

Towards the Definition of IOT using Agile

Dr. Shaveta Bhatia,
Associate Professor and Head of Department, Computer Applications,
Manav Rachna International Institute of Research and Studies

Alweena Iqbal, Jyoti Yadav, Vishakha Soni
Students, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies

Abstract

The Internet of Things is one of the biggest emerging technologies. This technology is now contributing in almost all the sectors including healthcare, home appliances, agriculture and transportation. In near future contribution and impact of IOT devices and products will be in almost every field. The industry is looking forward to lead off the potential of IOT. Although it is an emerging technology and is ready to contribute in almost every sector in near future, but it is still a concern how industry will deliver efficient services of IOT in big projects. At the same time agile methodology is also being adopted by software development industry. We can see Agile as an idealistic method that can provide better and improved quality of services. This paper briefs the concept of IOT, its application and services, Why we should use agile method in IOT projects. We have focused on scrum process of agile methodology and how scrum process of agile methodology and IOT can contribute to provide the better quality of services. Also this paper compares the Existing IOT model and Agile IOT model and the future scope of IOT using agile methodology.

1. Introduction

IOT is the next biggest revolution unreeling in the IT world. It is contributing in all sectors. These sectors include our Everyday life, transportation, healthcare, industry and agriculture. It is a revolutionary technology. Although IOT is making enormous progress in every sector, but versed delivery of services still stand up to an anxiety.

IOT is an emerging field. It is one of the greatest phenomena of this century gained a lot of popularity. To catch on the full excursion of IOT, modeling agility in IOT is important to provide better and improved delivery of services. Also Agile is very important to improve the quality of services. Modeling Agility Architecture in IOT is also very important and it is playing very important role making IOT more agile and flexible [1]. In IOT First of all, data is collected, senses, analyzes and then information is represented.

IOT is evidently the most trending technology, which is the intercommunion of smart devices. In this chapter we are focusing, how IOT is adopting agility to mend the quality and delivery of services to the business and technology and how Scrum framework of Agile Methodology is used to architect IOT devices or Application.

2. Internet of Things

Internet of Things is Buzzword today. Internet of Things has two keywords, “Internet” & “Things”. Internet as we all know is intercommunion of millions of computer systems to serve billions of users worldwide. It is a network of networks that connects millions of private and public networks. Similarly we can say that IOT is the intercommunion of things. It is a system of interrelated computing devices, digital machines, and things. And the thing could be any object, machines, appliances, animals, people, buildings, vehicles, plants and soils. These objects or things are embedded with software or electronics. So IOT is mainly a platform where we can connect everyday things which are embedded with either electronics software or sensors to the internet, and this in turn enables us to collect as well as commute between these things [2]. Now when we say things it can be anything and everything. Let’s say you have an internet platform where you can connect these things. If you take the example of a house which is connected to internet, you can connect to your lock, you can connect to your AC, and you can connect to light and all these can be managed on the same platform. Since you have a platform so you can also connect your car to this and keep a track of fuel meter, you can keep a track of your speed limit and you can also keep a track of location of the car as well [3].

Let’s take a real-world example to understand the implication of IOT in our everyday life. Let’s say tomorrow I come back home, it would be great if I wouldn’t even need a key to unlock my door, my home system should be aware that I have come home and it should unlock the door. Now this can be done if my mobile and my home devices are connected onto the same platform. Based on the location of my mobile it can identify that I am at my home so will automatically unlock the door and let me come in as well. These are something that is already happening but going forward what we need to understand is that when I have a specific component with me which can do a lot individually. Wouldn’t it be great if I can collaborate this component with my system of different components and build a better system? This is what Internet of Things is helping us to. You provide a podium through which all these things are adhibited through the internet, so internet becomes the medium through which you are connecting all these components or things to a platform.

