

# Internet of Things Laying the Testing Road-map for Better Returns

Unlike standard testing, in IoT testing, it is not just enough to ensure the device works properly but is equally important to ensure the device performs the intended function on the IoT scheme of things. For smooth and seamless functioning of IoT devices, comprehensive and all-encompassing testing methods is indispensable.

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# ABOUT IoT

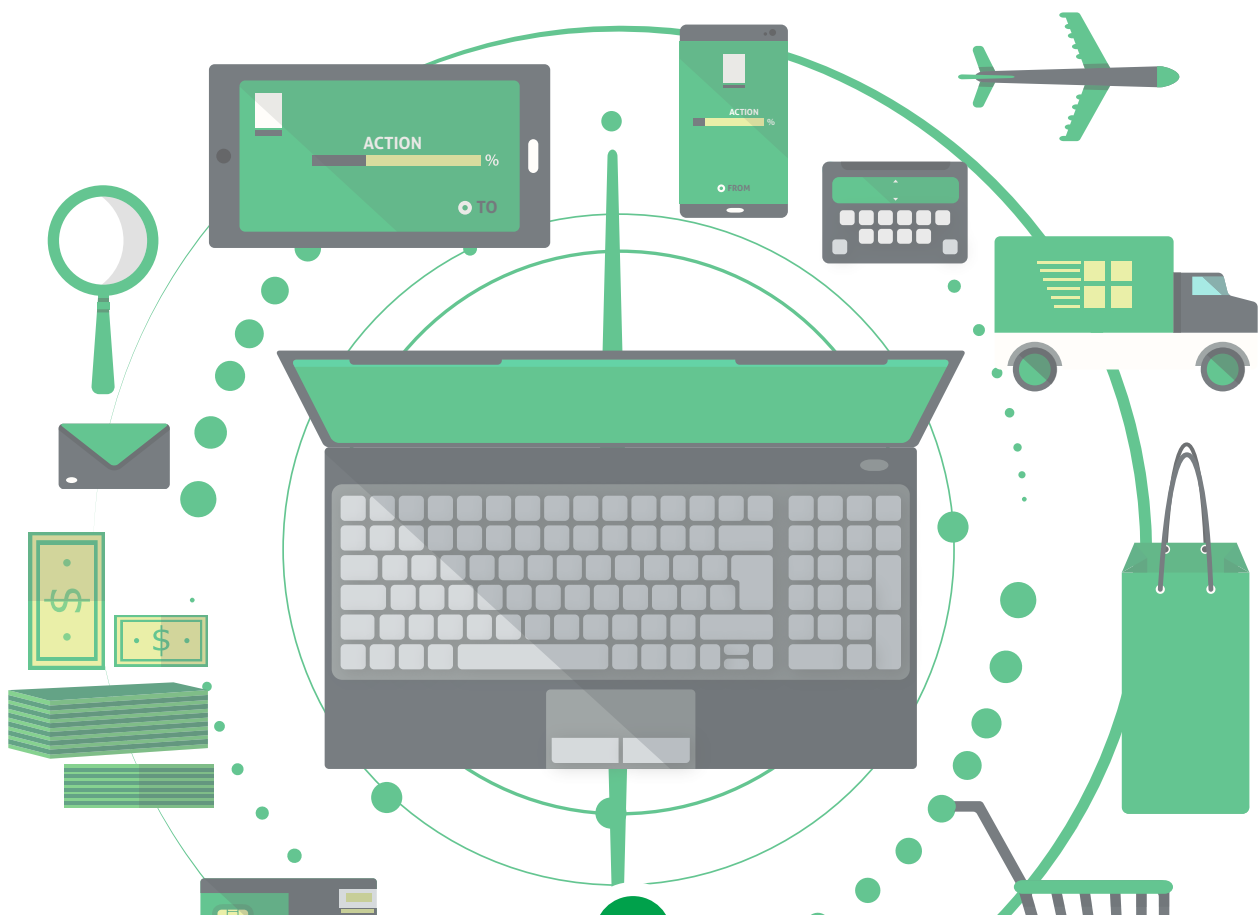
The Internet of Things (IoT) promises to revolutionize the way we live, work and have fun. Imagine a life when your refrigerator has the intelligence to auto-order groceries through the linked up smartphone before stocks run out or if the television auto records shows and transmits it to the smartphone for you to watch at leisure or if lights can switch on and off with motion sensor technology. Most of all, the potential for businesses to unlock new opportunities and improve customer satisfaction are endless.

