Building a Digital World, Enabling Smart Railways

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Accelerate Industrial INTELLIGENCE

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Huawei, Leading Provider of ICT Products and Solution

Vision & mission

Bring digital to every person, home and organization for a fully connected, intelligent world

170+
countries and regions

207,000
employees

55.4%
of employees work in R&D

5
in global R&D investment

>20%
R&D expense ratio

>140,000
active patents held globally
(*Huawei has one of the world's largest patent portfolios.)

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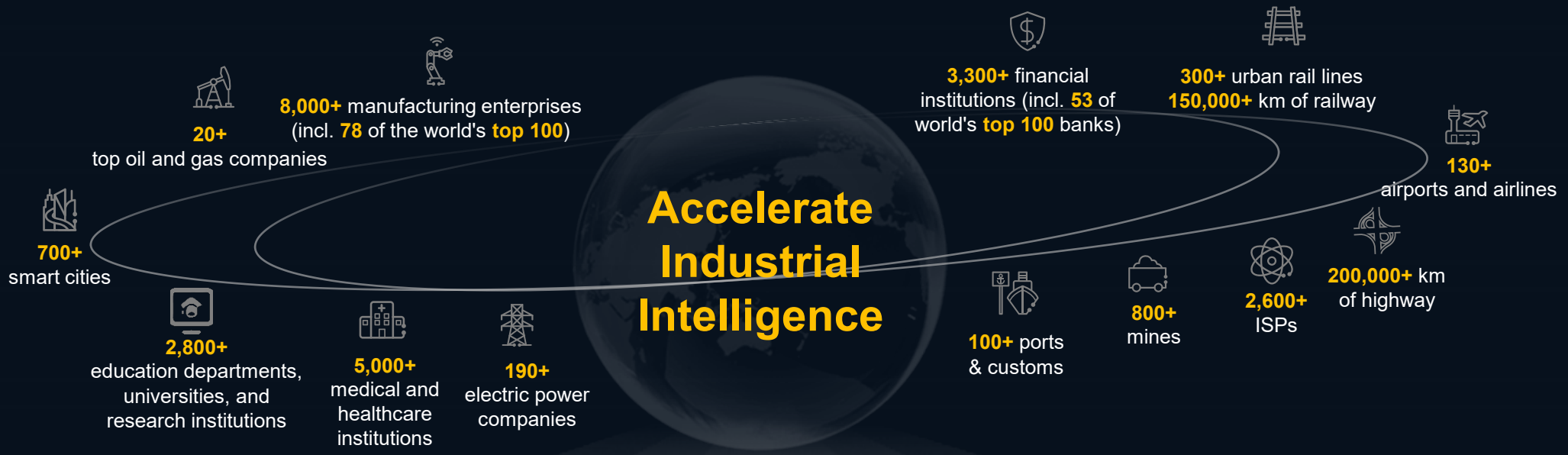
Enterprise business: Accelerating industrial intelligence and facilitating digital and intelligent economic development with customers and partners



First-ever
industrial intelligence reference framework

200+
industrial intelligent solutions

20+ industries
intelligent transformation practices

Partner-led
commercial and distribution sales and service system

40,000+
partners

65+
HUAWEI eKit products for the distribution market

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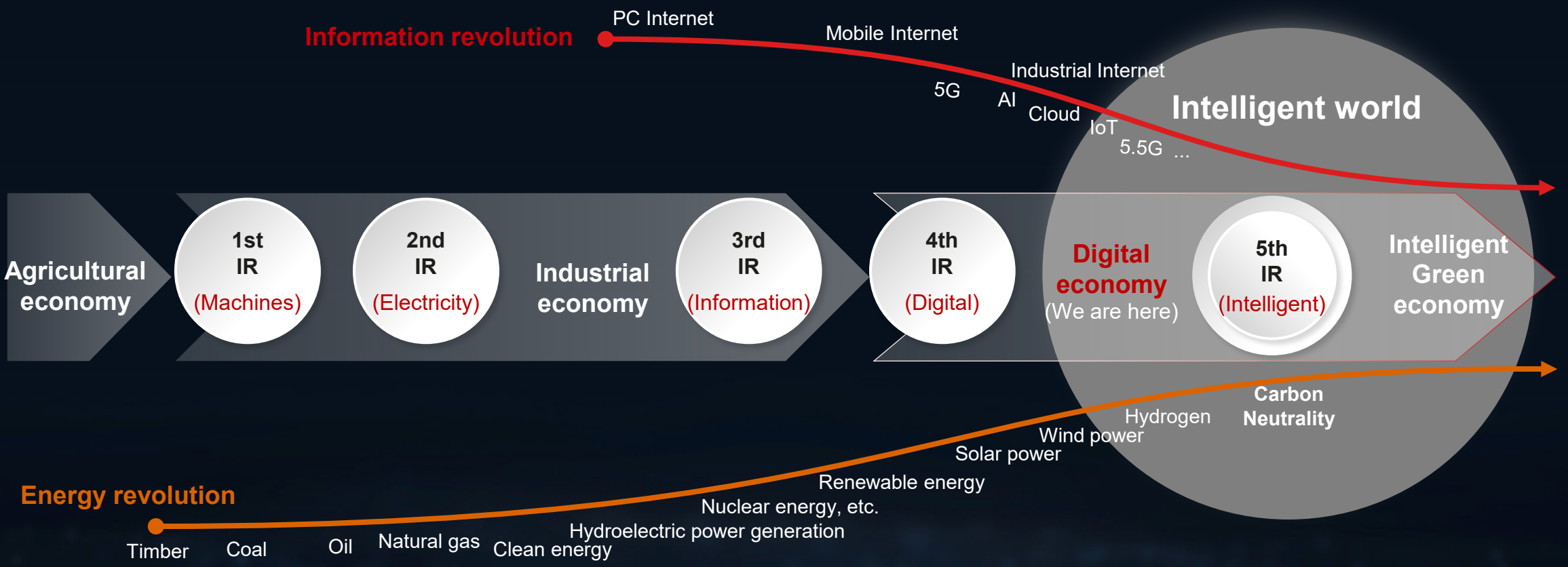
The 5th Industrial Revolution with Low-carbon, Digital, and Intelligent Transformations, Bring Closer to the Intelligent World



