

R3 - Architecture Documentation of Enterprise Applications on Lightweight 5G Telco Edge (EALTEdge)

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Blueprint overview/Introduction

Enterprise Application on Lightweight 5G Telco Edge is an Akraino approved blueprint family, which intends to make a complete ecosystem for 5G Telco Edge Enterprise level platform. Platform which can be leveraged by various Telecom operators to give value added services to end users.

The edge layer which this blueprint targets is the **Telco Edge**.

Below are the high-level features which this blueprint will go on to implement in phase-wise.

- Lightweight MEP Solution
- Autonomous MEP Edge Sites.
- Unified Portal for platform management and for App developers.
- Sandbox with SDKs and tools chains for MEC app developers
- Heterogeneous deployment on Multi-Arch.
- ETSI MEC Compliant.

Use Case

Lightweight MEC platform, enable real-time enterprise applications on 5G telco edge.

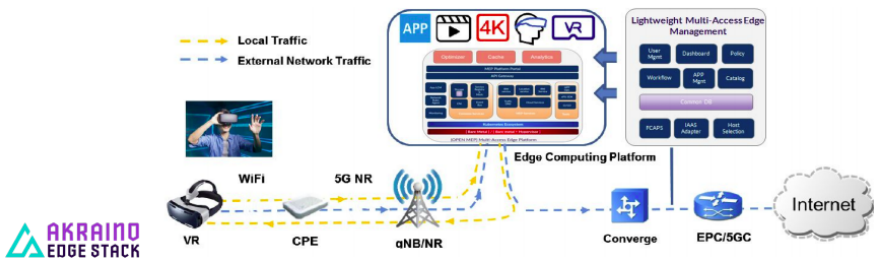
Applications:

Diverse types of applications in various sectors, not limited to below:
Gaming Applications, VR Live broadcasting
The industrial park, Campus office etc.
Video Orchestration and Optimization
Latency Sensitive Application for Enterprise scenarios Etc

Use Case 1

Use Case 1: Streaming media optimization Overview

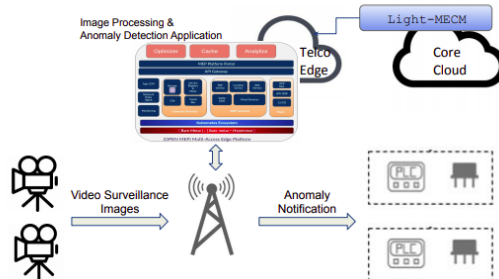
	Central Cloud based streaming	5G Telco edge based streaming
User QOE	Not so good user experience for latency sensitive streaming applications like AR	Improved user experience with reduced latency
CAPEX	High traffic on Enterprise WAN link leaving to Cloud	Minimizes the amount of streaming media that has to leave the enterprise boundaries
System Requirement	End device needs to be capable enough of handling computational needs	Offloads the computation from end devices to edge.



Use Case 2

Use Case 2: Machine Vision in Campus Network

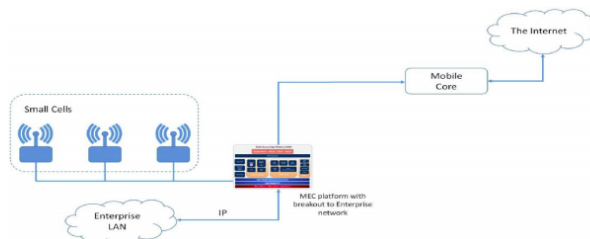
	Traditional Solution	5G Telco edge based streaming
Efficient production line space utilization	Distance between the camera of the machine vision system and the image analysis server is limited. Production line has dozens of machine vision servers at most, occupying much production line space	Centralized processing on Telco edge using wireless cameras on 5G network
Real time processing & feedback	Cloud based solutions doesn't provide real time response for detection and quick feedback due to delay	Real time response for detection and quick feedback
System Requirement	Multiple dedicated servers for computation intensive image processing & anomaly detection algorithms	MEC can provide shared GPU based high end servers at centralized Telco edge.



