trends and challenges in the digital age

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Helping the world communicate

International Telecommunication Union

A look back

1844:
"what hath God wrought"

…in 1844 - the first interurban **telegraphic** communication from Washington to Baltimore, 'morsed' by Samuel

In 1864, radio is predicted and in 1887, it is detected…

- Heinrich Hertz was the first to detect radio waves by causing a spark to leap across a gap that generated electromagnetic waves …

- He had mathematically predicted their existence in 1864

In 1865, the ITU was born as:

the International "Telegraph" Union

Danemark Bavière Norvège Wurtemberg Belgique Portugal Secrétaire Suisse Bade Turquie Prusse Italie Grèce Secrétaire Espagne
Pays Bas Bavière Hanover France Belgique France Suède Espagne Russie Autriche

141 years ago!

this means…

- That the ITU is the oldest international organization in the world…
    - … with its work spanning three centuries
- The the organization pre-dates the United Nations, and is now one of its specialized agencies
- A recent report by Booz Allen Hamilton and leading scholars ranks the ITU among the "*World's Top 10 Most Enduring Institutions*", one that has:

    "changed and grown in unswerving pursuit of success and relevance - yet remained true through time to its founding principles"
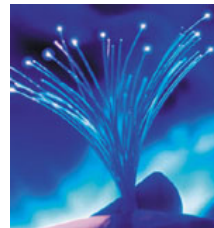
we have come a long day since the ITU was first created.

…*from the first mobile phone?*

1910: Lars Magnus Ericsson and his wife Hilda
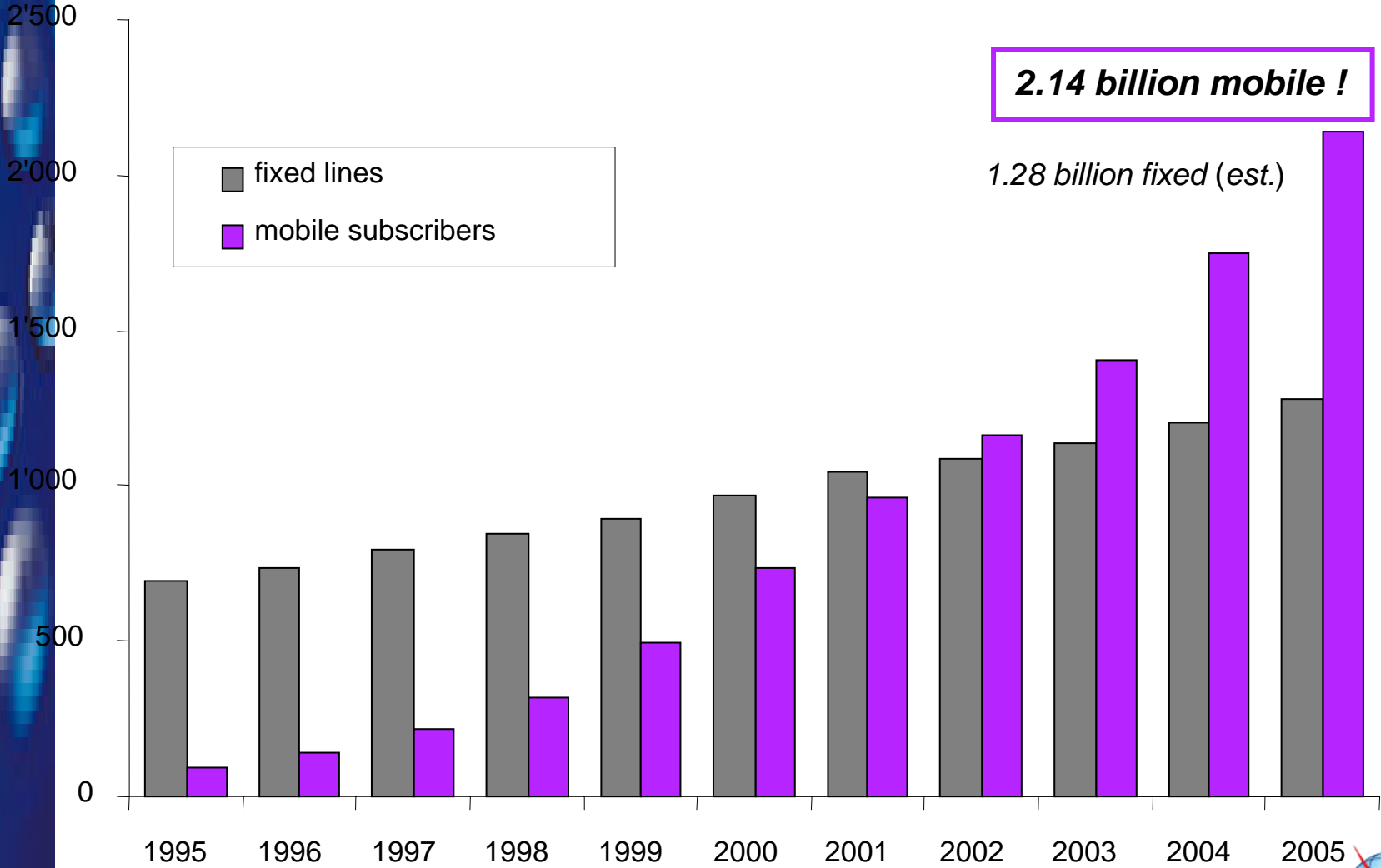
Copyright 1994 Anders Suneson

today's hi-tech world

today's digital age would've seemed like science fiction back then…

- the birth of a World Wide Web of information, a revolution in itself (one billion internet users)

- growth of high-speed network infrastructure

- global proliferation of small mobile devices in our pockets – gateways to the world

- an emphasis on "always-on" communications and information access

- advances in computing to render information even more "ubiquitous"

an age which has brought about many transitions, challenges:

- from relatively static market environments to dynamic fast-paced innovation

- from heavy-handed regulation to increasing forbearance

- from "divergence" to "convergence"

- from local to global

- from low-speed to high-speed

- from sometimes-on to always-on
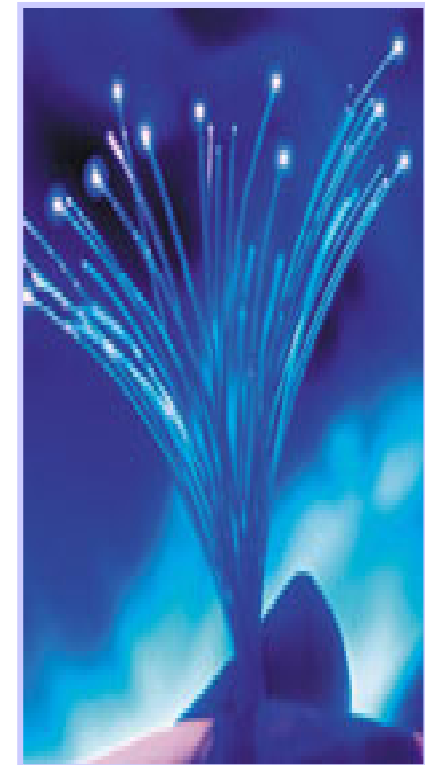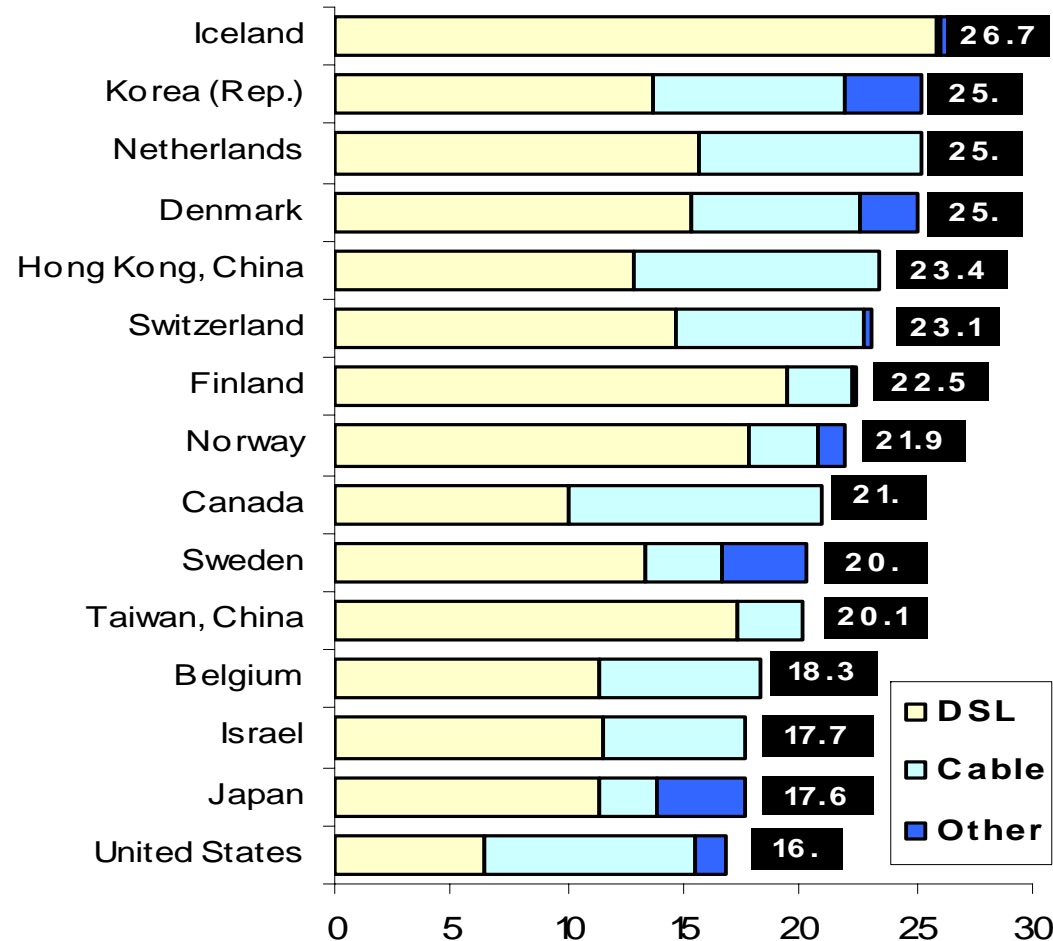
- from fixed to mobile

mobile certainly dominates

2.14 billion mobile !