IoT is a technology that converges micro-electromechanical systems (MEMS), wireless network and the internet, with devices connected to each other on a real time basis. Needless to say, it requires a great deal of synchronization and co-ordination to ensure everything works smoothly, without any hitches. Just as in a domino chain, one spindle anywhere in the chain can have a cascading effect, slightest of snag will throw the entire set-up into disarray, delivering opposite effect than intended.

For an IoT ecosystem of hyper-connected devices to flourish smoothly without any malfunction - use of high quality materials, a robust design, and above all, extensive testing is required.

A small change to any one cog in the labyrinth of devices, networks, protocols, back-ends, and machine to machine communication has the potential to impact not just the device, but all connected systems downstream.

For IoT to function, mobile apps and connectivity are necessary. Smartphones, tablets, sensors, wearables, smart televisions, gaming platforms, digital signage, customer experience kiosks, are all instruments of IoT. All these devices are required to have RFID, WiFi tags, mobile sensors such as barometer, proximity, gyroscope and so on to receive and transmit signals. To connect these devices WiFi, WiMax, Bluetooth, NFC, mobile network or any other medium is required.



# DIFFERENT TESTING APPROACHES

Testing for an IoT ecosystem is much more comprehensive and all-encompassing, compared to testing for stand-alone devices.

## Apps and Connectivity Testing

The basic requirement is to test whether all mobility enablers are functional and connect to the devices seamlessly.

The next test is to ensure continuous network connectivity of 3G, 4G, WiFi and other technologies, worldwide. There is a need to ensure uninterrupted, high-speed connectivity. In mobility, range is a major issue, making it necessary to test 3G and 4G devices under various signal strengths, including zero signal. The plethora of interconnected devices can cause various issues such as failing sensors, glitches in application accessibility, connectivity blocks and incorrect data pass. While much of the issues may be simple and can be counted as level-3 or level-4 issues on the technical defect log, the implication of such issues can have a profound impact on the way things operate, and by extension, can impact businesses, and day to day life in a big way. Consider the case of IoT sensors of a power plant generator that streams a live feed of information. Normally, these sensors may detect changes and relay it to the maintenance team, enabling prompt response to any issues. Any issues with connectivity may significantly delay or even block such notification, and may even feed incorrect data, leading to a critical situation in the city's power grid.

A key component of IoT are sensors, which transmit information from one instrument to another, apps or control centers. Much of the sensors in place are fragile, susceptible to wear and tear over time. Testers need to make sure the sensors are communicating as required, with each other and other devices. The performance of most sensors start to lag, with time, and a key part of testing is to ascertain sensor performance, and recommend replacement if required.

## Security Testing

Connectivity is the basic requirement for IoT, but brings with it new set of challenges, especially data privacy and security risk. Threats such as backdoor trojans, malware, viruses, DDoS attacks and more are ever present in an IoT ecosystem, resulting in disruption of the network and data theft.

To ward off such threats, continuous monitoring of devices and networks and real time evaluation of security configuration is required. IoT testers need to pay special attention to the security layers deployed to ensure the security apparatus is dynamic enough to respond to emergent challenges.

## Usability Testing

Unlike normal or standard testing, IoT testing requires defining and meeting the business requirements expected from the device. It is not enough to ensure the device works properly. It is equally important to ensure the device performs the intended function on the IoT scheme of things.

Wearable devices such as smart watches serve specific purpose, such as monitoring the calorie rate, heart rate, and so on. Such devices require a design-oriented testing approach, with diverse relevant test cases and scenarios. In addition to usability, sensory reactions including sight and sound needs to be tested and the test results need to be validated with user demographic information.

