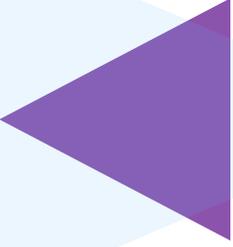




OPERATOR BENEFITS FROM BCE & BLOCKCHAIN IN ROAMING

A WHITE PAPER BY KALEIDO INTELLIGENCE & TOMIA



INTRODUCTION

Wholesale roaming is a microcosm of carrier operations as a whole: modest growth from traditional revenue streams allied to increased costs, derived from issues such as the need to accommodate the surge of MIoT (Mobile Internet of Things) traffic. The net result is a squeeze on margins which will continue without remedial actions.

Traditional techniques for charging, reconciliation and settlement are simply not equipped to cope with a world where the growth in roaming traffic events is increasingly driven by devices such as cars and industrial equipment rather than smartphones. Those techniques, exemplified by TAP (Transferred Account Procedures) were designed to manage voice calls: unable to differentiate between devices and network technologies, they mean that operators in turn are losing revenue by being unable to optimise the monetisation of IoT.

The first TAP specification was released by the GSMA in 1995, as the mechanism by which wireless operators exchange roaming billing information. While specifications evolved to support new services, the procedures are no longer capable of keeping pace with the plethora of devices and technologies which now roam across networks. Furthermore, those techniques are increasingly perceived as inefficient and labour-intensive: given the pressure on margins, there is a need to cut settlement costs, particularly resource-related, while also developing new revenue streams.

Looking at the future of roaming settlement, there are two complementary technologies that operators (and/or their clearinghouse vendors) can deploy to achieve the twin goals of additional revenues and reduced costs.

The first, BCE (Billing and Charging Evolution) is a simplified and flexible optional settlement method, designed to address the weaknesses in TAP and specifically enabling (via an automated process) the differentiation between different kinds of devices and traffic, and thereby facilitating the introduction of far more tailored, nuanced billing.

The second, blockchain, offers a wealth of advantages, including near real-time settlement of charges using smart contracts; resolving any disputes or fraudulent transactions more effectively; and, identity management to reduce roaming fraud.

The aim of this White Paper is twofold:

- firstly, to alleviate the concerns of operators who may be worried about the potential costs and disruptions which they feel may accompany the implementation of these technologies;
- secondly, to illustrate the scale of the benefits which will accrue from deployment, both in terms of achieving cost savings and developing new revenue streams.

EXECUTIVE SUMMARY

TAP will be unable to cope with the combination of soaring roaming data traffic, the decoupling of retail and wholesale and the need to identify and distinguish between new kinds of traffic. In contrast, BCE has been specifically designed to enable wholesale billing and settlement processes including alternate billing and settlement options and is far more adaptable to work with wholesale roaming discount agreements.

BCE is based on bilateral agreements, with reports and settlement occurring at agreed intervals: annually, quarterly or monthly, rather than relying on the traditional, rigid settlement windows. This in turn enables MNOs to save on monthly and annual settlement costs.

In contrast with TAP, BCE includes support for, and aggregation of, IoT devices using technologies such as NB-IoT, LTE-M and (moving forwards) 5G SA.

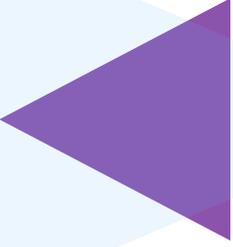
BCE thus allows for the introduction of new commercial models for roaming, such as charging on a per IMSI per day basis (where records would be combined into a single monthly report), volume-based charging or threshold-based charging (where the charging, or the discount applied, changes when a threshold is met) and specific charging for permanent devices.

BCE allows for faster and more efficient dispute resolution than TAP: if a dispute arises, the parties simply exchange detailed, non-aggregated reports (DDRs).

Operators can outsource the entire settlement and reconciliation process to their data clearinghouses, as a majority already do with TAP. In cases where different MNOs involved were served by different clearinghouses, then they too would be a party to the agreements.

As not all MNOs will be BCE-capable for some time, the two technologies will continue to coexist: BCE can run in parallel to TAP, with data being moved from the latter to the former and potentially allowing a single invoice to be created covering both BCE and TAP.

Blockchain-based applications agnostic to the DLT infrastructure for annual settlement discounting provide a single source of truth. Furthermore, as only hashes of the contracts are stored on the blockchain, this ensures data integrity and immutability (and compliance with GDPR requirements).



DEMYSTIFYING BARRIERS TO DEPLOYMENT

OVERVIEW

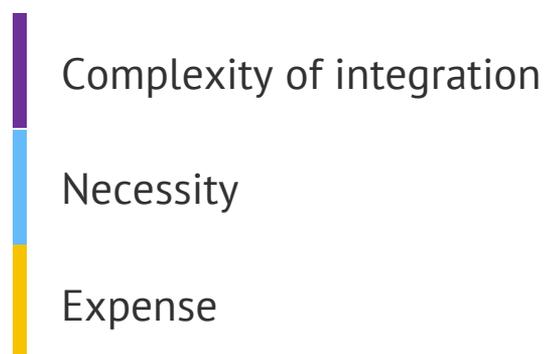
Although BCE and blockchain both present clear opportunities for carriers to address some of the key challenges around wholesale roaming, some players have the attitude that *"if it ain't broke, don't fix it"*: that the cost of deploying BCE and/or blockchain might ultimately exceed any savings made or new revenues generated, or that the technologies might be complex to integrate with existing platforms.

Furthermore, some carriers, particularly smaller players with no plans to launch 5G or NB-IoT and who are not dominant in M2M roaming, might feel they have no reason to deploy the technologies.

