

IMT-2000 members UTRA-TDD and UTRA-FDD

Dr. Christian Menzel, SIEMENS AG

christian.menzel@icn.siemens.de

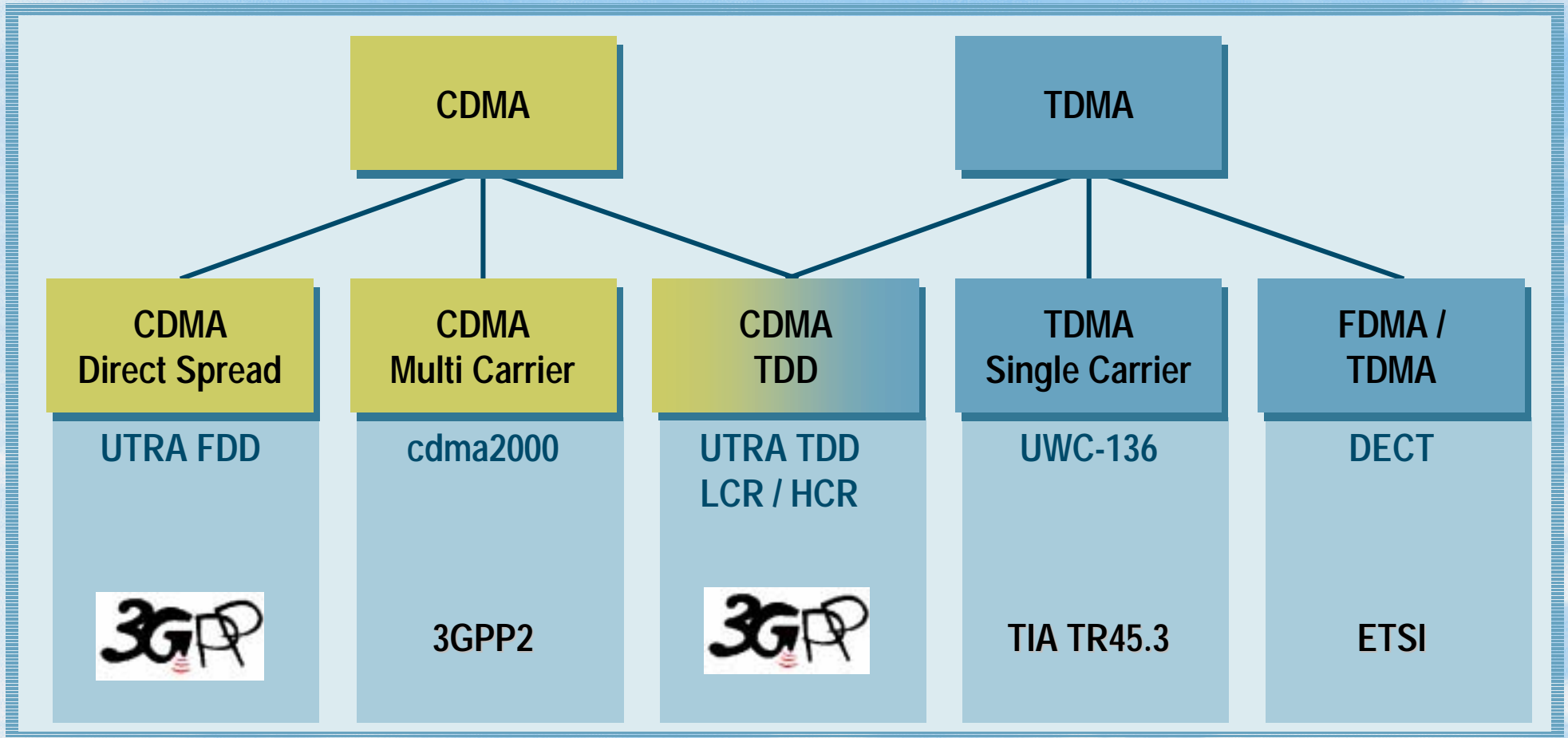
Author
Siemens AG, Munich

© Siemens AG 2000

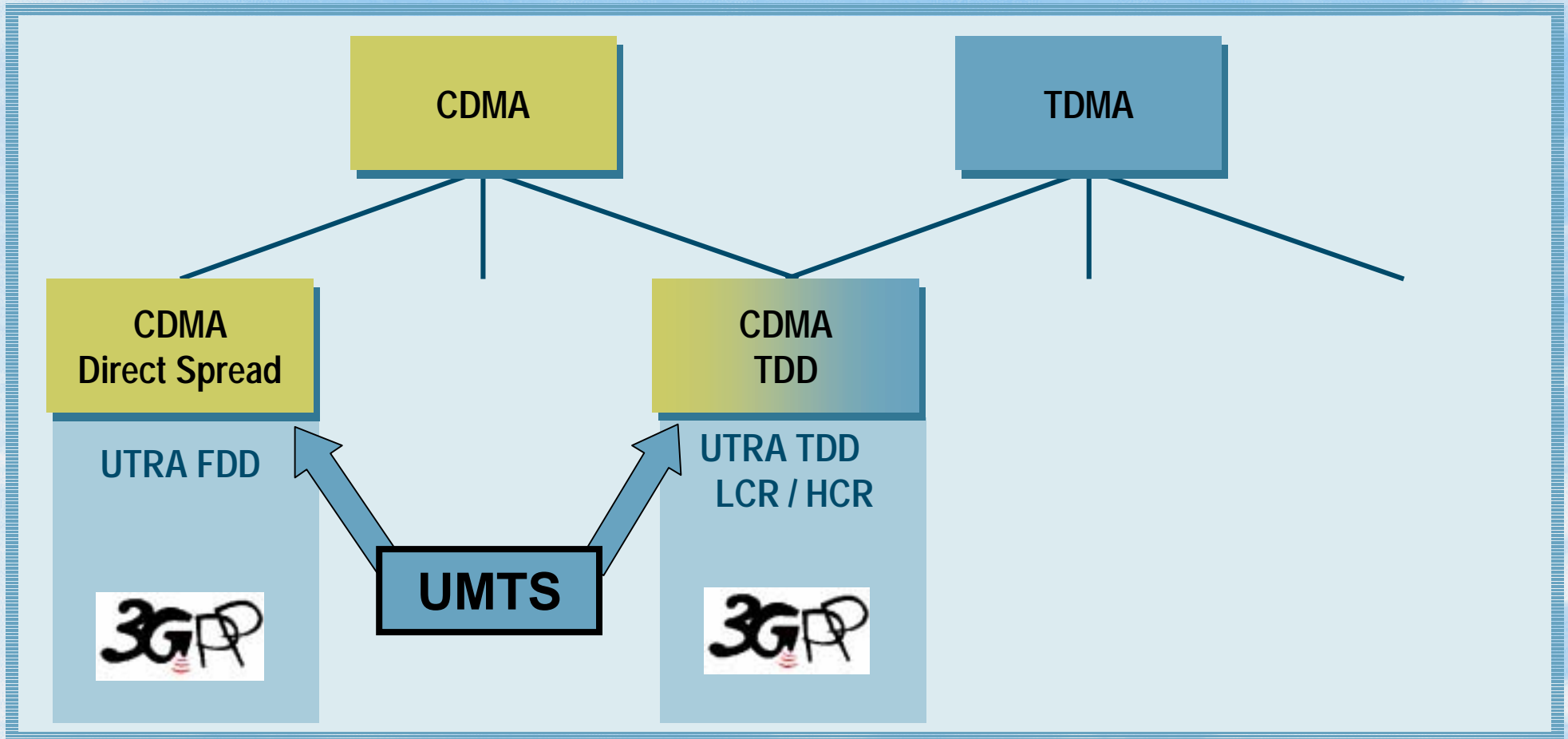
UTRA (FDD + TDD)

