Remote Sharing Network (RSN): A Collaborative Platform

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ABSTRACT
Collaborative development platform has become an important business strategy. A collaborative platform may facilitate the development and deployment of a collaborative environment. New or existing data can be communicated via the collaborative platform on various local environments to create a collaborative environment among multiple participants. The smartphone is a tool for both communication and productivity. As a result, it is the ideal device for collaboration. Through the collaborative technology different project stakeholders can discuss changes and requirements. The forum lets designers, systems engineers, project managers and other team members discuss projects on 3D models virtually as if they were having a round table discussion. This helps teams communicate more efficiently, saving the business time while increasing efficiency. The RSN Software solution is a robust communication tool that lets product development teams track projects in a transparent way. The key benefit of RSN Software is the ability to effectively exchange engineering data in the workflow processes for quick decision-making. It lets users check whether designs have adhered to the acceptable norms and ensures that site staff uses the latest designs, making quality assurance a much easier task and reducing the cost of errors.

Keywords
Collaborative Platform, NoSQL database, Push Notification, Cross Platform

1. INTRODUCTION
Engineers deal with drawings in 2D and 3D data while engineering a product. In addition to this, the design involves a lot of mathematical calculations and the response of the product is studied by plotting different graphs. The product design also involves team members working from different geographical locations to share the above data and engineer the product. Today there is no platform which can aid the team in exchanging product information during the product development. The Engineers need to attend formal meetings to take any necessary decisions and it becomes very difficult to cooperate when the people involved in the project – managers, consultants, technicians, etc are from different geographical locations. Collaboration among them is required at every stage of project management - which includes project conception, planning, budget preparation and implementation. Hence the availability of a collaborative platform will (1) Reduce the time (2) Reduce cost required for project management and product development (3) Uniting all partners involved in the product development life cycle. What we need is a platform for the online communication of all the project players and the process controlled provision and storage of project documents in the cloud or for the mobile collection of actual data at the engineering site.

2. RELATED RESEARCH
2.1. Need of a Collaborative Platform
A collaborative platform is a type of business software that adds broad social networking capabilities to work processes. The goal of a collaboration platform application is to foster innovation by incorporating knowledge management into business processes so employees can share information and solve business problems more efficiently. It helps give the team Confluence, as we do not require the need of emails and meetings and hence reducing the problems. In [1] as stated, a Collaborative Platform is a technology designed to facilitate communication, to cooperate, coordinate, solve problems, or to deal with negotiations of work groups. This elaborates the characteristics of the Decision Support System (DSS) against the Collaborative Platform.

2.2. Existing Collaborative Platforms
There are several collaborative platforms that exist. SyTron is one which supports e-learning system by providing a virtual classroom facilitating effective communication between the teachers and students via voice and text based information exchange [2]. Practo is a platform that provides online medical practice for doctors and facilitates the doctor-patient relationship [3]. ITWOcx is another example of a collaborative platform that facilitates exchange of various forms of data being dealt with by construction and infrastructure projects [4]. The existing platforms like these suggest the need of a platform like RSN solution to help exchange engineering data, i.e., 3D models, 2D graphs etc.

2.3. Software that helps Facebook scale
This research begins with examining the various tools and technologies used to build a social communication platform like Facebook. As mentioned in website citation [5], Facebook was built from scratch using tools like PHP, Linux and MySQL, but has now modified these to scale it to accommodate the website that we see today. For example, Facebook has optimized Linux to suit its requirements. In addition to these traditional software, Facebook has modified the operation by using custom-written software that are mentioned below.

Haystack is a scalable software that stores the massive amount of photos, videos, messages, etc. *Scribe* is a user-logging system that is highly scalable enough to handle the current population and more. A few other softwares that Facebook uses that are relevant for building a collaborative platform are:

2.3.1. Cassandra

Cassandra is an open source distributed database management system (running on NoSQL) which is robust and can handle data across many servers. It is described as having no "single point of failure". Facebook uses this software for its Inbox search.

