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NAVIGATING THE CHALLENGES AND OPPORTUNITIES OF SHIFTING IOT CONNECTIVITY DEMANDS

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Kaleido Intelligence

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Executive Summary

Emerging technologies, regulation, commercial strategy shifts as well as enterprise IoT customer requirements are leading to significant shifts in how IoT service providers must approach the market. To provide best-in-class solutions to customers, it is now essential to exert a level of control over the management of customer IoT deployments, where flexibility, transparency and reliability are paramount to ensuring success and long-term loyalty.

In recognition of this changing ecosystem, Kaleido Intelligence undertook a survey of 208 IoT connectivity service providers to better understand how they are approaching and perceive the market. The main aims of the survey were to target perceptions surrounding IoT platforms and infrastructure, eUICC (referred to as eSIM throughout this white paper), in addition to IoT monetisation as well as emerging 5G and cellular-satellite communications opportunities.



Only 41% of service providers have a level of control over the core network for connectivity, while only 27% of providers can offer real-time full visibility into network operations.

Management of the core network is essential to allow service providers to optimise operations while providing enhanced incident resolution and customer service. It offers a high level of flexibility to meet varying technical requirements.

49% of service providers believe that most IoT use cases cannot be addressed through roaming alone, with 65% of respondents believing a multi-profile SIM solution is essential to addressing global connectivity.



IoT roaming is increasingly subject to national regulation, as well as commercial constraints imposed by operators. Meanwhile, 'home routed' roaming cannot be used for latency-sensitive use cases, while also forcing data to cross borders. Having the capability to localise connectivity through programmable SIM technology in addition to local network infrastructure is essential to avoid these pitfalls.



81% of service providers offer some kind of Value-Added Services over and above connectivity, with only 1% of providers anticipating no changes in how connectivity is sold.

The commoditisation of retail airtime pricing, in addition to pressures on wholesale connectivity, means that profitability for pureplay resellers is a challenge. Finding ways to supplement connectivity revenue with Value-Added Services has evidently become a key requirement in the industry.

53% of service providers see converged cellular-satellite networks as important to future IoT development, with 63% believing that satellite will complement terrestrial cellular connectivity.



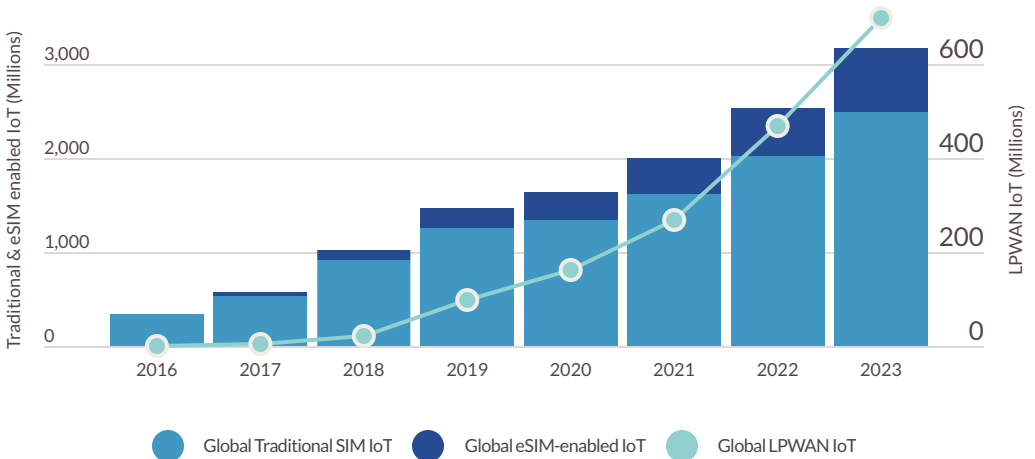
As 5G standalone networks begin to proliferate, new opportunities arise in IoT services, including the capability to support Non-Terrestrial Network connectivity. With many IoT deployments located in remote locations under- or unserved by terrestrial mobile networks, satellite communications can offer a differentiation point and path to new revenue channels.

The Changing Paradigm of IoT Connectivity

IoT Market Status

The IoT connectivity landscape has changed dramatically over the past 5 years. On the supply side of the market, new technologies such as eSIM, NB-IoT and LTE-M (LPWAN), 5G, and Non-Terrestrial Networks (NTN) have emerged, providing customers with increasingly flexible cellular-based solutions for varying IoT use case requirements. Meanwhile, the COVID-19 pandemic served as a 'window' into the extent of IoT roaming connectivity on mobile network operators' (MNOs) networks, leading to an increase in specifically negotiated wholesale tariffs and strategic approaches towards supporting IoT connectivity. Finally, shutdowns of longstanding 2G and 3G networks are growing in number as part of MNOs' efforts to reduce operational costs as well as free up valuable spectrum to support connectivity over more modern network architecture, with implications on existing IoT deployments as well as technology choice for future projects.

Global Traditional SIM, eSIM-enabled and LPWAN Cellular IoT Connections in Millions, 2016-2023



Source: Kaleido Intelligence, 2023 Connectivity Data Hub

On the demand-side of the market, the development of various technologies augmenting the flexibility of cellular IoT has positioned it as a viable solution for both mission-critical as well as non-critical IoT applications. As connection volumes increase, it is apparent that enterprise customers are becoming both more demanding as well as more sophisticated when it comes to IoT connectivity expectations. Simplicity and flexibility are key concerns, while the need to ensure that connectivity is available and compliant with local regulations is at the forefront of customers' minds. In a 2023 survey of 800 enterprises with a good or better understanding of the cellular IoT ecosystem conducted by Kaleido Intelligence, 89% of respondents reported that the ability to ensure a solution

was safe from commercial or regulatory restrictions was one of their top 5 priorities for IoT connectivity. Meanwhile, 86% of the respondent base reported that the ability to be able to adapt to varying commercial and technical needs was among the top 5 factors that they would look for in an IoT connectivity service provider.



89% of IoT-focused enterprises ranked regulation and compliance as part of their top 5 concerns.

Source: Kaleido Intelligence, Enterprise Cellular IoT Connectivity Survey H1 2023

86% of IoT-focused enterprises ranked high commercial and technical flexibility among their top 5 expectations from service providers.



