Mediendienste über LTE: Techniküberblick und Kapazität

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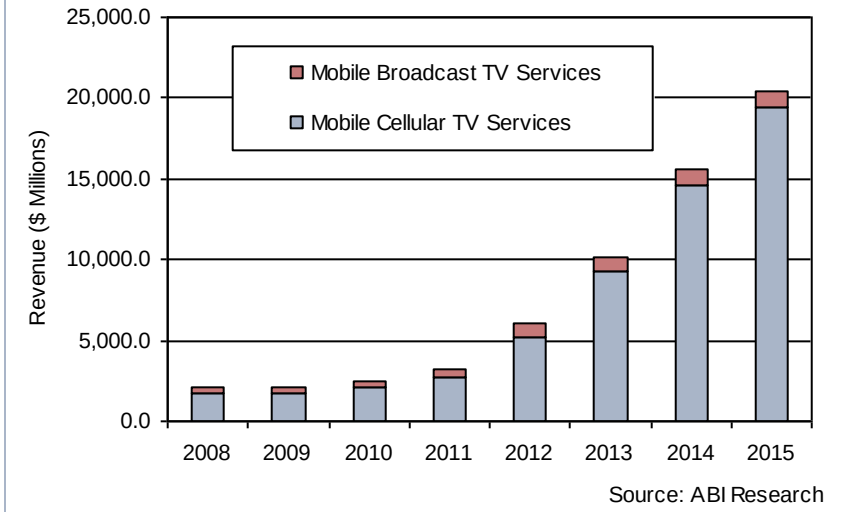
Outline

- Mobile TV market trend
- LTE landscape
- eMBMS overview:
  Multimedia Broadcast/Multicast Service for LTE
- Conclusion

Mobile tv market Trend

External market report

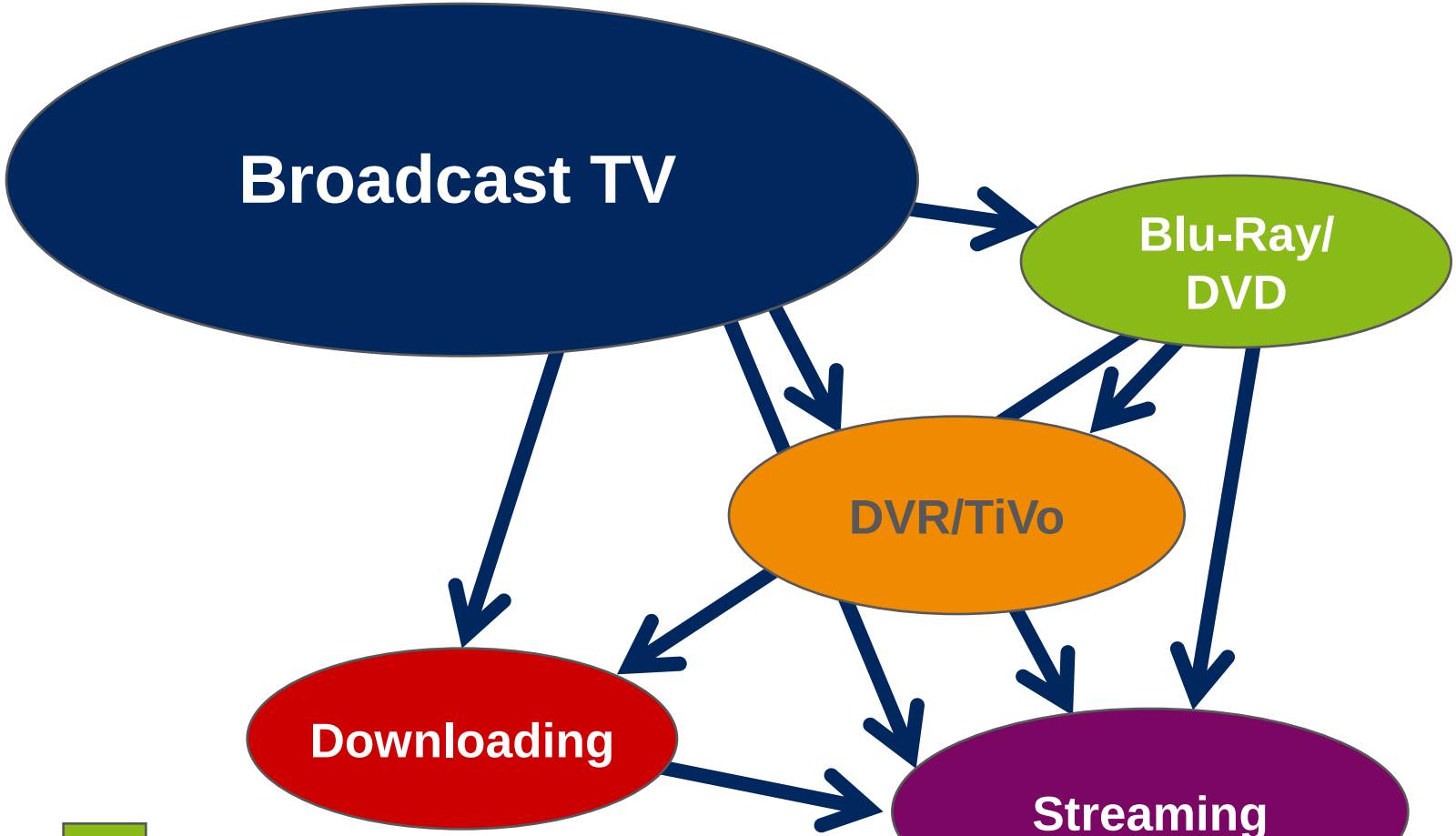
Mobile TV Revenue by Service Type
World Market, Forecast: 2008 to 2015



- Mobile TV services generated only $2.1 billion in revenue worldwide in 2009 due to flat subscriber growth from the economic recession and discounted service pricing
- The revenues will grow at a healthy 52% CAGR from $2.5 billion in 2010 to $20.5 billion in 2015
- Mobile cellular TV subscriptions will contribute 95.1% ($19.5 billion) to the total revenues in 2015
- Mobile broadcast TV subscriptions will contribute 4.9% ($1.0 billion) to the total revenues in 2015

