5G HEART

5G-HEART.EU

ACTA LTD
Advanced Communications Testing Applications

Active & Passive KPI measurements, suited for 5G-Networks (an application of 5G-HEART aquaculture pilot)

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5G HEART: Health, Transport and Aquaculture validation trials

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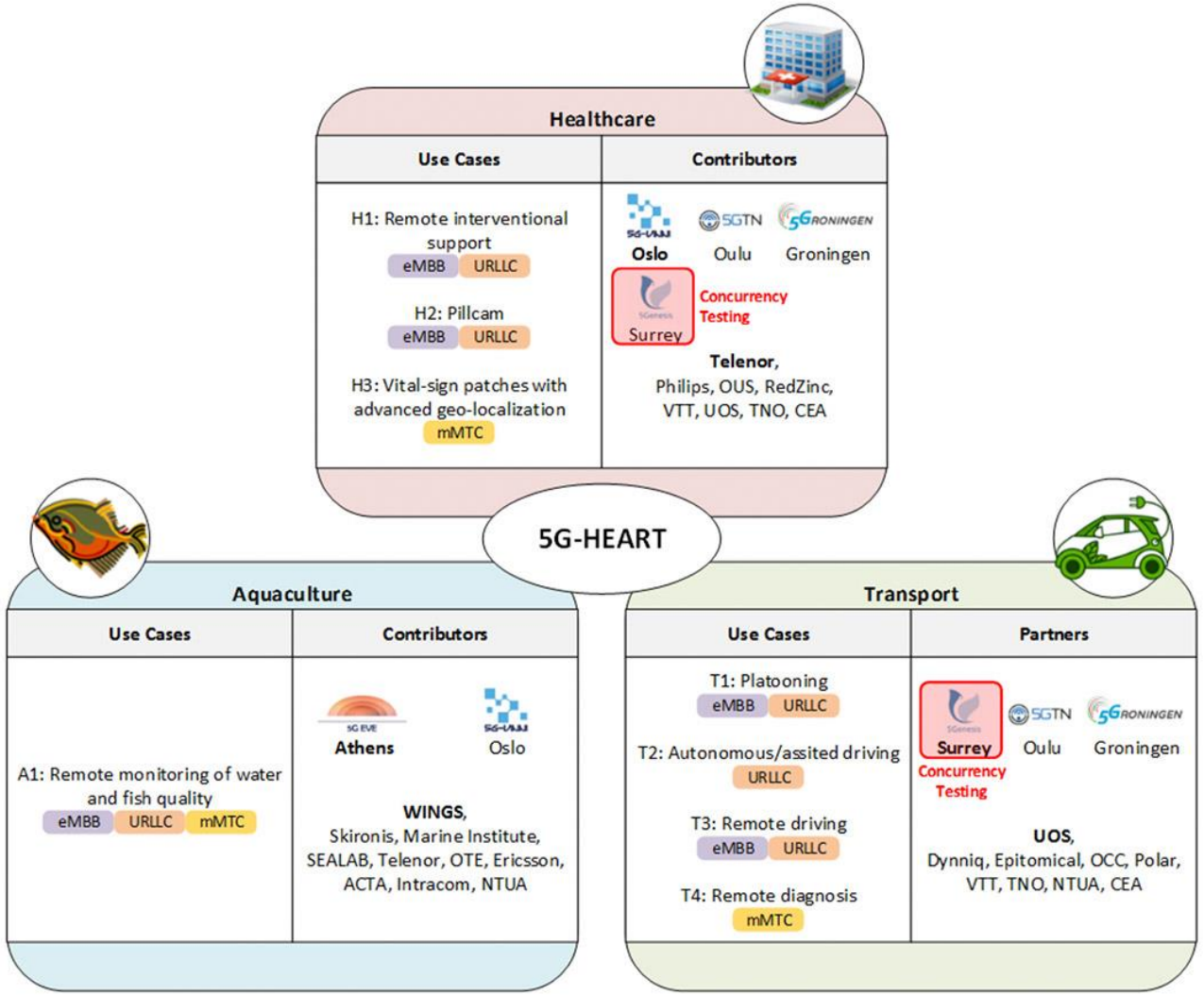
Why KPI measurement and analysis

