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LTE Roaming: Global Market Status and Drivers for Growth

Deployment plans, vendor choices and monetization strategies

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Contents

This Informa Telecoms & Media/Tata Communications White Paper is the first of two on the LTE roaming market that cover the key challenges it faces and the opportunities arising from its development. The second White Paper, which will be published later on this year, will focus on the evolution of roaming in the face of changing technology, regulatory, and business models and the strategies operators can adopt to benefit from this nascent and fast-developing market.
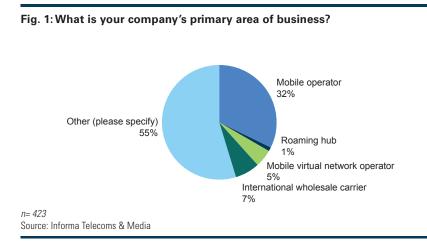
Executive summary

1 **The global mobile roaming market is at a crucial moment in its development, with a myriad of technological, strategic and regulatory forces re-shaping a market that is made even more dynamic by changing end-user behavior. Operators have a unique opportunity to capitalize on these changes and must prepare in the right way to be able to remain competitive.** With the arrival of LTE comes a new technology standard that both creates new capabilities for operators in terms of quality of experience offered to their subscribers, and at the same time also significantly increases the complexity of implementing and managing a robust roaming services in multi-technology environment . In our Industry Survey, the biggest challenges facing operators in successfully implementing LTE roaming include technical, operational and strategic issues, including inter-standard roaming, LTE steering of roaming and an expected ˝signaling storm˝. As a broad base of end users increasingly look to use a myriad of different data services when they travel, it is essential that operators have the means to offer robust connectivity and a quality of experience that replicates home-market levels. Without the right underlying technical and operational foundation in place, operators will miss the opportunity that LTE provides to offer the enhanced quality experience of mobile broadband services when subscribers travel.

2 **This paper finds that the majority of operators have yet to finalize their LTE roaming strategy as they are at the early stages of in-market LTE rollouts. There are numerous building blocks that operators need to put in place to realize the LTE opportunity, including the increased complexity and challenges that come with LTE roaming service deployment.** LTE offers operators the opportunity to streamline the number of roaming partners they have as much as it creates new service opportunities. According to the survey, 54% of operators expect to have fewer than 50 bilateral roaming partners as they evolve toward LTE, suggesting a growing role for roaming hubs as operators look to LTE to reduce roaming complexity.

3 **This paper also highlights that the mobile data roaming opportunity remains largely untapped, but is set to accelerate at an even greater rate than at present. While over 40% of survey respondents expect to see an increase of more than 30% in annual data roaming traffic over the next three years, operators must put in place the right technical and operational capabilities as well as pricing structures to be able to tap the huge latent demand for LTE roaming services.** Legacy issues surrounding ˝bill shock˝ means that many mobile travelers use mobile data much less than they do at home, representing a significant opportunity for operators to increase customer value and roaming revenues. Operators will need to continue to rethink their approach to pricing to stimulate roaming data usage if they want to encourage roaming data use and minimize the frequency that users connect to free WI-FI networks. Reducing roaming complexity while expanding roaming reach at the same time as positioning to maximize the potential of the enhanced capabilities of LTE is the considerable challenge that operators face, and is one this paper hopes to help operators meet.

The survey respondents

In May and June 2013, Informa Telecoms & Media conducted an online survey of the global telecoms industry about emerging LTE roaming trends. More than 400 responses were received, of which 188 were from operators (see fig. 1).

In terms of company types, operator respondents represented the largest percentage, illustrating their interest in the nascent LTE roaming market. There were a range of non-categorized respondents (˝Others˝), which included regulators, consultants, systems integrators, component suppliers and OTT service developers. So the LTE ecosystem is well represented in this segmentation of the respondents, especially in the number of operators that have already launched LTE or are planning to launch.

Fig. 1: What is your company's primary area of business?

Mobile operator 32%
Roaming hub 1%
Mobile virtual network operator 5%
International wholesale carrier 7%
Other (please specify) 55%

n= 423
Source: Informa Telecoms & Media

The survey respondents were distributed around the world (see fig. 2). Europe and Asia Pacific were especially strong regions, because of the early LTE rollouts there and because of the large amount of intra- and inter-regional roaming within them. LTE rollouts are taking place in the other regions, but more sporadically there.
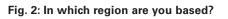
LTE roaming market status
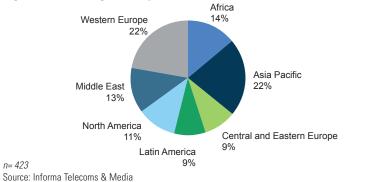
LTE market overview

LTE network launches are accelerating in all regions as operators look to increase network capacity and offer higher-speed mobile broadband access than 3G provides. Building on TeliaSonera's world first LTE launch in Sweden and Norway end-'09, there were 108 networks deployed by end-March '13. Of these launches, the majority were in Western Europe (see fig. 3).

