Pipeline
Technology for Service Providers.
www.pipelinepub.com Volume 14, Issue 2

The Growth & Edge of IoT

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Despite having been the subject of much discussion and investment over the past five years, the development of the Internet of Things (IoT) remains at a relatively early stage.

In practice, the reason is that, like the 'classic' Internet itself, the IoT requires not only the development of viable business models but also a transformation in the way that partaking businesses operate. That said, those players who have already entered the market are already realizing benefits. That said, opportunity still abounds: in a survey conducted by Vodafone in 2017, 95 percent of respondents who stated that they had adopted IoT projects also claimed to have seen tangible benefits. In the same survey, 51 percent of adopters reported that IoT has either increased revenue directly or enabled new revenue streams.

Juniper Research believes that the IoT will develop over six distinct phases, with erstwhile M2M network strategies eventually developing into highly networked, automated deployments that may be classified as an 'intelligent IoT.' The evolution from closed-loop networks such as SCADA and M2M is well underway, with service provider business models and platforms supporting data aggregation and application enablement having driven the greatest changes in the market over the last three or so years.

Nevertheless, there are still significant challenges to be solved. These can be summarized in the form of two key concepts: business process transformation and scale.

Although the IoT is presently represented by just over 21 billion connections globally, much of the data produced by connecting devices is transient enough so as to be of little value if it is not analyzed immediately. Or, this data creates challenges when analyzed retrospectively. What does this mean in practice? Essentially, these challenges result in projects that are slow (beyond 6 months) to realize ROI (return on investment), while operating costs are elevating owing to high bandwidth and storage requirements. In turn, this has constrained IoT deployment sizes, with many businesses unwilling to implement a company-wide IoT strategy.

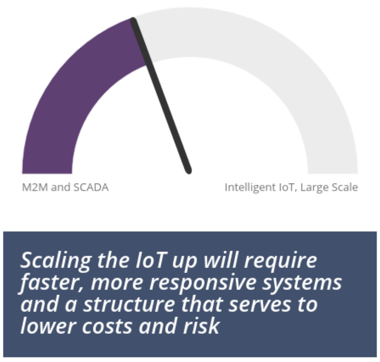

Figure 1: From M2M to IoT Scale
(Click to Enlarge)

Computing at the Edge to Drive Scale

Juniper's research report, The Internet of Things: Consumer, Industrial & Public Services 2018-2023 has found that the emergence of edge computing services and applications will serve as a significant driver for overcoming the issues described above. Edge computing in itself is not a new concept: placing computing intelligence in nodes at the edge of a network for the purposes of industrial automation has been common practice for many years. However, the level at which devices are now being networked, from the field to corporate environments, is rising to a point that has never before been reached.

Defining Edge Computing in the IoT

Edge computing is a rather broad term. Smartphones, for example, can be viewed as edge computing devices owing to their position in the network and high CPU capacity. However, many MCUs (microcontroller units) positioned at the edge of a network merely serve as IoT sensors and data-gatherers. Here, computing power to process this data is required at the edge of the wider Internet. Increasingly, this is commonly referred to as the 'fog', i.e., between the cloud and IT or OT (operations technology) networks. There are, however, key differences between the broader term 'edge computing' and 'fog computing':

Edge computing represents the data ingestion, processing and information communication of any endpoint device at the edge of a network, such as a microcontroller unit, PC, smartphone or gateway device.

Fog computing represents the movement of traditional cloud services, such as networking, processing and application enablement to the edge of the network. Fog computing devices are typically smart gateway units connected to a local area network.

A loose representation of the architecture for these concepts is shown in the following figure.

