ITU Centres of Excellence Network for Europe

Faculty of Electrical Engineering and Information Technologies in Skopje

Online Training Course on

Future Broadband: Ultra-broadband Internet, Clouds, IoT and Artificial Intelligence

25 May – 21 June 2021

TRAINING COURSE OUTLINE

COURSE DESCRIPTION

Title	Future Broadband: Ultra-broadband Internet, Clouds, IoT and Artificial Intelligence
Objectives	This course will include technologies, regulation and business aspects. It will cover Internet technologies, including IPv6, DNS, DHCP, IPv4 to IPv6 transition, HTTP 2.0, IPX, IP QoS, Cybersecurity, as well as Internet governance. Also, it will also cover future ultra-broadband Internet access, including future metallic access (MGfast), future optical access (XG-PON, NG-PON2, DWDM), Carrier Ethernet, optical transport network and MPLS/VPN, SDN/NFV and network slicing for fixed and mobile, Submarine cable, Satellite broadband access, as well as future broadband business and regulatory aspects. Further, it will cover ITU's Cloud Computing, future OTT and telecom clouds (cloud-native PaaS, microservices, Machine Learning as a Service, Blockchain as a Service), clouds security and privacy, ITU's Internet of Things (IoT) and Web of Things (WoT), Data management and Big Data architecture, IoT/BigData security and trust, uses of Artificial Intelligence (AI)/ Machine Learning (ML) for Internet and telecoms, as well as governance of clouds, IoT and AI. Finally, the course will also cover future ultra-broadband telecom services, future OTT services (OTT voice, OTT video and AR/VR/XR, Web 3.0), tactile Internet, Industry 4.0 and Smart City services, Intelligent operation network and Digital twins, Space-terrestrial integrated network (STIN), future clouds/IoT/AI services, future Internet network neutrality vs. telecom's QoS, as well as business and regulatory aspects of future telecom, clouds/IoT/AI and OTT services.
Dates	25 May - 21 June 2021
Duration	4 weeks
Registration deadline	24 May 2021
Training fees	USD 150
Course code	21OI26412EUR-E

DESCRIPTION OF THE TRAINING COURSE

This course will focus on Future Broadband: Ultra-broadband Internet, Clouds, IoT and Artificial Intelligence, including technologies, regulation and business aspects. It will cover Internet technologies, including IPv6, DNS, DHCP, IPv4 to IPv6 transition, HTTP 2.0, IPX, IP QoS, Cybersecurity, as well as Internet governance. Also, it will include future ultra-broadband Internet access, including future metallic access (MGfast), future optical access (XG-PON, NG-PON2, DWDM), Carrier Ethernet, optical transport network and MPLS/VPN, SDN/NFV and network slicing for fixed and mobile, Submarine cable, Satellite broadband access, as well as future broadband business and regulatory aspects. Further, it will cover ITU's Cloud Computing, future OTT and telecom clouds (cloud-native PaaS, microservices, Machine Learning as a Service, Blockchain as a Service), clouds security and privacy, ITU's Internet of Things (IoT) and Web of Things (WoT), Data management and Big Data architecture, IoT/BigData security and trust, uses of Artificial Intelligence (AI)/ Machine Learning (ML) for Internet and telecoms, as well as governance of clouds, IoT and AI. Finally, the course will also include future ultra-broadband telecom services, future OTT services (OTT voice, OTT video and AR/VR/XR, Web 3.0), tactile Internet, Industry 4.0 and Smart City services, Intelligent operation network and Digital twins, Space-terrestrial integrated network (STIN), future clouds/IoT/AI services, future Internet network neutrality vs. telecom's QoS, as well as business and regulatory aspects of future telecom, clouds/IoT/AI and OTT services.

LEARNING OUTCOMES

Upon completion of this course, participants will be able to:

- Understand Internet technologies, including IP, DNS, DHCP, IPv6, Internet networking, HTTP 2.0 and Web services, IPX, IP QoS, cybersecurity, as well as Internet governance;
- Understand future ultra-broadband Internet access including future metallic access, next generation optical networks (XG-PON, NG-PON2, DWDM), Carrier Ethernet, optical transport networks and MPLS/VPN, Submarine and Satellite broadband access;
- Perform technical, business and regulatory analysis for future ultra-broadband Internet access, including NG-PONs, Carrier Ethernet, Submarine and Satellites;
- Understand future Cloud Computing including OTT and telecom cloud services, Internet of Things (IoT), BigData architecture, Machine Learning (ML) and Artificial Intelligence (AI) , including AI/ML for Internet and telecoms, as well as governance of clouds, IoT and AI;
- Understand future ultra-broadband Telecom and OTT data services, tactile Internet, Industry 4.0 and Smart City services, Space-terrestrial integrated network, future clouds/IoT/AI services, as well as future network neutrality vs. telecom's QoS;
- Perform technical, business and regulatory analysis of future ultra-broadband telecom, clouds/IoT/AI and OTT services.

