

# Understanding Computers Networks through Five Layer Model

**Module Code ITS2135**

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**GDSE 68**

# STUDENT ASSESSMENT SUBMISSION AND DECLARATION

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|---|-------------------------------|-------------------------------------|--|
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Student signature: Chamith

Date: 2024.06.11

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## 2. Table of Content

|  |    |
|--|----|
| 1. Acknowledgement .....                   | 2  |
| 2. Table of Content .....                  | 2  |
| 3. Table of Figures .....                  | 3  |
| 4. Glossary of terms .....                 | 3  |
| 5. Topics .....                            | 4  |
| 6. Introduction .....                      | 4  |
| 6.1. Overview of Computer Network.....     | 4  |
| 6.2 Importance of network models .....     | 6  |
| 6.3 Introduction to five layer model ..... | 7  |
| 7. Five Layer Model.....                   | 8  |
| 7.1. Physical Layer .....                  | 8  |
| 7.2 Data Link Layer .....                  | 10 |
| 7.3 Network Layer.....                     | 12 |
| 7.4 Transport Layer .....                  | 13 |
| 7.5 Application Layer .....                | 15 |
| 8. Conclusion.....                         | 17 |
| 9. References .....                        | 17 |
| 10. Appendix.....                          | 18 |
| 10.1 Gantt chart.....                      | 18 |

### 3. Table of Figures

#### List of Image

|                                     |    |
|-------------------------------------|----|
| Figure 1 : Computer Network .....   | 5  |
| Figure 2: Network Model Layers..... | 7  |
| Figure 3: Physical Layer .....      | 9  |
| Figure 4: Data Link Layer.....      | 10 |
| Figure 5 : Network Layer.....       | 12 |
| Figure 6: Transport Layer .....     | 14 |
| Figure 7: Application Layer.....    | 15 |

#### List of Table

|  |    |
|--|----|
| Table 1: Computer Network Advantages & Disadvantages .....     | 6  |
| Table 2: Physical Layer Protocols & Technologies used .....    | 9  |
| Table 3: Data Link Layer Protocols & Technologies used.....    | 11 |
| Table 4 : Network Layer Protocols & Technologies used .....    | 12 |
| Table 5: Transport Layer Protocols & Technologies used .....   | 15 |
| Table 6: Application Layer Protocols & Technologies used ..... | 16 |

### 4. Glossary of terms

TCP - Transmission Control Protocol

UDP - User Datagram Protocol

IP - Internet Protocol

IEEE - Institute of Electrical and Electronics Engineers.

IJSE - Institute Of Software Engineering.

MAC -Media Access Control

OSI - Open Systems Interconnection

DOD - Department of Defense

RFC - Request for Comment

CRC - Cyclic Redundancy Check  
MAC- Media Access Control address  
PPP - Point-to-Point Protocol  
HDLC - High-Level Data Link Control  
HTTP - Hypertext Transfer Protocol  
HTTPS - Hypertext Transfer Protocol Secure  
FTP - File Transfer Protocol  
DNS - Domain Name System  
SSH - Secure Shell

## **5. Topics**

1. Introduction
2. Physical Layer
3. Data-link Layer
4. Network Layer
5. Transport Layer
6. Application Layer
7. Conclusion

