

OPS Practices and Challenges in the AI Era

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China Telecom Overview



- **Position:** A state-owned operator and a Fortune Global 500 company.
- **User Base:** **440 million** mobile subscribers & **240 million** wireline broadband subscribers.
- **Core Technical Strategy:** Pioneering Cloud-Network Convergence, powered by an Intelligent Cloud-Network Operation System.
- **Services:** A full spectrum including wireline broadband, mobile, voice, leased-line/VPN, IPTV, cloud, IOT, AI, and ICT.
- **Global Reach:** Operations spread across more than 25 countries and regions.

Integrated Operation

- Cloud network situation to see more clearly
- Important business developments visible
- Reduce costs and increase efficiency visible

Scheduling efficiency

- The event process can be seen more clearly
- Cloud-network fault repair is faster
- Cloud-network scheduling capabilities are stronger

Fast response

- Customer reports timely support
- Quick response to service commissioning
- Service quality continues to improve

Safe operation

- Strengthen inventory-based management
- Establish a closed loop process
- 1 minute to discover, 5 minutes to locate, 10 minutes to restore



Self-intelligence capabilities extend from the network to cloud and IT systems, supporting the Cloud-Network Convergence strategy

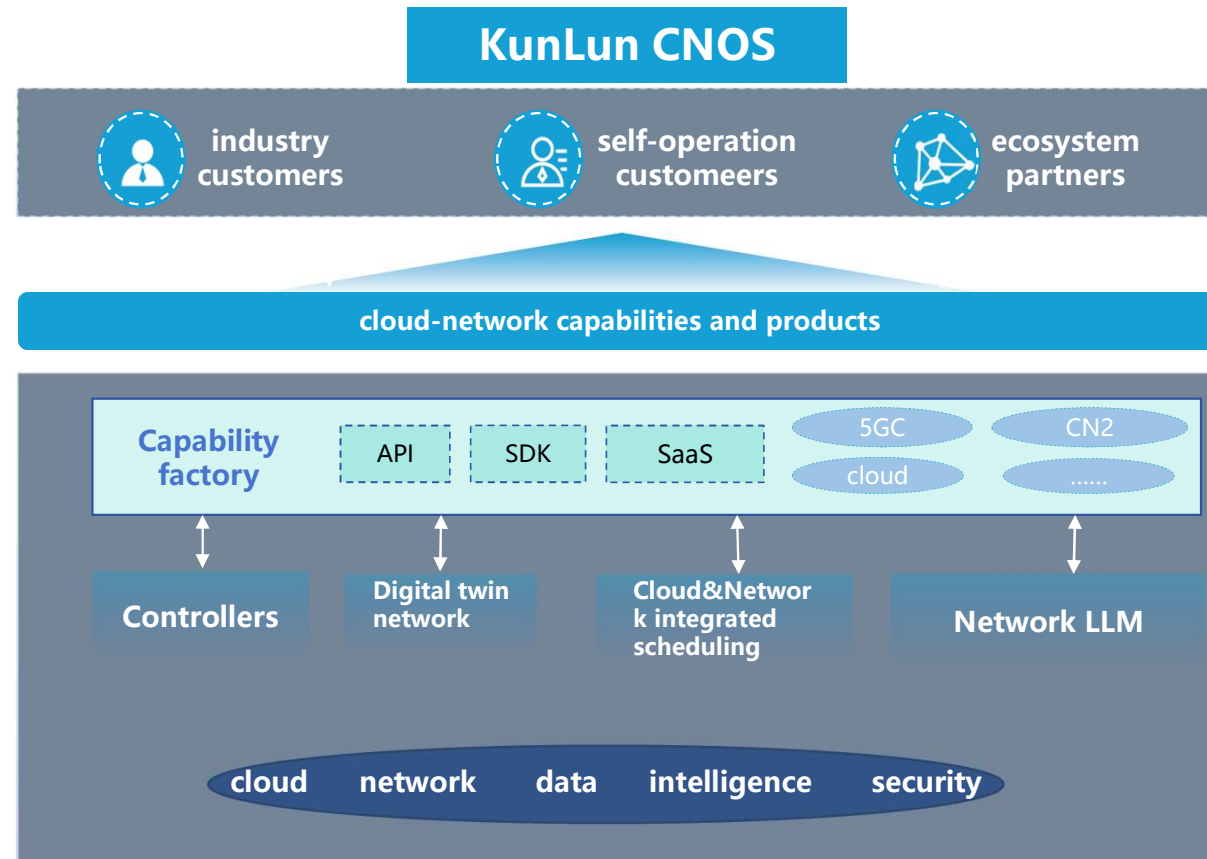
China Telecom –Kunlun Cloud-Network Operating System (CNOS)



Through the core provided by the Kunlun CNOS, the E2E and multi-domains adaptive, self-learning, and self-optimizing AI native mechanisms are constructed for cloud-network operation scenarios. The NaaS capabilities are opened to empower internal and external customers.

