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White Paper

Understanding today's smartphone user

An updated and expanded analysis of data-usage patterns in six of the world's most advanced 4G LTE markets

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Foreword

This discussion paper is the latest in a series on smartphone-user trends published by Informa Telecoms & Media in partnership with Mobidia. The aim of this paper, in keeping with the four previous papers – the first of which was published in February 2012 – is to harness Mobidia's extensive global dataset to create groundbreaking new research on smartphone-user behavior, particularly in light of the transition from 3G to 4G LTE that is underway in many of the world's leading mobile markets, and the parallel explosion in Wi-Fi device numbers and coverage globally. The aim is to select the most telling data from Mobidia's vast dataset to detail and interpret this key inflection point in the mobile industry, one that has service providers and vendors looking for answers as to how smartphone users are evolving and what that means for everything from LTE and Wi-Fi deployment plans to existing and new mobile revenue streams.

As with previous papers in this series, readers should be aware that the source of the primary usage data cited throughout is the Mobidia My Data Manager application, specifically end-users who have agreed to share their usage data with Mobidia on a strictly anonymous basis. The application has millions of active users across hundreds of countries, and more than half the users have agreed to share their usage data with Mobidia. That has led to a sample size of more than 100,000 end-users across the six leading 4G markets covered in this paper: the US, Canada, Japan, South Korea, Germany and the UK.

I would like to extend my sincere thanks to the team at Mobidia for their vision and dedication to producing this thought leadership and making it freely available to the industry. In particular, this project would not be possible without the support and expertise of Chris Hill, Eric Eden and Allison Lenters at Mobidia. In addition, I would like to thank Lucy Powell, Robin Marcus and Shalia Mughal at Informa for all of their hard work to create and deliver the final product.

Finally, we welcome feedback on this paper, whether that be questions, comments or suggestions for future topics and trends to explore. The evolution to LTE and parallel expansion of Wi-Fi is a huge transition that is reshaping the mobile industry, and our aim is to contribute to the industry's ability to understand and capitalize on this transition.

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Introduction

LTE is the future of the mobile industry, and in some leading markets it is also the present. The purpose of this research is to explore, quantify and interpret the behavior of smartphone users in the world's most advanced 4G LTE markets. The aim is to shed new light on these leading markets, and by extension to chart how the world's other mobile markets may develop as they make the inevitable transition to LTE services.

Another inescapable trend in the industry is the growing importance of Wi-Fi. With virtually every smartphone and tablet supporting the technology, and with network coverage exploding and usability improving daily, Wi-Fi has cemented its position as the dominant carrier of wireless data traffic, as detailed in earlier papers in this series. However, previous papers also found that the introduction of LTE might slow the growth of Wi-Fi traffic and start to tilt the balance of power back in favor of cellular, a trend that is central to operator data networks and revenues – and one that will be explored further in this paper.

It's been more than six months since Informa and Mobidia provided insights on smartphone-user behavior in LTE markets, and much has changed since then. First and foremost, the global number of LTE subscriptions has more than doubled, from 45 million in 3Q12 to 91 million in 1Q13. Although this is certainly a testament to the momentum of LTE, it also means that there is now a significant sample of Mobidia My Data Manager users in a large number of LTE markets. This development has enabled us to double the number of markets covered in our analysis from three to six, introducing coverage of Europe via the LTE markets of Germany and the UK, along with Canada, which had close to 2 million LTE subscriptions at end-1Q13. Overall, the six markets covered in this paper accounted for 92% of global LTE subscriptions at end-1Q13 (see fig. 1).

Fig. 1: LTE subscriptions, major markets, Sep-12 to Mar-13 (mil.)

Country	Sep-12	Dec-12	Mar-13
Canada	1.28	1.67	1.99
Germany	0.37	0.57	0.70
Japan	7.10	10.16	13.84
South Korea	11.72	15.81	19.60
UK	0.00	0.25	0.32
US	22.33	35.90	46.95
Total	**42.80**	**64.36**	**83.41**
Global LTE subs	45.34	69.20	90.51
Selected markets' share of global LTE subs (%)	94	93	92

Source: Informa Telecoms & Media

It should be noted that the number of LTE subscribers using the Mobidia My Data Manager application as of end-1Q13 was, naturally, larger in the much larger LTE markets of the US, South Korea and Japan, but it still reached in the hundreds and thousands in the smaller LTE markets, yielding a large enough sample for analysis.

Another note about methodology is that the sample for this paper has been limited to smartphone users running My Data Manager on the Android operating system. Although there are interesting differences in usage behavior between Android and iOS users, as detailed in previous papers, the high-level trends across the two dominant OSes are similar. In addition, the open nature of Android means Mobidia can capture more-granular usage data on Android than on iPhones and other devices running iOS. Finally, Android is now the dominant smartphone OS both globally and in the markets under study. For example, Android devices accounted for 50% of global smartphone shipments in 2011, a figure that rose to 70% in 2012, according to Informa Telecoms & Media data. This makes Android smartphone users increasingly representative of all smartphone users.

The impact of LTE on Android-smartphone data consumption

It has become something of a rule of thumb that mobile data traffic doubles every year, and network-technology vendor Ericsson recently confirmed in its Mobility Report that total global data traffic on mobile networks doubled from near 800 petabytes in 1Q12 to some 1,600 petabytes in 1Q13. But that's the overall picture, and our focus here is on end-user trends in the world's top LTE markets, which in many ways are leading indicators for the future of the mobile industry. Although it is important to note that the growth of overall mobile network traffic is driven partly by new users and devices, traffic per smartphone user is a key driver of total mobile traffic, particularly in mature markets where penetration is high and net additions are low.

