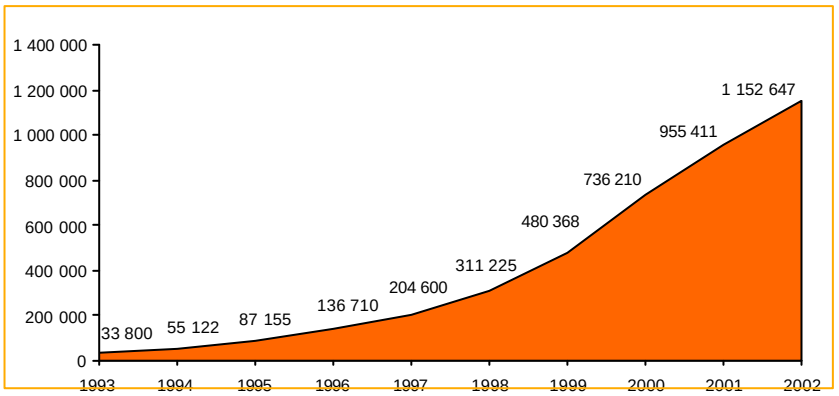
Spectrum and licensing issues for IMT-2000

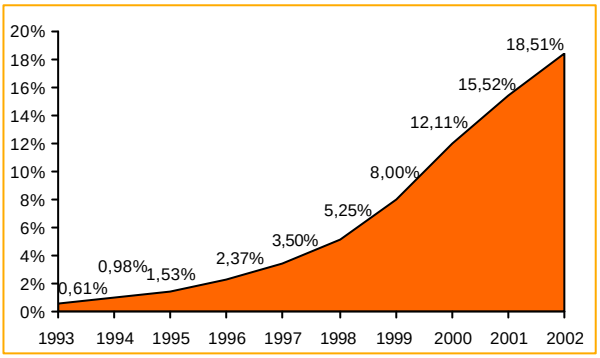
ITU – BDT Seminar on IMT-2000 for CEE and Baltic States
Ljubljana, Slovenia, 1-3 December 2003

1 – An outstanding growth of the worldwide mobile market : between 1993 and 2002 he number of subscribers has been multiplied by nearly 34



Subscribers in thousands
Source : IDATE

2 – While in 1993 less than 1% of the world's population owned a mobile phone, end 2002 nearly 1 out of 5 inhabitants of the planet was equipped

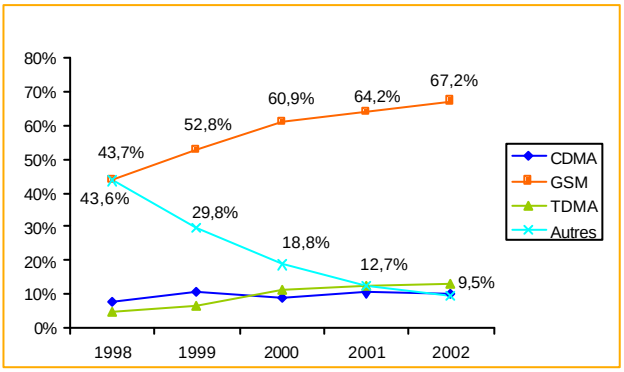


Source : IDATE, US Bureau of Census

- The penetration rate :
  - is more than 400% above the average in Western Europe and 250% above in North America
  - is a bit higher than the average in Eastern Europe and South America and a bit below in the Middle East
  - is lower than the average in Asia Pacific and significantly below the average in Africa

Source : Global Mobile

3 – GSM has become the leading international standard



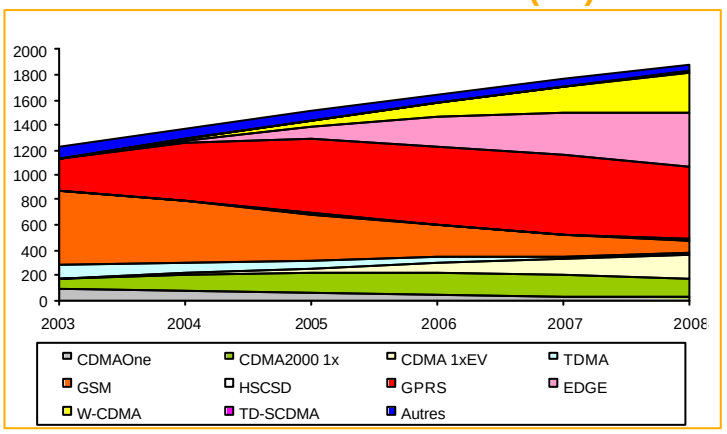
Source : Strategy Analytics

- The decline of analog technologies has benefited mainly to GSM, its market share is 98% in Europe, the Middle East and Africa and above 70% in Asia Pacific
- The market share of CDMA is around 10%
- The one of TDMA is approximately 13%

