

COMPUTER NETWORK CS-602 UNIT -01

NOTES WITH EASY EXPLANATION

Topic 1: Computer Network (3 Pages RGPV Answer)

Introduction

Aaj ke digital yug me computers aur devices ko ek dusre ke saath communicate karne ki zarurat hoti hai. Agar har computer alag-alag kaam kare aur data share na kar sake to communication bahut difficult ho jayega. Isi problem ko solve karne ke liye Computer Network ka concept introduce kiya gaya.

Computer Network ke through users data, files, printers, internet connection aur anya resources share kar sakte hain. Aaj internet, banking, social media, online education aur cloud computing sab computer networks par hi depend karte hain.

Definition

Computer Network is a collection of interconnected computers and devices that communicate with each other and share data, resources and services through communication links.

Simple Definition

"Jab do ya do se adhik computers communication medium ke madhyam se connected hote hain aur information exchange karte hain, use Computer Network kehte hain."

Why Computer Network is Needed

Computer Network ke bina modern communication possible nahi hota.

Main Needs

1. Data Sharing
2. Resource Sharing
3. Communication
4. Reliability
5. Cost Reduction
6. Centralized Management

Example:

Ek college me 100 computers hain.

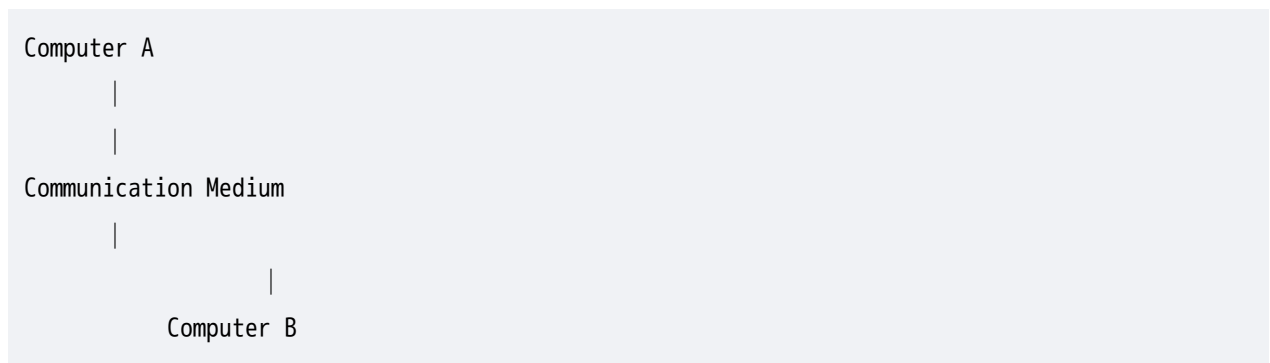
Agar network na ho:

- Har computer alag printer use karega.
- Data manually copy karna padega.

Agar network ho:

- Sab computers ek hi printer use karenge.
- Files easily share hongy.

Basic Structure of Computer Network



Communication Medium:

- Cable

- Fiber Optic
 - WiFi
 - Radio Waves
-

Components of Computer Network

1. Sender

Data bhejne wala device.

Example:

Laptop

2. Receiver

Data receive karne wala device.

Example:

Mobile

3. Communication Channel

Data transfer ka path.

Examples:

- Twisted Pair Cable
 - Optical Fiber
 - WiFi
-

4. Protocol

Communication ke rules.

Examples:

- TCP
 - IP
 - HTTP
 - FTP
-

5. Message

Transfer hone wali information.

Examples:

- Text
 - Image
 - Video
 - Audio
-

Working of Computer Network

Step 1

Sender data prepare karta hai.

Step 2

Data packets me convert hota hai.

Step 3

Communication medium ke through travel karta hai.

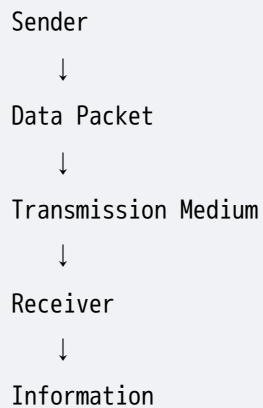
Step 4

Receiver packets receive karta hai.

Step 5

Original data reconstruct hota hai.

Flowchart



Characteristics of Computer Network

Connectivity

Devices connected hote hain.

Communication

Information exchange hoti hai.

Resource Sharing

Resources share kiye ja sakte hain.

Scalability

Naye devices add kiye ja sakte hain.

Reliability

Backup systems available hote hain.

Real Life Applications

Banking

ATM aur bank branches network ke through connected hoti hain.

Education

Online classes aur LMS systems.

Healthcare

Patient records sharing.

E-Commerce

Amazon, Flipkart.

Social Media

Instagram, Facebook, WhatsApp.

Advantages of Computer Network

1. Resource Sharing

Printer, storage aur software share kiye ja sakte hain.

2. Fast Communication

Email aur instant messaging possible.

3. Cost Effective

Hardware cost reduce hoti hai.

4. Data Backup

Centralized backup possible.

5. Scalability

Network expand karna easy hota hai.

6. Reliability

Alternative paths available hote hain.

Disadvantages of Computer Network

1. Security Risks

Hackers attack kar sakte hain.

2. Virus Spread

Virus poore network me spread ho sakta hai.

3. Maintenance Cost

Network management expensive ho sakta hai.

4. Dependency

Server fail hone par services stop ho sakti hain.

Applications of Computer Network

- Internet
- Email
- Video Conferencing

- Cloud Computing
 - Online Banking
 - E-Commerce
 - Social Networking
 - Remote Access
-

Conclusion

Computer Network modern communication ka backbone hai. Yeh devices ko connect karke data sharing, resource sharing aur communication ko easy banata hai. Internet, online education, banking aur cloud services sab computer networks par depend karte hain. Isi wajah se Computer Network aaj ki digital duniya ka ek essential part hai.

RGPV Examiner Keywords

Computer Network
Communication
Data Sharing
Resource Sharing
Protocols
Connectivity
Communication Medium
Sender
Receiver
Scalability
Reliability

Ye answer exam me likhoge to **12–14 marks ke liye sufficient length** ho jayega.

Next Topic: *Goals, Components, Architecture, Classification & Types of Computer Network* (3-page detailed answer).

Topic 2: Goals, Components, Architecture, Classification & Types of Computer Network

Complete 3-Page RGPV Answer

Introduction

Computer Network ka main purpose computers aur devices ke beech communication establish karna hai. Sirf devices ko connect karna hi kaafi nahi hota, balki network ke kuch specific goals hote hain jinke liye network design kiya jata hai. Kisi bhi network ko samajhne ke liye uske goals, components, architecture aur types ko samajhna bahut zaruri hai.

Aaj Internet, Banking, Cloud Computing, Social Media aur Online Education sabhi computer networks par depend karte hain.

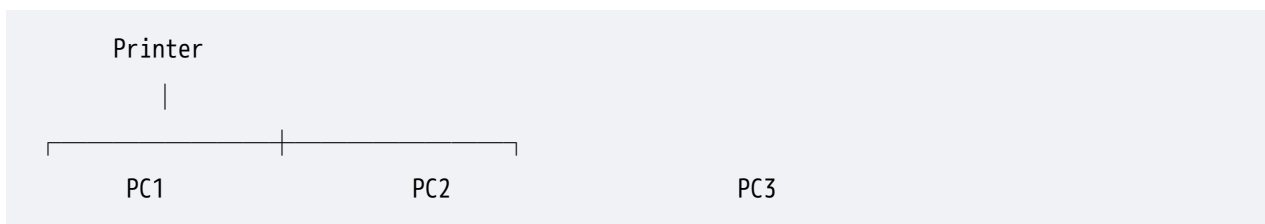
Goals of Computer Network

Network banane ke kuch important objectives hote hain.

1. Resource Sharing

Network ke through multiple users ek hi resource use kar sakte hain.

