The changing face of cyberspace

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today's cyberspace…

- Started off as elite network for chosen few but now accessed by over a billion users worldwide

- Most people use the Internet for email/messaging and web surfing

- WWW increasingly used as the information resource of choice for adults and children alike

- Dial-up fading out to give way to broadband, through upgrading of copper networks (ADSL) and cable modems

…is rapidly evolving

- industry trends now point to the increasing use of "anytime/anywhere" radio technologies for internet access

  – explosion of mobile cellular networks

  – wireless broadband networks for nomadic users

- there is a growing use of multimedia in cyberspace (e.g. audio/video, iptv)

- an expectation of the "always on" status of users

- cyberspace becoming "ubiquitous" for users?

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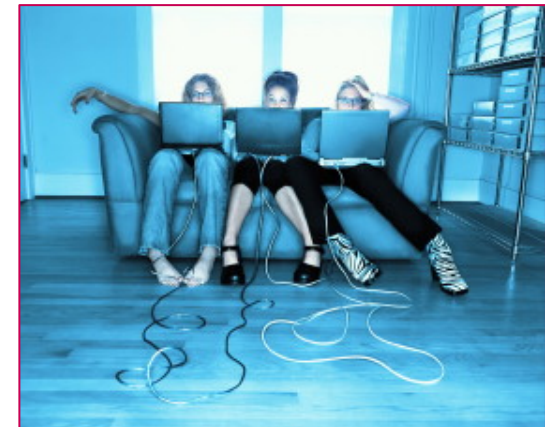
devices, too, are becoming ubiquitous

- laptops and palmtops, for example

- but more so, the mobile phone and its accessories

  - mobile handsets overtook fixed lines in 2002, on a global basis

  - the most "intimate" ICT device ever known

  - loss/theft causes panic and disruption!

  - a growing mirror of the self?
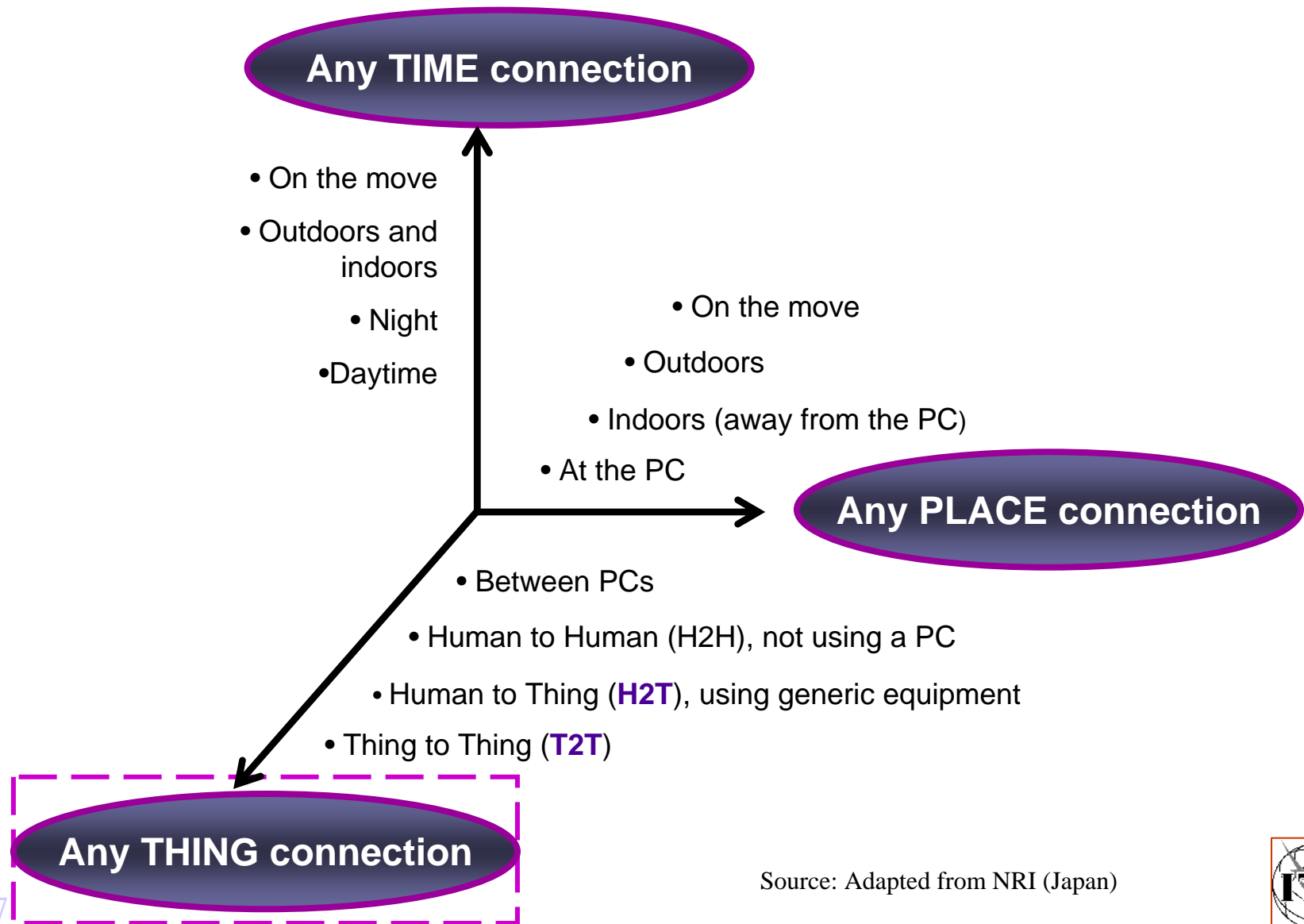
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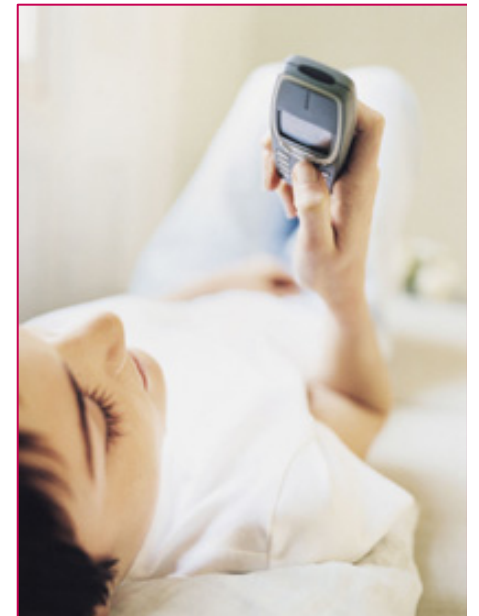
the ubiquity of radio

