WHITEPAPER

5G & MEC Opportunity and its Challenges

ENSURING QUALITY ON SCHEDULE

Rebaca

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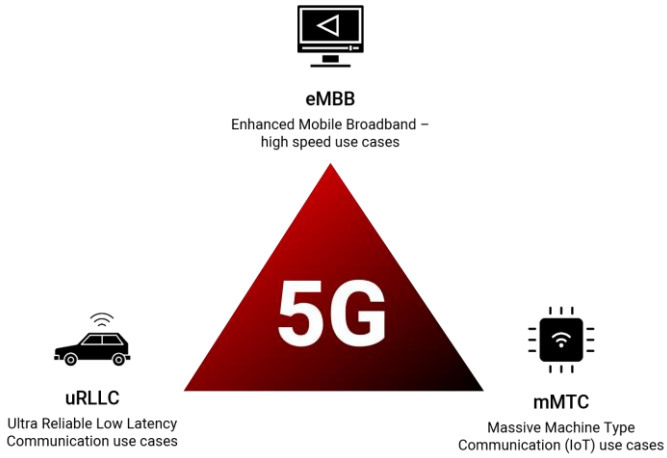
1. What is 5G?

The fifth generation of cellular networks would provide the world faster connectivity speeds, ultra-low latency, and greater bandwidth is advancing societies, transforming industries, and dramatically enhancing day-to-day experiences. Services that we used to see as futuristic, such as e-health, connected vehicles, and traffic systems, and advanced mobile cloud gaming have arrived. With 5G technology, we can help create a smarter, safer, and more sustainable future.

2. Key Features of 5G

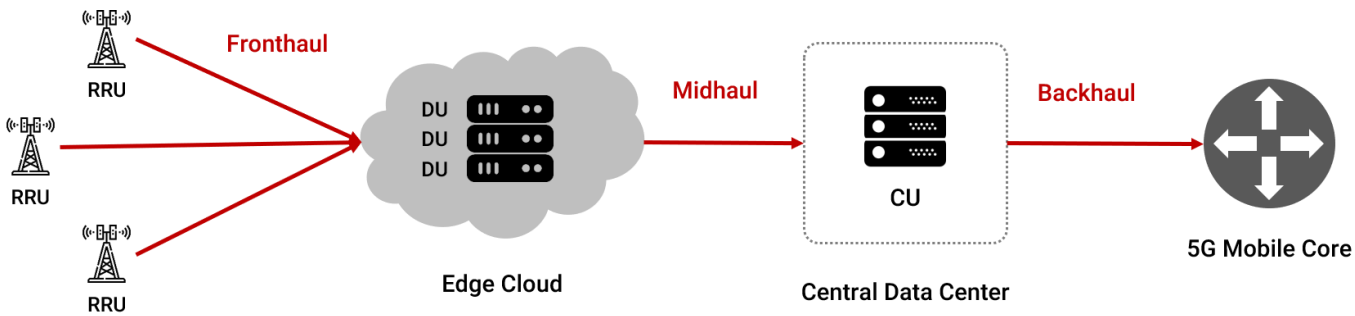
- Higher multi-Gbps peak data speeds
- Ultra-low latency
- More reliability
- Massive- network capacity
- Increased availability
- More uniform user experience
- Network Slicing

