



Capturing LTE opportunity

May 2011

IEEE ComSoc / IST: 19as. Palestras sobre Comunicações Móveis



Agenda

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BROADBAND



Why LTE?

Operator approaches

Network evolution

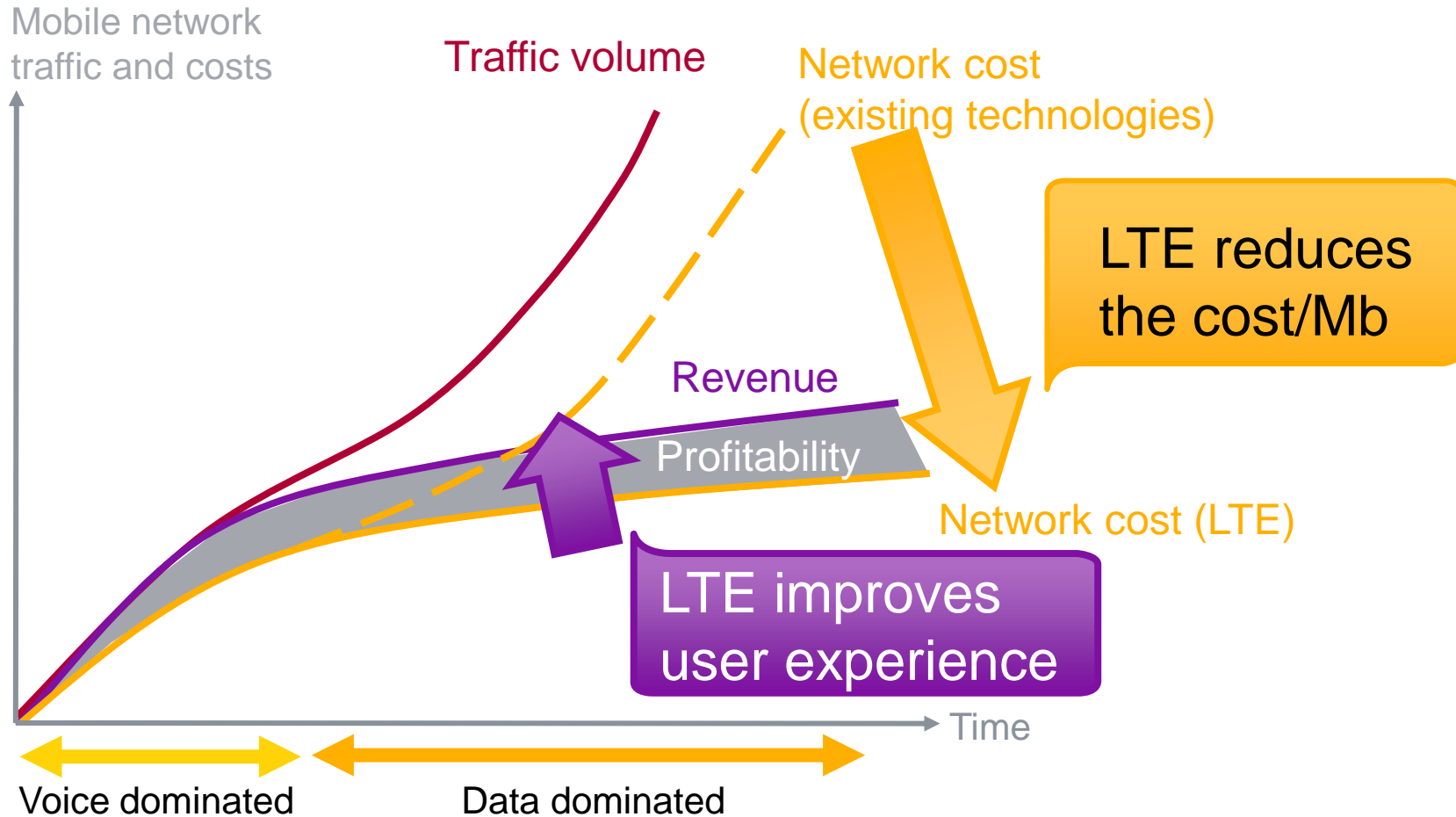
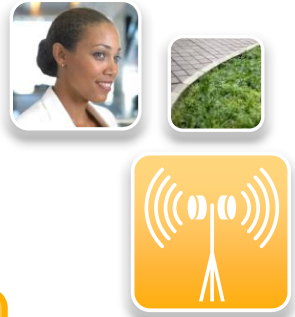
NSN approach

Summary

Motivation for LTE

The CSP view

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Source: Light Reading (adapted)

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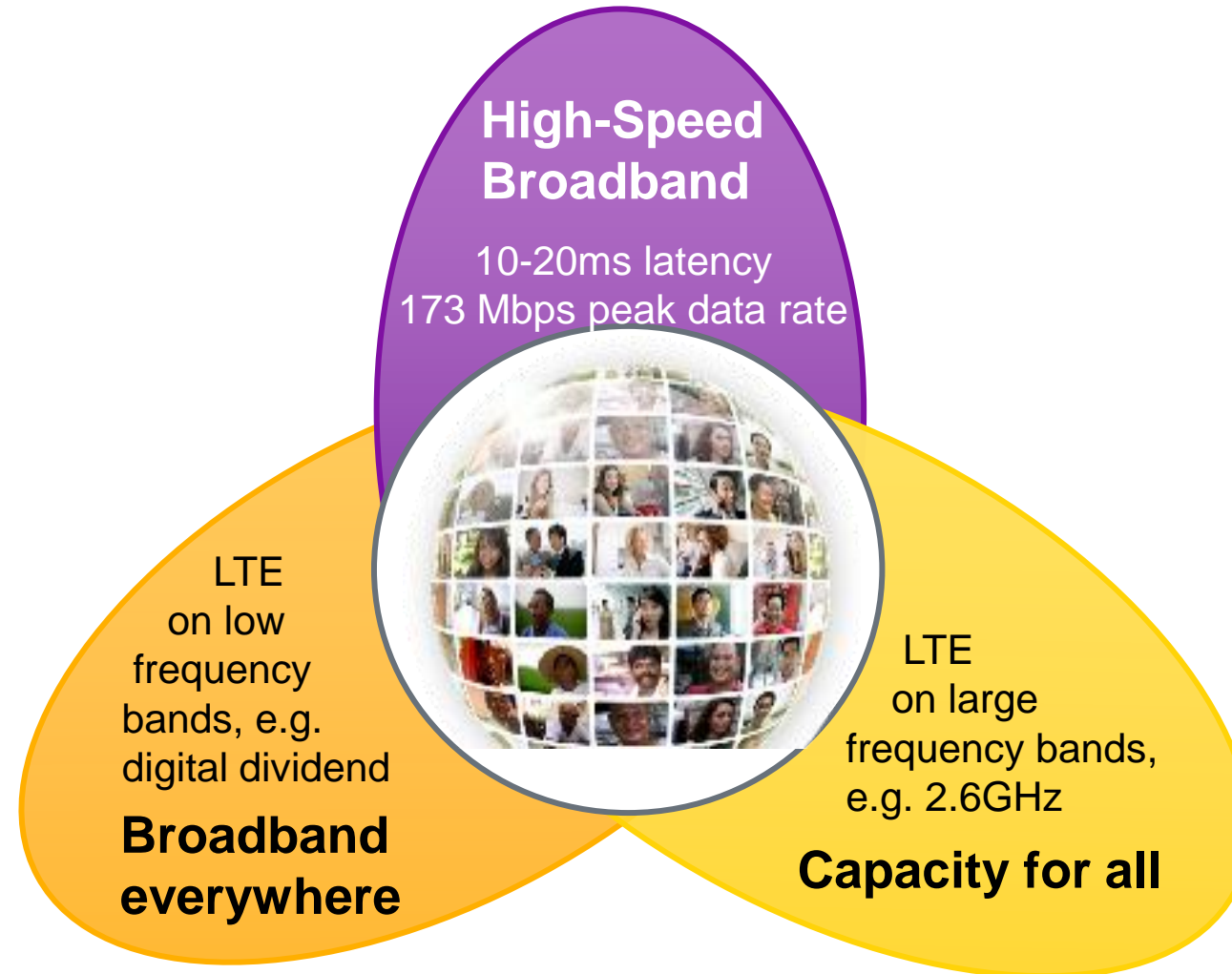
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Motivation for LTE

