Telecom policy research at ITU: Some hot topics

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Policy Research Forum
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The Internet of Things

Telecom Policy Research: Main programmes

● **ITU New Initiatives Programme**

 ➢ **Begun in 1999**

 ➢ **Around 16 workshops held to date**

● **Building Digital Bridges**

 ➢ **Begun in 2004**

 ➢ **Development of "Digital Opportunity Index"**

● **WSIS Thematic Meetings**

 ➢ **Seven meetings organised/co-organised by ITU**

● **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**

 ➢ **WSIS Stocktaking Database (More than 2'500 ICT projects)**

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New Initiatives Programme

- **Workshops: Recent examples include:**
  - ➤ **"Tomorrow's Network Today" (October 2005)**
  - ➤ **"Ubiquitous Network Societies" (April 2005)**
  - ➤ **"Shaping the future mobile information society" (March 2004)**
  - ➤ **"Radiospectrum management for a converging world" (February 2004)**
- **Country case studies**
  - ➤ **More than 50 studies completed**
  - ➤ **See www.itu.int/casestudies.**
- **Resource websites**
  - ➤ **See www.itu.int/ni.**
- **Published reports**

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Bits and Bahts:
Thailand Internet Case Study
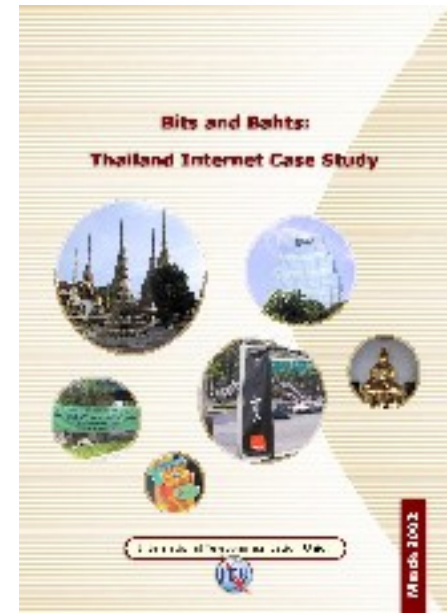
Upcoming New Initiatives workshops

- **What rules for IP-enabled NGN? (23-24 March 2006, Geneva)**

- **2006-07 work programme questionnaire**
  (see: **http://www.itu.int/osg/spu/ni/questionnaire06-07/index.html**)

- **Possible future topics include:**

  - **Future of voice**
  - **IPTV**
  - **E-government**
  - **E-health**
  - **Content without frontiers**
  - **Next Generation Universal Service**

  - **> Privacy and data protection**
  - **> Info Society in 2015**
  - **> Wireless Networking**
  - **> Peer-to-peer**

Building digital bridges

- **Multi-stakeholder partnership involving ITU, MIC Korea, KADO, UNCTAD, LBS and other partners**

- **Workshop, Sept 2004, Busan, Rep. of Korea**

- **WSIS Thematic Meeting on multi-stakeholder partnerships for bridging the divide, June 2005, Seoul**

- **Launch of "Digital Opportunity Index" at WSIS in Tunis, November 2005**

- **Workshop on "Digital transformation in the information society", with London Business School, Geneva, 1-2 June 2006**

A new tool for international comparisons: Digital Opportunity Index

- **A composite index made from 11 separate indicators**
- **Structured around:**
  - **Opportunity (e.g., Coverage and tariffs)**
  - **Infrastructure (e.g., penetration rates for individuals and households)**
  - **Utilisation (e.g., access to Internet and broadband connections)**
- **Separate indices for fixed and mobile as well as a combined index**
- **Launched at WSIS Summit in Tunis**

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DOI Indicators

	Indicator	Goal post	Indicator weight	Category weight
Opportunity	**Percentage of population covered by mobile**	**100**	**33%**	**33%**
	Internet access tariffs as a % of per capita income	**.16**	**33%**	
	Mobile tariffs as a % of per capita income	**.20**	**33%**	
Infrastructure	**Proportion of households with a fixed telephone**	**100**	**20%**	**33%**
	Mobile cellular subscribers per 100 inhabitants	**100**	**20%**	
	Proportion of households with Internet access	**100**	**20%**	
	Mobile Internet subscribers per 100 inhabitants	**100**	**20%**	
	Proportion of households with a computer	**100**	**20%**	
Utilization	**Internet users per 100 inhabitants**	**85**	**33%**	**33%**
	% of fixed broadband in fixed Internet subscribers	**100**	**33%**	
	% of mobile broadband in mobile Internet subscribers	**100**	**33%**	

Source: ITU/UNCTAD/KADO "Digital Opportunity Index", see http://www.itu.int/osg/spu/statistics/DOI/index.phtml.

Overall rankings (based on analysis of 40 major economies)

DOI	Country	DOI	DOI	Country	DOI
1	**Korea (Rep.)**	**0.76**	**29**	**Thailand**	**0.34**
2	**Hong Kong**	**0.67**	**30**	**Russia**	**0.34**
3	**Japan**	**0.66**	**31**	**Egypt**	**0.33**
4	**Denmark**	**0.65**	**32**	**China**	**0.31**
5	**Sweden**	**0.66**	**33**	**Venezuela**	**0.30**
6	**Taiwan-China**	**0.63**	**34**	**Brazil**	**0.27**
7	**Canada**	**0.63**	**35**	**Colombia**	**0.26**
8	**Singapore**	**0.63**	**36**	**South Africa**	**0.25**
9	**Netherlands**	**0.63**	**37**	**Philippines**	**0.22**
10	**Switzerland**	**0.61**	**38**	**Indonesia**	**0.18**
11	**Austria**	**0.60**	**39**	**Peru**	**0.28**
12	**United Kingdom**	**0.60**	**40**	**India**	**0.14**

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Source: ITU/UNCTAD/KADO "Digital Opportunity Index", see http://www.itu.int/osg/spu/statistics/DOI/index.phtml.

