Edge Computing

Evolving to the next wave of computing

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Document Objective

This document has multiple objectives:

- Introduce the concept of Edge Computing to the reader.
- Describe why Edge Computing will change how we architect customer facing systems as well as supporting Internet of Things (IOT) based systems.
- Provide industry examples of Edge Computing use cases.

Over the past 50+ years in the technology industry we have seen several evolutions of computing technology from a completely centralized mainframe beginning, through the client server era, evolving to a cloud centric model, which we are in the midst of currently. Although a fully centralized model like mainframe and cloud provide the advantages of centralized control of data and processing, they often require high speed networks and low latency to properly take advantage of both data movement and the ability to process that data. Edge computing partially swings the pendulum back to a more distributed pattern where a subset of data and processing power is closer to the endpoints. The difference now is, these endpoints are not just people at terminals or PC's but multiple device types, sensors, cameras, automobiles, and appliances of every imaginable type. With the continuous advances in ubiquitous networking including the worldwide rollout of the 5th generation (5G) of mobile networking, these devices will continue to proliferate and be always connected. In order to take advantage of the data collected by these endpoints and act upon them in real-time, a new computing model is needed to support the Internet of Things (IOT). That is where Edge Computing becomes that next wave in computing models.

Edge computing is still in its infancy and your company will need to determine how to best leverage this computing model to provide a better customer service as well as reducing overall technology costs. The HCL Software team can provide subject matter expertise across multiple industries as well as the right architecture patterns and the products to help your journey to the Edge Computing model.

What is Edge Computing

In recent years with the continued proliferation of Internet of Things (IOT) devices and their connected wired and wireless networks and addition of the promise of 5G networks with increased bandwidth and reduced latency, the data produced by these endpoint devices has been growing rapidly. 5G networking will be as much as a shift to the information technology industry as cloud computing was in the past decade. IDC estimates that there will be over 150 billion devices connected worldwide by 2025. Consequently, it is not practical or in some cases even technically possible to move all the data produced by these IOT devices to large centralized datacenters either customer owned or in the public cloud. The data collected at these endpoints is valuable. If the data was available to be processed closer to the endpoint, it could be immediately acted upon real-time rather than attempting to rationalize large datasets to provide meaningful actions.

Centralized cloud environments provide several great advantages to enterprises both large and small. Companies which at one time had to maintain large compute capacity just to support peak loads can now variablize compute and storage capacity real time and pay for capacity in a utility model much like they pay for electricity. This model is very centralized where these compute resources are located in large datacenters either within an enterprise or at cloud providers such as Amazon Web Services, Microsoft Azure or the Google Cloud. Although this model is very efficient for the sharing and management of resources, it is difficult to support the devices and users at the endpoints. For years we have used Content Delivery Networks (CDN's) to push commonly used *content* to the edge of the network. This topology was put in place to reduce bandwidth and network latency for delivery of content. Edge Computing takes this a step further by not only delivering content but compute resources as close to the endpoints as possible.

Edge Computing Architecture

The edge tier provides a decentralized infrastructure where a subset of computing resources is distributed in the communications path from the data source(s) to the cloud. This provides the ability to satisfy computational needs closer to the source providing improved performance by reduced bandwidth needs and reduced latency. The issue of data volume created by the IOT tier is reduced where the edge tier could pre-process the device data only sending the pertinent enterprise data to the cloud.

Management of the IOT devices are also performed at the edge tier reducing the need to push large updates from the enterprise cloud.

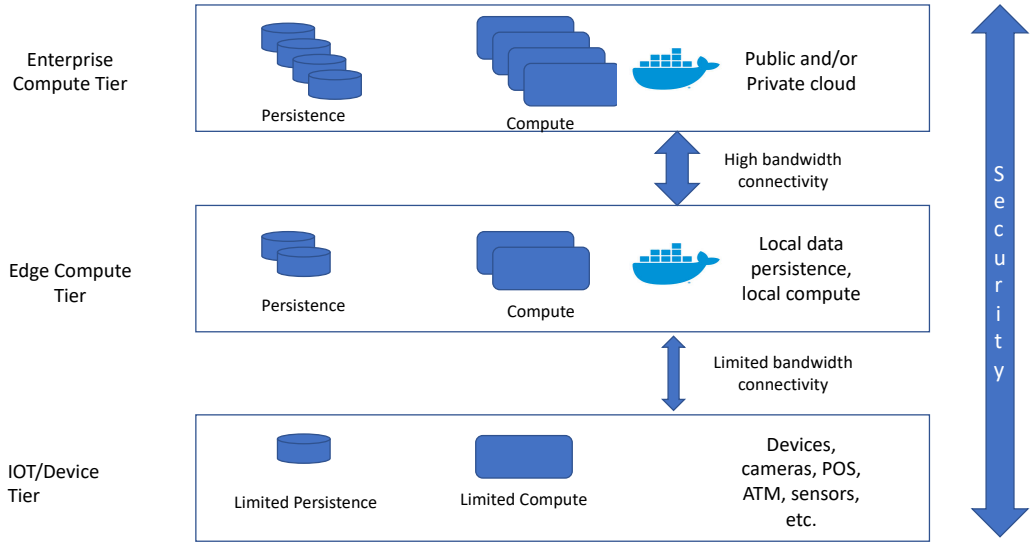

Figure 1, Edge Logical Architecture

The compute resources at the edge tier are managed much like enterprise resources and are a distributed extension of the enterprise where applications are deployed using container technologies and managed using tools such a Kubernetes for deployment and orchestration all requiring systems management tools for patch, deployment and endpoint management.

