

Chapter 5

Results

In this chapter, the author will give more comparison information from BlackBerry Operating System and Android Operating System based on technical and security views such what kernel both operating systems are using, how the synchronization works, and how the security authentication process. First, the author find what the technical aspects are which is kernel, push technology, applications, memory management, data management, synchronizing, wireless data transport, authentication, and JavaScript processing. And then for the comparison between technical perspective and user perspective both operating systems will be explained in the next chapter.

5.1 Secondary Data Collecting

5.1.1 Kernel

Kernel is the essential core of a computer operating system and it provides basic services that work in the system.

5.1.1.1 BlackBerry Kernel

BlackBerry cryptographic kernel by Research In Motion is using Firmware version 3.8.6.5 for BlackBerry device software version 6.0, and Firmware version

3.8.5.85 used for BlackBerry device software version 5.0 and it has been validated from Federal Information Processing Standards (FIPS) 140-2.

5.1.1.2 Android Kernel

Android depends on Linux kernel version 2.6 to maintain the important parts of system software. Linux kernel is a like a layer between software stack and hardware.

5.1.2 Push Technology

Push technology is an automatic data distribution technology between user's computer and the core server. Examples of push technology are email messages, calendar updates, and contact updates.

5.1.2.1 BlackBerry Push Technology

Blackberry can do everything like PDA, such as connecting itself harmoniously through push technology. Blackberry Enterprise Server or Desktop Redirector software “pushes,” can redirects like calendar updates, new e-mails, and other data directly over the internet to the user and the cell phone network.

To begin with, the software finds a new message which has arrived or the data has changed. Then, the information compressed and redirected to the handheld unit. The server uses hypertext transfer protocol (HTTP) and transmission control protocol (TCP)

to communicate with the handhelds. Thus, the data encrypted with Triple Data Encryption Standard (3DES) or Advanced Encryption Standard (AES).

After all of the parameters have been set, the software needs to wait for update the content. When the data or new message has arrived, the software formats the information for transmission and displays it on the BlackBerry. It gets e-mail messages into an electronic envelope so the user can choose whether to open or obtain the rest of the message.

5.1.2.2 Android Push Technology

Little bit different from BB, android's using Google sync to send e-mail for Gmail accounts then it will set up automatically to sync up with the device. Furthermore, Google Sync is a service from Google that supports over-the-air (OTA) synchronization of Google Mail, Google Contacts, and Google Calendar with PC and mobile device Mail, Calendar and Address Book applications. Google sync is a two way service. If changes has been made on one device it will be backed up automatically to Google account and all other devices share the same Google account will also automatically synchronized too, so the user do not have to afraid of losing device because the data is securely stored.

5.1.3 Applications

Application or application software is a collection of computer programs to support specific tasks of the users. Also, application software is called middleware, for examples Microsoft Word, Microsoft Excel, and Microsoft Power Point.

5.1.3.1 BlackBerry Applications

In BlackBerry applications, actually BlackBerry devices support BlackBerry Java Applications and BlackBerry Browser Applications. The developers create BlackBerry Applications using BlackBerry development tools or third-party development tools. BlackBerry Browser Applications are the applications based on web that the user can use to get the content of the web on BlackBerry devices.

Games on BlackBerry devices are the example of simple applications on BlackBerry Java Applications. In complex applications, BlackBerry Java Applications supported with advanced user interface and several options for data management, storage, and network communication. BlackBerry Java Applications can choose whether a client-only architecture or client/server application model. Client-only architecture is the applications that do not send or receive data from a content server. Client/server applications are that the applications send and receive data from content server.

5.1.3.2 Android Applications

The Java programming language is used for Android applications. To begin with, The Android will be operating the system a multi-user Linux system in which each

application is a different user. Each application assigned to different unique linux ID (this ID can only be used by the system and it is unknown to the application). This system will set off all permissions into one application so only the user ID that has been already assigned to that application can access them. Each process has its own virtual machine (VM), so an application's code runs in isolation from other applications. Android starts the process when any of the application's components need to be executed, and then it will shut down the process automatically when it is no longer needed or when the system must recover memory for other applications.

5.1.4 Memory Management

Memory management is to manage the computer memory which is used to store information in electronic devices.