5G promised and delivers new capabilities

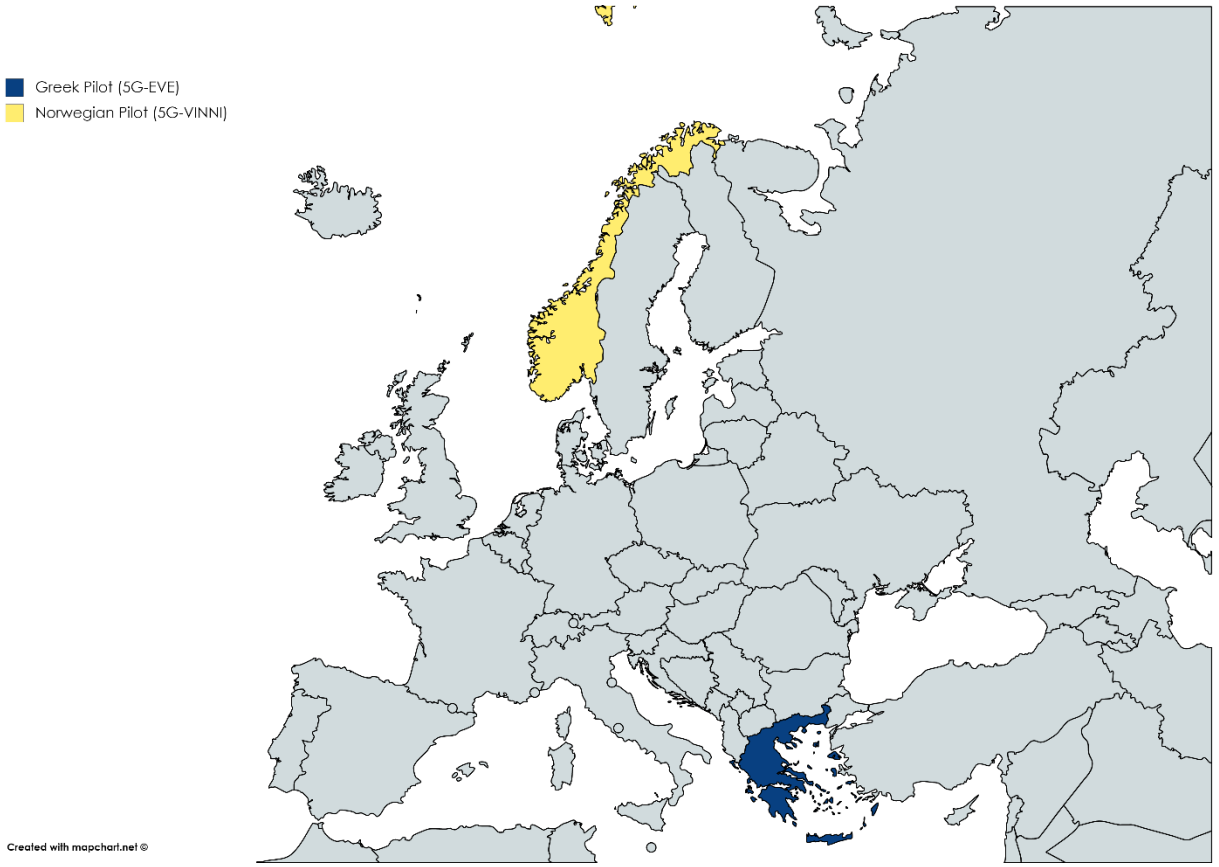
Need to measure Key Performance Indicators in real time in order to:

1. Validate claims and adjust configuration
2. Monitor resources and verify SLAs
3. Identify issues and take corrective actions
4. Analyze and Improve Resource Allocation and Planning
5. Improve end-user QoE

