

A Software Development Process by Integrating Agile Methodology with Cloud Computing

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Abstract: In a current era, the software industry is very dynamic in nature. The organizations are repetitively changes their software requirements to adjust with current environment. They demands not only for fast delivery of software products but also for accepting changing requirements. In this aspect, agile methodologies are very auspicious in software industry. Agile method encourage evolutionary development and delivery, iterative approach, rapid and flexible response to change and adaptive planning. Again the cloud computing plays an important role in an organization. It helps to reduces burden on hardware, to speed-up operations, makes software more manageable, makes easier for clients to access various services, to reduce cost and to provide data center storage solutions. However, cloud development is not easy task for several software engineering projects like the project that need to change depend upon reusability.

In this paper, we have integrated the agile technology with the cloud-computing model, which is helpful to minimize the development cost, to satisfy customer's requirement and improve the reusability. Agile technology enhance the opportunity provided by cloud computing via releases software iteratively and receiving user feedback more frequently.

Index terms: Agile, Cloud, Scrum, Software Development Process, Organization.

I. INTRODUCTION

In this IT era, agile methodology is a widely popular approach to project management. It is a lightweight software development process. This method is based on iterative and incremental development process in which requirements and solution develop through collaboration between self-organizing and cross-functional teams [1]. It is providing high-quality software to the global users in shorter periods and are effectively handling the continuous changes on the requirements from the users. Many IT individuals who have understood the deficiencies of regular software management processes are consuming agile development methods in organizations. Many organizations all around the globe are experimenting with the different available agile development methods [2].

In this paper, we proposed the cloud computing services in agile development project. Cloud computing changes today's computing infrastructure as well as adjust the way of getting computing resources, managing and delivering software, solutions and technologies. Cloud computing additionally brings new concerns, challenges and needs in cloud-based application testing and assessment. One of them is scalability measurement and execution assessment for online applications, which gave as a service in cloud infrastructures. Cloud computing plays a key role to change the way information technology delivered and managed. The result will be enhanced cost productivity, simple development and capacity to dispatch projects on demand basis.

II. AGILE SOFTWARE DEVELOPMENT TECHNIQUES

There is a number of specific agile development techniques such as Scrum, Adaptive Software Development, Extreme Programming, Crystal etc. In this paper, we discussed about Scrum agile development technique.

Scrum is an iterative and incremental agile software development approach for managing product development. Scrum is design to add energy, clarity, focus and transparency to project team's development software systems. It permits team to operate in close nearness to adoptive rapid system evolution [3]. Scrum is a lightweight agile project management framework with wide applicability for controlling and managing iterative and incremental projects. Scrum has stored expanding fame in the agile software development community due to its simplicity, verified output and ability to act as a wrapper for various engineering practices encouraged by other agile methodologies. The following fig. 1 shows the scrum life cycle

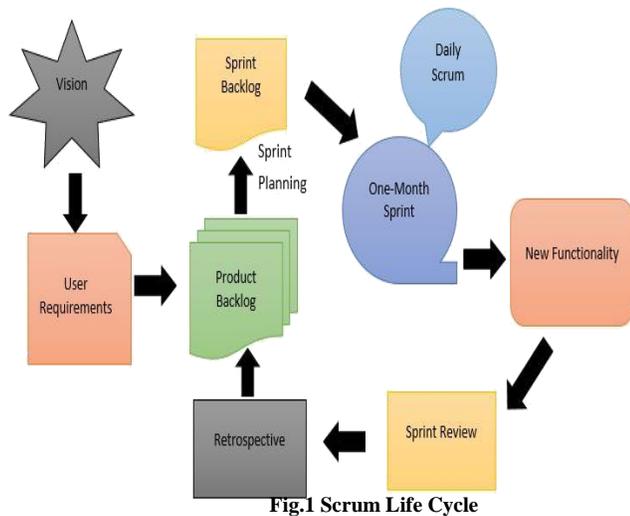


Fig.1 Scrum Life Cycle

A. Scrum Team:

A scrum team is cross-functional team that is responsible for developing the product. Scrum teams created by 5 to 9 members consisting of developers, business analysts, testers, etc. and have no team leader to give tasks or decide how an issue is resolve. A unit of the team decides how to address issues and solve problems. Individual member of the Scrum team is an essential part of the solution and possible to carry a product from launch to completion.

