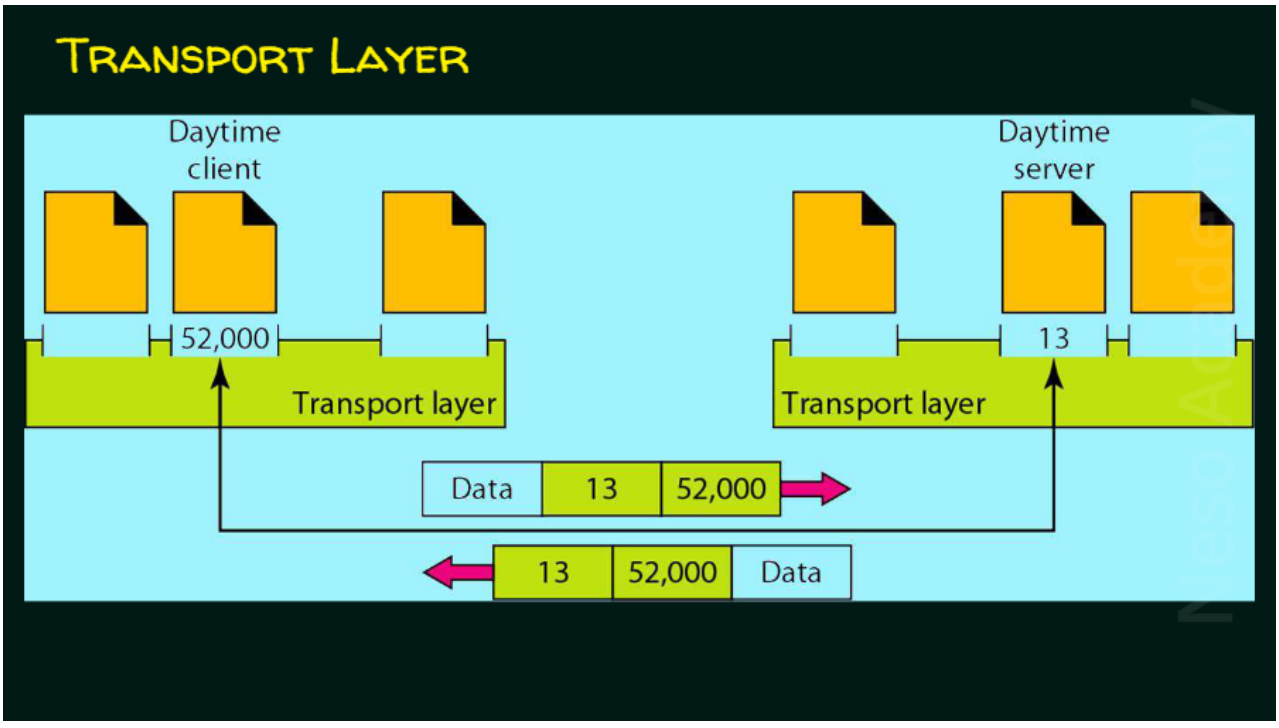


Transport LayerNeso Academy

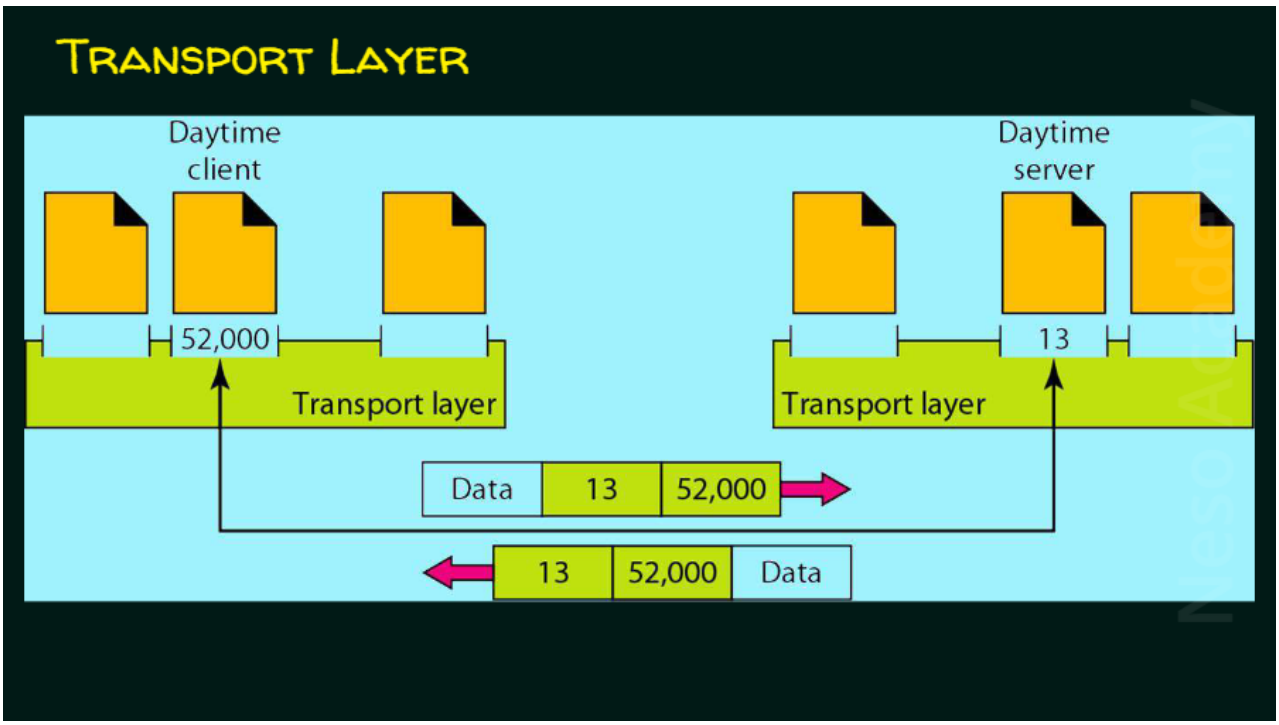
Computer NetworksA Bottom up approachPort NumbersNeso Academy



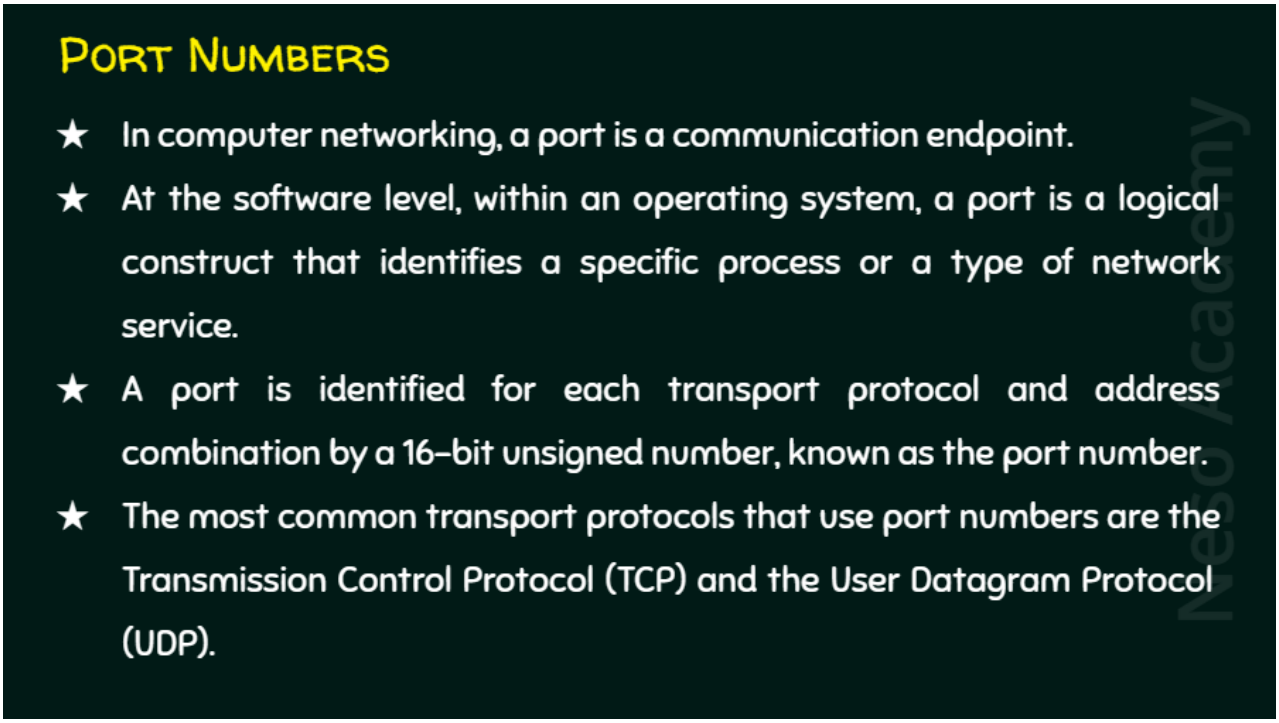
OutcomesUpon the completion of this session, the learner will be able to★Understand the role of port numbers.★Know the various ranges of port numbers.★Understand well-known, registered and dynamic port numbers.★Know how port number is used in URLs.Neso Academy



Transport LayerNeso Academy



Transport LayerNeso Academy



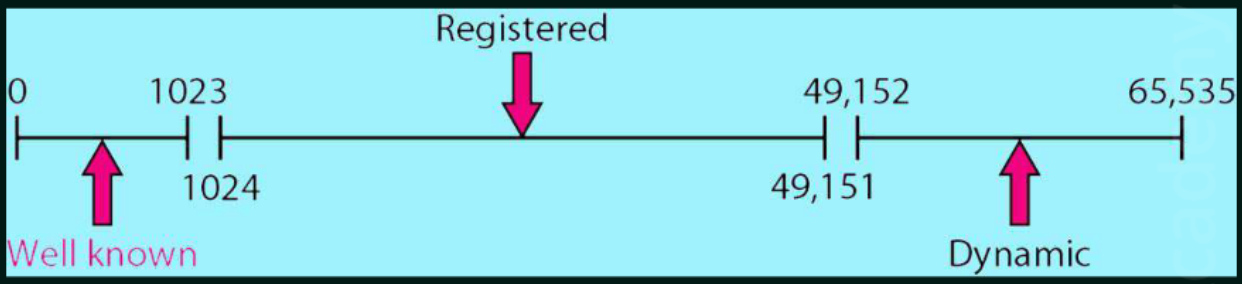
Port Numbers★In computer networking, a port is a communication endpoint.★At the software level, within an operating system, a port is a logical construct that identifies a specific process or a type of network service.★A port is identified for each transport protocol and address combination by a 16-bit unsigned number, known as the port number.★The most common transport protocols that use port numbers are the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).Neso Academy

Port Numbers

- ★ In computer networking, a port is a communication endpoint.
- ★ At the software level, within an operating system, a port is a logical construct that identifies a specific process or a type of network service.
- ★ A port is identified for each transport protocol and address combination by a 16-bit unsigned number, known as the port number.
- ★ The most common transport protocols that use port numbers are the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).

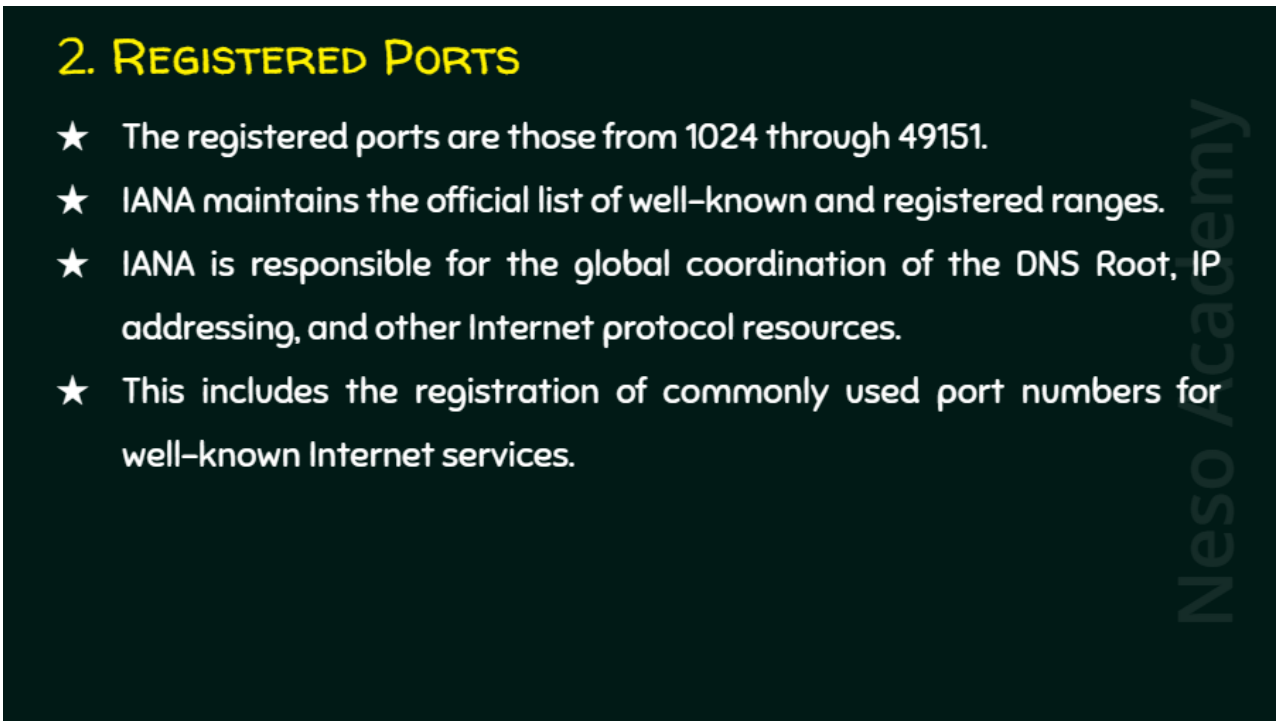
Port Numbers★In computer networking, a port is a communication endpoint.★At the software level, within an operating system, a port is a logical construct that identifies a specific process or a type of network service.★A port is identified for each transport protocol and address combination by a 16-bit unsigned number, known as the port number.★The most common transport protocols that use port numbers are the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).Neso Academy

Port Numbers

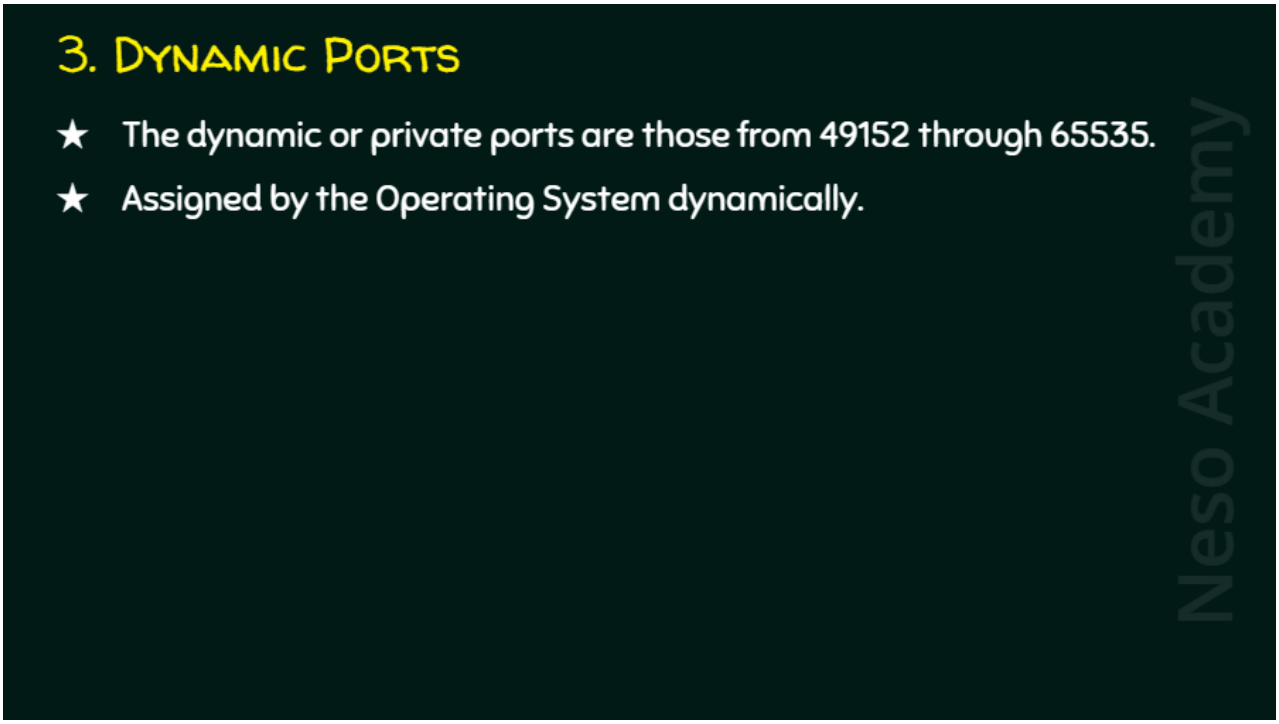


- ★ This includes the registration of commonly used port numbers for well-known Internet services.
- ★ The port numbers are divided into three ranges:
  - ○ Well-known ports,
  - ○ Registered ports, and
  - ○ Dynamic or private ports.

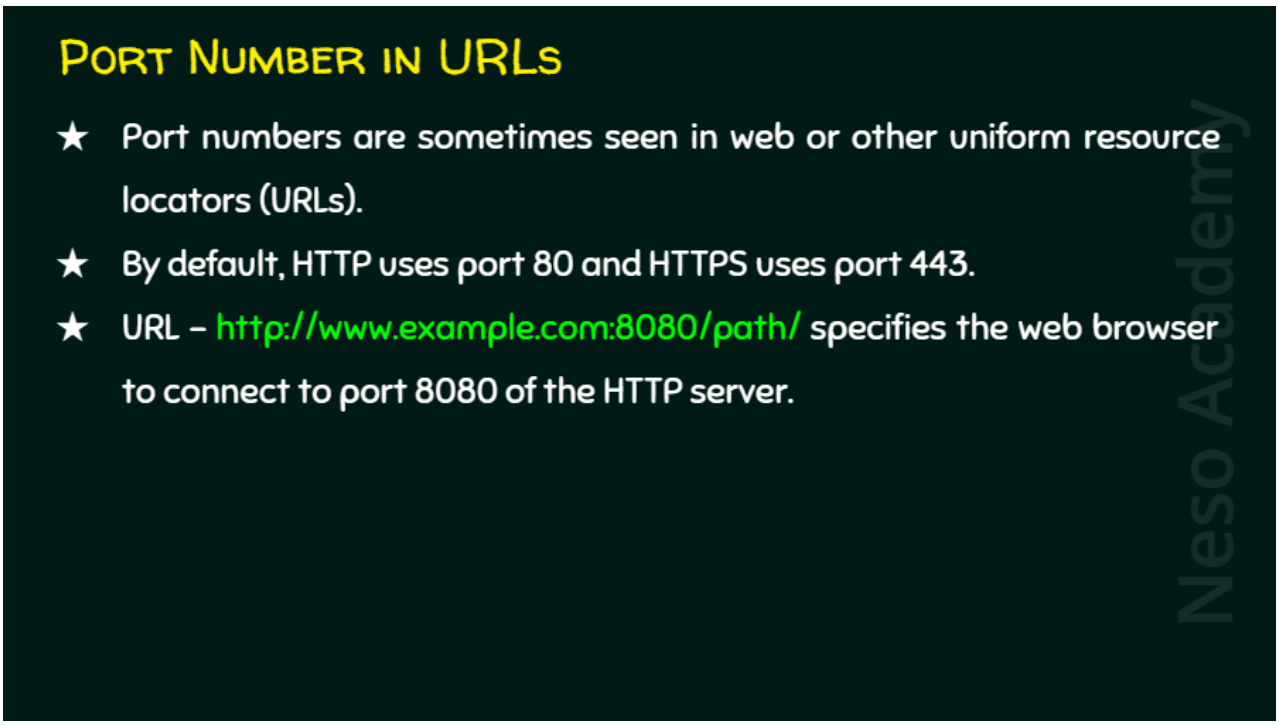
Port Numbers★This includes the registration of commonly used port numbers for well-known Internet services.★The port numbers are divided into three ranges:○Well-known ports,○Registered ports, and○Dynamic or private ports.Neso Academy



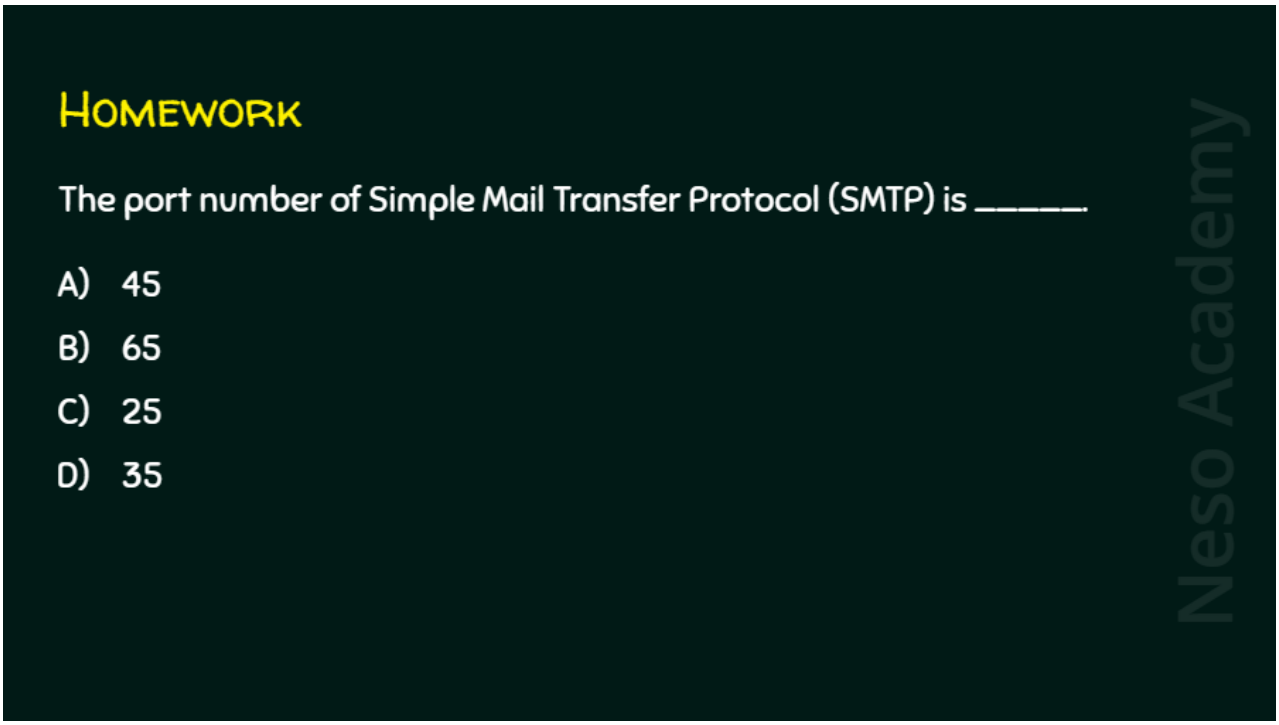
2. Registered Ports★The registered ports are those from 1024 through 49151. ★IANA maintains the official list of well-known and registered ranges.★IANA is responsible for the global coordination of the DNS Root, IP addressing, and other Internet protocol resources. ★This includes the registration of commonly used port numbers for well-known Internet services.Neso Academy



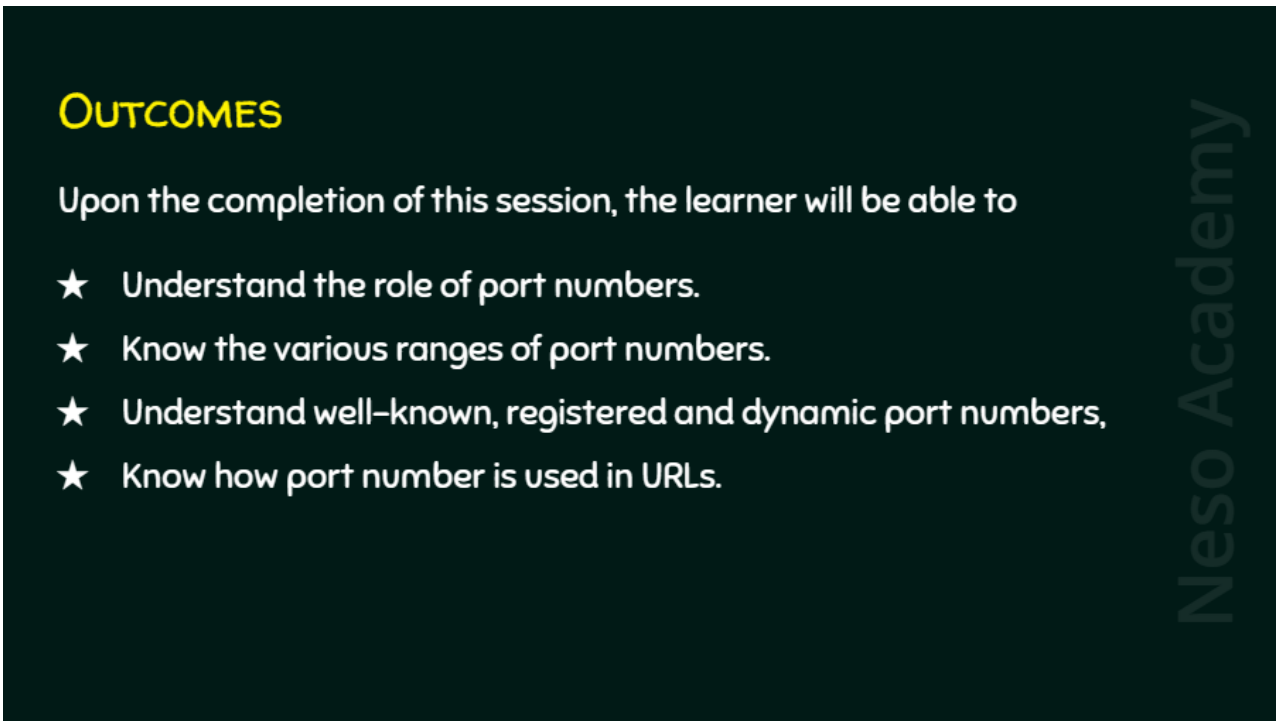
3. Dynamic Ports★The dynamic or private ports are those from 49152 through 65535.★Assigned by the Operating System dynamically.Neso Academy



Port Number in URLs★Port numbers are sometimes seen in web or other uniform resource locators (URLs). ★By default, HTTP uses port 80 and HTTPS uses port 443. ★URL - http://www.example.com:8080/path/ specifies the web browser to connect to port 8080 of the HTTP server.Neso Academy



HomeworkThe port number of Simple Mail Transfer Protocol (SMTP) is _____.A) 45B) 65C) 25D) 35Neso Academy



OutcomesUpon the completion of this session, the learner will be able to★Understand the role of port numbers.★Know the various ranges of port numbers.★Understand well-known, registered and dynamic port numbers,★Know how port number is used in URLs.Neso Academy

Thank you!Neso Academy

Outcomes

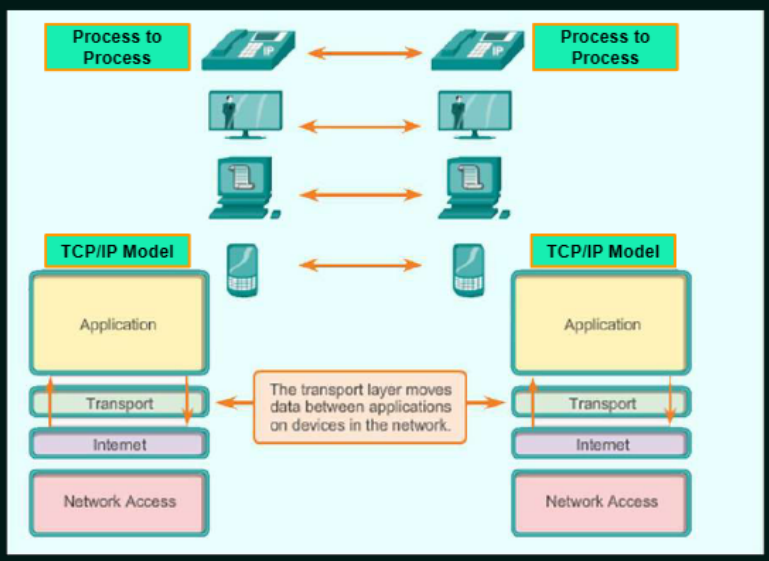
Upon the completion of this session, the learner will be able to

- ★ Understand about Reliability-Delay tradeoff.
- ★ Understand the need for TCP and UDP.
- ★ Know the applications that use TCP/UDP.

Neso Academy

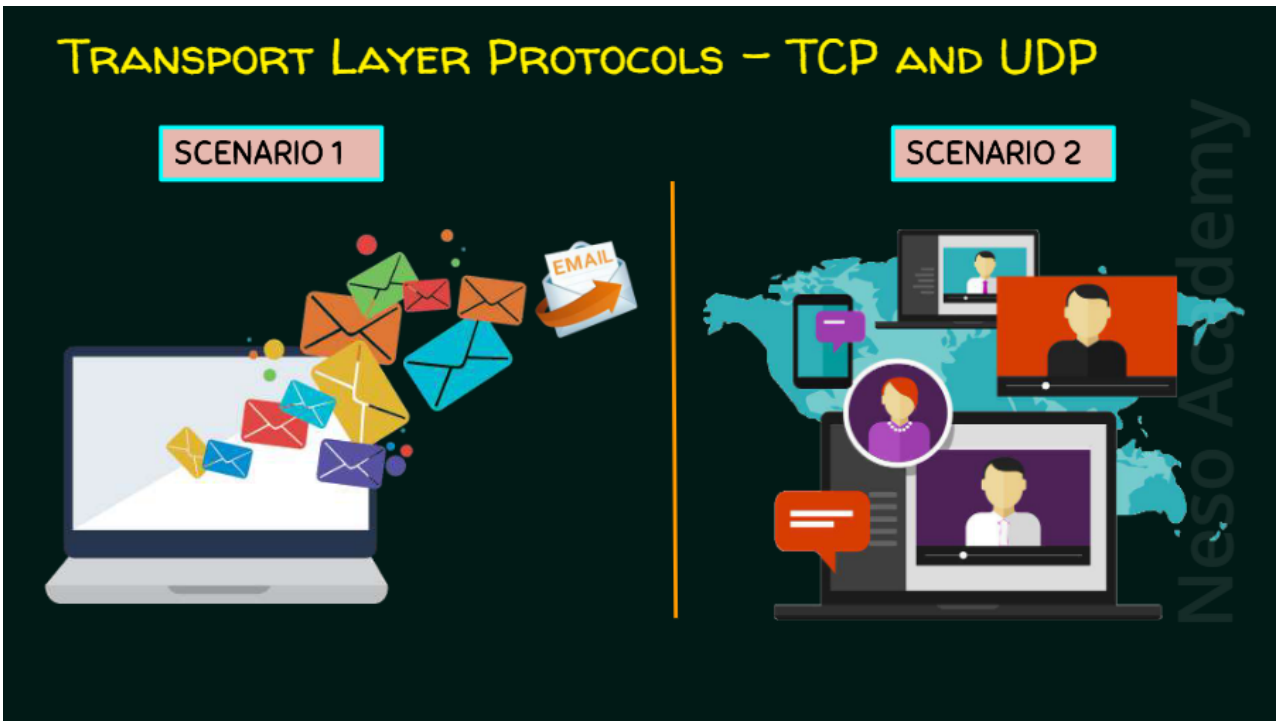
Outcomes★★★Neso Academy

Transport Layer Protocols

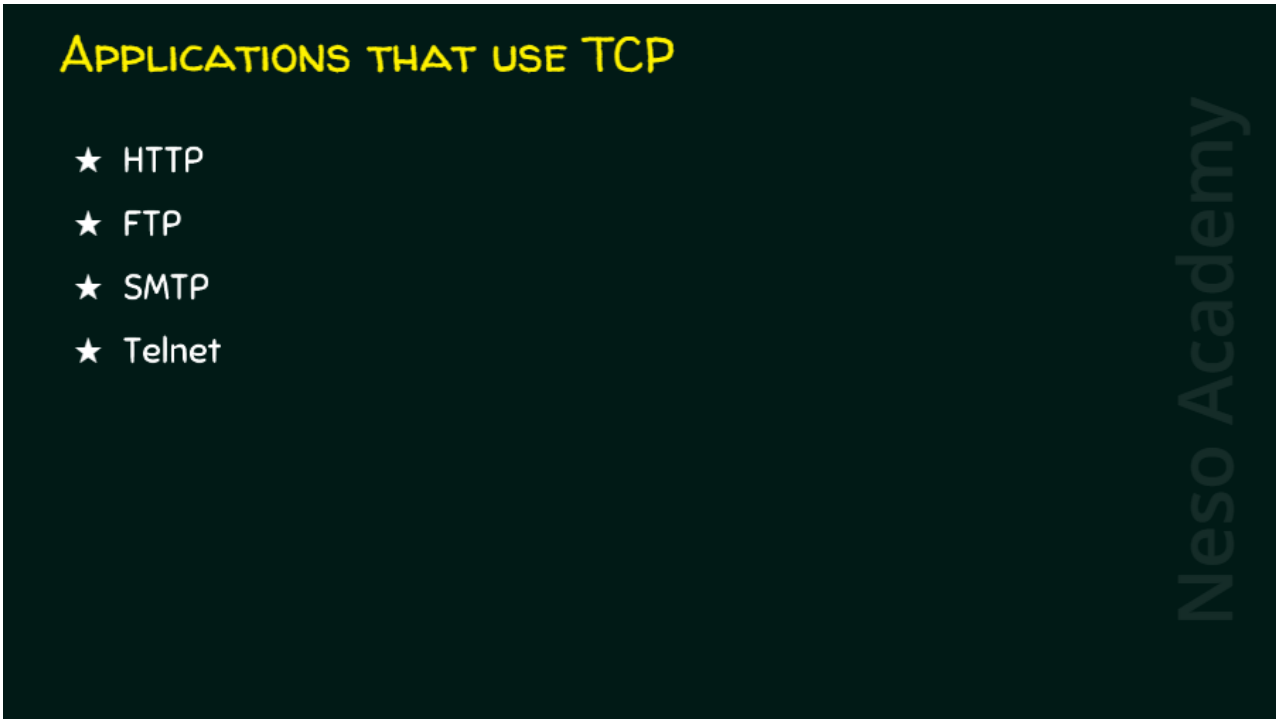


Neso Academy

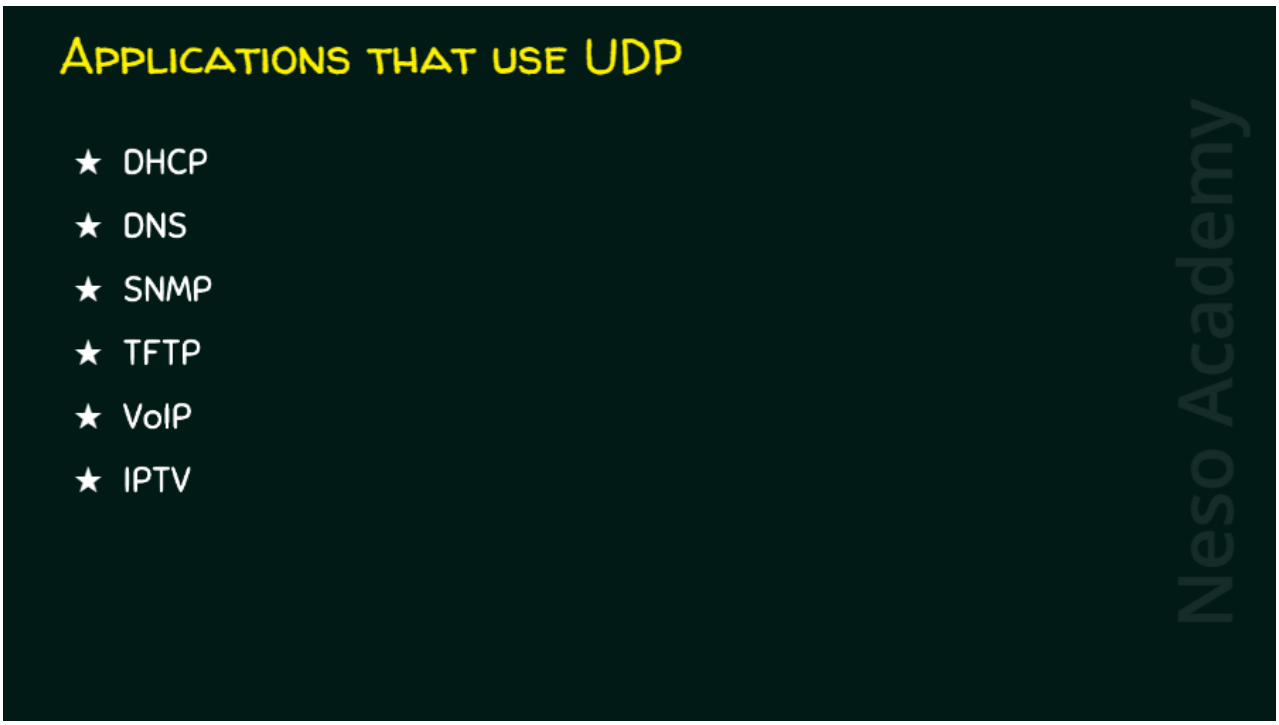
Transport Layer ProtocolsTCP/IP ModelTCP/IP ModelProcess to ProcessProcess to ProcessNeso Academy



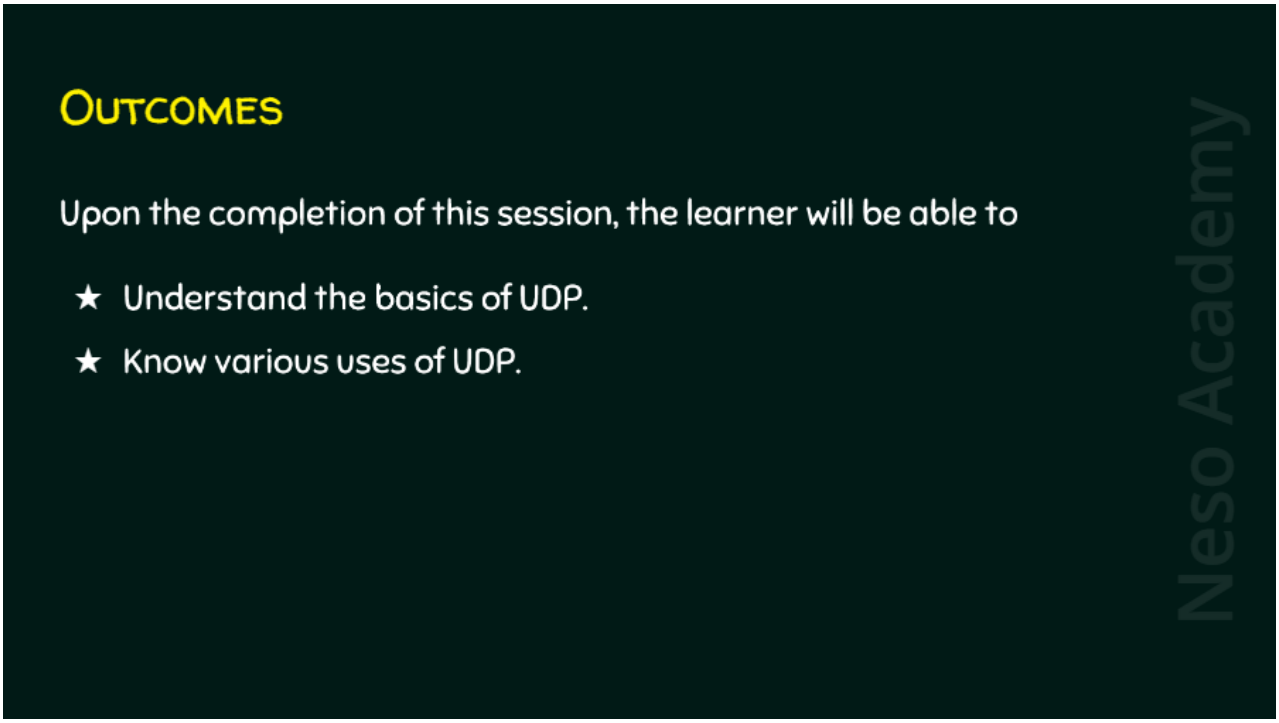
Transport Layer Protocols -TCP and UDPNeso Academy



Applications that use TCP★★★★Neso Academy



Applications that use UDP★★★★★★Neso Academy



Outcomes★★Neso Academy

UDP

- ★ UDP = User Datagram Protocol.
- ★ Simple protocol that provides the basic transport layer function.
- ★ Used by applications that can tolerate small loss of data.
- ★ Used by applications that cannot tolerate delay.
- ★ Used by:
  - ○ Domain Name System (DNS)
  - ○ Simple Network Management Protocol (SNMP)
  - ○ Dynamic Host Configuration Protocol (DHCP)
  - ○ Trivial File Transfer Protocol (TFTP)
  - ○ IP telephony or VoIP
  - ○ Online games

Neso Academy

UDP★★★★★○○○○○○Neso Academy

UDP

- ★ Connectionless and unreliable.
- ★ Prior communications are not required in order to set up communication channels or data paths.
- ★ UDP-based server applications are assigned well-known or registered port numbers.
- ★ UDP client process randomly selects port number from range of dynamic port numbers as the source port.
- ★ UDP is suitable for purposes where error checking and correction are either not necessary or are performed in the application; UDP avoids the overhead of such processing in the protocol stack.
- ★ No Error control.

Neso Academy

UDP★★★★★★Neso Academy

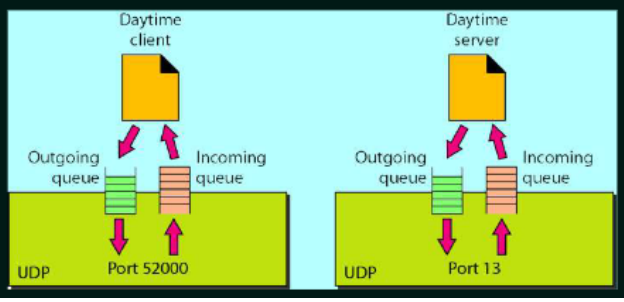
UDP

- ★ Time-sensitive applications often use UDP because dropping packets is preferable to waiting for packets delayed due to retransmission, which may not be an option in a real-time system.
- ★ No Flow Control.
- ★ Encapsulation and Decapsulation.
- ★ Queuing.

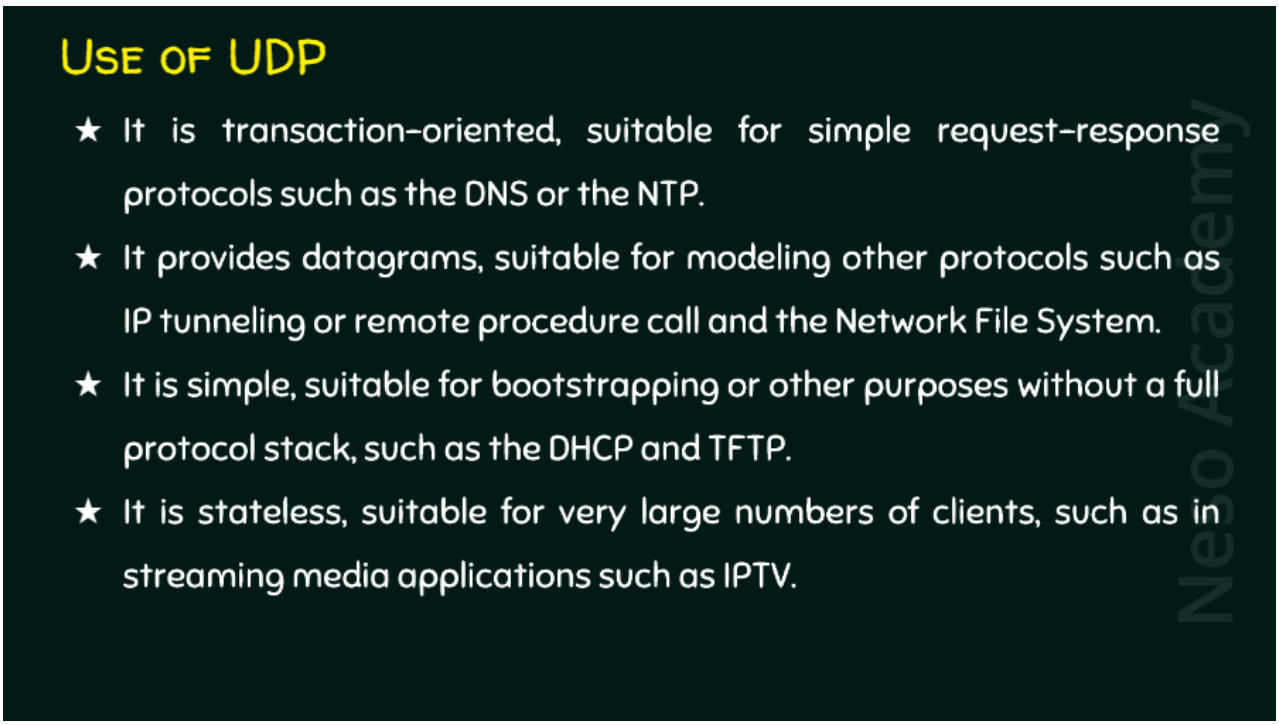
UDP★★★★Neso Academy

UDP

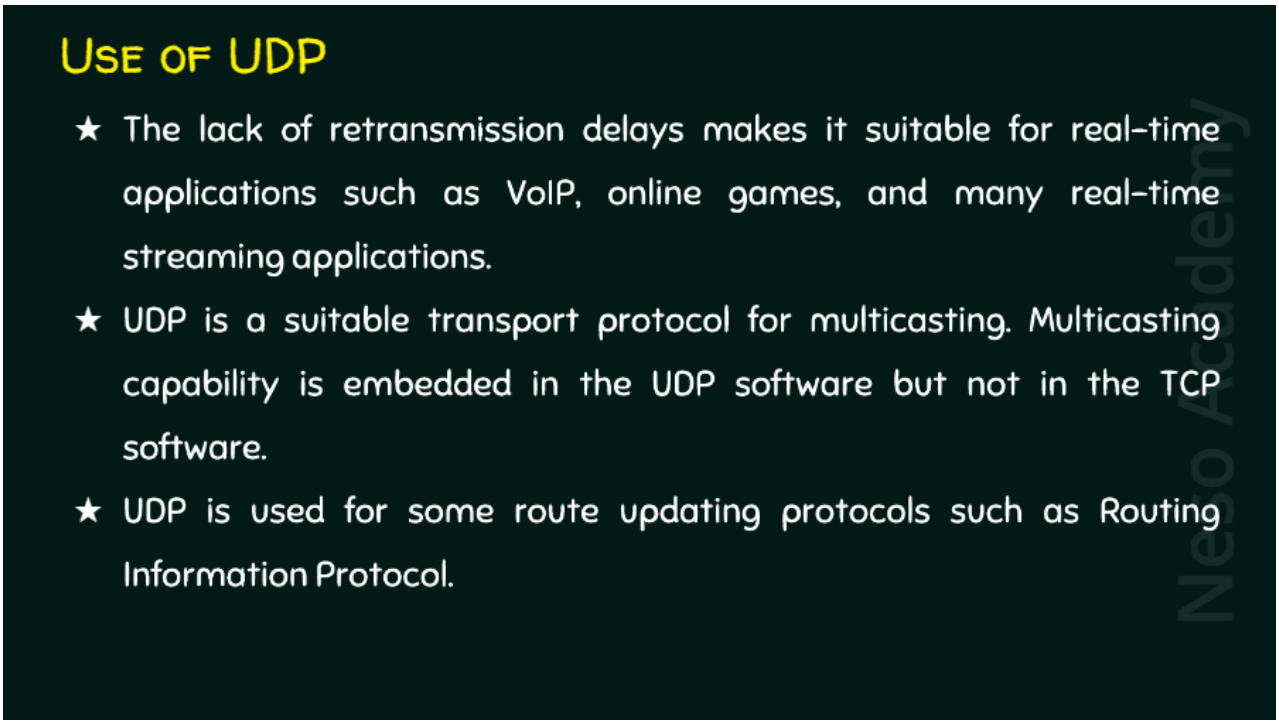
- ★ Time-sensitive applications often use UDP because dropping packets is preferable to waiting for packets delayed due to retransmission, which may not be an option in a real-time system.
- ★ No Flow Control.
- ★ Encapsulation and Decapsulation.
- ★ Queuing.



