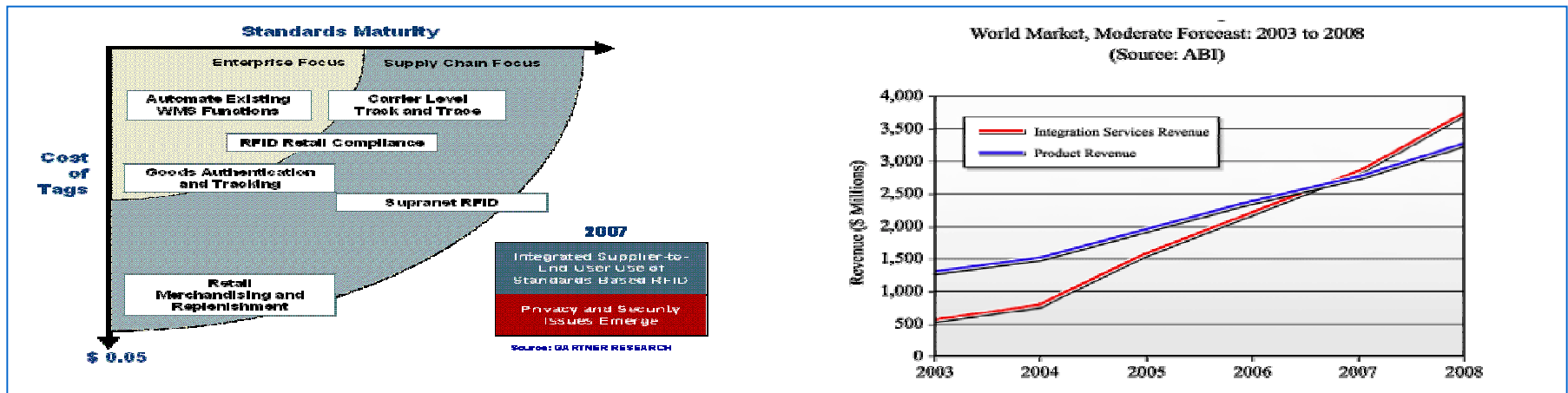
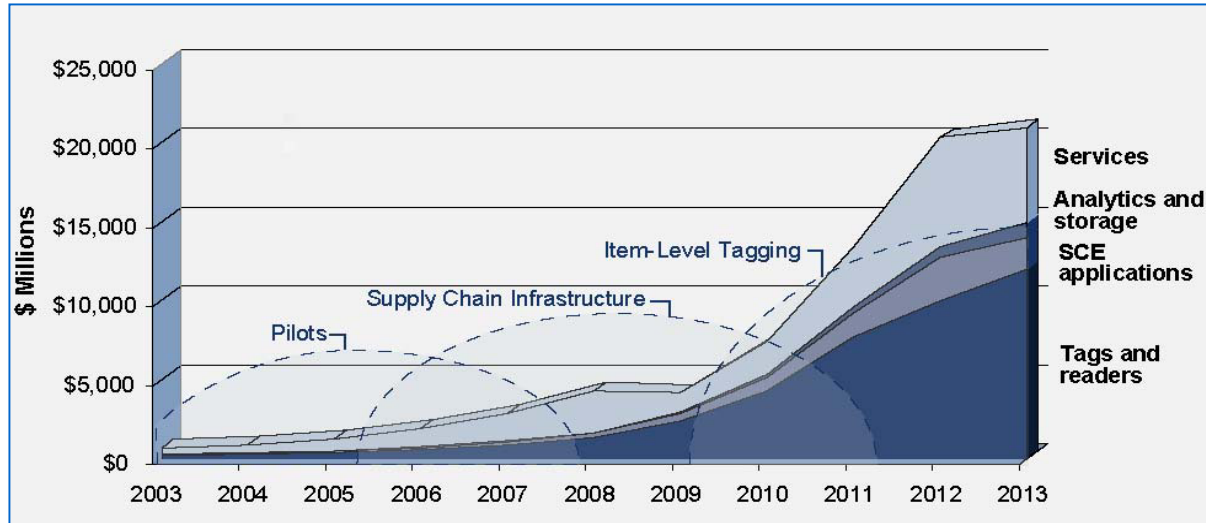


Putting RFID to work

RFID enabled Business Solution

RFID Is A Fast Emerging Technology Poised For Rapid Growth...

