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A measurements & KPI Validation platform for Automated Logistics

(a Use Case for Smart Cities of the 6G-PATH EU 6GSNS R&D Program)

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UC-CITIES-2 – “Automated Logistics” Overview

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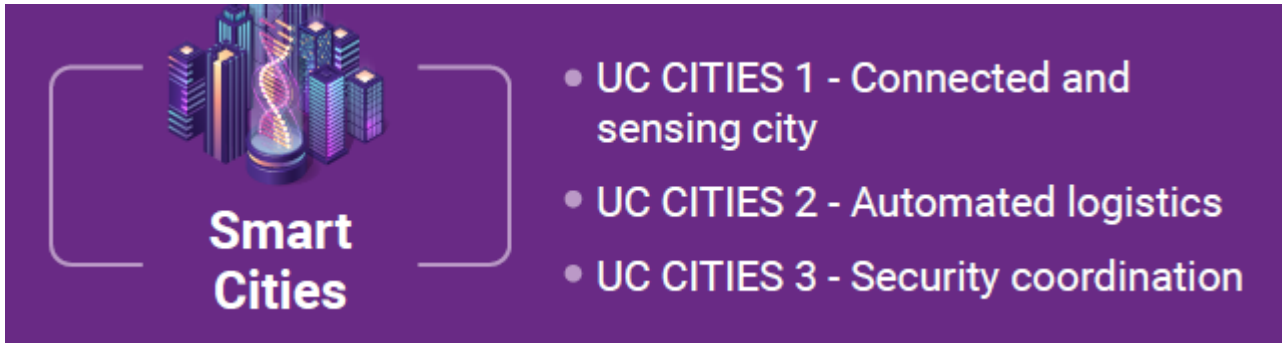
- The ***Smart Cities UC-Cities-2 – Automated Logistics***, addresses one of three use cases for this vertical:
  - interconnected and intelligent cities,
  - **automated logistics**, and
  - security coordination.

- This Use-Case investigates how Automated Guided Vehicles (AGVs) can improve both the production process and employee safety for UC stakeholders, such as a logistics warehouse.
  AGVs can potentially streamline operations by reducing delivery times, limit the manual effort in moving heavy object, minimizing workers’ risk of injuries, improve remote monitoring.

- All these are achieved be exploiting and validating the integration of large-scale extreme IoT-Edge-Cloud scenarios, supported by OTE’s 5G SA† testbed.



† Stand Alone 5G

UC-CITIES-2 – “Automated Logistics” Partner Roles

In the Smart Cities *UC-Cities-2 Automated Logistics*, the key players will be OTE and ACTA.

- OTE is a Test Bed owner.
  - 5G SA Network Infrastructure provider
  - Local cloud infrastructure provider
  - Warehouse Robot and User-End Devices provider

- ACTA is a Use Case owner
  - Test and Measurement Platform Integrator
  - KPI and Performance measurements acquisition and processing
  - Use Case Scenarios execution

Both OTE and ACTA will be involved in the robot integration and operational design.

KPIs/KVIs
(*6G-Path introduces KVIs evaluation beyond net KPIs)*

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Use Case KPIs (*KPIs are measured real-time using ACTA's KVap / Probe cluster*)

KPI name	Description	Objective
Availability	High availability required, so that the human AGV operator should be able to connect and control AGV remotely (if necessary)	99,999%
Reliability	Same as above for availability	99,999%.
Latency	Low	<5ms
Throughput	High	>3Gbps

Use Case KVIs

(*KVIs are gathered, using questionnaires answers, from end user stakeholder/beneficiary, network operator/provider, integrator*)

KVI name	Description	Objective
Processing time	Reduction in processing time	10%
Route optimization	Reduction in route optimization	10%
QoE	Improvement in QoE perceived due to high-throughput and extreme low latency capabilities	10%
Safety	Improvement in employee safety, since the employees will avoid transporting heavy goods, thus avoiding possible injuries	20%
Service Delivery time	Reduction in overall service delivery time	15%

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Test cases related to Smart-Logistics / Warehouse automation

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Responsibilities & Task in operating the robot as within a warehouse.

- **Issuing commands:**
  Direct and Control the robot for performing specific tasks.
- **Emergency intervention:**
  In case of an unexpected situation, initiate operator's control of the robot.
- **Data verification:**
  Ensure the seamless and errorless reception of sensor data and camera stream from the robot.
- **Network performance evaluation**:
  Analyze network performance metrics(latency/throughput,..).

