Estimating the Mobile Edge Computing Infrastructure Performance (MECPerf)

FED4FIRE

Federation for FIRE Plus

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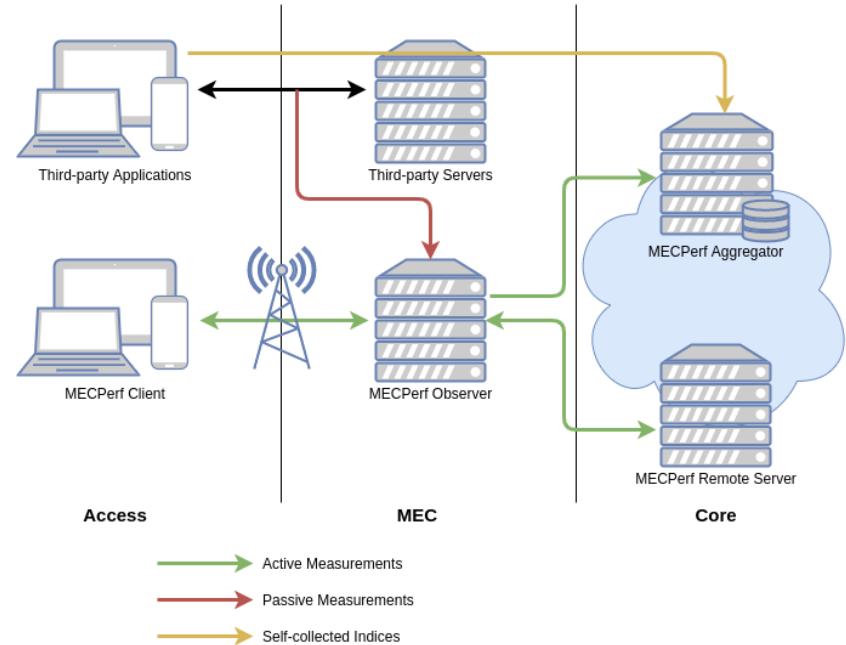
Virtual Review

20 November 2020

Objectives

Use NITOS to validate MECPerf in an operational environment

MECPerf is:

1. A tool for measuring application- and network- level KPIs in a Mobile Edge Computing environment

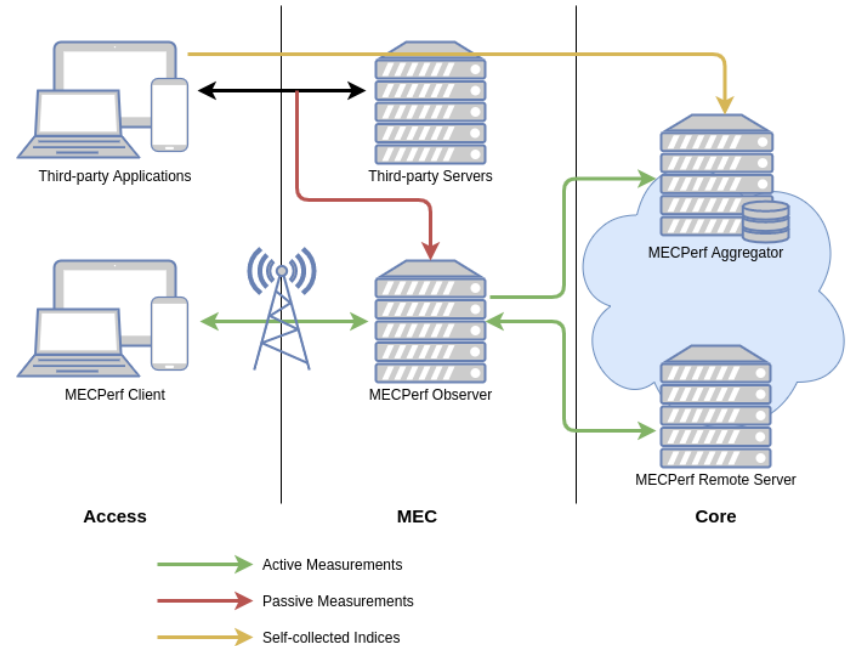2. An open interface for providing the measured KPIs

Why MECPerf?