1.28 billion fixed (est.)

Legend:
- fixed lines
- mobile subscribers

Years: 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005

…and speed is on the rise

Top 15 Broadband economies, Jan 2006
Total penetration (per 100 capita), by technology

Country	Value
Iceland	26.7
Korea (Rep.)	25.
Netherlands	25.
Denmark	25.
Hong Kong, China	23.4
Switzerland	23.1
Finland	22.5
Norway	21.9
Canada	21.
Sweden	20.
Taiwan, China	20.1
Belgium	18.3
Israel	17.7
Japan	17.6
United States	16.

Legend:
- □ DSL
- □ Cable
- ■ Other

X-axis: 0 5 10 15 20 25 30

all signs of the times!

- Innovation in **digital** technologies and popularity of **portable ICT** devices

- **Speed,** speed and more speed

- Growing value of **information,** esp. timely and "on-the-go" information

- **"Lifestyle" and "Personalization"** of ICTs
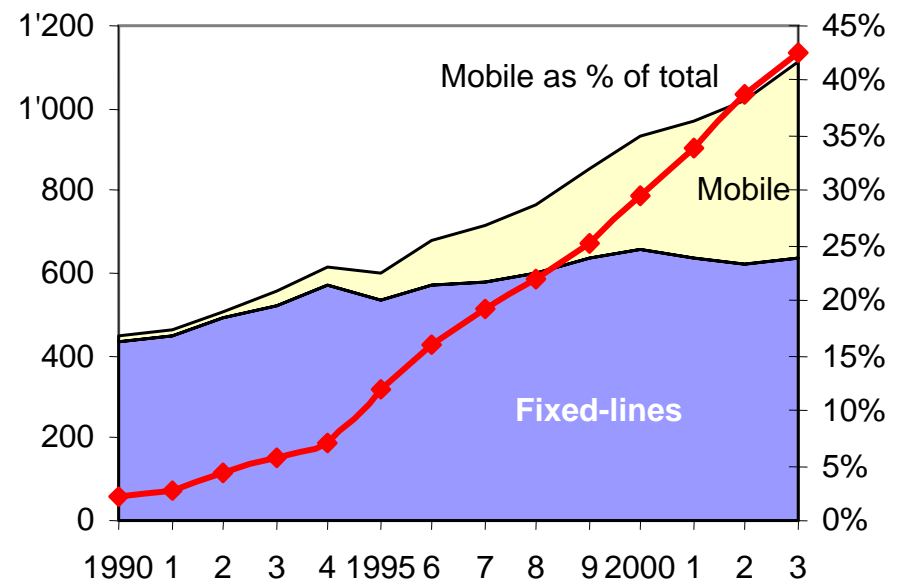
- **Mobility** as an integral element

the near saturation of traditional markets…

Telecom services revenue, in US$ bn

Fixed-line and mobile services revenue, in US$ bn
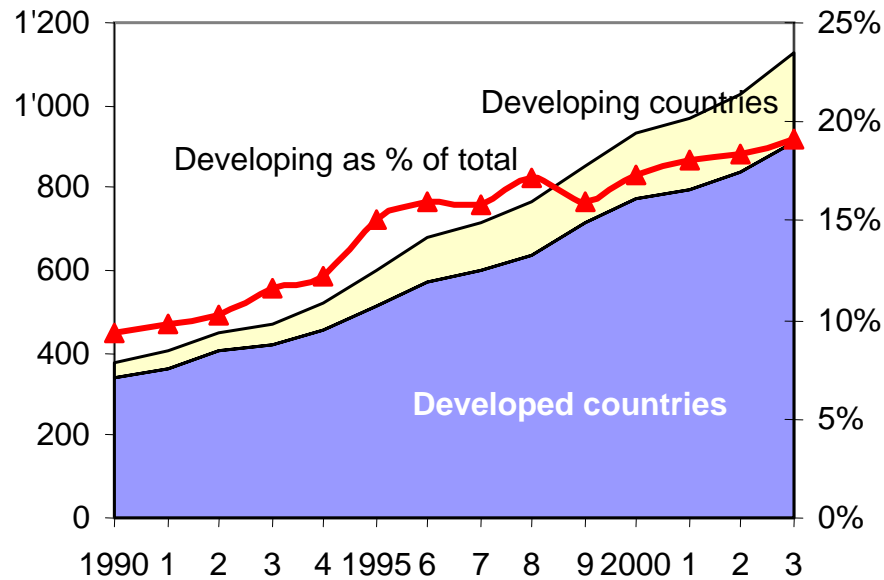
Developing countries growing faster that developed ones