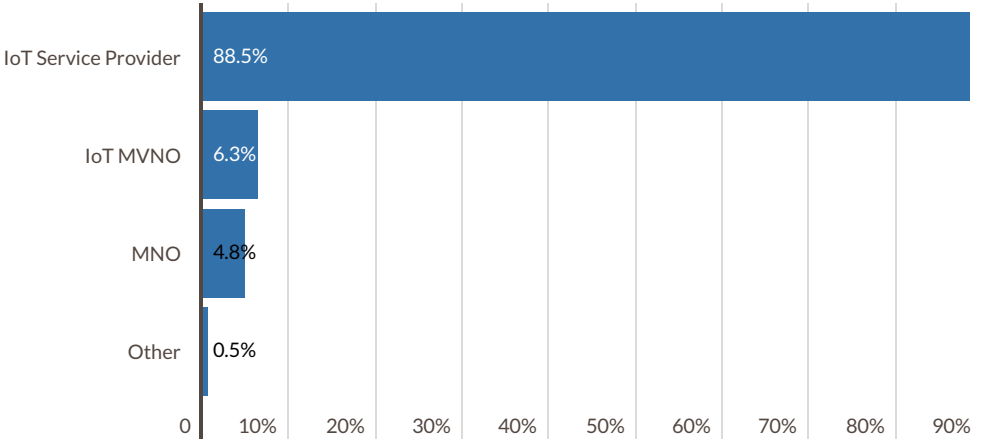
Source: Kaleido Intelligence, Enterprise Cellular IoT Connectivity Survey H1 2023

For many operators, the volume of IoT connections on their networks is low in comparison to everyday smartphone subscribers. Additionally, the comparatively low amount of data consumed by devices has meant that traditional mobile subscription revenue is far more lucrative than IoT connectivity. In turn, this has meant that investment priority, where delivering best-in-class solutions to support that connectivity is concerned, has been relatively low: the industry as a whole has been slow to deliver dedicated infrastructure to support connectivity, while the vast majority of connections that are deployed across borders continue to rely on roaming with best-efforts communications principles, with an architecture known as 'home routing'. Here, data traffic is transported from the endpoint device to the home network before being routed back to the visited network. In this manner, connection latency is increased, while cross-border data flow is unavoidable.

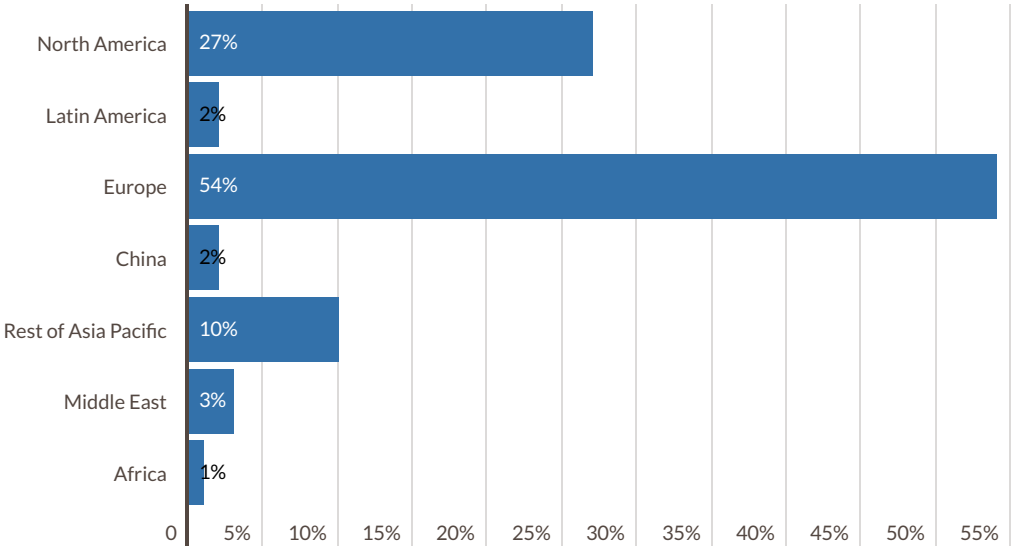
As demand for IoT connectivity rises and device deployment sizes increase, data collected by devices becomes both increasingly valuable to customers, with the importance of ensuring service reliability and transparency increasing in parallel. Meanwhile, an increase in enterprises looking towards IoT as part of their digital transformation strategies will inevitably mean that requirements in the context of connectivity become highly diverse. This means that service providers must modernise the way they approach and deliver IoT connectivity: the proliferation of IoT devices coincides with falling costs for connectivity and devices, while the overall margin for the end customer is typically low. The loss of service availability, particularly when large volumes of devices are considered, is not financially viable. Ultimately, the market today is in a state of flux where solutions for connectivity technology, infrastructure, and commercials have been developed to greatly enhance the level of service that providers can offer their end customers.

In order to better understand the current perception of the market from service providers' point of view, Kaleido Intelligence undertook a survey of 208 IoT connectivity service providers at managerial level and above from December 2023 to January 2024. The following sections will examine these in turn, with survey results collected for this white paper serving to help readers understand service providers' positioning and perceptions surrounding this dynamic ecosystem.

Survey Demographics (208 respondents): 'Which type of organisation best describes who you work for?'



Survey Demographics (208 respondents): 'Where is your Business Unit based?'



