5G++ Driving Smart Port Upgrades

Xu Mengqiang, General Manager, China Mobile Ningbo, Zhejiang

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A Port to the World

Ningbo is located in the southeast coast of the Chinese mainland and in the south of the Yangtze River Delta, one of the most economically developed regions in China. Once a key port on the ancient Maritime Silk Road, Ningbo's ports have always played an important role in its economic prosperity. It was China's earliest port to open to the outside world, and is currently a primary hub of the Belt and Road Initiative. Ningbo-Zhoushan Port is currently the largest port in the world.

Cargo throughput: 1.119 billion tons in 2019; the world's only super port with annual throughput of over 1.1 billion tons, world's No. 1 port for 11 consecutive years

Container throughput: >27.53 million TEUs in 2019; ranked 3rd globally; one of the must-visit home ports for the world's largest shipping companies

International routes: >240 routes, connecting over 600 ports in more than 190 countries and regions; one of the busiest ports in the world

The Need to Transform

The Ningbo-Zhoushan Port is currently transforming from just a large port to a global, first-class port. A complete transformation is needed to address its many challenges from efficiency, cost, safety & security, etc.

Efficiency

- Freight pressure: Urgent optimization needed for larger vessels and overall operational efficiency
- Customs clearance efficiency: Intelligent/Info-based cargo handling efficiency and capacity improvements urgently needed
- Collaboration: Intelligent operation flows urgently needed to improve perception and collaboration between the port's productive factors

Cost

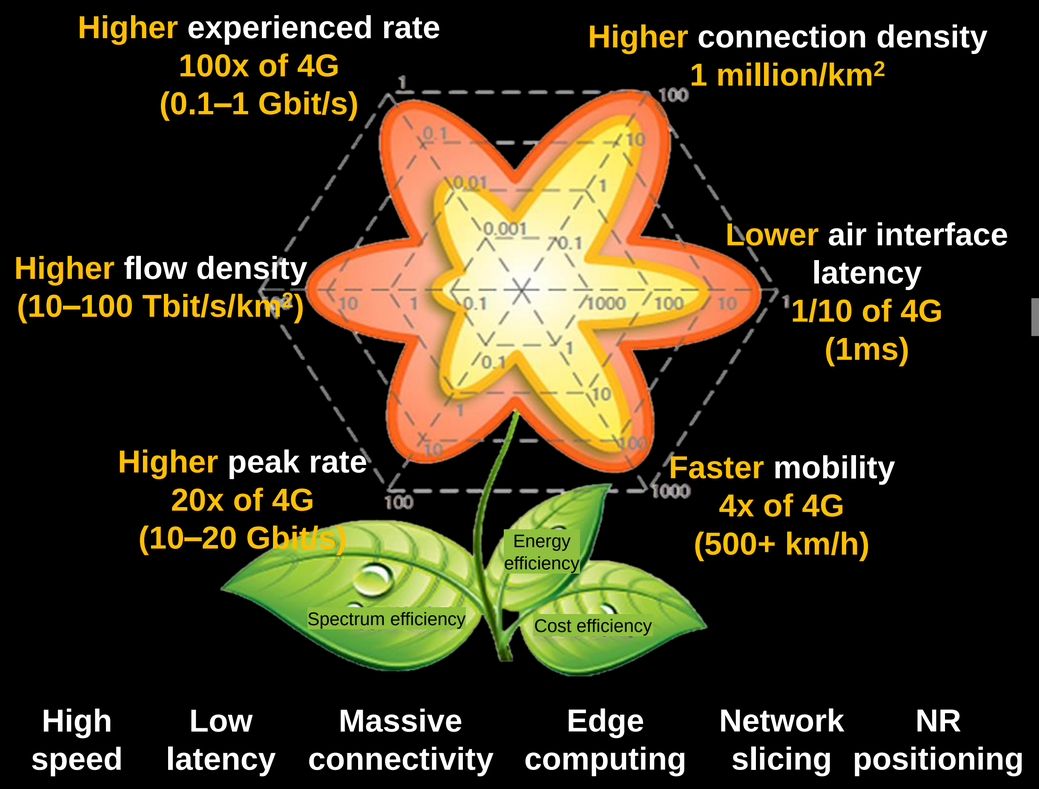
- Fierce competition: Conglomerate competition and cost problems exacerbated by COVID-19
- Labor costs: Increasing every year, accounting for a large proportion of overall capital expenditure
- Cargo handling costs: Increasing every year from depreciation of port equipment, fuel consumption, etc. as throughput increases

