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DIGITAL LIFE FOR EVERYDAY ITEMS

Tomorrow's IoT Forecast: RAIN

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Suppose You Wanted to Connect Every Item in Your Everyday World

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You'd Probably First Ask *Why*?

To connect people and businesses to items

- To identify, locate and authenticate those items
- To store and access each item's attributes, history and ownership

Item's physical life

Item's digital life

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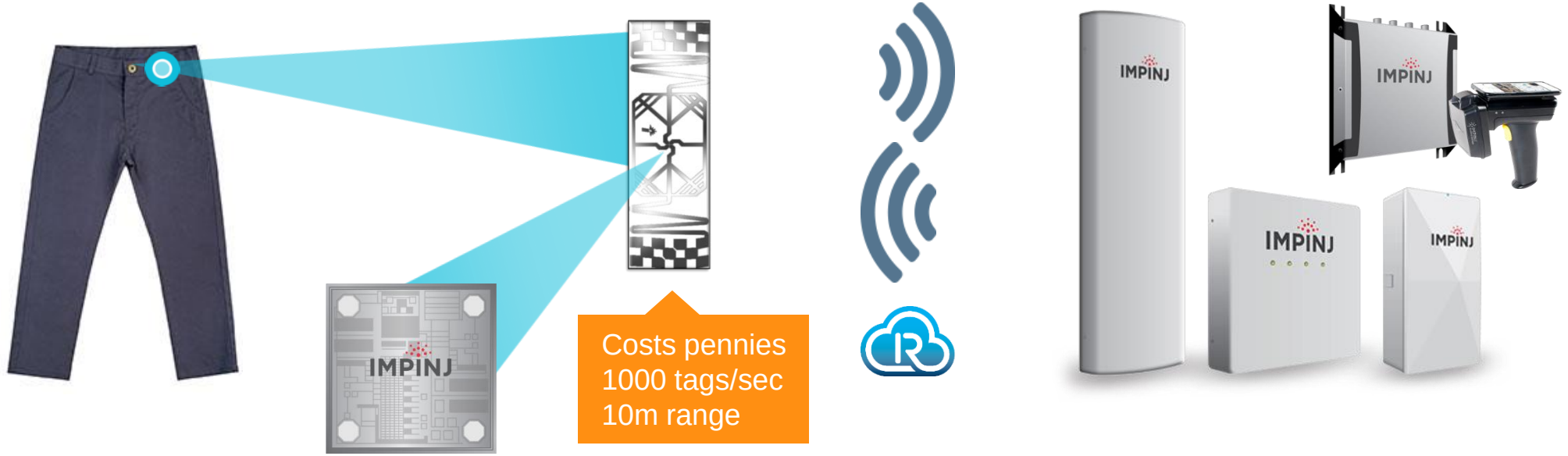
Then You'd Ask *How?*

You'd use a wireless technology suitable for connecting items

- No batteries
- Unlimited life
- Fast & long range
- Small & low cost
- Unique identifier on every item
- You'd call it **RA**dio **I**dentificatio**N**

RAIN RFID



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Am I For Real?

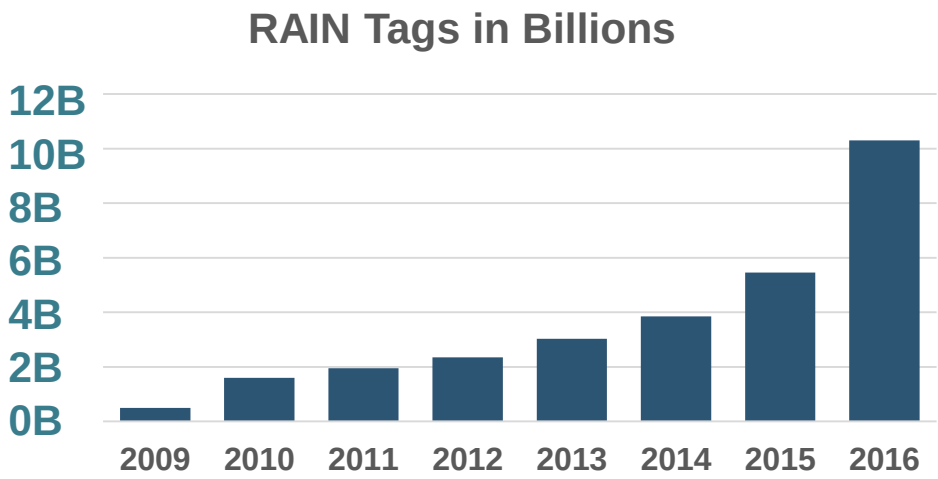
A few of the **billions** of items (or things) already connected

