



GUJARAT TECHNOLOGICAL UNIVERSITY

Syllabus for Master of Computer Applications, 5th Semester

Subject Name: Advanced Networking (AN)

Subject Code: 4659308

With effective
from academic
year 2019

1. Learning Objectives:

- Develop strong analysis, design, implementation, testing and troubleshooting skills in students regarding TCP/IP based networks and services as relevant to the computer networking needs of the IT industry.
- Establish a strong conceptual foundation of the TCP/IP protocol stack, services and related tools/technologies so as to facilitate the development of the above mentioned skills.
- Design and implement customized TCP/IP based application layer services.
- To familiarize with security and performance issues in TCP/IP networks
- To familiarize with Wireless Networks, WiFi and Mobile Networks, Browser Networking, XMLHttpRequest and Server-Sent Events (SSE) and WebSocket and WebRTC
- Create a strong conceptual foundation and offer maximum possible development of required theoretical and practical skills for students aspiring to make a career in Computer Networking like Network Designer, Network administrator, etc.
- To learn how to listen to local network traffic and analyze different protocols.

2. Prerequisites:

Digital Data communication concepts, Layered architecture as per OSI and TCP/IP model, Functionality of all layers in the OSI and TCP/IP model, Concepts of LAN, WAN, Internet, HTTP, Ethernet, General concepts in routing and basic routing algorithms like Dijkstra's shortest path, distance vector routing, link state routing, etc., Overview of popular application layer services like HTTP, DNS, FTP etc.

3. Course Contents:

Unit	Course Content	Weightage Percentage
Unit I	Primer on Latency and Bandwidth, Building Blocks of TCP and UDP and Transport Layer Security (TLS). Speed Is a Feature, Components of Latency, Speed of Light and Propagation Latency, Last-Mile Latency, Bandwidth, Delivering Higher Bandwidth and Lower Latencies, TCP Three Way Handshaking, Congestion Avoidance and Control, Bandwidth Delay Product, Optimization for TCP,UDP and Network Address Translator, NAT Traversal, STUN, TURN and ICE. TLS Handshake, TLS Session Resumption, Chain of Trust and Certificate Authorities, Certificate Revocation, TLS Record Protocol and Optimizing for TLS	30 %
Unit II	Wireless Networks, WiFi Ubiquitous Connectivity, Types of Wireless Networks, Performance Fundamentals of Wireless Networks, From Ethernet to a Wireless LAN, WiFi Standards and Features, Measuring and Optimizing WiFi Performance, Optimizing for WiFi Networks.	10 %
Unit III	Browser Networking, XMLHttpRequest and Server-Sent Events (SSE) Primer on Browser Networking, XMLHttpRequest: Brief History of XHR, Cross-Origin Resource Sharing (CORS), Downloading and	30 %



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	uploading Data with XHR, Monitoring Download and Upload Progress, Streaming Data with XHR, Server-Sent Events (SSE): EventSource API and Event Stream Protocol.	
Unit IV	WebSocket and WebRTC Introduction to WebSocket, WebSocket API, WebSocket Protocol, WebSocket Use Cases and Performance, WebRTC: Standards and Development of WebRTC, Audio and Video Engines, Real-Time Network Transports, Establishing a Peer-to-Peer Connection, Delivering Media and Application Data, DataChannel, WebRTC Use Cases and Performance.	30 %

4. Text Book:

- 1) Ilya Grigorik, “High-Performance Browser Networking”, 2013: First Edition, O’Reilly
E-book book also available <https://hpbn.co/>

5. Reference Books:

- 1) Douglas E. Comer, “Internetworking with TCP/IP - (Vol. 1) Principles, Protocols, and Architecture”, 6th Edition, Prentice Hall of India (PHI) Publishers.
- 2) Behrouz A. Forouzan, “TCP/IP Protocol Suite”, 4th Edition, McGraw-Hill
- 3) W. Richard Stevens, G. Gabriani, “TCP/IP- Illustrated, Vol. 1 (The Protocols)”, Pearson Publishers.
- 4) Chris Sanders, “Practical Packet Analysis using Wireshark to solve real world problems”, No Starch Press, Inc.

6. Chapter wise Coverage from the Text Book:

Unit No.	Text Books	Topics/Subtopics
1	Book-1	Chapter 1 to Chapter 4
2	Book-1	Chapter 5, Chapter 6
3	Book-1	Chapter 14 to Chapter 16
4	Book-1	Chapter 17 to Chapter 18

7. Accomplishment of the student after completing the course:

- 1) Have thorough understanding of TCP/IP based systems, services and related tools and technologies
- 2) Be fluent in design and developing TCP/IP socket based networking solutions
- 3) Effectively use available OS commands/utilities as well as popular third party tools for TCP/IP networking depending upon the needs
- 4) Be geared to adapt to more sophisticated networking related packages and hence develop relatively complex applications more reliably and faster.



