MOBILE BROADBAND INNOVATION:
3G TO 4G EVOLUTION AND IMPACTS
2010 OUTLINE

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Course Outline

Making Sense of Wireless

Highlights

This course covers: 3G, Evolved 3G, 4G (IMT Advanced), WiMAX (IEEE 802.16e, IEEE 802.16m), Wi-Fi Advances, Fixed-Mobile Convergence, Smartphone Platforms and Application Optimization.

Introduction

Today's wireless networks and technologies are the culmination of massive innovation and investment, and represent some of humanity's greatest achievements. However, this is only the beginning of a new era of computing and communications, which will be enabled by new wireless technologies such as LTE and WiMAX, and which will lead to a wealth of new mobile platforms and applications. The result will be new ways of doing business, as well as entirely new lifestyles.

It is crucial that technologists and businesses understanding the true capabilities as well as limitations of these technologies. In this one day course, Peter Rysavy, president of Rysavy Research, provides a fundamental understanding of how different wireless technologies function, their latest and forthcoming advances, their inherent capabilities, their market realities and how best to use them.

Comprehending mobile broadband requires an understanding of its role relative to wireline technologies. Peter thus begins with an explanation of the latest wireline advances such as passive optical networks (PONs), and assesses where wireless and wireline are competitive versus complementary. He then reviews wireless technology fundamentals before delving into how Wi-Fi technology works, why its impact on the networking industry is so significant, how Wi-Fi relates to other wireless technologies such as WiMAX and cellular, and the role the technology will play in the future. Peter briefly discusses the capabilities and mechanisms of the evolving IEEE standards such as 802.11n and the new work in 802.11ac and 802.11ad for very high-speed operation. The course also takes a hard look at hotspots, and the rapid rise and fall of municipal Wi-Fi networks.

Meanwhile, cellular operators are deploying 3G systems around the world, providing throughput rates of well over 1 Mbps. In the US, Verizon Wireless and Sprint are expanding their CDMA2000 EV-DO coverage and AT&T is aggressively deploying High Speed Packet Access (HSPA), an enhanced version of Universal Mobile Telecommunications Systems (UMTS). Globally, hundreds of UMTS networks are already in operation. The course explains all these technologies, including their capabilities, spectrum used, the best suited applications, as well as optimal application deployment strategies. The course examines how wireless technology is evolving towards 4G, as specified in the International Telecommunications Union (ITU) project called IMT (International Mobile Telephone) Advanced. New technologies, close now to deployment, include HSPA+, CDMA2000 Rev B, and OFDMA-based technologies such as 3GPP Long Term Evolution (LTE). Also covered are femto cells and other fixed-mobile convergence architectures.

Companies have struggled with marketing broadband wireless solutions for the last decade, but the momentum of WiMAX promises a standards-based approach that could finally ignite the potential of this market, both in fixed and mobile applications. The WiMAX forum now has hundreds of vendors, including equipment vendors, service providers and systems integrators. WiMAX is based on the IEEE 802.16e-2005 standard with user-achievable rates of several Mbps in bands below 11 GHz. This course explains the inner workings of IEEE 802.16 and addresses questions such as where will WiMAX is competitive, bands used for deployment, what products can be expected in what time frame and to what extent does the use of orthogonal frequency division multiple access (OFDMA) provide inherent advantages over code division multiple access (CDMA) technologies. The course also discusses the evolution of WiMAX to Release 1.5 and then Release 2.0 to be standardized in IEEE 802.16m.