TARGET POPULATION

This course is targeted at managers, engineers and employees from regulators, government organisations, telecommunication companies and academia, who are interested in understanding, implementation and regulation of Future Broadband: Ultra-broadband Internet, Clouds, IoT and Artificial Intelligence, including technologies, regulatory and business aspects. Other institutions and individuals that are dedicated in building their capacity related to Future Broadband: Ultra-broadband Internet, Clouds, IoT and Artificial Intelligence are also welcome to participate.

ENTRY REQUIREMENTS

No prior knowledge or qualification is required to register for this course, considering the given target population.

TUTORS/INSTRUCTORS

NAME OF TUTOR(S)/INSTRUCTOR(S)	CONTACT DETAILS
Prof. Dr. Toni Janevski, tutor	tonij@feit.ukim.edu.mk (www.feit.ukim.edu.mk)
Dr. Marko Porjazoski, tutor's assistant	
Dr. Tomislav Shuminoski, tutor's assistant	

TRAINING CONTENTS

The training contents are organized in 4 Modules, where each of the Modules is covering a given topic area with given contents, as shown in the table below:

Topic	**Contents**
Module 1: **Internet technologies, QoS, Cybersecurity and Internet Governance**	• Internet fundamental architectures • Main Internet technologies (IP, TCP, UDP, DHCP, DNS) • IPv6 and transition IPv4 to IPv6 • IP interconnections (IPXs) • HTTP 2.0 and Web services • End-to-end IP Quality of Service (QoS) • Cybersecurity and privacy • Internet governance
Module 2: **Future ultra-broadband Internet access: NG-PON, Carrier Ethernet, Submarine and Satellites**	• Future metallic access (Multi Gigabit fast - MGfast) • Future optical access (XG-PON, NG-PON2, DWDM) • MEF 3.0 Carrier Ethernet • Optical transport network and MPLS/VPN • SDN/NFV and network slicing for fixed and mobile • Submarine cable • Satellite broadband access • Satellite systems for broadband Internet in Next Generation Access Technologies (NGAT) • Business and regulatory aspects of future ultra-broadband Internet access

Topic	Contents
Module 3: **Future Cloud Computing, IoT/BigData and Artificial Intelligence by ITU**	• ITU's Cloud Computing architectures (edge computing) • Future OTT and telecom cloud services (cloud-native PaaS, microservices, Machine Learning as a Service, Blockchain as a Service) • Security and privacy of clouds • ITU's Internet of Things (IoT) and Web of Things (WoT) • Data management and Big Data architecture • IoT/BigData security, privacy and trust • Artificial Intelligence (AI) and Machine Learning (ML) framework by ITU • AI/ML for Internet and telecoms • Governance of clouds, IoT and AI
Module 4: **Future ultra-broadband Telecom, clouds/IoT/AI and OTT services**	• Future ultra-broadband telecom services • Future OTT services (OTT voice, OTT video, OTT AR/VR/XR, Web 3.0) • Tactile Internet for remote operations • Industry 4.0 and Smart Sustainable City services • Intelligent operation network and Digital twins • Space-terrestrial integrated network (STIN) • Future clouds/IoT/AI services • Future Internet network neutrality vs. telecom's QoS • Business and regulatory aspects of future telecom, clouds/IoT/AI and OTT services

TRAINING SCHEDULE

Week	Topic	Exercises and interactions
Week 1	Module 1: **Internet technologies, QoS, Cybersecurity and Internet Governance**	Learning topics from course materials: • Internet fundamental architectures • Main Internet technologies (IP, TCP, UDP, DHCP, DNS) • IPv6 and transition IPv4 to IPv6 • IP interconnections (IPXs) • HTTP 2.0 and Web services • End-to-end IP Quality of Service (QoS) • Cybersecurity and privacy Internet governance
		Discussion / Forum
		Self test quiz
Week 2	Module 2: **Future ultra-broadband Internet access: NG-PON, Carrier Ethernet, Submarine and Satellites**	Learning topics from course materials: • Future metallic access (Multi Gigabit fast - MGfast) • Future optical access (XG-PON, NG-PON2, DWDM) • MEF 3.0 Carrier Ethernet • Optical transport network and MPLS/VPN • SDN/NFV and network slicing for fixed and mobile

