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HOW TO RUN AN IoT ENABLED BUSINESS

Optimising IoT eSIM & Connectivity Service Orchestration

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eUICC SUPPLEMENT 2018

Why the future is embedded

PLUS: eUICC brings new capabilities for IoT devices and new revenue opportunities for network operators, say Stream executives • How eSIMs are different to traditional cards • Why it's make your mind up time for MNOs • eSIM and eUICC market predictions • News at **www.iot-now.com**

IoT Now eUICC SUPPLEMENT

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eUICC embeds new capabilities into IoT devices and offers revenue opportunities for network operators

Embedded subscriber identification modules (eSIMs) are replacing traditional SIM cards because of their ease of deployment and the capability they have to enable organisations to select and manage the connectivity their IoT applications require. eSIMs, also called embedded universal integrated circuit cards (eUICCs), provide enterprises with the flexibility to select optimal capacity from different operators while also gaining enhanced management control and visibility into eSIM-enabled device performance. Here, Nigel Chadwick, the chief executive of Stream Technologies, and his colleague Alan Tait, the company's chief technology officer, explain how eSIMs, in parallel with the company's IoT-X connectivity management platform, are transforming MNOs' and enterprises' IoT connectivity and operational capabilities

IoT Now: How do you feel that eSIM fits into the existing connectivity landscape?

Nigel Chadwick: It's quite simple, eSIM has been designed to be the most evolved connectivity solution that enables consumers, enterprises, original equipment manufacturers (OEMs) and mobile network operators (MNOs) to deliver on their connected device strategies.

We see that eSIM will be the replacement of the existing connectivity solutions due to being a standards compliant technology that is of interest to all parties, fully supported by MNOs and backed by the GSMA.

IoT Now: What does Stream and the company's IoT-X platform bring to the eSIM landscape?

NC: eSIM is an incredibly natural progression of our Connectivity Management Platform, the network infrastructure and commercial offerings

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IoT-X naturally lends its traditional connectivity management and orchestration capabilities to eSIM profile management

that we have been building throughout Stream's history.

This technology is an evolution of our multi-network approach. For almost two decades Stream has provided high quality connectivity services on multiple network operators simultaneously for enterprises within the M2M and IoT sector. We feel that the eSIM connectivity market can make use of this experience because it is nascent and needs to be executed correctly from day one.

Alan Tait: IoT-X naturally lends its traditional connectivity management and orchestration capabilities to eSIM profile management. And, through our integrations with Idemia and Giesecke & Devrient for both the M2M and consumer eUICC specifications, we are capable of providing and managing the physical eSIM and their respective subscriptions. This capability, coupled with our existing and long standing network agreements, is ideal for building a world-first global eSIM connectivity offering that is built on N+1 resilient global IP network and managed through IoT-X, our industry leading connectivity management platform.

IoT Now: Do you see benefits for the MNO with this model?

NC: Yes of course, there are some clearly strong benefits such as enhanced revenue and reputation for the MNOs who are enabling eSIM connectivity on their network through allowing consumers, enterprises or OEMs to gain this level of connectivity flexibility.

But what we are also seeing is that many MNOs are seeking the next wave of enhanced revenue from connected devices on their network. This is creating a large amount of interest within the MNO community regarding selling managed eSIM connectivity that may include connectivity profiles from other MNOs to their global clients. This approach will allow them to maintain their relationship and derive further revenues from their existing contracts.

These two paths of engagement naturally fit with our strategy of enabling MNOs to use IoT-X as a replacement, overlay or side-by-side deployment to existing connectivity management platforms. During 2017 we saw a rapid increase in demand for a more agile and flexible connectivity management platform that can serve international clients with eSIM connectivity as part of a cost-effective business model.

IoT Now: What benefits do you envision for the enterprise client?

AT: Our experience in this market has taught us that the management of complex relationships with MNOs can be very resource heavy and require specific expertise within the industry. Our managed connectivity offerings for connected eSIM devices will allow the enterprises to deploy their solutions with Stream or their MNO in the knowledge that this is taken care of.

