

STUDY OF MODERN OPERATING SYSTEMS OFFERING FUNCTIONALITIES FOR MOBILE COLLABORATIVE NETWORK

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Abstract. Today, people have recognized that the communication data access should not be the ultimate goal of Mobile Phone. Mobile Computing and the ability to support cooperative work on mobile terminals are becoming more significant in the present era. People can access the data, files and other resources, connected to the system, remotely. One can use to the machine in other city virtually. One of the issues which need to be addressed in the above stated scenario is operating system support. Many operating systems are developed that support the mobile collaborative work. They offer many advanced functionalities in protocols, communication properties, data formats and concrete technologies. All these functionalities need sophisticated and supporting hardware to be implemented. In this paper we would highlight the functionalities of the current systems that they offer in the field of the mobile collaborative work. These functionalities are concerned with the issues like bandwidth, data security, system's safety and speed of data movement.

Keywords—Mobile Collaborative Network; PDA; Symbian; Distributed Network; Groupware systems; OSs; Mobile Computing

I. INTRODUCTION

In today's world, mobile computing (MC) is getting more attention than before due to an increased user interest in mobile devices such as laptops, PDAs, tablets or smartphones etc day by day [14]. Following the success of desktop computers and laptops, the latest market trend shows a rapid increase in the use of smart phones that are capable of performing most of the computation tasks themselves that a personal computer is capable of doing. Every individual whether he is a child or an adult possess at least one such computation device.

This can be clearly seen in our daily life as a poor man also either possess a mobile phone or has access to it. It has altered the way of doing business. One of the major aspects of mobile computing is portability [1]. One can access the server and the resources, connected in the system, remotely. It has become possible to use computing capability without a pre-defined direct connection, to a network to publish or subscribe to information.

The rapid and accelerating movements towards the use of mobile technologies have provided individuals and organizations with the ability to work in novel and previously unanticipated ways [9]. Along with the exponential improvement in performance & capacity of wireless communication systems, the information can be easily accessed using mobile devices.

In order to improve their framework and rising up data coverage, the mobile networks are spending a large amount. The continuous advances in mobile technology are impacting user life. Many corporate organizations have adopted this form of communication for their expansion. These have the potential to provoke even more radical changes in work practices and even greater level of mobile work and distributed collaboration [13]. Great advancements have been made in the field of the communication channels.

Technologies about mobility can be divided into two generations; in the first-generation, the technologies focus on the ability to access information everywhere. Their solutions included e-mail, calendaring, messaging and tracking. Hardware requirements for this connection were also very high [10]. Special high quality hardware electronics were designed, that support such communication system.

The second-generation technologies are on their way right now, as a number of authors have commented, research on collaborative mobile work is now beginning to emerge as an important field in mobile computing [15]. Not only hardware, but the software support for mobile collaborative work, is also of great importance. Special software system has to be adopted that offers the required features.

Today a large number of operating systems provide the facility of mobile collaboration. These operating systems have to include special features for the making the collaboration between the devices more facilitated and useful.

The motivation behind this study is to identify the features introduced for mobile collaboration. There are many requirements which must be taken into account for the mobile collaboration. These features enable the system to transfer large amount of data by increasing the bandwidth of the system. This data should not be accessible by anyone else except for the desirable persons. To help this problem, operating system has to include the features of data security. Data safety is another important requirement regarding mobile collaborative work. Otherwise it would not be possible to make sure that there are no two connections that do not affect each other. These are the basic features that the operating systems offer for mobile collaborative work. With the advent of new technology so many features have been introduced in addition to these features.

Users have been raising concerns on the security of feature enhancement of mobile collaboration. In order to get active participation from users for mobile collaboration functionalities, the vendors need to address the user concerns appropriately by either accommodating their requests in later versions of mobile devices or help the users understand the perspective of device vendors, so that both parties are on the same page. This will not only resolve misunderstanding among consumers but also help them to figure out future direction of mobile market collectively. This will reduce the hurdles in path of technical growth of mobile market by securing user trust and their involvement in the technological advancement.

This paper is organized as follows. Section 2 reports the literature survey on different operating systems used for mobile collaborative network. In section 3, we propose some issues related to the features introduced for mobile collaboration scenario. Section 4, covers the results and discussions. In section 5, we conclude our work and in section 6 we proposed future directions.

