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Your inside track on the technology topics that matter

IoT AT THE EDGE OPENS UP A WHOLE NEW WORLD

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Tech Trends – your new inside track to the topics that ***really*** matter.

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WHERE IS THE EDGE? YOU'LL KNOW IT WHEN YOU HIT IT

Edge intelligence is being trumpeted as the next big step in enabling IoT but definitions of the edge are nebulous and the current base of deployed devices are dumb and inflexible. **George Malim** goes closer to the edge to understand how greater intelligence will open up new opportunities.

The edge has many definitions, most of which depend on the devices, network and applications involved. There's the network edge, the cloud edge and the edge device to consider all of which are at least partly able to define themselves as the edge. Regardless of your definition the edge is certainly gaining traction: the most recent ***Forrester Analytics Global Business Technographics Mobility Survey*** reported that 25% of global telecoms decision-makers are already implementing or expanding edge computing in 2019.

"The definition of the edge depends largely on who is talking about it," confirmed Rob Milner, the head of smart systems at **Cambridge Consultants**. "When you talk to cloud providers, they view the edge as being something a bit like a smaller data centre that's a bit closer to end users but, for a device maker, that still looks like a data centre. Ultimately edge intelligence needs to be more on the devices themselves or if not there, somewhere nearby like a 5G base station."

Ron Neyland, senior director of IoT & E2C Advanced Solutions and Technologies for **HPE**'s IoT and Edge CoE & Labs, explained that the edge can actually be a large territory. "The simplest answer is that edge is everything beyond the data centre and cloud," he said. "It's where the 'things' of IoT are. By keeping compute, storage, data management, and control at the edge, companies can minimise insight delay and reduce data backhaul bandwidth requirements."

Different kinds to consider

Others agree that there are many different forms of edge to consider. "It's helpful if you visualise the edge as a spectrum between the device and the compute," said Marc Flanagan, the EMEA director for Edge and IoT Solutions at **Dell Technologies**. "On the right edge, what we call the far edge, is where data is generated at the device. Then you have the edge of the IoT network, where the compute power creates the less time sensitive business insights which are then delivered to the hub."

Regardless of the precise definition of the edge, it's important not to lose sight of the benefits of adding intelligence at the edge. "The edge is where the action happens," said Glen Robinson, the emerging technology director at **Leading Edge Forum**. "Data can be generated almost anywhere, but our ability to do something meaningful with it is slightly more constrained.

"[This is] due to the need for additional capabilities, such as processing, memory, storage – all of which require power –

Rob Milner
head of smart systems
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Marc Flanagan
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which is a resource that is frequently in limited or occasional supply at the source of data creation. Therefore, the edge is a location [to which] we can get sufficient power…to run a small compute system that can process data and do something useful with it.”

Andrew Grant, the senior business development director for Vision and AI at **Imagination Technologies**, detailed the advantages of embedding intelligence at the edge. “Embedding intelligence at the edge reduces latency and data transfer,” he said. “It’s a key problem for cameras. So using neural network accelerators, along with traditional computer vision algorithms, the intelligent camera can send only the most important frames or metadata. For example, being able to identify suspicious packages left behind in densely populated public areas.”

“For a vehicle travelling at even 30mph, it makes sense for the vehicle to be able to make split-second decisions rather than sending data back to the cloud and suffering buffering,” he added. “This could literally be the difference between life and death. Commentators now believe that a self-driving vehicle could generate as much as four terabytes of data a day which would need to be moved around the vehicle.”

Low latency, fast computing

Low latency and accelerated computing throughput are clear benefits, along with reduced cost and provision of a better experience to customers. “The fundamental benefit is that if we can move the compute, and the inherent intelligence that brings, closer to the ‘things’, we can materially improve and affect the way things are done,” said HPE’s Neyland.

He continued, “By moving the compute power and intelligence closer to where the data is being originated – in other words to the edge – you can do the analysis right there, and materially improve operations. Further, whereas previously you may have only been able to act on a small percentage of the data, at the edge you can utilise the data to a far greater extent. This allows improved results, earlier detection of issues, greater efficiency, reduced costs and other benefits.”

Cost reduction also resonates with Dell’s Flanagan. “There are two significant benefits to businesses embedding intelligence at the edge,” he said. “The first is cost. It’s naturally more cost-effective to process at least some data at the edge – data transmission is expensive, so by bringing compute closer to the origin of the data, you can reduce the volume of data you are transmitting back to the hub and therefore reduce the cost.

“The second is speed. Many use cases just cannot accept the latency involved in sending data over a network, processing it and returning a response. Autonomous vehicles and video surveillance in manufacturing are both great examples, where even a few seconds delay could mean the difference between an expected outcome and a catastrophic event.”

A substantial shift

Although much of the technology required to enable edge intelligence is mature, a substantial shift is required from the traditional, centralised hub and spoke architecture of data collection, analytics and action. A new era where edge intelligence is the norm will require new approaches to how operations are run.

“A lack of skills, security, the costs of the cloud and a lack of maintenance support will all hinder the growth of edge computing,” said Sam Wiltshire a talent consultant at recruitment firm **Paratus People**. “For organisations looking to move towards this model, don’t underestimate the initial legwork involved. It’ll be as transformative – and beneficial – as moving to the cloud, with the associated training, infrastructure investment and process changes.”

“Most edge implementations are going to occur in areas with little to no on-site IT support,” he added. “That makes a lack of internal skill a challenge. A potential solution is to use low-cost monitoring solutions that will forewarn of issues and allow tech support to be deployed to the scene quickly.”

This changed architecture coupled with the new operating model it ushers in could actually turn out to be the greater challenge for edge intelligence than the need to deploy programmable, intelligent devices. People as well as the technology will need to change. After all, as the old saying goes, if you aren’t living on the edge, you’re taking up too much room.

MultiTech introduces mPower Edge Intelligence for IIoT

MultiTech Systems has built on its application-enablement platform with the launch of mPower Edge Intelligence. This is embedded software that offers programmability, network flexibility, and better security and management for scalable Industrial Internet of Thing (IIoT) solutions.

mPower unifies and evolves the MultiTech smart router and gateway firmware platforms. The company is providing ongoing support of the current feature-sets, but now MultiConnect rCell 100 Series customers gain access to the programmability of the MultiConnect Conduit gateway. At the same time, gateway customers can enjoy the extra security features available on the rCell.

mPower Edge Intelligence simplifies integration with various upstream IoT platforms with the aim of streamlining edge-to-cloud data management and analytics. It also provides the programmability and processing capability to execute critical tasks at the edge of the network to reduce latency, control the costs associated with network and cloud services, and ensure core functionality. The latter even applies when connectivity is not available.

The new security features include a signed firmware validation, enhanced firewall and virtual private network settings, secure authentication and more.

"MultiTech understood early on the importance of edge intelligence, and has been translating that understanding into smart, innovative solutions on their router and gateway products for several years," said Dan Shey, Vice President and IoT Practice Director at ABI Research. "mPower brings together the best of their prior offerings for a unified customer experience, then builds on them to address known pain points in the IIoT market including: improved resiliency, enhanced security, lifecycle management and total cost of ownership."

Linking harsh environments and remote locations at the edge

Cisco Systems has introduced networking technology built to withstand harsh environments like chemical plants, oil refineries and mines. It is designed to provide Information Technology (IT) and Operational Technology (OT) teams with intent-based networking capabilities to scale and accelerate IoT projects. Intent-based networks capture business intent and translate it into network policy.

Cisco's developments for IoT at the edge include:

- The Cisco Catalyst IE3400 Heavy Duty Series Switch which will be available in summer; the Cisco Catalyst IW6300 Heavy Duty Access Points which will be available in autumn. Both are IP67-rated. They are managed by the Cisco DNA Center for network assurance and segmentation across campus, branch and OT environments.
- The Cisco Industrial Router can connect remote locations securely and improves applications' performance.
- Acquiring Sentryo, which provides "unparalleled visibility into OT devices, allowing IT teams to collaborate and secure these sensitive networks," according to Cisco.

"A secure connection is the foundation for every IoT deployment," said Liz Centoni, senior vice president and general manager, IoT at Cisco. "By extending intent-based networking to the IoT edge, we are helping IT and OT teams work together to reduce operational complexity, boost the bottom line, and improve worker safety."

Ubuntu release focuses on infrastructure and IoT

Canonical has released Ubuntu 19.04, which focuses on open infrastructure deployments, the developer desktop, IoT, and cloud-to-edge software distribution.