Mobile markets growing faster than fixed-line markets

Source: ITU Internet Reports 2005: The Internet of Things

…leads to a rapidly – changing market landscape

New players – new roles
Old players – new roles

Application Providers

Network Operators

Network Equipment Manufacturers

Portal Operators

Consumer

End user

Business

Application Developers

Device Manufacturers

Content Providers

Virtual Operators

Source: EITO

Service area

Application area

Technology area

ITU
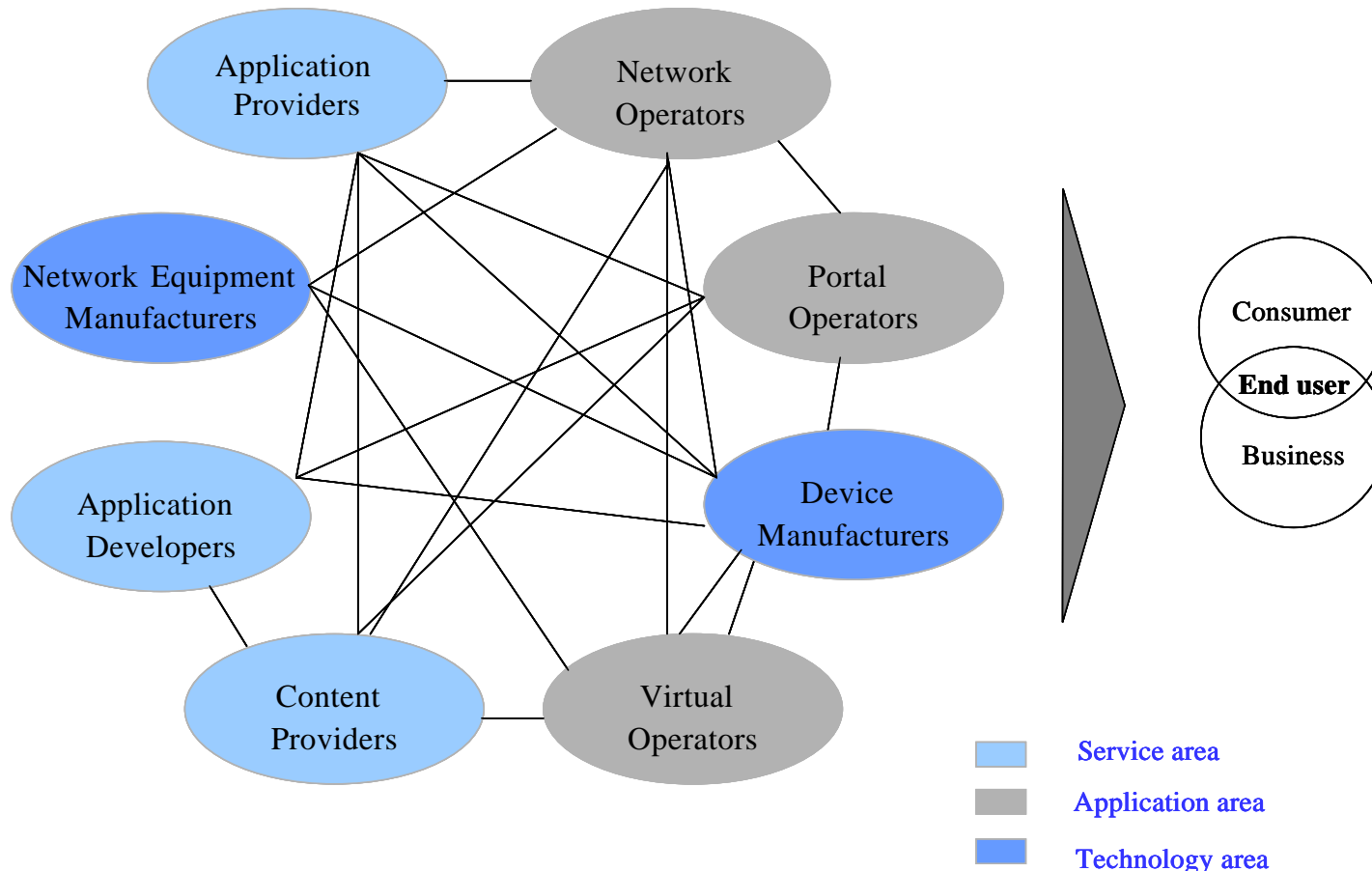
more about the ITU

today's

International Telecommunication Union

- ITU is an international organization where governments and private sector coordinate global telecom networks and services
- "International <u>Telecommunication</u> Union" since 1934
- 190 Member States, 650 Sector Members, 75 Sector Associates
  - Only International Organization to have both private sector members, governments and civil society as members
- Headquarters Geneva, 11 regional offices, 790 staff / 83 nationalities
- Secretary-General: Yoshio Utsumi (Japan)
- Deputy Sec-General: Roberto Blois (Brazil)
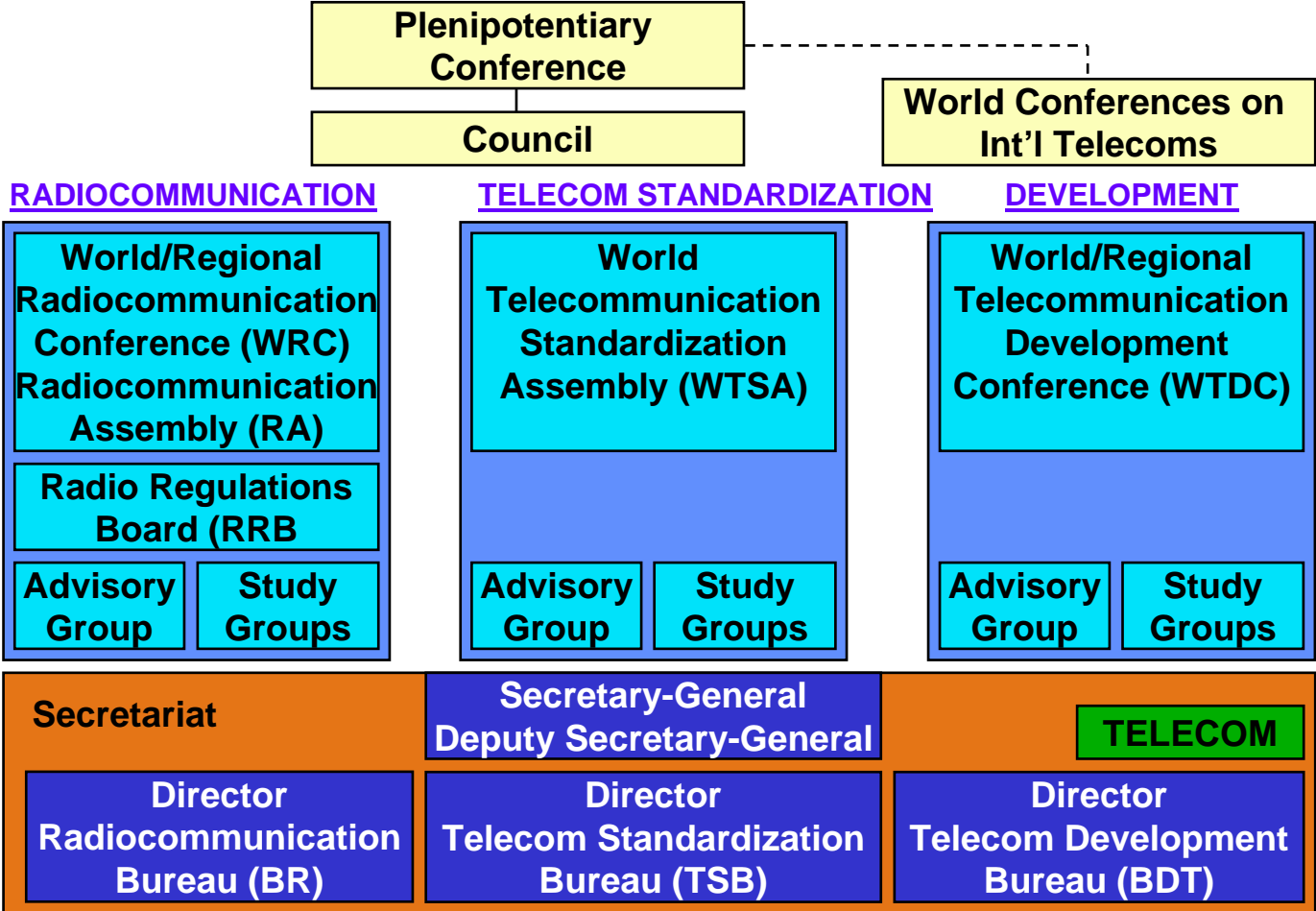
- *2005 budget = CHF164m (USD 130m)*

what is the mission of the ITU?

- To maintain and extend international cooperation for the development of telecommunications

- To provide technical and policy assistance to developing countries

- To harmonize actions of Member States and promote cooperation between Member States and Sector Members

- To promote at international level, the adoption of a broader approach to issues of telecommunications in the global information economy and society

  – WSIS originally proposed at ITU in 1998 and later endorsed by UN

- To extend the benefits of telecoms to all the world's inhabitants

- In sum, to **"Help the world communicate"**

how the ITU is structured

```
                    ┌─────────────────────┐
                    │    Plenipotentiary   │- - - - - - - - - ┐
                    │     Conference       │                  │
                    └─────────────────────┘       ┌───────────────────────┐
                    ┌─────────────────────┐       │ World Conferences on  │
                    │       Council        │       │    Int'l Telecoms     │
                    └─────────────────────┘       └───────────────────────┘
```

RADIOCOMMUNICATION   **TELECOM STANDARDIZATION**   **DEVELOPMENT**

World/Regional Radiocommunication Conference (WRC) Radiocommunication Assembly (RA)	World Telecommunication Standardization Assembly (WTSA)	World/Regional Telecommunication Development Conference (WTDC)
Radio Regulations Board (RRB		
Advisory Group / **Study Groups**	**Advisory Group** / **Study Groups**	**Advisory Group** / **Study Groups**

Secretariat	**Secretary-General** **Deputy Secretary-General**	**TELECOM**
Director Radiocommunication Bureau (BR)	**Director Telecom Standardization Bureau (TSB)**	**Director Telecom Development Bureau (BDT)**

international treaties

- **Constitution and Convention of ITU**
  - Two complementary treaties, containing mainly housekeeping details but also some longstanding international commitments (e.g. common carrier tradition)
  - Major update in 1992; minor updates in 1998 & 2002

- **International Telecommunication Regulations**
  - Thin (10 Articles) treaty concerning mainly accounting practices. Last update 1988 – under review since 1998

- **Radio Regulations**
  - Thick (>10'000 pages) treaty governing use of radio spectrum. Updated every WRC

according to the International Telecommunication *Constitution* (Marrakesh, 2002), the role of ITU is:

- International cooperation in telecommunications
- Technical assistance to LDCs
- To promote technical development
- To extend the benefits of telecoms
- To promote telecoms for peaceful use
- To harmonize national policies
- To promote telecoms in cooperation with other national and regional bodies

in other words, ITU's role is in the following areas:

- **Spectrum allocation and registration**
- **Coordination of national spectrum planning**
- **International telecoms standardization**
- **Collaboration in international tariff-setting**
- **Cooperation in telecoms development assistance**
- **Measures for ensuring safety of life**
- **Extension of universal access**
- **Policy reviews, research and information exchange**

policy research at the Strategy & Policy Unit (SPU)

- **ITU New Initiatives Programme**
  - Begun in 1999
  - Around 17 workshops held to date

- **Building Digital Bridges**
  - Begun in 2004
  - Development of "Digital Opportunity Index"

www.itu.int/spu

- **Main research/data publications**
  - ITU Internet Reports: 7 editions since 1997
  - World Telecom Development Report: 7 since 1994
  - Trends in Telecom Reform: Annual since 1998
  - World Information Society Report: 1st edition, 2006
  - WSIS Stocktaking Database (More than 3'000 ICT projects)
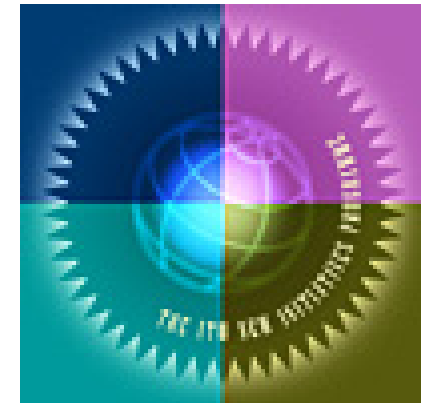
let's talk mobile

mobile has made it impact not only in quantity but also in quality

- the mobile has become a portable daily necessity not unlike e.g. a pen or a piece of ID?

- it is typically no more than one metre away from users (day & night) – it's used even when fixed line available

- it often replaces wristwatch & alarm

- its loss causes panic and major disruption in daily life

- it is reflective of individual identity (as an extension of the self) (e.g. fashion accessory, personal diary, photo album)

- it indeed has wide appeal and can facilitate shared experiences (e.g. moblogging, P2P exchange)

- it's the most intimate ICT device around, creating "emotional attachment" in users

the giants in mobile

Total mobile subscribers: Top 15 economies (Jan 2005)

Economy	Subscribers
China	335
United States	181
Japan	92
Russia	74
Germany	71
Brazil	66
Italy	63
United Kingdom	61
India	47
France	47
Spain	39
Mexico	38
Korea (rep.)	37
Turkey	35
Philippines	33

