Enabling Port Logistics and Security with 5G Technologies

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Mediterranean Ports and Shipping
Portorož, Slovenia, 2022

Company Profile

- Company facts
  - Startup established in 2014
  - Located in Ljubljana, Slovenia
  - 100% employee ownership
  - 100% IPR ownership
  - First employees Q4 2017 (6, +10 associates)
  - Trusted R&I partner in EU H2020

- Core Expertise: development, engineering and operation of telco grade Quality Assurance (QA) and Critical Communications Systems (CCS)

- Main technologies verticals
  - QA | Quality assurance of mobile, fixed and cloud systems | *www.qmon.eu*
  - CC | Solutions for 5G/IoT-based critical communications | *5gsafety.net*

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Ports & Society

Import&Export

Digitalization

Automation

Adaptability

Resilience

TEN-T

Cyber

Open

Green

Efficient

Sustainable

Critical Infrastructure

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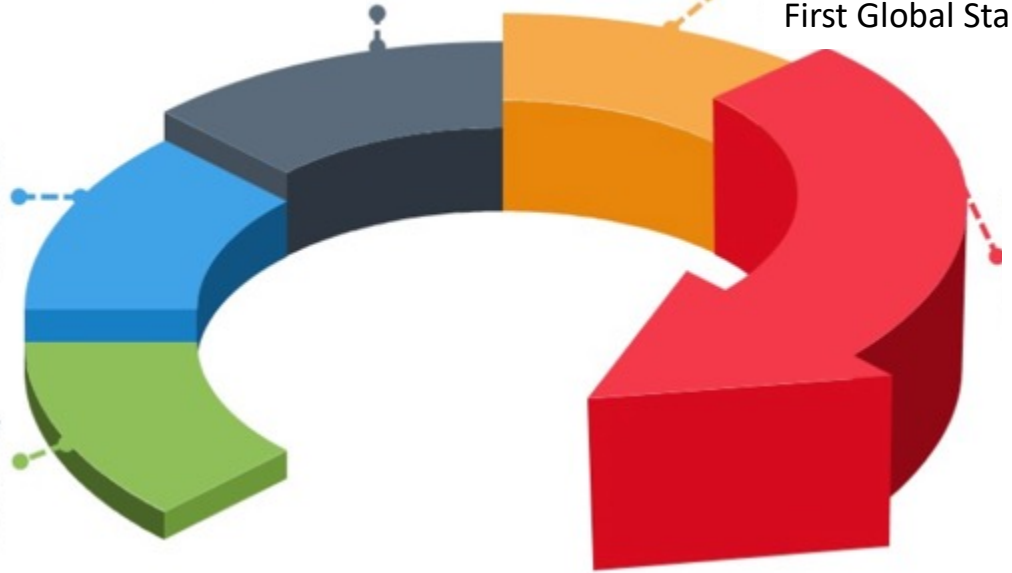
Mobile Technologies Evolution

3G/UMTS
Data
Multimedia

4G/LTE
All IP
First Global Standard!

2G/GSM
Digital System
Roaming, SMS

NMT
Analog System
Voice



5G/NR
VNF/CNF, Cloud-native, mMTC, eMBB, URLLC, V2X

Support for Industrial Verticals needs!