Clearly, the extent to which these represent barriers to adoption will vary from operator, but in the first instance it is important to understand that in most instances the route to deployment is relatively straightforward, particularly if the roadmap is followed with a trusted partner such as a clearinghouse which can shoulder much of the "heavy lifting".

In these cases, the operator will not need to concern itself with the minutiae of BCE compliance (or, in the case of blockchain, node management) as the infrastructure can be run by third parties.

Perceived Barriers to Deployment of BCE and/or Blockchain



Source: Kaleido Intelligence

DEMYSTIFYING THE BARRIERS

#1 Complexity of Integration

TAP will not be able to cope with the combination of soaring roaming data traffic, the decoupling of retail and wholesale and the need to identify and distinguish between new kinds of traffic.

In addition to a sharp rise in revenue leakage, future reliance on TAP would add substantially to the manual input required for settlement, with the prospect of a massive increase in CDRs which generate no revenue.

BCE has been specifically designed to address wholesale billing and settlement processes including alternate billing and settlement options and is far more adaptable to work with wholesale roaming discount agreements.

While TAP relies on invoices generated for each event (call, text message or data transfer), BCE enables billing based on usage data aggregated on a per-day basis.

In terms of implementation and integration, there are important procedural differences between TAP and BCE. For example, under TAP files are sent daily, with notification files sent if there is no traffic: under BCE, frequency of the exchange is as agreed between the two parties. TAP has a returns account procedure for rejects and disputes, while BCE's new reporting format covers the need to invoke DDRs if required. Meanwhile, current reporting systems used for TAP will not support BCE without changes.

However, BCE still shares a number of common elements with TAP, including agents and the TADIG (Transferred Account Data Interchange Group) codes used as the primary identifiers within file contents and file names. Additionally, payment processes will remain the same.

From a practicality standpoint, and to reduce disruption, the implementation of BCE should ideally occur at a point when an operator or their partners are launching new services (e.g. an updated IoT portfolio) so that the service is optimised for billing and charging from the outset.

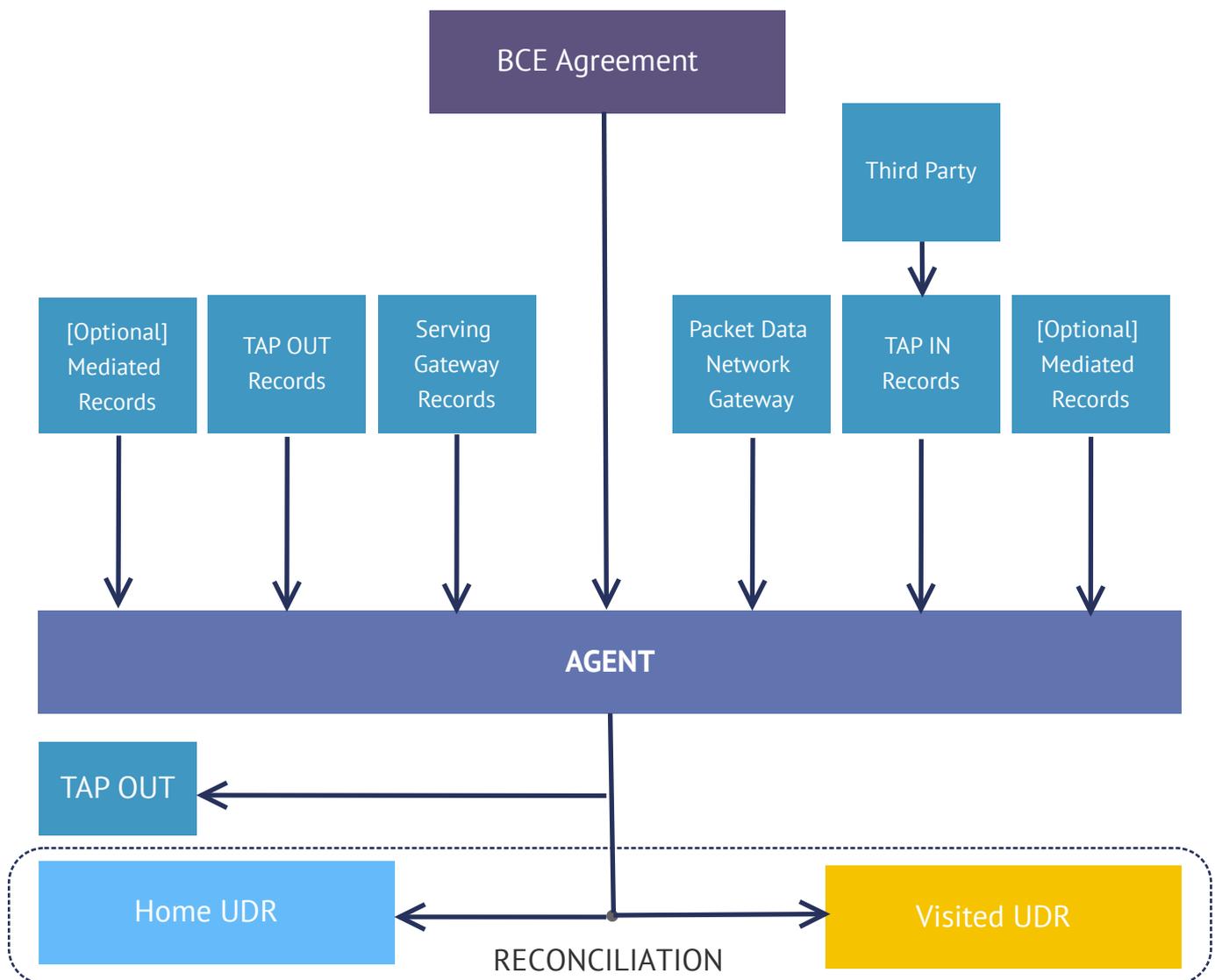
#2 Expense

The cost of migrating from TAP to BCE has been cited as an inhibiting factor, and certainly, for in-house implementation this will vary from operator to operator and depend on whether optional procedures are implemented. However, all MNOs adopting this approach would need to create a billing statement report, apply a rating to it and send it to their partner for reconciliation along with the charging document.

