Technology Arts Sciences
TH Köln

Course Manual NSA

Network Security and Automation

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─ General information

Long name	Network Security and Automation
Approving CModule	NSA_BaTIN, NSA_BaET
Responsible	Prof. Dr. Andreas Grebe Professor Fakultät IME
Valid from	winter semester 2022/23
Level	Bachelor
Semester in the year	summer semester
Duration	Semester
Hours in self-study	60
ECTS	5
Professors	Prof. Dr. Andreas Grebe Professor Fakultät IME

Literature

J. Kurose, K. Ross: Computernetzwerke - Der Top-Down-Ansatz, Pearson Studium, 6. Auflage, 2014

A. Tanenbaum: Computernetzwerke, Pearson Studium, 5. Auflage 2012

G. Schäfer: Netzsicherheit: - Grundlagen & Protokolle - Mobile & drahtlose Kommunikation - Schutz von Kommunikationsinfrastrukturen, dpunkt.verlag, 2. Auflage 2014

W. Stallings: Foundations of Modern Networking, Pearson Education, 2016

J. Doherty: SDN and NFV Simplified, Pearson Education, 2016

J. Edelman: Network Programmability and Automation, O'Reilly 2018

Internet-Standardisierung: IETF Standards (RFCs), www.ietf.org

LAN-Standards: IEEE, ieeexplore.ieee.org (freier Zugang über TH Köln)

Telekommunikationsstandards: ITU-T Standards, www.itu.int

Web-Standardisierung: W3C Standards, www.w3c.org

Final exam

Requirements	Knowledge and Competences of Module Networks and Protocols (NP) alternate requorements: knowledge and competences of IP networking courses or CCNA (ITN and RSE) Networking Fundamentals TCP/IP Protocol Family ISO/OSI Model and Protocols IPv4/IPv6 Addressing, Subnetting, and Routing Switching Techniques TCP/UDP Transport Techniques Application Protocols Network Implementation Competences (Client, Server, Switch, Router)
Language	German
Separate final exam	Yes

Details	In a final examination (written, optionally oral), the students demonstrate their competences in summary form. The exam comprises the following sub-areas, in which six taxonomy levels (reproduce, understand, apply, analyze, synthesize, and evaluate) are included. 1.) A good command of basic concepts, concepts and techniques. Typical tasks are multiple-choice questions, open questions, evaluation of statements regarding their correctness. 2.) Application of planning and valuation techniques. Typical tasks are planning tasks of networks or subsystems. 3.) Examination of proposed solutions for correctness, identification of errors in statements or given networks. Typical tasks include the analysis of given network architectures and system statements.
Minimum standard	Achievement of the individual minimum score per exam, typically 50% of maximum score.
Exam Type	EN Klausur

− Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	Fundamentals for the construction of hierarchically structured networks, corporate networks with redundancy techniques, wireless LAN (WLAN), cross-location communication, WAN techniques. Introduction to network security with details on attacks, security targets, cryptographic procedures, encryption, packet filters, secure infrastructures, virtual private networks. Introduction to distributed network management and service quality techniques. Techniques for network virtualization, software-defined networking and network automation.
Skills	Students acquire the skills to analyse medium-sized, cross-location corporate networks using suitable tools, to select suitable architectures and to plan and implement corresponding networks. They name and identify hazard situations for corporate networks. Suitable security mechanisms are to be selected, designed and implemented. Tasks and methods of software-controlled networks including virtualization are known and mechanisms for network automation are planned and implemented.

Special requirements

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Accompanying material	Online materials: Slides for the lecture Exercises sheets Tutorials for tools (e.g. Wireshark) Material collections such as IOS command list, ASCII character table Optional: Network simulator tool Cisco PacketTracer Optionally, participation in two Cisco Academy CCNA (Cisco Certified Network Associate) modules is possible. The contents of the CCNA 2 and CCNA 3 modules are then also available as material.
Separate exam	No

Knowledge	Excerpt of the contents:
	Hierarchical networks, redundancy, STP, EtherChannel, FHRP, Single-area and Multiarea OSPF, OSPF security technologies, WLAN, WAN connection, PPP, xDSL
	Network security with security goals, cryptographic methods, algorithms, packet filters, ACL, NAT, FireWall, DMZ, VPN, IPsec
	SNMP, Syslog, QoS - Quality of Service
	Software Defined Networking (SDN), SDN Controller, Cloud, Virtualization, Ansible, JSON, YAML, REST API

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	2
Exercises (shared course)	0
Tutorial (voluntary)	0

− Practical training

Learning goals

Goal type	Description
Knowledge	Identify, structure and classify concepts and technologies for medium-sized, cross-location corporate networks. Master network analysis techniques and tools, know network design steps and methods for network planning. Identify security-relevant network gaps and know suitable measures for network security and their implementation. Know the tasks of network automation and virtualisation and master their implementation for suitable network areas.
Skills	Planning, implementation and analysis of VLAN architectures, WLAN networks, cross-site VPN and packet filter firewall. Implementation and analysis of network management with SNMP and Syslog. Implementation and analysis of network automation on network elements (e.g. router, switch, host, SDN controller) via REST API with Phython scripting or Ansible YAML scripting.

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	1
Tutorial (voluntary)	0

Special requirements

ULP NP passed or comparable knowledge

Accompanying material	Online materials: Self-learning tasks Practical instruction per test date Tutorials for tools (e.g. Wireshark) Material collections such as IOS command list, ASCII character table RFC standards (www.ietf.org) Optional: Network simulator tool Cisco PacketTracer Optionally, participation in two Cisco Academy CCNA (Cisco Certified Network Associate) modules CCNA 2 and CCNA 3 is possible. The successful completion of the module-accompanying labs is recognized.
Separate exam	Yes

Separate exam

Exam Type	EN praxisnahes Szenario bearbeiten (z.B. im Praktikum)

Details	There are several lab dates with different tasks. The following tasks have to be completed for each date: Independent solution of the preparatory self-learning tasks (homework). Solution of the network design, implementation and analysis tasks in a small team (typically 2 students), if necessary with the help of assistance. Optional participation in Cisco Academy CCNA (Cisco Certified Network Associate) modules is possible. The successful completion of selected CCNA 1 and CCNA 2 labs is recognized for the internship.
Minimum standard	Successful participation in all lab dates, correct solution of all self-learning tasks and completion of all tasks of the lab date.