The network of the future: What's over the horizon

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industry transitions

- from static market environments to dynamic fast-paced innovation
- from low-speed to high-speed
- from “divergence” to “convergence”
- from local to global
- from fixed to mobile
- from sometimes-on to always-on
- from one medium to multimedia
- from distinct to bundled

growth of multimedia services

- Multimedia services being delivered on a variety of platforms
  - TV
  - PCs
  - Mobile phones
  - PDAs...
- In a variety of ways (thanks to high-speed network infrastructure)
  - Live streaming
  - Downloads, e.g. peer-to-peer

trends towards the ubiquity of networks

- In addition, the availability of technology is on the rise
  - 2 billion mobile phones
  - 1 billion internet users
- Developments under way to take this further:
  - Towards universality, i.e. bridging the digital divide and providing access for “anyone” and “everyone”
  - Towards ubiquity, i.e. creating a network available “anytime” and “everywhere”

some current challenges for industry players

- Declining ARPU/average revenue per subscriber
  - e.g. mobile operators
- Saturation of traditional markets
- Introduction of new services and channels for delivery
- Multiple services, multiple providers
  - Different environments, different notions of business strategy and service delivery

Ongoing shift to all-IP networks

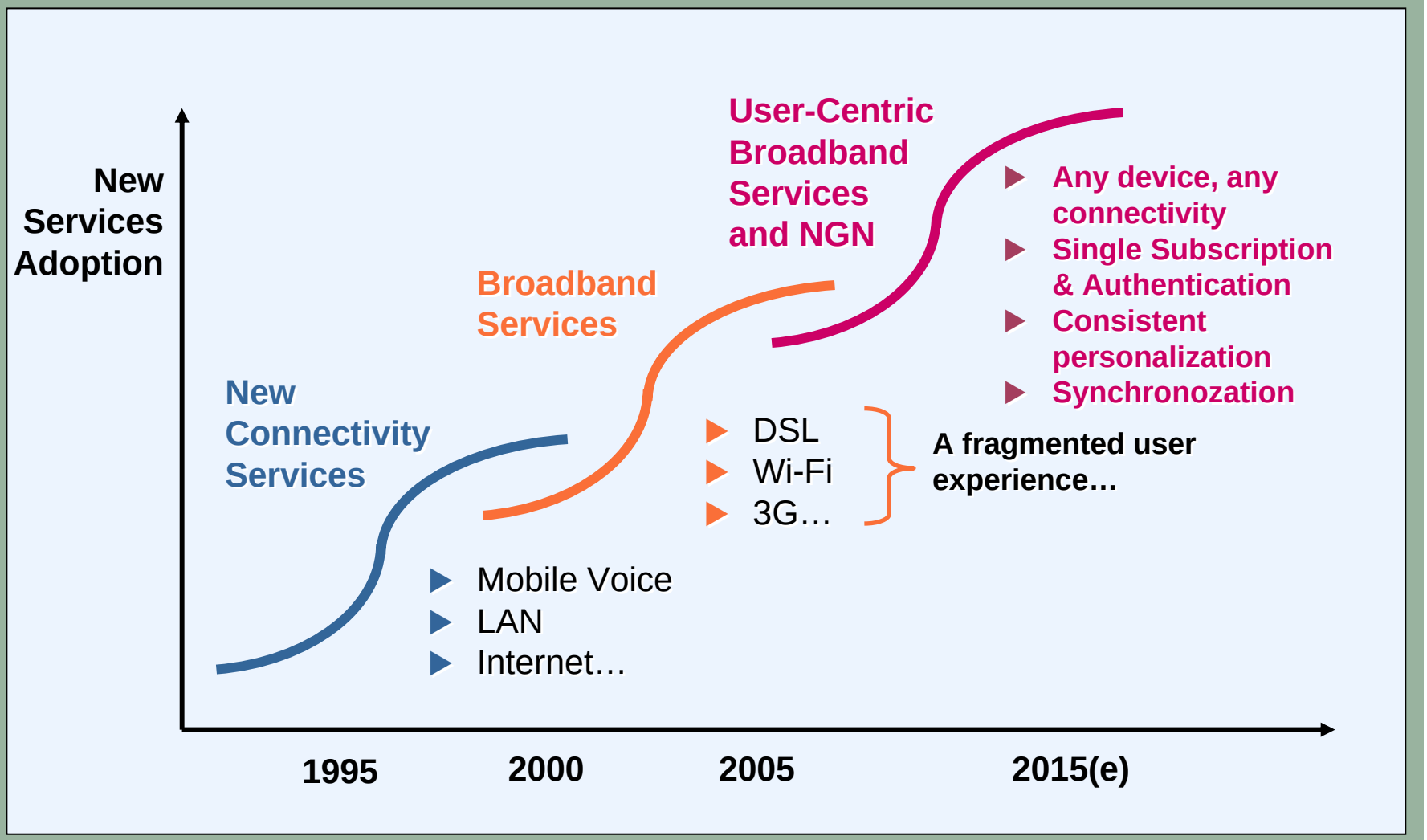
- Trend away from circuit-switched networks to packet-based networks
- Next generation networks will have the capability of carrying voice, data, video, multi-media over the same network
- Users will be connected through multiple access networks based on different technologies (optical fibre, coaxial cables, and WLAN, 3G networks)
  - but all networks will speak the same language, the language of “IP”