5G HEART: Ecosystem



5G HEART: Aquaculture vertical cartography

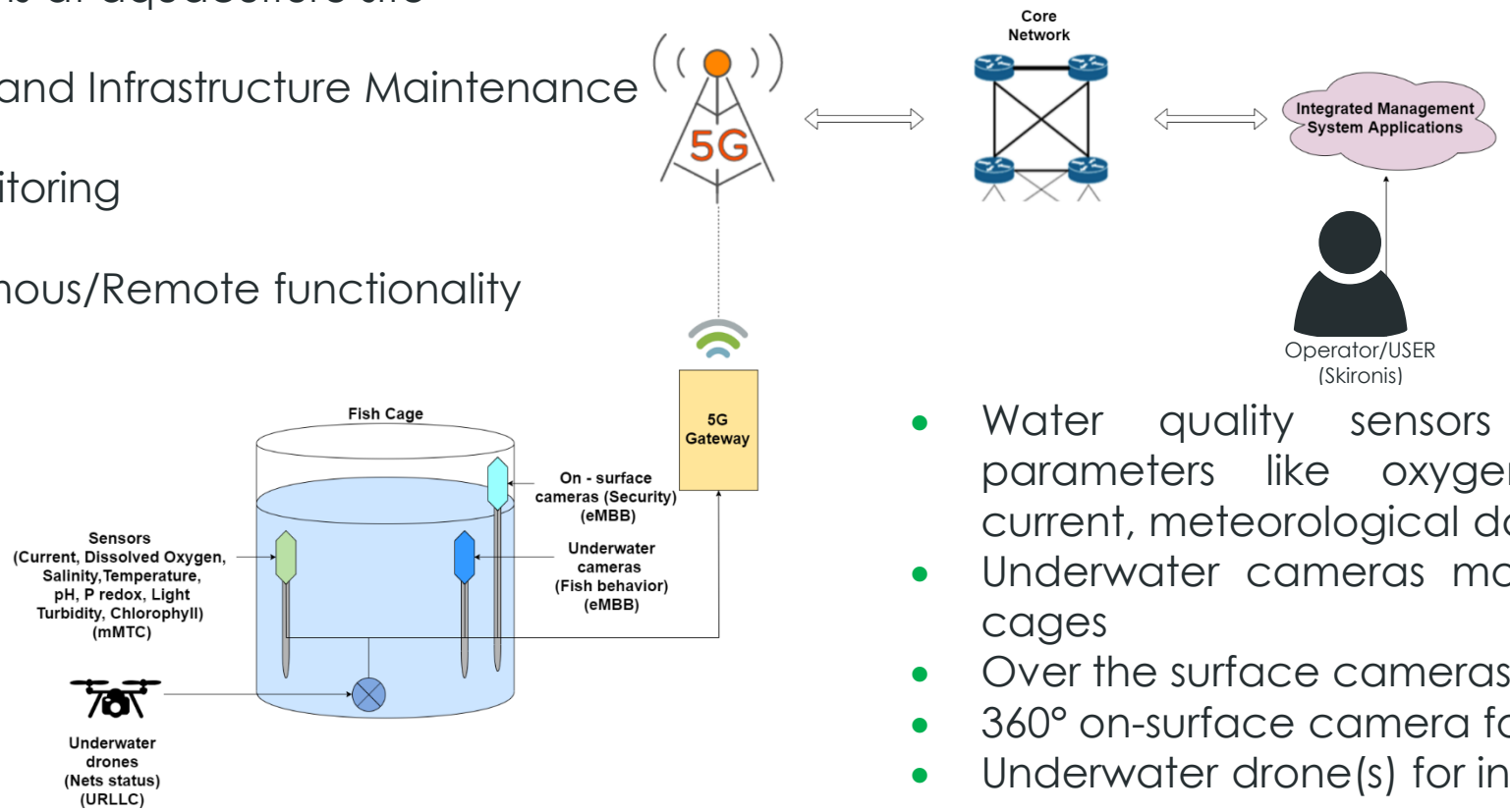


The aquaculture vertical will build a cross-border aquaculture use case with one pilot in a Greek fish-farming unit on floating facilities of fifty thousand (50.000) m3 in the area of "Kato Aloni", Megara Bay, and one in Norway.

5G HEART: Aquaculture Vertical Use Case

The main features under development are:

- Remote monitoring of physical conditions at aquaculture site
- Security and Infrastructure Maintenance
- Fish monitoring
- Autonomous/Remote functionality



- Water quality sensors measure at real-time parameters like oxygen, temperature, salinity, current, meteorological data
- Underwater cameras monitor fish behavior in the cages
- Over the surface cameras are used for security
- 360° on-surface camera for infrastructure monitoring
- Underwater drone(s) for infrastructure monitoring

KPI categories and validation

- In a traditional, physical network, routing of services was carefully engineered with the **service topology typically mirroring the network topology**. Because of this, it was easy to infer service quality from network quality and as a result, many services were simply not monitored at all. However, virtualized networks (5G being a good example) break this 1:1 relationship, potentially leaving many services essentially invisible to the operations teams.
- Therefore the Network Operators should monitor and continually measure the Network performance while Service Providers should do the same for the services and applications they deliver to the end-users.
- Correlation of the two measurement types should be performed when an event occurs that requires troubleshooting and maintenance.
- Finally since QoE is also becoming important, more and more the user-end device is called to participate in the KPI validation cycle.

