

WiMAX Fremtiden er Trådløs
TEKNA Oslo Mars 2007

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Alternative trådløse bredbåndsteknologier

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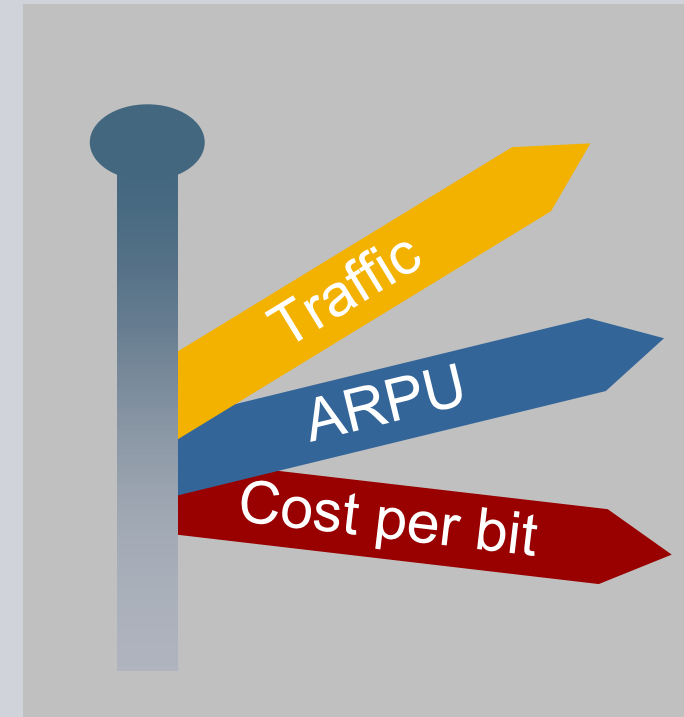
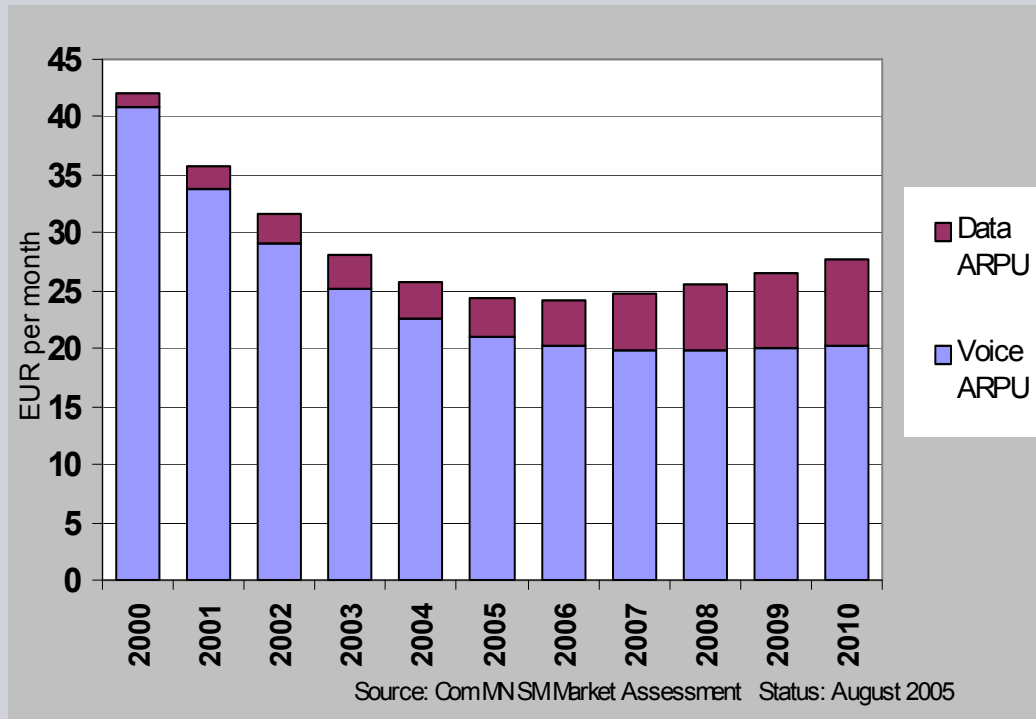


Agenda

- **Introduction**
- **Flash OFDM**
- **EDGE Phase 2**
- **HSPA**
- **HSPA+**
- **LTE, NGNM**

Global market trends

ARPU increasingly generated with data services



Key Success Factors for Operators:

- Offer **attractive new data services** to generate additional revenues
- **Improve Cost Position** for early ROI.

Web 2.0

-> All of my connected applications – always with me

Multimedia Computer – optimized for Web 2.0

All of my **connected applications**, always with me

5.3 © 2006 Nokia

NOKIA

Nokia N93

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-> example of a multimedia computer into which the 'classical' mobile phone has evolved

Nokia N93 – winning awards and tests

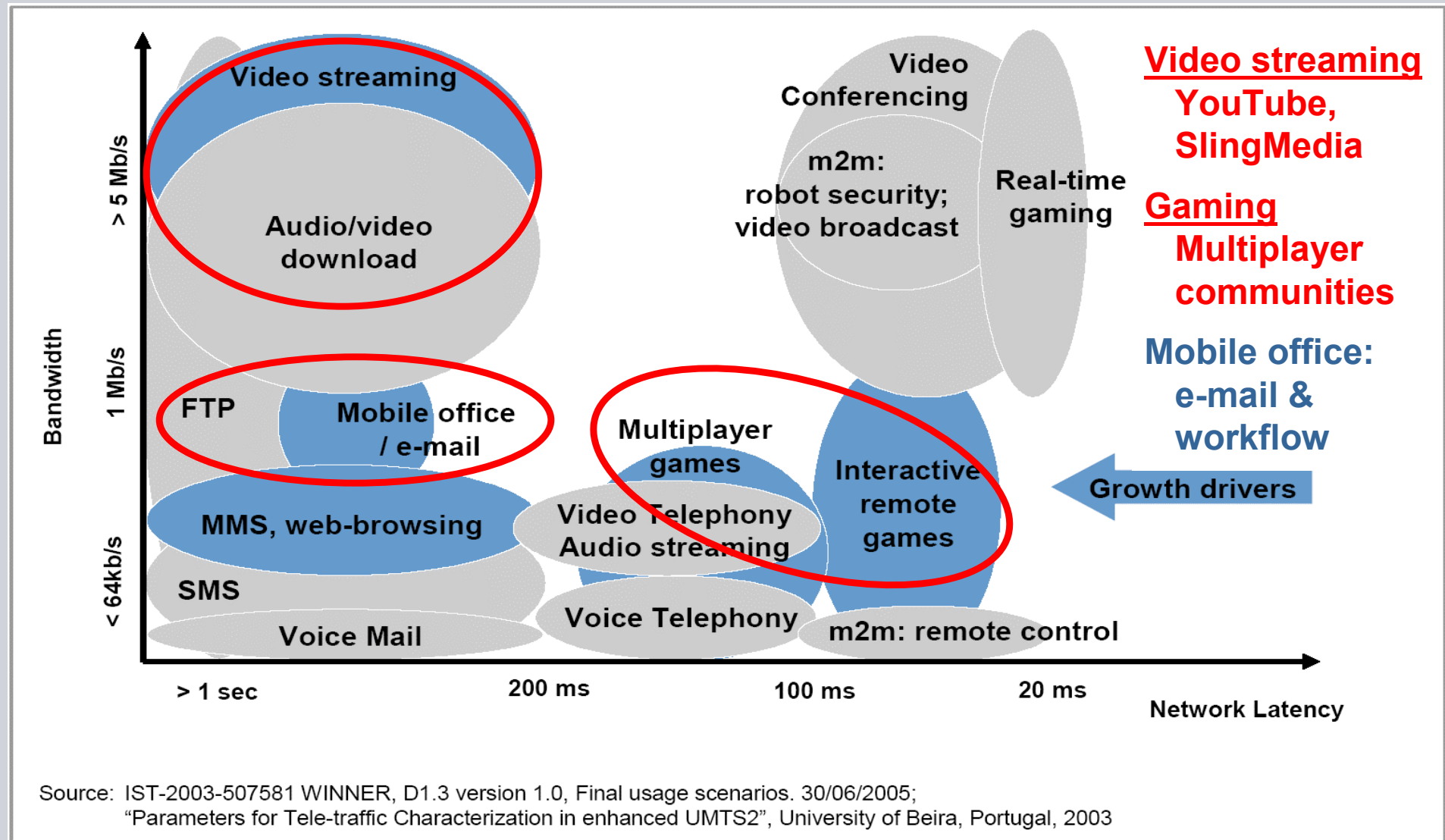


Interactive Broadband drives Service Innovation
Shorter Latency and Higher bandwidth requirements for new services