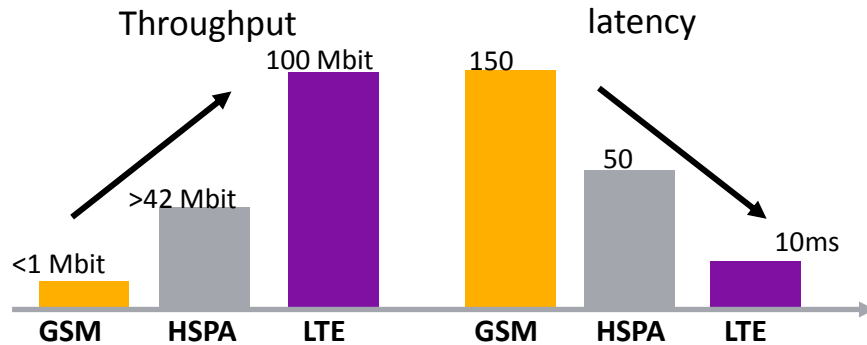
Customer view: better broadband experience

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WHY LTE?

Superior mobile broadband user experience



Industry commitment behind the ecosystem

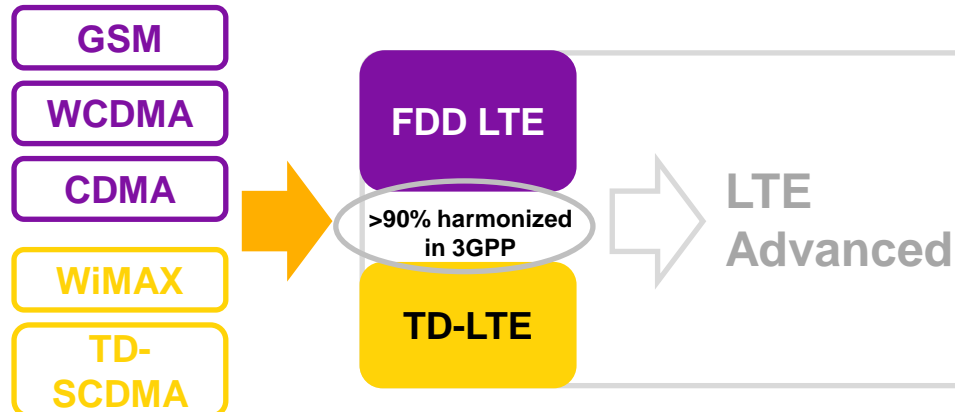
> 380 million LTE subscribers by 2015

Forecast for LTE lead markets by Research and Markets

55+ LTE networks expected to be in commercial operation by end 2012

113 LTE network operator commitments in 46 countries

Technology convergence



Extensive range of radio spectrum support

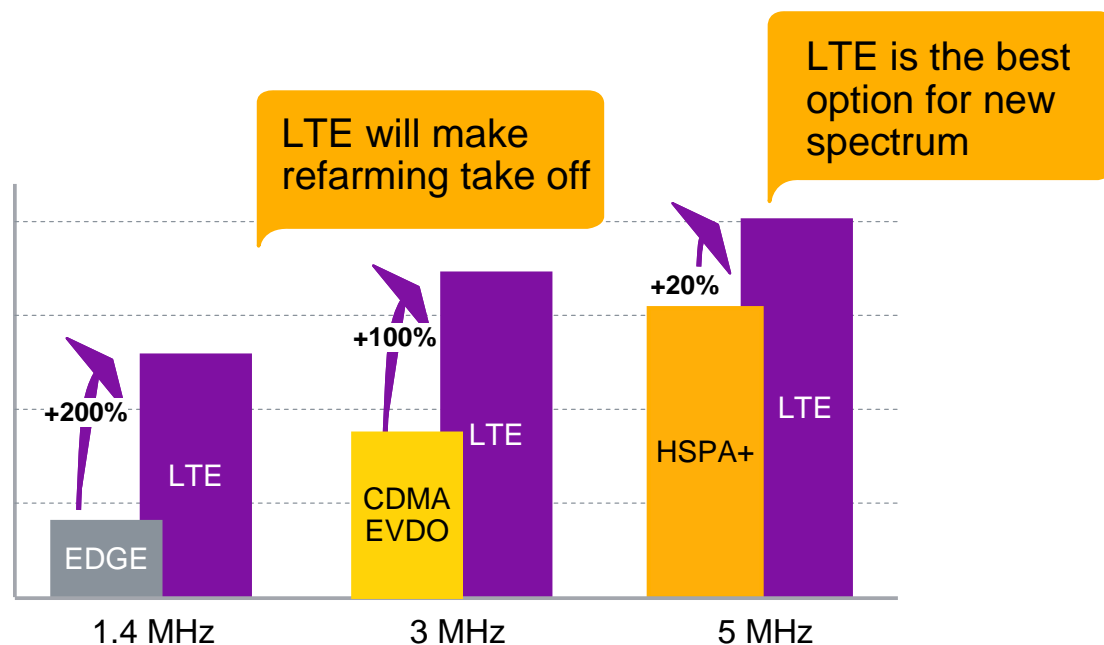
22 different FDD frequency band options
9 different TDD frequency band options

Single operator may deploy both FDD+TDD LTE for maximum utilization of spectrum assets

+ new ones still being specified both for new band deployment and re-farming cases