Some characteristics of Next Generation Networks (NGN)

- Packet-based transfer
- Decoupling of service provision and network
  - creates opportunities for those service providers, who do not own content, to offer content/applications
- Broadband capabilities with end-to-end QoS, transparency
- Inter-working with legacy networks
- Generalized mobility
- Unrestricted access by users to different service providers
- Unified service characteristics, i.e. perception of “same service” by users

Source: ITU Study Group 13

NGN - The third wave?



Source: Adapted from Souheil Marine, Alcatel

Ubiquitous Networks and Ubiquitous Computing

- Ubiquitous computing
  - Embedding computational power into everyday items
  - "intelligence" moves to the edges
    - e.g. smart objects/structures, intelligent appliances
- Ubiquitous networks
  - always-on, anyone, everywhere network access
  - Giving network access to "anything"
  - In this way, everything becomes 'networked'
  - NGN networks will most likely be the core/backbone infrastructure for deploying ubiquitous networks

Making networks ubiquitous: 4 key technological enablers

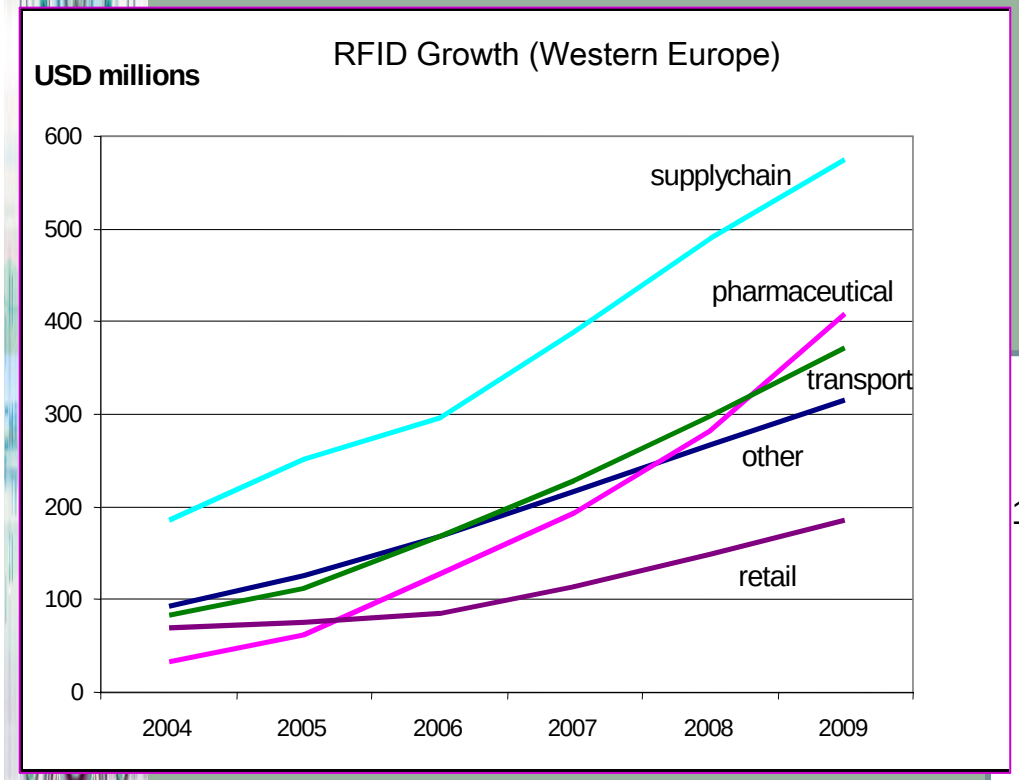
- *Tagging* Things: RFID
  - enables real-time identification and tracking
- *Sensing* Things: Sensor technologies
  - enables detection of environmental status and sensory information
- *Thinking* Things: Smart technologies

