Course Overview

- Introduction and History
- Data in Wireless Cellular Systems: IMT-2000
- Data in Wireless Local Area Networks
- Internet Protocols
- Routing and Ad-Hoc Networks
- TCP over Wireless Link
- Services and Service Discovery
- System Support for Mobile Applications

3rd Generation Cellular Systems

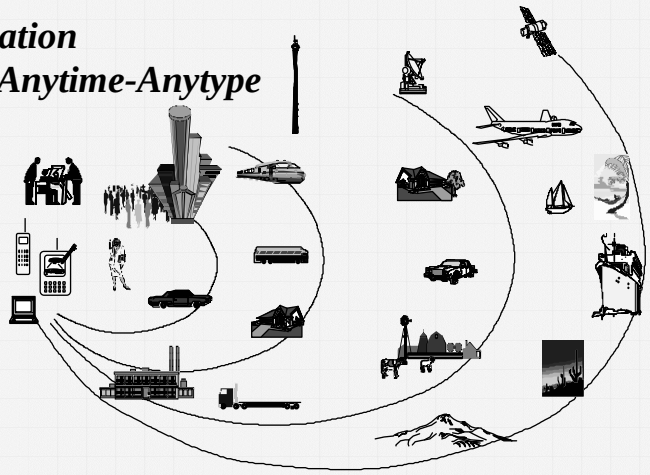
- next generation mobile communication systems under development at ITU and ETSI (one of GSM study groups)
- European project is Universal Mobile Telecommunication System (UMTS), while ITU project is called International Mobile Telecommunications 2000 (IMT-2000), formerly known as Future Public Land Mobile Telecommunication System (FPLMTS)
- time horizon: basic standards by 2000, commercialization by 2005, “life” expectancy beyond 2025
- mobile access part of future Broadband ISDN network
- service objectives
  - broad range of customizable telecommunication services up to 2 Mbps, subset of B-ISDN
  - support Universal Personal Telecommunications (UPT), fixed network service for personal mobility, allowing registration and deregistration at any terminal
  - support wide range of terminal types

3rd Generation Cellular Systems

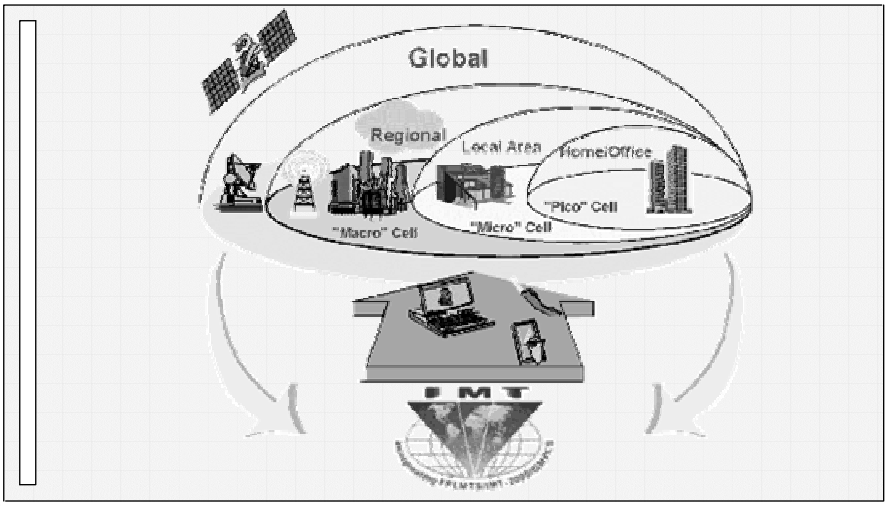
- support public and private environments
- operation in, and roaming between, different operating environments
  - sparse, rural, suburban, urban
  - indoor/outdoor
  - residential/business
  - pedestrian/vehicular
- provide integrated satellite component
- combine range of existing wireless systems (cellular, cordless, mobile data, paging) to share infrastructure costs and harmonize services
- allow flexible and rapid creation of new services
- efficient usage of spectrum resources
- enable provision of wireless local loop

What is IMT-2000?

