



# **IP Generic Training Programs**

## Catalog of Course Descriptions





# Catalog of Course Descriptions

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## Introduction

Ericsson has developed a comprehensive Training Programs service to satisfy the competence needs of our customers, from exploring new business opportunities to expertise required for operating a network. The Training Programs service is delineated into packages that have been developed to offer clearly defined, yet flexible training to target system and technology areas. Each package is divided into flows, to target specific functional areas within your organization for optimal benefits.

**Service delivery is supported using various delivery methods including:**

Icon	Delivery Method
	Instructor Led Training (ILT)
	eLearning (WBL)



## BGP Overview & Fundamentals



LZU 108 8532 R1A

### Description

BGP Overview & Fundamentals consists of 2 modules: BGP Overview and BGP Fundamentals. Both parts end with a Knowledge Assessment.

BGP Overview module describes the background to BGP, what BGP is, reasons for using BGP and the different types of deployment scenarios for BGP.

BGP Fundamentals module describes what BGP is, why we use it and how it works. It also goes deeper into the peering process, how BGP shares prefixes and what attributes are used in path selection

### Learning objectives

On completion of this course the participants will be able to:

- 1 Know what Border Gateway Protocol (BGP) is
- 2 Understand why operators need to use BGP
- 3 Describe the market driver for BGP
- 4 Explain the way operators use BGP
- 5 Know the typical deployment scenarios for BGP
- 6 Appreciate the value it provides to the customers from technical point of view
- 7 Understand how BGP can be used by different groups of customers (Enterprises, Service Providers)
- 8 Explain what makes BGP different from other routing protocols
- 9 Describe how BGP works
- 10 Understand what a Finite State Machine is
- 11 Explain the different states in the BGP peering process and what messages are sent between each state.
- 12 Describe the different attributes that BGP sends and how these are used to select the best path.
- 13 Understand what BGP route Summarization is and why it important





- 14 Explain what makes BGP different from other routing protocols
- 15 Appreciate the challenges with worldwide BGP routing

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593
OSPF <u>or</u> IS-IS Overview & Fundamentals	LZU 108 8536 <u>or</u> LZU 108 8534

### Duration and class size

The length of the course is 1.33 hours.

### Learning situation

This is a self-paced web based course

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### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	Growth in the Internet BGP Concepts What is BGP Why BGP BGP Routing Policy Typical Deployment Scenarios How BGP works BGP Peering Sharing Prefixes BGP Attributes Summary	



## BNG Fundamentals



LZU1089743 R1A

### Description

This course covers the fundamentals for Broadband Network Gateway (BNG). It includes the main functionalities in BNG such as subscriber management (IPv4 and IPv6), PPP, PPPoX, AAA, AAAA, DHCP, CLIPS and QoS. The course explains some details of the BNG related features in Ericsson products and services. The course is completely based on theory.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Subscriber Management
- 2 PPP
  - 2.1 Local Authentication
  - 2.2 Centralized Authentication
  - 2.3 RADIUS
- 3 AAA
- 4 DHCP and CLIPS
  - 4.1 DHCP (IPv4)
  - 4.2 CLIPS
  - 4.3 DHCPv6 (IPv6)
- 5 Redundancy
- 6 QoS for subscriber session

### Target audience

The target audience for this course is:

Service Planning Engineer, Service Design Engineer, Network Design Engineer, Network Deployment Engineer, Service Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer, System Administrator, Fundamentals







**Prerequisites**

Successful completion of the following courses:

General IP networking knowledge.

BNG Overview, LZU1089744

Fixed Broadband Subscriber Management Overview, LZU1088524

**Duration and class size**

The length of the course is 1 hour

**Learning situation**

This is a web-based interactive training course with multimedia content.

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1		



## BNG Overview



LZU1089744 R1A

### Description

This is an introduction course for Broadband Network Gateway (BNG), its role in the network and overview of its main functionalities. It also introduces some of the BNG related features in Ericsson products and services. The course is completely based on theory.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Introduction to BNG
- 2 Network reference
- 3 Main BNG functionalities
  - 3.1 Subscriber management overview
- 4 BNG in Ericsson products

### Target audience

The target audience for this course is:

Service Planning Engineer, Service Design Engineer, Network Design Engineer, Network Deployment Engineer, Service Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer, Field Technician, System Administrator, Business Developer, Customer Care Administrator, Fundamentals

### Prerequisites

Successful completion of the following courses:

General IP networking knowledge.





**Duration and class size**

The length of the course is 1 hour

**Learning situation**

This is a web-based interactive training course with multimedia content.

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1		



## DHCP-CLIPS Fundamentals



LZU1088460 R1A

### Description

This course provides fundamentals of the DHCP protocol. It also explains Ericsson's method of managing DHCP subscribers – CLIPS

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand what DHCP is and how it is used.
- 2 Describe the role of DHCP client, server, relay and proxy.
- 3 Explain in details DHCP IP address assignment process.
- 4 Describe the differences between Static and Dynamic CLIPS.
- 5 Understand RADIUS's role in CLIPS.

### Target audience

The target audience for this course is:

All

### Prerequisites

Successful completion of the following courses:

Fixed Broadband Subscriber Management Overview  
IP Overview & Fundamentals

### Duration and class size

The length of the course is 0.5 hours.



**Learning situation**

This course is a Web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	What is DHCP DHCP IP Address Assignment DHCP IP Address release DHCP Message fields DHCP IP Address Lease Renewal and Rebinding DHCP Redundancy and Failover DHCP Options DHCP Relay Function DHCP Proxy Server Function Clientless IP Service Selection Dynamic CLIPS Static CLIPS RADIUS Accounting and Authentication DHCP RADIUS Proxy Summary	

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## Ethernet OAM Enhancement



LZU 108 8518 R1A

### Description

This course provides information about protocols used for Ethernet OAM (Operation Administration and Maintenance). It explains functionality provided by 802.1ag, 802.3ah and Y.1731 protocols. This course requires good understanding of Ethernet fundamentals

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand protocols used for Ethernet OAM (Operation Administration and Maintenance)
- 2 Understand the functionality provided by 802.1ag, 802.3ah and Y.1731 protocols

### Target audience

The target audience for this course is:  
Fundamentals

### Prerequisites

Successful completion of the following courses:  
Ethernet Transport Overview and Fundamentals, LZU1088519

### Duration and class size

The length of the course is 1 hour

### Learning situation

This is a self-paced web based course



### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
	What is Ethernet OAM	
	Why Ethernet OAM is needed	
	Ethernet OAM Environment	
	802.3ah Protocol	
	802.1ag Protocol	
	Ethernet Maintenance Levels	
	ITU Y.1731	
	Summary	



## Ethernet Standards



LZU 108 7591 R1A

### Description

Ethernet is becoming one of the main standard communication protocols used in transport networks to handle the requirements of transporting data traffic in the networks in an efficient way.

