CHILL WITH PTC WINDCHILL: ROBUST PRODUCT DESIGNING FOR INTERNET OF THINGS (IoT)

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June 7th Tuesday 4:00 pm – 4:45 pm

BIO DATA

JAY NALLANI

Lead Business Analyst at TE Connectivity http://www.te.com/

- 15+ years of industry experience (Automotive, Technology, Electronics)
- **Areas of Specialty:** Implementing PLM Solutions, Pro/E-CREO, CAD Data Management, Engineering Bill of Materials, Production Support, Project Management, UAT, Enterprise Integrations and Customer Engagement.
- **Internet Presence:** LinkedIn
- **Hobbies**: Boy Scouts, Soccer Coach, Bollywood Music Choreography and Playing Drums.

BIO DATA

ZACK LYON

Product Development Engineer at TE Connectivity HEMS (Hybrid Electric Mobility Solutions)

- 25 years of industry experience (Automotive, Medical, Test Measurement, Electronics, Recreational, Office Seating and Casegoods)
- **Areas of Specialty:** 25 years of Pro/E-CREO usage – 15 years President Pro/Users of the Carolinas. WWW. PROUSERCAROLINAS.ORG
- **Internet Presence:** LinkedIn, FaceBook
- **Hobbies**: Motorcycles, Hang Gliding, Alt Energy Technologies

OUR CONNECTED WORLD

TE is the World Leader in Connectivity & Sensor Solutions

$170 BILLION CONNECTIVITY AND SENSOR MARKET

6%* GROWING ANNUALLY

*6% estimated annual market growth rate over the next 5 years

TE

By 2020, 250 million **connected cars** are expected[1], increasing TE's content-per-car by 4-6% per year.

With robotics installations rising[2], TE's **connected factory** solutions are expected to improve assembly-line efficiency by 20%.

Demand for minimally invasive procedures using **connected medical** devices expected to grow by 7%.

Reliable always-on operations enable **connected data centers** to efficiently transmit 2.4 million emails globally per second[3].

20.8 BILLION by **2020**

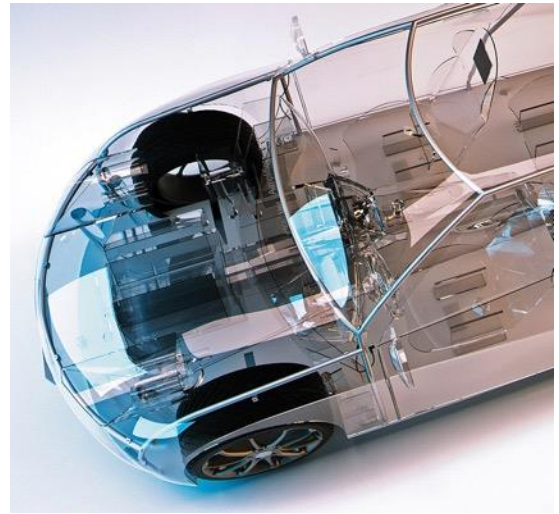
CONNECTED THINGS[4]

[1] *Gartner, "Predicts 2015: The Internet of Things"*

[2] *International Federation of Robotics, "World Robotics: Industrial Robotics 2015"*

[3] *World Wide Web Consortium (W3C), "1 Second – Internet Live Stats"*

[4] *Gartner, "Gartner Says 6.4 Billion Connected 'Things' Will Be in Use in 2016, Up 30 Percent From 2015"*



80% REVENUE*
from harsh environment applications

TE's **highly engineered** products and integrated solutions perform in harsh environments where failure is not an option, meeting customers' highest demands for excellence in quality and performance.

DEMANDS EXCELLENCE IN ENGINEERING & MANUFACTURING

Leader in Harsh Environment Connectivity

- High Pressure
- Vibration
- High Voltage
- Moisture
- Temperature

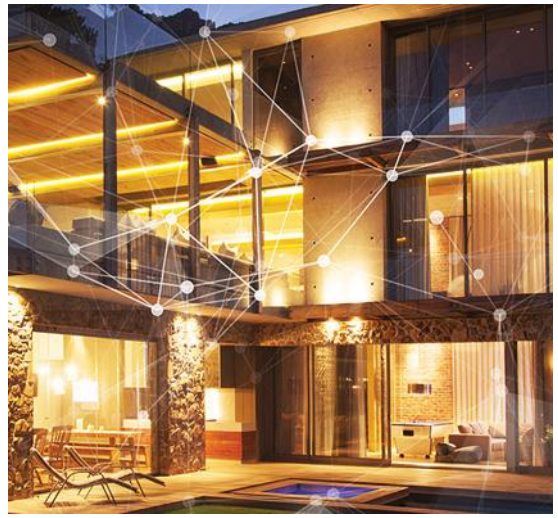
*Based on FY15 Revenue

A WORLD LEADER IN SENSORS

TE has an unmatched range of sensor technology

Driver-assist technology interacts with other vehicles and detects roadway disruptions.

Medical devices can more accurately monitor patient health, providing physicians with immediate insight during procedures.



Appliances and systems in connected homes detect vibration, temperature, and motion, adding convenience and safety to our daily routines.

INNOVATION LEADERSHIP

13,500
PATENTS
granted or pending

$625M
invested in R&D and
Engineering FY15

7,000+
ENGINEERS
globally

ENGINEERING CLOSE TO OUR CUSTOMERS

2015 THOMSON REUTERS
TOP100
GLOBAL INNOVATORS
5 YEARS IN A ROW

2015 BEST INNOVATION PRACTICES FROM A MULTINATIONAL COMPANY
Recognition from the
Shanghai Government

ROBUST PRODUCT DESIGNING FOR INTERNET OF THINGS (IoT)

Agenda

- Understanding the complexity of IoT in product development
- Networking Physical Objects
- An Example of IoT
- Organizing Windchill tools for IoT
- Lessons learned

Expectation/Takeaways

1. Better understanding of coordinated use of Windchill for IoT.
2. How to network physical objects and best utilize IoT resources.
3. The challenges of IoT management using Windchill.

UNDERSTANDING THE COMPLEXITY OF IoT IN PRODUCT DEVELOPMENT

IoT HISTORY

- The notion of IoT started in 2009, at which the number of devices connected to the internet exceeded the population of world of 6.8 billion.
- CISCO Research Statistics:
  - In the year 2015, there will be approximately 25 billion connected devices
  - In the year 2020, an estimated 50 billion connected devices through cloud computing.
- Cyber physical systems:
  - Allow for incredible opportunities but also come with new risks

Cisco reaserch

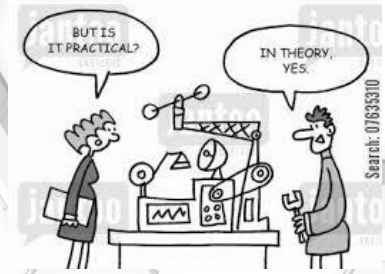
What is IoT ?

The **Internet of Things** (**IoT**) refers to the network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems.

- All around us we hear and discuss a lot of digital ideas, concepts and technologies such as:
  -- Computing information, Connected to the Network, Big Data and Analytics.
- And then we also are exposed to and may use some or possibly all of the following in our day to day life

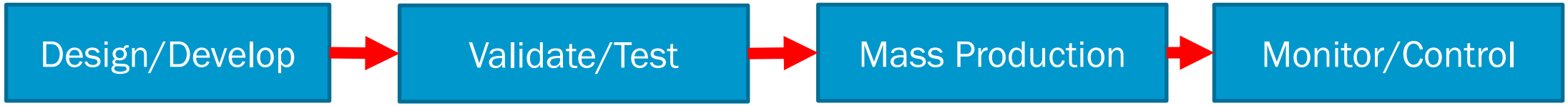
PTC	PDMLink	Creo (ProEngineer)
ThingWorx	Axeda	Coldlight (Neuron)
WorkGroup Manager	Part Classification	And more....

