Android vs. iOS

A critical analysis of the open vs. closed debate between Google and Apple

Introduction

On October 18th, 2010 Steve Jobs, CEO of Apple, made a rare appearance at the 4th quarter 2010 earning call of Apple. He publicly spoke out against Google Android and said, “Google loves to characterize Android as open, and iOS and iPhone as closed. We find this a bit disingenuous and clouding the real difference between our two approaches” (Snell, 2010). He went on to say that the real debate lies in ‘fragmented vs. integrated’. Android is very fragmented, has 100 different versions on 244 different handsets and the user is left to figure out how the Operating System (OS) works. This as opposed to the iPhone where every handset works the same and uses proprietary software with an integrated App Store (Snell, 2010). Briefly, the debate is between Android and iOS, both trying to dominate the mobile market. Android is open source and the iPhone uses the closed source iOS. The two different approaches, open and closed, are at the centre of the debate. The statement of Steve Jobs already implies the importance of this ongoing debate between open and closed mobile platforms. Tim Berners-Lee further shows the importance of this debate in a recent article, ‘Long Live the Web: A Call for Continued Open Standards and Neutrality’. In this article he said the following:

[Not] using open standards creates closed worlds. Apple’s iTunes system, for example, identifies songs and videos using URIs that are open. But instead of ‘http:’ the addresses begin with ‘itunes:’ which is proprietary. […] The iTunes world is centralized and walled off. You are trapped in a single store, rather than being on the open marketplace. For all the store’s wonderful features, its evolution is limited to what one company thinks up. (Berners-Lee, 2010: 83)
But is the debate really about the dichotomy open vs. closed? This paper will provide a constructive contribution to this debate by mapping it in order to find out if the debate is really about open vs. closed or if this dichotomy is used as a strategy to position the platforms in the mobile market. This paper will also find out how fragmented and integrated fit into the debate and if the debate is translated beyond Google and Apple. To accomplish this the framework of discourse analysis combined with (the) Actor-Network-Theory will be used. This model is a strong analytical method for mapping the routings of an ongoing discourse (Van den Boomen and Schaefer, 2005: 38).

The importance of an academic view of this debate is further shown in the fact that there has been little academic research done in relation to Google Android and it is openness. There is one thesis that showed a critical analysis of the openness of Android (Svačina, 2009). Research has also been done on the security mechanisms of Android (Shabtai, 2009). But the open vs. closed debate between Apple and Google, the scope of this debate and the dichotomy has not yet been researched on an academic level.

The debate will be viewed in the light of mobile technology, the Operating System iOS of the iPhone, the open source operating system Google Android and the mobile phone ecosystems of Google and Apple. It will also take into account the Terms of Service, End-User License Agreements and technical design of these Operating Systems (OS). Closely related and therefore also included are the iTunes App Store and the Android Market (both can be used to buy applications for the iPhone and Android phones). This paper will also look at other domains such as legislation and network neutrality in relation to both the systems. Furthermore openness will be seen as a concept. Geert Lovink already argued that ‘open source’ is not just about software but is a utopian dream for some and a business model for others (2003: 196). Also Mirko Schaefer and Marianne van den Boomen argued that “[o]pen source functions as a generative and transformative concept, so that the term ‘open source’ can itself be described as an open concept” (31). This paper is in line with these researchers and also argues that ‘openness’ is a concept because this will help to understand the position of the term openness that Google Android advocates in this debate.

The structure of this paper is as follows. Firstly, to get a better understanding of
what exactly is meant with the terms open, closed, integrated and fragmented. This paper will start with discussing these concepts in terms of meaning and implicitness. Secondly, this paper will map the debate, the various participants and argue whether or not the terms open and closed are reflected into the technical design and licenses of both systems. Lastly, this paper will draw conclusions based on these findings.

