The future of global IoT connectivity

Hyperscale IoT Connectivity could save enterprises 28% of their global connectivity cost.

TRANSFORMA INSIGHTS

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Preface

This paper is a collaboration between Transforma Insights and Telia on how the landscape in global IoT connectivity is changing in the last decade. These changes herald a new approach, we call Hyperscale IoT Connectivity, that will bring an array of new capabilities and benefits to companies that will adopt this new way of procuring IoT connectivity.

The analysis presented here is based on an extensive set of research undertaken by Transforma Insights on behalf of Telia Company into the relative impact of adopting a hyperscale approach to connectivity, versus Transforma Insights underlying expectations for how connectivity is otherwise likely to be supported.

A full report with underlying research, methodology and definitions is available on request from Transforma Insights.

Telia

Telia is the new generation telco. 20,800 experts in technology, business and people working together to serve 24 million customers large and small. On our strong connectivity base, we build digital ecosystems that empower people, companies and societies to stay in touch with everything that matters – on their terms.

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TRANSFORMA INSIGHTS

Transforma Insights is a research firm focused on the world of Digital Transformation (DX). Led by seasoned technology industry analysts Transforma Insights provides advice, recommendations and decision support tools for organisations seeking to understand how new technologies will change the markets in which they operate.

Read more at www.transformainsights.com/

Main author: Matt Hatton (Transforma Insights)

Contributing authors: Timo Ogliastri (Telia), Rachit Saksena (Telia), Matt Arnott (Transforma Insights), Katja Kalliorinne (Telia), Therese Ericson (Telia)

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Executive summary

Companies looking to procure connectivity for IoT devices could save on average 28 percent by using a ‘Hyperscale IoT Connectivity’ solution where compliance, security and cloud optimization are standard features. In total, these savings equate to USD117 billion for enterprises around the world over the next decade. This is the key finding of an extensive new set of research undertaken by Transforma Insights.

Buying IoT connectivity involves an increasingly complex set of decisions. The technology landscape is fragmented, regulatory requirements are becoming ever stricter, the number of tools on offer can be dizzying and the scale too is becoming ever greater. The costs of missteps are increasing dramatically.

In this report we examine how the provision and support for global cellular IoT connectivity is changing and the consequent requirement for a new hyperscale approach, which meets all the new demands for localization, increased security, and compliance with various regulations, and does it at scale.

The key headlines of the research are as follows:

- Companies using cellular IoT technology that is not scalable and cloud-native will potentially need to pay more than USD100 billion in extra costs between 2020 and 2030. This equates to 28 percent of the total spend on cellular connectivity over the period.
- The single largest component of this is additional device-to-cloud integration cost which accounts for over a quarter of the total. This cost can be reduced through a simplification of application, architecture and data routing complexity. Missed revenue opportunities due to slower time-to-market and additional security costs are the next largest categories.
- The Consumer and Government sectors stand to save the largest amount in absolute terms. Manufacturing, on the other hand, stands to save the most proportionately; failing to use Hyperscale IoT Connectivity will result in greater compliance costs for the sector than its entire spend on cellular connectivity.
- Connected vehicles is the biggest single application, with car manufacturers potentially saving USD40 billion – or the equivalent of 20 percent of all connectivity spend.

Figure 1: Additional spend requirements 2020 – 2030

Adopters of a 'Hyperscale IoT Connectivity' solution stand to benefit in several different areas, from direct cost savings related to integrations with cloud providers to costs associated with failing to comply with regulation.

[Source: Transforma Insights, 2021]