4 – What about the future? (1/2)

- According to forecasts (OMSYC, OVUM, Strategy Analytics), nearly one third of the world's population should own a mobile in 2008
- The number of subscribers should reach 1.8 - 1.9 billion, representing a cumulated growth rate of approx. 70% on the 2003-2008 period
- Asia Pacific should strengthen its supremacy in terms of number of subscribers, Western Europe's share should decrease to 18% and the one of the other regions should be close to 10%
- Western Europe should keep its leadership in terms of penetration rate (approx. 82%), followed by North America (approx. 68%), Eastern Europe (approx. 45%) and South America (approx. 33%). The other regions would display a penetration rate below the worldwide average
- Mobile services and handsets revenues should reach US$ 6 to 700 billion in 2008

4 – What about the future? (2/2)



Source : Strategy Analytics

- **GSM and its evolutions (GPRS, HSCSD, EDGE, W-CDMA et TD-SCDMA) should strengthen their leadership on the worldwide mobile market, with a market share close to 78% in 2008, against 19% for the « CDMA family» (CDMAOne, 2000 1x et 2000 1xEV)**
- **According to the analysts the « GSM family» technologies would become dominant even on the American markets**
- **Despite a slower take off, the number of W-CDMA subscribers would be well above the one of CDMA 2000 1x EV subscribers in 2008**
- **CDMA 2000 technologies should reach a significant market share in the Americas only (approx. 44%)**

I - The need for globally harmonized frequency bands

1 – The spectrum allocation process

- Efficient spectrum allocation requires a global approach taking into account user needs, economic criteria and technological evolution

  1st step : designation in the framework of international regulatory bodies and with the involvement of administrations, spectrum users and manufacturers of the most suitable bands for a certain service

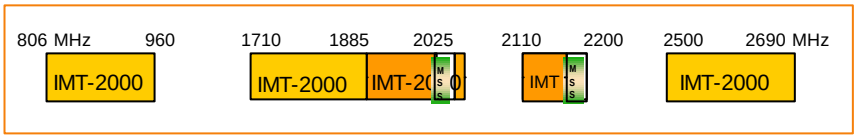
  2nd step : establishment of international agreements including harmonized frequency plans for the concerned bands, as well as of technical standards

  3red step : freeing of the bands at the national level taking into account local conditions. In order to facilitate the introduction of new services and technologies, as well as a rational re-allocation of the spectrum between its usages, spectrum refarming funds should be set up. These funds , involving national regulatory bodies, spectrum users and manufacturers, should be in charge of the management of refarming operations

  4th step : granting of operating licenses to users

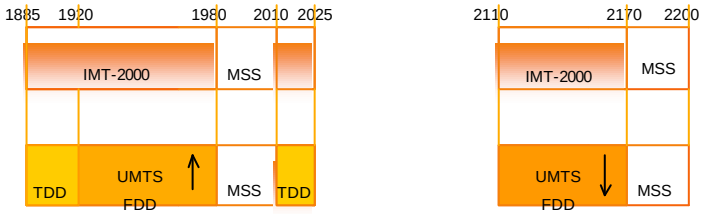
2 – Current IMT-2000 frequency bands

- WARC-92 identified the initial bands for IMT-2000 deployment, i.e. 1885-2025 MHz and 2110-2200 MHz, also called core bands
- WRC-2000 identified three additional bands for terrestrial IMT-2000; i.e. 2500-2690 MHz, 806-960 MHz and 1710–1885 MHz
- In June 2003, the Radio Assembly revised the recommendation ITU-R M.1036-1 “Frequency arrangement for implementation of the terrestrial component of International Mobile Telecommunications–2000 (IMT-2000) in the bands 806-960 MHz, 1710-2025 MHz, 2110-2200 MHz and 2500-2690 MHz”



3 – The core bands

- UMTS/IMT-2000 will be implemented first in most countries of the world (Europe, Asia and some American countries) in the bands identified by WARC-92
- Most operators should use the frequency plan such as established in arrangement B1 of ITU-R Recommendation 1036



4 – The extension bands (1/2)

- The 806-960 MHz and 1710-1885 MHz bands are intensively used by 2G/2.5G networks, in particular by GSM/GPRS 900 and GSM/GPRS 1800 networks
- Ongoing investments in 2G/2.5G are necessary to cope with the still growing demand for these services
- The 2500-2690 MHz band is the only extension band not used by 2G/2.5G systems in most countries of the world. It thus allows to extend 3G capacity in order to prevent congestion that could appear in the core bands in densely populated areas
- Refarming of this band in Europe can only be envisaged by 2008 since it is currently used for a wide range of services
- An ITU decision related to frequency arrangements in this band is expected in 2004 in order to ensure global harmonization and equipment availability by 2008

