

View on Long Term Evolution

2nd, Nokia China Academia Summit

Company Confidential

Environment and Vision

- **Packet only networks, packet data performance**
- **Competition from other systems**
- **Technology development**
- **Key operators clearly more active than early days on 3G, requirement driven by them**
- **Standardisation situation – 3GPP, 3GPP2, IEEE (802.16e)**

LTE 3GPP Rel'8 Overview

Key targets

- up to 100 Mbps peak in DL
- up to 50 Mbps peak in UL
- increase 95% coverage probability for high bit rates;
 - 2 to 3 times Release 6 HSDPA
 - 2 to 3 times Release 6 Enhanced Uplink
- Server roundtrip delay < 30 ms
- One-way air interface delay up to 5 ms
- Idle to Active delay 100 ms (excluding paging)

Key characteristics

- Cellular coverage & mobility
- Scalable bandwidth of 5, 10, 15, 20 MHz, also 1.25 and 2.5 MHz
- PS domain only
- FDD & TDD duplexing
- Asynchronous base stations
- Enable re-use 1 w/o macro diversity

Key solutions

- Downlink OFDM
- Uplink Single Carrier FDMA (cyclic prefix with time or frequency level generation)
- MIMO
- Modulation $\pi/2$ shift BPSK (UL), QPSK, 16QAM, 64QAM (DL)
- Implicit radio bearer setup for basic QoS
- Fast allocations on shared channels

LTE Development After 3GPP Rel'8

- After 1st LTE release higher peak data rates available either through
 - Higher modulations [64QAM+] (=> very limited range)
 - More MIMO-streams [e.g. 4 x 4] (=> increased complexity)
 - Wider bandwidths [> 20 MHz]
- Requirement for wider bandwidth leads to
 - More difficulties in finding spectrum, new bands will be needed (WRC07 Agenda Item 1.4)
 - Higher power consumption
 - More limited uplink range

3.9G and Beyond: Telecom vs Internet Access

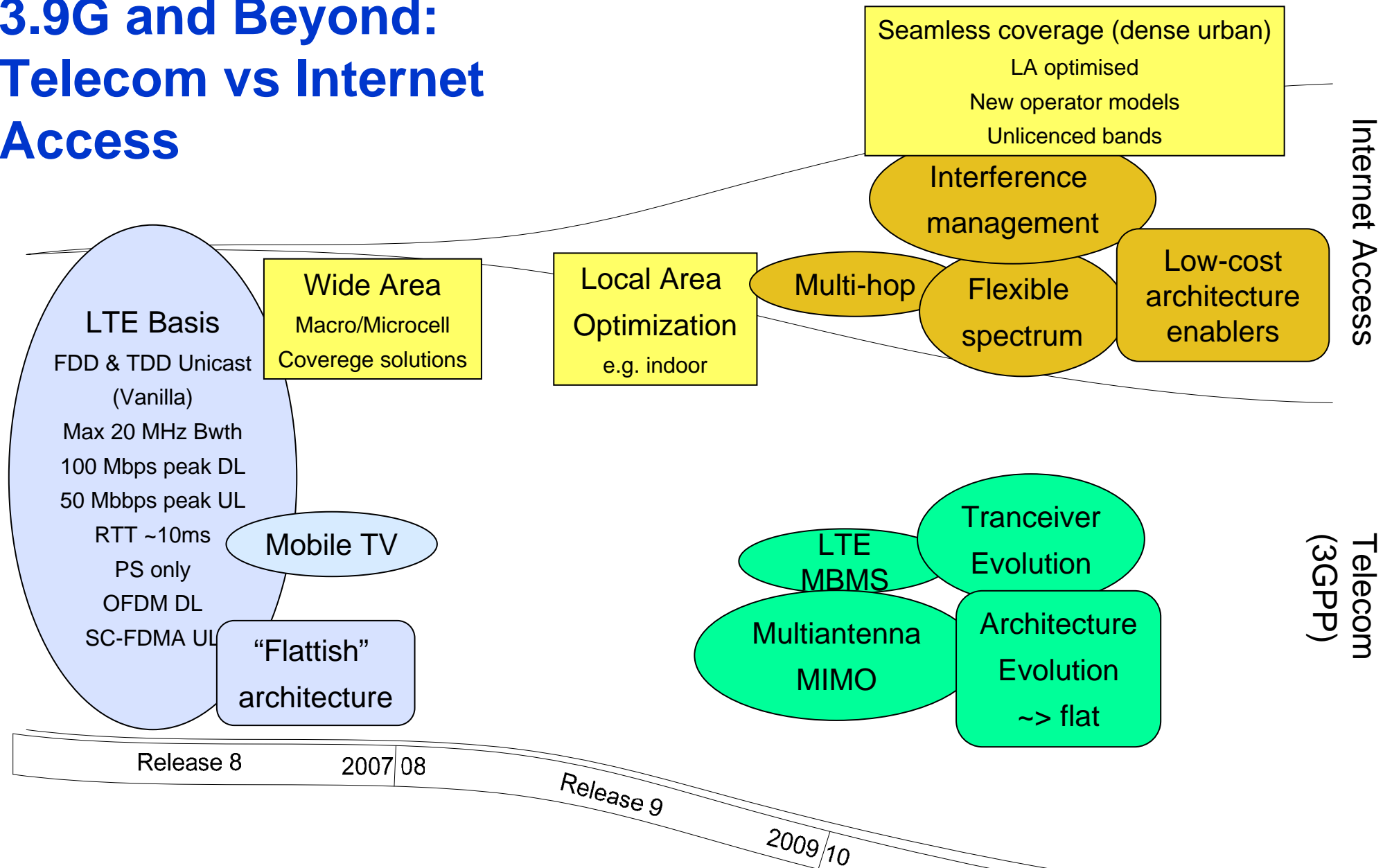


Photo and Bio



- Xiangguang joined Nokia in Jan 2001 as R&D Engineer in Nokia Networks after he earned his M.Sc. (Electromagnetic and Microwave Engineering) from Beijing University of Post and Telecommunications. In Jan 2002, he joined Mobile Network Lab of Nokia Research Center (NRC) as Research Engineer where he devoted on cellular competences building up in the team and research on (E)GPRS and WCDMA RRM algorithms. Since March 2003, Xiangguang was appointed as Research Manager to lead a team on system performance and protocol research of WCDMA and CDMA2000, and the Research Manager to lead a team on Radio System Performance in RAD Lab since July 2004 till now. Xiangguang is author of several technical papers and holder of a few issued and/or pending patents.