



Review Open Call

“SME Cascaded Experiments”

5GinVivo

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FOGUS Innovations & Services

Virtual Review Meeting Open Call Experiments

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FOGUS Innovations & Services P.C



..IN A NUTSHELL

- Located in Athens (Kaisariani), Greece
- Founded on 2016 by a group of industrial and academic ICT experts
- Scope: *to Integrate state-of-the-art research and technological advancements towards immersive communication and computing experiences..*



- ✓ System intelligence and automation (Data analysis and AI components)
- ✓ Performance evaluation (Fogus WAN emulator, 5G Experimentation testbed)
- ✓ Network deployment and service provisioning (Fogus IoT platform, Fogus Media)
- ✓ Custom software production (Solution design & implementation)

• Wireless communications

- MEC / 5G RAN Integration
- 5G service prototyping and testing
- IoT platform design and implementation

• Security

- Blockchain-proof network design
- TMP modules
- GDPR compliance with SIEM

5GinVivo experiment



..IN A NUTSHELL

- FED4FIRE+ experiment: F4F+-SME-COD19203-03
- 5G Infrastructure-associated Network application for Vertical industries: performance evaluation -5GinVivo-
- Assess FOGUS network applications in an open mobile network with experimentation and performance monitoring features
- Use of the PerformLTE/ TRIANGLE platform
 - University of Malaga – Prof. Almudena Diaz
- Completed in 3 months duration as planned (from 3/2/2020 to 3/5/2020)
- Experiment report has been submitted

Outline



- Experiment Description
- Experiment Results
- Business Impact
- Feedback





Experiment Description

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Experiment Description

BACKGROUND & OBJECTIVES

Background:

- 5G openness: New paradigm shift in service provisioning over 5G networks
 - Verticals/OTT service providers can manage and monitor the network resources that their services consume.
- NetApps are required: Tools for enabling this new paradigm shift
 - FOGUS offers such a NetApp/tool for network monitoring: **FOGUS Media tool** is a user's experience management tool for multimedia services that can monitor NetApp related-KPIs and trigger network management actions.
- Reliable experiments for NetApp development: Open experimentation mobile network infrastructure
 - FOGUS offers a tool for emulating the transport network: **FOGUS WAN emulator** is an SDN controlled virtual network that can be part of a physical IP network.

Objectives:

- Extract realistic measurements over a mobile network, towards:
 - Getting valuable insights and enhancing our tools
 - Position ourselves in the associated market

PerformLTE platform provides openness plus automation for such kind of experimentation..

Experiment Description

BACKGROUND & OBJECTIVES

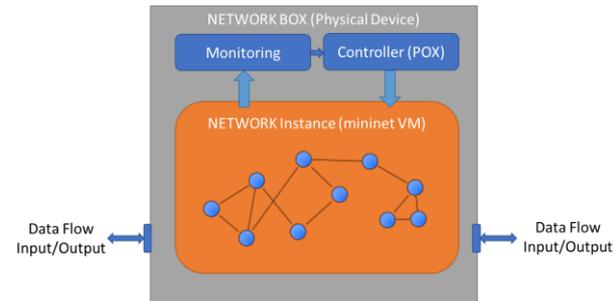
FOGUS Media Tool

- Video consumption client
- Exploits YouTube API
- Collects subjective evaluations from end users (user mode)
- Collects application related parameters (auto mode)



FOGUS WAN Emulator

- Physical network node that emulates an IP network
- Dynamic topology
- Path control from SDN controller
- Outputs real time measurements