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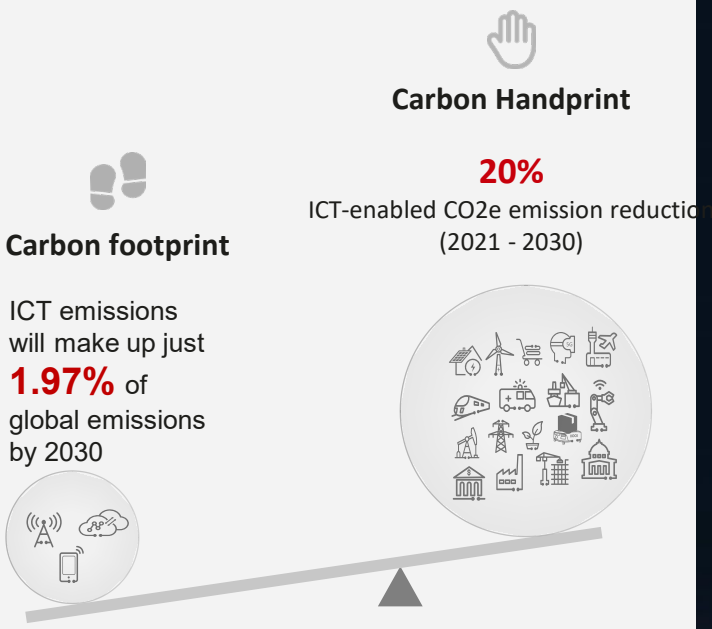
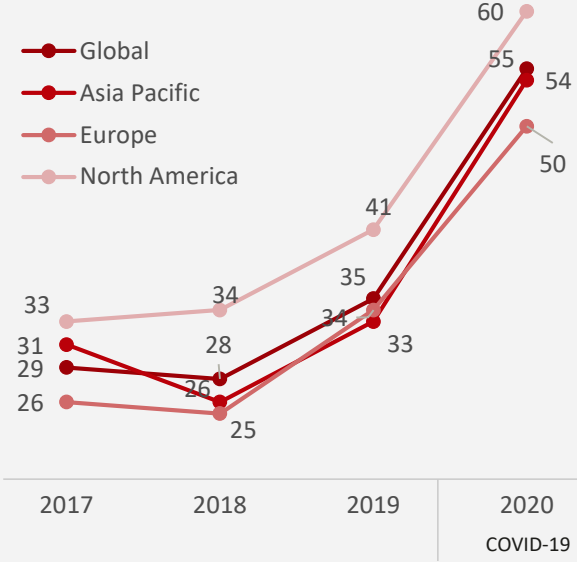
Challenges and Opportunities to Accomplish for Smart Era

Green Mobility Need Digitalization
10 times of emission reduction



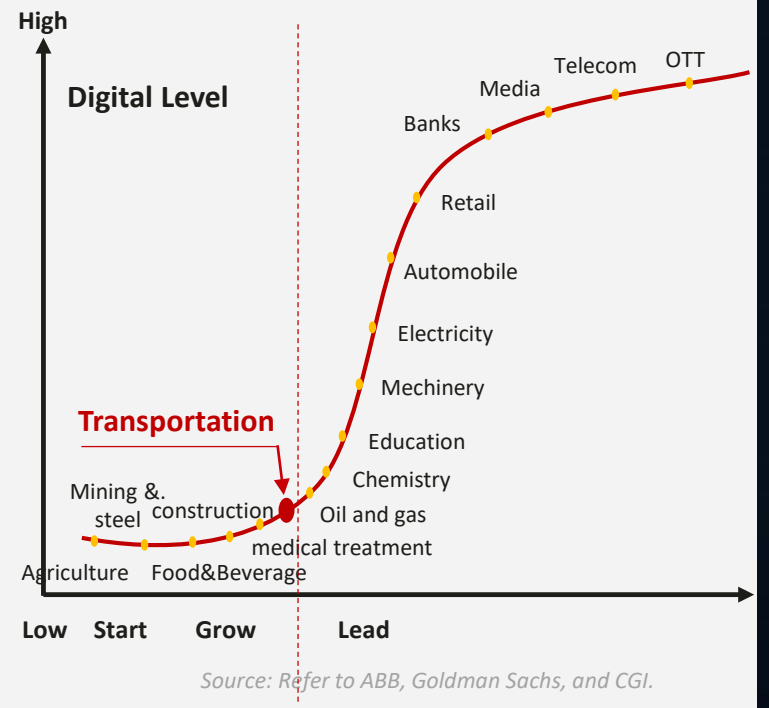
Carbon neutrality brings challenges and opportunities to the industry

Epidemic Speeds up Digital Progress
Seven years ahead of schedule



Average % of partially or fully digital products and services

Transportation Digitalization at a Turning Point: New ICT (5G, AI, etc.)