3. 5G triangle and use-cases



4. Edge RAN in 5G

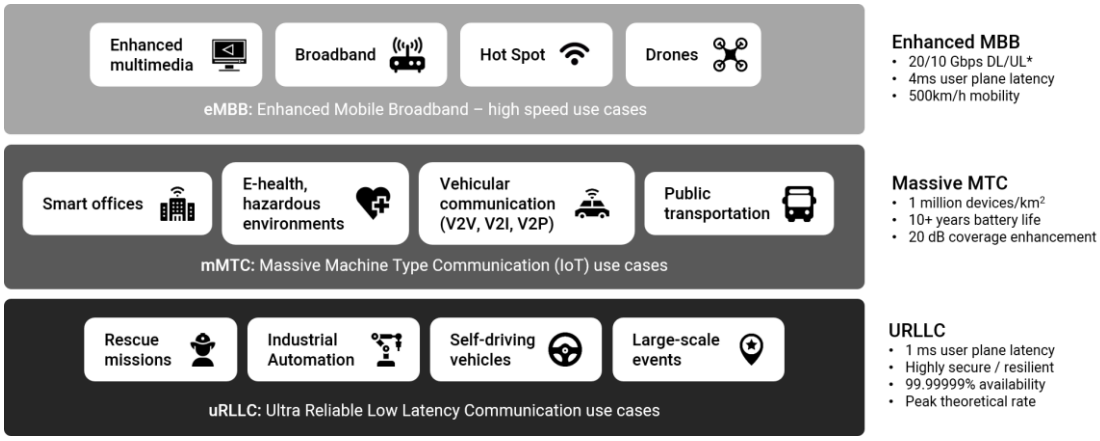
3GPP has introduced Open-RAN to disaggregate the RAN architecture and enable many different RAN technologies. Open-RAN enables moving radio resources to the edge of the network. This shift reduces latency, improves user experience, and makes the network more efficient. The deployment of Open RAN at the network edge is beneficial for 5G applications like IoT, autonomous vehicles, private 5G, remote healthcare, etc.



While O-RAN opens new opportunities and helps in realizing exciting and innovative use cases, it also introduces additional integration challenges associated with the multi-vendor eco-system. Validating inter-operability between disaggregated RAN components and its interface with the Operations and Management systems poses a huge deployment challenge that did not exist before.

5. Application of 5G Use-cases

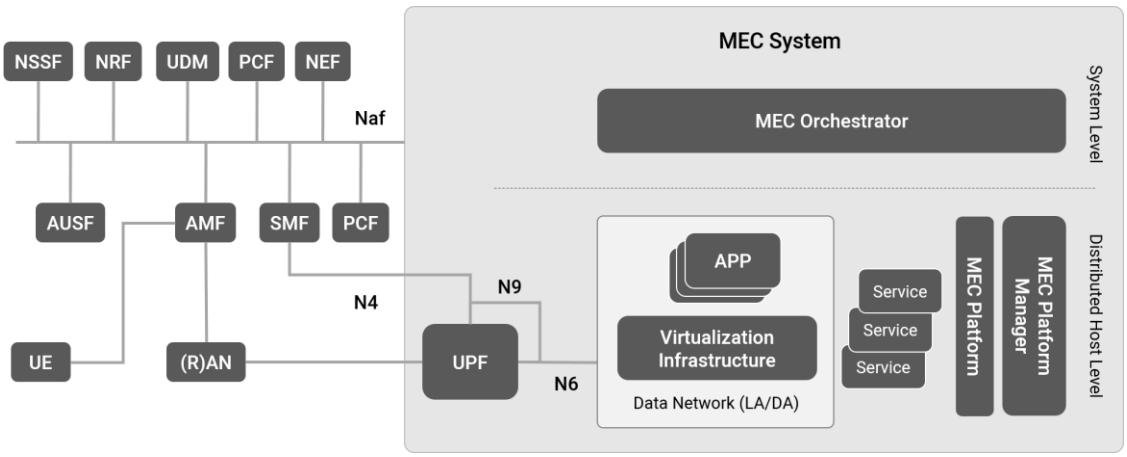
5G is and will impact a large number of industries and applications. Developing test cases that validate the different application use cases and solution architectures is important. The integration environment in most cases would be



multi-vendor, hence the adoption of test cases already developed and authoring new ones or making modifications needs to be simple. Moreover, because of the plethora of applications being added to the 5G bandwagon, the validation framework architecture should enable the addition of new protocols rapidly.