Now smart appliances based on Ubuntu will enable control decisions to move to the edge for 'edge-centric' business models. Amazon published Greengrass for IoT on Ubuntu, as well as launching the AWS DeepRacer model for the developer community working on autonomous ground vehicles which runs on Ubuntu.

Ubuntu 19.04 integrates innovations from key open infrastructure projects including OpenStack, Kubernetes, and Ceph. It offers life-cycle management for multi-cloud and on-premise operations, "from bare metal, VMware and OpenStack to every major public cloud," according to the company.

Microsoft's Visual Studio Code joined the list of developer tools published as snaps including IntelliJ, PyCharm and microK8s.

Litmus launches LoopEdge 2.0 edge computing platform

Litmus Automation has released LoopEdge 2.0, an edge computing platform designed to connect all industrial assets and derive value from their data through instant analytics. This second major release of the platform increases its integration and analytics capabilities.

"The number one thing [customers and partners] have been asking for is out-of-the-box analytics components inside of LoopEge," said Vatsal Shah, CEO, Litmus Automation.

LoopEdge 2.0's new features include:

- An analytics database for data and event processing at the edge
- Integration with leading IoT clouds, such as Microsoft Azure, AWS, Google IoT Core
- Integration with big data platforms, enterprise software, and cloud or on-site databases
- Marketplace for running artificial intelligence and machine learning applications at the edge
- Greater device management for real-time monitoring
- Refreshed user interface suited to Operational Technology, data science, or IT requirements
- An Open Platform Communications Unified Architecture (OPC-UA)server at no cost.

LoopEdge is designed to manage the complete edge lifecycle from secure edge device onboarding to device management to cloud connectivity.

It enables users to collect data from existing industrial systems (like programmable logic controllers, distributed control systems and sensors) and run applications locally on top of the data, such as event processing, Lambda functions, machine learning models, and more – all in an offline first deployment.

EdgeX Foundry offers production-ready release of open framework for IoT edge

EdgeX Foundy, a project running under the Linux Foundry (LF) Edge umbrella organisation within the open source Linux Foundation, has made its production-ready Edinburgh release available. The project's aim is to establish an open, interoperable framework for edge IoT computing which is independent of hardware, silicon, application cloud, or operating system. The Edinburgh release was created collaboratively by the projects members from around the world.

The Edinburgh release is intended to help the digital transformation of IoT use cases as a platform for real-world applications, both for developers and end users, across many vertical markets. EdgeX community members have created a range of complementary products and services to support it. They include commercial support, training and customer pilot programmes, and plug-in enhancements for device connectivity, applications, data and system management and security.

Edinburgh is the fourth release on the EdgeX roadmap. It provides a stable API baseline to standardise IoT edge applications and help future-proof IoT investments.

The intention is to foster an ecosystem of interoperable microservice-based capabilities and decouple investments in edge functionalities from any particular backend application or cloud.

Yokogawa launches Sushi Sensor solution for IIoT in Europe

Yokogawa Electric Corporation chose the MultiConnect Conduit IP67 Base Station, a LoRaWAN ruggedised IoT gateway, for its Sushi Sensor solution, which was recently launched in Europe.

Yokogawa's solution was developed for industrial plants, covers vast areas and supports heavy-duty use in hostile environments. It works with advanced analytics such as AI and machine learning in a cloud environment. MultiTech's LoRaWAN gateway captures and manages information from sensors.

Sushi Sensor is an OpreX Asset Management and Integrity wireless solution. The first product, the XS770A, launched in Japan in 2018, measures vibration and surface temperature to monitor machine or equipment conditions. It complies with LoRaWAN and is IP66/67/explosion proof.

- Separately, MultiTech won the Corporate Award from LoRa Alliance, voted for by fellow Alliance Members, and Derek Wallace, director of product management at Multi-Tech, has been elected as the organisation's regional vice chair for North America.

IoT Global Network tech trends REPORT

A few years ago, it was fashionable to argue that all IoT data must end up in the cloud and that all the really smart stuff was therefore in the cloud. This was a throwback to machine-to-machine (M2M), when we expected data from all connected devices to be sent to a central server for processing and subsequent distribution of the information created.

HOW IoT AT THE EDGE ADDS VALUE FOR ENTERPRISES

Robin Duke-Woolley

CEO

Beecham Research

That approach was the most cost-effective method, given the types of applications that were being connected at the time, which were not time critical for business operations. Typically, they were kinds of status monitoring of activities that could require some field support like repair, replenishment, reset, and so on.

Since then, the opportunities for connecting assets and devices have evolved considerably. Several billion devices are now connected to the Internet using an increasing variety of connectivity technologies – fixed line, Bluetooth, cellular, LoRa, Sigfox, Wi-Fi and satellite to name a few. All incur costs in one form or another.

Over the next few years, many more billions are expected to be connected. As they multiply, many will need near-real time processing of the data they generate, as IoT becomes more central to business operations. Further, IoT in the enterprise is rapidly encompassing business-critical activities where any interruption of service could be catastrophic. ▶

Extreme examples

Take as one extreme example the future of connected, autonomous vehicles. If they relied exclusively on a wireless network to operate, as mobile handsets do, what would happen if a network suffered downtime? What would happen if those vehicles needed to operate in areas where there was poor or no coverage?

Even in areas with good coverage, if all the data processing for vehicle operations were conducted in the cloud, it would take time to send the data for central processing and then return it to the vehicle to be acted on. That latency could be more than 100ms for each vehicle, which is an eternity when considering the traffic issues, even in a medium-sized city. In addition, this method would demand an enormous amount of processing in the cloud for all the vehicles that may be connected at any one time. It would also consume large amounts of cellular connectivity and the costs associated with it.

A question of balance

As this shows, some connected devices need their data processing to be carried out in real time with minimal latency and with no risk of downtime. That means close to the point where the data is created – at the network's edge where the devices are located. In the case of autonomous vehicles, processing data at the edge is critical to the operation of the vehicle itself, but other data, such as warnings of incidents well ahead and potential traffic delays, and even booking service appointments can still be processed centrally.

This means there is a balance to be struck for each type of application – how much processing should be carried out at the edge versus in the cloud? At the same time, connectivity to the cloud comes at a cost – in particular, when using cellular or even satellite connectivity. Enterprise IoT users must assess all of this when defining requirements for their IoT solution.

(continued on page 11)

What is edge processing and what are the key benefits?

Edge processing refers to the execution of data aggregation, manipulation, bandwidth reduction and other logic directly on an IoT sensor or device. In the context of enterprise IoT, which includes industrial IoT (IIoT), 'edge' refers to the computing resource close to the sources of data, for example industrial machines such as wind turbines, industrial controllers supervisory control and data acquisition (SCADA) systems and magnetic resonance (MR) scanners. These edge computing devices typically reside away from the centralised computing available in the cloud.

The aim is to put basic computation as close as possible to the physical system, making the IoT device itself as 'smart' as possible. Only the data that needs to go to the cloud is sent there. This could be to put data from an individual device into a wider context, such as data analytics related to the performance of a complete solution.

Processing data at the edge has several key benefits, in particular:

- **Bandwidth and storage costs** – as the amount of data required for 'smart' operations increases, and the number of Internet-connected devices continues to grow, the cost of sending data to the cloud and storing it centrally also grows. The bandwidth cost can be significantly reduced by only sending data to the cloud that is required for operations at that level and sending it in summarised form. Local processing at or near the edge reduces the amount of bandwidth needed.
- **Reliability** – a primary motivation for edge adoption is robust and reliable support for hard to reach environments. Many industrial and maintenance businesses cannot rely on internet connectivity for mission-critical applications. As noted in the example above, connected cars cannot meet their potential without local processing. Even wearables need to be resilient to work effectively without constant connectivity. For these use cases and many more, being reliable offline makes all the difference.
- **Latency** – is the time difference between an action and a response. The latency introduced by sending data to the cloud, processing it centrally, the return journey to the edge and then the data being acted on incurs delays that may be unacceptable when near-real-time actions are required. Manufacturing companies cannot afford this delay for their mission-critical systems. For example, cutting power to a machine just too late is the difference between avoiding and incurring physical damage.
- **Privacy and security** – a system that relies on connectivity to the cloud inherently presents more security risks. Data privacy is related to this: protecting privacy is both a potential asset and a risk for businesses in a world where data breaches occur regularly. Companies largely reliant on cloud technology have been scrutinised for what they know about users and what they do with that information. ▶

