0 Outline

1 General O-RAN Architecture

2 General Aspects and Principles

3 Current and Future Features

4 Slicing and TC SMs

5 Summary
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1 O-RAN Architecture

Figure: O-RAN Architecture
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2 General Aspects and Principles

▶ Principles
  > Forward compatibility/extensability
  > Lean/efficient i.e., zero overhead principle
  > Low coupling/agile. Support diverse use cases

▶ Design Features
  > O-RAN E2AP
  > Static and dynamic polymorphism
  > Plug-in system Lean/efficient i.e., zero overhead principle
  > Minimal yet complete APIs

▶ FlexRIC paper https://bit.ly/3uOXuCV
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3 FlexRIC v0.1

- E2AP protocol v1 (20/26 messages in ASN.1)
- MAC, RLC and PDCP Service Models to monitor
- nearRT-RIC and E2 Agent
- iApps for low-latency communication
- Approx. 10 K LOC

Figure: FlexRIC v0.1
3 FlexRIC v0.2

- FlexRIC has become Multi-X
  - Multi-vendor i.e., OAI and srsRAN
  - Multi-RAT i.e., 4G and 5G
  - Multi-language i.e., C and Python
  - Multi-agent
  - Multi-xApp

- New protocol between the xApp and the RIC i.e., E42
- New SMs have been developed (Slice and Traffic Control)
- FlexRIC has grown from approx. 10K to 50K LOC.
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4 Slice SM

➤ E2 Control Procedure
   > Add
     - Add a slice in the MAC scheduler
   > Modify
     - Associate a UE with a slice
   > Delete
     - Delete existing slice

➤ E2 Report Procedure
   > Slice Statistics
     - RAN: number of slices, slicing/UE scheduling algorithm, parameters for each slice
     - UE: number of connected UEs, associated slice for each UE
Figure: srsRAN 4G eNodeB and OAI 5G gNodeB monitoring PDCP, RLC and MAC SM
4 Traffic Control

- Currently 3GPP does not provide any mechanism to treat the flows carefully.
- Currently in 3GPP we only have the UPF and the SDAP and RC SM does not consider flows.
4 RRUL Amarisoft 5G SA
4 Traffic Control SM

- Treating data flows as first class citizens.
- We designed and implemented a Ran Function with 6 stages: Classifier, Policer, Queue, Scheduler, Shaper and Pacer.
- We achieved promising results that are under review.

Figure: Traffic Control
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FlexRIC has proof as a very valuable tool for our research work e.g., virtualization/recursion, ML/AI or TC.
FlexRIC is advancing at a considerable pace
Next release is planned for July
Thank you!