

Ubiquitous Cloud Based Bookcafé

Imran Ahmed, Satish Janghel and N. Ch. S. N. Iyengar

School of Computing Science and Engineering, VIT University Vellore-632014, Tamil Nadu, India

imranahmed2k9@gmail.com, satishjanghel@gmail.com, nchsniyr@vit.ac.in

Abstract

Cloud services provide platform for multiple users to remotely store , share and update data items. Mobile virtual environment and effective use of cloud computing made this great success. . This paper is an implemented real time web and mobile application named BookCafé using cloud database storage (common for both web and mobile) provided by Amazon web service. BookCafé is a storage where all the books will be stored with year wise and subject wise classification for student's purpose. Update's can be done at any time. They can have like laptops, smart phones, and tablet computer devices. Users of Online web application (non smart) access through user interface for signing, reading and uploading new books category wise. By uploading the android application on Google Play store, smart phone users can avail all the facilities on their handheld devices. The students either through mobile (android based) or through web, share and upload new books from anywhere in the campus by connecting to cloud.

Keywords: *Cloud Computing, Web Services, Cloud Application, Android Application*

1. Introduction

Cloud Computing has become an attractive computing paradigm which presents a pool of computing resources that can be availed by the users on demand at a low cost, thus making the users free from the overhead of setting up an expensive infrastructure to launch their applications. In networking terminology, the cloud symbol is used to denote any network. Thus the term “Cloud Computing” means “Computing based on internet” which implies that the variety of services offered by cloud computing namely SaaS, PaaS, IaaS, etc. are accessible only via internet. Cloud Computing is similar to Grid Computing in which computing resources are gathered from distributed locations to achieve a specific objective. Small to medium size enterprises largely benefit from the features of cloud computing as it is economical.

Amazon is one of the popular cloud service providers in offering Infrastructure as a Service. It offers various computing resources on demand in the name of Amazon Web Service (AWS) and is accessible to any users over Internet through the URL aws.amazon.com. Amazon Elastic Compute Cloud (Amazon EC2) and Amazon Simple Storage Service (Amazon S3) are some of the well-known services of AWS. The users can hire computing power from Amazon EC2 as and when required and they will be charged only for what they use. Users can store their large volumes of data in Amazon S3 and can avoid buying expensive storage servers.

Cloudbees is a cloud service provider that offers PaaS to develop and run web applications. It also integrates the various services offered by AWS including Amazon VPS, Amazon S3, Amazon Dynamo DB, etc. Integration of Cloudbees with AWS provides tremendous

flexibility and simplicity in the development and deployment of applications.

Android is a linux kernel based mobile operating system developed by Google and is basically designed for mobile devices with touch screen viz. smart phones and tablets. It provides specialized user interface for televisions, cars and wrist watches. Android is one of the widely used mobile Operating Systems. Google Play Store serves as the official app store for the Android OS and it is being operated by Google in which android OS based applications can be downloaded either for free of cost or for a payment. The applications can be directly downloaded to an android device from the PlayStore mobile app. New applications can be uploaded to the PlayStore via Google play developer console.

SQLite is an open source database. SQLite helps high quality relational database peculiarities like SQL syntax, transactions and arranged articulations. The database obliges restricted memory at runtime (approximately 250 KByte) which makes it a decent candidate from being installed into different runtimes. SQLite is implanted into each Android gadget. Utilizing a SQLite database as a part of Android does not oblige a setup system or organization of the database. One just need to characterize the SQL statements for making and upgrading the database. A short time later the database is naturally overseen by the Android stage. Access to a SQLite database includes getting to the record framework. This could be moderate. In this way it is proposed to perform database operations non-concurrently.

PHP is a web improvement server-side scripting language which is additionally utilized as broadly used programming language. PHP code might be essentially blended with HTML code, or it could be utilized within blending with different tempting engines and web frameworks. PHP translator is generally used to process a PHP code, which is typically executed as a web server's local module or a CGI programmable.

A cloud database is a database that normally runs on a Cloud Computing platform, for example, Amazon EC2, Rackspace, GoGrid, and Salesforce. There are two regular arrangement models: clients can run databases on the cloud freely, utilizing a virtual machine image, or they can buy access to a database administration, kept up by a cloud database supplier. Of the databases accessible on the cloud, few are SQL-based and few utilize a NoSQL data model.

