

Training Course Outline

ITU and National Institute of Telecommunications

Title	Future fixed and mobile broadband internet, cloud computing and IoT/AI
Modality	Face-to-face
Level	Intermediate
Dates	24 – 25 October 2024
Location	National Institute of Telecommunications (NIT), Warsaw, Poland
Duration	2 days
Language	English
Region	World or Multi-Regional
Registration type	Application and selection
Registration deadline	3 October 2024
Training fees	500 USD
Description	<p>This course focuses on future fixed and mobile broadband Internet, cloud computing and IoT/AI, including technical, business and regulatory aspects. It covers Internet technologies (IPv6, QUIC, DNS, QoS, cybersecurity), future fixed-terrestrial and satellite broadband including gigabit metallic, cable, and optical broadband (FTTH/FTTR, 50G-PON), submarine cable, satellite broadband, as well as transport networks (ITU's OTN, SD-WAN, Carrier Ethernet). Further, course includes future mobile broadband, including 5G-Advanced and future 6G mobile broadband (ITU's IMT-2030), as well as future WiFi technologies and their uses by telecom operators. It also includes the Internet of Things (IoT) ITU framework, existing and future IoT, Big Data and Quantum Internet, as well as Artificial Intelligence (AI) technologies including the ITU framework for Machine Learning (ML), AI/ML based QoS/QoE, security, 5G/6G operations, and Generative AI for telecom sector. Further, it also covers cloud and edge computing for telecoms and OTTs, future fixed and mobile services including voice, video, XR/AR/VR, critical IoT services (URLLC, IIoT, Smart City), V2X, Quantum Internet applications, and metaverse. Finally, the course includes regulation and business aspects of future Internet, clouds, metaverse, crypto (blockchain), IoT and AI.</p>

<i>Training topics</i>	<i>Wireless and Fixed Broadband</i>
<i>Certification</i>	<i>Certificate</i>
<i>Code</i>	<i>24WS500141MUL-E-D</i>

1. TARGET POPULATION

This course is targeted at managers, engineers and employees from regulators, government organizations, telecommunication companies and academia, who are interested in Future fixed and mobile broadband Internet, Cloud Computing and IoT/AI, including technologies, standardization, regulation and content. Other institutions and individuals that are dedicated in building their capacity related to Future Fixed and Mobile broadband Internet, Cloud Computing and IoT/AI.

2. ENTRY REQUIREMENTS

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

3. TRAINING OBJECTIVES

At the end of the training, the participant should have gained an understanding of the key aspects of:

- Internet technologies
- Future fixed-terrestrial and satellite broadband
- 5G-Advanced mobile broadband
- Future wireless broadband: WiFi 6th and 7th generation
- Future mobile broadband: 6G/IMT-2030
- IoT, Big Data and Quantum Internet
- Artificial Intelligence (AI) technologies
- Cloud and edge computing for telecoms and OTTs
- Future fixed and mobile services
- Regulation and business aspects of future Internet, clouds, IoT, and AI

4. METHODOLOGY

This course will be delivered using face-to-face training methodology, which is defined as follows:

- The course will be conducted as two full days lecture sessions in a face to face manner at the premises of National Institute of Telecommunication (NIT) in Warsaw Poland, on 24th and 25th October 2024. The participants will be given possibility to listen to the lectures and to interact with the tutor on the given topics.
- All presentations from face to face lectures/sessions on a given course Day will be made available on the ITU Academy platform (before the start of that course day).
- Final Quiz test will be assigned online on the ITU Academy platform on 1st of November 2024 and will remain open for 72 hours, however different date can be agreed in coordination with the course participants (depending on their travel plans back to home) at the end of Day 2.
- All information in the course be given in a timely manner (prior to the event) by the course tutor on the ITU Academy platform.

5. ASSESSMENT AND GRADING

The evaluation of the participants will be based on 80% from the Final Quiz and 20% from the participation at the face-to-face course, thus reflecting both the quality and the quantity of time spent on the course.

Attendance to the course is mandatory in order to access the Final Quiz.