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Interactive Broadband drives Service Innovation

Shorter Latency and Higher bandwidth requirements for new services



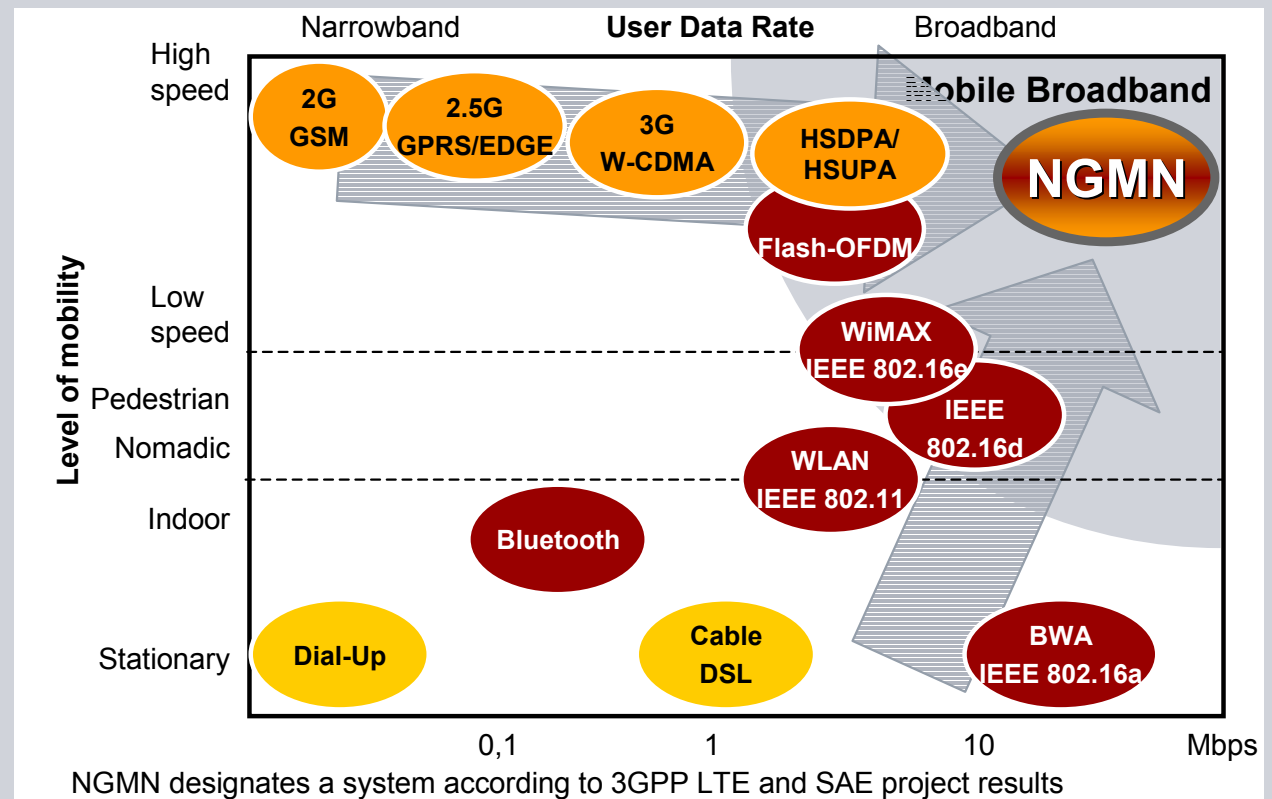
Trends in Mobile Data

Several technologies moving to the same target: Mobile Broadband

→ **Mobile** technologies become more and more **broadband**
(3G HSPA, TDD-HCR, TDD-LCR)

→ Alternative wireless **broadband** technologies become more and more **mobile**
(WLAN/WiFi, WiMAX)

Source: Com MN SM Market Assessment



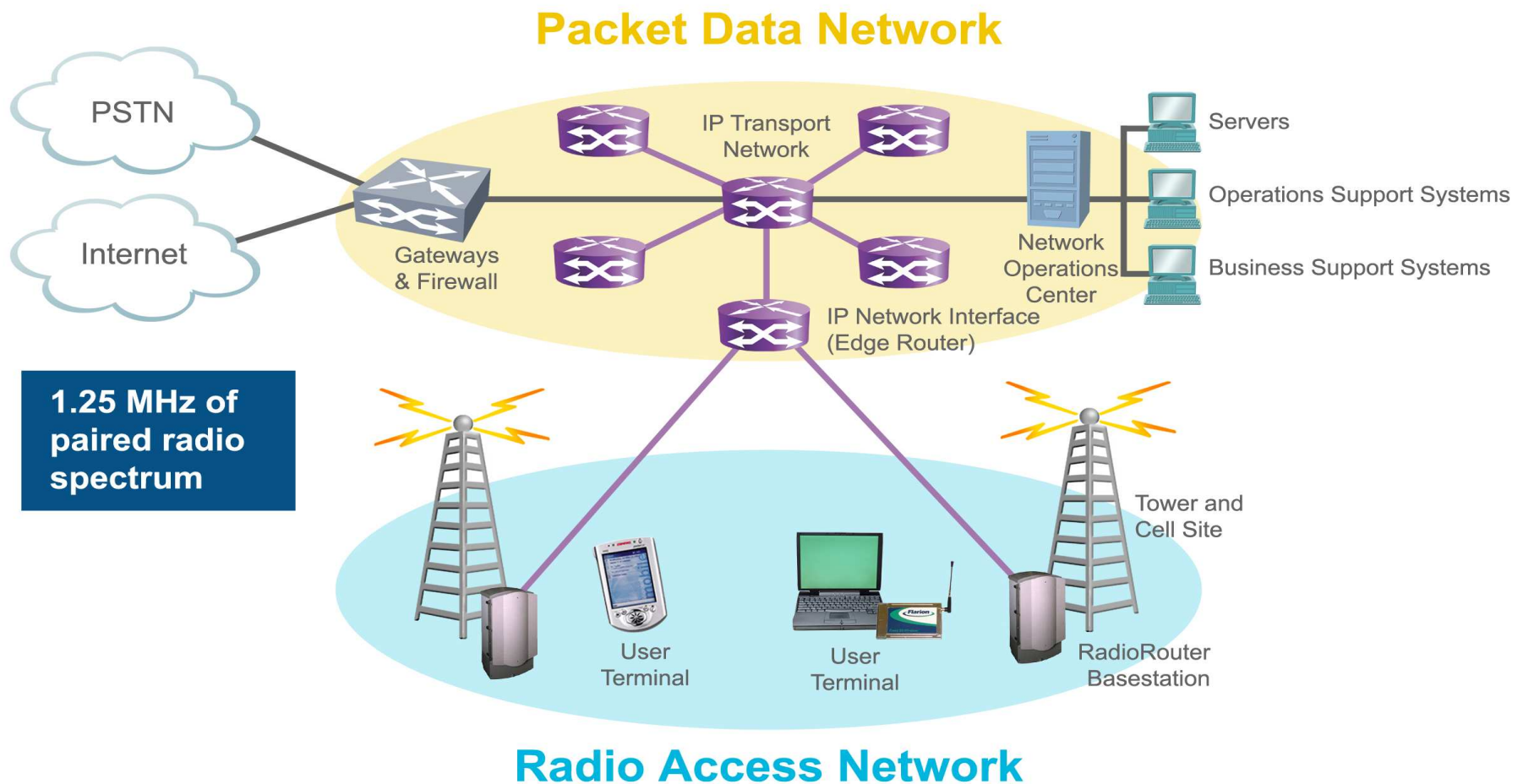
- Several technologies will coexist for Mobile Broadband, but operators need to reduce number of deployed technologies for cost reasons.
- HSPA and WiMAX have highest potential today
- **NGMN** (3GPP LTE & SAE) is under work to finally address all needs.