CNOS Core functions

- **Cloud&Network Controllers:** Real-time data collection and configuration for infrastructure, unified abstraction and unified control of heterogeneous resources
- **Cloud&Network Digital Twin:** Storage of real-time operational data and correlation between the virtual and the real cloud and network resources, as well as twin visualization.
- **Cloud&Network Integrated Scheduling:** Time-division and domain-division tidal scheduling of the cloud, integrated perception and analysis of computing and network
- **Network LLM:** LLM empower scenarios such as operation and decision-making, and small AI models are quickly constructed
- **Capability factory:** The product based on capability factory and basic capabilities are open to internal and external customers

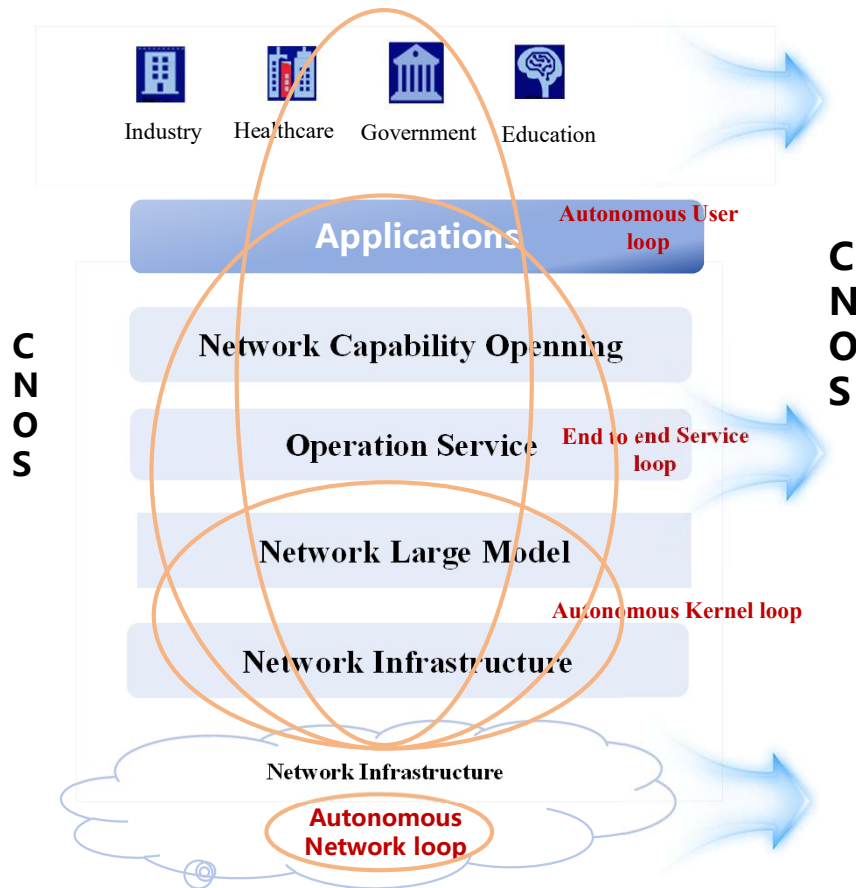


AI-based Cloud-Network Operating Architecture

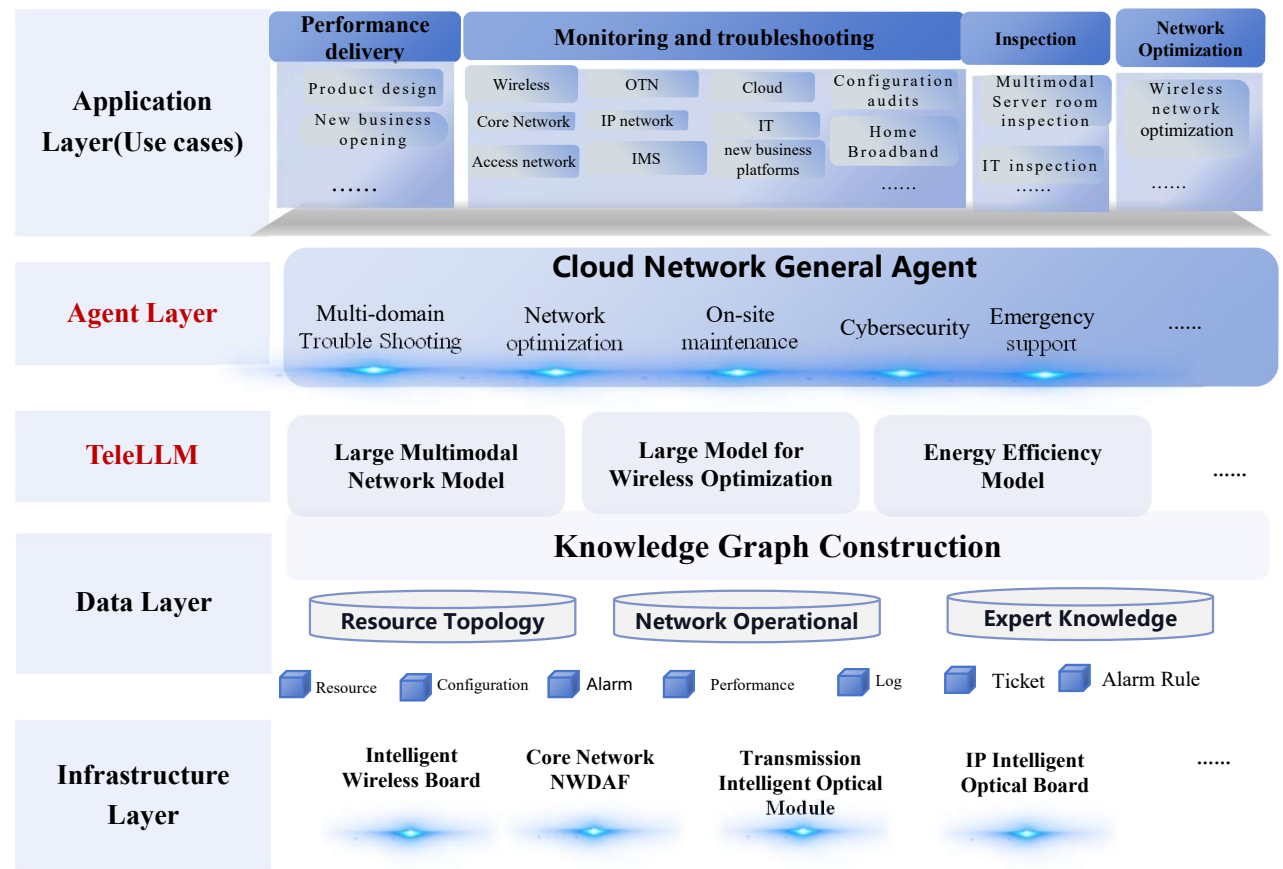


Intelligent Autonomous Operation

4-layer-4-loop



AI Native Cloud Network Operation Architecture