Operators can alternatively outsource the entire settlement and reconciliation process to their BCE agent, as a majority already do with TAP. In cases where different MNOs involved were served by different vendors, then they too would be a party to the agreements. Thus, the raw data would be extracted for both TAP and BCE, before being sent to the agent in the agreed format. The agent then separates and packages the traffic according to the given criteria, generates the TAP and BCE reports and reconciles incoming BCE reports with the served network data before settlement takes place.

There are several other attractions of using an outsourced approach. To begin with, it means that MNOs are not obliged to maintain dedicated compliance specialists in-house: even for Tier 1 operators, the roaming department would typically comprise a small team within a much larger IT department, and thus keeping abreast of both evolving standards and issues such as pertinent local regulations (and indeed maintaining local systems to comply with these regulations) would be a time-consuming (and inefficient) process. Secondly, by using a third party providing a combination of revenue assurance and an automated reconciliation process, with reporting tools covering both traffic streams, the risks of duplicated traffic and charging can be avoided.

Outsourced Approach for Wholesale Billing



Source: Kaleido Intelligence Based on GSMA Model

Wholesale roaming is a microcosm of carrier operations as a whole: modest growth from traditional revenue streams allied to increased costs, derived from issues such as the need to accommodate the surge of MIoT traffic. The net result is a squeeze on margins which will continue without remedial actions.

Certainly, for any operator experiencing even modest levels of MIoT roaming traffic, the additional revenues accrued from differentiated consumer/MIoT pricing allied to savings around the automation of reconciliation and discount agreements should comfortably exceed BCE implementation costs, particularly if the outsourcing option is selected.

#3 Necessity

While few operators are currently BCE-capable, most recognise its inevitability. TAP is viewed as too complex, expensive and difficult to upgrade, and hence will remain static, in “maintenance mode”, for the foreseeable future. This means that it will not support any future charging models, such as daily charges.

Additionally, new charging models might arise outside the BCE standards that could be supported on a bilateral basis, such as signalling-based presence models, where signalling events may be used detect more IoT devices that are not predefined or otherwise visible.

It should be observed that no other industry-approved alternatives to BCE have emerged, meaning that BCE will become the de facto replacement for TAP for wholesale roaming, as well as the standard for IoT and any other next generation services. What this means is that to decouple wholesale and retail roaming, and to be able to monetise new services and business models, operators will have no choice but to deploy BCE.

THE BENEFITS OF BCE & BLOCKCHAIN IN ROAMING

INTRODUCTION

The following schematic provides an illustration of where the primary benefits in the wholesale roaming arena of BCE and blockchain reside, individually and/or in tandem. Please note that in each case BCE and blockchain deployments complement and reinforce one another. Thus, for example, for dispute resolution acceleration, the benefits are heightened if both technologies are deployed.

Primary Benefits in Wholesale Roaming, Combining BCE and Blockchain

		BCE	BLOCKCHAIN
1	Automate Wholesale Roaming	✓	✓
2	Aggregation Based on Radio Access Technology Used for MIoT	✓	✓
3	Accelerate Reconciliation	✓	✓
4	Implement New Commercial Models	✓	
5	Accelerate Dispute Resolution	✓	✓
6	Enable Standardisation of Discount Agreements	✓	✓
7	Support High Volumes of Data Traffic	✓	✓
8	Reduce Roaming Fraud		✓

Source: Kaleido Intelligence

AUTOMATION OF WHOLESALE ROAMING



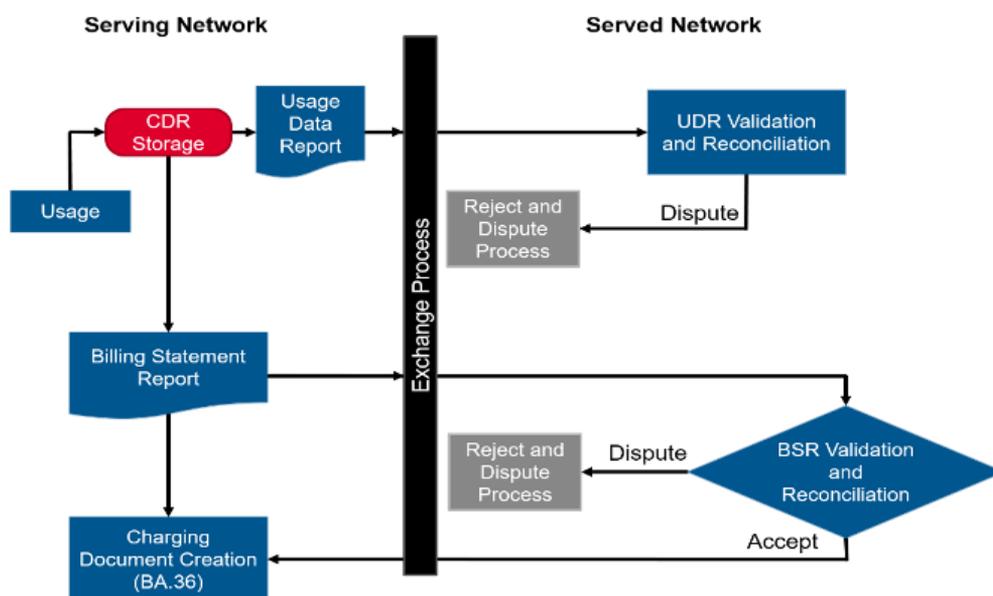
The [mobile] industry pays on average \$6/roamer in overhead costs to settle roaming transactions.