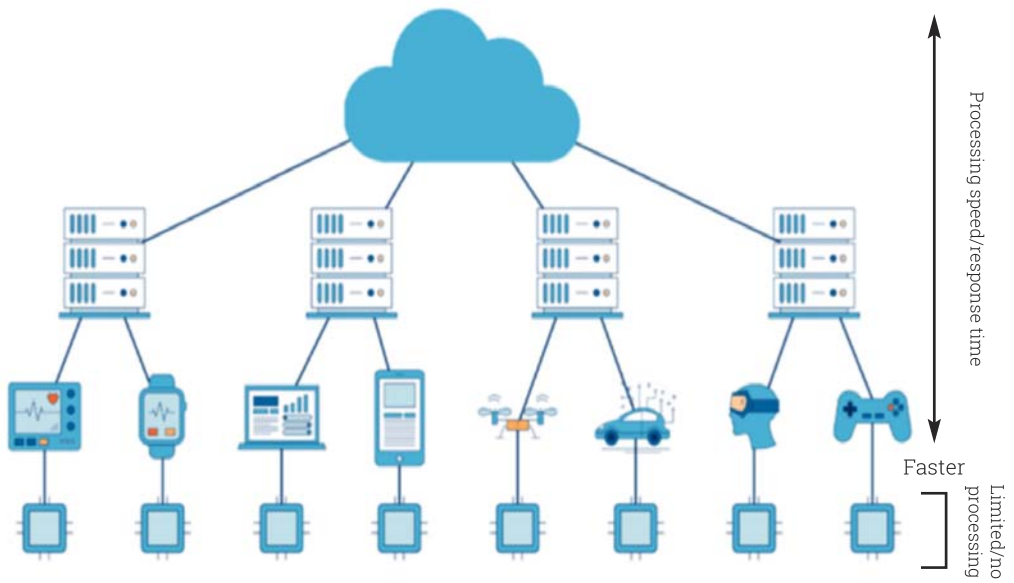
Centralised cloud
Centralised data centres are farthest from the network edge. However, they offer a much greater density of compute, storage, and networking resources.

Edge infrastucture
Small, distributed data centres provide a resource-dense midpoint between edge devices and the centralised cloud. Low roundtrip latencies of 5-10ms.

Edge devices
Real-time data processing within devices is based on applications' needs.

Edge sensors & chips
Data collection & origination.

The edge computing ecosystem comprises four primary areas



From edge sensors to the centralised cloud (Source: WinSystems)

How should edge processing be organised?

As Internet-connected devices proliferate, the efficiency of data transmission and processing is becoming increasingly important. Cloud computing has traditionally provided a reliable and cost-effective method for handling data, but the continuing, rapid growth in IoT has created a need for lower network latency and higher reliability. Edge processing is emerging to meet these demands.

It involves placing computing resources closer to where the data originates – such as motors, pumps, generators – or at the 'edge' where there are sensors. These processing resources may be located in the devices themselves or in edge infrastructure at a slightly higher level that can act as small, local data centres.

For example, Tesla cars have powerful onboard computers which allow data processing in near-real time, collected by the vehicle's many peripheral sensors. This enables the vehicle to make timely, autonomous driving decisions.

On the other hand, in the healthcare sector, most wireless medical devices do not have the resources to process and store large streams of complex data. As a result, smaller, modular 'data centres' are deployed to provide storage and processing capacity at the edge.

The chart illustrates four layers for the evolving edge processing ecosystem:

- **Edge sensors and chips** are where data is collected initially. They include sensors and chips manufactured for a wide range of use cases in addition to the standard application-specific integrated circuits (ASICs) and application-specific standard products (ASSPs), which are optimised for specific use cases.
- **Edge devices** provide the first line of processing and storing of sensor information. They include the edge sensors and chips, which collect the data, as well as the computational resources to process and analyse it, to an extent. These edge devices range from smart watches to autonomous vehicles.
- **Edge infrastructure** – data centres come in all shapes and sizes. More recently, microdata centres are being deployed to offer a very local, resource-intensive midpoint between the edge devices and the centralised cloud. They provide far more data processing and storage capacity than the edge devices themselves, and extremely low latency compared with the centralised cloud, which could be located a long way away.
- **Centralised cloud** has become a a primary location for storing, analysing and processing large-scale data sets, but is not the place for analysing data and delivering insights in real time. It is where data from many different sources at the edge is aggregated to provide an overall system perspective or other historic data. It is also where most of the integration between operational technology (OT) data and IT data tends to happen, for ongoing distribution to the wider enterprise.

The edge infrastructure level can aggregate data from edge devices or edge sensors, or both. One example is the recently-launched mPower Edge Intelligence offered by MultiTech. It extends the functionality of MultiTech router and gateway products. mPower Edge Intelligence simplifies integration with a variety of popular upstream IoT platforms to streamline edge-to-cloud and management and analytics, while also providing the programmability and processing capability to execute critical tasks at the edge of the network.

This reduces latency, controls network and cloud service costs, and ensures core functionality – even in instances when network connectivity may not be available. It also provides strong security features. ►

Privacy in healthcare

Privacy is an acute issue in healthcare. For instance, in the US under the Health Insurance Portability and Accountability Act (HIPPA). Each hospital bed currently has about 20 sensors and it is estimated (by IBM) that data breaches cost the healthcare industry three times more than any other sector.

As the number of sensors collecting and processing data continues to grow, privacy represents real value for healthcare companies looking to balance innovation with protection of patients' data. Edge processing helps to alleviate some of these concerns by bringing processing and collection into the environment where the data is produced. If necessary, it can then be encrypted.

Integrating OT and IT

The OT domain involves operational processes like industrial and factory automation, supply chain management and asset monitoring: the IT domain involves business process and office automation, enterprise web and mobile applications where data is consumed. Integrating OT and IT brings together the whole enterprise into one system, sharing the same data.

The OT can benefit from this integration with a more efficient, scalable, managed and secure infrastructure into which numerous applications are layered. They include predictive maintenance and remote asset monitoring and management.

Benefits on the IT side include secure real-time communication with the enterprise's assets while retaining the requisite efficiency for creating, scaling, maintaining and securing the infrastructure. The result is an opportunity for better operational performance, protection of profit margins, customer retention and the creation of new business models.

In this way, edge processing for IoT is not just an opportunity to improve operational performance. It has implications throughout the enterprise that ultimately impact both its efficient use of resources and potential for cost reduction, as well as the ability to compete in the market through superior customer support.

EDGE INTELLIGENCE EMPOWERS IIoT TO DECENTRALISE DECISION MAKING

Prasad Kandikonda is the vice president of engineering at MultiTech. His team has recently developed the company's mPower Edge Intelligence embedded software that adds to its application enablement platform to bring new programmability, enhanced security and ease of management to large-scale deployments at the edge. The software is network-technology agnostic and means organisations can add more intelligence at the edge, enabling more decentralised decision making, he tells **George Malim**.

George Malim: First of all, let's define what we're talking about. What and where is the edge?

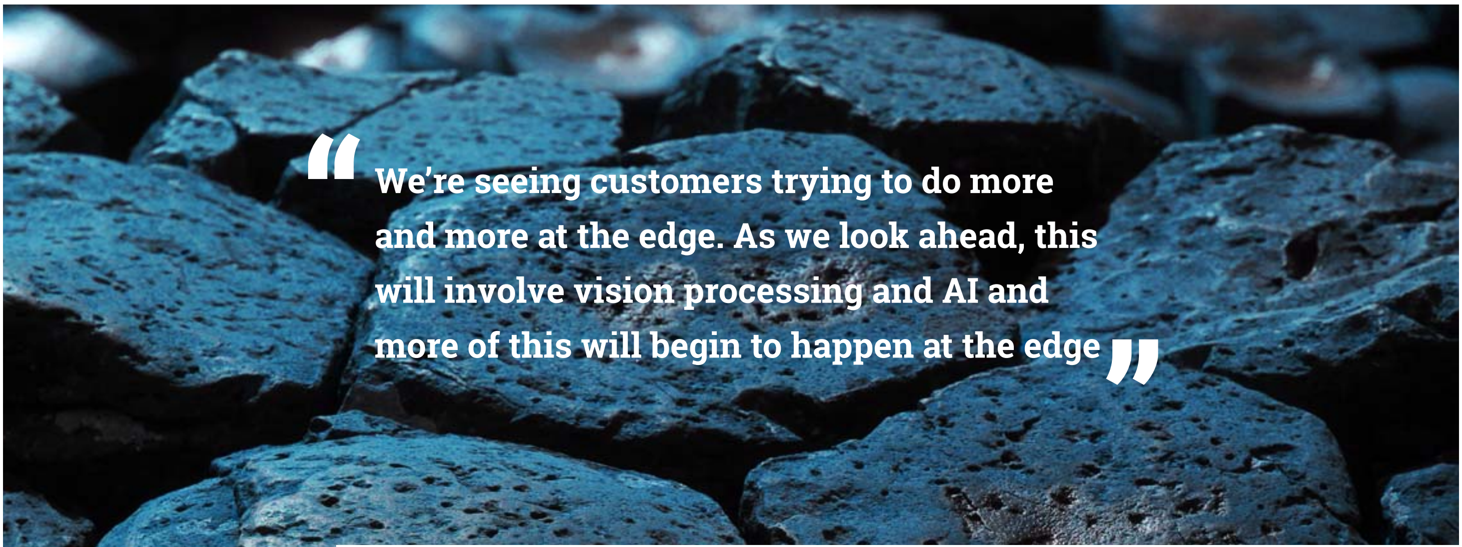
Prasad Kandikonda: The edge essentially is where the action happens. It's where sensors are deployed, data is gathered or actuators are triggered. Today, the edge is very basic in terms of its capabilities. We have a lot of sensor devices deployed and they're mostly in place to determine some change in conditions such as increased temperature or humidity. They then forward that data upstream to be analysed, processed and acted upon.

