



# IPIC 2023

9th International  
Physical Internet Conference

June 13-15, 2023  
Athens, Greece



## 5G&AI enabled services in Port operations tailored to logistics and safety applications

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**13-15 JUNE 2023** Athens, Greece  
[www.pi.events/IPIC2023](http://www.pi.events/IPIC2023)

alice | Alliance for  
Logistics Innovation  
through Collaboration  
in Europe



Expanding the logistics Scope

# About 5G-LOGINNOV

H2020-ICT-2018-20: Information and Comm. Technologies

Topic: ICT-42-2020

Type of action: IA

September 2020-August 2023 (36 months)



## Project aim

5G-LOGINNOV's vision is to optimize freight and traffic operations at Ports and Logistics hubs via innovative concepts, applications and devices supported by 5G technology, the IoT, AI-enabled data analytics, next generation traffic management systems, Cooperative, Connected and Automated Mobility (CCAM)

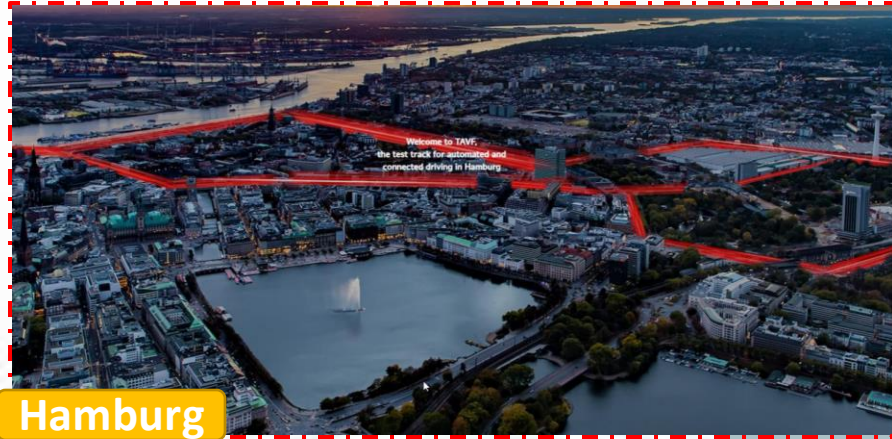
## Objectives

- Improve the efficiency of logistics operations, putting at the centre of attention the sustainability of the logistics supply chain
- Support the "Green" Port Industry vision by reducing the hub's operation emissions
- Enhance safety and security operations

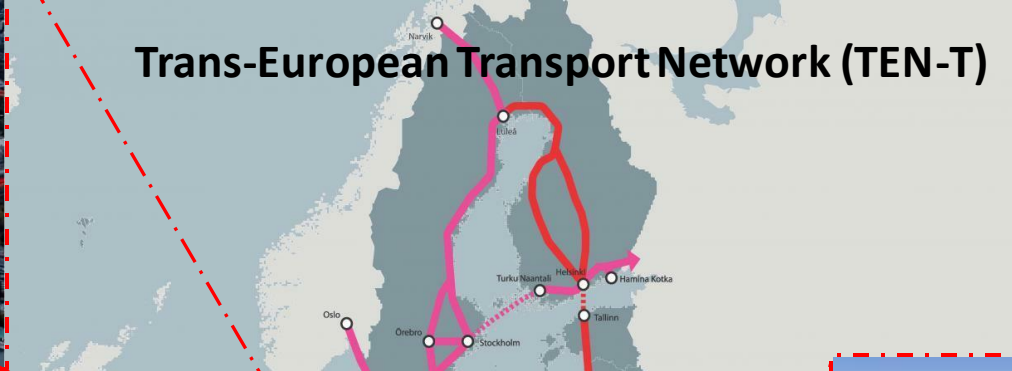
## Expected Outcomes

- Improve the efficiency of logistics operations via 5G&AI enabled video analytics services related to port control, logistics and remote automation.
- 5G-enabled low carbon truck platoon mobility management (Green Light Optimum Speed Advisory, GLOSA)
- Involvement of new market actors (e.g., SMEs) in the innovation processes

