

PCI Smart Station Solution



CONTENTS

- 01 PCI Technology Group Introduction
- 02 Business Pain Points & Requirements
- 03 Overall Architecture of Smart Station
- 04 Innovative Applications of Smart Station
- 05 Solution Advantages & Proven Cases





0

1

PCI Technology Group Introduction

30 + Years of Innovative Development

Ten
Billion
Era

Founded ECS TECHNOLOGY (Stock Code: ECTH)
Combined with international capital, it became the second largest IT distribution company in Asia-Pacific, with a business scale of more than 30 billion RMB, creating PCI's first 10 billion era.

2004-2014

Transformation

Opened the era of intelligence

In 2004, Launched a strategic transformation to enter China's intelligent rail transport market.

In 2007, Acquired Xintai Technology and listed on A-share main board.

In 2008, Entered the intelligent technology sector in China.

In 2010, Undertook the security of Guangzhou Asian Games and entered the new field of intelligent city construction.

In 2013, Completed major asset restructuring, comprehensively formed three strategic industrial layouts, namely intelligent city, intelligent rail transit and intelligent urban transport.

Hundred
Billion
Era

Recreated PCI(Stock Code: 600728)
Insisted on independent research and development, mastered the core technology of artificial intelligence, occupied the high-end of the value chain, and constructed a 100 billion era of artificial intelligence with PCI as the core.

2015-2020

Innovation

Practiced artificial intelligence

In 2015, Jointly invested in the establishment of CLOUDWALK Technology.

In 2016, Continued to expand and consolidate the artificial intelligence industry.

In 2017, Established the Central Research Institute, establish a mechanism spearheaded by full-time chief scientists; released the IDPS Urban Traffic Brain.

In 2018, Delivered and opened three metro lines in Guangzhou, contributing to the opening of a new chapter of metro access in Guangzhou's districts.

In 2019, Obtained electromechanical system construction and operation maintenance project of Guangzhou Metro in the "13th Five-Year Plan" (ten lines), and jointly built the world's first intelligent station.

In 2020, Jointly invested in the construction of Changsha's first intelligent metro line 6.

2021-Now

Win-Win

Innovatively forge a 100 billion industry

In 2021, Jointly established the Greater Bay Area Railway Industry and Investment Group, selected to become the dual-chain master unit of Guangzhou's artificial intelligence and rail transport industry chain.

In 2022, Jointly invested in the construction of Changsha Metro Line 6 officially put into operation; made strategic investment in Unity China.

In 2023, Released the world's first industry large model; raised nearly 2 billion, continued to increase investment in "AI+transportation"; elected as one of the first batch of strategic industrial cluster chain master enterprises in Guangdong Province.

In 2024, Layout overseas markets and establish strategic partnerships in Europe and Southeast Asia; Invest in Traffic Control Technology, layout rail transportation signal system business.

In 2025, In 2025, Released the PCI Traffic OS under the guidance of the MIIT; acquired domestic signal company Hisense Weilian (officially renamed PCI Weilian); established a rail transit signal joint venture with Siemens and GILHG International Holdings to explore the global market.

1992-2003

Start

Created ten billion era

In 1992, PCI Founded

In 1999, PCI obtained international venture capital, expanded international business layout.

In 2001, Established ECS Technology as a joint venture and listed on Singapore Main Board.

In 2003, Diversification strategy, provided information and communication technology value-added services.

Marketing Services

Establish a **domestic marketing service network** centered on six major battle zones and an **international marketing service network** centered on the **Hong Kong representative office**, radiating **Southeast Asia and the Middle East**, implementing a "**customer-centered**" service philosophy, providing 24/7 demand response and technical support, and co-creating digital intelligence value.

Jointly establish **1** industrial investment group

- Greater Bay Area Rail Transit Industrial Investment Group

Establish **3** major rail transit joint ventures

- Established Changsha Suicheng Rail Transit Co., Ltd. with capital from Guangzhou Metro, China Railway Electrification Engineering Group Co., Ltd. and Changsha Metro Group Co., Ltd.
- Established PCI Chuangzhi Technology Co., Ltd. jointly with Nanning Rail Transit Group Co., Ltd.
- Preparing to establish a joint venture company with Dongguan Rail Transit

6 major regional marketing and service networks

More than 30 regional branches worldwide

- | | | |
|-----------------------------------|---------------------------------|--------------------------------|
| • Guangzhou Region (Guangzhou) | • South China Region (Shenzhen) | • East China Region (Hangzhou) |
| • South Central Region (Changsha) | • West Region (Chengdu) | • North Region (Beijing) |

2 major overseas operating entities

PCI Hong Kong (Hong Kong R&D Center)

PCI Singapore subsidiary (International Marketing Headquarters)

Strength Certification



Top 500 Service Enterprises in China

**National Intellectual Property
Demonstration Enterprise**

Safety Technology Prevention System Design,
Construction and Maintenance Qualification
Certificate (Level 1) of Guangdong Province

**National Science and
Technology Enterprise
Incubator**

**Top 10 Operational Capabilities of Digital
Economy Specialized Industrial Parks in China**

CMMI5 Certified Enterprises

National 5G Convergence Intelligent Integration Park

**Guangdong New Generation Artificial
Intelligence
Open Innovation Platform**

Hurun China Artificial Intelligence Enterprises Top 50

Grade A Qualification for Special Design of
Building Intelligence System

**Top 100 Chinese Software
Enterprises**

Key Software Enterprises Encouraged by the State

Several **Subsidiaries** Selected for
National
SRDI "Little Giant" Enterprise

Electronic and Intelligent Engineering
Professional Contracting Level 1 Qualification

**ISO27001 Information Security
Management System Certification**

High-tech Enterprise

ISO9001 Quality Management System
Certification

**Forbes China Artificial Intelligence Innovation
Application Scenario Enterprise**

Artificial Intelligence Backbone Enterprise of
Guangdong Province

R&D Honours

Basic Algorithm R&D Level Entered the International First-class Echelon

- **World Smart City Award - Leading Enterprise in Global Smart Cities**
- **Top Tournament in Computer Vision Recognition**
The 4th International Image Recognition Competition organised by IEEE and Google WebVision, 3rd place worldwide
- **Publish research results in the international core journal Nature "Scientific data"**
- **China's Highest Artificial Intelligence Honour**
Wu Wenjun Award for Scientific and Technological Advancement in Artificial Intelligence
- **Multi-modal Large Model TransCore-M** : ranked second on the MMBench
- American Good Design Gold Award MUSE
- iF Design Award
- Muse Design Award Silver Award
- French Design Award Gold, French Design Award Silver
- The 50th Geneva International Exhibition of Inventions Silver Award
- 2025 Forbes China AI Innovation Application Scenario Enterprise
- Hurun China Artificial Intelligence Enterprises Top 50

Ministry of Industry and Information Technology

Artificial intelligence large model engineering technology and application of Industrial public service platform project
Key Tasks Unveiled Winning Units
New Information Consumption Demonstration Project
Industrial Internet Pilot Demonstration Project
Outstanding Artificial Intelligence Products and Application solutions
IoT Key Technology and Platform Innovation, Integration Innovation and Convergence Application Project
List of Pilot Demonstration Project for Big Data Industry Development

Cyberspace Administration of China

Approved by the CAC Dual Filing Certification with LargeModel Services

Ministry of Public Security

First Prize of Science and Technology Award of the Ministry of Public Security

China National Intellectual Property Administration

The 24th China Patent Award

Industry Associations

China Urban Rail Transit Science and Technology Progress Award
China Urban Rail Transit Association Third Batch Recommended List of Urban Rail Transit Autonomous Equipment

Provincial Scientific Research Supervisory Unit

First Prize of Guangdong Provincial Science and Technology Award for Scientific Progress
Guangdong Intelligent Manufacturing Pilot Demonstration Project
Guangdong Patent Award

R&D Capacities

Build a basic shared technology platform for cross-industry, invest about **10% of intelligent business income** in research and development every year, continue to increase investment in research and development of cutting-edge artificial intelligence core technology, and expand the leading edge of the transportation digital track.

