UNLEASH THE POWER OF LIMITLESS CONNECTIVITY
Cloud & Virtualization

Distributed Multi-layer Infrastructure Management for Multi-Access Edge Computing Services: Using Kubernetes to implement a MEC architecture

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What is Driving Need for Multi-Service Virtualized Edge Solution

Enterprise Infrastructure Rapidly Evolving to Improve Performance and Security while Reducing Complexity and Cost

- Growing number and diversity of remote sites
- Profusion and diversity of business applications
- Shift towards cloud-native
- More data and intelligence residing at the edge
5G Connected Health Experiment Environment

Declarative Orchestration

IoT Gateway Tenant
- System
- Dashboard
- API Server

5G Core Cloud Tenant
- Mobile 5GC
  - AMF
  - SMF
  - UPF

Compute Node
- IoT Clinic
  - Heart Rate
  - Blood pressure
  - Weight
  - Height
  - Glucose
  - Cholesterol
- gNB / UE Simulator
- Sensors
- Patient Stations

Virtualization OS

Virtual Switch

Guest OS

Service Chain

Internet

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True adaptive environments require a shift from prescriptive, open loop to descriptive constraint, closed loop operational models leveraging telemetry, automation, and intelligence.

Industry is moving in the towards truly adaptive operational models and technologies like Kubernetes is a helping in the shift.

A mesh of inter-working controllers operating on common declarative and operational telemetry to drive automation.
Translating MEC onto Kubernetes

<table>
<thead>
<tr>
<th>Device</th>
<th>3rd party</th>
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<tbody>
<tr>
<td>MEC system level management</td>
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<td>MEC system level</td>
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<td>MEC platform</td>
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<td>MEC host level management</td>
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MEC Architecture

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<td>CNCF KubeFed</td>
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<tr>
<td>Helm, Capability discovery, Descheduler, NSM, Constraint policy scheduling, Chaining</td>
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<tr>
<td>K8s Deployments, Pods, VMs</td>
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<td>MEC applications</td>
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<td>Virtualisation infrastructure (e.g. NFVI)</td>
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<tr>
<td>VMs + CNF + NSM</td>
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<tr>
<td>K8s Cluster MEC host</td>
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<td>K8s API</td>
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MEC Architecture with Kubernetes Overlay

* Custom components and extensions added by implementation highlighted in bold red
Enables scheduling of applications with consideration of network connectivity as a declarative resource constraint

Expression of constraints, including those that relate to network connectivity, such as bandwidth, latency, and jitter

Constraints consulted when scheduling pods to nodes, including invocations to a network controller when required connections don’t currently exist

Constraints monitored to ensure they remain compliant, and reconciliation taken if there is a violation
Kubernetes Declarative Chaining

Workloads will be based on VMs, containers, serverless and “future technologies”

Separate abstracted workload specification from underlying technology

Leverage specialized hardware when and where it exists

Declare network chains between workloads regardless of underlying technologies

Span chains across single or multiple physical hosts
Apply To Public / Private Cloud Integration

Industry solutions will include public and private clouds, must be able to support cross cloud deployments and automation in a consistent way.

Cannot always deploy custom schedulers / controllers when integrating with clouds outside your administrative control.

Leveraging process pipelines, like GitOps, in conjunction with custom “controllers” and standard Kubernetes constructs provides a route to capability.
Communications Service Providers need strategies to monetize the growth of containerized applications & multi-cloud technology services on the network edge.

CNCF projects and the Kubernetes eco-system can be leveraged to build MEC service deployments compatible with cloud technologies while enabling application portability.

Kubernetes is an intent-based closed loop automation system that can support declarative specifications of virtualized and containerized service function chains.

Extensions to Kubernetes scheduling with connect-based constraints is a powerful tool to enable optimal deployment of workloads across a distributed edge compute network.

Extending Kubernetes to support a common abstraction over ubiquitous workload technologies, declarative application chaining, and supporting diverse hardware capabilities is essential to enabling MEC applications.
Thank You!

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