2. Surviving Techniques

Chieu *et al.* (2009) discussed primary scaling of Web applications in virtual cloud computing platform [1] in which versatility is different in gaining various undertakings at present included in working together on the web. Cloud computing [2, 3] gives efficient processing model that allows clients to access assets on-interest. They presented scaling methodology with steering and adjusting client appeals in front-end load-balancer. The drawback is virtualized cloud computing environment aims at dynamic scaling of web application at threshold but fails below threshold level and scaling approach for back-end load balancer

Deng *et al.* (2010) focused applications of distributed storage are worth specifying, firstly it is lower layer of cloud base, and secondly it is the foundation of virtualization [7]. The drawback is Cloud storage aims at two areas in the field but fails at upper layer of the cloud infrastructure which supports the functions of layers below it.

Wahib *et al.* (2011) proposed embedded web services using cloud applications [2, 10]. Cloud Application aims at web service deployment to be used by applications residing in the same cloud but fails for external calls from other clouds.

Koufi *et al.* (2012) conveyed android enabled mobile service for cloud emergency medical

services like usage of Personal Health records (PHRs) [12, 15]. Emergency medical systems accessible by android enabled mobile devices. Cloud EMS fails at providing aid for similar type of symptoms of disease.

Ghorpade *et al.* (2013) discussed framework for executing android applications on the cloud. At present, smartphones are very common which run various types of applications. This made life of users simpler as various things can be accessed via single touch. For this, author proposed a cloud based virtual environment which can protect stored data. Android emulator [25] can be used for the execution of android applications in a system. Execution of cloud applications on the cloud aims at android activity which waits for result in background but fails to reduce file transfer cost.

Makhija and Hemarjani (2013) conveyed android based application framework and cloud computing for C language [23]. Under the MHRD, access to helpful data have been made. This application can be run on Aakash tablet using Sakshat web entry. Setting up a server and sending application on cloud to test scope of diverse gadgets. Implementation of SAAS aims at providing various software as a service but fails to provide service on lower version of android.

3. Architecture

The architecture of cloud storage has been divided into various modules and these are following modules:

- 3.1 Amazon Web Service
- 3.2 Local Database for Web and Android
- 3.3 Bookcafe as a Web Application
- 3.4 Bookcafe as an Anroid Mobile Application

3.1 Amazon Web Service

The Amazon web service has been provided by the third party called as CloudBees. It provides all services of Amazon without any cost or credit card involvement and acting as mediator between Amazon web services and BookCafe. After successful signup it provides a set of services

Repositories at cloud , Builds at cloud , Application at cloud and Databases at cloud

CloudBees enables the users to access the Amazon Web Services which provides a complete set of services covering the entire life cycle of an application from coding to testing, debugging and deployment of the application. To develop this application, Amazon web service has been used as database storage. CloudBees on behalf of Amazon provide fully functional and managed MYSQL as Database-as-a-Service (DaaS). CloudBees SDK has to be downloaded to maintain a remote connection with remote database. Configuration of the database is provided as 5MB with 20 connections for storage by DaaS. MYSQL Work-Bench is used to run SQL script to fetch the data, modify, add or delete data to the database.

3.2 Local Database for Web and Android

The database to maintain homogeneity in the web and android consists of five tables and this database is situated in the server. Copy of database is updated in the Amazon database provided as DaaS periodically since the number of connection to cloud database is restricted

and as well as number of queries per day is also limited. So for this cron job is performed to update Amazon database based on the number of queries per day.

3.2.1 Database

The server database consist of five tables namely book, bookparts, login, register and votedbook. The Figure 3 show five tables which are kept on phpmyadmin and php script is used to interact with database and perform operations on the database.