Example



Sab computers ek hi printer use kar rahe hain.

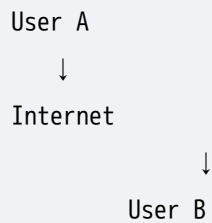
Benefits

- Cost kam hoti hai
 - Resources efficiently use hote hain
-

2. Communication

Users ek dusre ke saath information exchange kar sakte hain.

Example



- Email
 - WhatsApp
 - Video Calls
-

3. High Reliability

Agar ek system fail ho jaye to backup system available hota hai.

Example



Network continuously work karta rehta hai.

4. Cost Reduction

Ek hi software ya hardware multiple users use kar sakte hain.

Example

- Shared Printer
 - Shared Storage
 - Shared Internet
-

5. Scalability

Network me naye devices easily add kiye ja sakte hain.

Example

PC1

PC2

PC3



PC4 Added

Network ko expand karna easy hota hai.

Components of Computer Network

Computer Network kai components se milkar banta hai.

1. Sender

Jo data send karta hai.

Example

Laptop

2. Receiver

Jo data receive karta hai.

Example

Mobile Phone

3. Message

Transfer hone wali information.

Examples

- Text
 - Audio
 - Video
 - Images
-

4. Communication Medium

Data transfer ka path.

Examples

Guided Media

- Twisted Pair Cable
- Coaxial Cable
- Optical Fiber

Unguided Media

- WiFi
- Radio Waves
- Microwave

5. Protocol

Communication ke rules.

Examples

Protocol	Use
HTTP	Web Browsing
FTP	File Transfer
SMTP	Email
TCP/IP	Internet Communication

Architecture of Computer Network

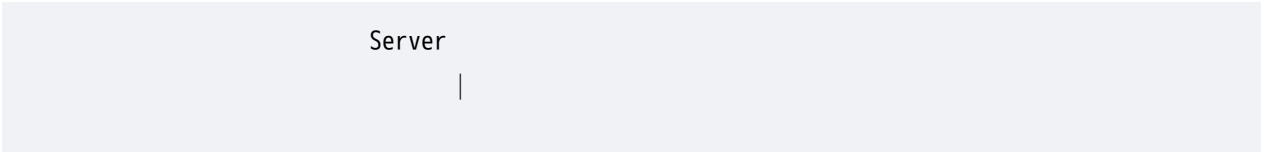
Network architecture batata hai ki devices kis tarah organize aur communicate karte hain.

Mainly do types:

1. Client Server Architecture

Is architecture me ek dedicated server hota hai jo services provide karta hai.

Diagram



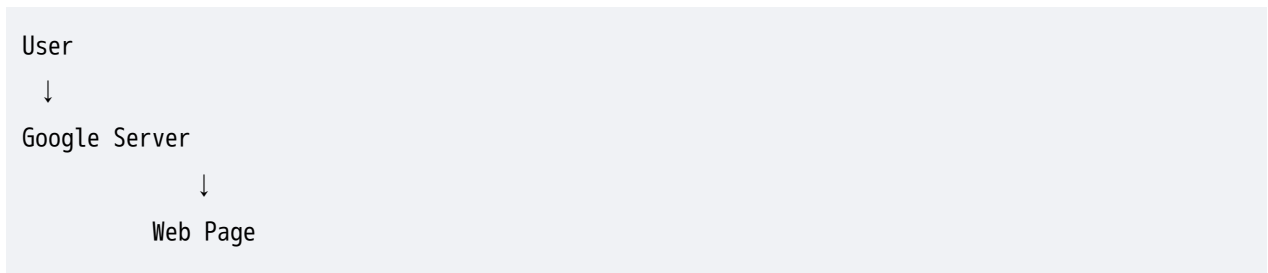


Working

1. Client request bhejta hai.
2. Server request process karta hai.
3. Server response send karta hai.

Example

Google Website



Advantages

- Centralized management
- Better security
- Easy backup

Disadvantages

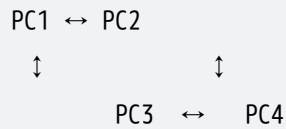
- Server failure se poora system affect hota hai
- Costly

2. Peer-to-Peer Architecture

Sab computers equal hote hain.

Koi dedicated server nahi hota.

Diagram



Working

Har computer client bhi hai aur server bhi.

Example

Torrent Network

Advantages

- Low cost
- Easy setup
- No dedicated server required

Disadvantages

- Security weak
- Large networks ke liye suitable nahi

Classification of Networks

Network ko geographical area ke basis par classify kiya jata hai.

1. PAN (Personal Area Network)

Definition

Personal devices ke beech network.

Example

Mobile



Bluetooth Earbuds

Range

1–10 meters

2. LAN (Local Area Network)

Definition

Small area me network.

Example

Computer Lab

Diagram

PC1 — Router — PC2



PC3

Range

Building level

Advantages

- Fast speed
 - Low cost
-

3. MAN (Metropolitan Area Network)

Definition

City level network.

Example

Entire City Network

Range

10–100 km

Applications

- City Internet Providers
 - Cable TV Networks
-

4. WAN (Wide Area Network)

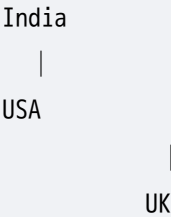
Definition

Large geographical area cover karta hai.

Example

Internet

Diagram



Range

Worldwide

Advantages

- Global communication
- Large coverage

Disadvantages

- Expensive
- Complex management

Comparison of PAN, LAN, MAN and WAN

Feature	PAN	LAN	MAN	WAN
Range	Few meters	Building	City	Worldwide
Speed	Medium	High	Medium	Variable
Cost	Low	Low	Medium	High

Example	Bluetooth	College Lab	City Network	Internet
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Applications of Computer Networks

Education

- Online classes
- LMS portals

Banking

- ATM networks
- Online banking

Healthcare

- Patient records

Business

- Resource sharing

Social Media

- Facebook
 - Instagram
 - WhatsApp
-

Advantages of Network Architecture

- Better communication
 - Easy resource sharing
 - Centralized management
 - Scalability
 - Cost effectiveness
-

Conclusion

Computer Networks communication aur resource sharing ke liye essential hain. Network ke goals communication, reliability aur resource sharing ko achieve karna hai. Network architecture mainly Client-Server aur Peer-to-Peer hoti hai. Geographical area ke basis par PAN, LAN, MAN aur WAN networks use kiye jate hain. Modern Internet aur digital services inhi concepts par based hain.

RGPV Examiner Keywords

```
Goals of Network
Resource Sharing
Communication
Reliability
Cost Reduction
Sender
Receiver
Protocol
Client Server Architecture
    Peer to Peer Architecture
        PAN
        LAN
        MAN
        WAN
    Scalability
```

PYQ Priority: ★★★★★

Ye topic RGPV me bahut frequently poocha jata hai:

- Goals of Computer Network
- Components of Network
- Client Server vs Peer-to-Peer
- PAN, LAN, MAN, WAN Comparison

Next Topic: *Layered Architecture, Protocol Hierarchy, Design Issues, Interfaces and Services*

(Full 3-page answer with diagrams and flowcharts).

Topic 3: Layered Architecture, Protocol Hierarchy, Design Issues, Interfaces and Services

Complete 3-Page RGPV Answer

Introduction

Jab computers ek dusre ke saath communicate karte hain, to bahut saare tasks perform hote hain jaise data transmission, error checking, routing, addressing aur security. Agar ye saare kaam ek hi program kare to system bahut complex ho jayega.

Isi problem ko solve karne ke liye **Layered Architecture** ka concept introduce kiya gaya. Isme communication process ko alag-alag layers me divide kiya jata hai, jahan har layer ek specific task perform karti hai.

Aaj ke sabhi modern networks (OSI, TCP/IP) layered architecture par based hain.