2.1 Why do we need IOT?

To better understand the need for IOT let's take an example of IOT in real-world scenario. Suppose a patient is at home, he is on constant life-support where his status is being checked to a health monitoring system present on the cloud. Let's say at a point there is certain issue with respect to his health. Let's say there is some clutter with his heartbeat or his blood pressure is low, now what happens is since the system on the cloud is connected to a hospital as well. This information would get passed on to the hospital as well. There what would happen is that they would get the accomplished details with respect to the patient and the important information with respect to the current situation of the patient as well? We made aware with respect to what issue exactly is the patient facing as well as enable them to consignment an ambulance straightway to bring the patient back to the hospital as well. Now meantime once the patient has been picked up and the brought back to the hospital, there could be prescriptions, there could be medicines, there could also be an operating theater made ready in case of an emergency situation as well. There would be doctors on standby who have the complete history of the patient, who have the complete details of the present condition of the patient as well. So this in turn brings in a lot of transparency and reduces a lot of endeavor and time as well involved with respect to this.

Now what if same thing let's taken today scenario, there has to be someone monitoring this patient's health and if there is a vacillation, they need to call the hospital, they need to call request for an ambulance and meanwhile once the ambulance is here, they take the patient and they are back into the hospital, then again there needs to be a lots of checkups that need to be done because the doctors are not fully aware, again there is a lot of tests that need to be run and this in turn leads a lot of delay as well. In certain emergency cases as such now if a system can do this then this is exactly where our future lies it and what we have to definitely move forward to now. Internet of Things basically is expanding the interdependence of humans to interact, contribute and conjunction with things around us [4].

3. Applications of IOT

I.IOT in Everyday Life: - This is one of the first industries to deploy IOT at its service. Let's take an example how IOT serves in our daily life. Consider a home appliance such as A.C.; currently what you do is that you go home, turn on your A.C.; and wait for it to reach a temperature you like. But what if when your car was five minutes away, your A.C. received a message, what if it was connected to a cloud which has a dashboard containing all the relevant information like the location of your car, the all set temperature and the temperature at which you like to your room, and when you reach home, your A.C. is already set to the temperature you like. Another Example of IOT in our day-to-day life is home lighting. When you enter in your room, the light turns on automatically and when you go out the light turns off as well. These are the best known example of IOT in

our everyday life. Other Everyday things that are connected to the internet are wearable technology, smart phones, online shopping, vehicles, analytics, personal computer and music.

II.IOT in Smart Cities:-Smart cities are the most talked about prospects of IOT. When we think about smart city is that smart city solution is very specific to that one city. The problems faced in one city is very different than the problems faced in another even global issues such as waste control, traffic management, availability of finite drinking water and pollution, impact different cities with different intensities. So the only way to really make a city smarter is to cite a specifically to a problem. One such problem consistent among most urban city is traffic, so imagine an intelligent device like a traffic camera, a camera that can monitor the road of traffic jams, accidents, rains and etc, and communicate that statistics to a gateway. Now this gateway also receives data from various other cameras from all around the city, quickly learns and denounce patterns in traffics, analyze the situation, denounce its impact and relay this information to other cities that connect to the highway via their own monitoring system, now the traffic management systems then can drive routes for cars around these projects and live instructions could be send to the drivers via a radio channels and their respective smart device. Smart cities are also really helpful to save our time. Suppose you are new in city and don't know where the parking is, but you don't need to move hours to find the parking in the city. IOT devices can help you to find where the parking is exactly to navigate you, and you can save your time and energy.

III.IOT in Health Care: - IOT empowers health care professionals and improves the quality of care. IOT performs analysis and real time testing on valuable data. It ultimately reduces the unsustainably high cost of medical devices. IOT provides Real Time Data, makes devices smarter and provides far superior analytics in Health Care.

IV.IOT in Agriculture: - "Agriculture" this sector is most neglected despite the importance at wholes; however manual handling obtains results in lots of energy, labor cost and other inaccuracies, which make all its processes less effective. IOT here can provide number of solutions such as precision farming, smart irrigation and smart greenhouse. The first two cases are pretty similar, as in both cases there are sensors detecting various parameters at each level of the soil; we have moisture content, temperature and weather conditions. One can tell the correct depth to show the crops or the right time to water them. But one of the more intriguing solutions is the smart Greenhouse. We could use embedded devices in these Greenhouses. We could not only just monitor it regularly but we could practically control climate inside the Greenhouse.

V.IOT in Industry: - In industry IOT could proofed be a changer. Industry is one of those fields where both faster developments and quality of products are the brittle motive for a higher return on investment. There are still some problem that are need to be addressed in industries, these problems are:- inconsistency in data entry, time consumption and reporting, labour and staff training cost and lack of security. IOT comes to the rescue again in the industry also. IOT improves the line of command immensely it optimizes packaging and makes quality tests so much easier to done.