## **6. Introduction**

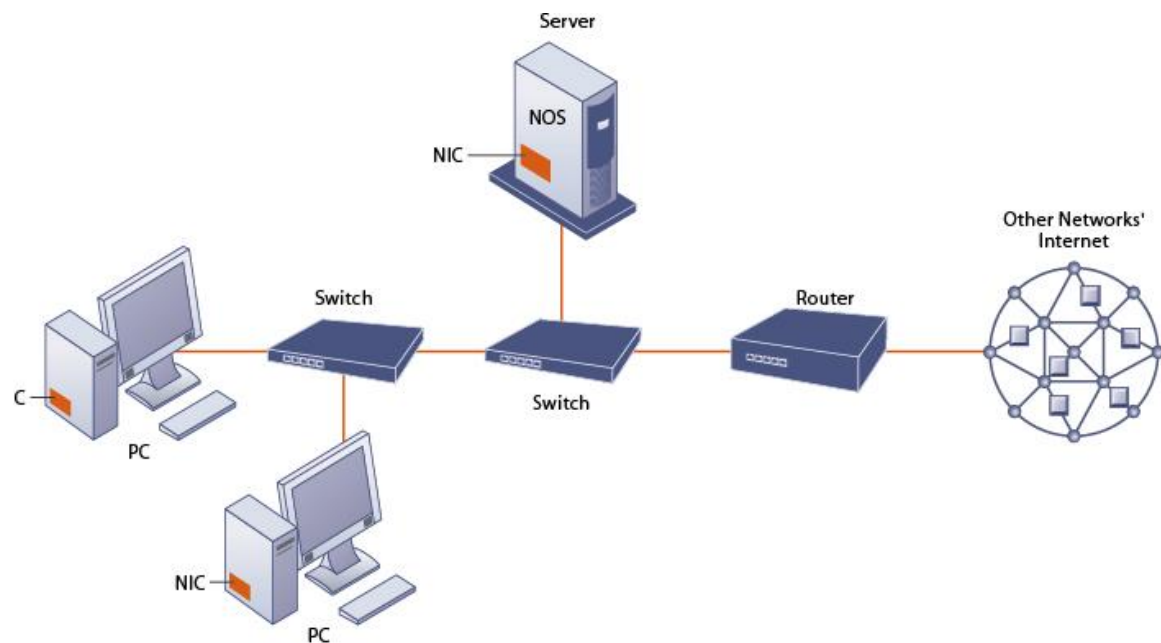
### **6.1. Overview of Computer Network**

Computer Network is a collection of two or more computing devices which are interconnected for the purpose of sharing resources. (Hardware / software)

The Communication is based on an agreed set of rules. It means Protocol. Two or more computing devices are connected to one another by the linkages. We can sent information over these links through the Communication Protocols.

(geeksforgeeks, 06 Feb, 2024)

The ports are used to refer to the destination devices.



*Figure 1 : Computer Network*

We can see two main devices categories in Computer Network.

1. Network Devices

These devices inter-connect other devices.

E.g.: Router, Switch, Repeater, Hub, and Bridge

2. End User Devices

This devices are used by the final user.

E.g.: Pc, Laptop

We can categorize computer networks through a number of factors, network size, and Topology and organization goals. Below have some network types.

PAN - Personal Area Network

LAN - Local Area Network

SAN - Storage Area Network

CAN - Campus Area Network

MAN - Metropolitan Area Network

WAN - Wide Area Network

Below Have Advantages & Disadvantages of Computer Network.

*Table 1: Computer Network Advantages & Disadvantages*

| Advantages   | Disadvantages  |
|--|--|
| <ul style="list-style-type: none"><li>• Reliability</li><li>• Flexibility</li><li>• Connectivity</li><li>• Central storage of data</li><li>• Faster problem solving</li><li>• Security through Authorization</li></ul> | <ul style="list-style-type: none"><li>• Expensive</li><li>• Virus</li><li>• Less of information</li><li>• System can be hack</li></ul> |

## **6.2 Importance of network models**

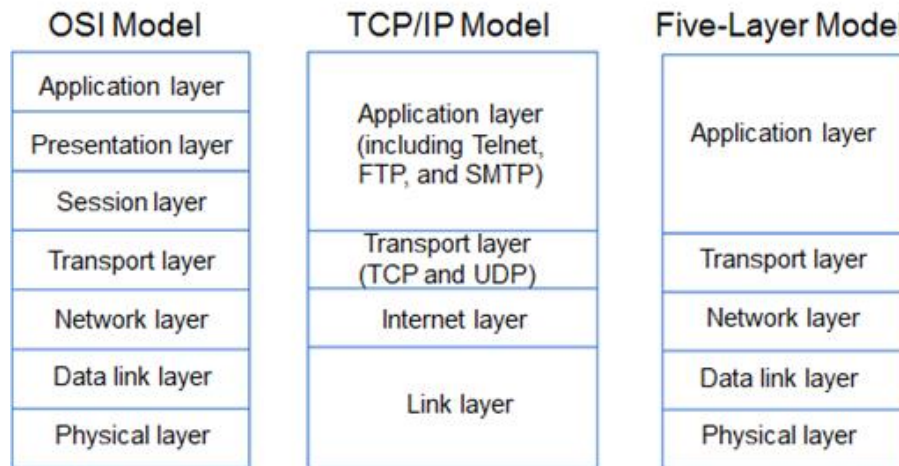
Network Models are frameworks, predefined structured. This frameworks help in designing / analyzing the architecture and behavior of networks.

