An Effective Way to Apply Agile Manifesto in Development of Cloud Application through Agile Service Networks

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Abstract- This paper attempts to map how the requirements of based applications can be fulfilled by ASN's key features by applying Agile Manifestos. Even though ASN's has many key features like collaborative in nature, emergent, dynamic and business-oriented in nature including agility in this mapping is for the approach of iterative and incremental development. For the continuous change in requirements from the user it is necessary to apply Agile Manifestos to cloud based applications which in turn increases to run business enterprises at good pace.

But agile practices (or principles) relating it in to ASN's key feature are not being implemented in practice.

Index Terms- Agile Manifesto, Agile Service Network (ASN), Cloud Computing.

I. INTRODUCTION

Cloud computing is an emerging paradigm, in which it provides resources as a service over a network (i.e. internet) in which a business enterprise environment is created by providing a computing infrastructure on-demand and is usually priced as pay-per-use basis. Enterprises aims at reducing cost by converting capital expenditure into the adoption of cloud computing platforms for certain type of applications.

The cloud computing services is mainly divided into 3 categories-

1.**Infrastructure as a Service (IaaS)** – IaaS cloud providers supply resources like Virtual-machine disk image library, raw (block) and file-base storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs) and software bundles on-demand from their large pools installed in data centers [1]. Examples of IaaS providers includes: Amazon EC2, Google Compute Engine, HP Cloud, Rackspace

2. **Platform as a Service (PaaS)** - In this, cloud providers delivers a computing platform, typically including operating system, programming language execution environment and database and web server [1]. Examples of PaaS are AWS Elastic Beanstalk, Google App Engine, Windows Azure cloud Services, AppScale.

3. **Software as a Service (SaaS)** – In this business model, using SaaS, users are provided access to application software and databases. Cloud providers manage the infrastructure and platforms that run the applications. It is sometimes referred as 'on-demand software'' and service is pay-per-use basis [1]. Examples include Google Apps, Microsoft office 365, Petrosoft, Tradecard, and Salesforce.

We are focusing on software engineering challenges for migration to the service cloud paradigm. The challenges are establishing the context, modernizing the software architecture, managing non-functional and QoS requirements in the cloud, verification & validation in the cloud, performance and prime problem is requirements engineering. Requirements engineering is a very important activity, which can affect the entire application development by uncertainty in the user requirements. It gathers all requirements (I.e. from user or consumer), which is concerned with the analyzing and documenting the requirements. As Cloud applications are dynamic in nature, where user or consumer requirements will be changing inconsistently .Hence by using Agile Manifestos, we can overcome the user requirement problems to some extent. The characteristics of agile manifesto are consumer demand focused, communication-oriented, flexible (doesn't affect functionality for expected or unexpected change), fast release (encourages rapid and iterative development on demand), time & cost, responsive and learning (research or iterative work helps in improvement during and after product development)[8].With these characteristics of agility we can satisfy necessary requirement of cloud computing requirements with Agile Service Networks (ASN).Context adaption is used in ASN's to achieve Agility. We are considering ASN's usefulness in modeling cloud computing applications by extracting cloud computing requirements from literature and mapping these on ASN's characteristics.

This paper shows that by combining ASN, the values of Agile Manifesto can be mapped to cloud applications development and not just for iteration. User requirement or consumer interactivity can enhance the cloud applications.

The rest of this paper is organized as follows. Section II summarizes relative work about current state of cloud computing. Section III addresses the characteristics of cloud computing and overview of both Agile Manifestos and Agile Service Networks. Section IV shows our proposed work mapping both agility and ASN concepts can fulfill cloud computing requirements with description and figure pictorize our technique. Section V concludes paper and future work to be done.

II. RELATED WORKS

The traditional application development model follows a classic waterfall model, each process phase (requirements, design, implementation, verification and maintenance) flows sequentially and cascades downward to the next phase [3].In this approach, specifying the requirements is in the early stage which

takes longer time than expected this results to an early, unfinished end which then negatively impacts on development phase.