Communication
Anywhere-Anytime-Anytype



IMT-2000 Vision



Cellular/PCS Data Speed Evolution (to IMT-2000)

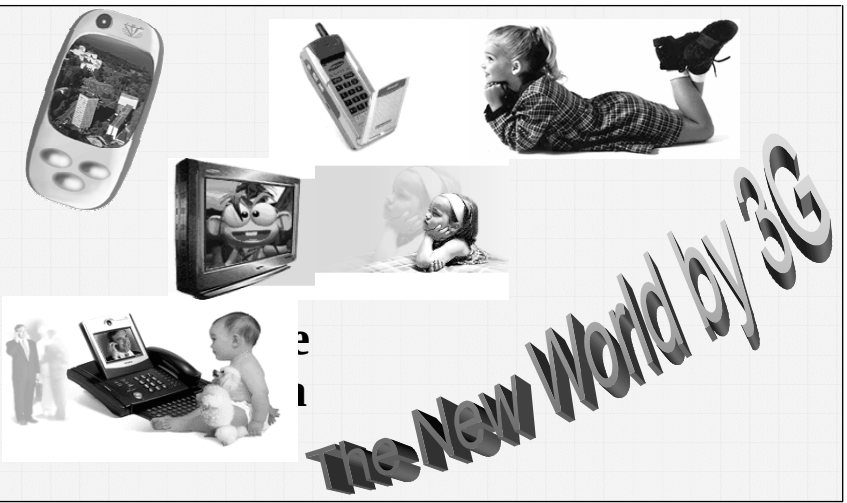
Low Speed Data	Medium Speed Data	High Speed Data
8Kbps ~ 14.4Kbps	32Kbps ~ 64Kbps	144Kbps ~ 384Kbps
Text data, Graphic	Graphic, Image	Image,Video
Remote Login, E-mail, Text mode Internet	Internet, Internet VOD	Multimedia, VOD,
Now	~ 1999	~2000 (IMT-2000)

- ➔ **Data Speed Performance will reach to the IMT-2000 grade,**
- ➔ **Data Service Applications will be completely matured before the Commercial Deployment of the IMT-2000 system.**

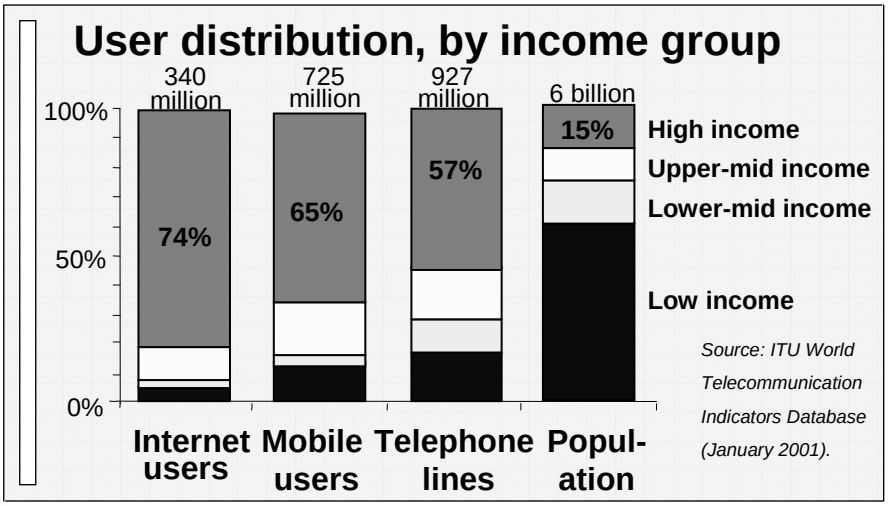
IMT-2000 Minimum Performance Capabilities

- Vehicular:
  - Bandwidth ≥ 144 kbps,
  - error rate ≤ 10^{-6}
- Outdoor to Indoor and Pedestrian:
  - Bandwidth ≥ 384 kbps,
  - error rate ≤ 10^{-6}
- Indoor Office:
  - Bandwidth ≥ 2 Mbps,
  - error rate ≤ 10^{-6}