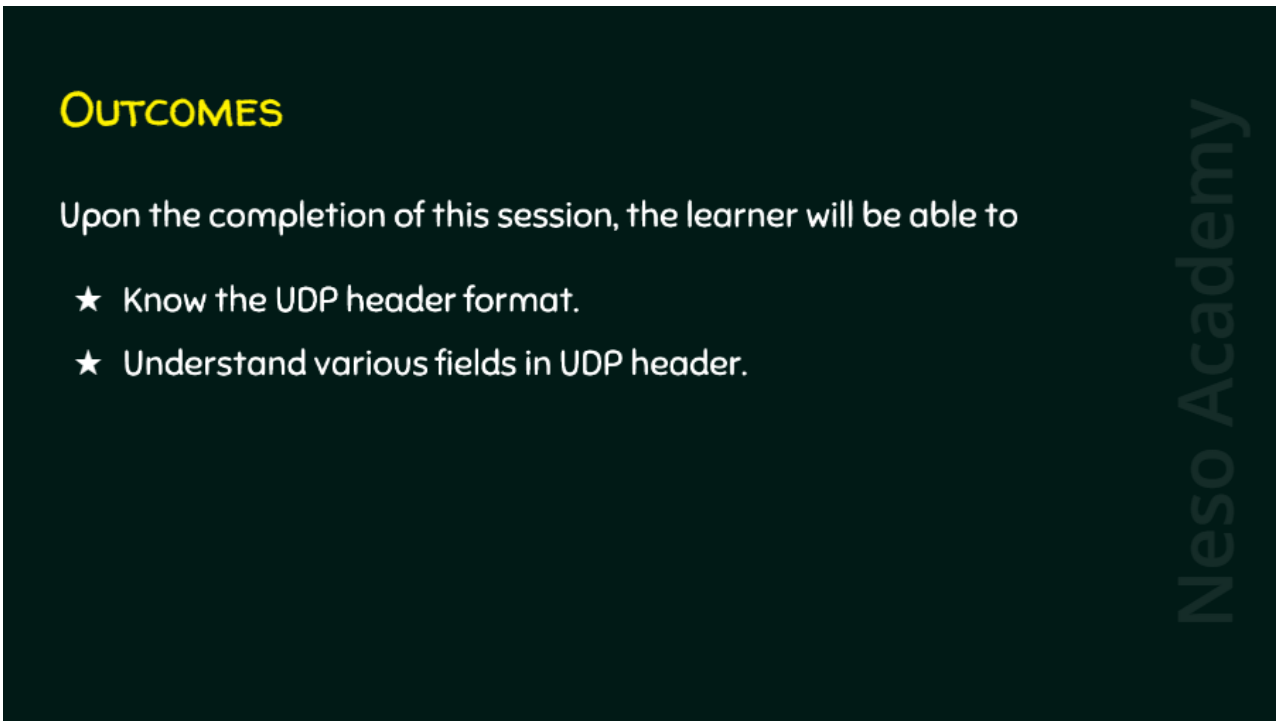
UDP★★★★Neso Academy



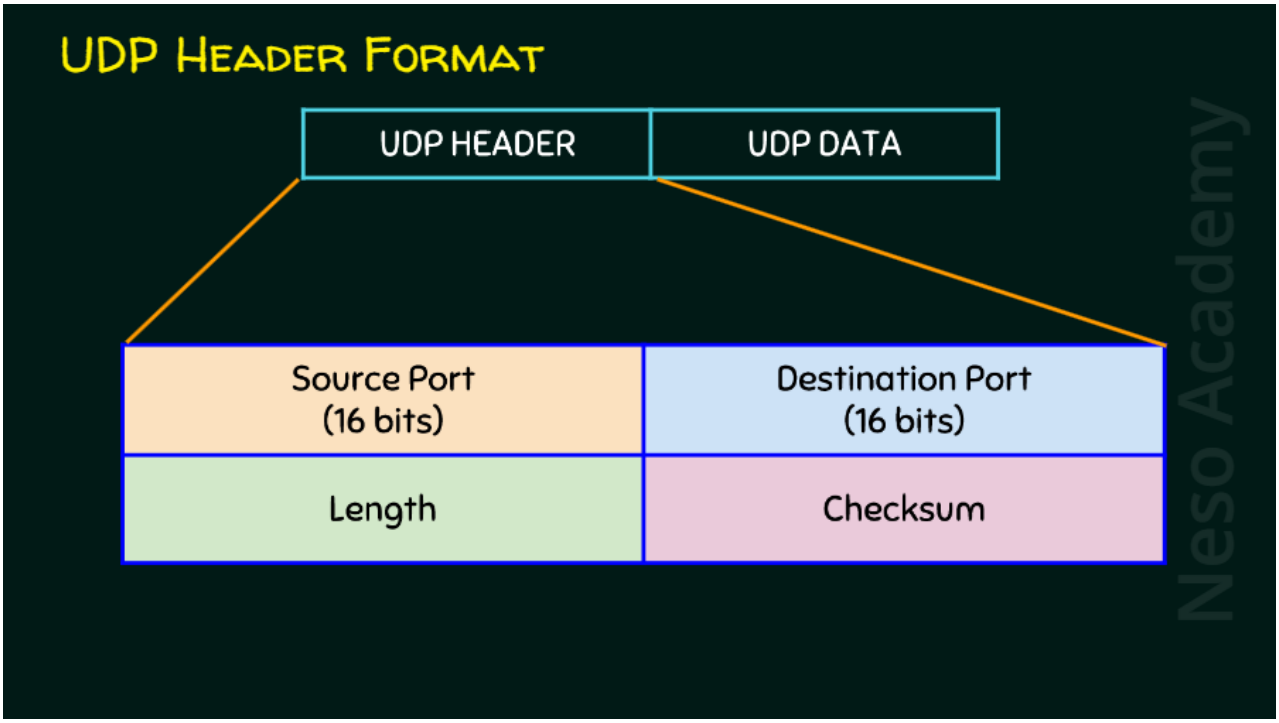
Use of UDP★★★★Neso Academy



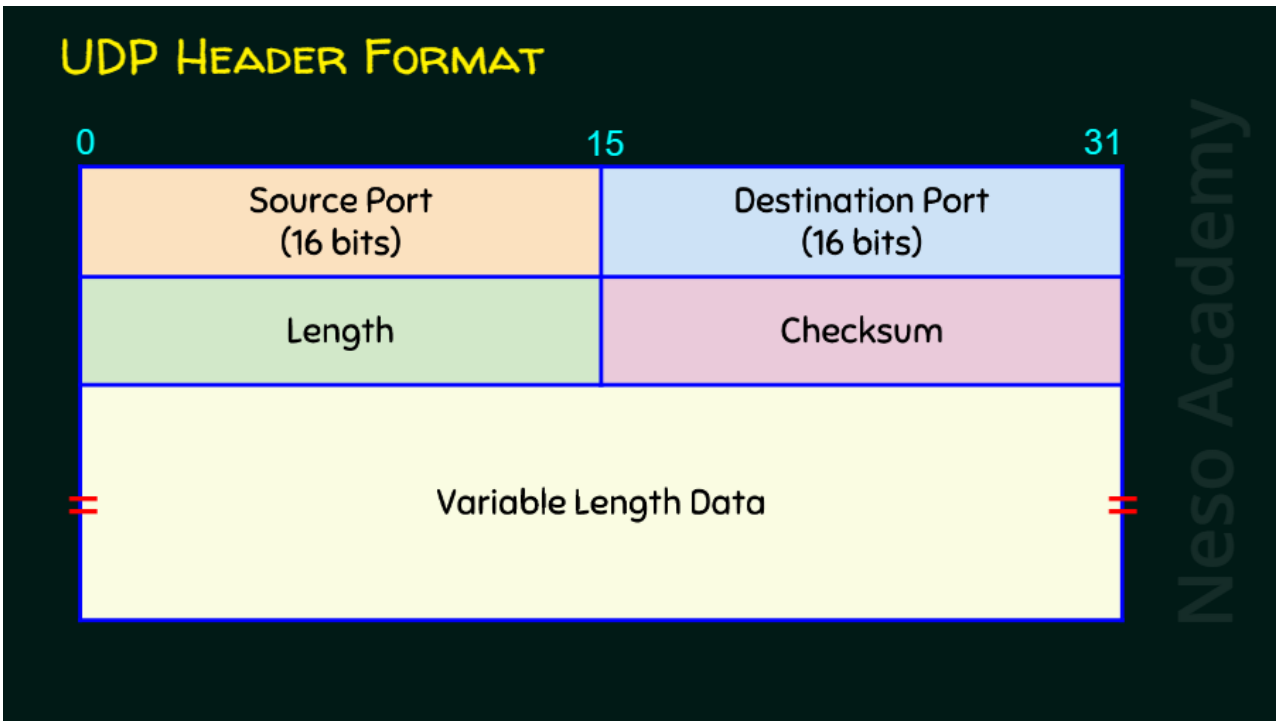
Use of UDP★★★Neso Academy



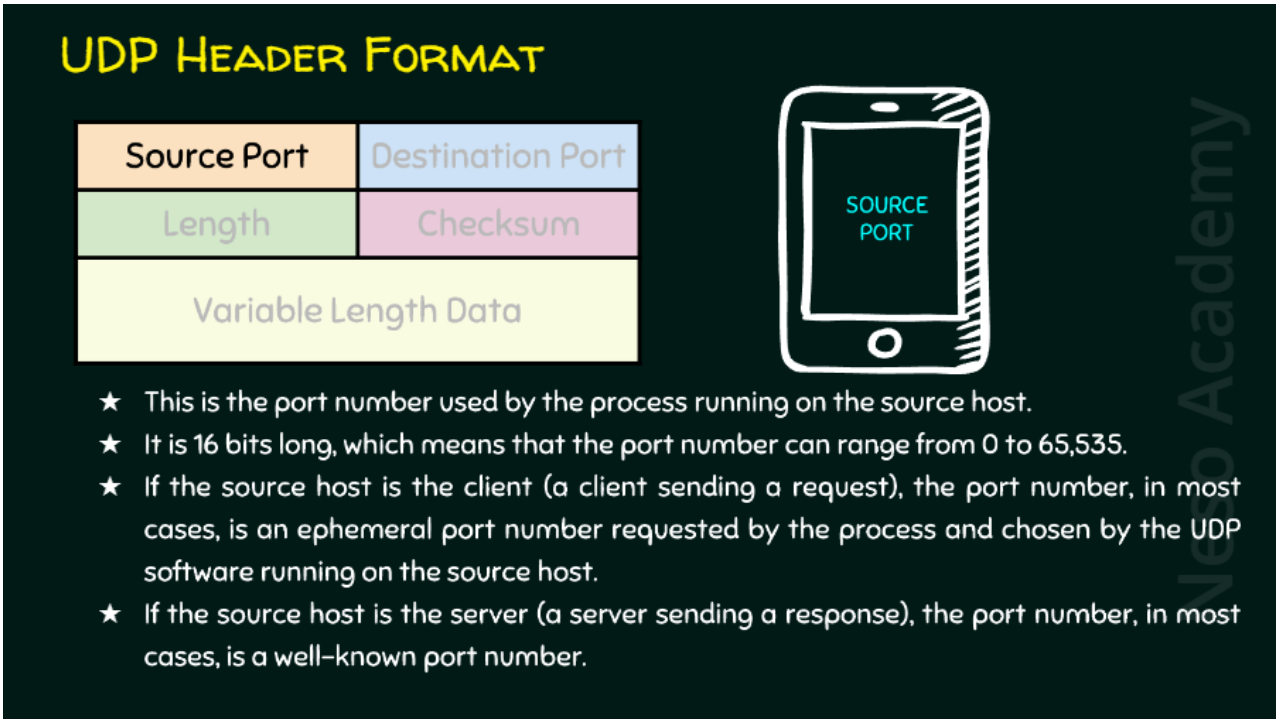
Outcomes★★Neso Academy



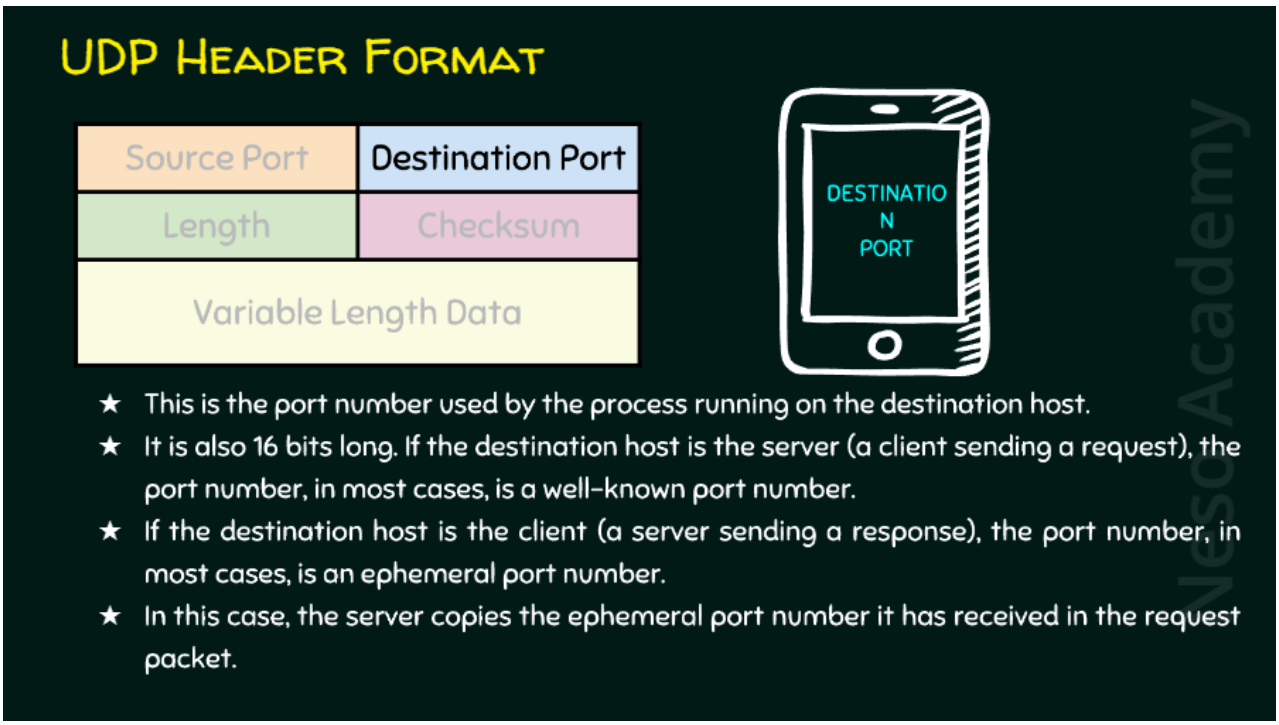
UDP Header FormatNeso Academy



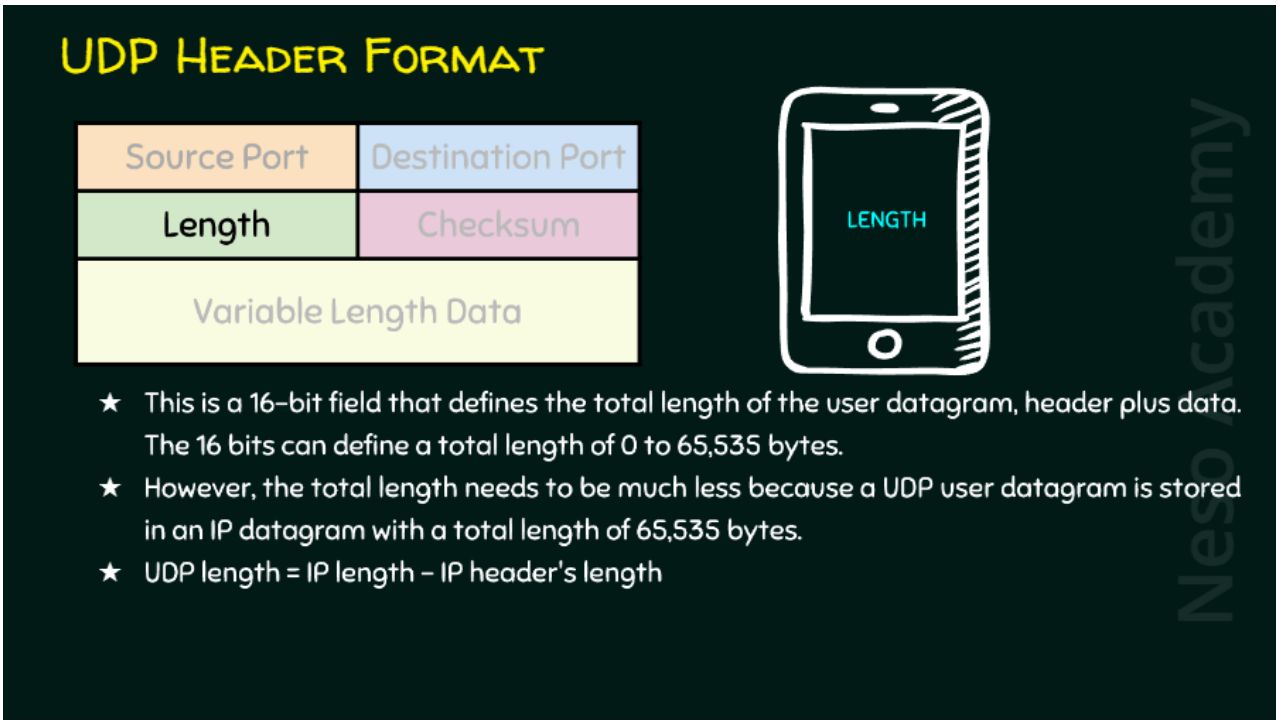
UDP Header Format01531==Neso Academy



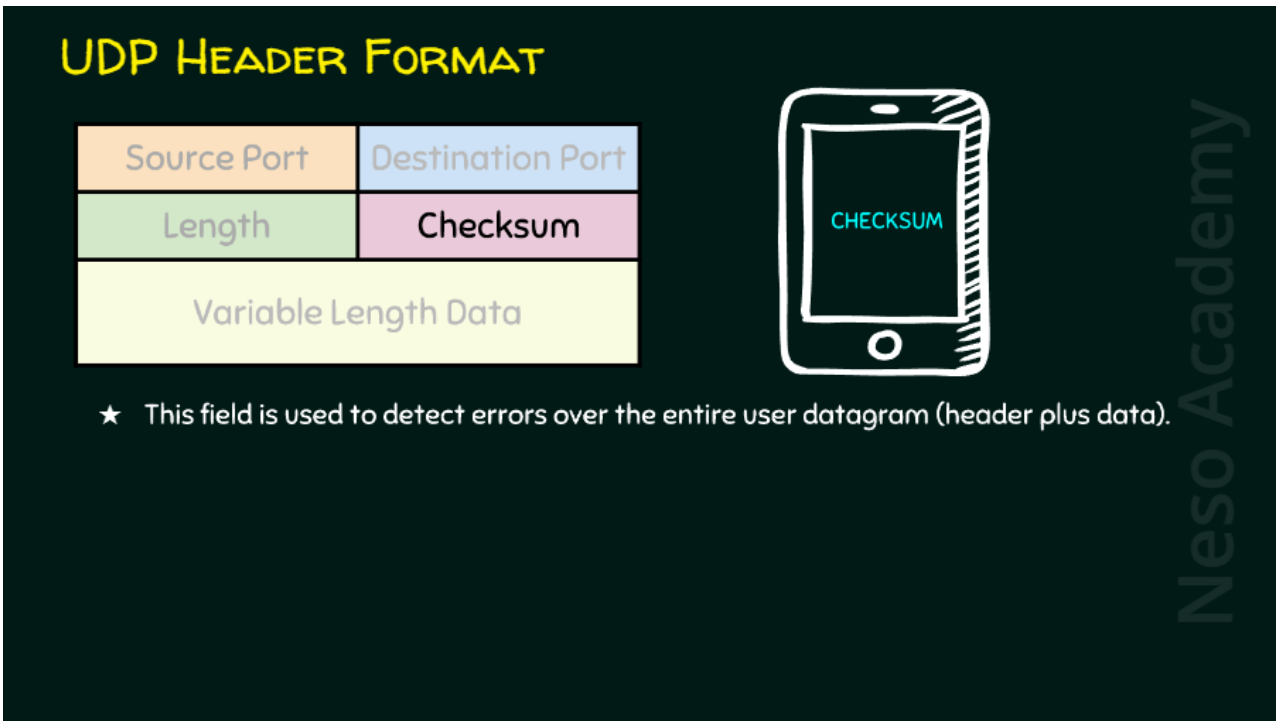
UDP Header Format★★★★Neso Academy



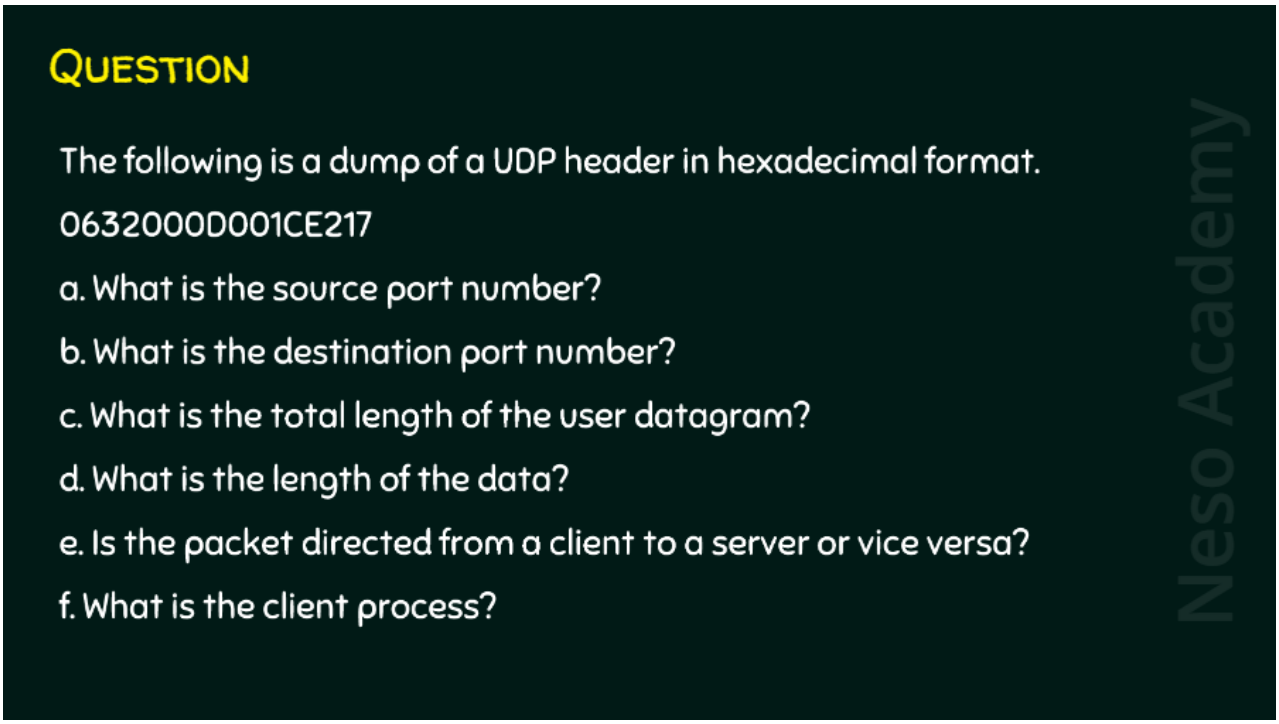
UDP Header Format★★★★Neso Academy



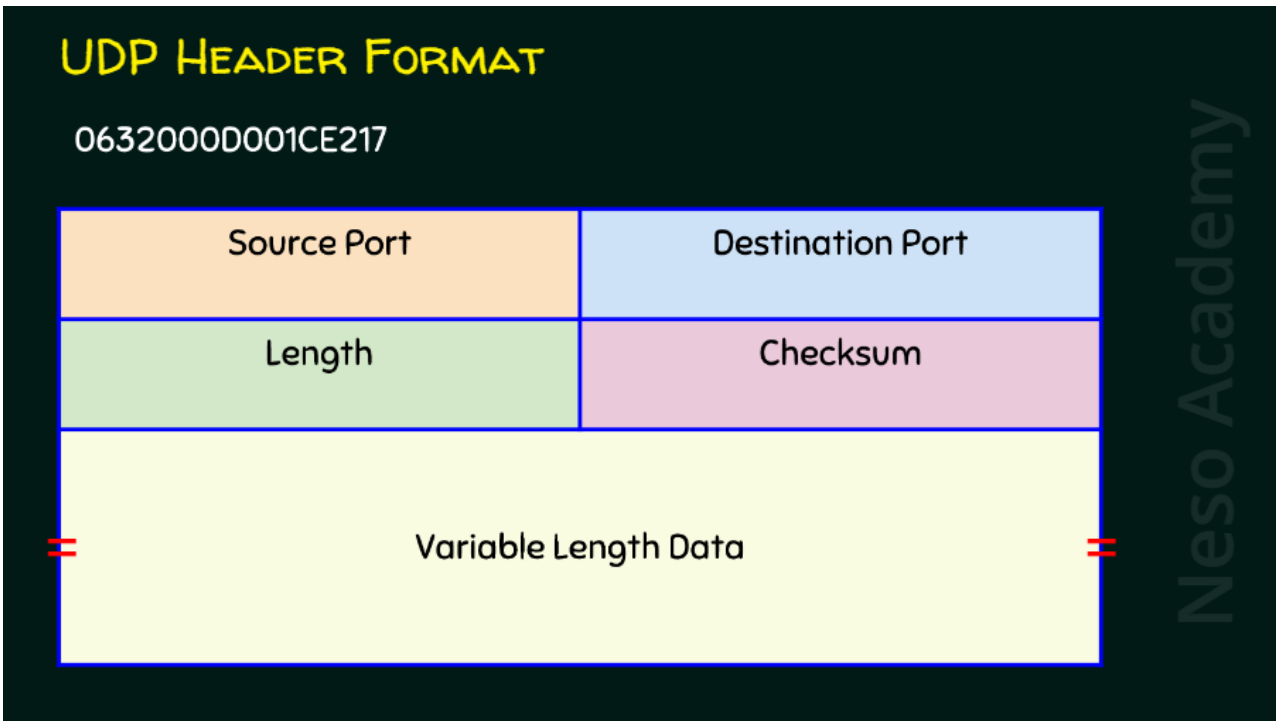
UDP Header Format★★★Neso Academy



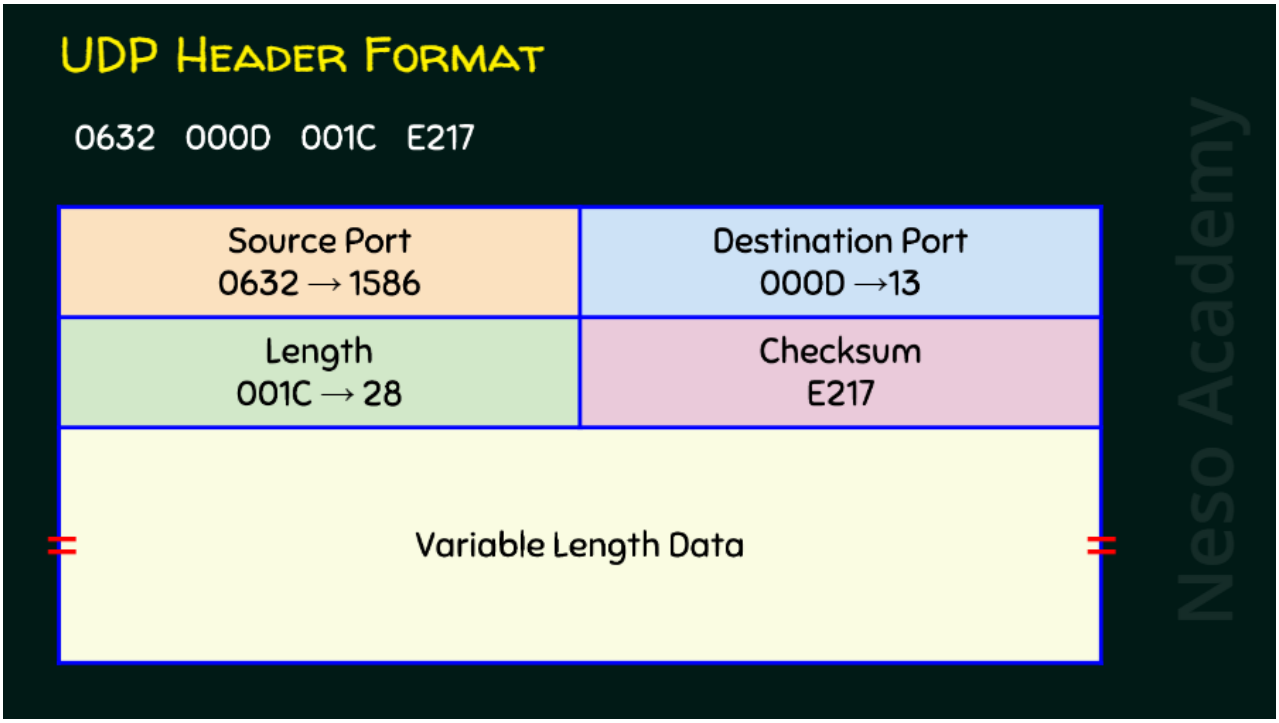
UDP Header Format★Neso Academy



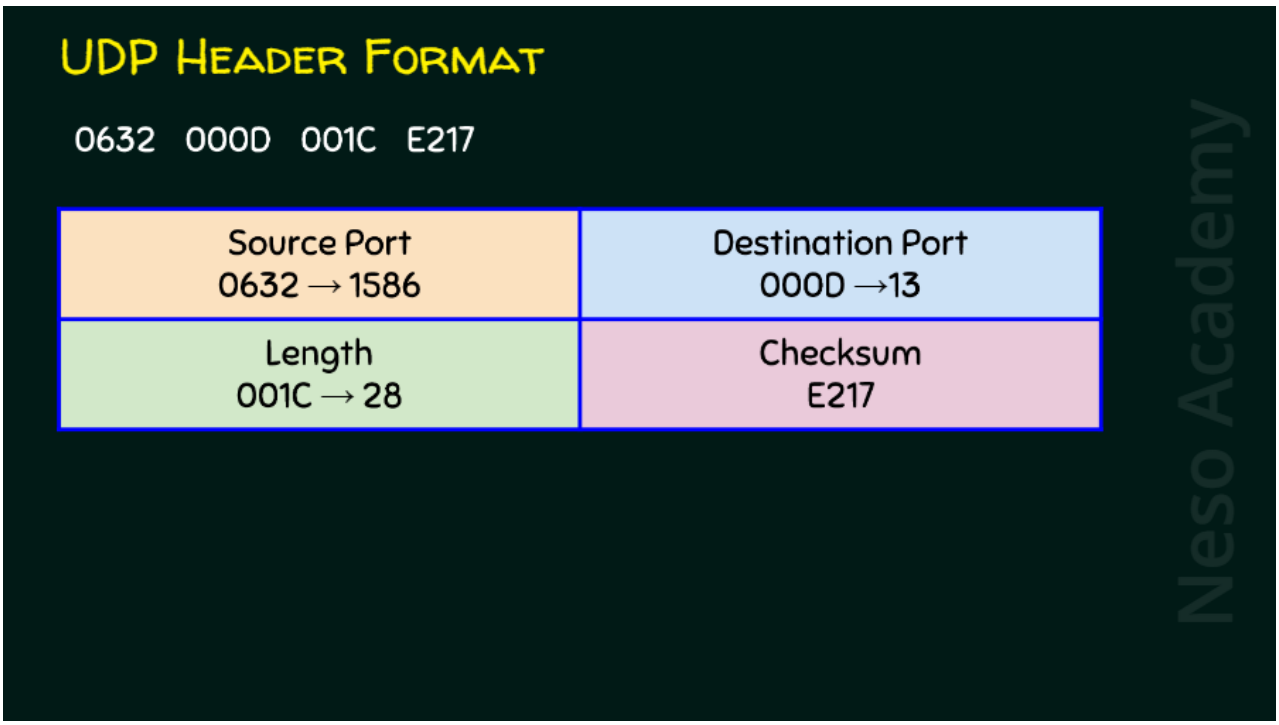
QuestionNeso Academy



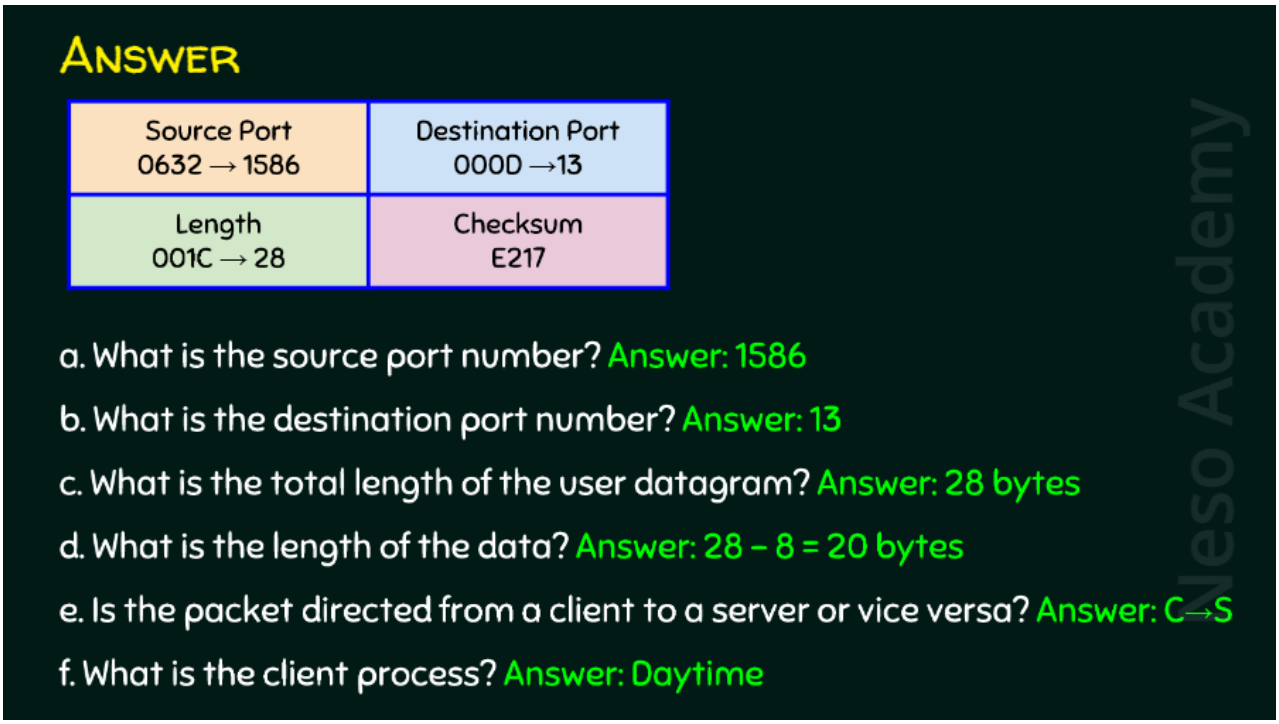
UDP Header Format==Neso Academy



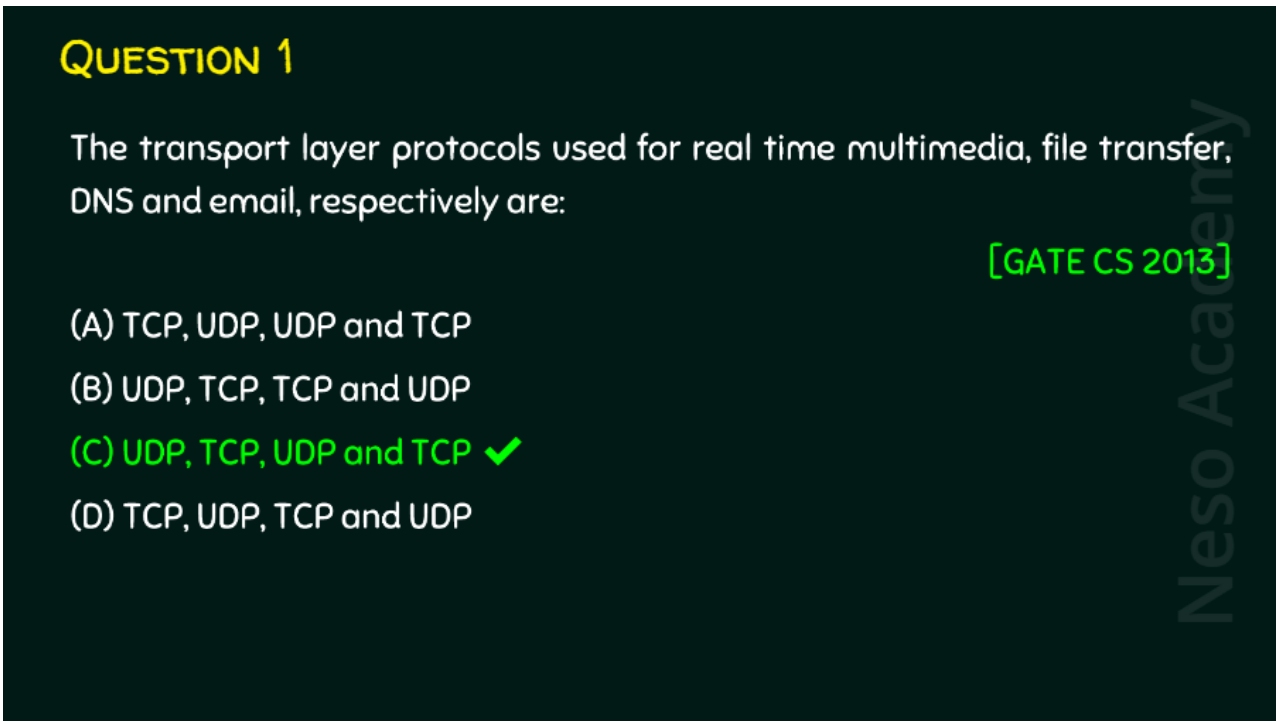
UDP Header Format→→→==Neso Academy



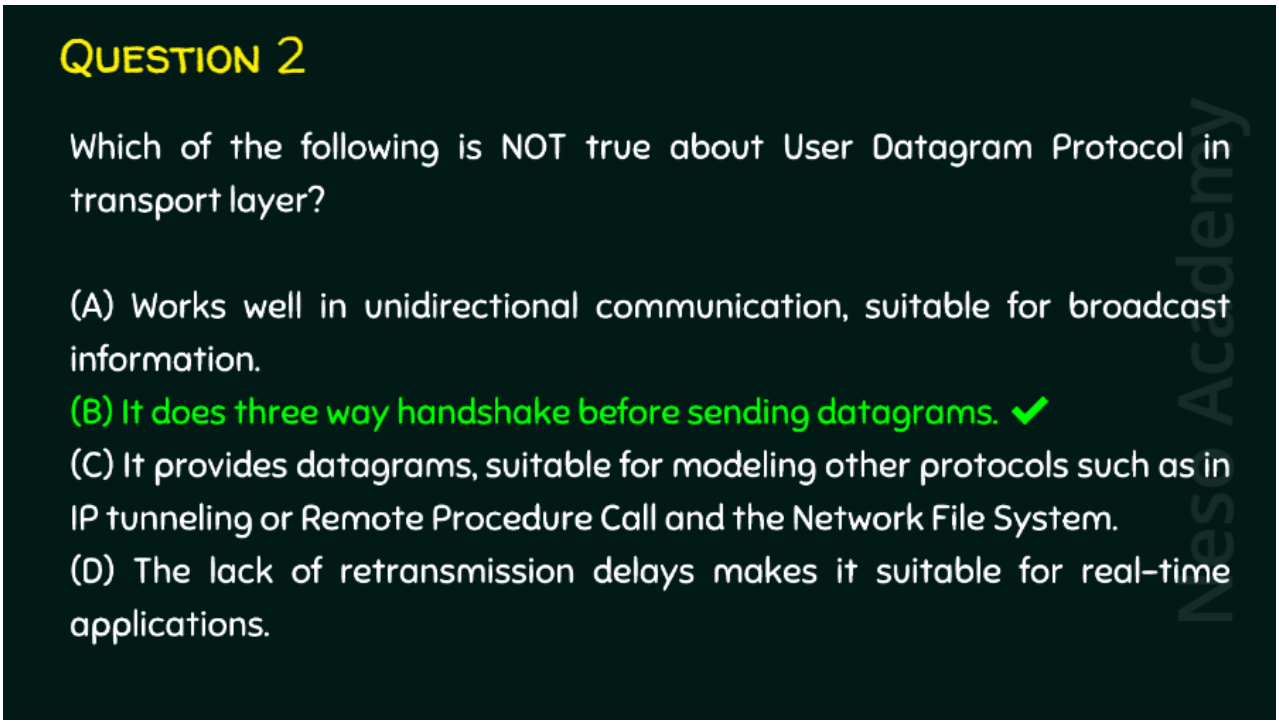
UDP Header Format→→→Neso Academy



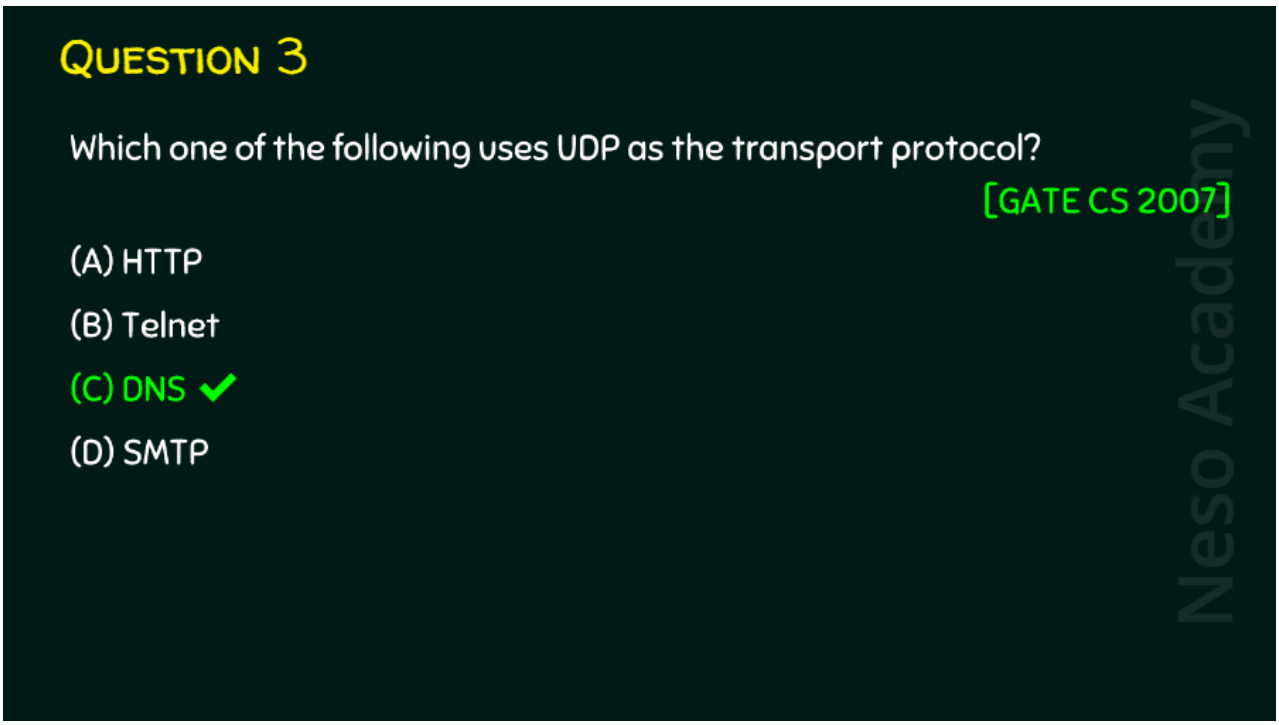
Answer→→→→Neso Academy



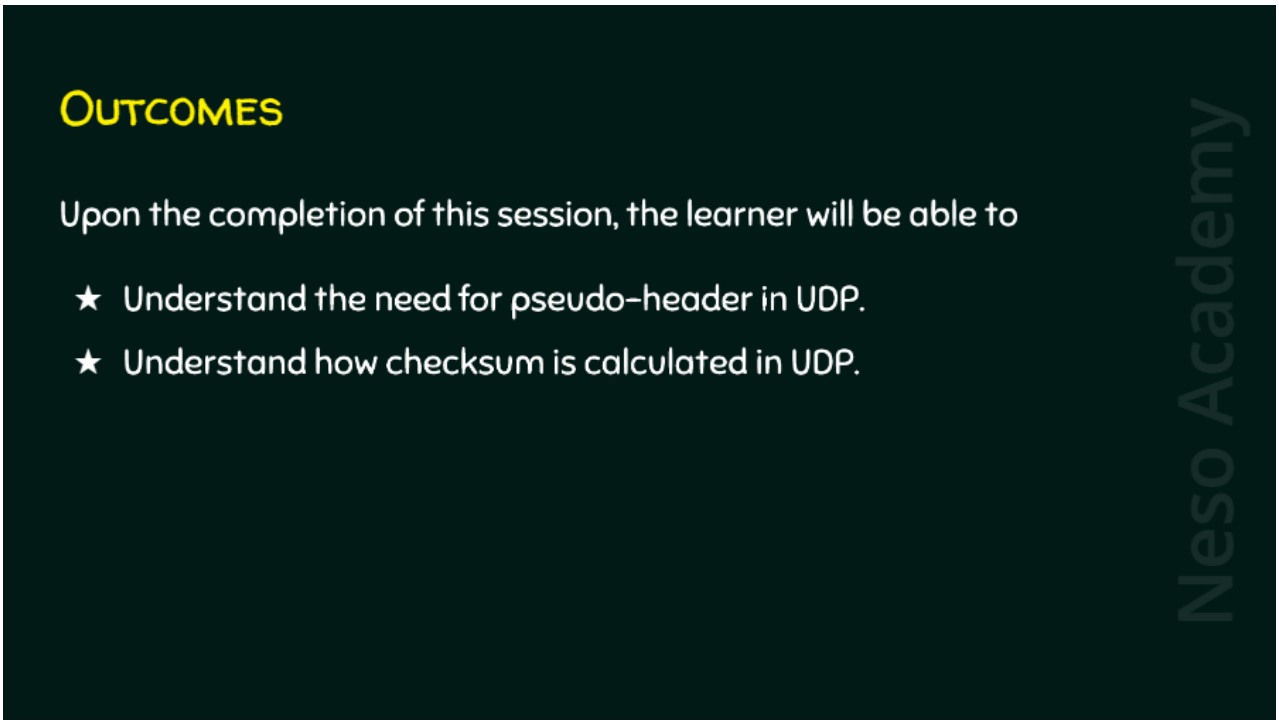
Question 1✓Neso Academy



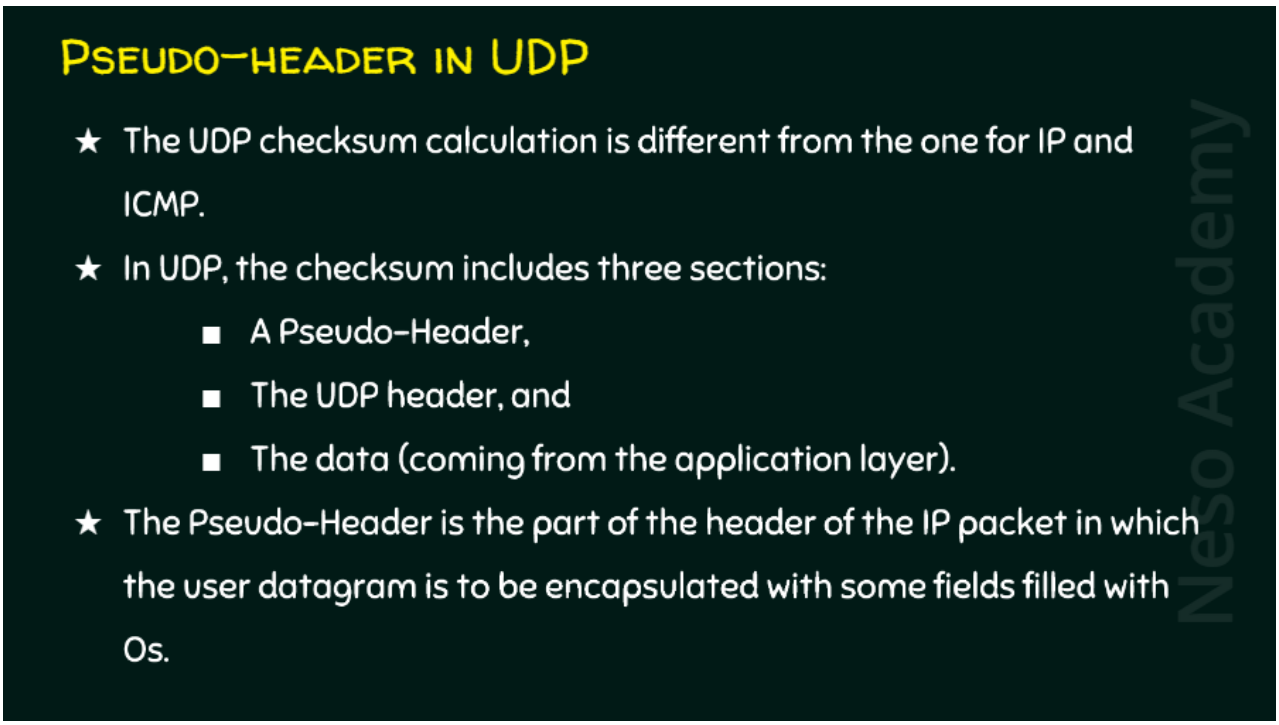
Question 2✓Neso Academy



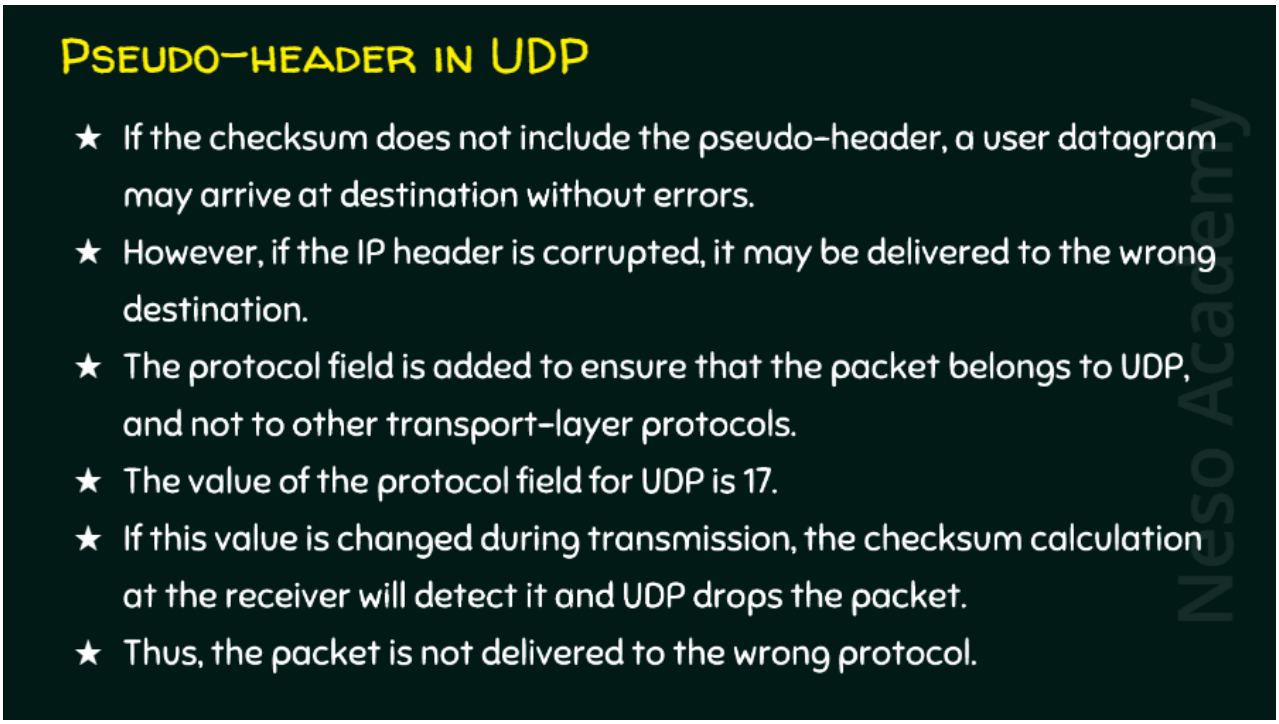
Question 3✓Neso Academy



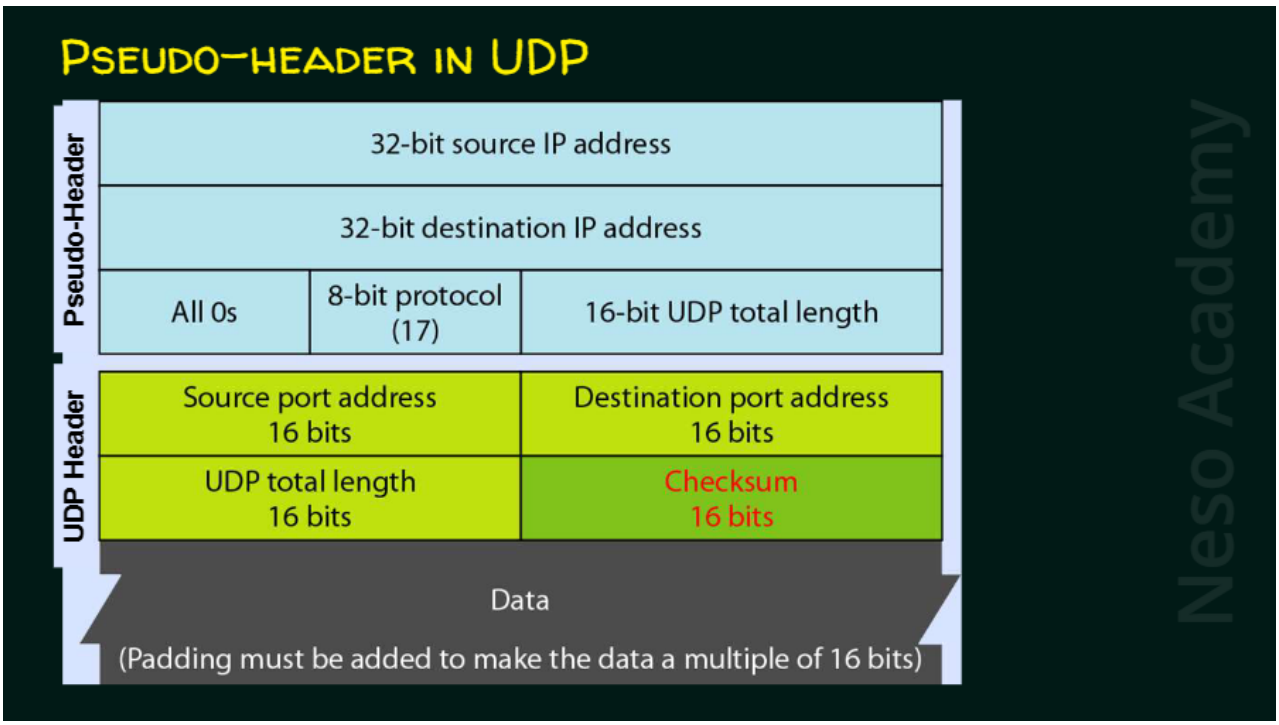
Outcomes★★Neso Academy



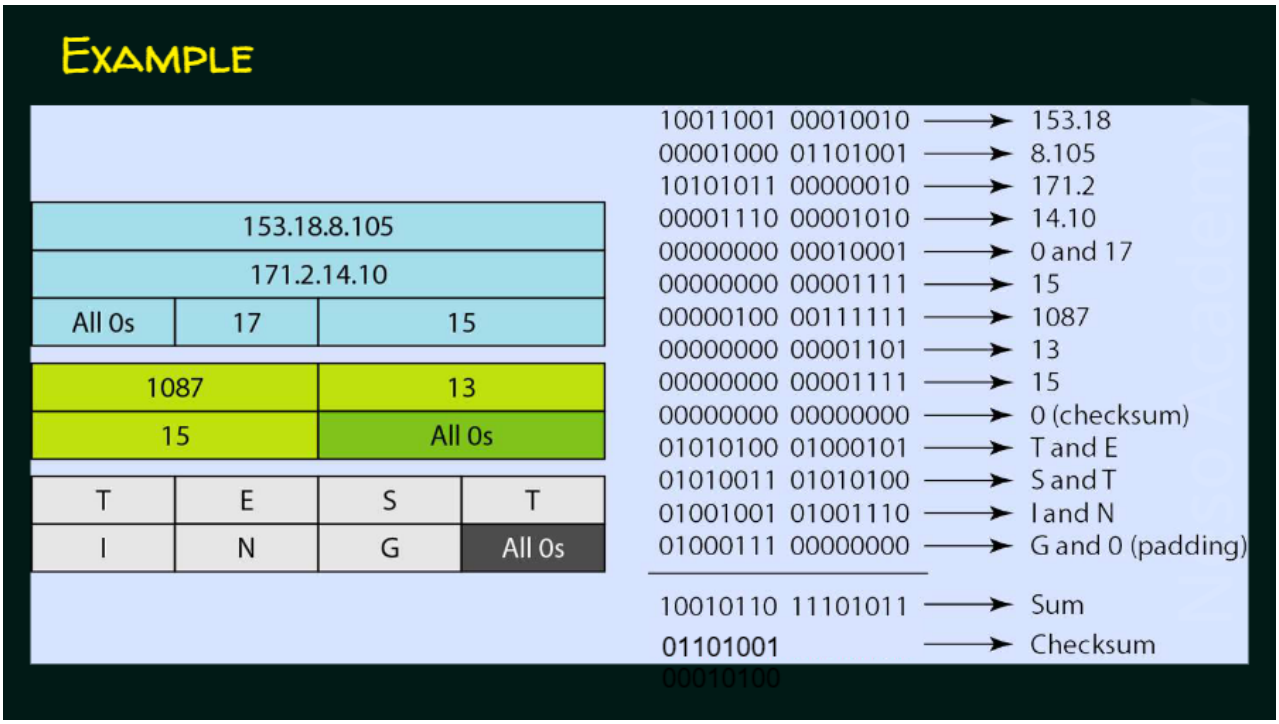
★★■■■★Pseudo-header in UDPNeso Academy



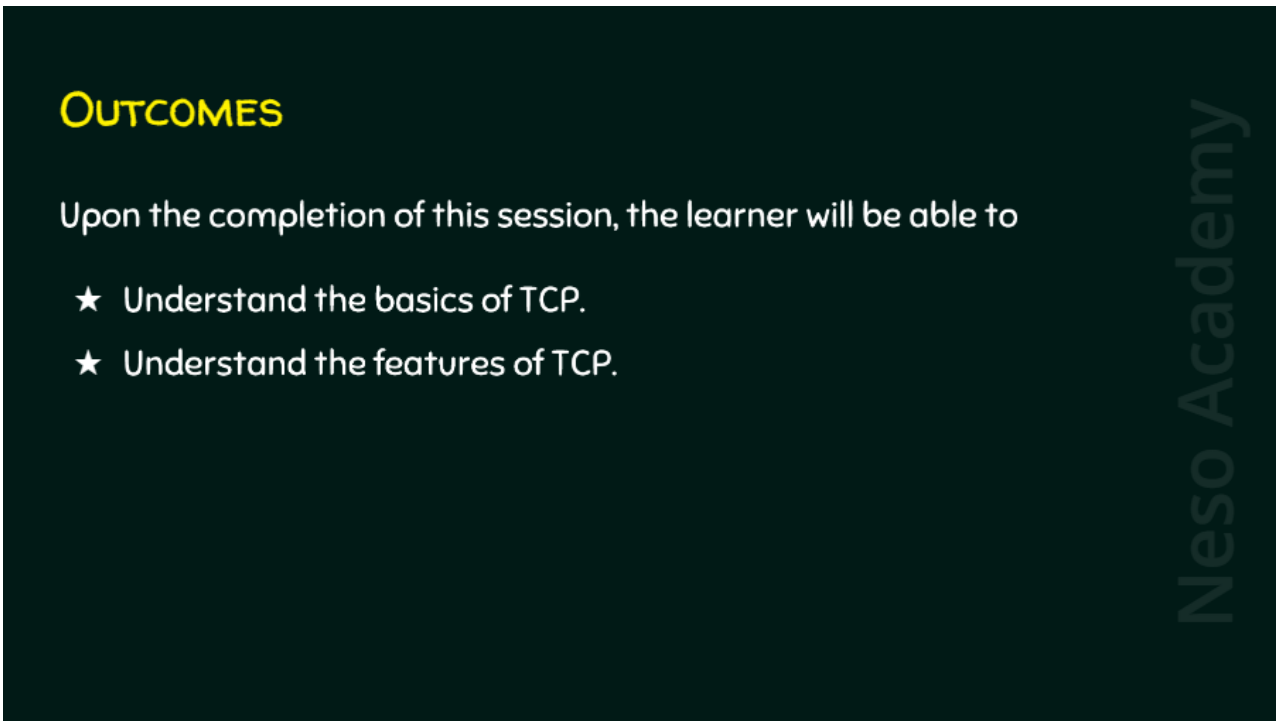
★★★★★★Pseudo-header in UDPNeso Academy



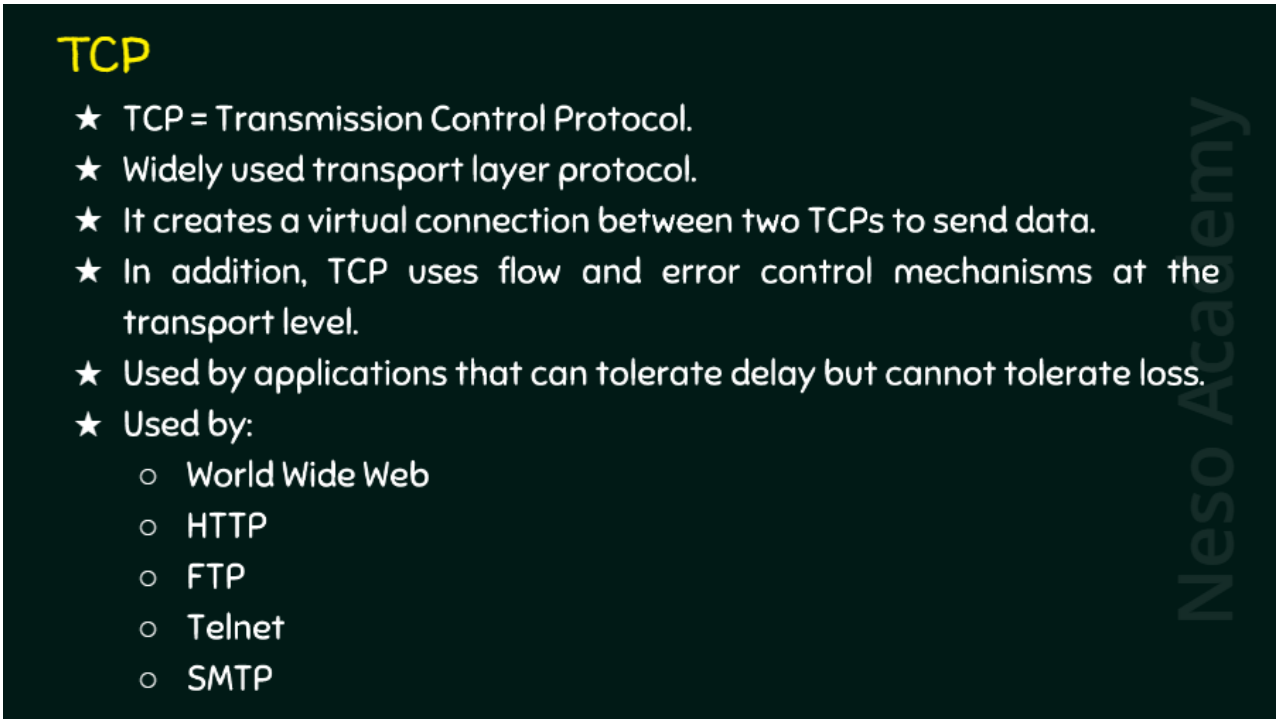
Pseudo-header in UDPUDP HeaderPseudo-HeaderNeso Academy



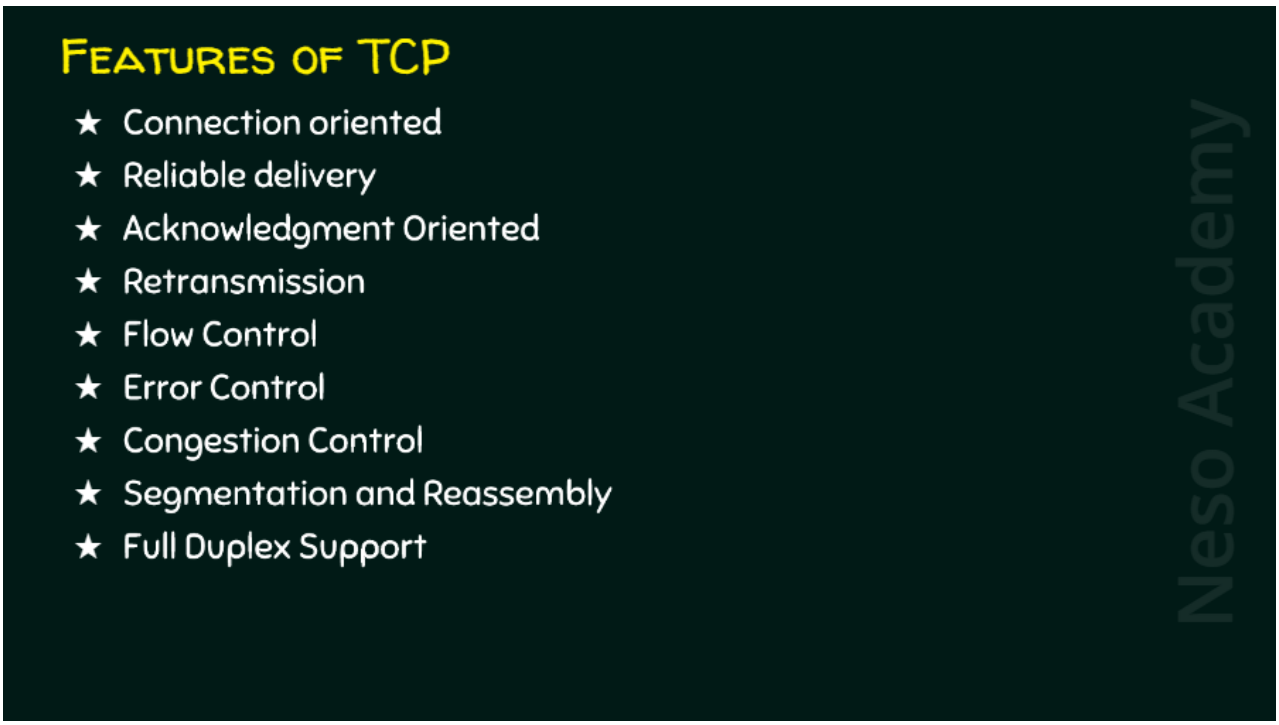
Example01101001 00010100Neso Academy



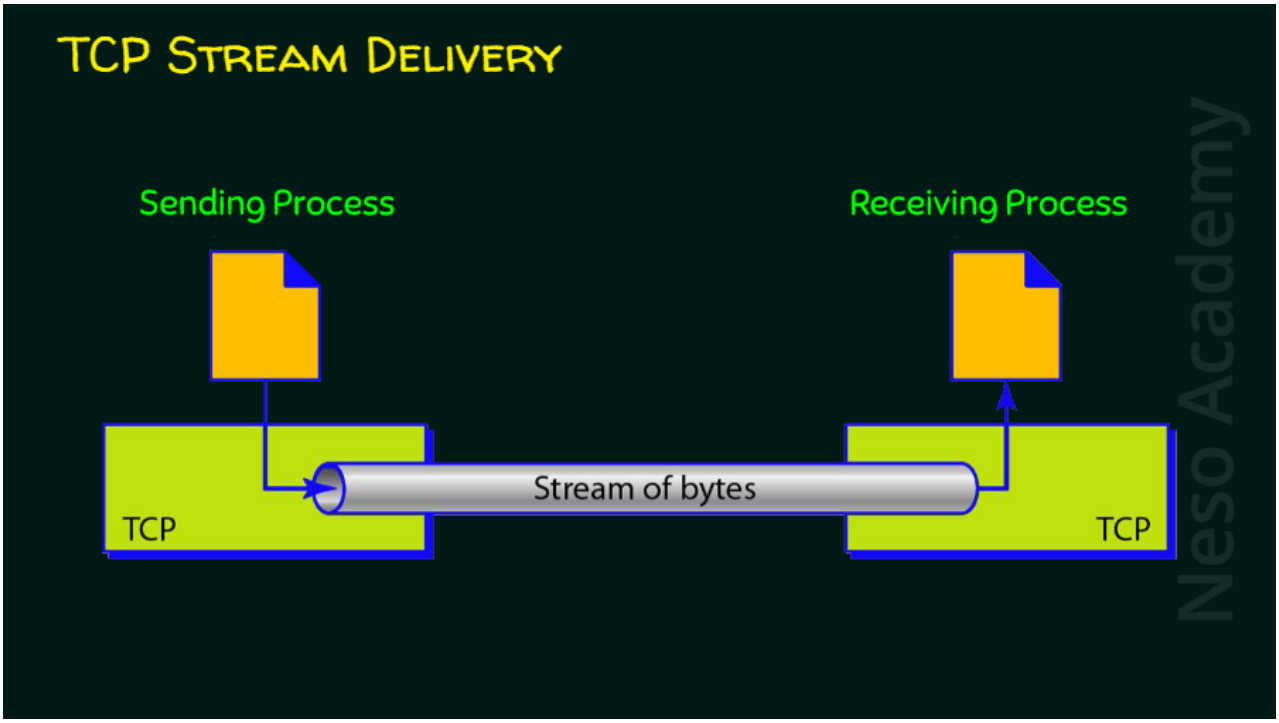
Outcomes★★Neso Academy



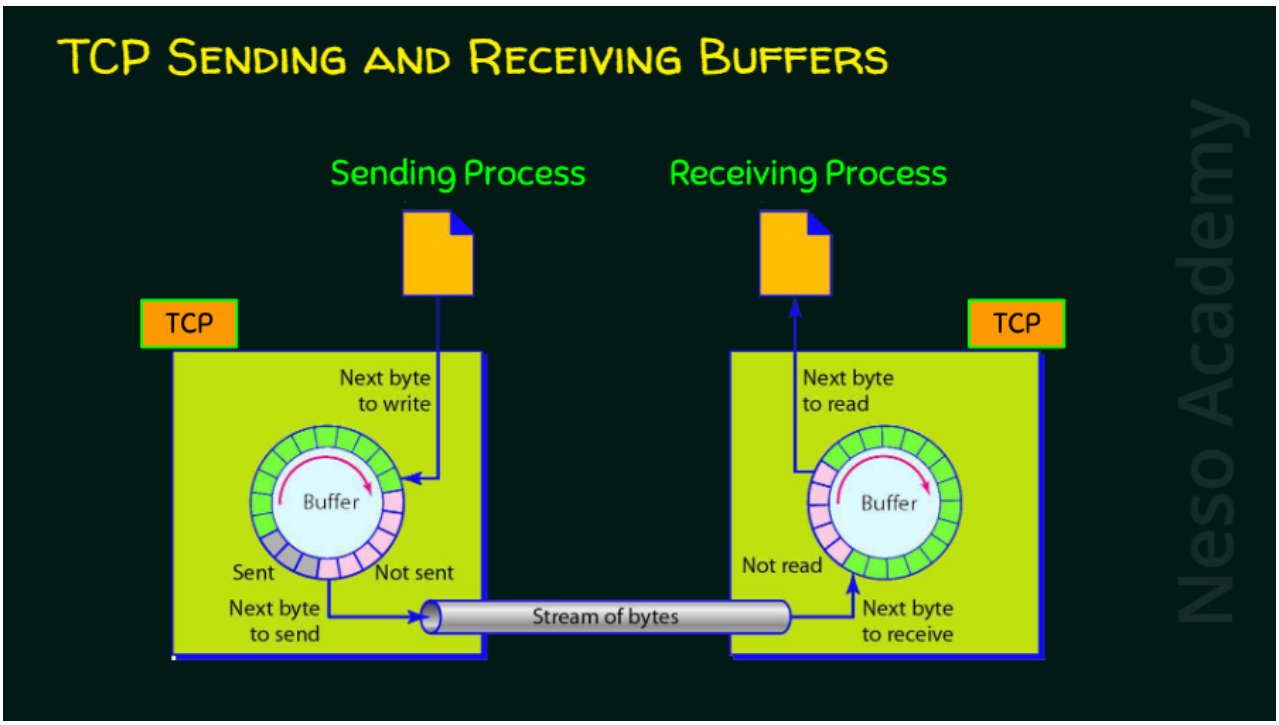
TCP★★★★★★○○○○○Neso Academy



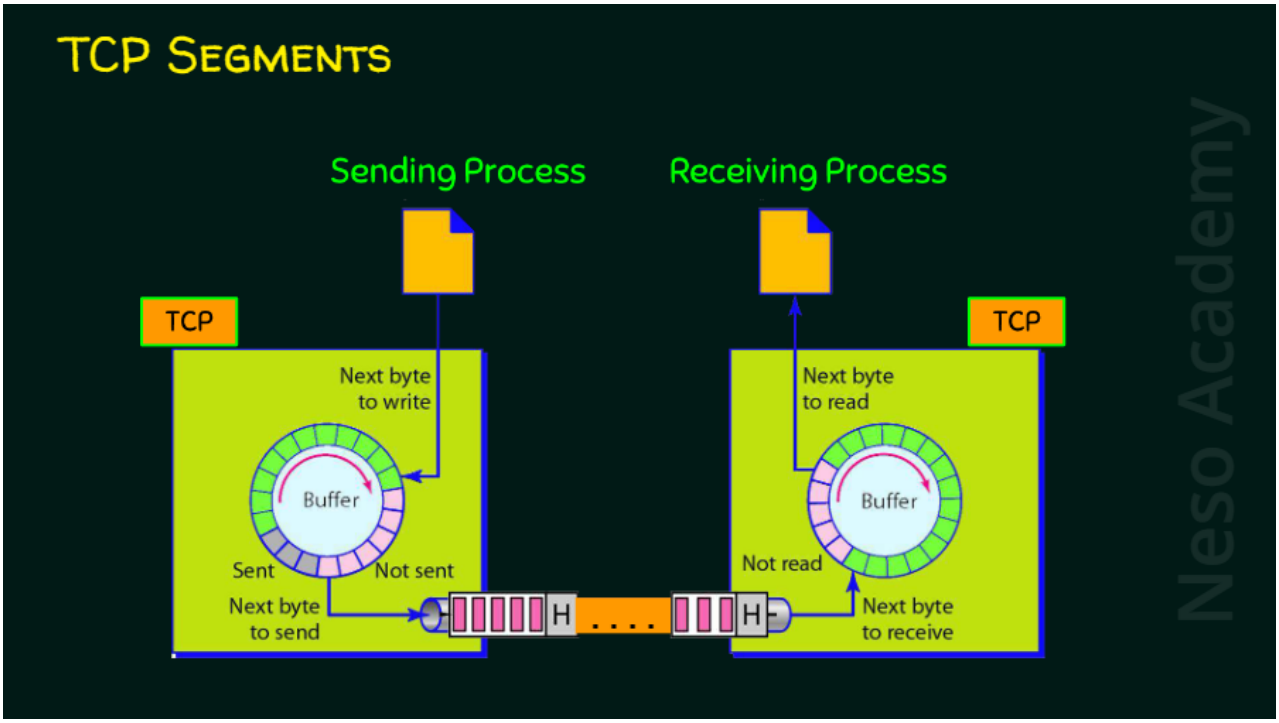
Features of TCP★★★★★★★★★Neso Academy



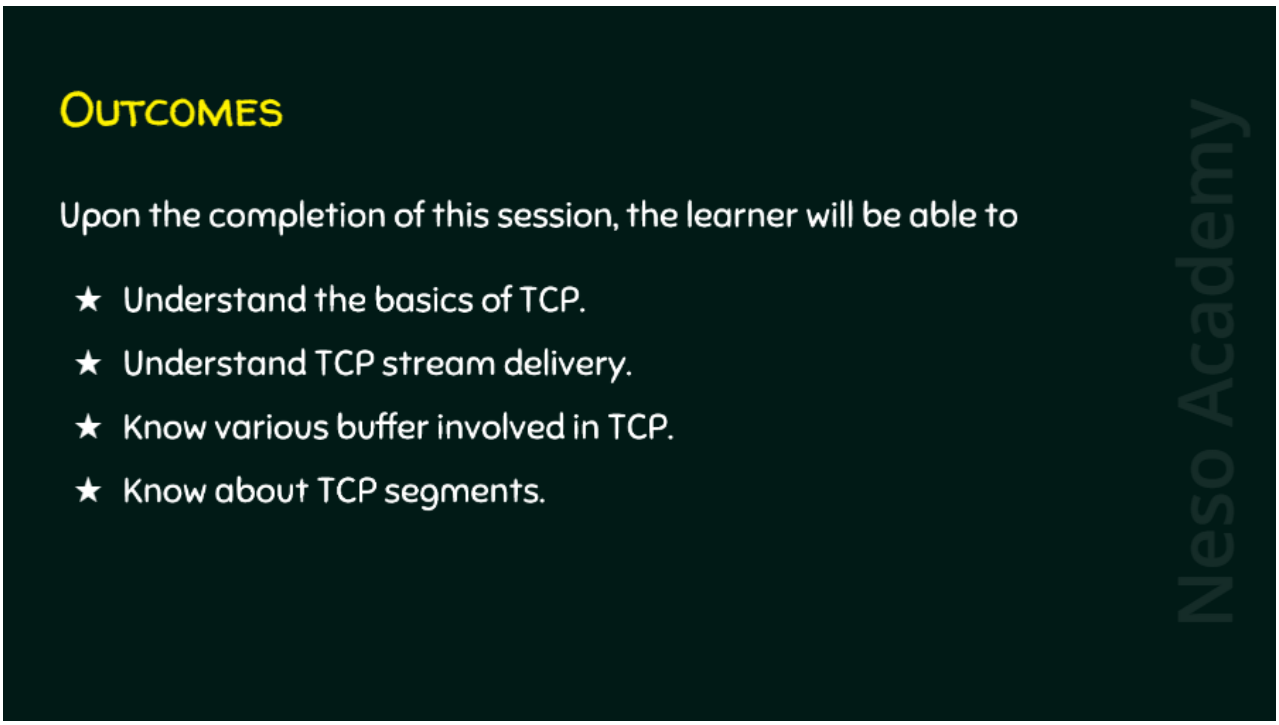
TCP Stream DeliveryNeso Academy



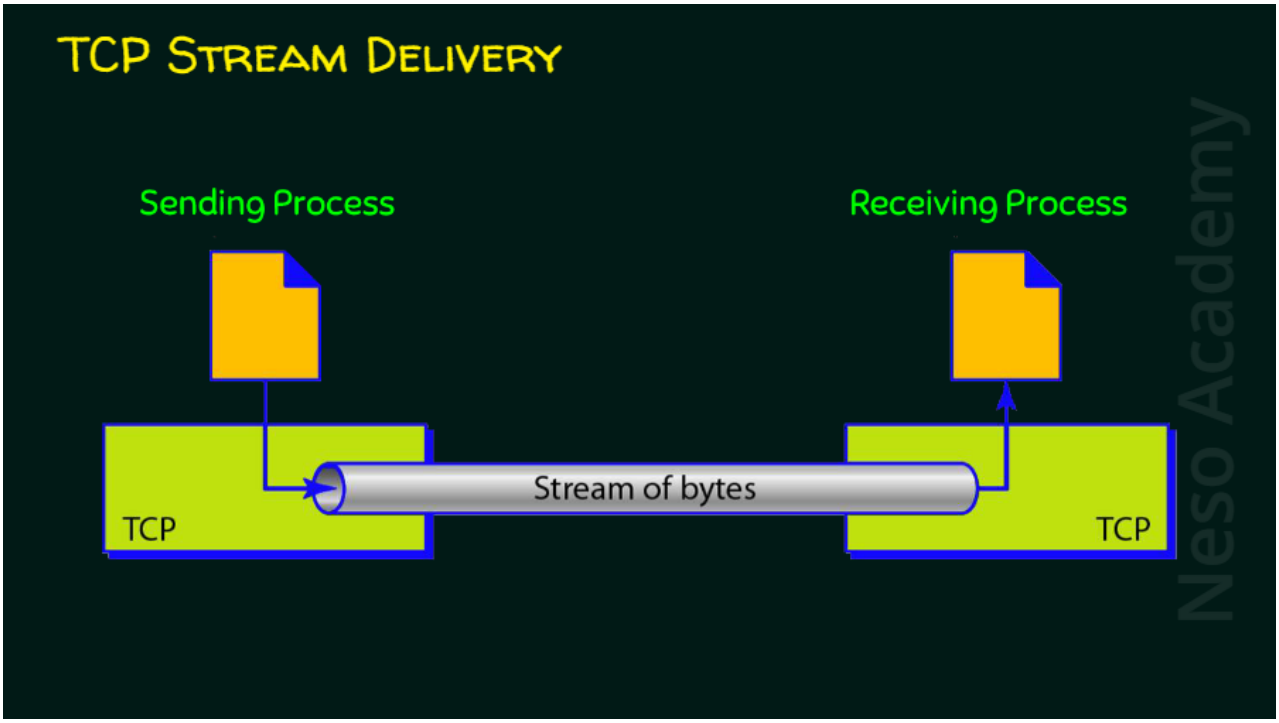
TCP Sending and Receiving BuffersNeso Academy



