

# SmartEdge R6, SM480 R6 and NetOp R6 Training Programs

## Catalog of Course Descriptions



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
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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)
	Seminar (SEM)
	Workshop (WS)
	Virtual Classroom Training (VCT)
	Web Based Learning (WBL)
	Short Article (SA)
	Streaming Video (SV)
	CD-ROM (CD)
	Structured Knowledge Transfer (SKT)
<b>Delivery Enablers</b>	
	Remote Training Lab (RTL)
	Web Portal (WP)
<b>Ericsson Education E-Learning</b>	
	EEOnline @ <a href="http://learning.ericsson.net/eeonline/">http://learning.ericsson.net/eeonline/</a>

## SmartEdge R6 System Survey



LZU 108 2107 R1A

### Description

SmartEdge R6 System Survey is a 4-hour lecture, web based learning module. This is required preparation for other SmartEdge add-on technology courses.

This course module describes common foundation information for the SmartEdge family of products including SE1200, SE800, SE400, and SE100. It explains the hardware and software architecture of the system and Redback Networks unique Context and Binding architecture.

This is a 100 percent theory course module.

### Learning objectives

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

1. Explain Redback SmartEdge hardware and software architecture
2. Explain Redback Context & binding architecture
3. Explain the Command Line Interface and File Management structure
4. Explain how to enable management traffic on the system

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### Prerequisites

The participants should have a solid understanding of general networking technologies.

### Duration

The length of the course is approximately 4 hours.

### Learning situation

This course is a Web Based Learning (WBL) module.

It includes a recording of the lessons with power point presentations combined with interactive quiz sessions to review information presented.



## 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	<ul style="list-style-type: none"><li>• SmartEdge Highlights</li><li>• SmartEdge Architecture</li><li>• System Level</li><li>• Hardware Architecture</li><li>• High Availability &amp; Software Architecture</li><li>• Forwarding architecture</li><li>• Quiz time</li><li>• Redback Context &amp; Bindings Architecture</li><li>• Quiz time</li><li>• Command Line Interface &amp; File management</li><li>• Navigating through the CLI</li><li>• File management</li><li>• Back to CLI</li><li>• Debugging on the system</li><li>• Quiz time</li><li>• Example configuration to enable Management traffic</li><li>• Enabling traffic cards</li><li>• Quiz time</li></ul>	

## SmartEdge R6 System Operations and Maintenance



LZU 108 2108 R1A

### Description

SmartEdge R6 System Operations and Maintenance is available for students who have or will participate in a course package containing SmartEdge System Survey course and has operational experience managing the SmartEdge platform.

This course module describes the hardware architecture of the chassis, traffic cards, XCRP cards, and fan/alarm unit to support overall understanding of system functions. It shows how to identify hardware failures, replace cards and units in case of failures, and perform software upgrades. Hands-on exercises allow participants to master SmartEdge CLI syntax of system operations and maintenance related commands.

Theory to hands-on ratio of this course is 30/70.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge system operations and maintenance, hence saving time and money.

### Learning objectives

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

1. Describe high level system hardware architecture
2. Describe chassis layout and cabling to the rack
3. Identify port alarms
4. Identify LED with operational states of traffic cards and XCRP
5. Identify layout of traffic cards and XCRP cards
6. Handle hardware replacement of traffic cards and XCRP cards
7. Handle replacement of Fan/Alarm unit
8. Handle replacement of air filter
9. Perform multiple level hardware diagnostics routines on traffic cards and XCRP
10. Identify multiple levels of alarm statuses
11. Perform full release SmartEdge operating system (SEOS) upgrade
12. Perform module patch upgrade

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers



### **Prerequisites**

The participants should have operational experience managing the SmartEdge platform as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Introduction to SmartEdge</li><li>• High level system hardware architecture</li><li>• Chassis layout</li><li>• Cabling to the rack</li><li>• Alarms</li><li>• XCRP card</li><li>• Traffic card</li><li>• Port Alarms</li><li>• LED states in relation to operational states</li><li>• Replacements and Repairs</li><li>• Description of package labels</li><li>• Replacement of traffic cards</li><li>• Replacement of XCRP cards</li><li>• Replacement of Fan/Alarm unit</li><li>• Replacement of air filter</li><li>• Power on Diagnostics</li><li>• On Demand Diagnostics</li><li>• Understand XCRP switchover</li><li>• Perform full release SmartEdge operating system (SEOS) upgrade</li><li>• Perform module patch upgrade</li></ul>	

## SmartEdge R6 System Troubleshooting



LZU 108 2109 R1A

### Description

SmartEdge R6 System Troubleshooting is available for students who have or will participate in a course package containing SmartEdge System Survey course and has operational experience managing the SmartEdge platform.

This course module describes system functions and ways to verify operational health and traffic flow through the system. It outlines steps to troubleshoot the XCRPs in case a switchover has occurred, and where to find logs to do investigation on cause of switchover. Hands-on exercises allow participants to master SmartEdge CLI syntax of system troubleshooting related commands.

Theory to hands-on ratio of this course is 30/70.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge system troubleshooting, hence saving time and money.

### Learning objectives

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

1. Confirm operational health of SmartEdge system
2. Investigate system redundancy
3. Run root cause analysis routines on active and standby XCRP
4. Explain fundamental processes on the system such as ISM, CSM and understand what it does and its relationship with other functions
5. Create core dumps of fault processes
6. Perform general connectivity troubleshooting for ports, circuits, interfaces, and traffic flow
7. Understand the use and impact of debugging on the SmartEdge system
8. Use the bootrom environment in case the system does not start
9. Navigate through CLI lines with EMACS
10. View CLI history logs
11. Create aliases and macros for common troubleshooting routines

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers



### **Prerequisites**

The participants should have operational experience managing the SmartEdge platform as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Perform system health check and examine system alarms</li><li>• Investigate system redundancy</li><li>• Run route cause analysis routines on active XCRP and standby XCRP</li><li>• Explain fundamental processes on the system such as ISM, CSM and understand what it does and its relationship with other functions</li><li>• Create core dumps of fault processes</li><li>• Perform general connectivity troubleshooting for ports, circuits, interfaces, and traffic flow</li><li>• Understand the use and impact of debugging on the SmartEdge system</li><li>• Use the bootrom environment in case the system does not start</li><li>• Navigate through CLI lines with EMACS</li><li>• View CLI history log</li><li>• Create aliases and macros for common troubleshooting routines</li></ul>	

## SmartEdge R6 System Administration and Security



LZU 108 2110 R1A

### Description

SmartEdge R6 System Administration is available for students who have or will participate in a course package containing SmartEdge System Survey course and has operational experience managing the SmartEdge platform.

This course module describes administrative and security functions on the SmartEdge system. It shows how to enable per context services and administrative privileges per context. In addition it shows how to configure connection to external servers such as Syslog for logging files, TACACS+ for authentication and accounting of administrative users, and many other administrative tasks. Hands-on exercises allow participants to master SmartEdge CLI syntax of system administrative and security related commands.

Theory to hands-on ratio of this course is 30/70.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge system administration tasks, hence saving time and money.

### Learning objectives

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

1. Understand difference between management connection via SSH and Telnet
2. Identify and enable specific services within context
3. Configure administrative access control lists
4. Understand system logging
5. Configure communication to transfer logs to a Syslog server
6. Understand default privilege levels of CLI commands and how to modify them
7. Configure AAA for administrator users with TACACS+ server
8. Perform password recovery in case administrator user record is lost
9. Configure DNS
10. Enable Lawful Intercept (LI)
11. Configure NTP

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers



### **Prerequisites**

The participants should have operational experience managing the SmartEdge platform as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Understand difference between management connection via SSH and Telnet</li><li>• Identify and enable specific services within context</li><li>• Configure administrative access control lists</li><li>• Understand system logging</li><li>• Configure communication to transfer logs to a Syslog server</li><li>• Understand default privilege levels of CLI commands and how to modify them</li><li>• Configure AAA for administrator users with TACACS+ server</li><li>• Perform password recovery in case administrator user record is lost</li><li>• Configure DNS</li><li>• Enable Lawful Intercept (LI)</li><li>• Configure NTP</li></ul>	

## SmartEdge R6 add-on ISIS Configuration and Monitoring



LZU 108 2111 R1A

### Description

SmartEdge R6 add-on ISIS Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course

This course module covers technology background of IS-IS protocol as well as multiple configuration tasks. It describes role of IS-IS in IP networks, protocol operations, link state database content and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of IS-IS related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Identify main IP routing elements
2. Build and verify IP infrastructure on the SmartEdge system
3. Understand role of IS-IS protocol in IP networks
  - Describe IS-IS protocol and common terminology
  - Describe IS-IS protocol operations and adjacency forming
  - Describe IS-IS protocol network topology
  - Describe role of LSP in IS-IS
  - Describe LSP ID and how it is build
  - Explain best route selection from a router perspective
4. Configure IS-IS Level 1 area
  - Define IS-IS routing instance
  - Assign NSAP address
  - Define area type for IS-IS
  - Assign interfaces to IS-IS instance with corresponding metric
5. Configure Multiple IS-IS area network
6. Configure Level 2 – Backbone area
7. Implement IS-IS Attached bit – a way out of Level 1 area
8. Implement IS-IS Level 2 Route Leaking mechanism
9. Implement IS-IS IP summarization
10. Control routers Level 2 participation with overload bit
11. Verify configuration and troubleshoot IS-IS problems
12. Configure redistribution other protocols into IS-IS
13. Troubleshoot IS-IS related problems



### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

SmartEdge R6 System Survey LZU 108 2107

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Routing language</li><li>• Topology Reference Network – configuration, verification</li><li>• Integrated IS-IS – Introduction</li><li>• IS-IS – Practical Exercise</li><li>• IS-IS – Verification of route tables</li><li>• LSP entries in the IS-IS database</li><li>• Verification of IS Neighbors</li></ul>	
2	<ul style="list-style-type: none"><li>• Verification of Routing state</li><li>• Debug behavior in the SEOS</li><li>• Extending IS-IS network</li><li>• Multiple IS-IS area network</li><li>• Level 2 – Backbone</li><li>• Attached Bit</li><li>• Level 2 Route Leaking</li><li>• Summarization</li><li>• Overload Bit</li><li>• IS-IS Redistribution</li></ul>	

## SmartEdge R6 add-on VPLS (using IS-IS) Configuration and Monitoring



LZU 108 2112 R1A

### Description

SmartEdge R6 add-on VPLS (using IS-IS) Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course as well as SmartEdge IS-IS add-on module