Digitalization in Transportation become Inevitable

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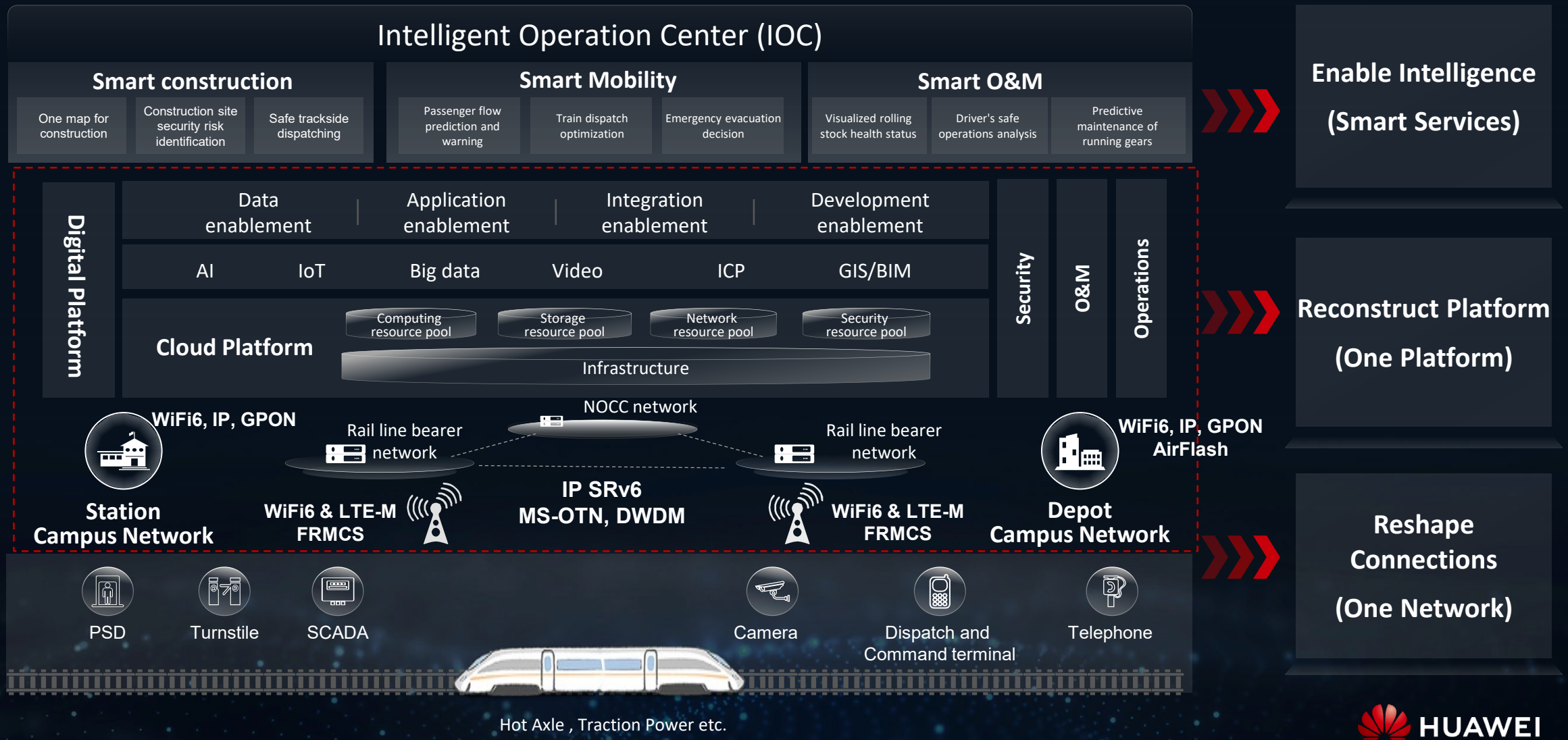
Comprehensive ICT Infrastructure for Smarter Digitalized Railways



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FRMCS: A Key Enabler for Railway Digitalization

Smart Freight Yard

Predictive Maintenance

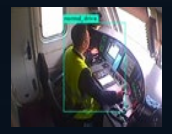
O&M Efficiency

Smart Construction

Railway IOC

ETCS 2/3
(Moving Block)