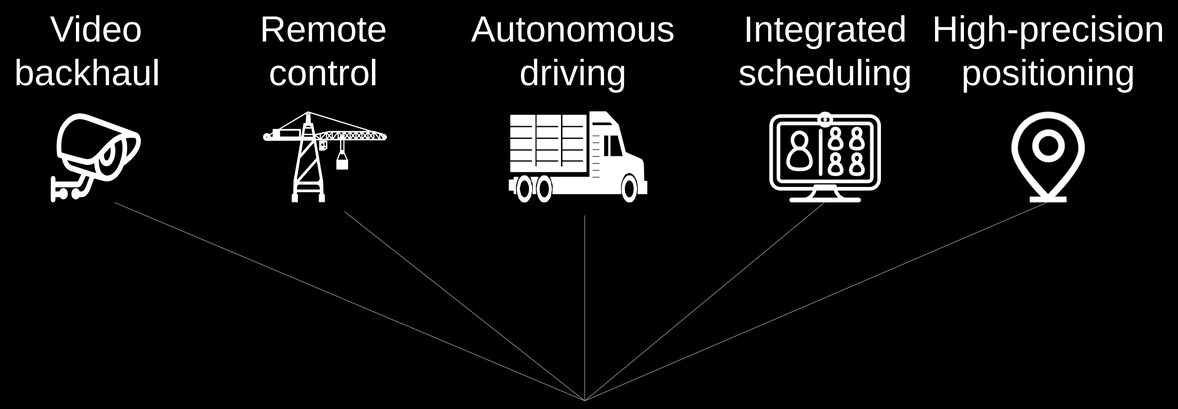
Safety & security

- Personnel safety: High pressure is placed on frontline personnel to prevent safety accidents
- Equipment safety: For many mobile equipment, operation blind spots and driver error present substantial safety risks
- Information security: Safeguards against production data leaks, hacks, etc. urgently needed

5G Enablement

The explosive growth of 5G applications in 2020 is proving it can be an accelerator for smart port upgrades, through innovative integration with AICDES, based on its 3 basic capabilities and 3 enhanced capabilities





Combination

AI IoT Cloud Data Edge Security

Win-win Partnerships

- September 2018, Smart City Expo in Ningbo: Zhejiang Seaport and China Mobile Zhejiang 5G smart port strategic cooperation agreement signing ceremony

- May 2020, 5G+ Action Promotion Conference: Signing ceremony for the Zhejiang Seaport, China Mobile Zhejiang, Huawei, and Zhenhua Heavy Industries strategic cooperation agreement on 5G-powered smart port applications in the Meishan Port Area.

The Approach

China Mobile Ningbo's "365" approach: Making Ningbo-Zhoushan Port a 5G-powered smart port

One of China Mobile's leading demonstration projects and model use cases

3 goals

- Higher efficiency
- Lower labor costs
- Better security

6 capabilities

- **A**I
- **I**oT
- **C**loud
- **D**ata
- **E**dge
- **S**ecurity

5 scenarios

- Remotely controlled rubber-tired gantry crane
- Horizontal transport container truck
- Bridge crane intelligent tally
- Assisted berthing
- Coordinated scheduling of port operations

