RFID and e-Manifest

Transparent Tracking of Goods and Personnel

Daniel Munyan, Principal Scientist for Automated Identification Technology

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- Founded 1959
- Specializing in:
  - IT and business process outsourcing
  - Systems integration and development
  - Management and technology consulting and professional services
- $14B in revenues, 68% commercial
- Nearly 92,000 employees in locations worldwide
- Serving 15 industries on six continents
- CSC brings
  - Knowledge/expertise
  - Responsive/flexible partnership
  - Innovative/creative approach
  - Full life-cycle solutions

The Plan

- Introduction: One of the technical benefits that flow from eManifest
- The Premise/Promise
- What is Radio Frequency Identification?
- How RFID is being used today
- The Largest RFID Implementation Today - DoD Supply Chain
- What About Hazardous Waste Transportation and Disposal?
- Total visibility
- Nested visibility
- Standards
- When does RFID pay off for Hazmat Transport and Disposal?
- What is next for RFID Technology?

The Premise/Promise

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Transparent Tracking of Goods and Personnel

- Transparent: Invisible, Clear, See-Through
  - Automatic
  - Start to Finish
  - Never Hidden

- Tracking: Follow Along Route, Remember Route
  - Identify goods and personnel at distribution points
  - Do not lose track of objects in-transit
  - Trace back the route of transit to the beginning
  - Calculate elapsed time between points in-transit

The Premise/Promise

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Transparent Tracking of Goods and Personnel

- Goods:
  - Serial Number
  - Product Information
  - Container Content
  - Location

- Personnel:
  - Identification
  - Proximity
  - Direction
  - Location
  - How many

What is RFID?

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- **Radio Frequency Identification**: Automated Wireless Data Input/Output

- **Uses:**
  - Identify people and things
  - Locate people and things
  - Transmit Sensor Data about people and things

- **Attributes:**
  - No requirement of line of sight with the reader.
  - Environmentally robust
  - Permanent
  - Reusable

RFID Components

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Tags	The data carrier. Identity number is programmed into the memory.
Antenna	Connected to the chip. Could be traditional wire or coil or could be printed antennas using conductive inks.
Reader	The data capture device; portable or fixed (installed), connected to a Savant or network.
Savant	Servers which act as local repositories for data and associated information, supporting sophisticated, flexible middleware for serving Database/XML queries.

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RFID Systems: How They Interact

Tags

- Device made up of an electronic circuit and an integrated antenna
- RF used to transfer data between the tag and the antenna
- Portable memory
- Read-only or read/write
- Active or passive
- Usually attached to specific items

Antenna

- Receives and transmits the electromagnetic waves
- Wireless data transfer

Reader

- Communicates with the tag via antenna
- Receives commands from application software
- Interrupts radio waves into digital information
- Provides power supply to passive tags

Host Computer

- Reads/writes data from/to tags through the reader
- Stores and evaluates obtained data
- Links the transceiver to an application, e.g., ERP

RFID Frequencies

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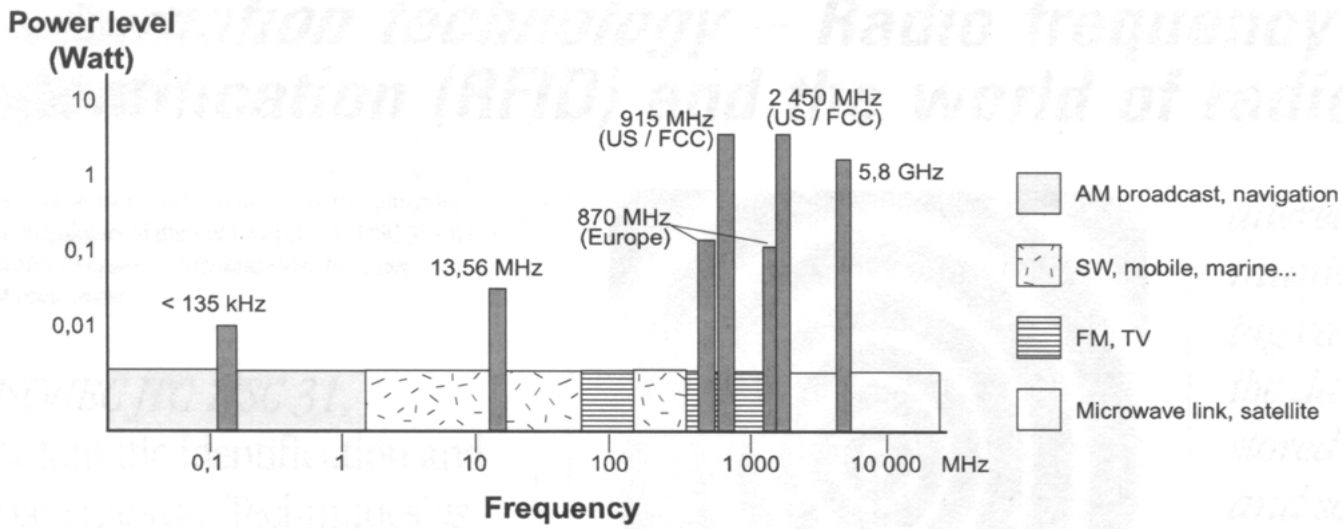
135 kHz: Animal ID: Low frequency, 1m range, OK with metal and water.

13.56 MHz: Contactless Smartcard

433 MHz: Most Common Active Tag Frequency

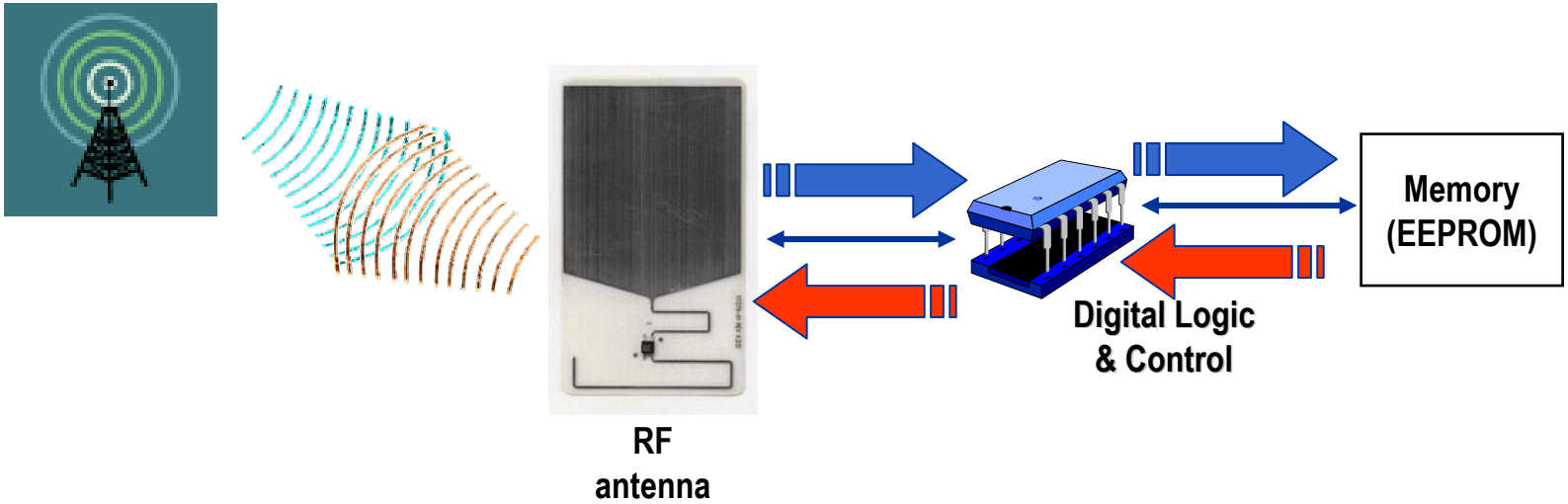
868MHz/915MHz: UHF: Medium range, fast data transfer – Passive Tags