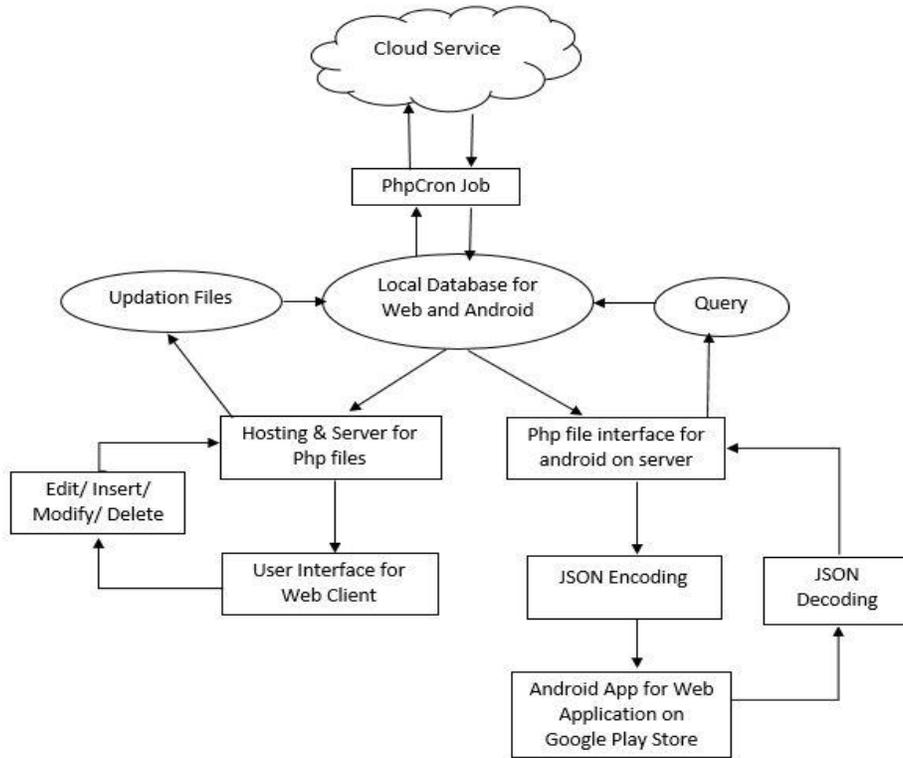


Figure 1. Architecture of Cloud Storage for Android and Web

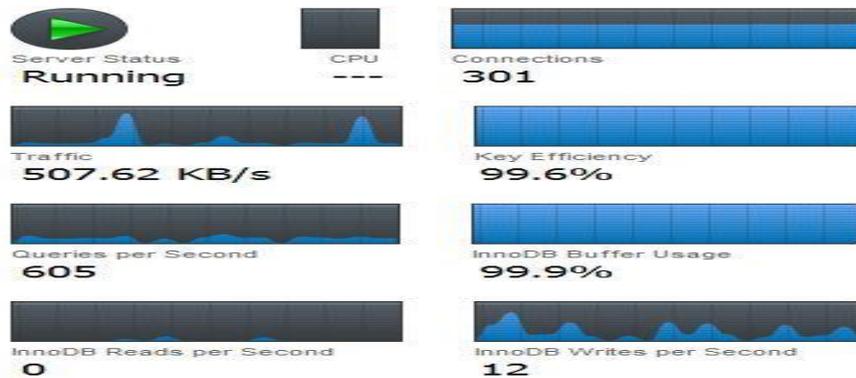


Figure 2. An Instance of Cloud as DaaS

Table	Action	Rows	Type	Collation	Size
book	Browse Structure Search Insert Empty Drop	1	MyISAM	latin1_swedish_ci	3.1 KiB
bookparts	Browse Structure Search Insert Empty Drop	1	MyISAM	latin1_swedish_ci	2.2 KiB
login	Browse Structure Search Insert Empty Drop	1	MyISAM	latin1_swedish_ci	5.1 KiB
register	Browse Structure Search Insert Empty Drop	1	MyISAM	latin1_swedish_ci	2.1 KiB
votedbook	Browse Structure Search Insert Empty Drop	0	MyISAM	latin1_swedish_ci	1 KiB
5 tables	Sum	4	MyISAM	latin1_general_ci	13.4 KiB

Figure 3. Database of Five Tables

3.2.2 Book

The table book has the following attributes book(uid, bid, bookname, bookcover, cat, readcount,created). It has bid attribute as primary key for table and it is auto-increment and it has attribute like name of the book, path to the cover of the book and category it falls and date it is created as timestamp value as given in Figure 4.

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	uid	int(255)			Yes	NULL	
2	bid	int(11)			No	None	AUTO_INCREMENT
3	bookname	varchar(200)	latin1_swedish_ci		Yes	NULL	
4	bookcover	varchar(255)	latin1_swedish_ci		No	None	
5	cat	text	latin1_swedish_ci		No	None	
6	readcount	int(11)			Yes	1	
7	created	date			Yes	NULL	

Figure 4. Table Book

3.2.3 Book Parts

This table contains the parts of the book as chapters. Here bid is foreign key and part number act as primary key and story keep the whole information of the chapter its whole text as shown in Figure 5.

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	bid	int(10)			Yes	NULL	
2	partno	int(10)			No	None	AUTO_INCREMENT
3	story	text	latin1_swedish_ci		Yes	NULL	

Figure 5. Table Bookparts

3.2.4 Login

This table keep the login credentials for the user to login. It has following attributes such as uid which act as unique user identification for user, then it has role which describe it is a user or admin of the site, username is the primary key which is login id, password is store as an encrypted form using md5 technique. It also contain email id and last login which user has and it is stored by calling mysql function now().

