A Tour on FlexRIC

OPEN AIR INTERFACE

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Mosaic5G

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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

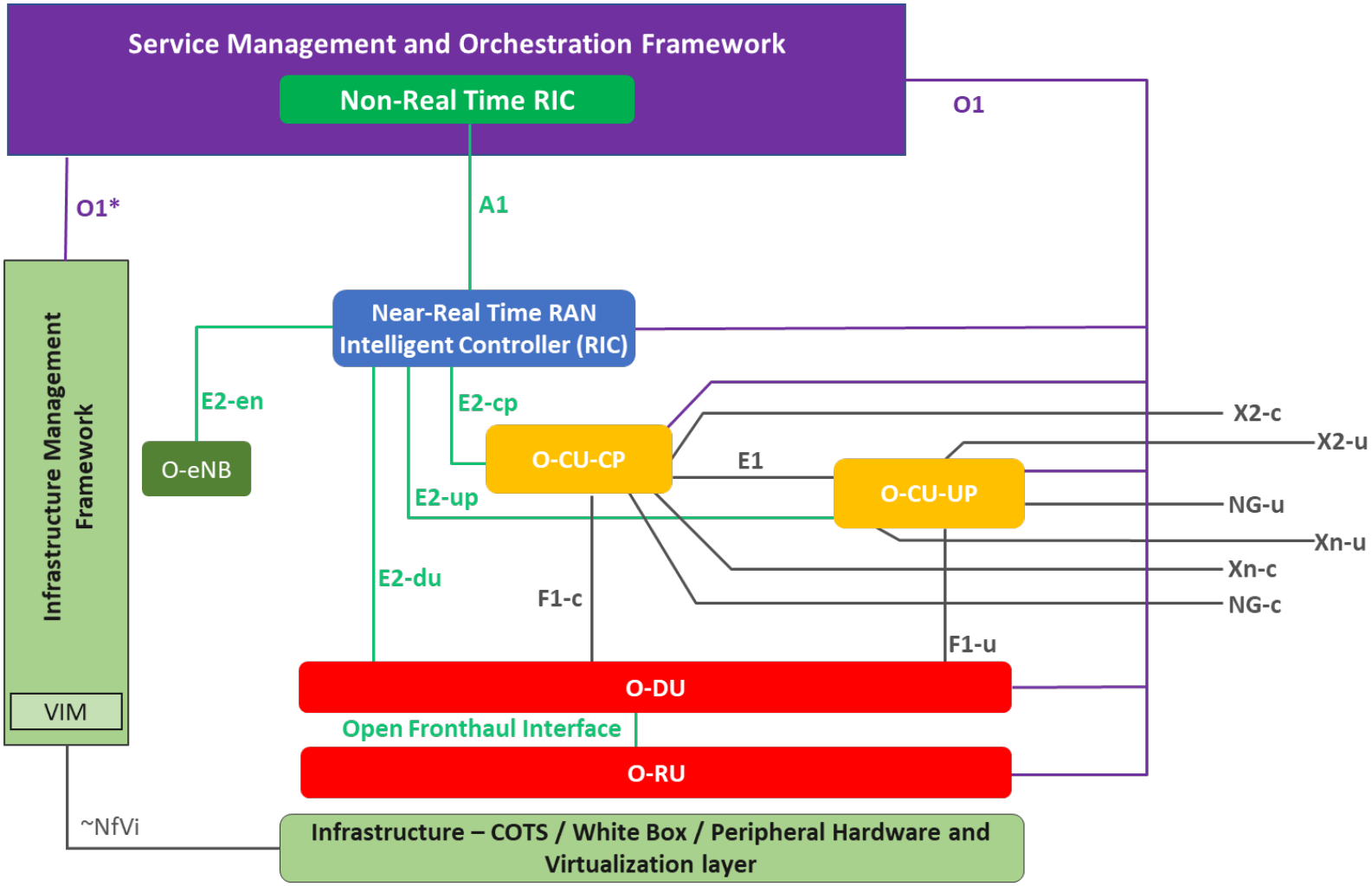

Figure: O-RAN Architecture

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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