With that significant qualification in mind, what does the future hold? Surprisingly, it is a world of moderate growth in data traffic on mobile networks, even though the mobile networks under study are the most advanced in the world, supporting the most advanced smartphones running the most-data-hungry applications. In other words, the old rule of thumb about

mobile data traffic doubling every year appears to be breaking in the six leading LTE markets covered in this paper. Of course, Android smartphone users are not the only source of traffic on mobile networks, but given that they represent the largest segment of end-users and account for the most monthly usage, patterns in traffic growth among Android users are likely to have a significant impact on change in total mobile traffic.

Specifically, Mobidia data reveals that for Android smartphone users, the average growth in monthly cellular data usage across the six markets studied was 1.17% between August 2012 and April 2013. Looking at individual markets, the strongest growth between August 2012 and April 2103 came in the UK, where average monthly cellular data usage rose 7.54%, to 638MB. South Korea was next, with 4.35% growth, followed by the US, with 2.03%, and Japan, with 0.16%. Both Canada and Germany saw traffic declines in the period, of 0.05% and 7.01%, respectively (see fig. 2).

What could explain such a dramatic change in the growth rates of cellular traffic? Although there are inevitably a variety of factors contributing to such high-level trends across a number of very different markets, one of the most important is the introduction and rapid adoption of tiered data plans, taking the place of unlimited plans. Service providers in leading LTE markets have often paired the launch of LTE with the introduction of tiered data plans, in attempt to re-establish a link between data traffic and revenue. Some, including Verizon Wireless and AT&T in the US, have gone farther and launched tiered data plans that can be shared across multiple devices, in a bid to encourage individuals and families to connect multiple devices to mobile networks. In the case of Verizon, the initiative is certainly working, with the operator reporting that 61% of its postpaid connections were on Share Everything tiered data plans as of end-2012.

Structural factors are another area dampening cellular-traffic growth in the six markets, given that they are mature with relatively low subscription growth, and smartphone penetration is relatively high, meaning that fewer subscribers are upgrading to more advanced devices. For example, in the US, the largest of the six markets, total mobile subscription count was up 2.7% year-on-year at end-1Q13, and smartphone penetration of the mobile market is already near 50%.

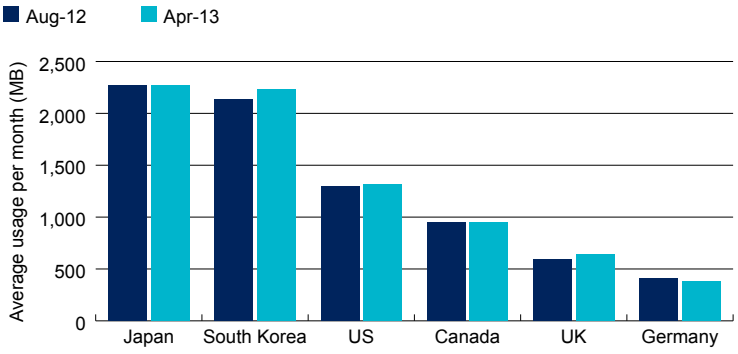
From a global point of view, it is also true that much of the growth in mobile data traffic is being driven by emerging markets, where the migration to smartphones is in full swing and net subscription additions are often still significant.

The rise of Wi-Fi across LTE and 3G devices

While earlier papers in this series have left little doubt as to the central importance of Wi-Fi for smartphone users, one of the more recent papers found evidence that the launch of LTE was turning the tide back in favor of cellular.

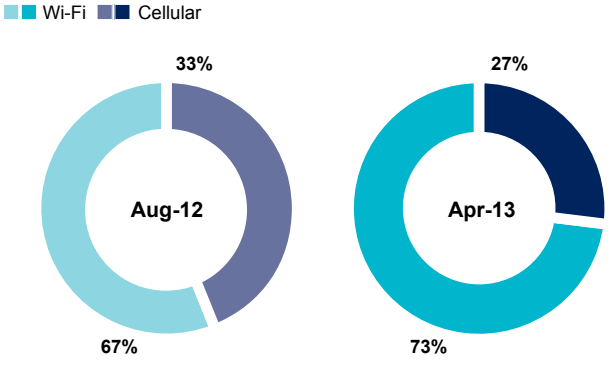
However, the latest Mobidia data clearly shows that Wi-Fi has regained its edge, with growth in Wi-Fi traffic significantly outpacing that of cellular. Across the six markets, average monthly Wi-Fi traffic jumped 35.67% in the eight months between August and March, compared

Fig. 2: Android smartphone users' average monthly cellular data use, major markets, Aug-12 and Apr-13



Note: Cellular data use only. Excludes Wi-Fi.
Source: Mobidia

Fig. 3: Percentage of data use via cellular and Wi-Fi for Android smartphone users, major markets, Aug-12 and Apr-13



Note: Figures cover Canada, Germany, Japan, South Korea, UK and US.
Source: Mobidia

with a 1.17% increase for cellular. On average across the six markets, Wi-Fi accounted for 73% of total traffic on Android smartphones in April, up from 67% in August (see fig. 3).

As we will explore later in the paper, the recent findings do not contradict those in the earlier work, but rather suggest that the behavior of smartphone users in the most advanced LTE markets is entering a new phase as LTE networks mature and tiered data plans take hold. In other words, the rising data load on LTE networks has combined with the ever-increasing coverage and usability of Wi-Fi to tilt the balance of smartphone traffic back in favor of Wi-Fi.

