Programme Communication Networks and Services ComNETS
(VAP ingénieur 3eme années, Télécom SudParis)

Programme syllabus (S9)

CONTENTS

ComNETS programme (3ème année TSP)
Communication Networks and Services

Coursework Description

This program introduces students to ICT fundamentals that provide the needed background for in-depth study of networks and services. The objective is for them to learn how to understand, analyze, and design networks while also becoming acquainted with deployment, operation, optimization, and control of these networks and services. Given this strong underlying framework, the program's students meet the program's targets of both an in-depth theoretical background and practical knowledge.

This unique program covers the entire span of services, network infrastructures, virtualisation, Cloud, from access networks all the way to the core networks and services. The coursework addresses specific issues such as All-Web convergence, Online Social Networks, Cloud, Service-Oriented Computing, Internet of Things and Smart Grids.

The program also offers real-world breadth. In addition to six key technical courses, a course on telecom management and economics gives students essential information about markets in Europe. Moreover, each student becomes involved in concrete projects and produces a master's thesis. The master's thesis can be conducted in collaboration with industrial partners or research laboratories. Students are also invited to join the ICIN international conference (www.icin.co.uk).

World-renowned experts from Orange Labs, CISCO, ITRON, Telecom Italia and European Technical Standard Institute (ETSI) are invited to give lectures.

The course are in English and jointly taught with MSc students from University Carlos III of Madrid (Spain), Asian Institute of Technology (Regional), Hong Kong University of Science and Technology (Hong Kong), National Chiao Tung University (Taiwan).

Prerequisite

There is no S8 prerequisite.

Courses / modules

Module	ECTS	Code	Coordinator	Hours
Social Networks, Internet of Things, Smart Grid and New Trends for Future Services	4	NET7001	N.Crespi	15
Wireless Access and Transport Technologies	4	NET7003	B. Jouaber	18
Service-oriented Computing	4	NET7011	S.Tata (W. Gaaloul)	15
Communication Services and All-Web convergence	4	NET7012	N. Crespi	21(+3 days if ICIN)
Complex systems in wireless communications	4	NET7005	H. Afifi	18
Optimisation: Theory and Network applications	4	NET7006	W. Benameur	27
Business Modelling and ICT	4	MGT7001	P.Vialle	15
Project (for ingénieurs only)	4	NET7515	N.Crespi	1 month
Internship in the industry				6 months

Module NET7001	Social Networks, Internet of Things, Smart Grid and New Trends for Future Services

Department : RS2M
Coordinator : Noel Crespi   **Phone :** 01 60 76 4 6 23
Email : noel.crespi@telecom-sudparis.eu   **Room :** D107

Objectives:
The coursework introduces students to new trend in service creation and deployments. It addresses Communication Services, Internet of Things, Online Social Networks, Smart Grid and the XaaS paradigm.

Topics:

- P2P systems, P2P SIP, architectures and Service Overlays
- Social Networks and Social Communications
- Innovation in Telecom industry
- The Cloud and XaaS paradigm
- Internet of Things
- Service Creation
- Smart grids

Organisation

15 hour coursework

Evaluation

Evaluation integrated in NET7004.

Bibliography and recommended reading will be proposed

Module NET7011	Service-oriented Computing

Department : INF
Coordinator : Samir Tata (W. Gaaloul)   **Phone :**
Email : samir.tata@telecom-sudparis.eu   **Room :**

Objectives

This course introduces fundamental concepts for Service-Oriented Computing (SOC) and business process management (BPM). SOC is a computing paradigm that is used by major enterprises and government agencies. SOC represents computing in a collection of loosely coupled services. BPM includes methods, techniques, and tools to support the design, enactment, management, and analysis of operational business processes. This course aims at presenting concepts, principles, and tools for SOC and BPM. It provides students with a comprehensive introduction to service-oriented computing by covering most known technical solutions and the research opportunities that exist. Students will also learn about the programming model of Web services and business processes and apply this knowledge to a group project in which they practice team work.

Programme

- Introduction to SOA and BPM
- Web services
    - SOAP-based Web services
    - RESTful Web services
- Introduction to BPM modeling languages (Petri-nets, EPC, BPMN)
- Service composition
    - Behavioral-based (BPM and BPEL)
    - Architectural-based (SCA)
Service integration and mediation (ESB)
News trends
    - Semantic Web services (description, discovery and composition)
    - Cloud Computing

Module NET7003	Wireless Access and Transport Technologies

Department : RS2M
Coordinator : Badii Jouaber
Email : Badii.jouaber@telecom-sudparis.eu

Phone : 01 60 76 42 08
Room : A106.01

Objectives

This course addresses radio resource allocation, sharing, control and management for wireless and cellular networks. It basically addresses PHY and MAC layers.