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Key Technology 1: High Guaranteed Software-defined Technology



Problem Solving

- ✓ **End-to-end network service assurance requirements :** across different multi-type networks.
- ✓ **Service quality identification:** Traditional IP networks are difficult to identify user service traffic and user intentions.
- ✓ **Inconsistent cross-vendor models:** The north-south YANG models of different vendors are mostly proprietary YANG models

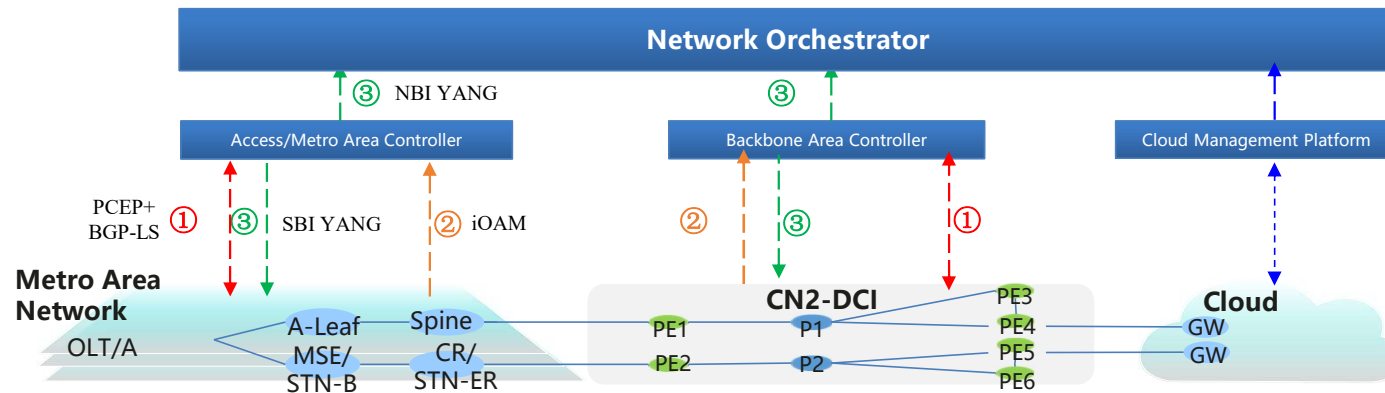


Key Technology

Dynamic guarantee protocol: For the end-to-end traffic guarantee requirements of multiple types of networks, IPv6 native-based traffic engineering protocol is introduced

in-band Flow Information detection: A service-based inband detection scheme is proposed, and the encapsulation of IPv6/SRv6 flow-based service quality detection is standardized

Model-driven Service configuration: A model-driven integrated plug-in is introduced, including multiple vendors (13+) and multiple protocols (8+) on the southbound.