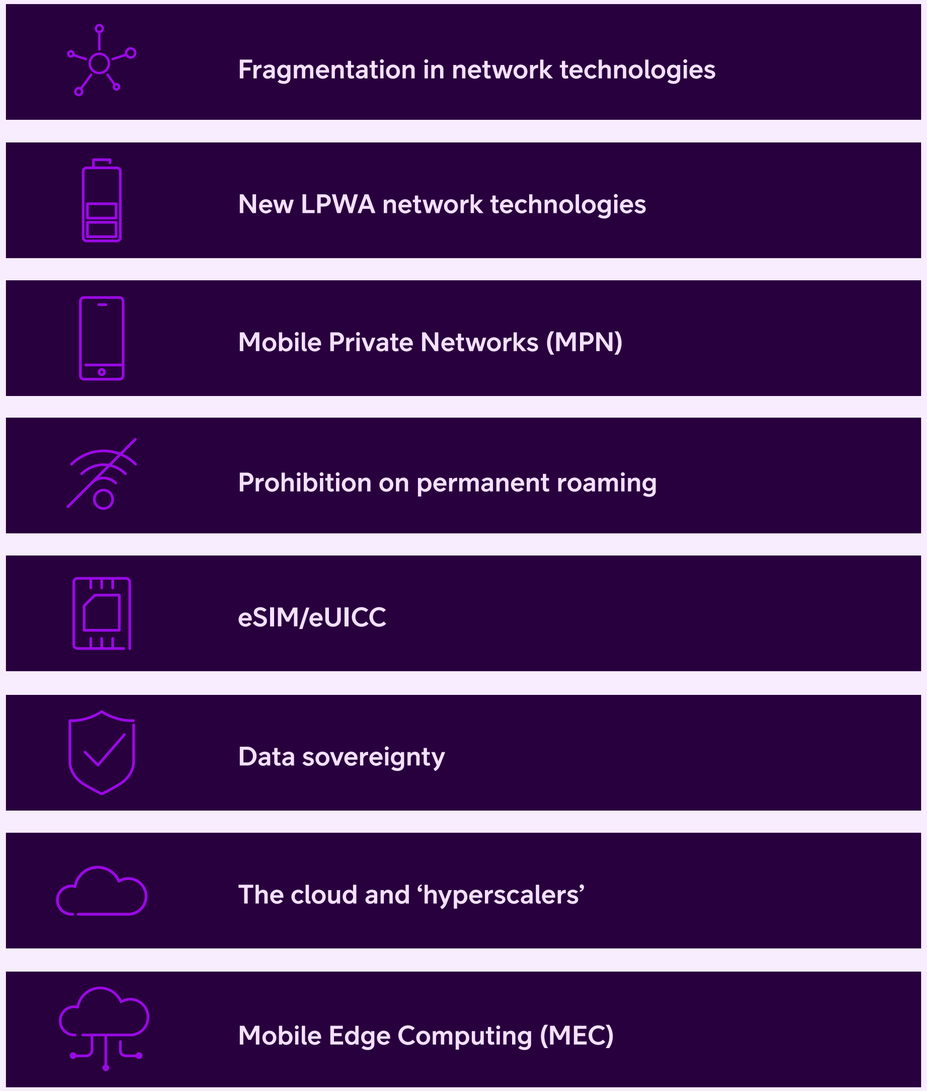
Connecting IoT devices worldwide in the 2020s

The provision of global IoT connectivity has changed immensely in just a few years.

The manufacturing sector stands to make the largest proportional savings, equivalent to 153% of its eventual total connectivity spend.

A decade ago, the ways in which global connected devices were supported was relatively simple. You put a SIM card into a 2G/GPRS modem and the device could go almost anywhere in the world and, courtesy of long-established roaming agreements, could connect on at least one network, and data flowed via the public internet to the client. Simple, but not very flexible or cheap. At the same time, the process of building an IoT – or what would have been called machine-to-machine or telematics – offering was complex, involving customized application development and data management. In the intervening decade those two elements have flipped. Today there is a wide range of user-friendly resources available for anyone starting to develop a new IoT application. We can call it the 'platformization' of IoT. In contrast, the provision of global connectivity has become much more complicated, with a lot more care needed in making decisions about how to connect a product. It is this complexity, and the ways in which it can be addressed, that is the subject of this White Paper.

Figure 1: Additional spend requirements 2020 – 2030



[Source: Transforma Insights, 2021]

8 trends that effects the future of connecting devices globally.

Transportation and Storage
The Transportation and Storage sector will be able to make cost savings of up to 21% to their future global IoT connectivity cost by adopting a new approach.

The growing complexity in supporting global IoT connectivity takes many forms:

Fragmentation in network technologies
The days when 2G networks spanned the world are numbered. Starting with a few countries and operators over the last decade, there are now dozens of countries where 2G and 3G networks have either been switched off or are about to be. In Canada and the United States there will be no active 2G networks after 2021. The Asia-Pacific countries Australia, Japan, Singapore, South Korea and Taiwan have already switched off 2G and, in many cases, 3G, networks. Many more countries will follow shortly. In Europe, Switzerland will become the first country to switch off 2G altogether, in 2021, with dozens of operators announcing similar plans. The result is that any developer trying to choose a network technology cannot rely on 2G or 3G networks being available. There is also a highly varied approach to deploying 4G and, now, 5G networks. Some markets have more than 99 percent 4G population coverage but the vast majority do not, meaning that IoT devices will need to rely on 2G and 3G networks. Furthermore, 5G will also be even more targeted at population centres. All this creates a patchwork of networks that soon becomes a headache for anyone developing a global product.

