

COLLABORATIVE INNOVATION DAY
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5G for Port Logistics

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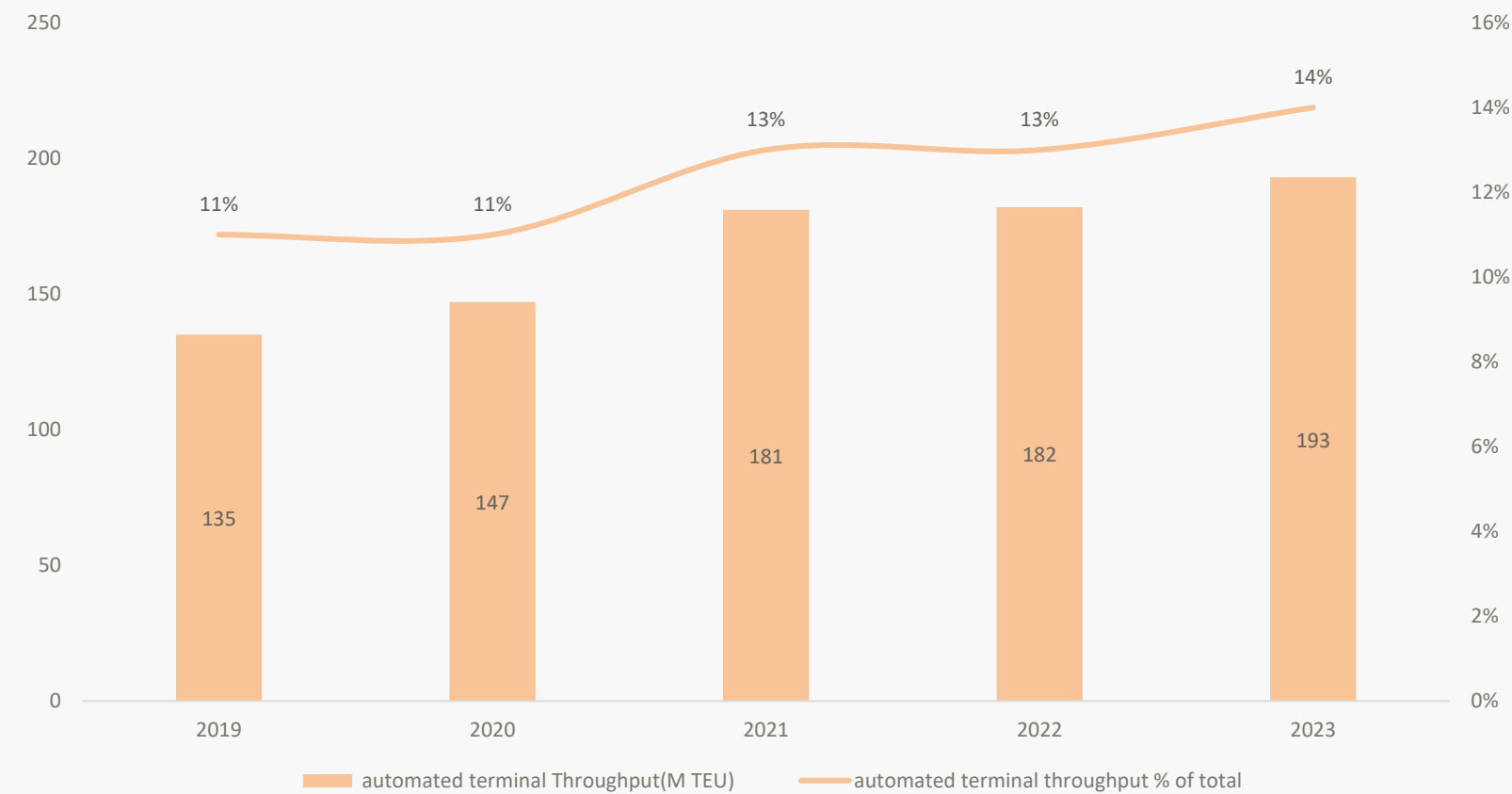


