RFID and the Internet of Things

ICT Trends and Challenges in a Global Era
MSU/INT/BSL Programme, 4 July 2005

Lara Srivastava
Strategy and Policy Unit

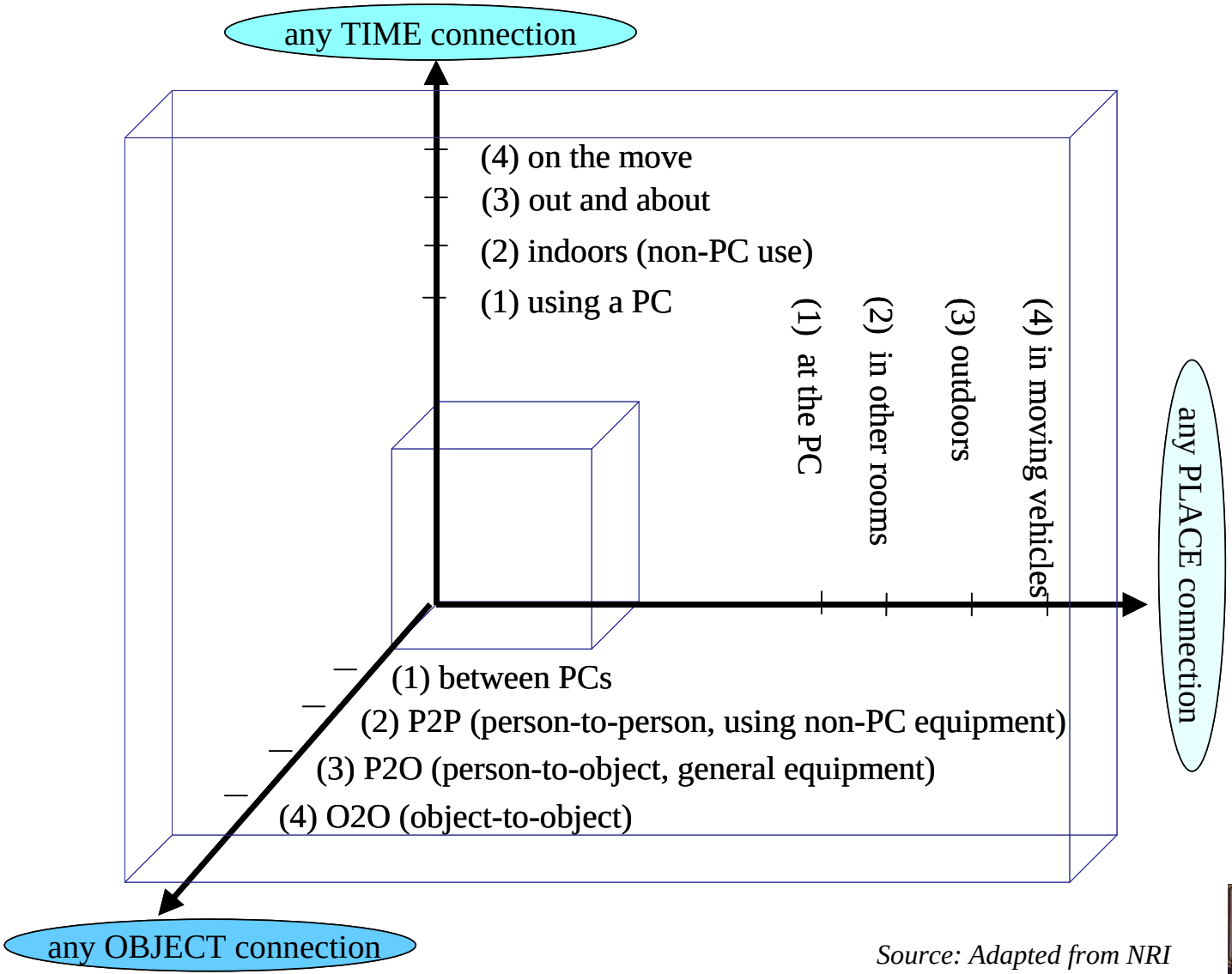
International Telecommunication Union

Note: The views expressed in this presentation are those of the author and do not necessarily reflect the opinions of the ITU or its membership. Lara Srivastava can be contacted at lara.srivastava@itu.int