#	Name	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	1 uid	int(255)			No	None	
<input type="checkbox"/>	2 role	varchar(10)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	3 username	varchar(200)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	4 email	varchar(200)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	5 password	varchar(200)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	6 lastlogin	timestamp		on update CURRENT_TIMESTAMP	No	CURRENT_TIMESTAMP	ON UPDATE CURRENT_TIMESTAMP

Figure 6. Table Login

3.2.5 Register

The register table has seven attributes namely uid, username, email, gender, register date, password, address, profile picture. This table stores all information of the user during the registration process and profile updating.

#	Name	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	1 uid	int(255)			No	None	AUTO_INCREMENT
<input type="checkbox"/>	2 username	varchar(200)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	3 email	varchar(255)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	4 gender	int(2)			No	None	
<input type="checkbox"/>	5 registerdate	date			No	None	
<input type="checkbox"/>	6 rpass	varchar(200)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	7 name	varchar(200)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	8 mobile	int(100)			Yes	NULL	
<input type="checkbox"/>	9 address	varchar(255)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	10 picture	varchar(255)	latin1_swedish_ci		Yes	NULL	

Figure 7. Table Register

3.2.6 Voted Books

This table maintains the number of votes a book has gain after it has been published for reading and is used for providing most read books available in the web application.

#	Name	Type	Collation	Attributes	Null	Default
<input type="checkbox"/>	1 bid	int(11)			Yes	NULL
<input type="checkbox"/>	2 uid	int(11)			Yes	NULL

Figure 8. Table Votedbooks

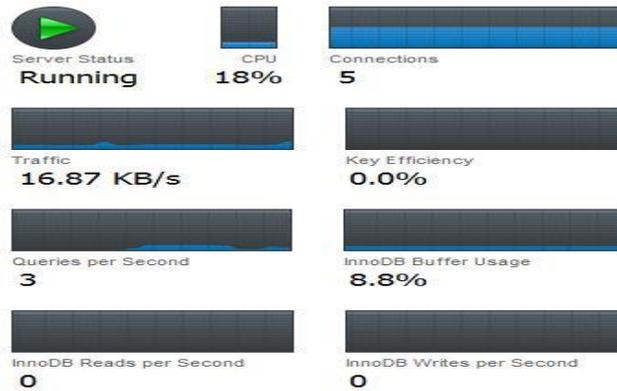


Figure 9. An Instance of Local Database

3.3 BookCafe as a Web Application

BookCafe provides web interface for the new users to register themselves and then login into the web application using their account credentials. Users are privileged to write new books of various categories like engineering, commerce or stories. It also provide a platform to new writer to show their skills of writing books.