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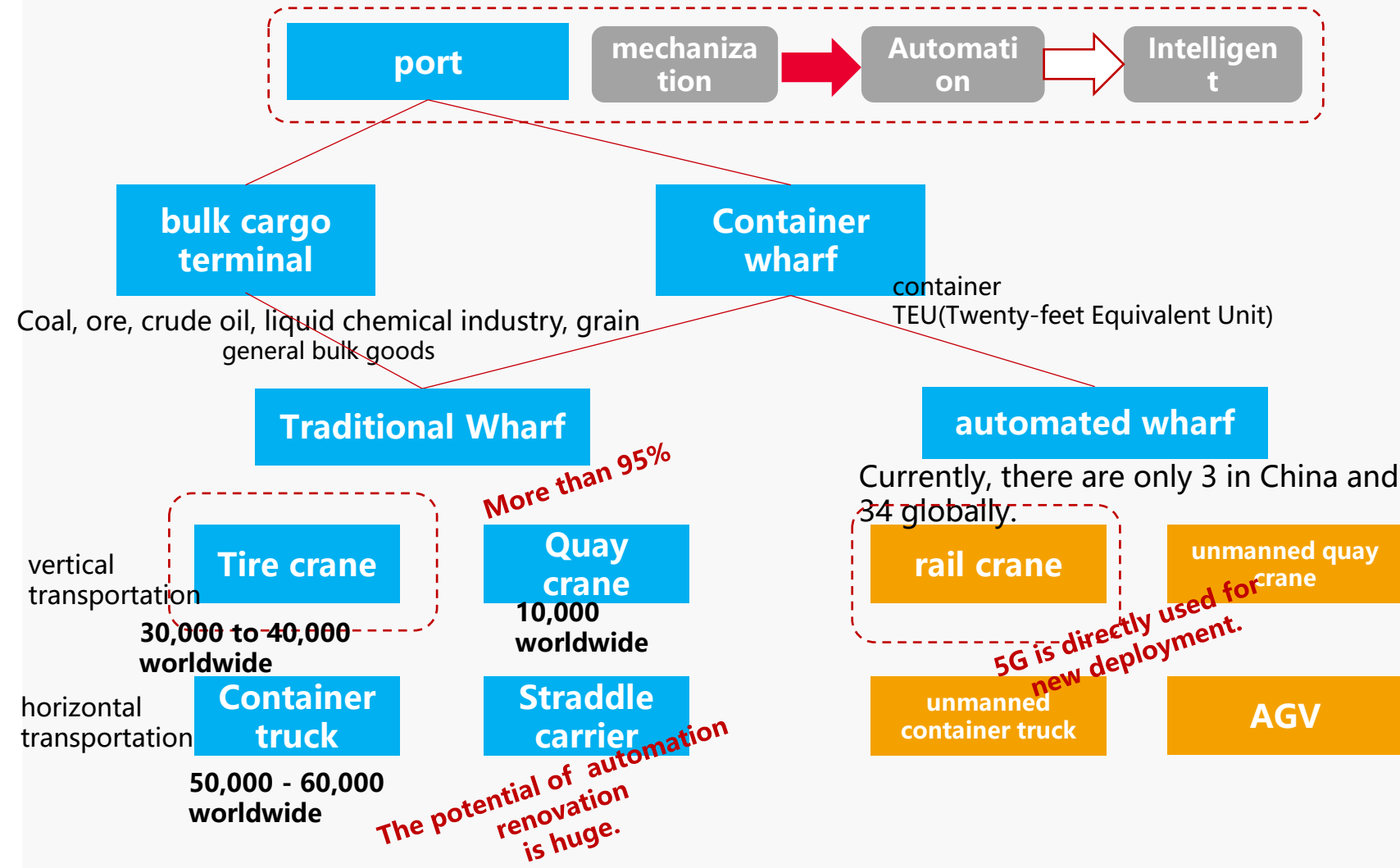
The smart port market has a large market space and is accessible to operators

Large proportion of non-automated wharfs

Container throughput of automated terminals accounts for only 13% in 2021



Huge potential for automatic modernization of existing wharfs, and obvious opportunities for new wharfs



Currently, multiple ports have commercialized remote control and unmanned container truck. There is strong requirement for automating logistics at ports.