Key Technology 2: Digital Twin Network

Solves the challenges of cross-domain, cross-network, cross-cloud-network, cross-business, and network dynamic correlation as well as network-resource integration. Constructs a full-connection data foundation for Cloud & Network, Business & Cloud-Network, Resources & Operation Status, and Network. Achieves over 90% tree-building rate for TOP20 customer resources

Resource and data sharing

Real-time Data and Capability Opening and Sharing

- Data sharing
- Data self-service subscription

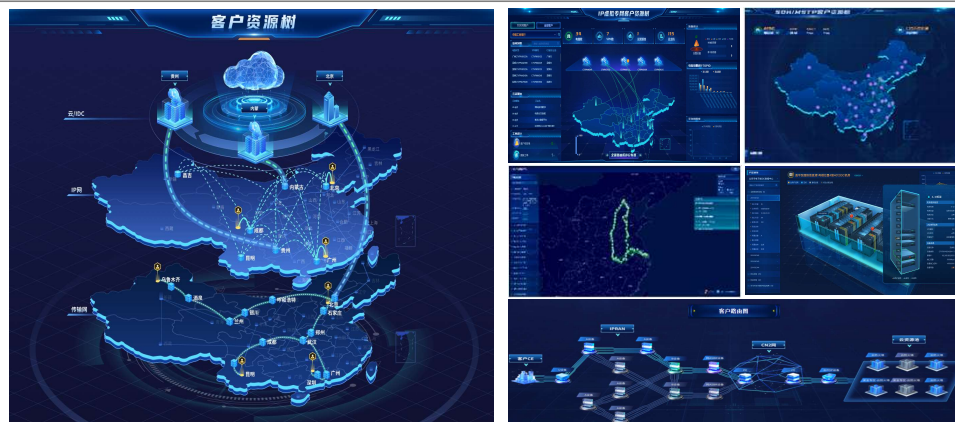
Integrated Management of All Specialties

- **Group management:** There are 387 resource objects in 7 majors, 20 networks.
- **Data catalog:** Provide 792 APIs for resource activation and query

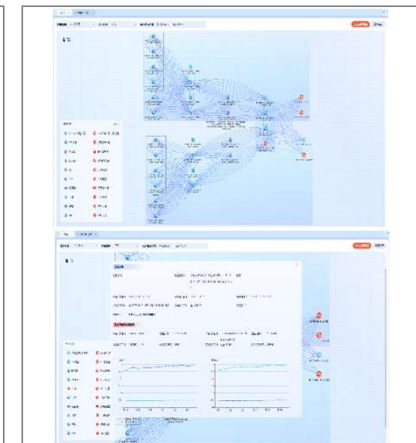
Cross-domain resource association services

Leveraging the integrated data management platform, we construct a Customer-Resource Tree and a Cloud-Network Connectivity Map, delivering end-to-end data services to various applications.

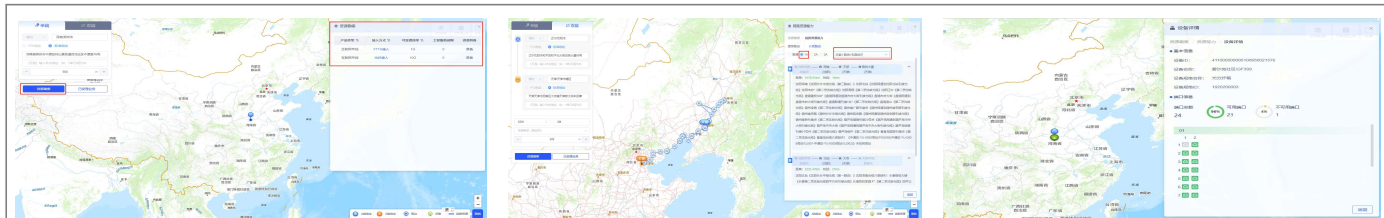
- **Resource Tree View:** Provisioning services for the backbone resources of Dedicated Cloud Networks, 5G, and Transmission, etc.
- **Connectivity Map**



Solving the issues of invisible, blurry, and incomplete visibility of customer products and networks, we provide end-to-end customer resource trees for Dedicated Cloud Networks.



5G/IoT CE Topology: End-to-End Visualization & Alarm Location



Addressing the issues of untimely, inaccurate, and non-end-to-end resource visibility for customers, we provide end-to-end resource exploration capabilities.

