Curriculum: CISCO – network technologies

Name of the module	CCNA1 (03.02. – 17.02.2024)

Introduction to computer networks

Ways of using the network for work and communication. LAN and WAN devices and network topologies. What a network consists of (routers, switches, physical media etc.). Internet and its development. Server-client and peer-to-peer models. Methods of communication in networks (unicast, multicast, broadcast). Protocol as a means of exchanging information.

Practice: introduction to network devices.

The number systems and conversions between them

Positional notation with a common base. Conversions between binary, decimal and hexadecimal systems.

Practice: conversions between number systems.

The IP Protocol, subnetting (FLSM and VLSM)

Description of the IP protocol as a basic communication tool in IP networks. Hierarchical structure of the IP protocol. IP address and its anatomy. Creating subnets with a subnet mask. Subnetting of networks into evenly sized blocks (FLSM). Subnetting with variable mask length (VLSM).

Practice: exercises for network subnetting – FLSM and VLSM.

The network layer models TCP/IP and ISO

Characteristics of individual layers with their function of TCP/IP and ISO layer models. Description of layers from the point of view of network activity.

Practice: exercises in a network analyzer for monitoring network traffic.

The basic configuration of routers and switches

IOS operating system, its structure and navigation. Switching between modes and basic configuration of routers and switches - hostnames, securing IOS modes, encryption. Message of the Day (MOTD) configuration. Configuration of IP address and subnet mask on network interfaces. Basic security settings. Secure remote management. Managing recovery and backup of configuration.

Practice: exercises for basic configuration of routers and switches.

Introduction to routing

Characterization of the basic concepts and processes of routing. Routing table. Static and dynamic routing.

Static routing

Connecting of networks by static routing. Configure static routes using the next hop IP address of the router. Configuration of static routes via output interface. Routing with default route.

Practice: static routing exercises for various network scenarios.

Summarization of IPv4 networks

Benefits of network summarization. Calculation of the summary address in binary and decimal number systems. Application of summarization in routing.

Practice: exercises for calculation and configuration of summarized IP network space.

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Name of the module	CCNA2 (20.02. – 07.03.2024)

Introduction to dynamic routing

Characteristics of functions and use of dynamic routing protocols. Classification of dynamic protocols. Comparison of Distance-vector and Link-state. A closer look at Distance-Vector protocols (operation, routing loops prevention, network lookup). Administrative distance and its importance in determining the best paths to destination networks.

Routing Information Protocol (RIPv2)

Routing Information Protocol vo verzii 2 (RIPv2) – operation principle, configuration and verification, troubleshoot.

Practice: RIPv2 configuration exercises for various network scenarios.

Enhanced Interior Gateway Protocol (EIGRP)

Operation principle DUAL algorithm (Successor, Feasible Successor, Feasible Distance, Feasibility Condition). Description of the work databases EIGRP uses. Unequal load balancing explained. Optimizations in metric calculation. Configuration, verification and troubleshooting of the protocol.

Practice: EIGRP configuration exercises for various network scenarios.

Open Shortest Path First (OSPF)

Operation principle of Link-State protocols (how a router describes its surroundings through Link-State packets, how topology tables are stored, how the SPF algorithm calculates the best paths based on collected network data). Description of hierarchical model (single-area, multiarea). Roles of routers in individual areas. Configuration, verification and troubleshooting of the protocol.

Practice: EIGRP configuration exercises for various network scenarios.

Floating static routes

Importance of floating static paths in redundant topology.

Practice: Floating static routes configuration exercises for various network scenarios.

Network Address Translation (NAT)

Access lists as a means of filtering network IP traffic. Properties of NAT translation (advantages / disadvantages). Forms of translations: static, dynamic and PAT translation.

Practice: NAT configuration exercises for various network scenarios.

IP address autoconfiguration - DHCP

Characteristics of communication between DHCP server and DHCP client. Description of the DHCP Relay agent. Finding misconfigurations that may occur in real world deployment.

Practice: DHCP configuration exercises for various network scenarios.

Route redistribution

Redistribution - a tool for cooperation between incompatible protocols (RIPv2, OSPF, EIGRP). Metric value adjustment for network advertisement from one to another routing protocol.

Practice: Route redistribution configuration exercises for various network scenarios.

