STRATEGY ANALYTICS
Research, Experts, and Analytics

IoT

Arm Drives Deeply into IoT with Pelion Platform, Partners with Vodafone to Speed IoT Adoption

Report Snapshot

One of the major challenges facing the adoption of IoT has been the cost, simplicity and security of implementing devices at scale. While the industry has moved forward in offering device and connectivity platforms that simplify the effective monitoring and management of thousands of devices, it is clear that much deeper cross-industry partnerships are still required in order to significantly reduce the complexity and costs faced by organisations when implementing Internet of Things (IoT) solutions.

This report assesses Arm's IoT platform strategy, how the Pelion IoT Platform was built, the acquisitions and partnerships that have been established by Arm and what merits the partnership with Vodafone in particular, will bring in order to help Arm realise its IoT ambitions.

IoT Ecosystem

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Contents

Exhibits

1. Analysis

1.1 Changing M&A Market Dynamics

The IoT market is undergoing a period of reflection and consolidation as we head to the mid-point of 2019. High-value IoT acquisitions are slowing. Pragmatism is replacing aggressive expansion. Mobile World Congress this year proved to be a showcase for partnerships between different kinds of IoT platform players[1]. For example, Microsoft (Azure) announced alignments with SAP, Inmarsat and myDevices, Arm partnered with Vodafone and China Unicom, while Vodafone also got together with AT&T[2], after recently partnering with IBM. HPE announced it had partnered with the automotive supplier Continental.

Companies that traditionally may have had end-to-end ambitions for IoT platforms are appearing to be taking a more practical perspective. At the same time, those vendors that form key components of the IoT ecosystem, such as hardware and connectivity/networking vendors, are pushing forward in an attempt to solve the complexity and fragmentation challenges that exist in the industry.

1.2 Arm: Forging a Path from Smartphones to the IoT

Among these vendors, Arm, which has formed a key bedrock of the mobile industry, with its Arm core and SoC designs, has been moving into the IoT space in a more focused fashion over the past few years. This has, of course, been assisted by the Arm's acquisition by Japanese telecommunications giant, SoftBank Group for UK £23.4 Billion in 2016, enabling greater funds for relevant strategic acquisitions (Softbank Chief Executive Officer Masayoshi Son highlighted IoT as one of the key reasons for the acquisition, along with Arm's potential in artificial intelligence, driverless cars, robotics and ride sharing).

Arm has been diligently building out a fully-fledged IoT platform through a combination of internal developments, strategic acquisitions and partnerships.

Underpinning these developments has been a key focus on security first, down to the silicon level, supported by the acquisitions of companies such as Offspark and PolarSSL (a software library implementing the SSL and TLS protocols, rebranded to Mbed TLS to better fit inside the Arm Mbed ecosystem) and Sansa Security (a provider of hardware security IP and software for advanced system-on-chip components). Krisztian Flautner, ARM's general manager for IoT business stated about the Offspark acquisition in 2015 "We have always said that security must be the foundation of any IoT system and the acquisition of Offspark is evidence of us making that happen,"[3]