# 5G-LOGINNOV Living Labs



Hamburg



Athens



Koper

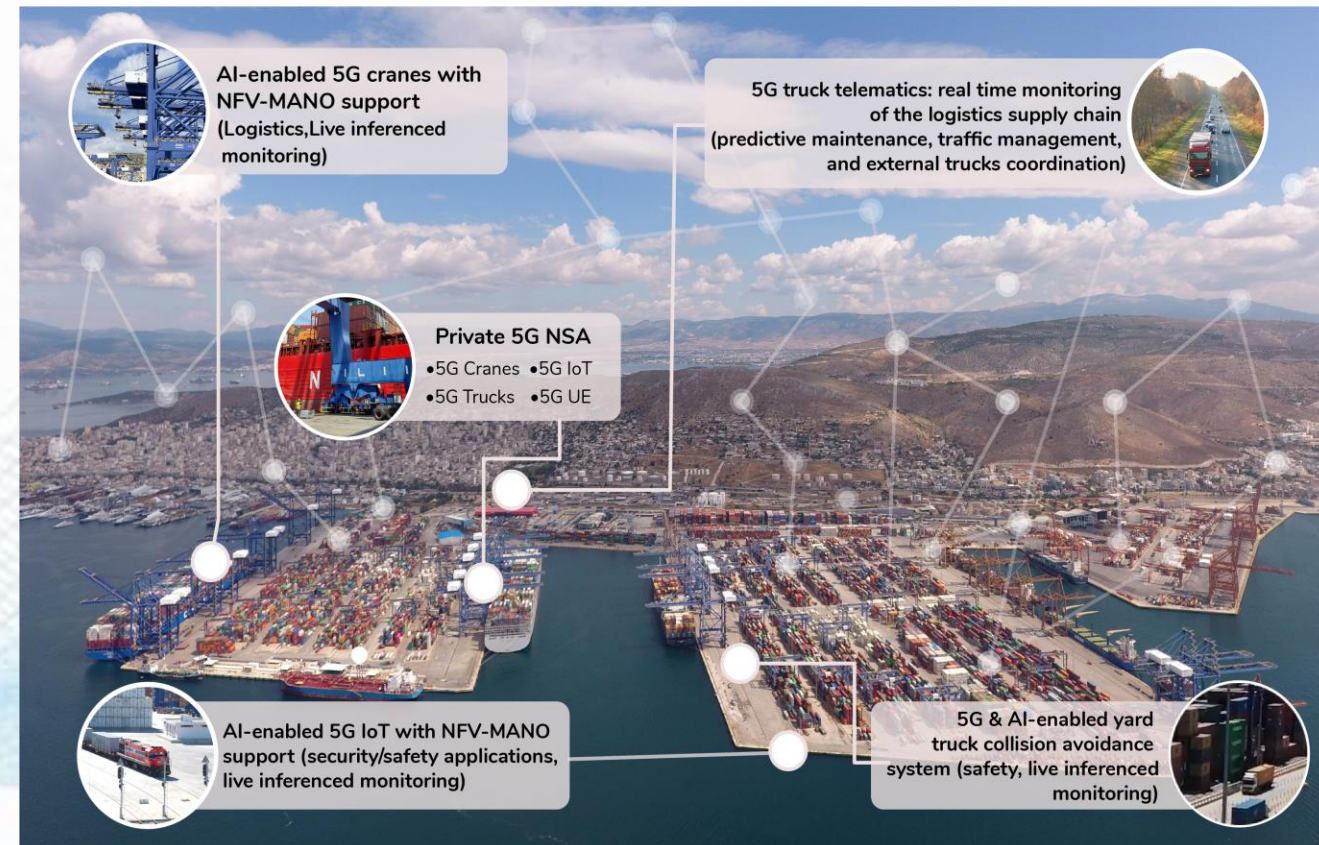


# Use Case Overview – Athens LL

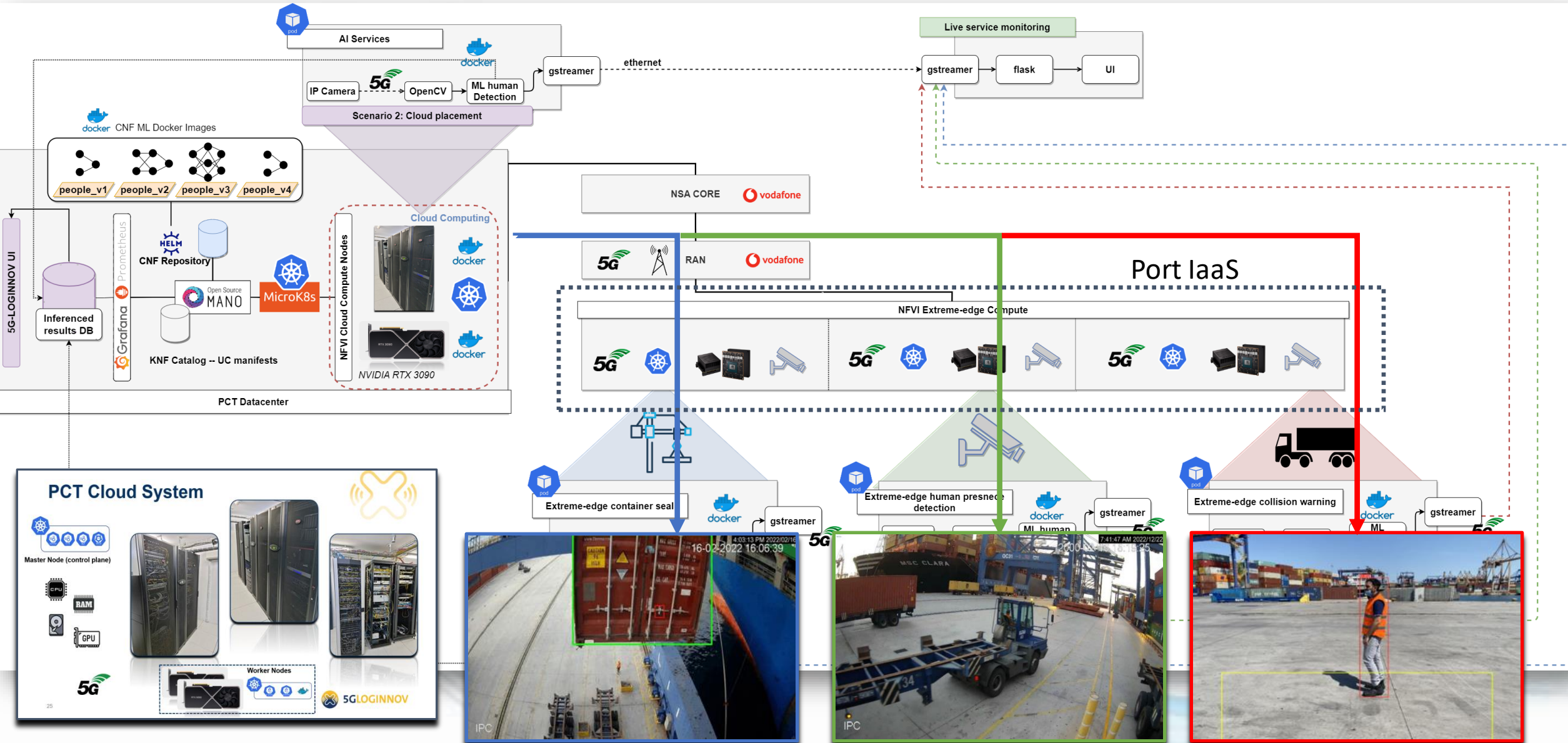
## Truck Telematics

- Truck Fleet Management Platform
- Predictive Maintenance
- 5G&AI enabled collision warning system
- 5G&AI enabled surveillance and monitoring
- 5G&AI enabled container seal detection