New LPWA network technologies
Adding further to the fragmentation is the arrival of new IoT-specific network technologies: LTE-M and NB-IoT. These new technologies are optimized for IoT, with long battery life and low cost. The upgrading of LTE networks has been patchy, and even where it has been done, there are varying levels of optimization of those networks, for instance to maximize battery life. These technologies will be invaluable for supporting many new IoT use cases, but it takes time to put roaming agreements in place to allow global roll-outs. Some agreements exist, but not to the required extent. Over the course of 2021 we expect significant progress for LTE-M roaming, which is generally the technology favoured by moving devices. NB-IoT tends to favour static devices and national deployments, for example smart metering. As a result, LTE-M will tend to be favoured for global deployments.

Mobile Private Networks (MPN)

The arrival of 5G has stimulated increased interest in private network deployments, either based on dedicated infrastructure, or on using a 'slice' of an operator network. These capabilities provide for increased security and reliability for industrial applications. Today, they are most frequently used in freight terminals and factories. MPNs provide an additional set of capabilities, but also a further layer of complexity between device and network. Some next generation features and functionality will be available only to certain users and devices, creating multiple tiers of use of 5G which did not exist in other technologies.

Prohibition on permanent roaming

During the 2010s many regulators, for instance in Australia, Brazil, China, India and Turkey, introduced or enforced rules that prohibited devices managed by overseas operators via roaming agreements. Sometimes these were explicit rules and in other cases based on local registration requirements or tax obligations. There were also commercial equivalents, particularly in the US and Canada, where the operators themselves prohibited their roaming partners from having devices permanently roaming on the network. Ensuring compliance with regulator and partner rules about permanent roaming has become a critical potential stumbling block for multi-country IoT deployments.

eSIM/eUICC

As a way to solve the problem of permanent roaming, the mobile industry developed the eUICC (Embedded Universal Integrated Circuit Card), a chip which performs the same function as the old swappable SIM cards that were almost universally used in mobile phones. The difference is that the eUICC is embedded in the device, with the SIM profile being changeable over-the-air (OTA) to become a local network device through a process known as 'subscription management'. The most flexible form of eSIM/eUICC is compliant with the GSMA1 eSIM Architecture, which ensures interoperability between operators. The eSIM/eUICC capability makes it possible to remotely configure – most notably selecting the network – devices that are distributed in the field without the need for human intervention. This is useful for companies selling IoT devices that might end up anywhere in the world, with the eSIM localizing the device onto a national network without the need to configure it manually. Initially there was a lack of eUICC compatible devices, but this has been largely resolved.

Data sovereignty

As well as stricter rules around permanent roaming, there are increasingly compliance requirements related to data, where it is sent, and how it is used. The most prominent is the EU's General Data Protection Regulation (GDPR) but it is far from being the only territory that has such rules. Compliance with these regulations often necessitates a new architecture for supporting IoT, for instance with local instantiations of IoT platforms to prevent data being inappropriately managed in other countries.

The cloud and 'hyperscalers'

The shift to the cloud has been the defining feature of IT in the 2010s, one which has been dominated by the so-called hyperscalers, most notably Amazon Web Services, Google and Microsoft. Increasingly, IoT applications are hosted using these cloud players and it has become more critical to ensure seamless delivery of IoT data to the cloud. Furthermore, the hyperscalers are increasingly interested in connectivity. The need to support edge applications, and to manage the relationships between cloud and edge devices, are critical to their future success.

Mobile Edge Computing (MEC)

The last couple of years has seen something of a shift to the 'edge', a counterpoint to the move to the cloud mentioned above. For some applications, processing and data storage need to be located near to the application rather than in the cloud. The round-trip delays of interrogating a central server which is hundreds or even thousands of kilometres away is just too much for applications such as AI/machine learning, augmented reality, autonomous vehicles and numerous other IoT use cases. Mobile Edge Computing (MEC) takes advantage of the fact that mobile network infrastructure is very well placed to support this drive to the edge. For many edge use cases, the 'network edge' is the optimum location, being close to the device, but at the same time removing, or substantially reducing, the burden of loading additional compute and storage capability on to the edge device with the associated increased cost and energy demands. This prime position is likely to be further enhanced in a 5G world where the final 'hop' to the edge device has very low latency, typically 10ms, compared to 50ms for LTE.