This is according to a report by Roam in association with T-Mobile USA and Ericsson. Meanwhile, Deloitte notes that roaming clearing and settlement costs can reach up to 15% of an MNO's operating profits.

One of the key benefits to be derived from BCE is the automation of the wholesale roaming process. The system is based on bilateral agreements, with BCE reports and settlement occurring at agreed intervals: annually, quarterly or monthly, rather than relying on the traditional, rigid settlement windows. This in turn enables MNOs to save on monthly and annual settlement costs, while the combination of automated settlements and flexible settlement periods provides greater efficiency in cash flows.

BCE also automates processes such as support for in-house control and the self-validation of invoices through the ability to validate invoices by comparing them with actual traffic. Meanwhile, reconciliation ensures a pre-invoicing audit of data.

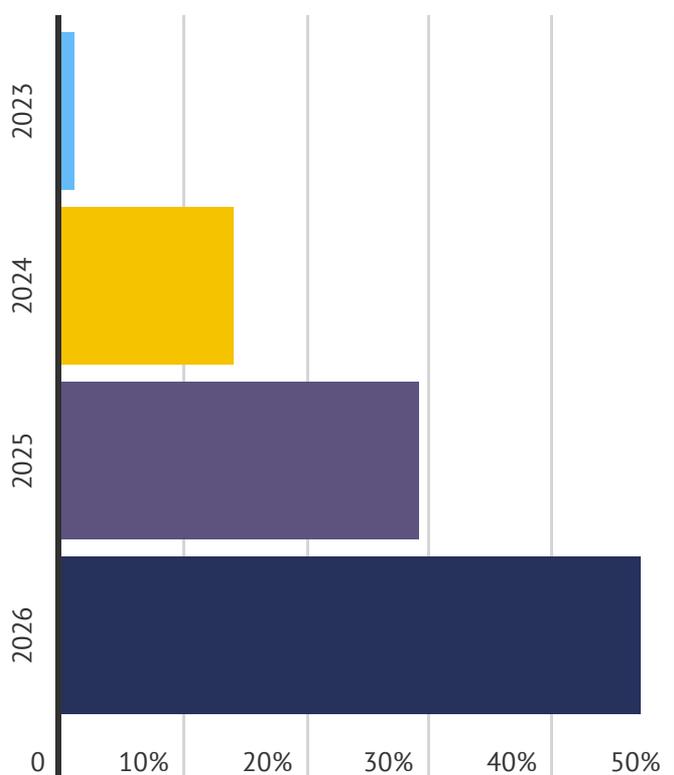
BCE Settlement Process



Source: GSMA

According to Kaleido, over \$10 billion in wholesale roaming revenues will be settled annually using BCE by 2026 and will represent around 47% of total wholesale roaming revenues from IoT and consumer mobile roaming traffic settled globally. This proportion is expected to be higher in North America and Europe & Central Asia, representing around 50% and 62% by 2026 respectively.

Total Wholesale Roaming Revenues Settled Using BCE As A Proportion of Total Wholesale Roaming Revenues, 2023-2026



Source: Kaleido Intelligence

ENABLE IDENTIFICATION OF IoT DEVICES

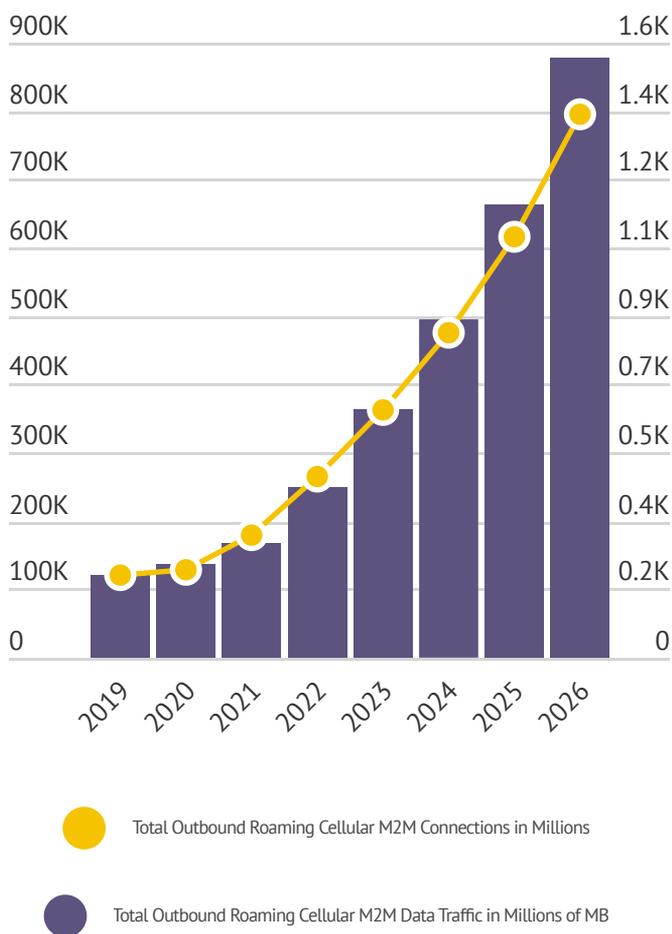
The emergence of IoT (Internet of Things) ecosystems, where physical devices and vehicles are internetworked to facilitate the use of developments such as big data analysis, artificial intelligence (AI) and automation, poses three fundamental problems from a roaming perspective:

- firstly, a surge in volume;
- second, a proliferation in the number of device profiles to be identified.
- Third, a greater variety of network technologies in use.