Yes, I'm for Real

RAIN is Established

- RAIN Industry Alliance
- Worldwide Spectrum & Standards
- Global Tagging Ecosystem

Market has Adopted (1)



Complementary and Expansive

Items Beacons Internet Payment

Blue Chips are Deploying

DELTA TARGET macy's Coca-Cola Audi

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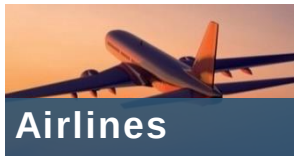
(1) Industry-wide volumes (a) for the years 2010 and 2011 are based on VDC Research: "Strategic Insights 2013: RFID, Contactless & RTLS Technology," (b) for the year 2012 is based on IDTechEx: "RFID Forecasts, Players and Opportunities 2014—2024," 2013, (c) for the years 2013 and 2014 are based on IDTechEx: "RFID Forecasts, Players and Opportunities 2016—2026," 2015, (d) for the year 2015 is based on research conducted by IDTechEx subsequent to the publication of its most recent report, and (e) for the year 2016 is based on data presented by the RAIN RFID Alliance

The True Internet of *Things*

Retail

- Increase Store Efficiency
- Improve Customer Experience

DECATHLON ZARA (1)



Airlines

- Reduce Lost Baggage
- Speed Bag Offloading

BOEING DELTA

Automotive

- Identify / Track Vehicles
- Fast, Cashless Fueling

VOLVO Audi

Food

- Streamline Operations
- Ensure Quality

Coca-Cola

Datacenter

- Track Assets
- Enhance Security

WELLS FARGO intel

Healthcare

- Automate Drug Tracking
- Improve Asset Utilization

DeRoyal Hanmi

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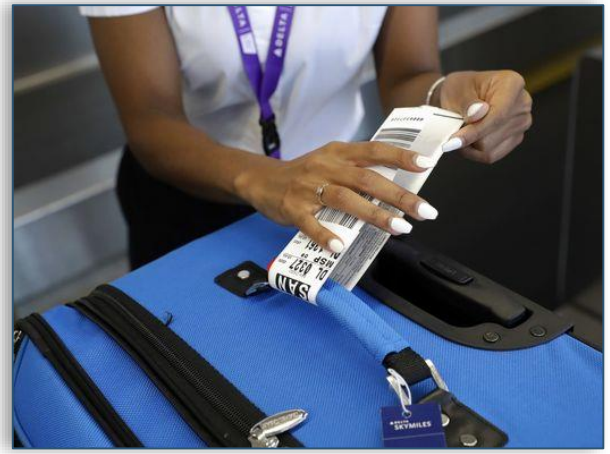
(1) These RAIN programs may, but do not necessarily, use the Company's products.

Extending the Internet by 1000×

In the News

- "Delta Air Lines is investing $50 million to soothe one of air travel's biggest headaches: lost and delayed luggage
- Delta already has one of the airline industry's best luggage-handling records but hopes that by deploying a [RAIN] system globally it can improve further
- Ultimately the bag tag might be replaced with permanent [RAIN tags] in our suitcases"



Internet of Things

Source: http://www.usatoday.com/story/travel/flights/todayinthesky/2016/08/31/delta-leads-quest-end-lost-airline-luggage/89641986/