- **IMT-2000 and UMTS-UTRAN**
- **The need for 3G**
- **History, progress and elaboration of UMTS-UTRAN**
- **Characteristics and capabilities**
- **Conclusion**

IMT-2000 Terrestrial Radio Interfaces



IMT-2000 Terrestrial Radio Interfaces



UTRA (FDD + TDD)

Organizational Partners

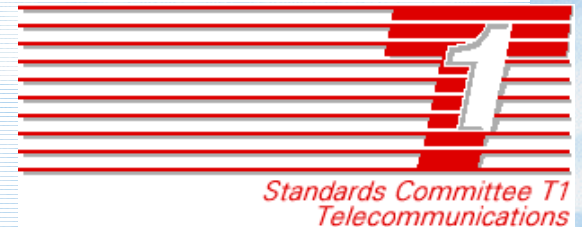
3GPP is:

- Open to all national/regional Standards Development Organizations irrespective of their geographical location (*Organizational Partners*)

CWTS



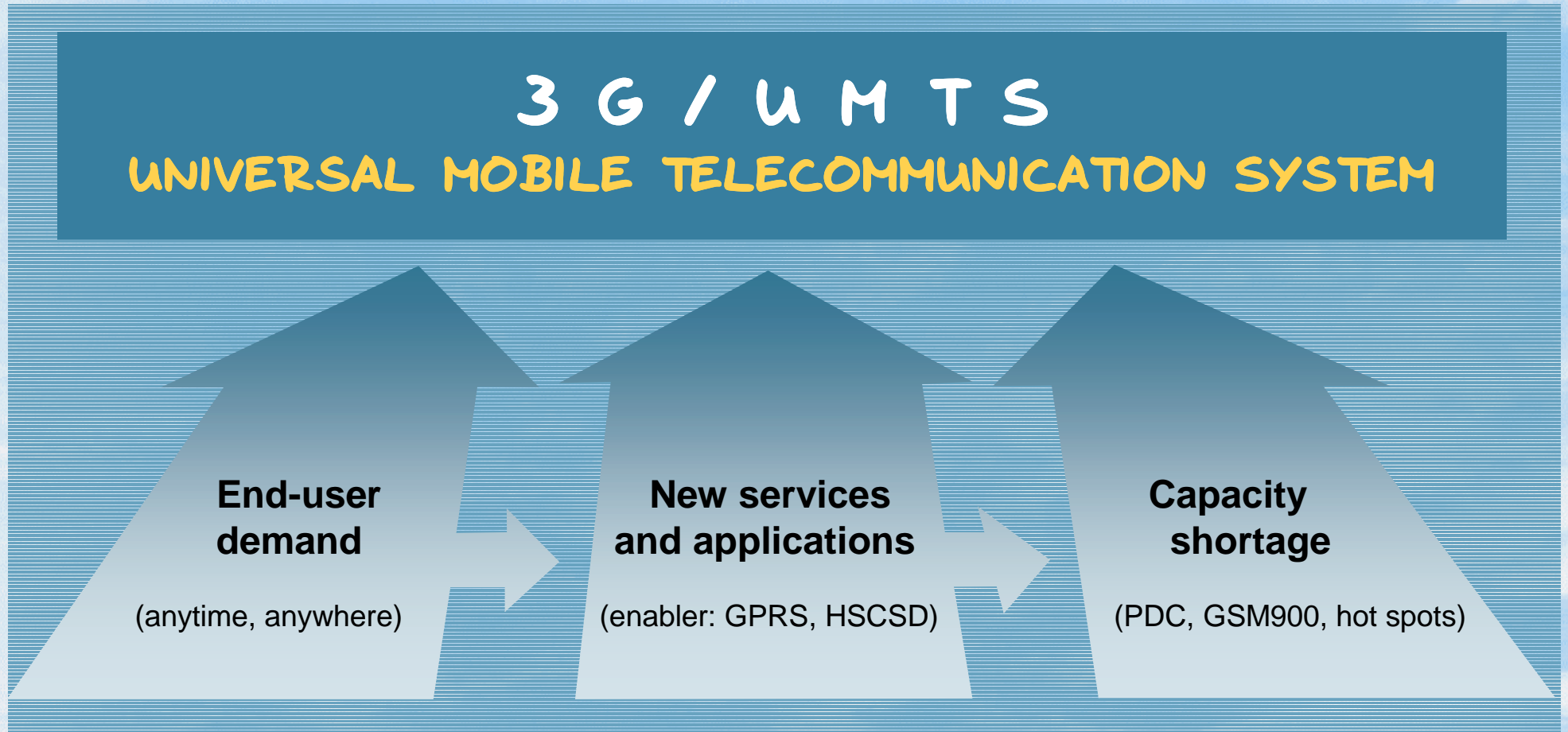
ARIB



UTRA (FDD + TDD)

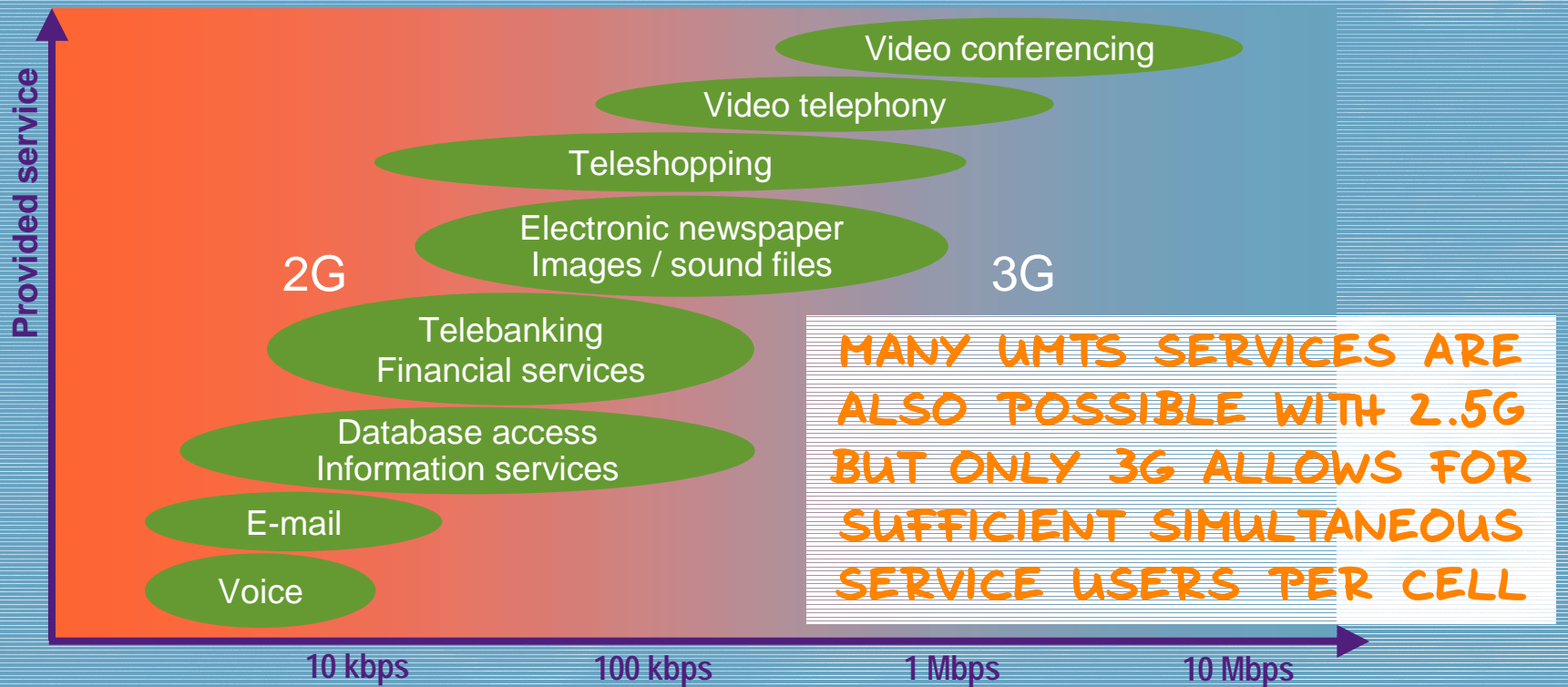
- **IMT-2000 and UMTS-UTRAN**
- **The need for 3G**
- **History, progress and elaboration of UMTS-UTRAN**
- **Characteristics and capabilities**
- **Conclusion**