I am simple design engineer – how do I understand all this ?

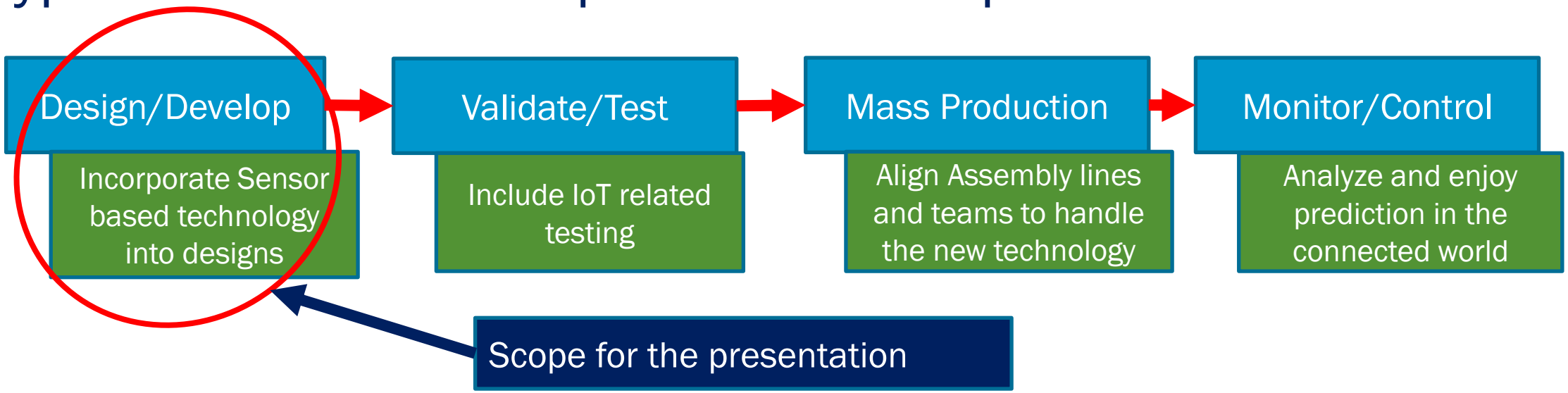


UNDERSTANDING THE COMPLEXITY OF IoT IN PRODUCT DEVELOPMENT

Typical Product Development



Typical Product Development with IoT process



Question: What are the advantages for a Design Engineer ?

UNDERSTANDING THE COMPLEXITY OF IoT IN PRODUCT DEVELOPMENT

Advantages for a Design Engineer

#1-Disadvantange. *Past testing Engineers loose visibility of how the product is performing ?*

Typical Product Development

Design/Develop → Validate/Test → Mass Production → Monitor/Control

#2-Disadvantage. Engineers don't hear until after the problem started

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Typical Product Development with IoT process

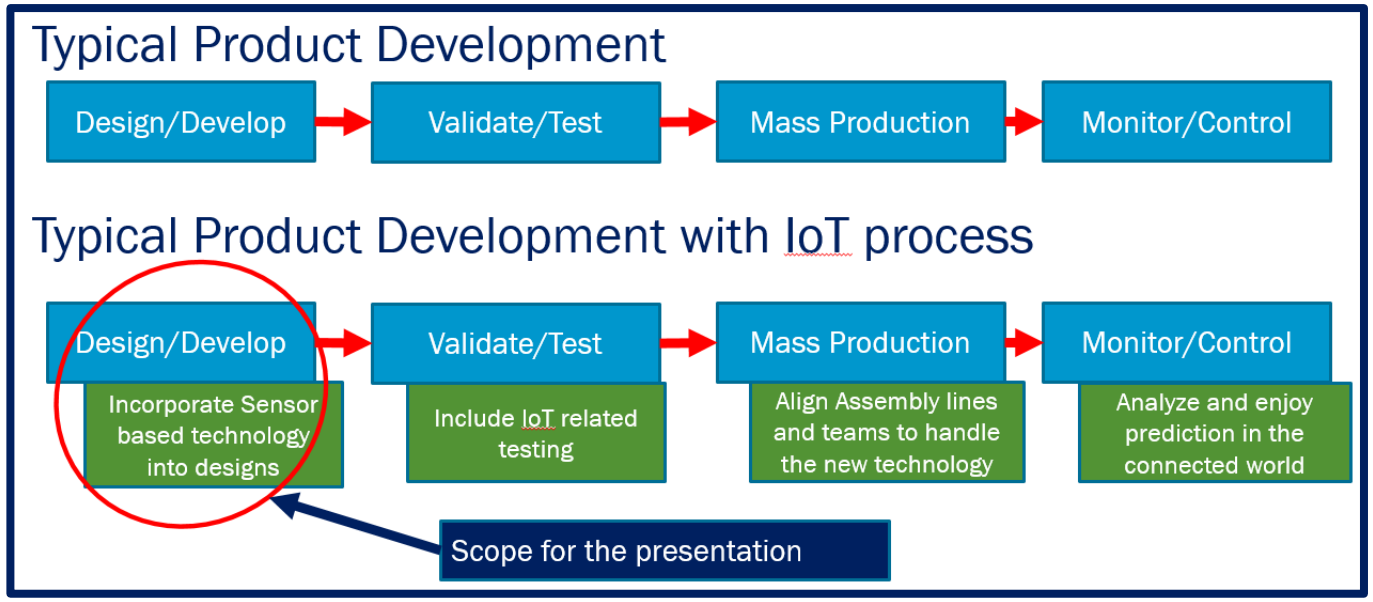
#2-Advantage. With IoT Engineers can write and implement requirements around data analytics.

Design/Develop	Validate/Test	Mass Production	Monitor/Control
Incorporate Sensor based technology into designs	Include IoT related testing	Align Assembly lines and teams to handle the new technology	Analyze and enjoy prediction in the connected world

#1-Advantage. *From testing, engineers now gain visibility into real time product performance with less assumptions.*

Question: What should a Design Engineer do next ?

