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# The How's and Why's of **IoT Adoption**

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## INTRODUCTION

Internet of Things (IoT) is the buzzword of today. Experts, Analysts, Companies, and Industries are all talking about it. Lately, we are seeing a proliferation in similar terms with varying degrees of technological convergence; some examples are: Internet of Everything (IoE), Industrial Internet of things (IIoT), Internet of living things (IoL), Internet of Robotic things (IoR) or even **Intranet** Of Things (IoT).

This is one technology trend that has been mushrooming so rapidly that the numerical projections by the analysts and industry watchers have also undergone tremendous change in just a short span of 24 months. Moreover, the actual numbers have completely surpassed all the projections that were made 5 years ago.

For example, last year, IHS forecasted that the IoT market will grow from an installed base of 15.4 billion devices in 2015 to 30.7 billion devices in 2020 and 75.4 billion in 2025.

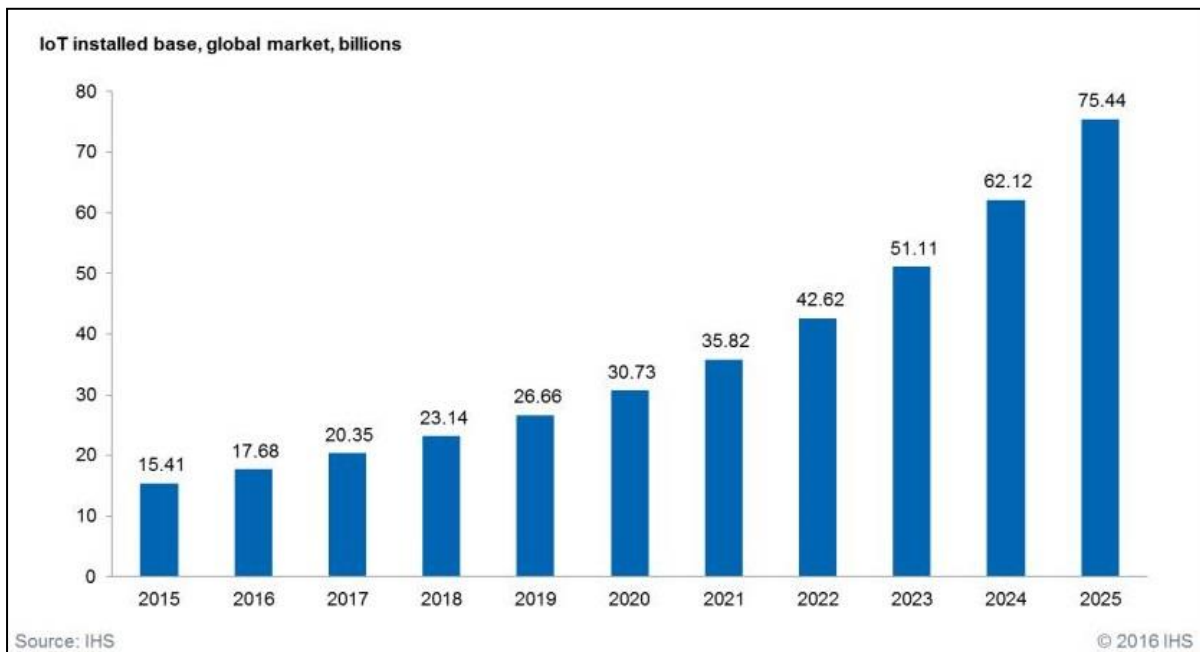


Image courtesy: IHS

With such promising stats, businesses today wonder: How can I keep up with the rapidly evolving, IoT-driven digital landscape? How can my business leverage the benefits that IoT provides? Can I IoTize my existing systems? How would I know if my business is IoT-compliant? What all steps must I take to ensure the IoT adoption is successful and that my legacy systems are not compromised?

This whitepaper tries to answer these questions for you and sheds light on the "why" and "how" of IoT adoption for your business.