Environmental monitoring applications will be able to make cost savings equivalent to 162% of their project connectivity costs in the coming 10 years.

1 https://www.gsma.com/esim/esim-specification/

A new approach is needed to global IoT connectivity

To fully take advantage of the new technologies available and to mitigate the risk associated with the new commercial and regulatory reality, connectivity offerings must also change.

At the end of 2020 Transforma Insights estimated that there were over 1 billion cellular IoT Connections worldwide, approximately a sixfold increase over the decade. By 2030 this figure is expected to grow to 4.8 billion. With success comes greater regulatory and commercial scrutiny, increasing the complexity and cost of compliance. Success also brings a richer array of capabilities with which to better serve the needs of clients. These create a dizzying array of options and a degree of disruption as the new technologies bed in. There has never been a more challenging time to juggle all the possible connectivity options to ensure compliance and optimum performance.

Transforma Insights has identified a set of characteristics of an optimum global cellular IoT connectivity offering, which it considers under the umbrella of Hyperscale IoT Connectivity (HIC).

Firstly, the connectivity needs to be 'Local'. It is no longer acceptable to rely solely on roaming. It is adequate for some applications, not least those that actually move between countries on a regular basis. But that does not apply to most connections. Transforma Insights estimates that at least 70 percent of cellular connections remain active in just one country for the lifetime of the device. Being local means having eSIM/eUICC capability to localize the connectivity onto a domestic network, thereby avoiding issues of compliance or commercial friction between operators. This is most flexible and future-proofed when implemented using the GSMA eSIM specifications.

Using eSIM/eUICC avoids one of the main pitfalls of roaming-based connectivity, as exemplified by a car manufacturer which faced a massive PR and logistics disaster a few years ago when its US connected cars had their SIM cards suspended. The non-US mobile operator with which the car manufacturer had contracted to provide services was determined to be in breach of a prohibition on 'permanent roaming' by the host network in the US.

The car manufacturer had acted in good faith but had perhaps failed to do its due diligence on how its connectivity would be supported and had suffered the consequences. Local connectivity avoids these types of challenges. Being local also means local break-out of the data flows to ensure compliance with the associated data sovereignty regulations, and to allow faster deployment.

Connected vehicles
The providers of connectivity for connected vehicles will be able to make 20% cost savings to their future global IoT connectivity cost by adopting a new approach.

"There has never been a more challenging time to juggle all the possible connectivity options to ensure compliance and optimum performance."

Figure 2: The four characteristics of Hyperscale IoT Connectivity (HIC)

Local
- Full localisation of the connection and the data
- eSIM/eUICC for localising the device onto a domestic operator

Adaptive
- Easy cloud and edge integration
- Fast to deploy
- Strong data visualisation and management

Secure
- A new architecture to ensure end-to-end security
- IoT devices are within the enterprise perimeter

Collaborative
- Complex set of participants that need to work closely together.
- Standards-based approach alongside CSP and other partners

[Source: Transforma Insights, 2021]

Asset tracking and monitoring applications will be able to make cost savings of up to 57% of their future global IoT connectivity cost by adopting a new approach.

Hyperscale IoT connectivity (HIC) is also adaptive, able to reflect the varying and changing demands of the devices connected with it. It must be easily integrated with cloud and edge capabilities. It must also be quick to roll out in new territories. The solution must provide the enterprise customer with the ability to easily visualise data flows, draw insights and manage the devices.

The third major characteristic of Hyperscale IoT Connectivity is that it is secure. Such a solution does not consider the company's remote IoT devices as being something separate from other elements of its ICT infrastructure. It extends the network perimeter. As such, old architectures, for instance involving VPNs, may not be appropriate.

Finally, HIC will be collaborative. No global solution can be supported by a single mobile network operator at the same time as meeting the other requirements noted here. Every Communications Service Provider (CSP) needs partners, both software and hardware platforms, as well as, critically, other CSPs. CSPs need to be able to interoperate and interconnect with others around the world. As such, HIC will ideally involve a set of pre-integrated partners. It will also be based on internationally recognised standards. When it comes to connectivity there is one overwhelming rule: standards win. That's not to say that all standards win, as there are many examples of standards that have not survived. However, where a technology has been proven useful, it is usually the most standardised version, with the greatest community of collaborating companies participating, that has dominated. Take the example of GSM versus CDMA. The latter was arguably a superior technology, but the former was much more standards-based and had a larger and more active community that helped to develop it.

