Mosaic5G.io
Enabling Agile 5G Service platforms
What is Mosaic5G?

An ecosystem of projects delivering agile 4G/5G service platforms and tools

For rapid prototyping
Why Mosaic5G?

Leverage SDN, NFV, MEC, and AI tech enablers

&

Complement OpenAirInterface in building an E2E solution
Why Mosaic5g?

Open Wireless Innovation

Enabling Agile 5G Service Platforms

Fusion of communication, computing, and analytics
Mosaic5G Stack

**JOX**
(Orchestration & Management)

- JSlice controller
- JCloud controller
- JOX plugins
- VNFM

**Store**
(Data & Service & App)

- Open Data APIs
  - Monitoring Apps
  - Control Apps
  - Analytics Apps
  - SDK

- Knowledge Base

**FlexRAN**
(RAN Platform)

- Virtualization & Slicing
- RAN Runtime

**LL-MEC**
(Edge/CN Platform)

- Virtualization & Slicing
- Edge/CN Controller

**OAI-RAN & OAI-CN**
(Infrastructure)

- RAN-CU (Edge Node)
- Cloud

12/11/2019
FlexRAN (2015-Present)
A Flexible and Programmable Platform for SD-RAN

- Realtime and Non-Realtime RAN control
  - centralized and distributed
- Enable RAN intelligent through meshed control apps
  - Decouple control plane from control logic
  - Multi-level abstractions to support different RAN deployments
  - Monolithic, Cloud-RAN, Disaggregated RAN
  - Extendable FlexRAN Control-plane protocol
- Network Store: an ecosystem of network app developers
  - FlexRAN SDK and App SDK
  - Extendable APIs
LL-MEC (2016-Present)
A Low Latency Multi-access Edge Computing Platform

- Abstraction and Programmability on UP
- Radio network Information basis status through FlexRAN
- IP-service endpoint and real-time RAN information on per user/service/flow level
- Network Store: an ecosystem of network app developers
  - LL-MEC SDK and App SDK
  - Extendable APIs
JOX (2017-present)
An event-driven Orchestration Core

- Network Slicing and subslicing Support
  - TOSCA compliant for slice and subslice templates
  - package generator

- Template manager and onboarding
  - package generator

- Optimize the operational environment
  - Slice-specific logic
    - optimization in VNFs scheduling and network slicing

- Northbound APIs
  - Expose a REST northbound API
  - Slice-specific life-cycle operations
STORE (2018-present)
A Distribution Repository of Reusable Network Applications

- **Use cases**
- **Open Data APIs**
  - 4G/5G meshed service based
  - Software Development Kits
    - Facilitate the design, development, test and update of an application
    - Include libraries that implement specific functions/methods for network programmability/monitoring/control
  - Open Data API
    - Be coupled with SDKs and place the apps at the center of the 5G network to publish their capabilities
    - Perform diverse operations to the underlying network including monitoring, control, and programming
  - Datasets
    - Collect realistic set of datasets using Open5G lab at EURECOM
    - Produce new set of datasets and share with the R&D community upon request

- Datasets Models
- Control Apps
- Charms Templates
- Platform Snaps

- Decision Making
Mosaic5G Ecosystems

MOBILE OS & DEVICE MAKERS

NETWORK APP DEVELOPERS

TELECOM TECHNOLOGY PARTNERS

SERVICE PROVIDER
Salient Demonstrated
Mosaic5G Use-cases

- Flexible functional split (JoX)
- Network slicing and vBS (FlexRAN, LL-MEC, Store)
- Mobility Management (FlexRAN, Store)
- Spectrum Management (FlexRAN, Store)
- RAN data mining and Analysis (FlexRAN)
  - https://www.crawdad.org/keyword-4G.html
- Centralized Coordinated Scheduling and Interference management (FlexRAN)
- RAN-aware video optimization (LL-MEC and FLEXRAN)
- Load balancing and Traffic steering (LL-MEC)
- Zero-conf 4G service deployment (JoX)
Mosaic5G Next Step