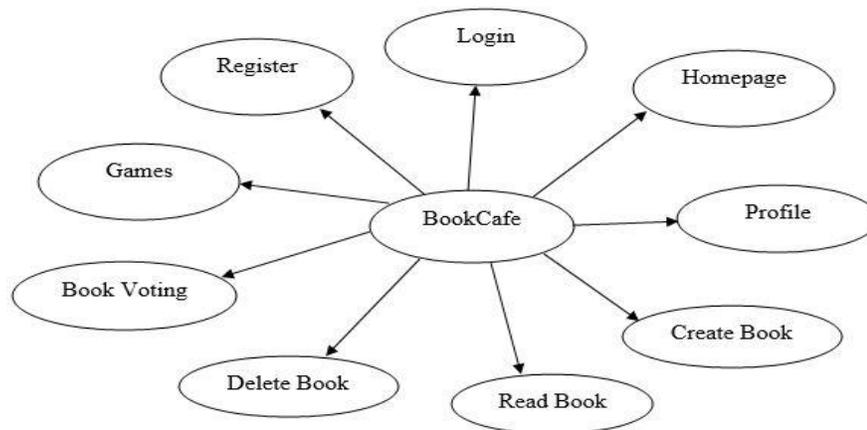


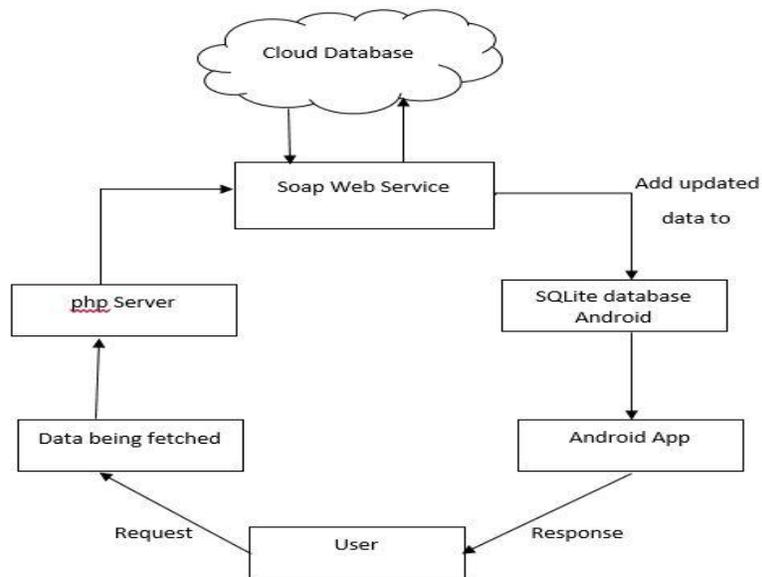
Figure 10. An Overview of BookCafé

The web interface is connected by php a scripting language to the amazon cloud services and it is stored on the server which enables the users to connect whenever they want. A cron job is performed for the modification in the amazon cloud database as DaaS. Games are also provided for the purpose of the entertainment.

3.4 Bookcafe as an Android Mobile Application

It provides the android version of the web application BookCafe. It aims to provide ubiquitous application which is available anywhere whether on handheld devices or computers. This application consists of the following components.

1. Cloud Database
2. PHP Script
3. SQLite
4. SOAP Web Service



3.4.3 SQLite

SQLite is a software library of database in android that provides a self-contained, server less, with zero configurations, transactional SQL database engine. SQLite is the widely deployed SQL database engine in the android application. It is server less means it does not require any other process or system to operate. It is zero configurations mean no setup or administration is required. SQLite can be stored as single file disk and it is very small and light weight whose size is around 400 KB which is fully configured and it is around 250 KB which is less configured. Since it is self-contained so it does not have any dependencies. SQLite transactions are fully ACID-compliant allowing safe access from multiple process and threads. SQLite is written in ANSI-C and available on UNIX.

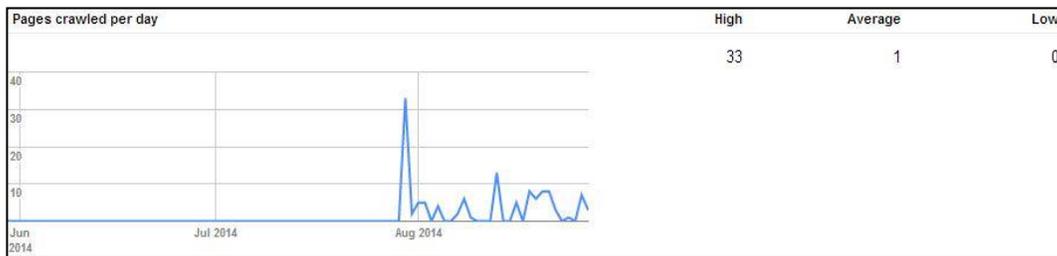
3.4.4 SOAP Web Service

It is simple object access protocol. It is a communication protocol between two applications in cross platform. SOAP is a format of sending messages. SOAP is platform and language independent and it is based on XML. Usage of soap web service involves following steps between php script and android application.

- i) For setting up php soap web service one needs nusoap package.
- ii) After download and setting up the nusoap in php environment it have following pseudo code

Algorithm:

- a) First need is include the nusoap library in the code for providing web services. Then need to include database connection file to fetch data from cloud.
 - b) One has to provide the url of the service one is going to use.
 - c) Then include wsdl extension url to get the service.
 - d) Now create new instance of SOAP server by calling new soap_server in nusoap.
 - e) Configure the WSDL file by the namespace.
 - f) Now one need to register all the function that one is going to provide in the web service.
 - g) After all this one need to provide definition of the function in the file.
 - h) Start the service to accept connection for web service.
- iii) After setting up the server in php script this wsdl xml based file is used in android for making queries to the database.



4. Tools Used

Various tools have been used for the creation of BookCafe as web application and android application. The various tools used are the following

- 1. XAMPP
- 2. Eclipse
- 3. Android SDK
- 4. CloudBees services as DaaS
- 5. MYSQL WorkBench
- 6. PHPMYADMIN
- 7. Remote Server (www.2freehosting.com)

The essential requirement of BookCafe are:

- Android Smart Phone
- With version in the range of 2.2 till 4.4
- With Internet connection or Wi-Fi connection

5. Experimentation and Performance Evaluation

5.1 Experimental Setup

Amazon web service has been used for cloud database storage to develop the Bookcafe web application and android application. Cloud computing offers remote services like content delivery, storage, networking and databases. BookCafé describe an application for writing and reading books of various categories and made these books available on their handheld devices such as smart phones. Online web application contains the user interface for signing in to access books and read and write books. This paper is very useful for the students who can read books anywhere.