6. Integrated MEC Deployment in 5G Network

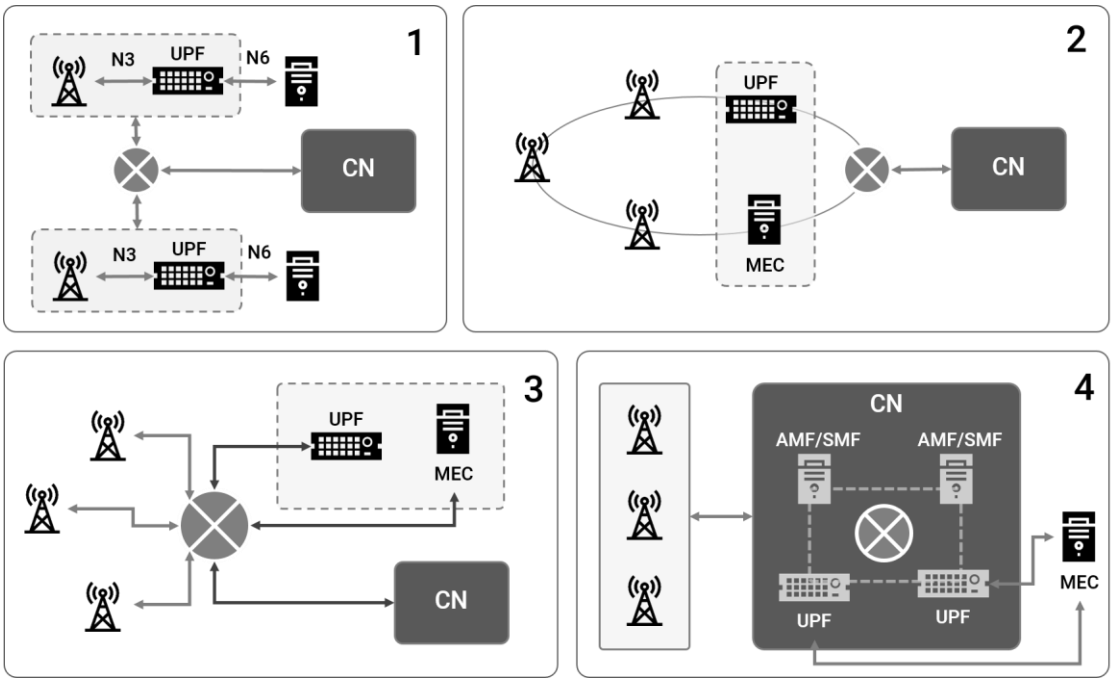
- **MEC hosts** are deployed in the edge.
- The **User Plane Function (UPF)** takes care of the user plane traffic towards the targeted MEC applications in the data network.
- The **MEC management system, orchestrating the operation of MEC hosts** and applications, may decide dynamically where to deploy the MEC applications.



6.1 Deployment Options

- **MEC** and the **local UPF** collocated with the **Base Station**.
- **MEC** collocated with a **transmission node**, possibly with a local **UPF**
- **MEC** and the **local UPF** collocated with a network aggregation point
- **MEC** collocated with the **Core Network functions**

The options presented above show that MEC can be flexibly deployed in different locations from near the Base Station to the central Data Network. Common for all deployments is the UPF that is deployed and used to control the traffic towards the targeted MEC applications and towards the network.



Validating different deployment configurations for various applications is extremely critical. Moreover, there is a big demand to get these done rapidly, hence the entire testing process needs to expedite the authoring of the test cases and validating them against different configurations. Automating the testing process is needed such that execution of the test cases, validating them, and identification of the failure reasons become part of a continuous testing pipeline.

7. Challenges of MEC and 5G Testing

- **Use case driven testing strategy**: With hundreds of use cases and tons of industries already on the 5G radar, it's really important to identify and rapidly test the important use cases to validate a solution for an industry. Developing a testing model based upon different 5G capabilities like very high throughput, sub-millisecond latency, massive connections, enhanced video services are essential for any validation exercise. The test case authoring for different application uses cases need to be abstracted so that application level domain knowledge is sufficient and one does not need deep knowledge of all the underlying network and transport layers.
- **Automation**: The diversity of the network technologies and the application use cases of MEC necessitates an automation environment that contains multiple different Test Tools. Integration between tools is important, tools should have extensive REST API support. MEC has dozens, hundreds, or thousands of locations to

configure, deploy, turn up, monitor, and maintain. Analyzing all this using statistical data and analytics driven automation is a prerequisite for 5G /MEC test environments and assurance.

- **Dynamic Network Slicing Support:** Network slicing is one important use case of 5G, slices will be dynamically created, used, and deleted. Also, slices need to be created for few seconds to few hours depending on the usage and requirements, using different traffic including A/V. The Test framework should have the ability to support Dynamic Slice testing against different traffic type.