Kaleido estimates that the number of IoT/M2M roaming devices will increase from 212 million in 2019 to 1.1 billion by 2025, while the volume of data traffic generated by these devices will increase from 111PB per annum to 617PB per annum.

IoT/M2M Roaming Devices in Millions and Annual Roaming Traffic in Millions of MB, 2019-2026



Source: Kaleido Intelligence

This will in turn place a significant strain on MNO systems, potentially impacting on performance and increasing costs. On the second point, systems and procedures designed purely around individual uses of mobile handsets for voice and data may struggle to distinguish between a human using a smartphone and a piece of connected industrial machinery.

The TAP process is too rigid for 5G and/or IoT technologies, most notably in its inability to differentiate between traffic types and to support the low level of detailed billing required, meaning that labour intensive, manual settlement is required.

Indeed, for IoT devices, it could also cost more to implement TAP billing than the revenue generated through the process, as records would be generated on a daily basis.

The nature of IoT device traffic also makes legacy billing models (predicated purely on data volumes) impractical, in that many roaming IoT devices may also generate significant numbers of events (and thus use network resource) in the form of location updates, but not actually consume much data. Furthermore, many of these devices stay silent (and hence undetected) for long periods. This lack of visibility around traffic volumes and sources, in turn, translates into revenue leakage – an inability effectively to monetise that traffic and those devices.

Furthermore, the IoT revolution is increasingly global: in sub-Saharan Africa, IoT solutions are being rolled out in volume in sectors such as mining (with remote-controlled machinery for mineral extraction), agriculture (crop monitoring) and healthcare (for diagnoses of illnesses in rural areas).

Given that a significant volume of IoT devices will, at various times, be deployed in or (if vehicular) travel across national boundaries, it is imperative that roaming solutions are introduced by operators worldwide which can identify these devices and also recognise any anomalies in their usage patterns which might signify fraud.

In contrast with TAP, BCE includes support for, and identification of, IoT devices using technologies such as NB-IoT, LTE-M and (moving forwards) 5G SA.

To distinguish between traffic types (2G/3G/4G/5G), BCE includes an aggregation dimension field for the RAT (Radio Access Technology)-type that can be used; when in use, different billing structures can be used for the different technologies.

Some of the Tier 1 operators are effectively using their recently signed NB-IoT and LTE-M roaming agreements as testbeds for BCE, given that there are currently only a modest number of agreements in place involving a modest number of devices (and thus running BCE in tandem with TAP is not resource intensive). Deutsche Telekom recently (March 2021) expanded its IoT roaming agreements, with other Tier 1s including Vodafone, Telia, Orange and Telecom Italia, making its NB-IoT service now available in 20 countries, including the US.

IMPLEMENT NEW COMMERCIAL MODELS

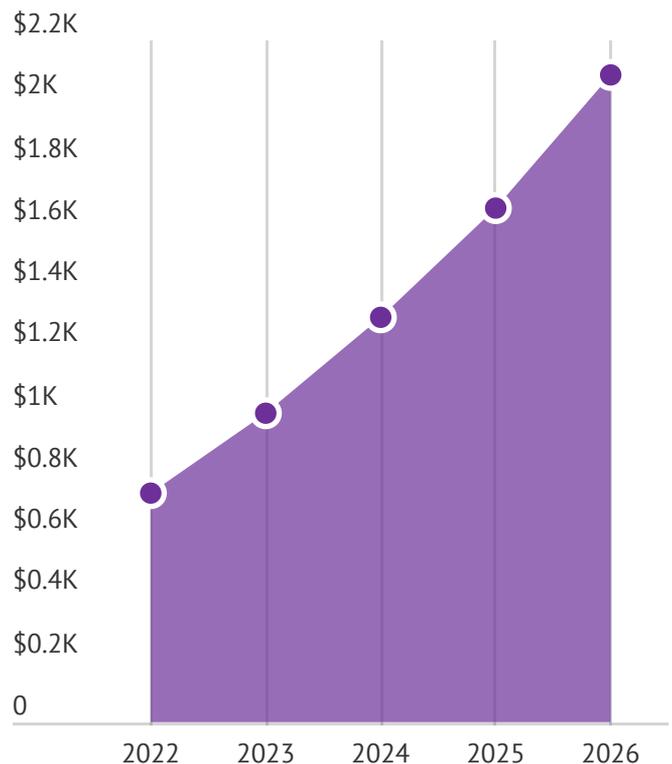
BCE allows for the introduction of new commercial models for roaming, such as charging on a per IMSI per day basis (where records would be combined into a single monthly report), volume-based charging or threshold-based charging (where the charging, or the discount applied, changes when a threshold is met). For example, this allows differential charging per GB depending on whether aggregated traffic is LTE or NB-IoT.

It can also support use cases where the wholesale amount is a fixed charge regardless of the usage or number of devices connected. Additionally, BCE supports mutual forgiveness in instances where the charges are zero.

For example, Kaleido predicts that by implementing the BCE-based day pass model, where operators are able to monetise permanently roaming low-traffic IoT devices by charging a fixed fee per IMSI per day, operators can generate around \$2 billion in additional revenues annually by 2026. Kaleido estimates that there were around 125 million permanently roaming devices generating low volume traffic of less than 10MB per month in 2020.

Indeed, it is BCE's ability to distinguish between (and therefore facilitate the monetisation of) different types of IoT traffic, particularly over NB-IoT, that is perceived by their operator clients as the most compelling reason for deployment in the first instance.

