



RAIN[™]
RFID

Digitally Connected RAIN Embedded Solutions for IoT

Eric Wood, VP Product Management, Printed Electronics

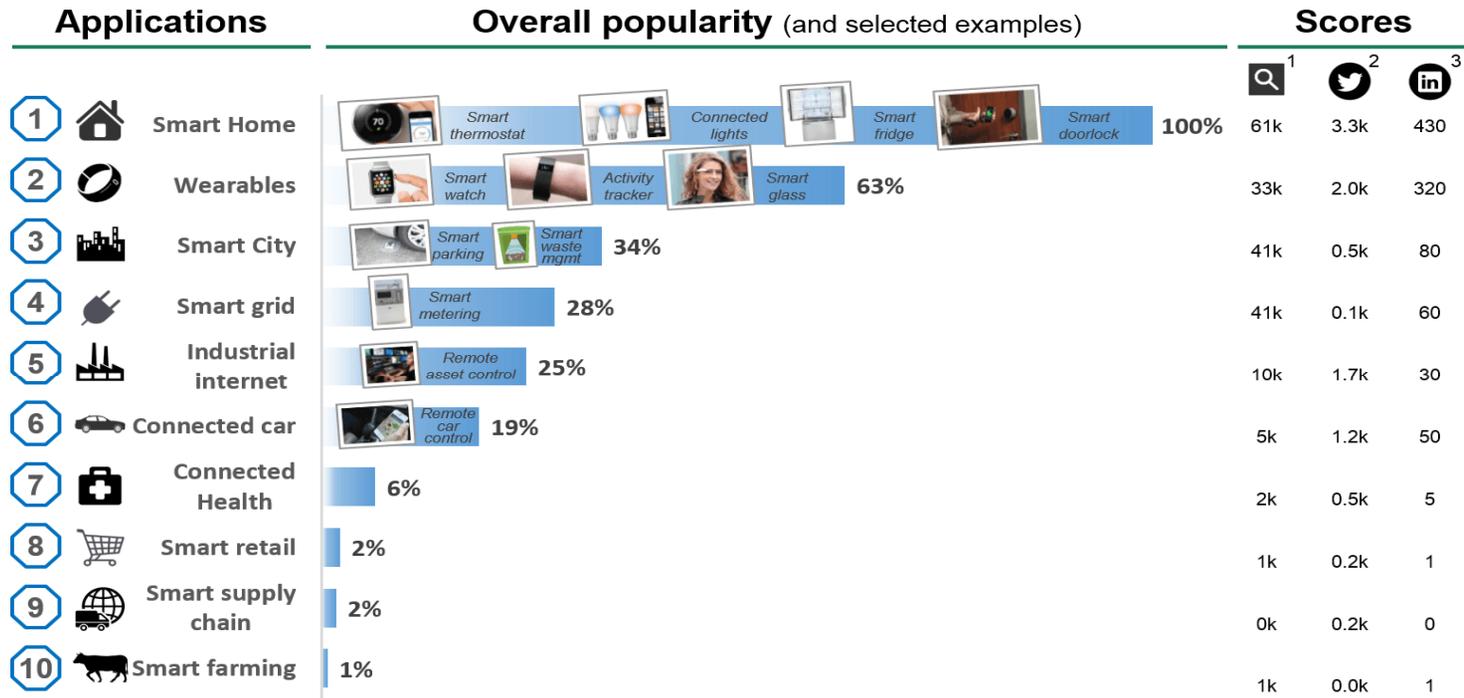
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That's quite a mouthful...what does it **mean**?

- Digitally Connected
 - Information is available **when needed**
- RAIN Embedded
 - Incorporates RAIN technology **effectively**
- Solutions
 - All the **pieces**

What the Internet thinks about IOT

Top Internet of Things applications were ranked based on the number of searches on Google, tweets on Twitter, and reviews on LinkedIn. The highest score received a rating of 100% and other IoT applications were ranked with a percentage that represents the relation to the highest score. **Period:** Q4 2014