  (e.g. those enabling smart homes, smart vehicles etc.)
  - build intelligence into the edges of the network
- *Shrinking* Things: Nanotechnology
  - makes possible the "networking" of smaller and smaller objects

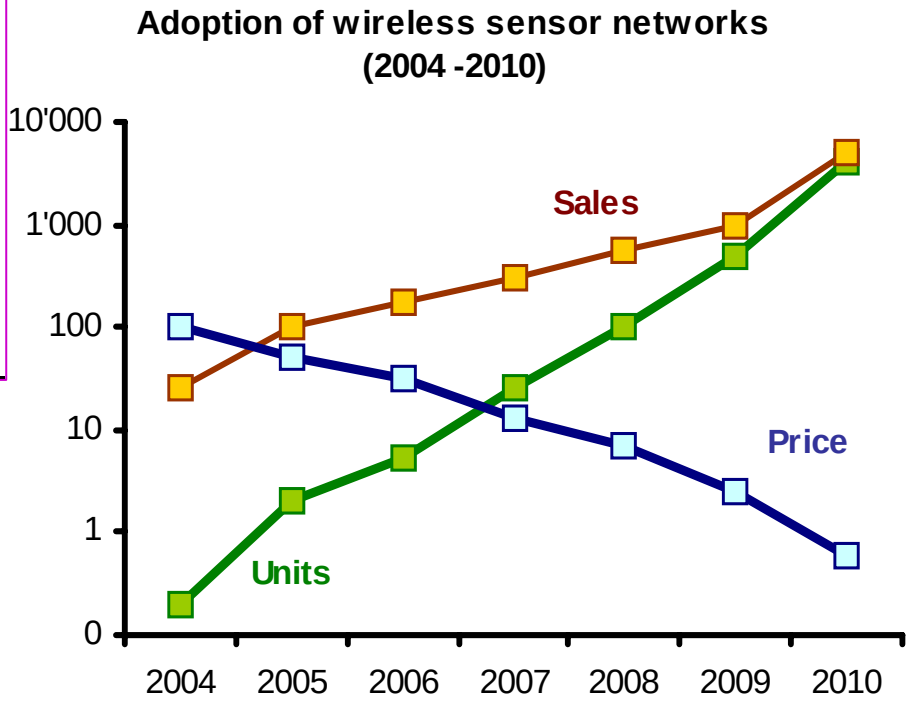
tomorrow's radio: everywhere

- 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
- radios would be all around us, becoming "ambient" in the environment
- ... thereby radically transforming technology access
  - Making it "indistinguishable" from daily life

