



## TCP/IP Fundamentals

- 4 Days
- Lecture and Hands-on Labs

### Course Overview

Over the course duration, participants will engage in a combination of lectures and hands-on lab sessions that covers foundational networking skills on modern networks, ranging from physical devices to network function virtualization. The course begins with an introduction to essential packet analysis tools like Wireshark and Termshark, followed by practical training in capturing PCAP files using TCPdump. Students will then delve into the fundamental aspects of networking architecture, including a clear understanding of the OSI model and an exploration of TCP/IP protocols. Using network function virtualization, students will build the lab infrastructure, involving the setup of network namespaces and Ethernet bridges, thereby facilitating a more profound comprehension of Ethernet switching and routing. Students will develop a clear understanding of a cloud based networking since NFV (network function virtualization) is used to build the entire network.

The course also covers IPv4 addressing, routing, and ARP protocols, with students gaining hands-on experience through practical lab exercises. The curriculum further explores topics such as NAT, IPv4 subnets, and the analysis of IPv4 headers. Students will also gain insights into routing protocols like OSPF and BGP, culminating in a challenging mini-project that allows them to apply their acquired knowledge.

Sessions dedicated to UDP, TCP, TLS, ICMP, DHCP, and DNS protocols provide a holistic understanding of various networking aspects. Following these sessions, the course integrates network troubleshooting labs to put theory into practice. These labs serve as an opportunity for students to apply their knowledge and refine their skills in diagnosing and resolving networking issues. Overall, “TCP/IP Fundamentals” is an ideal choice for individuals seeking to establish a strong foundation in network analysis and troubleshooting.

### Who Should Attend

Personnel looking for entry level understanding of IP networking.

### What You'll Learn

- Demystify cloud networking by understanding the concept of Network Function Virtualization (NFV).
- Explain the benefits and applications of NFV in modern networking.
- Build a complete NFV network that demonstrates Ethernet access, Ethernet switching, and IP routing
- Develop an understanding of key networking terminologies and concepts that will promote communications within a network team or environment.
- Observe and describe the principles and mechanisms of IP routing.
- Configure and manage IP routing settings in a network environment.
- Inspect IP, UDP, and TCP Headers Using Wireshark
- Analyze and interpret IP, UDP, and TCP headers in network packets.
- Understand the concept of IP namespaces for network isolation.
- Use iptables and ip2 commands to demonstrate L3 Functionality
- Master the use of iptables for firewall configuration.
- Utilize the ip2 commands to illustrate Layer 3 (L3) functionality in networking.
- Explore Domain Name System (DNS) fundamentals.
- Configure and manage local host records for DNS resolution.




- Gain a comprehensive understanding of Transport Layer Security (TLS) and Secure Sockets Layer (SSL).
- Implement TLS and SSL protocols for secure network communication.
- Develop troubleshooting skills to identify and resolve connectivity problems.
- Apply troubleshooting techniques to diagnose and address network issues effectively.
- Write a bash script to deploy a test network in seconds.
- Advanced students are encouraged to deploy NFV using python or ansible playbook sample taken from the follow on course

## Outline




### AI LLM Toolkit

-  Lecture + Lab: Large Language Model toolkit for AI Solution Assistance

### Wireshark essentials

-  Lecture + Lab: Introduction to Wireshark
-  Lecture + Lab: Introduction to Termshark
-  Lecture + Lab: Capture PCAP Files Using TCPdump




### TCP/IP Introduction

-  Lecture + Lab: Networking Architecture: The OSI Model
-  Lecture + Lab: Introduction to TCP/IP
-  Lecture + Lab: LAB: Navigating your Network





### Build the Lab Infrastructure

-  Lecture + Lab: LAB: Build the Network Namespaces
-  Lecture + Lab: LAB: Build the Ethernet Bridges

### Ethernet Access

-  Lecture + Lab: Ethernet Switching
-  Lecture + Lab: LAB: Build and Connect Veths
-  Lecture + Lab: LAB: Ethernet Analysis with Termshark




### IPv4 Addressing

-  Lecture + Lab: IPv4 Addressing
-  Lecture + Lab: LAB: Enable IP Forwarding in a Linux Kernel
-  Lecture + Lab: LAB: Assign IP addresses
-  Lecture + Lab: LAB: Confirm Link Connectivity




### IP Routing

-  Lecture + Lab: IP Routing Overview
-  Lecture + Lab: LAB: Configuring Static IP Routes
-  Lecture + Lab: Packet Forwarding Header Analysis


### Address Resolution Protocol

-  Lecture + Lab: ARP (Address Resolution Protocol)
-  Lecture + Lab: LAB: Linux Bridge Management
-  Lecture + Lab: LAB: Analyzing ARP with Termshark

## NAT (Network Address Translation)

-  Lecture + Lab: NAT (Network Address Translation)
-  Lecture + Lab: Iptables
-  Lecture + Lab: LAB: Enable the NAT (Network Address Translation) with Iptables



## IPv4 Subnets

-  Lecture + Lab: Subnetting

## IPV4 Headers

-  Lecture + Lab: IP Headers
-  Lecture + Lab: LAB: Analyzing IPv4 Headers with Termshark


## Routing Protocols

-  Lecture + Lab: OSPF (Open Shortest Path First)
-  Lecture + Lab: BGP (Border Gateway Protocol)



## Project

-  Challenge: Mini Project



## UDP Sessions

-  Lecture + Lab: UDP (User Datagram Protocol)





## TCP Sessions

-  Lecture + Lab: TCP (Transmission Control Protocol)
-  Lecture + Lab: TCP Analysis with Termshark

## TLS (Transport Layer Security) Sessions

-  Lecture + Lab: TLS (Transport Layer Security)
-  Lecture + Lab: LAB: TLS Analysis with Termshark



## ICMP Diagnostic and Error Reports

-  Lecture + Lab: ICMP (Internet Control Message Protocol)
-  Lecture + Lab: LAB: Traceroute/MTR Testing
-  Lecture + Lab: LAB: Speed Testing with IPERF (Internet Performance)
-  Lecture + Lab: LAB: ICMP Analysis with Termshark





## DHCP (Dynamic Host Configuration Protocol)

-  Lecture + Lab: DHCP (Dynamic Host Configuration Protocol)
-  Lecture + Lab: LAB: Install a DHCP Service with DNSMasq
-  Lecture + Lab: LAB: DHCP Packet Analysis with Termshark

## DNS (Domain Name Server)

-  Lecture + Lab: LAB: DNS - Understanding the Host File
-  Lecture + Lab: LAB: DNS - Understanding the /etc/resolv.conf File

## Network Troubleshooting Labs

-  Lecture + Lab: Network Troubleshooting Lab #1
-  Lecture + Lab: Network Troubleshooting Lab #2
-  Lecture + Lab: Network Troubleshooting Lab #3
-  Lecture + Lab: Network Troubleshooting Lab #4