2.3.2. Scribe

Scribe is defined as a "flexible logging system that Facebook uses for a multitude of purposes internally". It is highly scalable and can handle large number of logs at a time. It was built to accommodate the exponential growth of the use of Facebook as an application.

2.3.3. Hadoop and Hive

Hadoop is a tool to perform complex calculations on large amounts of data, otherwise known as big data. We can imagine the volume of data generated by Facebook, all this data is analyzed to derive current trends and patterns to help in introduction of new trendy features. This task is facilitated by open source tools such as Hadoop and Hive. These tools have gained popularity over the years and are increasingly being used by big corporations.

2.3.4. Thrift

Facebook cannot provide all the features by using one particular language, i.e., there is no language that is powerful enough. So it uses multiple languages like PHP for the front-end, Erlang for Chat, it also uses Java and C++ in several places. The website [5] defines Thrift as a cross-language framework that integrates all the above different languages together. This allows these languages to work with each other and hence make the necessary services available.

3. RSN SOLUTION AND ITS IMPLEMENTATION

The RSN Solution has 3 modules:

3.1. Database

RSN solution provides integrated project document control, collaboration, contract administration, defects and quality management and dashboard capability via the cloud and mobile devices. The RSN solution requires various software and a scalable as well as a consistent database to help build the collaborative platform. In [6] it is stated that, NOSQL databases are different from traditional databases in that they do not use SQL query language, no join operations and BASE is supported instead of ACID (which is the core concept of relational databases). In [7] it says how NoSQL database systems are today an effective solution to manage large data sets distributed over many servers. An important aspect of interest in NoSQL systems is their support for next generation web applications, for which relational DBMSs are not well suited. These are simple applications for which (i) data have a structure that does not fit well in the rigid structure of relational tables, (ii) access to data is based on simple read-write operations, (iii) scalability and performance are important quality requirements, and a certain level of consistency is also desirable [8]. More than fifty NoSQL systems exist [9], each with different characteristics.

Table 1. Categorization and Comparison of Different NoSQL Databases

	Performance	Scalability	Flexibility	Complexity
Key value stores (Redis, Scalaris)	High	High	High	None
Column stores (Apache CouchDB)	High	High	Moderate	Low
Document stores (CouchDB, MongoDB)	High	High	(Variable) High	Low
Graph databases (Neo4j)	Variable	Variable	High	High

They can be classified into a few main categories [8] like key-value stores, document stores, and extensible record stores. There are various NoSQL databases like Mongo DB, CouchDB, Cassandra etc, and in [10]-[11][Table 1] it states the various pros and cons of the different NoSQL databases. Cassandra is an open source distributed database management system which is robust and can handle data across many servers. It is written in java and when you need to store data so huge that it doesn't fit on server, but still want a friendly familiar interface to it. CouchDB is a classic document and BigTable stores. Its main point is the Database consistency, the ease of use and written in Erlang. CouchDB can be used for accumulating, occasionally changing data, on which pre-defined queries are to be run and places where versioning is important. Mongo DB is one of the popular NoSQL database and is written in C++. It retains some of the friendly properties of SQL. And can be used if there is a need of dynamic queries, preferably to define indexes, not map/reduce functions.

3.2. Push Notifications

A key requirement of the RSN solution is to keep the mobile users up-to-date as events occur in some data. An event can be the receiving of new data or changes made to existing data.

One way of providing timely updates is the use of push notification technology. In article [12], the paper introduces the various design issues for push notifications and reveals methods of implementing push notifications for Android and iOS using GCM (Google Cloud Messaging) and APNS (Apple Push Notification Service) respectively. Table [2] provides the different implementations of the two services.