Do you have the competence required to handle this?

This course covers the basics of Ethernet and related standards. The objectives of this course will be the prerequisites for many of the product Operations and Operation and Maintenance courses

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand the structure of the Ethernet frame and MAC address format
- 2 Describe the differences between bridging and switching
- 3 Understand Ethernet framing, Ethernet over PDH and Ethernet over SDH
- 4 Define and understand different Ethernet protection protocols
- 5 Understand the Operations, Administration and Maintenance (OAM) features of Ethernet
- 6 Define which traffic management mechanisms are available to manage Ethernet traffic performance assurance
- 7 Understand the use of IGMP over L2 Switches
- 8 Describe T-MPLS and PBT (PBB-TE)

### Target audience

The target audience for this course is:

Fundamentals





**Prerequisites**

Successful completion of the following courses:

There are no prerequisites for this course

**Duration and class size**

The length of the course is appr. 2 hours.

**Learning situation**

This is a self-paced web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	Introduction Bridge and Switching Ethernet Services Ethernet over PDH and SDH Ethernet Protections Ethernet OAM Traffic Management IGMP over Layer 2 Switch T-MPLS and PBT Test	

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## Ethernet Transport Overview & Fundamentals



LZU 108 8519 R1A

### Description

This course is made of two modules. First the Overview module that gives an introduction into Carrier Ethernet. It explains the need for Carrier Ethernet when building a common Ethernet transport network. It describes the key attributes that make it different from LAN-based Ethernet, and the role of Metro Ethernet Forum in promoting Carrier Ethernet.

The second module is the "Ethernet Transport Fundamentals, web based learning module. This module describes the Ethernet protocol in detail and key concepts Ethernet is based on. It also gives in depth explanation of some of the features Ethernet offers. Telecom Grade Ethernet is also described and the different Telecom Grade Ethernet Solutions are explained."

Both modules end with a knowledge assessment

### Learning objectives

On completion of this course the participants will be able to:

- 1 Describe the concept and solution of Carrier Ethernet
- 2 To learn about challenges in Telco Networks
- 3 To know the background on Ethernet
- 4 To know about Carrier Ethernet Services
- 5 Describe the Ethernet Protocol
- 6 Explain how Ethernet Works
- 7 Compare the different Ethernet Link Types
- 8 Describe Ethernet Bridging and Switching
- 9 Explain Ethernet Loop Avoidance
- 10 Describe the Rapid Spanning Tree Protocol
- 11 Explain the operation of Ethernet VLANs and the IEEE802.1q Protocol
- 12 Describe Ethernet Resiliency and Link Aggregation
- 13 Describe Ethernet Ring Protection





- 14 Understand Provider Bridging - QinQ
- 15 Understand Provider Backbone Bridging Mac-in-Mac

### Target audience

The target audience for this course is:  
Fundamentals

### Prerequisites

Successful completion of the following courses:

Ethernet Standards LZU 108 7591

### Duration and class size

The length of the course is appr. 1 hour.

### Learning situation

This is a self-paced web based course

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	BGP Concepts What is BGP Why BGP How BGP works BGP Peering Sharing Prefixes BGP Attributes Summary	



## Fixed Broadband Subscriber Management Overview



LZU 108 8524 R1A

### Description

Fixed Broadband Subscriber Management is a method to identify individual subscribers and provide differentiated services. This module gives an introduction into subscriber management for fixed broadband access. It identifies why service providers need subscriber management and discusses the associated deployment scenarios and technology options. It ends with a knowledge assessment

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand basics of subscriber management for fixed broadband
- 2 Understand typical deployment scenarios and technologies used

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

There are no prerequisites for this course

### Duration and class size

The length of the course is 0.25 hours.



**Learning situation**

This is a self-paced web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
	Trends and Drivers	
	What is Fixed Broadband Subscriber Management	
	Deployment Scenarios and Technology Options	
	Summary	



## IP Multicast Overview & Fundamentals



LZU 108 8529 R1A

### Description

IP Multicast Overview & Fundamentals is a combination of 2 modules: Multicast Overview and Multicast Fundamentals.

Both parts end with a Knowledge Assessment.

Multicast Overview module describes on a high level, what Multicast is and the benefits it has over other types of data transmission. It also explains what applications are possible with Multicasting.

Multicast Fundamentals module describes what Multicast is, why we use it and how it works. It describes the functionality of Multicast and the benefits associated. It also describes in detail all components of the multicast architecture

### Learning objectives

On completion of this course the participants will be able to:

- 1 Describe what Multicasting is
- 2 Understand the benefits Multicast has over Unicast and Broadcast
- 3 Explain when Multicast should and should not be used
- 4 Outline why ISP's need IP multicast technologies
- 5 Discuss the ways in which real-time applications use Multicast technology
- 6 Explain the IP multicast model and its applications
- 7 Understand the Multicast architecture
- 8 Explain Multicast addressing
- 9 Outline Multicasting at Layer 2
- 10 Discuss the concept of a Multicast distribution tree
- 11 Explain how multicast routing is different from Unicast routing
- 12 Detail all actions of a router when it receives a multicast packet
- 13 Understand the role of TTL thresholds





- 14 Explain Internet Group Management Protocol
- 15 Describe IGMP Snooping
- 16 List the different Multicast Routing Protocols Categories

## Target audience

The target audience for this course is:

Fundamentals

## Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593

## Duration and class size

The length of the course is appr. 2 hours.

## Learning situation

This is a self-paced web based course

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### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	What is IP Multicast? IP Transmission Types Advantages of Multicast Disadvantages with Multicast Multicast Applications IP Multicast Model Multicast Architecture Multicast Addressing IGMP Multicast Distribution Trees Multicast Routing Reverse Path Forwarding TTL Thresholds	

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## IP Overview & Fundamentals



LZU 108 8538 R1A

### Description

This course contains of two parts: Overview and Fundamentals. Both ends with knowledge assessments.

The first part gives an introduction into IP. It gives a short historic perspective. It explains the business drivers behind IP, how the networks are evolving to "all-IP", and how IP packet networks are different from circuit based telephony networks.

