Applied GIS

ISSN: 1832-5505
Vol-4 Issue-01 Jan 2016

Designing Internet of Things Software

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Abstract— As time goes on, the IoT radically alters research, manufacturing, commerce, and engineering. In this article, we'll look at how Agile may be used in IoT projects. Best practices from the agile methodology, such as monitoring, alerting, and preventing, may be implemented. However, a new approach to software architecture is required for the Internet of Things because of the need of device-level version control software. It affects how Internet of Things (IoT) gadgets are created. This article describes and analyzes the major software design choices taken when developing IoT applications.

Keywords— Internet of Things, Internet of Things software design choices, agile methodology, agile Internet of Things software development, agile, continuous integration and delivery, and effective embedded software development.

INTRODUCTION

By transferring them from Windows to the web, mobile, and the cloud, already-developed programs may be used in a variety of settings. Fast and error-free deployment is another area where we need to focus more attention. This meets the current need for flexible, mobile applications.

INTERNET OF THINGS (IOT)

To perceive or interact with their internal states or the external environment, physical objects with integrated technology form the Internet of Things [6]. The Internet of Things entails the networking of previously unconnected or under-networked physical objects and systems.By 2020, Gartner [19] predicts, there will be 20 billion IoT devices; by 2030, that number will rise to 100 billion.

In the digital enterprise of the future, technology will permeate every aspect of operations. Most of the things we encounter every day will have some kind of network connection under the IoT paradigm. The idea is predicated on the widespread presence of diverse objects that can communicate with one another and work together toward a common goal [20]. These objects include RFID tags, sensors, actuators, mobile phones, and many others. The services made possible by the Internet of Things will revolutionize manufacturing, healthcare, agriculture, and other industries in ways that were previously only imaginable in science fiction.

Agile

Instead of waiting until the very end of a project to deliver the finished product, the developers using the agile methodology release working versions of the software at regular intervals throughout the duration of the project [7].

Product development work is often broken down into smaller chunks by most agile development methodologies. This reduces the need for preliminary sketching and drafting. Sprints, which are shorter versions of iterations, often span between one and four weeks. A functional product should be provided after each iteration [7].

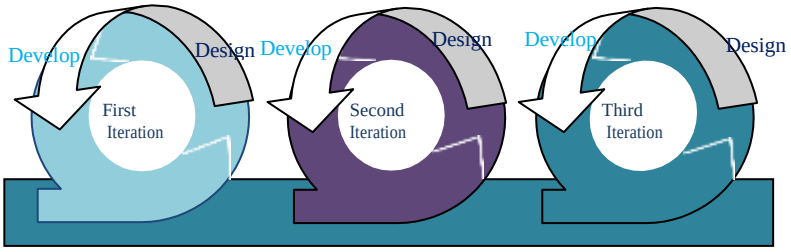


Fig. 1 Agile methodology

ISSN: 1832-5505
Vol-4 Issue-01 Jan 2016

AGILE AND INTERNET OF THINGS

A simplified framework is necessary for the implementation of IoT in many other types of operations, including industry, medicine, and agriculture. The Internet of Things is particularly relevant to agile in three key areas: regular updates, management, and adaptability to new needs. Consumers are looking for more individualized solutions to their problems. Businesses are always innovating to speed up the delivery of individualized goods to consumers. There has to be a more economical approach that nevertheless maximizes returns for investors.

Scrum and its best practices for managing the development of a real-time embedded system inside an interdisciplinary project have yielded rapid, efficient, and continuous outcomes [1]. Agile allows for the creation of high-performance and high-availability systems; it can even be employed successfully in systems that have geographically scattered teams [2].

Managing software and hardware is becoming more important as the number of internet-connected devices grows. So, it seemed sense to take a gradual, iterative approach to delivery. [16]