Network Model = Predefined structure + set of protocols and standards

Network Models are essential to understanding network architecture.

There are two major network models.

1. ISO/OSI Model
2. TCP/IP Model
3. Five Layer Model



*Figure 2: Network Model Layers*

Below have some Importance of Network Models.

- We can abstract the key components of the networks through network models.so its helps to simplification and abstraction.
- Easy to analyzed network performance.
- Network Model provide a visual sketch of the network architecture. So that makes it easier to identify patterns and significant nodes and connections.
- Optimizing load balancing , routing protocols
- Scalability
- Can find security flaws and provide defenses against attacks.
- Understand complex dynamics and relationships in systems.

(Gupta, February 1, 2021)

### **6.3 Introduction to five layer model**

The Five layer Model is a simple conceptual framework. This is helpful to analyze, design, and understand network architecture. This model divides five layers for communication process. Each layer have responsibility for specific data transmission. So following this



five layer models developers can troubleshoot network applications more effectively. Each layer serving a specific purpose in the data transmission process.

Even when two devices are connected to separate networks, the data transmitted from one can be accurately received and understood by the other through the layers.

(Mailsamy, Jun 23, 2020)

We can see five layer models.

- Physical Layer
- Data-Link Layer
- Network Layer
- Transport Layer
- Application Layer

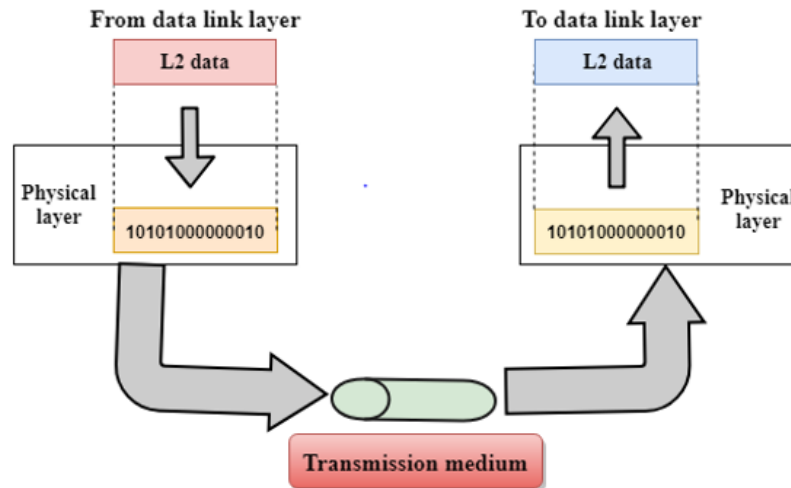
## **7. Five Layer Model**

### **7.1. Physical Layer**

This layer is Foundation layer in five layer Model. Hardware components covered this layer. This layer transmitting raw data bits in communication medium. And also this layer useful for maintain electrical, mechanical, activating, deactivating physical link between network devices.

(geeksforgeeks, 23 Jun, 2023)

The main purpose of this layer is transmitting raw bits over a physical between nodes.



*Figure 3: Physical Layer*

### Key Functions

- Data convert to the signals
- Signal Encoding
- Medium transmission
- Topologies
- Bit level synchronized between sender and receiver
- 

Below Have Examples of protocols and technologies used.

*Table 2: Physical Layer Protocols & Technologies used*

| Protocols          | Technologies Used        |
|--------------------|--------------------------|
| Ethernet           | local area networks      |
| Wi Fi              | Data Transmission        |
| Bluetooth          | Exchanging data          |
| Fiber optic Cables | Transmit data high speed |
| Coaxial Cables     | Broadband connections    |

## 7.2 Data Link Layer

Data link layer handled Data transport from one node to another. It manages error detection and repair from the physical layer and offers a dependable link between two directly linked nodes.

The layer makes guarantee that information sent from one device's network layer can be correctly packaged and transferred to another device's network layer. This is a detailed explanation of the Data Link Layer, including all of its sublayers, roles, and protocols.

(tutorialspoint, n.d.)

Main purpose of this layer is error-free communication between network devices on the same physical network section.