The Three Driving Forces Towards UMTS



UMTS Services Evolve from 2G Services

Tomorrow's Service Demand Requires High Data Rates



- UMTS will deliver seamless services from narrowband to broadband and will support flexible bandwidth on demand up to 2 Mb/s

Expected User Preferences:

mobile terminals will be the natural interface to access the Internet and Value Added Services

PC



- 1998 Actual PC Installed Base: 298 Million
- 2003 Estimated PC Installed Base:

550 Million

CABLE-TV



- 1998 Actual Cable-TV Installed Base: 199 Million
- 2003 Estimated Cable-TV Installed Base:

260 Million

MOBILE PHONE



- 1998 Actual Global Subscriber Base: 290 Million
- 2003 Estimated Global Subscriber Base:

1 Billion

Sources: CSFB, Dataquest

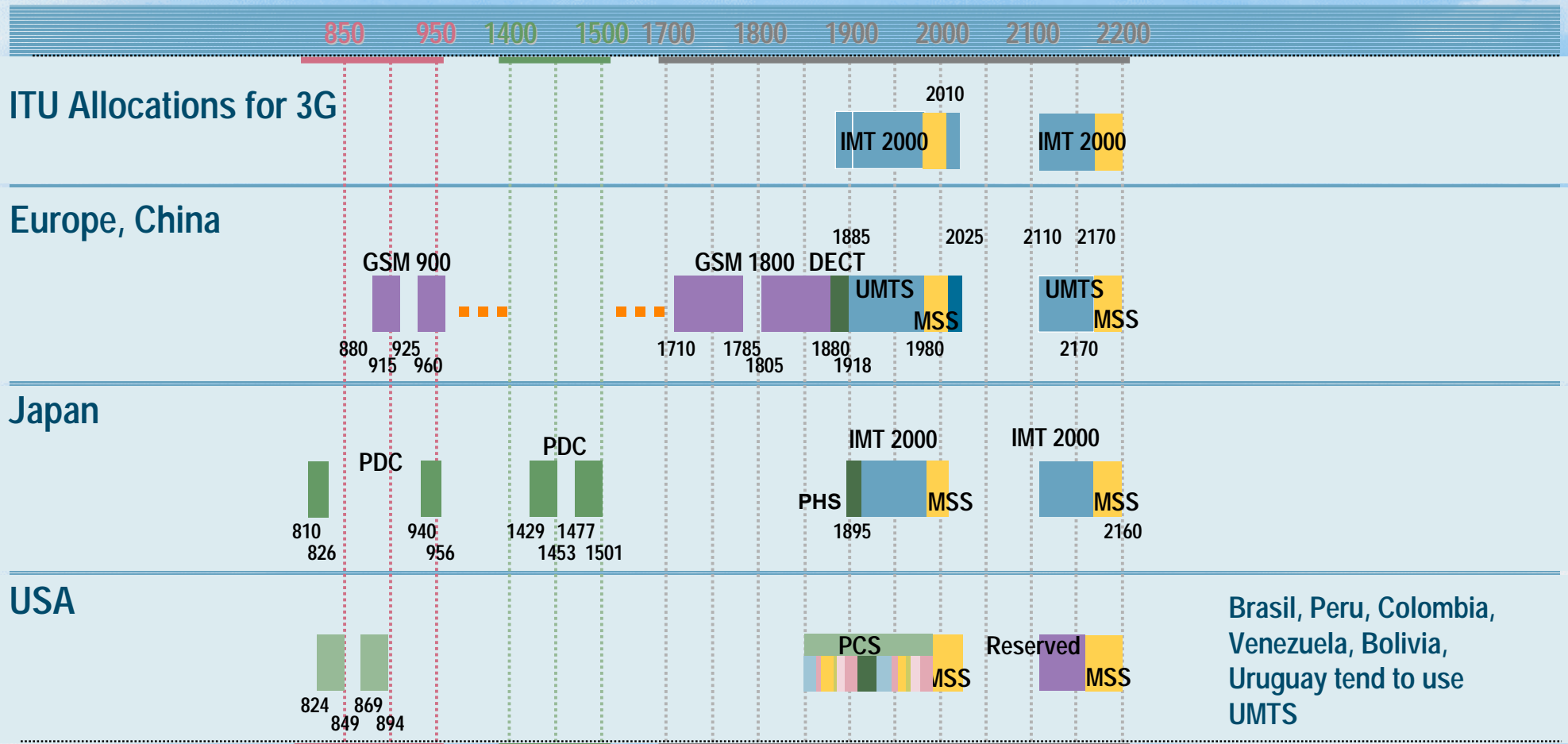
UTRA (FDD + TDD)

- **IMT-2000 and UMTS-UTRAN**
- **The need for 3G**
- **History, progress and elaboration of UMTS-UTRAN**
- **Characteristics and capabilities**
- **Conclusion**

A Brief History of UMTS Progress

- **Feb. 1992** **Malaga** ITU-R World Radio Conference identifies IMT2000 frequency bands
- **Jan. 1998** **Paris** ETSI selects W-CDMA for paired (FDD) and TD-CDMA for unpaired (TDD) UMTS-operation out of 5 competing modes
- **Nov. 1999** **Helsinki** ITU approves IMT-2000 Radio Interface specifications including FDD- and TDD mode approved in ITU meeting (M.1457)
- **Dec. 1999** **Nice** 3GPP approves UMTS Release'99 specifications both for FDD and TDD
- **Mar. 2001** **Palm Springs** 3GPP approves UMTS Release 4 specifications both for FDD and TDD

