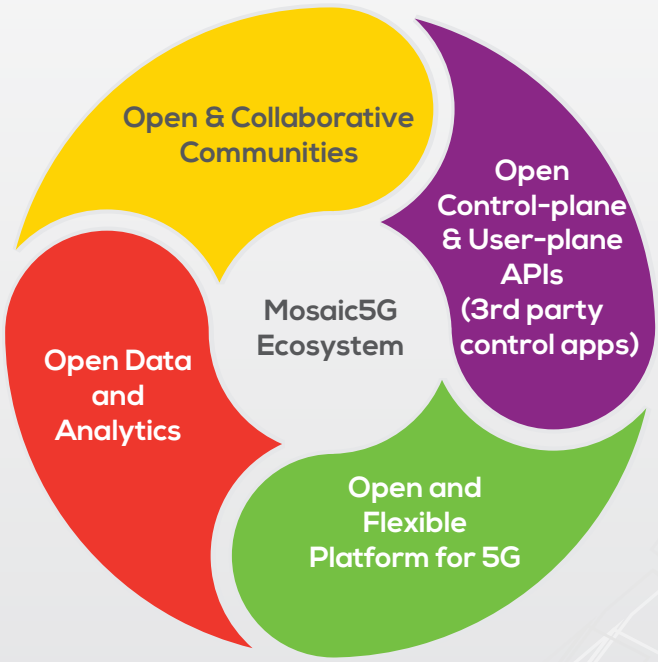
Mosaic5G

A community Led Consortium

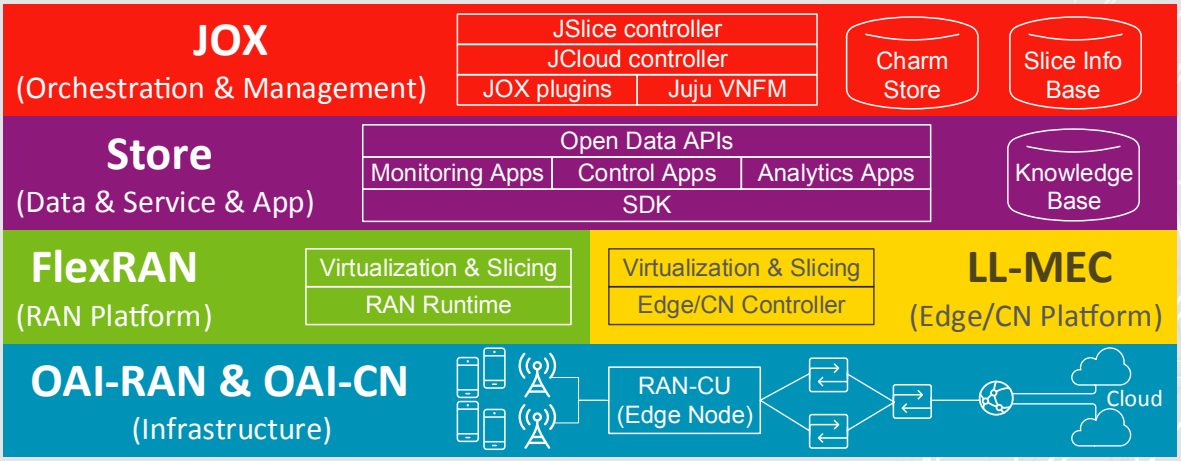
For Building Agile 5G Service Platforms & Opening Fast Wireless Innovation

Mosaic5G goal & ecosystem

Mosaic5G is a non-profit consortium-led initiative fostering a community of industrial and academic contributors for open-source software development to realize the 5G service-oriented vision. Mosaic5G is formed to develop, promote, and share an ecosystem of open-source platforms and use cases for 5G system research and development leveraging software-defined networking (SDN), network function virtualization (NFV), and multi-access edge computing (MEC) technology enablers.



Mosaic5G ecosystem schema



Mosaic5G currently provides five main platforms that are accessible through https://gitlab.eurecom.fr/mosaic5g/mosaic5g

(1) JOX is an event-driven Juju-based service orchestrator core with plugins to interact with different network domains.

(2) FlexRAN is a flexible and programmable platform to enable software-defined radio access network.

(3) LL-MEC is an ETSI-aligned MEC platform that can act as software-defined core network controller.