2.45GHz/5.8GHz: Microwave: Huge range, easily reflected



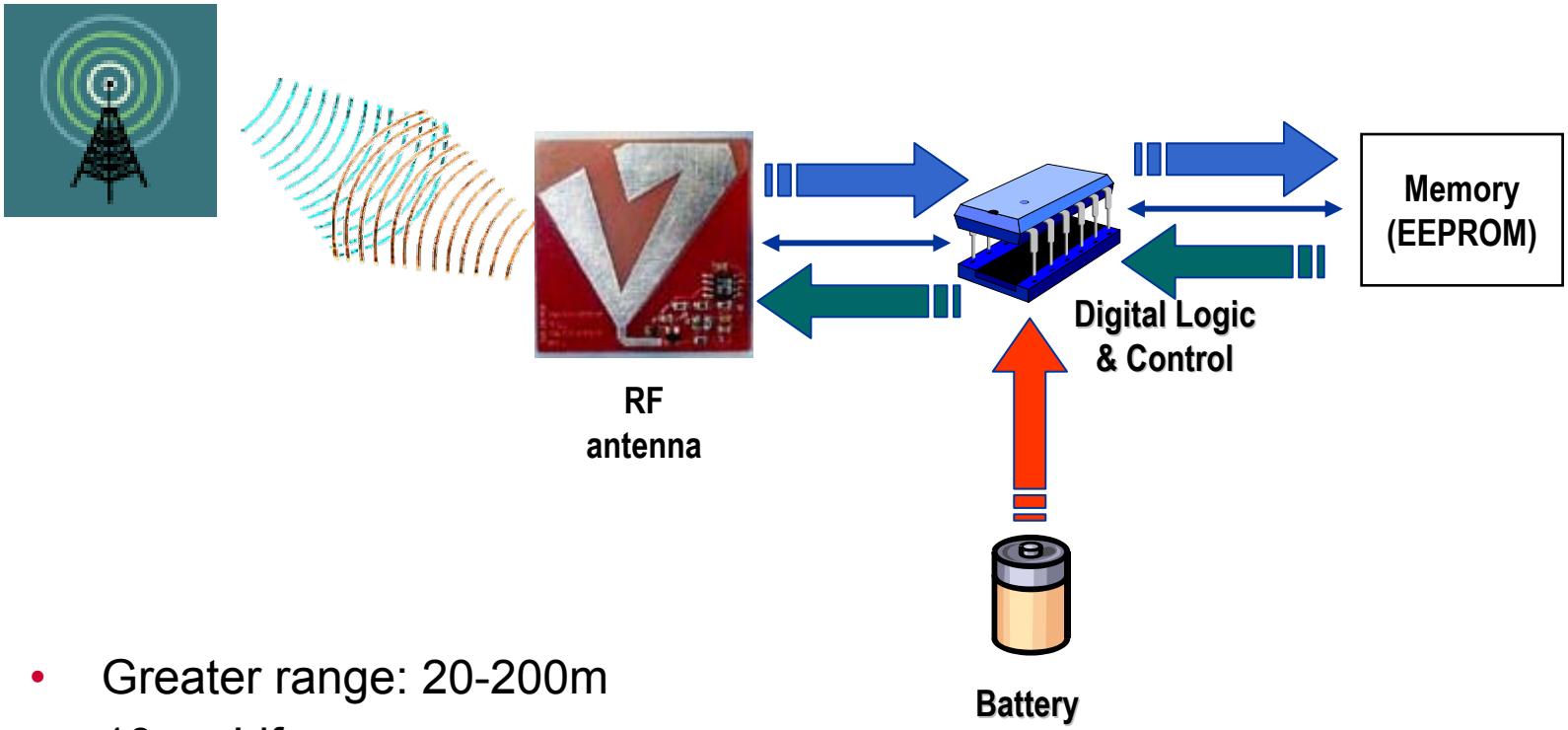
- The graph shows the specific frequency ranges ISO JTC 1/SC 31/WG 4 has selected for RFID.
- These power levels allow simultaneous powering of the tags by radio frequency energy as well as data communication between the transceiver and the (batteryless) tags.
- In the 915 and 2450 MHz range, the US allows higher power levels providing enhanced reading range. Programmes are underway to harmonize power levels.

Passive RF Tags



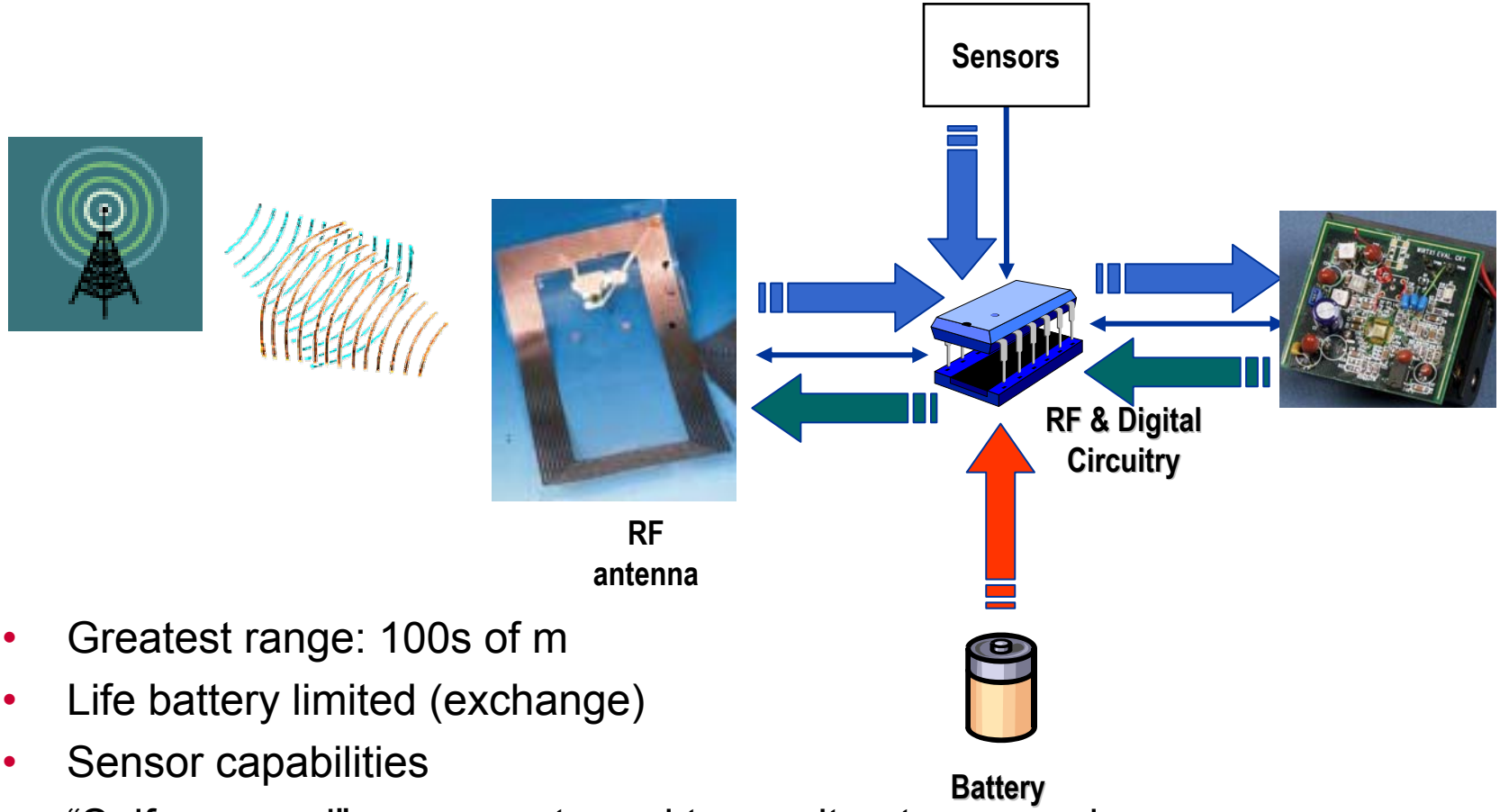
- Limited range: <10m (frequency dependent)
- Communication & power from interrogator RF beam