The second part is made for people who want more technical detail. Fundamentals presents the main concepts behind the IP protocol.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Learn about the business drivers for IP
- 2 Learn about the historical background
- 3 Learn about how the industry is going towards all-IP
- 4 Learn about packet switching versus circuit switching
- 5 Understand what is TCP/IP
- 6 Know the IPv4 Packet Structure
- 7 Know the IPv4 Address Schema
- 8 Know about classless IP addressing
- 9 Learn about the life of an IP Packet

### Target audience

The target audience for this course is:

Fundamentals



**Prerequisites**

Successful completion of the following courses:

There are no prerequisites for this course

**Duration and class size**

The length of the course is 1.25 hours

**Learning situation**

This is a self-paced web-based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	Business drivers for IP Historical background of IP How is the industry going towards all-IP? Packet switching versus circuit switching approach What is IP? What id TCP/IP? OSI Model IPv4 Package structure 32-bit address scheme of IPv4 IP addressing	

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## IP Routing Overview & Fundamentals



LZU 108 8593 R1A

### Description

This course consists of two modules, IP Routing Overview and IP Routing Fundamentals. The IP Routing Overview module describes what IP Routing is, why we use it and how it works. It describes the different types of routing available. It also describes the difference between switching and routing

The IP Routing Fundamentals module describes how IP packets are transmitted in an IP network. Provides information about how Routing Table is populated with route data. The purpose and main functionalities of Dynamic Routing protocols. It also presents techniques to reduce the size of Routing Tables

### Learning objectives

On completion of this course the participants will be able to:

- 1 Know the basics of IP routing
- 2 Describe how IP addresses and subnet masks used
- 3 Understand the differences between routing and switching
- 4 Know what routers and routing tables are
- 5 Compare static versus dynamic routing protocols
- 6 Understand the difference between interior and exterior routing protocols
- 7 Describe what IP routing is
- 8 Understand how IP packets are transmitted
- 9 Know the purpose and main characteristics of dynamic routing protocols
- 10 Compare Distance Vector and Link State Advertisement routing protocols
- 11 Understand the function of a Default Gateway router
- 12 Define what is Route summarization
- 13 Tell how does Administrative Distance influence route selection
- 14 Describe the importance of Convergence Time



**Target audience**

The target audience for this course is:  
Fundamentals

**Prerequisites**

Successful completion of the following courses:

IP Overview & Fundamentals                      LZU 108 8538

**Duration and class size**

The length of the course is appr. 0.77 hour.

**Learning situation**

This is a self-paced web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	What is IP Routing IP addressing Routing and Switching Routers and Routing Tables Static versus Dynamic Routing Protocols Interior versus Exterior Routing Protocols Packet Transmission Routing Protocols Default Gateways Summarization Administrative Distance Convergence Time	

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## IP-QoS Overview & Fundamentals



LZU 108 8528 R1A

### Description

The overview module describes what IP QoS is, why we use it and on a very high-level what are the requirements and how it works. It compares IP QoS to a road network and uses this analogy to explain certain topics. It also describes briefly about DiffServ and QoS marking

The Fundamentals module describes what IP QoS is, why we use it and how it works. It reviews a few concepts related to QoS, including throughput, delay, jitter and loss. It examines how IP Precedence is used and how this evolved to Differentiated Services. It describes the different roles and functions of all components that make up a DiffServ. It also describes congestion avoidance mechanisms and how IP QoS is mapped into layer 2 headers

### Learning objectives

On completion of this course the participants will be able to:

- 1 Know why we use QoS
- 2 Understand congestion avoidance
- 3 Explain the benefits of QoS to a service provider
- 4 Identify the benefits of QoS to an end user
- 5 Understand some typical deployment scenarios
- 6 Understand why previously used best-effort approach was sufficient but is now unsuitable for triple play services.
- 7 Revise the concepts of throughput, delay, jitter and loss.
- 8 Describe Integrated Services.
- 9 Understand per-hop processing.
- 10 Understand how IP Precedence is used.
- 11 Know how IP Precedence evolved to Differentiated Services (DS).
- 12 Be aware of the different DS components.

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- 13 Explain the different DiffServ functions like classification, marking, policing, queuing and scheduling.
- 14 Describe how the concept of the Token Bucket works.
- 15 Identify and explain different congestion avoidance mechanisms like RED and WRED.
- 16 Understand where the IP QoS marking is mapped into Layer 2 headers

### **Target audience**

The target audience for this course is:  
Fundamentals

### **Prerequisites**

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593

### **Duration and class size**

The length of the course is appr. 1.75 hours.

### **Learning situation**

This is a self-paced web based course



### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	Why QoS Congestion Avoidance Benefits of QoS to the Service Provider Benefits of QoS to the End User Typical Deployment Scenarios Network Requirements Addressing QoS Requirements IP Precedence Differentiated Services DS Components DiffServ Functions Congestion Avoidance IP QoS in Layer 2	

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## IPv6 Overview & Fundamentals



LZU 108 8537 R1A

### Description

This course contains two parts: IPv6 Overview and IPv6 Fundamentals.

The first part gives an introduction into IPv6. It identifies the current problem with running out of IPv4 addresses and it is focused on explaining what is IPv6 and why we need it.

The second part is a follow through from the IPv6 Overview. It presents the need for IPv6, the technical concepts behind IPv6, such as: Major changes compared to IPv4, the address model, packet structure and service protocol. Also some transition options from IPv4 to IPv6 are explored

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand why a new IP protocol is needed
- 2 Understand what is IPv6
- 3 List some benefits of IPv6
- 4 Compare the addresses used in IPv4 to IPv6
- 5 Understand that migration to IPv6 will take time
- 6 Identify the need of IPv6?
- 7 Classify major changes made in TCP/IPv6 compared to IPv4.
- 8 Be familiar with the address model
- 9 Know the Packet structure
- 10 Be familiar with Service Protocols
- 11 Transition Options from IPv4 to IPv6

### Target audience

The target audience for this course is:





Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593

### Duration and class size

The length of the course is appr. 2.33 hours

### Learning situation

This is a self-paced web based course

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	The Growth of the Internet Running out of IPv4 addresses What is IPv6? Comparing IPv4 to IPv6 addresses Migration Trends Major changes made in TCP/IPv6 compared to TCP/IPv4? IPv6 Address Model IPv6 Packet Structure IPv6 Service Protocols Transition options available from IPv4 to IPv6	

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## IPv6 Transition Mechanisms Fundamentals



LZU 108 8531 R1A

### Description

In this fundamentals course, we will cover the following topics:  
Firstly we are going to explore why we need IPv6 Transition Mechanisms.  
After that we will see that IPv6 was designed, at the beginning, with transition in mind: no D day. Hence, we will outline the three main types of IPv6 transition mechanisms.  
We will then describe in detail the Dual Stack, Tunneling and Translation mechanisms.  
This will bring us on to look at the migration trends from IPv4 to IPv6 over the upcoming years and explore some top approaches to IPv6 Transition.  
Finally, we will wrap this module up with a short summary

### Learning objectives

On completion of this course the participants will be able to:

- 1 Outline three main types of transition mechanisms
- 2 Describe dual stack, tunneling and transition mechanisms
- 3 Explain the migrations trends from IPv4 to IPv6

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

There are no prerequisites for this course

### Duration and class size

The length of the course is 1 hour.