II. LITERATURE SURVEY

Mobile collaborative work is becoming popular in business domain day by day. It has made possible to work in groups when people are working form remote areas. Everyone share expertise across sites and domains. Some of the employees may move from a location to another carrying devices (such as PDAs and laptops) in which they store documents.

In the past, efforts had been made to achieve the consistent mobile communication. Then the work was done to transfer the computing on the mobile devices. This has evolved the systems supporting mobile collaborative work. This communication was much faster using LAN and wired technologies. These wireless systems are very slow as compared to LAN, but they have provided considerable amount of facilities for the users. With the passage of time the usage and responsibilities of LAN were transferred to wireless networks. Mobile technology is improving since then. All the modern operating systems provide the enormous features regarding mobile collaborative work.

The main focus of the writer [1] is on the testing of three main environments for mobile devices that are hardware, software and network. The writer discusses each environment in detail and then generates results that show clear differences amongst the three environments.

A prologue of mobile computing is presented by the author [2]. Devices including personal digital Assistant (PDA), Smartphone, tablet computer, ultra-mobile PC, and wearable mainframe are compared. Also, operating systems such as Symbian, android, windows are also explained to a great extent. The restrictions of mobile computing are nominated, described and subjected by the author.

Based on the analysis and data collected, a concise idea about the market trends on cellular phone operating systems can be described. In addition to this the author [3] specifies and compared the various natures of different operating systems. This document also generates a few key points that could help the users to purchase the operating systems according to their work nature or personal interests.

The battle of operating systems in the world of smart phones is still in process. Diversity of Smartphone operating systems presents a dispute to device designers and software developers [4]. Nevertheless, studies about different Smartphone OSs and their rivalry are exceptional. As the first study to analysis all the major OSs under a standardized ecosystem frame, this paper increases the acquaintance on Smartphone OS market.

Many techniques are used to provide help and support to the software designing. Models for input and output of the data should be carefully implemented in such a way that supports the modeling of the system. There are a large number of distributed and collaborative systems that use agent based models [4]. Hierarchical systems may also be implemented, where many subsystems are present. These subsystems are interactive and tightly coupled. The typical methods and techniques can be adapted according to the requirements of the system design.

Android operating system is the main subject of discussion now days [6]. The potential security threats in android and some steps to overcome the problem are mentioned in accordance. The background and the future of operating systems in smart phones is the basic need for introducing any new feature in the OS [7]. Cell phone invention is a superlative technology. And in the next few years, internet linked mobile computing devices will drop drastically in worth and will augment in functionality. Therefore, there will be obvious victors and losers in the mobile market.

An important issue that had been tackled in the previous years is the connectivity of the mobile devices in the system. There are three modes of connectivity, i.e. fixed, mobile or ad-hoc. The fixed mode of communication is used for the devices that are permanently connected to the network system. When the users continue to move but have continuous access to the same network, in such cases the devices are connected by mobile connectivity. In the case ad-hoc connectivity mode a virtual group of users is established. All the user's computers can have either permanent network connectivity or they can be

connected to the network on irregular intervals. In this way of collaboration the processes can have several modes of availability. In this distributive collaborative network, more information transmission and information communication is required. In this collaboration of the mobile devices awareness of the collaboration should also be considered [8]. The behavior of the information transfer and dynamic location of the devices should also be taken into account along with actors and objects. The information collection in such a network of mobile devices is not an easy task.

From the various studies it has been found that android is a more sophisticated and user-friendly operating system than symbian. The android operating system not only thumps the symbian operating system on technical grounds, but also on the basis of attractiveness and sale [9]. While the Android message passing system encourages the construction of rich, mutual applications, it also introduces the possibility for assault if developers do not take safety measures.

The author [10] examines inter-application communication in Android and present several classes of impending attacks on apps. Incoming communication can put an application at hazard of malicious action and service launches. Authors describe a tool ComDroid, which can be used by developers to protect themselves from these kinds of vulnerabilities.

A contrast is made in a graphical form to describe the strong and weak points of every single operating system [11]. Modern operating systems have changed both the way, users use software and the underlying security architecture. To tackle this problem, author [12] presents the Aquifer security framework that allocates host export limitations on all data accessed as part of a UI workflow.

In the study of security of OS attacks authentication is on the bottom line [15]. Major problems are login spoofing, buggy software and Trojan Horses attacks. In fact it is a point to be noted that there is no any bigger threat which Microsoft windows faces. The main reason behind it is due to the following reasons:

- Linux operating system is having a larger user base as compared to the windows.
- Lack of root access in malware.
- Quick update procedure for Linux.