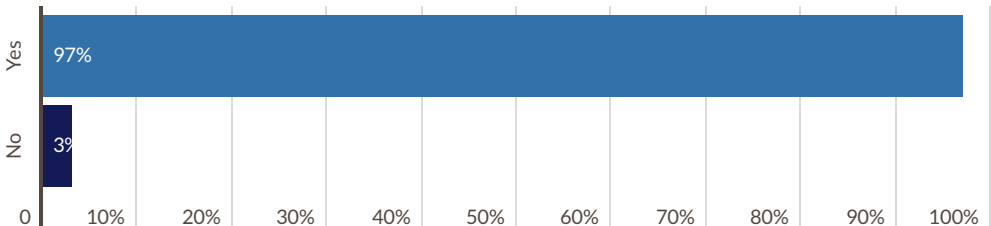
eSIM, IoT Platforms and Infrastructure

IoT Platforms & Infrastructure

IoT service providers face an increasingly difficult challenge where supporting IoT connectivity is concerned. The 'laissez-faire' attitude that was historically taken by MNOs and regulators towards IoT connectivity was significantly disrupted by the COVID-19 pandemic, which revealed the true extent of IoT roaming connectivity in the absence of roaming leisure and business travellers. In turn, this has led to legal and commercial barriers where devices deployed internationally are considered as roaming 'permanently' (typically 90 consecutive days or more). Overcoming such barriers requires either a strong commercial presence (to negotiate permanent roaming access with incumbent MNOs) or solutions to avoid roaming at a technical level. As we have observed in the previous section, enterprises are increasingly aware of such issues, demanding assurance against long-term risk, in addition to a strong capability to adapt to changing requirements.

Ultimately, the level of technical flexibility a service provider has boils down to how much control and amount of visibility that provider has over the operation of the network. MNOs and MVNOs that operate their own core networks are naturally in a better position in terms of visibility and control than connectivity resellers, who typically have no access to signalling information or more powerful diagnostics tools for issue identification and resolution. When it comes to internationally deployed devices, there are additional factors to consider. While core network ownership offers an advantage as described above, visibility when devices are operating overseas often depends on the level of integration achieved between the serving operator and the operator's network where devices are operating. This can mean that support levels for devices operating across different networks in different countries can vary, depending on the relationships that the service provider has with its partners. Ownership of core network architecture on a globally distributed basis can help offset these challenges.

Survey Q: 'Does your organisation have ongoing initiatives or future plans to optimise your network infrastructure to enhance visibility, customer support and deployment control?'

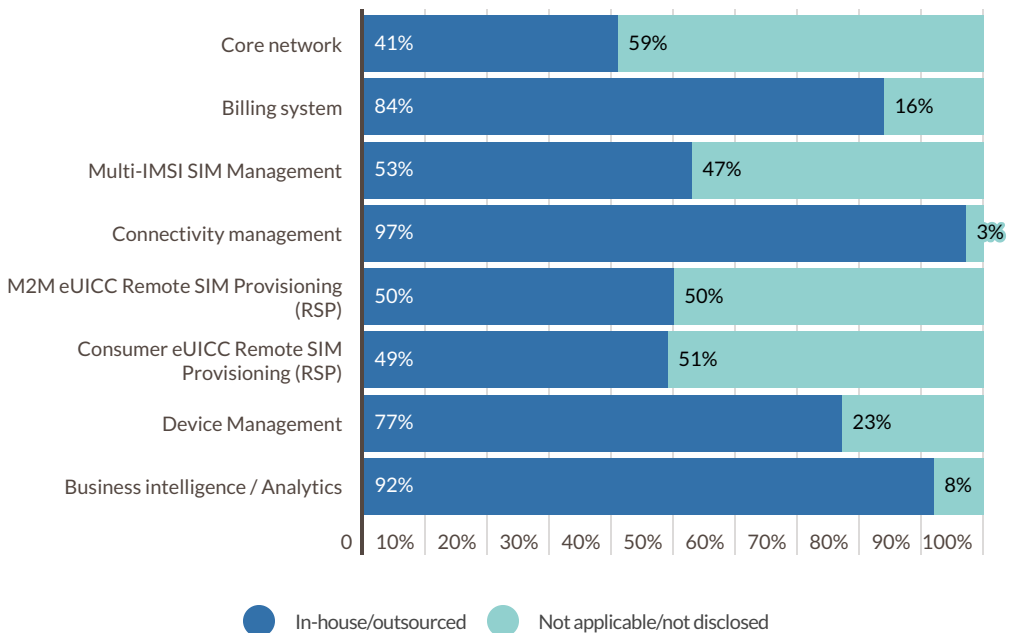


Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

From the survey results, it is clear that providers across the board are taking these kinds of issues seriously: 97% of the respondent base reported that they have plans to improve their infrastructure to deliver better visibility or customer support.

That said, when considering mobile network infrastructure, a large number of surveyed service providers have limited options. For example, 59% of the respondent base reported that the development and deployment of the core network is not under their control.

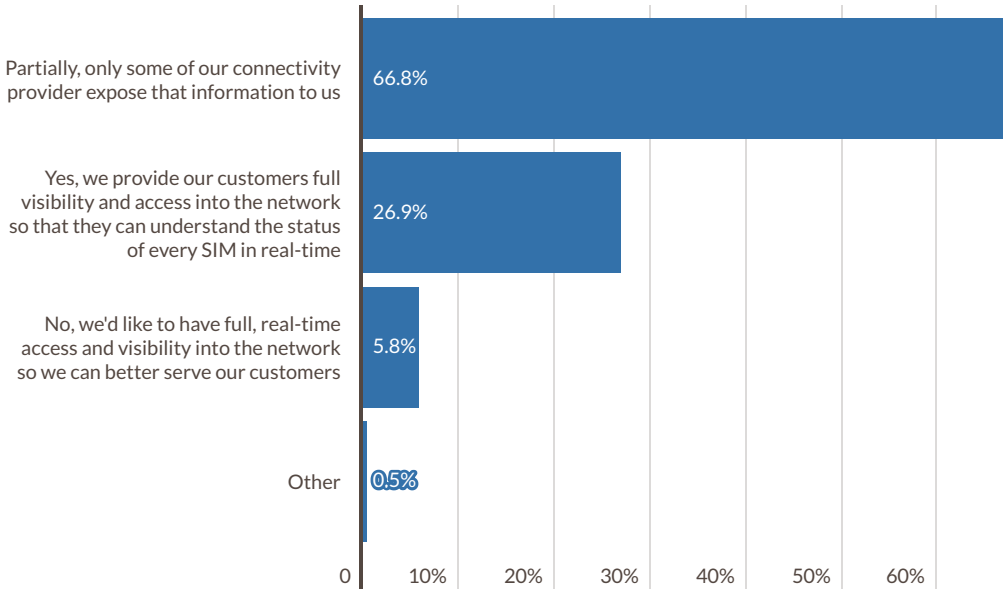
Survey Q: 'How does your organisation approach the following building blocks for a global connectivity solution?'



Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

Full access to and management of the core network represents a valuable asset when it comes to customer service, visibility, and optimisation potential. Ultimately, if the management of core network infrastructure is left to a partner servicing different entities and IoT use cases, priority in terms of support will vary, while configurations and development strategies may not be optimal for certain use cases. Meanwhile, the partner may not expose traffic running through the core network, which in turn will allow the service provider to offer a fully transparent solution to customers. Indeed, this is reflected in the survey: only 27% of surveyed respondents reported that they have full visibility into network operations, highlighting that this benefit is not only a result of core network management, but also a result of design and partnership approach as discussed earlier.

Survey Q: 'Do you provide your customers with full, (near) real-time visibility into the network?'

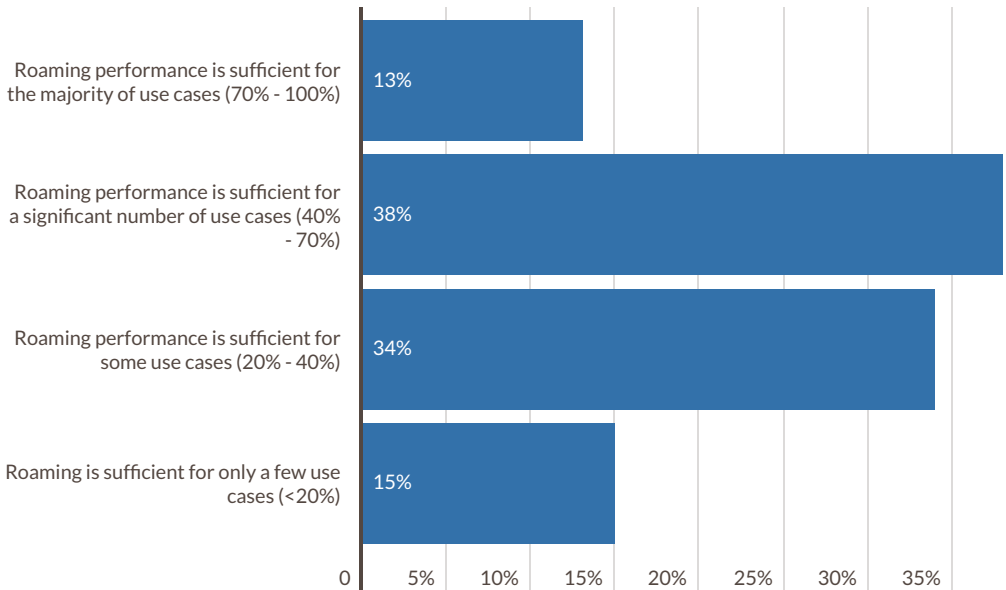


Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

eSIM

Where international connectivity requirements are concerned, roaming continues to form the basis for the majority of deployments. For many customers, basic roaming solutions offer a simple go-to-market strategy at a relatively predictable cost as long as devices are operated within the main footprint of the underlying roaming provider. However, relying on IoT roaming alone cannot meet the diverse customer requirements that exist in the market today. This is reflected in the survey results: while 51% of respondents believe that roaming can address most use cases, this is closely matched by the remaining 49% of respondents reporting that many use cases cannot be addressed through roaming alone.

Survey Q: 'How do you see the performance (data throughput and latency) of roaming based connectivity?'



Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

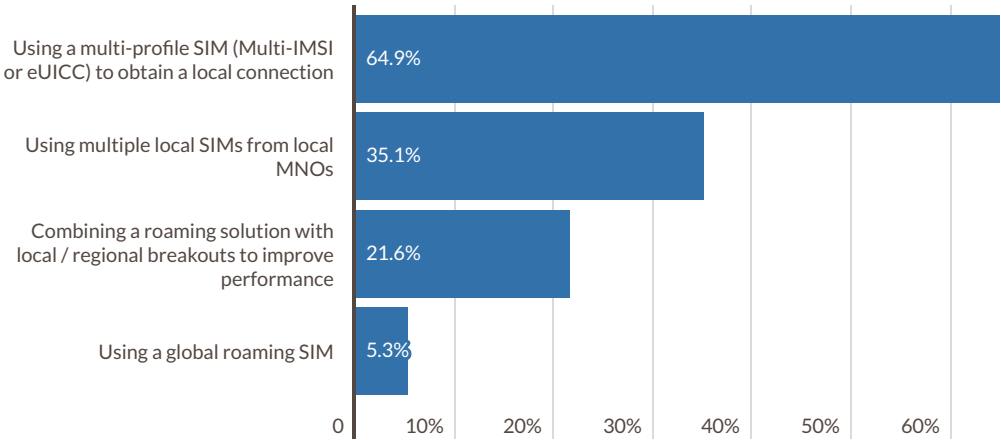
As such, it is important to consider how use cases where roaming is not fit for purpose can be addressed in an optimal manner. Technologies available that can potentially address this gap are twofold. In the first instance, eSIM, the combination of a standardised software architecture for remote SIM management in combination with either removable or embedded SIM form factors, may be leveraged. Alternatively, providers may use multi-IMSI technology, which allows multiple network (IMSI) credentials to be loaded onto a SIM card via a proprietary mechanism. eSIM, when conforming to GSMA specifications, offers IoT customers a standardised architecture and mechanism to reprogram SIM cards OTA (over-the-air) with new operator credentials. The need for eSIM was initially demanded by automotive OEMs due to the relatively high uptake of cellular technology for connectivity among vehicles, in addition to the international nature of automotive supply chains.

Over the years, the take-up of eSIM technology has spread to other verticals, with utilities use cases providing a notable example. 64% of respondents reported that demand for eSIM-based IoT connectivity solutions has gathered pace over the last 2 years.

Despite the flexibility that eSIM purports to offer, it has not resulted in the demise of 'legacy' SIM approaches, including single IMSI uSIMs in addition to multi-IMSI SIMs. Multi-IMSI technology was a precursor to the emergence of eSIM and, despite being a non-standardised mechanism to enable SIM cards to leverage multiple network credentials on a single SIM card, has retained a level of popularity for IoT use cases.