This course module covers technology background of VPLS service as well as multiple configuration tasks. It explains VPLS service, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of MPLS/VPLS related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on VPLS it also uses IS-IS to build MPLS backbone used in exercises. It is essential for students to have good understanding of IS-IS to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand what VPLS service is
2. Understand the principles of MPLS
  - Recognize different functions routers perform in MPLS networks
  - Describe label related operations performed by routers
  - Understand the concept of LSP
  - Configure and verify MPLS on SmartEdge
3. Understand LSP creation process
  - Explain LDP operations
  - Configure and verify MPLS label distribution through LDP
  - Configure and verify FEC filtering for LDP
4. Explain RSVP operations
  - Configure and verify MPLS label distribution through RSVP
  - Understand Fast Reroute LSP protection
  - Configure and verify Fast Reroute in node protection mode
  - Configure and verify Fast Reroute in link protection mode
5. Understand basic bridging functions



6. Explain how MPLS label stacking feature is used for VPN separation
  - Configure and verify targeted LDP for VPLS signaling
  - Understand concept of Pseudo Wire
7. Describe the difference between signaling and forwarding in VPLS network
  - Verify end to end packet flow through VPLS network
  - Explain actions taken by each router on the packet path
8. Configure and verify PPPoE connection over VPLS
9. Understand concept of hierarchical VPLS
  - Explain loop avoidance mechanism in VPLS
  - Configure and verify hierarchical VPLS network

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 Add-on IS-IS Configuration and Monitoring LZU 108 2111

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Introduction</li><li>• MPLS fundamentals</li><li>• Bridging basics</li><li>• Putting things in place within the SmartEdge</li><li>• VPLS lab topology</li><li>• MPLS backbone configuration flow diagram</li><li>• VPN context configuration flow diagram</li><li>• IP backbone connectivity and IS-IS configuration</li><li>• IP connectivity verification</li><li>• Configuration of MPLS and LDP</li><li>• LSP Verification</li><li>• Targeted LDP setup for VPN signaling</li><li>• LDP Verification</li><li>• Configuration of VPN context</li><li>• Pseudo wire verification</li><li>• Configuring CE router and connecting it to PE router</li><li>• Verification of end to end CE connectivity</li><li>• End to end packet flow walk through verification</li><li>• Configuration exercise - PPPoE over VPLS</li></ul>	
2	<ul style="list-style-type: none"><li>• Creating LSP with LDP</li><li>• LDP operations</li><li>• Limiting number of LSPs created with LDP</li><li>• LSP creation with RSVP</li><li>• RSVP operations</li><li>• Fast Reroute LSP protection</li><li>• Configuration of Fast Reroute in node protection mode</li><li>• Configuration of Fast Reroute in link protection mode</li><li>• Configuration exercise - corporate LAN over VPLS</li><li>• Hierarchical VPLS</li><li>• Hub and spoke configuration</li></ul>	



## SmartEdge R6 add-on BGP (using IS-IS) Configuration and Monitoring



LZU 108 2113 R1A

### Description

SmartEdge R6 add-on BGP (using IS-IS) Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course as well as SmartEdge IS-IS add-on module

This course module covers technology background of BGP v4 protocol as well as multiple configuration tasks. It describes role of BGP in Internet, protocol operations, differences between EBGP and IBGP and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of BGP related commands. Theory to hands-on ratio of this course is 30/70

While this course module focuses on BGP it also uses IS-IS to build networks used in BGP exercises. It is essential for students to have good understanding of IS-IS to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand role of BGP protocol in IP networks
  - Explain BGP protocol operation
  - Explain routing exchange process
  - Describe the differences between IGP and BGP protocols
2. Define and interconnect multiple Autonomous systems
  - Configure and verify status of BGP neighbor
  - Troubleshoot BGP session establishment
  - Find out the reason of BGP session reset
3. Describe different ways of IGP prefix injection into BGP
  - Configure and verify BGP network statements
  - Understand interaction between IGP and BGP
  - Explain best route selection from a router perspective
  - Configure default route injection on AS border router
4. Understand prefix aggregation concept
  - Describe impact of single AS behavior for Internet stability
  - Configure and verify prefix aggregation
5. Describe and configure IGP redistribution into BGP
6. Configure and verify IP prefix lists



7. Understand the difference between IBGP and EBGP
  - Describe and solve a challenge related to next hop attribute in IBGP
  - Understand the difference between signaling and forwarding path in transit AS
  - Explain the reason for full mesh requirement in IBGP
8. Configure and verify route maps
9. Describe BGP best path selection process
  - Explain influence of various BGP attributes on path selection process
  - Change BGP best path via route map configuration

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 Add-on IS-IS Configuration and Monitoring LZU 108 2111

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• IP routing fundamentals review</li><li>• Introduction to BGP</li><li>• BGP topology and configuration flow</li><li>• Building IS-IS based IP infrastructure</li><li>• Verification of networks</li><li>• Connecting autonomous systems</li><li>• Verification of BGP neighbor</li><li>• Analyzing disconnect causes and troubleshooting</li><li>• Injecting prefixes into BGP</li><li>• BGP network statements – configuration and verification</li><li>• Prefix aggregation concept and impact for Internet</li><li>• Configuration and verification of prefix aggregation</li><li>• Redistributing IS-IS into BGP</li></ul>	
2	<ul style="list-style-type: none"><li>• IP prefix lists – configuration and verification</li><li>• Implementing BGP transit AS – building IP connectivity</li><li>• Introduction to Internal Border Gateway Protocol</li><li>• Configuration and verification of I-BGP</li><li>• I-BGP and the next hop</li><li>• Troubleshooting IBGP signaling issues</li><li>• I-BGP and full mesh</li><li>• Verification of end to end forwarding (IBGP and EBGP)</li><li>• BGP path selection &amp; control</li><li>• Route maps – configuration and verification</li><li>• Expanding lab topology - exercise</li><li>• BGP attributes - influencing BGP best path selection</li><li>• BGP path selection algorithm</li><li>• Changing BGP best path with weight - exercise</li><li>• Changing BGP best path with local preference – exercise</li></ul>	

## SmartEdge R6 add-on MPLS L3VPN (using IS-IS) Configuration and Monitoring



LZU 108 2114 R1A

### Description

SmartEdge R6 add-on MPLS L3VPN (using IS-IS) Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course as well as SmartEdge IS-IS and BGP add-on modules

This course module covers technology background of L3VPN MPLS based service as well as multiple configuration tasks. It explains L3VPN service, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of MPLS/L3VPN related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on L3VPN it also uses IS-IS and BGP to build networks used in L3VPN exercises. It is essential for students to have good understanding of IS-IS and BGP to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand what L3VPN service is
2. Understand the principles of MPLS
  - Recognize different functions routers perform in MPLS networks
  - Describe label related operations performed by routers
  - Understand the concept of LSP
  - Configure and verify MPLS on SmartEdge
3. Understand LSP creation process
  - Explain LDP operations
  - Configure and verify MPLS label distribution through LDP
  - Configure and verify FEC filtering for LDP
4. Explain RSVP operations
  - Configure and verify MPLS label distribution through RSVP
  - Understand Fast Reroute LSP protection
  - Configure and verify Fast Reroute in node protection mode
  - Configure and verify Fast Reroute in link protection mode
5. Explain how MPLS label stacking feature is used for VPN separation
  - Understand routing information exchange in L3VPN network
  - Explain role of BGP and IGP in providers backbone

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- Understand IPv4 VPN address family purpose
  - Explain role of Route Target attribute in L3VPN network
  - 6. Describe the difference between signaling and forwarding in L3VPN network
    - Configure and verify IBGP for L3VPN signaling
  - 7. Verify end to end packet flow through L3VPN network
    - Explain actions taken by each router on the packet path
- 2

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 Add-on IS-IS Configuration and Monitoring LZU 108 2111
- SmartEdge R6 Add-on BGP (Using IS-IS) Configuration and Monitoring LZU 108 2113

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Introduction</li><li>• MPLS fundamentals</li><li>• Putting things in place within the SmartEdge</li><li>• MPLS L3VPN lab topology</li><li>• MPLS backbone configuration flow diagram</li><li>• VPN context configuration flow diagram</li><li>• IP backbone connectivity and IS-IS configuration</li><li>• IP connectivity verification</li><li>• Configuration of MPLS and LDP</li><li>• LSP Verification</li><li>• IBGP setup for VPN signaling</li><li>• BGP Verification</li><li>• Configuration of VPN context</li><li>• Connectivity verification between VPN contexts</li><li>• Configuring CE router and connecting it to PE router</li><li>• Verification of end to end CE connectivity</li><li>• End to end packet flow walk through verification</li></ul>	
2	<ul style="list-style-type: none"><li>• Second VPN configuration exercise</li><li>• Creating LSP with LDP</li><li>• LDP operations</li><li>• Limiting number of LSPs created with LDP</li><li>• LSP creation with RSVP</li><li>• RSVP operations</li><li>• Fast Reroute LSP protection</li><li>• Configuration of Fast Reroute in node protection mode</li><li>• Configuration of Fast Reroute in link protection mode</li></ul>	

## SmartEdge R6 add-on OSPF Configuration and Monitoring



LZU 108 2115 R1A

### Description

SmartEdge R6 add-on OSPF Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course

This course module covers technology background of OSPF protocol as well as multiple configuration tasks. It describes role of OSPF in IP networks, protocol operations, link state database content and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of OSPF related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Identify main IP routing elements
2. Build and verify IP infrastructure on the SmartEdge system
3. Understand role of OSPF protocol in IP networks
  - Describe OSPF protocol operations
  - Explain the difference between adjacency and neighborhood
  - Explain role of DR router
4. Describe different functions router can perform in OSPF network
  - Understand differences between different area types
  - Understand content of link state database
  - Explain differences between LSA types used by OSPF
5. Explain best route selection from a router perspective
6. Configure OSPF backbone area
  - Build OSPF Area Border Router
  - Verify OSPF operations
  - Troubleshoot OSPF related problems
7. Configure non backbone OSPF areas (normal, stubby, totally stubby)
8. Redistribute other protocols into OSPF
9. Summarize IP prefixes
10. Inject default route into OSPF



### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• IP routing fundamentals review</li><li>• Building IP Infrastructure</li><li>• Connectivity verification</li><li>• Introduction to OSPF</li><li>• Discovering OSPF neighbors</li><li>• Synchronizing link state database</li><li>• Adjacencies in broadcast environment</li><li>• LSA flooding</li><li>• Role of areas in OSPF networks</li><li>• Functional differentiation of routers in OSPF</li><li>• Configuration of backbone area</li><li>• Routing verification</li><li>• Administrative distance discussion</li><li>• Details of LSA1 &amp; LSA2</li></ul>	
2	<ul style="list-style-type: none"><li>• Verifying OSPF operations</li><li>• Troubleshooting OSPF related problems</li><li>• Configuration of non backbone area</li><li>• Verification of routing</li><li>• Details of LSA3</li><li>• Configuration and verification of route redistribution</li><li>• Details of LSA4 &amp; LSA5</li><li>• Configuration of stubby area</li><li>• OSPF database verification</li><li>• Configuration of totally stubby area</li><li>• OSPF database verification</li><li>• Prefix summarization</li><li>• Injecting default route into OSPF domain</li></ul>	