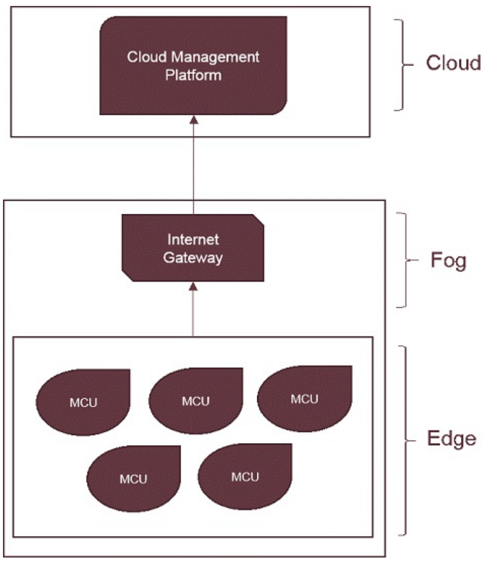

Figure 2: Edge vs Fog
(Click to Enlarge)

Impact of Edge Computing

Edge computing essentially brings data processing much closer to the source. This entails a number of potential benefits.

- **Latency**: that is to say, the time taken between data being recorded, analyzed and actioned can be considerably reduced. If edge devices are able to identify relevant data, and process it meaningfully, then that data must no longer be sent to a potentially far-off cloud server. As such, real-time or near-real-time applications can be enabled.

- **Bandwidth** is reduced, owing to less reliance on cloud computing services. As the IoT scales up, this reduction in bandwidth will reduce the likelihood of network bottlenecks.
- **Reliability** is increased, as deployments become less dependent on Internet connectivity uptime.
- **Data security** can be increased, by virtue of the ability to better anonymize and group sensitive data.
- **Automation** potential is increased via an increase of on-device machine learning capability closer to the data source.

For many companies potentially investing into the IoT, the ability to efficiently and quickly manage the data produced by devices in deployments will be key to reducing overall costs and enabling the ability to convert data into useful information. As such, speed and resilience can be viewed as critical components for achieving scale and, in turn, impacting wider business strategies towards the IoT.

Market Landscape

Edge computing services are presently at an immature phase of development, with one of our interviewees even going so far as to call it a 'Wild West,' on account of the number of players attempting to compete in the space. Indeed, vendors traditionally within OT, IT and networking markets are all promoting their services.

This means that deployment models—for example, how processing power may be distributed across edge devices—as well as business processes—for example how strategic and security policies are applied across OT and IT environments—remain in development. The latter point is particularly important, as a result of the growing recognition of cybersecurity risks present in IoT devices and deployments.

Meanwhile, there are technical challenges to be solved. Interoperability, for example, is— perhaps unsurprisingly—a critical issue that is being addressed via entities such as the OpenFog Consortium. Such issues will undoubtedly take time to solve, although the demand for edge computing services, particularly as 5G and supporting SDN (software defined networking) and NFV (network functions virtualization) are commercialized, will serve to accelerate market development. In tandem, this will increase potential project scope for customers, lower business risk and reduce ROI times.

Future Outlook

Juniper believes that edge computing, alongside supporting technologies such as LPWAN (low power wide area network) connectivity will serve to greatly increase the rate at which IoT connections are made. Even now, the expansion of partner networks and the development of greater understanding of IoT deployment strategies is serving to drive growth, although the aforementioned factors will likely begin to have a significant impact from 2020 and beyond. As such, by 2023, Juniper expects the IoT to comprise over 64 billion connections.

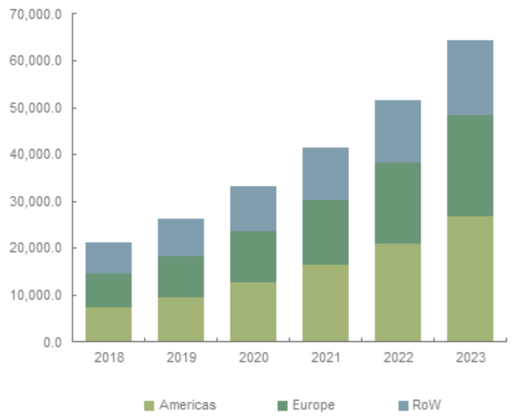

Figure 3: IoT Installed Base (m), Split by Region 2018-2023
(Click to Enlarge)

Nonetheless, further key challenges remain. Cybersecurity is—and will continue to be—a critical issue, with some form of regulation likely in future to set minimum standards owing to the risks involved. Additionally, costs and expertise are issues for many companies who cannot count connectivity and data analytics among their key competencies.