The vision

- Towards ubiquity in everyday life
  - Connectivity anytime and anywhere
- By anyone
  - Extending connectivity
- But <u>also</u> by any*thing*
  - The “Internet of things”
- Requires a paradigm shift in computing
- *Enter: **RFID,** enabler of the ubiquitous communication environment*

the next paradigm shift



Source: Adapted from NRI

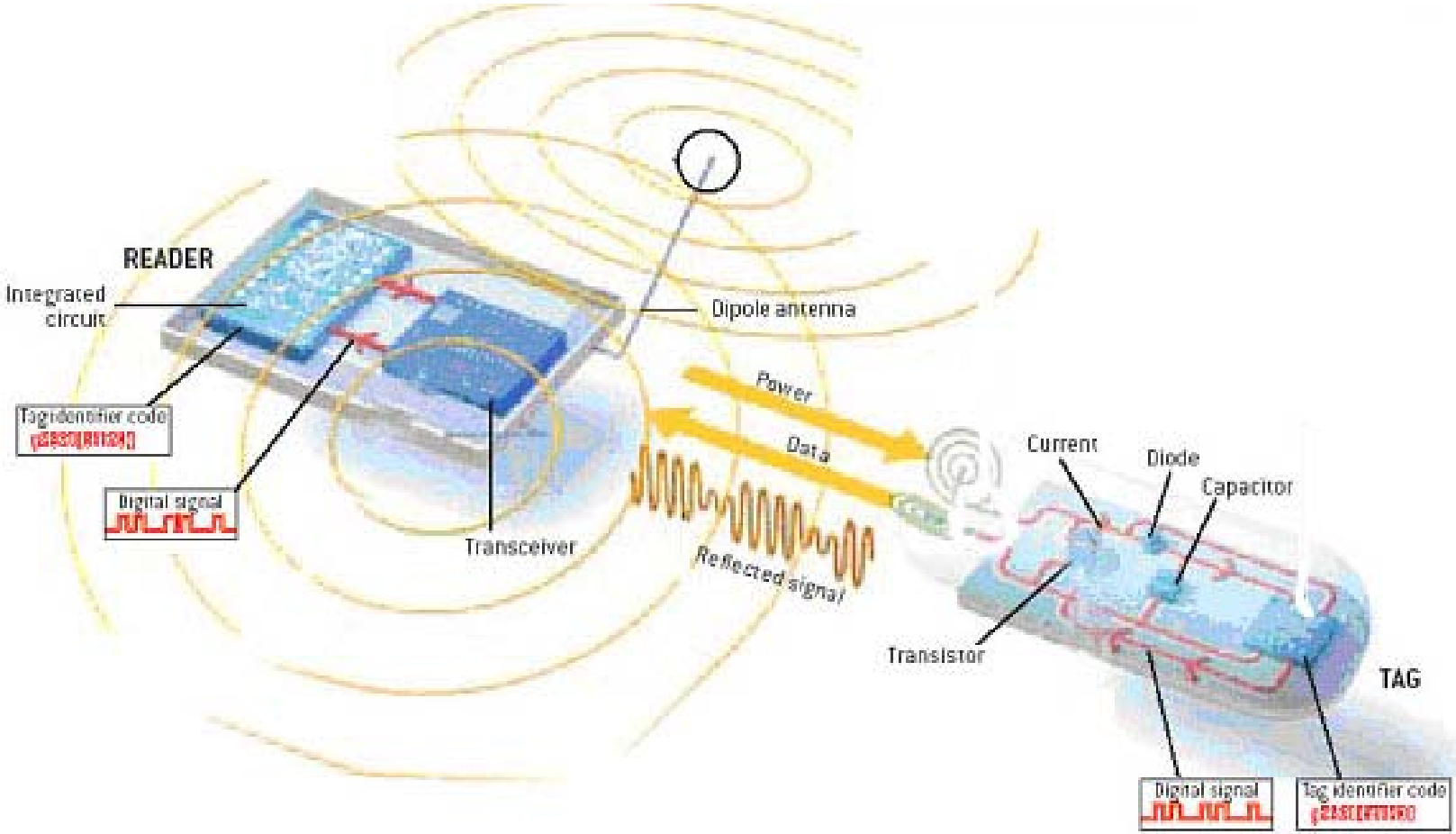
The Technology behind RFID

- What is RFID?
  - Short-range wireless technology
  - Seen as a means of identifying a person or object using electromagnetic radiation
- Simply put, RFID consists of:
  - Transponder (e.g. tag): holds data
  - Interrogator (or reader): reads data
  - Middleware (interface): forwards data
- RFID tags can be read-only or read/write and are typically no bigger than a grain of rice

Let's Radio in - On Spectrum Use

- Frequencies commonly used:
  - **125 kHz** (LF): access control, animal tracking, healthcare applications, PoS
  - **13.56 MHz** (HF): smart cards/shelves, patient monitoring, baggage tracking
  - **800-960 MHz** (UHF): highly suited to logistics and distribution (e.g. SCM applications). EPC.
- Harmonization
  - RFID use in LF/HF harmonized
  - UHF more fragmented
    (e.g. US/Canada uses 915 MHz, Europe uses 868 MHz)
- UHF seen as critical to widespread adoption
  - Due to extended read range for tracking goods
    (some newer tags can have read range up 6 m – 7.5 m)