- **Service Assurance and Managing the 5G-MEC Network:** Operating and maintaining such a diverse network is quite challenging as well. The support team needs to be aware of a variety of network technologies and use cases to be able to detect and rectify. Service assurance and performance monitoring need to be in place that will monitor every issue faced by remote applications and microservices. Without a validation, monitoring, and analyzing platform for the edge, the reliability of edge will always remain questionable and, hence, dissuade adoption.

- **Continuous everything:** 5G's unprecedented complexity needs a DevOps based approach with continuous testing, analysis, integration, and deployment across the lifecycle. Faster and flexible integration with new releases and products from different vendors. Continuous integration will be dynamic with test suites and cases to be updated regularly. The Test Scripts have to be such that they are easy to understand and adopt; important for a multivendor integration platform. Maturity analysis scores of different network functions have to be generated and tracked for stability.

- **Cloud native software based testing :** 5G testing architecture must be software based and highly configurable different test suites, test cases, their configurations, scalability, etc. These applications should utilize services and infrastructure provided by the cloud. Test tools protocols and services should be containerized to make them loosely coupled, reusable, and enabling faster development and deployment.

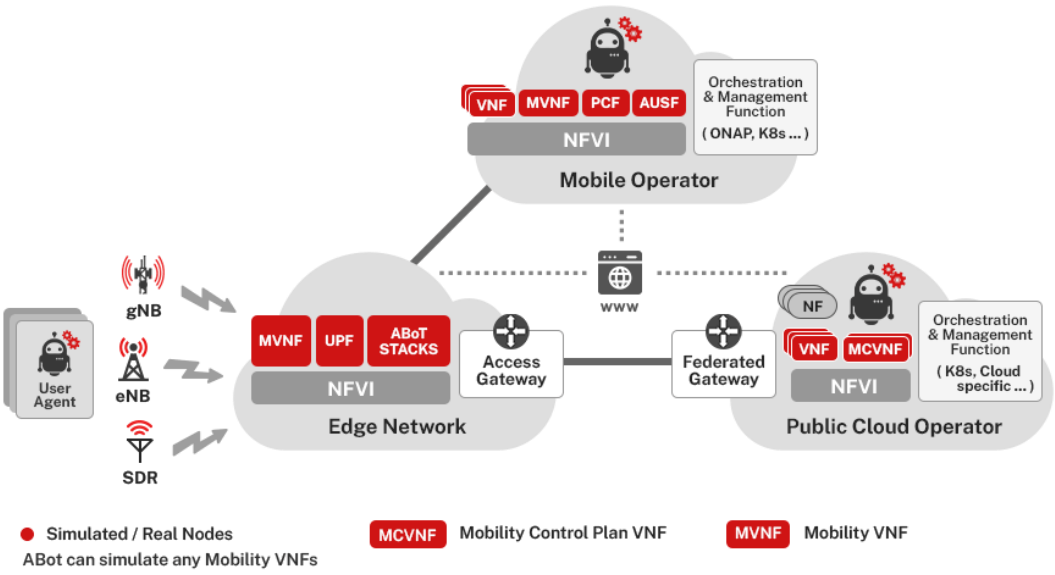
8. ABot for 5G-MEC Deployment Validation and integration:

ABot from Rebaca Technologies is a 5G/ORAN Network Protocol Tester and Analytics solution for End-to-End (E2E) Call Flow validation.