Table 2. Features of GCM and APNS

		GCM (Google Cloud Messaging)	APNS (Apple Push Notification Service)
Programming model	Notification paradigm	Point-to-point	Point-to-point
	Client Platform	Android 2.2+	iOS
Reliability	Delivery guarantees	Fire-and-forget	Fire-and-forget
Constraints	Notification Payload Size	4 Kbytes	256 bytes

The RSN application has a push notification service integrated in it. Push notifications notify the user when an event takes place in the application. The user can respond to the notification at any later time without disrupting the task he is currently doing. Notifications can be of two types - Push and Pull notifications. A comparative and explanatory study amongst the two is provided in article [16]. Paper [13] presents a component model for push notifications that enables to compare different implementation methods of push notifications. The website cited in [14] provides a detailed step-by-step explanation for an android developer to implement Push services using GCM. GCM or Google Cloud Messaging allows servers to send messages (ranging from a few bytes to as large as 4KB of payload size) to Android devices and vice versa, upstream data from the device back to the server. The website cited in [15] explains the APNS which is a robust tool for implementing push services on iOS devices. The messages are sent to a server that is maintained by Apple and further forwarded to the receiving device. Each device registers itself with the server and receives messages persistently. When the app is not open on the device, the user is notified of the changes and can be act upon it at a later time.

3.3. Visualization and Cross-platform tools

There are three types of mobile applications we can create - Native, Web and Hybrid. A study of these from article [18] tells that native apps are installed through the application store particularly for a single platform. They are created for a single platform with the help of SDKs and frameworks. Web apps are not real apps but rather websites that give the native look and feel of a native app and are run on a browser. Mobile web applications are developed as a single web site for all use on all devices with the help of frameworks. Hybrid apps are a combination of both web apps and native apps that take advantage of device features. Article [19] focuses on the need of a cross platform framework for mobile apps. All mobile platforms (Android, Windows, iOS) differ from each other, so the software developers have to develop an app for each platform if they want to reach a large audience which will be cumbersome. Cross platform application development with the help of various tools can help us overcome this disadvantage to a great extent by designing and coding across different platform. The RSN solution is to be developed using a cross platform framework to facilitate access on different devices.

The various tools that could be used for the development of such an app are Phonegap, Titanium Mobile, Rhodes, Kivy, jQuery Mobile, Sencha Touch, Qt etc. Table 3 and Table 4 shows a comparison of some important cross platform tools we came across [19] - [22].

Marmalade SDK allows us to write code and compile on Xcode (Mac OSx) or Microsoft Visual Studio (Windows). Applications are written in C++. It supports OpenGL ES 1.0 to 3.0. Marmalade Hub is the user-friendly GUI tool [24].

Xamarin helps us to write our apps in C# and deploy the code on iOS, Android, Windows platforms. Xamarin Studio is the IDE [25].

Table 3. Comparison Of Cross Platform Tools

Tools	Platforms supported	License	Open source
PhoneGap	Android, iOS, Windows, BlackBerry	Apache 2.0	Yes
Titanium	Android, iOS, BlackBerry	Apache public license v2	Yes (with limited features)
Marmalade	iOS, Android, Windows, Blackberry and Mac OSx	Proprietary	Yes
Xamarin	Android, iOS, Windows, BlackBerry, Mac OSx	-	Yes (with limited features)
Qt	Android, iOS, Windows, Mac OSx.	GNU General Public License	Yes

Table 4. Comparison Of Cross Platform Tools

Tools	Development Environment	Type	Type of app
PhoneGap	Native IDE of the mobile platform	Framework	Hybrid
Titanium	Titanium Studio (Eclipse-based)	Platform	Native
Marmalade	Preferred IDE (Visual Studio or Xcode)	Game Engine	Hybrid
Xamarin	Xamarin Studio	Framework	Hybrid
Qt	Qt Creator	Framework	Native/ Hybrid

Qt is a cross-platform application and UI framework for developers using C++. Qt Creator is supporting Qt IDE. Qt Designer helps to create the UI files with the help of simple drag and drop functions [26].

Visualization deals with the way images, videos, audios and other forms of data appear on the device. Mobile devices are characterized by a small display size, low processing power and less memory capacity. The last two points make it difficult to render 3D graphics [23].