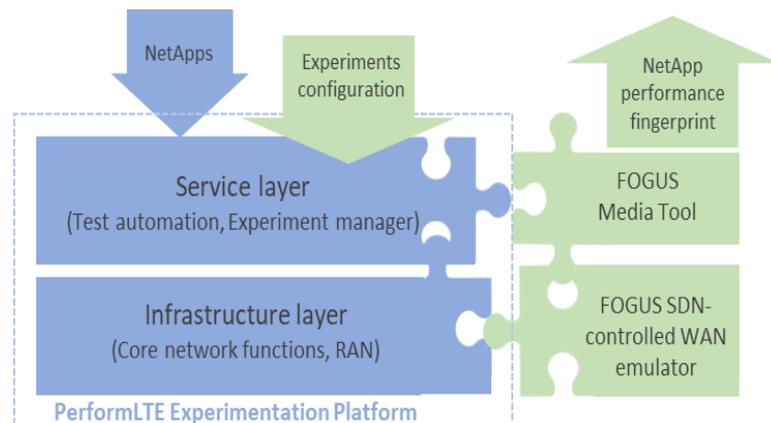
Experiment Description

STEPS FOLLOWED

- Familiarization with PerformLTE Platform (+run default tests)
- Integration of FOGUS Media monitoring tool

Components

- Web Portal + FOGUS Test cases in the frontend
- Experiment lifecycle Manager (ELCM) + FOGUS Test Case Descriptors
- Automation platform + FOGUS OpenTAP Plugins
- Default Applications (iPerf App, Ping App, Resource Agent App)
- FOGUS App
- Integration of FOGUS SDN-controlled WAN emulator
- Run Tests and use Grafana for visualization of the results



Experiment Description

STEPS FOLLOWED

- FOGUS Test Cases / Test executed
 - Single Device – Single RAT – Single Video
 - Single Device – Single RAT – Sequential Videos
 - Two Devices – Single RAT – Single Video
 - Two Devices – Two RATs – Single Video
- 
- Measurements from the application layer at end device
 - Measurements from the SDN controller
 - Measurements from the platform



Experiment Results

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Experiment Results

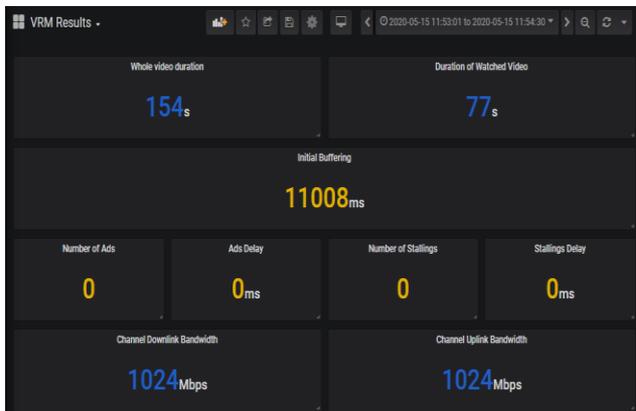
MEASUREMENTS



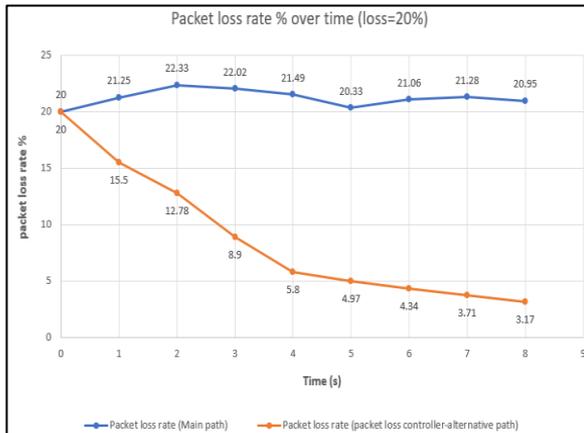
Translation formulas (app parameters to MOS values)
 Reference value metrics (PSNR/SSIM)
 Subjective tests