Source: ITU
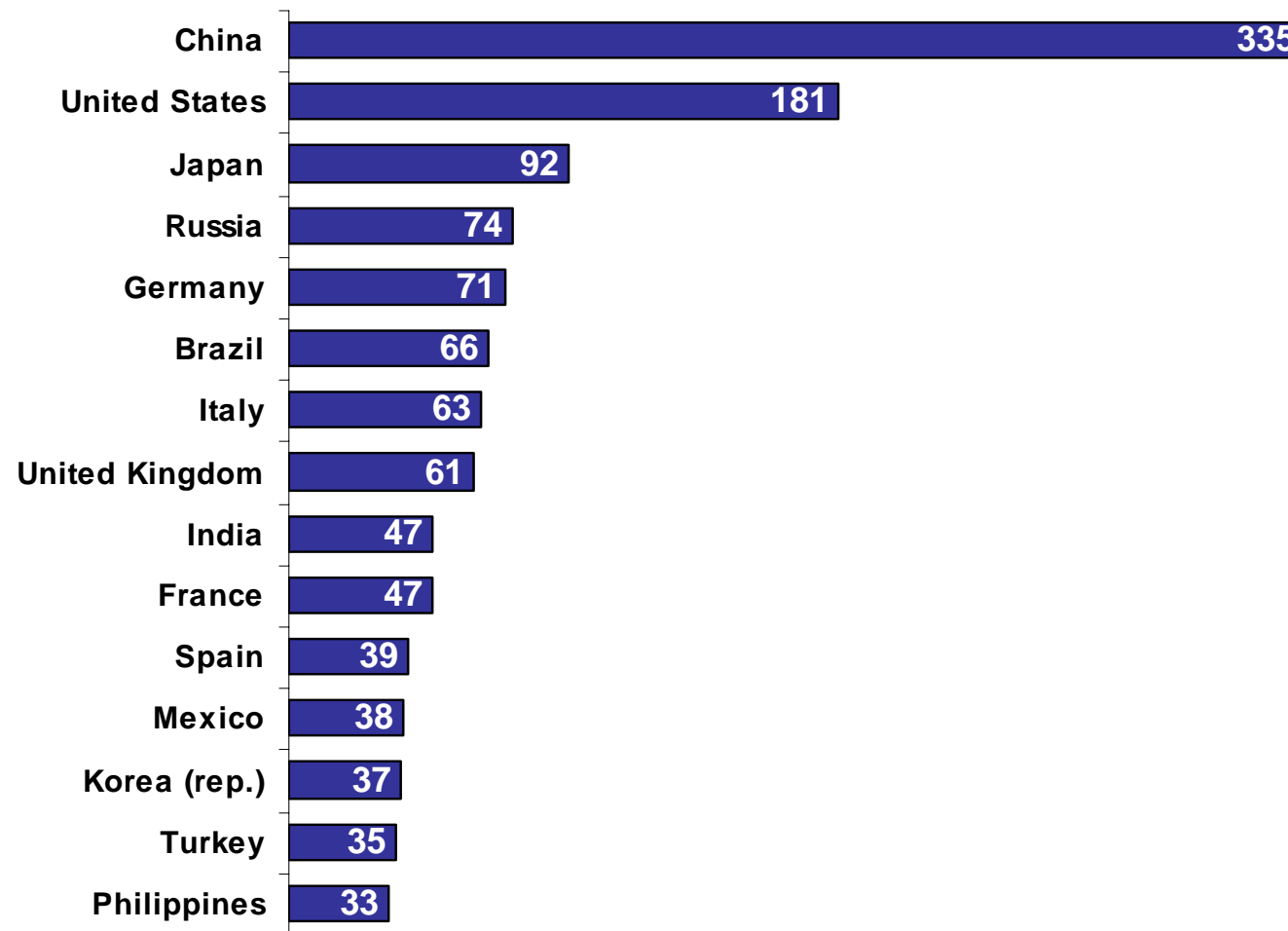
who leads in mobile density?

**Mobile subscribers per 100 inhabitants:
Top 15 economies (January 2005)**

Italy & UK also in
Top 15 for TOTAL subs

Economy	Value
Hong Kong, China	115
Italy	109
Luxembourg	107
Czech Republic	105
Israel	105
Sweden	103
United Kingdom	103
Portugal	102
Greece	101
Taiwan, China	100
Iceland	99
Lithuania	99
Austria	98
Denmark	96
Estonia	96
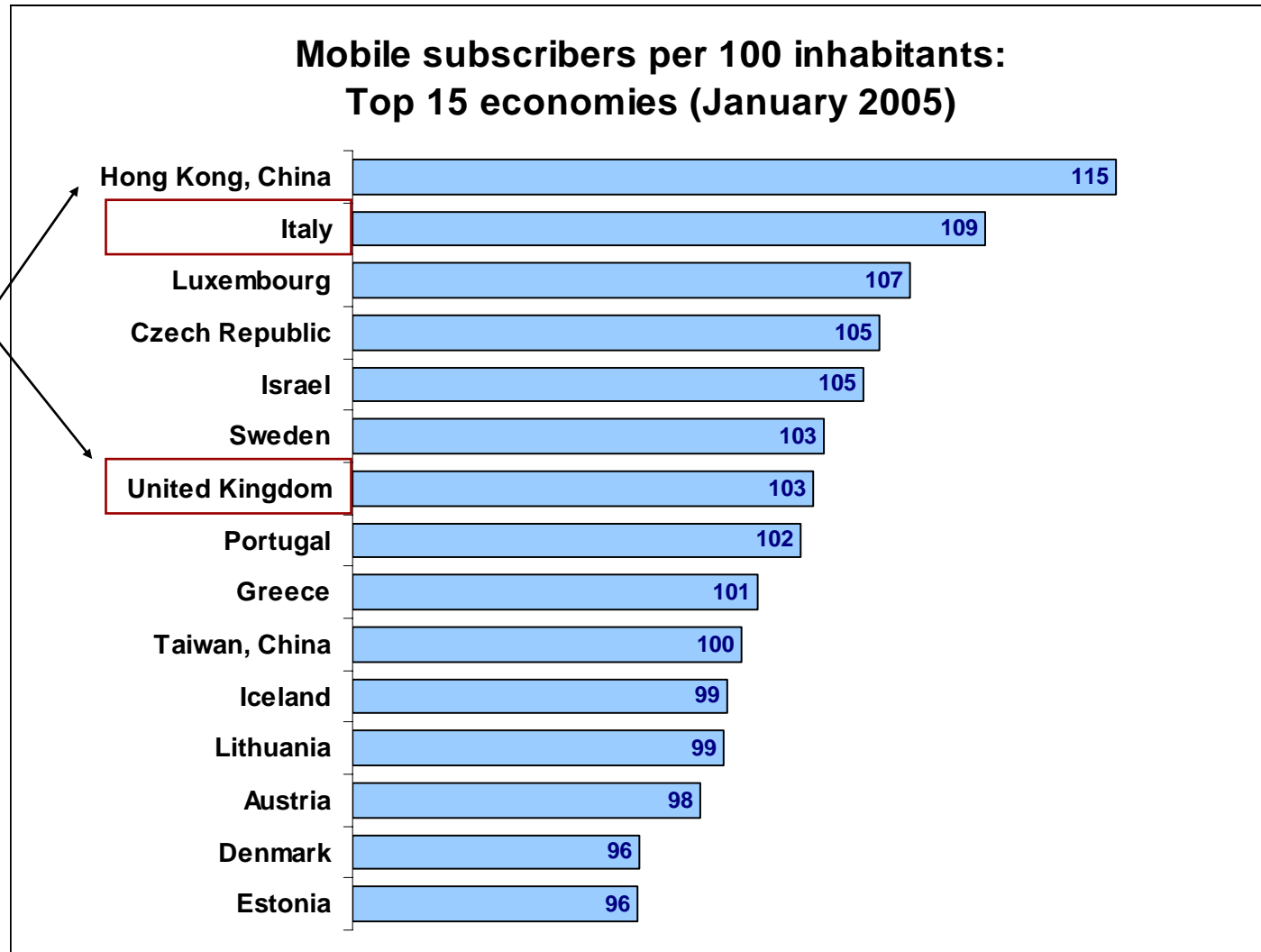
mobiles for extending access…

- Developing countries have seen the greatest impact of mobile communications on access to basic telecommunication services

- Cellular networks can be built faster than fixed-lines networks and can cover geographically challenging areas

- Mobile services have served to boost competition, and prepaid models have opened access to mobile cellular for those who would otherwise not qualify for telephone subscription plans

...and diversifying access, through networks like IMT-2000/3G

Users (millions) and penetration per 100 pop.

- Mobile subscribers
- Internet users
- Mobile penetration
- Internet penetration

95 96 97 98 99 2000 01 02 03 04 05

Source: ITU

Growth of IMT-2000 worldwide (in millions of users, year-end)

