EMCO: Automated Routing to MEC Apps

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Sundar Nadathur, Srini Addepalli: Intel
Agenda

- Edge Computing Requirements (Ravi)
- 5G and MEC big picture (Srini)
- MEC Deployment Scenarios (Sundar)
  - Introduction
  - Variations
MEC Apps are composite & distributed across and are to be securely connected
Requirements for Apps Connectivity

- Health Check & High Availability
- Latency sensitive Load Balancing
- Application Security
- Auto-updates to the Routes
- Support different flavors of Clusters
- Secure Inbound & Outbound Access to Apps
- Beyond Kubernetes based MEC Apps
MEC Deployment Scenarios

How EMCO can automate MEC networking
Agenda

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5G and MEC big picture

Private-5G and Public-5G Edges

- Private-5G Edges
  - Typically in the same site as 5G

- Public Edges in Telco / Enterprises
  - Telco Edges for MEC
  - Enterprise On-Prem MEC
  - Normally in the same routable network as Private-5G

Public Edges in Exchanges

- New Wave Edge Providers
  - Normally, these edges are not in the same network as 5G edges

Clouds
Enterprise (Developer) Challenges

Which Edges do I choose to deploy my applications to provide low-latency user experience to my users?

Which application instance to be mapped to a given UE session?

How do I ensure the secure connectivity and security of my application services from rogue users or compromised users?

How do I ensure that there is uniform connectivity even if I choose multiple edge/cloud providers?
Automation is the key

Find out the best possible edge locations to deploy applications
Automate deployment of application across these locations
Automate the connectivity and security across distributed apps

**Automate the connectivity of frontend app to the UEs either via automation of DNS Servers, traffic steering from UPF and/or via UE session matching (EDGEAPP architecture) methods (Traffic routing automation)**

**EMCO is an enabler for this automation**

- Placement decisions based on 5GFF API
- Deployment of frontend and backends of applications
- Automation of ISTIO to connect frontend and backends of applications

Traffic routing automation (focus of today presentation)
<table>
<thead>
<tr>
<th>Phase</th>
<th>Type of MEC App</th>
<th>MEC App reachability</th>
<th>Service Mesh (ISTIO) in MEC clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 : App in the same cluster as UPF App in different cluster near UPF (1:1) between UPF cluster and MEC cluster</td>
<td>Copy of Cloud App Original</td>
<td>Direct</td>
<td>No</td>
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<tr>
<td></td>
<td></td>
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<td>Yes</td>
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<tr>
<td>Phase 2 : App in multiple MEC clusters (including local)</td>
<td>Copy of Cloud App Original</td>
<td>Direct Indirect via one IP across multiple clusters</td>
<td>No</td>
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<td>Yes</td>
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<tr>
<td>Phase 3 : App in multiple MEC clusters (including local) with security applied</td>
<td>Copy of Cloud App Original</td>
<td>Direct Indirect via one IP across multiple clusters</td>
<td>No</td>
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<tr>
<td></td>
<td></td>
<td>Indirect via one IP for multiple Applications across multiple clusters</td>
<td>Yes</td>
</tr>
<tr>
<td>Phase</td>
<td>Type of MEC App</td>
<td>MEC App reachability</td>
<td>Service Mesh (ISTIO) in MEC clusters</td>
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<tr>
<td>Phase 4: App in multiple MEC clusters (including local) with security + with selection of MEC cluster based on 5GFF based service.</td>
<td>Copy of Cloud App Original</td>
<td>Direct Indirect via one IP across multiple clusters Indirect via one IP for multiple Applications across multiple clusters</td>
<td>No Yes</td>
</tr>
</tbody>
</table>
Agenda

- Edge Computing Requirements (Ravi)
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- **MEC Deployment Scenarios** (Sundar)
  - Introduction
  - Variations
Scenario 1: Cloud App With Edge Instances

- Clusters: MxN model
- C-GW: Cluster Gateway

Traffic flow from UE to cloud app

Need to pick a cluster and steer traffic to MEC app IP
Scenario 1 Solution In Detail

5G Core clusters

C-GW

TSC

UPF

9.0.1.2

S:172.16.1.2:49007
D:12.0.1.2:80

172.16.1.2

EMCO inserts TSC for DNAT, MEC LB, L7-LB (security, proxy)

S:4.0.1.2:31003
D:12.0.1.2:80

S:10.0.1.2:50001
D:9.0.1.2:80

DNS

foo.com

Cloud app1

12.0.1.2

SVC1

APP1

APP1

SVC2

APP2

MEC clusters

5G Core clusters

gNodeB

UE

10.0.1.2

gNodeB

UE
Scenario 2: Edge Apps Only

DNS controller, such as externaldns, configures Carrier DNS.