Edge computing aims at:

- Providing the benefits of cloud computing (e.g. virtualization, flexible allocation, …)

- Providing applications with low latency

- Keeping the offloading traffic local

MECPerf provides data for:

- Achieving optimal automatic resources orchestration (for MNOs)

- Checking the soundness of a MEC application deployment (for service providers)

Third-party Applications

Third-party Servers

MECPerf Aggregator

MECPerf Client

MECPerf Observer

MECPerf Remote Server

Access   **MEC**   **Core**

Active Measurements
Passive Measurements
Self-collected Indices

Measurements

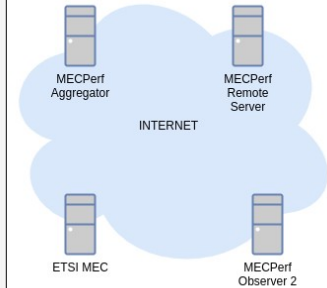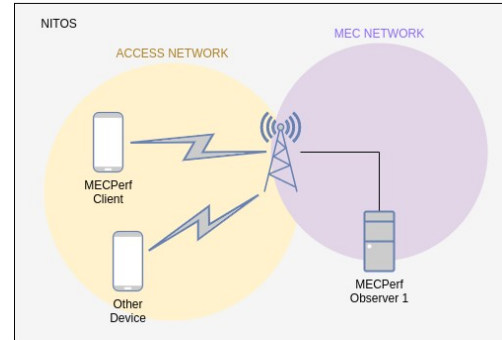Network- and application- level bandwidth and latency:

- Active measurements (network level)

- Passive measurements (application level)

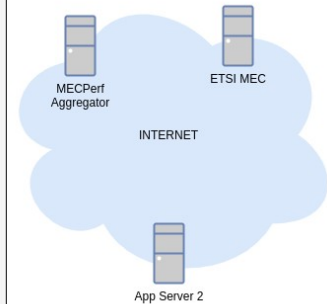- Self measurements (application level)
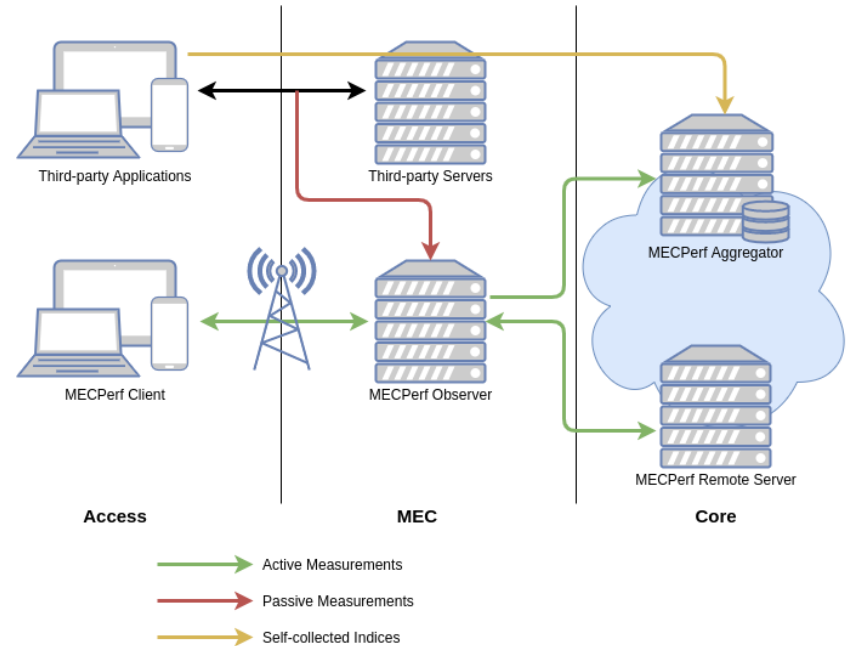
Experiments Setup

Active Measurements:

- TCP/UDP latency
- TCP bandwidth, Bottleneck capacity (UDP)

Passive/Self Measurements:

- DASH video streaming app
- Application bandwidth (passive/self)
- Latency (only passive)

Results – Active

For applications running on MEC a decoupling of functions is desirable:

- latency-sensitive components are best allocated between the mobile device and the MEC server

- high-throughput components are best positioned on the MEC server in communication with a remote cloud infrastructure