VI.IOT in Disaster Management: - The IOT cannot stop disasters from happening but it surely can help in preparedness and resilience during one. Evolutionary countries are more expose to the risk of natural disasters and often have limited means to sustain the effects; according to a study more than 95% of all deaths caused by a disaster occur in evolutionary countries. IOT can compensate for this by prediction, preparedness, response and recovery to rescue evolutionary and swelling countries from their pregnable position.

4. IOT Web Services

IOT provides different web services. But in this chapter we will talk about one of its mostly used web services that are Amazon Web Services.

4.1 Amazon Web Services

Amazon Web Services: - AWS is provided by Amazon.com. It provides on-demand cloud computing platforms to governments, companies or to any specific. It is a paid service. One has to pay to use this service. Now today's 70% of the whole cloud computing market is using AWS. Now you can imagine how big AWS is? Top most companies that are using AWS are Adobe, Amazon, NETFLIX, airbnb etc[5].

AWS provides the following services:-

I.AWS IOT Core: - AWS IOT core is made up of several different components from identity service, device gateway or message broker, the rules engine, device shadow and the registry. In AWS IOT Core, identity service plays an important role. The identity service is all about how we identify devices out in the field. Devices of course cannot have facebook pages or LinkedIn logins, so what we do instead is we use x.509 certificates. These certificates either be generated by AWS iot or they can be generated by a customers in their own PKI or HSM infrastructure. With these identity services and your x.509 certificates customers and then create fine-grained policies to restrict what a device can do whether it can send a message into AWS iot or whether it should be able to receive a message from AWS IOT Core. We then have the device gateway that sits behind the identity service figure. Devices can publish and subscribe to message using multiple protocols like TCP/IP and HTTP. IN AWS IOT Core you can control whether device can connect to the AWS IOT service, can publish a message, subscribe to a given topic for communication or receive a message. This is all linked by AWS IOT policy then you can attach to your certificate

II.Amazon FreeRTOS: - It is an operating system for micro controller. Small low power edge devices can be easily programmed, secured, deployed. We can also connect and manage them with the help of Amazon FreeRTOS. It uses the FreeRTOS kernel that is a popular open source OS. This OS contains software libraries and with the help of these libraries our small low-power devices can securely connect to AWS cloud services.

III.AWS IOT Greengrass: - AWT IOT Greengrass is an AWS service that helps the connected devices to run the Lambda function. It helps to keep device data sync. It can easily communicate with other devices securely even when they are not connected to the internet.

IV.AWS IOT 1-click: - With the help of this AWS service simple devices can trigger AWS Lambda function. We can easily perform actions such as notifying technical support, refilling goods, tracking possessions or services with the help of AWS IOT 1-click supported devices. These devices are easy to manage. We can execute our desired actions by creating device groups and associate them with a lambda function. This lambda function executes our desired action when triggered.

V.AWS IOT Analytics: - This tool helps in data analytics. The tools we use to get things done are generating more data than ever but this data is often noisy, inconsistent and highly variable this makes it hard or even impossible for business to gain value from it. This is where IOT analytics comes in a product of Amazon web services. IOT analytics help collect clean and analyze IOT data. In IOT analytics Firstly we collect data, process data and then analyze data.

5. Agility in IOT

Agile: - The term 'Agile' means ability to respond to changes. These changes may include from Requirements, Technology and People' [6].

- i.It is an iterative and incremental process.
- ii.It involves participation of customers.
- iii.Each iteration lasts from one to three weeks.
- iv.Delivers multiple Software Increments.
- v.Engineering actions are carried out by cross functional team.
- vi.Agile Manifesto that was published in 2001 highlights the importance of the development team, adapting changing requirements and customer envelopment.
- vii.Manifesto (public declaration of policy and aims).