Mobile Consumer Research Service

(Consumers) Viewing behavior
Migration between access technologies

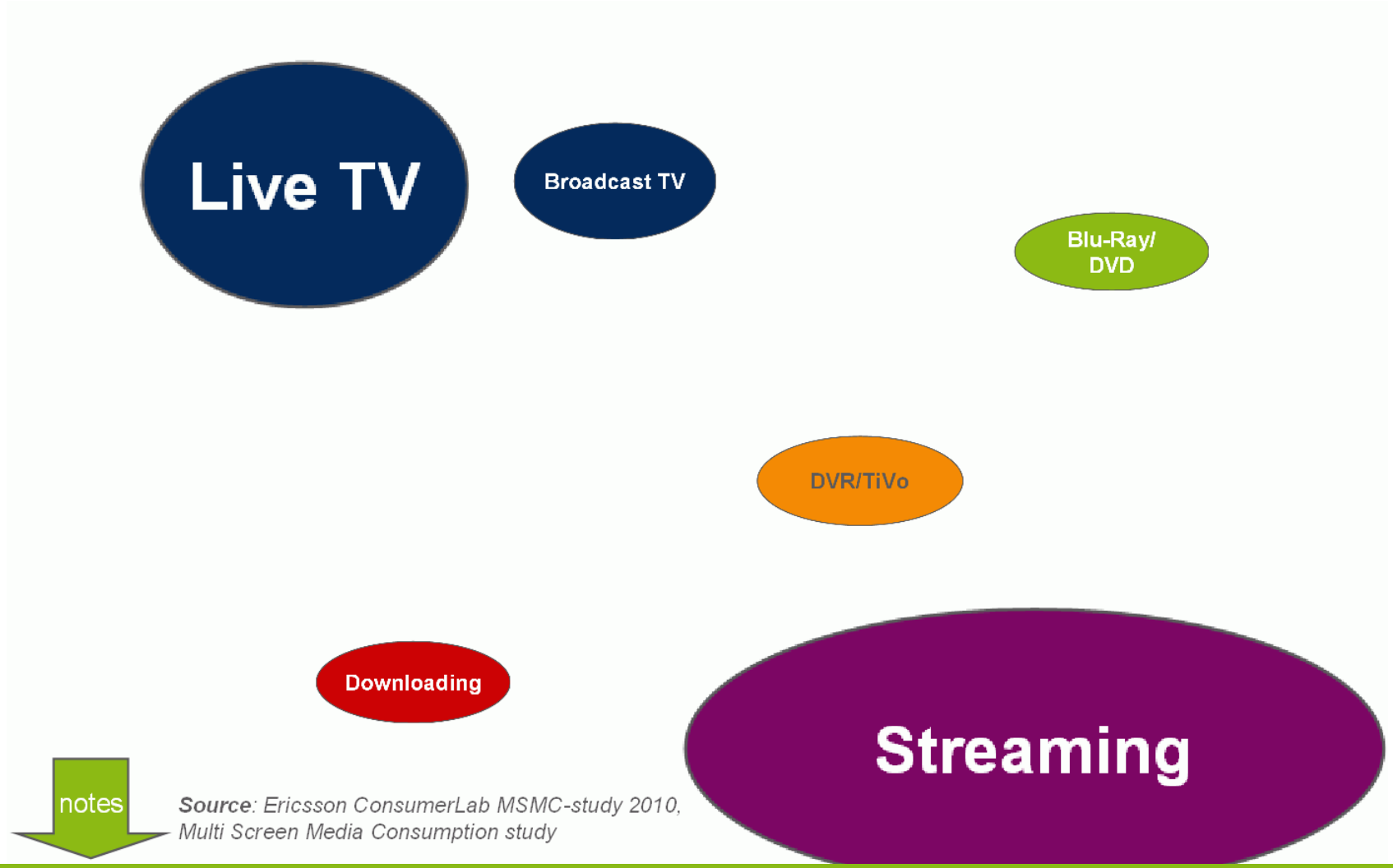


notes

***Source**: Ericsson ConsumerLab MSMC-study 2010, Multi Screen Media Consumption study*

Majority of non-live TV/Video consumption will be streamed

(Consumers) Viewing behavior
Migration between access technologies



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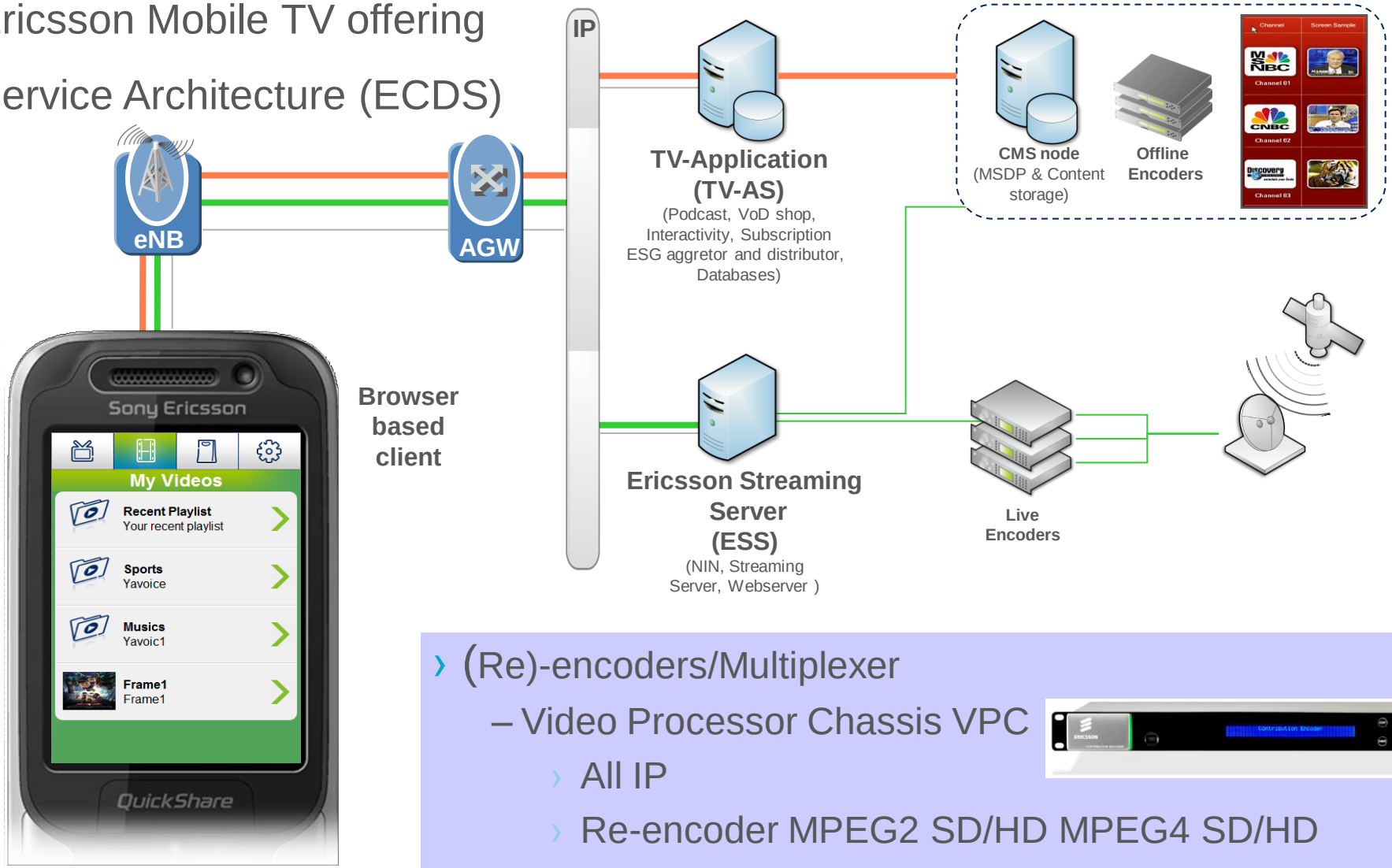
Majority of non-live TV/Video consumption will be streamed