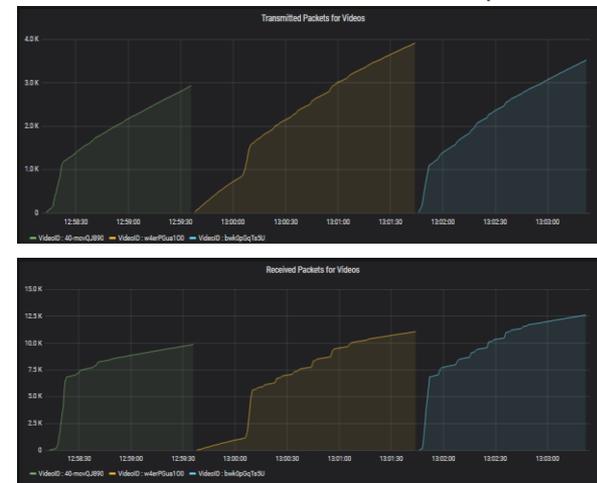
Application layer parameters (App)



WAN Parameters (Controller)



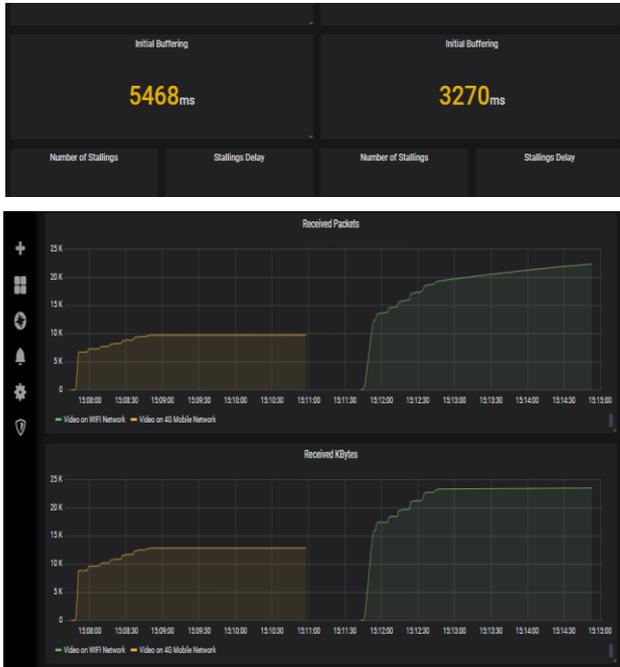
Mobile Network Parameters (Platform)