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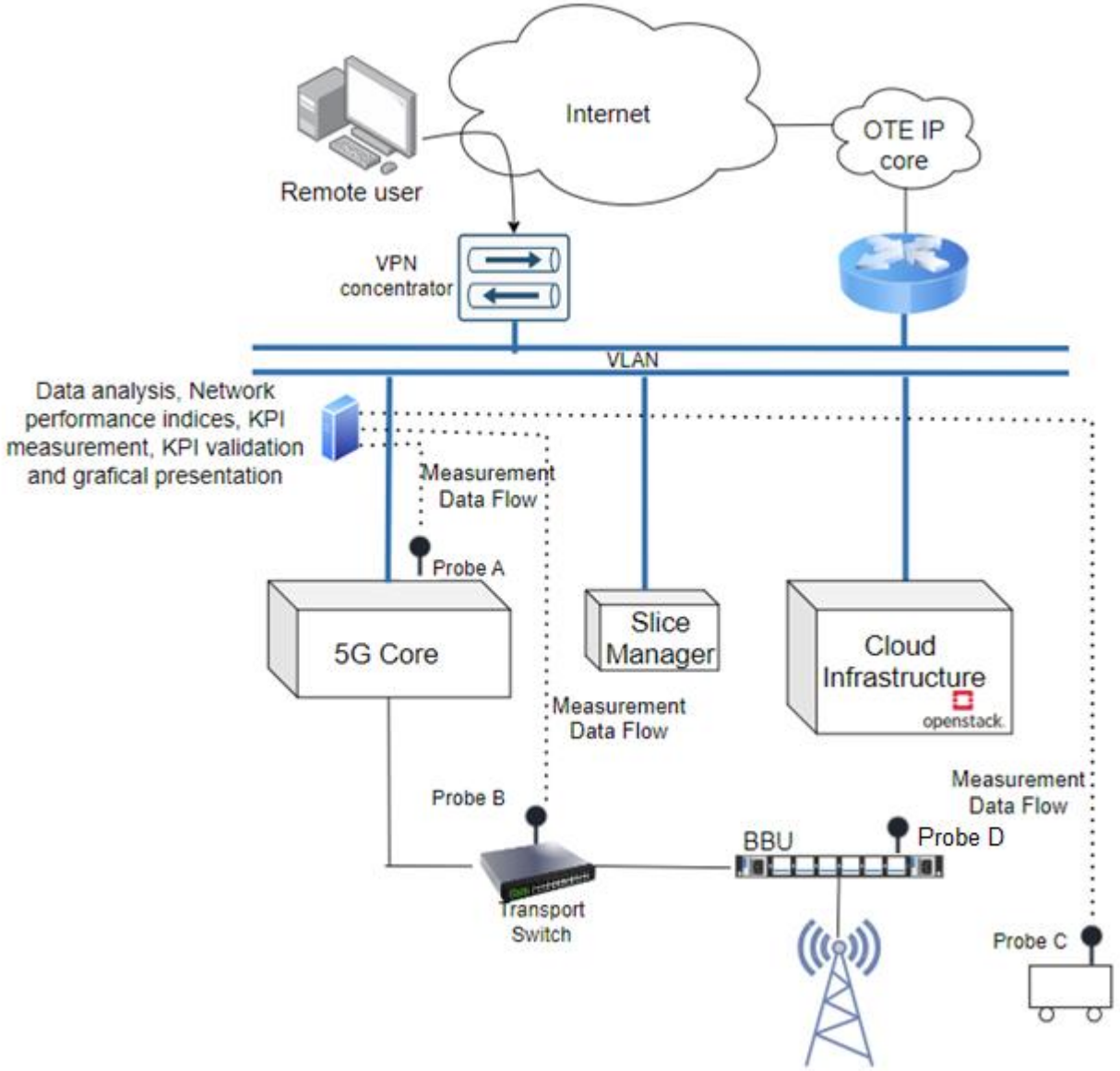
OTE's Lab Infrastructure Architecture

- Packet Core
  - SA Rel.16
- RAN
  - New Radio
  - Rel.17 functions
- Cloud Infrastructure
  - OpenStack
  - Application orchestration, monitoring services, ELCM
- Slice Manager
  - Translator
  - Security
- Robot, 5G gateway