5.1.4.1 BlackBerry Memory Management

The memory of BlackBerry device is managed by BlackBerry Java Virtual Machine (JVM). The main functions of BlackBerry JVM are performs garbage collection, allocates memory, and swap data from SRAM (Static Random Access Memory) and flash memory automatically. It is also share available memory between BlackBerry Java Application and BlackBerry device. BlackBerry device memory has three types which are flash, SRAM, and microSD expandable memory card. Flash memory is able to store BlackBerry operating system and all application modules. SRAM controls the transient data objects and runtime processes. BlackBerry memory

card, which is microSD is able to store media files, documents, and data from BlackBerry Java Application.

5.1.4.2 Android Memory Management

Android applications depend on automatic memory management handled by Dalvik's garbage collector and if the user is not conscientious with memory allocations it may cause performance issues for sometimes. Garbage collection could be very independent between applications though they are sharing some of the memory. Each application is in separate places that are in virtual machine and heaps. The Dalvik's garbage collector is currently using is to keep mark bits. With Dalvik's garbage collector, bits that indicate a particular object is "reachable" and for that the garbage should not be collected, separate from heap memory [34].

5.1.5 Data Management

Data management is to manage the device data such public data even for private data.

5.1.5.1 BlackBerry Data Management

Application Programming Interface has provided by the BlackBerry device to store the data to BlackBerry device memory. To support the API, BlackBerry has three ways which are Persistent Store API, MIDP RMS API, and File connection API. The

BlackBerry Persistent Store API and the MIDP RMS API (Mobile Information Device Profile Record Management System Application Programming Interface) are available on all Java based BlackBerry devices.

BlackBerry device saves the content to the file system directly using Java Specification Request (JSR) 75 APIs. Either BlackBerry Persistent Store API or MIDP RMS API, the user can store data to flash memory continuously. The BlackBerry Persistent Store API is created to robust data storage interface and it can save the Java objects without publish the data. The limit of an individual object is 64 KB. MIDP RMS API is to create a data store object and record the object continuously. The file connection API supports to save data directly to the file system on BlackBerry device or microSD card.

5.1.5.2 Android Data Management

Android supports some options for the users to save their application data such Shared Preferences, Internal Storage, External Storage, SQLite Databases, and Network Connection. Shared Preferences is to store private primitive data in key-value pairs. Internal Storage is to store private data on the device. External Storage is to store public data on external disk. SQLite Database is to store structured data in a private database. Network Connection is to store data on the server web network. Android manages the data by using Content Provider. Content Provider is able to store, retrieve and make data can be used to all applications. The number of content provider for data types like audio, video, and images is on android.provider package.

5.1.6 Synchronizing

Synchronizing is the computer operation to convince that files or systems in two or more locations are updated.

5.1.6.1 BlackBerry Synchronizing

The BlackBerry synchronization data can be used through BlackBerry Desktop Manager. BlackBerry Desktop Manager also can back up and restore the application database, and then the Synchronization API is used. BlackBerry Java Application built the synchronization logic. Almost all of applications send data to a server side application using HTTP or TCP/IP protocols through the Internet network. Another way is by using XML(eXtended Markup language) API to generate and parse XML the formatted data to send and receive through the wireless network. It needs to connect via USB connection using the BlackBerry Desktop Synchronization API and BlackBerry Desktop Manager.

5.1.6.2 Android Synchronizing

Android synchronize its data in a content provider and the data is stored locally. In this section, the author gives the explanation about Android synchronization through sync adapter. The sync adapter represents the account type and ContentProvider authority to the sync manager. First, the sync adapters extending the

AbstractThreadedSyncAdapter class and implementing onPerformSync() method while the sync adapter processed.

5.1.7 Wireless Data Transport

Wireless data transport is the communication through the wireless network such TCP or HTTP to get the information even to transport the data.

5.1.7.1 BlackBerry Wireless Data Transport

BlackBerry Java applications use HTTP, HTTPS, and TCP socket protocols to establish connections over the wireless network. When these applications build a connection over the wireless network, it can use one of two wireless gateways to proxy the connection to the Internet or to the corporate intranet. There is some BlackBerry Wireless data transport methods by using BES such as network gateway, using the wireless service provider's Internet gateway, using email, using SMS, and using PIN messaging to transport data.

When the user use the BlackBerry Enterprise Server as a network gateway, first, all traffic between application and BES will be encrypted using AES or triple DES encryption. The applications can communicate with application servers and web servers, because the BlackBerry Enterprise Server is located behind the organization's firewall and provides inherent data encryption. The BlackBerry MDS (Mobile Data System) Services provides HTTP and TCP/IP proxy service to allow the BlackBerry Java Application as secure gateway connections to the intranet.

By using the wireless service provider, Most of wireless service providers provide an Internet gateway that able to connect to the Internet through TCP/IP connectivity and some wireless service providers support a WAP gateway.

