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A Review Paper on Application Layer

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ABSTRACT: The Computer Network concept is most important and a relevant topic. Computer Network is all about the interaction or communication between multiple devices, systems. Nowadays the major goal of Computer Network is to improve or build the effective communication between the devices, systems by using different or numerous applications. The Application Layer plays an important role in this goal. It provides services and several high-level Protocols for message passing, transferring or managing data and information. This research paper addresses a set of Protocols comes under the Application Layer that are being used by Computer Network for a reliable or smooth communication between multiple devices and systems.

Keywords: OSI Model, Application Layer, Application Layer Protocols etc.

INTRODUCTION

A network is a set of devices or nodes that are connected via communication media or channels. Nodes can be any device, communication media/channels can be guided or unguided both. A computer network is an interconnection of various computers to share or exchange data and other important information through communication media. It can be guided or unguided (Kinza and Alexander 2023). Guided media include different type of cables and wires like: TCP (Twisted Pair Cable), UTP (Unshielded Twisted Pair Cable), Co-Axial, Optical Fiber cable. Unguided media includes Radio-waves, Micro-waves, in this we use different devices for wireless communication like: Routers. After establishing the connection between different devices, the communication protocols are used to exchange the data like: TCP/IP, HTTP (Hyper Text Transfer Protocol) (Kinza and Alexander 2023).

Best example of computer network is INTERNET. In this paper we shall provides detailed overview of OSI reference model, study about the Application Layer and its protocols which majorly used in transporting of data from one node /device to another node /device and conclusion about the research paper.

Objective:

1. To provide the overview of OSI Model
2. To study the Protocols comes under the Application Layer
3. Discuss about the security of the different protocols on the basis of different parameters.

Overview of OSI MODEL: OSI (Open System Interconnection) was first introduced by representatives of all major computer and Telecom companies in 1983. ISO (International Organization for Standardization) adopted the OSI reference model in 1984 for making communication easy or transferring of data easy as an International Standard. The model introduced by ISO is the first Reference Model used by all major companies for network communication in the early 1980s (Company).

OSI stands for Open-System Interconnection. OSI is an open-source reference model which is adopted by all the major computer companies for the communication over network. It allows open communication between different systems without requiring changes to the logic of the underlying hardware and software. It's just a reference model not a protocol that can be installed or run on any system. OSI model has 7-Layers each layer has its specific role and functions. Each layer plays an important role in transferring data and information.

7-Layers of OSI Model:

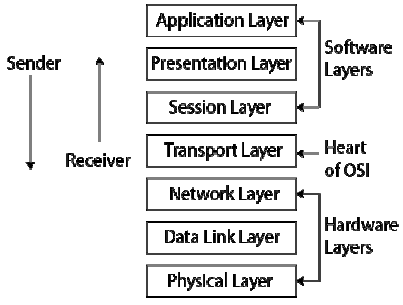


Fig. 1. Layers of OSI Model.

(Source: https://media.geeksforgeeks.org/wp-content/uploads/computer-network-osi-model-layers.png)

In this Figure: Transport Layer is the Heart of the OSI reference Model. OSI Model is divided into two parts:
1. Software Layers; 2. Hardware Layers.

1. Software Layers: These layers of OSI model mainly deals with the application related issues. These

are implemented only in the software. The APPLICATION Layer is closest layer to the end-users. It usually interacts with the software applications. These layers basically interact with the OS (Operating System) and further stores or preserve the data in a suitable manner.

2. Hardware Layers: These layers of OSI model deals with the transport issues of the data and information. These are mainly implemented with hardware but can also be implemented with software. The PHYSICAL Layer plays an important role in exchange of the data and information through physical medium from one system to other system. This Research Paper focuses on the Application Layer and the Protocols come under the Application Layer. In this research paper we are focusing specially on those Protocols which are usually needed for handling the Transferring of the data from one system to another.

Study of Application Layer: Application Layer is the 7th layer of OSI model. It is the top most layer of the OSI model, supports the communication process between end-user and application software (Company, A.). Application Layer plays an important role in data transferring and managing the data through different protocols. This layer is responsible for providing the network services to the end-users. It provides several high-level Protocols that are used for the managing and transferring of the wide variety of the data. A few Examples of Protocols provided by Application Layer: HTTP, FTP, SMTP etc (Company, A). It also provides facilities for managing the wide variety of the applications. Application Layer comes under the Software Layer (Upper Layer) of the OSI model, which mainly deals with the different types of software. This layer interacts with end-users. It is an abstraction layer that specifies the protocols and methods used by user for communication over the network (Singla, 2022).

