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A Study on Maintainability and Availability Parameters using Code Metrics

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Abstract

Programming support is a foremost characteristic from claiming programming improvement existence cycle; henceforth prior close estimation from claiming fill in to maintainability assumes a vibrant part. For large portions quite some time now, product professionals bring been gathering measurements from source book clinched alongside a exertion on superior see those product they would Creating alternately evolving. Maintainability list (MI) will be a composite metric that incorporates an amount for universal source book measurements under a solitary amount that demonstrates relative maintainability. Similarly as initially recommended the mi is comprised of weighted Halstead measurements (effort or volume), McCabe's Cyclamate Complexity, lines for code (LOC), & number about remarks [1, 2]. Two equations were presented: person that viewed as remarks & particular case that didn't.

The improvement about Open Source system(OSS) is generally unique in relation to that proprietary product. In the OSS improvement situation an absolute designer alternately assembly of developers composes those source book for those initially adaptation of the product & make it uninhibitedly accessible through the web. After that different developers are welcome to help the existing code to its next discharge. Settling on that source book of the product accessible on the web permits developers around the reality to help code, include new functionality, change of the existing source book and submitting bug fixes of the present discharge. Over such a product improvement situation the upkeep of the open sourball product may be a culprit errand. Creating an OSS framework infers an arrangement from claiming incessant upkeep deliberations for debugging existing purpose & including new purpose of the programming framework. Those transform for settling on the adjustments should programming frameworks after their main discharge is known as

support procedure. Those haul maintainability may be nearly identified with those programming upkeep on account of maintainability implies those effortlessness to perform upkeep of the framework. Suggested agenize based approach is give acceptable those cosset effective, productive Also exact answers for assess the programming (web application) RMA measurements including the screening to cloud registering administrations that methods "Testing/Debugging Similarly as An administration Evaluation". Proposed system has performs faster and produce more accurate results to assure the quality of the software related to the non-functional metrics such as RMA (Reliability, Maintainability and Availability). Obtained result are outperform as compared to existing methods.

Keywords : Code Metrics; Lines of Code Agent, Availability, Cloud Computing, Maintainability, Reliability, RMA. T/DaaS, Open Source Software, Maintenance, code lines, Halstead-Volume, Cyclomaticintricacy, Maintainability Index

I Introduction

In an evolving domain, programming is additionally inclined to software maintainability to adjust programming support is one of the key procedures of the software life cycle. The explanation behind the product updates is to keep programming operation, avert and revise flaws in the product and enhance the usefulness of the product. Support alludes to the alterations made to programming frameworks after their underlying discharge. It is unrealistic to build up a product framework that does not require support since change is the automatic nature of programming frameworks [1].Previously, an evolving environment, product is likewise inclined will transform. Product support is a standout amongst the imperative forms within the product life cycle. The reason for those product upkeep will be should stay with programming operational, on prevent Also right faults in the programming and upgrade the purpose of the product. Support eludes all the adjustments made on product frameworks then afterward it's to begin with discharge. Modern computational virtual world is no more isolated from the physical world and it has greater interference of human life. It is now the world which connects people to work together for achieving the target in all aspect of the life. Exponential growth of the this computational world is everywhere allowing the people to search and use seamlessly, on demand with mobility having faster speed and so on. This popularization has gain attention due to surrounding and parallel development and advancement all areas. Computer has size has shrinking every day whereas its power has increases exponentially. The open source technology community has also contributing to enrich this field to be grown on. Advent of the android devices cannot be ignored.

More far reaching idea something like cloud registering need been narrated & drafted through national organization for standard & innovation (NIST): as stated by NIST-. Cloud registering is quickly developing as an elective should customary registering. However, the standard will be some way or another same as, utility computing, grid computing, & group registering & conveyed registering previously,

more or less. Cloud registering manufacture and virtual standard to offering information also computations again a versatile system of hubs. Illustrations of such hubs incorporate end client computers, information centers, and web benefits. Such a versatile organizes for hubs is known as cloud. A provision In view of such clouds may be taken as a cloud provision. Cloud registering is cutting edge tot integrations for PC Furthermore organize innovations for example, such that quick micro-processor, gigantic memory, high-sounding system Furthermore dependable framework construction modeling [16]. Typically cloud registering benefits need aid sorted out under three groups:.

