



What About the Things?

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What is the Internet of Things?



- **“An infrastructure of interconnected objects, people, systems and information resources together with intelligent services to allow them to process information of the physical and the virtual world and react.”**

— ISO/IEC JTC 1/SWG 05 – November 2014

What is **Really** the Internet of Things?



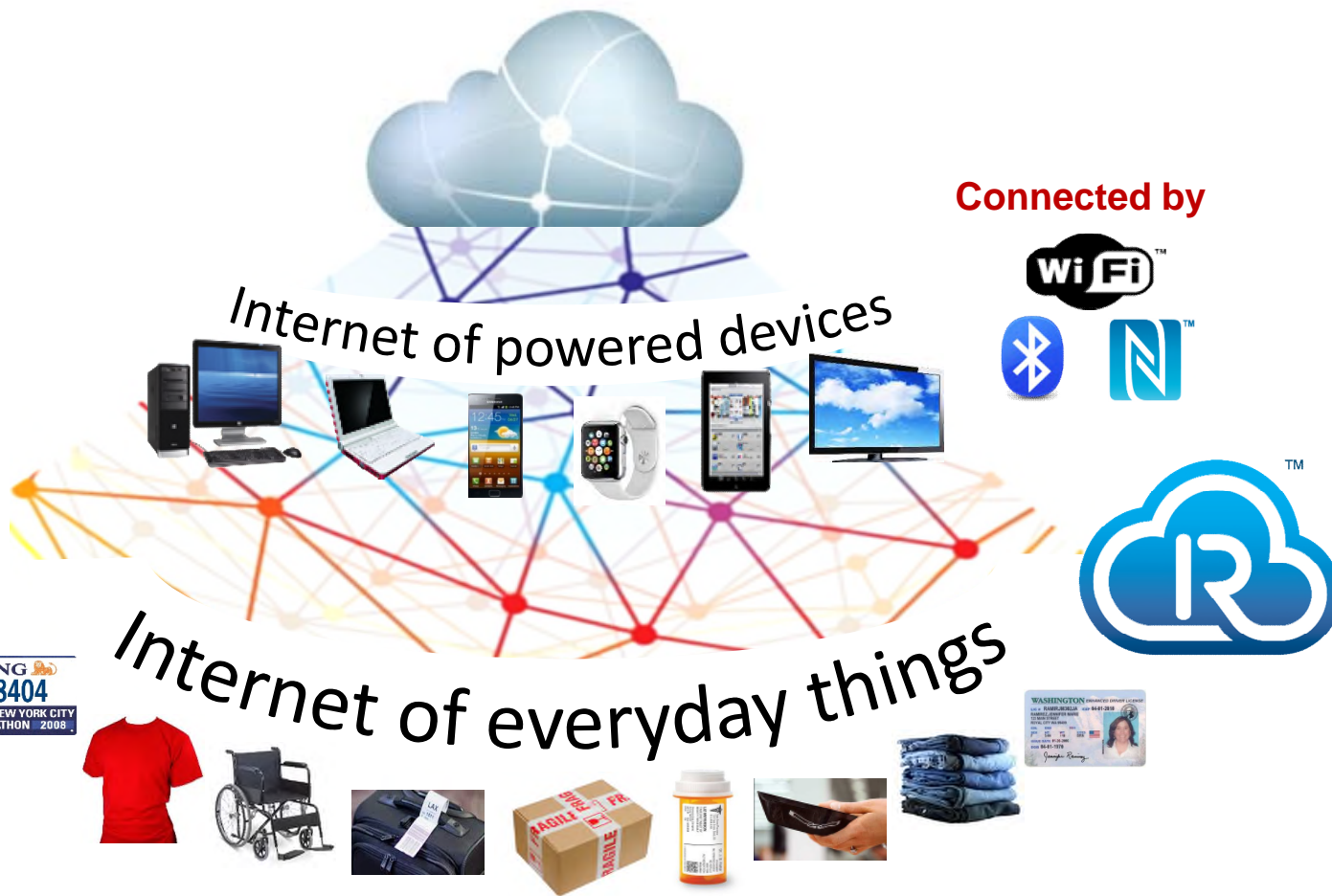
- **Depends on who you are!**
- **It is not just an internet of network connected devices (devices with an IP address)**
- **It is - socks, blue jeans and widgets**

