

ASSIGNMENT

BY

OGUNWOLE TOBI ISAAC

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COMPUTER SCIENCE DEPARTMENT

COLLEGE OF POSTGRADUATE STUDIES

REDEEMER'S UNIVERSITY

EDE, OSUN STATE, NIGERIA.

CSC 828 INTERNET TECHNOLOGY (ASSIGNMENT)

LECTURER IN CHARGE

DR. S.A. ADEPOJU

#1. Connection-Oriented Protocols VS. Connectionless Protocols

Connection-Oriented Protocols

A connection-oriented protocol is one where a communication session (or connection) is established before data is sent, maintained throughout the transmission, and terminated after the session ends.

Key Features:

- Requires a handshake before data transfer.
- Ensures data integrity, sequence, and delivery.
- Retransmits lost or corrupted packets.
- Involves higher overhead due to connection management.
- Slower but reliable.

Example Protocol:

- TCP (Transmission Control Protocol)
Used in email (SMTP), web browsing (HTTP/HTTPS), and file transfers (FTP).

Connectionless Protocols

A connectionless protocol sends data without setting up a connection. Each packet is sent independently and may travel different paths to the destination.

Key Features:

- No handshake or session setup.
- No guarantee of packet order or delivery.
- Lower overhead; faster than connection-oriented.
- Ideal for time-sensitive applications where some data loss is tolerable.

Example Protocol:

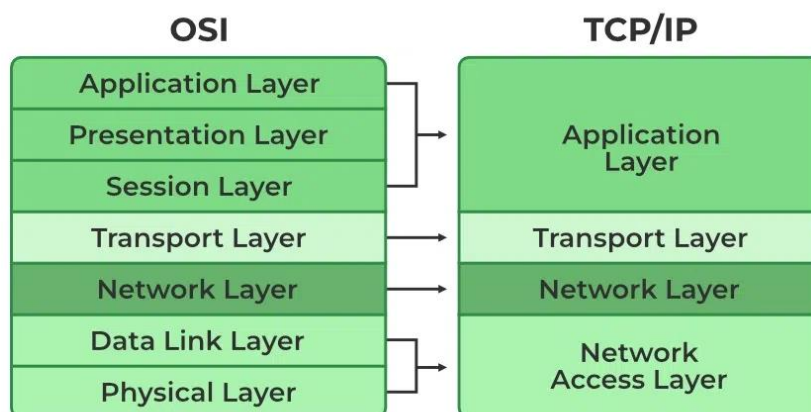
- UDP (User Datagram Protocol)
Used in live streaming, online gaming, VoIP, and DNS.

Connection-Oriented vs Connectionless Protocols comparison table

Feature	Connection-Oriented Protocol	Connectionless Protocol
Connection Setup	Required (establishes before transfer)	Not required
Reliability	High (ensures delivery, order)	Low (no guarantee of delivery/order)
Acknowledgment	Yes (acknowledges each data packet)	No acknowledgment sent
Speed	Slower due to overhead	Faster due to minimal overhead
Overhead	High (due to setup, management)	Low
Packet Sequence	Maintains sequence	Packets may arrive out of order
Error Control	Built-in (automatic retransmission)	Not built-in
Use Cases	Email, web browsing, file transfers	Streaming, gaming, VoIP, DNS
Example Protocol	TCP (Transmission Control Protocol)	UDP (User Datagram Protocol)

#2. TCP/IP and OSI model

Here is a diagram of the TCP/IP model side by side with the OSI model, showing how their layers correspond:



#3. IPV4 VS. IPV6

IPv4 (Internet Protocol version 4)

IPv4 is the **fourth version** of the Internet Protocol and is the most widely used version to identify devices on a network using an addressing system.

Key Features:

- Uses **32-bit** address space
- Provides about **4.3 billion** unique addresses
- Address format: **Decimal**, e.g., 192.168.0.1
- Header is simpler but **less secure**
- Supports broadcast communication
- Requires manual or DHCP configuration

IPv6 (Internet Protocol version 6)

IPv6 is the **newer version** of the Internet Protocol developed to address the exhaustion of IPv4 addresses, providing a vastly larger address space.

Key Features:

- Uses **128-bit** address space
- Provides approximately **3.4×10^{38}** unique addresses
- Address format: **Hexadecimal**, e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334
- More complex but **more secure and efficient**
- Does not use broadcast; uses **multicast and anycast**
- Supports **auto-configuration** (stateless and stateful)

Comparison Table: IPv4 vs IPv6

Feature	IPv4	IPv6
Address Size	32-bit	128-bit
Address Format	Decimal (e.g., 192.0.2.1)	Hexadecimal (e.g., 2001:0db8::1)
Address Space	~4.3 billion addresses	~340 undecillion addresses
Header Complexity	Simple	More complex, but efficient
Security	Optional (IPSec optional)	Mandatory IPSec support

Feature	IPv4	IPv6
Configuration	Manual or DHCP	Auto-configuration (stateless/stateful)
Communication Types	Unicast, Broadcast, Multicast	Unicast, Multicast, Anycast
Packet Fragmentation	Done by sender and routers	Done only by the sender
Routing	Less efficient	More efficient (hierarchical)
NAT (Network Address Translation)	Required due to limited addresses	Not needed due to vast address space
Backward Compatibility	Widely supported	Not directly compatible with IPv4
Deployment	Dominant, but limited	Slowly being adopted

Summary

- IPv4 is still the most used protocol but is running out of available addresses.
- IPv6 offers a much larger address space, better security, and more efficient routing, but its adoption is gradual due to legacy systems.

#4. Network Ports and Their Meaning

In computer networking, a port is a virtual communication endpoint for managing multiple services or applications on a device using the same IP address. Ports help the operating system distinguish between different types of traffic (like web, email, or file transfer).

Port Number Ranges

Port Range	Description
0–1023	Well-known ports – assigned by IANA for common services (HTTP, FTP, etc.)
1024–49151	Registered ports – used by vendors for proprietary applications
49152–65535	Dynamic/private ports – used for temporary or custom connections

#5. Common Network Ports and their uses

Port Number	Protocol	Description / Service Name
20, 21	TCP	FTP – File Transfer Protocol (data and control)
22	TCP	SSH – Secure Shell for remote login
23	TCP	Telnet – Unsecure remote login
25	TCP	SMTP – Sending emails
53	TCP/UDP	DNS – Domain Name System
67, 68	UDP	DHCP – Dynamic Host Configuration Protocol
80	TCP	HTTP – Web traffic (insecure)
110	TCP	POP3 – Receiving emails
143	TCP	IMAP – Internet Message Access Protocol
443	TCP	HTTPS – Secure web traffic
3306	TCP	MySQL – Database connection
3389	TCP	RDP – Remote Desktop Protocol
8080	TCP	HTTP Alternate – Often used for web servers

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