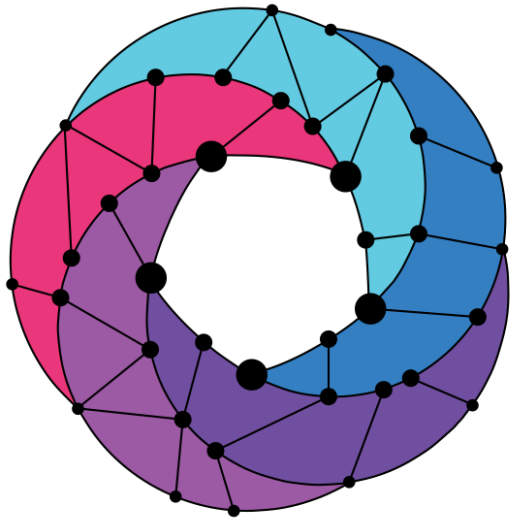


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Automated Deployment of an IP Telephony Service on UAVs using OSM

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Team Members

- Universidad Carlos III de Madrid
- IMDEA Networks Institute

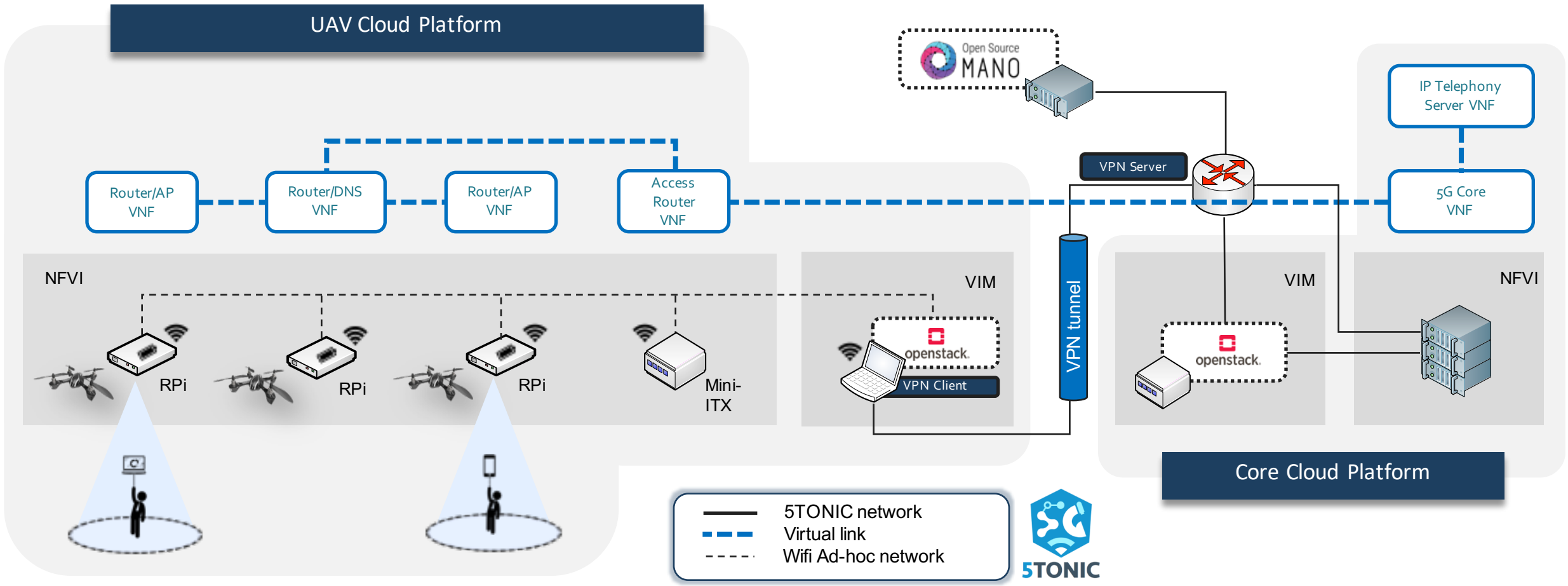
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Key Takeaways

- The PoC demonstrates the practical feasibility of automating the deployment of telecommunication services over resource-constrained devices, particularly UAVs.
- OSM is intended to support the orchestration of network services over the resource-constrained UAVs.
- The procedure details the different steps to build a functional NFV environment, based on resource-constrained platforms, and deploys a functional IP telephony service.
- Single board computers (Raspberry Pi model 3B+) are onboarded on small-size drones, serving as compute nodes.
- The PoC is based on open-source technologies (OSM and OpenStack).
- Scripts to support the pre-configuration of the resource-constrained platforms are made available to facilitate the reproducibility of the experiment.
- The detailed procedure could potentially be adapted and used in other environments in which resource-constrained devices might be available.
- The PoC includes a flight procedure. If this is reproduced, the experimenter should be sure to follow the appropriate security measures and the corresponding regulatory statements.