UNDERSTANDING THE COMPLEXITY OF IoT IN PRODUCT DEVELOPMENT

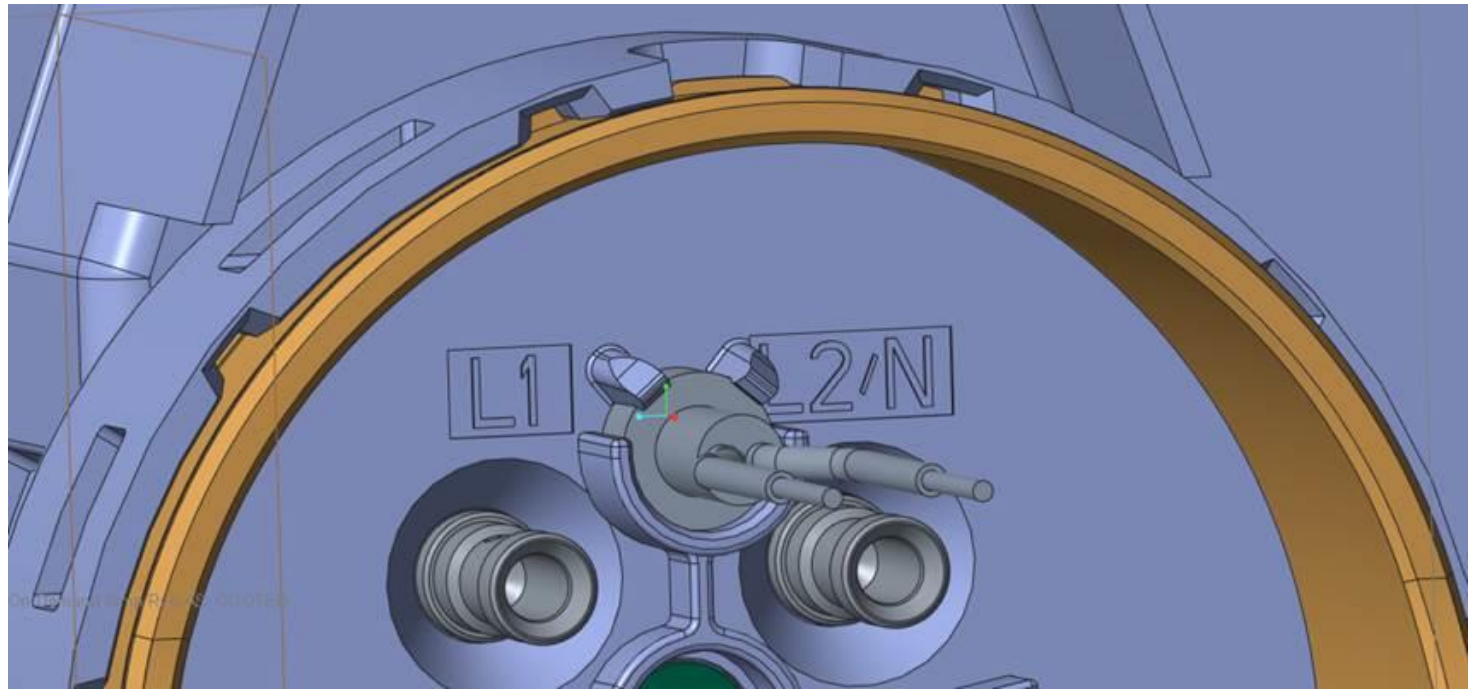


As an Engineer four key things ....

1. Increase Knowledge of Sensor Capability and Placement.
2. Think how the sensor-captured data can be used to check and improve the product design.
3. Find how your Product is used ? (Input controls thru smart devices ipad, iphones etc.,.)
4. Collaborative effort – Product is no longer standalone, it is a connected solution (Gathering Requirements)

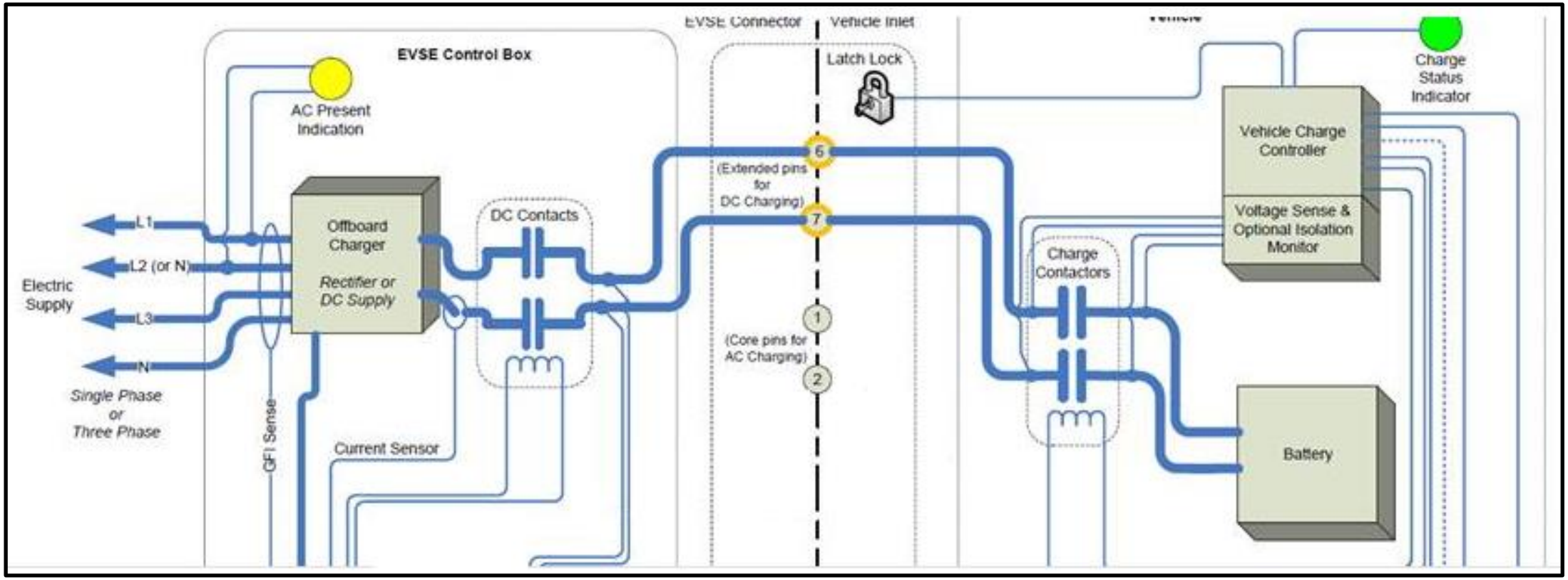
Question: Why these four things ?

WHY ENGINEERS SHOULD LEARN THOSE 4 KEY THINGS ?