**Learning situation**

This is a self-paced web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
	Why we need IPv6 Transition Mechanisms	
	Outline the tree main types of IPv6 Transition Mechanisms	
	Describe in detail the Dual Stack, Tunneling and Translation Mechanisms	
	Explore some top approaches to IPv6 transition	
	Summary	



## IS-IS Overview & Fundamentals



LZU 108 8534 R1A

### Description

This course consists of two parts: one overview and one fundamentals.

The Overview part provides introduction to the topic on a high level.

It provides a high level introduction to Intermediate System to Intermediate System (IS-IS). It explains ISIS role in Internet Protocol (IP) and Open Systems Interconnection (OSI) environments.

The Fundamentals part provides the essential information about the topic one must know prior to moving into the more detailed information of the topic.

Fundamentals are addressing the pre-requisite elements of the topic.

The Fundamentals part covers technology background of Intermediate System to Intermediate System (IS-IS) protocol.

It provides the essential information about ISIS.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understanding Intermediate System to Intermediate System (ISIS) role in data networks
- 2 Understanding key concepts of Intermediate System to Intermediate System (ISIS)

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593



**Duration and class size**

The length of the course is appr. 0.83 hour.

**Learning situation**

This is a self-paced web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	IS-IS Concepts Link State Database – Building common network view – Creating network topology – Topology of a broadcast network – Calculating best paths Neighbor Discovery Area Concept – Finding way out of L1 area – Suboptimal routing between areas IP Prefix Redistribution into IS-IS OSI addressing schema	

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## MPLS L2VPN Overview & Fundamentals



LZU 108 8513 R1A

### Description

L2VPN Overview & Fundamentals is a combination of 2 modules, the overview course and the fundamentals course. Both courses end with a Knowledge Assessment.

MPLS VPN's Overview module describes what MPLS VPN's are, why we use them and on a very high-level what are the requirements and how they work. It describes the different models for a VPN Service. It also describes briefly about MPLS VPN's.

MPLS L2VPN Fundamentals module describes what MPLS L2VPN is, why we use it and how it works. It describes the different roles and functions of all components that make up a MPLS L2VPN Service. It also describes in detail the different MPLS L2VPN services

### Learning objectives

On completion of this course the participants will be able to:

- 1 Know what a Virtual Private Network is (VPN).
- 2 Understand the business drivers for VPN's.
- 3 Explain the requirements of a VPN service.
- 4 Identify different VPN models.
- 5 Understand what an MPLS L3VPN is.
- 6 Understand what an MPLS L2VPN is.
- 7 Define the benefits of using MPLS VPN's.
- 8 Know why L2VPNs are used
- 9 Understand the how MPLS is used to setup L2VPNs
- 10 Revise MPLS and label switching
- 11 Describe the signaling that occurs to set up a L2VPN network
- 12 Understand the different L2VPN services – VPWS and VPLS
- 13 Understand the PWE3 Framework





- 14 Know the PW parameters and how they are exchanged
- 15 Be aware of the PW protocol stack, PW Control Word and O&M
- 16 Explain the difference between Ethernet, ATM and TDM (SAToP) carried over PWs
- 17 Describe how bridging works in VPLS, how loops are prevented and understand H-VPLS

### Target audience

The target audience for this course is:  
Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593
OSPF <u>or</u> IS-IS Overview & Fundamentals	LZU 108 8536 <u>or</u> LZU 108 8534
MPLS Overview & Fundamentals	LZU 108 8517

### Duration and class size

The length of the course is appr. 1.5 hours.

### Learning situation

This is a self-paced web based course



### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	What is a VPN Service? Business drivers for VPN's VPN Requirements VPN Models MPLS L3VPN MPLS L2VPN Benefits of MPLS VPN's Why L2VPN What is MPLS L2VPN Different L2VPN Services Virtual Private Wire Service Virtual Private LAN Service	





## MPLS L3VPN Overview & Fundamentals



LZU 108 8514 R1A

### Description

MPLS L3VPN Overview & Fundamentals is a combination of 2 modules, the overview course and the fundamentals module. Both courses end with a Knowledge Assessment.

MPLS VPN's Overview module describes what MPLS VPN's are, why we use them and on a very high-level what are the requirements and how they work. It describes the different models for a VPN Service. It also describes briefly about MPLS VPN's.

L3VPN Fundamentals module describes what L3VPN is, why we use it and how it works. It describes the different roles and functions of all components that make up a L3VPN Service. It also describes in detail the signaling and forwarding processes that make up a VPN service.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Know what a Virtual Private Network is (VPN)
- 2 Understand the business drivers for VPN's
- 3 Explain the requirements of a VPN service
- 4 Identify different VPN models
- 5 Understand what an MPLS L3VPN is
- 6 Understand what an MPLS L2VPN is
- 7 Define the benefits of using MPLS VPN's
- 8 Know what is Layer Three Virtual Private Network is (L3VPN) is
- 9 Understand the business drivers behind L3VPN
- 10 Describe the signaling that occurs to set up a L3VPN network
- 11 Revise MPLS and label switching
- 12 Understand the different roles that a router can have in an MPLS backbone (PE, P etc.)
- 13 Understand the function of the Route Distinguisher, Route Target and Inner label





- 14 Know how customer prefixes are exchanged
- 15 Be aware of the different types of routing, from CE to PE and across the backbone
- 16 Explain the MPLS label stacking and what each label represents
- 17 Describe the end-to-end packet walk through

### Target audience

The target audience for this course is:  
Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593
OSPF <u>or</u> IS-IS Overview & Fundamentals	LZU 108 8536 <u>or</u> LZU 108 8534
MPLS Overview & Fundamentals	LZU 108 8517
BGP Overview & Fundamentals	LZU 108 8532

### Duration and class size

The length of the course is appr. 1.25 hours.

### Learning situation

This is a self-paced web based course

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### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	What's a VPN service? Business drivers for VPN's VPN Requirements VPN Models MPLS L3VPN Concepts Benefits of MPLS VPN's L3VPN Layout Putting things into place – Signaling Putting things into place – Forwarding Summary	



## MPLS Overview & Fundamentals



LZU 108 8517 R1A

### Description

This course contains of two modules.