LTE allows to use spectrum most efficiently

Low frequencies for coverage; large bands for capacity



Band	MHz	Uplinks MHz	Downlink MHz		Region
1	2x60	1920-1980	2110-2170	FDD	UMTS core
2	2x60	1850-1910	1930-1990	FDD	US PCS
3	2x75	1710-1785	1805-1880	FDD	1800
4	2x45	1710-1755	2110-2155	FDD	US AWS
5	2x25	824-849	869-894	FDD	US 850
6	2x10	830-840	875-885	FDD	currently n/a
7	2x70	2500-2570	2620-2690	FDD	2600
8	2x35	880-915	925-960	FDD	GSM 900
9	2x35	1749-1784	1844-1879	FDD	Japan 1700
10	2x60	1710-1770	2110-2170	FDD	Extended AWS
11	2x25	1427-1452	1475-1500	FDD	Japan 1500
12	2x18	698-716	728-746	FDD	US 700 MHz Lower (Band A,B,C)
13	2x10	777-787	746-756	FDD	US 700 MHz Upper (Band C)
14	2x10	788-798	758-768	FDD	US 700 MHz Upper (Band D+)
17	2x12	704-716	734-746	FDD	US 700 MHz Lower (Band B, C)
18	2x15	815-830	860-875	FDD	Japan 800
19	2x15	830-845	875-890	FDD	Japan 800
20	2x30	832-862	791-821	FDD	EU Digital Dividend
21	2x15	1448-1463	1496-1511	FDD	New
33	1x20	1900-1920	1900-1920	TDD	UMTS core TDD
34	1x15	2010-2025	2010-2025	TDD	UMTS core TDD
35	1x60	1850-1910	1850-1910	TDD	US (TDD alternative to FDD)
36	1x60	1930-1990	1930-1990	TDD	US (TDD alternative to FDD)
37	1x20	1910-1930	1910-1930	TDD	US
38	1x50	2570-2620	2570-2620	TDD	2600 TDD part
39	1x40	1880-1920	1880-1920	TDD	China UMTS TDD
40	1x100	2300-2400	2300-2400	TDD	China TDD
41	1x194	2496-2690	2496-2690	TDD	Americas

Status: 3GPP R10, October 2010

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What drives some of the early LTE-adopters ?

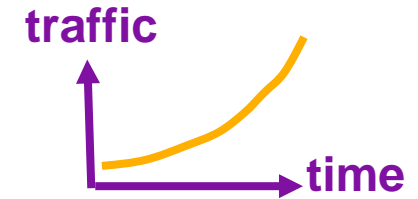
Necessity to join the largest ecosystem: global standard of 3GPP



New spectrum allocations for more competitive broadband strategy

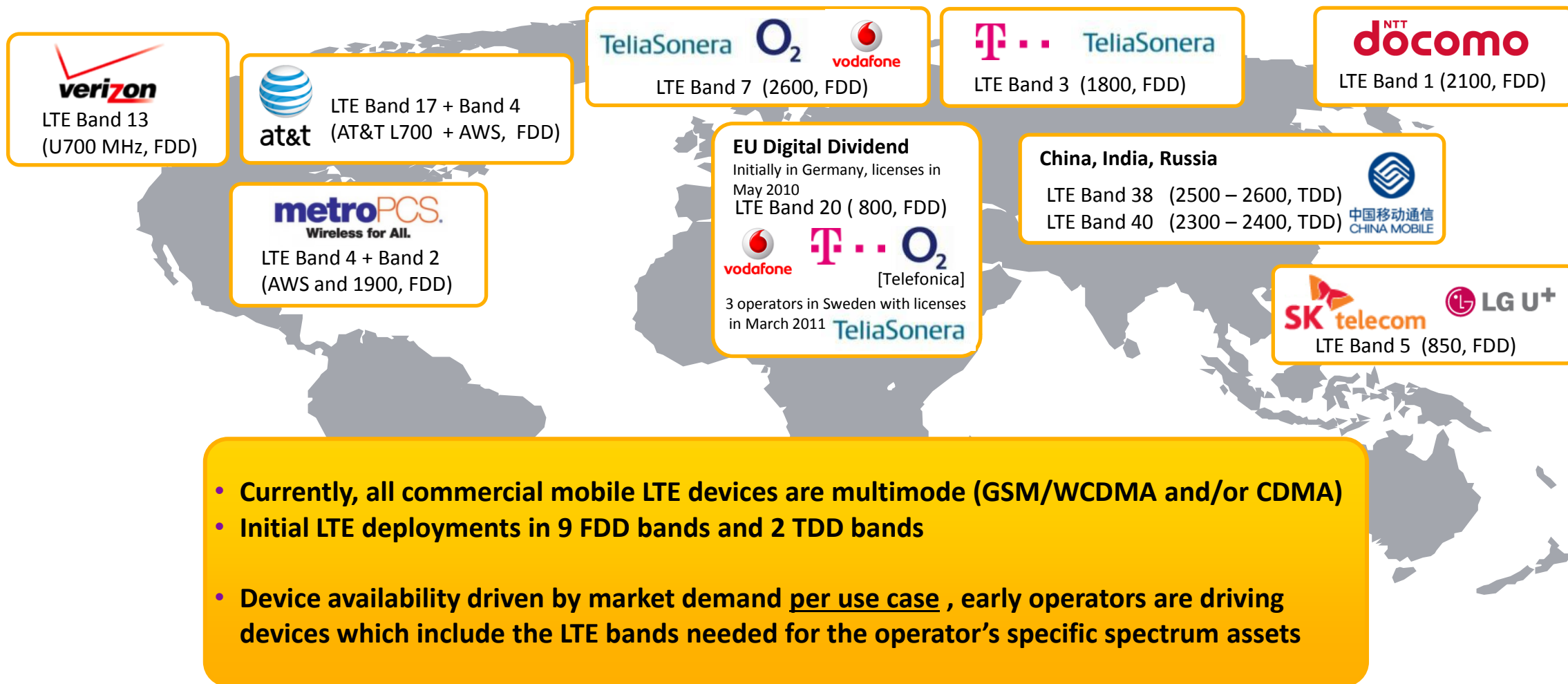


Immediate need for further mobile broadband capacity



NTT docomo

Frequency band vs. early LTE market demand



Devices for diverse service use cases



1. Maximum mobility mobile broadband

- Internet experience on-the-move with high capacity throughput
- Coverage expected everywhere
- Laptops and tablets connected with USB-sticks, data cards, mobile hotspots or phones as modems
- LTE + 3G multimode devices



2. Home and city level mobile BB "hotzone"

- Needs to match today's home Internet experience or exceed it
- Coverage and mobility needs less demanding as in number 1
- Home use case especially relevant for rural/suburban
- May include also operator branded VoIP
- Can use single mode LTE devices



3. Handsets and smart phones

- Voice is critical
- Internet experience becoming more important day-by-day (drives adding LTE)
- Coverage, mobility and service quality expected everywhere
- International and national roaming
- LTE + 3G/2G multimode devices



4. Consumer electronics

- Paradigm shift: focus on application specific service, not on data subscription (e.g. Kindle)
- Depending on device type different mobility requirements
- Wide variety of devices, but still emerging (e.g. e-book readers, game consoles, navigators, cameras)



5. Machine-to-machine

- Wide range of services for different industry verticals
- Depending on M2M use case different mobility requirements (e.g. fixed wireless surveillance cameras, transport logistics)
- Most major operators are active in M2M and LTE opens new opportunities

Early LTE service offering



1. Maximum mobility mobile broadband

LTE will typically start from this domain

Better end-user experience in LTE coverage areas + nomadic mobility to 3G/2G



2. Home and city level mobile BB "hotzone"

Specifically in rural and suburban areas
LTE could become a true alternative for wireline Internet



