Report

Market study into mobile app stores

The Netherlands Authority for Consumers & Markets
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Case no.: ACM/18/032693 / **Date: 11 April, 2019**

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Executive summary

For a Dutch version of this executive summary, see the next chapter.

In this market study, ACM analysed to what extent Apple and Google have the incentive and the opportunity with their app stores to influence the availability of apps and the functioning thereof. ACM therefore studied the relationship between app providers and mobile app stores.

Reason and perspective
The smartphone has become increasingly important. The Dutch consumer uses the smartphone more and more to access content and services on the internet. This is mostly done through apps. Apple and Google both have attained strong positions on this market with their operating systems (iOS and Android respectively) and accompanying app stores (the App Store and the Play Store respectively). Since the vast majority of Dutch consumers is only accessible through one of these channels, it is important to have an app present in both app stores for companies that want to reach every Dutch consumer with a smartphone.

Apple and Google determine and control what apps are available in their respective app stores. They are able to do so by setting the terms and conditions for their app stores, by determining what functionalities are available to app providers to utilize and to decide how apps are ranked and featured in the app stores. In that way, Apple and Google also have the opportunity to influence the availability and functioning of apps since they control the mobile operating system. App stores are thus the entities guarding the s*election* for *and presentation* of apps to consumers.

Since 2016, Internet Service Providers are, under the Net Neutrality Regulation, prohibited to treat similar Internet traffic differently. In short, the Regulation addresses ISPs to keep open the broadband connection between, on the one hand, the equipment of end-users, such as a smartphone, and, on the other hand, providers of digital services and content. The Open Internet Regulation does not directly address online platforms such as app stores. However, given the growing importance of app stores for app providers in order to reach end-users on their smartphone, it could be questioned whether app stores have the opportunity to restrict end-user rights effectively.

The growing importance of app stores in combination with the purposes of the Net Neutrality Regulation is the reason why ACM conducted this market study. ACM first analyses the app store ecosystem and the importance hereof. ACM also studies how the process of approval, selection and management of an app is done, of both own apps and third-party apps, and what influence this process has on what apps are available to end-users. Subsequently, ACM investigates in this market study how these findings and reports about the conduct of Apple and Google might influence public interests. ACM analyses the public interests that come with the mission of ACM as a market authority: 'competitive markets' and 'safeguarding consumer interests'. Finally, ACM will establish which of the identified practices might call for further investigation.

The app-ecosystem
The iPhone was the first smartphone, brought to the market in 2007. This smartphone was characterized with an operating system (iOS), with the ability to install apps on the iOS. One year later, Google launched its operating system Android. The launch of *smartphones* has therefore led to the rise and massive growth of online *platforms*. These platforms facilitate and organize online interactions between users and suppliers. Most of these interactions run through apps. Both Apple and Google

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enable third-party software developers to develop and offer apps for Google's Android and Apple's iOS. Consumers can access these apps by downloading them from an *app store.* App stores allow users to discover, install, update, and remove applications from their devices. Which app store is available, depends on the operating system. The *Play Store* is the primary app store installed on Android devices. The *App Store* (hereafter: App Store) is the only app store available for iOS. In the Netherlands, approximately 30-45% of the smartphones run on iOS, and 55-70% of the smartphones run on Android. In the app stores, both own aps and third-party apps are offered. The Play Store offered in total 3.3 million different apps, the App Store 2.2 million.

By opening up their platform to third-party app providers, Apple and Google activated indirect network effects effectively: the more apps in the app stores, the more consumers come to the platform, the more attractive the platform gets for app providers, etc. This increased the value of the products and services of Apple and Google. This effect increased as a result of smartphone producers that also chose for certain operating systems. So the success of Google and Apple's app stores comes partly from an integrated environment (smartphone, mobile OS, app store, apps) that enabled the app stores to profit fully from indirect network effects and reach scale.

Though both ecosystems opened up to app providers, both ecosystems are still closed enough to guarantee the quality of the app-ecosystem. This was and is mainly possible due to the control Apple and Google hold over their ecosystems. The lack of control is also the reason why Symbian and Windows lost this race against Apple and Google. For Apple, vertical integration turned out to be an important strategy to maintain control and guarantee the quality. For Android, bundling of APIs with the Play store cause Google to control their app-ecosystem.

Google and Apple have very different business models and thus different motives. Apple highlights the importance of privacy and security, while Google promotes their more open ecosystem and lower priced and even free services. But, even though they differ in many aspects, the app stores are essential for both Apple and Google to maintain control over their ecosystem. Also, they have the same goals with the app stores, namely attracting as many consumers as possible into their ecosystems to fuel their business models.

Most app providers are dependent on the app stores to reach their public. Apple and Google are both in a position to decide whether an app is available in the app store and how this app can reach its public.

Importance of the app store
ACM assessed whether the app stores and/or the app-ecosystems form a bottleneck within the app-ecosystem. This is analyzed by assessing whether there are viable alternatives available for apps and the app stores. It turned out that the browser or web-apps cannot be considered as a realistic alternative to most native apps since their functionality and usability is limited compared with native apps. It is also a lot harder to reach an audience with a web app since there is no central distribution point where consumers come to search for web-apps.

A possible realistic alternative to the app store is sideloading. Sideloading refers to the installation of apps on a smartphone without using the app store. For consumers, sideloading is not possible on iOS. Sideloading might be a realistic alternative on Android, but only for apps that already have a large brand awareness and established user bases.

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On Android, it is also an alternative to install a different app store, for example the Amazon App Store, Aptoide or Samsung Galaxy apps. Consumers are then able to download apps from this alternative app store. But, these app stores cannot offer the same options as the Play Store. These apps can, for example, not be updated automatically.

Another option to circumvent the app stores is pre-installing apps on Android smartphones, also referred to as pre-loading. This is usually accompanied by a fee. Since smartphone manufacturers generally prefer not to ship their devices with a large amount of third-party apps, pre-loading is usually reserved for a selected few, and are therefore very costly.

Within the iOS-ecosystem, there are no realistic alternatives for apps or the App Store, so the App Store forms a bottleneck within the iOS-ecosystem. Within the Android-ecosystem, some alternatives for apps and the Play Store exist, but only for app providers that already have achieved a certain amount of brand awareness.

The closed nature of both app-ecosystems cause high switching barriers for consumers but also causes high costs for app providers to offer their app in both ecosystems. Apple and Google might compete for app providers; but the popular and successful apps are present in both appstores. It is about becoming a default gateway for consumers to reach online content, and for providers of content to reach an audience. The app stores and their surrounding ecosystems form a very important base from which Apple and Google can expand their platform-ecosystem and secure the bottlenecks they have already captured.

Apple and Google have a large amount of bargaining power over app providers. Towards very large app-providers, this might be less.

Conduct
To get insights into the approval and selection processes of the app stores, ACM interviewed several app providers, received written input and spoke to Apple and Google. Furthermore, ACM studied the general terms & conditions of both Apple and Google and conducted a desk research to use the many digital sources that are available about this subject. All of this input combined gives insight into the conduct of Apple and Google as controllers of the App store and the Play Store, respectively.

App providers have remarks on the conditions on which access is granted and refused. App providers complain that the terms and conditions for access, especially for Apple, are open for multiple interpretations and that the reasons given for a refusal can be unclear. App providers experience problems with the interoperability with the operating system of with functionalities on the phone, like with Siri or the NFC-chip. Other app providers have indicated that even though their apps are given full access to the app stores they have a strong disadvantage compared with proprietary Apple and Google apps, due to the pre-installation of their own apps. Furthermore, app providers indicate that it is hard and/or expensive to be found by consumers.

Secondly, the commission levied by Apple and Google leads to complaints by app providers. When an app provider sells digital content or services in their app, they are required to use in-app purchases (IAP). Only apps that sell digital content that is delivered on the phone need to pay the commission: for example Spotify, Netflix, premiums in a game or subscriptions to a newspaper. For an Uber ride or a package from Bol.com, the use of IAP is not required. On these IAPs, the provider needs to pay a 30% commission, and 15% in the second year in case of a subscription. It is not allowed to link to payment methods outside of the app. App providers question the high fee percentage of the commission

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(especially in the case of subscription services), and the distinction between those apps that do and do not have to pay the commission over in-app purchases. On top of that, app providers state that when they use IAP, there is an inability to access customer data and consequently to offer the right level of services to customers.

Finally, app providers experience limited transparency & liability of Apple and Google. App providers have indicated that it can be difficult to get in touch with Google and Apple. In other cases, communication on rejections refer to vague terms & conditions, which makes it hard for app providers to adjust their apps. It is, especially for smaller and mid-size app providers, hard to get in touch with Apple and Google. Most often, it is not possible to communicate with Apple and Google about the refusal of an app. This not only leads to a delay for the app provider, but this also might damage the reputation of an app provider and might be very costly. Furthermore, Apple's terms and conditions allow them to imitate (Sherlock) apps in their store and shift all liability to app providers. App providers cannot do anything else but accept these terms & conditions.

ACM also spoke to Apple and Google and ask them about their views on certain topics, the used terms & conditions and several processes. Apple and Google point at matters as integrity, safety and the quality of the app stores and the ecosystems, the investments they made to develop the app stores and the opportunities the app stores give to app providers. According to Apple, favouring their own apps over third-party apps would not be rational. Apple wants to offer the best services possible to its users and therefore has no incentive to refuse a third-party that offers a higher quality app.

Public interests
Subsequently, ACM examined how the importance of the app store and the conduct, have influence on public interests. Specifically, the public interests of well-functioning markets and consumer protection are affected.

The combination of effective competition and innovation on a market ensures that end-users get the optimal combination of price and quality considering their personal preferences. However, well-functioning markets go beyond competition in the short run. When assessing effects on markets, ACM also takes the long-term effects on consumer welfare into account.

The app stores have greatly decreased entry barriers and have led to a flourishing of a variety of innovative apps. Google and Apple also safeguard the integrity and safety of their ecosystems, which benefits Apple, Google, app providers and consumers. By providing a development framework for app developers, Apple and Google have promoted innovation within their respective ecosystems and have facilitated the access to mobile consumers. The app stores have become a marketplace in their own right and are able to influence the access that app providers have to the platform and ultimately, mobile consumers. The app stores also made it easier for an app provider to reach the consumer and, the other way around, for the consumer to access online content and services . As a result, transaction costs between the app provider and consumer have decreased substantially.

At the same time, Apple and Google have a unique role since they simultaneously fulfill the role of both the app store operator *and* of the app provider. They may distort competition by limiting interoperability, complicating access or limiting the favorable displaying of third-party apps, thus disturbing equal access to the market. Several app providers that ACM interviewed gave examples of such conduct. Certain limitations within the ecosystem may be justified and actually benefit consumers, but this might limit the ability of app providers to offer certain services.

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We have also seen that some app providers do not have access to all the customer data they wish to have. This might impact the ability of the app provider to compete. Google and Apple have also significant discretion over the presentation of apps. Both may determine how to rank apps and what apps to feature.

To conclude, the 30 or 15 percent commission levied by Apple and Google may also affect competition. This distortion of competition is present when Apple and Google apply the terms and conditions, related to the mandatory use of IAP, differently to similar apps. The competition between categories of apps may be distorted as well. Apps that fall outside the category of digital content and services are favored in respect to apps that do fall within this category.

The public interest of consumer protection can be characterized by consumers who have options to choose from and who are able to make well-informed decisions. But consumers also benefit from high quality, safe products, and from their data being protected safely.

Consumers greatly benefit from the app stores. App stores make it easily accessible and convenient for consumers to reach and download apps on their mobile device. The large number of apps available in the app stores can lead to the discovery of new products, content and services. But the large number of apps can also lead to increased search costs. The app stores aim to reduce this problem of information overload by using algorithms and consumers rely on this. However, these algorithms are not transparent and affect consumer choice.

App stores have the incentive to have as many qualitatively good apps in the app stores as possible to grow the overall value of their ecosystem, which is beneficial for consumers. Consumers therefore benefit from a strict review process. However, this review process causes that apps with certain content is not available in the app store. For example, erotic content is prohibited by both app stores.

Consumers benefit the IAP system of Apple and Google. This increases the convenience for consumers: a consumer only has to enter their payment details once, and can thereafter pay with just one simple click, and it prevents sensitive data from going to third-party app providers that might not treat this data with care. On the other hand, the requirement to use IAP for certain apps may limit consumer choice: consumers are restricted to the payment systems chosen by Apple and Google. Furthermore, when app providers that are required to use IAP, remove the IAP option completely (e.g. Netflix and Spotify), consumers are affected because certain app functions are no longer available. There are also examples where the app provider fully passes on the 30% commission to their consumer prices, which negatively impacts consumers as well.

Findings and follow-up

In this market study, ACM received several reports from app providers about the conducts exhibited by Apple and Google. Given the important position of Apple and Google with their respective app stores and the public interests that might be at stake, ACM has identified three types of conduct that might warrant further investigation.

First, ACM has an indication that Apple and Google might favour their own apps over apps from competing app providers. Second, app providers have raised the issue that comparable apps are treated differently in some instances. Third, ACM has received reports from app providers that Google and Apple are not transparent in their communication. The upcoming Platform to Business regulation might form a solution to this problem.

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Further investigation might be done by exploring options for ex ante regulation, for example by additional regulation, similar to the European Open Internet Regulation. Further investigation may also be conducted under existing legislation, such as competition law. ACM is of the opinion that the findings of this market study warrant further investigation, based on either one of these legislative instruments.

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Managementsamenvatting

In deze marktstudie heeft de ACM onderzocht in hoeverre Apple en Google, met hun appstores en de prikkel en mogelijkheden hebben om invloed uit te oefenen op de beschikbare apps in de appstores en op het functioneren van deze apps. De ACM heeft hiertoe onderzocht hoe Apple en Google omgaan met appaanbieders die een app in een appstore willen plaatsen.

Motivatie en perspectief
De smartphone is over de afgelopen jaren steeds belangrijker geworden. De Nederlandse consument gebruikt de smartphone steeds meer om services en content op het internet te bereiken. Dit doet zij vooral door middel van apps. Apple en Google hebben beiden een zeer sterke positie verworven met hun besturingssystemen (respectievelijk iOS en Android) en bijbehorende appstores (respectievelijk de App Store en de Play Store). Aangezien de Nederlandse consument voor het overgrote deel slechts bereikbaar is via één van deze twee kanalen, is het voor een aanbieder die alle Nederlandse consumenten op zijn mobiele telefoon wil bereiken, noodzakelijk om in beide appstores aanwezig te zijn.

Apple en Google beslissen en controleren welke apps er in de respectievelijke appstores aanwezig zijn. Zowel door het stellen en toepassen van voorwaarden voor het publiceren van een app, het beschikbaar stellen van functionaliteiten voor apps, als het ranken en uitlichten van apps in de appstores. Daarnaast hebben Apple en Google de mogelijkheid om invloed uit te oefenen op de beschikbaarheid en functionaliteiten van apps door hun controle op het mobiele besturingssysteem. Apple en Google beschikken hierdoor mogelijk over een poortwachterspositie.

Sinds 2016 is het onder de Europese netneutraliteitsverordening niet toegestaan voor internetaanbieders om vergelijkbaar internetverkeer technisch verschillend te behandelen. Deze verordening zorgt ervoor dat internetaanbieders de breedbandverbinding open houden tussen enerzijds de apparatuur van eindgebruikers, zoals de smartphone, en anderzijds de aanbieders van online diensten of content. Platformen zoals appstores vallen als zodanig niet onder deze regulering. Maar gezien het toenemende belang van de appstores in het gebruik van mobiel breedband door eindgebruikers, kan de vraag worden gesteld of appstores effectief de mogelijkheid hebben om eindgebruikersrechten te beperken.

De ACM is deze marktstudie gestart vanwege het vooronderstelde belang van de appstores in de mobiele wereld bezien in combinatie met de gedachte achter de Europese netneutraliteitsverordening. De ACM analyseert allereerst het appstore ecosysteem en het belang hiervan. Tevens onderzoekt de ACM hoe het proces van goedkeuring, selecteren en managen van apps er uit ziet, zowel van eigen apps als apps van derden, en welke invloed dit proces heeft op de apps die beschikbaar zijn voor eindgebruikers.

Daaropvolgend onderzoekt de ACM in deze marktstudie hoe de bevindingen en signalen met betrekking tot de gedragingen van Apple en Google de publieke belangen kunnen beïnvloeden. De ACM analyseert hierbij de publieke belangen die samenhangen met de missie van de ACM als markttoezichthouder, te weten: 'concurrerende markten' en 'behartigen van consumenten belangen'. Tot slot stelt de ACM vast of/en zo ja welke signalen en bevindingen nader onderzoek vragen.

Het app ecosysteem

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In 2007 lanceerde Apple haar eerste smartphone, de iPhone. Deze mobiele telefoon werd gekenmerkt door een besturingssysteem (iOS) met een onderscheidende mogelijkheid om apps op het iOS te instaleren. Niet veel later volgde ook de lancering van het besturingssysteem Android, dat wordt gecontroleerd door Google. De lancering van smartphones heeft (onder meer) geleid tot de opkomst en groei van online platforms. Met deze platforms worden interacties tussen aanbieders en consumenten gefaciliteerd. Veel van deze interacties en services gaan door middel van apps. Zowel Apple als Google hebben het gemakkelijk en laagdrempelig gemaakt voor app aanbieders om apps te ontwikkelen voor Android en iOS. Consumenten kunnen deze apps downloaden, installeren, updaten en verwijderen via de appstore. Welke appstore beschikbaar is, is afhankelijk van het besturingssysteem. Op Android is de Play Store van Google de voornaamste appstore, deze wordt vooraf geïnstalleerd op de Android toestellen. Op de iPhone biedt Apple's App Store de enige mogelijkheid om apps te downloaden. In Nederland is op ongeveer 30-45% van de smartphones iOS geïnstalleerd, en op 55-70% Google-Android. In beide appstores worden zowel eigen apps als apps van derden aangeboden. In totaal zijn dit 3,3 miljoen apps in de Play Store en 2,2 miljoen apps in de App Store.

Door hun platform open te stellen voor andere appaanbieders, hebben Apple en Google effectief indirecte netwerkeffecten kunnen activeren: hoe meer apps in de appstore, hoe meer consumenten naar dit platform komen, hoe aantrekkelijker dit platform weer wordt voor appaanbieders, etc. Daarmee zijn de producten en services van Apple en Google in waarde toegenomen. Dit werd versterkt door de smartphone fabrikanten die ook voor een bepaald besturingssysteem hebben gekozen. Het succes van Apple en Google is daarom mede toe te schrijven aan de succesvolle integratie van smartphone, het besturingssysteem, de appstore en de apps, wat de mogelijkheid gaf om optimaal te profiteren van indirecte netwerkeffecten en een substantiële schaal te bereiken.

Ook al hebben Apple en Google hun ecosystemen geopend voor app aanbieders, beide ecosystemen zijn wel gesloten genoeg om de kwaliteit van het app-ecosysteem te waarborgen. Dit komt door de controle die Apple en Google over hun app-ecosysteem hebben. Dit is Symbian en Windows niet gelukt, doordat zij minder controle hadden. Hierdoor hebben zij het verloren van Apple en Google. Bij Apple is de verticale integratie van hardware en software een belangrijke strategie gebleken om de kwaliteit te waarborgen. Voor Android is dit de bundeling van API's en met Play Store. Dit zorgt ervoor dat Google de controle kan houden op zijn app-ecosysteem.

Ook de bedrijfsmodellen van Apple en Google verschillen enorm. Waar Apple zich meer richt op het belang van veiligheid en privacy, is Google meer gericht op het verzamelen van data, wat ze doet door middel van een open ecosysteem met lage prijzen en gratis services. Maar, voor beiden is de appstore een essentieel onderdeel van hun ecosysteem en beiden hebben hiermee hetzelfde doel: zoveel mogelijk consumenten in hun ecosysteem krijgen.

Appaanbieders zijn afhankelijk van de appstores voor het al dan niet slagen van een app. Apple en Google zijn in een positie om te bepalen of een app in de appstore komt en hoe deze weergeven wordt.

Belang van de appstores
De ACM heeft onderzocht in hoeverre de appstores een bottleneck vormen binnen het app-ecosysteem. Hiertoe heeft de ACM onderzocht of er realistische alternatieven zijn voor de appstores en voor apps. Hier uit blijkt dat de browser of web-apps veel minder functionaliteiten bieden dan native apps en daardoor geen realistische alternatieven zijn. Bovendien zijn deze web-apps moeilijker te vinden voor consumenten, omdat er geen centraal distributiepunt is, zoals de appstore.

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Een ander mogelijk alternatief is om apps via sideloading op de telefoon te installeren, hiermee wordt de appstore omzeild. Sideloaden is voor consumenten niet mogelijk op iOS. Op Android zou dit wel een alternatief kunnen vormen, maar alleen voor apps die al een grote naamsbekendheid en een grote klantenkring hebben of voor hele technische consumenten.

Op Android is het daarnaast mogelijk om, via sideloading, ook andere appstores te installeren, zoals de Amazon Appstore, Aptoide en Samsung Galaxy Apps. Consumenten kunnen dan ook vanuit die appstores hun app downloaden. Deze appstores bieden echter niet dezelfde mogelijkheden aan als de Play Store. Zo kunnen apps niet automatisch worden geüpdatet.

Appaanbieders kunnen daarnaast apps vooraf laten installeren op een Android smartphone, voor de voorinstallatie van apps dient in de regel betaald te worden. Omdat smartphone fabrikanten niet willen dat er te veel apps voor geïnstalleerd worden, is dit in de praktijk erg duur.

Omdat er op iOS geen realistische alternatieven voor de App Store zijn, concludeert de ACM dat de appstore een bottleneck vormt binnen het iOS ecosysteem. Op Android zijn er alternatieven, maar deze zijn alleen succesvol voor apps met een bepaalde grootte en bekendheid.

Het gesloten karakter van beide ecosystemen zorgt voor hoge overstapdrempels voor consumenten maar ook voor hoge kosten voor appaanbieders om hun app in beide ecosystemen aan te bieden. Apple en Google mogen dan met elkaar concurreren om appaanbieders: maar alle populaire en succesvolle apps zijn in beide appstores aanwezig. Het is Apple's en Google's doel de default toegangspoort te worden voor consumenten om online content te verkrijgen. De appstores vormen een belangrijke basis vanwaar Apple en Google hun ecosysteem kunnen vergroten en hun poortwachtersfunctie kunnen versterken.

Apple en Google hebben grote onderhandelingsmacht ten opzichte van appaanbieders. Ten opzichte van hele grote appaanbieders is dit mogelijk wel minder.

Gedragingen
Om inzicht te krijgen in de gedragingen van Apple en Google met de appstores, is de ACM in gesprek gegaan met verschillende appaanbieders, heeft zij schriftelijk input aan hen gevraagd en heeft zij met Apple en Google zelf gesproken. Ook heeft de ACM de voorwaarden van de appstores onder de loep genomen en heeft zij gebruik gemaakt van de vele digitale bronnen die beschikbaar zijn over dit onderwerp. Dit tezamen geeft een beeld van de gedragingen van Apple en Google in relatie tot de appstores.

Appaanbieders geven aan dat zij drempels ervaren in de toegang tot de eindgebruiker. Ten eerste door het goedkeuringsproces. Appaanbieders geven aan dat zij de voorwaarden van Google - maar voornamelijk Apple - te vaag vinden. Het is vaak onduidelijk waarom een app geweigerd wordt, appaanbieders zijn van mening dat zij hier onvoldoende toelichting bij krijgen. Ook zetten verschillende appaanbieders vraagtekens bij de reden voor de weigering. Deze volgt niet altijd uit de voorwaarden van de appstore. Daarnaast ervaren appaanbieders problemen met interoperabiliteit met het besturingssysteem of bepaalde functionaliteiten op de telefoon, zoals met Siri of de NFC-chip. Bovendien geven appaanbieders aan niet altijd een eerlijke kans te hebben ten opzichte van eigen apps van Apple dan wel Google die al op de telefoon geïnstalleerd staan of de wijze waarop ranking in de appstore geregeld wordt.

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Ten tweede hebben veel appaanbieders aan de ACM laten weten dat zij problemen hebben met de commissie die zij dienen te betalen over in-app purchases (IAP). Wanneer een appaanbieder bij Apple of Google digitale content of services verkoopt in zijn app, dient hij gebruik te maken van IAP. Dit houdt in dat de appstore de betaling afhandelt via de account van de consument. De voorwaarde geldt enkel voor apps waarbij de dienst daadwerkelijk op de telefoon geleverd wordt, bijv. Spotify of Netflix, premiums in een game, krantenabonnementen etc. Voor een rit van Uber of een pakket van Bol.com geldt dit niet. Over IAP dient de appaanbieder bij zowel Apple als Google een commissie te betalen van 30%, en bij abonnementen vanaf het tweede jaar 15%. Ook is het niet toegestaan om een link te plaatsen naar betaalmethoden buiten de app. Appaanbieders klagen over de hoogte van de commissie (in het bijzonder bij abonnementen) en het onderscheid dat gemaakt wordt tussen apps die wel en niet aan deze verplichting moeten voldoen.

Bovendien geven appaanbieders aan dat, wanneer zij gebruik maken van IAP, niet alle benodigde klantdata met hen gedeeld wordt. Hierdoor kan een appaanbieder niet zien wat de reden is dat een klant zijn abonnementskosten niet betaald heeft en is zij minder goed in staat om goede service aan haar klanten te leveren.

Ten slotte geven appaanbieders bij de ACM aan dat transparantie vaak een probleem vormt in het proces om een app in de appstore te plaatsen of te updaten. Zij geven daarbij aan voornamelijk problemen te hebben met de communicatie over de toepassing van de voorwaarden. Het is, met name voor de kleine tot middelgrote appaanbieders, moeilijk om in contact te komen met Apple en Google. Vaak is het niet mogelijk om in gesprek te gaan wanneer zij het niet eens zijn met de weigering van een app. Dit levert niet alleen vertraging op voor de appaanbieder, maar is ook schadelijk voor de reputatie en kan veel geld kosten. Ten slotte wijzen appaanbieders op voorwaarden van Apple en Google die hen slechts beperkt verantwoordelijk houdt van enige misstanden in de appstore, en op een voorwaarde van Apple die hen toestaat apps te imiteren. Appaanbieders kunnen niet anders dan deze voorwaarden te accepteren.

De ACM heeft ook met Apple en Google gesproken en hen om een toelichting gevraagd over de door hen gehanteerde voorwaarden, werkwijze en beweegredenen. Hierbij wijzen Apple en Google onder meer op zaken als de integriteit, veiligheid en kwaliteit van de appstore en daarmee het ecosysteem, de investeringen die zij hebben gedaan om de appstores mogelijk te maken en de kansen die dit biedt voor appaanbieders. Ook stelt Apple dat het niet in haar belang is om apps te benadelen, ze willen immers een zo aantrekkelijk mogelijke appstore aanbieden.

Publieke belangen
Vervolgens heeft de ACM onderzocht in hoeverre het belang van de appstores en de gevonden gedragingen invloed hebben op goedwerkende markten en consumentenbescherming.

Hierbij zien goedwerkende markten op de combinatie van effectieve concurrentie en innovatie. Zowel op korte termijn, als ook op de lange termijn: naast de effecten op prijs worden ook de effecten op innovatie, kwaliteit en diversiteit van producten en diensten in ogenschouw genomen.

Appstores hebben toegangsbarrières voor het aanbieden van apps verlaagd wat heeft geleid tot een grote toename aan diversiteit van en concurrentie tussen apps. De veiligheid en integriteit van de appstores die Apple en Google nastreven zijn van belang voor zowel Apple en Google zelf, alsook voor appaanbieders en consumenten. Door het ter beschikking stellen van ontwikkelprogramma's hebben de appstores bijgedragen aan lagere ontwikkelkosten voor apps en de prijs hiervan voor consumenten. De appstores vormen een geheel nieuwe marktplaats met een groot bereik onder

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consumenten, wat veel mogelijkheden biedt voor appaanbieders. De appstores het eenvoudiger gemaakt voor een appontwikkelaar om een consument te bereiken, andersom heeft de consument een centrale gemonitorde plek tot zijn beschikking om nieuwe functionaliteiten aan zijn smartphone toe te voegen. Zodoende zijn de transactiekosten tussen ontwikkelaar en gebruiker aanzienlijk verlaagd.

Tegelijkertijd hebben Apple en Google een unieke positie doordat zij zowel eigenaar van de appstore zijn als ook eigen apps hebben. Zij hebben daarmee de mogelijkheid om concurrentie tussen apps te verstoren en toegangsbarrières te verhogen door interoperabiliteit met het operating system en toegang tot functies van de telefoon te beperken of door eigen apps hoger te ranken in de appstore of voor te installeren. Meerdere appaanbieders die de ACM heeft gesproken hebben hier voorbeelden van gegeven. Dergelijke gedragingen kunnen – zoals Apple en Google aangeven - aan de ene kant de integriteit en veiligheid bevorderen, maar benadelen aan de andere kant wel de concurrentiepositie van apps van derden.

Ook wordt de concurrentiepositie van apps van derden soms verslechterd doordat zij geen toegang krijgen tot data die hen helpt om een goede service te leveren aan hun klanten. Daarnaast kunnen Apple en Google beïnvloeden hoe en in welke volgorde apps getoond worden in de appstore.

Tot slot heeft ook de 30% /15% commissie die Apple en Google rekenen over bepaalde IAP invloed op de concurrentie tussen en innovatie van apps. De commissie kan concurrentie in een bepaalde categorie aan apps beïnvloeden doordat derde partijen een commissie moeten afdragen en Apple & Google dit bij een vergelijkbare dienst niet hoeven te doen. Daarnaast is de concurrentieverstoring ook aanwezig als de verplichting tot het betalen van de commissie verschillend wordt toegepast bij vergelijkbare apps van verschillende derde partijen.

Consumentenbescherming ziet erop dat consumenten de mogelijkheden hebben om weloverwogen keuzes te maken, kunnen profiteren van veilige producten met een hoge kwaliteit en dat er op een rechtmatige en transparante manier wordt omgegaan met hun privacy en data.

De appstores hebben er voor gezorgd dat er veel apps op een laagdrempelige manier voor consumenten beschikbaar en vindbaar zijn. Het grote aanbod aan apps verhoogt wel de zoekkosten om een goede keus te kunnen maken. Om snel de juiste app te kunnen vinden, maken Apple en Google gebruik van algoritmes. Deze algoritmes zijn echter vaak niet transparant en hebben grote invloed op de keuze die consumenten maken.

Consumenten profiteren in principe van enkel kwalitatief goede apps in de appstore en hebben dan ook baat bij een goed selectieproces. Wel zorgt dit selectieproces ervoor dat apps met bepaalde content niet beschikbaar is, zo wordt bijvoorbeeld erotische content door beide appstores uitgesloten.

Consumenten profiteren enerzijds van het IAP systeem van Apple en Google. Zo hoeven ze maar één keer hun betaaldata in te voeren en die data komt niet bij verschillende appaanbieders terecht. Echter, consumenten hebben hier geen keuze in. Ook zijn sommige premium opties niet beschikbaar in apps. Daarvoor moet de consument naar de website om een premium abonnement af te sluiten. Bovendien kan het zijn dat producten wezenlijk duurder worden wanneer de appaanbieder de commissie die bij IAP hoort, doorberekent aan de consument.

Bevindingen en aanbevelingen
De ACM heeft in deze marktstudie verscheidene signalen met betrekking tot de gedragingen van Apple en Google ontvangen. Gegeven de belangrijke positie van Apple en Google met de

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respectievelijke appstores en de publieke belangen die mogelijk in het geding zijn, ziet de ACM drie (type) gedragingen die om nader onderzoek vragen:

Ten eerste heeft de ACM aanwijzingen dat Apple en Google hun eigen apps mogelijk bevoordelen ten opzichte van apps van anderen. Ten tweede geven appaanbieders aan dat vergelijkbare apps in bepaalde gevallen verschillend behandeld worden. Ten derde heeft de ACM signalen ontvangen van appaanbieders dat Google en Apple niet transparant zijn in hun communicatie. Deze laatste wordt mogelijk aangepakt door de recent aangenomen Europese *Platform to Business verordening.*

Vervolgonderzoek kan enerzijds door mogelijkheden te onderzoeken voor ex ante regulering, bijvoorbeeld in analogie met de doelstellingen van de Europese Netneutraliteitsverordening, of anderzijds door een interventie te doen op basis van de Mededingingswet. De ACM is van mening dat de gevonden problemen in deze marktstudie voldoende aanleiding geven voor vervolgonderzoek, op basis van één van deze genoemde instrumenten.

1   Introduction

1.1   Reason for looking into mobile app stores

The markets for smartphones and apps have evolved into a mature market over the past few years. The smartphone has become increasingly important for accessing content and services on the internet.[1] Furthermore, a considerable amount of internet traffic now goes through apps: of the 61 hours Dutch people spend on their mobile phones on a monthly basis, they spend 6 hours in the browser and 55 hours in apps.[2] Most of the products and services accessed on the smartphone, is done through apps. The average Dutch consumer has about 25 apps installed on their smartphone.[3]

The two largest mobile platforms, Android and iOS, have attained strong positions on this market. Over 99% of all smartphones in the world run on Google's operating system (Android, 86.2%) or Apple's operating system (iOS, 12.9%)[4]. In the Netherlands, the difference in market share between iOS and Android is smaller: between 30 and 40 percent of all smartphones in the Netherlands run on iOS, others (almost all of them) on Android (see also section 2.5). For companies that want to reach every Dutch consumer with a smartphone, it is important to have an app present in both app stores. If companies are unable to get access to consumers through the app stores, this might harm their ability to offer their services to consumers effectively.

Google and Apple determine and control what apps are available in their respective app stores; Play Store and App Store. They are able to do so by setting the terms and conditions for their app stores, which allows them to accept or reject the publication of new apps and to remove existing apps. The app stores also determine what functionalities are available to app providers to utilize and also what type of content or services they can offer in their apps. All of this, combined with the way apps are ranked in the app stores, influences the type of services, content and information that consumers can and decide to access through apps.

Apple and Google have the opportunity to control, force or restrict certain apps, software, user options or content by managing the respective operating systems in addition to managing the app store itself, for example by pre-installing, integrating or bundling certain functionalities with the operating system or the app store. They also determine the conditions that consumers and app providers need to comply with in order to interact with each other. App stores are thus the entities guarding the s*election* for *and presentation* of apps to consumers.

Since 2016, Internet Service Providers (hereafter: ISPs) are prohibited from blocking or slowing down of Internet traffic based on commercial considerations, under the European Open Internet Regulation[5]

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[1] https://www.sidn.nl/downloads/reports/SIDN_Trends_in_internetgebruik_2018.pdf, slide 5 and 6.
[2] Ibid.
[3] SIDN en GfK, "Trends in Internetgebruik 2016", 2016.
https://www.sidn.nl/downloads/reports/SIDN_Trends_in_internetgebruik_2016.pdf
[4] Tweakers, "Meer dan 99 procent van verkochte smartphones draait Android of iOS", 19 August 2016
https://tweakers.net/nieuws/114779/meer-dan-99-procent-van-verkochte-smartphones-draait-android-of-ios.html The article is based on: Gartner, "Gartner Says Five of Top 10 Worldwide Mobile Phone Vendors Increased Sales in Second Quarter of 2016"19-8-2016 http://www.gartner.com/newsroom/id/3415117
[5] Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union.

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- also known as the Net Neutrality Regulation. The objective of this regulation is "to protect end-users and simultaneously to guarantee the continued functioning of the internet ecosystem as an engine of innovation."[6] To this end, "end-users should have the right to access and distribute information and content, and to use and provide applications and services free of discrimination, via their internet access service."[7] In short, the Regulation addresses ISPs to keep open the broadband connection between on, the one hand, the equipment of end-users, such as a smartphone, and, on the other hand, providers of digital services and content.

The Open Internet Regulation does not directly address online platforms such as app stores, and there is still a difference between the role of ISPs and app stores within the internet ecosystem. However, given the growing importance of app stores for app providers in order to reach end-users on their smartphone, it could be questioned whether app stores have the opportunity to restrict end-user rights effectively as protected under the Net Neutrality Regulation.

The growing importance of app stores in combination with the purposes of the Net Neutrality Regulation is the reason why ACM is conducting this market study in order to gain a better understanding of how it works, and whether app providers are confronted with problems when publishing or developing an app.

1.2 ACM's perspective, public interests and the scope of this report

In this section, ACM elaborates on the perspective it uses in this report to assess the influence of mobile app stores. To this end, the statutory objective and the mission of ACM are discussed. Subsequently, the public interests that underpin ACM's work are addressed.

ACM has the statutory objective to work towards well-functioning markets, orderly and transparent market processes, and the proper treatment of consumers. In the statute creating ACM, the purpose of ACM is defined as "to monitor, safeguard and stimulate effective competition and ensuring equal conditions for the competition on markets and reducing restrictions to this[8]." In the explanatory note to the statue, this is explained further. The underlying idea is that well-functioning markets lead to results that are in the interest of consumers and companies. Competition stimulates companies to innovate, not to waste scarce resources in producing goods and services and to offer those products that consumers desire. Fair competition, access to markets and protection of consumers lead to an active economy, because companies can compete on a level playing field, and consumers get value for their money. This involves many public interests such as equal access to markets, affordability, sufficient investments in infrastructure, secure supply, no abuse of dominant positions, no fixing of prices where it harms consumer interests and the transparency for consumers when they choose products.[9]

The mission of ACM is to ensure that markets work well for people and businesses. When markets function well, businesses compete fairly with one another, and people and businesses are not harmed

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[6] Consideration 1 of the Open Internet Regulation.
[7] Consideration 6 of the Open Internet Regulation.
[8] Section 2, paragraph 5 of the Establishment Act of the Netherlands Authority for Consumers and Markets: "*The objective of the activities of the Authority of Consumers and Markets shall be to ensure that markets function well, that market processes are orderly and transparent, and that consumers are treated with due care. To that end, it shall guard, promote, and protect effective competition and a level playing field, and remove any impediments to these goals.*"
[9] https://zoek.officielebekendmakingen.nl/kst-33622-3.html

by unfair practices. People and businesses know what rules apply, and how they can exercise their rights.[10]

In its oversight style, ACM focusses on the effects of its actions. ACM uses its formal instruments to that end: to effectively intervene when this is needed. Related public interests give ACM a framework to assess whether there is a problem on a certain market. The two public interests ACM is focusing on in this report are 'competitive markets' and 'safeguarding consumer interests'.