5.1 Why Agile?

Existing IOT Model	Agile IOT Model
In the existing IOT Model, things are connected through sensors.	In Agile IOT Model, the triggered records are updated automatically through cloud centric

	platform.
In the existing IOT Model there are issues of limited resources and performance. They are unable to satisfy the rising demands of customers.	Agile IOT model is highly efficient, supports better performance, and satisfies the high demands of customers.
It is more rigid and follows top-down approach.	It is flexible and follows bottom-up approach.
It is resistant to changes, and does not adapt changes very easily. It takes a very long time to adapt the changes.	It welcomes changing requirements. Customer Requirement is the main priority in this model. It adapts the changes very soon.
Heavy Documentation	It focused more on software, not on documentation.
This model is high costly.	Since it uses cloud, so it is comparatively less costly.
There is no standard quality check in this model.	It ensures the quality check of products and services.

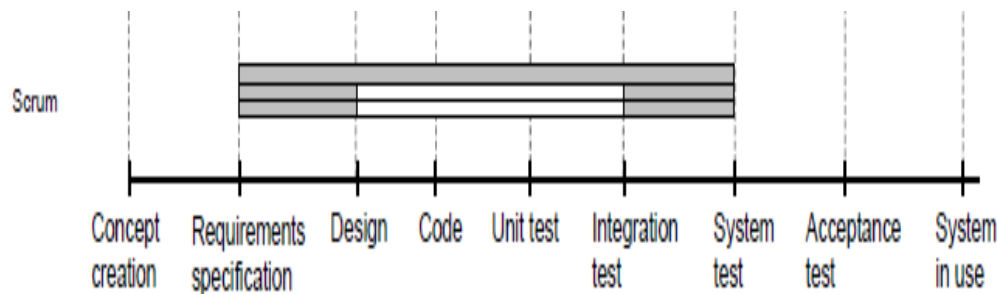
6. Architecture of IOT Devices

Almost every industry is moving towards the agility because of its adaptability of changes, flexibility and rapid development. As we know Agile has various methodology of Software development like XP (Extreme Programming), Scrum, Crystal family of methodologies and Features Driven Development and many more. But Scrum methodology is mostly used.

As Agile methodologies are enlargement in SDLC with the purpose to confer greater efficient software on time. Almost the 65% of the enterprise moved to SCRUM model, from the present normal software program existence Cycle version. SCRUM acknowledges that the systems improvement technique is an unpredictable, complex manner that could only be roughly defined as a general development. SCRUM defines the structures development method as a unfastened set of sports that combines acknowledged, possible gear and techniques with the satisfactory that a improvement crew can devise to build structures. On account that these sports are unfastened, controls to manage the procedure and inherent hazard are used [7].

6.1 Scrum Framework based IOT Architecture

The Scrum approach has been advanced for dealing with the structures improvement method. It's far an empirical approach applying the thoughts of industrial system manage principle to systems development resulting in an approach that reintroduces the ideas of flexibleness, adaptability and productiveness. Scrum concentrates on how the group participants ought to characteristic in an effort to produce the system flexibly in incessantly transshipment surroundings.



The primary consideration of Scrum is that systems improvement implicates numerous environmental and technical variables which can be probably to exchange at some point of the method. This makes the development method queer and complicated, requiring ductility of the structures development method for it with a purpose to reply to the adjustments.

6.2 Process

The basic of the scrum is empirical process. The empirical process is nothing but **inspect, adapt** and **transparency**. In scrum we follow these three rules and try to build up products around these areas.

