The Internet of Things

（IOT, 物联网）

-- Introduction

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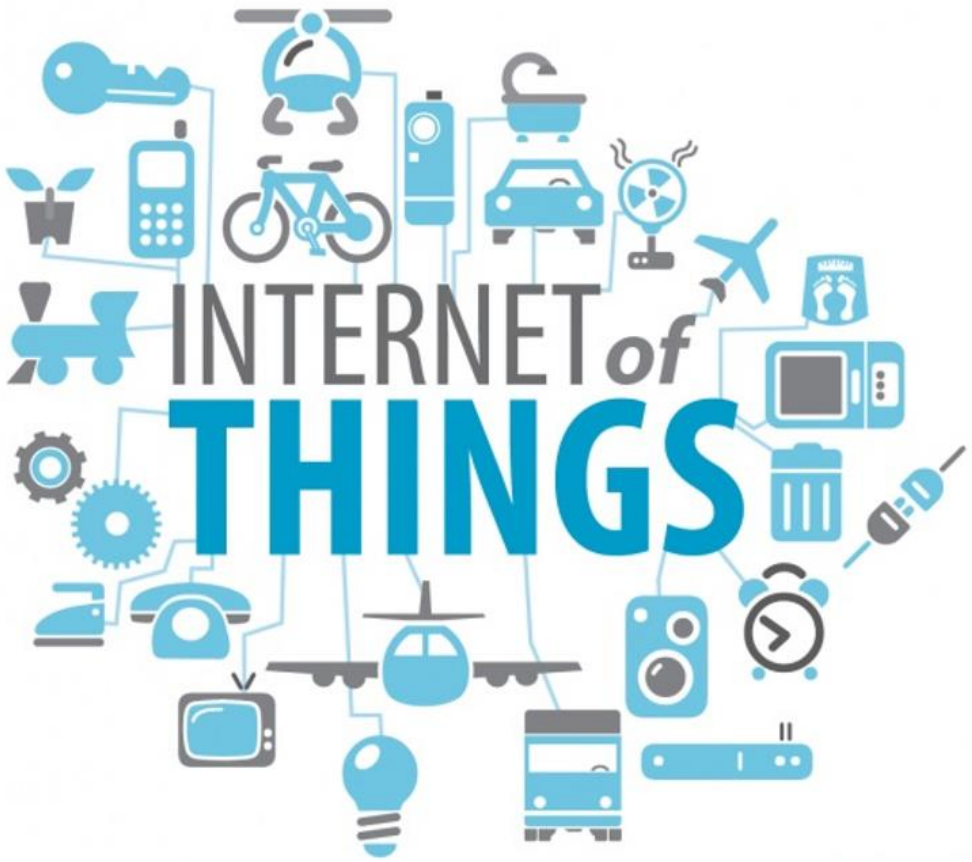
Outline

- General Description
- Market Overview
- Industry Overview
- The IT
- The Future



The Future Internet

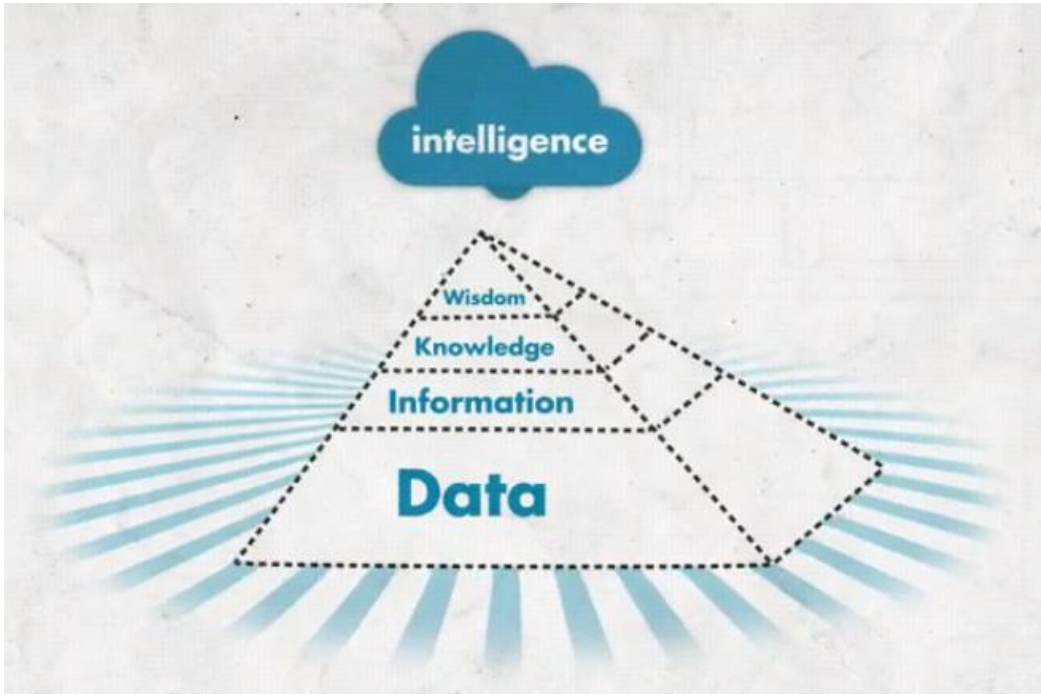
Internet of Services | Internet of Things | Internet of Media

General Description

Where are we at?

“10亿人与100万家电子企业互动，1万亿智能设备相互连接”(Lou Gerstner，IBM首席执行官，1995)
▪到2015年，将有1万亿传感器连接物理和数字世界，合并成为“物联网”(IOT)
-应用的清单是有限的，只有我们的想象力

- "A billion people interacting with a million e-businesses, with a trillion intelligent devices interconnected“ (Lou Gerstner, CEO IBM, 1995)
- By 2015 there will be 1 trillion sensors linking the physical and digital worlds merging to become an “**Internet of Things**” **(IOT)**
  - list of applications is limited only by our imagination



Originality of IOT 创意的物联网

The Internet of Things (IOT) is a concept originally coined and introduced by MIT, Auto-ID Center and intimately linked to RFID and electronic product code (EPC)

物联网(IOT)这个概念最初是由麻省理工学院(MIT)、自动识别中心(Auto-ID Center)提出的，与射频识别(RFID)和电子产品代码(EPC)紧密联系在一起，所有的物理物品都可以相互交谈。

"… all about physical items talking to each other.."

这一概念目前正受到计算和网络普及方面的发展以及下一代互联网络的发展的强烈影响，并在包括联合国在内的所有各级进行审议

This concept that is now being influenced strongly by developments in computing and network ubiquity and developments in the next generation Internet - and considered at all levels including United Nations

我们正进入一个无处不在的新时代，在这个时代，互联网用户将以十亿计，人类可能成为少数人，成为通信的创造者和接受者。互联网带来的变化将会被联合国的日常用品联网报告所推动的变化相形见绌

"We are heading into a new era of ubiquity, where the users of the Internet will be counted in billions, and where humans may become the minority as generators and receivers of traffic. Changes brought about by the Internet will be dwarfed by those prompted by the ***networking of everyday objects*** *" – UN report*

IOT = the future of the internet ?

R&D programs exist all over the world

– Europe (ambiant intelligence), Japan (ubiquitous computing), China

Complementary technological paths :

– From bar code to multiple electronic identification devices

– From early B2B (logistic) to massive applications (animals, children…)

And conflicting visions

– Narrow or global point of view

– Functional and practice-based or specific technical process

Supported by major socio-technique-economic trends

– From product to services

– From fixed to mobile technologies

– Physical and virtual worlds

– Complex and unstable technological choices and standards

  • Legal and industrial uncertainty / Governance and economic models

– Attractive technologies

  • But quite unknown and badly accepted

Facing various questions at stake :

– constituency, sustainability and (low) cost

– Portfolio of technologies, networks and applications

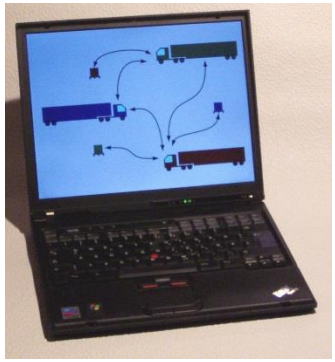
– Incentive and support for innovation for economic growth

– To implement pervasive but non intrusive information systems

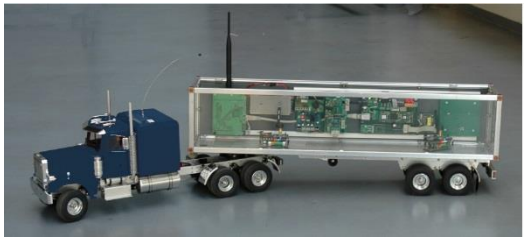
世界各地都有研发项目
-欧洲(ambiant intelligence)，日本(ubiquitous computing)，中国
互补的技术路径:
-从条形码到多种电子识别装置
-从早期的B2B(物流)到大规模应用(动物，儿童…)和冲突景象
-狭隘的或全球性的观点
-功能和实践为基础的或特定的技术流程
由主要的社会-技术-经济趋势支持
-从产品到服务
-从固定到移动技术
-物理和虚拟世界
-复杂和不稳定的技术选择和标准
•法律和行业的不确定性/治理和经济模式
——有吸引力的技术
•但不为人所知，也不为人所接受
面对各种利害攸关的问题:
-选民、可持续性和(低)成本
-技术、网络和应用的组合
——鼓励和支持创新促进经济增长
-推行普及但不具侵入性的资讯系统

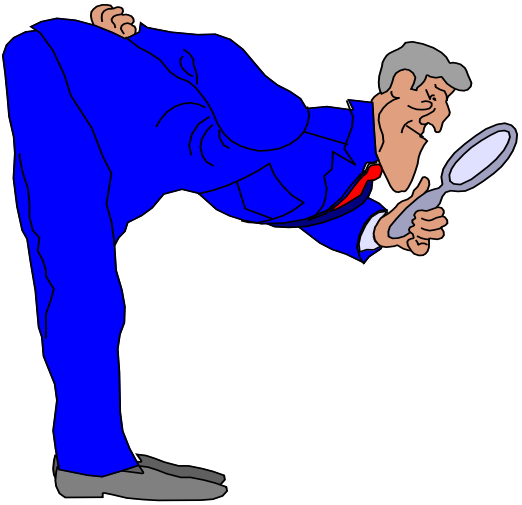
Hardware Layers

PC / Server



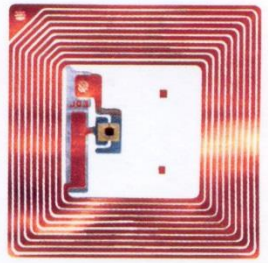
Truck / Container





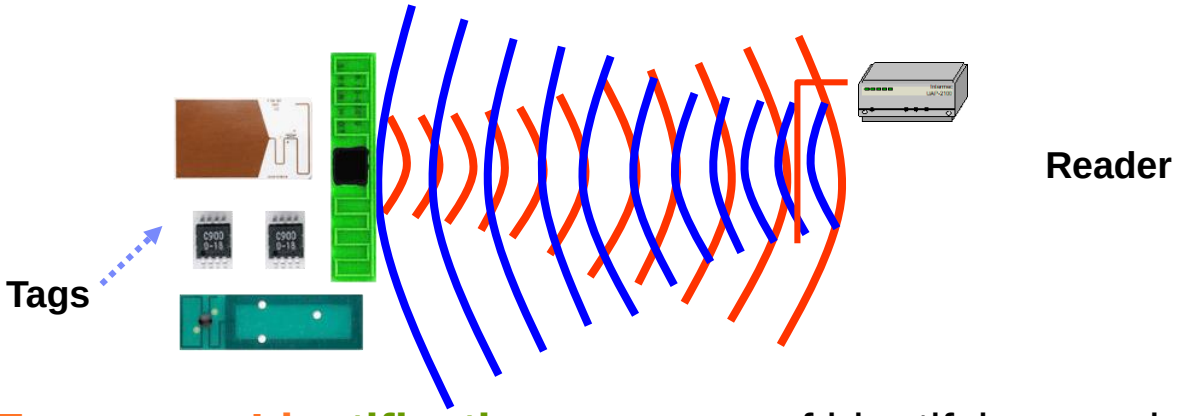
Sensor network

RFID



What is RFID?