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And Touching People's Lives

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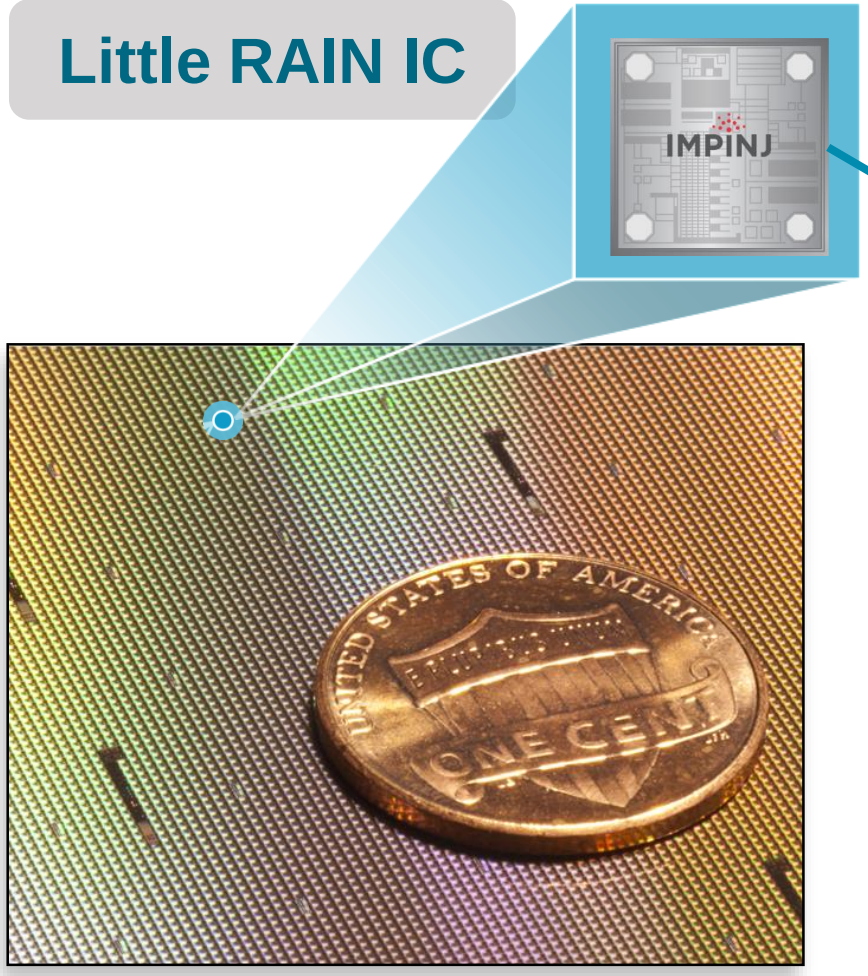
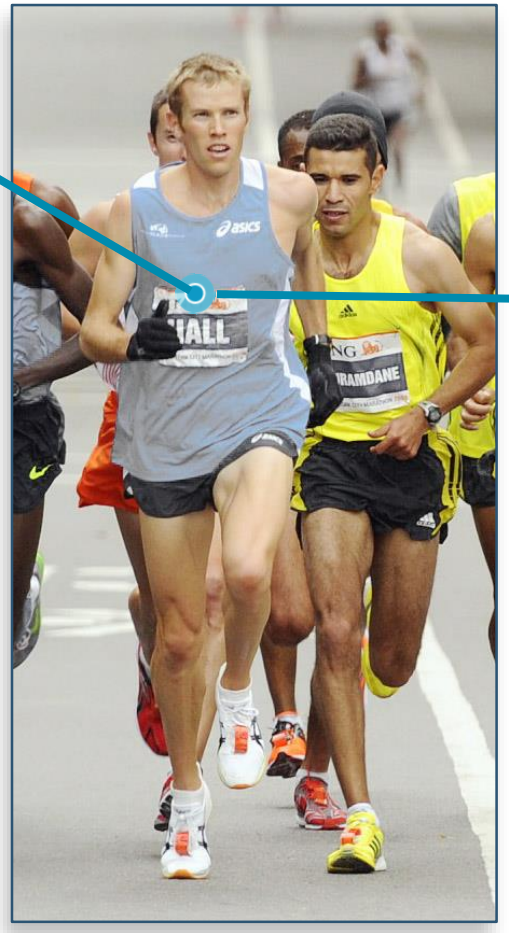
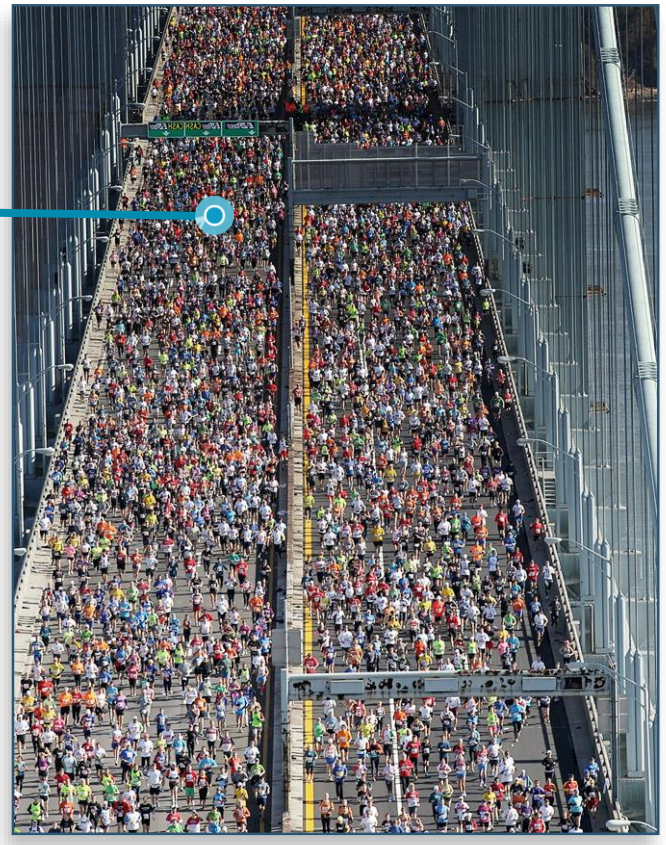
Little RAIN IC