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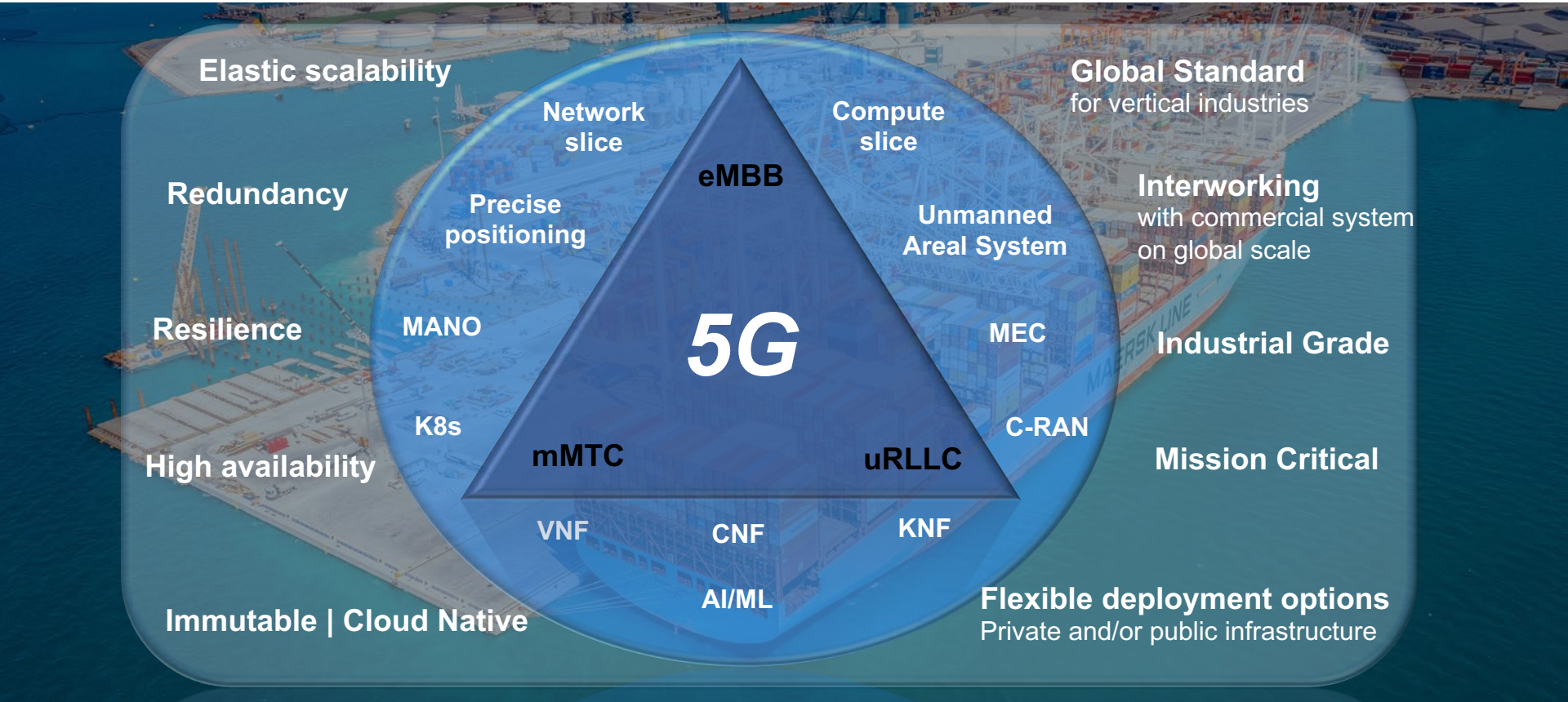
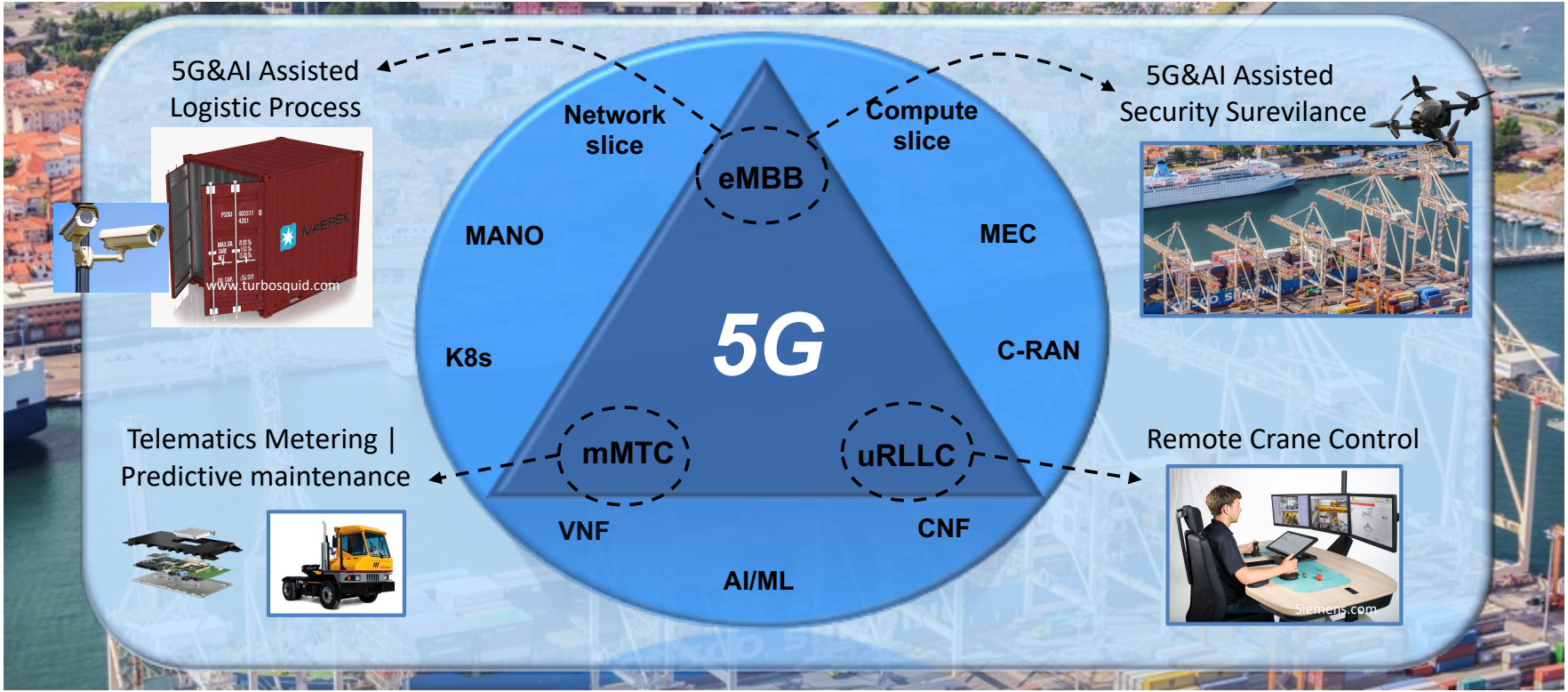
5G for Smart Ports



