

Opportunities and Challenges of Joint Edge and Fog Orchestration

IEEE Wireless Communications and Networking Conference, Barcelona

15th April 2018

Luca Cominardi, Osamah Ibrahiem Abdullaziz, Kiril Antevski, Shahzoob Bilal Chundrigar, Robert Gdowski, Ping-Heng Kuo, Alain Mourad, Li-Hsing Yen, Aitor Zabala



Where are we now in the edge and the fog?

ETSI Network Function Virtualization (NFV)

- Virtualization capabilities into mobile operator networks
- Decouple the network functions from the underlying hardware
- Dynamically deploy network services

ETSI Multi-access Edge Computing (MEC)

- Computing capabilities close to the end users
- Hosting environment at the network edge with low latency and high bandwidth
- Real-time access to radio network information

OpenFog consortium

- Computing, storage, control and networking functions closer to the users along a cloud-tothing continuum
- Collaborative usage of a multitude of devices
- Non-stationary and volatile devices are considered

Mobile operator centric

Enterprise centric





Edge and Fog synergies and commonalities

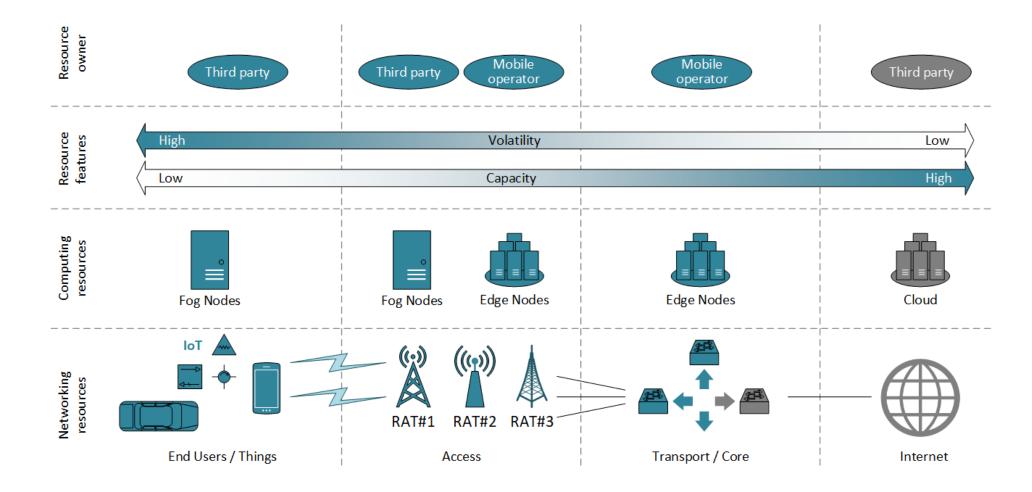


- Edge and Fog are stand-alone domains that require separate deployments eventually contending for the same physical resources (e.g., spectrum)
- Poor usage of Edge and Fog resources due to the lack of integration
 - Reduced cost-effectiveness because of the multiple separate physical deployments





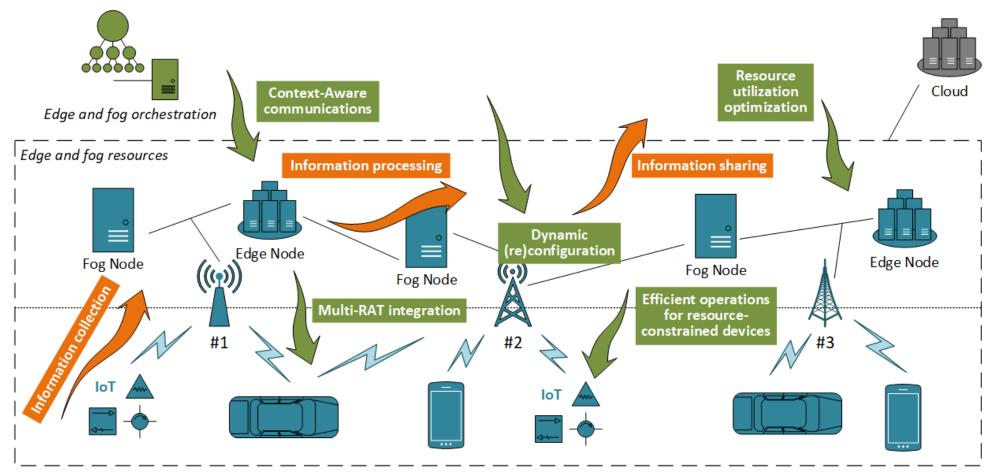
Edge and Fog resources and characteristics