The benefits of Hyperscale IoT Connectivity

Adopters of IoT that choose a hyperscale approach stand to benefit in many different ways. In some cases, there are direct cost savings related to integration with cloud providers, in other cases the cost associated with failing to comply with regulation will be mitigated.

A small number of the benefits are associated with the use of eSIM/eUICC to localise the network connectivity used by the device. The most obvious benefit is in improving Supply Chain Efficiency. By virtue of using eSIM/eUICC there is no requirement to physically change SIM cards, they will localise to a domestic operator as appropriate.

This also has the knock-on effect of removing the need for Local Connectivity Sourcing, i.e. going to the trouble of finding a local partner in each territory. With a Hyperscale IoT Connectivity (HIC) solution the single operator partner will have a network of operators which can provide localised connectivity in each market. Finally, eSIM/eUICC removes the unlikely, but potentially extremely costly, risk of non-compliance. We split these into two separate categories, one related to Commercial Compliance, that is having a roaming partner decide to cease supporting your connections, and Regulatory Compliance associated with Permanent Roaming where the prohibition is imposed by the regulator. The impact of these two is broadly the same: roaming-based connections are disconnected. Increasingly in the provision of global IoT connectivity, relying exclusively on roaming will not cut it. Within regulatory compliance we also consider tax compliance, i.e. the cost of meeting the taxation requirements of every territory.

Other benefits have similar profiles. For instance, the use of HIC removes or reduces other localisation costs through Low-Touch Provisioning, for instance by removing the need to set private APNs for every territory and thus making connectivity seamless across operators. Essentially this is about moving device and network configuration up into the software layer to allow for much better control of routing functionality. Simply doing SIM localisation through eUICC is not enough. The device itself also needs to be configured to the change in network.

Time to market
A Hyperscale IoT Connectivity solution is inherently portable, allowing companies using it to expand services to other territories seamlessly, generating revenue more quickly.

In the same way that there is no requirement to source a local connectivity partner, Hyperscale IoT Connectivity (HIC) also reduces the needs for the Platform Integration which is often required when adding connectivity from an additional operator. There are also regulatory compliance issues unrelated to roaming. Data Sovereignty is increasingly a critical issue for how IoT solutions are architected, to ensure for instance that applications are compliant with local data privacy regulations. For example, in recent years there has been the need to implement local instantiations of software platforms in particular territories. This can be costly, disruptive and create problems for the functioning of any application.

Another benefit that looks quite similar to compliance, in as much as it is only an issue when it is breached, is that of Security. Hyperscale IoT Connectivity solutions are inherently more secure, taking advantage as they do of SD-WAN or some comparable capability that extends the enterprise perimeter. The impact of being more or less secure is inherently difficult to measure, but without doubt the penalties (both reputational and financial) of security breaches are growing significantly as the scale of the IoT increases.

Some other of the benefits are equally hard to quantify. The first is that of Device-to-Cloud Integration. Increasingly IoT applications require more convoluted routing of data, for instance to cloud hyperscaler data centers or to Mobile Edge Computing (MEC) locations. A HIC solution, by virtue of its application awareness can deliver data as appropriate. A HIC solution is also better able to provide end-to-end Centralised Visibility and Management capabilities for the devices, knowing their location and status as well as allowing for better management and the performance of analytics on connectivity data.