4. DESIGN

RSN Solution is a collaborative platform for Engineers. RSN solution software is a fully integrated software platform spanning the entire lifecycle of engineering projects. The prototype as shown in Figure 1 will involve the following components: a server deployed in the cloud to facilitate exchange and storage of information. It is proposed to use a NoSQL DB like MongoDB, for managing the data. Dedicated apps are required to be written on Window/MAC/iOS/Android platforms along with push notification services. The user management module and the content management module manage the users and the content respectively.
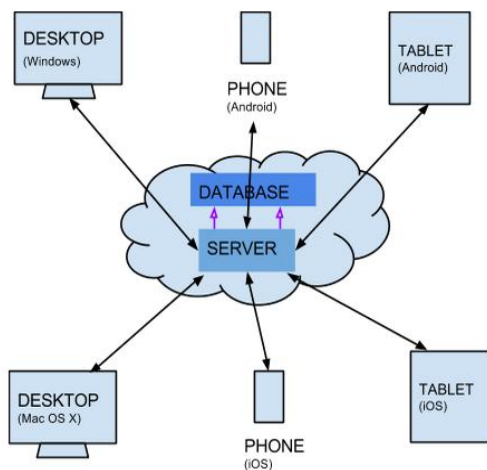
Figure 1. Overview of RSN Solution
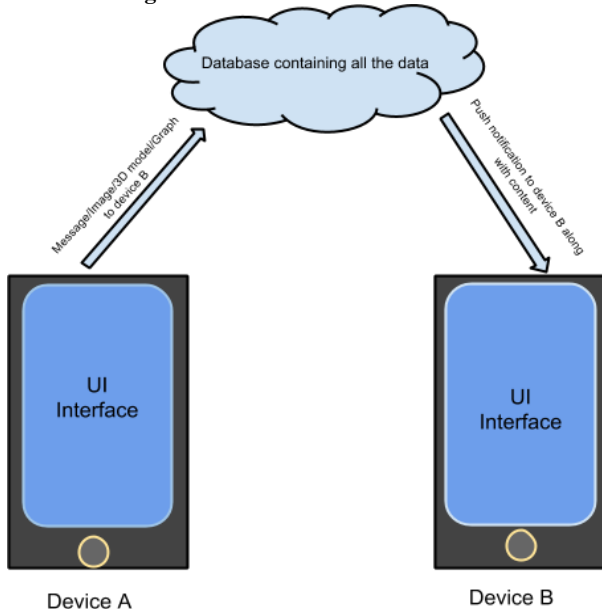
Figure 2. Implementation of RSN solution

Figure 2 shows the implementation of the RSN solution. The application is developed using Qt which is a cross platform framework. The application is deployed on iOS platform. The data is created on the Desktop whereas data can be viewed and modified on the mobile devices. The data created on the desktop is stored in the MongoDB database in the server deployed on the cloud. Spring Services provides a Mongo

Template and a GridFS Template for dealing with Mongo. MongoDB stores data in JSON format. Push Notifications are implemented by registering to the APNS for iOS. Engineers communicate with data in various forms: Messages, Images, Videos, 2D Graphs, and 3D models. Users can log onto the app using a unique login ID and password (hence registering themselves on the application server). They can communicate with other engineers and collaborate information like designs required for product development, ideas for implementation, etc.

5. CONCLUSION

The use of RSN Solution in the workplace creates a collaborative working environment. The solution supports people in both their individual and cooperative work thus giving birth to a new class of professionals, e-professionals, who can work together irrespective of their geographical location.

We provided detailed information about the features and the need of RSN solution. We presented the three different modules that are integrated to create the RSN solution. Each module elaborates the different technologies that have been explored with respect to the requirements of the solution. A framework for RSN Solution has been developed using Qt and MongoDB for frontend and backend respectively.

6. ACKNOWLEDGMENTS

7. DECLERATION

This article/typescript has not been submitted for publication elsewhere.

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