Subscription growth is accelerating as operators build out and expand networks and also adjust LTE pricing levels to make them attractive to a broad base of users. There were 90.5 million LTE subscriptions at end-March, with the top 10 markets led by the US and Japan (see fig. 4).

LTE roaming market outlook

If we map the status of LTE roaming deployments onto forecast data-roaming growth, we see how important LTE technology is, with its greater capacity and spectral efficiency, to both enable this growth and to harness effectively it by enhancing the customer experience of using mobile data roaming.

Fig. 2: In which region are you based?

n= 423
Source: Informa Telecoms & Media

The revenues from global mobile data roaming will increase dramatically between 2011 and 2016, delivering a total CAGR of 13.4%, or approximately US$13 billion, over the period compared with approximately US$5 billion for voice roaming, according to Informa Telecoms & Media research.

The majority of service growth (in service-specific units) is expected to come from data services; the annual volume (in MB) of data services is forecast to grow by 328% over the

Fig. 3: Global LTE deployments by region, 1Q13

Source: Informa Telecoms & Media

Fig. 4: Global, top 10 LTE operators, 1Q13

Source: Informa Telecoms & Media

Fig. 5: Global, voice, SMS and data roaming traffic in service-specific units*, 2011-2016						
Roaming traffic	2013	2014	2015	2016	Increase 2011-2016 (%)	CAGR 2011-2016 (%)
Voice traffic (mins 000s)						
Global total	54,409,531	62,533,731	69,159,700	74,551,861	111.8	16.2
SMS traffic (SMS 000s)						
Global total	12,772,717	15,201,615	17,364,576	19,236,429	149.7	20.1
Data traffic (MB 000s)						
Global total	4,424,146	5,841,650	7,290,409	8,694,187	327.9	33.7
*Includes local & international voice calls, originating & terminating SMS messages, and business & consumer data						
Source: Informa Telecoms & Media						

forecast period, compared with 112% for voice services' minutes and 150% for SMS messages (see fig. 5). The developing regions show particularly high CAGR rates in relation to data traffic growth, although these regions have relatively lower starting points.

Roaming service revenues will remain dominated by voice between 2011 and 2016, but the increasing penetration of smartphones, growth in application development and dissemination of data services to customers through app stores will help to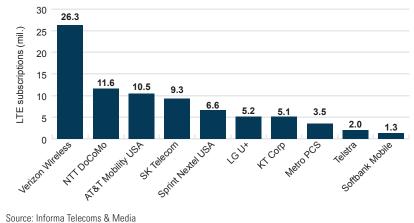 increase the share of revenues generated by data services, the only service that is expected to see growth in the coming years, according to Informa forecasts (see fig. 6).

While the economic downturn has had a considerable effect on the global roaming market, primarily by reducing the overall number of trips and also by reducing the frequency of roaming usage, the data roaming market remains largely untapped, with considerable latent demand waiting to be kindled by changes in usage behavior and operators' roaming tariffing strategies.

Market development: Strategies to increase LTE roaming usage and take-up

The high propensity to use data services in-market and the relatively low propensity to use them while roaming indicates that there is much for mobile operators to do if they are to realize the revenue potential of the roaming market, particularly in data

roaming. There is still significant latent demand among users for roaming data services from which operators could profit, and they could capture much of the roaming data use that currently goes over free Wi-Fi networks if they had the right service mix in place.

How are operators planning to approach the pricing of LTE roaming?

Under pressure from competition, regulation or a mixture of both, operators continue to reduce the amount they charge subscribers to use roaming services. During the second quarter of each year, there are a slew of operator announcements on reduced roaming rates ahead of the traditionally busy summer travelling period. A recent example of this was Swiss incumbent Swisscom sharply reducing, by as much as 70%, the prices of its mobile data roaming packages for the EU and to other destinations.

Related to the issue of the amount operators charge for roaming is how they price the services. Bundling of roaming services is becoming more widespread among some of the large multinational operating groups, with Vodafone, for example, charging a flat rate to enable subscribers to carry over

Fig. 6: Global, market shares of roaming service revenues, 2011 vs. 2016

2011

Data 36%
SMS 5%
Voice 59%

2016

Data 47%
SMS 4%
Voice 49%

Source: Informa Telecoms & Media

their home-market bundled voice and data allowances.

In terms of data, it is difficult for operators to assess whether charging per MB or using a daily rate leads to more profitable usage. After much experimentation on approaches to data roaming, an emerging trend is for operators to offer a range of roaming tariffs to meet the demands of customer segments, and, within that range, the distinct roaming demands of enterprise and consumer users. In this way, operators can offer daily data rates with a set data limit and per-GB rates for each different customer type.

