Register Your Twins

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Imagine a Truly Connected World

Internet Connectivity for Trillions of Items Every Year
We Have the Technology

- Small & low cost
- Unique identifier per item
- Uses RAdio IdentificatioN
- No batteries
- Lasts forever
- Fast & long range

Costs pennies
1000 tags/sec
10m range
It Can Connect Everything

Little RAIN IC

RAIN ICs on a silicon wafer

Big Opportunity

RAIN-enabled race tag

NYC marathon
Volumes are Growing Rapidly

RAIN is Established

- Worldwide Spectrum
- RAIN Industry Alliance
- GS1/ISO Numbering/Standards
- Established Tagging Ecosystem

Industry Unit-Volume Growth

Yearly RAIN Tag ICs in Billions

1. Industry-wide volumes (a) for 2010 & 2011 are based on VDC Research; "Strategic Insights 2013: RFID, Contactless & RTLS Technology," for 2012 is based on IDTechEx: "RFID Forecasts, Players and Opportunities 2014—2024," 2013, (c) for 2013 and 2014 are based on IDTechEx: "RFID Forecasts, Players and Opportunities 2016—2026," 2015, (d) for 2015-2018 are based on data compiled by the RAIN RFID Alliance.

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Adoption is Broad-Based

Retail apparel
• 80 Bn/yr opportunity
• ~10% connected

Supply chain
• 10 Bn pallets in use
• < 1% connected

Airline baggage
• 283 IATA airlines
• 1 fully deployed

Convenience stores
• 100 Bn/yr (Japan)
• 2025 METI plan
Envision Virtualizing the Physical World

**Digital Twins**
- Ownership*
- History
- Links

* Ownership can be temporary, such as for item custody

**Physical Items**
- Identity
- Location
- Authenticity

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Imagine the Opportunity

**Commerce**
- Drive efficiencies
- Reduce loss/waste
- Inhibit counterfeiting
- Automate contract fulfillment

**Businesses**
- Increase sales
- Improve customer satisfaction
- Virtualize and optimize operations
- Engage consumers via connected items

**People**
- Virtualize my possessions
- Automate data collection/retention
- Instant visibility to items in my world

This architectural view is item-owner-centric
- An owner owns an item
- An owner owns their item’s twin
- An owner benefits from the item’s digital life
So What’s Holding Us Back?

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<td>1. Digital life for physical items</td>
<td>1. Multiple numbering systems</td>
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<td>2. People engaging connected items</td>
<td>2. No number-to-cloud resolution</td>
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<td>3. Developers building an IoT ecosystem</td>
<td>3. Item ownership isn’t an internet concept</td>
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History: Internet Evolution

Internet

Corporate Intranets

Key Element: DNS

1. Request impinj.com IP address
   - Requestor
   - ISP’s DNS Server

2. Request .com domain IP address
   - ISP’s DNS Server
   - Root Server

3. Request Impinj.com nameserver IP address
   - ISP’s DNS Server
   - Domain Server

4. Request Impinj.com IP address
   - ISP’s DNS Server
   - Name Server
What people expect from the IoT
• I am an IoT driver, not a passenger
• I want direct access to my items & data
• I expect democratized access to my digital world
This view is manufacturer-centric, NOT item-owner-centric

- GSI Digital Link resolves a GTIN to a manufacturer’s URL
- EPCIS enables data sharing among trading partners
Identifier registration

• Ensure number uniqueness*
• Resolve identifier to twin (IP address)
• Link item-relevant services to twin
• Retain the ownership-transfer chain

Item ownership

• I own an item and its twin
• My item resolves to my twin
• I store my twin where I want to
• I determine the security for my twin
• I choose what data to share with others

* Registration is the only effective way to support multiple numbering systems and ensure EPC uniqueness
Key IoT Needs

Digital twins for physical items
• Location agnostic
• Owned by the item owner
• Protected by owner rights/privileges
• Resolved (to IP address) by item’s identifier

Identifier resolution for the IoT
• Distributed, decentralized
• Identifier-to-twin resolution
• Twin-to-item-services resolution
• Application resolution to twins/services

Key aspects of digital twins
• Each successive item owner creates a new twin
• Owner rights gate access to twin data, including by prior/future item owners
• Owner rights gate identifier resolution to prior twins’ IP address

Key aspects of a resolution service
• Registers item identifiers to digital twins
• Resolves identifier-based access requests to IP addresses
• Leverages blockchained item-ownership transfer to resolve item identifier to new owner’s digital twin
The Time is Now

Our opportunity
- RAIN-enabled item-to-cloud connectivity
- Business and people engaging connected items

Our responsibility
- We are enabling item connectivity
- We have the vision of connected items

A critical need
- We are key to delivering the IoT vision

Proposal: Form a consortium of industry bodies to
- Define standards for digital twins
- Architect identifier resolution for the IoT
Thank You