In many cases, ACM takes into account public interests not explicitly, but implicitly by referring to the objective of the legislature in a specific statute. In this report, this exercise is done more explicitly and more elaborately.

Effective competition combined with innovation ensures that end-users get the optimal combination of price and quality considering their personal preferences. However, well-functioning markets go further than competition in the short run. When assessing effects on markets ACM also takes the long-term effects on consumer welfare into account. These are not just the effects on prices, but also the effects on innovation and on the quality and diversity of products and/or services. Our oversight efforts are not only focused on the conduct of companies, but also on market structures.

The public interest of consumer protection can be characterized by consumers who have options to choose from and who are able to make well-informed decisions. But consumers also benefit from high quality, safe products, their data being protected safely and consumer rules being enforced.

1.3   Methodology and structure of this report

This market study aims to investigate whether certain conduct in the app store market leads to problems that ask for action from ACM or other authorities. As outlined above, ACM analyzes this market with a broader point of view in light of the fact that it is a multi-disciplinary authority.

With this market study, ACM studies a specific relationship within the digital economy: the relationship between the app store and the app provider and the impact of this relationship on the availability of apps. This relationship is part of a bigger ecosystem and this bigger ecosystem also influences this relationship. Therefore, ACM will first describe the structure and development of digital ecosystems and the place of the app stores within this ecosystem in **Chapter 2**.

Subsequently, ACM will study whether the app stores have a bottleneck position between app developers and mobile consumers: are there any possible alternatives to the app stores within the ecosystem and do these alternatives form a realistic option for consumers and/or app providers to reach each other? If not, potential problems could not be solved by the market on its own and intervention may be needed. These questions will be answered in **Chapter 3**. This chapter also outlines whether there are competitive restraints from actors within and outside of the ecosystems and whether there are any future developments that influence this.

To get insights into the approval and selection processes of the app stores, ACM interviewed thirteen app providers. These app providers differ in size from small independent businesses to large internationals. One group of app providers contacted ACM to give input, based on the press release of

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[10] https://www.acm.nl/sites/default/files/documents/acm-strategy-2019.pdf

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July 2018[11] or through another contact that had already been established with ACM before. The other group is approached for an interview by ACM itself. ACM approached these app providers based on the relevance of their app to Dutch society. ACM also approached a lot of app providers with relevant apps that were not able or willing to talk. An overview of the app providers ACM got into contact with is available in the confidential Annex 1. ACM spoke to the app providers about what their experiences are in both app stores; whether they experience problems within the approval process, about the transparency and communication with Apple and Google, and whether they think there are viable alternatives to reach Dutch consumers via smartphones. Besides these interviews, ACM received written input from several app providers, and conducted a desk research and a media review to verify the findings of the app providers.

Furthermore, ACM studied the general terms & conditions of both Apple and Google, to learn more about the specific rules of the app stores. ACM also spoke to both Apple and Google to ask for their opinion about this market, and for their explanation on the rationale behind their general terms & conditions.

All of this input combined gives insight into the conduct of Apple and Google as controllers of the App store and the Play Store, respectively. ACM gives an overview of this conduct in **Chapter 4** of this market study.

In **Chapter 5,** ACM will analyse whether the findings of Chapter 2, 3 and 4 have effects on public interests, as discussed in the previous section.

In the final chapter, **Chapter 6**, ACM discuss the main findings of this market study. In this chapter, ACM will consider which of the identified practices need further investigation.

Important notes

It is not the objective of this market study to carry out a competition-law analysis in which markets are defined, and where the presence of an undertaking with a dominant position is established. In this market study, any mention of the term 'market' is thus not within the meaning of 'market' in the competition-law sense.

This market study was discussed before finalization and publication with a group of academics with experience and knowledge about digitalization and platforms.

Members of this group:

- Prof. dr. José van Dijck, distinguished university professor media and digital society at Utrecht University.
- Prof. dr. Anna Gerbrandy, professor of Competition Law at the Europa Institute of Utrecht University School of Law
- Dr. Stefan Kulk LLM, assistant-professor at Utrecht University, School of Law
- Prof. dr. Erik Brouwer, professor of Competition and Innovation, Tilburg University, chair financed by ACM
- Prof. dr. Jarig van Sinderen, Professor of Economic Policy at the Erasmus School of Economics, Chief Economist at ACM
- Freek Bruggert, MSc LLM, competition specialist at ACM

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[11] https://www.acm.nl/en/publications/acm-launches-market-study-mobile-app-stores

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2   The app-ecosystem

In this chapter, we will describe the developments that have led to the creation of the two *app-ecosystems* that we know today, Android and iOS. In order to do so, we will explain the different chains and layers within the app-ecosystem, visualized in Figure 1. We will also describe what role the app stores play within the larger app-ecosystem, and how they emerged.
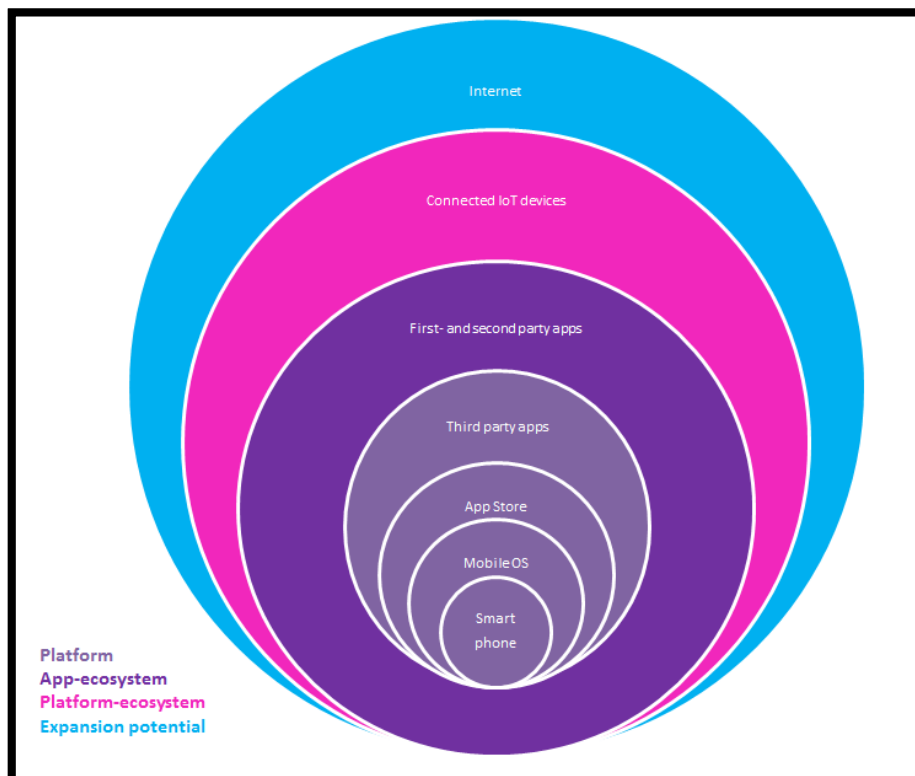
Figure 1: Ecosystem layers

2.1   Online Platforms

In this section, we will introduce three central, connected *online platforms*: the *smartphone*, the *mobile Operating System* and *the app store*. We also introduce *apps*, which can also form an online platform.

> An **online platform** is a technological, economic and socio-cultural infrastructure that facilitates and organizes online interactions between users and suppliers.[12]

Smartphones, Operating Systems and apps
Developments like digitalization, falling prices for the storage and processing of data, the implementation of advanced technology in smartphones and, more recently, the Internet of Things (hereafter: IoT) have contributed to the rapid rise and penetration of smartphones, since most online

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[12] Van Dijck, José, Poell, Thomas, De Waal, Martijn, "De Platformsamenleving" 2016, p. 11.

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services and IoT-devices are controlled through smartphone *apps*. The launch of *smartphones* has therefore led to the rise and massive growth of online *platforms.*

> A **smartphone** is defined as 1) a type of mobile device that uses a high-level mobile **operating system** (hereafter: OS), and 2) as a device that runs a wide variety of *applications* (hereafter: apps) that add extra functionality to the device.[13]

> An **app** is a software application that runs on a mobile OS (smartphone, tablet, smart watch, smart car etc.). Apps are generally smaller and have more focused functionality than software programs for desktops. A **native app** is an app that is developed for one specific mobile OS.

Examples of platform apps are Facebook, Booking or Spotify. These apps run on another platform; the smartphone with its mobile Operating System (OS). This makes the smartphone, in conjunction with the mobile OS as an infrastructure for apps to run on, a crucial online platform in the digital economy.

The iPhone was the first smartphone with a large touchscreen, brought to the market in 2007. This reconfigured and greatly expanded the world of mobile phones, adding new features, functionality and possibilities to mobile phones. The success of the iPhone was followed one year later by the launch of a smartphone OS, Android, which was compatible with all other smartphones. Android made it a lot easier to add more functionality to smartphones other than the iPhone, and it offered other smartphone manufacturers the chance to compete with Apple. The first Android device was released in 2008.[14] Today, over 99% of smartphones worldwide run on the Android OS, owned by Alphabet Inc's subsidiary Google Inc. (hereafter: Google) or on the iOS OS, owned by Apple Inc. (hereafter: Apple).[15]

In 2017, the average share of smartphone users per country in Europe was 63%. The Netherlands and Sweden share first place with an average share of smartphone users of 84%.[16] In 2018, Dutch consumers spend about 61 hours a month online on their smartphones, 55 hours within apps and 5.9 hours within the mobile browser.[17]

App Stores
In 2008, a year after the launch of the iPhone, Google and Apple opened up their mobile platforms by launching Software Development Kits (SDKs) to enable third-party software developers to develop and offer apps for Google's Android and Apple's iOS (third-party apps).

Consumers can access these apps by downloading them from an application store program (hereafter: *app store*). App stores allow users to discover, install, update, and remove applications from their devices. On top of the previously mentioned platforms, smartphones and mobile OSs, the app stores also form a separate platform for consumers to access apps and for app providers to reach an audience with their content or services.

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[13] Basole, R.C. & Karla, J. "On the Evolution of Mobile Platform Ecosystem Structure and Strategy" Business & Information Systems Engineering, 2011, 3:313, https://link.springer.com/article/10.1007/s12599-011-0174-4.
[14] https://android-developers.googleblog.com/2008/10/android-market-now-available-for-users.html, Last accessed on 31 January 2019.
[15] https://www.mobilecowboys.nl/b/smartphone-os-alleen-android-en-ios-nog-meetbaar-?bid=97495, Last accessed on 7 January 2019.
[16] https://www.cbs.nl/en-gb/news/2018/05/the-netherlands-leads-europe-in-internet-access, Last accessed 20 December 2018.
[17] SIDN, "Trends in Internet Use 2018", https://www.sidn.nl/downloads/reports/SIDN_Trends_in_Internet_Use_2018.pdf, Last accessed on 20 December 2018.

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The *Google Play Store*, first named Android Market, is the primary app store installed on Android devices that comply with Android's compatibility requirements. The Google Play Store (hereafter: Play Store) comes pre-installed on most Android devices and offers third-party apps as well as apps from Google (first- and second party apps).[18] On Android, there are also over a hundred other app stores available, of which some also come pre-installed (for example the Samsung Galaxy Store which comes pre-installed on Samsung devices).

The *Apple App Store* (hereafter: App Store) is the only app store available for iOS. It is not possible for consumers to access native apps outside the App Store.[19] The App Store also offers first-party apps and third-party apps. The App Store comes pre-installed on all iPhones.

The Play Store offered 3.3 million different apps in October 2018, the App Store 2.2 million.[20] Over 194 billion apps have been downloaded from both app stores worldwide in 2018.[21] In section 2.4, we will further elaborate on the functioning of both the Play Store and the App Store.

Platforms like the app stores that connect consumers and content suppliers are considered *multi-sided markets*.[22] This means the activity and scale of one user group can influence competition, welfare and scale of one or more of the other user groups on the platform in various ways. This is called *indirect network effects*.[23] Indirect network effects can make platforms grow exponentially. Network effects (indirect or direct) can be positive, creating more value by generating *demand*-side economies of scale, thus making growth a strategic stimulus for a platform instead of just achieving *production/supply*-side economies of scale. Network effects can also be negative, lowering the value of a network when more users join. One example from the app stores is that there are so many apps that it becomes very hard for an app provider to attract an audience for their app, also referred to as *crowding-out effects*.[24] Crowding-out effects can lead to diminished innovation output, less profitability for individual app providers, and could ultimately lower the attractiveness of the ecosystem as a whole for consumers and app providers.[25]

Indirect network effects in app stores between consumers and app providers are reinforced by network effects from other, connected platforms, for example the device manufacturers and consumers through the mobile OS and the smartphone. The more device manufacturers install mobile OS A, the more consumers run their smartphone on mobile OS A, and the larger the potential audience is for apps that are available for mobile OS A. So the success factor of app stores was not so much the smart device itself, but the device in combination with an integrated environment (smartphone, mobile OS, app store, apps) that enabled app downloads in a simple and user-friendly manner.

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[18] First-party apps are apps from the controller of the OS that are pre-installed on the smartphone.
[19] Technically, there are other ways on iOS for consumers to access apps. But as we will discuss in section 3.3, these alternatives are not viable options for the average consumer.
[20] http://www.businessofapps.com/guide/app-stores-list, Last accessed on 20 December 2018.
[21] App Annie "The State of Mobile 2019", downloaded on 16 January 2019.
[22] See for example: Evans, David S., "Some Empirical Aspects of Multi-sided Platform Industries", Review of Network Economics, Vol.2, Issue 3 – September 2003.
[23] *Direct network effects*, on the other hand, occur when users in one group benefit when more users join the same group. For example, Facebook or WhatsApp become more valuable for its consumers once more consumers join the specific network, since this means they can reach more people through the network.
[24] Juha Markus Winter, "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models", September 2014,https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.
[25] Ibid.

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2.2   The consumer

Different consumers have different needs, and prefer different aspects of an app and the app store. The average consumer can be considered to prefer at least a base level of safety, security, privacy, quality, low costs, an intuitive user interface, and innovative, new features. But overall, consumers visit the app stores to find, select and choose an app best suited to their needs. By making a selection of their preferred apps, consumers create their own personal app-library on their mobile devices. App stores make it easily accessible for consumers to reach and download new apps. App stores have an incentive to gain qualitatively good apps in the app stores to grow the overall value of their ecosystem, which is beneficial to consumers.[26]

For consumers, major benefits of the app stores are convenience, security and trust. Consumers only have to visit one central place to search for, discover, download and update apps, and all available apps have been screened, which makes them more trustworthy. Thanks to the platform that the app stores offer, consumers have access to news, entertainment, their social circle, music, and almost every other service possible from any given location in an app.

As said before, both app stores offer millions of apps. On the one hand, the large number of apps available can lead to increased opportunities to discover new products. On the other hand, the large offering could have an adverse effect due to increased search costs. The information overload makes it impossible for consumers to compare all the different products and their characteristics in order to choose the app best suited to their needs. The app stores aim to solve this problem through the use of algorithms, they sort through the information and offer consumers apps that meet their needs. Consumers rely on these mechanisms, since 44% of consumers chooses the app that comes first in the search results, and 87% of the consumers chooses an app from the top five results, which are mostly presented at the same time without the need to scroll down.[27] So the app stores play an important role in the *discoverability* of apps.

Discoverability is the degree to which (in this case) an app can be found or discovered by consumers. Discoverability is a concern for app providers, since apps cannot be used if consumers cannot find it.

Apps can be discovered by consumers through four main channels:

1) *Branded search*: this means a search within the app store on the product name (i.e. "Angry Birds"). This type of search only happens when the consumer is searching for a specific app of a specific brand.
2) *Non-branded search:* this refers to a search within the app store based on a description of the product (i.e. "shooter game"). This type of search happens when consumers know what type of app they want, but do not know a brand yet.
3) *Browsing category:* These apps are marked "trending", "tip of the day" or otherwise receive an attention boost within the app store through featuring, highlighting or recommending, outside the regular ranking mechanisms and search results. A special team of editors decide what apps will become trending. App downloads that follow this category concern apps that are

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[26] Notes of meeting with Google, 9 January 2019.
[27] Dogruel, Leyla, et all, "Choosing the right app: An exploratory perspective on heuristic decision processes for smartphone app selection", Mobile Media & Communication 2015, Vol. 3(1) 125–144, p. 10.

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discovered by consumers through "accidental exposure", when consumers are not actively searching for a specific app, but accidently encounter the app.

4) *External traffic:* This concerns traffic to specific apps within the app store through external (outside the app store) promotion, for example, through a Facebook campaign that directly links to the download page within the app store.

Table 1 shows the discoverability of apps in **[Confidential:**

	Play Store[28]
Branded search	[XXX]%
Non-branded search	[XXX]%
Browsing	[XXX]%
External traffic	[XXX]%
Other channels (e.g. backup, auto installs)	[XXX]%

Table 1: Discoverability of apps

[Confidential:

]. This means app stores are an important channel to discover new apps since around one half of app downloads concern apps that consumers would not have known or downloaded otherwise.

The payment for apps and digital content offered through apps goes through one channel, the app store. This might also be to the benefit of consumers since they do not have to provide their payment details to a large number of different entities all over the world. This also makes it possible to pay for digital content in a very simple, efficient manner without having to leave the app or fill out billing details again and again. But this also carries a few drawbacks for consumers. Since both app stores demand a 30% fee from the app provider for all paid digital content, this means the price for apps and digital content will be higher when the provider passes these costs on to consumers. An example is Spotify. When Spotify still offered the possibility to subscribe, €12.99 a month was charged for a subscription through the App Store, while all other channels charged €9.99 a month.[29] This will be discussed further in Chapter 4.

2.3   App providers

App stores have created new fortunes for entrepreneurs, changed the way business is done, and disrupted all kinds of markets. Think of the Uber app and Airbnb. For businesses that want to reach mobile users (potential or otherwise) with an app being present in the app stores is a good way of achieving this. For businesses to remain successful with their apps, creativity is constantly required, as the failure to innovate is punished by competition. A business can decide to outsource the development of its app to an *app developer,* and only take on the role of the *app provider*.

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[28] Additional information received on 12 February 2019 from Google.
[29] https://www.iculture.nl/tips/spotify-premium-duurder-ios-app/ Last accessed on 10 January 2019.

> **App developers** have technical expertise and develop apps for other companies that lack the technical expertise. An **app provider** is defined in this market study as the company that is offering content or a service via an app under its own brand in an app store. In some cases, for example when the app is developed "in-house", the app provider is the same entity as the app developer. In that case, we also speak of "app provider".

Since the launch of the App Store in the Netherlands, **[Confidential:**

[30]

[31]

].[32]

Given the millions of apps available in the app stores leading to crowding-out effects, it can be a challenge for app providers to be noticed by consumers. **[Confidential:**

].[33] Once an app receives a large amount of downloads within a short timeframe, the algorithms will push it up so it gets more visibility, which leads to more downloads, which again leads to more visibility etc. So the ultimate goal of an app provider is to enter the top 50 most popular apps to "get the bandwagon rolling". The best way to achieve this is to advertise the app on other platforms (for example Facebook or AdMob for mobile) and "buy" downloads, for example by offering the consumer an incentive. Outside the app stores themselves, Facebook is by far the most effective platform to reach an audience for an app, and to generate downloads in the app store.[34]

But competition for advertising space among app providers is fierce, which makes a launch campaign very expensive.[35] The costs of a "launch campaign" in order to reach the top 50 was around half a million US dollars in 2014.[36] But reaching the top 50 or featured categories does pay off, as it can boost app downloads over 2,000% if it concerns unknown apps.[37] This makes bringing an app effectively to the market expensive, and thus forms a barrier for startups.

Only a small number of all applications available in both app stores are actually actively used by consumers, consequently only a small number of all app providers generate the majority of downloads, and thus the majority of revenue.[38] This may also be the reason that 0.1% of all apps in the Play Store and the App Store are responsible for 85% of all app downloads,[39] and 3.3% of the Android app providers (3,000 providers) generate 85% of the downloads in the Play Store.[40] The top 25 app

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[30] Notes of meeting with Apple, 17 December 2018.
[31] Additional information received on 12 February 2019 from Google.
[32] Additional information received on 15 February 2019 from Apple.
[33] Notes of meeting with Apple, 17 December 2019.
[34] https://themanifest.com/app-development/how-measure-your-mobile-app-marketing; https://www.marketingcharts.com/digital-73296/attachment/tune-mobile-app-discovery-sources-dec2016, last accessed on 2 March 2019 and Notes of meeting with **[confidential:]**, 5 February 2019.
[35] Notes of meeting with **[confidential**:   ], 5 February 2019.
[36] Bresnahan, Timothy ea "Platform Choice by Mobile Apps Developers", 2014, p. 7.
[37] https://blog.apptopia.com/new-app-stores-app-of-the-day-gets-an-average-download-boost-of-1747, Last accessed on 2 March 2019.
[38] Sami Hyrynsalmi, Arho Suominen, Matti Mäntymäki, "The influence of developer multi-homing on competition between software ecosystems", Journal of Systems and Software, Volume 111, January 2016, Pages 119-127, https://www.sciencedirect.com/science/article/pii/S0164121215002010 /.
[39] PRIORI DATA, "App Store Intelligence for the 99%" 11-8-2015, http://blog.prioridata.com/a/app-store-intelligence-for-the-99.
[40] Sami Hyrynsalmi, Arho Suominen, Matti Mäntymäki, "The influence of developer multi-homing on competition between software ecosystems", Journal of Systems and Software, Volume 111, January 2016, Pages 119-127, https://www.sciencedirect.com/science/article/pii/S0164121215002010 /

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providers alone account for approximately one-fifth of all downloads.[41] Figure 2 offers an overview of the 20 most installed apps in 2018 in the Netherlands. The top 10 consists of 3 Facebook apps and 6 Google apps. There are no Apple apps present in the top 10 (or top 20). The reason for this is that most Apple apps are pre-installed on the iPhone, so these are excluded from the list.

Position 2018	App	Reach in 2018 (%)	Reach in 2016 (%)	Delta
1	WhatsApp Messenger	71	60	—
2	Google Maps	56	40	︿
3	Facebook	53	52	︿
4	YouTube	51	38	︿
5	Facebook Messenger	47	42	︿
6	Google Search	44	36	︿
7	Gmail	35	29	︿
8	Google Play-services	35	23	︿
9	Drive	32	24	︿
10	ING Bankieren	29	17	︿
11	Instagram	27	17	︿
12	Buienradar	25	19	︿
13	Marktplaats	25	21	︿
14	Rabobank Bankieren	23	20	﹀
15	Google Foto's	23	-	—
16	Spotify	23	-	—
17	NU.nl	21	20	︿
18	Twitter	19	17	︿
19	NOS	19	17	︿
20	LinkedIn	19	13	︿

Table 1: Top 20 smartphone apps, by reach

Figure 2: SIDN "Trends in Internet Use 2018"

These new opportunities for businesses that the app stores have created is often referred to as the *app economy*. The app economy encompasses the sale of apps, ad revenue and public relations generated by free apps, and the hardware devices on which apps are designed to run.[42] Worldwide, consumers spent over 101 billion US dollars on and in apps in 2018.[43] Games account for 80% of all app revenue.[44]

An app provider can have different incentives and goals for developing and monetizing an app:

1) Service to existing customers (Dutch Railways NS, ING mobile banking)

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[41] Ibid.
[42] https://www.techopedia.com/definition/28141/app-economy Last accessed on 17 January 2019.
[43] App Annie "The State of Mobile 2019", downloaded on 16 January 2019.
[44] https://blog.branch.io/the-2018-mobile-app-store-download-statistics-report/#, https://sensortower.com/blog/app-revenue-and-downloads-1h-2018 Last accessed on 8-1-2019 and Notes of meeting with Apple, 17 December 2019.

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2) Collect data (user data or otherwise) and/or for advertising (Facebook, Dutch news site nu.nl);

3) Premium apps (Netflix, YouTube Red);

4) Freemium/In-app purchases apps (Microsoft Word, Dutch weather app Buienradar, Spotify, Fortnite, Candy Crush);

For the first category, an app as service extension to existing customers, the app stores are less important to attract customers (new or otherwise). But for the other three, the main goal the app provider hopes to achieve with the app store is to attract new customers. When asked what the commission paid by app providers compensates Apple and Google for, both Apple and Google stated that they provide companies access to millions of customers (potential or otherwise).[45]

Table 2 lists what percentage of revenue generated through payments through the Dutch app stores stems from which business model.

[Confidential

	Dutch Play Store[46]	**Dutch App Store**[47]
In-app purchases	[XXX]%	[XXX]%
Subscriptions	[XXX]%	[XXX]%
Paid apps	[XXX]%	[XXX]%

Table 2: Revenue per business model

2.4   The app stores

The interaction between consumers and app providers is governed by the app store, which makes the app store a crucial entity. In this section, we will first introduce both app stores, their main business models, and how they differ from each other. We will subsequently describe the services the app stores offer to app providers, and how the app stores support and motivate app developers. Finally, we will discuss how app stores are compensated for their services.

2.4.1 App Store

Apple was founded in 1977 as a hardware company that focused on the development of computers, but also offers software that is only compatible with Apple's hardware. With the introduction of iTunes and the iPod, Apple showed the advantages of integrated development of hardware and software,[48] which, a few years later, led to the iPhone.

Apple's main source of income stems from hardware sales (about 80%), mainly the iPhone, which was responsible for 61% of revenue in 2018.[49] But Apple's revenue share from hardware is declining, while the services category (including, among other services, the App Store, Apple Music, Apple Pay) is growing.[50] On the 25th of March, Apple announced the launch of a number of new services, including Apple TV +, Apple News +, Apple Arcade and Apple card.[51][52]

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[45] Additional information received on 15 February 2019 from Apple and additional information received on 12 February 2019 from Google.

[46] Additional information received on 12 February 2019 from Google.

[47] Additional information received on 15 February 2019 from Apple.

[48] Dijck, José van, "The Culture of Connectivity", 2013.

[49] https://www.wsj.com/articles/apple-looks-to-expand-advertising-business-with-new-network-for-apps-1527869990, Last accessed on 20 February 2019.

[50] https://www.theverge.com/2019/1/29/18201562/apple-earnings-iphone-sales-revenue-fall-drop-holiday-quarter-q1-2019
; https://www.bloomberg.com/news/articles/2019-01-30/services-growth-is-next-in-sight-for-apple-as-iphone-sales-drop

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Among the other "GAFAM" platforms (Google, Apple, Facebook, Amazon and Microsoft), Apple is one of the highest valued companies worldwide, and the first company to exceed a market capitalization above one trillion US dollars.[53] Apple's total revenue for 2018 was over 265 billion US dollars, from which over 37 billion US dollars came from the services category. And the services category accounts for 14 percent of the revenue in 2018, which is the second largest part.[54] The revenue that the Dutch App Store generated for Apple in 2018 (from IAP) was **[confidential:]**.[55]

Even though iOS has a much smaller user base than Android, Apple users are more willing to pay higher prices for the hardware. This means that Apple has very high margins on hardware sales. So Apple sells less in absolute volume terms than its competitors, but captures the bulk of the profits because its products are priced higher. Apple aims for the high end of the market.[56] This will be discussed further in section 3.4.2.2.

To be able to continue to charge its customers higher prices, it is essential for Apple to offer the best possible user experience. This can be achieved by ensuring that software and hardware connect seamlessly and offering developers easy-to-use tools so they can make apps that get the best out of the hardware. This is also where Apple leads the way since Google has more issues with fragmentation, as we will further discuss in the next section. Apple also clearly seeks to distinguish itself from Google by making privacy and security the company's unique selling points.[57] Apple's review guidelines for the admittance of apps also clearly distinguishes itself from Google's on the user experience, privacy and security. Apple clearly focusses on the user experience over the developer experience,[58] and also puts much more emphasis on privacy, while Google pays more attention to the developers and their interests in their review guidelines.[59] This was recently illustrated by Apple's CEO Tim Cook, who stated the following*: "The truth is, we could make a ton of money if we monetized our customer — if our customer was our product. We've elected not to do that".*[60]

2.4.2 Play Store

Google as a search engine was founded in 1997 by Larry Page and Sergey Brin, two Stanford college students. At the university, they developed an algorithm that made data on the internet searchable through an index-technique: PageRank. In the subsequent years, Google gradually expanded its ecosystem by incorporating more services into its search engine.

Last accessed on 20 February 2019.
[51] https://www.economist.com/business/2019/03/26/with-iphone-sales-slowing-apple-bets-on-video-gaming-news-and-a-credit-card Last accessed on 27 March 2019.
[52] https://www.cnbc.com/2019/02/19/apple-shifts-priorities-to-grow-services-ai.html;
https://appleinsider.com/articles/19/02/13/apple-looking-at-april-launch-of-video-streaming-service Last accessed on 21 February 2019.
[53] https://www.reuters.com/article/us-usa-stocks-tech-apple-briefly-regains-title-as-most--aluable-u-s-company-idUSKCN1PT24N Last accessed on 19 February 2019.
[54] https://s22.q4cdn.com/396847794/files/doc_financials/quarterly/2018/Q4/10-K-2018-(As-Filed).pdf (p. 26), Last accessed on 21 February 2019.
[55] Additional information received on 15 February 2019 from Apple.
[56] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models", September 2014,
https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.
[57] https://www.theguardian.com/technology/2015/jun/03/apple-tim-cook-google-facebook-privacy;
https://www.recode.net/2016/2/21/11588068/heres-what-steve-jobs-had-to-say-about-apple-and-privacy-in-2010 Last accessed on 20 February 2019.
[58] Digital Methods Initiative (UvA) Winter School 2019, Part III: Store Policies and Developer Conditions,
https://wiki.digitalmethods.net/Dmi/WinterSchool2019AppsStoriesPolicy Last accessed on 21 February 2019.
[59] Ibid.
[60] https://www.recode.net/2018/3/28/17172212/apple-facebook-revolution-tim-cook-interview-privacy-data-mark-zuckerberg Last accessed on 21 February 2019.

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In 2005, Google bought Android, which was transformed by Google into the answer to Apple's competitors from all chains in the ecosystem (hardware suppliers, software suppliers, mobile operators etc.). Google's main competitive advantage over its competitors was the open-source character of Android, which will be further discussed in the next section, and the fact that Android was free.

Next to Apple, Google is one of the companies with the highest market capitalization worldwide, around 800 billion US dollars.[61] Google's total revenue for 2018 was close to 137 billion US dollars, from which around 20 billion US dollars came from the category "other revenues", in which the Play Store falls.[62] 116 billion US dollars in revenues came from advertising, and 595 million US dollars came from the other divisions.[63] So about 85% of Google's revenue stems from advertising. The revenue that the Dutch Play Store generated for Google in 2018 (from the commissions) was **[confidential:]**.[64]

In contrast to Apple, whose business model is mainly focused on selling hardware products and services to consumers, Google's business model is based on selling consumer attention and advertising space to advertisers. Most important for Google is to be present everywhere, so it can show ads and generate data, enabling it to allocate advertising space efficiently. In contrast to Apple and Microsoft, Android was not developed by Google to generate revenues through the sale of software or hardware. Android, apps, and the Play Store are only means to an end to become embedded everywhere on the internet, and to increase the audience for its services so it can create more advertising space. For Google, it is essential that its services are and remain easily accessible by consumers (mobile or otherwise), and that they also use Google's services for as long as or as often as possible. And while Google's services are also accessible for iOS users, Google cannot control this port of access because Apple reigns over the iOS ecosystem, and might one day decide to change the possibilities for Google.

But Google's business model is also slowly shifting away from advertising, since Google indicates that, in the future, revenues from non-advertising divisions will grow, and revenues from advertising will decline.[65] Nowadays, Google invests more in micro payments[66] and Artificial Intelligence (AI) powered services, stating it will transform into an "AI first" company.[67] Since AI is driven by data, Google's strategy to be present wherever it can subtract user data probably will not change much, so Android and the Play Store will stay essential for Google.

2.4.3 Services provided by the app stores

Generally, both app stores aim to make bringing an app to the market as easy as possible. For the app stores, it is important to offer a wide variety of quality apps to their customers, because this enhances the quality and functionality of their ecosystem. To achieve this, the app stores offer numerous services to support app developers.

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[61] https://www.investopedia.com/articles/active-trading/111115/why-all-worlds-top-10-companies-are-american.asp Last accessed on 21 February 2019.
[62] https://www.sec.gov/Archives/edgar/data/1652044/000165204419000004/goog10-kq42018.htm#s2C90234435305497B8545742542AABBD Last accessed on 21 February 2019.
[63] Ibid.
[64] Additional information received on 12 February 2019 from Google.
[65] Under "Trends in our business": https://abc.xyz/investor/pdf/20161231_alphabet_10K.pdf Last accessed on 19 July 2017.
[66] http://www.netopia.eu/chief-economist-paid-services-may-be-googles-future/ ;
https://www.blog.google/topics/journalism-news/building-better-web-everyone/ Last accessed on 21 February 2019.
[67] https://www.androidauthority.com/google-ai-first-812335/ Last accessed on 21 February 2019.

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Both Apple and Google provide a suite of software-development tools that developers can use for creating, testing and publishing apps. Apple has a technical team that assists developers with creating their apps, and Google offers free tutorials for developers. As a service for developers, Google offers a test environment so developers can beta-test their apps. The app stores also host and distribute the apps and app-updates for the developers, provide analytics tools to developers and technical support.

Both app stores make use of a review process to screen the apps (and their updates) that are offered before they can enter the app store. At Google, this is an automated process that takes about **[confidential:]**.[68] Apple uses a manual process, which takes about **[confidential:]**.[69] When an app is rejected, the app developer is offered the chance to adjust the app and submit it again for review. This way, the review process aims to enhance the security and quality of the apps offered in the app stores so consumers perceive the app stores as a trustworthy sale channel, which benefits both consumers and app providers.

The upfront costs to distribute an app are low to encourage risk-taking and to minimize barriers to entry for app providers. An app developer has to pay an annual fee of 99 US dollars to Apple, and a one-time fee of 25 US dollars to Google.[70] Both Apple and Google keep 30% of all revenue generated by an app with the sale of digital content within the app (In App Purchases, IAP) or the price paid for the app.

For paid or freemium apps that offer digital content and use IAP, the app stores cover credit card fees, handle tax and VAT compliance, and the billing process. Since February 2011, Apple also introduced the option of offering subscriptions (recurring payments) through the App Store and via IAP, from which Apple also takes a 30% cut.[71] Google followed Apple one year later and also introduced a subscriptions model.[72] Apple reduced the fee to 15% after the first subscription year in September 2016. Apple hoped this reduction would incentivize developers to offer more subscription-based content on the App Store.[73] Google followed suit in January 2018.[74]

Google and Apple make the use of their in-app purchases payment system (hereafter: IAP) mandatory for certain categories of apps, and do not allow linking to other payment methods from within the app, **[confidential:]**.[75] This guarantees that Apple and Google are compensated for the services they offer app providers.[76] Apple's motivation for the 30% fee is that Apple is the one that brings the customer to the app provider, as stated by former CEO Steve Jobs in 2011: "Our philosophy is simple – when Apple brings a new subscriber to the app, Apple earns a 30% share; when the publisher brings an existing or new subscriber to the app, the publisher keeps 100% and Apple earns nothing."[77] Another motivation mentioned by Google and Apple for making IAP mandatory is convenience and security for consumers realized by obligating the use of

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[68] Notes of meeting with Google, 9 January 2019.
[69] Notes of meeting with Apple, 17 December 2019.
[70] Notes of meeting with Apple, 17 December 2019 and notes of meeting with Google, 9 January 2019.
[71] https://www.theguardian.com/technology/2011/feb/15/apple-subscription-service-app-store Last accessed on 10 January 2019.
[72] https://android-developers.googleblog.com/2012/05/in-app-subscriptions-in-google-play.html Last accessed on 10 January 2019.
[73] Additional information received on 15 February 2019 from Apple.
[74] https://www.theverge.com/2017/10/19/16502152/google-play-store-android-apple-app-store-subscription-revenue-cut Last accessed on 10 January 2019
[75] Additional information received on 12 February 2019 from Google.
[76] Additional information received on 15 February 2019 from Apple and additional information received on 12 February 2019 from Google.
[77] https://www.theguardian.com/technology/2011/feb/15/apple-subscription-service-app-store Last accessed on 10 January 2019.

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IAP.[78] **[Confidential**:

].[79]

2.5 Platform-ecosystems

If a platform like the app store emerges and works with the companies supplying complementary products and services like apps and components like the mobile OS and smartphone, together they can form an *ecosystem* that can greatly increase the value of the complements and the initial platform, as more users adopt the platform and its complements. But in digital environments, ecosystems are complicated because of different technological layers that must be compatible and work together for the hardware and software to function.[80] We will explain this further: Digital products (information-based or otherwise) and services operate in systems: an MP3-file needs media player software compatible with MP3, the media player needs a compatible operating system, and the operating system needs compatible hardware. The convergence of traditional mobile telephony, internet services, and personal computing into a new industry with new vertical layers and chains like apps, app stores, operating systems and software layers that connect the different layers form an ecosystem. The need for everything in the ecosystem to be compatible with each other opens up the necessity to form the ecosystem around a single standard or architecture, sometimes referred to as "dominant design". When the controller of this dominant design, often referred to as "orchestrator",[81] is a platform itself on which other platforms can be built, the ecosystem becomes a *platform-ecosystem*.[82]

> We define an **ecosystem** as a set of businesses functioning as a unit and interacting with a shared, compatible market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market, and operate through the exchange of information, resources and artifacts.[83]
>
> A **platform-ecosystem** is an ecosystem that supports a collection of complementary assets with one platform as central controller of the underlying architecture that functions as a hub within the technology-based business system.[84]

An important characteristic of a platform-ecosystem is that it can grow indefinitely. This is because functionally unrelated products, services, platforms and even other ecosystems (platform ones or otherwise) can be bundled or integrated with the initial platform through apps. Think of smartphones that also function as portable navigation systems, e-book readers, game devices, medical diagnostic services etc.[85] The Internet-of-Things makes it possible to grow the platform-ecosystem infinitely to

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[78] Additional information received on 15 February 2019 from Apple and additional information received on 12 February 2019 from Google.
[79] Notes of meeting with Apple, 17 December 2019 and additional information received on 15 February 2019 from Apple.
[80] Martin Kenney and Bryan Pon "Structuring the Smartphone Industry: Is the Mobile Internet OS Platform the Key?", Journal of Industry, Competition and Trade, September 2011, Volume 11, Issue 3, pp 239–261 https://link.springer.com/content/pdf/10.1007%2Fs10842-011-0105-6.pdf
[81] Sami Hyrynsalmi, Arho Suominen, Matti Mäntymäki, "The influence of developer multi-homing on competition between software ecosystems", Journal of Systems and Software, Volume 111, January 2016, Pages 119-127, https://www.sciencedirect.com/science/article/pii/S0164121215002010 /
[82] Thomas, L.D.W, Autio, E, Gann, D.M., "Architectural leverage: putting platforms in context" The Academy of Management Perspectives 28 (2), 198-219, 2014
[83] Sami Hyrynsalmi, Arho Suominen, Matti Mäntymäki, "The influence of developer multi-homing on competition between software ecosystems", Journal of Systems and Software, Volume 111, January 2016, Pages 119-127, https://www.sciencedirect.com/science/article/pii/S0164121215002010 /
[84] Thomas, L.D.W, Autio, E, Gann, D.M., "Architectural leverage: putting platforms in context" The Academy of Management Perspectives 28 (2), 198-219, 2014
[85] Ben Eaton, Silvia Elaluf, Carsten Sorensen and Youngjin Yoo "Dynamic structures of control and generativity in digital

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other hardware, like smart cars, smart home devices, wearables etc. This forces formerly separate industry architectures into direct competition.[86]

In the Western world, we can distinguish five major platform-ecosystems organized around a single company as orchestrator: Alphabet, Amazon, Facebook, Apple and Microsoft, as is shown in Figure 3.[87]
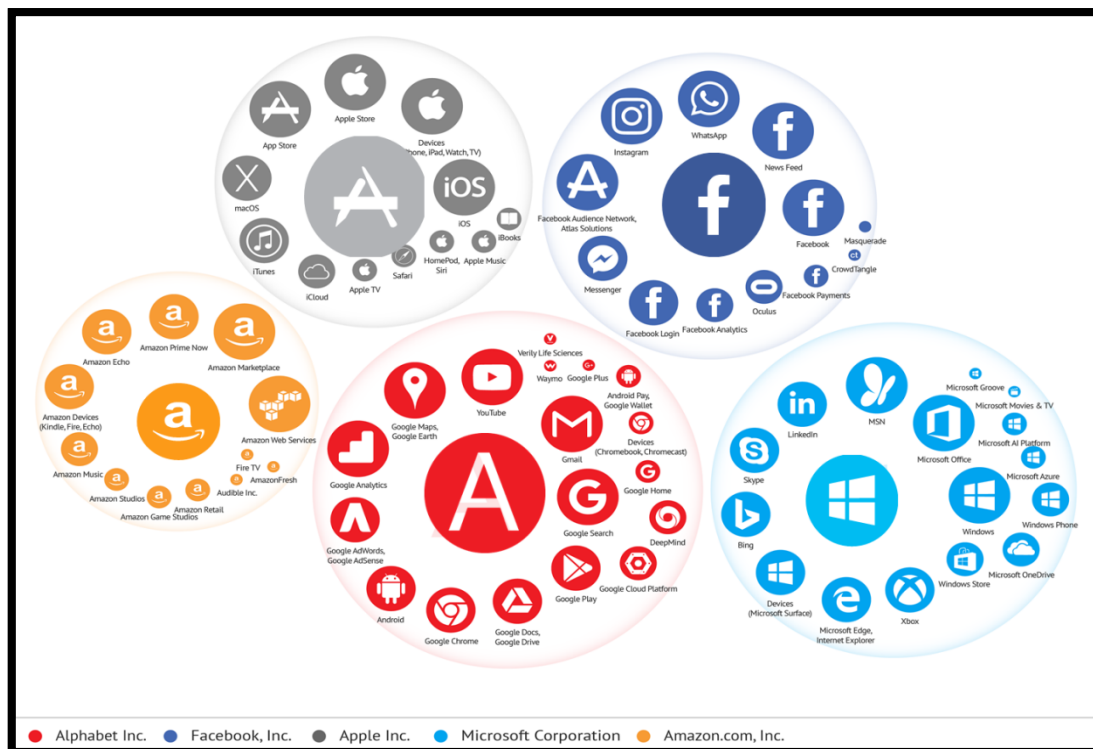

Figure 3: Five Western platform-ecosystems (Van Dijck et al, 2018)

These five platform-ecosystems all started out from a single platform, and each of the five starting platforms differed greatly from each other: Amazon as an online book store, Google as search engine, Apple as hardware company, Facebook as social network and Microsoft as software company. Each of the five platform-ecosystems built their own sub-ecosystem within the broader, open internet-ecosystem. And they all strive to become the default gateway for access to the broad internet-ecosystem as a whole. But as they grow their platform-ecosystems, they also grow towards each other, and enter each other's territories. So it is not surprising that it has been argued that competition in the online industry is turning from "a battle of devices" into a "war of ecosystems".[88]

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ecosystem service innovation: the cases of the Apple and Google mobile app stores", working paper April 2011, https://s3.amazonaws.com/academia.edu/documents/30785933/wp183.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL 3A&Expires=1547811827&Signature=K8zO%2Bt9Lix3s114e4hJ9LQY9tWk%3D&response-content-disposition=inline%3B%20filename%3DDynamic_structures_of_control_and_genera.pdf

[86] Martin Kenney, "Structuring the Smartphone Industry: Is the Mobile Internet OS Platform the Key?", Journal of Industry, Competition and Trade, September 2011, Volume 11, Issue 3, pp 239–261, https://link.springer.com/article/10.1007/s10842-011-0105-6

[87] José van Dijck, Thomas Poell and Martijn de Waal, "The Platform Society", Oxford University Press, 2018.

[88] Sami Hyrynsalmi, Arho Suominen, Matti Mäntymäki, "The influence of developer multi-homing on competition between software ecosystems", Journal of Systems and Software, Volume 111, 2016, Pages 119-127, https://www.sciencedirect.com/science/article/pii/S0164121215002010 /.

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In this market study, we focus on a sub-platform-ecosystem within the Google and Apple platform-ecosystems: the *app-ecosystem*. App-ecosystems also form an important basis for the rest of the platform-ecosystem, and also act as infrastructure for other platforms and platform-ecosystems. So it is impossible to discuss the app-ecosystem without also incorporating the larger ecosystem environment. As a result, we will encounter Apple's and Google's larger platform-ecosystems and other platform-ecosystems in several places in this market study.

App-Ecosystems
Nowadays within the app-economy, we can distinguish two prominent app-ecosystems: Android and iOS. The exact installed base of iOS versus Android differs per analyst, but it is clear that either Android or iOS is installed on almost all smartphones worldwide.[89] This means that the growth of one of the app-ecosystems user base automatically means a loss for the other app-ecosystem. According to most measurements, Android has a worldwide installed base around 85% and iOS has a worldwide installed base around 15%.[90] The Netherlands shows a different picture: iOS has a much larger installed base in the Netherlands at the end of 2018. According to Statista, Android has an installed base in the Netherlands of around 58%, while Apple has accumulated an installed base of 40%.[91] Statcounter sees an installed base of 56% for Android and 42% for iOS in the Netherlands.[92] In 2018, the Telecompaper Consumer Insights Panel reported an installed base of 30% for iOS and 70% for Android,[93] while Financieel Dagblad reported an installed base of 34% iOS and 66% Android.[94] This is visualized in Figure 4.
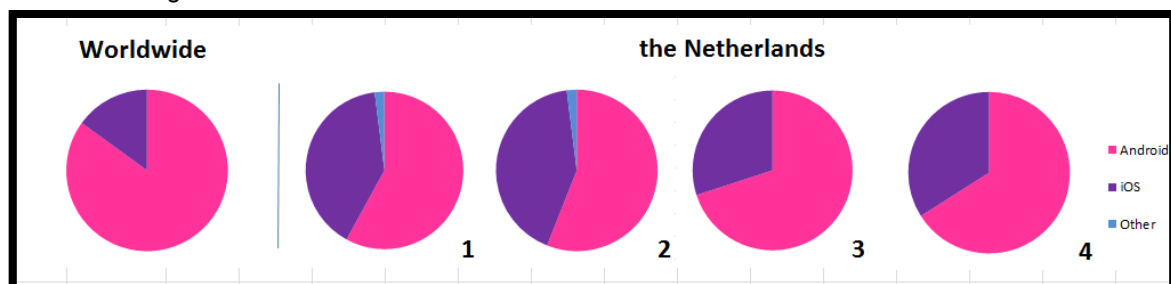

Figure 4: Market shares of Android and iOS, according to different sources: 1. Statista Android, 2. Statcounter, 3. Telecompaper, and 4. Financieel Dagblad

But this has not always been the case. In 2006, Symbian was the largest OS for mobile phones, followed by Microsoft Windows for smartphones, as is shown in Figure 5.[95]

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[89] https://www.mobilecowboys.nl/b/smartphone-os-alleen-android-en-ios-nog-meetbaar-?bid=97495 Last accessed on 9 January 2019.
[90] https://www.mobilecowboys.nl/b/smartphone-os-alleen-android-en-ios-nog-meetbaar-?bid=97495;
https://www.idc.com/promo/smartphone-market-share/os Last accessed on 9 January 2019.
[91] https://www.statista.com/statistics/640039/market-share-mobile-operating-systems-netherlands/ Last accessed on 9 January 2019.
[92] http://gs.statcounter.com/os-market-share/mobile/netherlands Last accessed on 9 January 2019.
[93] Data requested by ACM and provided on the 4th of February 2019 by Telecompaper. The data concerns 54.262 Dutch respondents who own a smartphone and are between 12-80 years old and is visualized in the apple pie diagrams.
[94] https://fd.nl/ondernemen/1288821/nederlandse-iphone-bezitter-geeft-meer-uit-aan-apps-dan-samsung-eigenaar?utm_medium=social&utm_source=app&utm_campaign=SHR_ARTT_20190211&utm_content=ondernemen Last accessed on 11 February 2019.
[95] https://www.mobileuserexperience.com/365/365/ Last accessed on 21 March 2019.

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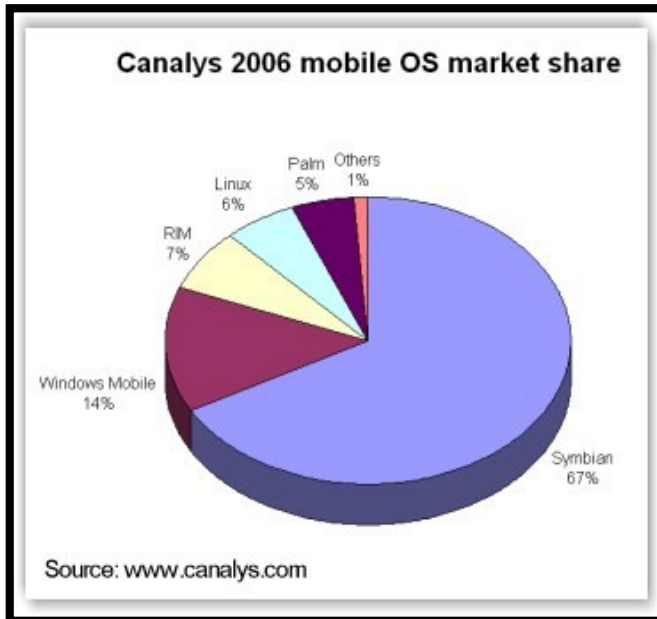Case no.: ACM/18/032693 / Date: 11 April, 2019

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Figure 5: Worldwide mobile OS market shares 2006, canalys.com

From 2008, the iOS-ecosystem, and, from 2010, the Android-ecosystems jumped ahead of the other mobile ecosystems, while the other ones started to decline, as is shown in Figure 6 (worldwide)[96] and Figure 7(the Netherlands)[97].
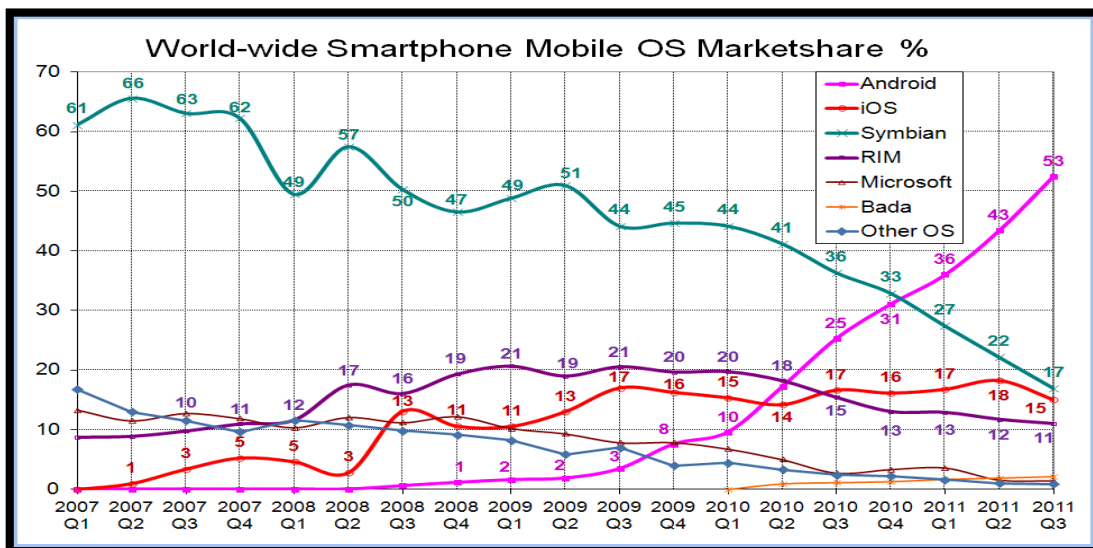

Figure 6: Worldwide mobile OS market share 2007 – 2011, Medium.com

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[96] https://medium.com/@christianhern/the-war-microsoft-should-have-won-65d836aa2358 Last accessed on 21 March 2019.
[97] https://www.statista.com/statistics/266136/global-market-share-held-by-smartphone-operating-systems/ Last accessed 25 February 2019.

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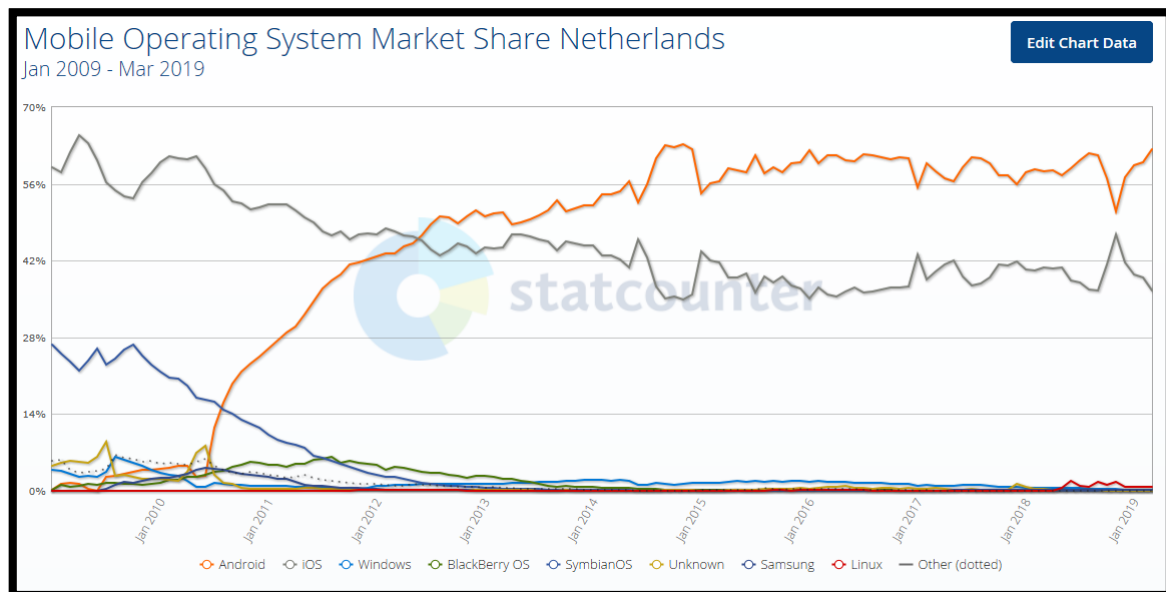**Case no.:** ACM/18/032693 / **Date: 11 April, 2019**

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Figure 7: Market shares mobile OS in the Netherlands 2009 – 2018, Statcounter

The main reason for this immense shift in market shares was the inability of the previous leading platform-ecosystems (Symbian and Windows) to set up a working ecosystem in such a way to start indirect network effects and gain critical mass, also referred to as "get the bandwagon rolling".[98]

As discussed before, indirect network effects mean that the platform that can successfully activate network effects in the first phases of the market has the best chance of eventually "winning" the market by making the market tip in its favor.[99] Offering complementary products through a "strategic alliance" with third parties is a very effective way to active network effects and grow an installed base of users, since this increases the value of the initial product for the consumer, and requires limited resources from the platform.[100] Opening up the platform to third-party developers by offering SDKs so third parties could develop apps for Android and iOS thus was a very effective way for Google and Apple to activate indirect network effects, and make their products and services more valuable. So Symbian, Windows and the supporting phone manufacturers were not able to activate and benefit from indirect network effects the way Apple and Google did, because they were not able to lower entry barriers enough for third-party developers. Developing apps for the other platform-ecosystems was just too hard for reasons we will discuss below.

The first reason was the complexity of the native programming languages available for the previous OS's.[101] It took a developer, on average, 15 months to learn to code for Symbian, while developing for Android would take less than six months to learn, as is shown in Figure 8.[102] Developing apps for Symbian was not only time-consuming, but also difficult and expensive due to the ecosystem fragmentation we will discuss below.

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[98] Varian, Hal and Shapiro, Carl "Information Rules: A Strategic Guide to the Network Economy", 1998.

[99] Varian, Hal and Shapiro, Carl "Information Rules: A Strategic Guide to the Network Economy", Harvard Business School Press,1998; Rietveld, J, Schilling, M.A., Bellavitis, C., "Reload and Relaunch: Value Creation and Value Capture In Platform-Based Markets", 2016 (1), 10169.

[100] Ibid.

[101] https://www.techradar.com/news/software/operating-systems/from-birth-to-death-why-nokia-s-symbian-was-the-future-of-mobile-tech-1127653 Last accessed on 22 February 2019.

[102] https://techcrunch.com/2010/07/05/mobile-developer-economics-2010/ Last accessed on 22 February 2019.

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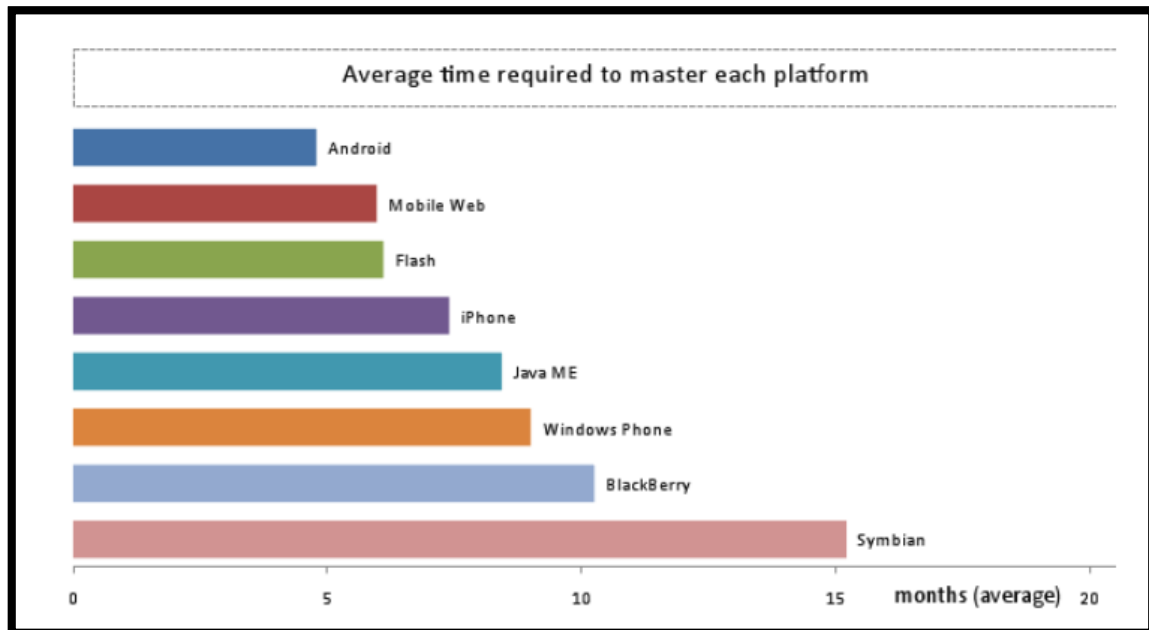**Case no.:** ACM/18/032693 / **Date: 11 April, 2019**

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Figure 8: Average time required to master each platform (2010)

A second reason is that the previous OS user interfaces and app stores were not very user-friendly. This made pre-installed or downloaded apps very hard to find since the consumer had to navigate several deep, non-intuitive menu layers. So consumers just did not have any incentive to download or use third-party apps or other functionalities of the phone.[103] When the iPhone was first launched, it had much less functionality than Nokia's phones. But because the functions on the iPhone were much more accessible, consumers could get more out of their iPhones.[104] And the launch of the App Store one year later completely solved this potential problem for the iPhone, because no matter the consumer's need, there was an app for it. This obviously stimulated app providers to offer their apps for iOS.

The third and most important reason is that the other ecosystems were not able to get the bandwagon rolling, was *fragmentation*. We distinguish between three forms of fragmentation in this study.

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[103] https://www.techradar.com/news/software/operating-systems/from-birth-to-death-why-nokia-s-symbian-was-the-future-of-mobile-tech-1127653 Last accessed on 22 February 2019.
[104] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.

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> **Platform-ecosystem fragmentation** happens in technology markets when different platform-ecosystems with different, incompatible standards are present (i.e. Android vs iOS), forcing consumers and complement providers to commit to an entire platform-ecosystem rather than maintaining free choice in mixing complements from different ecosystems.
>
> **Ecosystem fragmentation** happens when within one platform-ecosystem, several different software layers ("middleware") between the hardware and OS form different sub-ecosystems that are not compatible with each other. For example, different smartphone brands that all have their own software layer on top of the base operating system. Ecosystem fragmentation means the variety of smartphones from different manufacturers makes the task of developing applications that work consistently across the whole platform-ecosystem much harder.
>
> **Version fragmentation** happens when one software platform offers multiple incompatible (or partially incompatible) versions or variations of one product over time. For example the updates of an OS. This means that the OS lacks **backwards or forwards compatibility**.
>
> The opposite of fragmentation is **standardization**.

Ecosystem fragmentation was the main reason why Symbian and Windows could not activate network effects, and this was because they lacked control over the implementation of their OS by other smartphone manufacturers. This lack of a single central controller allowed every smartphone manufacturer to develop their own middleware on top of the base OS. So the different OS-versions for the different phone-brands were not compatible. This meant that app developers needed to develop their app again and again for every different smartphone brand and model.[105] Ecosystem fragmentation also makes it much more difficult to keep the ecosystem safe from malicious software.[106]

Microsoft, the last OS standing against Google and Apple, also lacked a lot of important and popular apps in their platform-ecosystem compared with Google and Apple. App providers and developers were already dedicated to Android and iOS and did not want to make the investments to develop their app for a third OS.[107] As a result, not all of the major apps were available on Windows, like Instagram and YouTube.[108] So there were not enough apps to attract Windows users away from Android and iOS, and the lack of consumers did not attract new app developers, so indirect network effects could not be activated. In 2010, Google and Apple captured most of the developers and consumers into their ecosystems.

Another reason why the previous app-ecosystems were not able to activate indirect network effects was their business model. Symbian and Microsoft's business models were dependent on the revenues from the licensing of the OS, while Google's was not and offered Android for free. And why would smartphone manufacturers pay for an OS when there is a free alternative available? When Microsoft finally started to offer their mobile OS for free in 2014,[109] indirect network effects already made the

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[105] https://www.techradar.com/news/software/operating-systems/from-birth-to-death-why-nokia-s-symbian-was-the-future-of-mobile-tech-1127653 Last accessed on 22 February 2019.
[106] https://opensignal.com/reports/fragmentation-2013/;
https://www.developersalliance.org/press-releases/2018/10/16/the-specter-of-fragmentation-is-back;
https://www.digitaltrends.com/mobile/what-is-android-fragmentation-and-can-google-ever-fix-it/
Last accessed on 29 November 2018.
[107] https://medium.com/@michaelgunawardena/the-rise-and-fall-of-windows-phone-5cda767f62c6 Last accessed on 25 February 2019.
[108] https://www.theverge.com/2017/10/10/16452162/windows-phone-history-glorious-failure Last accessed on 25 February 2019.
[109] https://www.theverge.com/2014/4/2/5574146/microsoft-making-windows-free-on-devices-with-screens-under-nine Last accessed on 25 February 2019.

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Android and iOS ecosystems too big to fail. The openness of Android gave Google access to a large group of experienced developers and enabled other hardware suppliers to integrate their own hardware into the Android ecosystem, enabling Google to take maximum advantage of indirect network effects and reach scale. So Android received support from several hardware suppliers and a large community of developers, while Apple was more dependent on its own expertise.

In 2017, Microsoft announced that it would phase out Windows for mobile. The main reason is they could not attract sufficient app developers.[110] And if the most important apps are not available in the ecosystem, it can break the whole ecosystem. [111]

Overall, Symbian and Windows lacked leverage and thus control over the other partners in the app-ecosystem, the phone manufacturers and mobile carriers.[112] As a result, Symbian and Windows were not able to activate indirect network effects successfully and guarantee compatibility, quality and prevent fragmentation. Apple observed this problem and learned that one key factor for platform-ecosystem success is attracting and maintaining third-party developers that increase the value of the ecosystem. To achieve this, the platform needs a technical architecture of standards (dominant design) that facilitates complements (third-party apps) and a broad compatibility with older product generations and devices from other manufacturers. The platform that controls this architecture also controls the supply of complements and can thus control the allocation of profits.[113] Where it took Symbian over seven years to offer 10,000 apps, it took Apple a little over a year to offer 100,000 apps.[114] Ecosystem fragmentation does not pose a problem for the iOS-ecosystem, since hardware and software are vertically integrated, and thus have maximum compatibility. Ecosystem fragmentation *does* form a serious threat for the Android-ecosystem, where one OS is offered to lots of different smartphone manufacturers. How Google handles this, will be further discussed in the next chapter.

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[110] https://www.cnet.com/news/windows-10-mobile-features-hardware-death-sentence-microsoft/ Last accessed on 25-2-2019.
[111] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.
[112] Lescop, Denis and Lescop, Elena, The Apple Twist (June 30, 2016). Digiworld Economic Journal, no. 102, 2nd quarter 2016, p. 13 . https://www.researchgate.net/profile/Denis_Lescop/publication/304158287_The_Apple_Twist/ ; West, Joel & Wood, David, "Evolving an Open Ecosystem: The Rise and Fall of the Symbian Platform.", Advances in Strategic Management 30:27-67, July 2013.
[113] West, Joel & Wood, David, "Evolving an Open Ecosystem: The Rise and Fall of the Symbian Platform.", Advances in Strategic Management 30:27-67, July 2013.
[114] https://www.zdnet.com/article/android-before-android-the-long-strange-history-of-symbian-and-why-it-matters-for-nokias-future/ Last accessed on 22 February 2019.

2.6   Observations

In this chapter, we saw that both Google and Apple have very different business models and, thus, different motives. The strength of one is the other's weakness. For example, Apple highlights the importance of privacy and security, while Google promotes their more open ecosystem and lower priced (and even "free") services. But they both monetize privacy and data: while the consumer products and services from the Android ecosystem are cheaper or free, but offer lower levels of privacy and security, the products and services from the iOS ecosystem are more expensive and offer more privacy and security. Even though they differ in many aspects, the app stores are essential for both Apple and Google to maintain control over their ecosystem. Also, they have the same goals with the app stores, namely attracting as many consumers as possible into their ecosystem to fuel their business models: for Apple, so it can sell iPhones and services, and for Google, so it can sell consumer attention and advertising space to advertisers.

For Apple, the App Store forms an important chain to make their iPhones more attractive. This enables Apple to charge higher prices. For Google, revenues from Android and the Play Store are less important than the scale of the Android-ecosystem. The most important thing for Google is that Android runs on as many devices as possible, maximizing the user base (including potential users) for its services.[115] The Play Store makes the whole app-ecosystem more attractive, so consumers will spend more time within the Android ecosystem and Android-powered apps. And the use of third-party apps on Android also benefits Google, since Google's mobile advertising SDKs like AdMob and Firebase are both present on approximately 75 percent of the top 200 apps on the Play Store.[116] So Android and the Play Store greatly enhance Google's business model.

Most app providers are dependent on the app stores to reach their audiences. But to be accepted within the app store is by no means a guarantee that the app can reach its audience. This is because the large number of apps available makes the app stores subject to crowding-out effects.[117] Only a few select apps are eligible for special promotion through featuring. Other apps that do not yet have a large brand awareness need to spend more money to get noticed.

In this chapter, we also described how different platform-ecosystems were and are competing with each other to become the default gateway to the larger internet-ecosystem, and how they all created their own sub-ecosystem within the broader internet, leading to the emergence of the two largest app-ecosystems nowadays: Android and iOS.

We also showed that competition between platform-ecosystems is mainly focused on gathering a user base on the initial platform (or platform market), because of the importance of network effects.[118] Once all users have been distributed, the platform (or platform market) tips, and competition stops. This means competition is not *on* the market, but *for* the market. Thus, the battle fought by online platform-ecosystems is not about dominating markets, but it is about becoming the default gateway to the

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[115] Android and the political economy of the mobile Internet: A renewal of open source critique by Kimberley Spreeuwenberg and Thomas Poell, First Monday, Volume 17, Number 7 - 2 July 2012, https://firstmonday.org/ojs/index.php/fm/article/view/4050/3271.

[116] https://mightysignal.com/top-android-sdks Last accessed on 21 February 2019.

[117] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.

[118] Varian en Shapiro, 1998; Autio, E., Thomas, L., "Tilting the Playing Field: Towards an Endogenous Strategic Action Theory of Ecosystem Creation "2016, working paper

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internet (or internet-based services) and content for a critical mass of users that can be monetized in various ways.[119]

Both Apple and Google changed the previous structure of the app-ecosystem into a new one, with the OS as the infrastructure and the app store as central controller of the architecture that navigates and allocates supply and demand. By successfully activating indirect network effects, Google and Apple were able to defeat all other app-ecosystems, and become the "winners". Nowadays, over 99% of smartphones are part of either Google's or Apple's app-ecosystem.

The app stores played a crucial role in the success of Apple and Google in becoming the two biggest app-ecosystems. For both Apple and Google, control over the App Store is essential to guarantee the value of the ecosystem, to prevent fragmentation, and to offer third-party app developers opportunities for innovation. This has resulted in Apple and Google creating ecosystems where everything is compatible, frictionless, with very low entry barriers for third-party developers to be innovative, disrupt existing markets, and allowing them to enhance the app-ecosystem. For consumers, this meant they had easy access to countless new services that made their lives a lot easier. But the importance of indirect network effects within the app-ecosystems also makes it very unlikely that another app-ecosystem can emerge, as is illustrated by the lost battles that Symbian and Microsoft had fought.

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[119] Varian and Shapiro, 1999, p. 289.

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3 Importance of the app stores

In the previous chapter, we described how Apple and Google opened up their app-ecosystems to third-party developers, thereby activating indirect network effects and enable all kinds of new innovations that would have never been possible without the opening-up of their app-ecosystems. We also discussed that both Google and Apple have opened up their app-ecosystems to a much larger degree than the previous app-ecosystems. This opening-up enabled Google and Apple to profit fully from indirect network effects, which created a lot of extra value for every market participant within the app-ecosystem. As we saw in the examples of Symbian and Microsoft, a central orchestrator that has a large amount of control over the market participants and their behaviors within the opened-up app-ecosystem is essential. Without this central orchestrator, the opened-up ecosystem will suffer from fragmentation, cannot offer as many opportunities for innovation, functionality and usability, and will become less secure. As the main chain in the app-ecosystem where the indirect network effects stem from, the app stores have a very important role in enabling Google and Apple to become the central orchestrator. But this control also grants the orchestrator a large amount of power over their app-ecosystem and every market participant operating within the app-ecosystem. Therefore, this position as orchestrator could transform the app stores into a *bottleneck*.

The assessment whether the app stores and/or the app-ecosystems form a *bottleneck* will be carried out in this chapter. We will analyze this by assessing whether there are viable alternatives available for apps, the app stores and/or the app-ecosystems.

3.1 Bottleneck

The biggest challenge today for content providers is to reach an audience. The best way to reach an audience is through a portal that is used by consumers to search for content.[120] This is especially relevant in online contexts, since the internet has made transaction costs disappear, and the distribution of content inexpensive and a lot easier. So bringing a digital product or service to the market is a lot more accessible, especially as a result of all the investments Apple and Google have made for making this process as easy as possible, and by significantly lowering entry barriers compared with the previous app-ecosystems. But combined with indirect network effects, the result is that the portal with the most users will control the market (or access thereto) for content providers. This portal then becomes a *bottleneck*.

A **bottleneck** is a platform that controls access to the market for content providers, product providers or service suppliers, as well as access to content, products or services for consumers, when no realistic alternatives are available outside of the platform, and when this platform becomes indispensable for businesses to compete or enter a market.

Alternatives to apps and the app stores
The app stores can become a bottleneck for access to online content, products and services if there are no viable alternatives available for the app stores within the app-ecosystem. In section 3.2, we will discuss whether the app stores form a bottleneck by first assessing whether there are alternatives for apps, and in section 3.3, we will assess whether there are viable alternative channels to offer and access apps outside the app stores within both app-ecosystems. We will differentiate between

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[120] Ruben van Oosten, "Ben Thompson: Wie de vraagzijde beheerst, wint" ESB Dossier Digitale Platformen, 20 December 2018.

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technical alternatives and how realistic these alternatives are in practice, by assessing the functionality and usability of alternatives to apps and app stores. We will also assess other channels for access to content, services and products.

Alternative (app-)ecosystems
As we have seen in the previous chapter, the battle fought by online platform ecosystems is not about dominating markets, but about becoming the default gateway to the internet (or internet-based services) and content for a critical mass of users that can be monetized in various ways. Consequently, one and the same platform with "bottleneck potential" can be important for very different companies with different business models. So competition over this potential bottleneck comes from a variety of different markets, which makes traditional market definition very difficult. This also means that maximizing revenues on the "bottleneck market" might not be the ultimate goal for the company to incorporate the bottleneck into its ecosystem. The bottleneck's true potential may lie in securing or expanding its business model, user base and/or platform-ecosystem on/to another market. So the economic incentives and rationale for platform-ecosystems to enter (new) markets can differ from the incentives and rationales of non-ecosystem companies.

In section 3.4, we will discuss whether there are viable alternatives available for the app-ecosystems, and whether the Android- and iOS ecosystems can be considered alternatives to each other. We will assess this by studying the opportunities for multi-homing, switching barriers and actual switching behavior. We will also discuss what incentives and rationales both Apple and Google might have with incorporating and controlling the app store within their app-ecosystems, and how the app stores are utilized in order to gain and maintain control over both app-ecosystems.

Competitive restraints
Controlling a bottleneck for businesses to reach consumers and for consumers to reach online content and services also grants the platform a large amount of *bargaining power* over the app providers on its platform.

We define **bargaining power** as the ability of one party to a contract to be able to influence the terms and conditions of that contract or subsequent contracts in its own favor, due to its possession of unique and valuable resources.[121]

This bargaining power could enable the platform to act independently of its competitors, customers and consumers, because there is a lack of sufficient countervailing buyer power. But when it concerns platform-ecosystems, potential competitive constraints not only come from the users of the platform and direct competitors. Other platform-ecosystems with very different business models can also form competitive restraints that prohibit other platform-ecosystems from acting independently. This is why we have to take a broader look across the boundaries of the ecosystem to assess if and how a potential bottleneck position of the app stores could be restrained by competitive threats. In section 3.5, we will assess whether there are competitive restraints from actors within the ecosystem and other, not directly competing ecosystems that could keep the app stores and their respective ecosystems in check.

Future developments

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[121] Argyres NS, Liebeskind JP. 1999. Contractual commitments, bargaining power, and governance inseparability: Incorporating history into transaction cost theory. Academy of management review, 24(1): 49-63.

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Finally, we will assess developments (current and future) that could form an alternative to apps, the app stores and/or the current app ecosystems (section 3.6).

3.2   Alternatives to apps

One possible alternative to the app stores without the consumer having to perform additional tasks like making changes to the OS or security settings, is making the service or content available through a regular webpage accessible with the browser. But content accessible through a regular webpage differs so much from a native app that it cannot be considered an alternative to a native app. The main reason is that an app is a software program that has access to the hardware of the device it runs on, and thus ads extra functionality. The browser is a way of offering static content, but by no means an option to offer a software program. This also follows from article 4.2 from Apple's App Store Review Guidelines about minimum functionality: *Your app should include features, content, and UI that elevate it beyond a repackaged website. If your app is not particularly useful, unique, or "app-like," it doesn't belong on the App Store*.[122] So a native app that offers similar functionality as a webpage would not be allowed in the App Store, as Apple also confirms: *Apps need to add real value and not just copy basic content in an app (like a restaurant app which has only the menu in the app) or offer something that looks like an ordinary website. If what the app offers is also possible within a browser, then it doesn't belong in the App Store. A web-app can simulate a native app, but a native app shouldn't only simulate a web-app or browser*.[123] In addition, Google states in its Program policy for developers that apps require minimal functionality and should offer the consumer a "responsive" user experience.[124]

However, there are ways to make a regular webpage look more like a native app, and also add some functionality of native apps. In this section, we will focus on these alternatives: the HTML5 mobile webpage or "progressive web-app" as an alternative to a native app.[125]

By a web-app, we mean a webpage that is accessible through the browser like a regular webpage, for example, by typing a URL in the mobile browser or through a query in an online search engine. The difference with a regular webpage is that web-apps offer extended functionality compared with a regular webpage such as opportunities for interactions, partially working offline, and push notifications (Android only).[126] Also, web-apps are more optimized for mobile than regular webpages are. For example, they have shorter loading times than regular webpages. Web-apps also lead to more engagement and sales compared with regular webpages on mobile.[127] Consumers can bookmark these webpages onto the home screen of their smartphones, which make them feel like native apps. Because web-apps are offered through the browser and are, in effect, just webpages, they do not have to be offered through the app stores. Developing a web-app is less complex than developing a native app. But the developer still needs to develop several versions of the web-app, since every browser and every OS has differences, for example in how they cope with HTML. But this will be less complex than developing two native apps for two different operating systems. Also, there are frameworks available

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[122] https://developer.apple.com/app-store/review/guidelines/
[123] Notes of meeting with Apple, 17 December 2018.
[124] https://play.google.com/intl/nl/about/developer-content-policy-print/
[125] https://repository.tudelft.nl/view/tno/uuid%3Abca47716-f811-4d46-919b-23d89cf25cf8, last accessed on 29 March 2019.
[126] https://developers.google.com/web/progressive-web-apps/; https://developers.google.com/web/fundamentals/instant-and-offline/web-storage/offline-for-pwa Last accessed on 8 February 2019.
[127] https://www.iculture.nl/nieuws/progressive-web-apps-safari-browser-ontwikkelingen/ Last accessed on 8 February 2019, https://www.pwastats.com/ Last accessed on 21 March 2019.

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that the developer can implement to solve this problem.[128] Therefore, web-apps are much easier to develop for cross-platform use.[129]

Functionality
But web-apps also have disadvantages. A HTML5 webpage is a lot less user-friendly than a native app, has fewer options for unique functions, is not saved on the device, has inferior performance and prolonged load instances compared with native apps, and cannot be visited offline (iOS).

On iOS in particular, the browser offers less functionality since Apple blocked Adobe Flash from the iPhone. Flash made it possible for developers to offer games and video content through the browser. According to some, Flash would even make it possible to sell apps directly to iPhone users, bypassing the App store.[130] The main reasons for not allowing Adobe Flash in iOS were security and battery drain, but the "most important" reason according to former CEO Steve Jobs was that "*Adobe also wants developers to adopt Flash to create apps that run on our mobile devices*", and this would mean an extra software layer, which would degrade the quality of apps in the iOS ecosystem and Apple's control, since these apps don't need to be offered through the App Store.[131] Flash would enable developers to develop apps that run on all mobile platforms.[132]

If an app needs access to the hardware to function (for example the camera or GPS), or if the app is more like a software program than just static content, a native app is preferred over a web-app, since a web-app has restricted access to a device's hardware functionality compared with a native app, and thus offers less functionality.[133]

User experience
Not just functionality is restricted with web-apps, as usability, the user experience, is also restricted. This means that, for static content too, a web-app has drawbacks over native apps. We illustrate this with apps that offer news, since news can be considered "static content", and one would assume that the offering of news does not require a software-like program. Several news app providers with whom ACM spoke tested browsers and web-apps as alternatives to their native apps, but they never sticked with them because they lost users and revenue.[134] One app provider gave as their main reason to hold on to their native app that web-apps do not offer the option of "swiping". And since consumers are so accustomed to swiping, the lack of this option negatively impacted the usability of the app.[135] Financial Times is another example of an app provider that chose not to offer an app on iOS, but instead made an HTML5-version (a web-app) available to its iOS users. After six years, they revisited this decision because of reader demands, and started offering a native app again, but only for existing subscribers ("reader app").[136] This will be discussed further in Chapter 4. So web-apps would only form an alternative for very simple content. A web-app is a good alternative when it concerns a one-time, instant experience and the app only needs to be used for a limited time.[137] This is especially true since a web-app is more accessible than a native app. A web app does not need to be downloaded and

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[128] https://ionicframework.com/pwa Last accessed on 21 March 2019.
[129] Notes of meeting with **[confidential:]**, 15 October 2018
[130] http://fortune.com/2010/01/29/behind-the-adobe-apple-cold-war/ Last accessed on 8 February 2019.
[131] https://www.apple.com/hotnews/thoughts-on-flash/ Last accessed on 8 February 2019.
[132] Maurits Kreijveld, Rathenau Instituut, "De kracht van platformen", October 2014
[133] Grønli, Tor-Morten & Hansen, Jarle & Ghinea, Gheorghita & Younas, Muhammad. (2014). Mobile Application Platform Heterogeneity: Android vs Windows Phone vs iOS vs Firefox OS. Proceedings - International Conference on Advanced Information Networking and Applications, AINA. 635-641. 10.1109/AINA.2014.7810.1109/AINA.2014.78; https://www.codica.com/blog/progressive-web-apps-vs-native/ Last accessed on 8 February 2019.
[134] Notes of meeting with **[confidential:]**, 8 January 2019 and **[confidential:]**, 30 January 2019.
[135] Notes of meeting with **[confidential:]**, 8 January 2019
[136] https://aboutus.ft.com/en-gb/announcements/ft-ios-app-returns-to-the-apple-app-store/ Last accessed on 7 February 2019.
[137] https://blog.ionicframework.com/how-to-make-pwas-with-ionic/ Last accessed on 21 March 2019.

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installed. You only need to click on a link, and the web app is available for use. If a more "in-depth" experience is needed for the digital service and/or it requires the use of more hardware features, native apps are the best option for this.[138]

Discoverability

There is no central store were all the available web-apps are displayed, like the app stores. Google offers a list with web-apps, but it is not a complete list.[139] Most search engines do, however, index web-apps. According to some, this is one of the reasons why Google has a larger incentive to make web-apps compatible with its OS and invest more in the possibilities of web-apps, in contrast to Apple.[140] However, at the time of this writing[141], there are rumors that Apple will offer more support for web-apps in iOS 12.2.[142] The app providers that ACM spoke with also indicate the difficulties to attract and retain an audience for a web-app as the main drawback.

Data tracking

Another drawback of web-apps is that they provide fewer options to track data, since they do not have access or only restricted access to most functions of the smartphone. For a company of which its business model is built on data gathering, web-apps would not be an alternative.[143]

Innovation

While both Google and Apple invest a lot in native apps and try continually to add new features and options for app providers, they invest a lot less in web-apps than they invest in development tools and opportunities for apps.[144] An example is that, with the current web-apps on both iOS and Android, it is not possible to offer a navigation service. Other mobile Oss that never took off did offer this option through the browser. According to app providers with which ACM spoke, this would also have been possible on iOS and Android if Google and Apple had invested more in web-apps.[145] App providers also state that Apple and Google made developing native apps so attractive for developers that web-apps just do not have much appeal.[146]

In conclusion, the browser or web-apps cannot be considered a realistic alternative to most native apps since their functionality and usability is limited compared with native apps, especially on iOS. It is also a lot harder to reach an audience with a web app since there is no central distribution point where consumers come to search for web-apps. Web-apps only form an advantage over native apps when it concerns a one-time, instant experience so users do not have to go to the trouble of downloading and installing an app.

3.3 Alternatives to app stores

In this section, we will describe possible alternatives to the app stores within the ecosystem, and consider whether they truly form a realistic alternative. We will assess other channels to offer and

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[138] Ibid.
[139] https://pwa-directory.appspot.com/ Last accessed on 8 February 2019.
[140] https://www.emerce.nl/achtergrond/apple-ondersteunt-eindelijk-pwas;
https://www.digitalcommerce360.com/2017/05/02/apples-dirty-little-secret-about-chrome/ Last accessed on 8 February 2019.
[141] 29 March 2019
[142] https://www.onemorething.nl/2019/02/ios-12-2-krachtigere-web-apps/ Last accessed on 8 February 2019.
[143] Notes of meeting with **[confidential   ]**, 15 October 2018.
[144] Notes of meeting with **[confidential:]**, 15 October 2018.
[145] Ibid.
[146] Ibid.

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access content. Furthermore, we compare the App Store and Play Store with other alternatives and channels for accessing apps, and set out their main advantages and drawbacks.

3.3.1 Sideloading

In this section, we will discuss whether *sideloading* could form a realistic alternative to the app stores. Sideloading refers to the installation of apps on a smartphone without using the official app distribution channels (usually the official app store). Although sideloading includes the installation of apps from unofficial app stores, we limit ourselves to sideloading outside app stores. In section 3.3.3, the installation of apps from other app stores will be discussed.

Sideloading is not possible on iOS like on Android. However, there are some options on iOS that make sideloading theoretically possible. First, we will discuss the theoretical options on iOS. Then we will discuss sideloading on Android.

Sideloading on iOS

- *Xcode*

Sideloading is also possible on iOS, but only for tech-savvier consumers. To be able to sideload apps in iOS, consumers first need to open a developer account. Then they need an Apple computer, and download the software program Xcode. This program gives the ability to access GitHub, a place where app developers can test their apps. Consumers need to go through a complex process to install the app onto an Apple computer, and then the app can be copied to the iPhone.[147] However, this method comes with a few restrictions. Consumers can only sideload a maximum of ten apps a week in this way, and the certificate of the apps is only valid for 7 days. So after this time period, the app needs to be re-installed.[148] Furthermore, sideloaded apps are not updated. Updating the app is only possible by sideloading the app again.

This option might only be realistic for tech-savvy consumers.

- *Enterprise Program*

Apple also has a special program where developers can offer apps for internal use by employees of their company only. This is called the Apple developer Enterprise Program (hereafter: Enterprise Program).[149] The Enterprise Program allows select companies to distribute internal corporate apps among their employees that give full root access to a device. These apps are not reviewed by Apple like it does for the App Store, because these apps are supposed to be downloaded and used only by employees. Facebook and Google used this program to distribute apps to consumers that would not be approved for the App Store. When Apple found out, it banned the apps and revoked the licence for the Enterprise Program.[150] The same holds true for apps with adult content and gambling games. They were also offered through this program, and a small group of consumers was prepared to follow all the necessary steps to download apps through this channel, mainly because this content is not available in the App Store.[151] So, in theory, this could form a "backdoor" for developers to offer apps outside the App Store. But in practice, this is not a realistic option since it is not allowed by Apple, and the channel will be closed off as soon as Apple finds out.

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[147] https://www.iculture.nl/gids/sideloading-apps-iphone-ipad-apple-tv/ Last accessed on 8 February 2019.
[148] https://www.iculture.nl/nieuws/apple-beperkt-sideloading-10-apps/ Last accessed on 8 February 2019.
[149] https://developer.apple.com/programs/enterprise/ ; https://www.slideshare.net/joshsc/apple-policy-prohibits-distributing-enterprise-certificate-apps-to-nonemployees Last accessed on 9 February 2019.
[150] https://techcrunch.com/2019/01/30/apple-bans-facebook-vpn/?guccounter=1 Last accessed on 9 February 2019.
[151] https://www.nu.nl/apps/5739093/porno-en-gokapps-misbruiken-testprogramma-van-apple.html Last accessed on 13 February 2019.

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- *Jailbreaking*

Jailbreaking permits root access to iOS, allowing the downloading and installation of additional applications, extension, and themes that are unavailable through the official Apple App Store.[152] On Android devices, this process is called "rooting". If a consumer jailbreaks their iPhone, other app stores become available on iOS, like Cydia.[153] But with every new iOS that became available, jailbreaking became harder and harder, and nowadays, it is only an option for "very skilled hackers or teams of hackers".[154] According to some, the need for it disappeared because Apple implemented the jailbreakers' best ideas in the new OS.[155] But the main risk of jailbreaking is that the smartphone becomes very insecure.

Sideloading on Android

An Android app consists of code, data and resource files that together form a file known as APK (Android Package Kit). An APK file contains all the content of an Android app, and is the file that Android-powered devices use to install the app.[156] When consumers download an app from the Play Store, they download the APK file. On Android, it is also possible to download APK files from other sources than the Play Store, usually referred to as "sideloading".

In the following section, we will discuss the pros and cons of sideloading on Android.

Freedom of business model vs security

Sideloading an app means app providers can circumvent the rules and review process of the app stores. This gives them more freedom in developing their app.[157] The downside for consumers is that apps offered outside the Play Store could be unsafe, since they have not been reviewed.[158]Furthermore, consumers have to turn off the security settings (which is a hassle) to sideload an app, which makes their smartphones less secure.[159]

Sideloading on Android Nougat (7.0) or lower is only possible if the consumer navigates to and changes the "Unknown Sources" setting in their Security Settings on their Android device, and presses "ok" after the prompt with the following text:

Your phone and personal data are more vulnerable to attack by apps from unknown sources. You agree that you are solely responsible for any damage to your tablet or loss of data that may result from using these apps.[160]

On Android Oreo (8.0) or higher, there is no such setting but it is handled on a per-app permission basis. If a consumer tries to download an APK file, they will be prompted with a notification that the

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[152] In some countries, jailbroken smartphones lose their warranty.

[153] https://www.lifewire.com/get-apps-not-in-app-store-1999916 Last accessed on 8 February 2019.

[154] https://motherboard.vice.com/en_us/article/8xa4ka/iphone-jailbreak-life-death-legacy Last accessed on 9 February 2019.

[155] https://motherboard.vice.com/en_us/article/8xa4ka/iphone-jailbreak-life-death-legacy Last accessed on 9 February 2019.

[156] https://developer.android.com/guide/components/fundamentals. Last accessed on 8 February 2019.

[157] https://venturebeat.com/2018/08/03/tim-sweeney-epics-ceo-on-fortnite-on-android-skipping-google-play-and-the-open-metaverse/view-all/ Last accessed on 13 November 2018.

[158] https://bgr.com/2018/08/06/fortnite-for-android-download-no-google-play-security-risks/; https://www.itpro.co.uk/security/31787/vulnerability-spotted-in-fortnite-android-installer; https://www.wandera.com/fortnite-android-sideloading/ Last accessed on 13 November 2018

[159] https://bgr.com/2018/08/06/fortnite-for-android-download-no-google-play-security-risks/; https://www.wandera.com/fortnite-android-sideloading/; https://www.wired.co.uk/article/fortnite-android-release-date-google-play; https://www.forbes.com/sites/ewanspence/2018/08/07/android-fortnite-battle-royale-google-apple-iphone/#6e87073c63ed Last accessed on 13 November 2018

[160] https://android.gadgethacks.com/how-to/android-basics-enable-unknown-sources-sideload-apps-0161947/; https://www.androidcentral.com/unknown-sources Last accessed on 8 February 2019.

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smartphone is not allowed to install unknown apps from this source and will be given the opportunity to change the settings for this specific source in the same way as with Android Nougat and lower, also with the same warning text.[161] On the one hand, this means the consumer has to change the settings every time they sideload an app. But on the other hand, it is more secure than Nougat and lower where there is a risk that consumers leave the setting on after they have sideloaded an APK file.

As a result, sideloading can impact the security and integrity of the overall ecosystem, because there is a whole suite of "scam" apps that look like the original, but contain malware. It is often hard for consumers to distinguish between apps that are safe to use and imitation apps that contain malware.[162] But for consumers, it also forms extra work to keep changing the security settings, and it may deter consumers from changing the settings because the notifications about security scare them off.

30% commission vs developing another platform
The main advantage for sideloading from an app provider's perspective is that providers do not need to pay the 30% commission. This was also the main reason for Epic Games to sideload their app Fortnite on Android.[163] Since Fortnite is available in the App Store, comparing the Fortnite iOS and Android app makes for an interesting case. However, Epic Games is not representative for all aspects for the average app provider or game provider, since Tencent, one of the Chinese "Big Five" platform-ecosystems, is a 40% owner of Epic Games.[164] This means Epic Games has access to the strategic insights and resources of one of Google's main competitors, Tencent.[165] This could also mean that smaller app providers do not have the resources and strategy to offer their app outside the Play Store successfully. Fortnite is also available through other platforms (PC, game consoles), but in this section, we will discuss Fortnite for mobile only.

According to estimates, Fortnite generated 385 million US dollars in the first eight months it was available on iOS, so this means an average of 48 million US dollars a month,[166] which would mean Apple earned over 14 million US dollars a month through the 30% commission, and over 115 million US dollars in eight months. Since Fortnite was available on Android a few months later than iOS, and Android users tend to spend less, it is not possible to equate Apple's earnings to possible earnings Google missed out on. But it is estimated that Google missed out on and Fortnite saved 50 million US dollars in 2018 by sideloading.[167]

Sideloading in order to circumvent the 30% commission also has its drawbacks. App providers need to create their own update regimes, which is a lot harder since updating sideloaded apps is only possible when consumers download a new APK file.[168] Many users may not be willing to do this. The app

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[161] Ibid.
[162] https://www.wired.com/story/imposter-fortnite-android-apps-already-spreading-malware/;
https://bgr.com/2018/08/06/fortnite-for-android-download-no-google-play-security-risks/;
https://www.forbes.com/sites/davidthier/2018/08/10/google-play-samsung-beta-a-major-warning-about-downloading-fortnite-battle-royale-on-android/#283f89cd50ae; https://www.wandera.com/fortnite-android-sideloading/;
https://www.wired.co.uk/article/fortnite-android-release-date-google-play;
https://www.forbes.com/sites/ewanspence/2018/08/07/android-fortnite-battle-royale-google-apple-iphone/#6e87073c63ed
Last accessed on 13 November 2018
[163] https://venturebeat.com/2018/08/03/tim-sweeney-epics-ceo-on-fortnite-on-android-skipping-google-play-and-the-open-metaverse/view-all/; https://www.wired.co.uk/article/fortnite-android-release-date-google-play Last accessed on 13 November 2018
[164] https://seekingalpha.com/article/4200438-fortnite-tencents-value-creation-work Last accessed on 9 February 2019.
[165] Petit, 2016.
[166] https://sensortower.com/blog/fortnite-revenue-november-2018 Last accessed on 9 February 2019.
[167] https://sensortower.com/blog/fortnite-revenue-google-play Last accessed on 9 February 2019.
[168] https://android.gadgethacks.com/news/5-reasons-why-fortnite-avoiding-play-store-is-terrible-idea-0186338/ Last accessed on 13 November 2018.

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provider also needs to develop its own download platform, and host the app.[169] Circumventing the Play Store also means that the app provider will miss out on promotion (free or paid) through the Play Store, like the featuring of apps. We will elaborate on this in the next section.

Discoverability

Discoverability is the degree to which digital content can be found in a digital environment. For apps, this is also important, and the decrease in discoverability is one of the main drawbacks of sideloading, since it is extremely hard to reach an audience outside the Play Store,[170] which was also confirmed by all the app providers that ACM interviewed for this market study.[171] Only consumers who are already familiar with an app and are willing to look for it outside the Play Store will sideload it. Apps that are not in the Play Store miss out on "passive discovery".[172] This will be illustrated below with the example of the Fortnite app.

StoreMaven estimates that Fortnite lost a total of 41% of downloads by not being present in the Play Store.[173] If revenue is correlated directly with the volume of installations, Epic Games misses out on 41% of revenues by sideloading, and it would have been more profitable to offer their app through the Play Store, which would mean a 30% loss. And the costs for setting up and hosting their own platform, payment service, etc, have not even been included. For apps with less brand awareness, the impact of sideloading on discoverability would be more than 41%.[174]

Fortnite's main competitor is a similar game app, Player Unknown's Battlegrounds Mobile (hereafter: PUBG). Both apps were released around the same time, and PUBG is available through the Play Store. Comparing these apps could gain more insight into the number of users Fortnite missed out on by sideloading, so we will assess the user counts and growth of both apps on Android and iOS below. It is noteworthy that both games are also available on PC and game consoles, but we will leave these channels out of the assessment. In addition, it is equally noteworthy that PUBG is developed by Tencent, which also happens to be a 40% owner of Fortnite's developer Epic Games. And finally, Fortnite is more popular in Western countries, while PUBG is more popular in Asia, like China and India. This is because Fortnite requires more advanced smartphones to run and is also more expensive than PUBG.[175]

Notes of meeting with **[confidential:]**, 15 October 2018
[169] https://android.gadgethacks.com/news/5-reasons-why-fortnite-avoiding-play-store-is-terrible-idea-0186338/ Last accessed on 13 November 2018.
[170] https://bgr.com/2018/08/06/fortnite-for-android-download-no-google-play-security-risks/; https://www.wired.co.uk/article/fortnite-android-release-date-google-play; https://venturebeat.com/2018/08/03/tim-sweeney-epics-ceo-on-fortnite-on-android-skipping-google-play-and-the-open-metaverse/view-all/ Last accessed on 13 November 2018.
[171] Notes of meeting with **[confidential:]**, 15 October 2018; Notes of meeting with **[confidential:]**, 14 September 2019; Notes of meeting with **[confidential:]**, 11 October 2018; Notes of meeting with **[confidential:]**, 22 October 2018; Notes of meeting with **[confidential:]**, 25 October 2018; Notes of meeting with **[confidential:]**, 8 January 2019; Notes of meeting with **[confidential:]**, 30 January 2019; Notes of meeting with **[confidential:]**, 6 February 2019; Notes of meeting with **[confidential   ]**, 5 February 2019; Notes of meeting with **[confidential:]**, 11 October 2018; Notes of meeting with **[confidential:]**, 3 December 2018.
[172] https://www.storemaven.com/fortnite-risky-android-launch-without-google-play-might-not-pay-off/?trafficSource=mobiledevmemo&cmpn=fortniteriskystrategypart1?SRC=MOBILE_DEV_MEMO Last accessed on 13 November 2018.
[173] Ibid.
[174] StoreMaven assumes that Google would have promoted and featured the Fortnite app in Google Play extensively, and accordingly estimates that Fortnite lost 70% of installs in the browse-category by not being present as a featured app. StoreMaven further estimates that Fortnite lost 30% of installs from the branded search category, since the sideloading process would be too difficult or lengthy for consumers compared to downloading from Google Play. Fortnite lost 100% of the non-branded search installs and they lost 30% of installs from paid traffic due to the complex sideloading process.[174] This amounts to a total of 41% decrease in installs by sideloading.
[175] https://www.pcgamesn.com/pubg-mobile-player-count Last accessed on 10 March 2019.

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PUBG had some serious advantages over Fortnite concerning the Play Store. For one, PUBG was named "game of the year" in the Play Store, so it received more attention by featuring than most other games.[176] Also, when consumers searched the Play Store for "Fortnite", Google showed a notification that Fortnite was not available, and listed PUBG at the top of the search query results.[177]

In August 2018, PUBG passed the 100 million downloads milestone on iOS and Android combined, while Fortnite already passed the 100 million app downloads on iOS alone a month earlier.[178] So on mobile only, Fortnite was initially more popular than PUBG. But, by the end of 2018, PUBG had caught up with Fortnite as both games have over 200 million downloads.[179] It is unknown if Fortnite received extra promotion on the App Store, though this could be plausible since Apple indicated that apps that are exclusive for iOS are often promoted.[180] If so, this could explain Fortnite's head start on iOS alone. But since PUBG caught up with Fortnite, this could mean that sideloading leads to fewer downloads once the attention and buzz from the release wears off.

Access to customers' billing information
When apps or digital content within apps are sold through the app stores, app providers have no or limited access to the billing information of their customers because the app stores process the transactions. So the app stores automatically hold the billing information, but do not provide this information to the app provider because of the privacy of the app store users, which will be further discussed in chapter 4. For suppliers of subscriptions in particular, having no access to this data makes it hard to approach their customers for discounts, upselling or other offers.[181]

If an app is offered through sideloading, app providers do not face this restriction. The downside is that app providers need to organize and secure their own payment-and-billing process.[182] For consumers, it could be beneficial if the app store arranged all payments. It would be more user-friendly and more secure if only a single company held the consumer's billing data and processed their payments instead of all the different app providers.

Today, sideloading might only be a realistic alternative on Android, and only for apps that already have a high brand awareness and established user bases. This mostly concerns apps that are also available on other platforms and have already achieved high brand awareness so they do not have to rely solely on the app stores as distribution channels. If they received less traffic through mobile, they could still gain users and revenue from desktop, game consoles and other platforms. So, in the future (near or otherwise), sideloading could possibly become a threat to the Play Store. If more developers followed Epic's example, it could lead to a loss of revenue for the Play Store.[183]

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[176] https://www.blog.google/products/google-play/announcing-google-plays-best-2018/?from=singlemessage&isappinstalled=0 Last accessed on 9 February 2019.

[177] https://techcrunch.com/2018/08/10/google-isnt-sure-how-to-spell-fortnite-battle-royale/ Last accessed on 9 February 019.

[178] https://www.gamespot.com/articles/pubg-hits-100-million-downloads-on-mobile/1100-6461229/ Last accessed on 1 March 2019.

[179] https://www.theverge.com/2018/12/18/18146774/pubg-mobile-players-fortnite Last accessed on 9 February 2019.

[180] Notes of meeting with Apple, 17 December 2018.

[181] https://repository.tudelft.nl/view/tno/uuid%3Abca47716-f811-4d46-919b-23d89cf25cf8, last accessed on 29 March 2019.

[182] https://bgr.com/2018/08/06/fortnite-for-android-download-no-google-play-security-risks/; https://android.gadgethacks.com/news/5-reasons-why-fortnite-avoiding-play-store-is-terrible-idea-0186338/ Last accessed on 13 November 2018

[183] https://www.wired.co.uk/article/fortnite-android-release-date-google-play Last accessed on 13 November 2018.

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3.3.2   Pre-installing

Another option to circumvent the app stores is pre-installing apps on smartphones, also referred to as pre-loading. It is also possible for the provider of the mobile OS to pre-install their own apps (first-party apps), but this is excluded in this analysis since we focus on options for third parties to offer their apps outside the app stores. Device manufacturers may pre-install their own apps or allow third-party app providers to have their app pre-installed. The former is usually accompanied with a fee. In this case, the smartphone manufacturer is the entity that the app provider does business with instead of the app store. In the Android app-ecosystem, these are mostly different entities. On iOS, the controller of the App Store is the same entity as the controller of the hardware.

This option may provide app providers with a way around the app store. However, to reach the same audience as through the app store, the app provider needs to access a lot of different, scattered portals because it needs to enter into agreements with all the smartphone manufacturers. Furthermore, the app providers which ACM has spoken with have indicated that it is costly to have their app pre-installed on a device. [184] Since smartphone manufacturers generally prefer not to ship their devices with a large number of third-party apps, pre-loading is usually reserved for a select few.

Facebook recently entered into agreements with several Android smartphone suppliers to pre-load the Facebook-app onto shipping devices,[185] but whether smaller app providers would have enough leverage to enter into these kinds of arrangements on this scale is questionable.

Apple only allows for third-party apps to be pre-installed in very rare circumstances. One such example was Google Maps, that came pre-installed on every iPhone. Apple made a deal with Google, to set Google as the default search engine on the iPhone. Google reportedly paid 1 billion US dollars to Apple, although more recent reports estimate a fee of 9 billion US dollars.[186] Regardless of what the actual fee was, this setting is related to the search engine in the Safari browser and not to the pre-installing of apps on the iPhone.[187] With the launch of the iPhone 6, Apple replaced Google Maps with Apple Maps.[188] As far as ACM is aware, the pre-installation of third-party apps is not possible within the Apple ecosystem and, as such, is limited to Apple's own apps.

To summarize, pre-installing is only an alternative for a very small number of apps, and only on Android.

3.3.3   Other app stores

On iOS, only Apple's App Store is available. On Android, there are a number of different app stores available besides the Play Store, for example the Amazon App store, Aptoide, and Samsung Galaxy Apps. But these alternative app stores are used less often compared with the Play Store. In **[confidential:]** of all apps on Android were downloaded through the Play Store, which means that the other app stores combined were responsible for less than **[confidential:]** of app downloads on Android.[189]

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[184] Notes of meeting with **[confidential:]**, 25 October 2018.
[185] https://www.independent.co.uk/life-style/gadgets-and-tech/news/facebook-app-delete-android-smartphones-samsung-galaxy-a8719081.html Last accessed on 10 February 2019.
[186] https://searchengineland.com/report-google-to-pay-apple-9-billion-to-remain-default-search-engine-on-safari-306082 It is unclear on what basis the fee is computed.
[187] Ariel Ezrachi and Maurice Stucke, "Virtual Competition", Harvard University Press, 2016.
[188] https://www.huffingtonpost.com/2012/06/11/apple-debuts-maps-app_n_1587726.html?guccounter=1; https://www.nytimes.com/2012/09/20/technology/apple-ios-6-leaves-out-googles-maps.html Last accessed on 5 March 2019.
[189] **[Confidential:]**.

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Google does not prohibit other app stores on Android, but they do prohibit the distribution of other app stores through the Play Store. There are two options for these other apps stores to reach consumers on Android. The first option is to pre-install the app store on shipping Android devices. This happens with the Samsung and Amazon app stores on some devices. The second option is the process of sideloading the app store. This process for consumers to enable sideloading as well as the thereto-related security risks are discussed in section 3.3.1.

In conclusion, other app stores are not an alternative for iOS, because no other app stores are available on iOS. On Android, other app stores are available, but they are not used that much. It is likely that this is caused by the same indirect network effects that enabled Google and Apple to win.

3.4 Alternative app-ecosystems

In the previous section, we ascertained that no realistic alternatives for apps or Apple's App Store exist within the iOS ecosystem. For the Android ecosystem, we ascertained that, for certain app providers, certain apps and for a certain niche audience, alternatives might exist. Although those alternatives have their drawbacks, and could never completely replace all the benefits of the Play Store.

To assess further whether the app stores form a bottleneck, we will look at possible competition between the different app-ecosystems. To assess this, we will review 1) the opportunities for app providers and consumers to multi-home and switch app-ecosystem and 2) Apple and Google's ecosystem strategies concerning interoperability and closure.

3.4.1 Opportunities for multi-homing and switching

As we have seen in Chapter 2, indirect network effects can make it very challenging for a starting platform to compete with the incumbent. This can lead to *market tipping*: a market outcome where one standard becomes dominant, or where two or more incompatible standards become dominant (duo- or oligopoly). This is especially true if one user group of the platform is not able to *multi-home* and becomes locked-in.

When several horizontal platforms co-exist, consumers and business users can, in theory, join and use several competing platforms in parallel. This is called **multi-homing**. Multi-homing can occur on both sides of the platform, on one side, or not be possible at all. If multi-homing is impossible and consumers or business users use only one platform for the specific service, this is referred to as **single-homing**.

In this study, we discern **two levels of multi-homing and single-homing**. The lower level of multi-homing can refer to the use of one or more app stores, and the higher level can refer to the use of one or more app-ecosystems.

In this section, we will assess whether app providers and consumers are able to multi-home, and if not, if there are opportunities for switching, and we will further look at actual switching behavior and switching barriers.

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3.4.1.1   *App providers*

App providers have opportunities to multi-home, since they can develop versions of their apps for different app stores as well as for different app-ecosystems.

Multi-homing is important for most app providers, because the app provider can reach over 99% of all smartphone users when their app is submitted in both the Play Store and the App Store. If they offer their app only for a single app-ecosystem, they miss out on a very important part of their potential audience. In fact, they miss out on a whole market since Android users are different from iOS users, they could be viewed as separate markets. We will further explain this distinction below. After that, we will assess the opportunities for multi-homing for app providers.

In the first half of 2018, 15 billion apps worldwide were downloaded from the App Store, and 36 billion apps were downloaded from the Play Store.[190] The worldwide apps' revenue from the first half of 2018 was 22.6 billion US dollars for the App Store and 11.8 billion US dollars for the Play Store.[191] So although the Play Store has more users and more than twice the amount of downloaded apps than the App Store, the App Store generated twice the amount of revenue compared with the Play Store. The main reasons for this difference are Apple users tend to be more willing and able to spend, and Google users have historically spend less on apps than Apple users. Also, the Play Store has a strong presence in developing countries while the App Store is also available in China.[192] So even with a smaller market share in terms of users, Apple is more valuable for app providers because Apple consumers are much more "high-end" customers and spend more.[193] The app providers which ACM spoke with also state they profit more from Apple users than Android users.[194] So the App Store forms a bottleneck for app providers to reach the market for iOS users, the high-end consumers who spend more, while the Play Store forms a bottleneck for app providers to reach the market for Android users, meaning a larger audience and increased reach. The only way to reach both markets effectively is to multi-home.

The fragmentation of all smartphone users over two different app-ecosystems is costly for app providers, because the app provider needs to develop his app separately for each ecosystem if he wants to reach both markets. Therefore, app providers indicate platform-incompatibility as a serious threat for the app-economy, and state that they wish they only had to develop one app instead of two.[195] This probably also explains why app-ecosystems are, for the most part, single-homing markets from an app provider's perspective. In 2013, only 1.7 to 3.2 percent of all apps were available on two or more app stores, and 5.8 to 7.2 percent of all app providers offered their apps in two or more app stores.[196] However, if only the most popular apps are taken into consideration (top 100 most downloaded worldwide), multi-homing is much more frequent: 39.2% of the most popular apps worldwide are offered in two or more app stores, and 42.7% of the app providers of the most popular apps develop for two or more app stores.[197] The app providers which ACM spoke with also indicated that most app providers first offer their app only in one app store. If the app proves successful, they will start developing the app for the other app store.

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[190] https://sensortower.com/blog/app-revenue-and-downloads-1h-2018 Last accessed on 8 January 2019.
[191] https://sensortower.com/blog/app-revenue-and-downloads-1h-2018 Last accessed on 8 January 2019.
[192] https://techcrunch.com/2018/07/16/apples-app-store-revenue-nearly-double-that-of-google-play-in-first-half-of-2018/?guccounter=1 Last accessed on 10 January 2019.
[193] https://www.telecompaper.com/nieuws/apple-app-store-boekte-omzet-van-usd-12-miljard-in-q3--1264891 Last accessed on 10 January 2019.
[194] Notes of meeting with **[confidential:]**, 6 February 2019.
[195] Gigaom Research, 2014, p. 13, Notes of meeting with **[confidential:]**, 6 February 2019.
[196] Sami Hyrynsalmi et al "App Store, Marketplace, Play! An Analysis of Multi-Homing in Mobile Software Ecosystems", 2012, p. 66, https://pdfs.semanticscholar.org/30e6/9ffe932366caee90de7af90db96b947e8c15.pdf.
[197] Ibid.

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App providers that have a business model that require them to use IAP could be more motivated to circumvent the commission levied by the Play Store than the App Store. This is because Apple customers generate more revenue, because they spend more money on and in services.[198] App providers with business models based on advertising could prefer Google over Apple, because Apple offers consumers more options for privacy protection.

Observations

Based on the above, we establish that multi-homing for app providers is expensive and time-intensive, and is therefore only a viable option for app providers that are already successful and generate enough profits to develop their app for both ecosystems,[199] which is less than 10% of all app providers. For start-ups, this may form an entry barrier that leads to fewer opportunities for niche products and innovation. For consumers, this means their initial choice for Android or iOS is not very dependent on the availability of apps, because all popular and known apps are present in both ecosystems. Combined with the insight from section 2.3 on discoverability, this also means that both ecosystems are actually very different from each other with regard to app differentiation. However, since only the most popular apps gain enough visibility, the differentiation gets lost through a lack of discoverability for new and unknown apps. Since these new apps will not grow, they also lack the resources to develop their app for the other app-ecosystem.

3.4.1.2   *Consumers*

The lower level of multi-homing for consumers is determined first by the choice for a smartphone and OS and second the app store(s) available within the chosen app-ecosystem. Within the iOS-ecosystem, consumers single-home since no other app stores are available. Within the Android-ecosystem, multi-homing for consumers is possible in theory, because there are more app stores available. But in practice, this is not common, as we already discussed in section 3.3.3 that less than **[confidential:]** of apps is downloaded through other app stores than the Play Store on Android. With regard to the higher level of multi-homing, consumers are not able to use more than one app-ecosystem on their smartphone, so this means consumers single-home. Below, we will further discuss consumers' switching behavior and switching costs regarding app-ecosystems.

In the Netherlands, 33% of consumers bought a new smartphone in 2018.[200] Of these consumers, 86% bought a new smartphone with the same OS, 9% bought a smartphone with a different OS on a voluntary basis, and 5% bought a smartphone with a different OS because their initial OS was no longer available (BlackBerry's RIM or Windows Phone).[201] When Dutch consumers were asked whether they plan to switch OS in the future, 93% state they stay with the same operating system, and 7% expects this may change.[202] So switching mobile ecosystem is rare in the Netherlands. Next, we will look at the reasons that form barriers for switching between app-ecosystem.

When we look at switching behavior between app stores, we automatically take other parts of the ecosystem in consideration, especially the mobile OS and smartphone. These are also parameters

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[198] https://www.wired.co.uk/article/fortnite-android-release-date-google-play Last accessed on 13 November 2018.
[199] Timothy Bresnahan, Joe Orsini and Pai-Ling Yin "Platform Choice by mobile app developers", 2014, https://conference.nber.org/conferences/2014/EoDs14/multihoming%20BOY.pdf.
[200] Data requested from Telecom Paper concerning the Telecompaper Consumer Insights Panel by ACM (6,677 recipients aged 12-80), received on 4 February 2019.
[201] Ibid.
[202] Data requested from Telecom Paper concerning the Telecompaper Consumer Insights Panel by ACM (13,945 recipients aged 12-80), received on 4 February 2019.

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that the consumer takes into consideration. The mobile OS may be the most important factor when choosing a smartphone, even more important than price.[203] The most cited reason for (US) consumers to switch form the iOS ecosystem to the Android ecosystem is price, while the most cited reason for consumers to switch from Android tot iOS is the user experience, as is shown in Figure 9. The availability of apps does not seem to have a large impact.[204] Another study also finds that the availability of apps is ranked of low importance,[205] as is shown in Figure 10. But as we have seen in the previous section, all the popular apps are available in both ecosystems. This could very well be the reason that the availability of apps is not seen as a concern.
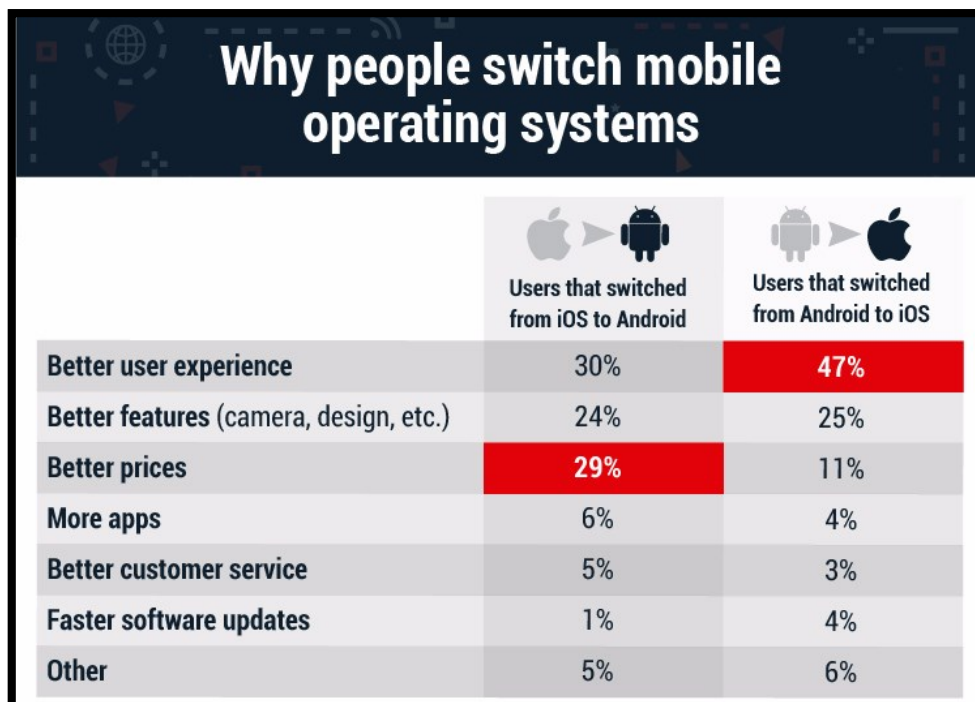

Why people switch mobile operating systems

	Users that switched from iOS to Android	Users that switched from Android to iOS
Better user experience	30%	47%
Better features (camera, design, etc.)	24%	25%
Better prices	29%	11%
More apps	6%	4%
Better customer service	5%	3%
Faster software updates	1%	4%
Other	5%	6%

Figure 9: Reasons for switching between mobile operating systems

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[203] Böhm S., Adam F., Farrell W.C. "Impact of the Mobile Operating System on Smartphone Buying Decisions: A Conjoint-Based Empirical Analysis" Mobile Web and Intelligent Information Systems. MobiWIS 2015. Lecture Notes in Computer Science, vol 9228.
[204] https://www.pcmag.com/news/363269/why-do-people-switch-between-mobile-operating-systems Last accessed on 18 February 2019.
[205] Böhm S., Adam F., Farrell W.C. "Impact of the Mobile Operating System on Smartphone Buying Decisions: A Conjoint-Based Empirical Analysis" Mobile Web and Intelligent Information Systems. MobiWIS 2015. Lecture Notes in Computer Science, vol 9228.

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Table 3. OS Characteristics Ranking					
Android Users			**iOS Users**		
Mobile OS Characteristics	**Average Ranking**	**Standard Deviation**	**Mobile OS Characteristics**	**Average Ranking**	**Standard Deviation**
Usability	3.62	3.05	Usability	2.89	2.40
Security	4.09	2.34	Functionality	3.77	2.33
Functionality	4.23	2.40	Performance	4.42	2.34
Performance	4.28	2.26	Security	4.60	2.45
OS Supplier	5.06	3.07	OS Supplier	5.25	2.93
Device Compatibility	6.00	2.32	Device Compatibility	5.85	2.44
Configurability	6.30	2.95	Preferred Apps	6.57	2.42
Preferred Apps	6.70	2.17	Number of Apps	6.94	2.73
Brand Compatibility	7.13	2.42	Configurability	7.02	2.45
Number of Apps	7.60	2.45	Brand Compatibility	7.70	2.19

Figure 10: Impact of the Mobile Operating System on Smartphone Buying Decisions

It is harder and more expensive to switch from iOS to Android than the other way around.[206] The higher cost of switching from iOS may be due to the fact that iPhone users may have other devices from Apple, which are incompatible with other brands,[207] that Apple offers a tool for transferring data from Android to iOS (but not the other way around),[208] and because of the tight integration of the Apple ecosystem.[209] Another source that raises switching costs is that all apps need to be re-downloaded and re-purchased,[210] and some apps may not be available in the other ecosystem. Learning costs also play their part in switching behavior. This means that consumers need to get accustomed to and grow familiar with other interfaces.[211]

Single-homing combined with an ecosystem strategy often leads to a form of lock-in that transcends the product's lifecycle, defined as *path dependency*.[212] After all, hardware has a limited lifespan. But if the hardware wears out, the consumer can normally break the lock-in cycle by buying another product brand (for example a smartphone, game console or coffee machine). But when consumers also have a whole suite of apps and other software that are not compatible with other app-ecosystems, this may raise switching costs since the apps cannot be ported over to another ecosystem. The longer the consumer uses one app-ecosystem and builds up files, data and information, the higher the switching costs and the harder the lock-in.[213] When the consumer also owns other (IoT) hardware, cables and other accessories that are only compatible with the initial smartphone, the odds of them buying a non-

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[206] Tim Wijkman, Telecom Paper, information received through e-mail on 19 November 2019.

[207] Grzybowski, Lukasz; Nicolle, Ambre "Estimating Consumer Inertia in Repeated Choices of Smartphones", The 22nd Biennial Conference of the International Telecommunications Society: "Beyond the boundaries: Challenges for business, policy and society", June 24th - 27th, 2018, Seoul, Korea, International Telecommunications Society, https://www.econstor.eu/bitstream/10419/190389/1/E2_1_Grzybowski-and-Nicolle.pdf.

[208] https://support.apple.com/en-jo/HT201196, Last accessed on 19 February 2019.

[209] Telecompaper, 2019.

[210] Böhm S., Adam F., Farrell W.C. "Impact of the Mobile Operating System on Smartphone Buying Decisions: A Conjoint-Based Empirical Analysis" Mobile Web and Intelligent Information Systems. MobiWIS 2015. Lecture Notes in Computer Science, vol 9228.

[211] Yuri Park, Yoonmo Koo, "An empirical analysis of switching cost in the smartphone market in South Korea", Telecommunications Policy, Volume 40, Issue 4, April 2016, Pages 307-318 https://www.sciencedirect.com/science/article/pii/S0308596116000136 .

[212] Meyer, Tobias Georg "Path Dependence in two-sides markets, A simulation study on technological path dependence with an application to platform competition in the smartphone industry", 08-2012.

[213] Varian and Shapiro, 1999, p. 123.

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compatible smartphone are even slimmer. This also seems Apple's strategy, which can be derived from an e-mail of former CEO Steve Jobs: *tie all of our products together, so we further lock customers into our ecosystem.*[214]

Observations

In this section, we established that consumers on iOS are not able to multi-home between app stores because there is only one app store available. We also found that consumers on Android in practice do not or very rarely multi-home between app stores.

We also found that switching behavior between app-ecosystems is also infrequent due to high switching costs formed by the app-ecosystem that is not compatible with other app-ecosystems, defined as path dependency. The app stores and apps that consumers already use and have downloaded play their part in raising switching costs. The availability of apps in the other ecosystem does not form an incentive for switching because there is not much visible differentiation between both ecosystems since the most popular apps are available in both ecosystems. Furthermore, the apps that are not available in both app stores also lack discoverability, so apps can't form an incentive for switching. And if new apps do become popular, chances that the app provider will also develop his app for the other ecosystem are very high.

So consumers are locked into the app-ecosystem. With the growth of IoT and the expansion of the platform-ecosystem to other sectors, path dependency can grow this lock-in indefinitely. This lock-in can make it possible for the platform to exploit consumers and prohibit smaller companies from becoming viable competitors, even when they offer better products.[215] The lock-in could also restrict consumer choices, decrease utility, and cause less innovative firm behavior.[216]

Single-homing and a lack of switching opportunities mean consumers cannot effectively be reached by the multi-homing side in any other way, and the platform becomes a bottleneck for reaching the single-homers. According to economic theory, this means that the platform can charge the multi-homing side a premium fee for accessing the single-homing side, once it has attracted a large single-homing group. If the single-homing users cannot be effectively reached by the multi-homing side in any other way, the platform will become a bottleneck for reaching the single-homers. This also causes fierce competition between platforms for single-homers in the first phases of the market (before the market tips) and great investments by platforms to get the bandwagon rolling.

In the next section, we will further assess the app-ecosystem and strategies of both Google and Apple concerning compatibility, standardization and fragmentation to gain more insight into where the path dependency and the bottleneck position originate from, how it is conserved, and how it is reinforced. We will also look further into the expansion of the platform-ecosystem into other sectors. This will provide more clarity regarding possible competitive restraints and where they might come from, which will be discussed in the section thereafter.

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[214] CNET, "Steve Jobs wanted to 'further lock customers' into Apple's 'ecosystem'" 2 April 2014, https://www.cnet.com/news/steve-jobs-wanted-to-further-lock-customers-into-apples-ecosystem/The e-mail was revealed in one of the lawsuits between Samsung and Apple. Also, 50% of consumers with an iPhone also owns an iPad. Only 4% of the iPhone owners also owns a tablet from Samsung (IAB, "Global Mobile Consumer Survey 2013 Addicted to connectivity: the Dutch Mobile Consumer Perspective", November 2013, p. 19, http://www.iabeurope.eu/files/1913/8574/2118/deloitte-nl-global-mobile-consumer-survey.pdf , Last accessed on 29 October 2018).

[215] Stefan Weiergraeber, "Network Effects and Switching Costs in the US Wireless Industry: Disentangling Sources of Consumer Inertia" May 2018, https://sweiergr.github.io/_downloads/networkeffectsandswitchingcosts.pdf.

[216] Yuri Park, Yoonmo Koo, "An empirical analysis of switching cost in the smartphone market in South Korea", Telecommunications Policy, Volume 40, Issue 4, April 2016, Pages 307-318 https://www.sciencedirect.com/science/article/pii/S0308596116000136.

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3.4.2   Interoperability

As we discussed in the previous section, the consumer lock-in present in both app-ecosystems leads to path dependency. This path dependency can be reached by performing an integration strategy that creates a platform-ecosystem around one dominant design that further secures and widens the initial bottleneck position. After all, the more gateways to the consumer the platform controls, the harder it becomes for third parties to access these consumers outside off the platform and vice versa. In this section, we will assess Apple's and Google's choices concerning compatibility within their app-ecosystems to gain more insight into how this enables them to acquire and maintain control over their app-ecosystem. We will start off with some theory on these integration strategies in section 0. Then we will discuss how and through what mechanisms Google and Apple control and expand their ecosystem. Finally, we will describe how this control enables Google and Apple to leverage their bottleneck position to other markets with an example.

3.4.2.1   Theory

Path dependency is reached by *vertical, diagonal* and *horizontal integration* where the initial platform ties more and more products, services and markets together (hardware, software, payment systems, IoT devices etc.). This process is described as a strategy by different authors under different names; vertical integration,[217] tipping across markets,[218] integration across markets[219] or platform envelopment.[220] This integration strategy can be performed by the orchestrator in three different ways:

1) Acquisition of existing companies;
2) Create a new market ("greenfield strategy"[221]);
3) Enter an existing market with a (for the integrator) new product;

The third way is viewed as a competitive attack by Eisenmann et al., and they identify three different ways in which integration can be performed:[222] (1) Conglomeration attack (diagonal integration of functionally unrelated products); (2) Intermodal attack (horizontal integration of weak substitutes); and (3) Foreclosure attack (vertical integration of complements that have been offered by third parties).

According to Eisenmann et al., these integration strategies provide a mechanism to make markets tip in favor of the platform that employs the strategy in a way that does not involve competition on the merits, breakthrough innovations or Schumpeterian "creative destruction".[223] This means that

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[217] Lina Khan, "The Amazon Antitrust Paradox", Yale Law Journal, 2017.

[218] *Tipping across markets occurs when a company crosses over the boundary of its existing market to absorb technical features from an adjacent market and bundle them to extend the company's platform. Tipping across markets seems particularly important in the context of technological convergence, which is pervasive among computers, telecommunications equipment and digital appliances. For example, Sunnyvale, California-based Palm Inc., originally known as a dominant company in personal digital assistants, has added cell phone, media player and handheld computer functions to its platform. In turn, cell phone manufacturers have added PDA, media player and handheld computer functions to their "smart" cell phones. Companies that tip across markets by bundling new features can leverage existing market power, technology or reputation to help them move into adjacent markets.* Gawer, A., & Cusumano, M. A. 2008. How companies become platform leaders. MIT Sloan Management Review, 49(2): 28.

[219] Khan, 2018.

[220] This paper explores a second path to platform leadership change that does not rely on Schumpeterian creative destruction: a phenomenon we call platform envelopment. Platform providers that serve different networked markets often employ similar components and have overlapping user bases. We define platform envelopment as entry by one platform provider into another's market, combining its own functionality with the target's in a multi-platform bundle that leverages common components and/or shared user relationships. Dominant firms that otherwise are sheltered from entry by standalone rivals due to strong network effects and high switching costs may be vulnerable to an adjacent platform provider's envelopment attack. (Eisenmann, Parker, Van Alstyne "Platform Envelopment" Strategic Management Journal, 2007).

[221] Tim Wu, "Blind Spot: The Attention Economy and the Law", 2017.

[222] Eisenmann, Parker, Van Alstyne "Platform Envelopment" Strategic Management Journal, 2007.

[223] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and

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companies can become dominant on more and more markets without offering the best product. This was also the case in 13 of the 30 by Eisenmann et al. researched cases.[224] This also means that the "one-monopoly profit theorem" does not apply to ecosystem-platforms with bottleneck ambitions, since the most important goal for entering a new market is not necessarily to maximize the revenues from the integrated or integrating market. We can identify three other goals for integrating markets, which we will discuss below.

The first goal of this integration strategy is to leverage the network effects, user base and reputation to other markets to protect and strengthen the initial bottleneck position.[225] But the strategy can also act as stepping stone to move into adjacent markets.[226] A third possible goal could be to leverage the lock-in to another layer or chain of the platform-ecosystem where the profits stem from, to secure value capture. This last one is only necessary if the chain in the ecosystem where the platform captures value might not be possible to secure with lock-in effects. If this chain is part of a platform-ecosystem controlled by the platform, it can be locked-in and secured by other chains of the ecosystem. So while value may be captured in a certain chain of the ecosystem, the lock-in may occur in another chain of the ecosystem.[227]

Since Google and Apple have different business models, they also have different chains in the platform-ecosystem where they capture value. This also means consumer lock-in can occur in different chains in the different platform-ecosystems. Lock-in at the iOS ecosystem occurs at the level of the App Store and the OS, while Apple captures the most value at the smartphone-chain (while value capture from and through the App Store and certain Apple apps is growing).[228] In the Android-ecosystem, Google captures the most value at the level of its apps through data extraction and showing ads (Search, Chrome, YouTube etc.), but it is hard to determine exactly where lock-in occurs, because every chain in its ecosystem is subject to at least some form of competition and some of Google's services are not very suitable for lock-in, like online search or the browser. As Kenney et al note, the true strength of Google's lock-in may be in the very diversity of services it provides. Some consumers may use search, Gmail, and Google maps, while another consumer might use Gmail, Google Scholar, and YouTube. So each user's commitment can be to a different set of services.[229] And the more Google-services the consumer uses, the more value the other Google services offer, since most of them are based on personalization.

Apple's ecosystem strategy is closed, but much more open to app providers than Symbian was. This enabled Apple to attract more app providers and at a faster pace, and activate indirect network effects. Google's app-ecosystem is also open to app providers and started more open to device manufacturers than Symbian was.[230] The availability of an "off-the-shelf" operating system that was also free, lowered entry barriers for device manufacturers[231] and enabled Google to attract more device manufacturers,

Advertising Based Business Models" September 2014,
https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.
[224] Eisenmann, Parker, Van Alstyne "Platform Envelopment" Strategic Management Journal, 2007.
[225] Eisenmann, Parker, Van Alstyne "Platform Envelopment" Strategic Management Journal, 2007.
[226] Gawer, A., &Cusumano, M. A. 2008. How companies become platform leaders. MIT Sloan Management Review, 49(2): 28.
http://sloanreview.mit.edu/article/how-companies-become-platform-leaders/
[227] Martin Kenney and Bryan Pon "Structuring the Smartphone Industry: Is the Mobile Internet OS Platform the Key?", Journal of Industry, Competition and Trade, September 2011, Volume 11, Issue 3, pp 239–261 https://link.springer.com/content/pdf/10.1007%2Fs10842-011-0105-6.pdf
[228] Ibid.
[229] Ibid.
[230] West, Joel & Wood, David, "Evolving an Open Ecosystem: The Rise and Fall of the Symbian Platform.", Advances in Strategic Management 30:27-67, July 2013,
https://www.researchgate.net/publication/279414044_Evolving_an_Open_Ecosystem_The_Rise_and_Fall_of_the_Symbian_Platform
[231] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and

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which led to a larger installed base of the Android OS, which, in turn, led to a larger audience for app providers in the Play Store.

Even though both Android- and iOS ecosystems are in several ways more open than Symbian and Microsoft, they are also much more vertically integrated. Microsoft's Windows software runs on hardware of different hardware suppliers based on the architecture of Intel. On top of the Windows OS, all kinds of third parties can build their own applications and market places and they do not need any approval from Microsoft. Both Apple and Google vertically integrated several functional layers of the ecosystem like software, apps and the app stores. This grants them control over the entire platform-ecosystem.[232] In the next section, we will further elaborate on how Apple and Google achieve and stay in control, and give one example for each platform-ecosystem on how they expand their ecosystem through integration.

3.4.2.2   *Apple's ecosystem strategy*

Apple has a closed platform strategy, or "walled garden" with vertically-integrated hardware and OS. This means the number of different iOS devices and models is limited, since Apple is the only device manufacturer for iOS. This closed strategy also means Apple has a smaller reach than more open ecosystems. But because the vertical integration grants Apple more control and means no fragmentation, Apple can provide a higher quality and thus charge higher prices.[233] The iOS-ecosystem also has several other characteristics regarding the app providers that grant Apple more control, which will be discussed below.

Control over APIs (or access thereto)
App providers face more restrictions on iOS than on Android. Distribution and monetization of apps is only possible through Apple's App Store, and development of apps is possible with Apple's own SDKs.[234] Apple's SDKs consist of "public APIs". APIs (Application Programming Interface) are technological specifications that enable app developers to gain access for their apps to the smartphone's hardware features, such as a camera or location services, or to particular services, such as Google Maps, and other apps installed on the device. APIs allow software programs and hardware, or different software programs, to communicate with each other. When an API is public on iOS, it means it is available for implementation in the app by developers. Before APIs are made public, they are private. This means the API is only accessible by Apple for testing and security purposes, and these APIs are not accessible for other developers. Private APIs are sometimes offered to selected developers that are authorized to use them. One example is the CarPlay API where game apps are not allowed.[235] When private APIs are tested enough and found to be safe and stable, they are released to all developers and become "public APIs".

Defaults within APIs
Public APIs also control which other services are the default that the app directs to and the defaults are always Apple's own pre-installed apps. For example, when the consumer clicks on a website link in an email, it always opens in Safari. Or, if the consumer uses voice commands through Siri to open up

Advertising Based Business Models" September 2014,
https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.
[232] Maurits Kreijveld, Rathenau Instituut, "De kracht van platformen", October 2014.
[233] Martin Kenney and Bryan Pon "Structuring the Smartphone Industry: Is the Mobile Internet OS Platform the Key?", Journal of Industry, Competition and Trade, September 2011, Volume 11, Issue 3, pp 239–261 https://link.springer.com/content/pdf/10.1007%2Fs10842-011-0105-6.pdf.
[234] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014,
https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf.
[235] Notes of meeting with Apple, 17 December 2018.

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a music streaming app, Apple Music is opened. Or when a website includes a physical address and the consumer clicks on it to get directions, Apple Maps launches.[236] For all these apps, third-party alternatives are available. But it is not possible for the developer to change the defaults in his app, so they cannot make it so that the app directs to Firefox instead of Safari, Spotify instead of Apple Music or Google Maps instead of Apple Maps.[237] For consumers, it is also not possible to change these defaults.[238] There have been, however, some third-party alternatives that enable developers to implement a pop-up window that offers the consumer a choice for which app they want to launch for the redirect, but this only works for that specific app.[239]

Tightly-integrated OS and app store
The fact that Apple is more closed and integrated than Android is also shown by the agreements and review policies for app providers. The Digital Methods Initiative of the University of Amsterdam found that changes to the policy documents for app developers at Apple took place around the same time as new releases of the OS, indicating Apple's OS is closely integrated with the App Store. When they performed the same comparison on the Play Store and Android, they found that the changes to developer policies happened independently of changes to Android. They conclude that the Play Store functions more as an independent app store compared with the App Store, which is partially shaped by the releases of Apple's other products.[240]

Drawbacks of a closed strategy
So Apple has control over its ecosystem through vertical integration. As long as Apple's focus for value capture remains with the hardware, a closed, vertical-integration strategy works best. But as Apple moves more into software services, it requires a more open strategy to succeed.[241] For example, if Apple wants to succeed with a music-streaming service, video-streaming service, game-streaming service or a news service,[242] it needs third parties to provide content because Apple cannot develop all content on its own. And to reach scale and profit from indirect network effects, Apple needs to provide these services on other devices than solely Apple's own devices to increase the audience and make the service more attractive for third parties to offer content through indirect network effects. This also means Apple has less control over the services they offer.

Below, we will discuss one example of how Apple employs this strategy to expand its platform-ecosystem.

Integrating music services
As we have seen in Chapter 2, Apple revolutionized mobile phones in 2007. From 2008, the App Store replaced costly software packages on DVDs and CDs with small, easy-to-download apps. The App Store transformed Apple from a hardware-with-software company to a platform-ecosystem. This is the same strategy Apple carried out with the iPod that was launched in 2001. In 2003, Apple released the iTunes Store, in which consumers could buy and download separate songs in MP3 format. This was the first opportunity to buy separate songs instead of the whole album and download them instead of ordering a CD. While the record labels objected to this model at first, Apple was able to enter

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[236] https://www.lifewire.com/choose-default-apps-on-iphone-4044162 Last accessed on 5 March 2019.
[237] https://sixcolors.com/post/2015/11/wish-list-change-default-apps-on-ios/ Last accessed on 5 March 2018.
[238] https://www.lifewire.com/choose-default-apps-on-iphone-4044162 Last accessed on 5 March 2019.
[239] https://www.macstories.net/news/choosy-open-source-framework-to-pick-default-apps-in-third-party-ios-apps/ ;
https://www.imore.com/choosy-aims-let-developers-enable-default-app-iphone-and-ipad Last accessed on 5 March 2018.
[240] Digital Methods Initiative (UvA) Winter School 2019, Part III: Store Policies and Developer Conditions,
https://wiki.digitalmethods.net/Dmi/WinterSchool2019AppsStoriesPolicy Last accessed on 21 February 2019.
[241] https://www.cnbc.com/2019/01/09/apple-walled-garden-starting-to-show-cracks.html Last accessed on 27 February 2019.
[242] https://www.apple.com/apple-events/march-2019/ Last accessed on 27 March 2019.

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agreements with the largest record labels by promoting iTunes as the solution against illegal downloading of songs.[243] At the time of its launch, iTunes offered 200,000 songs for 0.99 cents (dollars) apiece, and within 5 years after its launch, it had sold over 4 billion songs,[244] and revenues grew over 9 billion US dollar in 2013 alone.[245] The iPod had taken over 75% of the portable media player market in 2004.[246] And while iTunes's original goal was to boost iPod sales, its success proved to be a viable business model in its own right.[247]

But when Nokia and other mobile phones integrated media players with their mobile phones, the iPod rapidly lost market share.[248] To protect its business model, Apple integrated the iPod with the iPhone. Apple could do this effectively by leveraging the existing iTunes user base and complements of the iPod into a new product, the iPhone.[249]

But downloading separate songs is losing popularity since 2014, as streaming music is gaining popularity and iTunes loses market share to other streaming services.[250] But Apple was late, since the music streaming market was already forming, and established streaming services were rapidly growing their user base. To speed up Apple's music streaming service, Apple acquired subscription music-streaming service Beats Electronics for 3 billion US dollars in 2014, the most expensive acquisition Apple had ever made.[251] In 2015, Apple introduced Apple Music, which was based on the Beats acquisition[252] that brought Apple a much needed head start consisting of the music-streaming software technique, contracts with artists, patents and 250,000 monthly paying subscribers.[253]

But since the record labels had already entered into agreements with the streaming services where the public was, Apple had to incentivize the record labels to enter into agreements with Apple Music too. Apple tried to incentivize the record labels in the same way it swayed the record labels to iTunes, by responding to the – for the record labels problematic - streaming of their music through the "free", ad-sponsored music-streaming services like Spotify or YouTube. Apple agreed with the record labels that music streaming should be paid for and differentiate itself from the ad-based streaming services by stating that Apple Music will not have a free, ad-sponsored tier. After the initial trial period, consumers have to pay a monthly fee.[254] This also puts pressure on the likes of YouTube and Spotify, leading to further pressure on Spotify to convert more users into paying subscribers and a paid music-streaming version of YouTube.[255] There were also rumors that Apple tried to convince record labels to terminate

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[243] https://www.rollingstone.com/music/music-news/steve-jobs-music-vision-235915/ Last accessed on 2 March 2019.
[244] Ibid.
[245] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf
[246] Ibid.
[247] Ibid.
[248] Ibid.
[249] Martin Kenney and Bryan Pon "Structuring the Smartphone Industry: Is the Mobile Internet OS Platform the Key?", Journal of Industry, Competition and Trade, September 2011, Volume 11, Issue 3, pp 239–261 https://link.springer.com/content/pdf/10.1007%2Fs10842-011-0105-6.pdf
[250] https://www.recode.net/2017/9/20/16339484/music-streaming-riaa-spotify-apple-music-youtube-2017-revenue-subscription Last accessed on 2 March 2019.
[251] https://www.cultofmac.com/281196/apple-buys-beats-officially-3-billion/ Last accessed on 2 March 2019.
[252] https://www.apple.com/newsroom/2015/06/08Introducing-Apple-Music-All-The-Ways-You-Love-Music-All-in-One-Place-/ Last accessed on 2 March 2019.
[253] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf
[254] https://www.recode.net/2015/3/6/11559876/big-music-labels-want-to-make-free-music-hard-to-get-and-apple-says Last accessed on 2 March 2019.
[255] Ibid.

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or change their contracts with the other streaming services, enter into exclusivity agreements, and that Apple had offered to pay the license costs for YouTube if they withdrew their music from YouTube.[256]

Apple also had to incentivize consumers to subscribe to Apple Music, when other streaming services already had larger user bases. Apple did this by offering Apple Music with a free three-month trial period. Apple Music is also one of the few Apple apps that is available on Android.[257] This indicates that Apple is serious about achieving scale with Apple Music, and that it is more than just a complement to iOS. Apple Music is also embedded in iOS, with the app pre-installed on all iPhones and the only music-streaming service that is accessible through Siri, Apple's virtual assistant. We will discuss this further in Chapter 4. And it worked, as Apple Music recruited 10 million paying subscribers in six months, while it took Spotify six years to reach that number.[258] But Apple Music still lags behind Spotify at the end of 2018.[259] Figure 11 shows that most streaming services have comparable reach on both Android and iOS, except for Apple Music, which is more popular on iOS, and Google Music, which is more popular on Android.[260]
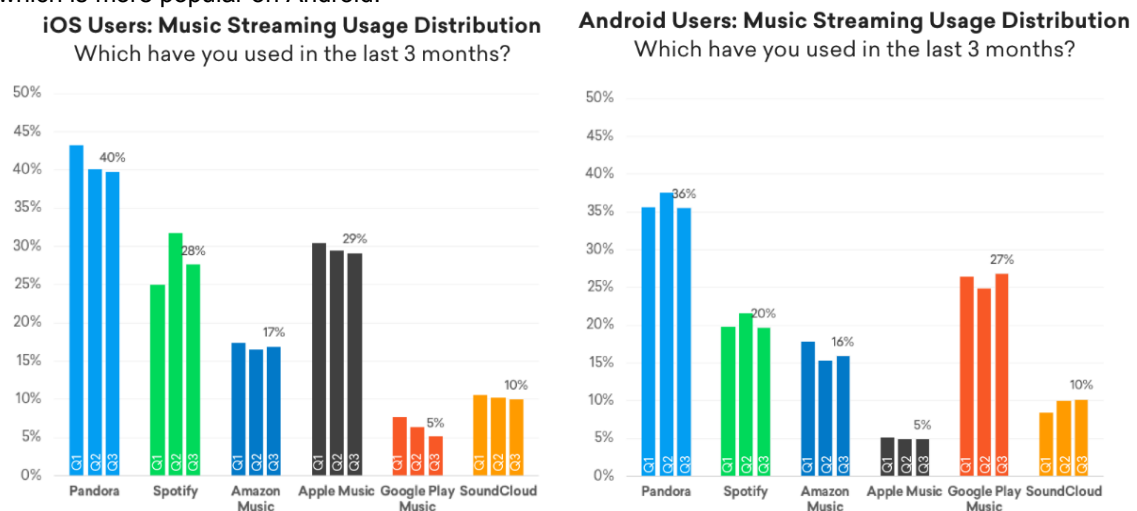

Figure 11: iOS and Android music streaming usage 2017

In the summer of 2018, the media reported that Apple is contemplating to bundle all of its streaming services (music, video, TV, magazines) into a single bundle as a subscription service.[261] Offering one bundle of streaming content in one subscription could form a serious threat to separate streaming services like Spotify and Netflix, since they do not have the other components to match Apple's offer.[262]

3.4.2.3 Google's ecosystem strategy
Google's strategy is less vertically-integrated than Apple's strategy. But Google still deploys vertical integration and is closed on strategic layers of the app-ecosystem. Google's business model is not based on the selling of hardware or the licencing of the OS, but on increasing the reach of its software services with a built-in advertising model. Since Google captures value with its services, it is almost

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[256] https://www.theverge.com/2015/5/4/8540935/apple-labels-spotify-streaming Last accessed on 2 March 2019.
[257] Ibid.
[258] http://fortune.com/2016/01/11/apple-music-10/ Last accessed on 2 March 2019.
[259] https://www.billboard.com/articles/business/8487726/apple-music-56-million-users-report Last accessed on 2 March 2019.
[260] https://www.goodwatercap.com/thesis/understanding-spotify Last accessed 16 March 2019.
[261] https://www.theinformation.com/articles/apple-eyes-streaming-bundle-for-tv-music-and-news Last accessed on 2 March 2019.
[262] https://bgr.com/2018/10/15/apple-music-tv-streaming-bundle-cash-cow/ Last accessed on 2 March 2019.

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irrelevant to Google who controls the other layers of the ecosystem, for example, if a smartphone is sold by Samsung or LG. So offering Android for free makes sense to Google, since this increases Android's reach. But even on what OS the smartphone runs is irrelevant to Google, as long as it can show ads to every smartphone user and has access to their data. And to secure that goal, Google has to keep the growth of other mobile OSs in check, because if another mobile OS became dominant, it could make changes that negatively affect Google's reach. As Kenney et al note: *Therefore, Google's licensing strategy with Android […] can be seen as a defensive play to keep any other OS from dominating the market and threatening Google's search advertising revenue.*[263]

The base Android operating system (Android Open Source Project, AOSP)[264] is open-source software and freely available to everyone. This makes it possible for hardware suppliers to customize the Android OS and develop their own user interface and applications.[265] The customized OS - called "forked" Android - is then tied to specific hardware. But this also comes with a great risk for the quality and security of the whole Android ecosystem, which also prevented Symbian from gaining market share: fragmentation. As we have seen in section 2.5, fragmentation also leads to the inability to activate network effects and grow the ecosystem, which played a major part in Symbian's downfall. So combatting fragmentation and gaining more control over the ecosystem go hand-in-hand.

In order to reduce fragmentation, Google launched the Open Handset Alliance (hereafter: OHA) with the introduction of Android.[266] This collaboration between approximately 80-90 companies (mostly hardware suppliers) and Google claims that it is strongly committed to greater openness of the mobile ecosystem in order to create more innovative products. For hardware suppliers, it is essential to join OHA since this is a strict condition of Google if the hardware supplier wants to provide Google's licensed software and services on his smartphone (Google Mobile Services). These proprietary services include apps like Search, Chrome, Gmail, the Play Store, Google Maps, and YouTube. These applications must be licensed from Google by device manufacturers, and can only be shipped on devices that meet Google's compatibility guidelines and other requirements. So hardware suppliers also need to pass Google's "compatibility test", which means they are not allowed to adapt Android in any way that Google deems undesirable. Most hardware suppliers comply with Google's demands, since it is the only way to be able to pre-install (among other apps) the Play Store on their smartphones. This behavior was fined by the European Commission, which led to Google offering Chrome and Search separate from the Play Store.

Devices with forked Android versions that make major changes to the operating system itself will not pass Google's compatibility test and therefore will not be able to offer or use the proprietary Google apps or services. Since forked Android OSs do not include any of Google's proprietary components, they stay incompatible with applications that require them. Also, they are not able to install the Play Store, and must ship with an alternative app store. Through its control over specific key components or chains in the Android platform, Google has proprietary control over the whole Android platform. This makes Android no less proprietary or closed than iOS or Windows Phone.[267] We will elaborate on this further in this section and give some examples of how Google operates with this strategy.

[263] Martin Kenney and Bryan Pon "Structuring the Smartphone Industry: Is the Mobile Internet OS Platform the Key?", Journal of Industry, Competition and Trade, September 2011, Volume 11, Issue 3, pp 239–261 https://link.springer.com/content/pdf/10.1007%2Fs10842-011-0105-6.pdf
[264] https://source.android.com/
[265] Kimberley Spreeuwenberg and Thomas Poell, "Android and the political economy of the mobile Internet: A renewal of open source critique" First Monday, Volume 17, Number 7 - 2 July 2012 https://firstmonday.org/ojs/index.php/fm/article/view/4050/3271
[266] http://www.openhandsetalliance.com/index.html
[267] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014,

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Possibly the most important service that is also part of the proprietary Google Mobile Services suite is the software layer that enables the integration with Google services; the system-app the Play Store Services (GPS). GPS is delivered on consumers' smartphones through the Play Store.[268] GPS is a software layer on top of the Android OS that enables Google to maintain and update first-party apps from the Google bundle and second-party and third-party apps downloaded through the Play Store.[269] This means smartphones running on Google's Android and make use of GPS are becoming more secure and up-to-date, even if they do not get any full OS updates from the device manufacturer or provider.[270] So Google is updating Android without actually updating the Android operating system. It actually only updates and supports the proprietary layer of Android.

In 2013, Google started to extend the functionality of GPS by adding new functions to GPS.[271] For example, Google added the Find My Device tracking feature to nearly all Android devices through a GPS update. Google has also added an app-scanning feature that watches for malware, making older devices more secure. Furthermore, Google is moving from developing new OS-functions in the open source form for Android to develop them as proprietary apps for GPS. This means apps or functionalities that were initially developed under open-source licenses as part of AOSP, are now being developed as Google's own proprietary applications.[272] So Google is unbundling apps and functionality from the Android OS, releasing them as separate, proprietary apps, whereas Apple is going in the opposite direction by bundling more apps with iOS. Gmail, Google Calendar, Google Keyboard, Hangouts, Chrome, Google Maps, Drive, YouTube, Keep, Google+, the Google search app—these are all apps that are unbundled from the original Android OS and thus update regularly from the Play Store, and can be installed on older Google Android devices. For comparison, before GPS, or on Apple's iOS, an update to a system app like Mail, Calendar, Messages or Safari requires a completely new version of the iOS operating system. On Android, they are automatically updated for everyone who has them installed through GPS.[273] Unbundling OS-functionality into separate apps also means that the app can be installed and used on older versions of Android, thus the app gains increased reach.

GPS also controls the availability of Google's proprietary APIs for app developers.[274] Traditionally, APIs were developed by the hardware manufacturers to let developers access hardware features (new or otherwise), as was the case with Symbian. But we also saw that this was one of the main reasons of the fragmentation of the Symbian OS, because every hardware supplier had their own APIs, meaning every app needed to be developed again for every different smartphone. With Google's Android, this is reversed, since Google's control over the APIs direct what hardware features can be present.[275] So control over the APIs also gives Google control over what smartphone features can be available on the smartphone, even though it concerns third-party smartphones.

https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf
[268] https://developers.google.com/android/guides/overview Last accessed on 4 March 2019.
[269] Ibid.
[270] https://medium.com/@anshuljain/an-advice-before-using-the-latest-version-of-google-play-services-953dd931b140 Last accessed on 3 March 2019.
[271] Kenney ea - Android and the Demise of Operating System Power - 2014
[272] Joé Lamesch "Market Definition in the Google Android Case", 2016, https://matheo.uliege.be/bitstream/2268.2/1812/4/MarketDefinitionGoogleAndroid_LameschJo%c3%a9.pdf
[273] https://www.howtogeek.com/179638/not-getting-android-os-updates-heres-how-google-is-updating-your-device-anyway/
[274] https://developers.google.com/android/guides/overview. Last accessed on 2 March 2018. For an overview of all Google Play Services API's, see: https://developers.google.com/android/reference/packages, and linked through https://developers.google.com/android/guides/setup. Last accessed on 4 March 2019.
[275] Kimberley Spreeuwenberg and Thomas Poell, "Android and the political economy of the mobile Internet: A renewal of open source critique" First Monday, Volume 17, Number 7 - 2 July 2012 https://firstmonday.org/ojs/index.php/fm/article/view/4050/3271

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GPS is also integrated in a large number of third-party apps through APIs to access functionalities such as push notifications, location and maps services. Without access to GPS, many apps would either crash, or lack important functionality.[276] This also means for app developers that if they developed apps for the open source Android, they would lack access to all the GPS APIs, which greatly restricts the possible functionality of the app. [277] **[confidential**:

]²⁷⁸

Nowadays, apps offered outside the Play Store can still make use of GPS APIs as long as the consumers that download these apps have the Play Store and GPS installed on their smartphones. So this still makes app providers that sideload apps or offer apps through other Android apps stores dependent on the Play Store and GPS, and also means that smartphone manufacturers need to license the Google Mobile Services bundle for the app providers to gain access to the Play Store and GPS. It would technically be possible for Google to restrict access to GPS for apps offered outside The Play Store, which would make sideloading nearly impossible, since every app developer would need to develop its own API, and that API would have much less functionality than the APIs the Play Store developers could use.[279] But for Google, it is also important that its APIs are present in as many apps as possible, since this enables Google to subtract data, which is relevant for its business model. So closing off GPS for apps offered outside the Play Store forms a realistic risk for Google if this incentivizes app developers or other app stores to develop other APIs, which also leads to more fragmentation. So as long as GPS APIs remain an essential input for app developers, Google stays in control of the Android-ecosystem, and it is less important through which channel the apps are downloaded.

While Google's motivation for GPS is to combat fragmentation, the incompatibility of GPS with open source Android actually contributes to the fragmentation of Android,[280] **[confidential**

²⁸¹**]**

Based on the above, we conclude that Google's strategy is more focussed on bundling its services with essential parts of the infrastructure the services run on (in this example the mobile OS) and leverage the whole bundle instead of leveraging one service or product through vertical integration. By bundling its services to essential components of the Android OS and making these essential parts closed, Google guarantees that these services have a wide reach and that Google remains in control over the infrastructure on which its services run. This also ensures everything is compatible and prevents fragmentation, while at the same time, it also enables Google to keep competing

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[276] https://www.androidpit.com/google-play-services-what-is-it-and-what-is-it-for Last accessed on 2 March 2019.
[277] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf
[278] **[Confidential:** **].**
[279] Notes of meeting with **[confidential:** **]**, 15 October 2018.
[280] https://www.phonearena.com/news/The-Google-Android-fork-Google-Play-services-Android-4.4-and-the-Nexus-Experience_id48229 Last accessed on 5 March 2019.
[281] **[Confidential:**].

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infrastructures in check, so it maintains enough leverage that its services also run on other infrastructures. We also saw that the entry point into the ecosystem for Google, or the bottleneck it starts with, is the operating system. Once it controls the OS as bottleneck, it starts to bundle its services onto the OS, only to unbundle them later to a new layer between the OS and the Play Store. Google promotes its infrastructure as open, but with the passing of time closes off more and more parts of the infrastructure by transferring them to the proprietary parts to increase its control.

Hereafter, we will discuss one example of how Google employs this strategy to expand its ecosystem by leveraging the whole bundle of services and the infrastructure to other domains.

Integrating car software
In 2014, Google announced the Open Automotive Alliance, *a global alliance of technology and auto industry leaders committed to bringing the Android platform to cars* (OAA).[282] OAA states it is a collaboration of mainly car manufacturers and Google around one common platform (Android Auto), which should drive innovation because of its openness.[283] Android Auto brings many of the popular Google apps to the car. After connecting a smartphone with the Android Auto app to a compatible car, drivers will be able to use Android apps and services specially designed for use in a car. Google also released APIs for developers to make their apps compatible with Android Auto. Apps that are available are for example music-streaming apps, certain navigation and maps apps, and apps for messaging and telephony.[284] Google's voice assistant is also available, making voice control possible. The APIs used for Android Auto are also used for Android Wear (smartwatches and other wearables), so this makes it easy for developers to offer their app on several different Android powered platforms.[285] But carmakers have been reluctant to integrate Android Auto in their dashboards. For one, since they did not want to lose control as the smartphone manufacturers did when they entered the Open Handset Alliance.[286] Second, because Google, with its company Waymo, is also the main rival of many car manufacturers with the development of self-driving cars. Android-powered vehicles will give Google access to much more data, which further accelerates the development of their self-driving car software. The car manufacturer did not want to share this data with Google.[287]

But since 2018, several carmakers have announced that they will start implementing Google's infotainment systems, based on Android, in their cars' dashboards. One of the reasons is that many consumers already use Google's apps through Android Auto on their smartphones over the dashboard systems that the car manufacturers offer.[288] Renault, Nissan and Mitsubishi were the first car manufacturers to announce their partnership with Google for the supply of infotainment systems for their vehicles, including services such as Google Assistant and Google Maps. This announcement made TomTom stock decline rapidly, since Google Maps would replace TomTom's navigation software.[289] So by offering a bundle with at least one item that carmakers really want (Google Maps), Google can make it so the carmakers accept the whole suite including the infrastructure, Android.

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[282] https://www.openautoalliance.net/#about Last accessed on 1 March 2019.
[283] Ibid.
[284] https://play.google.com/store/apps/collection/promotion_3001303_android_auto_all Last accessed on 3 March 2019.
[285] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014,
https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf
[286] Notes of meeting with **[confidential:]**, 15 October 2018.
[287] https://www.volkskrant.nl/nieuws-achtergrond/hoeveel-toekomst-is-er-nog-voor-tomtom-nu-het-met-grootmacht-google-moet-concurreren-~bc0af03d/ Last accessed on 3 March 2019.
[288] https://www.wsj.com/articles/google-to-partner-with-biggest-car-alliance-1537243260 Last accessed on 3 March 2019.
[289] https://www.reuters.com/article/us-renault-nissan-google-tomtom/tomtom-shares-crash-as-carmakers-opt-for-google-maps-idUSKCN1LY1F8; https://www.volkskrant.nl/nieuws-achtergrond/hoeveel-toekomst-is-er-nog-voor-tomtom-nu-het-met-grootmacht-google-moet-concurreren-~bc0af03d/ Last accessed on 3 March 2019.

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What makes this case also interesting is that Google's main competitor for Android Auto is Apple with CarPlay.[290] Apple first launched their own maps app, but this could not tip Google Maps. So Apple now also offers Google Maps.[291] This makes Android Auto and Apple's CarPlay more comparable.

3.4.3   Observations

In the previous Chapter, we discussed that indirect network effects played a very important role in determining who became the winning app-ecosystems. The inability to activate indirect network effects successfully at the right moment and the failure to combat fragmentation led to the decline of Symbian and Windows, and to the rise of the iOS and Android ecosystems. Apple and Google were able to successfully open up their ecosystems to third-party app providers, and could thus successfully activate indirect network effects. The app store plays a crucial role within both app-ecosystems, since indirect network effects mainly stem from the app stores.

Though both app-ecosystems opened up to app providers, both app-ecosystems are still closed enough to prevent serious harm from fragmentation. This is mainly possible due to the control Apple and Google hold over their ecosystems. For the iOS-ecosystem, vertically integrating hardware and software is an important strategy to prevent fragmentation, and to ensure quality. This also fits well with Apple's business model focused on the selling of hardware. For the Android-ecosystem, control over the APIs and bundling them with the Play Store creates an infrastructure to reach a wide audience for Google apps and third-party apps that implement Google APIs. This infrastructure also ensures that Google remains in control. If we combine these insights with the findings of Chapter 2, it is also notable that Apple and Google differ substantially in their business models and also their strategies. Apple competes with other players by commodifying previously free products and services, like we have seen with iTunes (vs illegal music) and music-streaming (vs ad-funded music-streaming). While Google competes with other players by making previously paid products and services "free" or ad-financed, for example the mobile OS. Thus far, Google and Apple have not met each other on one of these products, but instead, they seem to amplify each other, and use this to differentiate themselves from each other. For example, a unique selling point of Apple is privacy and security, while Google is less expensive than Apple.

The closed nature of both ecosystems and the lack of interoperability between the two app-ecosystems also cause high switching barriers for consumers, and make it costly for developers to offer their app in both app-ecosystems. This can negatively impact diversity and innovation in the app stores. This also makes the chance for another, competing app-ecosystem to arise very slim

The lack of interoperability and high switching costs leading to path dependency also cause a lack of competition between both app-ecosystems over consumers. Apple and Google do compete with each other over app providers. But since all popular and successful app providers are present in both app stores and it is very hard for smaller app providers to become visible, this competition does not lead to any observable differentiation between the two app stores.

Also, the competition between Apple and Google is not really about becoming dominant on a market for apps or mobile OSs. It is about becoming a default gateway for consumers to reach online content. The app stores and their surrounding ecosystems form a very important base from which Apple and Google can expand their platform-ecosystem and secure the bottlenecks they have already captured.

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[290] https://www.iphoned.nl/spotlight/carplay/ Last accessed on 3 March 2019.
[291] https://www.rtlnieuws.nl/economie/artikel/4452506/navigatie-tomtom-google-apple-mercedes Last accessed on 3 March 2019.

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In the next section, we will assess whether there are other competitive restrains that could put competitive pressure on Google's and Apple's app-ecosystems.

3.5 Bargaining Power

As we have seen in the previous chapters, the leverage or bargaining power of the orchestrator over the other market participants is dependent on the access to consumers. Also, the orchestrator must exercise a certain type of economic, social and technological control and governance over the ecosystem in order to guarantee quality,[292] for example, to prevent fragmentation. But as Rietveld et al. (2016) point out, the orchestrator is not only concerned with value creation, but also its own ability to appropriate as much of this value as possible itself (value capture).[293] When the initial platform possesses a large degree of architectural control, it has the ability to steer the different market participants and relations in a way that enables it to capture more value.[294] So the platform has an incentive to manage its ecosystem in a way that strengthens its own bargaining power while limiting the bargaining power of individual complement producers.[295] In other words: the higher the bargaining power or leverage of the other market participants in the ecosystem is, the greater the platform's incentive to increase the total value of the ecosystem is. But if the other market participants have too much bargaining power, it will lead to a decrease in quality and may lead to a collapse of the total ecosystem, as we have seen in chapter 2 with Symbian and Windows.

In this section, we will assess the bargaining power of the other market participants within the ecosystem: the app developers, smartphone manufacturers, and operators.

3.5.1 App providers' bargaining power

In this section, we will assess the influence and bargaining power of third-party app providers over Google and Apple, whether they have enough leverage to negotiate better terms for their apps and apps in general.

All the app providers which ACM spoke with, except for one, indicate that they have no leverage whatsoever over the terms and conditions the app stores apply.[296] Some providers describe it as a "take-it-or-leave-it" choice.[297] Also, most app providers indicate that it is very hard to come into contact with the app stores, especially the App Store. For most developers, legal challenges to decisions of the app stores are too hard and expensive, for example, if their app is refused. So the only options they have is to adjust the app, refrain from offering the app at all, or, in the case of Android, sideload the app as we have seen with Fortnite in section 3.3.1.

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[292] Ben Eaton, Silvia Elaluf, Carsten Sorensen and Youngjin Yoo "Dynamic structures of control and generativity in digital ecosystem service innovation: the cases of the Apple and Google mobile app stores", working paper April 2011, https://s3.amazonaws.com/academia.edu.documents/30785933/wp183.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL 3A&Expires=1547811827&Signature=K8zO%2Bt9Lix3s114e4hJ9LQY9tWk%3D&response-content-disposition=inline%3B%20filename%3DDynamic_structures_of_control_and_genera.pdf

[293] Rietveld, J, Schilling, M.A., Bellavitis, C., "Reload and Relaunch: Value Creation and Value Capture In Platform-Based Markets" Academy of Management Proceedings 2016 (1), 10169

[294]Ibid.

[295]Ibid.

[296] Notes of meeting with **[confidential:]**, 15 October 2018; Notes of meeting with **[confidential:]**, 14 September 2019; Notes of meeting with **[confidential:]**, 11 October 2018; Notes of meeting with **[confidential:]**, 22 October 2018; 25 October 2018; Notes of meeting with **[confidential:]**, 8 January 2019; Notes of meeting with **[confidential:]**, 30 January 2019; Notes of meeting with **[confidential:]**, 6 February 2019; Notes of meeting with **[confidential:]**, 5 February 2019; Notes of meeting with **[confidential:]**, 11 October 2018; Notes of meeting with **[confidential:]**, 3 December 2018.

[297] Notes of meeting with **[confidential:]**, 3 December 2018.

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Examples of apps that are adjusted to fit the terms and conditions come from Financial Times,[298] Spotify[299] and Netflix.[300] They did not agree with the 30% commission Apple charged, but they could not negotiate better terms, as will be further discussed in chapter 4. They could not negotiate better terms, but also did not want to withdraw their apps from the App Store because they were too dependent on the App Store as a channel to recruit new subscribers. **[Confidential:**

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Furthermore, if only an adjusted, restricted version of the app is available, while there are alternative apps available with more functionality, it represents a serious competitive disadvantage, as is illustrated by another example. One app provider indicated that the service he offers to consumers is subject to fierce competition. So if they are the only app in their market that is offered without the option to subscribe, this would harm them. According to this app provider, the only scenario to adjust their app is if all other, competing apps collectively decide they would do the same.[304] This is not allowed under current competition law. This app provider also indicated it tried to offer their content though a web-app. But this did not prove to be a viable option, since consumers refrained from using the app.[305]

[Confidential:

306

] since a smartphone that does not offer Facebook would make it very unattractive for a lot of consumers, which is also confirmed by Hyrynsalmi et al.[307] As we have seen in section 2.5, one major cause that Windows Phone was not adopted was that it lacked important apps like Instagram and YouTube.

[Confidential:

308

] The same holds true for some of Google's indispensable apps offered on the App Store, like YouTube and Google Maps.[309]

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[298] https://www.reuters.com/article/us-apple-ft/financial-times-pulls-its-apps-from-apple-store-idUSTRE77U1O020110831 ; https://aboutus.ft.com/en-gb/announcements/ft-ios-app-returns-to-the-apple-app-store/ Last accessed on 7 March 2019.
[299] https://support.spotify.com/nl/account_payment_help/subscription_information/spotify-through-the-app-store/ Last accessed on 7 March 2019.
[300] https://techcrunch.com/2018/12/31/netflix-stops-paying-the-apple-tax-on-its-853m-in-annual-ios-revenue/ Last accessed on 7 March 2019.
[301] Notes of meeting with **[confidential:]**, 11 October 2018.
[302] **[Confidential:]**
[303] Notes of meeting with **[confidential: x]**, 6 February 2019.
[304] Notes of meeting with **[confidential:]**, 8 January 2019.
[305] Ibid.
[306] Notes of meeting with **[confidential:]**, 25 October 2018.
[307] Sami Hyrynsalmi et al "App Store, Marketplace, Play! An Analysis of Multi-Homing in Mobile Software Ecosystems", 2012, p. 66, https://pdfs.semanticscholar.org/30e6/9ffe932366caee90de7af90db96b947e8c15.pdf
[308] Notes of meeting with **[confidential:]**, 25 October 2018.
[309] Maurits Kreijveld, Rathenau Instituut, "De kracht van platformen", October 2014

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As Roosendaal concludes, the limited availability of alternatives with a large user base makes the app providers dependent on both app stores: "*The dependencies of the value chain in this case seem to be related to the to the size of the group of users of both systems (Apple iOS en Google Android), and the freedom of these companies in their contracts with content providers. There is no legislation which imposes obligations on device suppliers about the acceptance of application and subscriptions in their Apple Kiosk or App Store and the Play Store. This allows them to set their own guidelines with regards to sales channels, the offering of content and pricing policies.*"[310] (Translation ACM)

We conclude that only the really large apps like Facebook, YouTube and Google Maps have enough leverage over the app stores to negotiate better terms.

3.5.2 Smartphone manufacturers' bargaining power

Since the iOS app-ecosystem is available on Apple's own smartphones only, there are no other smartphone manufacturers that could exert pressure on Apple. **[Confidential:**

[311]

[312]

] If the manufacturer strongly disagrees with the terms, its only option is to offer its smartphone with another OS. This means that the smartphone will not have access to, among other services, the Play Store and Google Play Services, which would make it unattractive to consumers.

Some smartphone manufacturers have developed their own forked Android with alternative apps for the Google apps, like their own app store. One such example is Samsung with its Tizen OS. But this never really took off because of the lack of developers, so Samsung could not activate indirect network effects.[313]

We conclude that smartphone manufacturers hold too little leverage over the app stores to be able to exert influence.

3.5.3 Operators' bargaining power

Before the emergence of 3G, the mobile ecosystems were highly dominated by mobile network operators and device manufacturers. The mobile network operators held most leverage since they acted as bottleneck for the access to consumers.[314] With the rise of 3G, the power partially shifted to device manufacturers. Nokia was not able to break this power. But when Apple launched the iPhone, it had strategical arrangements in place with the different mobile carriers, which yielded more profits for the carriers in the short run. But the iPhone also lowered the power of the mobile carriers over consumer access in the long run through attracting third-party app developers that could offer services through 3G and WiFi.[315] Over-The-Top (OTT) services in particular, such as WhatsApp and Skype,

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[310] https://repository.tudelft.nl/view/tno/uuid%3Abca47716-f811-4d46-919b-23d89cf25cf8, last accessed on 29 March 2019 .
[311] **[Confidential:**].
[312] **[Confidential:**].
[313] https://www.networkworld.com/article/2459147/samsung-delays-tizen-os-launch-indefinitely-due-to-lack-of-apps.html Last accessed on 7 March 2019.
[314] Lescop, Denis and Lescop, Elena, The Apple Twist (June 30, 2016). Digiworld Economic Journal, no. 102, 2nd quarter 2016, p. 13 . https://www.researchgate.net/profile/Denis_Lescop/publication/304158287_The_Apple_Twist/
[315] Ibid.

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formed a threat to the operators. So Apple changed the hierarchy of the mobile landscape and shifted the power from the mobile carriers to the app stores and mobile OS, or, as Winter states *Apple had effectively cut the operators out of the digital content value chain*.[316] Today, operators hold little leverage over Google or Apple.

3.5.4 Observations

We conclude that no other market participants in the ecosystem have enough bargaining power over the app stores to form a real competitive restraint, except for a few very large, indispensable apps that are also controller of their own platform-ecosystem. But their negotiations are confidential, so it is unknown to the public what they agreed to. This also makes it hard for other developers to refer to these negotiations if they want the same conditions to be applied to their apps. So only the large apps themselves benefit from the negotiations.

3.6 Future Developments

In this section, we will look at future developments that may challenge the bottleneck position of the app stores, since these developments could lead to competition over a new platform with bottleneck potential that could lure away consumers from the app-ecosystems. But the control over the app-ecosystems also gives Google and Apple a large head start in the competition over these platforms with bottleneck potential.

3.6.1 Digital Assistants

A digital assistant is a voice-controlled software that can perform tasks or services for an individual, like order groceries, command connected IoT home-automated products or services etc. They rely on voice recognition and artificial intelligence and are often integrated in smart speakers. Examples are Amazon's Alexa (and their smart speaker Echo) Microsoft's Cortana (available on, among other systems, the XboX and Windows PCs), Apple's Siri (available on, among other devices, the iPhone and their smart speaker HomePod) and Google Assistant (available on, among other devices, Android smartphones and their own smart speaker Google Home). The software also runs on smart speakers from other producers, like the Sonos smart speaker, which can run Google Assistant and Amazon Alexa.

The functionality of digital assistants can be extended by installing (third-party) "skills" (Amazon) or "apps" (Google) like weather or news programs, music or news services etc. Digital assistants in smart speakers have been available for a longer time in the USA than in Europe, and one in six adults in the USA owned a smart speaker in January 2018.[317] Digital assistants could form a threat for the use of smartphone apps, since a lot of smartphone app functions are also available through the digital assistant. 66% of Americans who own a smart speaker state they use their smartphone less and for less activities, since they started using their smart speakers for these activities.[318] The smart speaker is mostly used over a smartphone for music, search for real-time information (weather, traffic), factual information (history), news and alarms.[319] So smart speakers could form the next wave of consumer

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[316] Juha Markus Winter "Success Factors of Mobile Business Ecosystems: From Hardware-Centric to Content and Advertising Based Business Models" September 2014, https://aaltodoc.aalto.fi/bitstream/handle/123456789/14467/lic_winter_juha_2014.pdf
[317] https://venturebeat.com/2018/01/22/ai-assistants-are-poised-for-major-growth-in-2018/
[318] Accenture Digital Consumer Survey 2018 https://www.accenture.com/t20180302T094127Z__w__/us-en/_acnmedia/PDF-69/Accenture---2018-Digital-Consumer-Survey-Findings.pdf#zoom=50 Last accessed om 7 February 2019.
[319] https://www.nielsen.com/us/en/insights/news/2018/smart-speaking-my-language-despite-their-vast-capabilities-smart-

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tech, and render smartphones obsolete when it concerns fixed locations like the home environment. But when consumers are "on the go", they still use their smartphones. More importantly, the core functions of smart speakers are also controlled through an app on the smartphone.

So there are no clear signs yet that smartphones will disappear. But this could indicate that the use of certain apps will decline as consumers will use these apps on their smart speakers when they are at home. Also of note is that today's digital assistants are mainly developed by Google, Apple, Amazon and Microsoft. So even if it will become the next generation of consumer tech, it is still the same companies that control (and will control) it, possibly in a slightly different composition.

3.6.2   Game-streaming

As said before, mobile games form an important part of the mobile ecosystem, since over 80% of app store revenue is generated by game apps. A development that could possibly change this is the emergence of game-streaming services from a cloud-based environment. This means that any device, regardless of computing power, can run any game, since the hardware is in the cloud and is owned by the streaming provider and cloud provider. Currently, Google (Stadia, through the Google Chrome browser[320]), Microsoft (Project xCloud[321]) and Electronic Arts (Project Atlas[322]) are quite advanced in the development of their game-streaming services, followed by Apple and Amazon, among other firms.[323] Since game-streaming moves the entire heavy-hardware requirement from the device to the cloud, this means the portal for consumers to access games for streaming does not have to be an app but could also be a browser, which could mean that game apps in both app stores could lose popularity. So if game streaming were allowed on the iOS and Android platforms, and if consumers adopted it, it could become a competitor for both app stores regarding game apps. But for Google, there is more at stake. If they lost the battle for the game-streaming bottleneck, they could possibly also lose out on the 50 billion of watched hours of gaming content on YouTube in 2018. 50 billion hours to show ads.[324]

But for this example, the same holds true as for digital assistants: again, it is the same companies competing against each other to become the bottleneck. So if it replaced game-apps from the app stores, chances are slim that Google and Apple would not lose game-apps from their ecosystem.

3.7   Observations

In Chapter 2, we discussed that indirect network effects played a crucial role in determining who became the winning app-ecosystems. The inability to successfully activate indirect network effects at the right moment and to combat fragmentation has led to the decline of Symbian and Windows, and the rise of the iOS- and Android ecosystems. Apple and Google were able to open up their ecosystems successfully to third-party app providers, and could thus successfully activate indirect network effects. The app store plays a crucial role within both app-ecosystems, since indirect network

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speakers-all-about-the-music.html Last accessed on 7 February 2019.
[320] https://www.businessinsider.nl/google-projectstream-cloud-service-could-mark-beginning-end-game-consoles-2018-10/?international=true&r=US Last accessed on 7 February 2019.
[321] https://www.businessinsider.com/microsoft-project-xcloud-xbox-games-2018-10?international=true&r=US&IR=T Last accessed on 7 February 2019.
[322] Ibid.
[323] https://www.businessinsider.nl/netflix-of-gaming-apple-amazon-microsoft-google-2019-1/ Last accessed on 7 February 2019.
[324] https://www.theverge.com/2019/3/20/18274184/google-stadia-youtube-streaming-future-gaming-cloud Last accessed on 21 March 2019.

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effects mainly stem from the app stores. A central controller within the app-ecosystem is needed to guarantee quality, security, and to prevent fragmentation. But this could also mean that too much control is in the hands of a single market participant.

In the previous sections, we first assessed whether the app stores form a bottleneck for app providers to reach an audience and for consumers to reach online applications and add more functionality to their smartphones. Within the iOS-ecosystem, there are no realistic alternatives for apps or the App Store, so the App Store forms a bottleneck within the iOS-ecosystem. Within the Android-ecosystem, some alternatives for apps and the Play Store exist, but only for app providers who already have achieved a certain amount of brand awareness and/or a certain niche audience that is more tech-savvy.

Though both ecosystems opened up to app providers, both ecosystems are still closed enough to prevent serious harm from fragmentation. This was and is mainly possible due to the control Apple and Google hold over their ecosystems. The closed nature of both app-ecosystems and the lack of interoperability between the two app-ecosystems creates a platform-ecosystem around one dominant design that further secures and widens the initial bottleneck position. This leads to path dependency, which can grow infinitely with the growth of the platform-ecosystem. This also makes it costly for app providers to offer their apps in both ecosystems, and the odds of another, competing app-ecosystem arising are very slim. This could also reduce the incentives to guarantee quality and diversity, may lead to entry barriers for start-ups, and thus obstruct innovation.

Even though Google and Apple do compete with each other on certain domains, the competition between Apple and Google is not really about becoming dominant on a market for apps or mobile OSs. It is about becoming a default gateway for consumers to reach online content, and for providers of content to reach an audience. The app stores and their surrounding ecosystems form a very important base from which Apple and Google can expand their platform-ecosystem and secure the bottlenecks they have already captured.

We have also discussed the bargaining power of the other market participants in the ecosystem, and concluded that app providers have very limited bargaining power over the app stores since they are too dependent on the app stores to reach their public. The limited availability of alternatives with a large user base makes the app providers dependent on both app stores. We also concluded that smartphone manufacturers and operators hold too little leverage over the app stores to be able to exert influence. Only the very large app providers that also own their own platform-ecosystems seem able to exert some form of influence over the app stores.

Finally, we reviewed possible future developments that could influence the app stores. Digital assistants and game-streaming are likely to take over certain functionalities from the app stores. But like software for connected and self-driving cars, these are also emerging markets that have "bottleneck potential". As a result, the existing platform-ecosystems are competing with each other to "win" these markets, and add them to their ecosystems. Because of the existing app-ecosystems Google and Apple control, they are very likely to win this battle, and successfully integrate them into their existing ecosystems. If they succeed, they might lose some users from their app stores, but they will not really lose them from their ecosystems, since they only shift to another bottleneck within the platform-ecosystem.

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4   Conduct

In Chapters 2 and 3, ACM described how both app-ecosystems function, and explained the importance of the app stores for app providers to reach their audience and for consumers to reach online services. ACM also assessed the role of the app stores for both Google and Apple as a way for controlling the surrounding app-ecosystem. The app stores are an important bottleneck on mobile devices to offer and reach content and services. This is especially true for the iOS-ecosystem. Although there seem to be alternatives to the app stores, these alternatives are not always practical, viable or only offer a limited alternative option with less usability (such as the mobile browser).

The central question of this chapter is: how do Apple and Google fulfil their roles as providers of the app stores, and what kind of conduct do app providers experience in the app stores?

In order to be able to answer this question, ACM gathered information from three sources:
- Interviews and written input from sixteen app providers (see section 1.3 and Annex 1)
- Interviews with Apple and Google to include their point of views; and
- Desk research in order to compliment and substantiate the information gathered from app providers.

This chapter is structured around three overarching topics that encapsulate the information ACM has gathered from app providers and desk research:
- Equal access to the end-user
- In-app purchases
- Transparency & liability

To verify what ACM heard from app providers and has gathered through desk research, ACM also gave both Apple and Google the opportunity to provide their views on certain topics. Given that some of the information provided by app providers to ACM is confidential, it was not possible to get Apple's and Google's views on all the issues that were raised without breaking confidentiality.

In the first section of this chapter, ACM describes the information it gathered with regard to app providers getting equal access to the end-user: are there any terms and certain conditions or other obstacles that hinder access to the end-user? (section 4.1)[325]. In the second section, ACM describes the views of app providers regarding In-app purchases. The third section describes issues app providers have raised concerning transparency and liability. In Chapter 5, ACM will discuss how the issues raised in Chapter 4 can potentially impact public interests as set out in section 1.2.

4.1   Equal access to the end-user

The terms and conditions applicable for the publications of apps in the app stores have an impact on the type of apps that are available, the way that they are developed, and on the business case that app providers can realize with their app. In this section, a number of the terms and conditions mentioned by the app providers that ACM has interviewed during this market study will be discussed.

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[325] The factual process of access to the app stores can be found in Chapter 2.

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In this section, ACM will refer to certain terms and conditions. The following versions of the guidelines are used:

Apple:
- o App Store Review Guidelines, last updated on 4 June 2018 (hereafter: Apple's App Store Review Guidelines), downloaded on 17 October 2018 via https://developer.apple.com/app-store/review/guidelines/
- o Apple Developer Agreement, version EA1283 6/8/15 (hereafter: Apple's Developer Agreement), downloaded on 17 October 2018 via https://developer.apple.com/programs/terms/apple_developer_agreement.pdf
- o Apple Paid Applications Agreement version 109 of 19 October 2018 (hereafter: Apple's Paid Applications Agreement)

Google:
- o Developer Content Policy (hereafter: Google's Developer Content Policy), accessed on 23 October 2018 via https://play.google.com/about/developer-content-policy-print/
- o Developer Distribution Agreement (hereafter: Google's Developer Distribution Agreement), downloaded on 23 October 2018 via https://play.google.com/intl/ALL_nl/about/developer-distribution-agreement.html

4.1.1 Access to app store

App providers need the app stores to gain access to potential customers. However, Apple and Google have to exercise a certain degree of control in order to protect their platforms from unsafe and unwanted content. As such, both Apple and Google have a mechanism in place to control access to the app store.

Apple and Google each have a different way of dealing with the approval process. **[Confidential:**

].[326] Apple's approval process is carried out manually, every app published on the App Store is reviewed by an Apple employee.[327] Nevertheless, the App Store Guidelines and its approval process have been criticized for its vagueness and unpredictability.[328]

The aim of ACM is to understand better how the approval process works and what kind of other problems app providers face. In order to do so, ACM interviewed fourteen different app providers, and received input per e-mail from several app providers about their experiences with the App Store and Play Store.[329] These app providers differ from small businesses (independent contractors) to large international firms. ACM first outlines the review process, and subsequently describes the examples of conduct that app providers have reported to ACM.

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[326] Notes of meeting with Google, 9 January 2019.
[327] Notes of meeting with Apple, 17 December 2019.
[328] https://ijoc.org/index.php/ijoc/article/view/1904/926 p. 1266, last accessed on 29 March 2019.
[329] A (confidential) list of these providers can be found in Annex 1: Contacts (confidential).

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The review process

Millions of apps are available in both app stores, and Apple and Google receive even more submissions of app developers seeking access. Apple and Google each have a different way of dealing with the approval process.

According to Apple, their review process is carried out by a team of hundreds of app reviewers. These reviewers include Dutch speakers as well. According to Apple, the main focus of their app-reviewing process is to:

- guarantee security, fend off malware;
- comply with legislations (local and international);
- prevent inappropriate content, for example pornography;
- prevent interference with or obstruction to the functionality of the device, for example drain the battery; and
- perform quality control[330] [331]

Apple indicates that approximately 100,000 apps are submitted worldwide to the App Store every week. Apple aims to reach a decision within 48 hours. When app providers do not agree with a rejection of access to the App Store, an app developer can appeal the decision at Apple's app review board.[332] Updates of apps, in principle, have to undergo the same process as new apps. App providers have no insight into the actual review process. An app developer indicated that the outcome of the approval process in the past could be dependent on the person reviewing the app. However, more recently, this process has been made uniform.[333]

[Confidential:

][334] [335] As a result, app providers indicate that apps (or updates thereof) submitted to the Play Store are usually published, or rejected, within a matter of hours.[336]

Some app providers that ACM has interviewed argue that Apple's terms and conditions are intentionally, broadly defined. According to these providers, this broad definition makes it hard to gauge what is and what is not allowed.

Furthermore, it provides Apple with large discretion as to what it will and will not allow. The introduction to Apple's App Store Review Guidelines for app developers, for example, states:

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[330] According to Apple, approximately 40% of the submitted apps do not work the way the developer said they should. (Notes of meeting with Apple, 17 December 2019)
[331] Notes of meeting with Apple, 17 December 2019.
[332] Ibid.
[333] Notes of meeting with **[confidential:]**, 15 October 2018.
[334] **[Confidential:**

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[335] **[Confidential:**
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[336] Notes of meeting with **[confidential:]**, 6 February 2019.

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> *We will reject Apps for any content or behavior that we believe is over the line. What line, you ask? Well, as a Supreme Court Justice once said, "I'll know it when I see it". And we think that you will also know it when you cross it.*[337]

Examples
ACM has spoken to several app developers who complain about Apple's approval process. Apps are refused for reasons that are unclear or unreasonable. In other cases, access is refused without any explanation. Furthermore, correspondence on the reasons for refusal (if stated at all) is difficult or takes a very long time (see section 4.3.1).

One app by a well-known international company was refused because it would not have enough consumer reach. Apple was of the opinion that it would not be used by a sufficient number of consumers. By contrast, the app was successfully launched in the Play Store. The app provider explained to ACM that, without access to the App Store, it would be impossible to reach the critical mass necessary for the success of the app. In other words, although the app could be granted access to the Play Store, App Store access was indispensable for the success of the app. As a result, the app provider decided to cease the development and publishing of the app. The app would offer a service that would compete with a proprietary Apple app. According to this provider, Apple's competing service was launched within a matter of months after the app from aforementioned app provider was rejected.[338]

A smaller app provider complained to ACM that, when Google refuses an app, the app provider receives nothing more than a broad reference to the terms and conditions. According to this provider, the terms and conditions are long and broadly phrased, and, as such, it is difficult, if not impossible, to discern the reason for refusal. Larger app providers have an account manager, which allows them to solve small issues quickly (in section 4.3, we go deeper into the level of transparency of Apple and Google).

Templated apps
Another issue raised by an app developer during this market study has to do with a change in Apple's terms and conditions. Since 2018, templated apps are no longer allowed in the App store, if they are not submitted by the content provider directly (see textbox below). Templated apps are developed with the aid of a pre-set lay-out and functionalities (templates). They help in the quick and easy development of new apps, but, on the other hand, they may reduce the uniqueness of an app.

An earlier version of the Apple Guideline completely banned the use of templated apps.[339] Google does not ban or restrict the use of templated apps. In reaction to the policy change, app developers started a petition to change Apple's mind. The main criticism of developers was that the new guideline blocked apps on the basis of their way of programming instead of the added functionality: '*The reasoning behind the 4.2.6 rejection is problematic because Apple is not concerned with the end product but rather with the method with which the app is created. More specifically, if your app is easy to make but the end product is unique & functional, your app will still be rejected due to its templated code.*'[340]

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[337] See the introduction of Apple's App Store Review Guidelines.
[338] Notes of meeting with **[confidential:],** 3 December 2019.
[339] https://techcrunch.com/2017/12/20/apple-revises-its-controversial-guidelines-on-template-based-apps/?guccounter=1, , Last accessed on 29 March 2019.
[340] https://www.change.org/p/apple-please-allow-small-businesses-to-publish-apps-in-the-app-store, Last accessed on 29 March 2019.

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Small businesses, like restaurants, often do not have the financial resources and manpower to develop an app from scratch. That is why templated apps are beneficial to them. According to TechCrunch, some small app providers have lost substantial business or even had to close their business whilst Apple's partner (IBM) was allowed to continue selling templated apps.[341]

According to Apple, this condition is put in place in order to guarantee minimal functionality of the published apps. Apple wants apps to add real value and not just copy basic content (like a restaurant app that only has the menu in the app and therefore looks like an ordinary website). If what the app offers is also possible within a browser, then this app does not necessarily belong in the App Store, according to Apple.[342] In the revised Guideline, Apple provides two options, which allows for templated apps to be published in the App Store:

Apple's App Store Review Guidelines
Guideline 4.2.6 Design:
1. The templated app is submitted directly by the provider of the app's content; and
2. The template provider creates a single binary to host all clients content in an aggregated or "picker" model (restaurant finder app with separate customized entries or pages for each client restaurant, or as an event app with separate entries for each client event).

One of the app providers that ACM interviewed for this market study provides templated apps for businesses. Even though the app developer understands that Apple wants an App Store that does not consists of cloned apps, the change in the guidelines by Apple impacts his business model. Before the updated guidelines, the app developer could publish its clients' apps using its own developer account and update them at the same time. Due to the revised guidelines, the app provider can only offer its services if clients (potential or otherwise) are willing to pay for their own developer accounts. The other option that Apple allows for publishing templated apps, which is using the same developer account, limits its ability to monetize its unique selling point of offering its clients their own apps with their own logos and names.[343]

App store-like interface
A relatively large app provider has indicated to ACM that Apple prohibits apps with a store-like interface. According to this app provider, it had to adjust its app to make it more plain, this adjustment degraded the quality of the app. The app provider indicated that, on the other hand, a reference to the downloading of games outside the app is allowed.[344]

Apple has indicated that apps with a store-like interface or with an alternate home screen are rejected because these apps may confuse consumers. Consumers might confuse it for the App Store. If such an app offers offensive content, consumers may think that Apple has offered the content.

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[341] https://techcrunch.com/2017/12/08/apples-widened-ban-on-templated-apps-is-wiping-small-businesses-from-the-app-store/, Last accessed on 29 March 2019.
[342] Notes of meeting with Apple, 17 December 2019.
[343] Notes of meeting with **[confidential:** **]**, 24 August 2018].
[344] Notes of meeting with **[confidential:** **],** 25 October 2018].

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Apple's App Store Review Guideline
Guideline 4.7 (shortened version)
Apps may contain or run code that is not embedded in the binary (e.g. HTML5-based games, bots, etc.), as long as code distribution isn't the main purpose of the app, the code is not offered in a store or store-like interface, and provided that the software (1) is free or purchased using in-app purchase […] and should not attempt to extend or expose native platform APIs to third-party software; (3) is offered by developers that have joined the Apple Developer Program and signed the Apple Developer Program License Agreement; and (4) adheres to the terms of these App Review Guidelines (e.g. does not include objectionable content). […]

Desk research examples
ACM has found several examples of a refusal to access through desk research as well.

Samsung, for example, argued that the Samsung Pay Mini app was rejected from the App Store without explanation. Samsung Pay Mini is a payment system with which consumers can perform payments on non-Samsung mobile phones. It is a direct competitor of Apple Pay. Other app providers have informally complained to ACM that Apple has rejected other payment services as well. Apple has been alleged of blocking the payment service in protection of its own payment service, Apple Pay.[345] Apple Pay is available in certain countries and limited to the iPhone 6 and newer Apple phones. It is not yet available in the Netherlands.

Google's Developer Distribution Agreement
Device and Network Abuse
'We don't allow apps that interfere with, disrupt, damage, or access in an unauthorized manner the user's device, other devices or computers, servers, networks, application programming interfaces (APIs), or services, including but not limited to other apps on the device, any Google service, or an authorized carrier's network.' (emphasis added by ACM)

Google, on the other hand, was scrutinized, when it deleted all ad-blockers from the Play Store.[346] Similarly, in September 2014, the popular app Disconnect Mobile – which was downloaded over 20,000 times – was deleted twice from the Play Store.[347] Disconnect is a service that prevents apps from collecting user-data. According to Disconnect, it allows users to 'take back [their] privacy', freeing people from 'unwanted tracking'.[348] The Disconnect app was blocked by Google for interfering with other services. Disconnect tried to make its app compliant with Google's rules. But, according to Disconnect, Google's policies were *"so vague that Google could, in essence, ban any app in its*

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[345] http://english.etnews.com/20161212200003, last accessed on 29 March 2019.
[346] Web browser with built-in ad-blockers were exempted from this policy see https://www.androidpolice.com/2016/03/01/google-explicitly-bans-ad-blockers-from-the-play-store-except-all-those-ad-blocking-web-browsers-apparently/, last accessed on 29 March 2019.
[347] https://tweakers.net/nieuws/98355/privacy-app-disconnect-mobile-verdwijnt-voor-tweede-keer-uit-play-store.html, last accessed on 29 March 2019. Although the article refers to section 4.4 of the distribution agreement regarding, we have found the clause in the Distribution Agreement for developers regarding Privacy, Security and Deception under the header Device and Network Abuse (see the Developer Distribution Agreement referred to in the introduction of this chapter).
[348] www.disconnect.me/#about, last accessed on 13 March 2019.

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store.'[349] [350] According to Disconnect (in reference to an e-mail of Google), the stated reason for deleting the app was a violation of Google's developer policy guidelines, which was interference with the functioning of other apps.[351] [352]

In response to the removal of the Disconnect app by Google, Disconnect filed an antitrust claim for alleged abuse of dominance by Google.[353] [354] [355]

On the other hand, certain apps that do not interfere with but are complementary to other apps may be banned from Apple's App Store. In 2017, Apple deleted unofficial YouTube apps. The most prominent example is ProTube, an app that, among other functions, allowed users to make playlists without an account and to play videos in the background. According to Gessner, YouTube[356] requested Apple to delete this app because it wanted to develop its own service, YouTube Red, and sell it for 10 US dollars a month. ProTube was available for a one-off payment of 5 US dollars.[357] [358]

Apple has also been criticized for deleting the Finder For Airpods app, an application that allowed users to locate their lost AirPods using the Bluetooth function. According to the app provider, the App Review Board *'didn't like the 'concept' of people finding their AirPods and hence was deemed 'not appropriate for the App Store' '*[359]

Furthermore, apps are not allowed to mention the name of any competing mobile platform.

Apple's App Store Review Guidelines
Guideline 2.3.10
'Make sure your app is focused on the iOS, Mac, Apple TV or Apple Watch experience, and don't include names, icons, or imagery of other mobile platforms in your app or metadata, unless there is specific, approved interactive functionality.'

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[349] Ariel Ezrachi & Stucke, 'Virtual Competition' 2016, p. 185.
[350] https://www.businessinsider.com/why-google-banned-connect-mobile-2014-8?international=true&r=US&IR=T, last accessed on 2 February 2019.
[351] https://blog.disconnect.me/google-just-banned-our-new-android-app-before-it-even-launched/ last accessed 29 March 2019.
[352] https://tweakers.net/nieuws/103889/makers-privacy-app-disconnect-klagen-google-aan.html and https://blog.disconnect.me/google-just-banned-our-new-android-app-before-it-even-launched/, both last accessed March 2019.
[353] https://blog.disconnect.me/our-eu-antitrust-complaint-against-google/, last accessed on 2 February 2019.
[354] At the time of this writing (February 2019), it is unclear how the European Commission will respond to this claim. Politico.eu mentions the claim in reference to the European Commission's *Android Case* against Google (https://www.politico.eu/article/why-margrethe-vestagers-android-case-is-googles-worst-nightmare/) last accessed on 2 February 2019.
[355] At the time of this writing (12 March 2019), the Play Store offers two apps by Disconnect inc.: Disconnect Premium VPN and Disconnect for Samsung Internet Browser. The former seems to offer the same functionalities as Disconnect Mobile. As such, the app seems to be allowed in the Play Store again.
[356] YouTube is owned by Google.
[357] https://jonasgessner.com/protube2-statement.html last accessed on 2 February 2019.
[358] https://www.macrumors.com/2017/09/04/youtube-app-protube-pulled-from-app-store/, last accessed on 2 February 2019.
[359] https://gizmodo.com/finder-for-airpods-app-mysteriously-disappears-from-app-1790999059, last accessed on 14 February 2019.
https://macworld.nl/artikelen/nieuws/apple-weert-airpod-zoekapp-uit-de-app-store?API_COOKIE_REDIRECTED=True, last accessed on 14 February 2019.

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As a result, Apple is able to block any app that mentions the name of a mobile platform. For Pebble, a competing smart watch manufacturer, this resulted in some issues. App developers that developed apps for the Pebble watch were blocked (temporarily or otherwise) by Apple.[360]

Other apps such as Telegram, Reddit and Tumblr were temporarily deleted from Apple's App Store. In each of these cases, Apple deleted the apps because the contents violated Apple's Guidelines. Allegedly, the apps were displaying 'adult content'. After corrections by the app developers, the apps were allowed in the App Store again.[361] Furthermore, previously permitted apps are at times deleted from the app stores, for example, because the app does not fit the image of the App Store.[362] [363]

Apple has explained to ACM that the review is done manually, and, as such, mistakes can be made, especially given the sheer amount of apps that have to be reviewed (as mentioned earlier in this chapter, approximately 100,000 apps are submitted worldwide for review every week).

4.1.2 Interoperability

Besides access to the app store, app providers need access to interoperability functionalities. In many cases, an app needs to communicate with functions of the operating system. In order to develop a well-functioning app, developers for example need access to APIs (Application Programming Interface). An API facilitates the communication between hardware and a software application. An API gives an app access to, among other things, system functions, such as the brightness and color of your screen (see sections 3.4.2.2 & 3.4.2.3). Furthermore, APIs allow the integration of functionalities of other apps within the app of the app provider (see section 3.4.2.2).

In its market study on the commercial use of data, the UK Competition and Markets Authority (CMA) notes:

> *To collect data stored on devices, app developers need to interact with the Operating System (OS) of the device (such as Google's Android and Apple's iOS). These OS providers are responsible for the Application Programming Interfaces (APIs) which dictate how the software and hardware interact – including what information the app can access. APIs control the release of information according to the privacy controls in place at the OS level.[364]*

ACM has found several app developers complaining about the lack of access to essential APIs in app stores. In certain cases, Apple or Google restricts or refuses access to APIs. For example, an app developer indicated that it was not granted access to the API related to Wi-Fi information, which prevented the proper functioning of the app.[365] Interoperability limitations may be built into the app

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[360] https://nl.pcmag.com/smartphones/1756/arrogante-voorwaarden-van-apple-eisen-eerste-slachtoffer, last accessed on 14 February 2019.
https://gizmodo.com/5464970-apple-takes-the-word-android-out-of-itunes-app-description, last accessed on 14 February 2019.
[361] https://eu.usatoday.com/story/tech/news/2018/02/01/apple-removes-secretive-telegram-messagingapp-app-store/1086302001/, last accessed on 14 February 2019.
https://www.xgn.nl/nieuws/78078/reddit-ios-apps-verwijderd-uit-de-appstore, last accessed on 14 February 2019.
[362] An example is the app "Weed Firm", which was the most downloaded and most popular app in de United States. The app supplier states Apple forced him to censor his app, because it didn't match Apple's image.,
http://www.trouw.nl/tr/nl/4324/Nieuws/article/detail/3659603/2014/05/22/Apple-censureert-populaire-wietgame.dhtml, last accessed on 14 February 2019.
[363] At the time of this writing, 20 February 2019, the Weed Firm app is available again.
[364] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/435817/The_commercial_use_of_consumerf_data.pdf, last accessed on 28 February 2019.
[365] Note: the app provider indicated that access to the API would allow them to improve the service, for example related to the interplay between 4G and Wi-Fi. Notes of meeting with **[confidential:],** 3 December 2019.

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store development kit or the operating system. Both result in the absence of certain APIs for third-party app providers

Interoperability issues
According to Spotify, Apple uses a lack of interoperability to target competitors. Spotify, for example complains that Apple does not provide its app with the same interoperability as Apple does with their proprietary apps. Spotify, an app that competes against Apple Music, explains that its app is not interoperable with Siri. Users can command Siri to start Apple Music, however the platform operator is blocked from offering this function to its users.[366] [367] According to The Register, *private APIs have the potential to give Apple's apps a competitive advantage* and it argues that *Apple has for a long time favored its own services through APIs*. However, more recently Apple is becoming *slightly more open* by opening up *a few* private APIs to external developers.[368]

Another app provider indicated to ACM that changes in the operating system of Apple and Google can have a great impact on the interoperability of the app with the respective ecosystems. The provider indicated that such changes demand a lot of extra development from the provider, and that such changes often go unannounced (for a further elaboration on the changes in terms and conditions, see section 4.3.1).

Another example, f.lux was not allowed access to 'Apple's private APIs required for the app to work with iOS'.[369] F.lux offers a functionality that adapts the warmth of your smartphone screen or computer screen to the time of day (screen-dimming). Among other things, this should help the user sleep better.[370] Apple's documented APIs do not allow access to the APIs that f.lux requires to make the app work on iOS.[371] Therefore, the app had to be sideloaded. However, Apple stated that the f.lux's sideloading violated the Developers Agreement, and requested f.lux developers to make this way of installation no longer possible.[372] At the time of writing[373] f.lux is available in the Play Store, however it could not be used without root access to the device.[374]

In reference to the access to APIs, Apple has indicated that it distinguishes between private and public APIs. As a method of testing, Apple keeps an API private to test its functioning and stability. After a period of testing, APIs are made public. Public APIs have to be kept stable by and compatible by Apple from version to version. Occasionally, as a method of testing, Apple will grant access to private APIs to selected app providers. For all of Apple's APIs, it holds true that access will only be granted to the app provider if the API is directly linked to the functioning of the app.[375]

No access to the NFC-chip
Apple, to the dismay of certain app developers, currently does not provide access to its NFC-chip (the Near Field Communication chip allows a form of contactless communication between devices).[376] The

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[366] https://www.timetoplayfair.com/timeline/, last accessed on 29 March 2019.
[367] ACM has verified this lack of interoperability manually. At the time of writing (17 March 2019), it was not possible to play Spotify songs with Siri.
[368] https://www.theregister.co.uk/2017/06/13/apple_inches_toward_openness/, last accessed on 28 February 2019.
[369] https://www.macrumors.com/2015/11/11/flux-iphone-ipad-sideloaded-app-xcode/ last accessed on 14 March 2019.
[370] https://justgetflux.com/ last accessed on 20 march 2019.
[371] ACM is not aware what APIs f.lux was not authorized to use, in a blog post f.lux wrote: 'f.lux cannot ship an iOS App using the Documented APIs, because the APIs we use are not there.' (https://justgetflux.com/sideload/, last accessed on 14 March 2019.)
[372] https://www.iculture.nl/nieuws/apple-wil-geen-flux-sideloading-ios/, last accessed on 14 March 2019.
[373] 14 March 2019
[374] Root access means gaining a higher level of access to the device than intended by the device/software manufacturer. It is usually associated with security risks and hard to do for non-specialists, see section 3.3.1.
[375] Notes of meeting with Apple, 17 December 2019.
[376] For example, for contactless communication between a smartphone and a computer, or the smartphone and a

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Dutch government, for example, recently attempted to develop a more secure way of logging into governmental online applications. The Dutch government implemented e-Identification with NFC technology for Android phones.[377] Up until the time of writing, Apple could not or has not provided app developers with access to the NFC technology, therefore the eID method is currently not available for Apple users.[378] A similar restriction applies to the EU Exit app in the UK. EU citizens who continue to live in the UK after 'Brexit' are, according to a new EU Settlement Scheme, required to provide their passport details to the Home Office. [379 The app would simplify] and speed up this process for citizens. According to the BBC, Apple would not release the NFC function to third parties for *security and commercial reasons.* Despite a trip to Apple by UK's Home Secretary Sajid Javid, the technology company would not release the update.[380]

Another app provider complained to ACM that it was unable to launch a wireless payment service on the App Store. Upon finishing the development of the app, Apple blocked access to its NFC-chip necessary for the functioning of the payment service. By contrast, Android did grant access to the NFC-chip. Consequently, the payment service was phased out.

On the other hand, Apple's own services, such as Apple Pay, do work with NFC technology.[381]

Note: In the beginning of 2018, there were rumors of tests by Apple with the opening-up (limited) of access to the NFC-chip in iOS12.[382] In the meantime, this operating system has been released by Apple, but at the time of writing[383], access is not open (partially or completely) yet. According to the BBC, Apple has stated that the rumors are not true.[384 385]

On the Android platform, the first phone with access to the NFC-chip for third parties was released in 2010.[386] Opening up the functionality has been linked to security issues by certain commentators.[387]

Apple has indicated to ACM that it would not be rational to discriminate unfairly against third-party apps. If the third-party app offers better quality, Apple has no incentive to hinder the app in any way. Apple has explained that it wants to have the most popular apps available on its platform so that consumers will use its devices. After all, Apple earns the vast majority of its revenues from devices,

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payment terminal.

[377] Citizens can scan their passport or identification card with the use of an Android smartphone equipped with NFC technology to verify their identity. This method is generally considered to be safer than logging in with DigID.

[378] https://www.telecompaper.com/nieuws/overheid-wil-dat-apple-nfc-functie-openstelt-voor-digid--1252944, last accessed on 14 March 2019.

[379] 'The EU Exit app enables citizens to confirm digitally their citizenship instead of having to make an in-person visit to a registration centre or send off their passport in a postal application. 'Android users can apply remotely by leveraging the NFC functionality in their smartphone to read the security chip in their passport.' The app is not (yet) available on Apple. (see: https://www.nfcworld.com/2019/01/30/360263/apple-to-expand-iphone-nfc-functionality/ and https://www.gov.uk/guidance/using-the-eu-exit-id-document-check-app#how-to-use-the-app, both last accessed on14 March 2019)

[380] https://www.bbc.com/news/uk-politics-46043668, last accessed on 14 March 2019.

[381] https://support.apple.com/nl-nl/HT203027, last accessed on 14 March 2019.

[382] https://appleinsider.com/articles/18/05/25/apple-to-reportedly-unlock-iphone-nfc-chip-capabilities-in-june, last accessed on 14 March 2019.

[383] 14 March 2019.

[384] According to some, the functionalities are related to NFC-tags (https://www.macworld.com/article/3307191/iphone-ipad/what-apples-background-tag-reading-nfc-update-means-for-you-and-businesses.html) or so-called NDEF-data (https://www.nfcworld.com/2019/01/30/360263/apple-to-expand-iphone-nfc-functionality/), both last accessed on 14 March 2019.

[385] https://www.bbc.com/news/uk-politics-46043668, last accessed on 14 March 2019.

[386] https://www.nfcworld.com/2010/12/07/35385/google-unveils-first-android-nfc-phone-but-nexus-s-is-limited-to-tag-reading-only-for-now/, last accessed on 14 March 2019.

[387] https://www.slashgear.com/nfc-exploits-detailed-at-black-hat-conference-26240375/, last accessed on 14 March 2019. https://www.lifewire.com/turn-off-nfc-to-secure-your-android-smartphone-2532822, last accessed on 14 March 2019.

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and therefore wants to offer the best services possible to its users. As such, it treats all developers equally, including competing apps.[388]

4.1.3 Pre-installing own apps

Apple and Google are not only the distributors of their own app stores, they also offer their own apps in their respective app stores, and, as a result, directly compete with third-party app providers. Apple pre-installs a number of its own apps on the iPhone; like the Apple Music, Safari, Mail and Message app.[389] Some of these apps can be removed, while other ones cannot.[390] Only Apple's own apps can be pre-installed on the iPhone.[391]

Google, on the other hand, allows third parties (e.g. hardware manufacturers or telecom providers) to pre-install their own apps on smartphones running on the Google Android OS.[392] Up until the remedies imposed by the European Commission in the Google Android case, a license for the Play Store was only provided on the condition that hardware manufacturer would also install the Google Search app and Google Chrome on their smartphones. According to the European Commission, this practice by Google, given its dominant position on the market for app stores for the Android mobile operating system, constituted a form of illegal tying.[393]

According to research conducted by the European Commission in the Google Android case, pre-installation of apps can create a so-called status-quo bias. Consumers are more likely to use the apps that are pre-installed on their smartphones. Only in the case where the pre-installed app is of a lower quality than a competing app, consumers will download the competing app. However, according to the European Commission, this will not completely offset the advantage the pre-installed app has.[394]

In the interviews that ACM has conducted for this market study, several app providers mentioned that competing with pre-installed apps by Apple and Google on their respective OS puts them in a disadvantageous position. Not only because of the pre-installation, but also due to, as mentioned earlier in this chapter, the better interoperability these apps can achieve with the OS that is not always available to third-party apps. According to the same app providers, the combination of these two (pre-installation of own apps and better interoperability with the OS) results in consumers being more likely to use the apps developed by Apple and Google.[395] One app providers interviewed by ACM for this market study suggested that perhaps special rules should be put in place for companies that offer a platform (e.g. app store) and also offer their own services on their own platforms.[396]

According to Apple, favouring their own apps over third-party apps would not be rational, even though they pre-install their own apps on their own devices. If a third-party offers a higher quality app, Apple has no incentive to hinder the app in any way. Apple earns the majority of its money from devices, and therefore wants to offer the best services possible to its users.[397] Google previously stated that the pre-

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[388] Notes of meeting with Apple, 17 December 2019.
[389] https://support.t-mobile.com/docs/DOC-38562, Last accessed 29 March 2019.
[390] https://support.apple.com/en-us/HT204221, Last accessed 29 March 2019.
[391] https://support.apple.com/en-ug/HT207880, Last accessed 29 March 2019.
[392] Notes of meeting with Google, 9 January 2019.
[393] http://europa.eu/rapid/press-release_IP-18-4581_en.htm, last accessed on 14 March 2019.
[394] Ibid
[395] Notes of meeting with **[confidential:]**, 11 October 2018; Notes of meeting with **[confidential:]**, 6 February 2019; Notes of meeting with **[confidential:]**, 3 December 2018; Notes of meeting with **[confidential**:   ], 30 January 2019 and Notes of meeting with [**confidential**:   ], 11 February 2019.
[396] Notes of meeting with **[confidential:]**, 11 October 2018.
[397] Notes of meeting with Apple, 17 December 2019.

installation of Chrome and Google Search through the tying of the licensing of the Play Store with the pre-installation of these apps was necessary to allow Google to monetise its investment in Android.[398]

4.1.4 Ranking

A quintessential part of achieving success with an app is the ranking of the app. As we have seen in section 4.1.1, the app stores control the selection of apps offered within the app stores. By also controlling the technological architecture, the interface and algorithms, the app stores also control what information is shown to end-users and how (see section 2.2). By doing so, the app stores influence how attention is allocated and what features end-users take into account when comparing apps. This grants the app stores control over how end-users make their choices and what parameters app providers compete on. As Tristan Harris, former Google Design Ethicist puts it; "*If you control the menu, you control the choices.*"[399]

So even if an app is allowed in an app store, it is a challenge to be noticed by end-users. The ultimate goal of an app provider is to enter the top 50 of most popular apps to "get the bandwagon rolling" (see section 2.3). The best way to achieve this, is to advertise the app on platforms (including other ones) in order to influence the *selection*-mechanism of the app store. The *commodification* consists of "buying" downloads, for example by offering the consumer an incentive or through a Facebook campaign.[400] The costs of a "launch campaign" in order to reach the top 50 were around half a million US dollars in 2014,[401] an amount most startups do not have access to. According to one app developer whom ACM interviewed, Google changed the algorithm of the search function in the Play Store. The app provider said this was a much-discussed topic between Android app developers. The perception is that, due to this change, apps of bigger companies are ranked higher, and also are featured more often on the list of "other relevant apps". In general, app providers are of the opinion that there is a lack of transparency when it comes to ranking.[402]

Another way of getting noticed in the app stores is getting a positive review from the editorial team of the app stores. If your app gets a positive review, it will be part of the featured apps in the app store. According to both Apple and Google, it is not possible to pay to get featured, and that what apps get featured is decided by a separate team. However, an app provider whom ACM interviewed has their doubts about this. According to this app provider, it is possible to pay to get featured, and having a good relationship with an editor also helps to achieve this.[403]

4.1.5 Summary

As we have seen in this section, Apple manually reviews apps, **[confidential:**
                                  ]. App providers have remarks on the conditions on which access is granted and refused. App providers complain that the terms for access, especially for Apple, are broad (or too broad), and that the reasons given for a refusal can be vague. Apple and Google, on the other hand, put forward that controlled access is necessary to ensure a safe app store. Other app providers have indicated that they are granted access but not in the manner that they would want, for example because of limited access to APIs that are essential for the functioning of apps. In certain cases, these functionalities are, however, used by Apple for their own apps. Other app providers have indicated

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[398] Notes of meeting with Google, 9 January 2019.
[399] http://observer.com/2016/06/how-technology-hijacks-peoples-minds%E2%80%8A-%E2%80%8Afrom-a-magician-and-googles-design-ethicist/, last accessed on 18 March 2019.
[400] Notes of meeting with **[confidential:]**, 5 February 2019
[401] https://siepr.stanford.edu/system/files/multihoming%20BOY.pdf, p. 7, last accessed on 29 March 2019.
[402] Notes of meeting with **[confidential**:   **]**, 14 September 2018.
[403] Notes of meeting with **[confidential: **]**, 14 September 2018 and Notes of meeting with **[confidential**:   **]**, 5 February 2019.

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that, even though their apps are given full access to the app stores, they have a strong disadvantage compared with proprietary Apple and Google apps, due to the pre-installation of their own apps. Furthermore, app providers indicate that it is hard and/or expensive to be found by consumers.

4.2   In-app purchases

An important part of the discussion around the app store ecosystems centers around the commission charged by Apple and Google. As part of the approval process, an app developer has to pay an annual fee of 99 US dollars to Apple, and a one-time fee of 25 US dollars to Google (see section 2.4.3). Additionally, app providers that offer a paid app have to pay a 30% commission over these earnings. Furthermore, some of the app providers that offer paid content or services in their app stores have to pay the 30% commission over so-called 'in-app purchases' as well. This section focusses on the latter subject.

App providers that sell digital content or services in their app are obliged to use the 'In-app payments'-system of Apple and/or Google. This implies that the payment is handled by the app store via the account of the consumer. Apple and Google take a commission of 30% of these payments, or in the case of subscription services, 15% commission from the second year onwards.

Apple's former CEO Steve Jobs stated in this respect: *'Our philosophy is simple – when Apple brings a new subscriber to the app, Apple earns a 30% share; when the publisher brings an existing or new subscriber to the app, the publisher keeps 100% and Apple earns nothing.'[404]* In other words, if consumers choose to sign up for a subscription service (such as magazines, newspapers or streaming services) within the app, the commission fee needs to be paid.[405]

Apple and Google included the following about In-app purchases (IAP) in their terms & conditions.

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[404] https://www.computerworld.com/article/2509396/amazon-caves-to-apple--drops-kindle-s-in-app-button.html last accessed on 29 March 2019.
[405] The subscription service was launched in 2011, three years after the debut of the App Store.

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Apple's App Store Review Guidelines
Guideline 3.1.1 In-App Purchase
If you want to unlock features or functionality within your app, (by way of example: subscriptions, ingame currencies, game levels, access to premium content, or unlocking a full version), you must use inapp purchase. Apps may not use their own mechanisms to unlock content or functionality, such as license keys, augmented reality markers, QR codes, etc. Apps and their metadata may not include buttons, external links, or other calls to action that direct customers to purchasing mechanisms other than in-app purchase.

Guideline 3.1.5 (a) Goods and Services Outside of the App
If your app enables people to purchase goods or services that will be consumed outside of the app, you must use purchase methods other than in-app purchase to collect those payments, such as Apple Pay or traditional credit card entry.

Apple's Paid Applications Agreement
Guideline 3.11
Subscription services purchased within Licensed Applications must use In-App Purchase. In addition to using the In-App Purchase API, a Licensed Application may read or play content (magazines, newspapers, books, audio, music, video) that is offered outside of the Licensed Application (such as, by way of example, through Your website) provided that You do not link to or market external offers for such content within the Licensed Application. You are responsible for authentication access to content acquired outside of the Licensed Application.

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Google's Developer Distribution Agreement
In-store purchases
Developers charging for apps and downloads from Google Play must use Google Play's payment system.

In-app purchases
•Developers offering products within a game downloaded on Google Play or providing access to game content must use Google Play In-app Billing as the method of payment.
•Developers offering products within another category of app downloaded on Google Play must use Google Play In-app Billing as the method of payment, except for the following cases:
   ◦Payment is solely for physical products
   ◦Payment is for digital content that may be consumed outside of the app itself (e.g. songs that can be played on other music players).
•In-app virtual currencies must only be used within the app where they were first purchased.
•Developers must not mislead users about the apps they are selling nor about any in-app services, goods, content, or functionality offered for purchase. If your product description on Google Play refers to in-app features that may require a specific or additional charge, your description must clearly notify users that payment is required to access those features.

Both Apple and Google require app providers to use In-app Purchases (IAP) if they offer digital content or services, for example, subscriptions to news apps, premium content, game levels etc. Apps that offer physical products, like Uber or Bol.com, do not have to use IAP or, in the case of Apple, may not even use IAP. Both Apple and Google state that apps that have to use IAP, cannot link or use mechanisms to bypass IAP. For example, it is not allowed to include buttons, external links, or other calls to action that direct customers to purchasing mechanisms other than IAP. Although there is a small technical difference between Google and Apple in the rules, the main difference arises due to a difference in the enforcement of this policy.[406]

Several app providers that ACM has interviewed complain about IAP. The complaints relate to several aspects about IAP: (1) the obligation to use IAP, (2) the commission linked to IAP, and the fact that (3) it is prohibited to link to other payment methods. Each of these aspects are outlined below.

4.2.1 Obligation to use IAP

Numerous app providers that ACM has interviewed mentioned the obligation to use IAP and, more specifically, the extent to which this obligation is applied to different categories of apps.

As said, app providers are required to use IAP if they offer digital content or services. These products are not specifically defined in the guidelines of Apple or Google, but digital content and services can,

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[406] Google has an exception to content that may be consumed outside of the app, however this is generally limited to digital content like MP3s as provided in the policy. **[Confidential:**

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according to ACM, be interpreted as products that are delivered on a device (e.g. the mobile phone, a tablet or television). Music, videos, articles, games are examples of digital products. Products that are delivered outside the device, for example, a product ordered from Amazon or Bol.com, a taxi ride ordered through Uber or a hotel room booked on Booking.com, are not part of what Apple and Google consider to fall within the category of digital content and services. These products are considered to be physical products.

App providers complain about the distinction between categories of apps that are required to use IAP and those that are not. App providers also mentioned that it is highly unlikely that it is a coincidence that these digital services that are required to use IAP face competition from Apple's own apps, or possibly will do so in the future.[407] App providers call into question whether it is fair that, for example, Uber does not have to pay the commission, but Netflix does. According to several providers, app stores do not have do any additional work for apps that offer digital services compared with apps that offer physical products.[408]

ACM also interviewed an app provider who offers a "value added service", which is linked to physical products and is obligated to use IAP.[409] They are of the opinion that the services they offer in the app fall outside the scope of services that are required to use IAP. According to the app provider, they had no opportunity to discuss this with Apple.

Furthermore, one app provider whom ACM interviewed pointed out that they do not only pay 30% commission over their digital products, but also over physical products. This particular app provider offers a subscription service for a combined product: a physical subscription to a newspaper with also the option of reading the paper in the app. If a consumer subscribes through the app, the developer will have to pay the 30% commission on the whole subscription fee, and therefore also on the physical product.[410]

In addition, there are also app providers that state that Apple applies its terms and conditions, related to mandatory use of IAP, differently to similar apps. Several app developers told ACM about developers that deliver exactly the same service but who do not need to pay any commission to Apple.[411] They believe Apple is not consistent in what apps are reviewed strictly. According to them, apps with smaller turnovers are reviewed less strictly, and therefore can successfully try not to comply (fully) with the terms & conditions.[412]

Apple stated about this distinction what apps have to use IAP in an interview with ACM, that the digital products are actually on (or are consumed on) the iPhone.[413] Therefore, Apple is a party to the transaction. As for a transaction related to a physical product, Apple is not able to verify whether the transaction took place or not. In that context, Apple stated that apps that offer digital content, "require some extra work for Apple, for example, handling the billing process and tax services, compliance and covering credit card fees."[414]

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[407] Notes of meeting with **[confidential:]**, 11 October 2018
[408] Ibid.
[409] Notes of meeting with **[confidential:]**, 22 October 2018.
[410] Notes of meeting with **[confidential:]**, 9 January 2019
[411] Notes of meeting with **[confidential:]**, 22 October 2019.
[412] Notes of meeting with **[confidential:]**, 9 January 2019.
[413] Notes of meeting with Apple, 17 December 2019.
[414] Ibid.

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Google stated about the rationale for the distinction, that the Play Store cannot provide the same level of support for physical goods and services as it can provide for digital content. For example, if a Google Play user orders a car via Uber, the Google Play cannot verify whether the driver has actually picked up the user, and Google Play cannot help with refunds etc.[415]

4.2.2 The level of the commission linked to IAP

Besides the discussion about what apps are required to use IAP, there is a lot of discussion about the level of the commission. Both Apple and Google charge 30% for the purchase of an app and purchases in an app (IAP). For many game developers, IAP are an important stream of income[416], the CMA notes in this respect:

> *However, the primary method of monetisation is by offering games for free, but allowing users to make purchases within games (in-app purchases) if they want to – for instance to make a level easier. This 'freemium' model accounts, for example, for 90% of revenue generated from the 'games' category apps in the Apple app store. In practice, only a very small minority of players make in-app purchase, and app developers are particularly keen to acquire 'whales' (players with a high propensity to make such purchases).[417]*

For subscription services, the structure is slightly different. The fee for the first year of paid subscription is 30% but it is reduced to 15% after one year of paid services. This is the case for both Apple[418] and Google.[419]

Upon the launch of the subscription payment service, the commission bore most relevance to magazines and newspapers. At the time, media outlets had little objection to the fee:

o *'Of course we would always like to see a lower commission, but we are able to work with this commission rate at this time," said Philippe Guelton, chief operating officer of Hachette Filipacchi Media U.S., publisher of Elle*[420]

o *"In today's consumer marketing environment, we feel a 70 percent remit directly to the publisher is a sustainable and reasonable model we can work with," added Gregg Hano, Bonnier Corporation's group publisher for Popular Science. "The audience is, we think, extremely valuable."[421]*

Others had more objections:

o *"Our philosophy is simple too—an Apple-imposed arrangement that requires us to pay 30 percent of our revenue to Apple, in addition to content fees that we pay to the music labels, publishers and artists, is economically untenable," John Irwin, Rhapsody's president, said in a statement. He said his company "will be collaborating with our market peers in determining an appropriate legal and business response to this latest development."*

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[415] Answers to follow-up questions Google, 3 March 2019.
[416] Another way of making money for game developers is to show in-app advertisements. The commission does not apply to in-app advertising. However, the app developers often use an in-app advertisement service to which they also pay a fee.
[417] 'The commercial use of consumer data, Report on the CMA's call for information' p. 58, June 2015.
[418] https://developer.apple.com/app-store/subscriptions/, last accessed on 29 March 2019.
[419] Answers to follow-up questions Google, 12 February 2018.
[420] https://www.macworld.com/article/1157970/subscriptions.html, last accessed on 29 March 2019.
[421] https://www.macworld.com/article/1157970/subscriptions.html, last accessed on 29 March 2019.

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Some app providers that ACM has interviewed state that their main problem is not with the 30% commission itself, but that it comes with the obligation to use IAP. Given this mandatory use of IAP, they state this 30% commission is way too high, particularly if you compare it with a fee that they call to be in conformity with the banking sector: 2 to 3%.[422] Others state that the level of the commission is reasonable if you compare the 30% commission with the costs of distributing a TV show worldwide.[423]

The level of the commission is also part of the US Supreme Court case *Apple v. Pepper*. A group of iPhone buyers claim that prices of apps are artificially inflated since Apple takes 30% commission on apps that are sold through the App store. Pepper's complaint concludes that, understandably, developers pass that cost on to consumers. The complaint says that iPhone users have paid "hundreds of millions of US dollars more" for apps "than they would have paid in a competitive market."[424]

Two examples of app providers who increased the price of their premium subscriptions from 10 euros to 12.99 euros when purchased in the app, are Spotify[425] and Blendle[426]. Blendle explains this decision on its website by referring to the obligation of IAP, and Spotify has gone further by removing the option of purchasing a premium subscription in the app.[427]

As mentioned earlier in section 3.3.1, Epic Games decided to leave the Play Store and made its app Fortnite available only through sideloading. The reason behind this is the commission it needed to pay to Google for IAP.[428]

Other providers state that it is unfair that the commission comes in the form of a percentage, especially when it is a commission over a subscription service.[429] An app that asks only 4 euros as a subscription fee pays much less to Apple than an app developer that offers a subscription fee of 300 euros. However, the App Store does not put any more effort into nor does it offer additional services to the second app provider. According to app providers, it is understandable that app stores ask for a compensation for the service they offer, but it should not be a commission based on a percentage, and the compensation should be shared fairly.[430]

In reaction to a question of ACM about the level of the commission, Apple states that the 30% commission was introduced by Apple in 2008 when it first launched the App Store. The App Store commission is significantly lower than the fees and commissions demanded by mobile and other application software distributors at the time, which were as high as 70% of the sale price of the software. Apple sought to offer a lower commission in order to reduce barriers to entry for software developers.[431]

In reaction to the same question, Google stated that the Play Store competes with various app stores within the Android environment and with exclusive app stores on rival platforms, such as Apple's App

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[422] Notes of meeting with **[confidential:]**, 11 October 2018, Meeting Summary **[confidential:]**, 22 October 2018.
[423] Notes of meeting with **[confidential:]**, 5 February 2019.
[424] https://www.theverge.com/2018/6/20/17479480/supreme-court-apple-vs-pepper-antitrust-lawsuit-standing-explainer, last accessed on 29 March 2019.
[425] https://www.theverge.com/2015/7/8/8913105/spotify-apple-app-store-email, last accessed on 29 March 2019.
[426] https://www.blendle.support/hc/nl/articles/115000574769-Waarom-kost-Blendle-Premium-12-99-via-de-iOS-app-, accessed on 19 February 2019.
[427] Ibid.
[428] https://www.wired.co.uk/article/fortnite-android-release-date-google-play, last accessed on 19 February 2019.
[429] Notes of meeting with **[confidential:]**, 8 January 2019.
[430] Notes of meeting with **[confidential:]**, 8 January 2019.
[431] Answers to follow-up questions Apple, 15 February 2019.

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Store. The level of the commission fee charged is used by app stores to compete with each other, as a means to attract app providers on their platform.[432]

4.2.3 Prohibited to link to other payment methods

Apple has stipulated in its Guidelines that apps may not refer to out-of app purchases. This means that an app that refers to payment options outside of the app store bypassing the Apple payment system is in violation of article 3.1.1. of Apple's Paid Applications Agreement (see the textbox on p. 97).

In reaction to this condition, app providers with a subscription service have attempted to side-step the mandatory fee. Netflix is one of the app providers that has done so. In 33 countries, the streaming service disabled in-app subscriptions. Customers have to go to its website instead. They have to realize this by themselves when they do not see an option for subscription within the app, or contact the customer service to get informed about it.[433] Spotify attempted a different approach at first; users subscribing through the Apple's App Store were charged 12.99 euros, whereas those subscribing through other channels were charged 9.99 euros. Additionally, the streaming service specifically targeted its iOS customers to inform them of the price difference.[434] Spotify has publicly complained that the fee amounted to unfair competition between Apple Music and Spotify.[435] [436] John Prince, Communication officer at Spotify said in this respect: 'You know there's something wrong when Apple makes more off a Spotify subscription than it does off an Apple Music subscription and doesn't share any of that with the music industry'. In reaction to the attempts by Spotify, Apple blocked the app in 2016 because of violation of 'business model rules'.[437] At the time of writing, Spotify has stopped offering subscriptions through its app.[438]

Spotify has recently filed an antitrust complaint with the European Commission over the 'unfair tax' that Apple imposes on Spotify.[439] According to Spotify, Apple is '[…] essentially acting as both a player and referee to deliberately disadvantage other app developers'.[440] At the time of writing, it is not yet clear how the European Commission will deal with this case.[441]

Others, such as Fortnite, have attempted to by-pass the app stores altogether (see section 3.3.1). Amazon, on the other hand, has limited the services it offers in its iOS Kindle app in response to Apple's 30% cut. In 2013, Amazon decided to stop selling books through its Kindle app on iPhones and iPad to circumvent the commission.[442]

App providers that ACM has interviewed complain about the restriction to link to payment systems outside the app store as well. They mention that this restriction is not implemented or reviewed equally among app developers. One app provider told ACM about a competing app that offers the same subscription service and has a link in their app to go to the payment system outside the app. The

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[432] Answers to follow-up questions Google, 3 March 2019.
[433] https://www.theverge.com/2018/8/21/17764424/netflix-feature-bypass-apples-app-store-fees, last accessed 13 March 2019.
[434] https://www.theverge.com/2015/7/8/8913105/spotify-apple-app-store-email, last accessed 13 March 2019.
[435] https://www.theverge.com/2015/5/6/8558647/apple-ftc-spotify-app-store-antitrust, last accessed 13 March 2019.
[436] https://timetoplayfair.com/the-case/ last accessed 29 March 2019.
[437] https://www.recode.net/2016/6/30/12067578/spotify-apple-app-store-rejection , last accessed 13 March 2019.
[438] https://www.iculture.nl/nieuws/spotify-stopt-betalen-ios-app/ last accessed 13 March 2019.
[439] https://www.theguardian.com/technology/2019/mar/13/spotify-claim-apple-30-percent-app-store-commission-unfair-european-commission-complaint , last accessed 29 March 2019.
[440] https://newsroom.spotify.com/2019-03-13/consumers-and-innovators-win-on-a-level-playing-field/, last accessed on 29 March 2019.
[441] 29 March 2019.
[442] https://www.theverge.com/2013/7/30/4572170/amazon-finds-clever-way-around-apple-restrictions-with-kindle-ios-app, last accessed on 29 March 2019.

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provider presumes that the other app is not reviewed strictly. In the opinion of the app provider, this is due to the fact that the other provider has substantially less income. Therefore, this app is less interesting for Apple and is not monitored closely.[443]

The indication that the restriction not to link outside the app is applied differently, is also visible in the following case. For its cloud storage app Skydrive, Microsoft offered a subscription outside the app, which was not allowed in the Apple terms & conditions at the time. Apple banned the updates of the app from the App Store for ten months, and threatened Microsoft to banish all Skydrive apps and other Microsoft apps from the App Store. Eventually, Apple and Microsoft signed an agreement as a result of which users could buy extra storage space via the browser instead of the app.[444] This situation gives an example of a larger app provider that has more bargaining power vis-à-vis Apple than smaller app providers have. Smaller providers told ACM they do not even have the opportunity to get in touch with Apple to discuss certain options.

Apple stated in an interview with ACM that it does not allow linking to other payment systems, since this is the same as bypassing the commission, which is not allowed.[445]

Google let ACM know that subscription services like Netflix, Spotify or news services are required to use the Play Store Billing. The "consumed outside of the app"-exception is generally limited to digital content like mp3s.[446]

4.2.4 Access to customer data

To collect payments for purchases (including in-app), Apple and Google require customer data. When subscribing to the Play Store or the App Store, clients fill out payment details and personal information, including credit card information, name, e-mail address and zip code.[447] When users buy an app or use IAP, payments go through the App Store or the Play Store. As such, the customer data for these transactions are initially held by Apple and Google.

The Play Store gives the app providers access to its user's data. Apple users, on the other hand, are explicitly asked for their consent to share this data with 'third parties'. Notably, the app provider is considered to be a third party. Many users choose not to share their data.[448]

Note: This chapter focuses on the behavior of platform operators (Google and Apple) versus app providers. In this section, we go into the data app providers need to service their customers. Issues concerning behavior of platform operators against consumers (such as privacy) fall outside the scope of this chapter. They will, however, be discussed in a more general sense in chapter 5.

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[443] Notes of meeting with **[confidential:** **]**, 9 January 2019, and additional information received on 3 March 2019.
[444] https://www.theverge.com/web/2013/4/3/4178798/skydrive-ios-app-update-no-longer-blocked-by-apple, last accessed on 29 March 2019.
[445] Notes of meeting with Apple, 17 December 2019.
[446] Answers to follow-up questions Google, 12 February 2019.
[447] https://www.theguardian.com/technology/2011/feb/15/apple-subscription-service-app-store, last accessed on 29 March 2019.
[448] https://repository.tudelft.nl/view/tno/uuid:bca47716-f811-4d46-919b-23d89cf25cf8, last accessed on 29 March 2019.

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Limited access to data
Some app providers argue that they lose control over their own consumers in the App Store. When users buy an app or use IAP in the App Store, the app providers often do not see the details (payment or otherwise) of their customers.

An app provider explained to ACM that, due to this lack of customer data, they were unable to provide their own customers with refunds. Unsatisfied customers that paid through the App Store could not be compensated.[449] Furthermore, this same app provider indicated that they were unable to provide extra services to important customers. The app provider wants to offer extra services to important customers. It would, for example, allow these costumers to carry-over credits to subsequent months that would normally vanish. However, the app provider is unable to provide this service within the App Store since it could not identify its consumers. This particular app provider complained to ACM that Apple wrongly considered an app consumer an Apple customer, and acts accordingly.

Another app provider that offers a subscription service indicated that it was unable to see critical customer information in the App Store. For example, when a customer stopped paying for its subscription service, the app provider was unable to identify the underlying reason. If the payment is refused because the customer's credit card expired, the app provider wants to see this information and make a new offer to this former customer. The app provider was unable to access this kind of information for its app in the App Store. They also suggested to ACM that Apple can use the data to target their customers with marketing. [450]

The issues with access to data do not apply to the Play Store according to these app providers.

Customer data for subscription services
In principle, the issues apply to both one-off purchases and subscription services using IAP. However, the majority of complaints from app providers apply to subscription services that use IAP. The subscription feature was first launched in 2011 by Apple.

Ysebaert and William de Nolf, who were, at the time, directors of, respectively, media group Corelia and Roularta, complained that *Apple, managing the subscriptions, will control all of those subscribers' data – the newspapers won't have access to their own subscriber lists*.[451] Ysebaert, furthermore, complained that Apple was changing the rules while the game was still being played. These media groups were not the only one with complaints. The Financial Times withdrew its app from the App Store when it was forced to give up customer data to Apple. As an alternative, the newspaper developed and launched a web-based version.[452] [453] According to Apple, **[confidential**

][454]

Likewise, MLB.com let its app users know that "*In-app purchases are purchased from and billed by Apple iTunes, not MLB.com*" and that "*these purchases are subject to the terms and conditions of Apple iTunes.*" The App Store completes the transaction on behalf of the app provider. According to

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[449] Notes of meeting with **[confidential:]**, 22 October 2018.
[450] Notes of meeting with **[confidential:]**, 11 October 2018.
[451] https://www.theregister.co.uk/2011/01/15/itunes_newspapaer_crackdown/, last accessed on 29 March 2019.
[452] http://eprints.lse.ac.uk/73404/1/WPS2017-01_Lynskey.pdf p.14, last accessed on 29 March 2019.
[453] At the time of writing, the Financial Times is again available as an app in the App Store, although it is also available as a web app.
[454] Notes of meeting with Apple, 17 December 2019.

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TermsFeed, this illustrates the inability of app developers to provide resolutions to customer issues.[455] [456]

MLB refund conditions for Apple purchases

Purchasing an Apple iTunes Subscription

In-app purchases are purchased from and billed by Apple iTunes, not MLB.com. These purchases are subject to the terms and conditions of Apple iTunes. All billing and refund inquiries must be directed to Apple iTunes. MLB.com does not have access to Apple iTunes accounts or transactions. If you wish to confirm the type of subscription that has been purchased from Apple iTunes, please consult your Apple iTunes account or receipt as each subscription will have a unique billing name.

Spotify and Deezer collectively wrote a complaint to the European Commission. In this letter, along with other tech companies, the streaming services complained of the regular abuse of an advantaged position by online platforms.[457] The companies complained that online platforms make it difficult to access customer data from their own apps and favor their own competing apps on their app stores. Furthermore, the online platforms allegedly impose imbalanced terms and conditions, and engage in biased ranking.[458] More recently, Spotify has complained that it is '[not] even allowed to send emails to our customers who use Apple'.[459]

Apple, on the other hand, is of the opinion that a consumer is a customer of both Apple & the specific app provider. The consumer is a customer of Apple because they buy the app from Apple and enter into an agreement with Apple. The developer has data about its customer, since the customer needs to log onto the app with their account. Apple does not know what additional data developers would like access and which is compliant with privacy legislation. Apple can imagine this is about privacy sensitive data, however Apple is not allowed to share this data.[460]

4.2.5 Summary

The commission levied by Apple and Google leads to complaints by app providers. Both stores charge a commission on the purchase price of apps. For in-app purchases, it depends on the category of the app. We have seen that Apple levies the commission on all in-app purchases that offer paid digital content and services. Google indicated that it uses nearly the same distinction. However, ACM interprets that, in practice, the enforcement of Apple is stricter, and, as such, the complaints of app providers focus mostly on Apple.

With regard to both Apple and Google, the consumption of physical goods, for example on Uber-rides, is not subjected to a commission. App providers question the distinction between those apps that do and do not have to pay the commission over in-app purchases.

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[455] https://termsfeed.com/blog/in-app-purchases-terms-conditions/, last accessed on 29 March 2019.

[456] http://m.mlb.com/atbat/faqs/atbat/ipad, last accessed on 29 March 2019.

[457] https://www.businessinsider.nl/spotify-deezer-rocket-internet-letter-european-commission-2017-5/?international=true&r=US, last accessed on 29 March 2019.

[458] 'In particular, internet companies argue they are not able to access analytics data when customers sign up for service through app store portals. Further, app store owners allegedly promote their own products ahead of third-party offerings. For example, Apple often publishes App Store banners advertising Apple Music, a competitor to Spotify and Deezer.'

[459] https://newsroom.spotify.com/2019-03-13/consumers-and-innovators-win-on-a-level-playing-field/, last accessed on 29 March 2019.

[460] Notes of meeting with Apple 17 December 2019.

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The discontent of, particularly, app providers that offer subscription services further centres on two aspects; (i) the high fee percentage Apple charges for IAP, and (ii) the inability to access customer data and consequently offer the right level of services to customers. App providers that offer subscription services are of the opinion that 30% (for the first year) is a percentage that is much too high compared with the services they are offered. This group indicates that their complaints would be reduced if it were not prohibited to link to other payment methods. The limited access to customer data is directly linked to the mandatory use of IAP.

4.3 Transparency & liability

Several app providers argue that transparency is not the main problem in this market: the terms and conditions that need to be complied with are publicly available and clear. Google and Apple are transparent about these terms & conditions. One provider argued that the terms & conditions can be transparent since Apple and Google are dominant platforms: "you know what you sign for, it's just take-it-or-leave-it."[461] The actual problem, according to these app providers, lies in the interpretation and implementation of the terms and conditions, and, as a result, in the arbitrariness this creates.

Other providers argue that, although the terms & conditions themselves are transparent, they still find problems with the communication about the terms & conditions. In this section, ACM describes conduct that influences the transparency in the app store market.

4.3.1 Communication

ACM understood from several app providers that it is hard to get in touch with the app stores. When there are problems with the placement or the update of apps in the store, the only way to get in touch with Google is via a form on the website. There seems to be a difference in the ability of small and large app providers to get in touch with Apple and Google. For relatively small and medium-sized app providers, there is no possibility to get an account manager, and communication via email is also difficult. These app providers similarly argue that, when there are changes in the terms & conditions or in the software, developers are not informed. They have to monitor these changes themselves.

On the other hand, large app providers describe the contact with Apple and Google as constructive.[462] One of these providers also stated that they are notified by an account manager of Apple or Google when there are changes in the terms & conditions, both from Google and from Apple.[463] This developer has enough time to align their app with the new conditions.

This lack in communication causes problems for several providers. For example, ACM spoke to an app provider who experienced a possible content rights issue with Google.[464] Their app was removed from the store due to this issue. After ten days, the issue was solved and the app should have been replaced by Google. But Google waited for 21 days to replace the app. During this period, the app could not be found in the Play Store, but on top of that, the provider also missed out on ad revenues because of this. The ad-service the app provider used, AdMob (owned by Google), stops paying out revenues when an app is not in the Play Store for more than 10 days. The provider has, according to AdMob's conditions, no right for its advertising revenues then. The provider tried to get in touch with

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[461] Notes of meeting with **[confidential:**   **]**, 3 December 2018.
[462] Notes of meeting with **[confidential:**   **]**, 25 October 2018 and Notes of meeting with **[confidential:**   **]**, 6 February 2019.
[463] Notes of meeting with **[confidential:**   **]**, 6 February 2019.
[464] Notes of meeting with **[confidential:**   **]**, 14 September 2018.

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Google themselves to get their app replaced, but this seemed impossible. Finally, the app provider got into touch with Google about this via their account manager at AdMob, and their app got replaced.

Another example comes from an app provider who had problems with getting their app signed to confirm its identity.[465] [466] The provider works for a department within a larger organization. It took this provider three months to find out that this signing process should be done by the overarching organization instead of the department. If communicating with Apple was easier, this problem would have been solved in a couple of weeks instead of the three months it took.[467]

ACM spoke to several other app providers who claim that contact with both Google and Apple is very hard. Numerous examples can also be found online from other app providers who claim the review process of their update took a really long time. Also, information (detailed or even just any) about why it takes so long is not given. Some providers argue that this problem is less of an issue at Apple, since Apple gives more information about why an app is rejected then Google.

Apple explains that an app refusal is always accompanied by a reference to the clause in the terms on which the rejection is based.[468] Apple states that developers can communicate with their review teams through App Store Connect, which is the web portal developers use to upload, submit, and manage their apps. It includes a tool to communicate directly with the App Review team about a particular app. Developers may also communicate with the App Review by telephone or email. Apple says it has several development teams that are tasked with helping the developers, and besides that, there are several different private companies that support app developers. All apps, including those from Dutch and European developers are reviewed by a team of hundreds of app reviewers on the App Review team.[469]

Google states app developers can contact the Play Store developer support through chat or email. Besides, they can submit an appeal if they believe their app was rejected or their account was terminated in error. According to Google, there are various teams that support the Play Store developers, depending on the support needed.[470]

4.3.2 Open terms & conditions

Some providers argue that Apple and Google might be transparent about the term or condition on the basis of which the app is rejected, but that the terms & conditions are so all-encompassing that it is hard to find out what is actually wrong with the app.

One app provider that ACM interviewed mentioned that their app was rejected by Google because they placed an ad close to the menu button. Their app was rejected based on a general, open term, with no further explanation on how far ads are allowed to be placed near the menu button.[471]

Another example came from an app provider whose app was rejected by Apple in several countries.[472] The rejection was based on term 3.1.1., which obliges certain apps to use IAP. According to the

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[465] Both Android and iOS guarantee the identity of a certain app provider through so called "signed apps". This is comparable with the lock-sign in browsers, which confirms the identity of the developer. (Notes of meeting with meeting **[confidential:]**, 11 October 2018.).
[466] Notes of meeting with **[confidential:]**, 11 October 2018.
[467] Ibid.
[468] Notes of meeting with Apple 17 december 2019.
[469] Answers to follow-up questions Apple, 15 February 2019.
[470] Answers to follow-up questions Google, 12 February 2019.
[471] Notes of meeting with **[confidential:]**, 14 September 2018.
[472] Notes of meeting with **[confidential:]**, 22 October 2018.

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developer, the term was not applicable to their app. The more detailed explanation about the refusal of this app, differs subsequently per country. Getting into a dialogue with Apple about this was not possible according to the developer.

4.3.3 Liability

Both Apple and Google have clauses in their terms and conditions related to either the liability of Google (in the case of the Play Store) or the limited liability for Apple (in the case of the App Store). One of the limited liability clauses in the terms and conditions for the App Store states the following:

> **Apple Developer Agreement**
> *Guideline 14 Disclaimer of Liability*
> To the extent not prohibited by applicable law, in no event will Apple be liable for personal injury, or any incidental, special, indirect consequential or punitive damages whatsoever, including, without limitation, damages resulting from delay of delivery, for loss of profits, data, business or goodwill, for business interruption or any other commercial damages or losses, arising out of or related to this agreement or your use or inability to use the service, however caused, whether under a theory of contract, warranty, tort (including negligence), products liability, or otherwise, even if Apple has been advised of the possibility of such damages, and notwithstanding the failure of essential purpose of any remedy. In no event shall Apple's total liability to you under this Agreement for all damages (other than as may be required by applicable law in cases involving personal injury) exceed the amount of fifty dollars ($50.00).

In Google's terms & conditions, the following clause deals with the liability of Google in the Play Store[473]:

> **Google's Developer Agreement**
> *Guideline 9(b)*
> When permitted by law, Google, and Google's Suppliers and distributors, will not be responsible for loss profits, revenues, or data; financial losses; or indirect, special, consequential, exemplary, or punitive damages. To the extent permitted by law, the total liability of google, and its suppliers and distributors, for any claim under the terms, including for any implied warranties, is limited to the amount you paid us to use the applicable API's(or, if we choose, to supplying you the API's again) during the six months prior to the event giving rise to the liability. In all cases, Google, and its suppliers and distributors, will not be liable for any expense, loss, or damage that is not reasonably foreseeable.

According to one of the app providers that ACM interviewed, app providers have no choice but to accept these type of clauses in order to publish their app in the Play Store or the App Store. If a change is made in the OS, this might affect the functioning of the app, Apple and Google are not required to inform app providers beforehand. As a result of one of these changes, it took this particular app provider more than 2 months to carry out the required changes in order for the app to function properly. When something like this occurs, an app might not function properly or not at all during that period. App providers do not only occur costs because of the changes they have to make, but it also

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[473] Guideline 9(b) https://developers.google.com/terms/#b_limitation_of_liability.

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damages their reputation. When an app does not function properly, end-users blame the app provider and not the app store. That is why the app provider finds these type of clauses unbalanced and unfair, because all liability is put on the app provider, and none on Apple or Google.[474]

Going even further than limiting their liability, in Apple's developers terms, a clause is included that states the following:

Apple's Developer Agreement
Clause 11
Nothing in this Agreement will impair Apple's right to develop, acquire, license, market, promote or distribute products, software or technologies that perform the same or similar functions as, or otherwise compete with, any other products, software or technologies that you may develop, produce, market, or distribute. In the absence of a separate written agreement to the contrary, Apple will be free to use any information, suggestions or recommendations you provide to Apple pursuant to this Agreement for any purpose, subject to any applicable patents or copyrights.

According to Apple, the reason that this clause is included in the terms and conditions is **[confidential:**

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Acquisition & Imitation (Sherlocking)
The platform operators have great control over the success or failure of an app (see Chapter 3). Another consequence of this position is that app stores are able to monitor the success closely. Apple and Google are the first ones to notice an emerging app that is a threat or an opportunity. [475] To protect and/or enhance the business, a platform operator may be incentivized to acquire or imitate successful or threatening apps. Sometimes, app stores take over concepts or ideas from popular apps, integrating them into their corresponding operating system (or as a separate app) [476,] making the app providers (often startups) redundant and dispensable.

One example of this conduct is the following: as mentioned earlier, f.lux was not allowed access to the App Store (f.lux offers a screen-dimming functionality, see section 1.2 of this chapter). Shortly after this refusal of access, Apple introduced Night Shift, a function similar to f.lux, which was integrated within iOS. Apple asked f.lux to stop offering side-loading options to its users, since this was in contradiction with their terms and services, but briefly thereafter started offering its own variation of the function. In response, f.lux called on Apple to allow f.lux to release an iOS version of its app as the *'original innovators and leaders in this area.'*[477] At the time of writing[478], f.lux is not available in Apple's App Store, it is available in the Play Store but can only be used with root access.

Another example comes from a Dutch developer, Notifyr. The Notifyr app allowed iPhone users to forward notifications to their Mac. The function was integrated within the Apple ecosystem with OS X Yosemite, making the app obsolete. Other apps such as Carousel (Dropbox photo-app) and Mailbox

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[474] Notes of meeting with **[confidential:**   **]**, 3 December 2018.
[475] https://www.econstor.eu/bitstream/10419/152249/1/880328606.pdf, last accessed on 29 March 2019.
[476] https://www.rtlnieuws.nl/geld-en-werk/artikel/596316/deze-veelbelovende-apps-zijn-door-techgiganten-kapotgemaakt last accessed on 29 March 2019.
[477] https://justgetflux.com/news/2016/01/14/apple.html, last accessed on 4 March 2019.
[478] 4 March 2019.

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(e-mail swiping) applications were imitated by tech giants, and have substantially diminished in prominence.[479]

Others argue that Apple and Google have integrated many apps in their ecosystems. Google has bought Flutter (gesture technology), Sparrow (e-mail app), and Waze (navigation). While Apple acquired Siri, Cue (a personal assistant app), and Spotsetter (a social search engine).[480] Acquisitions can also be driven by other motives such as acquiring developers' talents (also dubbed as an acquihire).

4.3.4 Summary

In this chapter, the issues that some app providers experience with the limited transparency & liability of Apple and Google have been described. App providers have indicated that it can be difficult to get in touch with Google and Apple. In other cases, communication about rejections refer to terms & conditions which are open for multiple interpretation, which makes it hard for app providers to adjust their apps. Furthermore, Apple's terms and conditions allow them to imitate (Sherlock) apps in their store, and shift all liability to app providers. Apple, on the other hand, indicates that these clauses are in place to protect them against lawsuits.

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[479] https://www.rtlnieuws.nl/geld-en-werk/artikel/596316/deze-veelbelovende-apps-zijn-door-techgiganten-kapotgemaakt, last accessed on 29 March 2019.
[480] Dolata & Schrape, 'Collectivity and Power on the Internet: A Sociological Perspective' 2014.

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5 Public interests

In Chapter 2 and 3 of this market study, ACM discussed the functioning of app store ecosystems and the importance of app stores for the different market participants involved. In Chapter 4, ACM gave an overview of the information gathered from app providers about their experiences and information collected through desk research. Where possible, ACM also included the perspectives of both Apple and Google for the reasons as to why they set certain rules in their respective app stores. Whereas Chapter 2, 3 & 4 aim to give a factual representation of the inputs from app providers and literature, ACM in this chapter will examine how the public interests, as set out in section 1.2 of this market study, might be affected.

The central question of this chapter therefore is: given the important role that Apple and Google have with their respective app stores within the mobile ecosystem, how are the public interests that ACM oversees affected?

This chapter is therefore structured around the two public interests that are particularly relevant to the perspective of ACM (as discussed in the defined framework, see section 1.2):

1. Competitive markets (section 5.1)
2. Safeguarding consumer interests (section 5.2)

Note: In this chapter, ACM does not aim to carry out a competition-law analysis or to define markets within a competition-law context. Rather, we intend to describe how the public interests may be affected by Apple and Google with the app stores. This chapter should therefore not be read as a final conclusion, but rather as an exploration on the basis of the information that has been provided by app providers and Apple & Google, which have been supplemented by desk research and the input of experts.

5.1 Competitive markets

Healthy competition creates opportunities and options for business and consumers alike (see section 1.2)[481]. The realization of well-functioning markets goes much further than competition in the short run (static efficiency). When assessing effects on markets, ACM also takes the long-term effects on consumer welfare into account (dynamic efficiency). These are not just the effects on prices, but also the effects on innovation and on the quality and diversity of products and/or services. Our oversight efforts are not only focused on the conduct of companies, but also on market structures. The combination of effective competition and innovation on a market therefore ensures that consumers get the optimal combination of price and quality considering their personal preferences.

As described in Chapter 2, the app stores have greatly lowered entry barriers, and have led to a flourishing of a variety of innovative apps. The app stores have become a marketplace in their own right, and are able to influence the access that app providers have to the platform and ultimately, mobile consumers. In this section, we will describe how the conduct of Apple and Google might affect

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[481] https://www.acm.nl/sites/default/files/old_publication/publicaties/11993_strategy-document-20140801.pdf p.4 last accessed on 29 March 2019.

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competition and innovation in the app stores. As we will see in this section, many types of behavior both enhance and decrease competition and/or innovation.

New opportunities
Apple and Google have an incentive to provide consumers with a wide variety of apps in their respective app stores since this enhances the attractiveness of an app store and the mobile device. This wide variety of apps can lead and has led to a flourishing of the market place, and has consequently enhanced competition. The sheer amount of apps on both platforms is a clear illustration of this fact.[482] The respective app stores have created a new market, and, as a result, new opportunities for app providers, and a wide range of apps to choose from for consumers.

By providing a development framework for app developers, Apple and Google have promoted innovation and efficiency, and have facilitated access of app developers to mobile consumers. In many ways, this circumvents double work by app developers, and, in this way, reduces the costs of developing an app, and stimulates the affordability of apps for consumers. Furthermore, the app stores grant developers access to a large consumer base, whilst consumers are presented with a central market place where they can easily find a wide array of functionalities to enhance their mobile devices. Before the introduction of app stores, the majority of functionalities the app developer had to offer were distributed in different places. The app stores have as such significantly reduced transaction costs.

The safety and integrity of the respective ecosystems benefit Apple, Google, app providers and consumers alike. Given the large number of apps in particular, these apps have to be ranked and sorted to simplify the finding and selecting of apps.

Possible barriers
At the same time, Apple and Google have a unique position where they can control the parameters for competition. Both Apple and Google operate on the infrastructural level as well as offering services that use this infrastructure. This creates a potential for unfair competition and a tilted playing field. Whilst the app stores have greatly decreased entry barriers for many, they may be in a position to raise entry barriers for certain (highly competitive) app providers. This would decrease dynamic efficiency.

App providers build their apps within the framework of rules and demands set out by the app stores, and they have to agree with the terms and conditions set out by Apple and Google. For app providers, this is not a real issue if every app provider is bound by the same framework, so no one can compete on parameters outside of it. However, when Apple and Google apply rules differently, this may tilt the playing field. In certain areas, Apple and Google fulfill the role of the app store operator and the app provider at the same time. They may distort competition by limiting interoperability, complicating access or limiting the favorable displaying of third-party apps, thereby disturbing equal access to the market. According to app developers, Apple and Google have a wide margin of discretion to decide what apps are and what apps are not granted access (equal or otherwise).

Examples of conduct related to this possible barrier are that one app provider indicated that Google apps are better integrated with the Android ecosystem than third-party apps. As a result, this app provider is not able to offer the same type of functionalities in the app as Google can in its own apps. With regard to Apple, an app provider that competes with Apple has indicated that it was not granted

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[482] In 2018, Google's Play Store offered 3.3 million different apps in October 2018 and Apple's App Store 2.2 million. Over 194 billion apps have been downloaded from both app stores worldwide in 2018. See section 2.1.

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access to Apple's Siri. Likewise, another competing app provider argued that it was not granted access to the NFC-chip, which was necessary to launch its service. The apps of Apple, on the other hand, do have access to both Siri and the NFC-chip. Another app provider brought forward that it was not granted access to the app store at all, due to a lack of customer reach.

Certain limitations within the ecosystem may be justified and actually benefit consumers. The integrity of the ecosystem is one of the justifications that Apple gives for not making certain APIs (e.g. NFC-chip) available to third-party app providers. From a competition perspective, this might limit the ability of app providers to offer certain services (e.g. payment service) that require access to the NFC-chip. However, according to some, access to the NFC-chip also means that app providers could have unwarranted access to the iPhone.[483]

A conclusion on whether these limitations are in fact objectively justifiable is outside the scope of this market study, and should be subject to further research. If these risks prove to be limited, full interoperability would improve dynamic efficiency.

Strict control of access may hinder choices for consumers. For example, when Google blocked access to the Play Store for Disconnect[484], a privacy-enhancing app, this likely had a negative effect for those consumers that value privacy. Then again, it may have positively benefited app providers that earn money from running ads in their apps.

We have also seen that some app providers do not have access to all the customer data they wish to have. In certain instances, app providers complain that the data of their customers is directed to Google and Apple instead of the app provider themselves (i.e. the data will only be passed on to the app provider if the customer consents to the sharing of data with 'third parties'). From a privacy perspective, it can be argued in favor of this policy: after all, the data is shared with only one company. On the other hand, app providers may lose sight over their customers. This loss of control and the inability of direct contact between the app provider and its customers may reduce the ability of app providers to offer the level of customer service they would wish (such as refunds) and the ability of upselling.[485] This might impact the ability of the app provider to compete.

Google and Apple have significant discretion over the presentation of apps. Both may determine how to rank apps and what apps to feature. Since these factors play an important role for new apps to launch successfully and grow, they impact competition in that process. When Apple and Google use this mechanism to strengthen their own ecosystems, this may hamper innovation and the ability of third-party app providers to compete. Although it has become clear from this study that the presentation is quintessential for the success of most apps, ACM cannot conclude in this market study whether competition or innovation is harmed through this mechanism.

Furthermore, we have seen that Apple and Google levy a commission over the digital content and services offered in their app stores. Although the commission is not exclusively imposed on competing apps, the possible distortion of competition becomes most apparent when it is. The commission may affect competition within categories as well as competition between categories.

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[483] https://appleinsider.com/articles/18/05/25/apple-to-reportedly-unlock-iphone-nfc-chip-capabilities-in-june last accessed on 29 March 2019
[484] See section 4.1.1.
[485] https://repository.tudelft.nl/view/tno/uuid%3Abca47716-f811-4d46-919b-23d89cf25cf8, last accessed on 29 March 2019.

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Within a category, when Apple or Google levy a 30% commission over IAP, and third-party app providers have no other choice but to pass on this commission to users, it impacts their competitive position. This distortion of competition is also present when Apple and Google apply the terms and conditions, related to the mandatory use of IAP, differently to similar apps.[486]

The competition between categories of apps may be distorted as well. Apps that fall outside the category of digital content and services are favored in respect of apps that do fall within this category. The commission itself provides Apple and Google with a reward for their hard work and a stimulus for further innovation in the app stores. On the other hand, app providers have 30% less income to spend on innovative ideas, and app providers might be hesitant to develop new payment systems since they cannot be used, given these conditions.

5.2 Safeguarding consumer interests

Consumer interests are partially safeguarded by effective competition. However, the safeguarding of consumer interests go beyond competition and innovation. Consumers also benefit from transparency, which allows them to make well-informed choices, high quality, save products, their data being protected safely, and consumer rules being enforced.

As highlighted in chapter 2, consumers greatly benefit from the app stores. App stores make it easily accessible and convenient for consumers to reach and download apps (new or existing) on their mobile device. By downloading a selection of preferred apps, consumers can make their own personal app-library.

Presentation and pre-installation of apps
The large number of apps available in the app stores can lead to the discovery of new products, content, and services. But the large number of apps can also lead to increased search costs. The app stores aim to reduce this problem of information overload by using algorithms, and consumers rely on this.[487] By doing so, they can make it easier for consumers to find the app they are looking for. On the other hand, this gives Apple and Google the opportunity to influence consumer choice. This is due to the fact that it is not transparent how the algorithm determines in what order apps are highlighted in the search results for consumers. The presentation of apps in the app stores (ranking and featuring of apps[488]) and the pre-installation of apps on smart phones can affect consumer choice and usage as well.

Monitored app stores, the review process, and content
App stores have the incentive to have as many qualitatively good apps in the app stores as possible to grow the overall value of their ecosystem, which is beneficial for consumers.[489] Both Apple and Google have their own review process before an app is allowed into the app stores. In principle, consumers also benefit from a monitored app store: a well monitored app store should, in theory, result in the availability of safe and high-quality apps.

One of the reasons why the App Store is highly valued is because of the strict review process. Complaints about malware spread via an app downloaded in the App Store are rare. This is in contrast

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[486] See section 4.2.1
[487] See paragraph 0
[488] See paragraph 4.1.4
[489] Notes of meeting with Google, 9 January 2019

to the Play Store, for which Google has **[confidential:**

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However, Google's swift approval process is more often scrutinized, because a consequence of this process is that apps that carry malware are available in the Play Store.[490]

The content of the app stores is limited by the review process and the terms and conditions. It is not possible to access apps that have a certain content, e.g. erotic content or content related to marijuana, as such apps are removed from the app stores. It prevents consumers from being confronted with violent or erotic content but, at the same time, it also limits consumer choice in general. Also, some of this content is not prohibited to be shown, according to Dutch law.

However, in certain cases, app providers feel that this monitoring goes too far where it intervenes with their choices that do not violate the technical or legal conditions of the app store. One example is the app that was denied because of the assumed small consumer reach (see chapter 0). It can be questioned in this case if it is up to the app store to pre-determine whether an app is going to be used or not by consumers. Another intervention that might be questioned is, as mentioned in section 0, the adblocker apps that were removed from the Play Store in 2013. Similarly, the app Disconnect, an app that prevents unwanted tracking, was deleted several times. These apps were removed from the Play Store, because they intervene with the functioning of other apps. This is an example of a decision from the app store undermining the needs of consumers.

Payment in apps
As mentioned in Chapter 4, app providers that offer digital content and services in their apps are required by Apple and, in some instances, by Google to use IAP. This increases the convenience for consumers: a consumer only has to enter their payment details once, and can thereafter pay with just one simple click. If this requirement is viewed from the perspective of the safety of user-data, a good reason for the obligatory use of IAP might be found in Apple and Google wanting to protect the payment data of consumers. After all, the requirement prevents sensitive data from going to third-party app providers that might not treat this data with care. This could be beneficial to consumers. Although it does not imply that end-users are guaranteed that their data in general is safe if it is only available to Apple and Google.

On the other hand, the requirement to use IAP for certain apps may limit consumer choice: consumers are restricted to the payment systems chosen by Apple and Google. Furthermore, when app provides that are required to use IAP, remove the IAP option completely (e.g. Netflix and Spotify), consumers are affected because certain app functions are no longer available. There are also examples where the app provider fully passes on the 30% commission to its consumer prices, which negatively impacts consumers as well.

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[490] https://bgr.com/2018/01/31/google-play-store-malicious-apps/ last accessed on 29 March 2019.

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6 Findings and follow-up

In this chapter, ACM will list the main findings of this market study into mobile app stores. Furthermore, ACM will consider whether the conduct mentioned in Chapter 4 can justify further research to determine whether intervention is needed. This will be done given the importance of app stores as discussed in Chapter 3, and given the considerations of public interests involved in Chapter 5.

In this market study, ACM described the importance of the app stores for both Apple and Google in order to maintain their respective ecosystems. ACM also showed that the app stores form a bottleneck for app providers to reach consumers on both mobile OSs. On iOS, there are no viable alternatives for the App Store. Therefore, app providers have only limited options for reaching consumers on their iPhone outside of the App Store. Even though it is technically possible on Android for app providers to reach consumers circumventing the Play Store, this is only a realistic alternative for companies with an already established user base accomplished on other distribution channels. Furthermore, in this market study, ACM concluded that the majority of app providers have limited bargaining power vis-à-vis the app store. An app store with popular apps contributes to the attractiveness of the overall ecosystem, which means that Apple and Google both have an incentive to assist app providers. On the other hand, given the fact that both Apple and Google compete directly with a selection of third-party app providers, they also have an incentive to favor their own apps over apps of their competitors. An app store with popular apps contributes to the attractiveness of the overall ecosystem, which means that Apple and Google both have an incentive to assist app providers. On the other hand, given the fact that both Apple and Google compete directly with a selection of third-party app providers, they also have an incentive to favor their own apps over apps of their competitors.

According to ACM, the important position that Apple and Google both hold with the app stores on their respective ecosystems might also give them the opportunity to act in such a way. Based on this market study, ACM has identified three conducts that might warrant further investigation:

1. Favouring own apps over apps from other providers
2. Unequal treatment of apps in general
3. Lack of transparency

In the following sections, these will be further discussed.

6.1 Favouring own apps over apps from other providers

In Chapter 4 of this market study, ACM has mentioned a number of examples of conduct of the app stores that, in the view of other app providers, would affect competition between apps of Apple and Google themselves and third-party apps. In section 5.1, ACM focused on a set of these complaints, and described how the conduct might affect competition.

Examples thereof are limitations faced by third-party app providers regarding interoperability with the mobile OSs and the requirement to use IAP for apps that directly compete with Apple and Google. Apple's and Google's apps are, on the other hand, able to use their ecosystems to their fullest; they

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can be pre-installed, do not have to pay a commission, and have full interoperability. This raises the question whether there is, in fact, competition on the merits between apps. According to Spotify, Apple functions both as a referee and as a player, and that is why Spotify has filed a complaint against Apple with European Commission.[491]

6.2   Unequal treatment of apps in general

In Chapter 4, ACM noted certain conduct that potentially impacts competition between all apps, so not specifically apps that compete directly with apps of Apple or Google. It concerns conduct that restricts the interoperability in a seemingly unequal way, access to data concerning payments via in-app purchases and the featuring of apps in the app stores.

As examples of the restricted interoperability of the operating system, ACM found that certain apps were not able to function due to technical or interoperability restrictions such as access to APIs while other apps were apparently granted access to these APIs.

Also, ACM noted that limited access is granted to app providers to certain data concerning payments and customer relations while app providers are required to use the app stores payment systems for IAP. App providers have stated as a result they are not able to manage fully their customer relations.

A third example of possible problematic conduct is the featuring of apps in the app store (section 4.1.4). As discussed in Chapter 5, the featuring of apps can steer consumer choice and usage, thereby impacting competition between apps.

6.3   Lack of transparency

In section 4.3 of this market study, ACM described the problems that app providers experience with regard to the lack of communication with Apple and Google. With the exception of two large app providers, the other app providers that ACM interviewed all complained about a lack of transparency. According to these app providers, it is difficult to get in touch with Apple and Google. These issues are, according to app providers, most apparent when it concerns a discussion about the interpretation of the terms and conditions or an removal(unjustified or otherwise) of an app. In the opinion of ACM, transparency and the ability to get in touch with Apple and Google are important requisites for app providers to do business. Given the lack of bargaining power that the majority of app providers have, ACM believes that this warrants further attention.

On 13 February 2019, the European Parliament, the Council of the European Union and the European Commission reached a political agreement on the Platform to Business (hereafter: P2B) regulation.[492] This regulation aims to create a fair, transparent and predictable business environment for smaller businesses and traders when using online platforms. Most app providers which ACM spoke to, consider this regulation a step in the right direction, but believe the regulation does not go far enough. This is because the P2B regulation only requires platforms to be transparent but does not prohibit platforms, like the app stores, to carry out behaviour that might be deemed problematic.

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[491] https://newsroom.spotify.com/2019-03-13/consumers-and-innovators-win-on-a-level-playing-field/ last accessed on 29 March 2019
[492] https://ec.europa.eu/digital-single-market/en/business-business-trading-practices last accessed on 29 March 2019.

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ACM agrees with the app providers that P2B regulation is a good first step to solve some of the transparency issues that were raised by app providers. In order to determine whether the P2B regulation actually deals with the problems mentioned by app providers, ACM will stay in touch with the Dutch Ministry of Economic Affairs and Climate Policy, which is responsible for this regulation within the Netherlands and will not prioritize transparency issues at this moment insofar as these issues fall under the aforementioned regulation.

6.4   Follow-up

The findings of this market study as summarized in the previous three sections of this chapter ask for further investigation in order to verify the conducts raised by app providers in this market study. Naturally, in a market place as large as the app stores, mistakes can be made, and therefore it is necessary to investigate whether certain conduct is done systematically.

On the premise that intervention is needed, it can be debated whether there is a need for ex-ante regulation. In this context, ACM notes that, concerning access to broadband internet, the weighing of the same public interests resulted in ex ante regulation as laid down in the Open Internet Regulation. More specifically, these were the public interests regarding the protection of the rights of end-users to access and distribute information and services as they please over their internet connections, and also the public interest of maintaining competition with regard to offering services and applications without discrimination or subjective interferences from the company providing broadband internet. In spite thereof, it could be argued that general competition law could address the most problematic behavior in this domain, the legislature considered certainty for end-users and companies to be able to rely on the intermediate services of broadband internet sufficient to opt for ex ante regulation.

Whilst ex-ante regulation may increase certainty for app developers, and prevent problems (new or otherwise) from arising. Further investigation may also be undertaken under existing legislation, such as competition law, which is a more specific instrument and limits the regulatory burden on companies. ACM is of the opinion that the findings of this market study warrant further investigation, based on either one of these legislative instruments.

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Annex 1: Contacts (confidential)

The following companies were interviewed by ACM to gather information for this market study.

[Confidential:

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