Big Opportunity



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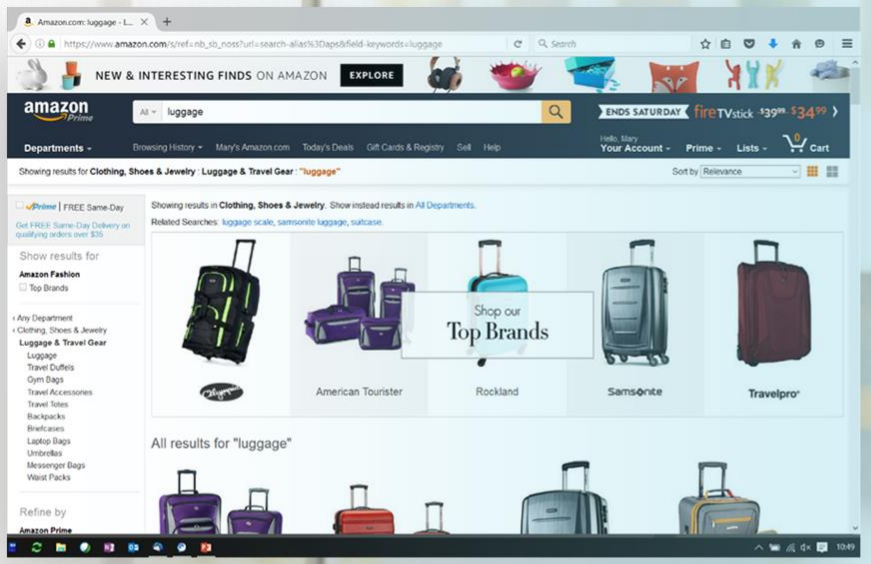
An IoT Tale From the Future…

I need some new luggage

I visit a retailer web page and order a RAIN-enabled suitcase

The retailer transfers the bag's electronic ID (EID) to me as owner



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An IoT Tale from the Future…

My luggage arrives

The shipper uses the bag's EID for delivery routing

The retailer linked the bag's EID to my home address and granted the shipper access to that information

An IoT Tale from the Future…

My futuristic home automation device includes a RAIN reader

Alexa/Siri/Assistant asks me:

Q: Register the bag's warranty? **A:** Yes
Q: Alert your RAIN-enabled phone to your new luggage? **A:** Yes
Q: Assign RAIN privacy protections appropriate for luggage? **A:** Yes
Q: Register the EID with your airline frequent-flier numbers & TSA? **A:** Yes

An IoT Tale from the Future…

Today is my trip to Amsterdam

I pack my bag with my RAIN-enabled stuff

I use the RAIN reader in my futuristic phone to link the bag's EID to my ticket, alert the airline, and alert TSA that my bag flies TSA pre-check

At the airport, I hand over my bag and head to security – no waiting in a check-in or bag-drop line

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An IoT Tale from the Future…

