PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

**MINISTRY OF HIGHER EDUCATION
AND SCIENTIFIC RESEARCH**

AMENDMENT TEMPLATE

MASTER'S COURSES

ACADEMIC

Institution	Faculty / Institute	Department
Mohamed Seddik Benyahia University Jijel	**Faculty of Exact Sciences and Computer Science**☐	**Computer science**

Domain: Mathematics and Computer Science

Branch: Computer Science

Specialization: Networks and Security (R&S)

Academic year: 2016 - 2017

<div dir="rtl">

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

نموذج تعديل

عرض تكوين ماستر

أكاديمي

القسم	الكلية/ المعهد	المؤسسة
الإعلام الآلي	العلوم الدقيقة والاعلام الالي	جامعة محمد الصديق بن يحي جيجل

الميدان : رياضيات و إعلام آلي

الشعبة : إعلام آلي

التخصص : الشبكات و الأمن

السنة الجامعية: 2016 / 2017

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SOMMAIRE

I – Master's profile: Networks and Security

1 - Training location :

Faculty (or Institute) : Exact Sciences and Computer Science
Department: Computer Science

2- Training partners * :

- Other academic institutions: None

- Companies and other socio-economic partners:

  1. Mohammed Seddiki ben Yahia Hospital, Jijel.

  2. Wilaya de Jijel Transport Department

  3. Entreprise Portuaire de Jijel

  4. Power Plant, Jijel

  5. CNAS, Jijel

  6. Algérie Télécom, Jijel

  7. Mobilis, Jijel

  8. OPGI of Jijel

  9. Caisse Nationale des Retraites (CNR)

  10. Jijel wilaya security force

  11. Algerian Qatari Steel (AQS), Jijel

- International partners: None

* = Present agreements as an appendix to the training course

3 – Training context and objectives

A – Access conditions

Admission to the first year of the Networks and Security Master's program is open to candidates holding a bachelor's degree (LMD) in computer science or another diploma recognized as equivalent.

B - objectives

This course provides students with in-depth knowledge of computer networks and cybersecurity.

In the area of computer networks, this training will broaden the spectrum of knowledge to include :

- The different network architectures, communication protocols, network infrastructures and emerging technologies associated with modern networks.
- New techniques for modeling and evaluating the performance of different network architectures,
- In-depth knowledge of network development, configuration and administration methods,
- New methods for implementing and testing computer networks,
- Classic and recent artificial intelligence techniques,

In terms of cybersecurity, the knowledge acquired will enable the holder to :

- Understand the various attack and intrusion techniques used on networks and computer systems
- Learn how to analyze threats, protect systems and data, and implement advanced cybersecurity mechanisms.
- Master new cryptographic techniques to protect information and data during transmission.

C – Business profiles and skills

On completion of this course, there are two possible outlets:

- Enter the world of network and security research.
- Putting the knowledge acquired into practice for the benefit of the job market. In an age when material technologies are within everyone's reach, competitiveness is measured by the added value of services, and by making the right decisions at the right time. As such, the Master's degree holder can contribute by :

- Analysis and development of computer networks and systems using a quality approach and proven techniques,
- Develop solutions (modeling, implementation and operation).

D- Regional and national potential for graduate employability

This Master's degree is based on research, and offers both professional and academic opportunities. Students graduating with this Master's degree will fit naturally into :

- Corporate functional departments,
- Consulting firms,
- Research centers and laboratories,
- Higher education, with the possibility of preparing a doctorate at the University of Jijel or another institution,
- Companies and startups specializing in networks and cybersecurity.

E – Gateways to other specialties

- Master in Computer Science
- Master in Telecommunications

F – Training follow-up indicators

The student will be assessed in two ways:

- - Final exam at the end of each semester

- - Continuous assessment (written tests, practical work, presentations, participation, etc.).

The final exam lasts 01h30 and is marked out of 20 points. Continuous assessment will include: tutorials, practical work, attendance, presentations and personal work.

The final average for the subject concerned will be calculated as follows:

$$\text{Subject average} = 0.6 \times \text{Final exam} + 0.4 \times \text{Continuous assessment average}$$

A make-up session will also be organized for students who have failed in the regular session.

G – Capacity: 25 students

5 – Specific equipment available

A- Teaching laboratories and equipment : List of existing teaching equipment for the practical work involved in the proposed course (1 list per laboratory).

Laboratory name :

N°	Equipment name	Number	comments
1	Practical training rooms (20 microcomputers each)	**09**	
2	Internet rooms	**04**	
3	Tele-education room	**01**	
4	Videoconferencing room	**01**	
5	Language Lab	**01**	

B- Internships and on-the-job training :

Place of training	Number of students	Length of internship
JIJEL Hospital	3	3 months
CNAS -Jijel	2	3 months
Algerian Qatari Steel	4	3 months
Algérie Télécom. JIJEL	2	3 months
JIJEL Port Company	2	3 months
Wilaya departments	4	3 months
Caisse National de Retraite	2	3 months
OPGI -Jijel	2	3 months
Power plant -Sonelgaz Jijel	4	3 months

C- Personal workspaces and ICT :

- A 1,200-seat reading room in the faculty library and a large room in the central library with over 3,000 seats.

- A search block.

- Rooms with office PCs.

- Internet rooms.

- Tele-education rooms.