## SmartEdge R6 add-on VPLS (using OSPF) Configuration and Monitoring



LZU 108 2116 R1A

### Description

SmartEdge R6 add-on VPLS (using OSPF) Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course as well as SmartEdge OSPF add-on module

This course module covers technology background of VPLS service as well as multiple configuration tasks. It explains VPLS service, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of MPLS/VPLS related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on VPLS it also uses OSPF to build MPLS backbone used in exercises. It is essential for students to have good understanding of OSPF to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand what VPLS service is
2. Understand the principles of MPLS
  - Recognize different functions routers perform in MPLS networks
  - Describe label related operations performed by routers
  - Understand the concept of LSP
  - Configure and verify MPLS on SmartEdge
3. Understand LSP creation process
  - Explain LDP operations
  - Configure and verify MPLS label distribution through LDP
  - Configure and verify FEC filtering for LDP
4. Explain RSVP operations
  - Configure and verify MPLS label distribution through RSVP
  - Understand Fast Reroute LSP protection
  - Configure and verify Fast Reroute in node protection mode
  - Configure and verify Fast Reroute in link protection mode
5. Understand basic bridging functions
6. Explain how MPLS label stacking feature is used for VPN separation
  - Configure and verify targeted LDP for VPLS signaling
  - Understand concept of Pseudo Wire
7. Describe the difference between signaling and forwarding in VPLS network
  - Verify end to end packet flow through VPLS network



- Explain actions taken by each router on the packet path
- 8. Configure and verify PPPoE connection over VPLS
- 9. Understand concept of hierarchical VPLS
  - Explain loop avoidance mechanism in VPLS
  - Configure and verify hierarchical VPLS network

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### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 Add-on OSPF Configuration and Monitoring LZU 108 2115

### **Duration and class size**

The length of the course is 2 days and the maximum number of participants is 10.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Introduction</li><li>• MPLS fundamentals</li><li>• Bridging basics</li><li>• Putting things in place within the SmartEdge</li><li>• VPLS lab topology</li><li>• MPLS backbone configuration flow diagram</li><li>• VPN context configuration flow diagram</li><li>• IP backbone connectivity and OSPF configuration</li><li>• IP connectivity verification</li><li>• Configuration of MPLS and LDP</li><li>• LSP Verification</li><li>• Targeted LDP setup for VPN signaling</li><li>• LDP Verification</li><li>• Configuration of VPN context</li><li>• Pseudo wire verification</li><li>• Configuring CE router and connecting it to PE router</li><li>• Verification of end to end CE connectivity</li><li>• End to end packet flow walk through verification</li><li>• Configuration exercise - PPPoE over VPLS</li></ul>	
2	<ul style="list-style-type: none"><li>• Creating LSP with LDP</li><li>• LDP operations</li><li>• Limiting number of LSPs created with LDP</li><li>• LSP creation with RSVP</li><li>• RSVP operations</li><li>• Fast Reroute LSP protection</li><li>• Configuration of Fast Reroute in node protection mode</li><li>• Configuration of Fast Reroute in link protection mode</li><li>• Configuration exercise - corporate LAN over VPLS</li><li>• Hierarchical VPLS</li><li>• Hub and spoke configuration</li></ul>	



## SmartEdge R6 add-on BGP (using OSPF) Configuration and Monitoring



LZU 108 2117 R1A

### Description

SmartEdge R6 add-on BGP (using OSPF) Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course as well as SmartEdge OSPF add-on module

This course module covers technology background of BGP v4 protocol as well as multiple configuration tasks. It describes role of BGP in Internet, protocol operations, differences between EBGP and IBGP and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of BGP related commands. Theory to hands-on ratio of this course is 30/70

While this course module focuses on BGP it also uses OSPF to build networks used in BGP exercises. It is essential for students to have good understanding of OSPF to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand role of BGP protocol in IP networks
  - Explain BGP protocol operation
  - Explain routing exchange process
  - Describe the differences between IGP and BGP protocols
2. Define and interconnect multiple Autonomous systems
  - Configure and verify status of BGP neighbor
  - Troubleshoot BGP session establishment
  - Find out the reason of BGP session reset
3. Describe different ways of IGP prefix injection into BGP
  - Configure and verify BGP network statements
  - Understand interaction between IGP and BGP
  - Explain best route selection from a router perspective
  - Configure default route injection on AS border router
4. Understand prefix aggregation concept
  - Describe impact of single AS behavior for Internet stability
  - Configure and verify prefix aggregation
5. Describe and configure IGP redistribution into BGP
6. Configure and verify IP prefix lists



7. Understand the difference between IBGP and EBGP
  - Describe and solve a challenge related to next hop attribute in IBGP
  - Understand the difference between signaling and forwarding path in transit AS
  - Explain the reason for full mesh requirement in IBGP
8. Configure and verify route maps
9. Describe BGP best path selection process
  - Explain influence of various BGP attributes on path selection process
  - Change BGP best path via route map configuration

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 Add-on OSPF Configuration and Monitoring LZU 108 2115

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• IP routing fundamentals review</li><li>• Introduction to BGP</li><li>• BGP topology and configuration flow</li><li>• Building OSPF based IP infrastructure</li><li>• Verification of networks</li><li>• Connecting autonomous systems</li><li>• Verification of BGP neighbor</li><li>• Analyzing disconnect causes and troubleshooting</li><li>• Injecting prefixes into BGP</li><li>• BGP network statements – configuration and verification</li><li>• Prefix aggregation concept and impact for Internet</li><li>• Configuration and verification of prefix aggregation</li><li>• Redistributing OSPF into BGP</li></ul>	
2	<ul style="list-style-type: none"><li>• IP prefix lists – configuration and verification</li><li>• Implementing BGP transit AS – building IP connectivity</li><li>• Introduction to Internal Border Gateway Protocol</li><li>• Configuration and verification of I-BGP</li><li>• I-BGP and the next hop</li><li>• Troubleshooting IBGP signaling issues</li><li>• I-BGP and full mesh</li><li>• Verification of end to end forwarding (IBGP and EBGP)</li><li>• BGP path selection &amp; control</li><li>• Route maps – configuration and verification</li><li>• Expanding lab topology - exercise</li><li>• BGP attributes - influencing BGP best path selection</li><li>• BGP path selection algorithm</li><li>• Changing BGP best path with weight - exercise</li><li>• Changing BGP best path with local preference – exercise</li></ul>	

## SmartEdge R6 add-on MPLS L3VPN (using OSPF) Configuration and Monitoring



LZU 108 2118 R1A

### Description

SmartEdge R6 add-on MPLS L3VPN (using OSPF) Configuration and Monitoring, available for students who did or will participate in a course package containing SmartEdge System Survey course as well as SmartEdge OSPF and BGP add-on modules

This course module covers technology background of L3VPN MPLS based service as well as multiple configuration tasks. It explains L3VPN service, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SmartEdge CLI syntax of MPLS/L3VPN related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on L3VPN it also uses OSPF and BGP to build networks used in L3VPN exercises. It is essential for students to have good understanding of OSPF and BGP to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand what L3VPN service is
2. Understand the principles of MPLS
  - Recognize different functions routers perform in MPLS networks
  - Describe label related operations performed by routers
  - Understand the concept of LSP
  - Configure and verify MPLS on SmartEdge
3. Understand LSP creation process
  - Explain LDP operations
  - Configure and verify MPLS label distribution through LDP
  - Configure and verify FEC filtering for LDP
4. Explain RSVP operations
  - Configure and verify MPLS label distribution through RSVP
  - Understand Fast Reroute LSP protection
  - Configure and verify Fast Reroute in node protection mode
  - Configure and verify Fast Reroute in link protection mode
5. Explain how MPLS label stacking feature is used for VPN separation
  - Understand routing information exchange in L3VPN network
  - Explain role of BGP and IGP in providers backbone

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- Understand IPv4 VPN address family purpose
- Explain role of Route Target attribute in L3VPN network
- 6. Describe the difference between signaling and forwarding in L3VPN network
  - Configure and verify IBGP for L3VPN signaling
- 7. Verify end to end packet flow through L3VPN network
  - Explain actions taken by each router on the packet path

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### Prerequisites

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 Add-on OSPF Configuration and Monitoring LZU 108 2115
- SmartEdge R6 Add-on BGP (using OSPF) Configuration and Monitoring LZU 108 2117

### 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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Introduction</li><li>• MPLS fundamentals</li><li>• Putting things in place within the SmartEdge</li><li>• MPLS L3VPN lab topology</li><li>• MPLS backbone configuration flow diagram</li><li>• VPN context configuration flow diagram</li><li>• IP backbone connectivity and OSPF configuration</li><li>• IP connectivity verification</li><li>• Configuration of MPLS and LDP</li><li>• LSP Verification</li><li>• IBGP setup for VPN signaling</li><li>• BGP Verification</li><li>• Configuration of VPN context</li><li>• Connectivity verification between VPN contexts</li><li>• Configuring CE router and connecting it to PE router</li><li>• Verification of end to end CE connectivity</li><li>• End to end packet flow walk through verification</li></ul>	
2	<ul style="list-style-type: none"><li>• Second VPN configuration exercise</li><li>• Creating LSP with LDP</li><li>• LDP operations</li><li>• Limiting number of LSPs created with LDP</li><li>• LSP creation with RSVP</li><li>• RSVP operations</li><li>• Fast Reroute LSP protection</li><li>• Configuration of Fast Reroute in node protection mode</li><li>• Configuration of Fast Reroute in link protection mode</li></ul>	

## SmartEdge R6 add-on PTA Configuration and Monitoring



LZU 108 2119 R1A

### Description

SmartEdge R6 add-on PTA (PPP Termination Architecture) Configuration and Monitoring course module is available for students who did or will participate in a course package containing SmartEdge System Survey course

This course covers technology background of PPP protocol as well as multiple configuration tasks for termination of PPP sessions on the SmartEdge system. It describes the negotiation of PPP sessions between client and server, dynamic bindings in the multiple-context environment, debugging and verification process for PPPoX, user authentication parameters including RADIUS, and the use of GREP, aliases and macros for troubleshooting. Hands-on exercises allow participants to master SmartEdge CLI syntax of PTA related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Explain PPP negotiation between client and server
2. Understand the system negotiation flow for dynamic bindings of circuits to context
3. Create configuration to support PPPoE session arriving on Ethernet
4. Debug and verify process for PPPoX
5. Create configuration to support PPPoE session arriving on Ethernet Dot1Q
6. Create configuration to support PPPoX session arriving on ATM
7. Describe system-level and context-specific-level authentication parameters
  - Walk through AAA negotiation with global RADIUS
  - Walk through AAA negotiation with context-specific RADIUS
  - Walk through AAA negotiation with context-specific local authentication
  - Walk through AAA negotiation with no authentication
8. Create configuration using all the different authentication methods
9. Use Global Regular Expression Parser (GREP) within CLI for troubleshooting
10. Create Aliases and Macros to assist with troubleshooting

