



*Communications for all in East Africa*

# New Technologies: 4G/LTE, IOTs & OTTS WORKSHOP

## **Title: LTE, IOTs & OTTS**

**Date:** 13<sup>th</sup>-17<sup>th</sup> May 2019

**Duration:** 5 days

**Location:** Kampala, Uganda

### **Course Description:**

This Course is designed to:

- Give an introduction to the Long Term Evolution. This course explains the evolution of 3GPP 2G & 3G wireless technologies towards 4G LTE, LTE-Advanced and LTE-Advanced-PRO, by presenting the underlying business drivers and technology enablers. This course describes the characteristics of the LTE system and architecture, its key features, its benefits, as well as the current LTE eco-system and state of deployments globally.
- Give an understanding of Internet of Things. It is designed to decipher how raw data is transformed through the pyramid (DIKW) to get information, attain knowledge and achieve wisdom. The course gives an understanding of sensor data mining and analytics, wireless sensor networks, cloud computing and IoT security. In addition, the course explains Over the Top Services; the types of content, methods of viewing and modes of access.

### **Course Objective and key benefits:**

Participants to the LTE, IOTs & OTTS Training will get an understanding of the benefits and challenges offered by LTE, IOTs & OTTS so that they will be in the position to:

- Understand the current state of the LTE eco-system and service offerings;
- Optimize their LTE strategy, based on LTE current & future capabilities;
- Understand all areas of their business that will be affected by LTE;
- Initiate an educated dialog with equipment vendors and service providers on procurement initiatives. Gain expert-level knowledge of IoT technology and tools
- Build a sound understanding of core concepts, background technologies, and the different features of the IoT landscape
- Learn about sensors, microcontrollers and communication interfaces to design and build IoT devices
- Learn how to select application-layer protocols and web services architectures for a seamless integration of various components within an IoT ecosystem
- Explore how to deploy various types of analytics on machine data to define context, find faults, ensure quality, and extract valuable actionable insights
- Understand cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms as well as the impact of OTTS.

## Pre Requisite

Basic understanding of wireless technologies.

## Who Should Attend?

Engineers / Technicians /Network Designers & Planners / Design & Deployment Engineers/  
Network Integration & Operations Engineers/Telecom Regulators

## Agenda

DAY	TIME	SESSION TITLE
DAY 1	AM	<i>Registrations</i> <i>Workshop &amp; Programme Overview</i>  <b>INTRODUCTION: BUSINESS-DRIVERS &amp; TECHNOLOGY-ENABLERS</b> Principles, motivations, and key requirements for LTE. Overview of the key technology & business drivers, including: higher spectral efficiency, all-IP network, Self Organizing Network (SON), Multiple-Input Multiple-Output (MIMO), high spectrum flexibility and scalability, higher peak data rates, lower latency, network sharing, lower costs per bits, improved user quality of experience  <b>LTE RADIO INTERFACE</b> Detailed description of the LTE radio interface and procedures.
	PM	<b>LTE SPECTRUM OVERVIEW</b> Overview of the standard FDD and TDD bands allocated for LTE, as well as their adoption in the different regions of the world.  <b>MIMO TECHNOLOGIES IN 3GPP LTE AND LTE-ADVANCED</b> Overview of the different Multiple input multiple output (MIMO) technologies introduced in LTE such as spatial multiplexing, transmit diversity, and beamforming.
DAY	TIME	SESSION TITLE
DAY 2	AM	<b>QoS IN LTE</b> Description of the QoS mechanisms in LTE; e.g. PCC framework, EPS bearers, QCI

		<p>profiles, QoS for VoIP. And others.</p> <p><b>VOICE SERVICES WITH LTE</b></p> <p>Description of the pros and cons of the different options to support voice on LTE, including: Circuit Switched Fallback (CSFB), Simultaneous Voice and LTE (SVLTE), Voice over LTE via Generic Access (VoLGA), Voice Over LTE (VoLTE), Single Radio Voice Call Continuity (SRVCC), and Over-The-Top (OTT). VoWifi.</p> <p style="text-align: center;"><b>Introduction to Internet of Things</b></p> <ul style="list-style-type: none"> <li>• Concept and definitions <ul style="list-style-type: none"> <li>○ Embedded Systems, Computer Networks, M2M (Machine to Machine Communication), Internet of Everything (IoE), Machine Learning, Distributed Computing, Artificial Intelligence, Industrial Automation</li> <li>○ Interoperability, Identification, localization, Communication, Software Defined Assets</li> </ul> </li> <li>• Understanding IT and OT Convergence: Evolution of IoT &amp; Industry 4.0</li> <li>• IoT Adoption <ul style="list-style-type: none"> <li>○ Market statistics, Early adopters, Roadmap</li> </ul> </li> <li>• Business opportunities: Product + Service model <ul style="list-style-type: none"> <li>○ Development, deployment and monetization of applications as service</li> </ul> </li> <li>• Use cases</li> </ul>
DAY	TIME	SESSION TITLE
<b>DAY 3</b>	<b>AM</b>	<p style="text-align: center;"><b>Concept of Data, Information, Knowledge and Wisdom</b></p> <ul style="list-style-type: none"> <li>• Knowledge discovery process</li> <li>• DIKW pyramid and relevance to IoT</li> <li>• Microcontrollers: cost, performance and power consumption <ul style="list-style-type: none"> <li>○ Commercial microcontroller-based development boards</li> <li>○ Selection criteria and tradeoffs</li> </ul> </li> <li>• Industrial networks, M2M networks</li> </ul> <p style="text-align: center;"><b>Sensor Data Mining and Analytics</b></p> <ul style="list-style-type: none"> <li>• Transducer: Sensor and Actuator <ul style="list-style-type: none"> <li>○ Sensors – Types of sensors, sampling, analog to digital conversion, selection criteria of sensor and ADC</li> </ul> </li> <li>• Data acquisition, storage and analytics</li> <li>• Signals and systems <ul style="list-style-type: none"> <li>○ Signal processing, systems classification, sampling theorem</li> <li>○ Ensuring quality and consistency of data</li> </ul> </li> <li>• Real-time analytics <ul style="list-style-type: none"> <li>○ Understanding fundamental nuances of IoT and Big data</li> </ul> </li> </ul>