A. Software-as-a-Service (SaaS).

B. Platform-as-a-Service (PaaS) &.

C. Infrastructure-as-a-Service (IaaS).

Cloud registering likewise may be separated under five layers including clients, applications, platform, foundation and servers. The five layers look like additional sensible and clearer over the three Classes [23]. The additional service of the cloud to be included is "Software Engineering as a Service" in brooder sense is main concerned of the research proposal. In concrete, "Debugging/ testing as s Service" is of modern interest of the software engineering research communities.

II Problem Statement

Analysis of the performance of the software product to check the quality of the product i.e. verification and validation is major concern in software engineering field. Modern software development has adopted the idea of RAD (Rapid Application Development) in conjunction with Agile approach to fasten the development process requires refined planning and high quality blending of the umbrella activities to do keen analysis and monitoring of the product during development. Three important metrics always keep in mind by the developer i.e. RMA (Reliability, Maintainability and Availability). Secondly the Availability has the new non-functional metrics got attention in modern days due to advent of cloud computing and their popularization. As well as distributed concept has also influenced the availability and reliability of the software greatly (limit to maintain the transparency). Open sources technology has come with new avatar "Version control" that's also need better reliability and on-demand availability of software product. As much as Maintainability chose by outline will be a noteworthy trademark about result that could aggravate support convenient, quick and prudent. For the conclusion of item design, maintainability turns into the inalienable result quality. Maintainability assessment is a critical route should assess result maintainability. Previously, late years, huge numbers researchers have connected those numerous criteria choice making hypothesis in the field In light of mulling over maintainability influencing attributes, and obtained beneficial comes

about. Propose system has adopted the idea of idea of cloud computing service delivery model and proposed (enhanced) a new service "Testing/Debugging as a Service" to evaluate the quality of the software product. Proposed system also adopted the concept of the software agent to fasten evaluation of the RMA (Reliability, Maintainability and Availability) analysis of the software using cloud computing service. Propose system has surveyed and find following issues must that must be address in context of the cloud computing and the also present the idea of need of agent integration. These are-

1. Reliability and Scalability Measurement of the web software product
2. Availability Analysis
3. Maintainability Evaluation

Same time writer [1] & [2] recommended an agenize based answer for tackle the over recorded QoS parameter that extraordinarily influence the execution of cloud administration particularly SaaS. Yet the fundamental issue same time taking a gander [1] & [2] is the acknowledgment & viability of the agenize for cloud to finer streamlining of the service conveyance. The primary needing side of the point in the article [1] and [2] is acceptance of the recommended component. Moreover the necessities for such quick provisioning of the cloud need been discuss in the later quite a while in the article [3] [4]. Our fundamental exploration worth of effort may be with improved& assess the programming maintainability Also accessibility utilizing the cloud agenize based proving ground. Point of interest destination of the suggested agenize far reaching dissection of the programming item (Web SaaS Service) on weighs those RMA measurements (non-functional metrics). Taking after objectives need been attained alternately fathomed for coordinating of the versatile agenize should cloud registering administration realization-.

Will assess Also conveyed those cloud registering administrations (T/dDaaS) utilizing agenize (for superior and quick delivery) utilizing government funded cloud for example, such that "New relic Also ever information state funded cloud administration provider".

Deploying a web benefits under SaaS standard & examination and assess those RMA measurements of the web result in the cloud nature's domain with the assistance for altered agenize. To SaaS advancement at any point information need been subscribed. In which jsp based requisition need been create & deployed on it.

Assessment& state funded PaaS (platform concerning illustration a Service) on investigated & assessed the maintainability of the running programming administration coordination a SaaS sending on it & delivering through agenize.

Measuring the execution of the recommended explanatory methodology (influenced starting with Aneka) Previously, cloud benefits for example, such that state funded at any point information.

III. Proposed Contribution

In this fast growing computational world the seamlessness access and uses are the primary concern before developing the product. Portability, flexibility and fault tolerance are the other important aspect that ensures the seamlessness of the software product. Designing plays an important role in maintainability and reliability of the software product. Functional independence is the key factor of the software designing which says "High Cohesion and Low coupling" plays a vital role in maintainability and increasing the reliability of the software product. XaaS (X as a Service) of the cloud has plays a vital role to fulfill computational need on demand basis in cost effective manner (rent basis) with the promises of broad network access (can be access on thin/thick devices) having greater reliability and maintainability (somehow, elasticity or dynamic scaling) assurance. Secondly, Modern era is reflection of human creative thinking and application of optimize solution for the problems mapped and simulated into the machines using technological skills and advancement on it.

III.i Proposed Algorithm

SQA of the software product and its associated resources in cloud PaaS is an important function that provides analytical statistics to evaluate the RMA (Reliability, Maintainability and Availability).

