



COURSE DESCRIPTION CARD - SYLLABUS

Course name

ICT network optimization [S2EiT1-SKiTi>OST]

Course

Field of study

Electronics and Telecommunications

Year/Semester

2/3

Area of study (specialization)

Computer Networks and Internet Technologies

Profile of study

general academic

Level of study

second-cycle

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

15

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

A student starting the subject should have a basic knowledge of the construction and operation of computer networks. In particular, he should know the basic protocols that ensure communication in the network (ARP, IPv4/IPv6, RIP, DHCP). He or she should also have the ability to obtain information from the indicated sources and have a willingness to cooperate as part of a team.

Course objective

To provide students with the basic knowledge of methods, technologies and protocols necessary to understand the network optimization process. To develop in students the ability to select and modify solutions and protocols to solve an optimization problem.

Course-related learning outcomes

none

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

none

Programme content

This subject presents selected solutions used to achieve optimal performance of computer networks. Topics covered include protocols, techniques and mechanisms used in TCP/IP networks.

Course topics

Część I. Sieci przełączane – VLAN i agregacja łączy

Wykład 1. VLAN i segmentacja sieci

- Koncepcja VLAN i segmentacja logiczna sieci
- Protokół VLAN Trunking Protocol (VTP)
- Dynamic Trunking Protocol (DTP)
- Diagnostyka problemów VLAN i trunków

Wykład 2. Agregacja łączy – EtherChannel

- Cele i zastosowania EtherChannel
- Metody negocjacji i konfiguracja
- Scenariusze wdrożeniowe i typowe problemy

Część II. Routing w sieciach IP

Wykład 3. OSPFv2 – podstawy

- Charakterystyka protokołu OSPF
- Konfiguracja OSPF w obszarze pojedynczym
- Rozgłaszanie trasy domyślnej

Wykład 4. OSPF – zagadnienia zaawansowane

- OSPF wieloobszarowy
- Typy LSA i wybór najlepszej ścieżki
- Sumaryzacja i filtrowanie tras

Wykład 5. OSPFv3

- Różnice pomiędzy OSPFv2 i OSPFv3
- Obsługa IPv6 oraz IPv4 w OSPFv3

Część III. Routing międzydomenowy

Wykład 6. BGP – podstawy

- Zastosowanie protokołu BGP
- Konfiguracja eBGP
- Sumaryzacja tras i obsługa IPv6

Wykład 7. BGP – zagadnienia zaawansowane

- Multihoming i redundancja połączeń
- Route-maps, listy ACL i BGP communities
- Proces wyboru najlepszej ścieżki

Część IV. Usługi IP i sieci nakładkowe

Wykład 8. Usługi sieciowe IP

- Synchronizacja czasu – NTP
- Protokoły redundancji pierwszego skoku (HSRP)
- Translacja adresów sieciowych NAT

Wykład 9. Tunele i sieci nakładkowe

- Tunele GRE
- IPsec – podstawy zabezpieczania ruchu
- Technologie LISP i VXLAN

Część V. Architektura i utrzymanie sieci

Wykład 10. Architektura sieci przedsiębiorstwa

- Model hierarchiczny sieci LAN
- Skalowalne architektury kampusowe

Wykład 11. Sieci programowo definiowane

- SD-Access – koncepcja i architektura
- SD-WAN oraz Cloud OnRamp

Wykład 12. Diagnostyka i monitorowanie sieci

- NetFlow
- SPAN, RSPAN i ERSPAN
- IP SLA oraz Cisco DNA Center Assurance

Część VI. Bezpieczeństwo infrastruktury sieciowej
Wykład 13. Kontrola dostępu i bezpieczeństwo sieci

- Architektura bezpieczeństwa Cisco SAFE
- Network Access Control (NAC)
- Bezpieczeństwo punktów końcowych

Wykład 14. Bezpieczeństwo urządzeń sieciowych

- Listy kontroli dostępu (ACL)
- AAA (RADIUS, TACACS+)
- Zone-Based Firewall
- Control Plane Policing (CoPP) i hardening urządzeń

Part I. Switched Networks – VLANs and Link Aggregation

Lecture 1. VLANs and Network Segmentation

- VLAN concepts and logical network segmentation
- VLAN Trunking Protocol (VTP)
- Dynamic Trunking Protocol (DTP)
- Troubleshooting VLAN and trunk configurations

Lecture 2. Link Aggregation – EtherChannel

- Purpose and use cases of EtherChannel
- Negotiation methods and configuration
- Deployment scenarios and common issues

Part II. IP Routing

Lecture 3. OSPFv2 Fundamentals

- Characteristics of the OSPF routing protocol
- Single-area OSPF configuration
- Default route advertisement

Lecture 4. Advanced OSPF

- Multiarea OSPF design
- LSA types and path selection
- Route summarization and filtering

Lecture 5. OSPFv3

- Differences between OSPFv2 and OSPFv3
- IPv6 and IPv4 support in OSPFv3

Part III. Interdomain Routing

Lecture 6. BGP Fundamentals

- Role of BGP in enterprise and Internet routing
- eBGP configuration
- Route summarization and IPv6 support

Lecture 7. Advanced BGP

- Multihoming and redundancy
- Route-maps, ACLs, and BGP communities
- BGP path selection process

Part IV. IP Services and Overlay Networks

Lecture 8. IP Network Services

- Time synchronization with NTP
- First Hop Redundancy Protocols (HSRP)
- Network Address Translation (NAT)

Lecture 9. Tunneling and Overlay Technologies

- GRE tunnels
- IPsec fundamentals
- LISP and VXLAN technologies

Part V. Enterprise Network Architecture and Operations

Lecture 10. Enterprise Network Architecture

- Hierarchical LAN design model
- Scalable campus network architectures

Lecture 11. Software-Defined Networking

- SD-Access concepts and architecture
- SD-WAN and Cloud OnRamp

Lecture 12. Network Monitoring and Troubleshooting

- NetFlow

- SPAN, RSPAN, and ERSPAN
- IP SLA and Cisco DNA Center Assurance

Part VI. Network Security

Lecture 13. Network Access Control and Security Architecture

- Cisco SAFE security architecture
- Network Access Control (NAC)
- Endpoint security concepts

Lecture 14. Network Device Security

- Access Control Lists (ACLs)
- Authentication, Authorization, and Accounting (AAA)
- Zone-Based Firewalls
- Control Plane Policing (CoPP) and device hardening

The following topics are covered during the labs:

1. Introduction. Virtual local area networks
2. Distributed VLANs.
3. Switching between VLANs.
4. Link aggregation techniques - Etherchannel.
5. Static routing
6. First Hop Redundancy Protocols (HSRP as an example).

Teaching methods

Lectures: depending on the topic discussed and the interest of the students, the lecture is conducted in one of three forms: traditional lecture (multimedia presentation supplemented by examples given on the blackboard), problem lecture (discussion with the students on the solution of a given problem), or conversational lecture (involving the students in the discussion, controlling the course of the lecture depending on the answers given, etc.).

Laboratory exercises: exercises are conducted in the laboratory of Huawei or Cisco Network Academy. During the course of the exercises, students perform tasks presented by the instructor, which involve the proper connection of devices switches, routers and computers) and configuration of network devices in accordance with the requirements of a given exercise .

Bibliography

none

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	58	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	42	2,00