5G Assured Use Cases



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5GLOGINNOV

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5G-LOGINNOV Project | H2020

Athens Living Lab

5G to improve port operations efficiency and employee safety and to reduce costs, traffic congestion and environmental footprint

Hamburg Living Lab

5G to improve port operations, connecting Hinterland to Hamburg's port facilities

Koper Living Lab

5G to improve logistic processes automation in ports and mission critical services with continuous business & technical-related 5G system optimization

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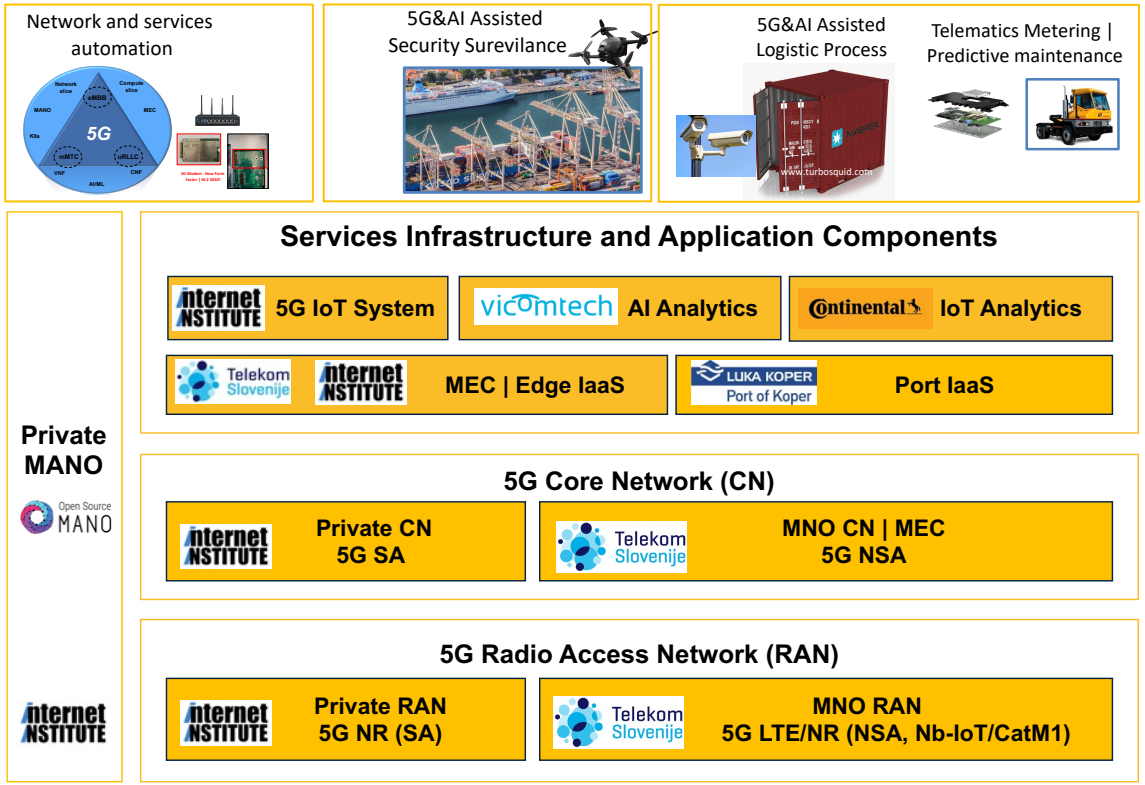
Ports 5G Infrastructure and Application Ecosystem



