XVIII World Water Congress
International Water Resources Association (IWRA)

Digital Twin Songtao Reservoir

Dr. Bin Sui

Inspur Smart Technology Co., Ltd

XVIII WORLD WATER CONGRESS
Water for All
Harmony between Humans and Nature

第18届 世界水资源大会
水与万物：人与自然和谐共生

XVIII World Water Congress
International Water Resources Association (IWRA)

Content

- Water conservancy industry's digital transformation
- Case presentation and Experience sharing

Water conservancy industry's digital transformation

XVIII World Water Congress
International Water Resources Association (IWRA)

The construction of digital twin river basins is the core of smart water conservancy construction

Hydraulic automati on

Automation of water

In 2001, Golden Water Project

Water conservancy informatization

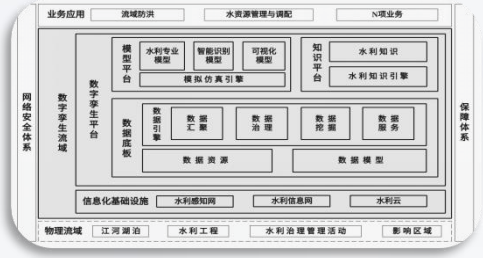
Construction and management go hand

In 2019, 《Smart Water conservancy Overall Solution》

Smart water conservancy V1.0

Unified architecture design

In 2021, 《Top level design of smart water conservancy》



Smart water conservancy V2.0

The digital twin technology system has been introduced into the construction of smart water

Water conservancy industry's digital transformation

XVIII World Water Congress
International Water Resources Association (IWRA)

National Policy

During the 14th Five Year Plan, comprehensively promote the construction of smart water conservancy

Overall Architecture


水 利 部 文 件

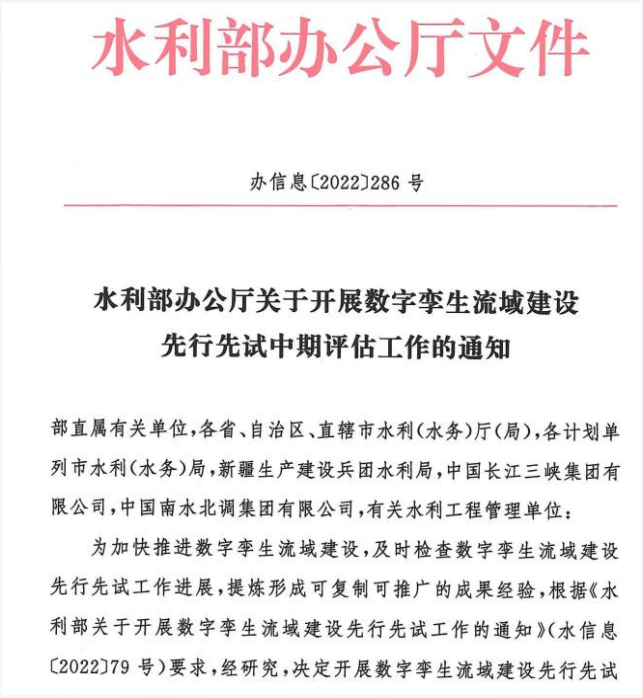
水信息〔2022〕147 号

水利部关于印发《数字孪生流域建设技术大纲（试行）》的通知

部机关各司局，部直
（局），各计划单列市
国长江三峡集团有限
工程管理单位：
《数字孪生流域
现印发给你们，请结

The Ministry of Water Resources has issued a digital twin river basin construction plan to guide the construction of smart water conservancy in the new stage

Daring to try and Foretasting


水利部办公厅文件

办信息〔2022〕286 号

水利部办公厅关于开展数字孪生流域建设先行先试中期评估工作的通知

部直属有关单位，各省、自治区、直辖市水利（水务）厅（局），各计划单列市水利（水务）局，新疆生产建设兵团水利局，中国长江三峡集团有限公司，中国南水北调集团有限公司，有关水利工程管理单位：

为加快推进数字孪生流域建设，及时检查数字孪生流域建设先行先试工作进展，提炼形成可复制可推广的成果经验，根据《水利部关于开展数字孪生流域建设先行先试工作的通知》（水信息〔2022〕79 号）要求，经研究，决定开展数字孪生流域建设先行先试