For fulfillment of cloud application requirements there are many other techniques and methods like AAS, SOA and SOE and for software development in cloud IEDF and alone ASN features can only be implemented. But user-centric requirements should be highly –prioritized [3]. Hence with that idea mapping some of the cloud based requirements with ASN's key features and Agile principles.

Requirements engineering was the first activity carried out in this paper to support and analyze it with regards to cloud based application. It plays a vital role in success or failure of any project [4]. Mapping the requirements of cloud based application to the key features of ASN's was already worked upon. ASN's was chosen because it's a promising paradigm able to deliver flexible and agile cloud computing application.

Though the previous works have shown the mapping of cloud requirements, but the greatest challenge of cloud which emphasis on user profile is always been the most neglected area and had been the field of research till date.

Our greatest concern here was to bring into focus the prime requirement of cloud based application i.e., customers interactivity and higher priority to customers' requests, which is the most ignored cloud computing application requirement but of greater importance though, using agile manifesto.

Agile principles might have been used elsewhere in other context of research on various topics earlier but our main attempt to use agile principles to mapping of cloud based application to ASN's is the strong characteristics of agile i.e. self-organizing, iterative and incremental development.

There are different agile methodologies like SCRUM applied to different cloud based application prior but the basic characteristics of agile which can satisfy the most basic and demanded requirement of cloud based application is been carried out in this paper by showing how mapping of cloud based application to key features of ASN's can be advantageous using agile manifesto in simpler context.

III. RESEARCH ELABORATIONS

A. Requirements of Cloud Computing

This section provides a list of cloud application development requirements ,elicited from literature [2].This literature was extracted by topic search string "Cloud Computing Requirements OR Challenges" in major search engines(ie. Google ,IEEExplore) from the papers we have enlisted some main requirements for cloud applications.

The Cloud Computing requirements are summarized as follows :-

- **Additiveness:** They must satisfy all the cumulative needs or resources even when demanded by large number of consumers.
- **Security:** All cloud application must be secured and signed to guarantee privacy. Without security consumer won't accept any policies because they may even withdraw in the middle.

- **Reliability:** The system must be reliable i.e., there shouldn't be any disruption in any services for any changes made.
- **Monitored:** The cloud application needs to constantly monitor all QoS.
- **Composable:** To personalize any resource collection it must be Composable via web 2.0.
- **Managing:** Risk management has to be deployed in cloud computing application in order to satisfy customer needs continuously [2].
- **Consumer Centric:** Client satisfaction should be given higher priority since clients pay for accessing services.
- **Standard:** For the business enterprise, cloud computing application must expose standard interfaces to enable services to be commoditized.
- **Self-healing:** In order to sustain accidental or imminent failure back-up is provided.
- **Data-Integrating:** There is a need to integrate and data to interoperate, logic and users on a global scale [2]. As cloud application users are in global scale, complete synchronizations of a system are done which enables smooth and non-disruptive consolidation.
- **Privacy:** To ensure that there is no third-party involvement in the transaction between end user and application provider to enable silent business environment.
- **User-friendly:** Cloud computing applications are used in different locations hence it should have standard – interfaces to achieve user-friendliness.
- **User-controllable:** As per the user requirement service consumption and QoS is constantly monitored.
- **Consumer-interactive**: Cloud application should iteratively interface with consumer (or user) in order to facilitate changing needs.
- **Control-decoupling**: It should provide decoupled application control, to prevent cloud platform from becoming brittle as demands change dynamically [2] i.e. it should be loosely coupled .Decoupled control in the cloud means that each unit is an independent controller.
- **Dynamic –billing:** The mechanism embedded in the cloud that keeps track of service usage of cloud applications. It must be fault-tolerant and well – monitored.
- **Scalability**: The ability to change services or resources for sudden growth of demand or depreciation in requirements. It accommodates increased business needs or changes with existing resources.
- **Auditability:** There should be clear picture of financial aspects (like gain or loss) if any in adopting applications in cloud and it has to provide automated statistics.