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers



### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• PPP technology behavior</li><li>• PPPoE message exchange sequence</li><li>• Dynamic Bindings concept and configuration</li><li>• PTA lab with Ethernet, configure and validate</li><li>• Quiz on PTA concepts</li><li>• Debugging on the SmartEdge</li><li>• Debug AAA exercises</li><li>• Examine who is debugging on the system</li><li>• Enable debugging output for a specific circuit</li><li>• Quiz on Debugging operation</li><li>• Verification Process for PPPoX</li><li>• Investigate subscriber connection</li><li>• PTA lab with Ethernet Dot1Q, configure and validate</li></ul>	
2	<ul style="list-style-type: none"><li>• PTA lab with ATM, configure and validate</li><li>• Authentication parameters in the SmartEdge</li><li>• System level authentication parameters</li><li>• Context level authentication parameters</li><li>• Quiz on PPP authentication details</li><li>• Negotiation room game</li><li>• Create configuration using different authentication methods</li><li>• Global Regular Expression Parser (GREP) concepts and examples</li><li>• Aliases and Macros concepts and examples</li><li>• Role of RADIUS server for AAA</li><li>• PTA lab with RADIUS, configure and validate</li><li>• Context-specific RADIUS configuration</li><li>• Global RADIUS configuration</li></ul>	

## SmartEdge R6 add-on L2TP Configuration and Monitoring



LZU 108 2120 R1A

### Description

SmartEdge R6 add-on L2TP (Layer 2 Tunnel Protocol) Configuration and Monitoring course module is available for students who did or will participate in a course package containing SmartEdge System Survey course and SmartEdge add-on PTA (PPP Termination Architecture) Configuration and Monitoring course module.

This course covers technology background of L2TP protocol as well as multiple configuration tasks for the use of LAC and LNS tunnel endpoints. It describes the L2TP operations of tunnel establishment, session establishment within the tunnel, and disconnection operations. Students will have an in-depth exploration of the negotiation flow within the system, and perform many debug and verification exercises. Hands-on exercises allow participants to master SmartEdge CLI syntax of L2TP related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand L2TP protocol and technology overview
  - PPP deployment architecture using L2TP
  - L2TP Terminology (LAC, LNS, LTS)
2. Explain L2TP Operation
  - L2TP tunnel establishment
  - L2TP PPP session establishment
  - L2TP PPP session disconnection
  - L2TP tunnel disconnection
3. Follow L2TP negotiation flow on the SmartEdge
  - LAC tunnel setup
  - LNS tunnel setup
  - Role of L2TP local-name
  - Role of L2TP peer-name and domain name
4. Create configuration for L2TP LAC and LNS tunnel endpoints
5. Debug and Verify L2TP LAC and LNS environment
  - Verify subscriber connection to LAC
  - Verify LAC environment
  - Verify LNS environment
6. Understand the role of RADIUS server to provide tunnel authorization details
7. Create configuration for L2TP LAC using RADIUS



8. Understand L2TP tunnel switch (LTS) function
9. Create configuration for L2TP Tunnel Switching
10. Debug and Verify LTS environment

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- SmartEdge R6 add-on PTA Configuration and Monitoring LZU 108 2119

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• L2TP protocol and technology overview</li><li>• PPP deployment architecture using L2TP</li><li>• L2TP Terminology (LAC, LNS, LTS)</li><li>• L2TP Operation</li><li>• Establishing L2TP Tunnel</li><li>• Establishing L2TP PPP session</li><li>• Disconnecting L2TP PPP session</li><li>• Disconnecting L2TP Tunnel</li><li>• L2TP negotiation on the SmartEdge</li><li>• LAC tunnel setup</li><li>• LNS tunnel setup</li><li>• L2TP local-name</li><li>• L2TP peer-name and domain name</li><li>• Practical Training: Create configuration for L2TP LAC and LNS tunnel endpoints</li><li>• Practical Training: Debug and Verify L2TP LAC and LNS environment</li><li>• Investigate subscriber connection to LAC</li><li>• Investigate LAC environment</li><li>• Investigate LNS environment</li></ul>	
2	<ul style="list-style-type: none"><li>• Quiz: Individual challenges to investigate various conditions and explain to the class</li><li>• Practical Training: Create configuration for second tunnel</li><li>• RADIUS technology introduction</li><li>• Practical Training: Create configuration for L2TP LAC using RADIUS</li><li>• L2TP tunnel switch (LTS) introduction</li><li>• Practical Training: Create configuration for L2TP Tunnel Switching</li><li>• Debug and Verify LTS environment</li></ul>	

## SmartEdge R6 add-on IP QoS Configuration and Monitoring



LZU 108 2121 R1A

### Description

SmartEdge R6 add-on IP QoS (Quality of Service) Configuration and Monitoring course module is available for students who did or will participate in a course package containing SmartEdge System Survey course.

This course covers fundamental concepts of QoS as well as multiple configurations for various QoS policies. It illustrates how Metering and Policing policies work with traffic classification and rate-limiting. It explains queuing and scheduling and includes configuration exercises for PQ, EDRR, and PWFQ policies. Hands-on exercises allow participants to master SmartEdge CLI syntax of QoS related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand Quality of Service (QoS) background and fundamental concepts
2. Explain QoS terminologies such as classification, marking, queuing, and scheduling
3. Describe Token Bucket and how it relates to rate calculation
4. Understand concepts of QoS policies of Metering and Policing
  - Explain classification and rate limiting
5. Configure and implement QoS Metering policy
  - Build basic IP infrastructure to support lab topology
  - Configure QoS Metering policy
  - Configure QoS Metering policy with Classes
6. Explain Queuing and Queue maps
  - Describe system default Queue maps
  - Create custom Queue map
7. Understand Scheduling algorithm for Priority Queuing (PQ)
8. Configure and implement QoS PQ policy
9. Explain the concept of Congestion avoidance mechanisms such as Random Early Discard (RED)
10. Configure and validate PQ policy with RED
11. Understand Scheduling algorithm of Enhanced Deficit Round-Robin (EDRR)
12. Configure and implement EDRR policy
13. Understand concepts of Scheduling algorithm for Modified Deficit Round-Robin (MDRR)

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14. Understand Scheduling algorithm for Priority Weighted Fair Queuing (PWFQ)  
    Explain hierarchical scheduling
15. Configure and implement various PWFQ policies
16. Explain multi-drop precedence for PWFQ

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge system.



## 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	<ul style="list-style-type: none"><li>• Introduction to Quality of Service (QoS)</li><li>• QoS Terminology (Classification, Marking, Queuing, Scheduling)</li><li>• Concept of time and rate</li><li>• QoS Policy Metering / Policing</li><li>• Classification and rate limiting</li><li>• QoS Policy Metering exercises</li><li>• Case 0: Building the Topology</li><li>• Case 1: QoS Policy Metering</li><li>• Case 2: QoS Policy Metering with Classes</li></ul>	
2	<ul style="list-style-type: none"><li>• Introduction to Queuing</li><li>• Queue Mapping exercise</li><li>• Scheduling: Priority Queuing (PQ)</li><li>• Case-3 QoS PQ exercise</li><li>• Congestion avoidance: Combining PQ and RED</li><li>• Scheduling: Enhanced Deficit Round-Robin (EDRR)</li><li>• Case-4 EDRR exercise</li><li>• Scheduling: Modified Deficit Round-Robin (MDRR)</li><li>• Scheduling: Priority Weighted Fair Queuing (PWFQ) and Hierarchical Scheduling</li></ul>	
3	<ul style="list-style-type: none"><li>• Case-5: Configure PWFQ for two subscribers each with different max rate policies within one port.</li><li>• Case6: Test PWFQ minimum rate.</li><li>• Case7: Test PWFQ policy with Max Rate and Weight combination.</li><li>• Case8: Test max rate for priority group with the exceed option.</li><li>• Case9: Test PWFQ policy applied to port level as well as child circuit levels. What happens when there are multiple PWFQ policies in one hierarchy tree?</li><li>• Case10. Apply PWFQ policy to subscriber record</li><li>• Congestion avoidance: PWFQ multi drop precedence</li></ul>	

## SmartEdge R6 add-on DHCP / CLIPS Configuration and Monitoring



LZU 108 2122 R1A

### Description

SmartEdge R6 add-on Configuration and Monitoring for DHCP & CLIPS (Dynamic Host Control Protocol & Clientless IP Service) course module is available for students who did or will participate in a course package containing SmartEdge System Survey course.

This course covers technology background of DHCP process as well as multiple configuration tasks for termination of DHCP & CLIPS sessions on the SmartEdge system. It describes static and dynamic bindings in the multiple-context environment, debugging and verification process for DHCP environment, user authentication parameters including RADIUS. Hands-on exercises allow participants to master SmartEdge CLI syntax of DHCP and CLIPS related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Explain DHCP process between client and server
2. Understand the system negotiation flow for static / dynamic bindings of circuits to context
3. Compare bind interface and bind subscriber static bindings
4. Create configuration to support DHCP session arriving on Ethernet
5. Debug and verify process for the DHCP environment
6. Create configuration to support DHCP session arriving on Ethernet Dot1Q
7. Create configuration to support CLIPS session arriving on Ethernet
8. Debug and verify process for the CLIPS environment
9. Create configuration to support CLIPS session arriving on Ethernet Dot1Q
10. Describe RADIUS for CLIPS (Context specific authentication, Global Authentication)

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, System Engineers, and Field Technicians



### Prerequisites

Successful completion of the following courses:  
SmartEdge R6 System Survey (LZU1082107)

The participants should be familiar with and have practical experienced with IP networks, a basic understanding of DHCP as well as a solid understanding of general networking technologies.

### Duration and class size

The length of the course is 1 day and the maximum number of participants is 8

### Learning situation

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations, hardware and software demonstrations and practical exercises on the hardware and local craft terminal in a classroom with complete SmartEdge R6 equipment setup.

### 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	<ul style="list-style-type: none"><li>• DHCP introduction, process and design rules</li><li>• Static Bindings concept and configuration</li><li>• Subscriber configurations for DHCP</li><li>• Verification process for the DHCP environment</li><li>• CLIPS introduction</li><li>• Dynamic Bindings concept and configuration</li><li>• Subscriber configurations for CLIPS</li><li>• Verification process for the CLIPS environment</li><li>• CLIPS lab with RADIUS, configure and validate<ul style="list-style-type: none"><li>-Context-specific RADIUS configuration</li><li>- Global RADIUS configuration</li></ul></li></ul>	

## SmartEdge R6 Advanced Service Engine



LZU 108 7595 R1A

### Description

SmartEdge Advanced Service Engine (ASE), available for students who did or will participate in a course package containing SmartEdge System Survey course.