Ericsson's activities in The Mobile TV Services Domain

Ericsson Mobile TV offering

Service Architecture (ECDS)

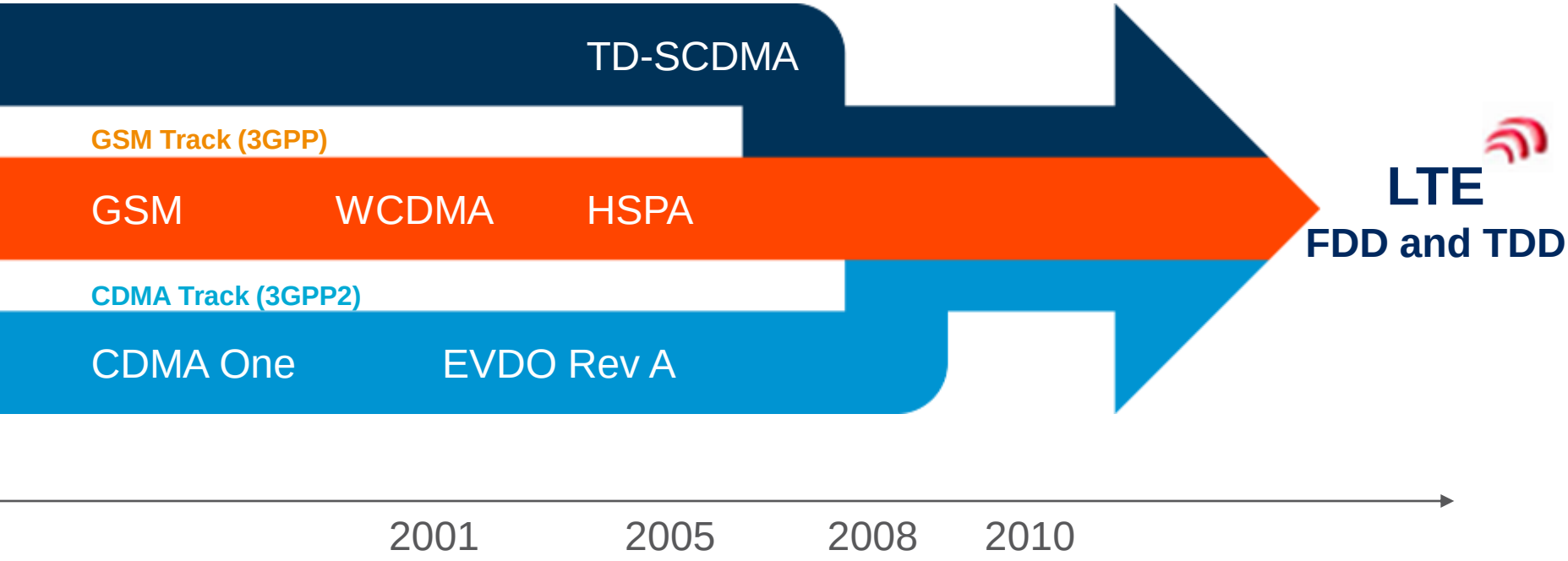


- (Re)-encoders/Multiplexer
  - Video Processor Chassis VPC
    - All IP
    - Re-encoder MPEG2 SD/HD MPEG4 SD/HD
  - Multiplexer