Typical Port 5G UC value analysis

Vertical transportation: RTG remote control



Crane: 18 Cameras for Full Monitoring



Central control room: one person controls 4 tire cranes

Efficiency improved by **30%+**

- Yard transfer from 50 minutes to less than 20 minutes
- Lift from 25 to 28 cases to 35 to 40 cases/hour

Reduced manpower by **128 k€ /set/year**

- Average salary 3.5 k€ / month
- 3 drivers x 4 shifts per day per RTG

Personnel security **risk 0**

- No high-altitude work required

5G



Horizontal Transportation: IGV



Unmanned IGV: 5 cameras (3 front + 1 rear + 1 full view)



Central control room: remote monitoring/control

Scheduling efficiency improved by **20%+**

- IGV information visualization
- Automatic scheduling and continuous optimization of algorithms

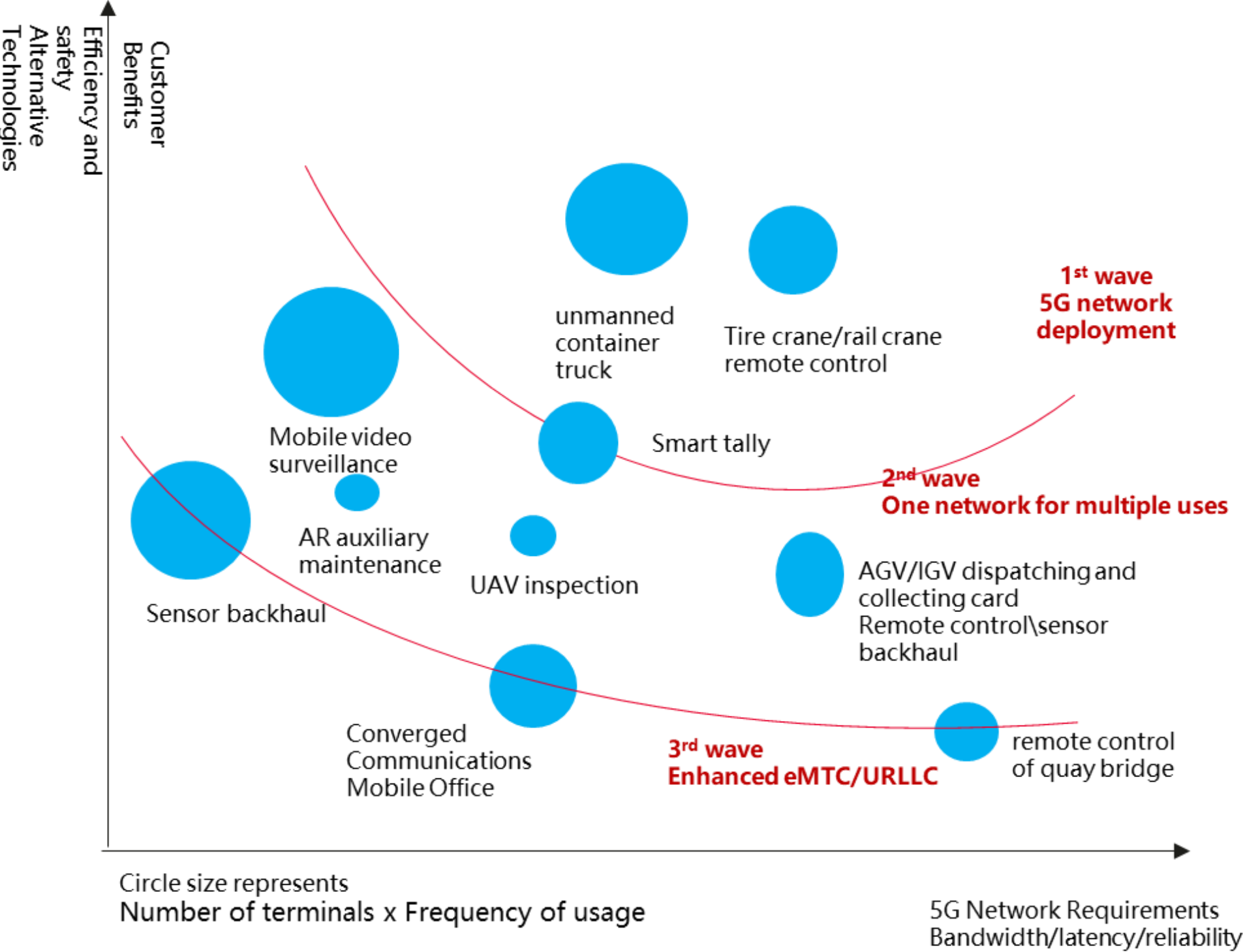
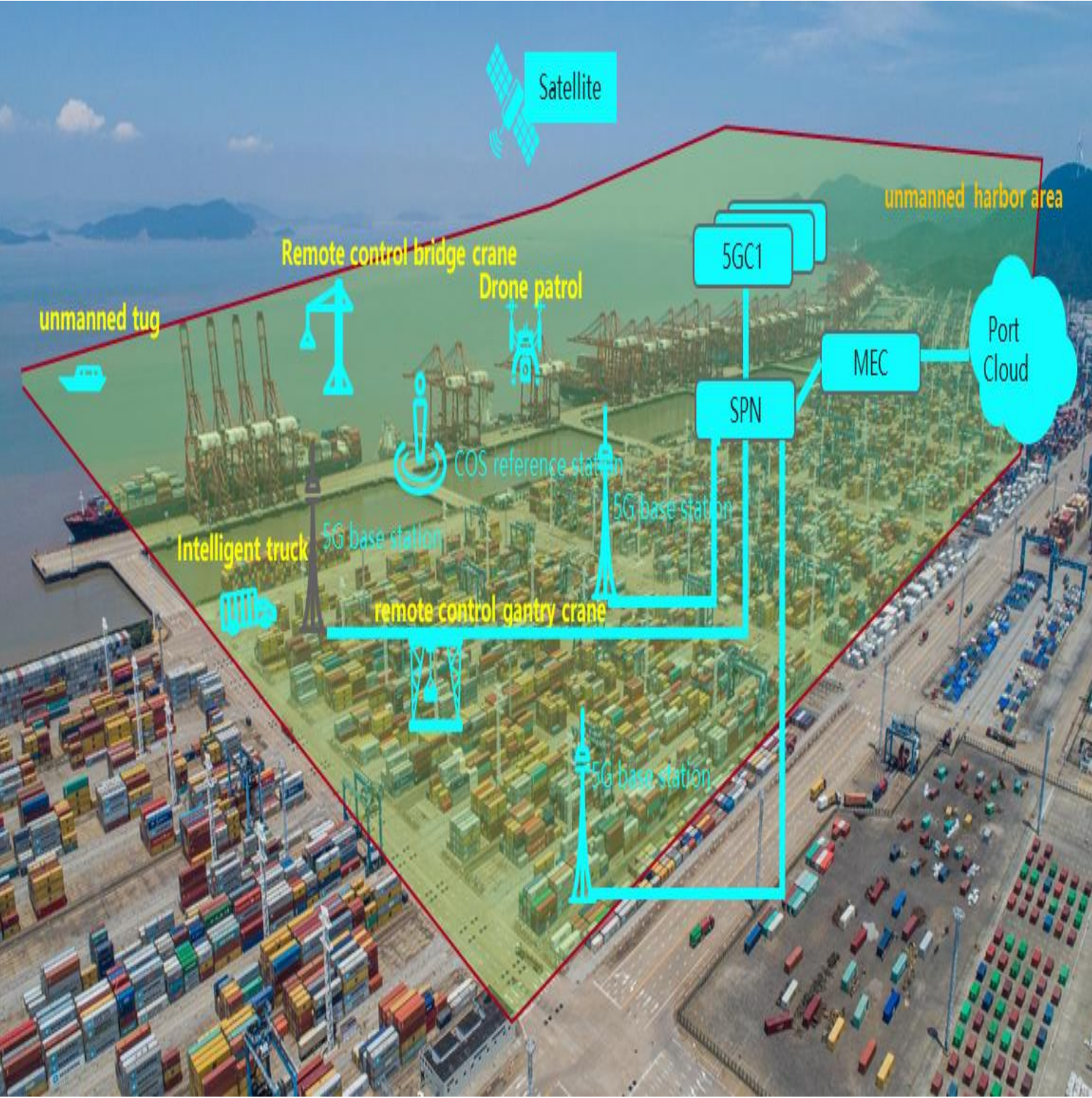
Reduced manpower by **51k€ /vehicle/year**

- Average salary 2 k€ /month
- 2 drivers x 2 shifts per day per AGV

Personnel security **risk 0**





- Unmanned site

Typical 5G port layout with 5G deployment and related service phases



Summary of Service Requirements: the Highest Requirements are Latency and Uplink Bandwidth

- In the remote control scenario of the gantry crane (RTG/RMG), multiple gantry cranes are aggregated in the yard, which has the highest requirements on network bandwidth and latency.