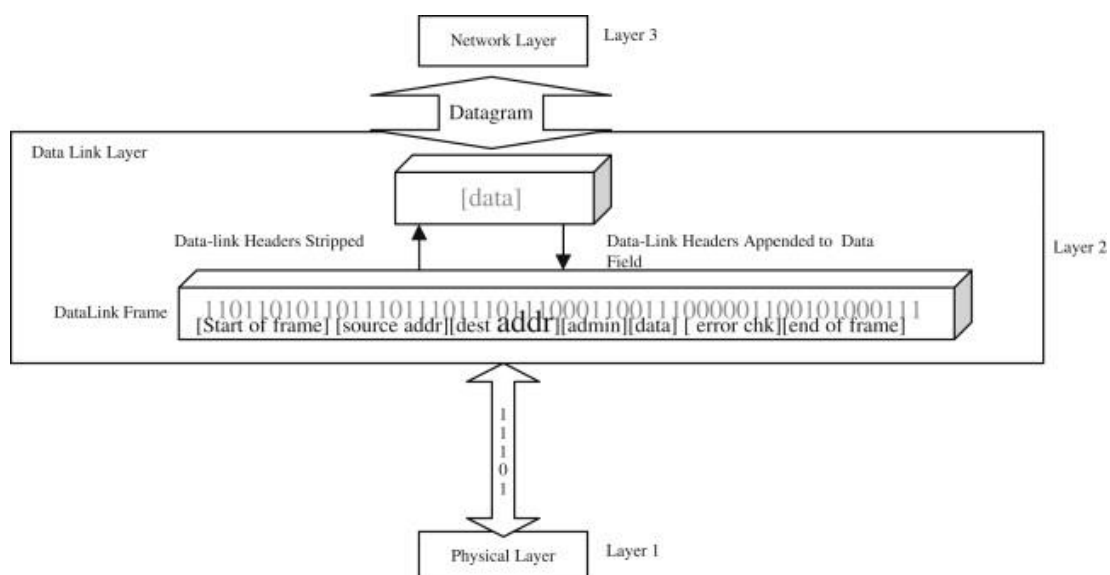


Figure 4: Data Link Layer

### Key Functions

- Creates structured data packets for transmission by encapsulating raw bits into frames and adding headers and trailers. The headers and trailers carry control information, which includes source and destination MAC addresses, frame time, and error detection codes.

- Errors detect and solve this errors in the transmitted data.
- Prevent receiving end overflow
- Manage data transmission rate
- Media access control
- Avoid collisions
- Make fair access

Below Have Examples of protocols and technologies used.

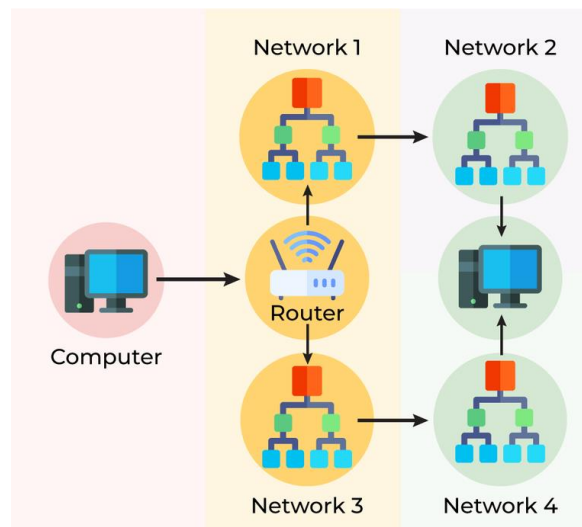
*Table 3: Data Link Layer Protocols & Technologies used*

| <b>Protocols</b> | <b>Technologies used</b>                   |
|------------------|--|
| Ethernet         | Collision detection and manage             |
| Wi fi            | Employ Carrier sense several access points |
| PPP              | Straight links establishing two nodes      |
| HDLC             | Error detection capability                 |
| MAC Address      | Data link layer devices identify           |

### 7.3 Network Layer

This Layer provides for data transfer across multiple networks. This layer manages logical route for data to take from the source to the destination. And also controls logical addressing.

(CloudFlare, n.d.)



*Figure 5 : Network Layer*

#### Key Functions

- Gives devices individual IP addresses. So that data may be directed to the right place.
- Uses a variety of routing protocols and techniques to determine the best route for data packets to take as they travelling across networks.
- Packet forwarding is a technique used to forward data packets from one network to another, guaranteeing that they reach their destination.
- Splits large data packets into more manageable chunks for delivery.