With our managed eSIM connectivity service offering, the key benefit is that the consumer, enterprise or OEM will gain all the advantages of eSIM technology through a single supplier that provides the physical SIM and high quality connectivity services from pre-integrated MNO partners. Quite simply, this allows the devices to be deployed with peace of mind that they will always operate on a highly secure and resilient solution at market leading commercial rates from one service provider. Customers will also retain an incredibly high level of control and visibility into subscriber performance for their eSIM connected devices regardless of what MNO profile has been utilised.

Nigel Chadwick, Stream Technologies

Alan Tait, Stream Technologies

From a technical perspective, Stream offers a single integration point for all the key interfaces that will allow the enterprise to grow its portfolio of agreements and connected devices without worrying about scaling or re-integrating for new services. Key features include:

- Secure global IP data integration points for routing device data from the wireless networks to each enterprise's infrastructure or applications
- Simple restful application programme interfaces (APIs) for subscription and subscriber management
- Transparent billing interface and granular invoicing
- Superlative user interface for management of all connected devices

NC: We feel the enterprises that are currently choosing an eSIM solution for their deployment strategy are typically at that reinvigoration stage of their digital transformation strategy and require a high level of service from an established, well respected and knowledgeable connectivity service provider.

IoT Now: With the market apparently ready for this solution, do you feel that 2018 is the year that eSIM connectivity will boom?

NC: Yes, we firmly believe that. 2017 showed a substantial increase in interest and procurement processes from the enterprise market throughout the year and IoT-X has been a major catalyst in evolving the engagement of the eSIM market for IoT as a whole.

AT: This is an extremely MNO-friendly technology and solution set and it offers the opportunity to bring significant net new revenue to the operator market from connected devices at little or low impact on resources from the MNO. As such we are seeing increasing numbers of network operators are realising the benefits to their strategy of enabling eSIM in their market.

This level of commitment to the technology by both enterprises and MNOs will only further allow the analysts' projected IoT volumes to be realised.

IoT Now: How does Stream and IoT-X enable the enterprise to utilise eSIM connectivity in a more integrated and simple approach?

AT: Stream has continually focused and invested in the development of our IoT-X platform to be the next evolution of connectivity management platforms. Our mantra has always been to build an agnostic and scalable management layer that will allow enterprises to deploy devices in the most simple and efficient manner possible; eSIM profile orchestration is the natural evolution in this step.

Our technical approach to integration with MNOs is completely innovative in comparison to existing players in the market, which enables us to integrate new operators within a matter of weeks anywhere in the world. Our eSIM strategy is to enable any enterprise to use their SIM manufacturer and MNO supplier(s) of choice, to date we have an integration with both Idemia and Giesecke & Devrient and we're fully compliant with any over-the-air (OTA) remote subscription management platform that is GSMA compliant.

NC: Enterprises are crying out for a simple and effective solution that enables them to deploy their devices using an eSIM connectivity solution while having complete trust in a party to deliver and work with them as their strategy grows and changes. Our roadmap is particularly exciting for new features and integrations that will further enable the both the enterprises and MNOs to increase visibility and control of their devices.

Simply put, IoT-X allows enterprises, OEMs and MNOs to fully realise and execute on their connected device strategy.

Enterprises are crying out for a simple and effective solution that enables them to deploy their devices using an eSIM connectivity solution

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It's make your mind up time for network operators

2018 will see one of the most disruptive technologies to hit the telecoms industry for a long while, embedded universal cards (eUICCs), ramp up deployment volumes. These cards, sometimes called eSIMs, will not only enable the rapid deployment of potentially millions of IoT devices around the world, but will also present mobile network operators (MNOs) with some difficult decisions

"As we enter the IoT era, most connected devices still offer no security for data storage and communication exchanges, cannot ensure software or firmware integrity, and offer insufficient protection from cyber-attacks"

Realistically, technologies such as LoRa, SigFox and the rest will never be more than localised solutions for IoT connectivity. While excellent for many applications, these technologies cannot provide the global reach or the agnostic network connectivity upon which the vast majority of IoT devices will depend. It could be argued however that narrowband IoT (NB-IoT), being cellular-based, is the enabling technology for the exploitation of eUICC capabilities, and herein lies the difficulty for MNOs.