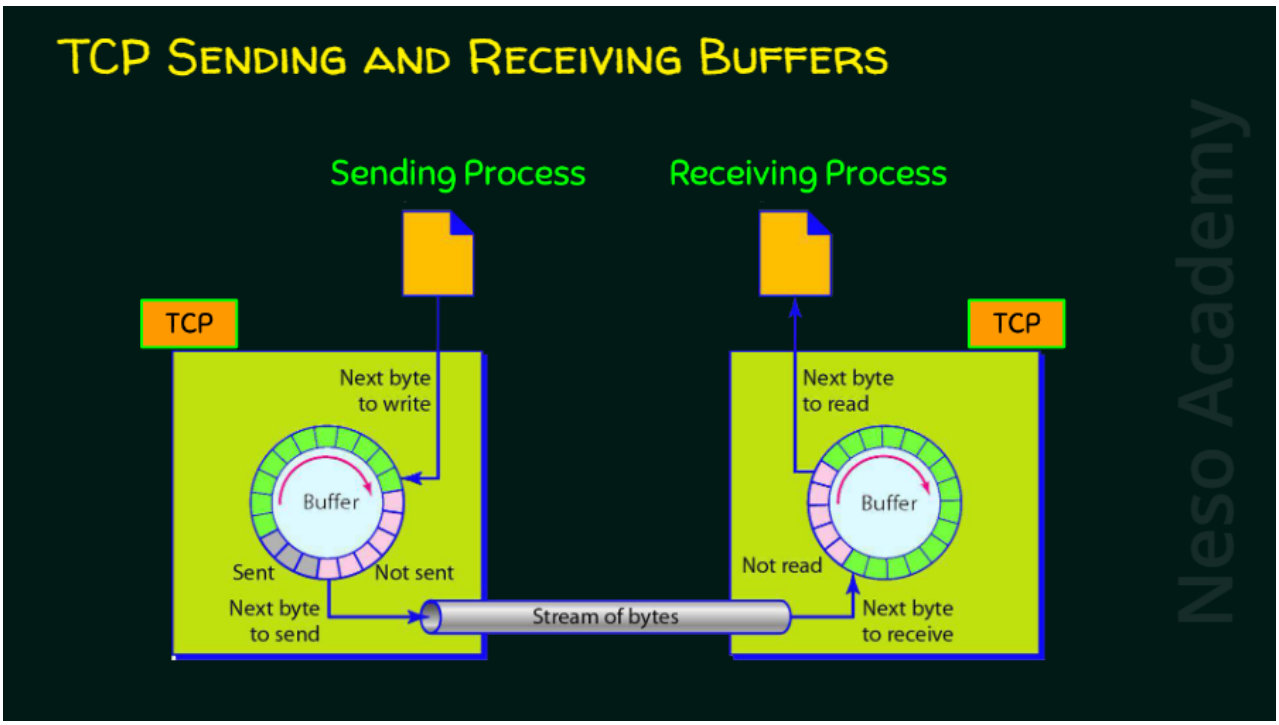
TCP Segments. . . . Neso Academy



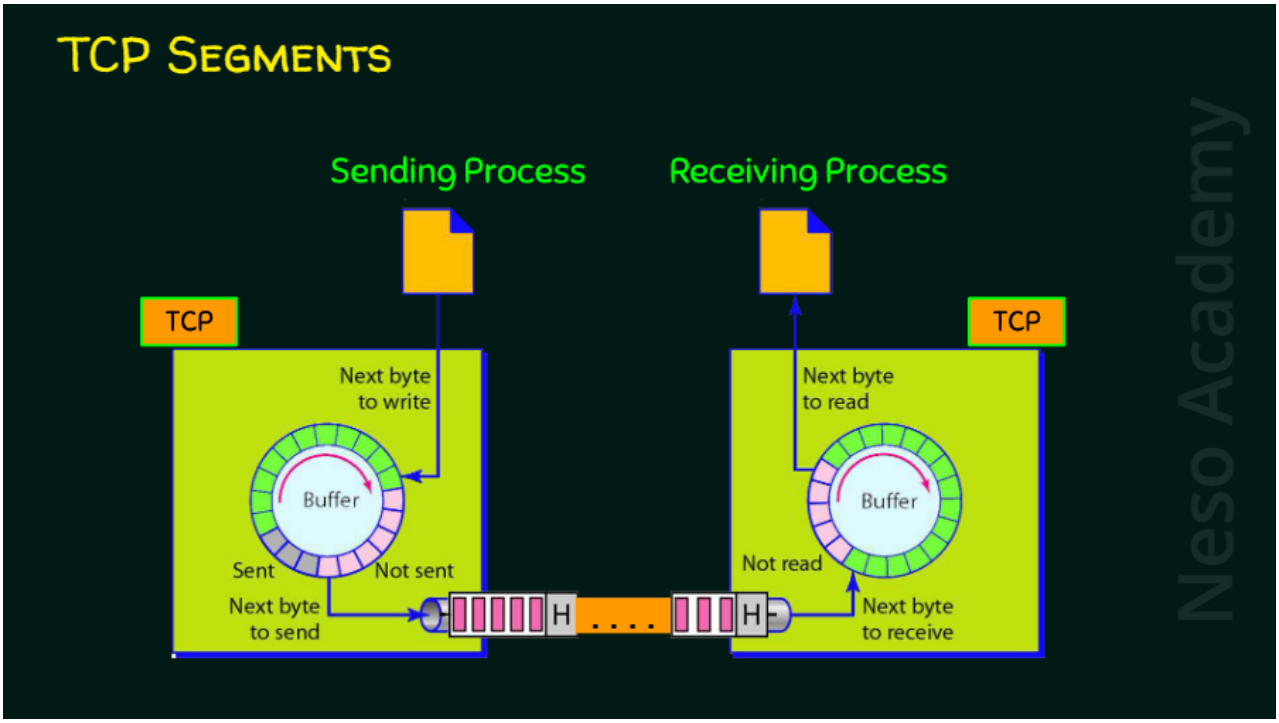
Outcomes★★★★Neso Academy



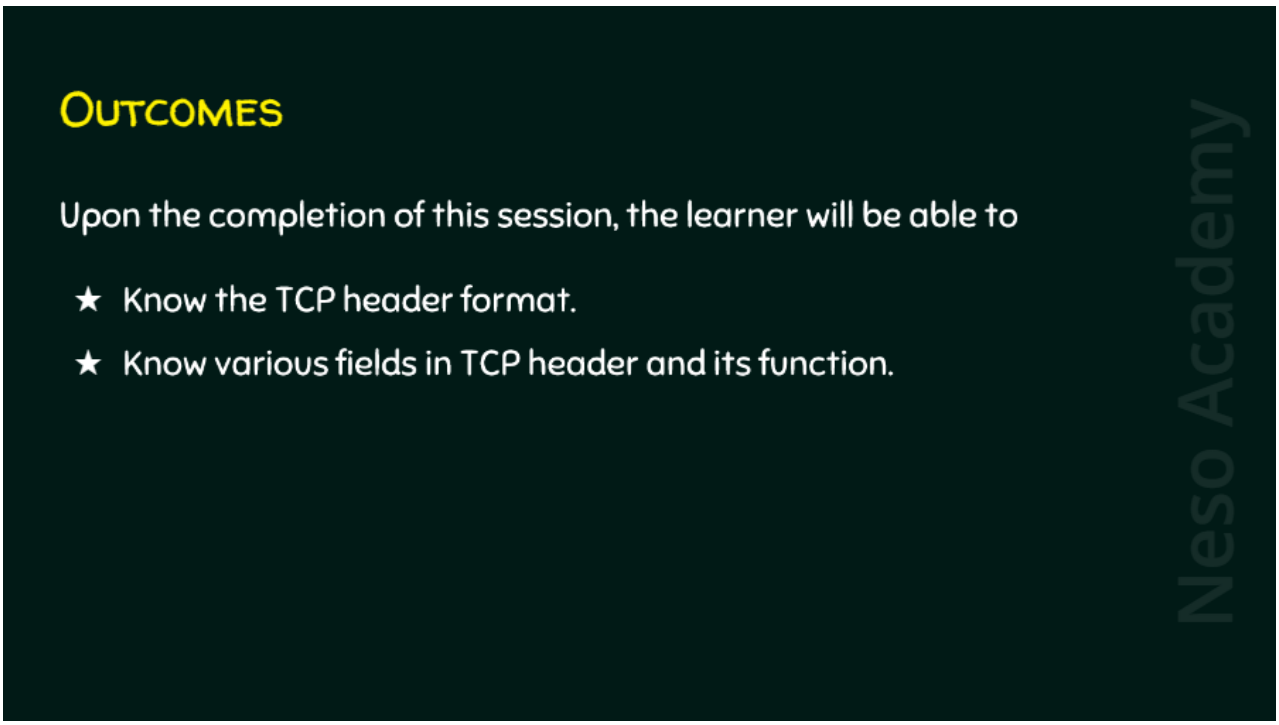
TCP Stream DeliveryNeso Academy



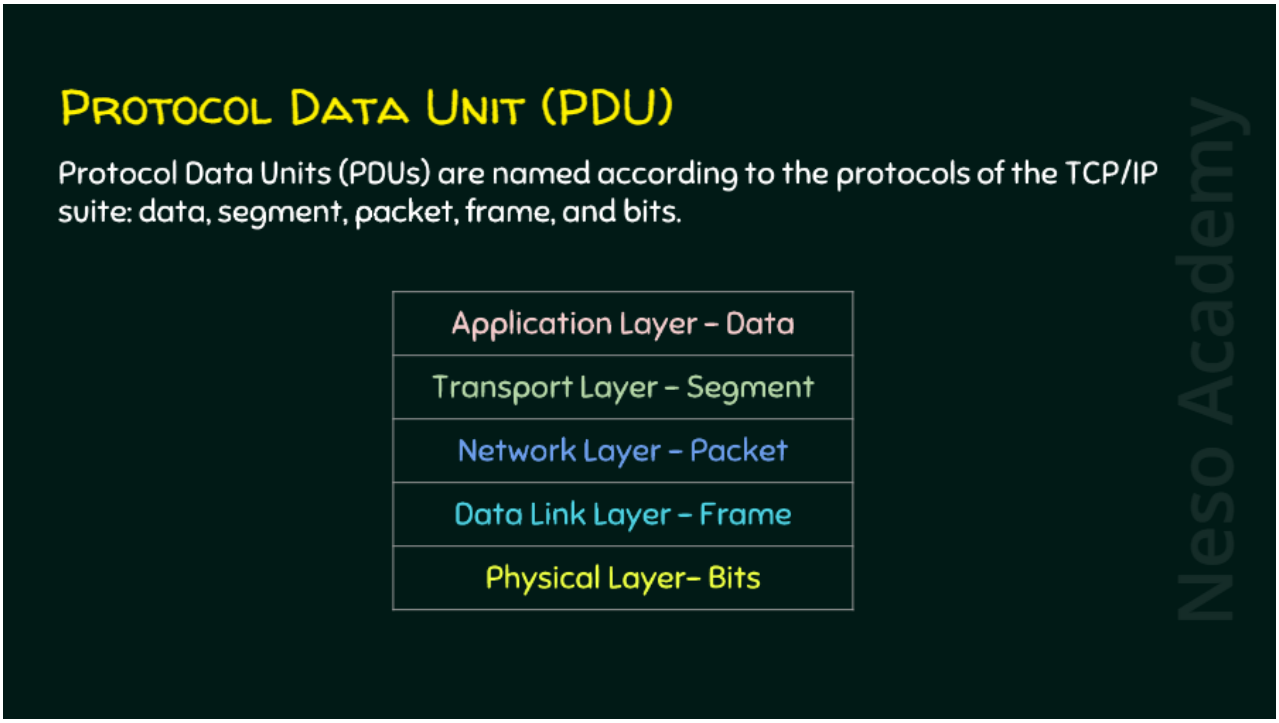
TCP Sending and Receiving BuffersNeso Academy



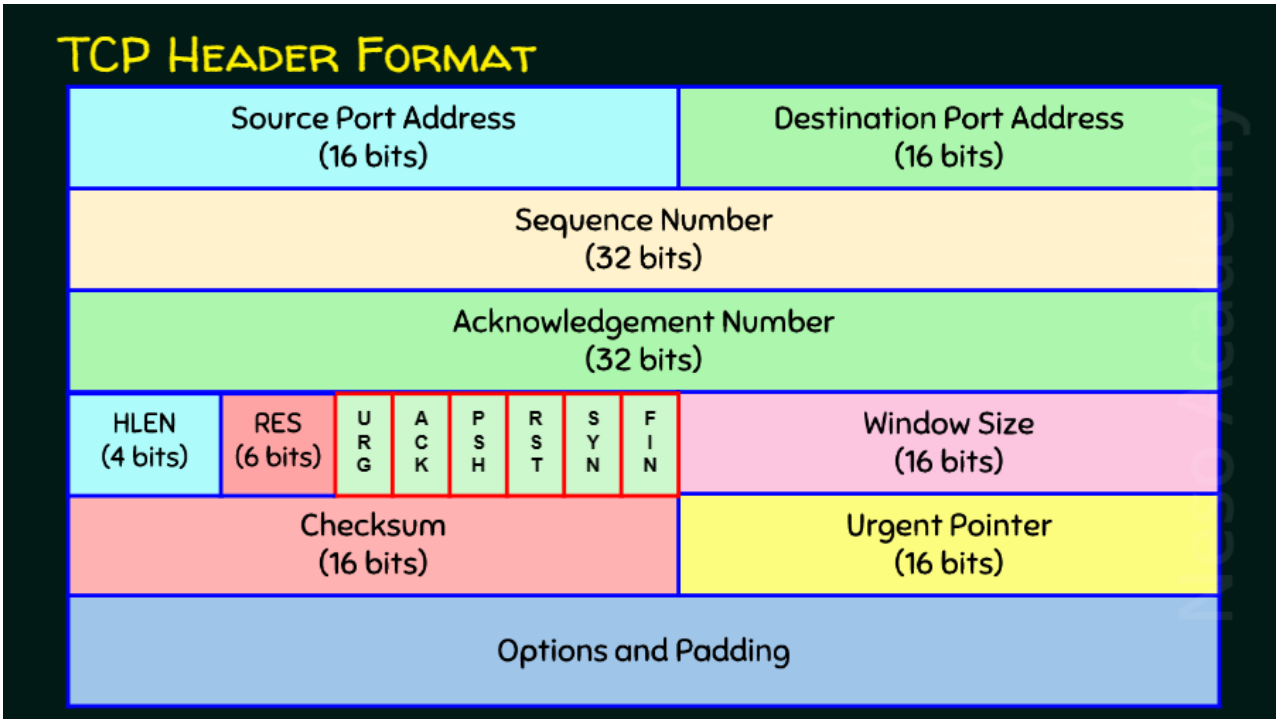
TCP Segments. . . . Neso Academy



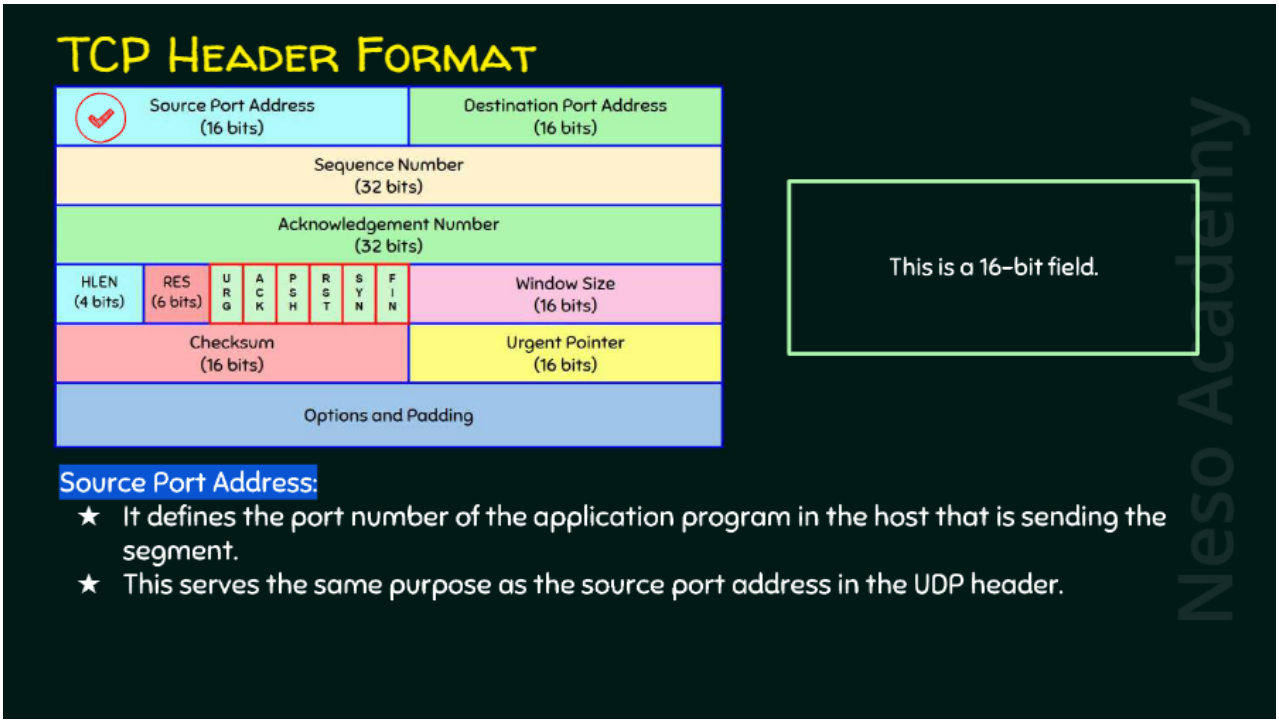
Outcomes★★Neso Academy



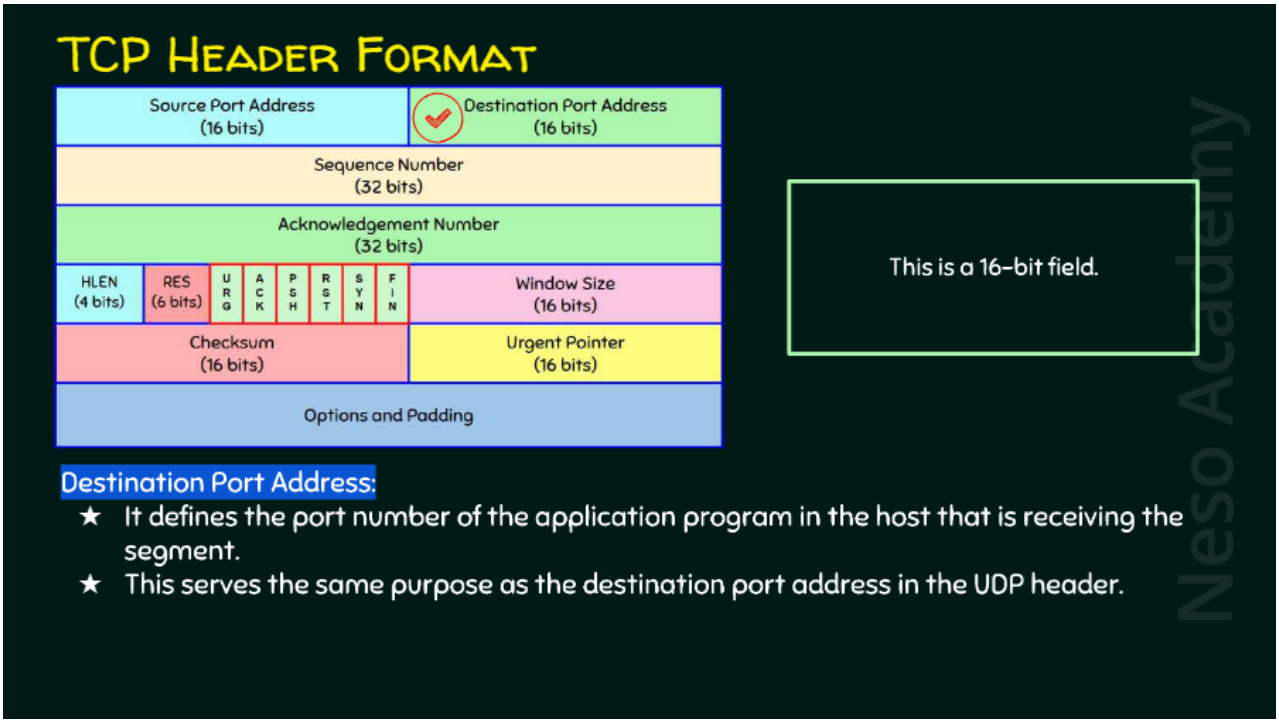
Protocol Data Unit (PDU)Neso Academy



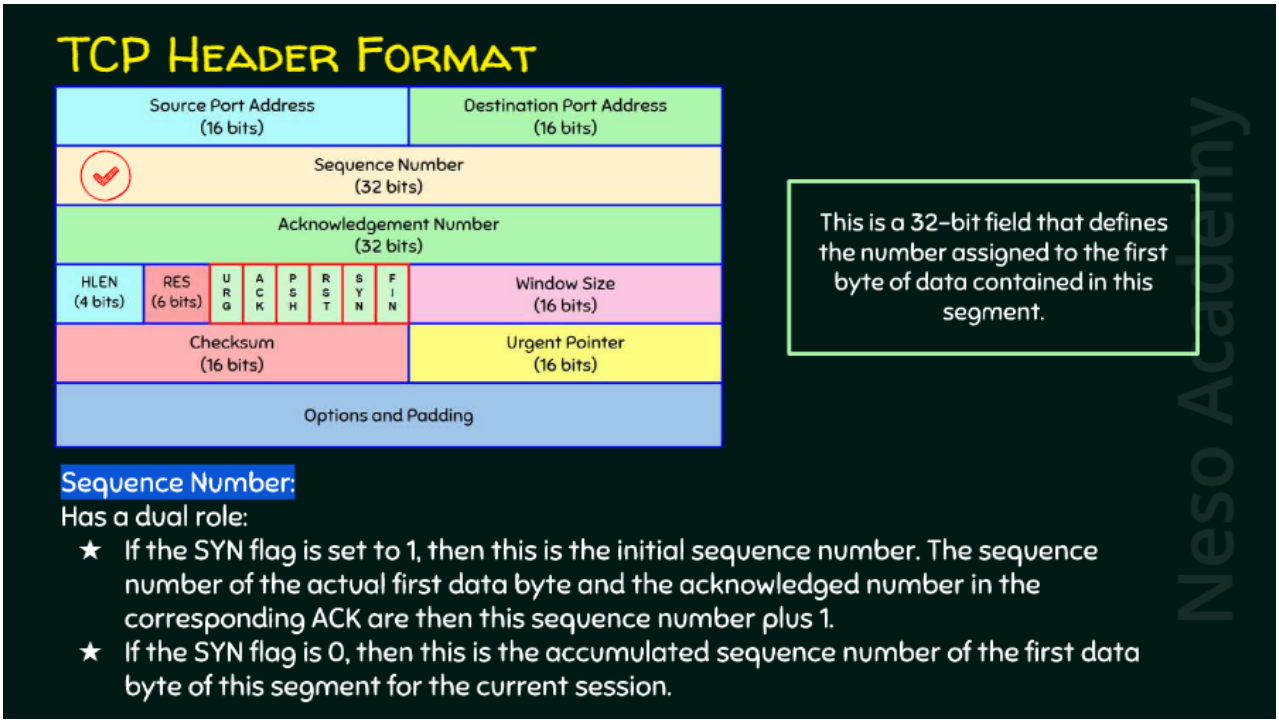
TCP Header FormatURGACKPSHRSTSYNFINNeso Academy



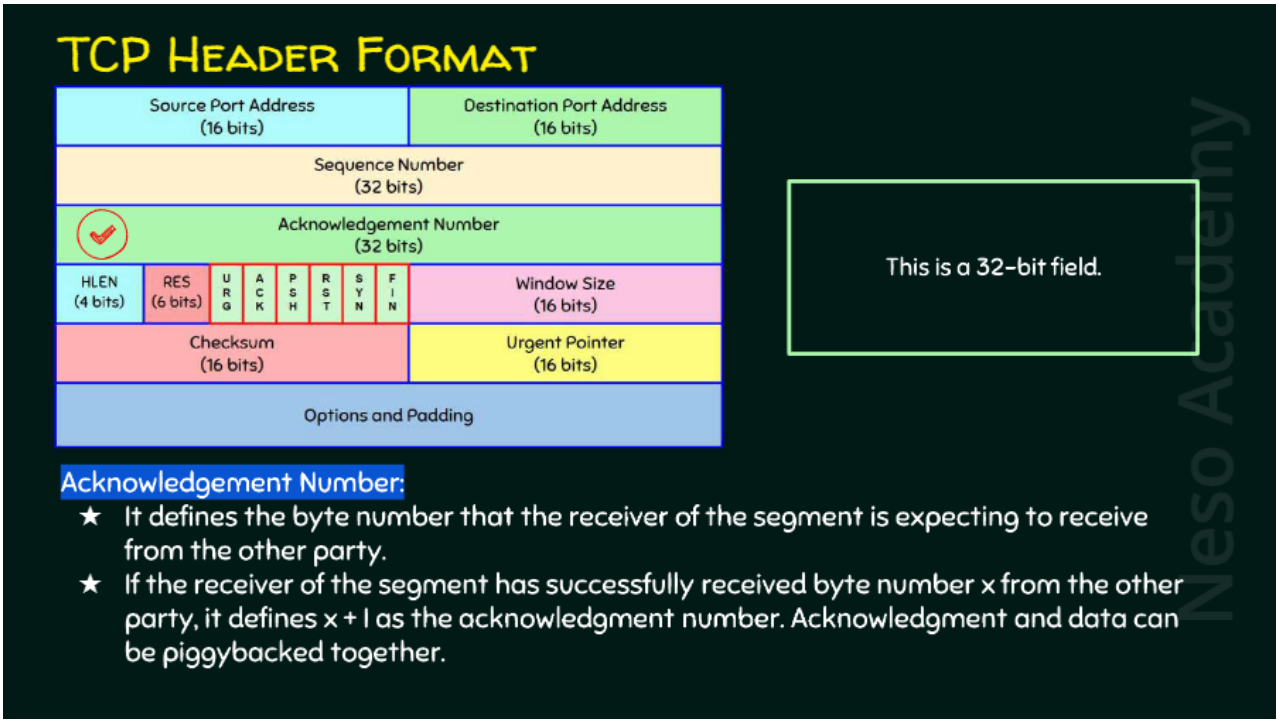
TCP Header Format★★Neso Academy



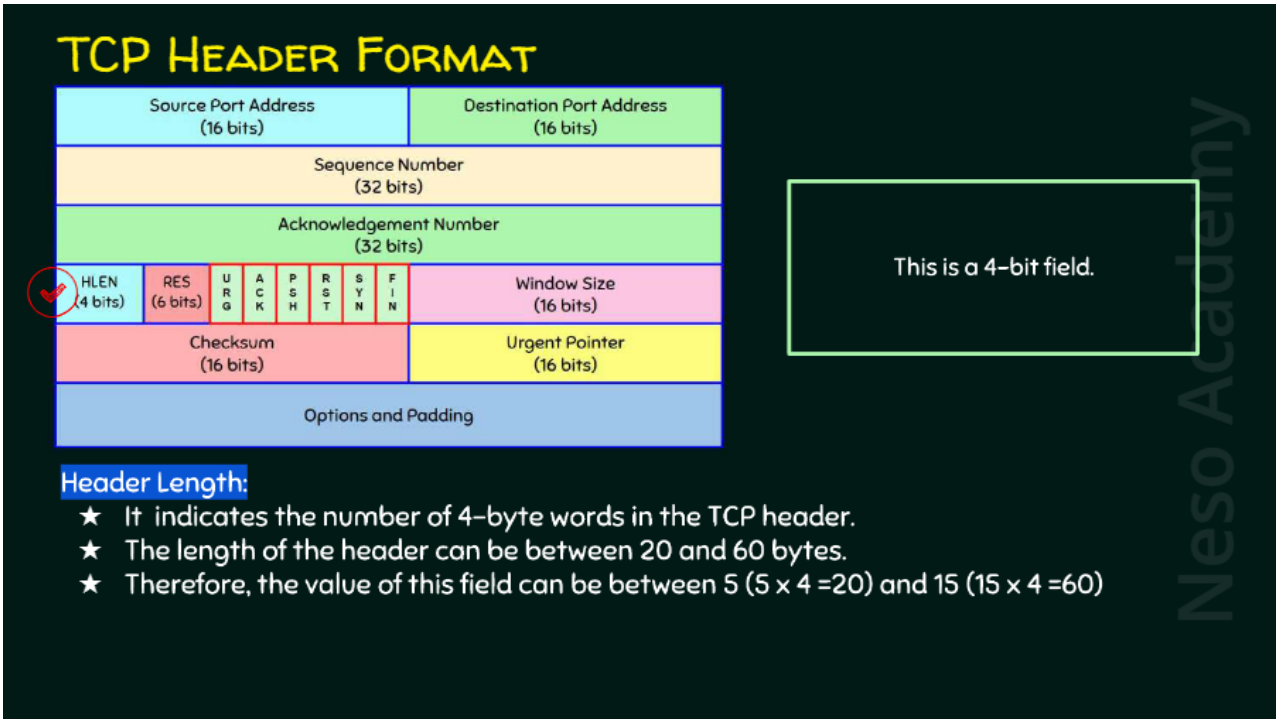
TCP Header Format★★Neso Academy



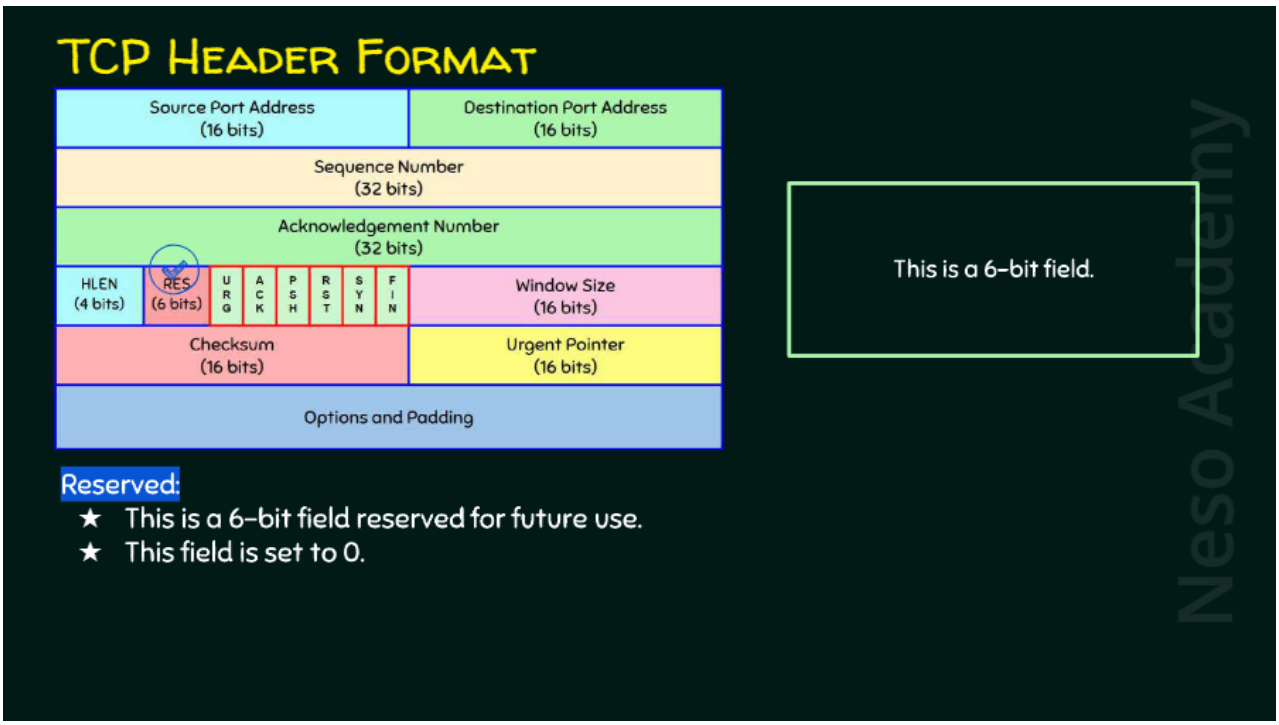
TCP Header Format★★Neso Academy



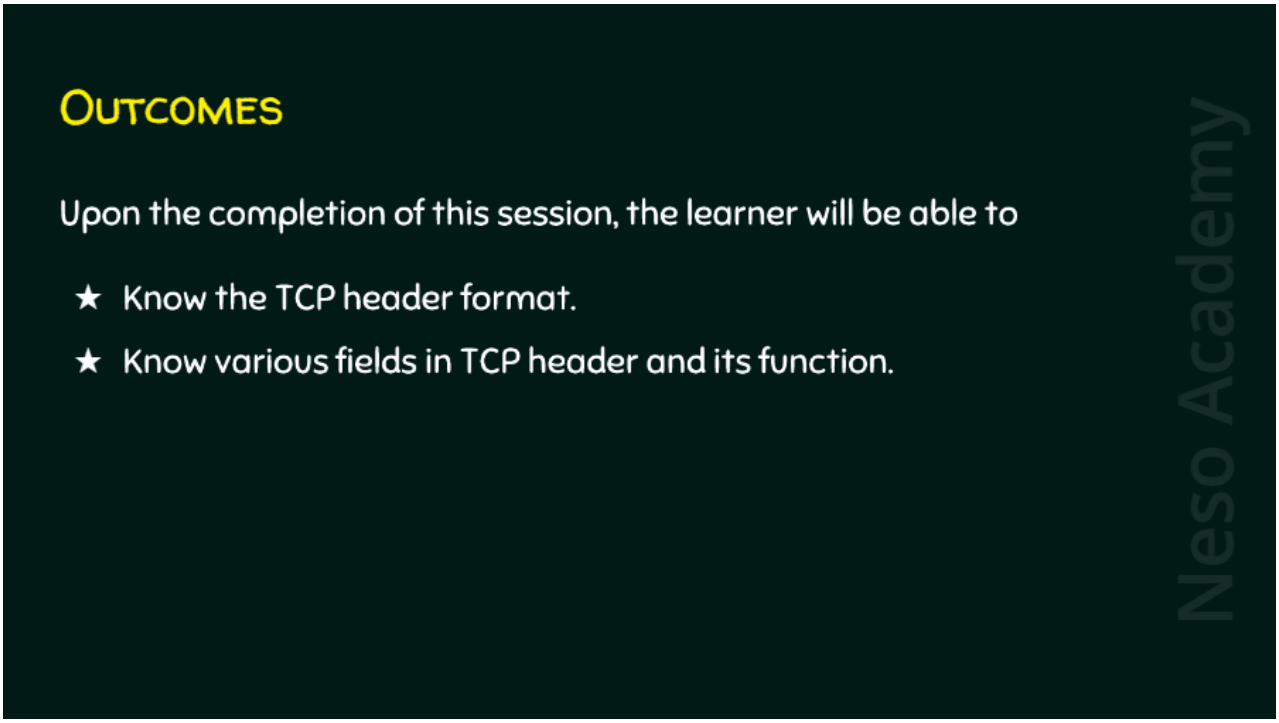
TCP Header Format★★Neso Academy



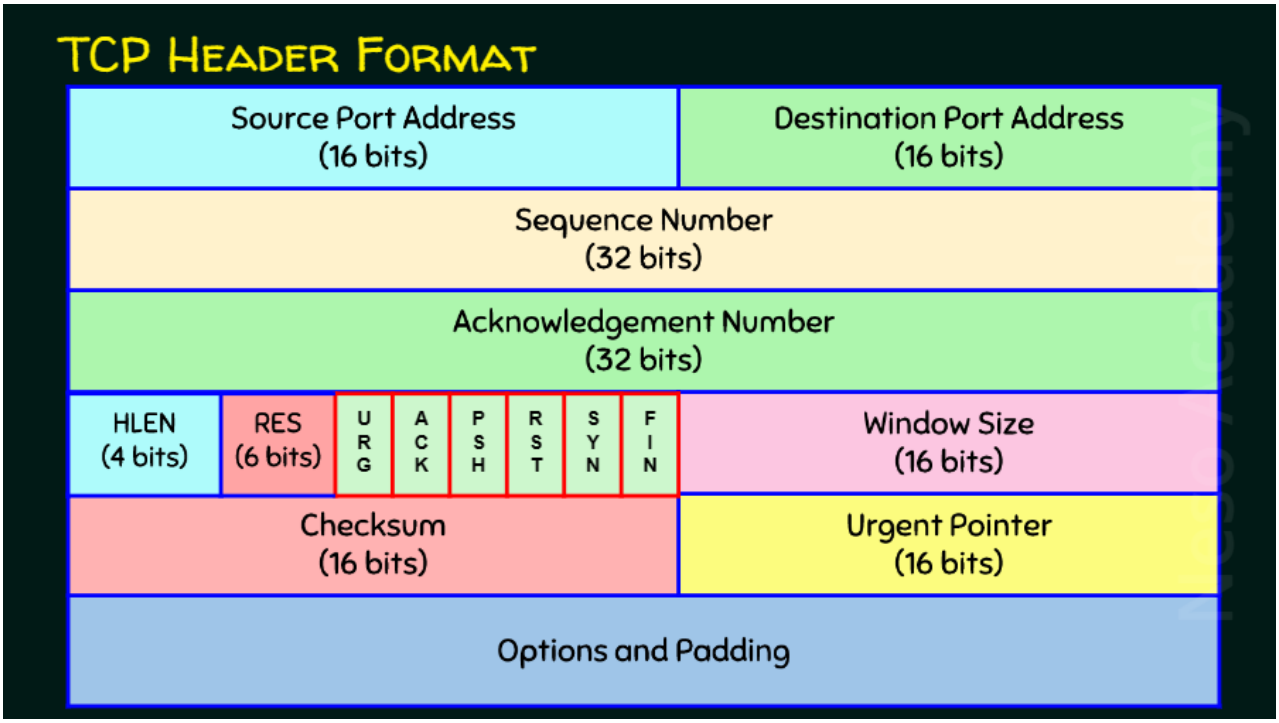
TCP Header Format★★★Neso Academy



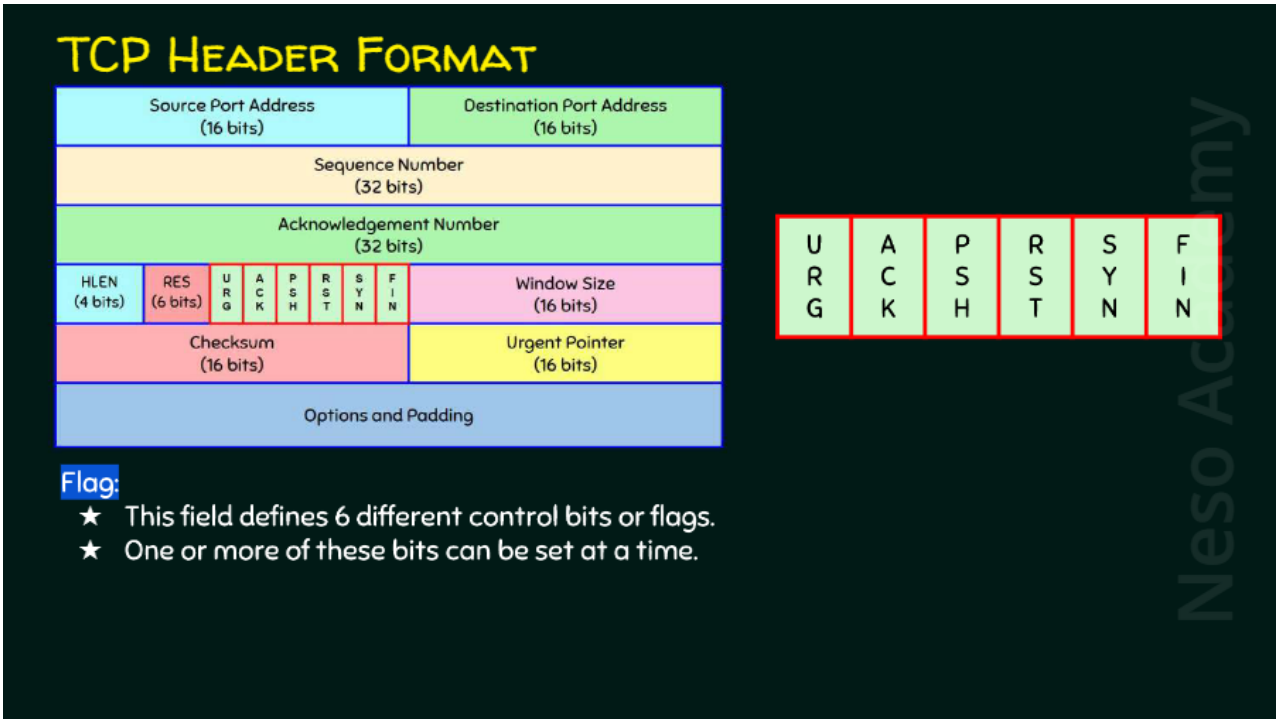
TCP Header Format★★Neso Academy



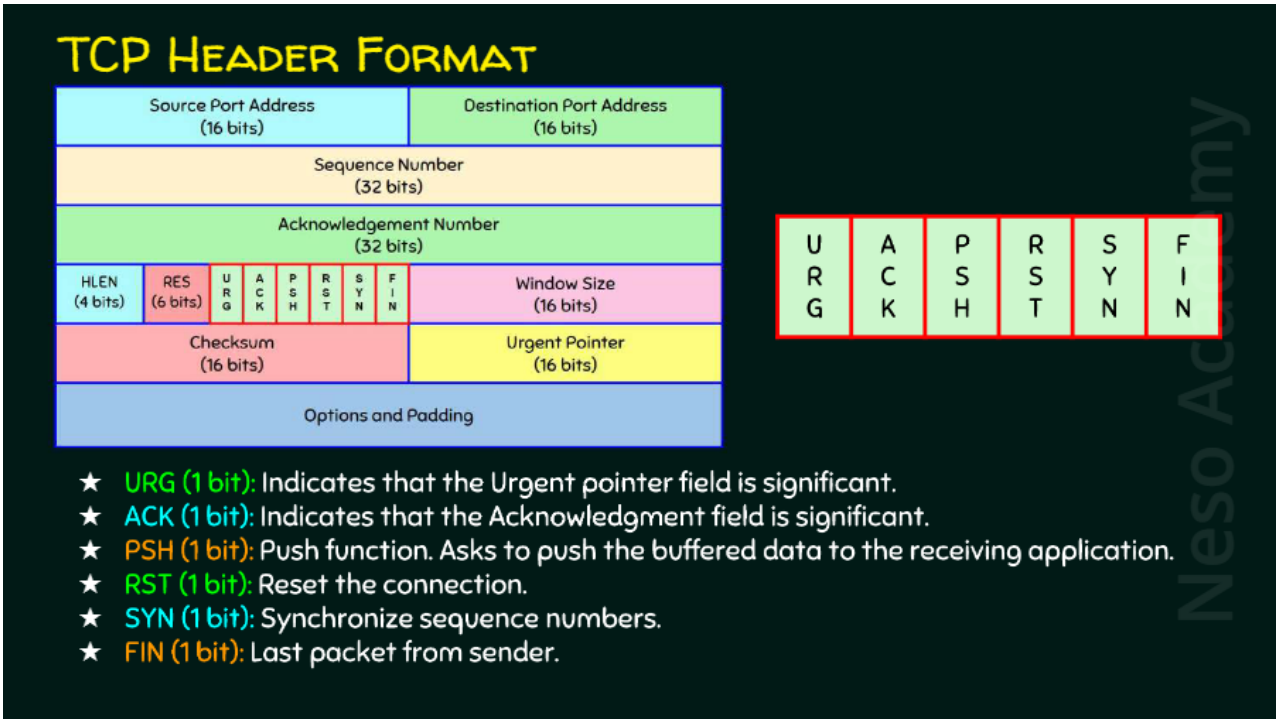
Outcomes★★Neso Academy



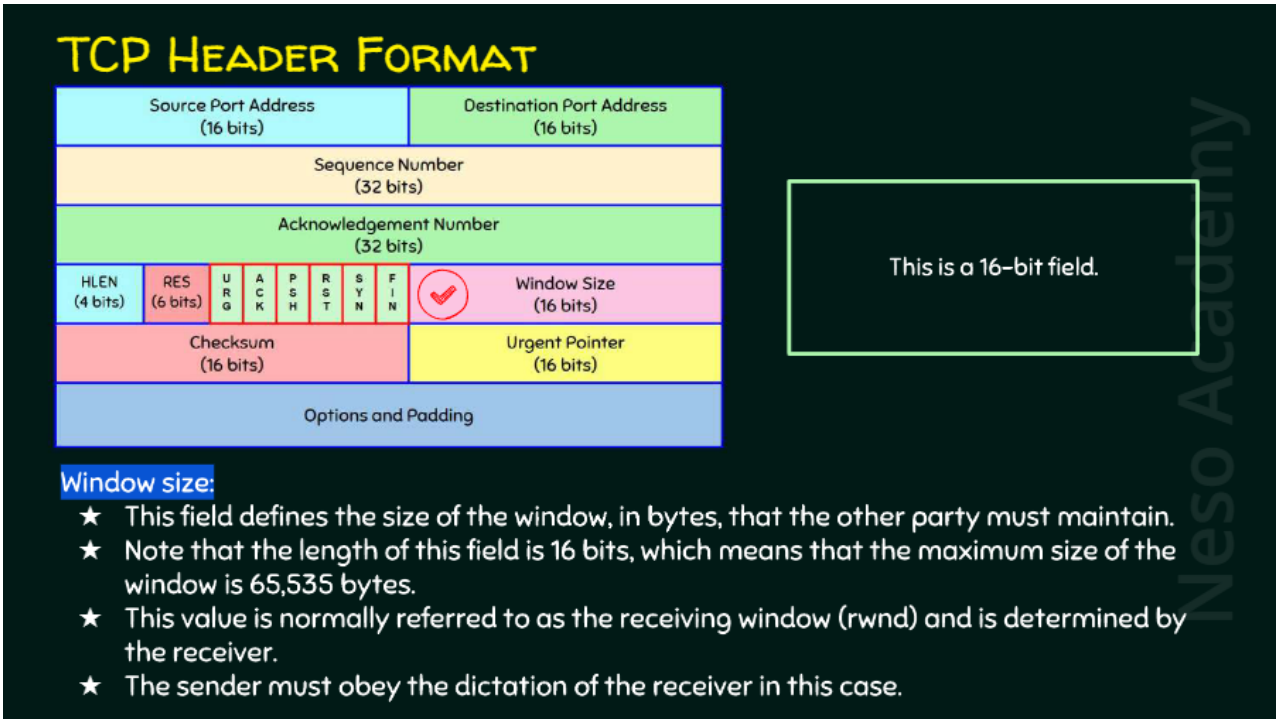
TCP Header FormatURGACKPSHRSTSYNFINNeso Academy



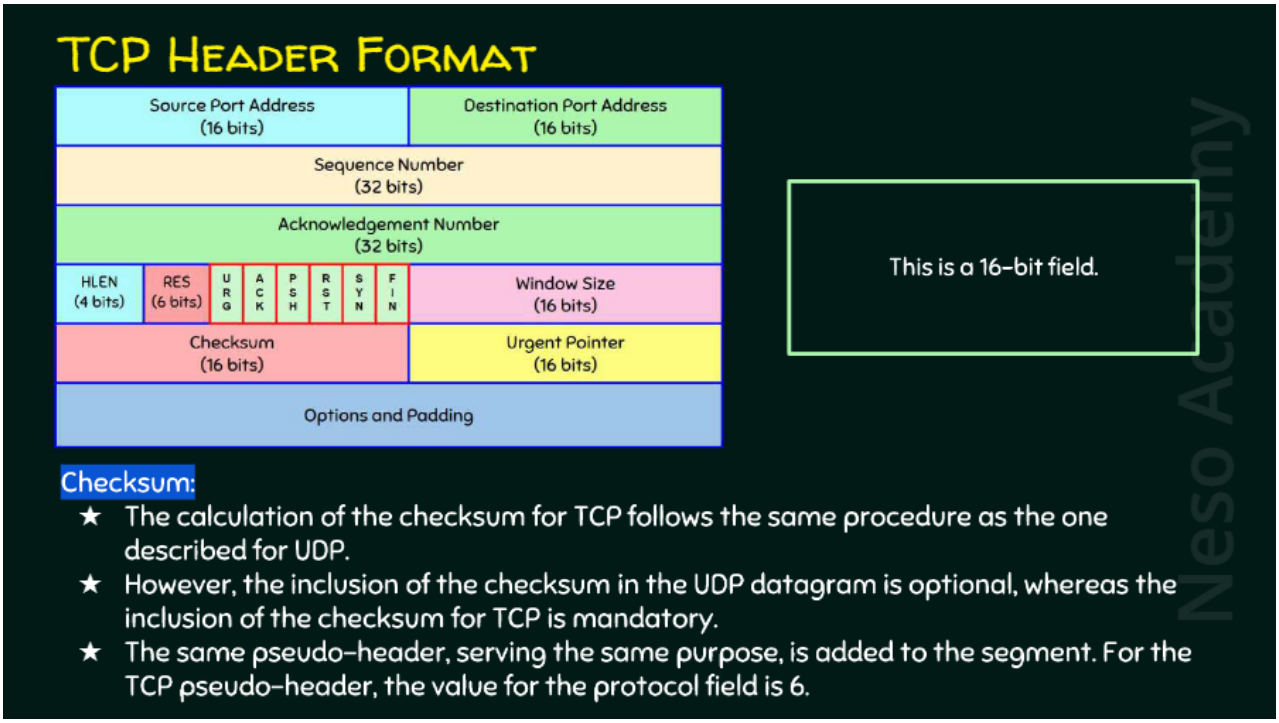
TCP Header Format★★Neso Academy



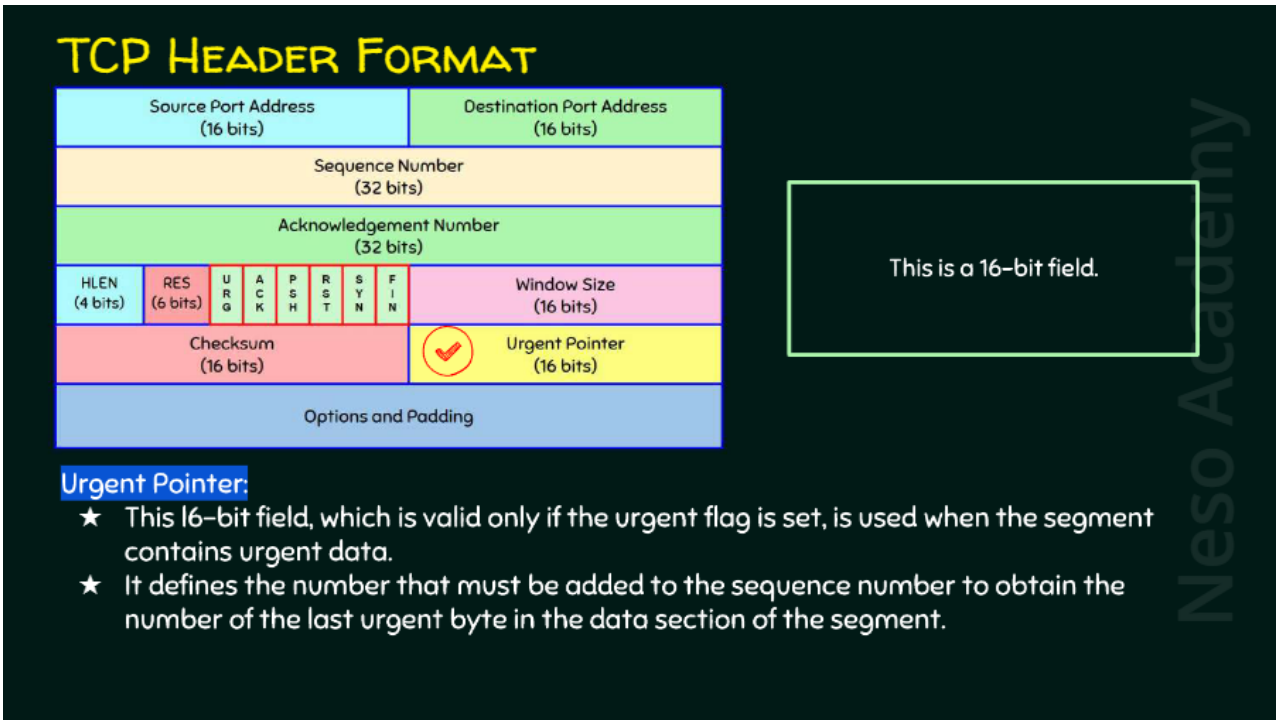
TCP Header Format★★★★★★Neso Academy



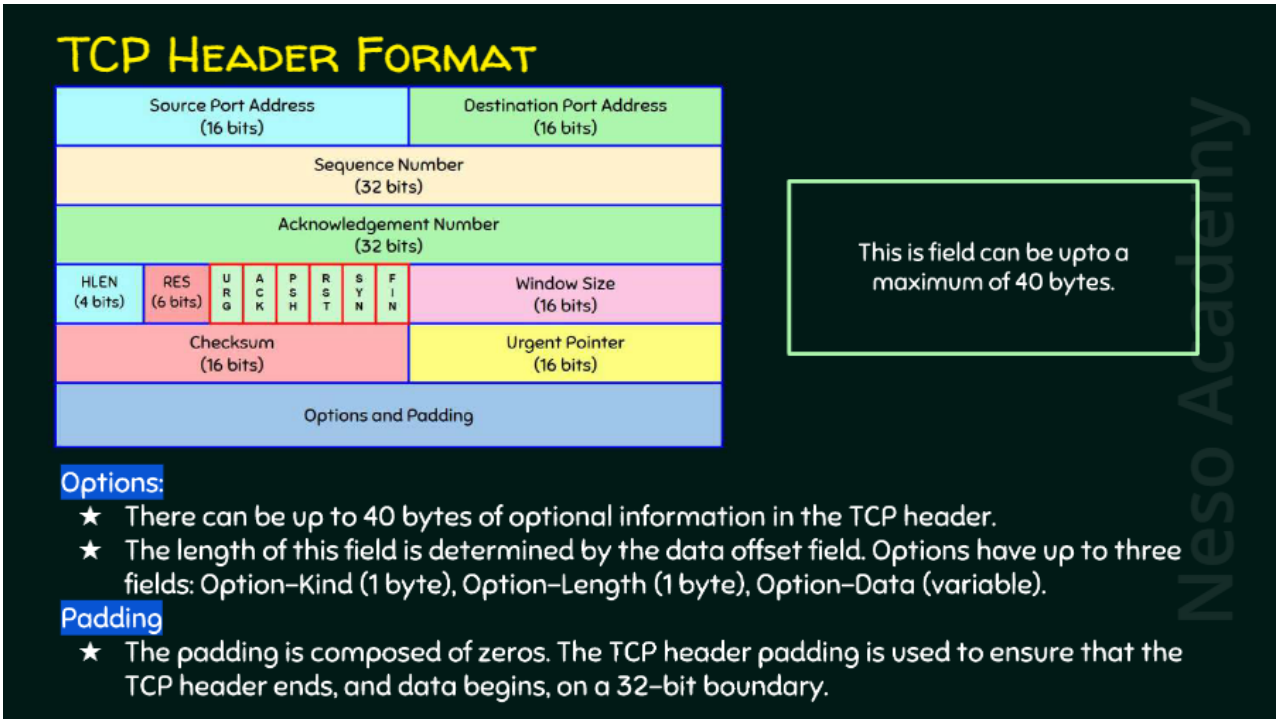
TCP Header Format★★★★Neso Academy



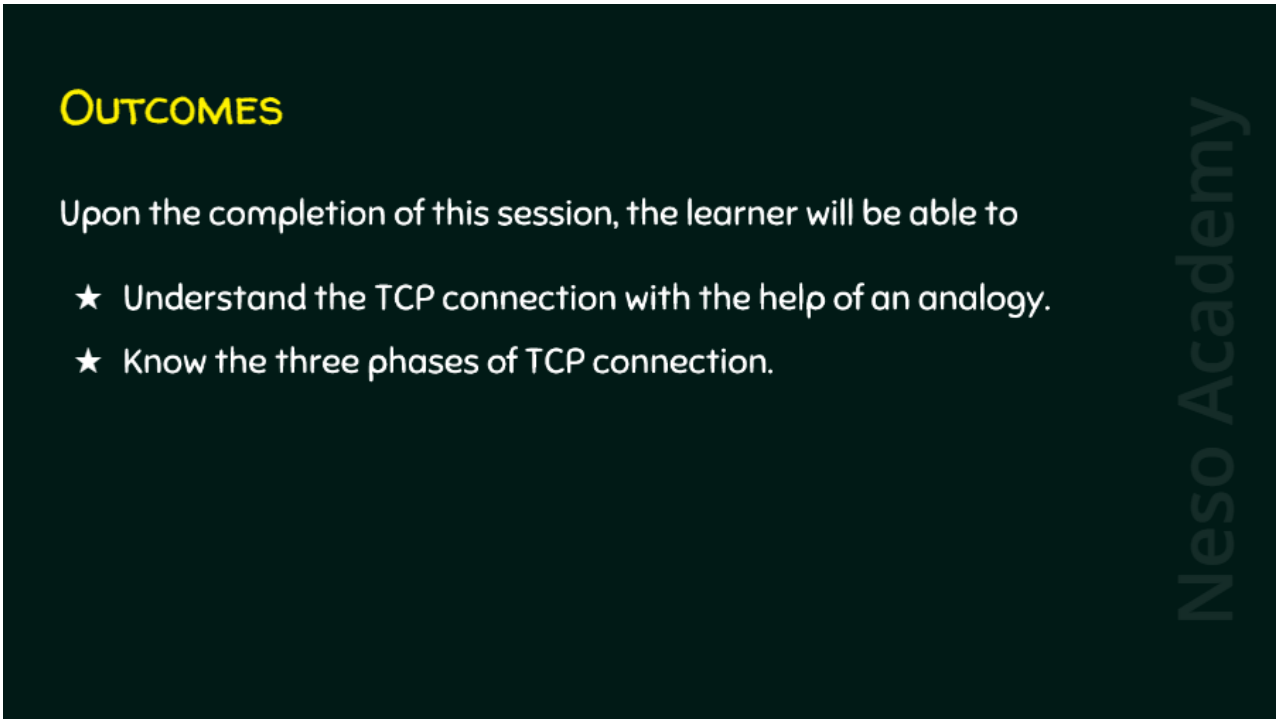
TCP Header Format★★★Neso Academy



TCP Header Format★★Neso Academy



TCP Header Format★★★Neso Academy



Outcomes★★Neso Academy

TCP Connection

- ★ Connection-oriented.
- ★ Virtual path.
- ★ Acknowledgment process.
- ★ Retransmission of lost or damaged frames.
- ★ TCP connection – Virtual not Physical.
- ★ IP – Connectionless.
- ★ Full-duplex mode.
- ★ Approval from other party.

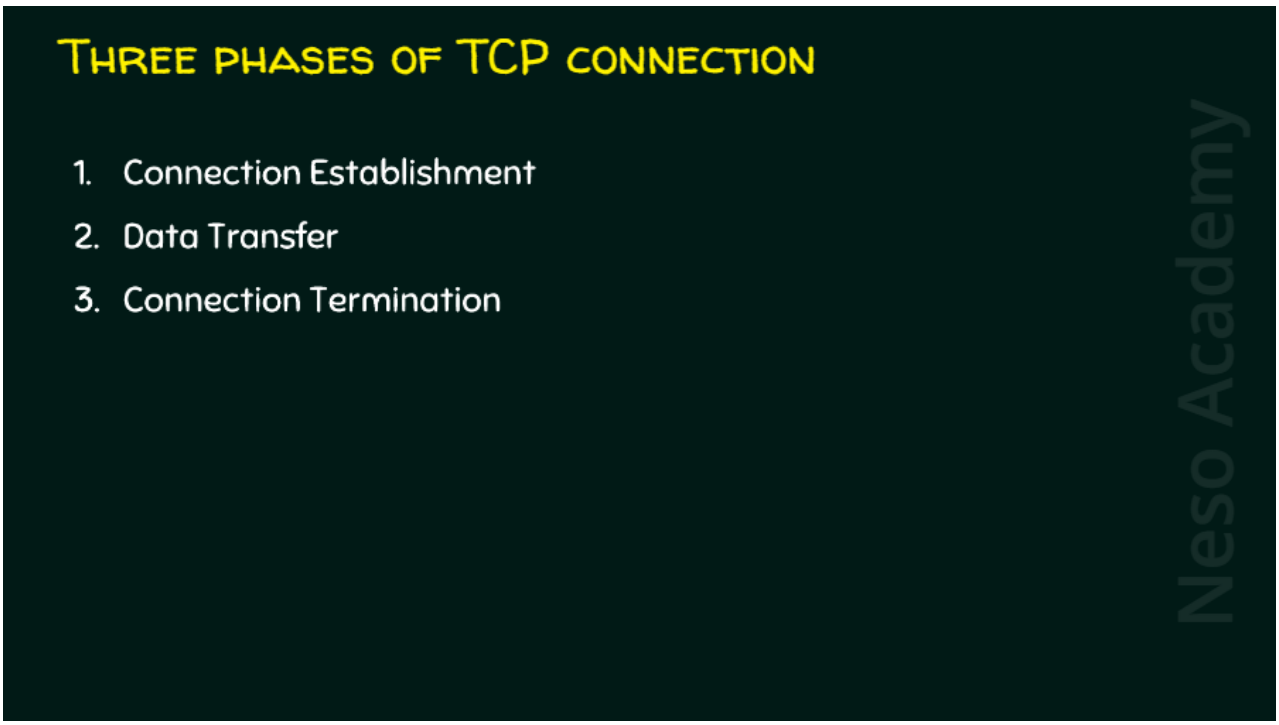
Neso Academy

TCP Connection★★★★★★★★Neso Academy

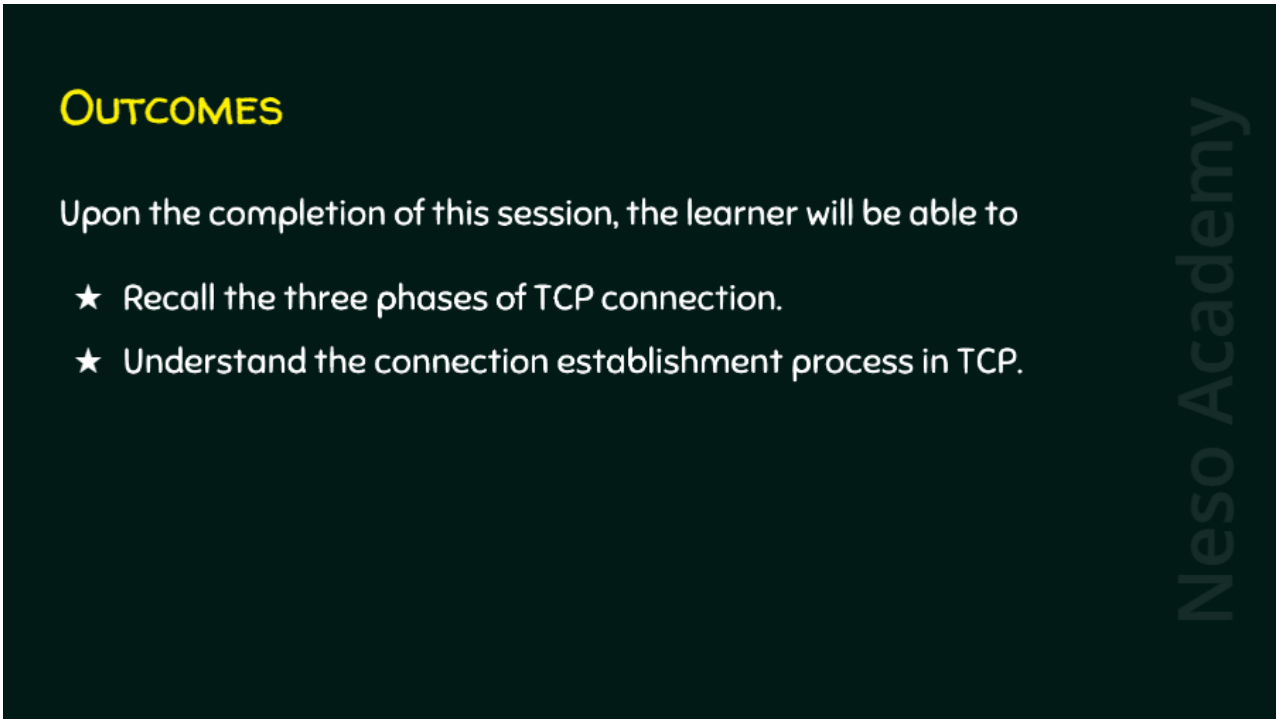
Analogy

Neso Academy

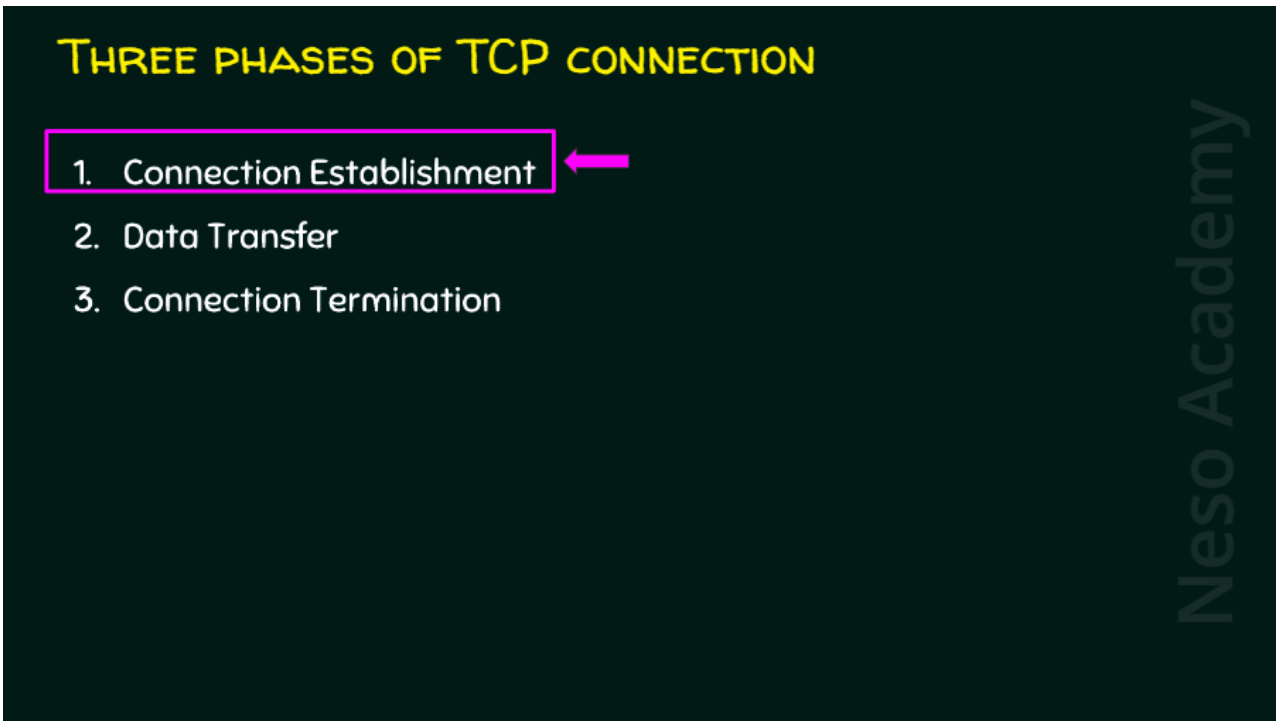
AnalogyNeso Academy



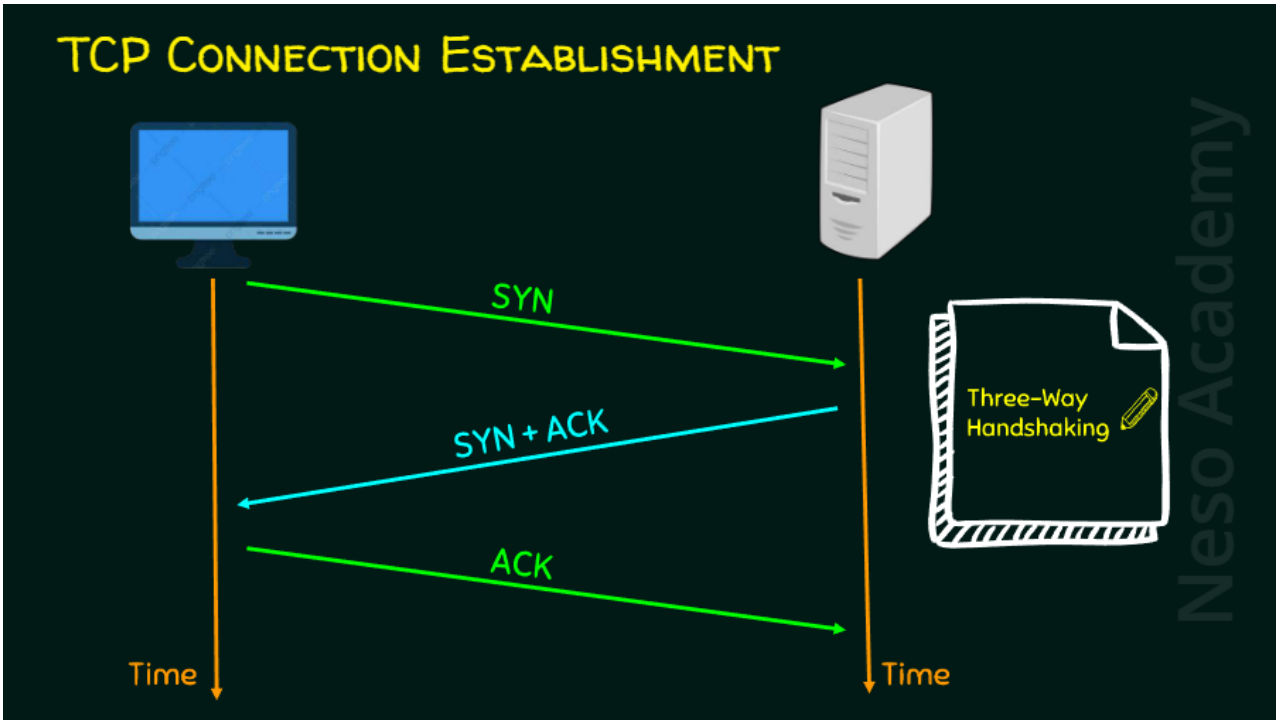
Three phases of TCP connectionNeso Academy



