



> **BUSINESS MADE SIMPLE**

MIMO-OFDM in Long Term Evolution (LTE)

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Agenda

- > Why LTE Now?
- > LTE Baseline Technologies
- > Key Aspects of LTE Service Roll-Out
- > Summary



Changes Underway with Devices, Applications & Market Place – A New Era for the Industry

New Types of Devices/Connectivity

- >MP3/iPOD
- >Consumer Products
- >Embedded wireless – laptops, game devices ...



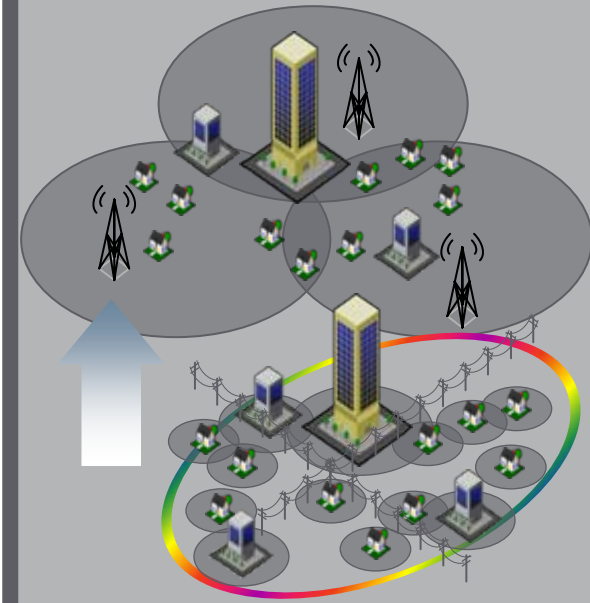
More demanding applications

- >Interactive online gaming
- >IMS rich voice services
- >Video explosion
- >Mobile TV



