Mosaic5G

Agile 4G/5G Service Delivery Platforms and UCs

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Use-case Driven Agile 4G/5G Service Platforms

Founded by Eurecom and Launched in 2016
Merged with OpenAirInterface in May 2021
OpenAirInterface

Founded in 2014 as a “Fonds de Dotation” = Endowment Fund

• A compliant 4G/5G RAN and CN components in a commodity x86 box or cloud infrastructure
  • Even major vendors adopt this approach to some extent

• Types of software
  • Amarisoft (closed-source, often combined with 3rd party OSS solutions)
  • OAI (open-source code, 4G/5G RAN and EPC/5GC, 3GPP-friendly licensing)
  • ORAN OSC (partially open-source RAN, 3GPP-friendly licensing)
  • srsLTE/srsRAN (open-source, 4G/5G RAN, OSI licensing)
  • OMEC (EPC, OSI Licensing)
  • Magma (EPC/5GC, OSI Licensing)
  • Free5gc (5GC, OSI Licensing)
  • Open5gs (EPC/5GC, OSI Licensing)
Towards OpenRAN and OpenCN

- Existing OpenRAN
  - TIP Open RAN
  - O-RAN
  - Open RAN (US)
  - Open RAN (JP)
  - Vendor-specific Open RAN solutions

→ Need for
  - Standardized Interfaces in a multi-vendor Ecosystem
  - 4G/5G Service-delivery Platforms
  - Reusable Components

- OpenCN
  - 3GPP Service-based architecture
  - Missing an SD-CN platform to enable runtime control
    - CP and UP programmability (e.g. mobility mgt, traffic redirection)

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Mosaic5G Dual Objectives

1. Provide an ecosystem of open source 4G/5G service platforms, reusable components and use-cases

Unlock open innovations in mobile networks

2. Provide Software-Development-Kits and Network App Store to compose a range of specialized 4G/5G network-service platforms tailored to diverse use-cases
Mosaic5G 3 Platforms Highlights
Unlocking OpenRAN and OpenCN Models

1. FlexRIC (SD-RAN): Flexible RIC and E2 Agent SDK
2. FlexCN (SD-CN): Flexible CN Controller and SDK
3. Trirematics: Intelligent RAN and CN operators
4. Use-case driven 4G/5G CI/CD platforms

➔ Data-driven 4G and 5G networking and more ...

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OSA/Mosaic5G 3 Platforms

**OSA/Mosaic5G 3 Platforms**

**Triermatics** (Orchestration & Management)
- AI Operator
  - Resource Control
  - Monitoring
  - CRD
  - Kubernetes
- Store Img Hub
- Blueprints

**FlexRIC** (Ran Platform)
- RT Controller
- RAN Agent

**FlexCN** (Edge/CN Platform)
- LL Controller
- Edge/CN Agent

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

**OAI public license 1.1** (4G+5G RAN, 5GCN, SPGW-C, SPGW-U, Mosaic5G)

**3-Clause BSD License** (4G MME & HSS)

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Cloud-native Telco Software
OAI/M5G Clusters

Controllers

RAN/CN UP
Edge Apps

kubernetes

kubernetes

Core / RAN C-Plane

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FlexRIC

A Flexible RAN Intelligent Controller and SD-RAN platform
FlexRIC
A Flexible RAN Intelligent Controller

• Following 5G design principles, FlexRIC
  • Comply with O-RAN E2AP

• Designed in a form of **SDK** to compose a range of SD-RAN controllers, each specialized for a particular use-case

• Multi-RAT, Multi-vendor, Multi-service
FlexRIC SDK

A Flexible SD-RAN platform

• **Generic E2AP agent and server library → SDK**
  - Compliant with ORAN-SC RIC/E2
  - Extendable and plug-and-play service models
  - Command line interface (CLI)

• **Controller Specialization, such as**
  - Slicing (FlexRAN like)
  - Recursive (in a same way as Flowvisor)
  - Realtime down to sub ms

• **Advanced Service models (SM)**
  - Fine-grained monitoring
  - Slicing Control, Traffic Control, Mobility Control
  - Network store

• **Design Features**
  - Ease-of-use, efficiency, reusability
  - SOLID design pattern
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FlexCN
Flexible Core Network Controller and SD-CN platform
FlexCN SDK
A Flexible SD-CN Controller

• Comply with 3GPP secure services and capabilities exposure (NEF)
• Designed in a form of SDK to compose a range of SD-CN controllers, each specialized for a particular use-case
  • Multi-roles: AF, NWDAF, P4 Controller
FlexCN SDK
A Flexible SD-CN platform

- Multi-Roles (scenario-dependent AF, NWDAF, )
- Monitoring per UE/QFI/Slice
- Traffic Control (AF/SMF/PCF/UPF)
- UE management (UDM/UDR)
- Mobility Management (AMF)
- Slice management (NSSF)

Traffic Control use-case:
- Traffic Redirection: TS 29.244 R 16.05 5.4.7
- Traffic Steering: TS 29.244 R 16.05 5.4.8
- P4 controller:
FlexCN SDK
Monitoring per UE/QFI/Slice

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Trirematics

An Agile RAN and CN operator
Trirematics T9S
An Agile 4G/5G Operator

• Day 0/1/2/n RAN and CN **Operator** in a cloud native environment
  • **Multi-x:** vendor, version, container, os, machine
  • **Mon-X:** Monitoring of RAN/CN and Infr. resources
  • **MLOPS:** ML engines, Models, and data-sets
  • **Auto-X:** Automate lifecycle OPs and decision making
  • **GITOPS:** Fast and reliable service delivery

• **Target**
  • ETSI ZSM Compatibility
Trirematics T9S Components

- Auto-X
- Monitoring (Mon-X)
- AI/ML (MLOPS)
- Mobile Network Resources (FlexRIC, FlexCN)
- Infrastructure Resources (cpu, memory, networking, etc.)

- Event/pull/push-based decision
- Zero-touch mobile network optimization
- Zero-touch optimization
- GITOPS

Multi-X Environment
(Kubernetes, openshift, docker, podman, etc.)

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Trirematics T9S
Multi-x deployment Example

Kubernetes Cluster

Node 1 (OS Ubuntu 18)
- 3rd party SW (e.g., srslte)
- oai-enb
- Container runtime (Docker)

Node 2 (OS Centos 8)
- oai-gnb
- oai-cn
- Container runtime (Docker) vs. Container runtime (podman)

Physical network

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Final Word

OSA Mosaic5G Project Group just bootstrapped

Unlock open innovations in Open 4G/5G RAN/CN arenas from a rich ecosystem of reusable platforms, components, and use-cases
Discover more at: https://openairinterface.org/mosaic5g

Join US for the 2021 Fall OAI Workshop: https://openairinterface.org/fall-2021-openairinterface-workshop/