**Defining open, closed, integrated and fragmented**

*Openness and fragmentation*

According to a post on the Official Google blog, openness means open technology as well as open information. Open technology can be split into the categories of open source software (for example Android) and open standards (Rosenberg, 2009). These two are not to be confused with each other but are linked to each other in the sense that open standards are used to build (or at least part of) Android. The open source nature of Android means that customers have the freedom to choose whichever Android mobile device they want. According to Eric Schmidt (CEO of Google), Android is the inverse of what Apple does with iOS. This means that with Android the developers have the freedom to use whichever tools they want, they can choose on which platform they develop the applications and Google does not have to approve the application before it is added to the App Market (Ha, 2010). But other claims by representatives of Google show that it is more than the opposite of Apple. Any Rubin (VP of engineering at Google) said in an interview “this is the definition of openness: it's not just open source, it's the freedom to get the information that you're actually looking for […] openness is the means by which you get the product that you want” (Krazit, 2009). In 2007 he blogged “Android is the first truly open and comprehensive platform for mobile devices” (Rubin, 2007).

Karl Svačina has done research into the openness of Android, a phenomenological and empirical study into how designers, operators and users experience the openness of Android. Svačina made the following remarks about the term open “when Android claims to be open, this claim relates not only to the

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1 Open standards are standards that can have any committed expert involved in the design, that have been widely reviewed as acceptable, that are available for free on the Web, and that are royalty-free (no need to pay) for developers and users (Berners-Lee, 2010: 82). Examples are HyperText Markup Language (HTML, xHTML, HTML5), Cascading Style Sheets (CSS), JavaScript and the Internet Protocol (IP).
software development model. It also relates to the platform's openness towards new applications, new devices and new uses. By saying that it is open, Android implies that it is suitable and desirable for a wide variety of uses” (2009: 8). These uses also include modification and distribution. The term open also implies a business model where the revenue does not come from selling the mobile platform (Van den Boomen and Schaefer, 2005: 39). Additionally, it implies a certain type of governance, or lack thereof; the more restrictions the less open the system becomes. A question arises here, how open is Android really? Svačina found several discrepancies between what Google claims to be open and how developers, operators and users perceive this openness. In his conclusion Svačina stated that “Android is open for mobile operators in that they can make changes to the platform, but at the same time, taken from the perspective of users, these very changes may in fact mean ‘closing’ the platform” (65). It can be stated that open is certainly not truly open as Andy Rubin claims it is; openness is a concept that can be fitted to one’s needs.

Fragmentation can be seen as an implication of the open source nature of Android. It can be split into two categories, device- and ecosystem fragmentation. Device fragmentation simply means that the different devices that Android runs on all have different specifications. Ecosystem fragmentation means that many customized versions of the OS emerge as well as the variety of App Markets and the many different carriers and OEMs that are involved (Fuld, 2010; Paul, 2010a). Both types of fragmentation imply measurements and restrictions to prevent the challenges that they bring with them. Fragmentation can cause compatibility issues because applications that are built for one version of Android might not work (or not as good) on other versions. And as pointed out by Peter Vesterbacka of Rovio, the company that has developed the mobile game Angry Birds, “Android is growing, but it is also growing complexity” (Fuld, 2010). The complexity that the fragmentation inherits is another challenge for Google.

Closed systems and integrated systems

Closed systems are characterized by the fact that they run proprietary software. A metaphor used to describe these kinds of systems is ‘Walled Gardens’ (Berners-Lee, 2010; Lyons, 2010). The spokesmen of Google characterize iOS as

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2 Original Equipment Manufacturer (OEM), a manufacturer of equipment that may be marketed by another manufacturer. HTC for example is an Android OEM (Dictionary of IBM and Computing).<http://www-03.ibm.com/ibm/history/documents/pdf/glossary.pdf>
closed (and as the opposite of what they are doing). At the 2010 TechCrunch Disrupt, Eric Schmidt defined closed systems as Apple having its own development tools, hardware, marketplace and they have to improve the application that you submit. In addition he said that Android and openness is about adding choices (Viticci, 2010). In another interview he went as far as saying that “Apple is an extreme expression of a closed system” (Harrison, 2010). Furthermore, the source code of iOS is not available for download and cannot be modified by everyone. The term closed implies more than what Eric Schmidt claims to be the opposite of Android. The term closed implies a certain type of business model which is Apple having the sole control of how they develop and update it. Closed systems are centrally controlled and deployed by commercial concerns (Galloway, 2004: 148). Secondly, it implies a close relation and exclusive deals with the carriers, this to ensure that the ecosystem stays closed. Furthermore, it also implies a restriction on communication when it comes to explaining the policies, controversies and technical design.