## SO, WHAT IS IOT?

The vision of IoT is to bridge the gap between the physical and digital world by bringing the concepts and technical components together. It aims to create a seamless network of billions of connected, identifiable objects in the physical world that communicate with each other, as well as other elements in the digital ecosystem.

As the cost of sensors become cheaper, networks are becoming larger, generating petabytes of data. Even though only a small fraction of that data is being put to use, it is revolutionizing the way we communicate with our ecosystem.

Imagine what a connected world would look like: the alarm that wakes you up in the morning; while you are still getting up, it sends a signal to the Geyser to prepare the water for bath. The Geyser in turn instructs the coffee machine to prepare a hot coffee and tunes your TV or Radio to show the latest news or weather report; your personal assistant then gives you updates on the plans for the day. So before you know it, you are all set for the day; all you need to do is have coffee and leave!

The promise of IoT is a comprehensive and highly automated system to fulfill your everyday need. Sounds magical, isn't it? That's what IoT has in store for us in the not so distant future.

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## THE CHANGING FACE OF INDUSTRIES (OR BUSINESSES) IN THIS NEW AGE

IoT is also changing the way we do business; connected devices and systems have given companies unmatched insights into not only their own products and services but also into customer behavior and expectations. One of the major shifts that IoT has enabled is the "**As a Service**" industry, where focus has shifted from selling products to selling "Products As a Service" and from selling mere services to selling personalized, contextual, "Productized Services".

Leaders and innovators, who have successfully adopted these emerging technology trends and created new and innovative services, are now changing the entire face of businesses and rendering many product services and companies obsolete. We have seen well-established, venerable companies go out of business, predators becoming prey, and those failing to move ahead with time, being left far behind by "new kids on the block". In a sense, industries/businesses are being forced to "shape up or ship out."

## MARKET TRENDS

You might wonder; what led to the rise of this industry-wide revolution? Some of the factors that have been conducive to the growth of IoT are:

- **Miniaturization:** Rapidly evolving technologies has made it possible to bundle huge computing powers and connectivity options in tiny packages.
- **Easy access to technology:** There’s easy access to a wide variety of sensors, mobile computing, and visualization in the market.
- **Drop in hardware costs:** Storage and memory hardware has become much cheaper that what it used to be.
- **Connectivity options:** The market is flooded with a plethora of connectivity options; ranging from Ethernet to satellites and from low-power wide area networks (WANs) to light-enabled wireless transmission devices (LiFi).

With so many factors around to support growth, IoT thrives today. It is quite imperative that many other technology areas will also get affected by it. Here are some of the technologies trends that are going to have a major positive impact:

- **Big Data Analytics:** Big Data and IoT is a match made in heaven. Big Data existed even before IoT came into picture to perform analytics. A piece of information/data can be termed as Big Data when it demonstrates the 4 Vs: volume, variety, velocity, and veracity. As millions of devices get connected, Internet of Things will trigger a massive inflow of Big Data.
- **Artificial Intelligence:** Artificial Intelligence is a way of making a computer, a computer-controlled robot, or software think intelligently; in the same way as humans do. For e.g., the Google AI, AlphaGo, beat legendry Chinese player in a board game called GO in 2016; it did it again in March, 2017.
- **Additive manufacturing in IoT:** 3D printing, also known as additive manufacturing (AM), refers to processes used to synthesize a 3-dimensional object from successive deposition of layers of material. Optomec Aerosol Jet technology is a high-volume printing solution for the production of 3D antennas and 3D sensors that are tightly integrated with an underlying product, ranging from Smartphones to Industrial Components.
- **Security in IoT:** Security and testing frameworks play an important role in the development of any IoT application. Each IoT device you use is connected to the Internet and has the potential to be accessed by hackers. Major IT companies have raised concerns regarding IoT security and hence have started boosting their Cyber security solutions for IoT framework. There are various risks and challenges involved in security as we head towards the being a connected world:
  - Data Encryption—use of SSL certification becomes a must
  - Data verification & authentication
  - Vulnerability to hackers