4 – The extension bands (2/2)

- The 2500-2520 MHz and 2670-2690 MHz sub-bands are allocated to satellite and terrestrial IMT-2000 subject to market demand (Resolution 225)
- The outstanding subscriber and traffic growth experienced by terrestrial 2G services should continue for 3G
- Satellite IMT-2000 services constitute a complement to terrestrial IMT-2000 services and should have enough spectrum in the spectrum already identified for them below 2.5 GHz, in particular in the core bands
- Thus, the entire 2500-2690 MHz band is required for terrestrial IMT-2000 services in order to cope with long term demand in high population density areas

5 – The issue of mobile coverage in lower population density areas

Percentage of rural population in some countries of the world

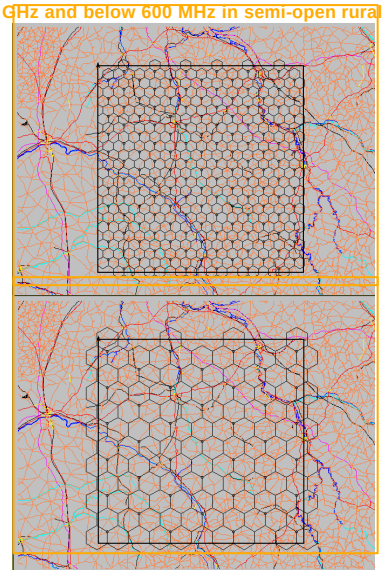
Australia (2000)	15,0%
Brazil (2000)	18,8%
China (2000)	63,9%
Czech Republic (1999)	29,0%
Germany (1998)	28,9%
India (2001)	71,5%
Indonesia (2000)	58,0%
Kazakhstan (1998)	39,0%
Mexico (1999)	25,3%
Morocco (2001)	44,1%
Romania (2001)	47,3%
Russia (2000)	27,1%
Slovenia (1998)	48,0%
South Africa (2001)	47,0%
Turkey (2000)	32,4%

Source : ITU

- In most developing countries, despite a mobile coverage that exceeds fixed coverage, there is a lack of telecommunications infrastructures in lower population density areas. Since, compared to fixed networks, mobile networks are characterised by lower roll-out costs and a higher speed of deployment, the extension of mobile coverage seems the most efficient solution for providing these regions with the infrastructures required for their opening up and economic development
- In developed countries where mobile phones have turned into a mass market product considered by most people as an essential tool for improving their personal security, mobile coverage of rural areas is becoming a political priority

6 – The need for a cost-effective solution

The coverage area of UMTS/W-CDMA sites at 2 GHz and below 600 MHz in semi-open rural areas



- It is generally admitted that compared to higher frequencies, lower frequencies facilitate the establishment of radio electric links. Thus, the coverage area of a base station, in particular in rural areas, is significantly larger and roll-out costs are noticeably lower
- Resolution 228 of WRC-03 recognizes in particular that in numerous developing countries and countries with huge sparsely populated areas there is a need for a cost-efficient implementation of IMT-2000 systems and that the propagation characteristics of frequencies below those identified in footnote 5.317A (806 to 960 MHz) result in larger cells
- This resolution invites ITU-R to carry out the required technical and regulatory studies on the utilization of frequencies below those that have been identified for IMT-2000 in footnote 5.317A

7 – The usage of spectrum between 29.7 and 960 MHz

- As of today, approximately 5% only of the VHF and UHF spectrum are allocated to terrestrial public mobile systems
- In a country like France, broadcasting systems utilize nearly 9 times more spectrum in these bands than public mobile systems
- Modified ITU Council Resolution 1185 decides to hold a Regional Radio communications Conference (RRC) in order to plan terrestrial digital broadcasting services in Region 1 and the Islamic Republic of Iran in the 174-230 MHz and 470-862 MHz bands. The 1st session of this RRC will take place in May 2004 and the 2nd at the beginning of 2006 the latest
- The main goal of the RRC is to establish a new regional agreement including the frequency plans for digital broadcasting services and the arrangements governing the transition from analog to digital broadcasting
- Further to the migration from analog to digital broadcasting systems, part of the frequency bands currently allocated to terrestrial broadcasting could be released

