5G-LOGINNOV
Athens Living Lab

Piraeus Container Terminal (**PCT**)

SIS 96, Hamburg, 13thOct.
I.T.S. World Congress 2021

Dr. Pavlos Basaras
Institute of Communications and Computer Systems (**ICCS**)

5GLOGINNOV

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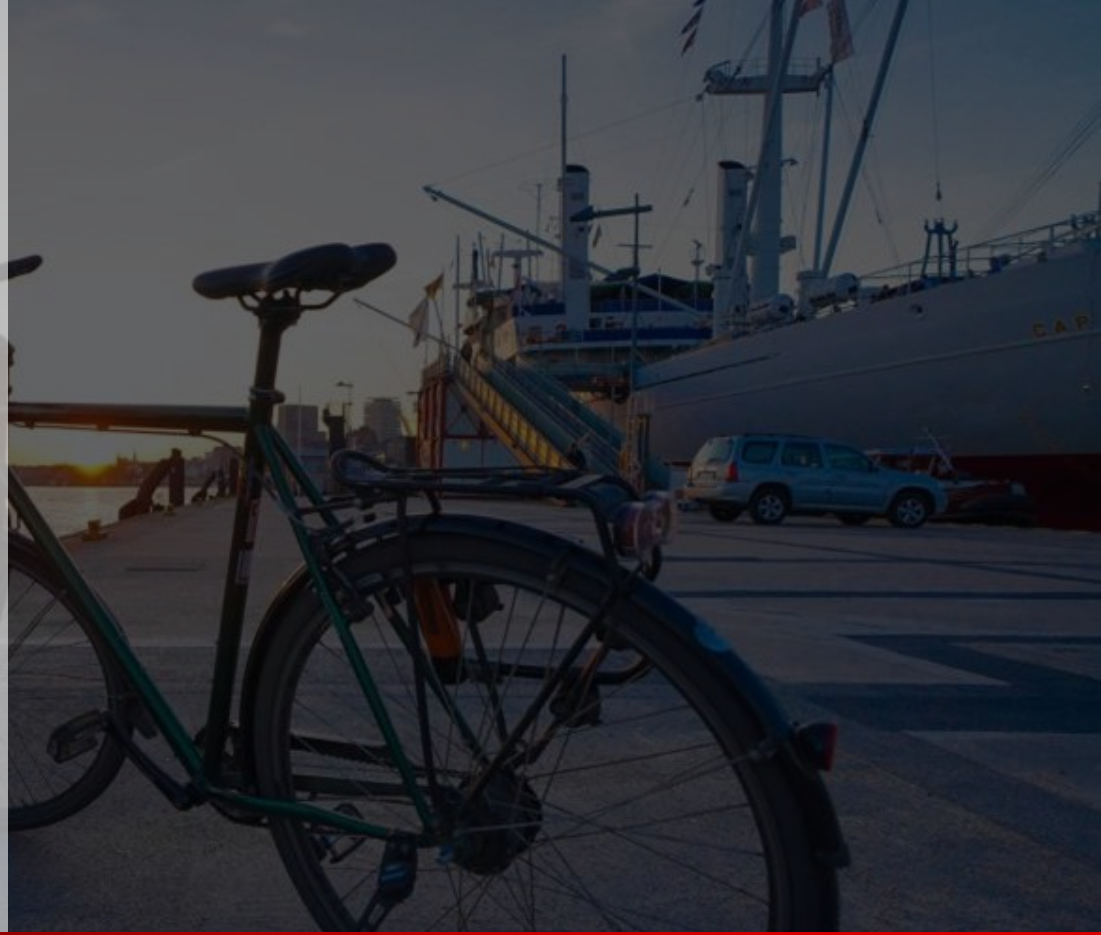
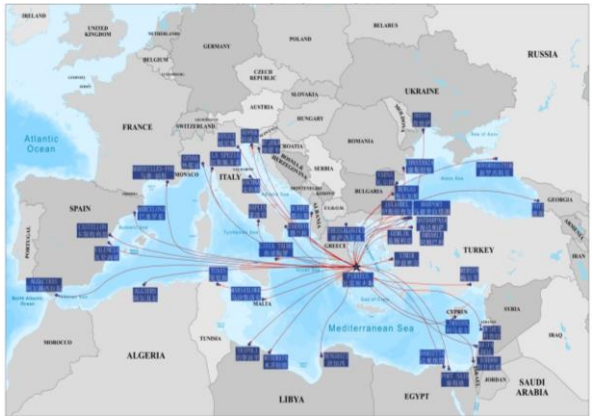
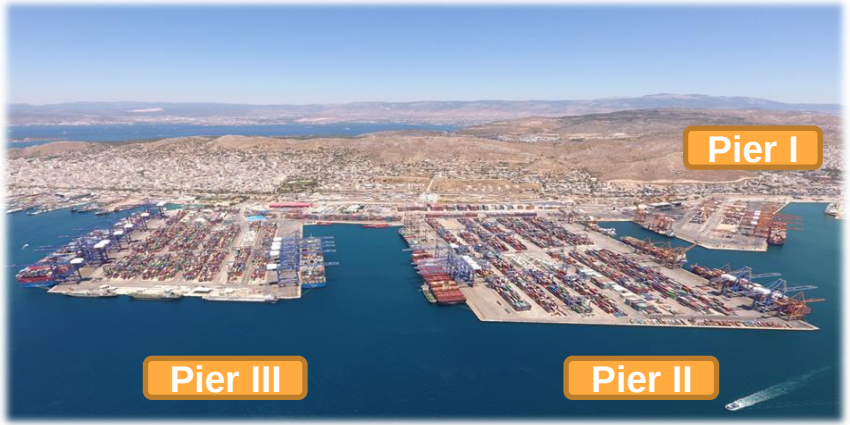