At the country level, Canada showed the strongest growth in average monthly Wi-Fi use per subscriber in the period, with a 62.3% increase, from 2.155GB in August to 3.498GB in April, helping explain its relatively low growth in cellular traffic. South Korea had the highest average monthly Wi-Fi usage, hitting 5.575GB per subscriber in April, compared with 2.232GB for cellular. The two European markets addressed here had the lowest average monthly usage across both cellular and Wi-Fi. Cellular usage was particularly low, at 382MB per user in Germany and 638MB per user in the UK in April, leading cellular to represent a mere 13% of total traffic on Android smartphones in Germany and 18% in the UK.

The transition from 3G to 4G – and Wi-Fi

Although the above clearly illustrates that Wi-Fi is gaining ground on cellular traffic for Android smartphone users in the six markets under study, it is important to move to another level of granularity to investigate the relative usage of Wi-Fi on 3G and 4G LTE Android smartphones, respectively.

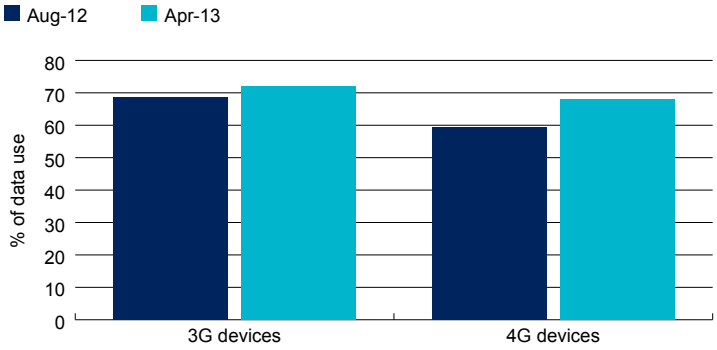
First, we compare Wi-Fi's share of traffic on 3G devices across all six markets with its share of traffic on 4G devices. Although Wi-Fi accounts for the majority of traffic on both device types, in August Wi-Fi took a significantly greater share of traffic on 3G devices than it did on 4G devices, accounting for 68.5% and 59.5% of total traffic, respectively (see fig. 4). That validates the theory that the availability of more-advanced LTE devices and networks can reduce end-users' reliance on Wi-Fi.

However, the catch is that this phenomenon looks to be fleeting rather than permanent, based on the Mobidia data from April, which shows Wi-Fi as a share of total traffic on 4G devices jumping significantly to 67.9%, up from 59.5% in August. That nine-percentage-point increase is more than twice the rise Wi-Fi saw as a share of total traffic over 3G devices, where it reached 72.2% in April, up from 68.5% in August.

In addition to the obvious draw of using free Wi-Fi networks to limit usage of relatively expensive 4G LTE services, one factor in the increasing penetration of Wi-Fi traffic on 4G devices is simply the increasing maturity of the most advanced LTE markets. South Korea is on the cutting edge of global LTE penetration, with the technology accounting for 40.3% of its total mobile subscriptions at end-March, and LTE penetration has reached significant levels in the US, Japan and Canada (see fig. 5).

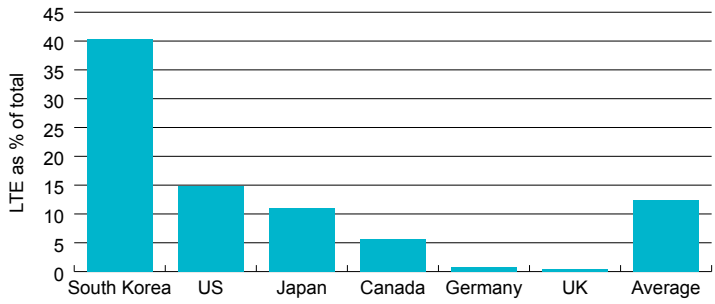
As many end-users know from firsthand experience, there is a unique period after a mobile network launches when it remains lightly loaded, meaning that a relatively small number of end-users can enjoy lightning-fast speeds rivaling

Fig. 4: Percentage of data use via Wi-Fi for 3G and 4G Android smartphone users, major markets, Aug-12 and Apr-13



Note: Figures cover Canada, Germany, Japan, South Korea, UK and US.
Source: Mobidia

Fig. 5: LTE subscriptions as % of total mobile subscriptions, major markets, Mar-13



Source: Informa Telecoms & Media

those of the newest Wi-Fi networks. But LTE networks in South Korea, the US and Japan are now seeing significant loads, particularly in major metropolitan areas, meaning that speeds faster than Wi-Fi are becoming harder to come by in those markets. This helps explain why LTE-smartphone users are more frequently seeking out Wi-Fi as the fastest available connection, and at low or no cost.

To test this theory, we look to South Korea, the most mature LTE market by far in terms of penetration. As expected, Wi-Fi use as a share of total traffic on LTE devices is on the rise, having grown from 62.1% in August to 69.9% in April, outpacing the growth in Wi-Fi traffic on 3G devices over the same period. Wi-Fi's share of data use on 3G devices remains higher, however, at 79.9% in April, up from 73.4% in August (see fig. 6).