无线电频率识别，一种使用无线电频率传输来识别一个独特的物体或人的方法
- RFID标签贴在物件上，储存的信息可写入或重写到标签内嵌的晶片上
-标签可以远程读取时，他们检测到一个无线电频率信号从一个阅读器超过一段距离
-阅读器然后通过企业网络发送标签信息到后端系统进行处理或显示给最终用户

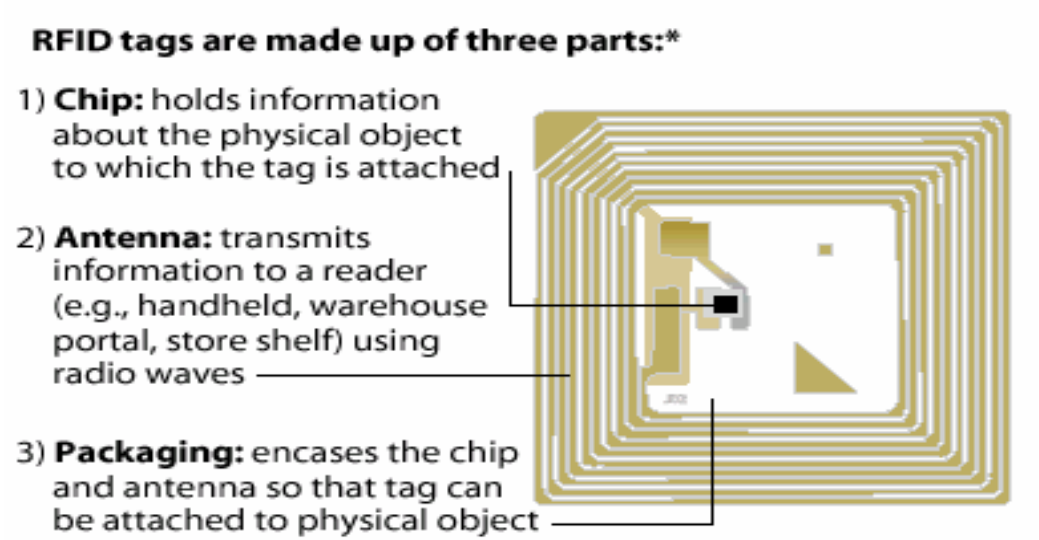


- **Radio Frequency Identification**, a means of identifying a unique object or person using a radio frequency transmission
  - RFID tags are affixed to objects and stored information may be written and rewritten to an embedded chip in the tag
  - Tags can be read remotely when they detect a radio frequency signal from a reader over a range of distances
  - Readers then either send tag information over the enterprise network to back-end systems for processing or display it to the end user

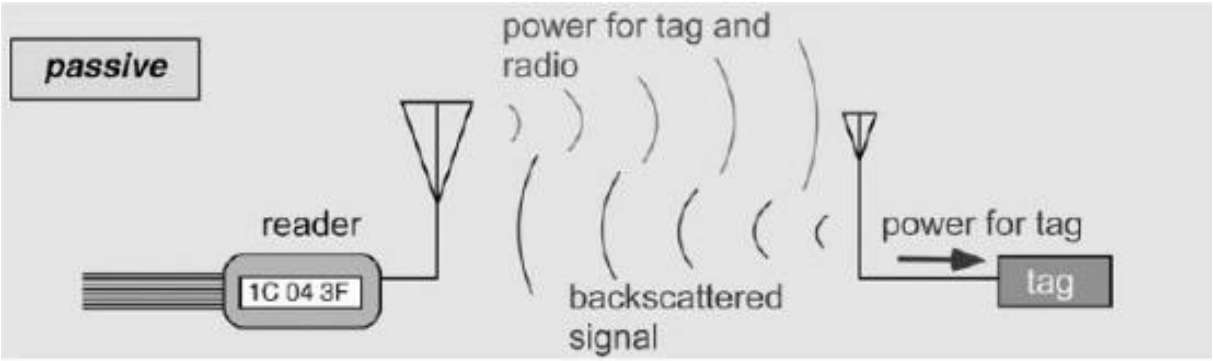
RFID Tag technologies

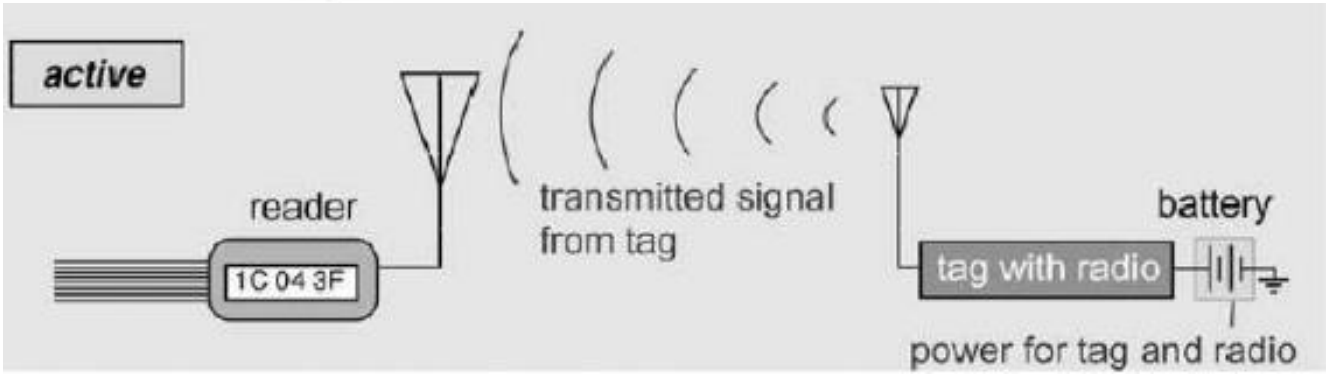
标签的组成部分：
——芯片
——天线
- - - - - -包装
▪不同类型的RFID标签
——读/写能力
➢只读
➢一次写/读过很多(蠕虫)
➢读/写
——电源
➢被动标记
➢主动标签
➢半有源标签

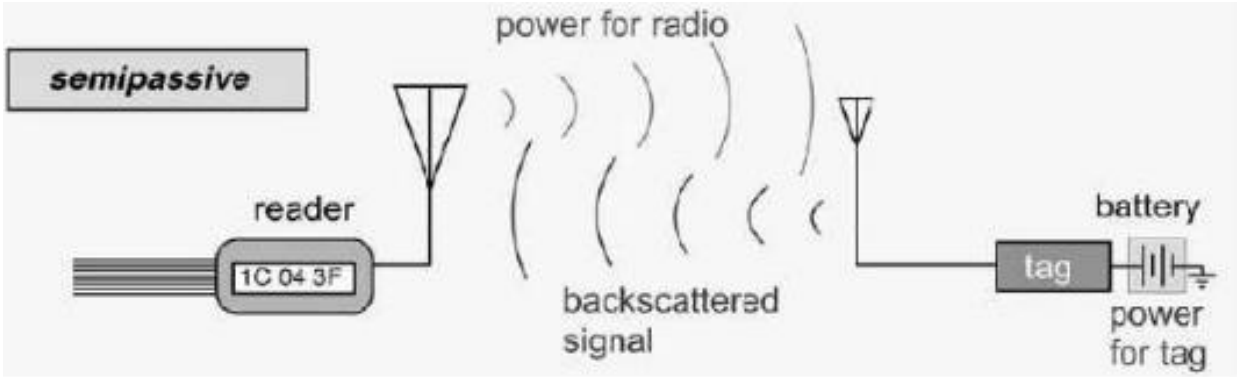
- Components of a tag:
  - **Chip**
  - **Antenna**
  - **Packaging**
- Different types of RFID tags
  - Read/write capability
    - **Read Only**
    - **Write Once/Read Many (WORM)**
    - **Read/Write**
  - Power source
    - **Passive tags**
    - **Active tags**
    - **Semi-active tags**



RFID Power Source







RFID Reader Technologies

基于要完成的工作或工作类型，阅读器技术有三种基本选择

- There are three basic choices for reader technology – based on the job or type of work to be performed

Stationary	Mobile	PCMCIA
■Entrances - portals 入口,门户网站 ■Conveyors across assembly lines 在装配线输送机 ■Points of sale 销售点 ■Overhead 开销	■Hand-held 手持 ■Wireless or batch 无线或批处理 ■One-piece or two piece tagging 整体或两块标记	■Mobile service agent 移动服务代理

The Electronic Product Code (EPC)

电子产品代码(EPC)

ePC是什么
-产品编号计划
-为每个项目分配一个数字
▪EPC位于RFID标签内
▪相关实时信息通过互联网每个对象存储和访问
▪它是一个开放的、以标准为基础的系统，促进了价值链伙伴之间的协作
-跨行业采用(可口可乐、沃尔玛、菲利普、UPS……)

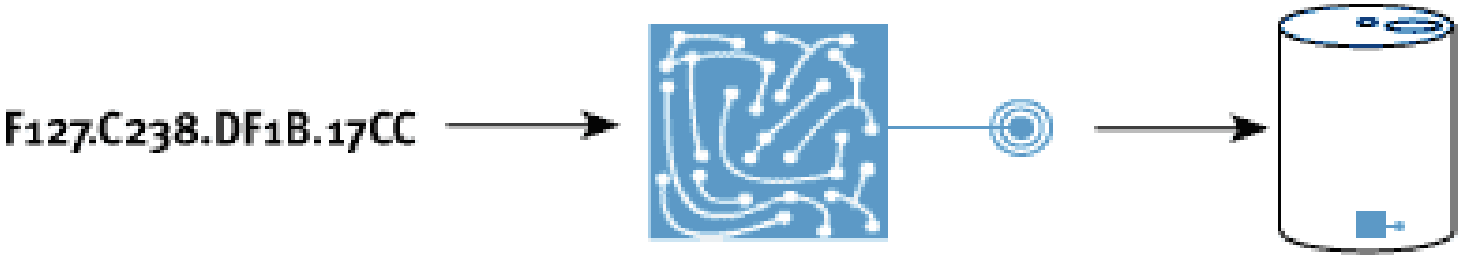
- What is ePC
  - A product numbering scheme
  - Assign a number to each item

EPC™ - variable length product identification code

可变长度产品识别码

- EPC resides in an RFID tag
- Real-time information related to each object is stored and accessed via the internet
- It is an open, standards-based system that facilitates collaboration among partners in the value chain
  - Adopted across industries (Coca-Cola, Wal-Mart, Philip, UPS…)

How dose EPC work?



ePC Code -
Unique Number - 96 bits long

Smart Tag -
Made from microchip w/ antenna-
Transmits ePC code

Soda Can -
Typical object becomes unique
because of "Smart Tag"

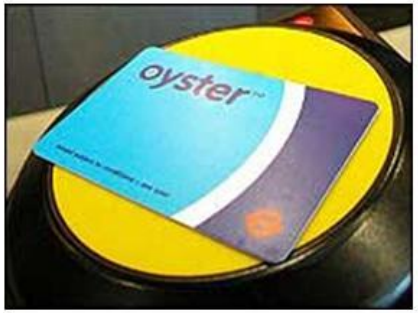
Soda Can -
Trasmits ePC code from
embedded "Smart Tag" on
side of can

Reader -
Could be found in shelving,
appliances ,etc
Trasmits ePC to Internet

Internet -
Translates ePC code into
useful information

Tomorrow's ubiquitous world of tags, sensors and smart systems

未来无处不在的标签、传感器和智能系统



物联网概念的开放问题

Open Issues of IOT Concepts

- What is a thing?
  - Things that are computers equipped with communication interfaces.
  - Things that are not computers, but who are associated with computers equipped with communication interfaces.
- What is the identifier of a thing?
  - A serial number, such as an EPC code.
  - An IP address.
  - Other, for example a fix hash value, or ad hoc naming scheme.
- Authentication
  - Is there a need/way to authenticate a thing? In other words is it possible and needed to prove the identity of a thing.

