DYNAMO: Dynamic MEC Orchestration of Cellular Networks

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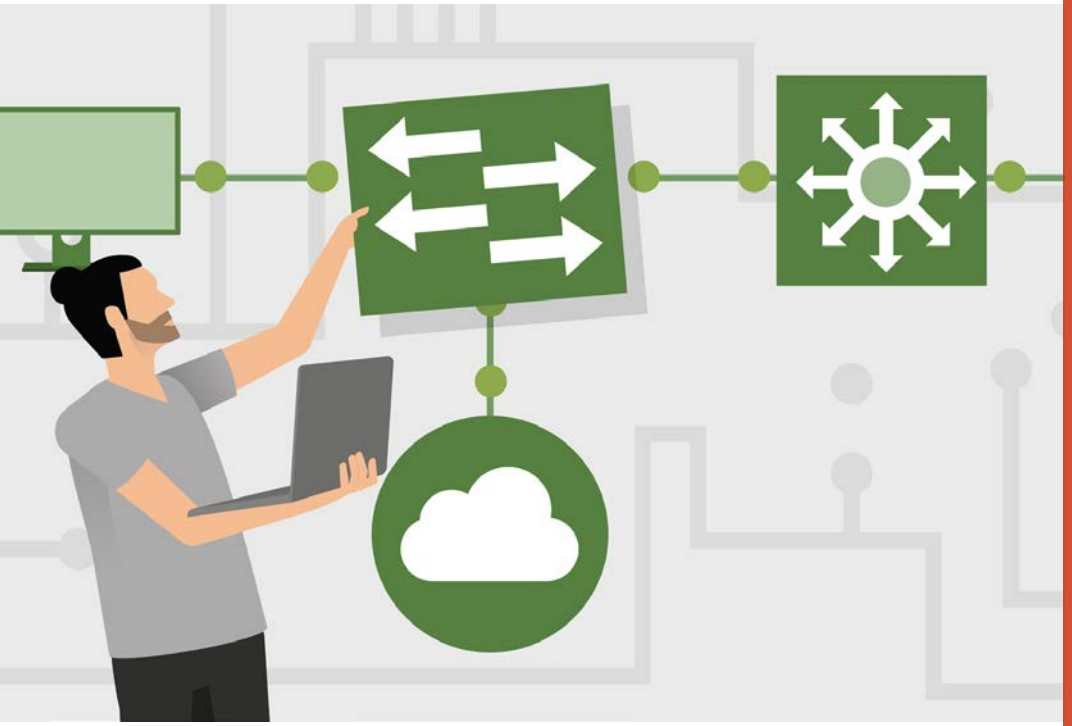
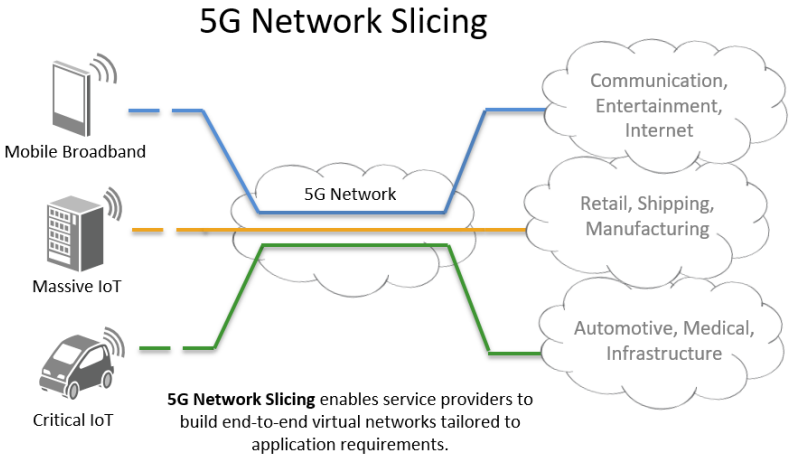


Experiment description

Experiment description

CONCEPT AND OBJECTIVES

- Network Slicing in Cellular Networks
- Dynamic Orchestration
    - Deployment Automation
    - Closed-Loop Automation
    - Service Assurance
- To prove that it is possible to orchestrate IRIS testbed resources using an external MANO system