DNS query returns edge app IP

Traffic flow from UE to edge app

Carrier DNS

5G Core clusters

DNS Ctrlr

gNodeB
UE

APP1
APP1

APP2
SVC2

SVC1

APP1

APP1

UPF

UPF

C-GW

UPF

UPF

5G Core clusters

UE

UE

UE

UE

MEC clusters
Scenario 2 Solution In Detail

EMCO inserts TSC for L7-LB (security, proxy)
Scenario 3: Edge Apps Only + Inter-MEC LB

- Traffic flow from UE to edge app via LB
- DNS query returns LB IP
- DNS controller configures Carrier DNS with Inter-MEC LB’s IP

5G Core clusters

Carrier DNS

DNS Ctrlr

Inter-MEC Load Balancer

MEC clusters

SVC1

APP1

APP1

SVC2

APP2

gNodeB

UE

gNodeB

UE
Scenario 3 Solution In Detail

5G Core clusters

- Carrier DNS
- 12.0.1.2
- TSC
- UPF
- C-GW
- Inter-MEC Load Balancer 12.0.1.2
- DNS Ctrlr
- SVC1
- APP1
- SVC2
- APP2
- MEC clusters

- 1. foo.com
- 2. 12.0.1.2
- 3. 10.0.1.2:50001
- 4. 172.16.1.2:49007
- 5. 4.0.1.2:31003
- 6. 12.0.1.2:80

EMCO inserts TSC for L7-LB (security, proxy)

- S:12.0.1.2
- D:12.0.1.2:80

12.0.1.2

- C:GW
- Traffic Steering Controller

- gNodeB
- UE
- 10.0.1.2

- TSC
- UPF

- DNS Ctrlr
- SVC1
- APP1
- SVC2
- APP2

- MEC clusters
VARIATIONS
Variation 1 of Scenario 1: Local MEC

Why Local MEC?
- Less resources
- Less admin/mgmt overhead

Traffic flow from UE to app

DNS query returns cloud app IP

EMCO inserts TSC for DNAT, security

5G Core + MEC clusters

Cloud app1
Variation 2 of Scenario 1: Hub

Why Hub?
- May not have access to UPF cluster
- More administrative control over resources

DNS query returns cloud app IP
Traffic flow from UE to app

EMCO configures TSC for DNAT, LB, L7-LB (security, proxy)
Variation 3 of Scenario 1: Service Mesh

- Clusters: MxN model
- C-GW: Cluster Gateway

Need to pick a cluster and steer traffic to service mesh’s Ingress gateway IP

Traffic flow from UE to cloud app

DNS query returns cloud app IP

5G Core clusters

gNodeB

UE

APP1

Cloud app1

SVC1

APP1

APP2

SVC2

12.0.1.2

foo.com

gNodeB

UE

APP2

APP1

SVC2

12.0.1.2

foo.com

Cloud app1

DNS

Clusters: MxN model

C-GW: Cluster Gateway

870
Matrix of Deployment Variations

Service mesh on/off in each phase; 5GFF API for MEC cluster selection in P4.

<table>
<thead>
<tr>
<th>UPF cluster access for EMCO</th>
<th>Scenario</th>
<th>No L7-LB</th>
<th>L7-LB with Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Cloud app with edge apps</td>
<td>P1</td>
<td>P1</td>
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<tr>
<td></td>
<td>Edge Apps Only</td>
<td>P1</td>
<td>P1</td>
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<tr>
<td></td>
<td>Edge Apps Only + Inter-MEC LB</td>
<td>P2: L4 LB</td>
<td>P2: L4 LB</td>
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<tr>
<td>No</td>
<td>Cloud app with edge apps</td>
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<tr>
<td></td>
<td>Edge Apps in Separate MEC clusters</td>
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<tr>
<td></td>
<td>Edge Apps with Inter-MEC LB</td>
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Call To Action

• Questions?
• You are welcome to join us!

https://lists.project-emco.io/g/emco-dev/topics
Thank You