There are 46 pilot projects in the digital twin river basin、44 pilot projects in the digital twin water conservancy engineering、48 pilot projects In the digital twin irrigation area

Water conservancy industry's digital transformation

XVIII World Water Congress
International Water Resources Association (IWRA)

The overall architecture of smart water conservancy based on the digital twin technology system

Business applications

- Basin Flood Control
- Water resource management and allocation
- N business applications

Supported Application Platform

- Unified Portal
- Unified user
- unified authority
- Electronic Signature
- unified messaging
- Unified release
- CA authentication
- ……

Digital twin Plat-form

Model Platform
- Hydraulic Mechanism Model
- AI Model
- Visualizat-ion Model
- Simulation Engine

knowledge platform
- knowledge base
- knowledge map
- Historical Scenarios
- expertis
- Rule
- Knowledge Engine

Data Baseplate

Data Engine
- Data Aggregation
- Data Governance
- Data Value Mining
- Data Service

Data Resources
- Basic Data
- Monitoring Data
- Business Management Data
- Cross-industry Data
- Geospatial Data

Basic Support Platform
- IoT（Internet of Things）Platform
- Video Networking Management Platform

Infrastructure

- Perception device (Rainfall, water level, flow rate, water quality, etc)
- Communication network（3G/4G/5G，microwave，IPV6，etc)
- computing power（Cloud computing，HPC, Edge Computing)

Inspur Ability | Joint partners | Inspur Ability and Partners

Basic information of Digital Twin Water Network Construction in Hainan Province

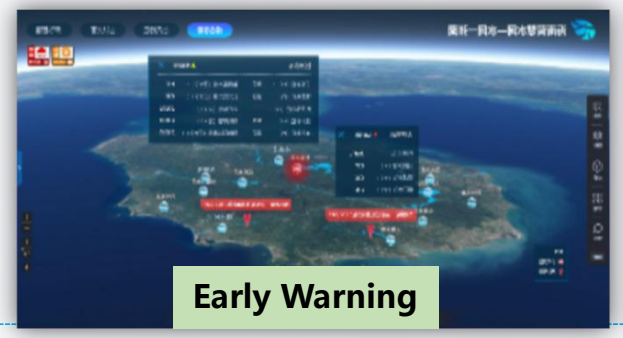
Program Value

Visible | See more Accurately | Looking Wider | Looking Further

Solution

Digital base plate of river basin

The DT of Water Conservancy Engineering


Early Warning


Preview of a Performance

Construction Effect

The platform has over 17156 users, with an average of 2000 users per day. The inspection mileage of the reservoir manager App has reached 250000 kilometers and reported over 1700 issues, the reservoir manager App has becoming a powerful tool for daily inspection and maintenance of reservoirs.