4

State-level Joint Laboratory and Enterprise Technology Centres

2

Artificial Intelligence Research Institutes

10+

Provincial Technology and Engineering Centres, Provincial and Municipal Research Bases

18

State-level Scientific Research Projects

30+

International PCT Patent Applications

2000+

Patent Applications or Software Copyrights

400+

Invention Patent Applications

20+

National, Group, Enterprise and Industry Standards

RMB 1.5 billion +
Total R&D investment in the past 5 years (2019-2024)

Over 2700-person
technology research and development team

200,000+m²
R&D Base

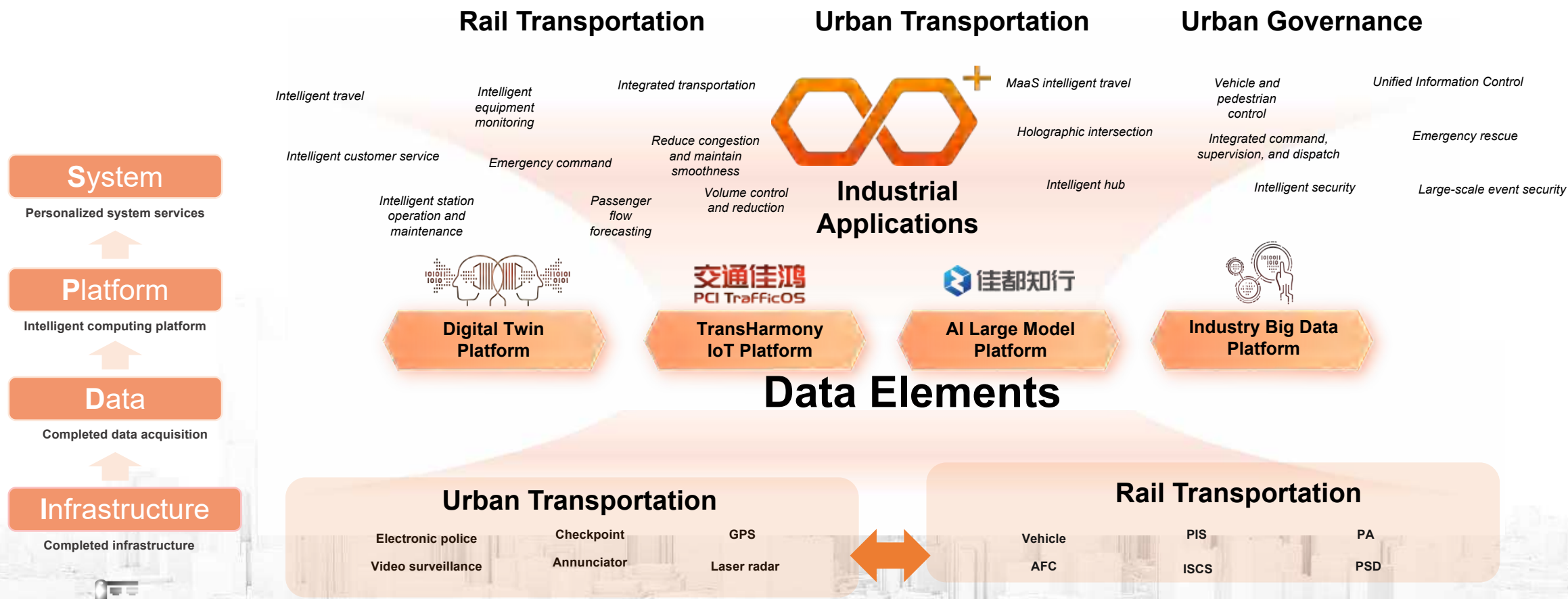
16

Subsidiary High-Tech Enterprises

Core Technologies

Build a City Agent from "ground to underground" under the drive by data based on the IDPS theory.

1 Digital Intelligence Base, 4 Technology Platforms, ∞ Industry Applications



Joint Innovative Demonstrations of Intelligent Rail Transportation



Malaysia KUTS ART AFC Project

The first hydrogen power smart traffic AFC system benchmark project in Southeast Asia

- Serve the first smart express system of East Malaysia; the first hydrogen power urban traffic system in Malaysia to boost the development of green public traffic in Southeast Asia.
- Undertake the whole-line task for design, supply, installation and testing of auto ticket sales and checking system in Blue Line (14 stations) and Red Line (7 stations).
- Integrate diversified payment, including banknote/QR code, NFC, E-wallet, VISA/Master credit card, compatible with local mainstream value cards and unified cards.
- Create application center-level settlement and internet ticket platform, to lay the foundation for forging the new generation smart traffic system for Kuching, Malaysia.



Guangzhou Metro's 13th Five-Year Plan Project Electromechanical General Integration

A benchmark project of multi-line and multi-specialty construction + operation and maintenance integrated innovation, covering 144 stations across 10 lines

- It is the first time in China's urban rail transit industry to adopt the "construction + operation and maintenance" general contracting model. It is a rare large-scale integrated general contracting construction service project involving multiple lines and specialties in China.
- It encompasses smart station projects on 10 lines, pioneering the scenario-based implementation of "AI + rail transit" technology products. It has contributed to the creation of the country's highest-speed metro lines (Lines 38/22), with floor structures capable of withstanding maximum peak wind pressure exceeding 3400 Pa.
- It features the country's first ten-million-level face recognition database, enabling seamless passenger passage.
- It creates the country's first modular prefabricated platform screen door installation case, where the installation of a single platform screen door module unit takes only 15 minutes, reducing the installation duration by 73%.
- Through innovative technologies, efficient management, and collaborative efforts, it has continuously overcome various complex procedures and numerous interface challenges, efficiently completing joint debugging and testing.



MTR QR Code Ticketing System Project

Mobile payment boosts the construction of a world's leading city subway smart travel benchmarking project

- The first mobile payment ticket system in Hong Kong's transportation field was put in service in June 2020, realizing seamless connection with Octopus card and end-to-end joint debugging with all turnstiles and optimizing Hong Kong residents' experience of convenient QR code scanning for subway taking.
- The low bandwidth IoT device protocol was applied innovatively in the urban rail transit field for the very first time, which greatly improves the response speed and system stability of turnstiles.
- Based on advanced open-source technology, the system architecture realizes virtualization and container management of computing resource with high flexibility and low O&M cost.
- Fully comply with the international security authentication standard, realize auto-detection of connected devices, protect the passenger payment information and personal privacy based on several protection mechanisms.



Changsha Metro Line 6 Intelligent Metro PPP&EPC Project

The nation's first line-wide intelligent metro line, covering 34 stations

- It is Changsha's first smart metro line, a benchmark project in the field of smart urban rail transit, and the largest project with the most innovative applications in the country's smart urban rail transit industry.
- It is the longest line with the highest investment among the completed lines in Changsha, and Changsha's first PPP urban rail project. It encompasses general integration covering communication, signaling, integrated supervision, platform screen doors, smart metro, and other professional systems of rail transit electromechanical equipment.
- Based on the smart metro control platform, it considers the top-level, systematic, full lifecycle construction, operation, and maintenance for smart metro.
- Based on the "1811" construction blueprint, a smart metro line has been established, featuring the nation's first fully unmanned intelligent customer service system, a smart security inspection mode with centralized and AI-assisted image analysis, and a smart energy-saving system utilizing environmental control AI algorithms across the entire line.



Chengdu Metro Phase IV Communication and Integrated Supervision General Integration

A benchmark project for existing line renovation and extension line interconnection

- It is the country's strategy-level planning and design case for extension line construction schemes, meeting the construction needs of extension lines and forming unified access standards for easy flexible upgrades.
- It is the country's first line network-level interconnection project formed by the dissemination, renovation, and extension of two existing lines into three lines.
- It encompasses general integration covering communication, signaling, integrated supervision, platform screen doors, smart metro, and other professional systems of rail transit electromechanical equipment.
- It pioneers three integrated supervision interconnection adaptation schemes, completely solving the bottleneck of interconnection.
- It is the country's first project to achieve interconnection of extension lines for multiple systems such as integrated supervision, wireless, and CCTV using equipment from different suppliers. It pioneers a dual-mode IAU scheme, completely solving the interconnection problem of different UTS-U systems.