Multi-media
Dispatch



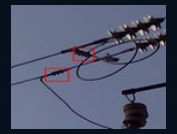
Locomotive
Video

Maintenance
Staff

Main-line, Station & Depot
Seamless Coverage

Track-side
Video

Perimeter
Detecting



6A/6C
Big Data

Track-side, Station & Depot
Fixed Coverage

FRMCS

FRMCS New Functions

ETCS 2/3
Moving block
ATO

Multimedia
Dispatching

Safety driving monitoring
PIS/CCTV

Track side IOT
& Video

Real-time train location
Train Status information
O&M Data

Real time Long-
Distance insight

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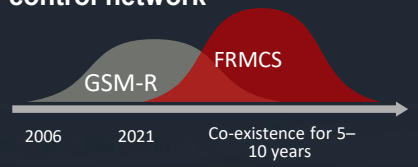
All-Optical Communications Helps Build Secure and Smart Railways

Acceleration & high safety level

350 km/h → 400 km/h: Signaling Safety — ETCS

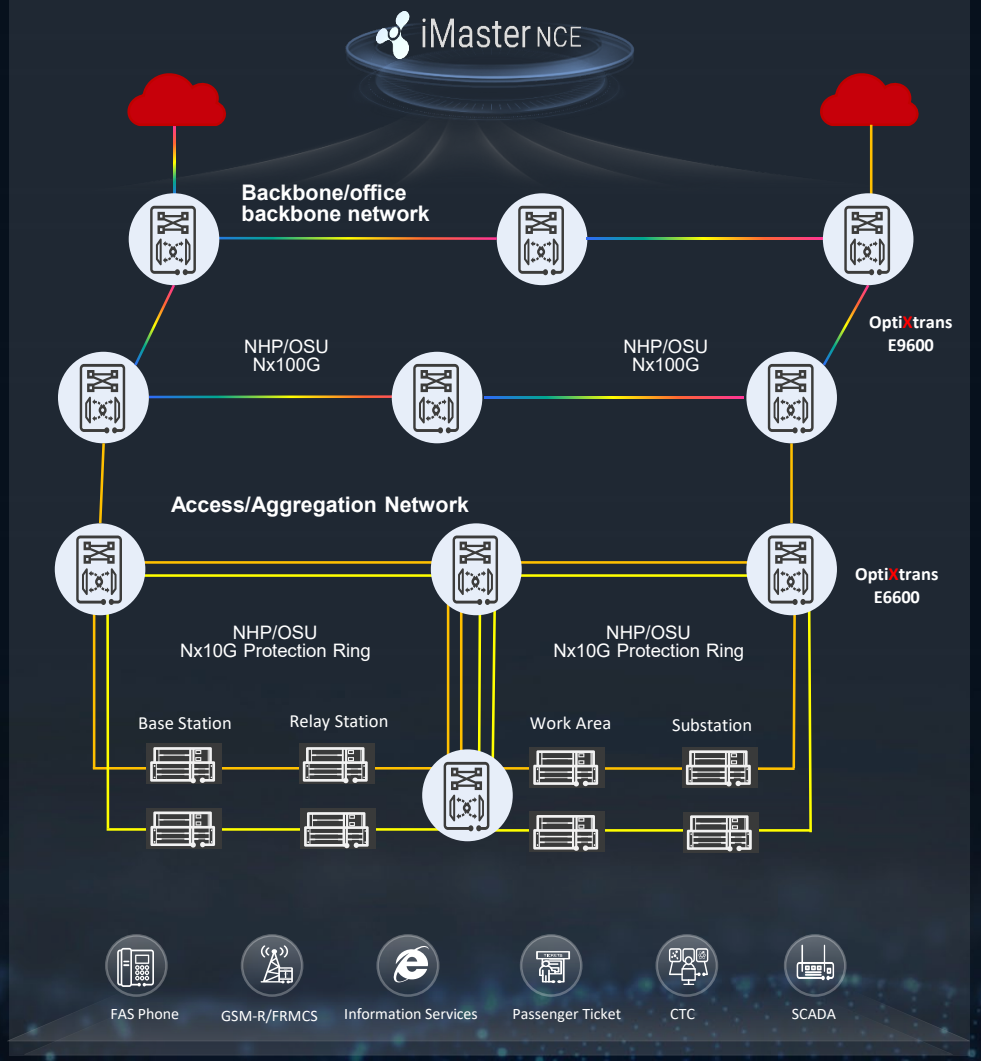
Power supply Safety — Latency < 10 ms

Smooth evolution of train control network



Simple operations

Inherit O&M habits and reuse workforce



Safe — Native hard pipe (NHP): OSU

100% service security
Physical isolation

100% failure cut-out rate
Zero jitters | Latency in ms

Compatible — Converged platforms

GSM-R (OSU/SDH/E1) + **FRMCS** (OSU/ETH)

Unified bearer, ensuring smooth network evolution

Simple — SDH O&M habits inherited

Simplified deployment
Single-fiber bidirectional 1588v2

Simplified O&M
Same as SDH control

OSU: Optical Service Unit

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Reconstruct Platform: AI Cloud-based Unified Platform

Unified scheduling

- Self-developed high-performance chips, including Kunpeng and Ascend, supporting x86+GPU*
- Unified management of hardware resources, scheduling in seconds, on-demand use, greatly improving utilization