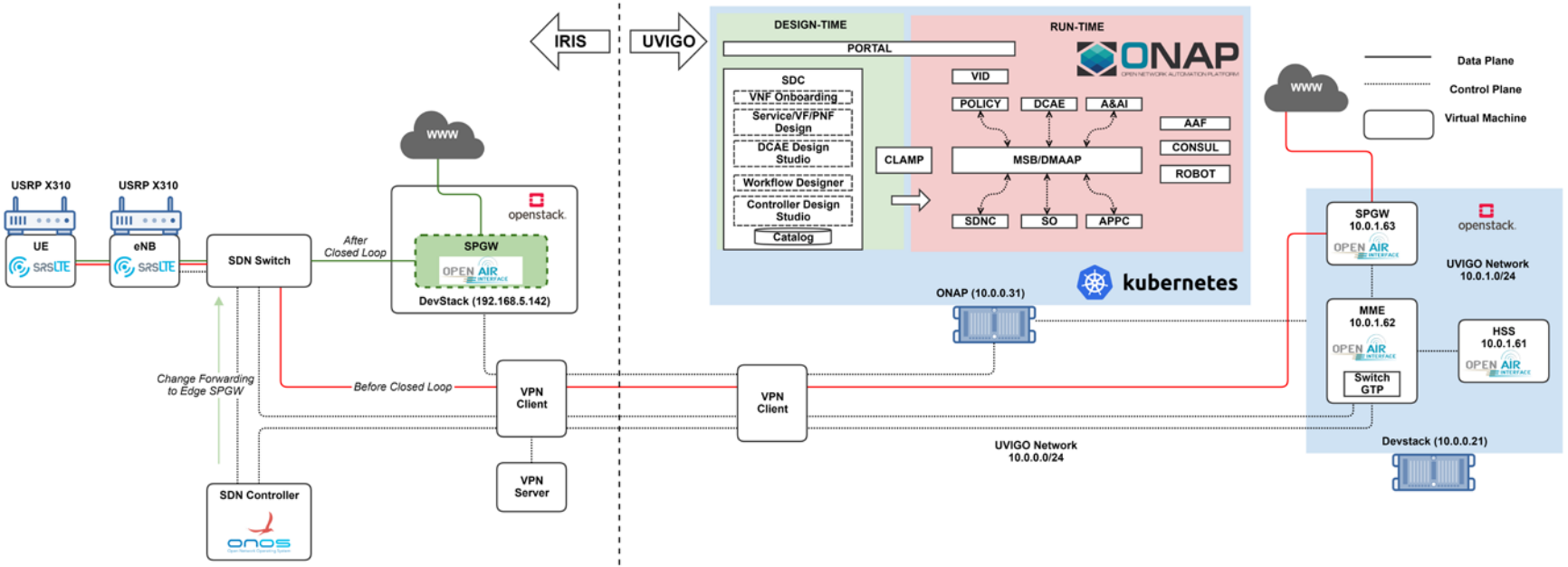
Experiment description

BACKGROUND AND MOTIVATION

- GTI, Information Technologies Group, AtlanTTic, Research Center for Telecommunication Technologies, University of Vigo
- DYNAMO in Fed4FIRE+ → Perfect fit for our research strategy
    - Veo5G
        - MWC 2018
        - MWC 2019
    - FastFlow5G (ORCA)
    - ETSI MEC Hackathon 2019 (2nd place)
- Motivation to further experiment with orchestration in close-to-real setups

Experiment description

EXPERIMENT SET-UP



Experiment description

EXPERIMENT SET-UP

1. Lauch vEPC with ONAP
2. Launch UE and eNB
3. Wait and see...

    The UE reports to ONAP its RTT value every second

    ONAP is configured with a Closed-Loop:

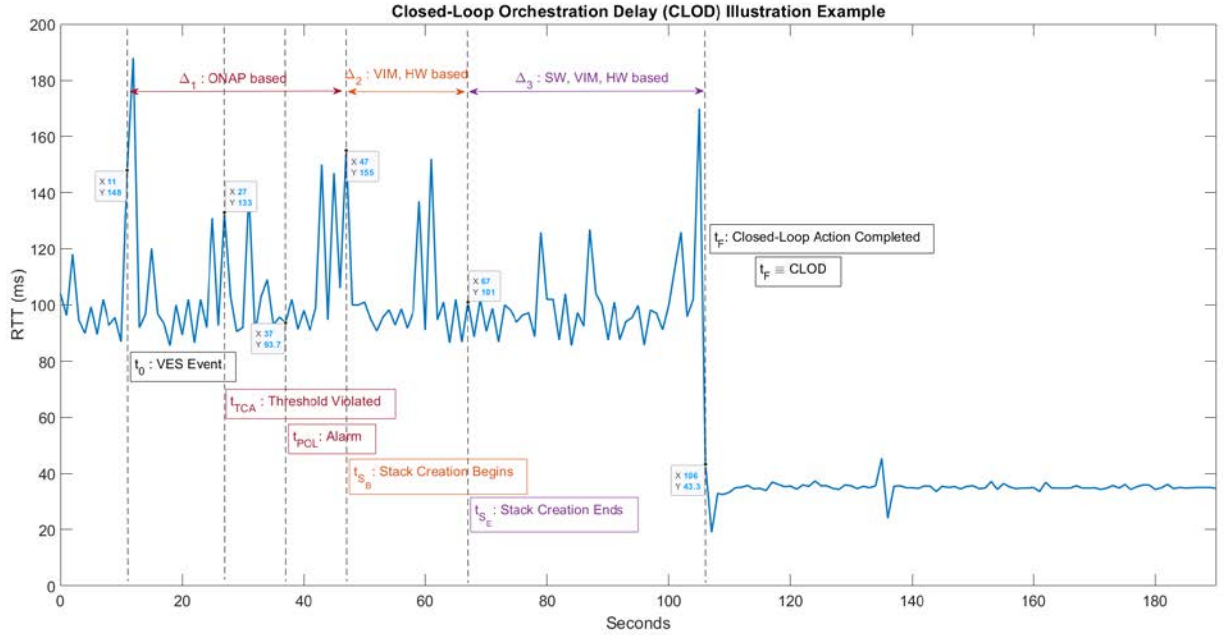
        Detects SLA violation

        Tiggers policy-driven actions to create a new SPGW module on Edge (IRIS)

