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Understanding today's smartphone user: Demystifying data usage trends on cellular & Wi-Fi networks

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Foreword

Informa Telecoms & Media chose to participate in this report because we firmly believe the data shared by Mobidia contains valuable new insights into global smartphone usage trends. We consider the analysis that follows to take a significant step in advancing discussion in this area of critical interest to the telecoms and media industries.

The emergence of on-device metering applications, such as Mobidia's My Data Manager, has enabled the capture of data at levels of granularity that have not been possible until now. This report will shed new light on total smartphone-originated traffic demand and, critically, present a complete view of usage behavior trends across cellular networks in domestic and roaming scenarios and through Wi-Fi-based access. This is, to the best of our knowledge, the first time that a holistic view of user behavior across all three principal aspects of wireless access has been presented.

Extracting the core value from data of this level of granularity is inevitably an iterative process and, by working in partnership with operators and other players such as Informa, Mobidia will continue to build upon the insights presented in this initial white paper to help unlock even more value for the industry.

Informa strongly believes that the trends outlined within this report are of major relevance to readers and can be used to derive meaningful and robust insights into the evolving usage behavior of today's smartphone user. It is important to note, however, that Informa has analyzed and interpreted the Mobidia-collated data used in this report with a sensitivity to and understanding of the specific methodology used to collect the data.

The data is based solely upon active users of Mobidia's My Data Manager application. As more than 600,000 users globally have downloaded the application and more than 30% of active users have agreed to share data with Mobidia on a strictly opt-in and anonymous basis, the sample represents a statistically significant and growing class of users that are data-usage-sensitive and savvy enough to use a dedicated application to monitor their daily data usage. This class of users does not necessarily represent today's entire mass-market smartphone user base, but Informa believes this is a significant and growing proportion of the overall smartphone population.

The sample collected refers only to smartphone users on the Android platform and does not include an analysis of users of other smartphone platforms, the users of which could display usage behavior that varies from those outlined in this report. Finally, the data refers to smartphone data usage during the month of January 2012 only and may therefore display some level of seasonal bias.

Informa and Mobidia will happily provide, upon request, additional details on the methodology and underlying data used in this report.

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The emergence of yield management strategies for data

Smartphone adoption is the key enabler to unlocking the single largest revenue opportunity for mobile operators today. The provision of connectivity to mobile phone users in the form of monthly integrated or standalone data plans and prepaid top-ups generated more than US$110 billion in service revenues in 2011. Rising smartphone penetration rates and the successful attachment of data plans to those devices will grow the value of small-screen access revenues to operators to more than US$230 billion by 2016, according to Informa Telecoms & Media forecasts.

Building small-screen access revenues into a US$100 billion annual market is already a considerable achievement, but today's mobile data market is arguably still in the early stages of development. Indeed, Informa argues that mobile data pricing models prevalent in the market today lag years behind the advanced segmentation seen in the mobile voice market. Fulfilling the industry's future growth potential by driving smartphone and data adoption into today's untapped customer segments will require operators to build an

in-depth understanding of all aspects of customer behavior to in order to deploy sustainable and profitable future pricing models. This includes the need to understand traffic demand by application, location and time of day as well as by the user's preferred means of access technology.

The transition away from unlimited data plans towards tiered pricing marks the first, but arguably the most important, step in the development of more advanced yield-management strategies designed to squeeze maximum returns from underlying demand for mobile data access. But this is just the first step in a long-term path towards more value-centric pricing.

The operator community built mobile voice services into a US$630 billion market. This growth was underpinned by yield-management techniques, adapted from lessons learned in the airline and hotel industries, that have allowed operators to develop differential pricing models for voice calls based on differences in perceived user value, including peak and off-peak, on-net and off-net, friends & family and dynamic pricing. The implementation of more complex pricing propositions has largely been possible because of the extensive

insights operators have been able to derive from the complete visibility they enjoyed of mobile voice usage patterns.

The extent of cellular-based, smartphone-originated data demand is well understood. Numerous data points released by operators, vendors and other players have accurately measured average monthly cellular consumption on smartphones. This has typically placed average monthly data usage in the range of 100-500MB per month, depending on the country or the operator in question.