Despite the regulation that caps the amount European operators can charge per MB when users travel in Europe, there is still a large disparity between operators' data rates; for instance, Vodafone UK currently offers daily data roaming in the EU at £0.69 (US$1.08) per MB, while Telenor Norway offers data access in the EU or EEA at a maximum cost of NOK29 (US$4.96) per day for 20MB.

After years of bill shock, a key emerging principle in roaming pricing is transparency. To increase roaming use, operators have to make sure that end users feel secure in knowing how much using mobile services when roaming will cost them. Some operating groups, such as Telekom in Germany and Orange, have introduced a travel app to help roamers to stay aware of how much they have used their mobile while travelling. Through awareness of mobile use, roamers are likely to use mobile services more rather than less – as long as they know how much it is costing

Fig. 7: Operators are using a lot of new types of data plan in their home market

n= 225
Source: Informa Telecoms & Media

them. Other operators, especially the large multinationals, can be expected to launch their own roaming apps as the year progresses.

To try and increase the use of data roaming with LTE, operators plan to launch a variety of new types of service plans, according to the survey: 50% of the survey respondents plan to launch application-specific plans, while almost as many plan to launch QoS-based plans to boost data roaming use and monetize traffic (see fig. 7).

There has been considerable interest in zero-rating certain applications among operators in numerous markets. The idea of zero-rated data, where content providers, rather than the mobile subscribers, pay the operator for consumers' use of their content, can be a "win-win-win" for mobile operators, content providers and subscribers.

There is considerable interest in zero-rated data in the US, with AT&T the most vocal about wanting to offer toll-free data, while Verizon and T-Mobile have also expressed interest in it. AT&T has gone as far as to survey its customers' interests in this type of data.

Outside the US, there are already some examples of zero-rated data. Facebook announced in March 2013 that it is partnering with 18 mobile operators in 14 countries to provide free or discounted data access to Facebook messaging for their subscribers. UK operator EE offers free access to film downloads as part of its tariffs without taking the data consumed out of the monthly allowance.

Approaches such as these are already shaping innovation in roaming tariffs and will do so more as operators learn what works best and what doesn't in profitably driving usage.

Service strategies: What new services will drive LTE growth?

One of the promises of LTE is that it enables operators to launch new services, including enhanced voice and messaging services, that exploit its capabilities.

Broadly speaking, LTE-only content and services haven't been a top priority for operators at this stage of the market's development, notwithstanding early Rich Communications Suite (RCS) launches over LTE and some other early moves into the market.

Operators aren't seeing LTE-only content as the main driver to differentiate 4G from 3G services yet. Instead, they are focusing on branding and different bundled voice/ data/ SMS allowances to make 4G distinct from 3G. That said, there are some early moves in this area, with operators launching LTE-only content/ services, and also testing of how LTE can be used to deliver VAS/ content better than over 3G. Some examples of this include:
- Sprint examining how LTE can be used to optimize mobile video delivery.
- The RCS launches by Metro PCS and operators in South Korea.
- Ericsson's partnerships with operators on using LTE for broadcast (including Telia, Verizon and Telstra).
- South Korean cellular operators, LG Uplus, SK Telecom and KT, are targeting mobile games to drive their LTE markets:
  - LG Uplus has launched "C-games", a cloud-based game platform that enables subscribers to play high-

memory games using smartphones through LTE connectivity.
- Similarly, SK Telecom launched two new price plans to promote games using LTE network and more plans to expand gaming content for LTE users.

Operators will build on these initial foundations to launch more services as LTE networks are deployed more widely and as subscription uptake gathers pace. This will become increasingly important for operators as they look to increase the value of the range of services available to LTE users to stem ARPU dilution and churn to OTT players.

Similarly, as operators launch LTE roaming and extend their footprints and capabilities, they will be in a position – and will also face a commercial imperative – to launch new types of services that use the capabilities of LTE. These services will be a mixture of the types of

services that operators launch in their home markets and also roaming-specific services, such as data-roaming usage applications, travel roaming-related applications and roaming-related location services (see fig. 8).

To offer each of these services, operators will need to be able to use the enhanced capabilities of LTE networks in the roaming context. They will need to closely align their LTE roaming technical capability with the services they see as the main usage drivers for LTE roaming.

While offering and monetizing services such as video streaming will be the most challenging from a technical perspective, each service that operators offer over LTE roaming will need to be provisioned to users to offer the best quality of experience possible. If the experience isn't comparable to the in-market experience, users will be

Fig. 8: What specific applications/services do you plan to launch in order to drive LTE roaming usage? (please select and rank your top three)

n=117 (mobile operators and MVNOs)
Source: Informa Telecoms & Media

more inclined to stop using it when roaming than they would when in their home market. Ensuring an optimal quality of experience for subscribers is inextricably linked to the operators' ability to create and monetize roaming data usage.

