COURSE DESCRIPTION CARD - SYLLABUS

Course name
Security in data storage systems

Course

Field of study
computer science

Year/semester
1/2

Area of study (specialization)
Cybersecurity

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	15	
Tutorials	Projects/seminars	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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Prerequisites

Student should have basic knowledge on: IT systems, including operating systems, basics of computer networks. Student should have abilities for information accessing from given sources and should be prepared to work in a team.

Course objective

Providing students with knowledge on models, architecture (including SAN, cloud storage, virtualization) and operation of media (magnetic, optical, flash), devices and systems for longterm data storage with emphasis on data security. Providing students with skills related to storage systems modelling, designing and testing.

Course-related learning outcomes

Knowledge

1. Student has detailed knowledge on storage media structure and operation (including magnetic, optical, flash) and storage systems for longterm data storage

2. student has knowledge on models, architecture (including NAS, SAN, cloud storage), interfaces, buses and communication protocols (including FC, iSCSI) used in data storage systems

3. student has knowledge on vulnerabilities and threats related to longterm storage

4. student has knowledge on methods, tools and rules for stored data protection.

Skills

Student can:

- provide assumptions, concept and design for data storage system including solutions based on computer networks,

- perform analysis of structure and operation of longterm data storage system including security level analysis,

- fulfill requirements related to high data security level.

Social competences

Student understands that:

- one of the important IT system aspects is data protection,

- it is necessary to update knowledge about particular tools and systems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Theoretical knowledge is verified during 45-minute test performed last lecture. To achieve positive result student should get more than 50% of points. Test topics are provided to students by email at the beginning of the semester.

Practical skills are verified during classes (related to particular design phases) and by assessment of final project and its documentation.

Programme content

Lecture

1. Introduction – storage media classification and parameters (capacity, BER, efficiency, life time), including flash, magnetic, optical), logical data organization (formating , bad sectors, partitions, FAT, NTFS, HPFS). Barriers, trends and prospects of development.

2. Storage buses (ATA, SATA, SCSI, SAS, FC, NVMe, Infiniband). Communication protocols for network storage systems: iSCSI, FCIP, IFCP.

3. Magnetical storage media, magnetic writing, data organization. Magnetic disks. Tape storage (helical, linear modes), standards (QIC, DLT, SDLT, LTO).

4. Optical storage media (technology, data coding, data organization), standards (CD, DVD, Blu-ray, holography).

5. Solid state storage media (flash, SSD).

6. Vulnerabilities and threats related to longterm storage systems. General description of tools, methods and rules of protection.

7. Backup. Backup schemas, backup servers, HSM (Hierarchical Storage Management), ILM, deduplication.

8. Storage system virtualization. Massive storage in computer networks (NAS, SAN, VSAN). IP storage. Cloud storage: models (including object storage model), examples (including Amazon Simple Cloud Storage Service). Cloud storage security.

9. Media durability and system reliability. Reliability metrics (MTBF, BER, RTO, RPO). Irreversible data deletion

10. Cryptography in storage systems (hard disk encryption, cloud storage encryption, flash encryption).

11. Current problems and trends.

Laboratory

Concept of a secure, network data storage system for the selected environment (company or institution). Analysis of the selected environment, assumptions and requirements for the designed system, with particular emphasis on security aspects, i.e. confidentiality, integrity and accessibility. Selection of the appropriate system architecture, protocols, network devices, software, backup, archiving and permanent data deletion in the designed system. Preparation of documentation for the designed system (including costs). System security assessment. Inclusion in the project of the latest technologies in the field of data protection and applicable legal provisions regarding data processing.

Teaching methods

Interactive lecture (with questions for students) with a use of multimedia presentation. Files with slides provided to students. Elearning.

Project in the form of consultation and verification of each design phases. Tasks performed in teams of 2 students with a use of computer hardware, software and Internet.

Bibliography

Basic

T. Bilski, Pamięć: nośniki i systemy przechowywania danych, WNT, Warszawa, 2008 (in Polish, PUT Library signature: W 119644).

J. W. Toigo, Zarządzanie przechowywaniem danych w sieci, Helion, Gliwice, 2004 (in Polish, PUT Library signature: W 109697).

S. Nelson, Profesjonalne tworzenie kopii zapasowych i odzyskiwanie danych, Helion, 2012 (in Polish, PUT Library signature: W 135831).

Additional

Z. Fryźlewicz, D. Nikończuk, Windows Azure. Wprowadzenie do programowania w chmurze, Helion, 2012 (in Polish).

P. Metzger, A. Jełowicki, Anatomia PC, Wyd. Helion, Gliwice, 1998 (in Polish)

F. Schmidt, SCSI i IDE. Protokoły, zastosowania i programowanie, Mikom, 1999 (in Polish).

T. Bilski, Quantitative Risk Analysis for Data Storage Systems, 20th International Conference, CN 2013 Proceedings, [A. Kwiecień, P. Gaj, P. Stera, Editors] Communications in Computer Science and Information Science 370, Springer Verlag, Heidelberg, 2013, s. 124-135.

T. Bilski, Network Storage Systems with IPSec Implementations, Information Systems Architecture and Technology, Networks Design and Analysis, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2012, 127-136

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4
Classes requiring direct contact with the teacher	45	2
Student's own work (literature studies, elearning, preparation for test, laboratory, project and documentation preparation)[1]	55	2

[1] delete or add other activities as appropriate