
5GCity
A DISTRIBUTED CLOUD & RADIO PLATFORM FOR 5G NEUTRAL HOSTS
Edge Computing Enhancements in an NFV-based Ecosystem for 5G Neutral Hosts
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Outline

- Introduction
- Edge computing enhancements in an NFV-based ecosystem
- Conclusion

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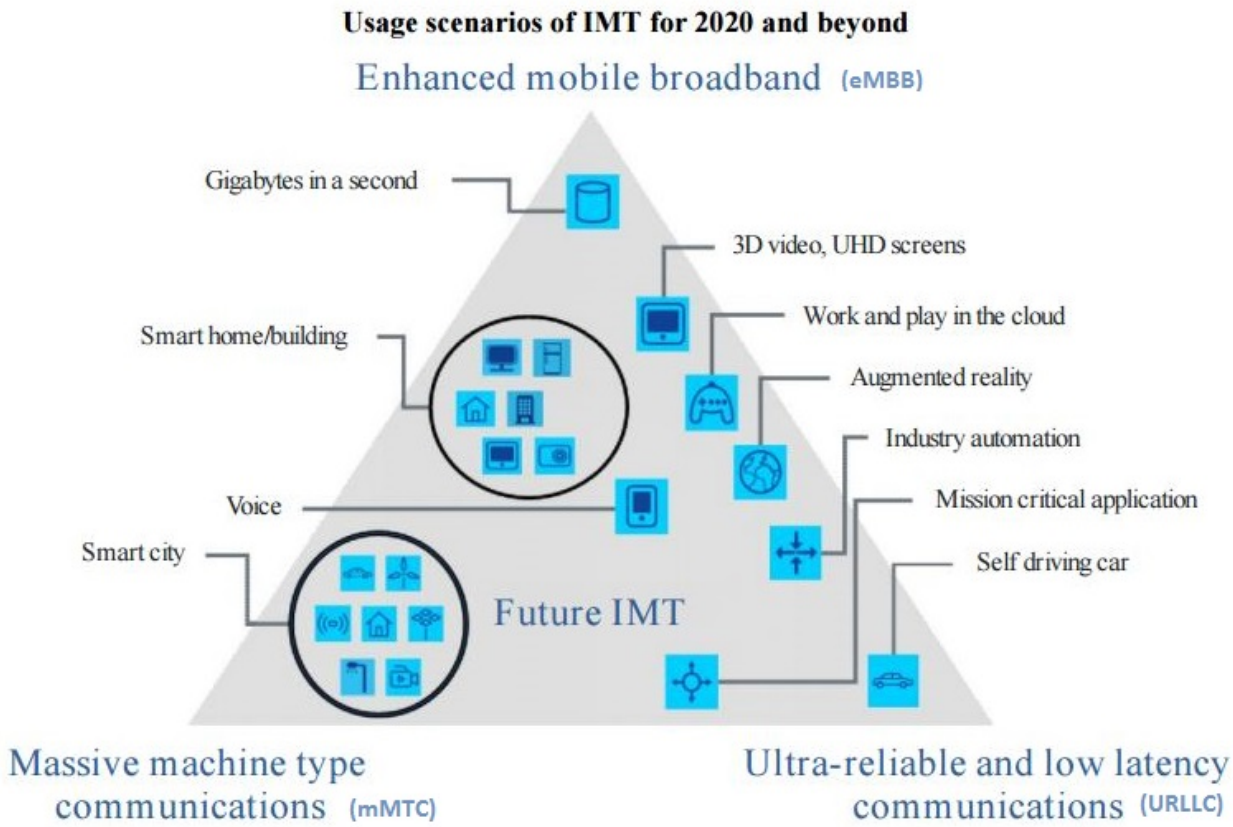
Introduction

- 5GCity is a second phase EU project, which design, develop, deploy and demonstrate, in operational conditions, a distributed cloud and radio platform for municipalities and infrastructure owners acting as 5G neutral hosts.

Introduction

- 5G usage scenarios for International Mobile Telecommunications (IMT)
  - eMBB
    - Large area coverage
    - Mobility is low
  - mMTC
    - Large number of connected devices
  - URLLC
    - Throughput, latency and availability



Introduction

- Future of the city will leverage on distributed electronic devices to make citizens' life better, such as devices are:
  - IoT Sensors
  - Smart infrastructure
  - Smart devices
  - Safety critical devices

- To be ready for IoT, 5G, industry and operators need to get onboard with NFV today.