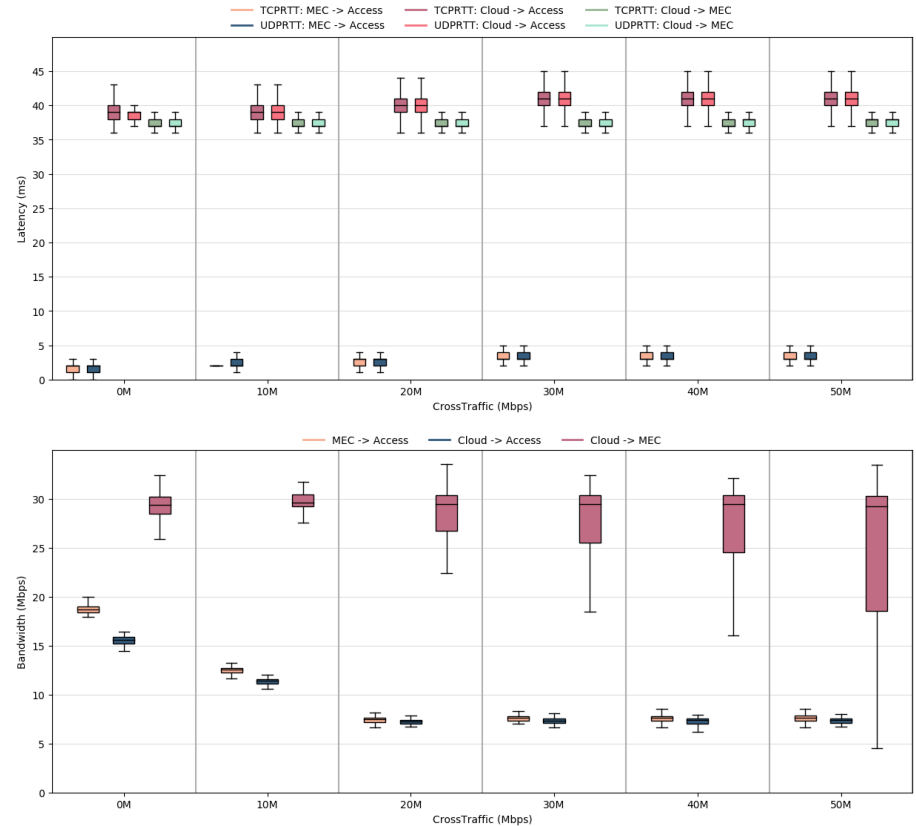# Results – Active

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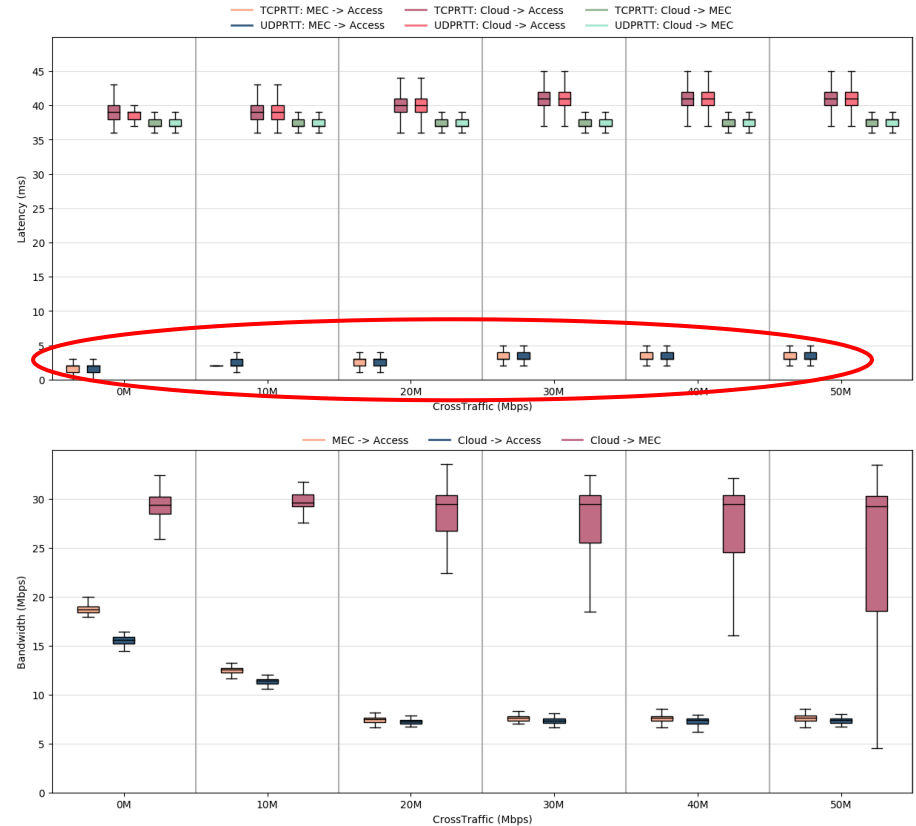For applications running on MEC a decoupling of functions is desirable:
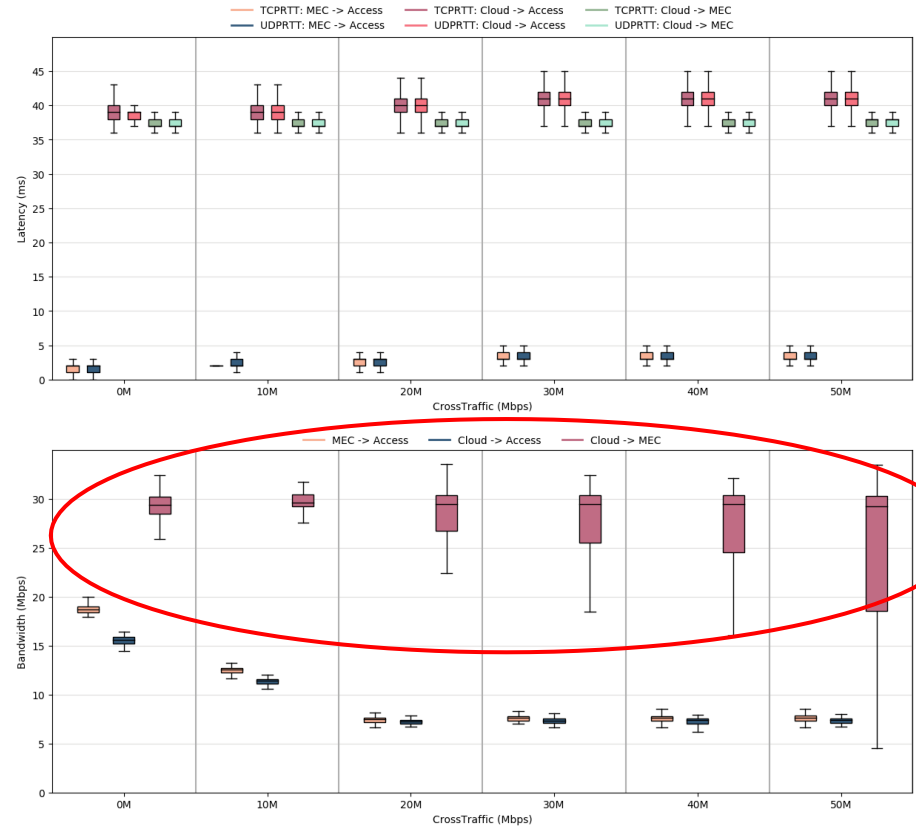
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Results – Passive/Self

- Passive and Self measurements highlighted the importance of self assessment of the performance, especially for applications with not continuous traffic patterns.