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The Future of Mobile Networking

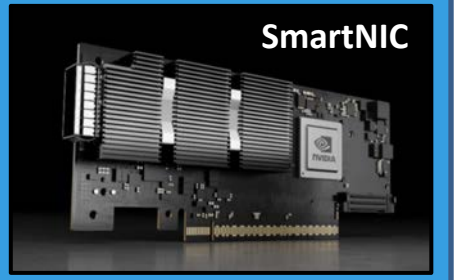
Application SW
VNF/CNF/KNF

Dedicated HW
PCI-based

COTS HW
x86 Server

5G NR
gNb/BBU

5G CN
AMF, SMF, UPF



AI/ML
SON

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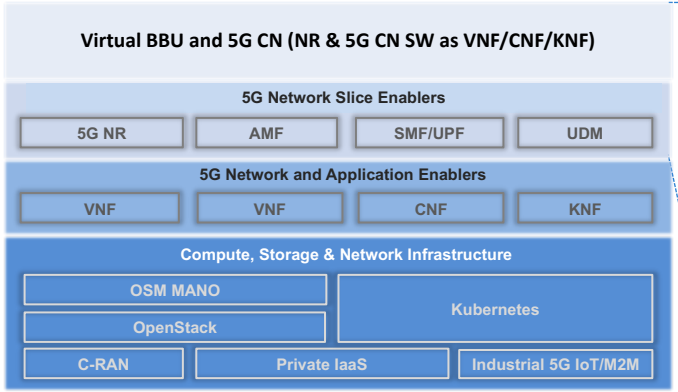
Private 5G Network | Building Blocks

LTE-A | NR
420 Mhz
450 Mhz
700 Mhz
800 Mhz
900 Mhz
1400 Mhz
1800 Mhz
2600 Mhz
3500 Mhz
…

Ant + RRH
250 mW – 20 W
FDD | TDD
MIMO 2x2|4x4

BBU Signal Processing
CPRI PCIe
QAM256



x86 Commodity Hardware

NR/5G (SA)
5GCN (SA)
gNb
VoNR
SMS
AES, SNOW, ZUC
QoS, QCI
IPv4, IPv6, IPv4&IPv6
Unstructured PDU
Rx & Cx external interfaces
…

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Private 5G Network | Bare-metal View

PCIe-based 5G NR Signal Processing (CPRI)

COTS x86 HW Portable IaaS

Integrated Private 5G System COTS Server, 48V Modular Power Supply

2 Port Omni Directional n78 Antenna

CPRI/eCPRI-based RRU (n78, 50Mhz)

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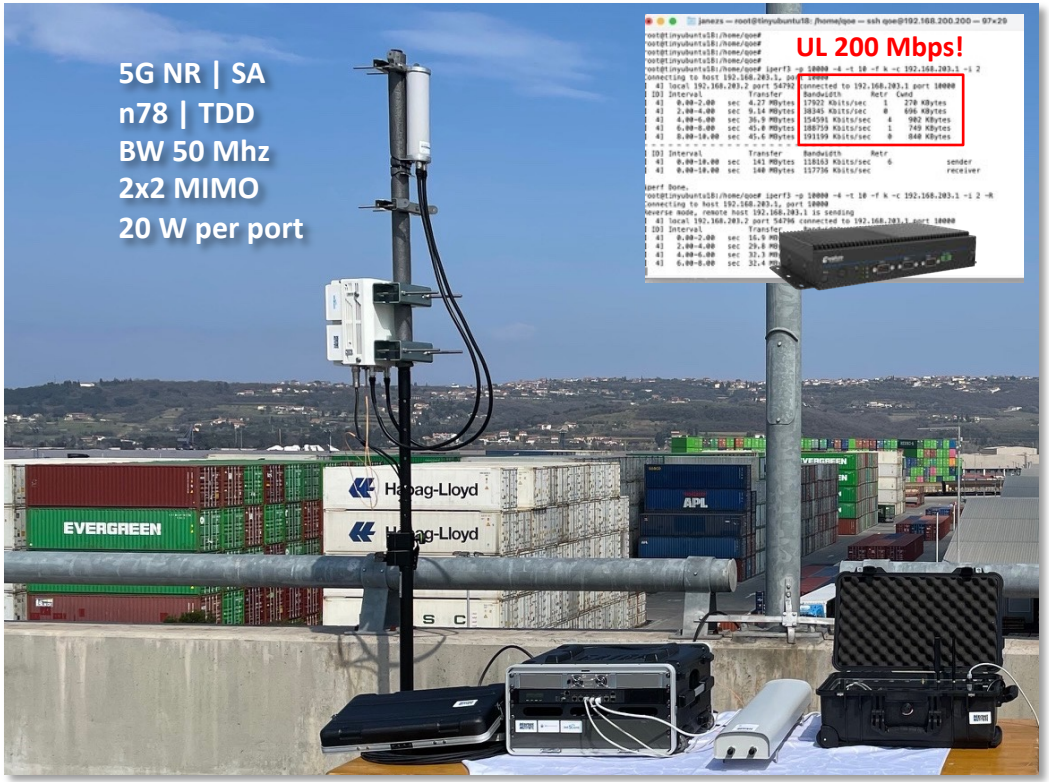
Private 5G Network | Operational Environment