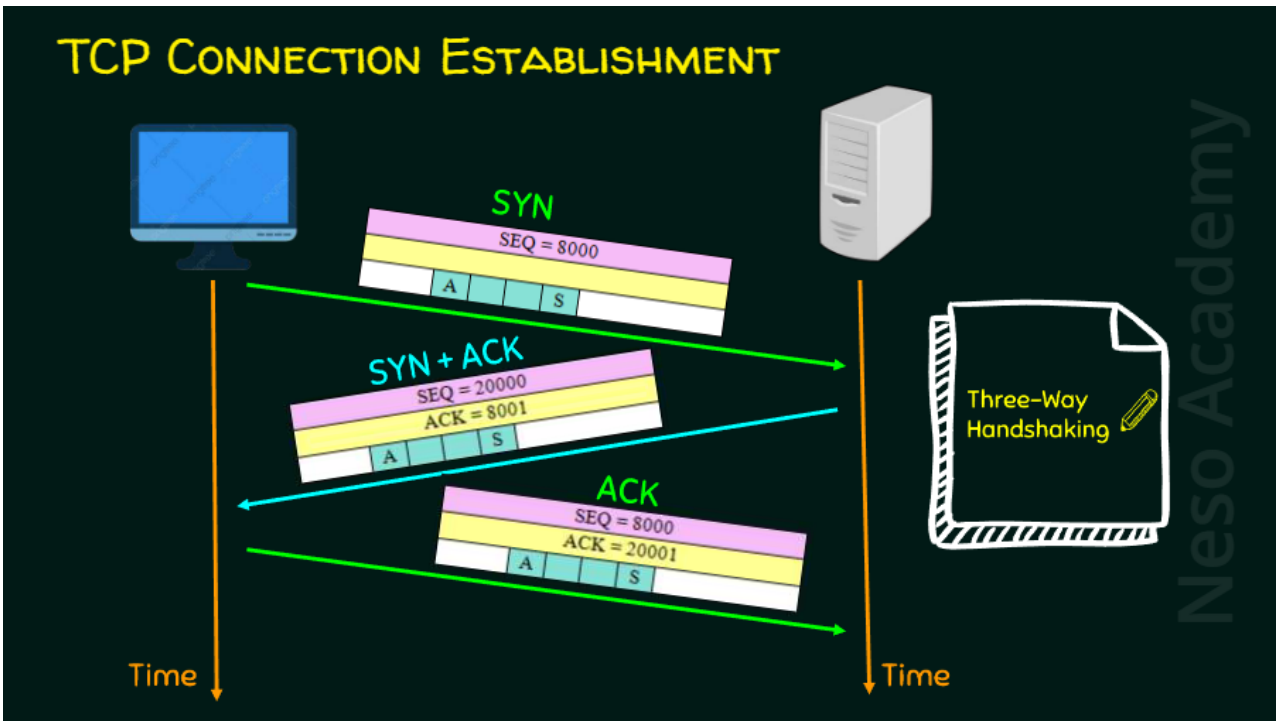
Outcomes★★Neso Academy



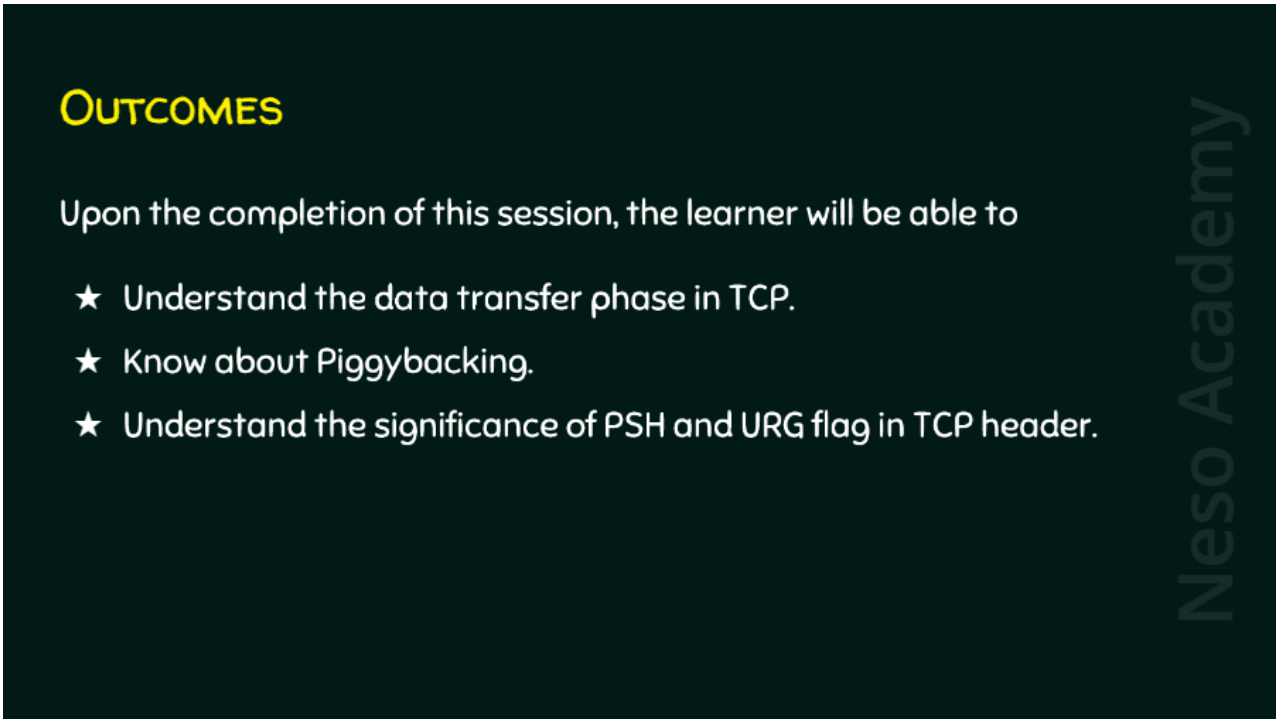
Three phases of TCP connectionNeso Academy



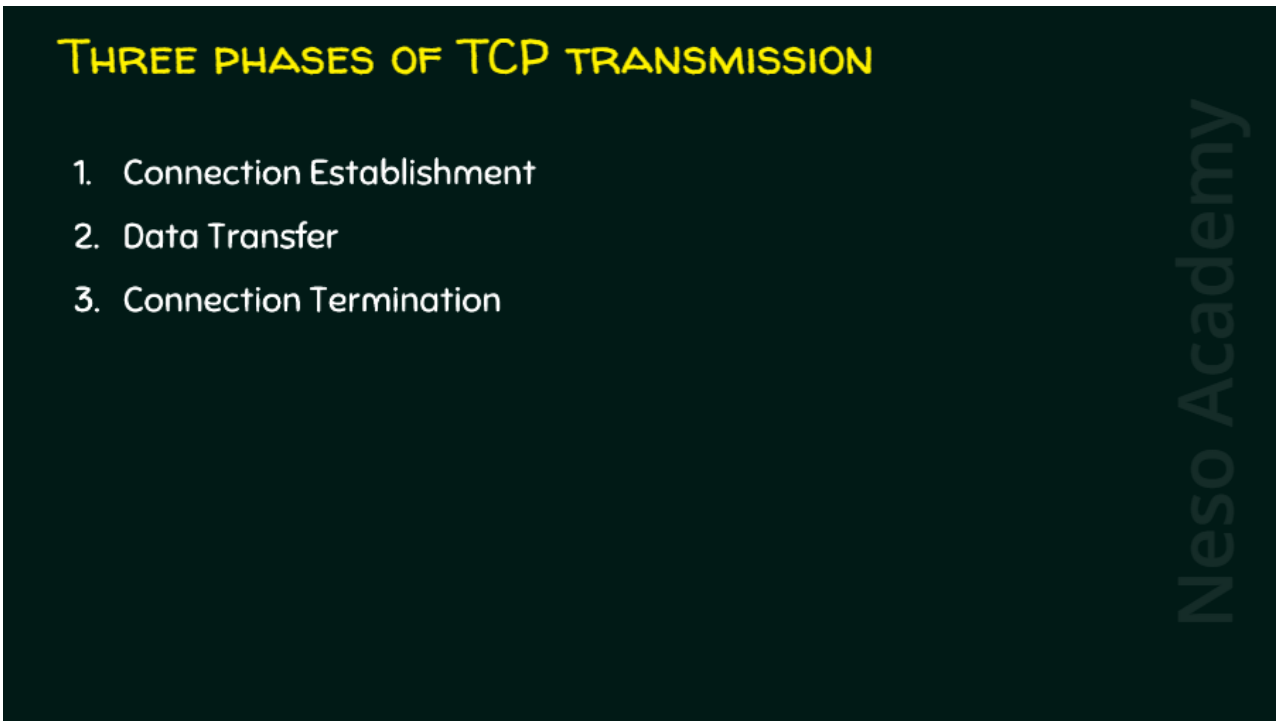
TCP Connection EstablishmentNeso Academy



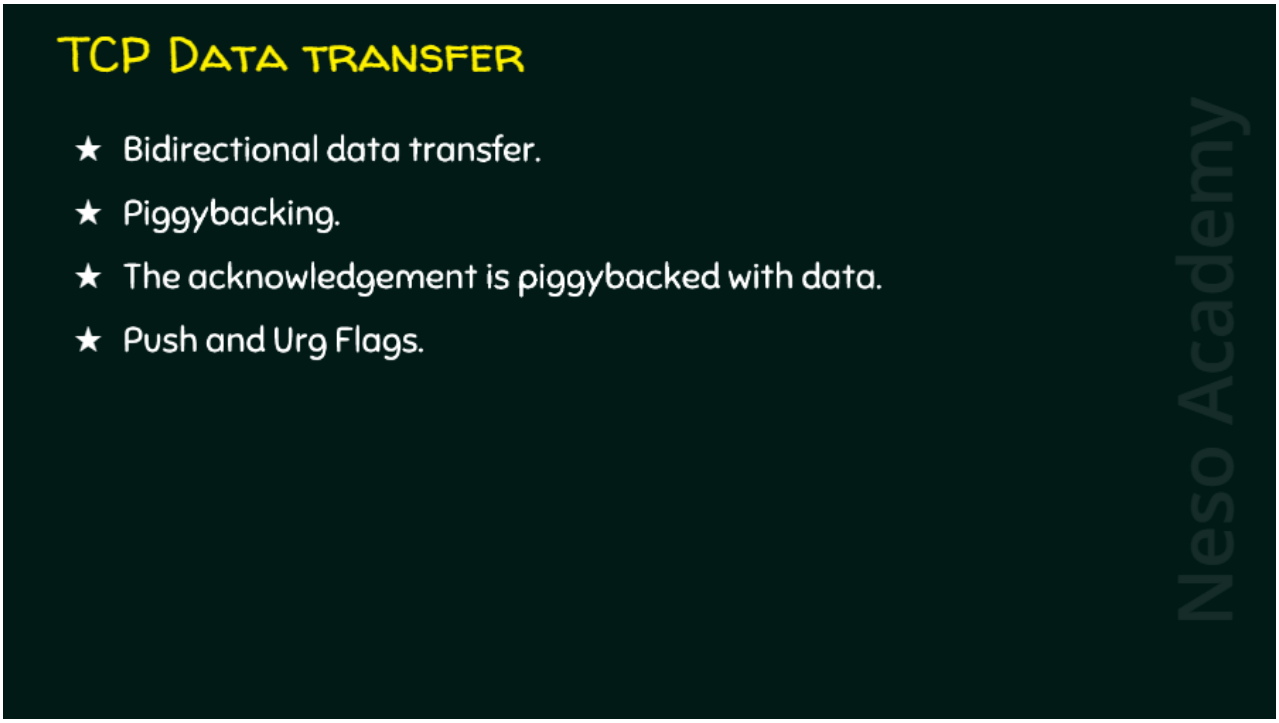
TCP Connection EstablishmentNeso Academy



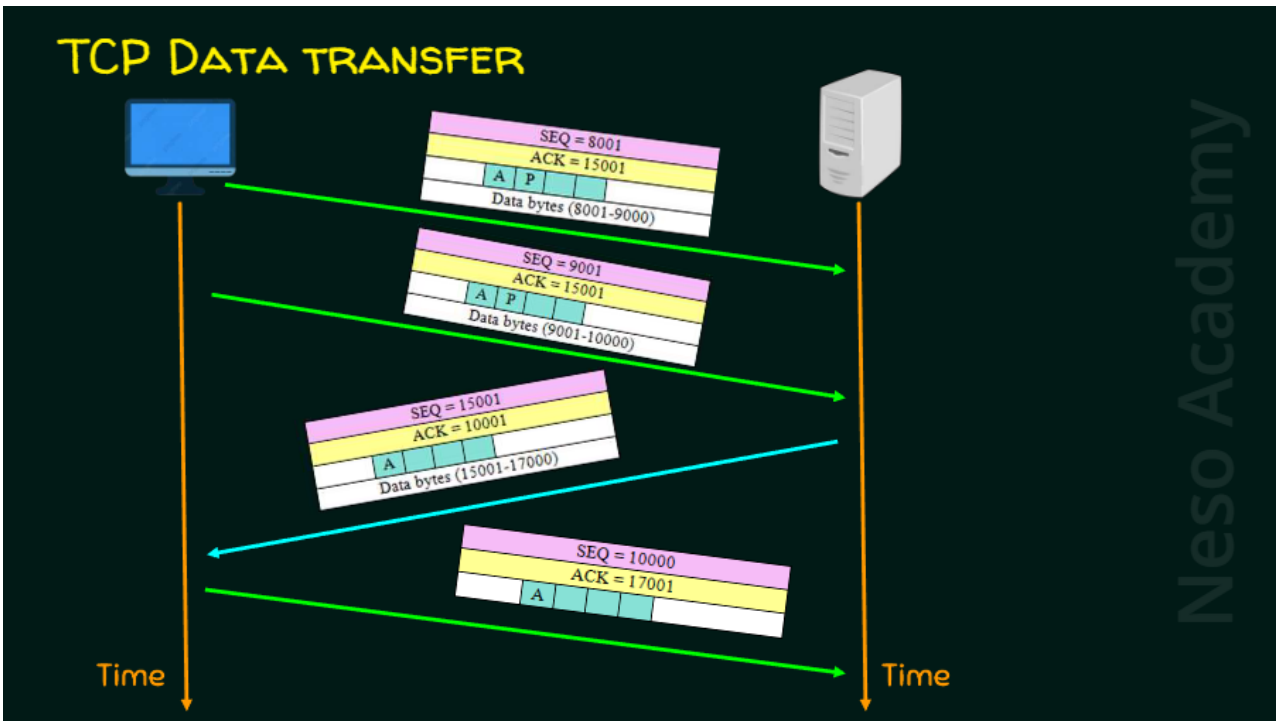
Outcomes★★★Neso Academy



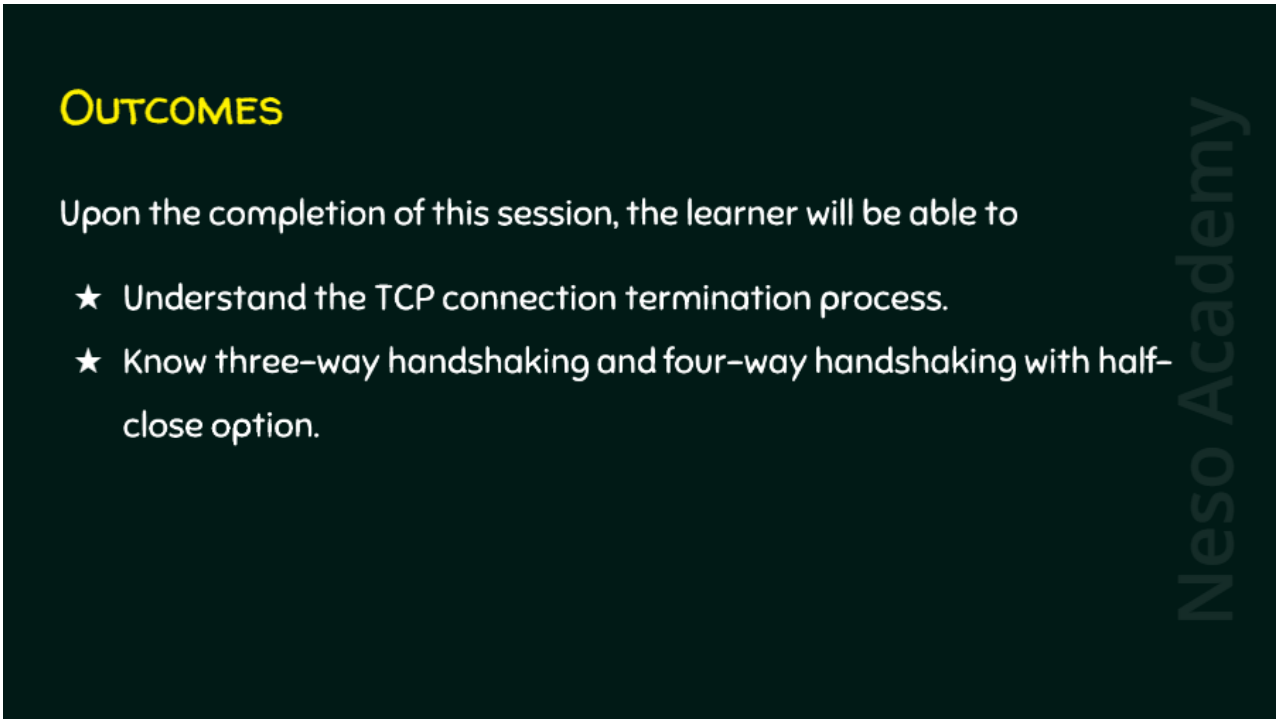
Three phases of TCP transmissionNeso Academy



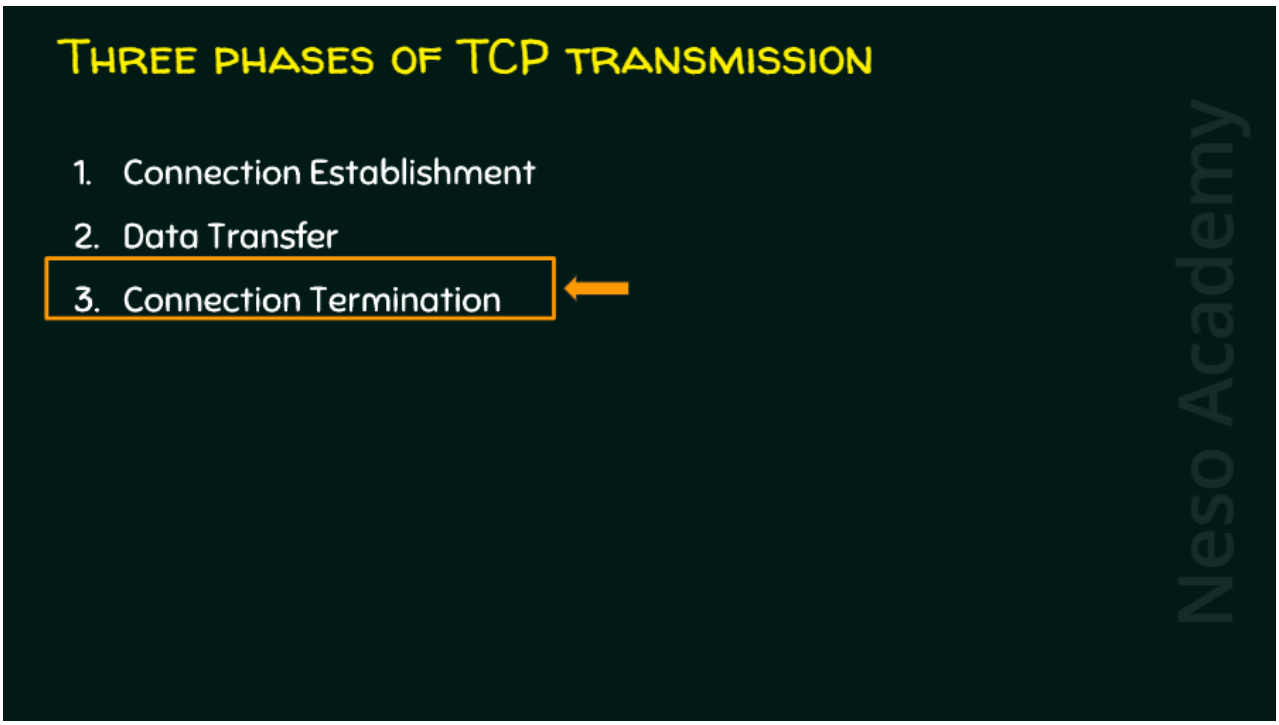
TCP Data transfer★★★★Neso Academy



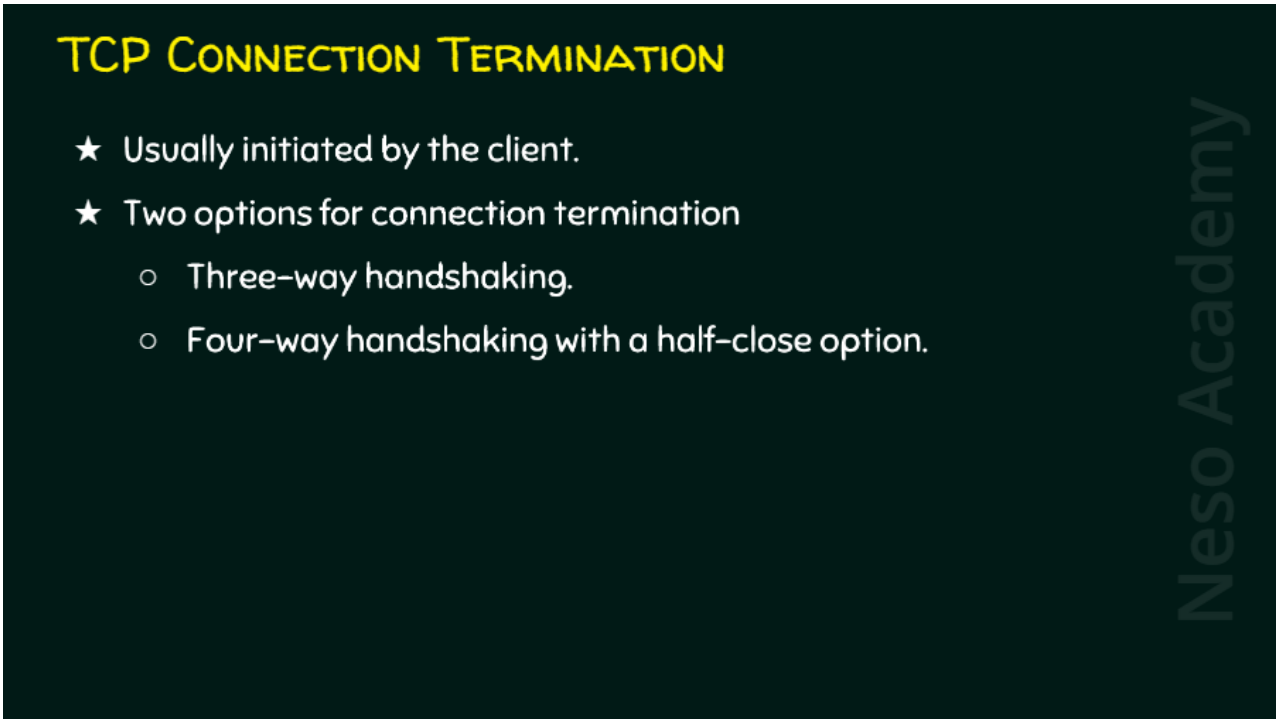
TCP Data transferNeso Academy



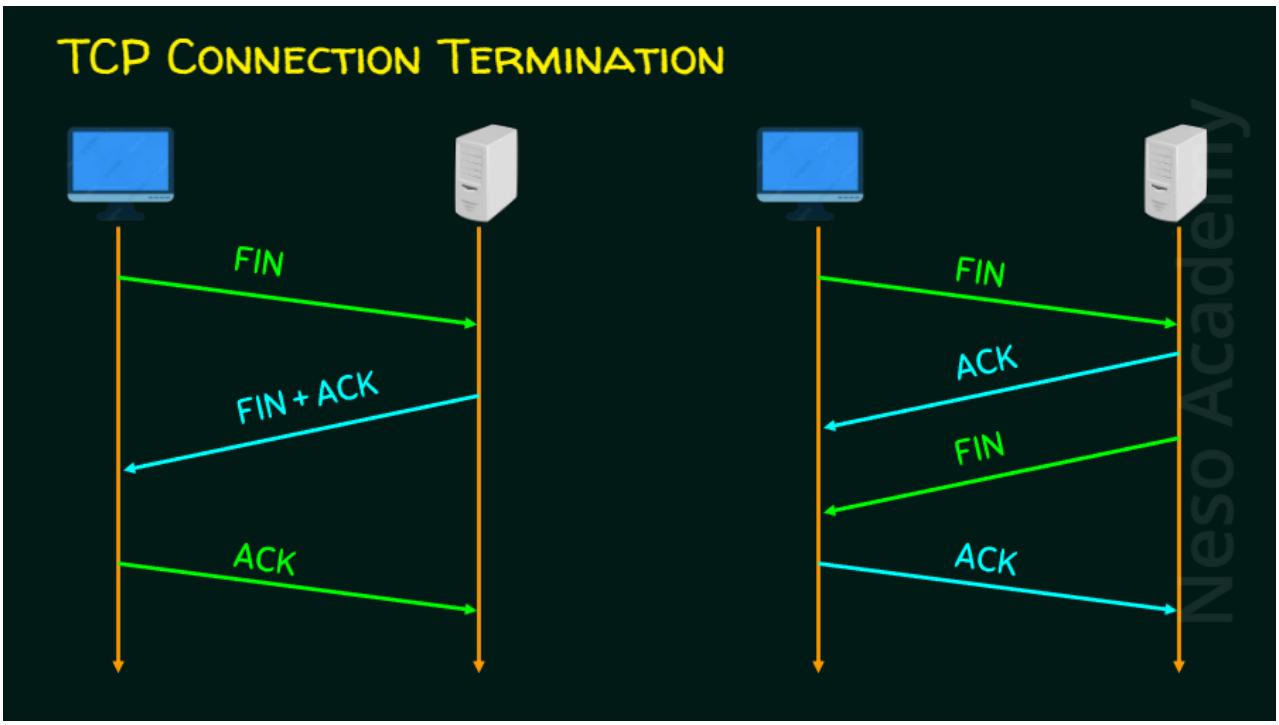
Outcomes★★Neso Academy



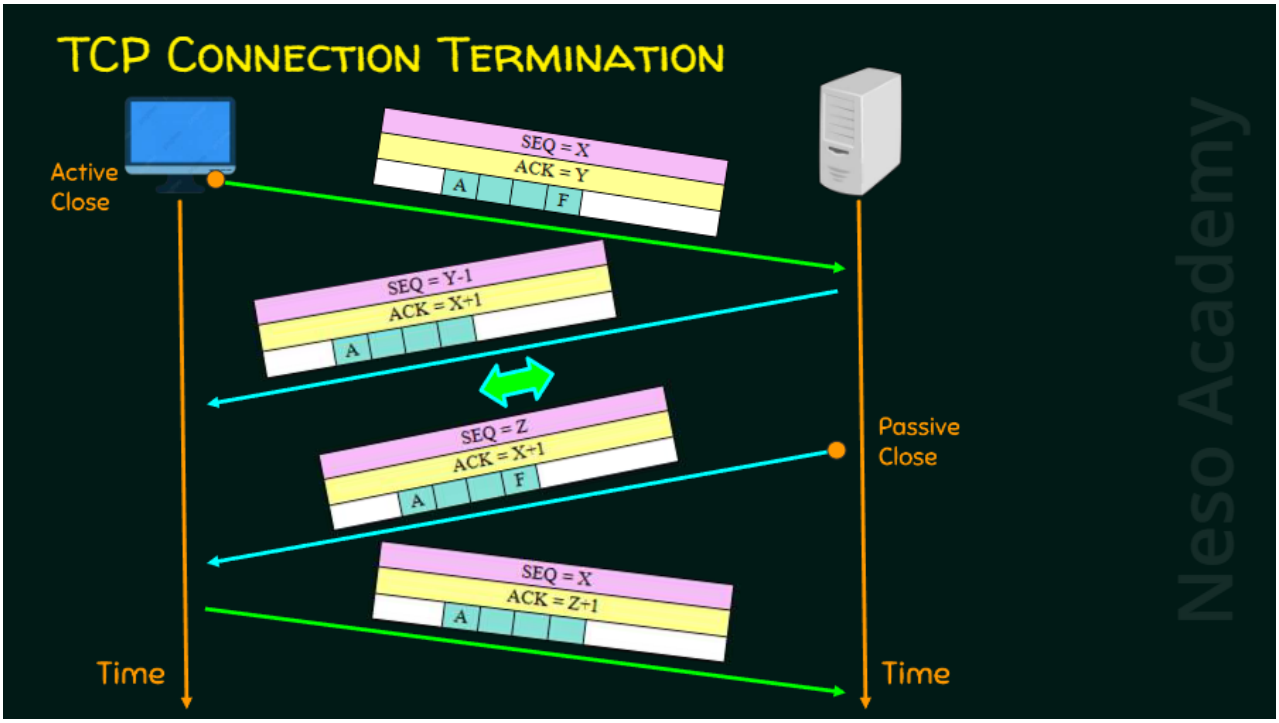
Three phases of TCP transmissionNeso Academy



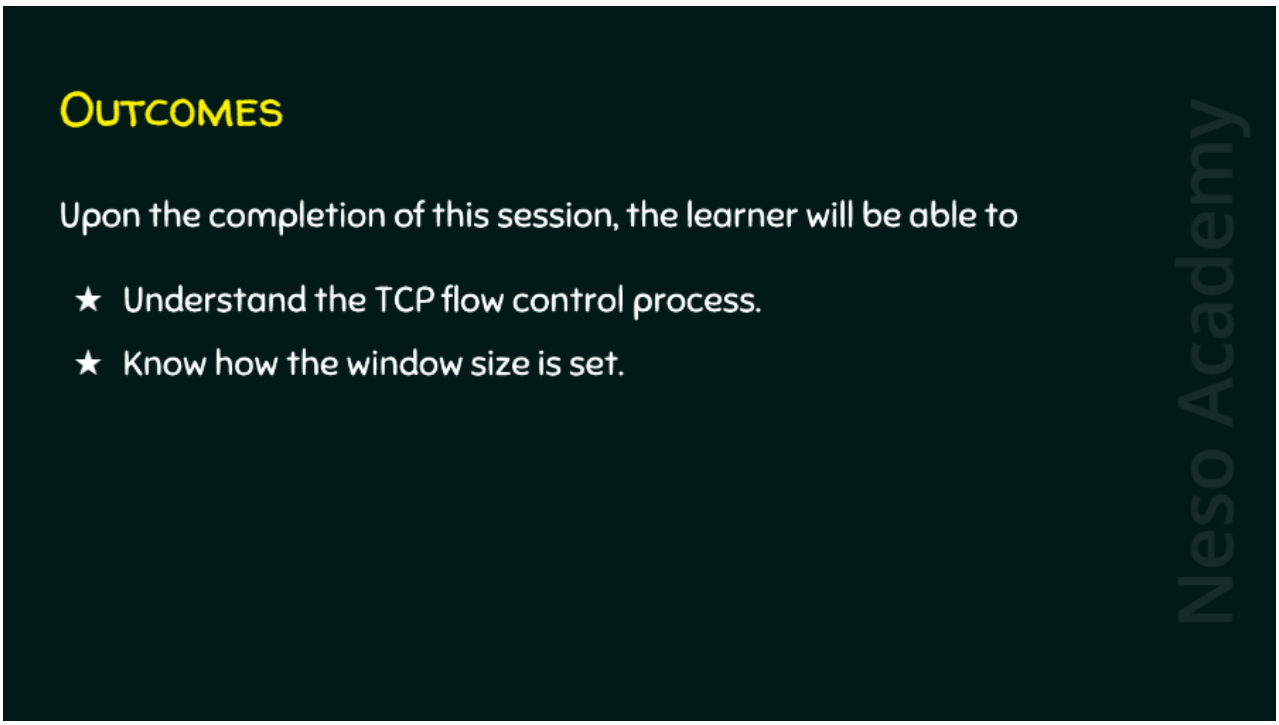
TCP Connection Termination★★○○Neso Academy



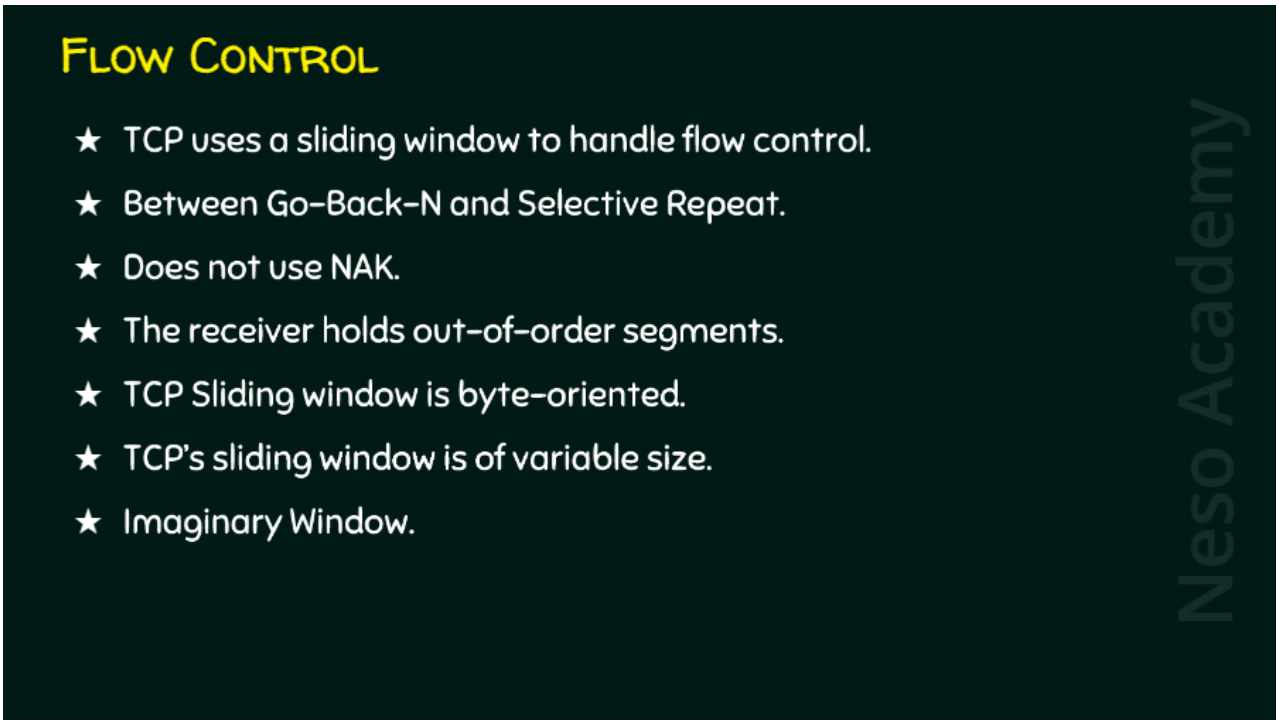
TCP Connection TerminationNeso Academy



TCP Connection TerminationNeso Academy

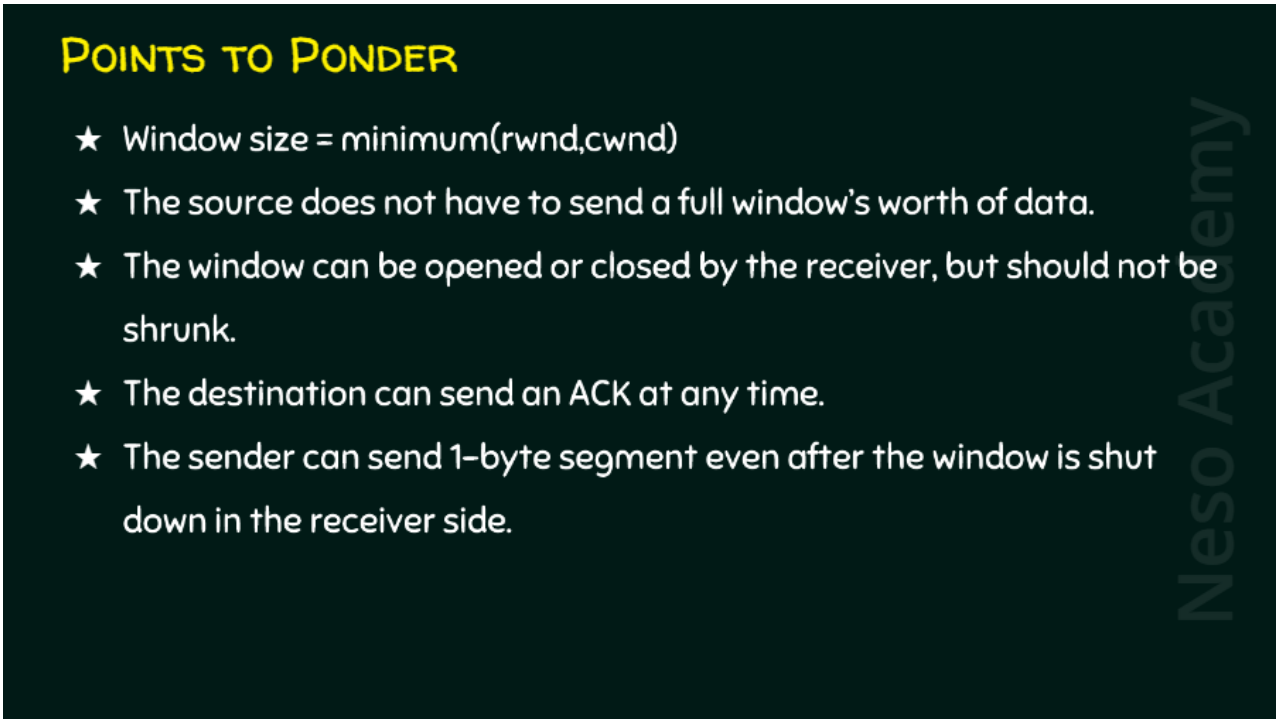


Outcomes★★Neso Academy

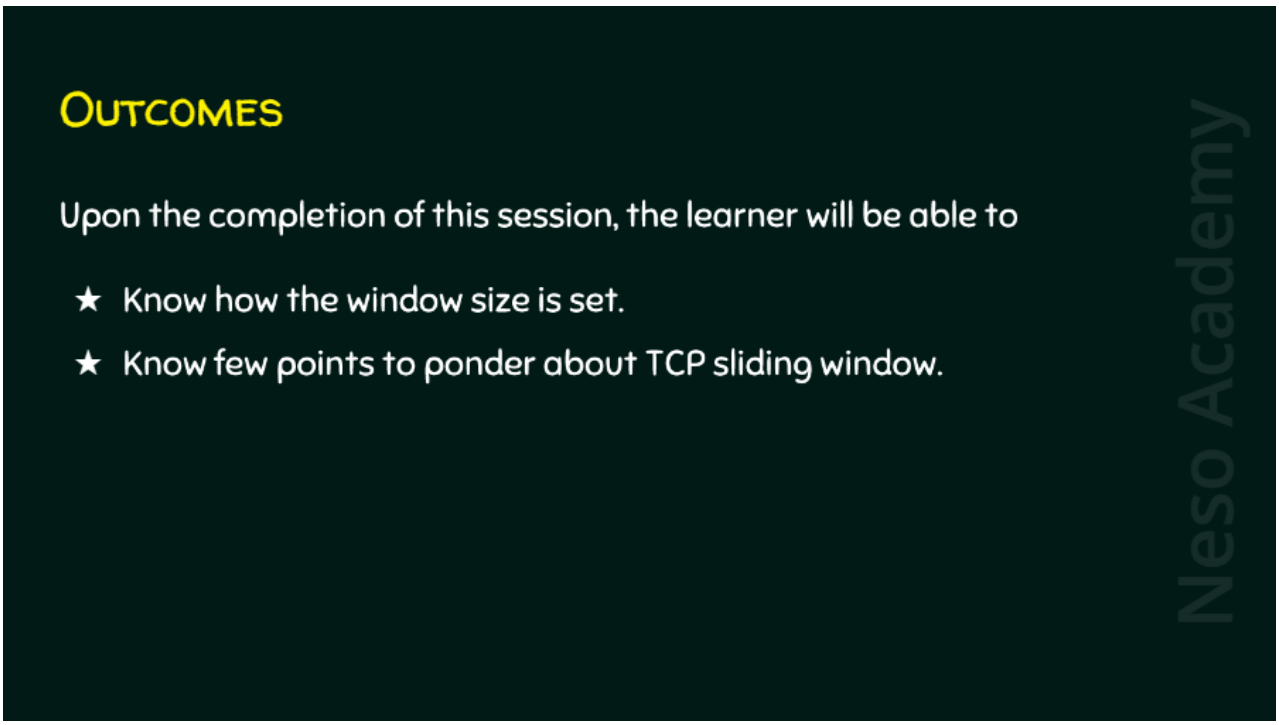


Flow Control★★★★★★★Neso Academy

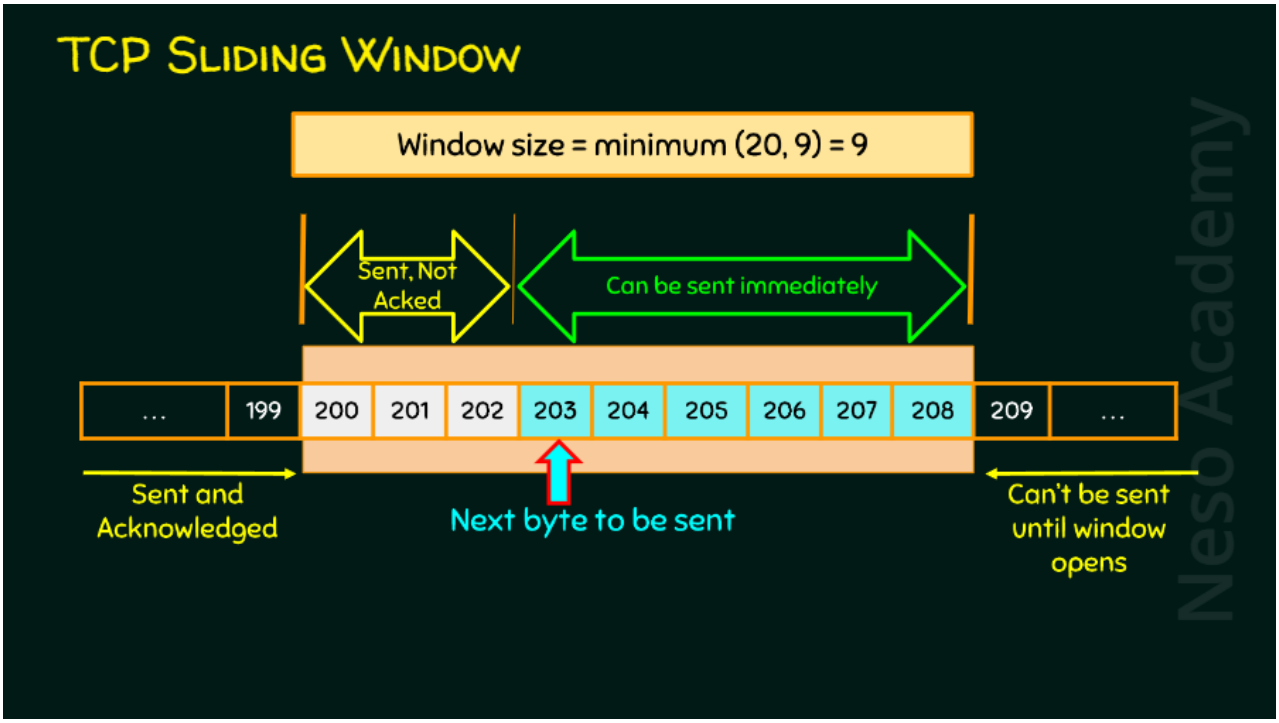
TCP Sliding WindowNeso Academy



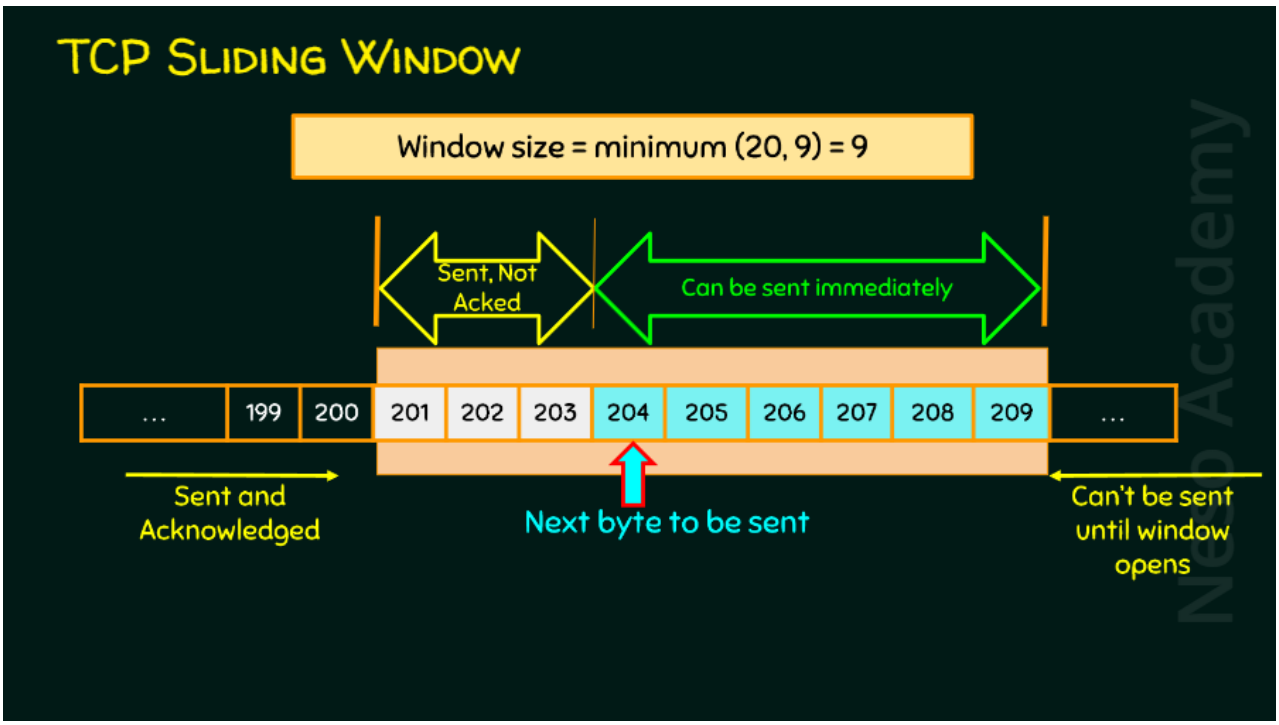
Points to Ponder★★★★★Neso Academy



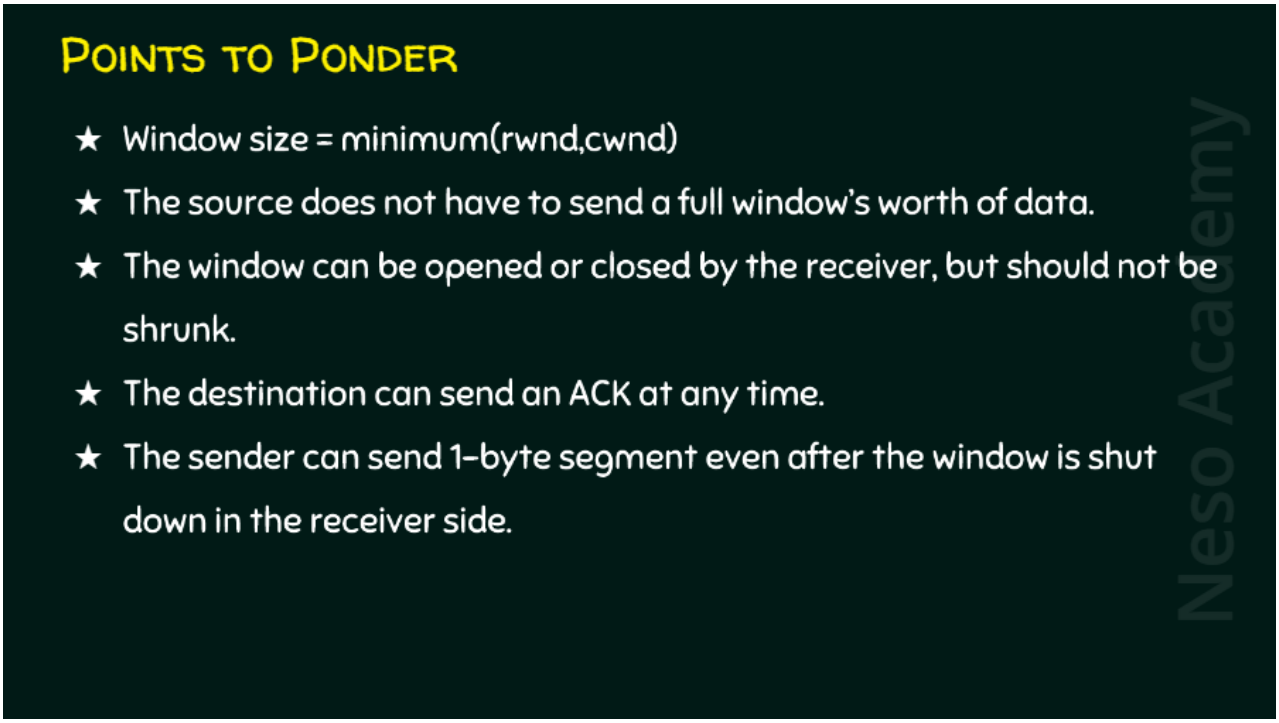
Outcomes★★Neso Academy



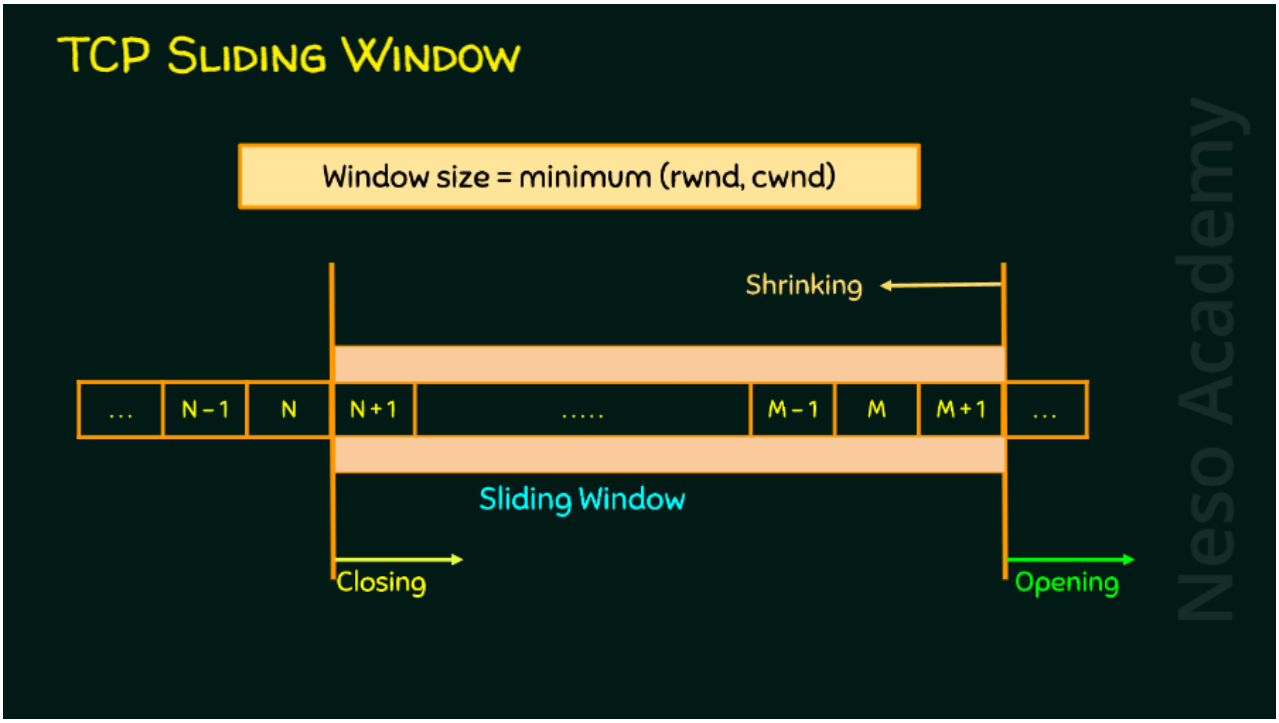
TCP Sliding WindowNeso Academy



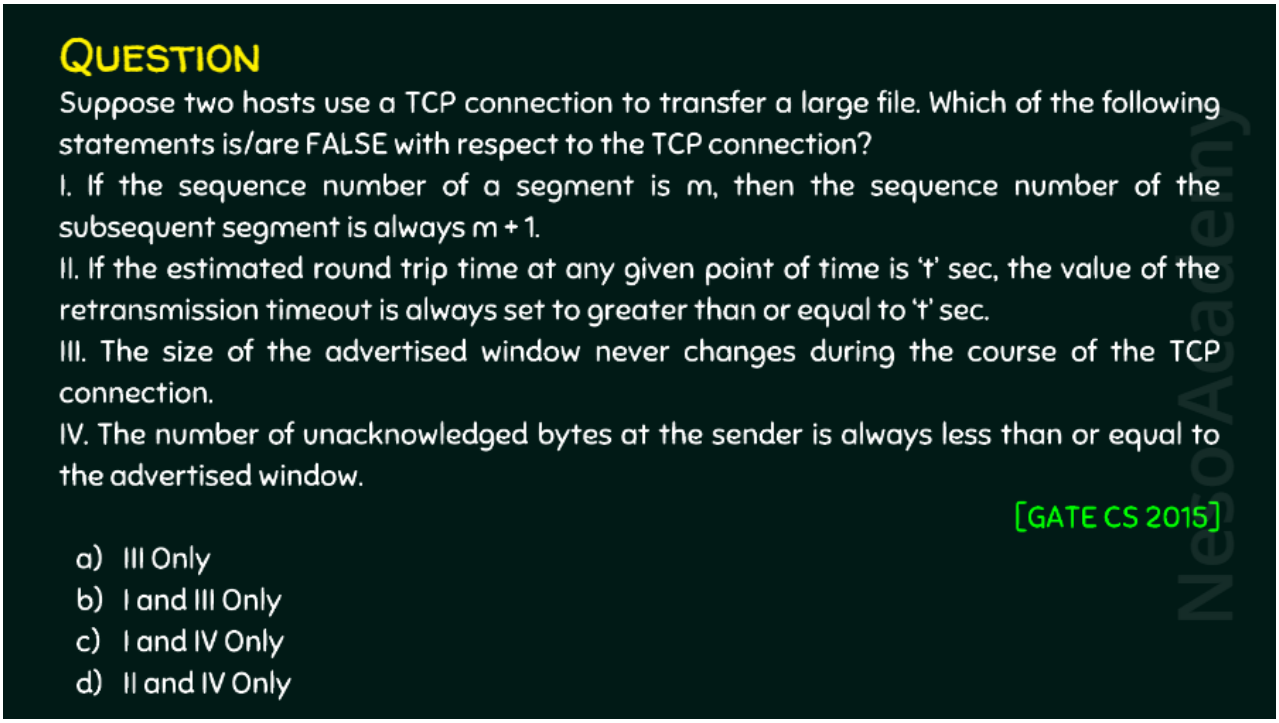
TCP Sliding WindowNeso Academy



Points to Ponder★★★★★Neso Academy



TCP Sliding WindowNeso Academy



QuestionNeso Academy

QUESTION 2

What is the value of the receiver window (rwnd) for host A if the receiver host B, has a buffer size of 5000 bytes and 1000 bytes of received and unprocessed data?

SOLUTION:

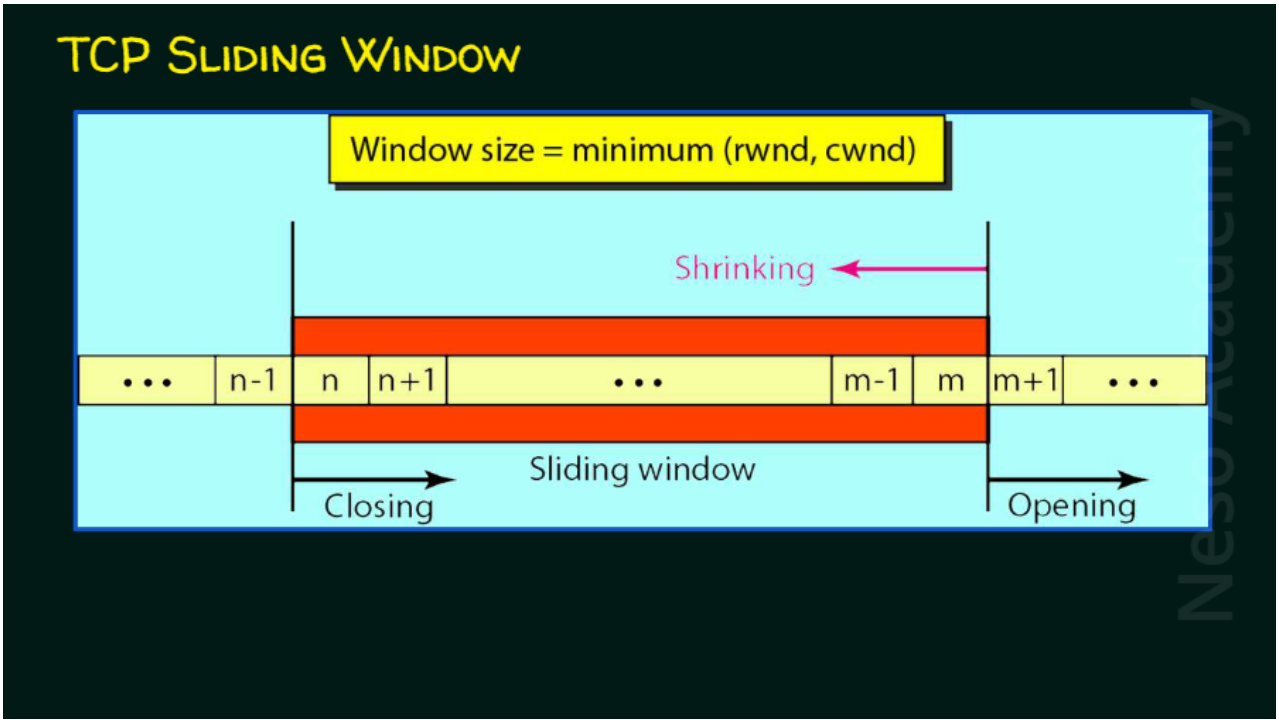
rwnd = 5000 – 1000

rwnd = 4000

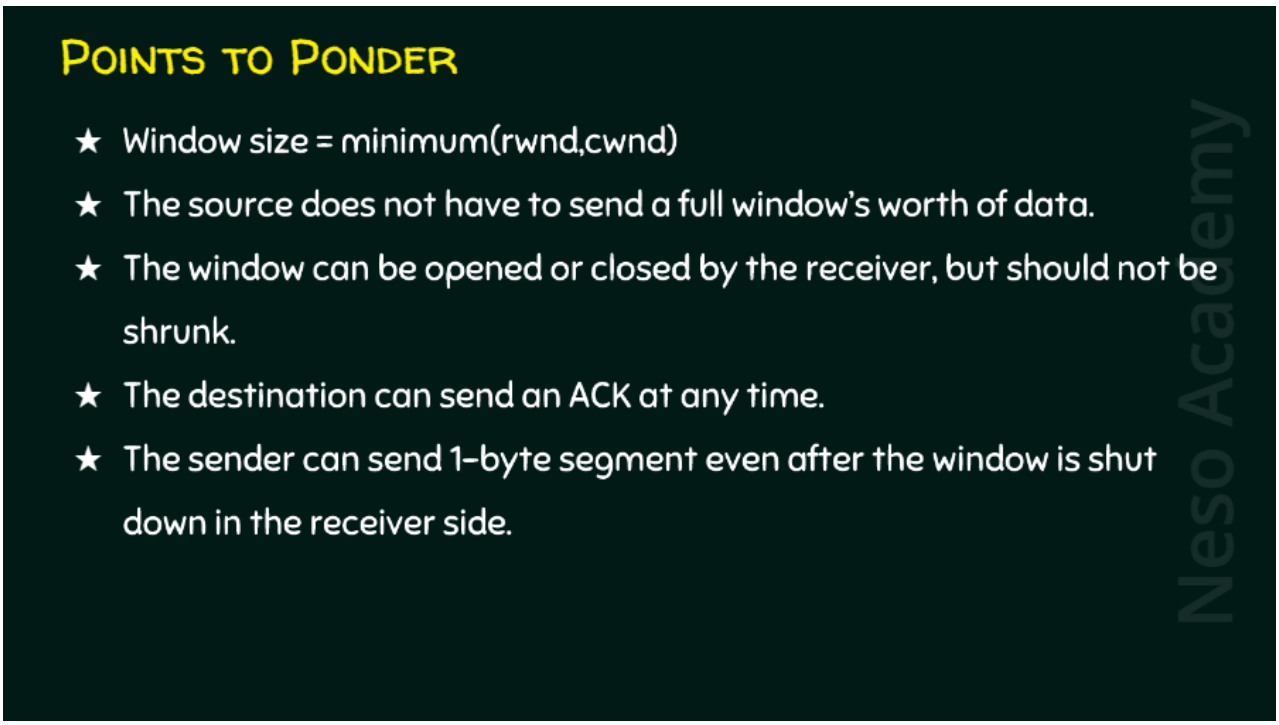
Host B can receive only 4000 bytes of data before overflowing its buffer.

Host B advertises this value 4000 in its next segment to Host A.