- Transparently computing KPIs from the analysis of the traffic produced by an application can be extremely useful, in order to obtain an assessment of the performance of those applications which do not provide their own performance.
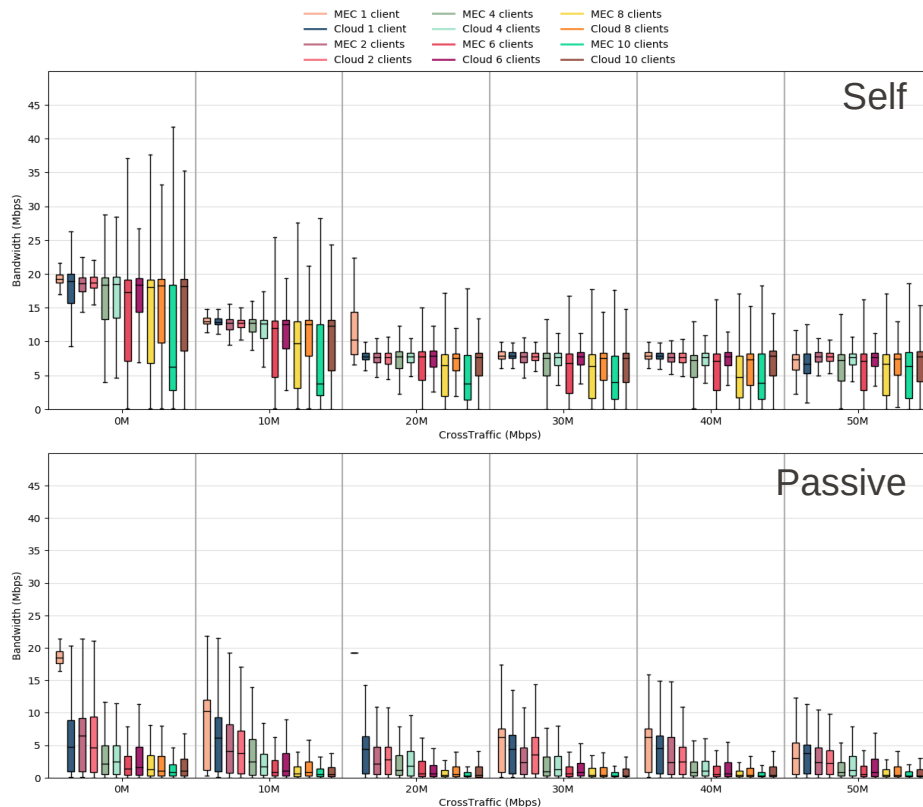
Business Impact

Funding

To cover personnel costs and travel expenses to pursue our research roadmap.

01

Publications

The data produced within the experiment is of paramount value since it allows us to publish on scientific conferences and journals.

Workshop paper at IEEE COMPSAC 2020.

Journal extension under preparation.

02

Visibility

MECPerf presented within several national and international projects:

- ETSI MEC

- BariMatera5G

- 5GCity hackathon (positioned 1st)

03

Business Impact – Added Value

Open source implementation

- The close-to-real world validation allowed to identify and correct bugs, and assess the soundness of MECPerf's implementation. Improved robustness and usability.

- Extended functionalities with more complex features.

Acquired knowledge

- Configuration, scripting, virtualization for improving possible future experiments.

- Wireless and wired technologies for better interpreting the results of the current and future experiments.

Business Impact – Future Research

1. Devise algorithms for the automatic management of MEC resources and their assignment to applications, basing on the applications' requirements and on the MECPerf's outputs.

2. Assessment, via MECPerf, of the performance of mobile applications in a MEC-enabled environment, in order to evaluate the suitability of a MEC solution for each one of them.

Both the activities would benefit from the availability of facilities such as the Fed4FIRE+ ones.

Business Impact – What If No Fed4FIRE+?

MECPerf was already in our plans. A prototype implementation with limited functionalities was already available.

BUT...

The completion of the MECPerf implementation and its experimental validation and evaluation would have been much harder without having access to funds to support such activities.

Without Fed4FIRE+ facilities the results of the experimental validation would have been extremely less sound, and setting up a such complex experimental environment would have been extremely hard.

Feedback – Used Resources

- One Testbed: NITOS
- Just indoor nodes
- Both WiFi and LTE technologies
- From 4 to 13 nodes simultaneously plus the LTE Base Station
  - Nodes were used as user equipments, access points, MECPerf components, cross traffic generators, and application servers
- Tools:
  - OMF – to load/activate/deactivate nodes
  - Command launching manually via SSH or automatically via bash scripts and cronjobs
  - Nodes configuration at different levels (e.g. iptables, route, software installation, etc.)

Positive experience, just few malfunctions promptly handled by the NITOS staff

Feedback – Design/Setup/Execution

Setup

The setup of a MECPerf experiment is rather complex and requires installing several software components and dependencies. Normal issues related to the process.

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Extremely useful to start implementing experiments. Some parts could be updated to remove now unavailable features.

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Every interaction with the NITOS staff was extremely smooth and any issue we had was generally solved in a few hours.

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Added Value

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The overall experience of experimenting within Fed4FIRE+ has been extremely positive in all aspects!!

Feedback – A Few Suggestions

1. A tool for specifying repeating periodic experiments could be added (together with the reservation of nodes)
2. Also a tool for automating experiments could be added. However, we could easily achieve it with scripting and cronjobs.

THANK YOU FOR YOUR ATTENTION

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