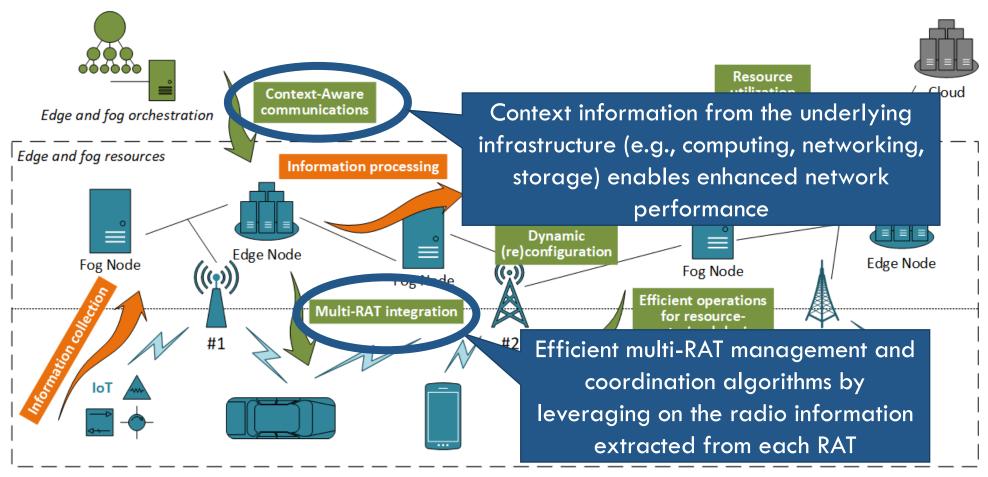
Edge and Fog joint orchestration opportunities







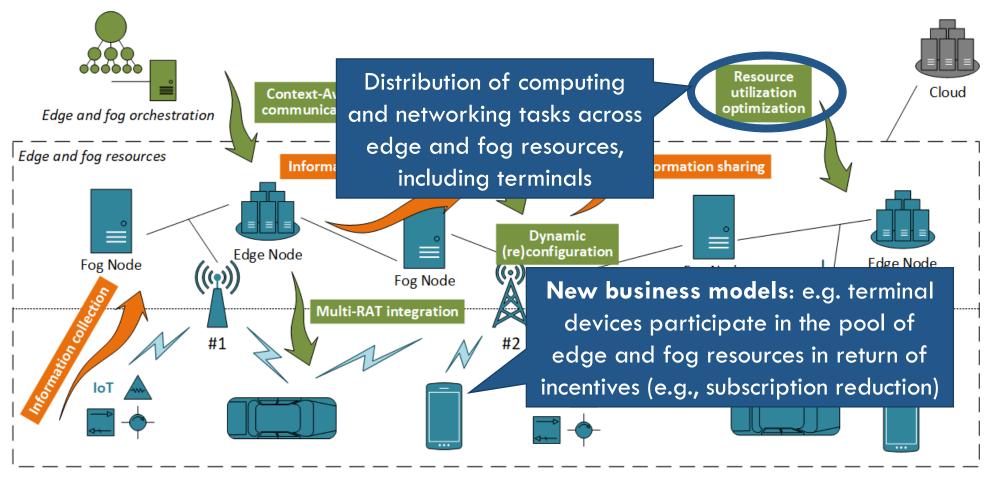
Edge and Fog joint orchestration opportunities Context-aware communications