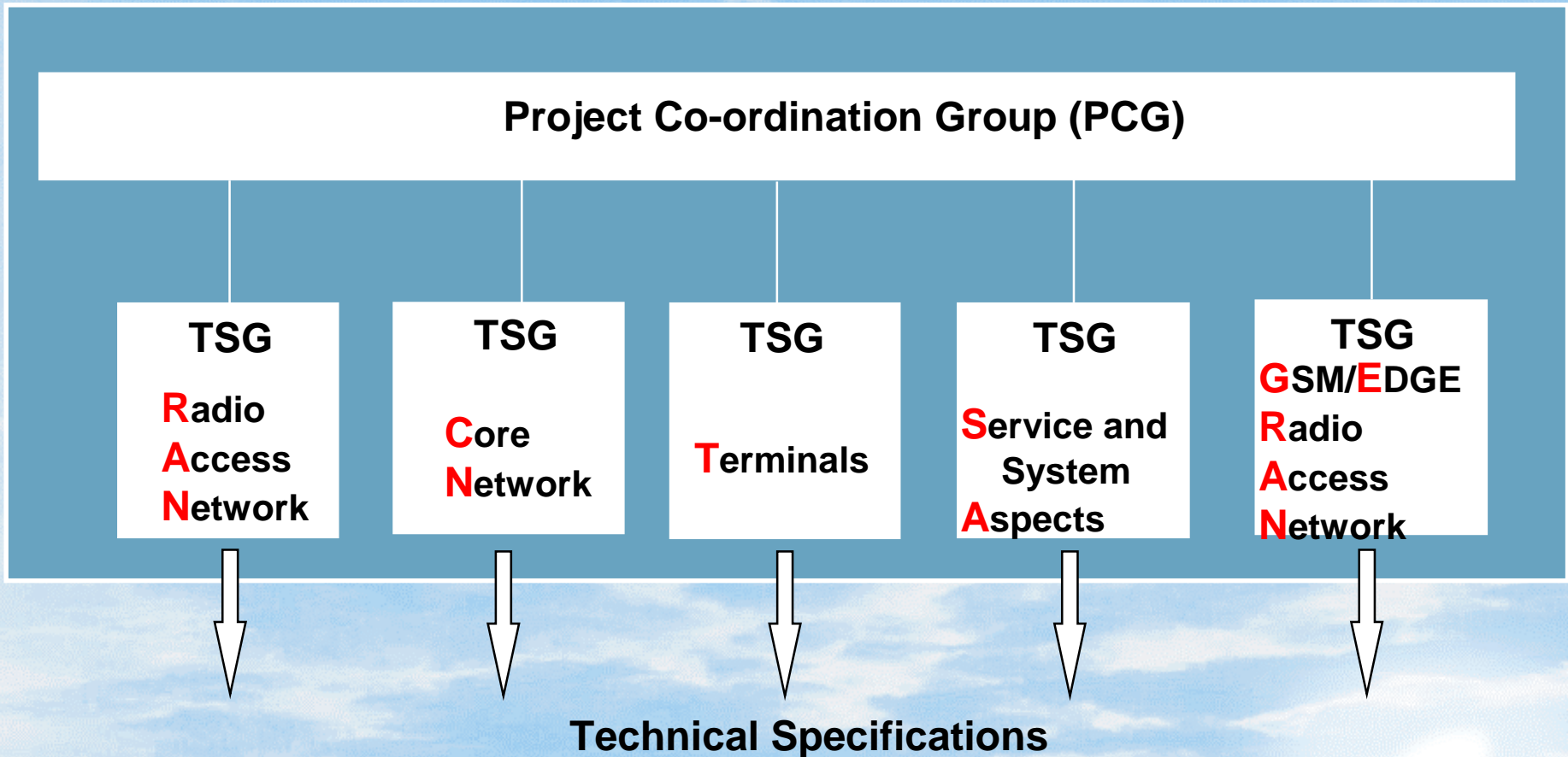
Frequency Ranges of Second and Third Generation



Brasil, Peru, Colombia, Venezuela, Bolivia, Uruguay tend to use UMTS

3GPP RAN - Standardisation Body for UTRA-TDD and -FDD

3GPP internal structure



UTRAN Specifications of 3GPP RAN

General

25.301: Radio Interface Protocol Architecture **FDD + TDD**
 25.302: Services provided by the physical layer
 25.304: UE Procedures in Idle mode and Procedures for Cell Reselection in Connected Mode

**Layer 3
RRC**

FDD + TDD
 25.331: Description of the RRC Protocol

**Layer 2
MAC/RLC**

FDD + TDD
 25.321: MAC Protocol Specification
 25.322: Description of the RLC protocol

**Layer 1
PHY**

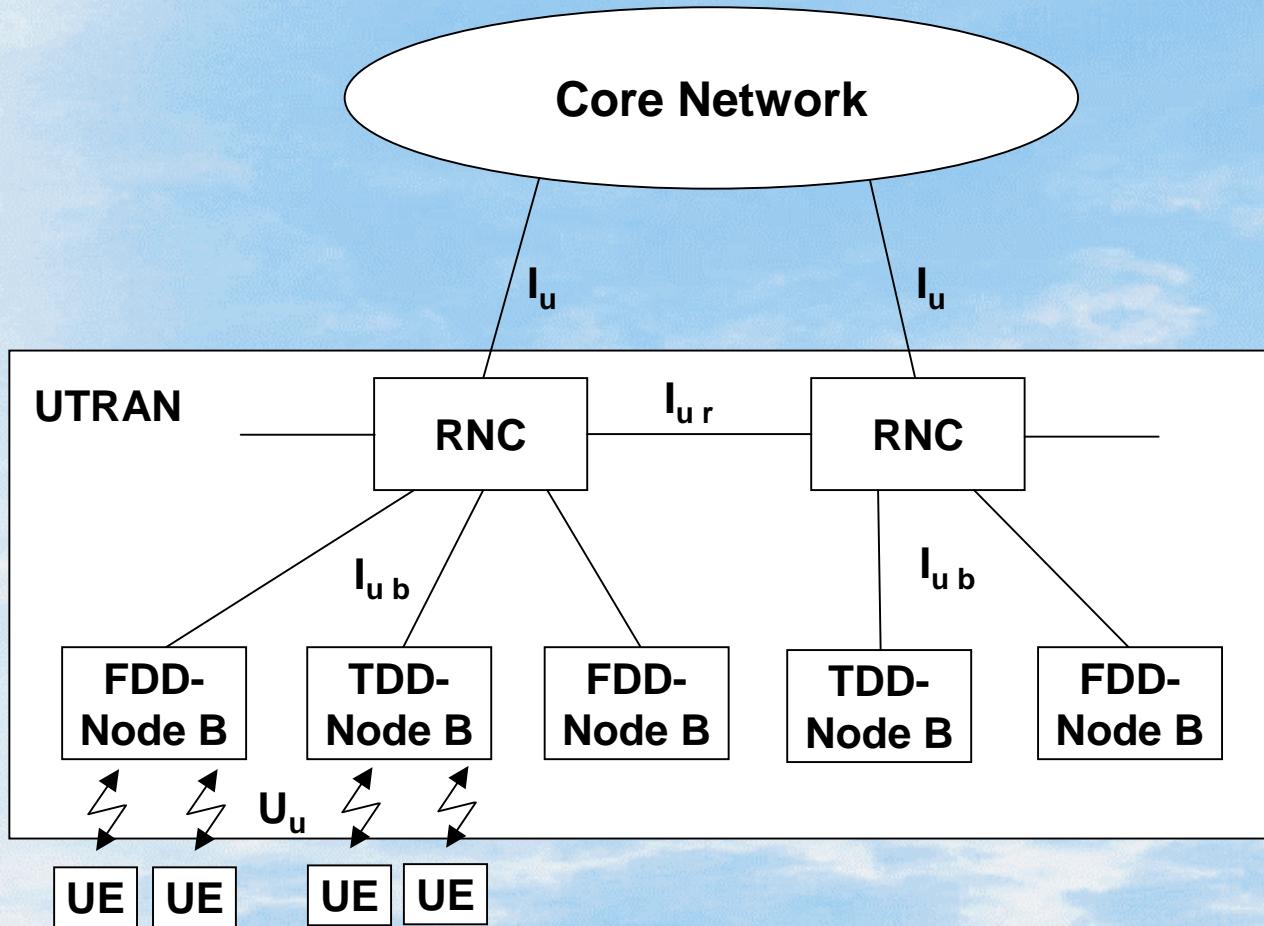
FDD
 25.211: Transport Channels and Physical Channels (FDD)
 25.212: Multiplexing and Channel Coding (FDD)
 25.213: Spreading and Modulation (FDD)