Alternative visions

- **Ubiquitous network societies** "*anytime, anywhere, by anyone and anything*" (Tokyo WSIS Thematic Meeting)

- **Ubiquitous computing:** "*The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.*" Mark Weiser (1991)

- **Next Generation Networks:** "*packet-based network able to provide telecommunication services and make use of multiple broadband […] transport technologies in which service-related functions are independent from underlying transport-related technologies.*" ITU-T Recommendation Y.2001
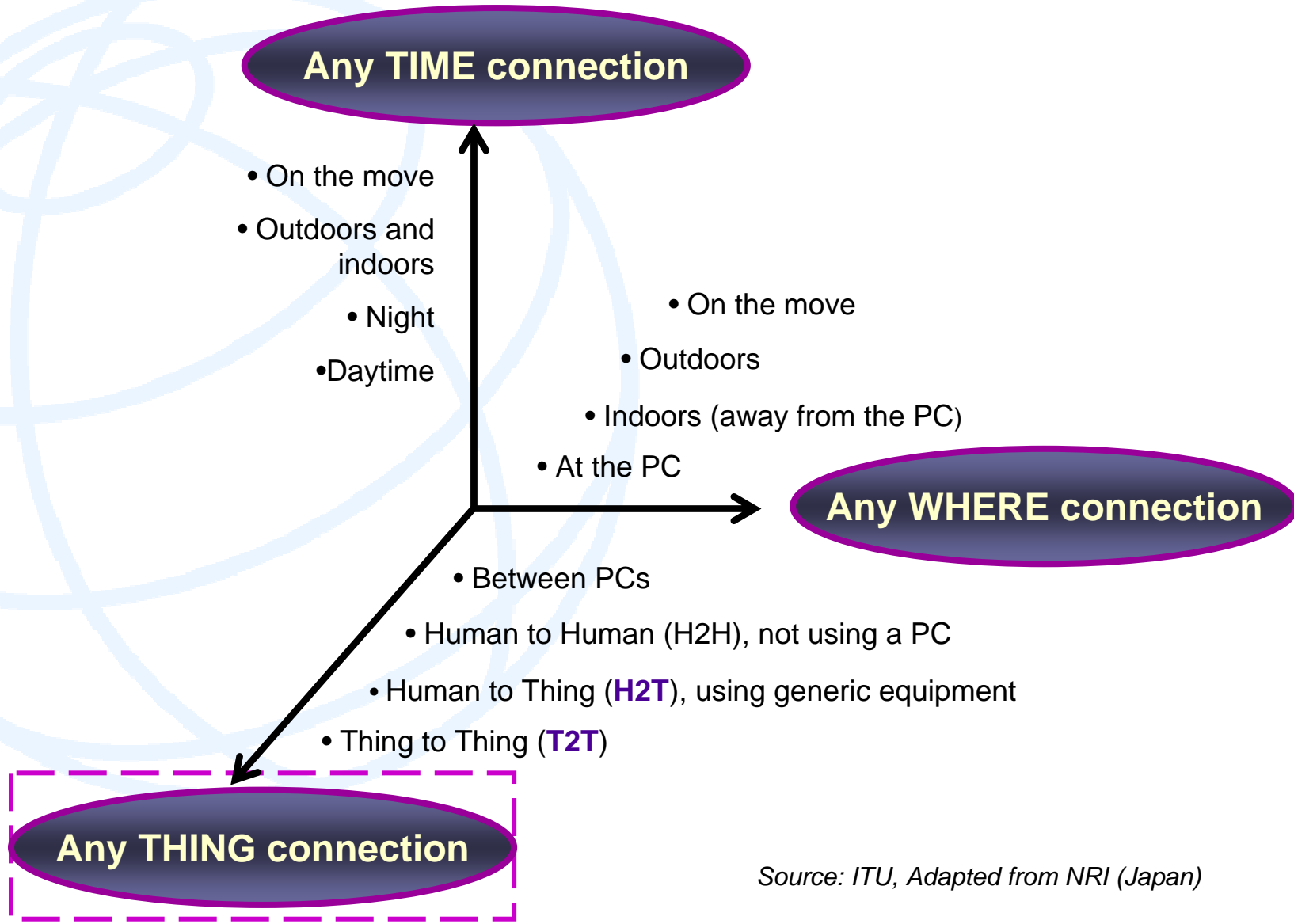
A new ubiquity for technology…

- **Weiser's vision**: dedicated IT devices will eventually disappear, while information processing capabilities will be increasingly available

- **Ubiquity** refers refers to unobtrusive connectivity anytime and anywhere, by anyone …
  - Extending connectivity to the underserved
  - Early example: reaching two billion mobile phones in 2005

- … but <u>also</u> by any*thing*
  - Creating a "network of things"
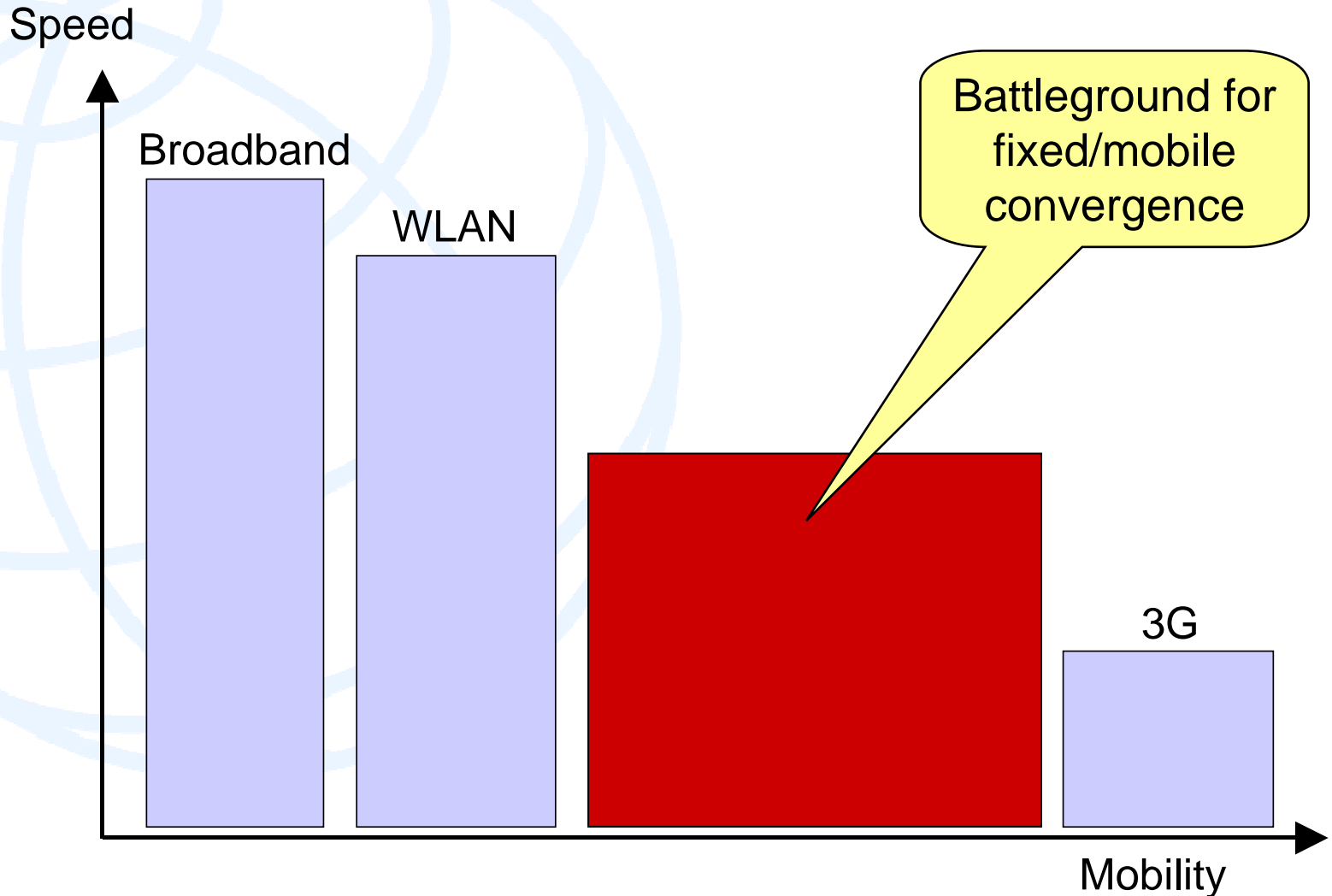
… enabling a <u>new</u> dimension

