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eSIM: Giving Manufacturers the Competitive Edge

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Executive Summary

The internet of things depends on devices that connect consumers, businesses and automated systems to data that facilitate better decision making. Manufacturers not only form a key part in this connected ecosystem, simply by providing devices that work as intended, they also stand to profit from the burgeoning demand for connected devices. Organizations looking to capitalize upon this opportunity often produce and store region-specific stock keeping units (SKUs) of essentially the same product. However, each has a different SIM to ensure connectivity and compatibility with regional mobile networks. The cost of producing and shipping numerous, almost identical SKUs, and managing the mobile network operators (MNO) in each territory can increase cost, limit scalability and add complexity for both manufacturers and the end users.

Manufacturers embracing eSIMs gain a competitive edge by providing products that 'just work'. An embedded SIM (eSIM) is soldered into the device and a management platform facilitates the activation and assignment of network operators, without the physical SIM card being touched. This leaves the end user with the simple task of selecting the appropriate network operator. The flexibility of the eSIM solution opens up new markets to manufacturers without forcing them to create and maintain additional localized product lines.

Embedded connectivity means that device performance data can be harvested from activation and throughout the device's entire lifecycle. This level of data enables predictive maintenance, which manufacturers can monetize as an additional service. Manufacturers will no longer have to rely only on the customer for product performance feedback and can now gain valuable insights that can be used to develop new products that reach the market faster.

Read this whitepaper to find out about:

✦ The four steps towards embedded connectivity

✦ How eSIM simplifies selling internationally

✦ How embedded connectivity:
  - Facilitates predictive maintenance
  - Helps beat competitors to market with improved products

✦ Examples of additional profit streams that come from connecting a device for their entire lifecycle

Part One: Four Steps to Embedded Connectivity

Arm believes that 1 trillion new IoT devices will be produced by the year 2035, and a growing number of device manufacturers are helping this prediction become reality. From discussions with enterprises the world over Arm understands that complexity can be a barrier to larger IoT projects. Manufacturers can eliminate much of this complexity by providing devices with embedded connectivity that 'just work' for the user.

Elements required for embedded connectivity

1. Take an eSIM

At 5x6 millimeters, the eSIM is roughly half the size of the Nano (4FF) SIM card. Unlike removable SIM cards, the eSIM is embedded during the manufacturing process – soldered into a sealed enclosure. It is extremely difficult to tamper with or remove an eSIM without causing significant damage to a device. An eSIM is also water resistant, an essential feature for any ruggedized IoT applications

2. Add a bootstrap profile

Every eSIM is configured with a bootstrap profile. The bootstrap profile guarantees that the device can obtain connectivity, regardless of its geographic location, and be used to download local network profiles when a device is first turned on. It may also be used as a fall-back profile if there are network issues in the location where the device has been deployed.

3. Link a management platform

A software platform that manages eSIMs is key to scaling IoT deployments. The simplicity and automation provided by a connectivity management platform make it possible to enroll, deploy, maintain and track thousands of devices remotely.

4. Choose a network

The ability to change network operator without physical interaction is a major benefit of eSIM. A global network of MNOs is an important part of the eSIM ecosystem because no one operator provides the coverage to support one trillion global IoT devices. A manufacturer can provide the device with the bootstrap profile and let their customers choose the network that best supports their needs post-deployment.

Now that the basics have been explained, let's move on to why manufacturers should be embedding connectivity into all their products.

Part Two: International Selling Simplified

No one operator can provide truly global connectivity, meaning manufacturers that want to provide their product globally must contract with more than one operator to secure operator-specific SIM cards. Without eSIM, manufacturers must create and maintain separate product lines for each mobile network operator to account for the different SIM cards required, despite the fact that the underlying device itself is exactly the same. eSIM enables single-SKU manufacturing for IoT devices.

Overcome the typical hurdles in providing connected products

⚠	⚠	⚠	⚠
Cost of multiple product lines	Complex region-specific distribution models	Difficulty of activating SIMs	Operator lock-in
✓	✓	✓	✓
Single product line developed and stocked by manufacturer	One global product for all markets, simplifying distribution	Single management platform across all networks	Freedom to choose operator and change operator in future

A single-SKU manufacturing process is easier to manage and reduces the costs and complexities of multiple product lines. Simultaneously managing large numbers of SKUs creates costly inefficiencies in management, production runs, sales forecasting, inventory management, and supply chain fragmentation. This can negatively impact engineering, production, quality, finance, and operational departments. eSIM removes the need to design, make, stock, ship, track, repair or replace multiple variations of what is effectively the same device.

eSIM programmability gives the end user more flexibility and more choices for connectivity.

eSIM agility reduces barriers to global markets for device manufacturers. Entering new geography no longer requires a new product and new inventory. If the manufacturer decides to target a new territory, existing products can be deployed in that region immediately.

Embedding a reprogrammable eSIM also means that one distribution model can apply across many borders and use cases. Instead of contracting with region-specific distributors or resellers, the manufacturer can supply a global distributor or major chain, ultimately saving costs by limiting the distribution channels used and increasing average deal size.

