SOLUTION BRIEF

Communications Service Providers
Network Management & Orchestration

Cloudify Expands Orchestration with Enhanced Platform Awareness

As edge networks support a wider range of workloads, Cloudify Spire adds Enhanced Platform Awareness for Kubernetes to intelligently place software that needs special hardware capabilities.

Initially, edge servers were optimized for networking functions such as routing, firewalls, and load balancing. But communications services providers (CommSPs) have expanded the types of applications on their edge servers as they experienced improved data traffic latency and a reduction of data on their backbone networks. This expanding use of edge servers requires new orchestration features that allow for workload placement based on specialized hardware functionality.

Cloudify, an Intel® Network Builders ecosystem partner, has developed Cloudify Spire, an orchestrator that uses Enhanced Platform Awareness (EPA) features for this new edge server environment.

Edge Node Applications Are Evolving

A new generation of edge computing is emerging as CommSPs expand the services deployed on this infrastructure beyond the initial networking-oriented services to include a wider range of enterprise services. From a CommSP's perspective, processing data at the network edge means less traffic on the backbone network. Additionally, using edge servers as a distributed first level of processing can reduce the processing load on data center servers. For some services, such as IoT, data processing can be done entirely at the network edge, removing the entire burden from the data center.

From the enterprise perspective, edge computing services mean that data is continuously available. Because data does not need to make a round trip to a distant data center, data security is improved and latency is reduced. Other enterprises are leveraging edge servers to create hybrid cloud environments that provide competitive cloud services that are targeted at particular workloads.

Supporting these expanding service workloads may require specialized hardware or compute features. Edge servers are economical because service lifecycle orchestration can be done remotely, and thus it's important that orchestrators know what features an application needs and which edge server has the capabilities to meet those needs.

For these applications, workload placement capabilities must be part of the orchestrator's decision-making process to be successful. Developed by Intel, EPA represents a methodology targeting intelligent platform capability, configuration, and capacity consumption. It provides hardware feature discovery and other capabilities that assist with software placement. Spire is an orchestrator built specifically to include edge environments, and it can access EPA capabilities in order to better understand the app deployment topology.

Spire Is Built for Edge Networks

Spire (see Figure 1) is a vendor-agnostic orchestration platform that connects and controls distributed networks, devices, and applications from the data center to the network edge. Spire manages distributed virtual environments, including OpenStack, Kubernetes, VMware, and others. Cloudify exposes RESTful APIs, which serve as the means to provision resources and manage their life cycle operations, and which can be utilized by higher level business systems like BSS/OSS or business workflows.