growth of radio & sensors

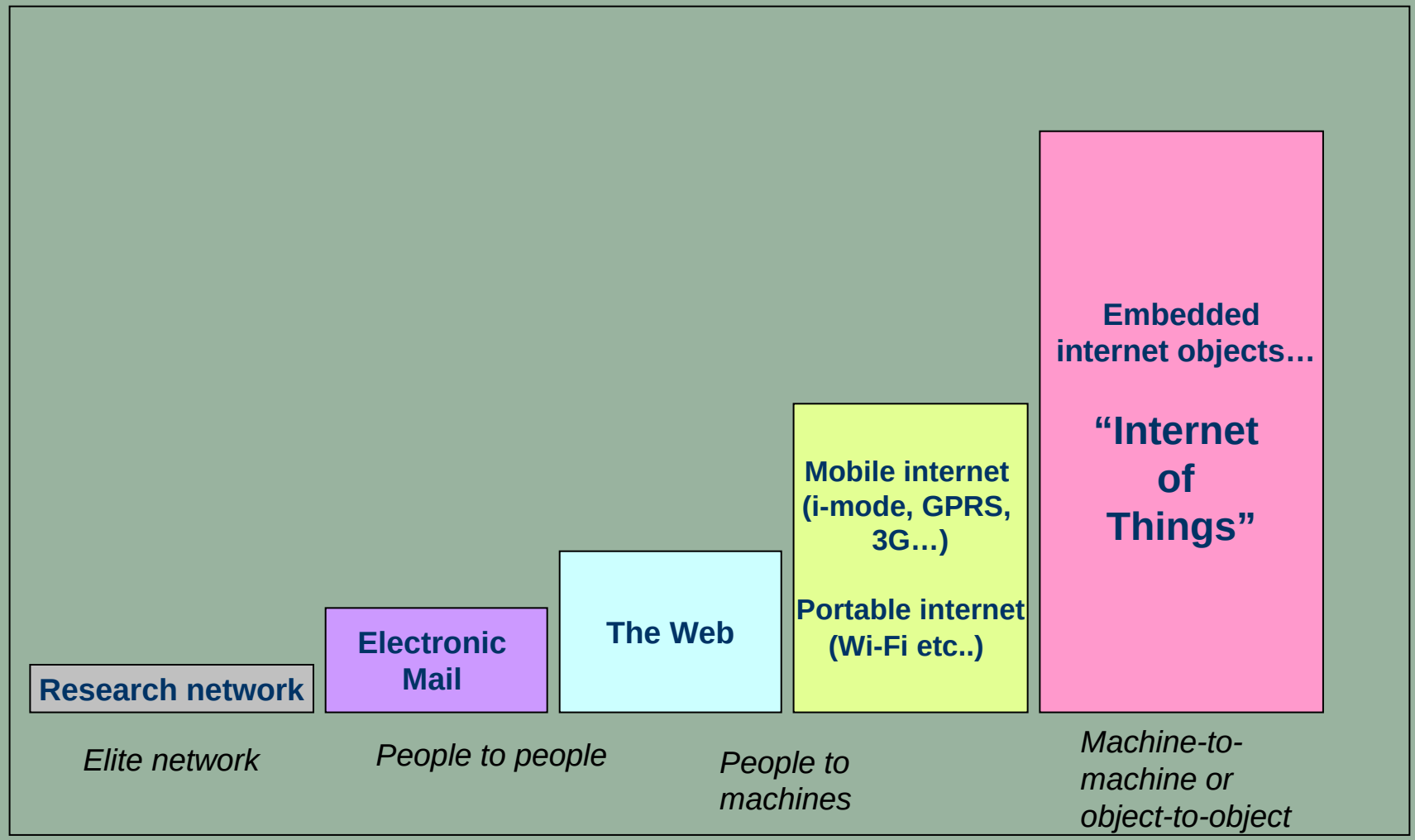


Source: ITU Internet Reports 2005: The Internet of Things, adapted from Juniper Research