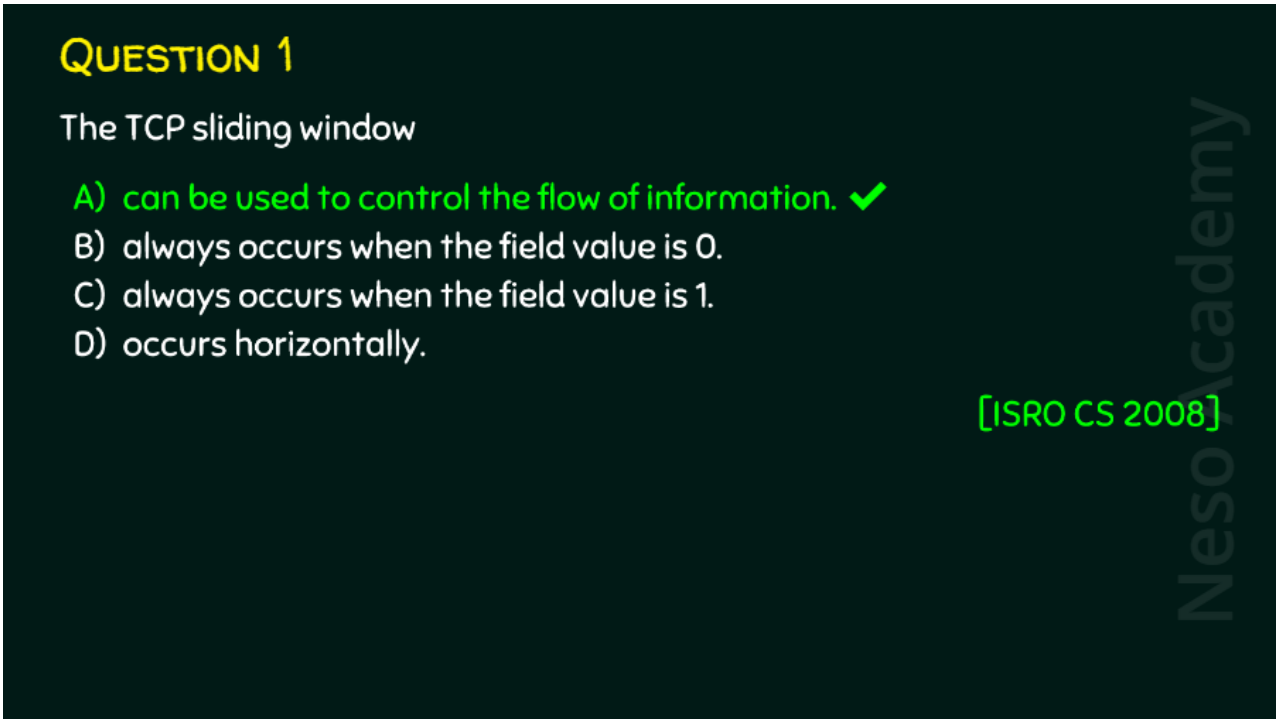
Question 2Neso Academy



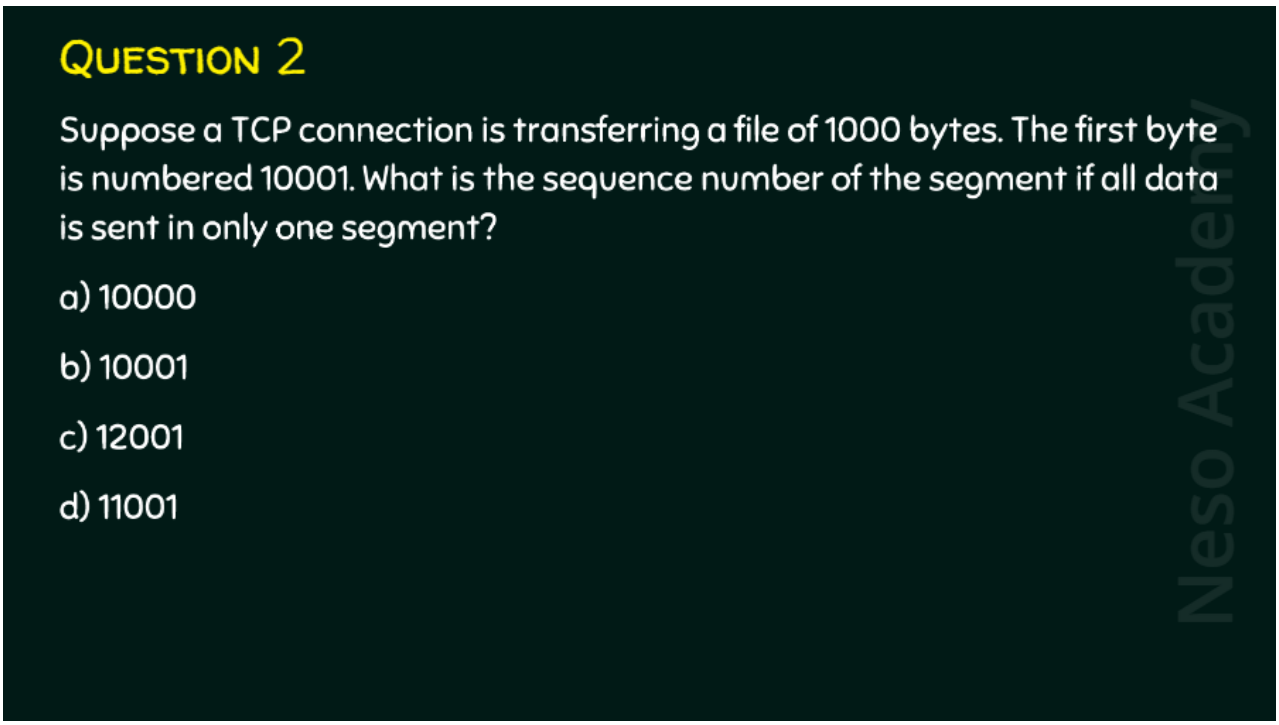
TCP Sliding WindowNeso Academy



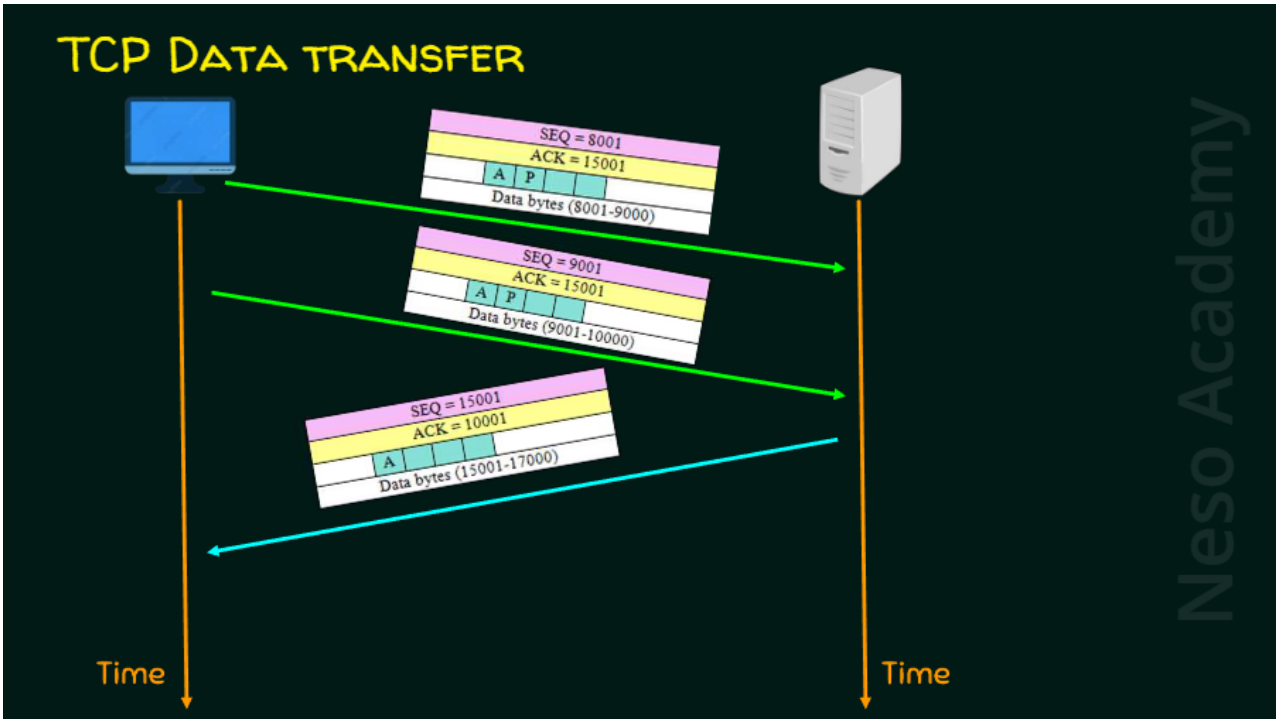
Points to Ponder★★★★★Neso Academy



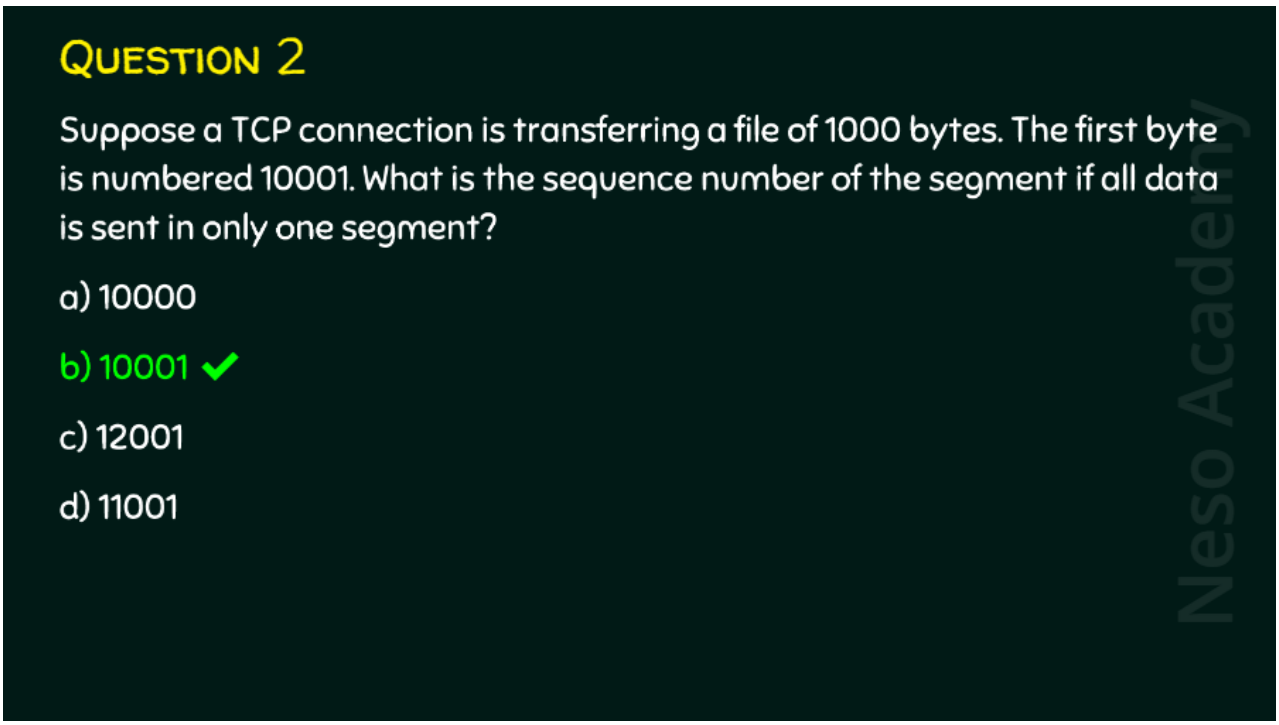
Question 1✓Neso Academy



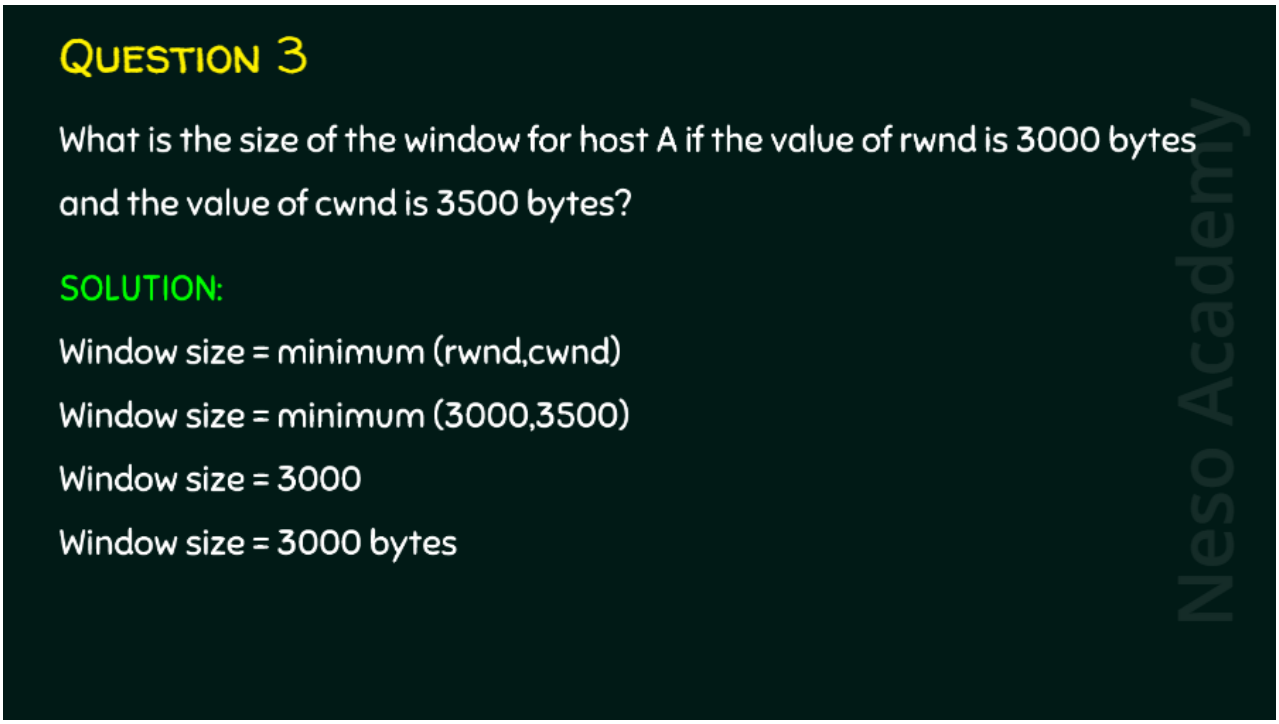
Question 2Neso Academy



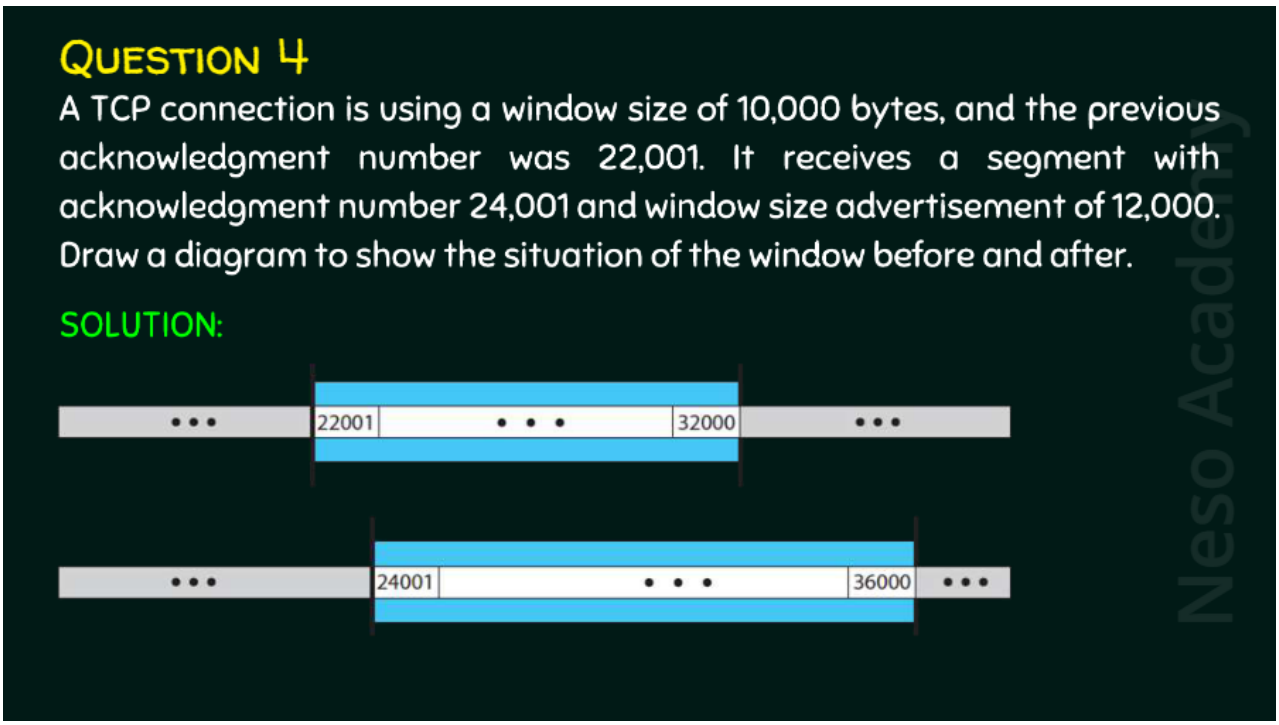
TCP Data transferNeso Academy



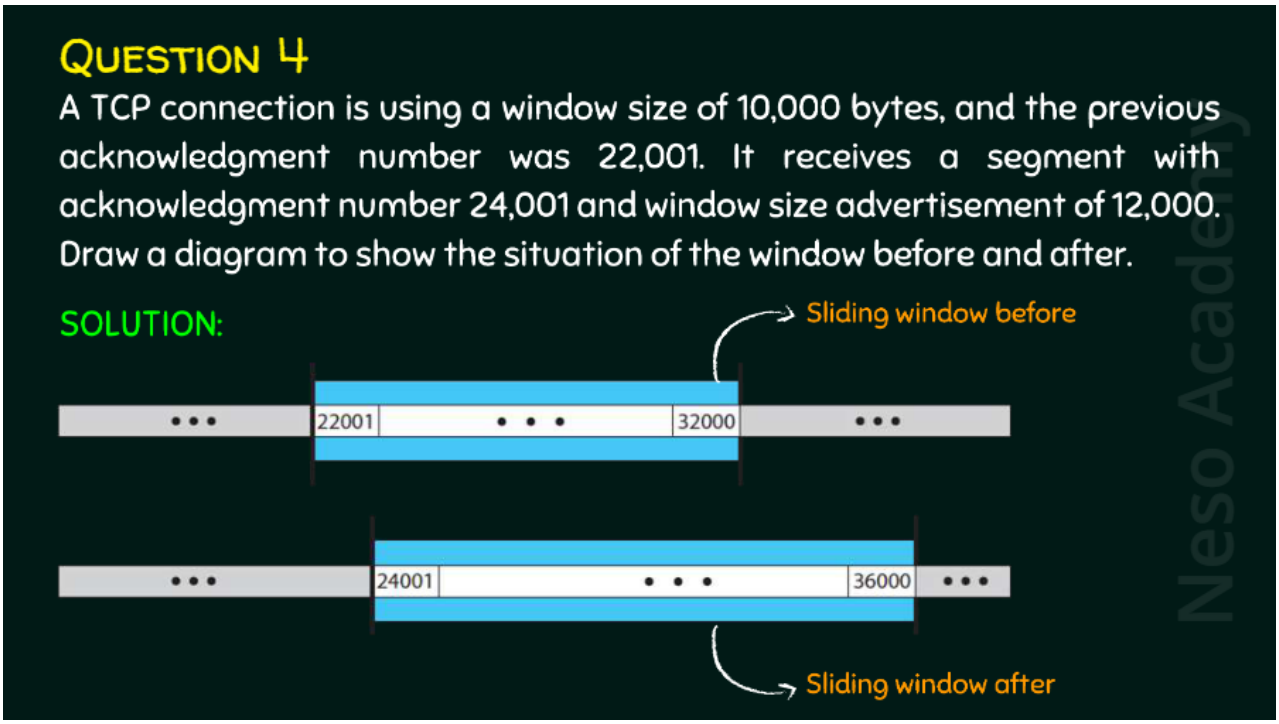
Question 2✓Neso Academy



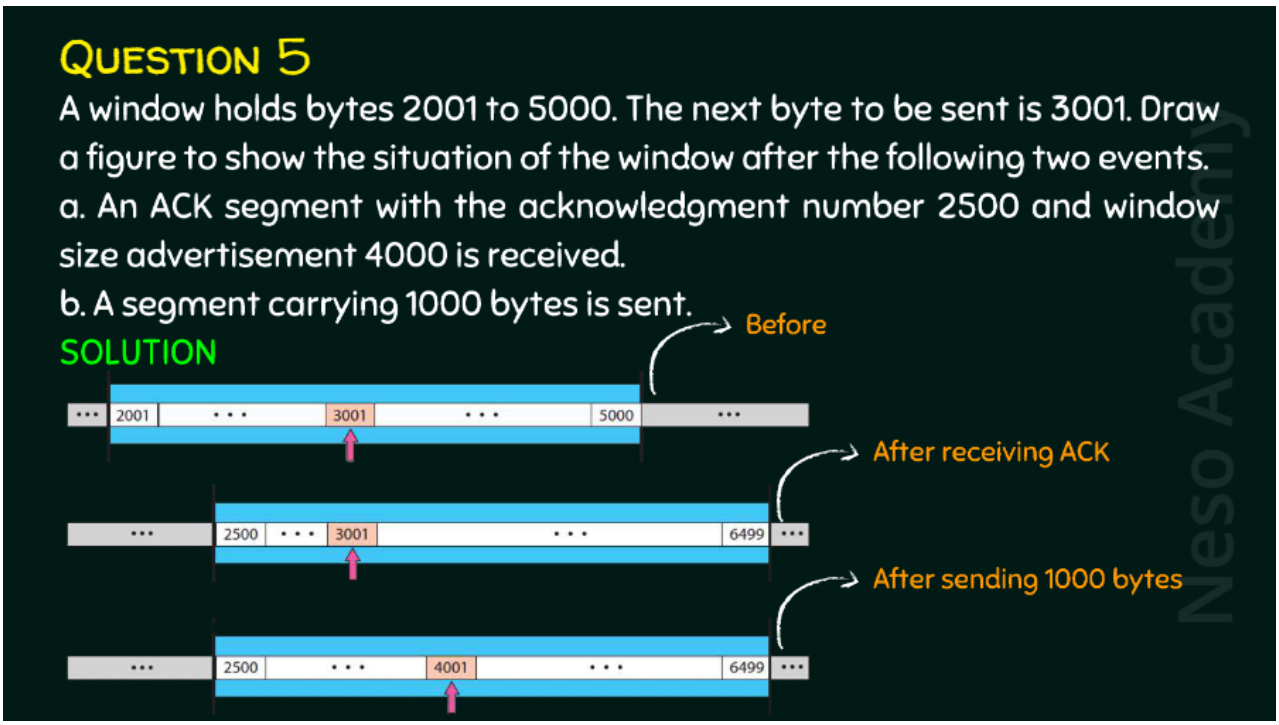
Question 3Neso Academy



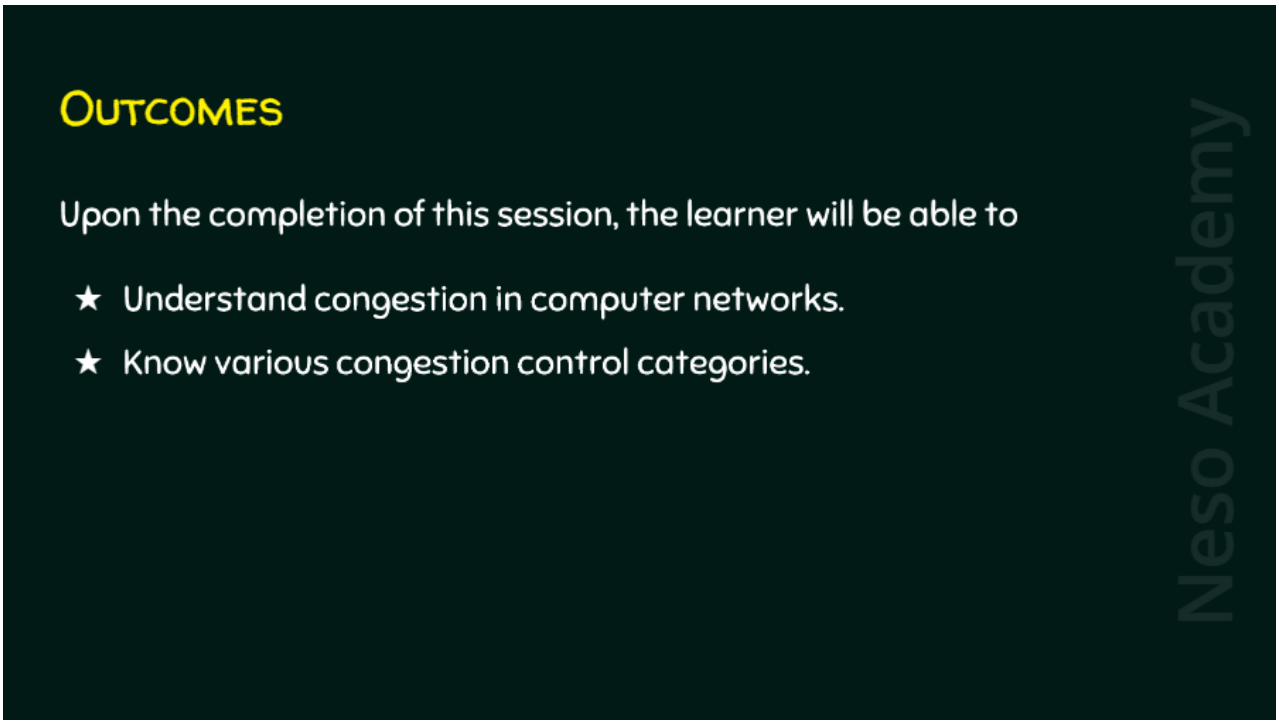
Question 4Neso Academy



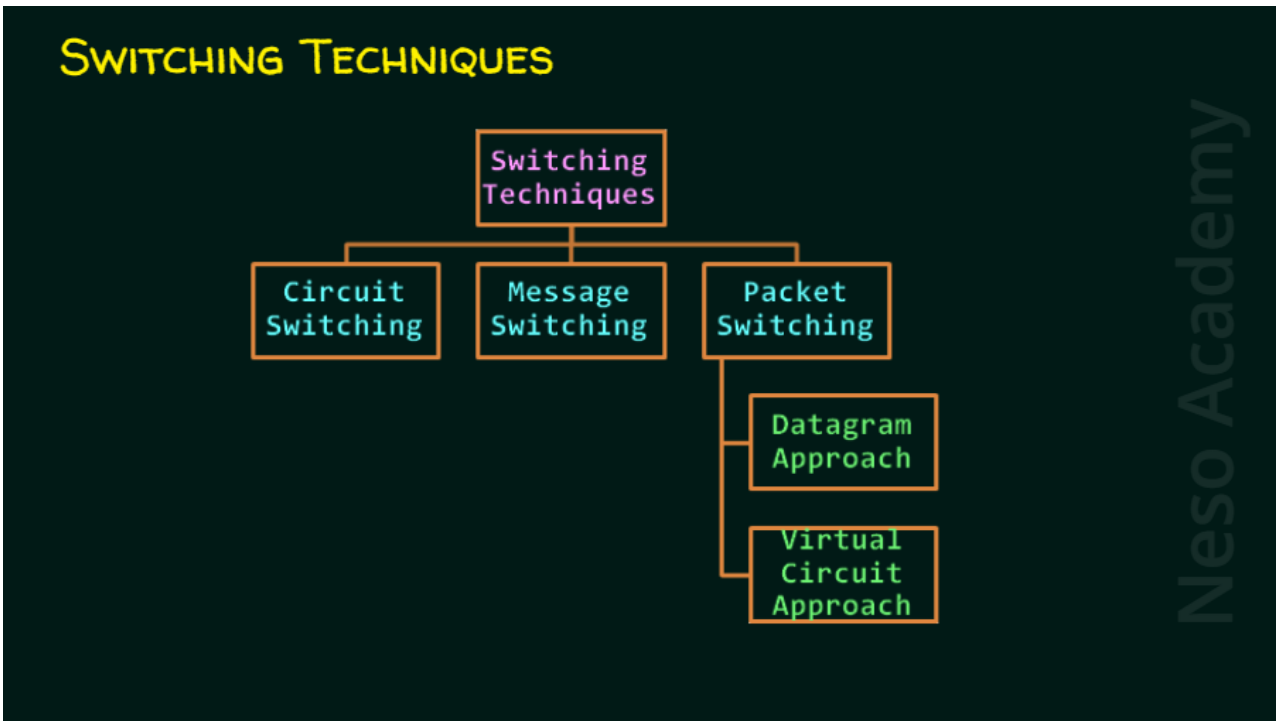
Question 4Neso Academy



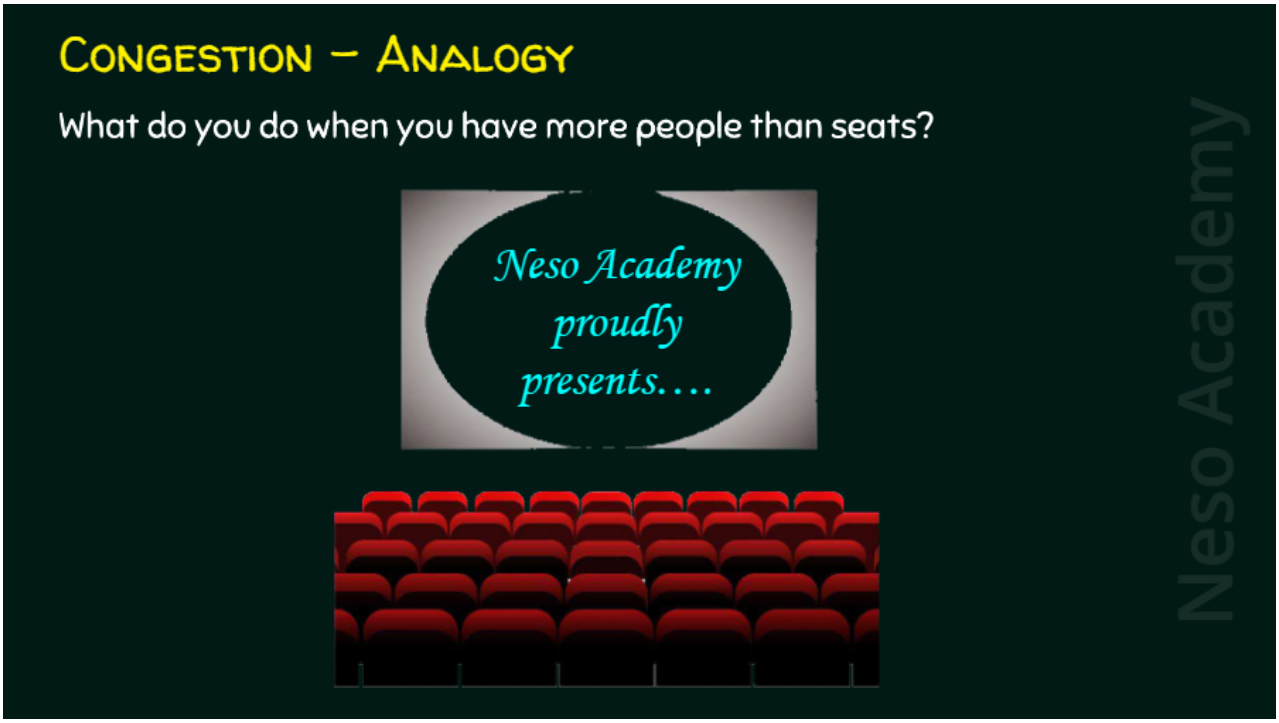
Question 5Neso Academy



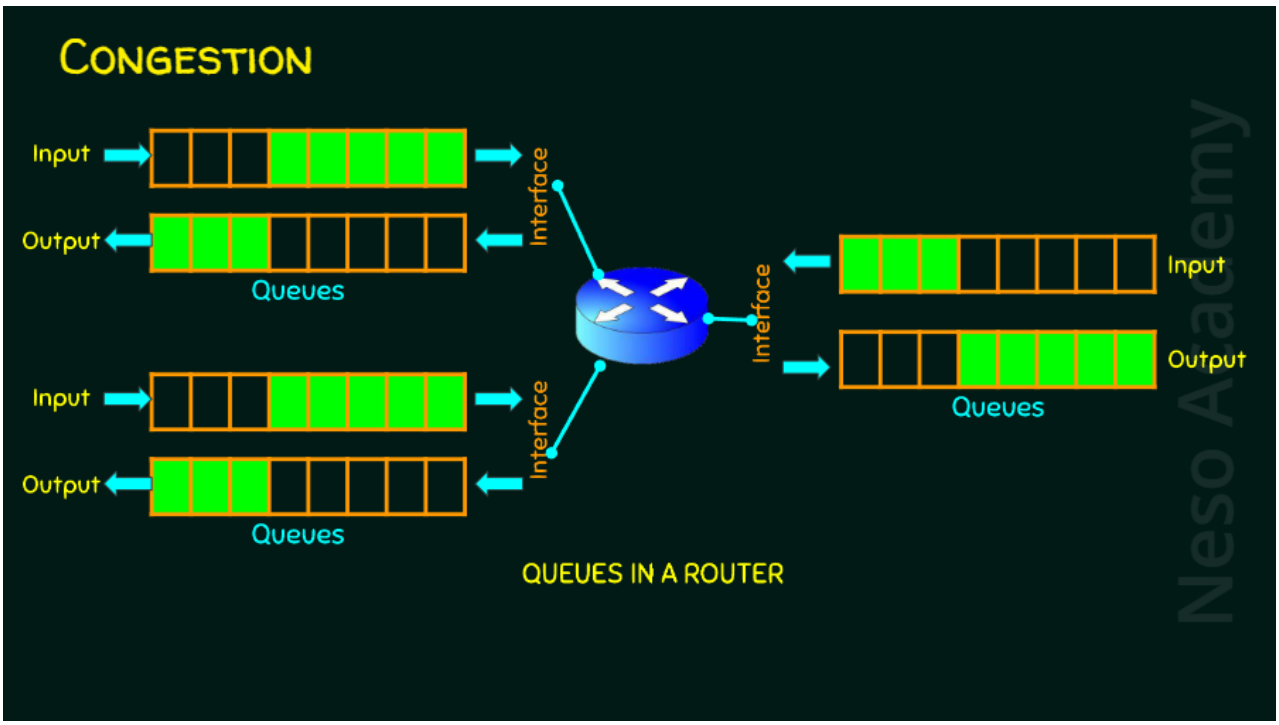
Outcomes★★Neso Academy



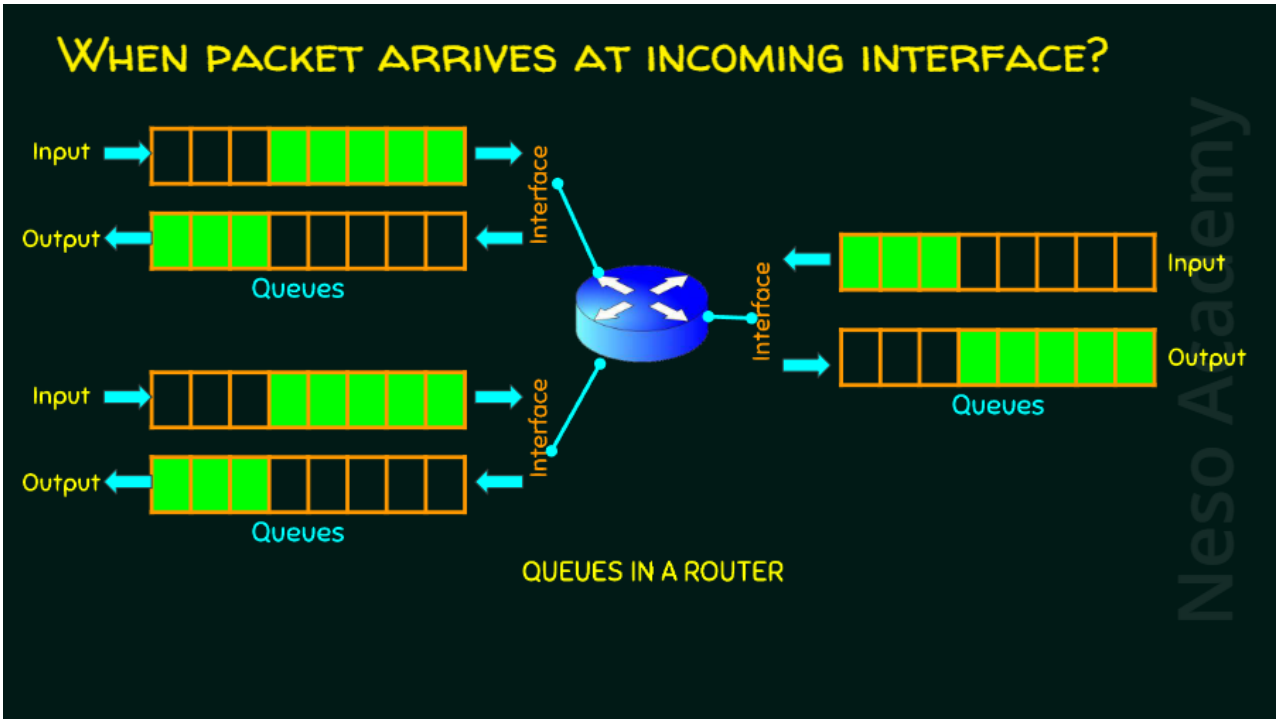
Switching TechniquesNeso Academy



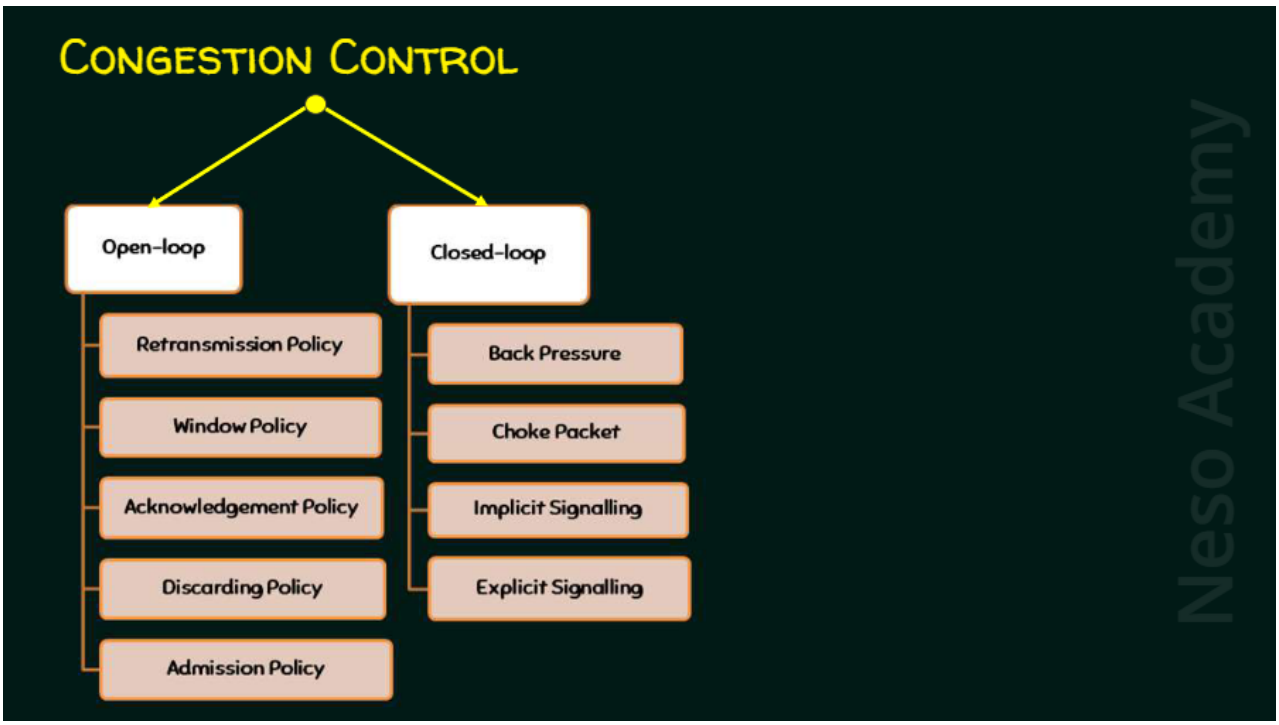
Congestion -AnalogyNeso Academyproudly presents....Neso Academy



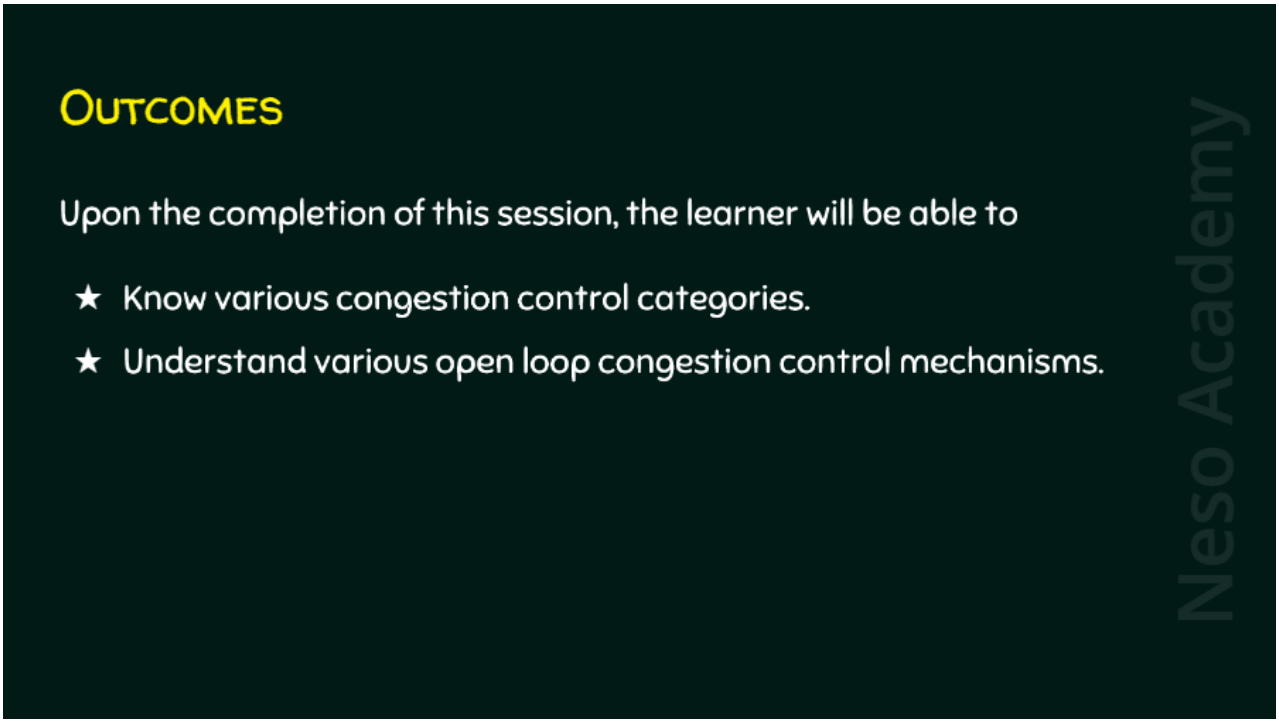
CongestionNeso Academy



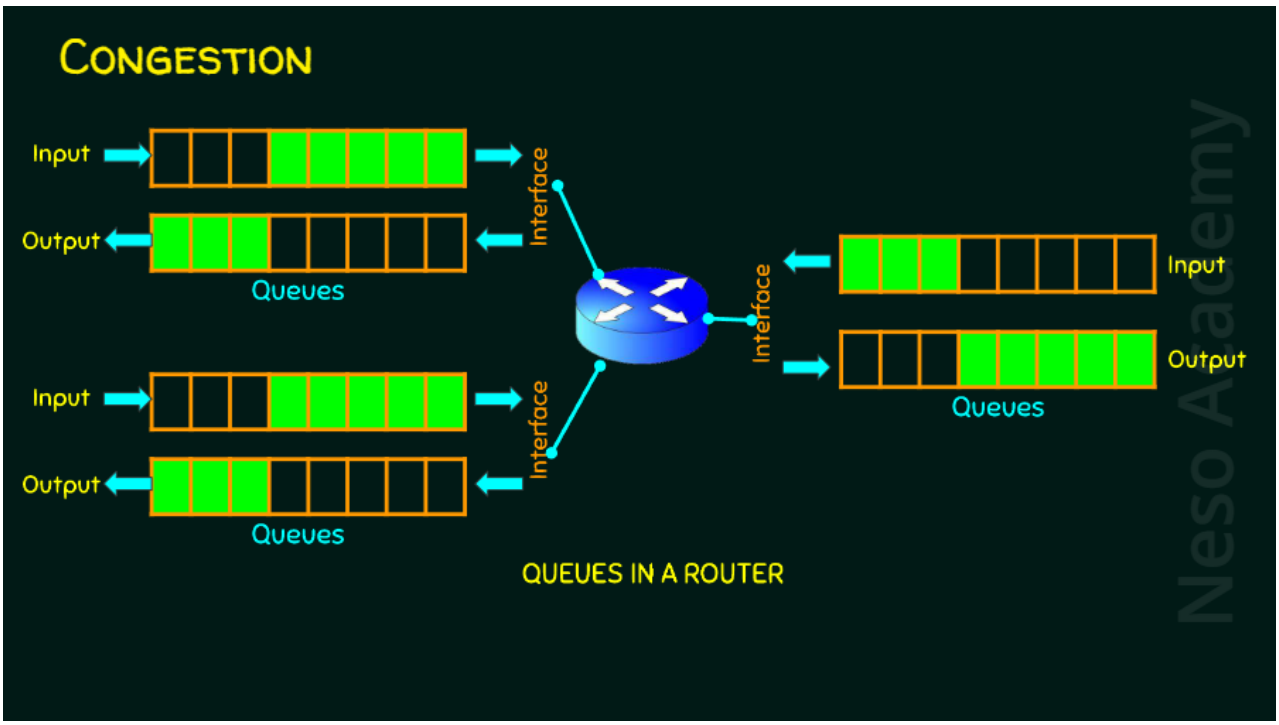
When packet arrives at incoming interface?Neso Academy



