



**International Telecommunication Union**

# **RFID: An IP Networked Application**

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## Radio Frequency Identification

- A method of identifying unique items using radio waves.
- Typically, a reader communicates with a tag, which holds digital information in a microchip.
- In addition there are chip-less forms of RFID tags that incorporate reflective material.





## RFID Frequency Bands

Band	123KHz	13.56MHz	315 MHz	418MHz	433MHz	868MHz	915MHz	2.4GHz
Detail	119-136 KHz 72dBuA/m @10m	13.553-13.567 MHz 42 dBuA/m @10m	314.7-315 MHz 65 dBuV/m @10m	418.95-418.975 MHz 10mW ERP	433.050-434.790 MHz 10mW ERP 10%	868-868.6 MHz 25mW ERP 1%	902-928 MHz	2400-2483.5 MHz
Range (passive)	Very Short	Very Short	Very Short	Very Short	Very Short	Very Short	Short <sup>1</sup>	Very Short
Range (active)	Short	Short	Long <sup>2</sup>	Long <sup>2</sup>	Long <sup>2</sup>	Long	Long	Long
Range adjustment	Very Good <sup>3</sup>	Good	Fair	Fair	Fair	Poor	Poor	Poor
Propagation through materials	Excellent <sup>3</sup>	Very Good	Good <sup>2</sup>	Good <sup>2</sup>	Good <sup>2</sup>	Fair	Fair	Poor
Directionality	Omni-dir	Omni-dir	Directional or omni-dir	Directional or omni-dir	Directional or omni-dir	Directional or omni-dir	Directional or omni-dir	Directional or omni-dir

1. 915 MHz is the only band that provides Short Range for passive tags (due to regulatory requirements)
2. Lower UHF bands (315, 418, 433 MHz) are the only bands that provide Long Range (with active tags), have good propagation, and can use directional antennas
3. 123 KHz is the only band with Very Good range adjustment and propagation characteristics



## RFID Today: Technologies and Applications

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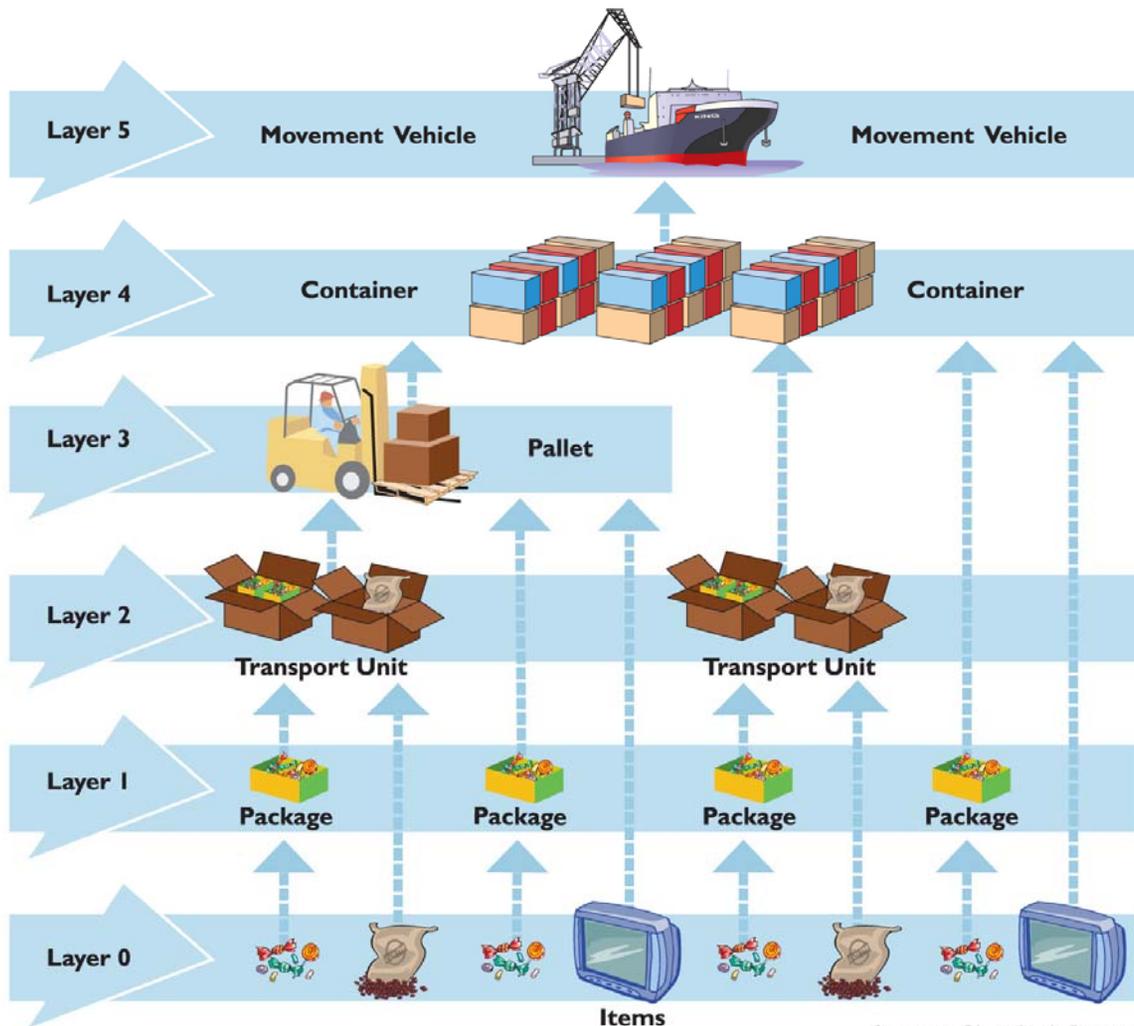
Tags	Readers	Middleware	RFID Networks Applications	Complimentary Applications
Passive Tags Hold the data— passive Unique ID (EPC code or UDI)	Fix	Read management	Referential item information systems for passive data (ONS and other)	Warehouse/Inventory Store Operations Mfg Financial
Active Tags Data Rich multi-frequency	Hand-held	Filter and aggregate	Document Libraries such as trade documents	Kanban Recyclable containers/pallets Yard Warranty
Secure Tags Monitoring-Sensing/Bio Metrics			Cold Chain , Health care applications will be developed	Quality Brand Security
GPS	Mobile/ Read/write and transmit	Publish subscribe data from routers, applications, web and air	Hosting and RFID enabled business application	Transportation Global Trace and Track Smart Secure Trade Lanes/Operation Safe Labour