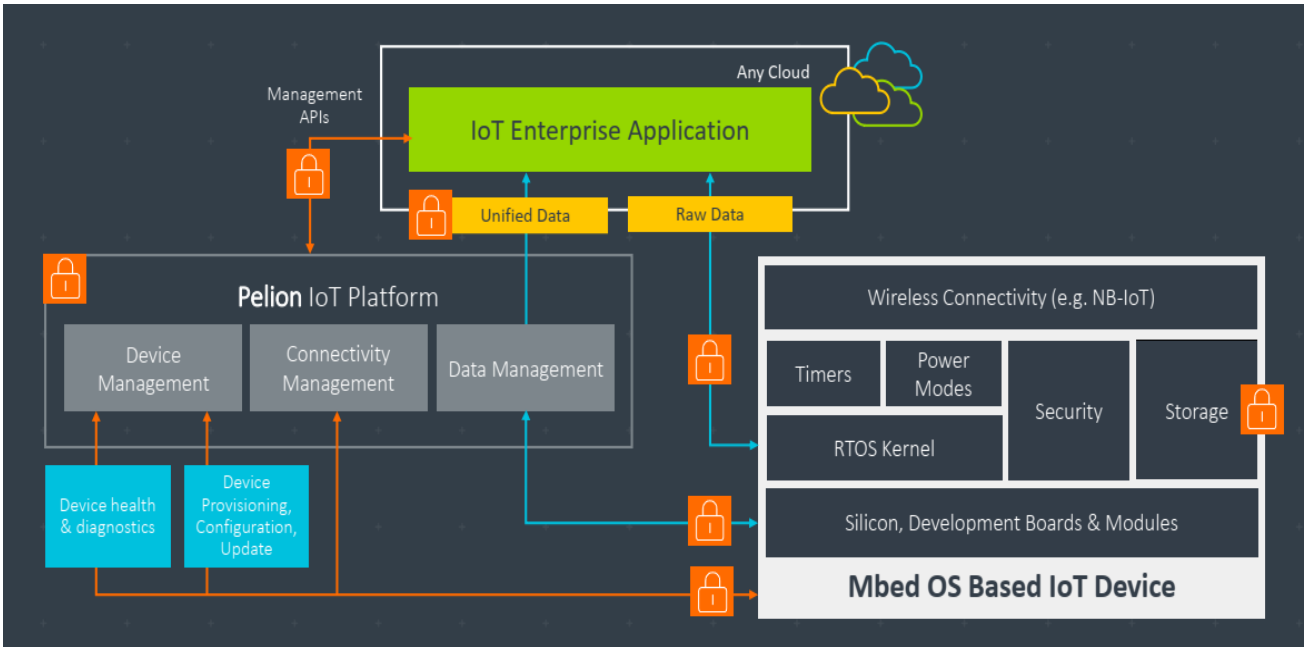
In 2017, the focus shifted to developing additional expertise in low power networks for the IoT, especially around NB IoT. In order to develop that, Arm acquired Mistbase and NextG-Com, for specialist engineering expertise in

[1] See Report: IoT @ Mobile World Congress 2019: 5G, Edge and Partnerships Dominate Agenda
[2] See Report: AT&T and Vodafone Collaboration Accelerates IoT Innovation in Automotive Industry
[3] https://www.computing.co.uk/ctg/news/2394340/arm-aquires-internet-of-things-security-firm-offspark

software and hardware IP that meets the new NB-IoT standard. NextG-Com offers a complete layer two and three software stack for NB-IoT, while Mistbase provides a complete NB-IoT physical layer implementation solution.

Arm has been forging ahead with designing secure chip and device architectures, increasingly in resource-constrained and low power devices that form a large part of the IoT, The ability to offer a secure embedded RTOS environment underpins an important part of an IoT platform is vital to an IoT platform and Arm has this capability with its Mbed OS components (see Figure 1). This is also one of the key reasons for Microsoft recently acquiring embedded RTOS vendor Express Logic[4] to connect to its Azure IoT Platform.

Figure 1: Mbed OS and the Arm Pelion IoT Platform Components



Source: Arm

Nevertheless, Arm was still fundamentally lacking some critical components required for a viable platform that it could offer to customers; namely connectivity and data management. As a result, it made several acquisitions to help in achieve that and form the core basis of the Pelion IoT Platform.

1.3 From Managing Devices to Connections: Stream Technologies Acquisition

As discussed, Arm addressed the Device Management Platform elements with Mbed, enabling organizations to securely develop, provision and manage connected devices at scale. The acquisition of Stream Technologies allowed Arm to fully develop connectivity management through the creation of the Pelion IoT platform, developed

[4] https://blogs.microsoft.com/blog/2019/04/18/microsoft-acquires-express-logic-accelerating-iot-development-for-billions-of-devices-at-scale/

from Stream's IoT-X capabilities. Stream supports physical connectivity across all major wireless protocols – such as cellular, LoRa, Satellite, etc. – that can be managed through a single user interface. Seamlessly connecting all IoT devices is important in ensuring their data is accessible at the appropriate time and cost across any use case.

The combination of Stream's technology with Arm's Mbed IoT Device Management Platform provides an end-to-end IoT platform for managing, connecting, provisioning and updating devices that is scalable and flexible. This scalability is critical as we see devices start to scale. In addition, Stream now works with GSMA compliant Embedded Subscriber Identity Module (eSIM) solutions, including Arm Kigen and other SIM solutions for secure identity and connectivity of IoT devices from the chip to the cloud.