Our proposed work is to schedule and monitor cloud SaaS application onto the cloud and evaluate the performance of the same using proposed agent based.

III.ii Proposed Algorithm for Provisioning Application and Resources

Algorithm has been (influenced from Aneka) developed onto the ever data so the data has been selected as test bed for better evaluation and measurement of the accuracy of the propose system. Finally the code has been evaluated and tested using ever data Cloud service Provider. They are following with respective functionality in the proposed system.

IV. Performance Evaluation and Results

Following public cloud service providers or tools (platform) and data set has been used for evaluating the effectiveness of the proposed monitoring and provision approach.

Dataset	Cloud Tools
JSP response page	EverdataPaaS Cloud
	New Relic

Table 1: Experimental Setup

IV.i DATA SET Snapshot

Figure 1.1 (a) is the snapshot request/response of the deployed SaaS application developed using Java web onto the codenvySaaS developer Cloud Platform

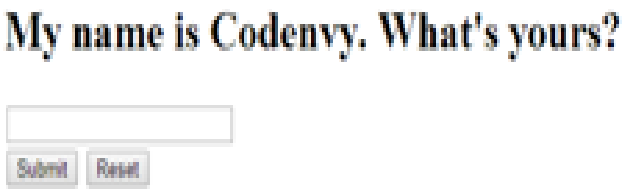

Figure 1 (a): Jsp request page of dataset developed on codenvy

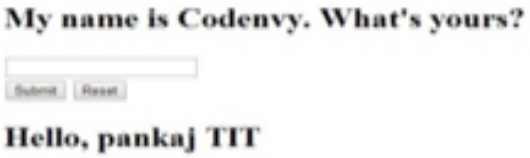

Figure. 1. (b): JSP response page of dataset developed on codenvy

IV.ii Results Obtained using Proposed Agent based Approach

Figure 5.2 (a) shows the apdex score of the SaaS application has been deployed onto the Cloudbees open cloud service provider. By Apdex score is an business standard with measure clients fulfillment for those reaction time for an provision or administration. It's An rearranged administration level concurred upon (SLA) result that provides for requisition managers preferred knowledge under how fulfilled clients are, as opposed on customary measurements such as Normal reaction time, which camwood a chance to be skewed to a couple exceptionally long reactions. Table1.2 (a) shows the obtained Apdex score of the deployed SaaS and has been monitor and provisioned by customized agents –

	Apdex Score
Browser (Yellow band)	**7.0**
App Server (Blue band)	**1.0 (.904-1.0)**

Table 2: Apdex Score

Note- The value of Apdex is signifies following-

i. 0 – 0.5 Average

ii. 0.5 – 1.0 Excelent

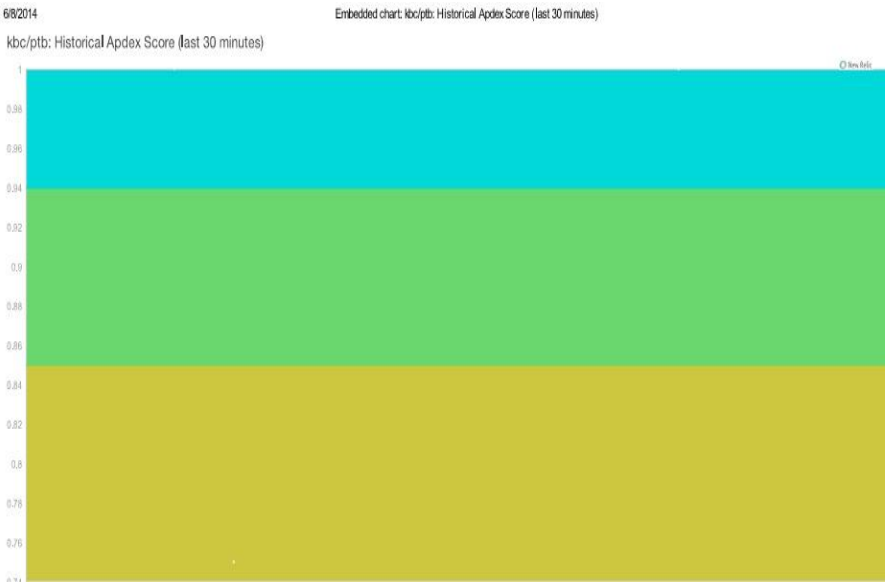

Figure 2 : Appdex Score of the SaaS using Agent while Accessing

IV.iii Average Loading Time

Figure 5.2 (b), (c), (d) and (e) shows the average loading, reposnse CPU usages (during request) of the deployed SaaS application. These statistics has been monitered and collected by various agents mentioned in the chapter 4. Table 5.2 (b) has shoown the avrage load time of SaaS