Semi-Passive RF Tags



- Greater range: 20-200m
- 10 yr. Life
- Limited sensor capabilities
- “Self-powered” uses interrogator RF beam for wake-up and communication

Active RF Tags



- Greatest range: 100s of m
- Life battery limited (exchange)
- Sensor capabilities
- “Self-powered” can operate and transmit autonomously

RFID Tags

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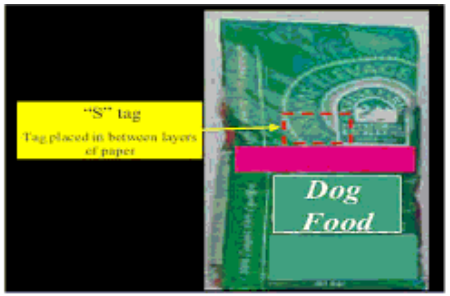
What Do Tags Look Like? – Anything at all

Timex SpeedPass watches

Verichip

DoCoMo and KDDI in Japan

Ear Tag (Button)



RFID Uses Today

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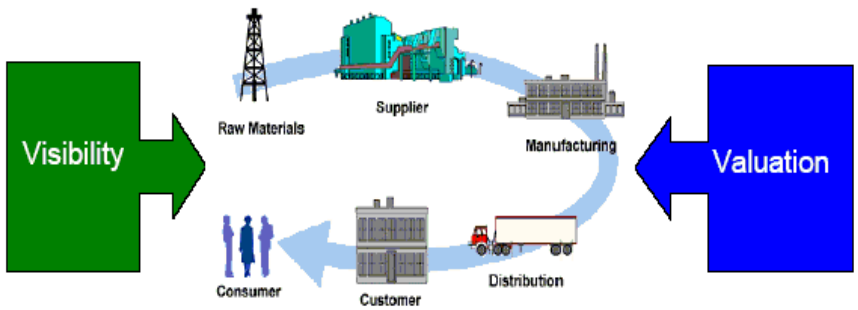
- **Supply Chain**: Track and Trace: All ISO Standards Pending.
  - *Reasoning:* Forester Research estimates 25% extra in inventories due to uncertainties of location and amount of goods in the pipeline.
  - FDA wants to insure quality control and eliminate gray/black market pharmaceuticals.



- ***Animal Identification***: Mostly Trace:
- Well Regulated by Standards
- *Markets:* National Animal ID Programs
- *Reasoning:* DHS just took over all cross border inspection for animals, plants, processed goods
- Eleven species to be identified and tagged.
- 100 million cows in US alone.

RFID Uses Today

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- ***Security***:
- Electronic Article Surveillance

- Asset Protection
  - Access Control
  - Multi-factor solutions

- ***Toll Collection:***
- Small cards stuck to window or bumper or anything rigid
- Huge read range - up to 100 meters
- Fast capture - up to 65 mph
- *Reasoning:* Replacing expensive human toll collectors, middleware, cash collection systems

RFID Uses Today

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- ***Contactless Smartcards:***

- ISO 14443 (Proximity), 0-1cm range

EDY: Euro, Dollar, Yen: Prepaid electronic money, using contact-less IC card technology. You can use "Edy" both at real shop and cyber place. You can charge "Edy" from credit card and from cash. In addition to payment function, "Edy" can be used with various services (mileage service, point service, etc.). "Edy" can be on other devices than card.

- ISO 10536 (Close Coupling) 0-10cm range

The Octopus Card: A single smart card to pay all the fares on underground, trains, ferries, buses and light rail in Hong Kong since September 1997. Goal is to grow non-transport purchases from 10% now to 50%.

- ISO 15693 (Vicinity Coupling Smart Cards) 0-1m range

Access Control Cards: Used for access control, credentials, ticketing, and automatic turnstile applications. Standard written by Texas Instruments, the largest producer of this technology.

The largest Opportunity for RFID Now?

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- ***US Department of Defense***

•During Operation Enduring Freedom (OEF), the USCENTCOM Combatant Commander identified the need for "in-the-box" visibility of material entering the theater.

•During Operation Iraqi Freedom (OIF), the use of active, data rich RFID tags was mandated for all material entering the theater.

•On February 20, 2004, Undersecretary for Defense issued an RFID Policy update which will mandate the use of passive RFID tagging at the case, pallet, and UID item packaging level for all solicitations after October 1, 2004 for delivery on or after January 1, 2005.

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Meals Ready to Eat (MRE's)

Courtesy photo

A Type 3 temperature and manifest tag is attached to a pallet of rations.

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Ammunition 2D Bar Code and Active RFID Tag

Data Matrix Bar Code

Data Matrix code

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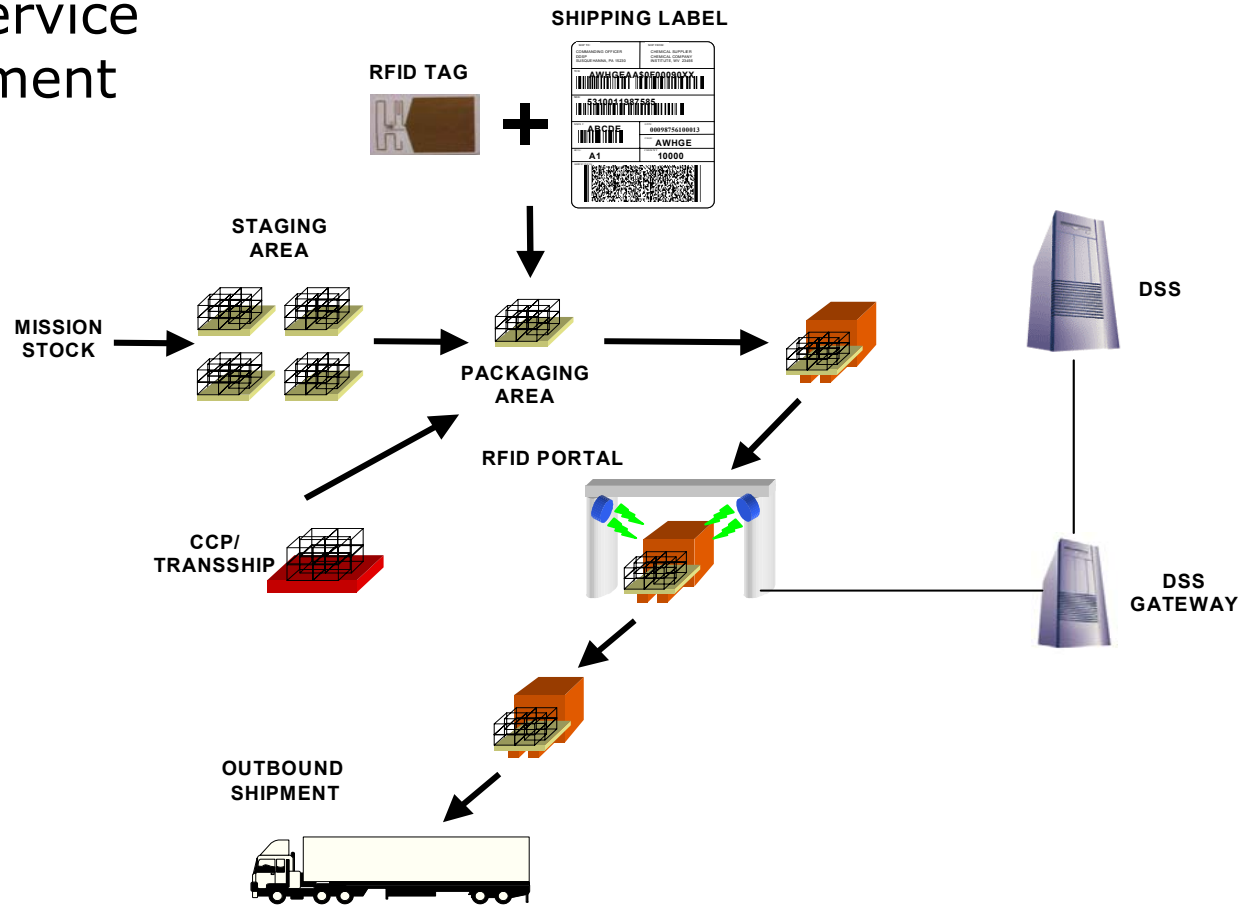
Joint Environmental Material Management Service (JEMMS)