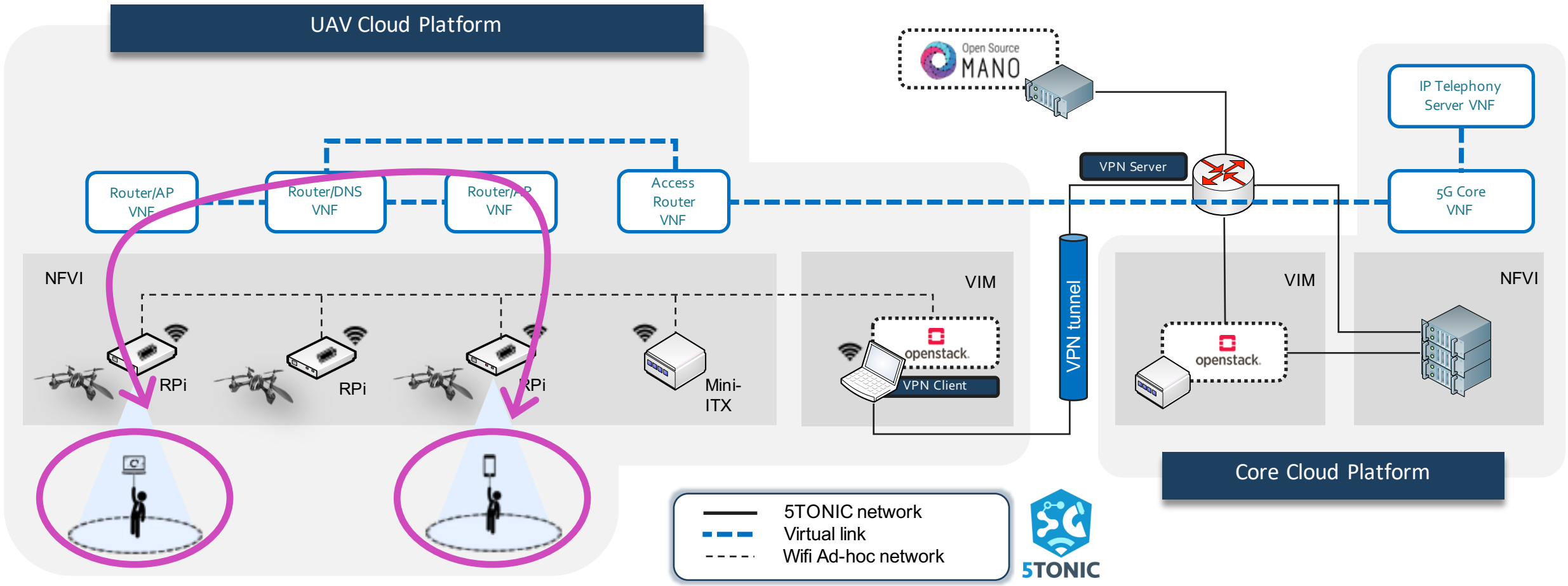
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PoC Scenario



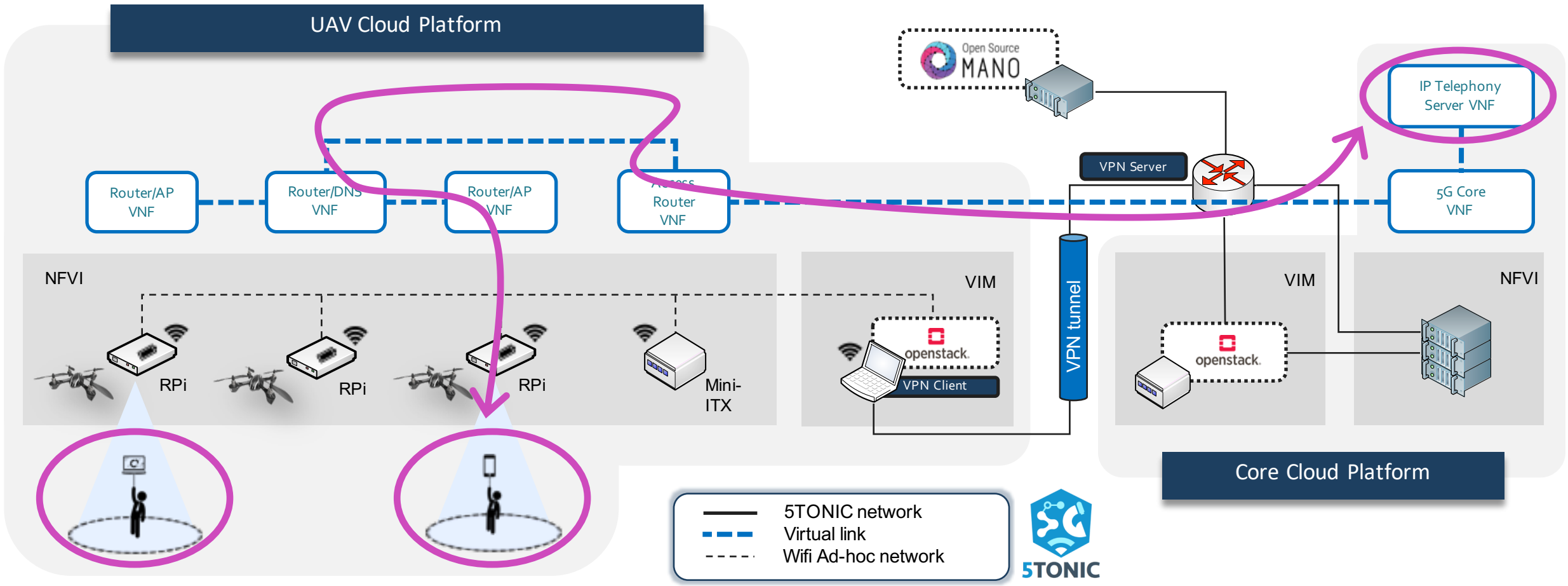
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PoC Scenario



