

Integrated Testing Approach For Social-Mobile-Analytics-Cloud (SMAC) Convergence Technology

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Abstract— SMAC is the latest buzz word that drives the enterprises in field of technology. It is a comprehensive tool built on the major four ends Social, Mobile, Analytics and Cloud that ties all these technologies together. The major objective of SMAC is to enhance the business operations, so that it could maximize the reach to their customers with minimal overhead involved. It provides a holistic solution for the current businesses regardless of the products, services offered, methodologies followed and the work flows executed. Individual evolution is happening in each of the terms involved in SMAC. Due to the digitalization influence, now every industry is focusing on integrating all these technologies in to one component, which requires some standards, policies, mechanisms, and management tools in order to automate the business process. Each technology involved in SMAC, has its own testing techniques involved. But when it comes for an integrated symbiotic technology, performing an end- to- end testing becomes much more complicated. Such combined testing technique must focus on resulting in optimizing the resource usage, saving the cost incurred and finally must fulfill the major expectation of the business involved with higher Return on Investment (ROI). So, the need for SMAC testing arises. This paper focuses on traditional testing techniques that are in practice associated the individual terms involved in SMAC and it also suggests effective integrated testing techniques for SMAC.

IndexTerms— SMAC, Social, Mobile, Analytics, Cloud, Testing.

I. INTRODUCTION

Social media can be described as web-based and mobile-based Internet applications [1]. It proves to be the quickest way to connect and communicate with the masses in the intended demographics. All major business houses recognize this and are working on the "Social" piece of the SMAC stack to engage their customer base through social media. While surfing the net, one can find every major organization is leveraging social media applications like Facebook, Twitter, YouTube, Whatsapp, Instagram, and other networking platforms for their success, which allows instant interactions among globally distributed communities enabling them to share text, videos, audios, images, etc. It is not just limited to business houses; today, you can even see that political parties are using social media to work to their advantage.

Majority of the business sectors, especially, IT industry have already started to integrate the social mobile analytics with cloud. This basically aims at bringing a huge transformation in the corresponding sectors' productivity; henceforth, the firm could bring much more value additions for their customers' and could bring a strong customer relationship. This in turn might reflect on the huge ROI of the corresponding firm. Netflix, located at United States, is one of the major media companies, which use SMAC technology [2]. When a viewer watches any television show, it asks them for rating it, by login with their social media like Facebook account and the rating is stored in Netflix cloud. Netflix, reviews the rating information stored in cloud, applies analytics on it. Such collected analytical information helps them in improvising their further services. As like this, almost all the applications used in day-to-day life require the use of mobile, media, analytics and cloud (SMAC) pack.

An average Internet user shares and consumes voluminous digital content in day-to-day life through the social services. From the data perspective, it leads to an extensive amount of data generated by humans [3] [4]. From a technical perspective, if the data to be stored is small, it can be stored locally. But, this growing of data demands elastic storage capabilities. So, Cloud computing comes into picture of SMAC, which provides a solution for storing social media, with supported technologies to access the data/information from any location at any point of time. The moment when huge data gets into cloud, it could become big data. Such data in cloud could be leveraged for analytics, so that the data could facilitate for decision making. Through analytics, the organization gathers insights of the customer mind, obtaining customer feedback and opinions. This helps in improvising the existing systems by adopting new strategies, and/or introducing new market segment. From the customer point of view, any such information must be available at their fingertip on a single click. This could be facilitated by mobility.

All day-to-day applications uses the social media, mobile, analytics and cloud. Due to rapid stride in the current business scenario, the application development time has decreased significantly. Any app or application can be developed within a day or within few hours. This is facilitated by the drag and drop apps supported by certain platforms and wizards. But validating or testing such apps or applications cannot be compromised and it may not be possible to be done in a day or hours. Before release, the app or application must be thoroughly tested in all possible ways. Especially, SMAC apps or applications, demands extra attention as applications must be tested thoroughly and the tester may need to test each of these four technologies individually, as well as an integrated testing technique is also essential. SMAC technology proves to be efficient for testing all the four technologies. Such testing approach helps the organization in optimizing the resource and it's cost effective as well. In SMAC, there are different technologies involved, but are inter-related with each other. So, in testing

perspective, two different strategies must be incorporated for testing the different technologies as well as the inter-related technologies:

- a) *Common Testing*, which includes testing of the functionalities that are common for each of these Social-Mobile-Analytics-Cloud pack technologies.
- b) *Customized Testing*, which includes some, personalized testing that is specific for the Social-Mobile-Analytics-Cloud pack individual technologies that are involved.

