IMPINJ™

DIGITAL LIFE FOR EVERYDAY ITEMS

Accelerating RAIN Adoption

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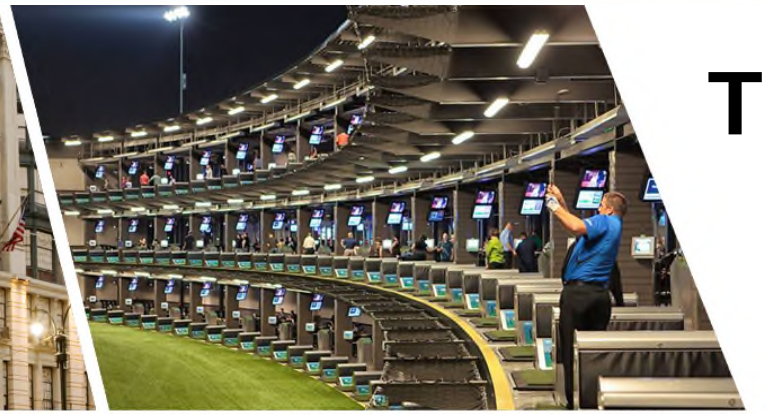

The RAIN® industry, today, connects just 0.1% of the world's connectible items

How can we, the Alliance members, accelerate RAIN® adoption by the remaining 99.9%?

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Task #1: Make Deployments Easier

- **Leverage our Alliance**
  - Collaboratively address industry challenges
  - Foster business relationships to drive deployments
- **Help our end users**
  - Retail, aviation, cosmetics and convenience stores are all represented here today
- **Deployability ⇨ repeatability ⇨ scale**
  - Drive fixed reading
  - Drive embedded tagging

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Making Deployments Easier

Drive Fixed Reading

- **1st RAIN adoption wave**
  - Handheld inventory counting, led by retail apparel
  - Humans overcame reading challenges
  - Improves inventory visibility
- **2nd RAIN adoption wave**
  - Fixed reading, led by aviation & supply chain
  - Transition detection, well-defined read zones & SW algorithms overcome reading challenges
  - Improves supply visibility
- **What can we improve?**
  - Deployment tools & learnings
  - Reader and tag sensitivity

Drive Embedded Tagging

- **1st RAIN adoption wave**
  - Inlays and paper labels
  - Attached-to but separate from items
  - Enables myriad form factors & rapid adoption
- **2nd RAIN adoption wave**
  - Embedded identifiers
  - IC and antenna integrated into item
  - Enables item authentication & theft protection
- **What can we improve?**
  - Consumer privacy protection
  - Embedding technology & know-how
  - Pre-encoded ID with registration & link to the cloud

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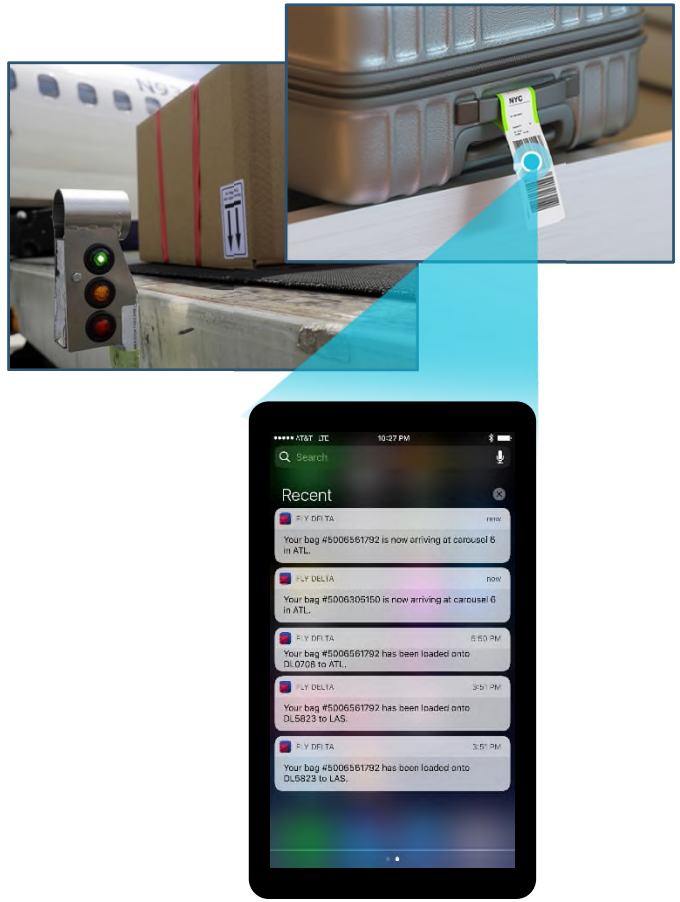
Task #2: Engage the Consumer