- Being Prototyped as a Uniform Hazmat Lifecycle Management Service
- Outbound Shipment



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Joint Environmental Material Management Service (JEMMS)

- Being Prototyped as a Uniform Hazmat Lifecycle Management Service
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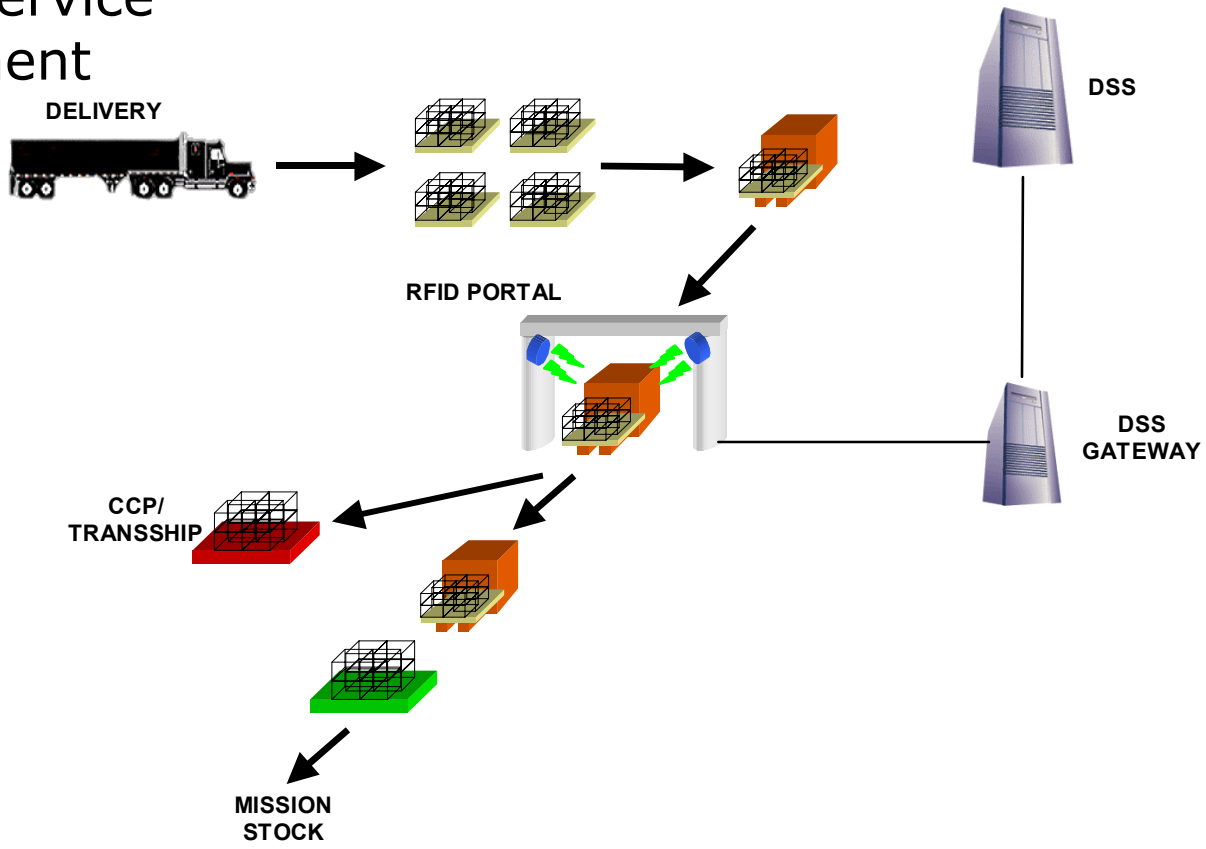

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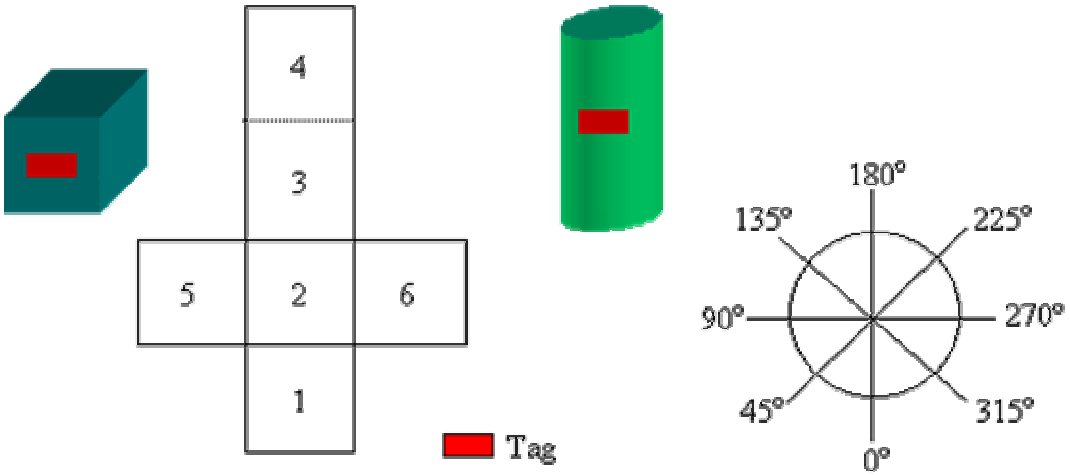
Advanced Hazardous Materials Rapid Identification, Sorting, and Tracking (AHRIST)

- AHRIST conducted four major series of validation tests for RFID intelligent tag products in 2000 & 2002:
- Environmental tests
- Ruggedness tests
- Technology and process validation tests
- Real-world tests in air and ground transportation
- Phase I beat all tags, Phase II demonstrated success



