

CMCC's view on developing AI integrated broadband networks

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Background

02

Trend and technologies

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Typical use cases

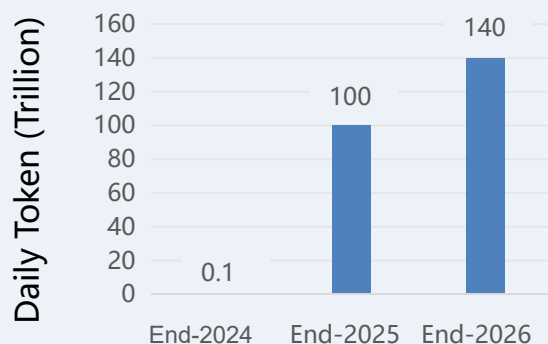
04

Conclusion

- ❑ Rapid growing of AI is driving the large-scale emergence of AI agents, AI terminals, and AI applications, pushing the broadband access evolution
- ❑ AI is reshaping network architectures, increasing traffic volumes and the upstream traffic

Token-Based Service Model

- Daily token consumption in China has reached **140 trillion**.
- Operators have launched **token-based service eco-systems**.

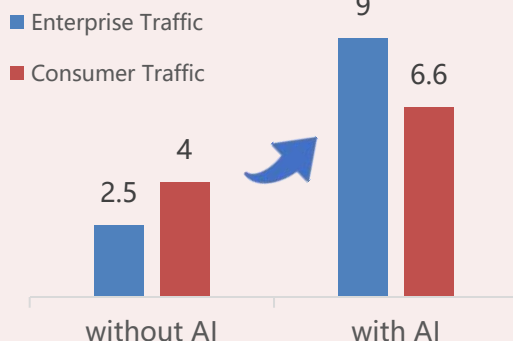


Source: China National Data Administration

AI-Driven Traffic Growth

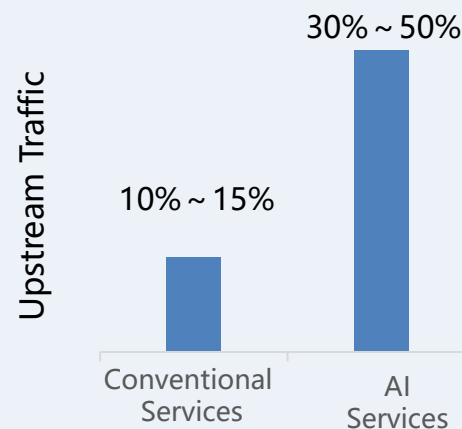
- By 2035, AI related traffic is expected to account for **25%** of total traffic.
- AI is expected **over 63% additional traffic growth**.

Traffic Growth Multiples by 2035



Significant Increase in Upstream Traffic

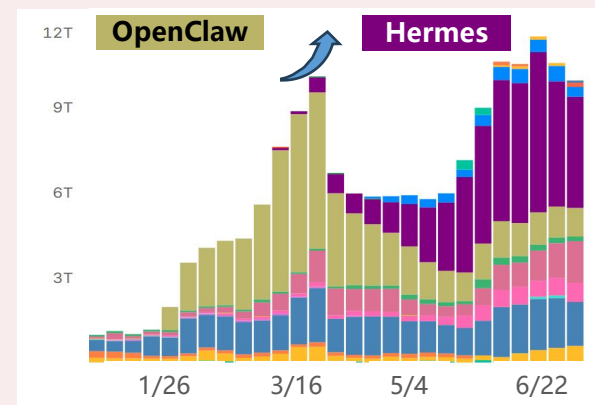
- For 9% of AI services, upstream traffic accounts for **over 50% of total traffic**.



Source: Cisco Report 2026: AI Impact on Wide Area Networks

Accelerating spreading of Industry AI Agents

- AI agents are rapidly gaining attraction as major token consumers, while industry agents are becoming the key productivity tools.