- Loosely-coded user interface
- Data generation in undesirable quantities
  
- **IT/OT Convergence:** Basically it's the integration of information technology (IT) systems used for data-centric computing and operational technology (OT) systems used to monitor events, processes, and devices. OT supports the manufacturing plant process comprising of sensors, devices, and software to monitor plant and equipment whereas IT combines necessary technologies for Information processing. One of the best possible use cases of IT/OT convergence is of capturing the data from a vehicle to monitor car performance, driving analysis, alerts for rash driving, Engine errors and so on.

Then there are the others such as Block chain, Light Fidelity (Li-Fi), LoRaWAN, Satellite Connectivity, and Nanoprinting technology that are likely to benefit.

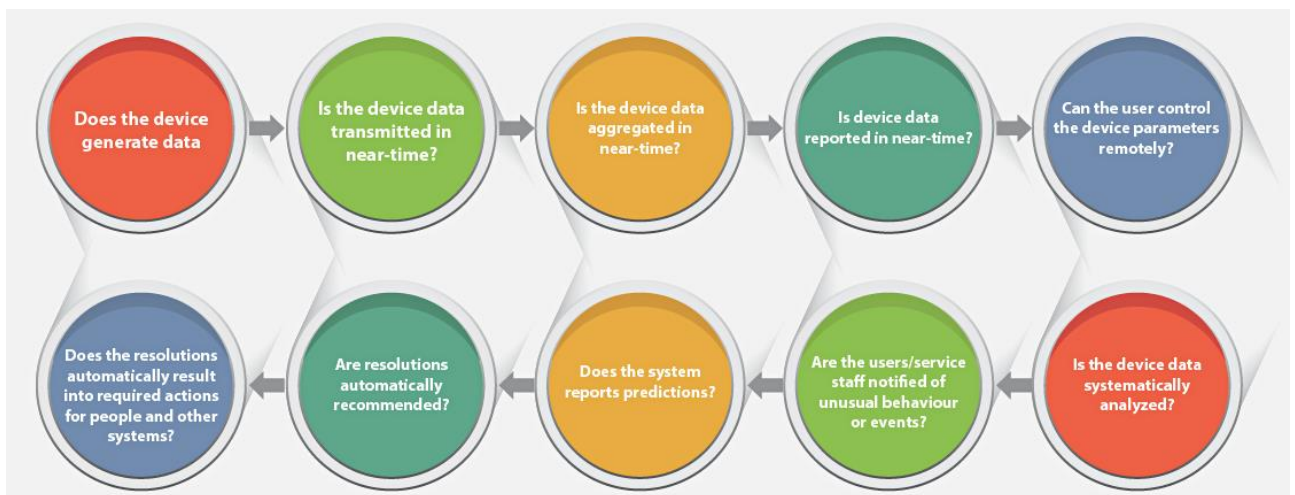
## TRANSFORMING THE EXISTING PORTFOLIO

It is always possible to recreate your applications from scratch and build a whole new ecosystem that is IoT-compatible; this approach is often referred to as the **Greenfield development approach**. However, greater opportunities and business potential lay in IoTizing (IoT-enabling) your *existing* portfolio. Organizations may consider optimizing their existing products or realize additional benefits or features for their R&D, consumers, or other stakeholders by IoT-enabling their existing products. This approach is called the **Brownfield development approach**.

Converting an existing product to a connected, intelligent product means identifying the gaps (how far is the product from "IoTization") and assessing/evaluating the right tools/technologies/platform to be IoTized. In addition, the business case, monetization plan, and cost benefit analysis and so on needs to be in place to motivate the efforts. So, if you are looking to adapt the Brownfield development approach, the we suggest you take the steps listed in the following sections

### Step 1: Maturity Assessment

The existing product can be very near, too far, or somewhere in the middle from being qualified as an IoT-enabled product. To assess the maturity levels of the product, one needs to answer the following questions based on what use case he/she needs to realize with the product:



It is important to look beyond the connected devices and protocols to drive business value from IoT investments. Success of an IoT initiative hinges upon capabilities in data acquisition, integration, analytics, and an in-depth expertise in enterprise business processes.