Key Technology 3: Network Large Model----QiMing

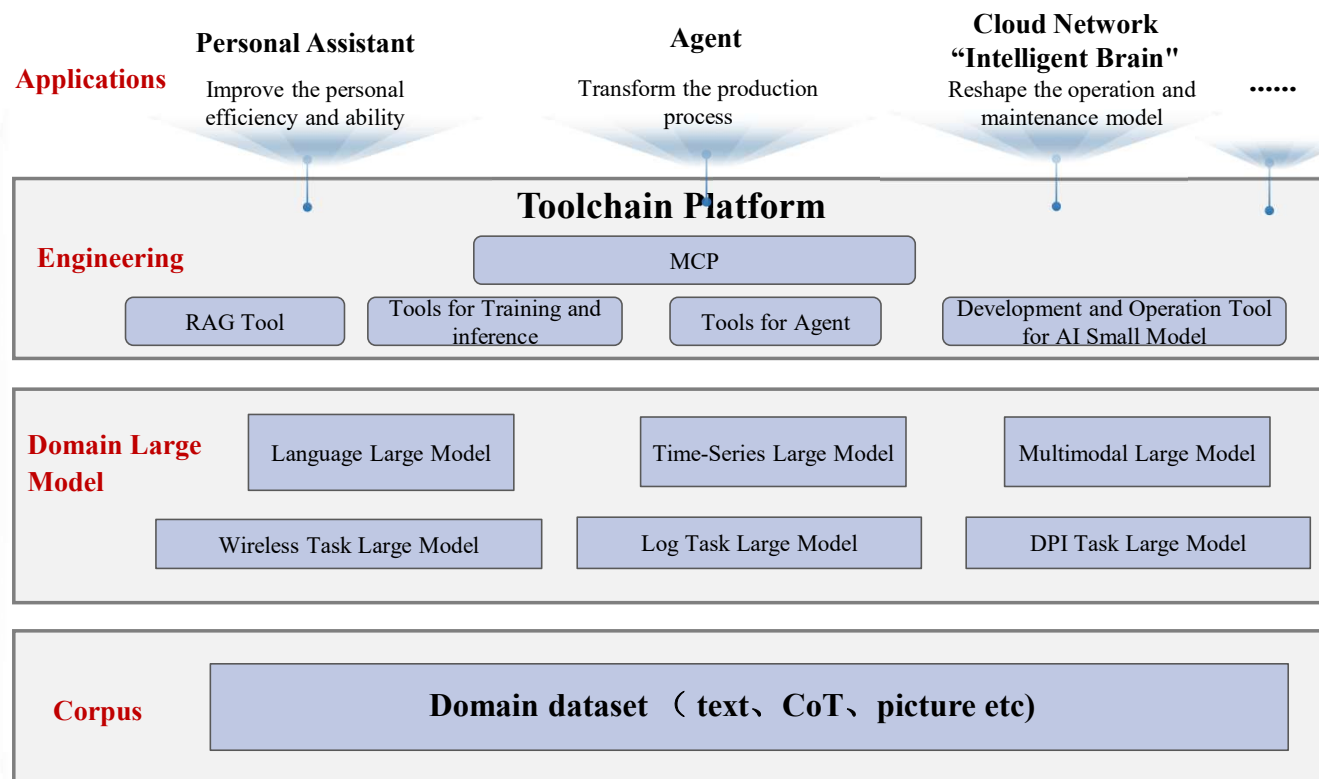


Built upon open-source general large models, the Network Large Model is a domain-specific large model designed for the autonomous cloud-network operation, empowered by robust computing capabilities and knowledge base. It can cover 5 major application scenarios that span the entire network lifecycle, Network planning, Construction, Maintenance, Optimization, Operation

Corpus. Data collection and processing, data augmentation, dataset quality Evaluation

Model Matrix. Model Distillation and Inference Optimization, LLM, Time-Series Large Model, Multimodal Large Model

Full-Process Toolchain. Model training and inference, Intelligent orchestration and collaboration, toolchain platform tailored for network scenarios