How an RFID system works



Source: Adapted from Scientific American 2004

Types of RFID

- Passive Tags
  - Require no power source/battery within tag. Tag uses energy of radio wave.
  - Most common and least expensive
- Semi-Passive Tags
  - Rely on battery built into tag to achieve better performance. Batteries power internal circuits of tags during comm.
- Active Tags
  - Use batteries for the entire operation, and can therefore generate radio waves even in the absence of an RFID reader

Standards for RFID

- RFID currently hindered by fragmented efforts towards standardization
  - With exception of development of standardization of identifiers/codes
- 2 main areas for RFID standardization
  - RFID frequency and protocols for communication of readers & tags/labels
  - Standardization of data formats placed on tags and labels
- Main international players include ISO, ETSI, EPCglobal

What is EPCglobal or the Electronic Product Code?

- Often heard about in the press – EPCglobal previously Auto-ID Centre
- Set up in 1999 at MIT- original mandate to define standards for UHF RFID
- EPCglobal's main focus today is standardization of data format embedded in RFID transponder
- EPC is not RFID. RFID is a medium for the transmission of EPC

More than a bar code?

- RFID transponders contain “unique” identifiers & are thus more than just the next generation of bar codes
- Information contained on on RFID tag can identify item but also: location, price, washing instructions, banking details, medical records etc…
- RFID already used in transport and supply-chain management. It is now being embedded under human skin, and talked about in the context of tracking bank notes and passports

Markets for RFID

- VDC predicts that global shipments of RFID systems to reach USD 2.7 billion by 2007, compared to 1.3 billion in 2003
- Frost & Sullivan more optimistic with predictions of 11.7 billion by 2010, and 1.7 billion in 2003
- But most analysts agree that much of the near-term growth will be from supply-chain management applications
- And EPC & item-level tracking seen to provide catalyst for widespread RFID adoption in medium-term and across industries

RFID Applications

- Business Applications, e.g.
  - Transport and Logistics.
  - Access control
  - Supply-chain Management
  - Medical/Pharmaceutical Applications
  - Manufacturing
- Public Sector Applications, e.g.
  - E-government
  - Defence/Security
  - Library systems
- Consumer Applications, e.g.
  - Personal welfare and safety
  - Sports/leisure
  - Shopping
  - Smart Lifestyles

Applications: SCM and Logistics

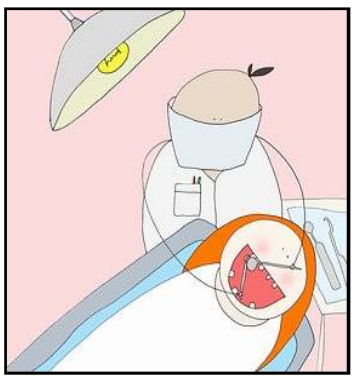
- RFID revolutionizes supply chain
- Tagging items enables transparent/total of visibility of inventory
- Read/write tags allows for management of info, such as contents, expiry date, manufacturer, origin

Example: Star Casino

Since 1997, Sydney's Star Casino uses RFID tags to track its 80'000 themed uniforms, which are tracked from point of issue to laundry to disposal. Unlike traditional bar code (which typically need replacement every 1-2 years), RFID usually outlasts garment.

Applications: Medical/Pharm'cal

- In hospitals, enables fully automated solution for information delivery at patient bedside
- Using WLAN, tags embedded in medication or patient bracelets can provide fast access to records
- Reduces pharmaceutical counterfeiting



Example: Dentalax and Dental Prosthetics:

In the lab, RFID embedded into a cast of a patient's teeth before it hardens. The tag then records every action or procedure on the prosthesis. Identity of cast can be checked easily by RFID readers, so it reaches the correct patient. Before delivery to dentist, lab retrieves RFID data to smart card.

Applications: E-government

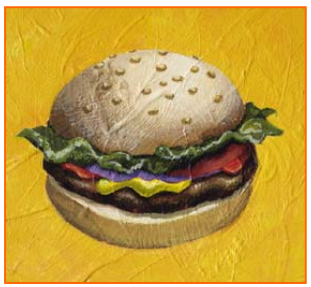
- Many authorities considering RFID for making services more efficient, secure
- Thwarting fraud, through tracking people, and money
- Privacy concerns: e.g. hoax story in US regarding homeless

Example: US State of Virginia and Driver's Licenses

Virginia is one of first US states to consider use of RFID in drivers' licenses. These may in future employ RFID in combination with biometric data, e.g. fingerprints. In Feb 2005, US House of Reps approved measure to have licenses comply with Federal anti-terrorist standards by 2008.