Week	Topic	Exercises and interactions
		• Submarine cable • Satellite broadband access • Satellite systems for broadband Internet in Next Generation Access Technologies (NGAT) • Business and regulatory aspects of future ultra-broadband Internet access
		Discussion / Forum
		Self test quiz
Week 3	Module 3: **Future Cloud Computing, IoT/BigData and Artificial Intelligence by ITU**	Learning topics from course materials: • ITU's Cloud Computing architectures (edge computing) • Future OTT and telecom cloud services (cloud-native PaaS, microservices, Machine Learning as a Service, Blockchain as a Service) • Security and privacy of clouds • ITU's Internet of Things (IoT) and Web of Things (WoT) • Data management and Big Data architecture • IoT/BigData security, privacy and trust • Artificial Intelligence (AI) and Machine Learning (ML) framework by ITU • AI/ML for Internet and telecoms Governance of clouds, IoT and AI
		Discussion / Forum
		Self test quiz
Week 4	Module 4: **Future ultra-broadband Telecom, clouds/IoT/AI and OTT services**	Learning topics from course materials: • Future ultra-broadband telecom services • Future OTT services (OTT voice, OTT video, OTT AR/VR/XR, Web 3.0) • Tactile Internet for remote operations • Industry 4.0 and Smart Sustainable City services • Intelligent operation network and Digital twins • Space-terrestrial integrated network (STIN) • Future clouds/IoT/AI services • Future Internet network neutrality vs. telecom's QoS Business and regulatory aspects of future telecom, clouds/IoT/AI and OTT services
		Discussion / Forum
		Self test quiz and Final Evaluation

METHODOLOGY (Didactic approach)

The course methodology will be as follows:

- Each module will be studied and discussed over a time period of one week;
- Course materials will be made available on a weekly basis;

- Discussion forums will be organized based on discussion topics given on a daily basis, where students are highly encouraged to participate and interact with instructors and other students;
- Quiz tests will be assigned weekly, one per module, at the end of a given course week;
- All announcements for all events (materials, quizzes and forums) will be given in a timely manner (prior to the event) by the course tutor.

EVALUATION AND GRADING

The evaluation of the participants will be based on 80% from the average Quiz marks (average score from the quizzes) and 20% from the participation with substantive posts in the discussion forums, reflecting both the quantity and the quality of time spent on the course. Overall grade higher than 60% success ratio is required to complete the course and obtain an ITU certificate.

COURSE COORDINATION

Course coordinator:	**ITU coordinator:**
Name: **Prof. Dr. Toni Janevski** Email address: tonij@feit.ukim.edu.mk	Name: **Jaroslaw Ponder** Email address: eurregion@itu.int

REGISTRATION AND PAYMENT

ITU Academy portal account

Registration and payment should be made online at the ITU Academy portal.
To be able to register for the course you **MUST** first create an account in the ITU Academy portal at the following address:
https://academy.itu.int/index.php/user/register

Training course registration

When you have an existing account or created a new account, you can register for the course online at the following link: https://academy.itu.int/training-courses/full-catalogue/future-broadband-ultra-broadband-internet-clouds-iot-and-artificial-intelligence

You can also register by finding your desired course in our training catalogue https://academy.itu.int/index.php/training-courses/full-catalogue

Payment

1. **On-line payment**

A training fee of USD 150 per participant is applied for this training. Payment should be made via the online system using the link mentioned above for training registration at https://academy.itu.int/training-courses/full-catalogue/future-broadband-ultra-broadband-internet-clouds-iot-and-artificial-intelligence .

2. **Payment by bank transfer**

Where it is not possible to make payment via the online system, select the option for offline payment to generate an invoice using the same link as above. Download the invoice to make a bank transfer to the ITU bank account shown below. Then send the proof of payment/copy of bank transfer slip and the invoice copy to Hcbmail@itu.int and copy the course coordinator. **All bank transaction fees must be borne by the payer**.

Failure to submit the above documents may result in the applicant not being registered for the training.

3. Group payment

Should you wish to pay for more than one participant using bank transfer and need one invoice for all of them, create an account as **Institutional Contact. Institutional Contacts** are users that represent an organization. Any student can request to be an institutional contact or to belong to any existing organization.

To do this, head to your profile page by clicking on the **"My account"** button in the user menu. At the bottom of this page you should see two buttons:

a. If you want to **become an institutional contact**, click on the "**Apply to be an Institutional Contact"** button. This will redirect you to a small form that will ask for the organization name. After you fill the name of the organization you want to represent, click on **"continue"** and a request will be created. An ITU Academy manager will manually review this request and accept or deny it accordingly.
b. If you want to **belong to an existing organization**, click on the **"Request to belong to an Institutional Contact"** button. This will redirect you to a small form that will ask you to select the organization you want to join from an organization list. After you select the correct organization, click on **"continue"**, a request will then be created. The Institutional Contact that represents that organization will manually accept or deny your request to join the organization.

ITU BANK ACCOUNT DETAILS:	
Name and Address of Bank:	UBS Switzerland AG Case postale 2600 CH 1211 Geneva 2 Switzerland
Beneficiary:	Union Internationale des Télécommunications
Account number:	240-C8108252.2 (USD)
Swift:	UBSWCHZH80A
IBAN	CH54 0024 0240 C810 8252 2
Amount:	USD 150
Payment Reference:	CoE-EUR 26412 – P.40595.1.03

4. Other method of payment

If due to national regulations, there are restrictions that do not allow for payment to be made using options 1 & 2 above, please contact the ITU coordinator for further assistance.

CERTIFICATES

Each fully registered participant who will successfully complete the course, based on the evaluation, will receive an ITU Certificate after the course.