Summarized



- **The IoT and smart systems are driven by a combination of:**
 - Sensors and actuators
 - Connectivity
 - People and processes
- **It is NOT a Technology or an Industry**

RAIN Enables the Physical Web



RAIN is an AIM Industry Alliance



RAIN RFID Alliance

- **Membership:** **100+** companies worldwide
- **Representing:** passive UHF RFID
- **Similar to:** NFC Forum, WiFi Alliance, and Bluetooth SIG
- **Founded in 2014 by:**



Membership



- **Currently 100+ members**
 - Manufacturers
 - System integrators
 - Test houses
 - Organizations
 - Academic establishments
 - Users

RAIN RFID Mission and Vision



Mission

To enable businesses and consumers to **identify, locate, authenticate** and **engage** items in our everyday world

Vision

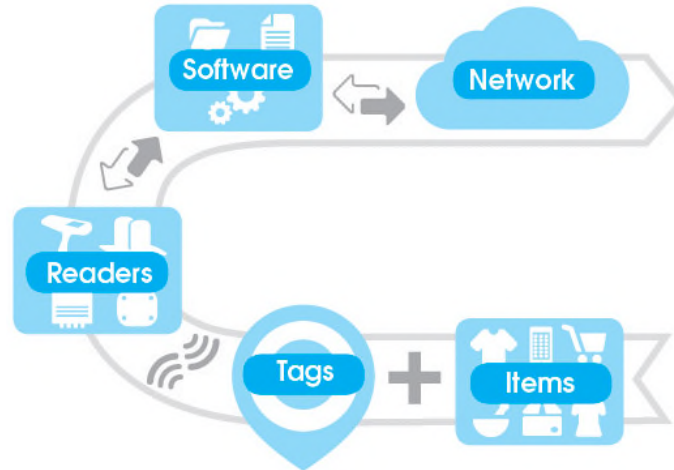
A future where everyday things are part of a connected world ... like raindrops to the sea



What is RAIN RFID?



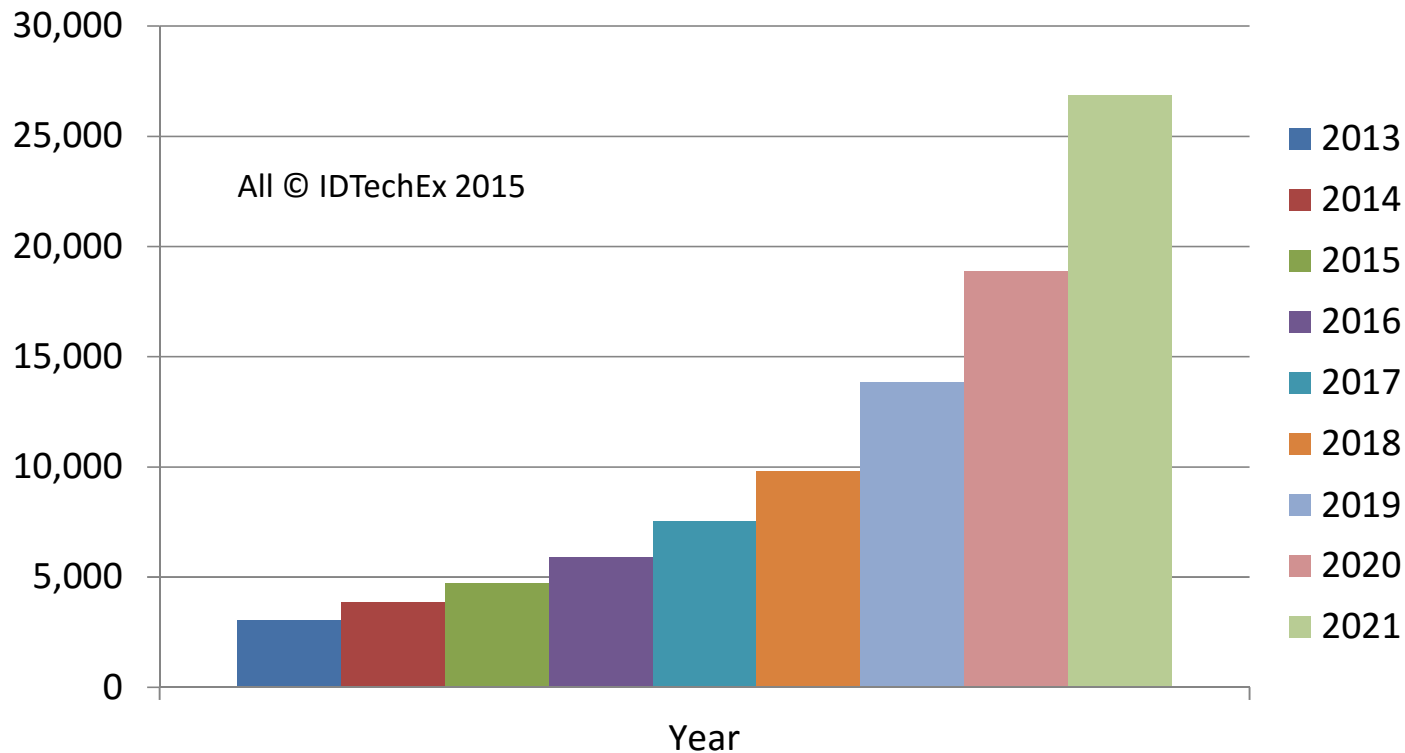
- RAIN RFID is a wireless technology that connects billions of everyday items to the internet, enabling businesses and consumers to **identify**, **locate**, **authenticate** and **engage** each item