For prevention of such attacks operating system uses the following:

- Operating system can have sand boxes, which is an environment in which program execution should not affect the rest of the computer.
- While giving full functionality of operating system it gives limited interaction with outside environment [16].

The four sources of heterogeneity including Topology, Devices, User Control and Coordination should be taken into account regarding the security of operating systems [17, 18].

In home devices can be connected either to Wi-Fi only whereas some use mixture of Ethernet, some devices are having multiple connection mode.

Every device supports its own different standard. . For example, light switches may use Z-Wave.

Different users have different requirement to use operating system [17].Some home users demand Xbox off after 9PM and some need security cameras to record. Simultaneous accesses to a device with multiple tasks are in process. Such access may be avoided. For instance, a climate control application may want the window open when a security application wants it closed [18].

Mobile collaborative work has improved the corporate culture in the industry. Especially in the last decade, a lot of advancements have been made to facilitate the business processes in organizations. Middleware is needed for the communication of the local hosts in the system. Experts have developed middle ware for the integration of the business processes and their automation as well. Currently there is trend of collaborative business in the market. The importance of the business process support between the organizations, for mobile collaborative work, is greatly emphasized. The operating systems should provide the software systems for workflow groupware systems. The business processes can be automated using such systems.

III. PROPOSED SOLUTION

Mobile Collaborative is a very effective way to work in groups when users are working form remote areas. Collaboration is defined as technologies that will allow synchronous and asynchronous real time seamless interactions between individuals who define objectives and work actively and effectively to achieve these common goals participating in agreed business process. There are various mobile operating systems which are being used currently. Of all these the major three IOS, android and windows phone have been discussed in this paper. The mobile operating system most effectively fulfilling the above definition of collaboration is android which has been built by Google. Android is a Linux based operating system for mobile devices and pc tablets etc. IOS is another UNIX based mobile operating system which is developed by Apple Inc. Windows phone is a mobile operating system based on windows operating system and is developed by Microsoft Corporation. All specifications in mobile collaboration are explained with regard to the three main operating systems.

There are few issues which need to be addressed in the above scenario these are listed below.

A. OS Support

The OS used in the mobile device should be such that it supports messaging, video/audio sharing etc. The amount of bandwidth that OS can withstand directly affects the quality and the amount of data shared.

B. Bandwidth

Mobile devices are very efficient and easy way to work from large distance areas but the issue is that the cellular companies usually have high speeds but they have limited bandwidth. One work around to this dilemma is that users use Wi-Fi to

connect but the issue with Wi-Fi is that users will have to communicate in a limited space.

C. Data safety

Data safety is another important aspect which needs to be taken into consideration when working in a synchronous environment. The way around this problem is that user can first work on the data which he wants to change in an offline environment and then publish it to others. In this way the data which can be stolen during the changing phase can be saved and users can share only that data which he wants to share in an online environment.

D. Confidentiality

Confidentiality is also a debatable thing. But then mobile devices have small screens as compared to desktops and laptops and so the issue of privacy is somewhat reduced. Also the distance between the users and the device is much reduced in case of a handheld mobile device which reduces the risk of compromising of data to a large extent.

Media synchronization is another feature in mobile collaboration which is supported by all three software.

Removable storage is also a specification in mobile collaboration which is also only supported by android.

Visual Voice Mail is also a feature which is supported by also all three operating systems.

Making folders is also a feature which is supported by android and IOS. The making of different folders also helps in mobile collaboration where the owner has the right to grant access to different mobile collaboration end points to the particular folder he wants to share.

Movie store can also be considered a mobile collaborative feature which is supported by iPhone through iTunes and through android market in android phone.

Voice recognition is also a feature which is supported by all three operating systems.

Voice assistant feature is only supported by IOS. Android based phone has only one disadvantage that it only lacks in security. Built in security is only found IOS and in windows phone. Android supports safety but only thorough third party apps.

Geolocation and Auto erase are two security functionalities of IOS and it is drawback in Android based phones because they lack in these two functionalities. Geolocation functionality purpose is that if cell phone is stolen or misplaced than it has a tracker from which it can be accessed from anywhere. Auto erase is that when and if cell phone is misplaced the user can erase the data on the phone remotely.