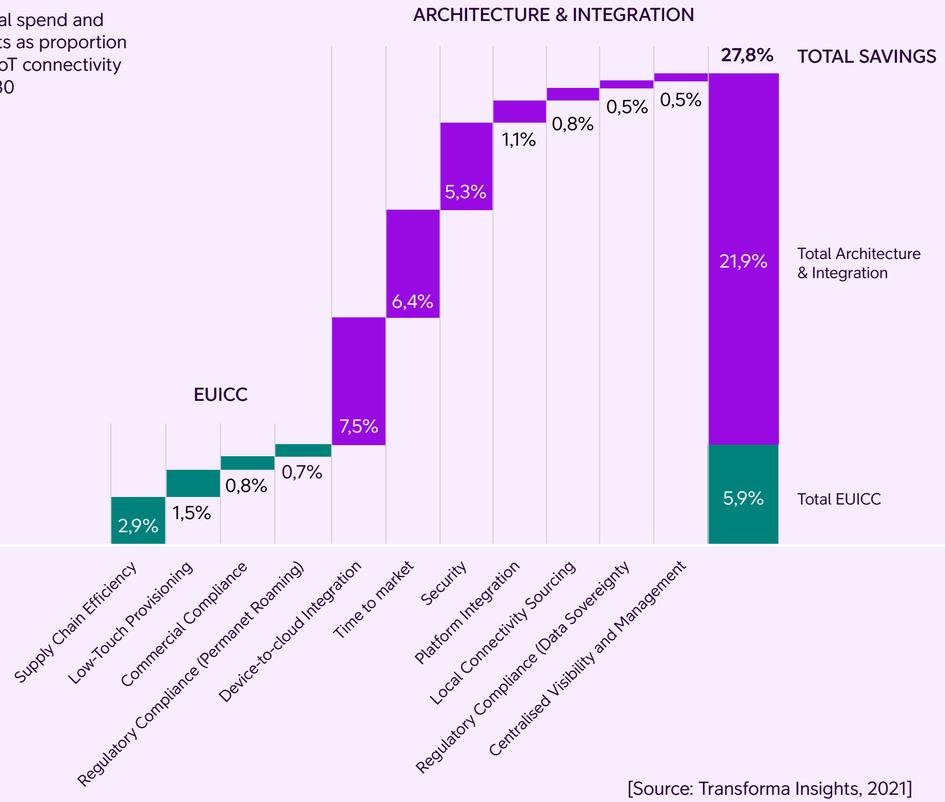
Finally, there is the overarching benefit related to Time-To-Market. All of the above issues that need to be navigated will inevitably cause delays for any company wanting to expand to selling solutions in another region. A Hyperscale IoT Connectivity solution is inherently portable, allowing companies using it to expand its services to other territories seamlessly, generating revenue more quickly.

Over the next few years many of these capabilities will be seen as ‘hygiene factors’, that is the bare minimum required to support connected devices.

The USD117 billion benefit of using Hyperscale IoT Connectivity

Buyers of global cellular connectivity for IoT have a choice. Either they can rely on traditional connectivity based on roaming and/or limited cloud integration, or they can opt for a hyperscale approach. An approach that on average will save companies 28% of their global IoT connectivity cost.

Figure 3: Additional spend and mitigations of costs as proportion of global cellular IoT connectivity revenue 2020-2030



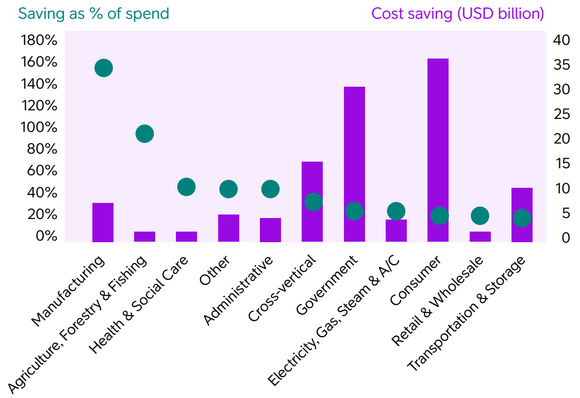
[Source: Transforma Insights, 2021]

Based on Transforma Insights' analysis, the cost savings associated with picking Hyperscale IoT Connectivity is the equivalent of 28% of connectivity costs. That equates to an additional USD117 billion cost globally between 2020 and 2030 to ensure compliance, add in missing functionality, mitigate security risks and otherwise compensate for adopting more traditional approaches to connectivity.

These savings break down as illustrated in Figure 3. The single biggest benefit is in improvements in Device-to-Cloud Integration, with the other two major benefits being felt in faster Time-to-Market, and lower costs of providing the equivalent levels of Security. Around one-fifth of the savings are accounted for by the benefits of using eSIM/eUICC, with the remainder accounted for by Architecture & Integration savings.

As seen in figure 4 the biggest impact by total costs are on the Consumer and Government verticals, reflecting their respective size. However, in terms of relative impact, it is Manufacturing that stands out, with potential incremental costs of over 100% of the expected connectivity spend; the cost savings from HIC will exceed the expected total spend on connectivity for the sector.