Tag Sales by Year



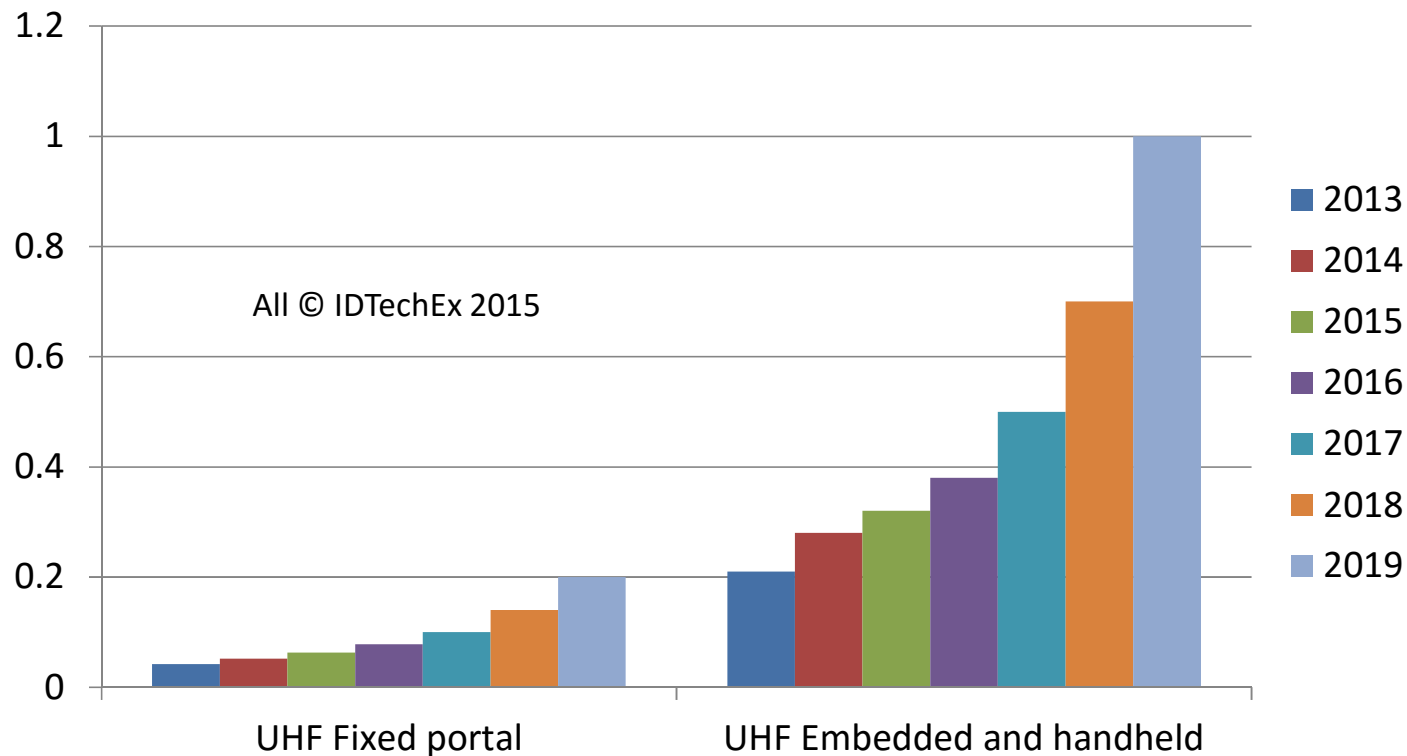
Number of tags (millions)