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PoC Scenario



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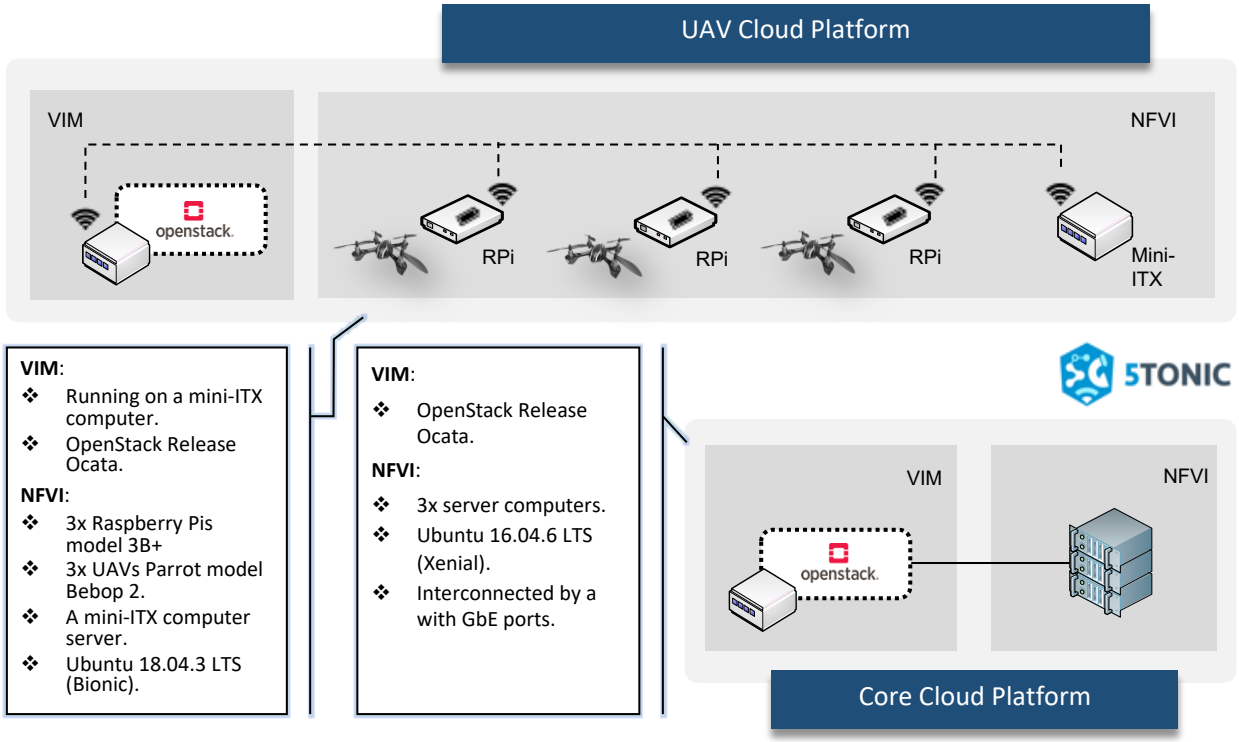
- All the details available in: http://tiny.cc/olxpjz

Nogales, B., Vidal, I., Sanchez-Aguero, V., Valera, F., Gonzalez, L. F., Azcorra, A. Automated Deployment of an Internet Protocol Telephony Service on Unmanned Aerial Vehicles Using Network Functions Virtualization. J. Vis. Exp. (153), e60425, doi:10.3791/60425 (2019).

RAN5GE Remote area Access Network for the 5th GEneration: http://5g-range.eu/

Testbed Setup

- Management and Orchestration software stack provided by OSM:
  - OSM Release FOUR, but subsequent releases might be used.
- Two independent cloud computing domains:
  - A core cloud platform, built by server computers.
  - A UAV cloud platform, comprising a set of RPis:
    - Each RPi is onboarded onto a UAV, enabling the transportation of computing, storage and networking resources.
    - Interconnection of the RPis through a Wi-Fi ad-hoc network
- Built and tested at 5TONIC, but it is reproducible in other environments