KPI measurements: Different Types

2 main types of measurements

- **Active** Performance Measurements: needed to validate that the actual performance of the network and service infrastructure delivers the planned(promised) performance KPIs, related to (max)throughput, (min)latency, (min) jitter, etc.
- **Passive** KPI measurements: needed to monitor the status of the network/infrastructure while the services are being delivered to the end-users. These include (current) throughput, real-latency, real-jitter, (current) packet loss etc.
- The first are intrusive and should not be performed (at large scale) while the network is delivering service since they can affect the quality of service delivery.
- The second are non-intrusive and are used in parallel to the service delivery for SLA and Service performance monitoring.
- For the first (Active) Performance Measurements, tools like iPerf, ping, network traffic generators/protocol analyzers are commonly used. They simulate the user traffic before this is injected into the network.
- For the second (Passive) measurement, network probes (commercial and/or open source), OWAMP and TWAMP tools are usually deployed.
- Both are very important and should be utilized by Network Operators and Service Providers.

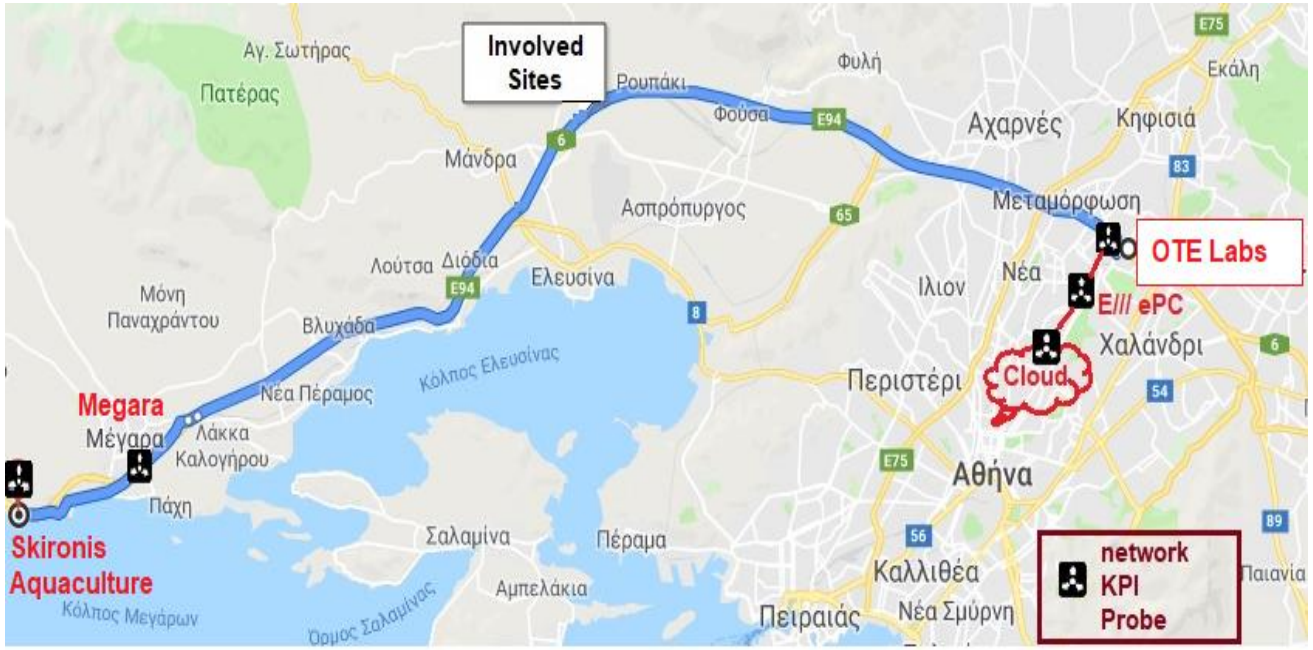
Types of KPIs and performance metrics

Network Metrics: Active and Passive monitoring of KPIs (see previous slide for explanation)

Service Metrics: Service layer metrics that used to mirror network KPIs, but do not any more after the drive for virtualization.