Reader numbers



Number (millions)



The importance of the IoT



- By the year 2020 the fully loaded cost of manufacturing by a worker in China will be the same as an enhanced manufacturing company in the USA
- RAIN RFID will enable that change





- **RFID Air Interface Standards**
 - ISO/IEC 18000-63 (2015)
 - GS1/EPC Gen2 (V1.2.0, and V2.0.1)



Standards – GS 1



- **Identification**
 - Tag Data Standard (TDS)
 - Tag Data Translation (TDT)
- **RFID Software Interfaces**
 - Low Level Reader Protocol (LLRP)
 - Discovery Configuration & Initialisation (DCI)
 - Reader Management (RM)
 - Application Level Events (ALE)



- **Data Side**

- ISO/IEC 15961 Data Protocol
 - Part 1 - Application interface
 - Part 2: Registration of RFID data constructs
 - Part 3: RFID data constructs
 - Part 4: Application interface commands for battery assist and sensor functionality
- ISO/IEC 15962:2013 Data protocol: data encoding rules and logical memory functions
- ISO/IEC 15963:2009 Unique identification for RF tags



- **Data Side**
 - ISO/IEC 15434 - Syntax for high-capacity ADC media
 - ISO/IEC 24791 Software system infrastructure
 - Part 1: Architecture
 - Part 2: Data management
 - Part 3: Device management
 - Part 5: Device interface



- **Internet of Things**

- ISO/IEC 18574 Internet of Things (IoT) in the supply chain -- Containerized cargo
- ISO/IEC 18575 Internet of Things (IoT) in the supply chain -- Products & product packages
- ISO/IEC 18576 Internet of Things (IoT) in the supply chain -- Returnable transport items (RTIs)
- ISO/IEC 18577 Internet of Things (IoT) in the supply chain -- Transport units
- ISO/IEC 29161 Data structure -- Unique identification for the Internet of Things



- **Security**

- ISO/IEC 29167 Security services for RFID air interfaces
- ISO/IEC 19823 Conformance test methods for security service crypto suites
 - Part 1: General
 - Part 10: Crypto suite AES-128 security services for air interface communications
 - Part 10: Crypto suite AES-128 security services for air interface communications
 - Part 11: Crypto suite PRESENT-80 security services for air interface communications
 - Part 12: Crypto suite ECC-DH security services for air interface communications
 - Part 13: Crypto suite Grain-128A security services for air interface communications
 - Part 14: Crypto suite AES OFB security services for air interface communications
 - Part 15: Crypto suite XOR security services for air interface communications
 - Part 16: Crypto suite ECDSA-ECDH security services for air interface communications
 - Part 17: Crypto suite cryptoGPS security services for air interface communications
 - Part 19: Crypto suite RAMON security services for air interface communications
 - Part 20: Crypto suite Algebraic Eraser security services for air interface communications
 - Part 21: Air interface for security services crypto suite SIMON
 - Part 22: Air interface for security services crypto suite SPECK

Technical Challenges



- **Identifying the “Things”**
 - Not IP based
 - No full time connectivity
 - Sensors
 - Storing data
 - Security

Identifying the “Things”



- **Not IP based**
 - Tablets, phones, Nest Thermostats, Fitbits
 - Devices
 - Shoes, jeans, widgets
 - Things with no inherent connectivity



Technical Challenges



- **Identifying the “Things”**
 - Not IP based
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 - Storing data
 - Security

Identifying the “Things”



- **No full time connectivity**
 - What is a “thing”
 - Need for “spot” checks
 - Need to understand the business process
 - Better control of ???