Chongqing Metro Line 15 Weak Current System Project

A benchmark project for AI large-model scenario-based applications

- It pioneers the concept of integrated urban rail development. Through the deep integration of integrated supervision, AFC, and communication, it breaks down system barriers using a unified data platform, supports cross-system linkage, and optimizes system collaboration logic using large models to improve emergency response efficiency.
- It empowers rail transit operations with large models, covering smart customer service, a comprehensive smart operation and maintenance platform, operation-led maintenance production assistance, and smart station operation management.
- It is the first to implement the "daytime" operation and maintenance intelligent agent. It conducts fault diagnosis and issue prediction for equipment such as platform screen doors and turnstiles, achieving functions such as fault light scheduling and automatic diagnosis, and promoting the upgrade of operation and maintenance to an "AI empowered mode".
- Based on hybrid models and AI algorithms, it features environmental control and intelligent energy-saving technology, assisting Chongqing Metro Line 15 in achieving integrated development of green and intelligent technologies.
- Through multi-modal fusion reasoning, it achieves a twin application of the station panorama, assisting train operation scheduling and ensuring efficient metro operations.



Shenzhen Metro

The country's first line network and station HarmonyOS benchmark project, achieving a "pilot station - line network" three-step approach

- In response to the Ministry of Industry and Information Technology's strategic deployment of "building an independently controllable industry operating system foundation," it actively plans and constructs "TransHarmony" based on open-source HarmonyOS, creating an industry-level IoT operating system with a fully independent and controllable technology path.
- Relying on the production cloud expansion of Shenzhen's NOCC Phase II project, it builds the first central-level TransHarmony super IoT platform, providing platform-level support for the pilot implementation of HarmonyOS stations, enabling interconnection among devices, and addressing the "diverse systems" phenomenon in rail transit systems.
- Focusing on scenario-based needs in rail transit, it constructs the first HarmonyOS smart station. Through open-source HarmonyOS development of subway station equipment, it achieves collaborative linkage among various systems, creating next-generation smart metro applications such as environmental control and energy conservation, "tap-to-operate" equipment maintenance, and one-touch station opening/closing.



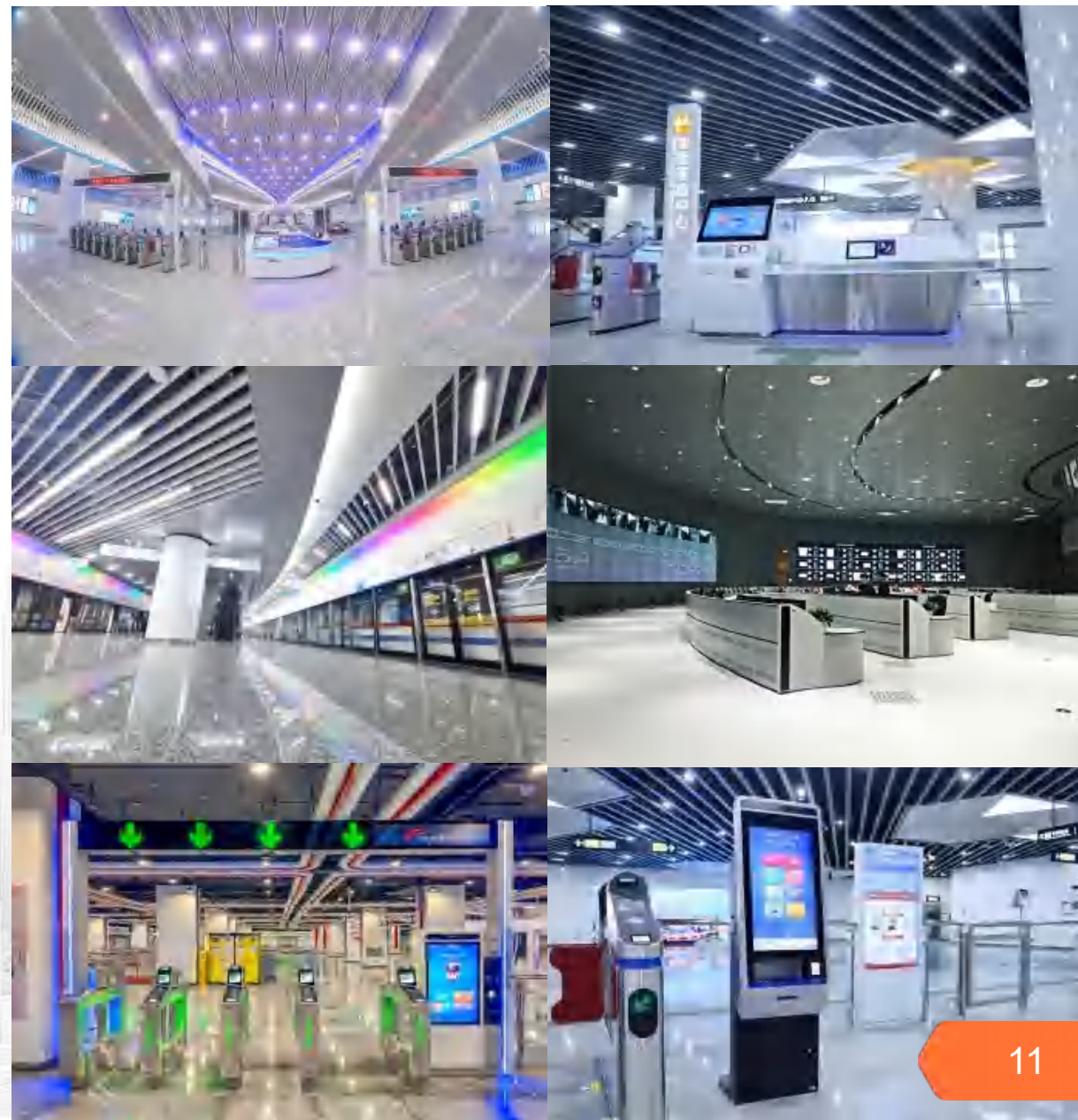
Intelligent Rail Transportation Benchmark Cases

Take advantage of the "chain master" of the rail transit industry chain, implant intelligent genes, consolidate the digital foundation, and accumulate the power of intelligent development for "**China on the Rail**".

- **48+** cities (home and abroad) ▪ **120+** lines
- **3500+** stations ▪ **4000+** kilometres

Delivery Cases in the Hundred Million of RMB

- Chongqing metro Line 15 weak current system project
- Wuhan metro line 12 automatic ticketing system project
- Changsha metro line 6 station equipment maintenance and service project
- Procurement of Automatic Ticketing System Equipment and Services for Tianjin Metro Line 6 Project
- AFC Project for Guangzhou Metro Line 2, Line 8 Extension and Line 4 North Extension Section
- Procurement of Communication System and Passenger Information Display System for Guangzhou Metro Line 10, Line 11, Line 12, Line 18, Line 22, Line 3 East Extension, Line 5 East Extension, Line 7 Phase 2, Line 13 Phase 2 and Line 14 Phase 2 Procurement of Integrated Business Production Cloud Platform for Guangzhou Rail Transit Line 11 and
- 13th Five-Year New Line Project
- Procurement of Equipment for Guangzhou Rail Transit Line 3 East Extension, Line 5 East Extension, Line 7 Phase 2, Line 10, Line 11, Line 12, Line 13 Phase 2 Project, Line 14 Phase 2 Project, Line 18 and Line 22
- Hefei Metro Line 5 Project Automatic Ticketing System Construction Project
- Wuhan Metro Automatic Ticketing System Clearance Centre Project
- Wuhan Metro Line 7 Phase I AFC System Project
- Dongguan Metro Line 1 phase I project comprehensive monitoring project
- Jinan Metro Line 4, Line 8 communication video surveillance system project
- Nanchang Metro Line 1 North extension, east extension and Line 2 east extension engineering electromechanical system integration project
-



Product and Solution Family of Intelligent Rail Transportation

Innovative Business

Smart Stations	★ Signal+
★ Grouped Stations	Minimalist Station
System Integration	Four-Network Integration
Intelligent O&M	Smart Energy Efficiency
Domestic Substitution	Digital Transformation
Network Operations Center	
AI Agent Application Scenarios	

Turnkey Total Integration Projects – New Build / Retrofit

Taking Signaling as the Enabler, "Signaling+" Integrated Projects

Single-Line Multi-Discipline & Multi-Line Multi-Discipline Large-Scale Turnkey Projects

Investment-Driven Large Turnkey Projects (Major Projects)

Investment, Construction, Operation Integrated Projects

Turnkey Integration

18-Discipline Integration Capabilities

Communication	Signal	Integrated Monitoring	Disaster Prevention & Alarm (FAS)	Environment & Equipment Monitoring (BAS)	Power Monitoring (PSCADA)
Access Control (ACS)	Security Screening	Automatic Fare Collection (AFC)	Platform Screen Doors (PSD)	Escalators & Elevators	Smart Metro
Ventilation & Air Conditioning	Gas Fire Suppression Systems	Water Supply & Drainage & Fire Protection	Process Equipment	Depot Intelligence	Onboard Systems

Service

System Integration Services

Maintenance Services: Electromechanical/Weak Current Maintenance, Smart Maintenance, Spare Parts,

Technical Services: Development, Consulting, Transfer, Promotion, etc.