MNOs also come with their own management platform. If the device is sold to 'just work', the SIM must be activated prior to being sold. Activation of the operator-specific SIM is limited to the platform provided by the operator, placing an administrative burden to selling internationally. A purpose built IoT platform for global device connectivity excels over traditional MNO solutions by consolidating visibility and management of devices, that are connected to multiple operators into a single view.

At the same time, the choice of eSIM improves the buyer's experience, rather than limiting it. eSIM programmability gives the end user more flexibility and more choices for connectivity. Users have complete freedom to change the operational location of the device at a later date, regardless of its intended location.

eSIMs can change operator or network as many times as is required. Operators' offerings change over time – 2G networks may be recalled, and 5G networks will become widespread. eSIMs allow manufacturers to provide future-proofed devices, alleviating customer concerns when investing in global IoT deployments.

Manufacturers operate more profitably while also increasing the opportunity to sell large volumes of devices globally.

## Part Three: Always on and Connected

Embedded connectivity gives the option to harvest a constant stream of device data. In a typical IoT deployment without eSIM, the manufacturer loses 'sight' of the device as soon as it rolls out the door. As a result, it's hard to harvest device-performance data and troubleshoot issues without sending an engineer onsite—which is both expensive and time-consuming.

Manufacturers are also often forced to rely on customer feedback. This approach comes with major limitations. The amount of data that can be amassed is insufficient to make decisions without placing a significant burden on the customer.

With a SIM card embedded into the device and connected to a management platform, a flow of analytics data can be gathered in real-time. 'Always on' connected devices provide new levels of insight for manufacturers, insight that can drive competitive advantage through predictive maintenance and predictive product improvement.

IoT informing the product roadmap
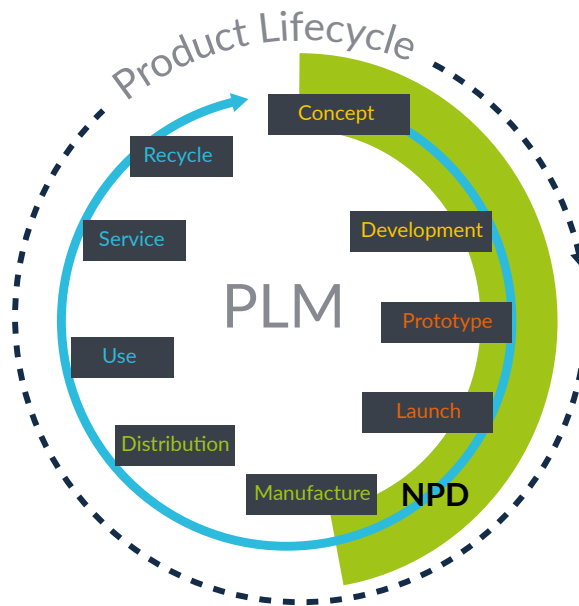
IoT data fills in many of the visibility gaps needed to make better decisions about the next generation of the product or inform new product development. Embedded connectivity enables the constant harvesting of device data pertaining to a product's performance and conditions in use.

Failures in the field and the conditions that cause them can help spot a growing issue and find a solution before customer complaints reach a critical mass. Plus, a clear picture of product performance and the conditions in which the products are being used can inform product improvement processes and future product launches. For example, a component can be re-engineered to withstand a new range of operating conditions, or product features can be removed if analytics identify that a particular function is underused.

Manufacturers can assess feedback and make decisions sooner without any manual input required from the end user. This results in products that better fulfill customer needs by anticipating and acting upon data sooner. These insights come much faster than traditional new product development (NPD) processes that are not guided by IoT, meaning manufacturers making use of embedded connectivity within their products can beat their competition to market.

Why is predictive maintenance difficult to achieve?

IoT is often distilled to the proliferation of sensors, but increasing amounts of complex, high-value devices are being connected. Providing the ability to predict with confidence when a device is at risk of failing or needs to be replaced is becoming increasingly important.

Despite the interest in predictive maintenance, the majority of manufacturers cannot harness the concept for their own efficiencies or for the customers paying for device servicing. This is because most of the insight sits in data that has not been collected. The sooner the device is connected, and its performance data captured, the more likely predictive maintenance can be achieved. eSIM enables this data flow to begin as soon as the embedded SIM is activated, at the start of the device's lifecycle.