- **Multi-tenancy:** Cloud based applications are sensible to multi-tenancy .It allows seamless sharing of resources and infrastructure among customers.

In the description of the above cloud computing requirements, it can be distinguished as application-specific requirements, in which computations are done in cloud and user-specific requirements, integration with the application is allowed

Application-specific requirements are : Additiveness, security, reliability, monitored QoS,composability,risk-managing,self-managing,standard,self-healing,data-integrating,control-decoupling,scalability and **User-specific requirements** are: multi-tenancy, privacy, user-friendly, user-controllable, consumer-interactive, dynamic billing.

B. Agile Manifesto's Overview

Agile methodology confines to iterative process. Iterative application development follows customer needs and allows fast response to changes. This distinguishes agile uniqueness from any other approaches such as "waterfall model".

The agile manifesto key values are as follows –

- Individuals and interaction over processes &tools-In agile development, providing self-organizations and self-motivated individuals with the environment [3] [1].
- Working software over comprehensive documentation- working software will be more useful than just delivering documentation.
- Customer Collaboration over Contract negotiation-requirements cannot be fully collected at the beginning of the development cycle. Consumer involvement is necessary i.e., iterative delivery approach is used.

Agile manifesto are used to produce higher quality software in a shorter period of time. If any dynamic change in the consumer requirement persists without any barriers it streamlines the development process. Other popular agile methodologies are SCRUM, Extreme Programming (XP), Crystal, Feature Driven Development (FDD), Avaion E3 and Agile Modeling.

C. Agile Service's Network Overview

Agile Service Network's (ASN) are an emerging paradigm defined as a global network of service-oriented application applications collaborating to achieve business gain. ASN's are seen as a dynamic, rapidly changing network of services and it is self-managing from the perspective of enterprise significance of cloud computing. Agility in this context, can be as immediate ability to react against unpredictable changes. Context change is reflected in the application and the content extension where a new content of context is added without rebuilding the whole application this context adaption is used in ASN's to achieve agility [1]. As ASN's are business oriented, business values can be computed, analyzed and maximized. These networks which enable collaborative service and emergent feature (considering all aspects) by interaction among many business environments [2].ASN are a promising paradigm able to deliver flexible and agile cloud computing application.

With these key features of ASN and principles of Agile we argue that requirements of cloud based applications can be fulfilled. That analysis is explained in SECTION IV.
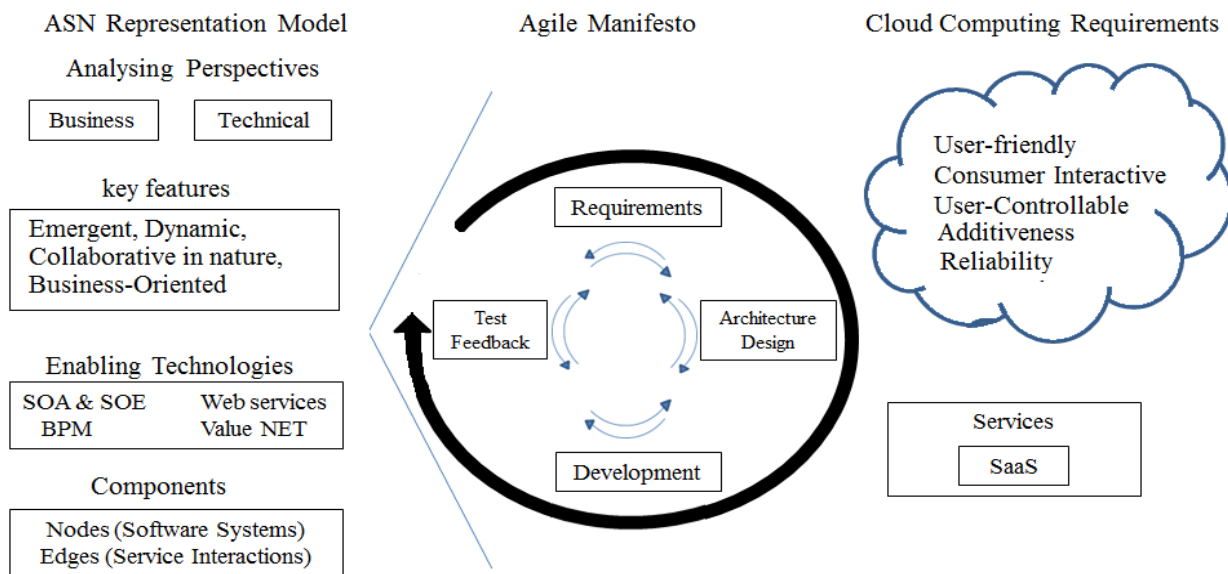
IV.   RESULTS AND FINDING