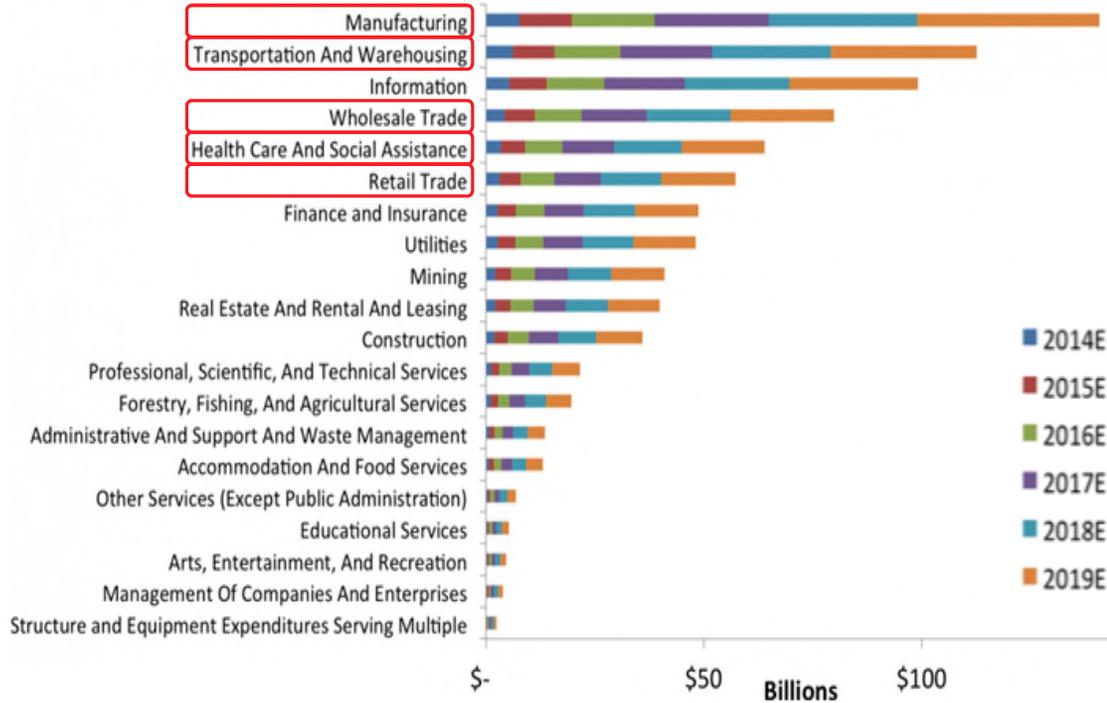


1. Monthly worldwide Google searches for the application 2. Monthly Tweets containing the application name and #IoT 3. Monthly LinkedIn Posts that include the application name. All metrics valid for Q4/2014.

Source: [IoT Analytics, February 2015](#)

What Business thinks about IOT

Investment in IoT Solutions, by Sector



Source: BI Intelligence; eMarketer, March 2016

Attitude towards IoT among decision makers, by Sector Aug 2015

	Transformational	Strategic	To consider	Not important	
Professional services	29.6%	45.8%	15.7%	7.4%	
Retail	28.4%	-88%	59.6%	7.9%	3.7%
IT	27.7%		50.4%	11.0%	6.2%
Manufacturing	24.8%	-91%	66.1%	6.9%	1.0%
Government	24.4%		41.5%	25.2%	7.7%
Finance	20.0%		58.4%	15.2%	5.6%
Transportation	18.4%	-85%	66.6%	9.9%	2.6%
Healthcare	17.6%	-90%	72.4%	6.8%	2.8%
Other	22.7%		45.1%	21.9%	4.4%
Total	23.7%	57.5%	12.7%	4.1%	

Note: n=2,350; numbers may not add up to 100% due to rounding
 Source: International Data Corporation (IDC), "2015 Global IoT Decision Maker Survey: Key Findings," Sep 10, 2015

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www.eMarketer.com

Why Now?

Evolving Regulatory Landscape

Regulatory compliance is a huge driving factor behind IoT adoption. For example, the **Energy Act (2007)** in the US accelerated efforts to monitor energy consumption.

The **Drug Supply Chain Act** gives drug manufacturers until late 2017 to electronically transfer and store transaction histories for their prescription drugs, including shipment information across their distribution supply chain. The law is designed to thwart **counterfeit drugs** which cost the sector **\$75 billion** annually.

Similar requirements in other sectors such as the **beverage and construction** sectors, where the product can change hands up to 10 times, will drive the deployment of millions of sensors to track machines and other assets. IoT will allow small and medium-sized businesses as well as large enterprises to **provide critical information quickly** to their customers and supply chain partners.