This course module covers technology background of IPSec protocol, Deep Packet Inspection functionality as well as multiple configuration tasks. It describes role of IPSec in IP networks,

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of ASE card configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

1. Understand architecture of the ASE card.
2. Identify main elements of the ASE card
3. Describe the role of Load Balancing, High Availability and Redundancy
4. Understand the role of IPSec in IP networks
  - 4.1 Describe IPSec protocol operations
  - 4.2 Configure IPSec related functions on the SmartEdge
  - 4.3 Perform troubleshooting for IPSec
5. Understand the role of Deep Packet Inspection
  - 5.1 Describe Deep Packet Inspection functionality
  - 5.2 Configure DPI related functions on the SmartEdge
  - 5.3 Perform troubleshooting for DPI
6. Configure all aspects of ASE card using CLI as well NetOp EMS

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers, Service Engineers,



### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies

Successful completion of the following courses:

- SmartEdge R6 System Survey LZU 108 2107
- NetOp R6 EMS Foundation and Operations LZU 108 2123

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SmartEdge lab and will be able to configure and monitor SmartEdge router with ASE card.



## 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	<ul style="list-style-type: none"><li>• <b>Introduction to ASE Card</b> Hardware Overview Architecture Software Upgrade Redundancy Load Balancing High Availability Exercises / Quiz</li><li>• <b>IPSEC</b> IPSec Introduction IPSec Configuration IPSec Operation and Maintenance IPSec Troubleshooting IPSec Exercises</li></ul>	
2	<ul style="list-style-type: none"><li>• <b>DPI</b> DPI Introduction DPI Configuration DPI Operation and Maintenance DPI Trouble shooting DPI Exercises</li><li>• Configuring ASE Service using the NetOp EMS</li><li>• Configuring ASE Service using the SmartEdge OS CLI</li></ul>	



## SM480 R6 System Overview



LZU 108 7597 R1A

### Description

SM480 System Survey is a web based learning module required as preparation for other SM480 add-on technology courses.

This course module describes common foundation information for the SM 480 product. It explains the hardware and software architecture of the system and Ericsson's unique Context and Binding architecture.

This is a 100 percent theory course module.

### Learning objectives

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

- 1 Explain SM480 hardware and software architecture
- 2 Explain Ericsson Context & binding architecture
- 3 Explain the Command Line Interface and File Management structure
- 4 Explain how to enable management traffic on the system

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### Prerequisites

The participants should have a solid understanding of general networking technologies.

### Duration and class size

The length of the course is approximately 4 hours.

### Learning situation

This course is a Web Based Learning (WBL) module.



It includes a recording of the lessons with power point presentations combined with interactive quiz sessions to review information presented.

### 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	<ul style="list-style-type: none"><li>• SM480 Highlights</li><li>• SM480 Architecture</li><li>• System Level</li><li>• Hardware Architecture</li><li>• High Availability &amp; Software Architecture</li><li>• Forwarding architecture</li><li>• Quiz time</li><li>• Ericsson Context &amp; Bindings Architecture</li><li>• Quiz time</li><li>• Command Line Interface &amp; File management</li><li>• Navigating through the CLI</li><li>• File management</li><li>• Debugging on the system</li><li>• Quiz time</li><li>• Example configuration to enable Management traffic</li><li>• Enabling traffic cards</li><li>• Quiz time</li></ul>	

## SM480 R6 System Operation & Maintenance



LZU 108 7609 R1A

### Description

SM480 System Operation & Maintenance is available for students who have or will participate in a course package containing SM480 System Survey course and has operational experience managing the SM480 platform.

This course module describes the hardware architecture of the chassis, traffic cards, SMRP cards, and fan/alarm unit to support overall understanding of system functions. It shows how to identify hardware failures, replace cards and units in case of failures, and perform software upgrades. Hands-on exercises allow participants to master SM480 CLI syntax of system operations and maintenance related commands.

Theory to hands-on ratio of this course is 30/70.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 system operation and maintenance, hence saving time and money.

### Learning objectives

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

- 1 Describe high level system hardware architecture
- 2 Describe chassis layout and cabling to the rack
- 3 Identify port alarms
- 4 Identify LED with operational states of traffic cards and SMRP
- 5 Identify layout of traffic cards and SMRP cards
- 6 Handle hardware replacement of traffic cards and SMRP cards
- 7 Handle replacement of Fan/Alarm unit
- 8 Handle replacement of air filter
- 9 Perform multiple level hardware diagnostics routines on traffic cards and SMRP
- 10 Identify multiple levels of alarm statuses
- 11 Perform full release Smart Metro operating system (SEOS) upgrade
- 12 Perform module patch upgrade



### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

- SM480 System Overview LZU 108 7597

The participants should have operational experience managing the Smart Metro platform as well as a solid understanding of general networking technologies.

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Introduction to SM480</li><li>• High level system hardware architecture</li><li>• Chassis layout</li><li>• Cabling to the rack</li><li>• Alarms</li><li>• SMRP card</li><li>• Traffic card</li><li>• Port Alarms</li><li>• LED states in relation to operational states</li><li>• Replacements and Repairs</li><li>• Description of package labels</li><li>• Replacement of traffic cards</li><li>• Replacement of SMRP cards</li><li>• Replacement of Fan/Alarm unit</li><li>• Replacement of air filter</li><li>• Power on Diagnostics</li><li>• On Demand Diagnostics</li></ul>	

## SM480 R6 System Troubleshooting



LZU 108 7607 R1A

### Description

SM480 System Troubleshooting is available for students who have or will participate in a course package containing SM480 System Overview course and has operational experience managing the SM480 platform.

This course module describes system functions and ways to verify operational health and traffic flow through the system. It outlines steps to troubleshoot the SMRP s in case a switchover has occurred, and where to find logs to do investigation on cause of switchover. Hands-on exercises allow participants to master SM480 CLI syntax of system troubleshooting related commands.

Theory to hands-on ratio of this course is 30/70.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 system troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Confirm operational health of SM480 system
- 2 Investigate system redundancy
- 3 Run route cause analysis routines on active and standby SMRP
- 4 Explain fundamental processes on the system such as ISM, CSM and understand what it does and its relationship with other functions
- 5 Create core dumps of fault processes
- 6 Perform general connectivity troubleshooting for ports, circuits, interfaces, and traffic flow
- 7 Understand the use and impact of debugging on the Smart Metro system
- 8 Use the bootrom environment in case the system does not start
- 9 Navigate through CLI lines with EMACS
- 10 View CLI history logs
- 11 Create aliases and macros for common troubleshooting routines



### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

- SM480 System Overview LZU 108 7597

The participants should have operational experience managing the Smart Metro Ethernet platform as well as a solid understanding of general networking technologies.

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Perform system health check and examine system alarms</li><li>• Investigate system redundancy</li><li>• Run route cause analysis routines on active SMRP and standby SMRP</li><li>• Explain fundamental processes on the system such as ISM, CSM and understand what it does and its relationship with other functions</li><li>• Create core dumps of fault processes</li><li>• Perform general connectivity troubleshooting for ports, circuits, interfaces, and traffic flow</li><li>• Understand the use and impact of debugging on the SM480 system</li><li>• Use the bootrom environment in case the system does not start</li><li>• Navigate through CLI lines with EMACS</li><li>• View CLI history log</li><li>• Create aliases and macros for common troubleshooting routines</li></ul>	

## SM480 R6 System Administration & Security



LZU 108 7608 R1A

### Description

SM480 System Administration & Security is available for students who have or will participate in a course package containing SM480 System Survey course and has operational experience managing the SM480 platform.

This course module describes administrative and security functions on the SM480 system. It shows how to enable per context services and administrative privileges per context. In addition it shows how to configure connection to external servers such as Syslog for logging files, TACACS+ for authentication and accounting of administrative users, and many other administrative tasks. Hands-on exercises allow participants to master SM480 CLI syntax of system administrative and security related commands.

Theory to hands-on ratio of this course is 30/70.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 system administration tasks, hence saving time and money.

### Learning objectives

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

- 1 Identify management access options during initial startup and normal operations
- 2 Understand difference between management connection via SSH and Telnet
- 3 Understand the difference between Administrator accounts in context local compared to other contexts
- 4 Identify and enable specific services within context
- 5 Understand privilege levels of CLI commands and how to modify them
- 6 Configure AAA using TACACS+ server for administrator sessions and CLI authorization
- 7 Configure administrative access control lists
- 8 Understand system logging
- 9 Configure communication to a Syslog server
- 10 Perform password recovery in case administrator record is lost

### Target audience



The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

SM480 System Overview LZU 108 7597

The participants should have operational experience managing the SM480 platform as well as a solid understanding of general networking technologies

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Management Access</li><li>• Access During the Initial Startup</li><li>• Access During Normal Operations</li><li>• Security for Management access</li><li>• Telnet and SSH access</li><li>• Exercise: Configure Management access</li><li>• Services within context</li><li>• Privilege levels</li><li>• Administrators and CLI Commands</li><li>• TACACS+</li><li>• Administrative access control lists</li><li>• Logging &amp; Syslog</li><li>• Password recovery</li></ul>	

## SM480 R6 add-on IS-IS Configuration & Monitoring



LZU 108 7601 R1A

### Description

SM480 add-on IS-IS Configuration & Monitoring, available for students who did or will participate in a course package containing SM480 System Overview course

This course module covers technology background of IS-IS protocol as well as multiple configuration tasks. It describes role of IS-IS in IP networks, protocol operations, link state database content and much more. Hands-on exercises allow participants to master SM480 CLI syntax of IS-IS related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Identify main IP routing elements
- 2 Build and verify IP infrastructure on the SmartMetro system
- 3 Understand role of IS-IS protocol in IP networks
  - 3.1 Describe IS-IS protocol and common terminology
  - 3.2 Describe IS-IS protocol operations and adjacency forming
  - 3.3 Describe IS-IS protocol network topology
  - 3.4 Describe role of LSP in IS-IS
  - 3.5 Describe LSP ID and how it is build
  - 3.6 Explain best route selection from a router perspective
- 4 Configure IS-IS Level 1 area
  - 4.1 Define IS-IS routing instance
  - 4.2 Assign NSAP address
  - 4.3 Define area type for IS-IS
  - 4.4 Assign interfaces to IS-IS instance with corresponding metric
- 5 Configure Multiple IS-IS area network
- 6 Configure Level 2 – Backbone area
- 7 Implement IS-IS Attached bit – a way out of Level 1 area
- 8 Implement IS-IS Level 2 Route Leaking mechanism
- 9 Implement IS-IS IP summarization
- 10 Control routers Level 2 participation with overload bit



- 11 Verify configuration and troubleshoot IS-IS problems
- 12 Configure redistribution other protocols into IS-IS
- 13 Troubleshoot IS-IS related problems

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

SM480 System Overview LZU 108 7597

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Routing language</li><li>• Topology Reference Network – configuration, verification</li><li>• Integrated IS-IS – Introduction</li><li>• IS-IS – Practical Exercise</li><li>• IS-IS – Verification of route tables</li><li>• LSP entries in the IS-IS database</li></ul>	
2	<ul style="list-style-type: none"><li>• Verification of IS Neighbors</li><li>• Verification of Routing state</li><li>• Debug behavior in the SEOS</li><li>• Extending IS-IS network</li><li>• Multiple IS-IS area network</li><li>• Level 2 – Backbone</li><li>• Attached Bit</li><li>• Level 2 Route Leaking</li><li>• Summarization</li><li>• Overload Bit</li><li>• IS-IS Redistribution</li></ul>	