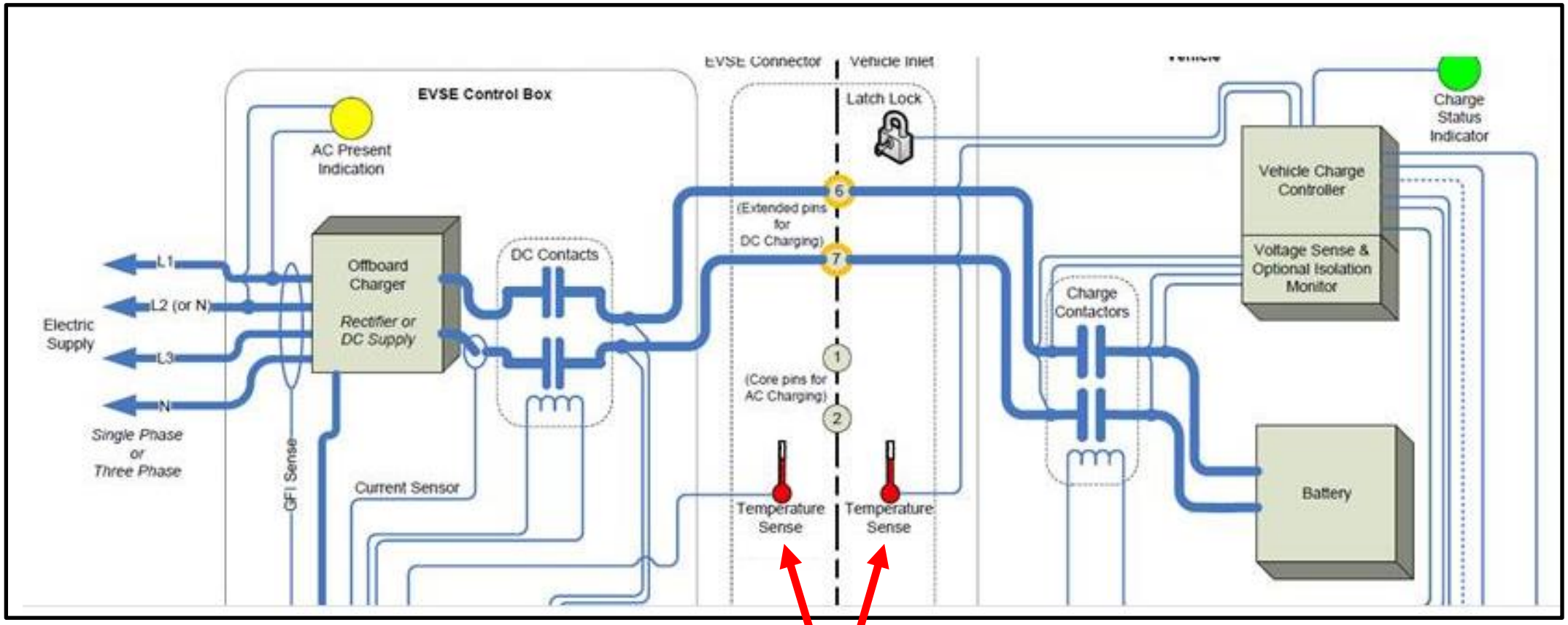
Networking Physical Objects

NETWORKING PHYSICAL OBJECTS -- NO SENSORS



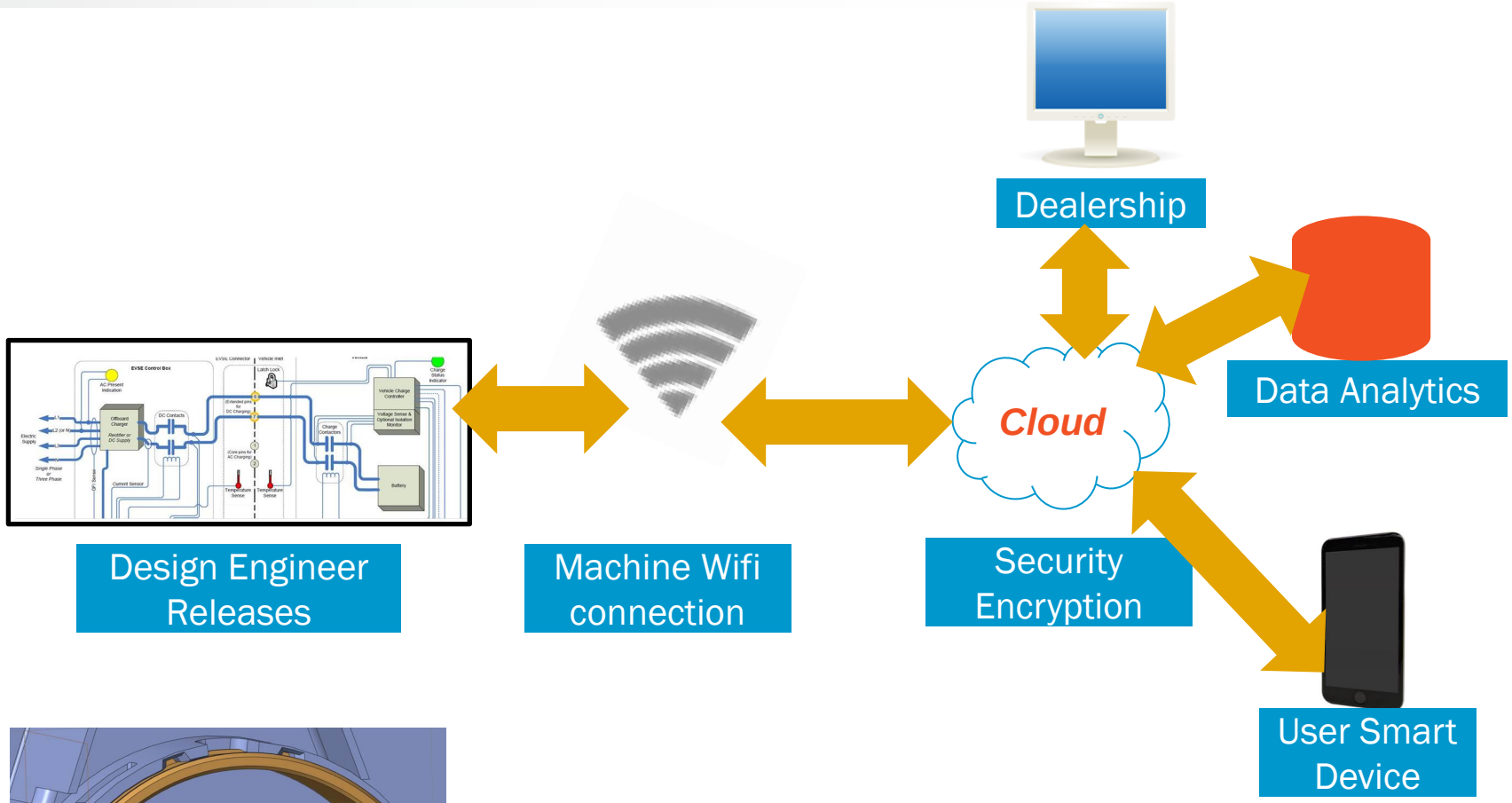
Electric Vehicle Service Equipment (EVSE) with no Sensor

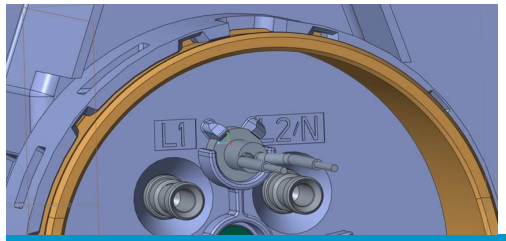
NETWORKING PHYSICAL OBJECTS - USING SENSORS



Electric Vehicle Service Equipment (EVSE) with Sensor

NETWORK PHYSICAL OBJECTS USING IoT





Electric Vehicle Service Equipment (EVSE) with Sensor

Why Engineers should learn these 4 key things ?

1. Increase Knowledge of Sensor Capability and Placement.
2. Think how the sensor-captured data can be used to check and improve the product design.
3. How your Product is used ? (Input controls thru smart devices ipad, iphones etc.,.)
4. Create a collaborative effort – Product is no longer standalone, it is a connected solution (Gathering Requirements)

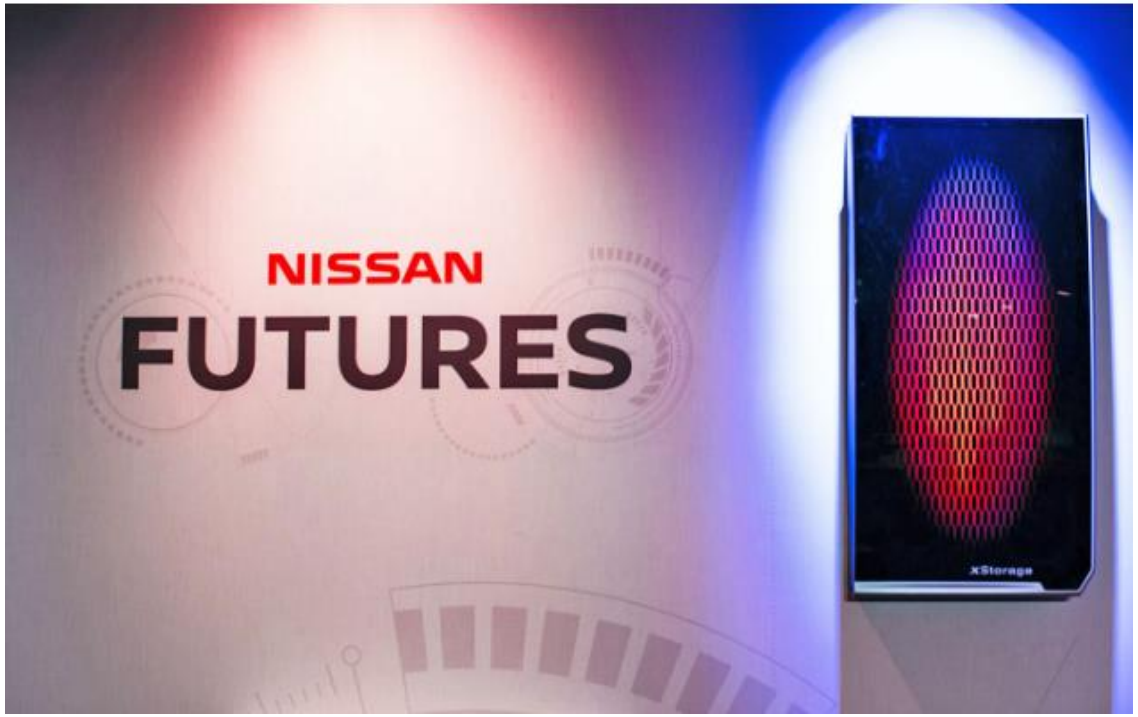
In the IoT world everything is connected, allowing accurate information to flow very fast, enabling engineers to respond to necessary changes at a faster pace.