8 – Conclusion

- UMTS/IMT-2000 will be initially implemented within WARC-92 bands
- The 2500 – 2690 MHz band will offer the required capacity for UMTS/IMT-2000 networks in densely populated areas in the longer term
- Globally harmonized frequency bands below those they already use in the 470 – 960 MHz spectrum range should be allocated to terrestrial public mobile services in order to achieve a cost-effective geographic extension of mobile coverage in lower population density areas, including and mainly in developing countries
- The amount of spectrum allocated should be sufficient to allow a competitive provision of public mobile services in these areas : 2*5 MHz per operator

1 – Awarded 3G licenses (1/3)

Country	Number of licenses	Allocation method	Date of allocation
Austria	6	Auction	11-2000
Belgium	3	Auction	03-2001
Denmark	4	Sealed bid	09-2001
Finland	4	Beauty contest	03-1999
France	3	Beauty contest	06-2001 & 09-2002
Germany	6	Auction	08-2000
Greece	3	Auction	07-2001
Ireland	3	Beauty contest	06 to 09-2002
Italy	5	Hybrid	10-2000
Luxembourg	3	Beauty contest	05-2002
Netherlands	5	Auction	07-2000
Norway	4	Beauty contest	11-2000
Portugal	4	Beauty Contest	12-2000
Spain	4	Beauty contest	03-2000
Sweden	4	Beauty Contest	12-2000
Switzerland	4	Auction	12-2000

1 – Awarded 3G licenses (2/3)

Country	Number of licenses	Allocation method	Date of allocation
United Kingdom	5	Auction	03-2000
Liechtenstein	2	Beauty contest	1999 (3G included in 2G licenses)
Guernsey	2	Beauty contest	04-03
Croatia	2+1	Beauty contest	03-2003 & 2004 (3rd license)
Czech Republic	3	"Direct granting" for incumbent operators, auction for unsold licenses	2 licenses granted in 2001 but challenging of their price
Poland	3	Beauty contest	12-2000
Slovakia	3	Beauty contest	06 & 07-2002
Australia	2 national + 56 lots	Auction	03-2001 (6 operators)
Hong Kong	4	Auction but failure	09-2001
Japan	11 regional	Beauty contest	06-2000 (3 operators)
Malaysia	2	Beauty contest	07-2002
New-Zealand	4	Auction	07-2000
Singapore	4	Auction but failure	2001

1 – Awarded 3G licenses (3/3)

Country	Number of licenses	Allocation method	Date of allocation
South Korea	3	Beauty contest	12-2000 & 08-2001
Taiwan	5	Auction	02-2002
Thailand	2 + ?	"Direct granting"	2002 & 2003?
Israel	3	Auction	12-2001

Source : IDATE

- China should grant 3 or 4 3G licenses in 2003, Canada should also grant 3G licenses 2003-2004 & the United States in 2004-2005 for an intended use by 2008
- The great majority of operators owning a 3G license has already decided to implement UMTS/W-CDMA technology

2 – License allocation methods and license conditions

- 4 types of allocation methods have been used :
  - Auctions
  - Beauty contests
  - Hybrid methods
  - "Direct granting "
- With auctions, the winners had to make a one-off payment corresponding to their bid
- In most other cases, governments have opted for an initial one-off payment followed by annual fixed price installments or installments determined as a percentage of the operators' turnover during the whole or partial duration of their license
- Most of the licenses are national and the number of licenses per country varies between 2 and 6, 3 or 4 in the great majority of countries
- Duration of the licenses : 15 or 20 years
- Most licenses include obligations related to :
  - Coverage
  - Provision of access to 2G networks by operators who have been granted a 3G license as well, to operators holding a 3G license only

3 – Some lessons that can be drawn from existing 3G licensing experiences

- High license prices and/or the excessive number of licenses granted considering the potential market explain :
  - Going out of business of certain 3G license holders : MobilCom in Germany, Xfera in Spain, OniWay in Portugal, Telefonica in Austria, Italy and Switzerland, Tele2 in Norway, Orange in Sweden
  - Refusal of others to pay the price of their license : Vodafone, Amena and Telefonica Moviles are challenging at the High Court the annual fee imposed by the Spanish government, Czech operators refuse to pay the fixed sum requested by the government
  - Failure of certain license allocation procedures : invalidation of the auctions and granting of the licenses at a price lower than the initial reserve price set-up by the government in Hong Kong and Singapore
- The operators' financial difficulties together with too heavy coverage obligations are behind requests for infrastructure sharing authorizations
- The same financial difficulties together with delayed availability of 3G equipments induce delayed network deployment and delays in the launch of 3G services
- Given the above elements it seems desirable :
  - To limit the number of licenses granted per country
  - To implement license allocation methods favoring qualitative criteria rather than financial criteria
  - To authorize infrastructure sharing and define coverage obligations spread over longer periods of time

Thank you!