3. Handsets and smart phones

Primarily CDMA-operators will drive early high-end "velcro" smartphones with LTE data
(HSPA+ competition with higher peak rate phones)

LTE VoIP + mass market later in the pipeline



4. Consumer electronics

Lots of potential in this space

A number of non-technical issues need to be addressed



5. Machine-to-machine

Lots of potential in this space

A number of non-technical issues need to be addressed



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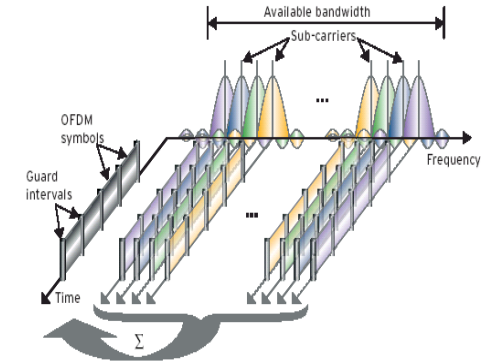
LTE / SAE* is specified for efficient mobile broadband

Improved Radio Principles

- Peak data rates [Mbps] 173 DL , 58 UL
- Scalable bandwidth: 1.4, 3, 5, 10, 15, 20 MHz
- Short latency: 10 – 20 ms
- 90% commonalities for LTE-FDD and TD-LTE

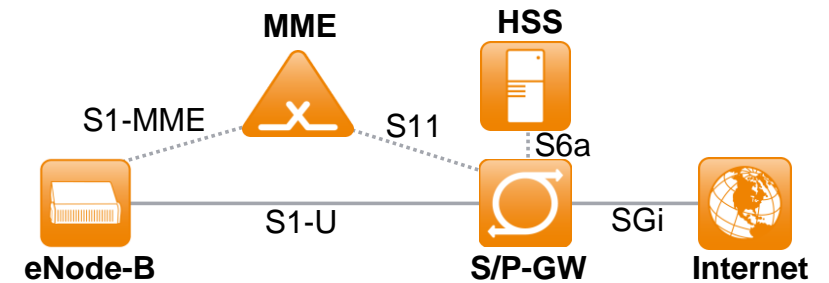
RF Modulation

- OFDMA in DL
- SC-FDMA in UL



Flat All-IP architecture

- 2-node architecture
- IP routable transport architecture



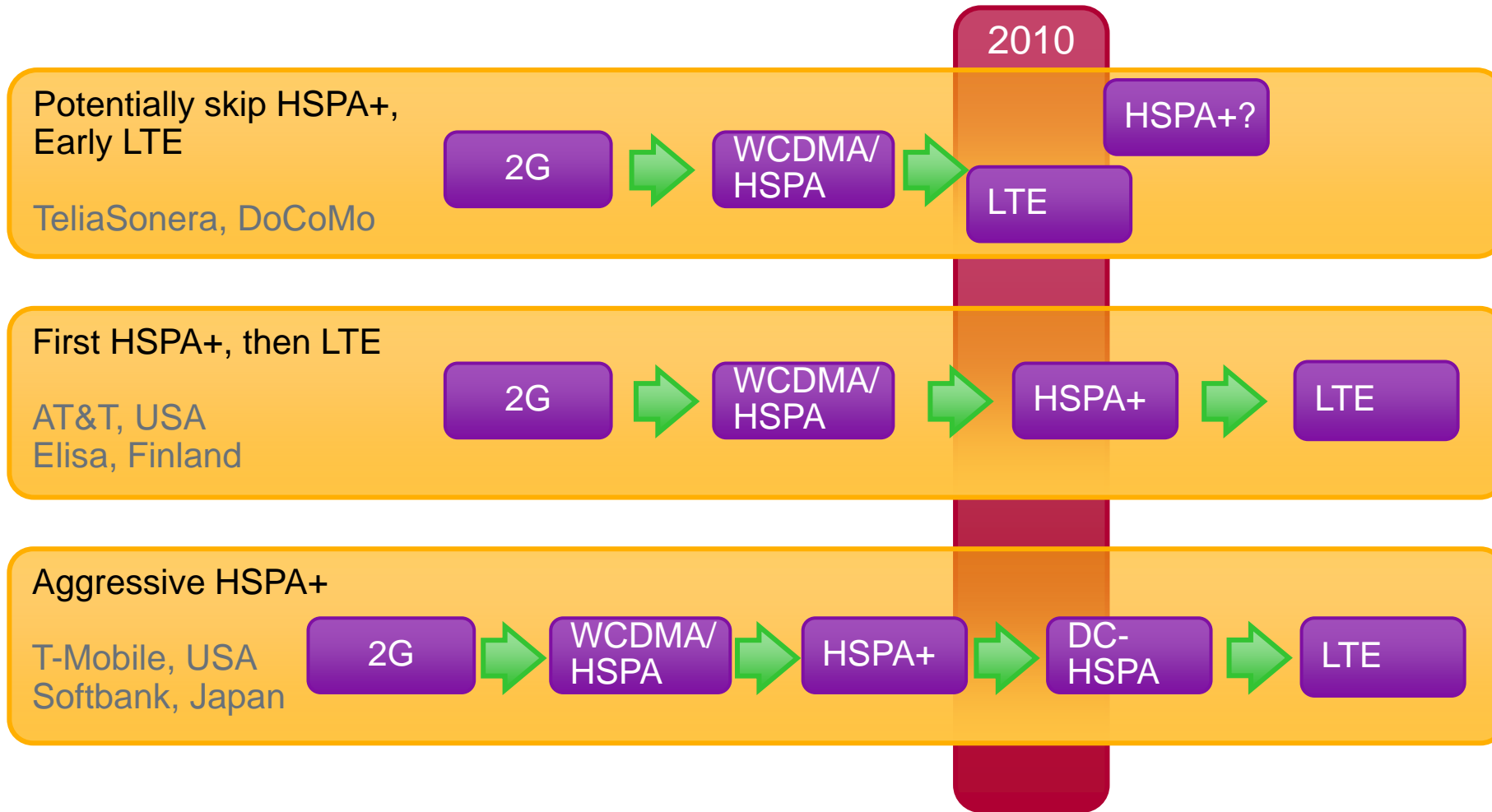
* SAE = System Architecture Evolution

Initial LTE Terminal Categories

	Class 1	Class 2	Class 3	Class 4	Class 5
Peakrate DL/UL	10/5 Mbps	50/25 Mbps	100/50 Mbps	150/50 Mbps	300/75 Mbps
RF Bandwidth	20 MHz	20 MHz	20 MHz	20 MHz	20 MHz
Modulation DL	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Modulation UL	16 QAM	16 QAM	16 QAM	16 QAM	64 QAM
Rx diversity	yes	yes	yes	yes	yes
MIMO DL	optional	2 x 2	2 x 2	2 x 2	4 x 4