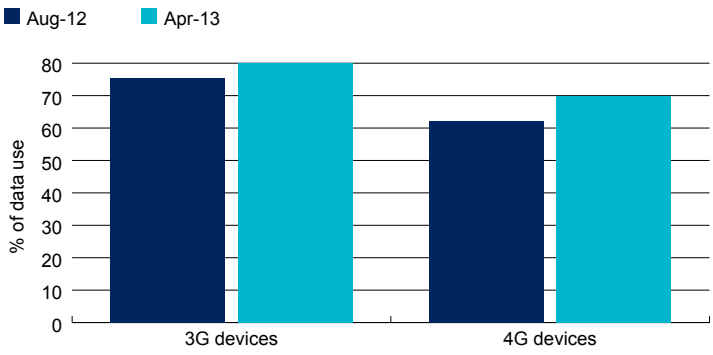
The trend seen in South Korea is replicated across the six markets tracked, but at the operator level – specifically the largest LTE operators by subscriptions in each of the six markets – we naturally see significant variations in overall Wi-Fi-traffic penetration, as well as the relative penetration of 3G and 4G devices. For example, in April, SK Telecom was in the middle of the pack in terms of Wi-Fi traffic penetration, with 75% on 3G devices and 68.6% on 4G devices, but it bucks the trend in South Korea in having higher Wi-Fi penetration on 3G devices than on 4G devices (see fig. 7).

Looking more closely at the data, SK Telecom's Wi-Fi-traffic penetration of 68.6% on 4G LTE devices is in line with South Korea's average of 69.9%, but its Wi-Fi-traffic penetration on 3G devices is much higher, at 75%, compared with the 62% average. This suggests that the difference in the figures is largely due to SK Telecom's 3G services, which are heavily loaded by virtue of the operator's success in securing 50% of the country's mobile subscriptions, well ahead of its closest rival, KT, which has a 30% share.

Space does not permit detailed analysis of all the operator data collected, but it is worth noting that Germany's Vodafone D2, which falls at the high end of Wi-Fi-traffic penetration across both 3G and 4G devices compared with top LTE operators in other markets, is actually in line with other operators in Germany, where all major operators have Wi-Fi-traffic penetration over 80% on 3G Android smartphones. This might seem surprising, given that Germany's public-Wi-Fi market is heavily regulated and thus has been slow to take off, but its private-Wi-Fi market – notably Wi-Fi used in broadband homes – has more than compensated, with Germany having one of the world's highest penetrations of Wi-Fi in homes. Features of the mobile market also come into play, of course, including Germany's relatively high mobile penetration: 131% at end-March, which tops 100% largely due to multiple SIMs and/or devices per subscriber.

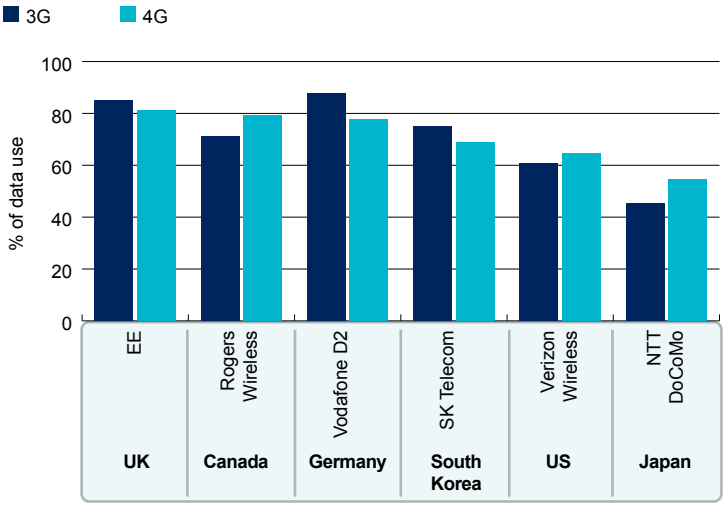
It is also interesting to note that the UK's Everything Everywhere is among the three LTE operators with higher Wi-Fi-traffic penetration on 3G devices than on 4G devices. This is in line with

Fig. 6: South Korea, % of data use via Wi-Fi for 3G and 4G Android smartphone users, Aug-12 and Apr-13



Source: Mobidia

Fig. 7: Percentage of data use via Wi-Fi for 3G and 4G Android smartphone users, selected operators, Apr-13



Source: Mobidia

the operator's recent comments that 37% of its 4G subs use less or no public Wi-Fi since getting 4G, though it is also true that the difference in Wi-Fi-traffic penetration on 3G and 4G devices is relatively small: 85% penetration on 3G devices compared with 81.2% on LTE devices. In addition, the carrier's Wi-Fi-traffic penetration across both device types is relatively high compared with those of the other carriers tracked, though its figure for 3G devices is in line with those of most other major operators in the UK, one of the world's most advanced markets for public and private Wi-Fi.

To examine Wi-Fi-traffic penetration in more detail in the LTE markets that are mature enough to have a significant sample for multiple operators, we can take advantage of a new capability in Mobidia's dataset, namely the ability to track device usage by radio interface. In other words, whereas previous analysis looked at Wi-Fi and cellular use by device type (3G or 4G), the chart that follows concerns only Android LTE smartphones, detailing share of traffic by air interface (see fig. 8). Note that only LTE and Wi-Fi are covered in the chart, not 2G/3G, so the percentages shown do not total 100%.

One of the most striking variations by both country and operator is the wide range of LTE traffic as a share of total traffic on Android LTE smartphones. KDDI in Japan has LTE-traffic penetration of 50.8% on Android LTE smartphones, and Telus in Canada has a figure of 9.1%. Of course, market structures account for some of these variations: LTE-traffic penetration is largely aligned with LTE-network coverage, which in turn depends on multiple factors, including spectrum bands and operator launch dates and rollout strategies, not to mention more basic factors, such as population density. LTE-spectrum bands alone are a significant factor, given their role in driving network capex and coverage, and by extension LTE traffic. For example, KDDI in Japan has deployed LTE in multiple bands, including 800MHz, leading to population coverage of over 90%, whereas Rogers in Canada has deployed it in the 2100MHz and 2600MHz bands, leading to significantly lower population coverage. Commercial aspects of the market also come into play, with LTE usage in Canada restricted by data tariffs that are relatively high in global terms.