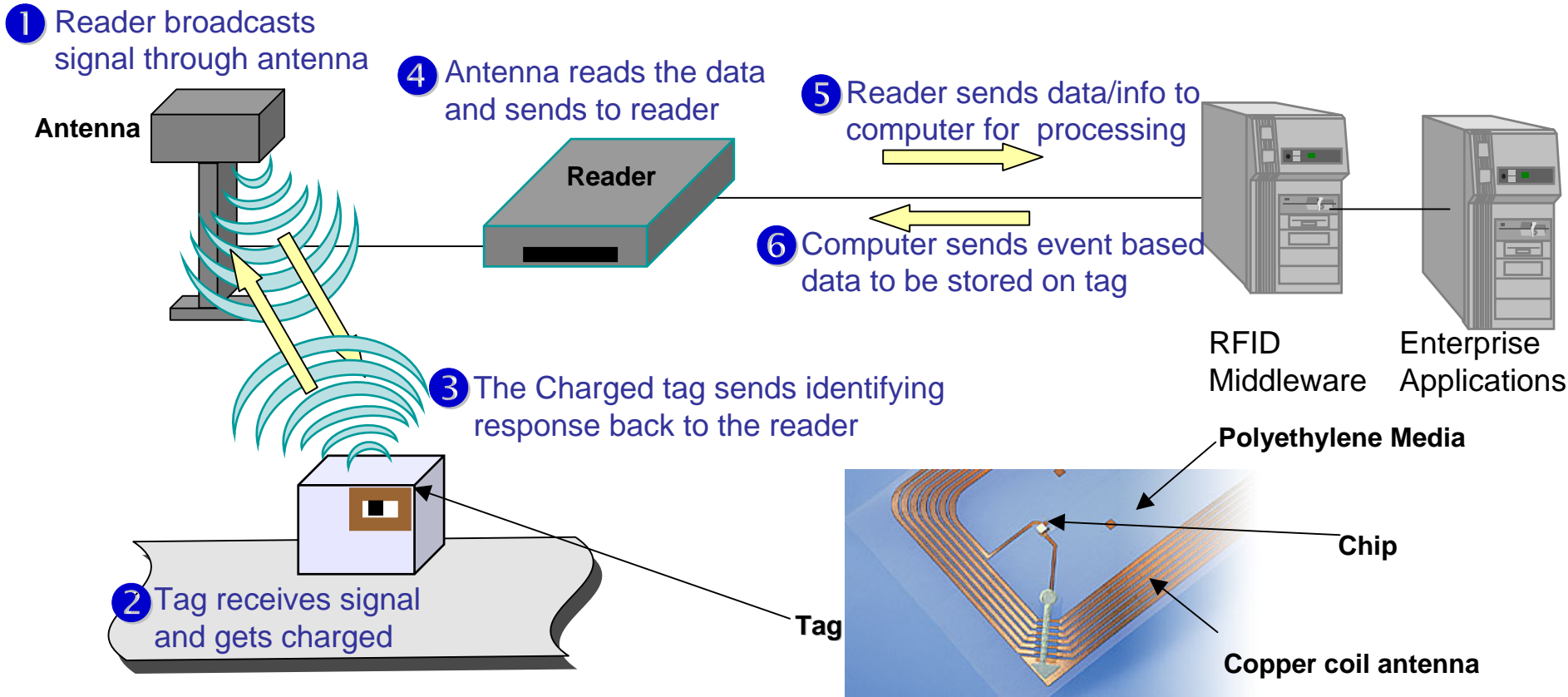


RFID- An Introduction

What is RFID? How does it work?

- **RFID identifies (SKU) individual items**
 - Cola can
 - Vial of aspirin
 - Component of aircraft engine
- **RFID tags are paper thin labels consisting of**
 - Integrated chip
 - Integrated antenna
 - Two varieties: Passive tags and active tags with (battery) power source
- **RFID readers can “read” many tags**
 - Line of sight not required
 - Anti-collision prevents interference
- **RFID readers may be**
 - Handheld or stationary

RFID – A Bird's Eye View



- Uses radio waves or micro waves for quick & automatic identification
- Detection/data transfer is contact-less and doesn't need line of sight
- Tags can store data and help maintain historical information