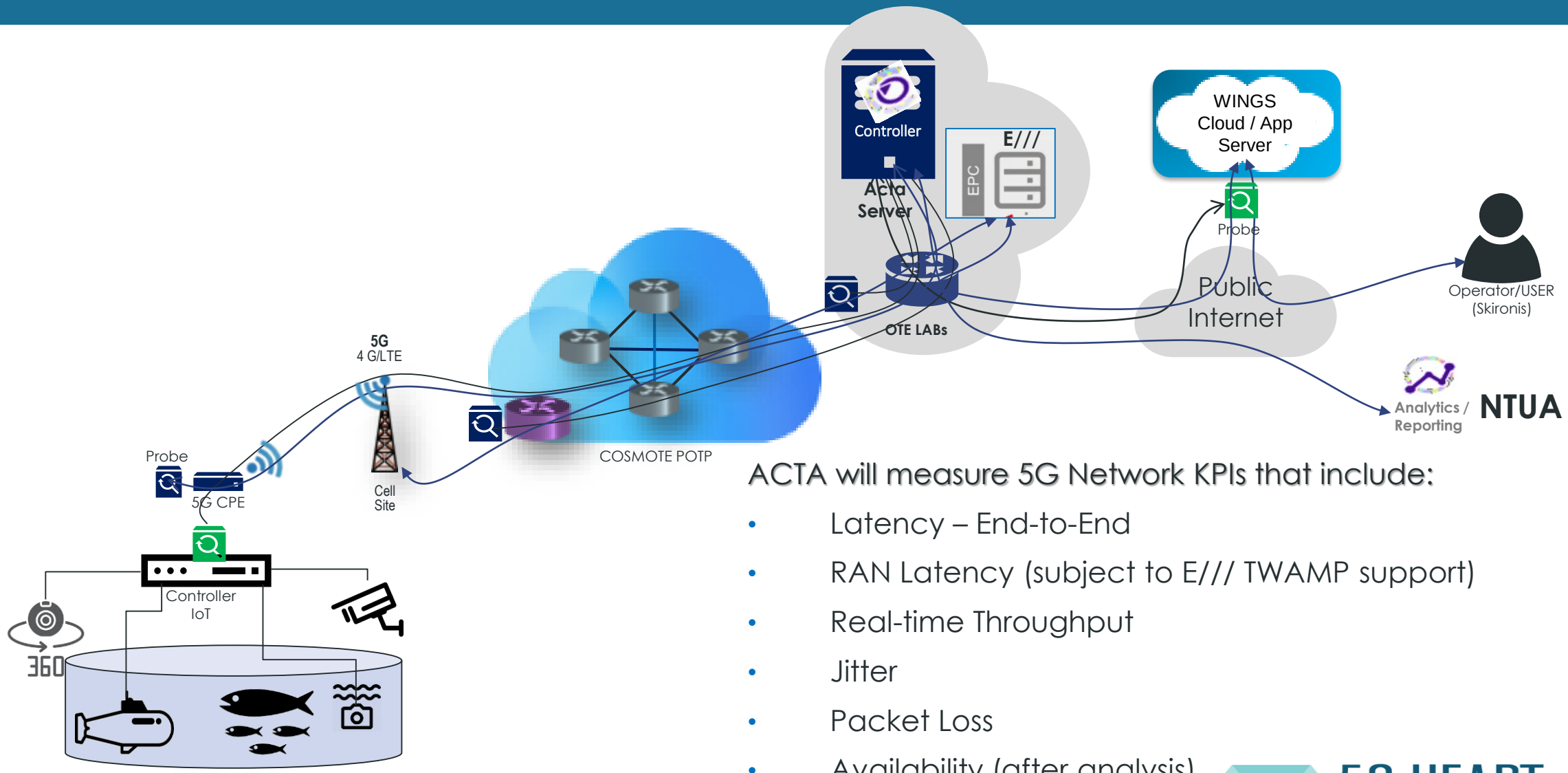
End-User Quality of Experience or measurable KPIs/Metrics where the end-device of the User and the User her/himself is part of the (measurement/monitoring and evaluation) process

5G HEART: Aquaculture Involved Sites



- A pilot 5G network implemented over optical Fiber Links and 10 Gbps POTP connections in Attiki.
- The Skironis Aquaculture site will be interconnected via OTE's CO premises at the City of Megara, to OTE LABs in the OTE-Academy building.
- Ericsson 5G ePC is also located in OTE-Labs premises and an interconnection to WINGS' Cloud and Application Server is established over Public Internet.
- ACTA will install probes for 5G network KPI and Service KPI measurements.

5G HEART: IoT KPI measurements



ACTA will measure 5G Network KPIs that include:

- Latency – End-to-End
- RAN Latency (subject to E/// TWAMP support)
- Real-time Throughput
- Jitter
- Packet Loss
- Availability (after analysis)

5G-HEART: Innovative Aspects (ACTA's role)

- Introduce both active and passive KPI measurements running simultaneously.
- Integrate under same controller existing and new network probes.
- Utilize both hardware probes (like Viavi MTS-5800) as well as software probes (open-source and proprietary).
- Feed the measurement in real time to the Analysis Engine (under development by NTUA).
- Contribute to the AI-Based Orchestration Engine (under development by WINGS).
- Assist in the correlation between Network KPIs, Service KPIs and End-User QoE.
- Introduce software probes in the end-user terminals (under investigation).

THANK YOU
FOR YOUR ATTENTION

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