Outline

The outline for the course is as follows:

Broadband Context

- Wireline versus wireless
- Wireline developments (e.g., passive optical networks, metro Ethernet, DOCSIS)

Wireless fundamentals

- Types of applications
- Modulation and error control
- Available and forthcoming spectrum and implications
- Overview of standards
- Principles of Code Division Multiple Access (CDMA)
- Principles of Orthogonal Frequency Division Multiple Access (OFDMA) and strengths/weaknesses relative to CDMA

IEEE 802.11

- Fundamental capabilities
- Architecture and protocols
- Interference management
- 802.11n: high speed
- 802.11ac, 802.11ad, very high speed
- Other key emerging IEEE WLAN standards

Wireless Hotspots and Municipal Wi-Fi

- Market trends
- Pros/cons versus 3G, WiMAX
- Architectures, standards and protocols
- Mesh and municipal Wi-Fi: capabilities, scalability
- Interference management

3G Technologies and Evolution to 4G

- Frequency bands
- CDMA 2000 - 1XRTT, EV-DO, EV-DO Rev A, EV-DO Rev B
- Enhanced Data Rates for GSM Evolution (EDGE) and Evolved EDGE
- Universal Mobile Telecommunications System (UMTS)/Wideband CDMA (WCDMA) including 3GPP releases 5 to 10
- High Speed Packet Access (HSPA) and HSPA+
- High Speed Packet Access (HSPA) and HSPA+
- 3GPP Long Term Evolution (LTE), LTE Advanced
- Architecture, radio interfaces, protocols, quality-of-service, dynamic policy
- System capabilities (throughput, latency, capacity) and limitations
- Security mechanisms
- Core network evolution (flatter architectures, Evolved Packet Core)
- Time Division Synchronous CDMA (TD-SCDMA)
- IP Multimedia Subsystem (IMS) for next generation services (e.g., integrated location/messaging/voice/video)

WiMAX and IEEE 802.16

- Role of WiMAX, market positioning and applications

- IEEE 802.16-2004, IEEE 802.16e-2005, Rel 1.5, IEEE 802.16m standards overview
- Available frequency bands (licensed versus unlicensed)
- Radio interface and protocols
- Capabilities
- IEEE 802.16j Multihop Relay
- Security architecture
- Capability and time frame compared to 3G

Technical Comparison of Wireless Technologies

- Throughput comparison
- Latency comparison
- Spectral efficiency comparison
- Capacity comparison

Fixed Mobile Convergence

- Standards (e.g., Unlicensed Mobile Access, IP Multimedia Subsystem)
- Dual-mode Wi-Fi approaches
- Femtocells
- Consumer versus business integration

Platform Developments

- Smartphone operating systems (BlackBerry, iPhone, Windows Mobile, Symbian, Google Android, mobile Linux)
- Mobile Internet Devices and Ultra Mobile PCs

Applications

- Applications driving mobile broadband
- Throughput considerations, factors affecting throughput, latency
- Mobile application architectures including native client, Web-based, middleware
- Capacity constraints of wireless networks

Conclusions

- Relative position of different wireless technologies
- Technology evolution
- The future of wireless networking
- Market directions
- Open discussion

Biography

Peter Rysavy is the president of Rysavy Research LLC, a consulting firm that has specialized in wireless technology since 1993. Projects have included analysis of technology capabilities, strategic consultations, system design, white papers, articles, courses and webcasts, network performance measurement and test reports.

Peter Rysavy is a leading international authority on the capabilities and evolution of wireless technology. He has written over a hundred articles, reports and white papers, and has taught forty public wireless courses and webcasts. He has also performed technical evaluations of many wireless technologies, including 3G networks, municipal/mesh Wi-Fi networks, hotspot networks, and wireless e-mail systems.

From 1988 to 1993, Peter Rysavy was vice-president of engineering and technology at LapLink where projects included LapLink, LapLink Wireless and connectivity solutions for a wide variety of mobile platforms. Prior to that, he spent seven years at Fluke Corporation where he designed communications hardware and software for data acquisition products.

Peter Rysavy is also the executive director of the Portable Computer and Communications Association (PCCA, http://www.pcca.org), a group that evaluates wireless technologies, investigates mobile communications architectures and promotes wireless-data interoperability. Peter Rysavy graduated with BSEE and MSEE degrees from Stanford University in 1979. More information is available at http://www.rysavy.com.