Easy-to-use application

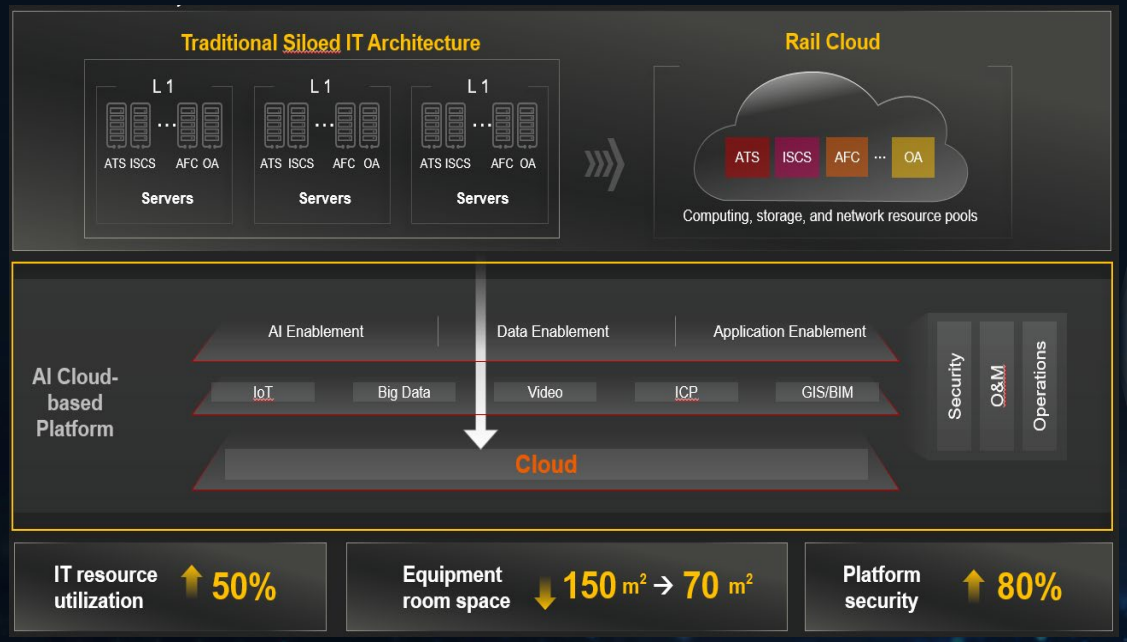
- **Industry-leading 100 billion-level** foundation model technology, greatly reducing AI development costs
- OptVerse AI Solver, adaptive optimization, improving the solution efficiency by 30%

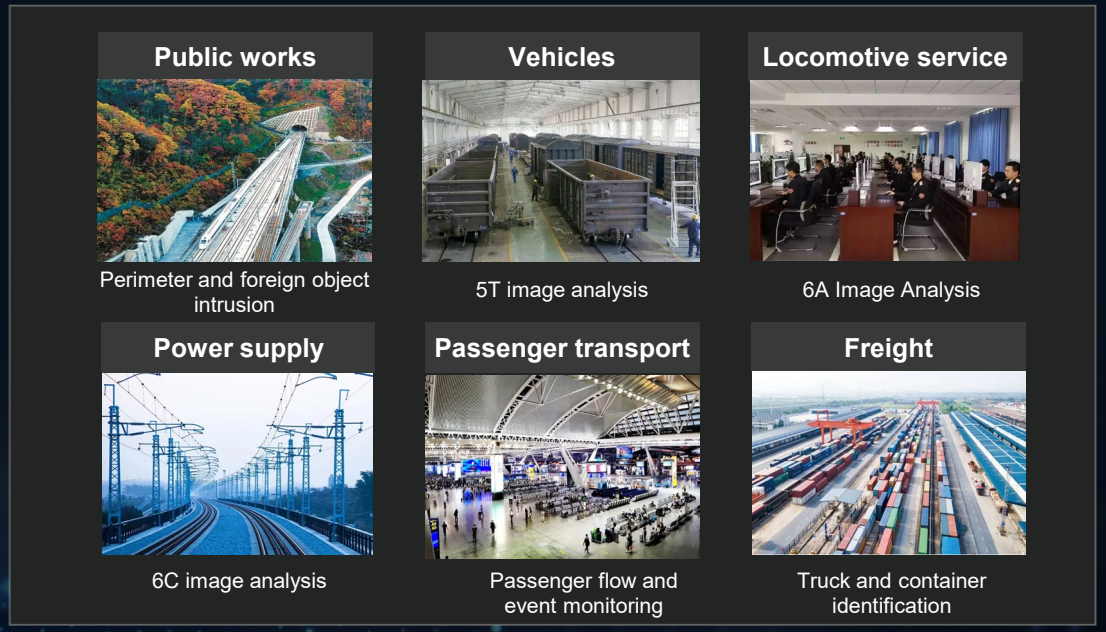
Cloud-edge collaboration

- Local development, central training, algorithm reuse, and data within the Intranet
- Management, data, service, and resource collaboration

Reliable innovation

- Self-developed AI platform ModelArts,
- Self-developed AI framework MindSpore,
- Self-developed operator library CANN,
- Self-developed AI chip Ascend