Digital Transformation: Enterprise Digitalization, Data Governance, Data Operations, etc.

ICT Services: IT Operations/Management, etc.

System Platform



Signal System



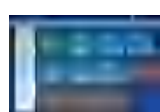
Integrated intelligent O&M Platform



ACC&NPS Fare (Internet-enabled) Clearing System



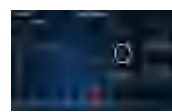
MLC&SC AFC (Diverse Architecture) System



CCTV Integrated Security Platform



PIDS Passenger Information System



Smart Security Screening System



AI Algorithm-based Smart Environmental Control & Energy Saving System



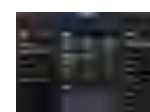
Intelligent Customer Service System



Rail Transit Intelligent Operations Platform



ISCS Integrated Monitoring System



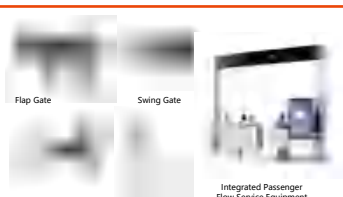
Converged Communication Dispatch Platform

Product Equipment



Pantograph Monitor Industrial Inspection Edge Box

Industrial Inspection Equipment



Smart / Access Gate

Fare Collection Equipment



Ticket Vending Machine (TVM) Cloud Ticket Vending Machine

Ticket Vending Equipment



Island Customer Service Center Vertical Intelligent Customer Service Center

Customer Service Equipment



On-Board HMI AIO

Communication Equipment



Half-Height Platform Screen Doors

Platform Screen Doors Equipment



Energy Efficient Environmental Control Cabinet

Energy-Saving Equipment



Control Signal Panel

Power Equipment



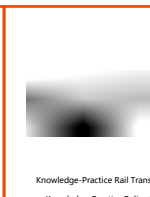
Edge All-in-One Device

Edge Control Equipment



Eye Cloud AI LLM AIO

Intelligent Video Analysis Equipment



Knowledge-Practice Multimodal LLM AIO

LLM AIO

Core Technology

Artificial Intelligence

- Transportation Large Models: Language Model, Vision Model, Multi-modal Model, Space-Time Decision Model

- Industrial AI
- Specialized AI

Digital technology

- Digital Twin
- Big Data

Industrial Control

- intelligent dispatching
- control algorithms
- Controller technology
- sensor technology

02

Business Pain Points & Requirements

Background: Operational Pressures Under Line Network Expansion



The core characteristics of smart metros in the new era of urban rail transit are reflected in several aspects: "Safety, Reliability, Convenience, Precision, Greenness, and Sustainability." With the networked development of rail transit and the evolution of management concepts, operational challenges brought by line network expansion are increasingly prominent, giving rise to three major demands: system collaboration, cost control, and equipment maintenance.



Cost Reduction & Efficiency Pressure

- Labor costs account for a persistently high proportion of total operational expenditures.
- Energy consumption costs continue to climb, while daily maintenance and major/overhaul costs grow annually as line mileage extends.
- The full outsourcing model exposes operating enterprises to significant management liability risks.



Massive Equipment Maintenance

- The maintenance workload during overhaul periods is enormous, and the localization rate of some key equipment is relatively low.
- Projects feature diverse equipment brands and long procurement cycles for spare parts.
- It is difficult to strike a balance between cost savings and mastering core technologies.



System Operation Collaboration

- Automation systems have long been built independently, resulting in numerous data silos.
- Low data integration and poor interoperability lead to inadequate cross-system linkage response speeds.
- Projects involve the integration of multi-vendor and multi-standard equipment with complex system interfaces, further increasing the difficulty of data interconnection.

Background: Prominent Contradictions in Existing Station Operation Management

Station staffing is streamlined, and safety compliance requirements are stringent. The existing operation management model has prominent contradictions in five aspects: safety prevention and control, operational efficiency, system collaboration, daily management, and intelligent operation and maintenance (O&M).

01 Insufficient Means for Operational Safety Prevention and Control

Safety prevention and control rely mainly on manual inspections and passive responses. Equipment anomaly alarms are scattered across independent professional systems. Emergency handling depends on paper documents and personnel experience, making it difficult to guarantee the standardization and traceability of responses under compliance requirements.

02 Operational Control Efficiency Urgently Needs Improvement

Pre-operation inspections require station-by-station and item-by-item verification, making manual checks prone to omissions. Acquiring production and operational data requires logging into multiple systems to piece information together. Station opening/closing operations involve various equipment types and rely on manual, item-by-item execution of operation tickets, making the process cumbersome and susceptible to omissions.

03 Low Efficiency in Multi-System Collaborative Operations

The project integrates automation systems from multiple vendors. Various disciplines are built and operated independently. Scenarios such as station opening/closing and emergency handling lack automated linkage. Operation steps are fragmented, requiring on-duty personnel to switch between multiple workstations.

04 Outdated Daily Operation Management Methods

Business operations are executed across multiple terminals, relying mainly on manual inspections and extensive paper ledgers, leading to slow information flow, difficult querying, and inconvenient statistical analysis. Under the unattended mode, manual inspections and paper ledgers can hardly meet operation management requirements.

05 Intelligent O&M System Not Yet Established

Professional O&M systems operate independently, and data cannot be shared. Key systems such as PSD, AFC, HVAC/Water/Power, and Communication still rely mainly on scheduled maintenance and post-failure repair. They lack condition-based and predictive maintenance capabilities, and there is a lack of quantitative assessment methods for equipment health status.

Scenario 1

Pre-operation Inspection: Cumbersome Process and Prone to Omissions

- More than a dozen inspections must be completed before daily station opening, involving construction confirmation, track clearance, PSL panel operation, turnout testing, and status checks of various systems, etc.
- Traffic controllers must verify the date and clock time with each station one by one, and stations must report inspection results station by station, resulting in low communication efficiency.
- Manual inspections can only observe surface-level conditions, making them prone to omissions and making inspection quality difficult to guarantee.
- With few on-duty station personnel, numerous pre-operation inspection items, and long processes, manual item-by-item execution is highly stressful.

Scenario 2

Equipment Failures: Difficult to Locate via Manual Troubleshooting

- There is a lack of centralized monitoring for PSD sliding door operational status and power cabinet parameters. Equipment anomalies are often discovered only after a failure occurs.
- AFC equipment operational status is scattered across various terminals, leading to delayed fault discovery and affecting the passenger transit experience.
- Communication systems feature a wide variety of equipment with scattered fault alarms. O&M personnel must switch between multiple systems to locate the fault source.
- End-to-end fault localization relies on personnel experience, requiring level-by-level testing and segment-by-segment troubleshooting. This is time-consuming and results in low repair efficiency.

Scenario 3

Equipment Hidden Hazards: Delayed Detection via Manual Inspections

- Daily equipment inspections are completed by personnel on foot. Inspection routes are fixed with long cycles, making it difficult to detect abnormal conditions in a timely manner.
- Real-time monitoring of operational parameters for HVAC/Water/Power equipment is lacking. Hidden hazards such as frequent pump startups and inefficient air conditioning operation are often detected only after failures or abnormal energy consumption occur.
- There is a lack of quantitative assessment for equipment health status. O&M personnel cannot accurately grasp the degree of equipment aging and potential failure risks.
- The O&M team size is limited, and hidden hazard investigation relies heavily on personnel experience and sense of responsibility, resulting in a high risk of missed or delayed inspections.



