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Market and Development Trends, Critical Evaluation of Proprietary Markets (Apple, Google, Microsoft, Nokia)

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1 Introduction

With growing smartphone sales, the power of companies like Google, Apple or Microsoft that provide the most common operating systems for those, globally increases. Microsoft and its operating system Windows Phone still struggles to increase its market share, whereas the whole market is dominated by Android and iOS running on 94% of smartphones sold in 2013 [Gartner 2014].

While it is well known and clear that Apple's iOS running on the iPhone or the iPad is of a closed and proprietary nature, Google's Android is basically open source [AOSP 2014]. However since Android's market share got bigger and bigger, Google moved more and more from open to closed source, particularly the companies own apps.

This paper deals with the issues described above: the smartphone market and its big players as well as proprietary licensing and its application in the smartphone market. It covers necessary background information and also takes into account criticism and different opinions about the situation at the time this paper was written (April-June 2014).

2 Smartphone Market

In 2013 53.6% of all mobile phones sold worldwide were smartphones. For the first time global annual smartphone sales were higher than feature phone sales [Gartner 2014].

As its importance rises it is necessary to take a closer look at the smartphone market: Who are the stakeholders in the market? Which companies do have significant influence? Which operating systems are the most important ones, what are their characteristics and are there serious alternatives?

2.1 Hardware Environment

When taking a closer look at the smartphone market the stakeholders can be identified quickly: A smartphone has to be designed and produced somewhere. Besides that it has to be sold and there has to be a network the smartphone can come back to in order to run properly and to achieve its desirable performance.

So aside from the operating system this paper focuses on there are two very important types of companies that influence the market and therefore the customer: Smartphone Producers and Mobile Network Operators (that also sell phones in many cases).

2.1.1 Smartphone Producers

"*A mobile phone that is able to perform many of the functions of a computer, typically having a relatively large screen and an operating system capable of running general-purpose applications.*" [Oxford 2014a]

This is how the Oxford Dictionary defines a smartphone.

The term smartphone first appeared in 1997, when Ericsson used it to describe its phone "GS 88" [Wiki 2014a]. However there is no clear transmission from feature phones to smartphones – several phones had aspects and specifications of what we today know as smartphones, for example "Simon", which was a not very successful personal communicator [Bloom 2012].

PDAs and Blackberry's already provided services like email for their customers but before the launch of the iPhone in 2007 [iPhone 2007] those products were not able to address the mass market and continued to be niche products [Gartner 2008].

With the iPhone Apple, a company that had not been in the mobile phone business before, launched a product that included features of a music player, a digital camera, portable computing and combined it with a mobile phone. As an input method it used a touchscreen in combination with its own operating system, iOS [iPhone 2007].

As a result the market for mobile phones began to change, new players like Apple gained market share while former giants like Nokia lost[1].

While this paper focuses on smartphones there is still an enormous amount of feature phones being sold, especially in developing countries. The global shares are partitioned as seen below:

1 Nokia still had 13,9% market share of sold mobile phones in 2013 [Gartner 2014]. However in 2007, when the iPhone launched, Nokia dominated the mobile phone market with a market share of 49,4%.
More information: http://www.bbc.com/news/technology-23947212

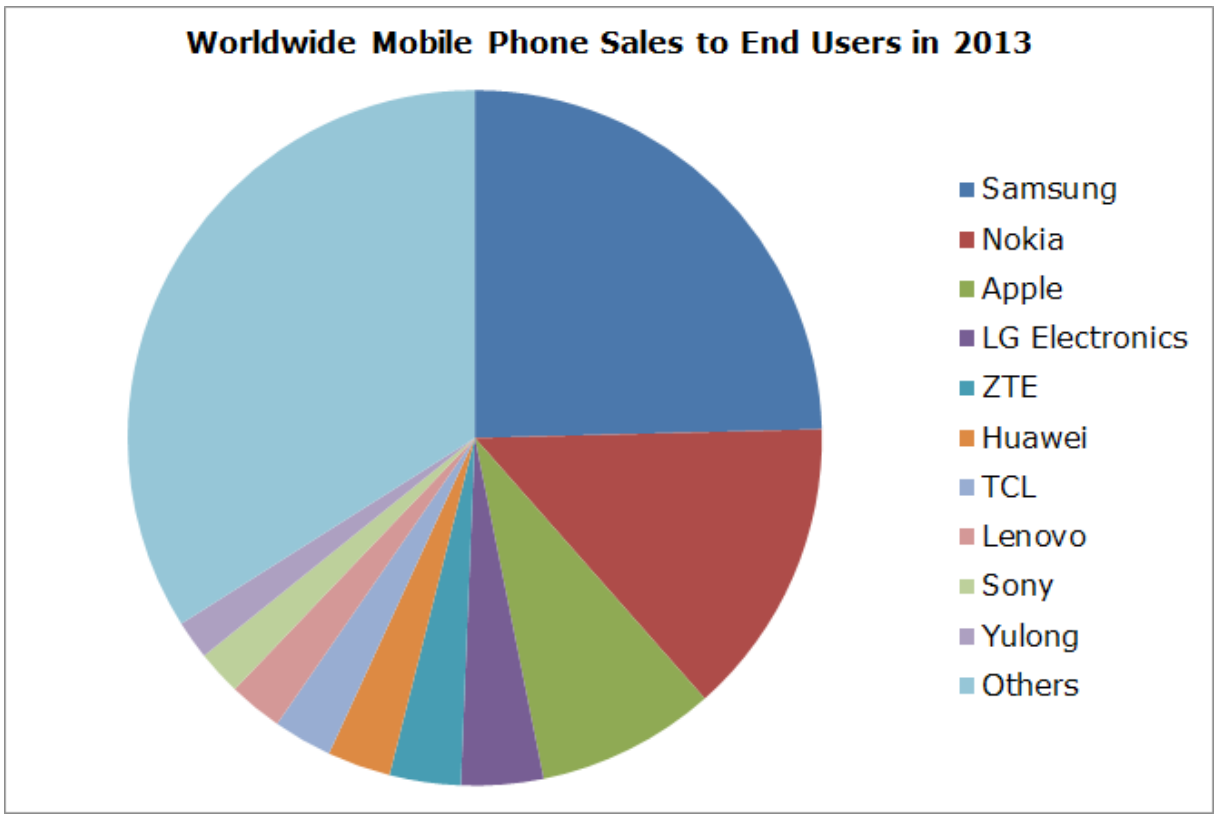

Illustration 1: Worldwide Mobile Phone Sales to End Users in 2013 [Gartner 2014]

If we only look at the smartphone market, which is more interesting in connection with proprietary markets, the producer landscape looks similar:

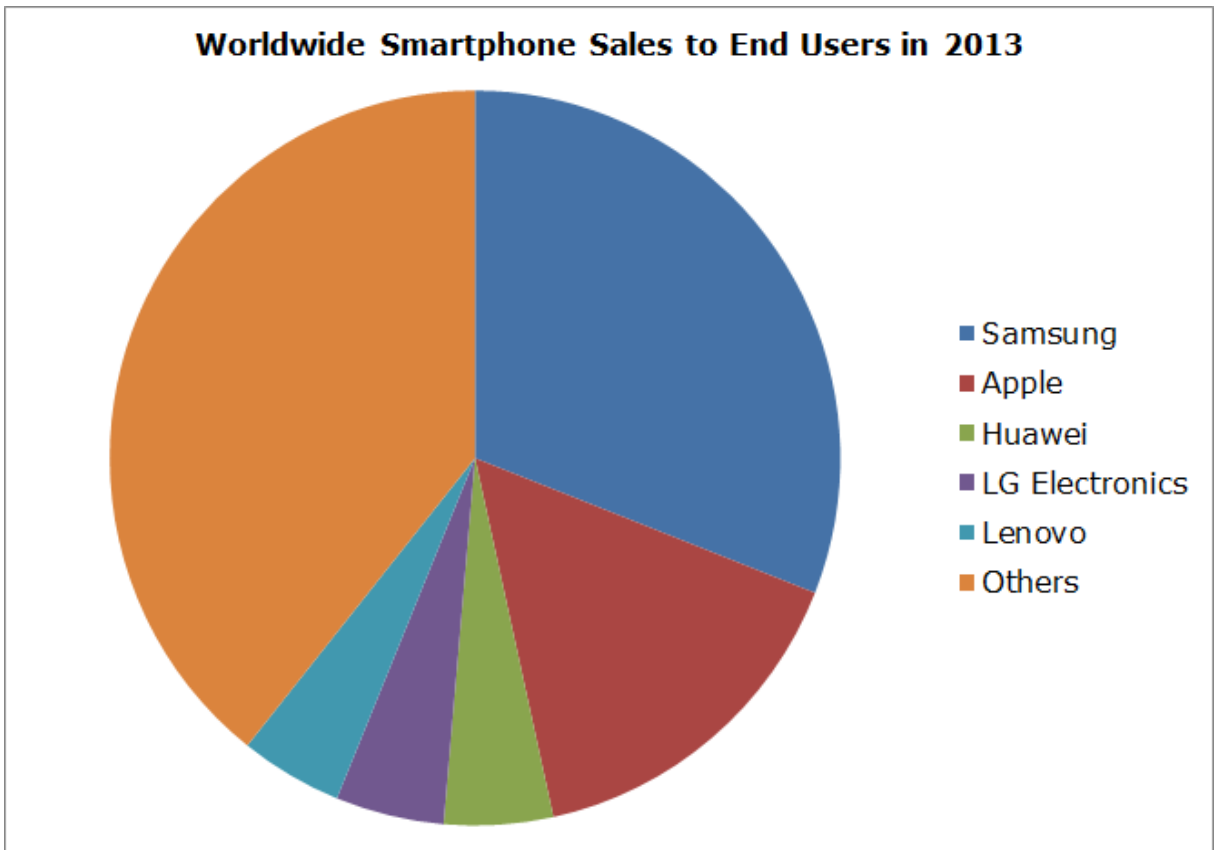

Illustration 2: Worldwide Smartphone Sales to End Users in 2013 [Gartner 2014]

When comparing the mobile phone and the smartphone market, several conclusions can be made for 2013:

- Samsung sold most mobile phones and the most smartphones worldwide. It sold more smartphones than feature phones.
- Apple only sold the iPhone (a smartphone) in various versions [Apple 2014]. It sold the second most smartphones worldwide.
- Nokia still sold a lot of feature phones but did not play a major role in the smartphone business.

As already mentioned at the beginning of this chapter, the numbers also show, that there will probably be more smartphones being sold in the years following 2013 [Gartner 2014].

Although there is a lot of competition with several companies producing smartphones there have still been new initiatives in the producing sector, for example:

- Fairphone: a phone produced by a Dutch company aiming to offer a smartphone without conflict materials produced under fair labour conditions [Fair 2014].
- Amazon Fire: the first smartphone produced by online retailer Amazon was announced in June 2014 [Amazon 2014].

By June 2014 it cannot be said if those initiatives will be successful in entering the market.

2.1.2 Mobile Network Operators

Mobile Network Operators (MNOs) are companies owning or controlling the necessary infrastructure and therefore providing wireless communication services for their customers. Traditional services by MNOs enable tele-

phone calls (voice), text messages (SMS) and internet connectivity (data) [Techo 2014a].

Smartphones change the way, networks are used through customers: Data gets more important and substitutes SMS or phone calls. New technologies allow MNOs to rethink their product portfolio and to explore new business areas: MNOs focus especially on the area of machine-to-machine communications, in which they hope to find higher margins than in their traditional businesses [Alcatel 2014]. In order to get there they use the technical features of smartphones (particularly in emerging markets) as well as their existing infrastructure to provide services for non-cellular devices where revenues are smaller but whose number is expected to rise in the future.

This paper focuses on three selected trends that influence or are influenced by MNOs in 2014:

- Collaboration: MNOs have access to very specified data, e.g. the billing information of the customer. With their own billing platforms they offer advantages for developers as well because it is easier for them to get new products into the market over a trustworthy channel.

  Through partnering with or investing in start-ups MNOs can use their resulting power and offer their customers special deals regarding their personal profiles. Best Practices for such partnerships include the cooperation between France's "Orange" and the online music streaming service "Deezer"[2] as well as several investments in the start-up sector through "T-Mobile" and its subsidiary companies [Kearney 2014][3].

2 Orange France partnered with the online music streaming site deezer.com in 2010. It began to offer Deezer premium packages to new subscribers. As a result the number of new paying subscribers on Deezer jumped from 6000 per month to 100.000 per month. Orange leveraged its own customer base and used its own billing platform for Deezer helping it to look trustworthy for potential users and offering Orange a perfect Marketing tool [Kearney 2014].

3 In 2011 T-Mobile Ventures operated over €720 million funds which it invested/invests mostly in Start-Ups [Kearney 2014].

- NFC: "*48% of the world's adult population is not able to access basic financial services in order to save, borrow or transact.*" [Kearney 2014].

  In 2012 2.5 billion adults globally did not have access to a bank according to the World Bank [WB 2012].

  Near-Field Communication (NFC) will lead to smartphones becoming a partial substitute for bank accounts. As of 2014 there is already growth in mobile payments and 90% of smartphone producers offer NFC-enabled handsets.

  Limited access to credit/debit cards will strengthen this trend especially in emerging markets [Heavy 2013]. Safaricom's M-Pesa is an example of how such a virtual currency could work: In March 2012 35% of the population of Kenya used the service and it already expanded to Tanzania, South Africa, Afghanistan and in 2014 to Eastern Europe [Wiki 2014b].

- As already mentioned above Mobile Network Operators see most potential in Emerging Markets: As smartphones are becoming cheaper not as wealthy populations gain access to them. However the cost of data e.g. in Africa is still very high as infrastructure is not highly developed. [recode 2014].

  In South East Asia a rising adoption of smartphones can be observed as well. Countries like Singapore and Malaysia already have a very high smartphone penetration rate and others will follow: It is estimated that until 2015 more than 40% of total global mobile revenues will come from South East Asia.

  If MNOs manage to keep investing in the IT infrastructure of the mobile network in those regions and if they continue building services and market those in the right way, emerging markets like China or India can become a promising investment [Amgoo 2014].

2.2 Mobile Operating Systems

Mobile Operating Systems (mobile OS) are operating systems which have been built for running mobile devices such as smartphones or tablet PCs. They identify the hardware of a device and offer various features through a certain user interface they provide [Techo 2014b].

Focusing on smartphones this paper takes a closer look at the market for Mobile Operating Systems: on the systems themselves, the companies mainly developing them and on alternative mobile OS that are niche products in 2014 but that address certain target groups and therefore might become more important in the future.

2.2.1 OS Development Companies

In the first part of this chapter the paper focused on hardware, the producers of mobile phones. However there are big differences between the hardware and software producers, when it comes to smartphones. The following graph gives an overview of the market share of the developing companies behind different mobile OS for smartphones:

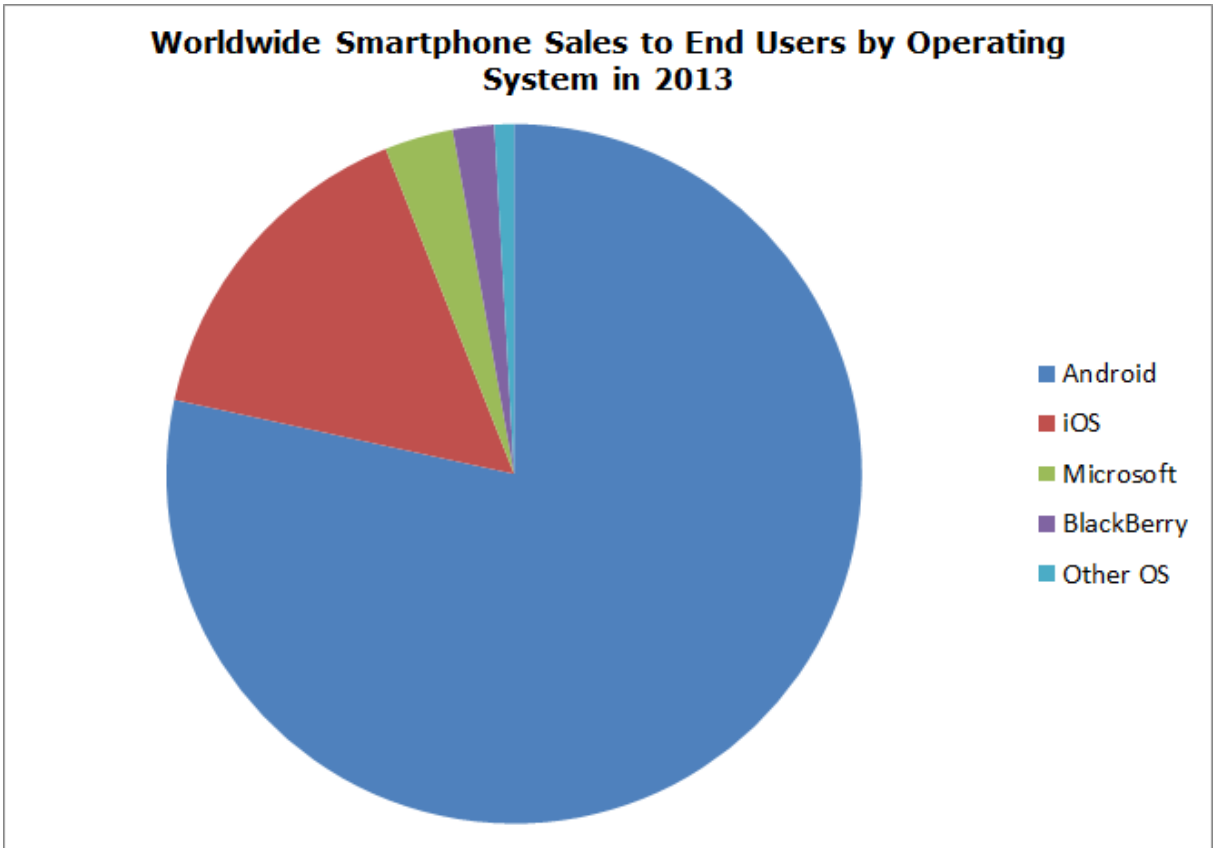

Illustration 3: Worldwide Smartphone Sales to End Users by Operating System in 2013 [Gartner 2014]

It can be inferred from the graph and the numbers it refers to that

- 97,2% of all smartphones sold in 2013 use either Android, iOS or Windows Phone as their mobile OS.
- Android dominates the market with a market share of 78,4%.
- Apple is the only relevant hardware producer developing its own software.
- Windows Phone increased its market share (2012: 2,5%, 2013: 3,2%) but is still at a very low level.
- BlackBerry consistently lost market share (2012: 5%, 2013: 1,9%).

Taking those facts into account this analysis focuses on the three most relevant mobile OS: Android, iOS and Windows Phone.

Samsung, Huawei, LG Electronics and many more manufacturers mainly use Android as their preferred OS while Nokia (whose mobile phone division is now owned by Microsoft) uses Windows Phone for the most part[4].

2.2.2 Android, iOS, Windows Phone

Illustration 4: Android Logo [Wiki 2014c]

Android is the leading mobile OS developed by Google. It is based on Linux and is primarily designed for tablets and smartphones.

The Google Play store offers over one million Android apps since July 2013.

Although the Android source code is released under open source licences (Android Open Source Project), most Android devices come with proprietary software parts (see next chapter).

Android runs on most phones produced by Samsung, Sony and many more [Crunch 2013].

According to "Developer Economics Q3 2013" 71% of mobile developers use Android [DevEco 2013]. Android is written in C, C++ and Java.

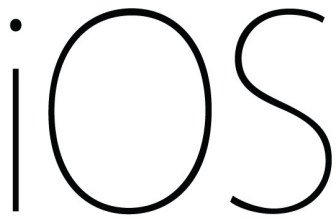

Illustration 5: iOS Logo [Wiki 2014d]

IOS is the mobile OS for all Apple products (iPhone, iPad, iPod Touch, Apple TV) and is developed by Apple Inc.

Since October 2013 the App Store offers more than one million iOS applications.

iOS is proprietary software. "Developer Economics

4 Nokia abandoned Android as a potential mobile OS because it "feared Samsung would come to dominate Android".
More Information: http://www.theverge.com/2013/7/18/4535002/nokia-chose-windows-phone-beacuse-it-feared-samsung

	Q3 2013" states that 56% of mobile developers use iOS [DevEco 2013]. iOS is written in C, C++ and Objective-C. Objective-C is Apple's main programming language. At WWDC 2014 Apple announced a new programming language called Swift that will replace Objective-C in the future [WWDC 2014].
Windows Phone *Illustration 6: Windows Phone Logo [Wiki 2014e]*	Windows Phone is a mobile OS developed by Microsoft. Windows Phone runs mostly on Nokia devices but in February 2014 it announced more hardware partners including Samsung, LG or Lenovo for the future [Gadget 2014]. Windows Phone is proprietary software. According to "Developer Economics Q3 2013" 35% of mobile developers were planning on adopting Windows Phone [DevEco 2013]. Windows Phone is written in C and C++.

2.2.3 Alternatives

Although the niche for additional mobile OS is relatively small in comparison to the market power of Google, Apple and Microsoft there is a relatively big number of alternative operating systems.

By reference to the topic of this paper the focus of this list lies on open source mobile OS:

- **Firefox OS**: Firefox OS (or Boot to Gecko) is a Linux-based mobile OS developed by the Mozilla Corporation.
  Firefox OS' goal is to be a "complete , standalone operating system for the open web" [Mozilla 2014]. Therefore the whole OS is free software and completely open-source.

Some ZTE phones and others are already based on Firefox OS and due to its use of open standards such as HTML 5 or JavaScript 27% of mobile developers were planning on adopting the platform in 2013 [DevEco 2013].

- **Tizen**: Tizen is a Linux-based mobile OS whose development is pushed by companies like Samsung or Intel. Tizens goal is to reduce the dependence on Android in the mobile OS market.
  Tizen already got tested on smartphones (June 2014) and Samsung announced to use Tizen with their Z series instead of Andorid [CBC 2014].
  Tizen is open source except for its software development kit, which is proprietary software [Wiki 2014g]

- **Sailfish OS**: Sailfish is a Linux-based mobile OS developed by the Finnish Company Jolla. It aims to compete with Android through its swipe user interface.
  Sailfish should be able to run most Android and MeeGo (former Linux-based OS for Nokia phones) applications.
  Sailfish OS runs on the Jolla Phone released in November 2013.
  The OS is open source although parts of its user interface are proprietary licensed [Wiki 2014f

- **Ubuntu Touch OS**: This OS focuses on markets where the Linux distribution Ubuntu is already popular: developing markets such as China and India will be the target group.
  It is the mobile version of the OS and Software made for Ubuntu Touch is also compatible with the PC version of Ubuntu.
  The OS is still being developed (June 2014) and will be open source [TechRev 2013].

- **Replicant**: Replicant is a free and open-source mobile OS which uses Androids open-source parts and replaces its proprietary com-

ponents with free software. It then offers the Replicant counterpart of the Android version to users of certain phone types, e.g. the Nexus S or the Galaxy S III.

Also Replicant closes discovered Android security vulnerabilities.

Replicant is financed through and supported by the Free Software Foundation[5] [Wiki 2014h].

5 The Free Software Foundation (FSF) is a global non-profit organization which promotes the freedom and the rights of computer and software users. It promotes the development and use of free software.
More information: http://www.fsf.org/about/

3 Proprietary Licensing

The term Proprietary Licensing/Software was already mentioned a couple of times.

This chapter shows the differences between various software licensing models, how proprietary software is applied in the smartphone market, how companies and corporations influence customers/developers and what customers can personally do against it.

3.1 Software Types

Software can be split in two big categories: free and proprietary software. While this paper focuses on proprietary licensing models it is still important to know the difference to other licensing models.

The figure below shows the different software categories:

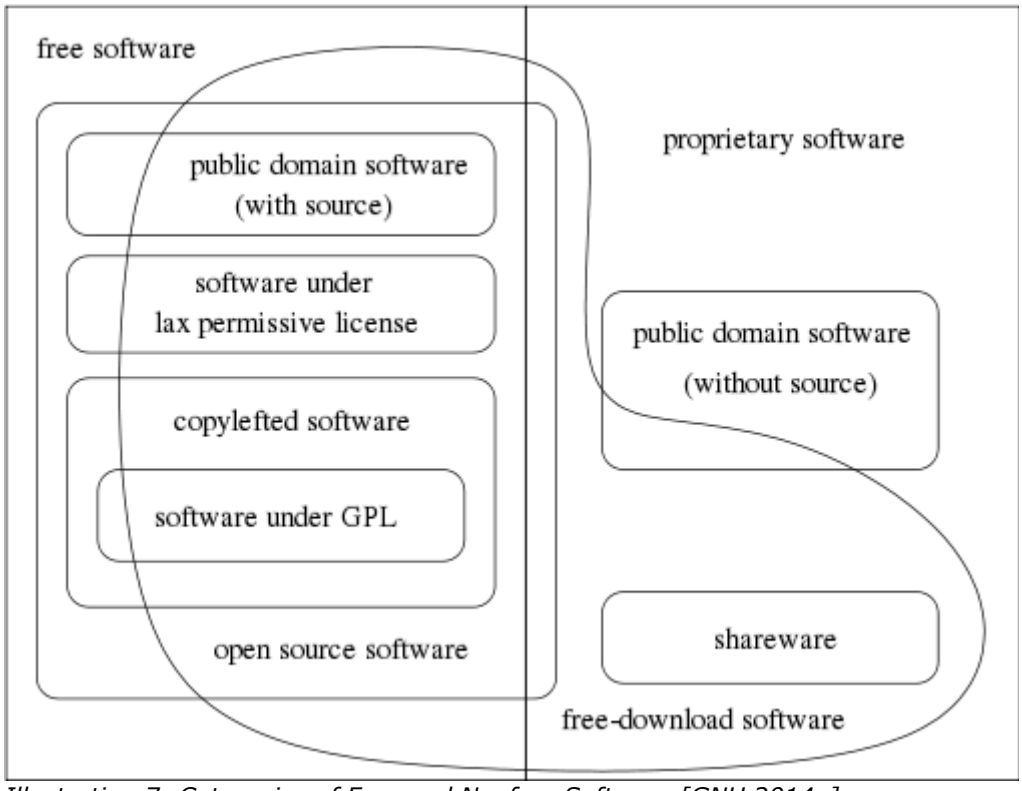

Illustration 7: Categories of Free and Nonfree Software [GNU 2014a]

3.1.1 Free Software[6]

The term “Free Software” was first used by Richard Stallman, the founder of the GNU project and the Free Software Foundation (FSF), in a bulletin from 1986. The definition was the following:

“The word "free" in our name does not refer to price; it refers to freedom. First, the freedom to copy a program and redistribute it to your neighbors, so that they can use it as well as you. Second, the freedom to change a program, so that you can control it instead of it controlling you; for this, the source code must be made available to you.” [GNU 2014b, Page 8]

Since then the definition of free software changed and was extended. Today (June 2014) the Free Software Foundation calls software free if the program's users “have four essential freedoms” [GNU 2014c]:

- The freedom to run the program as you wish, for any purpose (freedom 0).
- The freedom to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbour (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

As shown above the FSF categorizes Software. After finding the right category the FSF and other organizations license the software packages

6 “Free Software” is the term used by the Free Software Foundation. The Open Source Initiative like the FSF is an organization dedicated to open-source software. The OSI basically uses the same definition as the FSF but calls “Free Software” “Open-Source Software”.
In order to bear reference to the general topic of the paper the author chose the term “Free Software” to differentiate explicitly, especially when it comes to Android.

showing potential users what they are allowed or not allowed to do. There is an enormous amount of different licences ranging from very restrictive to completely open source[7]. In general software licences can be divided in three classes:

- GPL-Compatible Free Software Licenses
- GPL-Incompatible Free Software Licenses
- Nonfree Software Licenses

The GNU General Public License (GPL) is the most widespread free software license. The GPL demands the four software freedoms to be guaranteed and it also demands software to be "copylefted". "Copyleft" is a form of Copyright – it makes software free and requires all modified future versions of the software to be free as well. Copyleft therefore preserves the four freedoms in the long-run [GNU 2014d]. Non-copyleft free software does not match the GPL-criteria but can still be classified as free as long as it guarantees the four freedoms.

Nonfree software licenses are given away by corporations – most software companies producing proprietary software have their own license agreements. It has to be mentioned that software without a license is also seen as nonfree software: Modern copyright law ensures that copyrightable works are copyrighted by default. This means that software is classified as free software only then, when the copyright holders explicitly guarantee potential users the four freedoms listed above [GNU 2014e].

While it might look easier to monetize proprietary software there are business models for free software solutions as well: Many Linux distributions focus on installation and support for the free software and are charging for service. "Freemium" models where the basic product is free while complementary goods are sold as well as donations or crowd funding demon-

7 More Information about different licences: https://www.gnu.org/licenses/license-list.html

strate possibilities of how to run businesses with free software components [Wiki 2014i].

3.1.2 Proprietary Software

"*"Proprietary" indicates that a party, or proprietor, exercises private ownership, control or use over an item of property, usually to the exclusion of other parties.*" [Chill 2014]

Proprietary software is nonfree software. There is a copyright on proprietary software which means that the holder of the copyright is able to define the rules users have to follow and the conditions under which their software can be used. In general the user is not allowed to modify, share, study, redistribute or reverse engineer the software which is why the four freedoms of free software are not fullfiled [LINFO 2014].

Through copyrights, contract laws, patents, trade secrets (often the source code) software is internationally protected against infringement. With an End-User-License-Agreement (EULA) a software developing company defines the rights of its users.

Limitations for proprietary software are typically very strict: Vendors limit the number of devices the software is allowed to be used on with product activation codes, product keys, serial numbers or with the help of technological protection against copies. It is also common to distribute a software in different versions with certain features for different target groups: E.g. the Microsoft Office Package comes in various versions – depending on the type of use (for students, households, enterprises...) users are charged and product keys are given away.

Also the source code of proprietary software is usually not available and almost always kept secret [LINFO 2014]. The software is distributed in compiled form which means that only machines can read the code and humans cannot access it.

This practice also implies security issues: if there are mistakes or malicious features in the code it can be impossible for users/private developers to find them. Since Edward Snowden released secret governmental documents in 2013 it is also known that the US government allegedly works together with tech companies and uses known backdoors in proprietary software in order to spy on its users [Guardian 2013].

Another kind of proprietary software is called shareware: shareware is software which can normally be downloaded and redistributed for free. However it may cost something after a certain period of time or when the user wants to have access to certain features which have to be paid for separately.

Different licenses by different companies and vendors cause various problems:

- Proprietary file formats may not be compatible with other formats and software: If another person or company uses different types of software there could be problems reading or working with the files and protocols of the firm.
- In order to simplify work with their software developing companies often use Application Programming Interfaces (APIs). APIs are adapted to the particular software and often include individual specifications (such as routines, object classes and variables applied in the software) for programmers [Wiki 2014i].

  If a company wants to change their software they do not only have to get used to the new software and convert their previous files and IT infrastructure. They also often have to introduce and train their in-house developers to it as they are used to the APIs of the previous software solutions (for more details on the so called lock-in effect see next chapter).

- Proprietary software may be limited to specific hardware: The license of the product may include a linking of the software to certain hardware products. E.g. Mac OS X, the operating system of computers by Apple, may only be used on hardware made by Apple as well.

3.2 The Smartphone Market

The paper already mentioned the leading smartphone producers and the companies developing the leading mobile OS for the devices. While iOS and Windows Phone are obviously proprietary software and therefore controlled by Apple/Microsoft, Google claims that Android is still open-source and therefore free software. Practically most devices do come with proprietary parts of Android though as especially Google Play, the Android application store, and Google's native apps come only with license agreements and are not open-source.

This part of the paper focuses on proprietary software used in 97.2% of all smartphones sold in 2013 and on the impact of this situation [Gartner 2014].

3.2.1 Google Play, App Store, Windows Phone Store

Windows Phone is developed by Microsoft. Its store, the Windows Phone Store (previously Windows Phone Marketplace) allows users to search, purchase and download applications and games [Windows 2014].

iOS is developed by Apple. The App Store is its digital marketplace and allows users to browse and download various applications [Apple 2014a].

Android is developed by Google. Although its source code is released as Open Source the mobile OS has various proprietary features including Google Play (formerly Android Market), the marketplace of the mobile OS [Google 2014a].

Google Play, the App Store and Windows Phone Store are crucial parts of the respective Operating Systems: one of the reasons why customers buy smartphones is the availability of a large amount of applications which can be used on the phone.

Google Play, the App Store as well as Windows Phone Store are proprietary licensed. That means that Google, Apple and Microsoft control those markets: They decide which applications are allowed in the app store under which circumstances. However the conditions for customers and developers vary [Wiki 2014k]:

- **Google Play**: As of July 2013 there are over one million applications available in the Google Play store and more than 50 billion apps have been downloaded since the founding of the store ("Android Market") in 2008.
  In order to be allowed to put an application in the store, developers have to register. Registration costs 25$ and is non-recurring. Of every app sold over Google Play Google receives 30% of the price while 70% go to the developer or the developing company.
  Google controls the apps published: According to the "Google Content Policies" Google does not allow "sexually explicit material", "violence and bullying", "hate speech", "Impersonation or Deceptive Behaviour", apps including "intellectual property", "personal and confidential information", "illegal activities", "gambling", "dangerous products" and "system interference" [Google 2014b].
  Although Google controls every app in Google Play, Android users can activate to enable non-market application downloads on their phones. This allows them to download and install software directly from the developing companies.

- App Store: Also in the App Store there are over one million applications available since October 2013. Since its launch in 2008 those apps got downloaded more than 50 billion times as well.

Developers must pay 99$ per year if they want to publish applications in the app store. Depending on the origin of the developer/the company behind an application Apple charges 44-29% of its price if an app is sold.

Apple completely controls all applications in the App Store: Every application developed for iOS must be approved by Apple. The company reviews the App and, if rejected, gives feedback to the developing company about its decision. Since 2010 Apple does have the App Store Review Guidelines telling developers what they are not allowed to publish [Apple 2014b]. Nevertheless every new application has to wait at least a couple of days until it got tested and approved/denied by Apple.

The App Store Review Guidelines are very general and leave a lot of room for interpretation. This effect is intensified by the fact that developers whose application got denied access to the App Store are not allowed to publicize any details of the rejection notices. Previously developers even got a Non-Disclosure-Agreement (NDA) forbidding them to publish details about Apple's decision [NYT 2014].

Apple has also removed applications licensed under the GNU Public License from the App Store as the license does not match the criteria of the company [PCMag 2011]. The third freedom of free software ("the freedom to redistribute copies so you can help your neighbour") does not match Apple's criteria for the App Store [TÚAW 2011].

- **Windows Phone Store**: Compared to Google Play or the App Store the Windows Phone Store launched later, in 2010. Since then around 250.000 applications got registered and have been downloaded around 4 billion times.

  Individual developers must pay 19$ (companies: 99$) in order to upload their apps. This includes fees for unlimited paid apps and for 100 free app submissions. Microsoft gets 30% of the price of every

app sold over the Windows Phone Store. Students can submit applications for free.

Compared to Apple Microsoft is very specific on which content is allowed in the Windows Phone Store [TheReg 2010]: Copyrighted content, content harming others, "Defamatory, Libelous, Slanderous and Threatening" content, hate speech or Discriminatory, content about tobacco, alcohol, weapons or drugs as well as "Adult Content" and "Illegal Activities" are forbidden in the Windows Phone Store. Microsoft still has to approve all applications.

Smaller mobile OS developers also have proprietary online market places compared to those explained above. The Firefox Marketplace for Mozilla OS is currently (June 2014) the only marketplace for a mobile OS that does not charge developers.

3.2.2 Lock-in Effect

According to the Oxford Dictionary a lock-in is "an arrangement according to which a person or company is obliged to deal only with a specific company." [Oxford 2014b]

Relating to the smartphone market there are different kinds of lock-in effects: the lock-in effect mobile OS developing companies (especially Apple) create towards their users, the one mobile OS developing companies create towards app developers and the one Google created with its proprietary native apps towards smartphone producers.

Before the iPhone Apple was already known for locking in customers, especially when it comes to iTunes, the company's online store and media management system: for example Music bought on iTunes could only be handled with Apple devices such as the iPod. After being criticized and sued Apple removed its Digital Rights Management (DRM) conditions from music bought on iTunes [Apple 2009]. For iPhone users Apple offers a

broad ecosystem of services that work together with other Apple products only, e.g. iMessage, AirPlay or Time Machine. Although this does not force customers to stick to iPhones or iPads the disadvantages of changing the device often outweigh the advantages.

In May 2014 a “bug” was found that prevented users switching from an iPhone to an Android device from receiving iMessages. Although Apple fixed the bug users still have to deactivate iMessage manually if they change their device. If they do not do so received text messages could get lost [PCPro 2014]. This example shows how mobile OS developers use lock-in measures to retain customers.

Also mobile OS developing firms try to lock-in developers: different programming languages, cloud services and API's make it more difficult for app developers to code for another mobile OS.

Apple and Google both offer cloud tools for developers which help them to develop apps faster but which also makes it more difficult to abandon the particular mobile OS as a lot of work is stored in the mobile OS's cloud services [VisionM 2014b]. Google also switches more and more of its API's from Android to Google Play Services in order to get more control over the Android app ecosystem [VisionM 2014a]. Google strengthens its own position through supporting iOS with 90% of its API's: if a developer uses an easy-to-use, up-to-date and easy-to-implement Google API (e.g. for Google Maps) 94% of all smartphones sold in 2013 are supported.

Taking this into account Google also locks in smartphone producers: via making it as easy as possible for developers to use Google API's (not Android API's) it gets less attractive for producers to switch to another mobile OS. There have always been closed source Google apps like GMail, Maps or YouTube. However in 2010 Google began to close AOSP, i.e. open-source apps and replaced them with Google apps: the search engine, the music playing service, the calendar, the gallery and the camera have since

then been integrated into the Google app ecosystem. There are even differences between the AOSP Keyboard and the Google Keyboard for Android.

Since those apps are some of the major advantages Android offers, small and big manufacturers want to use them and therefore accept Android. This and the fact that Google API's attract developers helps Google to put pressure on manufacturers and to lock them in [ArsTech 2013].

On the other hand companies are aware of their dependence on Google. As a remedy manufacturers like Samsung, the biggest smartphone producer and main user of Android, keep developing their own applications. With those (often called bloatware[8]) they want to keep an insurance that they still have (inferior) applications for their devices, should they decide to abandon the Google Android one day [ArsTech 2013].

The following picture shows Samsung's versions of Google's applications that can be found on most Samsung phones:

8 Bloatware definition according to Oxford Dictionary: "Software whose usefulness is reduced because of the excessive disk space and memory it requires. Unwanted software included on a new computer or mobile device by the manufacturer."

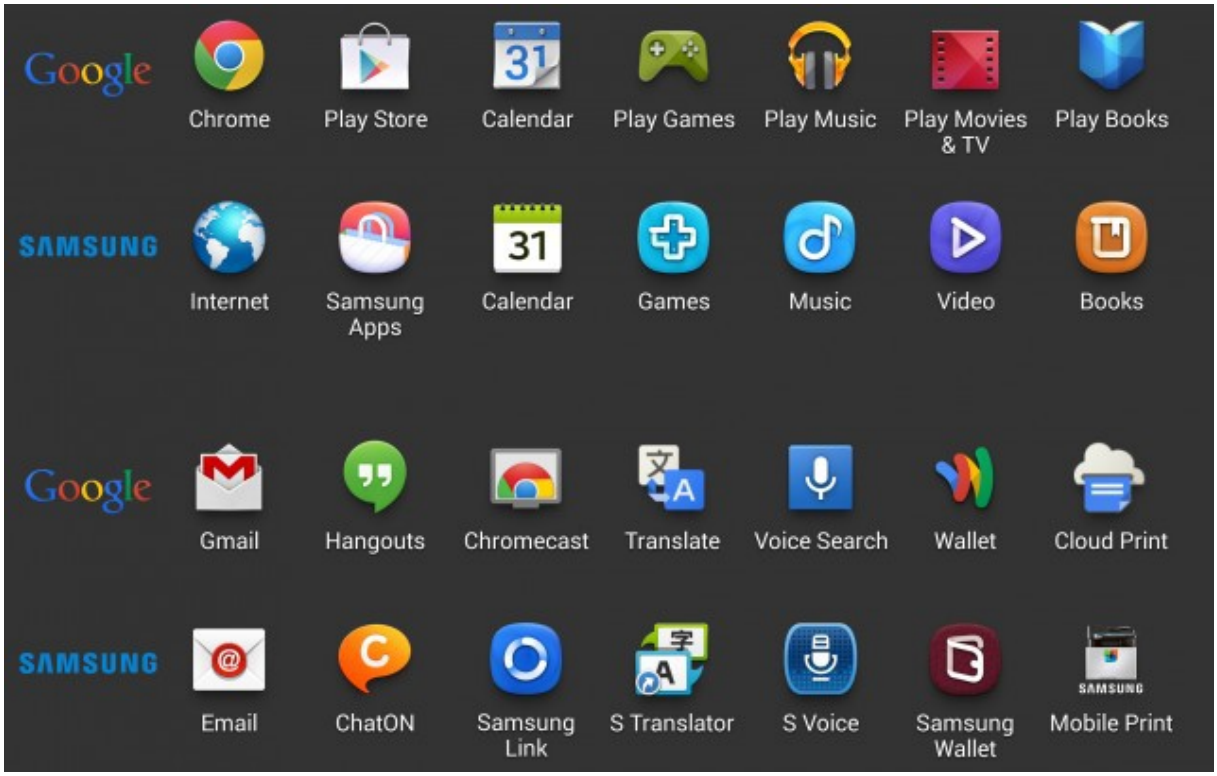

Illustration 8: Samsung's own Android applications [ArsTech 2013]

3.2.3 Rooting & Jailbreaking

The effects mobile OS developers and their proprietary markets have on consumers are implicit: if consumers want the latest smartphones and the most usable and up-to-date software running on them, they will have to buy a phone with iOS or Android (or Windows Phone) running on them.

Still there are possibilities for consumers to reduce corporate influence on them: Android phones can be rooted, iPhones can be jailbreaked[9].

Rooting is the name of a process that can be applied on Android devices giving the user more control over the system. Android devices often come with certain limitations manufacturers apply on their smartphones – sometimes certain specialized apps cannot be installed or bloatware cannot be removed without rooting the device. Rooting a device is different

9 As far as the research of the author (no technical background) went, there is no proper way to root/jailbreak a device running with Windows Phone yet (June 2014).

for most devices as manufacturers try to make the process as complicated as possible. Also it is not legal in every country because of copyright issues [Wiki 2014l].

Rooting a phone comes with a lot of advantages and disadvantages:

On the one hand rooting enables the possibility to install Apps not compatible with Google Play. It allows users of smartphones, that do not become updated through their manufacturers anymore to get the newest Android updates. It helps to extend battery life per removing pre-installed bloatware. Apart from that rooting also enables the installation of alternative operating systems like the very popular CynanogenMod[10] [Gizmodo 2013].

On the other hand rooting can be risky for device owners: if they do anything wrong they can destroy their devices ("Bricking"[11]). Also the warranty for their phone turns void; the manufacturer will not cover any damages which might occur as a result of rooting. Rooting can also cause security problems: as rooting is often combined with installing custom programs the risk of getting a virus becomes higher [About 2014].

Although rooting was not supported by smartphone manufacturers at the beginning (2008-2010) their resistance weakened in the following years. After all software like CyanogenMod is an alternative to the Google controlled Android.

The process of removing limitations and giving root access to users on iOS is called jailbreaking. Jailbreaking does give users superuser administrative permissions, which is similar to rooting an Android device. Legality of jealbreaking depends on the legal situation in the particular country. How-

10 CyanogenMod is an open source operating system that is not pre-installed on smartphones. It is a Firmware replacement for Android mobile devices. According to latest statistics (June 2014) CynanogenMod has over 12 million active installs of the software.
More information: http://www.cyanogenmod.org/

11 Definition of bricking according to Techopedia.com: "Bricking refers to a consumer electronic device that has been damaged beyond repair, making it utterly unusable, often because of damaged firmware. "

ever Apple controls its mobile OS much stricter than Google controls Android so there are different advantages and disadvantages:

The biggest advantage of jailbreaking an iPhone is that Apps can be installed that did not pass the App Store restrictions mentioned above. Besides that the iOS file system can be accessed and jealbreaked iPhones can be more customized [Wiki 2014m].

Similar to rooting jealbreaking an iPhone bears certain risks: the security of iOS – one of the biggest traditional advantages of Apple products – becomes undermined and the iPhone is probably getting more vulnerable to viruses. As jailbreaks are not supported by Apple every time the company updates its mobile OS the jailbreak gets erased and all apps installed are deleted. Similar to rooting there is also the risk of bricking the iPhone [TomsG 2013].

4 Conclusion

The smartphone industry is dominated by a small number of smartphone producers. Due to economies of scale[12] smartphones can be produced cheaper by a corporation like Samsung than by a start-up or a company like Fairphone which focuses on fair production circumstances of smartphones. Those manufacturers focus more and more on smartphones as the demand for feature phones is declining (June 2014). Former giants like Nokia missed this trend.

Mobile Network Operators are aware of changing business models due to a increasing circulation of smartphones. They focus more on emerging markets and they know about their advantage of having specific data like billing information. Mobile banking and additional services through MNOs will influence customers in the future.

Google, Apple and Microsoft control the market of mobile operating systems: 97,4% of all smartphones sold in 2013 were running on either Android, iOS or Windows Phone. Android dominates the market with over 75% market share.

There are alternative mobile OS which do focus on niches at the moment but which have the potential to increase their market share in the future. Firefox OS is the only operating system completely open-source which is sold on phones at the moment (June 2014). Tizen is pushed by Samsung and could become an Android alternative.

The three major developing companies for mobile OS offer software solutions that do not fit the criteria of free software according to the Free Software Foundation. They all offer proprietary software meaning that they have control over their mobile OS in different ways.

12 Economies of scale are cost advantages businesses gain through size.

While Apple and Microsoft obviously own their operating systems, Android is still based on the open-source Android Open Source Project (AOSP). However Google moves more and more features from the AOSP into the Google Play environment changing applications from free to proprietary software.

Proprietary environments also shape the marketplaces for mobile OS: Google Play, the App Store and the Windows Phone Store are all based on proprietary business models. Google, Apple and Microsoft control their markets through strict guidelines.

Supported by different measures Google as well as Apple try to lock-in their customers and developers. Customers do have the possibility to get more independence through rooting their Android smartphones or jail-breaking their iPhones.

4.1 Opportunities and Threads

The analysis underlying this paper shows that there are various trends in the smartphone market. These lead to opportunities as well as threads:

On the one hand Google, Apple and Microsoft can use their size to minimize costs and therefore make smartphones cheaper for consumers. Standardization is also an advantage consumers benefit from. Developers who do not have to focus on various operating systems can specialize and accelerate updates for fewer software systems. Additionally they can use APIs and cloud services provided by Google or Apple and ease the process once again. Manufacturers for Android and Windows Phone do not have to develop their own software and can focus on enhancing their hardware components.

On the other hand proprietary structures like the ones in the smartphone market means a lot of power for the companies owning those structures. Google and Microsoft are able to put a lot of pressure on manufacturers as

there are way more smartphone producers than mobile OS developing companies.

Also Google e.g. can influence more than 75% of global smartphone users. The big players are not afraid to use this power if there are dangers to their business models: Google already blocked all Ad-Block applications from Google Play. It also blocked all tethering features in the US when phone companies complained about them [Wiki 2014n].

Power through censorship in proprietary markets should not be underestimated as well. Also privacy problems should not be unmentioned: Google's business model is based on selling data.

Aside of mobile OS developing companies: When MNO's are expanding their services this might happen through the disposition of data. Taking over banking services in emerging markets MNO's power and responsibility will also rise.

4.2 Opinion of the Author

The author of this paper thinks that on the one hand progress in developing mobile OS is good & necessary. The fragmentation of Android is a problem and therefore initiatives like Google Silver[13] have a certain justification.

Nevertheless Google, Apple and Microsoft already do have a lot of power over consumers and manufacturers. Although there might not be an immanent threat there yet, it is important that trade commissions and cartel authorities watch the smartphone market closely.

13 "Google Silver" will supposably be the name of a smartphone label Google will implement in the near future. It will probably replace the Nexus phone series and it will offer users a premium Android experience. Silver should stop the fragmentation of Android and help Google get more control over its operating system.
Silver has not yet been officially confirmed through Google (June 2014).
More information: http://www.stuff.tv/android/android-silver-everything-you-need-know-about-google-s-upcoming-range-premium-smartphones/fe

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