AHRIST Program

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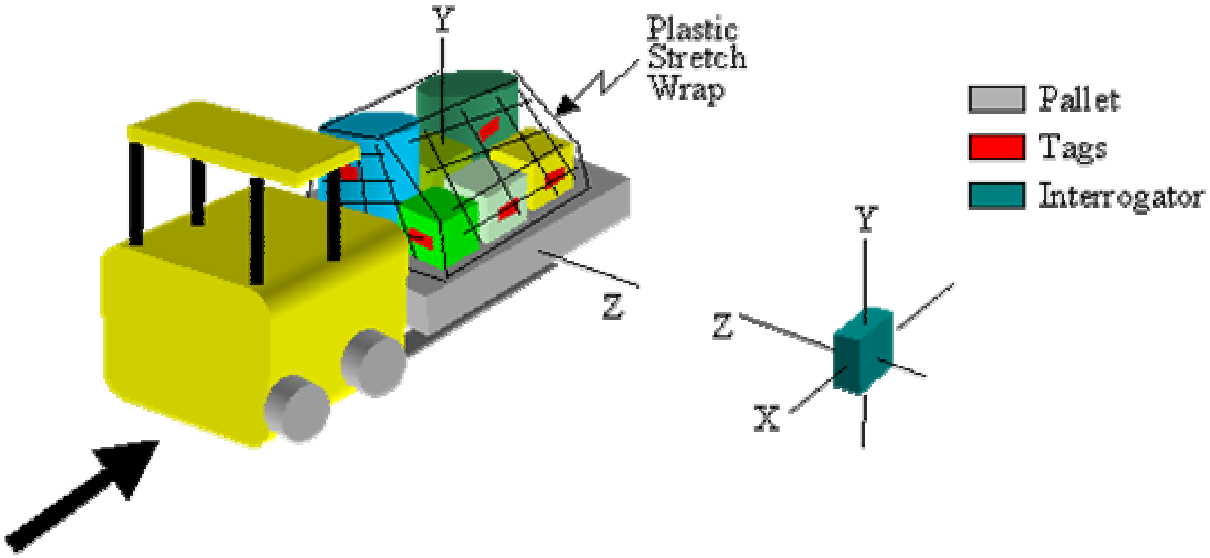
Multiple Tags mounted to Filled Containers on a Pallet secured with Plastic Shrink Wrap and transported by a Forklift



AHRIST Program

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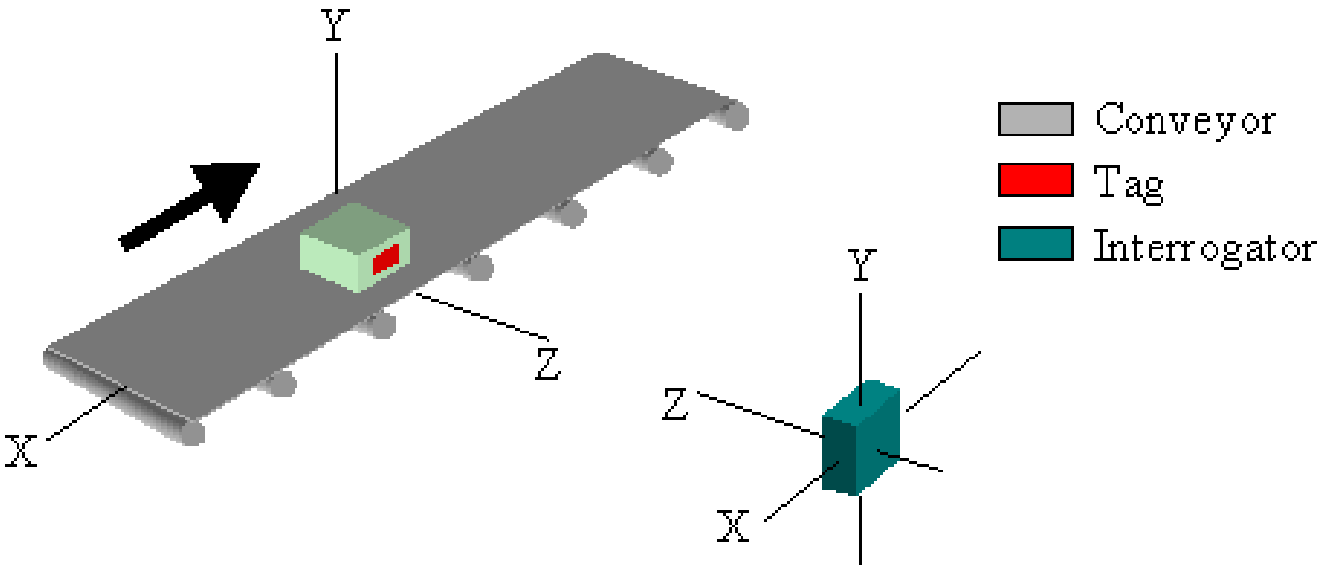
Single Tag mounted to a cardboard box transported on a Conveyor



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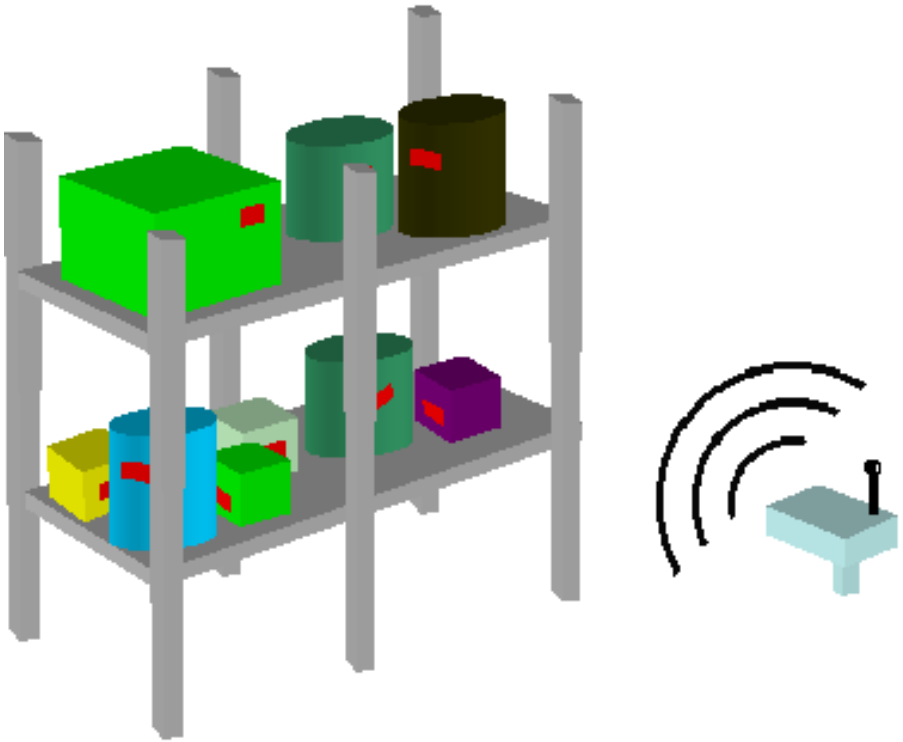
Warehouse Bin Product Identification Test



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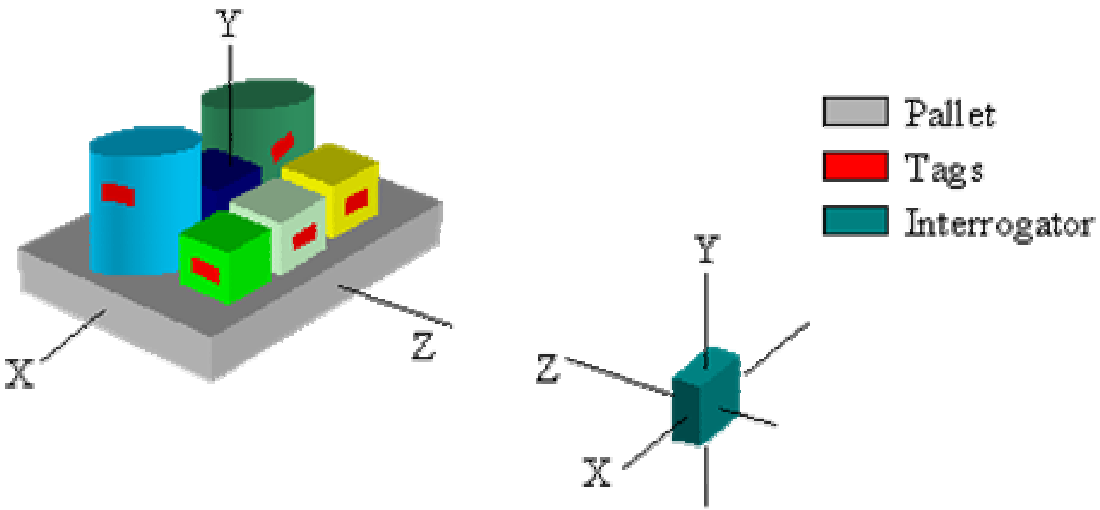
Multiple Tags mounted to Containers filled with Radioactive Material on a Pallet