03

Overall Architecture of Smart Station

Smart Station Management and Control Platform Architecture

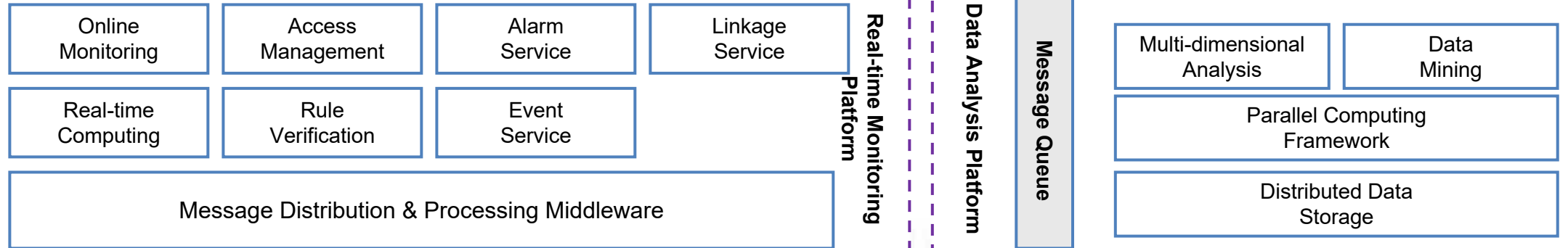


Application Layer

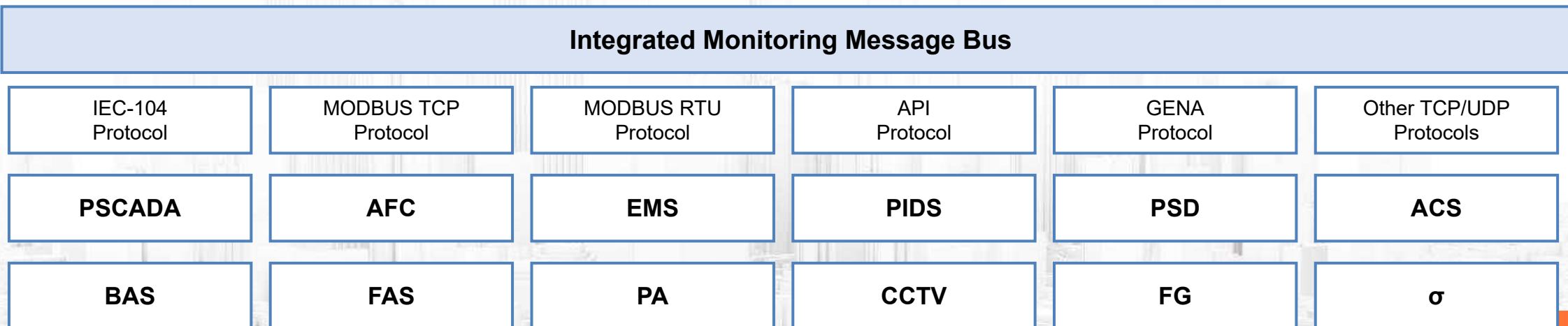


Smart Station Management & Control Platform

Platform Layer



Access Layer



Comprehensive Intelligent O&M Platform Data Architecture



Data
Applica
tion



Multi-theme Creation
& Application
Subscription

Equipment Intelligent Applications

Production Digital Applications

Equipment
Intelligent
Analysis Theme

Line Life
Prediction
Theme

Line Overhaul and
Reconstruction
Theme

Passenger Flow
Prediction
Theme

Maintenance
Optimization
Theme

Personnel
Management
Theme

Emergency
Command
Theme

Data
Proces
sing

Standardized
Storage

Equipment Status Data

(Alarm data, equipment status,
network topology, resource usage,
fault prediction, etc.)

Production Management Data

Material data, maintenance plan data,
emergency resource data, etc.

Evaluation and Training Data

Personnel capability data, user data,
fault cases, expert systems, etc.

Station Comprehensive Data

Station professional alarm data,
parking data, equipment data, etc.

Other Data

Historical data,
informatization data,
external data, etc.

Structured Processing

Data
Correction

Format
Unification

Data
Classification

Structure
Conversion

Data
Governance

Data Mining

Interface Protocol
Adaptation

TCP-IP

HTTP

Modbus

coba

UDP

SNMP

...

Data
Access



Equipment Production Network /
Offline Import



Office Management
Network



Public Network

Data
Percepti
on

Multi-disciplinary Data (M&E, Signaling, Rolling Stock, Power Supply,
etc.)

Alarm Data

Equipment Status
Data

Network Topology

Port Traffic
Data

Station/Yard
Data

Equipment Runtime

Power
Consumption

Rolling Stock
Operation Data

Digital I/O
Data

Analog Curve

Fault Case
Library

Equipment
Operation
Indicators

O&M Production Data

Spare Parts &
Materials Data

Personnel
Information

Equipment
Maintenance Data

Fault Handling
Records

O&M Plan Data

Work Orders /
Reports

External Information
Data

Weather Data

Major
Holidays/Events

Natural
Disaster Info

Public Service
Data

External
System Linkage

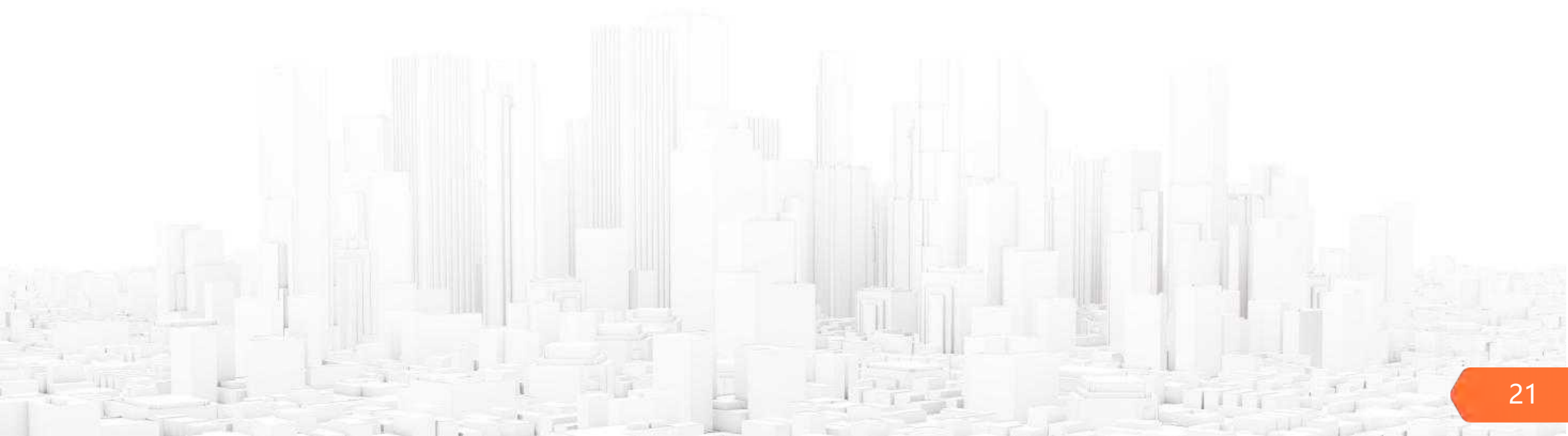
...



Innovative Applications of Smart Station



(1) Smart Station



Station Holographic Perception - Station Equipment Overview

Collect real-scene textures inside the station and perform high-definition design, modeling and rendering of the station 3D model to enhance the 3D application effects of the station 'Integrated Dashboard' and 'Video Station Patrol' in daily operations.



Digital Twin
Integrated
Dashboard



3D Model
Modeling
and
Rendering



- ◆ Real-scene Texture Upgrade: 3D modeling in photorealistic style, consistent with the current station interior decoration.
- ◆ Interior Decoration Modeling: Fine-grained local modeling of station interior walls, floors, ceilings, etc., to enrich and restore spatial details and enhance 3D immersion.

Station Holographic Perception - Integrated Dashboard



Based on a lightweight BIM station model, it enables visual presentation of building structures and equipment placement in platforms, concourses, entrances/exits and other areas, and integrates multi-dimensional station information including equipment basic information, status and alarms, passenger flow, environment, energy consumption, and train operation, achieving comprehensive perception of station operation status.