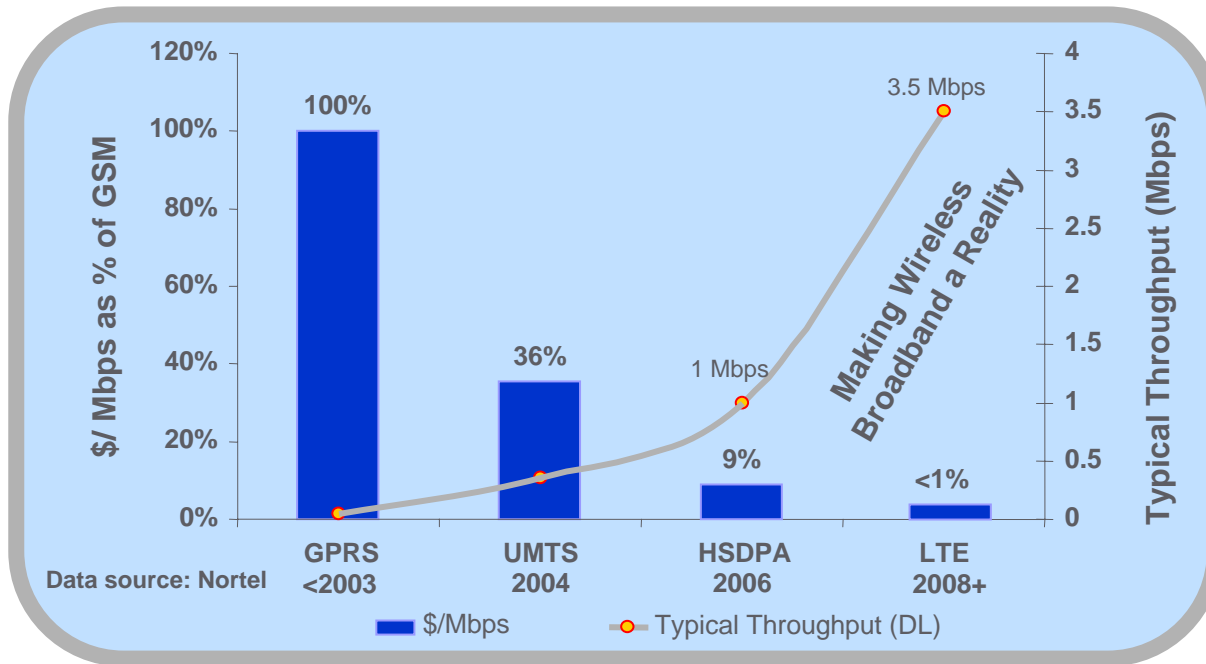
Converging market place

- >Colliding business plans
- >Service continuity with ubiquitous broadband access
- >Competing Technology (WIMAX, Rev-C, LTE)



Needs: Capacity/Performance, Cost and Seamless Experience

LTE Delivers Drastic Shift in Cost Structure, Capacity & Performance to Support the Masses



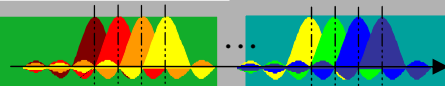
- ✓ 3-5X Spectral efficiency and new design eNodeB
- ✓ Flat architecture - Less Nodes to build/manage
- ✓ Lower spares inventory
- ✓ Low cost IP & DSP technology

- > **GPRS/EDGE/UMTS** introduced PS wireless data to the world
- > **HSDPA/HSUPA** deliver much higher performance making mobile broadband a viable alternative **but with limited capacity & still costly**
- > **LTE** will deliver the **right cost structure** making mobile broadband affordable for the masses

LTE Changes the Cost Structure with OFDM-MIMO and a Flat All IP-based Architecture



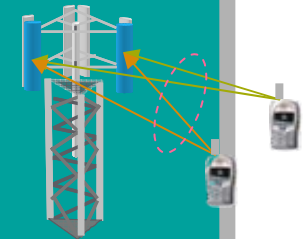
Peak Performance DL



- > OFDM/OFDMA in the DL
 - Spectral Efficiency (3-5x Rel'6)
 - Resistant to Multi-path interference
- > MIMO
 - Doubles the throughput
 - Deployment simplicity

Power Efficient UL

- > SC-FDMA – Lower PAR
 - Longer mobile battery life
 - Larger cell coverage
- > Multi-user (Virtual) MIMO
 - Simplifies mobile implementation
 - 25% increase in cell bandwidth

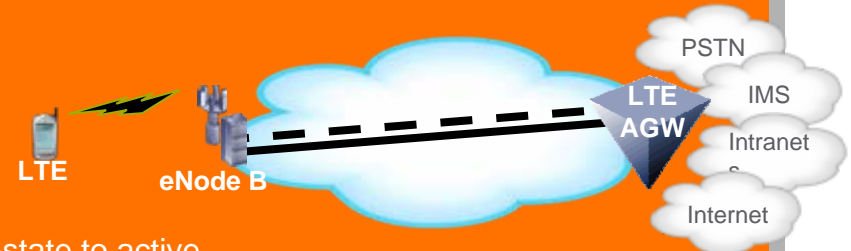


Scalable, Reusable and Compatible with 3G Access Networks

- > Scalable spectrum allocation (1.25, 2.5, 5, 10, 15, 20MHz) – great for in-band deployment
- > Inter 2G/3G/LTE & inter Non-3GPP mobility– smooth network migration to LTE and beyond