**5G&AI video analytics with NFV-MANO support**



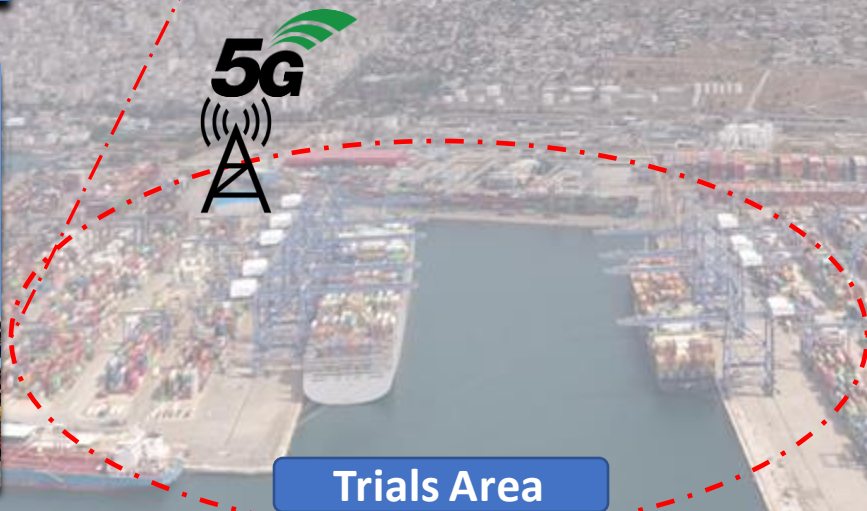
# Glimpse on Architecture & Services



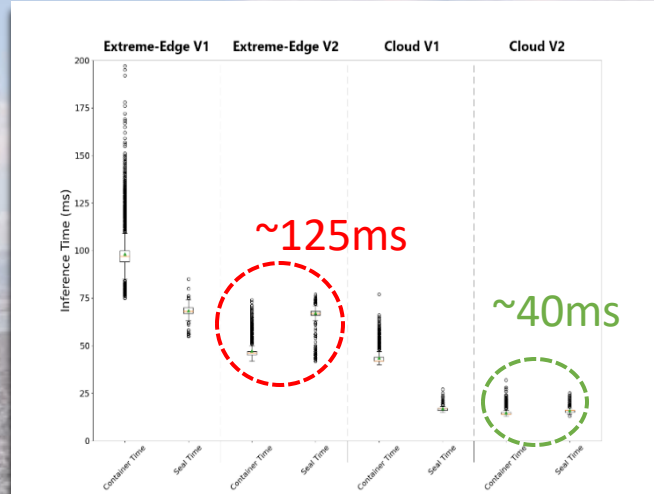
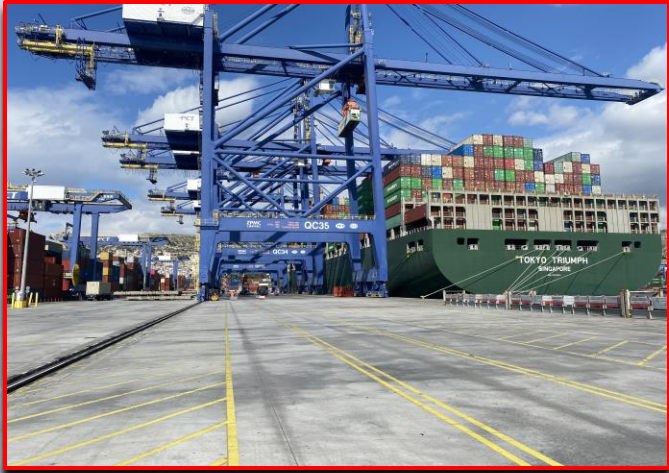
# 5G Trials Area - (5G KPIs)



RRU AAU 5639w



# 5G&AI enabled container seal detection



		Inference	
		seal	No seal
Ground Truth	seal	TP: 231	FN: 44
	No seal	FP: 75	TN: 41022