- The densest radio systems in the world are terrestrial radio and cellular
  - the ratio of radios to humans is nearing 1 to 1

- But we are soon entering a new era:
  - in which this ratio could exceed 1000 to 1

- Thus, radios would be all around us, becoming "ubiquitous" in the environment

- … thereby radically transforming the role of access technology
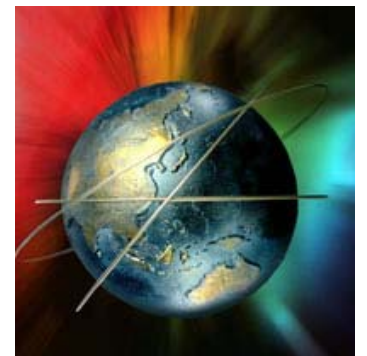
radio is fun to listen to, but that's not all

- radio enables "always on" connectivity that goes further still by connecting "things" (e.g. consumer items) to the network

- this is the vision underlying the concept of a "network of things"

    – As such, each thing would have its own "identity" in cyberspace

- i.e. the internet now connects computers to one another, but imagine if it could also connect computers to things, and things to other things

    – Thereby creating a "map" of the physical world in the virtual world

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it enables a 3rd 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)

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…leading to a paradigm shift in cyberspace

- this vision requires a paradigm shift in computing…
  - The ability to determine the status of everyday objects or thing in real-time
- …leading to paradigm shift in the nature of today's cyberspace
  - The complete mapping of the real world by the virtual world
- …combined with developments in miniaturization, this will further spur innovation in ubiquitous technologies and drive costs down
 - nanotechnology and the disappearing processor

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RFID is a key enabler for this shift

- the term RFID consists of two parts: *radio-frequency* (RF) and *identification* (ID)

- thus, RFID systems allow us to identify individual "things" in the environment

  - **typical system made up of reader, tag & middleware**

- RFID is not a new idea (first used in WW2), but its applications are very new

- RFID can wirelessly identify objects in real-time, without necessarily having line-of-sight
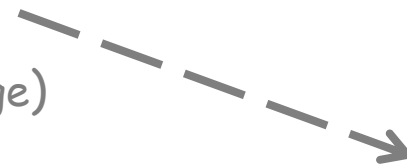
ITU
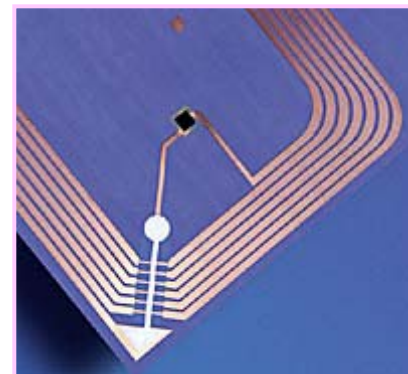
a big idea in a small package