Below Have Examples of protocols and technologies used.

*Table 4 : Network Layer Protocols & Technologies used*

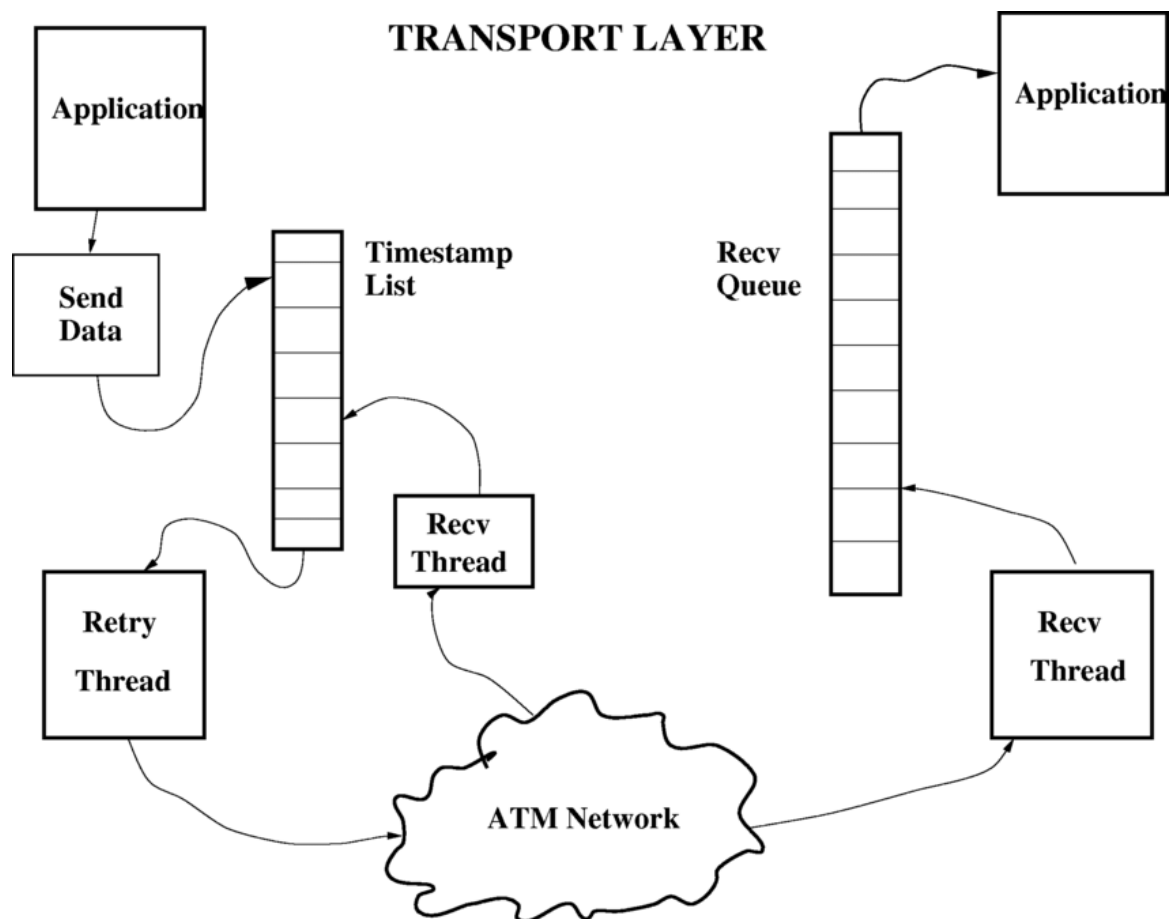
| Protocol | Technologies Used   |
|----------|---|
| IP       | enables the routing and logical addressing of data packets across connected networks  |
| ICMP     | Used error messages as well as  |
| ARP      | connects mac addresses and IP addresses   |
| OSRF     | Keep track of the topology of the network and employs a link-state routing algorithm. |
| BGP      | Oversees the data routing across the internet between independent systems.            |

#### 7.4 Transport Layer

This Layer handled by Data transfer and end-to-end communication between devices. Helpful to data is sent without errors in the right order and without any duplications and losses. It offers dependable data transport services.