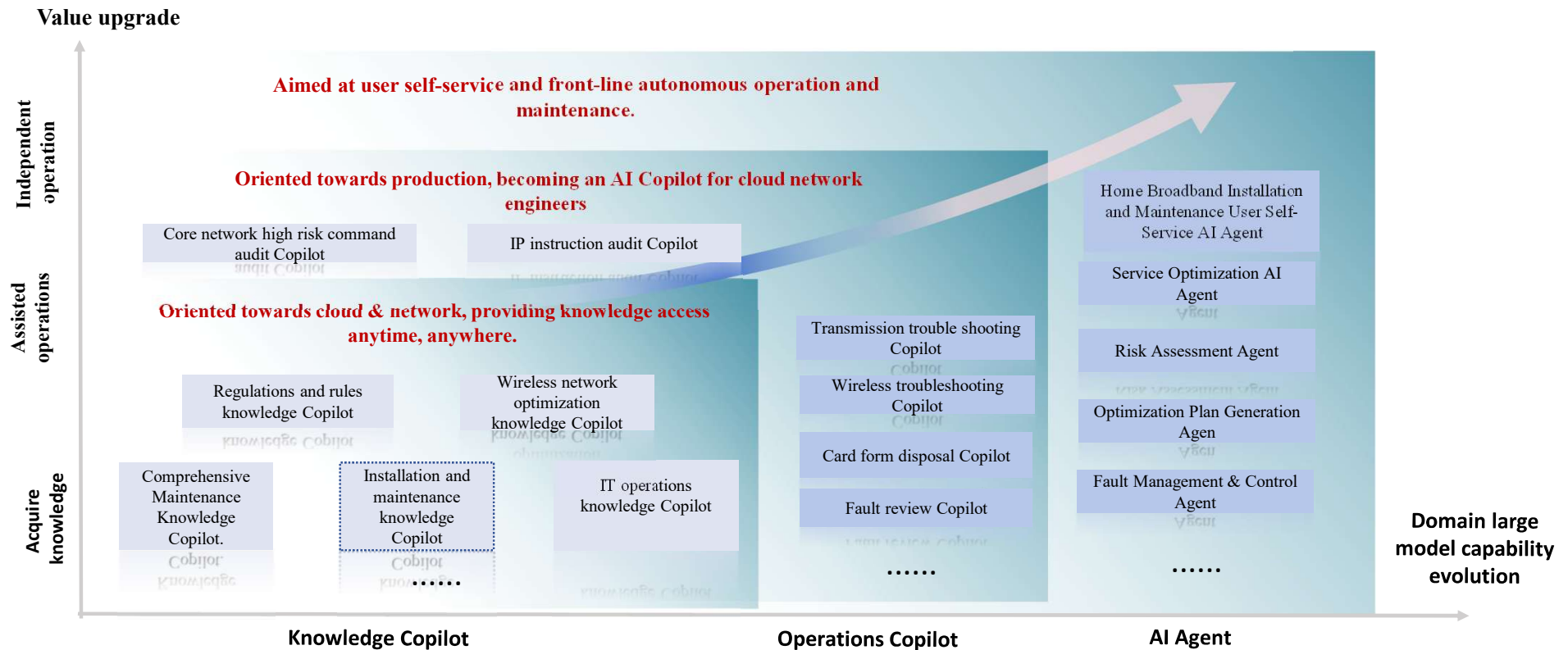


Key Technology 4: Agent deployment Scenarios



Agent scenario plan spans cloud-network operation scenarios and the progressive evolution of AI capabilities.

- **Knowledge Copilot** - providing easy access to cloud-network domain knowledge.
- **Operations Copilot** - an AI helper in production for cloud-network engineers.
- **AI Agent** – delivering autonomous services to achieve autonomous operations of services.



Key Technology 4: AgentOps----from Agent to Digital Employee



Agents

It is a "capability microservice" that can perceive, analyze, make decisions, and perform a single or type of task



Digital employees

Schedule one or more agents for specific job responsibilities and automate virtual job roles for business processes. They are aimed at solving complex tasks using AI Agents

Challenges:

- 1、 **Agent Quality**: Lack of unified naming and addressing, lack of full life cycle management, ambiguous job responsibilities, and blurred boundaries of human-machine authority, lack of multi-agent evaluation.
- 2、 **Security**: Data leakage risk, tool call abusing, prompt injection risk, compliance and auditing
- 3、 **Multi-agent communication guarantee**: Ensure the performance of streaming packets, reliability of important instruction communication, traceability and monitoring.

Key Technology 4: AgentOps—DEP+ACS



Through the construction of "Digital Employee Platform-DEP" and "Agent Communication System-ACS", it realizes the operation control from static job responsibilities and authority control to dynamic agent communication and model calling.

[DEP: Digital Employee Platform]



[ACS: Agent Communicate System]