Also of note in the data are variations within markets, such as the notable contrast between Verizon and AT&T in the US in terms of both LTE and Wi-Fi penetration. This is largely due to Verizon's relatively aggressive deployment and promotion of LTE, and AT&T's relatively aggressive deployment and promotion of Wi-Fi.

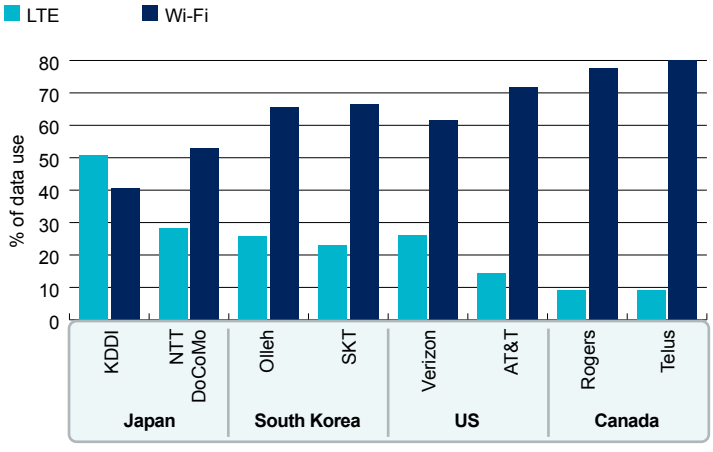
One final point is that Wi-Fi accounts for the majority of traffic on Android LTE smartphones for all the operators tracked apart from KDDI, which can be partly explained by the fact that the Japanese operator's LTE network is relatively new, having launched in September and having had only 75,000 subscriptions at end-March. The operator's sample size in this segment is therefore only in the hundreds, which is large enough to study but worth re-evaluating as it grows into the thousands, matching the sample sizes of other operators.

Understanding the distribution of Android smartphone users by data tiers

As mentioned earlier, operators have used the launch of LTE as an opportunity to introduce and/or expand tiered data plans. We now turn the analysis to the status and trends in data plans across the six leading LTE markets. Mobidia's data in this segment comes from details about data plans that end-users enter into the application so that it can help them manage usage and spending. As with all Mobidia datasets, this data is strictly anonymous and collected only from users who have granted permission.

We can use the data provided to establish a baseline of data-plan distribution by data allowance, or bucket, for 3G and 4G Android smartphone users across all markets studied. The largest number of Android smartphone users (35%) have

Fig. 8: Percentage of data use via LTE and Wi-Fi for 4G Android smartphone users, selected operators, Apr-13



Source: Mobidia

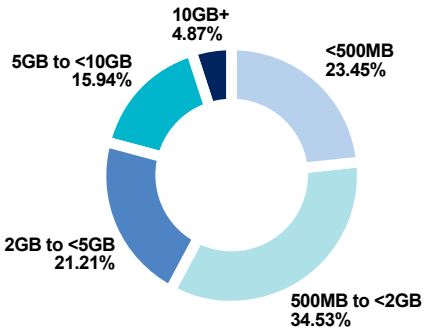
500MB-2GB plans, followed by 23% with plans offering less than 500MB and 21% on 2-5GB plans, with smaller shares for the larger plans (see fig. 9).

Operators naturally focus on moving subscribers to higher tiers, and one way to explore the opportunity to do so is to look at the percent of users who exceed their plan limit, segmented by plan bucket. As you might expect, a higher percentage of users on lower-tier plans tend to exceed their data limit: An average of 28.5% of Android smartphone users with plans offering less than 200MB went over their limit in April, compared with 9.4% of those with 5-10GB plans. There is also significant variation across markets, with the highest share of users exceeding their plan limit in South Korea, followed by Japan (see fig. 10).

Although the above data suggests that operators have been skilled in designing data-plan structures that encourage migration to higher tiers, there is also a risk that subscribers will move to lower tiers. To get a sense of this probability, we look at the percentage of Android smartphone users who used half or less of their monthly data allowance in April, segmented by plan bucket and market. The results are surprising in that on the lowest tier – less than 200MB a month – an average of 43.2% of subscribers used half or less of their data allowance. And the figure largely rises steadily as we move into higher tiers (see fig. 11).

Although this data could be taken to mean that there is a significant risk that users across all tiers might migrate to cheaper plans, it does not take into account the fact that end-users prefer plans that let them use core applications and services with some headroom for trying new things, all at a predictable monthly cost. But with the majority of end-users across six of the world's top LTE markets using less than half of their data allowance every month, operators certainly need to be aware of the potential for migration to

Fig. 9: Share of Android smartphone users by data plan, major markets, Apr-13



Note: Figures cover Canada, Germany, Japan, South Korea, UK and US.
Source: Mobidia

Fig. 10: Share of Android smartphone users who exceeded data limit by plan, major markets, Apr-13 (%)