什么是东西?
-装备有通讯接口的电脑。
-不是计算机，而是与计算机有通信接口的人。
▪什么是事物的标识符?
-一个序列号，例如EPC代码。
- IP地址。
-其他，例如修复哈希值，或特别命名方案。
▪身份验证
-是否需要/方法来认证一件物品?换句话说，证明一个事物的身份是否可能，是否必要。

身份保护
- Things可以用来跟踪人或物体，这些物体是由一组东西识别的。身份保护通过使用加密手段隐藏事物的身份来加强隐私。
▪通信协议
-通过各种接口与Internet网络进行通信
-通过MAC (OSI2)无线电协议，由EPCGLOBAL定义
-感谢IP协议，在这种情况下，事情是一个IP节点，并本地插入互联网云。
——其他,例如主机标识协议
▪事情到事情的沟通
-在某些情况下，事物与人沟通

- Identity Protection
  - Things can be used to track people or objects, which are identified by a set of things. Identity protection enforces privacy by hiding things identities thanks to cryptographic means.
- Communication Protocol
  - A thing communicates with the Internet network by various interfaces
  - Via MAC (OSI2) radio protocols, as defined by EPCGLOBAL
  - Thanks the IP protocol, in that case the thing is an IP node, and is natively plugged in the Internet Cloud.
  - Other, for example the Host Identity Protocol
- Things to Things communications
  - In some cases, things communicate with other things.

Market Overview

市场触发:沃尔玛扩大RFID授权到2006年包括所有供应商

Market trigger: Wal-Mart expands RFID mandate to include all suppliers by 2006

RFID杂志:沃尔玛在沙子上划了一条线

RFID Journal: Wal-Mart Draws a Line in the Sand

- In June, Wal-Mart required its top 100 suppliers to have products on pallets employing RFID chips and in cases with RFID chips beginning in January 2005
  - Pilot ramp-up in 2004 – starting with ~20 suppliers in Jan. '04.
  - Regional implementation roll-out – start with Texas region (3 DCs, ~150 stores)
  - By January '05 - ALL products flowing through Texas region for Top 100+
  - DSD and DC, all impacted formats, including SAMS Club

今年6月，沃尔玛要求其最大的100家供应商将产品放在托盘上
射频识别芯片和射频识别芯片的案例从2005年1月开始
- 2004年试点扩大- 2004年1月开始与20家供应商合作。
-区域实施推出-从德克萨斯州地区开始(3个DCs，约150家门店)
-到05年1月-所有的产品都在德州地区销售
-DSD和IDC，所有受影响的格式，包括SAMS俱乐部

- Wal-Mart has indicated it would start deploying Electronic Product Code (EPC) technology in the United States and then quickly move to implement it in Europe, then the rest of the world.

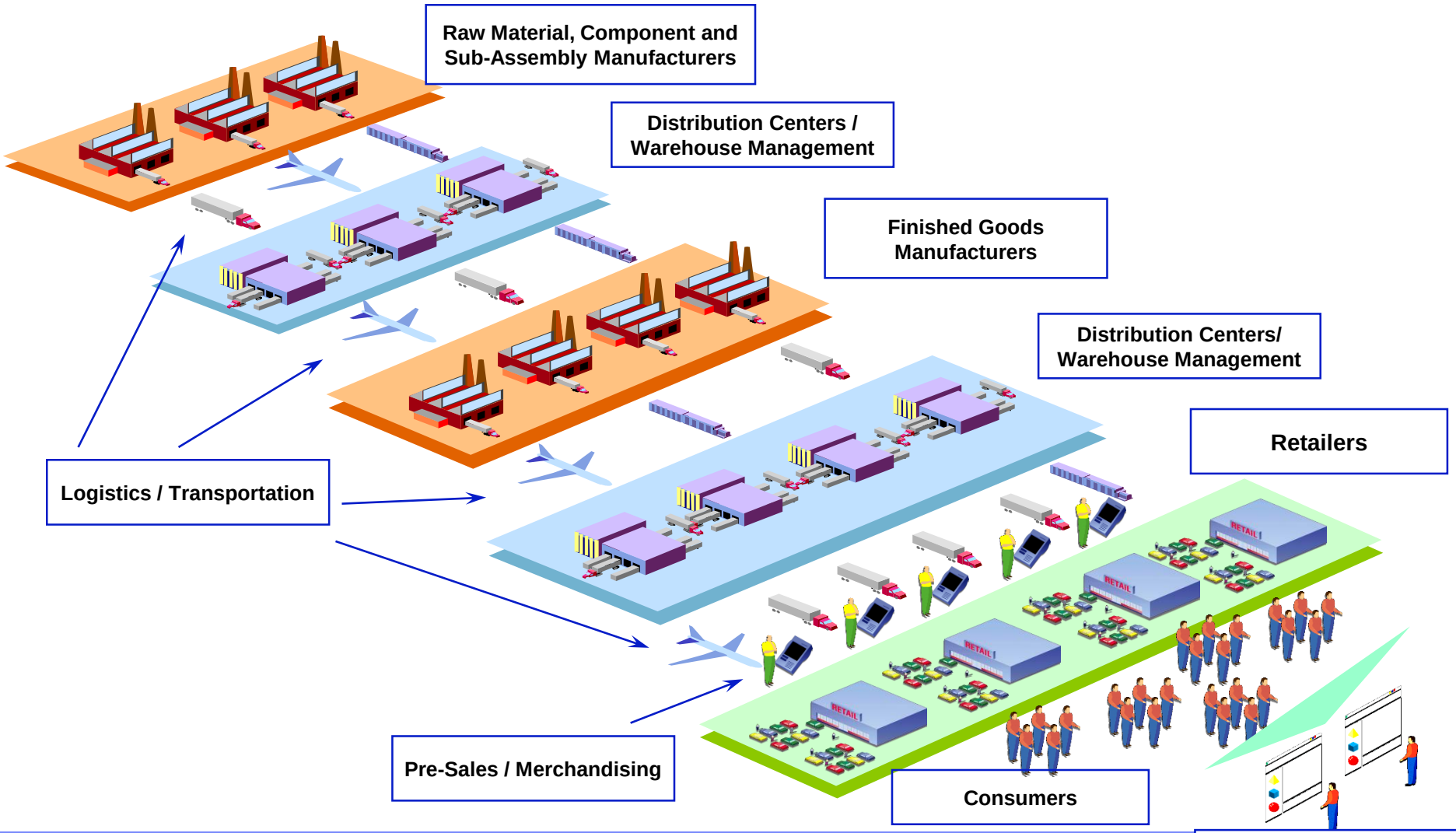
沃尔玛已表示，将开始在美国部署电子产品编码(EPC)技术，然后迅速在欧洲和世界其他地区实施。
今年8月，沃尔玛宣布，它将要求所有供应商在2006年之前实施RFID系统

- In August, Wal-Mart announced it would require all suppliers to implement RFID systems by 2006

WAL★MART®
ALWAYS LOW PRICES. Always.

Source: RFID Journal.

Supply Chain Model



市场触发:美国国防部要求供应商在2005年之前使用主动和被动RFID技术

Market trigger: U.S. DoD required suppliers to use active and passive RFID technology by 2005

- DOD memo: "The DOD will be an early adopter of innovative RFID technology that leverages the Electronic Product Code (EPC) and compatible tags. Our policy will require suppliers to put passive RFID tags on lowest possible service part/case/pallet packing by January 2005. We also plan to require RFID tags on key high-value items"

国防部备忘录:"国防部将是利用电子技术的创新RFID技术的早期采用者
产品代码(EPC)和兼容标签。我们的政策将要求供应商在2005年1月之前在尽可能低的服务部件/箱/托盘包装上使用被动RFID标签。我们还计划在关键的高价值物品上安装RFID标签"

- The new policy expands active RFID tracking of all:
  - sustainment cargo
  - unit movement cargo
  - ammunition shipments
  - pre-positioned materials and supplies.

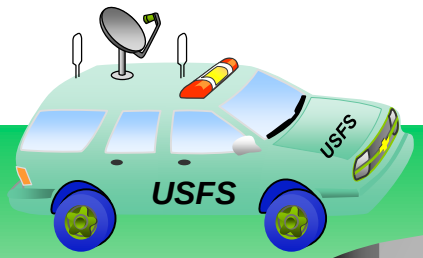
•新政策扩展了有源RFID跟踪所有:
维护货物
单元运动货物
弹药运输
-预先放置的材料和供应品

Military Usages!

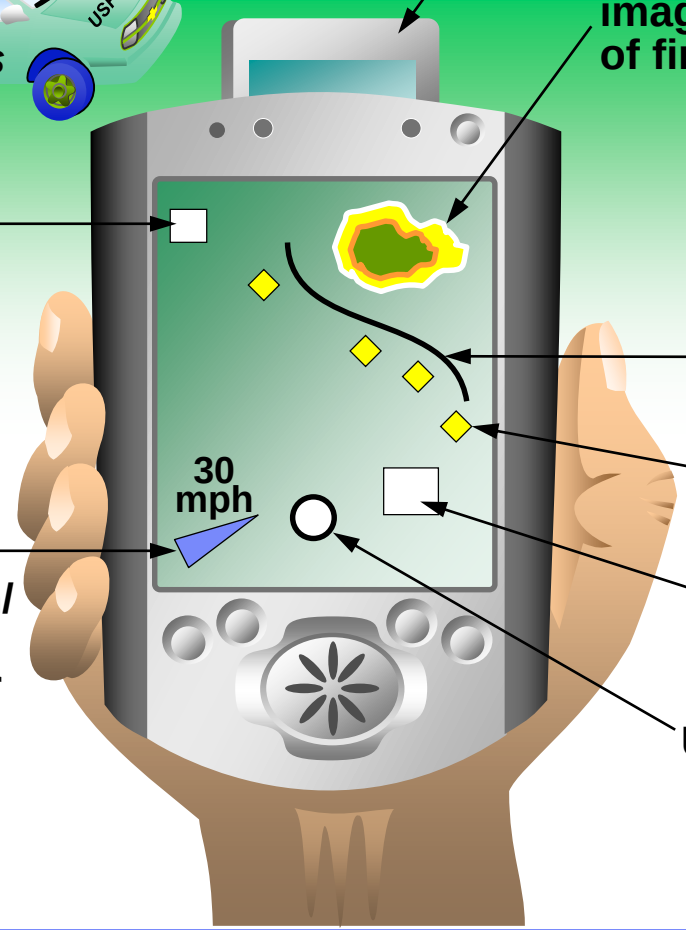
Source: RFID Journal.