Multitasking is another important feature in OS nowadays. Windows Phone 7 still does not have this feature whereas Android had this feature from day one. Later on this feature was introduced in IOS. The basic crux behind this feature is in Windows 7 based phone the user needs to pause the third party apps which are running in the background to do some work. Even in IOS based phone some tasks freeze until the user returns back to them. But the flip side to this feature is that not running a lot of apps in the background would consume less power.

Another aspect which needs to be taken in consideration is the lack of latest browser supports in IOS and Windows 7 based phones. Only Android based phones are there which normally do support flash in browsers.

Also another security related issue is that some features and applications on the phone demand access to the underlying hardware or firmware. Both IOS and Android based devices operate with permission based access. But their approaches are a bit different. Android application in this regard is much more sophisticated as compared to IOS or Windows based mobile OS. For example in IOS based phone if an application requires the use of user's location, the app displays a screen alert requesting permission to access the users current location. If the user denies the request the application fails and will be totally useless and the time and

Another important aspect of security is that Google allows any kind of application to be installed on Android based phones without checking its authenticity. This gives rise to many viruses and bugs in the phone. Whereas IOS and Windows based OS do checks the authenticity of the applications before distributing them in the market but one flip side to the above point is that the distribution of Android based applications is much more time saving and less costly than the IOS applications or the Windows based OS.

Also recent developments in mobile collaboration include videoconferencing, on-screen drawing capabilities, audio video sharing etc. Video calling is another important feature which is only built in Android based phones and is not included in Windows 7 based mobile operating system or in IOS based operating system.

On the other side is Android's model, which is much more sophisticated in the sense that it presents the user with a list of the application's permission requirements at the time of installing the application. The user at that point decides that it will provide the application with the following permission or not.

IV. CONCLUSION

This paper presents a robust technical analysis of the major mobile based collaborative operating system. All the mobile based OS have their own drawbacks and advantages for example Android is majorly advanced in collaborative features but the issue is that it lacks in security. IOS fulfills the security issue on its own but it takes care of the collaborative needs of the users through third party apps. Windows 7 based mobile OS also is far advanced in graphical user interface features but it lacks the built in robust collaborative features of the mobile OS which are the hall marks of today’s smart phones.

V. RESULTS AND DISCUSSIONS

A brief comparison of different features for mobile collaborative network is shown in Table 1 below.

TABLE 1. Mobile Computing Vs. Mobile Cloud Computing

OS	EXISTING FEATURES	DRAWBACKS	PROPOSED SOLUTION
ANDROID	REMOVABLE STORAGE	----	--
	MAKING FOLDERS	FIRMWARE ACCESS	ADVANCED FILE SYSTEM
	WATCH MOVIES	SLOW CONN	MOVIE STORE
	GEOLOCATION	THIRD PARTY CON	MORE AUTHENTICITY
	AUTO ERASE	SECURITY	NOTIFICATIONS
	MULTI TASKING		
IPHONE	VIDEO CALLING		
	MAKING FOLDERS	FIRMWARE ACCESS	ADVANCED FILE SYSTEM
	VOICE ASSISTANT	BROWSER SUPORT	USE LATEST VERSION
	WATCH MOVIES		MOVIE STORE
	GEOLOCATION	SLOW CONN	--
MULTITASKING	--	--	

Different proposed features along with their drawbacks are configured in the figure below.

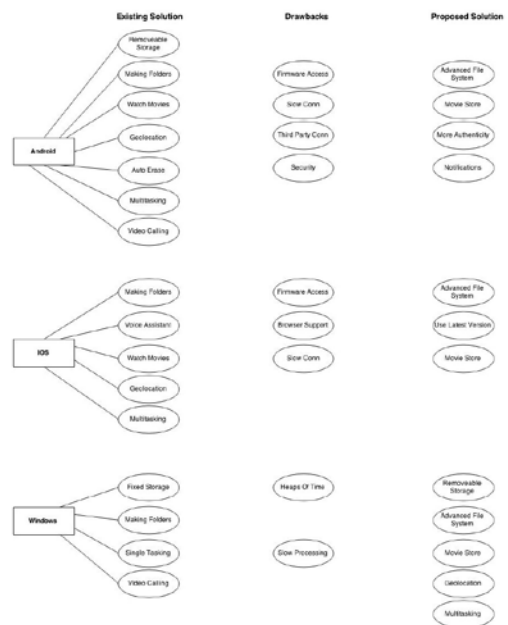


Fig.1. Comparison of different features in modern OS

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