New IoT Wholesale Roaming Revenue Opportunity in USD Millions Enabled by BCE: Commercial Day Pass Charge Per Unit Volume Model 2022-2026



Source: Kaleido Intelligence

ACCELERATE DISPUTE RESOLUTION

Within TAP, dispute management is slow and cumbersome, with numerous discrepancies emerging around usage reconciliation and rating structures. BCE allows for faster and easier dispute resolution: if a dispute arises, the parties simply exchange detailed, non-aggregated reports (DDRs). Additionally, telco contracts could align using a blockchain infrastructure which allows you to streamline all processes. As a result, payment discrepancy analysis and dispute resolution will take mere minutes where it currently takes most operators several days because of the iterative process between different providers. For example, TOMIA is using blockchain to reduce the transactional timeframe by saving time on settlement and dispute management, while also increasing the transparency of the process. The nature of blockchain, that the information is stored immutably, makes a lot of sense in this use case and the majority of disputes that companies deal with are the result of rate misalignment.

By implementing blockchain, time spent on dispute management will be sharply reduced. In addition, with automating the settlement supply chain, the first step towards driving future use cases (e.g. bandwidth on demand, IoT management) is achieved. This will bring automation to the next level and generate additional business value. It should also be emphasised that collaboration tools need critical mass to become successful. Therefore, it is important for BCE services applications to support multiple technologies, ie to be agnostic to the distributed ledger technology (DLT) and blockchain workflow so that, moving forwards, different DLTs may be used for different use cases.

ENABLE STANDARDISATION OF DISCOUNT ROAMING AGREEMENTS

Discount agreements are discounts for increased inbound roaming traffic, typically between operator groups and/or international alliances. They take the form of annexes to the standard international roaming agreements and specify commercial terms and prices; they are negotiated on an annual basis.

The processes which underlie these agreements are complex, labour-intensive and disparate: there are no agreed standards on how the discounts should operate or on how they should be presented.

Even standard settlement of wholesale roaming using TAP takes 45 days on average. The process for discounted settlement can take up to 12 months. The procedure is initially paper-based, before the data is put into an Excel sheet or a self-built database, at which point the invoices are submitted and the drawn-out procedure of resolving the differences in the traffic data begins, leading to revenue leakage and weak revenue assurance.

These are issues that can be addressed through the implementation of blockchain based solutions: indeed, the first MVP of the GSMA's Blockchain for Wholesale Roaming (BWR) Initiative (recently renamed the DLT Group).

SUPPORTS HIGH VOLUMES OF DATA

Given that TAP was designed in the first instance to record voice calls, it is perhaps unsurprising that it only supports up to 100 PB (17 characters). While this is not at present an issue for billing, the emergence of high usage IoT devices may mean that within a very few years roaming devices may be using levels of data in excess of this.

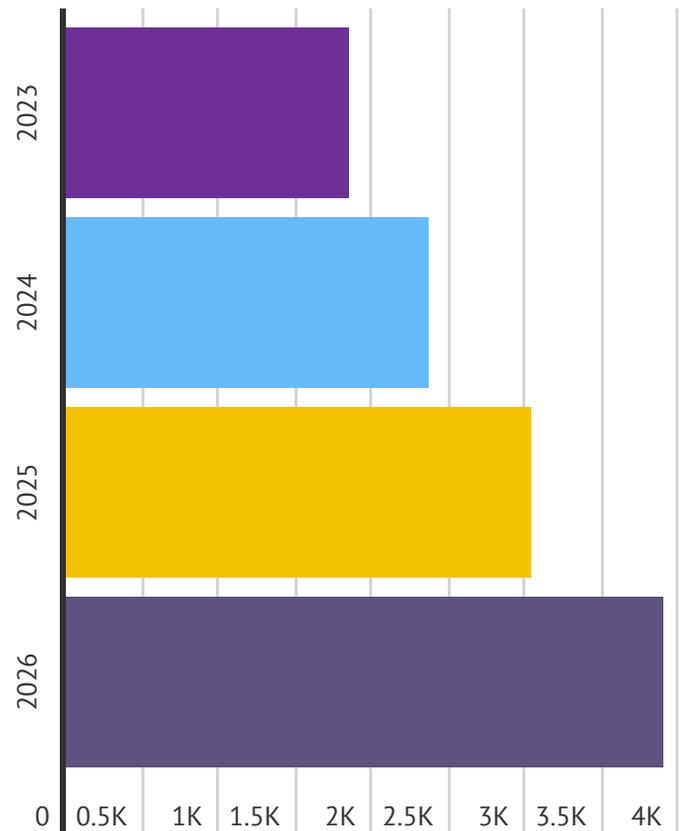
For example, the AECC (Automobile Edge Computing Consortium) estimates that global connected vehicle data traffic (including HD-Mapping, intelligent driving support and vehicle quality control) has the potential to exceed 10 exabytes per month per 2025, while these figures are likely to increase exponentially by the end of the decade as fully autonomous vehicles gain traction.

This in turn would mean the data usage above the 100PB limit would simply not be recorded, potentially resulting in significant revenue leakage in the latter half of the decade.

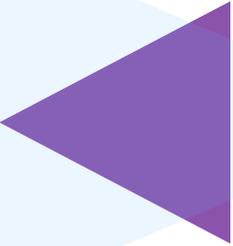
This is important because, in total, Kaleido forecasts that roaming data traffic generated by consumer mobile and IoT devices will reach 3,900 PB of traffic in 2026 representing an average annual growth rate of 46% between 2021 and 2026.