5.1.7.2 Android Wireless Data Transport

Android accommodates the Application Programming Interface that supports the Session Initiation Protocol (SIP) that lets the user add SIP based on internet telephone features to user applications. Android has a full SIP protocol stack and integrated call management services that set up the applications incoming and outgoing voice calls, without manage the sessions, transport-level communication, audio record or playback directly. SIP works via a wireless data connection, and then user device must have a data connection such mobile data service or Wi-Fi.

5.1.8 Authentication

Authentication is a way of process to confirm the truth whether someone or something is.

5.1.8.1 BlackBerry Authentication

The use of the BlackBerry Enterprise Server (BES) tools is permitted by BlackBerry to be given to the IT company department and to make sure the user to log in with a strong password. Furthermore, BlackBerry is also allowed the user to use

token-based two factors authentication and secure peripheral authentication. This kind of devices uses to be added (card reader for example). After the authentication policy has been set by the IT and the user cannot bypass or reset this policy on the user device. Finally, the IT can also verify something that required policies at one place and easy to deploy the devices through Over-The-Air (OTA) connections. Server-side authentication must require the user rely on HTTP authentication into the server. Also, it is able to use certificates.

5.1.8.2 Android Authentication

All Android applications must be signed with a certificate that private key is kept by developers. The certificate does not necessitate to be signed with certificate authority which means it is able to use self-signed certificates. The purpose of the certificates is to recognize application authors.

5.1.9 JavaScript Processing

JavaScript is a dynamic object oriented scripting language which is also known as functional programming language.

5.1.9.1 BlackBerry JavaScript Processing

If the browser encounters a `<script>` element, the browser itself holds the webpage to render its activities, retrieving and then executes the script and if the BlackBerry Browser finds any script that uses dynamic HTML effects, then the browser

will execute without error but produces no visual effect. The script processing is depending on the network gateway the browser such BlackBerry MDS or BIS network gateway, and WAP network gateway. If it is using through BlackBerry MDS connection or BlackBerry Internet Service network gateway, the server compile the JavaScript before sending it to device and it can reduce the time needed to process script for browser. Although the browser is blocked from rendering the web, it reduces the length of time. If it is using Wireless Application Protocol network gateway, the browser compiles the code and reads JavaScript libraries.

5.1.9.2 Android JavaScript Processing

The same rendering and JavaScript engine used by WebView as the browser and it works under the control one of the application. First, JavaScript will run inside the WebView and then call out to give a signal in Activity. This method could be used by the JavaScript to starts any kind of actions like a new activity or to fetch some data from a database or ContentProvider. The API here works so simple, it is just use the `addJavaScriptInterface()` method on WebView and the user could also pass an object methods for the JavaScript and the name the user want to use it when user want to make a call. Second, the Activity also can invoke JavaScript methods and then use the `loadUrl` method.

5.1.10 Summary Table Comparison Technical Aspect

	BlackBerry	Android
Kernel	Firmware 3.8.6.5 (OS 6.0) Firmware 3.6.5.85 (OS 5.0)	Linux kernel 2.6
Push Technology	Using BB Desktop Redirector software. Steps: - Find a new message. - Compress and redirect the information to handheld. - Update content. - New message arrived in BB.	Using Google Sync. Steps: - Two way service (Google account and device). Support OTA sync of Gmail, contacts, and calendar.
Applications	Using BB Dev. Tools. BB devices support BB Java Apps and BB Browser Apps.	Using different unique Linux ID. Only user assigned user ID can access app with permission.
Memory Management	Managed by BB JVM Allocates memory. Swap data from SRAM and flash automatically.	Managed by Dalvik's garbage collector. Garbage collection is an independent app and to keep mark bits.
Data Management	Use API to store the data to device. To support API: Persistent Store API, MIDP RMS API, and File connection API. Save content to the file system using JSR 75 API.	Use ContentProvider to store the data. To save data: Shared Preferences, Internal Storage, External Storage, SQLite Databases, and Network Connection.
Synchronizing	Through BB Desktop Manager. Steps: - BB Java App builds the sync logic. - Send data using HTTP or TCP/IP. - Or using XML API to generate and parse XML.	Through Sync Adapter Steps: - The data stored in Content Provider locally. - Sync adapters extending the AbstractThreadedSyncAdapter class. - Then, implementing onPerformSync() method.
Wireless Data Transport	Methods: using BES as a network gateway and wireless service provider as Internet gateway. Using HTTP, HTTPS, and	Methods: using SIP through API. Using SIP needs data connection. It has full SIP protocol stack.

