UE Network applications

ECTS
6 crédits

Composante
UFR PhITEM (physique, ingénierie, terre, environnement, mécanique)

Période de l'année
Automne (sept. à dec./janv.)

- **Langue(s) d'enseignement:** Anglais
- **Ouvert aux étudiants en échange:** Oui
- **Code d'export Apogée:** PAX9SCAK

Présentation

Description

Security of Network and Applications

The objective of this class is to introduce security principles, on the theoretical, organizational and technical aspects. The points which are more specifically developed are: detection errors, firewall technics, network architecture, cryptology and VPN, anti-virus strategy. Are also discussed how to implement a security strategy, and some elements for the definition of a security policy. Some elements about safe networks, or networks for safety or critical applications, are also studied.

Lesson	Topic
1	**Introduction to networks, error detection and correction**
	Bases of network, theoretical elements of error correction and detection, application in the case of parity, CRC, checksum.
	DEPENDABILITY - SECURITY
2	**Dependability - security - risk analysis**
	Concepts, application to networks and information systems, simple application examples.
	TECHNOLOGY FOR SECURITY

3	**Attack strategies**
	The phases of an attack, types of attacks.
4	**Technologies for security:**
	Network infrastructure, filtering, security protocols, VPN.
	METHODOLOGIES
5	**Cryptography**
	Theories on symmetric and asymmetric cryptography, DES, RSA, application to encryption, hash calculation, signature, certificates.
6	**Virology**
	Bases of virology. application to encryption, hash calculation, signature, certificates.
	LABS on NETWORK AND SECURITY
Lab 1	**Firewalls and wireless networks**
Lab 2	**Communication security and encryption**

Distributed Algorithms and Network Systems

Objectives Distributed algorithms aim at obtaining a global goal by exploiting a large number of simple devices (``agents''), and their local interactions. These algorithms can be for the purposes of estimation in a wireless sensor network, or control e.g. of a self-organized robotic fleet. This introductory class will first review the necessary tools from graph theory and Markov chains, and then present consensus: a prototypical example of distributed algorithm, as well as a building block for more complex algorithms. Theory will be accompanied by implementation on a real-world sensor network: FIT/IoT LAB.Class schedule

1. Introduction: network systems
2. Graphs: fundamentals of algebraic graph theory
3. Markov chains: convergence to invariant measure, Perron-Frobenius theorem
4. Consensus (time-invariant graph)
5. Consensus (gossip: randomly varying graph)
6. Consensus-based algorithms: using consensus as a building block of other algorithms (e.g., localisation from relative measurements, least-squares regression, gradient descent minimization, distributed Kalman filter, counting nodes in an anonymous network)
7. Labs (3): implementation of distributed algorithms on real sensor network, remotely using FIT/IoT LAB. Programming language: C.

Programmable Sockets

This two-sessions lab aims at establishing a communication with a PLC-like computer controlling a levitating ball. The work is related to the IP (TCP and UDP) libraries on Python, and to some more high-level protocols or technologies (HTTP, GRPCio for security constraints, etc.).

Heures d'enseignement

CM	CM	31,5h
TP	TP	22h

Période : Semestre 9

Bibliographie

Security of Network and Applications

- S. Ghernaouti-Hélié, "Sécurité informatique et réseaux", *Dunod*, 2005.
- J. Steinberg & T. Speed, "SSL VPN, Understanding, evaluating and planning secure, web-based remote access", 2005.
- F. Halsall, "Computer networking and the internet", *Addison Welseley*, 2005.

Distributed Algorithms and Network Systems

- F. Bullo, J. Cortes, and S. Martinez, Distributed Control of Robotic Networks, Princeton, 2009. Available on-line.
- M. Mesbahi and M. Egerstedt, Graph Theoretic Methods in Multiagent Networks, Princeton University Press, 2010.
- D.A. Levin, Y. Peres, and E.L. Wilmer, Markov chains and mixing times, American Mathematical Society, 2010.
- F. Garin, L. Schenato, A survey on distributed estimation and control applications using linear consensus algorithms, in "Networked Control Systems", A. Bemporad, M. Heemels, M. Johansson eds, Springer Lecture Notes in Control and Information Sciences, vol. 406, Chapter 3, pp. 75-107, Springer, 2011.

Infos pratiques

Lieu(x) ville

Grenoble

Campus

Grenoble - Polygone scientifique