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Review Open Call 6: MECinFIRE experiment

FEC 7

GRIDNET

Evaluation of MEC for 5G Cloud-RAN networks over Fed4FIRE+

F4FP-06-M30

Experiment Description

OVERALL CONCEPT

- 5G networks are expected to widely apply in practice Multi-access Edge Computing resources
  - Relying on bringing devices closer to the network edge
  - Regardless of the technology used to access the network
- 5G redefines the operation of the cellular stack through the integration of splits over the stack
  - How can we integrate edge resources and bring services closer to the network?

Experiment Objectives

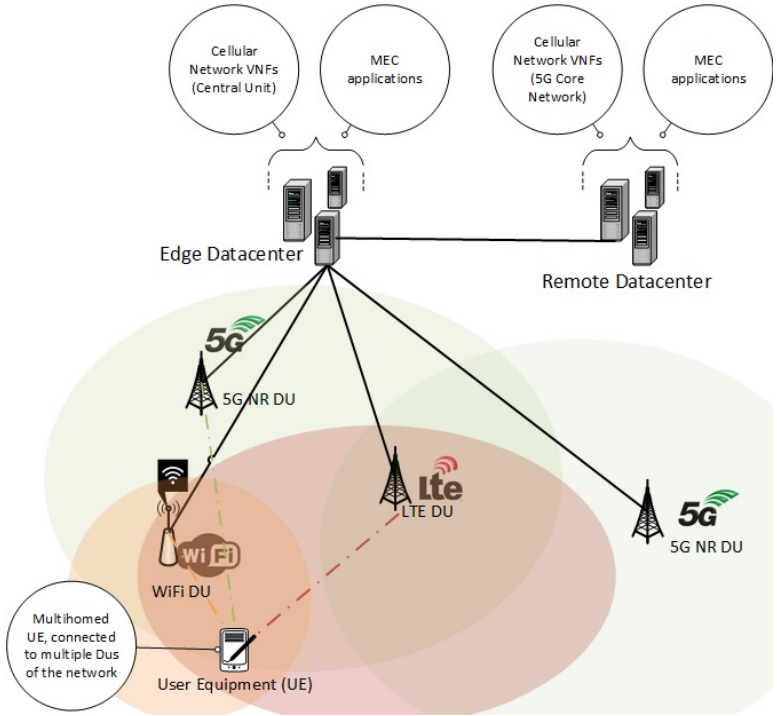
- Given the 5G architecture for base stations, with part of them running at the Cloud, we want to develop and test a solution for Multi-access edge computing
- Specific objectives of the project include:
  - ***To develop and evaluate a solution for collocating the edge computing services with the access part of the network.***
    - Using the OpenAirInterface (OAI) platform
    - Based on prior contributions provides an integration of non-3GPP technologies to the RAN.
    - This solution was extended to allow placement of services very close to the radio access network.

Experiment Objectives

- Specific objectives of the project include:
  - ***To dynamically switch among technologies serving the end user based on the measured latency times for accessing the services.***
    - Cognitive mechanism at the MEC part of the network, where based on the measured latency times, we dynamically switch to using other heterogeneous DUs.
  - ***To experimentally evaluate the solution and collect extensive measurements about service-to-UE latency and vice-versa.***
    - We used the NITOS wireless testbed for our experiments
    - Our main performance indicator was the measured latency times for reaching services located on the edge contrary to other MEC deployments.
  - ***To provide a comparison among our solution and the ETSI proposed method for collocating the services with the Core Network.***
    - We directly compare our solution versus one of the ETSI proposed methods for placing edge services.