Figure.1. Representation of Cloud Computing requirements with ASN's features through Agile.

The figure1 shows, how we facilitating cloud computing requirements with ASN's key features by applying Agile Manifestos (or principles) [3] and table 1. maps with its features [2]. Using this method user-centric requirement can be satisfied to the extent which is necessary for business enterprises of cloud application development.

The figure.1 shows, how we facilitating cloud computing requirements with ASN's key features by applying Agile Manifestos (or principles) [3] and table 1. Shows mapping with its features [2], which is explained further. In figure.1 some of the cloud computing requirements are listed which is mainly focusing   on cloud's Software as a Service (SaaS). These

requirement are taken in iterative cycles in Agile Manifesto, where each phases are interconnected and each phase being a feedback mechanism to others [3], it is then fed to the ASN. In ASN depending upon different analyzing perspectives like business or technical different enabling technologies are used like SOA, Web Services, Value NET and BPM as mentioned. With the key features of ASN , which is explained in SECTION IV cloud requirements can be fulfilled.

The below outline diagram simply explains how the application of agile principles lead to successful delivery of the cloud based application. the contributors as stated above are :-
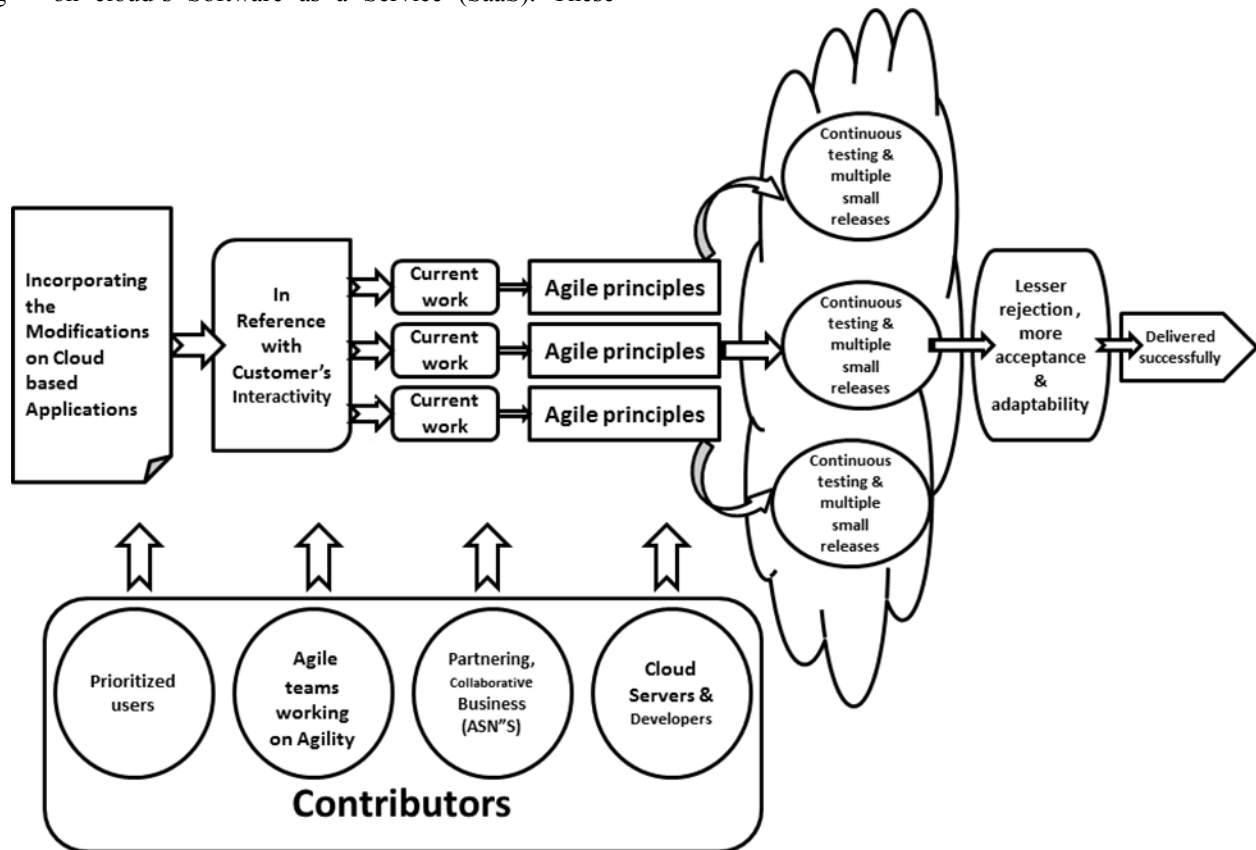