Project results

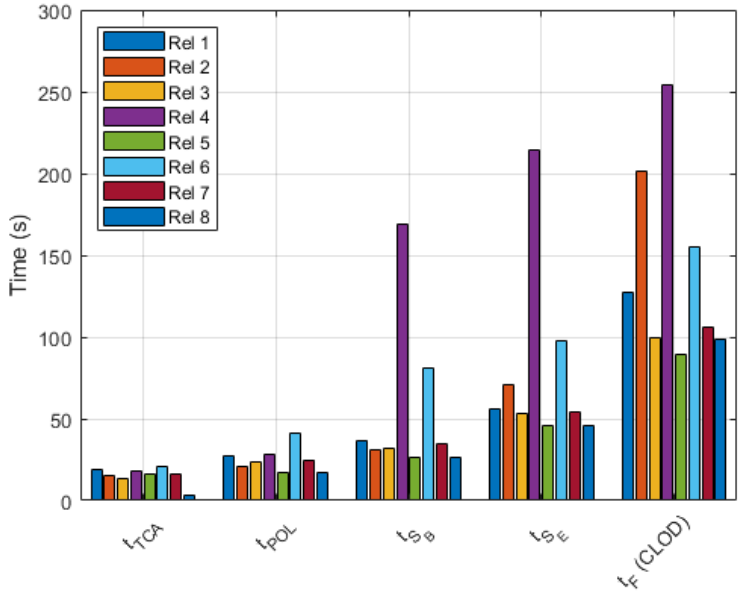
Project results

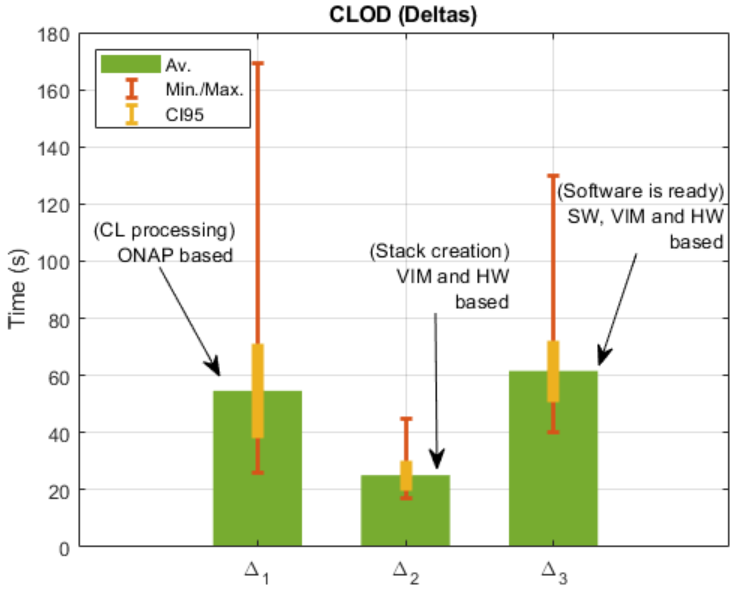
LATENCY REDUCTION FOR UE



Project results

CLOSED LOOP ORCHESTRATION DELAY





Project results

LESSONS LEARNED

- The full stack of technologies (MANO, VIMs, VNF Software) and the policy driven actions during a CL may be highly tightened to the specific application in mind
    - Designing ad-hoc routines per setup vs deeper standardization efforts of the sull stack ecosystem
- Instantiating of large workloads (e.g., VMs) in runtime is not viable for critical services
- Current MANO platforms are still not well prepared for real-time responsiveness

Business impact

Business Impact

BACKGROUND: UNIVERSITY OF VIGO

- Research
  - GTI Research group: part of the “atlanTTic Research Center for Telecommunication Technologies”.
  - Research in networking. Focus on creating dynamic and flexible 5G networks adapted to real-time user and operator requirements.
- Education
  - Telecommunication Engineering School.
    - Networking, wireless communications, cybersecurity, virtualization, data analytics.
- Transference of technology
  - Collaboration with national and international telco companies.
    - Operators (Telefonica, Vodafone, Orange), neutral operators (Cellnex, Retegal), BSS/OSS (Optare), manufacturers (Iskratel, Televés, Centum)

Business Impact

VALUE PERCEIVED (I)

- DYNAMO perfectly fits our research strategy:
  - Network Slicing, RAN sharing, MEC and latency reduction solutions, orchestration.
- New expertise gained in the experiment
  - Edge + Core clouds.
  - Complex architecture.
    - Measure and understand real-time limitations.
- Future ideas
  - Compare orchestration platforms.
  - Analyze container integration.

Business Impact

VALUE PERCEIVED (II)

- Exploitation of results:
    - Academic publications.
    - Teaching (undergraduate, graduate and postgraduate degrees in networking and cellular communications).
    - Extend our collaboration with telco companies interested in networking, MEC and dynamism.
- Fed4FIRE+ direct impact:
    - Cost reduction, and more important: experiment acceleration.

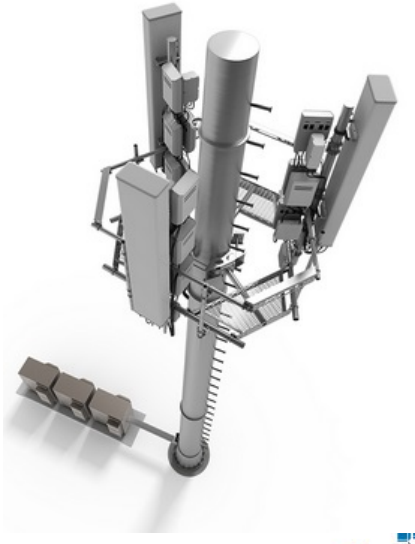
Business Impact

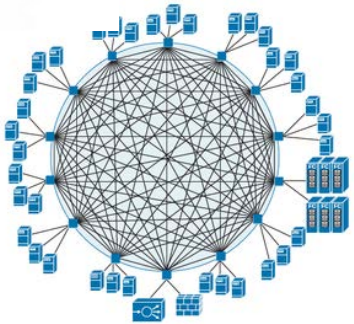
FUNDING

- Appropriate funding for completing the experiments
    - Personnel costs

MOST VALUABLE COMPONENTS

- Specialized components
    - Radio elements
    - Networking devices
- Large virtualization infrastructures
- Simple interface