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FLASH OFDM

High Coverage Solution



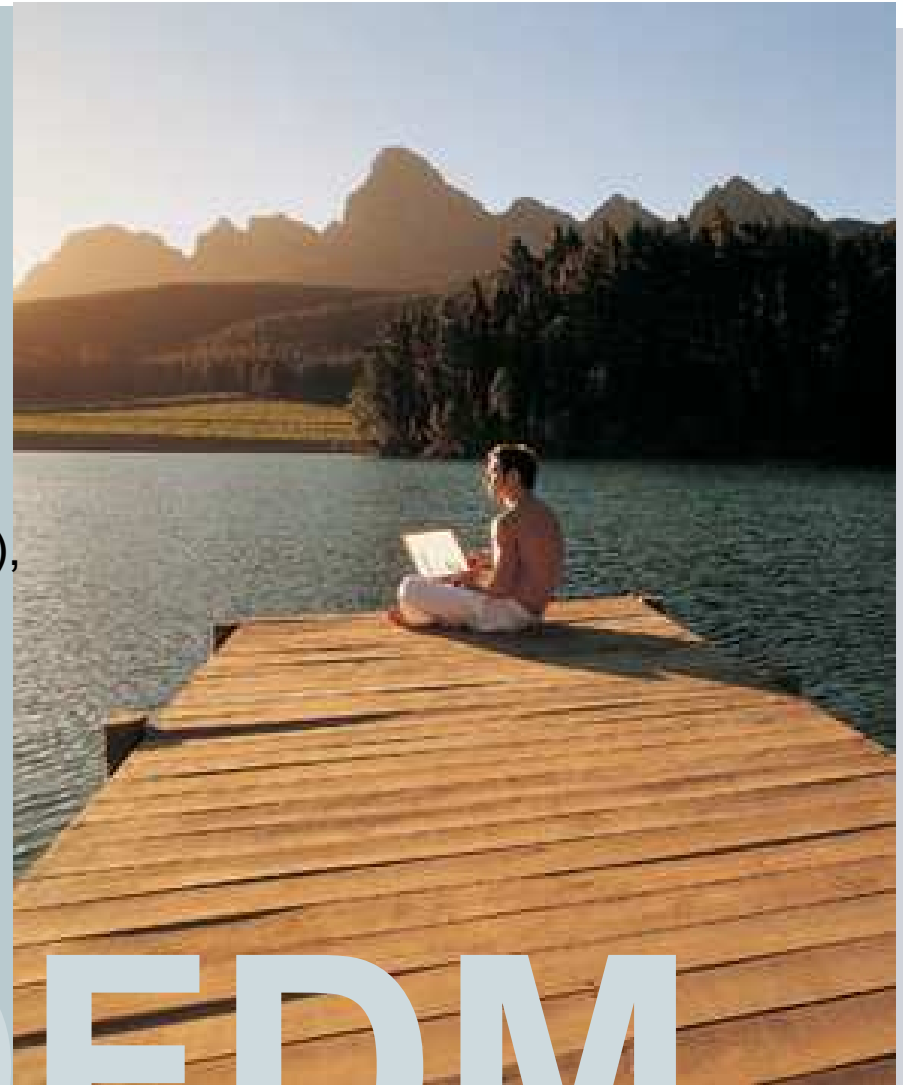
Flash-OFDM @ 450MHz is a cost-efficient solution for rural application

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For network operators wanting to start with an cost-efficient and fast solution for DSL-like data services

Characteristics:

- Especially suited to cover large geographical areas, due to frequency band of 450 MHz
- Optimized for data usage (low latency < 50ms), Superior performance vs. cdma-450
- High bandwidth up to 2,6 Mb/s
- High-speed mobility up to 250 km/h
- Complementing GSM networks, where spectrum does not allow W-CDMA operation