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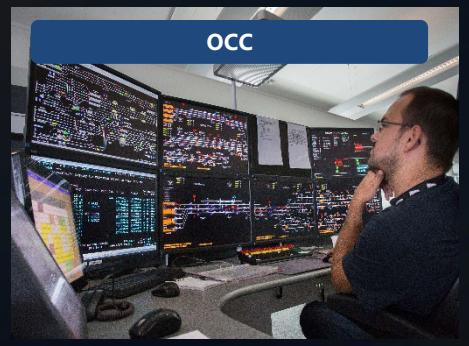
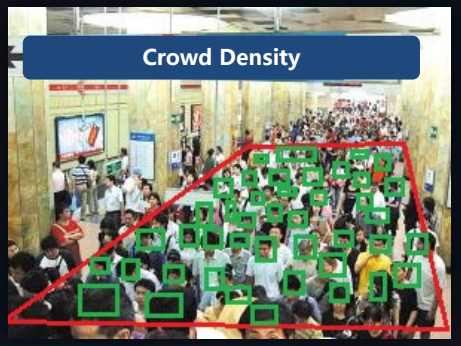
Smart Railway: Safe Journey and Enhanced Operation Efficiency

Operations Efficiency & Safety



- Real-time positioning and control of the train (visualized operations);
- Moving blocks;
- Undesirable Behavior surveillance; Violation of operation (e.g. dozing of, smoking, using cell phone, etc.)

Passenger Safety



- Crowd density detection;
- Emergency evacuation control;
- Operation facilities' malfunction detection to prevent passengers incident (e.g. escalator)

Construction Safety

- Hazard detection and alert-warning;
- Minimize the accident at construction site;

Maintenance

- Minimize the risk at worksite
- TFDS (Trouble of Moving Freight Car Detection System): 360 degrees Laser Cameras scanning RS surface

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TFDS: Pangu Railway Model Prevents Missed Alarms

Challenges

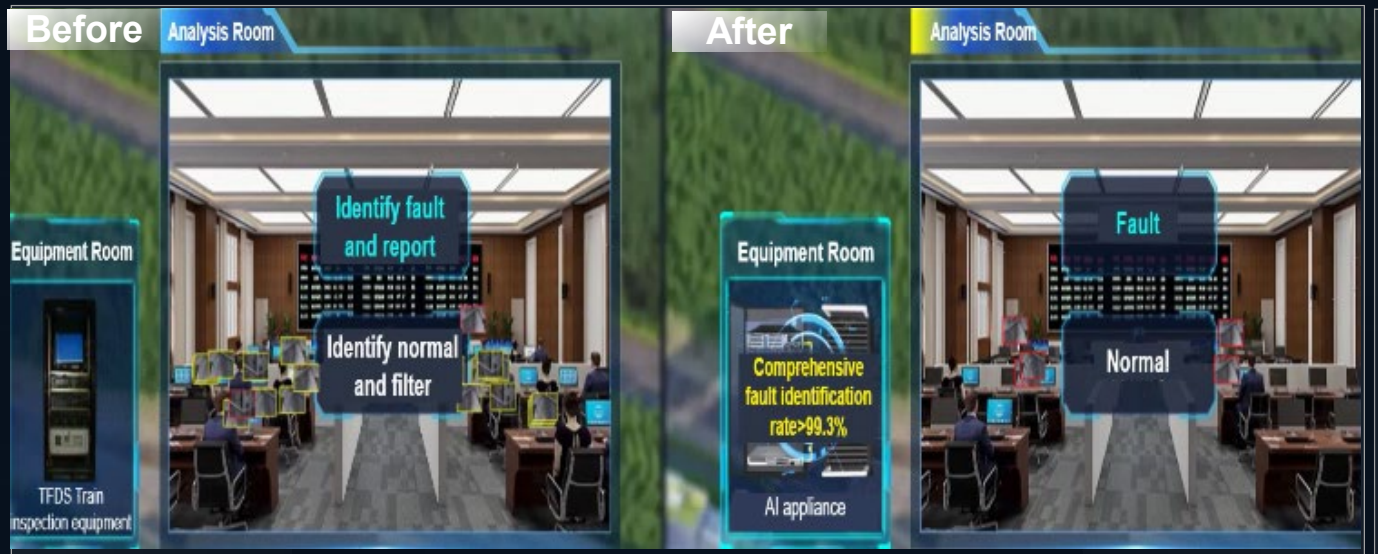
Heavy analysis workload

Hundreds of millions of images need to be analyzed every day.

Manual analysis

24/7 manual image analysis (15,000 images/person/day on average)

Solution



Model

3 billion parameters, **millions** of "difficult case" pool

Algorithms

Identify **67** vehicle models and **430+** types of faults

AI appliances

Deployed on demand, which complete identification within **5 minutes**

Benefits

95%+

of fault-free images filtered out

4000 images → < 200 images

AI identification

> 99.3%

overall fault identification rate

2x faster operations

Critical: 100%

Minor: > 99%

Warning: > 98%

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Multi-dimensional Sensing, Multi-technology Convergence, and High-precision Detection of External Intrusion Events with AI