Athens LL geographical overview
Piraeus Container Terminal (PCT)

- TEN-T core port
- Port and consolidation and distribution services
- ISPS certified
- Road/Rail connection to Balkans and central Europe
- Free zone area type 1
- Container and RO-RO
- Car terminal, Cruise terminal, Oil terminal
- 1st in Mediterranean and 4th in Europe in terms of container throughput
- 1st in Europe in passenger-vessel visits





Athens LL Use Case Objectives and Technologies

- **5G-LOGINNOV Objectives**
  - Redistribute truck traffic within the port based on real-time and accurate positioning
    - Optimal container job allocation (operations efficiency)
    - Coordination with external trucks
  - Port control, logistics and remote automation (far-edge computing services)
    - Safety/security applications
    - Logistics and port automation services
  - Reduce the environmental footprint of operations
  - Reduce operational costs

- **Partners**
  - Piraeus Container Terminal (**PCT**): Living lab
  - **Vodafone**: Mobile network operator, external truck monitoring platform (Innovus)
  - **ICCS**: Living lab leader, computer vision and analytics, NFV-MANO, 5G-IoT design

5G-LOGINNOV at Piraeus Container Terminal

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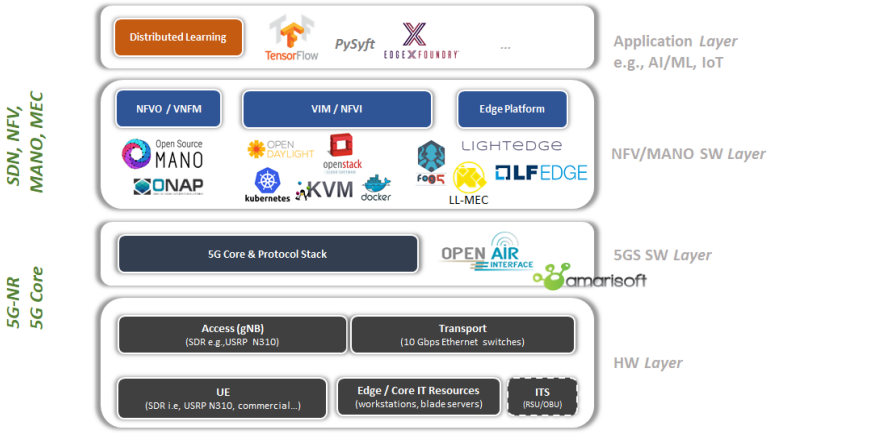
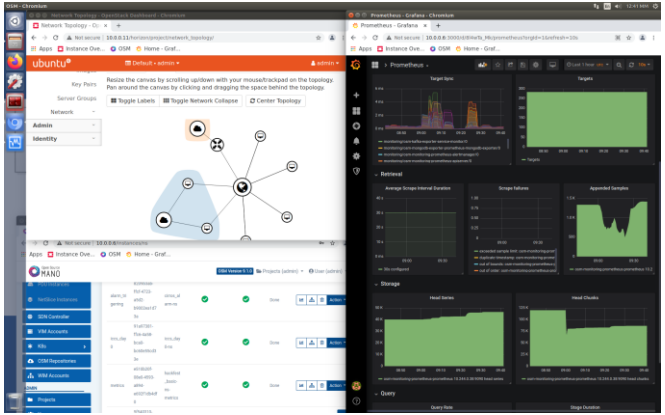
The ICCS 5G TestBed: Technologies in a Nutshell

- 5G New Radio and 5G Core
- Network Functions Virtualization (NFV)
- Management and Orchestration (MANO)
- Mobile/Multi-access Edge Computing (MEC)
- Software Defined Networking (SDN)
- Distributed AI/ML



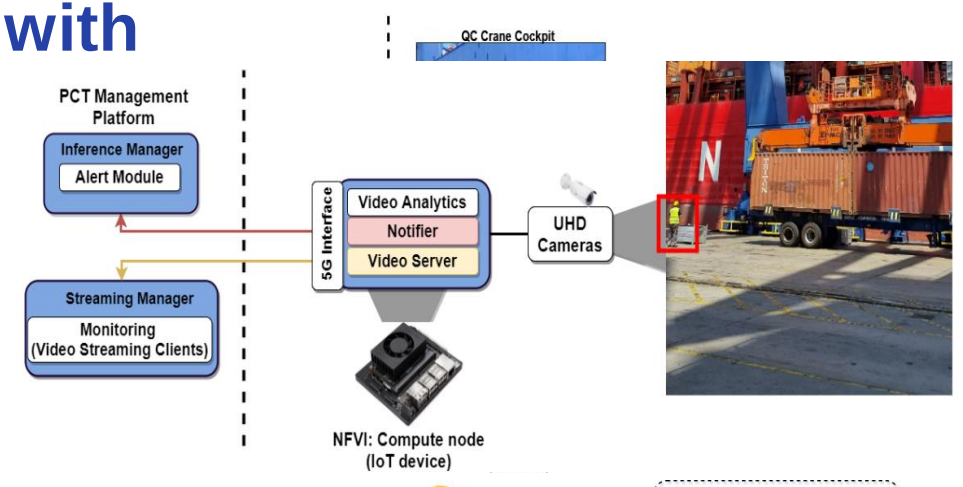
In-lab testing equipment (IoT device)

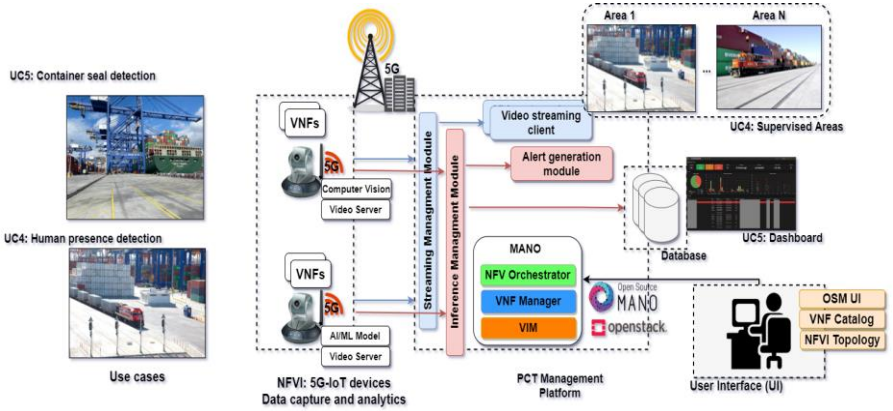
- Sensors (camera), Compute node (video analytics), SDR interface USRP B210 (cellular comms.)