78m   134m   269m
Growth 71%   *Growth 100%*

2003   2004   2005

Number of countries with 3G/IMT-2000 services

1   4   18   41   68   78

2000 2001 2002 2003 2004 2005
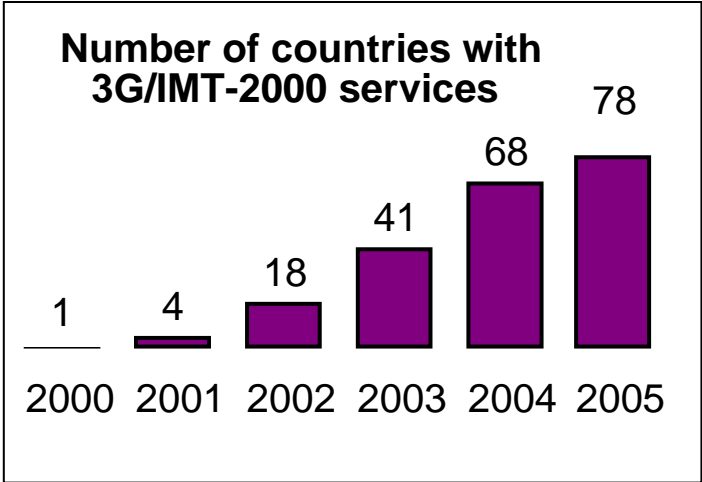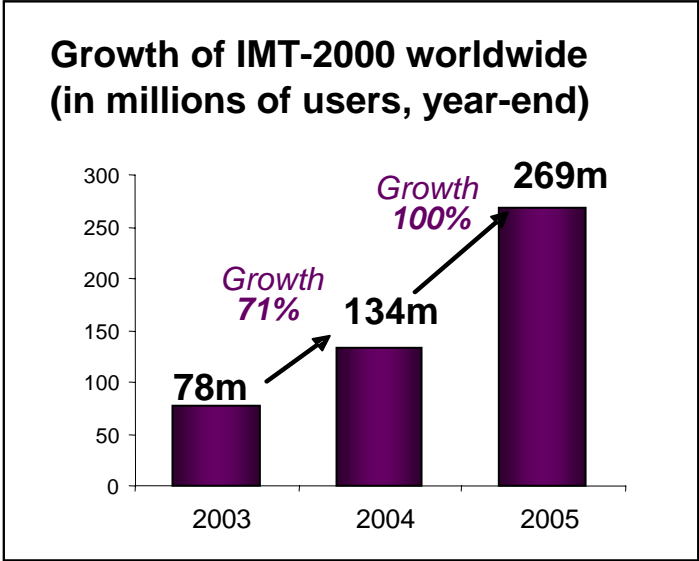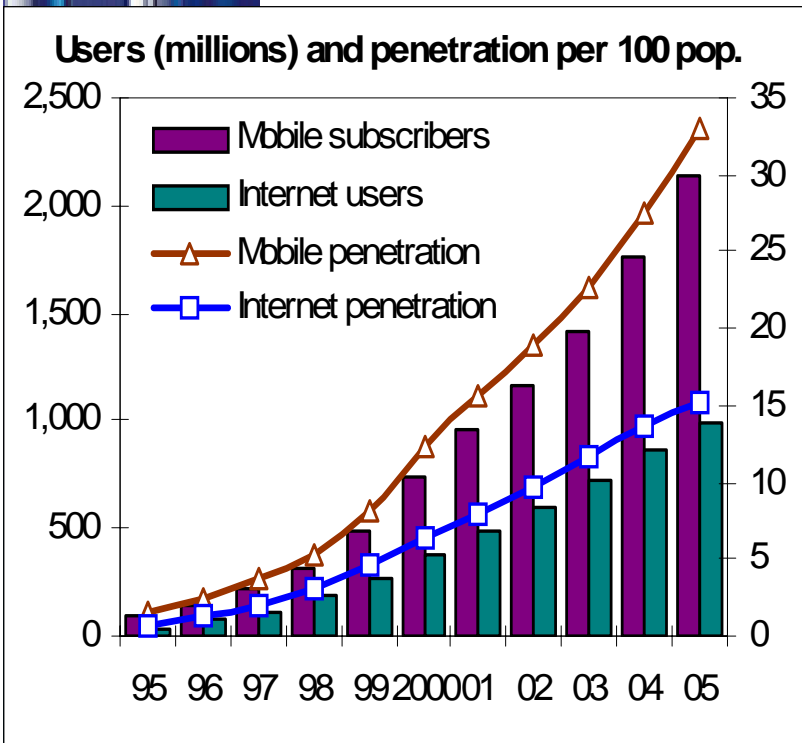
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with higher speeds, mobile multimedia begins to take off!

- mobile TV
- news & information alerts
- information/internet browsing
- downloading of wallpapers and ringtones
- digital audio and video
- ticketing and transaction services
- gaming
- gambling

converging objectives: towards ubiquitous broadband connectivity

Key question: how to make effective use of spectrum to achieve this objective?

Source: MIC
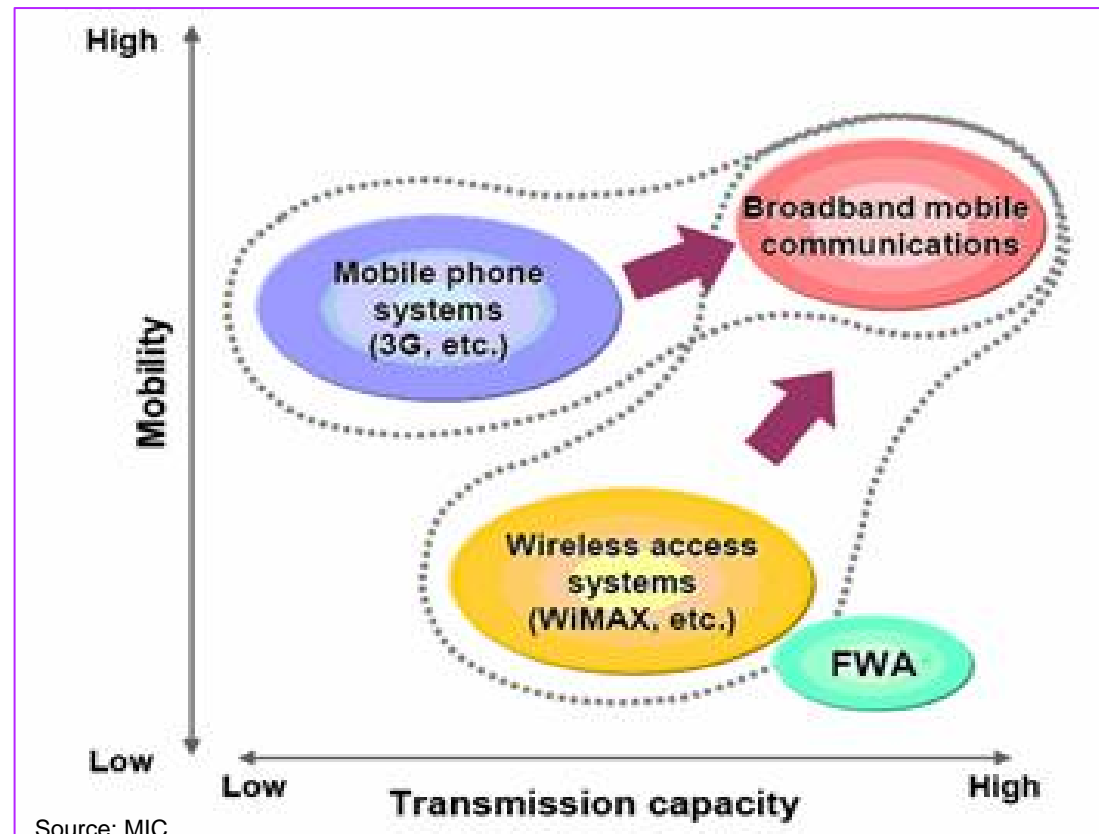
manufacturers continue to aim for more personalization …

- **fashion phones:** e.g. chocolate-like phones such as Nokia's 7380, LG's slim KG800 & Motorola RAZR, athletes' sport smartphones

- **security phones:** e.g. fingerprints, or Pantech's finger-writing PG-2800

- **mood phones:** e.g. Orneta biorhythm for windows-based smartphones

Source: Nokia

- **smelly phones** e.g. Samsung's patent application for perfume-spraying mobile phone functionality

- **slow phones** e.g. NTT DoCoMo's handset which slows down talking speeds
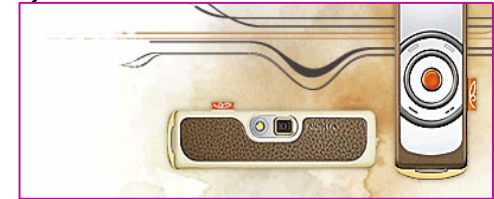
…while operators scramble to push multimedia services

- large proportion of content still stems from personalization services (e.g. ringtones, wallpapers)
  - driven by events or brands unrelated to the mobile industry, e.g popular TV series. Will this change in the future?

- analysts predict that content will diversify over the next years, first to more audio & video services (e.g. mobile TV, with share of personalization services decreasing

Global mobile entertainment revenues (in USD millions)

e.g. digital music more popular over mobiles than PCs in Japan!

Source: Informa

- Total mobile entertainment revenues set to rise from 15.8 to 42.8 bn USD by 2010

- (how) will traditional mobile players re-position themselves?
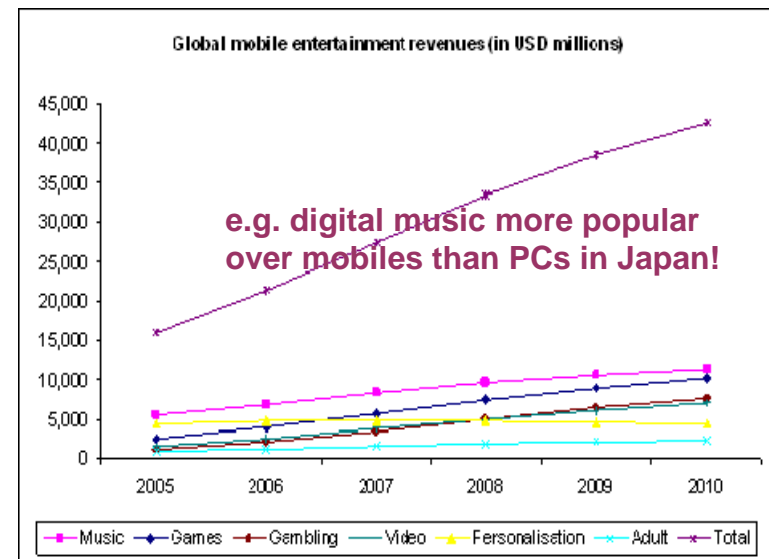
challenges of a high-speed highly-mobile world

untapped market opportunities?
need for new business models?