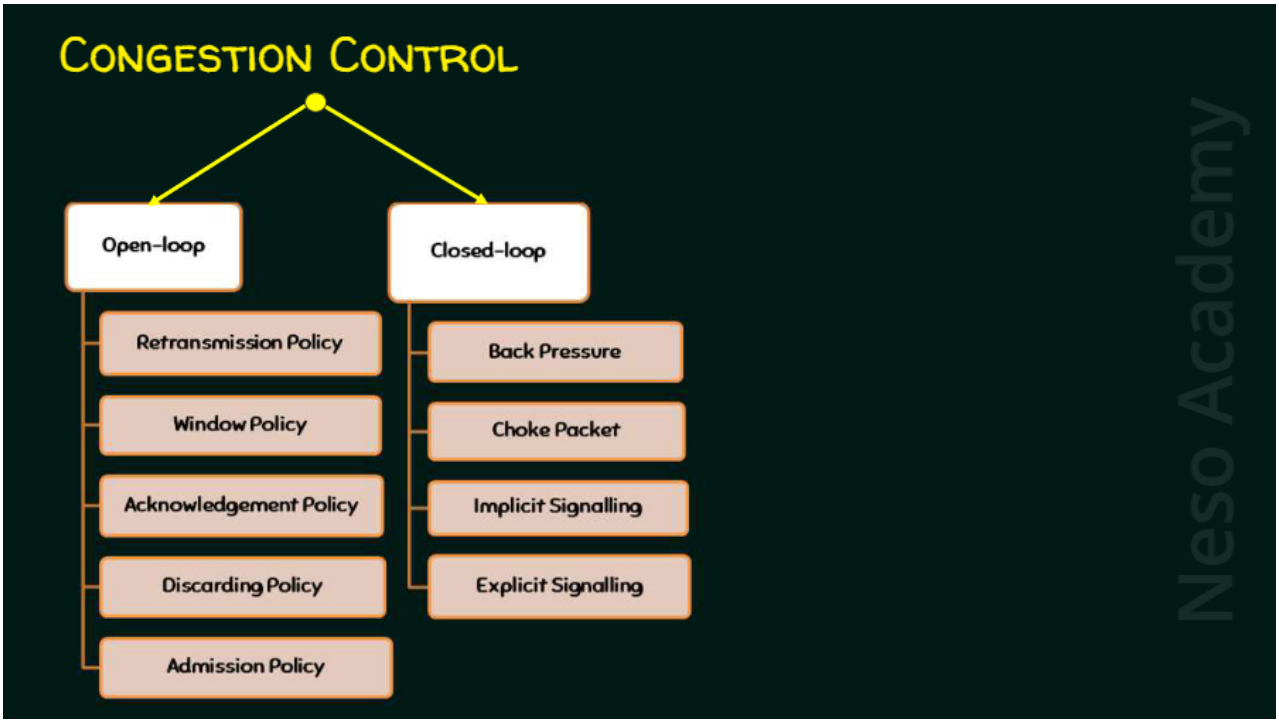
Congestion ControlNeso Academy



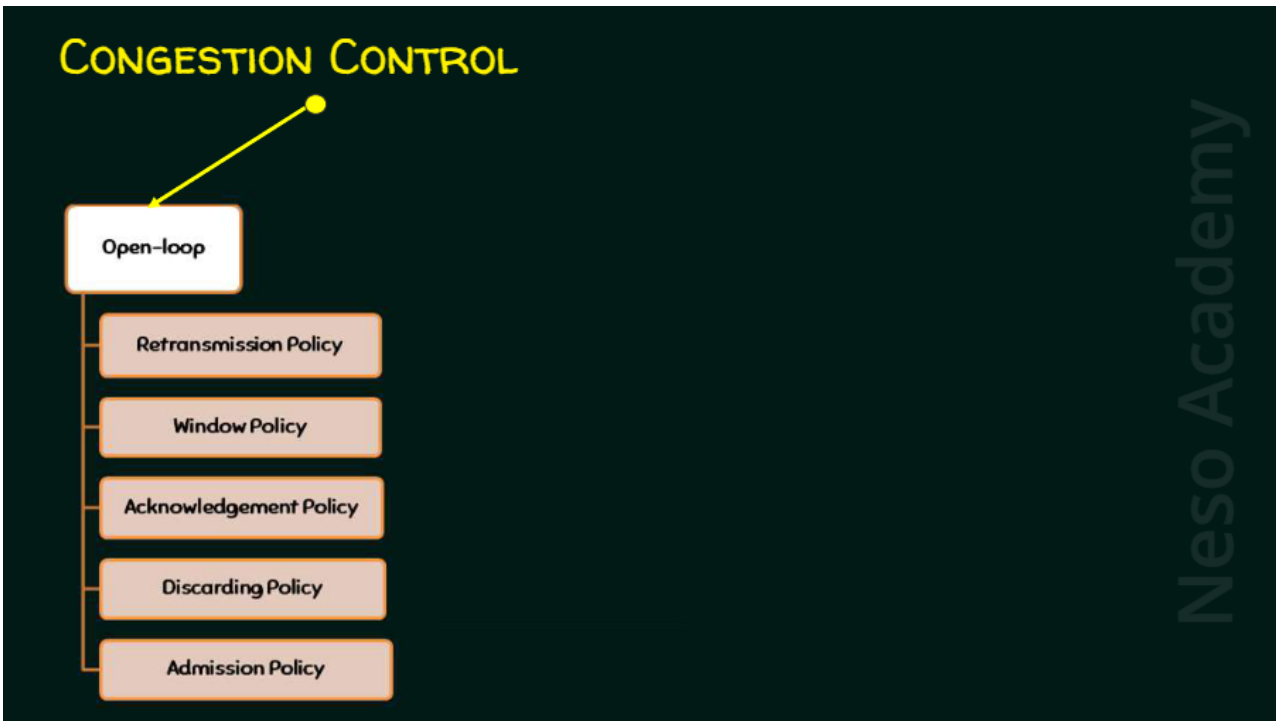
Outcomes★★Neso Academy



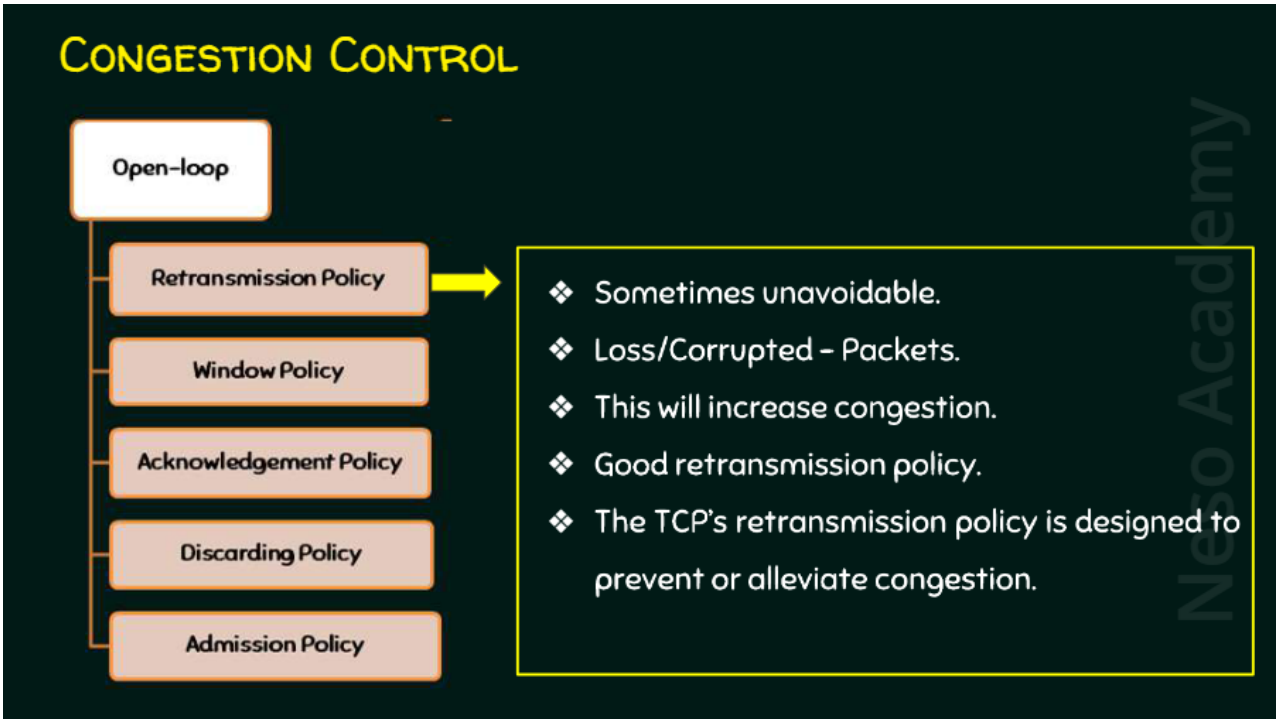
CongestionNeso Academy



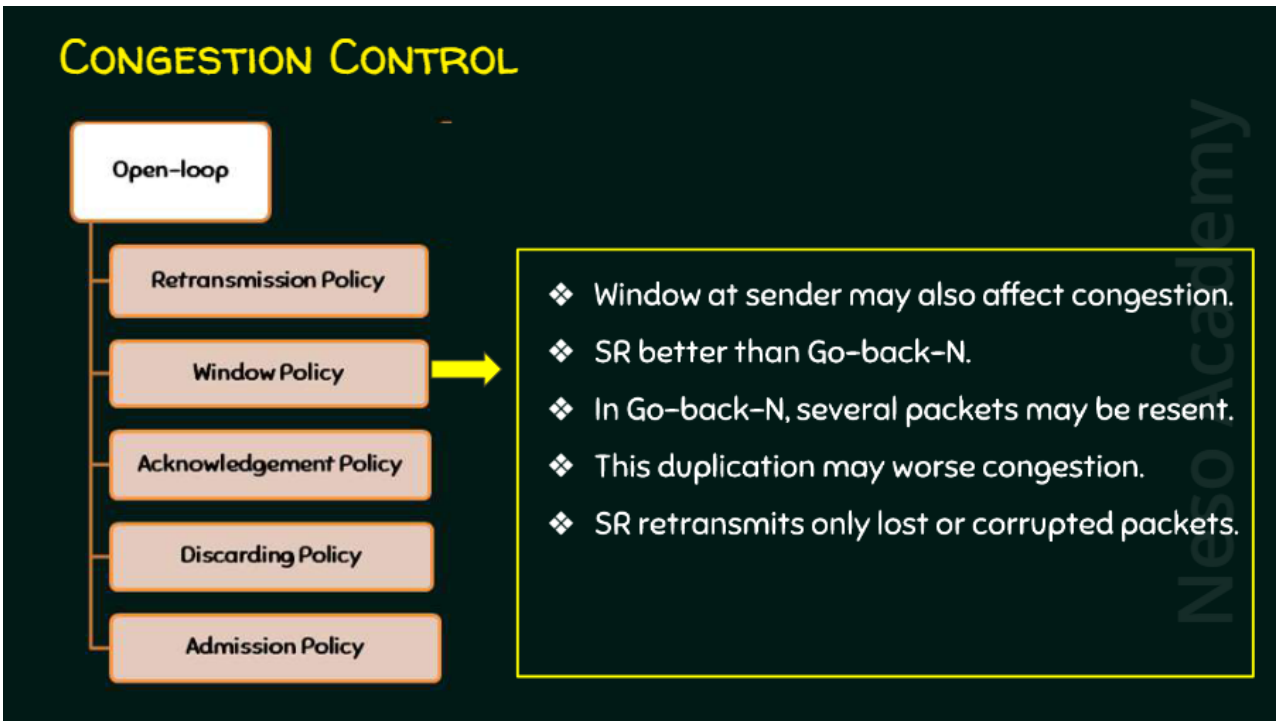
Congestion ControlNeso Academy



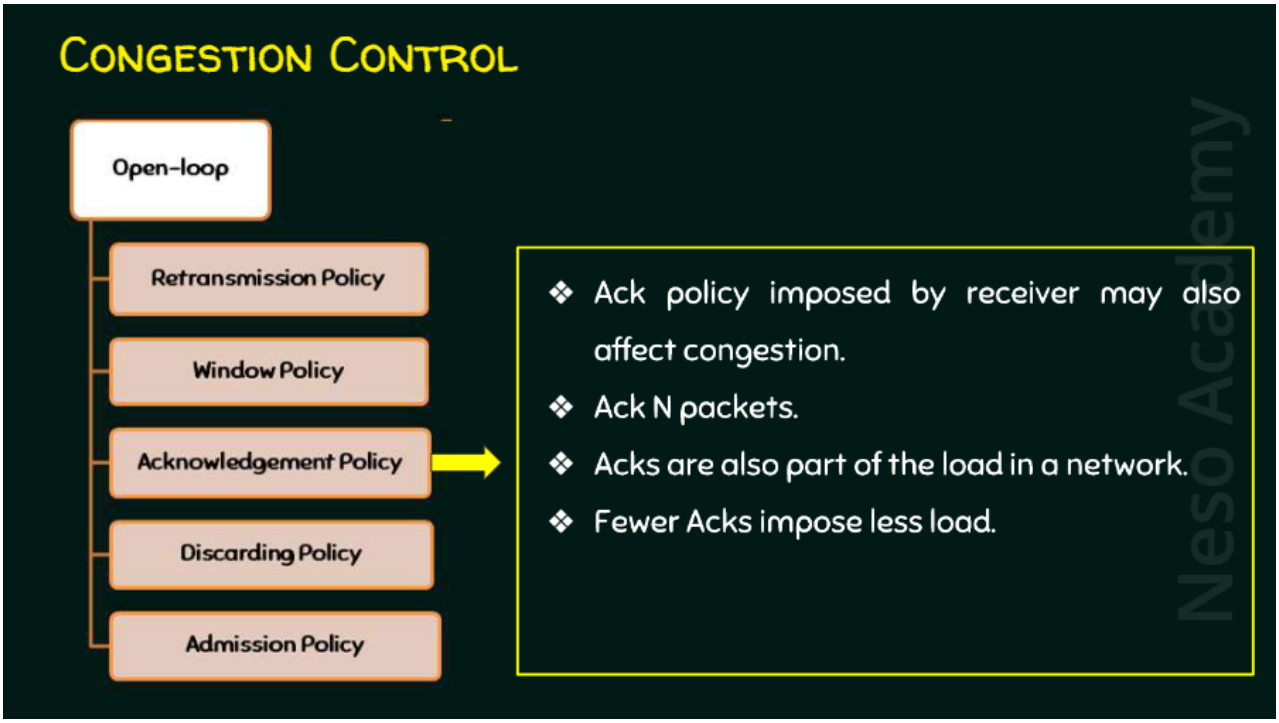
Congestion ControlNeso Academy



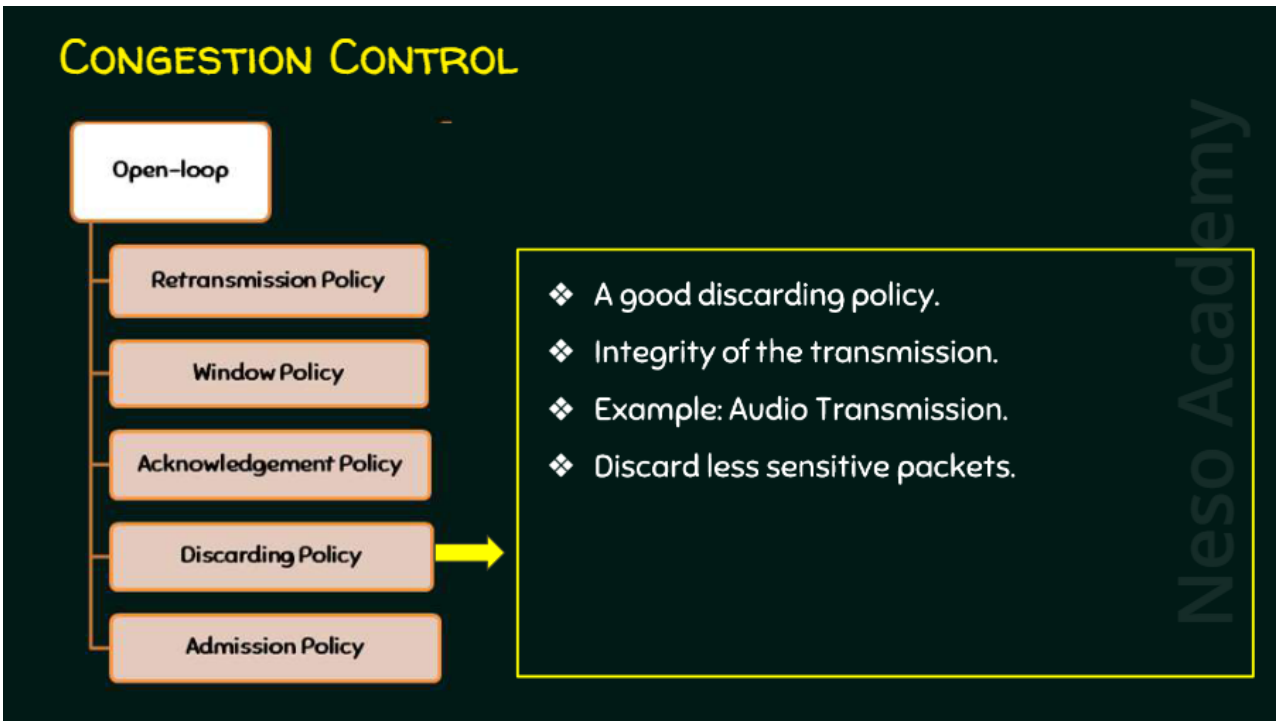
Congestion Control❖❖❖❖❖Neso Academy



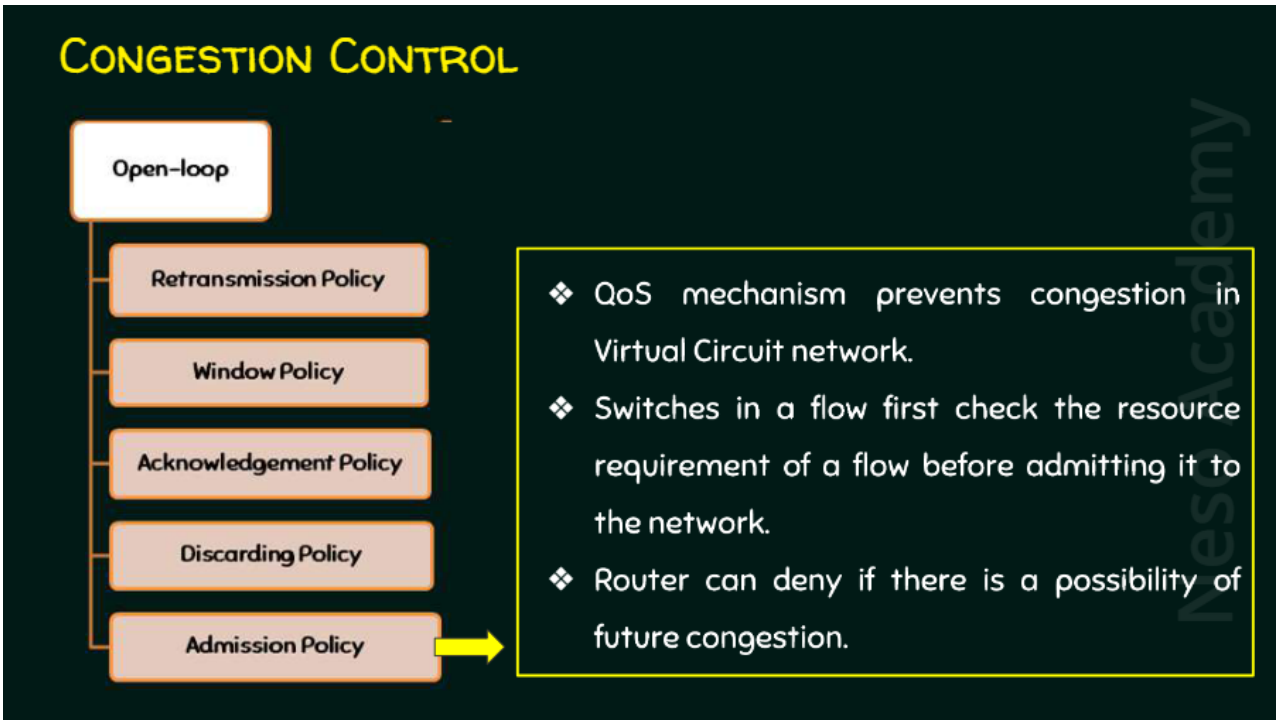
Congestion Control❖❖❖❖❖Neso Academy



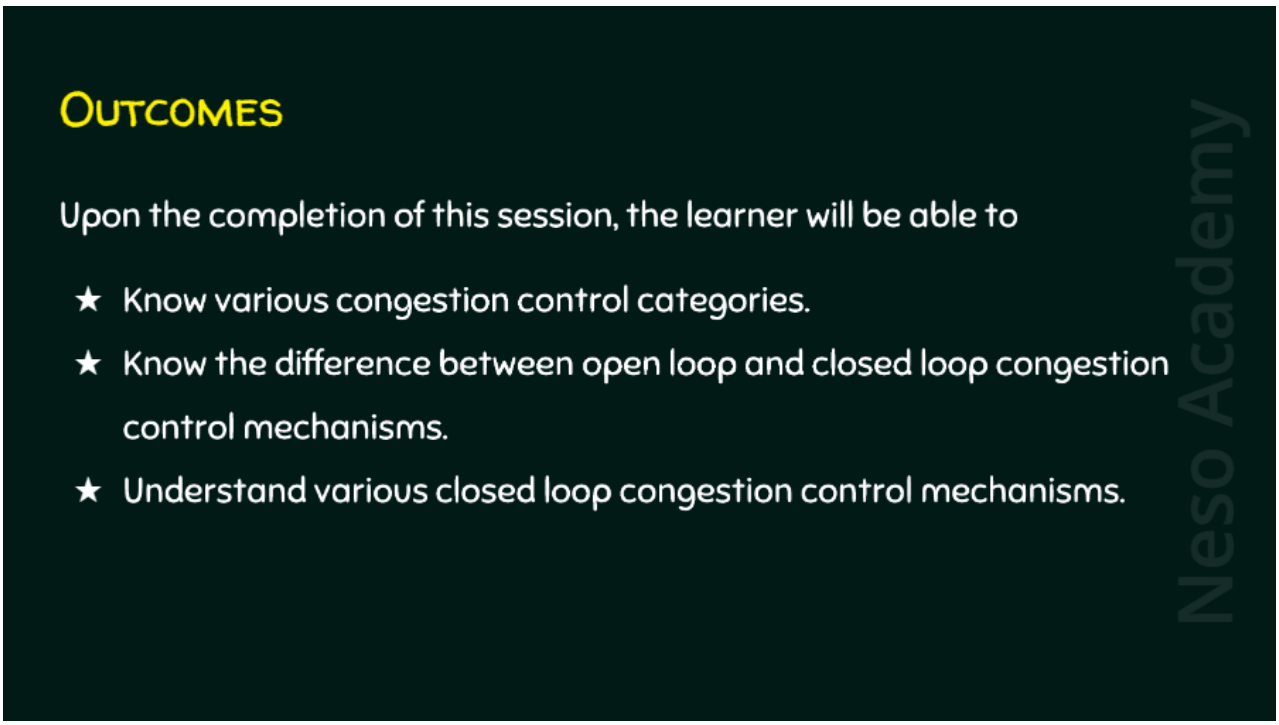
Congestion Control❖❖❖❖Neso Academy



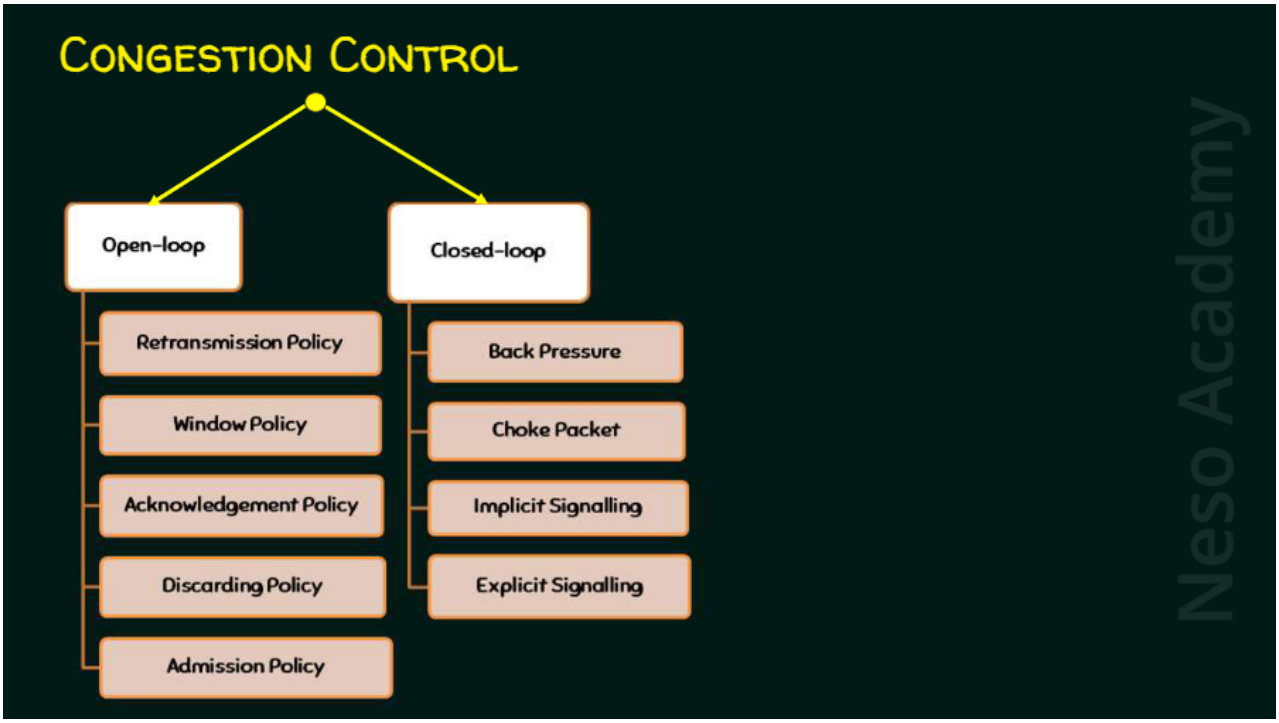
Congestion Control❖❖❖❖Neso Academy



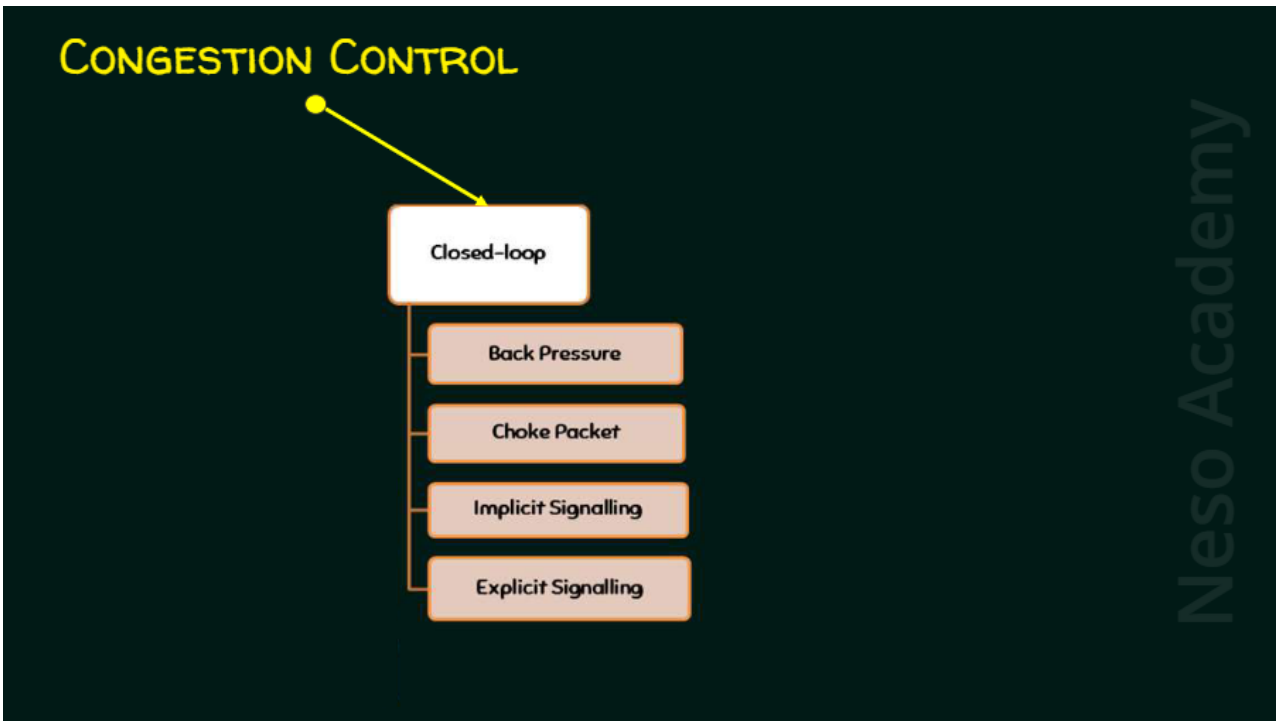
Congestion Control❖❖❖Neso Academy



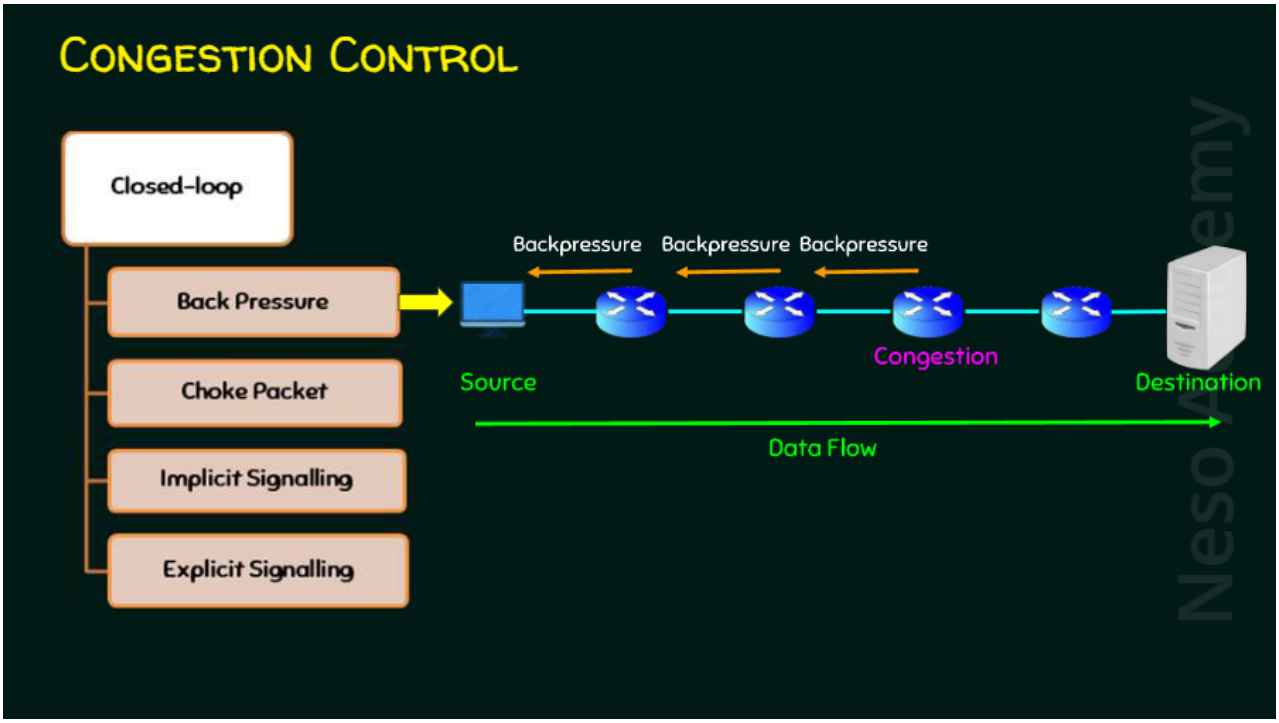
Outcomes★★★Neso Academy



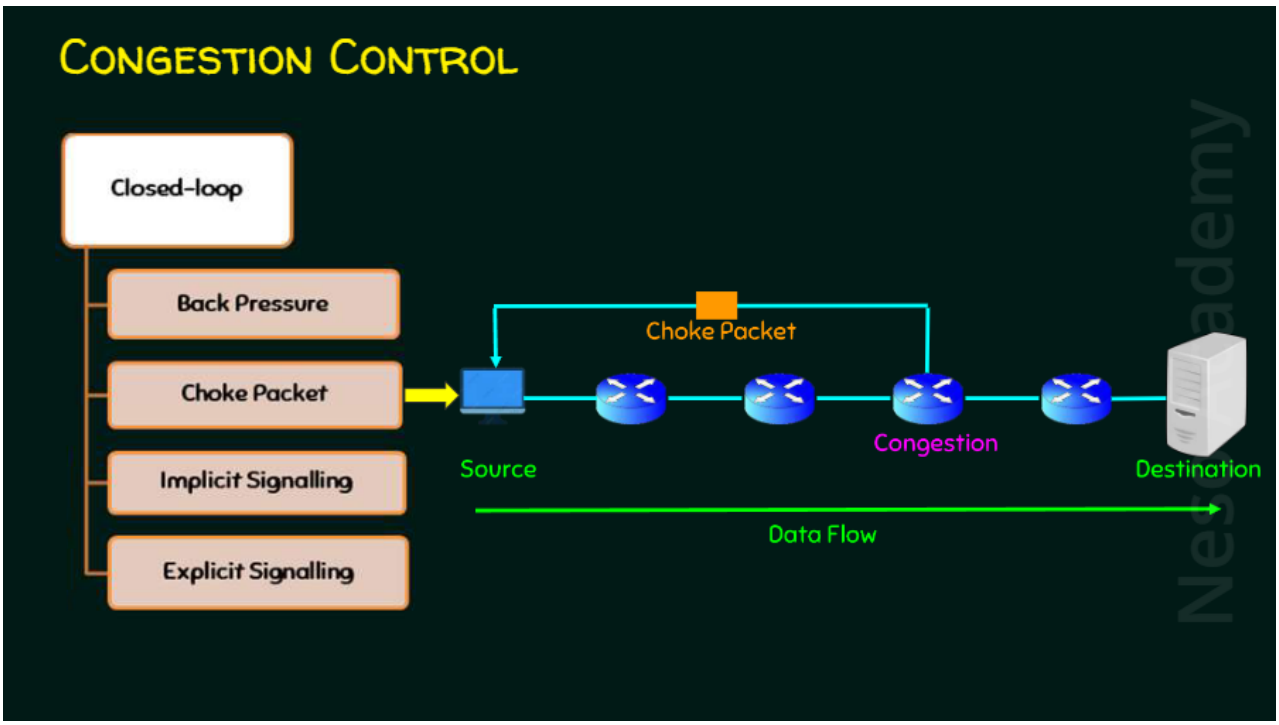
Congestion ControlNeso Academy



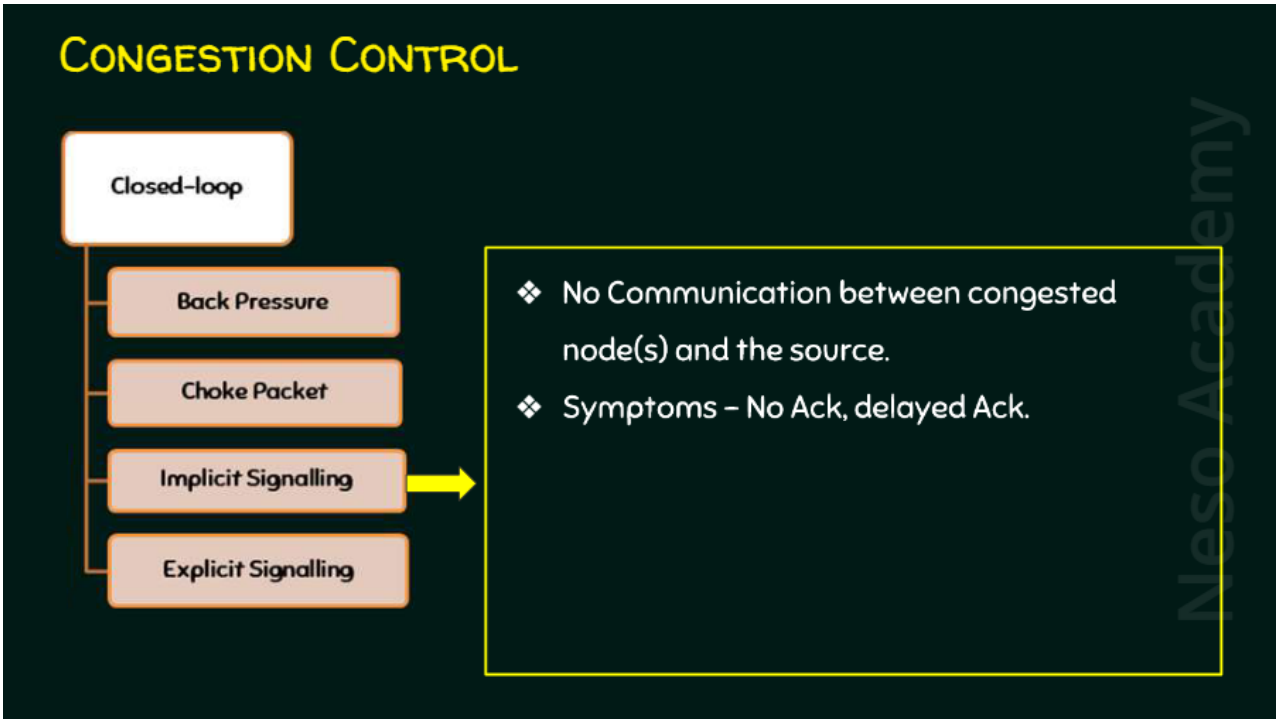
Congestion ControlNeso Academy



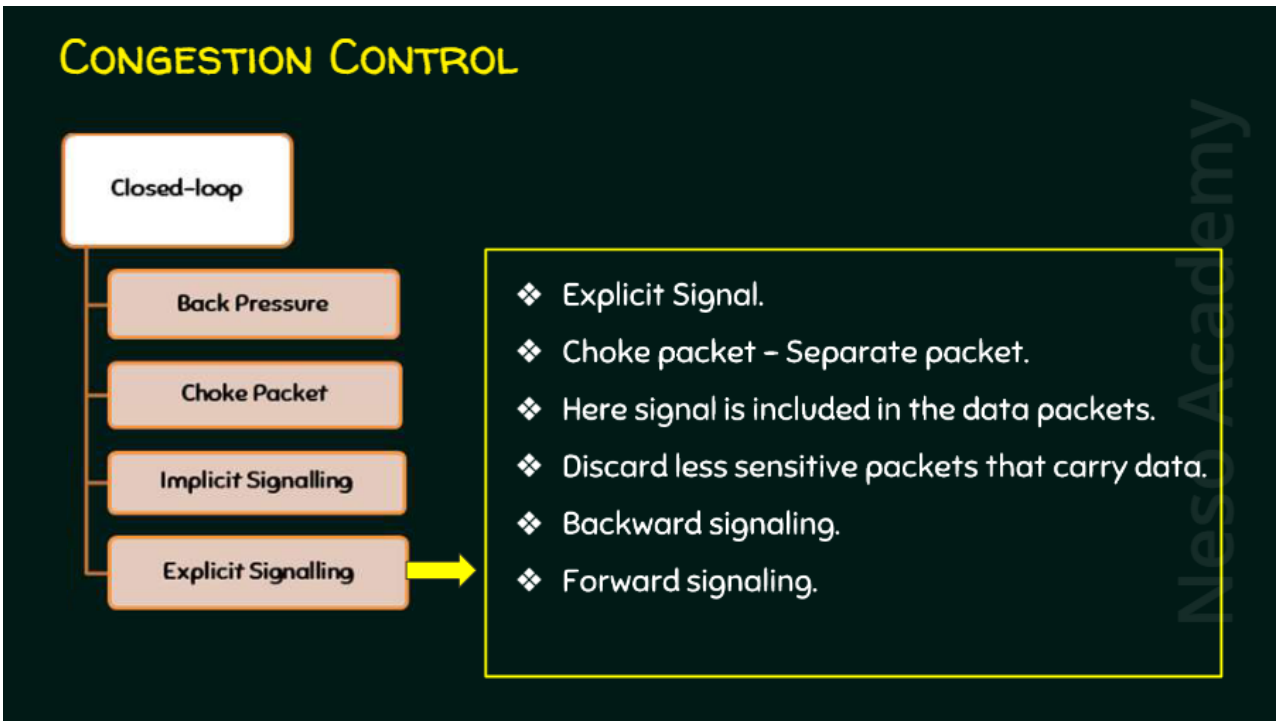
Congestion ControlNeso Academy



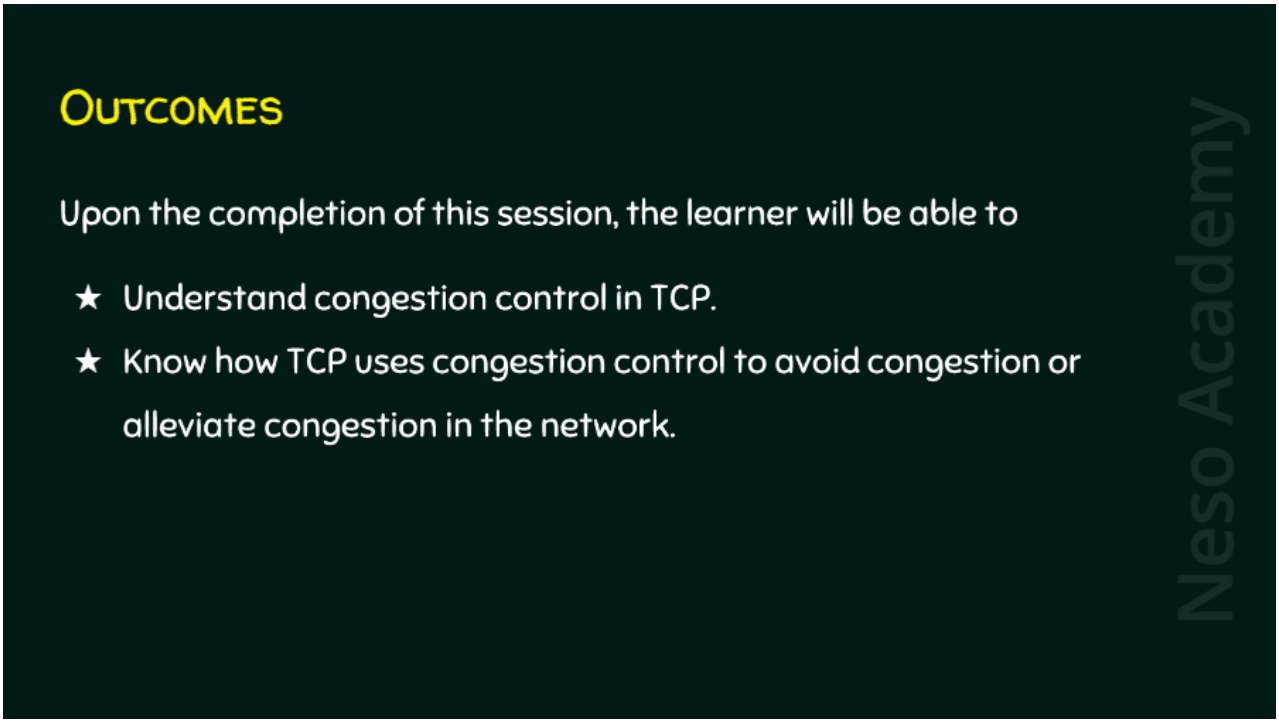
Congestion ControlNeso Academy



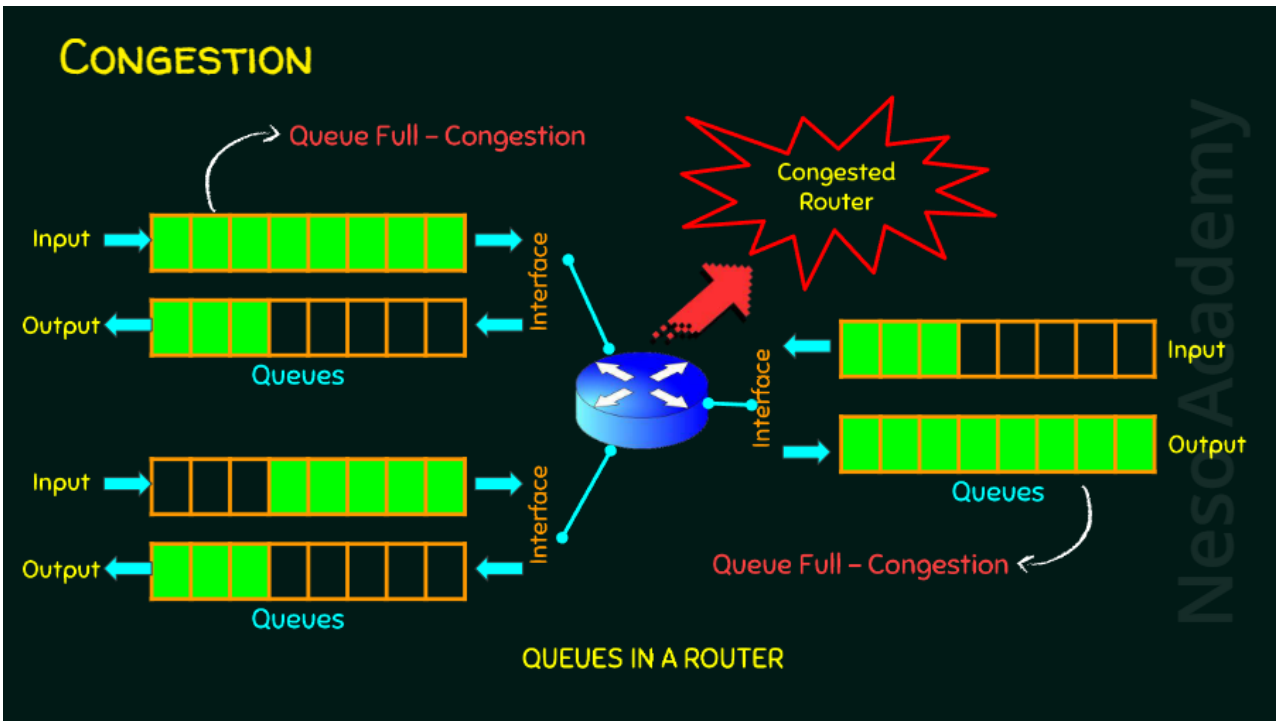
Congestion Control❖❖Neso Academy



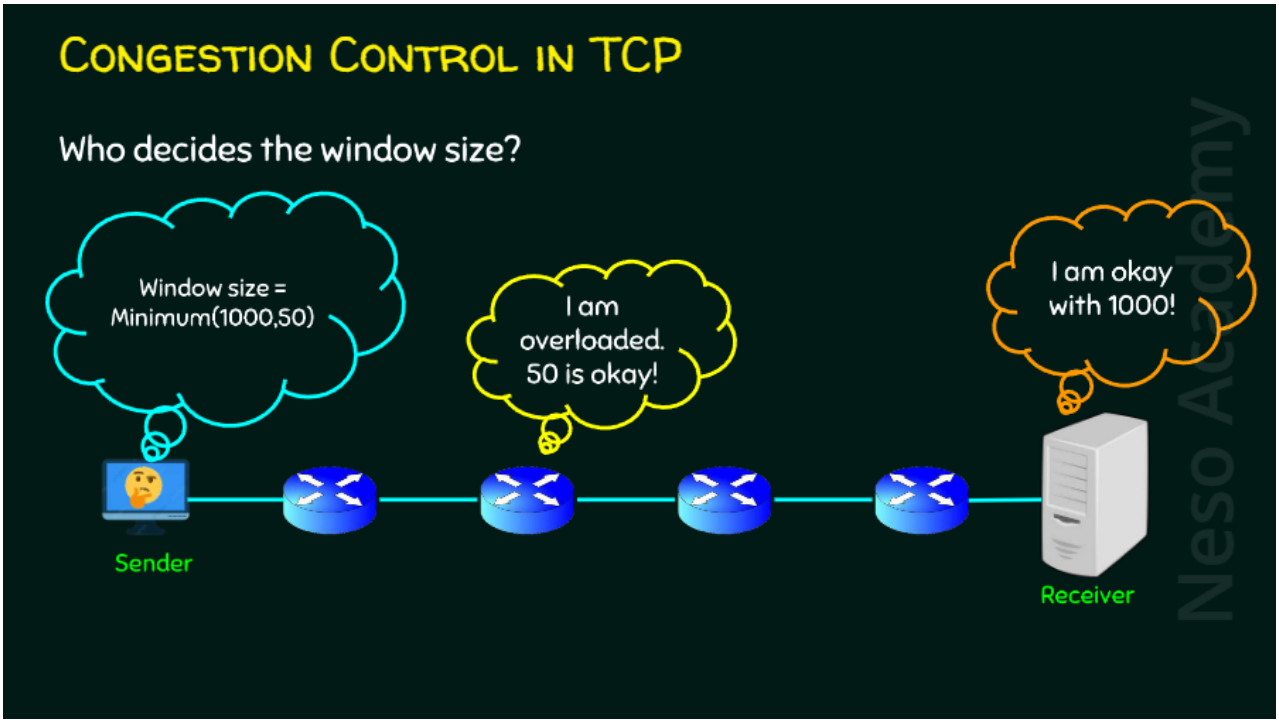
Congestion Control❖❖❖❖❖❖Neso Academy



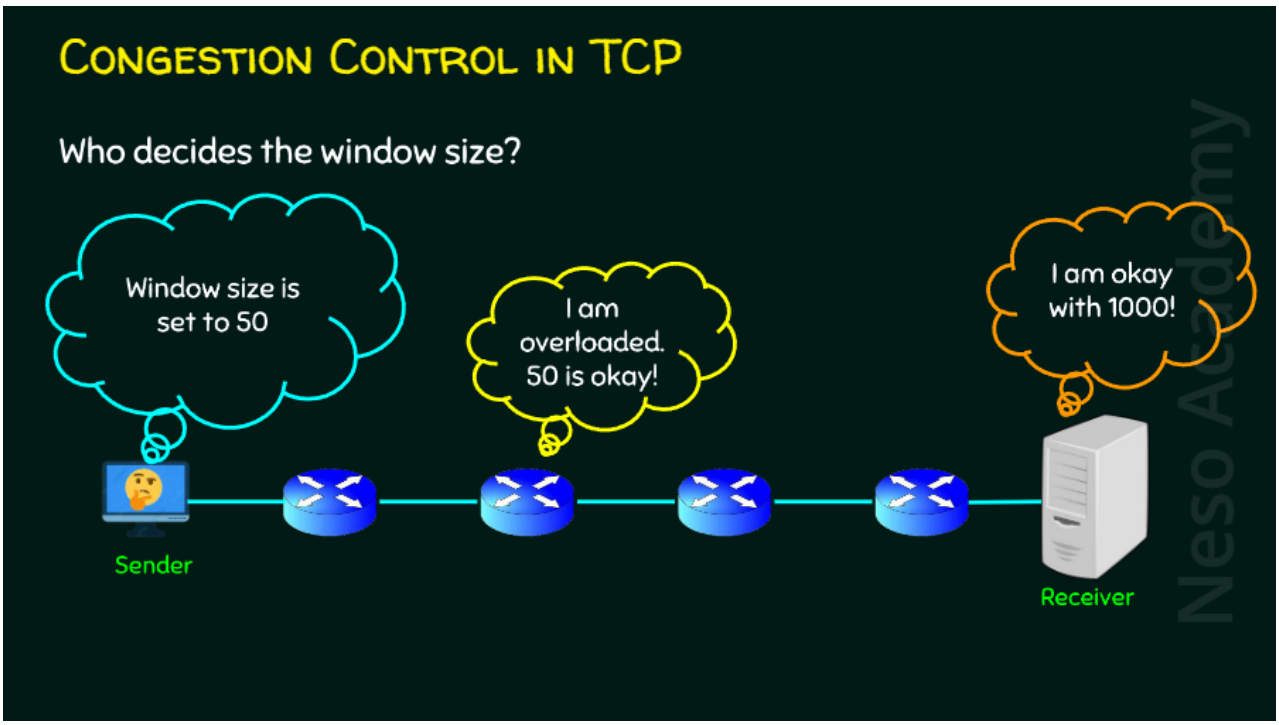
Outcomes★★Neso Academy



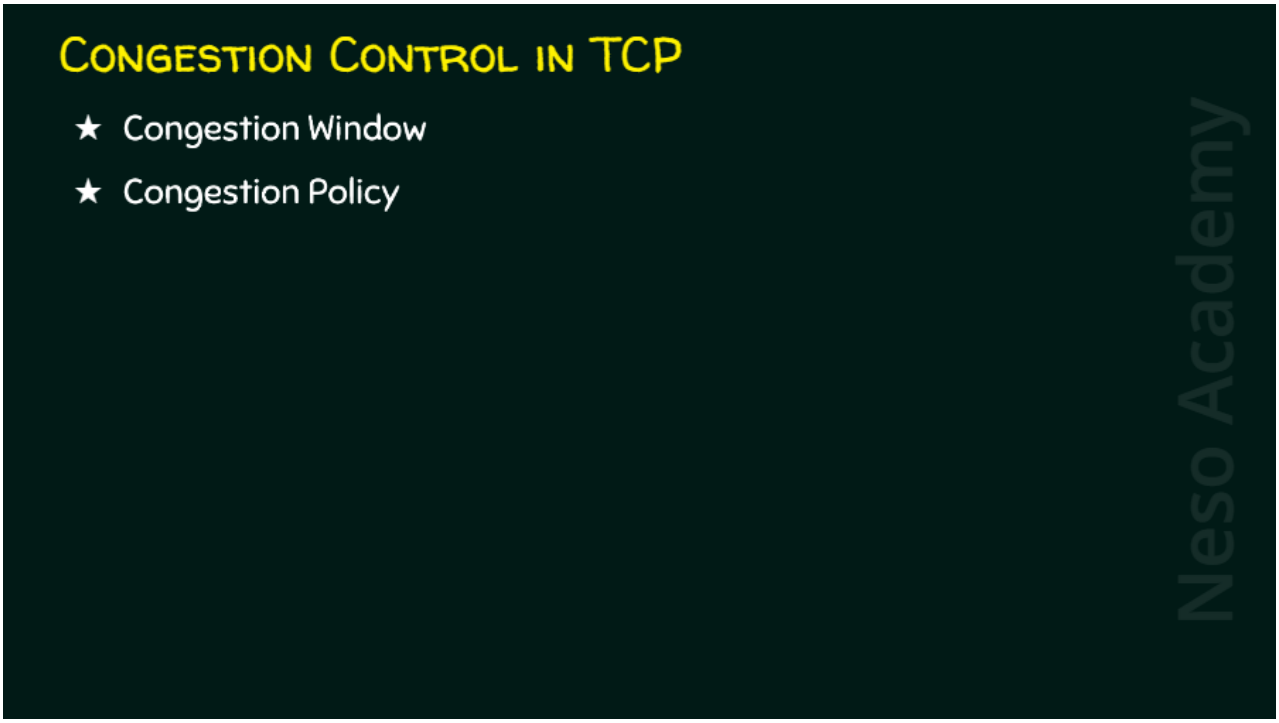
CongestionNeso Academy



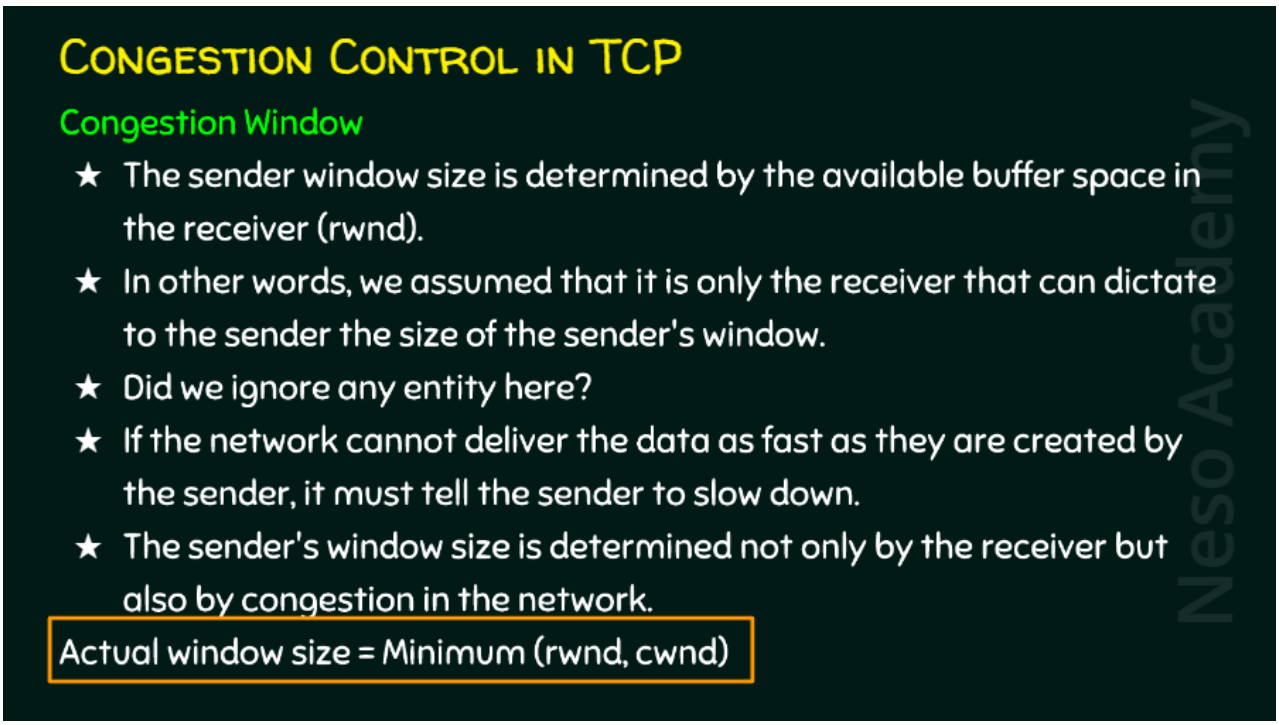
Congestion Control in TCPNeso Academy



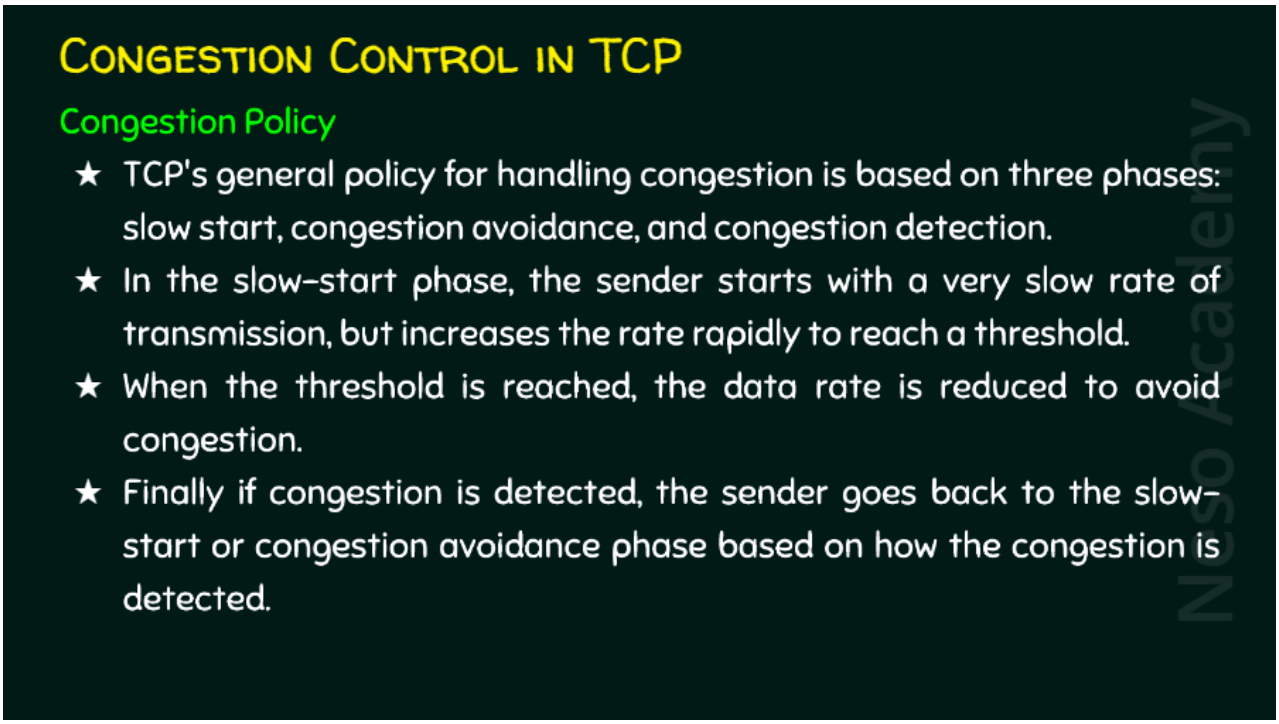
Congestion Control in TCPNeso Academy



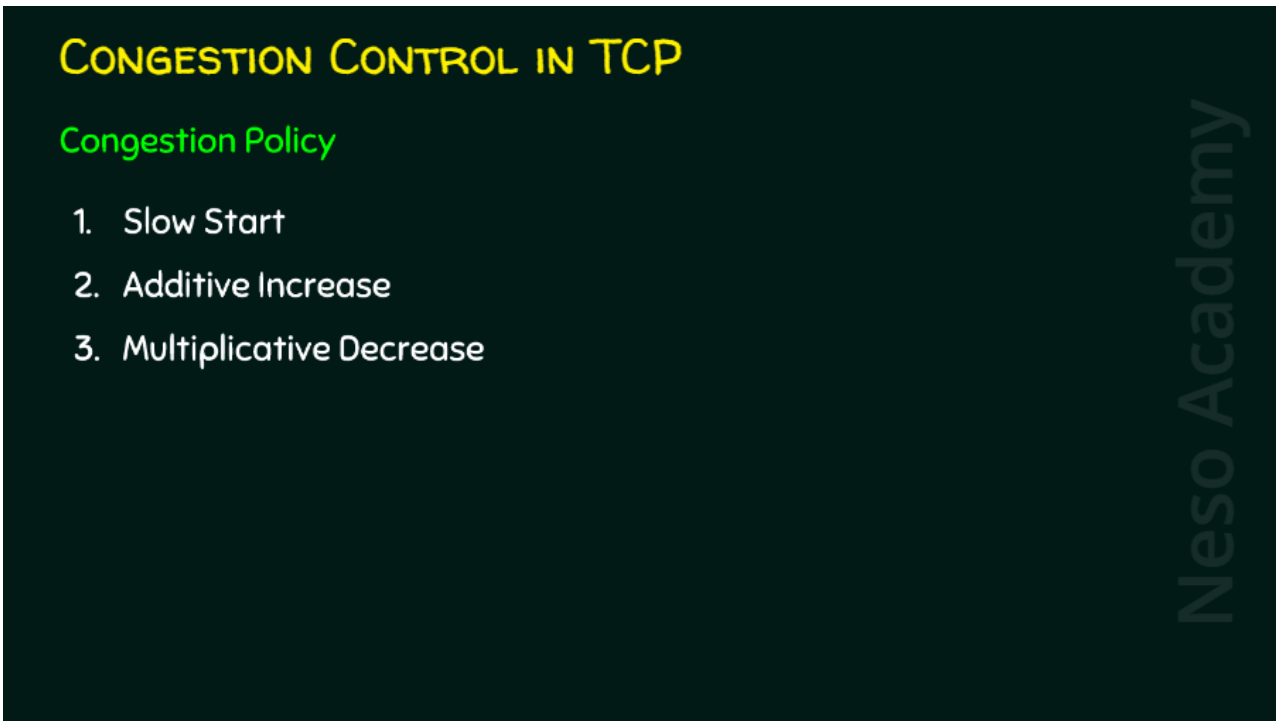
Congestion Control in TCP★★Neso Academy



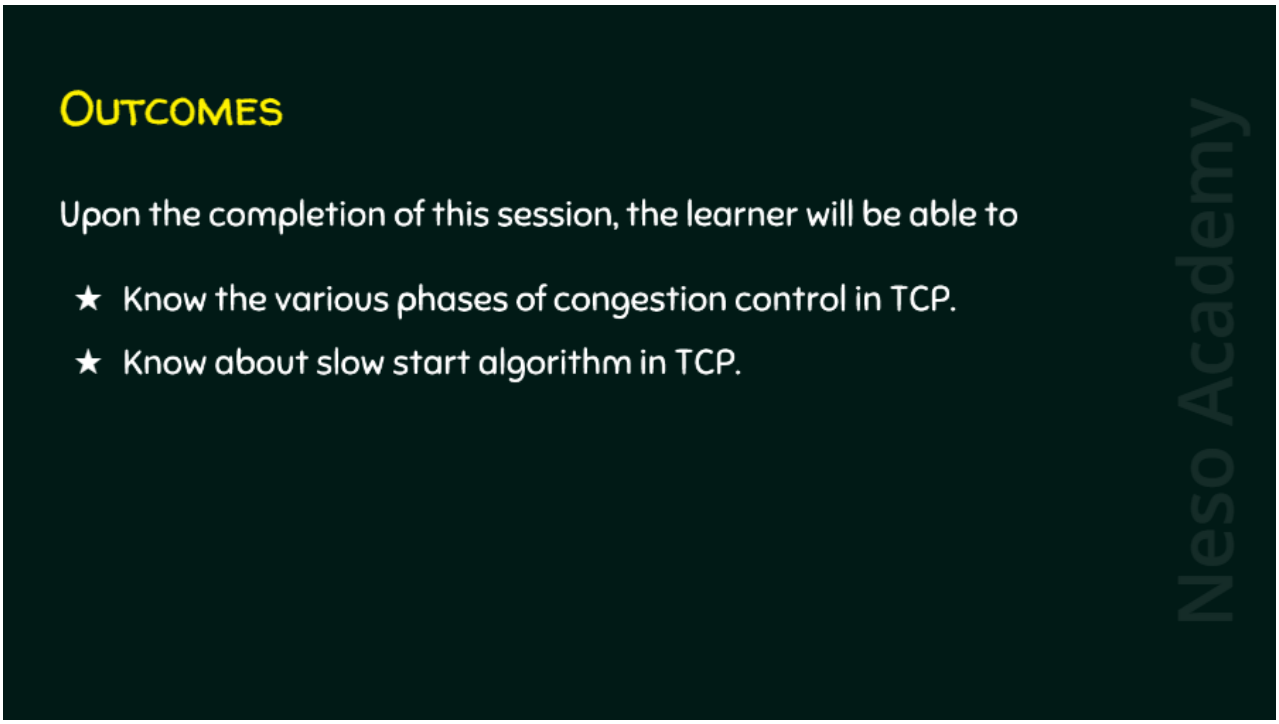
Congestion Control in TCP★★★★★Neso Academy



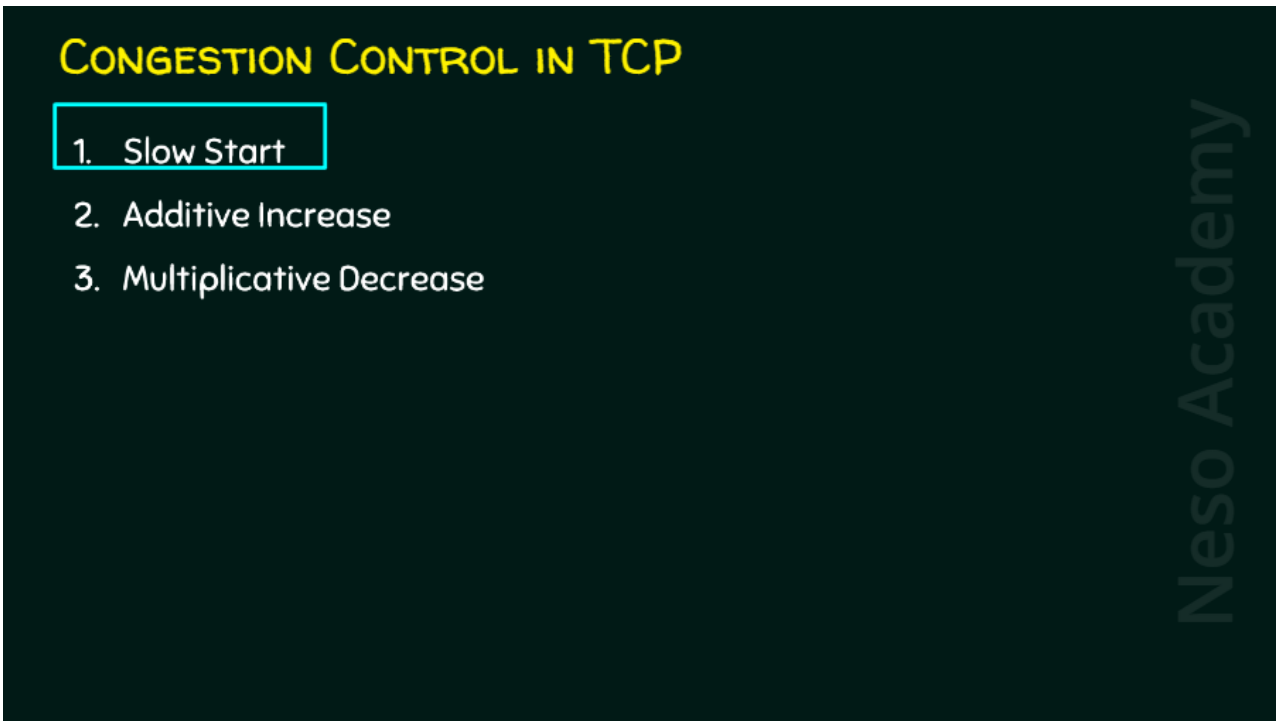
Congestion Control in TCP★★★★Neso Academy



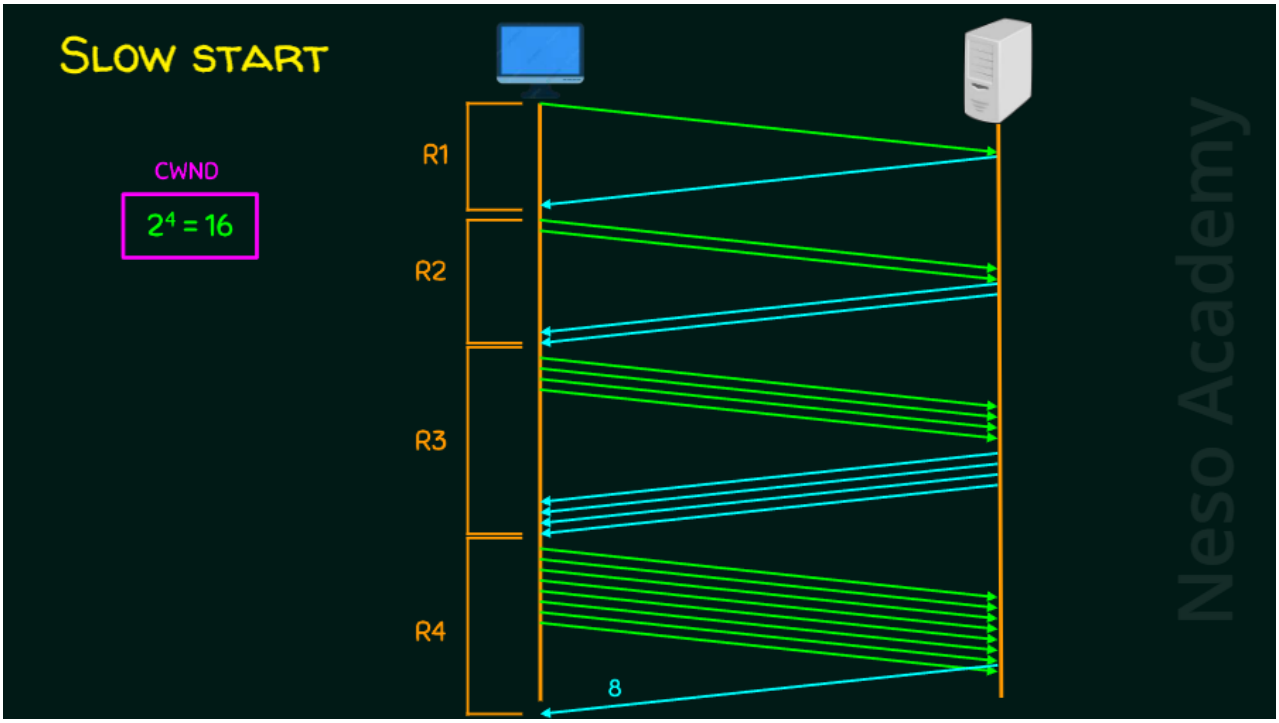
Congestion Control in TCPNeso Academy



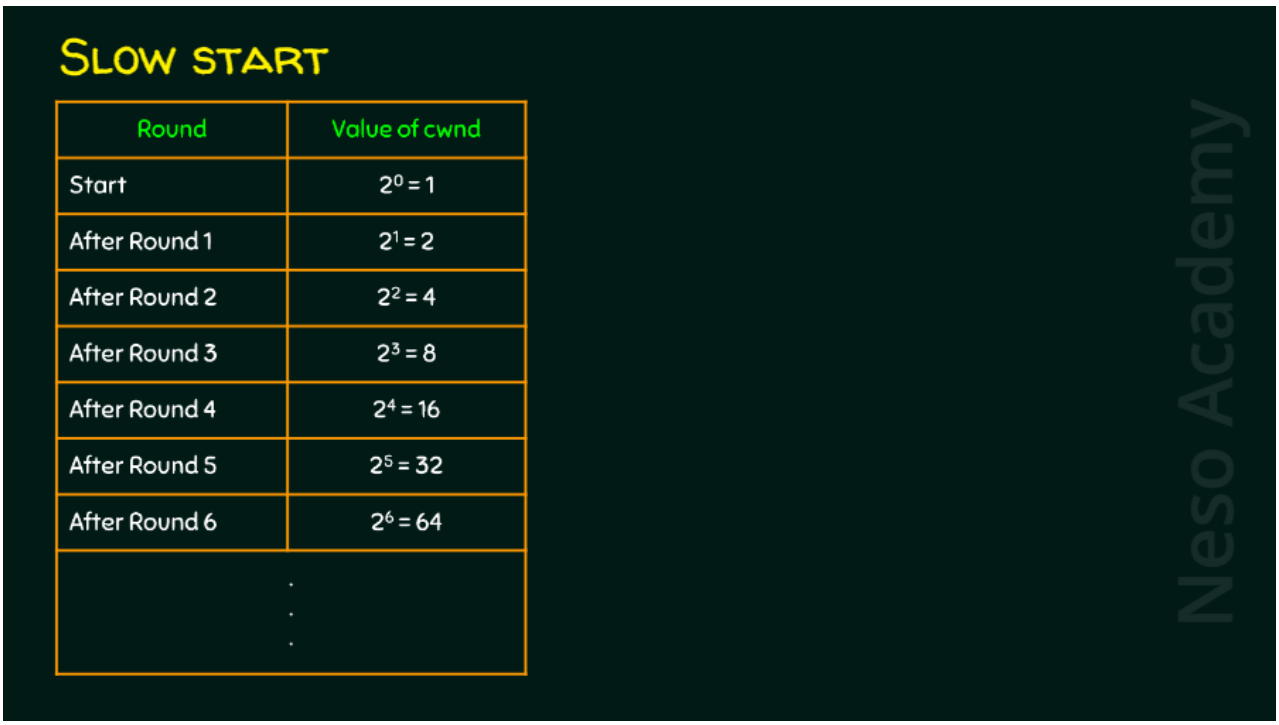
Outcomes★★Neso Academy



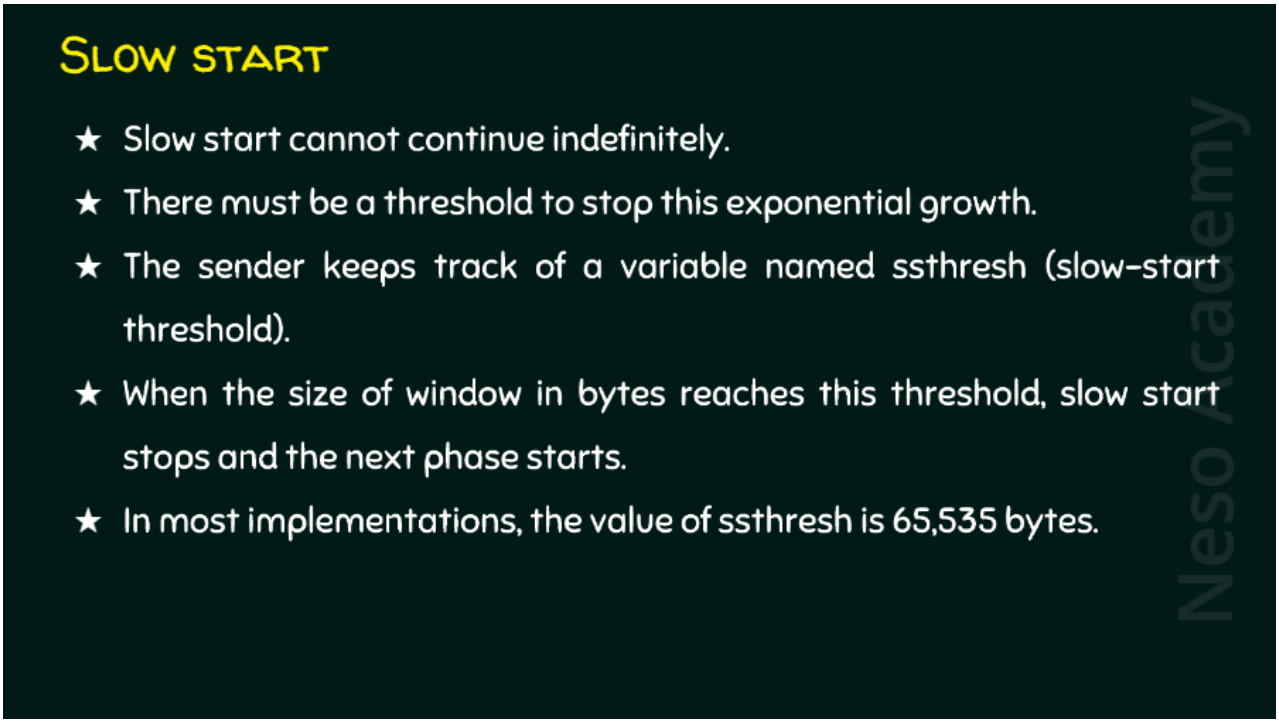
Congestion Control in TCPNeso Academy



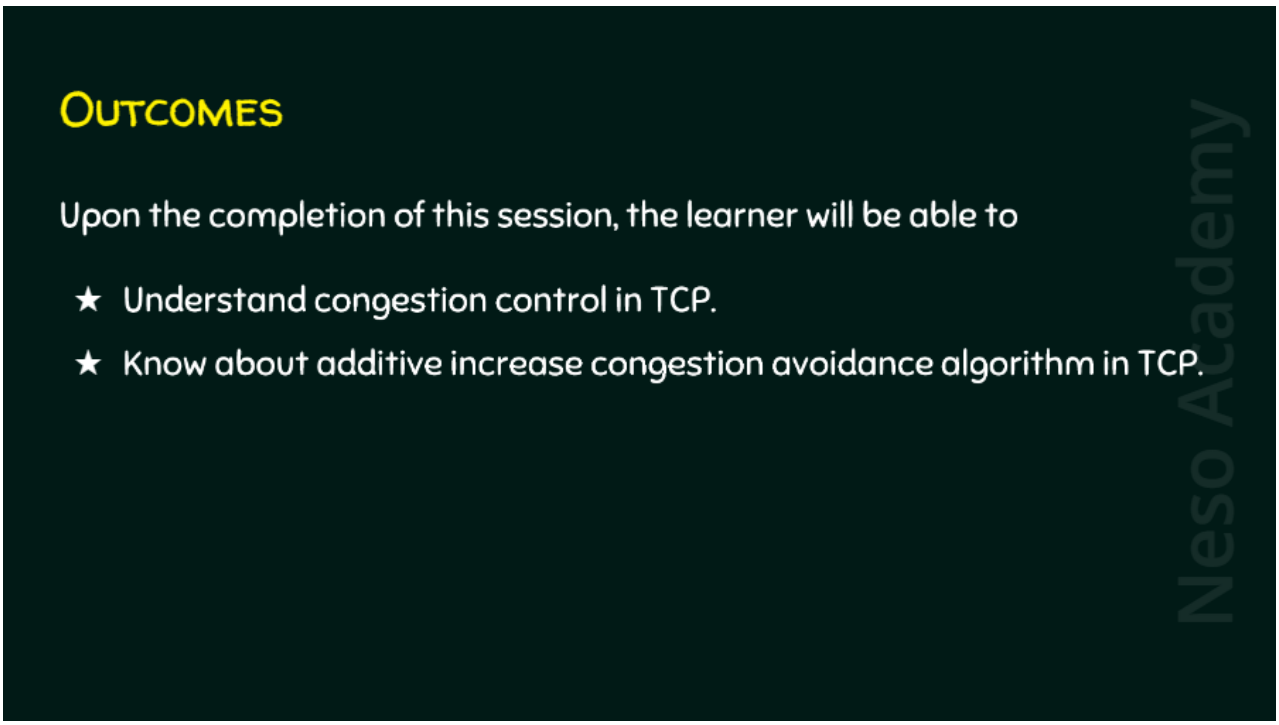
Slow startNeso Academy



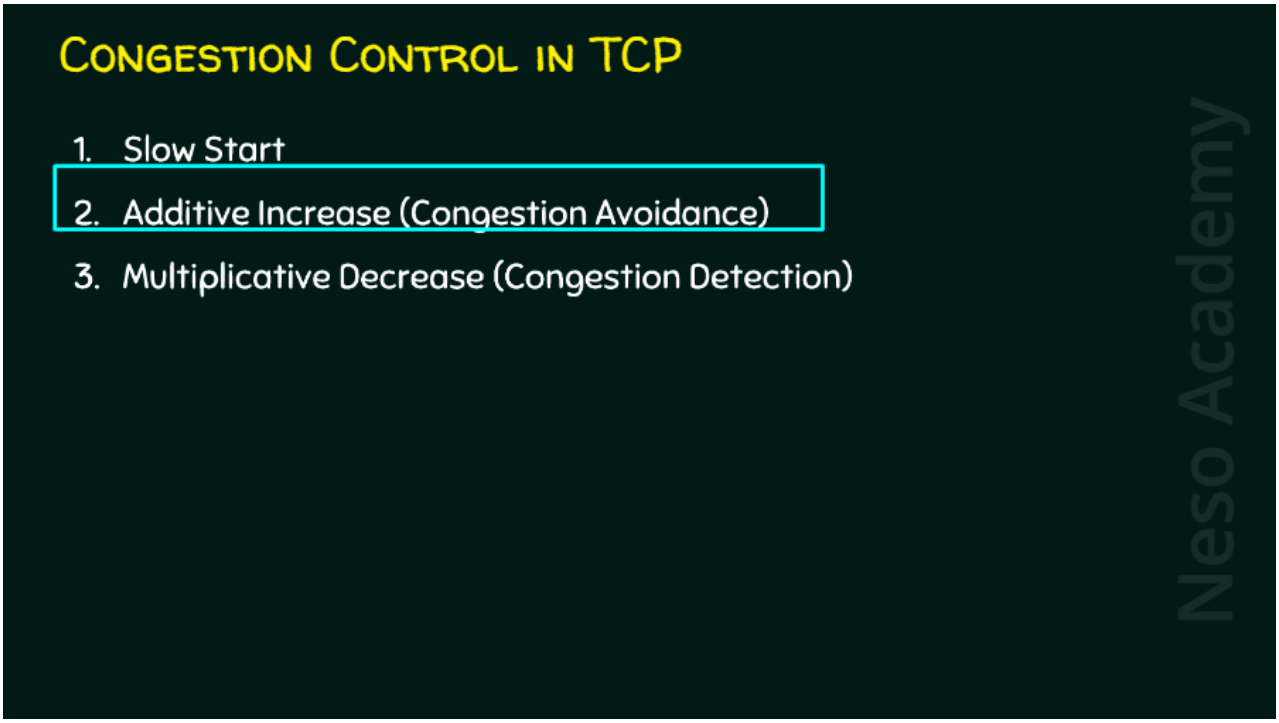
Slow startNeso Academy



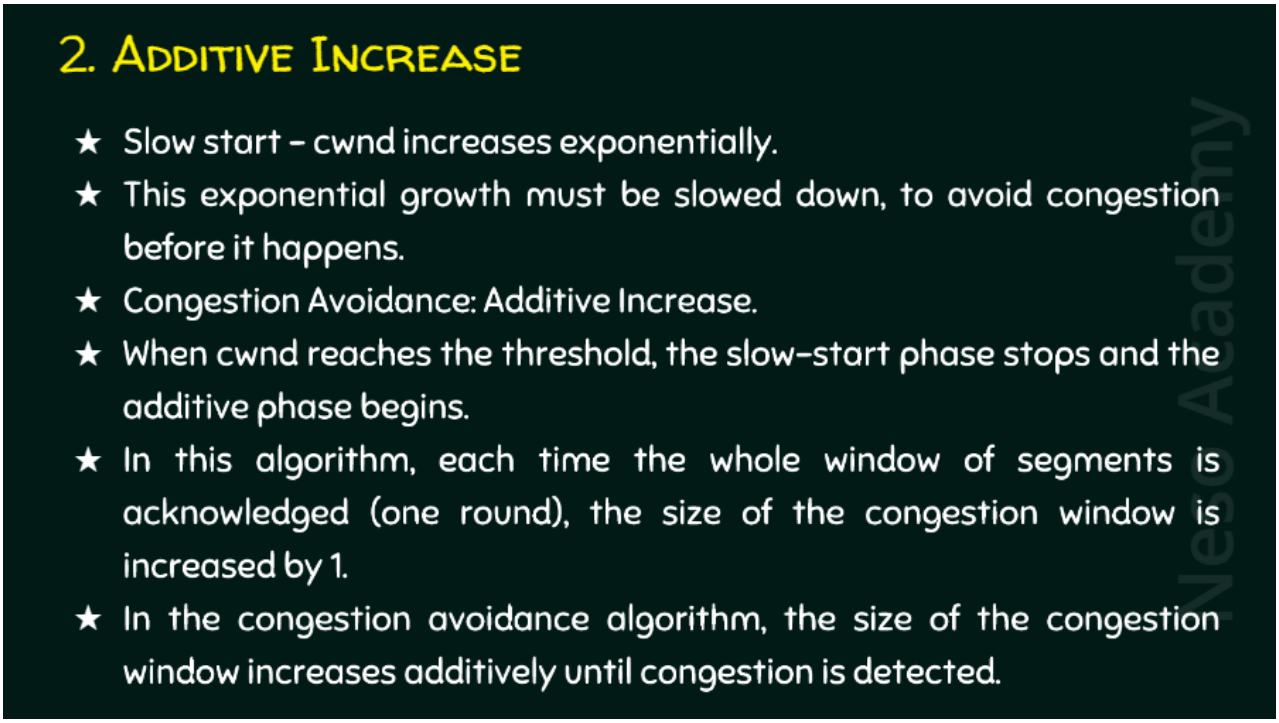
Slow start★★★★★Neso Academy



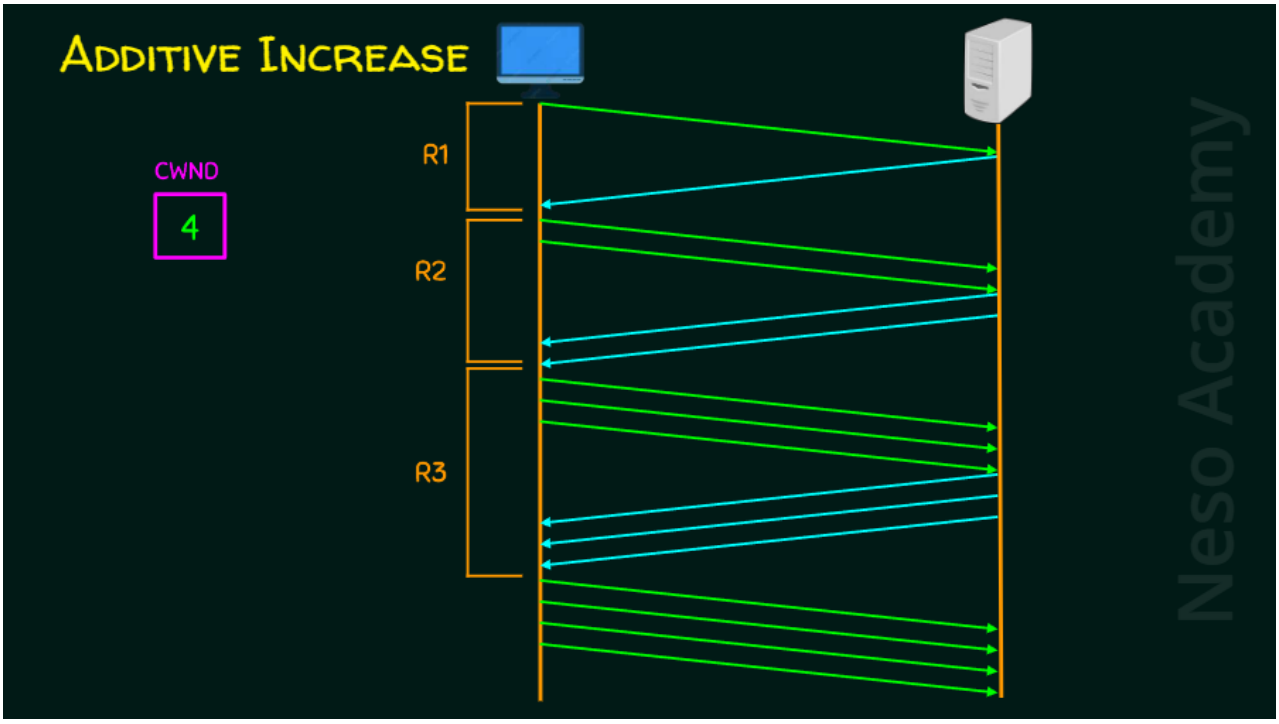
Outcomes★★Neso Academy



Congestion Control in TCPNeso Academy



2. Additive Increase★★★★★★Neso Academy

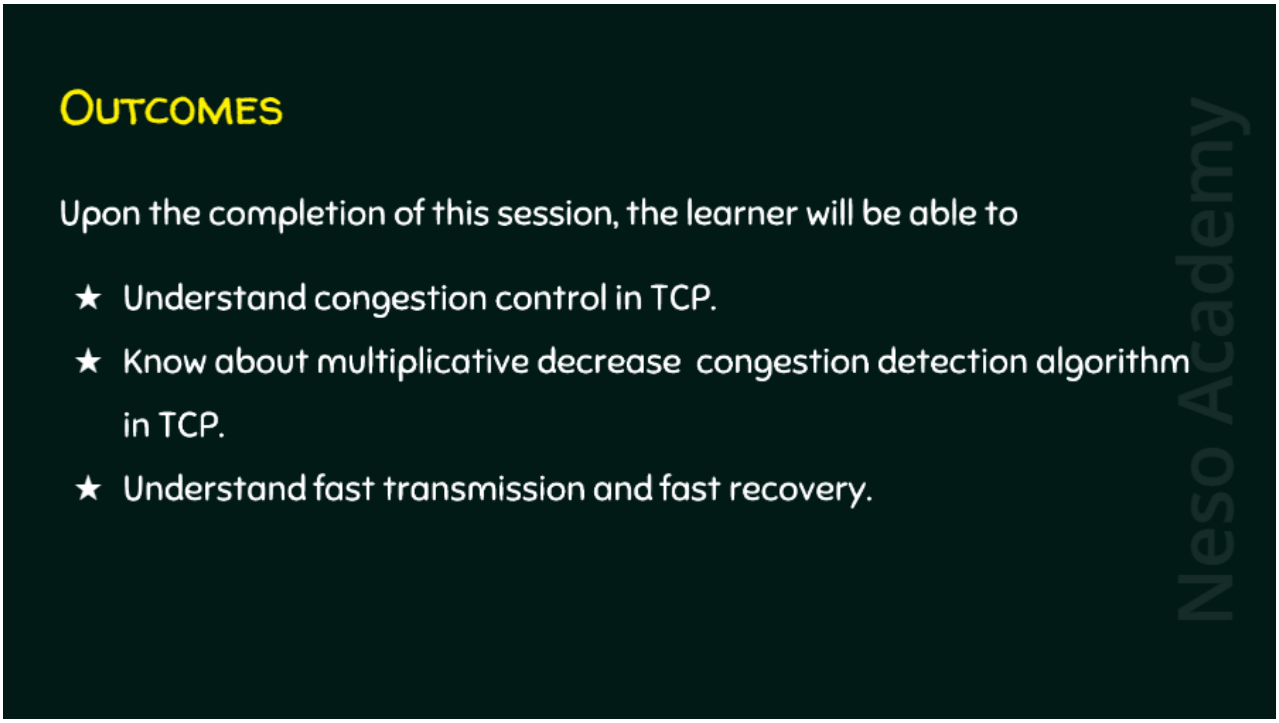


Additive IncreaseNeso Academy

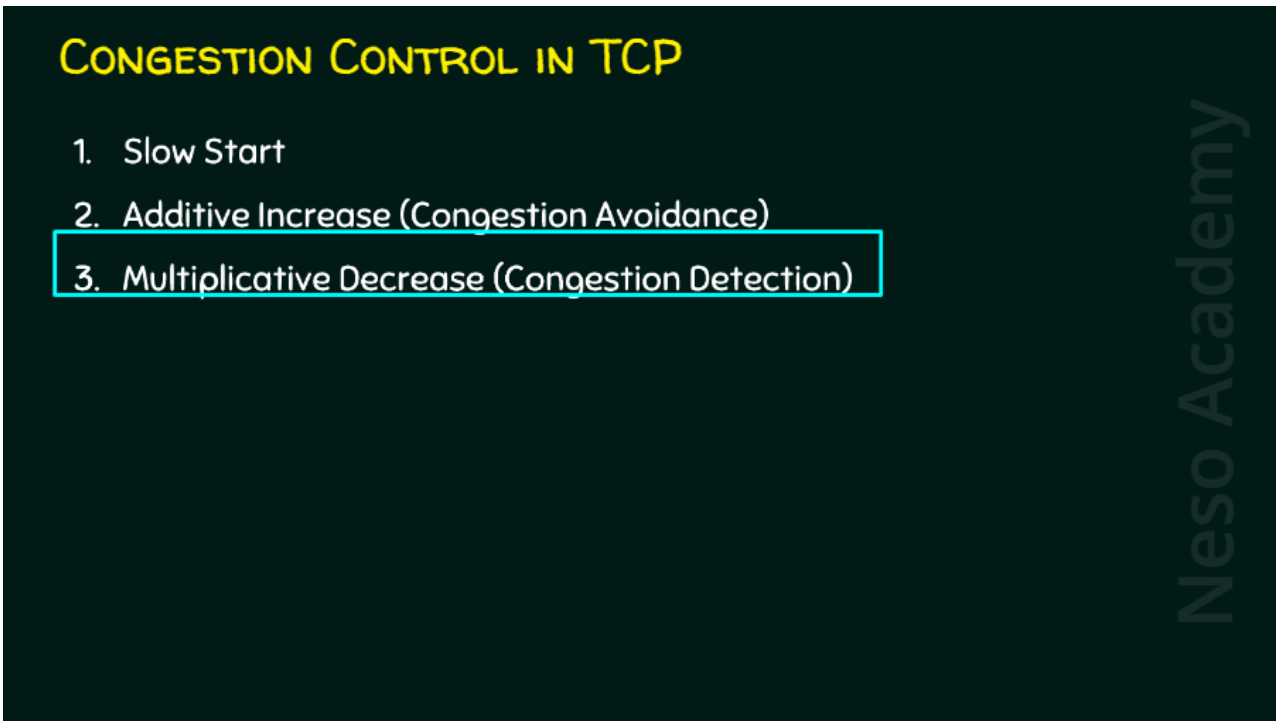
Additive Increase

Round	Value of cwnd
Start	1
After Round 1	2
After Round 2	3
After Round 3	4
After Round 4	5
After Round 5	6
After Round 6	7
. . .	