- **Drive consumer-facing use cases**
  - RAIN's future is delivering the benefits of item connectivity directly to people
- **Teach consumers about RAIN**
  - Envision a future when consumers request RAIN-enabled item connectivity from businesses
- **Craft our position on consumer privacy**
  - RAIN Alliance position statement
  - Playbook to address challenges

Delta Airlines is the first large RAIN deployment to directly benefit consumers



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Engaging the Consumer

Create Privacy Statement

- **Focus on people**
  - Address core concerns
  - Avoid technological answers
  - Focus on our commitment to privacy
- **Align our membership**
  - Commitment to addressing privacy
  - Common messaging; unified responses
  - An issue that affects one of us affects all of us
- **Lead, don't follow**
  - Our Alliance is our voice
  - Be proactive, not reactive

Create Privacy Playbook

- **Be prepared**
  - The first big RFID privacy story is likely to hit RAIN even if the cause is another type of RFID
- **Learn from others**
  - Learn from social media's issues & their seemingly reactive, rather than proactive, responses
- **Show RAIN's value**
  - RAIN reduces waste/loss, helps track items like airline baggage and improves food safety
- **Educate the consumer**
  - RAIN's read range is room-sized
  - RAIN incorporates build-in privacy protections
  - RAIN tags can be removed or electronically killed

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Task #3: Educate Our Ecosystem

- **We advance the industry via education**
  - Optimize deployments for success
  - Future-protect industry investments
- **End users appreciate being informed**
  - They want to take advantage of future cost reductions and technology improvements
- **Drive long-term understandings**
  - Newer, more sensitive ICs and smaller inlays generate less backscatter
  - Cloud memory is cheaper and more reliable than tag memory

A tag antenna is like a mirror, backscattering information by changing its reflectance

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Educating Our Ecosystem

Don’t Specify Backscatter Strength

- **Older tag ICs generate strong backscatter**
  - Older, high-power tag ICs need large antennas
  - Large antennas & large power swings produce a large backscatter signal
- **Newer tag ICs generate less backscatter**
  - More sensitive tag ICs allow smaller antennas
  - Small antennas & small power swings produce a small backscatter signal
- **Specifying minimum backscatter hurts two ways**
  - Requires larger tag antennas
  - Requires older tag ICs that absorb more power
- **Don’t constrain future cost reductions**
  - Instead specify tag reflectance (mirror shininess) and reader sensitivity

Tag Memory Costs More than Cloud Memory

- **Tag memory cost = 1 million times cloud memory**
  - Rough order-of-magnitude analysis
    - Tag memory: $\$10^{-5}$ per bit = $\$10^{8}$ per Terabyte
    - Cloud memory = $\$10^{2}$ per Terabyte
  - The difference is $10^{8} \div 10^{2} = 1$ million
- **Tag memory is less reliable than cloud memory**
  - Tag ICs are exposed, breakable
  - Tag ICs can disconnect from the antenna
- **Instead put memory in the cloud**
  - A tag IC is a pointer to a digital twin in the cloud
  - A barcode/QR code can be a backup to the pointer

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Task #4: Sell the 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

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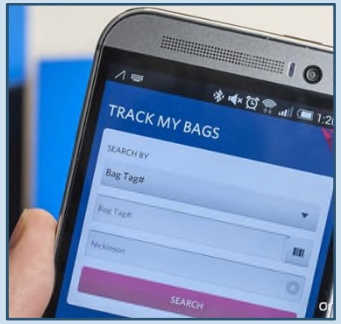
What We Must Deliver

Today: Item Connectivity

Reading



Identification

Future: Digital Life for Items

IoT Opportunity

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

What We Must Deliver

1. Digital twins for physical items
2. Item number resolution to the twin
3. Item history, ownership and links stored in the twin

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YES to RAIN; NO to RFID

RAIN® = Future

- **One frequency:** 900 MHz
- **One standard:** ISO 18000-63 = GS1/EPC UHF Gen2
- **RAIN® Alliance with more than 160 member companies**
- **Much promise:**

RFID = Confusion

- **Many frequencies:** LF, HF/NFC, 433MHz SRD, UHF, microwave, UWB
- **Many standards:** ISO 11784/5, 14443, 15693, 18000; GS1/EPC HF; GS1/EPC UHF Gen2
- **No representative industry alliance**
- **Many issues:**

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Our Opportunity is Now

- **We have a name: RAIN**
  - We connect items to the cloud
- **We have a huge opportunity**
  - Retail apparel, aviation, supply chain, food, more
  - IATA's efforts place us squarely in front of people
- **Now is the time to together create momentum behind the RAIN name, brand and vision**
  - Referring to our RAIN market and technology as RFID undersells our value
  - Can you imagine Bluetooth or WiFi being as successful at they are today if we called them both "RADIO"

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Deliver Our Vision

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RAIN will Connect Every Item in Our Everyday World