	BlackBerry	Android
Authentication	TCP connections. BES: all traffic will be encrypted using AES or 3DES.	Integrated call management service to set up incoming and outgoing voice calls, transport level communication.
JavaScript Processing	Types: IT policy, app authentication, and server-side authentication. IT policy can verify through OTA connections. Server-side authentication: with HTTP authentication. Using BB MDS or BIS, and WAP network gateway. Steps: - If the browser found a <script> element, then it pauses the rendering, and then executes the script. - BB MDS or BIS: compile the code, block rendering web page, and reduce the length of time. - WAP: compile the code and read JavaScript library.	Types: Signing Application. Apps must be signed with certificate. The certificate does not need to be signed with certificate authority. Self signed certificates. Using WebView. Steps: - JavaScript runs inside the WebView, and give signal in Activity. - Fetch data from database or ContentProvider. - Use addJavaScriptInterface() method on WebView and name it. - Use Activity to invoke JavaScript method and then use loadUrl method.

Figure 16: Comparison BlackBerry and Android Technical Aspect

5.2 Experiment Result

In this section, the author already made some experiment about BlackBerry operating system and Android operating system through using BlackBerry Torch 9800 and Samsung Galaxy S.

First, the author tries to test both devices on May 24 and May 31 by booting both devices, checking both internal storage memory, checking the push email both devices,

and testing the internet connection through open several websites. The author reason to experiment both devices is to get more understanding while experiencing both operating systems rather than just get the information from secondary data collecting. First, the author tries to check both the internal storage memory and get the result which are BlackBerry Torch has 4 GB internal storage, and Samsung Galaxy S has 16 GB internal memory. After that, the author tries to test both email synchronization through push email and found out the result that BlackBerry Torch is able to synchronize all emails include Hotmail, Gmail, and Yahoo without any additional configuration, meanwhile Samsung Galaxy S needs to have additional configuration such change their setting internet connection protocol until the device is synchronize. A week after, the author also wants to try the performance of both processing by booting both device together and the result shows that BlackBerry is almost 2 minutes to be ready to use, and the Samsung Galaxy S is only needs about 30 to 40 seconds to be ready to use, and one of the factor that makes the difference is the different processor while BlackBerry is using 624Mhz and Samsung is using 1Ghz. The author also wants to know about the internet connection through testing into some websites like facebook.com and hotmail.com. The result of BlackBerry needs approximately 15 to 25 seconds to open both websites with 60 to 80 % of 3G signal, and the result of Samsung needs approximately 5 to 15 seconds to open both websites with 60 to 80 % of 3G signal.

The author also compare user interface both device, and the result is Samsung Galaxy S is more attractive to the user such more animation while changing widgets, opening, or closing applications. Also, Samsung Galaxy S has Super AMOLED that makes the screen is easy to see when the device is straight down to the sunshine and it makes

better user friendly rather than Torch. Here is some of the user interface result picture both devices:



Figure 17: Samsung Galaxy S Widget Example

From this picture, it shows that it using the Buddies application which is Social Hub that able to connect to Facebook, Twitter, and MySpace just in one single application. Also in the right picture, it shows the Daily Briefing that needs the internet connection in order to check the currently weather, financial, and even news.



Figure 18: BlackBerry Torch Widget Example

From this picture, it shows that in “All” widget that shows all the applications on device such Messages, Social Feeds, Camera, etc. Also, it has Favorites, Frequent, Media, and Downloads widgets to make it more interactive by sliding right or left, or using the track pad to left or right.

In order to find the truth of BlackBerry applications and Android applications, so the author counts the total of both devices. For BlackBerry, it used the BlackBerry App World and counts the total applications and found out the result is 31.546 free and paid applications on BlackBerry App World. For Android, the author just found around 20.000 free applications and did not want to continue because in Android market, it is not shown the total applications on each category and it still has so many applications. However, in BlackBerry App World it is written the total applications on each category.

Here is the summary of the author experiment table:

	BlackBerry Torch 9800	Samsung Galaxy S
Booting	almost 2mins to be ready	30-40sec to be ready
Push Email	All emails are able connect to device.	All emails are able connect to device but it should have additional configuration.
Internal Storage	4 GB	16 GB
Open Website	15-25 sec	5-15 sec
User Friendly	Less attractive interface than Android	More attractive and innovative interface than BB
Apps	31.546 free and paid apps	Just found 20.000 free apps

Figure 19: Experiment Table

5.3 User Survey Result

Here is the result based on ten (10) users' survey from non IT and IT. It is just want to know about people's opinion. The questionnaire is used to capture 10 users' suggestion about the comparison BlackBerry and Android OS as additional information not used for statistical data.