It is now clear that these cellular-only numbers have significantly understated the true level of smartphone usage by excluding Wi-Fi-based usage from the numbers circulated within the industry. Informa's analysis reveals that a cellular-only measurement of user demand can understate smartphone-originated traffic by a factor of several multiples in the world's most advanced Wi-Fi markets. In the UK, data usage on cellular networks accounts for just 19% of the total smartphone-originated traffic (see fig. 3). Put another way, Wi-Fi traffic dwarfs cellular traffic in the UK by a factor of more than 4:1 in the sampled smartphone base.

Operators are acutely aware that Wi-Fi usage is well entrenched within their customers' day-to-day usage behavior, but the fragmentation of Wi-Fi hot-spot networks has rendered the accurate measurement of such usage effectively an impossible task. The implementation of network-centric analytical tools based upon deep-packet inspection engines means that a smartphone can be monitored as it moves around a cellular network, but, as soon as the smartphone connects to a Wi-Fi access point, it effectively "goes dark" and all subsequent usage becomes invisible to the operator. This paper will shed light on those dark spots and make a series

Fig. 1: Active Wi-Fi users as a percentage of total smartphone users, selected countries, Jan-12
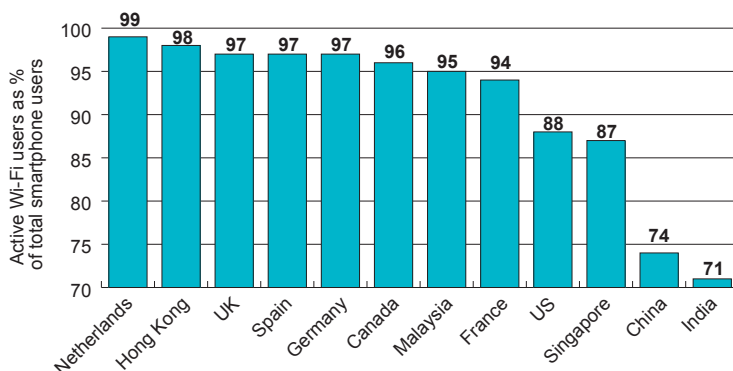
Source: Mobidia

of conclusions based upon new insights that can be derived from an holistic view of today's smartphone user.

For the first time, Informa and Mobidia are demystifying smartphone data usage across both cellular and Wi-Fi networks.

Understanding the extent of Wi-Fi usage on smartphones

The expansion of Wi-Fi into hundreds of millions of private homes and offices around the world, the deployment of more than one million public Wi-Fi hot spots by the end of 2011 and the growth of a vast and mature ecosystem built of thousands of devices has established Wi-Fi as the most heavily-used wireless technology in the world in terms of the volume of data transmitted. The low cost of integrating Wi-Fi chipsets has made it a must-have feature in every smartphone that comes to market and a rapidly-growing number of data-centric feature phones.