Use Case 3

Use Case 3: Mobile office

	Traditional Solution	5G Telco edge based streaming
CAPEX & OPEX	<ul style="list-style-type: none"> Networks are deployed and managed separately by the IT administrators in Enterprises. Enterprises have to continuously upgrade their IT infrastructure. 	<ul style="list-style-type: none"> Telco infrastructure including 5G network & Telco Edge would reduce the administrative overhead for the Enterprises. Service Providers will take care of upgrading their wireless infrastructure periodically
Coverage	Limited coverage specially for outdoor with current IT infrastructures which are based on WIFI	Can provide good outdoor coverage
Data privacy	Using cellular network + cloud will have following issues <ul style="list-style-type: none"> Enterprise office data traffic is transmitted through the core network, and the delay cannot be guaranteed. Enterprises' requirements that data cannot go out of the campus cannot be met. 	With Telco edge enterprise data needn't leave enterprise boundary and delay can be guaranteed.



Business Drivers

The EALTEdge Blueprint is for the Telco Edge, it targets the telecom operators to leverage this blueprint platform services and provide value added service, in return for better revenue generation. It also provide an Application Development Ecosystem by providing open SDK to developer community to develop application which can be tested and deployed easily on the MEP sites.

Overall Architecture

The Enterprise Applications on Lightweight 5G Telco Edge platform architecture consists of a MECM (Controller) Cluster (Cloud) and single to multiple MEC Host Sites .

The MECM Cluster is a Central Cloud Server which controls the deployment of applications on MEC Hosts. The MECM node can be a single node or a multiple node K8S Cluster.

Overall architecture diagram of the blueprint.

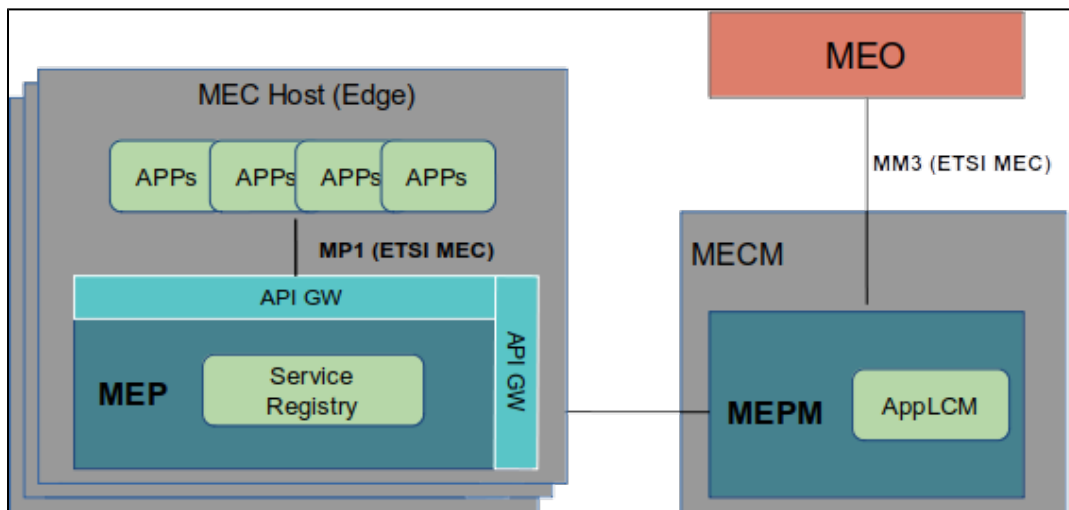


Figure 1 – EALTEdge R3 Architecture

MECM:

MEC Manager is the central entity in the MEC system responsible for application and service deployment in an highly distributed computing environment, it provides overall view of hosts and applications deployed in the hosts. MEC Manager is the central entity in the MEC system responsible for application and service deployment in an highly distributed computing environment, it provides overall view of hosts and applications deployed in the hosts.

MECM comprises of MEP manager which performs the following tasks

Application Package Management: On-boarding of application packages and if necessary adjusting them to comply with operator policies, keeping a record of on-boarded packages

Applicatin LCM: Selecting appropriate MEC host(s) for application instantiation based on user inputs, keeping record of instantiated applications on specified hosts. Also carries out other LCM operations like query, deletion, termination etc.