荣誉证书

Top 10 Big Data Application Cases in Hainan Province in 2021

2022 IDC China and Asia Pacific Water Conservancy, Smart City Award

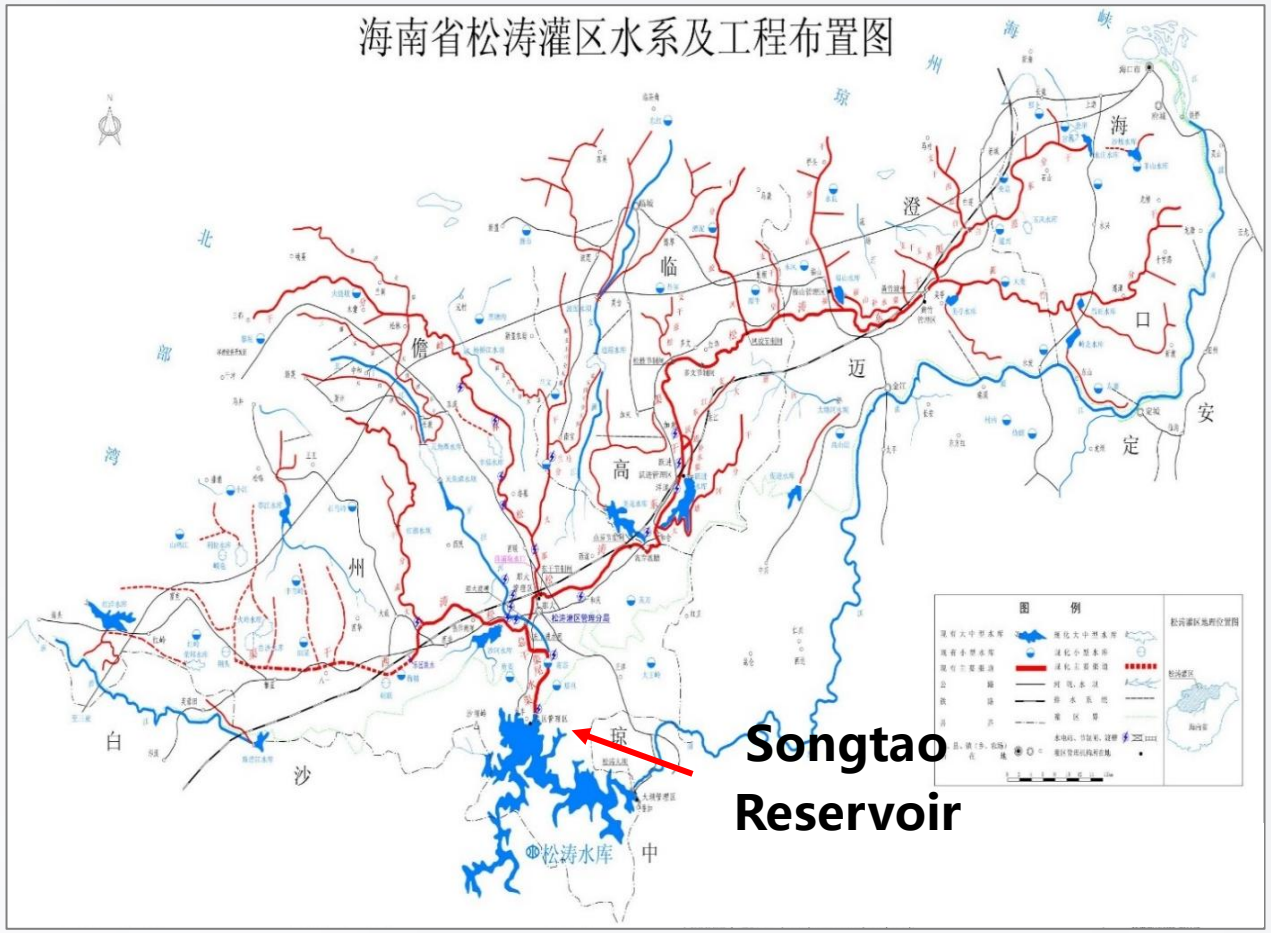
序号	应用案例名称	先行先试单位	承担单位	合作单位	参建人员	简介
	字孪生流域指挥决策电子沙盘	水利厅	厅	勘测设计研究院有限公司	向学建、卢晓明、严乐军、袁轲、郭伟华、张霞、冯天文、黄旺星、黄启有、李宜雪、郭军宏、游杰、徐广达	度平台，采用虚幻引擎、GIS云等先进技术，初步搭建覆盖“一江一湖四水”范围的数字化场景，利用数字仿真引擎，对流域防洪、水资源调度与管理等重点业务进行“四预”仿真，在2022年数字孪生流域建设工作中发挥了重要作用。适用于数字孪生流域建设指挥中心的各类场景的灵活搭建与应用
12	数字孪生松涛水库	海南省水务厅	海南省水务厅	浪潮智慧科技有限公司	杨向权、张晓柳、赵光辉、倩倩、吴祥跃、陈星、周劲松、汪子棚、房爱印、欧阳彤、张磊、尹曦萌、高玲、牛月华、代建翔	通过技术探索与水利业务深度融合，为后期的数字孪生水利工程建设提供可复制可推广的经验做法。应用了GIS+BIM、VR、云渲染、规则引擎、AI识别、机器学习等技术在库区监测、运行管护、水库防洪与水资源调度中实现松涛水库智能化管理，结合上下游防洪安全及用水需要和水库安全状况，落实“四预”一体化过程，为水库的安全运行管理提供有效支撑

Recommended List of Application Cases for Pilot Projects in the 2022 Digital Twin Watershed by the Ministry of Water Resources

Case presentation and Experience sharing

XVIII World Water Congress
International Water Resources Association (IWRA)

