

LTE ADVANCED AND THE RADIO INTERFACE

Since we launched our LTE service and got experience from the network, many questions emerged. The whole team had their questions answered and were taken to a higher level by Widermind's LTE Advanced Training"
- Tony Oldén, Manager Radio Network Planning, TeliaSonera Sweden

Course Description

LTE Advanced introduces features in the network such as Carrier Aggregation, Self Optimized Networks (SON), Coordinated Multi Point (COMP), Heterogenous Network, enhanced Inter Cell Interference Coordination, eICIC, Enhanced MIMO Support and Relay Architecture.

The course "LTE Advanced and the Radio Interface" combines a thorough analysis of the E-UTRA (LTE Radio Interface) with a careful description of all the new features of LTE Advanced.

One of the most important parts of the LTE is the E-UTRAN protocol Architecture which is analyzed in-depth as is also the Layer 1 information Processing.

The new modulation schemes and methods are discussed by studying OFDM and MIMO in E-UTRA. The Synchronization & Network Access and the Downlink and Uplink Transmission Procedures are also described.

Content

ORGANIZATIONS AND STANDARDIZATIONS

- 3GPP, IETF and Internet standardization bodies
- Arena Towards Next Generation
- IMT advanced and LTE-A Features and Requirements

INTRODUCTION

- Terminology



- Evolution of Mobile Systems and 3GPP Releases
- GSM / GPRS
- The split Architecture
- UMTS and LTE Network Elements
- Data rate versus Mobility
- Encapsulation & Tunneling
- Traffic Case: Network Attach
- Protocol Stacks
- EPS Mobility Management (EMM) states
- LTE Mobility management – Tracking Areas
- Dual registration and ISR
- Mobility in Connected mode

- Tracking Area List
- Mapping coverage

ENHANCEMENTS IN HSPA+ ADVANCED R8/R9

- LTE Advanced features
- LTE Capabilities vs IMT-2000 and IMT-advanced
- LTE-Advanced time-line
- New Frequency Bands for LTE-A
- Technical Performance and Test Environments
- Spectral Efficiency: Cell-, Peak-, Mean- and Cell Edge User-
- Spectrum, Bandwidth and Scalability
- Latency, Mobility and Handover
- VoIP Capacity
- Requirements Related with Capacity, Peak Data Rate and Latency
- LTE-Advanced Rel-10 and Rel-11

E-UTRA OVERVIEW

- WM-Map_01: E-UTRA Overview
- E-UTRA Terminal Categories
- GUTI & S-TMSI
- Areas and Identities
- WM-Map_02: Mobility in Idle mode

E-UTRA PROTOCOL ARCHITECTURE

- Simplified Bearer Establishment
- WM-Map_03: E-UTRA Channel Architecture
- RRC procedures, System Information, UE States
- RRC Connection Reconfiguration
- Overview of E-UTRA Layer 2

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- Layer 2: Packet Data Convergence Protocol and Radio Link Control
- E-UTRA Protocol Architecture A
- Hybrid ARQ and Medium Access Control
- From IP Packet to TB

LAYER 1 INFORMATION PROCESSING

- Fixed Reference Channel
- WM-Map_05: DL-SCH Scrambling & Modulation
- Channel coding, Turbo Coding and Rate Matching
- Scrambling and Modulation
- OFDM and MIMO in E-UTRA
- From IP Packet to Radio Wave
- OFDM and Multi carrier Transmission
- Subcarrier Orthogonality
- Modulation: Higher-Order, technique comparison
- Scheduling, Link Adaptation
- WM-Map_06: OFDM Signal Generation
- Multi-path Propagation, Cyclic Prefix
- WM-Map_07: OFDM Signal Generation (IFFT)
- MIMO, Multi-antenna Configuration
- WM-Map_08: MIMO, Spatial Diversity (STBC)
- E-UTRA Transmission Modes and Radio Frame (FDD)
- Downlink and Uplink Sub-frames

SYNCHRONIZATION & NETWORK ACCESS

- E-UTRAN Transmission
- WM-Map_09: Cell Search and SI Acquisition

- PBCH Coding and Mapping
- Random Access, RA signal flow
- PRACH Configuration index
- RA Preamble Formats, Generation and Mapping

DOWNLINK TRANSMISSION PROCEDURE

- WM-Map_10: Downlink Sub-frames
- PHFICH and PDCCH Coding and Mapping
- Downlink Control Information (DCI)
- Transmission Mode and DCI Format
- PDCCH Format and Search Spaces
- WM-Map_11: DL Transmission Scheduling & HARQ
- Resource Allocation Types
- Modulation and Coding Scheme
- Transport Block Size Index
- Semi-Persistent Scheduling, Configuration
- Discontinuous Reception
- Channel Status Reporting

UPLINK TRANSMISSION PROCEDURE

- WM-Map_12: Uplink Transmission Scheduling & HARQ operation
- PHICH and PUCCH Coding and Mapping
- UCI Multiplexed on PUSCH

ENHANCED MIMO SUPPORT

- MIMO and MIMO in LTE Advanced
- Enhanced DL MIMO Support Up to 8x8 antenna configuration
- Enhanced UL Transmission and multiple access

- TM9 8x8 MIMO
- Uplink Transmission Scheme
- Downlink Transmission Scheme Layer 5, 6, 7 and 8
- Enhanced multiple antenna transmission
- Designing enhanced MIMO systems

CARRIER AGGREGATION (CA)

- Carrier Aggregation introduction and Options
- Carrier Aggregation at protocol layers
- Carrier aggregation example and Scenarios
- Creating carrier aggregation signals
- Architectural Alternatives Option 1, 2 and 3
- Downlink Control Channels and Impacts
- Achieving Carrier aggregation

RELAY ARCHITECTURE

- Relay Architecture - Concept
- Classification
- Protocol Stacks
- Channel Mapping
- Multi-hop relaying
- Relaying summary

HETEROGENEOUS NETWORK & eICIC

- Introduction HetNet
- Enhancements for Home eNodeBs
- Mobility and RRC State Models
- H(e)NB

- HeNB/CSG operation
- Femtocells, standardization, Potential gains, Graph
- Femtocell – Users vs Data Volume
- Inter-Cell Interference Coordination in LTE
- Improvements of Latency in the Control and User Plane
- HeNB mobility enhancements
- Fixed wireless customer premises equipment (CPE)
- ICIC and eICIC

COORDINATED MULTIPOINT (CoMP)

- CoMP, Definition
- Coordinated Multipoint Transmission or Reception
- Transmission or Reception
- CoMP, geographically separated points
- Two possible situations of joint processing
- Uplink CoMP

SELF ORGANIZED NETWORK (SON)

- SON introduction, graph
- SON Description
- SON network enhancements

Target audience

Target audience is telecom engineers and radio engineers working with the LTE system.

Pre-requisites

The participants should have some prior knowledge about mobile systems.

Course length

3 days

Widermind communicates the knowledge you need to develop and implement new technologies for current and future network operations. Our clients are telecom operators, system integrators, system suppliers and consultancy firms.

Based in Stockholm, Sweden, we develop courses backed by a comprehensive network of associates. Our instructors employ technical and pedagogical skills that have made Widermind training well known and appreciated as one of the best services in the field.

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