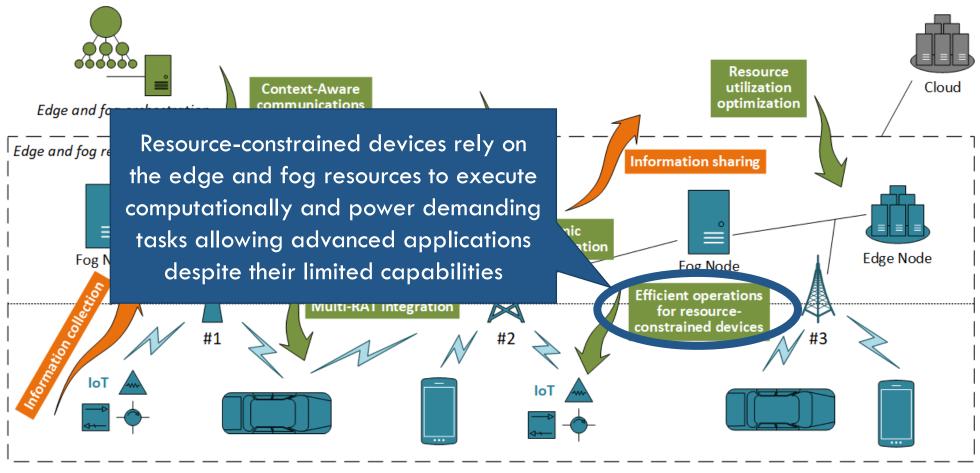
Edge and Fog joint orchestration opportunities Resource utilization enhancement







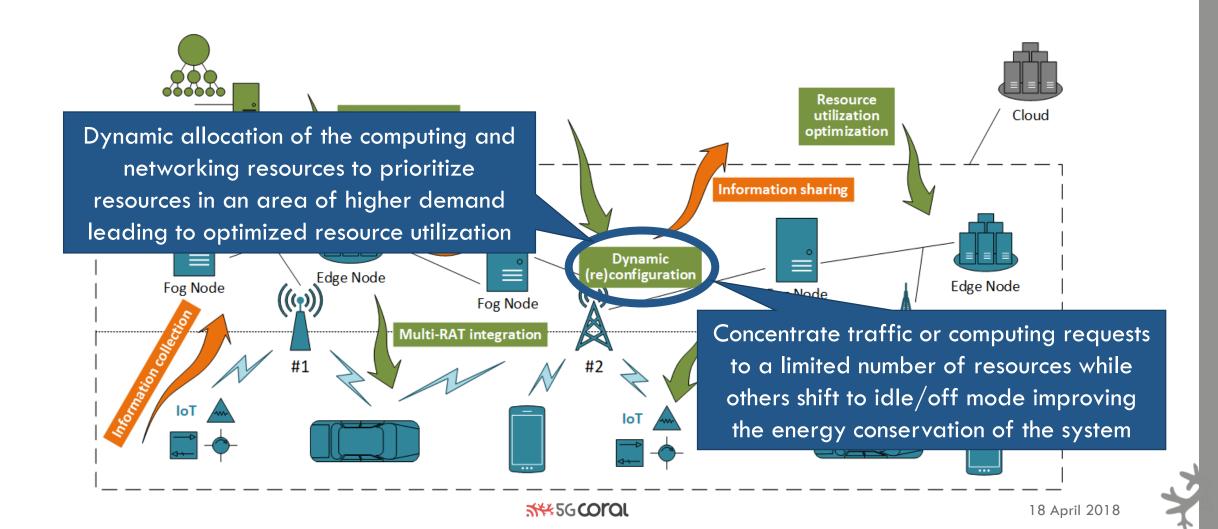
Edge and Fog joint orchestration opportunities Efficient operation for resource-constrained devices