Business Challenges

High labor costs

Billions a year

Huge economic loss

Hundreds of millions of dollars every year

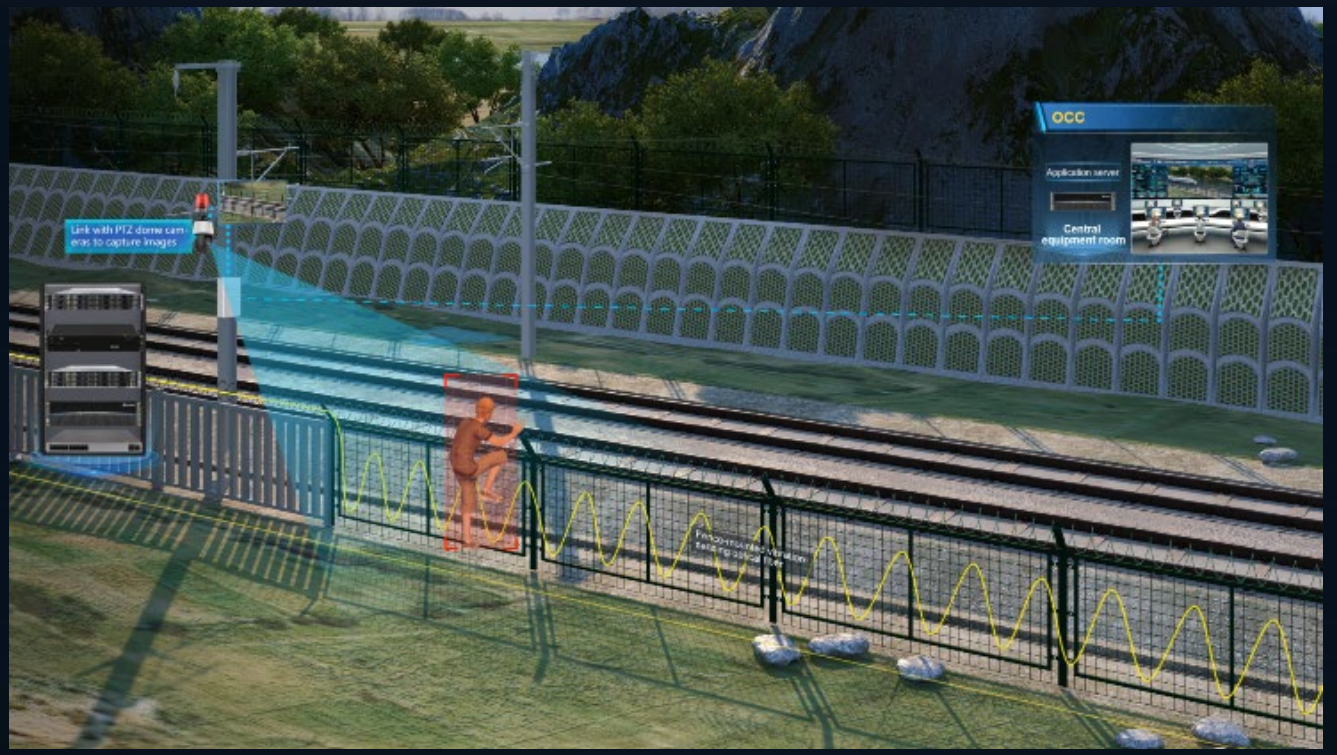
Low manual efficiency

Thousands of people across the country analyze videos.

High false positives of existing technologies

High false positive rate

Solution



Benefits

Optical-vision (level crossing)

Missing report < 1%

False positives < 1/km/day

Resists strong environmental interference such as level-7 wind and heavy rain.

Video AI (tunnel entrance)

Detection rate ≥ **95%** (daytime)

False positive frequency ≤ **2**/day/channel

(Test data of Chengdu-Chongqing high-speed rail at night)

Phase noise suppression algorithm, improving the precision by **80%** compared with traditional radars

The ODSP module is enhanced, and the number of valid signals collected reaches **99.9%, with no false negatives.** Unique feature identification algorithm, improving alarm accuracy by **90%.**

Huawei-developed **GhostNet** visual backbone model, which outperforms the most advanced MobileNet architecture in terms of efficiency and precision.

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Leading ICT Infrastructure Provider in Global Rail Industry

Industry Organization

10+
Railway industry organizations

3000+
Approved contributions to Industry Standards

UIC · European Railway Agency · ETSI World Class Standards · 3GPP A GLOBAL INITIATIVE

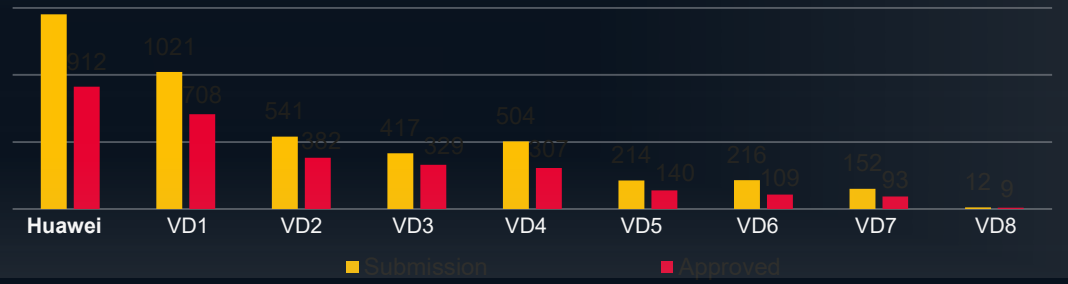
2022.9
Huawei Global Railway Summit @Berlin InnoTrans