- The virtualization trend leading to introducing of neutral hosting
  - Neutral hosting allows infrastructure owners to partition and share network resources among various tenants
    - Increase the diversity of 5G slice users
    - Owns and administer lots of edge computing equipment

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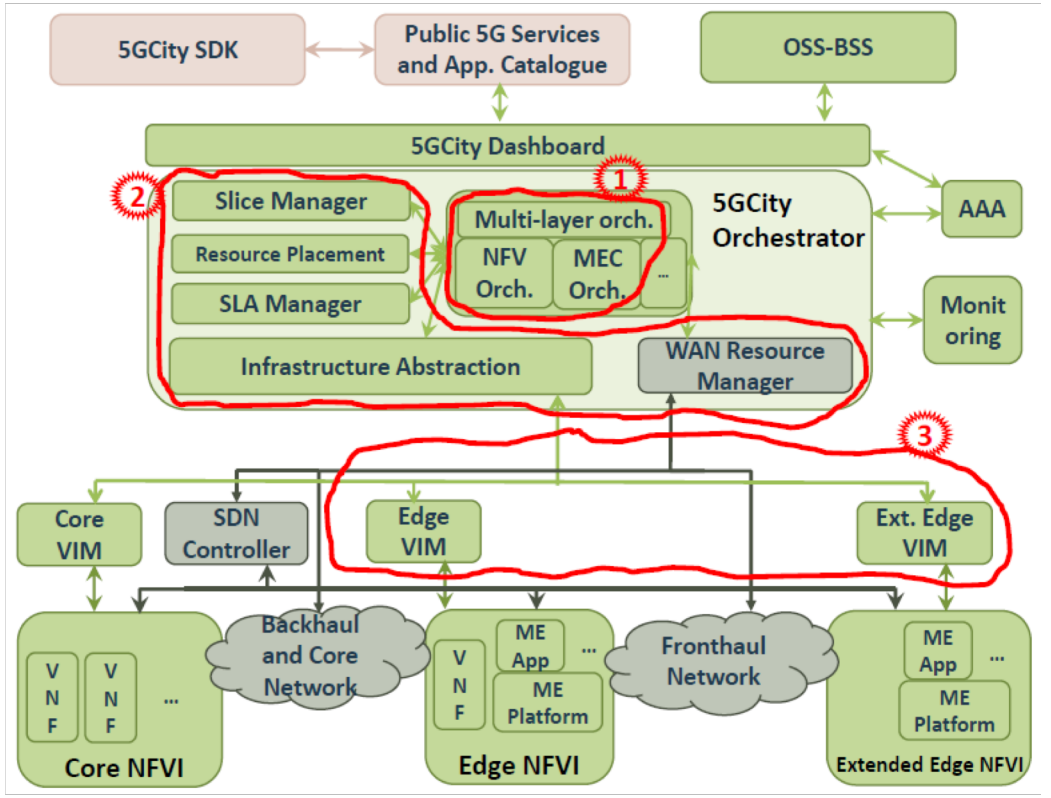
Edge computing enhancements in an NFV-based ecosystem

- The **platform** that empowers this kind of 5G neutral host need to
  - Be **compatible** with the NFV ecosystem.
  - **Support** series of **edge computing** enablers.
  - **Integrate** the **NFV** and the **MEC orchestrators**.
    - NFV orchestrator performs the actual **deployment of functions** on **NFV Infrastructure**.
    - MEC orchestrator focus only on controlling the **edge applications** and the **edge platform management**.