RFID Eco System


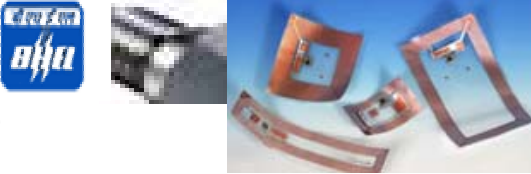




Silicon

RF Engineering

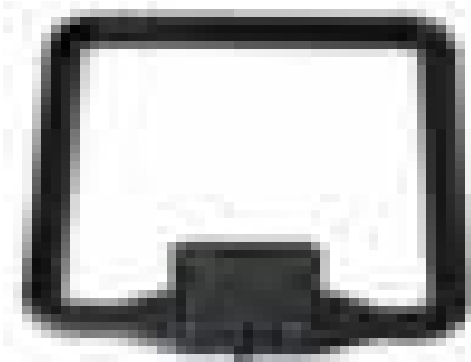
Edge & Application Processing

Frequency used for tags

<p>Low (125-134 kHz)</p>	<p>Read range – 2 meters Great penetration Slow data rate Costlier tag antennas Multiple tags cannot be read together</p>	
<p>High Frequency (13.56 MHz)</p>	<p>Read range – 1 meter Good penetration Simultaneous read capability @ 50 tags Most progress on standard setting</p>	
<p>UHF (868, 902-928 MHz)</p>	<p>Read range –10 meters. Fast data rate Simultaneous read capability @ 50 tags</p>	
<p>2.45 GHz</p>	<p>Read range – 1 meter Very fast data rate</p>	

- Spectrum use is often regulated by governments (13.56MHz designated for ISM applications in most countries)
- UHF frequencies (850 - 960 MHz) for RFID vary from country to country
- Read range is greater with battery powered tags (active/semi passive)

Equipment used: Readers and Antennae



Readability and range depend upon the design of readers and antennae

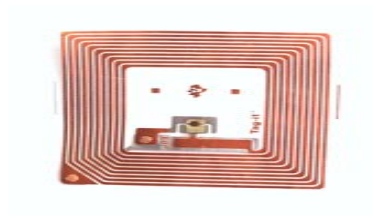
Reader Classifications

- Frequency of operation
- Air Interface Protocol
- Antenna number, type, configuration
- Power Outputs
- Connectivity with host
- Form factor and mounting

