

# Architecture Evaluation of Mobile Application: Whatsapp

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**Abstract:** Software become an unavoidable in every once life. Quality of the software is an import aspect in the software development life cycle. Quality for a software is represented in terms of functional and non-functional requirement. Software architecture is used to represent the using set of components and is connectivity as a relationship between these components. To assure the development process meet the requirement given by the user, the Software Evaluation is used. Early detection of error protect the software development producing the defect software. ATAM is the one of the method used to detect the risk, non-risk, scenarios and tradeoff in the earlier stage of development life cycle. Here in this paper security scenarios for mobile application has been elicited and compared with the scenarios extracted from the whatsapp application. Comparison shows few scenarios need to added with existing scenarios in order to improve / ensure full security for the metadata.

**Keywords:** ATAM, Software Evaluation, Whatsapp;

## I. INTRODUCTION

Quality software are developed by designing quality software architecture. Quality has been maintained by analysing the architecture during the development process of the software architecture[4]. The given problem statement and requirement specification are taken as the metrics against which the software architecture is evaluated. Very high-level design of large software are described using software architecture. Overall structure of the software is expressed as abstract, structured manner in the software architecture. Identifying the major components and the interaction between these component is the main goal of software architecture. Software is developed to meet the set of user requirements. User expectations are described as functional requirements in terms of services. The quality of these services is specified as non-functional requirements. A formal definition given by Sommerville [1996] states that “Software engineering is concerned with the theories, methods and tools for developing, managing and evolving software products.” Requirements engineering, design, programming, integration, delivery, and maintenance are the six processes of software life cycle. It is very important to perform the requirement engineering properly, otherwise the developed software not useful for the end user even though the code run properly. Software Requirements Specification (SRS) document is a formal document where the specifications for the new software product written.

Design of the software system is the next step, this is the beginning stage of the Software Architecture. Software Architecture to be the high-level design stage and it is software design at the highest level of abstraction. Representation of the architecture is an important aspect. Success of the succeeding steps in the software development is in representing the architecture clearly. Software architecture can be represented as various methods of diagrammatic and descriptive. Set of components and connectors are defined with relationships between different components is represented as Software Architecture. In addition, a software architectural description of a system may have many different external agents, commonly called “stakeholders” [Bass, L. et.al 1998, P. Clements et.al 2002, IEEE 2000, Kruchten P. 1995], and each stakeholder may have different expectations and requirements from the same system. Wolf [Perry, D et.al. 1992] defines the “Software Architecture = {Elements, Form, Rationale}, A Software Architecture is a set of design elements that have a particular form.” Architectural design is motivated by three arguments [Bass.L et al 1998]. First, At very early stage of the design process stakeholders discuss about an artefact. Second, it allows for early assessment or analysis of quality attributes. Finally, the decisions captured in the Software Architecture can be transferred to other systems. Commonly used definition for “Software Architecture is “It is a program or computer system is the structure or structures of the system, which comprise software components, the externally visible properties of those components, and the relationships among them”[Bass.L et al 1998]. [M. Shaw 1990]”. Software Architecture is an abstraction of the runtime elements of a software system during some phase of its operation. A system may be composed of many levels of abstraction and many phases of operation, each with its own software architecture”. Is the another well-known definition of Software Architecture. Following perspectives are covered in the early design of Software Architecture, they are system functionalities of the domain are decomposed, system structures are divided into components and their interactions are defined, and allocation of functionality to that architecture[R. Kazman et.al 1994]. Software architectural Evaluation provides assurance to developers that given architecture will meet the requirements in terms of both functional quality and non-functional quality, it also assures that understanding of architecture, detection of defects with early architecture. Software architectural Evaluation has some limitation commonly

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## Architecture Evaluation of Mobile Application: Whatsapp

- To take out the important scenarios, there are no systematic methodologies exists
- Clients requirements specification and stakeholders are not covered fully
- During evaluation the accessibility is very poor, need to access more related documents in same or similar projects