Advanced Infrastructure: U.S. Forest Service

- Ad hoc Network to Fight Forest Fires



Field truck



Card

IR satellite imagery of fire

Truck

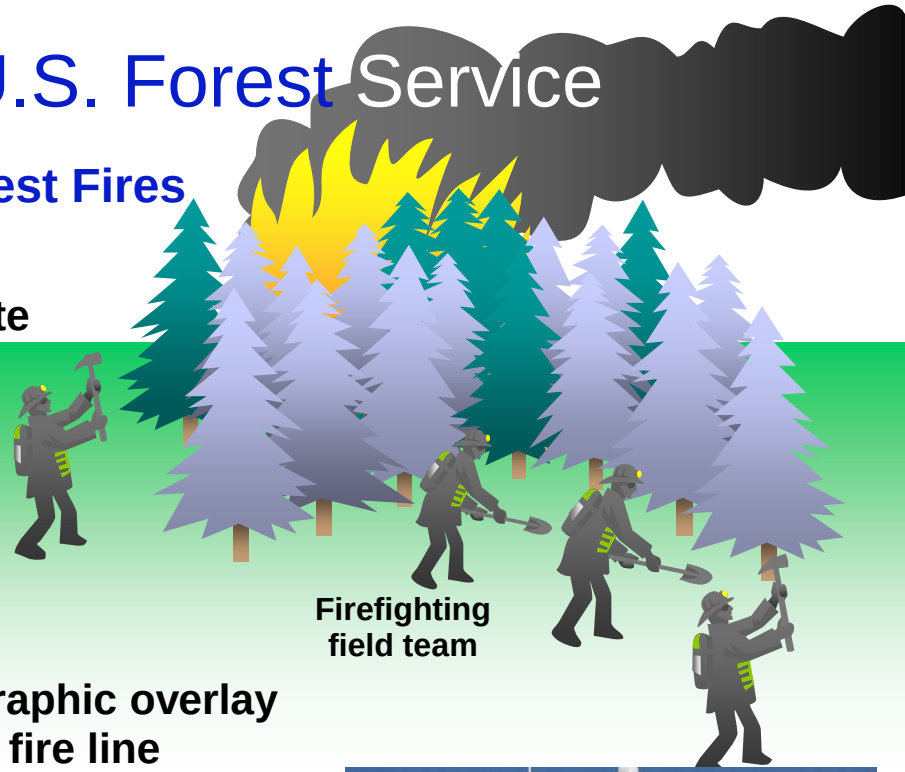
Graphic overlay of fire line

Firefighters

Wind direction/ speed indicator

Trailer

User



Firefighting field team

Command center trailer

Key Alliance Partner:

BOEING

IOT Opportunities

物联网将成为通信行业新的增长点，通信设备制造商将从中受益。
预计到2010年，M2M(机对机)业务收入将占电信运营商总收入的20%。
▪亚历山大资源公司预计到2010年物联网将带来2700亿美元的巨大市场。
物联网应用将在最近3年内以50%以上的复合增长率发展，终端出货量将达到2600万
▪Forrester预测物联网将发展成为规模达数万亿的巨大电信市场

- IOT will be a new growth pole in communication industry, from which communication equipment manufacturers will get benefit.
- It is predicted that M2M (Machine to Machine) business revenue will take up 20% of telecommunication carriers total by 2010.
- Alexander Resources anticipates that IOT will bring a huge market of 270 billion dollars by 2010.
- IOT Application will develop at a compound growth rate of more than 50% in the nearest 3 years and terminal shipments will amount to 26 million
- Forrester predicts that IOT will develop into a huge telecommunication market of trillions by 2020

物联网授权的应用程序

Applications Empowered by Internet of Things

Global Environmental Observation

- GIS systems
  - Atmospheric
  - Vegetation / Ground Water
  - Surface / Water Temperature
- GHG Tracking
  - Consumption metering
  - Atmospheric measurements
- Reporting Systems
  - Mash-ups / SOA / Web 2.0

全球环境的观察
•GIS系统
•大气
•植被/地下水
表面/水温
•GHG跟踪
•消费计量
•大气测量
•报告系统
•混搭/ SOA / Web 2.0

Global Action / Management Plans

- Early Warning Systems
  - Famine / Drought
  - Natural Disasters
- Environmental Mitigation
  - Carbon-trading
  - Conservation Planning
- International Agreements
  - Ratification
  - Implementation

全球行动/管理计划
•预警系统
•饥荒/干旱
•自然灾害
•环境缓解
•碳交易
•保护规划
•国际协议
•批准
•实现

Global

Observation

Implementation

Local

Local Environmental Observation

- Capacity building
  - Awareness of threats
  - Identifying impact
- Data Entry
  - Web 2.0 / Wiki data logs
- Appropriate Technology
  - SMS / Mobile Phone usage
  - Cultural adaptation

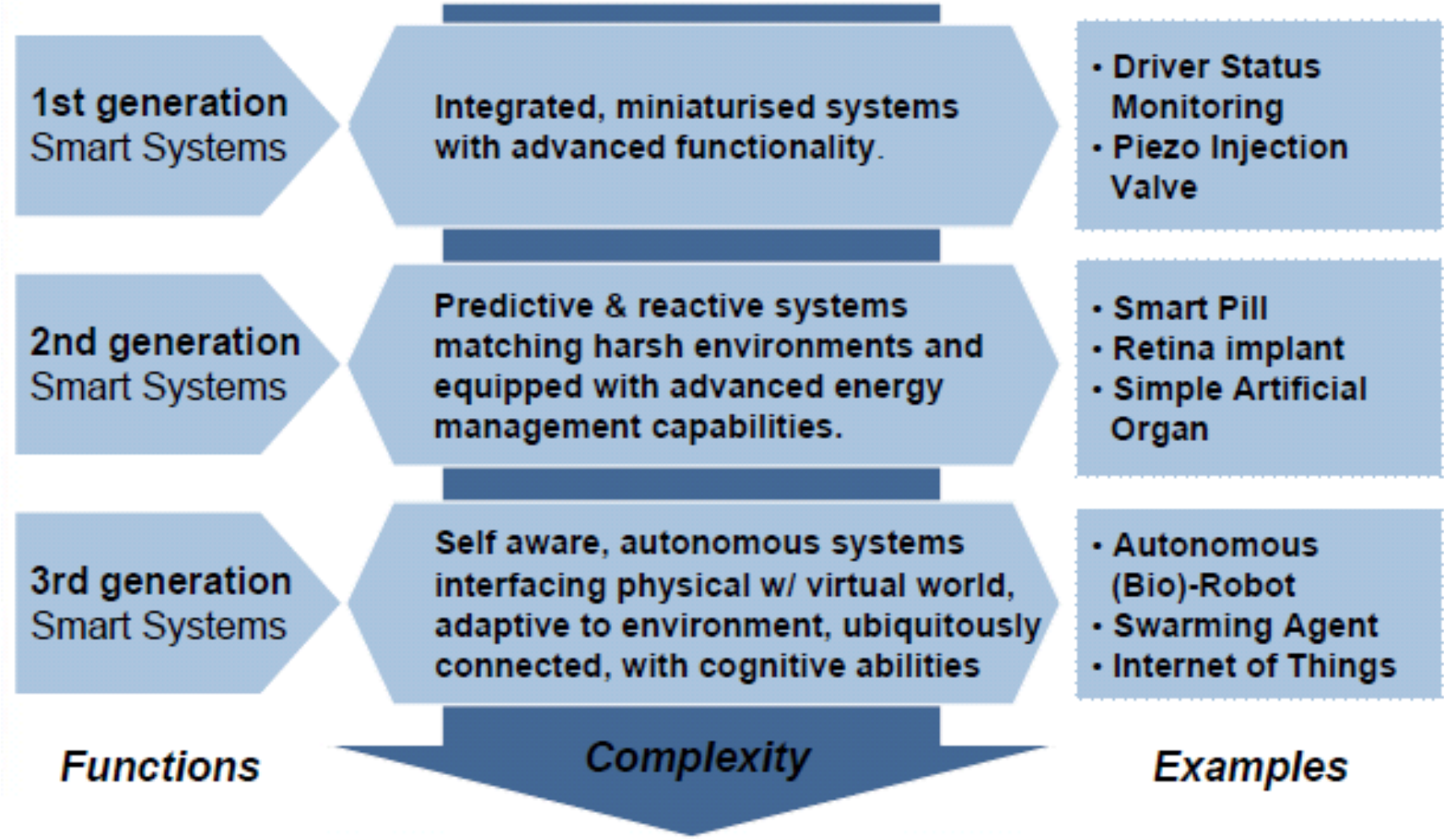
当地环境的观察
•能力建设
•威胁意识
•识别的影响
•数据输入
•Web 2.0 / Wiki数据日志
•适当的技术
•短信/手机使用
•文化适应

Local Action / Management Plans

- Resource Management
  - Access / Allocation
  - Enforcement
  - Support and Funding
- Professional Development
- Response Planning
  - Early warning response
  - Conflict avoidance

当地行动/管理计划
•资源管理
•访问/分配
•执行
•支持和资金
•专业发展
•响应计划
•预警反应
•避免冲突

Smart Systems Evolution



Internet of Things in 2020

推断技术趋势和正在进行的研究

Extrapolation of technology trends and ongoing research

	Before 2010	2010-2015	2015-2020	Beyond 2020
Vision society People	• Socially acceptable RFID	• Pervasive RFID	• Interacting objects	• Personalised objects
	• Realising benefits (food safety, anti counterfeiting, health care) • Consumer concerns (privacy) • Changing ways to work	• Changing business (processes, models, ways to work) • Smart appliances • Ubiquitous readers • Access rights • New retail and Logistics	• Integrated appliances • Smart transportation • Energy & Resource conservation	• Mastered ambient intelligence • Interaction of physical and virtual worlds • Search the physical world (google of things) • Virtual Worlds
Politics & Governance	• De-facto governance • Privacy legislation • Address cultural barriers • Future Internet governance	• EU governance • Frequency spectrum Governance • Sustainable Energy Consumption guidelines	• Authentication, trust and verification • Security, social well-being	• Authentication, trust and verification • Security, social well-being
Standards	• RFID security and Privacy • Radio frequency use	• Sector specific standards	• Interaction Standards	• Behavioural Standards

	Before 2010	2010-2015	2015-2020	Beyond 2020
Vision technology	• Connecting objects	• Networked objects	• Executable objects /semi-intelligent objects	• Intelligent objects
Use	• RFID adoption in logistics, retail and pharmaceutics.	• Increased interoperability	• Decentralised code execution • Global applications	• Unified network that connects people, things and services • Integrated industries
Devices	• Smaller and cheaper tags, sensors and active systems	• Increasing memory and sensing capacities	• Ultra high speed	• Cheaper materials • New physical effects
Energy	• Low power chipsets • Reduced energy consumption	• Improved energy management • Better batteries	• Renewable energy • Multiple sources	• Elements of energy harvesting

Market drivers

Market	↑Increasing end-user knowledge of IOT technology, its applications, and its advantages ↑Emerging and growing markets for different IOT applications across multiple industries ↑Demand driven by large retailer requirements, CPG and supply chain vendors' investment ↑Industry systems integration and process expertise developing
Economic	↑Rapidly decreasing cost of RFID tags and readers
Physical / Technical	↑Technology is beginning to mature ↑Technical and physical interoperability, interference and data overload issues will be overcome ↑Chip and frequency standards are expected to evolve globally
Standards	↑Industry-wide standards for many applications leading to interoperability amongst different manufacturers' products, including hardware
Social / Political	↑Government requirements for cross-border trade ↑Regulatory mandates

增加终端用户对物联网技术、其应用及其优势的了解
新兴且不断增长的市场,不同的物联网应用程序跨多个行业
需求驱动的大型零售商需求、CPG和供应链厂商的投资
行业系统集成和专业发展过程