That Wi-Fi is an integral form of smartphone connectivity is well understood, but the extent of active Wi-Fi adoption among smartphone users has remained uncertain. The data collected by Mobidia shows that Wi-Fi usage is close to ubiquity amongst the sampled smartphone users. In the developed markets, more than 90% of sampled smartphone users also use Wi-Fi as a means of data connectivity – in Hong Kong and the Netherlands, it is over 98% (see fig. 1). A wider examination of Wi-Fi adoption on a country-by-country basis highlights that this trend is truly global. Even in the major emerging markets of China and India, seven in 10 of the sampled users also use Wi-Fi to enable smartphone data usage (see fig. 1). While the smartphone users of these two markets are undoubtedly early adopters, it
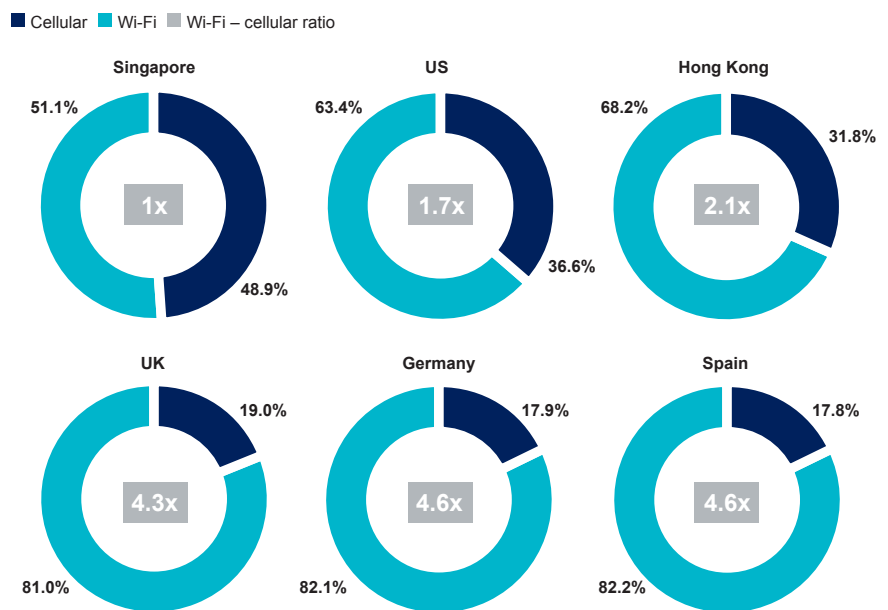
is clear that Wi-Fi will play a critical role in the lives of the smartphone generations of tomorrow in those markets. It is therefore no surprise that some of the world's largest and most ambitious carrier deployments of public Wi-Fi networks are taking place in China, India, Brazil and other emerging markets.

Just as important as understanding how many customers are using Wi-Fi, is knowing how much data those users are consuming. Within the sample user base under analysis, Wi-Fi is

the primary form of connectivity for the overwhelming majority of users and it is apparent that Wi-Fi has become firmly entrenched in day-to-day usage. On a global basis, Wi-Fi accounted for more than two-thirds (70%) of all smartphone-originated data traffic within the sample base at the beginning of 2012 (see fig. 2). This leads to many important conclusions, but uppermost must be the recognition that operators do not enjoy anything close to complete visibility on the usage of key applications on smartphones by their customers. More positively, this

Fig. 2: Global smartphone-originated data traffic distribution, Jan-12

Wi-Fi 69.6% Cellular 30.4%

Source: Mobidia

Fig. 3: Smartphone-originated data traffic distribution, selected countries, Jan-12

■ Cellular ■ Wi-Fi ■ Wi-Fi – cellular ratio

Singapore — 51.1% / 48.9% — 1x
US — 63.4% / 36.6% — 1.7x
Hong Kong — 68.2% / 31.8% — 2.1x
UK — 81.0% / 19.0% — 4.3x
Germany — 82.1% / 17.9% — 4.6x
Spain — 82.2% / 17.8% — 4.6x

Source: Mobidia

data implies that the total aggregated demand for data consumption on smartphones is vast and the potential addressable market for operators is bigger than previously estimated. Irrespective of the access technology used, each megabyte of data consumed represents an opportunity that can be turned into revenue with the right value proposition.

As one would expect, there is wide variation in the distribution of smartphone-originated traffic across cellular and Wi-Fi networks, both across countries, but also across individual operators within those countries (see fig. 3). There are a variety of factors that have an impact on the share of traffic between Wi-Fi and cellular, but the most important are the level of development of Wi-Fi in terms of private and public hot-spot density, the maturity of carrier Wi-Fi strategies, the quality of experience on cellular networks and, finally, the pricing structure of mobile data services. In countries that benchmark high in terms of in-home Wi-Fi penetration and where mobile operators have highly-evolved carrier Wi-Fi strategies, cellular usage on smartphones is dwarfed by Wi-Fi. Interestingly, in markets such as Singapore and Japan, cellular usage represents a far higher proportion