Notably, 65% of survey respondents believe that a multi-profile SIM solution, such as multi-IMSI or eSIM, offers the optimal way to achieve global coverage. Only 5% of respondents reported that a global roaming SIM solution is optimal and serves as a means to underline the fact that historical approaches to IoT connectivity internationally are no longer viewed as appropriate as they once were. While a global roaming SIM, something which is often offered by MNOs, provides end-customers with a good roaming footprint across many different countries, roaming connectivity is increasingly subject to scrutiny in the form of regulator and operator stances towards permanent roaming, while pricing outside the main coverage zones may vary considerably, and thus introduce unwanted expense.

Survey Q: 'What, in your opinion, is the optimal way to achieve true global coverage?'



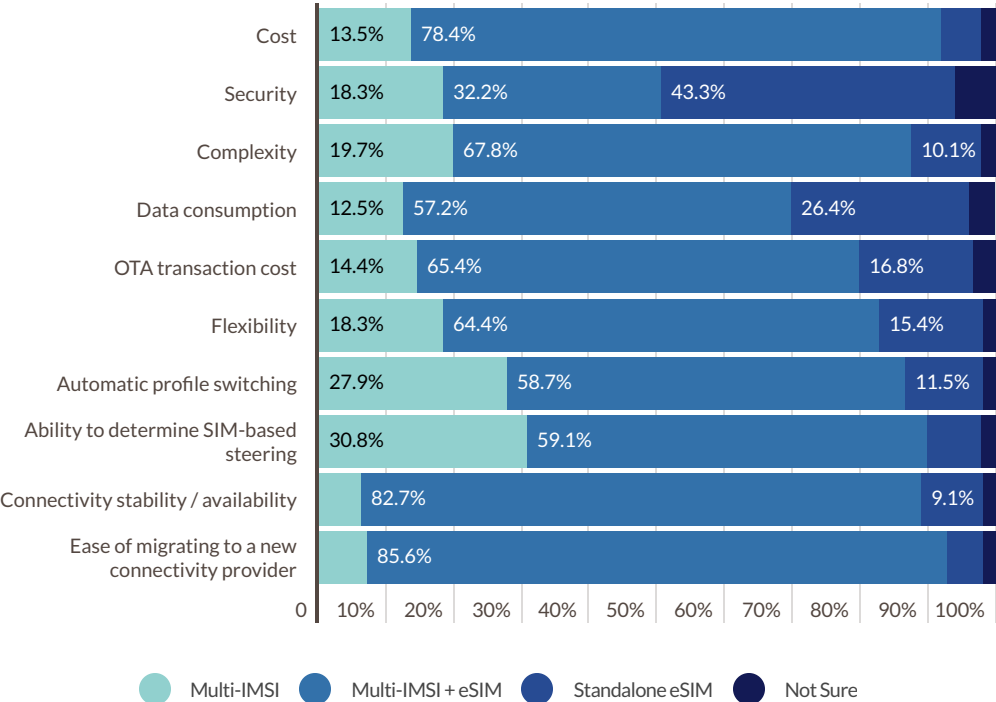
Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

Today, many operators are examining the possibility of enhancing roaming connectivity by introducing solutions such as regional or local breakouts. These allow latency to be reduced and thus deliver improved performance for more critical IoT applications while also eliminating risks related to cross-border data compliance and data privacy requirements. Nonetheless, progress towards this, at least where MNOs are concerned, has been slow, while connectivity within a roaming scenario remains subject to possible regulatory or commercial barriers.

Comparing multi-IMSI and eSIM directly introduces some interesting results. Among leading non-MNO IoT service providers, it has become common practice to layer multi-IMSI technology on top of eSIM, enabling a dual layer of flexibility in the context of network access programmability.

In this context, various IMSIs accessible to service providers are often used to offer regional or local access for connectivity and optimise connectivity, with eSIM being utilised only where a local eSIM profile is required by the inbound market in question or where the end customer requires that the device estate is migrated to a completely new connectivity service provider. The benefits of this approach are evidently appreciated by a large majority of survey respondents, who believe that a combined multi-IMSI and eSIM solution is superior in nearly all aspects versus other approaches, save for overall security, where 43% of surveyed service providers believe that a standalone eSIM solution is optimal.

Survey Q: 'Between Multi-IMSI, Multi-IMSI combined with eUICC (eSIM) and Standalone eUICC (eSIM) solutions, which solution do you believe performs best according to the topics below?'



Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

Perhaps one of the reasons behind this sentiment is the fact that, under the currently deployed GSMA eSIM specification aimed at IoT applications, the underlying architecture means it is challenging to realise the full benefits of the potential flexibility afforded by eSIM. For example, mandated support for SMS creates difficulties for NB-IoT devices, while TCP/IP protocol overheads can cause unwanted battery drain on constrained devices.

As such, it is not surprising to see that 41% of survey respondents reported that some IoT devices are not optimised for eSIM OTA campaigns.

In contrast, combining multi-IMSI technology with eSIM enables OTA flexibility for constrained devices, as well as unconstrained devices, that, by and large, cannot be matched by eSIM alone. Since OTA using multi-IMSI merely updates the list of available IMSIs stored on the SIM card, OTA optimisations are much less resource-heavy than full eSIM profile swaps. Additionally, the only costs incurred for this activity are via the data consumed rather than the chargeable eSIM service executions involved with profile management OTA.

What's Next

Near-term

The white paper has demonstrated how enterprise IoT customers place a high value on technical and commercial flexibility as a means to cater to diverse requirements. Not only does this mean that traditional reseller approaches are likely to see a gradual decline, given a lack of control over both device visibility and support, but it also underlines the need for service providers to look toward solutions that offer enhanced capabilities. Ownership of core network services forms one part of this approach, given the ability to optimise deployments on behalf of the customer, while also offering the potential to provide best-in-class customer service in terms of support and reliability. Additionally, providers should look towards solutions that enable a considerable level of OTA control over the SIM fleet, such as is the case with multi-IMSI technology in combination with eSIM. Regulation was already top-of-mind for many service providers at Mobile World Congress in 2023, and this is likely to continue as operators and regulators see an increasing amount of IoT roaming connections on their networks—the inability to circumvent any restrictions that do arise risks losing business in the long-term.