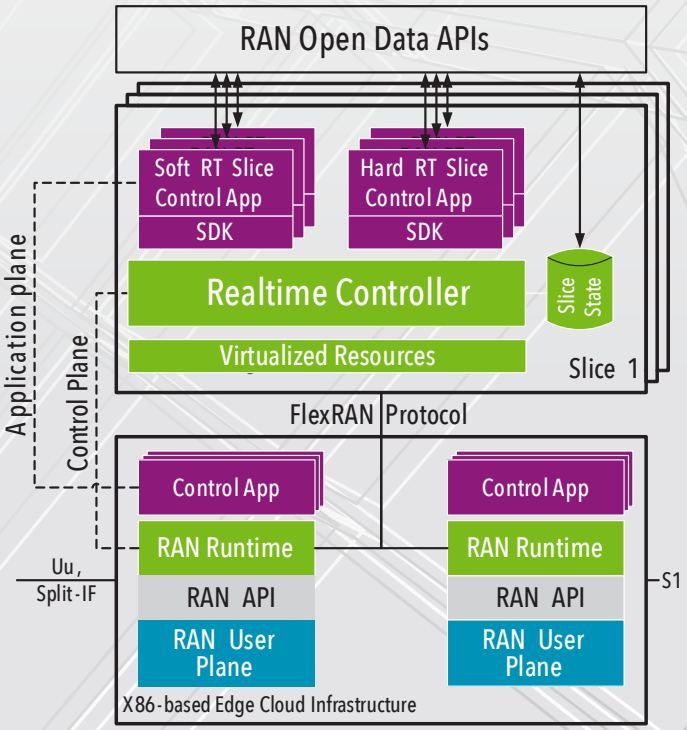
(4) OpenAirInterface RAN (OAI-RAN) is a 3GPP compatible implementation of a subset of RAN features in Release 14 with support of FlexRAN.

(5) OpenAirInterface CN (OAI-CN) is a 3GPP compatible implementation of a subset of CN features in Release 12 with support of LL-MEC.

Additionally, a constellation of platform packages, software development kits (SDKs), network control applications and data sets is included under Mosaic5G Store repository.

FlexRAN
in a nutshell

FlexRAN platform is the first open-source software-defined RAN platform and is designed with flexibility supporting separate control and user plane operations. Moreover, it can either centralize RAN domain control logics among multiple base stations or delegate control decisions in a distributed manner. Hence, FlexRAN provides modulated control functions, separated controller/agent control framework and well-defined APIs for "on-the-fly" control reconfiguration.

