### **Tips for Developing IoT-ready Products**

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### **Dinner Talk**

Sigma Xi, Orange County Chapter Dinner Meeting, Tuesday September 21, Mimi's Cafe, 17231 17th St, Tustin.)

Zoom Meeting https://cccd-edu.zoom.us/j/94539973303

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### Agenda

- Definitions of IoTs
- What Constitutes a Smart product
- Survey: How important lots is for your company?
- <u>Usage and Benefits</u> of IoT-ready Products
- <u>Technology Trends</u> in Building IoT-ready Products
- <u>Considerations in designing</u> IoT-ready products
- <u>Considerations in Managing</u> Requirements for IoT-ready Products
- <u>PLM for Managing Requirements and Workflow</u>
- <u>Cloud PLM for Managing Requirements and Workflow</u>
- <u>Cloud PLM for Designing</u> complex IoT-ready products
- Survey: What Factors/ Characteristics Drive selection of <u>IoT-Development Platforms</u>/ Vendors?
- Concluding Remarks

### Definitions of Internet-of-Things (IoTs)

Many definitions of IoT exist, Since a universal definition has not been created yet.

IoT Definition (McKinsey Corporation, 2010) "In what's called the Internet of Things, sensors and actuators embedded in physical objects – from roadways to pacemakers – are linked through wired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet"

IoT Definition (Feng, 2012) "IoT refers to the networked interconnection of objects, equipped with ubiquitous intelligence. IoT will increase the ubiquity of the Internet by integrating every object for interaction via embedded systems, which lead to a highly distributed network of devices communicating with human beings as well as other devices"

IoT Definition (Bosch Corporation, 2014): "IoT is the next generation of Internet. It is a global system of IP- connecting computer networks, sensors, actuators, machines and devices" (Bosch Corporation, 2014)

### What Constitutes a Smart Product

A smart product consists of three elements. These are physical components, smart components and connectivity components (Porter & Heppelmann, 2014).

- 1. The physical component is the product's mechanical and electrical parts & features.
- 2. The smart components are the product's software, sensors, data storage and other similar features.
- 3. The last component is the connectivity components. It consists of the protocols or ports that enable the connection between products or human beings.

At the core of the loTs, lays the smart product - equipped with RFID technology.

Radio-frequency identification (**RFID**) uses electromagnetic fields to automatically identify and track tags attached to objects.

# Q: Survey: How important for your company to adopt IoT functionality into your products?



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### Usage and Benefits of IoT-ready Product

- The internet of things (IoT) has taken the world by storm in recent years.
- Everything from home appliances to smart office, to handheld devices to driverless cars IoT-ready products are connecting 3Ps (people, places and products) to data and services like never before.
- However, with those <u>IoT-ready products</u> there is a need for complex and effective <u>smart components</u> and flexible RFID connectivity components.
- Flexibility is required to provide a greater control and interoperability between globally dispersed workingteams, supply-chains, data and services.

### Technology Trends in Building IoT-ready Products



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## <u>Considerations in Managing</u> Requirements for IoTready Products

- First, a clear set of requirements are critical to start with and then throughout the entire life-cycle of a new product introduction (NPI) process to deliver the product as envisioned and on time.
- While IoT helps create better user experiences and greater customer satisfaction, there's also a clear need to manage the requirements that define how IoT capabilities will work in the first place.
- Traditionally, requirements are written as action items online and shared via online data management systems (ODMS) via cloud partners.

# <u>Considerations in Managing</u> Requirements for IoTready Products

- Without streamlined requirements, engineers could spend more time fixing problems than solving problems.
- This often leads to over-engineered products which, in the case of an IoT product, can inadvertently affect key features such as connectivity or security.
- It can also lead to NPI delays because engineers may be forced to fix new problems or issues that wasn't in scope.
- It can also lead to putting security and other IoT components at risk (such as design features or scopecreeping).
- It may present difficulties in controlling or meeting the deadlines.

Considerations in designing IoT-ready products

- There are several considerations in designing...
- IoT devices must include secure, fast connectivity, a sophisticated data management, and a robust device management.
- Traceability is essential for keeping product launches on track.
- It's important that original requirements are intact and aligned with the resulting final product – meaning for every feature, use an appropriate test case that's reviewed and approved
- Each step in this process must be documented for easy future reference or for historical perspectives.

Considerations in designing IoT-ready products

- IoT development requires electrical, mechanical, and software design teams to work together from start.
- However, as soon as the product line scaled from simple hardware-defined products to more complex hardware-and software-defined products, a Product Life-cycle Management (PLM) system is required to manage frequent requirements changes in a controlled manner.
  PLM system helps bring all development teams and design models together into a single platform and helps get as-designed products to customers on time.

### PLM for\_Managing Requirements and Workflow

- A single PLM architecture enables collaboration across all teams, faster design approvals, and provides traceability from concept to final product launch.
- With automated PLM workflows, all team members are instantly aware of new or updated requirements allowing timely collaboration.
- In addition, all stakeholder approvals can be captured for historical reference throughout the NPI process.
- For those operating in regulated industries, it's even more critical to use PLM to drive requirements that comply with regulatory and safety standards.

**Cloud PLM for Managing** Requirements and Workflow

- PLM systems, especially when cloud-based, help teams avoid the most common issues around requirements: missed requirements and over-engineered products
- The success or failure of any connected device is tied to how well requirements are defined and managed from early new product inception (NPI).
- Innovative IoT companies have come to understand that requirements management via Cloud PLM is the key for the success of product launch.

<u>Cloud PLM for Designing</u> complex IoT-ready products

- Cloud PLM systems provide better traceability of requirements by connecting them directly to product design, linking design inputs to design outputs, or linking to the affected part of the product record.
- This connected requirements approach ensures that every time requirements change, local and dispersed teams are immediately notified to consider the impact to downstream design elements such as connectivity, security, and compatibility.

Survey: What Factors/ Characteristics Drive selection of <u>IoT-</u> <u>Development Platforms</u>/ Vendors?



Credit : Engineering.com {Ref. 2, p. 16}

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### **Concluding Remarks**

- Today, most product development teams want to add IoT type functionality into their products.
- The biggest obstacle to launching products with IoT features was reported as lack of skills within the product teams, and lack of common communications protocols.
- When it comes to selecting the proper IoT development platform, survey respondents said the platform has to address performance issues such as ease of connectivity, security and ease of development, plus several other considerations.

## Concluding Remarks (Cont'd)

- Today, most product development teams want to employ a Cloud PLM for managing all life-cycle development processes.
- However, requirements conflicts are often difficult to control.
- In the rush to get cutting-edge IoT products to market, some key requirements can be overlooked,
- The single most important consideration, however, was "selecting a vendor you can trust."
- Finding the right partner to help your company develop an IoT strategy is considered to be more important than the functionality of the IoT platform itself.

### **Credits and References**

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- 2. Engineering.com, Research Report: IoT Features in New Product Development, <u>https://www.engineering.com/ResourceMain.aspx?resid=712</u>
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