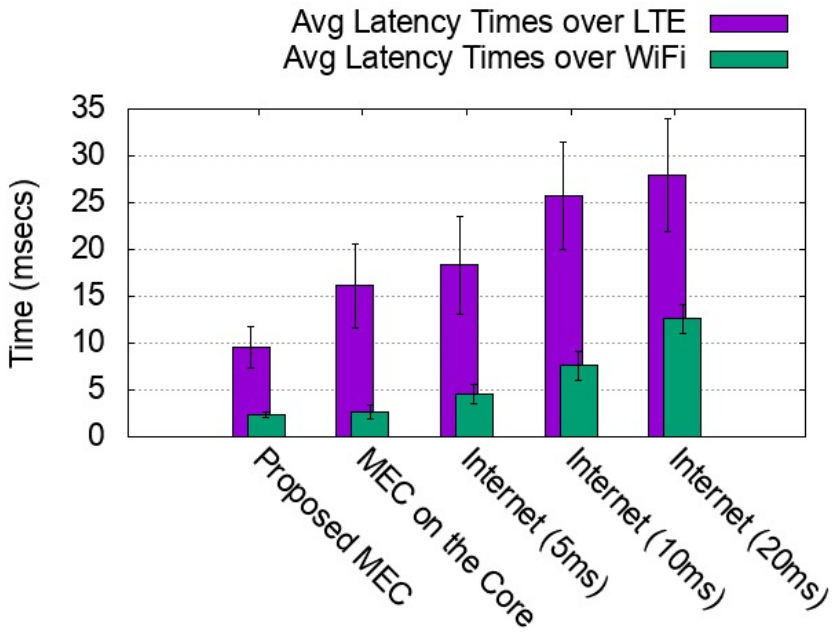
Experiment Setup

- We used the NITOS testbed to deploy our proposed setup
- Seven nodes with different capabilities were used:
  - a node used to run the OAI Core Network
  - a node used to run the OAI CU
  - a node with a USRPB210 device, for running the DU part of OpenAirInterface,
  - a WiFi node loaded with the WiFi DU software (offered from the testbed)
  - one node for running the MEC services
  - two nodes with WiFi interfaces and LTE dongles, for connecting to the WiFi DU and LTE DUs respectively.



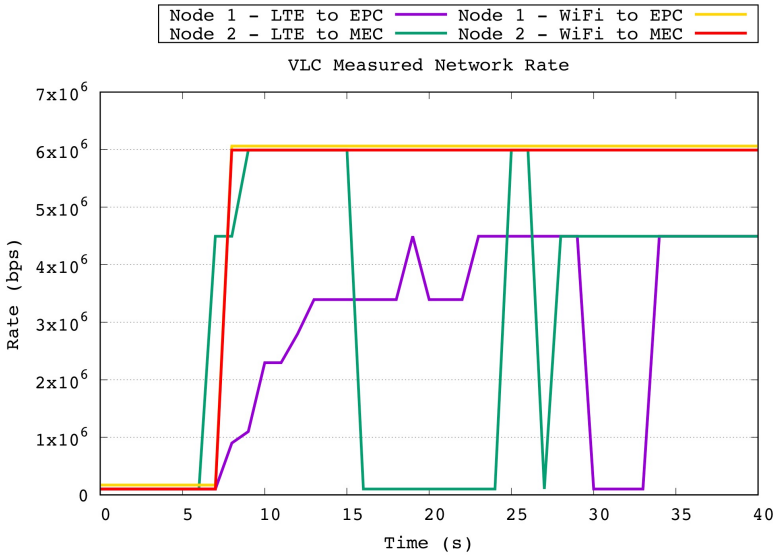
Results and Measurements

- We compare the latency time for both access technologies between the UE and the service using two different deployments
  - one being on the DU (through our contributions), with approx 0.250ms delay between the DU and the MEC service
  - one being on the core network.
  - Through artificial delay that we created, we emulate placement of services in the Internet as well
- Results show a very clear benefit of our solution compared to other placements (EPC).



