



Simplifying Edge Orchestration

Enable your enterprise customers to easily and quickly operate applications and network services on the edge cloud.

Authors Executive Summary

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Emerging workloads, including 5G, video analytics, and the Internet of Things (IoT) are driving an increasing appetite among enterprises for edge solutions that go beyond what is available in the public cloud or on-premises.

In virtually any industry, enterprises are seeking to engage in digital transformation through implementing cloud principles in distributed IT environments. For example, they want to deploy applications and network services at gas stations, shopping malls, airports, local doctors' offices and more. Communications service providers (CoSPs) can serve this need by capitalizing on existing investments in places where they already have a presence.

One significant hurdle for CoSPs in achieving success at the edge is service, application, and network orchestration for thousands of distributed locations. If an enterprise customer struggles to deploy a CoSP's edge solution, they may consider other options such as hyperscale public cloud or even a smaller public cloud solution. But with edge orchestration solutions from Hewlett Packard Enterprise (HPE) and Intel® technology, CoSPs can address enterprise needs and launch their businesses into an edge-empowered future.

Business Challenge: Cumbersome Legacy Orchestration Approaches

Computing is transitioning from centralized data centers to the edge, driven by enterprises seeking bandwidth savings, lower latency, and data sovereignty to support their digital transformation efforts. What the "edge" looks like depends on the enterprise. It could be a hub for a wireless access network (WAN) or private wireless network. Or, it could be a PC at a gas station, or a camera at a retail store or sensors and applications in a remote medical clinic. Historically, CoSPs have focused on low-level technology, performing provisioning activities either manually or with purpose-built appliances—in either case cycle times are long and inefficiencies abound. This approach does not succeed when trying to bring all the diverse pieces of the network edge into a single, carrier-grade, cloud-native telemetry and automation regime. CoSPs need a way to deploy an orchestration system that is capable of massive scaling and of evolving toward increasing levels of software-defined automation and agile continuous integration/continuous delivery (CI/CD).

CoSP networks have close proximity to the client—and capitalizing on this investment is crucial to a CoSP's bottom line. But without an easy-to-use, end-to-end solution for managing applications close to the edge, CoSPs often lose that monetization opportunity to public cloud solutions. Especially as enterprises adopt a multicloud strategy and the edge becomes more complex, CoSPs need an orchestration solution that supports fast time to market (TTM), agile development methodologies such as CI/CD and most importantly, full automation.

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Edge orchestration combines edge-cloud infrastructure, edge-cloud CoSP services, and edge-based applications into a holistic, seamless offering for enterprise customers (see Figure 1).

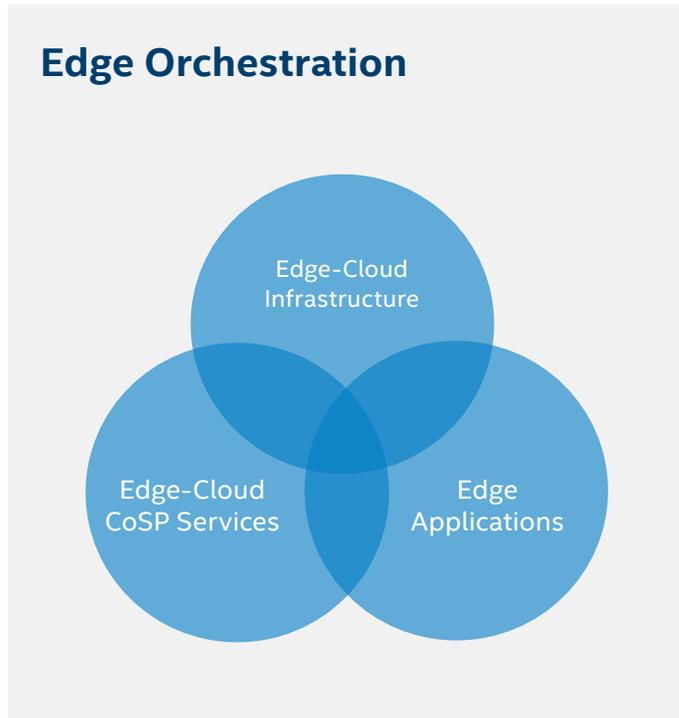


Figure 1. By combining edge-cloud infrastructure, edge-cloud communications service provider (CoSP) services and edge applications, edge orchestration creates a seamless experience for enterprise customers

Solution: As-a-Service Agile Edge Orchestration

The typical CoSP system integration approach often takes too long and is unable to fully meet the needs of today's evolving edge landscape. CoSPs must be able to quickly adapt to real-time research and development in 5G, IoT and more, where software architecture changes often. There is no time to "re-invent the wheel" every time something changes—instead, to be successful CoSPs must offer "orchestration as a service" (OaaS). Through automation, OaaS enables CoSPs to quickly create new services without having to write a lot of new code.