### Brownfield development challenges

Brownfield IoT development is moving at a much slower pace than it should because of some of the challenges on the way. This can effectively hold back the industry from leveraging its enormous possibilities and present potential challenges and difficulties for the IoT industry as a whole.

**Challenges**

1. The newer models needs to be drawn out from the legacy design as much as possible, in order to shorten development time and leverage investment already made in previous iterations. This restricts the choice of components and free hand
2. Inheriting hardware, embedded software and tools limit the flexibility of their design and development process
3. In case of Industrial IoT, we have to deal with existing infrastructure and machinery and need to design a new ecosystem to adapt those legacy systems
4. Moreover, most of the firms that own and manage this plant equipment have no prior knowledge and experience in development for connected environments, and that makes transition to IoT even more challenging
5. Many manufacturers do not prefer to IoTize their product/facility as it requires high maintenance; the costs involved are also high due to modification and customization of devices according to the old systems

### Step 2: Use Case Prioritization

To gain most out of the IoTization, it's important that the use cases are well prioritized and selected based on their alignment to the business case. All those use cases that are relevant to the business and are imperative to implement tops the list.

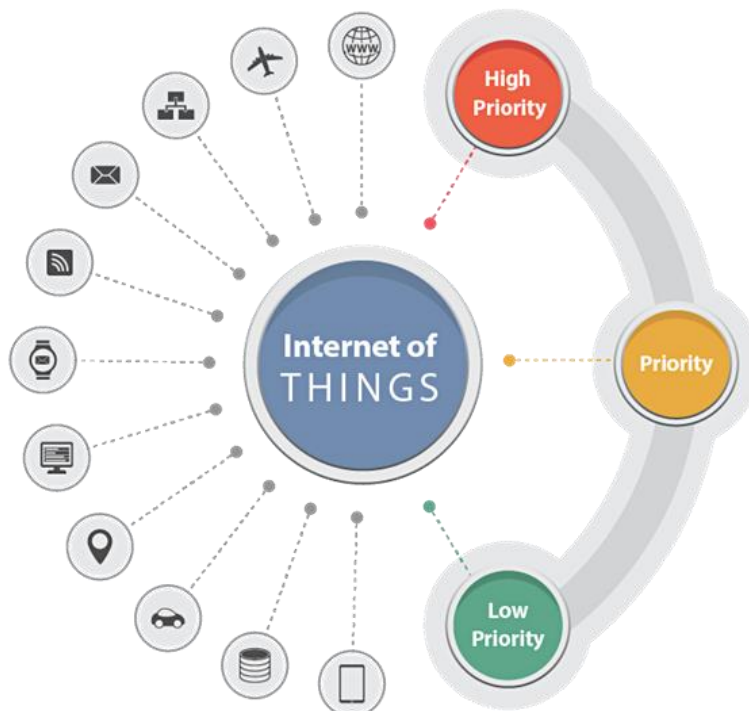


Figure 1

There are apprehensions about the return of investment (ROI) of IoTizing existing products. However, if there is clear value, people will be willing to pay a little extra for it. Moreover, in other use cases where no direct value to the consumer is derived, organizations are going to realize optimized operations and cost savings which is a great ROI in itself.

For the success of the Brownfield project, we will need to provide a simple, reliable, secure, scalable, and robust solution that doesn't intrude upon the existing design of the product. Rather it should augment the existing design.