Use Cases	Overall Requirements	Latency	Bandwidth	difficulty degree
 Gantry crane (remotely controlled)	<ul style="list-style-type: none">■ Downlink control signal transmission, low latency■ Uplink video data transmission, large bandwidth	1) Average latency < 15 ms (CT scanning period) 2) Maximum latency < 224 ms	<ul style="list-style-type: none">■ Uplink: 20 Mbit/s to 50 Mbit/s, depending on the specifications and number of cameras■ Downlink: < 1 Mbit/s	★★★★★
 AGV/IGV unmanned truck	<ul style="list-style-type: none">■ Low latency, high reliability, multi-client, signal blocking, and large-range motion	< 50 ms (emergency intervention and remote control)	<ul style="list-style-type: none">■ Uplink: 10–40 Mbit/s, depending on the camera specifications and quantity	★★★★★
 Smart tally	<ul style="list-style-type: none">■ Large uplink bandwidth	<100ms	<ul style="list-style-type: none">■ Uplink: 20–40 Mbit/s, depending on the specifications and number of cameras	★★★
 Video surveillance	<ul style="list-style-type: none">■ In multi-connection scenarios, based on the terminal and data type.	100 ms	<ul style="list-style-type: none">■ The uplink ranges from 3 Mbit/s to 30 Mbit/s.	Considering the actual service scenario, the requirements for 5G are not high. In the project, the requirements of the customer can be met.

- 5G gantry crane remote control, unmanned container truck, and smart tally are core services of ports.
- The requirements for network coverage, network bandwidth, low and stable latency are high.
- Technical measures must be applied to ensure the reliability