Edge computing enhancements in an NFV-based ecosystem

- Multi-tier orchestration and edge infrastructure management extensions

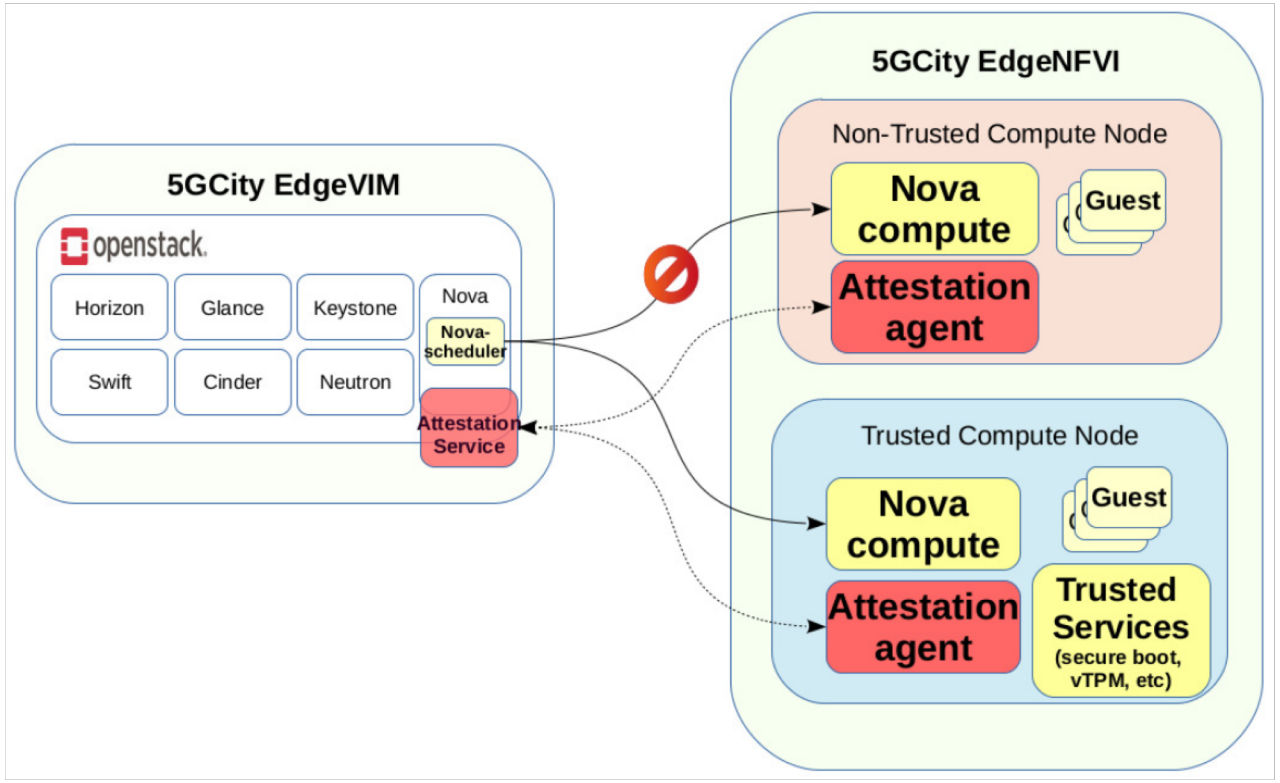
1) Multi-layer orchestration
2) Rest of the orchestration functionalities
3) Edge virtualization security and trust developments



Edge computing enhancements in an NFV-based ecosystem

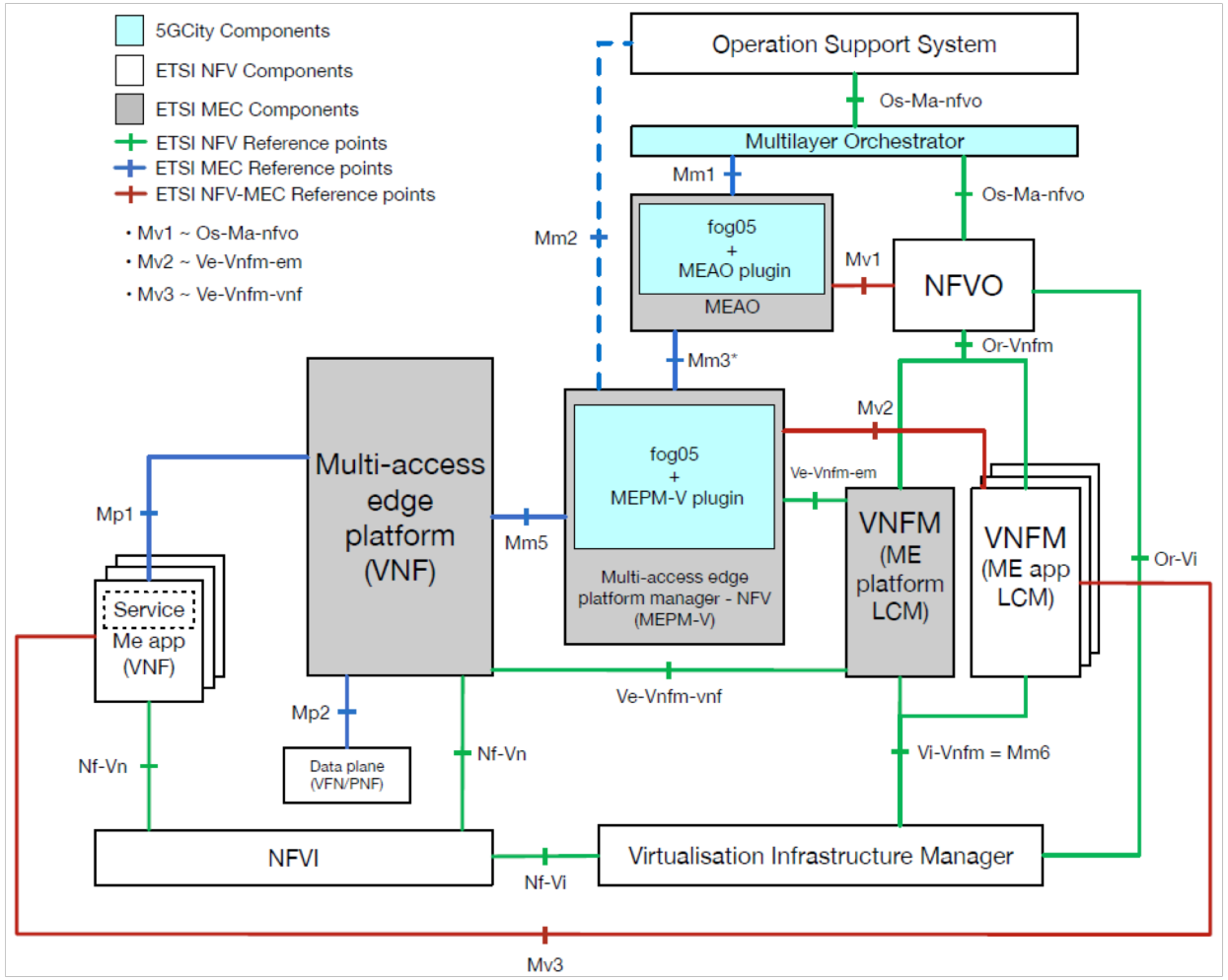
- Multi-tier orchestration and edge infrastructure management extensions