What's perhaps surprising, given the enhanced capabilities of LTE, is that a large proportion of the survey respondents have no plans to launch roaming services to take advantage of these capabilities. However, it can be expected that if operators successfully deploy specific services and applications that drive LTE roaming use –and when the barriers to deploying them decrease – then the operators that currently have no plans to launch LTE services will face a strong strategic imperative to do so.

LTE roaming deployment strategies

There are significant challenges to implementing LTE roaming, primarily because a change in roaming architecture is required, including the transition of the GRX service to LTE roaming in the next few years, which means maintaining simultaneous SS7 and Diameter signaling networks.

LTE roaming also offers challenges from a strategic perspective if operators replicate the bilateral-roaming-agreement approach in the LTE domain. This will lead to a significant increase in complexity as new roaming partners are added for LTE, including the operationally-intensive inter-operator testing required.

While LTE roaming is still very much in its infancy from a deployment perspective, early moves are being made. Some operators have already implemented bilateral LTE

roaming: South Korean operator SK Telecom and Hong Kong's CSL have launched an international LTE roaming service, for example. In an aggressive move to encourage LTE roaming use, the LTE roaming plans offered by the two operators are the same as their 3G roaming charges.

Meanwhile, in June 2013, Tata Communications and Telecom Italia Sparkle implemented the first LTE roaming peering between two IPX providers, laying the foundation for growth in LTE roaming traffic. This, along with SK Telecom and CSL's agreement, shows that the early movers are pioneering how to implement LTE roaming and laying the initial parts of the foundation for others in the industry to build on.
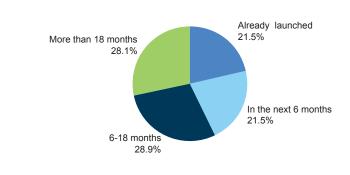
LTE roaming deployment timing

With LTE network launches gathering pace, operators are already formulating their LTE roaming strategies. Despite a handful of early LTE roaming deployments, notably between SKT and its roaming partners in Asia Pacific, as well as between Telstra in Australia and CSL in Hong Kong, for the majority of operators, even those that launched LTE early such as Verizon and TeliaSonera, these discussions remain at an early stage.

The timing of in-market LTE launches is critical because operators can gain a clear competitive advantage if they launch early in the right way, forcing rivals to react to blunt any first-mover advantage.

The timing of LTE roaming is less critical than the timing of in-market LTE because, for the majority of ordinary mobile users, LTE roaming is not a core service that determines how they chose their mobile operator. The exception to this is the enterprise market; LTE roaming will be more of a critical factor in the selection of a mobile service provider for this sector. Given that the enterprise market historically accounts for around 80% of operators' roaming revenues, offering LTE roaming is the next logical step that operators will need to offer after launching in-market LTE, and is a service that will likely be a key differentiating factor in future enterprise roaming negotiations.

Informa's LTE roaming survey shows that the largest percentage of the operator respondents, 43%, either have launched or plan to launch LTE roaming in the next six months – and a further 29% plan to launch in 6-18 months time (see fig. 9).

Fig. 9: When do you plan to launch LTE roaming?

Already launched
21.5%

In the next 6 months
21.5%

6-18 months
28.9%

More than 18 months
28.1%

n=121 (mobile operators, international wholesale carriers)
Source: Informa Telecoms & Media

Given that each region differs significantly in terms of in-market LTE deployment readiness, it's no surprise that there is also a marked disparity between the LTE roaming plans of the operators from the different regions.

Because LTE launches are just starting to be rolled out in Africa and Latin America, the majority of operators in these regions, 52.9% and 41.2% respectively, plan to launch LTE roaming from 2015 on. Conversely, because of the more advanced status of in-market LTE rollouts in Europe, Asia Pacific and North America, the majority of operators in these regions have either launched LTE already, or plan to by the end of 2014.

Scope and range of LTE roaming agreements

The economic downturn has had a considerable effect on the global roaming market, primarily by reducing overall business and leisure travel but also by reducing the frequency of roaming: Actual and forecast growth in the number of trips made by mobile users fell over the 2007-2011 period at a CAGR of 8.5%, according to Informa research. However, this trend is now reversing and the number of trips mobile users make is forecast to grow by a CAGR of 15.4% between 2011 and 2016. Not surprisingly, the enterprise sector is forecast to remain slightly more resilient to the economic downturn than consumers with a CAGR of 7.53% in the number of trips that enterprise mobile users make over the forecast period. The gap is narrowing though; the number of trips made by consumers is expected see a CAGR of 7.24% over the same period, primarily as a result of increased usage

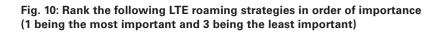and experimentation tied to price cutting.