## SM480 R6 add-on VPLS (using IS-IS) Configuration & Monitoring



LZU 108 7604 R1A

### Description

SM480 add-on VPLS (using IS-IS) Configuration & Monitoring, available for students who did or will participate in a course package containing SM480 System Overview course as well as SM480 add on IS-IS Configuration & Monitoring course

This course module covers technology background of VPLS service as well as multiple configuration tasks. It explains VPLS service, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SM480 CLI syntax of MPLS/VPLS related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on VPLS it also uses IS-IS to build MPLS backbone used in exercises. It is essential for students to have good understanding of IS-IS to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Understand what VPLS service is
- 2 Understand the principles of MPLS
  - 2.1 Recognize different functions routers perform in MPLS networks
  - 2.2 Describe label related operations performed by routers
  - 2.3 Understand the concept of LSP
  - 2.4 Configure and verify MPLS on SM 480
- 3 Understand LSP creation process
  - 3.1 Explain LDP operations
  - 3.2 Configure and verify MPLS label distribution through LDP
  - 3.3 Configure and verify FEC filtering for LDP
- 4 Explain RSVP operations
  - 4.1 Configure and verify MPLS label distribution through RSVP
  - 4.2 Understand Fast Reroute LSP protection
  - 4.3 Configure and verify Fast Reroute in node protection mode
  - 4.4 Configure and verify Fast Reroute in link protection mode
- 5 Understand basic bridging functions



- 6 Explain how MPLS label stacking feature is used for VPN separation
- 6.1 Configure and verify targeted LDP for VPLS signaling
- 6.2 Understand concept of Pseudo Wire
- 7 Describe the difference between signaling and forwarding in VPLS network
- 7.1 Verify end to end packet flow through VPLS network
- 7.2 Explain actions taken by each router on the packet path
- 8 Configure and verify PPPoE connection over VPLS
- 9 Understand concept of hierarchical VPLS
- 9.1 Explain loop avoidance mechanism in VPLS
- 9.2 Configure and verify hierarchical VPLS network

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### Prerequisites

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SM480 System Overview LZU 108 7597
- SM480 add-on IS-IS Configuration & Monitoring LZU 108 7601

### 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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Introduction</li><li>• MPLS fundamentals</li><li>• Bridging basics</li><li>• Putting things in place within the SM 480</li><li>• VPLS lab topology</li><li>• MPLS backbone configuration flow diagram</li><li>• VPN context configuration flow diagram</li><li>• IP backbone connectivity and IS-IS configuration</li><li>• IP connectivity verification</li><li>• Configuration of MPLS and LDP</li><li>• LSP Verification</li><li>• Targeted LDP setup for VPN signaling</li><li>• LDP Verification</li><li>• Configuration of VPN context</li><li>• Pseudo wire verification</li><li>• Configuring CE router and connecting it to PE router</li><li>• Verification of end to end CE connectivity</li><li>• End to end packet flow walk through verification</li><li>• Configuration exercise - PPPoE over VPLS</li></ul>	
2	<ul style="list-style-type: none"><li>• Creating LSP with LDP</li><li>• LDP operations</li><li>• Limiting number of LSPs created with LDP</li><li>• LSP creation with RSVP</li><li>• RSVP operations</li><li>• Fast Reroute LSP protection</li><li>• Configuration of Fast Reroute in node protection mode</li><li>• Configuration of Fast Reroute in link protection mode</li><li>• Configuration exercise - corporate LAN over VPLS</li><li>• Hierarchical VPLS</li><li>• Hub and spoke configuration</li></ul>	

## SM480 R6 add-on BGP (using IS-IS) Configuration & Monitoring



LZU 108 7602 R1A

### Description

SM480 add-on BGP (using IS-IS) Configuration and Monitoring, available for students who did or will participate in a course package containing SM480 System Survey course as well as SM480 add-on IS-IS Configuration & Monitoring course.

This course module covers technology background of BGP v4 protocol as well as multiple configuration tasks. It describes role of BGP in Internet, protocol operations, differences between EBGP and IBGP and much more. Hands-on exercises allow participants to master SM480 CLI syntax of BGP related commands. Theory to hands-on ratio of this course is 30/70

While this course module focuses on BGP it also uses IS-IS to build networks used in BGP exercises. It is essential for students to have good understanding of IS-IS to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Understand role of BGP protocol in IP networks
  - 1.1 Explain BGP protocol operation
  - 1.2 Explain routing exchange process
  - 1.3 Describe the differences between IGP and BGP protocols
- 2 Define and interconnect multiple Autonomous systems
  - 2.1 Configure and verify status of BGP neighbor
  - 2.2 Troubleshoot BGP session establishment
  - 2.3 Find out the reason of BGP session reset
- 3 Describe different ways of IGP prefix injection into BGP
  - 3.1 Configure and verify BGP network statements
  - 3.2 Understand interaction between IGP and BGP
  - 3.3 Explain best route selection from a router perspective
  - 3.4 Configure default route injection on AS border router
- 4 Understand prefix aggregation concept
  - 4.1 Describe impact of single AS behavior for Internet stability
  - 4.2 Configure and verify prefix aggregation
- 5 Describe and configure IGP redistribution into BGP



- 6 Configure and verify IP prefix lists
- 7 Understand the difference between IBGP and EBGP
  - 7.1 Describe and solve a challenge related to next hop attribute in IBGP
  - 7.2 Understand the difference between signaling and forwarding path in transit AS
  - 7.3 Explain the reason for full mesh requirement in IBGP
- 8 Configure and verify route maps
- 9 Describe BGP best path selection process
  - 9.1 Explain influence of various BGP attributes on path selection process
  - 9.2 Change BGP best path via route map configuration

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

SM480 System Overview LZU 108 7597

SM480 add-on IS-IS Configuration & Monitoring LZU 108 7601

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.

## 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	<ul style="list-style-type: none"> <li>• IP routing fundamentals review</li> <li>• Introduction to BGP</li> <li>• BGP topology and configuration flow</li> <li>• Building IS-IS based IP infrastructure</li> <li>• Verification of networks</li> <li>• Connecting autonomous systems</li> <li>• Verification of BGP neighbor</li> <li>• Analyzing disconnect causes and troubleshooting</li> <li>• Injecting prefixes into BGP</li> <li>• BGP network statements – configuration and verification</li> <li>• Prefix aggregation concept and impact for Internet</li> <li>• Configuration and verification of prefix aggregation</li> <li>• Redistributing IS-IS into BGP</li> </ul>	
2	<ul style="list-style-type: none"> <li>• IP prefix lists – configuration and verification</li> <li>• Implementing BGP transit AS – building IP connectivity</li> <li>• Introduction to Internal Border Gateway Protocol</li> <li>• Configuration and verification of I-BGP</li> <li>• I-BGP and the next hop</li> <li>• Troubleshooting IBGP signaling issues</li> <li>• I-BGP and full mesh</li> <li>• Verification of end to end forwarding (IBGP and EBGP)</li> <li>• BGP path selection &amp; control</li> <li>• Route maps – configuration and verification</li> <li>• Expanding lab topology - exercise</li> <li>• BGP attributes - influencing BGP best path selection</li> <li>• BGP path selection algorithm</li> <li>• Changing BGP best path with weight - exercise</li> <li>• Changing BGP best path with local preference – exercise</li> </ul>	

## SM480 R6 add-on OSPF Configuration & Monitoring



LZU 108 7600 R1A

### Description

Smart Metro Ethernet add-on OSPF Configuration & Monitoring, available for students who did or will participate in a course package containing SM480 System Overview course

This course module covers technology background of OSPF protocol as well as multiple configuration tasks. It describes role of OSPF in IP networks, protocol operations, link state database content and much more. Hands-on exercises allow participants to master SM480 CLI syntax of OSPF related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Identify main IP routing elements
- 2 Build and verify IP infrastructure on the SM 480 Smart Ethernet Switch system
- 3 Understand role of OSPF protocol in IP networks
  - 3.1 Describe OSPF protocol operations
  - 3.2 Explain the difference between adjacency and neighborhood
  - 3.3 Explain role of DR router
- 4 Describe different functions router can perform in OSPF network
  - 4.1 Understand differences between different area types
  - 4.2 Understand content of link state database
  - 4.3 Explain differences between LSA types used by OSPF
- 5 Explain best route selection from a router perspective
- 6 Configure OSPF backbone area
  - 6.1 Build OSPF Area Border Router
  - 6.2 Verify OSPF operations
  - 6.3 Troubleshoot OSPF related problems
- 7 Configure non backbone OSPF areas (normal, stubby, totally stubby)
- 8 Redistribute other protocols into OSPF
- 9 Summarize IP prefixes
- 10 Inject default route into OSPF



### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

SM480 System Survey LZU 108 7597

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM 480 Smart Ethernet Switch lab and will be able to configure and monitor SM 480 Smart Ethernet Switch system.



## 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	<ul style="list-style-type: none"><li>• IP routing fundamentals review</li><li>• Building IP Infrastructure</li><li>• Connectivity verification</li><li>• Introduction to OSPF</li><li>• Discovering OSPF neighbors</li><li>• Synchronizing link state database</li><li>• Adjacencies in broadcast environment</li><li>• LSA flooding</li><li>• Role of areas in OSPF networks</li><li>• Functional differentiation of routers in OSPF</li><li>• Configuration of backbone area</li><li>• Routing verification</li><li>• Administrative distance discussion</li><li>• Details of LSA1 &amp; LSA2</li></ul>	
2	<ul style="list-style-type: none"><li>• Verifying OSPF operations</li><li>• Troubleshooting OSPF related problems</li><li>• Configuration of non backbone area</li><li>• Verification of routing</li><li>• Details of LSA3</li><li>• Configuration and verification of route redistribution</li><li>• Details of LSA4 &amp; LSA5</li><li>• Configuration of stubby area</li><li>• OSPF database verification</li><li>• Configuration of totally stubby area</li><li>• OSPF database verification</li><li>• Prefix summarization</li><li>• Injecting default route into OSPF domain</li></ul>	

## SM480 R6 add-on VPLS (using OSPF) Configuration & Monitoring



LZU 108 7605 R1A

### Description

SM480 add-on VPLS (using OSPF) Configuration & Monitoring, available for students who did or will participate in a course package containing SM480 System Overview course as well as SM480 add on OSPF Configuration & Monitoring course.