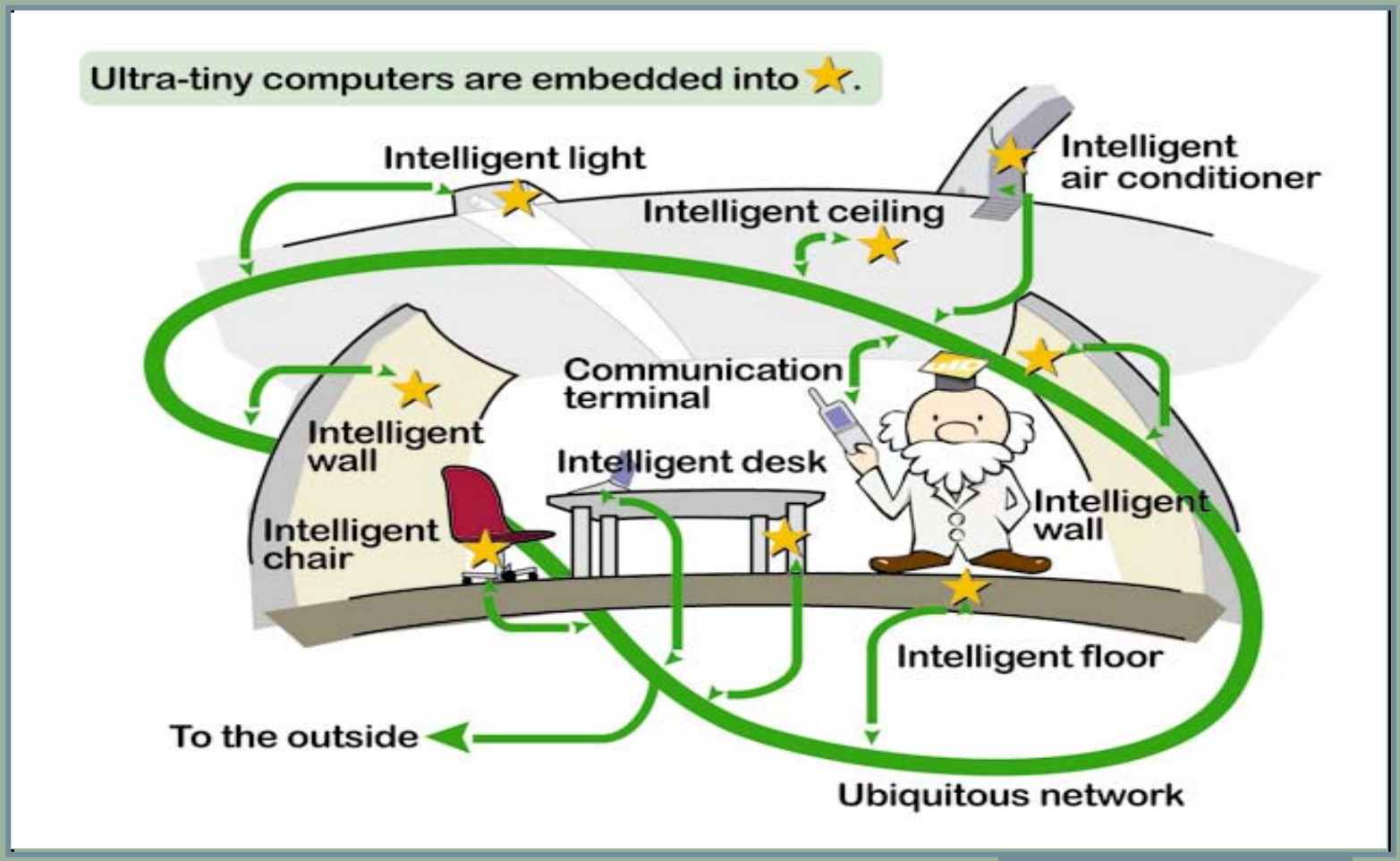
Source: ITU Internet Reports 2005: The Internet of Things, adapted from Harbor Research

the changing nature of cyberspace?