What is Layered Architecture?

Definition

Layered Architecture is a networking approach in which communication functions are divided into different layers, and each layer performs a specific task while providing services to the layer above it.

Simple Definition

"Communication process ko multiple layers me divide karna Layered Architecture kehlata hai."

Why Layered Architecture is Needed?

Without Layers

```
Communication Program
|
├ Error Control
├ Routing
├ Security
├ Addressing
  │
  ├── Data Transfer
  ├── Flow Control
  └ Session Management
```

System bahut complex ho jayega.

With Layers

```
Application Layer
  ↓
Transport Layer
  ↓
```

Network Layer



Data Link Layer



Physical Layer

Har layer ek specific kaam karti hai.

Advantages of Layered Architecture

1. Simplicity

Complex system ko simple parts me divide kar deta hai.

2. Easy Troubleshooting

Problem kis layer me hai ye easily identify kar sakte hain.

3. Flexibility

Ek layer ko change karne se poora system affect nahi hota.

4. Standardization

Different vendors ke devices communicate kar sakte hain.

5. Reusability

Ek layer ke protocols dusre networks me bhi use kiye ja sakte hain.

Protocol Hierarchy

What is Protocol?

Protocol communication ke rules hote hain.

Definition

A protocol is a set of rules that governs communication between devices in a network.

Examples of Protocols

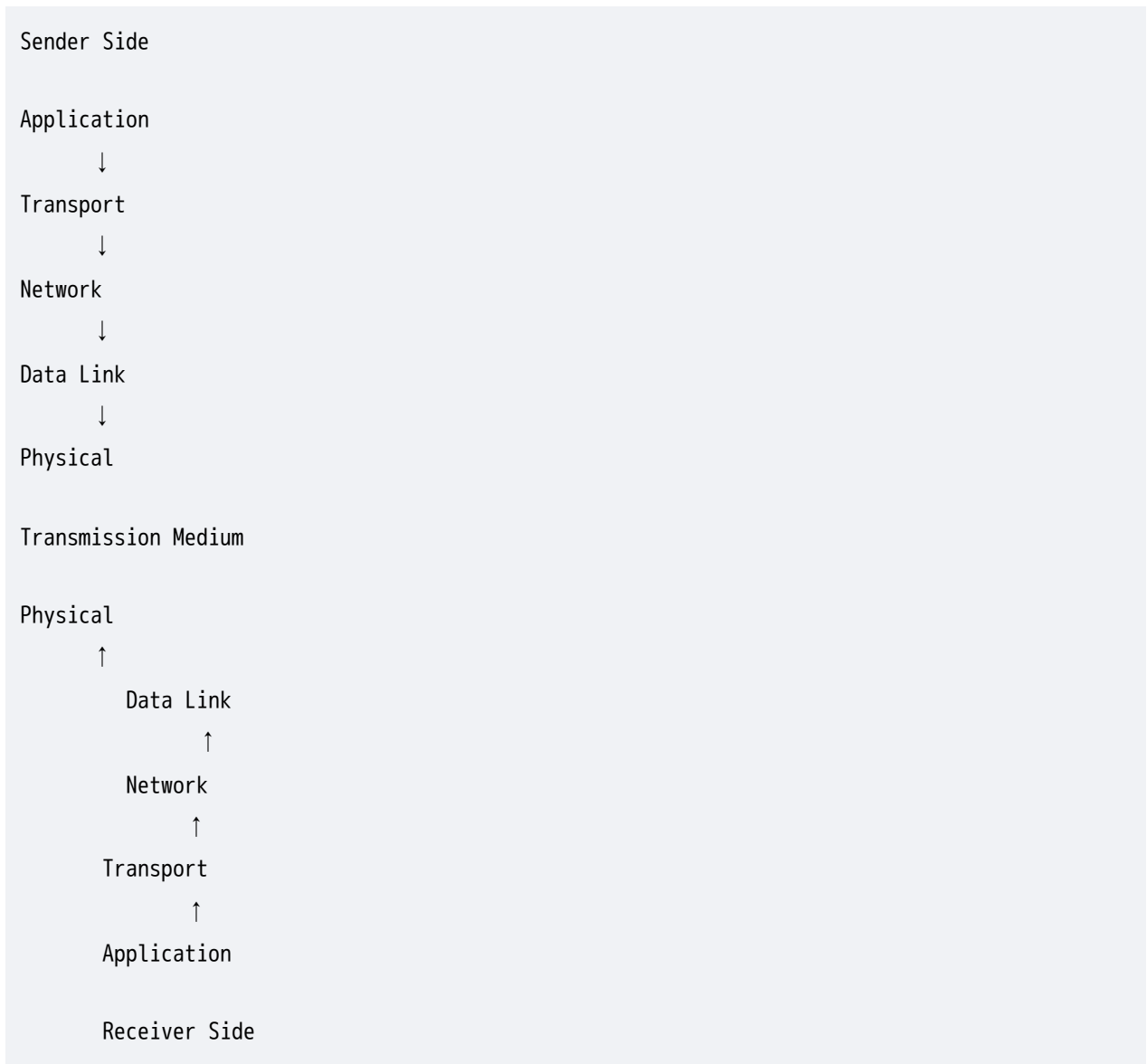
Protocol	Function
HTTP	Web Browsing
FTP	File Transfer
SMTP	Email
TCP	Reliable Communication
IP	Routing

Protocol Hierarchy

Har layer ka apna protocol hota hai.

Application Layer	→ HTTP, FTP
Transport Layer	→ TCP, UDP
Network Layer	→ IP
Data Link Layer	→ Ethernet
Physical Layer	→ Cables

Protocol Hierarchy Diagram



Design Issues in Layered Architecture

Network design karte samay kuch important issues solve karne padte hain.

1. Addressing

Data ko correct destination tak pahunchana.

Example

House Address



Data Address

Network me IP Address use hota hai.

2. Error Control

Transmission ke dauran data corrupt ho sakta hai.

Example

Original:

10101010

Received:

10100010

Error detect aur correct karna zaruri hai.

3. Flow Control

Sender aur receiver ki speed different ho sakti hai.

Example

Fast Sender



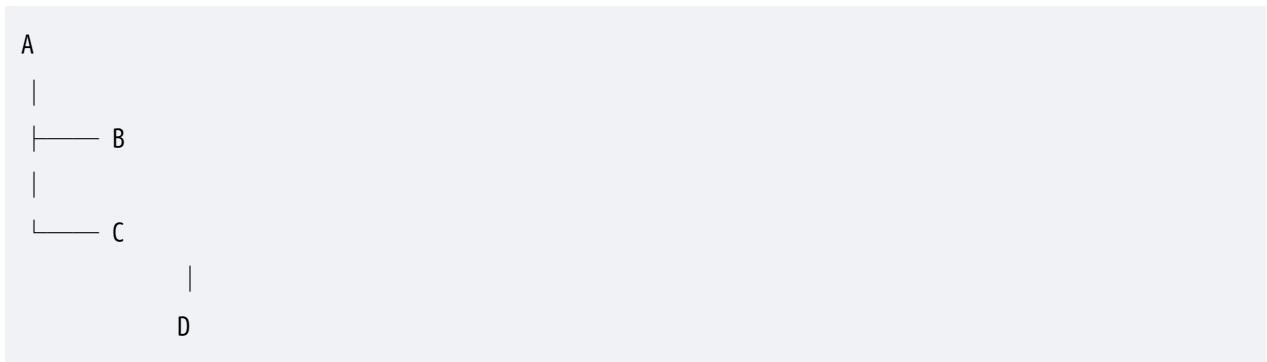
Slow Receiver

Flow control ensure karta hai ki receiver overload na ho.

4. Routing

Data ko destination tak bhejne ke liye best path select karna.