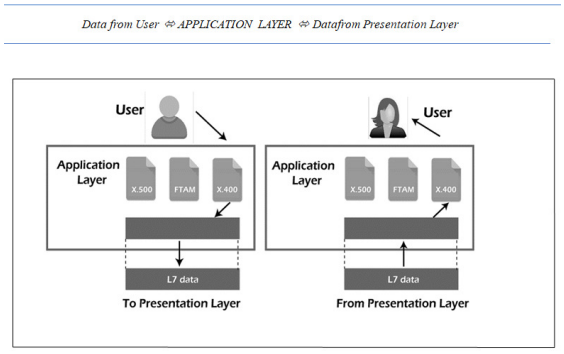


Fig. 2. Data flow Representation of Application Layer.

(Source: https://static.javatpoint.com/tutorial/computer-network/images/osi-model10.png)

Role of Application Layer: (Singla, 2022).

— By using the Protocols of Application Layer user can transfer several types of data and information.

— It provides storage facility.

— Application Layer provides facility for handling Data transparency issues which commonly occurs during the transferring of the data.

— It allows end-user to interact with other software applications.

— It provides high level Protocols for data transferring and managing.

The Protocols which are used in Application Layer depend upon what information user wants to send or receive.

Application Layer Protocol ensures connection between user applications and the network server and exchange data between severs, devices. List of Application Layer Protocol Majorly used for the Data Transfer and the exchange of the data between the user and network servers (Joshi, 2023).

1. FTP: FTP stands for File Transfer Protocol. FTP is the protocol which allows the transfer of files from one device to another device over a network. By default, the Port number for FTP data is 20 and the port number 21 is for control (Gartner. (2022). A port is the endpoint of communication, allows data transfer between server and computer.

FTP promotes a reliable file sharing and efficient data transfer via remote computers. It allows user to send multiple files at a time. It has the ability to send large amount of data. Without FTP you may have to send data files one by one. FTP uses TCP (Transfer Control Protocol) as a Transport Protocol. It also allows uploading, sharing or downloading of files over files. FTP uses three different modes: block, stream, and compressed (Gartner, 2022). It manages data and information without boundaries in a string.

Security Challenges of FTP: It does not provide any encryption to the path by which information travels, which simply means that any hacker can intercept an FTP transmission easily. One of the biggest security challenge with FTP is it use clear-text passwords, which are easy to crack. FTP does not secure passwords because passwords does not undergo through any encryption process. In other words, a password "JERRY2003" exactly looks like "JERRY2003" in FTP. But in another secured protocols it does not looks exactly same, they use algorithms to mask the passwords like: "JERRY2003" may looks like "dj18734saksng8937d7d8s9d77" (Gartner, 2022).

2. TFTP: TFTP stands for Trivial File Transfer Protocol. It is stock version of the FTP. It is simple as compare to the FTP. User can easily read or write files from a remote server. It is responsible for the data transferring between the different systems without any authentication. The port number for TFTP data transfer is 69 (Jain, 2023). It is used in personal area networks (PAN) where the use or implementation of FTP is expensive. It is the simplified vesrsion of the FTP. It is useful when a short memory data is needed to share. Usually in PAN short memory data or data which has less storage are shared between different devices. With TFTP there is a high security issues it is not a secured protocol or doesnot provide any encrypted interface for the communication or sharing the data files.

3. HTTP/HTTPs: HTTP stands for Hyper Text Transfer Protocol. HTTP is a type of text which is specially coded with the help of a coding language and

i.e. HTML (Hyper Text Markup Language) (Jain, 2023). HTTP plays an important role in websites, webservers. It establishes communication between the websites and web servers in web browsers. It is a set of protocols that provide standards to a web browser and it is responsible for the data transferring from one system to another system. It is used to send different type of data over network like: text, images, and other multimedia files (audios, videos). These files are shared on the www. WWW stands for World Wide Web the father of WWW is Tim Berners-Lee, www was developed in 1989 (Inventor of www). The web user can indirectly use HTTP for opening their web browser. It is based on IP, is majorly used for the delivery of the data from server to client or client to server. It is based on client and server requirements. It is a request and response protocol.

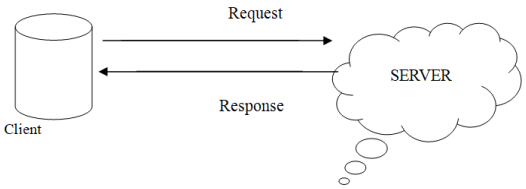
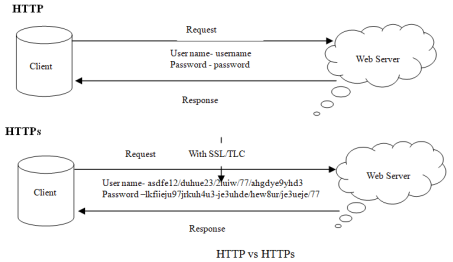


Fig. 3. HTTP.