The airline uses RAIN readers to track and route my bag

The airline verifies my bag's destination using RAIN-enabled belt loaders

And sorts it using RAIN-enabled sorters

At the carousel, my futuristic phone beeps when its RAIN reader reads my bag coming my way

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An IoT Tale from the Future…

My vacation is over; today I fly home

The airline alerts me about an issue as I board the plane – my bag will be delayed

I arrange delivery to my work and track progress with my phone

My phone RAIN-authenticates my bag, and vice versa, when the driver delivers my bag

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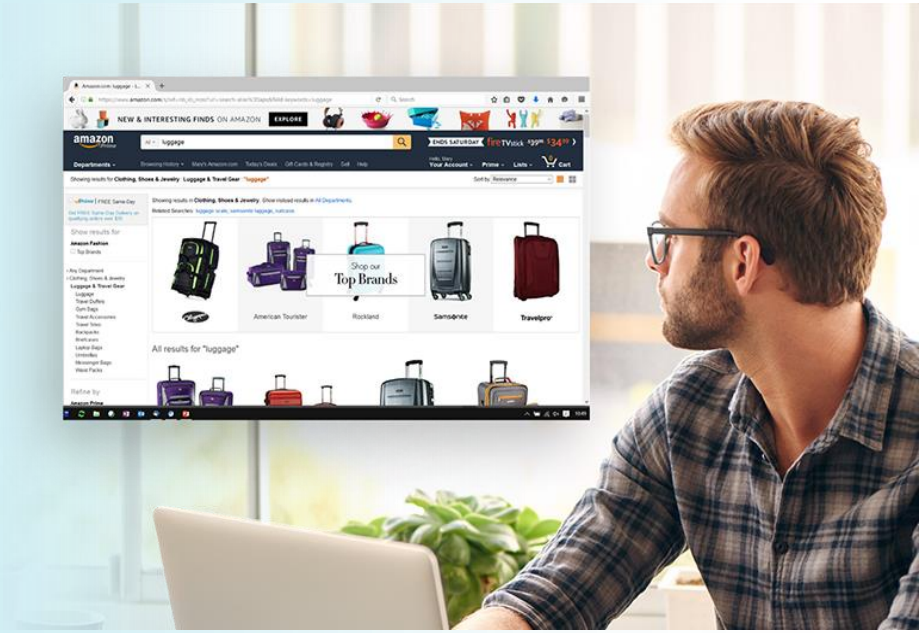
An IoT Tale from the Future…

Alas, I realize my bag is too big – I want something smaller

I buy a new bag from the retailer and repeat the process



Alexa/Siri/Assistant, please transfer ownership of my old bag to my friend

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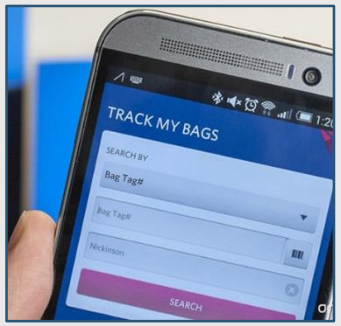
Progress Towards the Vision

In Progress – Item Connectivity

Reading



Identification

Inevitable – Digital Life for Items

IoT Opportunities

1. Digital life for physical items
2. People engaging connected items
3. Developers innovating an IoT ecosystem

IoT Issues

1. Item identity has multiple numbering systems without name resolution
2. Item history {where, when} isn't accessible
3. Item attributes {data, context} aren't linked
4. Item ownership isn't an internet concept