The Stream acquisition offered a number of key benefits to Arm:

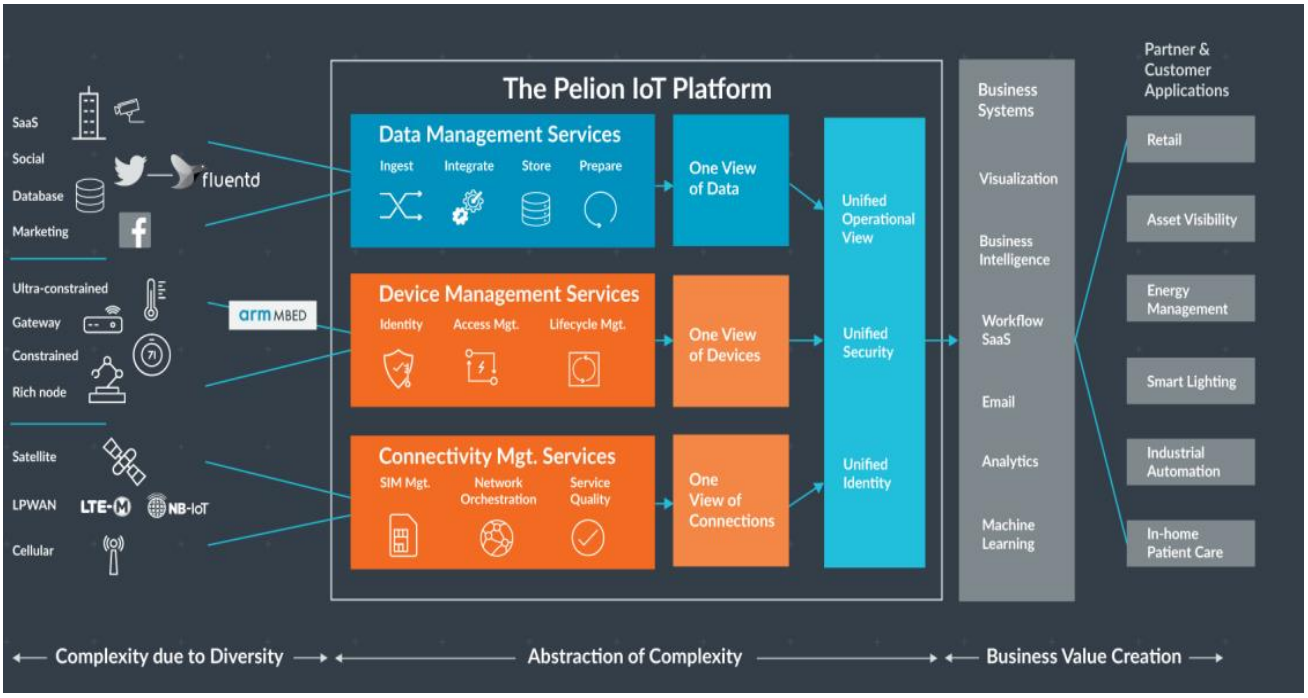
- **Single pane of glass for customer visibility and management capabilities throughout the device's lifecycle – deployment, connectivity, provisioning, management, and updates.**
- **eSIM orchestration that communicates and connects policies enabling zero touch on boarding for efficiencies and scale of IoT connections.**
- **Global aggregation across network types and flexible wireless connectivity options that can be optimized across devices, regions, and use cases that are deployed.**
- **Billing and reconciliation through APIs and automated controls that can charge based on any event for increased flexibility.**
- **Connecting and managing devices regardless of network type to steer reliable and trusted data, seamlessly push new updates and features, and optimize quality-of-service and latency for troubleshooting**

1.4 From Managing Devices and Connections, to Managing Data: Treasure Data Acquisition and the Creation of the Pelion IoT Platform

Treasure Data was a global leader in enterprise data management providing the ability to aggregate and translate large volumes of scattered and siloed data. The company's technology deals with data from any source - CRM, ecommerce systems, edge, IoT devices, and any third-party data. The result for customers is an ability to derive actionable insights from a disparate data mix.