Data plan	UK	Germany	Canada	US	Japan	South Korea	Average
<200MB	15.14	25.12	20.31	34.96	29.20	44.05	28.13
200 to 500MB	13.50	24.51	14.97	10.30	18.31	39.19	20.13
500MB to <1GB	9.98	14.21	11.88	13.35	12.50	34.38	16.05
1 to <2GB	6.69	11.11	10.53	10.45	16.67	31.51	14.49
2 to <5GB	6.54	10.00	8.59	6.58	4.65	26.43	10.47
5 to <10GB	0.00	20.00	4.33	4.26	11.87	15.97	9.41
10GB+	0.00	0.00	2.27	3.58	12.50	8.54	4.48
Average	7.41	14.99	10.41	11.93	15.10	28.58	14.74

Source: Mobidia

Fig. 11: Share of Android smartphone users who used 0-50% of data limit, by plan, major markets, Apr-13 (%)

Data plan	UK	Germany	Canada	US	Japan	South Korea	Average
<200MB	53.23	39.13	43.60	43.64	52.55	27.00	43.19
200 to <500MB	54.24	38.73	41.71	46.92	40.85	26.51	41.49
500MB to <1GB	57.62	50.42	46.15	56.08	56.25	26.27	48.80
1 to <2GB	61.31	57.64	51.28	60.76	50.98	24.98	51.16
2 to <5GB	62.15	75.00	62.03	62.85	67.99	29.19	59.87
5 to <10GB	73.68	53.33	68.85	69.28	58.94	39.73	60.64
10GB+	95.92	100.00	79.55	81.49	62.50	61.84	80.22
Average	65.45	59.18	56.17	60.15	55.72	33.65	55.05

Source: Mobidia

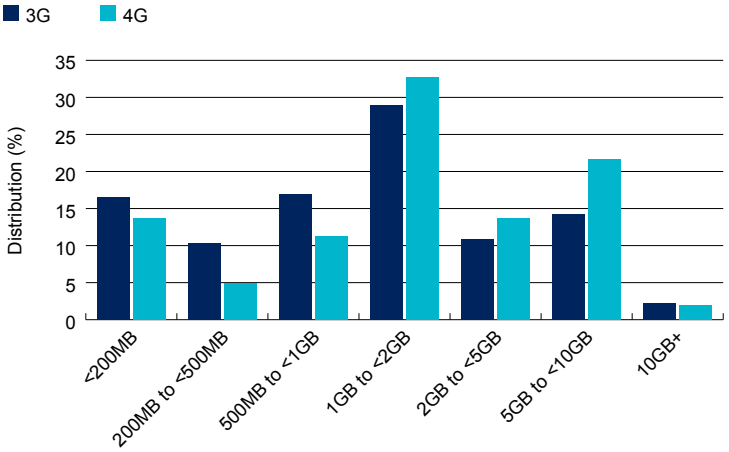
cheaper plans. This is particularly true in light of the steady rise in end-users' awareness of their data usage, via applications such as Mobidia's My Data Manager, alongside the ever-increasing opportunity to use Wi-Fi for data services. Such factors could lead end-users to move down to tiers that still cover their mobile data usage needs while leaving some room to spare.

Mobidia's data also provides clear evidence of how the introduction of LTE is helping operators boost data revenues by migrating subscribers to higher data tiers. At the country level, we can compare the distribution of data plans in Canada among 3G and LTE Android smartphone users. The result could come straight out of the business case for operator LTE deployment: LTE users have significantly higher penetration of data plans over 2GB than 3G users, and significantly lower penetration of data plans under 1GB. The largest gaps are in the 200-500MB segment, which accounts for 10.3% of 3G-smartphone plans, more than twice the 4.9% for LTE; and in the 5-10GB segment, which accounts for 21.7% of LTE-device plans, compared with 14.3% for 3G (see fig. 12).

With Mobidia's data we can extend the analysis to data-plan use by tier and device type, which paints a mixed picture of LTE's impact on the distribution of data plans. On the plus side, users of LTE smartphones tend to use a significantly higher share of their data allowance than those with 3G smartphones. For example, in the under-200MB-plan segment, LTE-device owners use an average 200% of their data allowance, up from 173% for 3G users. Similarly, in the 200-500MB tier, LTE-device users use an average 73%, compared with 43% for 3G-device users. The figures show that there is a clear incentive in both segments for LTE-smartphone users to upgrade to larger data plans (see fig. 13).

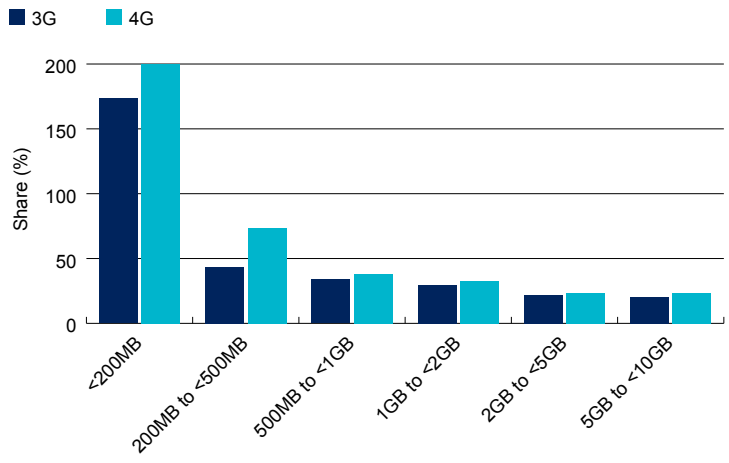
But the data also reveals that in the 500MB-1GB segment and higher, LTE has little impact on data-plan use relative to 3G. What's more, average data-allowance use for LTE devices falls to 38% in the 500MB-1GB tier and declines further to 23% in the 2-5GB tier, making subscribers in these tiers candidates for migration to cheaper plans. Of course, having a substantial base of subscribers paying for large amounts of data that goes unused can help generate healthy returns for operators, but in the long run it seems inevitable that subscribers will become more active and expert in managing their mobile data spend and usage, with the help of both operators and providers such as Mobidia.