Fig. 4: UK, smartphone-originated data traffic distribution, by operator, Jan-12
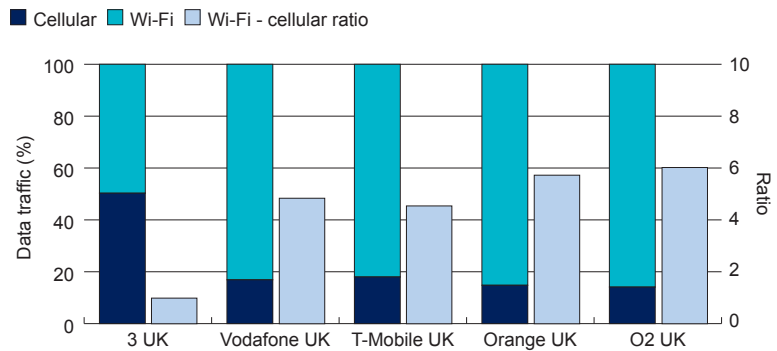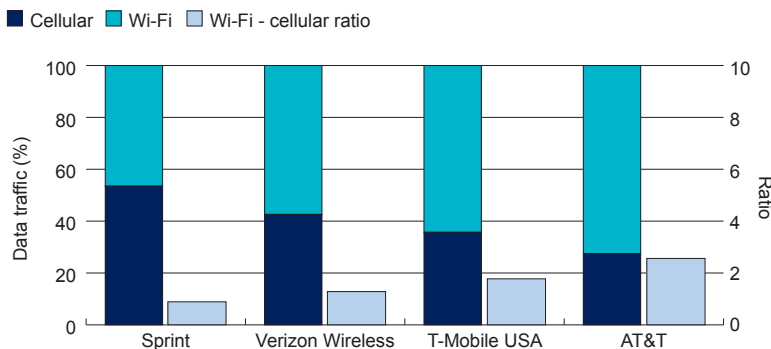

Source: Mobidia

of total smartphone traffic, which is due in part to the build-out of world-leading, advanced mobile broadband infrastructure, but, more importantly, because of the prevalence of unlimited cellular data plans or generously-sized bundles at competitive prices.

It is important not to generalize about country-level trends, because it is evident that there are subtle, but important differences in the share of traffic splits between different operators within a single market (see figs. 4 and 5). UK operator O2 and AT&T in the US, as the industry poster children of the so-called "capacity crunch era" of 2010 and 2011, have been two of the biggest proponents of driving Wi-Fi usage among their customers. The success of

these strategies is evidenced by the fact that, in their respective markets, each operator ranks highest in terms of Wi-Fi as a percentage of overall smartphone data usage. Conversely, Sprint in the US and 3 UK have not promoted Wi-Fi to their customers, preferring instead to offer competitively-priced unlimited data plans on their cellular networks. The Mobidia data clearly reflects the resulting impact of these strategic decisions on smartphone usage behavior among their customers.

There is no single right or wrong strategy when it comes to Wi-Fi, but operators must be alert to the trends across all forms of network options and must make informed, insight-led decisions based upon a deep understanding of customer trends and factors including their market position, network and spectrum holding and the overall composition of their customer base.

Whatever the share of Wi-Fi, there can be no question that users place enormous value on Wi-Fi connectivity and that there is huge overall demand for data. Informa believes that, by analyzing these trends more deeply and making decisions using the right customer insights, operators have a major opportunity to monetize overall demand more effectively, either by capturing existing data traffic "share"

Fig. 5: US, smartphone-originated data traffic distribution, by operator, Jan-12

Source: Mobidia

from Wi-Fi and migrating this to cellular networks, by stimulating additional demand through new cellular pricing models or by finding innovative ways to monetize the demand for ubiquitous Wi-Fi access; for example, by offering a differentiated experience to free Wi-Fi.

Smartphone-based application usage trends across cellular and Wi-Fi networks

The usage behavior of smartphone users varies according to their choice of access network. By analyzing variations in application-level usage trends access technologies, it is apparent that today's data-savvy customers are making deliberate and informed decisions about the applications they use, how much they use and for how long, depending on their current available forms of connectivity.
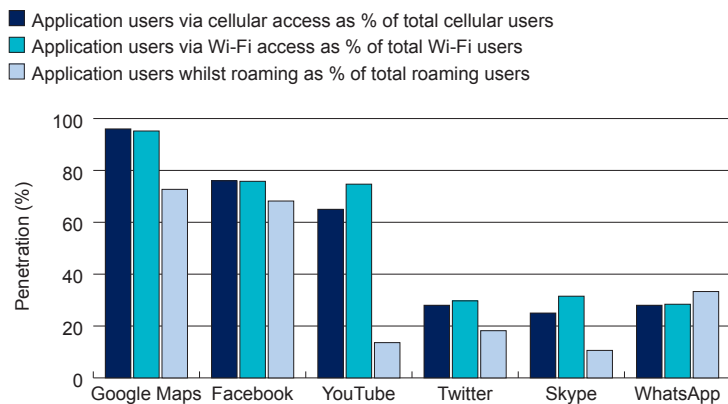
The emergence of intuitive and easy-to-use connection-management clients on smartphones is enabling customers to control connection choices based principally upon the application to be used, the cost of access or their perceptions around the quality of network experience. In the UK, for example, high-bandwidth applications such as YouTube, iPlayer and other video and audio streaming services are most popular on Wi-Fi