On the one hand, MNOs will want to offer seamless connectivity for a wide range of IoT devices to their customers, and on the other, they don't want to make it easy for their customers to churn to another provider. With the advent of eUICC however, the ability to provide multiple network profiles over-the-air makes both of these scenarios possible.

"As we enter the IoT era, most connected devices still offer no security for data storage and communication exchanges, cannot ensure software or firmware integrity, and offer insufficient protection from cyber-attacks," explains Remy Cricco, the chairman of the board at the **SIMalliance**. "Similarly, the logistical complexities of efficiently managing billions of devices once deployed in the field are unprecedented."

"With the industry working to address these challenges, the eUICC should be considered as a proven solution which is available for immediate deployment," he adds. "Because it is built on the UICC platform – the most widely distributed and secure application delivery platform in the world – it delivers the advanced security required by IoT/M2M use cases. This underlying security is coupled with the significant advantages associated with over-the-air (OTA) remote provisioning and management, which enables emerging security challenges and threats to be addressed in real-time, keeps critical applications safe, and simplifies lifecycle management."

A new report from consulting firm **McKinsey**, 'eSIM for consumers – a game changer in mobile telecommunications?' points up the potentially disruptive effect of eUICC deployment. The report says, "Targeting new clients through promotional activities may be as easy as having them sign up by scanning the bar code of a print advertisement and activating the service immediately – without ever meeting a shop assistant or getting a new SIM card. By conveniently adding secondary devices such as eSIM-enabled wearables and other IoT gadgets to a consumer's main data plan, operators might improve take-up rates for those services. On the other hand, the ease of use and ease of operator switching has the potential to weaken the network operator's position in the mobile value chain, as customers may demand more freedom from contractual lock-ins, as well as more dynamic contractual propositions."

This view is backed up by the **GSMA** which, in a 2017 survey of the main challenges faced by operators, found that the removal of intermediaries in the supply chain and higher customer churn were of greatest concern. With remotely provisioned SIMs, users can manage their subscriptions directly on a device. The organisation says, "A clearer separation of the cost of the network service from the device may leave operators more vulnerable to disintermediation, given that handsets can be sold through other distribution channels. The potential combination of non-operator handset financing or leasing plans and remote SIM provisioning could present new competitive challenges for operators."

Indeed, churn may be more of a factor in markets dominated by pay as you go, since customers can switch operators more easily and price competition can intensify through short-term promotions. However, other factors such as

network quality, coverage and customer service remain important considerations for customers when choosing an operator. Furthermore, existing obligations with regards to 'know your customer' will remain and it is not expected that mobile number portability processes will change in the foreseeable future.

There are, however, other threats to the status quo that operators have been desperately trying to preserve in which they have sole ownership of the customer. As McKinsey points out, a wholesaler may do deals with a number of different operators and could offer a range of tariffs without telling the customer which network is providing the connectivity. The customer could then be 'auctioned' dynamically among network operators for a period of time. Electronic profiles could even be switched among operators seamlessly for the client.

Also, voice services over social-media platforms which rely mainly on Wi-Fi connectivity can suffer unreliable call quality could benefit from the introduction of eSIMs which would facilitate smoother handovers with dynamic and automatic operator selection. Perhaps one of the most disruptive new ventures of this type is **Google**'s Project Fi, an MVNO offer which recently launched in the US and aims to provide the best available data network performance on mobile devices by combining mobile data and Wi-Fi connectivity. McKinsey points out that in such cases, the decision regarding which network to connect to will be based on the fastest available speed and bandwidth. In addition, social media voice services mean that mobile phone numbers will no longer be the only unique client identifiers. A user's online communication account, for example Hangouts, will be enough to set up a phone call.

The transition to mainstream adoption of a standardised remote provisioning technology in the handset market will likely take a number of years due to supply-side and demand-side factors, according to the GSMA. It says there will be a period of reconfiguration as ecosystem members adjust to new manufacturing, logistical and supply chain processes, as well as a phase of customer education and associated customer service. There is of course also a huge installed base of handsets with a removable SIM that will remain in circulation, and handset replacement cycles are lengthening. On average the handset replacement cycle is two to three years in most developed markets and four years in the majority of emerging markets so the transition will be gradual. The traditional removable SIM which contains a single operator profile will likely continue to account for the majority of connections in the mid-term, but will co-exist with multiple SIM model solutions. Initial deployments are likely to be on specialist devices, or in mixed deployment scenarios with traditional physical SIMs. Ultimately, long-term adoption will be driven by original equipment manufacturers (OEMs) implementing the technology and mobile operators enabling support for remote provisioning.