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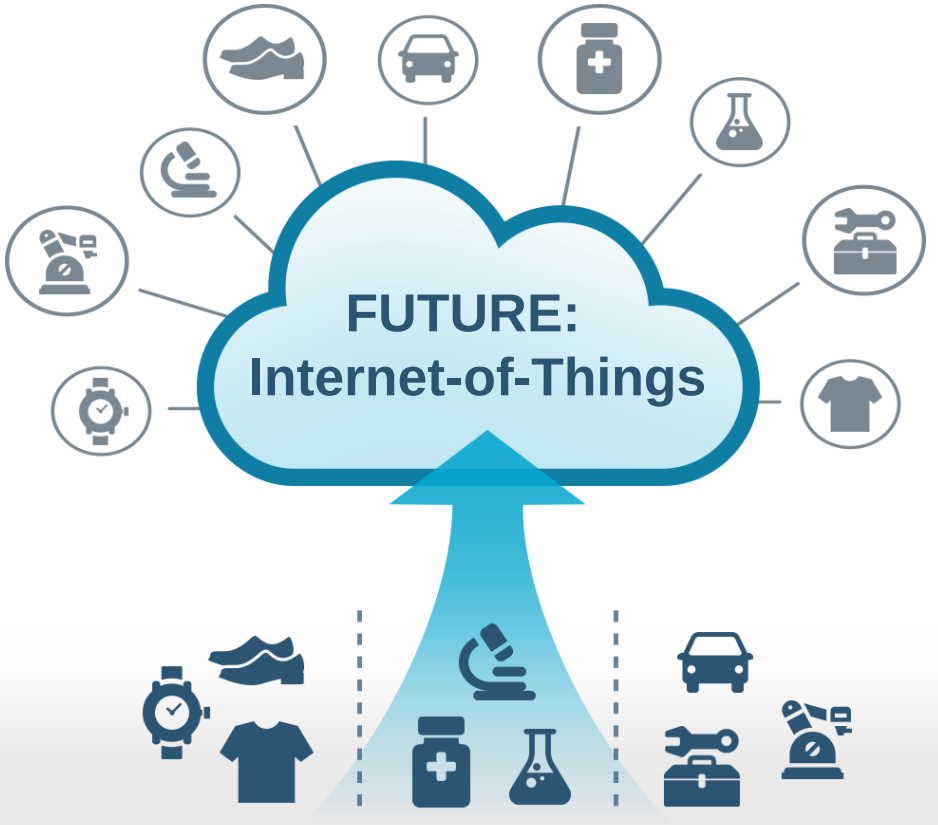
History as a Guide

Internet Evolution

PAST: Private Networks Era

IoT Expectation



TODAY: Private Networks of Things

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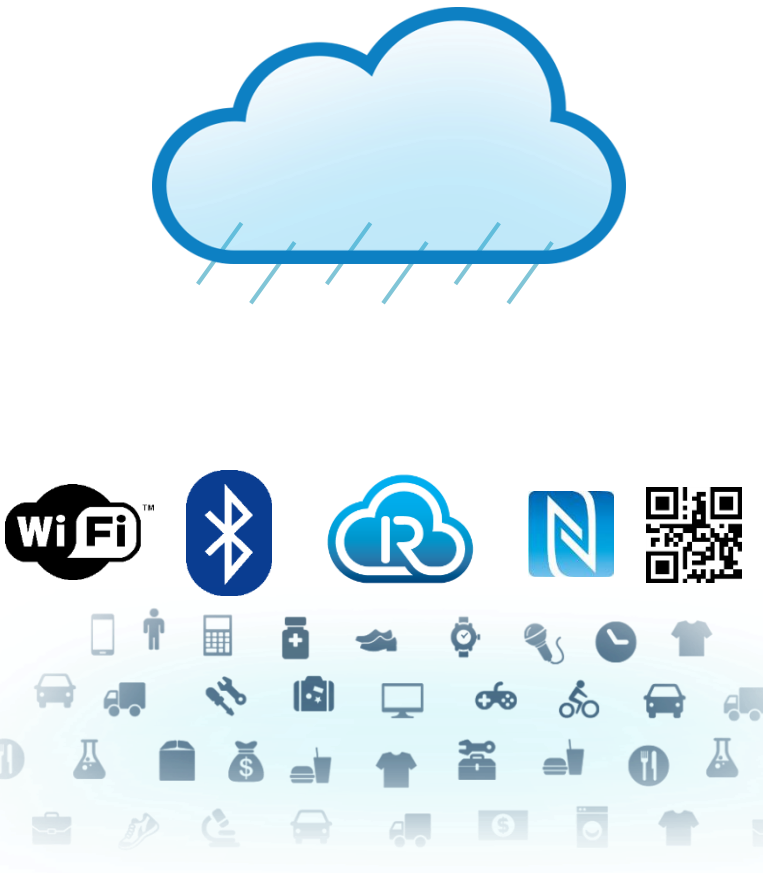
Proposal: IoT Architecture for Items