Tag/Transponder
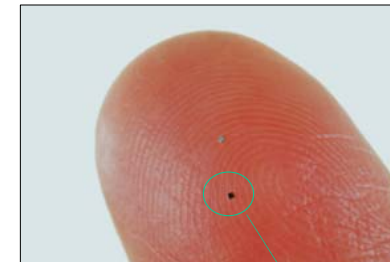located somewhere within this dark dot
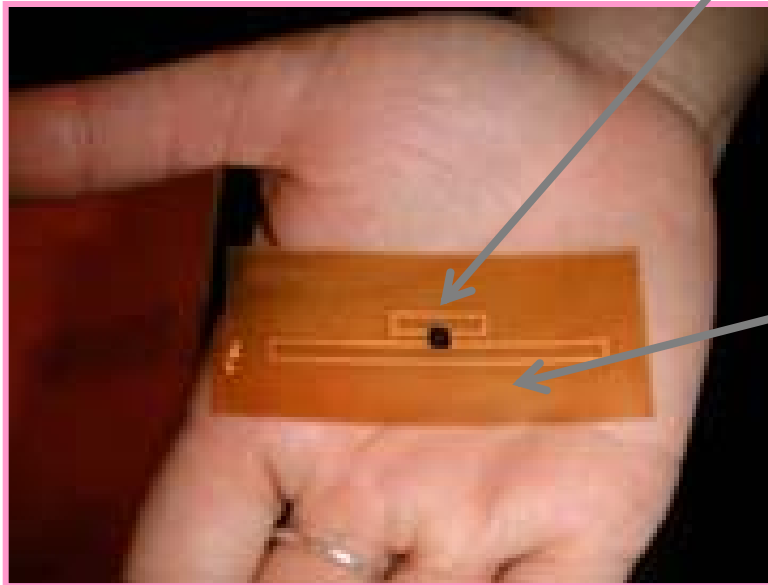
Some Hi-tech
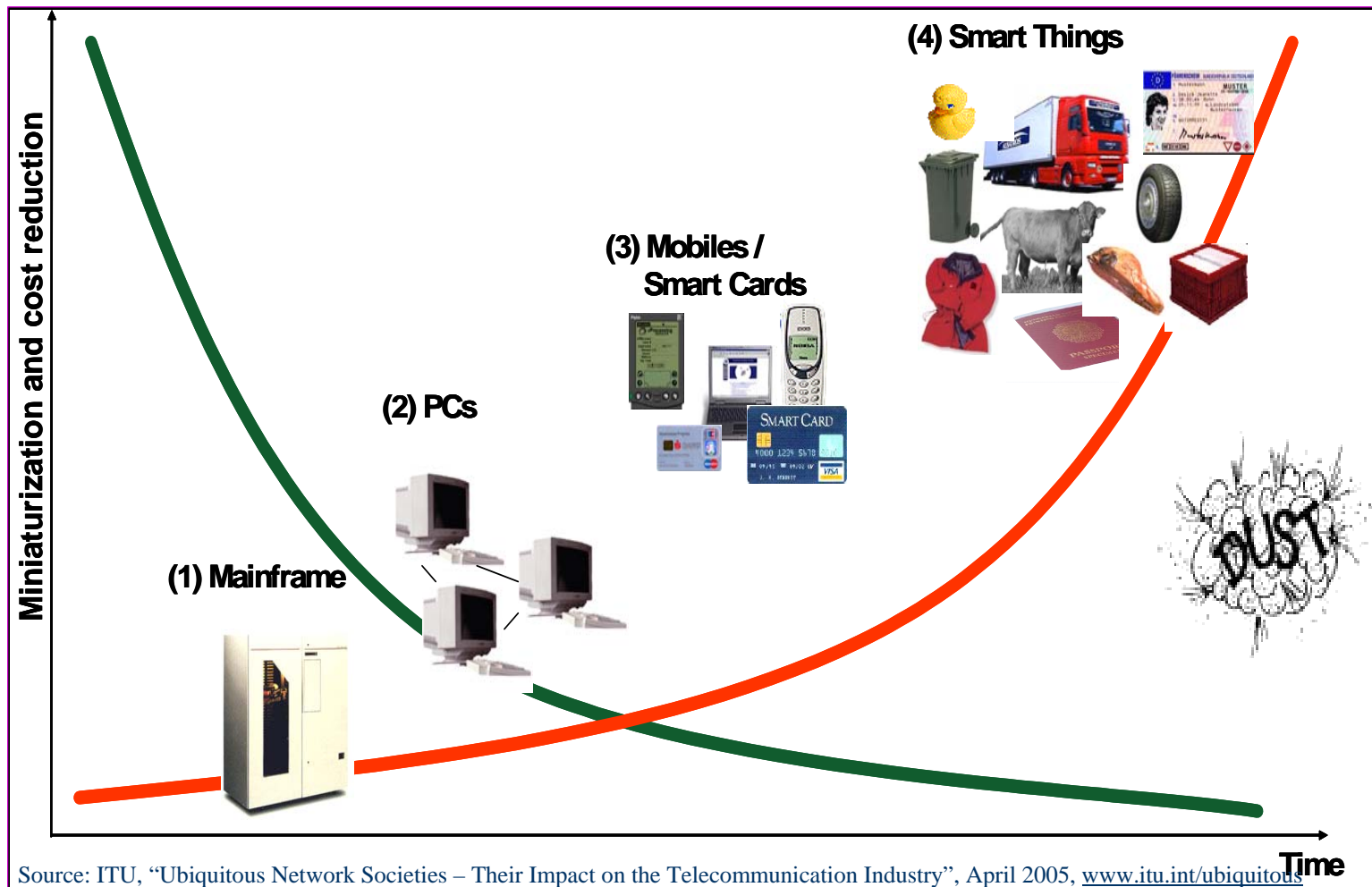Orange Material
For Display

Interrogator
(…waiting back stage)

and shrinking all the time…

- μ-Chip (Hitachi)
  - World's smallest at 0.4 mm x 0.4mm x 0.15mm
  - No power source (no battery)
  - Reading distance: approx 30 cm

approx. 50mm

- Scientists now working on developments to shrink computing power further
  - Nanotechnology and the disappearing processor
  - One day "**smart dust**"?

- Not science fiction – but bordering on science fact!
  - MIT, Berkeley etc… working on autonomous sensing and communications under a square mm