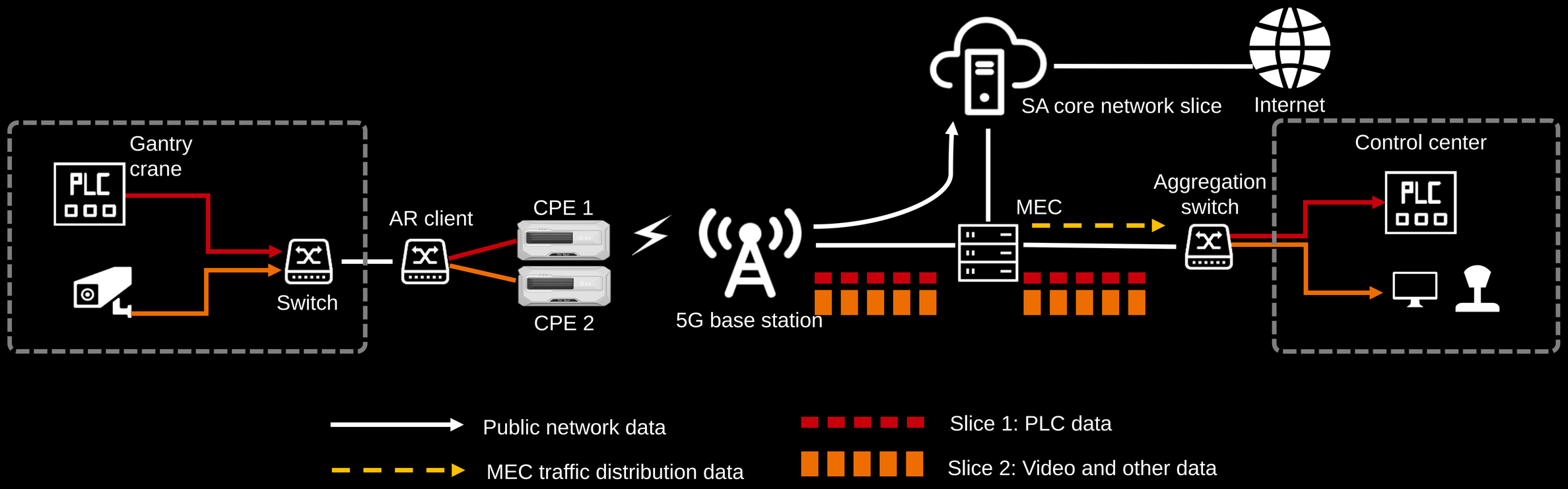
Network Coverage

Building a smart port starts with the network. China Mobile Ningbo was among the first in China to deploy 5G macro base stations in harbor areas. It has already built a 5G B.E.S.T. network that supports both 2.6 GHz and 4.9 GHz bands and plans to deploy more 5G base stations that support low frequency bands. This will build out the critical infrastructure that underpins a 5G-powered smart port.

- 5G base stations **58**
- Harbor areas **5**
- Berths **35**
- Container yards **77**

Core Capability

China Mobile Ningbo deployed China's first mobile edge computing (MEC) server for ports and was among the world's first to customize 5G slicing. This delivers two key advantages for remotely controlled 5G pantry cranes: 1. low latency transport of PLC heartbeat packets; 2. large uplink bandwidth for videos.



Superior Performance

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Conducted new technology trials to explore new smart port 5G applications. Make the most of 5G's low latency, large bandwidth, and high reliability to meet the explosive demand for applications.

Low latency

7 ms

Near theoretically lowest round-trip latency possible

Large uplink bandwidth

747 Mbit/s

World's first 4.9G 3U1D technology pilot, supporting operations of six gantry cranes

High reliability

24/7

Supporting 5G-enabled remote control of rubber-tired gantry cranes at ports

High Security and Reliability

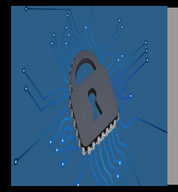
Assessed cyber security of the Ningbo-Zhoushan Port and launched the "Powered by SA: China Mobile Smart Port MEC Security Application" project, which became the only 5G use case incorporated in GSMA's Powered-by-SA Use Case Repository

Changes in 5G infrastructure and services bring new risks and challenges

1. More service scenarios
2. Complex network structure
3. More security risks
4. More difficult to manage

Build service-centric and risk-informed E2E security management and control system