- Language laboratory

- videoconferencing room

II – Semester organization chart

1- Semester 1 :

Teaching Unit	SHV 14-16 wks	Weekly Hours Volume				Coeff	Credits	Evaluation mode	
		C	TD	TP	Other			Continuous	Exam
Fundamental TU									
FTU1 :		**3h**	**3h**	**1h30'**		**5**	**10**		
Networks and protocols		1h30'	1h30'	1h30'		3	6	YES	YES
Distributed systems		1h30'	1h30'	--		2	4	YES	YES
FTU2 :		**3h**	**3h**	**--**		**4**	**8**		
Cryptography		1h30'	1h30'	--		2	4	YES	YES
Information theory		1h30'	1h30'	--		2	4	YES	YES
Methodology TU									
MTU1 :		**3h**	**3h**	**1h**		**5**	**9**		
Algorithm with guaranteed performance		1h30'	1h30'	1h		3	5	YES	YES
Data mining and extraction		1h30'	1h30'	--		2	4	YES	YES
Discovery TU									
DTU1 :		**1h30'**	**--**	**1h30'**		**2**	**2**		
Architecture for intelligent computing systems		1h30'	--	1h30'		2	2	YES	YES
Cross-cutting TU									
CCTU1 :		**1h30'**	**--**	**--**		**1**	**1**		
English I		1h30'	--	--		1	1	--	YES
Total Semester 1	**360h**					**--**	**30**	**--**	**--**

2- Semestre 2 :

Teaching Unit	SHV	Weekly Hours Volume				Coeff	Credits	Evaluation mode	
	14-16 wks	C	TD	TP	Other			Continuous	Exam
Fundamental TU									
FTU3 :		**3h**	**3h**	**1h30'**		**5**	**10**		
Advanced networking		1h30'	1h30'	1h30'		3	6	YES	YES
Distributed databases		1h30'	1h30'	--		2	4	YES	YES
FTU4 :		**3h**	**1h30'**	**1h30'**		**4**	**8**		
Security protocols		1h30'	1h30'	--		2	4	YES	YES
System vulnerabilities		1h30'	--	1h30'		2	4	YES	YES
Methodology TU									
MTU2 :		**3h**	**1h30'**	**2h30'**		**5**	**9**		
Performance evaluation		1h30'	1h30'	1h		3	5	YES	YES
Networks and multimedia flows		1h30'	--	1h30'		2	4	YES	YES
Cross-cutting TU									
CCTU2 :		**3h**	**--**	**1h30'**		**3**	**3**		
Technical Reports		1h30'	--	1h30'		2	2	--	YES
English II		1h30'	--	--		1	1	--	YES
Total Semester 2						--	30	--	--

3- Semestre 3 :

Teaching Unit	SHV 14-16 wks	Weekly Hours Volume C	TD	TP	Other	Coeff	Credits	Evaluation mode Continuous	Exam
Fundamental TU									
FTU5 :		**3h**	**1h30'**	**3h**		**5**	**10**		
System and network security administration		1h30'	--	1h30'		2	4	YES	YES
Virtualization and cloud computing		1h30'	1h30'	1h30'		3	6	YES	YES
FTU6 :		**3h**	**--**	**3h**		**4**	**8**		
Internet Application Systems and Protocols		1h30'	--	1h30'		2	4	YES	YES
Web services		1h30'	--	1h30'		2	4	YES	YES
Methodology TU									
MTU3 :		**3h**	**--**	**2h30'**		**5**	**9**		
Simulation and emulation of networked systems		1h30'	--	2h30'		3	5	YES	YES
Methodology and evaluation of IT systems		1h30'	1h30'	--		2	4	YES	YES
Cross-cutting TU									
CCTU3 :		**3h**	**1h30'**			**3**	**3**		
Project management and entrepreneurship		1h30'	1h30'			2	2	--	YES
Corruption and work ethics		1h30'				1	1	--	YES
Total Semester 3						**--**	**30**	**--**	**--**

4- Semester 4 :

Domain : **Mathematics & Computer Science**
Branch : **Computer Science**
Specialization : Networks & Security

End-of-study project culminating in a dissertation and oral presentation

	SHV	Coeff	Credits
Personal work	170	6	12
Practical training	210	9	18
Seminars	/	/	/
Other	/	/	/
Total Semester 4	390	15	30

5- Overall summary of training: (indicate the overall HV separated into courses, TD, for the 04 teaching semesters, for the different types of TU)

HV \ TU	FTU	MTU	DTU	CCTU	Total
Courses	270	135	22.5	112.5	540
TD	180	90	22.5	45	337.5
TP	157.5	90	/	/	247.5
Personal work	90	45	/	45	180
Internship	/	210	/	/	210
Total	697.5	570	45	202.5	1515
Credits	57	27	2	7	**120**
% in credits for each TU	60%	30%	2.22%	7.78%	

III - Detailed program by subject

Master's title: Networks and Security
Semester: 1
TU Title : FTU1
Subject title: Networks and
Credits: 6
Coefficients: 3

Objective

The aim of this course is to consolidate fundamental knowledge of computer networks, with particular emphasis on the OSI and TCP/IP reference models. It aims to deepen understanding of IP addressing, covering IPv4, IPv6 and transition strategies between these two versions. In addition, it explores in detail the protocol suite of the TCP/IP stack and the main routing protocols, providing students with the essential foundations for designing, configuring and securing efficient networks.

Recommended prior knowledge

Basic knowledge of computer networks covered in undergraduate courses.