This course module covers technology background of VPLS service as well as multiple configuration tasks. It explains VPLS service, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SM480 CLI syntax of MPLS/VPLS related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on VPLS it also uses OSPF to build MPLS backbone used in exercises. It is essential for students to have good understanding of OSPF to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Understand what VPLS service is
- 2 Understand the principles of MPLS
  - 2.1 Recognize different functions routers perform in MPLS networks
  - 2.2 Describe label related operations performed by routers
  - 2.3 Understand the concept of LSP
  - 2.4 Configure and verify MPLS on SM 480
- 3 Understand LSP creation process
  - 3.1 Explain LDP operations
  - 3.2 Configure and verify MPLS label distribution through LDP
  - 3.3 Configure and verify FEC filtering for LDP
- 4 Explain RSVP operations
  - 4.1 Configure and verify MPLS label distribution through RSVP
  - 4.2 Understand Fast Reroute LSP protection
  - 4.3 Configure and verify Fast Reroute in node protection mode
  - 4.4 Configure and verify Fast Reroute in link protection mode
- 5 Understand basic bridging functions



- 6 Explain how MPLS label stacking feature is used for VPN separation
- 6.1 Configure and verify targeted LDP for VPLS signaling
- 6.2 Understand concept of Pseudo Wire
- 7 Describe the difference between signaling and forwarding in VPLS network
- 7.1 Verify end to end packet flow through VPLS network
- 7.2 Explain actions taken by each router on the packet path
- 8 Configure and verify PPPoE connection over VPLS
- 9 Understand concept of hierarchical VPLS
- 9.1 Explain loop avoidance mechanism in VPLS
- 9.2 Configure and verify hierarchical VPLS network

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers.

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SM480 System Overview LZU 108 7597
- SM480 add-on OSPF Configuration & Monitoring LZU 108 7601

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Introduction</li><li>• MPLS fundamentals</li><li>• Bridging basics</li><li>• Putting things in place within the SM 480</li><li>• VPLS lab topology</li><li>• MPLS backbone configuration flow diagram</li><li>• VPN context configuration flow diagram</li><li>• IP backbone connectivity and OSPF configuration</li><li>• IP connectivity verification</li><li>• Configuration of MPLS and LDP</li><li>• LSP Verification</li><li>• Targeted LDP setup for VPN signaling</li><li>• LDP Verification</li><li>• Configuration of VPN context</li><li>• Pseudo wire verification</li><li>• Configuring CE router and connecting it to PE router</li><li>• Verification of end to end CE connectivity</li><li>• End to end packet flow walk through verification</li><li>• Configuration exercise - PPPoE over VPLS</li></ul>	
2	<ul style="list-style-type: none"><li>• Creating LSP with LDP</li><li>• LDP operations</li><li>• Limiting number of LSPs created with LDP</li><li>• LSP creation with RSVP</li><li>• RSVP operations</li><li>• Fast Reroute LSP protection</li><li>• Configuration of Fast Reroute in node protection mode</li><li>• Configuration of Fast Reroute in link protection mode</li><li>• Configuration exercise - corporate LAN over VPLS</li><li>• Hierarchical VPLS</li><li>• Hub and spoke configuration</li></ul>	

## SM480 R6 add-on BGP (using OSPF) Configuration & Monitoring



LZU 108 7603 R1A

### Description

SM480 add-on BGP (using OSPF) Configuration and Monitoring, available for students who did or will participate in a course package containing SM480 System Survey course as well as SM480 add on OSPF Configuration & Monitoring course.

This course module covers technology background of BGP v4 protocol as well as multiple configuration tasks. It describes role of BGP in Internet, protocol operations, differences between EBGP and IBGP and much more. Hands-on exercises allow participants to master SM480 CLI syntax of BGP related commands. Theory to hands-on ratio of this course is 30/70

While this course module focuses on BGP it also uses OSPF to build networks used in BGP exercises. It is essential for students to have good understanding of OSPF to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Understand role of BGP protocol in IP networks
  - 1.1 Explain BGP protocol operation
  - 1.2 Explain routing exchange process
  - 1.3 Describe the differences between IGP and BGP protocols
- 2 Define and interconnect multiple Autonomous systems
  - 2.1 Configure and verify status of BGP neighbor
  - 2.2 Troubleshoot BGP session establishment
  - 2.3 Find out the reason of BGP session reset
- 3 Describe different ways of IGP prefix injection into BGP
  - 3.1 Configure and verify BGP network statements
  - 3.2 Understand interaction between IGP and BGP
  - 3.3 Explain best route selection from a router perspective
  - 3.4 Configure default route injection on AS border router
- 4 Understand prefix aggregation concept
  - 4.1 Describe impact of single AS behavior for Internet stability
  - 4.2 Configure and verify prefix aggregation
- 5 Describe and configure IGP redistribution into BGP



- 6 Configure and verify IP prefix lists
- 7 Understand the difference between IBGP and EBGP
  - 7.1 Describe and solve a challenge related to next hop attribute in IBGP
  - 7.2 Understand the difference between signaling and forwarding path in transit AS
  - 7.3 Explain the reason for full mesh requirement in IBGP
- 8 Configure and verify route maps
- 9 Describe BGP best path selection process
  - 9.1 Explain influence of various BGP attributes on path selection process
  - 9.2 Change BGP best path via route map configuration

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

Successful completion of the following courses:

SM480 System Overview LZU 108 7597

SM480 Add-on OSPF Configuration & Monitoring LZU 108 7600

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• IP routing fundamentals review</li><li>• Introduction to BGP</li><li>• BGP topology and configuration flow</li><li>• Building OSPF based IP infrastructure</li><li>• Verification of networks</li><li>• Connecting autonomous systems</li><li>• Verification of BGP neighbor</li><li>• Analyzing disconnect causes and troubleshooting</li><li>• Injecting prefixes into BGP</li><li>• BGP network statements – configuration and verification</li><li>• Prefix aggregation concept and impact for Internet</li><li>• Configuration and verification of prefix aggregation</li><li>• Redistributing OSPF into BGP</li></ul>	
2	<ul style="list-style-type: none"><li>• IP prefix lists – configuration and verification</li><li>• Implementing BGP transit AS – building IP connectivity</li><li>• Introduction to Internal Border Gateway Protocol</li><li>• Configuration and verification of I-BGP</li><li>• I-BGP and the next hop</li><li>• Troubleshooting IBGP signaling issues</li><li>• I-BGP and full mesh</li><li>• Verification of end to end forwarding (IBGP and EBGP)</li><li>• BGP path selection &amp; control</li><li>• Route maps – configuration and verification</li><li>• Expanding lab topology - exercise</li><li>• BGP attributes - influencing BGP best path selection</li><li>• BGP path selection algorithm</li><li>• Changing BGP best path with weight - exercise</li><li>• Changing BGP best path with local preference – exercise</li></ul>	

## SM480 R6 add-on L2 Services Configuration & Monitoring



LZU 108 7599 R1A

### Description

SM 480 add-on L2 Services Configuration & Monitoring, available for students who did or will participate in a course package containing SM480 System Overview course

This course module covers technology background of layer 2 services as well as multiple configuration tasks. It explains various layer 2 concepts, guides participants through configuration steps, dives into MPLS features and much more. Hands-on exercises allow participants to master SM480 CLI syntax of layer2 related commands.

Theory to hands-on ratio of this course is 30/70

While this course module focuses on layer 2 it also uses IP for verification and building MPLS backbone. It is essential for students to have good understanding of IP to successfully complete this course.

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SM480 configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Explain role of Metro Ethernet networks
- 2 Recognize different types of Ethernet links
- 3 Explain what is Ethernet tagging
  - Understand a concept of stacked VLANs
- 4 Explain bridge operations
- 5 Configure bridged network using SM 480
- 6 Explain loop avoidance mechanisms used in bridged networks:
  - STP & RSTP
  - MAC Move Detection
- 7 Configure and verify loop prevention on SM 480
- 8 Configure IP interface for a bridge (BVI interface)
- 9 Explain concept of Ethernet link aggregation groups (LAG)
- 10 Configure and monitor LAG group
- 11 Understand differences and configure different types of cross connections
  - Non interworking cross connections



### Interworking cross connections

Cross connecting LAG groups

#### 12 Understand the principles of MPLS

Recognize different functions routers perform in MPLS networks

Describe label related operations performed by routers

Understand the concept of LSP

Configure and verify MPLS on SM 480

#### 13 Understand LSP creation process

Explain LDP operations

Configure and verify MPLS label distribution through LDP

Configure and verify FEC filtering for LDP

#### 14 Explain how MPLS label stacking feature is used for traffic separation

#### 15 Understand concept of Virtual Leased Line (VLL)

#### 16 Configure and monitor static VLL

#### 17 Configure and verify targeted LDP for VLL signaling

#### 18 Configure and verify dynamic VLL

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### Prerequisites

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SM480 System Overview LZU 108 7597

### 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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM480 lab and will be able to configure and monitor SM480 system.



## 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	<ul style="list-style-type: none"><li>• Introduction to Metro Ethernet networks</li><li>• Introduction to Ethernet<ul style="list-style-type: none"><li>• - Ethernet link types</li><li>• - Ethernet tagging (VLAN)</li><li>• - Stacked VLANs</li></ul></li><li>• Bridging theory</li><li>• Building basic bridged network<ul style="list-style-type: none"><li>• - Creating bridge</li><li>• - Forwarding rules for trunk and tributary circuits</li><li>• - Bridge profiles</li><li>• - Bridged interface</li></ul></li><li>• Loop avoidance through STP &amp; RSTP</li><li>• Configuration and verification of RSTP</li><li>• Explanation of loop detection via MAC Move Detection</li><li>• Configuration and verification of MAC Move Detection</li><li>• Configuring IP interface for a bridge (BVI interface)</li><li>• Ethernet link aggregation (LAG) - theory</li><li>• Configuring and monitoring LAG groups</li><li>• Cross connection configuration<ul style="list-style-type: none"><li>• - Non interworking cross connections</li><li>• - Interworking cross connections</li><li>• - Cross connecting LAG groups</li></ul></li></ul>	

## SM480 R6 add-on IP QoS Configuration & Monitoring



LZU 108 7606 R1A

### Description

SM 480 add-on IP QoS (Quality of Service) Configuration and Monitoring course module is available for students who did or will participate in a course package containing SM 480 System Survey course.

This course covers fundamental concepts of QoS as well as multiple configurations for various QoS policies. It illustrates how Metering and Policing policies work with traffic classification and rate-limiting. It explains queuing and scheduling and includes configuration exercises for PWFQ policies. Hands-on exercises allow participants to master SM 480 CLI syntax of QoS related commands.

Theory to hands-on ratio of this course is 40/60

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of SmartEdge configuration, monitoring and troubleshooting, hence saving time and money.