Fig. 12: Canada, distribution of data plans for Android smartphone users, 3G and 4G devices, Apr-13



Source: Mobidia

Fig. 13: Canada, Android smartphone users share of data allowance used by plan, 3G and 4G devices, Apr-13



Source: Mobidia

Trends in application use across LTE and 3G smartphones

We now turn to applications, a huge topic in its own right but one that can be only briefly touched on in this paper. First, we provide a baseline of traffic trends for popular applications across the six markets under study, on both 3G and 4G devices. The data is presented as cellular traffic as a percentage of total traffic (cellular plus Wi-Fi) for each application, to detail each application's relative reliance on mobile networks

and how this reliance changes with the introduction of LTE.

The data reinforces what many have learned from their own smartphone usage: that certain applications are more likely to be used on the move, often out of range of Wi-Fi. Not surprisingly, Google Maps saw an average 53.5% of its usage on cellular networks in April via Android 3G smartphones, increasing marginally to 54.6% for 4G smartphones. Facebook is another classic example of an application that end-users want to access anywhere and at any time, putting it toward the top of the list, with 46.3% of traffic on cellular networks via 3G smartphones, increasing to 51.2% on 4G devices (see fig. 14).

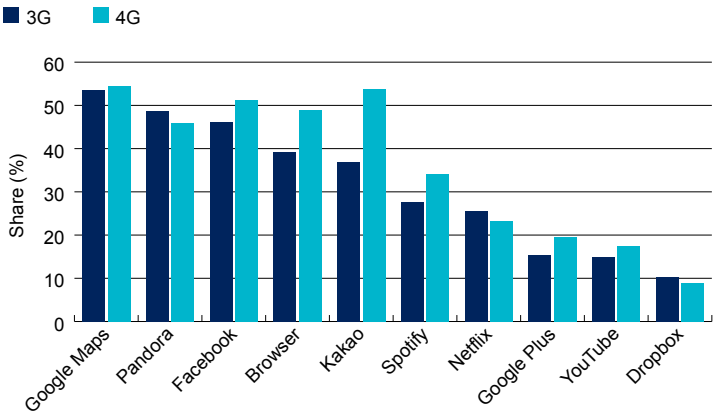
Not all applications see the same differences in cellular usage between 3G and 4G devices, but there is a pattern: Cellular traffic as a share of total traffic is higher for seven of the 10 applications studied on 4G smartphones than on 3G. It is not surprising that applications such as Web browsing and Kakao – an OTT voice-and-messaging application that is particularly popular in South Korea – see significant increases in cellular traffic on 4G relative to 3G smartphones, but it is more of a surprise that data-hungry applications such as Pandora, Netflix and Dropbox see marginal declines on 4G relative to 3G. This is most likely because such applications are as suited for stationary use over W-Fi as over cellular networks.

Looking in more depth at one of the most popular applications, the following chart details Facebook minutes of use (MOU) by market and device type, along with penetration of the application, which is defined as the number of active users of the application divided by the total number of users in that segment, such as Android 3G smartphone users in the US. The application has impressive penetration among Android 3G smartphone users in North America, the UK and Germany, where it ranges from 55-71%. That's well above the penetration rates of 26% and 41% seen in South Korea and Japan, respectively (see fig. 15).

Of even more interest is the MOU data, which brings a metric traditionally applied to circuit-switched voice into the world of applications, supporting more-detailed insights into smartphone-user behavior. In the case of Facebook across six of the leading LTE markets, one of the standout results is the jump in MOU between users of 3G and 4G smartphones. All markets see an increase, but the amount varies hugely, from 1% in Germany to 46% in South Korea, where monthly Facebook MOU leaps from 273 on 3G smartphones to 400 on 4G devices. Top in absolute usage terms is the US, which sees a monthly 523 MOU on 3G devices, increasing to 602 on 4G. This level of MOU for a single application – particularly one that provides its own voice and messaging services – helps explain why MOU for traditional voice services in the US have plateaued.

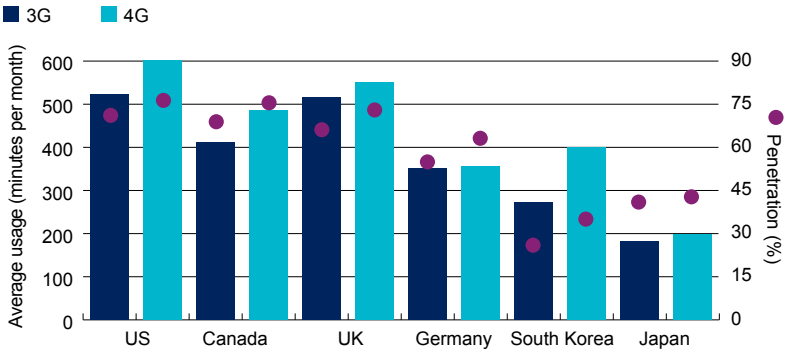
Finally we turn to Netflix, because no discussion of 3G-to-4G migration is complete without considering the impact of video traffic and the applications driving it. The impact of Netflix on fixed-broadband networks

Fig. 14: Android smartphone users, selected apps, cellular as % of total traffic, 3G and 4G devices, major markets, Apr-13



Note: Figures cover Canada, Germany, Japan, South Korea, UK and US.
Source: Mobidia