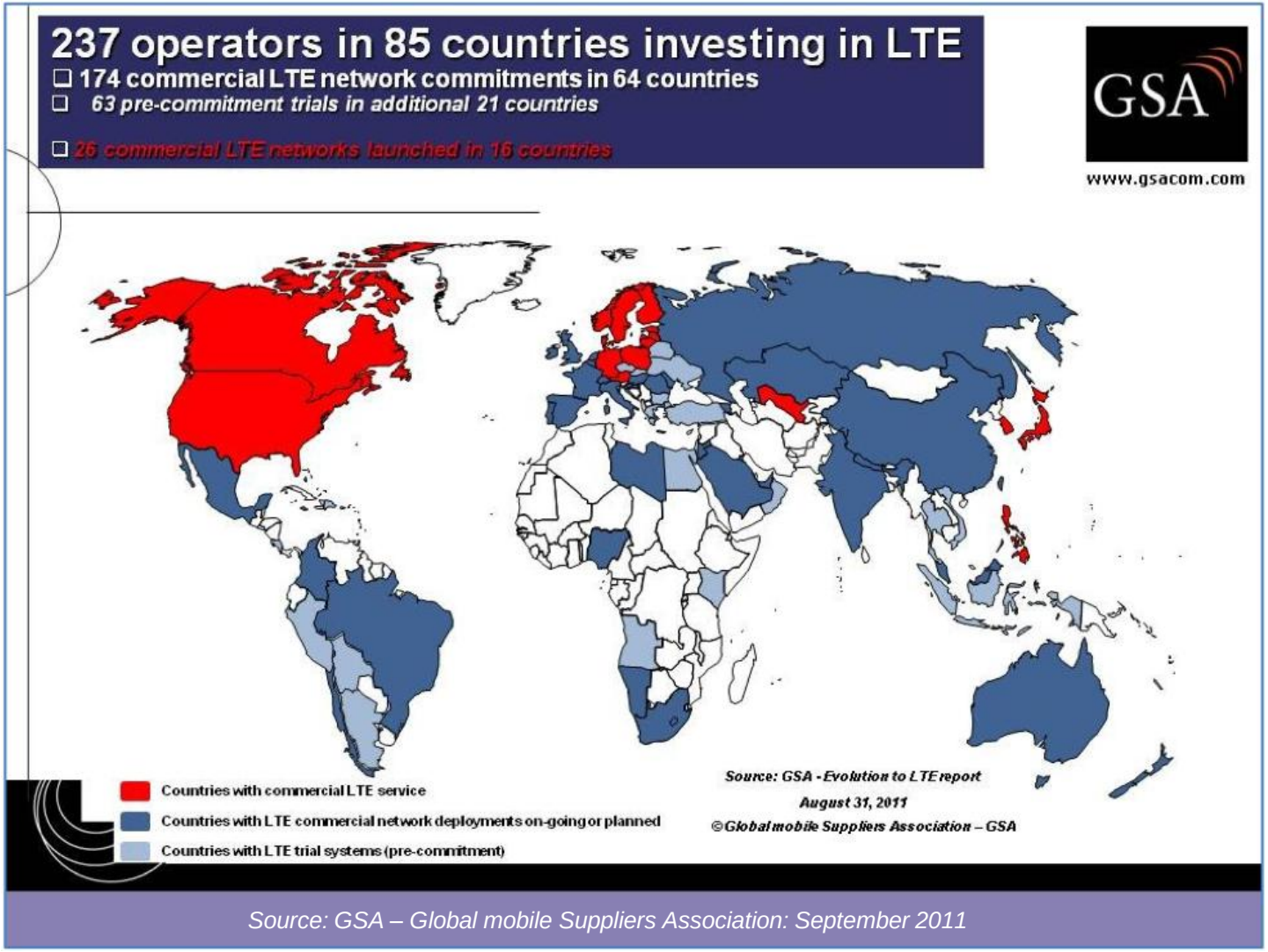
LTE Landscape

Mobile System Evolution

Global Support

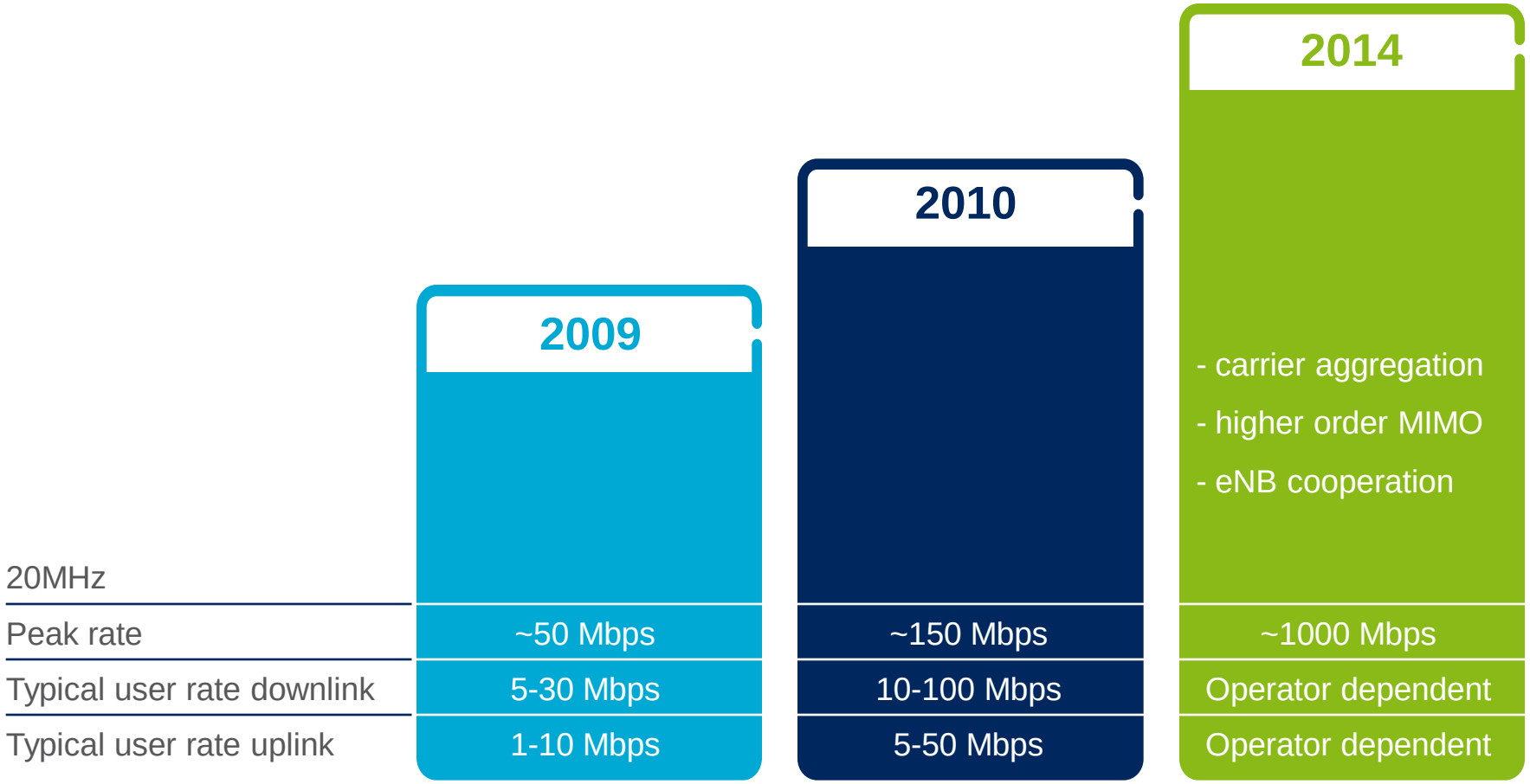


LTE is gaining momentum



Source: GSA – Global mobile Suppliers Association: September 2011

Commercial LTE Speed evolution



smartphone success story

› Sold smartphone units increased 72% in 2010

	2009	2010
mobile devices	1,211,239,600	1,596,802,400
thereof: smartphones	172,376,100	296,646,600