HTTPs stands for Hyper Text Transfer Protocol Secure. HTTPs is the secured version of the HTTP. It provides more security as compare to the HTTP; it uses SSL (Secure Socket Layer) and TLS (Transport Layer Security) for providing more security (Jain, 2023). It is responsible for the encrypted and secured network communication because it is associated with SSL/TLS. When the user visits a website over internet, if the URL (Uniform Resource Locator) of that website starts from HTTP then it means that the site is not encrypted with SSL/TLS. HTTPs encrypts all the data and messages which are shared over a network, provide highly secured interface for the communication over a network between server and client.

HTTP + SSL / TLC HTTPs

HTTP vs HTTPs: HTTP and HTTPs both the protocols are used to exchange data and information of a particular website between web servers and web browsers. But there are some differences between HTTP and HTTPs. The major difference between both of them is security, HTTPs provide more secured and encrypted interface for sharing of data over a website as compare to the HTTP. HTTPs use SSL/TLC for increasing the security of communication path, which is used for the data sharing between the web browser and web server (Jain, 2023).

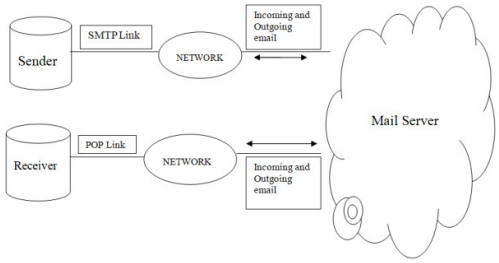


HTTP vs HTTPs.

4. SMTP: SMTP stands for Simple Mail Transfer Protocol. Email (Electronic Mail) is a most valueable service nowdays for sharing data from one computer to another computer over internet through a Email address. Email is a unique address given to every email user. SMTP is a push protocol. It is used to transfer mail from one user to another user over internet. It use two protocols for retrieving the mails at the receiver side *i.e.* POP (Post Office Protocol) or IMAP (Internet Message Access Protocol) (Jain,). In SMTP we are not able to reduce the size of the email. It also provides facility like: email tracking , it is reliable method or protocol for a email delivery. SMTP use two methods for sending or receiving the email from one user to another (Jain, n.d.).

A. End-to-end encypted Method. In this method user can interact directly with each other before and after sending email. It is a method used by the different organisations for the communication with each other.

B. Store and forward Method. This method is specially used within a particular organisation for the communication. In this method SMTP server will store the email to itself until it is successfully forwarded to the receiver's SMTP (Jain, n.d.). It also has security issues it does not provide any encrypted path for the data transmission. It also have security issues like : encryption, data privacy, access control and authentication. SNMP cloud allows third party to gain access over network to a network device.

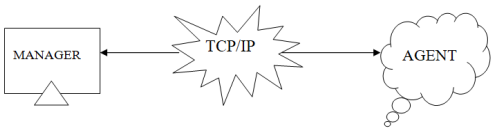


Working of SMTP.

5. SMNP: SMNP stands for Simple Management Protocol. It provides a set of rules which helps in managing and controlling devices over internet. It uses TCP/IP as a transport protocol. It is an Application Layer protocol specially designed for the controlling and managing devices over internet. It helps in the installing of the different type of devices on the physical layer.

It used for managing devices in a heterogeneous network (made up of different LANs and WANs). SMNP has two components : Manager and Agent can be any device like router (Jaiswal, n.d.). Manager can be a host , a host runs the SNMP program on client side and a agent can be a router that runs the SNMP program on the server. It makes the managing and controlling of devices easy by a simple interaction between the manager and the agent. A manager works on client side and a agent works on server side. A manager checks the agent by sending request for an information, if the agent responds then it means agent is available at that time. The response of the agent reflects the behaviour of the agent. An agent helps in the

management and controlling process by informing the manager about the unusual conditions.



Relation between Manager and Agent.

CONCLUSION

In this research paper we discussed about the different Application Layer Protocols which are majorly used for the data transfer and management. In this research paper we discussed about the five high level protocols which are used for the data transmission. Each protocol plays an important role in transferring of data and information but we concluded that HTTPs protocol provides more security to the data transmission. Mostly we saw that FTP, TFTP, SMNTP, HTTP, SMNP does not provide high level security or authentication to the data files. These protocols do not provide any encryption to communication path as compared to the HTTPs. HTTPs provides extra security and encryption to the data transmission by adding two protocols (SSL/TLC) in the communication path. HTTPs provides the facility of the masked algorithms to mask the passwords it makes the encryption strong or transmission of data more secure, no hacker or third party can intercept this easily.

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