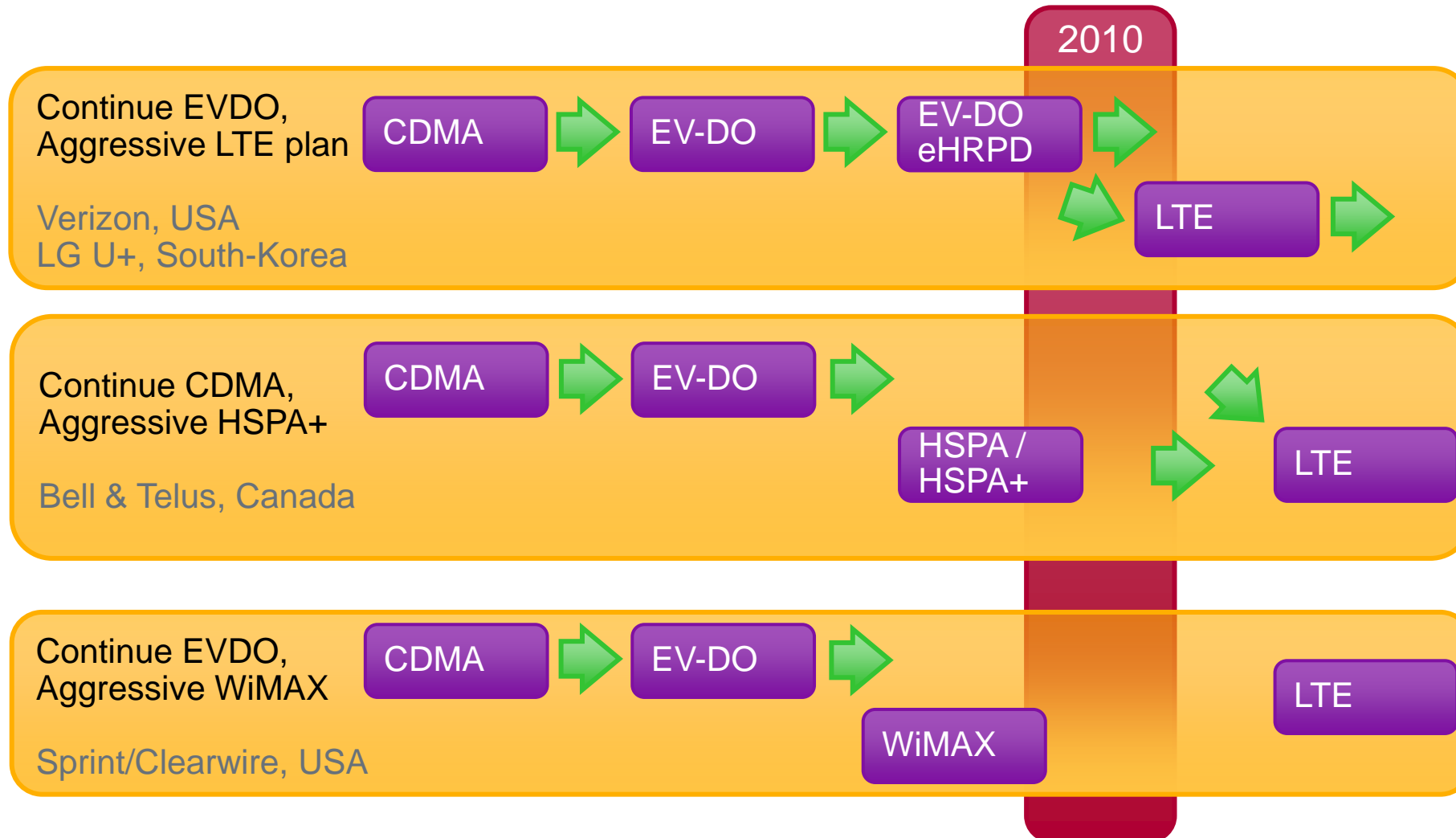
Evolution paths to LTE

3GPP operator examples



Evolution paths to LTE

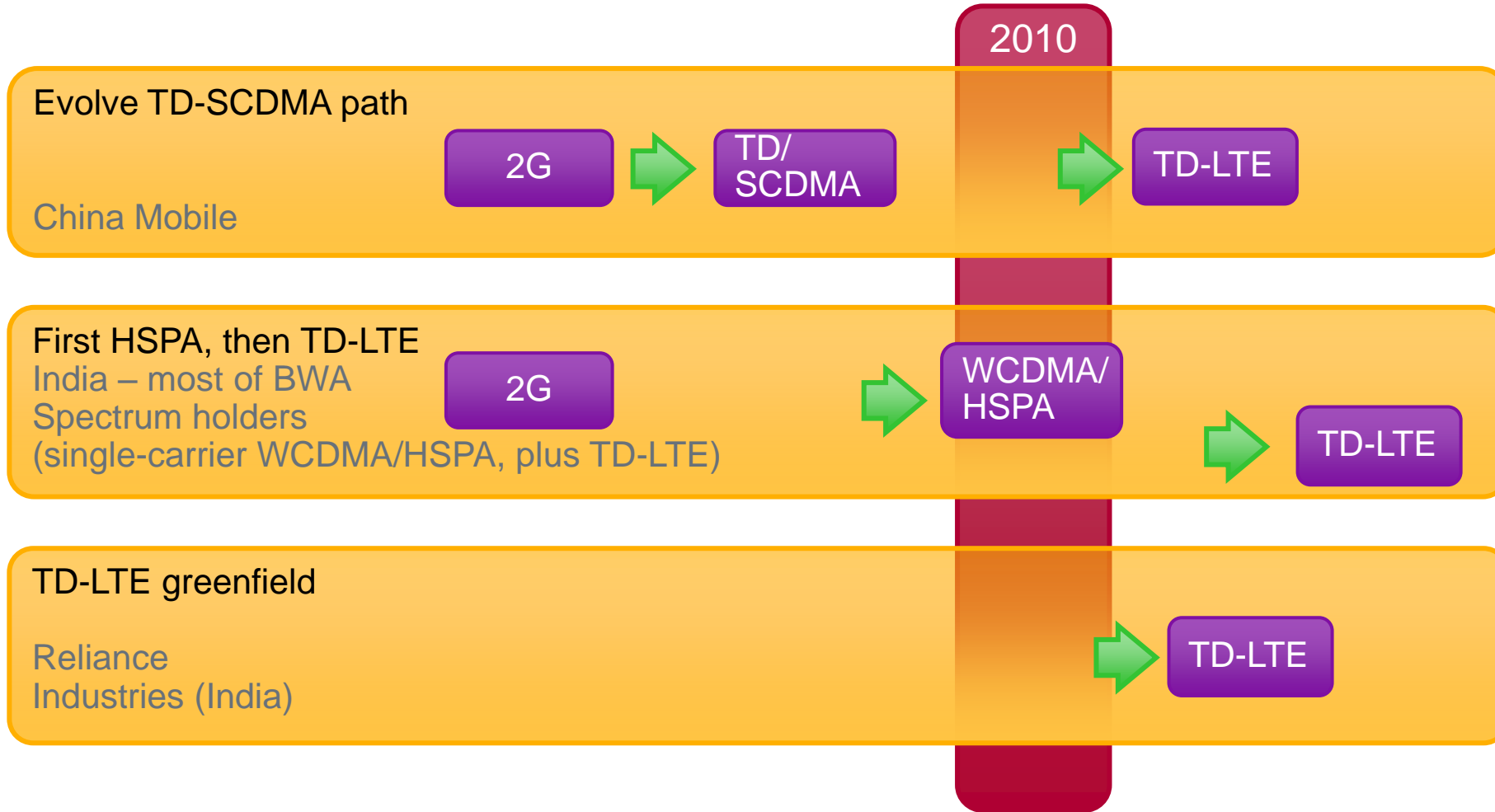
3GPP2 operator examples



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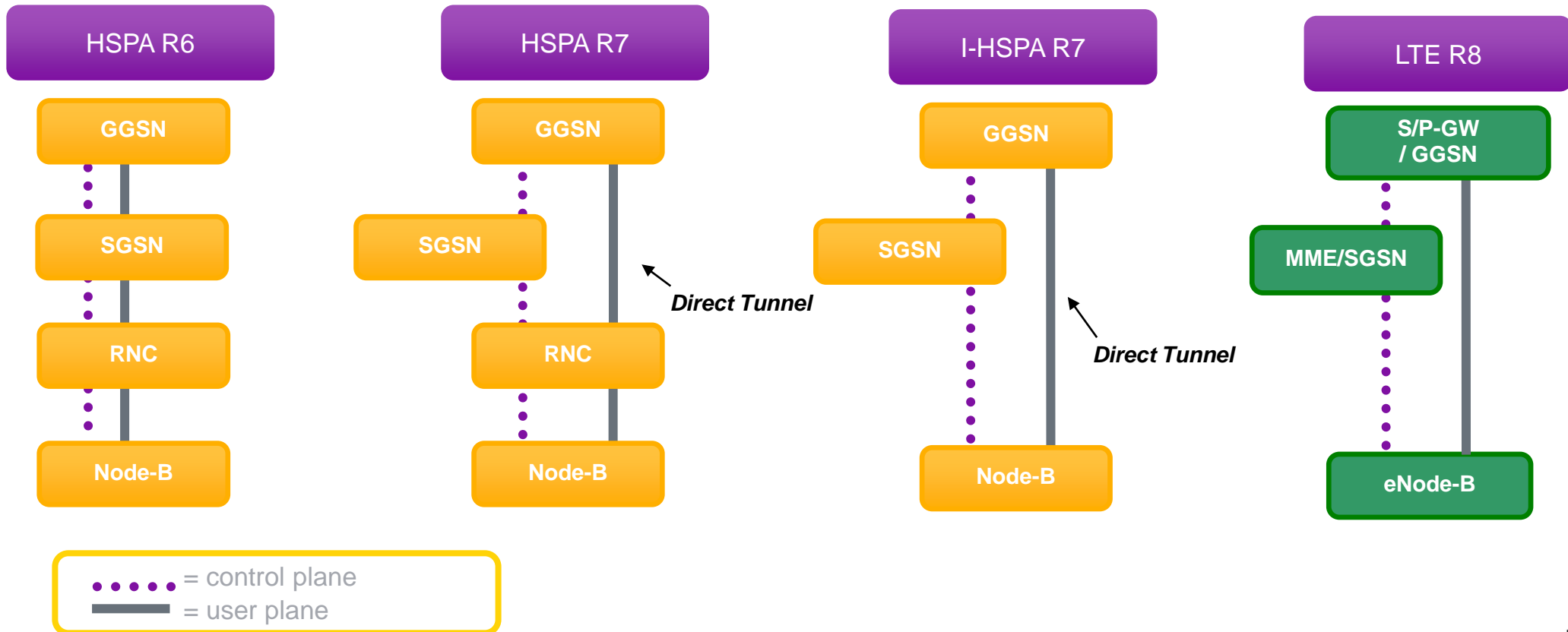
Evolution paths to LTE