Monitoring tools and equipment (1/3)

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ACTA Network Performance monitoring components (KVaP)

- Central management system software
  - Viavi FUSION application, based on Network Integrated Test, Real-time analytics and Optimization (NITRO) environment.
- Hardware (HW) and software (SW) network probes
  - SFPs (Small Form-Factor Pluggable) in Network Equip. Sockets.
  - Viavi. 1 Gbps JMEP3, 10 Gbps JMEP10.
  - JMEP micro Ethernet probe for Ethernet and IP performance assurance.
- Server / Monitoring and Control
  - SUPERMICRO SERVER SYS-5019D for hosting the application, analytics and one(or more) software probe.
- Desired & Offered Functionality
  - Allow access to the measurement KPIs via a KAFKA interface.

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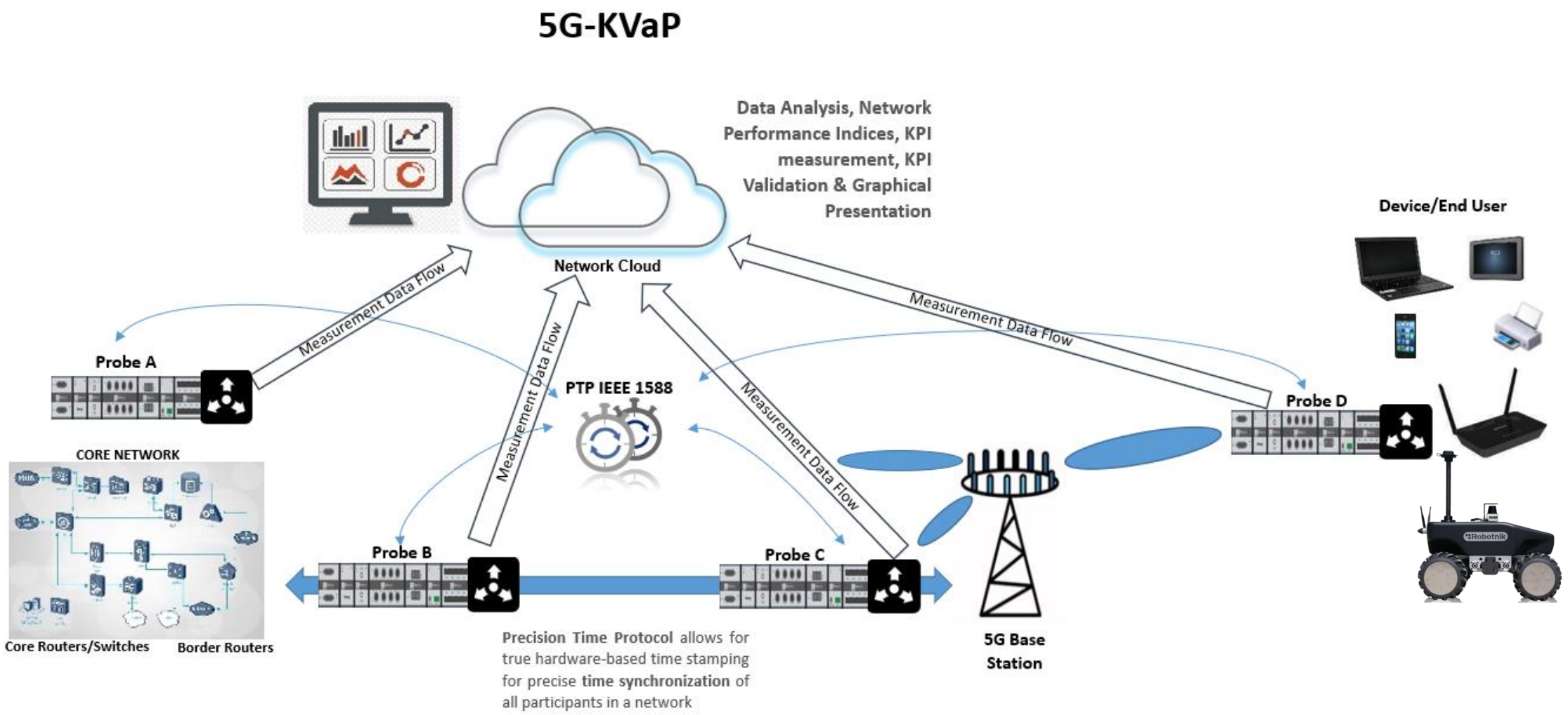
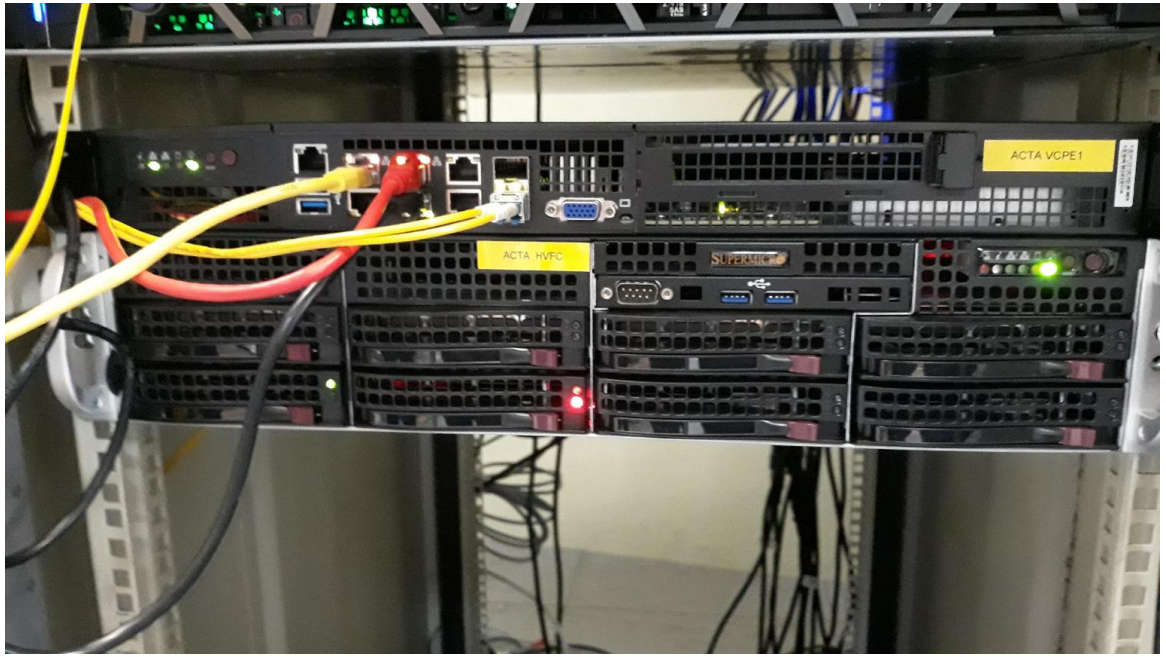
ACTA KVaP (KPI validation Platform) based on probes and network segmentation (2/3)