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# Data Model

## NESTED VISIBILITY



Source: ChainLink Research



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## The Value of RFID

- Today:
  - Serving the customer
  - When you call it/ it answers
- Later:
  - Enables higher levels of automation and data accuracy
  - Life time tracking attached to products—authentication, history, care
  - Global Trace, Track and Security of business processes
  - Enables real-time





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## Customers Want a Network Model

- o Everything in RFID is dependent on the network
  - The value of RFID is inherently about linking across enterprises, thus integrating the business network or supply chain
  - The applications on this network are increasingly mobile/wireless
- o By 2009 significant share of traffic on our networks will be RFID related
  - So, leverage my network assets, converging all application and frequencies on one platform (data, voice, video, RF, GPS)
  - Total cost of ownership
- o By 2014 reader populations may approach 300 million
  - Help me preserve my bandwidth by making decisions as close to the edge as possible
  - Help with the chaos to manage my heterogeneous devices

## RFID has Become an IP Networked Application



From		To
Serial	➔	IP
Proprietary/Closed	➔	Standards Based/Open
Separate Networks	➔	Converged Networks
High Cost	➔	Affordable

**Industry mandates are driving adoption**



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## Cisco Brings Value to RFID

### Cisco delivers an Intelligent Foundation for RFID Networks

#### Convergence

- Providing expertise in adding applications on a single network
- Providing leadership in applying network services to RFID