Any TIME connection

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

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

Any WHERE 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

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Source: ITU, Adapted from NRI (Japan)

Viewed from a different perspective
Fixed/mobile convergence

What's driving the market? (1) Growth of the internet

Estimated internet users
worldwide, millions

Year	Users
1995	40
1996	74
1997	117
1998	183
1999	277
2000	399
2001	495
2002	622
2003	725
2004	873

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Source: ITU Internet Reports 2005: The Internet of Things
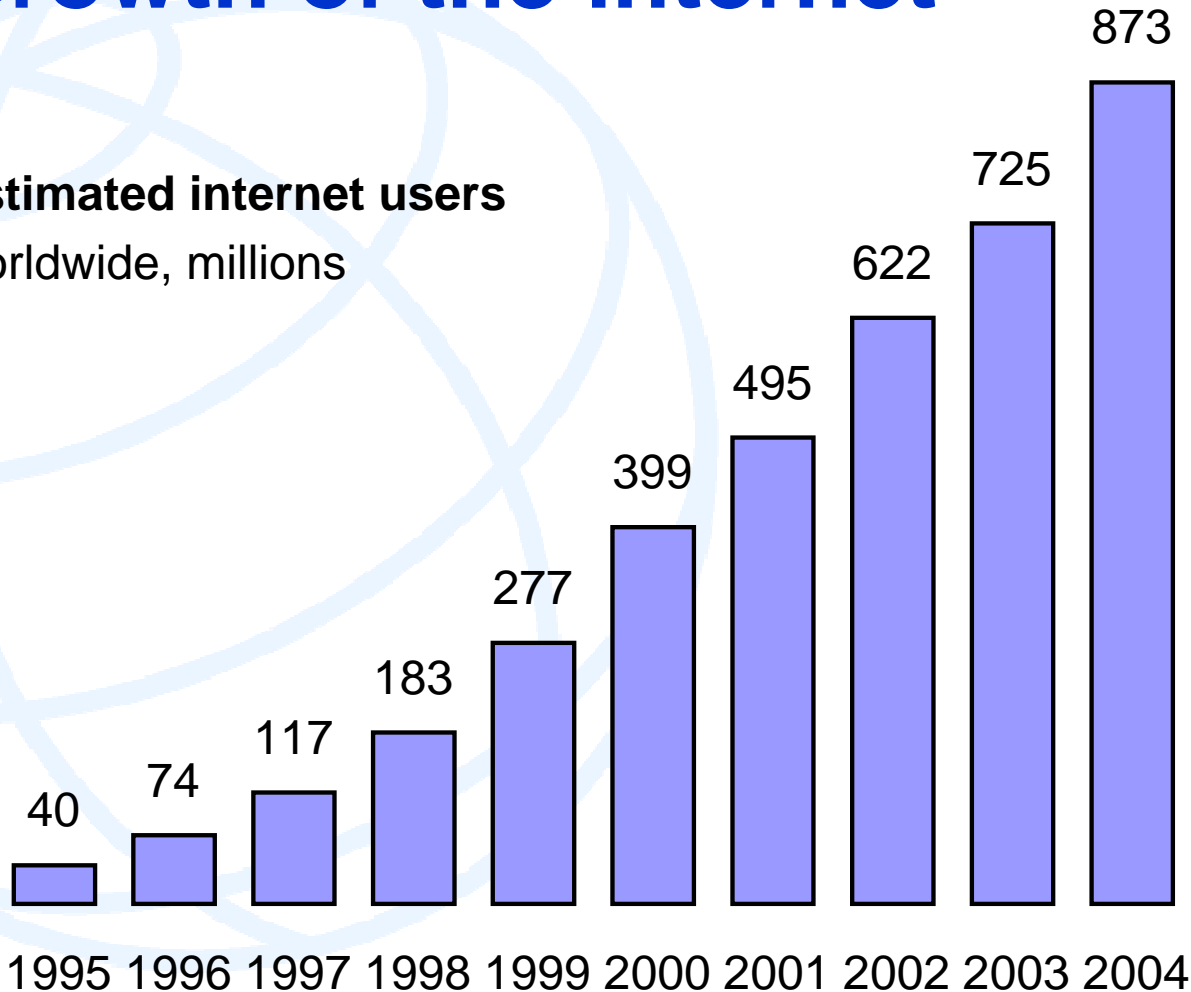
What's driving the market? (2)
Development of 3G mobile