Deeply integrate with industrial infrastructure



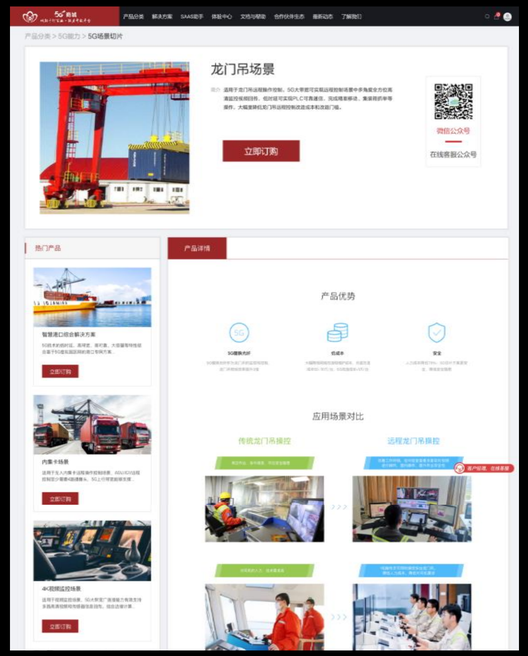
Detect security risks in new forms

Establish a collaboration mechanism for security management

Develop a holistic security solution

Self-service Purchase

Atomic-level capabilities are encapsulated into a standard set of API-based slice products on China Mobile Zhejiang's 5G online store. Users can select the slices they need, customize specifications, place orders with one click, and activate services online. In addition, users can obtain network SLA monitoring data in real time on the self-service page.

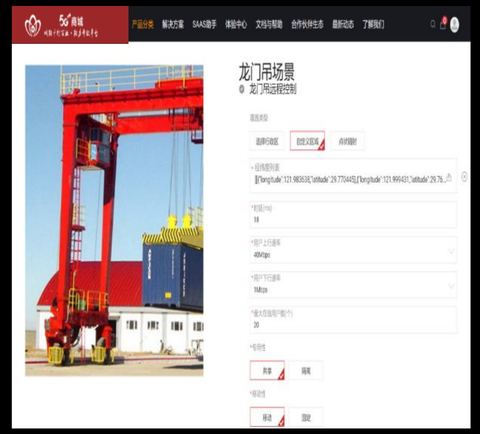


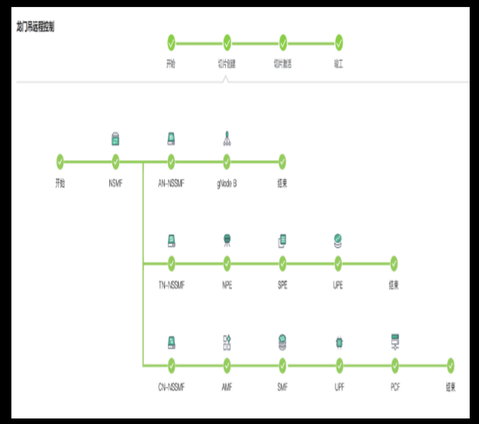
1 Click "Order Now"

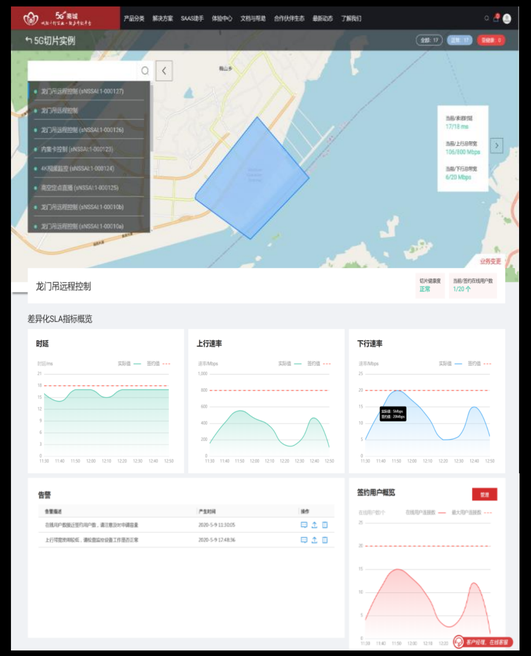
2 Configure slice parameters

3 Slice activation and provisioning

4 SLA indicators







Application | 5G-powered Remote Control of Rubber-tired Gantry Cranes

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In April 2019, China Mobile Ningbo and Ningbo-Zhoushan Port jointly developed China's first 5G remote control application for rubber-tired gantry cranes. This application enables real-time backhaul of 16-channel HD videos and remote control of gantry cranes. In May 2020, 6 5G-powered, remotely controlled gantry crane clusters were put into production, the largest scale of its kind in China. Next, they will promote the development of industry standards for 5G rubber-tired gantry crane remote control systems.