Overview of Songtao Reservoir: **The Songtao Reservoir is located in the Nandu River Basin and is an important component of Hainan's water network planning in the northwest of Hainan. Its main problem is uneven distribution of water resources, with some rivers exceeding the standard for water quality all year round, and severe waterlogging in urban areas and cities**



Existing infrastructure

- **Monitoring Station:** There are a total of 625
- monitoring stations in the Nandu River Basin
- **software platform:** IoT center, data center, AI center, application support center, and water network
- **Business functions：** Flood Control and Drought Relief, Water Resource Management, Digital Songtao

Problems and Gaps

- **The intelligence level of business applications is relatively backward**
- **Insufficient coverage and elements of water conservancy perception**
- **Weak analysis and calculation foundation of advanced technical data such as professional models and artificial intelligence**

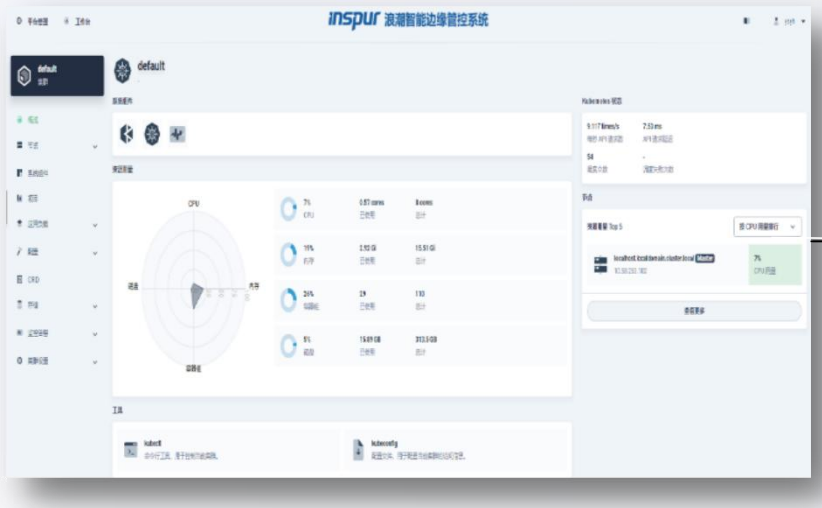
Necessity

- **An important lever for achieving digital management of river basins**
- **Key Measures for Ensuring Engineering Construction and Safe Operation Management**
- **The inevitable requirements for integrated management of river basins**

Case presentation and Experience sharing

XVIII World Water Congress
International Water Resources Association (IWRA)

Adopting a combination of software and hardware to build a new generation of digital public infrastructure for water conservancy. With edge computing as the core, traditional RTU is replaced by edge intelligent gateway



Unified Control

EIS200

EIS800

EIS800（colony）

Edge Intelligent Gateway

unified Access

Camera

Panoramic camera

UAV

Tipping bucket rain gauges

snow gauge

Float type water level gauge

Integrated radar

Groundwater monitoring station

Automatic evaporation station

Soil moisture station

ADCP

Gate opening meter

Slope displacement monitoring

Water quality station

Unmanned ship

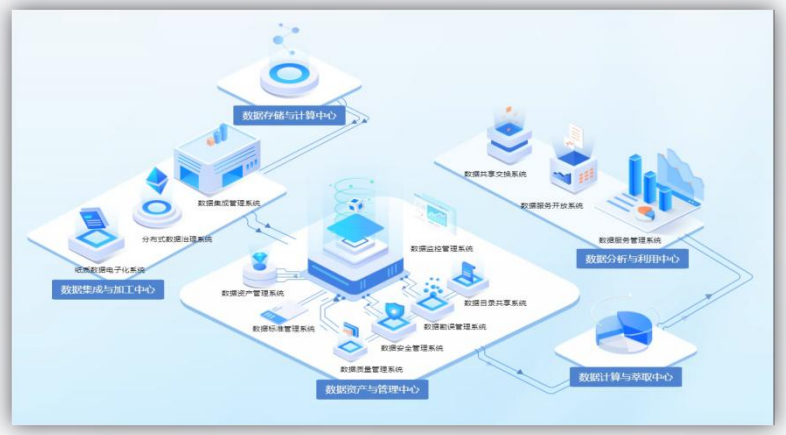
Unmanned vehicle

Osmotic pressure monitoring

Case presentation and Experience sharing

The data governance platform is a platform tool that integrates, governs, and serves massive multi-source heterogeneous data for digital twin water conservancy.