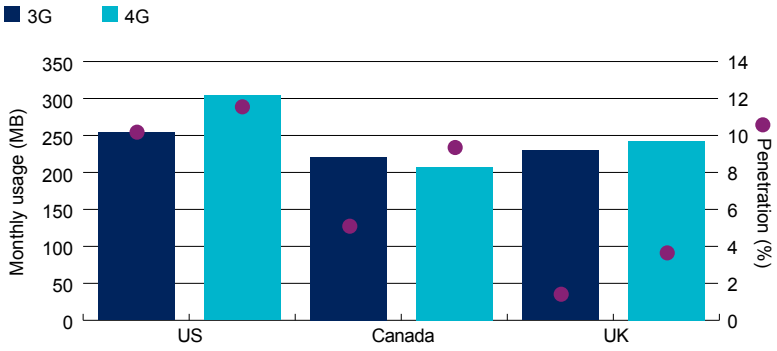
Fig. 15: Facebook penetration and avg. minutes of use per month for Android smartphone users, 3G and 4G devices, major markets, Apr-13



Source: Mobidia

has been well documented, but less is known about its impact on mobile networks. Based on Mobidia's data, it is clear that the impact is relatively limited at this stage in the US, Canada and UK, the only markets of the six tracked where the service has launched. Penetration on Android 3G smartphones ranges from 1.4% in the UK to 5.1% in Canada and 10.2% in the US, though it is higher in each market on 4G smartphones, as you might expect due to the superior data speeds and lower latency of LTE compared to 3G. It is more of a surprise that average Netflix traffic on mobile networks is 6% lower in Canada on 4G devices than on 3G, at 207MB a month. The 4G-traffic figure is 5% higher than the 3G one in the UK and 16% higher in the US (see fig. 16).

Fig. 16: North America and UK, penetration and avg. monthly cellular data use for Netflix among Android smartphone users, 3G and 4G devices, Apr-13



Note: Cellular traffic only, excludes Wi-Fi traffic
Source: Mobidia

Of course, Netflix lends itself to stationary usage, which in turn lends itself to use of Wi-Fi. In addition, end-users are understandably reluctant to stream movies on mobile data plans with usage limits, limiting the penetration and usage levels of Netflix on 3G and 4G networks.

Conclusions

- One of the most striking findings in this paper is that growth in mobile data traffic appears to be slowing in the six leading LTE markets covered in this paper – which can be taken as an indicator for the global mobile industry. Specifically, Mobidia's data reveals that for Android smartphone users, the average growth in monthly cellular data usage across the six markets studied was 1.17% in the eight months between August and April. Although many mobile operators would welcome that development – and, in fact, have actively pursued it – they now have to understand with some urgency how it will affect their mobile data strategies and revenues.
- Wi-Fi usage relative to cellular is accelerating, with Wi-Fi accounting for 73% of total traffic in April on Android smartphones across the six markets, up from 67% in August. This raises the question of how high Wi-Fi traffic penetration can go on smartphones, and how fast – and the impact this will have on the cellular-data business.
- Wi-Fi traffic is making inroads on LTE smartphones at an even faster rate than it is on 3G smartphones, rising from 59.5% of total traffic in August to 67.9% in April. The increase in penetration was more modest on 3G devices, though it started from a higher base: 68.5% in August, rising to 72.2% in April. The clear implication is that the migration to 4G does not solve the Wi-Fi challenge – if anything, it amplifies and accelerates it. Although some service providers have tackled Wi-Fi and looked at ways to integrate it into their strategies, many others have not – and this research shows that time is not on their side.
- The analysis of Android smartphone user distribution by data tiers finds that the move to tiered data plans is a double-edged sword for service providers. On one hand, tiered plans have re-established a link between data traffic and revenues and provided an engine for boosting data revenues by encouraging smartphone users to move to higher tiers as their usage increases. On the other hand, the research finds that most smartphone users in most tiers use less than half of their data allowance every month, indicating a risk that they will move to lower tiers with lower prices.
- The presence of LTE is clearly encouraging smartphone users to move to higher tiers, based on analysis of one of the leading LTE markets. But for users with 1GB data plans and over, 4G-smartphone users are similar to 3G users in that they use a third or less of their data allowance per month. In other words, LTE does not eliminate the risk that end-users will migrate to lower data tiers. This is particularly true in light of the increasing use of Wi-Fi.
- Mobidia's data reveals that some applications are benefiting more than others from the migration from 3G to 4G smartphones. Operators would be wise to gain further insight on the applications driving both minutes of use and traffic on their mobile networks, with Google Maps and Facebook being classic examples. Initial evidence also indicates that video applications such as Netflix have limited penetration on mobile networks across both 3G and 4G smartphones, with end-users reserving the bulk of their usage for Wi-Fi networks.

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Mobidia develops and delivers intelligent, client-based solutions for enhancing wireless data with leading mobile operators around the world. Mobidia's popular My Data Manager application has been downloaded over 1.4 million times by subscribers around the world looking to better manage their mobile data usage and data plans. Mobidia offers a white-labeled version of the application to mobile operators for customizing to increase subscriber satisfaction and decrease care costs, to increase the efficiency of up selling and cross-selling promotions, and to develop a unique view of usage trends across cellular, roaming, and Wi-Fi networks. A cloud-based architecture allows for integration with back end billing and analytics systems.

Mobidia is headquartered in Vancouver, British Columbia with local presence in the U.S., Europe and Asia. For more information, visit www.mobidia.com or call 604-304-8640