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Name of the module	CCNA3 (09.03. – 23.03.2024)

Introduction to switched networks, VLAN

Ethernet as a technology, frame header The switch – how it works in the network, how it learns MAC addresses, how it switches frames. Frame switching methods - store and forward switching, cut-through switching, fragment-free switching. Hardware equipment of switches – fixed, modular and stackable configuration. What are VLANs, benefits in segmentation and configuration on Cisco switches. Routing between VLANs – router-on-a-stick, routing on multilayer switches.

Practice: VLAN configuration exercises for various scenarios in a switched networks.

Encapsulation and tagging of VLAN frames

802.1Q protocol (trunk) – how is tag added into the frame, transmission of tagged frames between switches in VLAN networks, 802.1Q header and its fields.

Practice: Static trunk configuration exercises in a switched networks.

Autoconfiguration of trunk link

Dynamic Trunking Protocol (DTP) – configuration modes (static, dynamic), DTP frame header and its fields.

Practice: Dynamic trunk configuration exercises in a switched networks.

VLAN database synchronization (protocol VTP)

VTP protocol – characteristics of the protocol for VLAN database synchronization in a switched domain. Operation principle, modes of operation. Configuration, verification and troubleshooting of the protocol.

Practice: VTP configuration exercises in a switched networks.

EtherChannel, PAgP and LACP protocols

EtherChannel - connecting physical links into one logical port. EtherChannel protocols – PAgP and LACP. Advantages and limitations of port grouping. Configuration, verification and troubleshooting of EtherChannel groups.

Practice: EtherChannel configuration exercises in a switched networks.

Network redundancy, protocols FHRP

Explanation of a proper network design without central points of failure, gateway redundancy by FHRP protocols (HSRP, VRRP, GLBP).

Practice: VRRP configuration exercises in a switched networks.

Hot Standby Router Protocol (HSRP)

Properties, concepts of active and backup router. Equal balancing across multiple gateways. Configuration, verification and troubleshooting of the protocol.

Practice: HSRP configuration exercises in a switched networks.

Spanning Tree Protocol (PVST+/RPVST+)

STP operation, root bridge selection and elements that affect it . Variations – PVST+, RPVST+.
STP data unit – BPDU (explanation of selected header fields). Protection against unauthorized devices intervention in the STP topology. Protection against unauthorized devices connecting to the STP topology. Configuration and troubleshooting of individual STP variations.
Practice: exercises for STP tree calculations. STP configuration in a switched networks.

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Name of the module	CCNA4 (26.03. – 11.04.2024)

Access Control Lists (ACL)

An introduction to access lists as a tool for filtering IP network traffic. Differences between standard and extended access list. Configuring and troubleshooting of standard and extended access lists.

Practice: ACL configuration exercises for various network scenarios.

Security of LAN networks

Explanation of various forms of protection against LAN attacks, such as Dynamic ARP Inspection (ARP), IP DHCP Snooping/Spoofing, DHCP starvation, STP attack, double VLAN tagging

Practice: configuration exercises for different LAN security mechanisms in a network.

Port security

Protection of switched ports (port security) on the switch against unauthorized MAC addresses.

Practice: port security configuration exercises in a switched networks.

IP protocol in version 6 (IPv6)

Identification of the appropriate protocol addressing scheme in LAN and WAN networks. Technological requirements for using the protocol, comparison with IPv4. Address types, notation. Methods of migration from IPv4 to IPv6 (dual-stack, tunneling, NAT64). Dynamic allocation of IPv6 addresses: SLAAC, stateless DHCP, stateful DHCP.

Practice: basic configuration exercices for IPv6 addressing scheme.

Dynamic routing in IPv6

Description of dynamic routing changes in an IPv6 environment. Configuring and troubleshooting of IGP routing protocols.

Practice: RIPNG, EIGRPv6 and OSPFv3 configuration exercises for various network scenarios.

Virtual private network (VPN)

Introduction to virtual networks. VPN division: static and dynamic VPN. Security of virtual networks - confidentiality, integrity, authorization, authentication and packet replay protection.

GRE and IPSec

Introduction, explanation of terms, methods of packet transmission. Tunnel, transport mode. ESP and AH headers. Packet security algorithms.

Practice: GRE and IPSec configuration exercises for various network scenarios.

Border Gateway Protocol (BGP)

Overview of the differences between IGP protocols and EGP. Definition of autonomous system, administrative domain. Assignment of a unique number by the IANA authority within the autonomous system. Path-vector algorithm. Formation of iBGP/eBGP neighbor relations. Basic configuration and troubleshooting of neighbor relationships and network advertisements in BGP.

Practice: BGP configuration exercises for various network scenarios.