Example

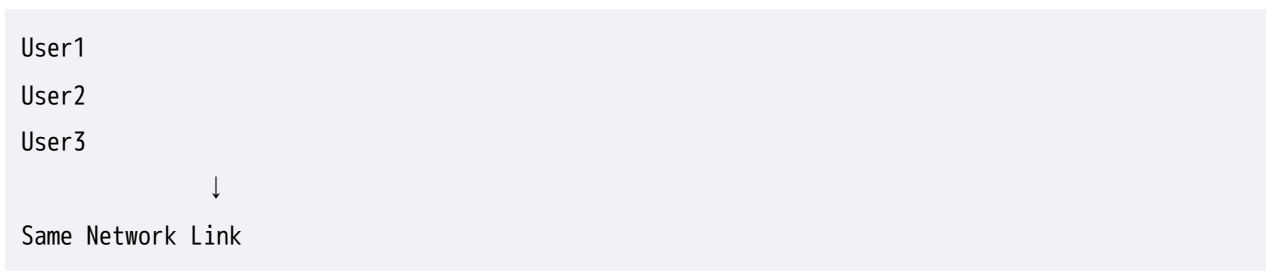


Network shortest path choose karta hai.

5. Multiplexing

Multiple users ek hi communication channel use kar sakte hain.

Example



6. Security

Data ko unauthorized access se protect karna.

Methods

- Encryption
 - Authentication
 - Firewalls
-

7. Reliability

Data safely deliver hona chahiye.

Interfaces

Definition

Interface is a point where two adjacent layers communicate with each other.

Diagram

Layer 5

Interface

Layer 4

Why Interfaces are Important?

- Layers ko independent banati hain.
 - Communication standardize karti hain.
 - Layer implementation hide karti hain.
-

Services

Definition

A service is a facility provided by one layer to the layer above it.

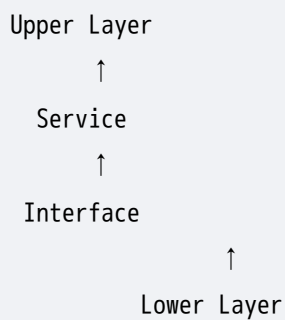
Example

Transport Layer:

Reliable Data Delivery

Application Layer us service ko use karti hai.

Relationship Between Layer, Interface and Service



Service Types

1. Reliable Service

Data guaranteed deliver hota hai.

Example

TCP

2. Unreliable Service

Delivery guarantee nahi hoti.

Example

UDP

How Layered Architecture Works?

Step 1

Application data create karti hai.

↓

Step 2

Transport layer segment banati hai.

↓

Step 3

Network layer packet banati hai.

↓

Step 4

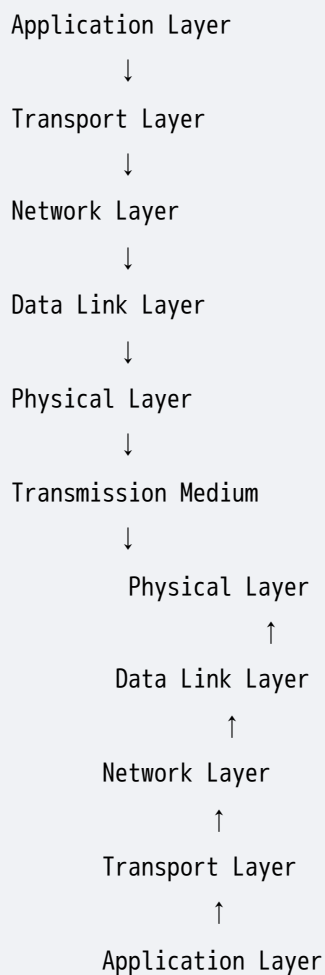
Data Link layer frame banati hai.

↓

Step 5

Physical layer bits transmit karti hai.

Complete Flowchart



Real Life Example

Suppose tum WhatsApp par message bhejte ho.

Message Type



Application Layer

TCP Segment



Transport Layer

IP Packet



Network Layer

Frame



Data Link Layer

Bits



Physical Layer

Receiver side par reverse process hota hai.

Advantages of Layered Architecture

1. Easy Development

2. Standardization

3. Better Maintenance

4. Easier Troubleshooting

5. Modularity

6. Scalability

Disadvantages

1. Processing Overhead

2. Delay Increase

3. Layer Duplication

Kuch functions multiple layers me repeat ho sakte hain.

Applications

- Internet
 - Mobile Networks
 - WiFi Systems
 - Cloud Computing
 - Enterprise Networks
 - Data Centers
-

Conclusion

Layered Architecture networking ka foundation hai. Ye communication process ko manageable parts me divide karta hai. Protocol hierarchy communication rules define karti hai, interfaces layers ke beech interaction provide karti hain aur services upper layers ko facilities provide karti hain. Isi approach ki wajah se OSI aur TCP/IP jaise modern networking models successfully kaam karte hain.

RGPV Examiner Keywords

Layered Architecture
Protocol Hierarchy
Design Issues
Addressing
Routing
Error Control
Flow Control
Interface
 Services
 Reliability
 Security
 Multiplexing
 Communication Layers

PYQ Priority: ★★★★★

Bahut frequently poocha jata hai:

- Explain Layered Architecture.
- Explain Protocol Hierarchy.
- Discuss Design Issues in Layered Architecture.
- Explain Interfaces and Services.

Next Topic:

Connection Oriented Service, Connectionless Service, Service Primitives & Their Functionality (Full 3-page RGPV answer with diagrams and comparison table).

Topic 4: Connection Oriented Service, Connectionless Service, Service Primitives &

Their Functionality

Complete 3-Page RGPV Answer

Introduction

Computer networks me data ek device se dusre device tak transfer hota hai. Lekin data transfer karne ke do alag methods hote hain:

1. Connection Oriented Service
2. Connectionless Service

Kuch applications reliable communication chahti hain (Banking, Email), jabki kuch applications speed ko importance deti hain (Video Streaming, Gaming).

Isi wajah se networking me dono types ki services use ki jaati hain.

What is a Service?

Definition

A service is a facility provided by one layer of a network architecture to the layer above it.

Simple Definition

Service ka matlab hai kisi layer dwara dusri layer ko di gayi facility.

Example

Transport Layer Application Layer ko reliable communication provide karti hai.

Application Layer



Service



Transport Layer

Connection Oriented Service

Definition

Connection Oriented Service is a communication method in which a connection is established before data transfer, maintained during communication and terminated after communication is completed.

Simple Meaning

Pehle connection banao,
fir data bhejo,
fir connection close karo.

Real Life Example

Telephone Call

Dial Number



Connection Established



Conversation



Call End

Phone call ke bina directly baat nahi ho sakti.

Working of Connection Oriented Service

Step 1: Connection Establishment

Sender aur receiver ke beech connection banta hai.

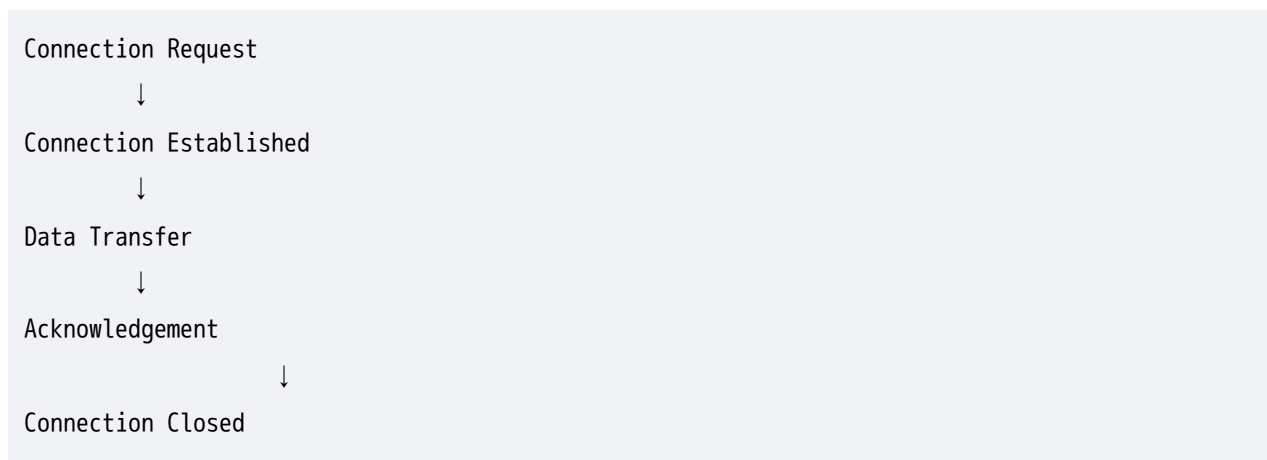
Step 2: Data Transfer

Data transfer hota hai.