The acquisition of Treasure Data represented a major part of Arm's IoT enablement mix. Its technology, along with that of Stream for connectivity management, combined with Arm Mbed Cloud and Arm's knowledge of the IoT hardware foundation, allowed Arm to create its Pelion IoT Platform (elements shown in Figure 2)

Figure 2: Arm Pelion IoT Platform



Source: Arm

1.5 Driving Down Cost and Complexity through Partnerships: "Any Device, Any Cloud"

Since the creation of the Pelion platform, Arm has been busy building out relationships with key partners, including CSPs (Communication Service Providers) and the broader developer community, to help drive eSIM enablement and drive scale through reduced cost and complexity. The stated goal of the Pelion Platform was to connect any device to any platform, which requires relationships with partners to enable easy integration with providers of choice, depending on the customer environment.

1.5.1 Intel Partnership

Late in 2018, Arm agreed to collaborate with Intel to remove IoT scaling barriers. Through the collaboration, the Pelion IoT Platform can on-board and manage Intel Architecture (x86) platforms, in addition to Arm-based IoT devices and gateways. The combination of Pelion Device Management with the Intel Secure Device Onboard (Intel SDO) service allows organizations to manufacture devices without any prior knowledge of end customer-specific on boarding credentials or even which application framework the end user will choose. This enables a more flexible cloud provisioning model and seeds a compatible base of Arm and Intel devices ready for management by the Arm Pelion IoT Platform, with on boarding into any application cloud.

1.5.2 myDevices Partnership

myDevices has partnered with numerous gateway and device manufacturers to create an ecosystem of LoRa-connected IoT solutions for specific vertical applications. myDevices'" IoT in a Box" solution enables SMBs or enterprises to set up and securely connect a gateway and sensors supported by Pelion Device Management and monitor the solution with Pelion Data Management.

1.5.3 Arduino Integration

Arduino opted to support Pelion Connectivity Management to give its users the option of data plans to suit a range of options, from single IoT prototypes to production IoT deployments. This allows for single development with the option to scale up supported by the Pelion Platform.

1.5.4 Linux Integration

Arm also supports Mbed Linux OS, which builds on Mbed OS, by enabling secure development and device management of IoT devices based on Cortex-A. Mbed Linux OS is integrated with Pelion IoT Platform and will open up new classes of IoT devices that are managed through the platform, providing organizations with additional flexibility and faster time-to-market for complex applications.

1.6 Global CSP Partnerships Critical to Scale

Figure 3: Snapshot of Tier 1 Arm Carrier relationships

Source: Arm

1.6.1 Sprint Curiosity IoT Platform

It was unsurprising that one of the first major Carriers to announce it was working with Sofbank-owned Arm, was Softbank-owned Sprint. Sprint decided to rebuild its previous connectivity platform environment, electing to piece together various elements from the Softbank Group of companies to create the “Curiosity IoT Platform”.

While the Curiosity IoT core and operating system were built with Ericsson, fellow SoftBank company, Packet, providing a distributed core network using bare metal servers at the edge. Sprint opted to use the following platform elements from Arm:

- Arm’s Platform Security Architecture (PSA) framework provides a common secure foundation for IoT devices: a holistic set of threat models, security analysis, hardware and software specifications, along with open source firmware.

- Arm Pelion Data Management to capture data from devices and integrated for analytics with other enterprise data sources.

- Arm Pelion Connectivity Management and Arm Kigen SIM solutions to securely manage and provision SIM connectivity across all devices deployed using multiple network protocols including cellular, satellite or LoRa.

- Arm Pelion Device Management: Security, management and over-the-air firmware updates for a wide range of IoT device types deployed on premises or in the cloud.

1.6.2 China Unicom Deal

Arm is also working with - China Unicom to deliver secure device management China with the Arm Pelion platform. It allows organizations to deploy and manage IoT at scale across verticals, including smart utility, smart cities, smart logistics and other industries, where China Unicom has a footprint.