### Step 3: Monetizing IoT

New products that have IoT features at its core, such as health bands, dash buttons, smart watches, and all those new innovative products, have a market of their own and manufacturers are quite certain about the business and ROI. However, companies are concerned about the ROI when the existing product is IoT-enabled or an IoTized model of the product is brought to the market. They are not sure how this will benefit them and their customers. They are riddled with questions like: Will it really help the R&D department of a medical device company to improve the device if they get usage parameters from thousands of users across the world back home? Will IoT-enabling the coffee maker, speaker, door bell, microwave oven and so on really bring value to the customer? Will it be sticky enough for the customer to use the feature beyond their initial inquisitiveness?

Monetization from IoT is available in four tiers:

- New Business Models
  - Variable pricing models
  - Acquisitions
  - New product development
- New Ecosystem Offerings
  - Offerings as a service
  - Selling data or insights
- External services delivery
  - Adding services to existing products
  - Reduced product failures
  - Improved health
  - Improved first-call resolution rate
- Internal operations improvement
  - Decrease energy costs
  - Decreased unplanned downtime
  - Improved productivity

In principal, monetary benefits of IoT is either

- Additional revenue through new products or services

OR

- Cost savings through efficient services and optimized operations

## SOME REAL-WORLD EXPERIENCES

Here are some real-world use cases of businesses that have benefitted from an IoT implementation.

### Service: Integrated Testing

#### Objectives: Test Automation Tool for MVAD Controller Software

##### Achievements:

- Automated the repetitive test cases **reducing the execution time** of the suite considerably
- Automated testing with devices and HMI **reducing manual intervention**

### Service: Cloud & Mobile

#### Objectives: Remote Monitoring of Air Compressor Data

##### Achievements:

- Provides functionalities such as: User management, alerts/Notifications, reporting, and analytics,
- Big Data is stored in a **NoSQL database on cloud** for Analytics
- IoT Platform uses this data on the server for populating the Mashups/Dashboards
- Availability: **99.99%**. Can communicate to **10,000 sites simultaneously**

### Service: Expertise - IoT System Architecture

#### Objectives: Remote Monitoring Solution on ThingWorx

##### Achievements:

- **1000's of devices monitored** in last 2 years
- **30% drop in issues** reported
- Increased Serviceability, **improved customer satisfaction**
- Provides inputs for continuous Product improvement

### Service: IoT-Hardware Design

#### Objectives: Continuous Glucose Monitoring System

##### Achievements:

- Small device footprint while ensuring **ease of use and competitive costs**.
- Sensor packaging design; manufacturing of sensor packaging
- **Design and prototype** of enclosure for charger
- Prototyped **functional sensor** inserter using 3D printing

Your business could benefit too. The next section shows you how you can do so with the help of a roadmap. The information would be really helpful should you decide to embark on this amazing transformation journey.

# DIGITAL TRANSFORMATION ROADMAP FOR LEGACY PRODUCTS LEADING TOWARDS INDUSTRY 4.0

P&ES helps their customers move from Monolithic device applications to cloud-based micro services. It also helps in the Product State Transition Roadmap:

## 1. Legacy As-Is State

Understand the current state of the Product which may be one of these:

- Monolithic
- Tightly Coupled Architecture
- Client Server Based

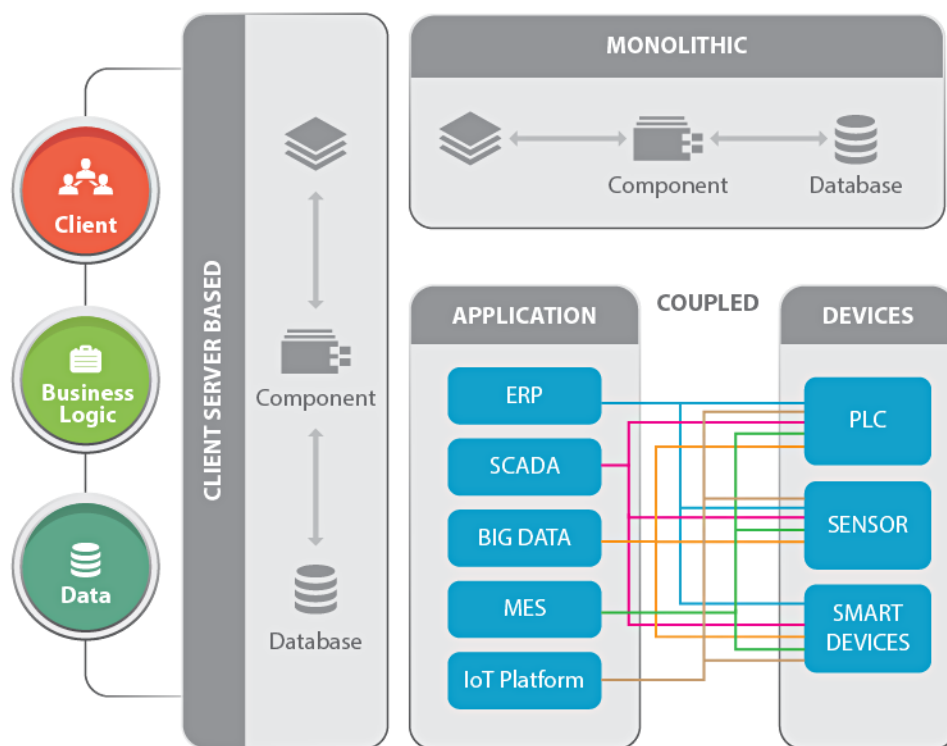


Figure 2

## 2. Modernization of Platform

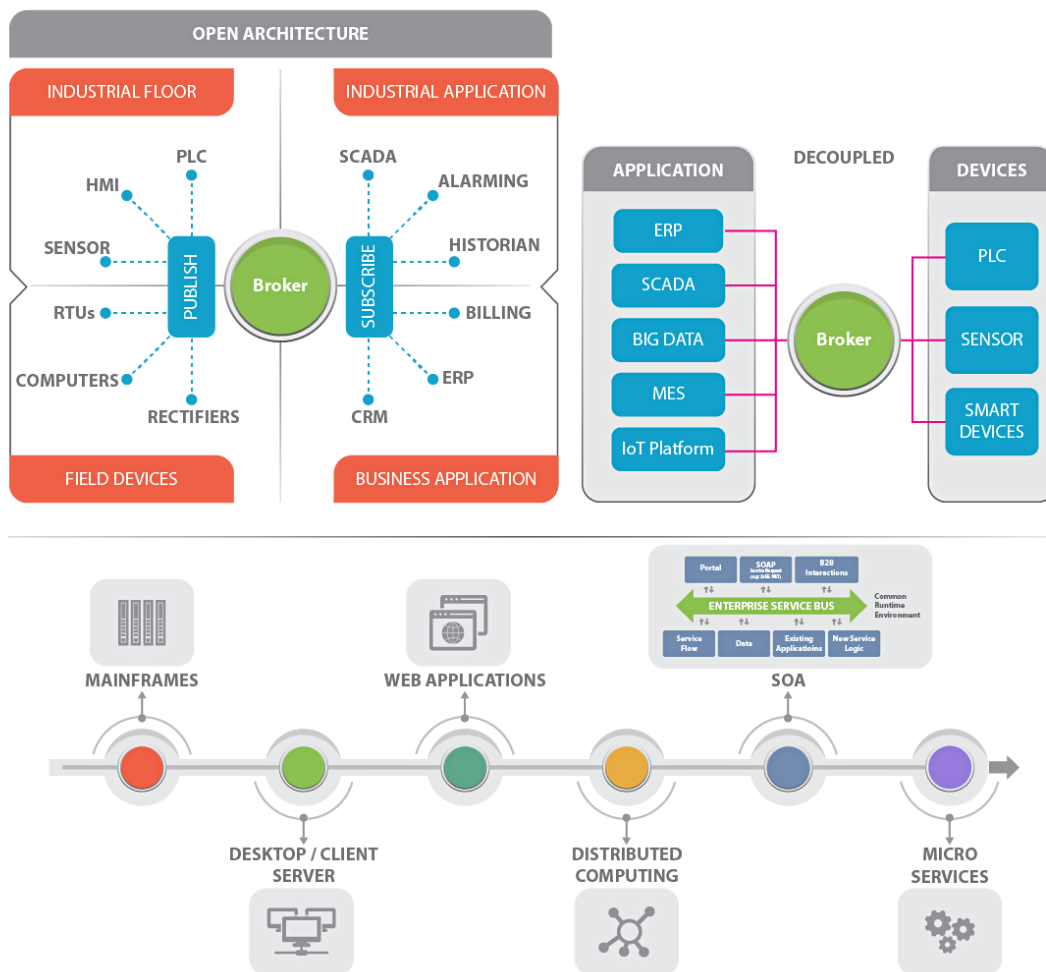
- Eliminate pain areas (Configuration, Security, Performance, and Availability)
- Integration and Convergence with other products
- UX (User experience) and UI
- Architecture harmonization (Modular arch., common objects & service models, interface standardization)
- Migration / Porting
- Expanding portfolio coverage (Tools covering additional product ranges and functions)