Apple has reserved the right to reject apps from the store and to determine what is supported on the OS, but characterizing it as the extreme expression of a closed system is a negative connotation. There are federal regulators who ensure that the system stays open enough and does not become entirely closed. The term closed is too strong; systems are never truly closed. This will become more apparent when sketching the Actor-Network of this debate.

Having discussed closed, what does integrated mean? With iOS, the desktop, mobile, browser and media experiences are integrated across service layers, hardware and software (Sigal, 2009). According to Steve Jobs, ‘integrated’ means that the services and products are directly integrated into the device. The App Store is integrated into the iOS and directly available for the consumers to use when they first use the device. It is a unified system where Apple is the hardware and software integrator and it allows (according to Jobs) for a better user experience (Sigal, 2009). Another example of an integrated system that Steve Jobs mentioned at the 4th quarter earnings call of Apple is the Nexus One phone.

3 A video of this can be viewed at Macstories.net. The video is originally by TechCrunch TV. Eric Schmidt’s remarks about the term open as being the opposite of closed systems are around the 31:00 mark.

<http://www.macstories.net/news/eric-schmidt-weighs-in-on-apples-closed-system/#ooid=9kZnBxMTrIdcnP__Wdccc4ohMKpzbtmz>
(Snell, 2010). The Nexus One is an Android phone made by HTC and sold by Google via an online store. In May 2010 Google decided to discontinue the online store and chose a different business model for selling the Nexus One. Therefore distancing themselves from the integrated approach and opting for fragmentation, many vendors now sell the Nexus One instead of just Google. Also calling iOS an integrated system gives it a less negative connotation as opposed to calling it a closed system.

Having discussed the meaning of the terms, it is argued in this paper that closed is not as closed as the term implies. Furthermore, Android is not as open as Google claims it is, and this will become even more apparent when mapping the various participants in the debate. With this in mind, the Actor-Network of the different approaches will be sketched.

**Mapping the debate**

The framework of the Actor-Network-Theory from Bruno Latour will be used to map the various actors in the open vs. closed debate. This theory takes humans as well as non-humans actors into account, both have agency and influence other actors. It is the actors that shape and fuel the discourse about the different approaches. The network of this debate is formed by a complex and intertwined dynamic between the Apple, Google, the spokesmen of the companies, the users, the developers, the Federal Communications Committee (FCC), the Electronic Frontier Foundation (EFF), carriers and OEMs, policies, and the technical design of the mobile phones. To structure this chapter the categories set forth by Mirko Schaefer in his dissertation *Bastard Culture* will be used. These categories are popular discourse, technical design and legislation. On the level of popular discourse the various participants communicate their ideas and discredit their opponents. At the level of technical design the ideas are implemented into the technology. Legislation is the means by which the ideas and technological concepts are manifested and regulated in the law (230-233). The categories are used because they give a good indication of the scope of the debate and they cover human as well as the non-human actors.

Shortly after the announcement of the first iPhone it was rumoured that Google was developing a gPhone, a phone that would be the iPhone-killer (Rubin, 2007).

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4 The Nexus One was sold via an online store which was located at: [http://www.google.com/phone/]
And shortly after the launch of the first Android phone (the T-mobile G1) articles on blogs and in magazines started to compare the different approaches of Google and Apple when it comes to the App Markets and application development (Chen, 2008; Burrows, 2008). It wasn’t until 2010 when the debate gained momentum and Eric Schmidt began to state that what they are doing was the opposite of Apple (Richmond, 2010). Google and the Open Handset Alliance (OHA)\textsuperscript{5} use the already existing discussion about open vs. closed systems as a vehicle to discredit Apple and they use the dichotomy as a unique selling point for Android. Furthermore, they stimulate a shallow open vs. closed discussion with their statements. A close look at the debate between the companies will show if this debate has any right of existence or if it is a false dichotomy.

Both companies firmly believe that their approach is the right one. Steve Jobs said in a Newsweek interview in January 2007 that “[y]ou don’t want your phone to be an open platform […] [Y]ou need it to work, when you need it to work” (Eckler, 2010). Jobs communication is more reclusive than the spokesmen of Google, usually speaking at the World Wide Developer Conference and the MacWorld event. But his e-mail correspondence has linked him directly to users and developers, as Ryan Tate of the site Gawker dubbed it ‘Steve Jobs Is Opening Up Apple One Email at a Time’. For example, a developer e-mailed a question about changes in the terms of the iPhone SDK. Steve Jobs responded by pointing him to a post by John Gruber explaining why Apple has changed section 3.3.1. Jobs also stated that Apple wants to safeguard iOS against sub-standard apps and processes that hinder the platform (Slepak, 2010). At the 2010 4\textsuperscript{th} quarter earnings call of Apple, Steve Jobs advocated his integrated approach, allowing for the seamless integration between the Mac OS X, developers, the market and focusing on user experience (Snell, 2010).

The spokesmen of Google on the other hand seem to be much more public and out in the open. Eric Schmidt and Andy Rubin both have worked at Apple and speak at multiple conferences a year and give several interviews. When Android

\textsuperscript{5} Here is some more information about the Open Handset Alliance (OHA) and what they are trying to accomplish can be found on their official website. “The [OHA] is a group of 79 technology and mobile companies who have come together to accelerate innovation in mobile and offer consumers a richer, less expensive, and better mobile experience. Together we have developed Android™, the first complete, open, and free mobile platform. We are committed to commercially deploy handsets and services using the Android Platform.” <http://www.openhandsetalliance.com>
was announced (November 5th, 2007), the OHA stated in a press release that Android is “the first truly open and comprehensive platform for mobile devices” (Open Handset Alliance, 2007). They want to change the mobile ecosystem and “[b]y providing developers a new level of openness that enables them to work more collaboratively” (Open Handset Alliance, 2007). Keep in mind here that Google is a company that needs to make revenue. As Andy Rubin stated at the Mobilize ’09 conference, “what good is for the internet is good for Google. […] Google’s core business is advertisement” (BNET, 2009). If a lot of Android devices are sold, it will drive more searches and advertisement income to Google.

In the next section it will become clear how the battle between the two approaches unfolds in the technical design, the corresponding licenses, and the App Store and Android Market policies. The section will also show whether or not the terms open, closed, fragmented, and the visions of the spokesmen are reflected into the design and licenses.

Technical design

For Android the supported development environment is Eclipse. This is the officially supported environment, using the Android Development Tools Plugin. But developers can also use JDK5, JDK6 and Apache ANT 8. Development can be done on a Windows, Mac or Linux Computer. Additionally the source code of the OS and the SDK are freely available for download. This indeed reflects some of the openness that Google advocates, freedom of choice for the developer.

For iOS application development the developer can use the Xcode, which is included in the iOS SDK, but third party development tools are allowed as well. The decision to allow third party tools was recently made by Apple, loosening their development restrictions (Miller, 2010). The source code for iOS is not freely available for download but the SDK is. Furthermore in 2007 Steve Jobs stated on the official Apple website that iOS is open for 3rd party developers and he wants to create a vibrant developer community around the iPhone with lots of new applications for the user (Jobs, 2007). This does not entirely reflect the closed nature of Apple that Eric Schmidt described. He explicitly said that you have to use Apple’s tools.

Some common ground between the two companies can be found, namely the

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6 The requirements for the Android SDK: <http://developer.android.com/sdk/requirements.html>
push for open standards. Both systems support open standards, for instance the Open Graphics Library (OpenGL) standard for visualizing 2D and 3D data. Both companies are pushing for HTML5 support. At the 2010 Google Atmosphere event Eric Schmidt said that the most interesting development for Google has been the arrival of the HTML5 standard. He went on to say that “everybody but Microsoft has embraced [HTML5] as the next step in browsing” (Williams, 2010). But a clash can also be seen here, one of the main discursive nodes in this debate. Steve Jobs made a lengthy statement about why iOS is not supporting Flash, calling Adobe Flash proprietary; it has technical drawbacks and Adobe wants developers to adopt Flash to create applications. He then demonstrated his support for open standards and the push for HTML5 (Jobs, 2010). Flash is still not supported on iOS but it is supported on Android. Do keep in mind here that a large portion of Apple’s revenue comes from selling the iPhone, iPods and iPads (all running iOS). If Flash hinders the platform and its user experience it could hurt their revenue. This in contrast to the business model of Google. Their main source of revenue lies in advertisement and Google does not actually sell Android to its users.

Both operating systems have restrictions incorporated in the technical design of the systems. The iOS has security measurements to detect modification. For example the iBrick issue that hit the headlines in September 2007. Trying to upgrade the firmware of the iPhone after un-locking (removing the simlock) the phone with unauthorized unlocking software would lead to an iPhone that would not do anything anymore, making the iPhone as useless as a brick (Miller, 2007). Also incorporated into the design are security measures to prevent the installation of unauthorized applications (which are not available in the iTunes App Store).

7 The Apple iOS reference library provides more information about what The Open Graphics Library (OpenGL) does “[it is] used for visualizing 2D and 3D data. It is a multipurpose open-standard graphics library that supports applications for 2D and 3D digital content creation, mechanical and architectural design, virtual prototyping, flight simulation, video games, and more” (Apple, 2010c).

8 Firmware is software imbedded into a hardware device. Refers to software that is stored on a chip in a digital device, such as a handheld computer or a digital camera, which is often used to control the internal functions of the device. Firmware maintains essential operational information and preserves critical timing and other settings when the power is turned off. It is not uncommon for firmware to require upgrading, which can usually be done via a software interface (Rutenbeck, 2006).
The restrictions on Android are, amongst others, that the carriers and OEMs can simlock the phones. Un-locked phones are available in some countries but come at a higher price. Despite being truly open as Google claims it does not give the user full control over the device. The agency of the carriers and OEMs is often neglected in this debate. The OEMs can make the device proprietary and have pre-installed software on them that the users cannot remove (Ganapati, 2010). The device is not truly open if the user cannot choose to remove the bloatware. It is safe to say that for the generic user Android is as open as the carriers or OEMs want it to be. Users who want to un-lock Android are resorted to rooting the OS, freeing it of its restrictions that the OEM has put on it or that are already built into Android. For instance, rooting can be used to bypass the internal storage limitations. The T-Mobile’s G1 phone was limited to running apps on the internal memory but after rooting the phone you can install and run applications on an SD-card or it can be used to remove the simlock (Sadun, 2008). But the argument could be made here that hackers and programmers are able to unlock closed code but users would not know how to do so (Lessig, 2006: 151). Several Android rooting tutorials are available on the World Wide Web but it does require a certain kind of technical knowledge. Therefore the Android device is closed for the generic user who does not know how to root the device and remove the restrictions.

**Legal level: governance, policies and licenses**

Not only the technical design but also the policies are crucial actors in the debate between the two approaches. They determine what developers, OEMs, and users can and cannot do with the devices. Also they establish a certain image of the company, be it closed or open.

The iPhone developer program license agreement gives Apple full rights over the applications; they can only be distributed through the app store. Reverse engineering of the SDK is not allowed. Developers are not allowed to hack or

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9 Bloatware can be defined as pre-loaded trial software and apps that cannot be deleted off the device by the user.

10 Rooting is gaining administrative or super user access to the Android OS. Once you have root access you can install custom software onto your device. It can be compared to jailbreaking the iPhone. Several tutorials can be found on how to root your Android phone. Google encourages users to root the Android phones to break free of the restrictions (for instance, a simlock) that carriers and OEMs put on the phone. But it is not without risks, rooting the Android device can lead to bricking it, making the device useless. (Moor, 2010) <http://www.talkandroid.com/7686-what-is-rooting-and-why-should-i-do-it-the-pros-cons-of-android-rooting/>
modify (or enabling thereof) any Apple products. Furthermore, the certification and the app can be pulled out of the store at any time and a developer has to enter the developers program in order to get the application submitted into the store (Chen, 2010a). The App Store policy is located in section 3.3.14 of the January 2010 license agreement “[a]pplications may be rejected if they contain content or materials of any kind (text, graphics, images, photographs, sounds, etc.) that in Apple’s reasonable judgment may be found objectionable, for example, materials that may be considered obscene, pornographic, or defamatory” (Apple, 2010a). This is highly subjective because what is reasonable judgment? The reasons for the rejection of apps have sparked controversy. For example in 2009 an app called My So Holy, enabling users to create self-portraits which resemble Jesus was rejected from the store. But a Baby Shaking app was approved, and later pulled from the store (Chen, 2010b). This controversy about the rejections has prompted Apple to open-up and published the App Store Review Guideline trying to provide clarity about the rejections but they’re still highly subjective and open to interpretation (Miller, 2010; Patel, 2010a).

The strict regulations and technical restrictions for not allowing unofficial applications have led to the jailbreaking of the iPhone. An example of jailbreaking program is iBoot. With this program you can run another OS on the iPhone, for instance Linux or ironically Android (iDroid project, 2010). Apple does not condone jailbreaking. What is at stake here, according to Apple, is that it will cost them money, sanctioned iPhone apps will be pirated and it violates the user license agreement. The EFF asked regulators to add jailbreaking to the Digital Millennium Copyright Act’s (DMCA) exemption list. The Copyright Office granted

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11 The iPhone developer program license agreement was a little hard to track down because it is not publicly available at the official website of Apple. The Electronic Frontier Foundation (EFF) got hold of a March 2009 version by invoking the Freedom of Information Act to obtain the developer agreement from NASA, who developed an iPhone app. On March 9th, 2010 Wired Magazine published the iPhone Developers License Agreement on their website (Chen, 2010a). The January 2010 version of the license agreement has recently been published on the EFF website (Lohmann, 2010). In this paper the January 2010 version of the license was used.

12 This guideline is not publicly available on Apple’s website, you have to login to the Apple Developers Program Website to be able to download the guidelines. The technology blog Engadget has posted the guidelines on their website and provides an analysis in the corresponding article (Apple, 2010b; Patel, 2010a).

13 Jailbreaking is the process of hacking an iPhone to free it the restrictions, allowing for software to be installed that is not approved by Apple (iPhoneCris, 2007).

<http://www.appleiphonereview.com/iphone-jailbreak/iphone-jailbreak/>
this request. Again, Apple has been forced to open-up their policies because jailbreaking has been legalized (Kravets, 2010; German, 2010).

Another example of Apple being forced to open-up their policies is the rejection of the Google Voice application from the App Store in 2009. This rejection prompted inquiries from the FCC, they wanted to know why the application was rejected and what role AT&T played in it. These inquiries have forced Apple and AT&T to open-up and reveal secret agreements between the two to disallow or cripple Voice-over-IP applications (Singel, 2009). This translates the debate into the domain of network neutrality. Interestingly enough though, the FCC recently made a statement that they did not enforce strict network neutrality regulations on wireless technology because Android is open (Patel, 2010b).

A crucial actor in this debate is the Apache 2.0 license (ASL).\textsuperscript{14} Even though the underlying Linux Kernel (licensed under GPLv2) forms the basis for Android, the OS itself is distributed under the Apache 2.0 license. This license determines the ‘openness’ of Android. Instead of option for the General Public License (GPL) the Apache License was chosen. GPL stems from the legacy of Richard Stallman and is about the absolute freedom. It allows the user to modify, use and improve the software. The essence of GPL is that changes in the software cannot be privatized and have to be shared with the community (Ippolita Collective, 2009: 31; Lovink, 2003: 196). Android is open source just like Linux but the difference is that ASL does not mandate that the modifications have to be shared and therefore Android is not truly open.

A related controversy is that Android uses the Java Virtual Machine (VM) Dalvik. Java is GPL licensed but because Google wants everything under the Apache license they’ve decide to build their own (proprietary) Java VM. Opting for ASL is a business decision as Andy Rubin explained at the 2008 Google I/O event. He stated that the ASL would allow anyone to modify Android without giving back to the community. It allows the OEMs to differentiate their devices from their competitors (and they can make the devices proprietary). This in turn will lead to more OEMs choosing Android (Metz, 2008; Paul, 2007). Eric Schmidt stated that being open is adding choices but how many choices do the OEMs have? Andy Rubin said at the Google I/O 2009 that the OEMs could choose between three

\textsuperscript{14} The Apache 2.0 license can be viewed here: <http://www.apache.org/licenses/LICENSE-2.0.html>
versions of Android. The ‘Google-free’, ‘strings attached’ and ‘the Google experience (or Google branding)’ version. The different versions and how they are implemented, designate different requirements on the OEMs and carriers. When Android is customized, manufactures are not allowed to use the ‘with Google’ branding on the phone. If the OEMs do want a Google-branded phone they have to comply with Google’s standards for the software (Richtel, 2009; Ricker, 2009; Ziegler, 2009).

The Android Market is not without restrictions either. First there is the Fifteen-minute refund window for customers, which does not give people much time to purchase, download and test the application. Applications in the market cannot be larger than Fifty Megabytes but often games exceed this limit. This leads the developers to offer the additional files for download at a different location. The process of downloading the different files takes over fifteen minutes and users miss the fifteen-minute window before even having installed the game (Wimberly, 2010). Also the market does not offer paid-for applications in all sections. There are several different alternative markets available which contributes to the fragmentation of the Android ecosystem. What these restrictions mean for the developers is that their applications have to go through a compatibility program, which is to minimize compatibility issues. This compatibility program allows the developer to test the application for the different devices that it will run on. The developers also have to comply with the Android Market Developer Distribution Agreement. Furthermore the application has to comply with the Android Market Program Policy, which says “[v]iolation of these policies may result in the denial of Android Market access or deletion of your Google Account” (Google, 2011). Also there are restrictions on explicit material, hate speech and malicious products. But all these restrictions do not seem as strict as the iTunes App Store and developer policies. That is not to say that Google has not removed any apps from the market, in June 2010 clones of the game Tetris where removed from the Android Market after Google received a DMCA take down notice (Paul, 2010b). If the Market were truly the opposite of what Apple does with their store, Google would not moderate the Market and remove applications. The more restrictions, the less open the market becomes.

There are 6 alternatives to the Android Market. Getjar (one of the largest), AppBrain, SlideME, MobiHand, OnlyAndroid, Appsfire and Aproov. Furthermore, Amazon is working on their own Android App Market (Bryant, 2010).

Fragmentation is still a big issue

Google is giving the developer a range of choices on what platform and with what program to develop the applications with; this does indeed reflect some of the openness that Google advocates. The compatibility program is there to minimize the compatibility issues stemming from the device fragmentation. Google is actively trying to minimize these issues but the complaints still remain. It is a problem and causes frustration for developers as well as users of the devices. Another frustration for the developers is the inability to target individual handsets in the App Market. However, recent changes in the market do allow the developers to filter out devices based on their specifications (Shankland, 2010; Paul, 2010a; Wimberly, 2010).

There are several factors that cause the fragmentation. First of all the rapid development cycle of Android is a contributing factor. New versions can have features and APIs that are not supported by older versions (Paul, 2010a). OEMs and the Apache license are also actors in the fragmentation of the Android ecosystem. Because of the Apache license the OEMs can customize the OS to differentiate themselves from their competition. Therefore many different and unique variations of Android appear on the market. Additionally, the users depend on the OEMs (not Google) for updating Android on their devices. Apple on the contrary distributes their iOS updates to all the devices through the iTunes platform. The fact that OEMs are responsible for the distribution of new versions of Android to the devices causes a discrepancy between the users. A lot of the devices are running different versions of Android. For example, users of the Samsung Galaxy S in the United States are still waiting for Samsung to role out the Android 2.2 (Froyo) update. But Samsung began rolling out the Froyo update in The Netherlands in November 2010. The users have the same device but

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17 PC magazine provides an explanation on what an Application Programming Interface (API) is. “[It is] a language and message format used by an application program to communicate with the operating system or some other control program such as a database management system (DBMS) or communications protocol. APIs are implemented by writing function calls in the program, which provide the linkage to the required subroutine for execution. Thus, an API implies that some program module is available in the computer to perform the operation or that it must be linked into the existing program to perform the tasks.”

<http://www.pcmag.com/encyclopedia_term/0,2542,t=application+programming+interface&i=37856,00.asp>

18 Android 2.2 Software Development Kit (Froyo) was officially released on May 20th, 2010, but Samsung Galaxy S Smartphone users are still waiting for their devices to be updated to Froyo. In
different versions of the OS. If being open means adding choices than the user should be able to choose when and where they get the update from. Furthermore, Google does not mandate that their own App Market is the only place where users can download applications. Many more app markets are available which contributes to the fragmentation of the ecosystem. Google spokesmen are not openly willing to partake in the fragmentation discussion, be it about the device fragmentation or the complexity of the ecosystem. Dan Morrill called it the F-word and just flat-out denied that fragmentation is an issue. Andy Rubin is trying to give it a positive spin by calling it legacy, something that is natural with the fast development cycle that Android has (Nickinson, 2010).

**Conclusion: rethinking the debate?**

In essence the debate is about the different approaches between two companies with different business models and the different ecosystems. This debate unfolds in the technical design, policies and license and App Market governance. The debate is not as straightforward as it appears to be at first sight. Open vs. closed is a false dichotomy that is kept alive by Google and the popular discourse. Google Android is not truly open and the Apple (and iOS) is not as closed as Eric Schmidt claims it is. And certainly Android is not the inverse of iOS. Fragmentation is a serious issue that Google keeps denying, using semantics or just flat-out denying it.

Furthermore, the fragmented vs. integrated debate is not the same as the open vs. closed debate. Android is fragmented and Apple does use an integrated approach while trying to safeguard the OS. But the open vs. closed debate entails much more than just the Operating Systems. When digging deeper into the open vs. closed discourse, dynamics between the different actors in this debate are revealed. The Actor-Network of the debate translates it beyond the two Operating Systems and companies and into the domains of legislation, network neutrality and user appropriation of the technology. Users trying to open-up the technology to free it from the restrictions incorporated into the design and

[recent tweets Samsung let their users know that the delay is due to complexity and unique functionality. They also stated that they are working hard on getting the update to all United States users as soon as possible.](http://twitter.com/#!/Samsungtweets/status/21619272165883905) [http://twitter.com/#!/Samsungtweets/status/21619486293495808]
policies. This appropriation of the technology cannot only be seen with the iPhone but also Android has been freed of the restrictions. Additionally, federal regulators keep a close watch to ensure that the systems stay open enough. The licenses and technical restrictions are crucial actors in the debate, they determine what users, OEMs, carriers, and developers can and cannot do with the devices. The agency of these licenses, the technical design and the OEMs cannot be neglected when analysing the open vs. closed debate.

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