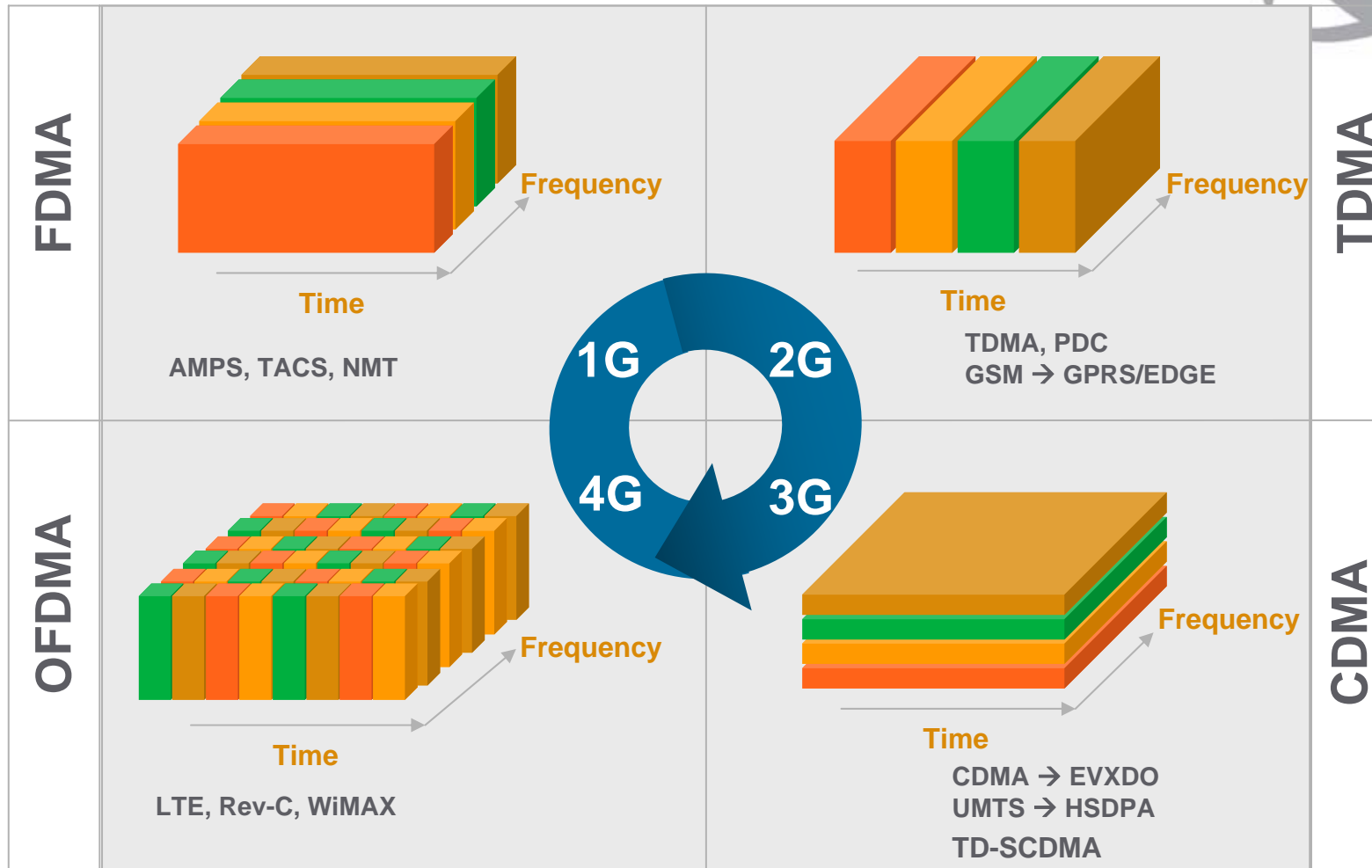
Flat All IP Architecture for Cost Reduction and Performance

- > Reduce CAPEX and OPEX Costs
- > Higher Network Performance
 - Efficient routing - reduce Latency (20 ms RTD)
 - Increasing Throughput (Peak @ 100/50Mbps DL/UL)
 - Always On – Less than 100ms transition from camped-state to active