Technical Challenges



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Technical Challenges



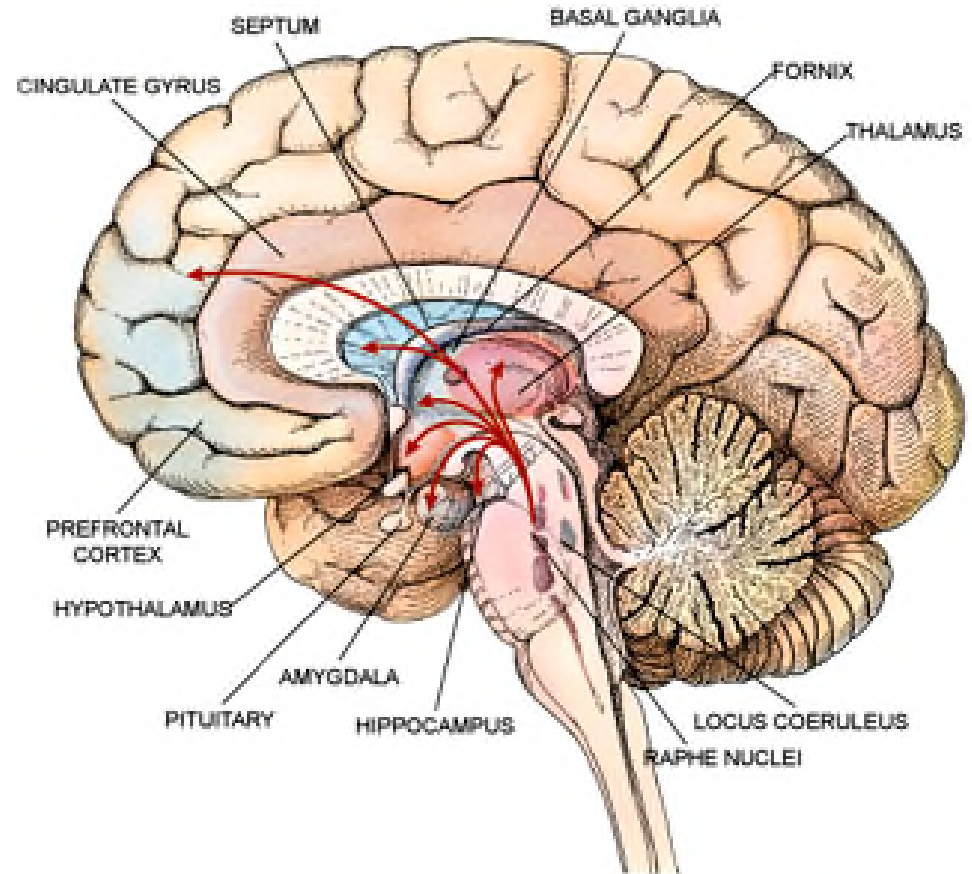
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Identifying the “Things”



- **Storing data**

- How much data?
- Type of data?
- Format?
- Segmented?



Technical Challenges



- **Identifying the “Things”**
 - Not IP based
 - No full time connectivity
 - Sensors
 - Storing data
 - Security

Identifying the “Things”



- **Security**
 - Where?
 - How much?
 - Why?



Technical Advancements



- The V2 logic layer enhances the V1 logic layer with the additions shown in italics.
 - **Select.** Choosing a tag population. A reader may select one or more tags based on a value or values in tag memory, *and may challenge one or more tags based on tag support of a cryptographic suite and authentication type.* A reader may subsequently inventory and access the chosen tag(s).
 - **Inventory.** Identifying individual tags. A reader initiates an inventory round. One or more tags may reply. The reader detects a single tag reply and requests the tag's EPC.
 - **Access.** Communicating with an inventoried tag. The reader may perform a core operation such as reading, writing, locking, or killing the tag; *a security-related operation such as authenticating the tag; or a file-related operation such as opening a particular file in the tag's user memory.* A reader may only access an inventoried tag.