### Learning objectives

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

- 1 Understand Quality of Service (QoS) background and fundamental concepts
- 2 Explain QoS terminologies such as classification, marking, queuing, and scheduling
- 3 Describe Token Bucket and how it relates to rate calculation
- 4 Understand concepts of QoS policies of Metering and Policing
  - 4.1 Explain classification and rate limiting
- 5 Configure and implement QoS Metering policy
  - 5.1 Build basic IP infrastructure to support lab topology
  - 5.2 Configure QoS Metering policy
  - 5.3 Configure QoS Metering policy with Classes
- 6 Explain Queuing and Queue maps
  - 6.1 Describe system default Queue maps
  - 6.2 Create custom Queue map
- 7 Understand Priority Queuing algorithm
- 8 Understand Weighted fair queuing algorithm
- 9 Understand Scheduling algorithm for Priority Weighted Fair Queuing (PWFQ)
  - 9.1 Explain hierarchical scheduling
- 10 Configure and implement various PWFQ policies



- 11 Explain the concept of congestion avoidance mechanisms such as Random Early Discard (RED)
- 12 Explain RED with multi-drop precedence

### **Target audience**

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers and Service Engineers

### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

- SM 480 System Overview LZU 108 7597

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to SM 480 lab and will be able to configure and monitor SM 480 system.



## 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	<ul style="list-style-type: none"><li>• Introduction to Quality of Service (QoS)</li><li>• QoS Terminology (Classification, Marking, Queuing, Scheduling)</li><li>• Concept of time and rate</li><li>• QoS Policy Metering / Policing</li><li>• Classification and rate limiting</li><li>• QoS Policy Metering exercises</li><li>• Case 0: Building the Topology</li><li>• Case 1: QoS Policy Metering</li><li>• Case 2: QoS Policy Metering with Classes</li></ul>	
2	<ul style="list-style-type: none"><li>• Introduction to Queuing</li><li>• Queue Mapping exercise</li><li>• Scheduling: Priority Queuing (PQ)</li><li>• Case-3a QoS PQ exercise</li><li>• Case-3b QoS PQ with rate limiting exercise</li><li>• Congestion avoidance: RED with multi drop precedence</li><li>• Scheduling: Weighted Fair Queuing (WFQ)</li><li>• Case-4 WFQ exercise</li><li>• Scheduling: Priority Weighted Fair Queuing (PWFQ)</li><li>• Case-5: PWFQ exercise</li></ul>	

## NetOp R6 EMS Foundation & Operations



LZU 108 2123 R2A

### Description

NetOp R6 EMS Foundation and Operations, a 2-day course available for students who did or will participate in a course package containing SmartEdge System Survey.

NetOp R6 EMS Foundation and Operations course explores in the details all functions of NetOp EMS System and provides broader understanding of the architecture and all functions provided by the system.

Theory to hands-on ratio of this course is 50/50

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of NetOp EMS operations, hence saving time and money.

### Learning objectives

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

- 1 Describe the NetOp EMS system architecture
- 2 Describe functions of all components of the system
- 3 Describe a role of all communication protocols used inside the system
- 4 Describe a redundancy functions of the system
- 5 Perform Network setup
  - 5.1 Add new Nodes to the NetOp EMS System
- 6 Perform system monitoring
  - 6.1 Access hardware and software system information
  - 6.2 Access fault information from Nodes, Cards, Port and Channels
  - 6.3 Read, filter and save Database logs
  - 6.4 Create and monitor statistics from Nodes, Cards, Ports and Channels
- 7 Perform provisioning of Nodes
  - 7.1 Create and manage Contexts, Interfaces, Profiles, Circuits, Subscribers, QoS Policies, L2TP Tunnels and Bindings
  - 7.2 Configure Routing Protocols
  - 7.3 Use Bulk Operations

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, System Engineers, Field Technicians and System Administrators



### **Prerequisites**

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.

Successful completion of the following courses:

SmartEdge R6 System Survey LZU 108 2107

### **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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to all functions of NetOp EMS lab.



## 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	<p>NetOp Foundation</p> <ul style="list-style-type: none"><li>• Overview</li><li>• NetOp EMS – system architecture</li><li>• NetOp EMS – redundancy</li><li>• NetOp EMS - security</li><li>• NetOp EMS – scaling</li></ul> <p>NetOp Operations</p> <ul style="list-style-type: none"><li>• Initialization<ul style="list-style-type: none"><li>• Connection to the Lab</li><li>• Introduction to NetOp EMS Client GUI</li><li>• Server Manager</li></ul></li><li>• Network setup<ul style="list-style-type: none"><li>• Basic configuration on the SmartEdge</li><li>• Adding Nodes</li><li>• Network Discovery</li><li>• Node Advertising</li><li>• Topology Maps and Icons</li></ul></li></ul>	



- 2
- Provisioning
    - Provisioning Cards
  - Provisioning Ports System Monitoring
    - Faults
    - SNMP Traps
    - Logs
    - Statistics
  - System Operations
    - Contexts provisioning
    - Interfaces Provisioning
    - Profiles Provisioning
    - Subscribers Provisioning
    - QoS Provisioning
    - Bindings
    - Routing Protocols
  - Using Bulk operations

## NetOp R6 PM Foundation & Operations



LZU 108 2124 R2A

### Description

NetOp R6 PM Foundation and Operations, a 2-day course available for students who did or will participate in a course package containing SmartEdge System Survey.

NetOp R6 PM Foundation and Operations course explores in the details all functions of NetOp PM System and provides broader understanding of the architecture and all functions provided by the system.

Theory to hands-on ratio of this course is 60/40

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of NetOp PM operations, hence saving time and money.

### Learning objectives

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

- 1 Perform network operations related to NetOp Policy Manager for SmartEdge systems
- 2 Establish initial communications between NetOp PM Client and the NetOp PM server and navigate through the GUI interface
- 3 Understand SmartEdge configurations required for NPM
- 4 Create Service Offerings and Service Attribute Variations
- 5 Manage subscriber accounts and connect active subscribers with services
- 6 Offer services through the Lightweight Web Portal

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, System Engineers, Field Technicians and System Administrators

### Prerequisites

The participants should be familiar with and have practical experience with IP networks as well as a solid understanding of general networking technologies.



Successful completion of the following courses:

SmartEdge R6 System Survey LZU 108 2107

### 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 Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to all functions of NetOp PM lab.

### 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	<ul style="list-style-type: none"><li>• NetOp PM – Foundation</li><li>• NetOp PM – Technology Overview</li><li>• NetOp PM – System Transactions</li><li>• Network Setup</li><li>• Basic SmartEdge Configuration</li></ul>	
2	<ul style="list-style-type: none"><li>• Services</li><li>• Subscribers</li><li>• Lightweight WEB Portal</li></ul>	

## NetOp R6 NSM Foundation



LZU 108 7596 R1A

### Description

NetOp NSM Foundation and Operation is a web based learning module required as preparation for other NetOp NSM add-on technology courses.

NetOP Network Service Manager (NSM) is a management tool to automate end-to-end provisioning for IP VPN Services. It is a plug-in module for NetOp EMS Server and supports provisioning circuits for IPsec VPN, L2VPN with Virtual Leased Line (VLL) and Virtual Private LAN Services (VPLS), and BGP MPLS L3VPN.

This course provides a broad understanding of the architecture and functions provided by the NetOP NSM system. This is an important base to establish before moving on to the Add-On course modules that focus on provisioning a specific type of VPN circuit.

This is a 100 percent theory course module.

### Learning objectives

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

- 1 Describe the NetOp NSM system architecture
- 2 Describe system functions
  - 2.1 Service Templates
  - 2.2 Customer and Account Management
  - 2.3 Provision workflow
  - 2.4 Monitor and Fault Management
  - 2.5 Reporting
- 3 Describe system security

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, Service Technicians, System Engineers, Field Technicians, System Administrators.

### Prerequisites

Successful completion of the following courses:

NetOp EMS Foundation and Operation LZU 108 2123

### Duration and class size



The length of the course is approximately 2 hours.

### Learning situation

This course is a Web Based Learning (WBL) module.

It includes a recording of the lessons with power point presentations.

### 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	<ul style="list-style-type: none"><li>• Overview NetOp NSM</li><li>• System architecture</li><li>• Feature Details</li><li>• Service Templates</li><li>• Customer and Account Management</li><li>• Provision workflow</li><li>• Monitor and Fault Management</li><li>• Reporting</li><li>• Security</li></ul>	

## SM480 R6 add-on OSPF Configuration & Monitoring



LZU 108 7693 R1A

### Description

NetOp NSM add-on for L3VPN is a 1-day course available for students who have completed the prerequisite courses: NetOp EMS Foundation and Operation, and NetOp NSM Foundation and Operation.

NetOP Network Service Manager (NSM) is a management tool to automate end-to-end provisioning for IP VPN Services. It is a plug-in module for NetOp EMS Server and supports provisioning circuits for IPsec VPN, L2VPN with Virtual Leased Line (VLL) and Virtual Private LAN Services (VPLS), and BGP MPLS L3VPN.

This add-on course for L3VPN explores in detail how to use NSM to provision circuits for BGP MPLS L3VPN.

Theory to hands-on ratio of this course is 50/50

With the help of the training documentation provided in this course and the guidance of the instructors, the attendees will learn the most efficient ways of NetOp NSM operations for L3VPN, hence saving time and money.

### Learning objectives

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

- 1 Describe key elements required in an MPLS L3VPN network topology
- 2 Describe requirements to use NSM to add L3VPN services
- 3 Create Service Templates
- 4 Create CLI Templates
- 5 Perform provisioning of L3VPN service using NetOp NSM
- 6 Perform system monitoring and fault management
- 7 Generate reports

### Target audience

The target audience for this course is: Network Design Engineers, Network Deployment Engineers, System Technicians, System Engineers, Field Technicians and System Administrators

### Prerequisites

Successful completion of the following courses:



- NetOp EMS Foundation and Operation LZU 108 2123
- NetOp NSM Foundation and Operation LZU 108 7596

### **Duration and class size**

The length of the course is 1 day and the maximum number of participants is 8.

### **Learning situation**

This course is based on Instructor Led Training.

It includes instructor-led lessons using power point presentations combined with educational modules including hands-on labs and student test cases. Participants will have remote access to all functions of NetOp NSM lab



## 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	<ul style="list-style-type: none"><li>• Introduction to L3VPN technology and key elements in network topology</li><li>•</li><li>• Requirements to use NSM to add L3VPN services</li><li>•</li><li>• Services Template L3VPN (service module)<ul style="list-style-type: none"><li>• • Create Service Template</li><li>• • Create CLI Template</li><li>• • Lab exercise</li></ul></li><li>•</li><li>• Provision workflow<ul style="list-style-type: none"><li>• • Create services Using Service Template</li><li>• Lab exercise: Design and activate a customer configuration and verify.</li></ul></li><li>•</li><li>• Monitor and Fault Management<ul style="list-style-type: none"><li>• • Discuss the options to monitor the service</li><li>• • Lab exercise: Perform monitoring and fault management tasks</li></ul></li><li>•</li><li>• Reporting<ul style="list-style-type: none"><li>• • Discuss reporting options and results</li><li>• • Lab exercise: Generate reports</li></ul></li></ul>	