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

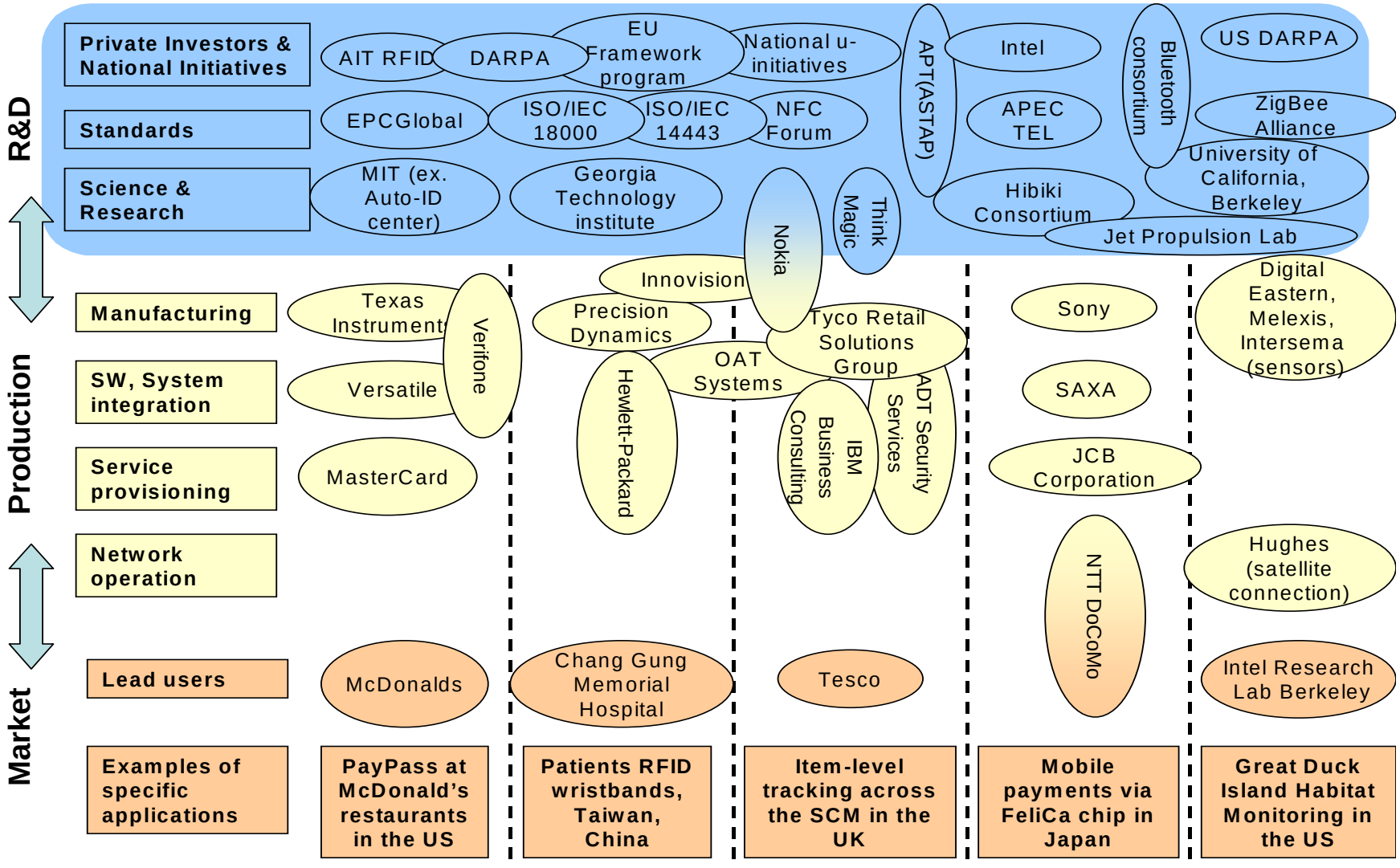
intelligence for “smart spaces”