3) Edge virtualization security and trust developments
   - **EdgeVIM** and **EdgeNFVI** are OpenStack-based solution - provides the following features to the Arm-based edge devices:
     - Virtualization-based security
     - Trust infrastructure



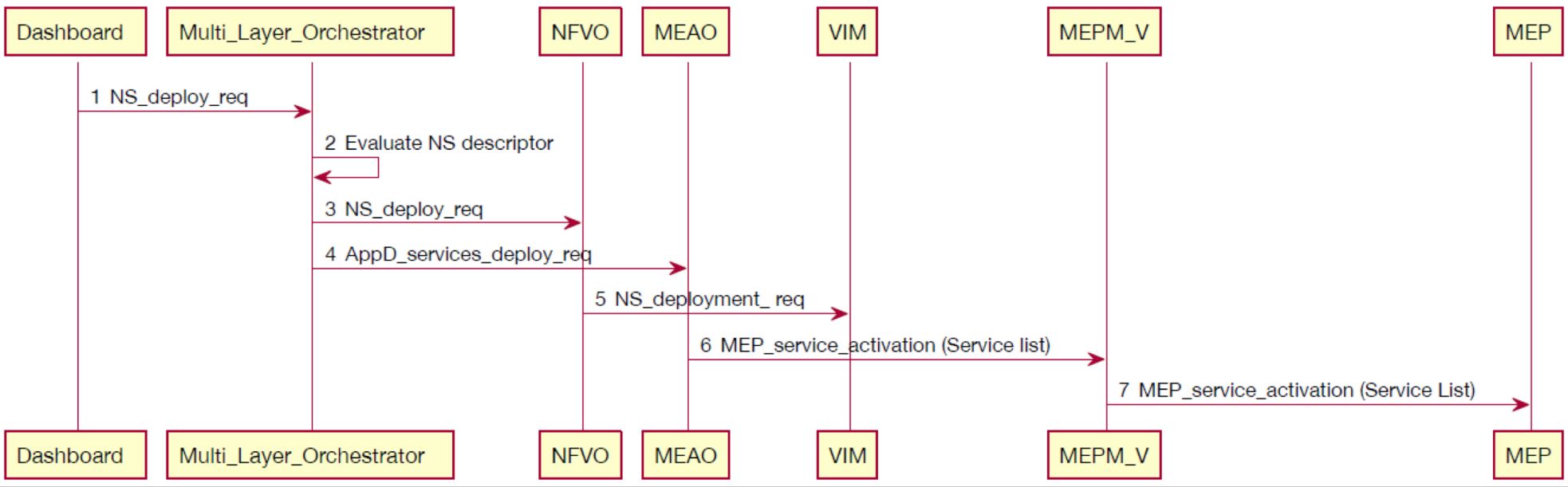
Edge computing enhancements in an NFV-based ecosystem