#### Intelligence

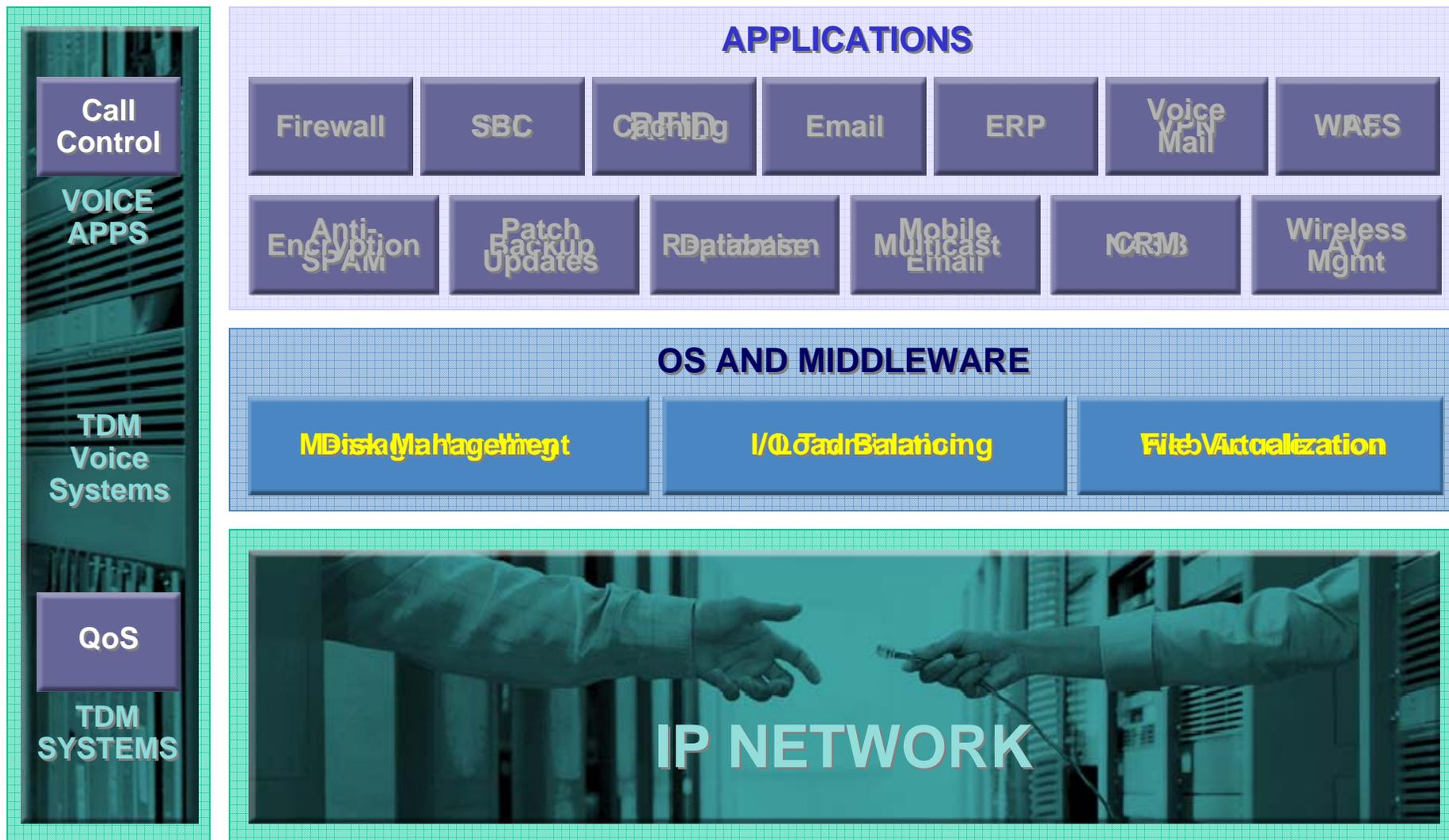
- Providing context such as location
- Providing localized response

- **Lower Total Cost of Ownership**
- **Competitiveness through agility**

- **Improved productivity**
- **Application optimization**

**Secure, Scalable, Available, Manageable, Flexible**

# Intelligence Has Migrated into the Network



# RFID Intelligence Is Also Migrating into the Network

## RFID APPLICATIONS

Security Services

Location Services

Device Management  
Services

Filtering Services

Prioritization  
Services

Aggregation  
Services

Interactive Services Layer

IP NETWORK

# RFID Applications

## Retail

Supply chain visibility  
Reducing out-of-stocks  
Inventory reduction



## Healthcare

Tracking high-value assets  
Pharmaceutical pedigree  
Reduction of errors



## DoD

Supply chain visibility  
Tracking assets  
Inventory reduction



## Manufacturing

Supply chain visibility  
Improved process flow  
Faster accounts receivables



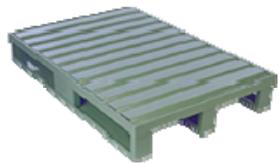
## Regulatory Compliance and Security



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# Intelligence at the Edge Is Critical