Figure.2.Simplified representation showing the outcome of applying agile principles.

- **prioritized users** who have been given higher priority and according to the users requests the modifications are incorporated in the cloud based applications.
- **agile teams working on Agility** where a team of people work collaboratively to satisfy the users by effectively applying   AGILE PRINCIPLES to cloud based application.
- **partnering, collaborative business environments (ASN's)** where ASN's   features are mapped to cloud based application using agile principles.
- **cloud servers and developers** here developers deal with cloud based applications and cloud servers take care of services to be provided to users over the internet on pay-use basis.

As we move from left to right side of the diagram the result of applying agile principle shows since agile is iterative and incremental in its characteristics there is continuous testing and multiple small releases of the cloud based application and hence due to this there is lesser rejection and more acceptance by the users and a trust and satisfaction is developed in them which adds on to the successful delivery of the application.

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Cloud Computing Requirements	ASN's Key Features	Agile Manifesto's
Additiveness	Emergent	Incremental, Emergent ,Evolutionary, Iterative
Reliability	Collaborative, Dynamic	Self-Organizing, Collaborative, Empirical &adaptive, Evolutionary
Self-managing	Emergent, Dynamic	Responding to changes, Self-Organizing
Consumer-Centric	Business-Oriented	Customer – Collaboration, Iterative, Incremental
User-Controllable	Dynamic	Iterative, Individuals &interactions over tools
Consumer interactive	Business-Oriented	Customer-Collaboration, Individuals &interactions over tools
Scalability	Dynamic, Emergent	Self-Organizing, Responding to change
Self-healing	Dynamic	Self-Organizing

Table 1.Mapping Cloud Computing requirements with ASN's key features by agile Manifesto's.

The requirements of cloud computing are facilitating by mapping it with ASN's key features by applying agile principles is explained as follows-

- **Additiveness:** ASN support Additively by its key feature emergent [2]. As in Agile Manifesto development process is iterative and emergent additional requirements or services are provided incrementally [3]. Context adaption is used, which is explained in SECTION III C. It exhibits flexibility to accommodate expected or unexpected changes rapidly.
- **Reliability:** As Agile principle states it is incremental [3] contextual change can be made in services and agile is also self-organizing & ASN's collaborative and dynamic nature makes more reliable. QoS measurement can be monitored [2].So even when any changes made in any services there shouldn't be disruption.
- **Self-managing**: This requirement can be mapped into ASN's feature of emergent and dynamic .Since ASN's are agile and dynamic it focuses on self-organizing

with responding to the changes and continuous development to the agreed level.