The edge is composed of predominately low-cost devices that have very little built-in intelligence. A lot of edge devices are not programmable and are static devices that are configured – permanently – to perform a single use case. They're also constrained because, typically, the network technology they use to connect to IoT platforms is pre-determined, embedded and not possible to change once they are in deployment.

GM: Cheap devices performing simple tasks looks an ideal model for IoT as it scales up into a market of billions of devices. Why do we need more intelligence at the edge and what's driving uptake in industrial IoT (IIoT)?

PK: There are multiple factors that come into play here. Customers are trying to do more at the edge and not refer everything back to centralised computing power and decision making. For example, a customer might have many sensors at the edge that they are trying to aggregate inputs from. This aggregation can be performed locally at the edge rather than each sensor sending its data individually to a centralised analytics function.

One of the major driving factors has been the possibility of aggregating bandwidth to optimise bandwidth utilisation across an estate of edge devices. To achieve this, it means doing more processing at the edge rather than sending every little piece of information across the network. Inevitably, this requires intelligence to be applied to identify which data should be handled at the edge and which data should be sent for centralised processing. ▶



This is just one aspect of the benefits of edge intelligence. Don't forget that the edge is increasingly a fragmented technical landscape with more and more connectivity options from low power wide area networking (LPWAN) to 5G becoming available. As a result, edge devices need the capability to process multiple inputs at the edge and discern what should be transferred to the cloud.

A further important factor is to ensure the edge has built-in survivability. If the edge device fails or the network fails, some kind of intelligence is needed to allow the edge to function even momentarily while a problem is fixed. It's an obvious benefit that an edge device can continue to operate even if it is not able to connect to centralised processing power and also that individual devices can continue to operate if there is a problem with another device.

GM: What about the issue of network latency? If all the data is sent back for centralised processing could this simply take too long for some applications?

PK: If you take legacy technologies, there has always been a limit in terms of the amount of time required for communication. There needs to be a level of quality of service (QoS) built-in to the network but that level is not always available for a variety of reasons. Therefore, for an application that needs a quick response, intelligence at the edge provides a solution.

If you take the example of a fire alarm, you want that to respond quickly. You don't want to have to wait for temperature sensors, for example, to send a message that traverses the cloud before sending an instruction to turn the water sprinklers on. Asynchronous events can be taken care of locally and in certain, critical situations, it's vital to have capability to act embedded at the edge.

GM: What are the main benefits of embedding intelligence at the edge for enterprise adopters and for service providers?

PK: Enterprises are extremely concerned about security and they need a lot more control in terms of integration and management of edge devices. From an enterprise point of view, they need the ability to enable security as they push in a new service. Security and dynamic configuration capabilities, along with the ability to programme devices, are the benefits that enterprise adopters are looking for and will gain from embedding intelligence at the edge.

Turning to service providers, they are more interested in trying to make software devices that capture more and more analytics data. They're looking at how to share edge devices across multiple customers, use cases and applications so they can cater for different types of end users.

They're looking at how to isolate devices that develop faults; they don't want the entire device network to be brought down because of one issue. This means a device being able to automatically disconnect from the network is important. The service providers' perspective is one of trying to make sure they get more from each device so they gain more information and maximise the output from every one.

GM: Can you give an example of how intelligence at the edge could be utilised?

PK: If you take a customer with gateways deployed as part of a rodent control project, they are trying to build intelligence at the edge rather than from the cloud. This is so that, as soon as a rodent is detected, the trap can be shut without having to address the question to a centralised intelligence resource. The need is to do something right now, not wait for feedback from the cloud.

In examples like this, you also need to consider what happens if the connection is lost. Does the device have enough edge intelligence to shut the trap when the rodent enters it even if it is not connected?

There are more acute situations to consider as well. For example, with fire fighters who have sensors on their fire suits, the system receives information about the temperature and the environment via a ▶

Prasad Kandikonda

vice president of engineering

MultiTech

gateway, but you want the gateway to determine something from that quickly, rather than the information going into the cloud for processing. There are use cases that are in life threatening situations like this and it makes sense to act on information locally and immediately.

There are situations where it makes sense to perform processing at the edge and others where it makes sense to do everything in the cloud. As the market matures this will become better understood but, in general, there are always use cases where you need intelligence that can be acted on as rapidly as possible. Edge intelligence is therefore a vital requirement and capability.

GM: What is MultiTech doing to enable intelligence at the edge?

PK: We recently launched our mPower Edge Intelligence software to bring greater programmability to the edge. This is the primary driver. We want to enable our customers to put their programs into edge devices. We're also trying to promote virtualisation via a Docker or similar type of container. That would ideally fit with both enterprises' and service providers' use cases. With the new software, enterprises can use our platform to push security upgrades and patches into their software to keep edge security up to the standard they require.

We're also focusing on making edge intelligence tightly integrated with the edge elements of popular IoT cloud platforms such as Azure, AWS Greengrass or Google Cloud to enable a more seamless integration between edge and cloud. Being programmable would enable customers to develop their own software and bring their own business logic to the edge. This is because the devices are dynamic and can be updated and provided with upgrades as required.

GM: This sounds great but today's dumb devices seem a long way from this kind of edge intelligence. What are the main barriers to rolling-out greater intelligence at the edge?

PK: One of the challenges is that there are going to have to be more powerful edge devices rolled out. From a technical point-of-view, there are platforms available now that are able to support this and the next generation of gateways have high-end compute modules built-in. However, the current estate of deployed devices does not have this capability.

The mPower software is designed to be taken to any platform and is able to tailor itself to the hardware depending on the use case and deployment situation. The idea is to make sure software development is much more easily programmable and more hardware independent.

GM: Is this ultimately leading to an erosion of centralised computing and analytics power? Do you see a point where the majority of intelligence resides at the edge and the traditional centre simply becomes a repository of record data?

PK: Centralised management is still going to be there. It's more about how much you want to do at the edge than any idea of the edge taking over. I think there will be more actionable data processed at the edge but the centre will probably be more involved with artificial intelligence (AI) and machine learning because it's still too early to bring those to the edge because of the processing power involved.

I see it as more of a marriage between increased intelligence at the edge and the processing power of the centre. It's not a conflict and I don't think we will ever get away completely from the centre because we will still need centralised management of the edge and co-ordination of the usage of devices.

GM: What's coming next in terms of edge compute innovation for IoT?

PK: We're seeing customers trying to do more and more at the edge. As we look ahead, this will involve vision processing and AI and more of this will begin to happen at the edge. Edge devices could help achieve automation in customers' deployments and intelligent decisions could happen at the edge.

We're seeing a transition from everything being centralised to more and more happening at the edge. When edge devices become more powerful you can do more from the edge – and people will – but you still need control from the centre. As much as possible will be done at the edge, but critical IT will continue to be kept at the centre.

GM: What do you see as MultiTech's role in this?

PK: For MultiTech, it's going to be about providing different options to customers. We want to give them a broad range of choices at both the low end and the high end. I really want to be able to offer breadth of product lines to support the convergence of different technologies.

