



# Cloud Computing and 5G Network Technologies' Advancements driving Advanced SLAs

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# Main Topics

- 5G Network Architectures - Main Principles
  - 5G Network Services & Service Provisioning Aspects
  - SLAs defining 5G Network Services Provisioning
  - SLAs negotiation and maintenance over 5G Network and Cloud Infrastructures
- Two EU funded projects focusing on this direction are:

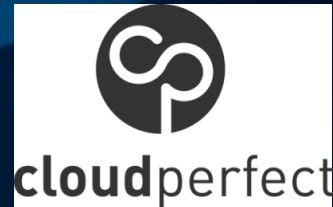


Project Homepage:

<http://www.5g-picture-project.eu/index.html>

Contact:

[5g-picture-Contact@5g-ppp.eu](mailto:5g-picture-Contact@5g-ppp.eu)



Project Homepage:

<https://cloudperfect.eu/>

Contact:

<http://cloudperfect.eu/#contact>

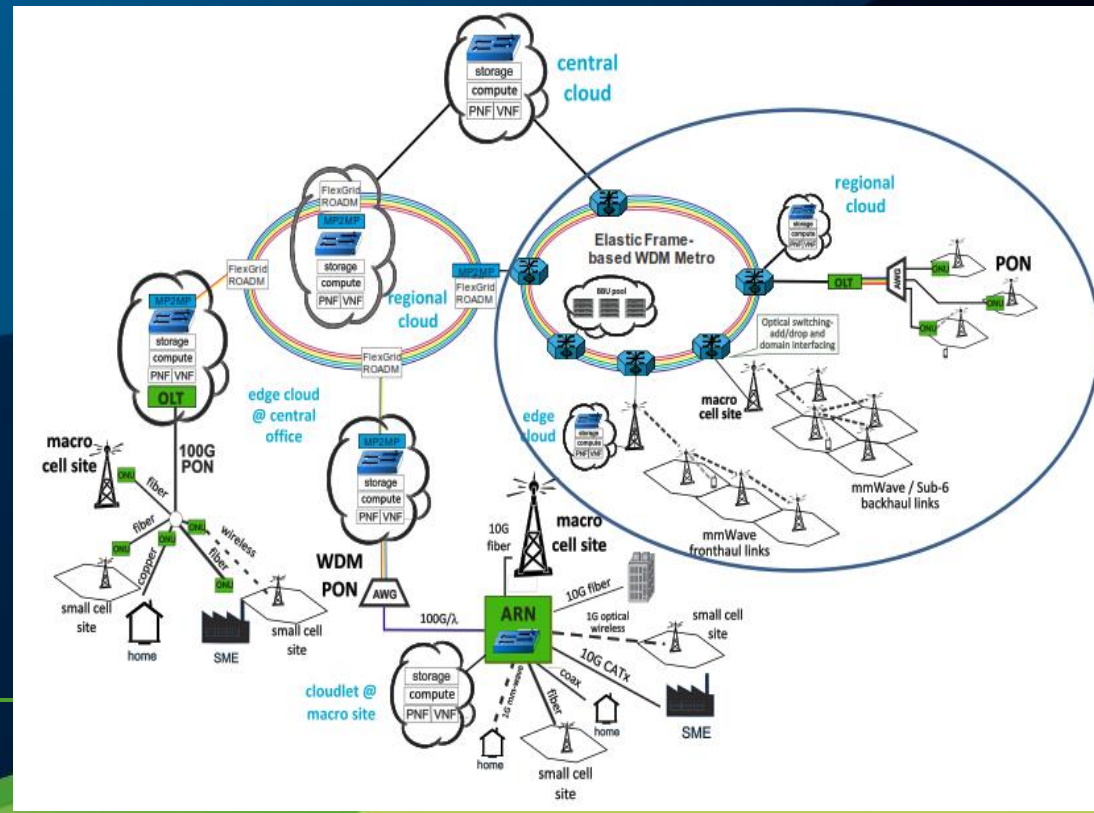
# 5G Networks Overview

5G Networks target at shifting from current, statically configured network and cloud infrastructures to flexibly configured infrastructures able to provide 5G network services upon request.

- **5G-PICTURE and CloudPerfect** are two EU funded projects aiming at delivering advancements in network and cloud resources management:
- **CloudPerfect** will enable IaaS/Cloud providers to enhance the stability and performance of their infrastructures, and optimise cloud resources allocation especially for application deployment.
- **5G-PICTURE** introduces the concept of network and compute resources disaggregation by defining flexible 5G architectures based on distributed pools of network & compute resources.