The first module, the Overview, gives an introduction into MPLS (Multiprotocol Label Switching). It explains the need for MPLS in a world evolving to "all-IP". It describes how networks are evolving, based on MPLS, what MPLS offers and on a very high level how MPLS works.

The second module, the Fundamentals, web based learning module. This module describes what MPLS is, why we use it and how it works. It describes the different roles and functions of all components that make up MPLS. It also describes in detail the label switching and distribution process and how these can be used to create VPNs (Virtual Private Network)."

Both modules end with a Knowledge Assessment

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand the importance of MPLS (Multiprotocol Label Switching) for next generation telecommunication networks.
- 2 Understand the basics of MPLS (Multiprotocol Label Switching).
- 3 Know what is Multi-Protocol Label Switching (MPLS) is
- 4 Understand why operators need to use MPLS
- 5 Describe how MPLS works
- 6 Compare MPLS to the OSI (Open Systems Interconnection) model
- 7 Understand the different roles that a router can have in an MPLS backbone (LER (Label Edge Router), LSR (Label Switch Router) etc.)
- 8 Explain the MPLS header and what each field means
- 9 Know the typical deployment scenarios for MPLS and how they are created – LSPs (Label Switched Path), FEC's (Forwarding Equivalence Class), label binding etc.
- 10 Describe the different label distribution and control modes
- 11 Explain how LDP (Label Switched Path) works, the message setup, LDP (Label





Distribution Protocol) ID etc.

12 Understand how MPLS VPN's work and are setup

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593
OSPF <u>or</u> IS-IS Overview & Fundamentals	LZU 108 8536 <u>or</u> LZU 108 8534

### Duration and class size

The length of the course is appr. 1.5 hours.

### Learning situation

This is a self-paced web based course

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	MPLS Concepts Why MPLS What is MPLS MPLS Functions and Roles Label Switching and Distribution MPLS Virtual Private Networks	



## OSPF Overview & Fundamentals



LZU 108 8536 R1A

### Description

This course gives a high level overview of the IP Routing protocol called Open Shortest Path First (OSPF).

It explains the role of this routing protocol in an IP Network.

This course also presents the main concepts behind the IP Routing protocol called Open Shortest Path First (OSPF).

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand the role of OSPF(Open Shortest Path First) in IP networks
- 2 Understand the main concepts of OSPF

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

IP Overview & Fundamentals	LZU 108 8538
IP Routing Overview & Fundamentals	LZU 108 8593

### Duration and class size

The length of the course is appr. 0.92 hour.

### Learning situation

This is a self-paced web based course





### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
1	OSPF Concept Link State Database – Building common network view – Creating network topology – Topology of a broadcast network – Calculating best paths LSA Flooding Introduction to concept of area	Self-paced

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## OSPFv3 Fundamentals



LZU 108 8535 R1A

### Description

This course will provide information about dynamic routing protocol for IPv6 - OSPFv3. It points out the differences and similarities between OSPFv3 and OSPFv2 used for IPv4 and ends with a knowledge assessment

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand the reasons why OSPFv3 was developed
- 2 List the differences from OSPFv2
- 3 List the similarities between OSPFv2 and OSPFv3
- 4 Understand OSPFv3 LSDB (Link State Database)

### Target audience

The target audience for this course is:

Fundamentals

### Prerequisites

Successful completion of the following courses:

There are no prerequisites for this course

### Duration and class size

The length of the course is 1 hour.





**Learning situation**

This is a self-paced web based course

**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (hours)</b>
	The reasons why OSPFv3 was developed Differences from OSPFv2 Similarities between OSPFv2 and OSPFv3 OSPFv3 LSDB Summary	



## IP Networking



LZU102397 R6A

### Description

This course will provide participants with an insight into and an understanding of the TCP / IP protocol stack from the physical layer to the application layer. Participants will learn the operation of different protocols and applications within the TCP / IP suite such as DHCP, DNS, NFS, NIS, NTP, HTTP, SNMP, SMTP, Telnet, FTP, TFTP and RTP. Participants will learn about IP addressing, both classful and classless (CIDR) and how subnetting / aggregation and VLSM operates. Participants will learn about different network devices and will develop a detailed understanding of LAN Switching, Routing and Routing protocols like (RIP, OSPF, and BGP & ISIS). Hands-on exercises using protocol analyzers are used to facilitate the understanding of theory sessions.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Networking Devices
  - 1.1 Networking Devices. (Hub, Switches & Routers Function) Explain ARP, CSMA/CD, and Transmission Types
  - 1.2 OSI MODEL. Vs. TCP/IP Suite
  - 1.3 IP Addressing
  - 1.4 Explain ICMP, Ping, Trace route
  - 1.5 Subnetting, VLSM, CIDR
  - 1.6 Perform Exercises on IPv4 Subnetting, VLSM & CIDR
  - 1.7 Describe IPv6 Addressing
- 2 Transport & application protocol
  - 2.1 Explain TCP, UDP and SCTP protocol structures, headers and functionality
  - 2.2 List and explain the operation of different protocols / applications such as DHCP, DNS, NFS, NIS, NTP, HTTP, SNMP, SMTP, Telnet, FTP, TFTP and RTP
- 3 Basic Router Configuration
  - 3.1 Explain Router Internal & external components
  - 3.2 Explain the booting process of the router
  - 3.3 Explain the router modes for the configuration of the router
  - 3.4 Explain the basic commands of the router
  - 3.5 Perform exercises for the basic commands on the router
- 4 Describe Routing Protocols and IP Switching and perform exercises
  - 4.1 Explain Basic Routing Concepts & Types of routing (Dynamic & Static)





- 4.2 Perform Exercises for Static Routing
- 4.3 Explain the Concept of dynamic routing protocol
- 4.4 Explain RIP
- 4.5 Explain OSPF
- 4.6 Explain BGP
- 4.7 Perform Exercises for RIP,OSPF,BGP
- 4.8 Explain ISIS
- 4.9 Perform Exercises on ISIS Routing protocol
- 4.10 Review Function of Switches, ARP & Explain VLANS, Types of Ports, Frame Tagging Types
- 4.11 Explain STP Functions on LAN Switches , different types of port of STP & States of STP
- 4.12 Perform Exercises on STP, STP Ports & STP States

### **Target audience**

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Planning Engineer, Service Design Engineer

### **Prerequisites**

Successful completion of the following courses:

There are no pre-requisites.