Pain points

5G-powered remote control for gantry cranes

Application | Self-driving 5G Container Trucks

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In May 2020, China Mobile Ningbo deployed 5G-powered Beidou reference stations, utilizing 5G, V2X, and high-precision positioning technologies. This enabled an end-to-end integrated network covering Meishan Harbor Area's container trucks, mobile port equipment, and the road, allowing existing trucks to be repurposed as self-driving container trucks.

Pain points

Self-driving 5G container trucks

Application | 5G-powered Intelligent Tally

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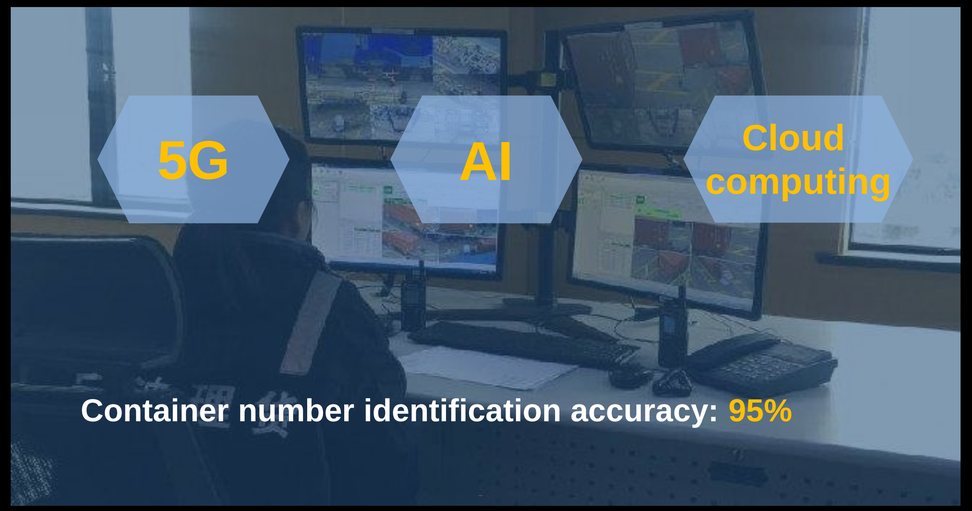
In December 2019, China Mobile Ningbo backhauled Ningbo-Zhoushan Port's HD videos of quay cranes in real time with 5G, AI, and cloud computing technologies. This improved container identification accuracy and reduced the manpower needed to conduct onsite tallies by automatically identifying container numbers and container damage.

Pain points

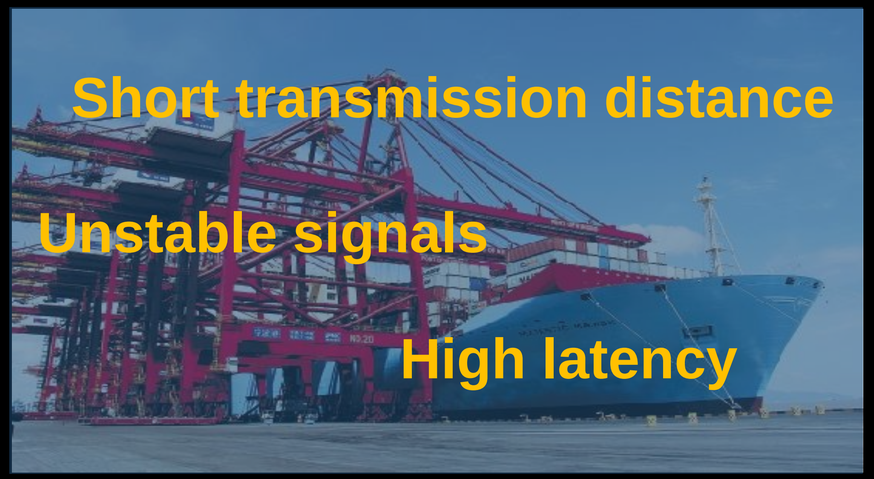
5G-powered intelligent tally



Application | 5G-powered Assisted Berthing

China Mobile Ningbo supports efficient assisted berthing by increasing the berth coverage through **low-frequency 5G, high-precision positioning, and laser technologies**. Pilot officers can use 5G-powered pilot scheduling devices to obtain the dynamic data about ships and the environment up to 1,500 meters away from the berth.