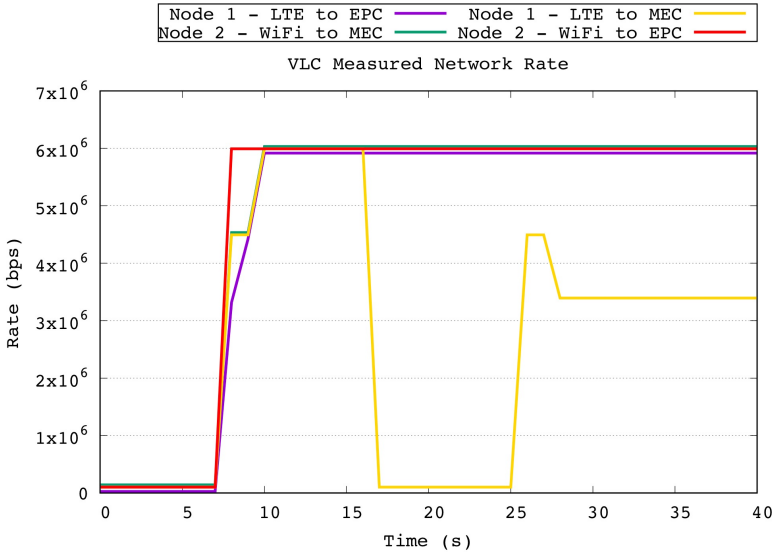
Results and Measurements

- Different placement of services:
  - We use adaptive video streams to check how long it takes to converge to an acceptable video quality at the UE side
  - Video servers are placed at the Edge or the Core network
  - Different technologies are used to access the video servers
- When both of the nodes use the same technology to access the network (one at the MEC and the other at the core)
  - the UE requesting from the MEC service gets better video quality
  - If they both use WiFi, they quickly converge to acceptable video quality (WiFi showed lower latency values)



Results and Measurements

- When the nodes use different technologies to access the network (one at the MEC and the other at the core)
  - the WiFi UE is able to very quickly converge to the highest video representation
  - in the scenario that the LTE UE is requesting the data to the MEC service, the rate is reached very rapidly in the experiment (less than 10 seconds)
  - for the case that the LTE UE is requesting at the EPC service, it takes just over 30 seconds to request the highest video representation available.(yellow line)



Business Impact

Key value: **explore new ideas that can enhance our existing product line**

- Strengthen our competitiveness in the 5G market
- Got a better understanding of what can be developed at the moment based on the company's needs
    - Our engineers working in the project are now acquainted with using COTS systems
- Currently in the process of identifying how our outcomes can be capitalized through a product

Fed4FIRE+ value

- Access to equipment that we would not invest in otherwise
  - Especially in Software Defined Radio equipment
  - No engineer of the company had previously a good grasp on the platforms
  - Was not considered as an investment option for the company
- Our involvement and the competencies that our engineers gained not allows us to start opening to a new market

Fed4FIRE+ value

- We were able to get access to a working experimental framework for deploying mobile base stations
    - Up to now the company's activities were focused to other wireless technologies (low power IoT, WiFi)
    - Now we have a deeper understanding of such networks
    - We consider enhancing existing products and the development of new ones.

Feedback to F4F+

- Resources and Tools
    - We made extended use of the NITOS testbed
    - Spent the first two 4-hour reservations on getting acquainted with the tools and methodologies for running the experiment
    - Beyond that point, almost all of our reservations were used to evaluate our framework
- We used 7 nodes in total with different specs for each (e.g. SDR, WiFi, LTE connectivity)
- Tools that we used:
    - jFed for initial reservations to the testbed
    - OMF tool for starting our nodes

Feedback to F4F+

- Problems: Once we were not able to find the resources we needed – we switched to another slot during which the testbed was not occupied
- Immediate support by the testbed team
    - Assisted us in the beginning to start the experiment
- We are very happy on the support that we received
- Added value: *We were able to observe in practice the benefits of the Multi-access Edge Computing technology and successfully evaluate our software prototype – would not have done this without F4F+*


Co-funded by the
European Union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Swiss Confederation

This project has received funding from the European Union's Horizon 2020 research and innovation programme, which is co-funded by the European Commission and the Swiss State Secretariat for Education, Research and Innovation, under grant agreement No 732638.

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