5 sets of Data Catalogs	6 types of Data Resources	3 types of Data Standards
Water Resources Data Resource Catalog	Basic data resources 300+	Industry standard specifications 600+
Water Data Resource Catalog	Monitoring data resources 200+	data dictionary 100+
Hydrological Data Resource Catalog	Business Data Resources 600+	Data element 1000+
Irrigation Area Data Resource Catalog	Government data resources 60+	
Engineering Data Resource Catalog	Spatial data resources 100+	
	Theme Data Resources 100+	

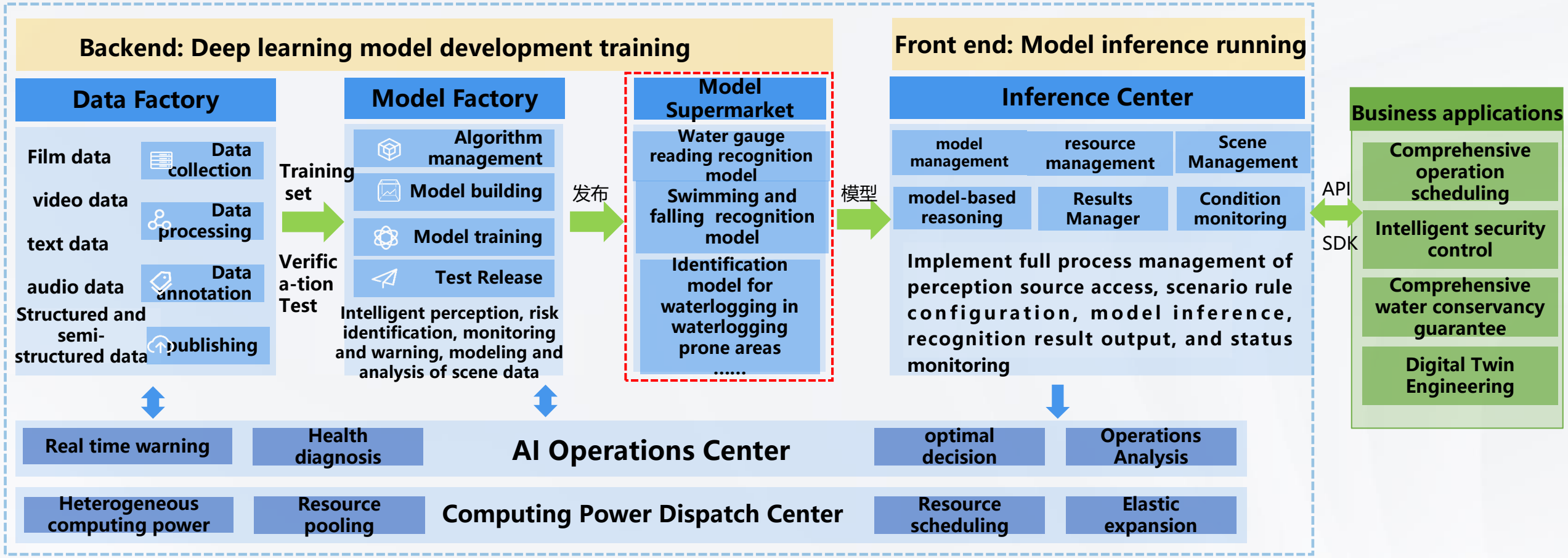


Data weaving platform

Inspur Water Network Information Model (WIM)

Data Quality Rules	Data Security	Data Services	Data Indicators
Basic Quality Rules 20+	Basic safety rules 20+	Basic Data Services 300+	Water resource indicators 20+
Business Quality Rules 30+	Business security 10+	Monitoring data service 200+	Flood and drought prevention indicators 80+
		Business Data Services 200+	Engineering construction indicators 40+
		Spatial Data Services 200+	Engineering operation indicators 50+
		Theme Data Service 100+	Soil and water conservation indicators 10+

AI platform, 1 set of tools+28 models+8 million training materials, various subdivision scenarios of water conservancy