Fig. 7: UK, service penetration of popular applications, by access technology of smartphone users, Jan-12

Legend:
- Application users via cellular access as % of total cellular users
- Application users via Wi-Fi access as % of total Wi-Fi users
- Application users whilst roaming as % of total roaming users

Source: Mobidia

networks and are consumed at much greater intensity (see fig. 6). Other less bandwidth-intensive applications, such as Google Maps, e-mail or browsing, have similar levels of adoption across both cellular and Wi-Fi networks. But it is arguably in roaming scenarios, where the price of data access runs the risk of incurring extreme costs to the end user, that behavior is most radically different. Users are extremely cautious when roaming and typically will limit their usage on cellular networks to low-bandwidth, time-sensitive, mobile applications, such as e-mail, social networks or browsing and maps (see fig. 7).

If operators are able to understand these subtle differences in usage across different access networks, they can use these insights to build more targeted propositions for their customers; for example, to build dedicated roaming plans around popular applications, such as an unlimited e-mail plan for roaming or a data bundle with inclusive zero-rated access to popular social networks.

Crucially, it is apparent that, by analyzing data usage at this level of granularity, operators must be extremely cautious in controlling connection-management decisions

centrally from the network. As has been argued here, the users are not only very capable of making their own decisions on preferred networks, but also demand the ability to retain that level of personalized control. There are circumstances where operator-selected connections decisions enforced from the network may be appropriate, but it is clear that operators must find the right balance between user-, device- and operator-controlled network selections. The "operator knows best" assumption is flawed. Operators should focus their efforts on proactively influencing and shaping customers' decisions through their pricing, customer engagement and network-planning strategies, rather than arbitrarily imposing connectivity rules that may go against deeply-entrenched user behavior.

A key part of Mobidia's analytics proposition is the ability to examine service adoption trends at a micro-granular level. This can give the users of the data the ability to monitor the launch, adoption and usage of almost any new application across cellular and Wi-Fi networks.

WhatsApp exploded onto the scene during the first half of 2011 when Dutch incumbent operator, KPN, directly

Fig. 6: Top 5 smartphone applications by absolute traffic volumes (MB) in UK by access technology, Jan-12

Rank	Cellular	Wi-Fi	Roaming
1	Browsing	Browsing	Browsing
2	Facebook app	YouTube	Facebook app
3	Tethering	Video and audio streaming	Google Maps
4	YouTube	Downloads	E-mail
5	Downloads	iPlayer	Tethering

Source: Mobidia

attributed a material drop in its service revenues to the widespread adoption of the popular IP-based messaging service amongst its smartphone users. Ever since KPN flagged the threat of over-the-top (OTT) services to core revenue streams, the operator community has put its full force behind evaluating and, arguably, underplaying the risk to its businesses. But an analysis of WhatsApp penetration levels in various markets suggests that there could indeed be a strong risk of revenue attrition around the corner. The Dutch and Spanish markets have arguably felt the strongest impact from OTT players and this is spectacularly supported by the sheer extent of WhatsApp penetration amongst smartphone users in the sample originating from those markets. WhatsApp has surpassed the 90% level there (see fig. 8) and, although that is likely to be lower in terms of overall market penetration, the implication is unambiguous. In other major European markets and in the US, the rates of service adoption are at a much less advanced stage, but operators must still prepare themselves and develop proactive responses should adoption of OTT services like WhatsApp go viral and reach levels witnessed in markets such as Spain and the Netherlands.