Campus 5G Networks

Manufacturing

Port

Mining

Oil&Gas

Grid

Healthcare

Portable
Private Network

Two types of
private
networks

Local Private Network

Public Private Network

Six core
capabilities

High bandwidth

150 Mbps → 300 Mbps
→ 1 Gbps

Stable low latency

50 ms → 20 ms → 10 ms

Precise positioning

3 m → 1 m → X cm

Reliable availability

Network availability

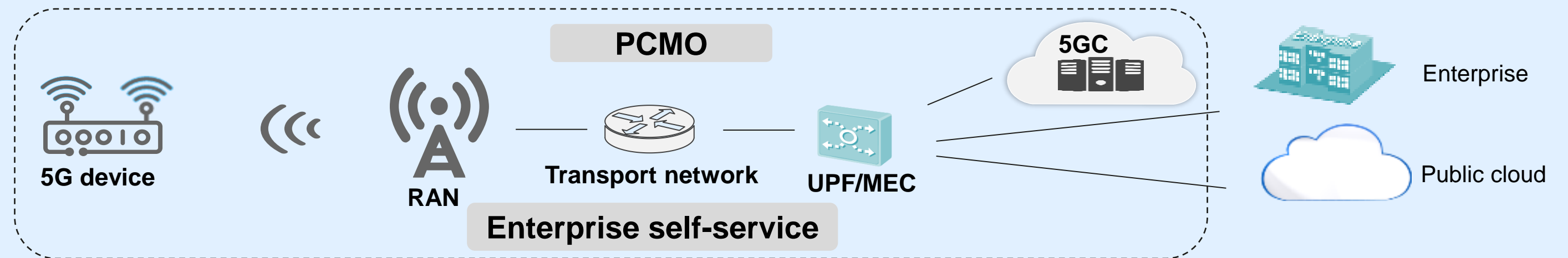
Efficient network

O&M
PCMO

**Simplified network
architecture**

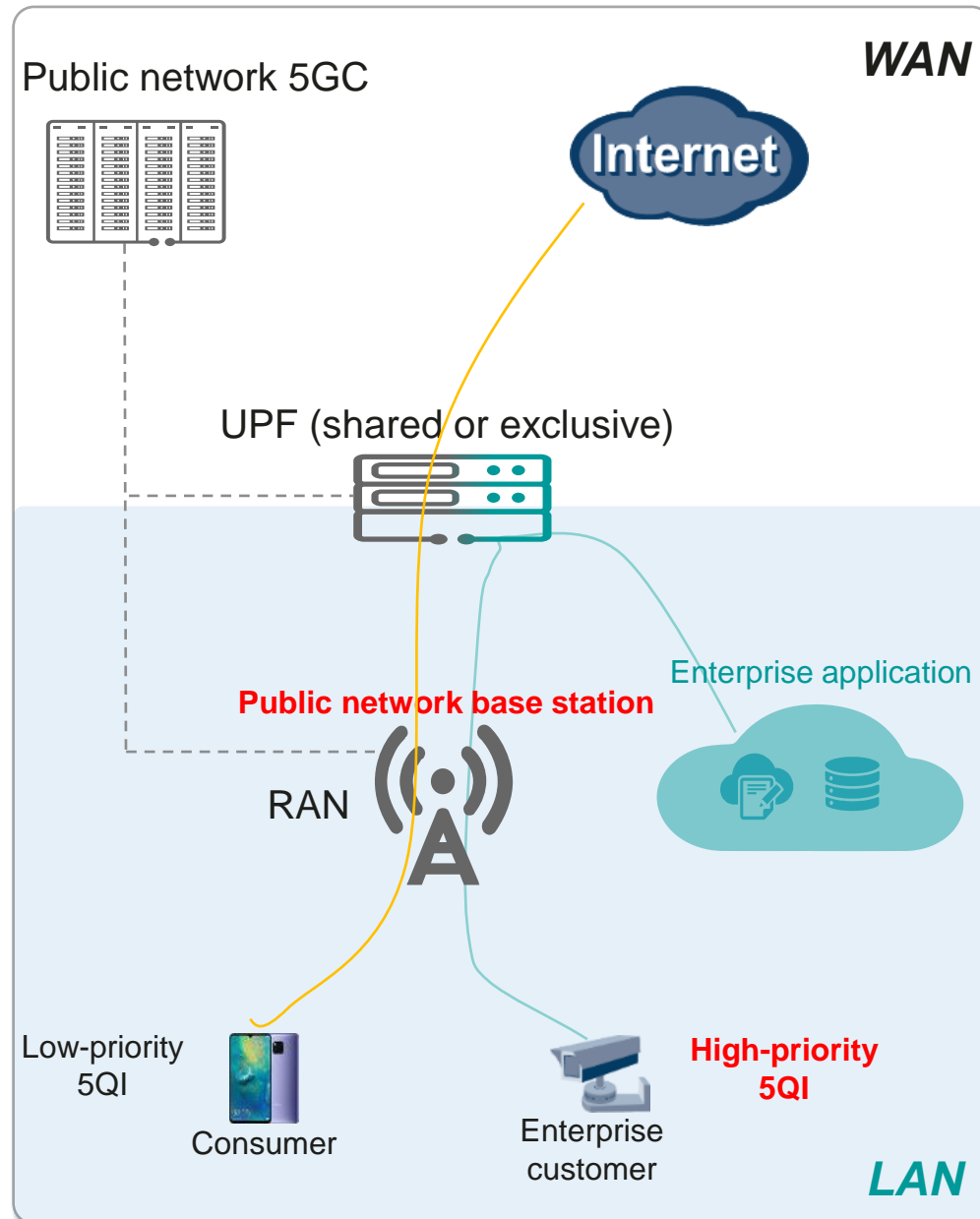
Public/private network,
slicing, and MEC