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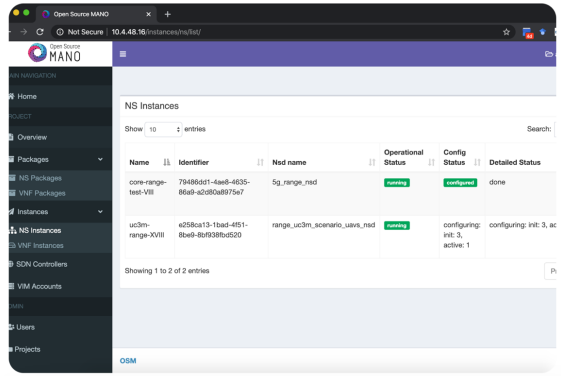
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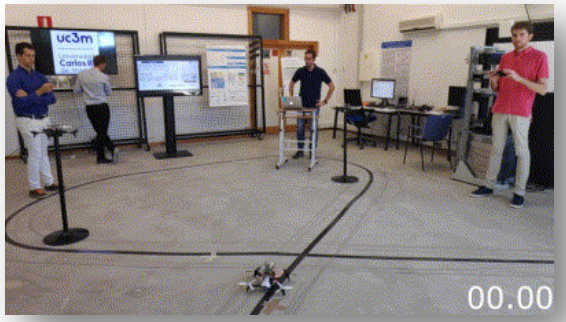
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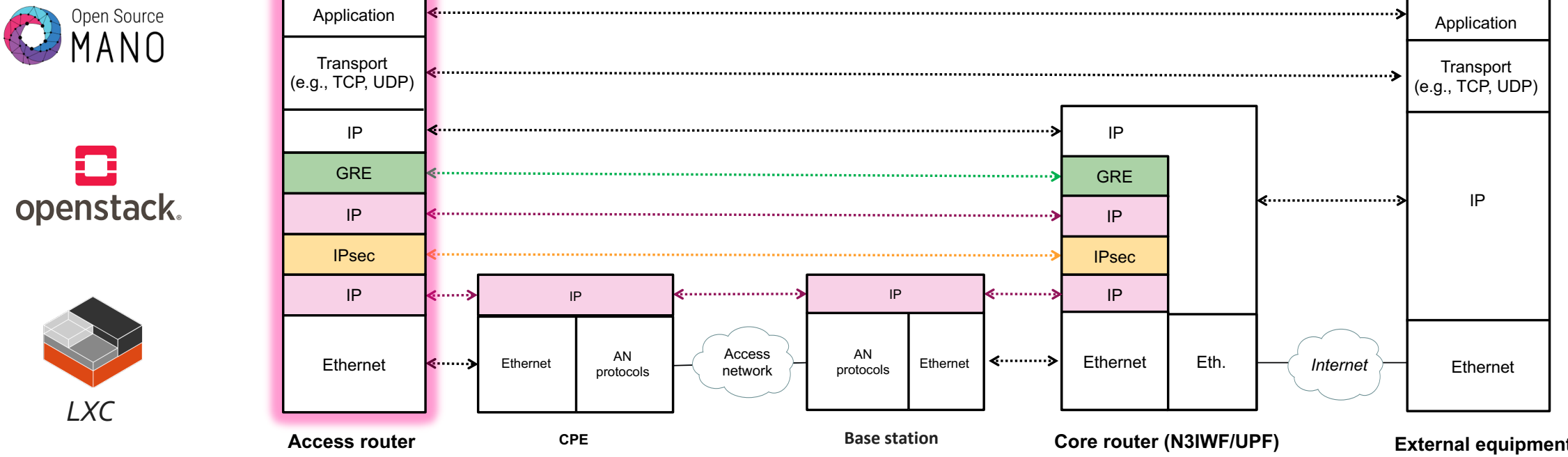
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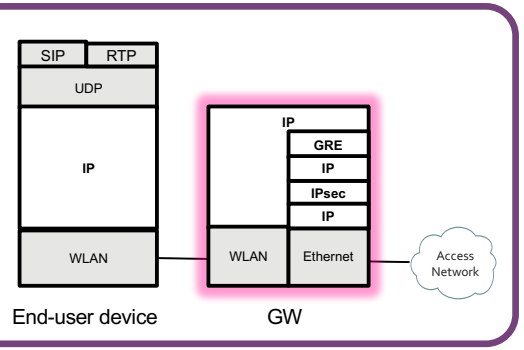
Network Service Description

- **IP telephony service**, to be provided to the users in the vicinity of the UAVs.
- Built up by the following components, which have been implemented as **VNFs**:
  - **Access Point VN**F: provides a Wi-Fi access point to end–user IP-phones.
  - **IP telephony server VNF**: responsible for managing the call signalling messages that are exchanged by the IP phones to establish and terminate a voice call.
  - **Domain Name System VNF**: supply a name resolution service, as needed in IP telephony services.
  - **Access Router VNF**: implements the user-plane protocol stack defined by 3GPP for non-3GPP accesses. It supports network routing functionalities between the IP phones and the telecommunications operator domain.
  - **Core Router VNF**: provides the user-plane protocol stack of a 3GPP N3IWF. It supports network routing functionalities within the telecommunication operator domain.
- All the content needed to carry out the experiment is provided in the public experiment repository http://vm-images.netcom.it.uc3m.es/JoVE/