Where operators strike LTE roaming agreements will largely be determined by the insights they have from their existing roaming traffic and expected future growth to new countries and regions. They will use new LTE agreements to position for this expected growth; for example, to tap the increasing traffic in the China-Africa roaming corridor.
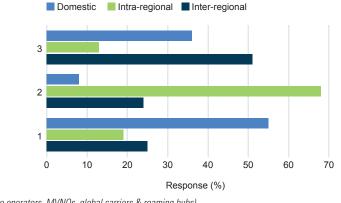
For many operators, especially in emerging markets, domestic roaming remains the most important roaming consideration. However, even in markets where domestic roaming is still in place, this framework is gradually being eroded in favor of lowering barriers to moving between the regions within countries: India is perhaps the most notable example of this, with domestic roaming expected to be removed later in the year. As domestic roaming regimes are removed, roaming considerations for these operators will give way to international roaming, whether it be intra-regional or inter-regional.

From a global perspective, domestic and intra-regional destinations remain the top strategies for LTE roaming, according to Informa's survey (see fig. 10).

Looking at this from a regional perspective, current market dynamics will be mapped onto the LTE roaming scenario, with for instance, inter-regional roaming the most important roaming destination for operators in the EU.

The number of roaming partners an operator can connect to is the sum of its bilateral and hubbing relationships. Roaming hubs have seen growth in the amount of traffic they carry since 2009 as operators look to consolidate existing bilateral agreements onto hubs, and also to extend their roaming reach. Moreover, the entrance of two major operating groups, Vodafone and France Telecom, has helped growth in the market, as these companies operate hubs as discrete commercial units while also migrating operating companies' roaming agreements onto their hubs. For smaller operators and new entrants, hubbing makes particularly strong financial

Fig. 10: Rank the following LTE roaming strategies in order of importance (1 being the most important and 3 being the least important)

n= 146 (mobile operators, MVNOs, global carriers & roaming hubs)
Source: Informa Telecoms & Media

and operational sense as it allows them to efficiently and quickly fill the destination gaps in the markets where their customers roam.

As operators roll out LTE, roaming hubs will play an even more central role in operators' roaming portfolio because they will seize the opportunity to streamline the number of partners they have. According to Informa's survey, the majority of the operators expect to have up to 50 bilateral roaming partners as they evolve their roaming strategies in step with LTE rollouts (see fig. 11).

From a regional perspective, operators in Africa, Asia Pacific and North America expect to have as few as 1-25 bilateral roaming partners in the next three years, showing the extent of consolidation of roaming partners as LTE networks are launched. Operators in the Middle East expect to have the highest number of LTE roaming partners in three years, at 51-100, a reflection of the number of bilateral agreements they currently have in conjunction with an apparent disinclination to move toward hubbing solutions to consolidate the number of interconnections.

From a global perspective, Western Europe will still be the main priority roaming destination for operators for the next 12 months as they roll out LTE (see fig. 12). Asia Pacific and North America will also be important roaming destinations for operators, reflecting the ongoing importance of traditional roaming routes and the continuing emergence of Asia as a travel destination. The growing importance of Asia represents an opportunity for operators to strike roaming

Fig. 11: How many LTE bilateral roaming partners do you expect to have in three years time? (please select one option)

n= 142
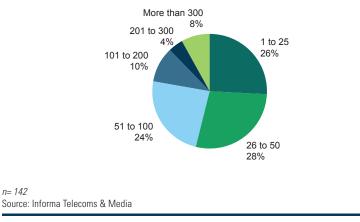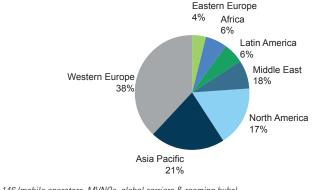Source: Informa Telecoms & Media

Fig. 12: Which one of the following roaming regions/ routes is considered the highest priority for the next 12 months as you roll out your LTE roaming service? (please select one alternative)

n= 146 (mobile operators, MVNOs, global carriers & roaming hubs)
Source: Informa Telecoms & Media

relationships with partners to tap the region's rising significance from a roaming perspective.

LTE roaming challenges

On the one hand, the LTE roaming opportunity is clear and straightforward: LTE roaming offers operators considerable opportunities to offer new roaming services and replicate the home LTE-user experience for users when they travel. But on the other hand, LTE roaming presents considerable challenges, and on every level: From a broad strategic perspective, operators first need to assess how they are going to position LTE roaming in the context of their other roaming services, just as they

need to evaluate how LTE sits in relation to their in-market portfolio of services.

Following on from this, there are even more implementation and technical challenges for the operator to overcome with LTE roaming than there are with in-market LTE services: How do my existing roaming agreements sit within my LTE roaming strategy? Do I strike new LTE roaming agreements or do I extend my existing agreements into LTE? Which of the enhanced technical capabilities of LTE can I use most effectively in the roaming context? How do I monetize these capabilities?