Phase 1: Genesis
- Mosaic5G & social media

Phase 2: Inception
- Mosaic5G waves

Phase 3: Establishment
- Mosaic5G demos & talks
- ETSI, ITU, IEEE, MWC, EUCNC
- >40 members have joined the community (operators/vendors, R&Ds, academia)

Phase 4: Maturity
- Mosaic5G vibes & community support
- Community feedback & Discovery Report

We are here
Merge → OSA
Mosaic5G-Contact

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Twitter: @mosaic5g
Linkedin: mosaic-5g
FlexRAN (2015-present)
A Flexible and Programmable SD-RAN Platform

- Plug & Play control apps
  - SDK for App-to-App and App-to-RAN
- FlexRAN Master Controller
  - Top level controller/orchestrator
  - eNB/UE state and resources
- FlexRAN Runtime
  - Abstraction and programmability of network functions
  - Extendable RAN APIs
  - Virtualized resources and states
  - Local controller
  - Support for heterogeneous deployments
- FlexRAN Protocol
  - Statistics
  - Configurations
  - Commands
  - Event Trigger
  - Control delegation
RAN Slicing use-case with DECOR


**LL-MEC (2016-present)**

A Low Latency Multi-access Edge Computing Platform

- **Plug & Play control apps**
  - Video Optimization

- **Application manager (Mp1)**
  - Low-latency: CoreAPI, MBus
  - Elastic: RestAPI, MBus

- **Platform (Mp2)**
  - Edge packet service (EPS)
    - Multi OpenFlow libs
    - Static and dynamic rules
  - Radio network information service (RNIS)
    - Real-time RAN information

- **Abstraction**
  - U-plane APIs: OF Agent
JoX (2017-present)
An Event-Driven Orchestration Core

- JoX orchestrates the E2E service lifecycle according to the slice manifest
  - Network slice and subslice Templates
  - Application APIs
  - Template manager
  - Slice/subslice manager
  - Plugins
- Manages the services over the infrastructure
  - Kubernetes and Operator
  - Juju and Charms
- Cloud Infrastructure
  - Physical machine, Docker, LXD, KVM, Manual
JoX Slices and sub-slices example

JoX Slices and sub-slices

MySQL
OAI-HSS
NSS₁
OAI-MME
OAI-SPGW
NSS₂

Model

OAI-HSS
OAI-MME
OAI-SPGW
OAI-SGW
OAI-HSS

12/11/2019
- **5G NR**
  - gNodeB

- **IoT**
  - LTE-M
  - NB-IoT
  - CU/DU split
  - NFAPI

- **5G Core**
- **D2D**
  - ProSE/LTE-V2X
- **FeMBMS**

- **Data-center deployments**
  - vEPC (OpenStack, Docker, KVM)
  - RCC (RRC,PDCP), VNFs
  - RAU (RLC/MAC,L1-high), V NFs or PNFs
  - RRU (L1-low), PNF
FlexRAN Abstraction
FlexRAN Abstraction

- **Resources** Radio spectrum resources, e.g., carriers, resource blocks, bandwidth

- **Processing/Capabilities** Functional block for CP/UP operations, delimited through functional block and described with capabilities

- **State** Status of BS CP/UP processing and associated configuration
FlexRAN Abstraction
FlexRAN Abstraction

1. Heterogeneous, disaggregated RAN

2. Homogeneous view for infrastructure owner

3. Embedded slices, infrastructure owner view

4. Embedded slices, slice owner view
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IoT
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5G Core

D2D
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FeMBMS

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Mosaic5G Use Cases

**E-HEALTH**
- Reshape the healthcare application in Health 4.0

**IOT**
- Leveraging IoT, innovations shift from products to solutions

**V2N**
- Enabling future intelligence transportation system

**GREEN NETWORKING**
- 5G Network slicing leads to smart grid innovation
Mosaic5G Call to Community for Innovation
MOSAIC5G MEMBERS

50+

NOKIA Bell Labs

EURECOM

TOSHIBA

bcom

Dell EMC

Inria

Group of Companies

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