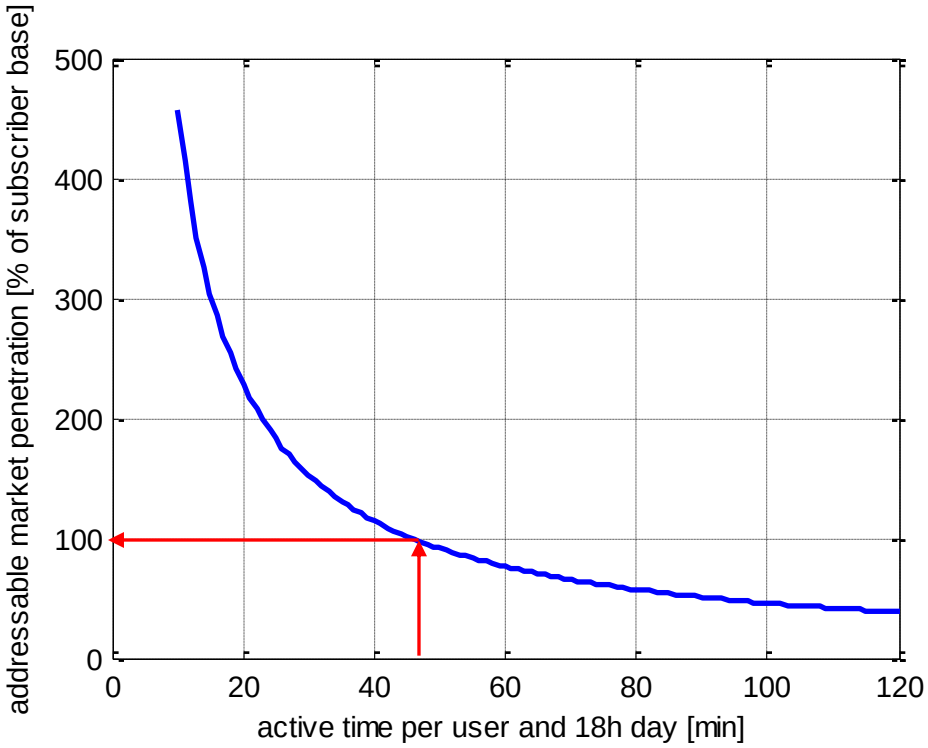
source: Gartner

› Predicted compound average growth rate 2009-2014: 22-40% depending on region

› Today smartphones are 3G, tomorrow will include LTE

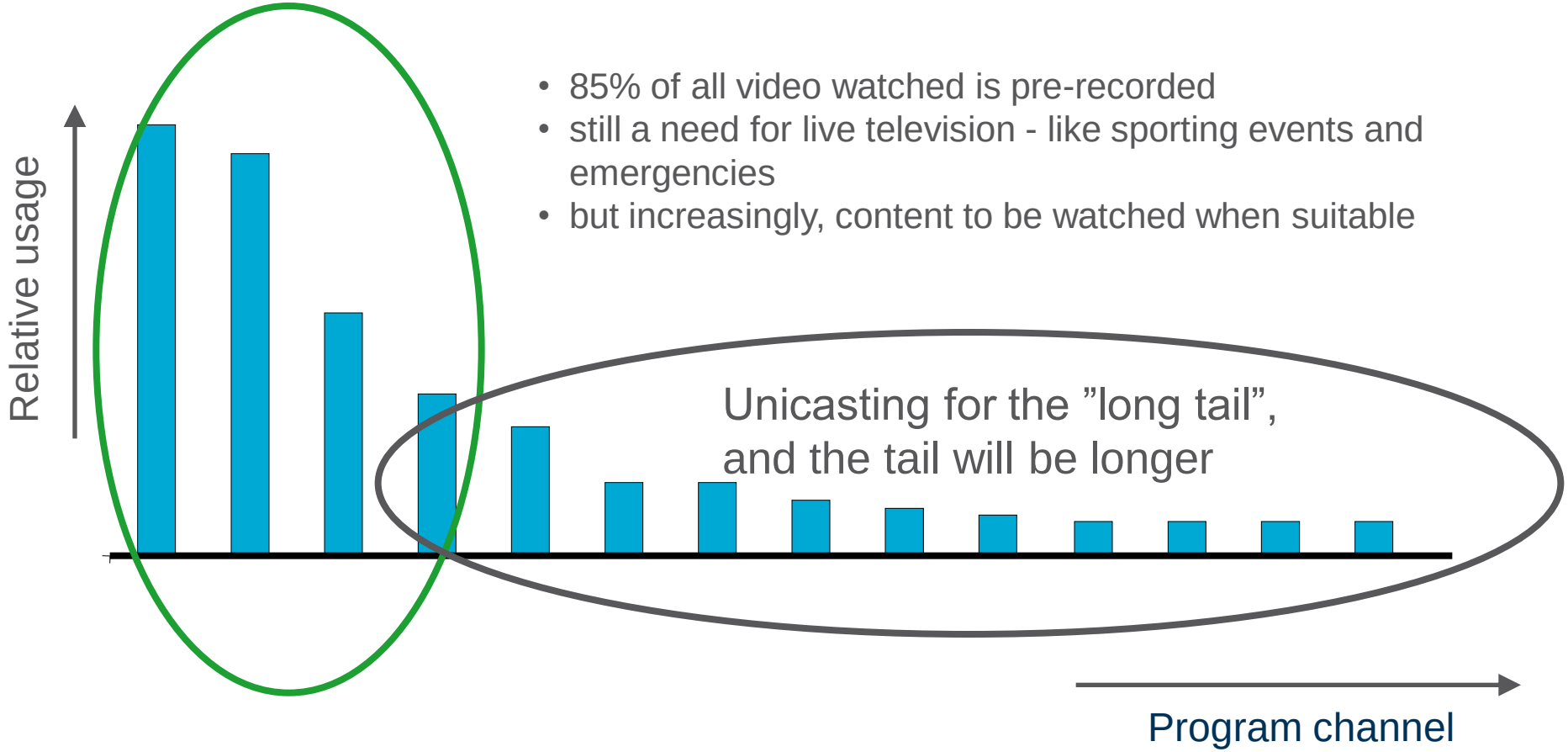
Unicast streaming capacity

- 20000 inhabitants/km^2; site-to-site distance 500m; 4 operators
  - –➔360 inhabitants / sector / operator
- 10MHz; 1b/s/Hz (conservative); 512kb/s/user
  - –➔streaming capacity: 20 users / cell; 5% blocking ➔ 15.2 Erlang
- Usage spread uniformly over a 18 hour day
- Example:
  - active time over 18h: 45min
  - addressable market penetration: 100%
- Could have assumed 20 Erlang capacity in case of 20MHz and some "overflow" streaming traffic may steal from best effort.
- This is for Release 8. For Release 9 with e.g. MU-MIMO capacity is higher.



Broadcasting and Unicasting domains

Broadcasting for the ”head”, in particular for live events ➔ MBMS



- 85% of all video watched is pre-recorded
- still a need for live television - like sporting events and emergencies
- but increasingly, content to be watched when suitable