As per the requirement for testing, a combinational approach of customized testing and common testing can be used.

The rest of the paper is organized as follows: Section II deals with the need for SMAC testing, Section III gives the SMAC testing challenges, Section IV describes the common testing techniques for SMAC, Section V gives the customized testing techniques for SMAC, Section VI explains the integrated approach for testing SMAC, and Section VII gives conclusion.

II. NEED FOR SMAC TESTING

As a result of digitalization influence, individual evolution is happening with respect to the each terms of SMAC. In recent years, industries are trying to utilize the SMAC as a whole. Software developments, started to integrate social mobile analytics and cloud testing under a common roof. As an impact of this, testing services becomes more and more complicated in performing end to end test. An integrated strategic approach is required for SMAC, which combines the various testing techniques that were traditionally followed by each of the individual testing's. Such technique(s) must result in managing the upcoming business challenges, adding values to the customer-client relationship, optimizing the resource utilization, cutting down the cost involved in testing and aims at higher ROI.

III. SMAC TESTING CHALLENGES

SMAC as a whole is integrated with many number of third party applications and most of it are initiated to different apps. As a result of such integrations, lots of challenges are involved in testing the SMAC as a whole. So, for testing such convergent application, tester needs to test individually each of the elements involved.

a) Social Application Testing Challenges

Majority of the organization leverage social networks for launching their new product, marketing the launched products among the public, selling their products, providing the services to their customers, as expected etc. Such type of social media applications must seamlessly run in any networking platform. Testing the social media applications can be seen from two perspectives, end user and application view.

From an *end user perspective*, testing the following seven parameters proves to be a major challenge:

- Platform independent
- Security
- Functionality
- Localization
- Load
- Performance and
- Usability

From the *application perspective*:

- Intuitive and user friendly interface
- Consistent user experience and user engagement functionalities
- Accuracy of localized apps
- Coverage even at peak usage without any interruption
- Speed and responsiveness even at peak loads (Performance Testing)
- Environment, as any number of devices can get connected during real time, from any sort of platform (cross browser).
- Safety of social media apps from security exploitation from fraudsters and Hackers
- Reporting the spywares, blockers, hackers etc.
- Security revisions

b) Mobile Testing Challenges

A recent survey states that gadgets like Smartphone's, tablets, and other mobile phones are multiplying five times, growing at a rate of about two people per second, faster than the human population. Another survey states that the number of mobile users has been surpassed by the number of desktop users. In order to satisfy the various requirements of their customers at various levels, the designers, developers and tester are facing a lot of designing, developing and testing issues.

Multiple mobile models from various device manufactures, unique behavior of such gadgets, varieties of mobile apps, different operating systems/platforms used, quiet often forces the designer, developer and tester to rethink the developing and testing strategies. The approach followed for designing, developing and testing a simple desktop application cannot be followed for testing the hand-held electronic gadgets. Mobile applications must be tested thoroughly and ensured that it runs efficiently and effectively on multiple platforms, across multitude networks before it is released in the market. An effective mobile testing plan is essential.

From an *end user perspective*, while testing mobile application, the following focus area proves to be a major challenge:

- Functionality, that ensures whether the mobile application works as intended to work adhering to the listed requirements

- Usability, ease of use of the application in mobile
- Installation, application must be easy to install and un-install, able to auto update
- Handling the events
- Allowing the application to juggle between different applications
- Block a call or message
- Doesn't block critical events like notification, incoming calls, emergency calls

From the *application perspective*:

- Mobile Operating Platforms and Multi-Platform Compatibility
- Mobile Connection Types
- Mobile Test Interface
- Mobile App Types
- Compatibility of device, application works well with the devices of different make, different screen size, different resolutions
- Performance, includes application server performance, CPU, availability of memory, performance of application while battery is low
- Security, ensure the protection involved when there is a possibility for threats
- Localization and internationalization

c) Analytics Testing Challenges

Analytics based testing is a herculean task as it involves directly in adding a value to the customer thought process by mining the patterns and bringing out the knowledge from user perspective. So it has to be done in the user perspective as it cannot be concentrated on limited timeline as user tastes might vary time to time.

d) Cloud Testing Challenges

Cloud testing is another vast area to be tested based on the access location and user base of the application. Cost involved in cloud testing is more if the organization needs their own test labs; also it incurs more maintenance challenges. These individual testing may result in increased cost in terms of high cost per test, could increase in number of test cases involved, duplicates time and efforts put forward, etc. This in turn might risk the organization to invest huge money for testing such applications. If there is an integrated testing technique, available to test all these four technologies at one stroke, it will be much more helpful and useful when compared to testing each of them individually. This could result in saving the cost, reduce the time invested in testing, lessen the resource utilized and hence could contribute in increasing the Return of Investment (ROI).

IV. COMMON TESTING TECHNIQUES FOR SMAC

The common testing for social media app involves testing of the components that are common to all these four technology.

a) Social Media Application Testing

- i) **Security Testing** – Social media applications are at higher risk rate of security vulnerability by the hackers and scammers. So, security testing is most essential one that involves through testing of the security holes and gaps by which any hackers can attack the system. Such security testing involves:
 - a. Static security testing, that involves review of the code for vulnerability holes
 - b. Dynamic security testing, which involves the utilization of automated tools and live testing for security breaches.

Such type of security based testing is done by a team of expert testers, by manually probing the application with some common known security vulnerabilities, and check whether such known issues are tested properly.

ii) **Functional Testing** – Functional testing begins with specifying the social media application requirements, tester selection, bug reviewing and test cases preparation. It is a combination of manual and automatic testing techniques.

iii) **Performance Testing** - Social media applications should be tested throw for spontaneous, correctness, fault tolerance, load balancing, peak hour performance, response time when multiple users' logs-in at a time, etc.

iv) **Usability Testing** – The social media applications should be tested for ensuring the following features with respect to the usability features, in the user perspective. While testing the application, it must focus on the functionalities such as readability with respect to the legible fonts, user-friendly, navigability of the website, social media accessibility, speed of the web site, the way how it responds to the user request, web page size etc.

b) Mobile Application Testing

Mobile testing is a process in which the application software that is developed for the mobile devices is tested for the functionality, consistency and usability [5]. Such developed application must work accurately as intended on any kind of devices irrespective of the brands and platforms. The following are the customized testing that has to be done on the developed mobile application to ensure the functionalities.

i) **Security Testing** - This testing is done for each and every possible and known security threats in the application. Security testing must involve testing of the device security, data protection, managing the essential infrastructures of the application, etc.

ii) Functional Testing – The functional testing can be performed for ensuring that the mobile application is working as per the requirements. Such testing is conducted driven user interface testing.

iii) Performance Testing – Performance testing is performed for checking the mobile application performance under certain situation like poor network coverage, low battery condition, simultaneous access of the server by multiple users, and other critical conditions. In performance testing, both the client and server side applications must be tested separately and together.

iv) Usability Testing – This testing is performed for ensuring that the application is working as per the user intention. Mobile usability testing is important for an application's success.

c) Analytics Testing

i) Security Testing – Security testing is important for analytical based applications as it involves lot of data, which could be in a structured or unstructured way. As potentially lot of data is available, security testing could involve in checking the authentication of the user, available formats of data, confidentiality of the data, security and privacy of the data, etc.

ii) Performance Testing – Application must be tested for ease of use, data accuracy, performance in peak hours with high loads, data completeness, etc.

iii) Usability Testing – Usability testing is carried out for checking the correctness of data, as provided. User data might have been taken from different sources and could have been analyzed. Such data helps in analytics to a greatest extent for the business success. So checking the correctness and usability of proper data must be ensured.

d) Cloud Testing

i) Security Testing – Security based testing is very essential for any cloud based application, as the customer relies on the third party for storing and accessing their data. So the application must be safe and reliable. Security testing is performed for ensuring the safeness of the data and its security, such that it should not be tampered by unauthorized users.

ii) Functional Testing – It is a test carried out to ensure the functionality of the application during real-time. The testing is for both internet-based applications and non-internet based application.

iii) Load Testing – It is an environment based testing that looks for the bottlenecks of the application during peak time.

iv) Performance Testing – It is also an environment based testing; the application is tested for its peak time performance. The application is subjected to a high workload at a given point of time and it's tested to check how it behaves.

