VoLTE and IMS Signaling Protocols for 4G/5G Networks Training Course



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Sharm El-Sheikh

4100 € (Per Person)

Ref: #TEL9963_285568

Course Introduction / Overview:

This course provides a comprehensive exploration of Voice over LTE (VoLTE) and the IP Multimedia Subsystem (IMS) signaling protocols that form the backbone of modern mobile voice communication. As the telecommunications industry transitions from legacy circuit-switched voice to all-IP networks, a deep understanding of VoLTE and IMS is critical for network engineers and architects. This program delves into the intricate details of the Evolved Packet Core (EPC) and IMS architecture, focusing on the key signaling protocols such as SIP and Diameter. Participants will gain a thorough understanding of VoLTE call flows, from registration and session setup to advanced features like Single Radio Voice Call Continuity (SRVCC). The curriculum is designed to be both theoretical and practical, drawing on principles outlined by leading experts like Dr. Gonzalo Camarillo in his foundational text, "The 3G IP Multimedia Subsystem (IMS): Merging the Internet and the Cellular Worlds.". BIG BEN Training Center has structured this course to equip professionals with the skills needed to deploy, manage, and troubleshoot complex VoLTE services in both 4G and emerging 5G network environments, ensuring high-quality voice service delivery and seamless user experiences.

Target Audience / This training course is suitable for:

- Telecommunications Engineers.
- Mobile Core Network Engineers.
- Network Operations Center (NOC) Staff.
- System Integrators and Testers.
- Radio Access Network (RAN) Engineers.
- Solution Architects and Network Designers.
- Technical Project Managers in Telecom.
- Quality of Service (QoS) and Performance Analysts.

Target Sectors and Industries:

- Mobile Network Operators (MNOs).
- Telecommunication Equipment Vendors.
- Mobile Virtual Network Operators (MVNOs).
- Internet of Things (IoT) Service Providers.
- Public Safety and Emergency Services.
- Government and Defense Communications Agencies.
- Technology Consulting Firms.

Target Organizations Departments:

- Core Network Planning and Engineering.
- Network Operations and Maintenance.
- Service Quality and Performance Assurance.
- Research and Development (R&D).
- Technical Support and Troubleshooting Teams.
- System Integration and Testing.
- Product Development and Management.

Course Offerings:

By the end of this course, the participants will have able to:

- Explain the architecture of LTE/EPC and the role of IMS for voice services.
- Analyze the key functions of IMS network elements like P-CSCF, I-CSCF, and S-CSCF.
- Decode and interpret Session Initiation Protocol (SIP) and Session Description Protocol (SDP) messages.
- Trace the complete signaling flow for a VoLTE-to-VoLTE call.
- Understand the mechanisms for Quality of Service (QoS) enforcement in VoLTE.
- Describe the Single Radio Voice Call Continuity (SRVCC) handover process.
- Identify common VoLTE issues and apply systematic troubleshooting techniques.
- Discuss the evolution of voice services towards 5G Voice over New Radio (VoNR).

Course Methodology:

The training methodology at BIG BEN Training Center is designed to foster a deep and practical understanding of VoLTE and IMS technologies. Our approach moves beyond traditional lectures to create an immersive and interactive learning environment. The course is built on a foundation of expert-led instruction, where complex signaling concepts are broken down into understandable modules. This is heavily supplemented with real-world case studies that illustrate VoLTE deployment challenges and solutions. Participants will engage in hands-on exercises, including the analysis of protocol traces and log files to diagnose simulated network problems. Collaborative group discussions and workshops encourage peer-to-peer learning and allow attendees to share their unique operational experiences. Each session includes dedicated time for Q&A to ensure all concepts are clearly understood. This blend of theoretical knowledge, practical application, and interactive engagement ensures that participants not only learn the material but also gain the confidence to apply their new skills effectively in their professional roles.

Course Agenda (Course Units):

Unit One: Fundamentals of LTE, EPC, and IMS

- Introduction to 4G LTE and Evolved Packet Core (EPC) architecture.
- Key components of the EPC: MME, S-GW, P-GW, and HSS.
- The evolution from Circuit-Switched (CS) to Packet-Switched (PS) voice.
- Rationale and business drivers for deploying VoLTE.
- Introduction to the IP Multimedia Subsystem (IMS) framework.
- High-level overview of IMS network elements and their functions.
- Understanding the relationship between LTE/EPC and the IMS core.

Unit Two: IMS Architecture and Core Signaling Protocols

- Deep dive into IMS functional elements: P-CSCF, I-CSCF, S-CSCF.
- The role of the Home Subscriber Server (HSS) in IMS.
- Application Servers (AS) and their function in service delivery.
- Introduction to Session Initiation Protocol (SIP) for session control.
- Analyzing SIP methods, headers, and response codes.
- Understanding Session Description Protocol (SDP) for media negotiation.
- The role of the Diameter protocol for authentication and authorization.

Unit three: VoLTE Registration and Call Flows

- The VoLTE device attach and default bearer establishment process.
- Detailed analysis of the IMS registration procedure.
- Understanding P-CSCF discovery mechanisms.
- Step-by-step signaling flow for a Mobile Originated (MO) VoLTE call.
- Tracing the signaling flow for a Mobile Terminated (MT) VoLTE call.
- Call release procedures and associated signaling.
- VoLTE-to-PSTN call scenarios and the role of MGCF/IM-MGW.

Unit Four: Advanced VoLTE Features and Interworking

- Quality of Service (QoS) in VoLTE: QCI, GBR, and non-GBR bearers.
- Policy and Charging Control (PCC) architecture for VoLTE.
- Single Radio Voice Call Continuity (SRVCC) for LTE to 2G/3G handover.
- VoLTE roaming architecture and key considerations (LBO and S8HR).
- VoLTE security mechanisms: authentication and media encryption.
- Rich Communication Services (RCS) and their integration with IMS.
- Handling of VoLTE emergency calls and location services.

Unit Five: VoLTE Troubleshooting, Performance, and Future Evolution

- Common VoLTE call setup failures and their root causes.
- Using protocol analysis tools for VoLTE troubleshooting.
- Key Performance Indicators (KPIs) for monitoring VoLTE service quality.
- Analyzing call drops, setup delays, and voice quality issues.
- Introduction to Voice over Wi-Fi (VoWiFi) and its interworking with VoLTE.
- The future of voice: Introduction to 5G architecture and Voice over New Radio (VoNR).
- Comparing VoLTE and VoNR architectures and capabilities.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

As networks transition fully to 5G Standalone, how will the role and architecture of the IP Multimedia Subsystem (IMS) evolve beyond voice services to support new, immersive communication experiences?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by providing a holistic and forward-looking perspective on mobile voice technology. Unlike programs that focus narrowly on either LTE or IMS in isolation, this training meticulously bridges the two domains, demonstrating how they interoperate to deliver seamless VoLTE services. The curriculum is structured logically, building from foundational EPC concepts to complex IMS signaling flows and advanced features like SRVCC, ensuring a solid and comprehensive understanding. A key differentiator is the course's emphasis on practical, real-world application. Instead of relying solely on theory, it incorporates detailed analysis of call flow traces and troubleshooting scenarios that mirror the challenges professionals face daily. Furthermore, the course is not static; it concludes with a dedicated module on the evolution to 5G and Voice over New Radio (VoNR), equipping participants with the knowledge needed to navigate the next generation of telecommunications. This blend of foundational depth, practical troubleshooting skills, and a clear vision of the future provides a uniquely valuable learning experience that prepares attendees for both current and future network environments.