## Soak Testing

Most IoT devices are planned for continuous usage. This calls for new types of stress, load, spike and other performance tests. The testing needs to simulate usage scenarios, correlated to environment and climatic conditions.

Soak testing involves measuring the system's reaction parameters to examine if the system can withstand huge load for extended period of time.

## Third Party Integrations

Many IoT devices perform complex tasks and need to leverage third party APIs and services for it. Such third party integrations invariably bring with it a large number of bugs. Fixing such bugs require a thorough study and understanding of third party APIs, expanding the scope of IoT testing.

## Challenges

As IoT testing is much more complex compared to normal testing, the existing traditional testing paradigms, procedures and approaches are of limited use for the emerging IoT technologies and devices.

### *The following are the key challenges:*

- When it comes to testing IoT devices, no two devices warrant exactly the same testing procedure. The problem is compounded by the lack of any universal IoT testing practice yet. There is a pressing need for a personalized testing approach for each unique device, but this naturally increases time and cost and therefore not viable.
- Usability testing is a niche area and befits IoT but the constraint is to find someone with the required skill.  
The resultant compromises may be manageable to an extent in a stand-alone system, but its impact could be profound in an IoT ecosystem where the device is part of a larger ecosystem, and underperformance or non-performance drags down the entire ecosystem.
- Setting up a test environment itself is a key challenge, for devices are meant to work in different environments and under different conditions, such as extreme temperature, water, noise vibrations, and compromised visibility.
- The world of technology is extremely fluid, and fast-changing. Testers are always under pressure to deliver more in less time, owing to the relentless market driven pressures and the short shelf life of products. The challenge posed by changing market conditions manifests itself in the IoT space as well.

With more investments and test automations, one can overcome the key challenges.

Test automation makes it possible to perform extensive testing in a short time, facilitating fast-paced developments. Gartner estimates the number of connected devices to touch 21 billion by 2020, and the immense scale makes automation the no-brainer solution for running an extensive gamut of tests on a wide range of devices. Testers are warming up to the requirements as well. HP's 2015 survey found 51 percent of respondents leaning towards agile approach to testing, and 16 percent adhering to pure agile testing.

Overall, it makes sense to approach IoT not just as a huge set of devices and services that interact with one another, but also as a multi-layered network which require testing for components of each layer. Successful IoT testing requires proper oversight of each layer, with automated tests modeling and vetting a wide range of possible scenarios.

It is important to test IoT over the network, to ensure its success in the actual usage scenario. This requires setting up the entire test environment, comprising multiple networked computers, routers, smart devices, network emulation tools, and data links, over real mobile networks. It is worthwhile to leverage network simulators as a viable alternative. It is also pertinent to use real devices, to ensure accuracy of test results.

### ROI

Investing on IoT testing is essential to overcome challenges if any, and to ensure the initiative takes off well. The result will surely pay off.

IoT players who undertake comprehensive testing to overcome the challenges, stand to gain big. The most significant purpose of IoT is to improve user comfort. For instance, if the user has to log in and reboot his system to make sure his fridge reorders provisions when supply is about to run out, then the whole purpose of IoT is defeated.

Comprehensive testing is the sure-shot way to ensure smooth and seamless functioning of IoT devices.

# About Suyati

Suyati provides marketing technology and integration services for companies that wish to combine the best of breed solutions and create a unified approach to customer acquisition. This unified digital marketing approach requires system integration between various CMS and CRM platforms, and a slew of eCommerce, Marketing Automation, Social Media Listening, email and social marketing, and customer service systems. Our specialized knowledge in Salesforce, open source and .Net based systems enables us to build effective custom integrated solutions for our clients.

Suyati's custom technology solutions have been deployed in companies in the US, Western Europe and Australia, and have helped many enterprises leverage the web/cloud/mobile technologies to acquire customers through integrated digital marketing. Suyati is based in Chicago with product engineering capability out of the US and India.



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