1. Have you ever used any Smartphone?

a. Yes

b. No

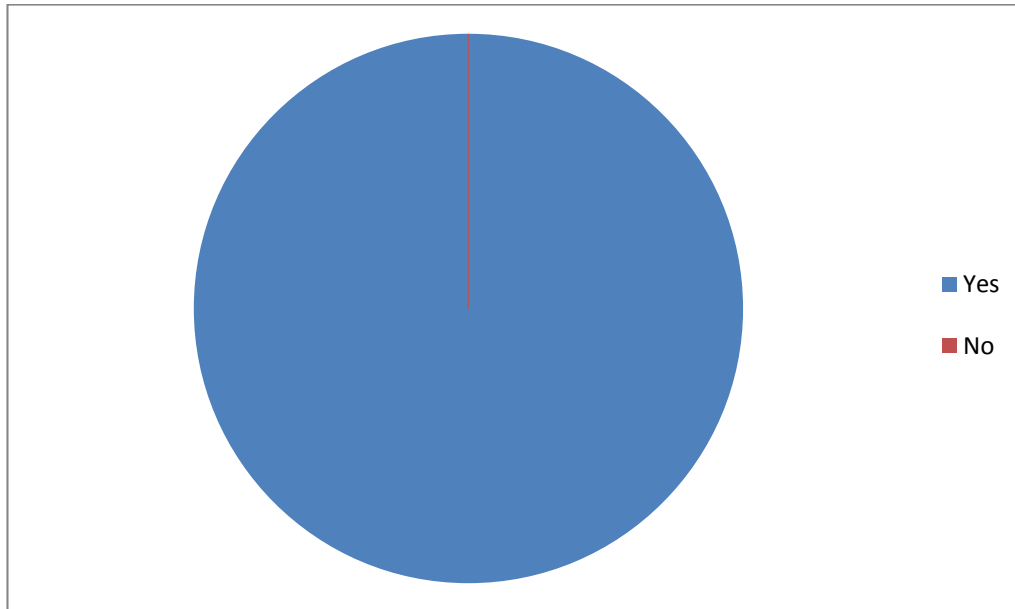


Figure 20: Have you ever used any Smartphone?

From the result, it shows that all respondents are ever used any Smartphone.

2. Do you know about Android?

a. Yes

b. No

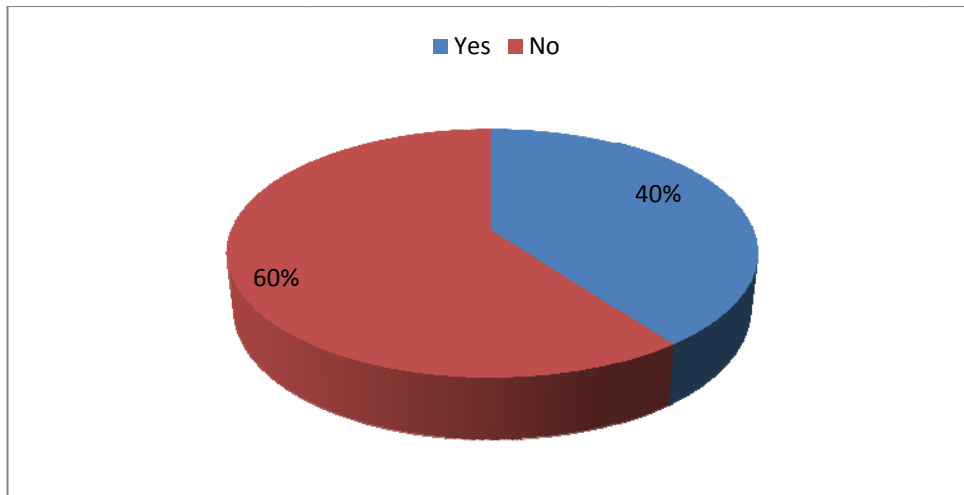


Figure 21: Do you know about Android?

It shows that only 4 people know about Android, and 6 people do not know about Android.