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Description of VNFs

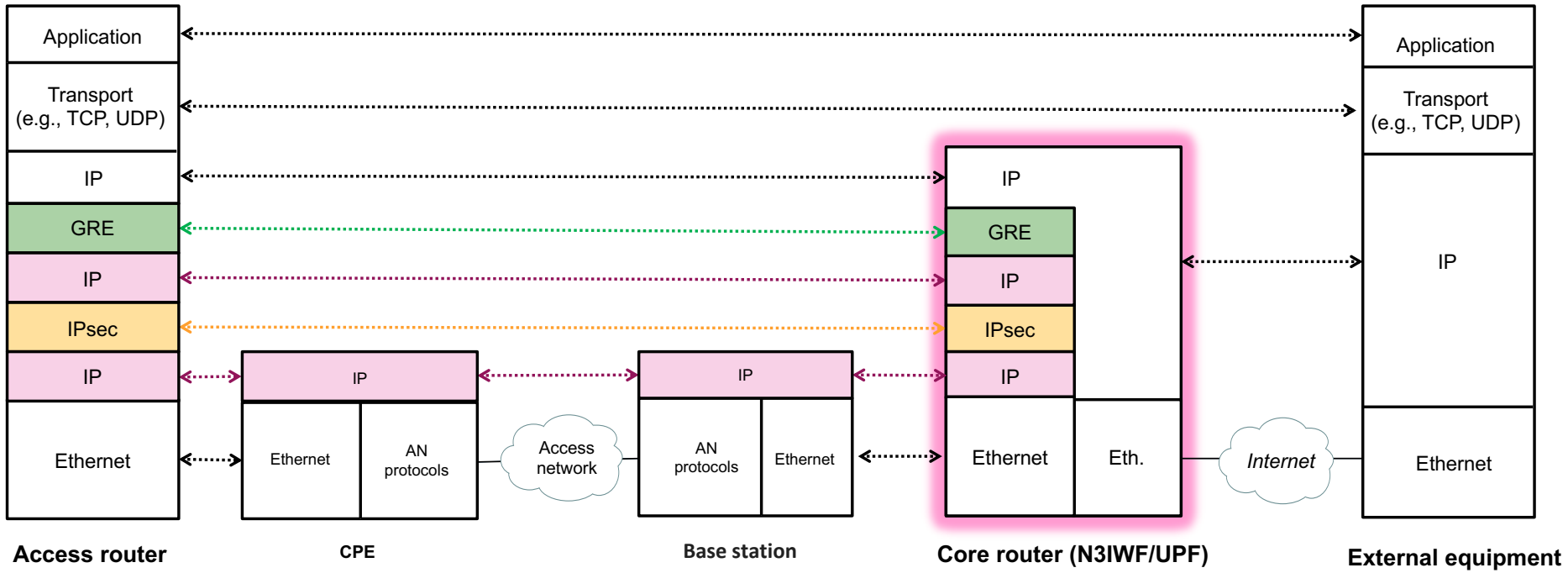




Access Router VNF
✓ Provides the implementation of the user-plane protocol stack of a 3GPP UE, to access the 5C core network via an untrusted non-3GPP access
✓ Enables the access of multiple end-user devices to the 5G-RANGE access network
✓ Developed as VM, using Ubuntu 16.04; 1 CPU, 1 GB memory, 5 GB storage
✓ Development based on the Linux ip-gre module and the ipsec-tools package

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Description of VNFs



5G Core Network VNF (5GC)
✓ Provides the implementation of the user-plane protocol stack of a N3IWF, as well as routing functionalities towards external networks (i.e., UPF functions)
✓ Prototyped as a VM, using Ubuntu 16.04; 2 CPU, 1 GB memory, 5 GB storage
✓ Development based on the Linux ip-gre module and the ipsec-tools package

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Description of VNFs

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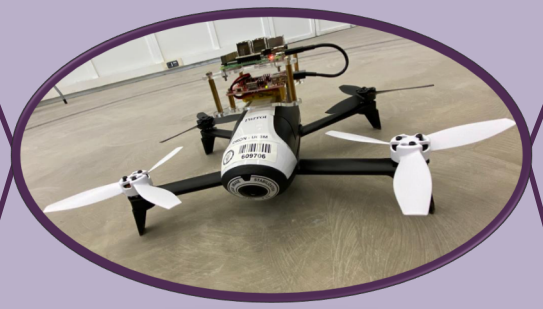
openstack

LXC

Linux

IP Telephony server VNF
✓ Provides the functions of an IP Telephony service based on the SIP protocol (i.e., proxying of call signalling messages and user registration).
✓ Developed as VM, using Ubuntu 16.04; 1 CPU, 1 GB memory, 5 GB storage
✓ Development based on the open-source SIP server Kamailio

Access Point VNF
✓ Provides the implementation of a Wi-Fi access point to 5G-RANGE users ✓ And routing functions for user and service traffic
✓ Prototyped as a LXC container, using Ubuntu 16.04; 1 CPU, 128 MB memory, 4 GB storage ✓ Running on Raspberry Pi 3 B+



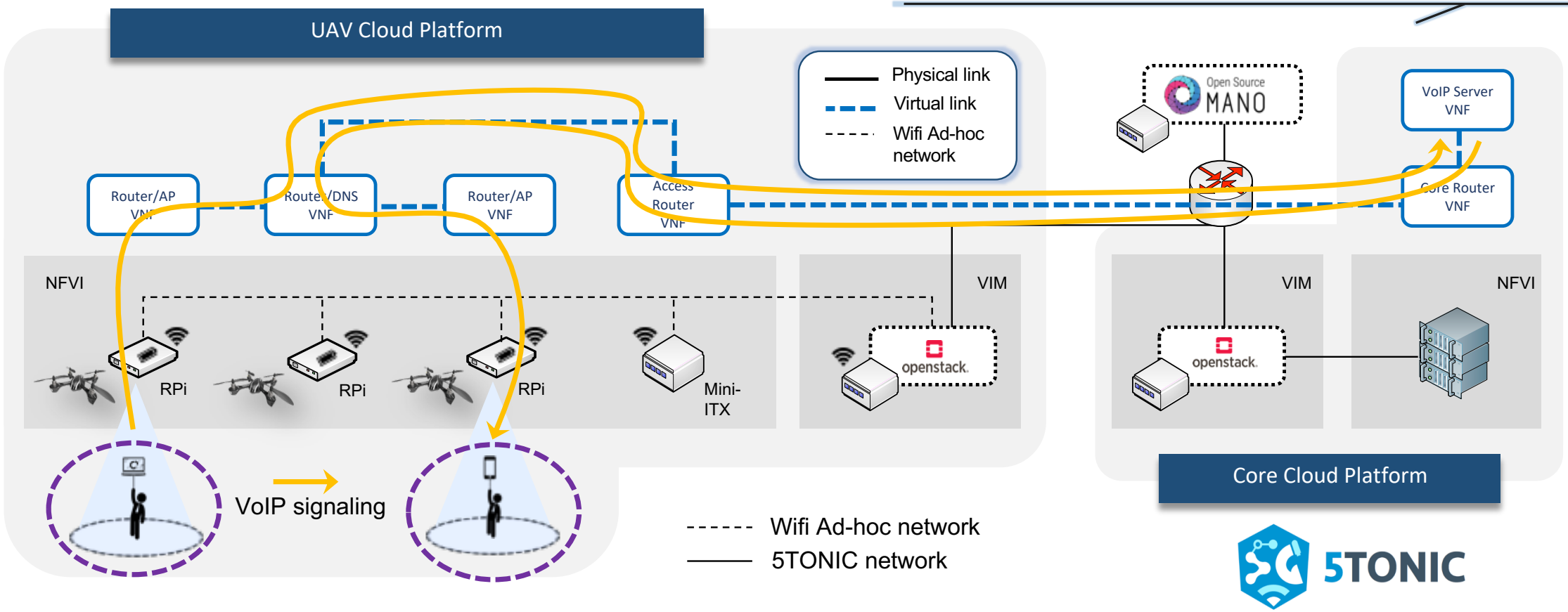
DNS VNF
✓ Provides a name resolution service, to support user identification in a functional IP telephony service ✓ And routing functions for user and service traffic
✓ Prototyped as a LXC container, using Ubuntu 16.04; 1 CPU, 128 MB memory, 4 GB storage ✓ Running on Raspberry Pi 3 B+