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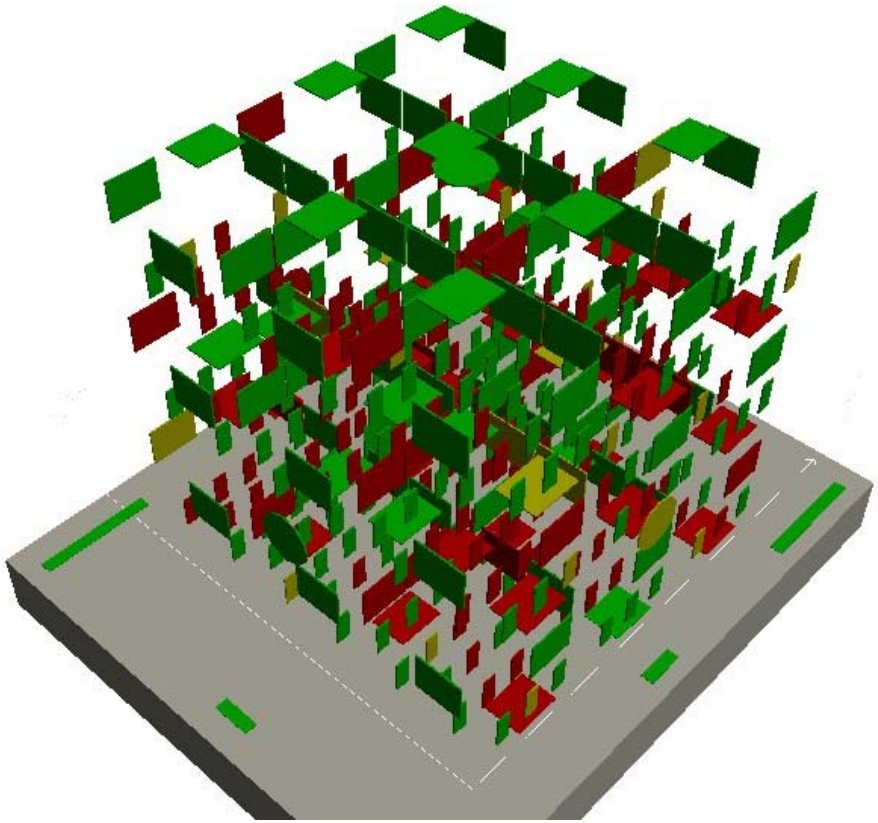
Multiple Tags mounted to Containers filled with Radioactive Material on a Pallet

- Red: Tags not read
- Yellow: Tags read intermittently
- Green: Tags always read



AHRIST II - Total Visibility

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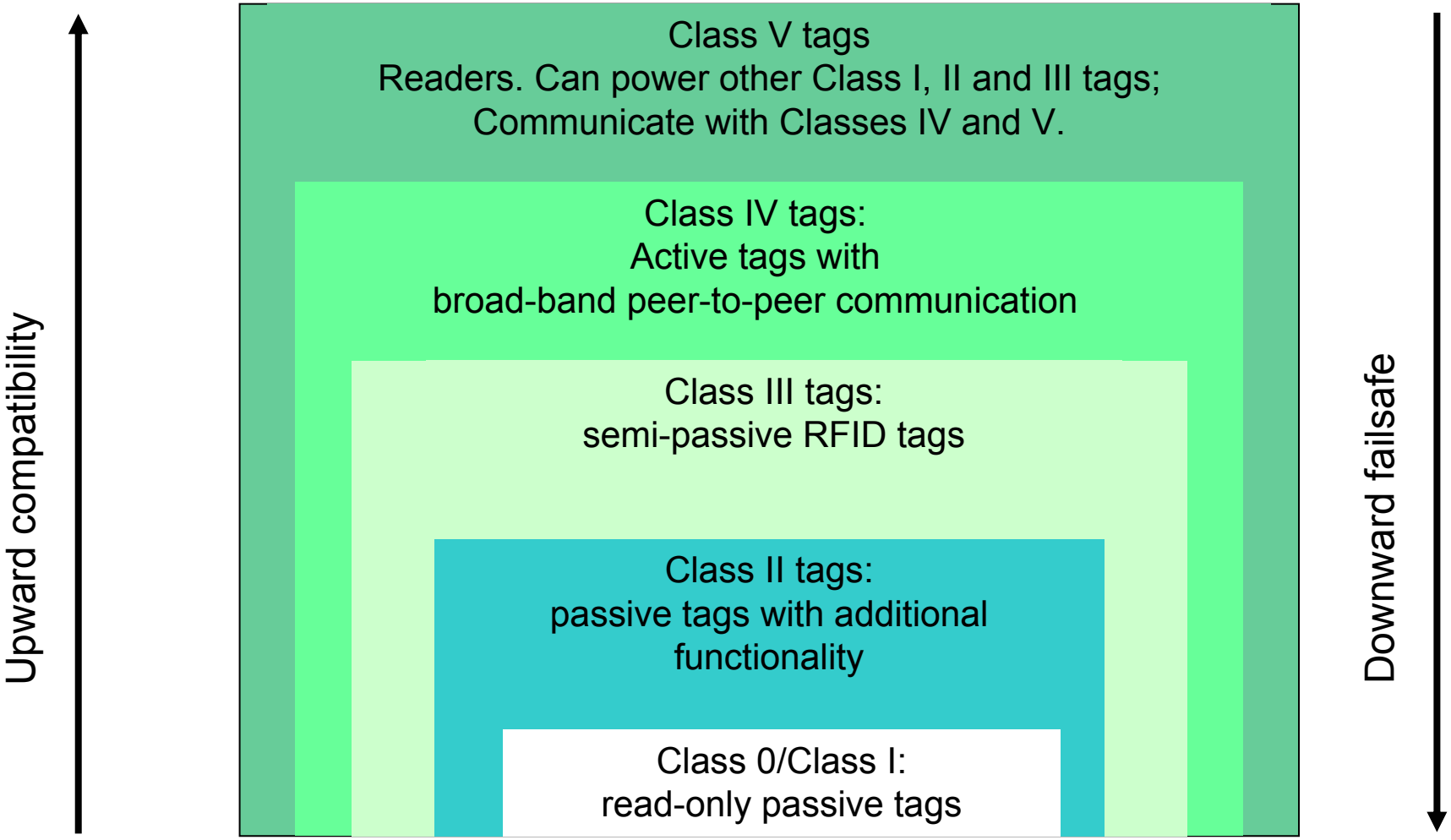
- Supply Chain Transponder Tag Types