Device-pipe-
chip 5G
private
network



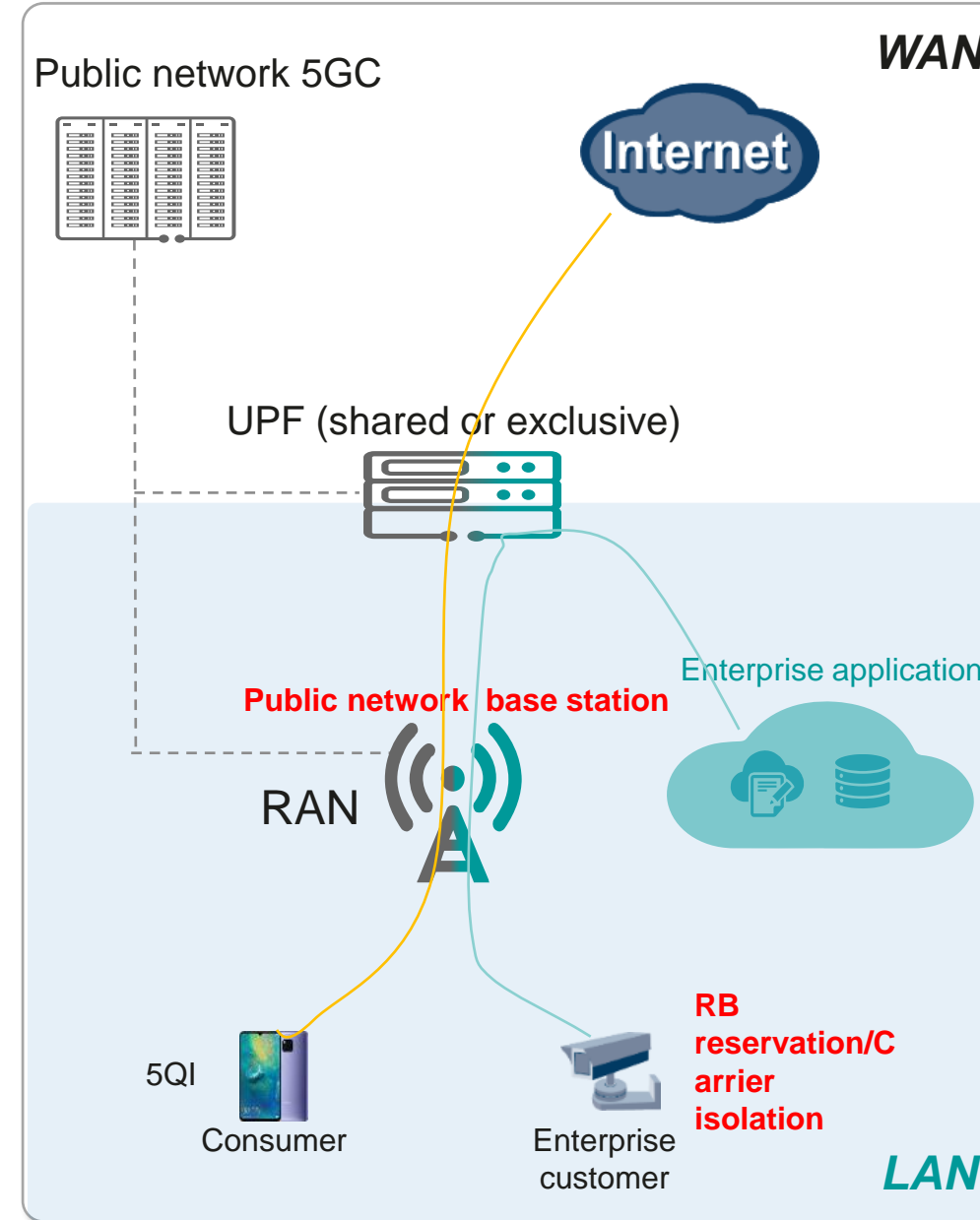
Three Types of Local Private Network

Public network for shared use



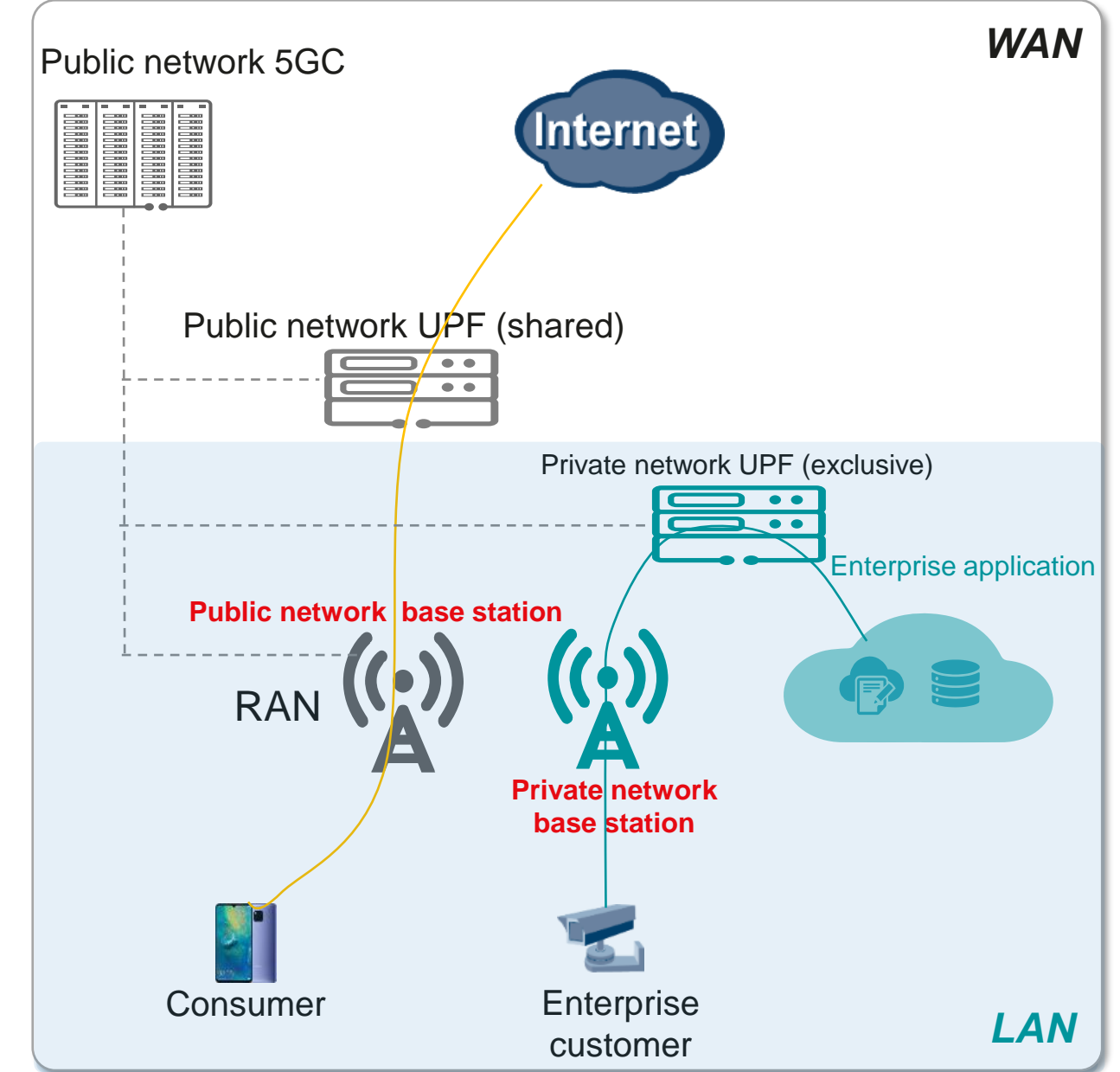
- RAN: **shared base stations** with 5QI-based **service priorities**
- Core network: shared 5GC, shared or exclusive UPF
- Transport network: shared
- Typical industries: education, healthcare, and government

Public network for dedicated use




- RAN: **shared base stations** with dedicated RBs/carriers for **hard isolation of resources**
- Core network: shared 5GC, shared or exclusive UPF
- Transport network: shared, with FlexE isolation
- Typical industries: electric power (substation), steel, coal mine, and manufacturing

Local private network



- RAN: **dedicated base stations** for **hard isolation of devices**
- Core network: shared 5GC and **dedicated UPF**
- Transport network: shared, with FlexE isolation
- Typical industries: steel, coal mine, and manufacturing

5G network solution has obvious advantages in smart port network construction.

	Wi-Fi/Microwave	optical fiber	5G 
➤ Construction difficulty	easy	difficult (Optical fibers need to be deployed, which is difficult for existing ports.)	easy
➤ Business Continuity	Low mobility (poor support for high-speed movement and handover)	Poor mobility	Good mobility and seamless switching (Slicing and QoS are supported, and SLA assurance is provided.)
➤ Spectrum	Unlicensed spectrum, Poor anti-interference capability	No spectrum issues	Licensed spectrum, Good anti-interference capability
➤ Latency	Latency instability	<1ms	Stable 20 ms
➤ Network security	Low	High	High (air interface encryption, 256-bit encryption)

Thank you.

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每个组织，构建万物互联的智能世界。

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organization for a fully connected,
intelligent world.

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