There are three key roles in a Scrum team:

- **The Product Owner:** Product owner shares the vision of the product, organizes the building functionalities and makes key decisions in the interest of the team or the project. There is single Product Owner who delivers the overall mission and idea of the product. The Product Owner is eventually responsible for managing the product backlog, managing the customer expectations, bridging the gap between the developers and other stakeholders and accepting completed increments of work. Ultimately, Product Owner is responsible for the success or failure of the product.
- **The ScrumMaster:** The ScrumMaster is responsible for taking care any kind of problem that the team is facing while building the product. It is not essential for him to totally understand the requirements. He must be sufficient capable to find solutions to situations. He has to create and maintain the best conceivable working situation for the team members

so that efficiently they can meet the goals of each sprint.

- **The Development Team:** The Development Team is a small team consisting of business analysts, developers, testers, etc. The team works together and building the application. The activities of each of the team members are adjusted in such a way that the objectives related with a specific sprint are accomplished. Team members are also responsible for identifying the complexity of the assigning tasks and allocating efforts. They are responsible for interactive the status of project daily to scrum masters, issues that they are facing to over the scrum masters and giving a demo of tasks finished by them to product owners during sprint reviews.

B. Scrum Events:

- **The Sprint:** The Sprint is a heart of Scrum. It is a time-boxed period of usually one month or less during which specific work is completed and made prepared for review. A new Sprint starts immediately after the finish of the earlier Sprint.
- **Sprint Planning:** The planning of the task to be perform in the sprint is done in Sprint Planning. Sprint Planning is created by the collaborative work of the whole Scrum Team. Sprint planning team meetings takes maximum eight hours for a one-month Sprint that determine which product backlog stuffs will be deliver and how the work will be succeed.
- **The Daily Stand-up:** The Daily Stand-up is a short communication meeting in which each team member quickly and clearly covers progress since the last stand-up, planned work before the next meeting and any obstacles that may be blocking his or her progress.
- **The Sprint Review:** The Sprint Review is the demo event for the team to represent the task completed throughout the sprint. The Product Owner checks the task against pre-defined approval standards and either accepts or rejects the work. The clients or stakeholders give feedback to confirm that to meet the business need.
- **The Retrospective:** It is the final team meeting in the Sprint to conclude what didn't go well, what went well and how the team can enhance in the next Sprint. It is an important opportunity for the team to emphasis on its general performance and identify

- strategies for continuous development on its procedures.

C. Scrum Artifacts

- **Product Backlog:** The product backlog is the specific most important document that reviews each requirement for a system, project or product. The Product Backlog is a well-organized list of everything, which is essential in the product and is the single source of requirements for any changes to be made to the product. The responsibilities of Product Owner is the Product Backlog, plus its content, ordering and availability. For future product releases, the Product Backlog records are required for all functions, features, enhancements, fixes and requirements that establish the changes to be made.
- **Sprint Backlog:** A sprint backlog is the particular list of tasks taken from the product backlog and finished in a sprint.
- **Increment:** An Increment is the sum of all product backlog items that has been completed since the last software release. It is depend upon the Product Owner to decide on when an increment is release and it's the team's responsibility to make sure that is contained within an increment is ready to be released.

D. Scrum Rules

The rules of agile Scrum should be totally up to the team and governed by what tasks best for their projects. The best agile trainers will tell teams to start with the basic scrum events and then examine and adapt based on your team's distinctive requirements so there is continuous development in the way teams work together. Scrum naturally focuses an entire organization on building successful.

III. CLOUD COMPUTING

Cloud Computing is a kind of internet-based computing, where shared information, data and resources provided to the computers and other devices on-demand. Cloud computing, also known as, 'on-demand computing'. Cloud computing and storage solutions provide users and enterprises with some capabilities to store and process their data in third-party data centers. Cloud Computing uses the central remote servers and internet to maintain applications and data [4]. Cloud computing allows Using cloud computing the clients or industries can be use many applications without installation and contact with their personal files at any computer using internet access. This

technology permits for much more effective computing by centralizing data storage, processing and bandwidth [5]. Following fig.2 shows the cloud computing service stacks