Training Set: 50K -> 500K images  
Validation: 30 hours

# 5G&AI enabled surveillance and monitoring

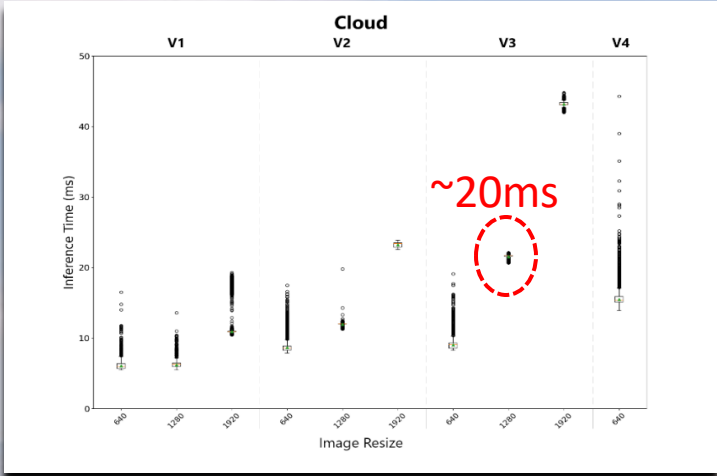


Area 1

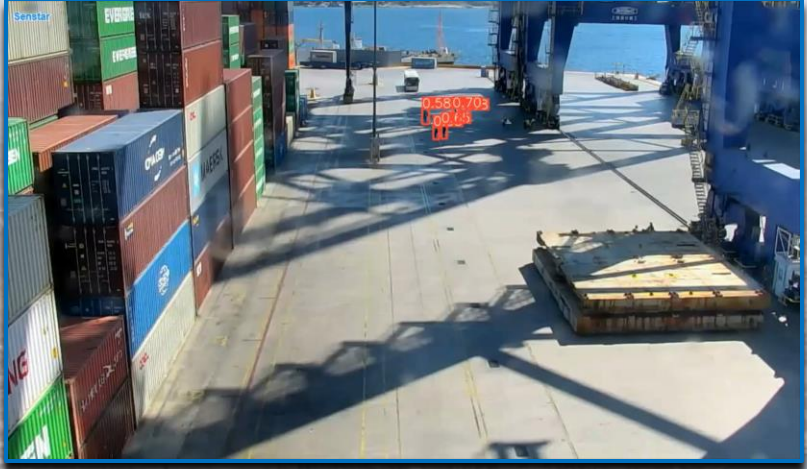


Area 2

Trained Set: 10K Images  
Validation: 30 hours

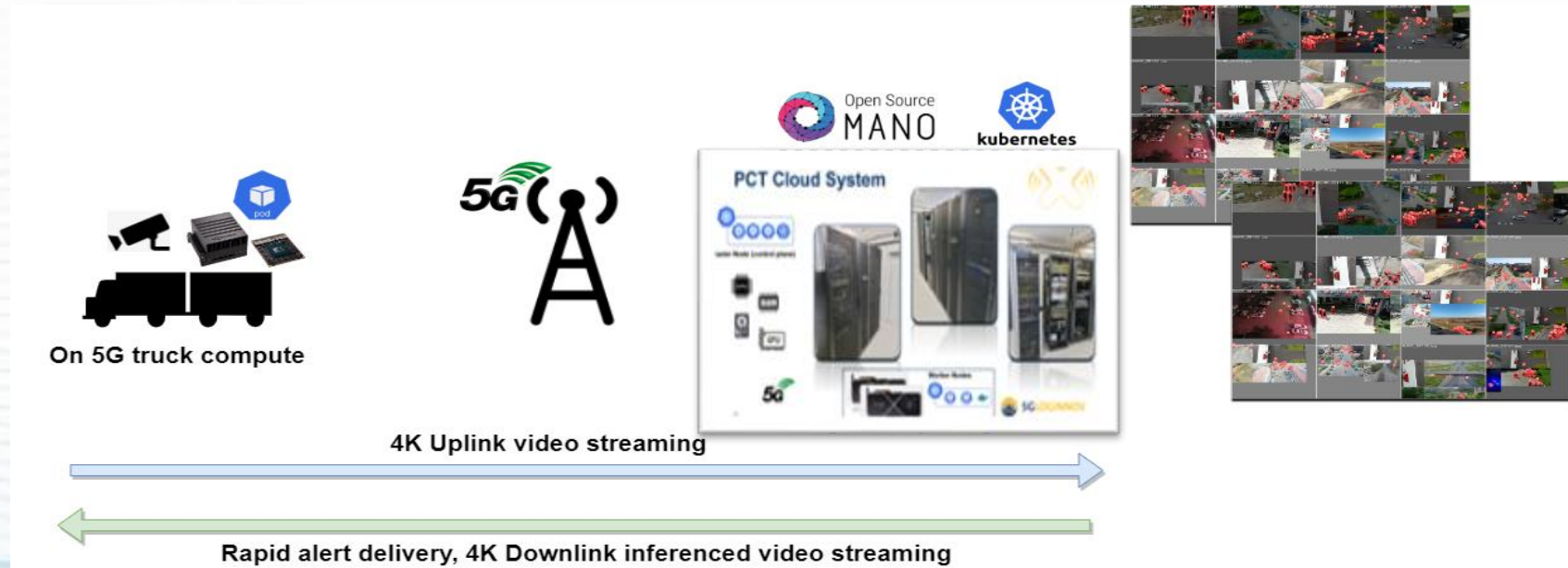


		Inference	
		Human	No Human
Ground Truth	Human	TP: 460	FN: 7
	No Human	FP: 1	TN: 132





# 5G&AI enabled collision warning system



# 5G&AI enabled collision warning system - cont.

Truck



Cloud



frame

- Frame ID
- Timestamp (t1)

frame

- Frame ID
- Timestamp (t2)



frame

- Frame ID
- Timestamp (t3)

Frame Network Delay (FND)

Frame Processing Delay (FPD)