We want our group to be one that can combine the various radio technologies and sensor technologies into one device. It's all about providing choice and flexibility to the customer, without putting too much of a burden on them, so the user has the power to do what they want to do with their own range of products.

This is an interesting time because things are starting to move and we will see how, as intelligence happens at the edge, the core changes. I see this evolving over time as the difficult struggle between IT platforms and the cost structure continues. However, there will certainly be at least some intelligence at the edge.

www.multitech.com

IoT BUSINESSES LOOK OVER THE EDGE AND LIKE WHAT THEY SEE

Networks can call on a growing armoury of connection technologies, but there's another revolution happening too – a much greater role is emerging for data processing at the network edge than was envisaged for the Industrial Internet of Things (IIoT). ***Jeremy Cowan*** reports.

Jeremy Cowan
editorial director
of IoT Global Network and Tech Trend Reports

The Internet of Things (IoT) was enabled by cloud-based intelligence with IoT devices at the network edge sending data back to the cloud for storage and analysis. However, that data can't be analysed and actioned in real-time. Also, it can be costly to transmit vast quantities of data, plus data security and privacy can be put at risk during transfer. Cloud-native solutions give device operators insights into their applications' performance, but for real-time services this is historical.

Some IoT users now expect service providers to anticipate problems using predictive analytics which need real-time data. Artificial intelligence (AI) and machine learning can optimise the performance of farms, factories, vehicle fleets, or oil & gas installations, and the best way to achieve that is through edge computing.

Edge computing can:

- Minimise the cost of data transfer to the cloud
- Speed data analysis
- Generate actionable intelligence at the device, where it's needed
- Reduce data privacy and security risks by removing personal identifiers before data transfer
- Enable decisions to be made locally with support from AI and streaming analytics, and
- Provide always-on computing where internet connections fail or are intermittent. ▶

Strategy first

MobiledgeX is helping IoT end users to evaluate their aims and needs. It is a wholly-owned subsidiary of **Deutsche Telekom** (DT), with headquarters in San Francisco, which aims to help jump-start industry-wide collaboration. MobiledgeX recently published a findings from a three-year research initiative based on one-to-one interviews with more than 200 businesses around the globe about their planned edge strategies. The data is available to interested parties and the company is inviting industries to contribute to it.

The research found multi-player and cloud gaming, V2X communications, and Industrial IoT are among the most viable near-term edge use cases, based on nine critical market and edge-related factors. The results of the research effort are summarised in independent data analysis from industry analyst, Chetan Sharma in the *"Edge Computing Framework: Understanding the Opportunity Roadmap"* report.

MobiledgeX's Early Access programme provides developers with free access to live edge infrastructure, consultative support, discovery and guidance from a team of edge experts. It also offers promotional support and opportunities to network with other edge application developers. The company has begun accepting applications for the six-month programme and aims to target developers in Europe, North America, and Asia across the rest of this year.

Sunay Tripathi, CTO and EVP of Engineering for MobiledgeX, said, "We're excited for our Early Access programme members to begin optimising their applications to leverage the edge and trial it in actual live edge networks to fast-track their journeys to the delivery of next-generation user experiences."

Developers whose applications are accepted will join the likes of organisations such as **1000 realities** which is already working with MobiledgeX. "Edge computing delivers the low latency that allows us to offer users of our augmented reality spatial mapping and positional platform the highest precision for a flawless experience, which will help us quickly and seamlessly scale our business across the globe," said Justyna Janicka, co-founder and COO of 1000 realities.

Low latency and costs

Reduced latency and cost optimisation are key factors driving the adoption of edge technology. There's also a big role for programmable embedded software that can provide enhanced security and enables task execution at the edge, which is why Minnesota-based **MultiTech Systems, Inc**. recently introduced its mPower Edge Intelligence.

MultiTech is a global supplier of machine-to-machine (M2M) and IoT communication solutions. Its mPower Edge Intelligence is an embedded software offering, building on its application enablement platform to deliver programmability, network flexibility, enhanced security and manageability for scalable IIoT solutions.

"When it comes to adding value and making smart choices, particularly related to security, the ability to make decisions at the edge of Industrial IoT networks is an absolute must," said Prasad Kandikonda, vice president of Engineering, MultiTech. "mPower Edge Intelligence reflects what we've learned from more than five years delivering smart devices to a variety of industries and applications that require device programmability, security and dependable upgrade paths across our product lines."

mPower unifies the MultiTech smart router and gateway firmware platforms. It means that MultiConnect rCell 100 Series customers can gain the programmability of the MultiConnect Conduit gateway, while gateway customers can benefit from the extra security features available on the rCell.

Analytics at the gateway or edge

mPower Edge Intelligence is designed to simplify integration with popular upstream IoT platforms and streamline edge-to-cloud data management and analytics. It also has the programming and processing capability to execute critical tasks at the edge to: reduce latency; control network and cloud services costs; and ensure core functionality. It even enables this when network connectivity is not available (for details see News on page 6).

Another common driver in IIoT is deploying analytics closer to the endpoint. As points out, with an IoT edge gateway you can use AI services locally to process data from downstream devices without sending full telemetry to the cloud. It may only be necessary to send a subset of your data to the IoT hub.

A gateway can isolate a downstream device, protecting it from exposure to the internet and sit between an Operations Technology (OT) network with no connectivity and an Information Technology (IT) network that can access the web. ▶

There are other benefits of using IoT edge devices as gateways: all devices connected to the IoT hub through the gateway use the same connection; it can smooth traffic flows while persisting with local messaging; and the gateway device can store messages and twin updates that cannot be delivered to IoT hub (for example, due to occasional or failed connectivity).

As Microsoft adds, an IoT edge device can also be used as a gateway to other devices: "Devices that cannot connect to the IoT hub can connect to a gateway device instead. The gateway provides IoT hub identity and protocol translation on behalf of the downstream devices. The gateway is smart enough to understand the protocol used by the downstream devices, provide their identity, and translate IoT Hub primitives."

Partial connection or disconnected environments are also addressed by **Flexera**'s FlexNet Edge, a component of its Software and IoT Monetisation Platform. The smart edge server enables updates and gathers device data from partially connected or disconnected environments. It also provides full automation and control for the delivery and deployment of software and firmware updates.

Deliberately disconnected

There are key use cases where applications and devices remain intentionally disconnected from the Internet – including high security business applications, high-performance computing software, industrial equipment and medical devices.

Suppliers need to keep these applications and devices up-to-date and secure. Buyers benefit from staying current, gaining access to the latest features, reducing support costs and downtime. In addition, says Flexera, insights gained from device status data allows suppliers to maintain an audit trail of software versions that have been deployed to specific devices. This data is valuable for making informed support and maintenance decisions, and in some cases is a regulatory requirement as in the USA's *FDA Medical Device Safety Action Plan*.

Matthew Dunkley, Flexera's senior director of strategy and product management, says, "FlexNet Edge extends our state-of-the-art solutions to the edge and into high security environments, including medical and industrial facilities. Our Software and IoT Monetisation platform provides a centralised management solution for all applications and devices – whether they're connected or disconnected."

Retail and transport

Applications of edge computing in the IoT are varied. New York-based **Veea Inc**., for example, was founded in 2014 and offers edge solutions for enterprise and mobile network operators to deploy applications at the network edge. Its Platform-as-a-Service (PaaS) supports verticals as diverse as retail, smart cities and connected healthcare. Stand-alone wired, wireless and computing solutions have limitations not shared by VeeaHub's hybrid connectivity that underpins what Veea says is a low-cost, ultra-reliable platform based on edge computing and its vMesh solution.

In shops the RetailHub can connect security cameras to the control centre to record and review footage. Security systems can be integrated with other stores and security services. Customer experience can be enhanced too, as in-store marketing and digital signage lets customers know about frequent changes to special offers, discounts and new products. As customers enter a retail zone, perhaps selling phones and tablets, proximity marketing enables the retailer to target customers interested in these product lines. And in a clothes store, inventory and purchases can be readily tracked and analysed.

Meanwhile, travellers increasingly expect transport services, such as trains and buses, to offer connectivity on the move that is comparable to their home or office. In reality, service speed and reliability is inevitably compromised in a fast-moving vehicle covering long distances. Veea's CEO, Allen Salmasi reports, "This can be addressed by installing an edge node inside the train itself, which manages connectivity and data processing locally, to avoid the need to communicate with distant servers."

An edge node can improve the speed and quality of response for online applications, but there are still challenges in fitting them across an entire railway fleet, since most carriages have a 40-year replacement cycle. Veea claims that its SmartTransport Hub offers an "affordable solution" which can be retrofitted to older rolling stock to deliver reliable connectivity and data services on the move.