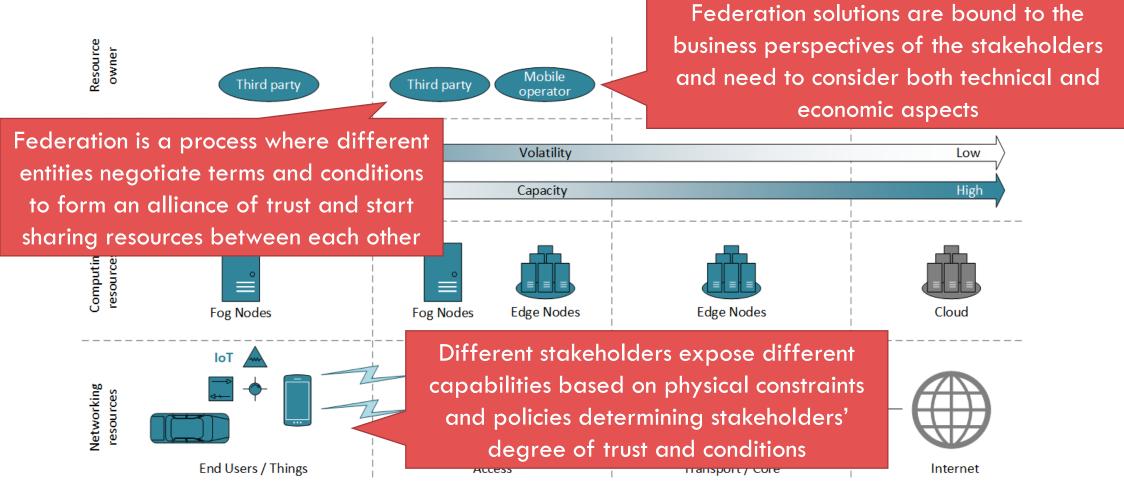
Edge and Fog joint orchestration opportunities Flexible and scalable functionalities





Edge and Fog joint orchestration challenges

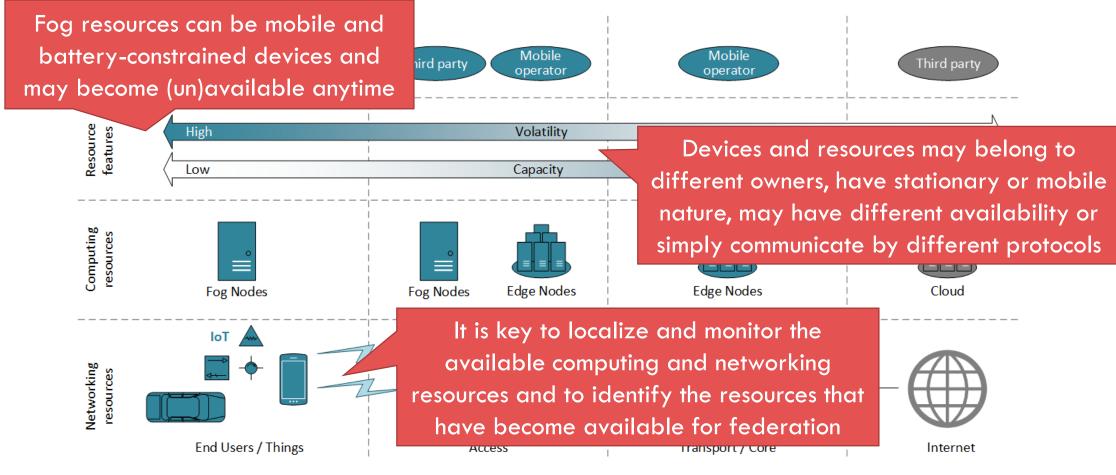
Federation mechanisms







Edge and Fog joint orchestration challenges Dynamic discovery of resources







Edge and Fog joint orchestration challenges

Multi-tenancy and security

tenant's needs (SLAs) and current status of the infrastructure Mechanisms to ensure security, isolation, and Mobile Mobile Third party Third party operator operator privacy among tenants are required Protection against Low Resour feature malicious applications High Low including third-parties Performance monitoring information to the tenants Fog Nodes **Edge Nodes** Secure exposure of service capabilities for SLA verification and management policies with a (((1)))Networking resources standard resource descriptor to the tenants for SLA negotiation RAT#1 RAT#2 RAT#3 Transport / Core End Users / Things Access Internet