- Integrated VNF-MEC orchestration solution



Edge computing enhancements in an NFV-based ecosystem

- Integrated VNF-MEC orchestration solution
  - Deployment of an Network Service over the 5GCity NFV enabled architecture



Edge computing enhancements in an NFV-based ecosystem

- Integrated VNF-MEC orchestration solution

ETSI-identifed Open Issue	5GCity Solution
1. Mapping between ME app VNFs and NS	In 5GCity, the MEAO maintains a register of ME app VNFs that are used as ingredients of NSs. This register is updated whenever the MEAO gets the NS descriptors of the NFVO
2. Usage of NFV Network Service.	In 5GCity, the MEAO maintains an extended NSD (NS Descriptor) with MEC-relevant fields that include dependencies of NSs to MEC services.
3. Communication between MEAO and NFVO.	In 5GCity, this communication goes through the Mv1 interface, which is developed as a subset of Os-Ma-nfvo
4. Communication between MEPM-V and VNFM via Mv2.	In 5GCity, this communication goes through Mv2, which is developed as a subset of Ve-Vnfm-em. MEPM-V acts as an Element Manager for the ME Platform and it keeps track of LCM operations initiated by the NFVO. It also accesses PM counters for the virtualized resources that host ME app VNFs related to the ME platform.
5. Communication between VNFM and ME App VNFs.	Since ETSI MEC doesnt cover this part in detail, 5GCity will use the NFV approach, i.e, Mv3 will be developed as Ve-vnfm-vnf without any changes, and it will be used for this communication.
6. MEC AppD vs NFV VFND for ME app VNFs.	5GCity uses both descriptors, with MEAO handling AppDs and NFVO handling VNFDs.

Edge computing enhancements in an NFV-based ecosystem

- Integrated VNF-MEC orchestration solution

ETSI-identifed Open Issue	5GCity Solution
7. VNF Package vs. MEC application package.	Similarly to the descriptors (see previous issue), 5GCity packages contain files (descriptors, VM images, executables etc.) related to both NFV and MEC.
8. NS/ME app onboarding.	The Multi-layer Orchestrator acts as the master for onboarding, dispatching requests to MEAO and NFVO. This means that the onboarding starts from the Multilayer Orchestrator, which will then validate eventual MEC information, and send MEC descriptors to MEAO and NFV descriptors to the NFVO.
9. Management of traffic redirection.	In 5GCity, the ME platform requests traffic redirection through Mm5. This information goes then to MEAO through Mm3*, and the MEAO creates a forwarding path based on the new traffic rules and uses Mv1 to ask the NFVO to instantiate them. The MEAO is the trigger for traffic redirection, then the actual configuration is done by NFVO for the NFV part and by the ME platform for the MEC-related part.
10. Comparison between AppD and VNFD data structures	Since 5GCity handles both descriptors in separate sub-orchestrators, the solution can be developed without requiring a deep comparison of the two data structures.

Edge computing enhancements in an NFV-based ecosystem

- Integrated VNF-MEC orchestration solution

ETSI-identifed Open Issue	5GCity Solution
11. NFV construct that corresponds to ME Host.	In 5GCity an ME Host is mapped with the NFVI present in a cabinet, meaning that an NFVI-PoP correspond to a ME Host. MEC should be able to reuse such as NFVI-PoP (basically, a data centre) and Zone (a set of co-located and well-connected physical resources which is a subset of an NFVI-PoP).
12. ME App VNF Instance Relocation.	The MEAO and the NFVO collaborate when it is time to relocate an ME App instance. This communication goes through a reference point separate from Mv1, because it is unrelated to Os-Ma-nfvo. Relocation is triggered by MEAO based on information coming from MEPM-V.
13.Application instantiation.	Similarly to issue 12, ME app instantiation is triggered by the MEAO.
14. Application instance termination.	Similarly to issue 12, ME app termination is triggered by the MEAO based on information coming from MEPM-V.

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Conclusion

- Neutral Hosting paly a main role in the deployment of 5G networks, especially in the urban scenarios where very dense small cell deployments are required to serve business on crowded districts and events.

- Both ETSI NFV and ETSI MEC bring innovation solutions and accelerate the adaptation of the neutral hosting.

- Develop a thin layer of orchestration on top of the individual NFV and MEC orchestrators in order to make them integrated.

- 5GCity platform provides solution for the ETSI-identified open issues.

Thank you!