Service Delay = FND + FPD

Satellite sync

```

iccs@extreme-edge:~-113x32
Seen 44/Used 24
Time: 2023-06-01T09:35:33.000Z
Latitude: 37.95734610 N
Longitude: 23.58423310 E
Alt (HAE, MSL): 50.195, 17.136 m
Speed: 0.04 kph
Track (true, var): 323.4, 4.6 deg
Climb: 2.40 m/min
Status: 3D FIX (9648 secs)
Long Err (XDOOP, EPX): 0.43, +/- 6.5 m
Lat Err (YDOOP, EPY): 0.44, +/- 8.3 m
Alt Err (VDOOP, EPV): 0.89, +/- 1.6 m
2D Err (HDOOP, CEP): 0.53, +/- 0.9 m
3D Err (PDOOP, SEP): 1.03, +/- 21.3 m
Time Err (TDOOP): 0.57
Geo Err (GDOP): 1.18
ECEF X, VX: 4614791.250 m -0.010 m/s
ECEF Y, VY: 2014640.570 m -0.010 m/s
ECEF Z, VZ: 3901742.950 m -0.020 m/s
Speed Err (EPS): +/- 0.6 kph
Track Err (EPD): n/a
Time offset: 1.000 sec
Grid Square: KML7tw
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ec*:1685603462,"clock_nsec":99998
More...
    
```

```

iccs@cloud-node:~-113x32
Seen 43/Used 29
Time: 2023-06-01T09:35:33.000Z
Latitude: 37.95967660 N
Longitude: 23.58601330 E
Alt (HAE, MSL): 47.292, 14.229 m
Speed: 0.01 kph
Track (true, var): 183.2, 4.6 deg
Climb: 4.74 m/min
Status: 3D FIX (9618 secs)
Long Err (XDOOP, EPX): 0.33, +/- 7.3 m
Lat Err (YDOOP, EPY): 0.39, +/- 8.0 m
Alt Err (VDOOP, EPV): 0.79, +/- 2.3 m
2D Err (HDOOP, CEP): 0.50, +/- 1.7 m
3D Err (PDOOP, SEP): 0.93, +/- 22.2 m
Time Err (TDOOP): 0.50
Geo Err (GDOP): 1.06
ECEF X, VX: 4614500.730 m 0.000 m/s
ECEF Y, VY: 2014719.400 m 0.000 m/s
ECEF Z, VZ: 3901945.160 m 0.000 m/s
Speed Err (EPS): +/- 0.5 kph
Track Err (EPD): n/a
Time offset: 1.000 sec
Grid Square: KML7tx
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z*:0.00,"ecefAcc":4.12,"ecefAcc
More...
    
```

```

iccs@extreme-edge:~-113x32
Every 0.1s: timedatectl; echo; chronyc tracking; echo; chronyc sources... extreme-edge: Thu Jun 1 10:56:36 2023
Local time: Thu 2023-06-01 10:56:36 EEST
Universal time: Thu 2023-06-01 07:56:36 UTC