## PALLETS/CASES/ITEMS



Pallet



Case



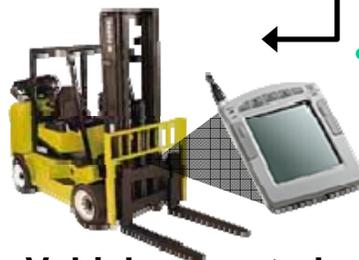
Item



Wireless

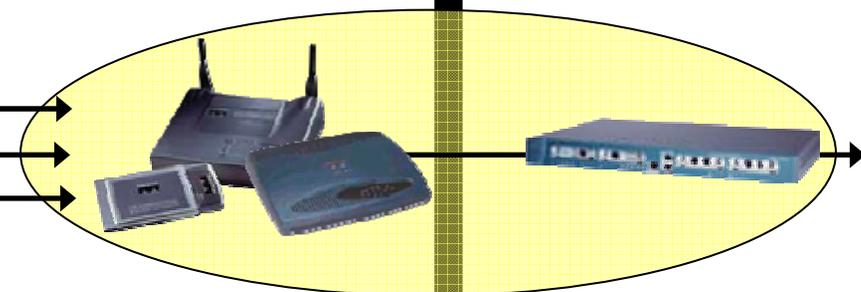


Fixed



Vehicle-mounted

## NETWORK ACCESS POINTS



- Read EPC
- Eliminate duplication/false reads

- Authentication
- Management
- Security
- Eliminate reader duplication

## B2B GATEWAY

- Packetize EPC data and reader IP address (location) into PML
- Aggregate data
- Multicast packet



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## Vision How Things Will Change...

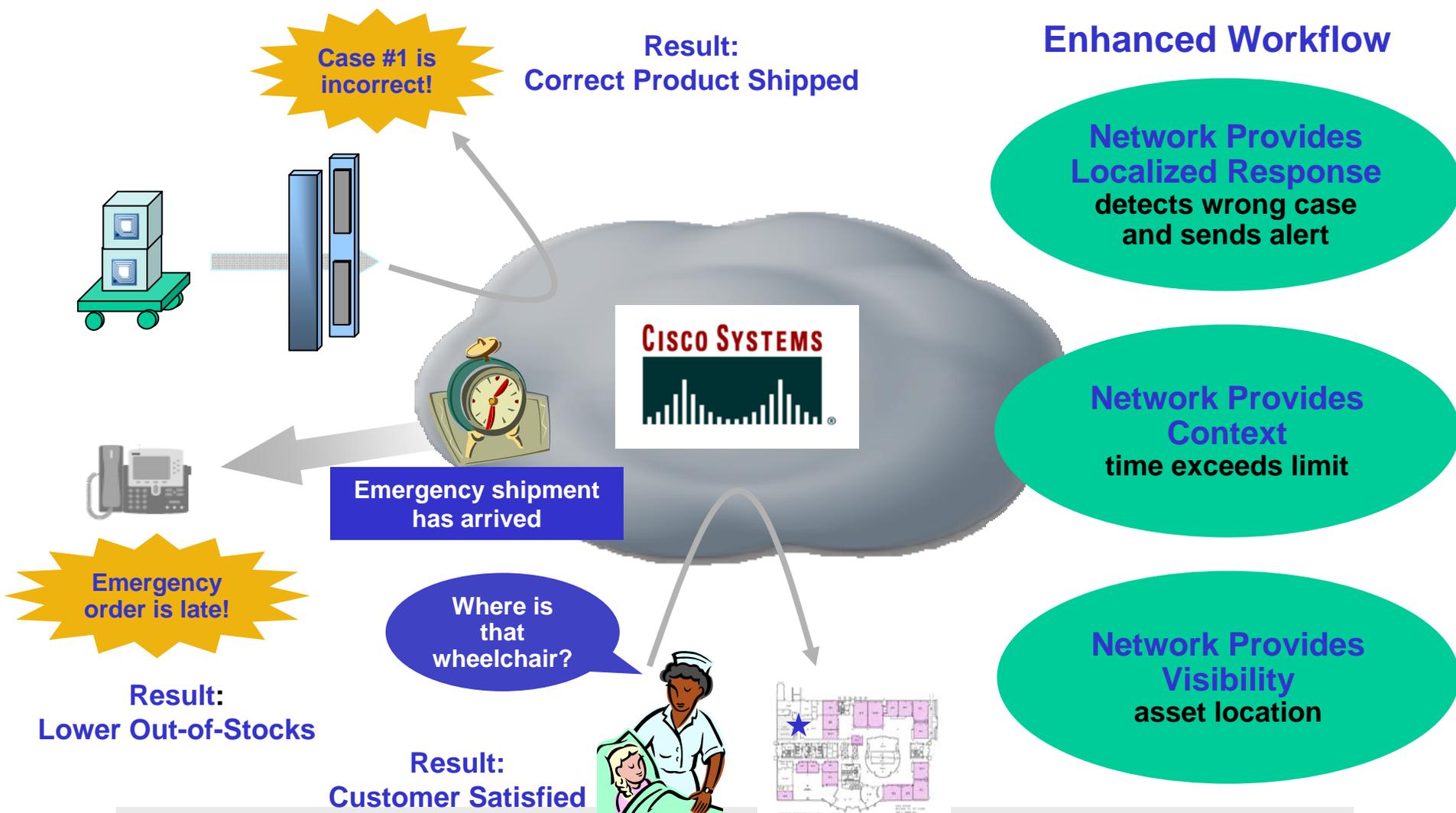
- Rate of adoption will accelerate over the next two to five years
- More versatility and vertical applications will be built into the pervasive layers
  - mobile/readers/sensors, etc.
- Wireless and edge devices will allow users to deploy hosted/webservices solutions, eliminating locally installed business applications servers (Unix, etc), thus increasing reliance on the network
- Poor performing networks do not scale