Adapted from: 5GINFIRE

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Call Establishment

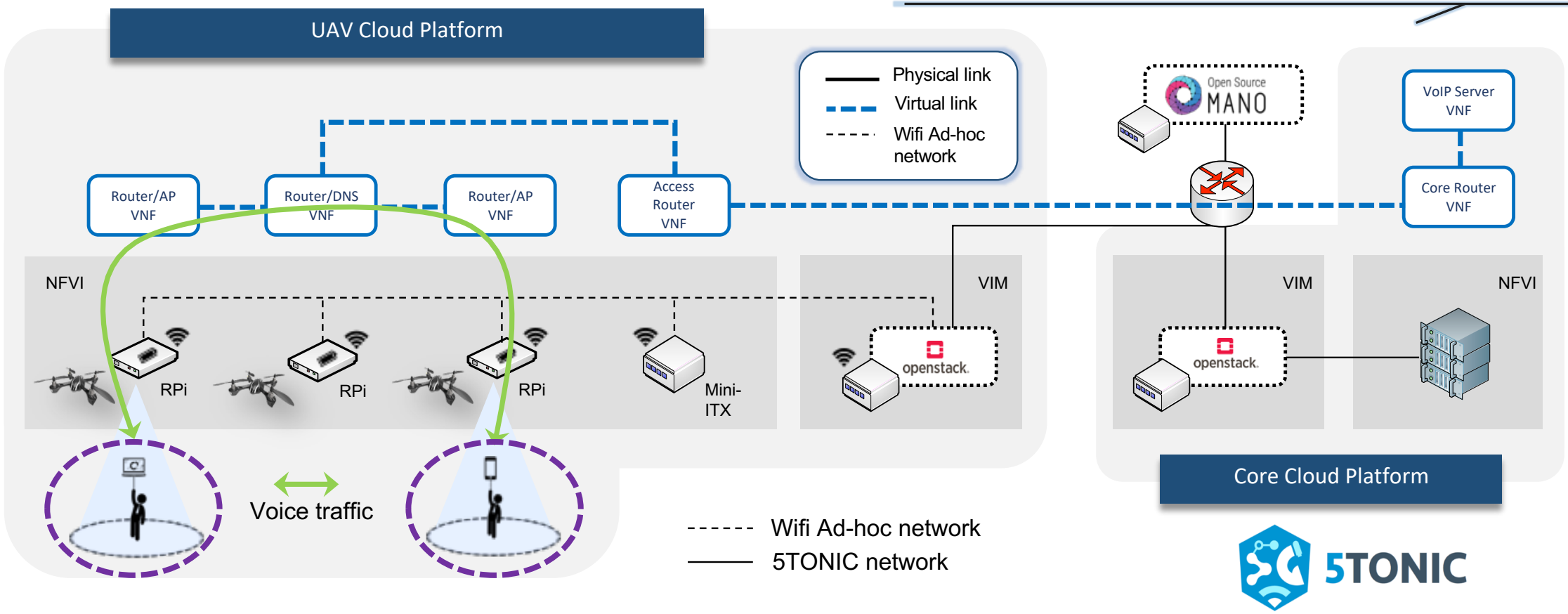
Once OSM completes the network service deployment, two end-users can establish a call through the VoIP server deployed in the core-cloud platform at 5TONIC.