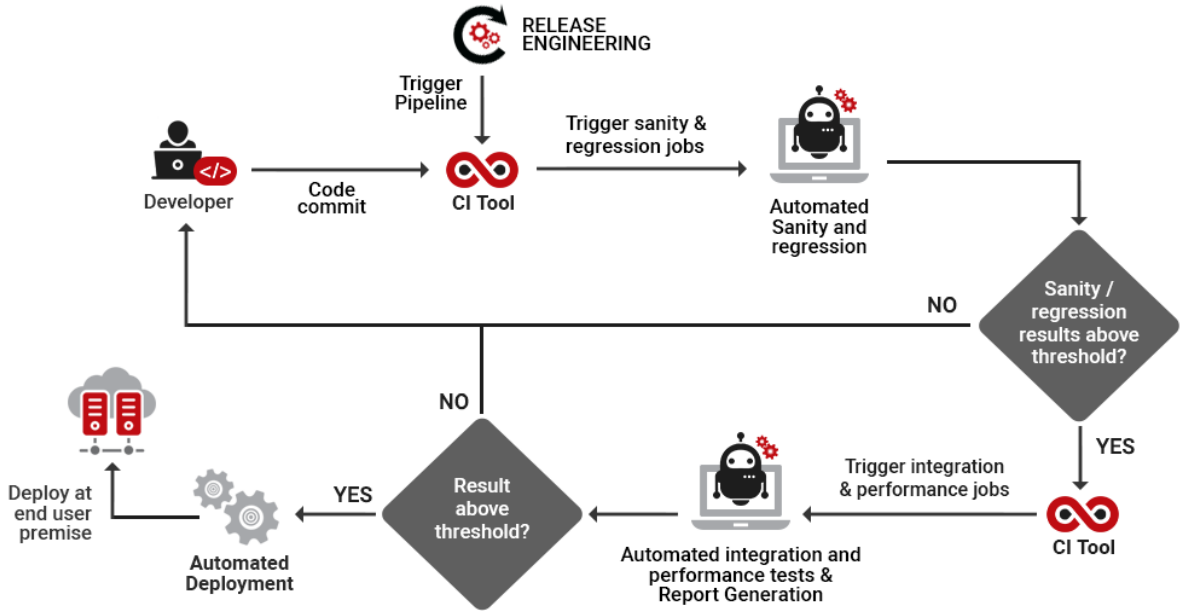
- **REST API Support**: ABot is Cloud native and its extensive REST API support enables it to work with other Orchestrators, Configuration & Provisioning tools. ABot architecture enables rapid implementation of new network protocol messages associated ABot as 5G- MEC Validation tool for Operators and End Customers.

- **Light weight stacks:** ABot's emulated protocol stacks are very lightweight and versatile to fit various architectures of the 5G- MEC solution for the different verticals. It can facilitate the integration of multi-vendor solutions within the RAN and the 5G Core.

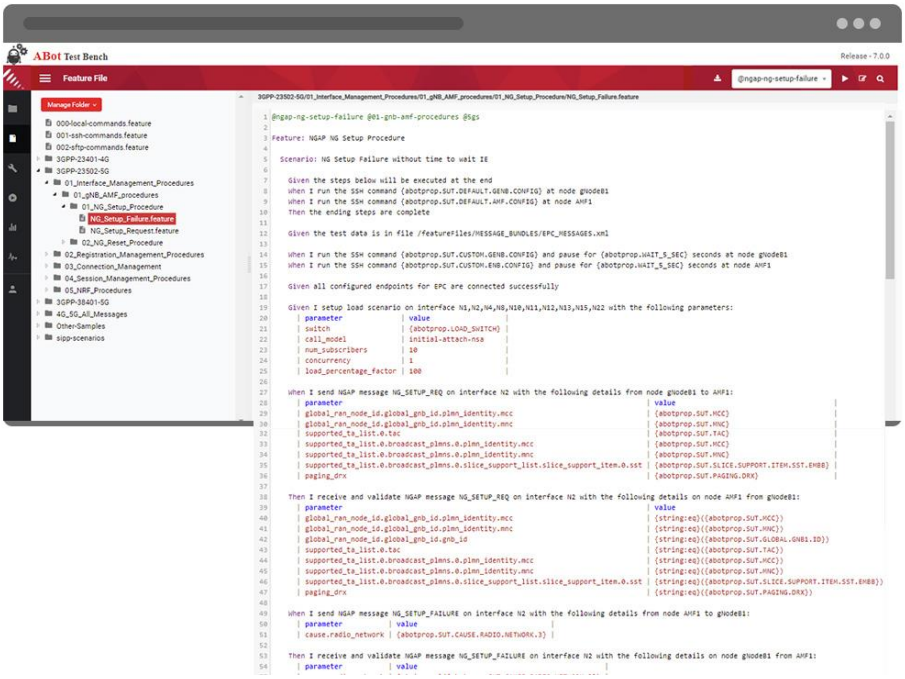
- **Infrastructure friendly:** 5G-MEC platform comprises of Edge and Cloud infrastructure of various configurations and capabilities, which can scale up and down in real-time. Hence it is important to validate a use case and the performance of the associated NFs on various infrastructure configurations. ABot cloud native stacks are lightweight and can easily be deployed on any network configuration.