View is used to organize the software architecture description, they are analogous to different types of blueprints made in building architecture. Set of system components and its relationships are represented as views. The notations, modelling techniques are specified in the viewpoint and used in view that express the architecture in the form of questions which collected from the set of stakeholders. The view point also specifies the presentation, model kinds used, conventions used and any consistency rules to keep a view consistent with other views. Software Architecture is a combination of components, connectors and connections. From the smaller subparts or components Architecture- based software are assembled into a system. Identify the essential subparts of the system under consideration is the very important task. After identifying the subparts, then find out how different subparts are communicate and is there any dependability exist?. The following external components such as people, other software systems, other hardware systems are having interest in the software system, and affect the system, are called "Stakeholders". The view, interest on the system and requirements of different stakeholders may differ. In order to bring into a maximum requirement satisfaction, architect need to balance between different stakeholders requirement. The perspectives from different stakeholders over view of the software architecture will differ from each, In traditional these perspectives are called as architectural views. Same system can be viewed in different Viewpoint from different stakeholders, the whole description of the architecture defined by combining these views. The following are the objectives of the architectural representation a. Based on the requirement designing different views, b. Represent full architecture by combining all views. The rest of the paper arranged as session 2 introduces the architecture of whatsapp, session 3 explains about representation of whatsapp architecture in terms of UML diagram and scenarios for security. Session 4 explains about the evaluation methods and finally comparison of scenarios

### I. WHATSAPP ARCHITECTURE

Message communication over mobile phone was started with SMS, when the communication medium reaches third generation the message communication between mobile phones makes use of applications like Whatsapp, Viber, Skype, Line, Hangout etc. Among these applications Whatsapp dominates and catch a permanent place for messaging service. Every day number of users added as a customers and total number of users crossed 1.5 billion. Apart from messaging whatsapp gives voice calling, video calling, group chatting with maximum of 100 members in a group. Whatsapp makes use of the contacts to communicate with others with the permission of user. Also makes use of camera to take photos, gallery store data such as images and videos.



Fig 1: XMPP Server

XMPP server (XMPP-Extensible Messaging and Presence Protocol) server used by the Whatsapp. To transfer message between the open source Ejabberd has been used, it transfer messgaes between two or more user at any point of time[3].

Whatsapp make use of both HTTP and XMPP for the communication. XMPP used during asynchronous federated limited purpose communication whereas HTTP used synchronous unfederated general purpose communication.

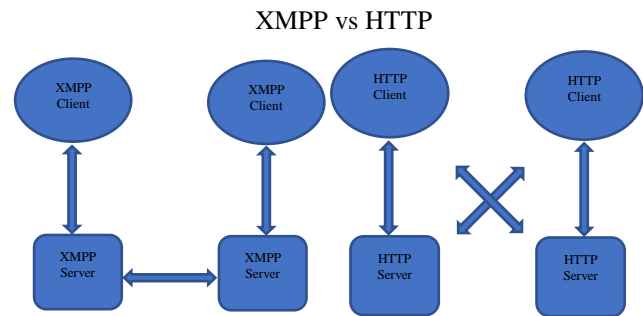


Fig 2: Comparison between XMPP vs HTTP

### II. UML REPRESENTATION OF WHATSAPP ARCHITECTURE

Components of the whatsapp and communications between them can be represented using following UML diagrams[5].