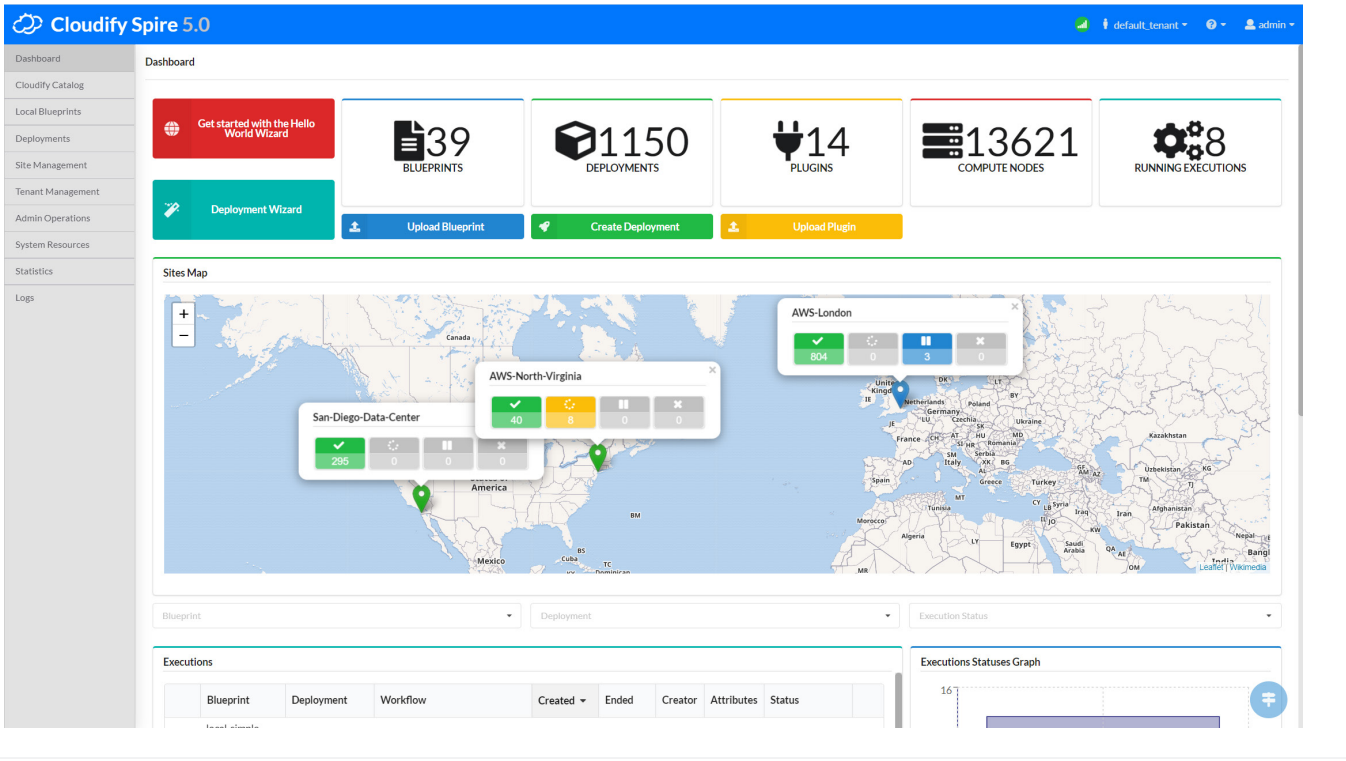

Figure 1. Cloudify Spire graphical interface.

Spire supports intent-based orchestration that lets the software translate business policies into network functions, automates implementation, monitors network state, continuously validates network operations, and, if necessary, takes corrective action to ensure the business policies are being implemented.

Spire features a centralized manager supported by regional managers to provide scalability for large distributed environments. The orchestrator has three main elements:

Blueprint: Cloudify uses the Topology and Orchestration Specification for Cloud Applications (TOSCA) as its network and web services modeling language. The Cloudify blueprint provides a hierarchy of multi-domain orchestration because it can describe both low-level elements such as cloud infrastructure and high-level multi-domain services.

Plugins: Plugins are used to map any endpoint into a library of TOSCA nodes. Spire uses both infrastructure plugins—including OpenStack, Azure, and AWS—and configuration plugins, which can include Ansible, Script, Terminal, and others.

Manager: The Spire manager is the daemon responsible for maintaining the current state of the system and execution of the workflow based on that state. The Spire manager can have a different role depending on the layer in which it is operating. For example, it can serve as a specific domain orchestrator to manage the resources of a specific service. At the same time, it can be used to manage multiple orchestrators and domains.

Intelligent Placements Using EPA

To expand its orchestration of distributed Kubernetes clusters to include requirements and criteria like location, resource availability, and special resource requirements, Spire works with the Node Feature Discovery (NFD) capability of EPA for Kubernetes. NFD detects and advertises the hardware and software capabilities of a platform that can be used to facilitate intelligent scheduling of a workload. Spire can then map pods that have specific requirements to those nodes that have the capabilities to support these requirements.