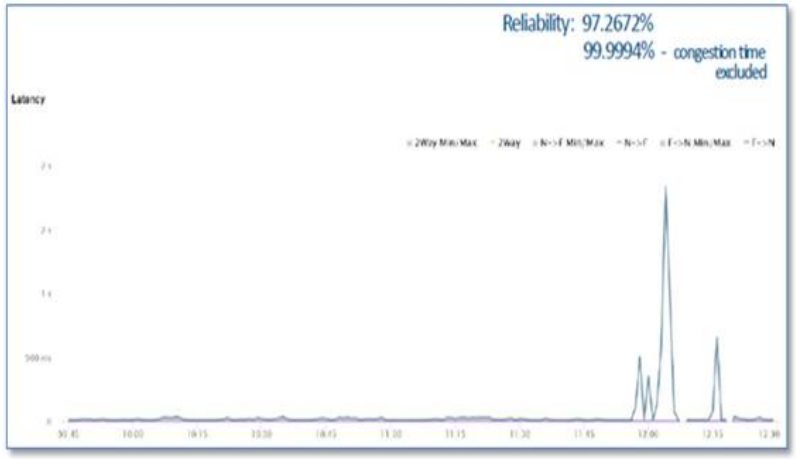
Monitoring tools and equipment (3/3)



Server

SFP probe

Dashboard



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Network validation and evaluation process-flow

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- The central network performance platform (ACTA's KVaP based on Viavi FUSION) is installed and configured on OTE's Lab VM-server.