TD-LTE specific operator examples

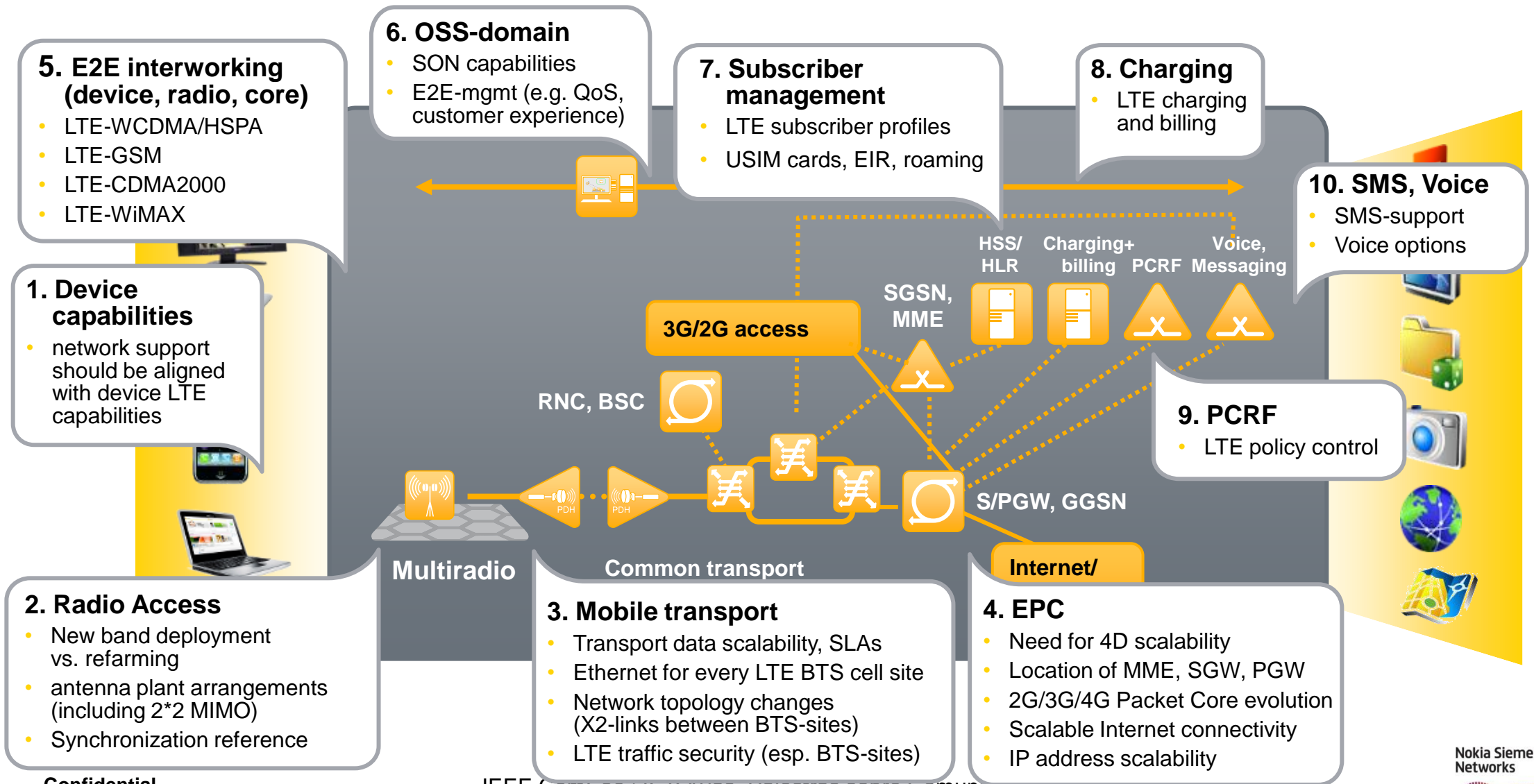


Flat LTE Architecture

- Direct evolution from Direct Tunnel usage
- Transmission delay time can be shortened by reducing the number of relay nodes
- Introduction of new services such as VoIP (real-time) etc.