Clarify job responsibilities

Separation of Human and Machine Privilege

Onboarding, Offboarding, Transfers

Performance review

Audit Traceability

Tool call monitoring

Prompt injection defense

Streaming Assurance

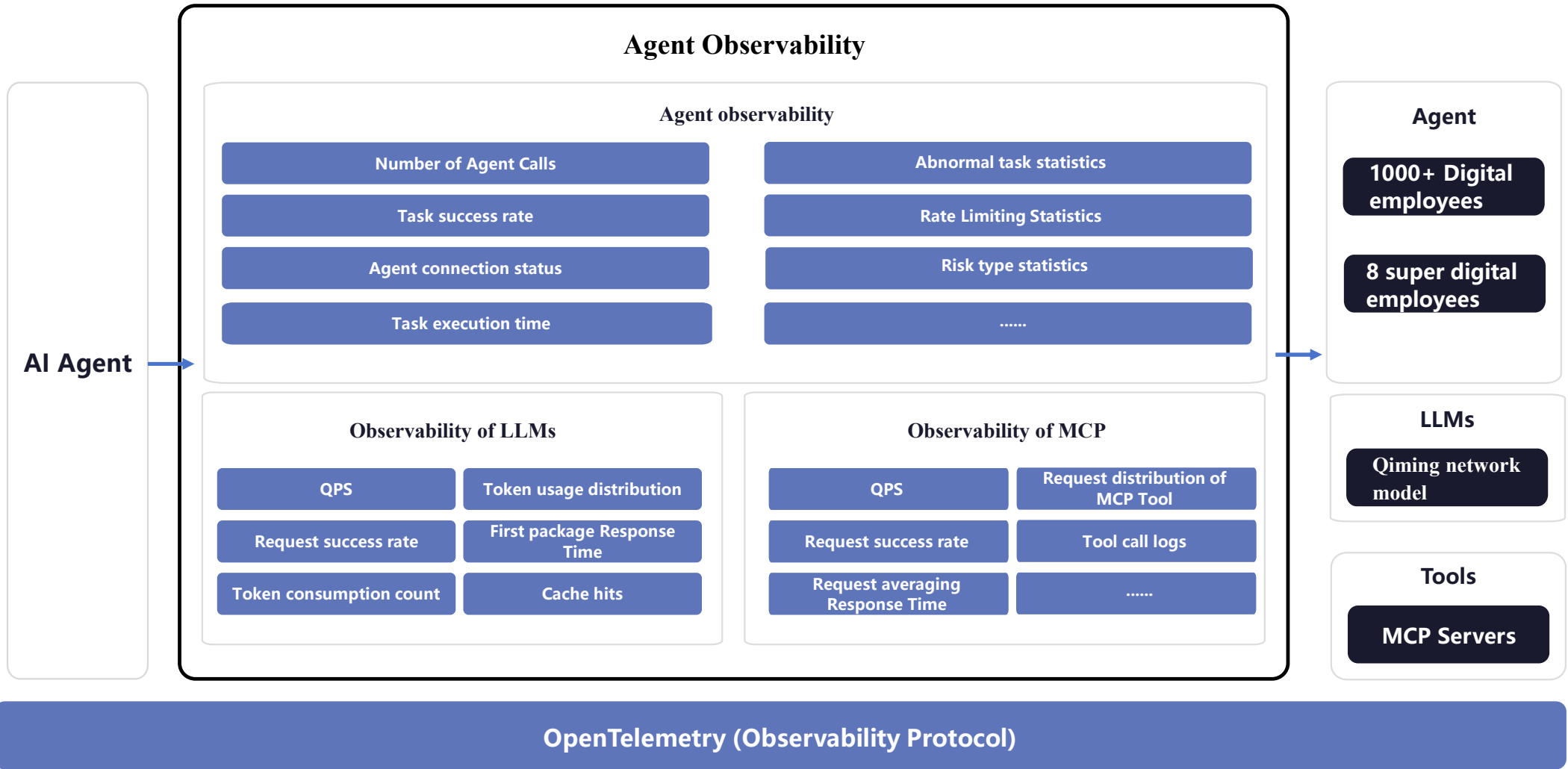
Unified naming and addressing

Sensitive content filtering



Agent Management &Ops+ Agent Communication

Key Technology 4: AgentOps—Observability



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Practice 1: Digital employee named as Xiaoqi



Based on the quantum + AI infrastructure, we are creating a new AI entrance for AI based cloud network operations, improve the efficiency of cloud network operations. Over 50 thousands of employees are using it in daily life.

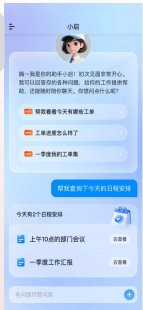
Smart Collaboration, Mobile Workflows, Easy Management



1 Personal AI Assistant + 1 Centralized Platform + N Portal for AI Copilot + X Integration of Ecosystem Applications

Redefining Personal Office Interaction

- Natural language integrated UI interaction
- Quantum encryption
- Mobile Office Integration
- AI Copilot for Work Ticket
- Knowledge Base
- Meeting minutes
- ...



Unified Coordination and Scheduling for Cross Operations

- Comprehensive scheduling
- Hazard Control & Management
- Trouble Shooting
- Perception enhancement
- Operations Support & Assurance
- Operation Changes
- Service activation
- ...



The Unified Portal for Copilot/Agents

- Customer service
- IT operations
- Comprehensive maintenance
- Emergency support
- In-sale control
- Monitor maintenance
- Network optimization
- ...



Accelerate Ecosystem App Migration

- Self-developed and applied in the province
- Professional company characteristic applications
- Ecological manufacturer application
- Internet AI applications
- ...