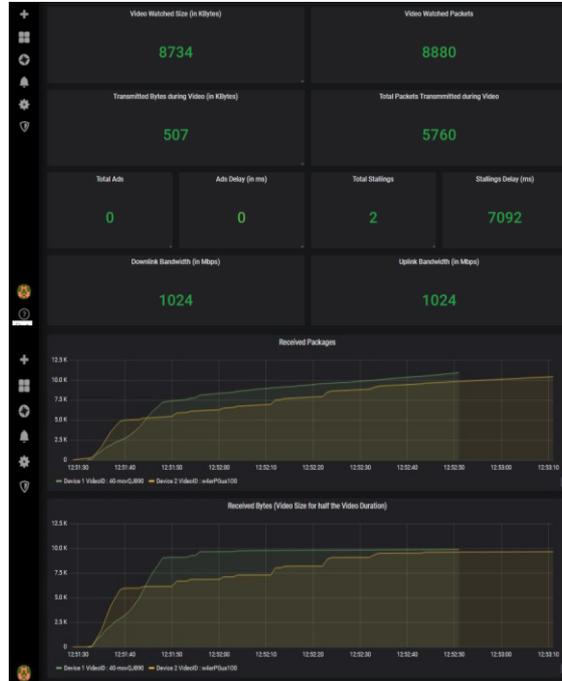
Experiment Results

MEASUREMENTS

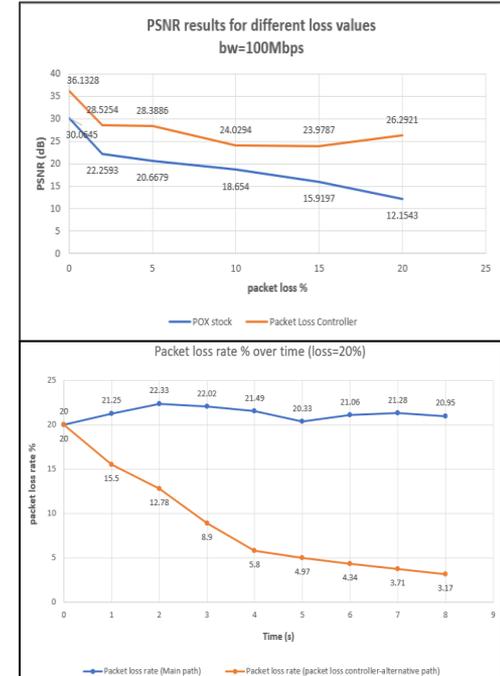
Different Networks -Test Results



Different Devices -Test Results



WAN Emulator Test Results



Experiment Results



KEY TAKEAWAYS

- The experiment proved that end-to-end monitoring during video consumption enables two key aspects:
 - User-centric management (given that QoE can be estimated from the collected data)
 - Network bottlenecks/issues can be available to the service provider, allowing for related adjustments at the app layer
- The measurements collected define a valuable source for further research study on QoE provisioning
 - Initial study of the results imply that the initialization time when a video starts is less annoying for the user (QoE), compared to potential stallings during the video consumption



Business Impact

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Business Impact



WHY WE CAME TO FED4FIRE+

- The set of combined tools that were offered for experimentation (in our case the mobile network infrastructure plus the automation experimentation facility)
- The well documented procedure provided by the Patrons
- The capability for full results collection (there is no restriction on the amount of data we collect)
- The funding that allows us to allocate workload to a valuable task for the evolution of our products
- The well-coordinated organisation of the related events and the transfer of knowledge activities

Business Impact

ADDED VALUE FOR FOGUS TOOLS

- The experimentation on a well-defined platform with the assistance of experts from the Patron, provided the company with knowledge and practical implementation details not foreseen in the product design phase.
 - The experiment conducted had a direct impact on the acceleration of the FOGUS media tool assessment, a key process prior any further research exploitation of the tool.
 - The experiment assisted the development procedure of FOGUS tools by providing feedback from a practical perspective. E.g., the need for a GUI/API for the FOGUS WAN emulator revealed during the experimentation process



Business Impact



IMPACT ON FOGUS'S BUSINESS

- FOGUS staff gained:
 - New knowledge on comprehending and configuring an end-to-end experimentation platform
 - Hands on experience on automated experimentation processes and acquired development skills



Business Impact

FOGUS R&D EVOLUTION

- The company, based on the knowledge gained, is developing its own platform for experimentation. A key asset for the positioning of the company in the related research community.
- FOGUS will adopt methodologies and open-source tools that also used during the experiment to run more automated tests on premises and will seek any new opportunity for large scale experiment with real end users in PerformLTE or other platforms.





Feedback

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Feedback

MAJOR TECHNICAL ASPECTS GAINED

- Technical knowledge from the Patron on:
 - Open TAP usage and related plug ins development
 - Familiarisation with Mobile network Infrastructures with SDRs

POTENTIAL ADDITIONS

- End-to-end 5G testbeds with real network slicing capabilities

Feedback



RESOURCES USED/ EXECUTION PROCESS

Platform components used

- The entire set of experimentation tools of the PerformLTE Platform (Portal/ELCM/TAP etc.)
- The test case examples of the Patron (during the familiarization phase)
- The RAN part of the infrastructure and mobile phones

Execution process

- During the 3 months period we managed to reserve the testbed on demand with no major problems or delays
- There were no technical aspects that negatively affected the execution process
 - Difficulties (related to the Covid-19 situation) faced mainly for hardware integrations (mainly the FOGUS SDN-controlled node) that would be easier to be applied with a physical meeting at the platform



Demo Video

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Demo Video



5G Infrastructure-associated network application for
vertical industries performance evaluation

5GinVivo



Demo Video



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**“SME Cascaded
Experiments”
5GinVivo**



**THANK YOU FOR
YOUR ATTENTION**

WWW.FED4FIRE.EU

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