- **CI/CD Integration and automation Support:** ABot test cases, the Analytics engine, and the extensive REST support for integration with any Orchestrator and CI/CT/CD pipeline make it an effective tool for 5G-MEC solutions.

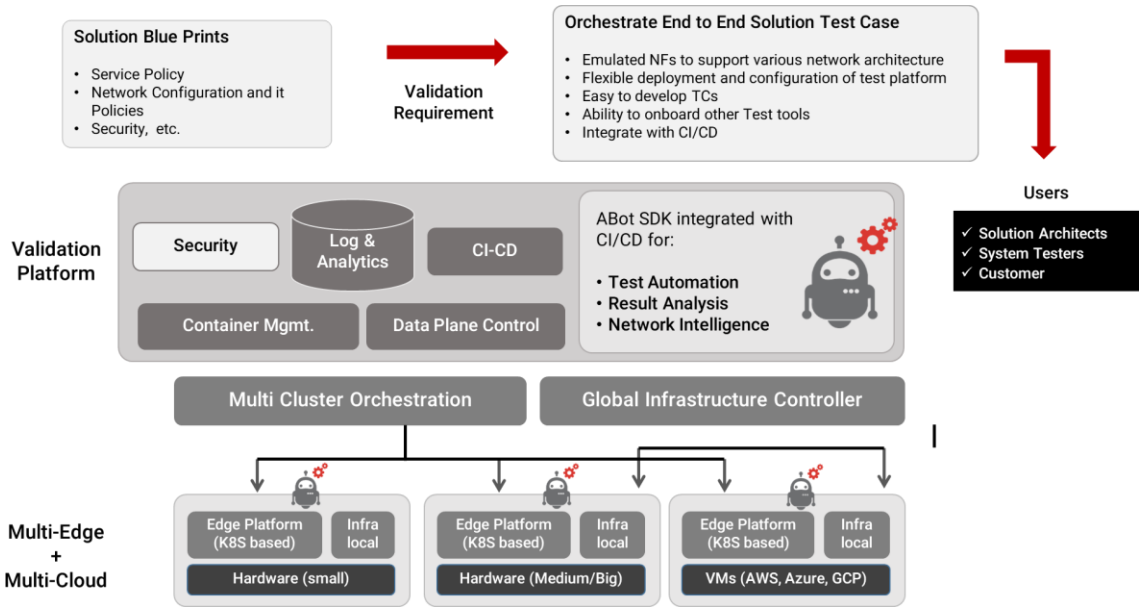


- **Extensive user friendly Use-Cases:** ABot provides extensive number of use-cases based on 5G slicing, be it eMBB, URLLC or mIoT. ABot English like e2e test scripts are easy to modify and can be executed by the operations team to deploy, verify, debug, and maintain a network. As these test cases are written in English like DSL, they are easy to understand for the operation & support team. They can even be provided to customers as a canned test case repository.

