# Smart Items Research Program


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# SAP Corporate Research

## Business Driven Technology Innovation

- Source and Create Technology that innovates business scenarios
- Leverage worldwide university and industrial research
- Validate the technology and the new business processes
- Impact SAP's Product Roadmap
- Karlsruhe, Palo Alto, Brisbane, Sophia-Antipolis, Johannesburg, Montreal

### CRC Palo Alto - Montreal

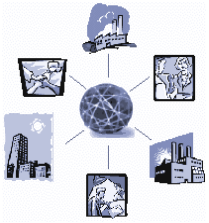
Primary research areas:

- Advanced Customer Interfaces
  - Desktop and mobile multi-modal user interfaces
    - Customer pilot stage
  - Socially aware interfaces
- Smart Items Research Program
  - Smart Vending
  - Auto-ID Infrastructure
  - Validation of Sensor nets

# Smart Items - Real World Business Visibility

## Smart Items Research Program

*Connecting the corporate world to digitally enabled objects that represent their goods, services and assets*



Digitally enabled
- Goods
- Services
- Assets
- Other environments

- Scalable infrastructures
- Effective support of existing applications
- New applications to support newly available information

## Smart Vending

Enterprise applications and digital connection architecture for vending machines

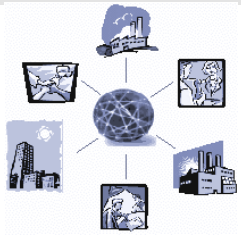
## Smart Items Infrastructure - Auto-ID

Tracking and responding to a high volume of products throughout the supply chain and beyond

- How much cash should be in the machine?

- Will the right product be there when my customer wants to buy?