This level of insight into service adoption on smartphones and understanding how they are being used on different networks will be critical for the development of future pricing, service and partnership strategies within operators. Without knowing what is happening on Wi-Fi networks, operators are vulnerable to major blind spots in the prevailing usage trends among their highest-value customers. Indeed, without such full visibility, there is a risk that the usage that today resides on Wi-Fi networks could be migrated to under-prepared cellular networks by a sudden shift in pricing or a new service proposition. This type

Fig. 8: WhatsApp service penetration by country, Jan-12
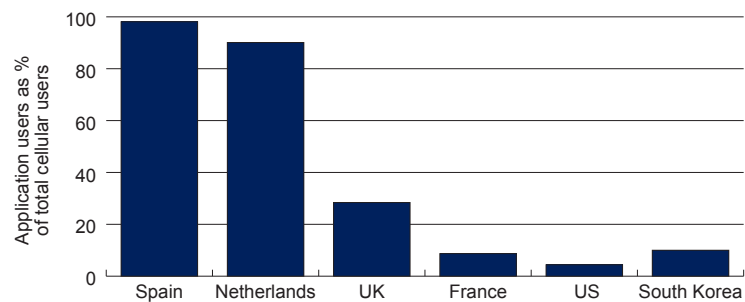
Source: Mobidia

of insight has major relevance across the entire operator business, but an immediate value can be exploited by marketing and product teams to build targeted propositions and associated pricing structures with a greater degree of confidence about the expected impact on networks or the level of customer adoption.

Informa also believes that data around application usage can be used to identify potential new partners that are reaching levels of critical mass adoption and, more importantly, to improve the negotiating position of operators when entering into potential partnership agreements with OTT players. Equally, insights into usage behavior can be used to underpin operators' own product and service development and go-to-market planning.

Mapping busy hour traffic across cellular and Wi-Fi networks

The dimensioning of busy-hour traffic is one of the most critical factors in network-planning and deployment strategy. Mobile operators build out their networks in order to ensure that the total available capacity is sufficient to ensure the network is not over-constrained and that an acceptable quality of experience is offered for

customers during the periods of peak consumption.

In order to develop a coherent Wi-Fi offload strategy, operators must understand busy-hour patterns and periods of peak demand across both cellular and Wi-Fi networks. Just as earlier analyses of cellular traffic loads highlighted different distributions of voice and data traffic flows throughout the day, there are similarly divergent trends shown in the example of smartphone-originated data traffic in the UK both between cellular and Wi-Fi networks and between weekdays and weekends (see figs. 9 and 10). Most interestingly, it is clearly demonstrated that Wi-Fi usage during weekdays is concentrated and peaks in the evenings when customers return to their Wi-Fi-enabled homes. Initial analysis also suggests that Wi-Fi has served to flatten peaks on the cellular network resulting in a much more even distribution of cellular traffic loads throughout the day – a major network-planning benefit for operators.

Data traffic is unevenly distributed throughout the day, but there is even greater variation in traffic distribution by location. It is therefore imperative that operators also crunch location-centric traffic data on cellular and Wi-Fi networks to pinpoint localized areas of peak-traffic demand. Finally, once temporal and spatial traffic distribution is understood

and variations between cellular and Wi-Fi networks have been identified, operators must also seek to examine the key applications that are driving peaks in traffic across cellular and Wi-Fi networks. This level of insight can help operators to develop targeted offload strategies that can seek to migrate traffic derived from specific applications across their various network assets to deliver it in the most profitable manner.

Based upon today's Wi-Fi traffic distribution trends, Informa believes that the migration, or offloading and onloading, of traffic share between cellular and Wi-Fi networks is primarily driven by free Wi-Fi availability in the home and the ease of device-led automatic Wi-Fi network selection. This implies that public offloading strategies still require fine-tuning, not least because the experience of discovering, selecting and connecting to these networks falls far short of users' expectations.