New Functionality - Optional



- **Loss prevention:** V2 enables tag-based EAS, in which codes stored in tag memory indicate whether the item to which the tag is attached is (1) store-owned or foreign and (2) sold or unsold.
- **Brand protection:** V2 enables cryptographic tag authentication.
- **Security:** V2 enables secure tag access and secure communications between reader and tag.
- **Files:** V2 enhances user memory with support for memory files and file privileges.
- **Consumer privacy:** V2 allows hiding portions of tag memory, reducing tag read range, or both



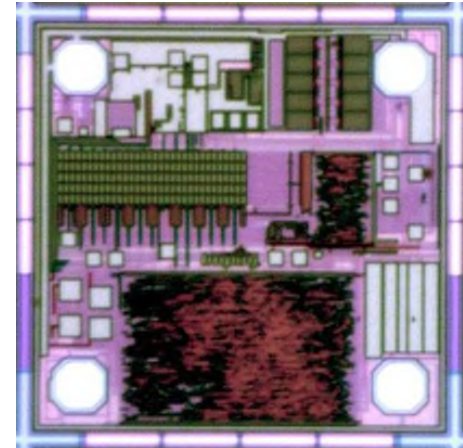
Reader	Manufacturer	Manufacturer	Manufacturer	Manufacturer
Interrogator Commands	A	B	C	D
Query	•	•	•	•
QueryRep	•	•	•	•
QueryAdjust	•	•	•	•
ACK	•	•	•	•
NAK	•	•	•	•
Req_RN	•	•	•	•
Select	•	•	•	•
Read	•	•	•	•
Write	•	•	•	•
Kill	•	•	•	•
Lock	•	•	•	•
Access	•	•	•	•
BlockWrite	•	○	○	○
BlockErase	○	○	○	○
BlockPermalock	•	○	○	○
Challenge	○	•	•	•
Authenticate	○	○	○	○
AuthComm	○	○	○	○
SecureComm	○	○	○	○
ReadBuffer	○	•	•	•
KeyUpdate	○	•	•	•
ReadBuffer	○	•	•	•
KeyUpdate	○	•	•	•
Untraceable	○	○	•	•
FileSetup	•	•	•	•
FileOpen	•	•	•	•
FilePrivilege	•	•	•	•
TagPrivilege	•	•	•	•
FileList	•	•	•	○
Flex_Query	•	○	•	○
BroadcastSync	•	○	•	○
HandleSensor	•	•	•	•

Shading Key
Mandatory Command
Gen2v1.2.0 and Gen2v2.0.1 and ISO 18000-63 Optional Commands
Gen2v2.0.1 and ISO 18000-63 Optional Commands
ISO 18000-63 Optional Commands

RAIN – Enabling the IoT



- The low cost solution to identification and data collection
- No batteries - lasts forever
- Reads 10m or more
- Reads 1000 tags/second
- Sensor options
- Encryption available



Learn More About RAIN



- **How to Join RAIN**

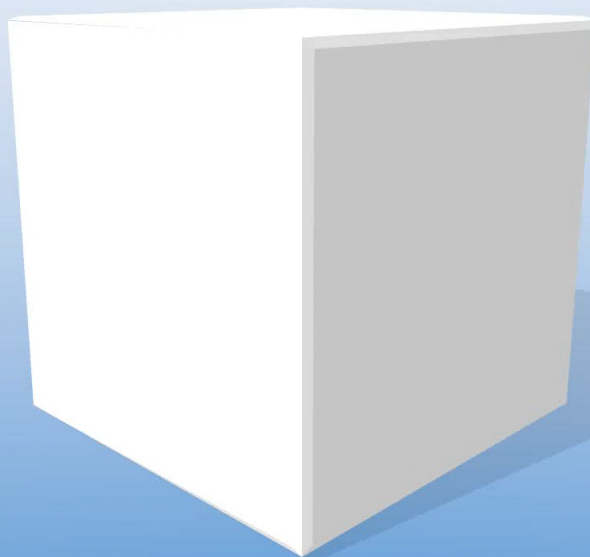
- www.RAINRFID.org has the details
- Dues are based on company revenue
- Manufacturers, System Integrators, Users, Academic Establishments, Test Houses

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- www.RAINRFID.org



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