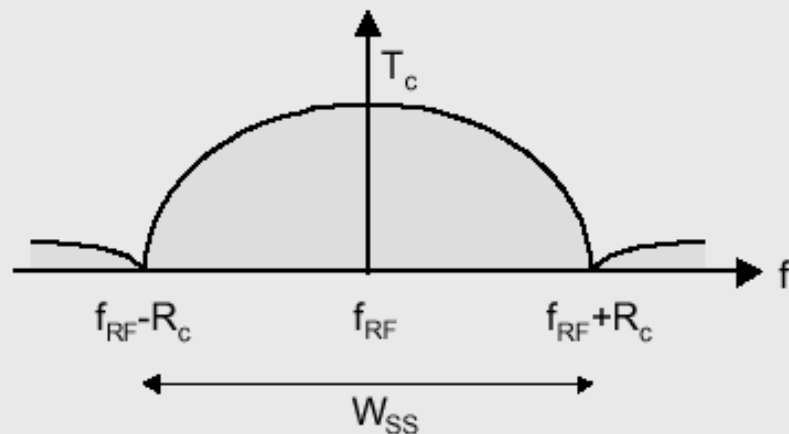
Flash OFDM

Spread Spectrum Techniques

Direct Sequence and Fast Hopping

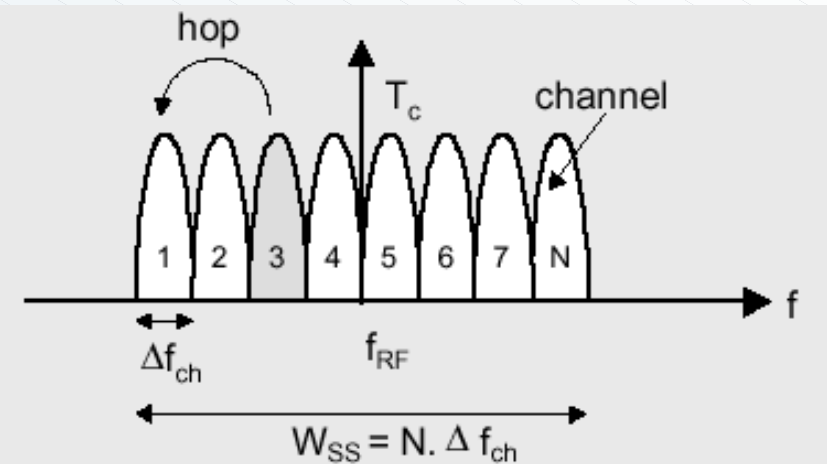
CDMA – direct sequence spread spectrum

- **Signal is spread across entire bandwidth**



OFDM – fast hopping spread spectrum

- **Signal is composed of multiple tones**



W-CDMA

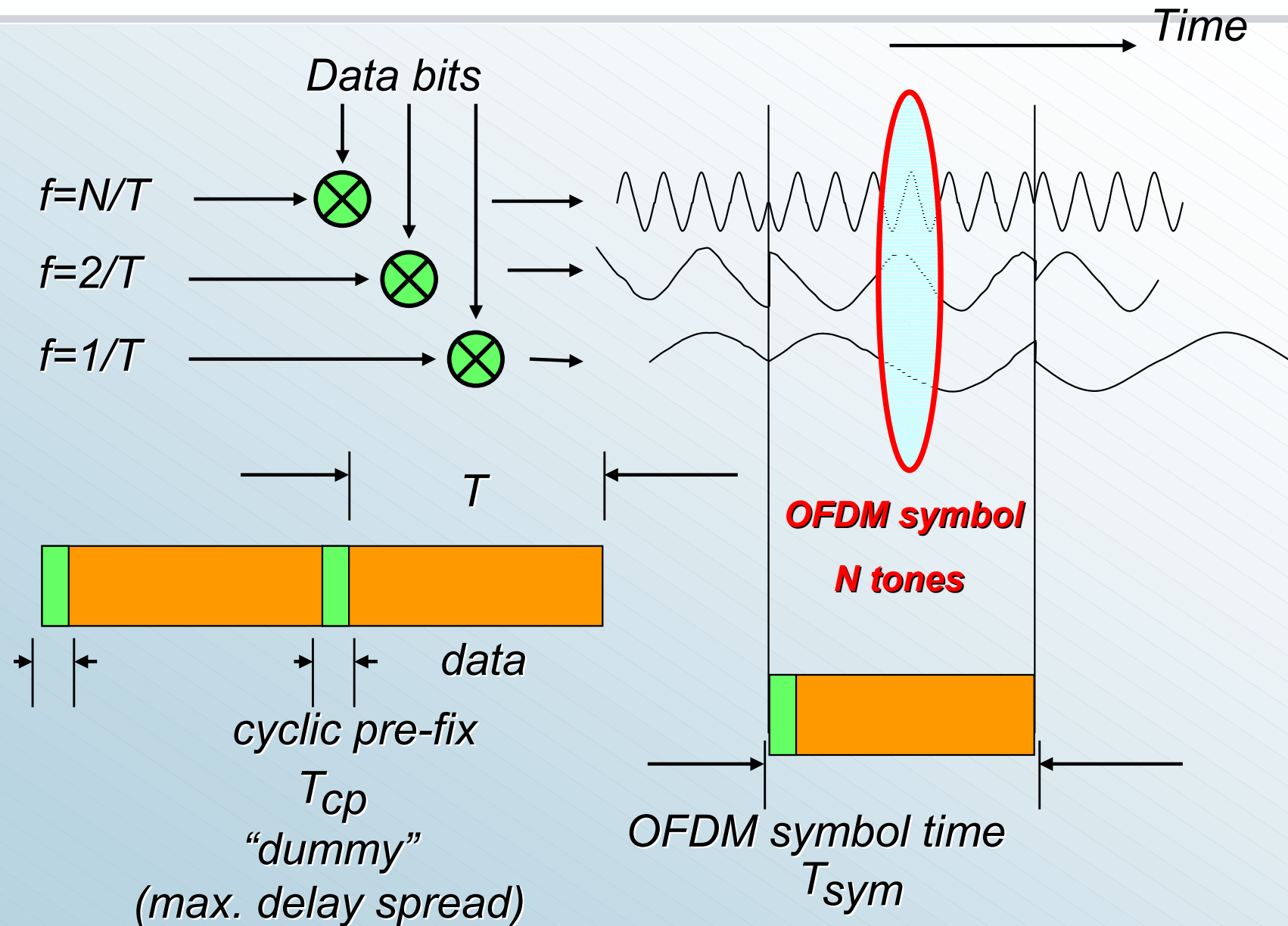
- wideband-CDMA (**5 MHz carriers**)
- all data signals are multiplexed on a **wide carrier** ;
- separation of signal information via „**codes**“

OFDM

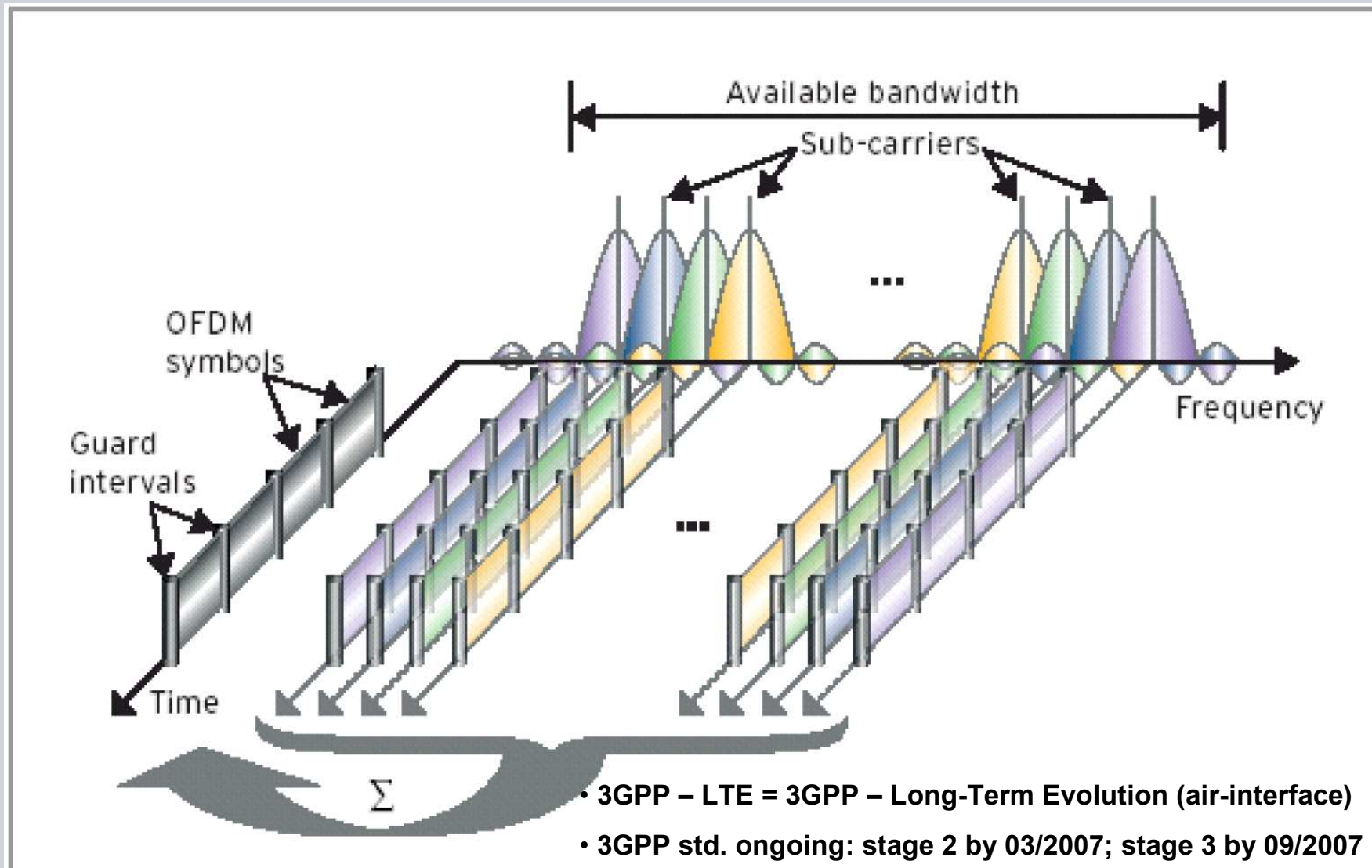
- “**tones**” are narrow-band signals
- flash-OFDM:
 - 113 tones in 1.25 MHz
- WiMAX 802.16d:
 - > 200 tones in 3.5 MHz
- => **ca. 10 – 20 kHz per „tone“**

OFDM

Orthogonal Frequency Division Multiplex

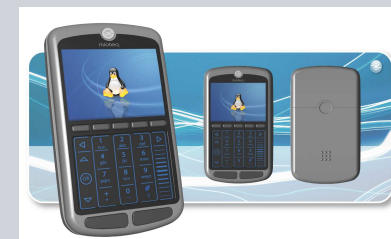


Scalable-OFDMA: High data rates



FLASH OFDM CPE

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EDGE Phase II

GERAN Evolution

What is GERAN Evolution ?