Pain points



5G-powered assisted berthing

Application | Integrated 5G-powered Scheduling

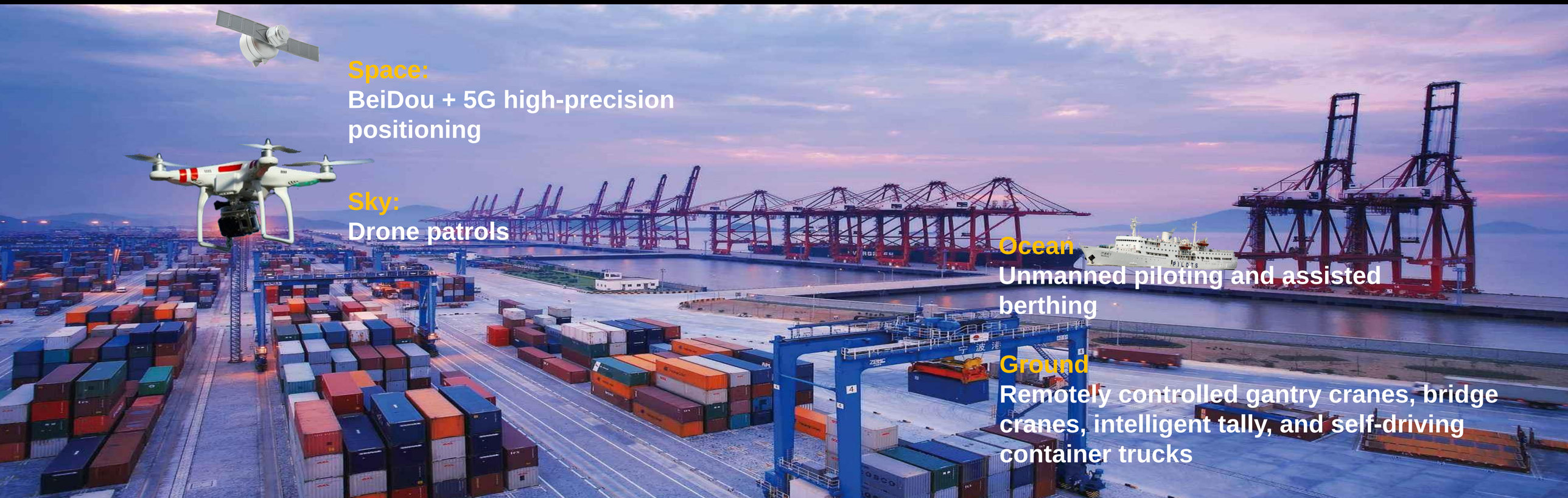
China Mobile Ningbo is building an integrated 5G-powered scheduling application at the Ningbo-Zhoushan Port. The **5G-powered and cloud-based intercom** platform will enable frontline operation personnel and background scheduling personnel to see and talk with each other more easily, making remote scheduling and command more efficient.

Pain points

Integrated 5G-powered scheduling

Future Outlook

China Mobile Ningbo will continuously work with partners to drive transformation and upgrades at smart ports through 5G and other new technologies and applications. The "5G+ smart port" system combines solutions for ground, sea, sky, and space. We hope that this reliable, efficient, and easy-to-maintain system will turn the Ningbo-Zhoushan Port into a global commercial showcase for 5G-powered smart port solutions, sharing our experience in smart port development worldwide.



A Shining Beacon in the Distance

The vision of world-leading 5G-powered smart ports in Ningbo shines bright in the distance, penetrating even the thickest fog. We will march towards the light unceasingly, hand-in-hand with our partners.

Thank You!