快速降低RFID标签和阅读器的成本

技术开始成熟
技术和物理互操作性,干扰和数据过载问题将被克服
芯片和频率标准预计将在全球发展

：行业标准对于许多应用程序导致互操作性在不同制造商的产品,包括硬件

政府对跨境贸易的要求
法规要求

Market Inhibitors 抑制性因素

Market	Availability of skilled experts 熟练专家的可用性 Over hyped value propositions, business cases, and timelines 在炒作价值主张、商业案例和时间表 Data ownership and security 数据所有权和安全
Economic	RFID tags are still expensive compared to barcodes (approx. $0.25) Implementation and back-end integration costs are very high ROI may not be immediate 与条形码相比，RFID标签仍然昂贵。0.25美元) 实现和后端集成成本非常高 ROI可能不会立即
Physical / Technical 国家特有的光谱波段 标签和阅读器之间的不兼容性仍然存在竞争对手制造商 读可靠性仍然需要改进。 RFID信号可以被阻塞在特定环境(如液体、金属) 数据加载产生的射频识别系统可以超载公司系统	Country-specific idiosyncrasies in regards to spectrum bands Tag and reader incompatibilities still exists between rival manufacturers Read reliability still needs improvement. RFID signals can be blocked in certain environments (e.g., liquids, metals) Data loads produced by RFID systems could overload company systems
Standards	Lack of flexible and global standards 缺乏灵活的和全球的标准 Cross-company data sharing model has not been defined. 跨公司数据共享模型尚未定义
Social / Political	End-user acceptance: Privacy, for example, remains a concern 终端用户接受度:例如，隐私仍然是一个问题

Industry Overview

IOT Industry Chain

Complete IOT industry chain includes:

- chip manufacturers
- communication module manufacturers
- hardware suppliers
- application equipments and software suppliers
- System integrator
- M2M service supplier
- traditional telecom carriers
- OEM
- consumers
- management counselors & testing
- certification suppliers. Communication chip vendors
- communication module manufacturers
- system integrators
- telecom carriers & OEM are at the core

物联网产业链
完整的物联网产业链包括:
- 芯片制造商
- 通信模块制造商
- 硬件供应商
- 应用设备和软件供应商
- 系统集成商
- M2M服务供应商
- 传统电信运营商
- OEM
- 消费者
- 管理咨询师与测试
- 认证供应商。通讯芯片供应商
- 通信模块制造商
- 系统集成商
- 电信运营商和OEM是核心

一些全球性行业的参与者

Some players in the global industry

Systems Management Domain IBM

Tagged Object Domain	Antenna & Reader Domain	Edge Domain	Premises Domain	Business Process Integration Domain	Enterprise & Business Application Domain
Philips Intermec Alien Texas Insts Avery Dennison Printronix Zebra Matrics Savi SAMSys Wherenet Wavetrend BlueSoft	Alien AWID Intermec Matrics Symbol TagSYS Savi Texas Insts Samsys Wavetrend FEIG BlueSoft	IBM OAT Systems ConnectTerra	IBM OAT Systems ConnectTerra Savi Wherenet	IBM OAT Systems Savi SAP	IBM SAP

Object Directory Domain

IBM VeriSign

Security & Privacy Management	IBM
RFID System Integrators	IBM, Intel, IPI, Intellident
Hardware Providers	IBM
Infrastructure & Storage	IBM
Application Management & Strategic Outsourcing	IBM

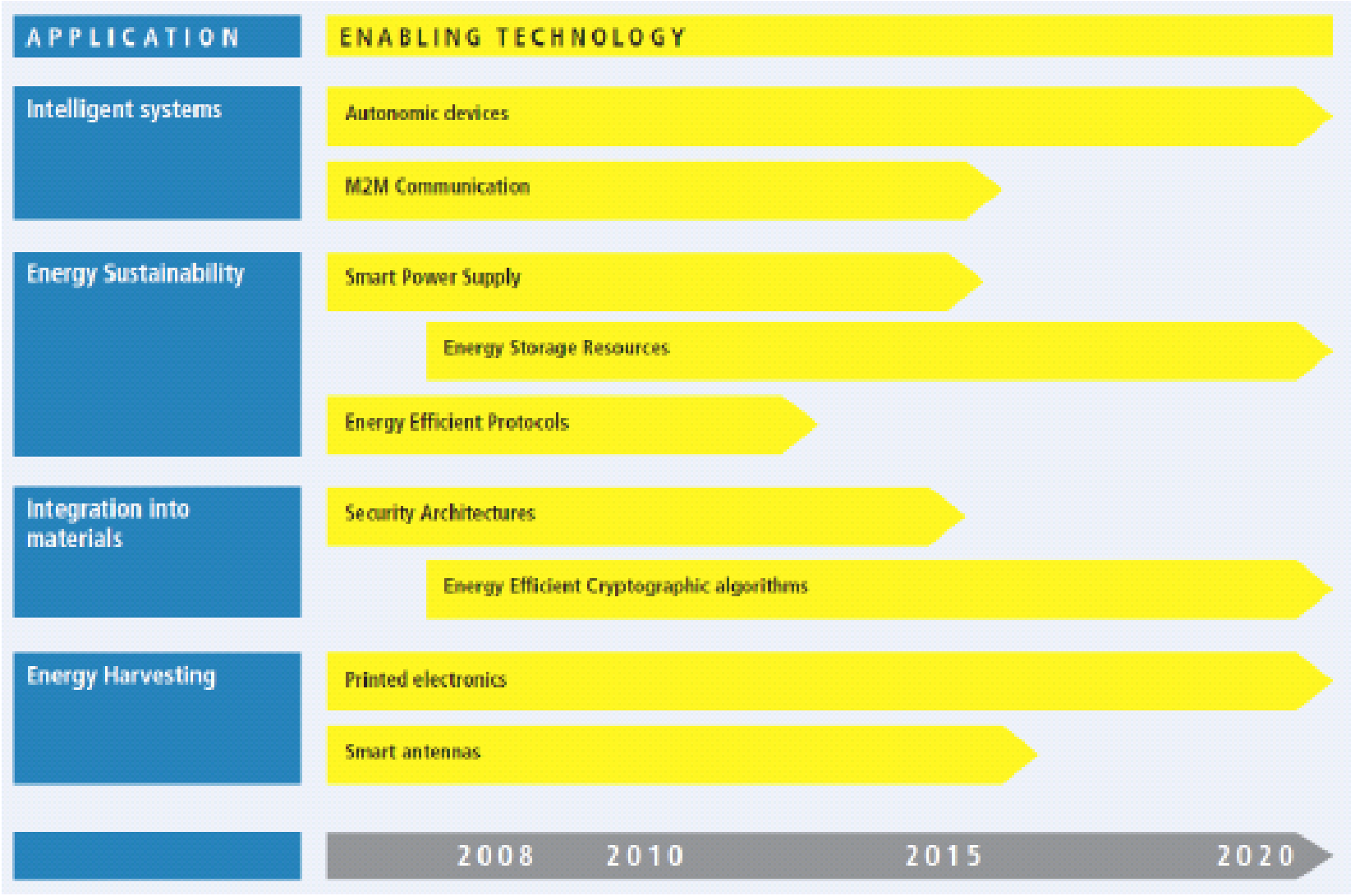
R & D for Internet of Things

- Research Priorities
  - Intelligent Systems
  - Energy Sustainability
  - Privacy and Security
  - Harsh Environment & Integration into Materials.
- Technology
  - Energy
  - Intelligence & Automaticity
  - Communication
  - Integration
  - Interoperability
  - Trust and Security

物联网的研发

- 研究重点
- 智能系统
- 能源可持续发展
- 隐私和安全
- 恶劣的环境和集成到材料中。
- 技术
- 能源
- 情报&自动性
- 沟通
- 集成
- 互操作性
- 信任和安全

IOT / RFID Research Priorities



开发智能无线识别系统的五大支柱:
- 多学科:从微/纳米到通信协议和集成，涉及不同的学科
- 聚合:不同技术的聚合，如纳米/微、传感器、平板电池/打印、打印天线、硅/聚合物
- 异构性:异构通信协议、传感器技术以及不同天线、电池、发电和显示器的组合

无线ID研究重点

Wireless ID Research Priorities

· 多功能:在不同频率和协议下运行的多功能微型智能RFID设备和阅读器，提高了质量、性能和成本效益，对安全和隐私友好，对用户具有全球兼容性和透明度。灵活、适应性强的射频ID设备(无源/有源)，根据应用要求将感应和驱动设备应用于多种材料中

Five pillars form the basis for developing smart wireless identifiable systems:

· 集成:非常高的小型化和集成水平，小尺寸、低功耗和低成本的要求意味着使用集成在芯片上的系统(SoC)和包内系统(SiP)实现的高集成

- **Multidisciplinary**: different disciplines are involved spanning from micro/nano to communication protocols and integration
- **Convergence**: the convergence of different technologies like nano/micro, sensor, flat batteries/printed, printed antennas, silicon/polymer
- **Heterogeneity**: heterogeneous communication protocol, sensor technologies, and the combination of different antennas, batteries, power generation and displays
- **Multifunctional**: multi functional miniaturized and smart RFID devices and readers operating at different frequencies and protocols, that have improved quality, performance and cost effectiveness, that are security/privacy friendly, and are world wide compatible and transparent for the user. Flexible and adaptable RF ID devices (passive/active), that incorporate sensing and actuating devices in a wide range of materials depending on the application requirements
- **Integration**: very high levels of miniaturization and integration, small size, low power and low cost requirements that imply high integration using a combination of system on chip (SoC) and system in package (SiP) implementation

A System of Systems and a Network of Networks…

Type of system	Identification (including readers)	Sensors	Connection	Integration	Data processing	Networks
Stakes	Identifying each object in a unique way and retrieving data stored in the object	Collecting information in the environment to enrich the functionalities of the systems	Connecting Systems between themselves	Integrating systems for data to be transmitted from one layer to another	Storing and analyzing data to launch a process or ease decision-making	Transferring data to and from physical and virtual worlds
Old technologies (examples)	Barcodes, simple RFID solutions	Thermometer hydrometer…	Cables, …	Middleware…	Excel, ERP, CRM…	Internet, Ethernet…
New technologies (examples)	Complex RFID solutions RFID, Surface Acoustic Waves, optical chips, ADN	Miniature sensors, nanotechnologies	Bluetooth, Near Field Communication, WiFi...	Complex middleware	Data warehouse 3D (compatible with RFID chips), Semantic Web …	EPCglobal network…

以独特的方式标识每个对象并检索存储在对象中的数据

在环境中收集信息，丰富系统的功能

将数据从一层传输到另一层的集成系统

存储和分析数据以启动流程或简化决策

在物理和虚拟世界之间传输数据

The IT

Linking Two Worlds

Middleware Server

Edge Server

RFID将物理世界与信息技术世界连接起来，以使计算机能够感知真实世界。

RFID links the world of Physics to the world of Information Technology in order to **allow computers to sense** the real world.

Information Technology

Reader

Physics

The **Physics challenges** and **IT challenges** of building RFID Systems are **about equal**.