In the US, the agriculture and food sector is deploying sensors on an ever-widening scale to monitor key production conditions, shipping time and other metrics as a means to comply with a new and comprehensive set of reporting requirements under the **2015 Food Safety Modernization Act**.

Growing Consumer Expectations

Consumers have grown to appreciate their smartphones, but in an IoT-enabled world, they are starting to understand that their phones can do more. With so much potential at their fingertips, **consumers expect to remain constantly connected** while also feeling in control of how and when they choose to connect to the people and things that matter to them the most.

Connected culture

Globally, individuals are developing a high affinity for full-time connectivity, which makes **consumer IoT a compelling proposition**.

Other factors driving IoT adoptions include Increase in broadband penetration, Development of wireless networking technologies, Growth in mobile control initiatives and Reduction in the cost of connected devices.

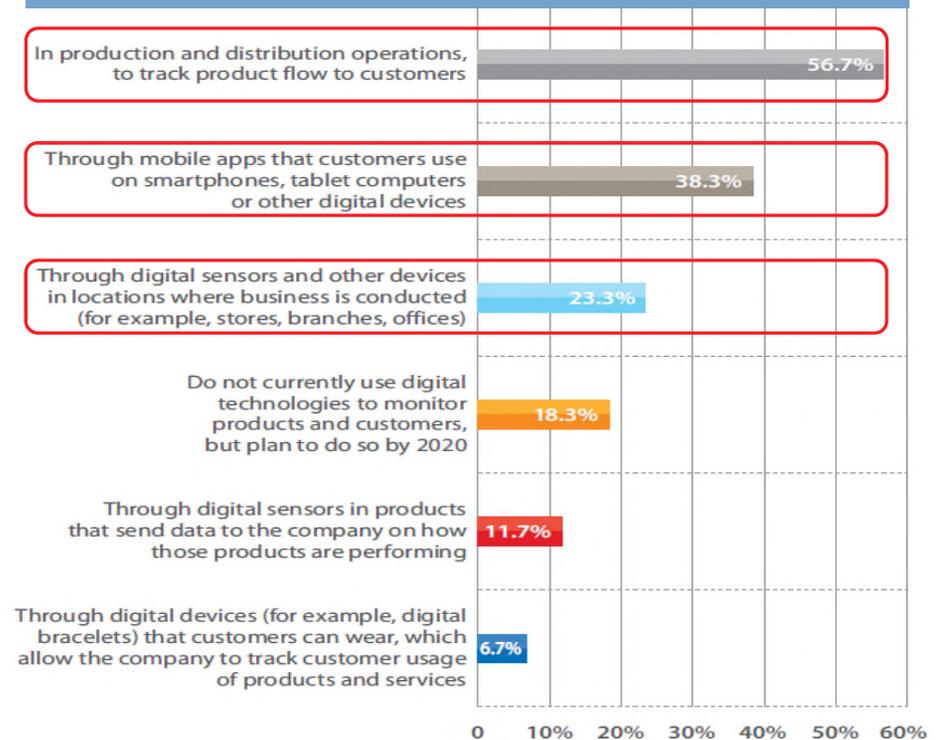
Source: [State of the Market: Internet of Things 2016 - Verizon](#)

What does the IOT Opportunity look like?

Impact of IoT on Packaging Companies

- Staying on top of these new developments will be vital to success in the near future as **consumers become accustomed to having sensors embedded** and playing decision-making and automation roles in more and more areas of daily life.
- According to a Smithers Pira report, global **IoT packaging will grow at a staggering 18%** per year to almost \$2.2 billion during the five year period to 2021.
- IoT is **revolutionizing the healthcare packaging** segment as it enables many possibilities such as tracking of shipments and missed medications, which in turn will enhance not only the clinical workflow but also the quality of life.
- IoT in packaging also offers many features previously unseen, such as **bi-directional communications**, tracking and status display mechanisms.
- A **smart medicine box** with smart pharmaceutical packaging can revolutionize in-home healthcare services. IoT smart packaging can help in controlling entry of substances in healthcare environments, which may be linked with security measures and also to the right patient, ensuring traceability.
- This is of great importance in emerging markets to tackle the challenges of **counterfeiting** as well as illegal recycling.