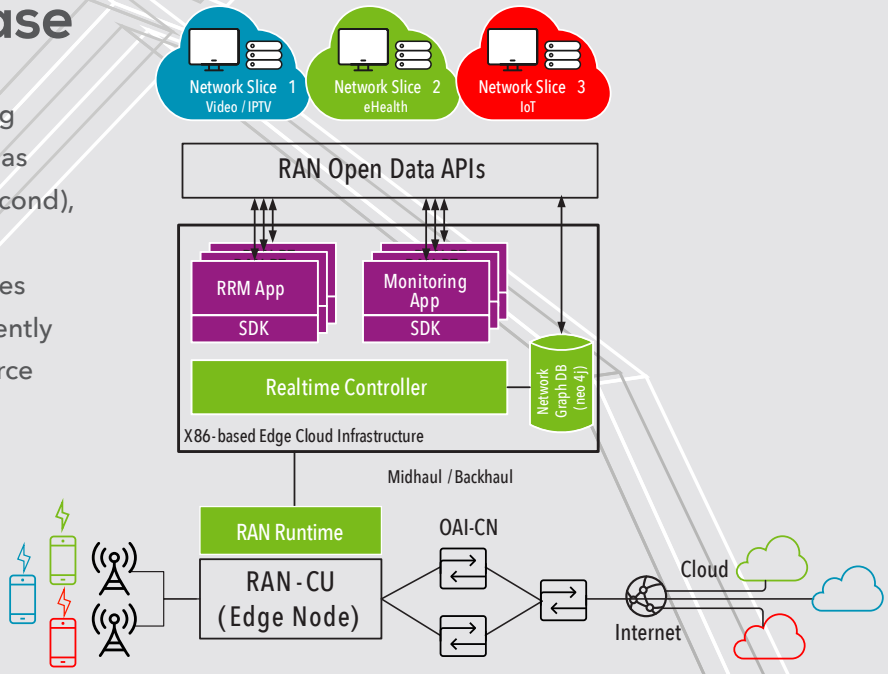


FlexRAN architecture

Two key elements resides in FlexRAN architecture: (a) Real-time controller (RTC) that enables coordinated control over multiple RANs, reveals network graph primitives and provision SDKs for control application, and (b) RAN runtime that acts as a local agent controlled by RTC, virtualizes underlying RAN radio resources, pipelines RAN service function chains and provides SDKs enabling distributed control applications. Practically, the developed FlexRAN protocol between RAN runtime and real-time controller can provide several characteristics: provide statistics, enable reconfiguration, trigger event and delegate control.

FlexRAN showcase

FlexRAN enables the slice-specific resource abstraction and scheduling to fulfill service requirements, such as throughput (Mbps), latency (millisecond), and reliability (packet drop). For instance, three different slice services (video, eHealth, IoT) can independently apply their customized radio resource management (RRM) control logics.

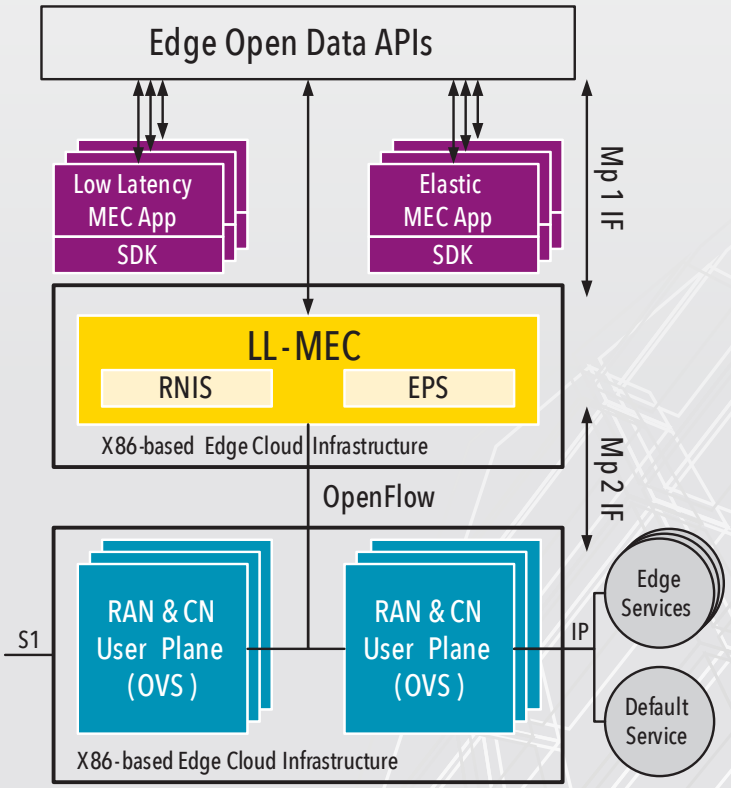


LL-MEC in a nutshell

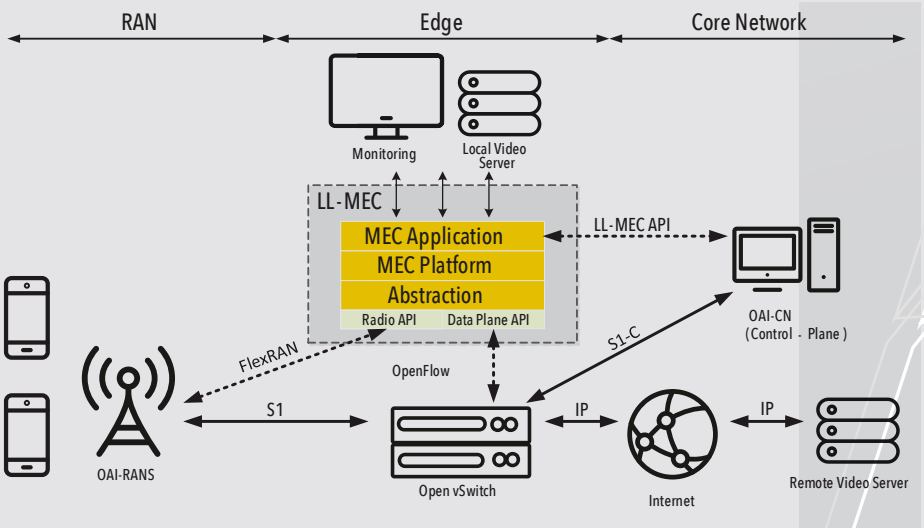
LL-MEC platform leverages SDN principle to separate user plane processing from its control logics at the edge and core networks. With OpenFlow, the user plane is abstracted for the purposes of monitoring, analysis and control. The OpenFlow protocol is applied over the Open Virtual Switch (OVS) to enable user plane programmability. Further, SDKs are provided to enable a flexible MEC application development environment.