	PM	<ul style="list-style-type: none"> <li>○ Usage of IoT data in various business domains to gain operational efficiency</li> <li>• Edge analytics</li> <li>• Data aggregation on edge gateway</li> </ul> <p><b>Wireless Sensor Area Networks: Evolution of M2M and IoT Networks and Technologies</b></p> <ul style="list-style-type: none"> <li>• Sensor nodes <ul style="list-style-type: none"> <li>○ Sensor node architecture</li> </ul> </li> <li>• WSN/M2M communication technologies <ul style="list-style-type: none"> <li>○ Bluetooth, Zigbee and WiFi communication technologies</li> <li>○ Cellular communication and LPWAN (LoRa and LoRaWAN) technologies</li> </ul> </li> <li>• Topologies</li> <li>• Applications</li> </ul> <p><b>Design and Development of IoT Systems</b></p> <ul style="list-style-type: none"> <li>• IoT reference architectures <ul style="list-style-type: none"> <li>○ Standardization initiatives</li> <li>○ Interoperability issues</li> </ul> </li> <li>• IoT design considerations <ul style="list-style-type: none"> <li>○ Architectures Device, Network and Cloud</li> <li>○ Centralized vs distributed architectures</li> </ul> </li> <li>• Networks, communication technologies and protocols</li> <li>• Smart asset management: Connectivity, Visibility, Analytics, Alerts</li> </ul>
DAY	TIME	SESSION TITLE
<b>DAY 4</b>	AM	<p><b>Cloud Computing and Platforms</b></p> <ul style="list-style-type: none"> <li>• Public, Private and Hybrid cloud platforms and deployment strategy</li> <li>• Industrial Gateways <ul style="list-style-type: none"> <li>○ Commercial Gateways solutions from various vendors</li> <li>○ Cloud-based Gateway solutions</li> </ul> </li> <li>• IaaS, SaaS, PaaS models</li> <li>• Cloud components and services <ul style="list-style-type: none"> <li>○ Device Management</li> <li>○ Databases, Visualization</li> <li>○ Reporting</li> <li>○ Notification/Alarm management</li> <li>○ Security management</li> <li>○ Cloud resource monitoring and management</li> </ul> </li> <li>• Example platforms: ThingSpeak, Pubnub, AWS IoT <ul style="list-style-type: none"> <li>○ AWS IoT Services <ul style="list-style-type: none"> <li>▪ Device Registry</li> </ul> </li> </ul> </li> </ul>

	<b>PM</b>	<ul style="list-style-type: none"> <li>▪ Authentication and Authorization</li> <li>▪ Device Gateway</li> <li>▪ Rules Engine</li> <li>▪ Device Shadow</li> </ul> <p style="text-align: center;"><b>IoT Security</b></p> <p>Standards and best practices</p> <ul style="list-style-type: none"> <li>• Common vulnerabilities</li> <li>• Attack surfaces</li> <li>• Hardware and Software solutions</li> <li>• Open-source initiatives</li> </ul> <p style="text-align: center;"><b>Analytics</b></p> <ul style="list-style-type: none"> <li>• Descriptive, Diagnostic, Predictive, and Prescriptive</li> <li>• Analytics using Python advance packages: NumPy, SciPy, Matplotlib, Pandas and Sci-kit learn</li> <li>• CASE STUDIES AND ROADMAP</li> <li>• Cold Chain monitoring</li> <li>• Asset tracking using RFID and GPRS/GPS</li> </ul>
DAY	TIME	SESSION TITLE
<b>DAY 5</b>	<b>AM</b>	<p><b>OTTS</b></p> <p><b>Introduction:</b> What is OTTS? Devices demystified: OTT vs. CTV and Smart TVS</p> <p><b>Differences in OTT advertising and creative support.</b></p> <p><b>Viewing methods</b>-On demand and Linear viewing</p> <p><b>Serving Technology</b>-Client side and Server side Ad insertion</p> <p><b>Platforms and Media owners</b>-MVPDs and vMVPDs</p> <p><b>Targeting Capabilities</b>-IP-based Programmatic TV and Traditional addressable TV</p>
	<b>PM</b>	<p><b>Q&amp;A SESSION</b></p> <p>Questions &amp; Answers session; Summary of key takeaway points; Open discussions on LTE; Sharing of experience with carriers; Feedbacks from attendees.</p>