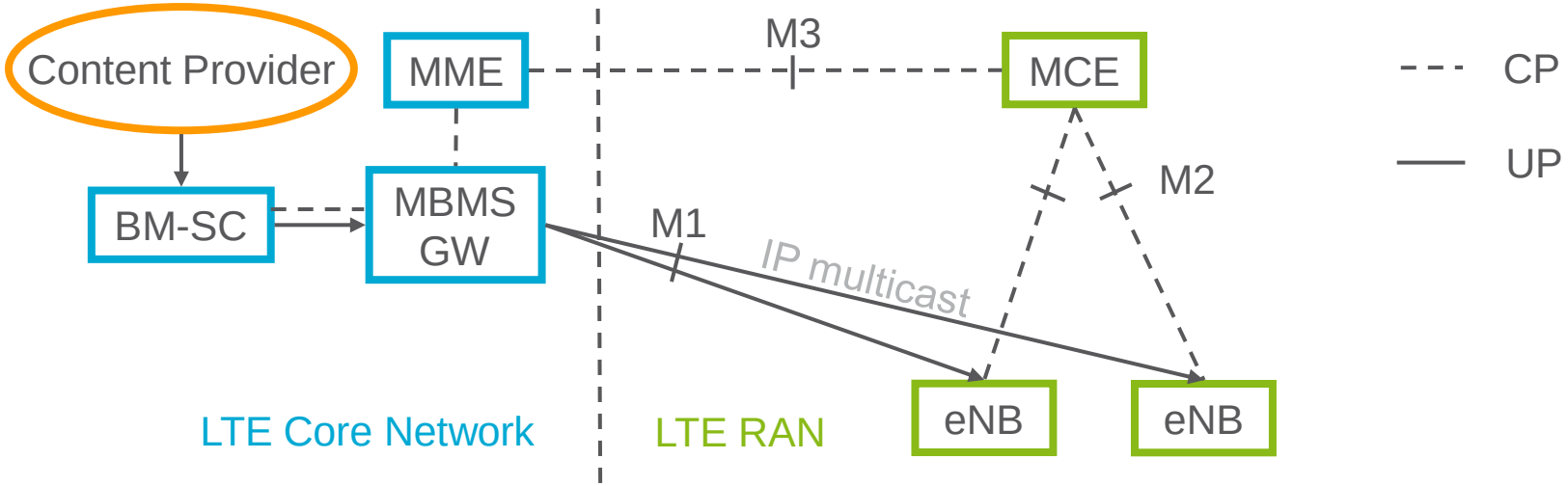
eMBMS Overview

Multimedia Broadcast/Mulitcast Service for LTE

MBMS Codecs/Service Layer tools

- CODECs: H.264, E-AAC+ or AMR-WB+
- Streaming delivery method for continuous reception
  - Re-use of existing Streaming Protocols (i.e. RTP)
- Download delivery method for file distribution
  - IETF file distribution protocols FLUTE and ALC
- Auxiliary functions for Content transmission methods
  - Post transmission File Repair function
  - Reception Reporting for files and streams
- Service access protection
  - Terminal/user authentication
  - Key Management via MIKEY
- FEC (Raptor code) on application layer supported
  - enables further reduced IP packet error rates

MBMS overall architecture



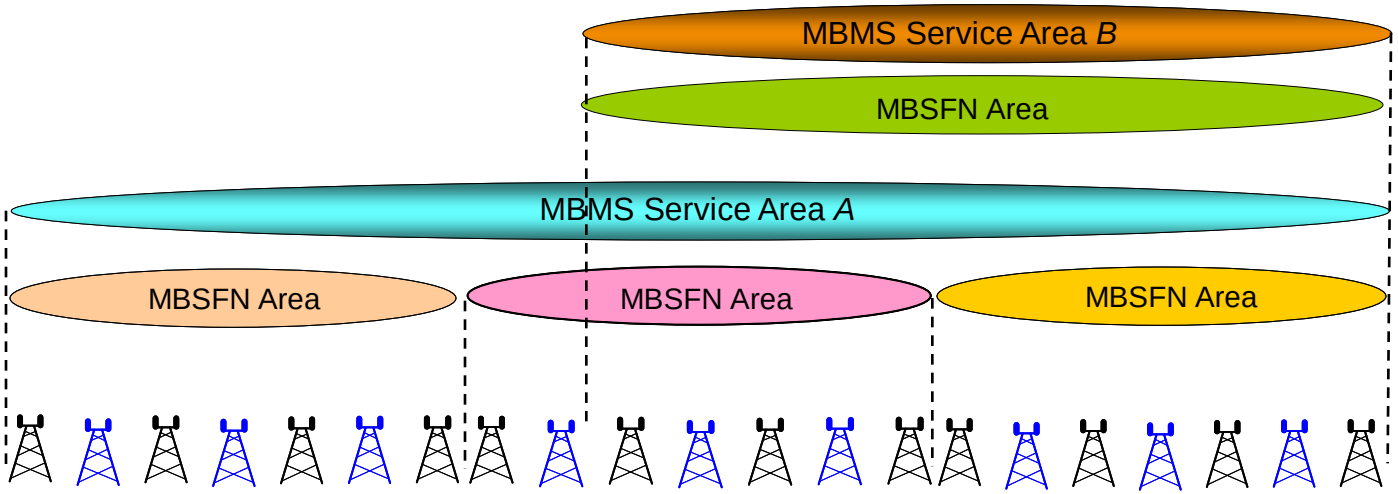
- BM-SC (broadcast multicast service center)
  - MBMS user service initiation and delivery
  - Specifies MBMS Service Areas
  - Charging
- MBMS-GW (MBMS gateway)
  - Broadcasts MBMS packets to each eNB transmitting the service on M1 interface
- MCE (Multi-cell Coordination Entity)
  - Physical resource allocation, MCS
  - Controls multiplexing of MBMS services
  - Admission control

- Control plane interfaces
  - M3: MBMS session management
  - M2: MBMS session management and radio configuration
- User plane interface M1
  - IP multicast to deliver the downlink packets
  - SYNC protocol for content synchronization

MBMS radio Interface characteristics

- Uses OFDM, like DVB-T
  - OFDM parameters differ, LTE optimized for very high user mobility at 2.6GHz and above, based on rather low cellular transmitter separation
  - Longer guard interval than for LTE unicast, to avoid inter symbol interference from neighbor cells
- MBMS uses Single Frequency Network (MBSFN) transmission
- Supported for FDD and TDD LTE
- LTE-MBSFN time multiplexed with unicast traffic
  - in contrast, MBSFN for UMTS requires dedicated carrier
    → introduction of MBSFN in LTE significantly easier than for UMTS

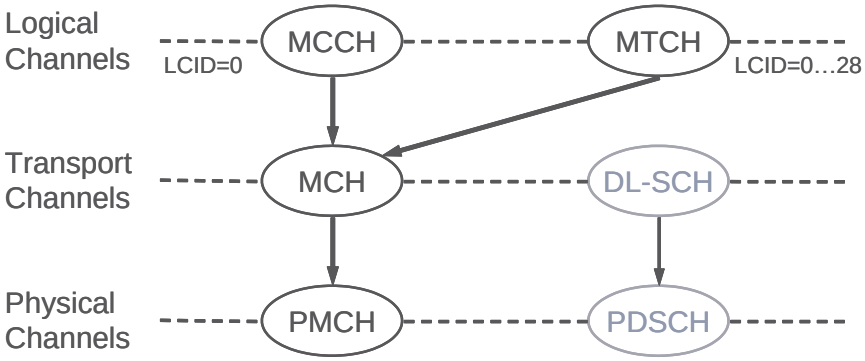
MBMS service area / MBSFN AREA



- MBMS Service Area allows service distribution in target regions
- eNBs transmitting MBSFN are required to be synchronized in time
- Overlap between MBSFN areas is supported
  - Enables local, regional, and national services
- Small cells enable reusing same radio resource for different service with little geographical separation (facilitates cross border coordination)
- Counting of MBMS interested UEs in connected mode for semi-static activation/deactivation of eMBMS session per MBSFN area