LL-MEC architecture

LL-MEC platform is aligned with the ETSI MEC Mp1 and Mp2 reference interfaces. The Mp1 interface enables low-latency or elastic MEC applications through Core API, REST API and message bus, while Mp2 can instruct user plane how to route traffic among applications, networks, services, etc. Within LL-MEC, two services are provided: (a) Edge packet service (EPS) (equivalent to traffic rule control) that manages the static and dynamic traffic rules and handles multiple OpenFlow libraries and OVS, and (b) Radio network information service (RNIS) that exposes real-time RAN information (e.g., user and radio bearer statistics) and delegates the control decision over the user plane.



LL-MEC showcase



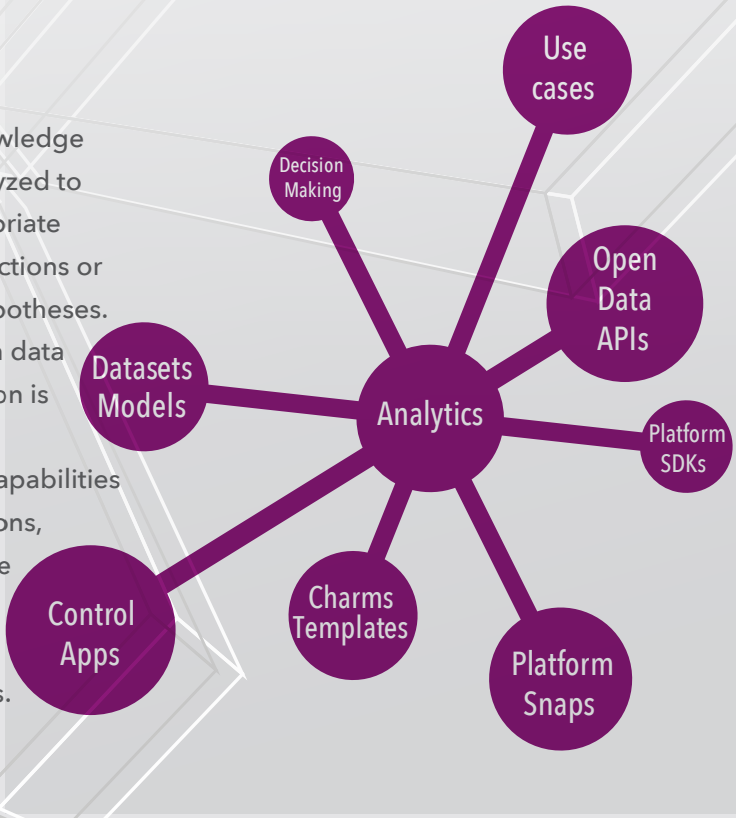
LL-MEC enables versatile applications, such as radio-aware video content optimization. It can adjust video quality based on the real-time per-user wireless channel quality to reduce the video stalling and to utilize all available radio resources. For instance, a user with poor channel condition only receives a 240p video, while another one can enjoy 4K video streaming when it is close to the base station.