	Low speed	High speed
High mobility	Mobile	Under development ? ?
Low mobility	PAN	WLAN/FWA
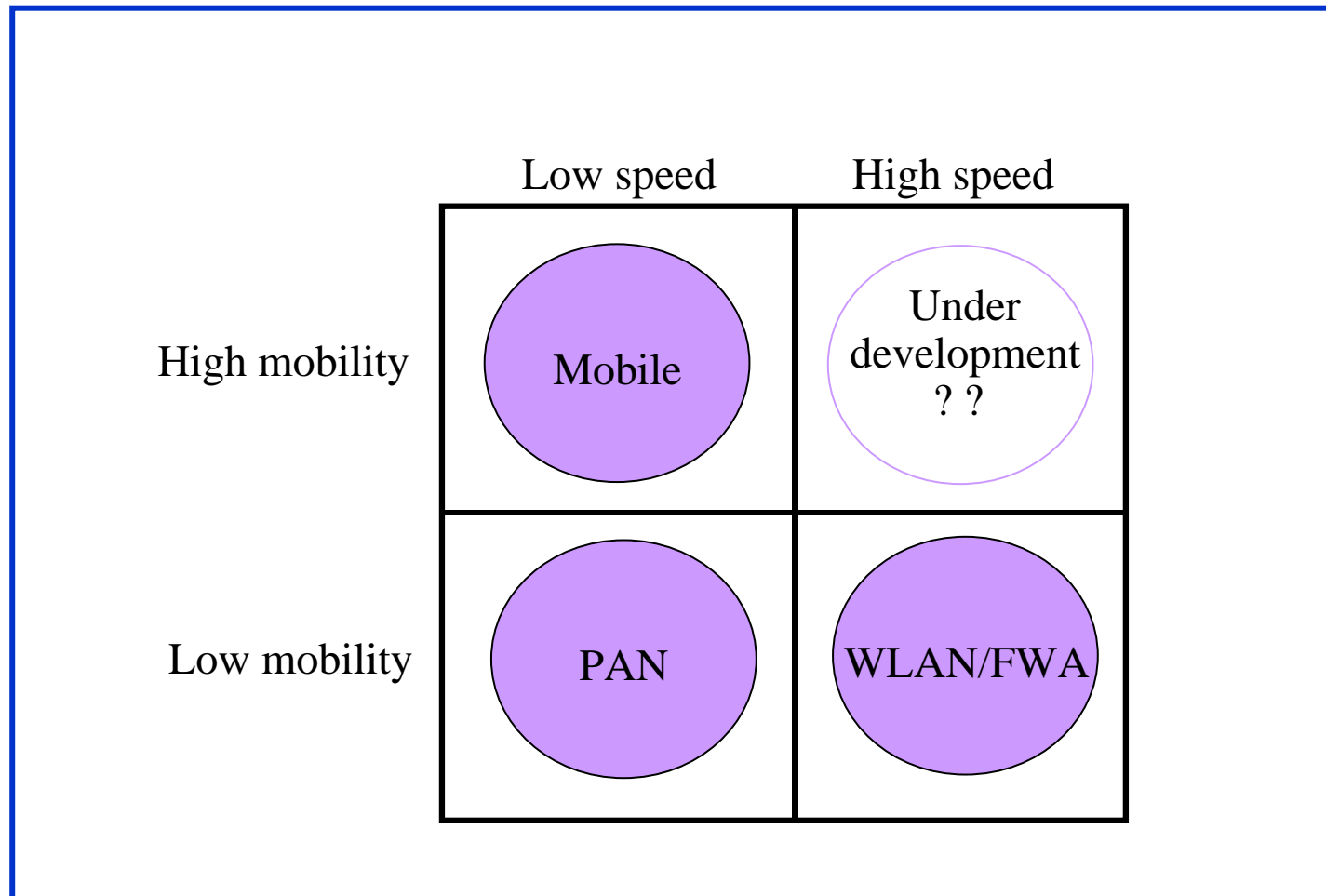
affordability a key problem

**price of mobile services hasn't decreased
at same rate as broadband, internet**

Average cost of ICT
usage worldwide, in
US$, 2003-2005

broadband
($/100 kbps) 40%

20 hours'
Internet access
25%

mobile basket
23%

Cost (USD)

70
60
50
40
30
20
10
0

2003 2005   2003 2005   2003 2005
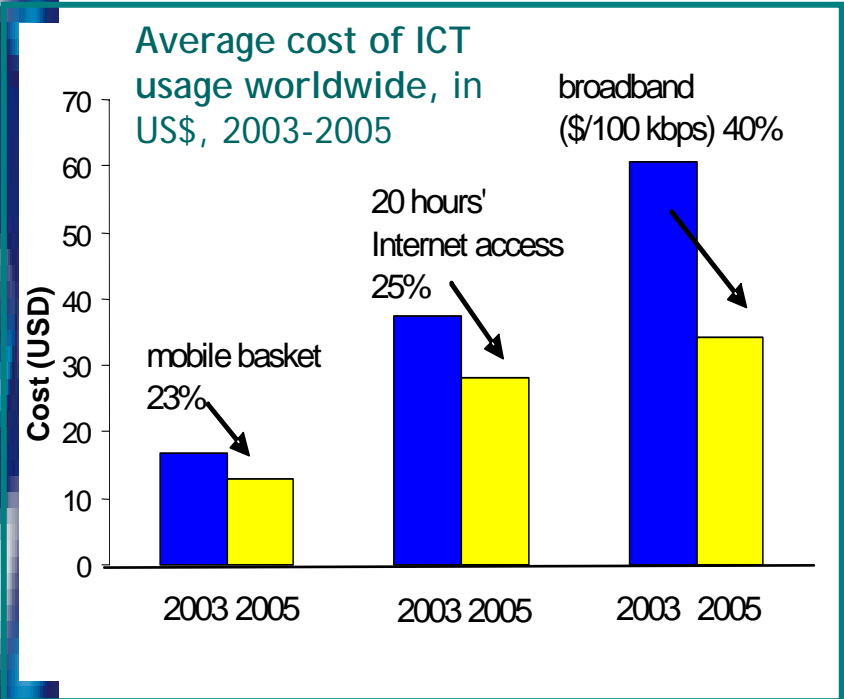
**cheap-to-produce services, e.g. SMS,
priced well-above cost in some regions**

**Average price of
an SMS,**
in US$, 2005

0.16
0.14
0.10
0.07
0.06

Americas   Asia   Africa   Europe   Oceania

Source: ITU World Information Society Report
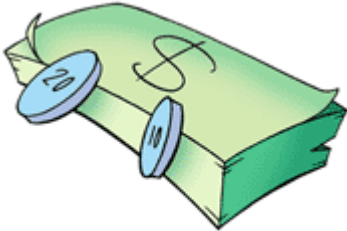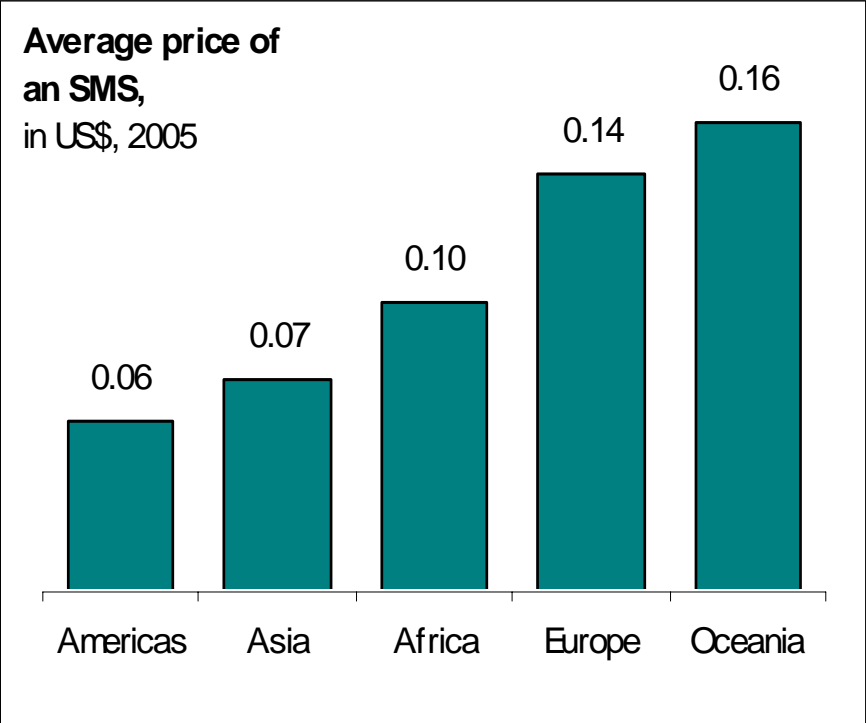
example: mobile roaming

- roaming =15% of global mobile revenues in 2004 (US$78.6 billion)

- EC first looked into issue in 2000, but to not much avail

- In 2005, a tariff comparison website was set-up

| Austria |
| Belgium |
| Cyprus |
| Czech Republic |
| Denmark |
| Estonia |
| Finland |
| France |
| Germany |
| Greece |
| Hungary |
| Ireland |
| Italy |
| Latvia |
| Lithuania |
| Luxembourg |
| Malta |
| Netherlands |
| Poland |
| Portugal |
| Slovakia |
| Slovenia |
| Spain |
| Sweden |
| United Kingdom |
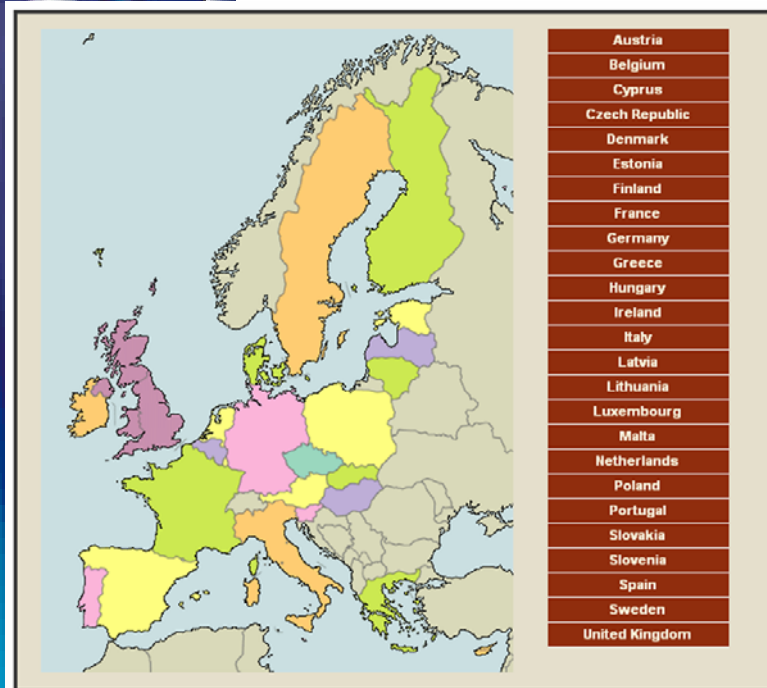
Informa estimates each fan at the FIFA World Cup will spend €36.50 on roaming charges!