RTC time: Thu 2023-06-01 07:56:36
Time zone: Europe/Athens (EEST, +0300)
System clock synchronized: yes
NTP service: active
RTC in local TZ: no
Reference ID : 50505300 (PPS)
Stratum : 1
Ref time (UTC) : Thu Jun 01 07:56:25 2023
System time : 0.000000063 seconds fast of NTP time
Last offset : +0.000000965 seconds
RMS offset : 0.000002251 seconds
Frequency : 56.534 ppm slow
Residual freq : -0.022 ppm
Skew : 0.169 ppm
Root delay : 0.000000001 seconds
Root dispersion : 0.000015355 seconds
Update interval : 16.0 seconds
Leap status : Normal
#10 Number of sources = 2
#5 Name/IP address Stratum Poll Reach LastRx Last sample
#- GPS 0 4 377 11 -42ms[-42ms] +/- 200ms
## PPS 0 4 377 11 +1055ms[+2143ms] +/- 958ms
Clock Time
1685506196.000001201#607879
    
```

```

iccs@cloud-node:~-113x32
Every 0.1s: timedatectl; echo; chronyc tracking; echo; chronyc sources; ... cloud-node: Thu Jun 1 10:56:36 2023
Local time: Thu 2023-06-01 10:56:36 EEST
Universal time: Thu 2023-06-01 07:56:36 UTC
RTC time: Thu 2023-06-01 07:56:36
Time zone: Europe/Athens (EEST, +0300)
System clock synchronized: yes
NTP service: active
RTC in local TZ: no
Reference ID : 50505300 (PPS)
Stratum : 1
Ref time (UTC) : Thu Jun 01 07:56:19 2023
System time : 0.000000238 seconds slow of NTP time
Last offset : -0.000000259 seconds
RMS offset : 0.000003218 seconds
Frequency : 51.071 ppm slow
Residual freq : -0.001 ppm
Skew : 0.110 ppm
Root delay : 0.000000001 seconds
Root dispersion : 0.000020929 seconds
Update interval : 16.0 seconds
Leap status : Normal
#10 Number of sources = 2
#5 Name/IP address Stratum Poll Reach LastRx Last sample
#- GPS 0 4 377 14 -46ms[-46ms] +/- 200ms
## PPS 0 4 377 17 +2608ms[+2492ms] +/- 1598ms
Clock Time
1685506196.00000365#262377
    
```

```

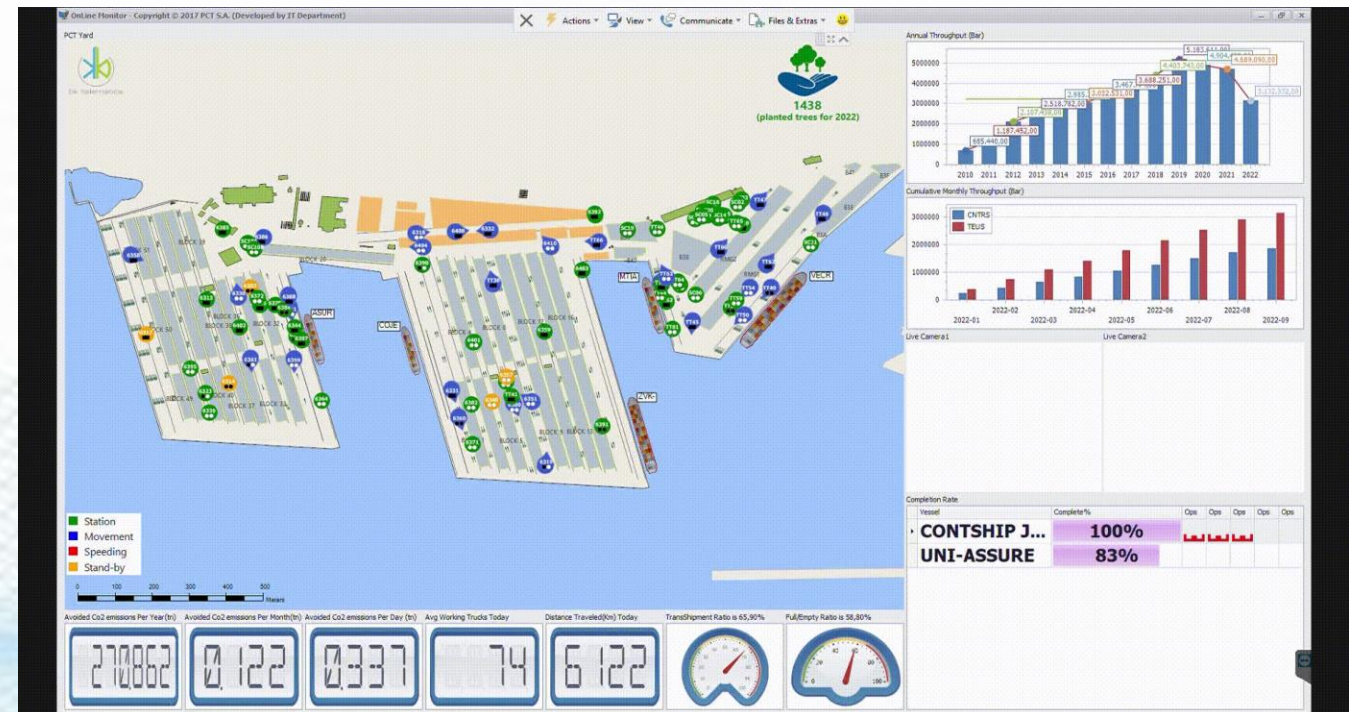
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```