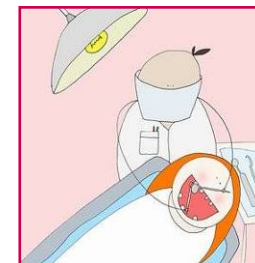- The linking of tinier and tinier things will increase network communications at a staggering scale
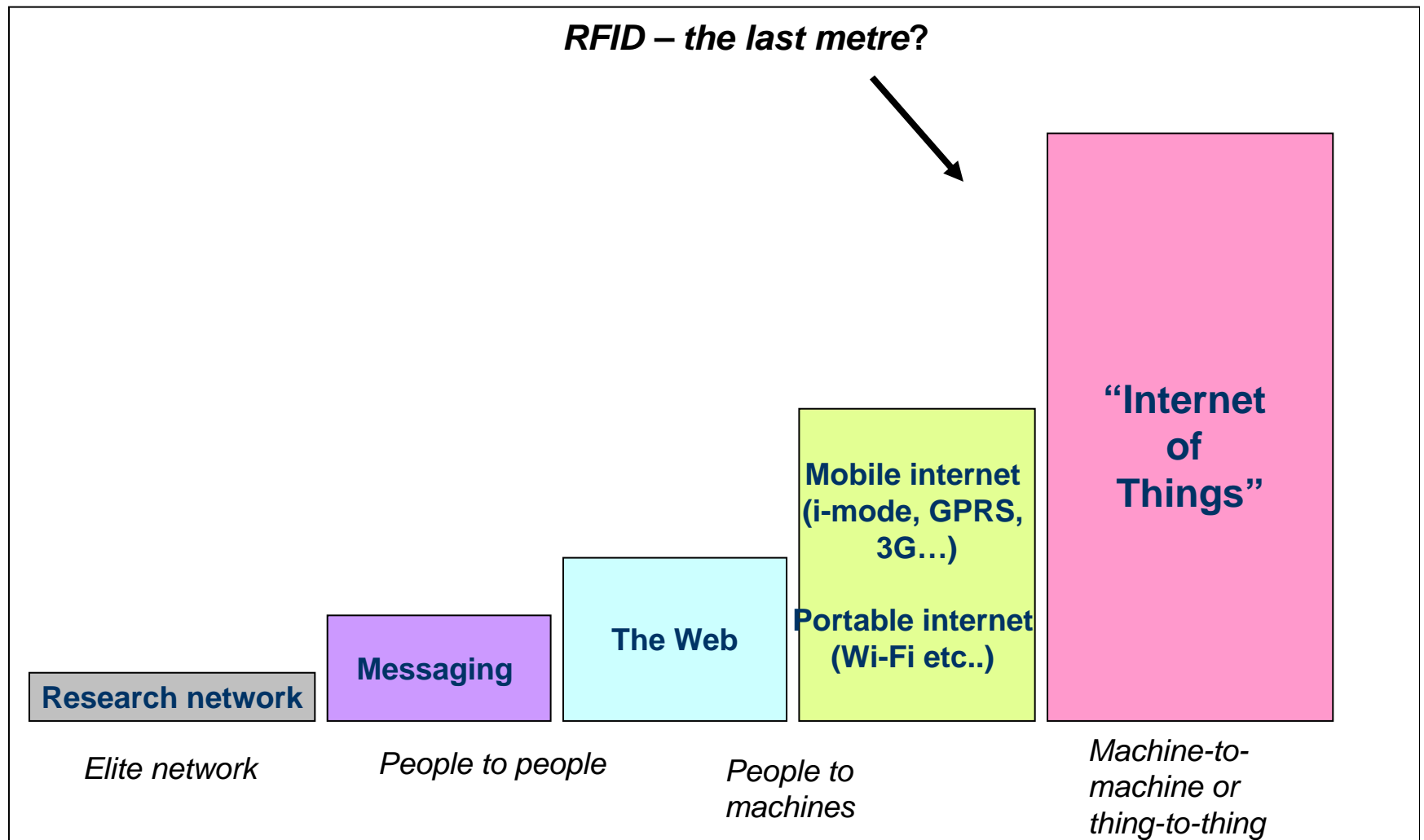
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shrinking size and shrinking cost

but expanding applications

for an expansion of cyberspace

RFID – the last metre?

"Internet of Things"

Mobile internet (i-mode, GPRS, 3G…)

Portable internet (Wi-Fi etc..)

The Web

Messaging

Research network

Elite network

People to people

People to machines

Machine-to-machine or thing-to-thing

Source: Adapted from ITU Ubiquitous Network Societies Workshop, Presentation Materials, "Ubiquitous Network Societies and their impact on the telecommunication industry", April 2005

like RFID, sensors are important enablers and complement tags

- sensors enable detection of environ-mental status & sensory information

- in combination with sensors, RFID can better track the status of things, e.g. their temperature, the presence of bacteria etc…

- sensors can replace human senses to monitor the environment

- as such, they act as a further bridge between the physical and virtual worlds

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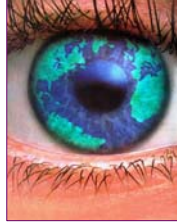
from tagging things, to tagging clothes, to tagging people?

- tagging money
- tagging passports
- tagging skin?
  - Baja Barcelona club, a pioneer?
  - For medical purposes?
  - Future uses?

Everyday items become networked

The Internet of Computing Devices

The Internet of Things

PCs

PDAs/Handhelds

IP Telephones

Barcode Scanners

Video Cameras

"Things" become networked by adding tags

Products	Cartons	Shipping containers
Pallets	Tires	Pharmaceuticals
People	Medical Assets	Pets
Rations	Livestock	Currency	Weapons

"Information" becomes networked by adding sensors

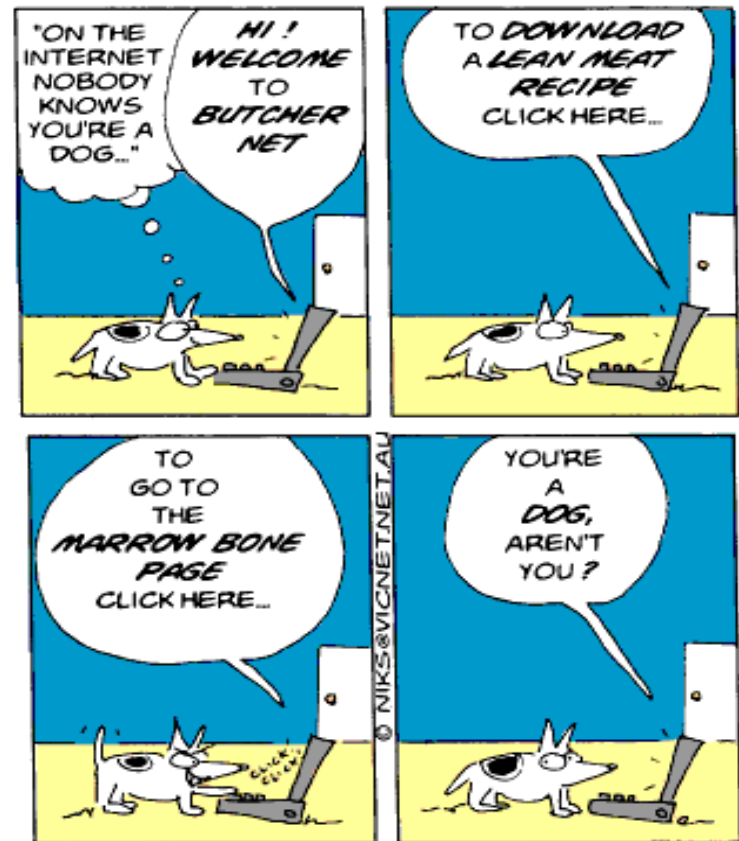| Temperature | Location |
Speed	Intrusion	Elevation
Direction	Shock/movement
Pressure	Light	Chemicals