Edge Use Cases

Retail

The retail industry is a traditionally highly distributed business with retail storefronts. There are elements of processing needs which are obviously centralized but there are many use cases where data should be processed either locally or at the edge where moving the massive amounts of data is not practical or even necessary.

- Customer loyalty data: Although this is managed at an enterprise level, data can be replicated to the edge, so the endpoint POS devices do not make round trips to the enterprise datastore reducing customer wait time.
- Store inventory control: Inventory for each store should be distributed and processed at the edge with the preprocessed data being transferred and managed at the cloud layer.
- Security camera data: Cameras collect massive amounts of data and should be persisted and processed at the edge layer.

Financial Services

The financial services industry has the opportunity to move a subset of the non-transactional processing and data to the edge where transactional integrity is not required.

- Security camera data: Data for both branch camera data and ATM camera data should be persisted at the edge. This real-time data can leverage artificial intelligence (AI) technologies to immediately act upon potential security and fraud events.
- Marketing programs: Marketing programs and offers tend to not change often and should be pushed to as close as possible to the devices to reduce latency and bandwidth needs. With the various campaigns closer to the end-user, real-time relevant offers to customers become a reality.

Industrial

The industrial sector leverages numerous robotic and sensors driving plant floors. There are also smart cars and sensors on distribution trucking. This is a highly distributed industry which lends itself well to edge computing.

- Smart sensors on plant floors to control inbound inventory and outbound produced products.
- Smart car sensors reporting detailed diagnostics where the details can be maintained on the edge and summary/metadata centralized in the cloud.

- Building control sensors where detailed environmental/system control data is stored locally and summarized centrally.

Public Sector

The public sector is moving much of its infrastructure to smart devices. Smart water meters using 4G and 5G technologies, traffic lights and traffic sensors to adjust traffic patterns as needed just to name a few. Although the size of the data with these sensors is small, the volume of the data is massive. Also, the nature of the data is decentralized.

- Smart consumer infrastructure: Collection of consumer data from water meters, electric meters etc. that can be collected at the edge with summary/processed data aggregated at the core.
- Smart public infrastructure: Traffic data, traffic lights, toll collection etc.
- Public safety cameras: Storage of video files with metadata stored in the cloud.

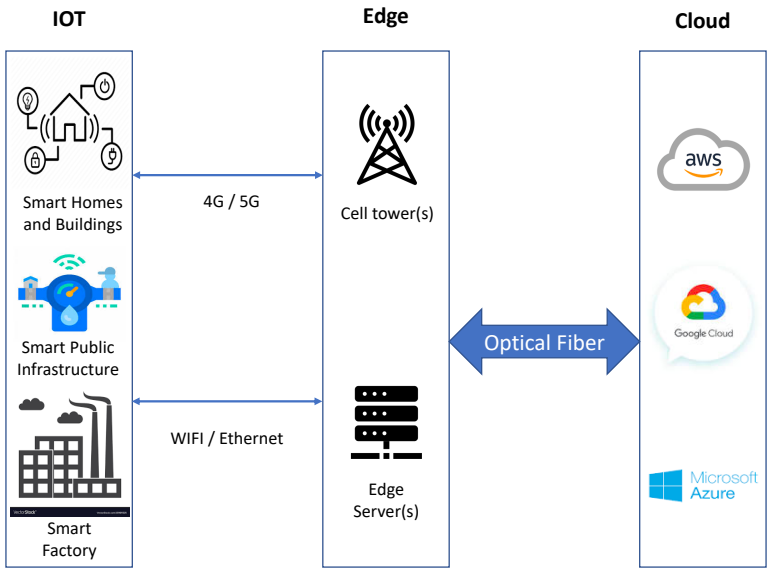

Figure 2 Physical Model

Figure 2 is an example of a physical model of the three-tier architecture supporting smart homes and buildings and smart factories.

Enabling HCL Software Products

HCL Software has some key assets to help customers move to the edge computing model. Below are two key products which provide functionality required in an Edge Computing architecture. Both components listed below are mature within the industry and are likely operating in your enterprise already.

Endpoint Management

The foundation for IOT devices and the edge computing tier is the proliferation infrastructure both compute, storage and the actual devices from a centralized topology to a more distribute topology. With the addition of these endpoints is the need to manage those devices to verify they are running the right level of patches, applications and supporting software. HCL BigFix should be the prominent tool to manage all the new endpoints. BigFix supports multiple operating systems and is positioned well to have a prominent role in this compute model. BigFix will also participate in the management of IOT endpoint devices thus a homogeneous BigFix environment from the IOT device, through the edge tier and within the enterprise cloud will give a complete picture of the entire ecosystem.

Edge Data Persistence

Edge computing moves a significant amount of data from the centralized datacenter to a federated model with data persistence to the various edge points. The data usage at these edge endpoints are multi-modal where there will be both transactional interaction as well as analytic workload. The HCL OneDB supports both OLTP and analytic workloads operating in a small footprint and also functions as an embedded database for the IOT layer of this topology. Data persistence at the embedded layer will grow significantly. A database environment, which can be used for both transactional and analytical workload, provides flexibility at the edge layer while maintaining a small footprint and scale as needed to replicate data to/from a central enterprise source.

Conclusion

Edge Computing is in the very early stages. Most large technology and telecom companies have embraced this upcoming trend and are developing strategies to position their products or services to support this next evolution in the technology industry. If your organization has not started the process of where this will fit in your strategic architecture, you should make it a priority. You will need to define the capabilities that this computing model will provide and incorporate that in your application domain strategy. HCL Software is ready to provide the technical expertise to help develop your Edge Computing strategy and find the appropriate initial use case which can quickly achieve value to your customers.