Top 10 3G mobile markets worldwide, millions of subscribers, 2004

Legend:
- □ CDMA 2000 1x
- ■ W-CDMA

Chart data (millions of subscribers, per 100 inhabitants):

Country	Value
Australia	3.9
Brazil	0.9
Israel	27.8
Italy	4.9
UK	4.8
Canada	23.3
China	0.7
Japan	20.1
Korea (Rep.)	57.4
USA	16.7

Per 100 inhabitants

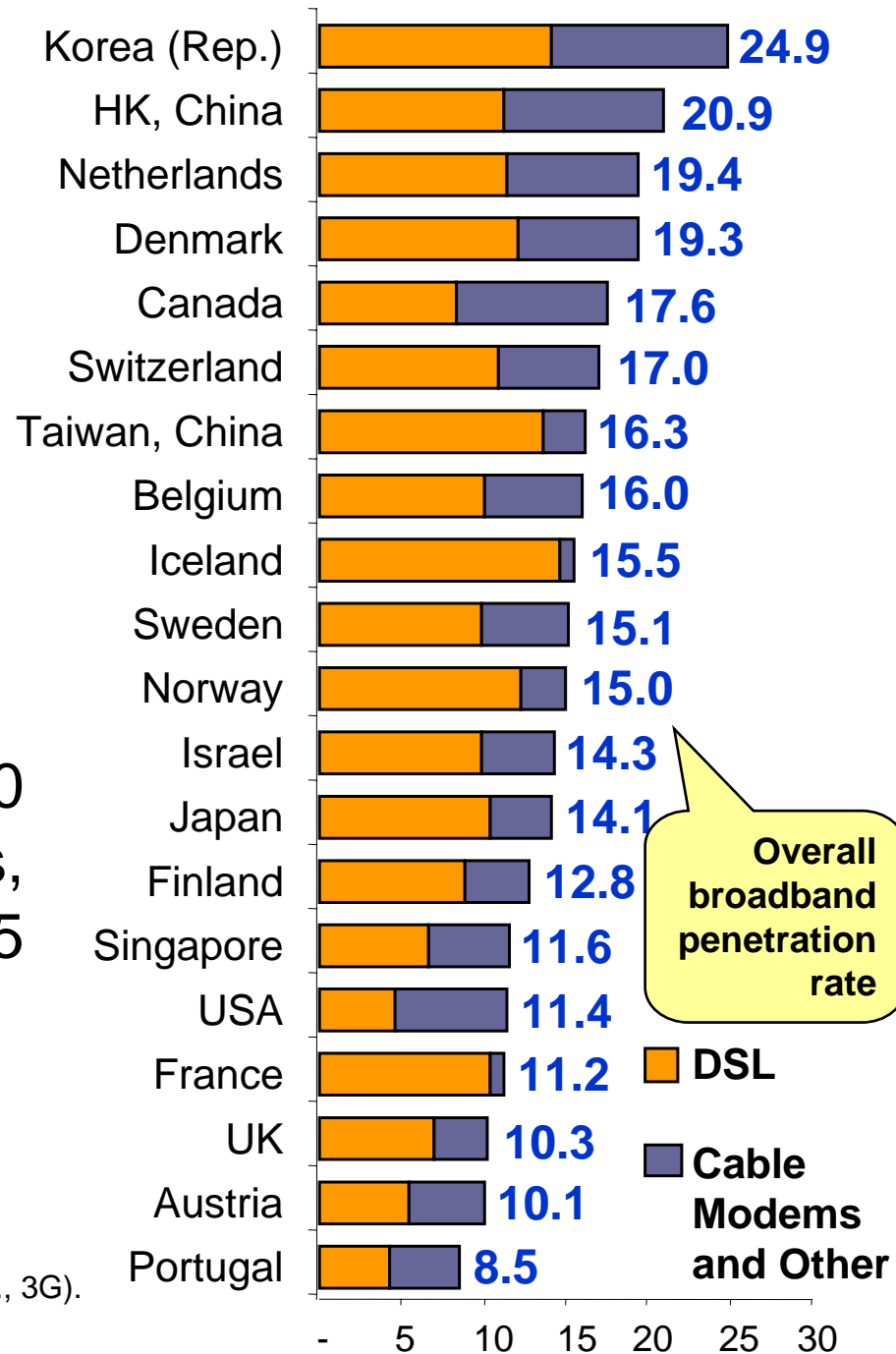X-axis: 0, 10, 20, 30, 40, 50, 60

Source: ITU Internet Reports 2005: The Internet of Things

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What's driving the market? (3) Broadband

Broadband subscribers per 100 inhabitants,
Top 20 nations, 1 Jan 2005

Overall broadband penetration rate

DSL

Cable Modems and Other

Korea (Rep.) **24.9**
HK, China **20.9**
Netherlands **19.4**
Denmark **19.3**
Canada **17.6**
Switzerland **17.0**
Taiwan, China **16.3**
Belgium **16.0**
Iceland **15.5**
Sweden **15.1**
Norway **15.0**
Israel **14.3**
Japan **14.1**
Finland **12.8**
Singapore **11.6**
USA **11.4**
France **11.2**
UK **10.3**
Austria **10.1**
Portugal **8.5**

