



Eltex Switching and Routing (fundamental level) v.1

Course duration: 40 academic hours (5 days)

Target audience:

- Graduates of technical universities and colleges beginning to work with Eltex equipment;
- Engineers without a networking background wishing to master the fundamentals of networking technologies;
- Sales and pre-sales support specialists of system integrators;
- Network engineers interested in updating and systematizing their foundational knowledge in networking technologies;
- Future and current network engineers preparing for the ECNT R&S certification exam.

Course pre-requisites:

- Confident computer user skills;
- Knowledge of Windows and Linux operating systems is preferred but not required.

Upon completion of the course, the participants will be able to:

- calculate the address space of local area networks;
- analyze network traffic;
- properly terminate twisted-pair cables;
- administer a computer network at an entry level.

have the knowledge of:

- networking fundamentals: OSI and TCP/IP models;
- IPv4 fundamentals;
- operating principles of DNS, DHCP, and HTTP;
- addressing rules in computer networks;
- computer network design concepts;
- data transmission principles in computer networks.

acquire the following skills:

- basic network equipment configuration skills;
- skills in troubleshooting network equipment and simple data communication networks.



Curriculum

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Activity	Description	Time
Topic:	1. Fundamentals of computer networks.	4 hours
Description:	1.1. Main elements of computer networks. 1.2. Types of networks. 1.2.1. Local area networks. 1.2.2. Wide area networks. 1.3. Network structure. 1.3.1. Endpoints. 1.3.2. Network devices. 1.3.3. Data transmission medium. 1.3.4. Software. 1.3.5. Protocols. 1.4. Standards and standardization organizations. 1.5. Interaction of devices in a network. OSI model. 1.6. TCP/IP protocol stack. 1.7. Protocol interaction. Encapsulation and multiplexing. Protocol data units (PDU).	2 hours
Lab:	1.1. Terminating twisted-pair cable. 1.2. Working with Wireshark.	2 hours

Activity	Description	Time
Topic:	2. Physical and data link layers.	6 hours
Description:	2.1. Data transmission media. 2.1.1. Coaxial cable. 2.1.2. Twisted-pair cable. 2.1.3. Optical fiber cable. 2.2. L2 frame structure. 2.2.1. Data link layer protocol. Ethernet. 2.3. MAC and LLC sublayers of the data link layer. 2.3.1. Collision domain. 2.4. Number systems. 2.4.1. Binary number system. 2.4.2. Hexadecimal number system. 2.5. Data link layer addressing. Types of MAC addresses. 2.5.1. Unicast MAC address. 2.5.2. Multicast MAC address. 2.5.3. Broadcast MAC address. 2.6. Switches and switching. 2.6.1. Frame-based switch operation. 2.7. Initial configuration of a MES switch. 2.7.1. Connecting to the switch. 2.7.2. Introduction to the MES switch CLI. 2.7.3. Configuring the hostname.	3 hours



	2.7.4. Banner messages. 2.7.5. Saving a configuration. 2.8. Physical layer diagnostics. 2.8.1. Copper cable diagnostics. 2.8.2. Optical transceiver diagnostics. 2.8.3. Power over Ethernet (PoE). 2.9. Data link layer diagnostics. LLDP.	
Lab:	2.1. Connecting to the training stand. 2.2. Basic switch configuration. 2.3. Neighbor discovery (LLDP). 2.4. Physical layer diagnostics.	3 hours

Activity	Description	Time
Topic:	3. Network layer.	4 hours
Description:	3.1. IPv4 addresses. 3.1.1. IP packet header. 3.1.2. TTL (Time to Live) field. 3.1.3. IP address format. 3.2. Types of casting. 3.3. Types of IP addresses. 3.3.1. Special-purpose IPv4 addresses. 3.3.2. Classful IP addressing. 3.4. IPv4 subnet mask. 3.4.1. Prefix length. 3.5. Network address, host address, and IPv4 broadcast address. 3.6. Network subnetting. 3.6.1. Reasons for subnetting. 3.6.2. Basic subnetting. 3.6.3. Subnetting formulas. 3.6.4. Basic division into 4 subnets. 3.6.5. Basic division of a /16 network into 50 subnets. 3.6.6. Variable Length Subnet Masks (VLSM) 3.7. The “logical AND” operation 3.8. L3 Diagnostics. ICMP Utilities. 3.8.1. Local host testing. 3.8.2. Remote host testing. 3.8.3. Path testing.	2 hours
Lab:	3.1. Dividing a network into a specified number of subnets. 3.2. VLSM subnetting.	2 hours

Activity	Description	Time
Topic:	4. Routing.	6 hours
Description:	4.1. Address Resolution Protocol (ARP). 4.1.1. ARP request and ARP response.	4 hours