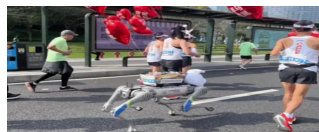


Source: OpenRouter

OANs Are Evolving Beyond Connectivity

Massive AI-agent interconnection and collaboration require optical access networks to deliver **both connectivity and beyond-connectivity capabilities**

Special Scenarios



Inspection (Chengdu, Shenzhen)



Emergency Response
(Fire, Earthquake)

**Highly Reliable Connectivity,
Remote Automated Control**

Commercial Scenarios

Show rooms, Guided Shopping, etc.



Product Introduction and Recommendation

Customer Reception and Service

**Reliable Connection, Seamless
Interaction, Zero Downtime**

Industrial Scenarios

Robots enabled autonomous material handling in factories.

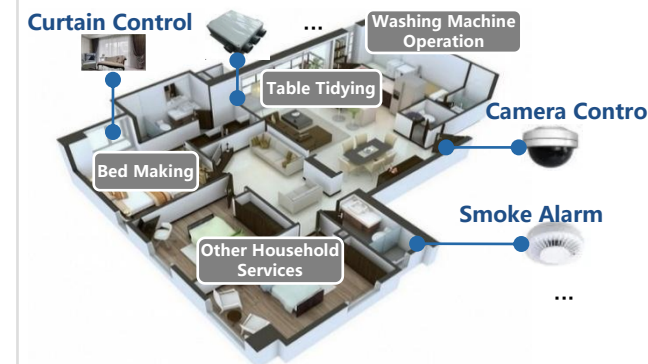


**Highly Reliable, Low-Latency
Connectivity for Autonomous
Operations**

Home Scenarios

Smart Home Control

Household Services



**Real-Time Training for In/Out-door
General-Purpose Tasks**

Connection Requirements

Multiple type Transmission

Traffic: 30–50% in upstream
Higher Bandwidth Demand

Ultra-Low Latency High Reliability

ToC: 10ms@99.99%
ToB: 1ms@99.9999%

Dynamic Networking

Dynamic P2P networking for Cross-Domain

Identity Management

Reliable, Controllable, and Traceable Operations

Additional Requirements

Computing Services

Device Side: 0.5–1 TFOPS
Edge Side: 100 TFLOPS

Data Services

Multidimensional Data
Secure Communication

In the AI era, OANs are evolving from connectivity pipes into a token-operation foundation, integrating transmission, computing, and supply for large-scale token services.

OANs are evolving beyond connectivity toward intelligent ISAC infrastructure

Upstream Transmission Assurance

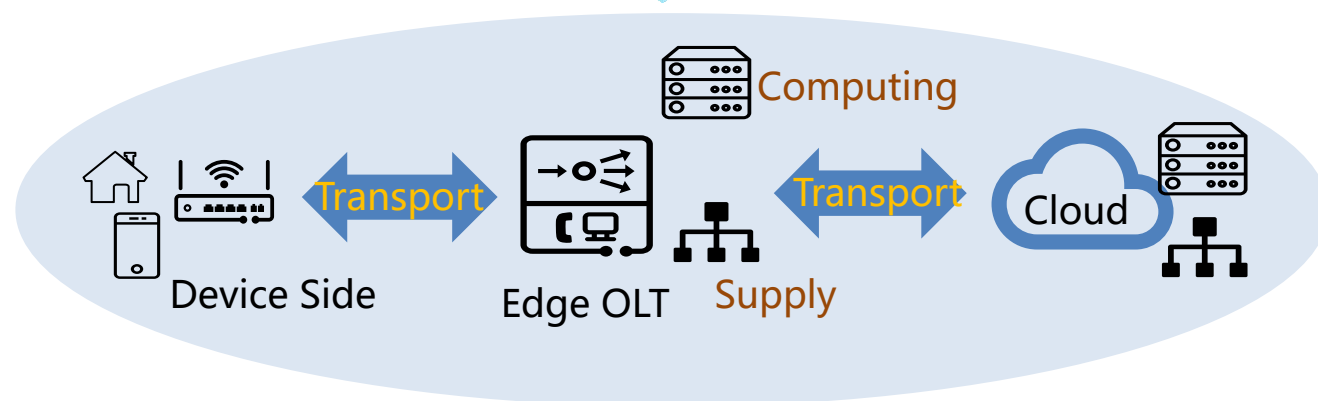
- Ensuring efficient Token transportation