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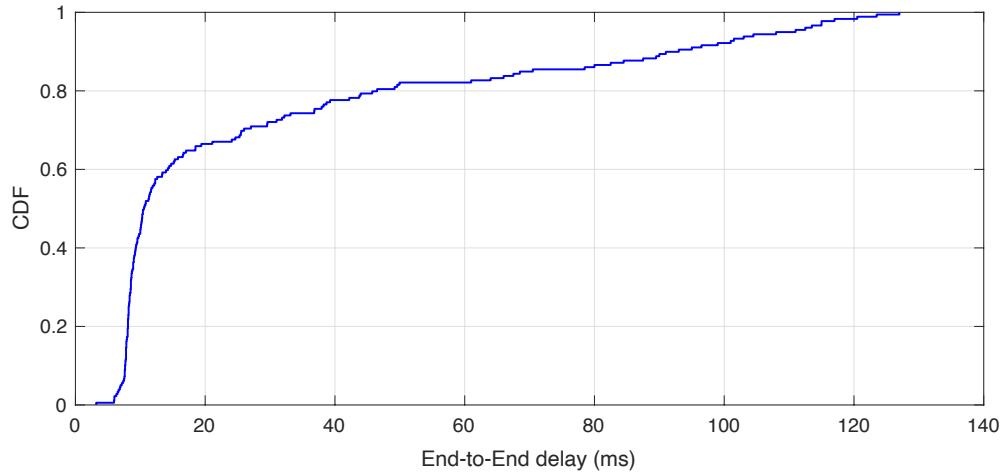
Voice Communication

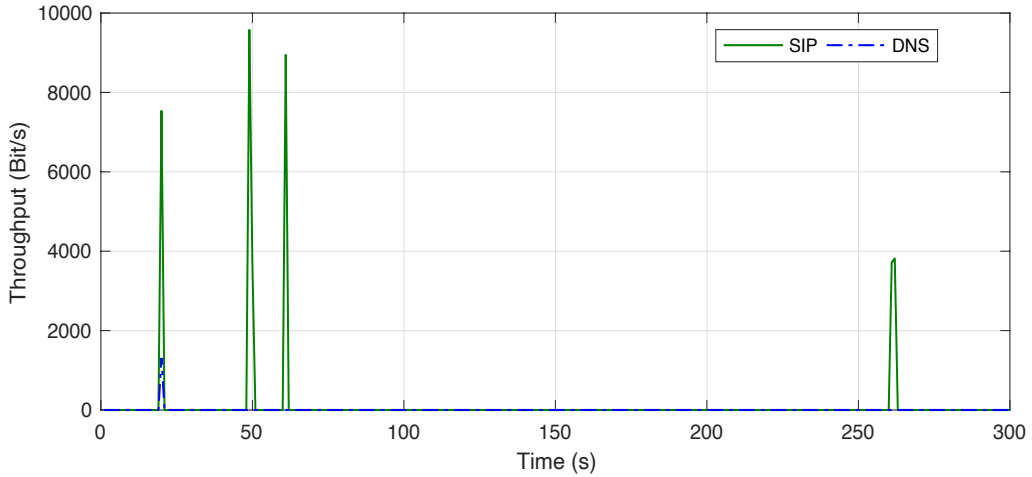
Right after the call has been established, both user can maintain an interactive communication, where voice is directly exchanged through the VNFs deployed over the UAVs.

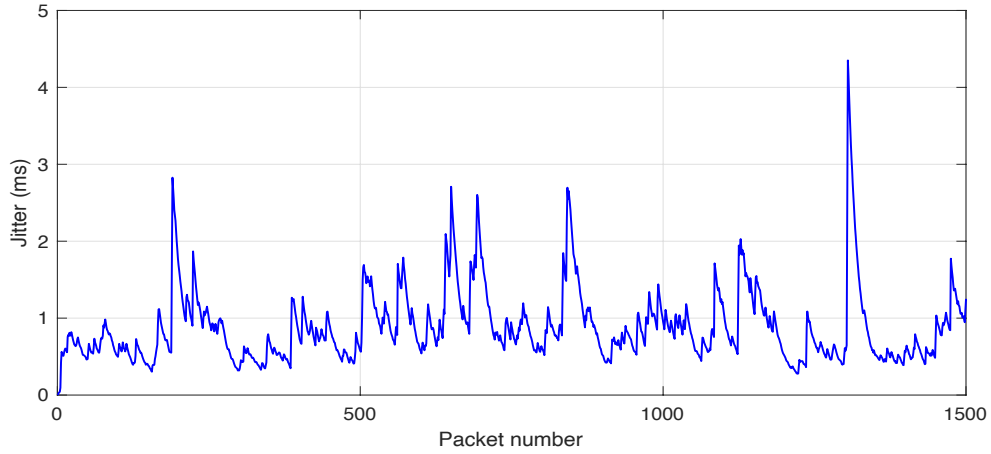


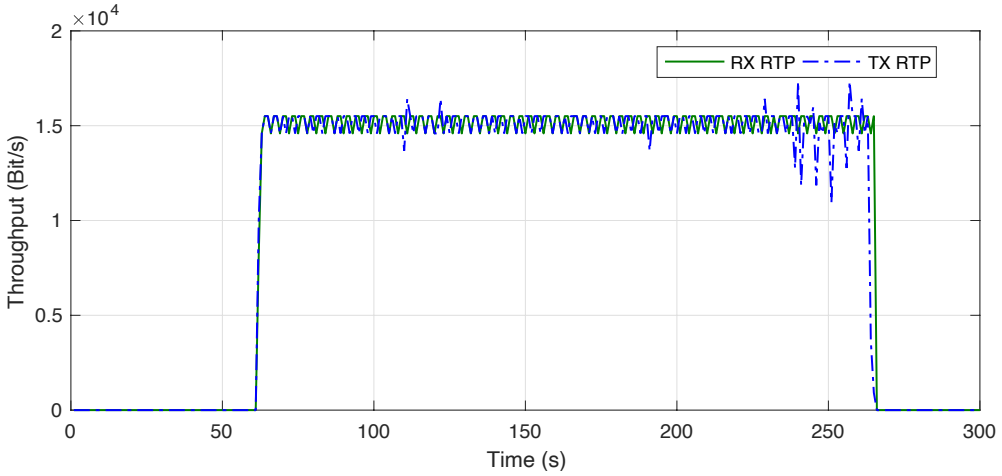
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Performance Results