```

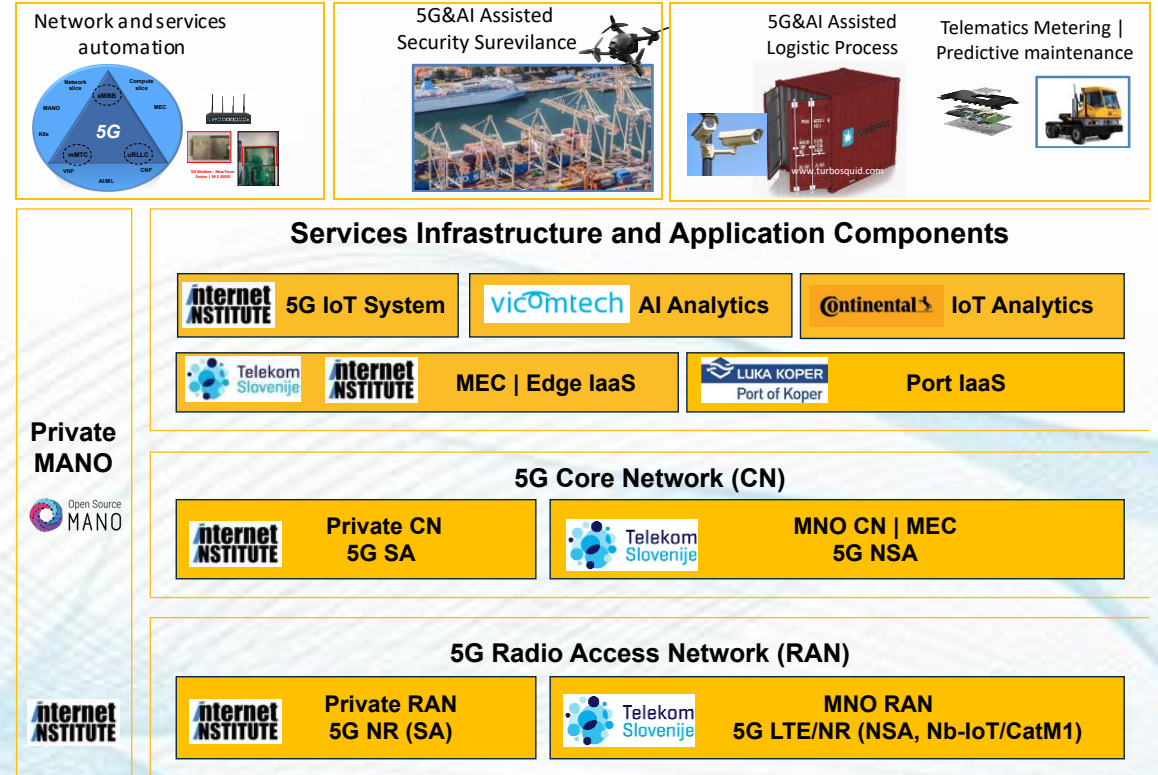
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```