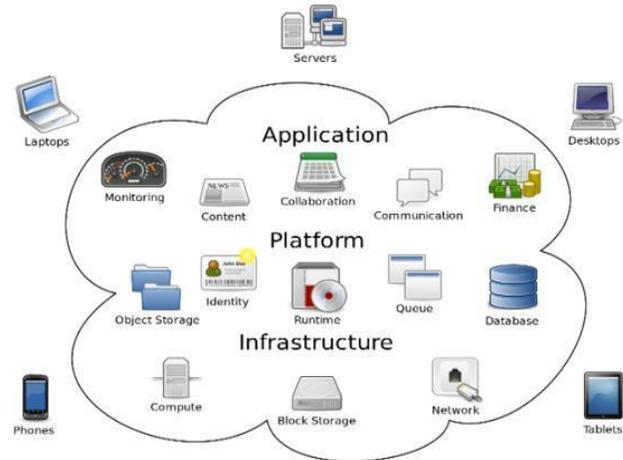


Fig. 2 Cloud Computing Services

In daily life, we can access the Gmail, Yahoo mail or Hotmail etc. which is nothing but the examples of cloud computing. We can send or receive the mails at any time but we need just an internet connection. The server and email management software is all on the cloud and is totally managed by the cloud service provider such as Yahoo, Google etc. The consumer gets to use the software alone and enjoy the benefits. The cloud model contain five crucial characteristics, three service models and four deployment models.

A. Characteristics Of Cloud:

- **On-Demand Capabilities:** We have access to services and power to change cloud services through an online control panel or directly through the provider. In addition, as per our requirement we can easily add or delete consumers and change storage networks and software.
- **Broad Network Access:** We can access any services through Smartphones, Tablets, Laptops or Computer. They can use any of these devices anywhere with a simple online connection.
- **Rapid Elasticity:** We can quickly and easily add or remove users, software features and other resources.
- **Resource Polling:** The cloud allows entering and using data within the business management software hosted in the cloud from any location and at any time.

- **Measured Services:** Our cloud provider can measure storage levels, bandwidth, processing and the number of user accounts and we need to pay according to our uses.

B. **Service Models:** cloud-computing providers bid their "services" according to different models.

- **SAAS:** In the Software as a Service model, users have access for application software and databases. The infrastructure and platforms that run the applications are managed by Cloud providers. Sometime SaaS is mentioned as "on-demand software" because user need to pay-per-use basis or using a subscription fee.

- **PAAS:** Platform as a Service provider offers a development environment to application developers. The provider usually develops toolkit and standards for development and channels for distribution and payment. Application developers can develop and run software solutions on a cloud platform without the any complexity of buying and handling the original hardware and software layers.

- **IAAS:** The capability provided to the customer is to storage, provision processing, networks, and other necessary computing resources where the consumer can deploy and run on subjective software, which may contain operating systems and applications. The customer do not need to manage or control the original cloud infrastructure but has control over storage, operating systems and deployed applications.

C. **Deployment Models:** The four cloud computing development models are as follows

- **Public cloud:** Public clouds involve a public service provider who deals free or pay-per-service fee structure. Public cloud providers operate and maintain the infrastructure using internet connectivity.

- **Private cloud:** Private clouds involves a distinct and secure cloud based environment in which the specified client can operate the cloud services.

- **Community cloud:** Community cloud models involve shared infrastructure between similar interest's communities' i.e. common computing concerns.

- **Hybrid cloud:** A combination of public, private, and community cloud models can host Hybrid clouds where end-users can enjoy the benefits of all three.

IV. PROPOSED WORK

The Agile Software Development processes optimize the opportunity provided by cloud computing by carrying out software releases iteratively and getting user feedback more frequently.