Standardization Objectives

... Performance

- ▶ Better spectrum efficiency/capacity (interference limited): + 50%
- ▶ Improved coverage (noise limited, speech & data):
 - sensitivity increase in DL + 3 dB
- ▶ Increased peak data rates (DL & UL): + 100%
- ▶ Increased mean bit rate at cell edges for UL & DL (cells planned for speech!): + 50%
- ▶ Reduced latency: RTT - 50 %

... Compatibility

- ▶ Coexist with legacy frequency planning
- ▶ Coexist with legacy mobile stations
- ▶ Avoid impacts on existing BTS, BSC and CN hardware
- ▶ Be applicable for Dual Transfer Mode and A/Gb mode interface

GERAN Evolution - Key Features

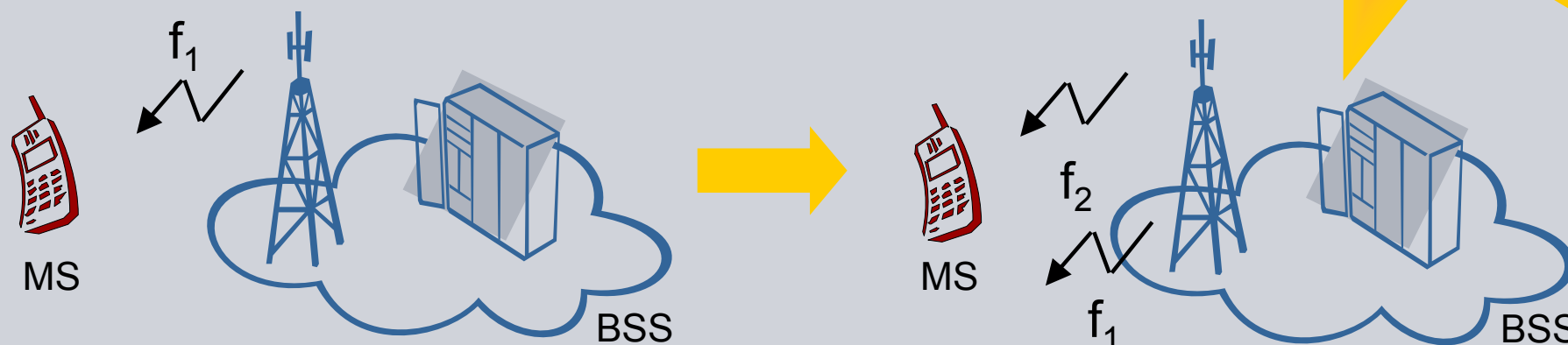
Multi - / Dual Carrier DL

► Allow the end user to get timeslots assigned from two carriers

☞ Increase of average data rates

☞ Increase of peak data rates

Supported by existing
Network HW –
can be extended to
more than 2 carriers



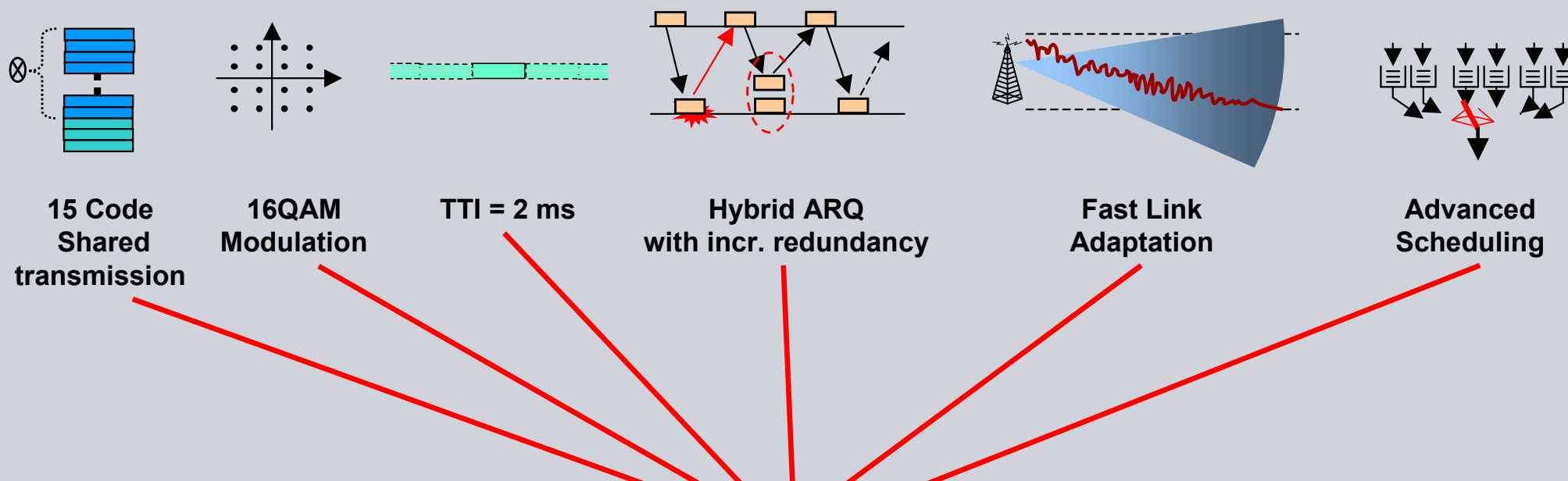
# of carriers	Air interface peak data rate [kbps] 4 TS@MCS-9/carrier	Air interface peak data rate [kbps] 8 TS@MCS-9/carrier
1	237	474
2	474	947

Peak Data rates up to 1 Mbit/s

HSPA

UTRAN Evolution

HSDPA



Benefit

Higher Downlink Peak rates: 14 Mbps

Higher Capacity: +100-200%

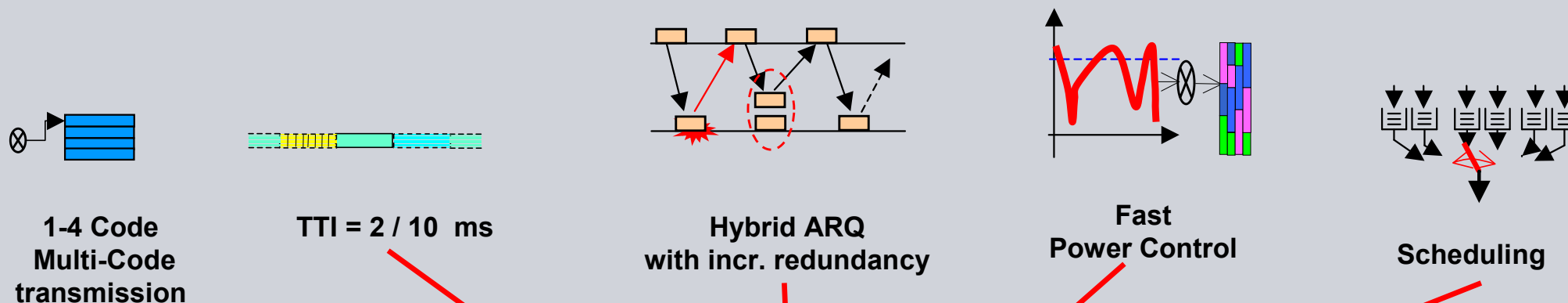
Reduced Latency: ~75 ms

Small upgrade of Radio network

HSDPA Terminals

UE Category	Parameters from 3GPP specifications							
	Mod. scheme	Maximum number of HS-DSCH codes received	Minimum inter-TTI interval	Max. no. of bit per transport block received within an HS-DSCH TTI	Total number of soft channel bits	Maximum data rate; Mbps	Theoretical max. data rate w/o channel coding; Mbps	IR HARQ possible at maximum data rate
1	16QAM	5	3	7298	19200	1,22	1,6	No
2	16QAM	5	3	7298	28800	1,22	1,6	Yes
3	16QAM	5	2	7298	28800	1,82	2,4	No
4	16QAM	5	2	7298	38400	1,82	2,4	Yes
5	16QAM	5	1	7298	57600	3,65	4,8	No
6	16QAM	5	1	7298	67200	3,65	4,8	Yes
7	16QAM	10	1	14411	115200	7,21	9,6	No
8	16QAM	10	1	14411	134400	7,21	9,6	Yes
9	16QAM	15	1	20251	172800	10,13	14,4	No
10	16QAM	15	1	27952	172800	13,98	14,4	No
11	QPSK	5	2	3630	14400	0,91	1,2	No
12	QPSK	5	1	3630	28800	1,82	2,4	No