# Predictive Maintenance

- A fleet of about 192-trucks (currently communicating over 4G and 5G)
- Telematics device installed on trucks
  - Telemetry data: CAN-Bus, GNSS, container presence sensors
- Applications
  - **UC7**: AI/ML predictive maintenance services



# Koper Living Lab



LL Leader: Janez Sterle - INTERNET INSTITUTE Ltd

janez.sterle@iinstitute.eu

# Hamburg Living Lab



<https://tavf.hamburg/en/>



Continental, Swarco, tec4u & T-Systems

**UC8/9: 5G-LOGINNOV Floating Truck and Emission Data (FTED)**

**UC10: 5G-LOGINNOV 5G GLOSA and Automated Truck Platooning (GTP) under 5G-LOGINNOV Green Initiative**

**UC11: 5G-LOGINNOV dynamic control loop for environment sensitive traffic management actions (DCET)**

LL Leader: Willenbrock Ralf, Product Manager, T-Systems

ralf.willenbrock@t-systems.com

## Precise Positioning and 5G Network




**SKYLARK**  
Precise Positioning Service

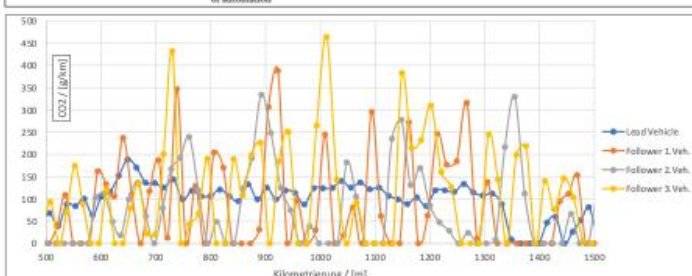

**Mobile Network Testing**  
**QUALIPOC ANDROID**  
The premier handheld troubleshooter

Difference GPS-3D-Signal

Altitude[m] / PS (blue line)  
Altitude[m] / JC (orange line)

## Platooning using ISO-23795-1 with LCMM

Communication scenario	Degree	Payload (bytes)	Tx rate (messages per second)	E2E latency (ms)	Reliability (%)	Data rate (Mbps)	Min range (m)
Cooperative driving for vehicle platooning	Lowest degree of automation	300-400	30	25	90		
Information exchange between a group of UEs supporting V2X application.	Low degree of automation	6500	50	20			350
	Highest degree of automation	50-1200	30	10	99.99		80

Teststrecke für Automatisiertes und Vernetztes Fahren in Hamburg (TAVF)

**GreenTransPORT: Das Projekt**

**Ziele**

- Mehrere Teststrecken (Urban Ring + die Hafenkai + die Binnenallee) realisieren
- Mehrere Testfahrzeuge (Kleinbusse, LKW, Busse) realisieren
- Mehrere Testanwendungen (V2X, V2I, V2N) realisieren

**Maßnahmen**

- Real-time Monitoring der Testanwendungen
- Real-time Monitoring der Testfahrzeuge
- Real-time Monitoring der Teststrecken

**Erwartete Ergebnisse**

- Validierung der Testanwendungen
- Validierung der Testfahrzeuge
- Validierung der Teststrecken



# Thank you!



**Pavlos Basaras, Project Manager**

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