Source: Peter Tomsu, , Cisco, ITU-T RFID Workshop, Feb 2006
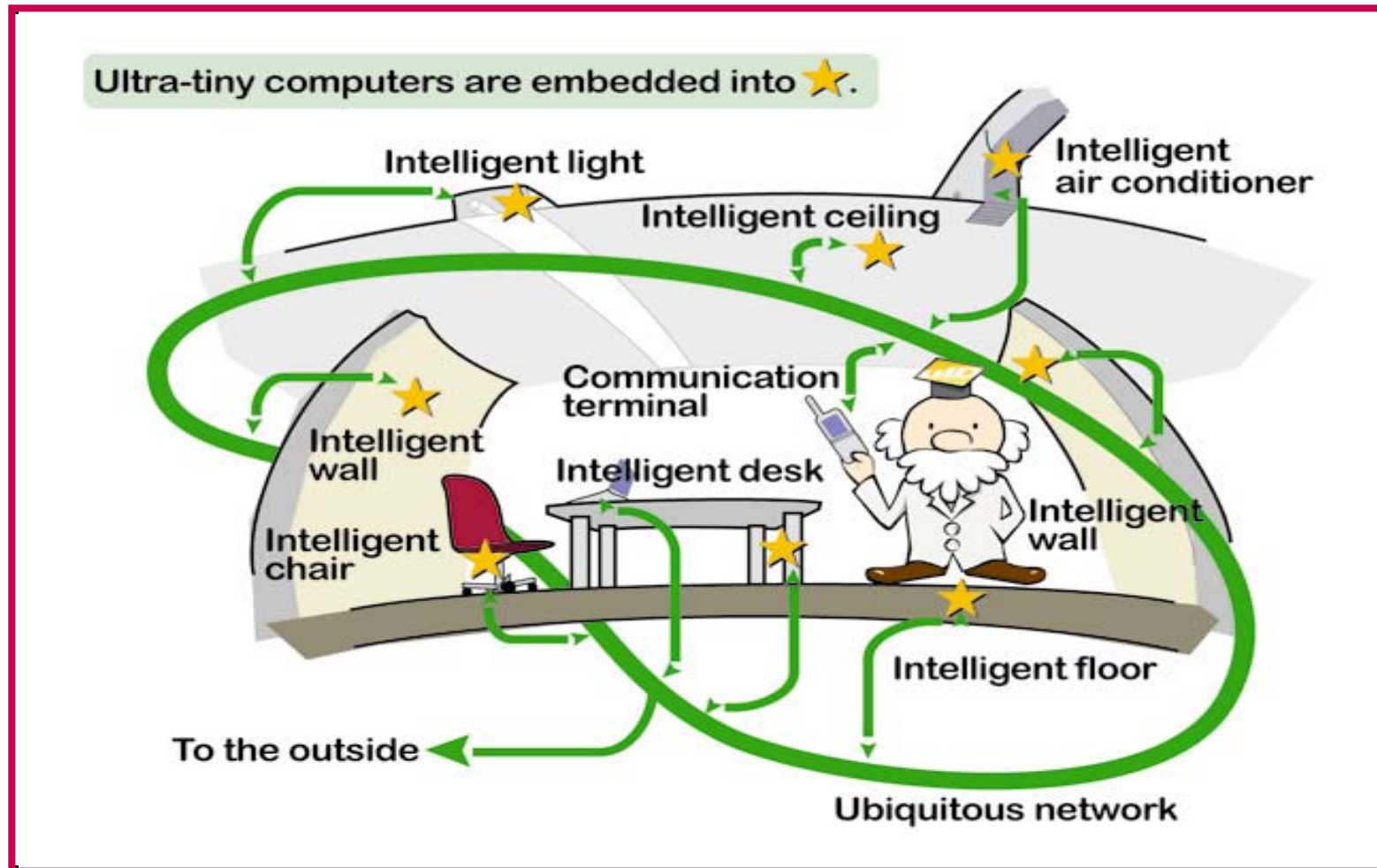
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learning new tricks

the old joke

the new joke

"On the Internet, nobody knows you're a dog."