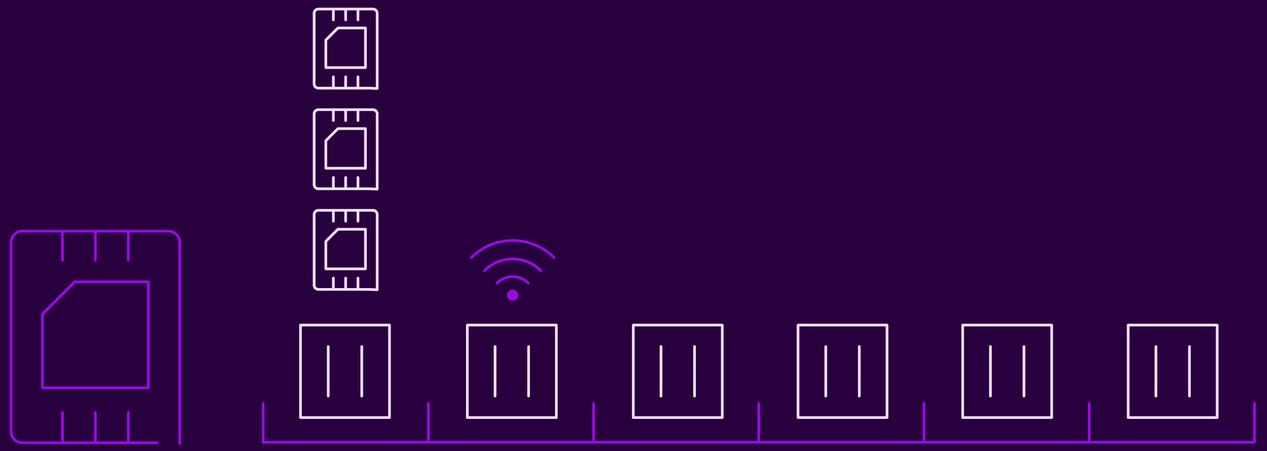
Figure 4: Compliance and mitigation costs by vertical over the period 2020-2030



[Source: Transforma Insights, 2021]

The modelling process also looked at hundreds of individual cellular IoT applications. The biggest, connected vehicles and video surveillance, saw compliance and mitigation costs of 20% and 24% respectively compared to their cellular IoT connectivity spend. Other applications see much higher proportions, typically by virtue of comparatively low revenue for those applications: environmental monitoring and asset tracking will make savings of 162% and 57% respectively, relative to connectivity costs.

Achieving hyperscale IoT connectivity - the easy way



The advances in edge, cloud and connectivity are creating a new world of opportunities. The biggest obstacles to global IoT connectivity today are not only about technology anymore, managing the global network of operators and the IoT data is becoming more and more challenging for our customers.

These new technology innovations and a strong belief in simplifying for our customers have led us at Telia to take a new unique approach to global IoT connectivity.

We understand the hassle of global deployments that you face: the need for continuous SIM support, producing and assembling products, including SIM cards, in one location and shipping them on without having to control which SIM cards goes in what product. Moreover, you face having to spend time and money on technical integrations and commercial discussions when entering new markets or adding a new operator or partner. And the hassle of receiving customer support from multiple partners. Yet after several months of work, you may still end up without connectivity because of local regulations or restrictions on roaming.

And as the number of devices being connected globally increases, so does the complexity and the need for a solution that supports the commercial, regulatory and technical aspects on a global scale. By combining new technology, Telia eSIM and our unique cloud native programmable network, with our strategic investment in an ecosystem of partners; we have made global IoT connectivity simple and secure.

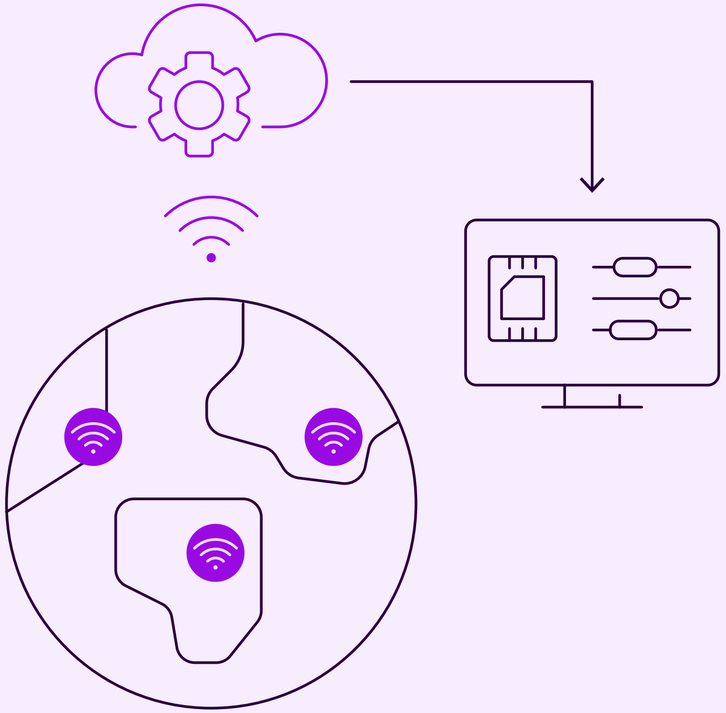
Our solution - Telia Global IoT Connectivity - lets you scale instantly without the hassle of multiple partners or technical integrations and stay compliant, all from a single interface. We bring you Hyperscale IoT Connectivity the Telia way.