Technology Considerations

Primary components of OaaS, which support the rapid on-boarding of new capabilities and new combinations of existing capabilities, include the following:

- Pre-built orchestration functions
- Motion of "Everything is a Service"
- Intent-based modeling service catalog
- Composability of services
- Service orchestration of edge-cloud infrastructure, edge applications and network services
- Self-service portal that the enterprise can use to compose its edge configuration

Tying all of these components together is intent-based modeling. Intent-based modeling is a novel way of describing services in a machine-readable way.

Historically, specifications have typically included a "human readable" part, written in free-form English that described the behavior of the service. As a result, every service description must be programmed by hand. Instead of using workflows to program the increasingly complex services that are to be combined and orchestrated, the intent-based model describes only what the service is meant to achieve (in the form of machine-readable models and policies). An intelligent piece of software reads the model and creates the necessary workflows on-the-fly, without human intervention. Intent-based modeling is service-agnostic and can be used to model network services, infrastructure services, applications or end-to-end services, creating a powerful tool to handle the dynamicity at the edge.

There are many locations encompassed in the network edge and a couple of those include:

- Next-Generation Central Office (NGCO): mini data centers typically using OpenStack, VMware vCenter, vCloud Director or Kubernetes
- Smaller devices and universal customer premises equipment (uCPE) using Kernel-based Virtual Machine (KVM) or Kubernetes

Specific orchestration requirements for on-premises or on small edge sites include the following:

- Lightweight
- Works behind the firewall
- Integrates with NFV orchestrators (NFVOs) that manage Near Edge data centers

Intent-Based Edge Orchestration from Hewlett Packard Enterprise (HPE)

With HPE's orchestration solutions, CoSPs have an alternative to building the entire edge orchestration offering themselves. The self-service portal is multi-tenant capable, where each CoSP customer sees their specific catalog of services, which is then deployed on the edge devices. The orchestrator handles all the detailed lifecycle management of edge-cloud infrastructure, applications and network services. In a nutshell, it constitutes an all-in-one edge-as-a-service solution.

This solution is an agile, model-driven application, using intent-based orchestration, not classic workflows. As described earlier, instead of coding every possible workflow, dictating each step, intent-based orchestration defines the rules and policies, then the system uses triggers to calculate specific workflows in real time. By describing all the business logic and behavior of all the applications and network services, intent-based orchestration makes it easy to change the system when a service is added or modified—often requiring just a change to a single line of code. This takes far less time than the traditional approach of re-writing and re-testing complex code. Pre-built components called "cartridges" allow for a plug-and-play approach to extending edge as a service with new features.

Using HPE Edge Orchestrator (see Figure 2), CoSPs can address a variety of vertical markets at the edge.