The Final Quiz will be open on the ITU Academy platform from 00:00 hours on Friday (1st of November 2024, after the return of participants to their home countries) according to the GMT time, and will remain open at least for 72 hours after opening, so each participant can choose the most convenient time to solve it. It will consist of 20 questions (multiple choices). However, after the start of the attempt the Quiz should be completed in 90 minutes.

The course is completed successfully with a total grade of 70% or higher. The grading will be completed by the course tutor after the course is fully completed.

Each fully registered participant who successfully completes the course with a total grade of 70% or higher will receive an ITU Certificate for this course.

The ITU certificates will be given to participants via the ITU Academy platform after completion of the course reporting and processing within the ITU.

6. TRAINING DETAILS & INSTRUCTIONAL APPROACH

Day 1:

Time (CEST)	Sessions/Topics covered	Key learning points (detailed learning outcomes)	Training activities details
10:00 – 11:00	1. Internet technologies	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • Evolution of fixed and mobile Internet • Open Internet architectures • Main Internet technologies (IPv4, IPv6, TCP, QUIC, DNS) • IPv6 addressing and implementation • IP interconnections and IP eXchange (IPX) • Web technologies and metaverse • QoS in Internet/IP networks • Cybersecurity and privacy • Internet 2030 and beyond • Governance of broadband Internet 	<p>Personal attendance at Lecture 1, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>
11:00 – 11:30	COFFEE BREAK		
11:30 – 13:00	2. Future fixed-terrestrial and satellite broadband	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • ITU's future gigabit metallic broadband • Future cable broadband (DOCSIS 4.0, full duplex) • Future optical access (FTTH/ Fiber To The Room – FTTR) • Future Passive Optical Networks by ITU (50G-PON, WDM-PONs) • Network slicing in ITU's PON context • Future PONs by IEEE • Carrier-grade Ethernet for telecoms 	<p>Personal attendance at Lecture 2, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>

		<ul style="list-style-type: none"> • SD-WAN (Software Defined - Wide Area Network) • ITU's fine grain Optical Transport Network (fgOTN) • Submarine cable transport networks • Satellite broadband (LEO, MEO, GEO) • Future integrated terrestrial and non-terrestrial (satellite) networks 	
13:00 – 14:00	LUNCH BREAK		
14:00 – 14:45	3. 5G-Advanced mobile broadband	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • IMT mobile broadband evolution • 5G-Advanced New Radio (NR) access • SDN, NFV and network slicing in 5G/5G-Advanced • 5G-Advanced Core architecture and functions • Time Sensitive Communication in 5G/5G-Advanced • 5G-Advanced QoS and QoE • 5G-Advanced non-public (private) networks • 5G-Advanced Non-Terrestrial Network (NTN) • Mobile access (5G-Advanced) in unlicensed bands • ITU spectrum management for 5G-Advanced 	<p>Personal attendance at Lecture 3, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>
14:45 – 15:30	4. Future wireless broadband: WiFi 6th and 7th generation	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • WLAN architectures • WiFi (IEEE 802.11) generations • WiFi 6 – Next Generation WiFi (IEEE 802.11ax) • WiFi 7 - Extremely High Throughput WiFi (IEEE 802.11be) • 5G - WLAN interworking architecture • Untrusted WLAN access in 5G network 	<p>Personal attendance at Lecture 4, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>

		<ul style="list-style-type: none"> • Trusted WLAN access in 5G and wireline access • Access traffic steering, switching and splitting for 5G-WLAN • WiFi for IoT services • Future business aspects of WiFi for telecom operators 	
15:30 – 16:00	COFFEE BREAK		
16:00 – 17:00	5. Future mobile broadband: 6G/IMT-2030	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • ITU framework for future mobile: IMT-2030 and beyond • IMT-2030/6G capabilities and usage scenarios • Immersive Communication (6G global ultra broadband) • Hyper Reliable and Low-Latency Communication (6G critical services) • Massive Communication (batteryless IoT in 6G) • Ubiquitous Connectivity (3D global coverage) • Artificial Intelligence and Communication (AI-native 6G network) • Integrated Sensing and Communication (AI, XR, digital twins) • Deterministic networking and Time-Sensitive Networks in 6G • Future IMT-2030/6G spectrum 	<p>Personal attendance at Lecture 5, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>
Day 1 Conclusions			