HOW DO WE APPLY THIS TO REAL WORLD USE CASES?

EXAMPLE: ELECTRIC VEHICLE INTERFACE WITH GRID

ELECTRIC VEHICLE INTERFACE WITH GRID

Environmental effects of life cycle product usage – areas of non-control

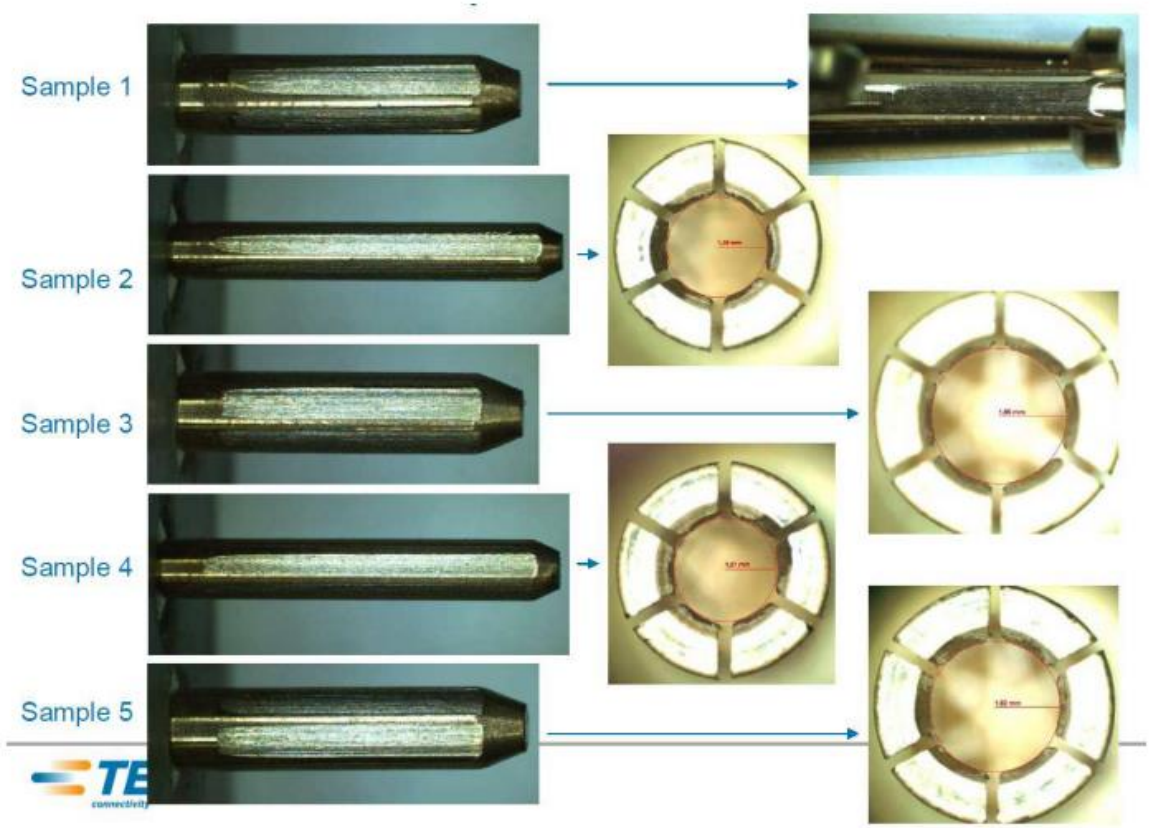


INTERNET OF YOUR ELECTRIC CAR

- As an example, it is normal for the electrical connections to realize some heating from charging and the contact interface conditions.
- An EVSE manufacturer would like to know REALTIME performance from it's various locations throughout the world. How are the heating profiles changing due to different environmental conditions. Automotive companies might also like to know what specific regions have greater or lesser charging issues. Or maybe a particular vehicle shows heating starting to exceed the recommended/approve level.
- Example: Arizona Vs Alaska (hot vs cold) Florida Vs Utah (salt vs dry) Oregon vs New Mexico (wet/humid vs dry/arid)

USING IoT THE USE OF THERMAL SENSORS TO MONITOR CONTINUOUS USAGE PATTERNS

Wearing after 10.000 test without dust contamination



THIS DOES NOT HAVE TO HAPPEN: IoT CAN HELP MAKE SAFER PRODUCTS

After N.C. Fire, Duke Energy Advises Customers to Suspend Use of Electric Car Chargers