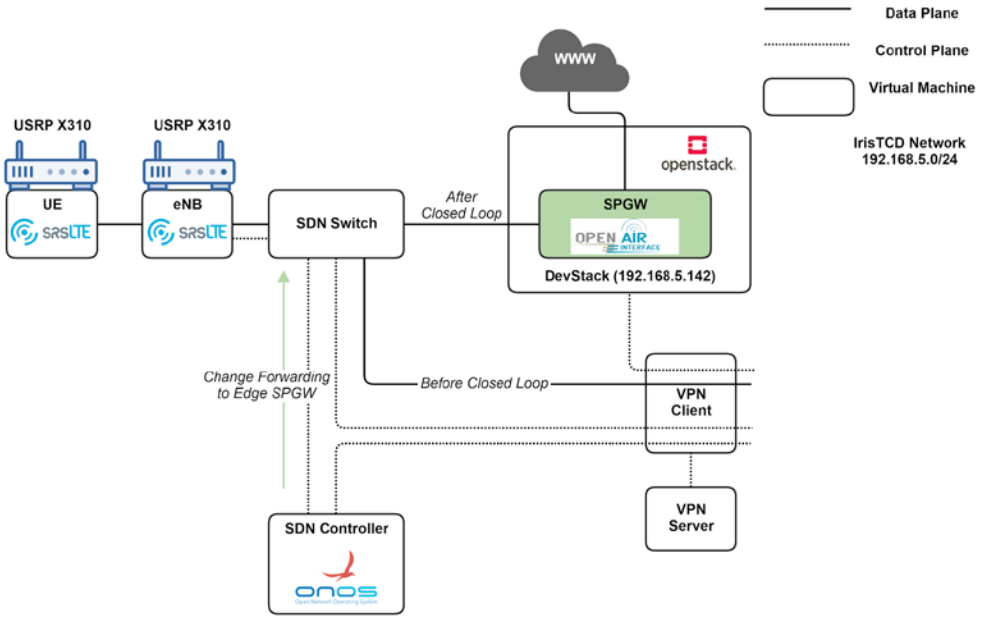
Feedback

Feedback

USED RESOURCES AND TOOLS

IRIS testbed

- 1 USRPs X310 + 1 VM for the UE
- 1 USRPs X310 + 1 VM for the eNB
- 4 VMs
- 1 large VM (DevStack)



Feedback

USED RESOURCES AND TOOLS

IRIS testbed

- Outstanding support by the IRIS Testbed Manager (Diarmuid).
- Flexibiblity: we were able to build a complex architecture interconnecting Vigo and IRIS.
    - Resources for the implementation of eNB and UE (2 X310).
    - Running srsLTE/OAI UE/eNB requires VMs with high computational power.
    - Devstack instance installed to implement a local cloud infrastructure.

Feedback

USED RESOURCES AND TOOLS

JFed tool

- Great tool to configure experiments on a easy manner.
- It allows you to have a single point access to resources in the Fed4FIRE+ federation.

Issues/Suggestions

- Sharing experiments between team members.
- The topology editor does not work properly in some ubuntu or windows machines.

Feedback

CREATION TIME ISSUES/SUGGESTIONS

Create an experiment when no resource is available

- Automated creation when requested resources become available

Improving information of deadlines

- Different testbeds may have different deadlines

RUNTIME ISSUES/SUGGESTIONS

Accidental shut down of a VM

- There is no option to start the VM

Edit topology in runtime

- Add/remove VMs if needed

Feedback

ADDED VALUE OF FED4FIRE+

- Allows you to use devices not usually available on regular labs.
- Efficient resource usage.
    - A bit of automation enables to launch the experiment quickly and use resources just when needed.
- Outside Fed4FIRE+ federation, there are not many testbed prepared to work with LTE/5G.
    - The resources diversity, tools and the possibility to combine infrastructures are a relevant added value.
- SDR devices and VMs with high computational power would be very valuable for us.

Feedback

SOME EXTRA SUGGESTIONS TO FED4FIRE+

- Enable reservation of dedicated resources
    - Time consuming installation of some software (DevStack >1h)
    - Specific driver configuration for shared devices between experimenters
    - New business model
- Consider to adapt/extend the federation environment to enable to test end-to-end network slicing concepts in general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WWW.FED4FIRE.EU