Smooth LTE-introduction 10 step “check list”



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Nokia Siemens Networks

We drive the **commercialization** of LTE

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- First to ship LTE-capable, commercial base stations (Sept.2008)
- Shipments to more than 200 operators worldwide

 LTE-capable Flexi BTS

The LTE era has started with Nokia Siemens Networks.

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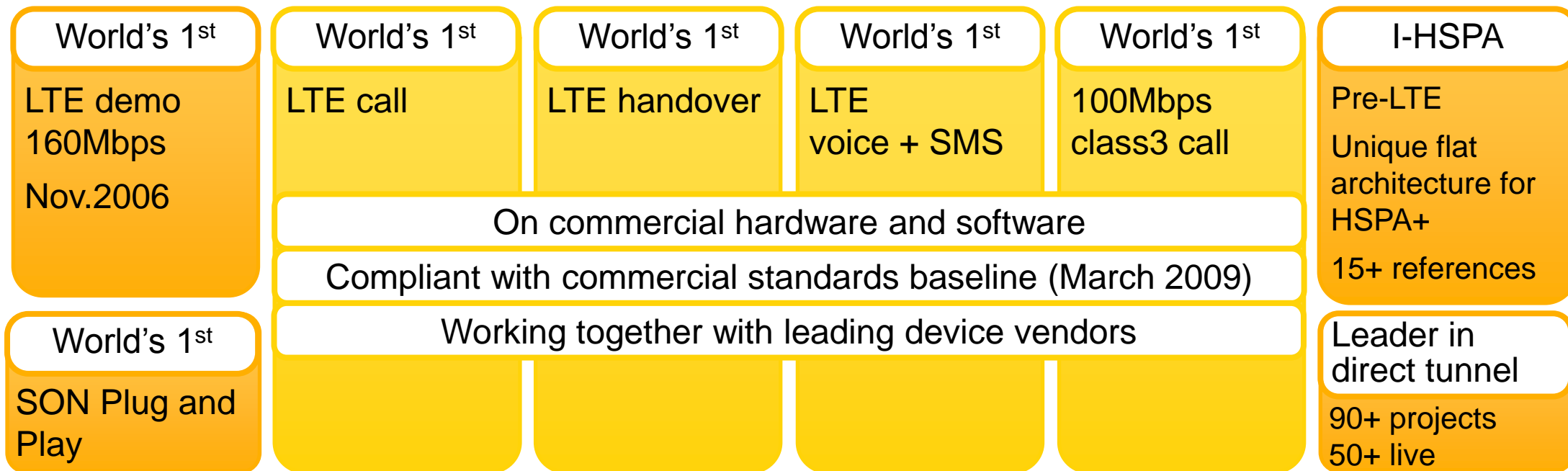
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Nokia Siemens
Networks



Nokia Siemens Networks

We drive the commercialization of LTE with a unique **holistic** approach



Nokia Siemens Networks

We ensure e2e interoperability with our unique **holistic** approach

1/2010
Record data speed 100Mbps

Nokia Siemens Networks and LG Electronics achieve record LTE data speeds
First data call at maximum downlink rate of 100 Mbps for a Class 3 USB wireless modem
Espoo, Finland – January 27, 2010

11/2009
End-to-end interoperability tested

Nokia Siemens Networks and LG complete first end-to-end interoperability testing of LTE
Espoo, Finland - November 24, 2009

11/2009
Industry first chipset

Qualcomm Now Sampling Industry's First Dual-carrier HSPA+ and Multi-Mode 3G/LTE Chipsets for Global Markets
SAN DIEGO — November 12, 2009 — Qualcomm Incorporated (Nasdaq: QCOM), a leading developer and innovator of advanced wireless technologies, products and services, today announced that it is sampling the industry's first chipsets for dual-carrier HSPA+ and multi-mode 3G/LTE. The Mobile Data Modem™ (MDM™) MDM8220™ solution is the first chipset to support Dual-carrier High-Speed Packet Access Plus (DC-HSPA+); and the MDM9200™ and t....

10/2009
Testing with 4 vendors

Nokia Siemens Networks conducts LTE interoperability testing with four leading device vendors
Dallas, Texas, USA - October 29, 2009

Further progress on the road towards commercial LTE deployment

9/2009
LTE call on March 2009 baseline

Nokia Siemens Networks Flexi Multiradio BTS

Best LTE user-experience most efficiently delivered



GLOBAL MOBILE
AWARDS 2009
WINNER



Winner:
Best Technology Advance 2009



Excellent
performance
in commercial
LTE network

TELIA



Winner 2009:
Green Network Hardware
and Infrastructure



Juniper
Research
Gold Award Winner 2010:
Green Infrastructure

- Software Defined Radio (same modules for all technologies)
- Smallest & most compact BTS
- Highest energy-efficiency weatherproof outdoor & indoor
- All-IP – all integrated, incl. wirespeed IPSec

Nokia Siemens Networks Flexi NS and Flexi NG

Best LTE user-experience most efficiently delivered

Flexi NG

- GGSN & S/P-GW
- Highest efficiency with **4D scaling**
 - Leading throughput: 360 Gbit/s
 - Leading session density: 21.6M
 - Leading signaling capacity: 108k trs/s
 - Leading service intelligence

Flexi NS

- SGSN & MME
- Evolution of field proven SGSN
- Leading signaling capacity: 22 k trs/s

- Simultaneous 2G/3G/LTE operation
- ATCA based platforms

Leading in all LTE relevant criteria

“EPC product platform will need to scale control-plane capacity, and specially that the transaction rate (i.e. signaling capacity) of the platform will be the key to system performance”