on the internet,
nobody knows you're a dog

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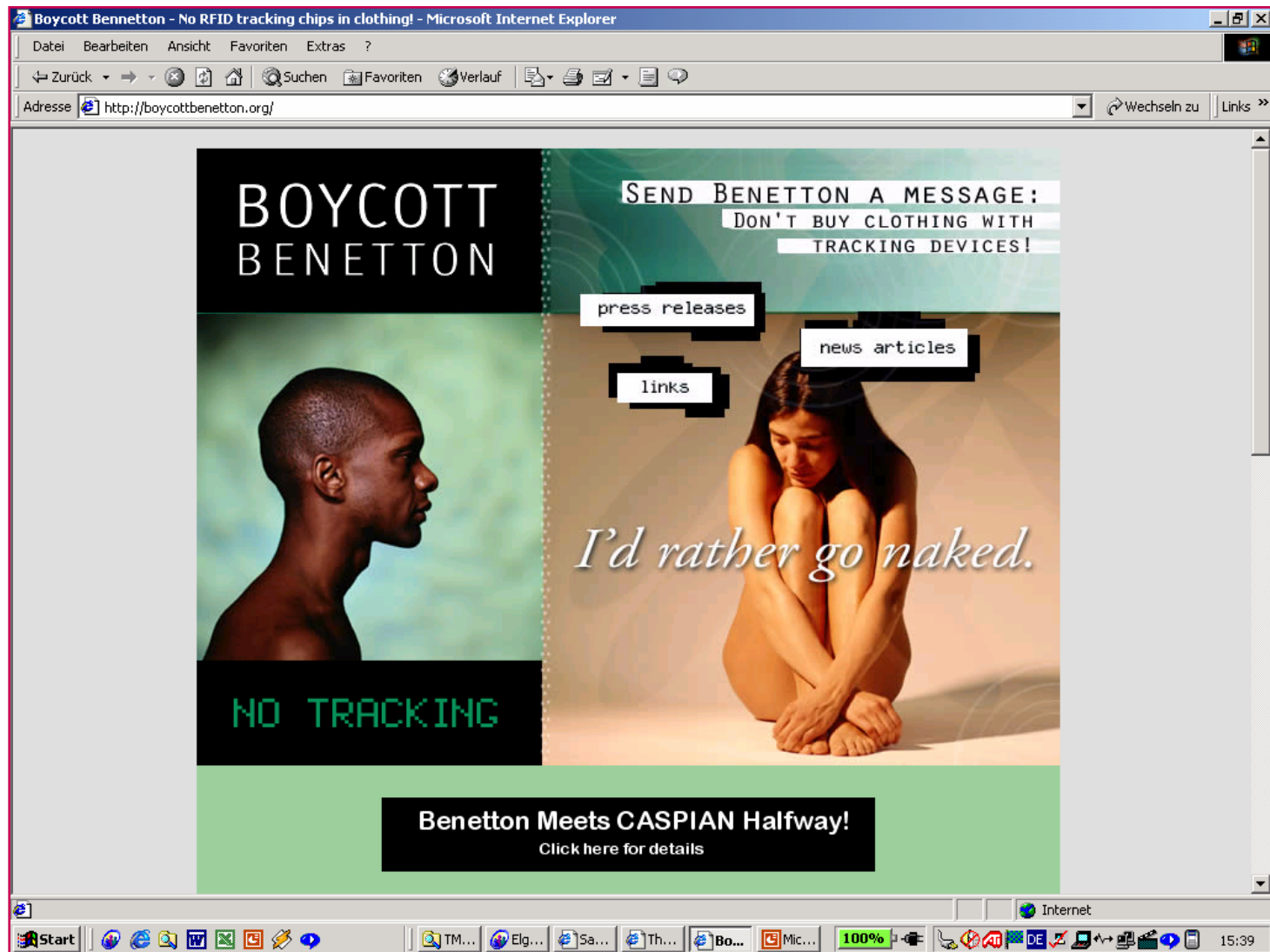# networks and computing intelligence become ambient

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so, what if ?

- Personal information and digital footprints also become "ubiquitous"
- And with the drop in cost of digital storage, no economic incentive to delete anything!
- RFID has already been plagued by delays due to consumer concerns
- Public sector has begun addressing the problem
  - e.g. EU Data Protection WP, Japan's RFID Guidelines

- How to avoid a privacy divide?
  - e.g. phenomenon of the supermarket loyalty card