Source: Ubiquitous ID Center

many players, many revenue streams, many bottom lines

Source: ITU Internet Reports 2005: The Internet of Things



Billing: what we're used to

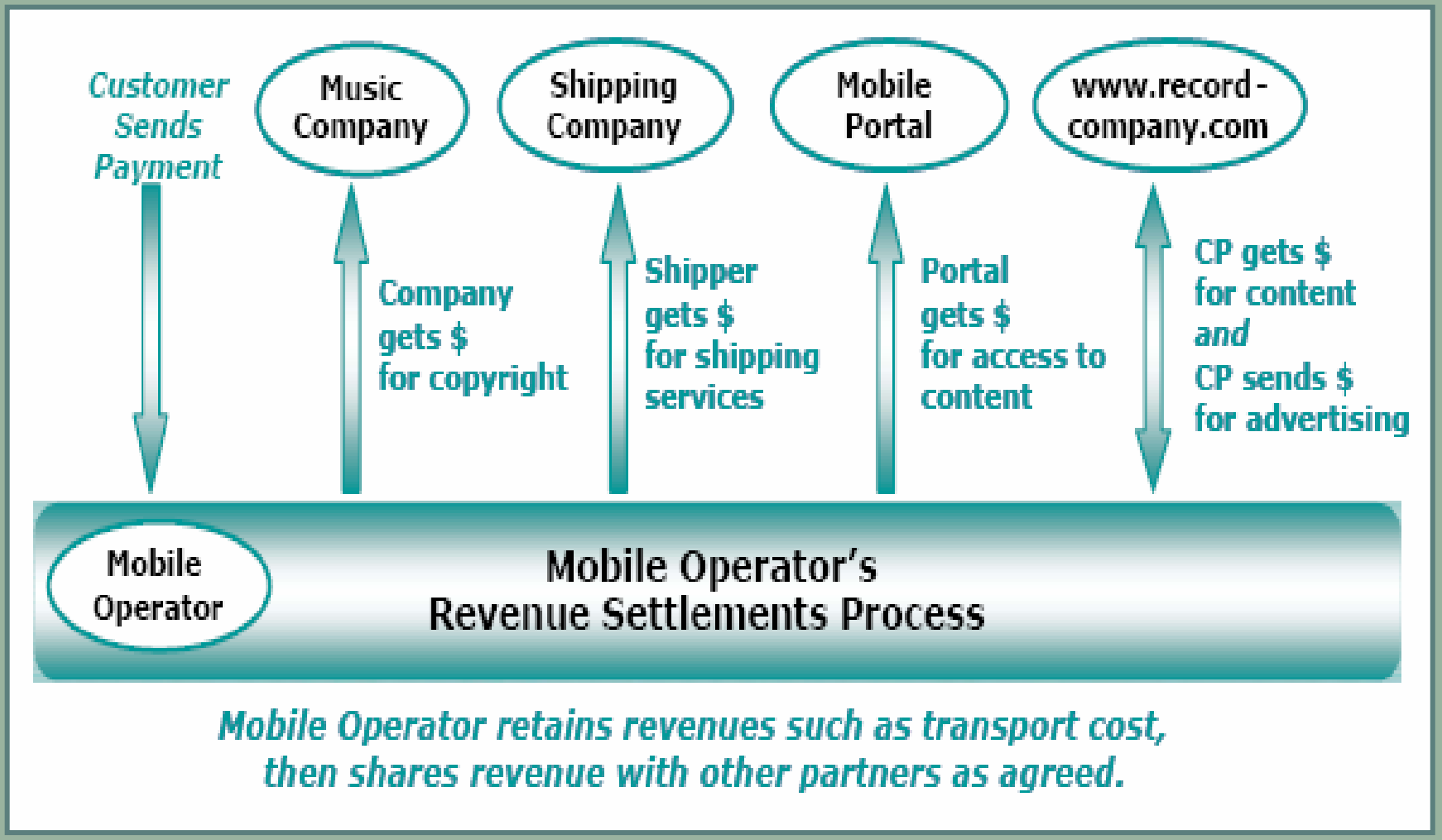
- Typically per-minute
  - e.g. traditional telephony
  - e.g. dial-up internet services
- Each network has a bill
  - separate bills for telephony, cable TV, internet etc...
- Separation of network billing from service billing
  - e.g. you might pay your ISP for the network and subscribe to content providers (e.g. the Economist) separately through your credit card