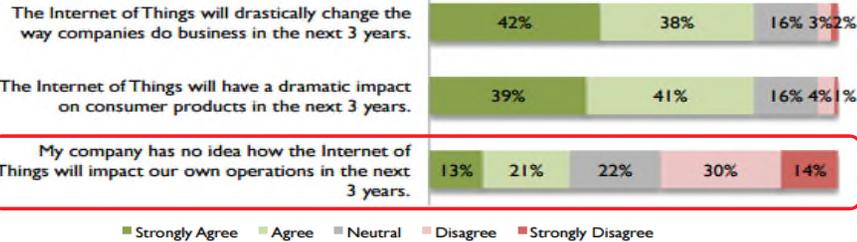
Ways in which CPG companies use IoT



Source: [National Association of Container Distributors, December 2014](#); [Life Sciences Logistics, April 2016](#); [Packaging News, May 2016](#); [Consumer Packaged Goods: Low Spending, Focused on the Supply Chain, TCS](#)

What does the IoT Opportunity look like?

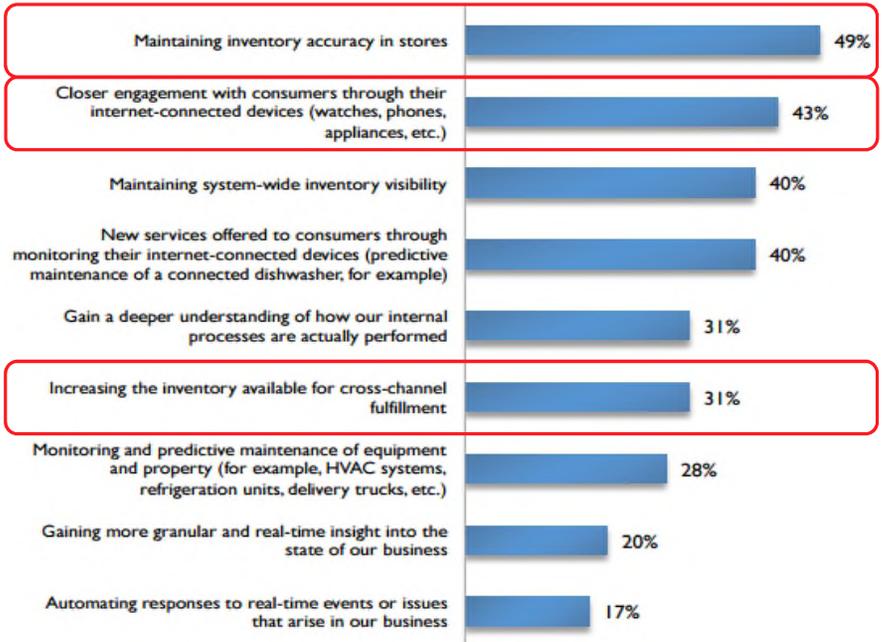
IoT Perceptions In Retail



Business Challenges Driving IoT Investments



Opportunities for IoT in Retail



Source: [The Internet Of Things In Retail: Great Expectations – RSR, AT&T, August 2015](#)

What does the IOT Opportunity look like?

Impact on Healthcare

- The healthcare Internet of Things market segment is poised to hit **\$117 billion by 2020**.
- **Security and privacy are of paramount importance.** Of all the personal data that gets accumulated, health data is one of the most sensitive categories. At the same time, digitizing and streamlining the sharing of health data has the potential for dramatic gains in efficiency and significant cost savings – Goldman Sachs recently estimated that Internet of Things (IoT) technology can save billions of dollars for asthma care.

Applications

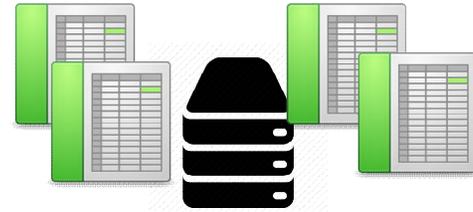
- **Flexible patient monitoring** - Keeping patients in a hospital setting is expensive. The average daily cost for a single inpatients was over \$1,700 in 2013. Remote monitoring products – such as the BodyGuardian Remote Monitoring System – give healthcare pros the option to move patients to their home and retain monitoring of their status by doctors and nurses. The BodyGuardian system addresses security requirements in several ways. The system separates patient identification information and observation data. In addition, the system encrypts data on the device, during transmission and in storage.
- **Improved drug management** - The expense of creating and managing drugs is one of the biggest issues facing the healthcare segment today. Forbes reported the average cost to develop an approved drug at \$55 million (drug companies have stated higher costs). In addition, there is a multi-billion dollar sector in fraudulent drugs.