Going forward, there are opportunities to more proactively shift traffic flows between networks based upon new pricing models. Initially, the most obvious opportunities could be to introduce differentiated pricing for time periods of cellular network under-

Fig. 9: UK, smartphone-originated data traffic distribution by time of day (weekday), Jan-12
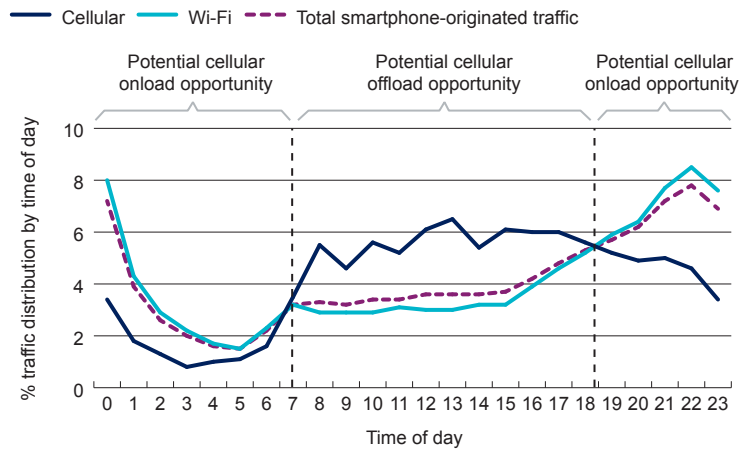
Source: Mobidia

utilization, but location-centric pricing and application-centric models will also evolve in the future as operators build more confidence about how, why and when customers use their smartphones.

The ability for operators to be able to use this data to pinpoint locations and times of peak Wi-Fi demand can also be used in more innovative ways. For example, if a network operator is able to know that a large portion of its customers access Wi-Fi networks in a specific shopping mall, the operator could proactively engage with the venue owner to build a stronger relationship

and work together to offer a wider range of incentives and promotions to use the locally-offered Wi-Fi access points; for example, by offering dedicated coupons or discounts to users in the given location.

Understanding the impact of SIM-swapping

The data captured by Mobidia has the ability to identify each time a customer swaps the SIM card within their smartphone. The phenomenon of SIM-swapping is driven by a number of factors, but the primary motivation for using multiple SIM cards is to take advantage of inherent price differentials across competing operators in domestic cellular and roaming scenarios. According to Informa Telecoms & Media data, there are more than 6 billion active mobile connections in circulation globally, but just 4.2 billion individual users of mobile services. This implies a ratio of 1.4 SIM cards per active mobile user.

Within the sample base studied in this report, there is evidence that SIM-swapping is a well-developed phenomenon, particularly in emerging markets where users are typically price-sensitive and where the largest

Fig. 10: UK, smartphone-originated data traffic distribution by time of day (weekend), Jan-12
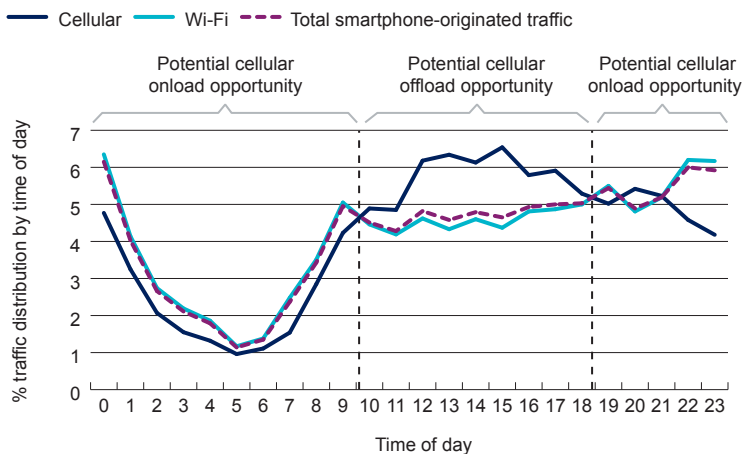
Source: Mobidia

opportunities for price arbitrage are because of on-net and off-net pricing. In markets such as Thailand and Indonesia, around 25% of total smartphone users are actively swapping their SIM cards (see fig. 11). Given that the sample data is likely to be inherently weighted towards less price-sensitive early adopters in emerging markets due to the cost of entry into the smartphone market, it is not inconceivable that the numbers could understate the overall prevalence of SIM-swapping in emerging markets.