### **Duration and class size**

The length of the course is 5 days and the maximum number of participants is 8.

### **Learning situation**

This course is based on theoretical and practical instructor-led lessons given in both classroom and in a technical environment using equipment and tools.

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**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

<b>Day</b>	<b>Topics in the course</b>	<b>Estimated Time (Hours)</b>
<b>1</b>	Networking Devices. (Hub, Switches & Routers Function) Explain ARP, CSMA/CD, and Transmission Types	<b>1.5 hour</b>
	OSI Model Vs. TCP/IP Suite	<b>1 hour</b>
	IP Addressing IPv4	<b>1 hour</b>
	Explain ICMP, Ping, Trace route	<b>0.5 hour</b>
	Explain Subnetting, VLSM, CIDR	<b>1 hour</b>
	Perform Exercises on IPv4 Subnetting, VLSM & CIDR	<b>0.5 hour</b>
	Describe IPv6 Addressing	<b>0.5 hour</b>
<b>2</b>	Explain TCP, UDP and SCTP protocol structures, headers and functionality	<b>2.0 hours</b>
	List and explain the operation of different protocols / applications such as DHCP, DNS, NFS, NIS, NTP, HTTP, SNMP, SMTP, Telnet, FTP, TFTP and RTP	<b>2.0 hours</b>
	Explain and perform exercises about ARP	<b>2.0 hours</b>
<b>3</b>	Explain Router Internal & external components	<b>0.5 hour</b>
	Explain the booting process of the router	<b>0.5 hour</b>
	Explain the router modes for the configuration of the router	<b>0.5 hour</b>
	Explain the basic commands of the router	<b>1 hour</b>
	Perform exercises for the basic commands on the router	<b>2 hours</b>
	Explain Basic Routing Concepts & Types of routing (Dynamic & Static)	<b>1 hour</b>
	Perform Exercises for Static Routing	<b>0.5 hour</b>

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4	Explain the Concept of dynamic routing protocol	<b>0.5 hour</b>
	Explain RIP	<b>0.5 hour</b>
	Explain OSPF	<b>1.5 hours</b>
	Explain BGP	<b>1.5 hours</b>
	Perform Exercises for RIP, OSPF, BGP	<b>2.0 hours</b>
5	Explain ISIS	<b>1 hour</b>
	Perform Exercises on ISIS Routing protocol	<b>0.5 hour</b>
	Review Function of Switches, ARP & Explain VLANS, Types of Ports, Frame Tagging Types	<b>1 hour</b>
	Explain STP Functions on LAN Switches , different types of port of STP & States of STP	<b>1.5 hour</b>
	Perform Exercises on STP, STP Ports & STP States	<b>2 hour</b>



## IP Quality of Service and MPLS



LZU1087716 R2A

### Description

This course will give the students an insight and understanding of QoS. The students will learn the operation of QoS supporting IP Protocols and MPLS. The hands-on exercises are used to facilitate the understanding of theory sessions.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand how Quality of Service (QoS) works
  - 1.1 Explain QoS Fundamentals and QoS related Protocols
  - 1.2 Analyze the enhancement of the IP networks to support transmission of Real Time data
  - 1.3 Describe QoS Basic Concepts
  - 1.4 Describe QoS Architectures
  - 1.5 Describe QoS Mechanisms
  - 1.6 Explain Resource Reservation Protocol (RSVP) – RFC 2205
  - 1.7 Explain Basic MPLS Concepts
  - 1.8 Describe MPLS Labels and Label Stack
  - 1.9 Explain MPLS Applications
  - 1.10 Describe Generalized Multiprotocol's Label Switching – GMPLS
  - 1.11 Perform practical exercises covering Class Based Marking (CBM) using IP Precedence, DSCP and basic MPLS setup

### Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer

### Prerequisites

Successful completion of the following courses:

IP Networking LZU102397 R6A





### Duration and class size

The length of the course is 2 days and the maximum number of participants is 8.

### Learning situation

This course is based on theoretical and practical instructor-led lessons given in both classroom and in a technical environment using equipment and tools, which are accessed remotely.

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	Explain QoS Fundamentals and QoS related Protocols	0.5 hour
	Analyze the enhancement of the IP networks to support transmission of Real Time data	0.5 hour
	Describe QoS Basic Concepts	0.5 hour
	Describe QoS Architectures	0.5 hour
	Describe QoS Mechanisms	1.0 hour
	Explain Resource Reservation Protocol (RSVP)	1.0 hour
	Explain Label Distribution Systems (LDP, RSVP-TE, BGP)	2.0 hours
2	Explain Basic MPLS Concepts	1.0 hour
	Describe MPLS Labels and Label Stack	1.0 hour
	Explain MPLS Applications	1.0 hour
	Describe Generalized Multiprotocols Label Switching GMPLS	1.0 hour
	Perform practical exercises covering Class Based Marking (CBM) using IP Precedence, DSCP and MPLS	2.0 hours

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## IP Security



LZU1087717 R2A

### Description

This course will give the students an insight and understanding of Security issues. The students will learn the operation of Security topics such as authentication, confidentiality, and integrity. The hands-on exercises are used to facilitate the understanding of theory sessions.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Understand how IP Security (IP Sec) works
  - 1.1 Describe the general methods used to mitigate security threats to Enterprise networks
  - 1.2 Explain Access control lists (ACL)
  - 1.3 Explain the purpose and use of Firewalls
  - 1.4 Explain Encryption techniques
  - 1.5 Identify different Security Services
  - 1.6 Explain how Virtual Private Networks (VPN) operate
  - 1.7 Explain IP Security (IPSec) – RFC 4301
  - 1.8 Explain Authentication Header (AH) – RFC 4302
  - 1.9 Explain Encapsulating Security Payload (ESP) – RFC 4303
  - 1.10 Explain Internet Key Exchange (IKE) – RFC 2409 v1/RFC 4306 v2
  - 1.11 Show some Transport Layer Security Protocols (SSL and TLS) – RFC 2246v1/RFC 4346 v1.1
  - 1.12 Perform practical exercises covering the configuration of an IPSec VPN tunnel (Phase I and Phase II negotiation)

### Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer







### Prerequisites

Successful completion of the following courses:

IP Networking LZU 102 397 R6A

### Duration and class size

The length of the course is 2 days and the maximum number of participants is 8.

### Learning situation

This course is based on theoretical and practical instructor-led lessons given in both classroom and in a technical environment using equipment and tools, which are accessed remotely.