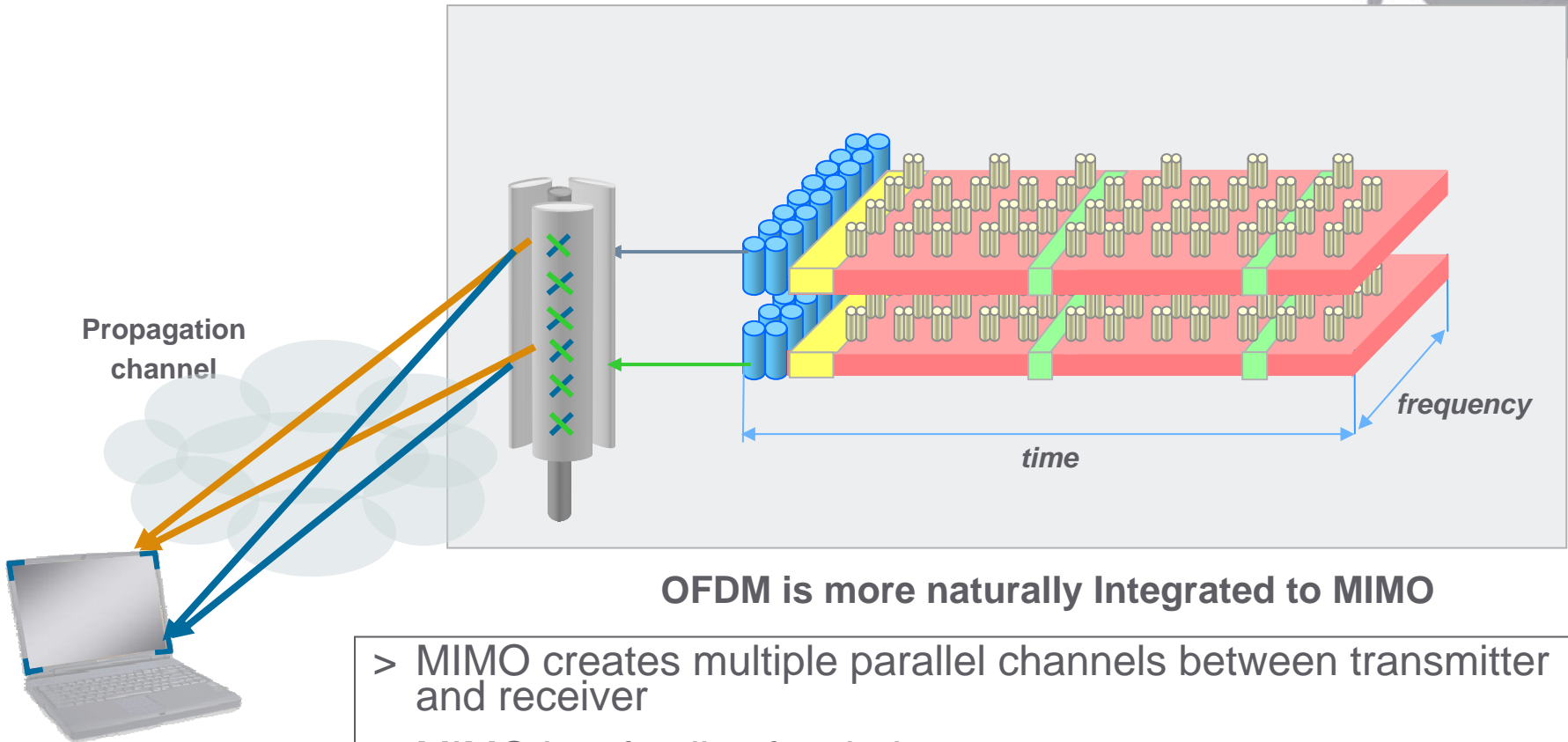
OFDM Improves Radio Access Efficiency

Moving from Voice to Broadband with VoIP



OFDM - scalable and most cost effective broadband solution

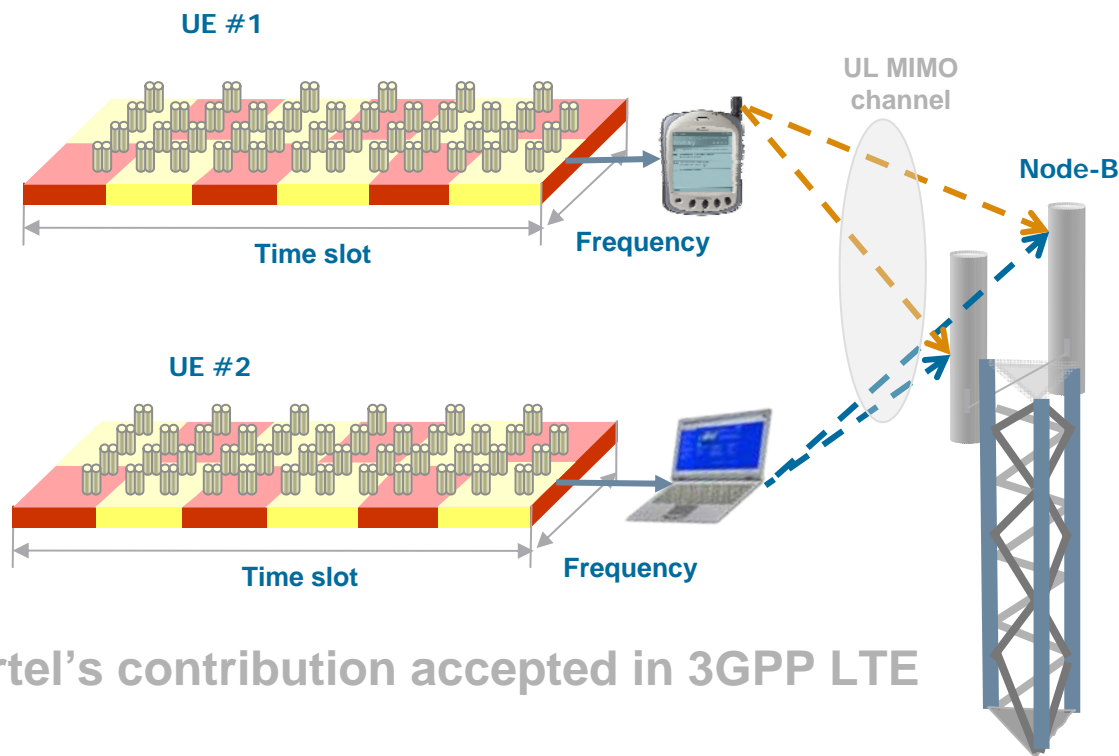
MIMO Antenna Technology – The Most Cost Effective Implementation in Multi-path Environment



- > MIMO creates multiple parallel channels between transmitter and receiver
- > MIMO is a family of techniques
