

Course ID

WIRELESSNET

Course Duration

3-4 days

Related Courses

Course Title

Wireless Network Structure, Operation, and Technologies

- RF Propagation Models, Fading Characteristics, and Link Budget Analysis (RFPROP, 3 days)
- Cell Planning and Site Development (CELLPLAN, 3 days)
- Traffic Engineering Models for Network Design (TRAFFIC, 3 days)
- Wireless Technologies: A Comparative Study (COMPARISON, 2-4 days)
- GSM: Network Architecture, Operation, and Design (GSM-I, 5 days)
- GPRS: Network Architecture, Operation, and Design (GPRS, 3 days)
- EDGE: Network Architecture, Operation, and Design (EDGE, 2 days)
- iDEN™: Network Architecture, Operation, and Design (IDEN, 4 days)
- cdmaOne/IS95: Network Architecture, Operation, and Design (IS95, 2 days)
- CDMA Technology and Its Evolution to cdma2000 (CDMA, 3 days)
- 1xRTT: Network Architecture, Operation, and Design (1XRTT, 2 days)
- 1xEVDO: Network Architecture, Operation, and Design (EVDO, 3 days)
- UMTS-FDD: Network Architecture, Operation, and Design (UMTSFDD, 3 days)
- UMTS-TDD: Network Architecture, Operation, and Design (UMTS-TDD, 2 days)
- WiMAX and Mobile WiMAX: An Advanced Tutorial Including 802.16e (WIMAX-TECH, 3 days)
- WiMAX/Mobile WiMAX (802.16/16e) Radio Planning and Optimization: A Comprehensive Workshop (WIMAX5D, 5 days)
- HSDPA: Network Architecture, Operation, and Design (HSDPA, 2 days)
- HSDPA: An Advanced Tutorial (HSDPA-ADV, 2 days)
- HSUPA: Network Architecture, Operation, and Design (HSUPA, 2 days)

Aimed At

Anyone who needs to understand the key concepts, structures, and operational details that underlie all wireless systems. This course is aimed at technical audiences.

Group Size

5-25

Prerequisites

At least one year experience in the field of communication engineering, fixed or wireless telephony, IT, or related technical fields.

Course In a Nutshell

From analog to digital to third and fourth generation (3G/4G) wireless, wireless technologies have come a long way since their inception in the early 1980s. While the technologies continue their rapid evolution, the underlying principles have stayed the same. A thorough understanding of the common underpinnings is a necessary prerequisite for studying any of these technologies.

In this course, you will learn the fundamental structures and processes common to all wireless systems such as frequency reuse, frequency planning, color code use and planning, handoff, call flows, and call establishment. Upon course completion, you will have a solid grasp of the problems that face a wireless engineer and how they are typically solved. You will also have a good understanding of how the wireless technologies have evolved. All of this will put you in a very good position to embark on a detailed study of the particular technology that interests you as well as to objectively evaluate the conflicting claims that are often made about the capabilities of technologies and networks.

Customize It!

You can customize this course to your organization's specific needs at little-to-no added cost. We offer distinct versions of this course for audiences such as network, equipment, or application designers, drive test or cell site technicians, and less technical audiences such as managers, executives, business planners, sales and marketing specialists, and operations and support personnel.

Course Outline

■ **A Brief History of Wireless Communications**

- Early mobile telephony services: MTS and IMTS
- Analog beginnings (1G): NMTS, TACS, and AMPS
- Transition to digital: D-AMPS, IS54
- Digital (2G) technologies: IS136, IS95 (cdmaOne), GSM, and iDEN™
- Paving the way for 3G (2.5G): GPRS and EDGE
- “Almost” universal wireless standard (3G): IMTS-2000, UMTS, cdma2000