- 5 10 15 20 25 30

Note: Figures used in slide do NOT include wireless broadband (e.g., 3G).
Source: ITU World Telecom Indicators Database.
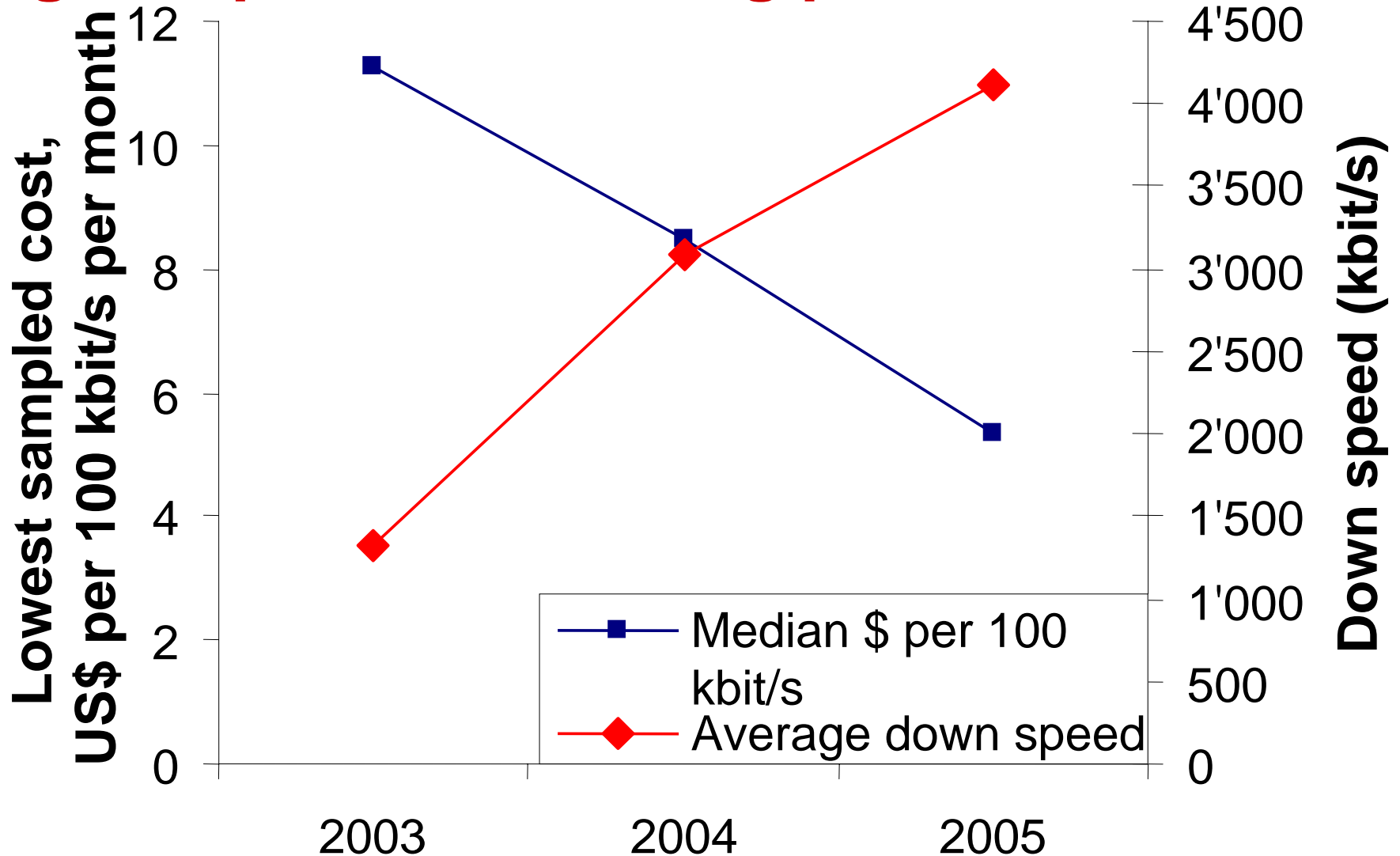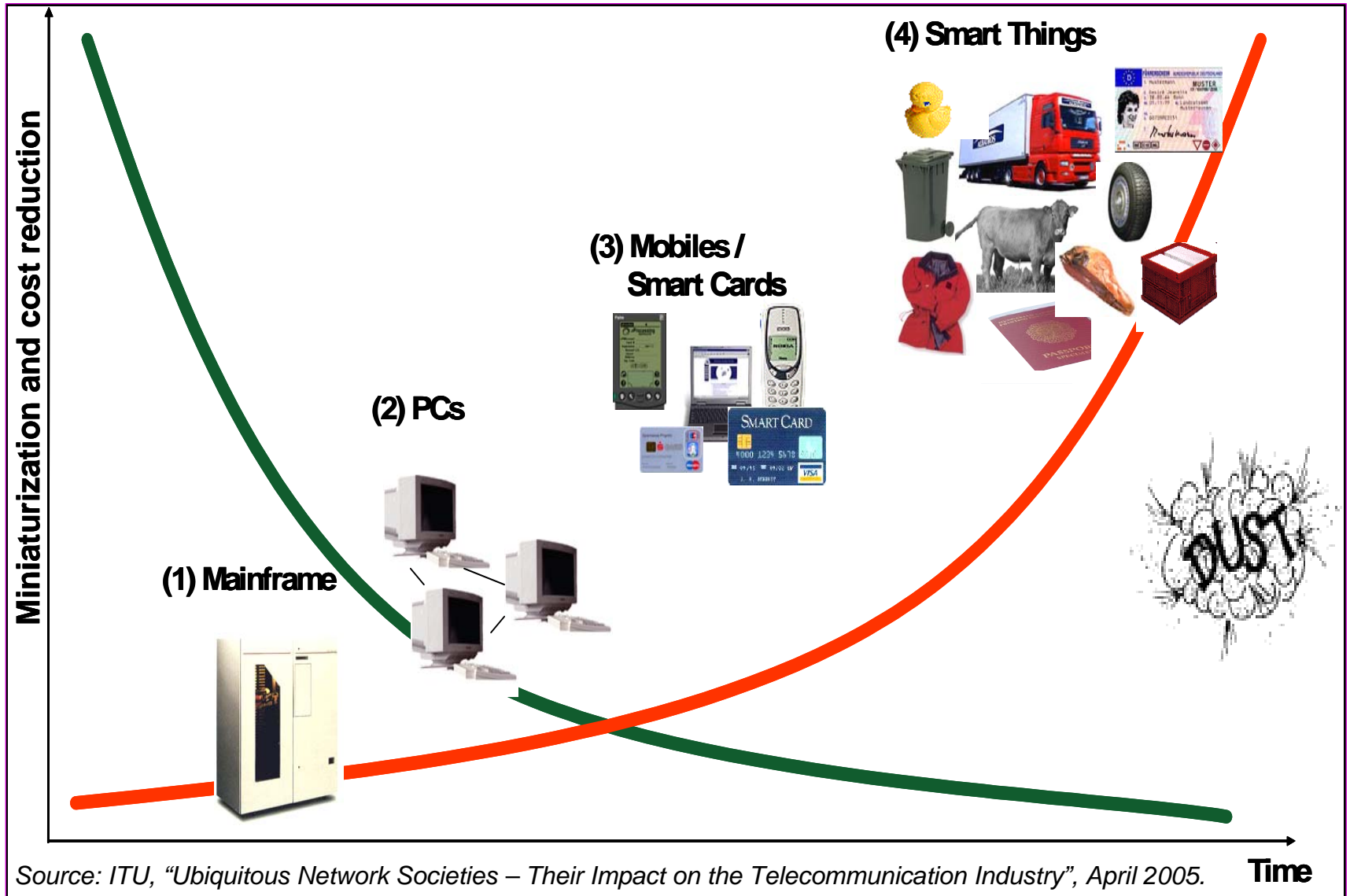
What's driving the market? (5)
"Miniaturization" of devices and prices