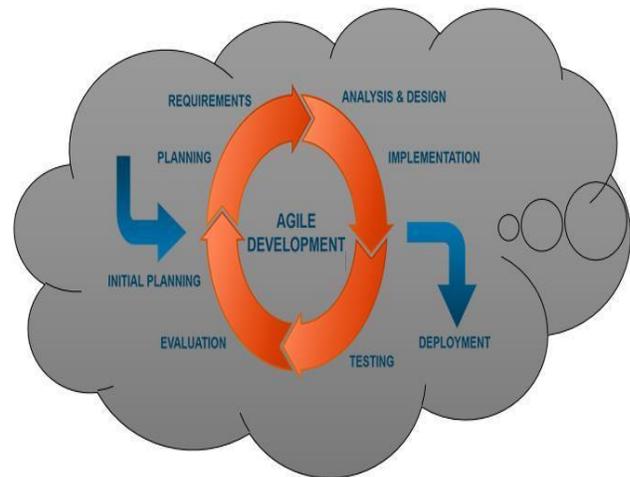


Fig. 3 Integration of Agile with Cloud

The purpose of Agile Software Development is to break down the project requirement into small and feasible segments. Each segments can be planned, developed and tested individually to maintain the high quality standard. Therefore, the development of each component become a single iteration process. Also Agile Software Development highlighted on developing collaborative relationship between application developers with end customer [7]. The whole development process is transparent to customer. This approach give feedback on all the task of project. The methods are flexible enough to hold change all the time and are capable of adjusting the quick changes within a smaller amount of the development time. Agile provides a crucial component such as a development platform that takings care of all the infrastructure requirements, which supports the rapid development cycles, can work towards the improvement of the agile project execution.

The Agile software development works into sprints. The objective of each sprint to optimize the most important work at some time instance and then review and re-optimize regularly to preserve software development on track and directly appropriate to the business needs of the

organization. As we know that Sprints are time-boxed, usually it will take one-month increments. The concept of time boxing forces both the technical as well as business teams to constantly prioritize the features and defects. In a current sprint, the transparency requires for continuous prioritization of tasks and management of all activities. While in the case of distributed teams, we may need a management tool such as Easybacklog, IceScrum, XPlanner etc. that can be access by all team members. Within the cloud model, using provision Agile management tools within minutes and scale globally with thousands of users without having to manage IT infrastructure.

When agile software development is used without clouds, development teams are limited to single physical server per development, staging and production server need. However, when cloud instances are used, developers will need to run automatic tests to find out the faults and fix the code. These types of tests run repeatedly ensure that the software passes all the required tests. Therefore, development teams have practically an unlimited number of servers available to them. They don't need to wait for physical servers to become free to begin or continue their work. Hence, using cloud with agile we can provide an unlimited number of testing and staging servers. Therefore, it reduces the time for software development.

Integration with agile and cloud computing provides more external services and development processes. Agile with Cloud Software development technique uses much project management, issue management, and many other types of testing environments. As we know that cloud computing, provide various services such as SaaS, IaaS, PaaS. The cloud also allows easy and effective coding so they will not require for buying additional physical servers for these purposes.

- At IaaS level, agile software development, use a combination of private cloud, public cloud and virtualization.
- At PaaS level, agile software development includes language environment and databases as services.
- The number of SaaS services support the agile software development, which delivers hosted testing automation for iOS devices.

Software Developer may use agile development but still sometimes, they experience delays in provisioning server instances and in installing essential basic platforms such as database software. The Commonwealth Bank reduces the provisioning of an Oracle database from three months to two minutes, agile software development teams can provision the servers that they want rapidly themselves,

rather than wait for IT operations to do it for them. Even though an agile methodology goals to squeeze all the inadequacies and delays out of software development, in practice it converts a serial activity. While Cloud computing can push it toward becoming a more Parallel Activity. This leads to more efficient, effective and better-utilized agile software development teams, which can give a provision that the servers need badly to, avoid any kind of delay in the process. Hence, Cloud Computing is easily able to turn Agile Development into a Parallel Activity.

V. ADVANTAGES OF INTEGRATED AGILE WITH CLOUD COMPUTING

- It provides an unlimited number of tested and staged cloud based applications.
- It turns agile development into a truly parallel activity by software reuse.
- It encourages innovation and experimentation, if a feature or a story looks interesting, a team can spawn a development instance quickly to code it and test it out.
- It makes more development platforms and external services available.
- It eases code branching and merging.
- It enhances continuous integration and delivery of cloud based components.

VI. CONCLUSION

The integration of agile technology with Cloud computing is the future of software development for global organizations of all shapes and sizes in industries. It designed to improve lower costs, business agility and ultimately better customer experiences. Putting agile technology together with the Cloud computing accelerates an organization's improvement pace. Agile development in the Cloud provides organizations superior control over process innovation, giving them more competitive advantage and chance through every vertical market. The elasticity of the agile and cloud together allows organizations to scope their IT to suitable their needs, instead of capitalize in equipment that they may not need. Today's most of leading companies have stunned their organizational gap and leveraged their global teams and IP. They have accomplished complete enterprise agility and deploying to clouds inside or outside of their company by taking repeatable agile, open and collaborative development approaches to global teams of developers.

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