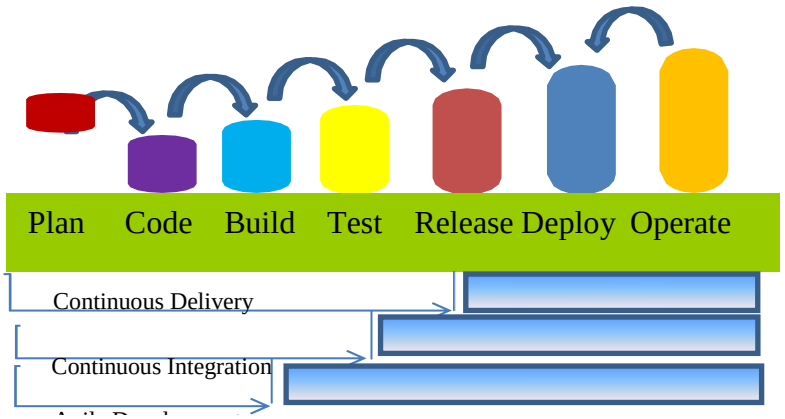
III ONE STEP AHEAD OF AGILE

Core software in IoT settings is designed to provide the necessary infrastructure and middleware layers to support things like service execution, data storage, transmission, and transformation, and system integration [22]. The focus of apps designed for the end user might be on providing information and services. The utmost precision and Quality of Service must be guaranteed by such fundamental infrastructure software. The software and hardware it is dealing with, as well as the resources it is using, are subject to change for a variety of reasons, such as failures, new interfaces and implementations, altered needs, etc. [22]

One of the main factors underpinning the IoT concepts is software. The capacity of software to adjust to changes in real time is crucial to their continued development. New approaches to software scalability, adaptability, and maintainability are required by the Internet of Things, yet these challenges are often overlooked throughout the design phase. In order to keep up with frequent changes in requirements, the Agile approach prioritizes speed of development. Faster development is required in IoT applications due to the rapidity with which requirements are subject to change. If operations were likewise flexible, it would be much more useful. Devops with CI/CD is an example of a future technology that may help meet this need for rapid application development and deployment. ―There are parallels to be drawn between the agile movement and adolescence, with both being insecure about their appearance, preoccupied with what others think of them, resistant to criticism, focused on fitting in with their peers, and unwilling to consider anything other than the conventional wisdom of the moment. But I have no doubt that it will develop further, opening out to the outside world, reflecting on its own actions, and becoming more successful as a result. — Philippe Kruchten [21]

Continuous Integration (CI): CI is a software engineering methodology. Its goal is to automate the integration process so that software may be integrated continually [55]. The development of an IoT system calls for a comprehensive strategy that combines data gathered in the conventional way, through the cloud backend, with data gathered directly from embedded smartphones or devices. It may be difficult to design and implement systems that work well in such a diverse setting, and doing so in a timely manner [24]. IoT problems that are a component of DevOps have been resolved thanks to the CI/CD (Continuous Integration and Continuous Development) suite of tools and services. DevOps is an acronym that stands for "Development and Operations" [25]. The word was first used in 2009. DevOps is a new approach to software development and operation that is gaining popularity in the business. DevOps encompasses the Continuous Deployment (CD) methodology since it encourages the regular and dependable release of new features and products.

The goal of continuous delivery (CD) is to automate as much of the process as possible, allowing for frequent software or modification deployments into production settings [23]. IoT is well-suited to CI/CD because it can accommodate the frequent software updates necessary to address issues like hardware failure, interface changes, and requirements adjustments. The most influential DevOps concept on specification is culture. Collaboration, shared accountability, and autonomous teams are all examples of the principles and practices that this concept supports [25].



ISSN: 1832-5505
Vol-4 Issue-01 Jan 2016

Fig. 2 CI/CD [Continuous Integration and Continuous Development]

RELATED WORK

Web applications continuous integration technique (WACIP) is presented by Lai and Leu [56]. Test-driven development (TDD) is only one of the many foundational problems that WACIP addresses. They stress that CI may reduce development risks and that web applications should be resilient in the face of rapid environmental change.

Jenkins Master-Slave architecture and CI in a mixed environment (Windows 8, Ubuntu, Fedora, etc.) are topics covered by Seth and Khare [57]. They also detail how their suggested CI might aid in creating apps for the Android platform

DevOps culture and CI are presented by Mitesh Soni [58]. According to Soni, the insurance sector must act swiftly in response to changing market conditions. Soni uses cloud computing, continuous integration, and the DevOps ethos to get the job done. Continuous delivery practices have been shown to improve system quality, deployment stability, feedback frequency, and responsiveness to changing requirements [59]. In place of manual, infrequent software releases, continuous delivery and deployment will become the norm [30].Everything that goes into developing, releasing, and maintaining software can and does benefit from automation [35].

CONCLUSIONS

IoT presents a problem for traditional business methods. A competitive advantage may be gained, however, by the use of an aligned framework that applies suitable value stream to processes like agile. Maintaining a culture of continual development in the face of intense competition is a crucial aspect for any business hoping to grow. However, IoT devices need a new approach to software development because of the necessity for firmware-level version control tools. It affects how Internet of Things (IoT) gadgets are created. There was a need for innovative new items. IoT problems have been resolved thanks to the CI/CD [Continuous Integration and Continuous Development] suite of tools and services.FUTURE WORKS

Future work can be to check with software design

decision impact for different IoT projects in different

domains whereoperating scenario is very diverse.

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