Edge Intelligence

- Unlocking the value of device- and edge-computing

Enhanced Information Sensing

- Multi-scenario data provisioning



Delivery Token On-demand

- New connectivity, transmission, and networking

Process Tokens Efficiently

- Device-edge-cloud collaborative optimization

Supply Tokens Intelligently

- Continuous network, environment, and user data to enhance AI agents

A new ICT infrastructure is emerging with AI agents-based access entities, enabling intelligent discovery, interaction, and collaboration through unified protocols and interfaces.

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AI technologies and applications are developing rapidly, driving optical access networks to evolve toward AI integrated computing and communication networks, enabling efficient carrying of all-scenario AI services with intelligent collaboration

Connectivity

Traditional broadband access ->

AI-pervasive services

Connecting users -> hundreds of millions of users + massive AI agents

Transported content

Transporting Byte -> transporting Byte+Token

By 2035, AI inference traffic will account for 25%

Network requirements

AI service experience is more sensitive to packet loss and latency / jitter

Embedded AI becomes the key feature

New interconnection entities

- Traditional human-centric
- Agents spontaneously generate latent traffic
- Coexist for the long term



New collaboration mode

- Network systems evolve toward embedded agent
- Agent needs for data collection, semantic recognition, and task orchestration



New interaction type

- Traditional text- and graphics-based user interfaces
- Agent interaction features multimode user interfaces



New resource supply

- Access network equipment embeds computing capability, for intelligent services
- The device-edge-cloud collaborative architecture enables on-demand computing



AI bring in agent-centric access networks: embedded agents covering architecture, protocols, and equipment for autonomous evolution

New system architecture

- Network functions and services must be rebuilt based on AI agents, forming a new access network architecture
- New interaction protocols: inter-agent and agent-tools
- Clarify inter-agent collaboration mechanisms, makes networks become fully agentic

Open optical-network large models

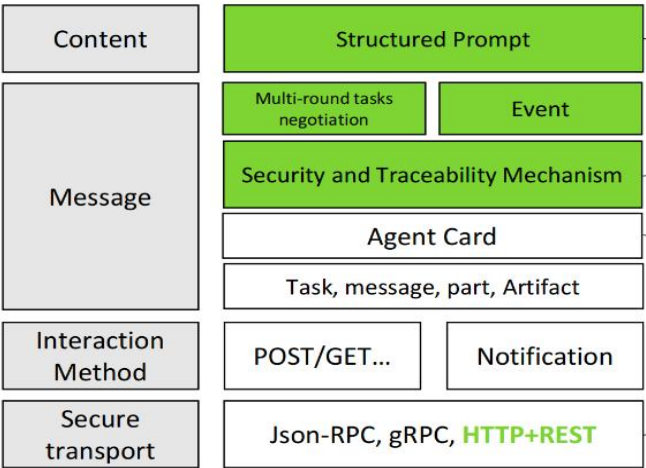
Open agent access mechanisms to the all-optical network

Open abstraction and invocation of network device capabilities

Oriented to cross-domain collaboration: A2A, MCP protocol opening

New agent communication protocols

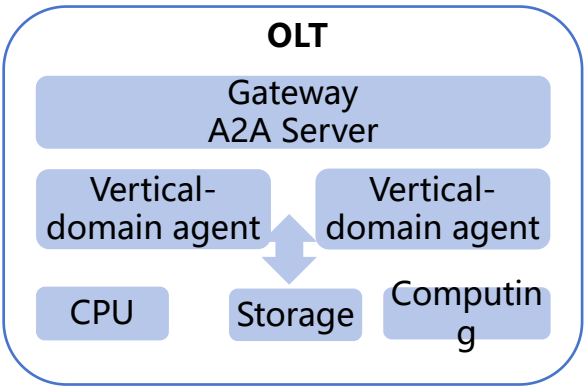
- Cloud-edge-device agent collaboration requires localizing the A2A, MCP protocols in P2MP optical-layer networks
- Computing-network resource abstraction presents a hybrid mode and structured description