Quantum + AI infrastructure

Quantum

Qiming Large Model

Operational Assurance Framework

Unified Access Guidelines

Data Capability Platform

Business Capability Platform



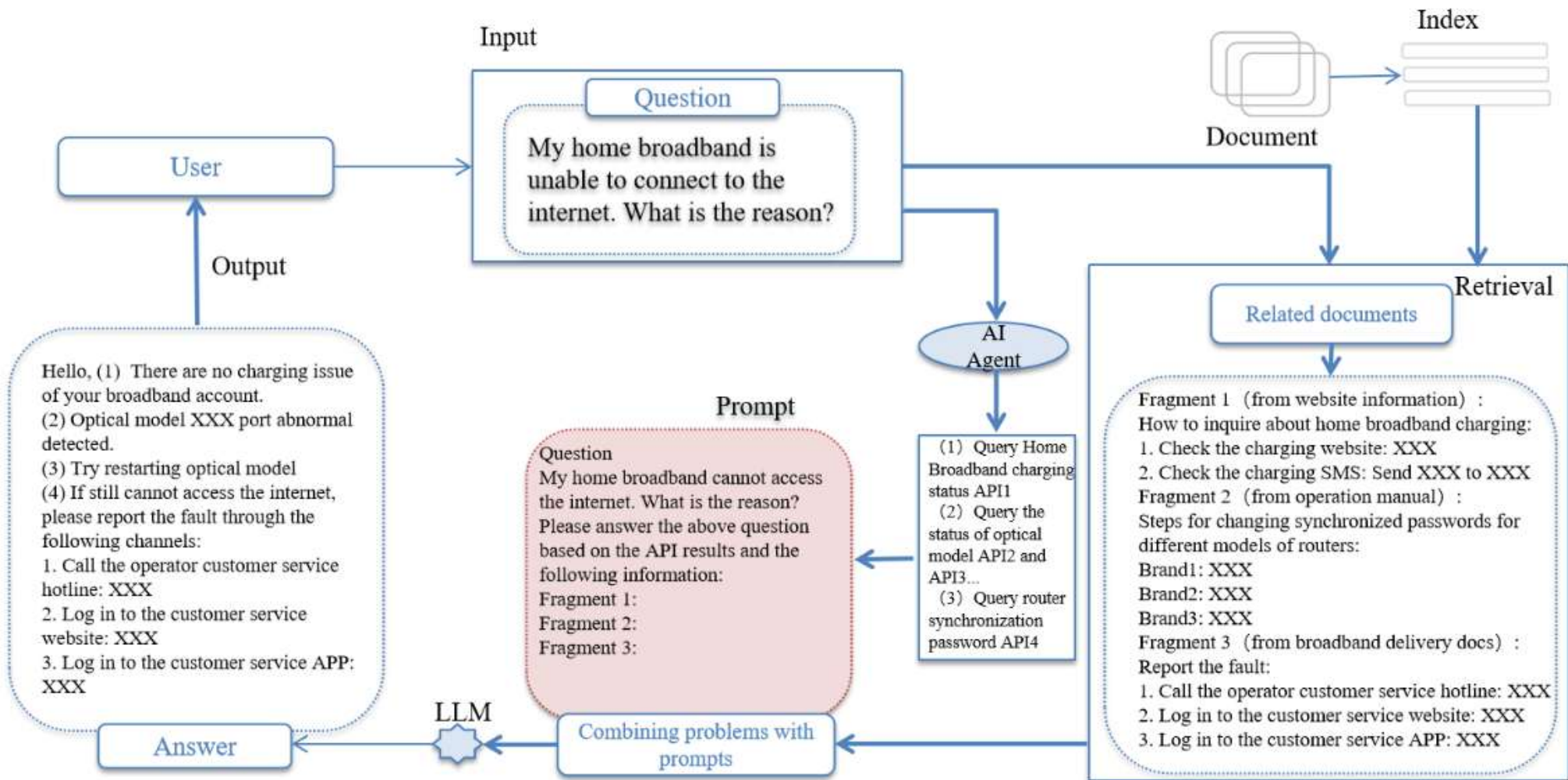
整合知识库中可访问的 153487 个文档
让AI搜索问答

您好！我是电信启明助手 小启，您的智能业务小帮手。
我可以解答装维、网优、天翼云、综维、制度等各类电信问题，还支持上传个人文档快速查询！

- 试试问我：
- 宽带故障怎么处理？
 - WiFi信号弱如何优化？



Practice 2: AI Agent for Home Broadband Self-service



Practice 2: Digital employees for Home Broadband Ops

Key points

1. Users are not familiar with the operation of the app, with deep menus, multiple steps, difficulty in accurately troubleshooting.
2. The process is fixed and can't to provide personalized troubleshooting solutions.

Traditional Self-Service APP



TASK COMPLETION

Siloed advice or knowledge-base chat

USER INTERACTION

Menu-driven interactions & rigid flows

PROCESS AUTOMATION

Static decision-tree logic

SELF-IMPROVEMENT

Static knowledge base

USER EXPERIENCE

Isolated session experiences

LLM-based AI Agent Leveraging Self-Service APP



API-driven, closed-loop problem detection & resolution

User-centric natural language understanding powered by LLM

Dynamic, real-time task planning based on user needs

Proactive self-improvement through user feedback & performance analysis

Personalized & continuous service with multi-user, cross-session context awareness

Efficiency

- 30% fault resolution efficiency improvement
- More Annual O&M cost savings

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Challenges and Considerations



- 1、 **Agent Communication Protocols:** Protocols for how agents share tasks, knowledge, messages, naming and addressing.
- 2、 **Observability :** Quality of agent, Logging, Tracing, Metrics, full life cycle management, multi-agent evaluation.
- 3、 **Security:** Data leakage risk, tool call abusing, prompt injection risk, compliance and auditing.

Thank you