Items have digital lives that mirror their physical lives

An item's physical life is its identity, location & authenticity

An item's digital life is its attributes*, history & ownership



** Attributes can be manufacturer data, item data, temporary possessor data, etc.*

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Proposal: IoT Architecture for Items

The item's digital life is contained in a journal

The item's digital identity resolves to the journal's URI

Journals store

1. pointers to item attributes {data, context}
2. history of an item's observations {where, when}
3. current and past item owners and their owner rights

** DNS is a metaphor for a discovery service that resolves item identities to URIs*

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Proposal: IoT Architecture for Items

Applications access journals to

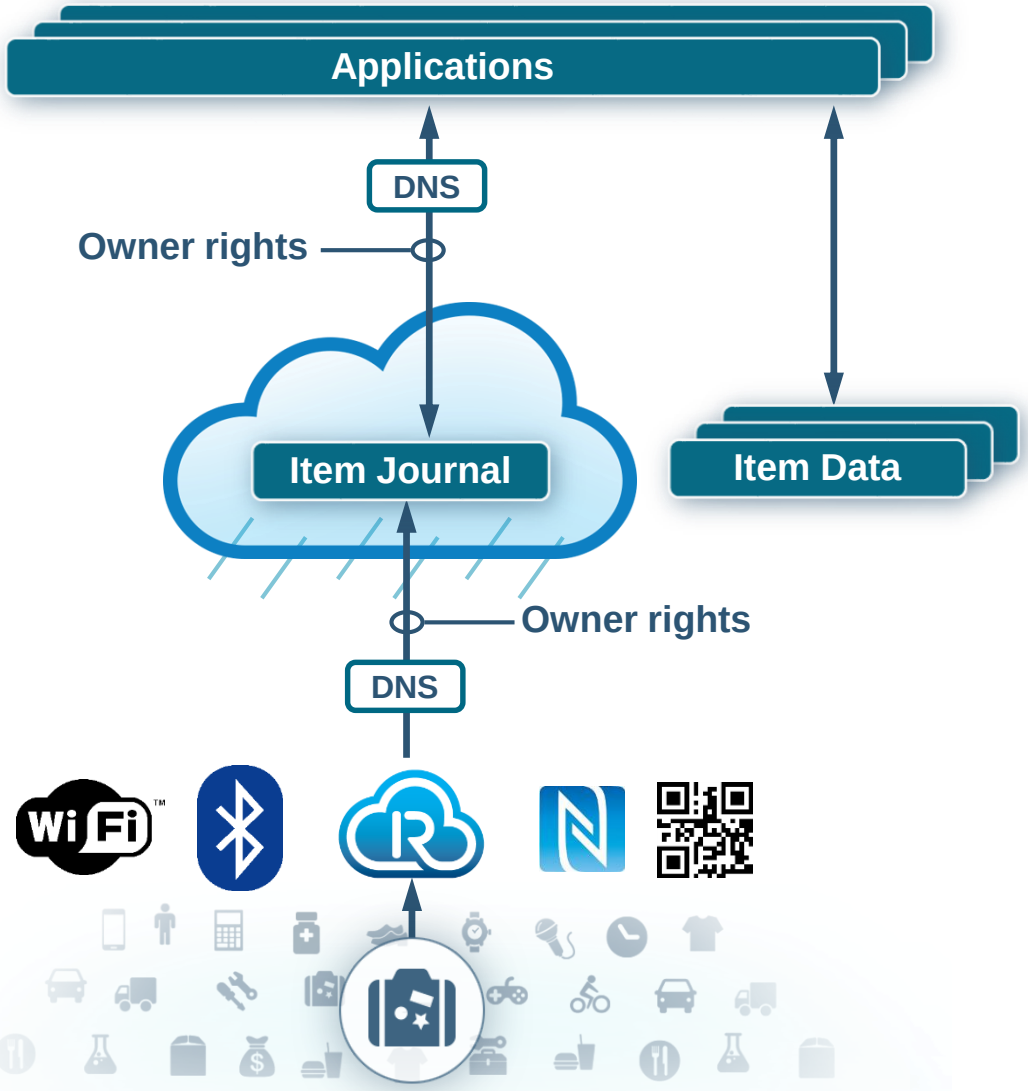
1. read/write pointers and observations
2. read or assign/transfer item ownership

all subject to persistent owner rights

Pointers & observations are atomic; ownership is chained

Pointers direct applications to item data

The virtual Electronic Product Code (EPC) is a journal entry, applicable to all items, and independent of the data carrier



