

## ***Android and Mobile Network Technologies***

### **Course Duration:**

- 2 days

### **Course Description:**

- This course provides an overview of Mobile Network technologies used in devices with Android operating systems.
- We will start with an overview of the Mobile Network Architectures from GSM (2G) over UMTS / HSPA (3G) to LTE (3G – 4G), also reviewing 802.11 (WiFi) as potential access technology and the related Core Network architectures up to IMS as service delivery platform.
- We will then identify the main protocols used for the Radio Interface and the communication with the Core Network functions and the Application / Service access, as before seen as an evolution of the Mobile Network towards all IP service delivery.
- Next part will be the identification and discussion of all main building blocks of an ANDROID system, starting from the Hardware view, Abstraction Layer (HAL) to Kernel functions and libraries (LINUX), ANDROID specific runtime engine up to the Application framework and the Application layer.
- With the architecture of the system in mind, we review the communication and call processing within ANDROID.
- One of the central items of the course is then the mapping of 3GPP signaling protocols and functional entities towards ANDROID functions and libraries, throughout the protocol stack.
- We will also discuss the available development tools and environment, such as Google SDK and NDK, ANDROID packages and the integration of vendor specific protocols and functions in order to build custom applications with ANDROID.
- The course will be concluded with a set of scenarios for ANDROID phone operations – legacy phones and VoIP (WiFi and VoLTE based). This will also include the discussion for some potential hurdles for the realization of certain services.

## **Prerequisites:**

- The student must possess a general understanding of network architectures in 3GPP. There is no particular knowledge required regarding 2G, 3G and 4G mobile network technologies.
- The student should be familiar with OS system architectures in general.

## **Course Target:**

- The student will gain an overview and an introduction to the usage and interworking of the different functions implemented in modern smartphones for mobile communication.

## **Who should attend this Course:**

- Anyone who need to understand the Android and mobile network terminology, features, interfaces and the applicability in future 3GPP networks.

## **Some of your Questions that will be answered:**

- What are the main differences in the baseband modems in terms of access technology between GSM, UMTS, LTE and WiFi?
- How does the communication and service delivery work towards a Mobile Network?
- How are ANDROID communication functions - such as voice and non-voice features – mapped to the network transport protocols and functions?
- What is Smartphone Architecture as viewed from 3GPP on one side and from the ANDROID perspective on the other side?
- Which are the main communication protocols that are supported and for which purpose?
- What are the main components and libraries an ANDROID system is composed of?
- Which are the most important tools used to build an ANDROID system?
- Which are network services on an ANDROID system, that may require special attention and why?

## Table of Contents:

## INTRODUCTION AND REVIEW OF MOBILE NETWORK ARCHITECTURES

- **The GSM Network**
  - ⇒ MS internal interface, SIM card and serial interfaces
  - ⇒ Core network communication, AS / NAS interfaces and protocols
- **Changes with UMTS / HSPA**
  - ⇒ UE internal interfaces, 3G SIM
  - ⇒ Protocol stack changes, CS and PS domains
  - ⇒ The Application domain and interfaces
- **Changes with LTE**
  - ⇒ Physical resource overview, scheduling
  - ⇒ Voice applications and LTE
- **Other wireless interfaces – WiFi Example**
  - ⇒ WiFi network architecture
  - ⇒ 3GPP interworking concepts

## THE MOBILE PROTOCOL STACK – 3GPP VIEW

- **Radio Interfaces**
  - GSM, UMTS and HSPA, LTE
- **Core Network Interfaces**
  - Bearer Transport Protocols to CS-CN, PS-CN and ePC
- **IMS and Application Access**
  - User-IP and embedded Signaling, Gm, Ut and ISC Interfaces

## ANDROID SMARTPHONE – SYSTEM ARCHITECTURE REVIEW

- **General Hardware Building Blocks**
  - Baseband Modem layer and interfaces
- **UNIX Kernel Functions**
- **Hardware Abstraction Layer (HAL)**
  - Audio, Camera, Sensors, GPS ...
- **Summary of the UNIX Library**
- **ANDROID Runtime Engine**
  - ⇒ Java Virtual Machine – Dalvik
  - ⇒ Android Core Library Summary – Bionic etc.
- **The Application Framework**

- ⇒ Telephony Manager
- ⇒ Resource Manager
- ⇒ Location Manager
- ⇒ Notification Manager
- ⇒ Activity Manager
- ⇒ et. al.
- **The Application Layer**
  - ⇒ Contacts, Phone et. al.

## Communication and Call Processing within an Android System

- **Functional Split**
- **Associated Libraries**
- **Generic vs. Vendor Specific Protocol Stacks**

## Mapping 3GPP Signaling to ANDROID Functions and Libraries

- **GSM Protocols (2G)**
- **UMTS / HSPA Protocols (3G)**
- **LTE Protocols (3G – 4G)**
- **802.11 (WiFi)**
- **Applications / User-IP / Services**

## Extending the Standard Framework

- **Integration of Vendor Specific Protocols and Functions**
- **Tool Environment**
  - ⇒ Google SDK - Java
  - ⇒ Google NDK – C, C++
  - ⇒ XML Files
  - ⇒ Android Packages
  - ⇒ Building Custom Applications with ANDROID

## Putting it Together: ANDROID Phone Operation

- **Legacy Phone with GSM, UMTS, HSPA**
- **VoIP – WiFi, VoLTE**
- **Some Potential Obstacles**
  - ⇒ Integration of Provider Specific Functions and Features  
QoS, Policing, Service related Bearer Establishment and Tagging)
  - ⇒ Conversational Voice and Video (Realtime and Sync Requirements)
  - ⇒ Dual Stack IP Operations