3. What are your most favorite Android features?
 - a. Open Source
 - b. Instant Messaging (YM,MSN,etc)
 - c. Multi Touch Screen
 - d. Multimedia (Camera,Video,Audio)
 - e. Other

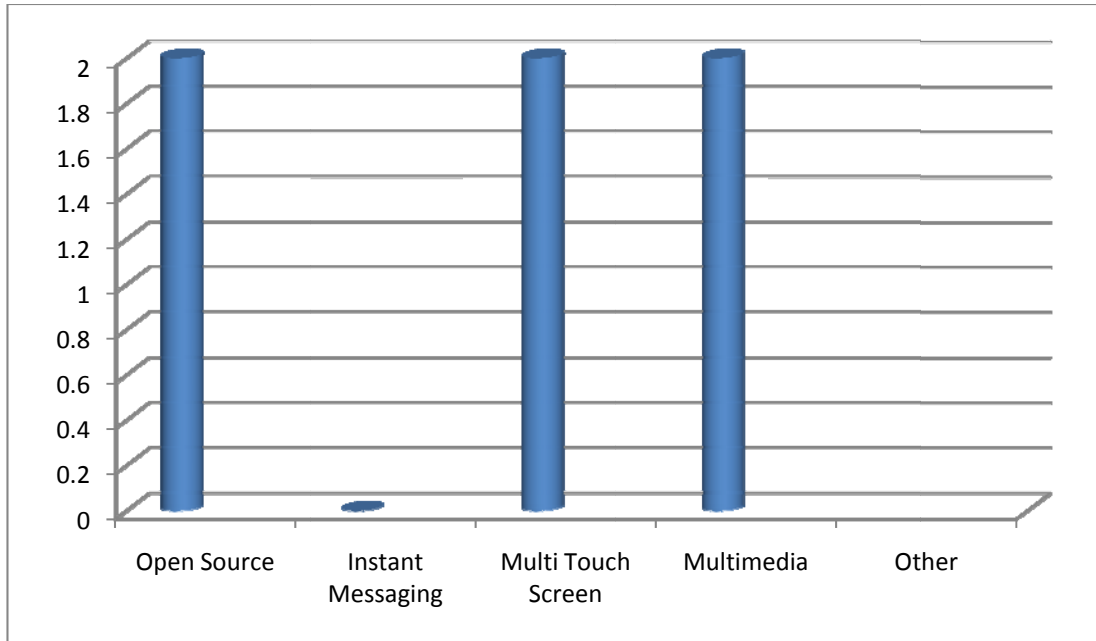


Figure 22: What are your most favorite Android features?

Based on the statistic, it shows that Instant Messaging, Multi Touch Screen, and Multimedia have been chosen each of 2 people as their most favorite Android features.

4. Do you know about BlackBerry?
 - a. Yes
 - b. No

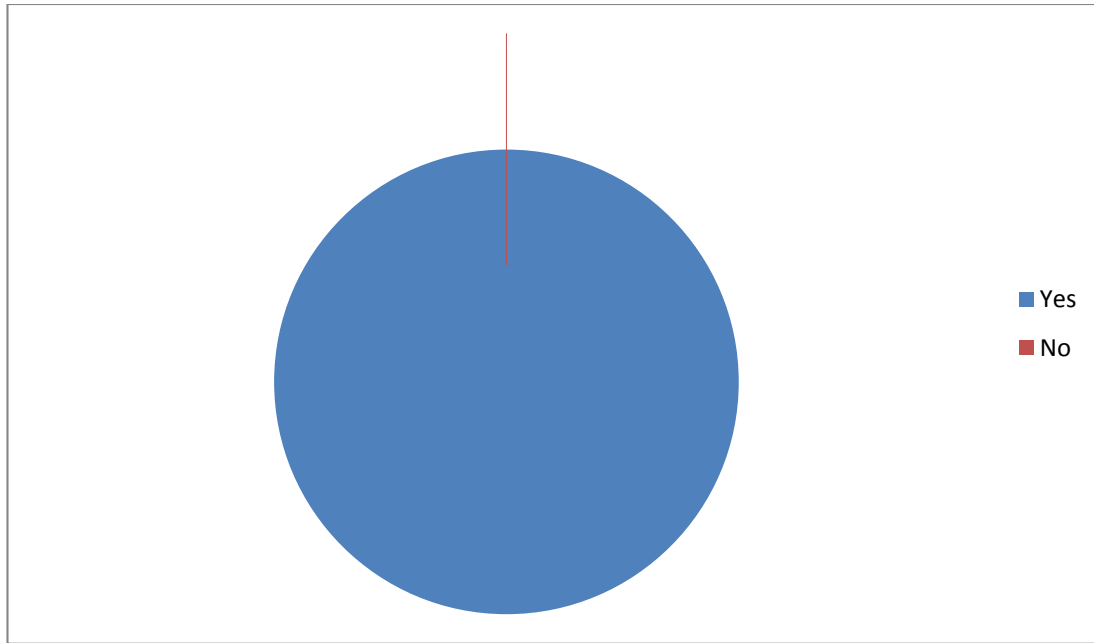


Figure 23: Do you know about BlackBerry?