Fig. 13: The top three challenges for LTE roaming

1. Inter-standard roaming
2. LTE steering of roaming
3. International and domestic signaling storm

n = 305
Source: Informa Telecoms & Media

While spectrum fragmentation and handset availability are major challenges, the survey respondents, from a global perspective, indicate that the top three challenges for LTE roaming are: inter-standard roaming: LTE steering of roaming: and an anticipated international and domestic signaling storm (see fig. 13).

The rollout of LTE networks is likely to have an impact on operators' steering-of-roaming agreements because 3G data users may roam onto 4G networks, even if they are not part of the preferred list of networks. Therefore, ensuring that preferred networks are roamed onto when subscribers travel within range of LTE networks that aren't part of an operator's preferred-partner network will be crucial to ensure roaming revenues as more operators roll out their LTE networks.

Spectrum fragmentation is another challenge the roaming industry has to deal with. While regulators within regions and between regions can help create a healthy LTE ecosystem by working together to identify spectrum that is as harmonized as possible between

countries, fragmentation remains a major problem. The dangers of fragmented spectrum are already looming, with Informa research identifying 11 spectrum bands being used for LTE, making it difficult for vendors and manufacturers to facilitate global roaming and achieve economies of scale on equipment.

Operator strategies for selecting roaming vendors

Given the considerable technical and strategic challenges to implementing LTE roaming, operators need to carefully assess their roaming vendor partners to be in a position to maximize the full potential of offering enhanced data roaming to their subscribers. This decision is surrounded by an extremely dynamic range of market realities, both technical and strategic, as well as possible future scenarios, including how much data travelers use currently compared with how much they are likely to use as operators' roaming strategies evolve in relation to travel patterns, regulation and evolving service strategies. What makes an operator's decision about its roaming vendor even more of a challenge is the uncertainty surrounding how these factors will develop.

Diameter signaling is an important element for the operation of LTE networks as it interfaces between the policy engine (PCRF) and the customer databases (HLR, HSS) for subscriber-mobility management and QoS policy. SIP signaling is also expected to become more important as operators start deploying VoLTE and RCS services. Session Border Controllers (SBCs) are considered to be pivotal components to enable this functionality. Each of these elements combine to create complexity and challenges to monetizing the growing use of roaming.

Informa expects Diameter deployments to both increase in number and evolve (in terms of technology, deployment type, etc.) as the first wave of LTE network deployments is completed. Over and above enabling LTE roaming, advanced functionality from Diameter components, Diameter protocol normalization, interoperability with legacy 2G/3G networks, and QoS policy are all expected to be considered during 2013. Given the fact that operators are also pushing towards online and real-time charging, Informa expects Diameter signaling to become a more important topic during this year.

Moreover, the rollout of LTE services – primarily VoLTE – is expected to drive signaling volumes even higher, increasing the need for operators to assess the Diameter infrastructure capabilities of potential roaming vendors. As operators plan their LTE roaming strategies, they are taking advice from Diameter specialists about dedicated signaling components rather

than adding an extra layer of functionality provided with other network elements (e.g., PCRF, HSS). Diameter is often considered to be a critical protocol for the operation of an LTE network and recent outages in 3G roaming have provided adequate proof that dedicated elements for Diameter load balancing are necessary.

This enhanced technical capability, while adding complexity, provides significant opportunities for operators to monetize current and new roaming traffic more efficiently and effectively.

There remains a lot of scope for operators to improve the roaming customer experience of existing services. While operators have complete visibility of customer usage on their own networks, they cannot build a complete near-real-time view of customers' usage while roaming. This is further complicated in scenarios where customers can access multiple networks when they roam because of the number of network-sharing agreements between operators. When choosing their roaming partner, operators should consider how far vendors can offer usage-based insights to

help enhance subscribers' roaming experience.

Another key approach to minimizing this complexity will be to reduce the number of roaming agreements operators have as they strike their LTE roaming agreements. Making new agreements for LTE roaming offers operators the chance to migrate or consolidate their current bilateral or hubbing roaming agreements to a new platform with a new or existing roaming provider.

As they assess roaming partners for LTE in the context of their overall roaming strategy evolution, operators will need to:
- Offer QoS within the LTE roaming context to harness the benefits of LTE.
- Ensure that the scope of the vendor's roaming footprint meets their current and likely future requirements.
- Assess the robustness of the signaling experience the vendor offers.
- Assess the capability to offer carrier-grade Diameter signaling.
- Ensure that the vendor can offer seamless reporting, monitoring and trouble-shooting across 2G-3G-4G.
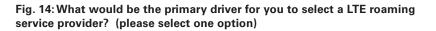
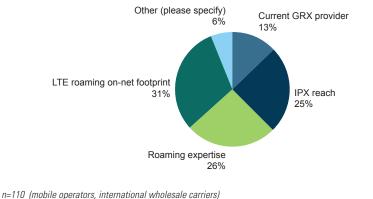- Ensure that the vendor can support CSFB signalling.