5.2 Performance Evaluation

5.2.1 Bookcafe Web Application Performance

The site is being index in Google by using Google web master such that it provide the statistics regarding the performance of the site such that it help developer to understand it's efficiency and performance. Here are the some parameters that need to discuss such that

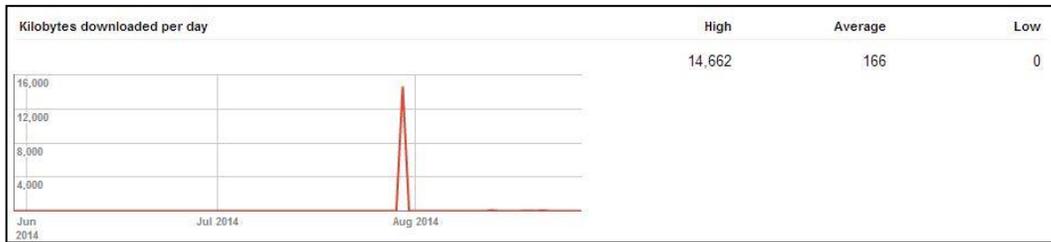
- i) Pages Crawled
- ii) Data Downloaded
- iii) Time for loading page

Pages Crawled

The site went live on July 2014 and data is being consider for the three months of June, July and august such that it shows the highest pages being crawled is 33 by robot of Google and average being around 1 per day.

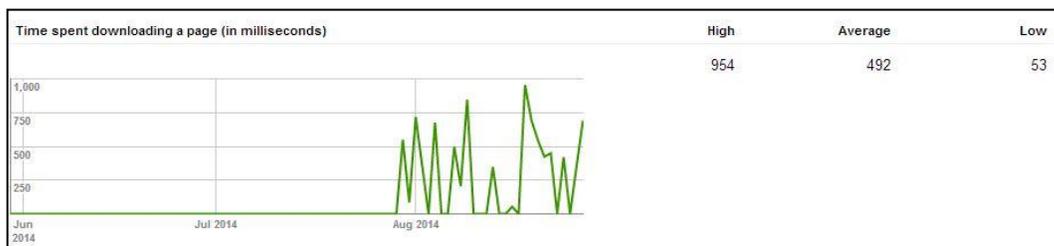
Data Downloaded

It is the amount of data being transferred between user and the web application .It shows amount of data being transferred and bandwidth being used. Here it shows the highest bandwidth use is 14662 KB per day and on average it is 166 KB per day.



Time for Loading Page

It is the amount of time spend in loading a particular page by server on client machine. Here it shows the time spend loading page is highest being 954 ms and average being 492 ms and it been as low as 53 ms to load a page.



5.2.2 Bookcafe Android Application Performance

The android application is being index in google by using google play store such that it provide the statistics regarding the performance of the application such that it help developer to understand it's efficiency and performance. Here are the some parameters that need to discuss such that

- i) Current Installs by User
- ii) Current Uninstalls by User
- iii) Daily Installs by User
- iv) Daily Uninstalls by User
- v) Current Installs by mobile carriers

Current Install by User

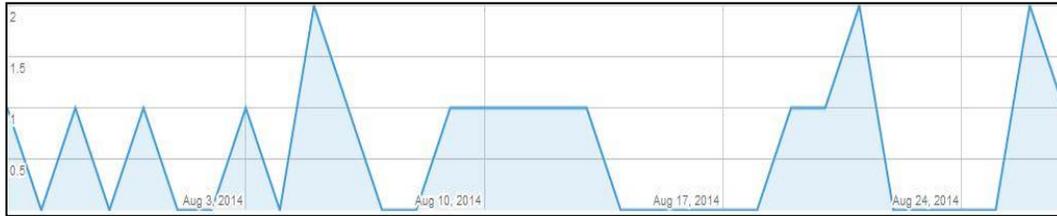
It shows currents install by user on their android device such that it reaches at it peaks at 14 installation on particular day and as low as 0 installation on particular day.



Current Uninstalls by User

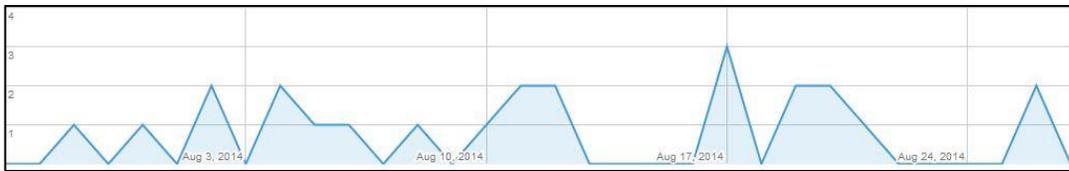
It shows currents uninstall by user on their android device such that it reaches at it peaks at 2 uninstalls on particular day by user from their android device and as

low as 0 installation on particular day.