- Roaming charges vary widely, with the highest rate found by EC to be 13 euros a minute (Maltese calling home from Latvia)

- EC now proposing a regulation (consultation period ended in May 2006) which will be put into effect no earlier than summer 2007

ensuring a level playing-field remains an important challenge

- ICT regulatory trends in Europe:
  - from *ex ante* to *ex post*
  - roll back of sector-specific regulation as markets become more competitive in favour of competition law

- mobile has traditionally been less regulated than fixed
  - many of the larger mobile markets remain relatively concentrated in Europe

- In the broadband world, concerns over access to incumbent's networks persist in many areas

regarding SMS: it's SOS!

- by some estimates, the total SMS revenues in 2005 were about 75 billion USD. Compare this to:
  - Global box office: 25-30 billion
  - Global music industry revenues: 35 billion
  - Videogaming, consoles & all software: 40 billion
- though SMS interconnection costs are very low, retail costs remain high
- this does not bode well for future mobile data and multimedia pricing
- though little has been done thus far, some regulators are imposing price caps on SMS termination (e.g. ARCEP).
- but some argue that intervention at retail level (rather than wholesale) may be required
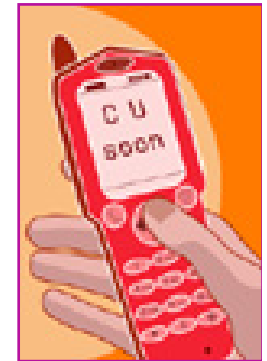
and content rules…?

- ## Specific forms of content
  - the 3Gs
  - regulating specific forms of content
  - increasing use of camera phones and user-generated content
  - protection of minors
- ## advertising
  - advertising rights & responsibilities
  - the problem of spam
- ## copyright and DRM
  - prevention of piracy & payment of appropriate royalties
  - rewarding content creation without limiting distribution
  - use of universal principles for DRM
- ## regulation of mobile transactions, mobile payments
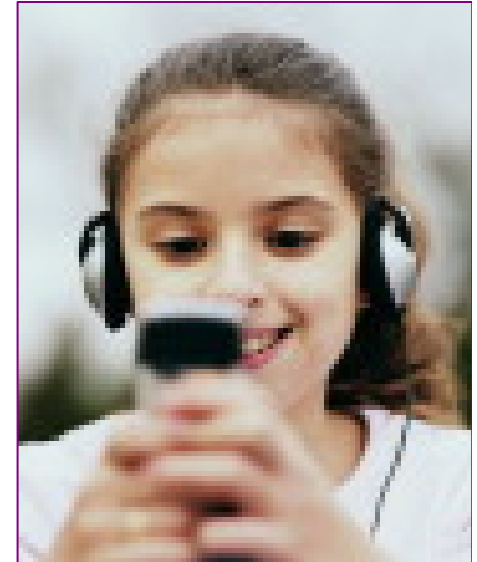
addressing content & convergence

- traditional separation of broadcasting and telecommunications giving way to increasing convergence: both in terms of media & regulation

- Europe's TWF Directive now being amended as *Audiovisual Media Services Directive* (AMS)
  - to cover (scheduled and on-demand) media services over internet, mobile, telecom, broadcasting and over "*any other electronic network whose principal purpose is the provision of moving images to the general public*"
  - regardless of technology used, multimedia services will be subject to a minimum standard of protection relating to e.g. advertising, discrimination, incitement to hatred

- Thus the directive will extend regulation to control audio-visual media services that have, until now, been untouched by specific regulatory intervention, and left to MS's general laws (and self-regulation has been the norm)

from the mobile, to the portable, to the ubiquitous…
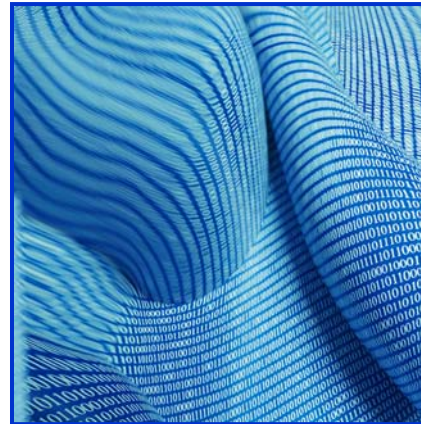
increasingly pervasive wireless communication environment

- Growth of high-speed and high-mobility networks
  - 802.16, 802.20 etc…

- Importance of new short-range wireless techs and applications
  - Zigbee
  - RFID

- From connecting people and PCs (devices) to connecting "things"

connecting things- a new dimension

Any TIME connection

- On the move
- Outdoors and indoors
  - Night
  - Daytime

- On the move
- Outdoors
- Indoors (away from the PC)
- At the PC

Any PLACE connection

- Between PCs
- Human to Human (H2H), not using a PC
- Human to Thing (**H2T**), using generic equipment
- Thing to Thing (**T2T**)

Any THING connection
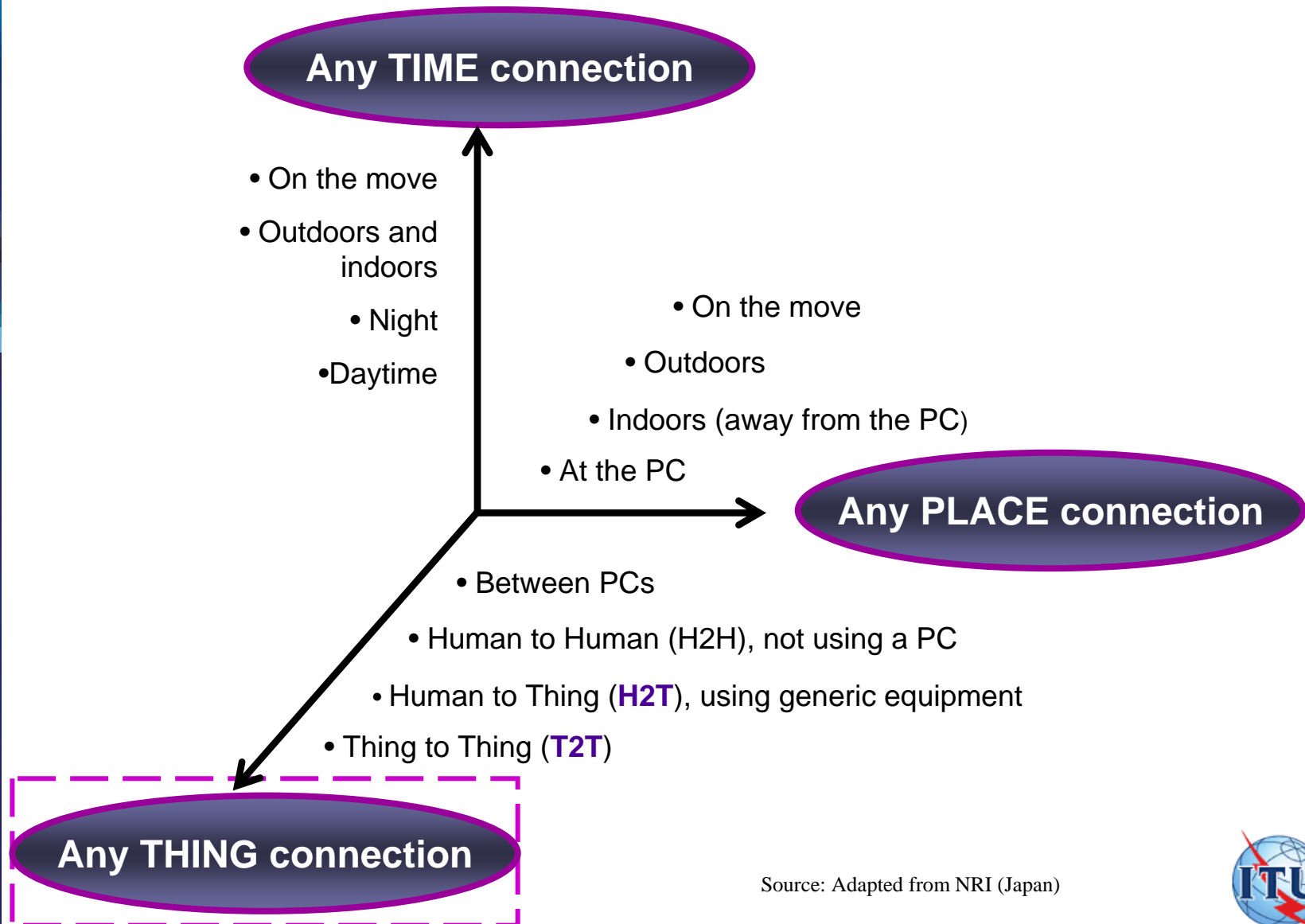
Source: Adapted from NRI (Japan)

the next internet:
an Internet of things?