# Auto-ID as Sensor Net example



Distributed model of the entire supply chain

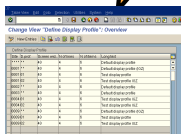
Local, often specialized applications

Local model is computer mirror of real world as reported by sensors

**Enterprise wide Applications**
- Supply chain planning
- Asset management
- Recalls, promotions, integrity, etc.

**Machine readable representation of the physical world**

Distributed Global Coherent Model



Net

**Coherent Representation**

Local Model | Local Model | Local Model

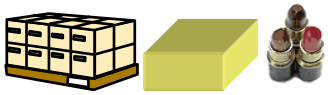
**Data Samples**

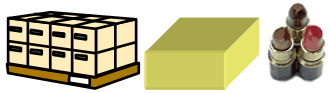
Net | Net | Net

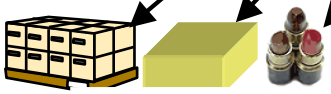
**Sensors**

mirror

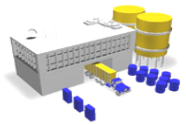
**Tagged products**



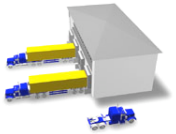




**Physical World**



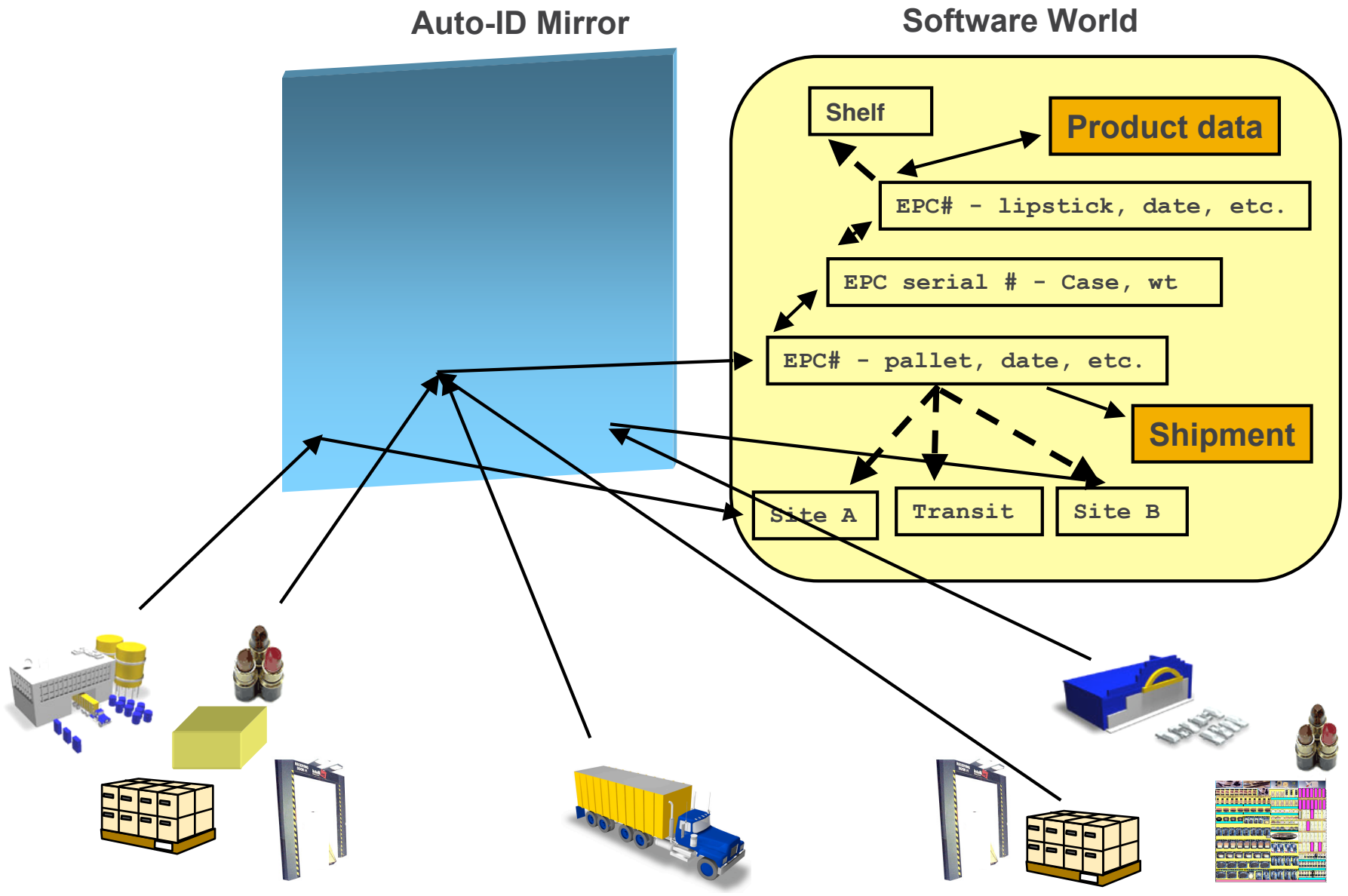
Manufacturer



Distribution

Retail

# Mirror from Physical to Corporate World



# Large Scale Sensor Net coupled to Enterprise Apps

Enterprise wide Applications

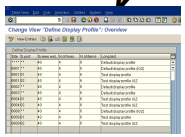
Distributed model of world based on sensors

Specialized, real time applications?

Local model is computer mirror of real world as reported by sensors

Machine readable representation of the physical world

Distributed Global Coherent Model



Net

Data Capture & Representation

Local Model

Local Model

Local Model

Data Samples

Net

Net

Net

Sensors (Actuators)

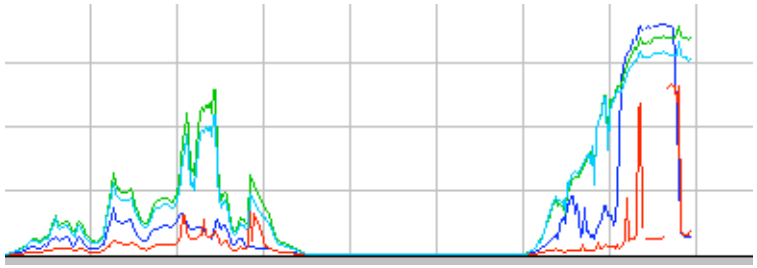
mirror

Real World

# Different kinds of Applications

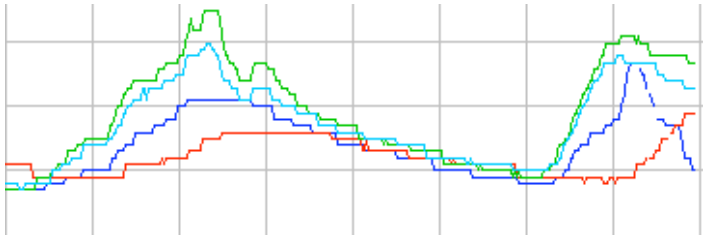
## Raw data

- E.g. Light Flux
- Ground moisture
- Stock Price



## Dedicated application

- E.g. Turn on sprinklers
- Control physical processes



## Analytic Application

- E.g. Plant growth
- Stock sector momentum
- Predict jet engine service need

## Information for Business Decision

- Grain yield per acre
- Future grain price
- Latest time until service

## Business Application

- Primary products trading application
- Aircraft service scheduling application

## Example domains

- Enterprise wide
  - Finance, Goods, services, assets, people
- Industrial
- Commercial/Retail
- Environmental
- Security/Defense
- Other

# Sample questions

- What information gathering and control is enabled by sensor net technology that can enhance business decisions or create new business applications?
- What kinds of information and control is not already available by conventional control systems? What is missing?
  - If sensor net technology was cheap and reliable, what new kinds of data would I gather?
- Where does the potential for self-organizing, quasi-autonomous operation offered by sensors nets have special value?
- Are there generalized (software) principles and needs for sensor networks that are applicable over more than a narrow domain?
- What are likely to be successful domains?
- What are the broad business applications enabled by sensor nets?
  - What new sensors does a CEO need to make better decisions?
- What are the barriers to broad business usage?
  - Lack of appropriate sensors (and actuators)?
  - Unreliable, power limited, communication?
  - Software infrastructure for data gathering?
  - Analytic software to utilize data?
  - Business applications to utilize analysis?
  - Competition from established technology?

# Sensor Net - Commercial Bonanza?

**… what application will transform the technology into a commercial bonanza?**

***"Everyone and their aunt and uncle is interested, But it's a struggle to find the business model."***

- **Deborah Estrin, director of UCLA's Center for Embedded Networked Sensing.**
  - **Quoted by Gregory T Huang – MIT Technology Review**