AHRIST II - Total Visibility

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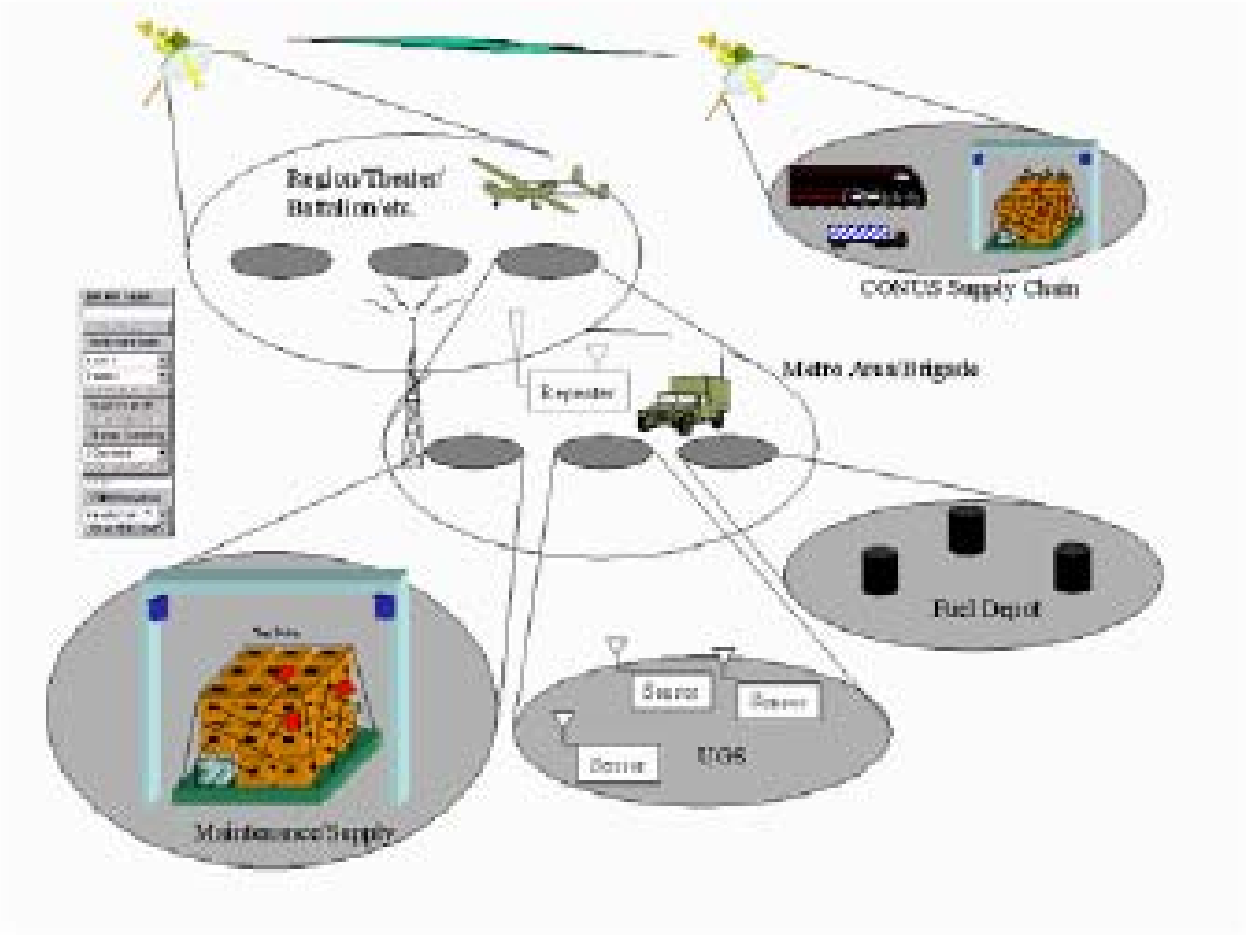
- In-Transit Visibility



AHRIST II - Total Visibility

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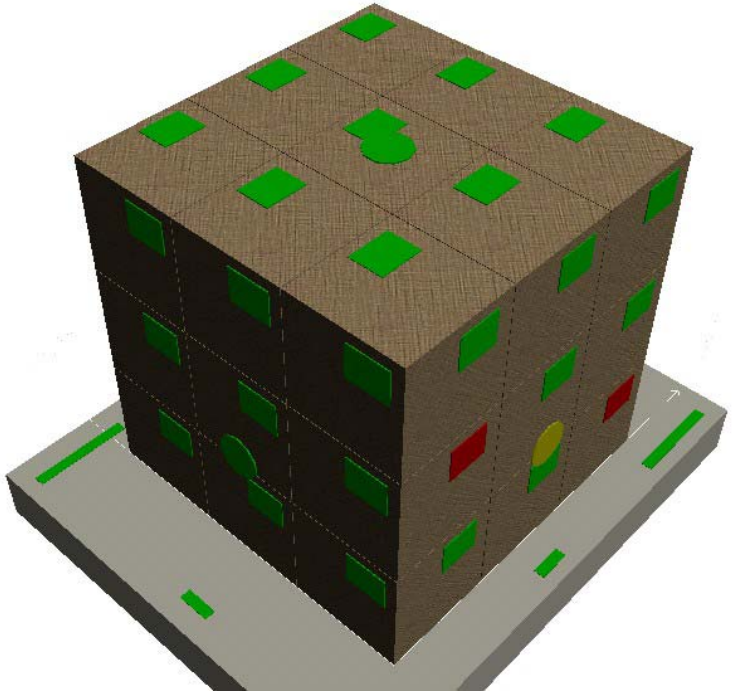
- In-Transit Visibility



Total Visibility

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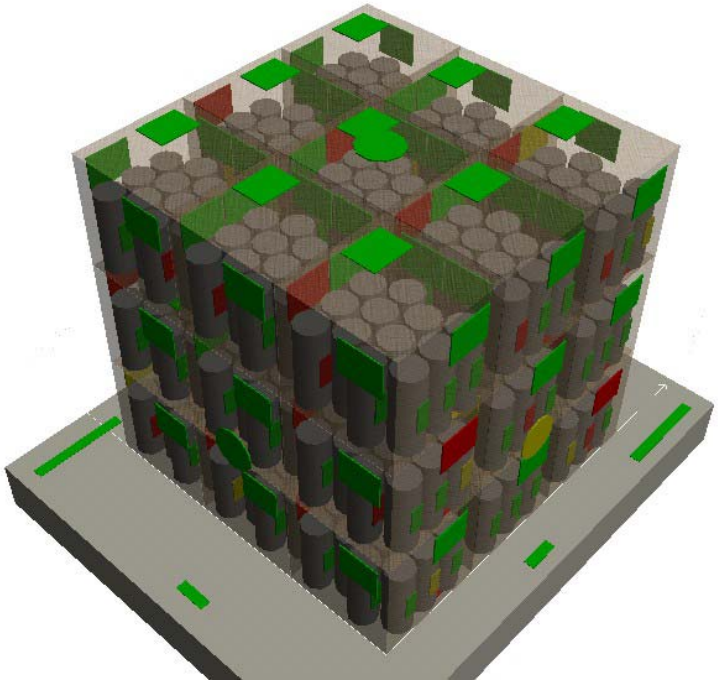
- In-Transit Visibility
- Nested Visibility



Total Visibility

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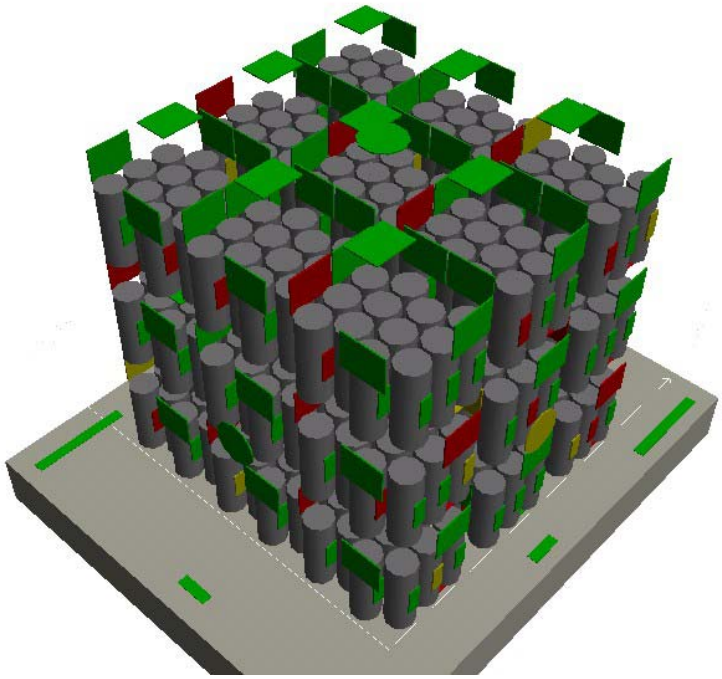
- In-Transit Visibility
- Nested Visibility
  1. Conex with RFID Reader
     - Large Memory
     - GPS Transmit/Receive