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Short description of the topics in the course	Estimated time (Hours)
1	Analyze the existing security threats types	1.0
	Explain Access control lists (ACL)	1.0
	Explain the purpose and use of Firewalls	1.0
	Explain Encryption techniques	1.0
	Identify different Security Services	1.0
	Explain how virtual Private Networks (VPN) operate	1.0
2	Explain IP Security (IPsec)	1.0
	Explain Authentication Header (AH)	1.0
	Explain Encapsulating Security Payload (ESP)	1.0
	Explain Internet Key Exchange (IKE)	1.0
	Show some Transport Layer Security Protocols (SSL and TLS)	1.0
	Perform practical exercises covering the configuration of an IPsec VPN tunnel (Phase I and Phase II negotiation)	1.0

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## IPv6 Networking



LZU1087424 R5A

### Description

This course gives a profound technical presentation of the Internet protocol IPv6. The course is focused on the protocols and mechanisms defined within IPv6 as well as functions affected by IPv6, such as routing protocols and DNS.

The course gives a clear view of how the Transition Mechanisms function and how they are used to establish IPv6 networks in a world of IPv4 networks and to ensure connectivity between different IPv6 networks and between IPv6 and IPv4 networks.

The students will get experience in how to set up an IPv6 network configuring routers and hosts.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Give a technical overview of IPv6 Networking
  - 1.1 Understanding the Limitations of IPv4
  - 1.2 Understanding the Benefits of IPv6
  - 1.3 Describe the IPv6 Header and Protocol Stack
  - 1.4 Comparing IPv6 to IPv4
  - 1.5 Identify the New Features
  - 1.6 Describe Main Bodies
- 2 Describe the IPv6 Header
  - 2.1 Understanding the IPv6 Header
  - 2.2 Comparing the IPv6 and IPv4 Headers
  - 2.3 IPv6 Extension Header
  - 2.4 Understanding ICMPv6 and ND Protocol
- 3 Describe the IPv6 Addressing
  - 3.1 Explain the Address Architecture
  - 3.2 Describe the types of IPv6 Addresses
  - 3.3 Describe Unicast, Multicast and Anycast Addresses
  - 3.4 Configuring Neighbor Discovery Protocol
  - 3.5 Configuring IPv6 Addresses
- 4 Describe the impact of IPv6 on Upper-Layer Protocols
  - 4.1 Describe DNS and DHCP for IPv6





- 4.2 Explain Transport Layer protocols
- 4.3 List and explain some applications
- 5 Describe Mobile IPv6 Concept and Components
  - 5.1 Understand the Building Blocks
  - 5.2 Explain Registration and Bindings
- 6 Describe the IPv6 Routing
  - 6.1 Describe Static Routes
  - 6.2 Configuring Different type of Static Routes
  - 6.3 Describe RIP for IPv6
  - 6.4 Configuring RIP for IPv6
- 7 Describe and Configure the Transition Mechanisms
  - 7.1 Introduction to IPv6 Transition Mechanisms
  - 7.2 Describe IPv6 over IPv4 GRE Tunnel
  - 7.3 Describe Automatic 6to4 Tunnels
  - 7.4 Explain ISATAP and Teredo
  - 7.5 Explain Tunnel Broker
  - 7.6 Describe Protocol Translation Mechanisms
  - 7.7 Configuring Static IPv6 NAT-PT
  - 7.8 Configuring Dynamic IPv6 NAT-PT

### Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, System Engineer

### Prerequisites

Successful completion of the following courses:

IP Networking	LZU 102 397 R6A
IP Quality of Service and MPLS	LZU 108 7716 R2A
IP Security	LZU 108 7717 R2A
Voice and Video over IP	LZU 108 7718 R2A

### Duration and class size

The length of the course is 2 days and the maximum number of participants is 8.

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### Learning situation

This course is based on theoretical and practical instructor-led lessons given in both classroom and in a technical environment using equipment and tools, which are accessed remotely.

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	IPv6 Introduction	1.5
	Describe IPv6 Header and Extension Header	1.0
	Describe ICMPv6	0.5
	Describe the Neighbor Discovery Protocol	0.5
	IPv6 Addressing	2.5
2	Describe the Upper-Layer Protocols	2.0
	Describe Mobile IPv6	2.0
	Describe and configure the Transition Mechanisms between IPv4 and IPv6	2.0



## IPv6 Quality of Service



LZU1087521 R3B

### Description

This course is a technical presentation of the feature related to IPv6: Quality of Service (DiffServ, RSVP / IntServ). IPv6 and this feature are essential in new generation networks.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Introduction to QoS
  - 1.1 Describe Building Block of IP QoS
  - 1.2 IP QoS Major Issues
  - 1.3 Describe the QoS Architecture
  - 1.4 Differentiate between Policing and Metering
  - 1.5 Describe Traffic Class and Flow label for IPv6
- 2 Congestion Management in IPv6 Networks
  - 2.1 Weighted Fair Queueing (WFQ)
  - 2.2 Class-Based Weighted Fair Queueing (CBWFQ)
  - 2.3 Low Latency Queueing (LLQ)
- 3 Congestion Avoidance for IPv6 Traffic
  - 3.1 Understanding the RED to reduce the effects of congestion on the network
  - 3.2 Describe the Weighted Random Early Detection (WRED)
  - 3.3 Understanding the Tail Drop
- 4 Traffic Policing and Shaping for IPv6 Traffic
  - 4.1 Understanding the rate-limiting features of CAR
  - 4.2 Describe the features of GTS, FRTS

### Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer





## **Prerequisites**

Successful completion of the following courses:

IPv6 Networking, LZU 1087424 R5A

IPv6 Routing, LZU1087520 R5A

## **Duration and class size**

The length of the course is 1 days and the maximum number of participants is 16.

## **Learning situation**

This course is based on theoretical instructor-led lessons given in a classroom environment.

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**Time schedule**

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	Introduction to IP QoS Models	1.5
	Describe Building Block of IP QoS	
	IP QoS Major Issues	
	Describe DiffServ and IntServ	
	Differentiate between Policing and Metering	
	Describe Traffic Class and Flow label for IPv6	
	Congestion Management in IPv6 Network	1.5
	Weighted Fair Queueing (WFQ)	
	Class-Based WEighted Fair Queueing (CBWFQ)	
	Low Latency Queueing (LLQ)	1.5
	Congestion Avoidance for IPv6 Traffic	
	Understanding the RED to reduce the effects of congestion on the network	
	Describe the Weighted Random Early Detection (WRED)	
	Understanding the Tail Drop	1.5
	Traffic Policing and Shaping for IPv6 Traffic	
	Understanding the rate-limiting features of CAR	
	Describe the features of GTS, FRTS	

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## IPv6 Routing



LZU1087520 R5A

### Description

This course is a profound technical presentation of the routing protocols RIPng, OSPFv3, ISIS for IPv6 and BGP4+. The protocols and their different functions in the Internet will be discussed.