The first and major emphasis is on radio access network architectures, procedures and methods. We will address resource sharing and radio resource allocation, control and management for TDMA, CDMA and OFDMA systems.

The course addresses Uplink and downlink interference management, scheduling issues and capacity evaluation for the air interface or the radio access network.

Physical to logical channel mapping for GSM and UMTS networks are also described along with the RAN architecture and the associated procedures and protocols.

QoS management and service classes will be presented and debated.

The course also addresses transport technologies. The use of dedicated lines, ATM and IP and therefore the evolution from circuit to packet switched technologies are discussed and analysed.

The impact of current choices on QoS and mobility management as well as the trends and evolutions toward beyond 3G networks will be discussed.

Organisation

18 hour coursework

Evaluation

Written test.

Programme

RAN architecture
Radio Access Network Architecture for GSM, GPRS and UMTS, network devices, interfaces and protocols

QoS definition and management in GPRS and UMTS

Access methods and radio resource management in mobile networks, mainly for
- TDMA systems,
- CDMA systems and
- OFDMA systems.

Scheduling issues for GPRS, UMTS and WiMAX
- downlink
- uplink

Physical to logical **channel mapping**
- for GSM
- for UMTS

Procedure and protocol used for resource allocation
- PDP Context and TBF allocation

Transport technologies in the RAN
- ATM versus IP
- QoS Classes and QoS mapping between radio and transport layers

Green IT

Bibliography
3GPP documents and scientific papers

Module NET7012	Communication Services and All-Web convergence

Department : RS2M
Coordinator : Noël Crespi   **Phone :** 01 60 76 46 23
Email : noel.crespi@telecom-sudparis.eu   **Room :** D107

Introduction: The conception and deployment of services is a key challenge for the telecom market. Services should fundamentally be tailored to user preferences, rely seamlessly on multiple access networks and bundle multiple service features (e.g. voice/video, social networks, presence, gaming and IPTV). This course will introduce services from legacy Intelligent Network, to IMS and web-based communication services. We will also present the actual challenges for communication services and evolution of the service architecture from telco 1.0 to current/future telco 2.0 with the openness of the operator's network and assts to third parties though APIs. P2P systems will also be presented.

Objectives:
The coursework introduces students to Next Generation Services, with a focus on Service architectures. The course describes in detail how communication services are conceived, developed and deployed in wireline and wireless networks.

The course concentrates on NGN (Next Generation Networks) architectures. The courses also address the webification of services (from the IMS to OTT solutions) that will significantly change the telecommunication industry worldwide with the replacement of today's networks.

The course also cover today's networks, to allow the students understand the changes that the world of telecommunications and internet is facing. Message flows and procedures are thoroughly examined in class and in small student groups to strengthen understanding. CAMEL-based service architectures, IMS/NGN   service architectures are particularly emphasized.

The course also introduces the alternatives to operator-centric architectures to provide communication services to the users. Other approaches such as Peer-to-Peer systems, web-NGN convergence, Social Networks, Cloud, are introduced.

Organisation: 21 hour coursework + ICIN conference (to be confirmed, priority to dual degree students).
Evaluation: Group work and oral presentation.

Programme

GSM/UMTS Network protocols: quick reminder
- SS7 and signalling basics, Supplementary Services, UMTS procedures

Intelligent Network
- IN principles, CAMEL
- Services: what are the challenges? Lessons learnt from IN.

Next Generation Networks
- SIP
- MEGACO, H.248
- IMS, NGN architecture, TIPSAN
- Multi-access to the services: 3G, WiFi, Cable. EPC.
- Service architecture
- Participation to ICIN conference (tbc)
- Web-NGN convergence,
- RCS
- Telco 2.0 and OTT
- IPTV
- WebRTC

UMTS standardisation at 3GPP
- Standardisation process and principles in ETSI and 3GPP
- Functionalities standardised in UMTS. Latest 3GPP updates.

Bibliography
Copy of the slides. Standards: selected technical specifications from 3GPP, IETF and ITU-T.

Module NET7005	Complex systems in wireless communications

Department : RS2M
Coordinator : Hossam Afifi   **Phone :** 01 60 76 47 08
Email : Hossam.afifi@telecom-sudparis.eu   **Room :** D408-01