#### Use Case representations:

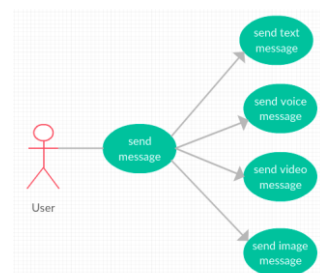


Fig 3: Use Case diagram for Whatsapp Messaging

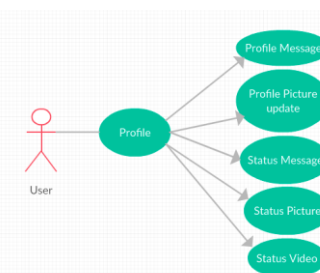


Fig 4: Use Case diagram for Whatsapp Profile/Status

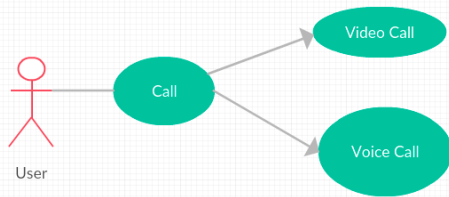


Fig 5: Use Case diagram for Whatsapp Call

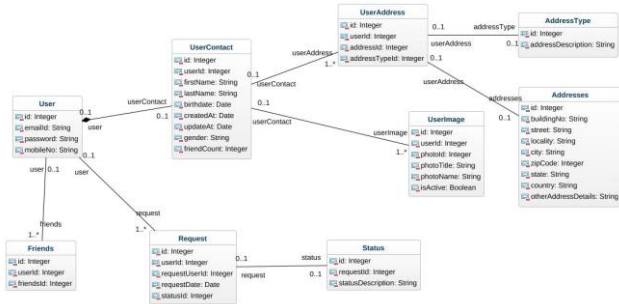


Fig 6: Class Diagram for whatsapp

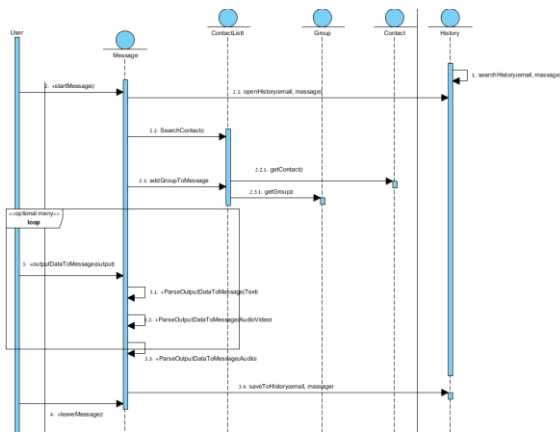


Fig 7: Sequence Diagram for whatsapp

### III. ARCHITECTURE OF WHATSAPP SECURITY

A long term key stored in the device memory, A shared key generated using this long term key and used to make a secured communication between another user[1]. A permanent communication channel was established between two user and this channel remains until reinstalled or device changed[2]. Man in the middle attack will be reduced with signal protocol because it uses Diffie–Hellman (D-H) key exchange method in each key generation on Off-the-recorded (OTR) based mechanism and ensures that no MITM attack is possible on any of the subsequently generated keys. There is a security concern when storing the data in the user device, it is not encrypted which will leads a lack in the security. Whatsapp makes use of the cloud server to backup, also makes use of google, amazon iCloud. There is no guaranty that these servers stores the data with encryption which may leads to data leaks. When the device theft, there no security for the past communicated data. Meta data is the another concern in terms of security. WhatsApp creates the end-to-end encryption to establish the communication channel between users. When the meta data of the user encrypted during transmitted through the communication

channel. Company terms allows to exchange the user data between two user when a communication channel established. Entire contact list will be share to other app with the permission of user. The following scenarios for security has been extracted for whatsapp mobile application

### IV. SECURITY SCENARIOS

- S1: Authenticate the user with mobile number and otp
- S2: Encrypt the data such as transit, phone numbers, timestamps, connection duration, connection frequency and user location must be stored to servers for future retrievals
- S3: Ensures that the message sender or receiver cannot be irrefutably
- S4: Communication channel between users using end-to-end encryption
- S5: Allow to share entire contact list with the app
- S6: Swapped the following information between the two parties: time of delivery, mobile

phone numbers involved in the messages, size of any digital content

Table 1. Comparison with Elicited Scenarios with Existing Whatsapp Scenarios: Security[6][7]

Concern	Proposed	Extracted Whatsapp	Status
Authentication & Authorization	Must be provided in order to avoid leakage of sensitive data.	S1	Available
Configuration	Once restoration is done, design should be able to reset the configuration	S2	Available
Validation	Design must provide validation to reduce bugs caused by invalid data, refuse access to malicious attacks- not filtering invalid characters	S3	Available
Synchronization	Over-the-air methods has to be considered to synchronize data		Need to include
Memory Limitations	Binary format can be used to configure files when memory is limited. Binary representation can also be used to store objects.		Need to include
Location	Authorized Data access must be enabled when sensitive data is accessed from a different location.	S2	

## Architecture Evaluation of Mobile Application: Whatsapp

OS	Avoid invalid access to any service that can be vulnerable to sensitive data	S1	
Communication	Declining to defend sensitive data, failing to resolve untrustworthy scenarios	S1	
Layer	Components must be grouped properly in appropriate layers.		Need to include
Data access	Proper data access mechanisms have to be implemented. Care must be taken when accessing large data sets are accessed. Avoid unnecessary access to open database with long time waiting.	S2	
Device	Device considerations have to be considered for aspects such as memory, storage space, network bandwidth, size of the screen at the time of design.		Need to include

7. ios security guide –  
“[https://www.apple.com/business/docs/iOS\\_Security\\_Guide.pdf](https://www.apple.com/business/docs/iOS_Security_Guide.pdf)”
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From the above table the security concern for the Synchronization, Memory Limitations and Layer need to include. Further to improve the efficiency of the usage of app, the following facilities can be included. An option of selectively adding contacts to the WhatsApp list. There must be some condition that can stop its parent company using information gathered through the whatsapp. Need to add security for the metadata in case of device theft.

### V. CONCLUSION

Software architecture is a representation of components and connectivity between these components. In this paper ATAM evaluation to extract the scenarios for mobile application has been used to compare with the security scenarios for the whatsapp mobile application. The results shows the scenario for the Synchronization, Memory Limitations and Layer need to include in order to make sure the full security for the application.

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