A new era of complex relationships

- Telecommunications moving away from a pure "pipes only" infrastructure-based industry (gone are days of POTS or POGS)
- What's carried on the pipes is adding more and more value
- Information and content now being brokered by growing number of players
- .. meaning that operators need to manage a large number of relationships with content developers and distributors

  e.g. through revenue-sharing agreements with providers

(many chefs – one soup)



Source: CSG Systems

and entirely new channels: Case in Point – the 3rd wave of VoIP

- 1995-1999:
  - "Internet phone", offered primarily over the public Internet (e.g. FreeWorld, Dial-up, DialPad)
- 2000-2002:
  - "VoIP", offered as discounted telephony over private IP-based networks (e.g. Net2Phone, iBasis)
  - Collapse of dot.com bubble left many VoIP companies struggling as incumbent PTOs also offered VoIP services or acquired VoIP operators (e.g. China Telecom, Teleglobe)
- 2003-Present:
  - "Voice over broadband", offered as free/flat-rate chat + discount calls to PSTN/mobile users (e.g. Vonage, Skype)
  - "Corporate IP", as users shift both data and voice to a unified IP platform
  - Voice over IP over mobile...

dilemma for today's mobile operators in particular

In a world moving to all-IP and one in which where radios might outnumber humans:

- Do they stick with **per minute billing** but be stuck with today's penetration/usage levels (or less as VoIP over mobile makes its mark)
- Or should they move to **flat-rate pricing** but hope that new revenue streams will make up for the lost revenue?

So how to evolve billing?

- How to move away from device-dependent billing?
- How to bill for object-to-object communications?
- How to make billing scalable?
- How to ensure multi-vendor, multi-service data collection and mediation?
- How to foster value-based billing?
  - flexible enough to charge in many different manners (by volume, by content type, by “event”...)?
- How to promote customized billing?
  - e.g. parent’s who’d like pre-pay billing for teenagers?
- Are we moving to the ONE “ubiquitous” user bill, for the ubiquitous network over the horizon?

a journey of a thousand miles must begin with a single step…

- Chinese proverb

Thanks!

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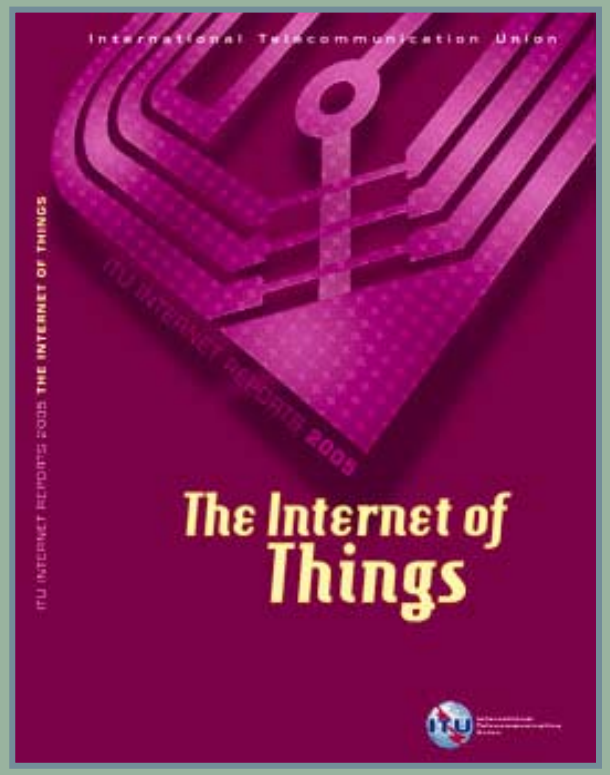

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