(javatpoint, n.d.)

Main purpose of this layer is complete data transfer between source and destination.



*Figure 6: Transport Layer*

### Key Functions

- Dependable communication session by establishing and breaking connections between devices.
- Breaking up big data files into small components for transmission.
- Data segmentation allows accurate rebuilding and efficient network transmission.
- Control the speed of data transfer
- Protect accuracy of data by identifying and fixing send data mistakes.

Below Have Examples of protocols and technologies used.

*Table 5: Transport Layer Protocols & Technologies used*

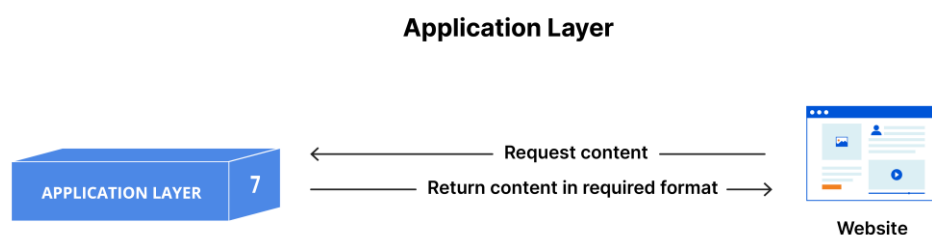
| Protocols | Technologies Used  |
|-----------|--|
| TCP       | Allows the safe helpful and error checked transfer of data between apps. |
| UDP       | Provides a low overhead connectionless communications                    |

## 7.5 Application Layer

This is the top layer of the five layer Model. Application Layer Communicates with end user apps / applications directly. It offers a range of protocols and network services that let app talk to each other across the network. Users and application processes can access network services through Application Layer.

(geeksforgeeks, 05 Sep, 2022)

The Main Purpose of this layer is to give user programs direct access to network resources and making it possible for users to perform tasks. Such as remote login, file transfers, web surfing. It supports end user operations.



*Figure 7: Application Layer*



## Key functions

- Make application level communication easier for services and protocols.(file transfers , email exchanges, web browsing)
- Allow access for share network resources , remote services
- Guarantees data protection during transmission and access to network resources to authorized users.
- Converts several data formats between the applications and networks.

Below Have Examples of protocols and technologies used.

*Table 6: Application Layer Protocols & Technologies used*

| Protocol | Technologies used   |
|----------|---|
| HTTP     | Transferring web pages  |
| HTTPS    | Secure data transmission using SSL/TLS encrypted                            |
| FTP      | Files transfer between client and network                                   |
| DNS      | Translate human readable domain names into IP addresses                     |
| Telnet   | Remote login capabilities to access and manage network devices and servers  |
| SSH      | Encrypted communication for remote login and other secure network services. |

## 8. Conclusion

As Summary the Five layer Model provides structured way to comprehend and organized designed network systems. Each layer provides unique and crucial functions for the process of data communication. And also making network architecture is simple to analyze and maintainability of network system. Each Layer based for specific set of functions. It making easier for manage, troubleshoot, and develop network protocols.

And also this five layer model used different protocols. It helps to communicate different devices, applications from various cohesive networking environment .When we followed five layer model helpful for flexibility in network architecture. Because of the layered structure resolving network issues and ease of troubleshooting. And also network administrators can isolate problems.

Important thing is when we followed multiple layers useful for enhanced security high. Encryption can be applied transport and application layers when we access control mechanism.

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## 10. Appendix

### 10.1 Gantt chart

| Task                              | 3 <sup>rd</sup><br>June | 4 <sup>th</sup><br>June | 5 <sup>th</sup><br>June | 6 <sup>th</sup><br>June | 7 <sup>th</sup><br>June | 8 <sup>th</sup><br>June | 9 <sup>th</sup><br>June | 10 <sup>th</sup><br>June | 11 <sup>th</sup><br>June |
|-----------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|--------------------------|
| Introduction                      |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Physical Layer                    |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Data Link Layer                   |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Network Layer                     |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Transport Layer                   |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Application Layer                 |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Conclusion                        |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Add citation links and references |                         |                         |                         |                         |                         |                         |                         |                          |                          |
| Check guidelines & submit         |                         |                         |                         |                         |                         |                         |                         |                          |                          |