Asked where he believes the biggest breakthroughs will be in market deployments, Salmasi said, "I guess in small, independent shops. They want 4G failover, because the internet can go down a lot in remote areas, so this (RetailHub) sustains payment facilities. We can also offer payment services replacing expensive Points of ▶

Sale (PoS). Traditional PoS is US$400-700 each, this is $50-70 and could even be free if there is a large volume opportunity."

Energetic solutions

A provider of integrated device-to-cloud solutions for the IoT, **Sierra Wireless** has joined **Duke Energy** and **Open Energy Solutions** (OES) to develop an intelligent edge platform to run more complex, centrally managed and containerised edge applications.

The robust edge platform uses Sierra Wireless AirLink cellular gateways and Duke Energy's Emerging Technology Office's work on the Open Field Message Bus standard. They aim to provide more decision-making capabilities at the edge, interoperability between the various smart grid elements and faster decision making.

Dr. Stuart Laval, director of technology at Duke Energy says, "This collaboration will leverage a ratified, robust networking platform with faster edge processing capabilities to enable next-generation applications, including advanced distribution automation and distributed energy resources integration that are key to delivering on the future of smart grids."

The Sierra Wireless platform is based on open standards, enabling more application and grid solution providers to deploy a variety of innovative solutions using AirLink gateways that help utilities manage smart grids of the future by: enhancing situational awareness for faster response times and service restoration; integrating distributed energy resource and microgrids more efficiently; and improving security and interoperability for existing grid equipment and infrastructure. Tom Mueller, vice president, Product Line Management, Sierra Wireless adds, "The distributed grids of the future will rely on intelligent edge processing to provide uninterrupted service, while bridging old and new technologies."

Don't all rush to the edge

Finally, edge computing is not a panacea for all problems and Paul Hughes, director of strategy at **Netcracker Technology**, offers some words of caution. Although progress has been made with standards, such as multi-access edge computing (MEC), Hughes explained, "The level of capability in today's devices grows almost exponentially every year thanks to faster processors, greater levels of storage, and faster connectivity to the internet. This strength of functionality at the edge shifts computing needs from a centralised data centre, to allow newer decentralised IoT applications.

"This does create greater challenges for keeping IoT services 'intelligently operating', as greater power to the individual end point requires greater management of the entire IoT device ecosystem. As intelligence grows, the promises of edge-based computing bring the need for intelligent device management, which comprises real-time data analytics, security and identity control functions, and even service assurance in cases of mission critical service offerings.

"Any operator looking to offer or manage IoT services on behalf of a customer, industry or business group must invest in solutions that ensure service continuity and service security, and use those tools to optimise the service to a service level agreement-centric level. This isn't an easy turn-key solution process. Service providers must plan well ahead, and design a comprehensive IoT edge management blueprint and long-term strategy that provides a full risk assessment, evaluates expected service activity expectations, business outcomes and long term vision before jumping in head first."

Justyna Janicka

co-founder and COO
1000 realities

Matthew Dunkley

senior director of strategy and product management
Flexera

Tom Mueller

vice president, product Line management
Sierra Wireless

Paul Hughes

director of strategy
Netcracker Technology

EDGE INTELLIGENCE GAINS MOMENTUM BUT SECTORS' PROGRESS VARY DRAMATICALLY

Successful deployment of intelligence at the edge relies on a spread of technologies. They include artificial intelligence (AI) and machine learning to enable edge devices with analytics and decision-making capabilities. How long will all this take, asks **George Malim**?

The promise of edge intelligence will lead to lower latency, faster decision making, better resource utilisation and reduced costs – but not all of these go together or even require the same technical foundations. The development of edge intelligence will therefore be highly fragmented with some industries and applications moving very rapidly, thanks to a strong and accessible business case, while others lag, waiting for device replacement cycles or the cost of chipsets to come down a level that can sustain a lower value business case.

There's a substantial shopping list of necessary hardware and software to be bought and deployed. "Edge computing requires IoT devices to be able to process high volumes of data efficiently and effectively," said Alistair Elliott, the chief ▶

executive of Solutions at **Pod Group**. "This means that IoT devices need advanced sensor, microcontroller, and SoC [system on a chip] technology, all of which is available today.

"The time it will take for devices, sensors and data processing capabilities to be rolled out to enable the full benefits of IoT at the edge depends entirely on the human factor."

He added, "The technology needed to deploy edge computing is already here. Whether it is rolled out depends on whether organisations are willing and able to invest the required resources. To successfully deploy an edge computing solution requires a significant upfront investment of time, human resources and money.

There is money to be made

Yet there is money to be made. "Having the data and the real-time analytics at increasingly granular levels grows the opportunity for monetisation – provided this is all compliant with data protection regulations – and enables organisations to follow in the footsteps of Google and Amazon," said John English, the director of service provider solutions at **Netscout**. "Service providers will gain from the practical application of data and the increased personalisation of services, but there will be a lot of intensive steps that need to be taken and therefore the full benefits will emerge, gradually over time."

Technological advancement is coming to an edge near you. "New wireless technologies, longer battery life, improved sensor technologies and continued improvement in computer power for low cost are all contributing to enabling IoT computing," said Alan Grau, vice president of IoT, Embedded Solutions, at **Sectigo**. "We are already beginning to see the benefits, but it will be years before we see the full benefit of these technologies. Early adopters are utilising AI, building out business use cases and creating IoT devices with strong security, but much work remains to be done. Integration, deployment and optimisation will continue for the next decade."

For Dave Baskett, a technical strategy manager at industrial IT software provider **SolutionsPT,** cost barriers are coming down. "Low cost, non-intrusive sensing and low power wide area networks are making edge sensing a much more realistic deployment option," he said. "But computing power and scale at the cloud have made true analytics and AI a realistic and deployable technology today. Edge computing is constantly improving. It's not about limits, it's about what is appropriate and practical depending on the challenges that organisations are trying to resolve and the different architectures in place."

Empowering energy

For some, the opportunity is already here. **EnergyHub** provides utilities with software and distributed energy resources (DERs), which are physical and virtual assets that are deployed across the distribution grid, typically close to load. They can be used individually or in aggregate to provide value to the grid, individual customers, or both. The company is already working with 40 utilities in the US.

"We work with a range of partners in a range of smart homes and we work with technologies…from the fairly dumb to the very smart with a lot of computing intelligence at the edge," explained Ben Hertz-Shargel, the vice president of analytics at EnergyHub. "The challenge within energy is the co-ordination of these devices. Historically, power distribution was very simple and a one-way process of delivering power to the customer. A transformation is now happening globally where the old model is breaking and a new, bi-directional model is emerging."

"Photo-voltaic capabilities mean that there can be over-generation at midday but, if utilities can get these devices under management and control them in a smart way, costs can be saved and electricity can be utilised more effectively," he added. "It's not critical to move as much intelligence as possible to these devices but the customer experience and the flexibility are critical so we can collectively co-ordinate enormous aggregation from these devices."

Hertz-Shargel gave the example of a potential brown-out being averted by the utility company being able to turn down smart air-conditioners. Incremental changes done on vast scale can make power grids more resilient. For instance, performing less cooling, or not heating water to such a high temperature would be hardly noticeable to a consumer but when each saving is aggregated across the smart households of a town, substantial demand is removed from the grid, avoiding brown-outs.

Each relatively unintelligent DER needs to play its role to make this vision a reality but the power companies are on-board and so are customers once they are assured the capability is non-intrusive and there are incentives to them for allowing their devices to be controlled by the power provider.

Distributed topography

This distributed topography of intelligent devices is a major change to the traditional, centralised model and management of this will need careful consideration. "In the future, networks will evolve into a sophisticated hierarchy of data centres," said Alan Carlton, the vice president of **InterDigital**. "It is not so much that the edge will replace the cloud rather it is more a case that the cloud will become much more distributed. This will allow functionality to be spun up, implemented wherever it is best to do so."

Moving intelligence closer to the point of use seems a theoretical no-brainer but a practical problem. "Edge requires a different approach to application architecture – microservices rather than monolith systems; serverless rather than dedicated iron," noted Joseph Denne, the founder and chief executive of **EDGE**.

He concluded, "As edge computing and edge networking grow, we expect to see services move closer to the point of use – out of the cloud and onto the edge. In the first instance this will be as a complementary service, extending and improving traditional clouds. But as connectivity improves, and localised processing capacity increases, we will see a significant shift towards the edge, ultimately relegating the cloud to a big data and storage solution in support of edge computing."