	4.1.2. ARP translation table. 4.1.3. Gratuitous ARP (GARP). 4.2. Routing table. 4.2.1. Sources of the routing table. 4.2.2. Route structure. 4.2.3. Cost. 4.2.4. Preference. 4.2.5. Load balancing. 4.2.6. Next Hop address 4.3. Router functions. 4.3.1. Decision-making algorithm. 4.3.2. Optimal route. 4.3.3. Packet forwarding mechanisms. 4.3.4. Packet routing. 4.4. Static routes. 4.4.1. Default static route. 4.4.2. Summary static route. 4.4.3. Floating static route. 4.5. Connecting to a network device. 4.5.1. Configuration files. 4.5.2. ESR router command line. 4.5.3. Command structure. 4.5.4. Command line help. 4.6. Basic ESR router configuration. 4.6.1. First-time router startup. 4.6.2. Configuring the device name. 4.6.3. Banner messages. 4.6.4. Configuring an IP address on an interface. 4.6.5. Configuring date and time. 4.6.6. Saving the configuration.	
Lab:	4.1. Initial ESR configuration. 4.2. Static routes. Ping and traceroute utilities.	2 hours

Activity	Description	Time
Topic:	5. Virtual local area networks.	5 hours
Description:	5.1. VLAN fundamentals. 5.2. Tagged and untagged traffic. 5.2.1. VLAN identifier. 5.2.2. VLAN types. 5.2.3. VLAN advantages. 5.3. Access ports and trunk ports. 5.3.1. Access ports. 5.3.2. Trunk ports. 5.4. Switch interfaces. 5.4.1. L2 interfaces. 5.4.2. L3 interfaces.	2 hours



	5.5. Inter-VLAN routing. 5.5.1. Inter-VLAN routing issues. 5.5.2. Router-on-a-Stick (ROAS) method. 5.5.3. Routing via an L3 switch.	
Lab:	5.1. Configuring VLANs and trunk links. 5.2. Inter-VLAN routing.	3 hours

Activity	Description	Time
Topic:	6. Transport layer.	4 hours
Description:	6.1. Transport layer addressing. 6.1.1. Sockets and addressing principle. 6.1.2. Port number groups. 6.2. Traffic segmentation during transmission. 6.2.1. Multiplexing. 6.3. Transmission Control Protocol (TCP). 6.3.1. TCP functions. 6.3.2. TCP segment header. 6.3.3. TCP connection establishment. 6.3.4. TCP reliability. 6.4. User Datagram Protocol (UDP). 6.4.1. UDP functions. 6.4.2. Main characteristics of UDP. 6.4.3. UDP datagrams. 6.4.4. Main application types using UDP.	2 hours
Lab:	6.1. Capturing TCP and UDP network traffic.	2 hours

Activity	Description	Time
Topic:	7. Application layer.	6 hours
Description:	7.1. Main application layer protocols. 7.2. Domain Name System (DNS). 7.2.1. DNS message format. 7.2.2. Domain name structure. 7.2.3. DNS hierarchy and operation. 7.2.4. Authoritative and non-authoritative DNS servers. 7.2.5. Configuration commands for setting up DNS. 7.2.6. DNS configuration example. 7.3. Hypertext protocols. 7.3.1. HTTP and HTTPS. 7.3.2. Interaction between application layer protocols and end-user applications. 7.4. Dynamic Host Configuration Protocol (DHCPv4). 7.4.1. Getting an IP address from a DHCP server. 7.4.2. IP address conflict and methods of preventing it. 7.4.3. IP address lease renewal.	3 hours



	7.4.4. Analyzing the DHCP protocol operation using Wireshark. 7.4.5. Configuring DHCP client. 7.4.6. Configuring DHCP server. 7.4.7. Checking DHCP. 7.5. Diagnostics at layers L4–L7. 7.5.1. Checking DNS. 7.5.2. DHCP configuration errors.	
Lab:	7.1. DNS and DHCP configuration on an ESR router.	3 hours

Activity	Description	Time
Topic:	8. Network address translation (NAT).	3 hours
Description:	8.1. Background of NAT development. 8.2. NAT terminology and operating principle. 8.2.1. Single translation. 8.3. Advantages and disadvantages of NAT. 8.4. Types of NAT. 8.4.1. Source NAT (SNAT). 8.4.2. Destination NAT (DNAT). 8.4.3. Configuring Source NAT. 8.4.4. Configuring Destination NAT. 8.4.5. Checking NAT. 8.4.6. Static NAT.	2 hours
Lab:	8.1. Configuring Source NAT.	1 hours

Intermediary and final controls: 2 hours

One free-of-charge attempt of certification test is provided within the frameworks of this course. The participant may use this attempt on the last day of the course.

In case the test attempt is unsuccessful, the participant may contact the Commercial Department for purchasing the additional attempt.

The participant may use the paid attempt within one calendar month starting from the data of course completion.