

Thought Paper

# TESTING IoT APPLICATIONS IN A HYPERCONNECTED WORLD



# Abstract

Internet of Things (IoT) is the latest technology that is being used across all the domains in-order to get smarter, accurate, easy to use, and cost-effective solutions.

Testing of IoT applications is very important before the launch to ensure accurate data is transferred safely and securely over public / private networks that is exposed to critical vulnerabilities, processing of received data is appropriate in different conditions that would in turn lead to right actions that are programmed to solve the purpose.

# Key Takeaways

The key areas covered in this thought paper are as follows

## 02

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Introduction to IoT technology

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Uses of IoT technology

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Types of testing in IoT applications

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Challenges in testing of IoT applications

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Unlocking the value of IoT in Testing



## Introduction

The Internet of Things (IoT) is broadly a network of objects like electronic gadgets in smart homes, vehicles, cameras, vending machines that have sensors and software embedded within them, to collect the information around them, transfer it through secure network for further processing and enable us to take appropriate actions.

Anything associated with the 'smart' keyword like smart phone, TV, home, and kitchen can be identified as using IoT technology embedded within them.

The architecture of IoT applications is quite complex that involves hardware devices embedded with software, network gateways, data encryption and decryption.

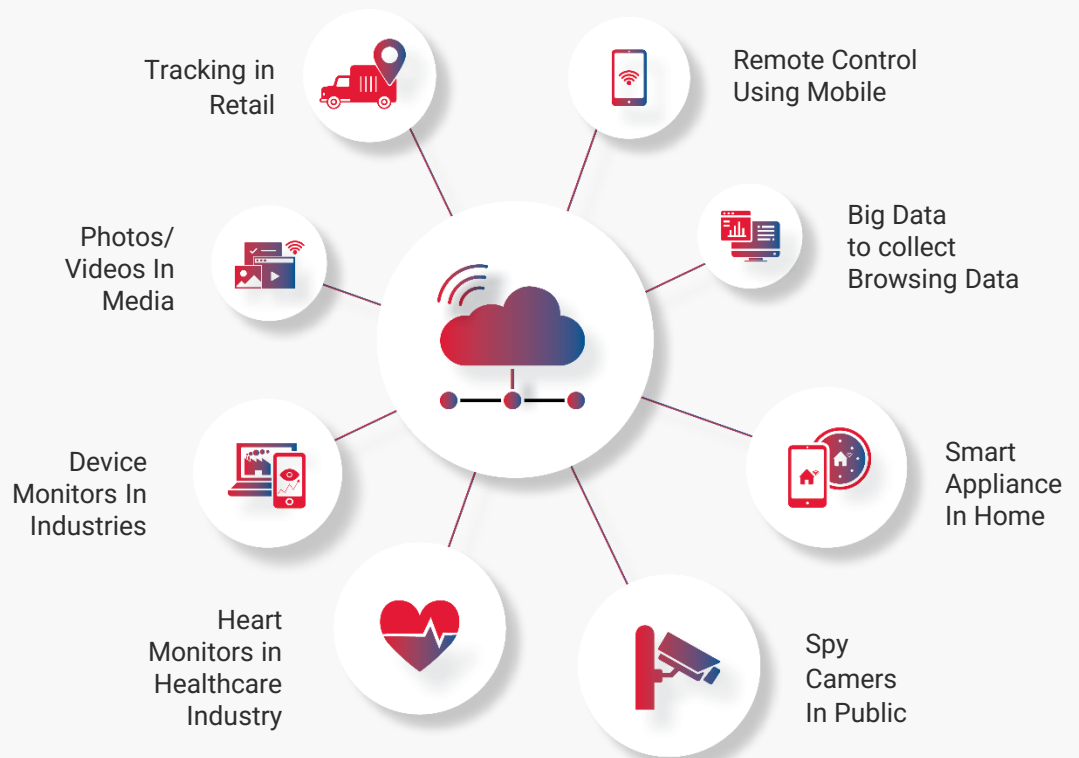


Fig.1



There are a few domains specific use-cases where IoT technology is used:



Use-Case 01

### **Retail / Supply Chain Management**

IoT technology is used to track the goods from source to delivery and monitoring availability of goods in specific locations of vending machines



Use-Case 02

### **Healthcare/ Life Sciences**

Monitoring and tracking of patient's condition, delivering medicines, advanced implants, and prosthetics



Use-Case 03

### **Energy (Oil and Gas):**

Monitoring of complex extraction and processing equipment like valves pipes, timely maintenance of equipment, collecting data across transport and business units for quick actions



Use-Case 04

### **Automotive Industry**

Self-driven/autonomous cars, traffic monitoring, safety driving solutions, and auto maintenance



Use-Case 05

### **Agriculture**

Progressive farmers use IoT technology to check soil acidity, humidity levels, light sensor, usage of irrigation system, pesticides, and sufficient nutrients



Use-Case 06

### **Telecom**

IoT is used in telecom industry for providing services for remote systems monitoring, Infrastructure on cloud platform, building virtual office space, asset management, and OTT services





The types of testing to be performed in IoT applications are:

### 01 Security Testing

IoT involves exchange of data in the network, it is very crucial to test if data is well encrypted, authenticated, and free from any vulnerabilities and threats. IoT automation testing tools can be used to perform the following security testing approaches:

- a. **Penetration Testing:** This is the methodology in which security professionals find and exploit security vulnerabilities in IoT devices. IoT penetration testing is used to check the security of your IoT devices in the real world.
- b. **Threat Modelling:** The process for determining the model with which the device can be breached.
- c. **Firmware Analysis:** Firmware analysis includes extracting and testing it for backdoors, buffer overflows, and other security issues.

### 02 Functional Testing

Validating the IoT system against functional requirements and specifications. This testing includes user interface testing, API testing, database, and client server communication. It can be done manually or using automation testing tools.

### 03 Communication Testing

Testing performed to validate the strength of communication between interconnected devices along with third party software like payment gateway, token validation, and end user validation. This also involves offline testing of the device.

### 04 Scalability Testing

Testing the quality and reliability of communication when number of devices are increased/decreased in the system.

### 05 Compatibility Testing

Testing the compatibility of IoT device with different hardware, network speeds, browser types, and operating systems.

### 06 Performance Testing

Testing the performance of the IOT device at optimal level of variable predictable conditions. Identify and fix glitches, if any. Performance testing tools can be used to test the same which will provide network virtualization that simulate the real environmental conditions.





## Challenges in IoT technologies foreseen

01

Due to complex architecture, testing in controlled environmental factors (Test lab with virtual environment created to isolate and simulate dependencies) might not be sufficient and complete

02

Data synchronization and integration across different devices located in different networks.

03

External dependencies like weather, time will have an impact on devices under test

04

Data security during transfer

05

Updates/patches applied to the devices

06

Downtime of devices

07

Network infrastructure should be same as real time.

## Unlocking the Value of IoT with Testing

IoT is one of the fastest growing technology across all the domains, therefore it is the need of the hour to define more stable testing process to enable deep dive testing, need advanced automation testing tools, appropriate environment setup and availability of resources with IoT testing skills-- this will help all our customers working in IoT market to succeed and avoid disastrous failure of products.

In conclusion, prepare for manual/automation testing according to the context of domain of AUT, devices in scope and the type of testing to be performed.



## Authors



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Naga Jyothi is an automation test architect with over 18 years of overall experience. She has extensively used different tools like Worksoft Certify, MF UFT, Selenium, Tosca, Squish, and many other tools. She has a rich experience in designing different automation frameworks taking into consideration of several factors that would lead to minimum maintenance and increase ROI in applications that cross cut across domains and technologies. She has experience in providing end to end project activities spanning across solutioning, estimation, planning, resourcing, delivering, root cause analysis, releasing, and maintenance. She has experience in working with different methodologies like Waterfall, Iterative and Agile.



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