Alistair Elliott

chief executive of Solutions
Pod Group

John English

director of service provider solutions
Netscout

Dave Baskett

technical strategy manager
SolutionsPT

Ben Hertz-Shargel

vice president of analytics
EnergyHub

Joseph Denne

founder and chief executive
EDGE

A KALEIDOSCOPIC ECOSYSTEM IS EMERGING TO SUPPORT THE EDGE

As edge computing gains momentum, it is having a profound effect on those whose infrastructure supports edge services. Edge providers are positioning themselves to capitalise on the opportunity, which is reshaping network architectures while relationships – collaborative and competitive – are constantly evolving between all kinds of providers, writes **Annie Turner**.

Lydia Leong

distinguished VP analyst
Gartner

Janakiram MSV

analyst, advisor and architect
Janakiram & Associates

Although much is made of the huge impact 5G will have on edge computing, especially for Internet of Things (IoT) applications, there are two things wrong with this world view. The first is that, as a **Strategy Analytics**' report, *Edge Computing: Decentralizing for Performance in the IoT*, pointed out in May, 44% of firms use edge computing in some form now, demonstrating that edge is not dependent on or waiting for 5G.

Secondly, edge is critical to 5G, rather than the other way round. Deploying resources at the network edge will be the only way for operators to provide the ultra-low latency, high speeds and super reliability that the more 'extreme' edge applications need. The usual examples to illustrate this are autonomous vehicles and the huge global market for interactive social gaming.

Strategy Analytics also predicts that by 2025, edge will used in 59% of IoT deployments: by this time, the necessary rearchitecting of telcos' core networks needed to support edge operations and business models will be well underway.

Hybrid cloud rules

It remains to be seen if telcos will apply lessons from their cloud experiences. The notion of private cloud, which operators thought they would create and dominate a decade ago, failed to materialise. It is being subsumed by public-private hybrid cloud because, it turned out, that although the network infrastructure is fundamental to cloud, so are the services that run over them and being customer-centric.

Amazon Web Services (AWS) was the first to grasp this and seize the opportunity. As Lydia Leong, the distinguished VP analyst at **Gartner**, put it, all the way back in 2013, would-be competitors to AWS "failed to understand that this is a software business, where feature velocity matters." She predicted then that two serious challengers were emerging in the shape of **Google Cloud** and **Microsoft Azure**. How right she was.

In July, Google Cloud was recognised for moving up the infrastructure as a service (IaaS) rankings to become, "more of a tier 1 provider as it invests in service, new ▶

David Kerr
SVP, Global Wireless Practice
Strategy Analytics

Brad Casemore
research VP, Datacenter Networks
IDC

analytics capabilities and builds out its portfolio with acquisitions", in Gartner's 2019 *IaaS Magic Quadrant* report, but beyond building out scale, Google is focused on the edge.

It designed the application-specific EDGE Tensor Processing Unit (TPU) to provide machine learning (a branch of artificial intelligence or AI) for low-power devices at the edge. The company also announced its Cloud IoT Edge platform in 2018, to extend its data Google Cloud data processing and machine learning capabilities to edge devices.

Increasingly, AI at the edge is a driving the adoption of edge services, pushing their potential beyond the original 'simple' compute, storage, and processing capabilities.

Microsoft Azure rises

Google Cloud still lags the second dominant force in the market, Microsoft Azure. Microsoft's public cloud offering has been a key part of the corporation's transformation since Satya Nadella became its CEO in 2014. As this article went to press, Microsoft reported its three-months' earnings to the end of June – it beat expectations in every part of its business.

However, in particular as the ***Financial Times*** noted in its Lex market analysis column, "While other big tech companies face rising costs to find new users, Microsoft has been selling cloud services to software customers, fattening revenues and margins."

Analyst, advisor and an architect, Janakiram MSV, writing in *Forbes* in May commented, "Microsoft has a unique opportunity in the IoT and edge computing markets. With innovative products such as Azure IoT Central, Azure Sphere, and IoT Plug and Play, the company is moving forward to become the segment leader."

Partnering with telcos

Microsoft Azure is partnering telcos to address the edge market. For instance, at MWC 2019, it announced an extension of its strategic partnership with **Telefónica**. Under the new agreement, they intend to create new, AI-powered, in-home experiences for customers and explore the use of intelligent technologies – including blockchain, 5G and edge computing – to transform the operators' network. The two will explore how AI and machine learning can be applied to optimise the network, reduce costs and, in turn, "drive industry-wide transformation".

That theme of industry-wide transformation through collaboration to advance telecoms is a common one. Many operators are working through a number of fora and initiatives, to figure out how they can move their interoperability up the IT stack beyond connectivity. The goal is to be able to expose services to each other and each other's customers in a uniform, straightforward fashion. In this way, they plan to overcome the limitations of their individual geographic footprints to serve customers seamlessly wherever they are.

These initiatives include:

- the **Linux Foundation**'s Open Network Automation Platform (ONAP)
- the European Telecommunications Standards Institute's (**ETSI**) OSM – Management and Orchestration stack aligned with its network functions virtualisation information models
- **TM Forum**'s Open APIs initiative.

A global fabric

The operators could be both aided and competed against in different markets in different circumstances by **Equinix**, the largest global data centre and interconnection firm, which underlines the complex interdependencies that edge deployments will often rely on. In April, it completed the latest upgrade to its Platform Equinix so that now, what Equinix calls its Cloud Exchange Fabric (ECX Fabric) is available in 37 markets on five continents. This means customers can connect directly to clouds in other regions and set up on-demand network connections between Europe, the Americas and Asia-Pacific region.

To unpack that further, organisations can plug their own distributed infrastructure into that of any other company's distributed infrastructure, including the world's largest network service and cloud providers, like AWS, Microsoft Azure, **Oracle Cloud Infrastructure** and Google Cloud. And no-one is pushing edge services harder than Equinix.

Even before the upgrade, network service providers themselves, for example, in the Asia Pacific were increasingly adopting Equinix's Cloud Exchange (ECX) Fabric to access global cloud providers, including **Axtel**, **Frontier Communications**, **Spectrum Enterprise** and **Telstra**.

Digital transformation

Brad Casemore, VP, Datacenter Networking, from research house **IDC**, explained, "digital transformation is driving enterprises to adopt multi-cloud strategies, which entail complex management of multi-cloud environments. As their applications become increasingly distributed – residing in on-premises data centres and public clouds – organisations are finding that the parameters of what constitutes a data-centre network must be redefined.

"In this context, IDC finds that interconnection architectures at the digital edge are becoming integral elements of a comprehensive network for the cloud era. The geographic expansion of ECX Fabric will play a valuable role in helping companies accelerate their digital transformation initiatives through having the ability to instantly deploy flexible, interconnection-oriented network architectures worldwide."

In this complex, shifting market, it is important not to be swept away by the hype. As David Kerr, SVP Global Wireless Practice, Strategy Analytics, warns, "[Challenges] include immaturity of the…market and perceptions among customers that they have no need to change their current setup. Other issues include a lack of familiarity with edge computing for IoT environments and a lack of transparency over the additional costs that could be incurred."

DASHING TOWARDS THE EDGE

Cloud is morphing into the hybrid cloud to meet the various data storage and management needs of industry. Already the next fine tuning of the data market for IoT is underway – at the edge, writes ***Anthony Savvas***. This shift in the market is progressing rapidly, with plenty of support from vendors.

IoT sensors in homes, public buildings and vehicles can be better served by data centres at that edge of the network, close to them, being able to tell them what to do quickly.

To efficiently process data nearer to its source, whether from IoT sensors or 5G mobile masts, various service providers are deploying data centres at the edge to fulfil that need. The idea is to reduce latency in the processing of data by not sending it all to cloud-based data centres for full processing and then grabbing it back from the cloud to support processes and applications at the edge. ▶

"Organisations that have embarked on a digital business journey have realised that a more decentralised approach is required to address digital business infrastructure requirements," says Santhosh Rao, principal research analyst at Gartner. "As the volume and velocity of data increases, so too does the inefficiency of streaming all this information to a cloud or data centre for processing."

Santhosh Rao

principal research analyst

Gartner

Gartner's prediction is that by 2022, as a result of digital business projects, 75% of enterprise-generated data will be created and processed outside the traditional, centralised data centre or cloud – up from less than 10% in 2018.