IMT-2000 Vision: Information Society

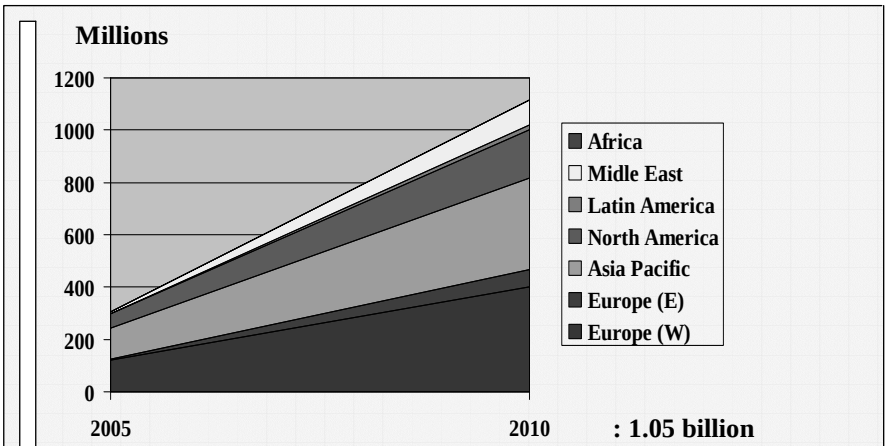


Digital Divide



Source: ITU World Telecommunication Indicators Database (January 2001).

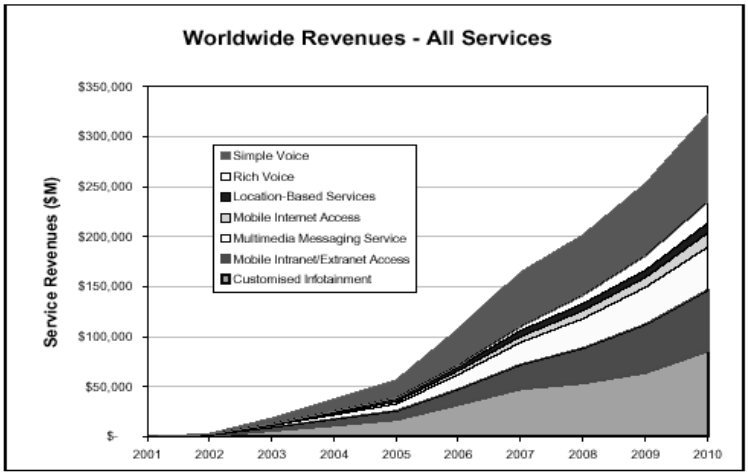
3G Subscriber Forecasts



Source: Global Mobile Forecasts to 2010

: 1.05 billion (60% 3G penetration)

Cumulative Revenue: US$ 1 trillion



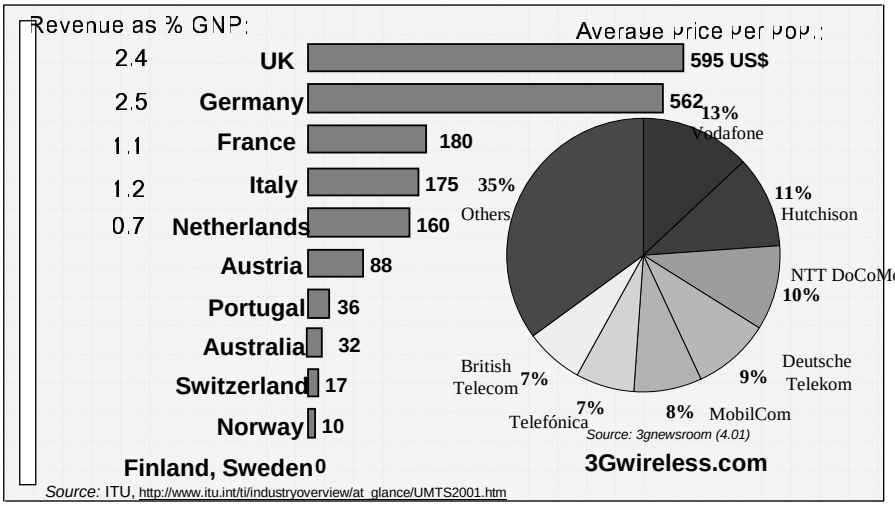
Source: UMTS Forum (April 2001)

Mobile Internet Dilemmas

✓ **In a mobile-Internet world:**

- ➔ **Which business model takes precedence?**
- ➔ **Who does the billing?**
- ➔ **How are revenues shared between content provider, service provider and portal?**