MBMS channels

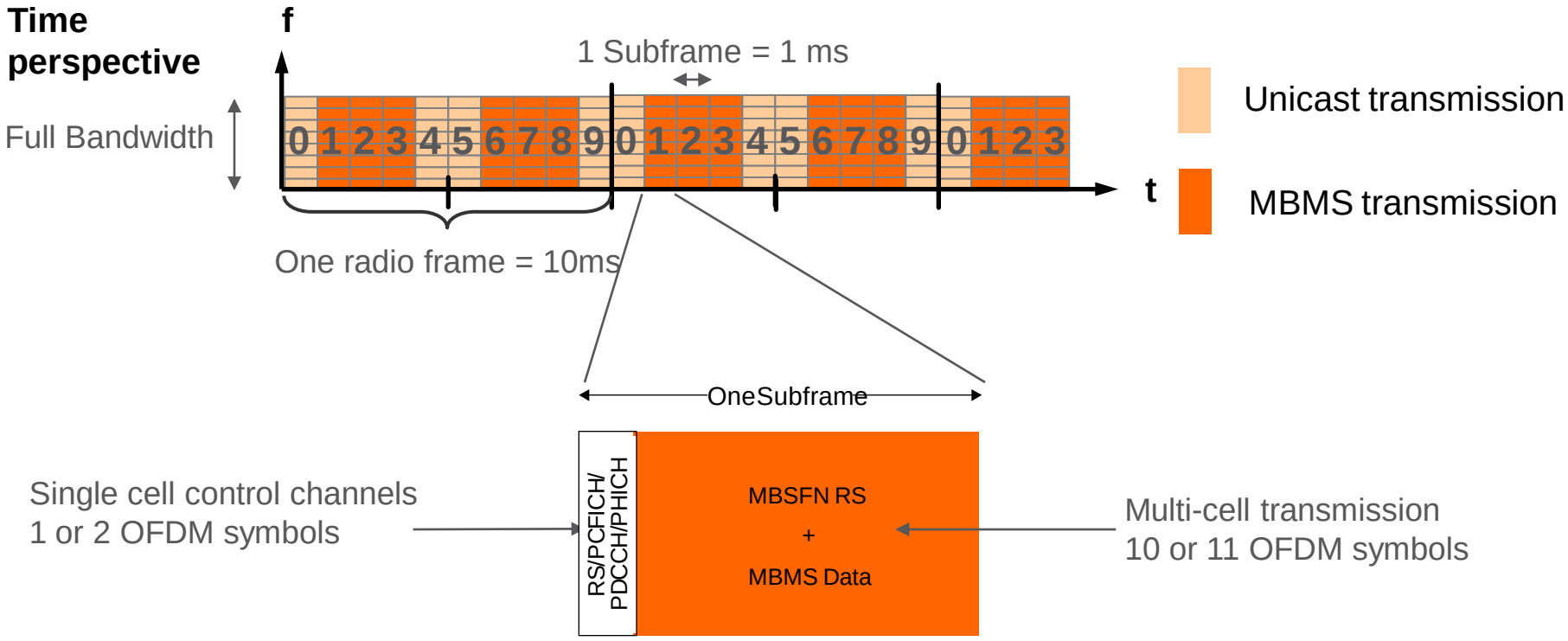
- Downlink channels related to MBMS
  - MCCH Multicast Control Channel
  - MTCH Multicast Traffic Channel
  - MCH Multicast Channel
  - PMCH Physical Multicast Channel



- A single transport block is used per subframe
- Different services (MTCHs) can be multiplexed in this transport block
- MCH is transmitted over MBSFN in specific subframes on physical layer
- MCH is a downlink only channel (no HARQ, no RLC repetitions)
- The MCS of a PMCH is fixed in the MBSFN area and selected by the network
- Multiple MCHs per MBSFN are supported

TDM of Unicast and MBMS

- TDM principle
  - MBSFN is not transmitted in subframes 0, 4, 5 and 9 (FDD) and subframes 0, 1, 5, 6 (TDD)
  - The subframe ratio available for MBMS ranges from 1/320 to 192/320 (=60%)
  - A 10/40ms pattern repeats over {1, 2, 4, 8, 16, 32} radio frames



Performance of MBSFN

Summary of MBSFN performance, dedicated carrier (TR 25.912)

Deployment Case	Spectrum Efficiency [bps/Hz]	Inter-site Distance @ 1bps/Hz [m]
1	3.13	1619
2	3.02	2310
3	0.99	1619
4	3.18	4375

Simulation assumptions

Case	Band (MHz)	Site to site distance (m)	Speed (kph)
1	2000	500	3
2	2000	500	30
3	2000	1732	3
4	900	1000	3

HDTV programs at 8Mb/s in 20MHz:

1b/s/Hz: 2-3

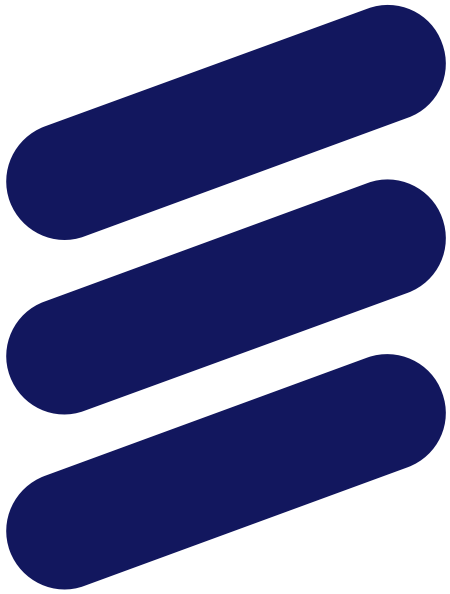
3b/s/Hz: 7-8

shared carrier capacity is 50% lower

R1-070674:
"LTE physical layer framework for performance verification"
Orange, China Mobile, KPN, NTT DoCoMo, Sprint, T-Mobile, Vodafone, Telecom Italia.

Conclusions

- Large variety and huge volume of 3G mobile multimedia terminals
  - smartphones, laptop dongles and embedded modules, tablets
- LTE is the next technology step that will be integrated into all these device types
- LTE provides the capacity for high quality unicast video streaming
- LTE cells are very small; for mobile usage, broadcasting is more efficient than unicasting only for very popular, e.g. live content
  - broadcasting also well suited for Podcasting / client-side caching
- eMBMS is an integral part of LTE and well suited for mobile multimedia broadcasting
- LTE in 800MHz will provide very good coverage also for eMBMS, even indoors
  - regulatory requirements to provide coverage in rural areas in some countries