MEC Host:

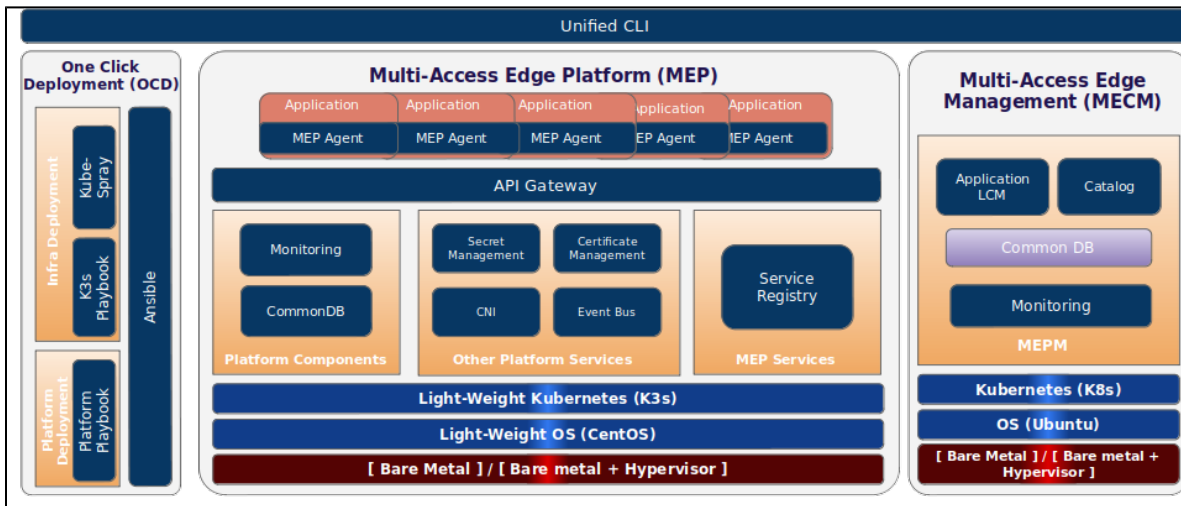
The MEC Host Sites are the components where the real action takes place. MEC Host components manages the execution of various Telco Edge Applications, it provides various services which can be leveraged by edge applications for smooth functioning and its planned to provide additional aPaas services like Machine Vision, Video Analytics , IoT Analytics etc in future releases. The MEP sites will be a single node or a multiple node K3S Cluster, on which applications will be deployed the MECM Application Management module. The MEC Host will be hosted on a light weight OS.

API: EALTEdge Blueprint provides ETSI compliance interfaces specified below for mentioned functionalities:

- MP1 : It is a interfaces between applications and MEP for Service Registry , Discovery and Service Availability Notification.
- MM3: It is a interface between Mobile Edge Orchestrator and the Mobile Edge Platform Manager is used for the management of the application lifecycle and keeping track of available mobile edge services.

Platform Architecture

The below diagram gives a overall architecture of the Enterprise Application on Lightweight 5G Telco Edge blueprint as given in Release 3.



Note: EALTEdge Blueprint Deployment has been tested on Cloud VM and is not tested on Bare-Metal Environment. Though, theoretically deployment should work in bare metal, provided hardware and software prerequisites are met. Kindly refer [R3 - Test Documentation of Enterprise Applications on Lightweight 5G Telco Edge \(EALTEdge\)](#) to get details on the tested deployment.

MECM Components:

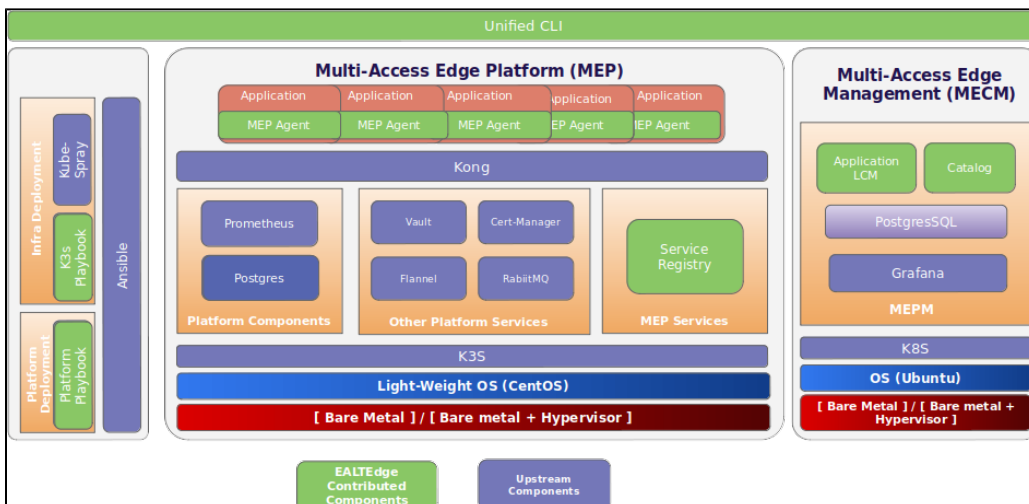
- Application LCM: Handles the application life cycle management of Applications.
- Catalog: Provides application package management
- Monitoring: Monitoring and Visualisation of platform and applications.
- Common DB: Persistent Database.