Miniaturization and cost reduction

(1) Mainframe

(2) PCs

**(3) Mobiles /
Smart Cards**

(4) Smart Things

DUST

Time

Four key technological enablers

- *T*agging **Things: R**FID
  - ➢ **enabling real-time identification and tracking**

- *S*ensing **Things: S**ensor **technologies**
  - ➢ **enabling detection of environmental status and sensory information**

- *T*hinking **Things: S**mart **technologies**
  - ➢ **building intelligence into the edges of the network**
  - ➢ **enabling smart homes, smart vehicles etc**

- *S*hrinking **Things: N**anotechnology
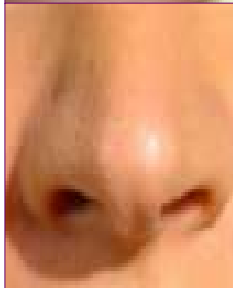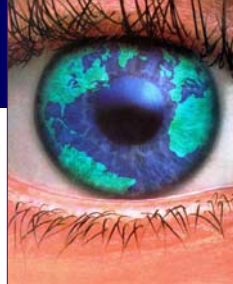 - ➢ **making possible the "networking" of smaller and smaller objects**

RFID multiplies network connections;
and maps the physical onto the virtual world
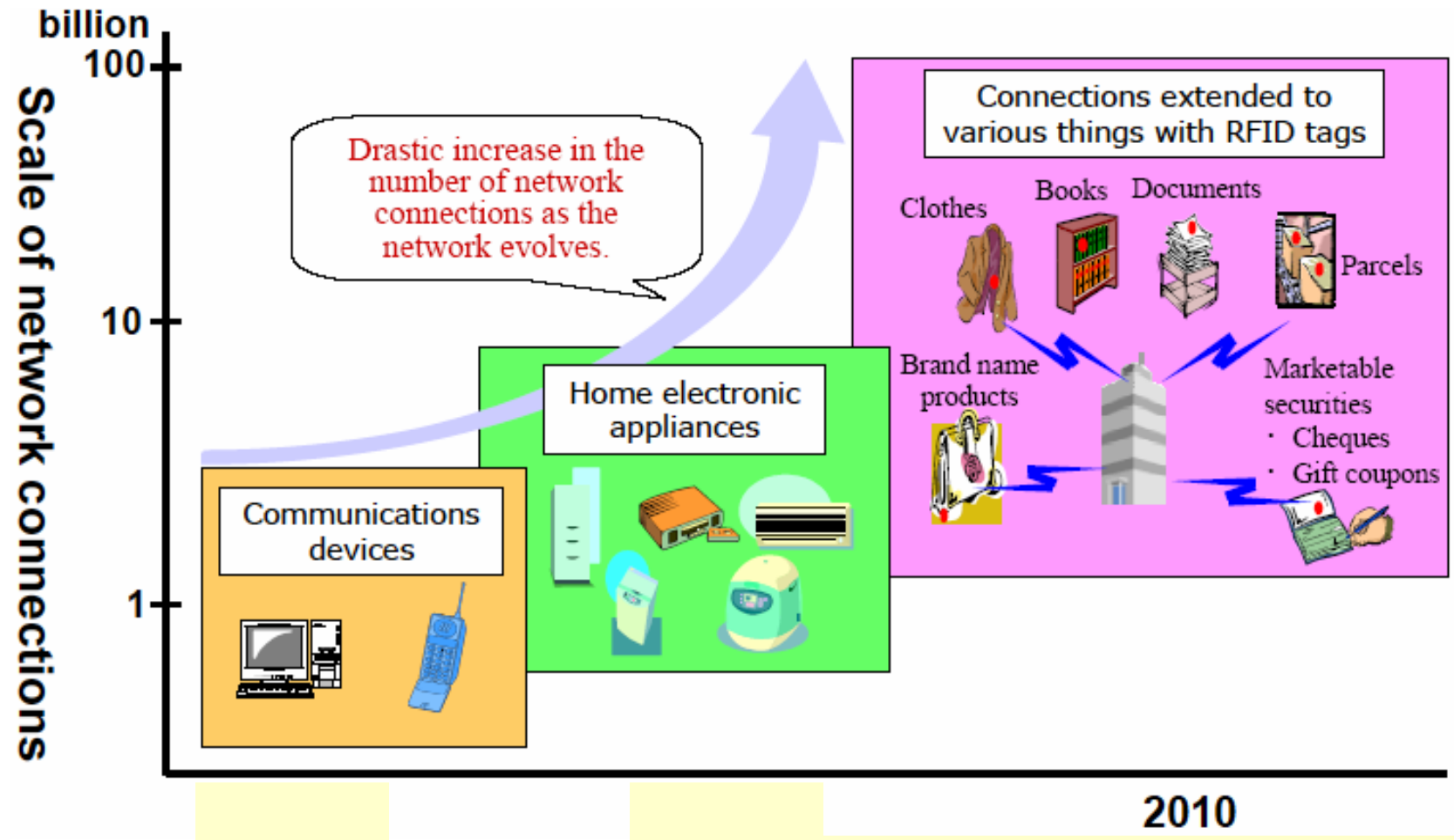
From RFID to sensors

- **Sensors detect context and humanise technological helpers**
  - **If RFID answers the question "what and where", a sensor might answer the question "how"**

- **A sensor detects, senses and/or measures physical stimuli,**
  - **e.g. motion, heat, speed, pressure, presence of bacteria etc…**

- **RFID combined with sensors enhance the data flow between objects**

- **Sensors can act as a further bridge between the physical and virtual worlds**