Total Visibility

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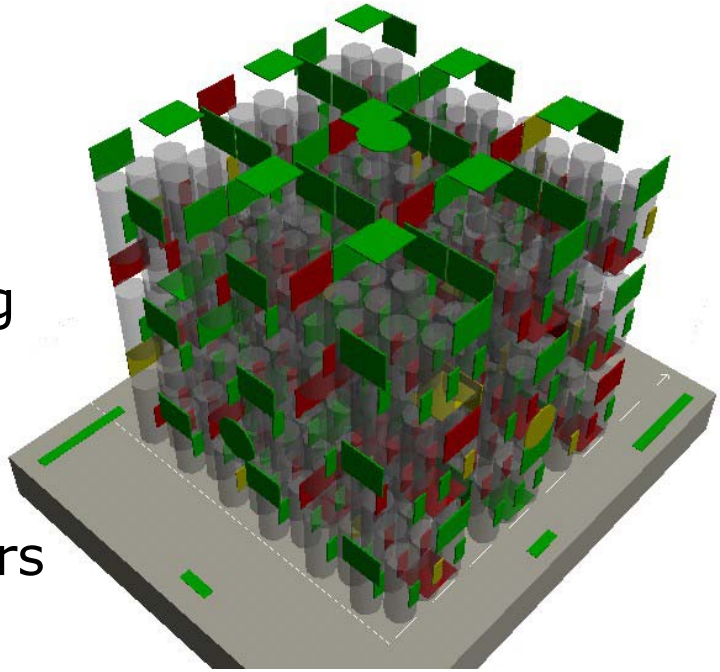
- In-Transit Visibility
- Nested Visibility
  1. Conex with RFID Reader
  2. Container with Class 4 Tag
     - Updates Conex as emptied or filled
     - Talks to other Containers
     - Conex updates system
     - System updates Mfg/Supply



Total Visibility

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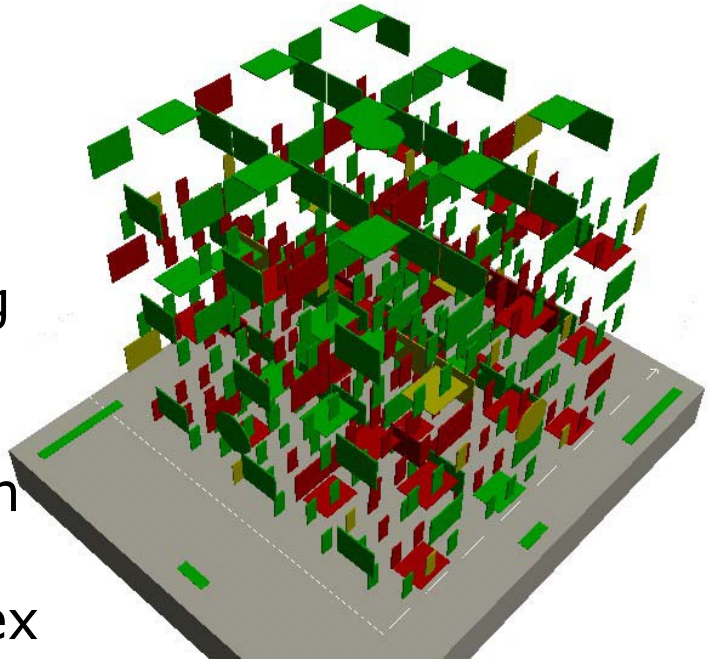
- In-Transit Visibility
- Nested Visibility
  1. Conex with RFID Reader
  2. Container with Class 4 Tag
  3. Pallet with Class 3 Active Tag
     - Updates Container when emptied or filled
     - Container updates Conex
     - Conex updates System
     - System updates Mfg/Supply



Total Visibility

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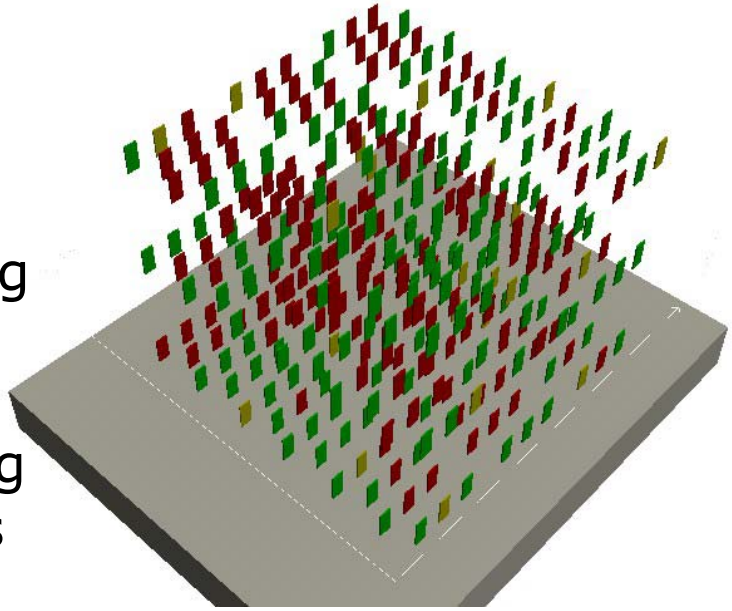
- In-Transit Visibility
- Nested Visibility
  1. Conex with RFID Reader
  2. Container with Class 4 Tag
  3. Pallet with Class 3 Active Tag
  4. Case with Class 1 or 2 Tag
     - Updates system as it is removed from Pallet
     - System updates Conex, Container, and Pallet



Standards for RFID

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- We can reasonably expect, according to industry and government authorities, that Electronic Product Code standards will be completed for all levels and frequencies of RFID tag within three years.
- We can reasonably expect that the ISO frequencies and rules for over the air interface will be purged of competing devices and signals within two years.
- We can reasonably expect that the cost of a Class One RFID tag, which can be written to with product data and not just a serial number, will reach the 5 cent threshold within five years.

e-Manifest and RFID

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- **Architecture:** Basic structure of an e-Manifest solution facilitated by RFID
- **Data:** Structuring, sharing, and managing e-Manifest data, made wireless with RFID
- **Security:** Keeping e-Manifest data and applications secure and private, by controlling RFID read-ranges and encryption
- **Infrastructure:** Getting online with the e-Manifest solution
- **Operations:** Management of the e-Manifest solution

When Does RFID Pay Off?

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Making Supply Chain RFID Pay for Transporters and Disposal Operators

- Systems Integration is key cost to control in implementing an RFID logistics solution.
  - Up to 80% of the cost of RFID is integration into current systems.

- The Hazmat transport and disposal industry is in a unique position to see costs fall dramatically
  - e-Manifest and RFID share costs while multiplying result

- When at least two RFID enabled trading partners reach about a 50% of trade being tagged, inefficiencies in inter-enterprise visibility and tracking will become apparent.

What is Next for RFID?

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The Future of RFID: Supply Chain

- Greater Tag Memory capability – Manifest size no barrier
- Introduction of Nested Visibility to secure containers in transit
- Paper thin batteries will add processing power for sensors to cheap RFID tags – Heat, Pressure, Radiation, Corrosion
- Commercial and military supply chain is being driven by ePC (electronic Product Code) standards for tags.
- IVT and Nested Visibility

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