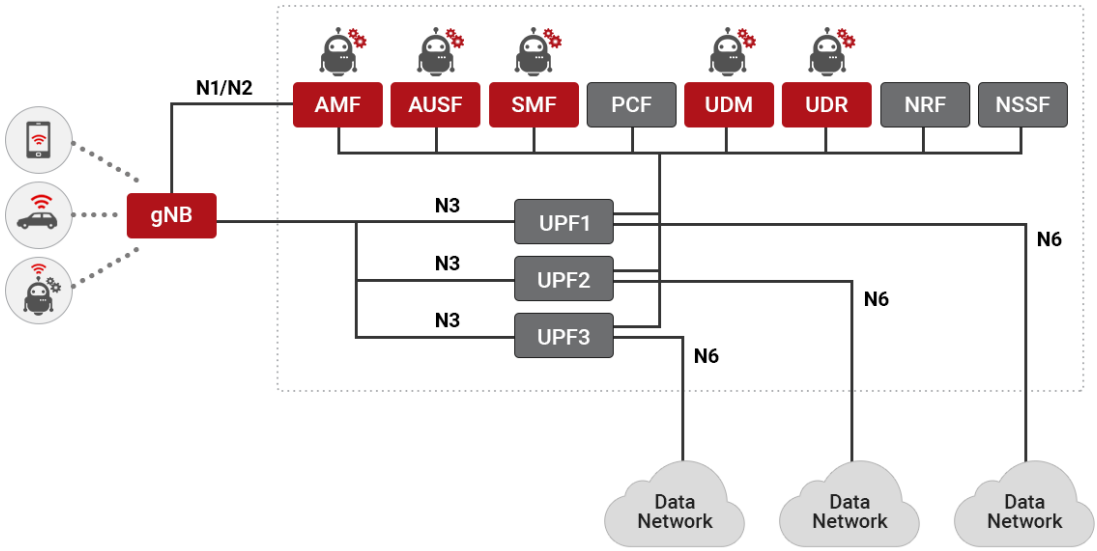


- **Helps in secured 5G-MEC deployment:** It is required to study network behavior models against which real time production network traffic patterns can be compared and verified. ABot behavior driven test cases and their Analytics enables one to capture various KPIs for different e2e uses cases and create models of expected behavior needed for anomaly detection.

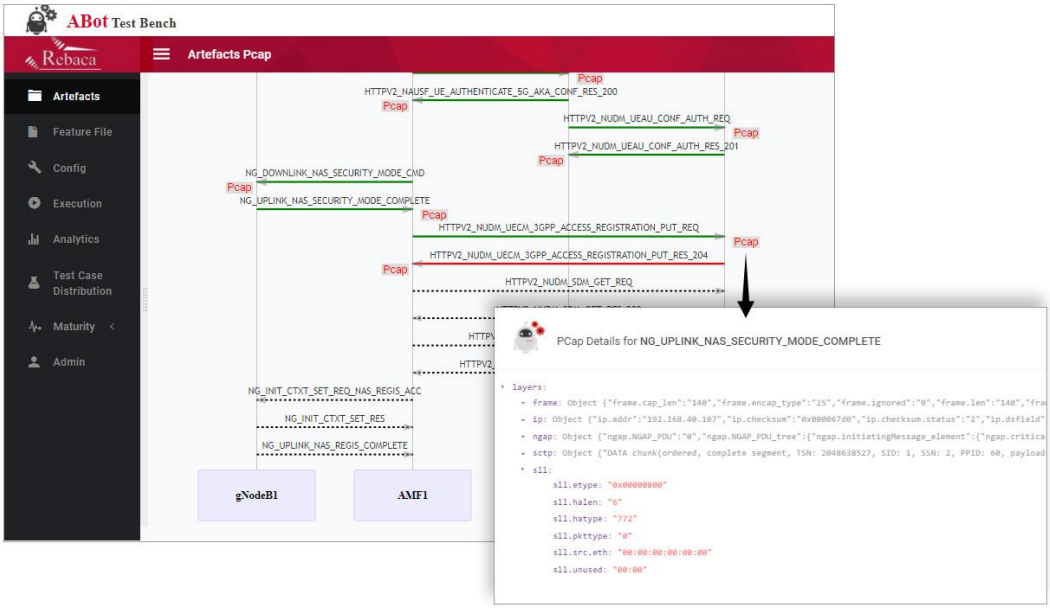
- **Distributed Architecture support**: ABot can be used to validate the various MEC exemplary reference architecture deployment models by running use case specific scenarios. One can utilize the flexibility of the test case and its REST support to automate validation of different architecture, emulate any NF required, etc. for the use case.