Operators have already lost visibility of Wi-Fi and roaming data usage, but the emergence of SIM-swapping also threatens to reduce operators' understanding of domestic cellular data usage. There is already fierce competition among operators to win customers onto their network, but, in active SIM-swapping markets, operators must also compete to maximize the share of spend across a single individual's multiple cellular accounts. SIM-swapping is a source of revenue leakage within an operator because every time a user swaps the SIM card in use, it effectively "leaks" potential revenue to a competing operator.

It has heretofore been difficult for operators to build the right propositions to mitigate SIM-swapping tendencies because of the inherent lack of full transparency of the usage behavior of SIM-swappers, but it can be expected that, with a more complete picture of the customers, operators will be able to build more targeted promotions to effectively "win back" share of total usage.

Conclusions

Mobidia's data has demonstrated that the total data demand from users is far higher than previously articulated by measurements based solely on a

Fig. 11: Popularity of SIM-swapping, by country, Jan-12
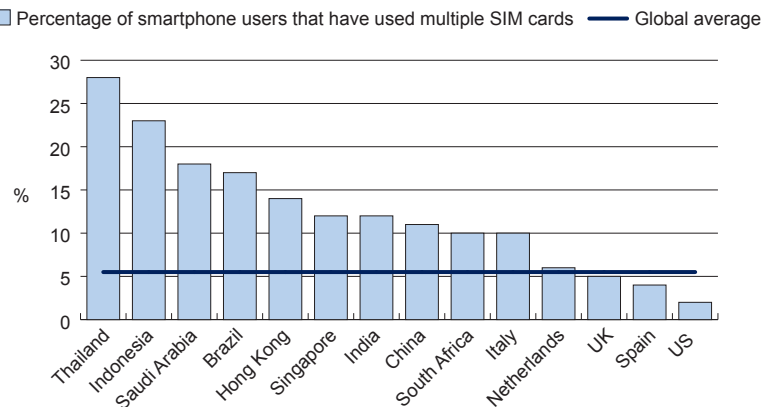
Source: Mobidia

cellular-centric view of smartphone usage. The ratio of Wi-Fi to cellular traffic varies significantly between countries, but it is clear that Wi-Fi is not only the primary form of data connectivity for an important and rapidly-growing class of smartphone user. Wi-Fi usage can exceed cellular by a ratio of more four to one.

Operators have traditionally enjoyed complete visibility of customer behavior for core voice and messaging services. However, while investments into DPI engines have helped improve the understanding of cellular data usage, Wi-Fi has been and remains a very significant blind spot for the operators. The emergence of device-centric usage monitoring can now shed light on this business-critical aspect of the smartphone market.

According to an Informa Telecoms & Media survey of operator executives, data pricing has been identified as the single most important strategy to sustainably and profitably manage data traffic growth. This strategy helps operators to understand the growing importance and application of yield-management strategies designed to squeeze maximum returns from their investments into the networks and devices that enable the mobile data ecosystem. The transition from

unlimited data plans towards tiered pricing and, in the future, towards more value-centric pricing offers significant revenue upside potential for mobile operators, but, without a complete insight into all aspects of smartphone customer behavior, operators will unlikely be able to capture the maximum return from this billion-dollar market opportunity.

Operators must invest into analytics capabilities that offer such insights and, more importantly, ensure that these are shared and taken full advantage of within all the relevant operator functions. The trends identified in this paper will resonate strongly in many important parts of the operator business, including strategy, marketing, network planning, customer care and roaming teams.

Finally, it is important to conclude that, while the value of this type of usage data to operators has been articulated in many ways and a number of recommendations for actions outlined, it is clear that this short report has only scratched the surface in terms of highlighting the significance of building a complete and granular view of smartphone usage behavior. It is inevitably an iterative process to pivot the data in ways that can enlighten the user and inform strategic decision-making and – ultimately – to make decisions that drive profit.

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ABOUT MOBIDIA

Mobidia develops software and solutions for enhancing mobile data networks. At the core of Mobidia's technology is a client-centric architecture that introduces network-edge intelligence to make mobile data networks more efficient, more profitable, and more usable. By leveraging the collective, distributed computing power of hundreds of millions of smartphones, Mobidia can enhance experiences for subscribers and lower costs and drive incremental revenue for mobile operators. Mobidia's popular My Data Manager application has been downloaded by over 600K 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, optimizing, and delivering a differentiated custom care, service promotion, and analytics solution.

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

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