From the result, it shows that all respondents know BlackBerry.

5. What are your most favorite BlackBerry features?
 - a. Instant Messaging (BBM, YM, MSN, etc)
 - b. GPS
 - c. Multimedia
 - d. Browser
 - e. Other

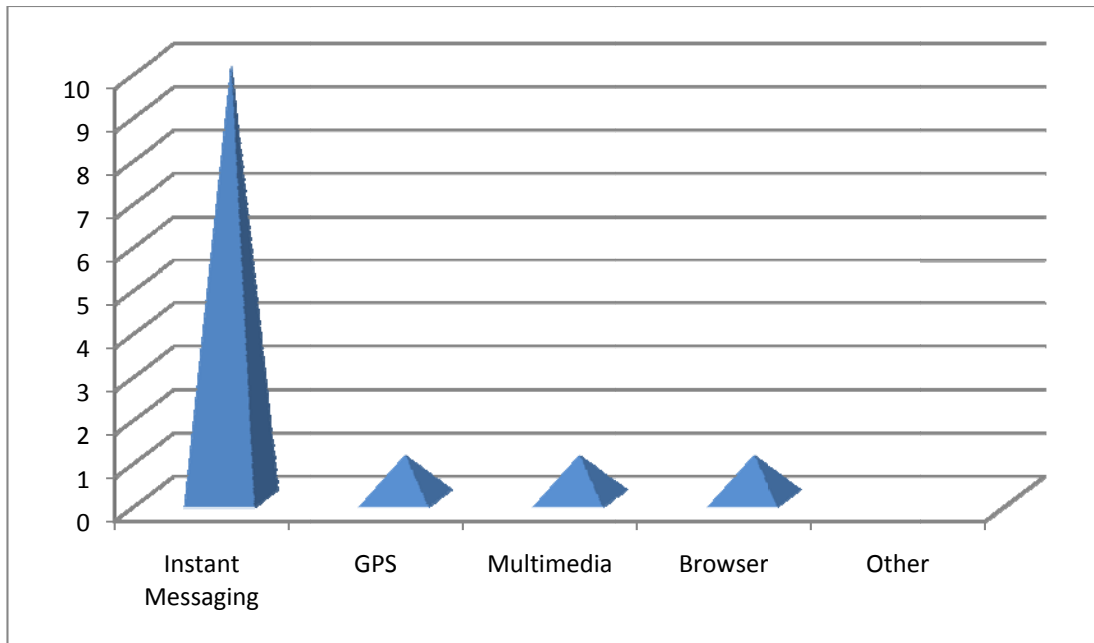


Figure 24: What are your most favorite BlackBerry features?

It shows that 10 people choose Instant Messaging as their favorite BlackBerry features, followed by GPS, Multimedia, and Browser.