November 7, 2011

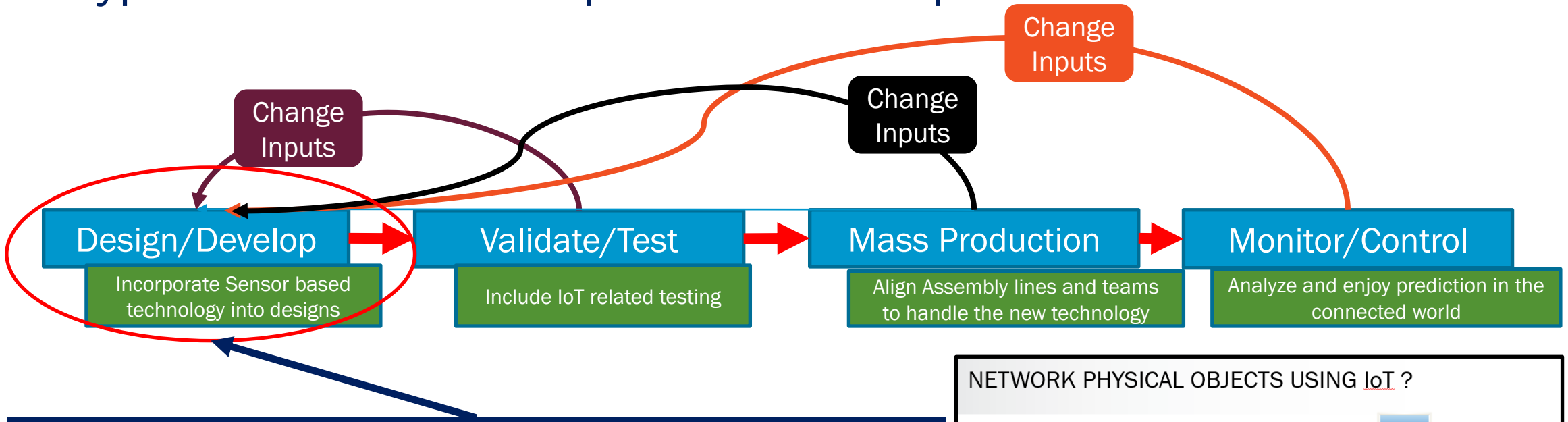
By EDWARD LOVETT via **NIGHTLINE**

CONSUMER SAFETY, CUSTOMER EXPERIENCE, CUSTOMER SERVICE

ORGANIZING WINDCHILL TOOLS FOR IoT

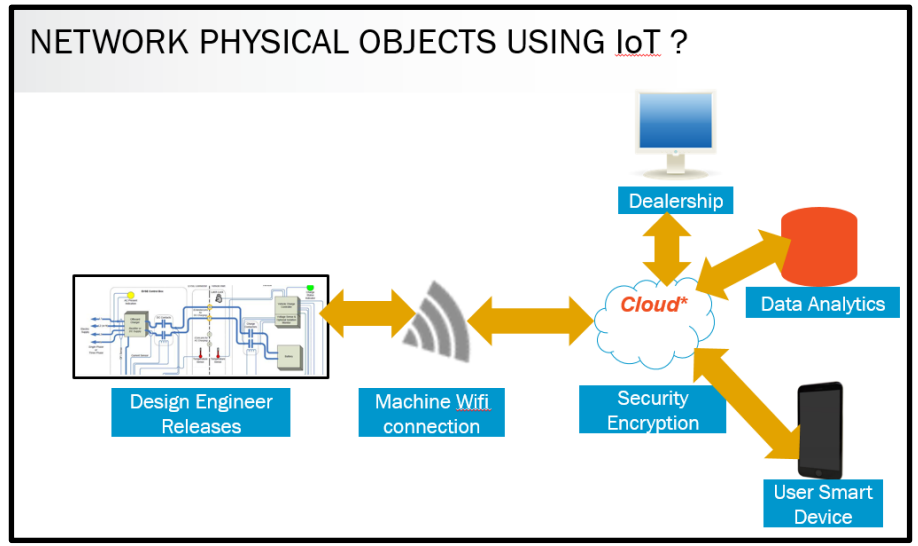
ORGANIZING WINDCHILL TOOLs for IoT

Typical Product Development with IoT process



In the connected world, **Change Inputs** come very fast as everything is connected. To accelerate Robust Product Designing with respect to IoT,

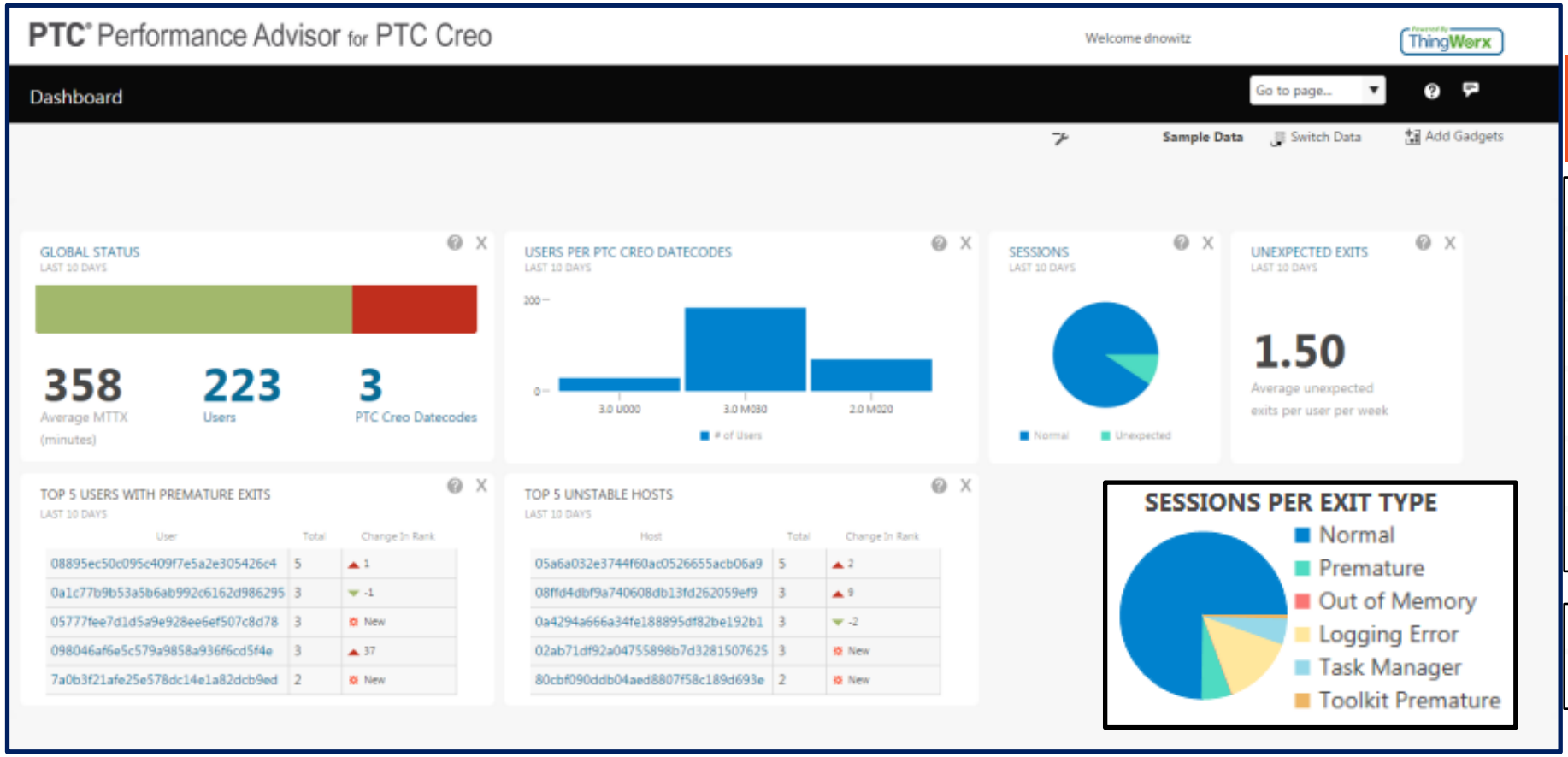
- As an IT professional organizing Windchill Tools.
- As a Designer/Engineer learn and incorporate new Tools.



PERFORMANCE ADVISOR IS A THINGWORX POWERED DASHBOARD

- **Performance Advisor for PTC Creo** helps to increase
  - Product development operational productivity,
  - Lower product development costs,
  - Lower the cost of IT by proactively detecting performance issues (hardware/software).

As an IT Professional - Organizing Windchill Tools for IoT



As a result Standardize

- Manufacturer
- Platform Type
- Machine Model
- Number of Cores
- RAM (in MB)
- Graphics Card