A2A-T protocol stack

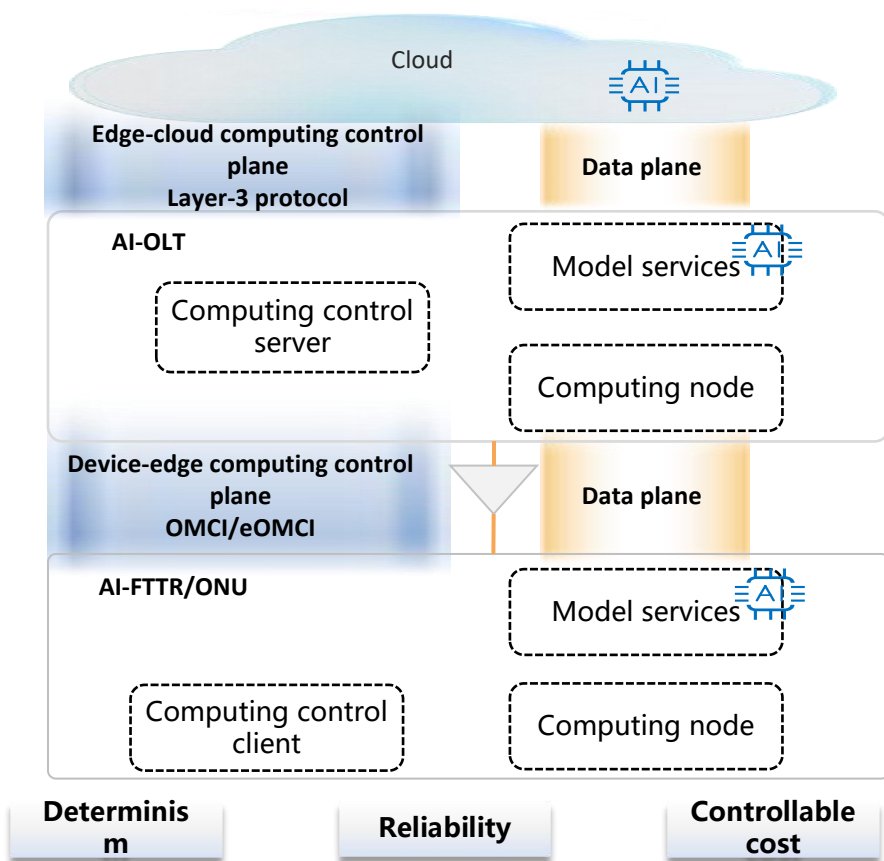
New software/hardware requirements

- OLT, FTTR equipment both embed agents
- OLT with enhance CPU/NPU and storage reach hundreds of TFLOPs computility, FTTR provides light computing capability
- Enhanced security control: identity authentication, encrypted communication, and attack-proofing

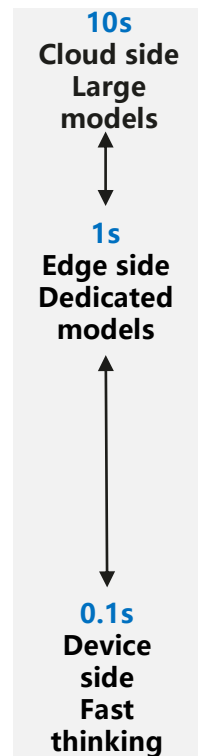


- ❑ Device-side AI experience demands make the edge to be the preferred scheduling point of the computing-power bus, enabling the low-cost, privacy-preserving computing
- ❑ Edge-device computing bus protocols can exploit the optical-layer for reduced cost and better deterministic, reliable processing; OMCI/eOMCI with extended MEs can meet these needs