V. CUSTOMIZED TESTING TECHNIQUES FOR SMAC

The customized testing for social media app involves testing of the components that are specific to the particular technology.

a) Social Media Testing

i) Advertisement Testing – Testing is done in order to ensure that the information accessing the advertisements is safe during the social media app access.

ii) Compatibility Testing – Testing for browser compatibility with the mobile apps.

iii) Localization Testing – Regardless of the location of the user, the media app must function in the similar way, where ever and whenever accessed.

iv) Load Testing – Testing the application for its performance during real-time, how it functions at peak time, hit rate, behavior of the application, etc.

v) Integration Testing – Testing for integrating the application with other application, for checking the intended functionalities.

vi) Quality Assurance (QA) – Testing for assuring the creativity and agility of the social media applications.

vii) Search Engine Optimization (SEO) Testing – testing for the social media application's on-page optimization, website validity, strength, interactive, etc.

b) Mobile Application Testing

i) Compatibility Testing - Compatibility testing ensures that the given application works fine in alignment with the customers' requirements, irrespective of the screen size, resolutions, internal hardware such as processor speed, memory, of the mobile device in concurrency with the requirements of the customer. In accustom with the evolution of the mobile devices, the compatibility testing must test the device with the various interfaces thoroughly.

ii) Localization and Internationalization Testing - Localization and internationalization testing is performed to test the features that are supported by the applications and the devices are working as per the requirements specified.

iii) Data exchange and synchronization testing - One of the major usages of the mobile device is exchanging data. Hence, it is highly recommended that the data exchange and synchronization among the various mobile devices, mobile to PCs, mobile to PDA using Bluetooth or infra red frequency and USB ports must be tested.

iv) Communication- The communication testing is done in order to verify the handshakes in a call as well as the protocols are working fine when a call flows between multiple users.

v) Interoperability testing - Interoperability testing is done in order to ensure that the various functionalities on the mobile agents like instant messaging, setting up a call, sharing a conference call, video messaging, audio messaging etc are intact with the communicating devices.

vi) Functionality testing - Functionality testing of a mobile device includes testing the aspects like storage media, controls, menus, and other functional aspects. A black-box type of testing is carried out for testing the application in order to ensure that the system is functioning as per the business requirements.

c) Analytics Testing

i) **Failover Testing** – This testing crucial for any analytics application for deploying. The objective of the test is to ensure the critical failure of the application when it reaches a threshold performance point that is a predetermined one.

d) Cloud Testing

i) **Stress Testing** - Stress testing is a type of testing that is done in order to verify the reliability and stability of the system/application. This test basically focuses on the error handling and robustness behavior of the application during extreme heavy load conditions. Its basic goal is to check beyond the normal operational point of the application and ensures that the system is behaving as intended during extreme conditions and is not crashed.

ii) **Fault Injection Testing** – Fault injection testing is performed by deliberately injecting/introducing the errors to the application in order to ensure that it can recover/withstand from the error based conditions. It is assumed that, if the system works properly as expected when the know faults are identified; the system may work properly when unexpected faults are occurring. Its basic objective is to identify the weaknesses and vulnerabilities of the system, if identified can be fixed and measures can be taken to avoid the same. This type of testing can be done either during run-time or during compile-time.

iii) **Compatibility Testing** – This testing checks for the compatibility of the application with the cloud infrastructure and ensures the interoperability of the system.

iv) **Browser Performance Testing** – This testing ensures that the application is supported by various types of available browsers.

v) **Latency Testing** – this testing check for the application's response time, between the application submitting a request by the user and how long it takes for the application to response the user, once its deployed.

vi) **Fail-over Testing** – This testing ensures that the application works well under peak load even if any components fail during real-time. Moreover, this test is done by simulation methods, as it will be difficult to do it in real-time environment, before deploying. It majorly tests for the reliability of the application.

vii) **Capacity Testing** – This testing is performed for determining the maximum capacity that a system might withstand during the present/future and other usage requirements during the usage scenarios that needs serious attention.

viii) **Scalability Testing** – This testing is to ensure the need of growing and varied demands or requirements of the system during its real-time working. It checks for the elasticity of the system i.e., scale in and scale out capacities of the application is in place based on the real-time scenario.