TDD
 25.221: Transport Channels and Physical Channels (TDD)
 25.222: Multiplexing and Channel Coding (TDD)
 25.223: Spreading and Modulation (TDD)



1 UTRAN - 2 Modes

UTRAN architecture



FDD and TDD Node B can be operated at one RNC

Legend

- UTRAN - UMTS Terrestrial Radio Access Network
- RNC - Radio Network Controller
- UE - User Equipment

UTRA (FDD + TDD)

- **IMT-2000 and UMTS-UTRAN**
- **The need for 3G**
- **History, progress and elaboration of UMTS-UTRAN**
- **Characteristics and capabilities**
- **Conclusion**

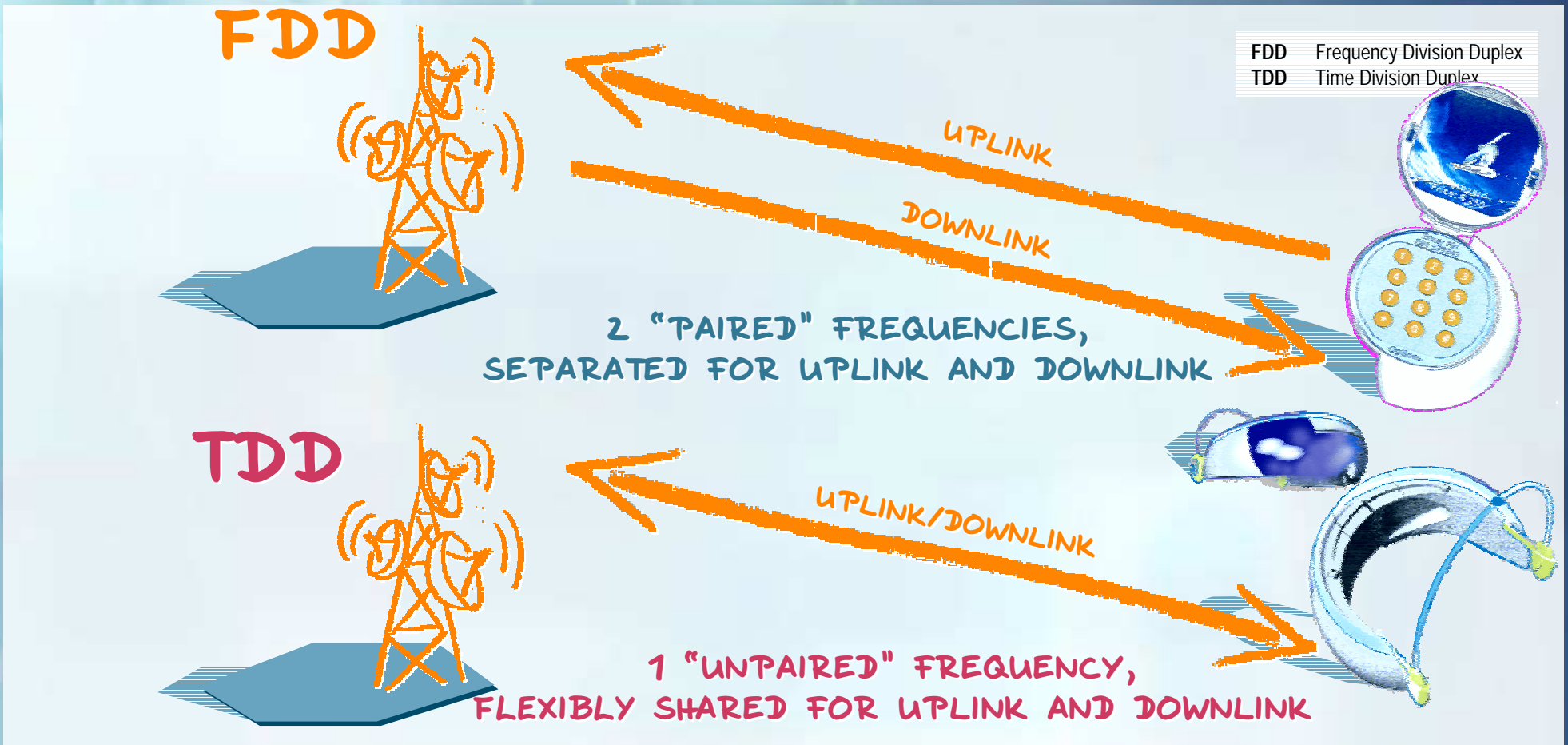
Characteristics and Capabilities: Different Radio Modes with Harmonized Parameter Sets

	FDD - Component	TDD - Component	
Multiplex technology	W-CDMA	TD-CDMA	TD-SCDMA
Bandwidth	2*5 MHz paired	1*5 MHz unpaired	1*1,6 MHz unpaired
Frequency Re-use	1	1	1 (or 3)
Handover	soft, softer (Interfreq.: hard)	hard	hard
Modulation	QPSK	QPSK	QPSK and 8-PSK
Receiver	Rake	Joint Detection Rake (Mobile Station)	Joint Detection Rake (Mobile Station)
Chip Rate	3.84 Mcps	3.84 Mcps	1.28 Mcps
Spreading Factor	4 – 256	1, 2, 4, 8, 16	1, 2, 4, 8, 16
Power Control*)	fast: every 667 μs¹⁾	slow: 100 cycles/s²⁾	slow: 200 cycles/s²⁾
Frame organisation	0.667 / 10 ms	0.667 / 10 ms	0.675 / 5 ms
Timeslots/Frame	N.a.	15	7