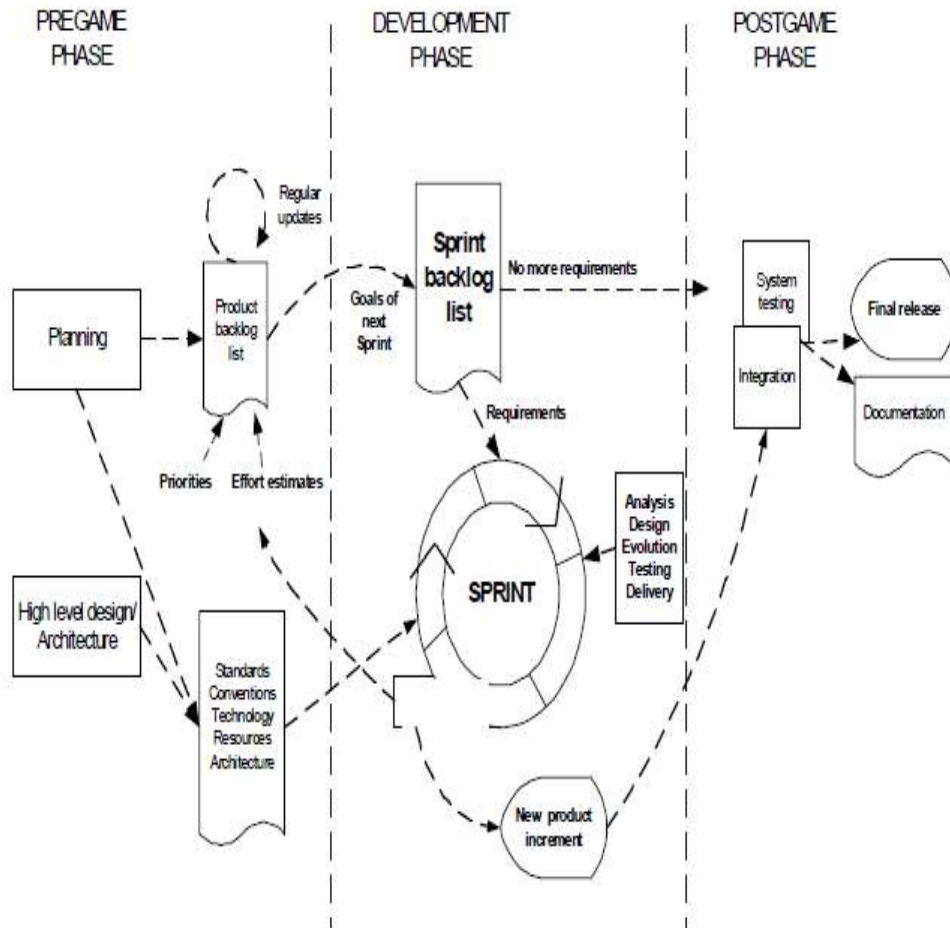


Figure 1. Scrum Process

In **The pre-game phase** we have two sub-phases: Planning and Architecture/High level design.

In the **Planning** phase the gadget which is being developed is defined. In this phase, Inspect rule is followed. In this there is a product owner, who owns the product backlog. This Product Backlog would have all the requirements and they would be prioritized by product owner in discussion to the project take holders. Product backlog is always owned by product owner and maintained by product owner. Once he start working on the sprint, the sprint team pick up the top prioritized requirements from the product backlog in discussion with the product owner, and then they become their sprint backlog. Now once these requirements are part of the sprint backlog, there is a detail added to all these requirements. A product backlog could have features, but in sprint backlog, you need to have user stories.

In the **architecture phase**, the design and architecture of the product or system is planned. We have sprint backlog, the sprint backlog is further broken down in user stories. A user story could be implementation

of the field level evaluation of the UI screen. Once the sprint backlog is formed, the team starts working on it [8]. During the sprint you have three meetings one is sprint planning, then is your sprint daily scrum and then sprint retrospective, and then at the end there is a meeting to review the design, provide demo to clients for feedback. For any feedback which is on the change of requirements goes back to the product backlog and it is re-prioritized. Note that all diagrams are created after the real execution [9].

The **development phase** is the agile part of the Scrum technique. This segment is dealt with as a "**black box**" where the queer is expected. The extraordinary environmental and technical variables (including time, qualities, necessities, resources, implementation technologies and equipment, or improvement strategies) diagnosed in Scrum, which can also alternate in the course of the technique, are determined and managed through numerous Scrum practices at some stage in the Sprints of the improvement section. In place of taking these matters into attention at the start of the software development program, Scrum handles them constantly, so that they can easily adapt the changes.

In the **post-game** the system is equipped for the release. The integration, testing and documentation are done in this stage. (Figure 1)[10].

7. Future Scope

In this paper, we have focused what is IOT, its applications, services and how Agile methodology is used in the architecture of IOT devices. By modeling Agile in IOT, we can provide fast and better services to the customers. Almost every industry is moving towards the agility because it adapts the changes very soon and its more focus is on customer requirements. Both agile and IOT are providing better and quality services and both can serve as a revolutionary technique in near future. But it needs more research and work to make it more superior in future. Although business is viewing it as an opportunity to fulfill their dynamic business needs [11].

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