Conversely, BCE supports data volumes based on Petabytes and can even end upwards to Yottabytes (a million Exabytes).

Total Global Roaming Data Traffic in PB Per Annum 2019-2026



Source: Kaleido Intelligence



THE ROAD AHEAD

BCE AND TAP CAN CO-EXIST!

As not all MNOs will be BCE-capable for some time, the two technologies will continue to coexist: BCE can run in parallel to TAP, with data being moved from the latter to the former and potentially allowing a single invoice to be created covering both BCE and TAP.

Additionally, M2M/MIoT traffic that can be differentiated may be billed using different processes if required: some M2M/MIoT traffic could be billed using TAP, with the rest using BCE.

BCE DEPLOYMENT TIMELINE

Initial BCE commercial agreements will be for NB-IoT and/or M2M wholesale roaming over the next 12 months, driven by Tier 1 players in Europe and North America.

For these BCE early adopters, there is expected to be a slightly longer road from implementation to commercial production than for those who follow them, given that they will be the players who must ensure that everything defined by the standards worked as it should. Hence, the timeframe for subsequent deployment amongst other Tier 1 players should be shorter.

THE ROLE OF THE CLEARINGHOUSE

With the combination of BCE and blockchain, it is possible that the larger operators might wish to remove the primary intermediary – the data clearinghouse – with operators assuming responsibility for subscriber identification, roaming billing and fraud identification and management. For each bilateral roaming agreement, a permissioned blockchain would be created; each operator would control blockchain nodes designated for that purpose.

However, the best clearing houses will continue to fulfil a critical role at the heart of the relationship. For example, in an environment increasingly defined by a plethora of device types and network technologies, MNOs will not have the visibility on traffic or the mechanisms to bill for the different types of network usage without clearing house advanced analytics and reporting.

Given the continuing trend towards managed services, not least around the cost savings involved from employing dedicated specialists with extensive experience and expertise in settlement processes, technologies and compliance requirements, most operators are likely to opt to maintain a relationship with data clearing houses.

Furthermore, as TAP and BCE will be coexisting for the foreseeable future, transitioning to an operator-operator model purely for wholesale roaming while maintaining TAP at the clearing house in tandem might well add costs rather than save them.

That said, the simplification and transparency offered by BCE (potentially enhanced by blockchain) will mean that MNOs will need to ensure that their data clearing houses support the latest technologies and are compliant with the relevant GSMA BCE standards.

It is worth observing that the data analysis of this raw data is overwhelmingly conducted as a managed service by the data clearinghouses in the cloud. However, the Tier 1 operators in particular will be keen to have feeds from the analysed data which they can combine with other sources. The emerging problem here relates to the disparity in national regulations around data localisation and privacy. Some countries stipulate that all data must be stored in-country, or that special exemptions must be granted to transfer data internationally. This in effect means that in such cases, there is a need for data clearinghouses to be able to offer in-house, on-premise managed solutions as well as cloud-based options.

Additionally, given a lack of regulatory guidance elsewhere on where the liability lies for data security (Carrier? Cloud provider? Managed service provider?), the MNOs will be keen to know where their data resides (and if it is encrypted), both to ensure compliance and the security of end users and the infrastructure.

ENABLING OPERATOR SUCCESS: TOMIA CASE STUDY

One of TOMIA's operator customers has several commercial wholesale IoT agreements with its roaming partners. These agreements are based on predefined IoT identification parameters such as MCC-MNC, APN information and IMSI ranges. The customer uses a volume-based charging model and settles the traffic via TAP files monthly. For a particular month, the following KPIs were observed:



However, relying only on APN and/or IMSI ranges for identification of M2M/IoT traffic does not serve as an accurate identification method. In many cases, there are more IoT devices connected to the network and generating very less or nearly zero usages. The current scenario represents that MNO lost the opportunity to monetise the M2M/IoT devices connected in the network. In addition, applying only volume-based charging leads to misaligned charging against the commercial agreement and causes inaccurate monthly settlement charges, inefficient cash flows and requires manual intervention and recalculations.

Approaches

In order to increase inbound roaming revenues and to charge effectively for devices connected in the network with less or no usage, TOMIA proposed the following solutions:

- TOMIA's M2M/IoT Detection; and,
- TOMIA BCE service – to support differentiated charging and rating

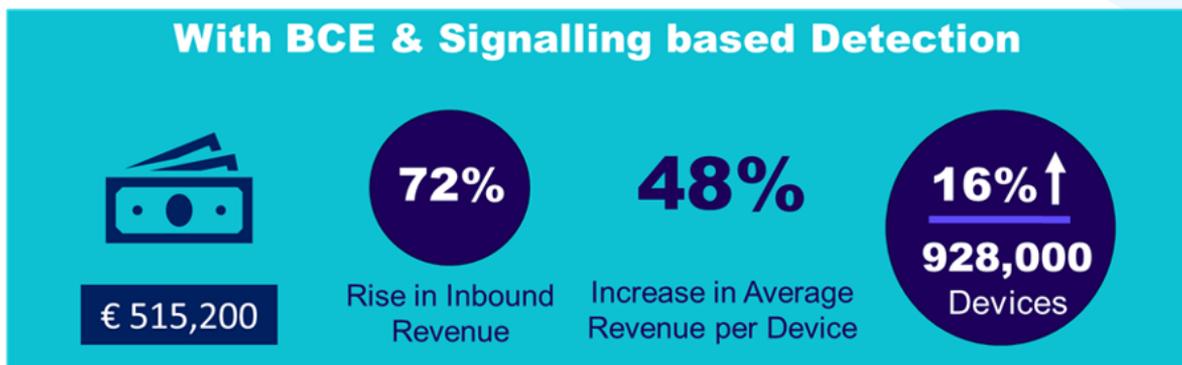
TOMIA's M2M/IoT Detection solution supports combining usages and signalling events to accurately identify devices connected in the network permanently or are silent devices. In order to apply differentiated charging based on M2M/IoT device profiles and usage behaviour, TOMIA's newly launched BCE service applies a daily or monthly surcharge or device fee. M2M/IoT devices can be segmented, such that differentiated fees or charging is supported. A list of devices / IMSIs identified based on signalling events and behavioural patterns is included in the monthly BCE settlement calculations, with devices/IMSIs charged a monthly surcharge and usage fees.