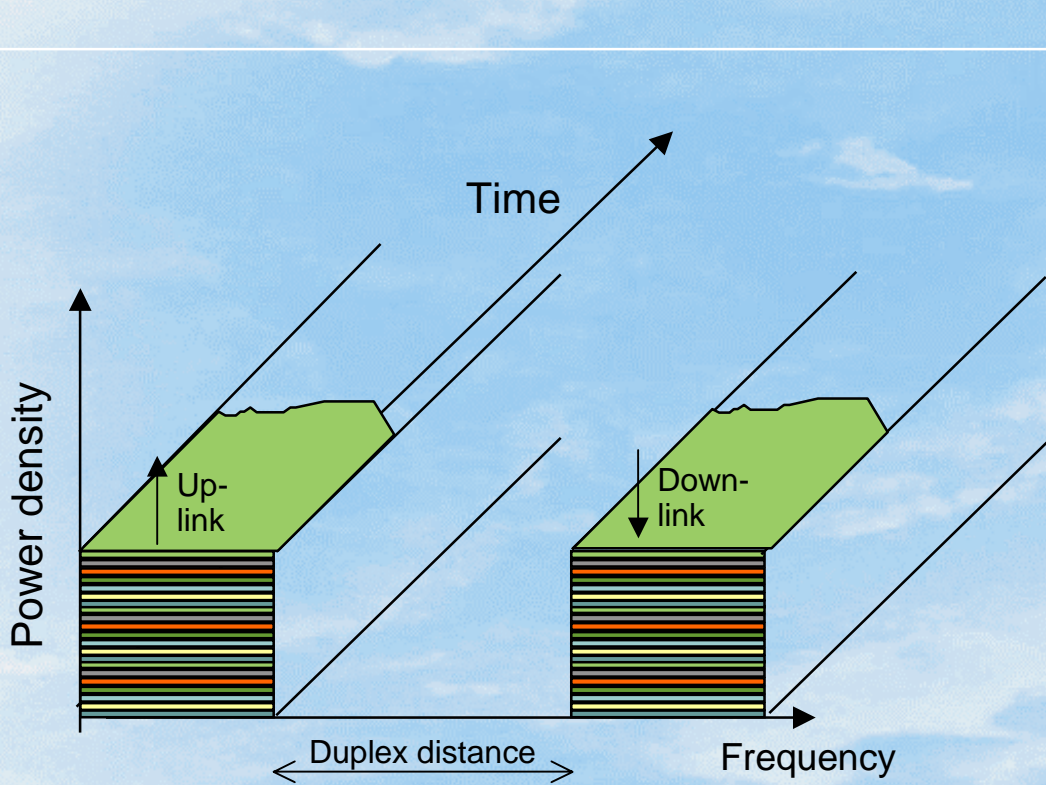
*) Range: 80 dB (UL); 30 dB (DL) in steps of..... ¹⁾ 0.25 to 1.5 dB

²⁾ 1, 2 or 3 dB

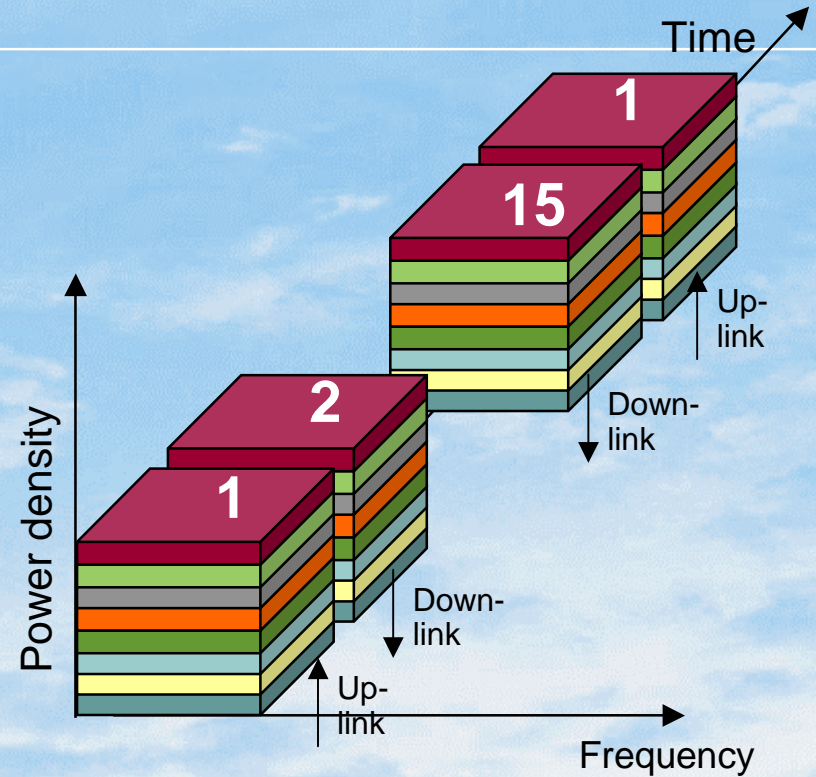
UMTS consists of 2 complementing radio options: FDD for paired bands and large area coverage and TDD for asymmetrical applications and hot spots