Research by Global Market Insights found that the global edge data centre market is set to exceed £13 billion by 2024, as more organisations set up their infrastructure facilities close to the source of data generation.

When it comes to applications like IoT and analytics for artificial intelligence (AI), companies want more control over data processing and storage at the edge of a network, rather than placing it in a centralised warehouse. The advantages include reduced network traffic, enabling real-time data analysis, lower operating costs and better application performance.

The telecoms sector is also expecting high adoption of edge-based resources. Increasing demand for 5G connectivity and the new use cases it can support are forcing operators to locate data facilities close to 5G towers to ease data management and improve security.

Vendors' investment

Given this background, it's no surprise that leading technology vendors are rushing in to support the developing edge market.

Julia White

corporate vice president

Microsoft Azure

Last year, Microsoft said it would invest $5 billion in IoT over the next four years. This built on the action it took in the previous year, launching network edge server systems in partnership with companies like Dell and Hewlett-Packard Enterprise (HPE) to make it easier for organisations to connect IoT platforms to Microsoft Azure clouds to manage and process their data.

Julia White, corporate vice president of Microsoft Azure said, "We're planning to dedicate even more resources to research and innovation in IoT and what is ultimately evolving to be the new intelligent edge. With our IoT platform spanning cloud, OS and devices, we are positioned to simplify the IoT journey so any customer – regardless of size, technical expertise, budget, industry or other factors – can create trusted, connected solutions that improve business and customer experiences."▶

Martin Courtney
analyst
TechMarketView

Tom Bradicich
vice president and general manager for converged servers, edge and IoT systems
HPE

Dimitris Mavrakis
research director
ABI Research

Martin Courtney, an analyst at TechMarketView, said of the investment, “Microsoft no longer doubts the scale of the commercial IoT opportunity now presented. And it is keen not to be outdone by its rivals – including Google Cloud, Amazon Web Services and BT Global Services – all of which are moving fast to stake their own claim in a rapidly growing market for IoT products and services.”

Open source

As for other major players, HPE has launched its Edgeline Converged Edge System solutions that promise to ease and speed the deployment of edge applications. Based on an open platform, enterprises can easily integrate a broad ecosystem of applications and operational technology (OT) devices, says HPE.

“This enables customers to act on the vast amounts of data generated by machines, assets and sensors from edge to cloud to drive efficiency and innovation,” the company said in a statement.

The new solutions include HPE Edgeline OT Link Platform, an open system that automates interplay between diverse operational technologies (OTs) and standard-IT based applications at the edge to support intelligent and autonomous decision making.

The systems management for HPE Edgeline is to ensure enterprise-grade reliability, connectivity and security. Or as Tom Bradicich, vice president and general manager for converged servers, edge and IoT systems at HPE, put it, “With this offering we enable our customers to accelerate the delivery of applications that capitalise on edge data, safeguarded by enterprise-class management.”

5G developments

Nokia has launched an edge cloud data centre solution to meet the diverse low-latency data processing demands of IoT and 5G applications, while at the same time addressing the developing cloud radio access network (RAN) market.

The Nokia AirFrame open edge cloud infrastructure expands Nokia’s AirFrame portfolio, delivering a layered network architecture that “optimises performance and operator costs as they evolve their networks and prepare for 5G”, according to the company.

The new AirFrame solution is pitched as a supporting technology for applications like virtual and augmented reality, video and real-time industry automation as 5G networks are rolled out commercially.

Cloud RANs will be key to delivering on the 5G promise of ultra-low latency and massive data throughput, and will need to be supported by a highly efficient cloud infrastructure solution, which is what AirFrame is, Nokia said.

Its AirFrame Open Edge server is compact; small enough for deployment even at base station sites, enabling operators to optimise network resources. The solution intelligently distributes workloads across the network, based on the type of data traffic and the latency and throughput each type requires. It is analogous to how the now legacy multi-protocol label switching (MPLS) is widely used by telcos to ensure the right packets go to the right destinations, at the right time.

The new hardware solution is complemented by an Open Platform for NFV (OPNFV)-compatible OpenStack distribution, built to run in small data centres while providing the performance and low latency required by the edge environment. In addition, Nokia’s ‘cloud-wise’ services and cloud collaboration hubs are designed to help operators plan and deploy edge cloud.

Dimitris Mavrakis, research director at ABI Research, remarked, “Nokia's AirFrame open edge cloud infrastructure distributes established AirFrame capabilities to the edge and offers a graceful introduction of edge computing. Its orchestration and feature compatibility with existing Nokia products provide for a lower friction transition to a distributed environment."

The idea is that by combining the Nokia ReefShark chipset and its real-time cloud infrastructure software, the Nokia AirFrame open edge server will deliver “the right decentralisation” of 4G and 5G networks. Nokia said it could work with operators to ensure that data centres’ capabilities are deployed exactly where they are needed to manage demands as they expand their service offering.

Developing autonomous cars

The development of autonomous cars will be slow if all the data from the vehicles has to go to the cloud for processing, so AI car expert Teraki is working with Microsoft to streamline the process.

Berlin-based Teraki says it will enable the efficient, mass volume collection of sensor data from cars on the Microsoft Azure Connected Vehicle Platform. Teraki supplies the Intelligent Edge Processing platform for the automotive industry, building embedded software for within vehicles to aid the generation of efficient and accurate data pre-processing. The AI-based solution is designed to enable car makers to process vast amounts of sensor data within cars in an efficient way.

The pre-processed data ensures more accurate predictions and detection of events, enabling data algorithms at the edge to make better decisions. ▶

Teraki Intelligent Edge Processing embeds in CPU- and RAM-constrained chipsets in cars, and integrates with the backend for the storage, labelling, training and analysis of data.

High amounts of car data are required to train and develop new AI-based car models. Teraki claims its edge processing capabilities help by enabling ten times more data per test-drive to enter the cloud. This provides faster insights about the relevance of specific data streams for the training and model update process. And it helps in gathering more, high resolution data quicker, which speeds up training of new models in areas such as predictive maintenance or autonomous driving functionality.

Daniel Richart, CEO of Teraki, said: "We are providing a fully working data chain stretching from the individual sensors in a car up to Azure used by many of our customers in the field."

Security

MultiTech Systems introduced mPower Edge Intelligence, an embedded software offering that builds on the company's established application enablement platform. It is designed to deliver programmability, network flexibility, enhanced security and manageability for scalable Industrial IIoT solutions.

mPower Edge Intelligence simplifies integration with various upstream IoT platforms to streamline edge-to-cloud data management and analytics, while providing the programmability and processing capability to execute critical tasks at the edge of the network to reduce latency, control network and cloud services costs and ensure core functionality – even in instances when network connectivity may not be available.

In response to evolving customer security requirements, mPower Edge Intelligence also includes a host of new security features including signed firmware validation, enhanced firewall and VPN settings, secure authentication and other capabilities (see News on page 6).

Growing alliances

The move towards edge networks will be driven by new alliances and new players, hoping to benefit from the biggest digital opportunity since the birth of the internet, delegates heard at the recently-held Datacloud Global Congress in Monte Carlo.

At the Edgecon conference, which was held during the Datacloud event, Mark Thiele, director of engineering for edge compute at Ericsson, said, "Edge is an opportunity to work with people you wouldn't normally be able to work with, including rivals, as the edge opportunity is so big and floats so many boats, there are plenty for everyone to climb into."

He added, "In 1992, when the first internet was around we were messing around with Mosaic, lists and IP addresses not knowing what it would turn into. By 1995, grandma was using it, but most of us weren't Jeff Bezos at Amazon who knew how to make money out of it.

"This is the next big opportunity though and we have to work together to build a network that can take advantage of it."

Edgecon heard predictions of 75 billion connected devices by 2025, illustrating why new edge networks and data centres are required to make up for the shortcomings of the existing global internet, as it simply can't cope.

Speaking at the new Finvest event, also held at Datacloud, Eddie Kilbane, CEO and co-founder of data centre services firm DataPlex Group, said, "The new edge networks will be built by new companies, not the telco incumbents as their existing networks are too old and cumbersome to build onto. The banks realise this and are ready to lend to make it happen."

At Edgecon a number of companies announced they have set up the Kinetic Edge Alliance, which is an ecosystem of industry players that plans to share the blueprints necessary to deploy edge networks in various scenarios.

The Alliance is now calling for other companies to join it to have a better chance of success in the new edge world, and they would be wise to consider this invitation.

Daniel Richart
CEO
Teraki

Mark Thiele
director of engineering for edge compute
Ericsson