Heavy Reading (11/2009) on Evolved Packet Core

In commercial
LTE network

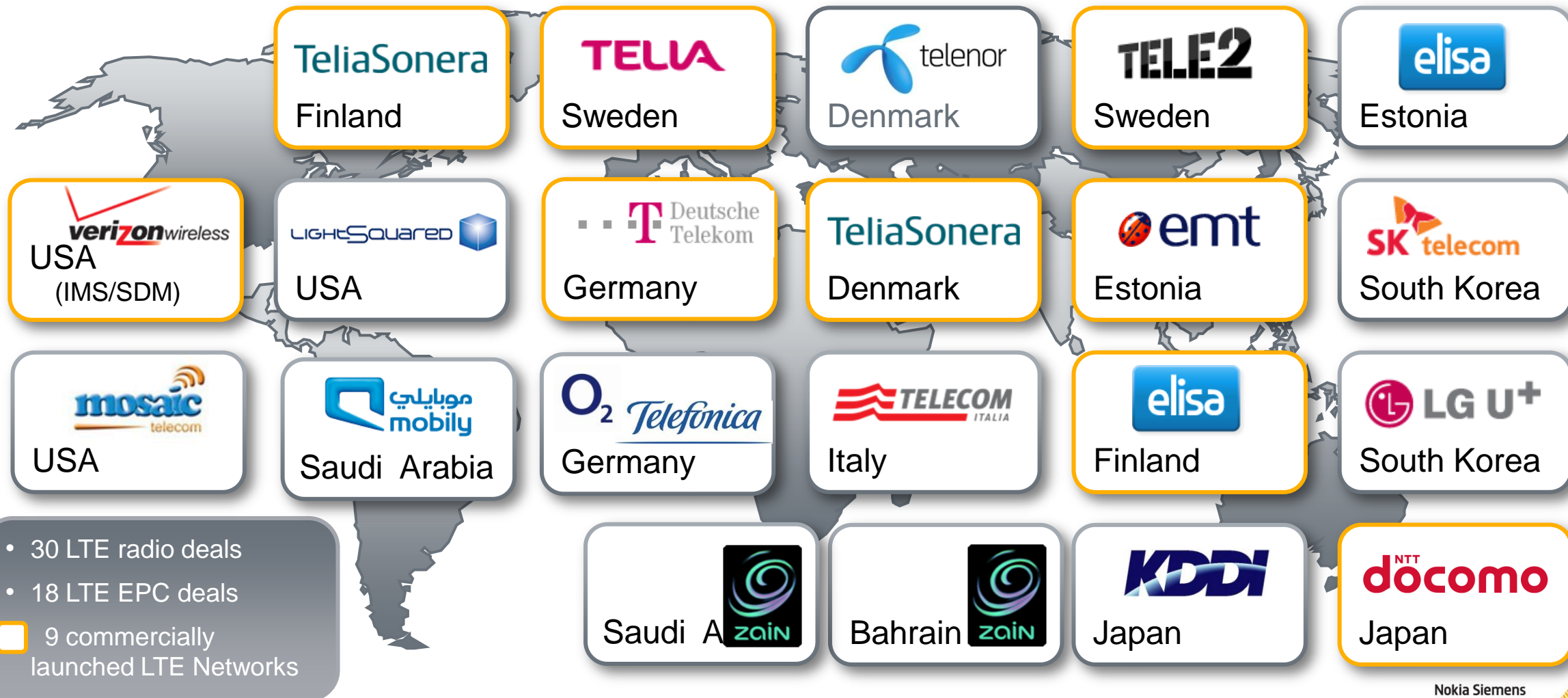
TELE2



Nokia Siemens
Networks



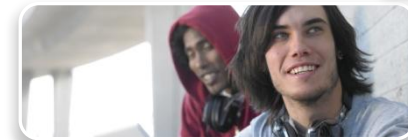
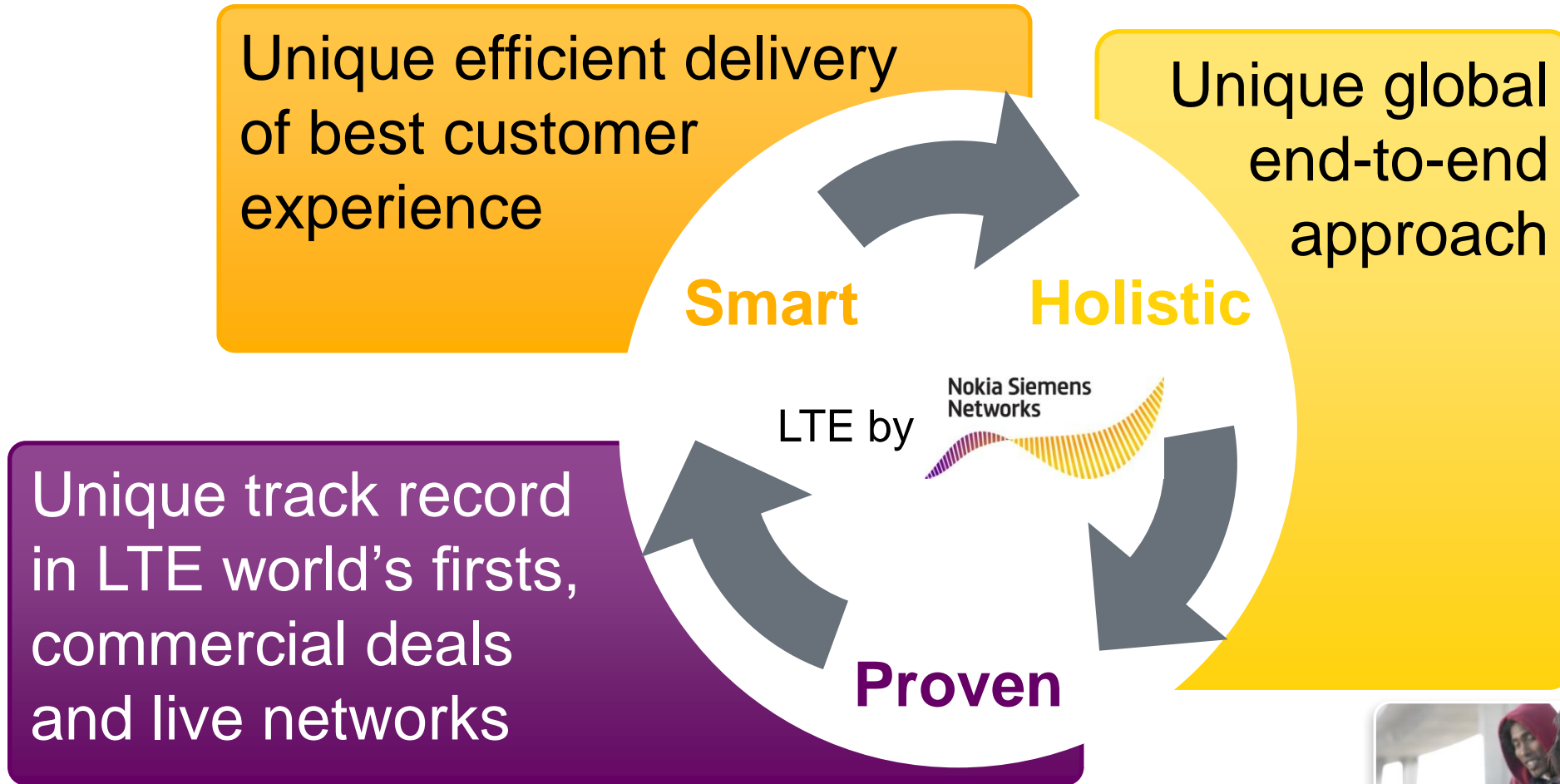
Nokia Siemens Networks - leading the LTE market with 37 commercial LTE customers



- 30 LTE radio deals
- 18 LTE EPC deals
- 9 commercially launched LTE Networks

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Nokia Siemens Networks' unique position in LTE



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- Strong market momentum around mobile broadband
- Mobile broadband is a growing business for operators
- Planning and implementing seamless 2G/3G/4G evolution is vital
- LTE timing depends on spectrum licences, competition and targeted end-user offering
- NSN is well positioned mobile broadband and LTE e2e solution provider and partner for operators with a proven track record