6. Either Android or BlackBerry, which one do like prefer?
 - a. Android
 - b. BlackBerry

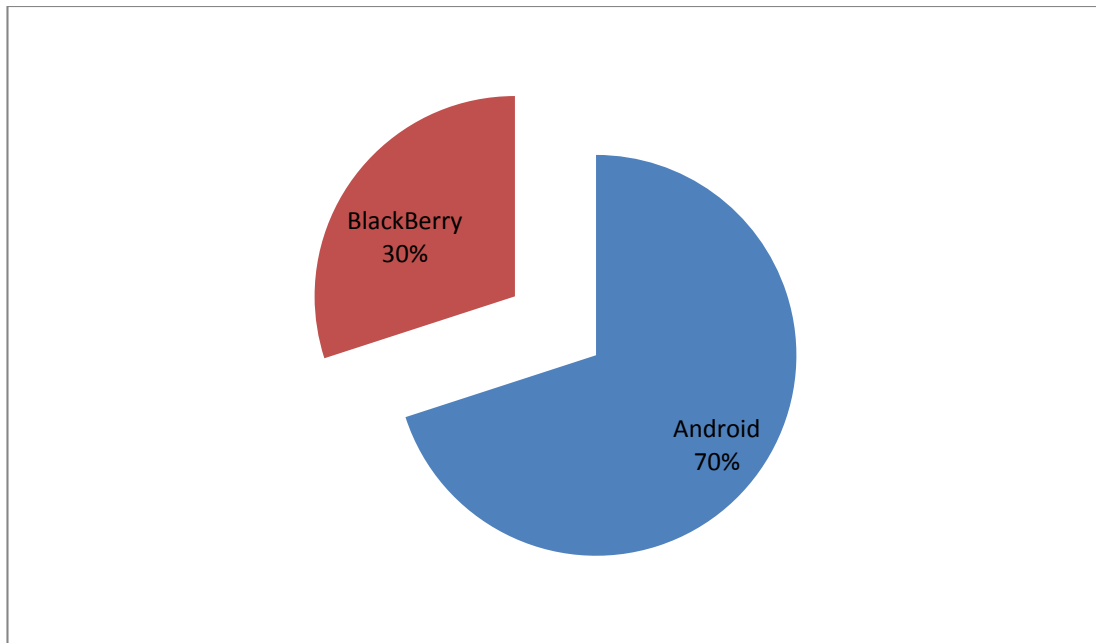


Figure 25: Either Android or BlackBerry, which one do like prefer?

From the result, it shows that only 3 people prefer to choose BlackBerry, and 7 people prefer to choose Android.

7. Why?
 - a. Open Source
 - b. Fast Processing
 - c. User Friendly
 - d. Multifunctional
 - e. Good Communication
 - f. Up-to-date Information
 - g. Other

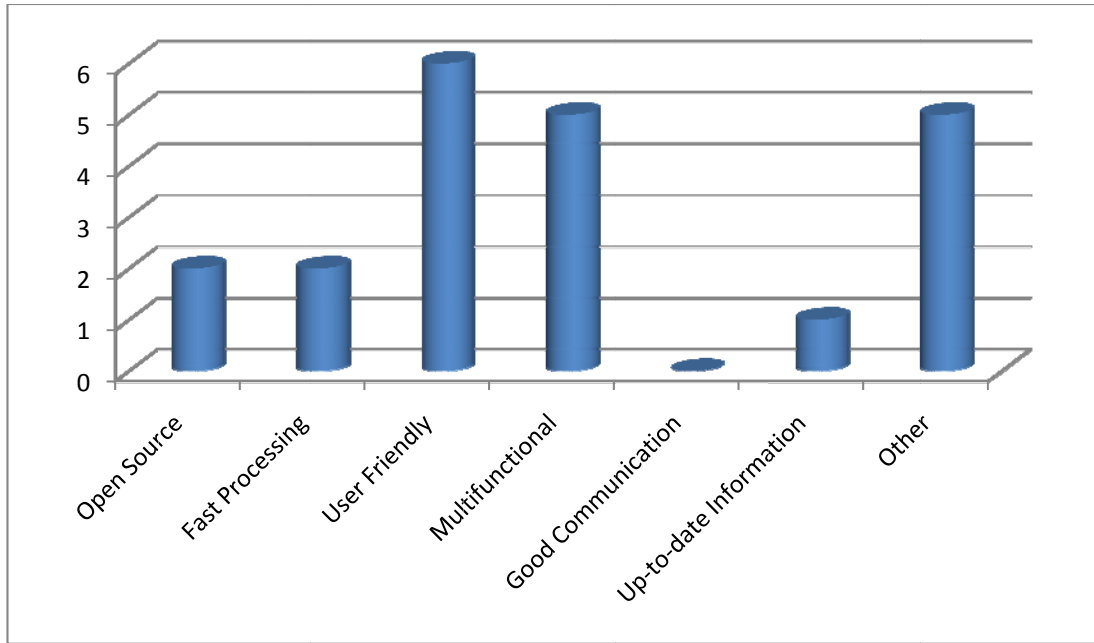


Figure 26: The Reasons are

The reasons are various. User friendly is the most reasonable either people to choose BlackBerry or Android, followed by Multifunctional and other reasons such as Android has more features compared to BlackBerry, and Android has more applications than BlackBerry, also for development purposes.

The purpose of using this user survey is to find out about the reason people are choosing either BlackBerry or Android and compared their opinion with technical aspect and user aspect as additional information. Based on the survey, it shows that people need a Smartphone that is easy to use or user friendly, and has multifunctional on its features. All respondents know about BlackBerry and not all respondents know about Android due to its new common technology. BlackBerry has Instant Messaging such as BlackBerry Messenger as favorite features based on people's opinion; however, Android has multi-touch screen, and multimedia that support its features.