There's no doubt that it is happening as the GSMA moves towards establishing a common standard for eUICC, with final certification expected sometime this year. Eventually however, operators will have to bite the bullet and go for large-scale adoption. Understandably, MNOs don't like to be forced into doing things they think might be bad for their business models, but in the case of eUICC, they they're going to have to.

The demand is apparently present among enterprises active in IoT verticals. "Due to the significant security and logistical benefits it delivers, the eUICC is already coming to prominence across key IoT verticals, including smart metering, connected cars and wearable devices," says Cricco.

The transition to mainstream adoption of a standardised remote provisioning technology in the handset market will likely take a number of years due to supply-side and demand-side factors, according to the GSMA

eSIM enables innovation over existing technologies

Both 2017 and 2018 saw enterprises and OEMs within the consumer and Internet of Things marketplaces utilise embedded subscriber identity module (eSIM) connectivity for the deployment of their connected devices globally. This push has shifted the strategy of mobile network operators (MNOs) to enable eSIM-connected devices to be deployed onto their networks, writes Niall Strachan, the chief product officer of Stream Technologies

With the anticipated adoption of eSIM technology and the global deployments at scale it enables, it is key that organisations deploying connected devices understand the key differentiators of eSIM compared to legacy connectivity solutions. These include:

- Multiple SIM cards from different MNOs
- Utilisation of existing roaming only solutions
- Alliance or MNO Group-based connectivity offerings
- Multi- international mobile subscriber identity (IMSI) SIM cards

The key advantage for a deployed device using eSIM is the ability to remotely programme and update the physical SIM card with new subscriptions at any point in the lifetime of the deployment. This enables the enterprise to take ownership of the decision process concerning which MNO to use within specific regions. When this feature is distilled down, it demonstrates a core benefit of removing the lock-in to one specific connectivity vendor. This also frees the enterprise to utilise other vendors, and their respective agreements to provide significantly enhanced quality of service (QoS)/connectivity capability and future proofing. Therefore, improved cost and coverage criteria are givens.

eSIM: simplification of existing processes

With the introduction of eSIM comes a significant simplification of supply chain and inventory management. Traditionally, enterprises would contract, integrate and manage the relationship with a single MNO for a specific region and replicate this relationship for each additional region in which they require connectivity. Alongside the operational impact of managing various commercial and technical relationships, there are also complex management procedures relating to the administration of the physically distinct SIM cards which are supplied by each MNO. Depending on the practices each operator adheres to, these management activities may extend into utilising a variety of support channels and connectivity management platforms. As the enterprise integrates with more operators, the issue of managing connectivity across the device estate becomes increasingly complex. This complexity can be taken away from the enterprise by selecting a communications

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Niall Strachan, Stream Technologies

management platform such as IoT-X by Stream Technologies, the power of which can be fully realised alongside the deployment of eSIMs. eSIM has been developed to shift the balance of managing multiple physical SIM cards away from a hardware supply chain process, in favour of using software solutions to enable the automation of profile selection on a single SIM solution over the air.

MNO global roaming agreements: are they truly global, cost efficient and effective?

For enterprises deploying devices internationally, it is essential they evaluate the various connectivity options available to guarantee a flexible and future proofed multi-country solution. Standard SIM cards as available from MNOs may provide global or near global coverage, through pre-agreed inter-operator roaming agreements, however, the availability, quality and cost for this coverage is agreed by the operators directly rather than by the enterprise. Devices that are deployed using this solution are locked in to only having coverage agreed by the third-party MNOs. This limitation clearly demonstrates that the traditional roaming solution is less practical for global deployments from a commercial or even regulatory position; where perhaps the costs are too high, or the SIM cards are prohibited from permanently roaming within the country.

The alliance model: does this provide more than the traditional approach?

To combat the limitations of using a single MNO, some operators have created alliances to offer a wider footprint coverage by combining their roaming agreements. In theory this approach would deliver a more flexible approach to the enterprise, however, the same limitations apply, expressly; vendor lock-in and a lack of future proof connectivity for deployed devices.

Alongside the issues faced by the enterprise, MNOs also face challenges in serving the enterprise through this alliance-based approach. Typically, alliances are based on a pay-to-play model for the operators. However, if an enterprise selects an alliance for connectivity, how does the alliance determine which operator owns the contract to service and monetise the enterprise? If the alliance is set up to contract directly with the enterprise, how do the alliance members select the connectivity partner for each region? This issue can become particularly problematic if certain operators in the alliance service the same region. This becomes a difficult balance in managing relationships which can become frustrating for all parties.

Multi-IMSI SIM cards: a non-standardised approach for global connectivity

In attempts to giving enterprises a greater control over their commercials and future proof their deployment, multi-IMSI SIM card solutions were introduced. Multi-IMSI SIM cards are widely considered as the non-standards compliant predecessor to eSIM. In situations where roaming was not cost effective for higher data usage, it was envisaged that a multi-IMSI SIM would deliver a new method of gaining a local IMSI for a specific region on a single SIM card. This meant that multiple local IMSIs could be applied to a single SIM and then selected for use as and when required.

This approach however was deployed without sufficient levels of industry standardisation and led to a large selection of multi-IMSI solutions that all worked differently, therefore resulting in confusion amongst enterprises. Furthermore, multi-IMSI offerings were often subject to concerns around native security and operability. This was due to the method that MNOs needed to implement their network infrastructure to support multi-IMSI SIMs. This rapidly limited the number of MNOs that supported multi-IMSI solutions and resulted in significant concerns relating to the future proofing of connectivity costs and respective coverage.

eSIM: a standardised approach providing control, security and peace of mind for enterprises – at the right price

With the evolution of traditional connectivity solutions, the GSMA created and launched the embedded universal integrated circuit card (eUICC) standard. This is a standard that provides enterprises with a solution which enables them to have more control over and to future proof their deployments of connected devices. eSIM technology provides enterprises with a programmable SIM and the software toolset to manage and develop a portfolio of MNO agreements that can be used to address their connectivity requirements. The enablement of the enterprise in this fashion is a complete shift in strategy for the industry. It truly opens the door to allowing a simpler standardised approach and protects the IoT devices deployed by enterprises from rate changes, governmental or regional regulation changes and wireless technology changes in the future.

With the evolution of traditional connectivity solutions, the GSMA created and launched the embedded universal integrated circuit card (eUICC) standard

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M2M set to lead embedded SIM deployments, but consumer applications will follow

The ability of embedded universal integrated circuit cards (eUICC) to enable remote provisioning and management capabilities has the potential to introduce greater flexibility for consumers and enterprises. The technology has been on the market for several years but volumes are expected to grow significantly as the Internet of Things (IoT) continues to mature and mass-market deployments ramp up. IoT Now reports on what the analyst firms are saying about the prospects for embedded SIM cards (eSIM) and eUICC

Although the overall market for SIM cards is large and relatively stable, with the number of SIM cards shipped globally forecast to increase from 5.4 billion in 2015 to 5.6 billion in 2020

Among the research firms that have ventured predictions for the growth of the eSIM market is **Transparency Market Research**, which has stated in a research report that the global eSIM card market will achieve a compound annual growth rate (CAGR) of 13.5%, rising from a valuation of US$4.09bn in 2016 to US$14.6bn by 2025. The report also found that the machine-to-machine (M2M) sector led the global eSIM market in terms of revenue contribution in 2016. While the sector is expected to retain its dominance over the forecast period as well, the smartphones market is projected to gather pace and account for a significant share of the overall market after 2019. The smartphone application segment is envisaged to achieve 26.3% CAGR from 2019 to 2025.

From a geographical perspective, the eSIM market in Europe accounted for the dominant share of the global market in 2016, with the North America market following, in terms of revenue contribution. This can be attributed to favourable government policies that have led to the swift uptake of automation and data exchange in manufacturing technologies, the report said.