UTRA modes



FDD mode



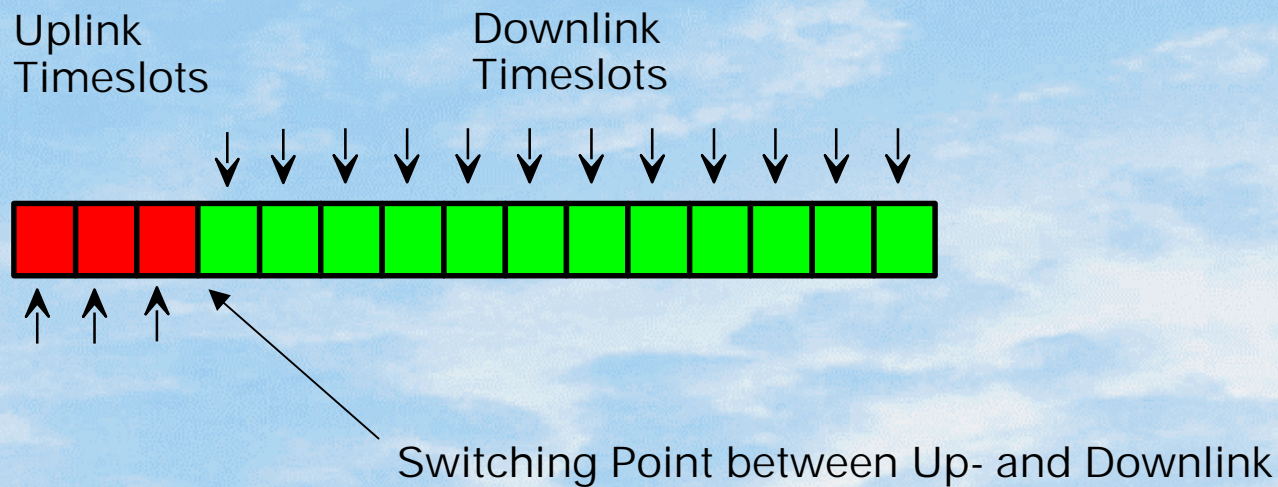
TDD mode

Both with harmonised bandwidth, chiprate and pulse shape

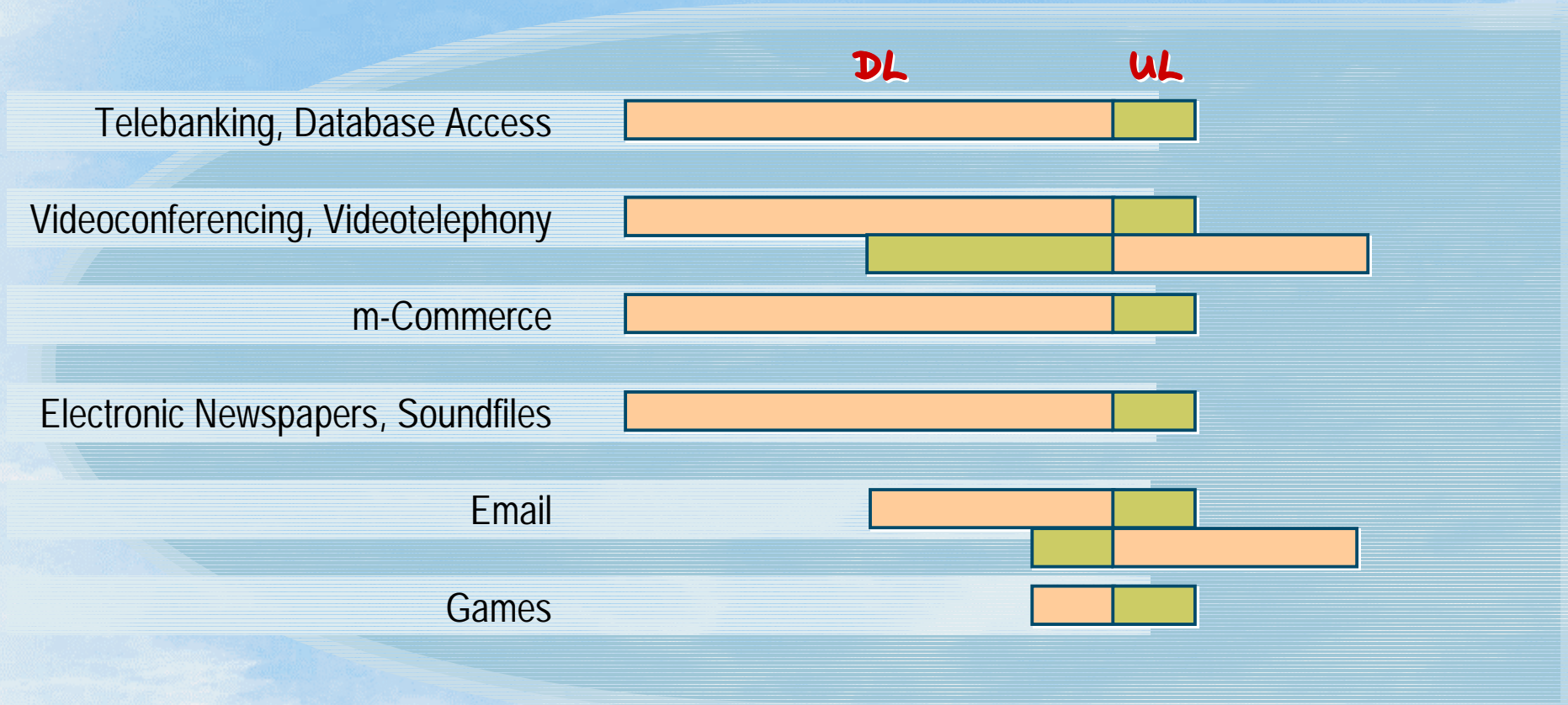
UTRA-TDD mode

Asymmetrical traffic handling

Asymmetrical Traffic in UTRA TDD mode



Multimedia Services & TDD



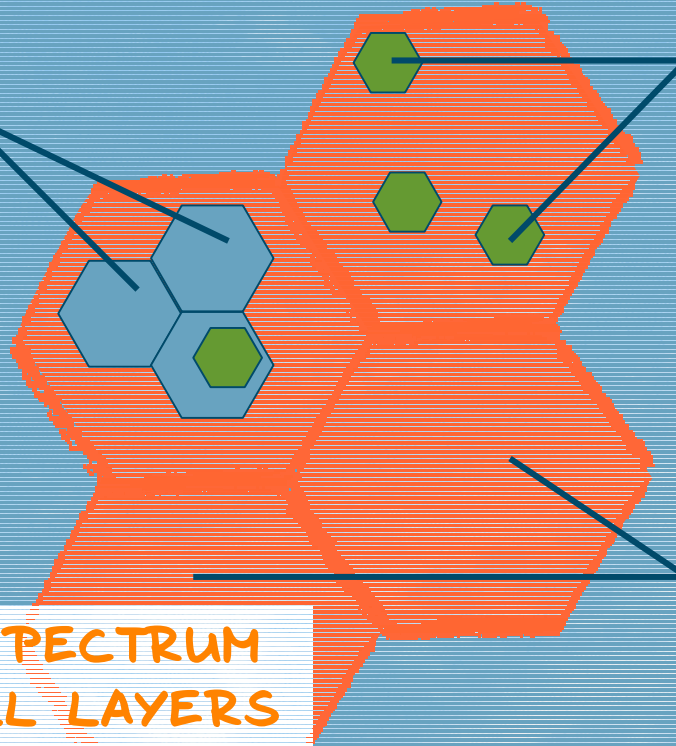
TDD can be perfectly matched to this asymmetry without wasting system capacity.

Cell Structures for UMTS

Micro Cell (FDD-/TDD-Mode)

Range: some 50 – 300 m

- Hot spots
- Medium mobility (> 10 km/h)
- Up to 384 kbps



'Indoor' Pico Cell (TDD-Mode)

Range: some 10 m

- Office / Home environment and "vertical networks"
- Low mobility (< 10 km/h)
- Up to 2 Mbps

Macro Cell (FDD-Mode)

Range: 350 m up to 20 km (outdoor)

- Suburban / rural
- High mobility (vehicle speed)
- Approximately 144 kbps

USING SEPARATE SPECTRUM FOR DIFFERENT CELL LAYERS SIMPLIFIES RADIO NETWORK PLANNING PROCEDURES

Deployment of UTRA FDD and TDD Mode

■ FDD mode for

- coverage driven roll-out
- public macro and micro cell environment
- data rates up to 384 kbps for high mobility

■ TDD mode for

- small cells with more asymmetric traffic
- asymmetrical and symmetric data rates up to 2 Mbps
- public micro and pico cell environment
- unlicensed cordless and public wireless local loop

→ SIEMENS SUPPORTS BOTH UMTS MODES
AND IS ABLE TO PROVIDE COMPLETE
SOLUTIONS FOR 3G-SYSTEMS

UTRA (FDD + TDD)

- **Introduction - The need for 3G**
- **A brief history of UMTS progress**
- **History, progress and elaboration of UMTS-UTRAN**
- **Characteristics and capabilities**
- **Conclusion**