Contents

I. A reminder of the fundamental concepts of computer networks.
    - Communication media and types of physical media.
    - Interconnection equipment: hub, switch, router, gateway, etc.
    - Network topologies and architecture.
    - Network classification: PAN, LAN, MAN, WAN.
    - OSI and TCP/IP reference models.
    - Intranet, extranet and internet.
    - Types of network addressing: physical addressing (MAC), logical addressing (IP), application addressing (port number), socket.
II. IP addressing.
    - Reminder of IPv4 addressing.
    - Principles and operation of IPv6 addressing.
    - IPv4 to IPv6 transition method.
III. TCP/IP protocol stack.
    - Network access layer protocols: Ethernet, Token Ring.
    - Internet layer protocols: IP, ARP/RARP, ICMP.
    - Transport layer protocols: TCP, UDP.
    - Application layer protocols: HTTP, FTP, DNS, DHCP, IMAP, PoP, SMTP.
IV. IP routing mechanisms and techniques.
    - Routing fundamentals.
    - Types of routing protocols.
    - Static and default routing.
    - Dynamic routing: distance vector protocols (RIP, IGRP), link-state protocols (IS-IS, OSPF), inter-domain routing protocols (BGP).
    - Multicast routing: PIM, DVMRP, IGMP.

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- PUJOLLE .G, Cours Réseaux et télécoms avec exercices corrigés, éditions EYROLLES.
- TANENBAUM .A, Réseaux, PEARSON EDUCATION editions
- PHILIPP .J, L'architecture des réseaux TCP/IP services - utilisations - implémentation - administration - sécurité. éditions ELLIPSES
- Forouzan, B.A. (2000). TCP/IP: Protocol Suite, 1st ed. New Delhi, India: Tata McGraw-Hill Publishing Company Limited.
- Cisco Systems (1999). IP routing fundamentals. Cisco Press.

Master's title: Networks and Security
Semester: 1
TU Title : FTU1
Subject title: Distributed systems
Credits: 4
Coefficients: 2

Objective

Introduce the problem of parallelism in operating systems and study the implementation of synchronization and mutual exclusion mechanisms in a distributed environment.

Recommended prior knowledge

Notions of operating systems seen in the license.

Contents

I. Introduction to parallel architectures.
  - Architecture and typology with a shared memory
  - Distributed memory architecture and typology + Architecture examples

II. General information on distributed systems
  - Notion of Distributed Operating System
  - Case studies: LOCUS; CHORUS; GIDE...

III. Fundamental problems in distributed systems + maintaining a global invariant
  - Mutual exclusion
  - Resource management: distributed producer/consumer
  - Inter-process synchronization and distributed rendezvous + Observation of a distributed calculation
  - Overall condition calculation
  - Evaluation of global predicates
  - Interlocking, termination+ Network paths
  - Diffusion of information in a network and calculation of a spanning tree; parallel diffusion and token diffusion + notion of process election in a distributed system

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

  - J.P. VERJUS et al " Synchronisation des programmes parallèles- Expression et mise en œuvre dans les systèmes centralises et distribués " BORDAS, 1983
  - M. RAYNAL "Systèmes repartis et réseaux: concepts, outils et algorithmes" EYROLLES, 1987
  - M. RAYNAL "Algorithmique du parallélisme: le problème de l'exclusion parallèle" DUNOD, 1984

Master's title: Networks and Security
Semester: 1
TU Title : FTU2
Subject title: Cryptography
Credits: 4
Coefficients: 2

Teaching objectives

Deepen your knowledge of cryptographic concepts, with a focus on the various encryption, digital signature and authentication techniques, as well as the various cryptanalysis methods associated with them.

Recommended prior knowledge

Basic knowledge of mathematics, and notions of classical cryptography seen in undergraduate courses

Contents

I. Classic cryptographic techniques
   - Monoalphabetic: Caesar, Playfair, Hill
   - Polyalphabetic: Vigenère
   - Transposition

II. Cryptanalysis of classical cryptography
   - Cryptanalysis by exaustive key search:
   - Linear cryptanalysis:
   - Cryptanalysis using frequency analysis
   - Limits of frequency analysis

III. Modern cryptographic techniques (DES, Fiestel encryption, S-DES, etc.)

IV. DES (Data Encryption Standard)

V. Contemporary symmetric encryption algorithms
   - DES variants (double and triple)
   - IDEA, Blowfish, RC5 and CAST

VI. BLOCK encryption operating modes (DCB, CBC, CFB, OFB)

VII.   Public key cryptography (RSA, ...)

Evaluation methods: Continuous assessment, examination,

Reference

   - Menezes, A. J., van Oorschot, P. C., & Vanstone, S. A. (1996). Handbook of Applied Cryptography. CRC Press.
   - Boneh, D., & Shoup, V. (2020). A Graduate Course in Applied Cryptography. Draft.
   - Goldreich, O. (2004). Foundations of Cryptography, Volumes 1 & 2. Cambridge University Press.

Master's title: Networks and Security
Semester: 1
TU Title : FTU2
Subject title: Information theory
Credits: 4
Coefficients: 2

Objective

Understand the fundamental concepts of information theory, such as entropy, compression and error-correcting codes, and their use in optimizing message transmission to ensure data integrity in the presence of noise.

Recommended prior knowledge

Basic knowledge of mathematics and number theory.