Medium-term

2024 will see the commercial emergence of the IoT specification for eSIM, with infrastructure deployments supporting this gradually maturing by 2027. The specification removes many of the technical barriers associated with current eSIM deployments used in IoT use cases, increasing the flexibility for customers to select a connectivity provider, in addition to being better able to support devices with constrained power or throughput capabilities. Service providers should expect that many enterprise verticals will look towards eSIM using the IoT specification as a de facto deployment technology as a means of ensuring a long-term failsafe against regulatory or commercial changes in the market.

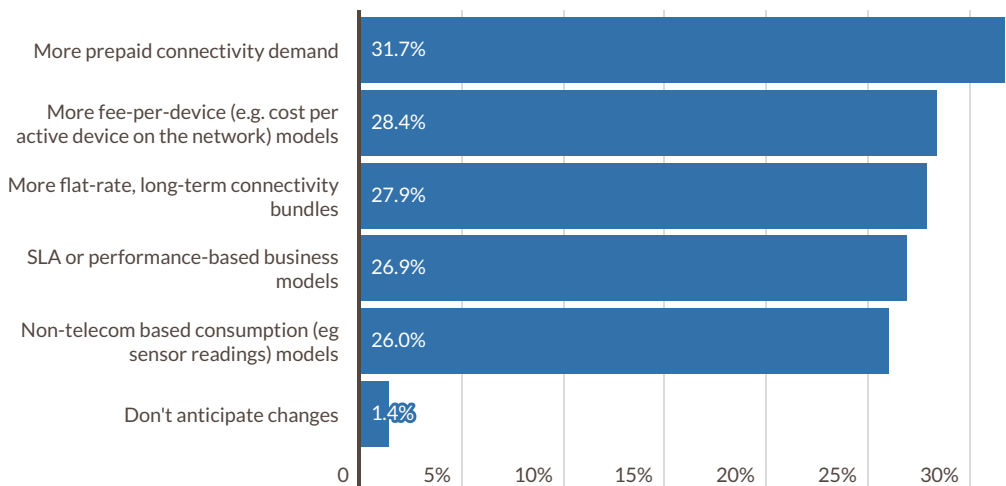
IoT Connectivity Monetisation

Billing

In parallel to how technological shifts are altering the way service providers can approach the IoT market, there are also shifts occurring on the commercial side of the market that must be considered, particularly as this concerns IoT connectivity monetisation. Where IoT roaming is concerned, the market is seeing a trend away from pure monetisation based on Megabytes consumed, with many MNOs now adding network access (active IMSI) based charging into negotiations with roaming partners. In part, this is in reaction to the increasing number of LPWAN (NB-IoT and LTE) roaming connections, which often consume so little data that they do not break thresholds to generate chargeable records. In such a scenario, devices are effectively operating for free while still consuming signalling resources on the visited network.

As the market for 5G IoT roaming connectivity begins to mature, a new wholesale billing and settlement framework, dubbed Billing and Charging Evolution (BCE), will emerge. In contrast to today's Transferred Account Procedures (TAP) framework, BCE offers considerable flexibility in terms of how wholesale connectivity can be monetised, enabling native differentiation in the context of Radio Access Type (RAT) in addition to allowing various flavours of non-traffic consumption business models alongside traditional traffic-based models.

Survey Q: 'How do you view retail business models developing for IoT connectivity?'



Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

Currently, the application of network access-based charging on the wholesale level means that IoT service providers negotiating with direct roaming partners or roaming hub or sponsor partners must either absorb those additional costs or pass them on to the customer. In either case, this may put

additional pressure on pricing, and may ultimately impact the retail pricing offering to the end customer. This is important, especially when considering the fact that retail pricing for IoT connectivity has, for better or for worse, become somewhat commoditised over the years. This is compounded by the emergence of LPWAN (NB-IoT and LTE-M) radio technologies, where connectivity is increasingly sold in long-term, prepaid forms.

Value-Added Services

Despite these forces serving to potentially disrupt the profitability of IoT service providers, there are many opportunities in the industry for players to improve monetisation capabilities. The most obvious of these is through the development of Value-Added Services (VAS), where the connectivity portfolio is supplemented by additional products or services to form more complete solutions. In this manner, end-customer complexity in terms of sourcing required products or services can be reduced, in turn enhancing customer 'stickiness.' Indeed, in Kaleido's 2023 enterprise survey, results showed that 52% and 57% of cellular IoT adopters placed a high value on providers' VAS and vertical solutions portfolios, respectively.

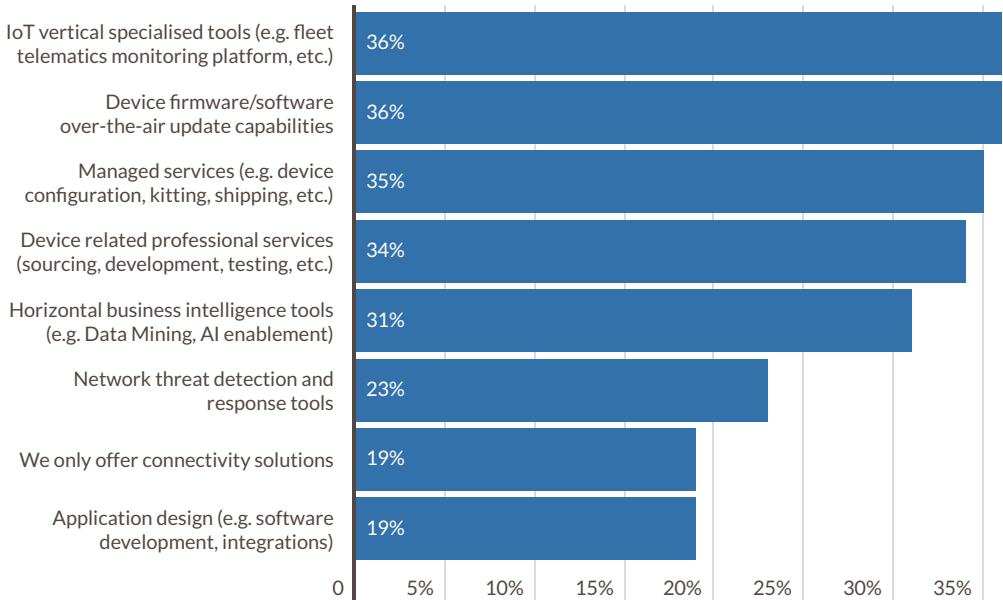


52% and 57% of cellular IoT adopter enterprises cited a VAS and vertical solutions portfolio as key influences behind buying decisions.