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Main references

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- Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2
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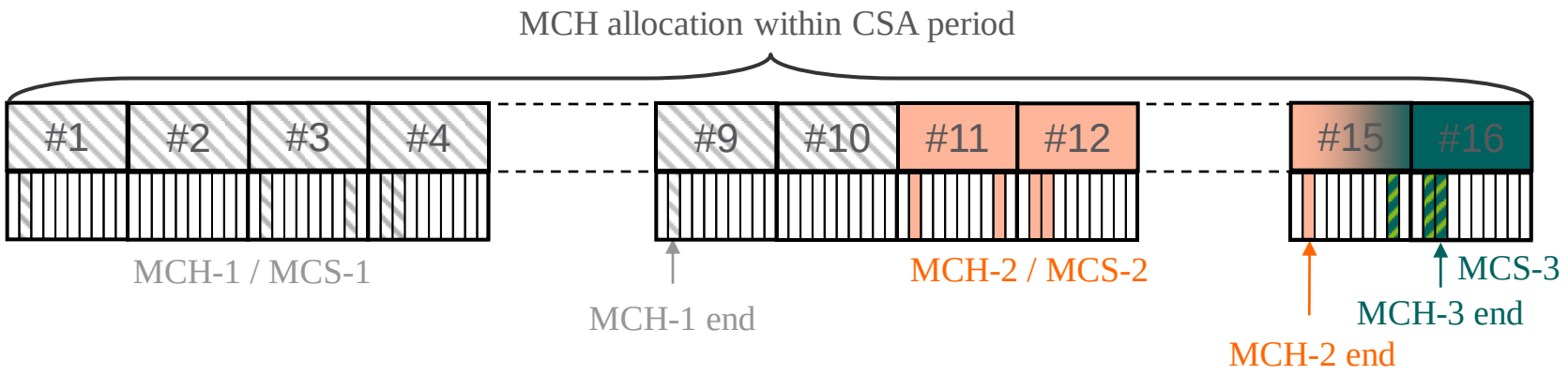
- Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification
  http://www.3gpp.org/ftp/Specs/html-info/36331.htm

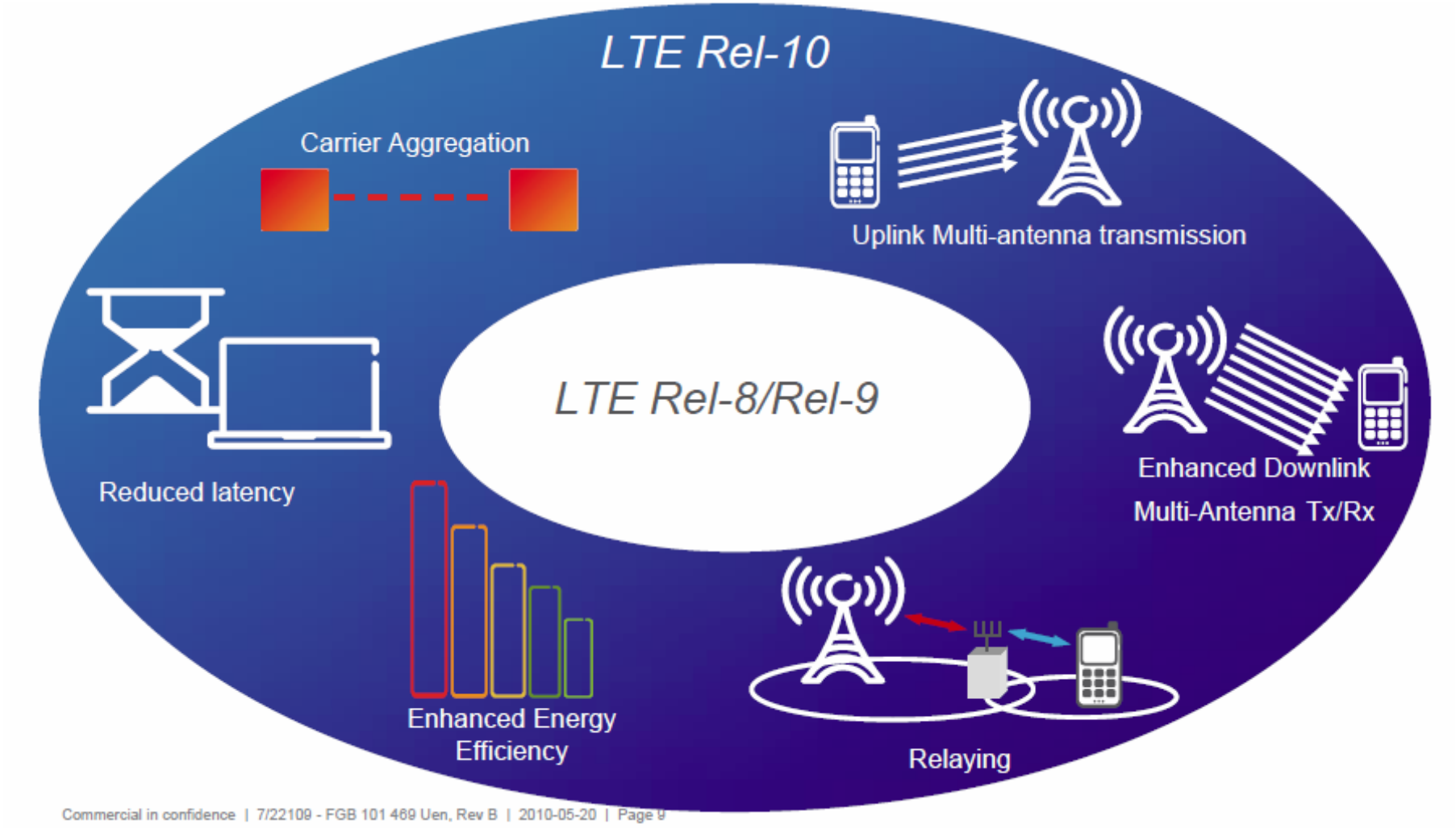
- Evolved Universal Terrestrial Radio Access Network (E-UTRAN); General aspects and principles for interfaces supporting Multimedia Broadcast Multicast Service (MBMS) within E-UTRAN
  http://www.3gpp.org/ftp/Specs/html-info/36440.htm

MBMS Signaling - Control Plane Radio Resource Configuration

- MCH subframe allocation
  - All MCHs within one MBSFN area use Common Subframe Allocation (CSA) pattern (same structure as SIB2 SAP)
  - Per MCH “consecutive” allocation within one CSA period
  - Configuration of CSA period: fine granularity for each MCH vs. increased interleaving and shorter delay



Evolution of LTE



LTE drive tests STockholm

throughput:

average: 30-60Mb/s

peak: 100Mb/s

Main system characteristics

System parameter	DVB-H	E-MBMS
transmission scheme	OFDM	OFDM
modulation constellations	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64QAM
radio channel bandwidth [MHz]	5 / 6 / 7 / 8	1.4 / 3 / 5 / 10 / 15 / 20
subcarrier spacing [kHz]	1 / 2 / 4	7.5 / 15
symbol duration T [μs]	224 / 448 / 896	67 / 133
guard interval	1/32·T … 1/4·T	1/4·T or 4.67μs
FEC		
- physical layer channel coding	convolutional, rate 1/2 … 7/8	Turbo, rate from 1/3
	RS (204,188,8) code	
- IP packet level	"MPE-FEC": RS block size 0.5 - 2Mbit	Raptor
time diversity		
- physical layer	max 896μs	1ms (TTI length)
- IP layer FEC	max 5s depending on MPE-FEC parameters and service bitrate	Virtually no limits from Raptor code. Only limited by delay.
frequency diversity (phy layer)	over entire occupied bandwidth	over entire occupied bandwidth