Step 3: Connection Termination

Communication complete hone par connection close ho jata hai.

Flowchart



Example Protocol

TCP (Transmission Control Protocol)

TCP Internet par reliable communication provide karta hai.

Examples:

- Email

- Banking
 - File Transfer
 - Web Browsing
-

Characteristics of Connection Oriented Service

Reliable

Data guaranteed deliver hota hai.

Error Checking

Errors detect aur correct kiye jaate hain.

Ordered Delivery

Packets sequence me receive hote hain.

Acknowledgement

Receiver confirmation bhejta hai.

Advantages

1. Reliable Communication

2. Error Recovery

3. Ordered Data Delivery

4. Suitable for Important Data

Disadvantages

1. More Delay
 2. More Overhead
 3. Connection Setup Time Required
-

Applications

- Online Banking
 - Email
 - FTP
 - Cloud Storage
 - Database Communication
-

Connectionless Service

Definition

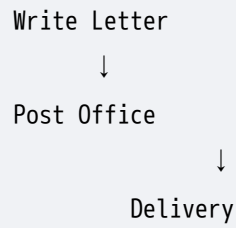
Connectionless Service is a communication method in which data is transmitted without establishing a dedicated connection between sender and receiver.

Simple Meaning

Connection establish kiye bina directly data send kar diya jata hai.

Real Life Example

Postal Letter



Sender aur receiver ke beech pehle connection nahi banta.

Working of Connectionless Service

Step 1

Data packet create hota hai.

Step 2

Packet directly network me bheja jata hai.

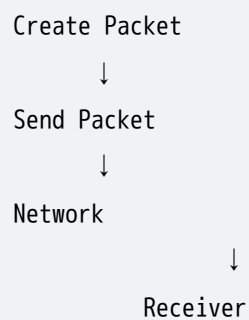
Step 3

Har packet independently travel karta hai.

Step 4

Receiver packet receive karta hai.

Flowchart



Example Protocol

UDP (User Datagram Protocol)

UDP fast communication provide karta hai.

Examples:

- Video Streaming
 - Online Gaming
 - VoIP Calls
 - Live Broadcasting
-

Characteristics of Connectionless Service

No Connection Setup

Fast Communication

Less Overhead

No Guarantee of Delivery

Advantages

1. Faster Communication

2. Low Overhead

3. Suitable for Real-Time Applications

4. Efficient Resource Usage

Disadvantages

1. No Reliability
 2. No Error Recovery
 3. No Packet Ordering
 4. Data Loss Possible
-

Applications

- YouTube Streaming
 - Zoom Live Video
 - Online Gaming
 - Voice Calls
 - IPTV
-

Connection Oriented vs Connectionless Service

Feature	Connection Oriented	Connectionless
Connection Required	Yes	No
Reliability	High	Low
Error Recovery	Available	Not Available
Speed	Slower	Faster
Packet Ordering	Maintained	Not Maintained

Protocol	TCP	UDP
Example	Email	Video Streaming

Service Primitives

Definition

Service Primitives are operations used by users or applications to access network services.

Simple words me:

Service ko use karne ke liye jo commands use hoti hain unhe Service Primitives kehte hain.

Types of Service Primitives

1. LISTEN

Receiver connection request ka wait karta hai.

Example

Server incoming requests ka wait karta hai.

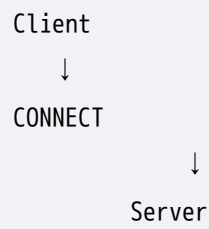
Server



LISTEN

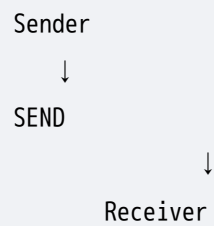
2. CONNECT

Connection establish karne ke liye use hota hai.



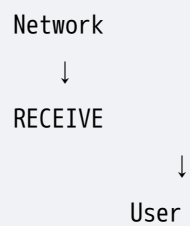
3. SEND

Data bhejne ke liye.



4. RECEIVE

Data receive karne ke liye.

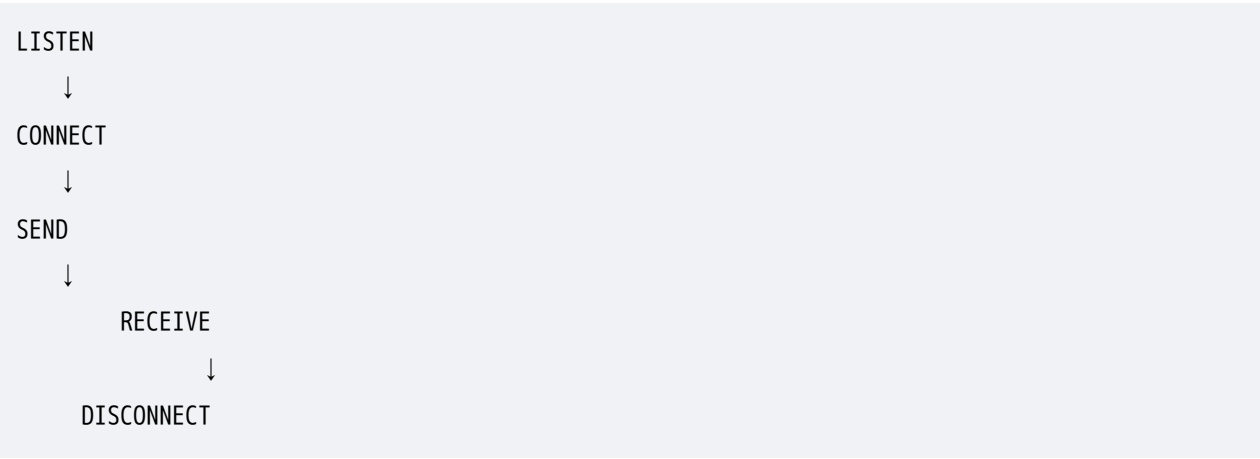


5. DISCONNECT

Connection close karne ke liye.