IoT devices and processes may prove helpful in better managing these costs. In 2004, the Food and Drug Administration (FDA) laid out guidelines for RAIN RFID and drug supply chain management. The first step was to add RFID tags to medication containers. Adding these tags enable producers, consumers and regulators to have greater confidence in the drug supply chain. The next step is embedding technology into the medication itself.

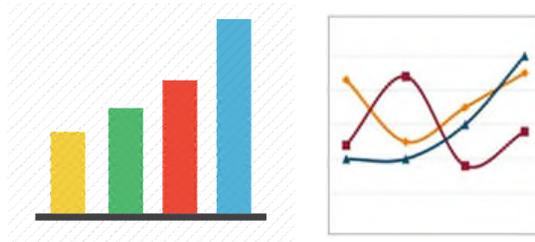
Source: [Forbes, April 2015](#); [CXO Media Inc., September 2015](#)

I is not simply the Infrastructure needed...

- **Information**
 - What, where, who, when



- **Insight**
 - Why, what for



- **Income**
 - What's in it for me/you/us?



Why is RAIN well positioned for IOT?

- Existing implementations
 - Billions of RAIN-enabled things in place currently
 - Infrastructure across a wide range of markets
- Cost-effective
 - Passive technology
 - Economies of scale
- Adaptable
 - Works across multiple markets and applications



Where is RAIN challenged in IOT?

- Relatively expensive/specialized infrastructure
 - No RAIN-enabled mobile devices
- Public perception
 - Privacy considerations
 - Don't understand value proposition
- IMT
 - Intranet of My Things



RAIN™
R F I D

Now what?

- **We know...**
 - IOT is **real**; there are use cases and interest and implementations
 - Companies are looking to implement solutions that drive **value**
 - RAIN RFID is a **perfect** complement to a wide variety of IOT use cases
- **We need...**
 - Effective ways to **incorporate** RAIN into every thing
 - Solutions that leverage RAIN technology **across organizational borders**
 - Global understanding of RAIN value: **branding**

Incorporating RAIN into every **thing** – effectively

- Ok, maybe not **every** thing, but...
 - The **right** things, where the benefit justifies the cost
 - Only applications that **make financial sense** will prosper
- Requires a **variety** of form factors and production methods
 - Traditional item-level tagging methods
 - “Smart” packaging
 - Embedded RAIN transponders
 - RAIN-enabled brand labeling

What does “Smart Packaging” mean?

- Are encyclopedias “**smart**”?
- Packaging should be able to facilitate conveyance of information
 - Status/history, consumer-centric data, perhaps contents
 - Standard formatting and “language”



Getting **RAIN** onto a Thing – or a Package

- **Methods:**

- Use a RAIN-enabled label

- Many options, formats, materials



- Print the antenna onto the package and affix a coupling unit

- Either sub-surface or over-surface
- Coupling unit affixed at any stage



- Use a RAIN-enabled Brand Label

- Many brands don't want a secondary RAIN label



- Embedded RAIN transponders

- Reusable RAIN use-cases



Going from “Educated Packaging” to Smart RAIN Systems

- The key aspect is conveying the information
 - Systems need to know what they’re looking for and how to interpret the information they get
 - Standard communications methods
 - Universal information interpretation



How can the **RAIN Alliance** help?

- Along with individual member organizations, continue to evangelize the use of RAIN in IOT
- Develop core operating practices for IOT – coordinating with other organizations such as NIST, GS1, and others
- Continue to bear the flag of interoperability and standards as it relates to the UHF RFID ecosystem of tags, readers, etc.

How is **RR Donnelley** supporting IOT?

- **Implementing high-volume flexible production systems for IOT solutions**
 - Printed Electronics combined with a variety of final form factors
 - Leveraging the best of print with the best of traditional electronics in a hybrid manufacturing solution
 - Printed antennas and circuits, printed batteries, traditional logic and other SMT components
 - Building customized solutions based on business needs
- **Building and/or supporting data service infrastructure**
 - From Intranet to Internet, enabling the insights our customers need to drive value with IOT



Thank You.

RR DONNELLEY