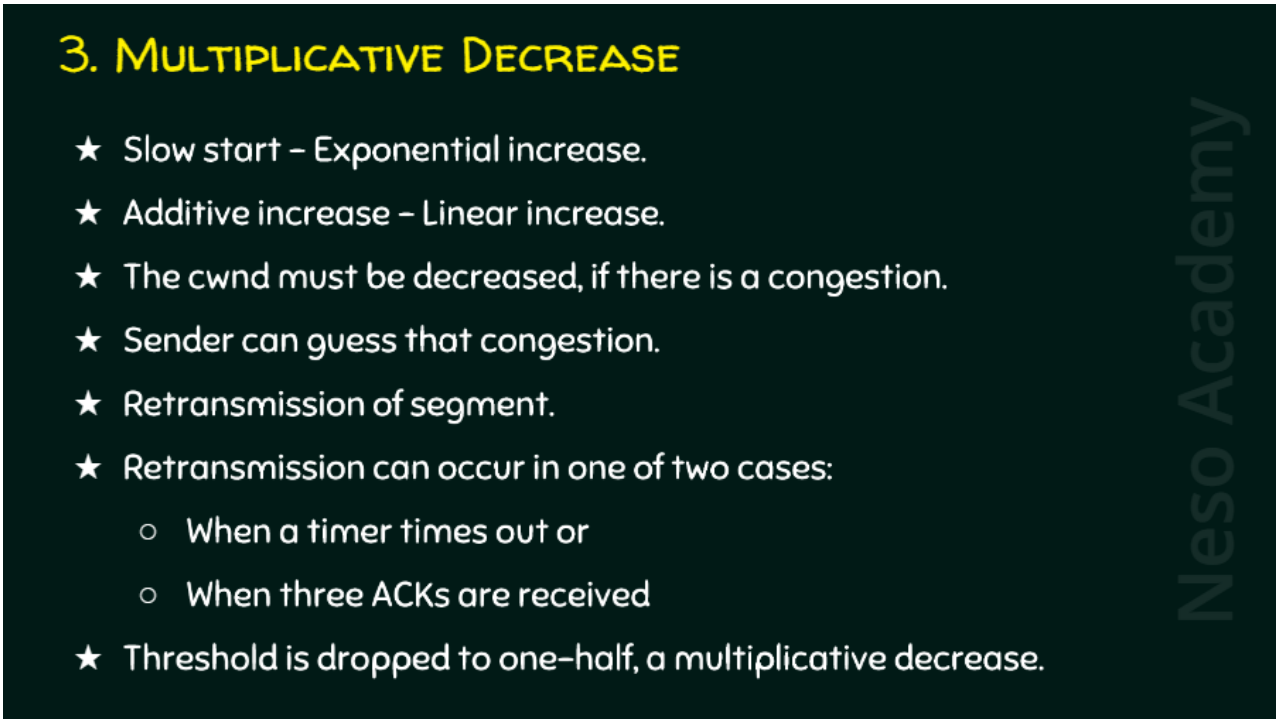
Neso Academy



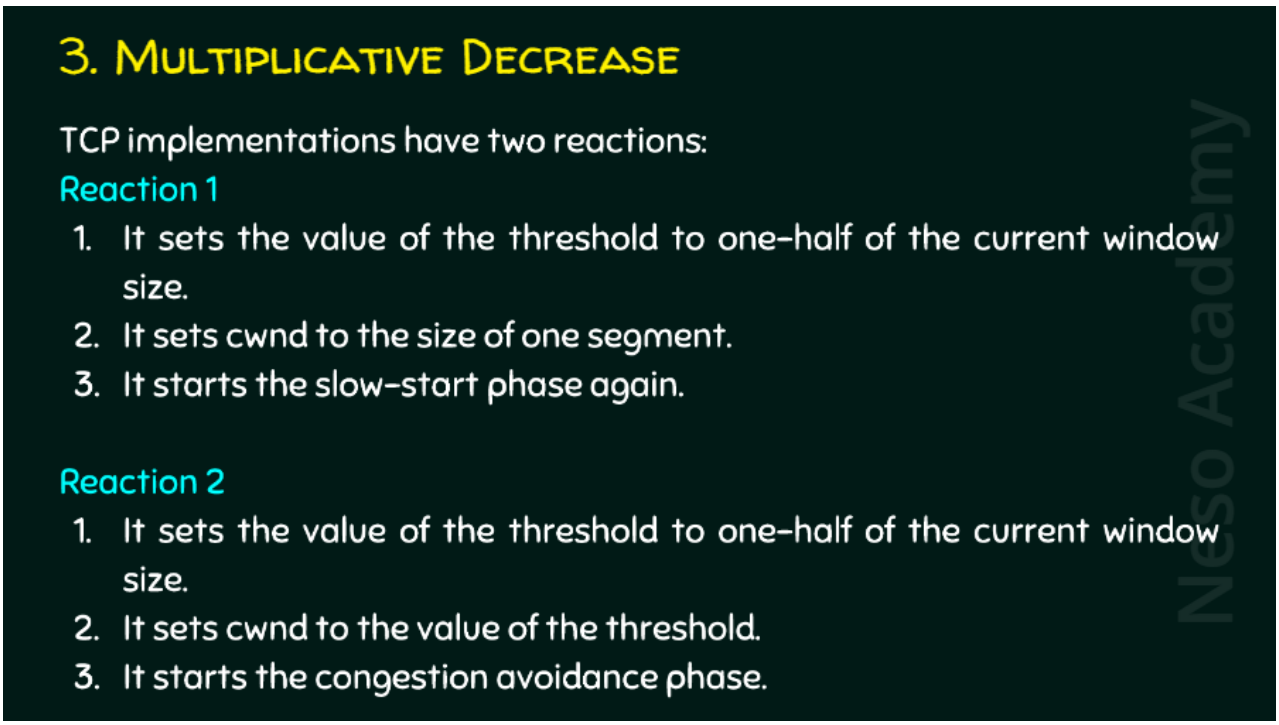
Outcomes★★★Neso Academy



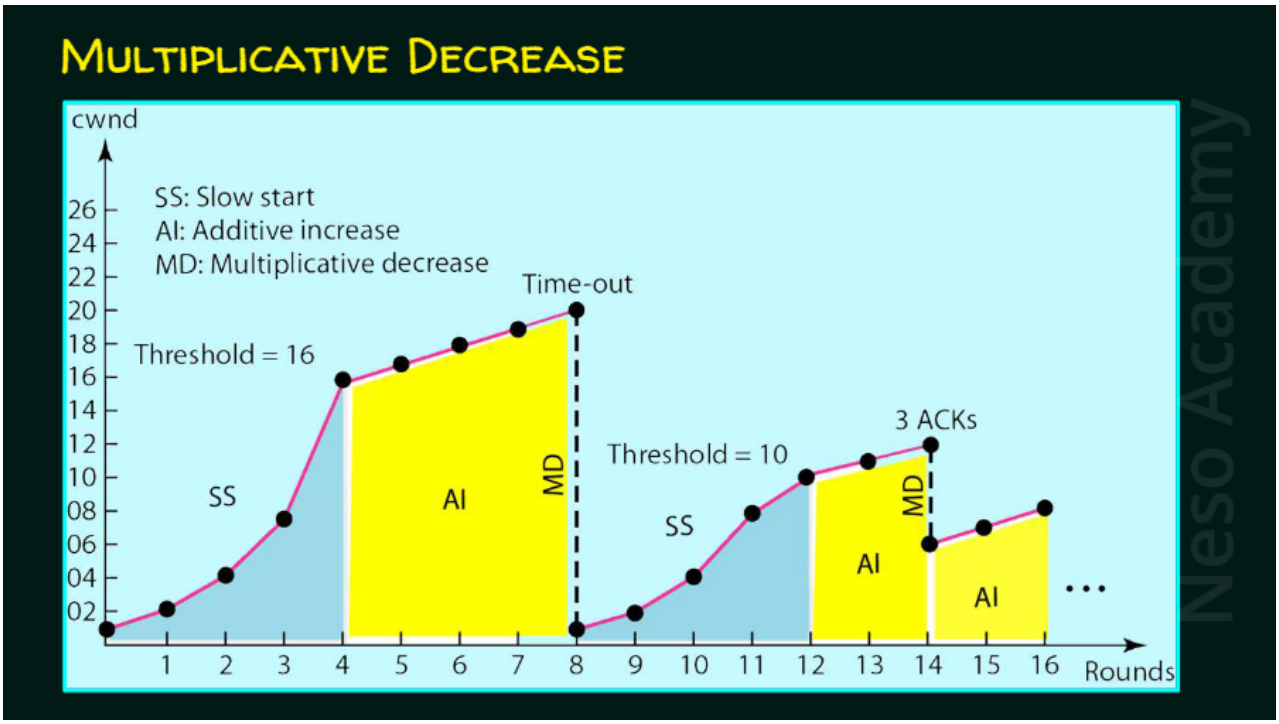
Congestion Control in TCPNeso Academy



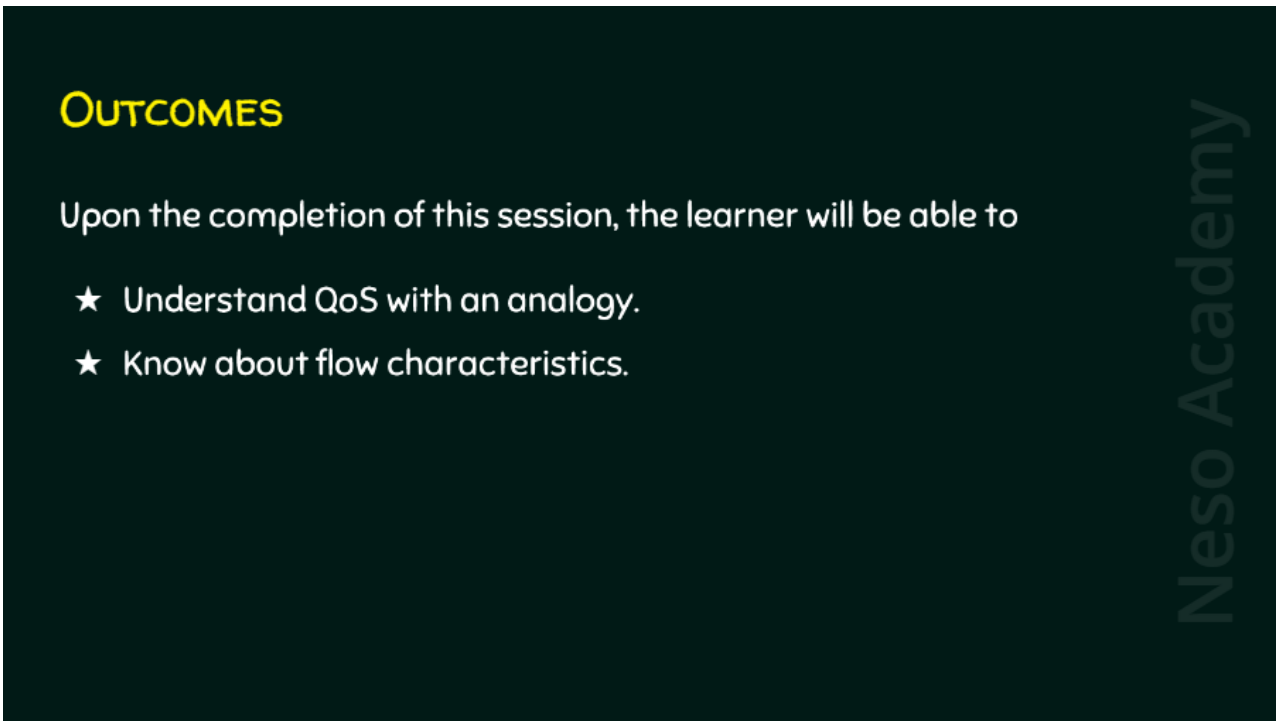
3. Multiplicative Decrease★★★★★★○○★Neso Academy