Contents

I. Foundations of information theory
    - Definitions and basic concepts (information, entropy, redundancy)
    - Shannon entropy and information measurement
    - Mutual information and channel capacity
    - Fundamental theorems of information theory

II. Information coding and data compression
    - Lossless coding: Huffman, Shannon-Fano and arithmetic codes
    - Variable-length coding and optimality of prefix codes
    - Data compression : Lempel-Ziv (LZ77, LZ78) and applications

III. Coding for reliable data transmission
    - Channel coding: necessity and general principles
    - Error detection and correction codes (Hamming, BCH, Reed-Solomon)
    - Convolutional and turbo codes
    - Applications to communication networks and data storage

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Gérard Battail, Théorie de l'Information, Masson, 1997.
- Richard E. Blahut, Digital Transmission of Information, Addison-Wesley, 1990.
- Birth of information theory: Author: Léon Brillouin (1889-1969)
- Théorie des codes ; Compression, cryptage, correction ; Jean-Guillaume Dumas, Jean-Louis Roch, Eric Tannier, Sébastien Varrette Collection: Sciences Sup, Dunod ; 2007

Master's title: Networks and Security
Semester: 1
TU Title : MTU1
Subject title: Algorithm with guaranteed performance
Credits: 5
Coefficients: 3

Objective

Solve complex optimization problems in various fields, including networking, cybersecurity and artificial intelligence, using both classical methods and meta-heuristics inspired by nature, such as evolutionary algorithms and methods based on collective intelligence.

Recommended prior knowledge

Basics of mathematics, functional analysis and algorithms

Contents

I. Approximation algorithms for scheduling, bin packing, multi-cutting, connectivity, classification, set coverage, warehouse localization, SAT.

II. Approximation algorithms for geometric problems (travelling salesman, Steiner tree, minimum weight triangulation, p-centers).

III. Approximation algorithms for bioinformatics problems: shortest common out-sequence and phylogenetic trees.

IV. Linear programming and the primal-dual method in approximation algorithm design.

V. Various notions of approximation.

VI. Randomized algorithms with guaranteed performance.

VII. Online algorithms: pagination and k-servers.

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- P. Siarry, Meta-heuristics: Simulated annealing, tabu search, variable neighborhood search, GRASP methods, evolutionary algorithms, artificial ants, particle swarms and other optimization methods, Eyrolles, 2014.
- E. D. Taillard, Design of Heuristic Algorithms for Hard Optimization, Series: Graduate Texts in Operations Research, Springer International Publishing, 2023.
- S. Mirjalili, A. H.Gandomi, "Comprehensive Metaheuristics: Algorithms and Applications Elsevier Science, 2023.

Master's title: Networks and Security
Semester: 1
TU Title : MTU1
Subject title: Data mining and extraction
Credits: 4
Coefficients: 2

Objective

Study the different data mining techniques and algorithms used to extract useful knowledge from large quantities of information and data, as well as the different stages in the data mining process, from data pre-processing and exploration to the application of classification, clustering and association algorithms.

Recommended prior knowledge

Basic Linear Algebra, Probability and Statistics

Contents

I.   Introduction (Data mining, Data warehousing)

II. Overall data mining process ;

III. Main models ;

IV. Decision trees ;

V.   Association rules ;

VI. Bayesian networks ;

VII.   Advanced classification models ;

VIII.   Validation of the quality of knowledge ;

IX. From extraction to knowledge management. Practical work on R and SAS.

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Nagabushna Sujihal: Data warehousing OLAP and Data mining. New Age International Pvt Ltd Publishers, 2008
- Alex Berson, Stephen J. Smith: data Warehousing, Data mining, & OLAP Edition Tata McGraw Hill, 2005
- Saporta G. Probabilités, analyse des données et statistique. Technip Paris, 1990
- Hans-Hermann Bock, Edwin Diday (January 2000): Analysis of Symbolic Data.Exploratory methods for extracting statistical information from complex data. Springer Verlag, Heidelberg, 425 pages, ISBN 3-540-66619-2. (Second edition)

Master's title: Networks and Security
Semester: 1
TU Title : DTU1
Subject title: Architecture for intelligent computer systems
Credits: 2
Coefficients: 2

Objective

Introduces the architecture of autonomous and adaptive systems and their platforms in intelligent environments. It covers concepts, standards, approaches, notations, methods and tools.

Recommended prior knowledge

AI basics

Contents

I. Multi-agent systems (MAS)
- Agents (definition, structure of intelligent agents, agent models)
- Concrete agent architecture (logical, reactive, BDI, hybrid)
- Multi-Agent Systems (MAS, environment, granularity, interactions in MAS, applications of agents and multi-agent systems).
- Multi-agent systems development platforms

II. Mobile agents
- Mobile agents (Definition, Principles and Characteristics, Structure, Process migration, Security)
- Example of mobile agent systems (Agent Tel, Agent Aglet from IBM)
- Mobile agents and the Client/Server model
- Mobile Agent-based distributed system infrastructure
- Application areas (Information retrieval, E-commerce)

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Jacques Ferber - Multi-agent systems: Vers une intelligence collective, InterEditions, 1995
- Jean-Pierre Briot, Yves Demazeau - Principles and architectures of multi-agent systems, Hermes, 2000
- Mandiau, R., Grislin-le Strugeon, E., Péninou, A. - Organisation et applications des SMA, Hermes, 2002
- Shen W., Norrie D. H., Barthès J-P. - A Multi-Agent Systems for Concurrent Intelligent Design and Manufacturing,Taylor and Francis, 2001
- Hela Hachicha, Pr Khaled Ghedira, Dr Adlen Loukil, Conception Et Implementation Des Agents Mobiles SurLa Base D'Uml , Editions Universitaires Europeennes, 2010.

Master's title: Networks and Security
Semester: 1
TU Title : CCTU1
Subject title: English I
Credits: 1
Coefficients: 1

Objective

Learn to use the English language to read specialized IT magazines and write documents and reports.

Contents

Use scientific documents and articles to study technical English and the essential terminology.