Antennas

建造RFID系统的物理挑战和IT挑战是差不多的。我们应该关注IT方面的挑战，与他人合作，共同克服物理方面的挑战

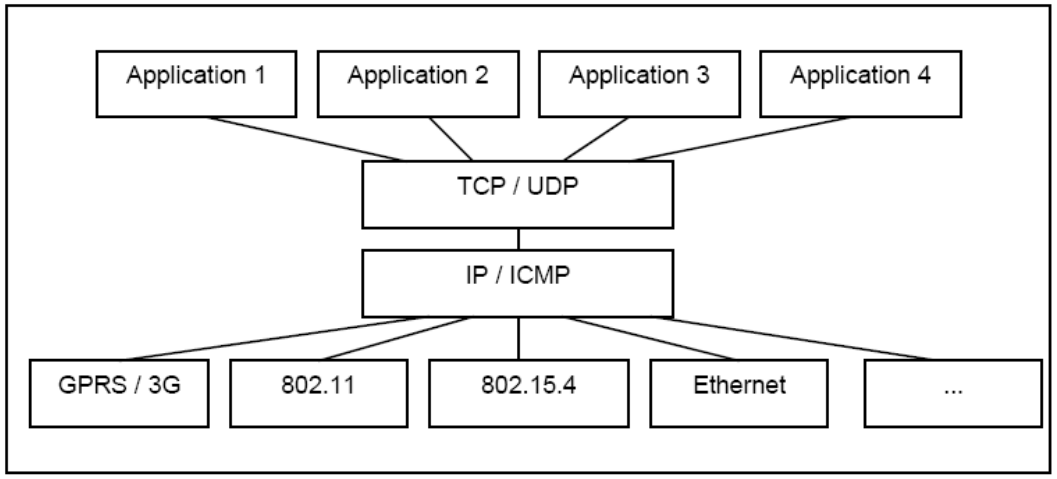
We should focus on the **IT** challenges and partner with **others** to overcome the **physics** challenges

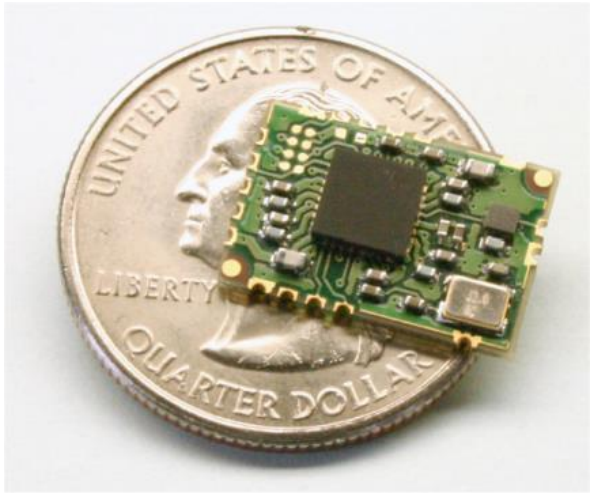
Tags on Product

What is IOT from Internet of Objects

- Until recently, smart objects were realized with limited communication capabilities, such as RFID tags, but the new generation of devices has bidirectional wireless communication and sensors that provide real-time data such as temperature, pressure, vibrations, and energy measurement.
- Smart objects can be battery-operated, but not always, and typically have three components:
  - a CPU (8-, 16- or 32-bit micro-controller),
  - memory (a few tens of kilobytes)
  - and a low-power wireless communication device (from a few kilobits/s to a few hundreds of kilobits/s).
- The size is small and the price is low: a few square mm and few dollars.
- **The Internet of Things**: **IP for Smart Objects**

直到最近，智能物体还只能通过有限的通信能力(如RFID标签)来实现，但新一代的设备具有双向无线通信和提供实时数据(如温度、压力、振动和能量测量)的传感器。
▪智能物品可以由电池驱动，但也不总是可以，通常有三个组成部分:
-一个CPU(8位、16位或32位微控制器)
-内存(几十千字节)
-和低功耗无线通信设备(从几千比特/秒到几百千比特/秒)。
尺寸小，价格低:几平方毫米，几美元。
▪ 物联网:智能物品的IP





Sample IOT Network

Middleware Server

Significant Product Movement Events

Dedicated Ethernet, 802.11

Multiple Edge Servers per Middleware Server

Edge Server Network

Item EPC, Antenna ID, Reader EPC, Timestamp

Serial, Dedicated Ethernet, 802.11

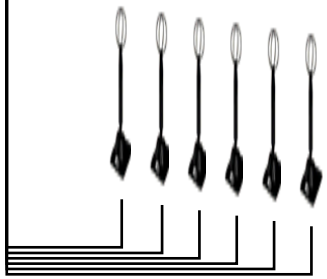
Multiple Readers per Edge Server

Reader Network

Item EPC, Antenna ID

Coax cable

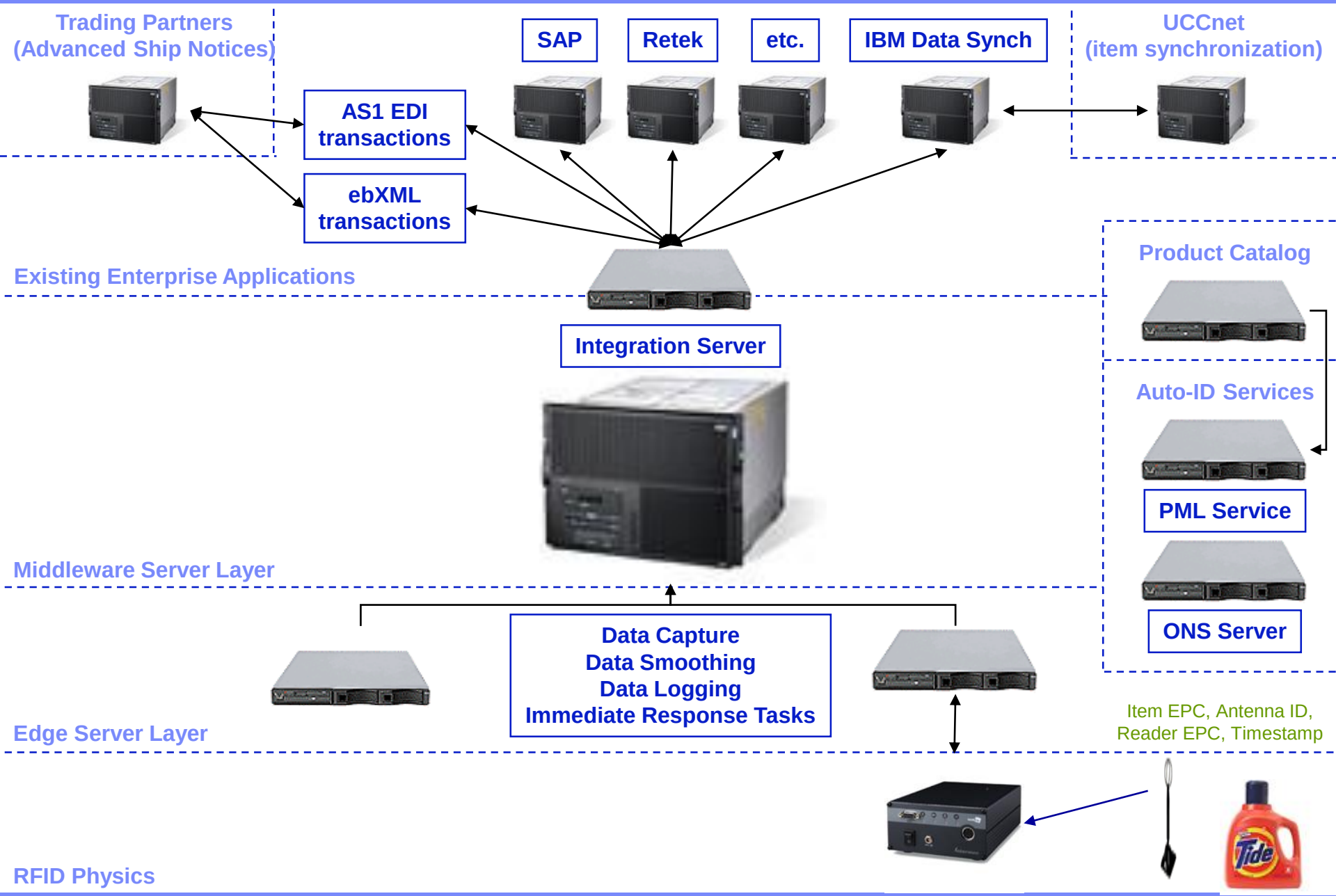
Multiple Antennas per Reader



Antenna Network

Item EPC

Multiple Products per Antenna


Trading Partners
(Advanced Ship Notices)
SAP
Retek
etc.
IBM Data Synch
UCCnet
(item synchronization)
AS1 EDI
transactions
ebXML
transactions
Existing Enterprise Applications
Product Catalog
Integration Server
Auto-ID Services
PML Service
Middleware Server Layer
ONS Server
Data Capture
Data Smoothing
Data Logging
Immediate Response Tasks
Item EPC, Antenna ID,
Reader EPC, Timestamp
Edge Server Layer
RFID Physics
Tide

IOT Challenges

解决方案成本高；
- 大规模部署困难
- 缺乏系统的应用系统
- 物联网知识传播不力，
- 潜在客户不足
- 缺乏统一的标准
- 产业链发展不平衡

- High cost of solutions;
- Difficulty in Scale deployment
- Lack of Systematic Application system
- Poor in disseminating IOT knowledge,
- Deficiency in potential customers
- Lack of unified standard
- Industry chain of Unbalanced development

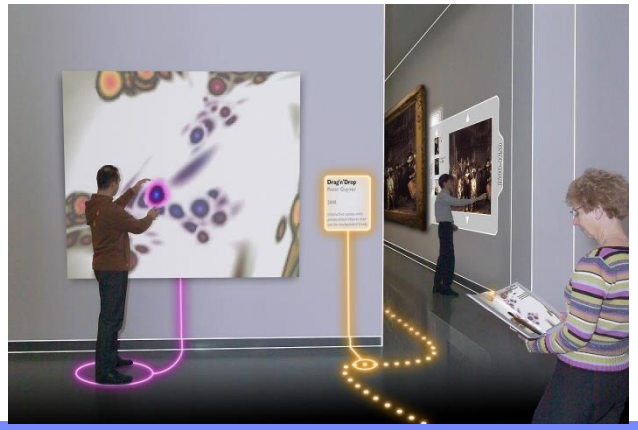
- **Various technologies with few key technologies**
- **Small-scale building**
- **Non-systematic Application**
- **Early Stage for IOT**

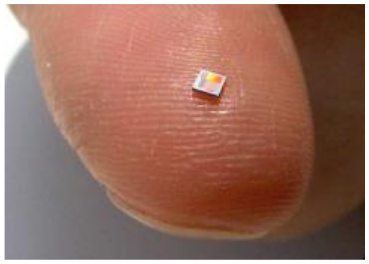
各种技术的一些关键技术
- 小规模的建筑
- 应用缺乏系统性
- 物联网早期阶段

物联网应用的关键开放问题

Key Open Issues of IOT Applications

- Architecture (edge devices, servers, discovery services, security, privacy etc.)
- Governance, naming, identity, interfaces
- Service openness, interoperability
- Connections of real and virtual world
- Spectrum (HF, UHF, ISM etc?)
- Standards





The Future

IOT Applications

Public Services

Automatic data logging;
Lighting of sings;
Environmental monitoring;
Safe guarding

自动数据记录;
唱的照明;
环境监测;
安全防护

Health Care

Medical Staff Management;
Remote Monitoring

医务人员管理;
远程监控

Industrial/Manufacturing

Equipment monitoring;
Industry Automation

设备的监控;
工业自动化

Financial Service

Mobile Trading
Mobile Vending Machine

移动交易
移动售货机

Transportation

Vehicle Information Communication System;
Vehicle Management;
Merchant Monitoring