If the key to predictive maintenance is to capture a complete profile of product performance, then the device must maintain constant connectivity. This is put at risk when devices move location; or would be at risk if the device does not have the ability to change networks remotely. With eSIM the device maintains its connectivity even when it crosses borders.
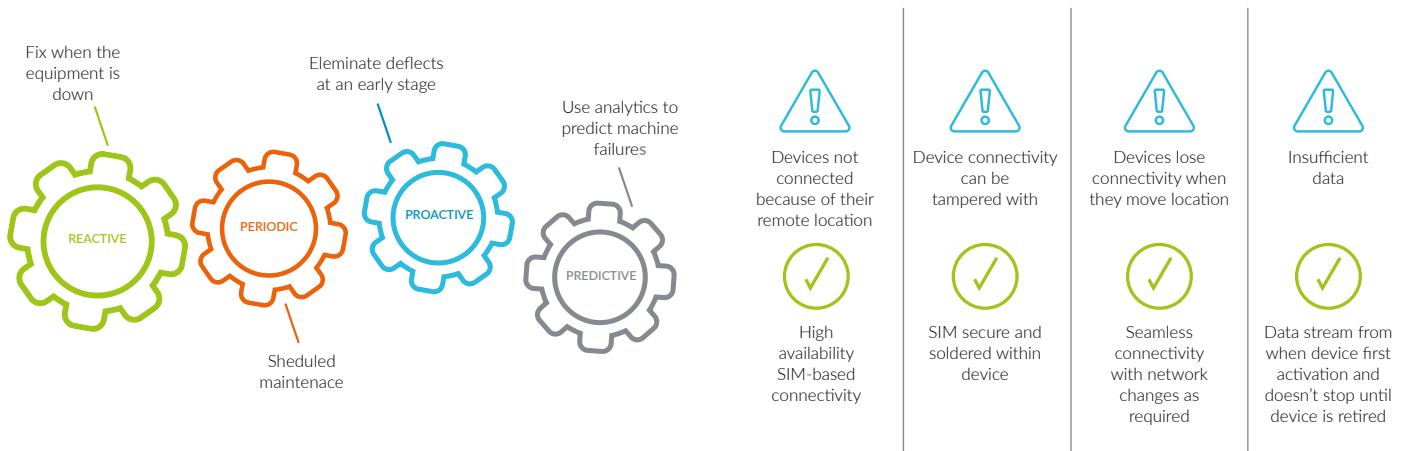
Enterprise buyers of IoT devices are paying to add retrofitted SIM cards to their devices to achieve predictive maintenance. Retrofitting connectivity is a costly endeavor and the benefit of embedded connectivity from the outset will be clear to buyers. Furthermore, security concerns can be alleviated as the risk of tampering with the SIM is much lower when the SIM is soldered into the device.

eSIM functionality means a device can remain connected and capture data at all times. This constant flow of data can be visualized in dashboards and support predictive preventative maintenance programs that reduce downtime.

Part Four: Profiting from Software and Services

Predictive maintenance can, and in most cases should, be offered as a paid-for additional service, because it has immense value to the buyer. Complementing hardware with services is a proposition that is not only attractive to new customers, it also creates new revenue streams that bolster existing hardware sales, and increase share of wallet without the cost of acquiring new clients.

Services like this often command higher margins than the sale of the devices themselves, while users benefit from improved device uptime and performance, as well as more consistent data collection. Better IoT devices, in turn, yield better business operations. If servicing is required, much of the diagnostics can be performed remotely, again cutting costs compared to engineer visits.

This is just one example of the additional revenue streams that become available to manufacturers embracing embedded connectivity. Device-as-a-service offers a way to monetize the product for its full lifecycle, rather than a one off payment on provisioning and occasional service income.

Providing a full device-as-a-service offering allows customers more flexibility in deciding between capital expense (CapEx) and operating expense (OpEx) models. For example, manufacturing and construction companies increasingly choose to lease heavy equipment instead of buying it, which has implications for cash flow, taxes, and other financial considerations.

Device or machine-as-a-service requires embedded connectivity to monitor the usage of the device so that it can be billed appropriately and remains secure. The same platform used to activate the SIM can be used to alert the manufacturer if a malicious action has interrupted connectivity, or even if the device has moved outside its intended operational location. Embedded SIMs are difficult to tamper with without damaging the machine, so it is incredibly difficult for anyone to act maliciously without the manufacturer being alerted. Device makers can use eSIMs to leverage these opportunities regardless of their location when complemented by a connectivity partner that offers a global roaming bootstrap profile, and simplified access to many global networks in a cost-efficient way.

Conclusion and Next Steps:
Choosing the Right Connectivity Partner

By this point, you will be excited about one or more of the opportunities that eSIMs have to offer. Your next step is selecting an IoT connectivity provider that can supply both the eSIM and the network of mobile network operators required to provide global coverage.

Numerous offerings claim to offer effective connectivity management, but when evaluating solutions for your business' specific needs, focus on these three prerequisites. Any inadequacy in these areas can hamper your IoT projects' profitability or derail them entirely.

Focus on flexibility, simplicity, and cost-efficiency when evaluating partners. Success depends on leveraging flexible networks, easily managing device connectivity, and embracing the cost-efficiency of a single vendor approach that offers access to MNOs around the world.

Seek consolidation. Where connectivity management is concerned, your goal should always be a "single pane of glass." Give preference to solutions that consolidate data from disparate sources and cost and carrier relationship data into actionable forms.

Look for a trusted partner ecosystem. When considering solutions and providers, don't just look at the technologies they are offering. Connectivity management can determine your competitive success. You need a provider that combines superior technologies with experience, an ecosystem of partnerships, and commitment to the success of your business.

To find out about how Arm Pelion Connectivity Management can support your eSIM deployment, email PelionCM@Arm.com.