The participants will learn how to configure the advanced features on an IPv6 routing.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Explain how the Routing Protocols are used in IPv6
  - 1.1 List the Routing Protocols used in IPv6
  - 1.2 Explain how they are working on a router and the hosts of an IPv6 network
  - 1.3 Explain static routing and dynamic protocol
- 2 Describe how OSPFv3 works
  - 2.1 Describe the OSPFng Header
  - 2.2 Explain Link State Advertisements (LSAs)
  - 2.3 Explain Link-State Database and Hello packets
  - 2.4 Explain Routing Calculations and SPF Algorithm
  - 2.5 Explain OSPF Areas
  - 2.6 Perform practical exercises covering OSPFv3 protocol
- 3 Describe how ISIS works
  - 3.1 Explain Support on data link layer
  - 3.2 Explain Hello packets
  - 3.3 Describe NSAP formats
  - 3.4 Describe Link State packets
  - 3.5 Explain Level 1 and Level 2 routers
  - 3.6 Describe Designated router election
  - 3.7 Describe the comparison with OSPFv3
- 4 Describe how BGP4+ is working
  - 4.1 Describe BGP Message Types
  - 4.2 Explain the BGP Header and Session
  - 4.3 Explain Internal and External BGP
  - 4.4 Understand Best Path Vector Algorithm
  - 4.5 Explain Path Vector Routing







- 4.6 List BGP Attributes
- 4.7 Perform practical exercises covering BGP4+ protocol

## Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer

## Prerequisites

Successful completion of the following courses:

IP Networking LZU102397 R6A  
IPv6 Networking LZU1087424 R5A

## Duration and class size

The length of the course is 3 days and the maximum number of participants is 8.

## Learning situation

This course is based on theoretical and practical instructor-led lessons given in both classroom and in a technical environment using equipment and tools, which are accessed remotely.

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### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	• Routing Protocols	2.0
	• List the Routing Protocols used in IPv6	1.5
	• Explain static routing and routing protocol	1.5
	• Explain how they are working on a router and the hosts of an IPv6 network	1.0
2	•	
	• Open Shortest Path First for IPv6 - OSPFv3	2.0
	• Explain Link State Advertisements (LSAs)	2.0
	• Explain Link-State Database and Hello packets	1.5
3	• Explain Routing Calculations and SPF Algorithm	1.5
	• Describe how ISIS works	1.5
	• Describe how BGP4+ is working	1.5
	• Describe BGP Message Types	1.5
	• Explain the BGP Header and Session	1.5

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## IPv6 Security



LZU1087522 R3A

### Description

This course is also a profound technical presentation of the advanced feature related to IPv6: IPSec. IPv6 and this feature are essential in new generation networks.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Describe how IPv6 Security (IPsec) is working
  - 1.1 Security Threats
  - 1.2 Basic Security Concepts and Security Associations
  - 1.3 Crypto Primitives
  - 1.4 Authentication Header (AH)
  - 1.5 Encapsulating Security Payload (ESP)
  - 1.6 Internet Key Exchange (IKEv2)

### Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer

### Prerequisites

Successful completion of the following courses:

IPv6 Networking LZU1087424 R3A

### Duration and class size

The length of the course is 1 days and the maximum number of participants is 16.

### Learning situation

This course is based on theoretical instructor-led lessons given in a classroom environment.





### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated time
1	Introduction	0.5
	Welcome	
	Presentation	
	Training Schedule	
	• IPsec	5.5
	• Security Threats	
	• Basic Security Concepts	
	• Security Associations	
	• Crypto Primitives	
	• Authentication Header (AH)	
	• Encapsulating Security Payload (ESP)	
	• Internet Key Exchange (IKEv2)	
	• Perform exercises covering these mechanisms and features	



## Voice and Video over IP



LZU1087718 R2A

### Description

This course will give the students an insight and understanding of Voice and Video over IP. The students will learn the operation of Voice and Video over IP networks as well as look at the call control protocols used for these such as SIP, H.323 and MGCP.

### Learning objectives

On completion of this course the participants will be able to:

- 1 Describe Voice over IP
  - 1.1 Describe how VoIP packets are generated and sent over IP networks.
  - 1.2 Describe the components of a VoIP network
  - 1.3 Describe how VoIP codecs work
  - 1.4 Understand how Real-Time Transport Protocol (RTP) and Real Time Control Protocol (RTCP) Protocols are used for real time communication.
  - 1.5 Perform VoIP Bandwidth Calculation
  - 1.6 Explain how IPTV systems work
  - 1.7 Understand the concept of Internet Group Management Protocol IGMP
  - 1.8 Describe MPEG video
- 2 Describe the Video and Voice over IP Call Control Protocols
  - 2.1 Explain H.323, Media Gateway Control Protocol (MGCP) – RFC 2705 and H.248 (MEGACO)
  - 2.2 Explain Session Initiation Protocol (SIP) – RFC 3261
  - 2.3 Perform Analysis of SIP signaling traces

### Target audience

The target audience for this course is:

Network Design Engineer, Network Deployment Engineer, System Technician, Service Technician, System Engineer, Service Engineer





### Prerequisites

Successful completion of the following courses:

IP Networking LZU102397 R6A

### Duration and class size

The length of the course is 1 days and 0 hours and the maximum number of participants is 16.

### Learning situation

This course is based on theoretical instructor-led lessons given in classroom environment.

### Time schedule

The time required always depends on the knowledge of the attending participants and the hours stated below can be used as estimate.

Day	Topics in the course	Estimated Time (hours)
1	▪ Explain how VoIP is sent over IP Networks	1.0 hour
	▪ Describe the different VoIP Codecs and their effect on Voice bandwidth	0.5 hour
	▪ Look at the Real-Time Transport Protocol (RTP) and Real-Time Control Protocol (RTCP)	0.5 hour
	▪ Explain Video over IP and the different applications	
	▪ Describe the implementation of a Video Conferencing System	0.5 hour
	▪ Describe MPEG video codecs	0.5 hour
	▪ Describe how IPTV works	0.5 hour
	▪ Explain the use of IGMP in Video over IP Networks	0.5 hour
	▪ Describe the Voice and Video over IP Call Control Protocols: SIP, H.323 and MGCP/MEGACO	0.5 hour
	▪ Perform theoretical exercises	0.5 hour
		1.0 hour
	0.5 hour	

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