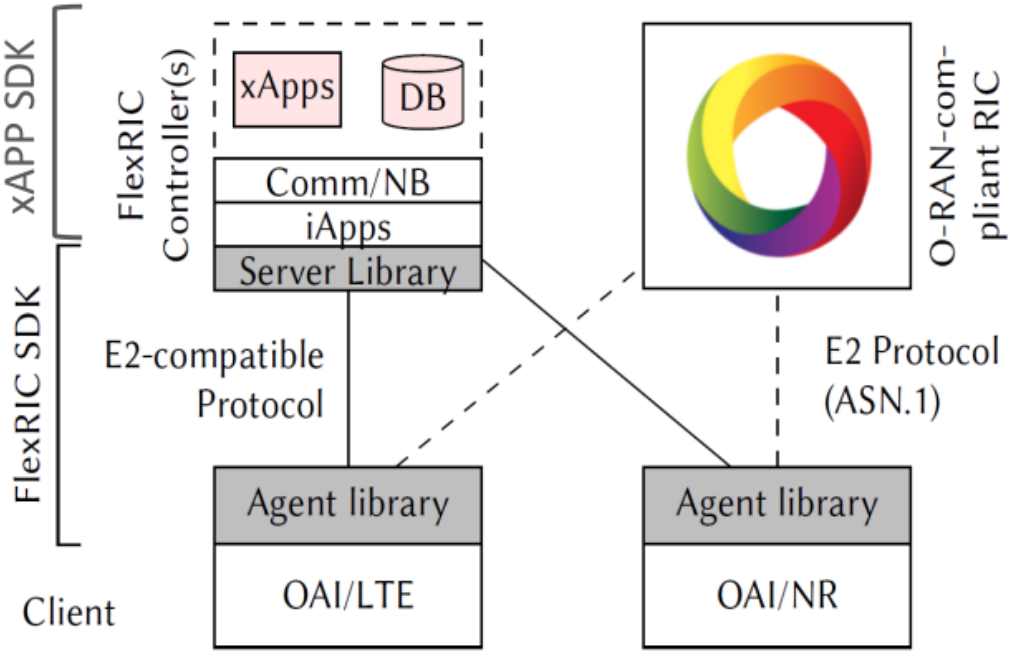

Figure: FlexRIC v0.1

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

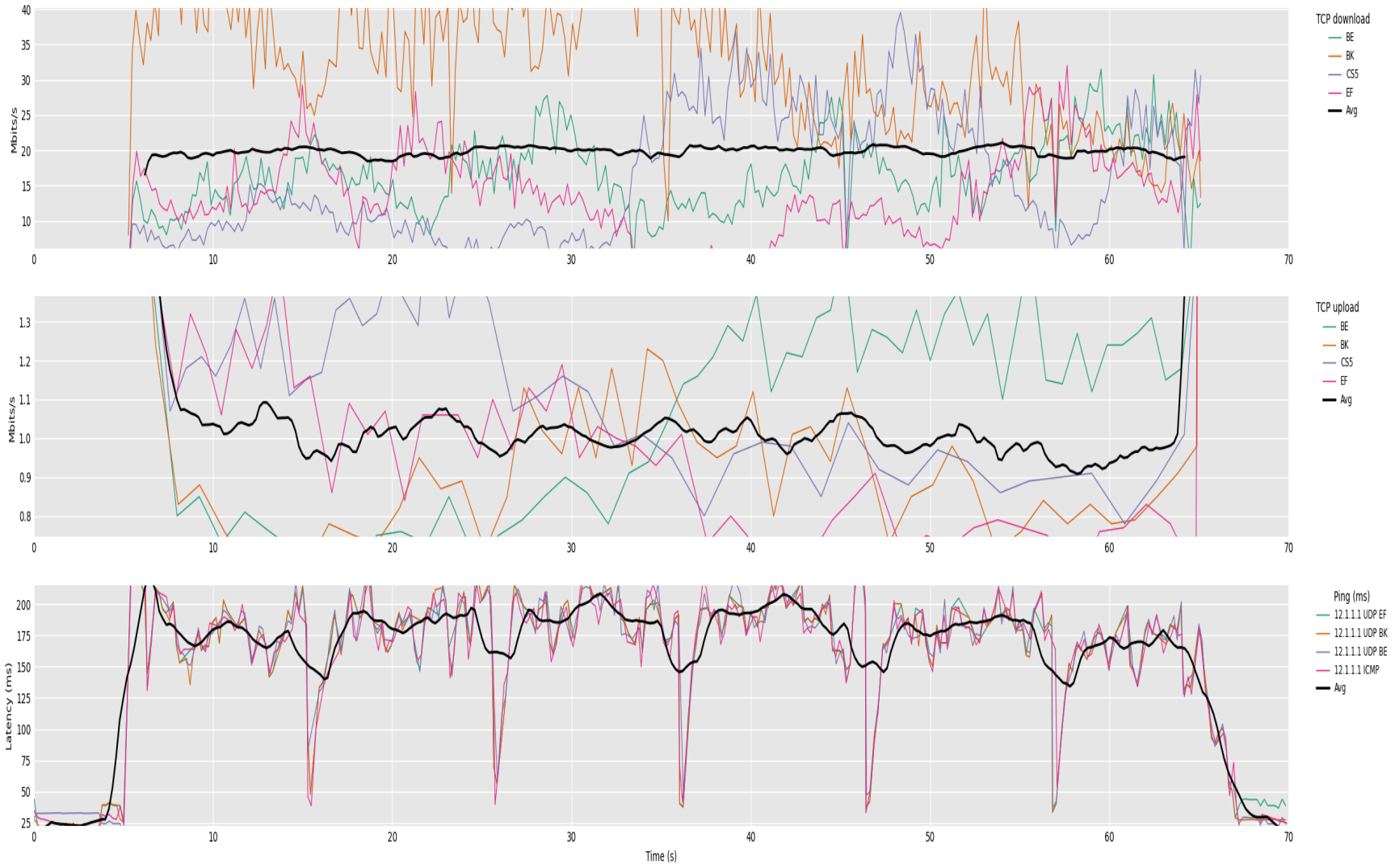
- E2 Control Procedure
  - Add
    - Add a slice in the MAC scheduler
  - Modify
    - Associate a UE with a slice
  - Delete
    - Delete existing slice
- E2 Report Procedure
  - Slice Statistics
    - RAN: number of slices, slicing/UE scheduling algorithm, parameters for each slice
    - UE: number of connected UEs, associated slice for each UE