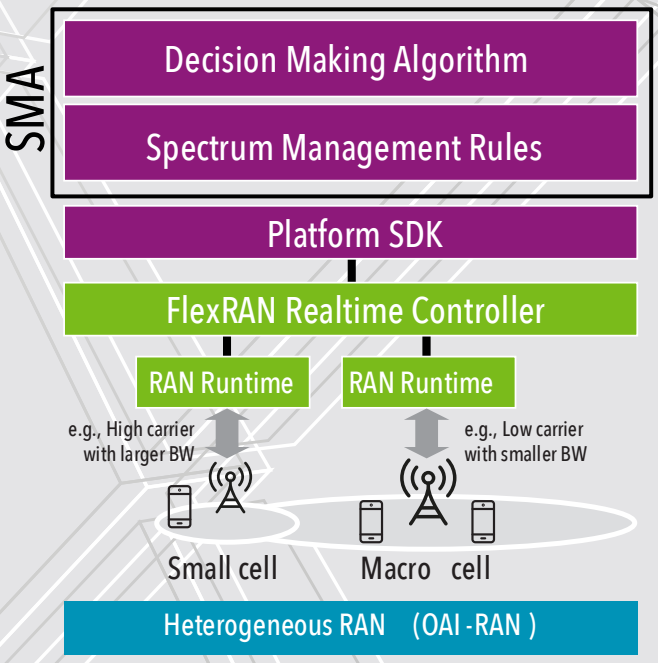
Store
in a nutshell

Store is in the form of a distribution repository that contains a constellation of platform packages, SDKs, control applications, datasets and models. It aims to develop and bundle plug-and-play network applications tailored to a particular use case, and also to compose and customize a network service delivery platform across reusable applications.

Store features

Store applications can operate either on a real-time structured data, i.e., JSON, that is being produced or on the previously recorded datasets as the offline mode. Datasets are the aggregated network information that can be processed to identify possible anomalies and to forecast future patterns. It can be utilized to generate the knowledge base and be analyzed to either find appropriate network control actions or validate some hypotheses. Through the open data APIs, an application is able to publish its knowledge and capabilities to other applications, or subscribe to the knowledge and capabilities from other applications.





Store showcase

Spectrum management application (SMA) is designed to manage and process different spectrum management policies and rules defined by various stakeholders (e.g., national regulator, license owner). Practically, SMA interprets these policies and makes decision on the eligible ways of spectrum usage that are decided based on a set of rules defined by the service providers. Finally, the optimal ones are enforced towards underlying RANs.

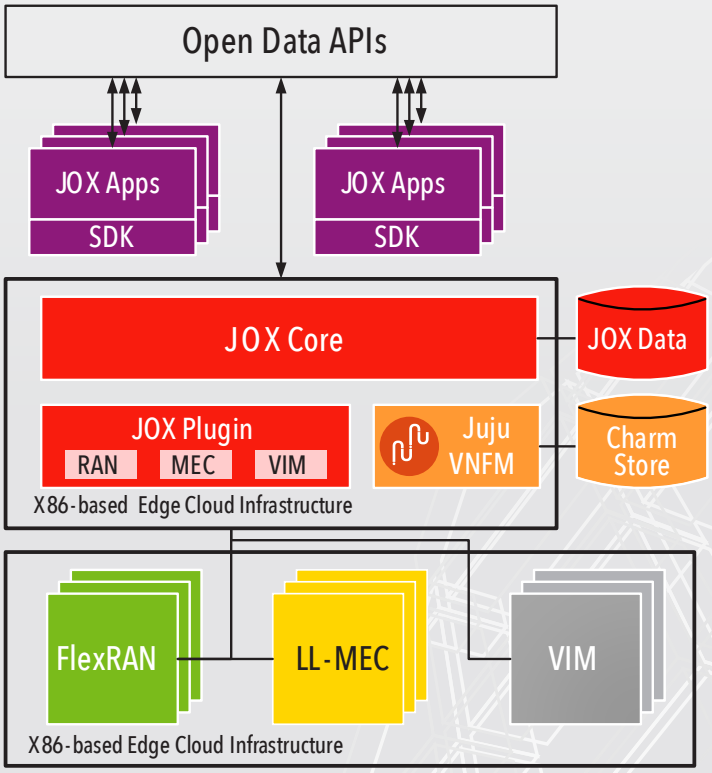
JOX

JOX
in a nutshell

JOX is a Juju-based orchestrator for the virtualized network that natively supports network slicing. Using JOX, each network slice can be independently optimized with specific configurations on its resources, network functions and service chains. JOX operates on top of the Juju virtual network function management (VNFM) with a plugin architecture to interface with FlexRAN, LL-MEC and virtual infrastructure management (VIM).