These requirements are borne out by Informa's survey, which indicates that a roaming vendor's LTE roaming footprint and expertise are the most important factors when operators make the decision to select a service provider (see fig. 14). A significant minority, 25%, said that IPX reach will be the primary driver.

As already discussed, roaming hubs are an option for operators to potentially reduce the increasingly complicated roaming ecosystem. They are designed to expedite and simplify the formation of new roaming partnerships by acting as a convergence point for all the roaming agreements of those operators attached to it. Joining a hub can benefit mobile operators in two main ways: it lowers the cost to an operator of offering roaming services; and it produces new revenues through new traffic with new partners and through offering new services.

While bilateral roaming interconnections will still play an important role, the added complexity that LTE roaming brings can be expected to lead operators to look more and more to hubs to reduce it. Among the survey respondents that were from roaming and wholesale departments, 40% are "likely" or "very likely" to outsource their Diameter signaling function, while 25% are still uncertain (see fig. 15).

IP eXchange (IPX) is a GSMA-defined industry-standard IP-based interconnection technology. It provides a number of advantages for roaming service providers based on

Fig. 14: What would be the primary driver for you to select a LTE roaming service provider? (please select one option)

- Other (please specify) 6%
- Current GRX provider 13%
- LTE roaming on-net footprint 31%
- IPX reach 25%
- Roaming expertise 26%

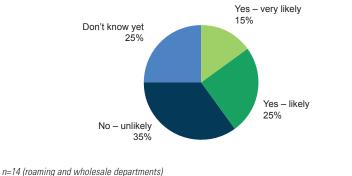*n=110 (mobile operators, international wholesale carriers)*
Source: Informa Telecoms & Media

improved interconnect and transit as well as improving the richness and experience of data roaming. IPX provides a consistent and robust route to improved roaming interconnect, particularly with data roaming.

IPX can help operators offer an enhanced data-roaming experience that can be managed from end to end and manipulated in real time, which is useful for providing specific data-roaming services requiring particular attributes (e.g., consistent connectivity, high bandwidth, low latency), and it is future-proofed for data-roaming services because it uses an all-IP core.

It will be crucial that IPX providers provide a solid platform for operators to be able to monetize IPX-based data roaming. The survey respondents chose roaming data clearing, roaming financial settlement (data, VoLTE), LTE-hosted DRA/DEA and roaming hub as the most important services an IPX provider needs to offer (see fig. 16).

Fig. 15: Do you plan ("what is your willingness") to outsource your diameter signaling network function (e.g., DEA) for international roaming to your IPX provider? (please select one option)

n=14 (roaming and wholesale departments)
Source: Informa Telecoms & Media

Fig. 16: Which of the following are the most important services that your IPX provider needs to offer as part of the basic LTE roaming service? (please rank your top three)

n = 110 (mobile operators, international wholesale carriers)
Source: Informa Telecoms & Media

Conclusions

The global mobile roaming market is at a critical juncture in its history. It presents operators with many new opportunities but also many new challenges.

Operators are re-assessing how they approach roaming pricing at the same time as launching new services to encourage profitable mobile usage by as many of their customers that travel as possible. But, as a result of legacy approaches, many mobile users either restrain their mobile use while traveling or turn off their phones when they begin their holiday: The fallout from charging extremely high roaming prices in the past has caused consumers to continue to be extremely cautious and wary about using roaming services.

Operators are addressing this "anti-roaming" mindset with gradual approaches to reducing prices. Although there is a gradual shift in the users' perceptions about how much roaming services cost, their perceptions that the cost of roaming is prohibitively high persist. This is the case even in the EU, where focused regulation at the wholesale and retail levels has led to roaming rates priced at a mild premium to home-market rates, a premium which is set to all but disappear

next year if the new proposed regulation comes into effect.

In regions without regulation to bring down retail roaming rates, roaming revenues are still predominantly generated from enterprise users. Because of this, operators in these regions, like those in Europe before regulation began, face the conundrum of how to lower retail roaming rates to encourage very price-sensitive consumer usage without reducing prices for enterprise users, whose usage patterns are less price-sensitive.

Operators in Europe answered this conundrum by resisting for as long as possible lowering retail rates by a sufficient amount to cause a significant increase in consumer usage because they wanted to maintain high enterprise roaming rates. Eventually, regulation forced their hand.

It is, however, questionable whether operators in other regions, in today's mobile market, will able to replicate this strategy.

Why? It is mainly because operators – in all regions – face a major threat to roaming revenues from OTT and Wi-Fi substitutes. These players are succeeding in capturing a high volume of voice and data roaming, and driving the so-called "consumerization" of enterprise mobile use. The threat from these players is pressing enough that they pose a very real danger to operators' enterprise roaming revenues – not just their consumer roaming revenues. Moreover, it's not just that OTT and Wi-Fi players pose a major threat to operators' enterprise and consumer revenue – it's also

that the operators risk missing the opportunity of a potential retail roaming user base that remains, to a large degree, untapped.