Assessment method: Examination

References (books and handouts, websites, etc.).

- Current events documents.
- Scientific articles in the field.

Master's title: Networks and Security
Semester: 2
TU Title : FTU3
Subject title: Advanced networks
Credits: 6
Coefficients: 3

Objective

Consolidate fundamental knowledge of advanced networks, such as wireless, cellular and ad hoc networks, with a detailed exploration of next-generation networks, including software-defined networks (SDN). Together, these concepts will enable students to design, configure and secure modern, scalable networks.

Recommended prior knowledge

Computer network architectures

Contents

I. Fundamentals of wireless networks
- Wireless communication media: electromagnetic waves, modulation and demodulation
- Wireless media access techniques (CSMA/CD, CSMA/CA)
- Wireless multiple channel access methods (FDMA, TDMA, CDMA, OFDMA)
- Wireless network classification (WPAN, WLAN, WMAN, WWAN)
- Overview of wireless communication technologies: Bluetooth, NFC, ZigBee, Wi-Fi, WiMax, satellite networks, etc.

II. Wireless cellular networks
- Definition and architecture (base station, mobile terminal, BSC, BSS, MSC)
- Cell division and frequency reuse
- Mobility management (handover and roaming)
- Evolution of cellular mobile network generations (1G, 2G, 3G, 4G, 5G)

III. Ad Hoc mobile wireless networks
- Mobile ad hoc networks (MANETs): definition, architecture, characteristics, challenges, fields of application, routing protocols
- Wireless Sensor Networks (WSNs): definition, sensor anatomy, architecture, characteristics, challenges, application areas, routing protocols
- Vehicular ad hoc networks (VANETs): definition, components, intelligent vehicles, communication modes (V2V, V2I, V2X), deployment environments (urban, rural, highway), services (road safety, traffic management, entertainment), characteristics and challenges, communication technologies (DSRC, WAVE, C-V2X).
- UAV ad hoc networks (FANETs): definition, anatomy and types of UAV, architecture, communication modes (U2U, U2I, U2X), characteristics and challenges, fields of application

IV. Software-defined networking (SDN)
- From traditional networks to SDN networks
- Software-defined network definition and architecture

- OpenFlow standard: concepts, architecture and operation
- SDN features and challenges
- SDN applications and use cases
- Network functions virtualization (NFV)
- Emerging SDN technologies : Network Slicing and SD-WAN

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Guy Pujolle: "Les réseaux" Edition 2008 Eyrolles.
- Aurélien Géron: "WiFi professionnel : La norme 802.11, le déploiement, la sécurité" Dunod.
- Nadège Faggion " Le GPRS : Du WAP à l'UMTS " Dunod 2002.
- Fabrice Le Fessant and Jean-Marie Thomas "Peer-to-peer: Comprendre et utiliser" Eyrolles May 2006
- Rao, GottapuSasibhushana. Cellular Mobile Communication. India, Pearson Education India, 2012.
- Chai Keong Toh. Ad Hoc Mobile Wireless Networks. United States: Prentice Hall Publishers, 2002.
- Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach, 1st Edition,(Packt publishing Ltd.) Elseiver Inc, October 2013 (ISBN-13:978-0124166752).

Master's title: Networks and Security
Semester: 2
TU Title : FTU3
Subject title: Distributed databases
Credits: 4
Coefficients: 2

Objective

Learn the concepts, architectures and techniques of distributed and federated database management, in order to acquire the skills needed to design, administer and optimize distributed database management systems, taking into account consistency, availability and performance constraints

Recommended prior knowledge

Notions of databases and systems

Contents

I.   Introduction: Distribution & Federation

II. Distributed databases
   - Major problems
   - Horizontal fragmentation
   - Evaluation and optimization of distributed queries

III. Federated databases
   - 2BC integration procedure: handling semantic heterogeneity, schema translation, schema integration
   - Cases of conflict in l?integration
   - Reference architecture

IV. Distributed data access
   - RDA, DRDA, SQL-CLI, ODBC, JDBC
   - Distributed views and distributed DBMS

V.   Replication
   - Replication objectives
   - Replication modes

Evaluation methods: Continuous assessment, examination,

References

   - Gardarin G., "Bases de données objet et relationnel", Ed. Eyrolles, 1999
   - zsu, M. T., & Valduriez, P. (2020). Principles of Distributed Database Systems (4th ed.). Springer
   - Stefano Ceri, Giuseppe Pelagatti, "Distributed Databases: Principles and Systems", McGraw-Hill College (January 1, 1984)

Master's title: Networks and Security
Semester: 2
TU Title : FTU4
Subject title: Security protocols
Credits: 4
Coefficients: 2

Objective

The course provides an in-depth understanding of the essential concepts of network security protocols, starting with the mathematical foundations of modular arithmetic and covering encryption (callback), hashing and digital signature mechanisms. The course examines authentication protocols, key management, digital certificates and Public Key Infrastructure (PKI), as well as their implementation in technologies such as IPsec, TLS and VPNs. On completion of the course, students will be able to apply best practices to secure modern networks.

Recommended prior knowledge

Basic knowledge of networks and cryptography.

Contents

  I. Cryptographic foundations
   - Modular arithmetic
   - Cryptographic algorithms
   - Digital signatures

  II. Authentication

  III. Key management

  IV. Digital certificates and PKI

  V. Secure communication protocols

  VI. VPN

Evaluation methods: Continuous assessment, examination,

References

   - Cryptography and Network Security: Principles and Practice, William Stallings, Publisher: Pearson Education, 2022.
   - Understanding Cryptography: A Textbook for Students and Practitioners, Christophe Paar and Jan Pelzl, Publisher :Springer, 2010.
   - Security Engineering: A Guide to Building Dependable Distributed Systems, Ross Anderson, Publisher :Wiley, 2020.