Several factors are contributing to the growth of the global eSIM market, including the ability of eSIMs to switch between network providers in real time over-the-air (OTA). This facility is of particular importance when used in connected cars and smart meters where it helps reduce significant operational and logistics costs. The report, titled 'eSIM Card Market - Global Industry Analysis, Size, Share, Growth, Trends and Forecast 2017–2025' stated that other factors fuelling the growth of the eSIM market include the standardised set of technical specifications which offers better security than conventional SIM cards. In addition, the compact design of eSIM is beneficial for original equipment manufacturers (OEMs) who can use the saved space to provide additional storage or increase the size of the battery in devices such as tablets and smartphones.

Although the overall market for SIM cards is large and relatively stable, with the number of SIM cards shipped globally forecast to increase from 5.4 billion in 2015 to 5.6 billion in 2020, according to research firm **IHS**, a transition is underway. "There is an interesting move towards wearable devices as companions to smartphones and other mobile devices, such as smart watches, health bands, glasses and smart clothes, which present a growth area for smart card suppliers and mobile network operators," Don Tait, a senior analyst, IHS Technology, has said. "The rising number of these devices in the market is an opportunity for ▶

operators and card suppliers to increase SIM penetration for both pluggable and embedded form factors."

Companion devices of the type Tait describes can have an additional SIM card inserted, such as a nano SIM, or an embedded SIM, such as eUICC. Wearable devices with SIM cards incorporated into them have the potential to increase mobile network operator (MNO) subscribers, leading to more addressable devices for SIM management and increased revenue streams. Companion devices are expected to spur growth in the SIM card market from 2015 to 2020, according to the IHS Digital Security Intelligence Service. IHS Markit predicts the eSIM market will grow almost nine-fold, from a relatively small base of 108.9 million shipments in 2016 to 986 million shipments in 2021.

Other research firms see similar growth. **Research and Markets**, in its 'Smart Card Technologies and Global Markets' report predicted the global market for smart card technologies will increase from nearly US$7.3 billion in 2017 to US$11bn in 2022 at a CAGR of 8.7%. The firm reports that the North American market is projected to grow from almost US$1.2bn in 2017 to US$1.7bn in 2022 while the Asia-Pacific market is set to grow more, expanding from a base of US$2.8 billion in 2017 to hit US$34.5bn in 2022.

Juniper Research sees eSIMs as having the potential to stimulate the M2M market and predicts that they will account for more than half of cellular M2M connections by 2020. In a study, titled 'M2M: Strategies & Opportunities for MNOs, Service Providers & OEMs 2016-2021' the firm concluded that introduction of the GSMA's embedded specification is likely to fuel the opportunity for service providers to offer remote provisioning of SIM cards. The study claimed that this would greatly enhance the capabilities of service providers to update and augment offerings and subscriptions.

The study argued that migration to OTA provisioning would facilitate a range of new business models, potentially increasing the lifetime value of M2M subscriptions while also reducing costs. Research author Sam Barker, sees that as vital for the success of IoT in less developed markets. "By making M2M affordable, the introduction of the embedded model can in turn allow farmers in regions such as sub-Saharan Africa and developing Asia to increase their yield, boosting crop production and helping to address the rising demand for food," he said.

Juniper Research sees eSIMs as having the potential to stimulate the M2M market and predicts that they will account for more than half of cellular M2M connections by 2020

IoT-X Platform

Evolved IoT Connectivity Management Platform for eUICC, Cellular and LPWA technologies.

eSIM Orchestration

Full functionality to enable, manage & invoice eSIM deployments on a global basis.

APIs Designed for a Modern World

Modern, clean & beautifully designed APIs.

Administration Portal

Single user interface presenting full management, control, monitoring analytics & billing for all sub accounts.

Bootstrap & Multi Network Ready

Stream's eSIM is bootstrap ready and able to transit data across multiple networks around the world.

Secure Integration

Secure eSIM services comprising of integrated technologies from Stream and RSP vendors available on a global basis.

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See device performance and usage across devices, IPs and protocol. IoT-X analytics increase visibility of connected objects.

Connectivity Options

Stream have pre integrated profiles available for global deployments or can integrate on behalf of enterprises to manage their connectivity.

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