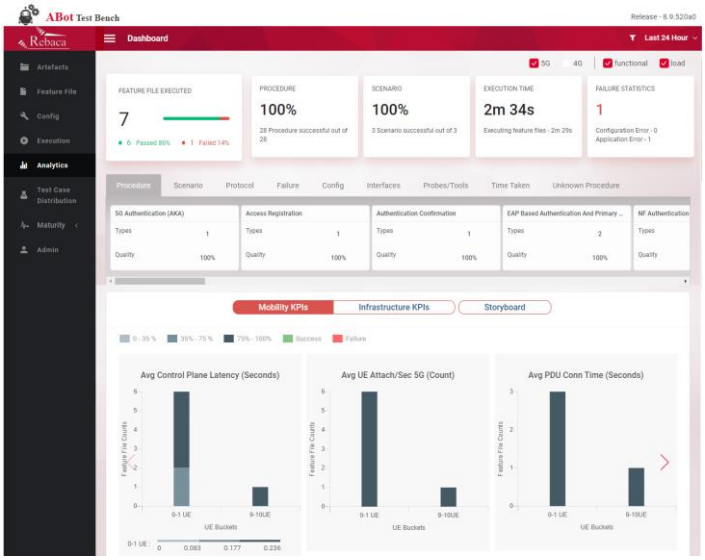
- **Network Slicing support:** ABoT provides the ability to select a particular 5G slice and generate traffic required to test the application use case on a MEC Platform. ABot test cases can be used to validate both functional and performance scenarios to help understand the scalability of a solution on any platform.



- **Analytics Support:** The Analytics module of ABot based e2e test case can be used to validate various aspects of solution deployment. ABot can help establish a correlation between Network Function performance and its infrastructure KPIs (NFVI, Container, etc.). Various network related KPIs are also derived from the executed test cases.

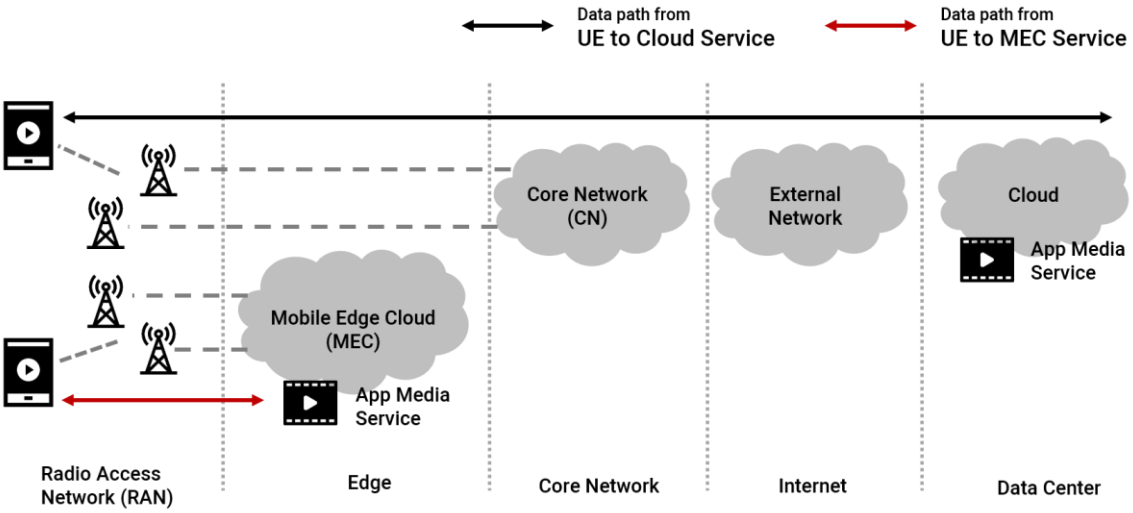


- **Providing Root Cause Analysis**: Intelligent correlations of KPIs enable optimization of the 5G-MEC platform resources. The network and infrastructure KPIs captured by ABot and the associated analytics generated, can be used to understand the behavior of the 5G-MEC platform against different use cases executed. This helps in root cause analysis.



- **Traffic characteristics analysis:** KPI information provided by ABot can be used to generate traffic characteristics models which can be used for modeling and understanding network and infrastructure behavior against different use cases. Such behavioral models can be used for maintenance, network planning, and detecting security threats for 5G-MEC network.

- **Video Traffic Slicing Support:** With respect to latency, bandwidth requirement, speed, guaranteed service level agreement, mobility, energy efficiency, data security ABot can simulate use-cases where different types of video traffic would be sliced as per the SSTs. This provides an assessment of the different ways the slices will operate.



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