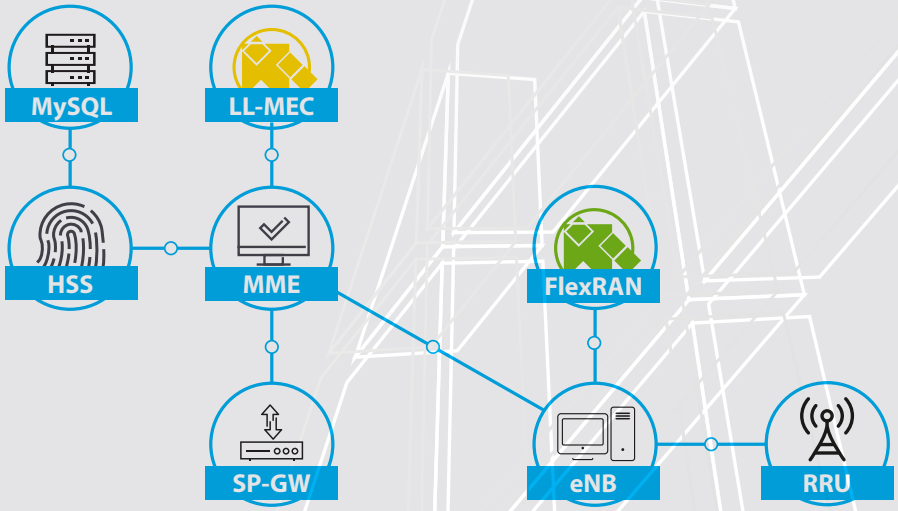
JOX architecture

JOX architecture includes two main components: (a) JOX core that includes JSlice and JCloud controller to control slice and cloud resources respectively, and (b) JOX plugin framework that enables different plugins for RAN, CN, MEC, and VIM to enable fast reactions like event handling and monitoring. Furthermore, it exposes the north-bound REST API to enable several basic operations such as create, (re-)configuration, on each JSlice, connected to a JCloud.



JOX showcase

JOX can orchestrate the deployment of the standard LTE service chain, i.e., eNB, MME, SP-GW, MySQL, HSS for a new JSlice, in different environments ranging from physical machine, container or virtual machine. Service dependencies may exist when deploying chains (e.g., the relationship between MySQL and HSS cannot be built until HSS is installed and configured). JOX orchestrates the service deployment and automatically handle dependencies and conflicts via Juju without any other actions.



Mosaic5G miscellany

Use cases

eHealth: Reshape the healthcare application in Health 4.0

5G provides innovative service with ultra-reliability and low-latency for touch and actuation in real-time throught the RAN programmability exposed by FlexRAN. Virtual and augmented reality provides an immersive therapy experience served by LL-MEC. To trigger healthcare application, eHealth service is supported by Store that provides exposed APIs for service-specific data handling.

Green Networking: 5G Network slicing leads to smart grid innovation

Verticals represented by smart grid application will complete digital transformation in 5G era. Via FlexRAN, diverse quality-of-service (QoS) demands in power grid areas can be fulfilled. JOX can manage scalable electronic device communications in a seamless manner. The distributed energy monitoring of shared network can be enabled by Store apps.

V2X: Enabling future intelligence transportation system

V2X enables the communication between vehicle with infrastructure, pedestrian, and network. Various communication services requirements on dedicated RAN/CN domain resources can be controlled by FlexRAN and LL-MEC. Multiple access technologies among public and private transportation systems can be managed by JOX. The P&P applications will rely on SDKs and datasets offered by Store.

IoT: Leveraging IoT, Innovations shifts from products to solutions

5G IoT can use critical machine-type communication for monitoring or mobile broadband communication for events. JoX can orchestrate and manage resources adhering different IoT needs. FlexRAN can serve for the needs of multi-service real-time IoT communications. While LL-MEC apps can offer content-based services adaptive to mobile edge computing for IoT.

Channel and venue

Mosaic5G **facts**

Mosaic5G was initiated as a natural evolution to build an agile 5G services platform on top of OpenAirInterface infrastructure.

Mosaic5G **membership**

User	Contributor	Sponsor Partner
Free of Charge	Free of Charge	Membership Fee
Access to the code and documentation	Access to the code and documentation	Establish a collaborative R&D project
Access to mailing lists and get support	Access to training and prototyping sessions	Create a collaborative PoC
Share use-case and PoC	Access to new features and fixes	Member of advisory board
	Lead a collaborative R&D project	Access to the Mosaic5G lab environment
	Contribute to the source code	User and partner benefits

Licensing model

Mosaic5G software components are under Apache V2.0 license. Licensing model of a new software component may be specific.

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Website: http://mosaic-5g.io
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