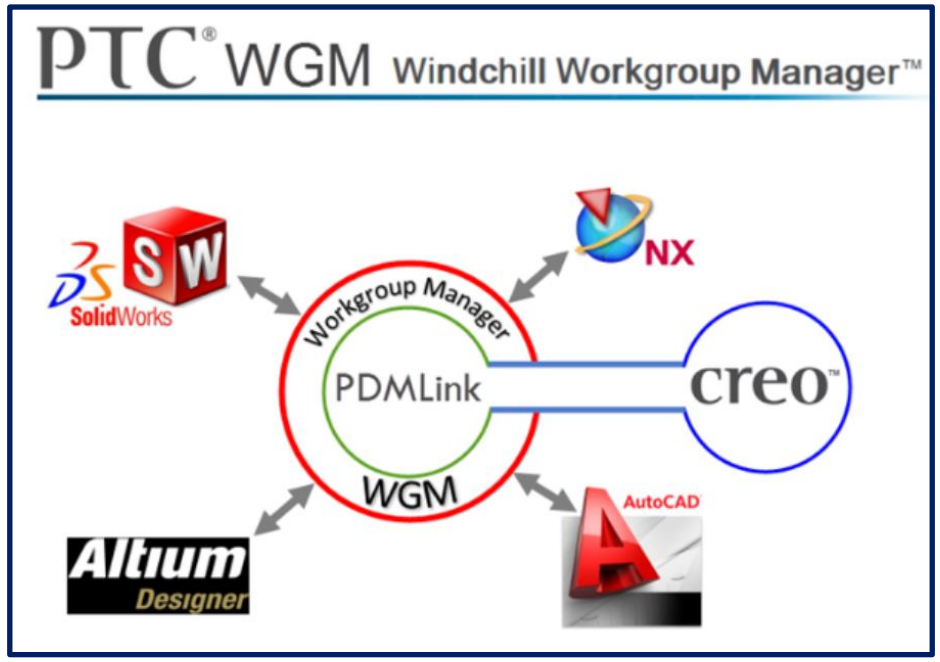
- Operating System
- JAVA Version

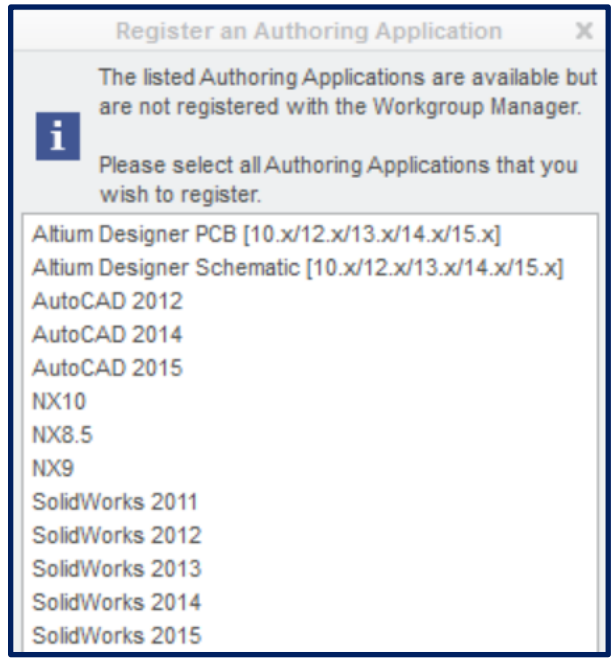
WINDCHILL WORKGROUP MANAGER

As an IT Professional - Organizing Windchill Tools for IoT

A common data link between multiple CAD applications and a Windchill server

- Promotes common practices with different cad users.
- Lowers Training costs.
- Instead of multiple systems now engineer has a place holder to place Mechanical, Electrical and Software Components all in one place.
- Motivates designer to think and build their systems engineering expertise.





Organizing Windchill Tools for IoT

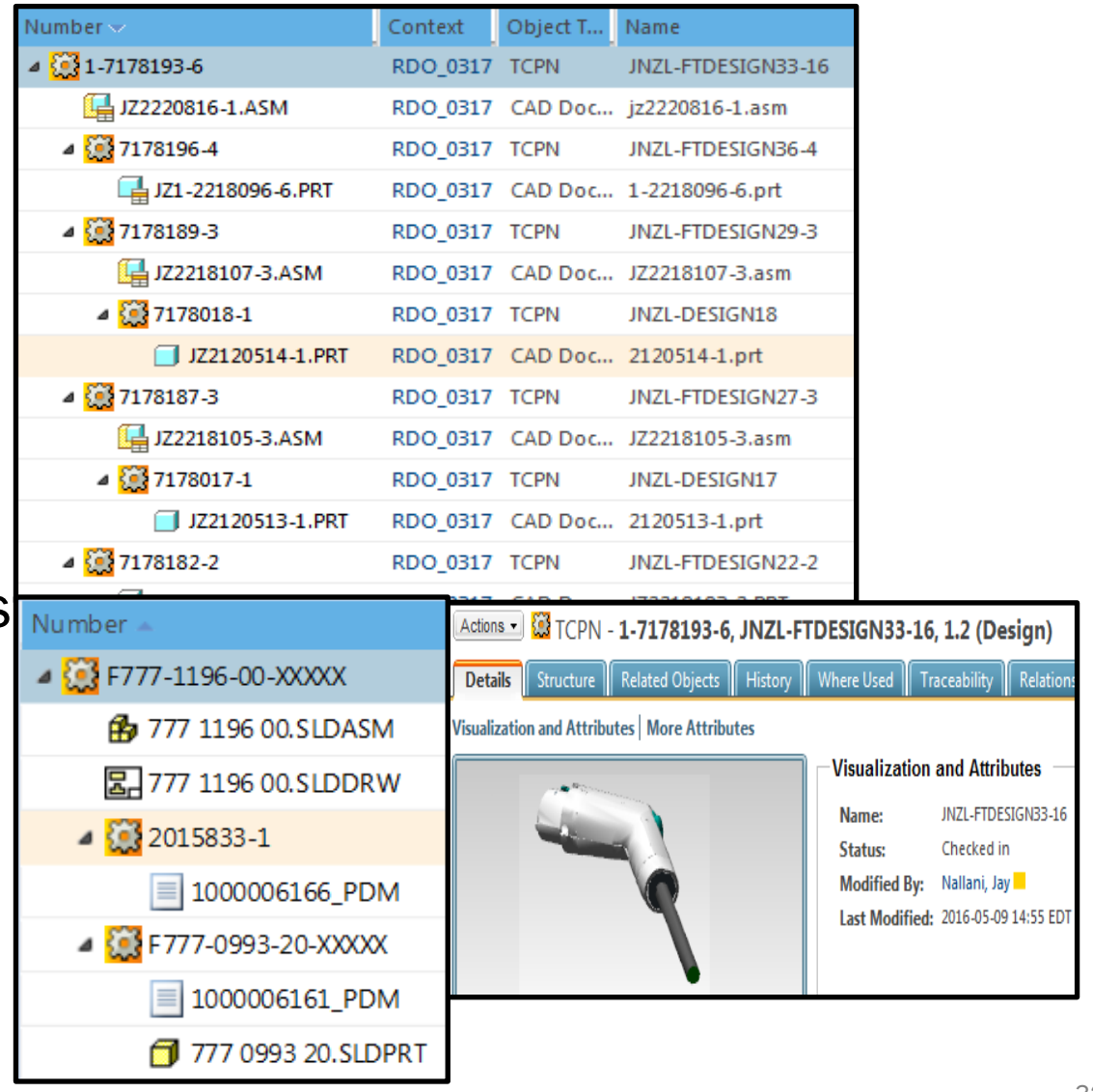
As a Designer/Engineer – Learn and Incorporate new Tools

- Grow the data digitally
  - Using WTParts
  - Using Product Structure/Bill Of Materials
  - Gathering Part Attributes
  - Alternate/Substitute Parts
  - Part Classification
  - Part and Document Relationships
  - Desktop Integration

- Re-Access required parameters/attributes to be captured in your CAD, Document & WTPart objects.