Complete Service Primitive Flow

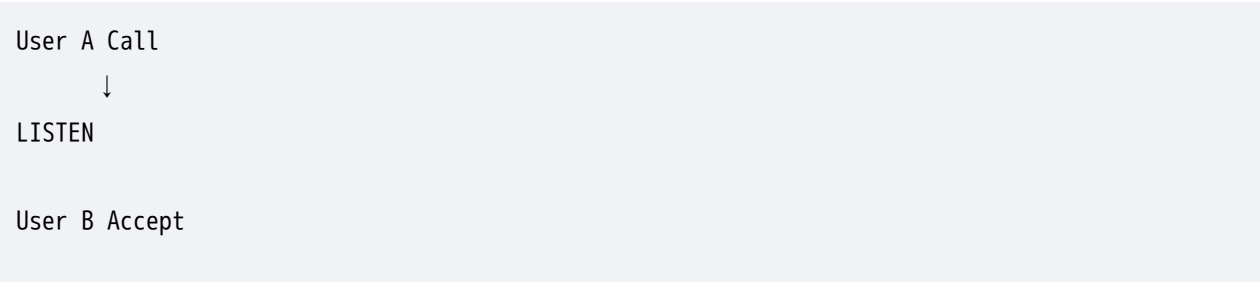


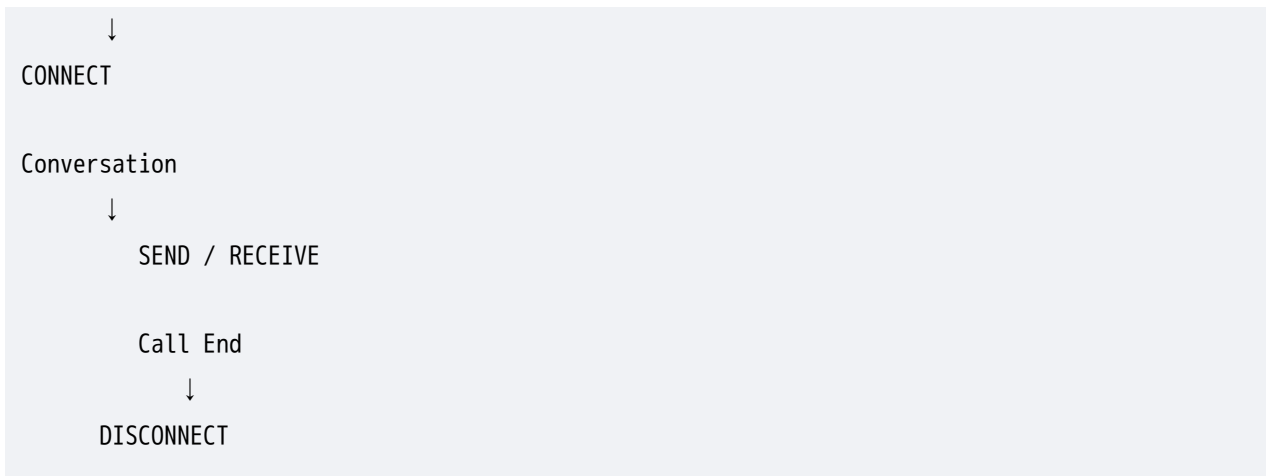
Functionality of Service Primitives

Primitive	Function
LISTEN	Wait for connection
CONNECT	Establish connection
SEND	Send data
RECEIVE	Receive data
DISCONNECT	Terminate connection

Real-Life Example of Service Primitives

Suppose WhatsApp Call:





Advantages of Service Primitives

Standard Communication

Easy Implementation

Reliable Communication

Layer Independence

Importance in Networking

Service primitives networking applications aur transport layer ke beech interaction provide karte hain.

Without primitives:

- Connection manage karna difficult ho jata.
- Communication standardize nahi ho pati.

Conclusion

Connection Oriented aur Connectionless services networking ke do fundamental communication methods hain. Connection Oriented service reliability provide karti hai jabki Connectionless service speed provide karti hai. Service Primitives communication establish, manage aur terminate karne ke standard operations provide karte hain. Modern protocols jaise TCP aur UDP inhi concepts par based hain.

RGPV Examiner Keywords

Connection Oriented Service

Connectionless Service

TCP

UDP

Reliable Communication

Packet Delivery

Service Primitive

LISTEN

CONNECT

SEND

RECEIVE

DISCONNECT

Acknowledgement

Data Transfer

PYQ Priority: ★★★★★

Most Frequently Asked:

1. Explain Connection Oriented and Connectionless Services.
2. Differentiate TCP and UDP.
3. Explain Service Primitives with neat diagram.
4. Explain functionality of LISTEN, CONNECT, SEND, RECEIVE and DISCONNECT.

Next Topic:

OSI Reference Model (Principle, Architecture & All 7 Layers in Complete Detail) – full 4–5 page RGPV answer with layer-wise functions, protocols, examples and diagrams.

Topic 5: ISO-OSI Reference Model (Open Systems Interconnection)

Complete 14-Mark RGPV Answer (4–5 Pages)

Introduction

Jab computers ek dusre ke saath communicate karte hain to communication process bahut complex hota hai. Data ko send karne ke liye addressing, routing, error detection, flow control aur transmission jaise kai tasks perform hote hain.

Isi complexity ko reduce karne ke liye **ISO (International Organization for Standardization)** ne **OSI (Open Systems Interconnection) Reference Model** develop kiya.

OSI Model communication process ko **7 layers** me divide karta hai jisse network design, implementation aur troubleshooting easy ho jaati hai.

Definition

OSI (Open Systems Interconnection) Reference Model is a conceptual framework developed by ISO that divides network communication into seven different layers, where each layer performs specific functions and provides services to the layer above it.

Simple Definition

OSI Model networking ko samajhne aur implement karne ke liye 7-layer architecture provide karta hai.

Why OSI Model is Needed?

Without OSI:

```
Communication Program
|
├ Routing
├ Security
├ Error Detection
├ Addressing
  │
  ├── Data Transfer
  ├── Session Management
  └ Physical Transmission
```

Bahut complex system ban jayega.

With OSI:

```
Application
Presentation
Session
Transport
Network
  │
  ├── Data Link
  └ Physical
```

Har layer apna specific kaam karti hai.

Principles of OSI Model

OSI Model design karte waqt kuch principles follow kiye gaye.

1. Different Functions → Different Layers

Har layer ka alag task hai.

2. Standard Interfaces

Layers ke beech standard communication.

3. Independent Layers

Ek layer change hone par poora system affect nahi hota.

4. Modularity

Complex system ko manageable parts me divide karna.

OSI Architecture

Complete OSI Model

```
+-----+
| 7. Application Layer |
+-----+
| 6. Presentation Layer|
+-----+
| 5. Session Layer    |
+-----+
| 4. Transport Layer  |
+-----+
      | 3. Network Layer    |
      +-----+
      | 2. Data Link Layer  |
      +-----+
```

| 1. Physical Layer |
+-----+

Data Flow in OSI Model

Sender Side

```
graph TD;
    Application --> Presentation;
    Presentation --> Session;
    Session --> Transport;
    Transport --> Network;
    Network --> Data_Link;
    Data_Link --> Physical;
```

Receiver Side

```
graph BT;
    Physical --> Data_Link;
    Data_Link --> Network;
    Network --> Transport;
    Transport --> Session;
    Session --> Presentation;
    Presentation --> Application;
```

Layer 7 – Application Layer

Definition

User aur network ke beech interface provide karti hai.

Ye user ke sabse closest layer hoti hai.

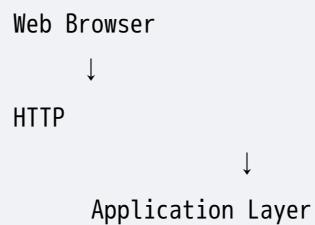
Functions

- Email services
 - File transfer
 - Web browsing
 - Remote login
-

Protocols

- HTTP
 - FTP
 - SMTP
 - DNS
 - Telnet
-

Example



Layer 6 – Presentation Layer

Definition

Data formatting, encryption aur compression provide karti hai.

Functions

Translation

Different systems ke data formats convert karna.

Encryption

Security provide karna.

Compression

Data size reduce karna.

Example

JPEG

MP3

GIF

PNG

Layer 5 – Session Layer

Definition

Communication session establish aur manage karti hai.

Functions

Session Establishment

Connection create karna.

Session Maintenance

Communication maintain karna.

Session Termination

Communication close karna.

Example

Video Call

Call start aur end karna Session Layer ka kaam hai.

Layer 4 – Transport Layer

Definition

Reliable end-to-end communication provide karti hai.

Functions

Segmentation

Data ko small segments me divide karna.

Error Recovery

Lost data recover karna.

Flow Control

Speed control karna.

Reliability

Reliable communication ensure karna.