	Average Load Time (Maximum)
Desktop (Yellow Line)	**1.4 sec**
App Server (Blue Line)	**4.41 sec**

Table 3: Average Load time

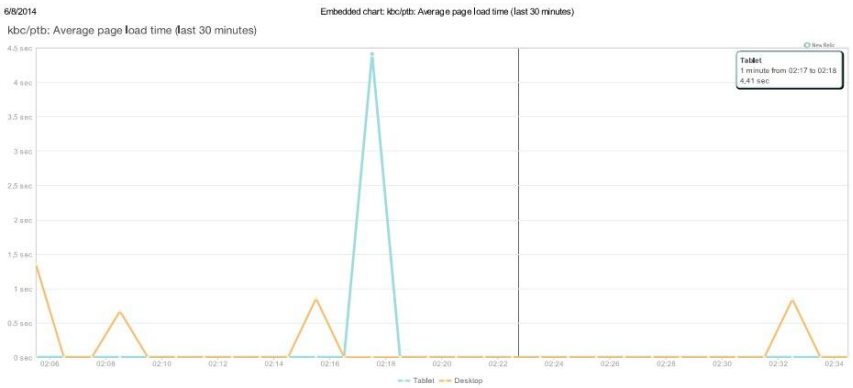

Figure 3: Average Loading of the SaaS monitered using Agent

IV.iv Average Response Time

Figure and Table 5.2 (c) shows the average response time of SaaS from cloud server using agent. This grapgh also tells the time spent of the SaaS in JVM (Java Virtual Memory) of application while requesting and in between response, as shown in small rectangle box.

	Average Response Time (in millisecond)
Minimum	**6.4 ms**
Maximum	**98 ms**

Table 3: Average Response Time

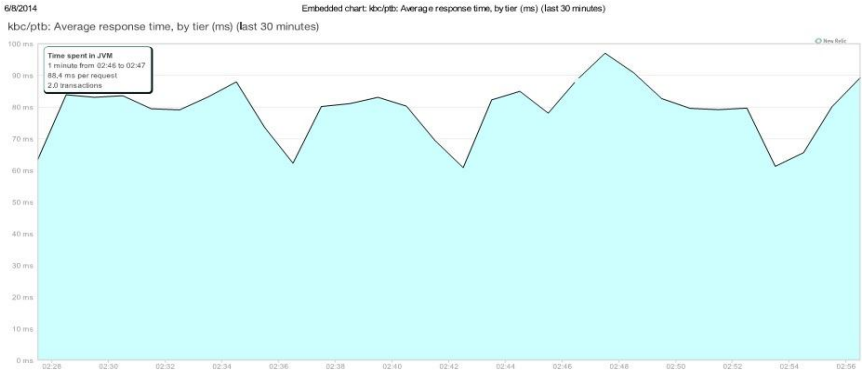

Figure 4: Average Response Time of the SaaS monitered using Agent

CPU Usages

Figure and table 1.2 (d) shows the amount of CPU usages by the deployed SaaS application. Agents are ready to monitor all such activities.

	CPU (in %)
Minimum	**.45**
Maximum	**1.58**

Table 4: CPU Usages

Figure 4: CPU Usages During provisioning ofthe SaaS monitored using Agent

V. Conclusion

With the headway in the telecommunication fields & advancement and upgrade over new conventions from claiming networks and cohered innovations web need currently new medium to right Also disseminate majority of the data over today. Cloud registering makes a virtual standard for offering information & computations again a through web alternately organize with the assistance for hosts alternately hubs were Hosting versatility. Set for such hubs (scalable) i. E. Organize known as cloud. And the deployed provision with respect to such versatile system is called cloud requisition. Cloud registering may be cutting edge tdt integrations for PC also organize advances for example, quick microprocessor, gigantic memory, high-sounding system also dependable framework construction modeling. In a far-reaching way those administration for cloud need been separated under three significant classes: SaaS (Software-as-a-Service), PaaS (Platform-as-a-Service), & IaaS (Infrastructure-as-a-Service).

VI. Future Work

Succeeding few domains have been selected in the form of future contribution a derivative of suggested solution based on agent whereas, the contemporary contribution can be further taken. T/DaaS for the Object oriented Software product. T/DaaS for cost estimation of the product.

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