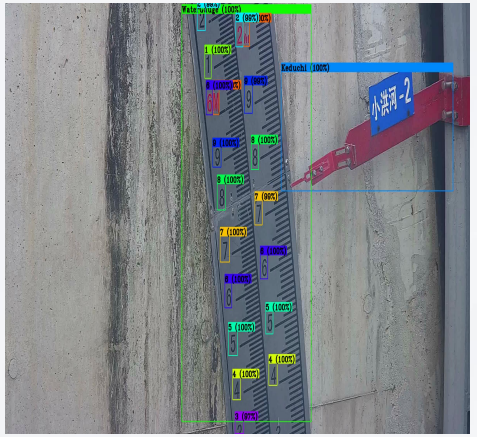


Case presentation and Experience sharing

XVIII World Water Congress
International Water Resources Association (IWRA)

NO.	Model Name
1	Restricted area entry monitoring (personnel intrusion)
2	Floating objects on the water surface
3	Water gauge identification
4	Identification of gate opening scale
5	Ship identification
6	Identification of illegal sand mining
7	Shoreline encroachment
8	Personnel swimming detection
9	Personnel riverbank fishing detection
10	Personnel illegal fishing detection
11	Vehicle intrusion monitoring
12	Vehicle violation monitoring
13	Vehicle illegal passenger identification
14	Engineering Guardian Identification
15	Pyrotechnic identification
16	Identification without safety helmet
17	Lifejacket identification
18	Sewage outlet detection
19	Indoor water and oil leakage detection
20	Personnel stay
21	Face recognition
22	authentication

Water gauge reading



Gate opening scale reading

Floating object monitoring model

Trip line monitoring (fence perimeter)

Trip line monitoring (fence perimeter) - night time

Helmet detection

Improved computing power

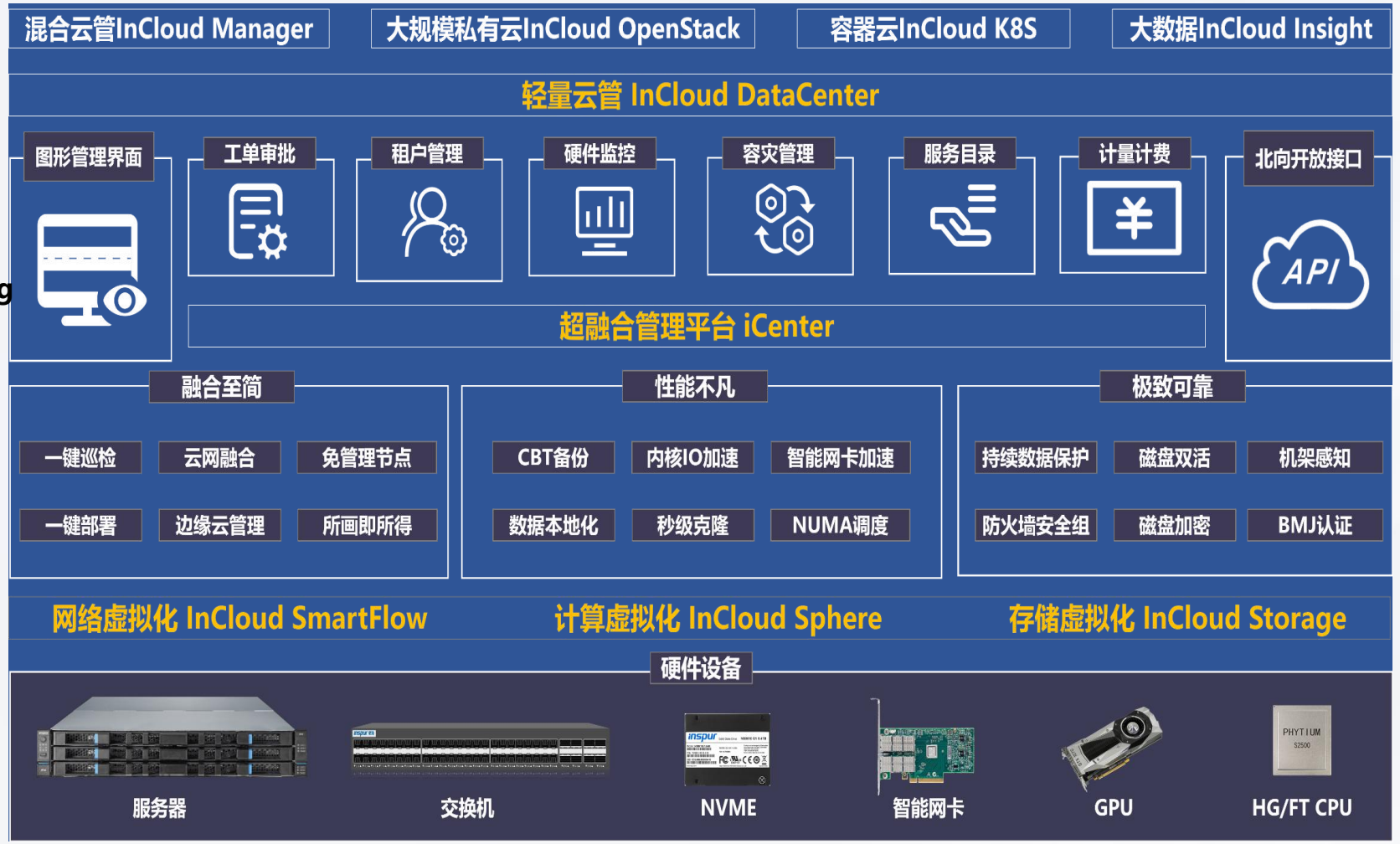
Plan to use computing resources from higher-level units