3G License Prices



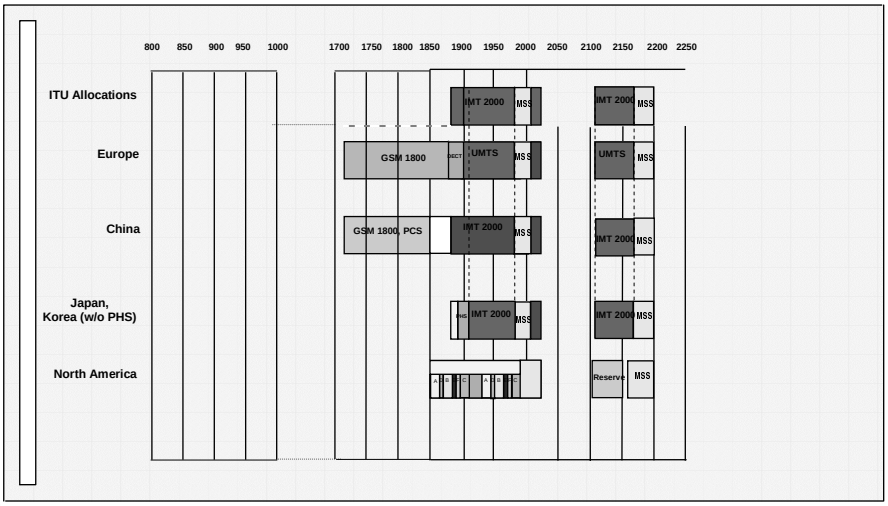
Source: ITU, http://www.itu.int/ti/industryoverview/at_glance/UMTS2001.htm

Mobile Operators (Rating & Debt)

BBB	BBB+	A-	A	A+	AA
TIM € 38					
AT&T $ 84			vodafone £ 21	verizon, Cingular	
	kpn € 23	BT £ 35; T Deutsche Telekom / T-Mobil € 65; orange € 23		Telefónica Móviles € 15	NTT DoCoMo

Outlook: Positive Stable Negative

Source: Standard & Poor's, 5.01 (debt in billion)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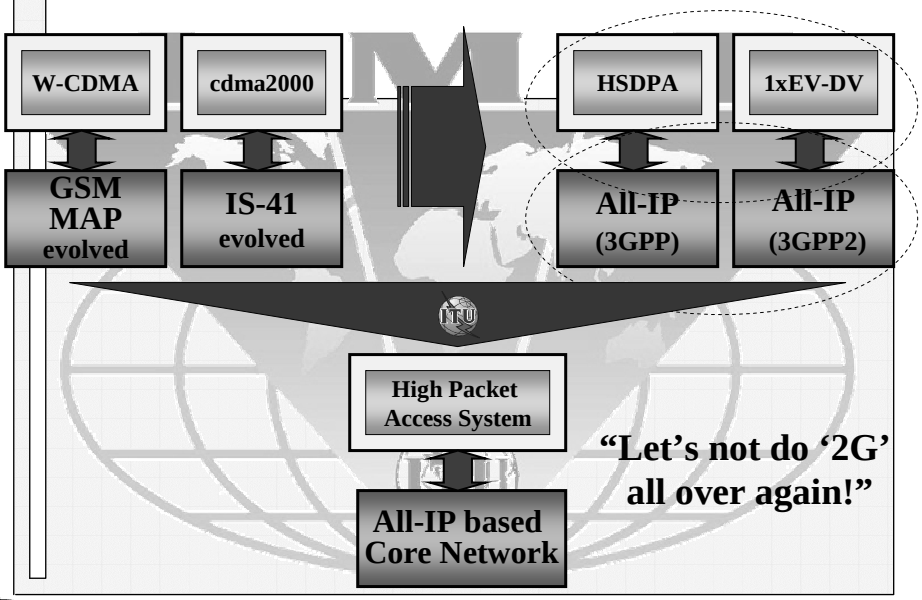
ITU Allocations
Europe
China
Japan,
Korea (w/o PHS)
North America
IMT 2000
MSS
GSM 1800
DECT
UMTS
GSM 1800, PCS
PHS
Reserve

Benefits of Globally Harmonized 3G Networks

- Increased 3G penetration and usage
- Manufacturers' development costs spread out across a larger installed base
- Ability for customers to roam with their services across regions, countries and systems
- Increased ability of the Information Technology, Internet and Personal Computer industries to provide mobile applications, solutions and subscriber devices
- Smooth and compatible evolution path from existing 2G infrastructures

Towards a Fully Harmonized 3G System



"Let's not do '2G' all over again!"

IMT-2000: ITU's Role