HSUPA



Benefit

Higher Uplink Peak rates: 2-5.76 Mbps

Higher Capacity: +50-100%

Reduced Latency: ~50-75 ms

Small upgrade of Radio network

HSPA Evolution HSPA+

- **Higher order modulation**
- **Shorter Latency**
- **Higher bitrates 42 Mb/s in DL and 11 Mb/s in UL**

NGMN Initiative by large MNO's: TMO, VF, CMCC, DoCoMo

Next Generation Mobile Networks



Initiated by CTOs of large MNOs:

T-Mobile, Vodafone, Orange, KPN

Subsequently extended by

SprintNextel, China Mobile, NTT DoCoMo

Goal of the NGMN initiative is to define

requirements for the creation of networks

- suitable for the competitive delivery of mobile broadband services, and
- cost-efficient eventual replacement of existing networks

Architecture-, feature-, time spec's initially sent to five leading vendors:

Siemens and Nokia,

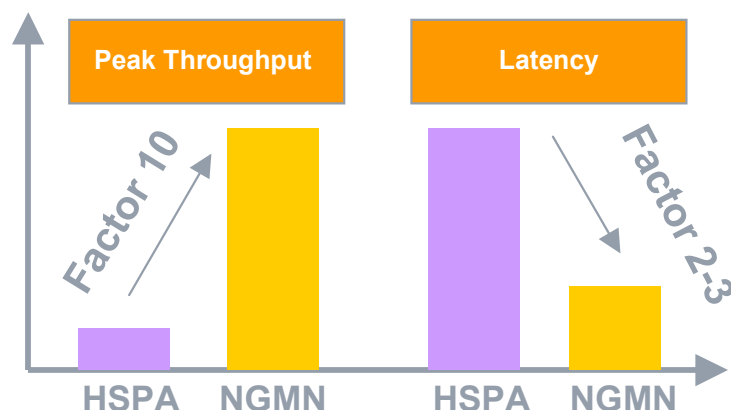
Ericsson, Nortel and Alcatel

The screenshot shows the 'ngmn-cooperation' website. The header is blue with the text 'ngmn-cooperation'. Below the header is a navigation menu with 'Home' and 'NGMN Members'. The main content area is titled 'Next Generation Mobile Networks'. The text describes the NGMN initiative, its goals, and its vision. It mentions that the initiative is led by KPN Mobile NV, Orange SA, Sprint Nextel Corporation, T-Mobile International AG & Co KG, and Vodafone Group PLC. The goal is to provide a set of recommendations for the creation of networks suitable for the competitive delivery of mobile broadband services and cost-efficient eventual replacement of existing networks. The vision is to provide a platform for innovation by moving towards one integrated network for the seamless introduction of mobile broadband services. The target architecture is an optimised Packet Switched (PS) network architecture, which will provide a smooth migration of existing 2G and 3G networks towards an IP network with improved cost competitiveness and broadband performance. Furthermore, NGMN addresses some of the key issues that underpin the success of mobile industry but, are beyond the activities currently undertaken in the industry. Examples of these issues include management of Intellectual Property Rights (IPR), interworking of different technologies, and operational aspects of running successful services. The details of the recommendations proposed by the NGMN initiative is captured in its White Paper, "Next Generation Mobile Networks Beyond HSPA & EVDO" version 2.0. The partners in NGMN project would like to extend the initiative to other members of the mobile industry ecosystem in order to realise the vision of NGMN via submission of their recommendations to the appropriate standardisation bodies and resolve the issues that are critical and yet outside the current scope of those bodies so that the benefits of mobility, interoperability and global reach can be extended to a new generation of services that are desirable, viable, and feasible. Any questions on this document ? Please contact questions@ngmn-cooperation.com

Operator Requirements

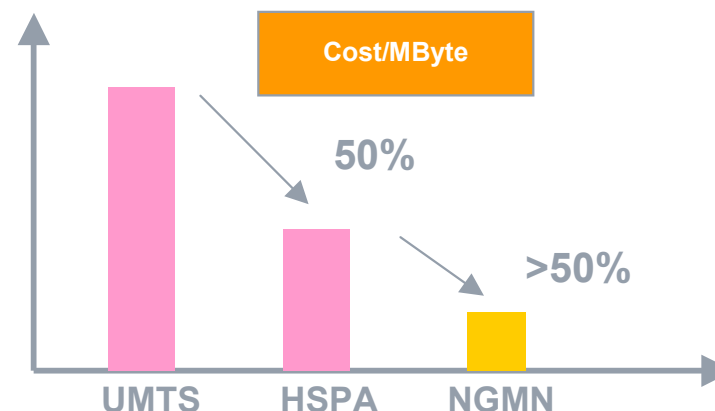
Two Key Success Dimensions

1 Superior User Experience



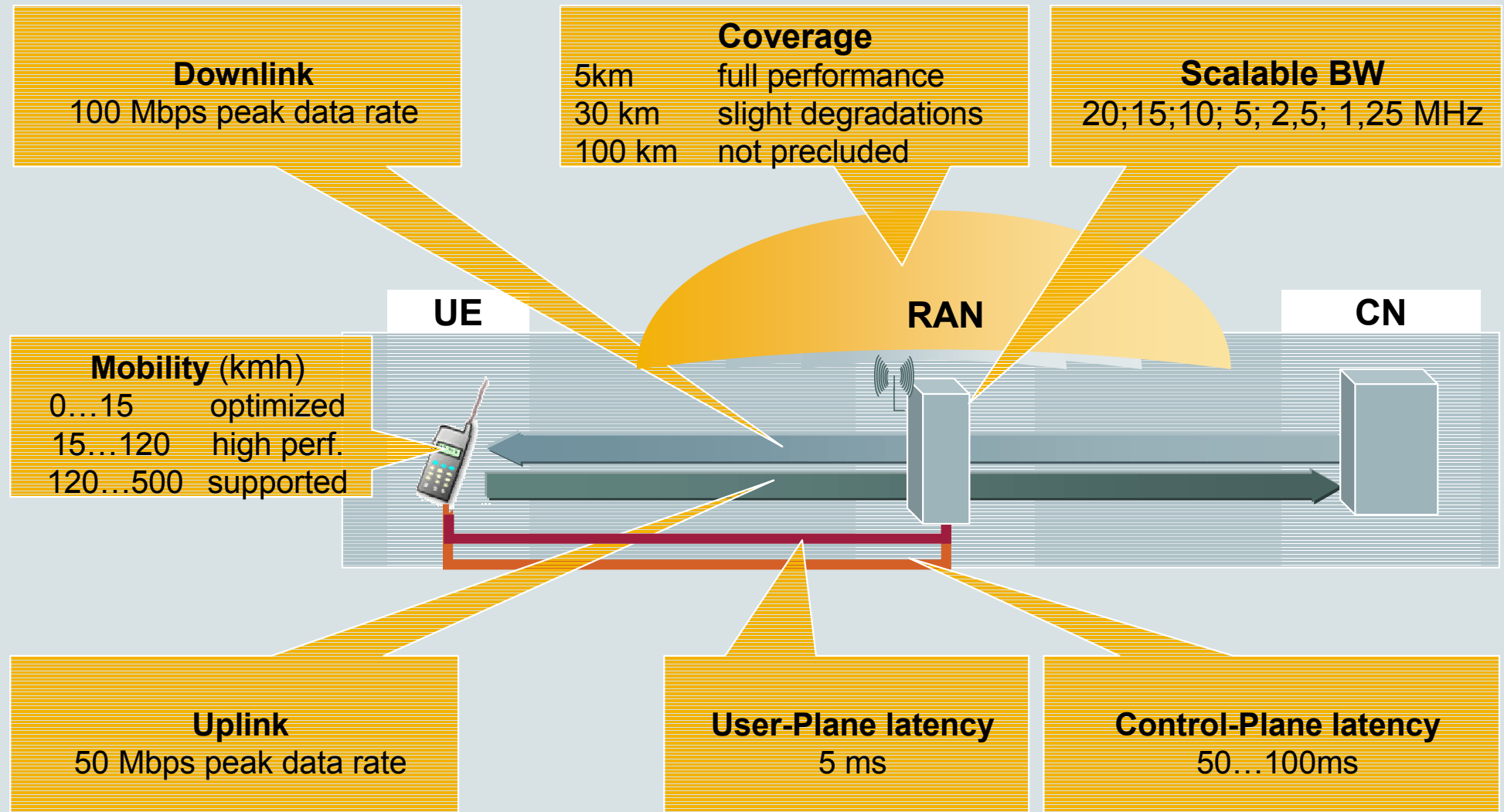
- **Throughput / Cell Capacity**
100 MBit/s Downlink (w/o MIMO),
50 MBit/s Uplink
 High performance at cell edges
- **User Data Latency**
 Total system roundtrip ≤ 30ms
- **Mobility**
 Cell Change << 100 ms,
 Inter-system change << 500 ms
e.g. VoIP at GSM quality