5G-IoT and Video analytics with NFV-MANO support

- 5G-IoT device tailored to the Living Lab needs
  - compute node, 5G interface, 4K camera
  - ~40 STS cranes at PCT
- Far-edge computing services (on-premise/local IoT processing)
  - Logistics applications (automation of port operations) – **Container seal detection**
  - Security and safety applications – **Human Presence**
- NFV-MANO support (day0 – day2)
  - Service orchestration (VNFs, CNF, PNFs) and lifecycle management
  - (Far-edge) computer vision assisted UHD video monitoring services (inference triggered alerts)
- Open source solutions (Openmano, k8s, Openstack) over commercial off-the-shelf (COTS) hardware

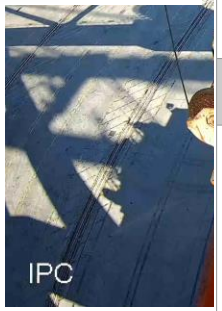




Far-edge computing with 5G IoT an
Support

Human Presence

Jetson AGX XAVIER



DEVELOPER KIT TECHNICAL SPECIFICATIONS	
GPU	512-core NVIDIA Volta™ GPU with 64 Tensor cores
CPU	8-core ARM® v8.2 64-bit CPU, 8MB L2 + 4MB L3
DL Accelerator	2x NVDLA
Vision Accelerator	2x 7-Way VLIW Vision Processor
Memory	32GB 256-bit LPDDR4x | 137GB/s
Storage	32GB eMMC 5.1
CSI Camera	16 lanes MIPI CSI-2
PCIe	x16 connector with x8 PCIe Gen4 or x8 SLVS-EC
Networking	RJ45 (Gigabit Ethernet)
Display	HDMI 2.0 Type A 2x DisplayPort via USB-C
USB	2x USB-C 3.1 (supporting DisplayPort and USB PD) Micro-USB 2.0 (serial port interface only)
Others	M.2 Key M (NVMe) M.2 Key E (PCIe x1 + USB 2.0 + UART (for Wi-Fi/LTE) / I2S + DMIC + GPIOs) 40-pin header (UART, SPI, CAN, I2C, I2S, DMIC, GPIOs) MicroSD / UFS card slot eSATAp (eSATA | USB 3.0 Type-A) 10-pin audio header 8-pin automation header (system power and related signals) 4-pin fan header
Power	DC power jack
Mechanical	105mm x 105mm x 65mm

5G Yard/External Trucks in PCT Port Operations

- 5G telematics device on **Yard trucks**
  - A fleet of 187 yard trucks (currently communicating over 4G)
  - 5G telematics device installed on trucks
    - Telemetry data: CAN-Bus, 5G localization, container presence and other custom sensors
  - Applications
    - Real time job allocation and traffic coordination within Piraeus port (about 2,5km area)
    - AI/ML predictive maintenance services