MEC Host Components:

- MEP Agent: Client Libraries for application developer for service registry and discovery.
- API Gateway: Single entry point for MEP Services.
- Certificate Management: Cloud Native Certificate Creation and Management.
- Secret Management: Cloud Native Secret Generation and Management.
- Event BUS: Message BUS Service offered to applications.
- CNI: Container Network.
- Service Registry: The service registry provides visibility of the services available on the MEC server.
- Monitoring: Monitoring and Visualisation of platform and applications.
- Common DB: Persistent Database.

Software Platform Architecture

The below image shows the software platform distribution and architecture for Release 3.0.



EALTEdge Software Components

Unified CLI: Command Line Interface provides the user interface to install the EALTEdge environment.

MEPM:

- **APPLCM:** Handles the application life cycle management including Application Creation, Instantiation, Termination, Deletion, Query etc. on one or multiple MEC Hosts.
- **Catalog:** Provides application package management including Application package Upload, Query, Deletion, etc.

MEP:

- **Service Registry :** The service registry provides visibility of the services available on the MEC server. It uses the concept of loose coupling of services, providing flexibility in application deployment. In addition, the service registry presents service availability (status of the service) together with the related interfaces and versions. It is used by applications to discover and locate the end-points for the services they require, and to publish their own service end-point for other applications to use. The access to the service registry is controlled (authenticated and authorised).

MEP Agent: Client Libraries for application developer for service registry and discovery.

Below are details of Upstream and Opensource software's used in various nodes of EALTEdge Environment.

OCD Node

S. No.	Software Name	Category	Version Number	Remarks
1.	Ubuntu	OS	18.04	Supports both 16.04 and 18.04
2.	GIT	Version Control	2.17.1	
3.	Ansible	Scripting Tool	> 2.5	
4.	GoLang	Language	> 1.12	
5.	KubeSpray	Tool	2.13	

MECM Node

S. No.	Software Name	Category	Version Number	Remarks
1.	Ubuntu	OS	18.04	Supports both 16.04 and 18.04
2.	Kubernetes	Orchestration	1.16.2	
3.	Docker	CRI	19.03	
4.	Helm	Application Package Manager	3.0.2	Running as Bin in MECM For ARM - 64 and X86
5.	Grafana	Analytics Dashboard	8.7	Running as POD in K8S Cluster
6.	Postgres SQL	Database	9.6	

MEC Host Node

S. No.	Software Name	Category	Version Number	Remarks
1.	Ubuntu	OS	18.04	Supports both 16.04 and 18.04
2.	Docker	CRI	19.03	
3.	K3S	Orchestration	1.18.2	
4.	Helm	Application Package Manager	3.0.2	
5.	Prometheus	Monitoring	2.18	
6.	CAdvisor	Container Metrics	0.36	
7.	RabbitMQ	Message Queue	3.7	
8.	Cert-Manager	Certification Management	0.15.0	
9.	Kong	API Gateway	1.5.1	
10.	Vault	Secret Management	0.5.0	

11	Postgres SQL	Database	9.6	
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APIs

Please refer the API Documentation link : [R3 - API Documentation Enterprise Application on Lightweight 5G Telco Edge \(EALTEdge\)](#)

Hardware and Software Management

Hardware Management

Currently for this blueprint Huawei Cloud Virtual Machines are being used for development , testing and CD hence there is no specific hardware management to be done.

Software Management

Gerrit Repo : [EALT Gerrit Repo](#)

Licensing

- GNU/common license