Protocols

TCP

Reliable

UDP

Fast but unreliable

Example

Email
Banking

TCP use hota hai.

Layer 3 – Network Layer

Definition

Source se destination tak best path select karti hai.

Functions

Routing

Best route determine karna.

Logical Addressing

IP Address assign karna.

Packet Forwarding

Packets ko destination tak bhejna.

Protocols

- IP
 - ICMP
 - ARP
-

Example



Best path choose karna.

Layer 2 – Data Link Layer

Definition

Reliable node-to-node communication provide karti hai.

Functions

Framing

Data ko frames me convert karna.

Error Detection

Errors detect karna.

Physical Addressing

MAC Address use karna.

Access Control

Medium access control.

Example

MAC Address
00:1A:2B:3C:4D

Layer 1 – Physical Layer

Definition

Actual transmission of bits.

Functions

Signal Transmission

Electrical Specifications

Data Encoding

Physical Topology

Example

10101010

Actual bits transfer hoti hain.

Devices

- Hub
 - Repeater
 - Cable
 - Fiber
-

Memory Trick for OSI Layers

Top to Bottom

All
People
Seem
To
Need

Data
Processing

Application

Presentation

Session

Transport

Network

Data Link

Physical

Bottom to Top

Please

Do

Not

Throw

Sausage

Pizza

Away

Physical

Data Link

Network

Transport

Session

Presentation

Application

Advantages of OSI Model

1. Standardization

2. Easy Troubleshooting

3. Modular Design

4. Protocol Independence

5. Better Development

Disadvantages

1. Complex Structure

2. More Layers

3. Theoretical Model

4. Processing Overhead

Real Life Example

Suppose you send WhatsApp message.

Application Layer

Message create.

↓

Presentation Layer

Encryption.

↓

Session Layer

Session manage.

↓

Transport Layer

TCP/UDP communication.

↓

Network Layer

IP routing.

↓

Data Link Layer

Frame creation.

↓

Physical Layer

Bits transmission.

One-Minute Revision

Application → User Services

Presentation → Translation, Encryption

Session → Session Management

Transport → Reliability, TCP, UDP

Network → Routing, IP

Data Link → Framing, MAC

RGPV Examiner Keywords

OSI Model
ISO
Seven Layers
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
Routing
Framing
TCP
UDP
IP Address
MAC Address

Most Expected Questions

7 Marks

1. Explain OSI Model.
2. Explain Transport Layer.
3. Explain Network Layer.
4. Explain Physical Layer.
5. Explain Data Link Layer.

14 Marks

1. Explain OSI Reference Model with neat diagram.

2. Explain all seven layers of OSI Model.
3. Draw OSI architecture and explain layer-wise functions.
4. Explain OSI Model with suitable example.

PYQ Probability: ★★★★★

OSI Model RGPV Computer Networks ka sabse frequently asked Unit-1 topic hai.

Next Topic:

TCP/IP Reference Model and Detailed Comparison between OSI and TCP/IP Models (3–4 Page Answer).

Topic 7: Principles of Physical Layer – Transmission Media, Bandwidth, Data Rate and Modulation

Complete 14-Mark RGPV Answer (4–5 Pages)

Introduction

OSI Model ki sabse neeche wali layer **Physical Layer** hoti hai. Ye layer actual communication medium ke through bits ko transmit karne ka kaam karti hai.

Jab hum WhatsApp message bhejte hain, website open karte hain ya YouTube video dekhte hain, to actual data Physical Layer ke through hi travel karta hai.

Physical Layer electrical signals, optical signals ya radio waves ke form me data transmit karti hai.

Physical Layer

Definition

Physical Layer is the first layer of the OSI model responsible for transmitting raw bits over a communication channel.

Simple Definition

Physical Layer data ko actual signals me convert karke network medium ke through transfer karti hai.

Position in OSI Model

```
Application
Presentation
Session
Transport
Network
  Data Link
    Physical ← Lowest Layer
```

Functions of Physical Layer

1. Bit Transmission

Bits ko transmit karna.

Example:

101010101

2. Signal Conversion

Bits ko signals me convert karna.

3. Physical Connection

Devices ko physically connect karna.

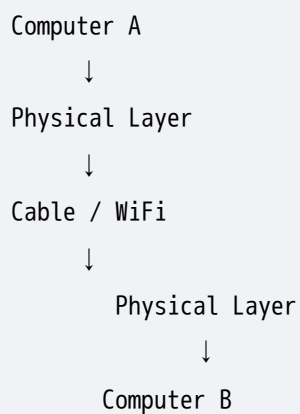
4. Data Rate Control

Transmission speed manage karna.

5. Synchronization

Sender aur receiver ko synchronize rakhna.

Physical Layer Communication

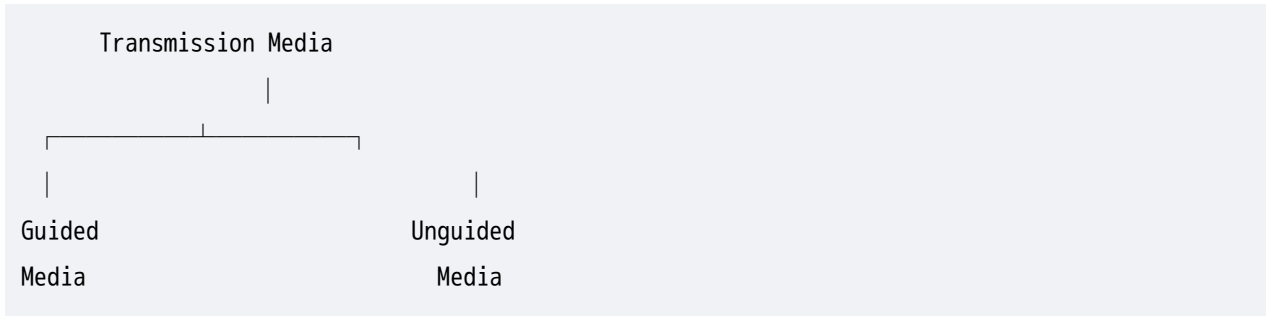


Transmission Media

Definition

Transmission Media wo path hai jiske through data sender se receiver tak travel karta hai.

Types of Transmission Media



1. Guided Media

Guided media me signals wires ya cables ke through travel karte hain.

Types of Guided Media

A. Twisted Pair Cable

Sabse common cable.

Structure

Wire A)))))))
Wire B ((((((

Dono wires twist ki jaati hain.

Types

UTP

Unshielded Twisted Pair

Example:

LAN Cables

STP

Shielded Twisted Pair

Extra protection available.

Advantages

- Cheap
 - Easy installation
 - Flexible
-

Disadvantages

- Noise affect kar sakta hai
 - Limited distance
-

Applications

- Telephone Network
 - LAN
-

B. Coaxial Cable

Twisted pair se better performance.

Structure

```
graph TD; CC[Center Conductor] --- I[Insulation]; I --- S[Shield]
```

Center Conductor

Insulation

Shield

Advantages

- Better bandwidth
- Less noise

Disadvantages

- Expensive
- Less flexible

Applications

- Cable TV
- Broadband

C. Optical Fiber Cable

Sabse advanced transmission medium.

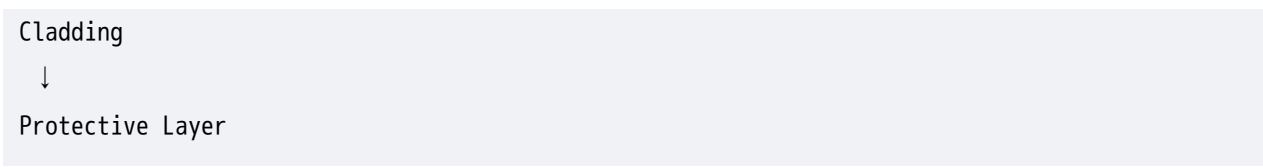
Data light signals ke form me travel karta hai.