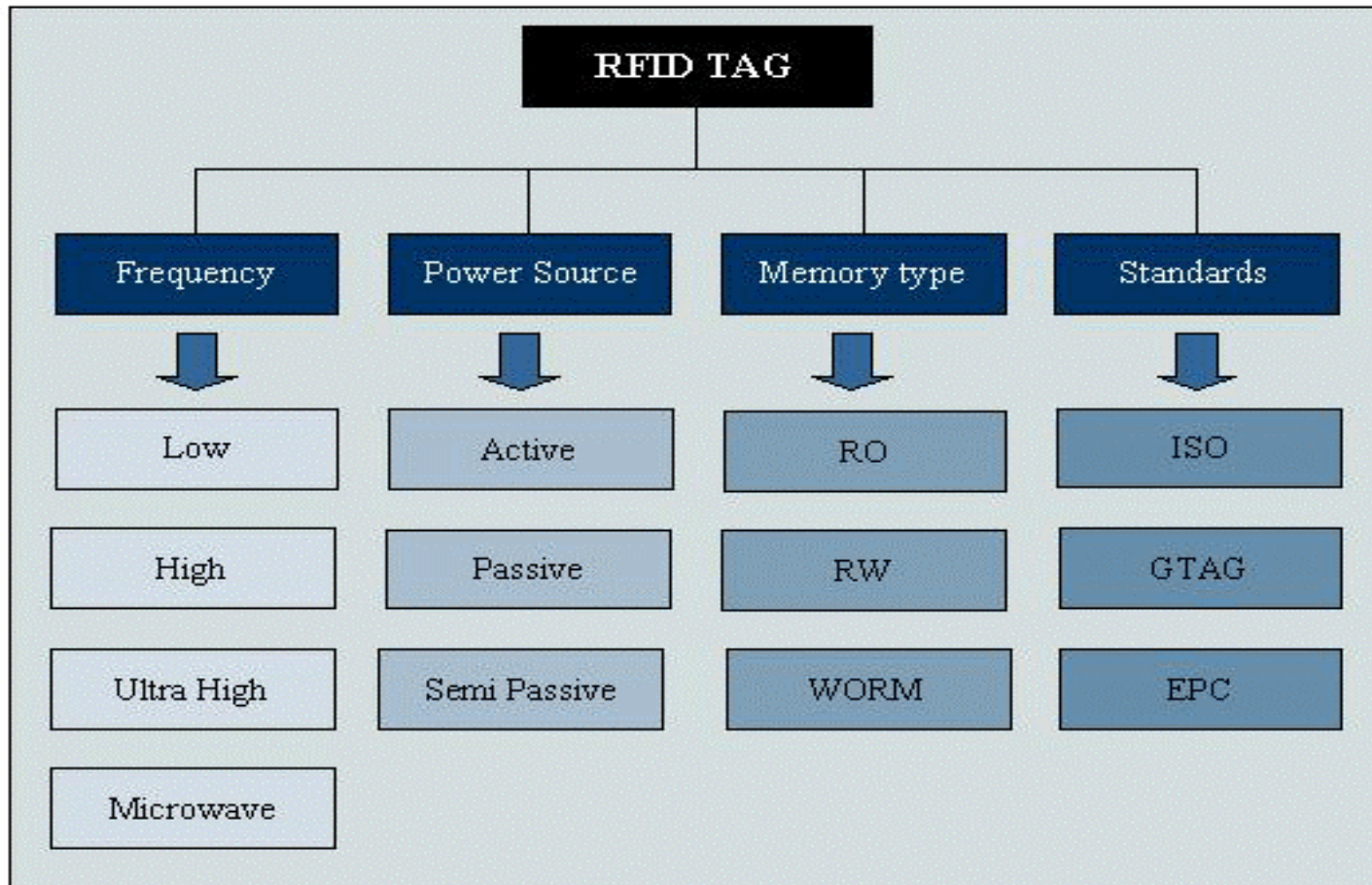


Tag Classifications

- Frequency of operation
- Power Source
- Memory type and size
- Air Interface Protocol
- Anti-collision support
- Operating environment support
- Form factor



Classification of Tags



Application Characteristics

- Identification only vs. Identification & Tracking
- Choke Point vs. Real Time Location system
- Inventory & Search vs. Real Time Location system
- Real Time vs. Batch
- Online/Networked vs. Offline
- Manual vs. Unmanned
- Closed Loop vs. Open Loop
- Global usage vs. Local usage
- Security & Privacy
- Tagging Level
- Data to be carried

Selection Criteria

Selection Criteria is governed by

- Application Characteristics
- Performance Requirements

RFID Use Cases in Various Verticals



RFID Applications and Value Chain

Manufacturing	Transportation	Retail	Telecom	Others
<ul style="list-style-type: none"> ▪ Supply chain management & distribution ▪ Production management ▪ Factory Automation ▪ Maintenance / condition monitoring ▪ Asset management 	<ul style="list-style-type: none"> ▪ Airlines baggage handling • Boarding pass • Package Tracking • Container Tracking • Yard Management • Toll collection • Fleet tracking • Rail car ID 	<ul style="list-style-type: none"> • Inventory management • Warehouse operation • Supply Chain Management • Interactive Kiosk • Self check out at POS • Electronic Article Surveillance 	<ul style="list-style-type: none"> • Asset Tracking and Management • Contact less Payment solutions using mobile phones • Billing solutions • Various Value Added Services 	<ul style="list-style-type: none"> • Contact-less payment (Banking) • Access Management • Library Management • Product/document Authentication • Auto immobilizer • Animal identification • Parking Control