3. Multiplicative DecreaseNeso Academy

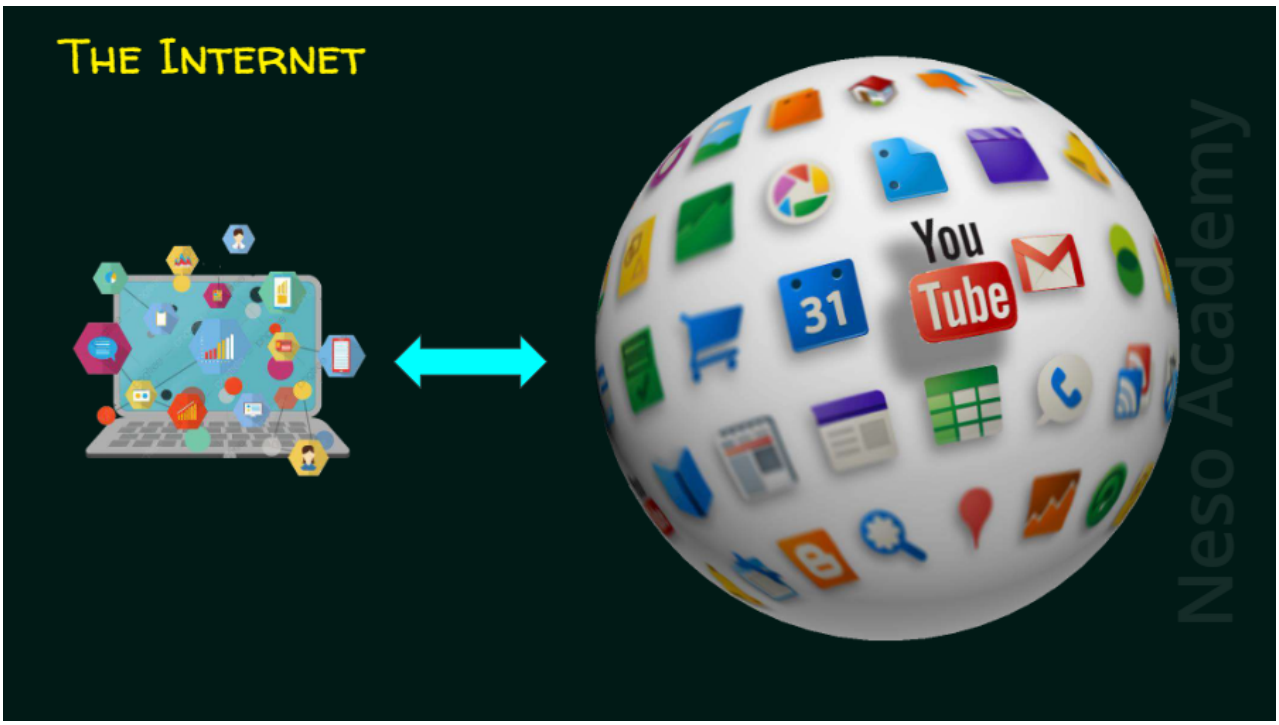


Multiplicative DecreaseNeso Academy

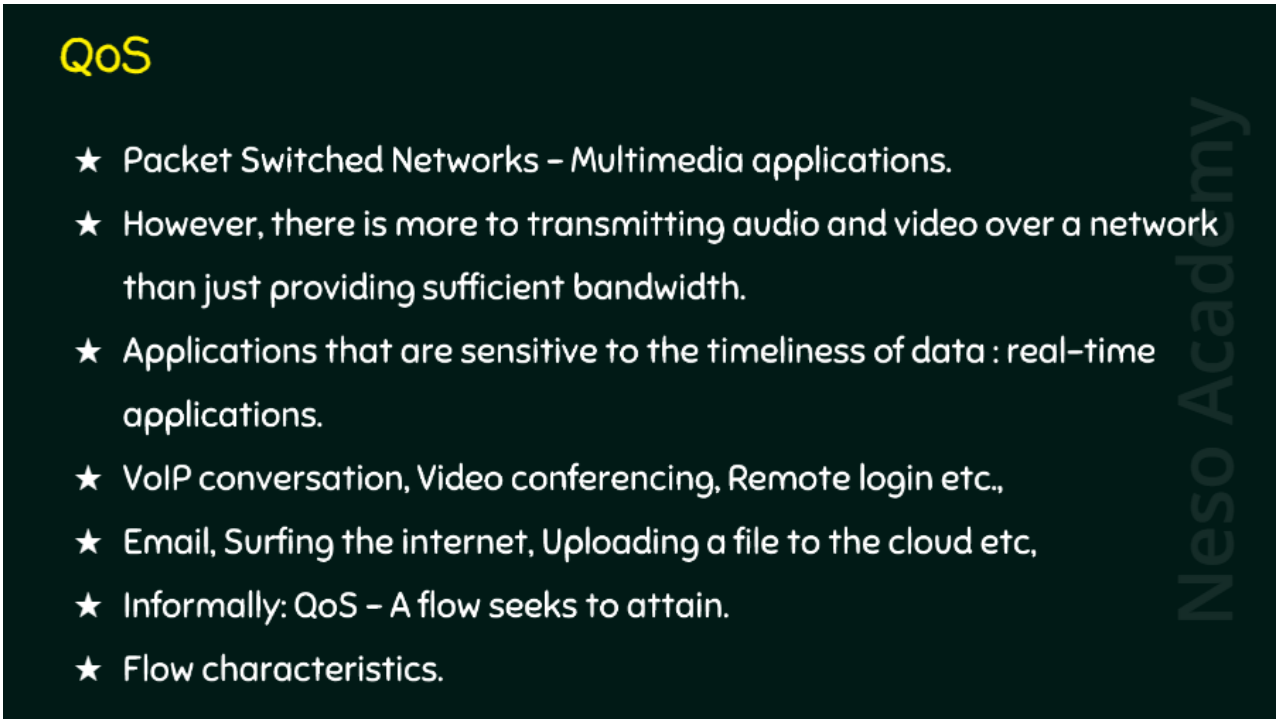


Outcomes★★Neso Academy

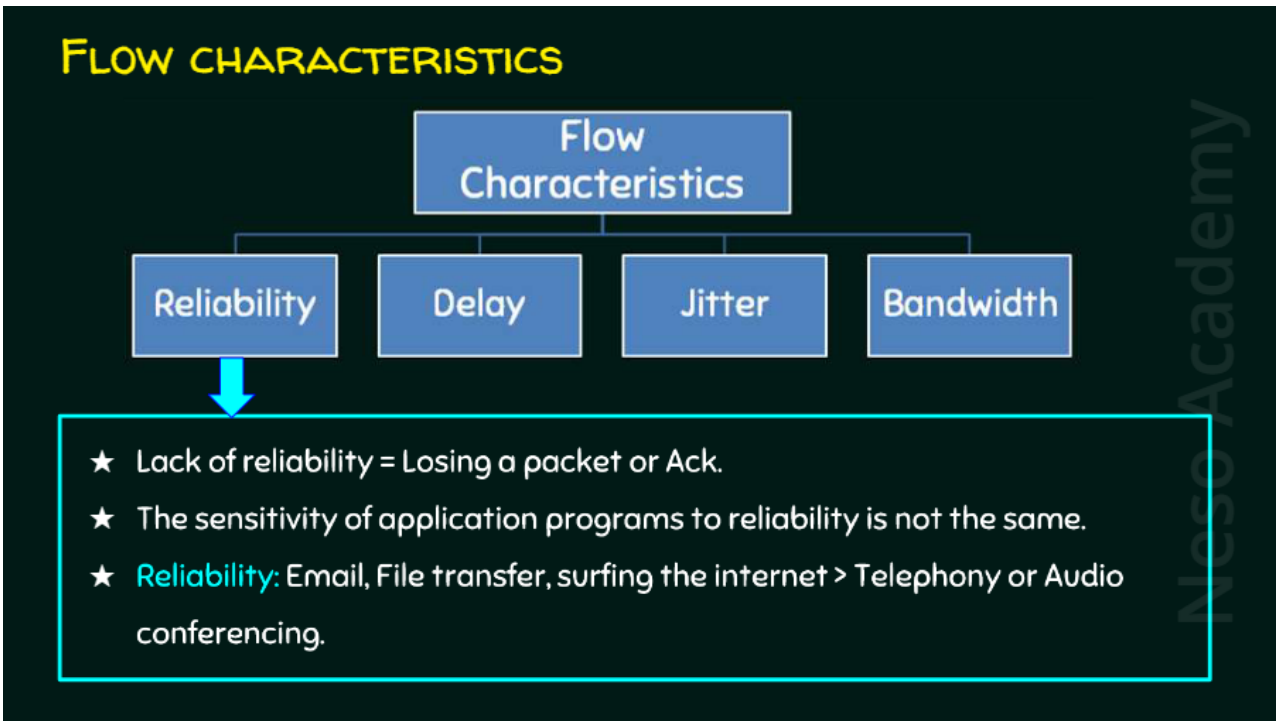
AnalogyNeso Academy



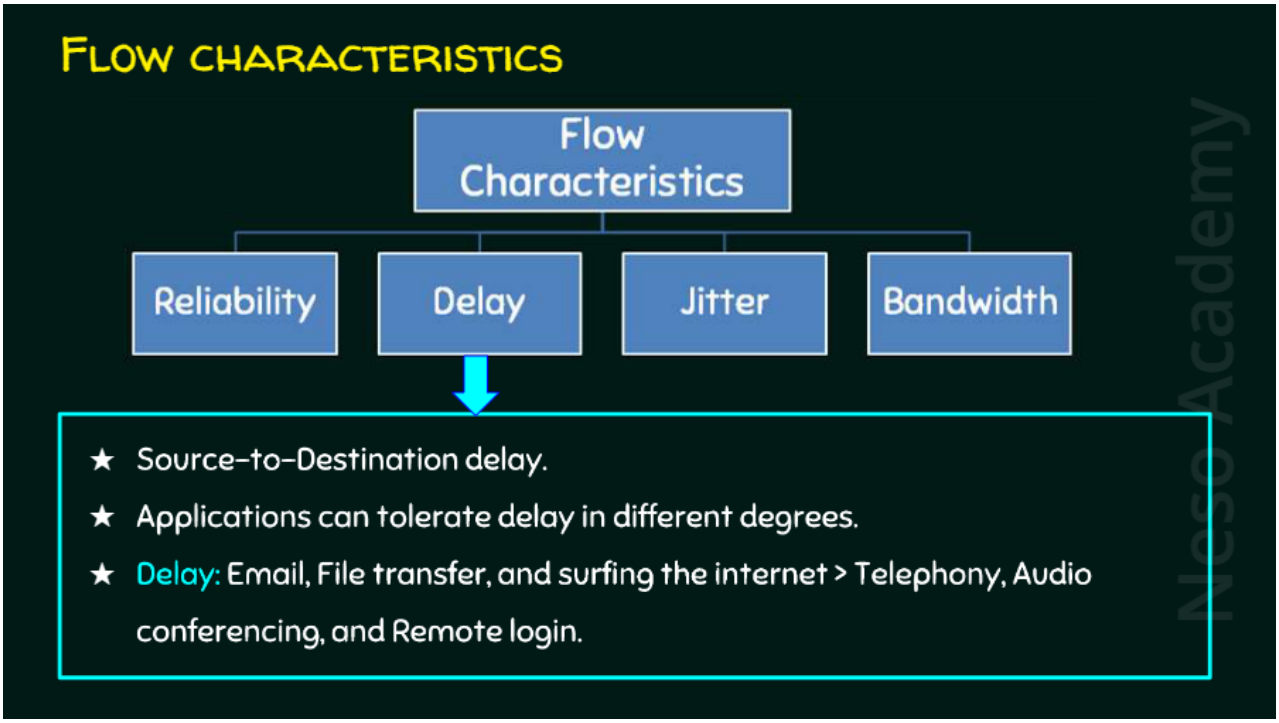
The InternetNeso Academy



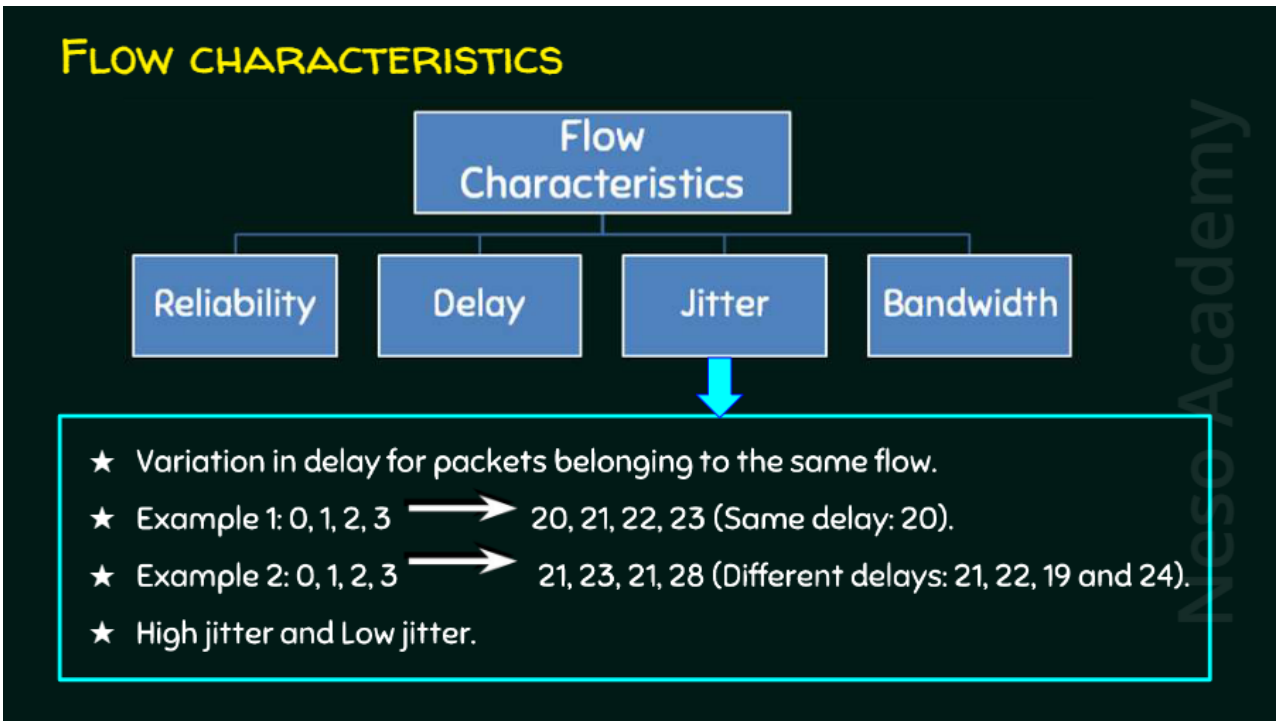
QoS★★★★★★★Neso Academy



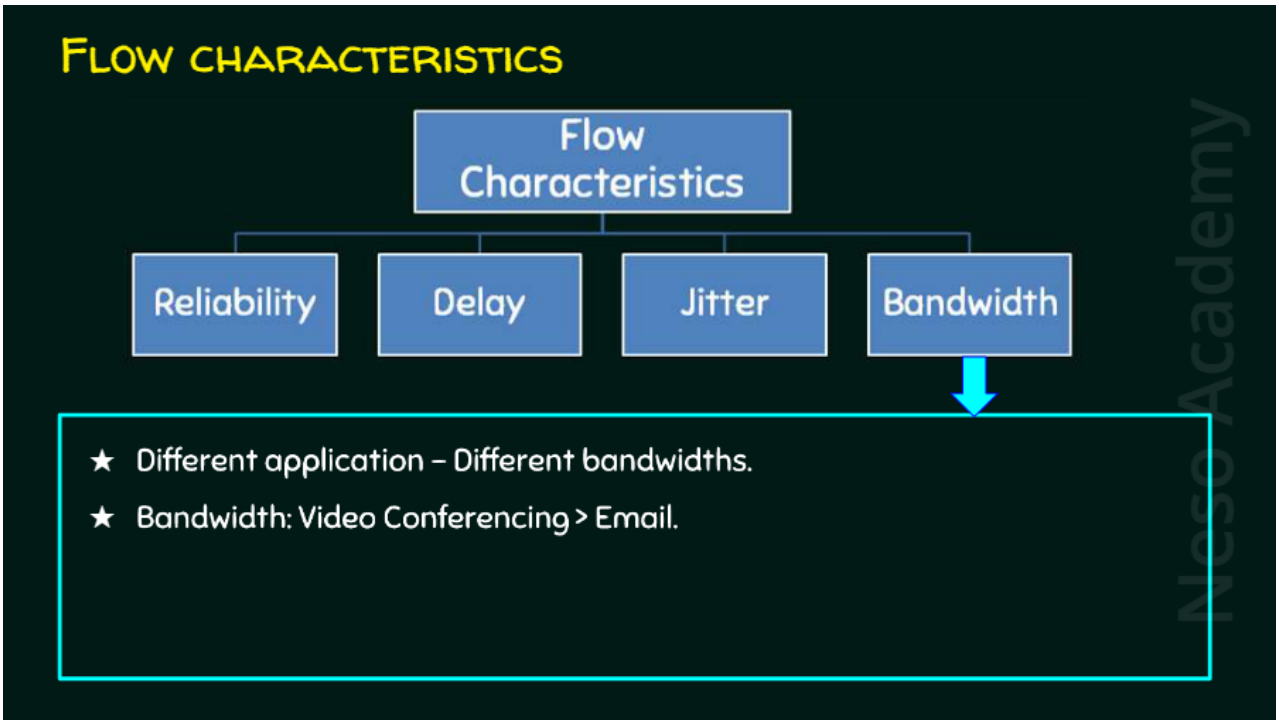
Flow characteristics★★★Neso Academy



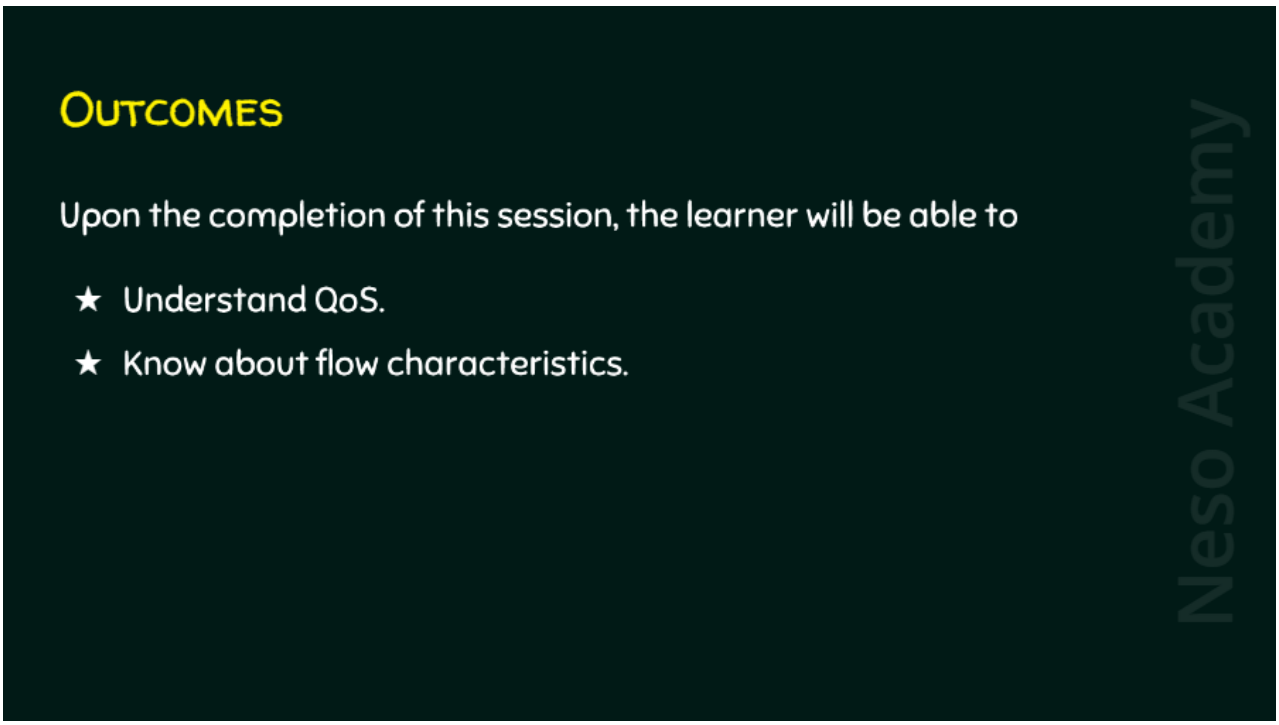
Flow characteristics★★★Neso Academy



Flow characteristics★★★★Neso Academy

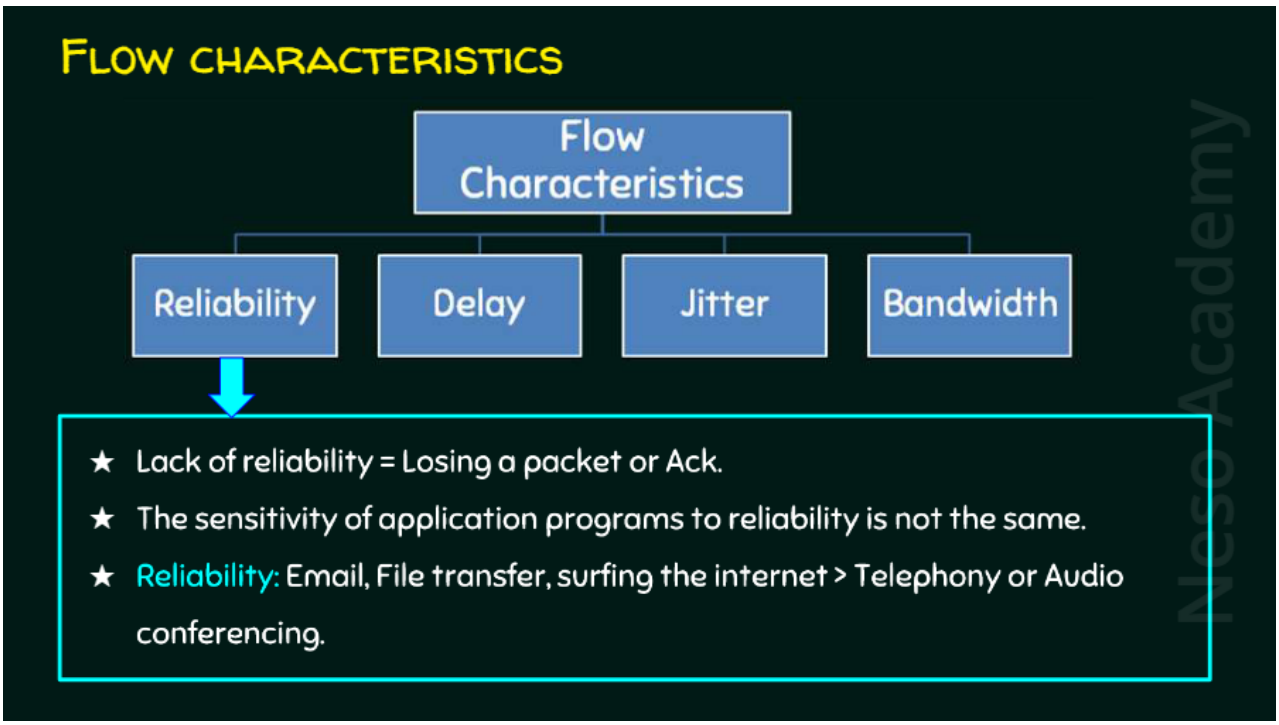


Flow characteristics★★Neso Academy

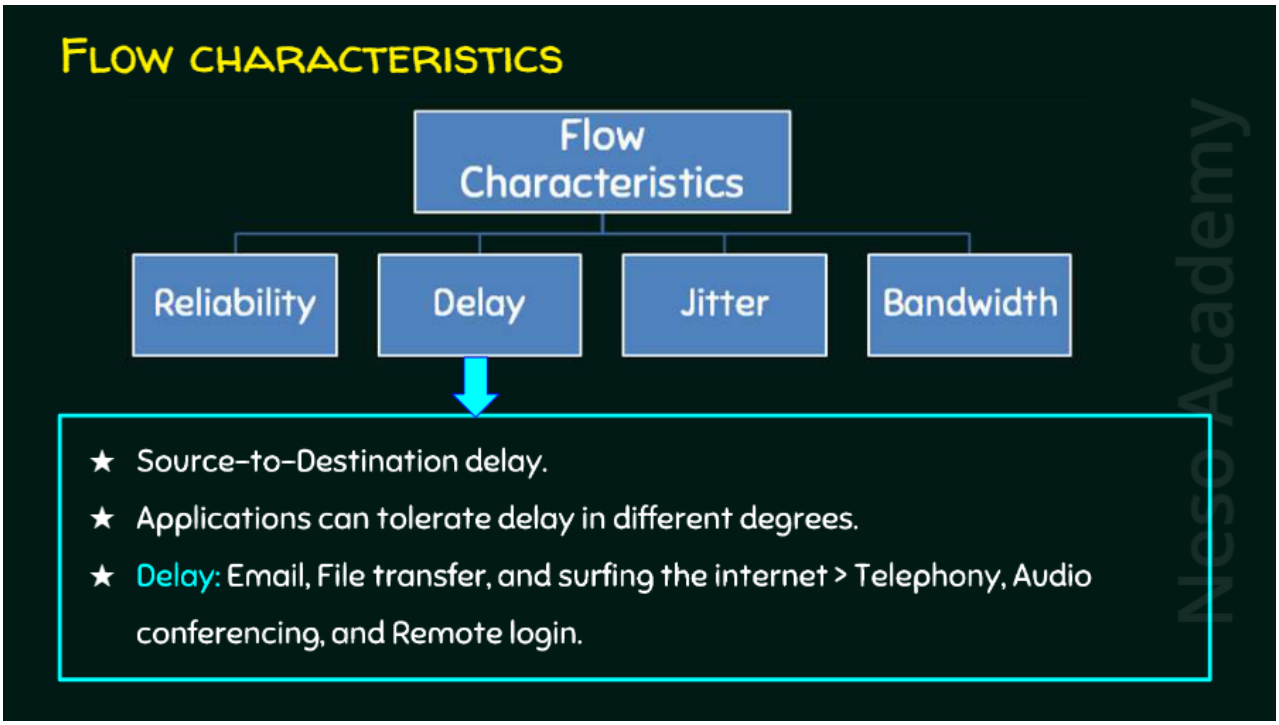


Outcomes★★Neso Academy

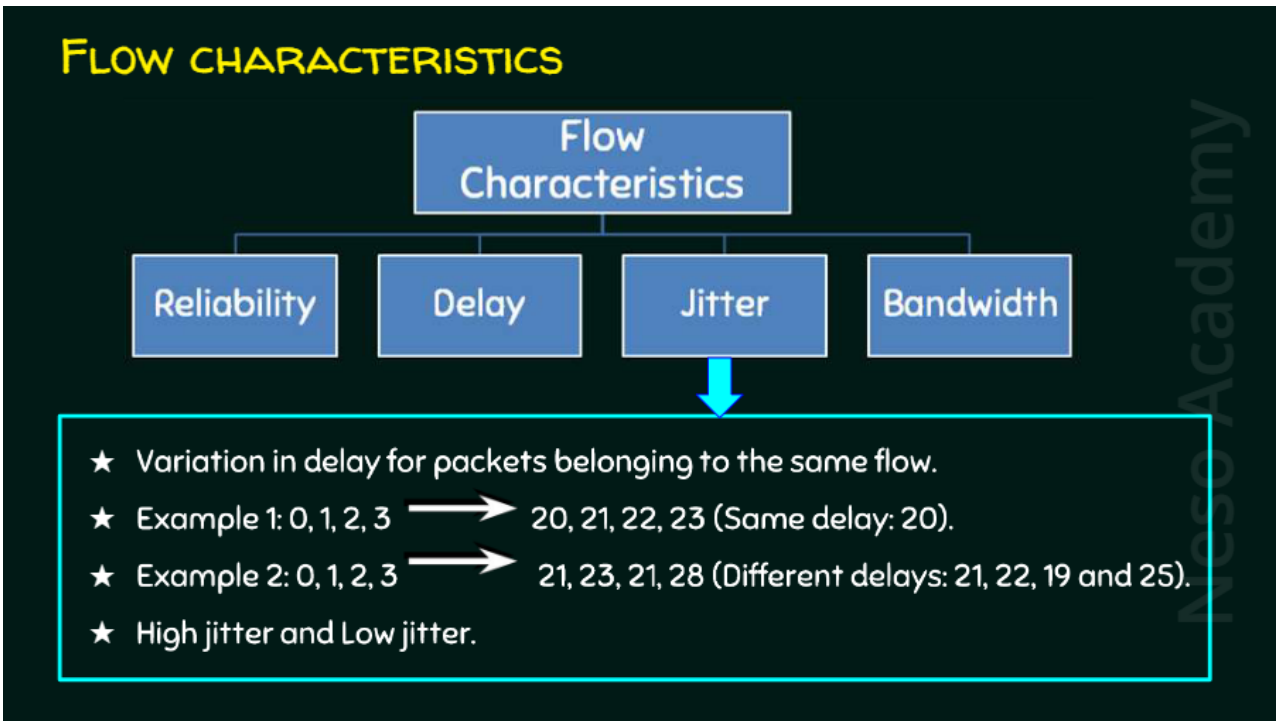
AnalogyNeso Academy



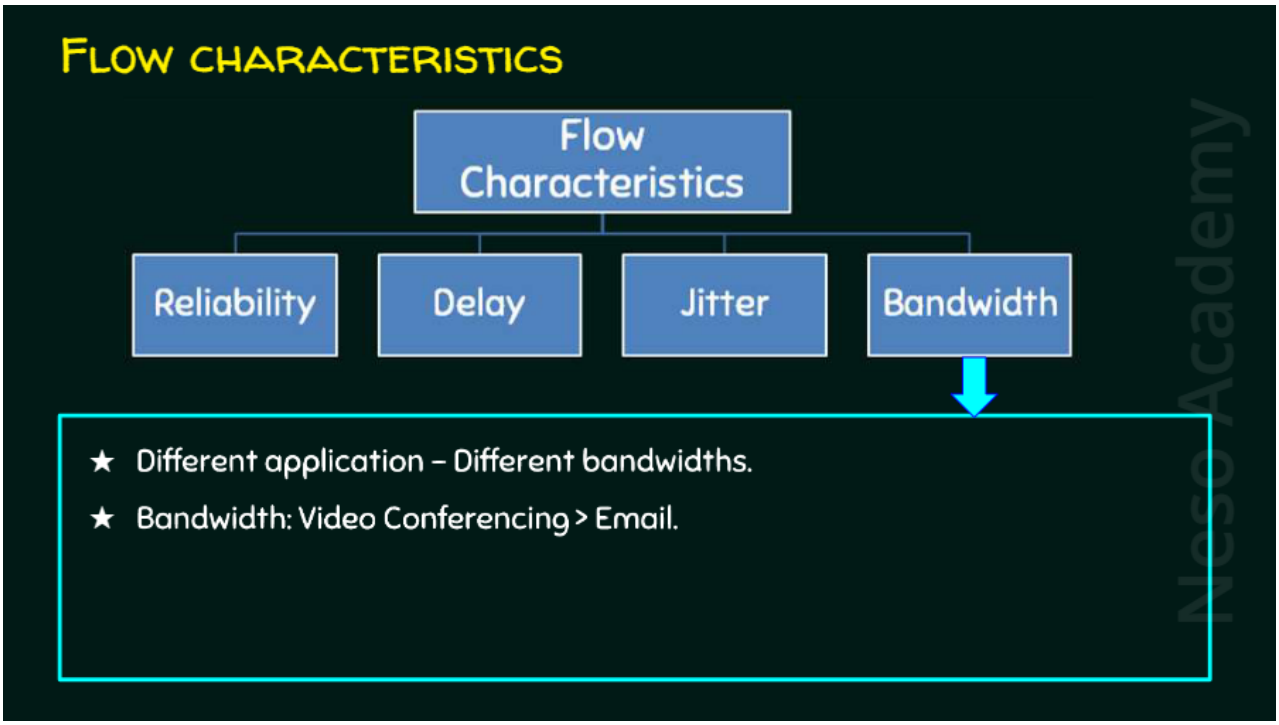
Flow characteristics★★★Neso Academy



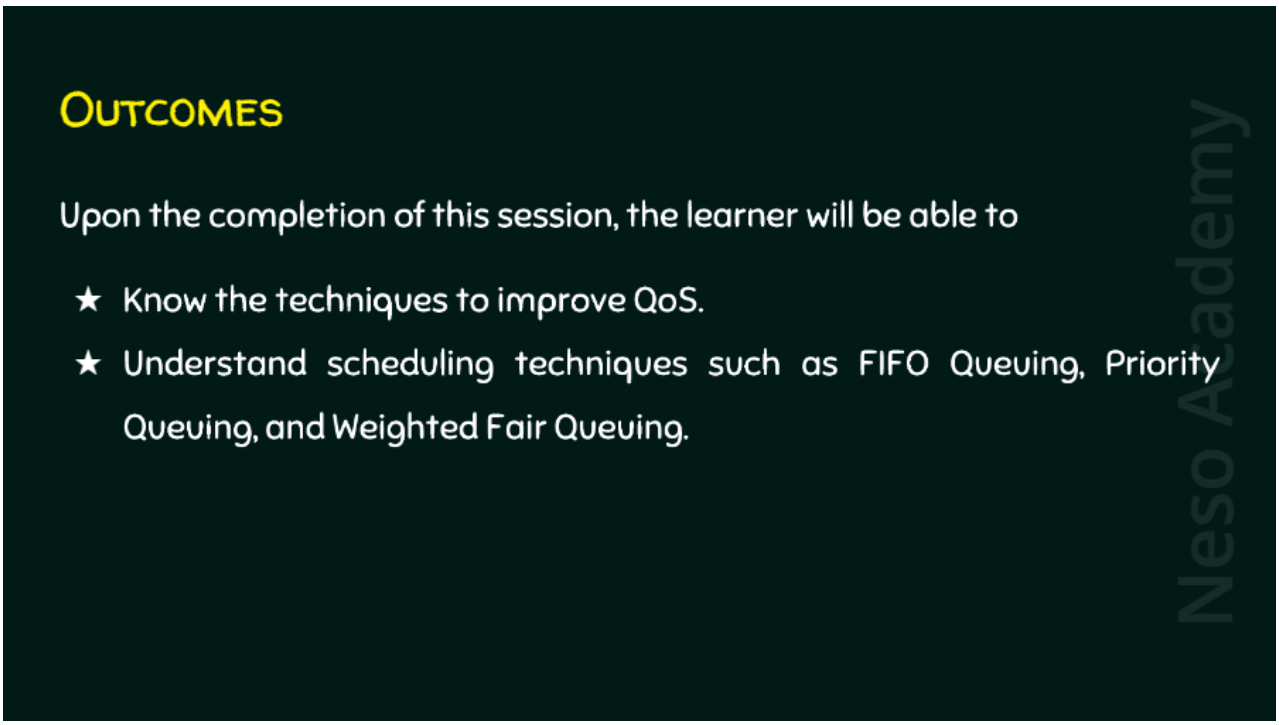
Flow characteristics★★★Neso Academy



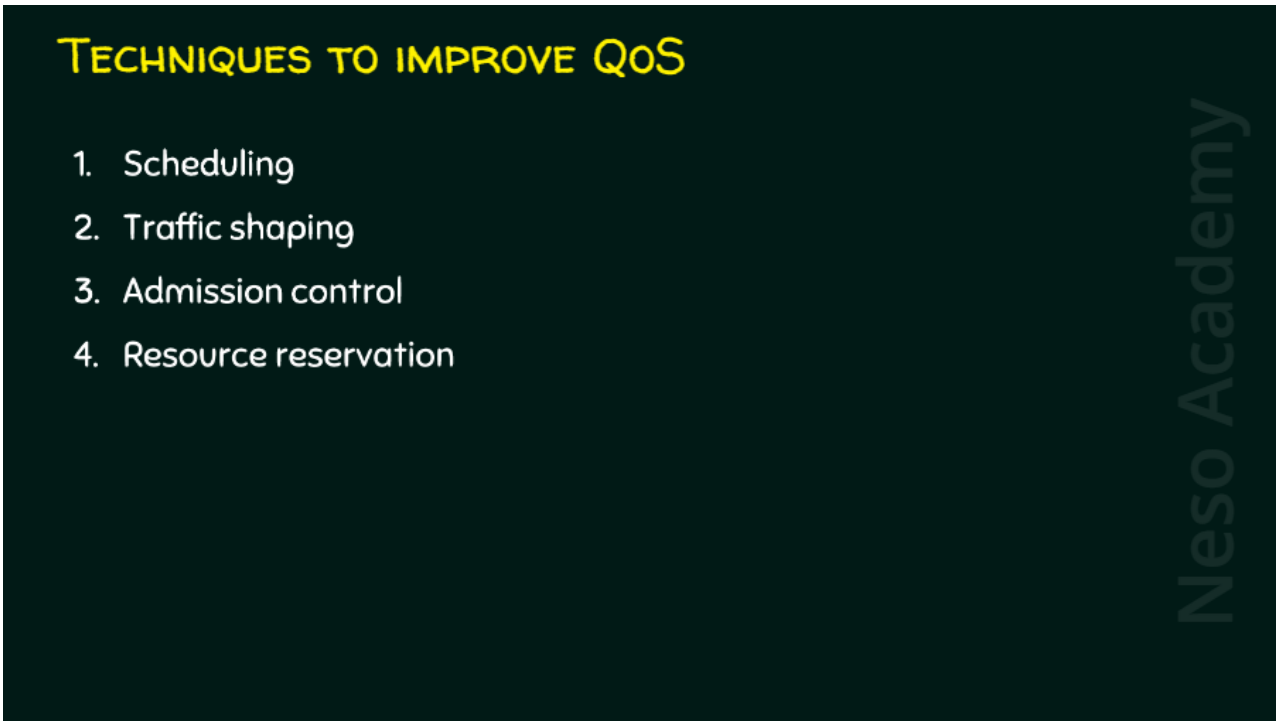
Flow characteristics★★★★Neso Academy



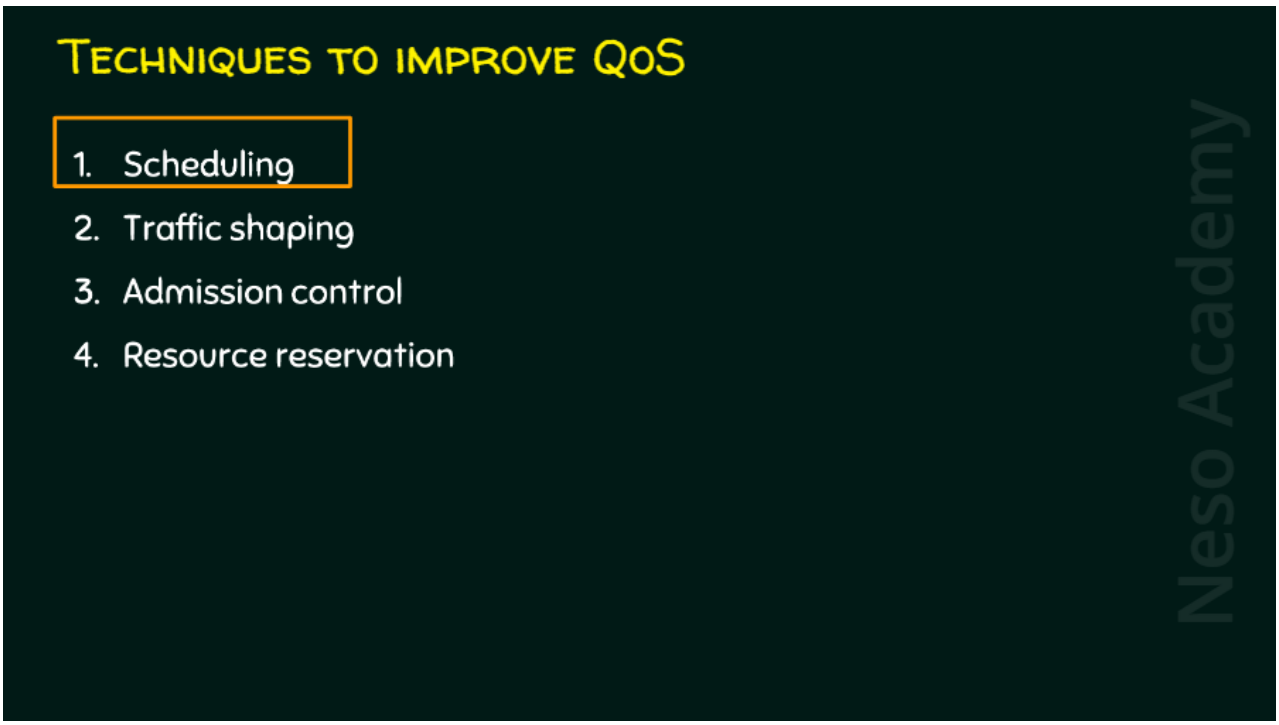
Flow characteristics★★Neso Academy



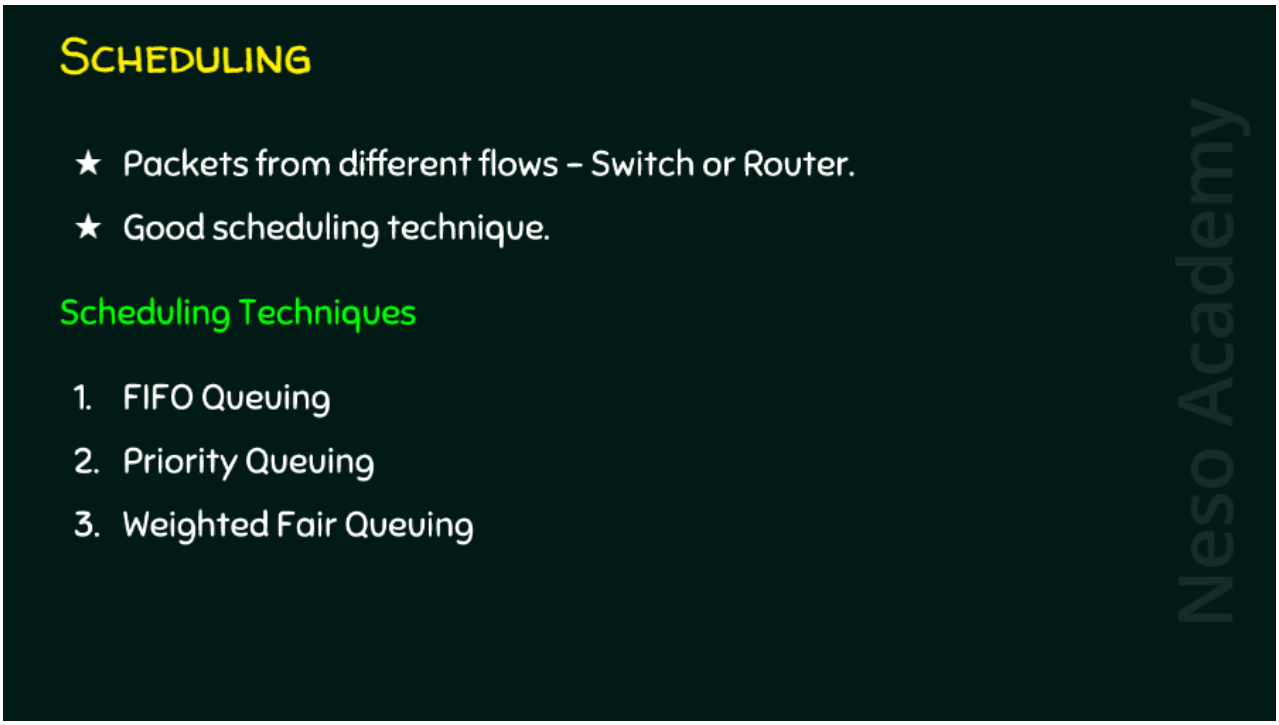
Outcomes★★Neso Academy



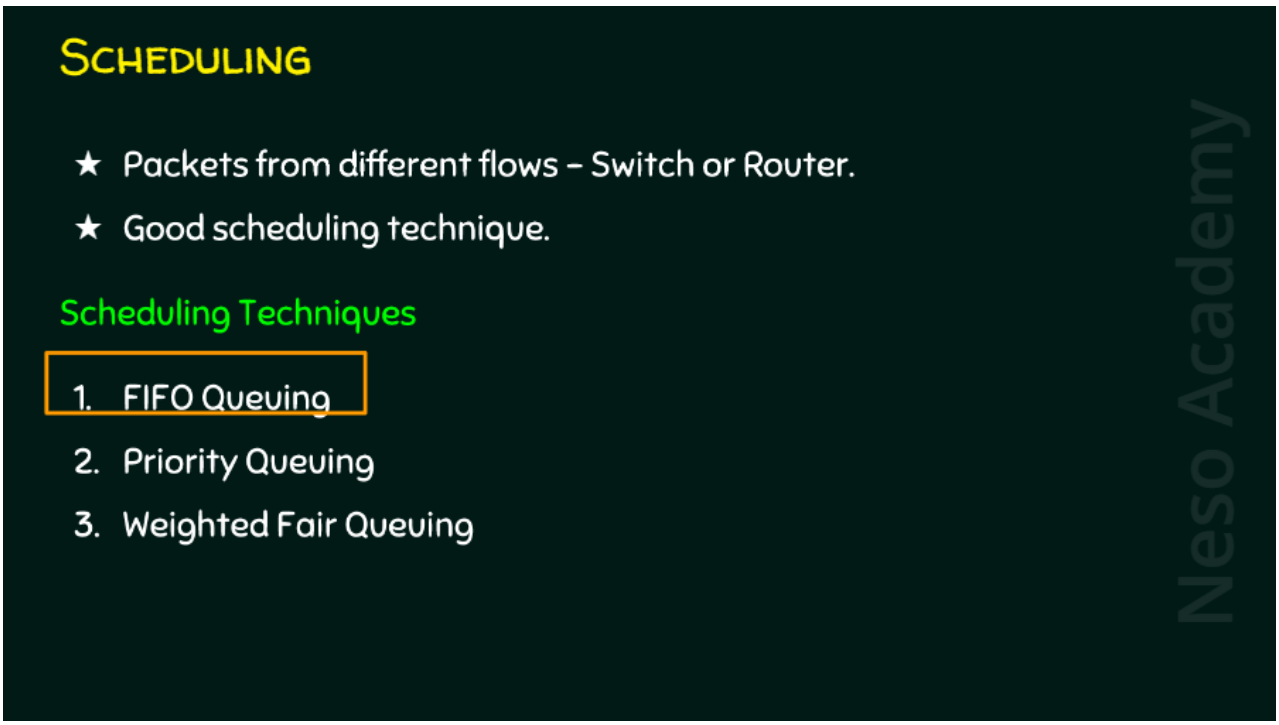
Techniques to improve QoSNeso Academy



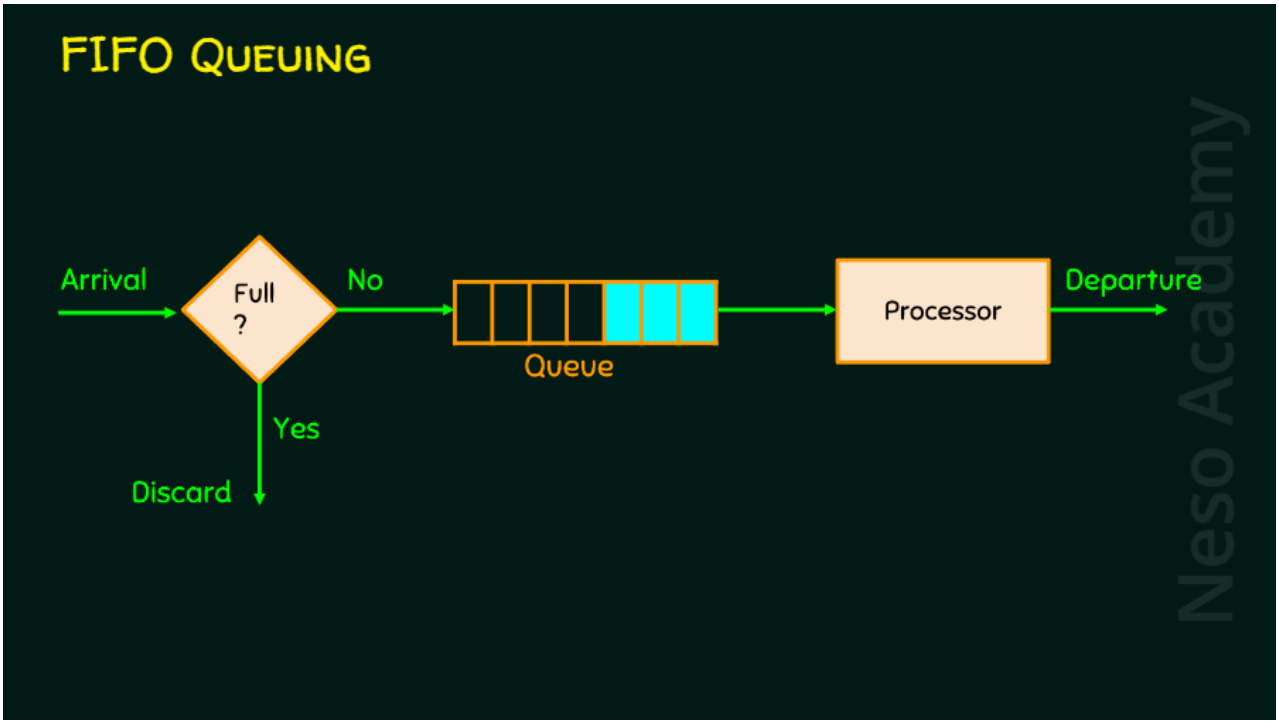
Techniques to improve QoSNeso Academy



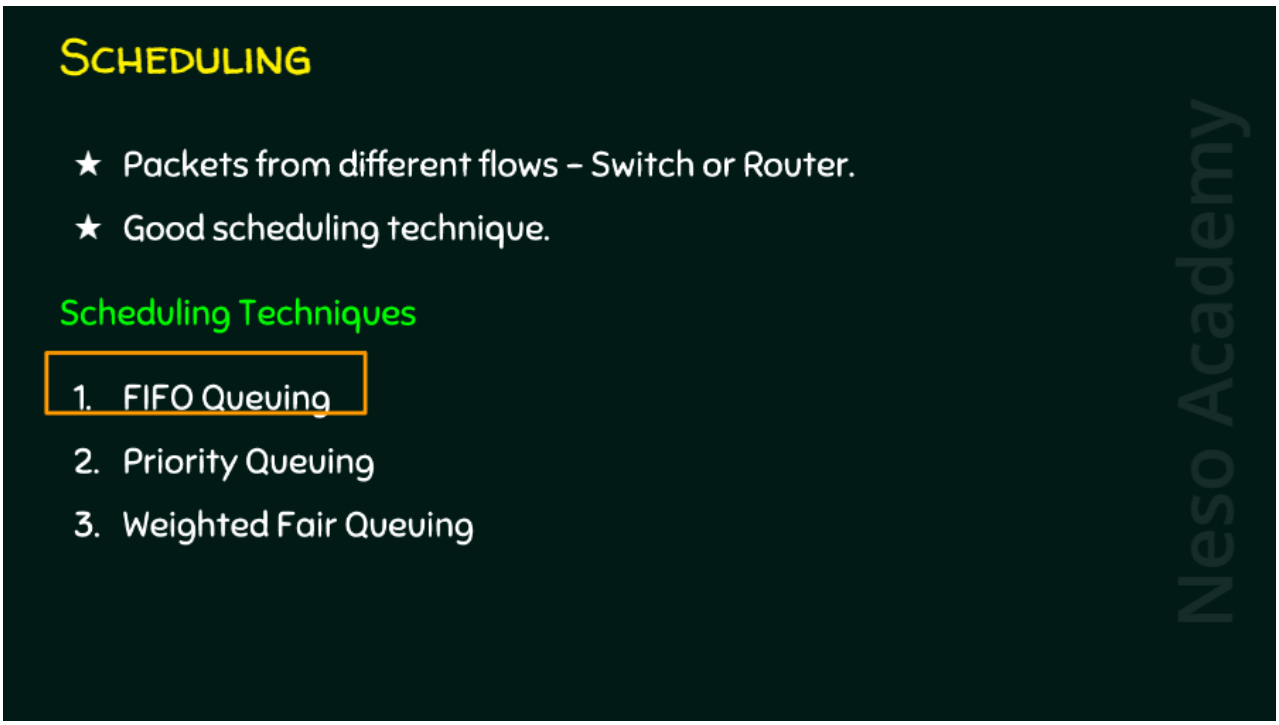
★★SchedulingNeso Academy



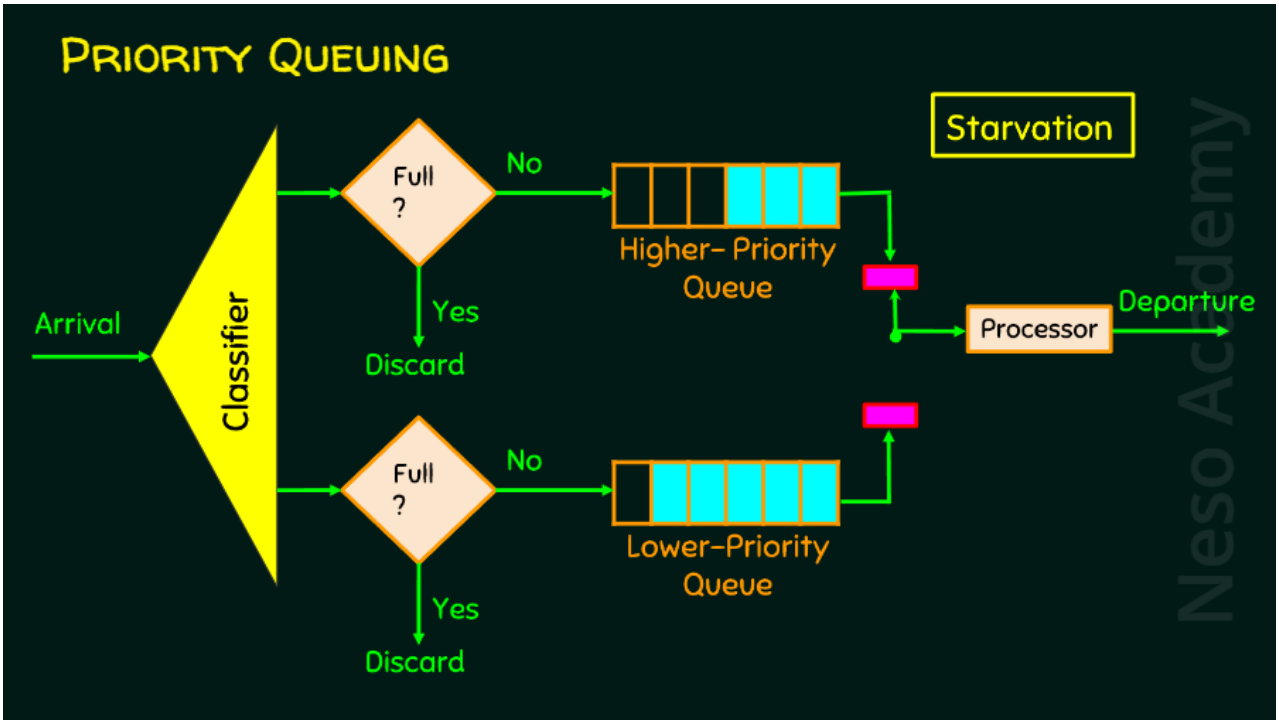
★★SchedulingNeso Academy



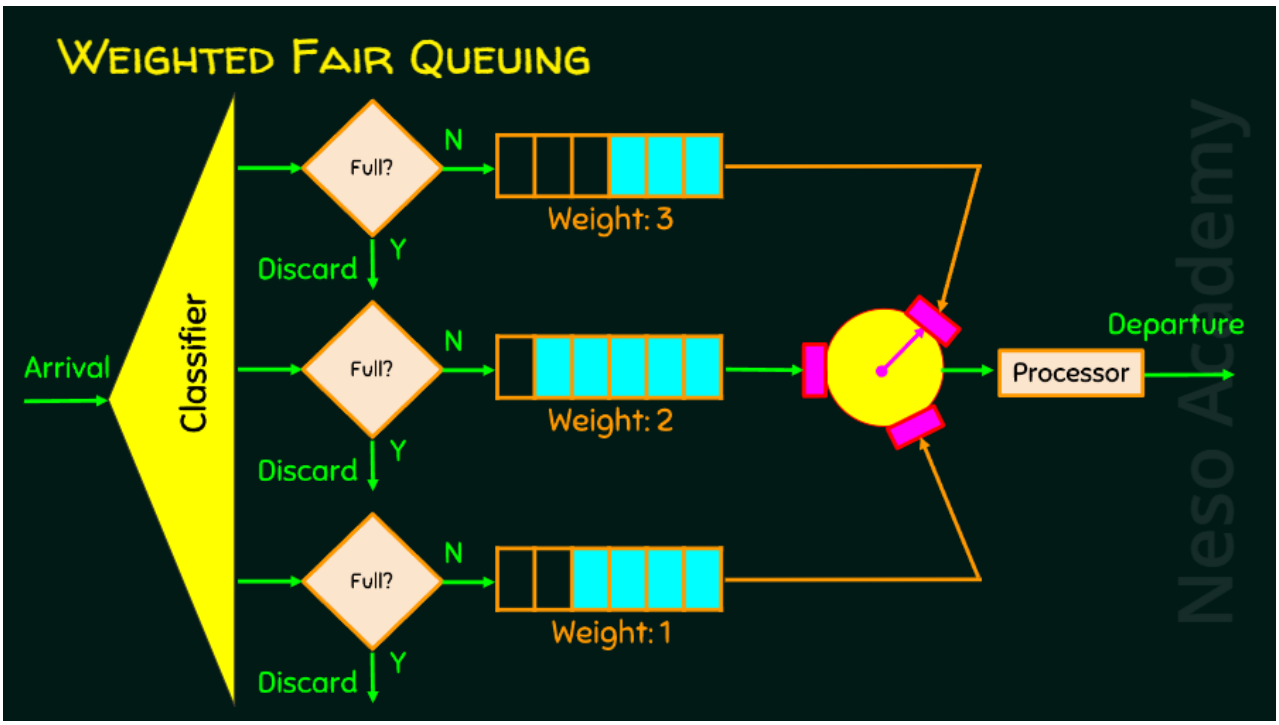
FIFO QueuingNeso Academy



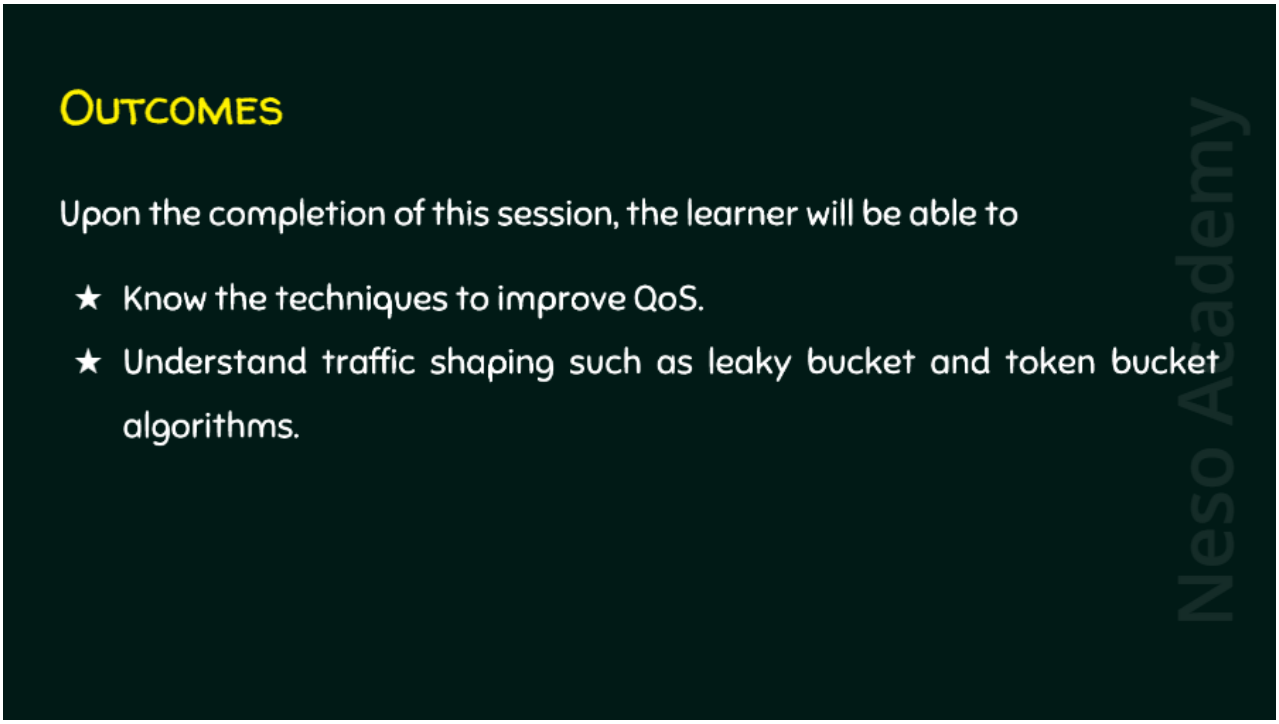
★★SchedulingNeso Academy



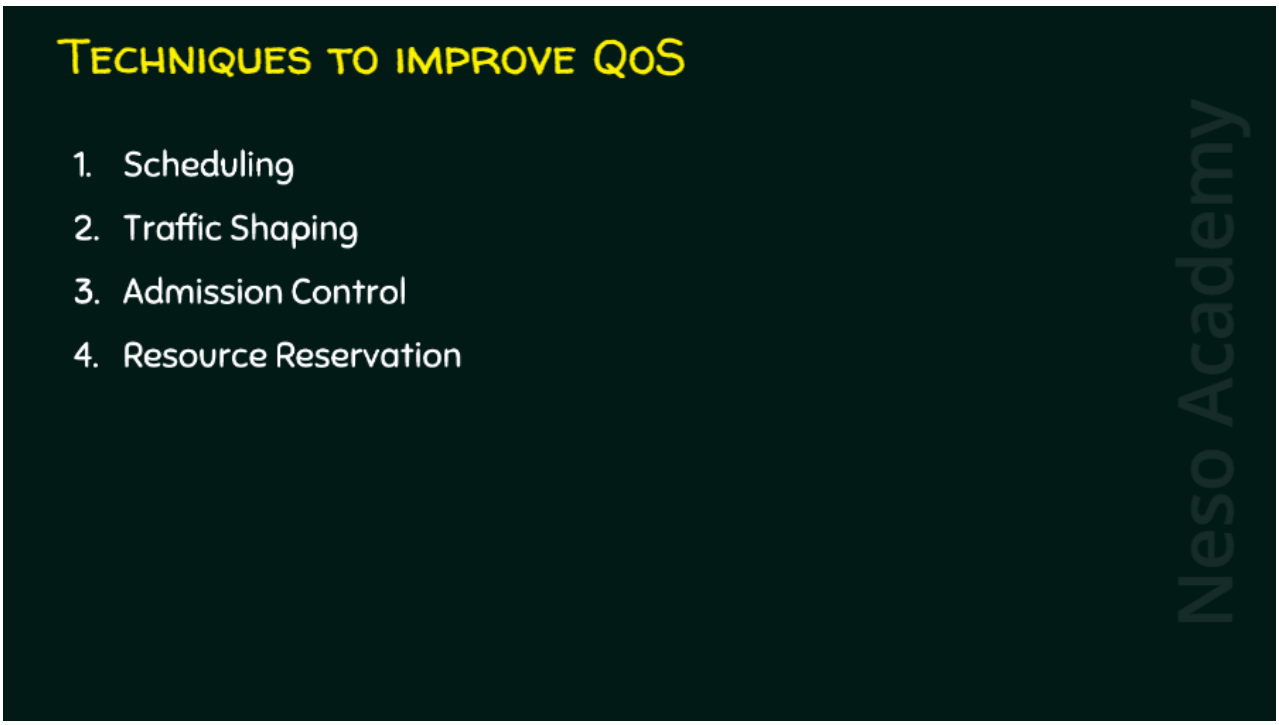
Priority QueuingNeso Academy



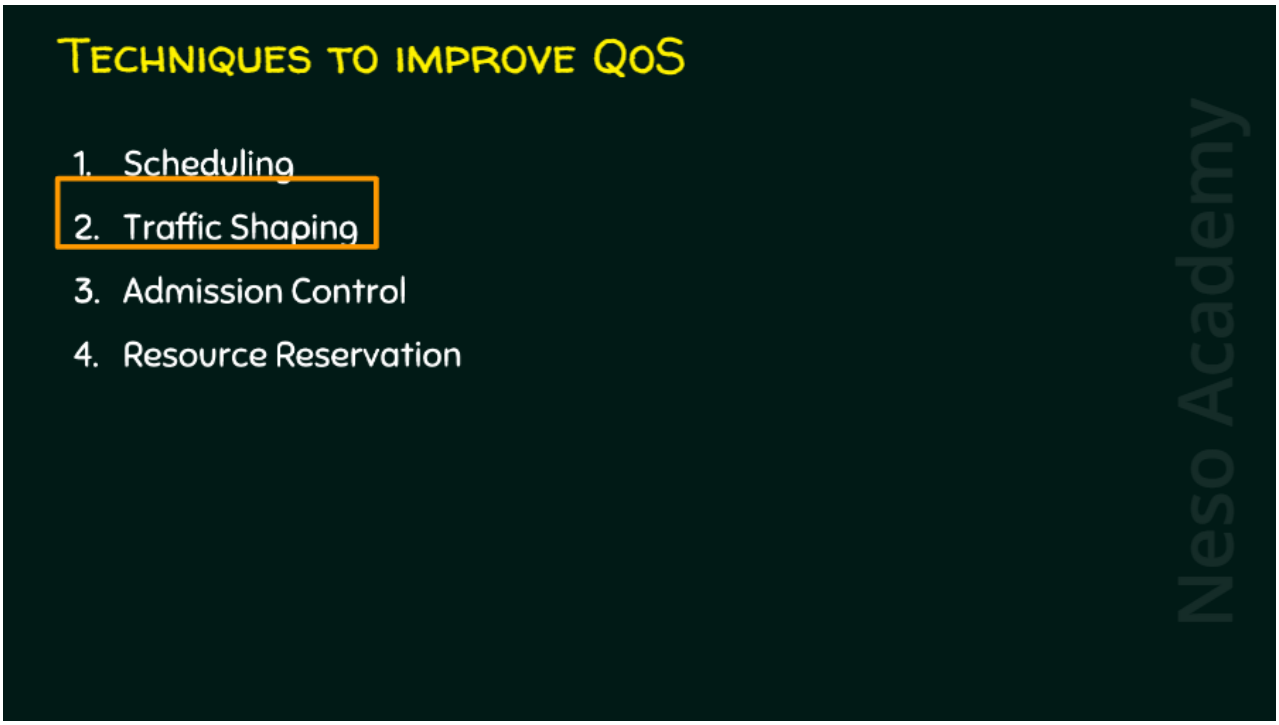
Weighted Fair QueuingNeso Academy



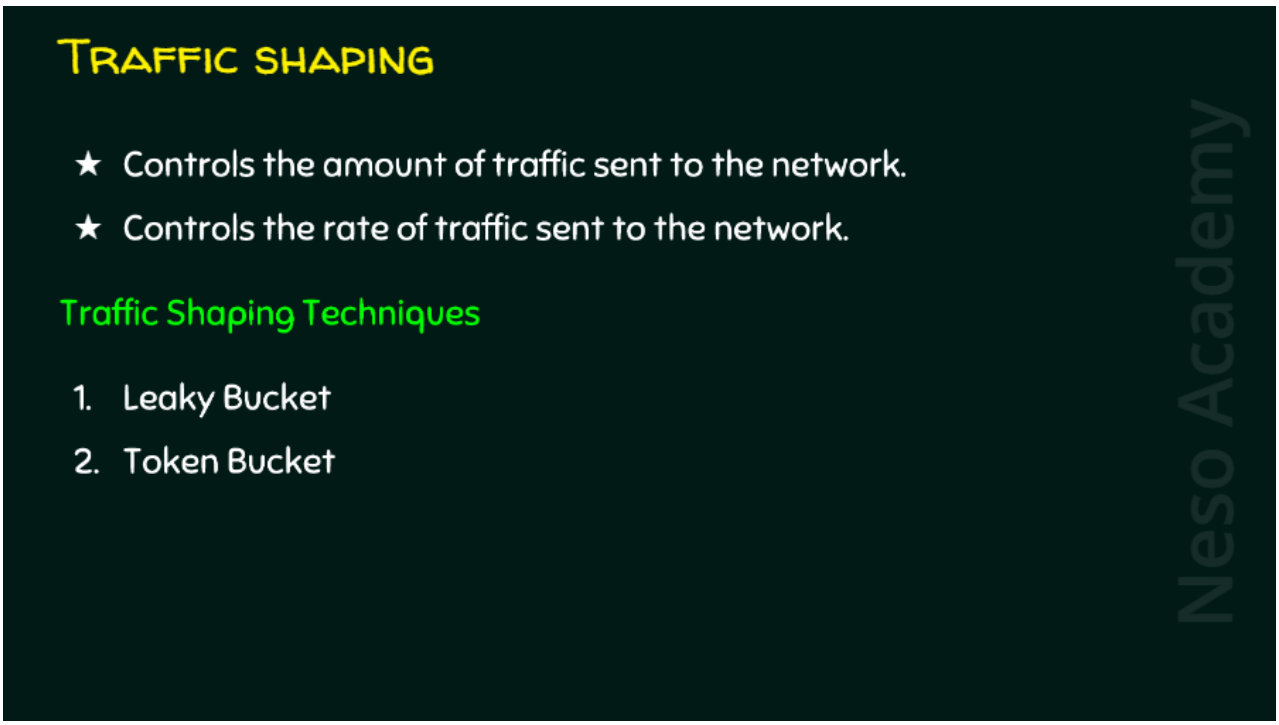
★★OutcomesNeso Academy



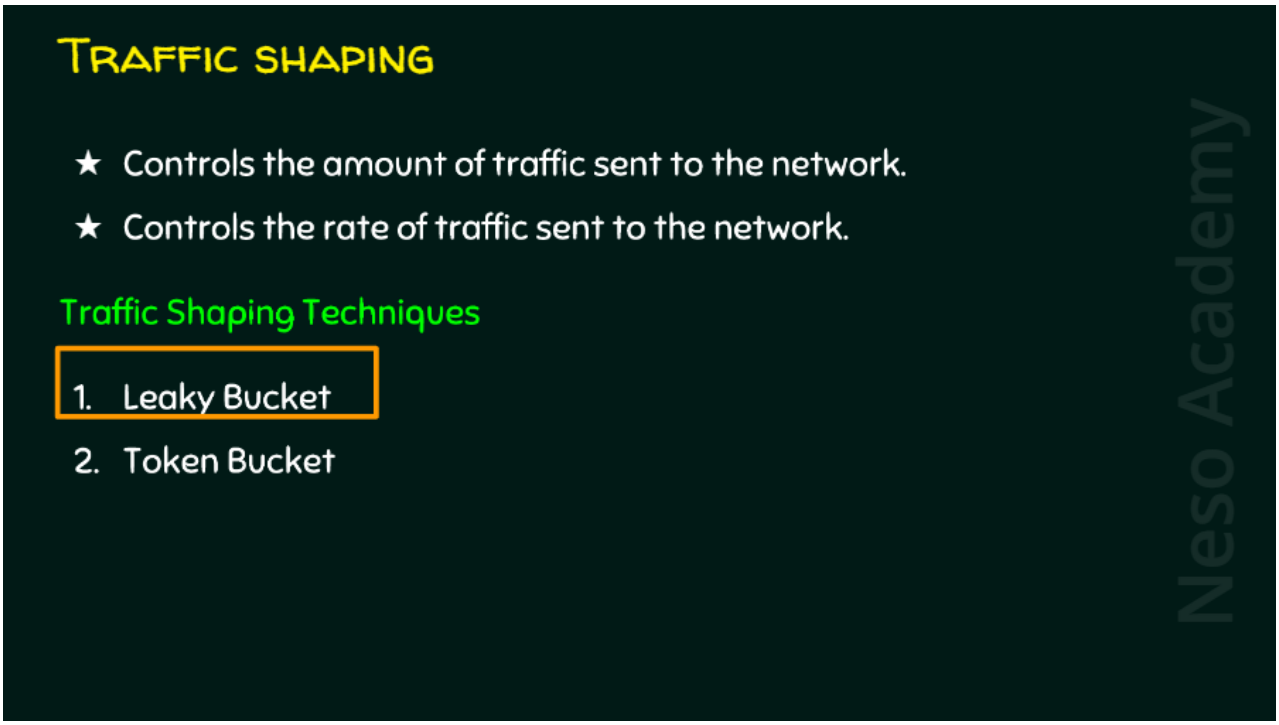
Techniques to improve QoSNeso Academy



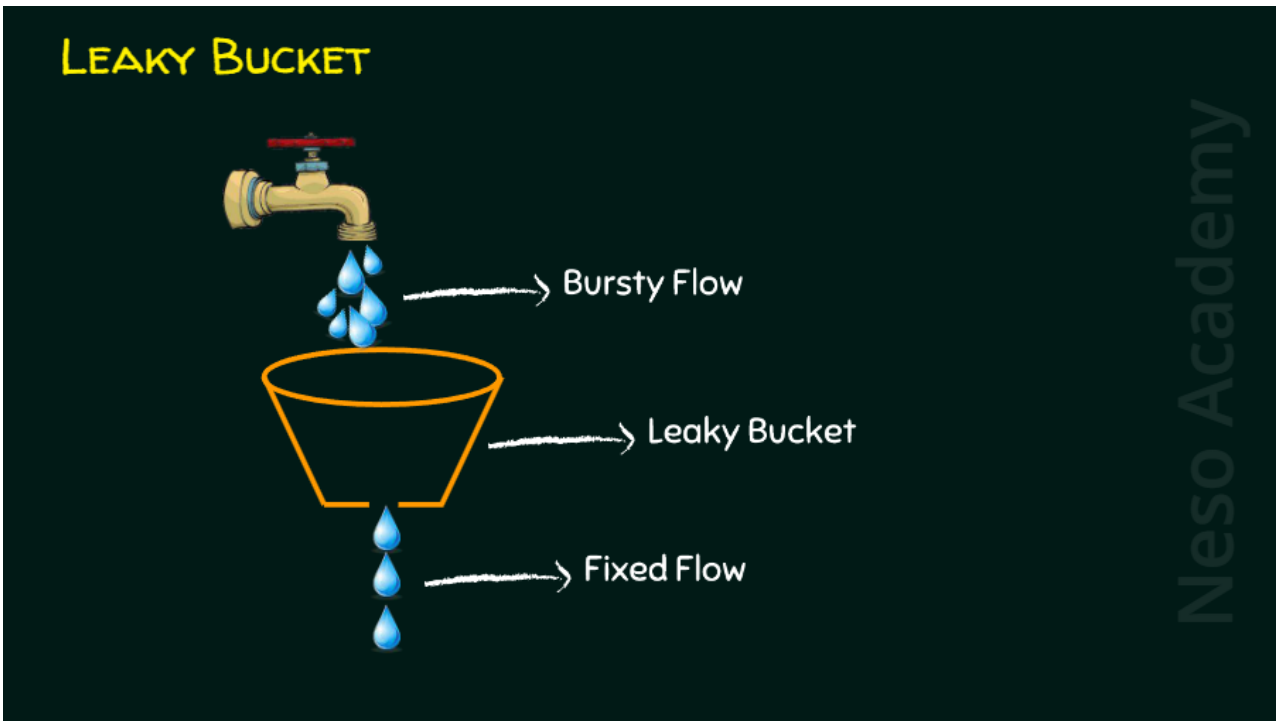
Techniques to improve QoSNeso Academy



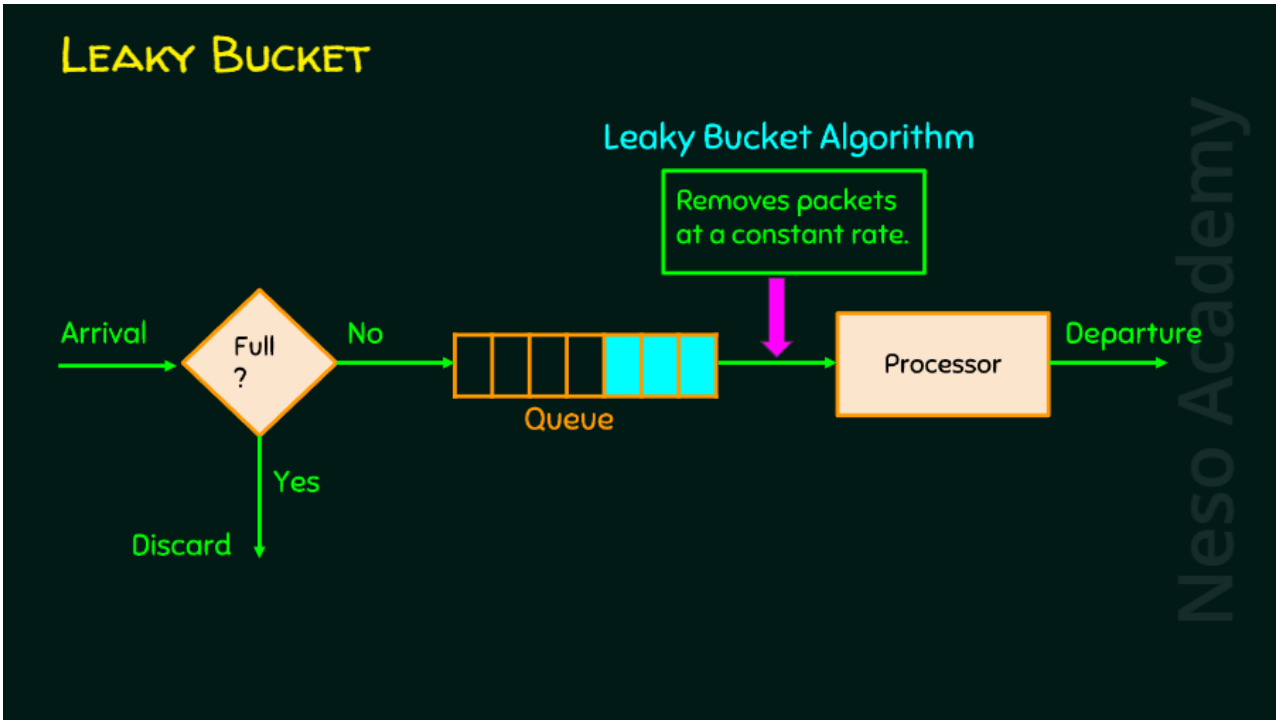
★★Traffic shapingNeso Academy



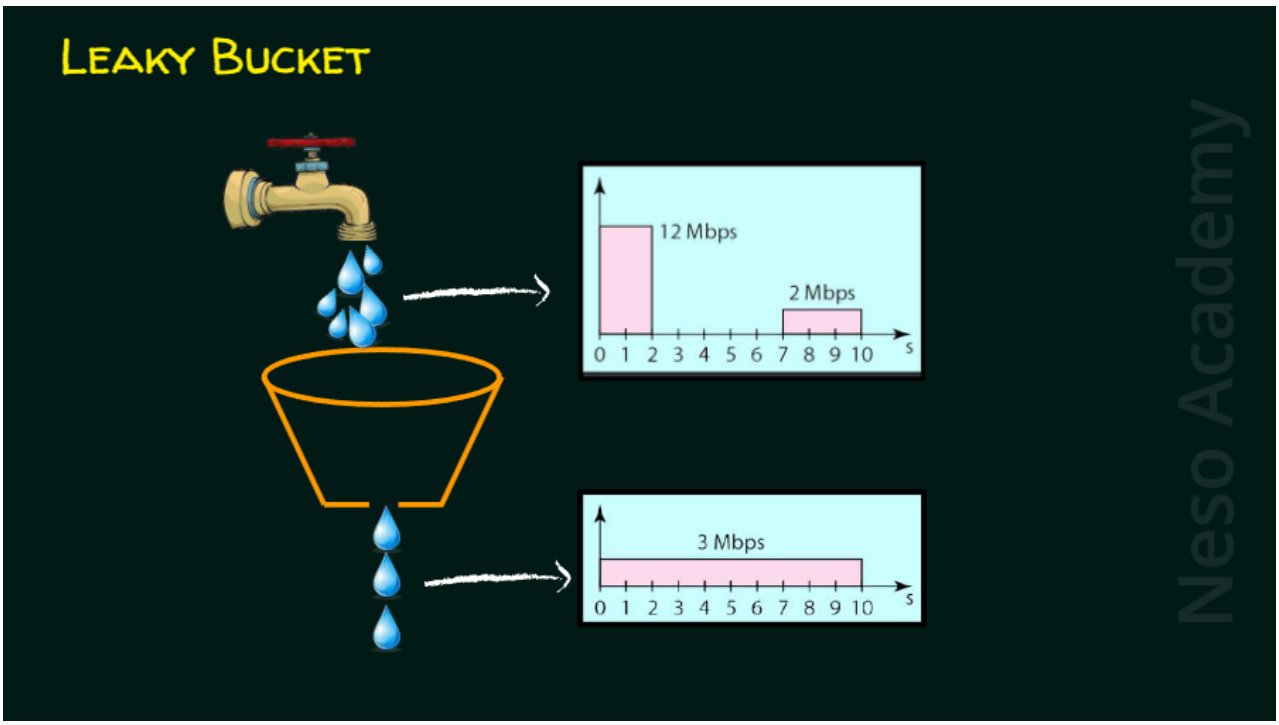
★★Traffic shapingNeso Academy



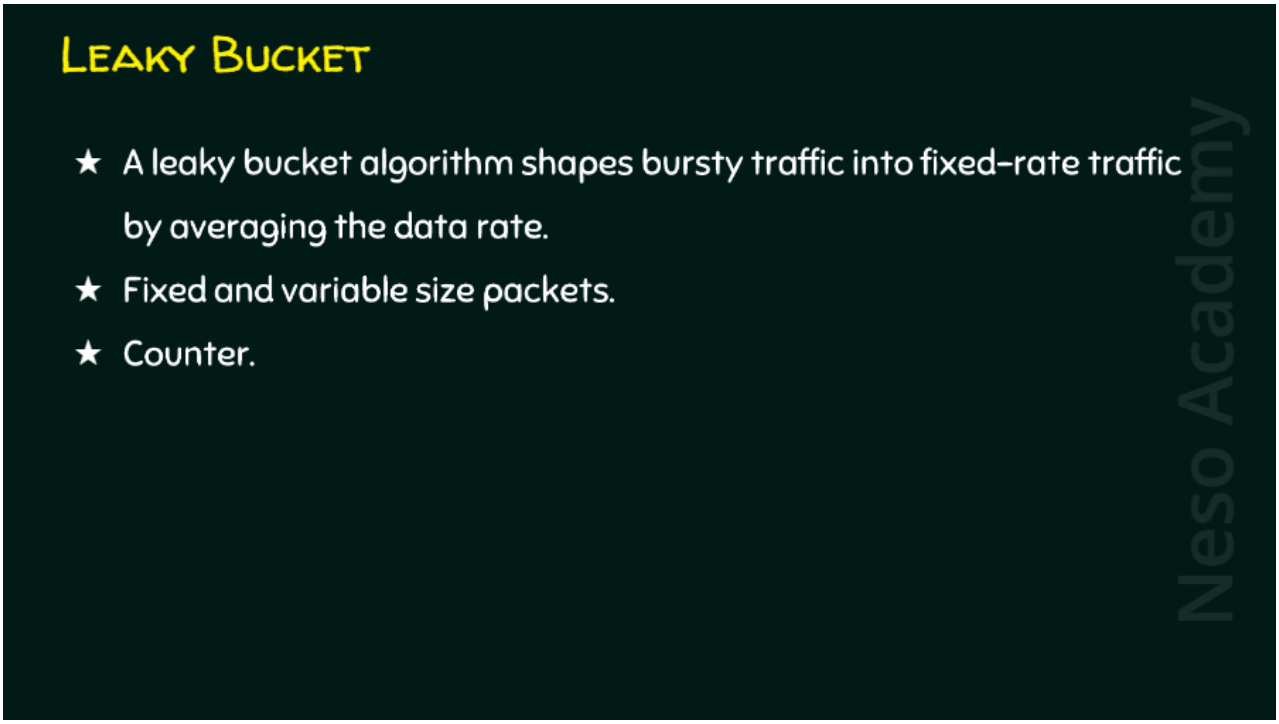
Leaky BucketNeso Academy



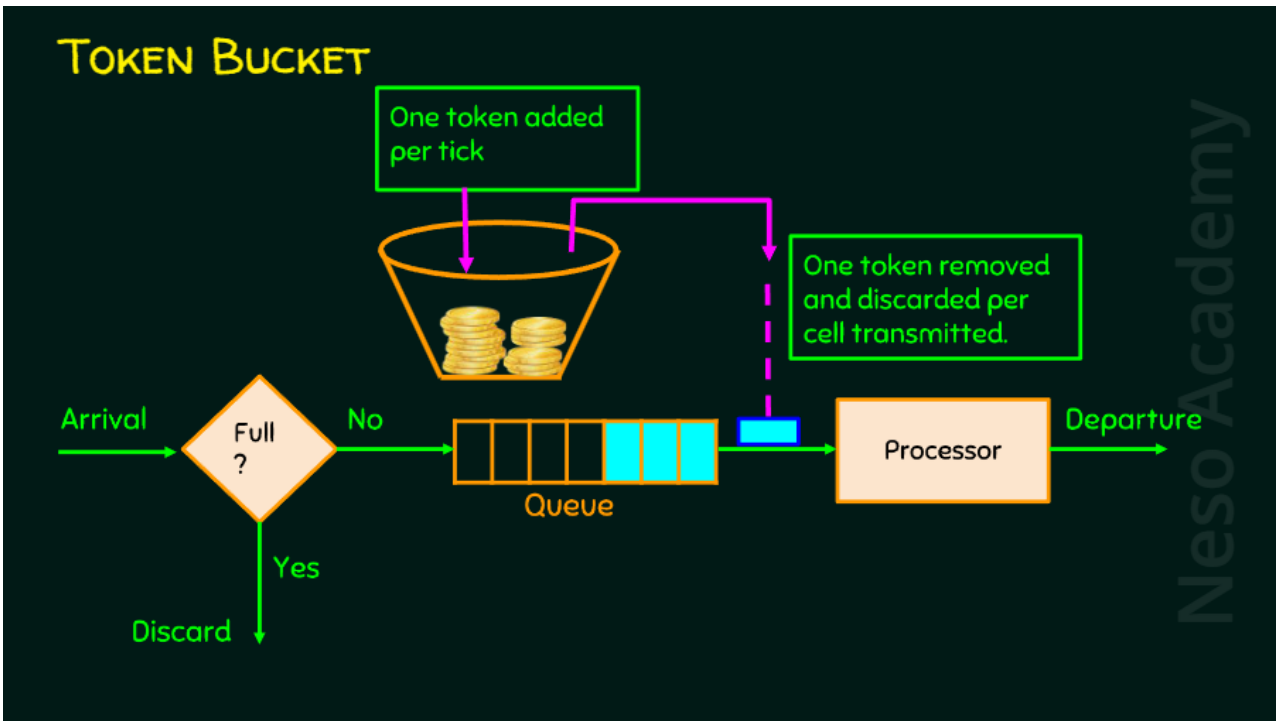
Leaky BucketNeso Academy



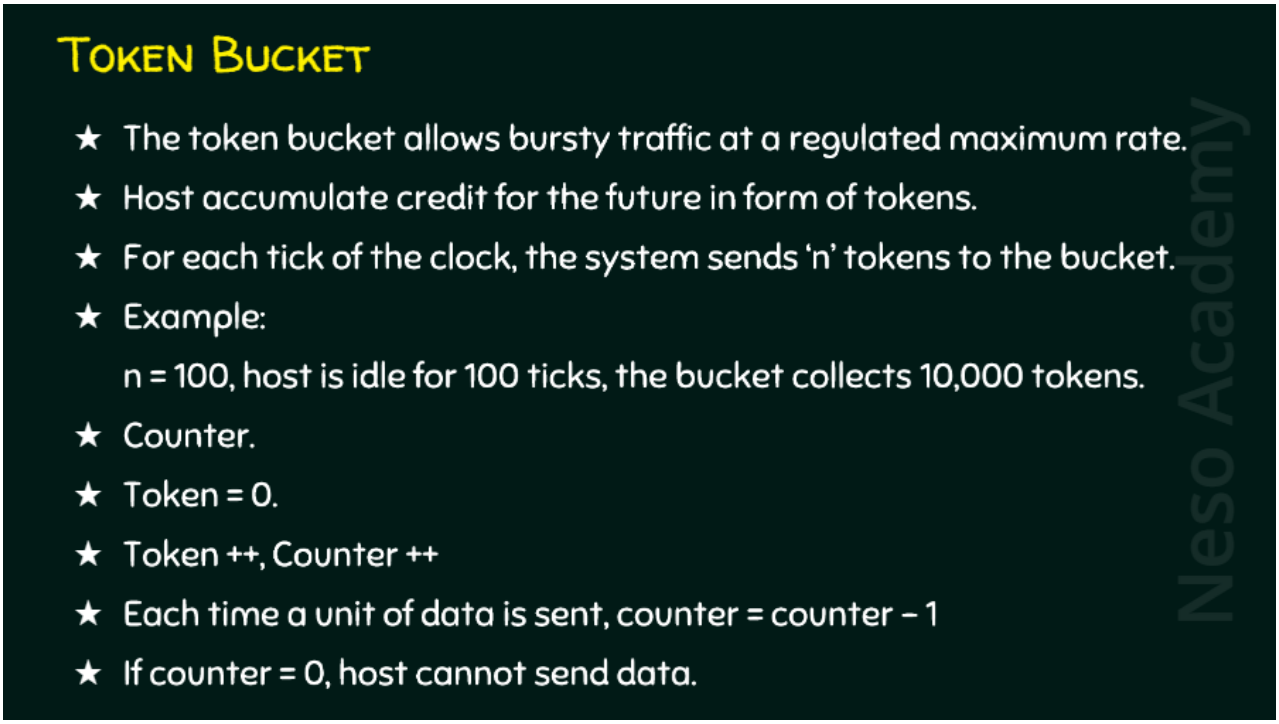
Leaky BucketNeso Academy



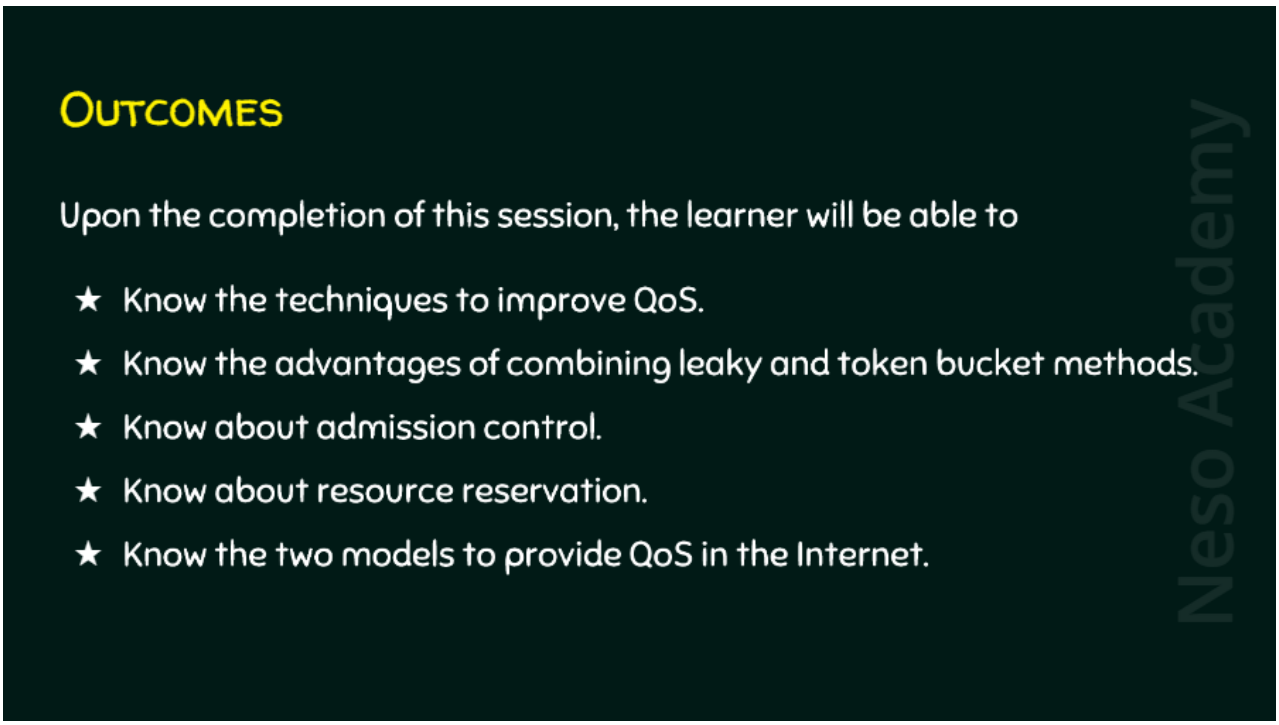
★★★Leaky BucketNeso Academy



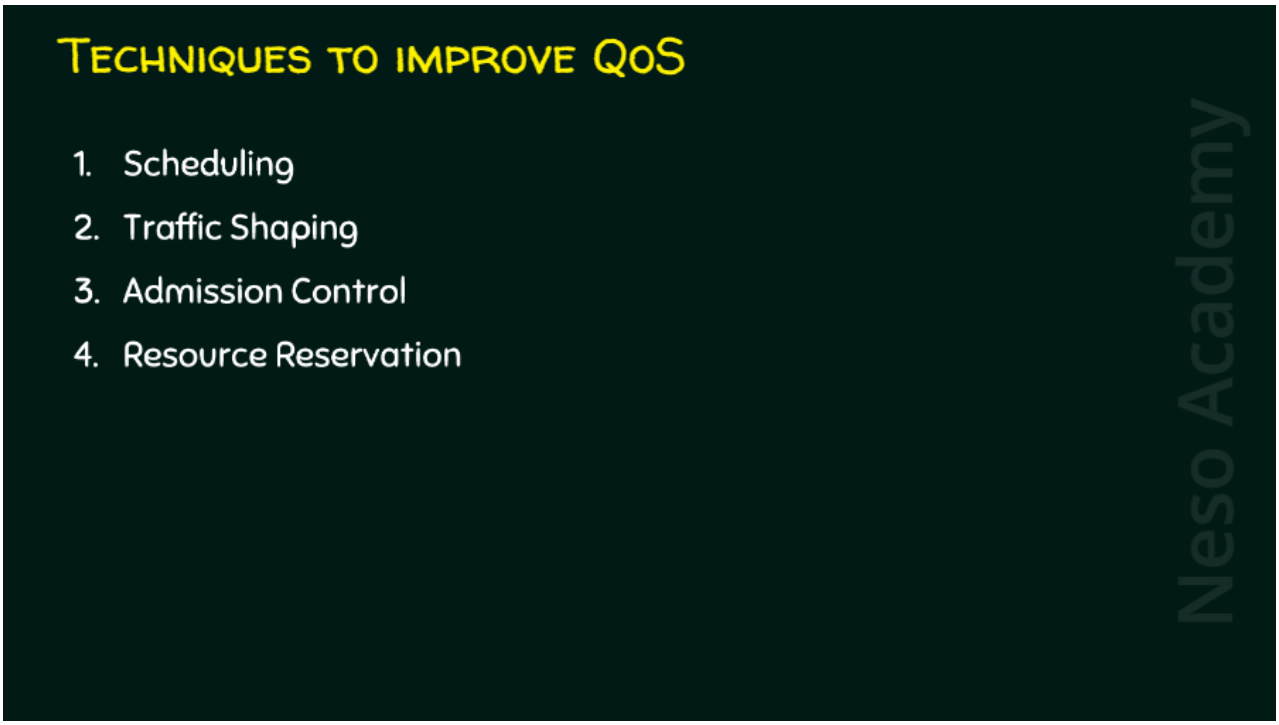
Token BucketNeso Academy



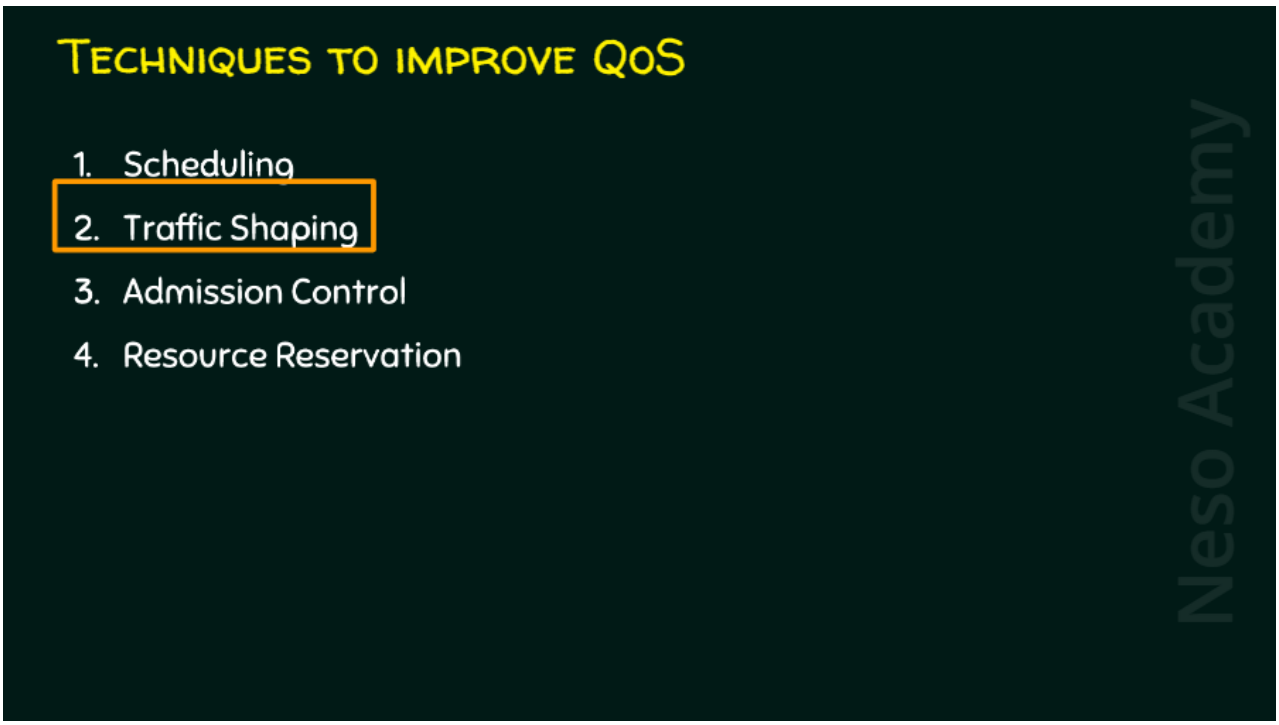
★★★★★★★★★Token BucketNeso Academy



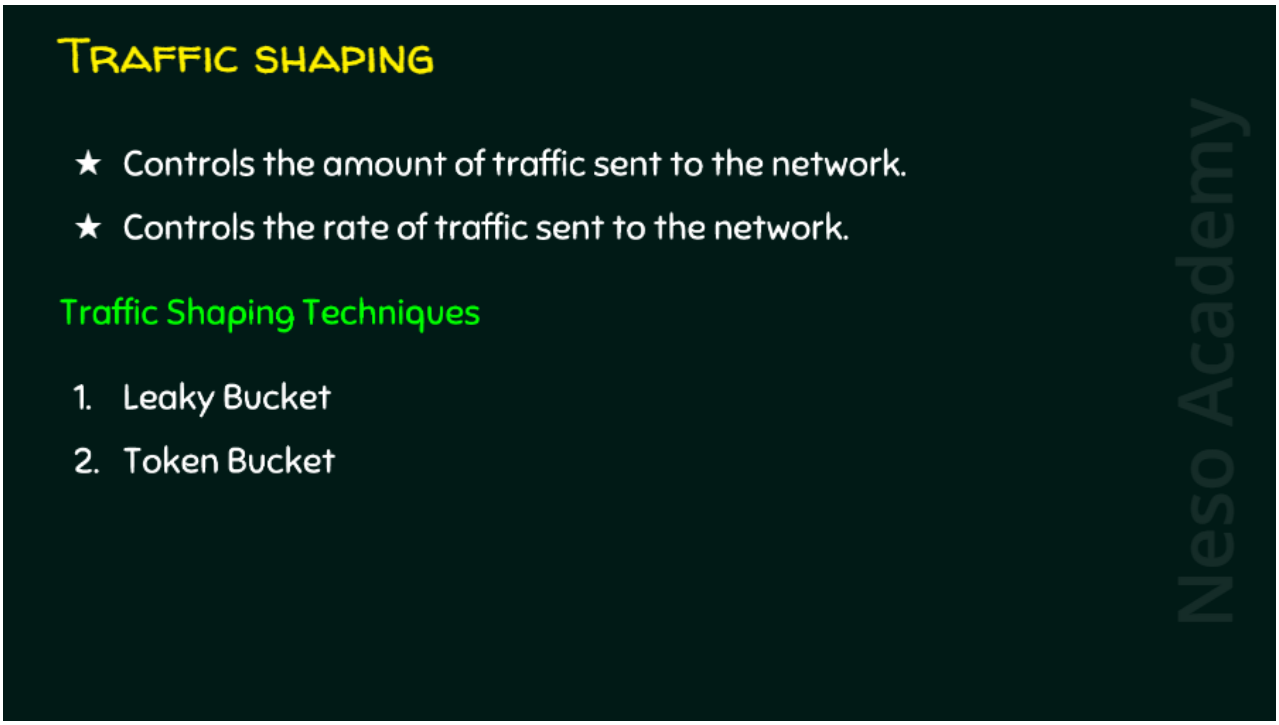
★★★★★OutcomesNeso Academy



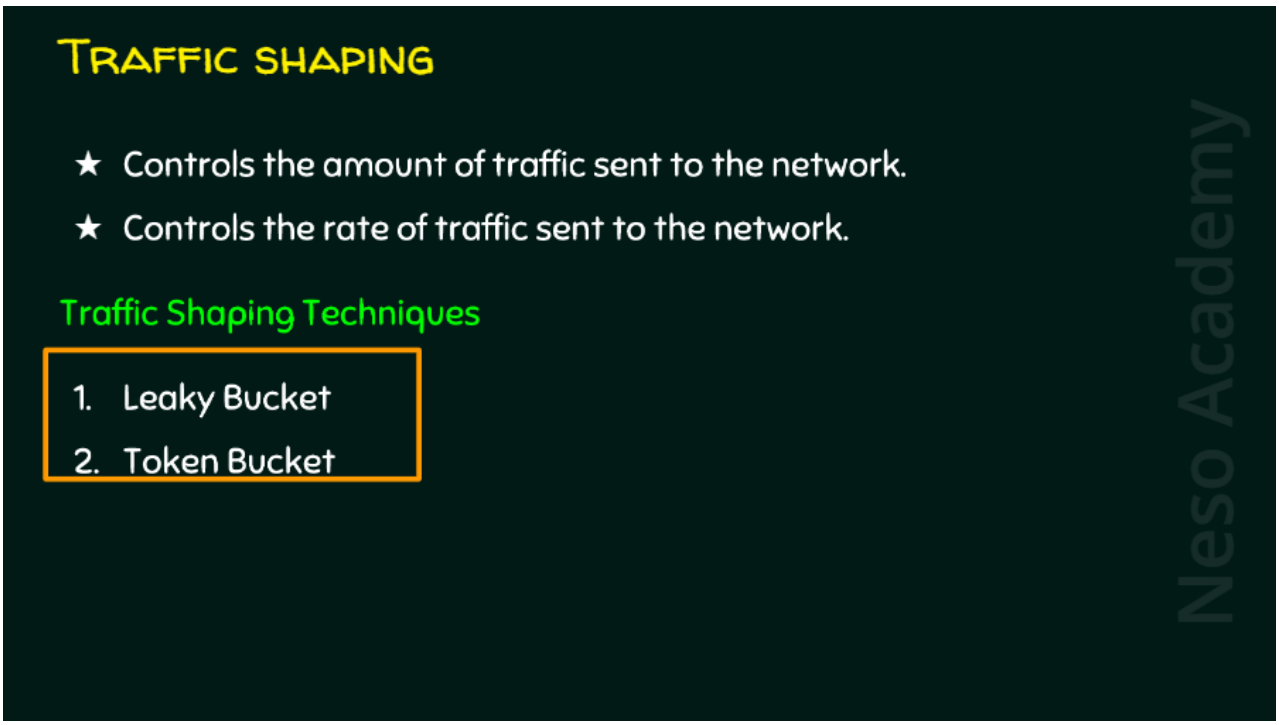
Techniques to improve QoSNeso Academy



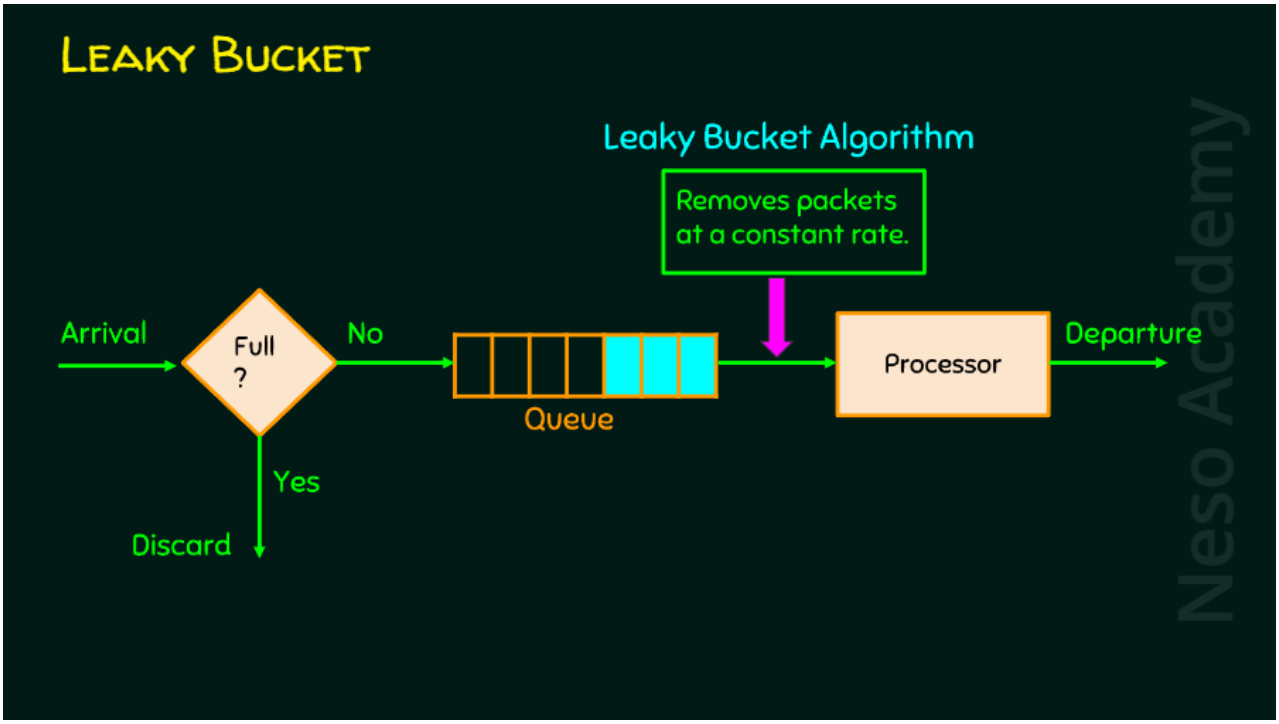
Techniques to improve QoSNeso Academy



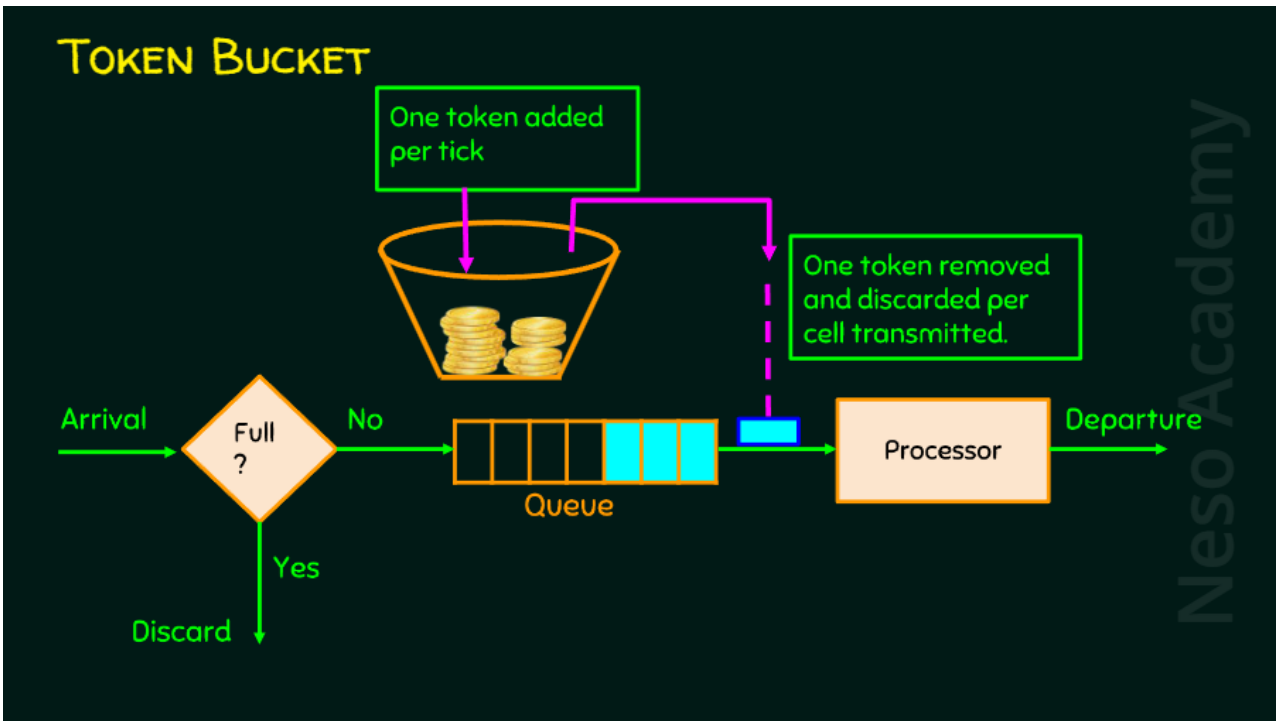
★★Traffic shapingNeso Academy



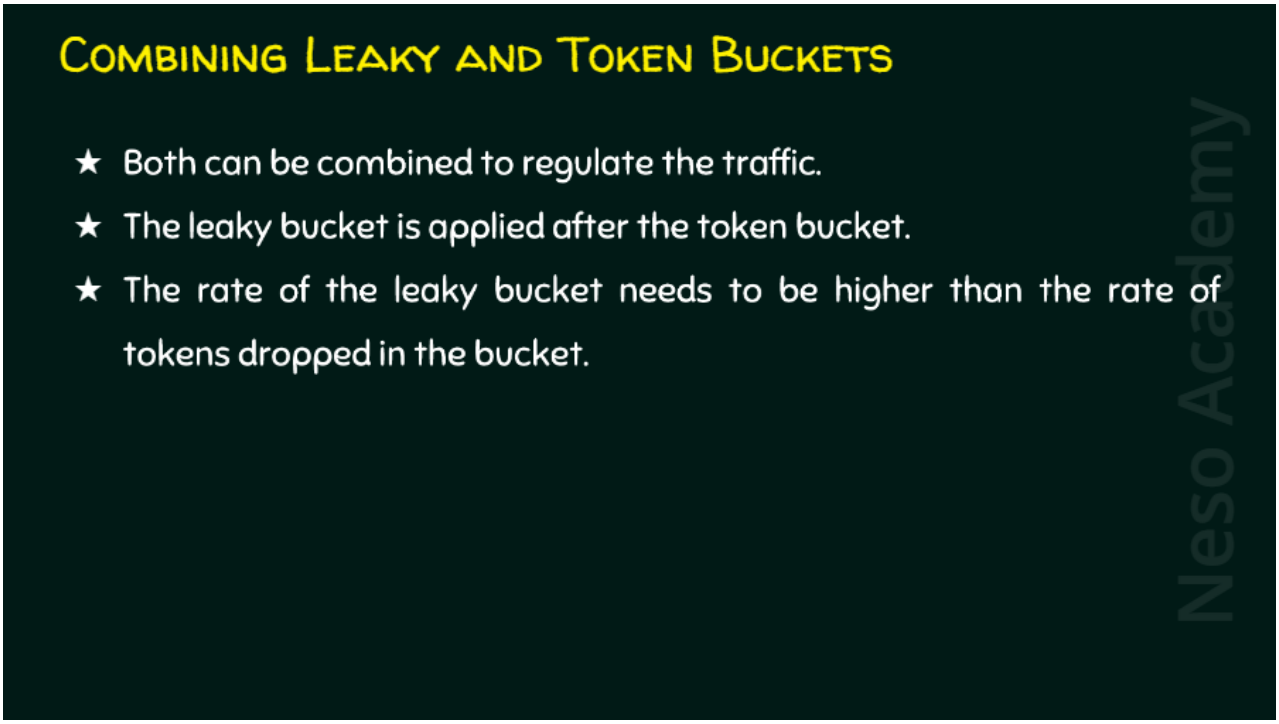
★★Traffic shapingNeso Academy



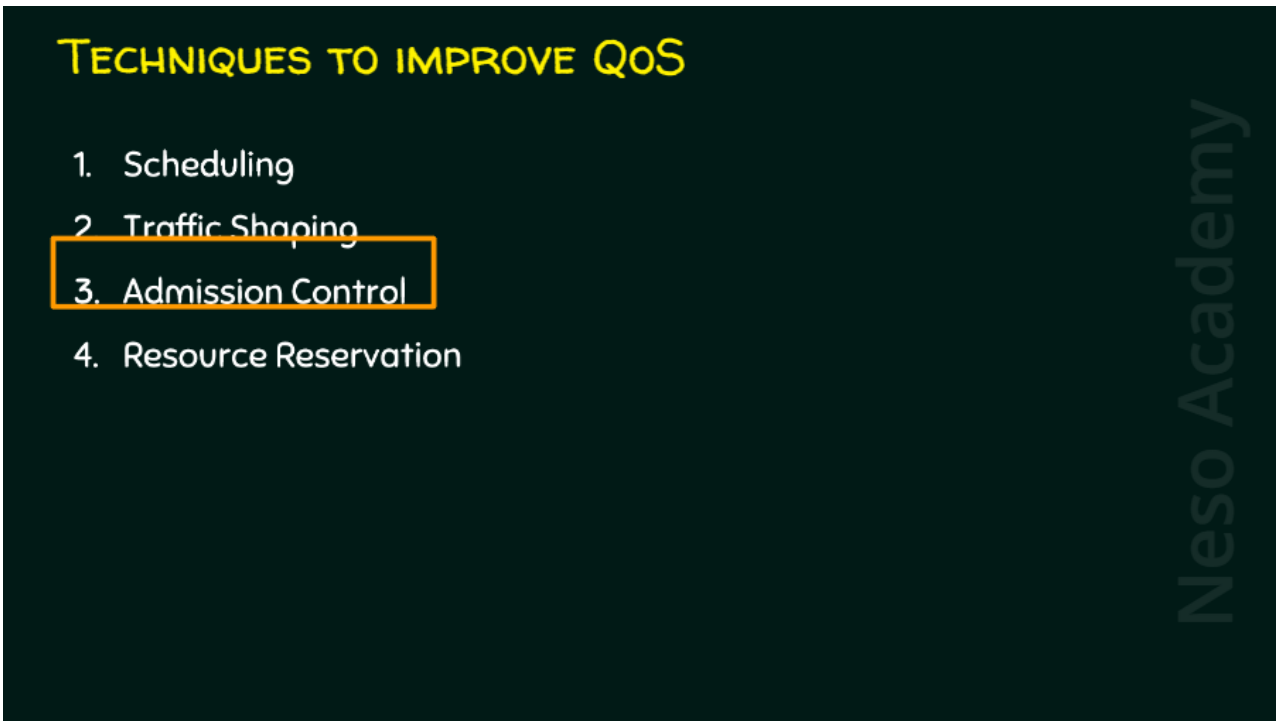
Leaky BucketNeso Academy



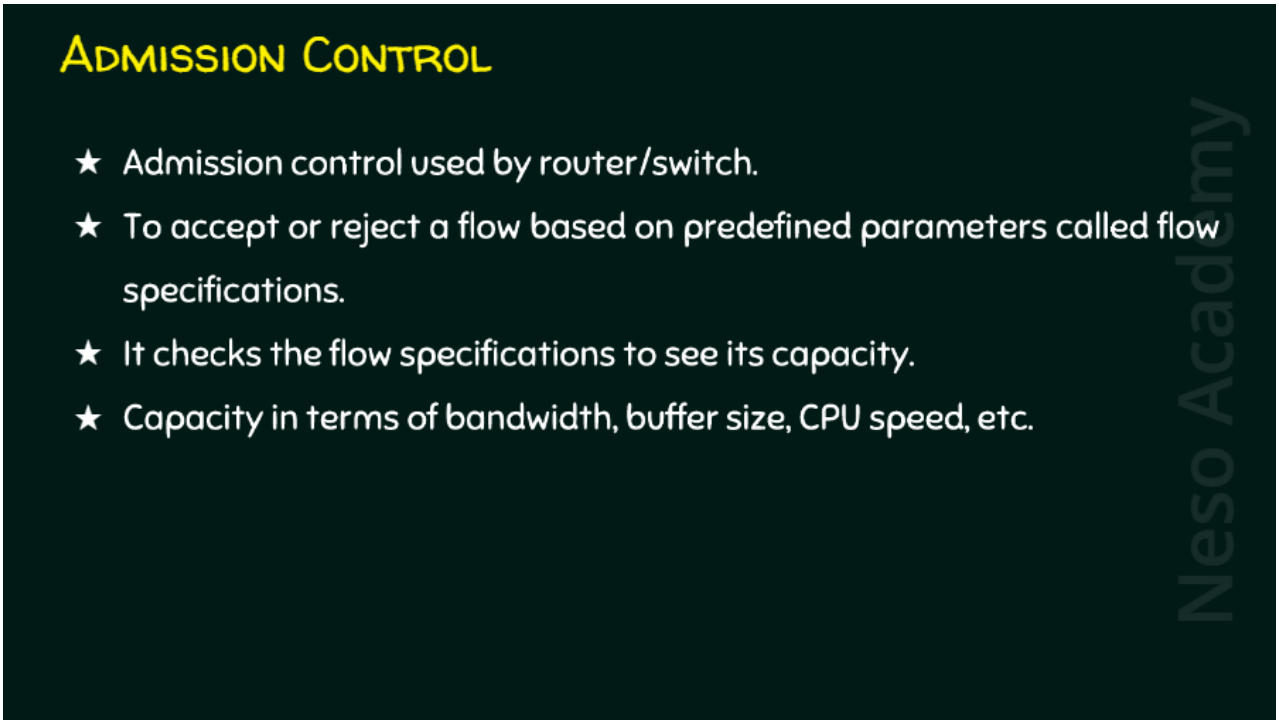
Token BucketNeso Academy



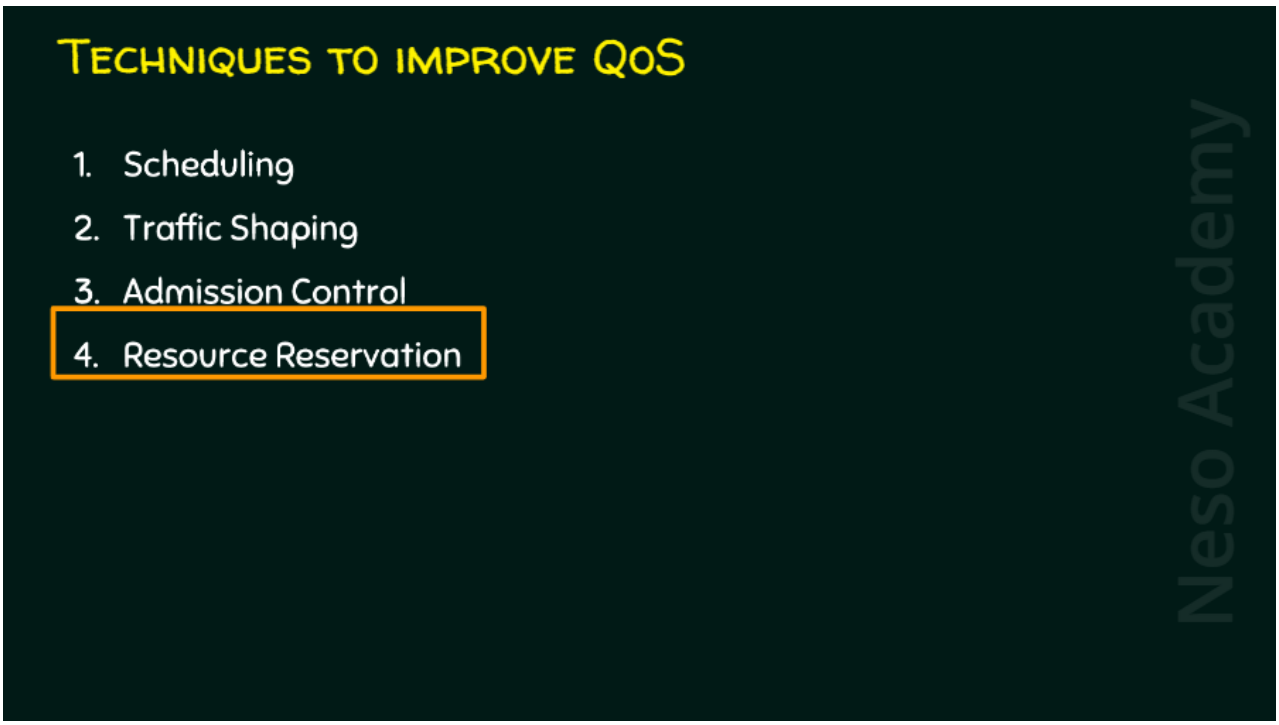
★★★Combining Leaky and Token BucketsNeso Academy



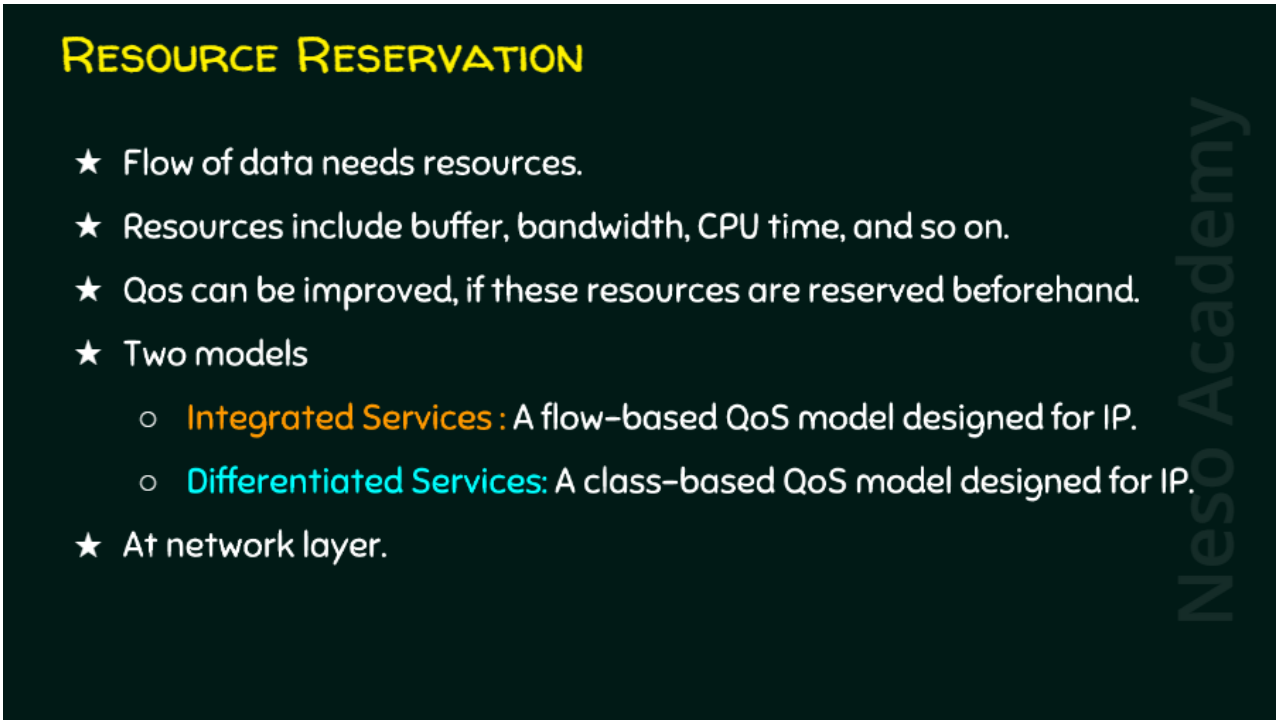
Techniques to improve QoSNeso Academy



★★★★Admission ControlNeso Academy



Techniques to improve QoSNeso Academy



★★★★○○★Resource ReservationNeso Academy