Chapter 6: Application Layer

Web: HTTP & HTTPS

HTTP (Hyper Text Transfer Protocol) is the foundation of the World Wide Web. Hypertext is a well-organized documentation system that uses hyperlinks to link the pages in the text documents. HTTP works on a client-server model. When a user wants to access any HTTP page on the internet, the client machine at the user end initiates a TCP connection to the server on port 80. When the server accepts the client request, the client is authorized to access web pages.

HTTPS (also called HTTP over TLS, HTTP over SSL, and HTTP Secure) is a protocol for secure communication over a computer network which is widely used on the Internet. HTTPS consists of communication over Hypertext Transfer Protocol (HTTP) within a connection encrypted by Transport Layer Security (TLS) or its predecessor, Secure Sockets Layer.

File Transfer: FTP, PuTTY, WinSCP

FTP (File Transfer Protocol) helps a user to transfer text-based or binary files across the network. A user can use this protocol in either GUI-based software like FileZilla or CuteFTP and the same user can use FTP in Command Line mode.

PuTTY is a free and open-source terminal emulator, serial console, and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection. It can also connect to a serial port.

WinSCP (Windows Secure Copy) is a free and open-source SFTP, FTP, WebDAV, and SCP client for Microsoft Windows. Its main function is secure file transfer between a local and a remote computer. Beyond this, WinSCP offers basic file manager and file synchronization functionality.

Electronic Mail: SMTP, POP3, IMAP

SMTP (Simple Mail Transfer Protocol) is used to transfer electronic mail from one user to another. Mail User Agent (MUA) is an application (e.g., Outlook Express, Thunderbird) that runs on a user's computer. Mail user agents are used to compose and send messages, as well as to display and manage messages in a user's mailbox.

POP3 (Post Office Protocol) provides a simple, standardized way for users to access mailboxes and download messages to their computers. When using the POP protocol, all your e-mail messages will be downloaded from the mail server to your local computer.

IMAP (Internet Message Access Protocol) is a standard protocol for accessing e-mail from your local server. IMAP is a client/server protocol in which e-mail is received and held for you by your Internet server.

DNS (Domain Name System)

The Domain Name System (DNS) works on the Client-Server model. It uses the UDP protocol for transport layer communication. DNS uses a hierarchical domain-based naming scheme. The DNS server is configured with Fully Qualified Domain Names (FQDN) and email addresses mapped with their respective Internet Protocol (IP) addresses.

P2P Applications

P2P (Peer-to-Peer) architecture is a distributed application architecture that partitions tasks or workloads between peers. Peers are equally privileged, equipotent participants in the application. They are said to form a peer-to-peer network of nodes.

Socket Programming

A network socket is presented as the endpoint of an inter-process communication flow across a computer network. Today, most communication between computers is based on the Internet Protocols. So, nowadays, most network sockets that we use are Internet sockets. A socket address possesses the combination between the IP address and a port number, much like one of the ends of a telephone connection has the combination between a phone number and a particular extension in a telephone system.

Application Server Concept: Proxy Caching, Web/Mail/DNS Server Optimization

Proxy caching allows a server to act as an intermediary between a user and a provider of web content. When a user accesses a website, proxies interpret and respond to requests on behalf of the original server.

Concept of Traffic Analyzer: MRTG, PRTG, SNMP, Packet Tracer, Wireshark

MRTG (Multi Router Traffic Grapher) is a tool to monitor the traffic load on network links. MRTG generates HTML pages containing PNG images which provide a LIVE visual representation of this traffic.

PRTG (Paessler Router Traffic Grapher) is a server uptime and utilization, network monitoring, and bandwidth usage software package for server infrastructure from Paessler AG. It can monitor and classify bandwidth usage in a network using SNMP, packet sniffing, and Netflow.

SNMP (Simple Network Management Protocol) is a tool (protocol) that allows for remote and local management of items on the network including servers, workstations, routers, switches, and other managed devices.

Wireshark is the world's foremost and widely-used network protocol analyzer. It lets you see what's happening on your network at a microscopic level and is the de facto (and often de jure) standard across many commercial and non-profit enterprises, government agencies, and educational institutions.

Packet Tracer is a powerful network simulation program that allows students to experiment with network behavior and ask "what if" questions. As an integral part of the Networking Academy comprehensive learning experience, Packet Tracer provides simulation, visualization, authoring, assessment, and collaboration capabilities and facilitates the teaching and learning of complex technology concepts.