2 Competitive Network Cost



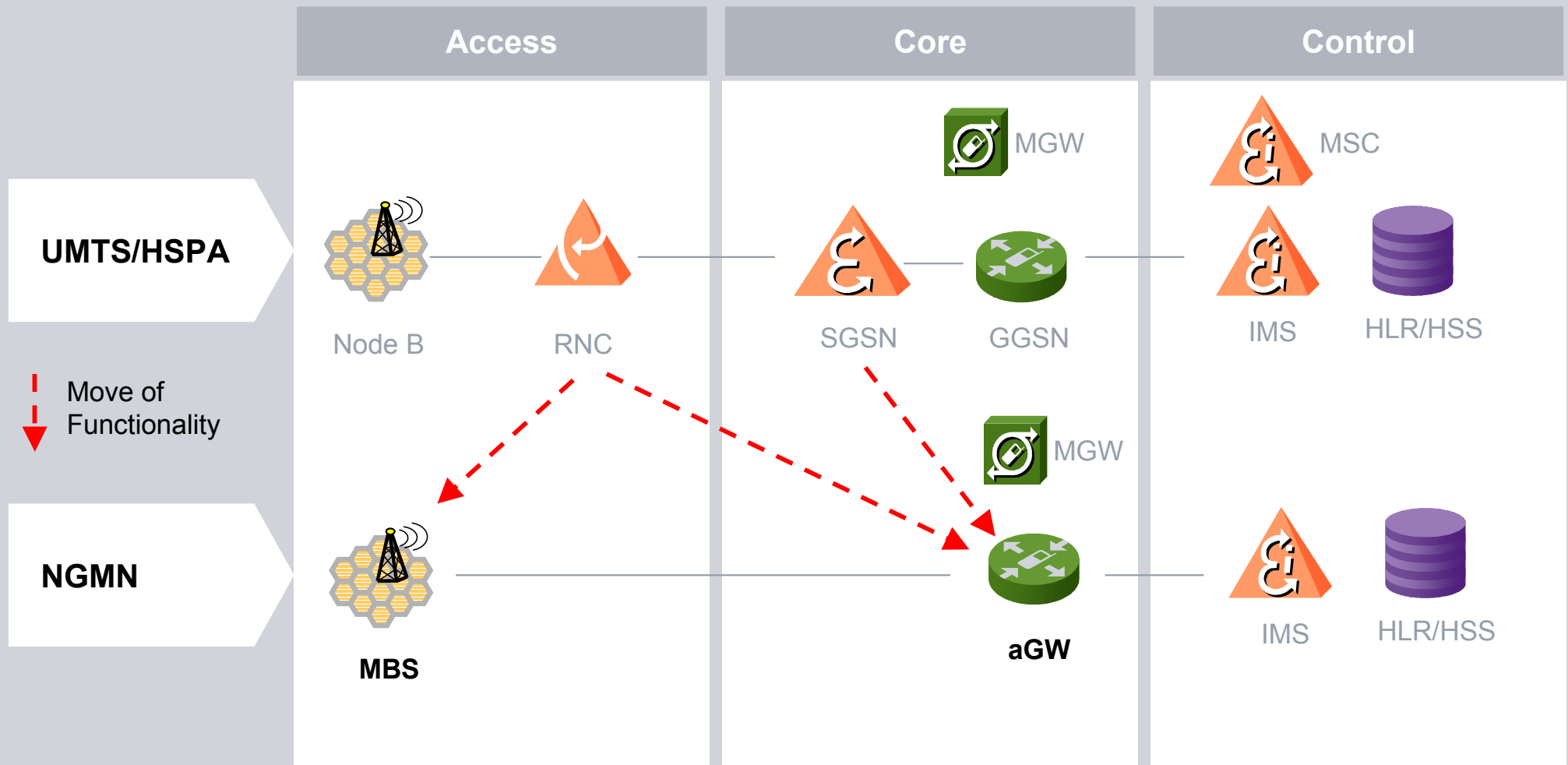
- **No more sites**
 Re-use of equipment and antennas (MBS)
- **Spectrum Efficiency**
 2-3 bit/Hz/cell (3...4 times HSPA)
 Scalable bandwidth (1.25 – 20 MHz ch)
 Re-farming support
- **Flat Network Architectures**
 IP interfaces & optimized all-IP Network
 Ethernet backhauling
- **Smooth Migration from existing networks**

3G Long term evolution (3G+) – Requirements



Key Architectural Concepts (simplified): 3GPP-SAE *

Flat and cost-effective NGMN architecture

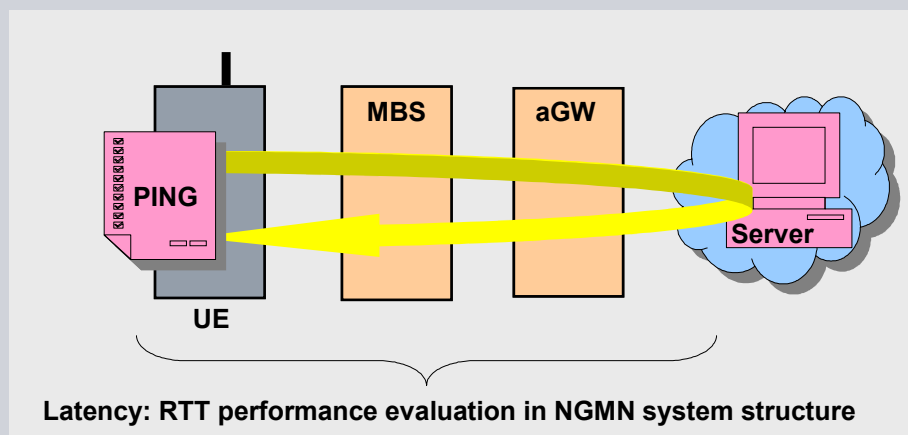
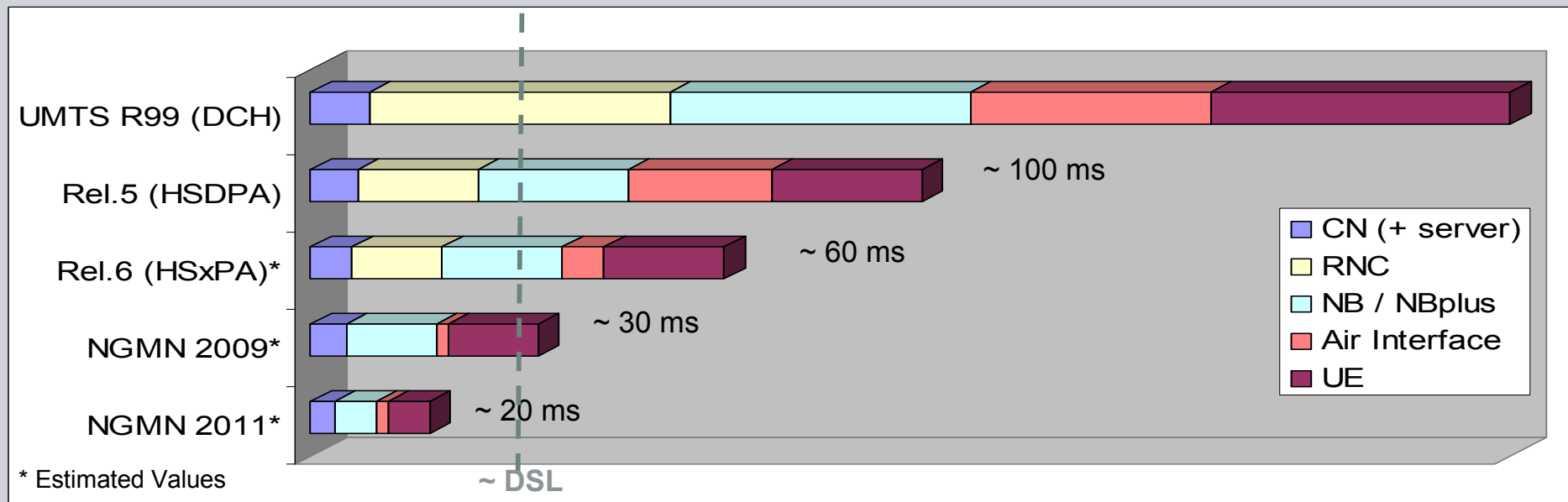