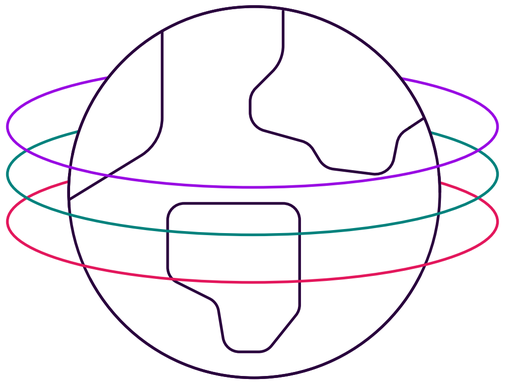
Local connectivity starts with a Telia eSIM

SIM cards might not be expensive, but changing them is. That is the value of using a GSMA compliant eSIM. You get the simplicity of a single SKU and the flexibility to manage SIMs over-the-air. Powered by eUICC to support multiple operator profiles, our Telia eSIM lets you change and manage your connectivity as you want. Activate, deactivate, change subscriptions and control roaming.

A highly adaptive solution with maximum security needs a unique cloud native technical design

Lift your IoT data to the cloud and get access to our programmable global network to manage your traffic cost-efficiently and comply with data regulation. Through self-service capabilities you keep IP traffic private and secure, define what the IoT devices can or cannot access, and how the data traffic should be routed. Management is made easy with one APN and one SMS short code that works seamlessly across the world and operator networks. Due to the cloud-native nature, deployment is fast and makes it easy to scale.





Collaboration is made easy with our eco-system of partners

Our pre-integrated ecosystem of partners makes sure you stay compliant and connected out in the world. In the Nordic and Baltics, you get the best digital infrastructure with Telia connectivity. For low-regulation markets we have roaming partners, but for the highly regulated markets we have negotiated local connectivity agreements. If you have an existing setup our modular platform lets you bring-your-own-operator.

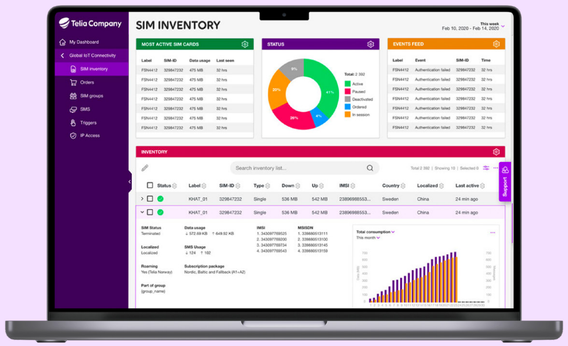
Telia footprint: Telia connectivity

Low-regulation markets: 400+ roaming partners

High-regulation markets: 10+ countries, across 4 continents

Simplicity comes through an intuitive web portal

Manage and monitor it all through an intuitive web portal. Dashboards and reports keep track of status, usage, costs and performance. With REST APIs you keep complete command of your connectivity by controlling our platform and network from a single interface. It also makes integration easy.



More information about our solution can be found on business.teliacompany.com

About the modelling

The analysis presented here is based on extensive research undertaken by Transforma Insights during August-October 2020. The starting point is Transforma Insights' existing IoT Connected Things Forecast [https://transformainsights.com/research/tam/market] of cellular IoT devices, annual shipments, and 'Value-Added Connectivity' revenue across hundreds of applications.

The forecast numbers of connections, and new additions, and derived numbers for live projects and new projects, constitute the main drivers for calculating the 11 categories of savings or mitigating costs that are discussed in Section 4, for instance 'Supply Chain Efficiency' savings calculated based on the per-device cost of manually switching SIM cards.

The sum of these savings from using Hyperscale IoT Connectivity are then compared with the equivalent Value Added Connectivity revenue figures to identify the proportionate impact.

Full details of the methodology for calculating each of the 11 elements, and definitions, are available from Transforma Insights:

https://transformainsights.com/research/reports/white-paper-hyperscale-iot-connectivity-usd117bn

global cellular connectivity for IoT
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Learn more about Telia Global IoT Connectivity at business.teliacompany.com
or send us a question through our online contact form.

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