3. **Cloud:** Move towards NextGen development, deployment & distribution platform and look for new commercial models for the products. The following aspects are looked into:

- Service Management
- Application Operations
- Devops
- Containerization
- Orchestration
- Micro service based
- Security
- Usage and Accounting
- Monitoring

4. Goal is to transform the product towards the following:

- Intelligent Smart Device
- NextGen cloud based Products
- Continuous Machine Learning, Predictive Maintenance, Real-time Analytics,
- Value Focused
- ROI and More business
- Micro Service Based
- Decoupled and Open Architecture



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## KEY TAKEAWAYS AND NEXT STEPS

- Create a design workshop on for Potential customers and apply the design thinking methodology
- Identify relevant assets/frameworks/startups
- Incubate a joint team at these workshops
- Rapidly build PoCs to validate different technologies
- Test and Demo the solution

Capgemini P&ES creates and invests jointly with customers in an **Accelerated R&D Environment** for potential customers, which is an intense atmosphere designed to foster creative thinking with a cross-functional global team of experts to architect, design, develop and manage Digital Transformation for our customers. P&ES gives customers the fastest and seamless path to connecting the NextGen Digital Transformation.

## CUSTOMER-CENTRIC DELIVERY APPROACH

**Products & Engineering Services (P&ES)** has moved from being just customer-focused to ‘customer-obsessed’ by adopting Customer 4.0—a customer led revolution where it starts with your customer’s outcomes in mind. P&ES employs new ways of working and thinking, where every customer’s journey is considered as their unique journey. Adopting Design Thinking, Agile and quick outcomes and closely working with the customer and shaping their products is the prime Unique Selling Point (USP).

**Insights-driven:** Focused on an insights-driven business for customers, harnesses data and analytics everywhere to differentiate its products and customer experiences. P&ES uses metrics for every outcome and measures the process. Continuously challenges the process, gather more data and apply analytics to develop potential insights and try out experiment.

**Fast:** P&ES helps customer to move from perfect to fast as customers like seeing results in couple of days/weeks compared to couple of months or years. Focused on deploying solutions in quick time, automate, follow Devops methodology and leverage the Cloud Capability.

**Connected:** Helps customer to move from silos to being connected using the Technology. Helping customers move from linear value chains to dynamic value ecosystems. It also helps the customer build a threat model based on the customer journey maps and customer touchpoints and make the all things/devices in the customer ecosystem connected securely.

**Rich Domain and Resource Experience:** P&ES has rich domain & resource experience to offer end-to-end IoT solutions for major industry sectors apart from other Industrial areas. The sectors are illustrated below: