

Upsell and loyalty strategies of operators:

Using public Wi-Fi as customer magnet



Public Wi-Fi is a tool in the toolbox of many operators. In this analysis – our fifth on the subject – we show how telcos, cellcos and cablecos in mature markets in Europe, America and APAC use public Wi-Fi to attract and retain customers – and to upsell.

We also update you on Wi-Fi usage and deployment. You might be surprised to see that the wide adoption of 4G LTE and an increasing use of mobile data meant more Wi-Fi, not less.

Is the smartphone a 3G/4G – or a Wi-Fi – device?

In August, OpenSignal¹ published a report showing the *share of time* smartphones had been connected to Wi-Fi – as opposed to 3G/4G – for 95 countries, see Figure 1.

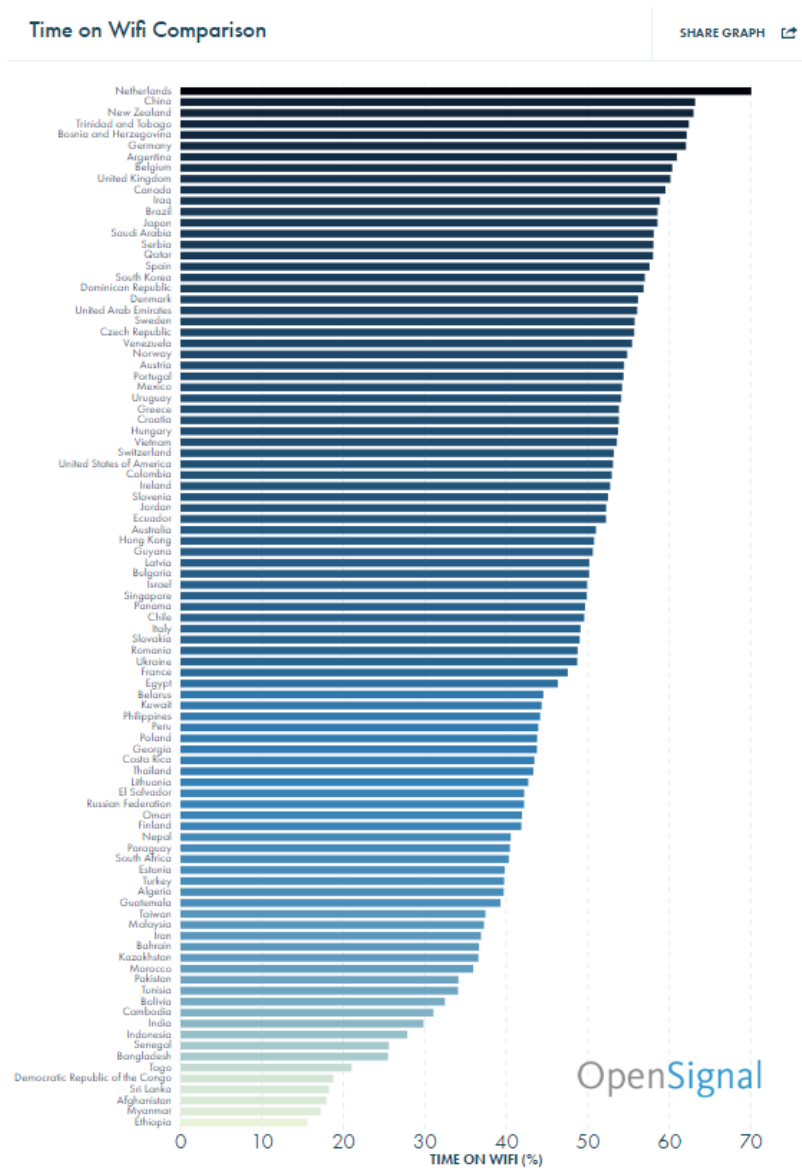


Figure 1. OpenSignal's ranking of countries after smartphones' share of time on Wi-Fi

The Netherlands tops the chart with a very high value of 70%, but in almost all mature markets, smartphone users spend **more time on Wi-Fi than on 3G/4G**.

¹ A company that provides a smartphone app to crowdsource actual network performance and coverage data; www.opensignal.com

Time on Wi-Fi isn't the same as data volume since most smartphones do not perform software updates unless they connected to Wi-Fi. Because most users have a variable (per GB) price of mobile data, there is, in addition, a user behaviour to manually prioritise Wi-Fi, especially when the user knows that he/she is about to use larger volumes of data. Previously published stats from App Annie indicate that, as a global average, **about 80% of smartphone data volume is over Wi-Fi**.

You can read more about this in our [blog post](#).

Benchmarking public Wi-Fi deployments

Clearly most of the Wi-Fi usage shown above happens at one location – the home. Since our last Wi-Fi deployment report², operators have however, in most cases, expanded their number of public Wi-Fi hot- and homespots³ significantly. We will soon come back to what this means for public Wi-Fi usage, but let's first take a look at the Wi-Fi deployments.

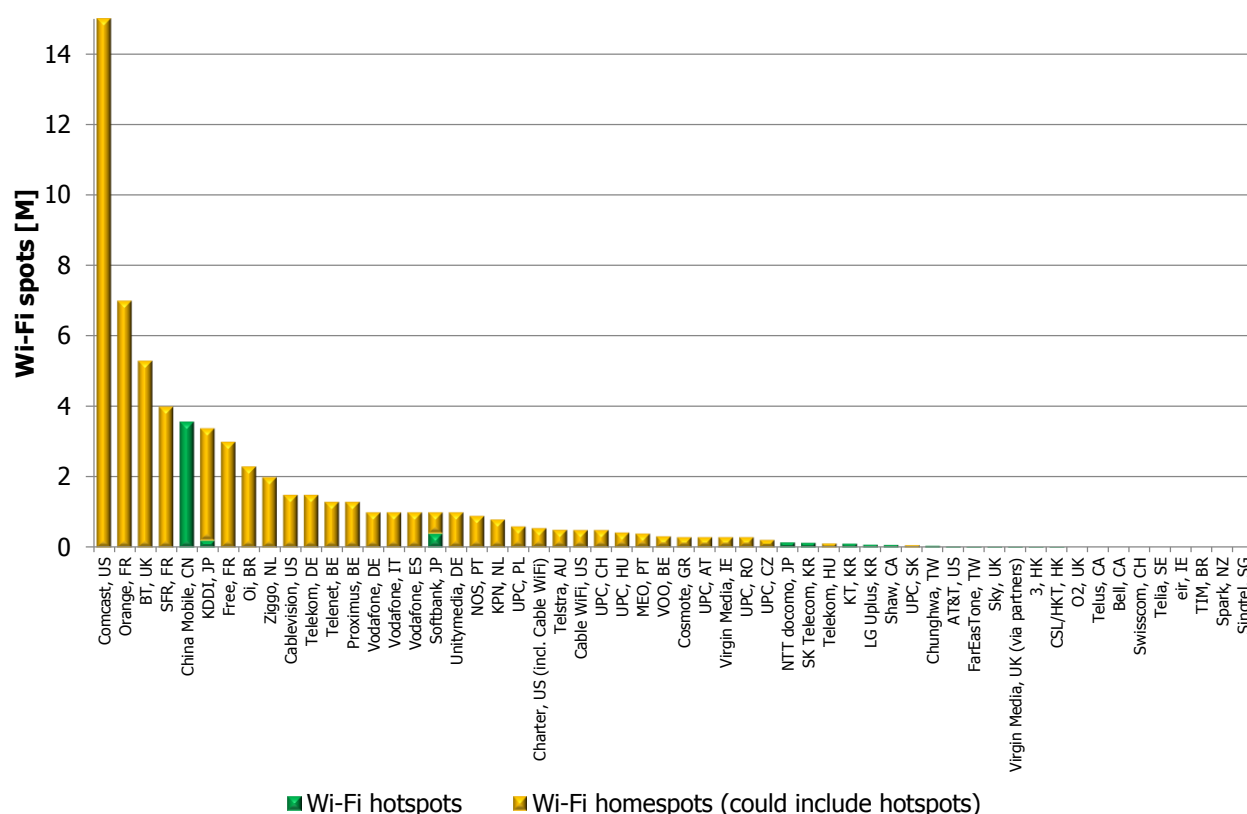


Figure 2. Reported Wi-Fi hot- and homespot numbers⁴ – all

² 2014 report: <http://tefficient.com/how-operators-use-wi-fi-to-strengthen-existing-business/>; 2015 update: <http://tefficient.com/how-carriers-are-using-wi-fi-across-the-world/>

³ A homespot is created by letting the router at the customer premise transmit two SSIDs – one private and one public

⁴ Most operators with homespots just report an (impressive) total and do not break out the hotspot number

We will soon break down Figure 2 further, but let's start by looking at the global leaders in the number of deployed Wi-Fi hot- and homespots.

#1: **Comcast** is the largest cable operator in the US with around 28 million customer relationships – of which 24 million subscribe to an Internet service via Comcast's cable network. If every one of these customers hosted a homespot, Comcast would have had 24 million homespots. The actual value by the end of June was **15 million**. This number might include regular Wi-Fi hotspots (if any). It might also include the 0.5 million **Cable WiFi** spots that Comcast's customers also have access to. Cable WiFi is a consortium providing Wi-Fi access to customers of five cablecos: Comcast (Xfinity), Time Warner Cable (now part of Charter), Cablevision (Optimum, now owned by Altice), Cox and Bright House (now part of Charter).



#2: **Orange** France has started to grow its number of homespots again and is currently reporting a total of **7 million**. This number includes a relatively large number of regular hotspots as well.



#3: **BT** has **5.3 million** Wi-Fi hot- and homespots – a number which hasn't been growing in many years in spite of BT's growing fixed broadband retail base (now above 9 million). BT used to be the #1 in our comparison, but Comcast and Orange France have both overtaken BT. BT's recent acquisition of the largest mobile operator in the UK, **EE**, might mean that BT no longer thinks mobile data offload is good for their business. An indication of this is that the inclusive BT Wi-Fi proposition which apply to the BT Mobile brand so far hasn't been extended to the EE brand.



#4: **SFR** has **4 million** Wi-Fi spots – a number which has been stable for a few years.



#5: **China Mobile** had 4.4 million Wi-Fi access points used solely as hotspots in mid-2014, but the company has since changed its strategy to focus on 4G (TD-LTE). As part of this, China Mobile wrote down the value of its Wi-Fi investment significantly in 2015. The company is no longer reporting Wi-Fi figures, but numbers from the Chinese Ministry of Industry and Information Technology suggest that about **a million Wi-Fi hotspots have been closed** in China during 2015. China Mobile isn't the only possible source, but our estimation is that China Mobile operated something like 3.5 million Wi-Fi hotspot access points in June 2016. It's still the world's largest Wi-Fi hotspot-only network run by a single operator.



Reported Wi-Fi spot numbers

When operators report the number of Wi-Fi *homespots*, the number corresponds to the number of access points since one (enabled) customer access point – in parallel to be the private access point of the household – becomes one homespot. The **amber** bars in our diagrams are thus believed to be highly comparable.

When it comes to Wi-Fi *hotspots*, reporting practices varies though. Also here, some operators put an equal sign between hotspots and access points, but since many operators have multiple access points per Wi-Fi hotspot, some operators are rather reporting the number of Wi-Fi zones than access points. This means that the comparability of the **green** bars in our diagrams varies. Examples of operators reporting hotspot **zones** rather than access points are Telia, KPN, KT (on average 2 access points per hotspot zone) and Sky (also around 2 access points per hotspot). Examples of operators **reporting access points** are SK Telecom and China Mobile.

In addition to the graphs in this analysis, we would love to provide an all-hotspot diagram. However, since so many operators don't break out their hotspot number from their *total* hot- and homespot number such a diagram would overlook operators with large – but not reported – hotspot deployments.

We will soon break down Figure 2 into continents of the world, but first let's look at the development in the number of reported Wi-Fi hot- and homespots in the 18 months from December 2014 to June 2016.

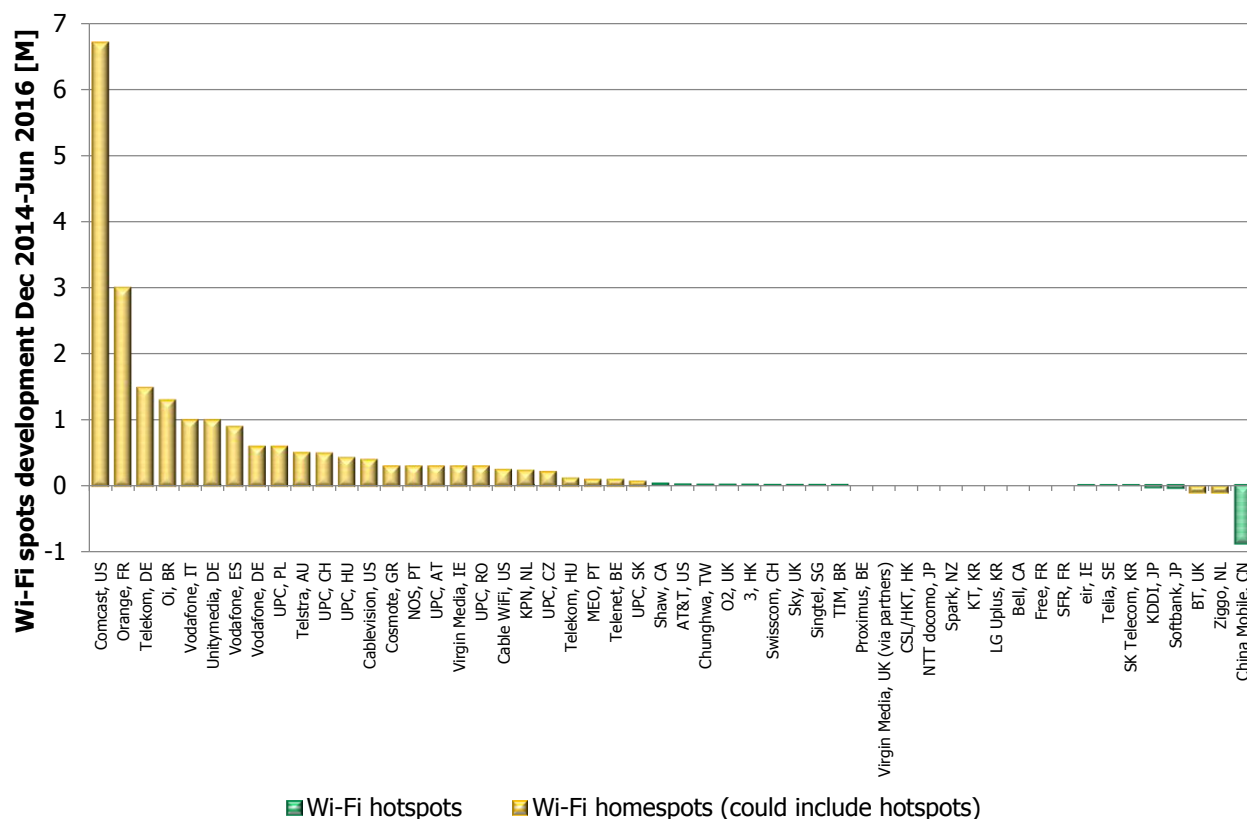


Figure 3. Development in reported Wi-Fi hot- and homespot numbers from December 2014 to June 2016 – all

Figure 3 indicates a very rapid development in the deployment of operator Wi-Fi. It is interesting that this Wi-Fi rollout happened simultaneously with a peak in mobile operators' rollout of 4G LTE. **Comcast** leads; added almost 7 million spots during these 18 months. **Orange** France is number 2 followed by **Telekom**, **Oi** and three **Vodafone** affiliates.

The only operator with (an estimated) significant reduction in the size of its Wi-Fi network is **China Mobile**. China Mobile is the only case where 4G rollout had a clear negative impact on Wi-Fi. The reason to this is that China Mobile was mandated to use the home-grown TD-SCDMA standard for 3G and consequently used Wi-Fi as a bridging technology waiting for 4G.

Let's now break down the totals as of June 2016 (Figure 2) into three regions – Europe, Americas and APAC & China.

This Wi-Fi rollout happened simultaneously with a peak in mobile operators' rollout of 4G LTE

Europe

Figure 4 shows the European subset. Orange France, BT and SFR are, as already mentioned, top ranked.

Free follows with 3 million Wi-Fi homespots. The operator with the highest density of Wi-Fi spots is arguably the Liberty Global held cableco **Ziggo** of the Netherlands with 2 million Wi-Fi hot- and homespots.

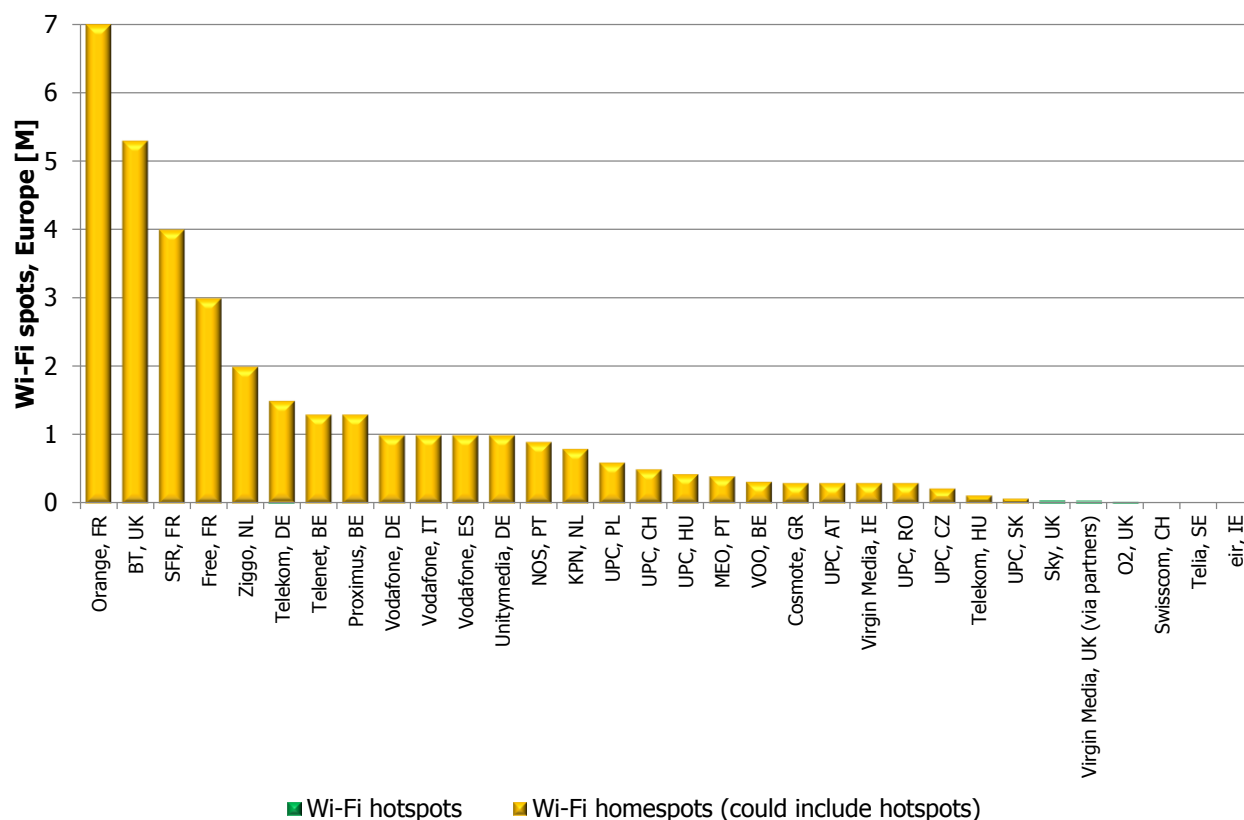


Figure 4. Reported Wi-Fi hot- and homespot numbers – Europe

Telekom has made a late entry into homespots and is currently reporting 1.5 million hot- and homespots in Germany. The number is growing fast, something which is also true for other Deutsche Telekom affiliates that too are under DT's partnership with Fon: Cosmote, Magyar Telekom and Hrvatski Telekom.

Telenet of Belgium, also part of Liberty Global, reports 1.3 million hot- and homespots, a number now matched by the telco incumbent **Proximus**. Telenet's customers have, in addition, access to VOO's 320000 homespots in southern Belgium, though.

Also **Vodafone** Group got a taste for Wi-Fi homespots – through the acquisitions of Ono in Spain and Kabel Deutschland in Germany. Vodafone has since, without acquisitions but in partnership with Fon, started to deploy Wi-Fi homespots in Italy and should there have reached around one million – the same as in Spain and Germany – by now.

Liberty Global has taken the Wi-Fi hotspot concept from Belgium and the Netherlands to all of its other European markets (branded UPC with the exception of Germany and Ireland): Germany (Unitymedia), Poland, Switzerland (see picture right), Hungary, Austria, Ireland (Virgin Media), Romania, Czech and Slovakia.



One Liberty Global operation is missing, though: Virgin Media in the UK. This is likely also why Liberty Global hasn't met the expressed target of 10 million Wi-Fi spots in Europe, see Figure 5.

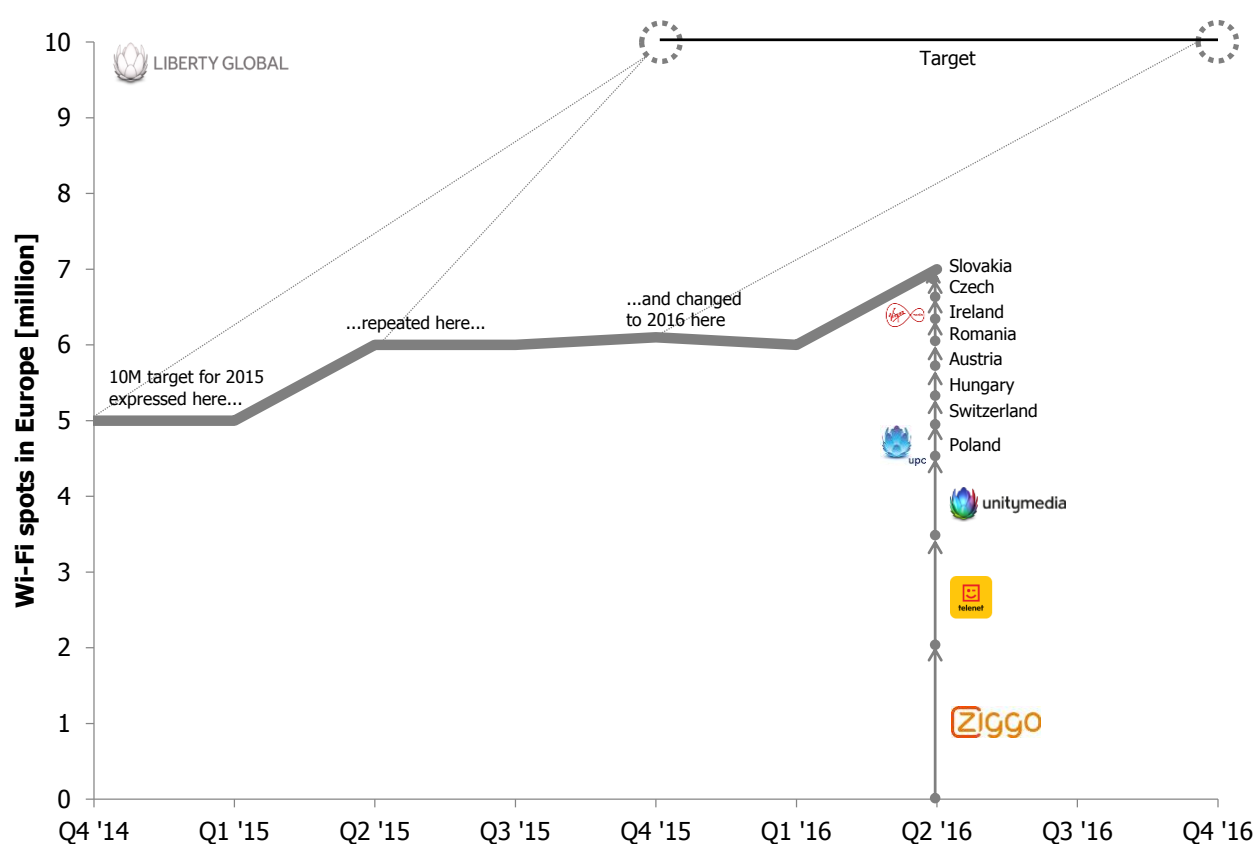


Figure 5. Liberty Global: Development in reported and targeted Wi-Fi spots – Europe

With BT “owning” the hotspot concept in the UK, Virgin Media has tested a different approach to Wi-Fi which includes being the sole wireless network in the London underground and partnerships with Sky and Arqiva when it comes to Wi-Fi hotspots around the UK. Rumours are that Virgin Media is about to launch Wi-Fi hotspots, but that technical problems have caused a delay.

Other reporting European operators without hotspots are Sky UK (formerly The Cloud), O2 UK, Swisscom, Telia and eir.

The Americas

Comcast's 15 million Wi-Fi spots is not just (by far) the highest number in the Americas, it's as shown also highest in the world. In Figure 6, we've truncated the scale to improve the visibility of the other operators.

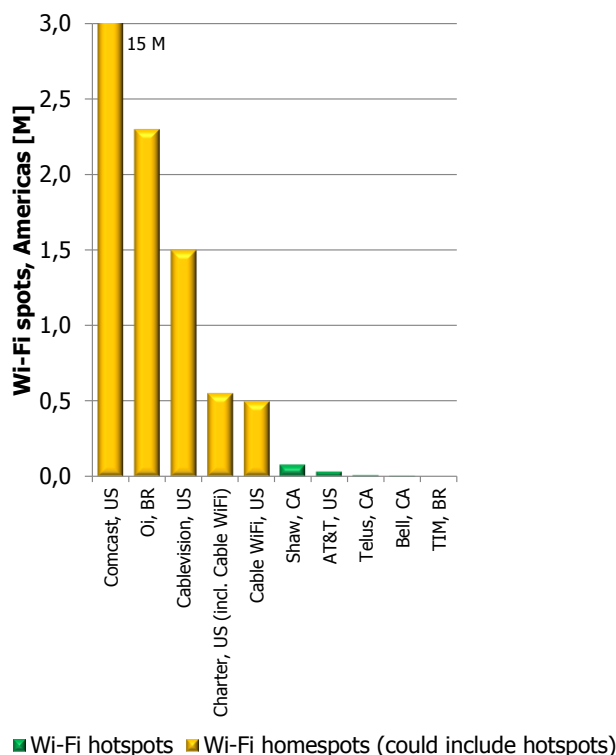


Figure 6. Reported Wi-Fi hot- and homespot numbers – Americas

Oi, the largest of Brazil's incumbents, is quickly expanding its number of homespots in cooperation with Fon. The current count is 2.3 million. Back in 2014, it was just one million.

US cableco **Cablevision** (trading under the Optimum brand name) follows with 1.5 million. Similarly to Comcast, this reported number could include Cable WiFi's 0.5 million spots. Cablevision leveraged its Wi-Fi network when launching **Freewheel**, a Wi-Fi-only service for mobile devices. We will come back to this.

Charter has through the recent acquisitions of Time Warner Cable and Bright House turned into the second largest cableco of the US. The Wi-Fi agenda of Charter is much behind that of Comcast, but the new larger Charter expresses an ambition to expand its Wi-Fi network.

Shaw, a Canadian cableco operating in the western parts of the country, has built a Wi-Fi network with 75000 hotspots. If relying on reported figures, it's the largest Wi-Fi hotspot network outside Japan and Korea. Shaw's telco competitors Telus and Bell are also having their own Wi-Fi hotspot networks, but significantly smaller.

AT&T operates 32000 Wi-Fi hotspots across the USA.

APAC & China

If there weren't hardly any green (hotspot) parts in the European and American diagrams, there are in the APAC and China chart, see Figure 7.

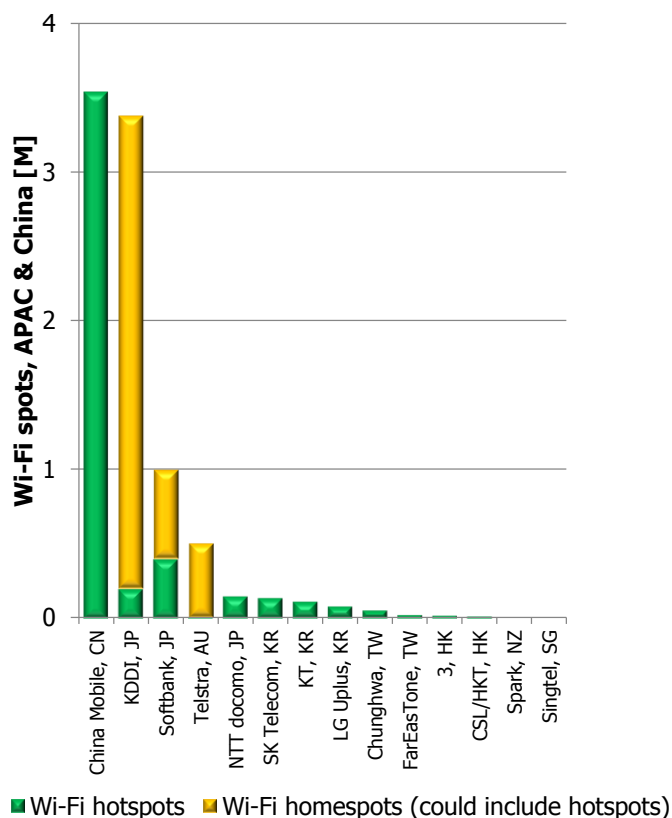


Figure 7. Reported Wi-Fi hot- and homespot numbers – APAC & China

China Mobile is, as mentioned, still likely the operator with the single largest network of Wi-Fi hotspots in the world.

The Japanese telco **KDDI** (with brand name “au”) follows. KDDI was one of the pioneers when it came to offloading mobile data to Wi-Fi⁵, but since 2014, KDDI stopped to report Wi-Fi deployment and offload figures, making us believe that progress stalled.

KDDI's competitor **Softbank** has a very large Wi-Fi hotspot network with 400000 hotspots. Softbank did previously push also homespots in partnership with Fon, but similarly to KDDI, there hasn't been any reporting on it lately.

The Japanese incumbent **NTT docomo** has, with a delay compared to KDDI and Softbank, established a Wi-Fi network of 150000 hotspots.

⁵ See e.g. our 2014 report: <http://tefficient.com/how-operators-use-wi-fi-to-strengthen-existing-business/>

We jumped over the Australian telco incumbent **Telstra** in Figure 7: The company adopted Wi-Fi quite late. Its Wi-Fi network consists of 4500 hotspots (some of which are located at phone booths, see picture) and 0.5 million homespots (in partnership with Fon) – almost all of it deployed in the last 12 months.

Also telcos in Korea, Taiwan and Hong Kong have established large networks of Wi-Fi hotspots. Hong Kong, essentially a city, is particularly well served by operators: **3** has 20000 hotspots and **CSL/HKT** 15000. Hong Kong's operators stand out positively when it comes to removing barriers between mobile and Wi-Fi with automatic authentication and offload. Unlimited Wi-Fi is included in the mobile plans of both 3 and CSL.



Public Wi-Fi usage

Many operators and regulators are today reporting mobile data traffic, see [our analysis](#). Too few operators and too few regulators are, however, reporting anything about operator Wi-Fi. We have made an effort to present stats from those that do – Hong Kong, the UK and Korea.

Hong Kong

If we start in Hong Kong, Figure 8 shows the development of:

- The number of public Wi-Fi hotspots provided by operators (upper, **grey**, line)
- The mobile data traffic (lower, **blue**, line)

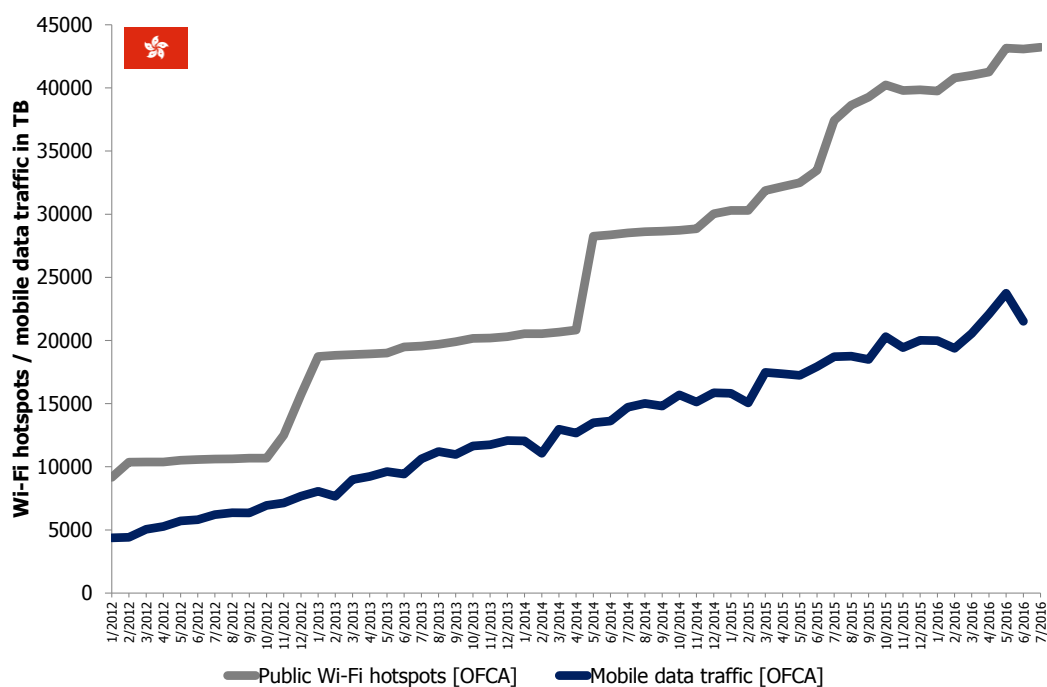


Figure 8. Development in number of public Wi-Fi hotspots and mobile data traffic in Hong Kong

Even though the number of public Wi-Fi hotspots grew significantly – from 10,000 to more than 43,000 during four years, the mobile data traffic grew – but only linearly. In most other mature markets (without a similar Wi-Fi focus from operators), mobile data would have had more of a hockey stick slope. The extensive use of Wi-Fi (for offload and indoor coverage reasons) by Hong Kong's largest operators is clearly an explanation – mobile data traffic is automatically offloaded to Wi-Fi without need for user interaction. In line with that ambition, Hong Kong's operators have also been among the first in the world with native **Wi-Fi Calling**⁶.

⁶ Read Aptilo's white paper "Seamless Next Generation Wi-Fi Calling", written by tefficient: <http://tefficient.com/wi-fi-calling-read-all-about-it/>

The UK

Ofcom of the UK is one of very few regulators to report both the number of public Wi-Fi hotspots operated by telcos⁷ as well as the traffic over these. Figure 9 compares the two.

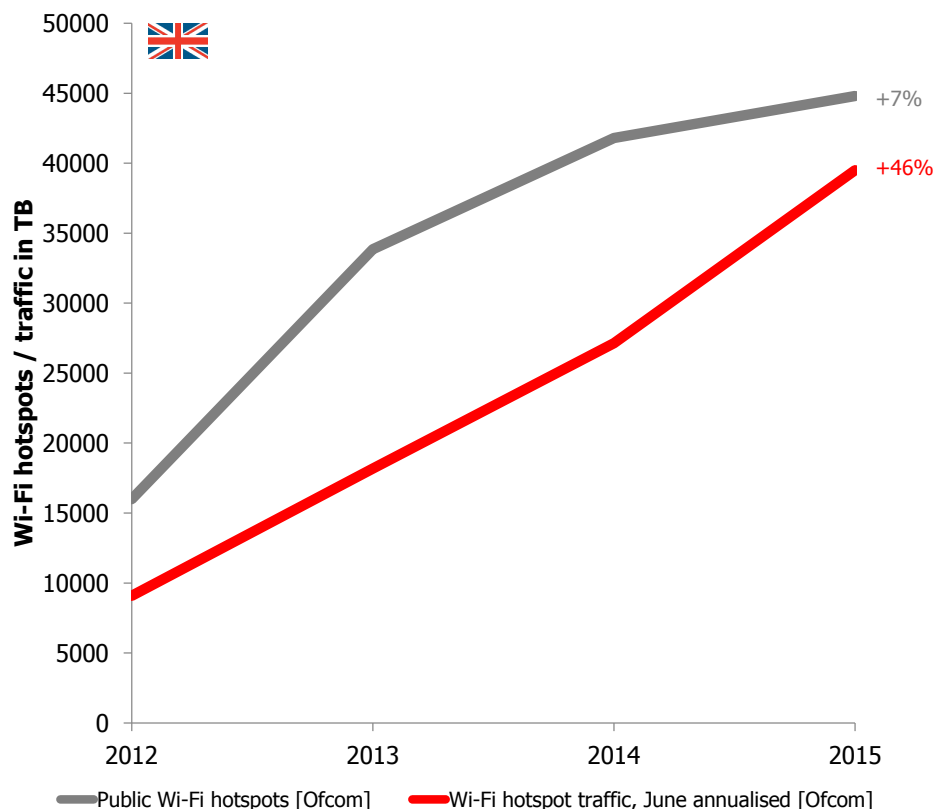


Figure 9. Development in number of public Wi-Fi hotspots and associated traffic in the UK

The number of public Wi-Fi hotspots (**grey** line) increased 7% from June 2014 to June 2015 – ending at 45,000, a number very close to Hong Kong which says something about the **lower density of hotspots in the UK**. Traffic over these hotspots (**red** line) increased significantly faster, 46%, which means that the average utilisation went up.

Figure 10 compares this Wi-Fi traffic trend to the mobile data traffic trend.

⁷ BT, KCOM, O2, Sky and Virgin Media plus Arqiva (from 2013). BT's (Fon) homespots aren't included, just the hotspots.

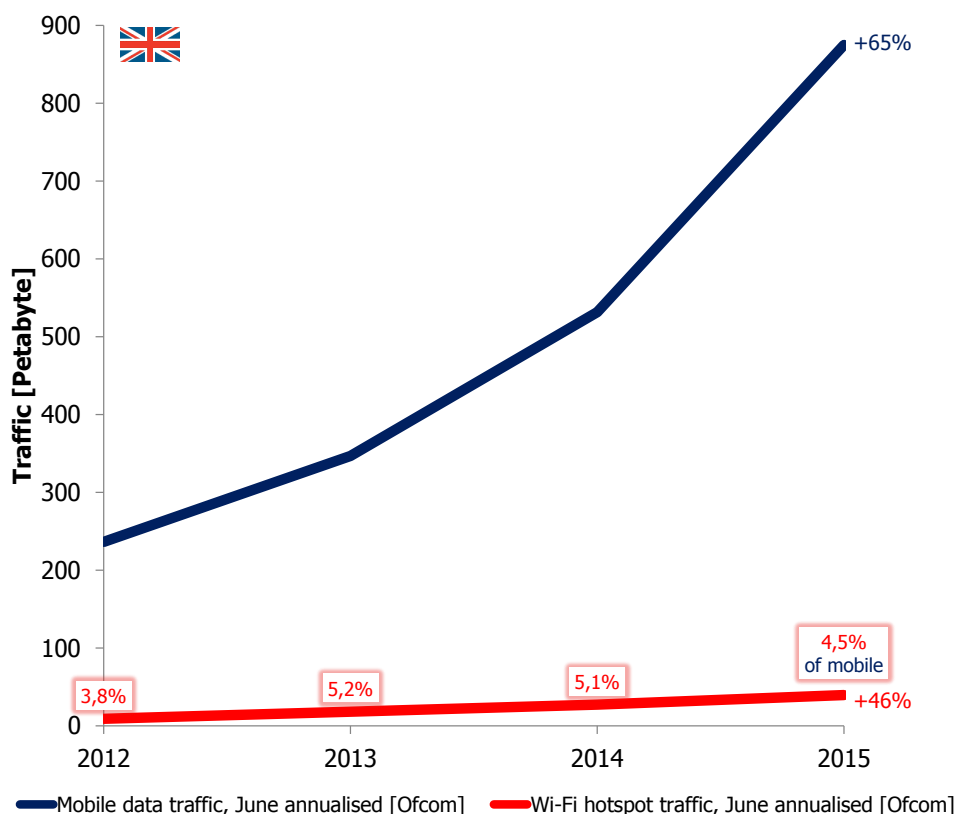


Figure 10. Development in mobile data traffic and public Wi-Fi traffic in the UK

In between June 2014 and June 2015, the mobile data traffic of the UK increased faster than the Wi-Fi traffic; 65% vs. 46%. During this year, UK operators expanded their 4G LTE networks and started to make 4G generally available in most plans.

With a few exceptions⁸, most of UK's mobile customers aren't auto-connected to operator Wi-Fi, but need to take manual action (login or download/use an app) to be. This is one possible reason to why the public Wi-Fi traffic increased at a slower rate than the mobile data traffic. The public Wi-Fi traffic represented **4.5% of the mobile data traffic** in June 2015. This was actually somewhat lower than the year before (5.1%). If the UK operators would have continued expanding the number of Wi-Fi hotspots as quickly as before, it's likely that the Wi-Fi traffic would have grown faster.

Let's for a minute return to the comparison with Hong Kong. Since it's not reported, we don't know how much traffic the Wi-Fi hotspots in Hong Kong take but it likely much more than in the UK:

- The density of Wi-Fi hotspots is very high – the landmass of Hong is less than 0.5% of UK's
- The largest mobile operators have auto-offload and have deployed a high number of hotspots (see Figure 8) – why would they if there wasn't a need?
- The mobile data traffic grows "just" linearly compared to UK's more exponential growth

⁸ O2 has started with SIM-based auto-authentication of O2 mobile customers when the entirely public O2 Wifi is available. 7000 of 13000 hotspots are currently supporting this. EE, O2 and Vodafone have started to use EAP-SIM to auto-connect customers to the Virgin Media operated Wi-Fi network in the London underground.

With its dense Wi-Fi grid and auto-offload, Hong Kong's leading operators remain relevant for customers who **seldom need to search for other networks** to satisfy a demand for either higher quality or unmetered capacity. This is true also for customers' non-SIM devices. The Wi-Fi situation has been more fragmented in the UK since Wi-Fi has been a tool for fixed operators rather than for mobile. Recent consolidation – BT's acquisition of EE and Virgin Media's acquisition of Arqiva's Wi-Fi business – might imply a change. Ofcom's numbers for June 2016 aren't expected until December – let's see if these indeed show a recovery in Wi-Fi's share of traffic.

Comcast (and the US)

The next set of figures show what an impact a significant rollout of Wi-Fi has – not only for the player doing it (Comcast in this case) but for a country as a whole given that the player is sizeable enough.

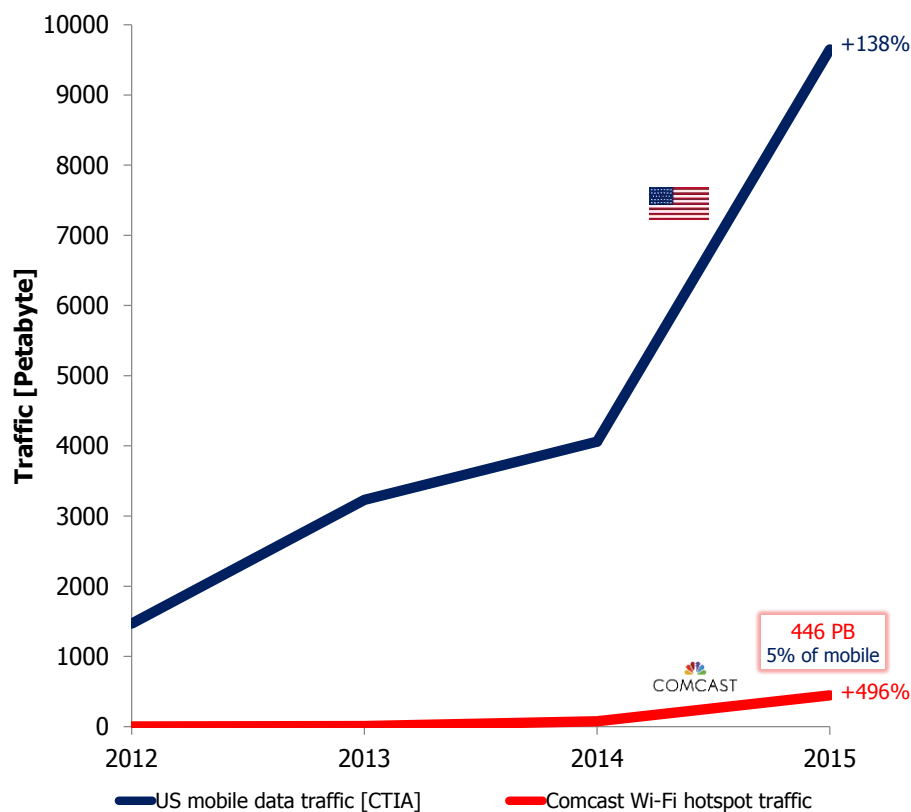


Figure 11. Development in mobile data traffic in the US and Comcast's public Wi-Fi traffic

In 2014, **Comcast** started to deploy Wi-Fi homespots on a wide scale. By the end of 2014, it had 8.3 million spots. By the end of 2015, 13.3 million. And in June 2016, 15 million. The effect on Comcast's public Wi-Fi traffic (**red** line) was obvious: In 2015 it was 446 Petabyte, up **496%** year-over-year.

Without any automatic SIM-based authentication (Comcast isn't yet offering mobile services), 446 Petabyte still represented **5% of the total mobile data traffic of the US** even though mobile traffic grew strongly in 2015.

It shows the offloading potential of massive Wi-Fi deployment – even when it's "just" hotspot-based like Comcast.

At a conference 20 September, Comcast's CEO disclosed that the company will launch its own **hybrid mobile/Wi-Fi service** by mid-2017.

Comcast's figures show the offloading potential of massive Wi-Fi deployment

Korea

Even though Korean operators were global pioneers in 4G – including early launches of LTE-A and VoLTE – and with an unprecedented lead in 4G coverage and speed⁹, Wi-Fi continues to play an important role in order to offload mobile data, but also to offer higher, combined, throughput than what 4G in isolation could offer.

Figure 12 below is based on figures from the Korean Ministry of Science, ICT and Future Planning (MSIP). In contrast to Figure 10 and Figure 11, the **red** Wi-Fi traffic line is only showing the traffic which has been *automatically offloaded* by the mobile operators to their own Wi-Fi networks.

⁹ See OpenSignal's global comparison: <http://opensignal.com/reports/2016/08/global-state-of-the-mobile-network/>

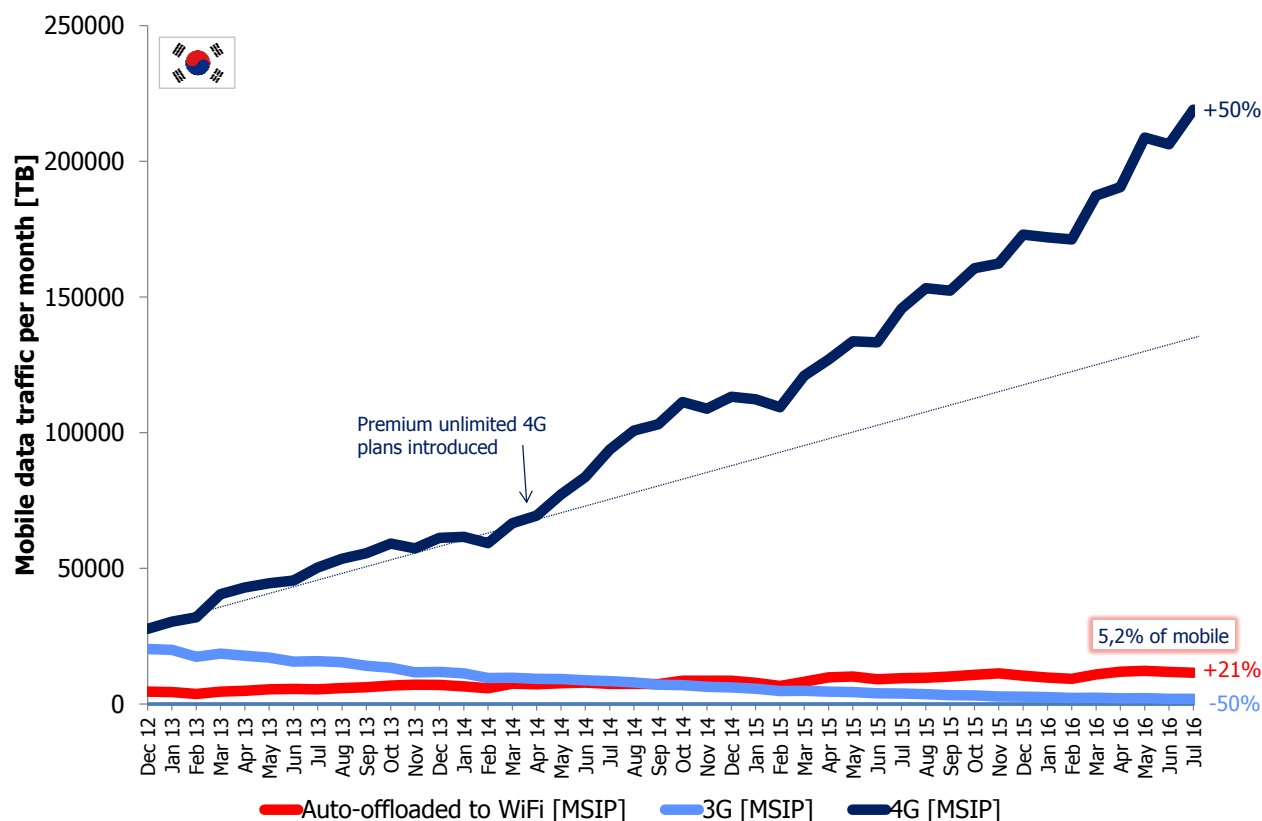


Figure 12. Development in mobile data traffic (3G, 4G and auto-offloaded to Wi-Fi) in Korea

Year-on-year (July 2015 to July 2016), the offloaded traffic grew 21% and was in July representing **5.2%** of the total mobile data traffic in Korea. Wi-Fi traffic originating from non-SIM devices – and from SIM devices manually connected to Wi-Fi – isn't included. This means that even if the 5.2% figure is similar to the figures seen in the UK and in Comcast's network, the Korean level of offloading is higher.

The 4G traffic (**blue**) grew yet faster, though: 50% year-on-year.

The automatically offloaded Wi-Fi traffic overtook the 3G traffic already late 2014 and 3G is rapidly becoming obsolete as data carrier. The importance of Wi-Fi offload increased in absolute terms since the introduction of 4G, but decreased in relative terms.

With hundreds of thousands Wi-Fi hotspot access points operated by the three Korean operators, one could perhaps expect yet more Wi-Fi offload than what Figure 12 shows. One explanation to the increase in mobile data traffic is, as often the case, the **introduction of premium unlimited plans**. It started in Q2 2014, see the arrow in Figure 12.

In Korea, unlimited means unlimited data volume but with speeds throttled after a certain cap. Let's use KT's **Olleh** as example, see Figure 13.

The increase in mobile data traffic is, as often the case, explained by the introduction of unlimited plans

olleh 

구분	월정액	데이터	
데이터 선택 109	109,890원	무제한 (30GB+일2GB+최대 5Mbps 속도제어)	Unlimited volume Full speed up to 30 GB per month 2 GB per day thereafter, limited to 5 Mbit/s
데이터 선택 76.8	76,890원	무제한 (15GB+일2GB+최대 3Mbps 속도제어)	Unlimited volume Full speed up to 15 GB per month 2 GB per day thereafter, limited to 3 Mbit/s
데이터 선택 65.8	65,890원	무제한 (10GB+일2GB+최대 3Mbps 속도제어)	Unlimited volume Full speed up to 10 GB per month 2 GB per day thereafter, limited to 3 Mbit/s
데이터 선택 54.8	54,890원	6GB (+밀당*)	} Limited volume, but with data rollover
데이터 선택 49.3	49,390원	3GB (+밀당*)	
데이터 선택 43.8	43,890원	2GB (+밀당*)	
데이터 선택 38.3	38,390원	1GB (+밀당*)	
데이터 선택 32.8	32,890원	300MB (+밀당*)	

Figure 13. Olleh's present 4G plan setup

First of all unlimited volume is only available on more premium plans. On the most premium, the speed is throttled to 5 Mbit/s once the 30 GB full-speed allowance is consumed. The two cheaper unlimited plans throttle speed to 3 Mbit/s after the cap.

Another explanation to why Korean's data usage has increased is demonstrated by the cheaper plans; Olleh has here included the possibility to **rollover** unused data which should mean that less data is voided.

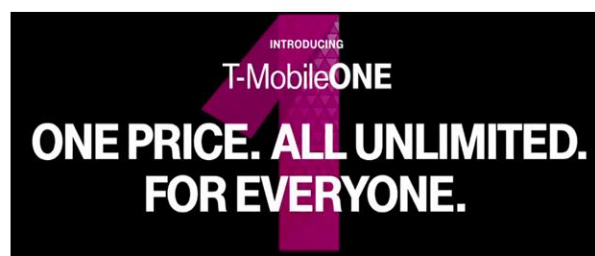
Another explanation to why 4G traffic outpaces offloaded Wi-Fi traffic in growth is that Korean operators have expanded their number of 4G sites significantly since 2013 without making a similar expansion of Wi-Fi.

Trending: Unlimited mobile data

As exemplified by the Korean case, **the comeback of unlimited mobile data** plans is a strong trend. Since unlimited data drives higher data usage, unlimited mobile data plans speak for operator-controlled Wi-Fi offload in order to handle high and increasing data volumes cost-effectively.

At the same day, 18 August, both **Sprint** and **T-Mobile** introduced their new unlimited mobile plans on the US market.

Sprint's plan is called **Unlimited Freedom** whereas T-Mobile calls its plan **ONE**.



Both Sprint and T-Mobile were previously offering unlimited options, but with the new plans, the two competitors lowered the entry price to unlimited significantly. T-Mobile's approach is more radical since T-Mobile ONE replaces all of T-Mobile's previous plans. Sprint is more careful, offering Unlimited Freedom as an option to the traditional bucket plans.

But are the plans truly unlimited? Short answer: No. Both Sprint and T-Mobile throttle video streams¹⁰ to a resolution of 480p – which is sufficient for small screens, but not for large. In both cases, customers can however buy themselves higher video resolution: 1080p costs 20 USD per month with Sprint Unlimited Freedom *Premium* whereas a T-Mobile ONE customer can increase the resolution to up to 4k for 3 USD per day or subscribe to T-Mobile ONE *Plus* which costs 25 USD more per month¹¹.

Regardless of which option a customer chooses, both Sprint and T-Mobile reserve the right to de-prioritise customers who have used more than (at present) 23 and 26 GB per month. This is quite a lot – so even if not truly unlimited, plans like this will encourage a data-spending behaviour.

Even if not truly unlimited, plans like this will encourage a data-spending behaviour



In the local US context of unlimited, it should be said that **AT&T** reintroduced an unlimited plan already in January – available solely as a bundle with AT&T's DirecTV (satellite) or U-Verse (IPTV) services. Albeit expensive, the combo plan has been a hit for AT&T who in June already had 5 million mobile customers on it.



Several European operators (in e.g. **Switzerland, Austria, Finland, Latvia** and **Lithuania**) have also reintroduced unlimited mobile data – sometimes with speed tiers or tethering limitations. And some operators like Elisa and DNA in Finland and '3' in the UK never stopped offering it in the first place.

We think unlimited mobile data will continue to gain traction in saturated mature markets since it has the potential to lift the ARPU. Even though operators will apply various tactics¹² – video-optimisation, speed tiers,

¹⁰ Sprint throttles music and game streaming as well. T-Mobile throttles tethering to 0.5 Mbit/s on the regular ONE plan whereas Sprint limits the throttling volume to 5 GB per month.

¹¹ Plus brings full speed tethering as well

¹² Often in conflict with net neutrality legislation or frameworks

fair usage policies, limitations on tethering, network-level ad blocking – mobile data traffic volumes will increase significantly. If costs shouldn't increase, it calls for **operator-controlled Wi-Fi offload**.

With unlimited mobile data, the end-user will no longer actively seek to offload to Wi-Fi so an operator offering it will have to make sure it happens automatically without user interaction.

Best practices for automatic offloading

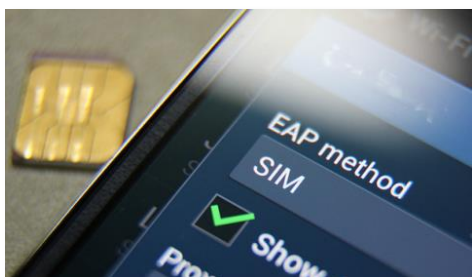
So how do you then accomplish automatic offloading to Wi-Fi? Here, mobile network operators (MNOs) or full MVNOs have a great advantage over all other type of operators or MVNOs: The HLR/HSS.

With this in place, an operator can provide **SIM-based authentication** using the EAP-SIM or EAP-AKA protocols. For SIM-based devices, there's then no need for cumbersome login procedures with passwords or for users to download, install and use a dedicated operator Wi-Fi app. It's also safer since EAP-SIM/AKA requires 802.1x which encrypts the communication (incl. the authentication data) between the device and the Wi-Fi access point.

Mobile network operators (MNOs) or full MVNOs have a great advantage

Operators without an HLR/HSS (or not using SIM-based authentication) have to rely on the end-user to take manual action: To login using a **username and password** that the operator previously shared. Even though this login typically just needs to be done once – the device will remember the password – it's apparently a hinder for many users¹³. Fewer users obviously result in lower total offload levels.

To assist, most operators without SIM-based authentication provide a **dedicated Wi-Fi app** to ease the use of the operator's public Wi-Fi. But it still requires the end-user to take action: Find the app, download it, install it – and still input the username and password before it's ready to use.



If the target is to offload as much as possible to an operator's Wi-Fi without losing control, any manual action required by end-users will lower the adoption rate and hence the total level of offloading. That's why we mean that **automatic SIM-based authentication is the best practice**¹⁴.

But not all operators covered here have it. Generally speaking, Asian operators are better at it than American and European operators. All three major operators in **Japan** and **Taiwan** are

e.g. using EAP-SIM/AKA to authenticate and connect mobile users to Wi-Fi automatically.

We highlight a few markets – France, the UK, Hong Kong and Singapore – because of certain local differences in how operators have dealt with Wi-Fi and offloading.

¹³ The support pages of non-EAP-SIM/AKA operators are full of questions from end-users on where to find the password. The need often arises when out and about, far from the password which might be printed on an operator letter at home or sent in an email which the user now doesn't have access to.

¹⁴ Not all devices have a SIM and that operators therefore still need to have authentication methods for non-SIM devices

France

Three out of four mobile operators in France have deployed sizable Wi-Fi networks, mainly consisting of homespots.

Orange has the largest network (even in Europe, see Figure 4) with 7 million Wi-Fi spots. But Orange's mobile customers aren't auto-connected to that Wi-Fi when available.



Instead, they are advised to download and install the Mon Réseau (My Network) app which, among other things, assists in finding Orange Wi-Fi spots. It doesn't actually connect to them, though: The user has to accept it each time.

SFR has 4 million Wi-Fi spots and an app called SFR WiFi. In it, the user toggles an Auto Connect WiFi button and enters an activation code which is sent as an SMS. From this point on, the device **auto-connects** to SFR's Wi-Fi using EAP-SIM.

Lastly, the best practice: **Free** with 3 million Wi-Fi spots. The mobile users aren't asked to do anything, they will simply auto-connect to Free's Wi-Fi using EAP-SIM when available. No app, no password, no passcode.


Free has less Wi-Fi spots than Orange, but likely a higher level of offloading thanks to this fully automatic setup.



The UK

BT has one of the largest Wi-Fi networks in Europe (see Figure 4). Until recently, when EE was aquired, BT didn't have a mobile network. BT instructed its fixed broadband customers to take advantage of their Wi-Fi network and save on their mobile data bills. A dedicated app helped BT customers to locate and connect to BT Wifi.

When BT launched **BT Mobile**, its MVNO offer for consumers, in March 2015, the company highlighted that it came with unlimited BT Wifi:

	<p>Data</p> <p>500MB</p> <p>BT Wi-fi</p> <p>Unlimited</p>	<p>Minutes</p> <p>200</p> <p>Texts</p> <p>Unlimited</p>	<p>£10^Δ /mth</p> <p>For non BT Broadband homes</p>
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Not being a mobile operator, BT has not used EAP-SIM/AKA to auto-connect its mobile subscribers to its Wi-Fi. In order to auto-connect, users have to install and use the BT Wifi app. Once fed with the right username and password, the app auto-connects mobile users. The procedure is the same for non-BT Mobile customers.



So far, BT has not extended the unlimited BT Wifi proposition to EE's mobile customers (even though BT now owns EE). There might be technical reasons to this – or BT will pursue a different Wi-Fi strategy from now on. It's interesting to note that **EE** – before being purchased by BT – started to use EAP-SIM to auto-connect its mobile customers. Not to any EE Wi-Fi (there isn't one), but to the **Virgin Media Wi-Fi network covering London Underground**.

It demonstrates that the Wi-Fi network doesn't need to be your own network – it can be a partner's network. Also O2 and Vodafone are using EAP-SIM to auto-connect its customers in the Underground.

Since the Virgin Media Wi-Fi network is the only available network (Wi-Fi or mobile) in the tube, this is likely leading to that operators pay more to Virgin Media than they would if the login would have remained manual. But for Londoners, the constant need to login (there's no coverage in between the stations) has been an annoyance and EE/O2/Vodafone are clearly doing this to make the commuting more convenient for customers. We think of it as a best practice.

Also customers of '3' are given access to the same Wi-Fi network, but in 3's case through a one-time login (automatic thereafter).



O2 is essentially a mobile-only operator. This didn't prevent O2 from building a fully open and free Wi-Fi network, starting in central London in time for the 2012 Olympics. That Wi-Fi network has now grown to 13000 hotspots around the UK. The motivation to why a mobile operator charging mobile data per Gbyte allows customers and non-customers to freely use a public Wi-Fi is multifaceted.

Branding is one, having a suitable proposition for venues (incl. analytics) another. O2's difficulties to find site locations in dense city areas could also have contributed; with Wi-Fi at strategically located venues, O2 could perhaps improve its network image at a low cost?

From the beginning, O2 didn't treat O2 customers any different:

They too had to login. This has though changed; **7000 of 13000 hotspots** now support auto-connect (based on SIM authentication) for O2 customers.

BT, with Wi-Fi,
doesn't use EAP-SIM

EE, without Wi-Fi,
does

Don't use your data. Use ours.

Checking emails. Uploading photos to Facebook. Watching funny cat videos on YouTube. Whatever you're into, get online for free, with over 13,000 O2 Wifi hotspots across the UK.

And if you're an O2 customer you can connect to over 7000 of those hotspots automatically - you don't even need to register. If you're not with O2, you can still register to use free O2 Wifi.

- Many O2 customers can automatically connect to over 7000 hotspots, without registering.
- It's up to 10 times faster than a normal mobile connection.
- There's no need to eat into your mobile data.



Lastly, **Virgin Media**. As mentioned, Virgin Media hasn't yet launched Wi-Fi homespots in the UK – unlike all other Liberty Global held operations in Europe. One reason might be that Liberty Global didn't acquire Virgin Media until mid-2013 and that it simply takes time. Another reason could be that BT was seen to have drained the Wi-Fi differentiation pond already. The rumour is anyhow that Virgin is about to launch homespots, but that the project is delayed.

In the meantime, Virgin partnered with Arqiva¹⁵ and Sky (The Cloud) to use their Wi-Fi hotspots – and the company built the London Underground Wi-Fi. In September 2016, Virgin confirmed the acquisition of the Wi-Fi business of **Arqiva** (with 31000 public access points). Virgin has a Virgin Media WiFi app for iOS, but not yet for Android. This app auto-connects to Wi-Fi when it has been set up.

Hong Kong

If the UK features a magnitude of Wi-Fi strategies, the two largest operators in Hong Kong have both gone for a maximum deployment and high offloading agenda.

3 is marketing its 20000 hotspot network as the largest in Hong Kong (picture to the right). Mobile customers are automatically connected to 3's Wi-Fi using EAP-SIM – no user action required (beyond enabling Wi-Fi). Unlimited Wi-Fi usage is included in the mobile data plans.



The competitor **CSL** is also having a large Wi-Fi network of 15000 hotspots. Mobile customers are also here entitled to unlimited Wi-Fi. In order to connect, a customer needs a username and password, but if downloading and using the CSL Wi-Fi app the connections can be made automatic following first setup.

Singapore

Singtel, the incumbent in Singapore, entered the public Wi-Fi space quite late. In 2014, the company presented a plan to build 1000 well-located high-speed Wi-Fi hotspots. At the same time a new plan, Combo, was launched introducing Wi-Fi on the mobile plan. Price points were raised by 3 SGD. The Wi-Fi data would, like mobile data, be capped (to 2 GB), but Singtel gave unlimited Wi-Fi allowances to June 2015. That period was later prolonged, first to 29 February 2016 and now to 31 March 2017. The number of Wi-Fi hotspots was 900 in June.



Note that Singtel has done this rollout despite a public Wi-Fi network, **Wireless@SG**, being provided by the government of Singapore. All three operators Singtel, M1 and Starhub are using EAP-SIM to auto-connect their customers to Wireless@SG. M1 and Starhub are not having any Wi-Fi network of their own. Starhub has though started a HetNet trial where Starhub's mobile users can be auto-connected to a dedicated Wi-Fi using EAP-SIM.

¹⁵ The terrestrial broadcaster of the UK

Wi-Fi Calling usage

Wi-Fi can be used to offload mobile data, but with native Wi-Fi Calling, Wi-Fi can also be used to offload mobile voice. Since both use the same IMS core, voice over LTE (VoLTE) and Wi-Fi Calling are perfect complements and both technologies offload voice traffic from circuit switched 2G/3G to a packet switched network (4G LTE or Wi-Fi).

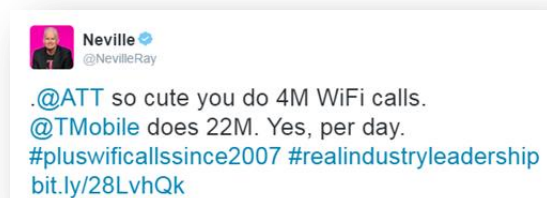
This brings potential quality benefits for the end-user, but another driver is that mobile operators can refarm 2G/3G spectrum when the 2G/3G traffic load decreases – also on voice – and instead use it for 4G LTE. This improves spectrum utilisation and, in the longer run, costs. Another obvious benefit with Wi-Fi Calling is that it can extend the coverage area for voice into those nasty corners indoors where mobile networks tend not to cover.

Read more about Wi-Fi Calling in [this whitepaper](#) that we wrote for Aptilo.

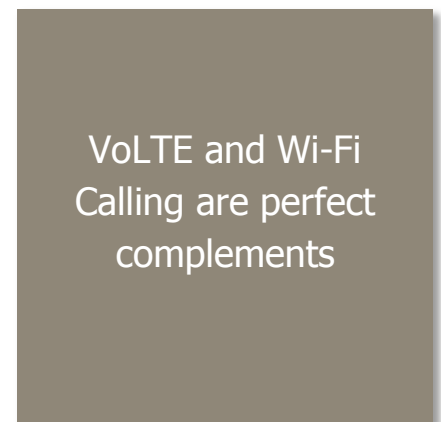
As highlighted in the Wi-Fi analysis of 2014¹⁶, **T-Mobile USA** has been the global pioneer in Wi-Fi Calling. T-Mobile is also one of the leading operators (outside of South Korea) when it comes to VoLTE adoption. A number of operators have, however, followed and introduced Wi-Fi Calling in 2015 and 2016:

- **EE**, UK
- **Rogers**, Canada
- **Bell**, Canada
- **Swisscom**, Switzerland
- **Vodafone**, UK
- **Orange**, Spain & Poland
- **3**, Sweden & Denmark
- **Telekom**, Germany
- **Telenor**, Norway & Denmark
- ... (the list is not exhaustive)

Another operator that launched Wi-Fi Calling is T-Mobile US' competitor **AT&T**: First on iOS devices – in October 2015. Then, in June this year, AT&T launched Wi-Fi Calling on its first Android device (LG G4). In conjunction with this, AT&T revealed that they carried **4 million calls over Wi-Fi** each day.



That figure spurred T-Mobile's CTO Neville Ray (see snip) to state his present figure: **22 million** calls over Wi-Fi each day.



¹⁶ <http://tefficient.com/how-operators-use-wi-fi-to-strengthen-existing-business/>

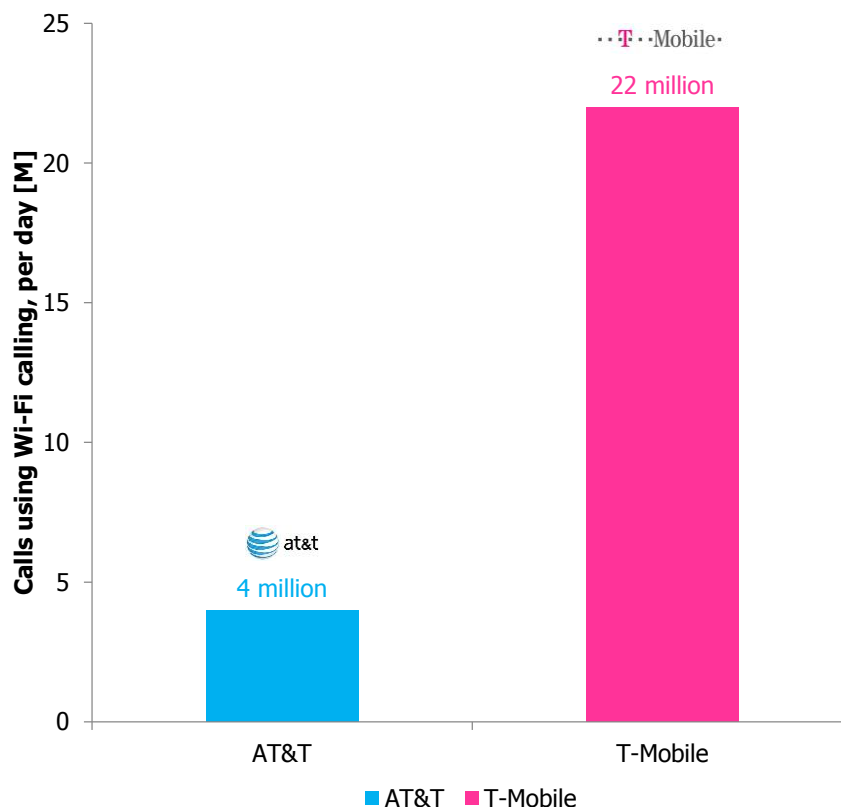


Figure 14. Number of Wi-Fi Calling calls per day, June 2016

Since AT&T has twice as many customers as T-Mobile, T-Mobile's figure is obviously more impressive. But are 22 million calls per day a lot? It depends on how you look at it. T-Mobile's CTO did, referring to 4Q 2015, mention that around **5% of all call minutes** were carried over Wi-Fi. To compare, T-Mobile's figure for VoLTE was 57% in Q2 2016.

But think of it this way: Those 22 million calls would likely not have happened that day without Wi-Fi Calling. There's no financial incentive for an end-user to use Wi-Fi Calling. Calls are charged the same. The effect on customer loyalty is, though, as important as the effect on revenue. A customer that can't call or be reached where he/she often is will be very likely to churn.

Wi-Fi Calling forgives constraints in mobile network rollout and planning.

When stating the 22 million call per day figure, T-Mobile also gave a few more figures:

- **6.5 million** customers use Wi-Fi Calling on a monthly basis
- In June, T-Mobile had nearly **44 million devices** on its network that support Wi-Fi Calling

Those 22 million calls would likely not have happened that day without Wi-Fi Calling

Best practices for using Wi-Fi to reap business benefits

We have shown that many operators continue to expand Wi-Fi networks and increase offloading levels by adding auto-connect functionality and Wi-Fi Calling. The question is why?

To increase prices

When **Singtel** included Wi-Fi into essentially all of its mobile plans in 2014, the company increased comparable price points with 3 SGD (2 EUR). This corresponds to 4% of Singtel's current postpaid ARPU. In mature markets like Singapore, ARPU is in slow decline and inclusive Wi-Fi could be used to mitigate that trend.



When Belgian cableco **Telenet** increased its fixed broadband prices in January 2015 with 2-3 EUR per month, the company motivated it with the investments done, specifically mentioning that their launch of EAP-SIM allows customers to "drastically reduce their mobile data usage".

Combo Plans

High speed WiFi with unlimited data
5x faster than regular WiFi

4G charges **waived** permanently

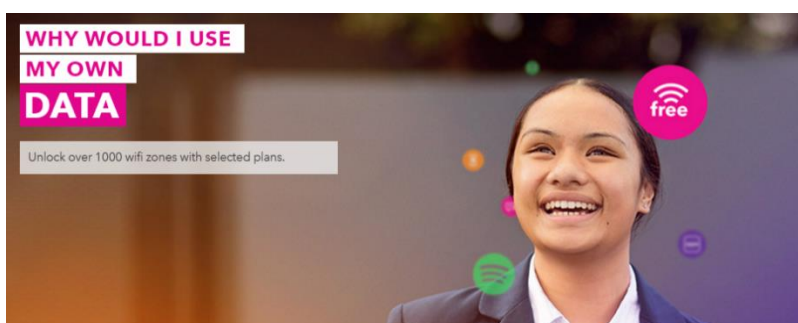
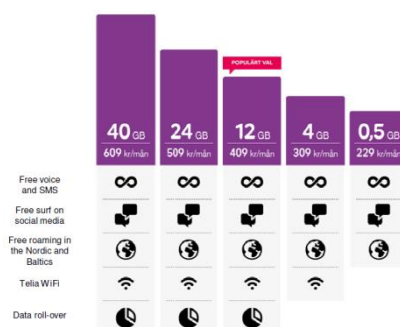
Up to **500 extra SMSes** /month

Up to **200 extra minutes** of talktime/month

To trigger upsell

Telia in Sweden today uses Wi-Fi as one of several upsell triggers in its mobile plans, see picture to the right. Unlimited access to Telia's public Wi-Fi is granted to postpaid customers – starting at the 4 GB plan. A customer on the 0.5 GB entry plan needs to pay 80 SEK (8.5 EUR) more in order to get access to Telia Wifi (and get 4 GB of mobile data).

Telia is since 2011 using EAP-SIM to auto-connect mobile users to Telia Wifi.



The way **Spark** (formerly Telecom) in New Zealand uses Wi-Fi as a mobile upsell trigger is a best practice in its simplicity.

All mobile customers, post- or prepaid, can use 1 GB of Wi-Fi data per *day* if they pay **19 NZD or more per month** (12 EUR).

A simple way to leverage Spark's Wi-Fi network with 1000 hotspots – many reused phone booths. Spark isn't yet using EAP-SIM.

The three Taiwanese operators **Chunghwa**, **FarEasTone** and **Taiwan Mobile** include Wi-Fi on more premium mobile plans. Offloading is automatic using EAP-SIM.

Proximus from Belgium uses its large network of Wi-Fi hot- and homespots to convince mobile customers to become Pack subscribers – since it's only **multi-play** customers who can access Proximus' Smart Wi-Fi. Combined with bundling discounts, it seems to work; 53% of Proximus' fixed consumer and small office customers were fixed-mobile converged in June 2016.

Surf wherever and whenever you want!

Thanks to Smart Wi-Fi, you switch automatically from 3G/4G to Wi-Fi for a stable connection without interruptions. It is completely secure and free!



Similar to Telenet, Proximus uses EAP-SIM to auto-connect to its Wi-Fi.

To attract and retain customers

Several operators are using Wi-Fi as a “**for all**” proposition, targeted to attract as many customers as possible – regardless of ARPU. And, of course, to retain them. A few examples:

T . . . Since April 2016, unlimited Wi-Fi is included in all of **Telekom**'s MagentaMobil plans in Germany. It's so far only automatic (using EAP-SIM) on some 2000 hotspots, though. Deutsche Telekom group, now deploying public Wi-Fi and homespots in most of its European integrated operations, has market-specific monetisation models – Hungary, Croatia, Romania and Greece currently all feature different methods.

Orange France and Poland have public Wi-Fi included in all (or almost all) mobile plans – but with automatic access only via an app. Also Orange France's competitors **SFR** and **Free** have chosen to include Wi-Fi on all mobile plans.



Vodafone is deploying Wi-Fi to attract fixed/cable customers, not mobile. In Germany, Spain and Italy, you need to be a fixed, cable or converged customer to get access to Vodafone's public Wi-Fi. Access requires login or app.

The Brazilian operators **Oi** and **TIM** include public Wi-Fi in postpaid and prepaid plans – if mobile data is included. Both of them auto-connect customers to Wi-Fi hotspots¹⁷ with EAP-SIM.

As mentioned, the two largest operators in Hong Kong, **3** and **CSL**, include public Wi-Fi in all plans – using auto-connect functionality.

The three Japanese operators **NTT docomo**, **KDDI au** and **Softbank** all include public Wi-Fi in all plans – using EAP-SIM for auto-connect.



Also **AT&T** has chosen to include public Wi-Fi on most mobile plans – using EAP-SIM for auto-connect.

¹⁷ Oi's Wi-Fi homespots aren't yet supporting EAP-SIM. TIM doesn't have homespots.

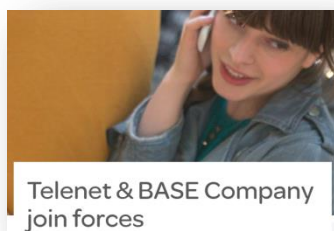
To disrupt

The Canadian cableco **Shaw** has built its public Wi-Fi network partly to disrupt the business of its fixed competitor in the west, Telus. Telus has an open-to-all Wi-Fi network with 8000 hotspots, but Shaw has 75000. These are only open to Shaw customers, though. But Shaw is also disrupting the *mobile*

business of Telus – as well as Rogers and Bell – with its savings message shown above. What's interesting is that Shaw in March 2016 acquired **WIND**, a Canadian tier-2 mobile operator which Shaw is now integrating and transforming. The question is if this will mean that Shaw in the future will tone down its disruptive message towards mobile?

Save \$50 a month on cellular data with Shaw Go WiFi*

Join the thousands of customers saving an average of 6 GB of cellular data per month just by using Shaw Go WiFi.



Supported by Wi-Fi, the Liberty Global held cableco **Telenet** was originally very disruptive in the Belgian mobile market. With more than 1 million MVNO subscriptions in a country with roughly 11 million people, Telenet has for a few years been the quickest growing mobile player. But also Telenet decided to buy a mobile operator: The ownership of **BASE** was transferred from KPN to Telenet in February. With the acquisition, Telenet gained 2 million mobile subscriptions. The MVNO subscriptions aren't on the BASE network yet; Telenet's original MVNO subscriptions will remain on the Orange network until 2018.

In August, Telenet started an ambitious rollout and modernisation program on the mobile network of BASE. The question is also here: Will Telenet be less disruptive with Wi-Fi from now on?

Ziggo in the Netherlands was also one of the Wi-Fi pioneers among cablecos in Europe. Also here, mobile operators were the focal point of Ziggo's disruption. As an MVNO, Ziggo hasn't been as successful as Telenet, though: Ziggo had 207200 mobile customers in June. The wholesale prices might have had an effect – perhaps also one reason to why Ziggo deployed Wi-Fi in the first place; to save on the MVNO bill.

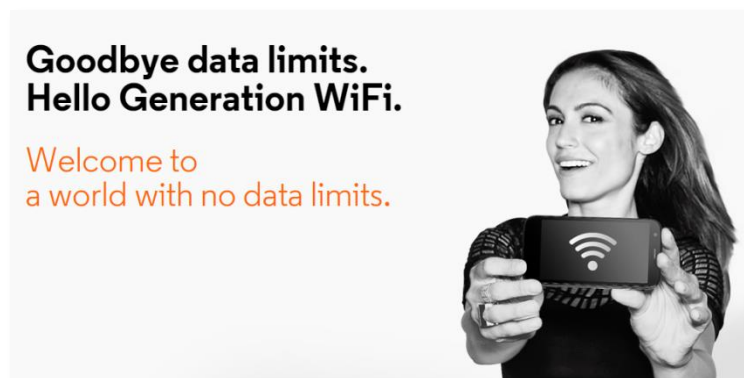
For a long time, it was rumoured that Liberty Global would buy T-Mobile, a mobile-only operator, thereby creating a parallel case to Belgium. Instead, **Vodafone** and Ziggo found each other in a 50/50 JV which recently was approved by the European Commission (subject to Vodafone selling its small fixed consumer base).

Ziggo's MVNO customers are already on the Vodafone network and it will be interesting to see if Ziggo's disruptive use of Wi-Fi will continue or gradually fade off. Unlike Telenet, Ziggo's *mobile* customers have public Wi-Fi included in their plans, see picture above.

So maybe we shouldn't expect more Wi-Fi disruption from cablecos that gradually become MNOs?

Mobiel Voldoende 4G	Mobiel Ruim 4G	Mobiel Enorm 4G	Mobiel Familie 4G
€34 €9 per maand*	€20 €15 per maand*	€30 €25 per maand*	€50 €45 per maand*
Info & opties Direct bestellen	Info & opties Direct bestellen	Info & opties Direct bestellen	Info & opties Direct bestellen
Data 200 300 MB	Data 1000 1500 MB	Data 3000 4500 MB	Data 5000 8000 MB
4G	4G	4G	4G
Belminuten 75	Belminuten 500	Belminuten onbeperkt	Belminuten onbeperkt
Sms onbeperkt	Sms onbeperkt	Sms onbeperkt	Sms onbeperkt
WifiSpots	WifiSpots	WifiSpots	WifiSpots

Cablevision, a New York-based cableco, launched a local assault on the mobile business of e.g. Verizon, AT&T, T-Mobile and Sprint when the company in February 2015 introduced its **Wi-Fi-only** service **Freewheel**.



For 10 USD per month, Freewheel users can enjoy unlimited voice, text and data – over Cablevision's Wi-Fi network in the greater New York area. Freewheel doesn't have any mobile fall-back; if there's no Cablevision Wi-Fi, there's no service.

The Freewheel customers need to have a specific Motorola handset.

Cablevision has never reported the number of Freewheel customers. Shortly

after Altice's acquisition of Cablevision (in June 2016), Cablevision declared that Freewheel was no longer available for new customers, but that the service would continue for existing Freewheel customers.

So maybe we shouldn't expect more Wi-Fi disruption from Wi-Fi only propositions either?

What incumbents without a Wi-Fi agenda rather should worry about is **Wi-Fi first**. The pioneer in this space is **Republic Wireless** in the US. Until recently, the handsets supported were, due to proprietary software, limited to a few not-so-well-known devices.

But in May, Republic Wireless added T-Mobile as its host mobile network¹⁸ and added seven new handsets to its line-up – where at least the new Samsung handsets are very well known.

What incumbents without a Wi-Fi agenda should worry about is Wi-Fi first



At the same time, Republic Wireless changed its plan structure, see picture to the right. If only considering the mobile data bundles ("Cell Data"), the price points aren't disruptive, but the point is that most users **could do with significantly less mobile data** by automatically be offloaded to Wi-Fi.

BEST VALUE				
\$15/mo	\$20/mo	\$30/mo	\$45/mo	\$60/mo
UNLIMITED Talk, Text & WIFI Data	UNLIMITED Talk, Text & WIFI Data	UNLIMITED Talk, Text & WIFI Data	UNLIMITED Talk, Text & WIFI Data	UNLIMITED Talk, Text & WIFI Data
1GB Cell Data	2GB Cell Data	4GB Cell Data	6GB Cell Data	→

¹⁸ Previously it was Sprint

Republic Wireless isn't reporting its customer base, but revenue figures indicate a customer base of in between 0.5 and 1 million.



Project Fi

Another Wi-Fi first attempt – also in the US – is carried out by a very well-known player: **Google**¹⁹. In April 2015, it launched **Project Fi**. The basic fee is 20 USD per month and each GB of mobile data is 10 USD. Unused mobile data is refunded each month²⁰.

Project Fi uses Sprint, T-Mobile and U.S. Cellular as host networks. Note that these three networks **are used interchangeably** – a Project Fi user can be on any of them depending on location: A **network of networks**. A Project Fi user needs to have a Nexus (5X, 6 or 6P) handset but BYOD (bring your own device) is fine as long as it's one of those there Nexus models. We expect that the rumoured **Pixel** phones, supposedly to be introduced 4 October, will be supported as well. To date, Google has not reported how many customers Project Fi has.

FreedomPop

Another Wi-Fi first option is provided by **Freedom Pop**. Based on a **freemium** model, a US user can consume up to 0.5 GB of data, 200 voice minutes and 500 texts per month without paying anything for that service. Higher usage is of course possible, but costs extra.

Wi-Fi plays a role in Freedom Pop's setup, but how is not really clear. There are many different premium plans, options, promotions and add-ons. In the US, Freedom Pop is an MVNO on Sprint's network. In January 2016, Freedom Pop said it had more than 1 million subscribers. In November 2015, the company expanded to Europe when launching in the **UK**, using '3' as host network. Freedom Pop has a target of 100000 users for the first year and has said that more than 50% of its UK subscribers don't pay anything. In August this year, **Spain** was added focusing on a zero-rated WhatsApp proposition.



If FreedomPop, Republic Wireless and Project Fi (albeit owned by Google) all are small, United States will soon witness the entry of a large industry player in this space of hybrid mobile/Wi-Fi services: **Comcast**. By mid-2017, the company – with 28 million customers to upsell to – will take its Wi-Fi assisted mobile proposition to market, utilising its Wi-Fi network of 15 million spots and its MVNO partnership with Verizon.

So will the telecom industry be "Ubered" by Wi-Fi first? There's yet no reported evidence of it happening, but disruptive players have been able to carve out a niche market – at least in the US. Traditional operators, with business to defend, need to relate to **public Wi-Fi as a threat and an opportunity**. The best advice is to study the best practices in this analysis and copy them.

If you don't do it, the Wi-Fi first players will.

Will the telecom industry be "Ubered" by Wi-Fi first?

¹⁹ Or, more accurately, Alphabet Inc.

²⁰ A practice Republic Wireless also had until May 2016

Conclusion

Smartphone users in almost all mature markets spend **more time on Wi-Fi** than on 3G/4G. Even with very high or unlimited mobile data allowances, Wi-Fi remains a key component of the connectivity experience of a smartphone user. [Even more so with a number of auxiliary Wi-Fi-only devices].

Facing disruption from Wi-Fi first players (whether they are start-ups, Google or cablecos), traditional operators need to **take control over the full customer experience** – including public Wi-Fi.

Some operators are already: In the midst of a growing adoption of 4G LTE and an increasing use of mobile data, our stats shows that operators deployed more Wi-Fi, not less. It also triggered more operators to enable automatic offloading of mobile data – and voice – to Wi-Fi.

Our analysis samples a number of **best practices** on how operators – technically as well as commercially – include Wi-Fi into a combined, carrier-grade, connectivity experience. The practices show how to use Wi-Fi to attract and retain customers – and to upsell.

Traditional operators
need to take control
over the full customer
experience – including
public Wi-Fi