Universal computing storage	Basic service support
simulation calculation	HPC
Model training, process reasoning, and other calculations	AI computing power
Local and remote disaster recovery	Local and remote disaster recovery centers

Redundancy and available space

Parallel Computing

CPU/GPU



Construction and visualization display of data base plate

L3: Key water conservancy projects

L2: Nandu River Basin

L1: Remote sensing images of Hainan Province

Dam

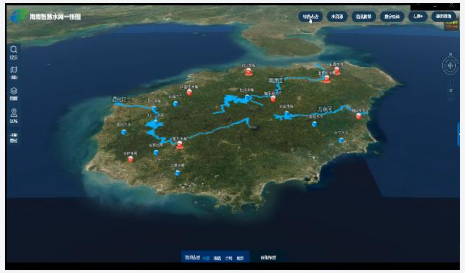
Spillway

Nanfeng water inlet

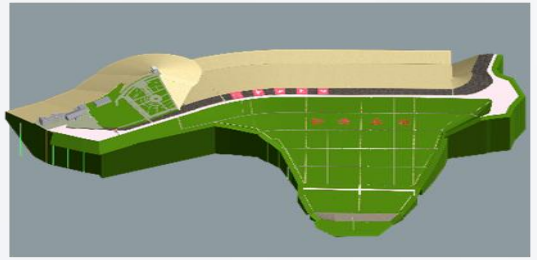
Sluice

Hoist

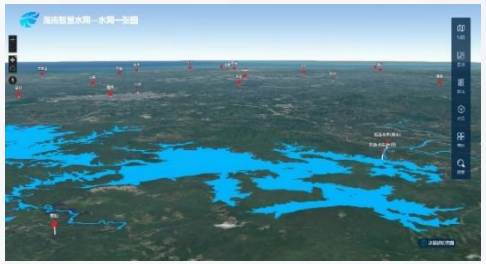
Control cabinet



River system in Hainan Province



water conservancy project



songtao reservoir

Case presentation and Experience sharing

XVIII World Water Congress
International Water Resources Association (IWRA)

Based on the digital twin scenario, strengthen the "four pre" business application of water conservancy engineering safety, which includes early warning of engineering safety situation, early warning of safety risks, rehearsal of safety status, and contingency plans for safety disposal