Master's title: Networks and Security
Semester: 2
TU Title : FTU4
Subject title: System vulnerabilities
Credits: 4
Coefficients: 2

Objective

Understand the various attack and intrusion techniques and their consequences on information systems, as well as mastering and acquiring the concepts and techniques of security architectures and methods deployed in the TCP/IP world.

Recommended prior knowledge

Basic knowledge of computer networks, programming and scripting.

Contents

I. General information on computer system security
- IT security objectives
- Origin of attacks
- Attack objectives, motivations and targets
- Security policy

II. Malware programs
- Virus
- Worms
- Trojan horses
- Other malware (spyware, ransomware, botnets, keyloggers, rootkits, ...)

III. Network vulnerabilities
- ARP vulnerabilities (ARP spoofing, ARP flooding)
- IP vulnerabilities (IP spoofing, Teardrop, tinyfragments)
- ICMP vulnerabilities (Smurffing, Redirect, Ping of death, Time exceeded)
- TCP vulnerabilities (TCP hijacking, SYN flooding)
- DHCP vulnerabilities (DHCP spoofing, DHCP flooding
- DNS vulnerabilities (DNS ID Spoofing, DNS cache poisoning)

IV. Application vulnerabilities
- Buffer Overflow
- Stack Smashing
- Format chains
- C formatting functions

Evaluation methods: Continuous assessment, examination,

References

- Solange Ghernaouti "Cybersécurité - Analyser les risques, mettre en oeuvre les solutions", 7th edition, Dunod 2022.
- Franck Ebel, "Sécurité informatique, ethical hacking - Tester les types d'attaques et mettre en place les contre-mesures", 4th edition, Epsilon 2018.

Master's title: Networks and Security
Semester: 2
TU Title : MTU2
Subject title: Performance evaluation
Credits: 5
Coefficients: 3

Objective

The aim of this course is to introduce the various concepts involved in quantitative and qualitative modeling.

Recommended prior knowledge

Fundamental mathematics, probability and statistics.

Contents

I. Modeling tools

II. Quantitative modeling
- Discrete Markov chains
- Continuous Markov chains
- Fish process
- Processes of birth and death
- Single queues
- Open and closed queuing networks

III. Qualitative modeling
- Petri nets
- Stochastic Petri nets

Evaluation methods: Continuous assessment, examination,

References

- Bruno Baynat, Thiérie des queues d'attente, Hermès - Lavoisier 2000.
- G. Pujolle, S. Fdida, Modèles de systèmes et réseaux, Tome 1 et 2, Eyrolles, Paris 1999.
- Ruegg, Processus stochastiques, vol.6, Presses polytechniques et universitaires, Romande, 1989.

Master's title: Networks and Security
Semester: 2
TU Title : MTU2
Subject title: Networks and Multimedia flows
Credits: 4
Coefficients: 2

Teaching objectives :

The aim of this course is to highlight the issues raised by the storage and distribution of multimedia data. Multimedia applications are covered (quality of service, different ways of broadcasting multimedia streams, Internet telephony (VoIP), etc.).

Recommended prior knowledge:

Basics of data coding, networks and TCP/IP protocol.

Contents

    I. A reminder of data coding and compression

    II. Applications for editing, coding and compressing sound, voice, images and video

    III. Multimedia network applications

    IV. Quality of service (QoS: InServ, DiffServ)

    V. Congestion and congestion control

    VI. Multicast broadcasting and multicast routing (IGMP, DVMRP, MOSFP, PIM)

    VII.   Real-time constraints on an asynchronous network: streaming and streaming servers

    VIII.   Internet television service (IPTV), VoIP (RTP, RTCP, SIP)

Evaluation methods: Continuous assessment, examination

References

- Jean-Guillaume Dumas, Jean-Louis Roch, Eric Tannier, Sébastien Varrette "Théorie des codes ; Compression, cryptage, correction", Collection: Sciences Sup, Dunod, 2007.
- Alain Trémeau, Christine Fernandez-Maloigne and Pierre Bonton "Image numérique couleur; De l'acquisition au traitement - Cours et applications", Dunod 2004.
- Olivier Hersent, David Gurle and Jean-Pierre Petit "L'essentiel de la voIP Dunod, July 2005.
- Sébastien Déon "VoIP and ToIP - Asterisk ; IP telephony (design, installation, configuration, deployment...)". 2007.
- Olivier Hersent, David Gurle and Jean-Pierre Petit "La VOIX sur IP", Dunod 2006.

Master's title: Networks and Security
Semester: 2
TU Title : CCTU2
Subject title: Technical Reports
Credits: 2
Coefficients: 1

Objective

The course covers two main aspects: one concerns the reading of technical documents, the other is linked to their writing. Students will learn how to analyze a scientific document and compare it with other content in the same field. They will also learn how to write and present high-quality manuscripts.

Contents

I.   Reading a technical report
- Analysis of technical scientific content
- Comparison methods

II. Writing a scientific document
- Using LATEX
- Creating and managing bibliographies with LATEX
- Document creation with LATEX
- Creating a presentation with LATEX

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- L. Chan-Sun. LaTeX Tutorial, June 2004. http://www. supinfo-projects.com/en/2004/latex/.
- T. Nemeth. Course document on the use of Latex2e, Dec. 2000. http://www.commentcamarche.net/ccmdoc/index.php3?Mot=latex.
- C. Rolland. LaTeX par la pratique. O'Reilly, 1999. ISBN 2841770737.