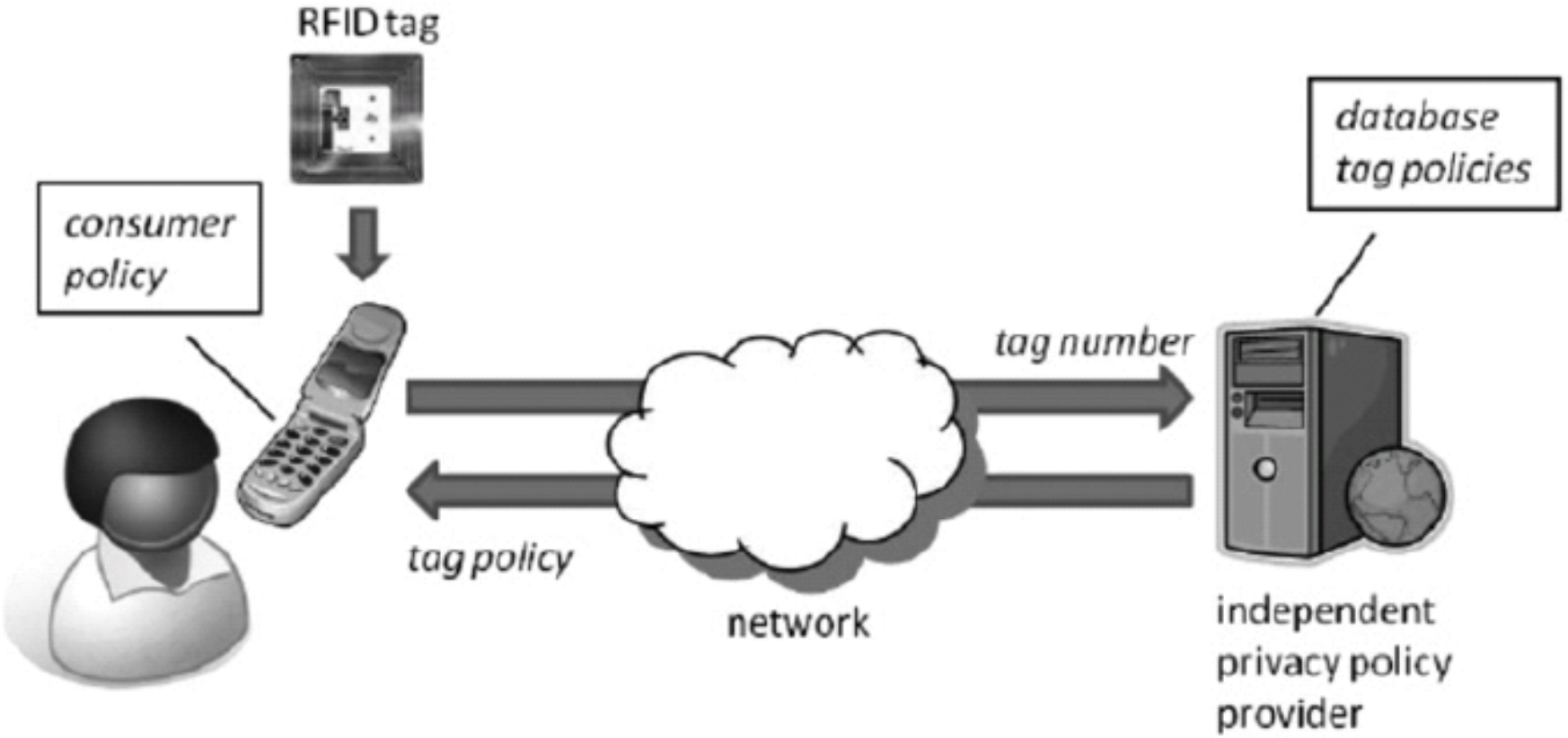
车辆信息通信系统;
车辆管理;
商人的监控

Building & Household

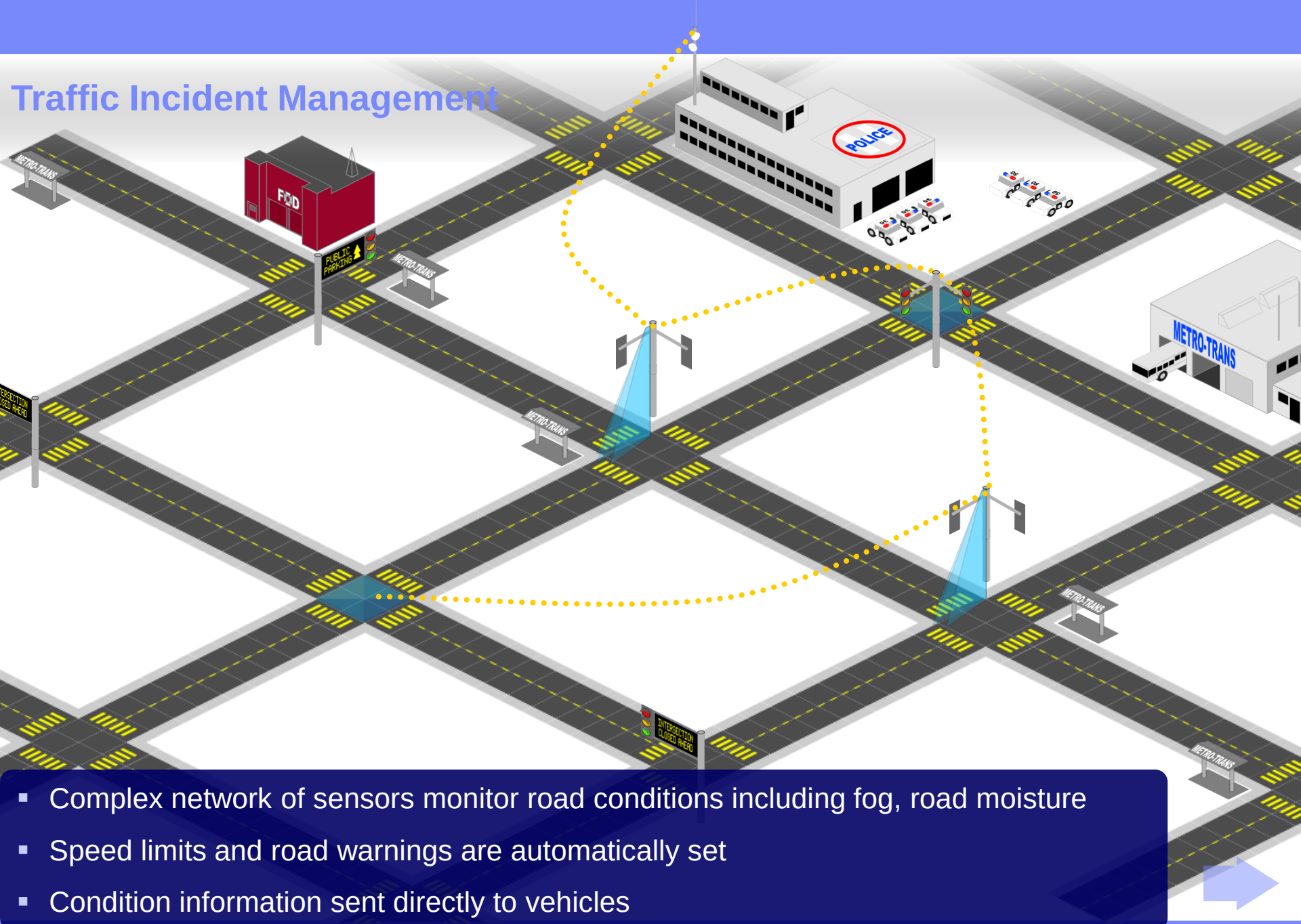
Intelligent Building;
Intelligent Home

智能建筑;
智能家

Mobile Phone in The Internet of Things

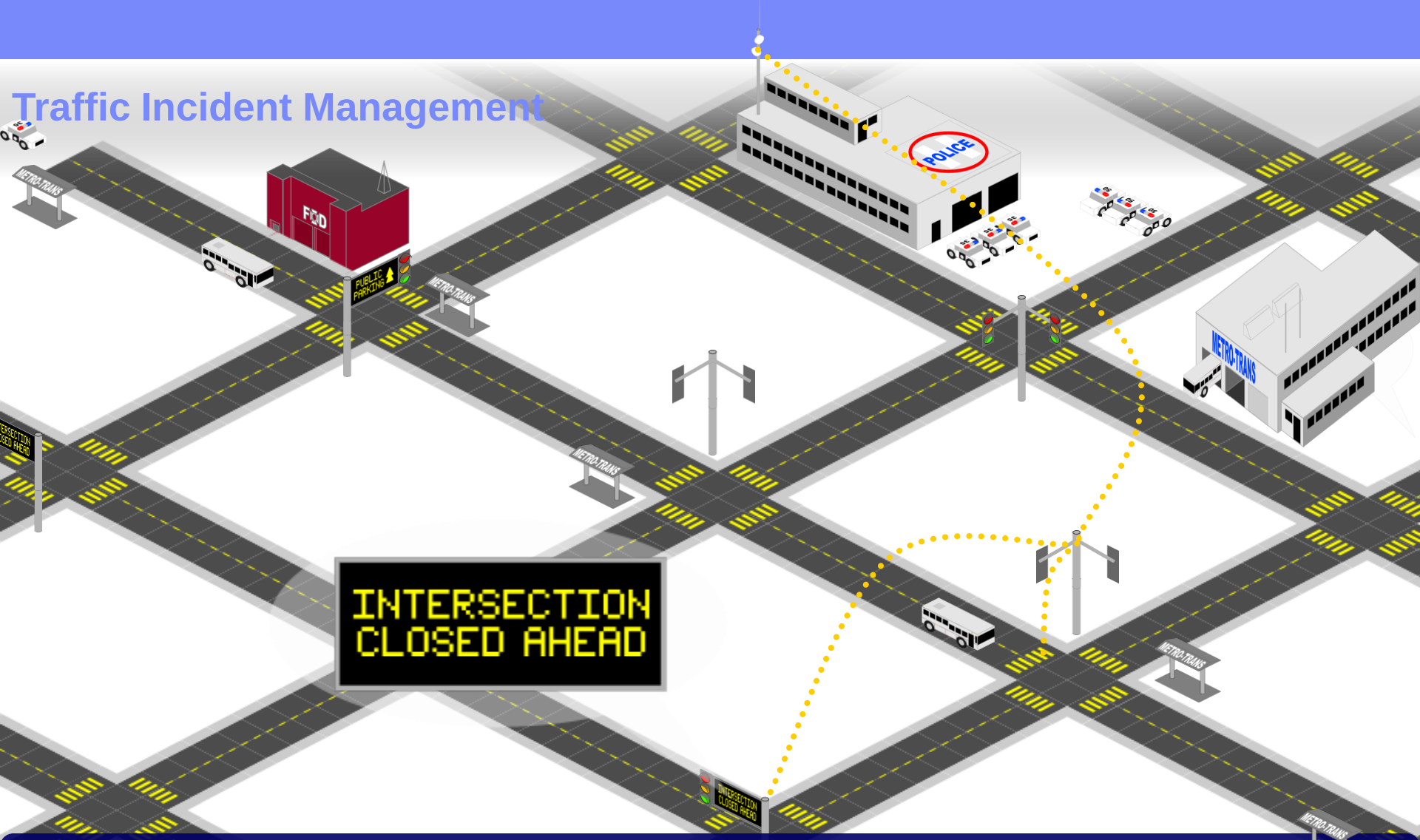


Traffic Incident Management



- Complex network of sensors monitor road conditions including fog, road moisture
- Speed limits and road warnings are automatically set
- Condition information sent directly to vehicles