Engineering Safety

Deformation

Osmotic pressure

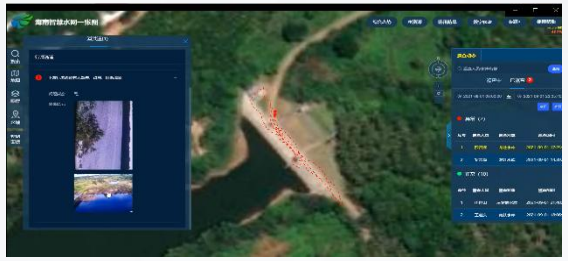
Transfusion

Engineering situation

Engineering operation

Personnel intrusion alarm

Water gauge reading



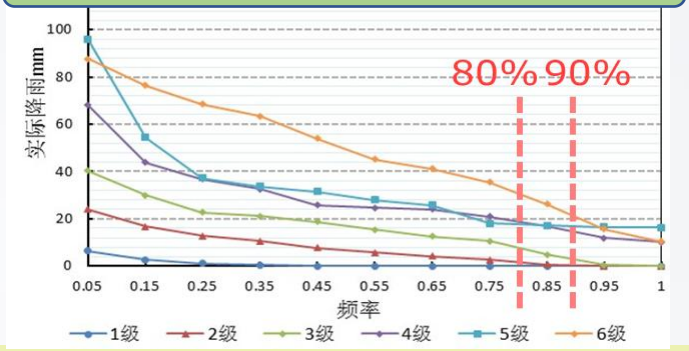
Patrol inspection

The "Four Precepts" for Reservoir Flood Control Regulation

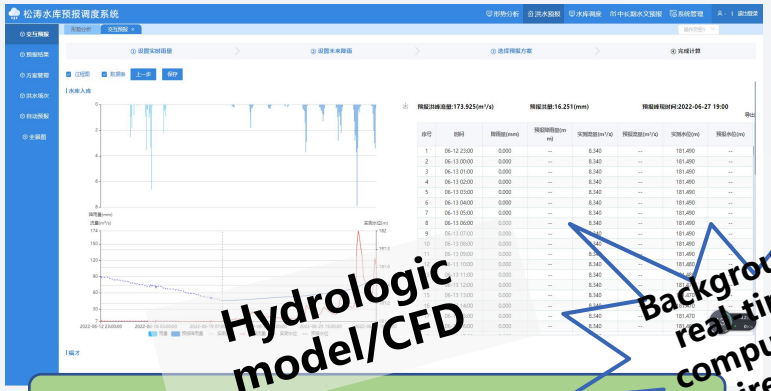
The Songtao Reservoir Basin has been constructed with models for flood forecasting, runoff forecasting, and reservoir scheduling, simulating and calculating various scheduling schemes to ensure flood control safety. Realize digital management, intelligent simulation, and precise decision-making of projects in smart water networks

Rainfall forecasting and monitoring

Analysis of water resource availability



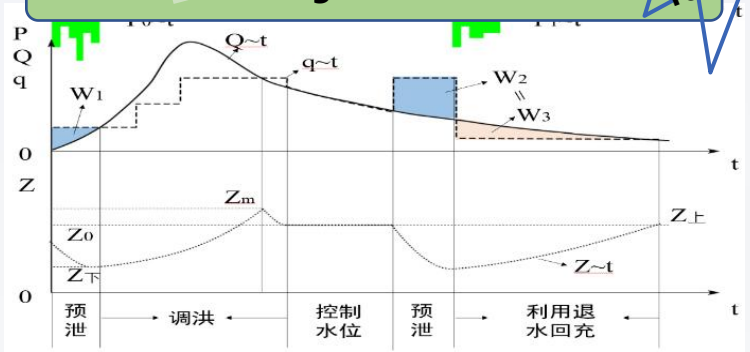
Forecast of incoming water volume



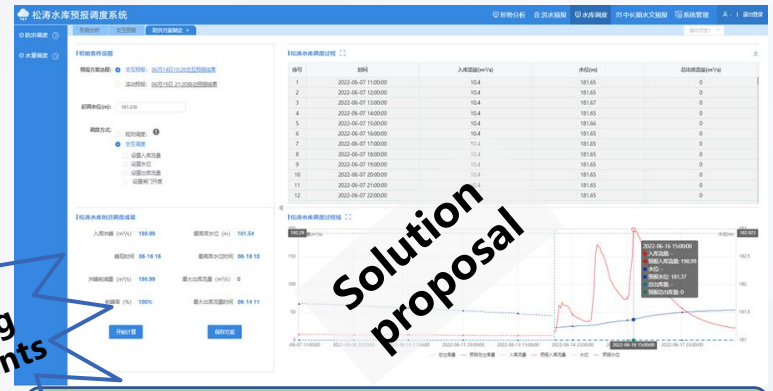
Hydrologic model/CFD

Background real-time computing requirements

Reservoir regulation calculation



Scheduling plan development



Solution proposal

Report to the competent department to organize expert analysis and judgment

XVIII World Water Congress
International Water Resources Association (IWRA)

Thank You