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Networks of wireless sensors can create environments increasingly sensitive to our needs…

Health care

Health management
(physical condition, movement)

Safety
(condition, location)

Climate, water quality
(rainfall, water quality)

Atmospheric pollution, vibration
(SOx, NOx, vibration)

Environmental risks

Security

Improved security, safety and comfort levels

Security, building status
(entry into building, strain, temperature, lighting, vibration)

Monitoring plant and equipment operation

Fires, toxic gas, equipment deterioration
(smoke, gas, strain)

Agriculture and production

Environment and crop growth
(growth rate, temperature, humidity, soil quality)

Apartment buildings

Fire, earthquake, flood, building failure
(smoke, temperature, vibration, strain, water level)

• Widespread distribution of a variety of different sensors
• Sensors configure themselves into ad-hoc networks
• Networks bring together various forms of environmental data and status information for use by advanced systems and applications
• No wiring required - reduces set-up costs

Distribution tracking

Distribution status, quality
(temperature, humidity, vibration)

Disaster response

Monitoring cities and countryside

Fire, landslide, liquefaction
(temperature, smoke, ground shift)

Monitoring structural integrity

Broken cables, loose bolts
(vibration, elastic waves)

Control center

Services

Other

Source: MIC (Japan)

…environments as intimate as our own body spaces (BAN)

- **A t-shirt might come equipped with sensors (**to measure e.g. temperature, respiration, rate, pulse,cardiogram**) and forward the collected data through a mobile network**

- **Such info can be forwarded to other devices like a watch,mobile phone or PDA**

- **Application areas: sport training, military, chronically ill patients, high fashion…**

Intimate sensors
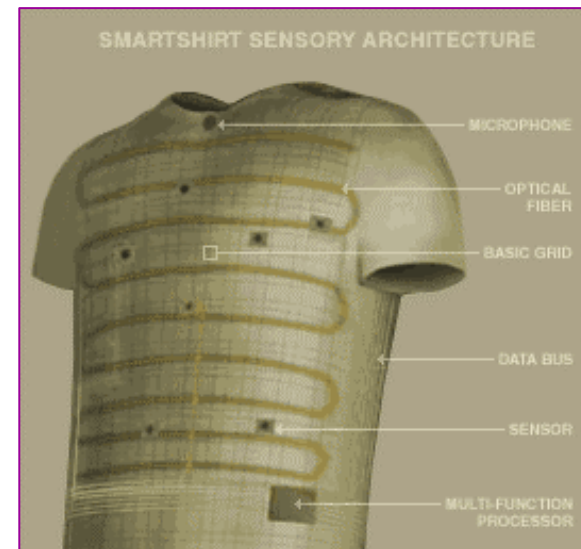
Source: Sensatex

A host of new uses for both RFID & sensors

- **For business**
  - ➢ **Transport and Logistics, e.g. SCM**
  - ➢ **Medical/Pharmaceutical Applications**
  - ➢ **Manufacturing, Agriculture**

- **For government**
  - ➢ **E-government**
  - ➢ **Defence and Security**
  - ➢ **e-health**

- **For the consumer**
  - ➢ **Personal welfare and safety, incl. Better access to healthcare and drug delivery**
  - ➢ **Sports, leisure and shopping**
  - ➢ **Shopping**
  - ➢ **Smart Lifestyles**

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Examples of the *Internet of Things* for the developing world

- **Nanotechnology**
  - ➢ **Water treatment, energy, agricultural productivity, pest control, drug delivery systems etc…**

- **RFID**
  - ➢ **Tracking items for export, e.g. beef tracking in Namibia**
  - ➢ **health care applications for remote/rural areas**
  - ➢ **Facilitating trade and facilitating innovation within the developing world (e.g. China & Wal-Mart)**

- **Sensors**
  - ➢ **preventing natural disasters**
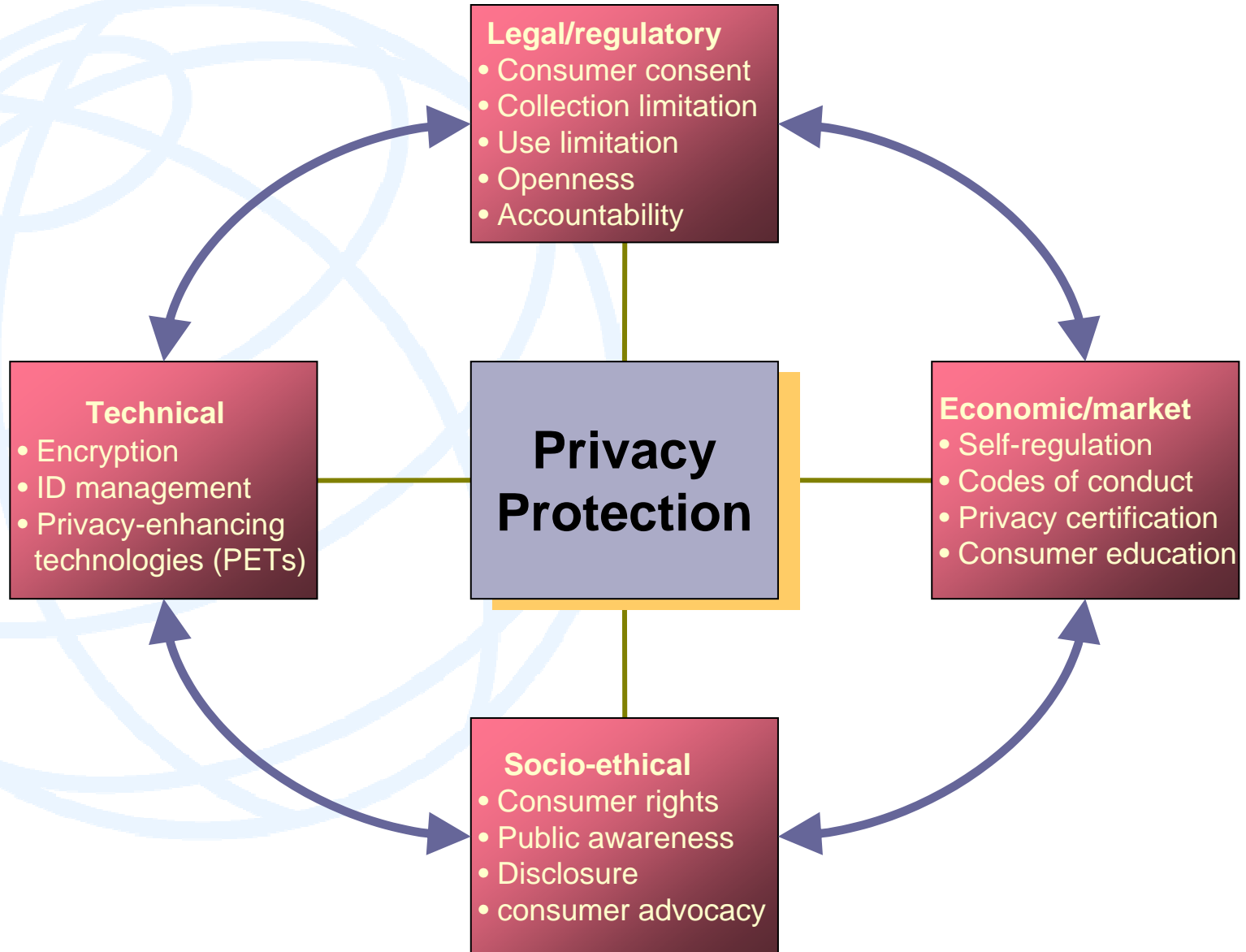 - ➢ **Improving health care delivery**