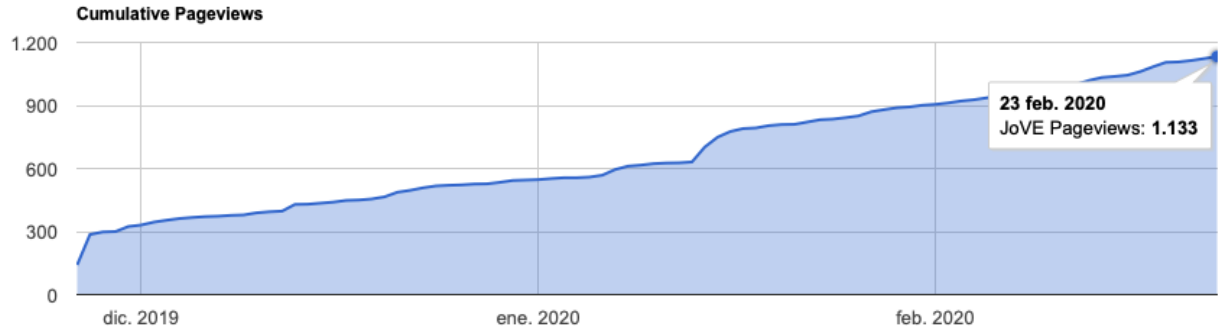




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Impact

- Video article published in the Journal of Visualized Experiments (JoVE):
  - Aims at facilitating the reproducibility of the NFV setup and experiment
  - More than 1K visits since November 2019

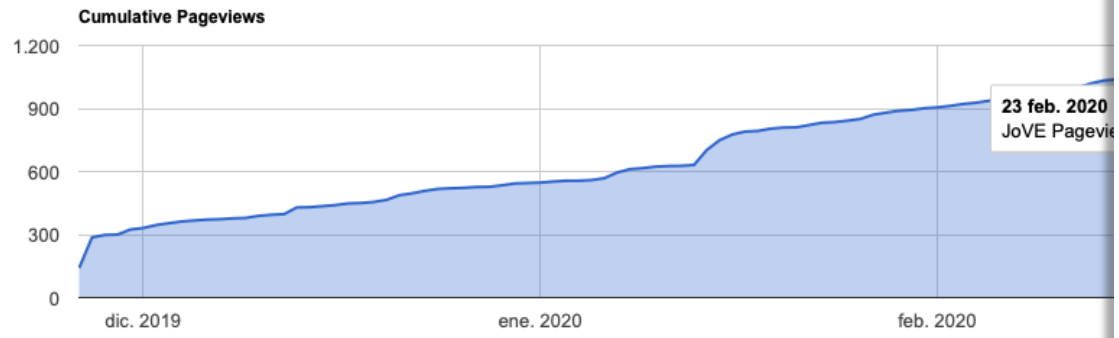


- Work contributed to the OSM upstream project:
  - Accepted by ETSI as an OSM PoC: https://bit.ly/37VG6xe
- Disseminated to a broader audience:
  - Coverage in the main national public TV channel and in the regional TV channel of Madrid.
  - Press release in Spanish media

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OSM PoC 10 Automated Deployment of an IP Telephony Service on UAVs using OSM

PoC Team Members

- Universidad Carlos III de Madrid (UC3M), IMDEA

All Poc team members are OSM members or participants

- Main contacts:
  - UC3M: Borja Nogales (bdorado _at_ pa.uc3m.es)
  - UC3M: Iván Vidal (ividal _at_ it.uc3m.es)
  - IMDEA, UC3M: Víctor Sánchez (victor.sanchez _at_ imdea.org)
  - UC3M: Francisco Valera (fvalera _at_ it.uc3m.es)
  - UC3M: Luis F. González (luifgon _at_ it.uc3m.es)
  - IMDEA, UC3M: Arturo Azcorra (arturo.azcorra _at_ imdea.org)

Abstract

The Network Function Virtualization (NFV) paradigm is one of the key-enabling technologies in the development of the 5th generation of mobile networks. This technology aims at lessening the dependence on hardware in the provision of network functions and services by using virtualization techniques that allow the softwarization of those functionalities over an abstraction layer. In this context, there is increasing interest in exploring the potential of unmanned aerial vehicles (UAVs) to

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Publicado 18/02/2020 12:57:56 CET

Una solución de drones basada en 5G ayuda a llegar a zonas de limitado acceso para identificar el foco del incendio

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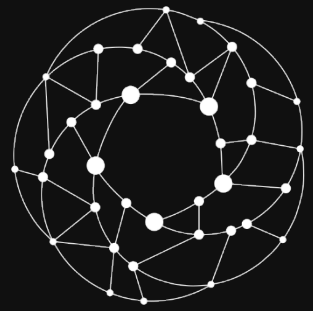


ts (JoVE):



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