Source: Kaleido Intelligence, Enterprise Cellular IoT Connectivity Survey H1 2023

Overall, just under 20% of respondents in Kaleido's latest survey reported they focus only on providing connectivity services, in spite of the wealth of partnership opportunities that exist to potentially offer more turnkey-focused solutions to end-customers. That said, a relatively large proportion of the response base offers capabilities surrounding device- and vertical-related solutions, which helps reinforce what has been observed in Kaleido's enterprise IoT survey.

Survey Q: 'What type(s) of Value-Added Services (VAS) do you offer, either via in-house or partner sourced products?'

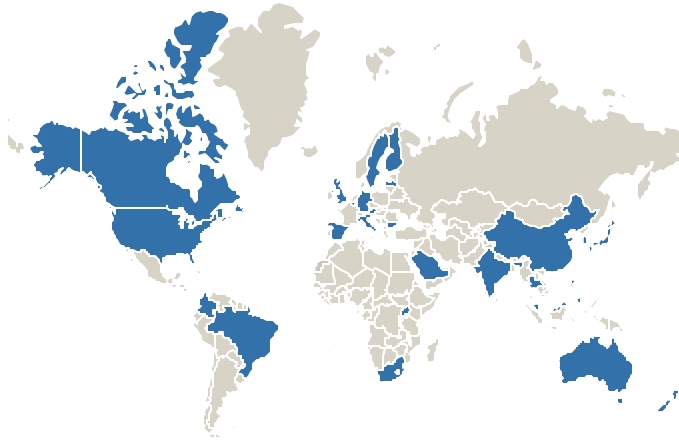


Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

Emerging Technologies

In addition to VAS, there are additional opportunities to consider. In the first instance, 5G standalone networks (using the 5G core rather than 5G non-standalone's LTE core) are gradually being rolled out across the globe. This is an important step for the market, as while 5G non-standalone can potentially offer higher throughput than LTE connectivity, other benefits, such as lower latency, high accuracy location services, and support for very high connection density, are not available until the 5G radio is supported by the 5G core.

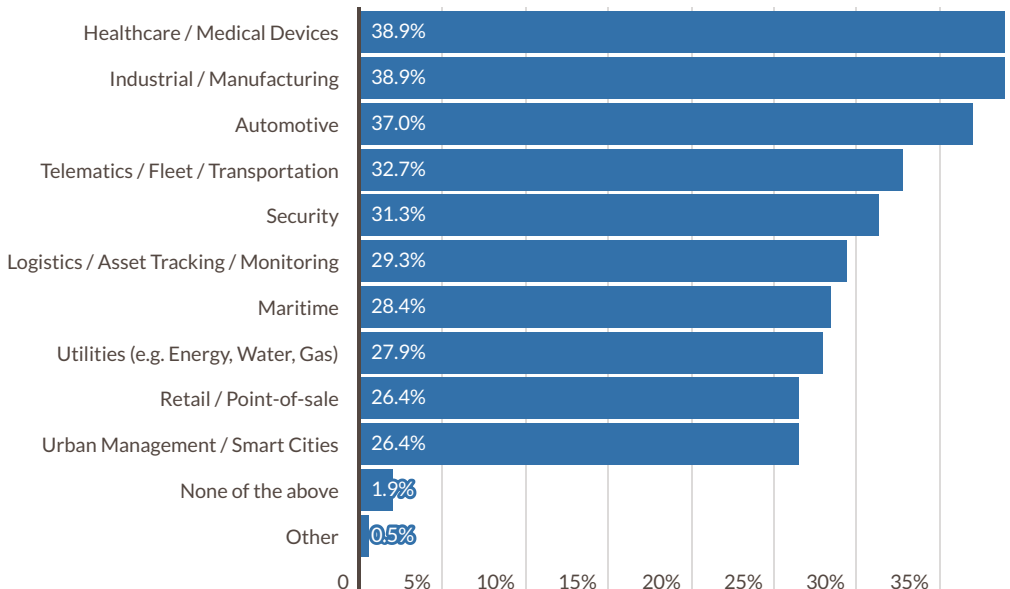
Operator 5G Core Launches Globally, November 2023



Source: Kaleido Intelligence, 5G Tracker Q4 2023

Kaleido's survey highlights that end-customer interest in 5G connectivity is already being seen across several verticals, with industrial, transportation and security seeing the strongest response from surveyed service providers. While solutions such as video surveillance may well benefit from 5G non-standalone connectivity due to the higher available throughput, it is certainly the case that automotive and industrial use cases will see many more benefits from 5G standalone. Here, solutions such as network slicing, private networks, in addition to enhanced support for specialised capabilities such as HD mapping and precise geolocation, are best served by 5G standalone network architecture.

Survey Q: 'Are you seeing customer demand for 5G among industry verticals, and if so, which ones?'



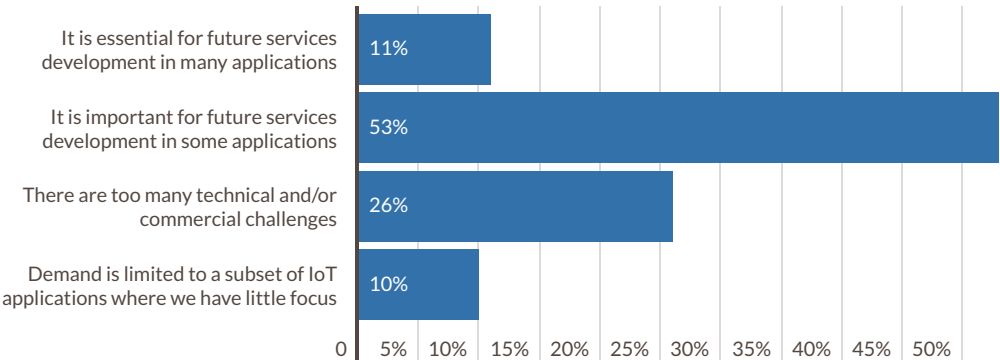
Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

At the time of writing, there are no extant agreements that enable 5G standalone roaming, while roaming on 5G non-standalone architecture is viewed by some in the industry as a somewhat unnecessary effort, given that the ultimate goal is to transition to 5G standalone services. Nevertheless, as shown earlier, domestic deployments of true 5G networks are accelerating worldwide: as such, it is important to consider that the ability to leverage the capabilities of 5G standalone networks for IoT depends either on the arduous task of sourcing local connectivity SIMs and contracts or on the ability to localise connectivity either via eSIM or multi-IMSI technology.