Opportunity

At TOMIA, we assist our customers to optimize their roaming cost and monetizing their revenue opportunities. With the introduction of the new billing and settling standards defined by GSMA, TOMIA has demonstrated an efficient revenue monetising opportunity for one of our customers to effectively increase their recurring revenues for their inbound M-IoT devices, while also showing an important use case to implement the TOMIA BCE service.

Using TOMIA's M2M/IoT Detection solution and TOMIA's newly launched BCE service, the customer was able to optimally:

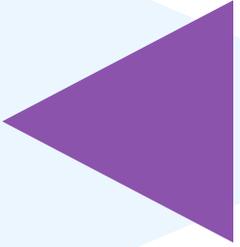
- Use a single settlement method / approach for settling of M-IoT agreements
- Identify 16% additional IoT devices by using signalling events
- Apply differential charging models as per IoT devices usages i.e permanent / silent etc
- Apply wholesale charging for M2M/IoT traffic by:
 - Applying a daily or monthly fixed fee per device
 - Applying usage-based charges.
- Increase monthly settlement charges by 72%
- Increase accuracy in charging as compared to TAP or IOT tariffs.
- Reduce or avoid manual calculation and settlement outside TAP on a monthly and yearly basis.



Conclusion

In its tests, TOMIA was able to successfully demonstrate to its customer the benefits of using BCE standards. Leveraging TOMIA's vast experience in wholesale settlement, network services using signalling and by using TOMIA BCE and analytical solution for M2M/IoT detection, our customer was able to:

- Build a valid business case towards upgrading to BCE settlement process for its M2M/IoT agreements.
- Identify areas to monetize optimally inbound M2M/IoT traffic.
- Increase revenues by identifying and charging permanent roaming and silent devices.
- Support differentiated charging across different type of devices and device usage behaviour



RECOMMENDATIONS



BCE presents operators with a means to automate and simplify wholesale roaming while being able to distinguish between different device and network types. It reduces revenue leakage and reduces settlement costs. It is essential that any MNOs wishing to monetise IoT, new services and/or 5G SA traffic implement BCE as soon as possible.



MNOs need to ensure that their data clearinghouses are BCE compliant.



The emergence of BCE will mean that in the future, commercial launch letters of any new roaming relationship will need to specify whether TAP, BCE or both will be used.



Current reporting systems will need to be reconfigured to support BCE, while in turn TAP should no longer be used as their feed to internal sources.



From a practicality standpoint, and to reduce disruption, the implementation of BCE should ideally occur at a point when an operator or their partners are launching new services (e.g. an updated IoT portfolio) so that the service is optimised for billing and charging from the outset.



While some operators may wish to manage BCE in-house, a managed service option may well be a more effective solution. Operators can thus outsource BCE to clearinghouses, as a majority already do with TAP, thus obviating the need to deal with day-to-day management (create a billing statement report, apply a rating to it and sending it to their partner for reconciliation) as well as keeping abreast of standards development and compliance issues.



Clearinghouses need to be able to offer customers in-house, on-premise managed solutions as well as cloud-based options.



Blockchain can be used on top of BCE provided the operators concerned agree to that. By incorporating blockchain into the stack, the net result will be fewer disputes, further reducing the time to settlement.



Ensure that blockchain applications are DLT agnostic to allow easier adoption in the future.

ABOUT TOMIA

TOMIA offers transformative connectivity solutions to service providers worldwide. Its innovative offering enables customers to manage a unified optimization process of both roaming and interconnect while driving the future of connectivity through new technologies and services such as VoLTE, NFV, and 5G. With regional headquarters in the US, Israel, Luxembourg, India, and a presence in over 30 countries, TOMIA serves over 400 operators including 30 tier-1 and six of the industry's largest groups.

To learn more visit www.tomiaglobal.com.

Contact TOMIA:

Daniella Torres | marketing@tomiaglobal.com

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 research service covers industry leading market intelligence and publications on Wholesale & Retail Roaming, 5G Roaming, IPX, IoT Roaming and Analytics & Fraud in Roaming. Research is led by expert analysts, each with significant experience delivering roaming insights that matter.

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

roaming@kaleidointelligence.com

Publication Date: 22nd June 2021

©Kaleido Intelligence | 2021. Kaleido aims to provide accurate information. The information provided here is designed to enable helpful data and insights on the subjects discussed. References to companies are provided for informational purposes only and Kaleido does not endorse any operator, vendor or service included in this research and market study. While information and content of this publication is believed to be accurate at the date of publication, neither Kaleido Intelligence nor any person engaged or employed by Kaleido Intelligence accepts any liability for any errors, omissions or any loss or damage caused or alleged to be caused directly or indirectly by what is contained in or left out of this publication. This white paper consists of the opinions of Kaleido and should not be construed as statements of fact. It contains forward-looking statements and market forecasts that have been developed based on current information and assumptions. These are subject to market factors such as, not limited to, unforeseen social, political, technological and economic factors beyond the control of Kaleido Intelligence.