1.6.3 Deeper into IoT with Vodafone: iSIM, bootstrapping and cross-platform support for faster adoption

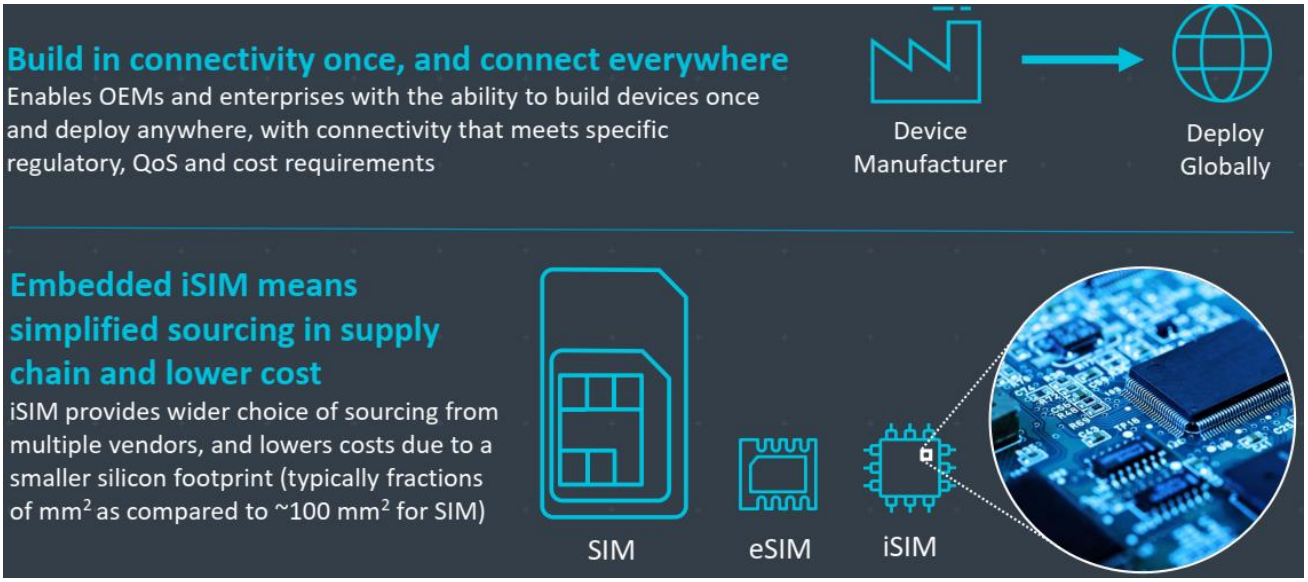
In addition to the Sprint deal, among others, Arm has been building carrier relationships outside the Softbank family of companies. The most extensive of these has been Vodafone, with whom Arm has been developing its iSIM.

Late last year, Vodafone and Arm announced they were partnering to develop iSIM (integrated SIM), which Arm believes is a step up from eSIM (electronic SIM). eSIM initially reduced the cost and management complexity of physical SIM cards, allowing IoT to become more scalable. As a result, companies that deploy large numbers of IoT devices aren't locked into their initial network operator or its pricing and access policies.

iSIM's moves SIM functionality into a device's permanent hardware array. Unlike eSIM, however, iSIM no longer relies on a separate processor; nor does it demand a significant share of a device's hardware footprint. iSIM enables hardware OEMs and processor design companies to design system-on-a-chip (SOC) architectures that integrate SIM functionality with an existing, on-board processor and cellular modem.

Located on a secure enclave on a system on chip (SoC), it affords a root of trust for the mobile network, made possible by an additional layer of authentication. This reuse is especially beneficial in payment, identity and critical infrastructure applications.