2023.6
UIC FRMCS Conference @Paris

2023.3
UIC HSR Conference @Morocco

Standard Contributions Glance

2989 Approved contributions to MCX specifications since 2015 (SA6)



Global Partners

10+
Joint-developed solutions in railway

50+
Key railway projects delivered since 2012 together

ALSTOM · SIEMENS · THALES · HITACHI Inspire the Next

2017-Thales delegation in Huwei HQ

CBTC/ETCS over LTE test

ST Electronics A company of ST Engineering · 中国交建 · 中国铁建 · 中国中铁 · 中国中车 CRRC · CRSC 中国通号

Global Industry Level

60+
Backbone networks implemented in railway

Wireless No.1

applications based on LTE in rail industry

Optical Transmission No.1

Global Market share for 13 consecutive years (total for all industries)

IP Network No.1

- Market share of Router in Global
- Contributions in IPV6 Standards

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Huawei is Committed to Serving Global Railway Customers

150,000+ km railway in 28 Years

50+
global railway customers

17
top 20 railway operators

10+
strategic partners

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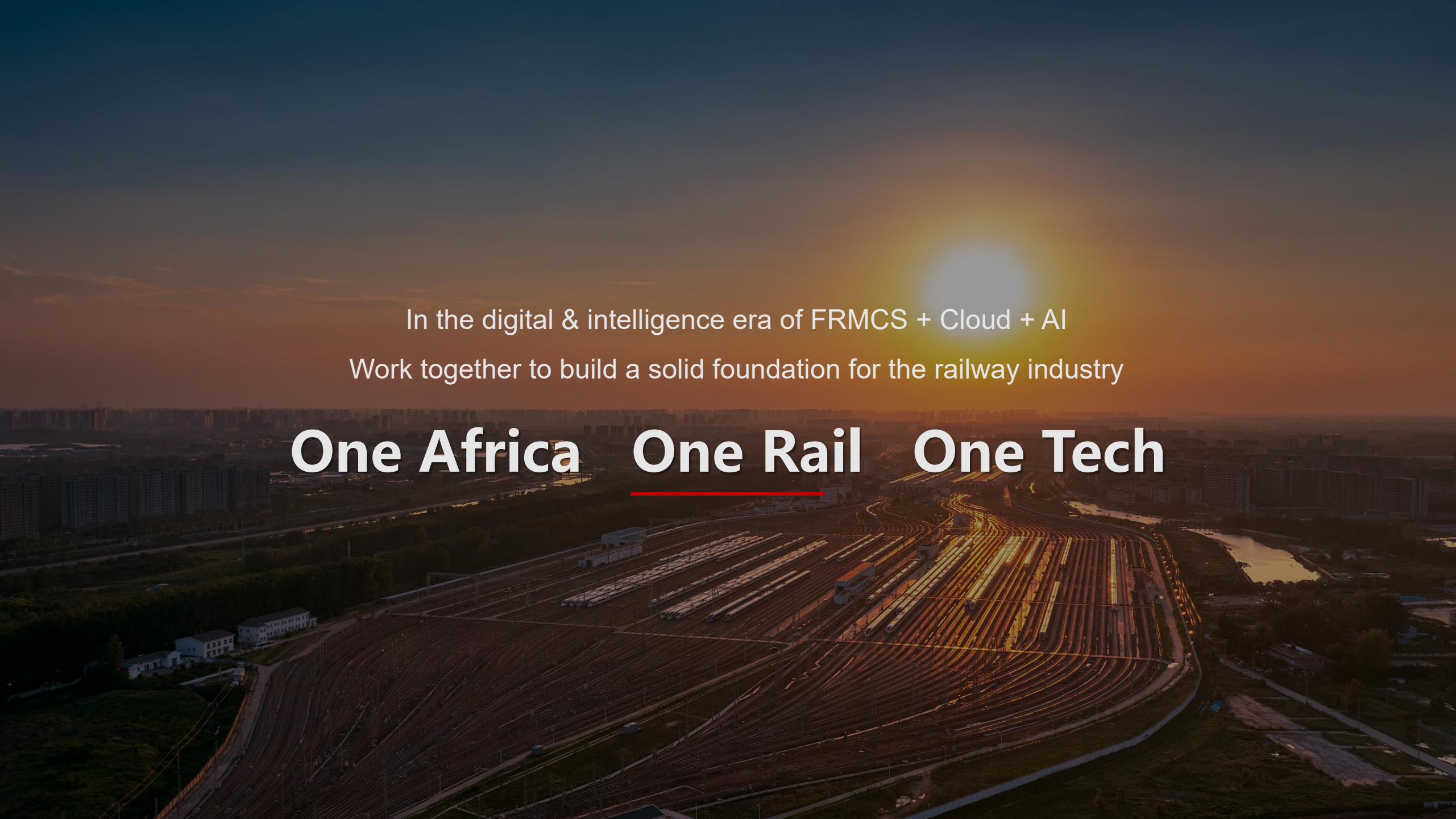
In the digital & intelligence era of FRMCS + Cloud + AI
Work together to build a solid foundation for the railway industry
One Africa One Rail One Tech