Traffic Incident Management

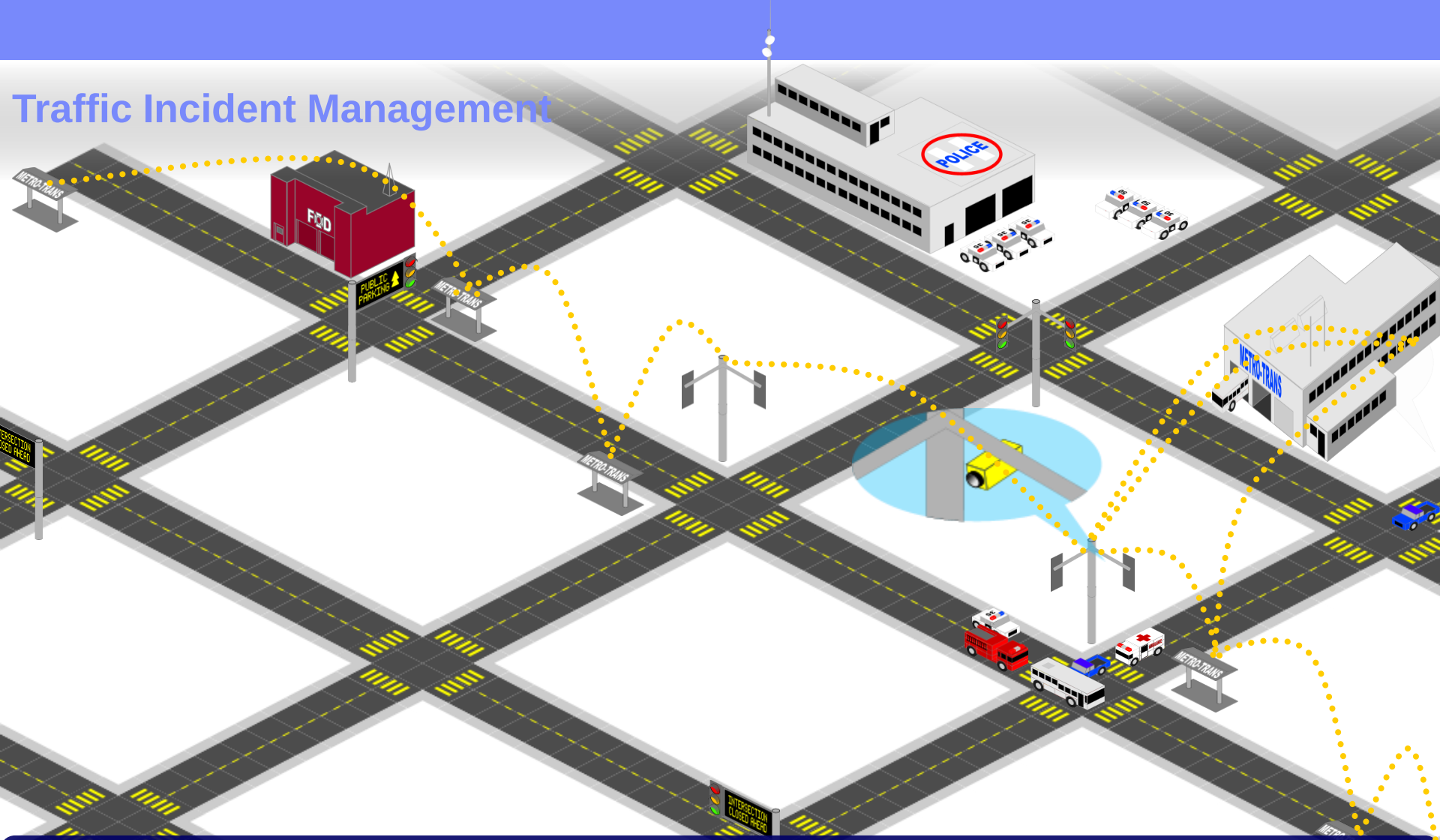


- Sensors on the bus and in the roadway report a potential accident
- Sensor data and real time images are transferred to the E911 dispatch center
- Traffic signal control is modified to begin routing around the incident

Traffic Incident Management

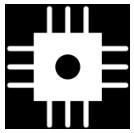
- Predefined automated incident response plan for public transit traffic incidents is activated
- Nearest police, fire and emergency medical assets are activated
- Traffic signal control facilitates arrival of first responders

Traffic Incident Management



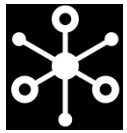
- Transit dispatch uses fixed cameras, sensors and on scene reports to determine that the bus is inoperative
- A substitute bus is dispatched
- System wide schedule information is updated at bus stops and to rider accessible information systems
- A connecting light rail train is held five minutes to accommodate the delay

IBM:
Smart Planet



Our world is becoming

INSTRUMENTED

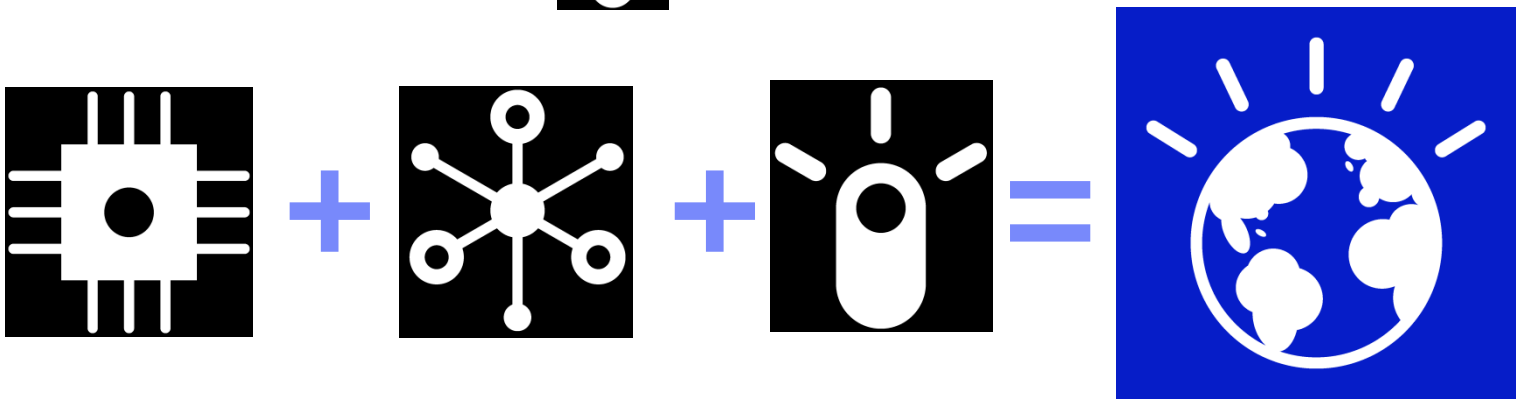


Our world is becoming

INTERCONNECTED

Virtually all things, processes and ways of working are becoming

INTELLIGENT



An opportunity to **think and act in new ways—** economically, socially and technically. 以新的方式思考和行动的机会——经济的、社会的和技术的

"Smart Services" -- Opportunities

当设备或系统出现灾难性故障时
▪当设备提供信息，以权衡库存
▪ 当维护费用昂贵时(如远程设备)
▪ 当了解场地、演出等信息时。
根据个人或用户类型，可以用来设计更好的产品或服务，或改进现有产品的营销

- When a device or system failure is catastrophic
- When the device provides information that trades off against inventory
- When maintenance is expensive (i.e. remote devices)
- When information about the location, performance, etc. of a device -- by person or by type of user -- can be used to design better products or services or to improve the marketing of existing ones

"Smart Services" -- Challenges and Limitations

- Some devices or products are so simple and inexpensive that adding networking and computation capabilities to them isn't worth the investment
- Some don't or can't have any information worth sharing
- Some have very short or very long useful lives
- Some don't have reliable network access
- Customers care about value and won't pay for anything else, so remote monitoring can usually be sold only as part of a shift from "pay for transaction" to "pay for performance" - i.e., the service being delivered in greater "uptime"
- There may be a "torrent" of information, little of which represents important events

有些设备或产品是如此简单和廉价，为它们添加网络和计算能力不值得投资
- 有些人没有或不能有任何值得分享的信息
- 有些产品的使用寿命很短或很长
- 有些没有可靠的网络接入
- 客户关心价值，不会为其他任何东西付费，因此远程监控通常只能作为从远程监控转向远程监控的一部分
“按交易收费”至“按表现收费”-即服务的“正常运行时间”较长
- 可能会有信息的“洪流”，其中很少有代表重要事件的

IoT as the APIs of Cloud

物联网是云的杀手级应用，尤其是混合云，后者正作为物联网的主要模式出现。
有鉴于此，api和围绕它们的合理策略对企业来说变得越来越重要。
api是连接有用信息和丰富数据到物联网的桥梁，通过将许多不同的事物连接成一个强大的网络，提供惊人的可能性，物联网变得有用。

The Internet of Things is the killer app for cloud, especially for hybrid cloud which as emerging as the primary model for the IoT.

- In light of this, APIs and a sound strategy around them is becoming increasingly important to enterprises.
- APIs serve as a bridge to connect useful information and plentiful data to the Internet of Things making the Internet of Things useful by connecting many disparate things into a powerful network that offers astounding possibilities.

APIs are the market enabler.

api是市场推动者。
没有它们，物联网设备将毫无用处。
通过暴露数据使多个设备连接起来，
api提供了互联网和事物之间的接口，揭示了以前未见过的可能性。
在接下来的一年里，api的力量和重要性将成为围绕物联网实现(更重要的是，物联网货币化)讨论的前沿话题

- IoT devices would be useless without them.
- By exposing data that enables multiple devices to be connected, APIs provide an interface between the Internet and the Things to reveal previously unseen possibilities.
- In the year to come, the power and importance of APIs will be at the forefront of the conversation around enabling, and more importantly, monetizing the IoT.

IoT in Cognitive Era -- Cognitive IoT

- Analysts project IoT data to yield insights driving potential economic value of as much as $11 trillion by 2025.

分析人士预计，到2025年，物联网数据将产生多达11万亿美元的潜在经济价值。
认知物联网就是这样一种方法，一种破译物联网数据的方法，可以有效地处理越来越大的输入，同时产生有意义的输出。
作为一种处理大量复杂物联网数据的强大、复杂的方式，认知物联网是开发这一现代资源的一个前所未有的机会。
事实上，认知型企业赋予了一种对物体、产品、流程和服务的思维能力，而物联网是它们这样做的不可或缺的能力

The cognitive IoT is just such an approach — a way of deciphering IoT data that can effectively handle increasingly large inputs while generating meaningful output.

Intended as a powerful, sophisticated way of handling massive amounts of complex IoT data, cognitive IoT is an unprecedented opportunity to exploit this modern resource.

Indeed, cognitive businesses confer a kind of thinking ability on objects, products, processes and services—and the Internet of Things is integral to their ability to do so.

Outline

- ✓ General Description
- ✓ Market Overview
- ✓ Industry Overview
- ✓ The IT
- ✓ The Future

The Future Internet

Internet of Services | Internet of Things | Internet of Media

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Why IBM?

Know-how

Business Consulting Services, Systems Integrations, High Volume systems, High Availability, Telecom

Hardware & Software

WebSphere, WESM, WEA, wBI, MQ Series, DB2, xSeries, pSeries, storage, …

Infrastructure on demand

eBusiness on Demand, hosting, managed storage, and network management

on demand

Open Standards

3GPP, MMS, SMS, WAP, SMPP, HTTP, SOAP, Parlay, SIP

Technology

WDE and SPDE architecture, research, patent leader, test labs

Partnerships

Air2Web, QPASS, Openwave, Nokia, Real Networks, Sun, Cisco, Veritas