# 5G Network Architecture - Main Principles

- **Distributed compute/storage resources (cloud/edge datacenters)** are used for hosting apps and/or network services.
- **Network/Cloud nodes enable resources virtualisation** (via H/W programmability & S/W definition at various layers)
- **Network/cloud resources are orchestrated to provide a service abstraction layer** over multiple domains for services provisioning
- **Various wireless/optical techs coexist** at access and transport network level.



# 5G Network Services

## 5G Networks' highlights related to network services provisioning:

- **5G Networks' architectures and technologies** will provide the means to move from the current service models of provisioning connectivity or cloud services separately, to **more complex network service provisioning models incl. a mix of infrastructure resources and network connectivity services, tailored to stakeholders' specific requirements.**
- 5G Network infrastructure ownership can be distributed between various stakeholders/ technology domains . → **A Single interface for resources provisioning- service deployment is needed over the different domains.**
- The service provisioning of 5G Network Services needs to be defined by new, **enhanced Service Level Agreements (SLAs)** the Service Targets of which shall be measurable by the 5G Network Infrastructures.

# Service Offerings over 5G Infrastructures

- **Type A: Transport Network Services**
  - Users: MNOs (Mobile Network Operators) or other tenants owning an access & core network but lacking a transport network.
- **Type B: Transport Network Services & Cloud Services**
  - Users: MNOs or other tenants owning an access network but lacking a transport network & cloud infrastructure.
- **Type C: End-to-End Telecom Services & Cloud Services**
  - Users: MVNOs or other tenants /verticals with no infrastructure, requiring end-to-end telecom services and possibly compute (cloud) resources for hosting applications.
  - Includes network service provisioning for hosting/supporting applications comprising of more than one (distributed) application modules (e.g. service function chaining).



# 5G Infrastructure Services Provisioning Aspects

- **Various resources/services can be provided (depending on the type) such as:**
  - Backhaul (BH) and/or Fronthaul (FH) network connectivity services.
  - Access network connectivity services.
  - Auxiliary services such as synchronization.
  - Cloud services, e.g. for Cloud-RAN (vBBUs hosting), core network elements hosting, etc.
- **In a dynamic, spatio-temporal varying context**
- **Supporting dynamically (time) changing QoS for each service**
- **Supporting scaling of resources based on specific triggering events (e.g. performance degradation, monitored events, external requests)**
- **Allowing evaluation of service provisioning on the basis of a number of KPIs such as:**
  - Performance (based on KPIs e.g.: Bit Rates, Latency, Jitter, Packet Loss, Compute Resources etc.).
  - Availability
  - Reliability

# CloudPerfect Advancements in Cloud Domain

CloudPerfect focuses on delivering (for IaaS (Service) providers):

- **A publicly accessible benchmarking tool/service** of various Cloud Infrastructures/offerings.
  - Can be used by IaaS/NaaS for self assessment purposes as well as to optimise (manually or automatically) the placement/deployment of apps/app components/VNFs.
  - Can be tailored to specific SLA objectives as benchmarking is based on various performance parameters.
- **An efficient, infrastructure agnostic, resource allocation/ application deployment tool.**
  - To be used to deploy apps/app components/network virtual functions on multiple clouds –compute infrastructure domains.
  - Providing also autoscaling functionalities; which can be tailored to specific SLA objectives.
- **CloudPerfect Advancements in the Cloud Domain can serve purposes in the 5G ICT domain.**

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# 5G-PICTURE Advancements related to SLAs

- **5G-PICTURE** leverages on advancements in SDN and Cloud Orchestration and addresses among others the following:
  - **A service management (SM) layer responsible for SLAs' initial definition, negotiation and maintenance from a single interface.**
  - **A network orchestrator** -integrating SM processes or simply interfacing with them- **for the deployment of network services on compute resources of various domains** and for the network resources provisioning a disaggregated SW/HW infrastructure.
  - **A Network Control Plane, orchestration hierarchy and configurable infrastructure** for supporting the various types of services/SLAs as aforementioned (A,B,C).

# Conclusions

- Enhanced service offerings over 5G Infrastructures have been identified reflecting the 5G networks disaggregated/flexible architecture.
- Services can range from Transport Services to E2E Telecom & Cloud Services.
- 5G Networks' service provisioning needs to be defined by new, enhanced SLAs.
- Advanced SLA mechanisms need to be supported by the underlying 5G (cloud and network) technologies.
- Projects from the IT domain (e.g. CloudPerfect) and from the 5G domain (e.g. 5G-PICTURE) address similar aspects of service provisioning & SLAs such as:
  - App deployment/resources allocation on multiple domains over a single interface .
  - Advanced SLA capabilities support e.g. runtime policies guarantees, autoscaling, etc.
  - High QoS guarantees via optimising resources provisioning over diverse networks/ cloud infrastructures.
  - Infrastructure configurability/programmability/disaggregation to enable the aforementioned targets.

**Thank You!**