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# The Intelligent Foundation for RFID Networks





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# Evolution of the Network

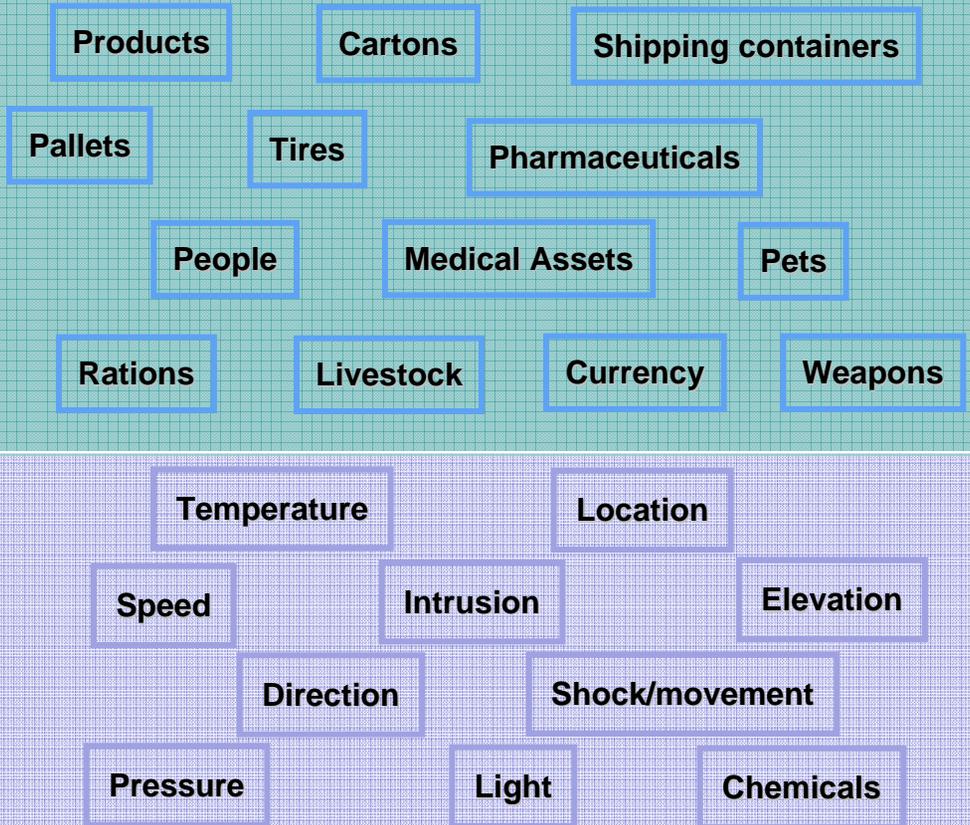
## The Internet of Computing Devices

- PCs
- PDA/Handhelds
- IP Telephones
- Barcode Scanners
- Video Cameras

“Things” become networked by adding tags

“Information” becomes networked by adding sensors

## The Internet of Things



### CHANGING THE WAY WE WORK, LIVE, PLAY, AND LEARN



**Delivering Intelligence to RFID**