The advent of LTE roaming offers operators the chance to re-evaluate their roaming strategies. Can they significantly increase roaming usage with new tariffs that encourage usage across the board? Can they reduce roaming-related costs as they launch LTE and collapse existing agreements into new ones? Can they exploit the capabilities of LTE to tap new usage scenarios and new users? Can they encourage existing roamers not to switch off roaming when they travel and seek out the nearest Wi-Fi hot spot?

LTE roaming offers operators the potential to exert more control over the overall roaming experience and bring it more in line with the data experience in the home market. Diameter signaling for LTE roaming will play a major role in terms of enablement and monetization, especially with the implementation of online charging in national and international markets.

As we've seen, the technical challenges to LTE roaming are not inconsiderable. From a high-level perspective, we have argued that operators must choose their roaming partners with a view to maximizing their current roaming capabilities while evolving them most effectively into the next generation.

The other major challenge that operators face is strategic. This can be boiled down to the following: How can operators encourage roaming use among

consumers while retaining enterprise roaming revenues against the encroachment to both from OTT and Wi-Fi players?

The outlook is extremely encouraging for the mobile roaming industry. Data-roaming usage is expected to grow by more than 40% annually, representing a significant opportunity for operators to tap new monetization opportunities if they can position themselves to take advantage of this increase by replicating successful in-market data strategies in the roaming context.

Given that bill shock remains one of the most significant barriers to data roaming, operators must closely assess how they can effectively deploy tools to ensure transparency on usage to drive traffic. Some operators, such as France Telecom and Deutsche Telekom, have already deployed data-usage applications to overcome end-user fears about roaming bill shock and operators should learn from these early deployments how to offer similar usage monitors to their customers to offer more transparency.

Earlier in this paper, the following questions were posed: How do my existing roaming agreements sit within my LTE roaming strategy? Do I strike new LTE roaming agreements or do I extend my existing agreements into LTE? Which of the enhanced technical capabilities of LTE can I use most effectively in the roaming context? How do I monetize these capabilities? This paper aims if not to have definitively answered these questions then to have provided an incisive framework within which to address them.

Recommendations

1. **Operators should ensure they have the technical capability to offer a good quality-of-service (QoS) to roaming end users to maximize the quality of their LTE roaming experience:** LTE roamers, especially enterprise roamers, will expect their in-market LTE experience to be replicated when they travel. Ensuring LTE data speeds and robustness of delivery will be essential for operators to position LTE roaming as a premium experience – especially to the enterprise market where critical applications will be accessed over LTE. Operators need to ensure their roaming vendor partners can offer a robust network with scalable reach to meet their key roaming requirements. According to Informa's survey, video calling and social networking will help driving LTE data roaming use, both of which require good QoS support to maximize the quality of the users' experience.

2. **Operators should approach LTE roaming with a view to monetizing as much data-roaming traffic as possible:** The availability of free Wi-Fi means users, especially consumers, often prefer a lower quality-of-experience (QoE) at no cost to a premium experience. It is essential that operators can ensure steering of roaming. This will minimize any roaming revenue leakage that results from the increased complexity of keeping subscribers on preferred networks as the LTE network rollouts will have an impact on preferential roaming agreements. Operators should look to partnerships to be able to capture as much roaming data use as possible by meeting end-user expectations on QoE in the context of how much they are paying for it.

3. **Operators should invest in improving tools to offer more transparency in roaming usage:** Bill shock is still the main barrier for data-roaming usage and it will be a major boundary for LTE roaming. Smartphone applications need to evolve to provide accurate and real-time information about usage and be integrated across other operator channels such as the Internet and the contact center.

4. **Inter-working and inter-operability capabilities are essential to offering a robust roaming quality of experience:** Legacy roaming expertise is paramount to enable operators to handle roaming traffic traveling across different technology standards and over equipment from different vendors.

5. **Operators need to partner with vendors that have a significant and scalable IPX reach from the physical layer to the application layer:** With the potential amount of data generated via LTE roaming, in particular at peak times (the so-called "signaling storm"), operators need to make sure the IPX infrastructure for roaming can handle unexpected spikes in traffic and also have the scale to handle long-term growth in signaling traffic.

6. **Operators should consider partners with established experience of mission-critical applications and with a carrier-grade solution on the Diameter-signaling network function:** As the mobile industry prepares for the advent of a signaling storm, Diameter entities in the IPX carrier vendor's network will play an increasingly critical role in mitigating the risks posed. Operators should select a roaming vendor with a global carrier-class IPX network and Diameter function infrastructure, coupled with a proven track record in global roaming.

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