UMTS satisfies the real needs of the end-user

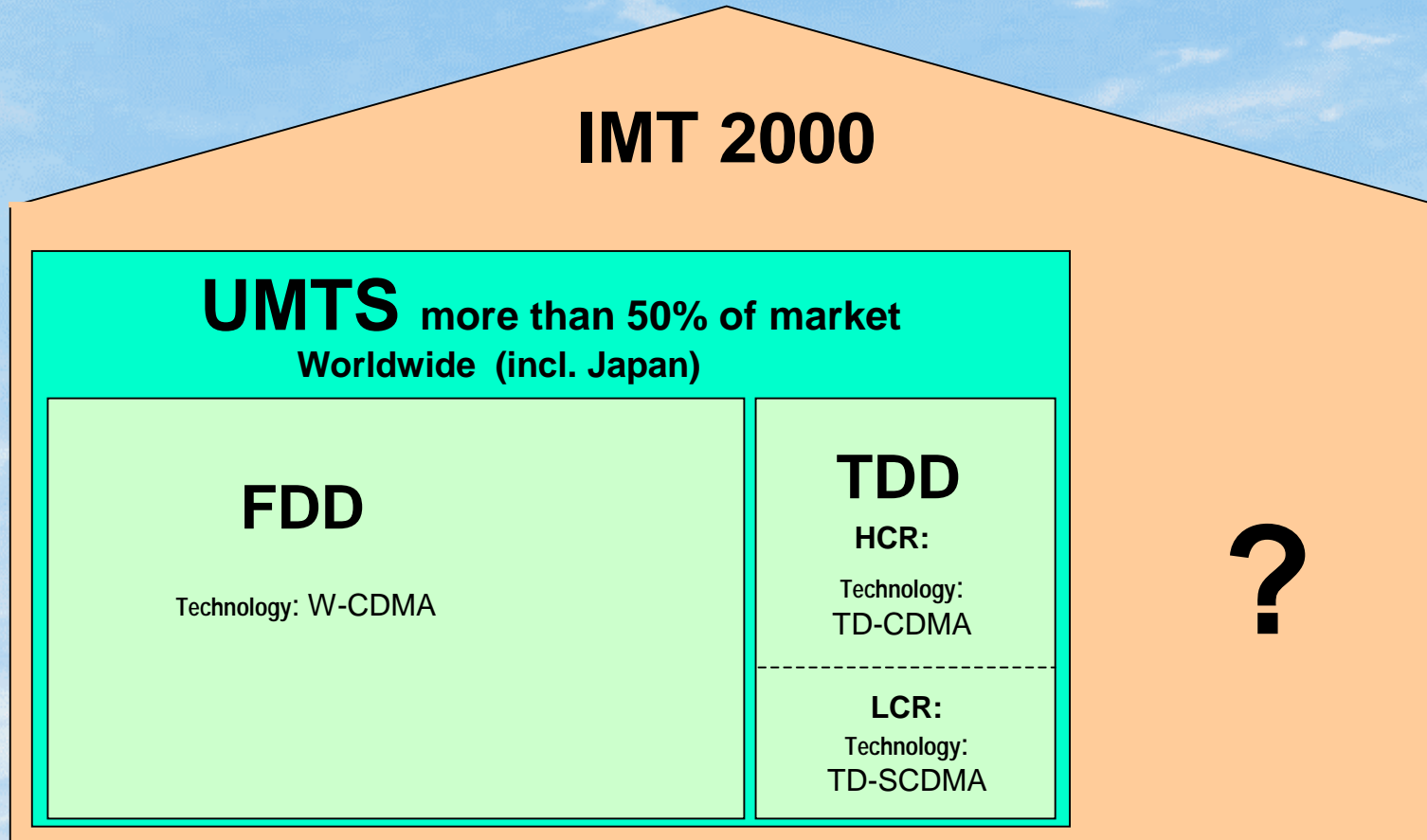
- + **Personalized** and highly customized
- + More individual **bandwidth**
- + **Always-On**
- + **Global** roaming
- + **Seamless** network, UMTS-GPRS-GSM
- + Rich **Multimedia** services: Information, Transaction, Entertainment

= my services - anytime - anywhere - on my device

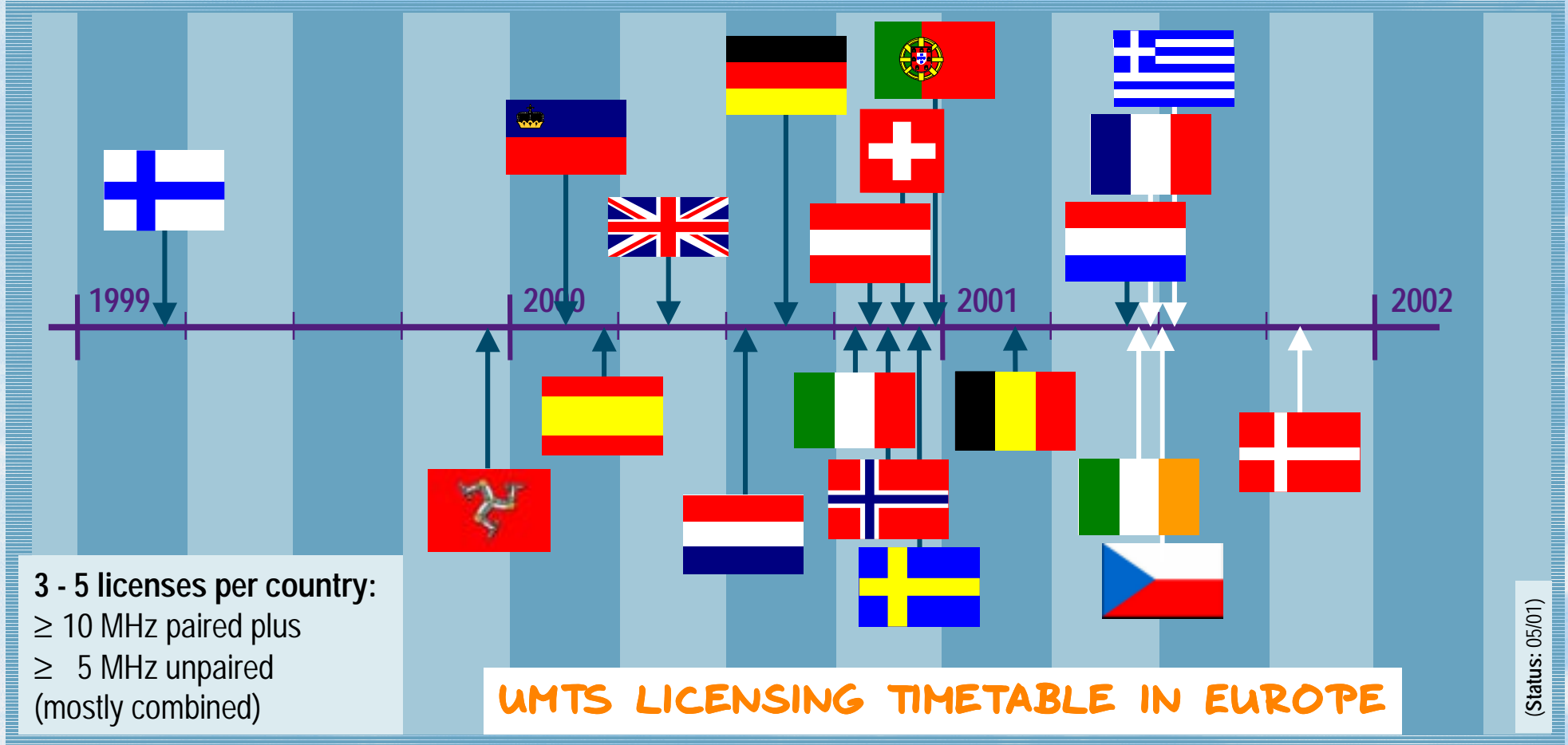
UMTS-UTRAN enhances capabilities of 2G:

- Lower Delays can be reached
 - Faster access, due to the new radio interface
 - Faster transmission, due to higher datarates per individual connection
- More and new spectrum is allocated (and more efficiently used!)
- Improves coverage in hotspot areas
- Handover to/from GSM/GPRS/GERAN is assured

UMTS will become the largest 3G market



In many countries UMTS-licenses have already been issued



Thank you!

Author
Siemens AG, Munich

© Siemens AG 2000