Advanced LPWA for IoT

Instructor Led | Duration: 2 Days | Course Number: 5G_201

5G

Internet of Things (IoT) is expected to dominate telecom market in the coming years where machines exchange data for intelligent applications. Devices and networks supporting Low Power Wide Area (LPWA) IoT often pose unique challenges such as low power, low cost, low mobility, and long battery life. This advanced course on LPWA IoT takes a detailed look at 3GPP's efficient LPWA IoT solutions of LTE-M (also called eMTC or LTE Cat M1) and NB-IoT. The network architecture enhancements required for IoT such as NIDD and SCEF are described. A brief overview of the UE module industry is given. The architecture of a UE is discussed. Wireless optimizations customized for LPWA IoT such as PSM and eDRX are explained. Characteristics and operations of UE categories M1 and NB1 and the network in support of LTE-M and NB-IoT are illustrated. Key technical features of EC-GSM are briefly described.

Intended Audience

Technical personnel working for wireless operators, equipment and device manufacturers, who need a detailed look at 3GPP's LPWA IoT solutions.

Learning Objectives

After completing this course, the student will be able to:

- Explain how of PSM and eDRX help increase UE battery life.
- Illustrate the functional architecture of a UE.
- Describe key features of UE Categories M1 and NB1.
- Summarize how basic communications between the UE and the network occur for LTE-M and NB-IoT.
- Compare capacity and battery life of UE categories M1 and NB1.
- Mention roles of IoT-centric protocols such as MQTT-SN and DoNAS.
- Explain how EC-GSM enhances performance of IoT devices compared to GSM.

Suggested Prerequisites

- [LTE_102] LTE Overview (eLearning)
- [TPR1001] Technology Primer: IoT in Wireless Networks (Instructor Led)

Course Outline

1. **Network Architecture and Device Architecture**
   - 1.1. LPWA technology
   - 1.2. LTE-M, NB-IoT, and EC-GSM
   - 1.3. LTE network architectures for data transfer
   - 1.4. Device, Module, and UE
   - 1.5. UE functional architecture
   - 1.6. External device identifiers
   - 1.7. UE module industry overview
2. **LPWA IoT-centric Features**
   - 2.1. Wireless optimizations for IoT
   - 2.2. Power Save Mode (PSM)
   - 2.3. eDRX in Connected and Idle modes
   - 2.4. High latency communication
   - 2.5. Extended Access Barring (EAB)
   - 2.6. Optimized TAU signaling
   - 2.7. Half Duplex (HD) FDD
   - 2.8. eMBMS for IoT
3. **LTE-M: A Closer Look**
   - 3.1. Characteristics of UE category M1
   - 3.2. Cat M1 UE-Network communications (e.g., Attach and IP data delivery)
   - 3.3. Network acquisition
   - 3.4. CE Mode A and CE Mode B
   - 3.5. LTE-M downlink and uplink channels
   - 3.6. Impact on UE battery life
   - 3.7. Supportable capacity
   - 3.8. Overview of VoLTE
4. **NB-IoT: A Closer Look**
   - 4.1. Overview of UE category NB1
   - 4.2. Deployment scenarios (in-band, guard band, and standalone)
   - 4.3. Cat NB1 UE-Network communications
   - 4.4. Non-IP Data Delivery (NIDD)
   - 4.5. Network acquisition
   - 4.6. Downlink and uplink data transmission
   - 4.7. Category NB1 battery life
   - 4.8. Network capacity for NB1 devices
5. **Appendix A: APIs and Protocols**
   - 5.1. APIs toward customer AS: OMA, OneM2M, and RESTful APIs
   - 5.2. Protocols: MQTT-SN, CoAP, and Non-IP
6. **Appendix B: Location Methods**
   - 6.1. Overview of UE location determination methods
   - 6.2. Location services for IoT
7. **Appendix C: EC-GSM: A Closer Look**
   - 7.1. IoT enhancements in EC-GSM
   - 7.2. EC-GSM vs. NB-IoT (e.g., coverage)