- And there remains a lack of clarity
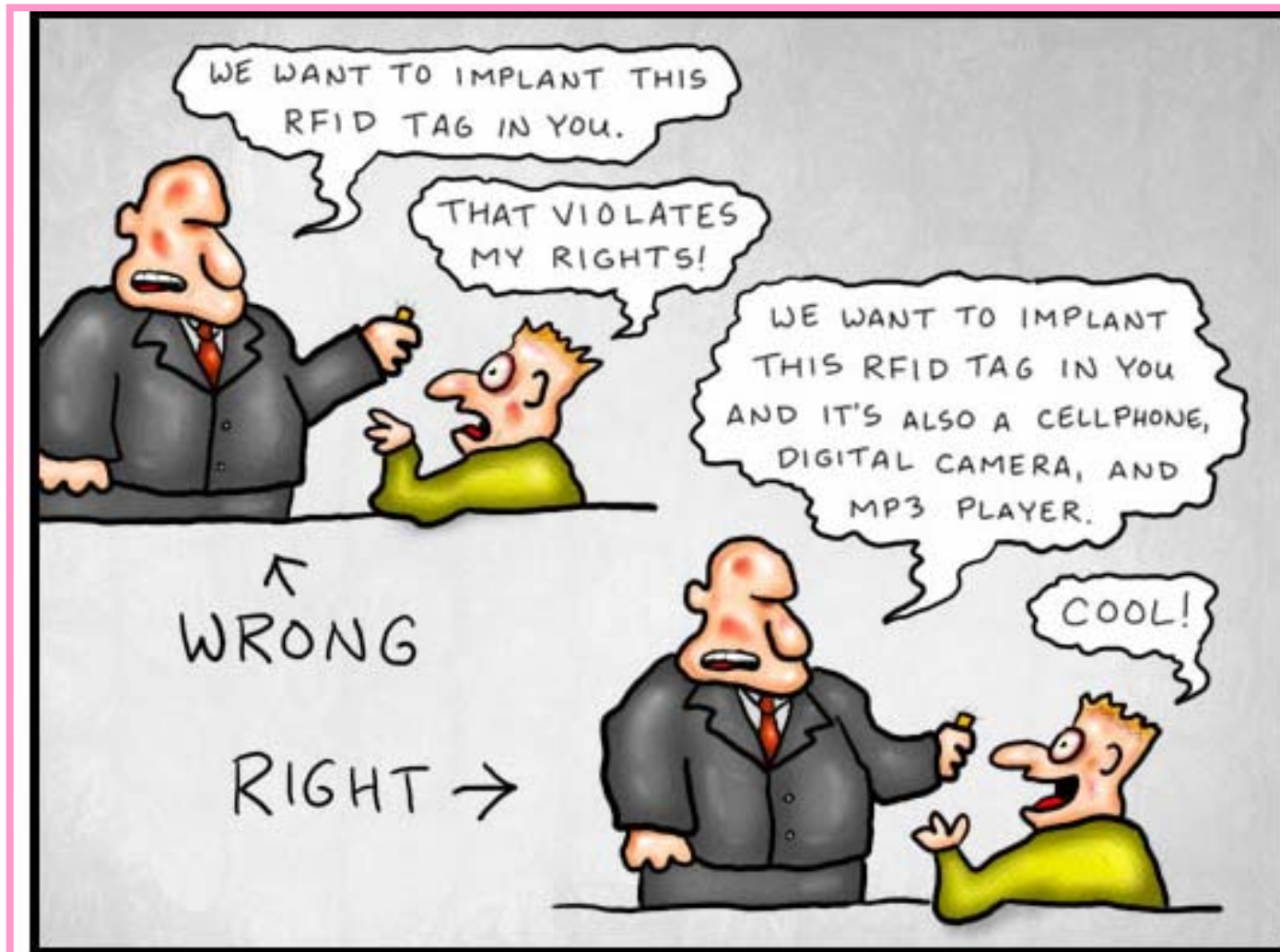 - How to convince users to take up the technology
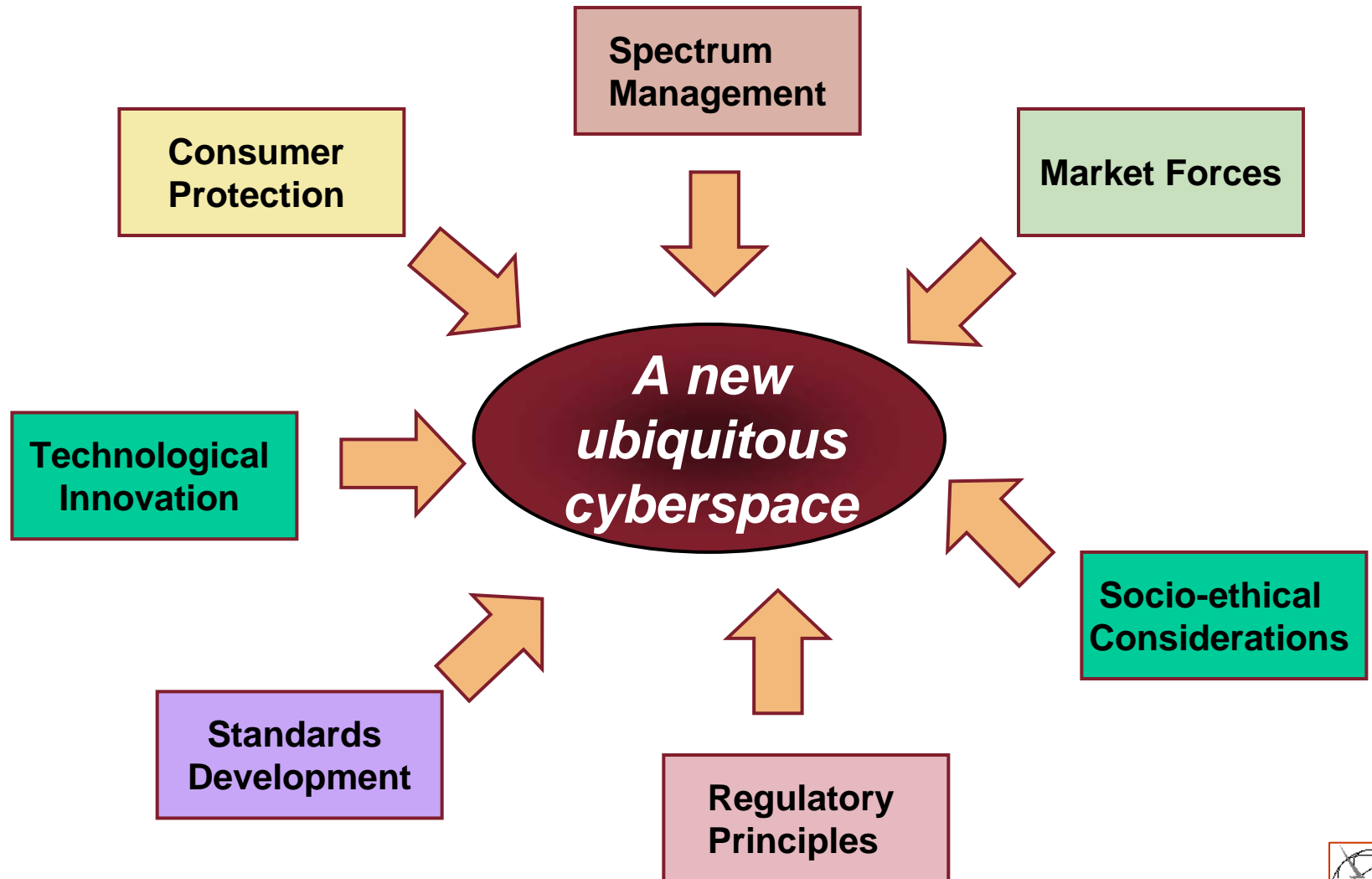
on the demand side: the boycott

on the supply side:
is this the whole answer?

many forces at work

Spectrum Management

Consumer Protection

Market Forces

Technological Innovation

A new ubiquitous cyberspace

Socio-ethical Considerations

Standards Development

Regulatory Principles

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important challenges

- ## Standardization at a global level
  - ### Standardization remains fragmented
    - not only in networking protocols,
      but also for tag formats (EPC, uCode…)
    - standardization for authentication/privacy needed

- ## Governance of Resources
  - ### Who owns the identifiers?