Important emerging policy challenges

- **Standards-setting and interoperability**
  - Harmonization required particularly in the area of transmission protocols
  - Competing tag formats: EPC and UCode
- **Governance of resources**
  - Who controls the unique identifiers?
  - More commercial value at stake than for the domain system?
- **Data protection and consumer privacy**
  - Information contained on tags should appropriately managed and controlled

Facets of privacy protection

Legal/regulatory
- Consumer consent
- Collection limitation
- Use limitation
- Openness
- Accountability

Technical
- Encryption
- ID management
- Privacy-enhancing technologies (PETs)

Privacy Protection

Economic/market
- Self-regulation
- Codes of conduct
- Privacy certification
- Consumer education

Socio-ethical
- Consumer rights
- Public awareness
- Disclosure
- consumer advocacy

Source: ITU Internet Reports 2005: The Internet of Things

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Towards a new digital ecosystem – the *Internet of Things*

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Source: ITU Internet Reports 2005: The Internet of Things
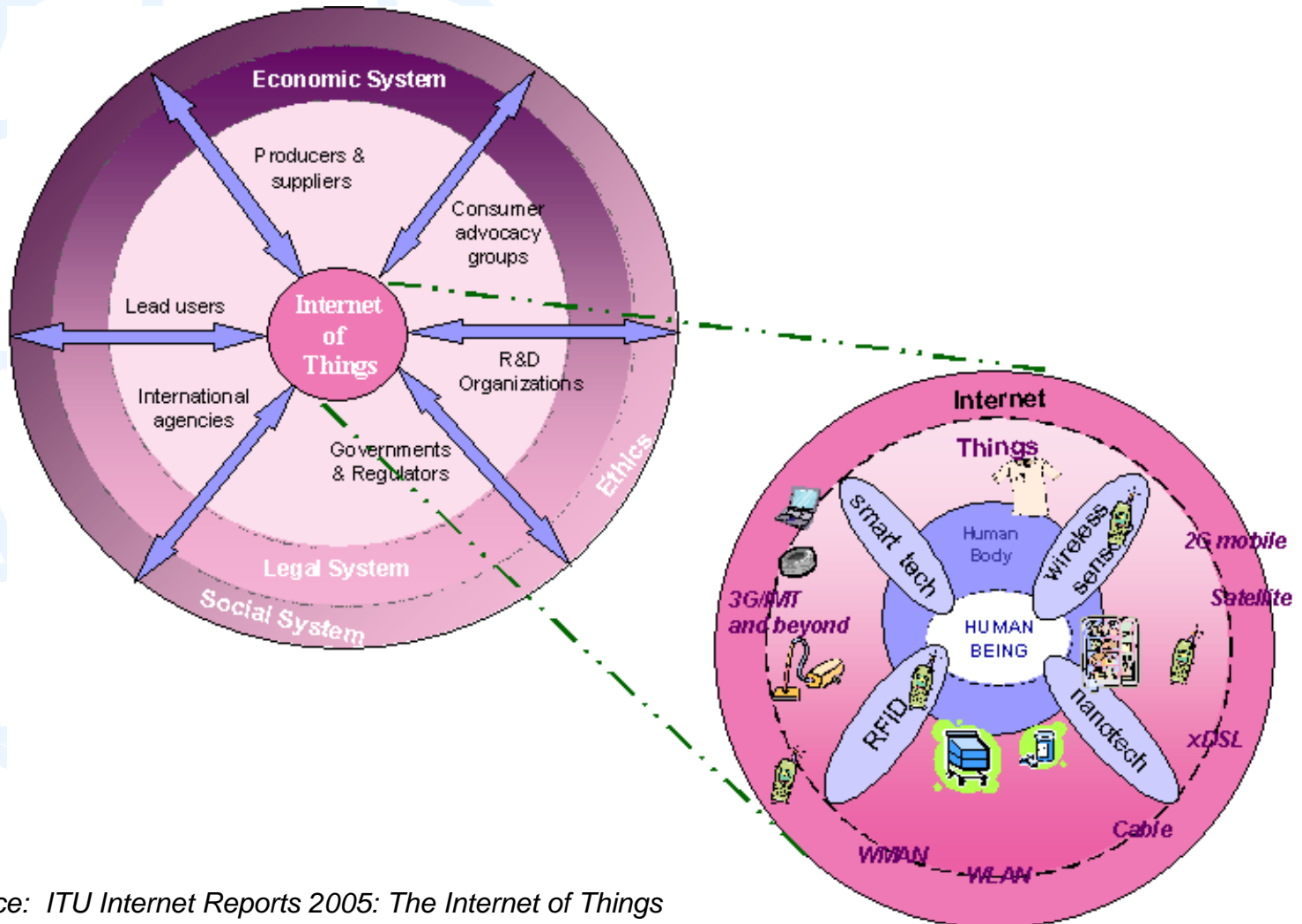
Thank you

The "Internet of Things" report is available at
http://www.itu.int/internetofthings

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