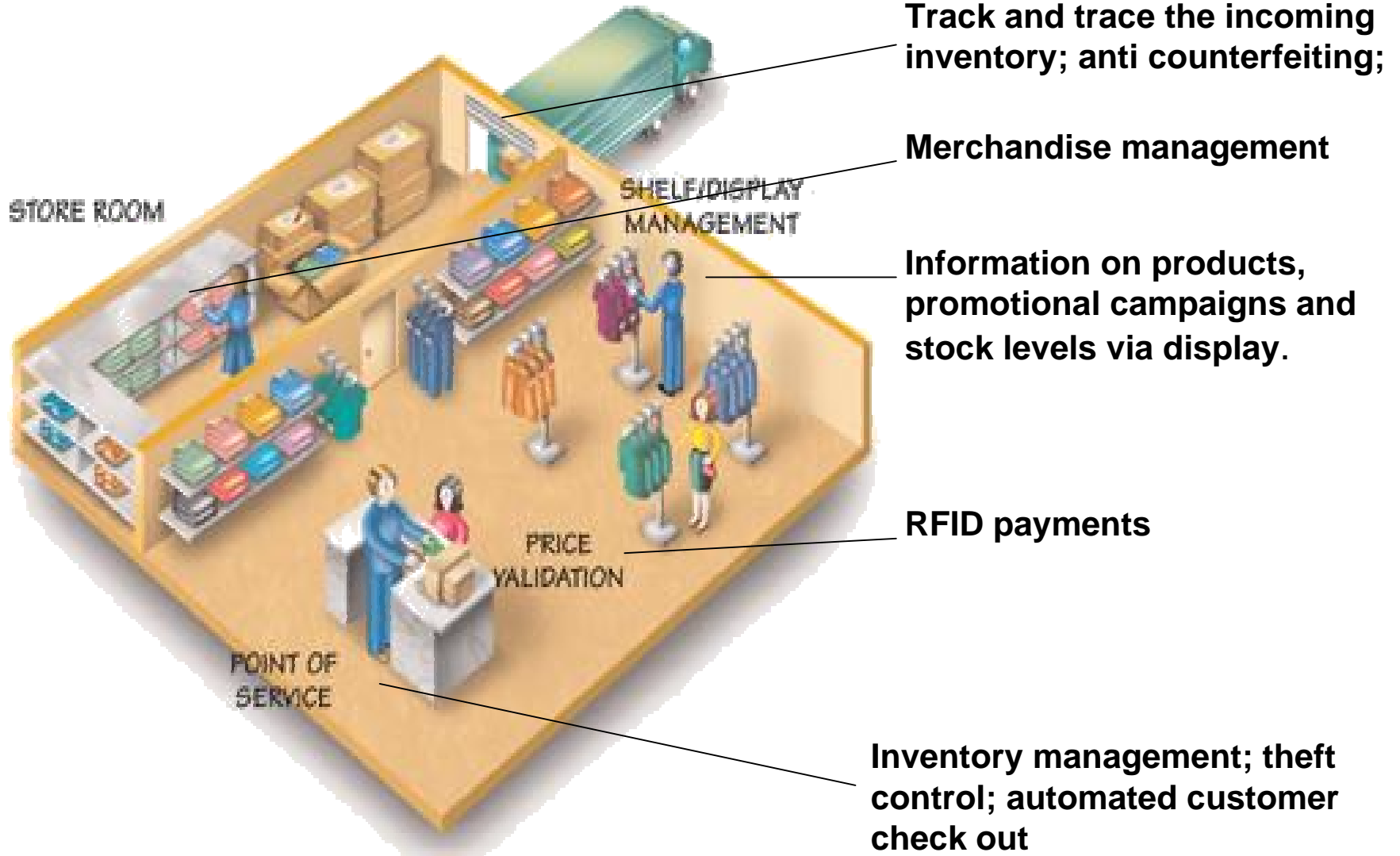


Silicon companies – TI, Philips, Siemens, Hitachi
 Tag manufacturers – EMS, TI, Matrics, Alien

RFID Reader / Antenna makers – EMS, TI, Matrics, Alien, Hitachi
 RFID Software providers – OAT, Sun, ORACLE, SAP, Globberanger, Matrics, ConneCTerra Savi

IT Solutions & Services providers
 Tata Consultancy Services
 Accenture, IBM GS, CGEY
 Wipro

Solutions for Retail



RFID Across the Supply Chain

RFID all the way

Manufacturing

Warehouse & Logistics

Sales, Delivery & Merchandising

Home Sales & Field Service



RFID Can Be Used In Various Points Throughout The Supply Chain

- **Manufacturing** - discretely identify products, the facility in which it was produced and the date of manufacture
- **Distribution Centers** - accurate inventory control and order fulfillment activities
- **Retailers** - track shelf activity, trigger automated fulfillment, improve customer checkout, billing and shrinkage
- **Reverse Logistics** - evaluate merchandise return speed to DCs, disposition of returned products, financials
- **Container/Yard Management** - Real-Time Locating Systems (RTLS) triangulate the relative position of tagged items. Useful also for specialized Kanban systems (requires expensive RFID Tags)
- **Asset Tracking** – tracking items such as returnable containers and high value products

Ultimately, the big cost savings and service benefits of RFID will come from a dramatically enhanced ability to manage inventory and orders across time and the supply chain. 3PLs are already firmly established in delivering these type of logistical applications.

Thank You

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