- Hardware probes are installed in the 5G network's key locations for better monitoring end-to-end, and segments (i.e. Radio Access) of the network.

- Software probes are installed in end-Devices (and in central server).
- Using the Dashboard, performance KPI testing scenarios
  a) are defined and programmed &
  b) are executed either 24x7, interactively (on-demand), or
  based on certain trigger conditions.

- The results are analyzed (real-time) or stored and processed later.

- KAFKA can be activated and configured to provide KPI measurement data to external applications.

Remarks and Next steps

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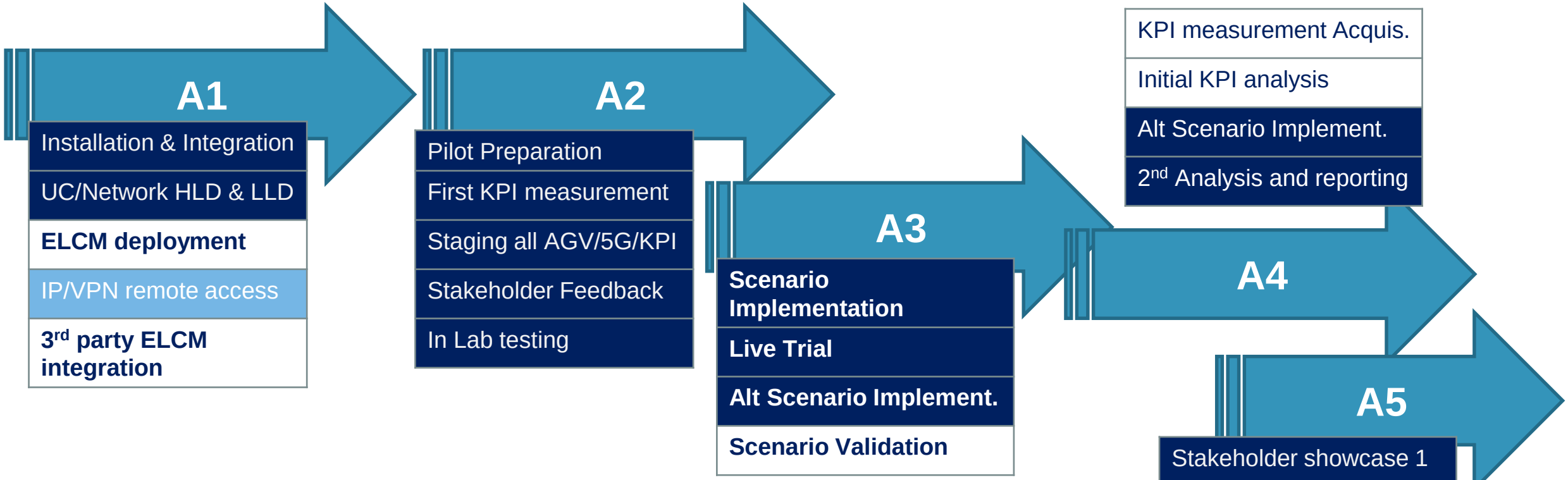
Current Achievement / Status

- The Smart-City-Logistics Use Case has been described in the blueprint document.
- The equipment BoM (for OTE & ACTA) for the UC have been identified.
  High-Level Design (HLD) and Interconnections have been finalized.
- The SA 5G network, at OTE Labs, is operational.
  Any needed configuration will be performed during installation of the additional equipment.
- The KPI & performance monitoring HLD is done for a related 5G network.
- The VIAVI© network monitoring application is installed in ACTA-Lab (together with the Dashboard application).

Next steps

- 5G network upgrade: RAN upgrade in progress, AI-enhanced slicing mechanism design is in progress.
- The IP addressing scheme Low-Level-Design will be defined.
- The KVaP server configuration will be completed, & the server will be moved to OTE Labs.
- The capability of extracting the network performance measurement data from the commercial application, via KAFKA interface, is under development.
- The related ELCM local installation is being planned out.
- During installation of the ACTA server, the KAFKA interface will be configured on the application.
- The local ELCM will collect the network performance measurements.
- A RFP for the Warehouse Robot is issued by OTE.

Roadmap and time plan



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Thank you for you attention!

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