Daily Installs by User

It shows daily install by user on their android device such that it reaches at it peaks at 3 installation on particular day and as low as 0 installation on particular day and thus maintaining at least 2 installation per day.



Current Installs by Android Version

It shows details installation according to android version on android device such that it reaches at it peaks at 5 installation on particular day and as low as 2 installation on particular day and thus maintaining at least 2 installation per day according to particular android version.



5.2.3 Current Installs by Carriers

It shows installation according to mobile carrier. Such that it gives information that how much which mobile carrier contribute to android device installation and downloading of the application. It is shown that Airtel, Sprint, TMobile, Verizon Wireless, contribute to 16.66% installation by device with their respective mobile carrier.

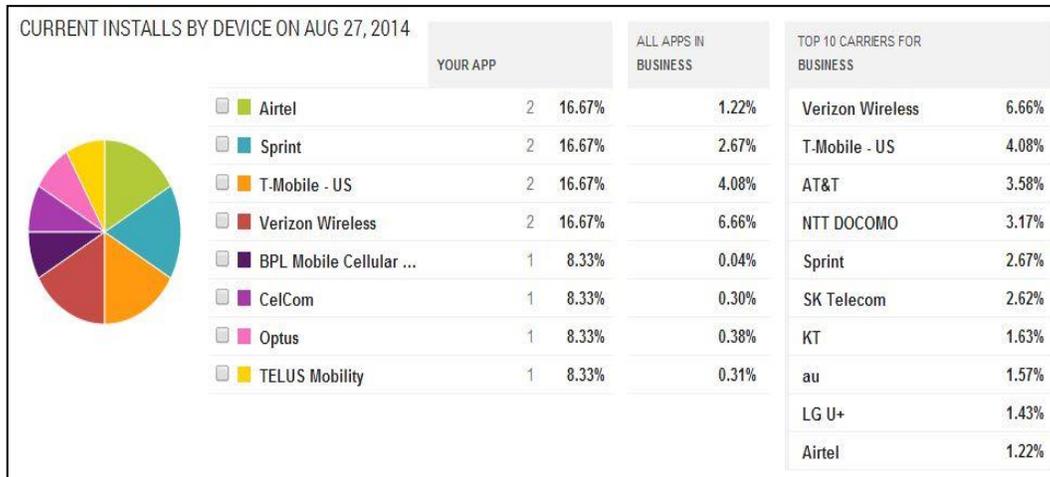


Figure 11. Current Installs by Carriers

Performance

Performance of the application is measured on the basis of three features where their feedback is provided by the user. Accessibility, Responsiveness and UI friendly

Accessibility

It is parameter that how site is accessible, it is there is occurrence of any problem that user faces while accessing the application whether on android or on web. From the feedback of the user we have achieved following accessibility performance which is 4.6 out of 5. We have taken a scale of 5 to record the input from user about accessibility

$$\text{Accessibility} = \frac{\sum \text{user accessibility input}}{\sum \text{number of users}} = 4.6 \text{ on the scale of } 5.$$

UI Friendliness

This parameter has been used to gain how user friendly the application is using reading and writing books. The feedback obtain from user on scale of 5 it shows the following user interface friendliness.

$$UI = \frac{\sum \text{user interface friendliness input}}{\sum \text{number of users}} = 4.5 \text{ on scale of } 5$$

Table 1. Sample Feedback by Users

name	email	responsiveness	user interface	accessibility
aju	ajinkya91123@gmail.com	4.1	4.2	4.1
chitti	chittiiit42@gmail.com	4.9	5	4.3
imran	imranahmedvit@gmail.com	4.8	4.2	4.6
pratik	pratban@gmail.com	4.2	4.9	4.3
ranit	rankitdua@gmail.com	4.2	4.7	5
sameer	sampatel91@gmail.com	4.9	4.3	4.7
shubham	shubhambajpai@gmail.com	4.2	3.9	5
sati	sjanghel@gmail.com	4.5	5	4.8

Responsiveness

This parameter is used to test how responsive application is whether android or web. It measures delay it is taking in measuring the response user is getting and it based on entirely on the feedback of user.

$$\text{Response} = \frac{\sum \text{user response input}}{\sum \text{number of users}} = 4.4 \text{ (on scale of } 5.)$$

This is the structure of the feedback which has been designed for the user to give feedback to user site responsiveness and accessibility and it user interface easiness.