- ## Thwarting technological colonization
  - ### ensuring that cultural differences are respected

- ## Consumer protection
  - ### Data protection, privacy, health issues
  - ### Cybersecurity
    (e.g. network security, spam)

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techno-social implications

- environment of surveillance
- monitoring of human behaviour
  - if all actions are recorded/traceable, guilty until proven innocent?
  - will legal system adapt?
- effect on individuality, self-expression, and decision-making
- role of human intimacy and traditional forms of human communication

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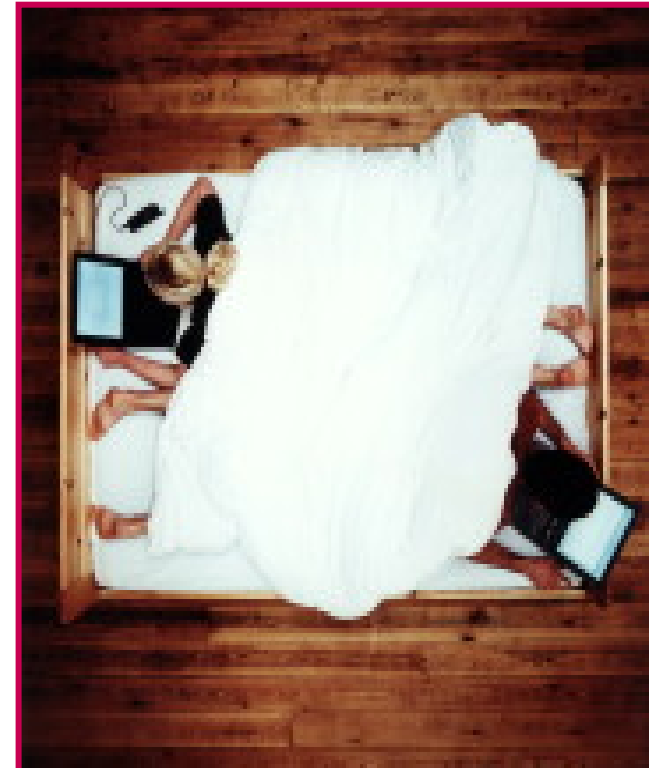
shifting the "faustian bargain" of technology in our favour

- every new technical development creates "tensions" between old and new

- but the "fever" and excitement of innovation often leaves little space for discussion of long-term consequences

- important to identify 'traditional' features that are irreplaceable and may potentially be hampered by technology, and devise means of protecting them

- limits of new technologies must be known in order to fully take advantage of their benefits
  - in the "design" phase, rather "deployment" stage

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from the mobile phone to the radio tag:
technology as extension of the self…
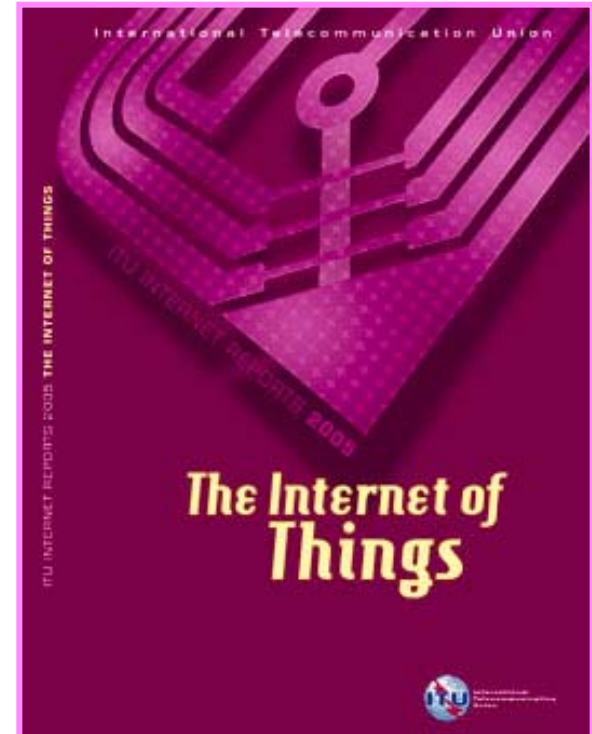## *a new organic network*?
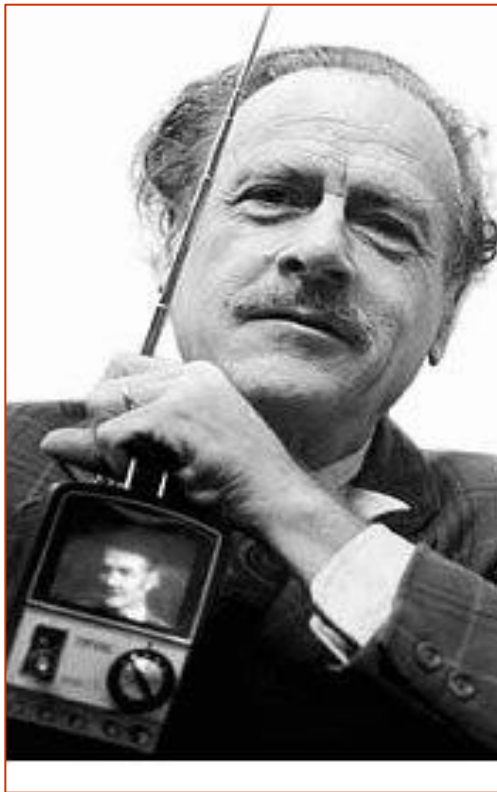
In the electric age, we wear all mankind as an extension of our skin

- Marshall McLuhan

t h a n k   y o u

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ITU Internet Report 2005 on "<u>The Internet of Things</u>" launched at the *World Summit on the Information Society*, Tunis, November 2005

www.itu.int/internetofthings

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