 - Use multiple channels to send the same information stream to achieve diversity → improve coverage
 - Use multiple channels to send multiple information streams → increase throughput

Nortel Pioneering Collaborative MIMO

25Mbit/s UL in 5MHz - Prototype in September 2006



Nortel's contribution accepted in 3GPP LTE

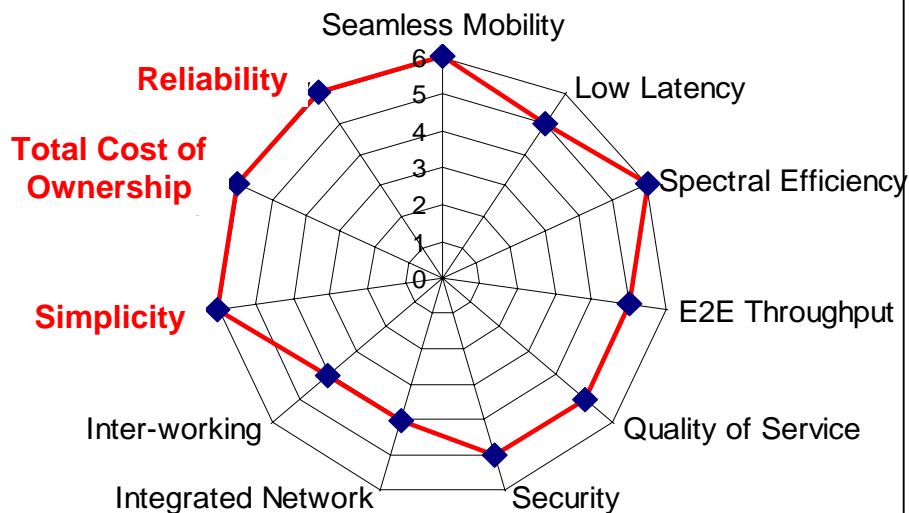
MIMO-Like UL w/out multiple TX – reduce UE complexity, power consumption, size and cost