Station
Holographic
Perception

Station 3D View

- Covers concourse, platform, entrances/exits, equipment rooms and other areas, with area selection support;
- Supports drag, zoom in, zoom out, view angle conversion, pan and other operations;
- 3D real-time status display of key equipment (AFC, PSD, BAS, etc.);

Passenger Flow Statistics

- Passenger flow statistics and real-time trend, covering real-time and cumulative passenger flow;

Train Arrival Notification

- Up/down train arrival notification and delay alarm;

Electronic Emergency Plan

- Visual display of emergency plans and operation suggestions;

Equipment Statistics

- Equipment alarms and handling timeliness;

Station Environment

- Real-time temperature, humidity, CO2 concentration, etc. in each area;

Operation Information

- Display of today's and tomorrow's operation hours and station master on duty information;

Alarm Information

- Real-time aggregation and display of alarms and event information from all station professional systems;



Station Holographic Perception - Equipment Status Perception



② Entrance/exit passenger flow hover and click status response

① Train arrival notification, train direction and status hover and click status response

③ Car Crowding Level: displayed on station model by car density level, supporting hover and click status response



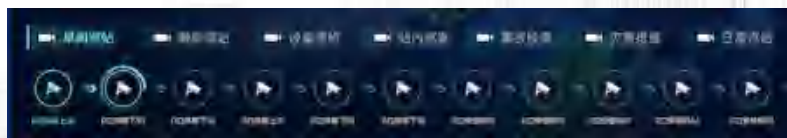
Intelligent Video Inspection

In video station patrol, daily inspection routes can be pre-configured, and intelligent video station patrol can be initiated upon activation. Through video station patrol, station staff can perform cloud-based station patrol in the station control room, and respond to and handle issues promptly when detected on CCTV.

In the system backend, the algorithm continuously learns and optimizes intelligent station patrol content, making video station patrol increasingly preferred by station staff, reducing workload and improving efficiency.



① Inspection Route Configuration



② Inspection Task Selection



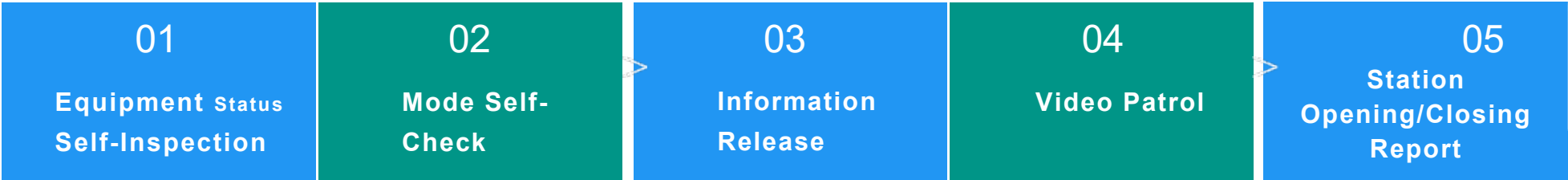
③ Video Inspection



Intelligent One-Touch Station Opening/Closing



In traditional station opening/closing operations, personnel must walk to each operation area and perform manual steps one by one, which is time-consuming and inefficient. With one-touch station opening/closing, the operation time is significantly reduced.



- PSD Self-Inspection
- Escalator/Elevator Self-Inspection
- AFC Equipment Self-Inspection
- PIS/PA Equipment Self-Inspection
- FAS Equipment Self-Inspection
- BAS Equipment Self-Inspection

- Major Systems
- Minor Systems
- Tunnel Ventilation
- Lighting System
- Water System

- PA
- Announcement
- PIS Display

- PSD Opening/Closing Confirmation
- Escalator/Elevator Start/Stop Confirmation
- Verify Roller Shutter Door Operation

- Record One-Touch Station Opening/Closing Process
- Generate One-Touch Station Opening/Closing Report

Value and Benefits

- No on-site personnel required at entrances/exits;
- Linked control after safety confirmation, simple and convenient, with operation traceability;



Extensive Equipment Control Capability

Industry-First Four-Layer Safety Assurance Implemented

Key Scenario Video Linkage

Intelligent Station Opening/Closing Report Generation

Multi-Scenario Drills

Support Station Opening/Closing Business Configuration

Intelligent One-Touch Station Opening/Closing - Pre-Operation Inspection (Station + Line Dispatcher)

PC佳都

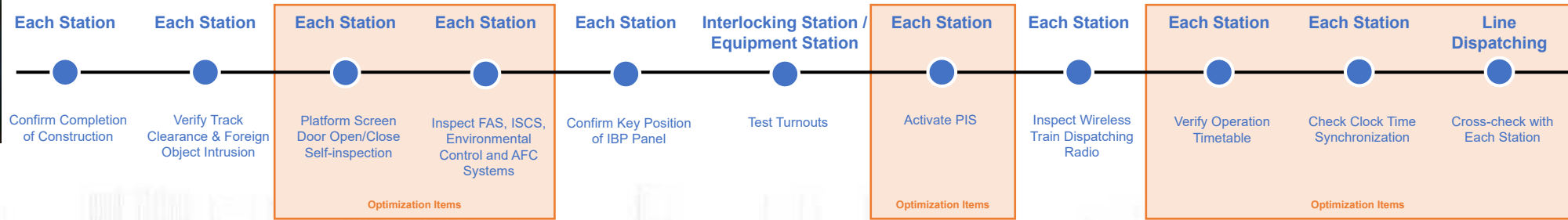
Current Status: Stations are required to complete pre-operation inspection daily, including: confirming construction completion, line clearance and foreign object intrusion; operating PSL panel to check platform screen doors; performing switch tests, checking FAS, ISCS, environmental control, AFC and other system status; turning on PIS displays; verifying date and clock time with line dispatcher one by one; reporting inspection results to dispatcher individually; etc.

1) Line dispatchers must verify date and clock time with 34 station staff one by one, heavy workload; 2) Each station must report inspection results to dispatcher individually, low communication efficiency; 3) Manual inspection is prone to omissions and only covers surface issues;

Pre-Operation Inspection Process:



Business
Pain
Points



➤ Pre-Operation Inspection Application

Provides Pre-Operation Inspection Application based on existing interfaces between the management platform and ISCS system.

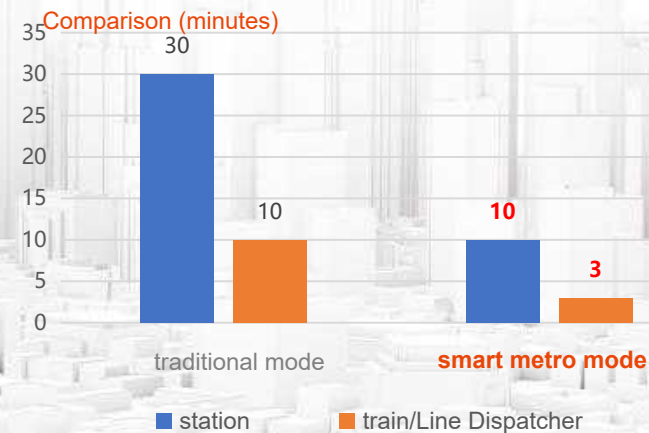
Station Side: New station Pre-Operation Inspection Application for station duty officers, automatically completing partial inspection items to reduce staff workload:

Solution 1) PSD self-inspection; 2) PIS display auto-on; 3) Professional system self-inspection; 4) Verify operation timetable; 5) Clock time;

Line Side: New pre-operation inspection application for line dispatchers, directly obtaining completion status and results from all stations without item-by-item verification.

Economic Benefits

➤ Pre-Operation Inspection Duration



Each station saves 20 minutes daily, dispatcher saves 7 minutes, total 11.5 work hours saved per day across the line, 4,179 work hours saved annually, saving RMB 108,600 per year.

1 work hour calculated at RMB 26



(2) Intelligent O&M System and Platform



Platform Screen Door (PSD) Intelligent O&M System



Product Introduction

The PSD Intelligent O&M System establishes interfaces with PSD maintenance units, laser detection hosts, DCU door controllers, etc. It also adds sensors to collect electrical parameters at key circuit nodes, door movement speed, belt vibration, etc., enabling full information monitoring of PSD equipment, visualization of cabinets and key components, and PSD motion analysis with hidden danger warning.



