

300262 - OPTICAL - Next- Generation Optical Network Infrastructures for Future Cloud-Based Services

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2019
Degree: MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019).
(Teaching unit Optional)
MASTER'S DEGREE IN APPLIED TELECOMMUNICATIONS AND ENGINEERING MANAGEMENT
(MASTEAM) (Syllabus 2015). (Teaching unit Optional)
ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Spadaro, Salvatore
Others: Spadaro, Salvatore

Prior skills

Fundamentals of optical communications systems and architectures

Degree competences to which the subject contributes

Basic:

CB6. (ENG) CB6 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.

CB8. (ENG) CB8 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios.

CB10. (ENG) CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

Transversal:

02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Teaching methodology

The subject will be based on:

- Lectures about: 1) Current transport technologies to support cloud-based services; 2) adoption of innovative optical technologies and systems for intra/inter data centres interconnections and, 3) Control and Management architecture and technologies for the overall optical data centres resources.
- Technical use cases discussion with active participation of students; tutorial papers available in literature will be used as a starting point to identify the main requirements of future data centres to support and provide cloud-based services.
- Technical presentations given by groups of students.

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Learning objectives of the subject

At the end of the subject, the student will be able:

- To critically evaluate current bottlenecks of transport technologies to support requirements of future cloud-based services and applications.
- To identify main performance parameters to be met once intra/inter data centre interconnections are designed.
- To benchmark different technological solutions for the transport networks against the requirements raised by the supported applications and services.

Study load

Total learning time: 75h	Hours large group:	27h	36.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	48h	64.00%

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Content

<p>Current transport network technologies for cloud-based services and applications</p>	<p>Learning time: 12h Theory classes: 4h Self study : 8h</p>
<p>Description: The aim of this part of the subject is to identify the main bottlenecks of current transport networks for intra/inter data centres interconnections (e.g. scalability, energy consumption, etc.) to support future services and applications.</p> <p>Related activities: Starting from scientific articles available in the literature, the students (organised in groups) are requested to prepare a set of slides to identify some of the use cases and related requirements of future applications and service (e.g., virtual data centres service, latency, energy consumption, etc.)</p>	
<p>Optical systems and technologies for cloud computing and data centres interconnects</p>	<p>Learning time: 22h Theory classes: 10h Self study : 12h</p>
<p>Description: In this part of the subject, different optical technologies will be discussed highlighting the potential of each one as candidates to be used for intra/inter data centre interconnections (fast switching technologies based on SOA, flex-grid and flex-rate, etc.).</p> <p>Related activities: Besides the lectures, the students are requested to review technical tutorial-like papers on available data centre networks design and topologies using optical technologies and systems. The main aim is to critically benchmark the different available proposals.</p>	
<p>Enabling optical systems for energy-efficient optical networks</p>	<p>Learning time: 12h Theory classes: 4h Self study : 8h</p>
<p>Description: One of the requirements in next generation data centres is power efficiency. Optical technologies able to reduce the power consumption will be presented and discussed; special emphasis will be devoted to the sleep-mode approach to keep limited the power consumption experimented.</p> <p>Related activities: The students will be requested to review technical papers available in the literature about the "sleep-mode operation" of optical systems (optical transceivers, optical amplifiers, etc.), enabling energy efficient interconnection systems.</p>	

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Control/Management plane for data centre networks based on optical switching

Learning time: 29h

Theory classes: 9h

Self study : 20h

Description:

The aim of this part of the subject is to introduce control and management architectures and technologies solutions for the overall orchestration of data centres resources, including both network and IT resources. Prior to this, requirements from the management point of view of future data centres will be identified. SDN-based centralised architecture for optical transport network will be discussed.

Related activities:

The students (organised in groups) will be requested to review and prepare some slides from technical articles available in the literature related with architectures for the efficient management and control of data centres resources. Technical discussion will follow-up).

Qualification system

The overall evaluation will be performed through a final exam and the evaluation of the individual presentations/reports on the different topics.

Bibliography

Basic:

Ramaswami, Rajiv; Sivarajan, Kumar N; Sasaki, Galen H. Optical networks : a practical perspective. 3rd ed. San Francisco [etc.]: Morgan kaufmann, cop. 2010. ISBN 9780123740922.