5.3 Implementation Overview of Bookcafe

Bookcafe Web Application

This is home page of web application of bookcafe. It provides interface for user to upload, write books for those who want use their desktop or laptops. It also provide interface who want to read books online on their desktop. This bookcafe application not only provide interface for reading and writing books but also provide a platform for entertainment to play games online and it also include profile creation of the user who want to read the book and play games such that it provide individual functionality of the web application. It also include search system which shows books based on the number of reader of that particular book or user can search book by author name or by title of book or by can genre of the book they want read such that this search system will also display books closet to match user want to read.



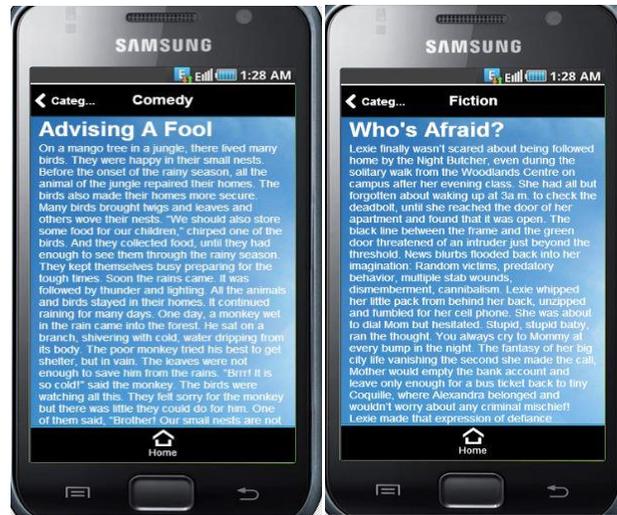
Bookcafe Android Application

This is android version of the application that user want to access the books on their mobile or on their tablet such that this application of android provide flexibility to read book on the go. User do not have to worried of the system they have to carry laptop or desktop to read or write their favourite books. The first screen shows the home page of android application where it displays information of the developers who created the application and login trigger to enter into the application.



The second screen shows the categories of the books the user want to read such that user can select books depending upon the choices available. This list includes categories like engineering, medical. For example, it shows two categories of which books are shown. The user can read books online on their tablet or smart phones. Such that user get facility to read books on the go or where ever they like to read book. Such that user get ubiquitous environment for reading and writing books.

Therefore this android application is very useful and friendly to read and write books whenever and wherever they like. It is ubiquitous application whether web or android.



6. Conclusion and Future Work

Cloud Computing is a computing which depends on sharing of computer resources instead of handling applications on personal devices or local servers. A cloud database is a database that normally runs on a Cloud Computing platform. Android is mobile OS which is portable working framework focused around the Linux kernel that is presently created by Google. BookCafé describes an application for writing and reading books of various categories and made these books available on their handheld devices such as smartphones and also via Online web application through cloud. Both web and android had their own advantages. Hence combined the advantages of both and made it better in writing and reading books. This application is very useful for students of any university who can read desired books and also can upload non existing books from anywhere. Our future work is to extend it for editing books in android application.

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Authors



Imran Ahmed is currently pursuing post-graduation at VIT University Vellore, Tamil Nadu in Computer Science and Engineering stream. He has done Bachelor of Technology in Computer Science and Engineering from University Institute of Engineering and Technology, CSJM University, Kanpur. His major interest work area is Cloud Computing, Artificial Intelligence and Web development.



Satish Janghel is currently pursuing post-graduation at VIT University Vellore, Tamil Nadu in Computer Science and Engineering stream. He has done Bachelor of Engineering in Information Technology from Shri Shankaracharya College of Engineering and Technology, Bhilai. His major interest work area is Cloud Computing, Software Testing and Android development.



Dr. N. Ch. S. N. Iyengar (born 1961) is currently Senior Professor at the School of Computing Science and Engineering at VIT University, Vellore-632014, Tamil Nadu, and India. His research interests include Agent-Based Distributed secure Computing, Intelligent Computing, Network Security, Secured Cloud Computing and Fluid Mechanics. He has authored several textbooks and had nearly 167 research publications in reputed peer reviewed international journals. He served as PCM/reviewer for many international journals and conferences. He is Editor in Chief for IJSEA of AIRCC, Guest Editor for SI: Cloud Computing and Services of Int'l J. of Comm.N. and Sys. Sc., and Editorial Board member for Int. Journals like IJConvC (Inderscience -China), IJCA (USA), IJAST (SERSC), etc