• 3GPP - SAE = 3GPP - System Architecture Evolution

• 3GPP - LTE = 3GPP - Long-Term Evolution (air-interface)

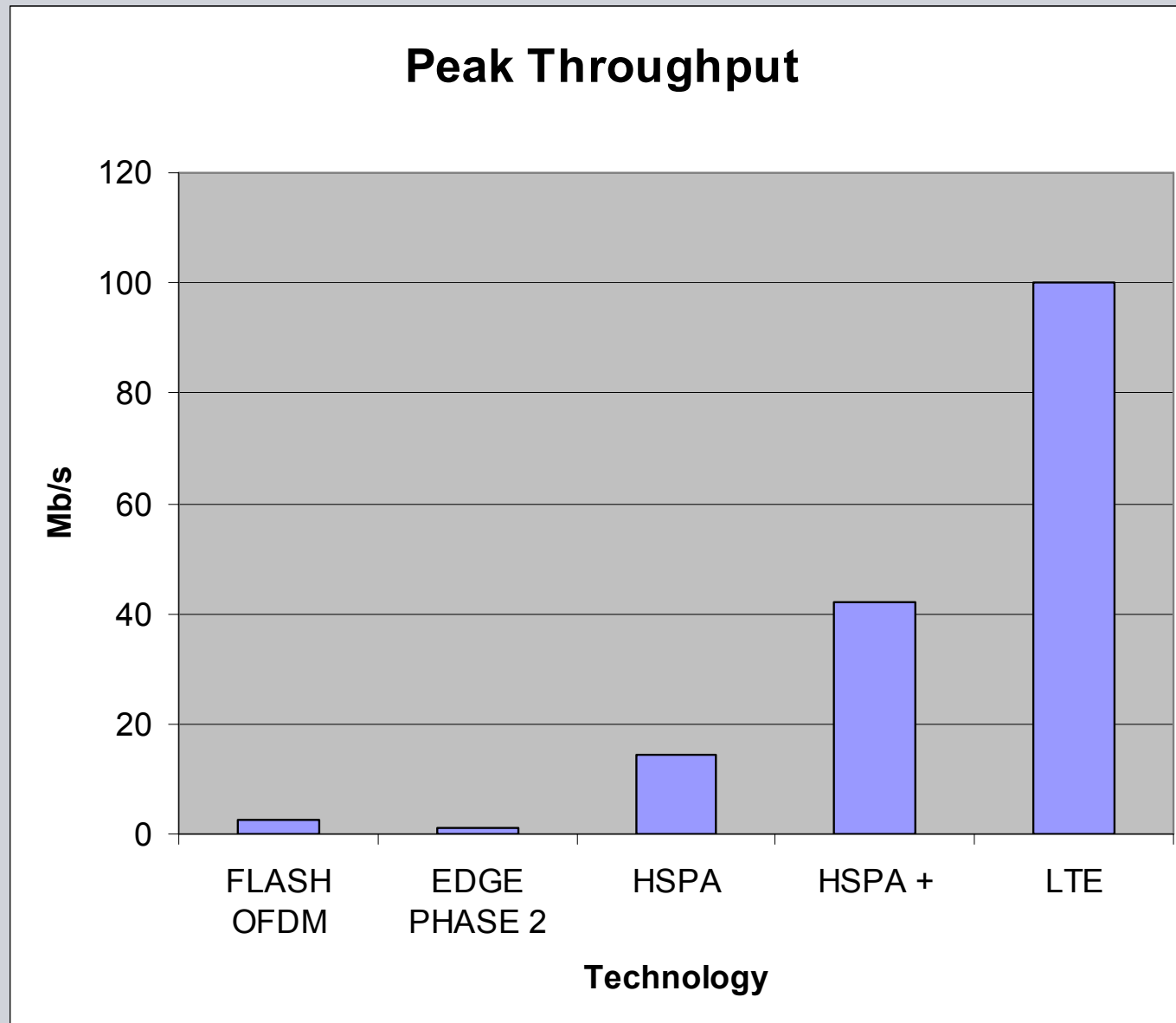
3GPP-SAE *: latency reduction by factor 2-3 vs. HSPA

Latency reduction: node aggregation + simplified interfaces (all-IP)

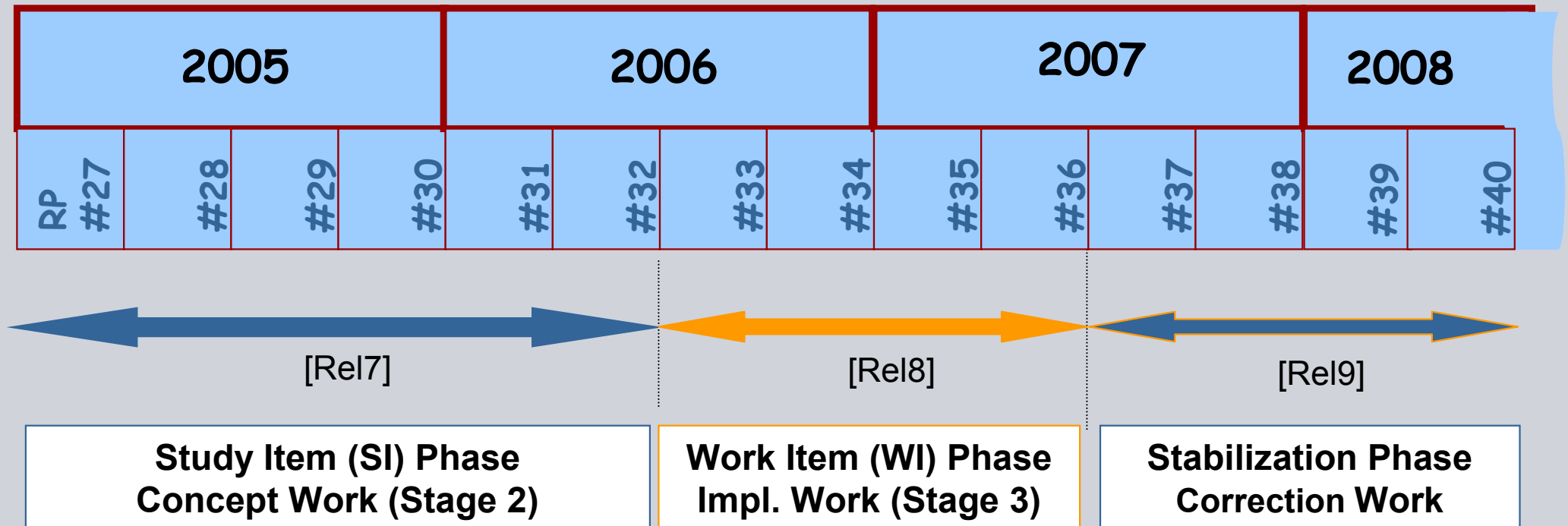


- 3GPP - SAE = 3GPP - System Architecture Evolution
- 3GPP - LTE = 3GPP - Long-Term Evolution (air-interface)

Peak Throughput vs Technology



3 GPP Work Plan



Takk for oppmerksomheten!