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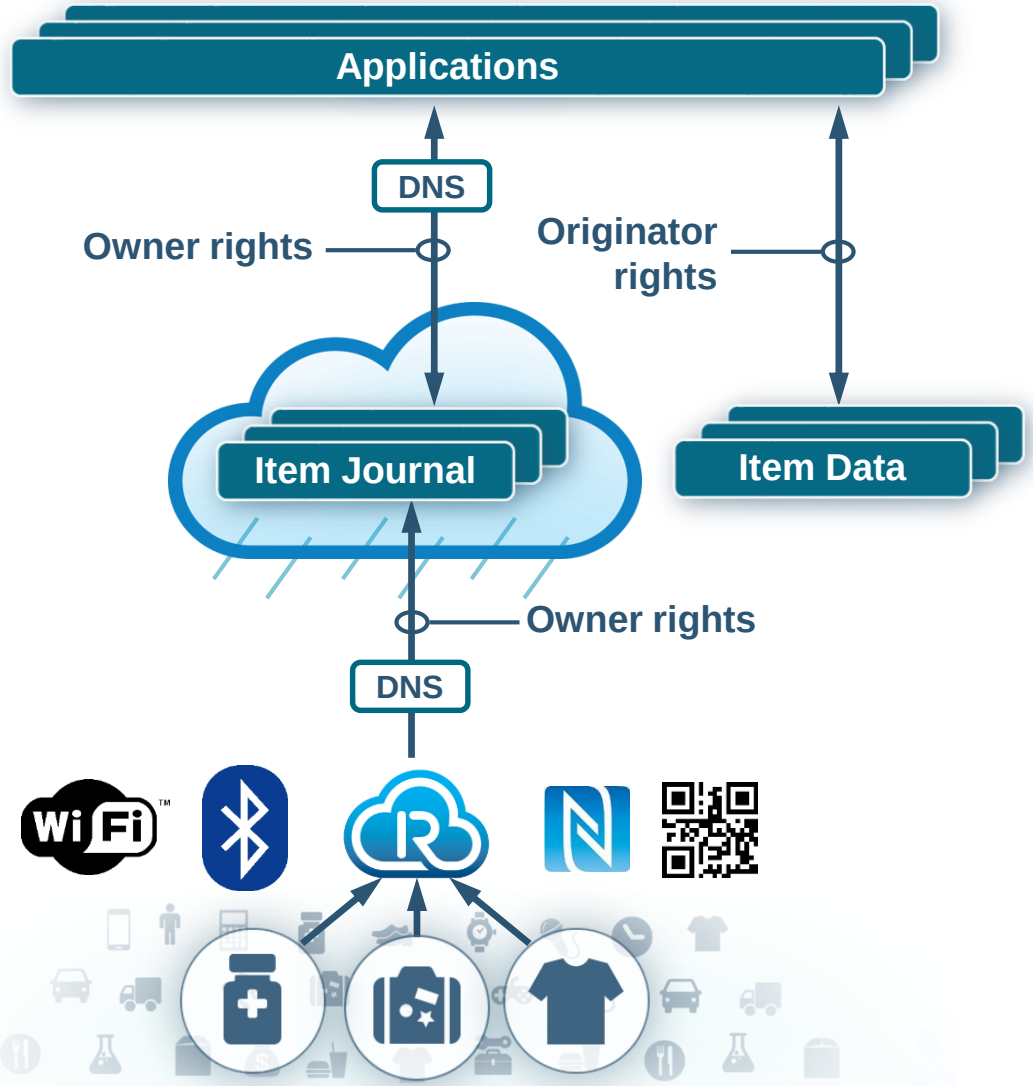
Proposal: IoT Architecture for Items

Originator rights determine who can access item data

Journal entries must be authenticated/signed

Journals are cloud-based, open-source, replicable and enforce eventual consistency



This IoT architectural view is item-owner-centric

- *An owner owns an item*
- *An owner owns their item data*
- *An owner benefits from the item's digital life*

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IoT Architectural Principles

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RAIN will Better Our World

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

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DIGITAL LIFE FOR EVERYDAY ITEMS

THANK YOU