Master's title: Networks and Security
Semester: 2
TU Title : CCTU2
Subject title: English II
Credits: 1
Coefficients: 1

Objective

Improve English language skills, particularly translation and comprehension of scientific texts

Contents

Study IT technical English

Evaluation method: Examination

Master's title: Networks and Security
Semester: 3
TU Title : FTU5
Subject title: System and network security administration
Credits: 4
Coefficients: 2

Objective

Understand the methods, tools and solutions used to ensure the security of IT systems and networks.

Recommended prior knowledge

Solid grounding in networks, operating systems and cybersecurity.

Contents

    I. The concept of network security policy

    II. Securing local networks (VLANs, NAC, Zero Trust Architecture).

    III. Firewalls and intrusion prevention systems (IDS/IPS).

    IV. Proxy server security

    V. Securing DNS and mail infrastructures

    VI. Topology, segmentation and DMZ

    VII.   Encrypting communications with SSH and SSL

    VIII.   Machine compromises and operating system protection mechanisms

    IX. File and storage security (encryption, BitLocker, LUKS).

    X. Infrastructure Security and Zero Trust Architecture

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Jacques Philipp: "Systèmes Unix / Linux et Windows : Architecture, conception, utilisations, administration, sécurité" published by Ellipses 2009
- Bernard Boutherin , Benoît Delaunay: "Sécuriser un réseau Linux" Eyrolles 3rd edition November 2006
- François Pignet: "Réseaux informatiques : Supervision et administration" Eni December 2007

Master's title: Networks and Security
Semester: 3
TU Title : FTU5
Subject title: Virtualization and cloud computing
Credits: 6
Coefficients: 3

Teaching objectives :

Understand the principles of virtualization, manipulate virtualization concepts through practical tools and discover the notion of cloud computing and its applications.

Recommended prior knowledge

Computer systems and networks; Operating systems; Distributed systems

Contents

I. Virtualization principles
- Introduction
- Virtualization domains
- Virtualization tools
- Security and virtualization
- The different types of virtualization
- Advantages & disadvantages of virtualization
- Data centers and virtualization

II. Virtualization: Case study

III. Cloud Computing
- Introduction
- The different Cloud Computing services
- The different types of Cloud Computing
- Cloud computing applications
- Cloud players
- Cloud data storage and management
- Safety and compliance
- The advantages and limitations of the Cloud.

IV. Cloud Computing: Case study

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Philippe GILLET, "Virtualisation des systèmes d'information avec VMwareArchitecture", Edition ENI, 2010
- Eric MAILL?, "Virtualisation avec VMware vSphere 4", Edition ENI, 2011
- Guillaume Plouin, "Cloud Computing, Sécurité, stratégie d'entreprise et panorama du marché", Edition DUNOD, 2013
- Mathieu Zarrouk, "Cloud Computing, Maîtrisez la plateforme AWS, Amazon Web Services", Edition ENI, 2012
- Christopher Moyer, "Cloud computing applications", Pearson Edition, 2011

Master's title: Networks and Security
Semester: 3
TU Title : FTU6
Subject title: Internet application systems and protocols
Credits: 4
Coefficients: 2

Objective

This course aims to equip students with the knowledge and skills needed to design and implement robust distributed systems for the modern Internet. The course explores various architectural models and modern communication paradigms. Students will have a substantial amount of practical work, with a final synthesis project.

Recommended prior knowledge

Basic knowledge of computer networks.

Contents

I. Course introduction
- Network applications
- Distributed architectures (Client/Server, P2P, etc.)

II. RPCs
- Communication in network applications
- RPC systems - Distributed object architecture - Modern systems
- Java RMI

III. APIs and service-oriented architecture

IV. The HTTP protocol

V. REST API

VI. GraphQl

VII.   Microservices architecture and gRPC

VIII.   Blockchain and Distributed Ledger Systems

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- James Gough, Daniel Bryant, Matthew Auburn; "Mastering API architecture:Design, Operate, and Evolve API-Based Systems", Publisher :O'Reilly Media, 2022.
- "RESTful Web Services, Leonard Richardson and Sam Ruby; O'Reilly Media, 2007.
- "Web API Design: The Missing Link: Best Practices for Crafting Interfaces that Developers Love," Google cloud, APIGEE, 2018.
- Don Tapscott, Alex Tapscott, "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World," 2016

Master's title: Networks and Security
Semester: 3
TU Title : FTU6
Subject title: Web services
Credits: 4
Coefficients: 2

Objective

Familiarize students with the design, deployment and security of web services. It covers communication protocols, WSDL, UDDI and SOAP architectures, as well as the various Java APIs (JAXP, JAX-RPC, JAXM, JAXR, JAXB).

Recommended prior knowledge

Basic knowledge of networks and the Internet

Contents

I. Introduction

II. Web evolution

III. The 3rd generation Web

IV. Architecture
- SOAP
- WSDL
- UDDI

V. Implementations
- Java APIs (JAXP, JAX-RPC, JAXM, JAXR, JAXB)
- Implementation with JAX-RPC
- Apache SOAP, Apache Axis

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- Web Services with SOAP, WSDL, UDDI, ebXML...Enterprise Solutions ;Author(s) : Jean-Marie Chauvet ; Publisher : Eyrolles ; pages ; 2002
- Xml and Web services; Author(s): Cyril Vincent; Publisher: Eni; 2003
- Online examples: http://soapclient.com/soaptest.html
- http://www.uddi.org
- UDDI server: http://uddi.microsoft.com and http://uddi.ibm.com

Master's title: Networks and Security
Semester: 3
TU Title : MTU3
Subject title: Simulation and emulation of networked systems
Credits: 5
Coefficients: 3

Objective

Understand software tools for simulating computer networks, to facilitate the study of the interaction between protocols and the behavior of a network at different scales.