■ **Architecture and Operation of a Wireless Network**

- Key concepts that underlie wireless networks
 - Radio spectrum licensed for Cellular
 - Paired forward and reverse channels
 - Cellular (800 MHz) and 1900 MHz (PCS) bands
 - Frequency reuse: Necessity and consequences
 - Handoff or handover
 - Multiple access technologies: Evolution and standards
 - Analog, FDMA, TDMA, CDMA
 - FDD versus TDD
- Core network architecture
 - Base station
 - Backhaul
 - MSC
 - HLR
 - VLR
 - AuC
 - EIR
- Making a call
 - Cell search techniques
 - Initialization and registration

- Authentication
- Paging
- Keeping in touch while in motion
- Active and inactive status: The VLR and HLR updates
- Voice calls vs. packet data services

■ **Wireless Network Design and Deployment**

- Frequency reuses patterns
- TDMA vs. CDMA tradeoffs
- Subscriber capacity and cell sizing calculations
- Co-channel interference
- Cellular antenna design
- Cell sectorization
- Channel spacing and channel bandwidth
- Traffic capacity and subscriber density economics
- Macro cell, mini cell, pico cell: When and how used
- Cellular network design parameters
- Traffic engineering models
- Hard, soft and softer handoff
- Handoff algorithms
- Dynamic power control features and advantages
- Deployment steps and considerations

■ **Radio Propagation in a Mobile Environment**

- Free space path loss
- Path loss in a mobile environment
- Multipath: Rayleigh and Rician fading
- Effects of constructive and destructive interference
- Delay spread
- Flat fading and frequency selective fading
- Coherence bandwidth
- Inter symbol interference
- Carrier to interference ratio
- Link budget analysis

■ **Transmitting Information over Radio Channels**

- Channel coding
 - FEC Convolutional coding, Viterbi decoding
 - Interleaving
 - Equalization
- Rake receiver
- Transmit/receive diversity
- Source coding: Vocoder and compression algorithms
- Digital modulation basics
 - QPSK
 - 8PSK
 - QAM
 - MSK

- OFDM

- **GSM: The Dominant 2G Technology Worldwide**

- GSM frequency bands
- GSM system architecture
- GSM base transceiver station components
- The GSM base station controller
- GSM radio interface channelization
- GSM physical and logical channels
- GSM framing structure
- GSM slot timing alignment
- GSM transmitting and receiving chain
- GSM network subsystem
- GSM Key Performance Indicators (KPIs) and measurements
- From GSM to 3G: Overview of GPRS and EDGE (or EGPRS)

- **Understanding CDMA: The Core Technology for 3G Evolution**

- Key concepts and attributes of CDMA systems
- CDMA pioneers
- Bit and chip intervals
- Basics of Direct Sequence Spread Spectrum (DSSS)
- CDMA spectrum spreading
- Cross correlation
- Recovering the signal
- Processing gain
- Examining some CDMA engineering concepts
- Soft handoff
- Dynamic power control
- Rake receiver
- Comparing WCDMA and cdma2000

- **3G, 4G, and Beyond**

- cdma2000: From 1xRTT to 1x EVDO (Rev. 0, A, B), and Ultra Mobile Broadband (C)
- UMTS: From GSM to UMTS, HSDPA, HSUPA, and 3GLTE
- WiMAX, Mobile WiMAX, WiBro (S. Korea)
- Proprietary technologies: ArrayComm's i-Burst and Flarion (Qualcom)'s Flash-OFDM
- OFDM and MIMO in a nutshell
- Technical and Marketing challenges facing the evolving broadband wireless systems

- **Course Recap, Discussion, and Evaluations**

- You will learn in interactive lecture format from an instructor who's among the more knowledgeable and dynamic in the industry.
- Along with lecture, we use exercises, puzzles, case studies, and interesting class activities to enrich the instruction and drive home the essential points.
- If you already know something about wireless, we will build on what you

How You Will Learn

know. We'll compare and contrast what's familiar with what's new, making the new concepts easier to learn as well as more relevant.

- If your background is less technical, we will use meaningful and ingenious examples and analogies to simplify the complex subject matter.
- The Participant Handbook will provide you with a structure to which you can add the information and insight offered in real-time, turning it into a valuable reference resource you can take back to your job.

Revised

Jan 21, 2008