VI. INTEGRATED APPROACH FOR SMAC TESTING

For testing SMAC application, an integrated approach has to be followed as shown in the figure 1. It involves:

- i) Identification of the scenario
- ii) Creation of Test Cases
- iii) Configuring Test Bed
- iv) Identifying the test types
- v) Report generation

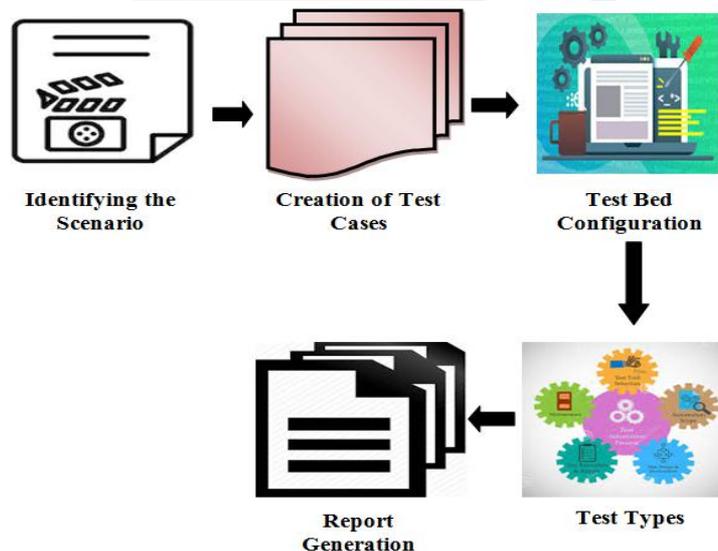


Figure 1. Integrated approach for testing

i) Identification of the scenario

The first process in testing SMAC is to identify the testing scenario. Scenarios like wireframe analysis. The scenario acts as a blue print for crowd source testing and exploratory testing as well. This process identifies the major functionalities and is used as a source for performance based testing.

ii) Creation of Test Cases

After identifying the scenario, they are further broken down into test cases. The test cases are written by considering the various usability and functionality of the system under test. Nowadays the applications are mostly developed with web-based responsive technologies, test cases must be created with multiple break point. The social

media related test cases are given with more attention that specifically focuses on covering the third party based integration type of testing.

iii) Configuring Test Bed

Creating and configuring test environment plays a key role in the testing process. As its difficult to create a test lab that covers the entire requirements into one frame, various levels of test beds are created based on the requirements and with other necessary configurations that are apt for the social, media, analytics and cloud.

iv) Identifying the test types

The first type of testing that is can be done in the initial level is, functional testing followed by compatibility test done as per the traditional practice. In a parallel way, performance testing can also be initiated on the product. Once these tests are done, it can be followed by exploratory testing. Identifying the test type is a crucial step as it involves user perspective analytics. So, internal crowd source testing is practiced as a level, in order to bring out the reality behind the expectation of the real users as a part of testing.

v) Report generation

Reporting generation is the final process in SMAC where the results are obtained for the various levels of testing process. The report thus generated includes the root cause of the defects, which can be subjected to rectification.

VII. CONCLUSION

Software system development will be incomplete without testing it. Organizations are majorly focusing on SMAC technologies. Even though SMAC applications can be tested separately based on the technologies involved, it is also essential to do common testing as it involves four different technologies for smooth and unailing performance. This approach of testing need to be done with a correct coupling of right set of people involved, done at the right platform with a proper set of planning and thus, it enhances the quality of the system. This paper provides an insight on the various testing techniques available for testing a SMAC based testing; however, it is recommended that other set of tests, that can be performed on the individual technologies can also be experimented for ensuring the proper functionality of the system.

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