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Main Trends in the Edge Cloud Ecosystem

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The decentralization of the Internet through edge computing brings a new set of challenges that require new solutions to meet the performance and cost requirements of the edge cloud. This creates opportunities for investments and M&A across the technology ecosystem as these recent examples indicate:

- Equinix acquires Packet, a developer of bare metal automation platform. Packet received investments from SoftBank Group, Dell Technologies, Capital Battery Ventures, Third Point and Samsung NEXT.
- Siemens acquires Pixeom a developer of Docker container-based solutions to deploy and orchestrate cloud applications on commodity hardware on premises. Siemens plans to use the solution in factory automation.
- Pensando emerged from stealth in October 2019 having raised $278 million to date. Investors include Cisco, HPE, Lightspeed Ventures, Equinix and Goldman Sachs.
- Volterra which provides a platform for deploying applications in multi-cloud and edge computing environments raises $50 million in funding from Khosla Venture and Mayfield in addition to other strategic investors.

In this article, we review major trends in sectors fundamental to realizing the edge cloud. For context, we highlight key drivers that stimulate the rise of the edge cloud.

The Edge Cloud Drivers

A few trends are defining the evolution of the edge cloud:

1. Extending successful enterprise cloud services towards the edge. This means the harmonization of technologies, development environments and business models of the cloud with the network edge.
2. Optimizing the cost of data transport between the network edge and the cloud infrastructure. The success of cloud services places increasing demand on transport capacity. The edge cloud optimizes the cost structure of the end-to-end network.
3. Meeting the performance requirements of emerging applications requires placing the compute, storage and networking infrastructure at the network edge. Such applications include for example virtual and augmented reality, robotics and automation, artificial intelligence and machine learning.
4. Regulatory requirements for data localization and consumer privacy rights.

The technology ecosystem approaches the edge cloud on the basis of one or more of the above drivers. For instance, cloud players have an interest in extending cloud services. Telco players have an interest in improving the performance of networks to monetize edge applications. The enterprise has interest in optimizing cost and performance while maintaining compliance with regulatory requirements.

Edge Cloud Ecosystem Evolution and Trends

To give a 360-degree perspective on developments in edge computing we cover a few key sectors that form the foundation of the edge cloud: Cloud players/hyperscalers, data center players, silicon vendors, software stack and hardware (servers and storage).

Cloud Players / Hyperscalers

The public cloud players view the edge cloud as an extension of their services. They seek to reduce reliance on the connectivity layer between the enterprise and the cloud.

Several applications are driving the extension of cloud services to the edge. Important services include data intensive Artificial Intelligence (AI) and Machine Learning (ML) applications in different use cases such as video surveillance and image recognition. They also include IoT applications to scale the deployments of sensors and devices. To meet the requirements of these services, the cloud players provide scaled-down version of their cloud software environment to develop applications that run efficiently at the edge and synchronize with the cloud when possible and desired.

Another trend is placing instances of the cloud infrastructure at local data centers, enterprises of telco central offices to improve performance metrics such as latency and jitter (an example of this is AWS Wavelength service).

Data Center Players

Private data center operators are physically positioned closer to end users and enterprises than the hyperscalers. This allows them to provide edge service to their enterprise customers leveraging their proximity. Additionally, some of these players are leasing part of their facilities to the public cloud operators to locally host instances of their cloud infrastructure (example of this is Equinix and its relationship with Azure).

Another key trend is the evolution of micro data centers that could be as small as around 300 sq. ft. in size. The infrastructure design of these data centers is unique to support high-density computing with power density exceeding 1,500 W / sq. ft. An example of this includes VaporIO and EdgeConneX.

Silicon Vendors

There are two key trends related to silicon for edge computing: 1. Increased variety of types of processing; and 2. Low-power computing and storage.

The 'cloud' is largely powered by general purpose processors based on the x86 architecture. Applications such ML made it necessary to develop different types of engines to handle complex and arithmetic intensive processing. These engines include Graphic Processing Units (GPUs), Field Programmable Gate Arrays (FPGAs), and Tensor Processor Units (TPUs). The variety of processing is giving rise to different types of System on Chip (SoCs) that combine different functions on one chip.

To place computing at the device or enterprise, low-power compute engines and storage become critical to meet field deployment models. Of the many examples in this segment to list, we mention Google TPU and edge TPU solutions targeting machine learning applications.

Cloud and Orchestration Software Stacks

The edge cloud software stack is one of the most critical elements in the overall edge ecosystem. The edge cloud is fundamentally a highly distributed cloud concept that encompasses different types of compute infrastructure including servers in data centers, gateways, and different types of edge devices. This requires software solutions that bridge the centralized cloud with the edge cloud, in addition to different solutions to control and manage the edge cloud.

A key rising area are the cloud-of-cloud solutions that seek to allow enterprises deploy workloads across multiple clouds. Another area includes software to deploy and manage microservices at the edge, including software to manage different types of compute and storage infrastructure.

Enabling the telco edge cloud is an active area for software development as exemplified by many open source projects that address the telco edge cloud, including extension of OpenStack features to meet the edge deployment requirements. Moreover, enabling the telco edge cloud is giving rise to a number of companies that are developing solutions to broker deployment of edge workloads between developers and the fragmented telco virtualization infrastructure.

Additionally, there are a number of open source projects and companies in the process of developing and distributing edge stack for enterprise and IoT applications. An example is ioFog by Edgeworx.

Hardware - Servers & Storage

Hardware for the edge cloud has some unique requirements because of the intended use case and deployment model.

Among the key trends in edge hardware is the integration of different functions into a single unit, for instance compute, storage and networking into a single rack unit. Another trend is the rise of “data-center-in-a-box” solutions where compute, storage, networking and power are packaged into a single enclosure. The computing could consist of different types of processors depending on use case (e.g. x86, ARM, GPU or other). Such solutions have various use cases. For instance, they are used where the cloud could not be reached easily or cost effectively. Initially, such solutions were used for data storage, but increasingly compute processing is being integrated to process data at the edge to the extent required by the application.

Concluding Remarks

The edge cloud is a catalyst for innovation across the entire technology ecosystem. Cloud services have proved to be successful, but requirements for data localization, cost and performance optimization create a valid business case for edge computing services. The edge cloud is necessary to launch and scale many applications such as industrial automation, autonomous vehicles including drones, robotics and IoT. In this paper we reviewed developments in a few important segments. However, many other sectors also play an important role, such as security, networking and distributed ledger technologies. All these will make the edge cloud a key area of investment and M&As in the years to come.

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