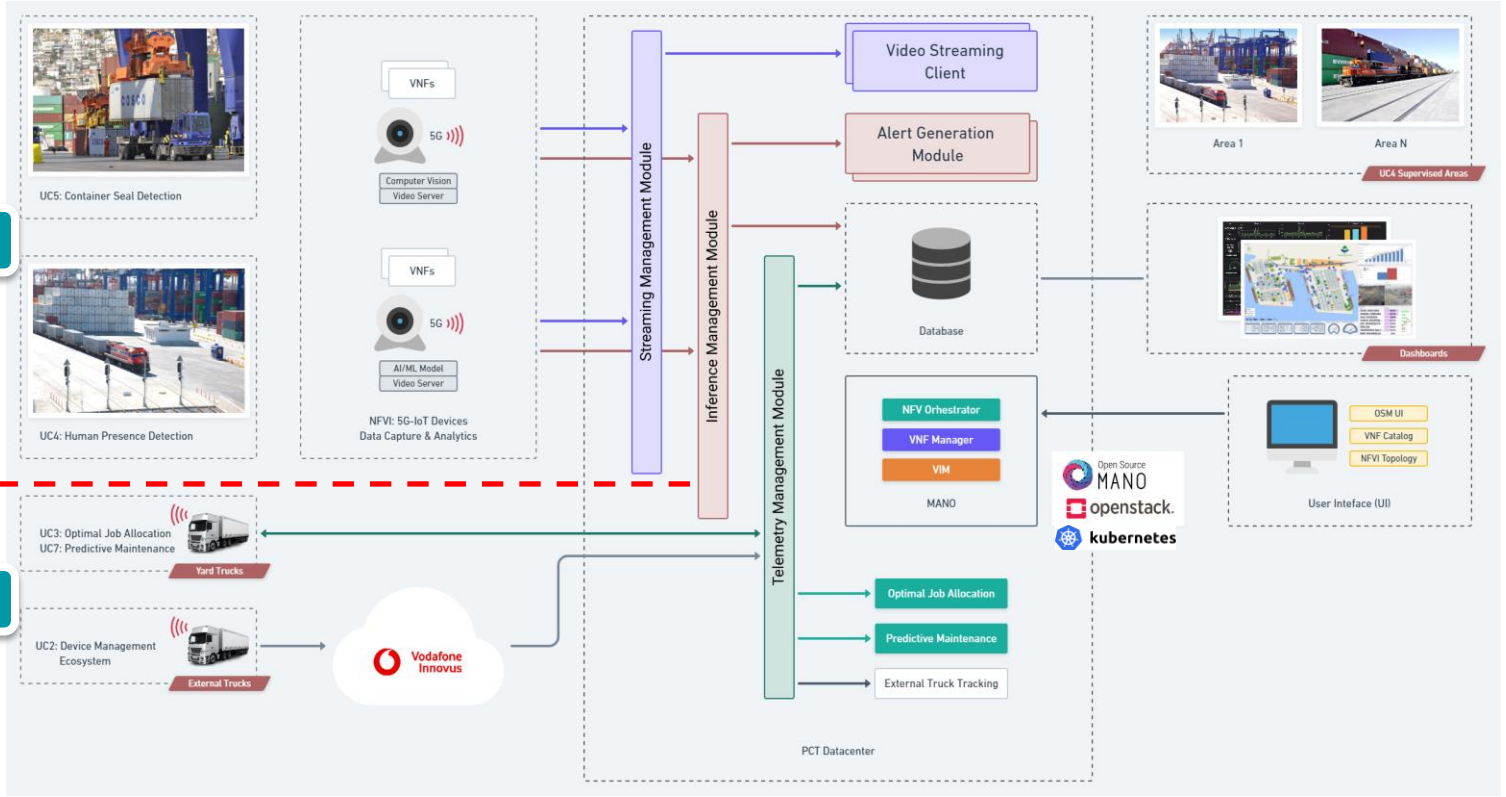
- 5G telematics device on **External trucks**
  - 30-35000 visits per month (about 1100 visits per day)
  - Real-time monitoring of the logistics supply chain (live tracking/positioning of external 5G trucks)
    - Telemetry: CAN-Bus, localization and other sensors
    - Real time cargo/goods end-to-end transportation view
    - Expected arrival time, traffic conditions, etc.

5G-LOGINNOV Use Cases – Athens LL

5G IoT Device Plane

MANO service components deployed over 5G

5G Truck Plane



GET IN TOUCH

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Thanks for your attention!