1. Download Wireshark is a network packet analyzer from its official webpage <https://www.wireshark.org/>
2. Install Wireshark under Windows/Linux/MAC/Solaris platform
3. Wireshark Installation, understanding the Wireshark Environment / Menu System, to start and stop live capture of traffic from given wired ethernet network interface, capturing options, store captured data in different supported file formats, to open already stored captured data file.
4. Analyze Transmission Control Protocol (TCP) Traffic
Established of TCP Connections, Termination of TCP Connections, How TCP Tracks Packets Sequentially, Review the Trace File: Packet Loss Detected by the Receiver – Fast Recovery, Packet Loss Detected by the Sender – RTO Timeout, Improve Packet Loss Recovery with Selective Acknowledgments, TCP Flow Control, The TCP Window Size > Zero Can Still Stop Data Transfer
5. Analyze User Datagram Protocol (UDP) Traffic : Normal UDP Traffic, UDP Problems, Dissect the UDP Packet Structure, Filter on UDP Traffic
6. Analyze IEEE 802.11 (WLAN) : Wireless LANs (WLANs) Traffic, Signal Strength and Interference, Capture WLAN Traffic, Monitor Mode vs. Promiscuous Mode, 802.11 Traffic Basics like Data Frame, Management Frame and Control Frames etc., Normal 802.11 Communications, Dissect the 802.11 Frame Structure, Filter on All WLAN Traffic, Frame Control Types and Subtypes
7. Capture Wi-Fi and Bluetooth Traffic and Interpret/ Analyze the corresponding header and payload using Wireless Traffic Sniffing tools like WireShark-USB/AirCrackng/Kismet, etc.
8. Write a java socket program for implementation of echo (Algorithms: Client Side: Create a socket which binds the IP address of server and the port address to acquire service, After establishing connection send a data to server, Receive and print the same data from server, Close the socket and End the program, Server Side: Create a server socket to activate the port address, Create a socket for the server socket which accepts the connection, After establishing connection receive the data from client, Print and send the same data to client, Close the socket and End the program).
9. Write a java client-server application for chat using TCP/IP (Algorithms: Client Side: Start writing the program, include all necessary package in java, create a socket in client to server, client establishes a connection to the server, client accept the connection and to send the data from client to server, client communicates the server to send the end of the message and Stop the program, Server Side: Include all necessary package in java, create a socket in server to client, server establishes a connection to the client, server accept the connection and to send the data from server to client and vice versa, server communicate the client to send the end of the message and Stop the program).
10. Write a java program to Perform File Transfer in Client & Server Using TCP/IP (Algorithms: Client Side: Establish a connection between the Client and Server, Socketss=new Socket(InetAddress.getLocalHost(),1100), Implement a client that can send two requests (i) To get a file from the server (ii) To put or send a file to the server, After getting approval from the server ,the client either get file from the server or send, file to the server, Server Side: Implement a server socket that listens to a particular port number, Server reads the filename and sends the data stored in the file for the 'get' request, reads the data from the input stream and writes it to a file in the server for the 'put' instruction, Exit upon client's request and Stop.



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11. Write a java program to implement simple client-server application using UDP (Algorithms: Client Side: Create a datagram socket with server's IP address, Create datagram packets with data, data length and the port address, Send the datagram packets to server through datagram sockets, Receive the datagram packets from server through datagram sockets and Close the socket, Server Side: Create a datagram socket with port address, Create datagram packets with data, data length and the port address, Send the datagram packets to client through datagram sockets, Receive the datagram packets from client through datagram sockets and Close the socket.
12. Implement real-time video streaming and data exchange using Web RTC (i) Get video from your webcam (ii) Stream video with RTCPeerConnection (iii) Stream data with RTCDataChannel (iv) Set up a signaling service to exchange messages (v) Combine peer connection and signalling and (vi) Take a photo and share it via a data channel. Download the sample source code and Learn Step by Step:
<https://codelabs.developers.google.com/codelabs/webrtc-web/#9>
The practical examination exercises would be based on lab exercises above list except Lab # 12. For Lab # 12 a documentation/report/file should be maintained.

References:

<https://www.wireshark.org/>

<https://www.wireshark.org/download/docs/user-guide.pdf>

<https://www.aircrack-ng.org/>

<https://www.kismetwireless.net/>

<https://webrtc.org/>