Applications: Shopping/Retail

- Wal-Mart first/largest retailer to deploy RFID for item-based tagging (SCM)
- First advantage in future for customers is the speedier checkout, e.g. Pintokona
- Contactless payment cards are an early application



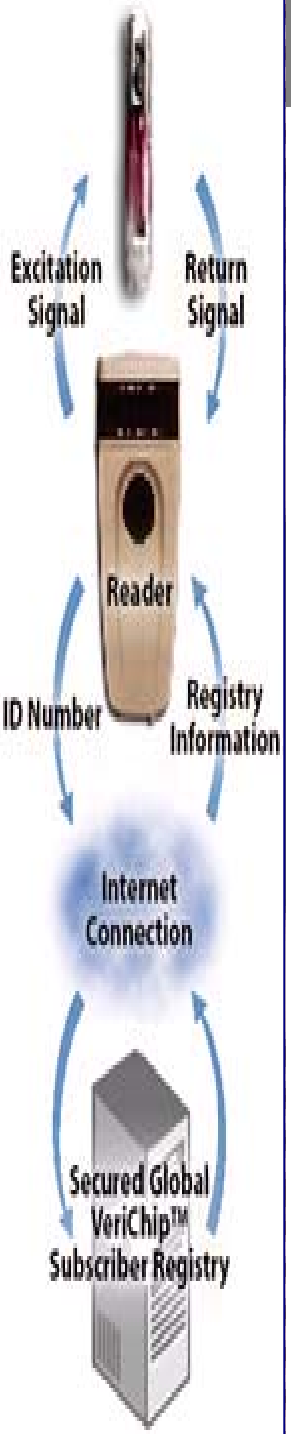
Example: Making McDonald's fast food even faster

Mastercard's PayPass is a wireless credit card system using RFID. It has been deployed at McDonald's, where customers only need to wave their PayPass card near an RFID card reader and thie amount is automatically charged to their credit card account.

Applications: Smart Lifestyles

- RFID deployment in combination with sensor technologies to develop smart appliances, houses, and cities
- RFID environments for physically challenged or elderly
- RFID readers are getting smaller

Example: Smart Watch (U. of Washington/Intel)
Working prototype is an intelligent, integrated and responsible system, capable of prompting users who leave house or workplace without essential items, e.g .keys, wallet, which are tagged. When the watch passes a reader, information is sent to a personal server that checks whether all critical items are present.



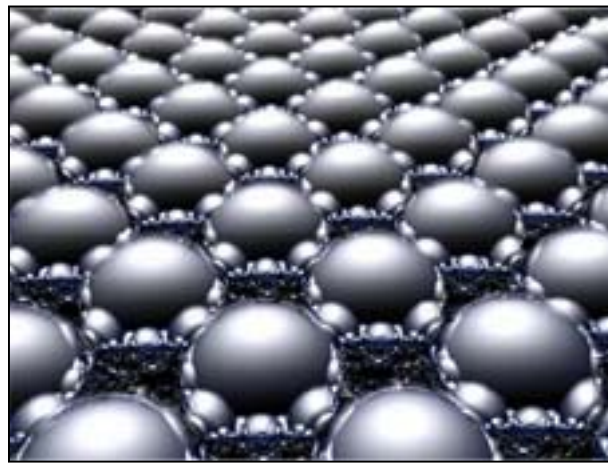
Applications: The Human Chip

- Verichip™ developed by Applied Digital Solutions is the size of a grain of rice
- Already being used today, e.g. by Baja Beach Club in Barcelona
  - VIP patrons can order drinks by simple wave of the hand
  - Access control to exclusive lounges

- Verichip™ Recently approved by US FDA (Food & Drug Administration), for now, for medical purposes

More about the future of RFID

- Combination with sensor technologies
  - For remote measuring of specific phenomena, e.g. Golden State Foods tests, R&D in Japan
- The “ubiquitous” mobile phone and RFID
- From smart chips, to smart materials to “smart dust”?
  - Getting nano



The road to RFID: Challenges

- Standards-setting and interoperability
  - Harmonization is required to ensure smooth development, widespread adoption
  - Spectrum, communication protocols and tag formats
- Governance of resources
  - Who controls the unique identifiers?
  - More commercial value at stake than DNS
- Data protection and consumer privacy
  - Information contained on tags should appropriately managed and controlled

Social and Human Impacts

- Better personal security
- More efficient care of human health
- Increase in quality of life

….. but also:

- (perceived) societal, individual surveillance
- …and its effect on individuality and self-expression
- impact of technology on human relationships and intimacy

thank you

lara.srivastava@itu.int

International Telecommunication Union