Objectives	Programme
This course gives a general presentation on the wireless technologies used in the near field, local area and metropolitan applications. We focus on the IEEE standards but we also address selected and successful ETSI technologies. Three teaching staff will contribute with the lessons divided into a near field communication domain, LAN MAN and DVB and finally simulation tools. In the near field communication we describe the most known wireless technologies such as zigbee, Bluetooth and UWB. We show how these systems are evolving in the current industry. We describe service integration in wireless networks and discovery. This part is also enriched with some practical work in our laboratories. The second part describes the evolution of the Wifi family and all new variants. It gives also a detailed course on security principles and protocols. It ends with the presentation of Wimax and DVB-H metropolitan techniques. This part is concluded with practical sessions and some experimentation. . The last part is dealing with simulation and emulation. We present the most used tools for wireless network simulation and we make some practical work on examples to see how these tools can optimize the network design and use these examples to demonstrate system and architecture shortcomings and problems. **Organisation** 18 hour coursework **Evaluation** Written test.	**WLAN, WPAN, WMAN, DVB-H**: Introduction **WiFi** Standards, performance, usage and applications, new evolutions **WiMAX, DVB-H** Usage and standard **Security** Basics, architectures, algorithms **Bluetooth** Standard, performance, usage and applications **Zigbee, UWB** Standards and usage **Service discovery** in wireless Networks (jxta, UPnP,…) **Security in Wireless Networks**: PANs, LANs and cellular **Wireless Networks Simulation** (tools and methods) **Smart Grids** Practical on: WiFi, Security, Service Discovery

Module NET7006	Optimisation: Theory and Network applications

Department : RS2M
Coordinator : Walid Benameur   **Phone :** 01 60 76 47 13
Email : walid.benameur@telecom-sudparis.eu   **Room :**

Introduction

Designing a minimum cost network with high performance is an important challenge for network operators. Some mathematical and computer science tools are required to model and solve complex network optimization problems. This course will provide students with analysis, modelling and optimization capabilities by presenting principles from combinatorial optimisation and game theory. These notions will be applied to wireless systems, networks design and optimization problems.

Objectives

This course focuses on the fundamentals of optimization theory: graph algorithms, linear programming, integer programming, and complexity theory. Some network optimization problems will be solved using some of the mathematical methods presented in the course. An introduction to game theory applied to wireless communication networks will also be provided. A main focus will be given to traffic engineering, network topology design, frequency assignment, network routing, dimensioning, and pricing problems.

Organisation
27 hour coursework

Evaluation
Written test.

Programme

Some graph algorithms

Linear programming basics

Introduction to Integer programming

Traffic engineering

Network topology calculus

Network optimal routing and dimensioning

Frequency assignment

Pricing

Game theory

Bibliography
Telecommunication Network Design Algorithms, A. Kershenbaum, Mcgraw-Hill;
Network Optimization, Balakrishnan, Moire, Chapman Hall/CRC;
Network Optimization: Continuous and discrete models; Bertsekas, Athena Scientific
Routing, Flow, and Capacity Design in Communication and Computer Networks, M. Pioro, D. Medhi, Morgan Kaufmann
Game Theory for Wireless Engineers, A. MacKenzie and L. DaSilva

Module MGT7001	Business Modelling and ICT

Department: MMS
Coordinator: Pierre Vialle   **Phone:** 01 60 76 47 93
Email: pierre.vialle@telecom-em.eu   **Room:** E415

Technological and service innovation induce the rise of innovative business models based on varying manners of managing revenues, costs and exchanges. This course develops the theory and practical applications of business modelling in the case of ICT-based businesses.

Objectives
- Define the various dimensions of business models and their interaction
- Examine the main parameters of successful business models
- Design business cases and models
- Learn from successful business models in various contexts
- Appraise successful strategies

Expectations: Participation in courses, teamwork, document research. Pedagogical methods : Course, case studies, student's presentations

Class schedule :
- Introduction
- Theoretical foundations for business modelling
- The dimensions of business models and their interaction: value-chains and activity model, supporting infrastructure, role model, value proposition, financial model
- The evolution of business models with technological innovation
- Tactics for capturing value
- The role of user's participation
- Analyses of various cases (i.e. mobile business models, web business models, digital games business models, TV and movie business models)

Organisation: 15 hours lecture, workload 30 hours.

Evaluation: Personal work, teamwork, test

Bibliography
Leading the revolution., G. Hamel, Boston, Harvard Business School Press, 2000.
Place to space: Migrating to eBusiness Models., P. Weill and M. R. Vitale, Boston,Harvard Business School Press, 2001.
Internet Business Models and Strategies, A. Afuah and C. Tucci, Boston, McGraw Hill, 2003.

NET7515	Project

Department : RS2M
Coordinator : Noël Crespi
Email : noel.crespi@telecom-sudparis.eu

Phone : 01 60 76 46 23
Room : D107

Objectives	Topics
In parallel to this specialization coursework, students are involved in concrete projects requires personnel and team work. The student can choose his/her advisor in any department in Telecom SudParis: there have been advisors from RS2M, LOR, RST and INF departments as well as Telecom Business School. **Organisation** 1 months (partly in parallel to coursework). **Evaluation** Written document and feedback from the advisor.	Topics are jointly proposed by advisors or students.