Figure 4: Arm iSIM



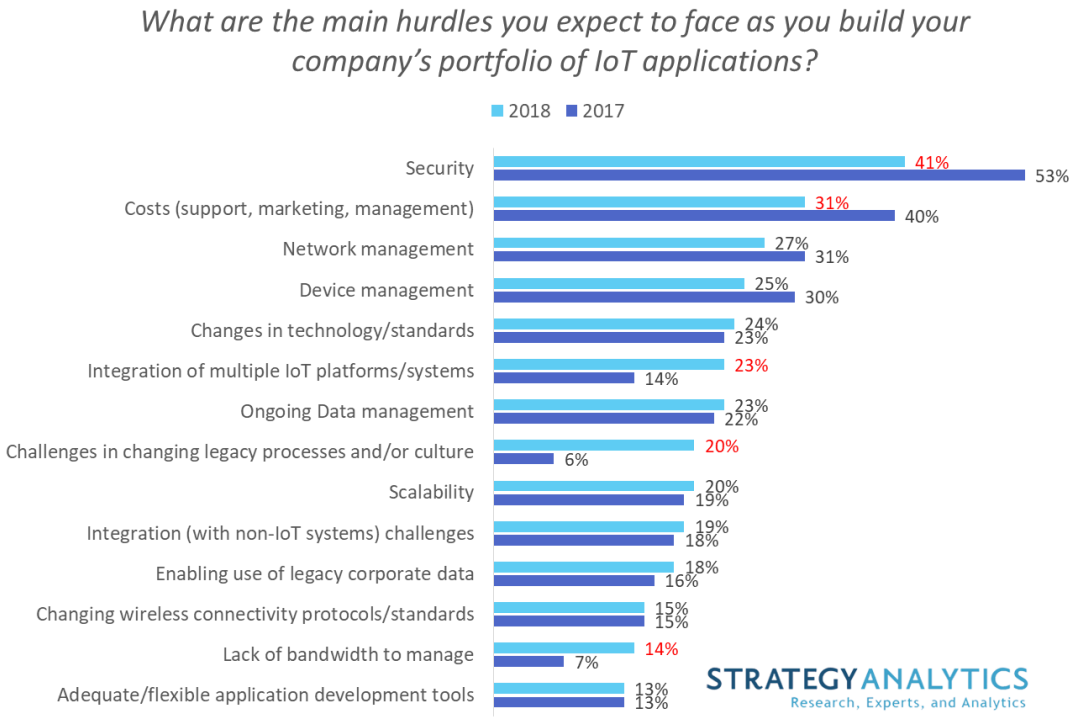
Source: Arm

At MWC 2019, Arm and Vodafone built on the iSIM partnership to expand the previous agreement around integrated SIM (iSIM), to enable remote provisioning for devices using Narrow Band-IoT (NB-IoT) and Long Term Evolution for Machines (LTE-M) using Arm Kigen iSIM. The deal provides anyone deploying IoT devices globally with the means to develop and deploy a single IoT product that can be shipped and connected anywhere in the world. Vodafone's global IoT network enables organisations to connect IoT devices across the broadest global footprint through the Vodafone IoT platform or the Pelion IoT platform.

2. Implications

Arm has been diligently building out its IoT strategy in earnest over the last 4 years. It wisely decided to begin with security down to the silicon level (Kigen iSIM), supported by the acquisitions of companies such as Offspark and PolarSSL (a software library implementing the SSL and TLS protocols, rebranded to Mbed TLS to better fit inside the Arm Mbed ecosystem) and Sansa Security (a provider of hardware security IP and software for advanced system-on-chip components).With a clear hardware and RTOS strategy, it has since moved to build out all the other necessary platform elements: Device Management, Data Management (Treasure Data) and Connectivity Management (Stream Technologies).

Figure 5: What are the main hurdles you face in building out your company's portfolio of IoT applications?



Source: Strategy Analytics IoT

Backed by Softbank, Arm has successfully moved into the IoT Platform space and beyond its Arm core and SoC designs to become a credible platform with security at all levels. The modular nature of the platform means it can form all or part of a CSPs white label IoT platform solution, as highlighted by the relationship with Sprint and the interoperability with Vodafone's GDSP platform. Arm's position in the ecosystem means it is not competing directly with IoT platform vendors such as Vodafone, Ericsson, or Cisco Jasper. Instead, Arm has focused on making itself interoperable with other vendor platforms. Strategy Analytics believes this is a shrewd approach-in our most recent

end user research, integration of multiple IoT platforms and systems was highlighted as one of the major hurdles for companies in comparison to the previous year (see Figure 5).