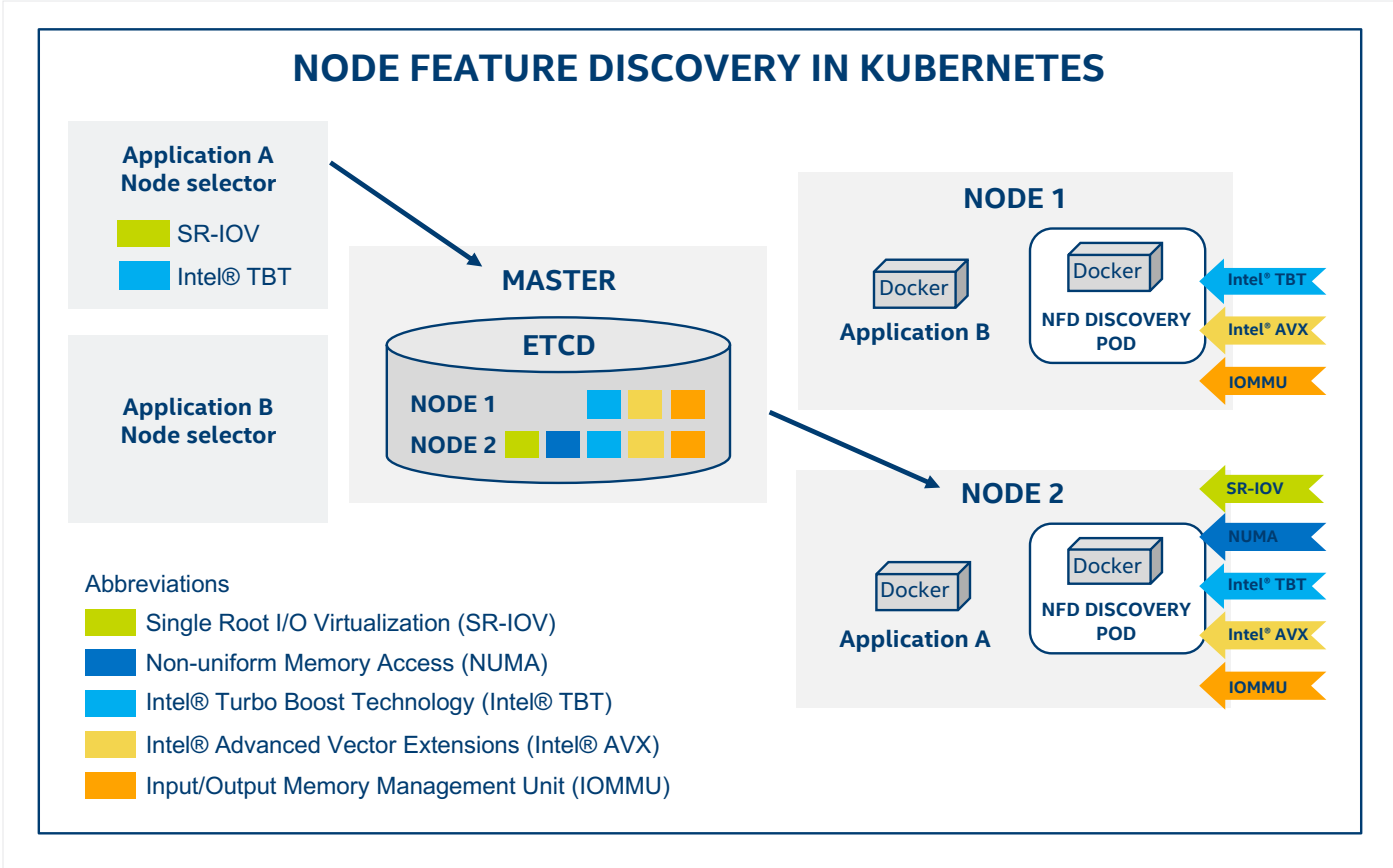

Figure 2. Utilizing NFD, each Kubernetes node is labeled with a list of the hardware capabilities it supports. In this figure, SR-IOV and NUMA are supported by Node 2, giving Node 2 an advantage for supporting performance sensitive workloads.

Some of these special hardware and software capabilities that can be detected and advertised by NFD include:

- **Data Plane Development Kit** (DPDK), an open source set of software libraries and drivers for high-performance packet throughput in an Intel® architecture-based server.
- **Single root input/output virtualization** (SR-IOV): Allows hardware resources, such as network interfaces, to be shared by multiple virtual machines. SR-IOV gives each VM a direct connection to the I/O device, enabling very fast data movement since the packets don't have to be passed through the virtualization layers.
- **Intel® QuickAssist Technology** (Intel® QAT): Intel QAT is a hardware encryption/decryption engine that accelerates cryptography requests providing additional performance and reducing the compute load on the CPU.
- **Non-Uniform Memory Access** (NUMA): A shared memory architecture for a multiprocessor system that describes the placement of main memory modules with respect to each of the processors.
- **CPU Pinning:** Allows applications to bind or unbind a process or a thread to a specific CPU core or to a range of cores or CPUs. Once pinned, the operating system ensures that a given thread executes only on the assigned core(s) or CPU(s) each time it is scheduled.

Spire uses NFD to label the hardware capabilities each Kubernetes node supports. Spire is also able to provision workloads to non-Kubernetes hybrid environments. It can also detect node features on cloud servers for NFD-enabled placement.

Conclusion

Orchestrators like Spire are essential for cost-effective management of edge server networks, and with expanding enterprise use cases, adding in server hardware discovery features is important. By leveraging EPA, Spire helps CommSPs make placement decisions that can provide optimized workload performance.

About Cloudify

Cloudify provides core-to-edge orchestration that enables service providers and enterprises to automate, manage and virtually transform network and application services from the core location to branches and multi-access edge devices. Cloudify radically simplifies end-to-end network automation through its open source, intent-based orchestration platform, which connects and manages distributed containers, network elements, and edge devices on physical servers or the cloud—all under a common automation scheme. With its award-winning TOSCA-based technology, Cloudify ensures flexibility, prevents vendor lock-in, and reduces cost and time. Cloudify has headquarters in Herzliya, Israel, and offices in the US and Europe. Visit us at cloudify.co to learn more.

About Intel® Network Builders

Intel Network Builders is an ecosystem of infrastructure, software, and technology vendors coming together with communications service providers and end users to accelerate the adoption of solutions based on network functions virtualization (NFV) and software defined networking (SDN) in telecommunications and data center networks. The program offers technical support, matchmaking, and co-marketing opportunities to help facilitate joint collaboration through to the trial and deployment of NFV and SDN solutions. Learn more at http://networkbuilders.intel.com.

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