PSD Intelligent O&M System Overview



PSD Cabinet Visualization



PSD Key Components Visualization



PSD Motion Intelligent Analysis

Communication Intelligent O&M System

Product Introduction

Communication Intelligent O&M customizes monitoring points for each subsystem, and obtains data by directly establishing interfaces with each subsystem's network management system, deploying self-collection hosts/data communication equipment performance collection software, etc., achieving a monitoring coverage rate of 90%. Leveraging data-driven and intelligent diagnostic algorithm capabilities, it enables full monitoring of key communication equipment, end-to-end intelligent diagnostic analysis, and performance status assessment.



Communication Intelligent O&M System Overview



Network Topology Visual Monitoring



End-to-End Business Logic Analysis



PIS Train-Ground Wireless Performance Analysis



AFC Intelligent O&M System

Product Introduction

The AFC Intelligent O&M System performs data enhancement, access and analysis of existing equipment, enabling visual monitoring and intelligent inspection of host equipment, network equipment, AGMs, TVMs and other devices, improving fault troubleshooting and daily inspection efficiency. It also implements hidden danger warning and fault prediction based on equipment mechanism models, reducing corrective maintenance frequency and failure rate.



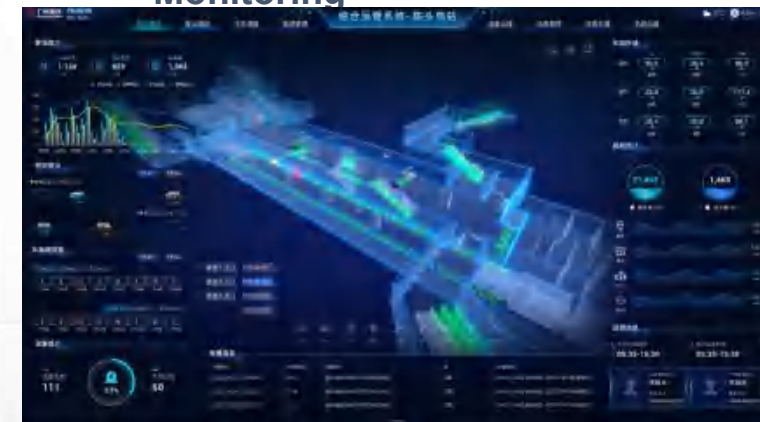
AFC Intelligent O&M Overview



AGM Component Visual Monitoring



AFC System Topology Visual Monitoring



AFC Passenger Flow Analysis and Intelligent One-Touch Inspection Based on Smart Station

Escalator/Elevator Intelligent O&M System



Product Introduction

Escalator/Elevator Intelligent O&M adds operating condition monitoring of key equipment such as motors, gearboxes, drive wheels, and tension springs on top of the status information and conventional alarms sent by existing escalators/elevators to the integrated supervisory control system, filling gaps in existing monitoring points. Based on in-depth analysis of operating conditions, it enables identification and prediction of escalator/elevator fault hazards.

Station
Monitoring
Overview



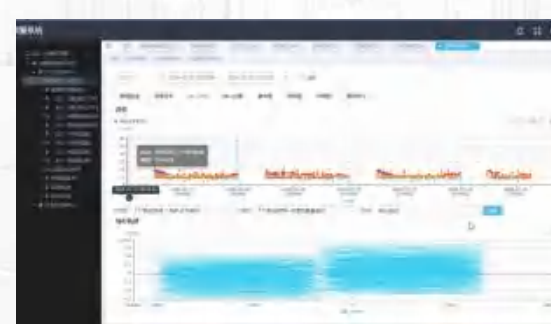
Equipment
Monitoring
Details



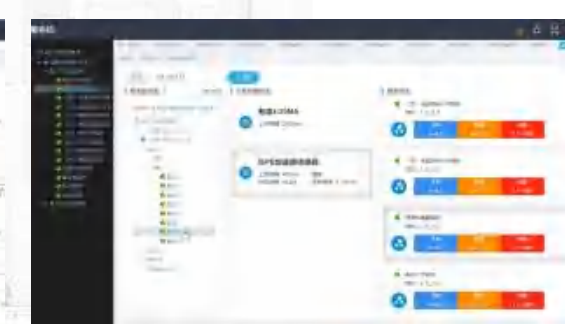
Monitoring
Alarm List



Hidden Danger Warning - Time
& Frequency Domain Analysis



Operating Condition -
Motor Axis Trajectory



Rule Engine - Monitoring
Threshold Configuration

Power Subsystem Intelligent O&M

Function Introduction

Power System Intelligent O&M obtains underlying data through interfaces with the power system network management system and installation of battery inspection devices. It implements intelligent O&M functions including: power cabinet intelligent monitoring, distribution cabinet output terminal monitoring, visual circuit monitoring, battery monitoring and intelligent analysis. It helps O&M personnel achieve remote inspection, intelligent meter reading, and rapid fault location of the power system, significantly improving daily maintenance and fault handling efficiency.



Power Cabinet Intelligent Monitoring



Distribution Cabinet Output Terminal Monitoring



Visual Circuit Monitoring



Battery Monitoring and Intelligent Analysis

Integrated Supervisory Control System Intelligent O&M

Function Introduction

The Integrated Supervisory Control and Electromechanical Intelligent O&M Platform obtains managed electromechanical equipment data through interfaces with the integrated supervisory control system, and develops a one-touch intelligent inspection module based on point tables and inspection procedures. The platform is equipped with an autonomous collection module to monitor performance of general equipment such as servers, FEPs, and switches. The system builds status assessment models for key equipment and components based on large models, deeply mining potential hidden dangers, predicts equipment performance degradation in advance, reduces electromechanical equipment failure rates, and improves electromechanical system O&M quality.



Integrated Supervisory Control & Electromechanical Platform



Intelligent One-Touch Inspection Function



Integrated Supervisory Control Host Performance Monitoring



Electromechanical Equipment Status Assessment



05

Solution Advantages & Proven Cases

Smart Station Solution Advantage Analysis



Built upon the Smart Station Operation and Management Platform, this solution integrates data from multiple specialized electromechanical and intelligent analytics systems, eliminating the barriers inherent in siloed, single-discipline system architectures. Tailored to the operational characteristics of metro systems—such as low staffing levels, high labor costs, and stringent compliance requirements—it enables a comprehensive enhancement of both operational safety assurance capabilities and equipment maintenance efficiency.

Operational Safety Proactive Prevention and Control

The alarm manager pushes device abnormalities in real time, the electronic pre-plan presets standardized disposal procedures, and after an event is triggered, the pre-plan can be quickly retrieved and devices can be linked. Safety management and control has shifted from passive response to active disposal, and the standardization of disposal across different stations and different shifts remains consistent.

Comprehensive Dashboard Centralized Monitoring

The integrated dashboard aggregates station equipment overviews, signal data, BAS environmental information and alarm managers, and graphically displays the real-time status of all equipment across the station. With streamlined station staffing, on-duty personnel can grasp the overall operation status of the entire station through a single interface, eliminating the need to switch between multiple systems.



One-click switchyard operation

One-click station opening and one-click station closing solidify the station switching process into a standardized pre-plan. A single operation can link up all station equipment such as entrance and exit rolling shutters, escalators, environmental control systems, and lighting to execute in sequence, and station switching records are automatically retained. With long operating hours and few on-duty personnel, the operation time is significantly shortened.

Intelligent inspection replaces manual work

The video inspection automatically patrols public areas according to a custom route. The equipment inspection automatically queries the operating status of the equipment and outputs the results, with traceable historical records. The labor cost is high, and the inspection personnel have shifted from "running to every point and recording every item" to "checking results and verifying anomalies", and the coverage of inspection has been greatly increased.



Unified Operation and Maintenance of Multi-professional Equipment

Electromechanical intelligent analysis covers more than ten systems such as PSD, AFC, water, ventilation and electricity systems, integrated monitoring, video surveillance, power supply, transmission, broadcasting and so on. The equipment has diverse brands and complex interfaces. Under the unified platform, real-time monitoring of the status of professional equipment and centralized alarm management are realized, and operation and maintenance personnel do not need to switch across systems.



Cross-system linkage and coordinated disposal

The linkage service solidifies cross-system operations such as those involving switch stations into standardized plans, and the equipment monitoring service provides unified real-time status data for various business applications. The requirement for system integration is high. Unified data interfaces avoid redundant construction and data inconsistency, and the efficiency of cross-professional fault correlation analysis and collaborative disposal is improved.