The emergence of 5G standalone connectivity also raises the possibility of supporting IoT connectivity through converged cellular and satellite network technologies. Interoperability to that end has been standardised in 5G within Non-Terrestrial Network (NTN) support, which enables unmodified cellular devices to access NTN-capable satellites and coverage where agreements between the service provider and the satellite network operator are in place. Although the market for NTN solutions is immature at present, with commercial services only beginning in 2024, growth potential is indubitable: on the one hand, the capability to access satellite networks using traditional cellular devices brings the cost of deployments down to a significant degree, given the economies of scale enjoyed by cellular IoT hardware versus traditional, expensive satellite equipment. Secondly, many IoT projects are located outside cellular networks' main coverage footprints. This is due to the fact that physical network design has traditionally focused on servicing areas that have a relatively high population density rather than full geographic coverage.

According to the survey, some 53% of respondents believe that converged cellular and satellite network service will be important to the future development of IoT connectivity for some applications. This is an understandable sentiment: the satellite network is only going to be used when the terrestrial network is not available. Meanwhile, the high costs inherent in designing, launching and operating satellite networks means that the cost of access will likely remain above terrestrial cellular pricing for the foreseeable future.

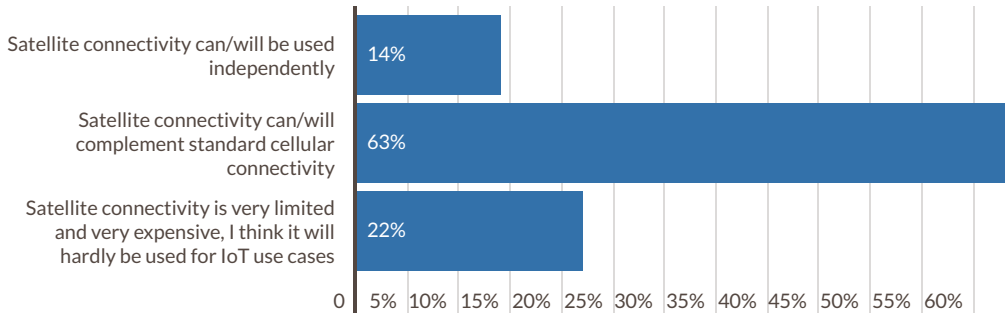
Survey Q: 'How important is satellite connectivity and terrestrial mobile network convergence to future IoT connectivity services development?'



Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

Nonetheless, as we can observe, relatively few respondents in the survey cite technical or commercial challenges as major barriers to the broader rollout of solutions. 63% of the response base believes that satellite technology will complement cellular connectivity, with only 22% believing that technical limitations and pricing will hamper its success.

Survey Q: 'How important is satellite connectivity and terrestrial mobile network convergence to future IoT connectivity services development?'



Source: Kaleido Intelligence, IoT Service Provider Survey Q4 2023

What's Next

Near-term

The commoditisation of airtime pricing for connectivity, coupled with increasing price pressure trends on the wholesale side of the market, has created a challenging environment for pure-play connectivity providers. As such, it is imperative for service providers to consider monetisation strategies that deliver revenue beyond airtime: the ability to deliver VAS either in-house or via partnerships has been shown to be valued by enterprise IoT customers, given the fact that it removes a level of sourcing and integration complexity away from the end-customer in instances where solutions have not already been deployed by them. Meanwhile, it is important to consider the fact that the ability to streamline operations through greater ownership and management of the solution not only serves to enhance the user experience but also offers the ability to cater to a much more diverse range of clientele in terms of connectivity performance and quality-of-service requirements.

Medium-term

As commercialisation of 5G standalone networks proliferates across the globe, new opportunities will arise in the form of 5G IoT connectivity and converged cellular and satellite networks under NTN. New billing models will be required, both at wholesale and at retail level, leading to a need for a high level of flexibility in any deployed billing modules, while providers will need to ensure that their infrastructure and connectivity partnerships are well-developed in order to cater to solution demands that a much more diverse than those seen in the 2G-4G era.

About floLIVE

floLIVE designed and developed an elastic, robust core cellular infrastructure that is the largest connectivity backbone in the world. Through this powerful infrastructure, the company offers numerous services to mobile operators, IoT MVNOs and Global Enterprises seeking seamless, compliant, high performance and regulatory compliant connectivity, anywhere in the world. With a global carrier library that is based on interconnected local core mobile networks, floLIVE ensures low latency, high performance, and full compliance with privacy acts, data regulations, and roaming restrictions. As of today, more than 20 mobile operators are on board the platform, giving companies multi-tier connectivity access. Through direct access to our network, customers can monitor their devices, access real-time network events and usage, switch operators remotely, and troubleshoot failures ahead of time, providing a seamless experience that keeps devices connected at all times. Through one integration, one SKU and one platform, customers have a world of connectivity and endless possibilities.

About Kaleido Intelligence

Kaleido Intelligence is a specialist consulting and market research firm with a proven track record delivering telecom research at the highest level. Kaleido Intelligence is the only research company addressing mobile roaming in its entirety. Our Mobile Roaming & Connectivity research service covers industry leading market intelligence and publications on Wholesale & Retail Roaming, eSIMs, 5G Roaming, IPX, Private Networks, IoT MVNOs, IoT Roaming and Roaming Analytics & Fraud. Research is led by expert analysts, each with significant experience delivering roaming insights that matter.

For more information on this market study and the surveys or if you have further requirements, please contact:

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