HPE Edge Orchestrator

VNF = virtual network function
 MEC = multi-access edge computing

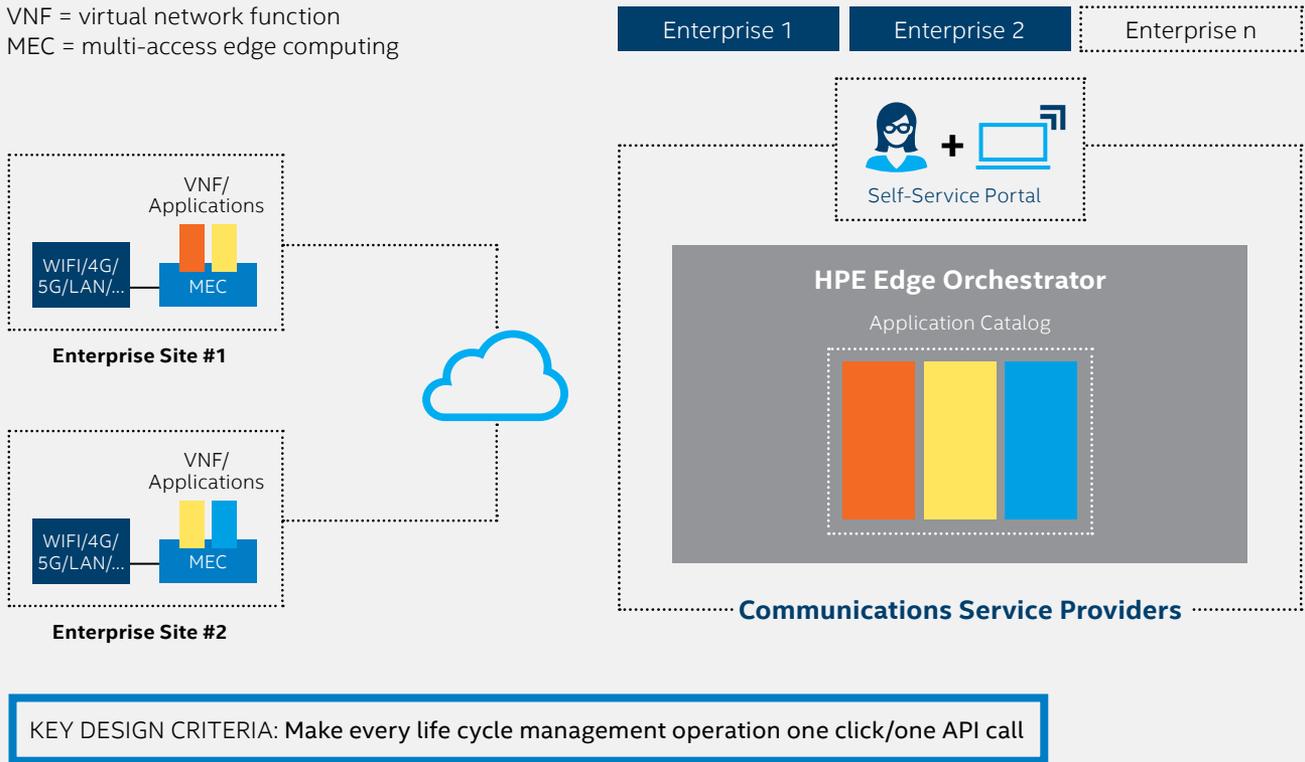


Figure 2. HPE Edge Orchestrator: enabling zero-touch service management for self-service on-demand enterprise services

Intel® Technologies and Toolkits Deliver a Data Foundation for the Communications Service Provider (CoSP) Edge

Intel offers an unmatched portfolio for the unique requirements of edge implementations. This includes Intel® Xeon® processors, accelerators for the edge, and networking and storage components to move faster and store more at the edge. Intel also offers optimized software built on open standards, with toolkits and reference designs to accelerate trusted deployments. This includes Open Network Edge Services Software (OpenNESS) and the Intel® Distribution for OpenVINO™ toolkit:

- **OpenNESS.** This SDK abstracts complexity, simplifies edge deployments and enables code reuse from cloud to edge. It's the "easy button" to deploy innovative services at the edge, providing a reference toolkit with samples.
- **Intel Distribution for OpenVINO toolkit.** This SDK helps CoSPs harness the full potential of artificial intelligence (AI) and computer vision across multiple Intel® architectures to enable new and enhanced use cases. It enables heterogeneous execution across Intel architecture-based platforms from edge to cloud.

Conclusion

Applications deployed at the edge are an increasingly important aspect of a CoSP's ability to monetize their network and services. However, many CoSPs struggle to innovate fast enough to take advantage of the huge

opportunity the edge offers. One crucial component of success at the edge is zero-touch, automated service orchestration across a large distributed landscape. CoSPs' customers demand scalability, flexibility, and ease of use. With an edge platform based on the latest technology innovations from HPE and Intel, CoSPs can increase their ability to offer OaaS and launch new 5G, IoT, AI, and other edge applications.

Edge Orchestration Architectural Considerations

- **Scalability** is necessary as additional use cases emerge on the near and far edge. HPE Edge Orchestrator can help scale edge solutions.
- Solution **flexibility** must allow for different network configurations. Intent-based orchestration is an excellent way to achieve this goal.
- **Ease of use**, such as a self-service portal, is paramount to customer adoption. Deployment, management, version control and upgradability—the entire fully automated lifecycle—must be easy for the end customer.

Contact your Intel representative or visit intel.com/network for more information.

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- [Intel® Network Builders Edge Ecosystem](#)
- [Intel and the Edge Cloud](#)
- [Intel® Network Builders Program Goes to the Edge white paper](#)



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