Listen & Solve NGMN Operator Requirements



NGMN = T-Mobile, Orange, Vodafone, KPN, NTT DoCoMo, Sprint, China Mobile > 700M subs.

NGMN Requirements



Major Cost Items

- > Antenna leases (\$3k/year/antenna) / site space leases
- > Feeder cable leases from Tower companies (~\$600/year/antenna)
- > Capex on antenna build-out (~\$21k → antennas, cables, labor)

- > Utility cost associated with additional power consumption

- > Backhaul leases from Telcos (~\$3k/year)

- > Capex on cell-site equipment
- > Capex on structural improvements for new radio equipment

Nortel focuses on the Total Cost of Ownership and Simplicity with Reliability built in

Leveraging Nortel's Strong HSDPA Terminal Partnership to Build an LTE Ecosystem



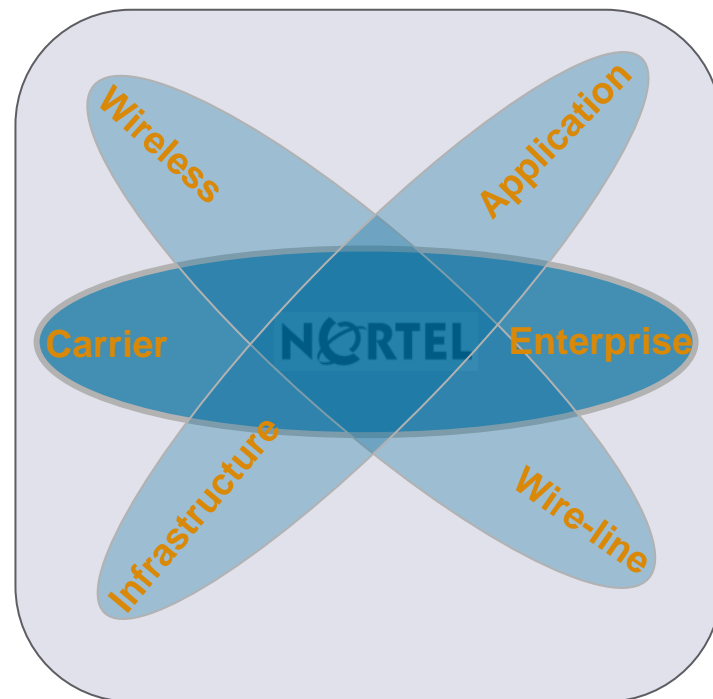
- > Unique HSPA co-development activities with Qualcomm
 - Industry First HSDPA data calls at 3.6Mbps and 7.2Mbps
 - Industry First HSDPA 7.2Mbps at 850/900 Mhz
- > Strong IOT program with major chipset and terminal suppliers



TTM leadership through partnerships and early inter-working

LTE in a Nutshell

- > Advancing devices & value added services in a converging market place are the drivers for LTE now
- > OFDM-MIMO and IP-based technology deliver the cost structure with capacity and performance
- > Listen and Solve NGMN requirements
- > Leverage a strong 3GPP ecosystem to achieve time to market advantage



Be ahead of the pack with LTE