Day 2:

Time (CEST)	Sessions/Topics covered	Key learning points (detail learning outcomes)	Training activities details
10:00 – 11:00	6. IoT, Big Data and Quantum Internet	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • ITU Internet of Things (IoT) framework • Mobile Internet of Things (NB-IoT, RedCap) • Non-mobile IoT technologies (LoRa, SigFox) • Industrial IoT (IIoT) technologies • QoS for IoT (massive vs. critical IoT) • Big Data architectures • Big Data Driven Networking (bDDN) • Big Data use in the telecom sector • Blockchain technologies • Quantum Key Distribution Network (QKDN) • Quantum Internet 	Personal attendance at Lecture 6, with physical presence in the course and the opportunity to discuss questions with the tutor.
11:00 – 11:30	COFFEE BREAK		
11:30 – 13:00	7. Artificial Intelligence (AI) technologies	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • ITU’s framework for Machine Learning (ML) in future networks • Network intelligence levels by ITU • AI models and data • ITU’s architecture for collaborative decentralized ML for intelligent IoT • Digital twins and AI • AI/ML network slicing management leveraging QoS from verticals • AI/ML operations in 5G/6G mobile networks • AI for QoS/QoE, network and capacity prediction and planning • AI in spectrum management 	Personal attendance at Lecture 7, with physical presence in the course and the opportunity to discuss questions with the tutor.

		<ul style="list-style-type: none"> • AI for security and fraud detection and prevention by telecoms • Generative AI for telecom sector 	
13:00 – 14:00	LUNCH BREAK		
14:00 – 14:45	8. Cloud and edge computing for telecoms and OTTs	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • ITU’s cloud computing architecture • Cloud ecosystem • Cloud service models (SaaS, PaaS, IaaS, Machine Learning as a Service, Blockchain as a Service, Robotics as a Service) • Cloud-native and microservices for OTT providers and telecoms • Edge computing (ITU’s framework, 5G/6G edge use cases) • Blockchain based Zero Trust Architectures • Quantum cloud services • Future OTT cloud services • Future telecom cloud services 	<p>Personal attendance at Lecture 8, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>
14:45 – 15:30	9. Future fixed and mobile services	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • Future telecom and OTT voice services • Future IPTV and video streaming • Virtual/Augmented/eXtended Reality (VR/AR/XR) • Telecom and OTT massive IoT services • Future critical IoT/AI services (URLLC, Industrial IoT, Smart City) • V2X services • Quantum Internet applications • Future OTT services (Web 3.0 evolution) • Metaverse evolution • Future Internet vs. QoS, QoE and network neutrality 	<p>Personal attendance at Lecture 9, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>

15:30 – 16:00	COFFEE BREAK		
16:00 – 17:00	10. Regulation and business aspects of future Internet, clouds, IoT, and AI	<p>Outline, discuss, use, analyze, design and evaluate the following topics using technical, business and regulatory aspects:</p> <ul style="list-style-type: none"> • Future Internet governance • Business aspects and regulation of metaverse • Security and trust in IoT • Crypto regulation (blockchain) • Business aspects and regulation of clouds • Data governance • AI inclusion, social inequalities, transparency and data • Future AI regulation • Future digital economy and markets • Business aspects for future telecom and OTT services 	<p>Personal attendance at Lecture 10, with physical presence in the course and the opportunity to discuss questions with the tutor.</p>
Day 2 Conclusions			

7. TUTORS/INSTRUCTORS

Name of tutor(s)/instructor(s)	Title	Contact details
Prof. Dr. Toni Janevski	Professor Doctor	tonij@feit.ukim.edu.mk

8. TRAINING COURSE COORDINATION

Course coordinator	ITU coordinator
Name: Dr. Sylwester Laskowski Title: Doctor, Chief Training Specialist Email address: s.laskowski@il-pib.pl	Name: Célia Pellet Title: Associate Capacity Development Officer Email address: ituacademy@itu.int