- **Consumer centric:** ASN came from a business-oriented study[1] it prioritize consumer requirements which is clearly an agile by iterative and continuous collaboration with a consumer increases their trust about the service which in turn makes sustainable business environment.
- **User-Controllable:** Cloud computing applications should empower users to dynamically control their service [2] consumption and requested QoS according to changing needs which in turn it's an agile's iterative process. Individual's interaction and customer collaboration can be done. As agile supports transparency communication, collaboration will be a significant constraint and it is dynamic in nature.
- **Consumer interactivity:** cloud computing applications should integrate consumer-interactive feedback in order to increase adaptability to changing user needs [2] which is ASN's business oriented feature.
- **Scalability:** Emergent feature of both agile [2] & ASN [3] makes it possible to respond to changes either to grow bigger or shrink accordingly and it allows dynamic feature.

By mapping cloud computing requirements with agile principles and ASN's key features we can list out a few advantages and disadvantages which are as follows :-

A. Advantages :

The advantages of using Agile manifestos in developing cloud applications in ASN are listed as follows-

- As in cloud based application development individual and interaction over processes with the consumers is iterative there won't be any chances of cancelling or rejecting the service or resource after its development and, services can be quickly delivered.
- The prime benefits of agility include faster revenue growth, more effective responsiveness to risks and reputational threats and greater, more lasting cost reduction.
- In this method requirements change by delivering the software in multiple small releases increasing the client confidence and enables consumer to communicate the business requirements change at higher pace [3].
- Opportunity to rapidly adopt and apply game changing technologies to the enterprise.
- Enhanced partnering opportunities due to increased business interoperability (I.e., engineering approaches to facilitate compatibility between different clouds, including service deployment across diverse cloud providers) [13].
- It increases flexibility
- Customers interaction is achieved by applying Agile principles , where in the customer and team collaborate to adaptively craft the product given time, cost, quality and functionality [8].

- Capability to measure progress by using empirical technique [11].
- Using Agile, they embrace change, reduce development cycle time and attempt a useful compromise between no process and too much process.

B. Disadvantages:

The disadvantages of using Agile manifestos in developing cloud applications in ASN are listed as follows-

- Difficulty faced by the consumer- able to authoritatively, comprehensively, unambiguously and defining the requirements of the system which can be understood by the provider.
- The principles of agility some way reinforces the notion of direct communication, the need for collaboration, communication and openness.
- Other requirements of cloud applications like security, multitenancy, dynamic billing, privacy etc. yet to be mapped from ASN using agile manifestos. So it can't be considered for application development.
- Without practical implementation it is difficult to tell, that this technique can be used for all kind of cloud applications.

V. CONCLUSION AND FUTURE WORK

In this work, we have tried the possibilities of using ASN as a viable engineering paradigm for software engineering in clouds. We then concluded a mapping between Agile Manifestos and ASN's characteristics which can harness cloud computing requirements. Feasibility of ASN in this regard requires further investigation.

This shows that cloud based applications should not only focus on technical aspects but even social aspects and user-centricity, is needed for cloud computing for turbulent business environment.

Large scale agile application development still remains an active research area.

In the study on how both ASN and agility can be implemented on cloud-based application development. Further findings can be done on how-

- Flexible context adaption technique to propose a framework that can be used in Agile Service Networks to increase the agility in cloud applications.
- A socio-concept model for the cloud should be developed. As cloud is more focused on user profiles, social aspect and user-centricity.
- It needs novel software engineering approaches and technologies to deliver agile and to improve business enterprise.

All these tasks are interesting challenges, since a starting concept model for ASN's doesn't exists yet.

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