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5G for the Ports | Todays Challenges

- Deployment model
  - Commercial vs Private network deployment
- Spectrum
  - Operator leased vs own spectrum
- Frequencies & BW
  - Bands: 2.6 Ghz 3.6 Ghz, 3.8 Ghz
  - BW: 20 Mhz - 400 Mhz
- Native support for industrial standards
  - SCADA, PROFINET, TSN,..
- Technology maturity
- Technology complexity
- Reliability & resilience
- Cyber security
- Value for money (price)

”Scientia potentia est | Knowledge is power"
Thomas Hobbes (1668)

"Do not use a cannon to kill a mosquito"
Confucius (551-478 BCE)

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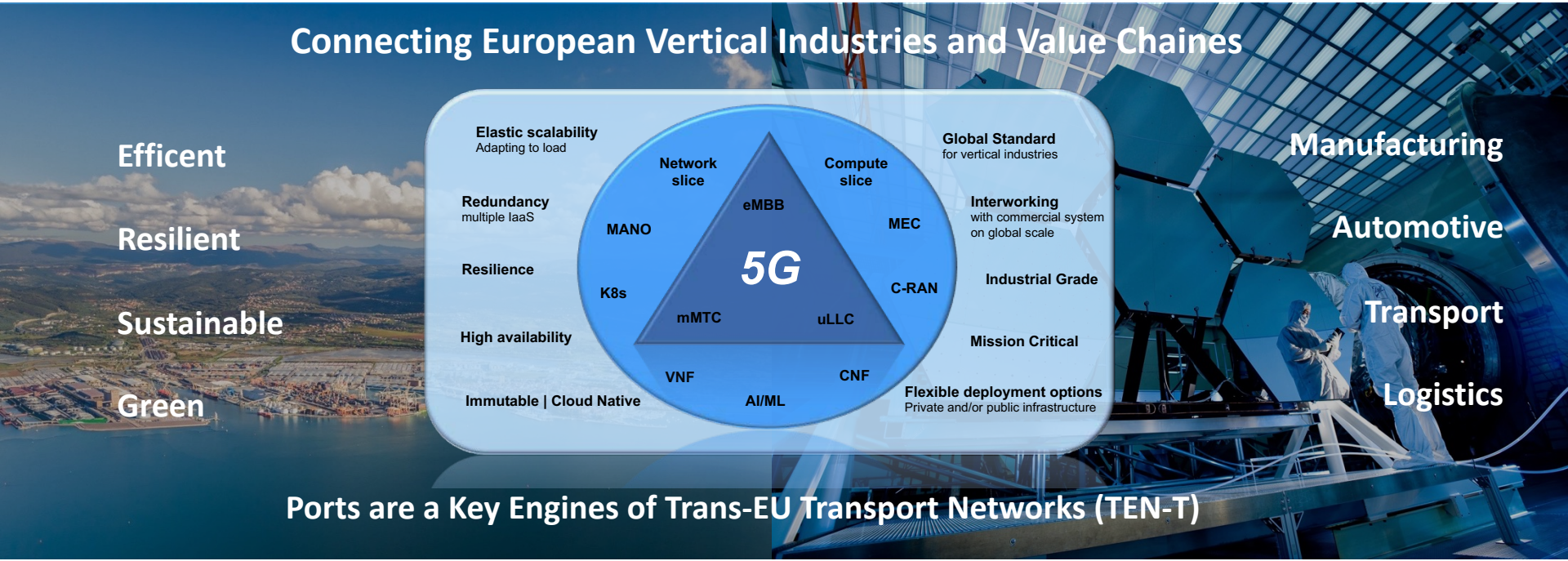
5G as Enabler of Future Smart Ports



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Thank you!