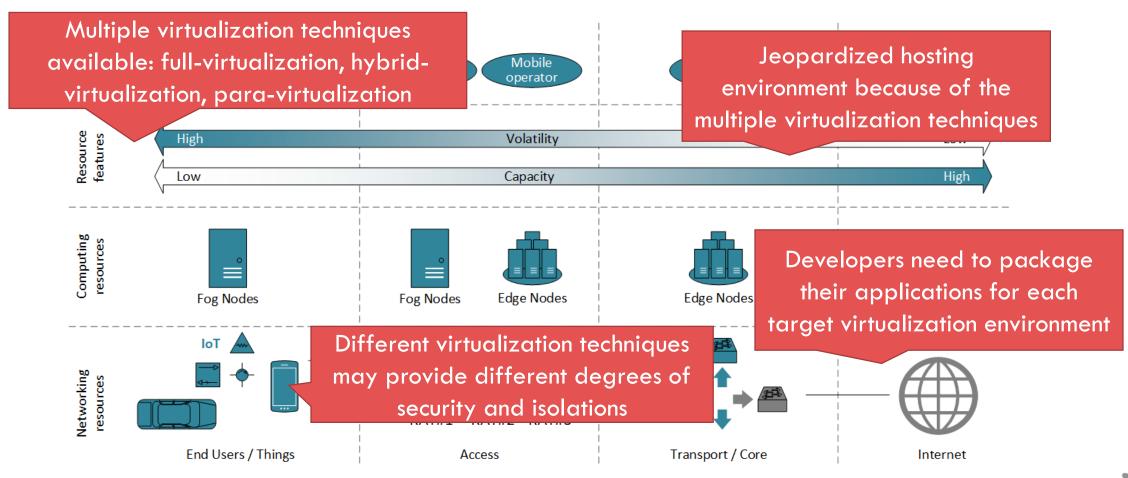




Admission control based on



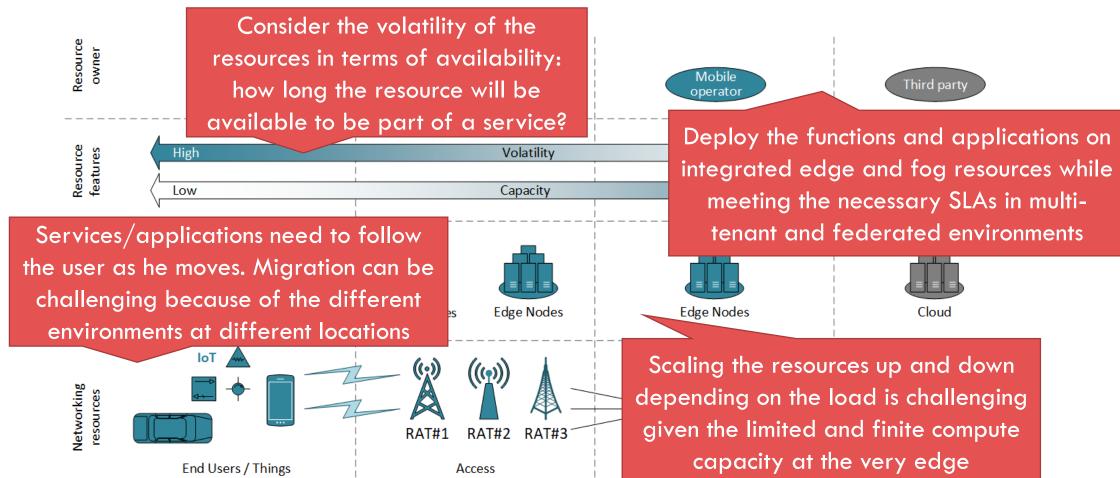
Edge and Fog joint orchestration challenges Multi-virtualization technology coexistence







Edge and Fog joint orchestration challenges Dynamic functions and applications placement















Consortium partners and acknowledgment























This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 761586.