- Technologies like RFID have the potential to tag every item on the planet

- Combined w/ sensors, they can create context-aware applications, linking the real world to the virtual world

- Developments in "smart materials" and nanotech will further drive this revolution

www.itu.int/internetofthings

➢ **ITU Internet Report 2005: The Internet of Things**
➢ **ITU Internet Report 2006: digital.life**

4 key technological enablers

- *T*agging Things: R$_{FID}$
  - enables real-time identification & tracking

- *S*ensing Things: S$_{ensor\ technologies}$
  - enables detection of environmental status and sensory information

- *T*hinking Things: S$_{mart\ technologies}$
  (e.g. those enabling smart homes, smart vehicles etc.)
  - build intelligence into the edges of the network

- *S*hrinking Things: N$_{anotechnology}$
  - makes possible the "networking" of smaller and smaller objects

a future of smart things

Miniaturization and cost reduction

Time

(4) Smart Things

**(3) Mobiles /
Smart Cards**

(2) PCs

(1) Mainframe
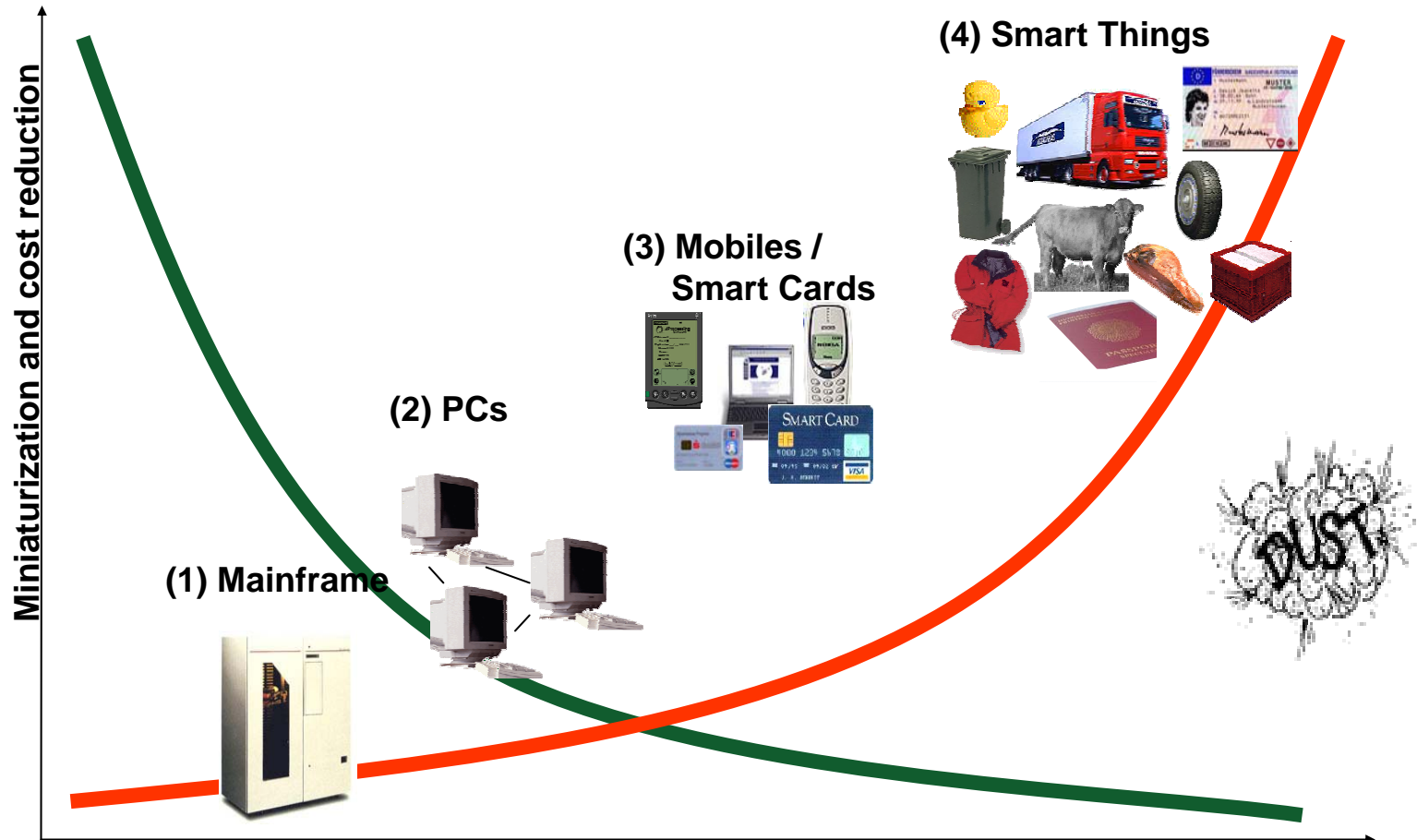
Source: ITU, Ubiquitous Network Societies, ITU, 2005

e.g evolution of RFID-enabled & sensor-enabled smart mobiles

- **the diabetic's mobile**
  - equipped with a sensor to test glucose level, an RFID reader to read information on booklets/articles or prescription drugs, and an RFID tag containing vital medical information
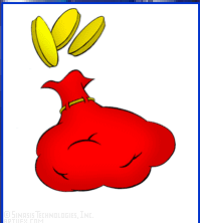
- **the shopper's mobile**
  - the sensor senses restaurants nearby, the RFID reader easily scans product information and the embedded tag enables up-to-date information on sales and promotions in the shopper's vicinity and facilitates e-transactions

- **the kid's mobile**
  - the sensor senses detects the proximity of peanuts (if child has an allergy) or any other danger (e.g. smoke, gas), the RFID reader can enable the child to read printable tags on assignments, and the embedded tag sends out location information to concerned parents or teachers as well as serving as a micro-payment platform (e.g. for buying snacks or drinks without having to carry cash)

from mobility to ubiquity

- the overwhelming use of mobile communications today is but a beginning
- we are witnessing the dawn of a new era of ubiquitous/ ambient connectivity
- growth of technologies like wireless sensor networks and RFID mean that in the future, individual items or things may become networked, leading to an "internet of things"
- what issues can already be addressed in an always-on multimedia environment that might foster the growth of ubiquitous networking, and ensure its user-centric, healthy & safe development?

From smart mobiles to ambient networking

Ultra-tiny computers are embedded into ⭐.

Intelligent light
Intelligent air conditioner
Intelligent ceiling
Communication terminal
Intelligent wall
Intelligent desk
Intelligent wall
Intelligent chair
To the outside
Intelligent floor
Ubiquitous network

Source: Ubiquitous ID Centre
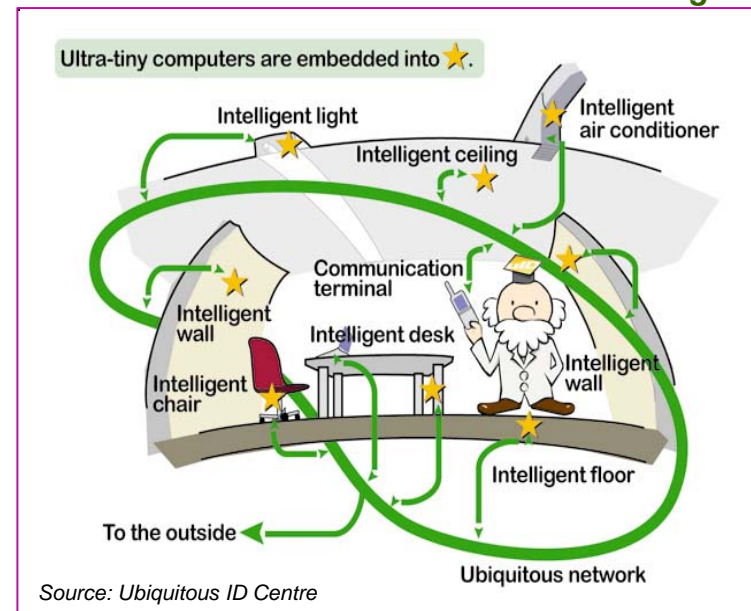
important emerging challenges

- **S**tandards-setting and interoperability
  - Harmonization required particularly in the area of transmission protocols
  - Tag formats have *de facto* standard "EPC"

- **g**overnance of resources
  - Who controls the unique identifiers?
  - More commercial value at stake than DNS…

- **d**ata protection and consumer privacy
  - Information contained on tags should appropriately managed and controlled

the privacy problem

- **S**trong opposition to some of these technologies:
  - CASPIAN, EPIC, EFF

- **p**ublic sector is becoming more aware of problem, e.g. EU Data Protection WP

- **S**till, lack of clarity as to rules and guidelines for use of technologies like RFID, for instance, and no harmonised approach to digital identity management

- **r**isking a "privacy divide"?

individuality and surveillance

- growth of citizen journalism
  - through use of camera phones and moblogging, all human activities susceptible of being recorded
  - climate of security threats and terrorism may mean that vigilantes become increasingly common

- lack of technical and economic incentives to delete any information about anyone

- Such an environment of surveillance (real of perceived) may lead to lack of individuality, self-expression and greater anxiety in decision-making (no matter how small)

- these elements are crucial to individual and societal development
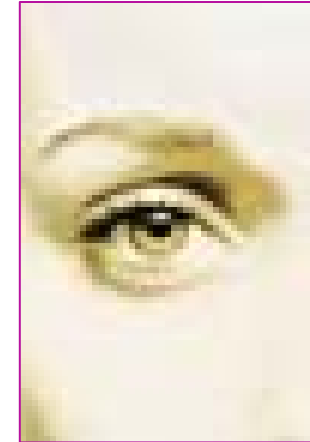
how to be future-proof?
... by ensuring a holistic approach

Example: Privacy and data protection

Socio-ethical principles

Socio-ethical principles

BBB-type
programmes

MARKET-BASED

public
awareness

self-regulation

user consent

codes of conduct

user education

POLICY/

privacy certification

REGULATORY

TECHNICAL

legislation/guidelines

Encryption

consumer advocacy

ID management
tools

accountability

Mobile phone jammers

harmonization

Biometrics   Content filters

P3P/Privacy   DRM tools
preferences

Socio-ethical principles

Source: ITU

… through global dialogue

- development of harmonized approaches, e.g.:
  - spectrum management
  - licensing
  - global standards
- information exchange, e.g. on regulatory best practices
- development and interoperability of privacy-enhancing technologies (PETs)
- data protection schemes across borders and articulation of global digital identity management principles
- global efforts for increasing security in critical infrastructure
- international cooperation on digital rights management
- governance issues

more information

- *…on **ITU's Strategy and Policy Unit** (SPU) Activities:*

  – **www.itu.int/spu**

- *…about ITU's **New Initiatives Programme:***

  – **www.itu.int/ni**

- *… about the **SPU's publications***

  – **www.itu.int/spu/publications**

ITU Young Minds Programme

www.itu.int/youngminds

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