Structure

```
graph TD; C[Core]
```

Core

↓



Advantages

- ✓ Very High Speed
- ✓ Large Bandwidth
- ✓ Long Distance
- ✓ Noise Free

Disadvantages

- ✗ Expensive
- ✗ Difficult Installation

Applications

- Internet Backbone
- Undersea Cables
- Data Centers

Comparison of Guided Media

Feature	Twisted Pair	Coaxial	Fiber
Speed	Low	Medium	Very High
Cost	Low	Medium	High
Distance	Low	Medium	High

Noise	High	Medium	Very Low
-------	------	--------	----------

2. Unguided Media

Wireless communication.

Signals air ke through travel karte hain.

Types of Unguided Media

A. Radio Waves

Features

- Long distance
 - No direct line of sight needed
-

Examples

FM Radio
WiFi
Bluetooth

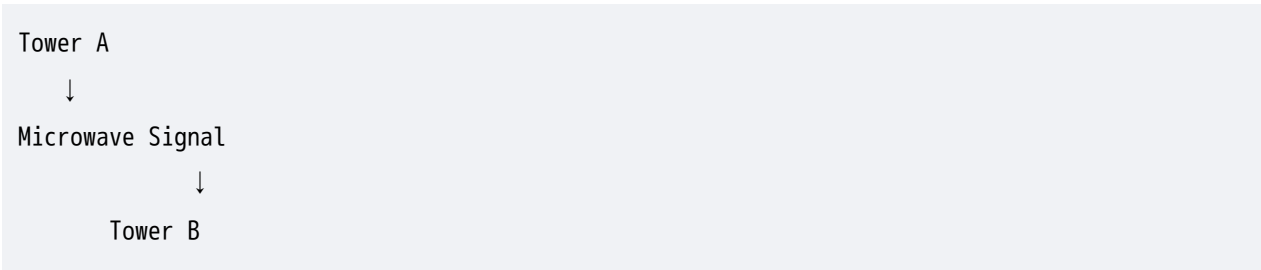
B. Microwaves

High frequency signals.

Example

Satellite Communication
Mobile Towers

Diagram



C. Infrared

Short distance communication.

Examples

- TV Remote
 - IR Sensors
-

Comparison of Unguided Media

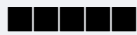
Media	Range	Example
Radio Wave	Long	WiFi
Microwave	Very Long	Satellite
Infrared	Short	Remote

Bandwidth

Definition



Small Bandwidth



Factors Affecting Bandwidth

Transmission Medium

Signal Quality

Network Congestion

Hardware Capability

Advantages of High Bandwidth

- ✓ Faster Download
 - ✓ Better Streaming
 - ✓ More Users Supported
 - ✓ Better Communication
-

Data Rate

Definition

Data Rate is the actual amount of data transmitted per second.

Simple Definition

Actual speed at which data transfer ho raha hai.

Example

Bandwidth:

100 Mbps

Actual Transfer:

60 Mbps

Data Rate = 60 Mbps

Data Rate Formula

Data Rate = Data Transferred / Time

Difference Between Bandwidth and Data Rate

Bandwidth	Data Rate
Maximum Capacity	Actual Speed
Theoretical	Practical
Road Width	Cars Running

Modulation

Definition

Modulation is the process of converting digital signals into analog signals for transmission over long distances.

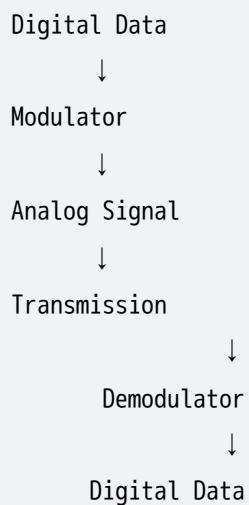
Why Modulation Needed?

Computer digital data use karta hai.

Transmission medium analog signals prefer karta hai.

Isliye conversion zaruri hai.

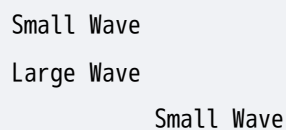
Modulation Process



Types of Modulation

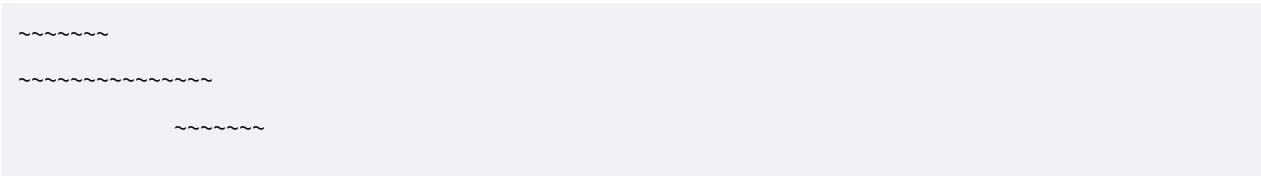
1. Amplitude Modulation (AM)

Amplitude change hoti hai.



2. Frequency Modulation (FM)

Frequency change hoti hai.



3. Phase Modulation (PM)

Phase change hoti hai.

Comparison of Modulation Techniques

Technique	Changes
AM	Amplitude
FM	Frequency
PM	Phase

Real-Life Applications

AM Radio

Amplitude Modulation

FM Radio

Frequency Modulation

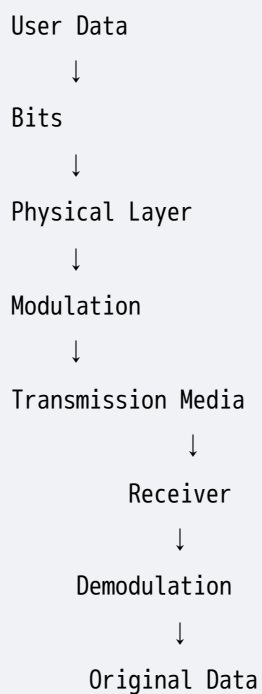
Satellite Communication

Microwave + Modulation

Mobile Communication

Advanced Modulation Techniques

Complete Physical Layer Flowchart



Advantages of Physical Layer

- ✓ Actual Communication
- ✓ Supports Wired and Wireless Transmission
- ✓ Provides Signal Conversion
- ✓ Supports High-Speed Communication

Limitations

- ✗ No Error Correction
 - ✗ No Routing
 - ✗ No Security
 - ✗ Only Bit Transmission
-

Conclusion

Physical Layer OSI Model ki foundation hai. Ye actual bits transmission, transmission media selection, bandwidth management, data rate control aur modulation jaise important functions perform karti hai. Twisted Pair, Coaxial Cable aur Optical Fiber guided media ke examples hain, jabki Radio Waves, Microwaves

One-Minute Revision

```
Physical Layer
↓
Bit Transmission

Transmission Media
↓
Guided + Unguided

Guided
↓
Twisted Pair
Coaxial
```

Fiber

Unguided

↓

Radio

Microwave

Infrared

Bandwidth

↓

Maximum Capacity

Data Rate

↓

Actual Speed

Modulation

↓

Digital → Analog

AM → Amplitude

FM → Frequency

PM → Phase

RGPV Examiner Keywords

Physical Layer

Transmission Media

Guided Media

Unguided Media

Twisted Pair Cable

Coaxial Cable

Optical Fiber

Bandwidth

Data Rate

Modulation

AM

FM

PM

Signal Transmission

Bit Transmission

PYQ Priority: ★★★★★

Most Repeated RGPV Questions:

1. Explain Physical Layer with functions.
2. Explain Transmission Media.
3. Compare Twisted Pair, Coaxial and Optical Fiber.
4. Define Bandwidth and Data Rate.
5. Explain Modulation and its types.
6. Explain Physical Layer with neat diagram.

 **Unit 1 Complete Ho Gaya** (Computer Network → Physical Layer tak poora syllabus cover).