Partnerships with Intel, myDevices and Arduino have been facilitated not only through in house development, but also through the acquisition of Stream Technologies, which has given Arm a robust, network bearer agnostic connectivity management offering. The shift to iSIM not only leverages the push into eSIM across the IoT space, but also plays into Arm's silicon expertise, while at the same time fellow UK-founded partner Vodafone stands to leverage the benefits of preferred partner for iSIM bootstrapping in IoT projects using ARM Pelion or Kigen iSIM. Devices using an iSIM will boot up before defaulting to the chosen network for that particular deployment, but will default onto Vodafone in the absence of a stipulated provider. This not only expands Vodafone's channel reach through Arm, but gives Arm a huge CSP partner with global reach that it can offer to its customers and partners. We believe this collaboration is a big step forward for greater customer choice, fewer device SKUs, higher volume and velocity through IoT supply chains and lower deployment cost.

Of course challenges remain. As highlighted in this report, Microsoft has (and is) acquiring the ability to replicate some of core elements of the Pelion platform, especially data management, where it is the key "go-to" provider for data management with Azure IoT. Nevertheless, Arm is taking responsibility for securing the critical elements of an IoT platform down to the silicon level; given that security remains the key hurdle to companies looking to deploy IoT (see Figure 5), this is encouraging for the industry. Arm is developing multiple industry partnerships and is making itself easy to work with -either in a modular fashion, or with Pelion in its entirety-and therefore we remain positive about Arm's ability to sustain a strong position in the IoT for many years to come.

3. How Can We Help You?

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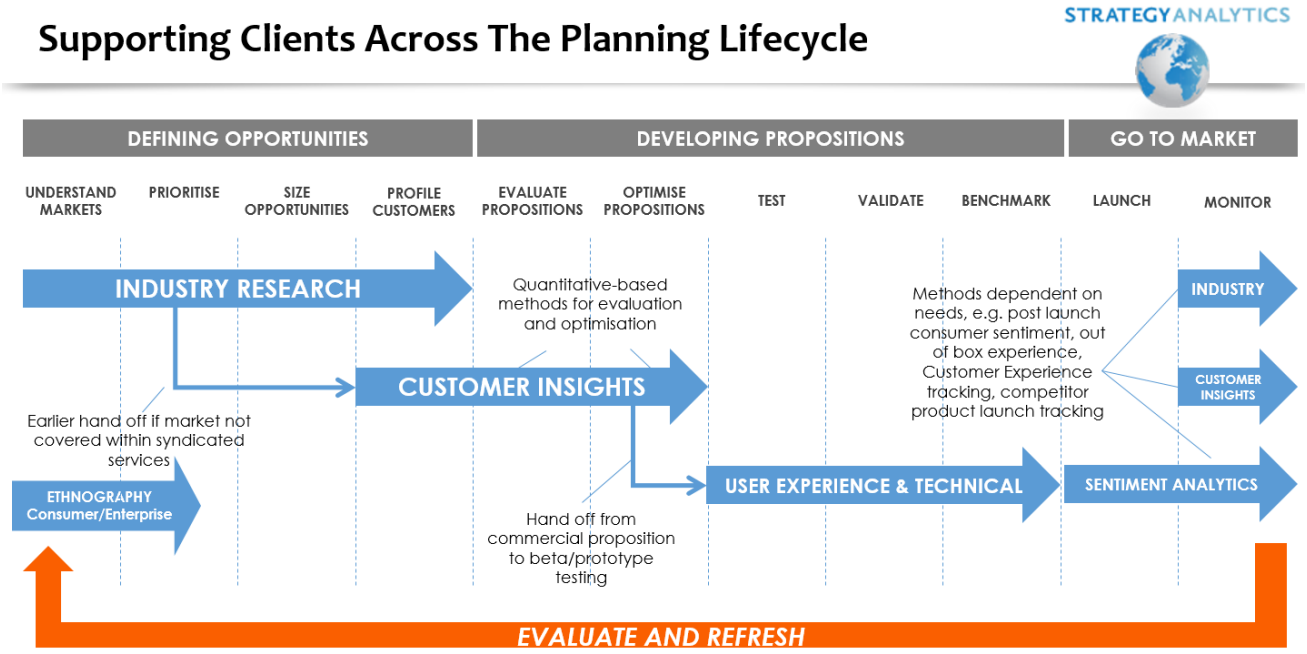

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