Partial implemented applications of PCI Technology in smart stations

Guangzhou	Tianhe Smart City Station	Panoramic Monitoring and Management	Holographic Perception	Data Analysis	Smart Customer Service	Smart Ticket Booking System	Smart Security Check	Smart Security
	Line 18, 22	One-Click Switch Station	3D-assisted surveillance	Video Station Patrol	energy management, energy control	Maintenance Management	Mobile Station Affairs	Smart Security Check
		Route Visualization	Voice Scheduling	Passenger flow trends	Passenger Flow Forecasting	Emergency Response	Equipment Management	Energy Efficiency Analysis
Changsha	Line 6	Panoramic Monitoring and Management	Smart Switching Station	Intelligent Inspection	Smart Customer Service	Emergency Command	Operation Indicator Statistics and Classification	Smart Energy Efficiency
		Intelligent Flood Control	Smart Security Inspection	Passenger Guidance	Route Management			
Chengdu	Line 17, 18, 19	One-Click Switch Station	Comprehensive Dashboard	Video Inspection	Panoramic Site Inspection	One-click self-diagnosis	Free Inspection	Server Room Inspection
		Mechatronic Remote Inspection	Smart Passenger Flow	Emergency Management	Flood Situation Analysis	Elevator Emergency Control	Substation Automatic Data Filling	
Dalian	Xi'an Road Station	Smart Switching Station	Station 3D Panoramic View	Intelligent Inspection	Smart Customer Service	Smart Ticket Booking System	Smart Side Door	Smart Security Inspection
		Scenario Management	Passenger Service Terminal	Passenger Information Guide	Passenger Flow Monitoring	Passenger Flow Management	Shift Handover Management	Data Statistical Analysis
Ningbo	Line 7	Automatic Switching Station	Automatic Station Patrol	energy management and control	Typhoon and Flood Prevention	environmental analysis	Passenger Flow Analysis	Intelligent Operations and Maintenance
		Smart Security	Multi-scenario linkage under fully automatic operation					

Changsha Metro Line 6 Smart Metro



Design + Construction + Operation + O&M
PPP (Public-Private Partnership) Model

China's First Smart Metro, 34 Stations Across the Entire Line

Contract amount: 10.1 billion yuan. Undertaking 18 main disciplines and over 30 subsystems, including 11 core independent disciplines.

Building a national demonstration and industry-leading benchmark for smart urban rail.

System Integration Scope



Core
Independent
Products

Smart Station Management and Control Platform, Cloud Platform, ISCS, PIS, CCTV, BAS, PSCADA, ACS, PSD, AFC, Intelligent O&M, Smart Security Inspection, Smart Energy Saving.

Integrated Design, Production/Supply, Installation, Commissioning, Acceptance, Warranty, O&M

Project Advantages

- Strong alliance, maximizing economic benefits, saving 13.6% of investment for the government.
- Unified supply, integrated implementation, and easy management.
- Shareholders directly participate in construction, operation, and O&M with seamless connection, reducing operation preparation costs by about 60%.
- Reduced engineering interface coordination, full-line smart upgrade, rapid deployment, taking 6 months from design to implementation and opening.
- Overall project schedule coordination, effectively shortening the project cycle, opening 1 month ahead of schedule.

Project Highlights

- China's first line where full-line smart urban rail bidding was implemented. "116" Cloud Platform + Urban Rail Brain + 6 Major Smart Applications.
- Industry's first full-line unattended intelligent customer service, reducing 136 personnel. Labor cost savings: 8.84 million yuan/year.
- Industry's first full-line intelligent image recognition and centralized image recognition smart security inspection, reducing image recognition personnel by 60%, cost reduction of 6 million yuan/year.
- Full line adopts self-developed AI algorithm for intelligent environmental control and energy saving. After third-party testing, the energy saving rate increased by over 30%, stations saved 6.15 million kWh of electricity, saving 4.84 million yuan in electricity bills.

Guangzhou Metro Line 18 & 22 Smart Metro



Design + Construction + O&M Full Lifecycle Management

China's benchmark project for large-scale, multi-line, multi-discipline integrated construction + O&M.
China's first smart travel paradigm built upon a smart metro management and control platform as the foundation, constructing a full-time, panoramic smart travel experience.

System Integration Scope

Ventilation and Air Conditioning System
(including Intelligent Environmental Control
Equipment Monitoring System)

Integrated Business
Production Cloud
Platform

ISCS

Smart Station
Equipment
Monitoring System

FAS

Automatic Fire
Suppression System

ACS

PSD

Public/Dedicated
Communication System

AFC

PIS

Including equipment supply, system commissioning,
acceptance, warranty, and O&M

Project Advantages

Integration of Design, Construction, and O&M

- Reduce construction funding pressure: installment payments by proportion during construction and O&M periods;
- Low O&M costs: O&M costs not exceeding 85% of the owner's independent O&M;
- Overall project planning and resource integration, enhancing the project's **overall schedule control and construction management level**.
- Streamlined and efficient management and control, facilitating investment and progress control.

Project Highlights

- The first metro line in China with a maximum speed of 160 km/h (Line 18/22).
- Integrated application of more than 10 core self-developed software from PCI, including the Smart Metro Management and Control Platform, Integrated Supervisory Control Platform, Cloud Platform, Smart Customer Service, etc.
- Multiple innovations: Digital Foundation, Fully Automatic Operation (FAO), **Facial Recognition Access**, Smart Customer Service, Smart Information Guidance, Smart O&M, Smart Environmental Control, etc.

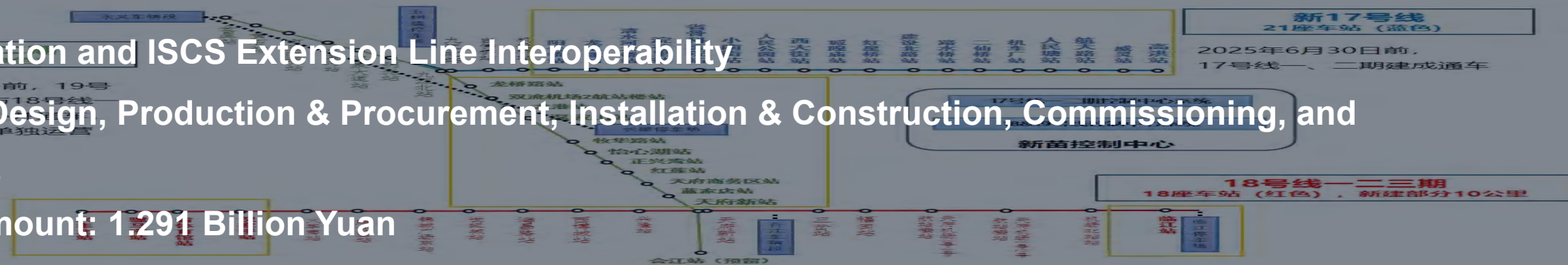
Chengdu Metro Line 17, 18 & 19

Communication and ISCS Extension Line Interoperability

Integrated Design, Production & Procurement, Installation & Construction, Commissioning, and

Acceptance

Contract Amount: 1.291 Billion Yuan



Equipment Procurement, Construction & Installation, Integrated Design, System Commissioning

Commu nication

Passenger Information, CCTV
Transmission System, Wireless System
PA, Public Security Communication

ISCS

ISCS, PSCADA
FAS, BAS
ACS

Project Advantages

- Pioneered three adaptation solutions to thoroughly solve the **bottleneck problem of interoperability**.
- Pioneered a dual-mode TAU solution to thoroughly solve **interoperability issues between different LTE systems**.
- First application of **Edge All-in-One Appliance** and transparent gateway technology in existing line ISCS renovation projects.

Project Highlights

- **China's first** line-network-level interoperability project formed by extending, dismantling, and reorganizing two existing lines into three lines. — Engineering Complexity.
- **China's first** extension line interoperability project achieving interoperability across multiple systems such as ISCS, wireless, and CCTV using equipment from different suppliers. — Technical Complexity.
- Deeply integrating the Huajia MOS Smart Metro Brain to build a smart station and smart maintenance platform, leading the development of Chengdu Metro's smart urban rail. — Innovation Leadership



THANK YOU

PCI 佳都科技

城市慧变得更好!
perfect city