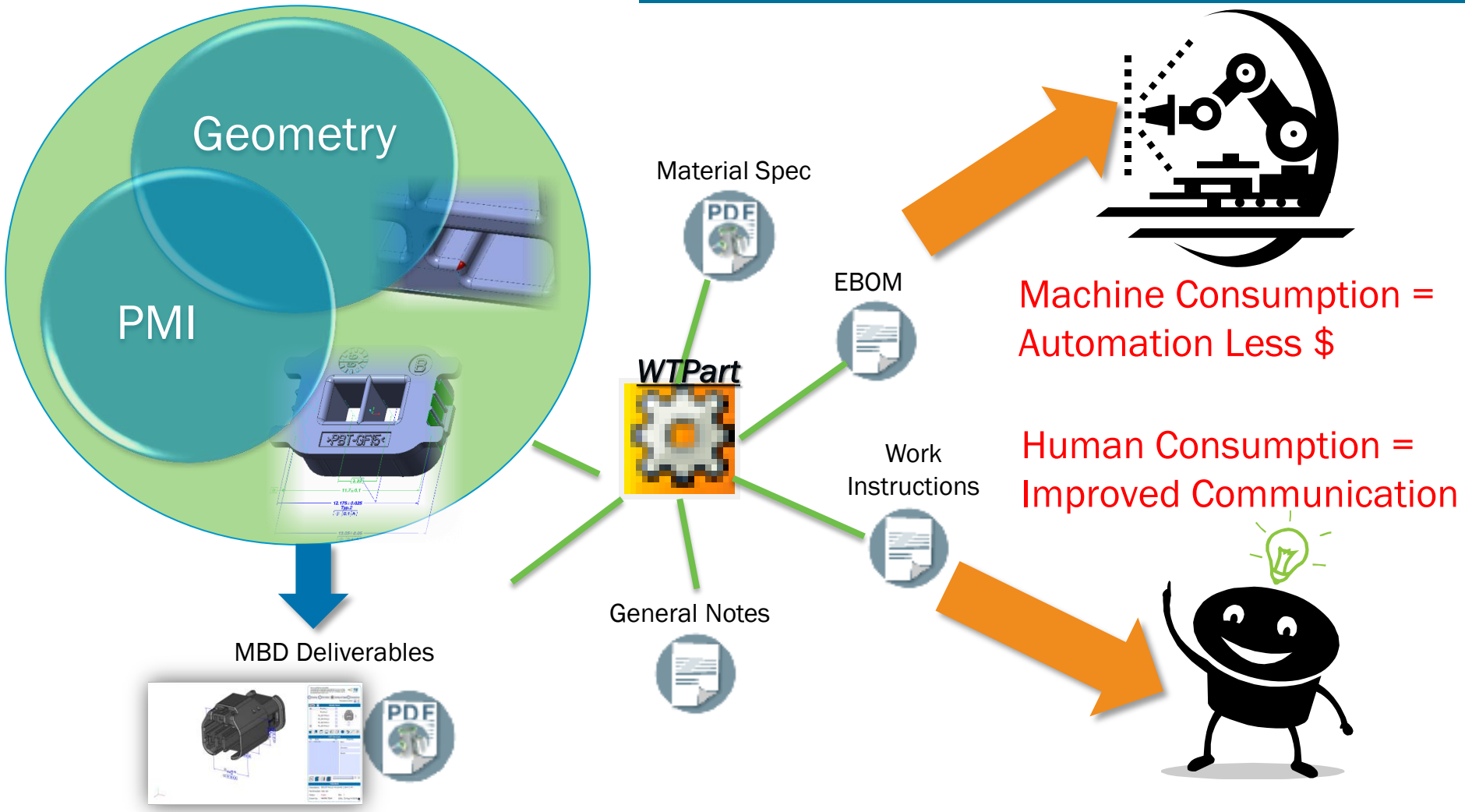
- Bingo searches

- Change Management



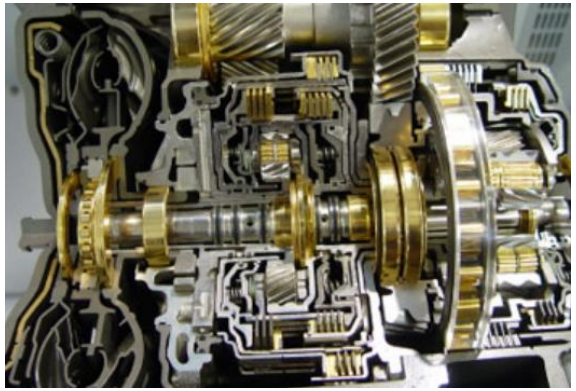
MODEL-BASED ENTERPRISE - ENABLING DIGITAL ENGINEERING AND MANUFACTURING

As a Designer/Engineer – Learn and Incorporate new Tools



THE CHALLENGES OF IoT

A CHALLENGE - IMPROVING THE DESIGNER SKILLS



There is lot going on inside, Where is the problem ?
What to measure ?

What to measure ?

1. Pressure
2. Temperature
3. Position
4. Vibration
5. Humidity
6. Fluid Property
7. Magnetic Field

What type of features ?

- Non-contact measurement
- Rotational speed
- Magnetic surface
- Coating (Epoxy, Glass)
- Mechanical Overload protection
- Sealed or unsealed env
- Oil and moisture resistance
- Size
- Energy Consumption

As a Designer or Engineer improve your knowledge and skills around Sensor Based Technology, Smart Sensors, data analytics.,. So you can help your company gather Requirements.
Reference TE Connectivity Sensor Site (http://www.te.com/usa-en/products/sensors.html)

THE CHALLENGES OF IoT – TE Connectivity

- Plastic and Metal connectors, once molded, will not see the original shape again
- Types of Products in TE are completely different than regular industry.

- Updating the software in Production Line
- Traditional manufacturing company, so how to handle an IoT Product Line.

THE CHALLENGES OF IoT MANAGEMENT IN WINDCHILL

- Availability of Sensor Compatible CAD model ready for a designer or engineer to incorporate in their assembly.
- Synchronizing the upgrade cycles of various software/hardware involved
- Building a suite of automated testing scripts
- Keeping up with user-experience

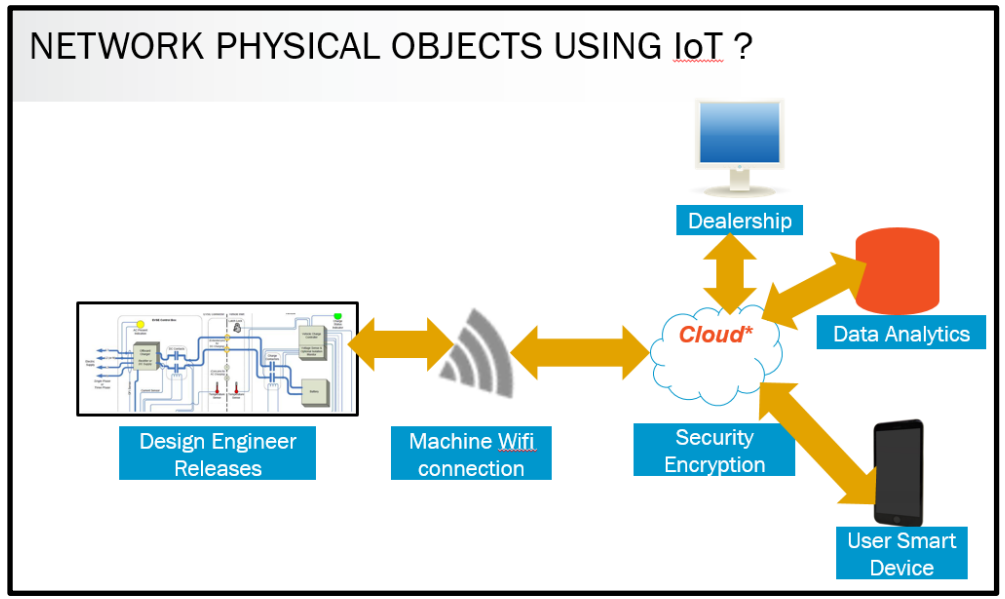
SUMMARY - ROBUST PRODUCT DESIGNING FOR IoT

IoT (connected) products are much more complex than non-connected products. They tend to have more inter-related components (hardware, software, firmware, connectivity, Cloud, application, data, approvals and certifications etc. etc.) and engineers needs to understand the relationships between those components and how changes in one can impact on others, what test cases need to be rerun etc.

Therefore, a more “connected” toolset is required to help manage and control the design and development processes.

From an engineer’s perspective, they will need to be cognisant of all of the inter-relationships. Due to the complex nature of the products, it is unlikely that a single engineer will have an overall understanding of the total product so they need a well structured and configured toolset like PTC tools.

SUMMARY - ROBUST PRODUCT DESIGNING FOR IoT



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TE
connectivity
LIVE
WORX16™
TAKE A FRESH LOOK AT THINGS
liveworx.com