Recommended prior knowledge

Basic knowledge of fundamental mathematics, probability and statistics. Basic knowledge of computer networks. Programming and scripting basics.

Contents

I. Network modeling/performance assessment
- A little mathematical formalism
- Some ideas about simulation

II. Introduction to simulation
- Systems, models and paradigms
- Computer simulation

III. Simulation and emulation

IV. Simulator
- Technology
- Classification

V. Examples of simulators
- Presentation
- Concepts
- Uses

Evaluation methods: Continuous assessment, examination,

References (books and handouts, websites, etc.).

- P-J. Erard, P. Déguénon, "Simulation par événements discrets", Presses polytechniques et universitaires, Romande, 1999.
- Gérard Fleury, Philippe Lacomme, Alain Tanguy, "Discrete-event simulation", Eyrolles, 2006.
- Ruegg, "Processus stochastiques", vol.6, Presses polytechniques et universitaires, Romande, 1989. .

Master's title: Networks and Security
Semester: 3
TU Title : MTU3
Subject title: Methodology and evaluation of IT systems
Credits: 4
Coefficients: 2

Teaching objectives

The aim of this course is to enable the student to simulate a process and see how the prototype behaves.

Recommended prior knowledge

Proficiency in a graphics programming language such as C++.

Contents

    I. Modeling tools

    II. The different types of simulation

    III. Generating random numbers

    IV. State-based approaches (finite-state automata, markov chains)

    V. Hybrid approaches: Petri nets

    VI. Discrete-event simulation
- Application to queues and Petri nets

    VII.   Study of some simulation languages (ARENA-SIMAN, QNAP2)

Evaluation methods: Continuous assessment, examination,

References

- P-J. Erard, P. Déguénon, Simulation par événements discrets, Presses polytechniques et universitaires, Romande, 1999.
- Gérard Fleury, Philippe Lacomme, Alain Tanguy, discrete-event simulation, Eyrolles, 2006.
- Ruegg, Processus stochastiques, vol.6, Presses polytechniques et universitaires, Romande, 1989.

Master's title: Networks and Security
Semester: 3
TU Title : CCTU3
Subject title: Project management and entrepreneurship
Credits: 2
Coefficients: 2

Objective

Acquire a global vision of projects, and provide practical tools for anticipating cost, deadline and performance drift on industrial projects,

Recommended prior knowledge

Notions in information systems

Contents

I. Introduction to Project Management
- Project and Management Definition
- Project Lifecycle Models
- Information System (IS) Project Management
- Load Estimation: Case of the COCOMO Model

II. Delay Planning Techniques
- Gantt chart
- PERT network

III. Quality and Risk Management

IV. Launching and managing a startup
- Human composition and business model
- International Development
- Finance and Legal
- Incubators/Accelerators/Nurseries/FabLAb
- Coworking spaces
- Mentoring/Financing/Bisuness Angels
- Venture Capital

V. Computer systems and networks

Evaluation method: examination

References

- Blank, S. & Dorf, B. 2012. "The Startup owner's manual: The step-by-step guide for building a great company". K&S Ranch inc.
- Ries, E. 2011. "The Lean Startup: How Constant Innovation Creates Radically Successful Businesses". Portfolio Penguin

Master's title: Networks and Security
Semester: 3
TU Title : CCTU3
Subject title: Corruption and work ethics
Credits: 1
Coefficients:1

Objective

Inform and sensitize students to the risk of corruption and encourage them to contribute to the fight against it.

Contents

I.   Concept of corruption:

II. Types of corruption :

III. Manifestations of administrative and financial corruption :

IV. The reasons for administrative and financial corruption :

V.   The effects of administrative and financial corruption :

VI. The fight against corruption by local and international bodies and organizations

VII.   Methods of dealing with and combating corruption

VIII.   Models from the experience of certain countries in the fight against corruption:

Evaluation method: Examination,

References

- الفقي , مصطفى. الفساد الإداري والمالي بين السياسات والإجراءات
  http://www.cipe-egypt.org/articles/art0900.htm
- محمود , مهيوب خضر . من معالم المدرسة العمرية في مكافحة الفساد .
  http://www.hetta.com/current/mahyoob23.htm
- بزاز , سعد . حملة ضد الفساد
  http://www.saadbazzaz.com/index.asp?fname=articles%5C7540.htm&code=display
- طه , خالد عيسى . ملاحقة الفساد الإداري
  http://www.azzaman.com/azzaman/articles/2004/03/03-29/802.htm
- الفساد الإداري وجرائم إساءة استعمال السلطة الوظيفية
  http://news.naseej.com.sa/detail.asp?InSectionID=1431&InNewsItemID=123076
- السيف , خليفة عبد الله . متى نرى آلية صحيحة لمحاربة الفساد
  http://www.alwatan.com.sa/daily/2002-10-19/resders.htm
- (1) الفساد الإداري والمالي
  http://www.mof.gov.kw/coag-news11-4.htm
- (2) الفساد الإداري والمالي
  http://www.mof.gov.kw/coag-news11-5.htm
- إدارة التغيير والموارد البشرية .
  http://www.ituarabic.org/11thHRMeeting/doc6.doc