Figure: srsRAN 4G eNodeB and OAI 5G gNodeB monitoring PDCP, RLC and MAC SM

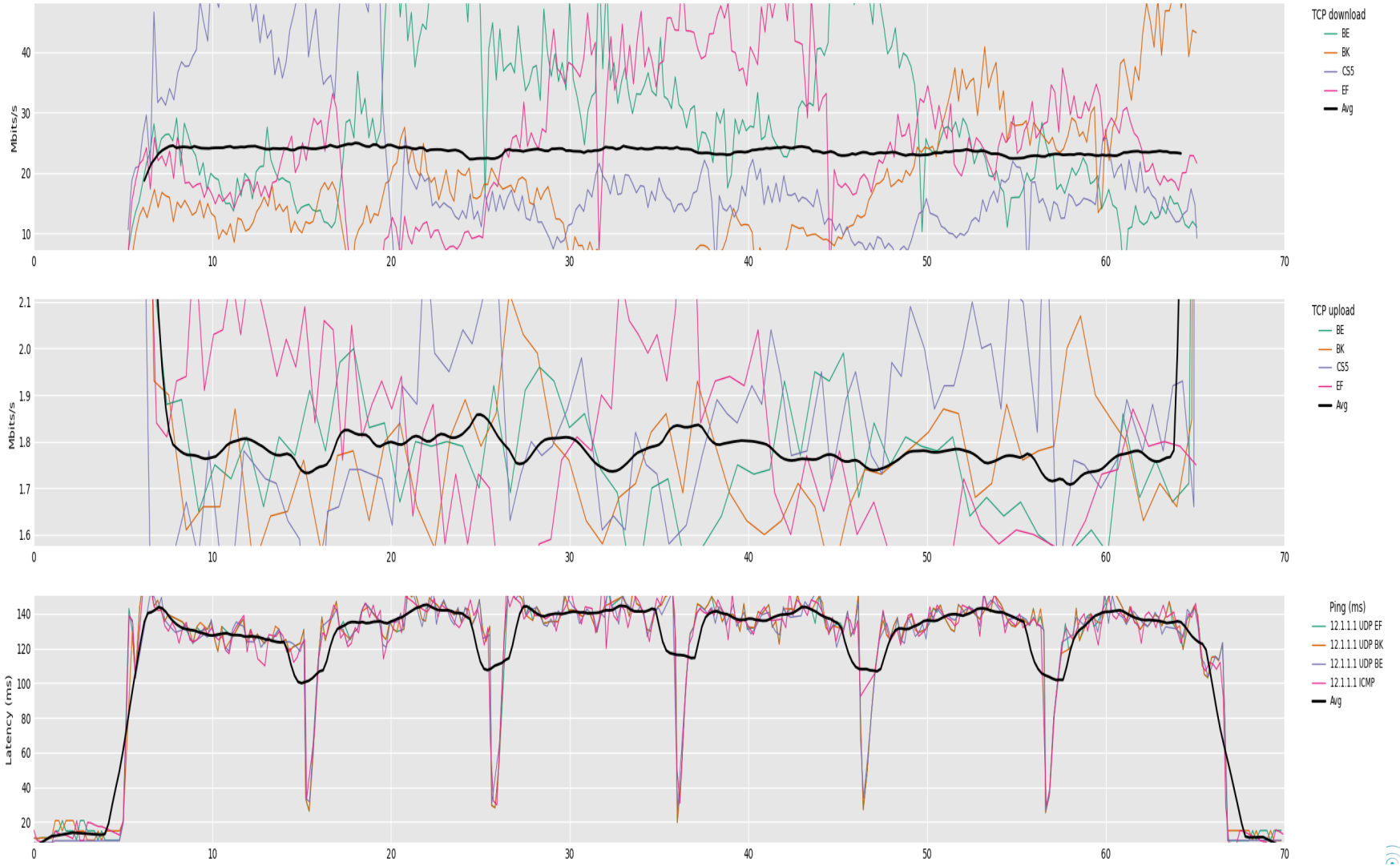
4 Traffic Control

- 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 RRUL OAI 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

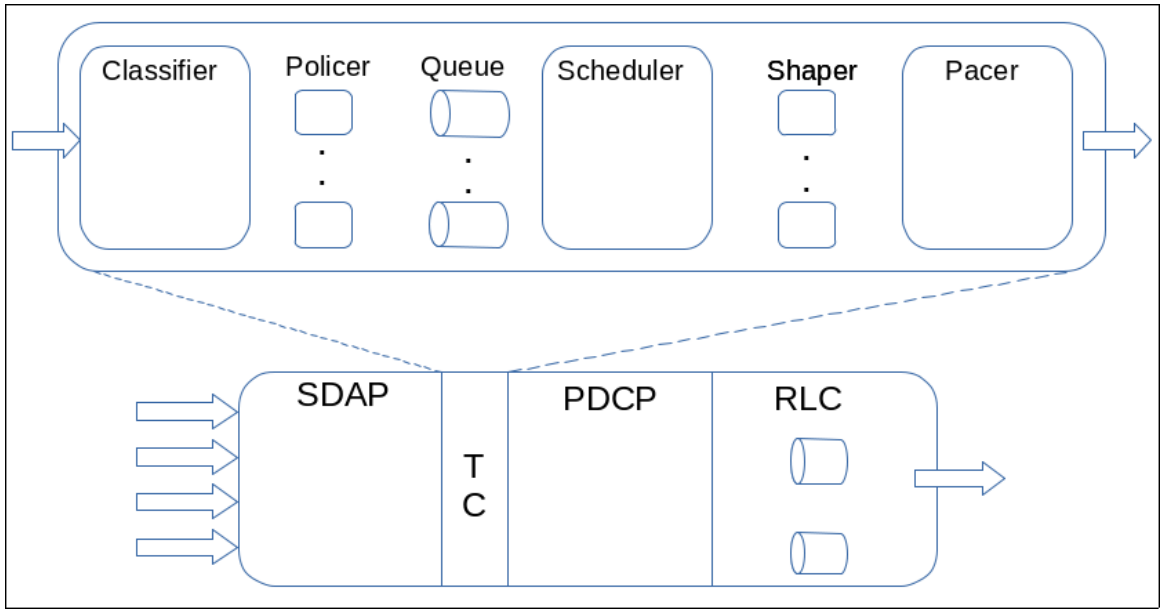


Figure: Traffic Control

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5 Summary

- 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!