Device-edge-cloud collaborative computing bus architecture



Closed-loop task experience



Computing bus

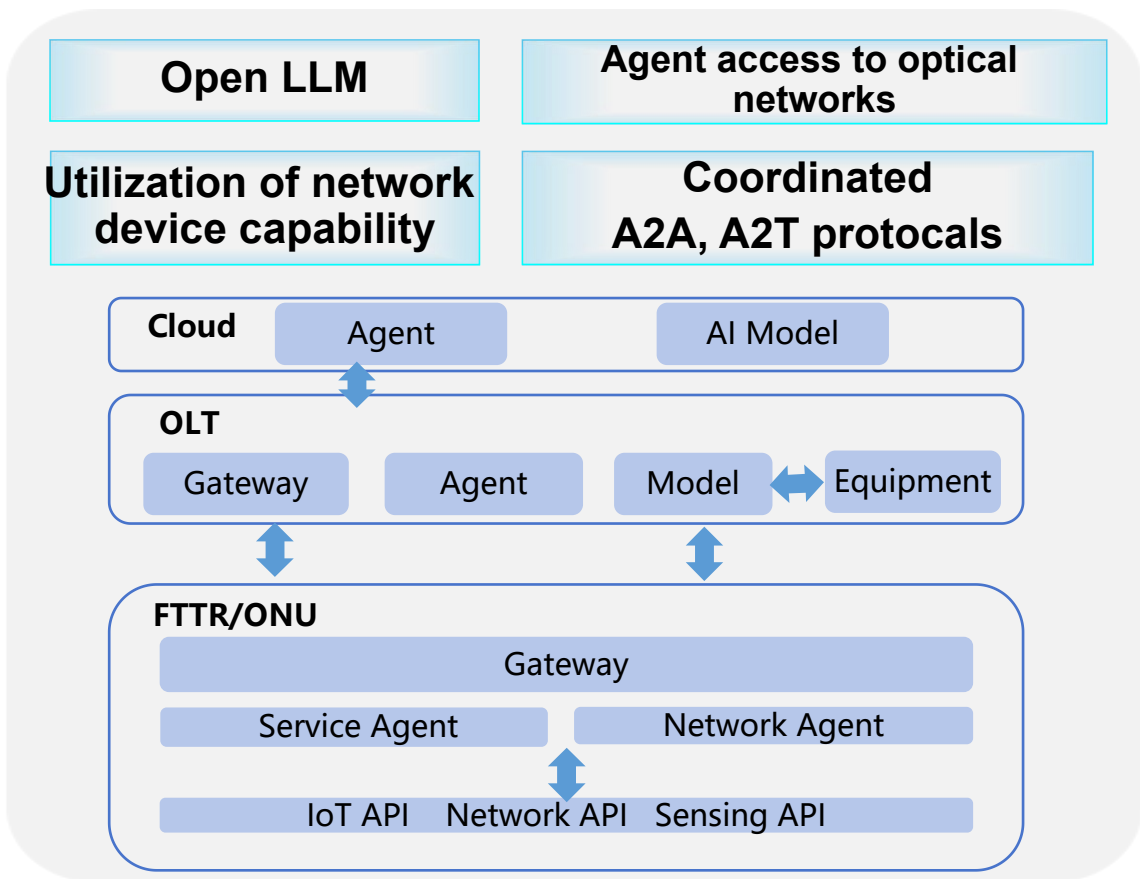
- **Device-edge collaboration:** the edge provides computing services to devices through the PON+FTTR collaborative architecture
- **Centralized management:** the computing bus adopts a centralized control architecture to guarantee end-to-end service processing latency

Computing bus protocols

- **OLT and FTTR/ONU: OMCI/eOMCI is one option for computing scheduling**
 - **Determinism:** control- and data-plane are isolated, keep intelligent computing services unaffected by other traffic, with bounded latency and response time
 - **Reliability:** protection switching ensures un-interrupted services and fast failure recovery
 - **Low cost:** quickly realized by adding a few MEs for computing requests and computing configuration, and computing release

AI applications are driving OAN evolution to agent embeded architecture, it is necessary to explore AI OAN development path from technical structure, protocol standards to equipment requirements

Structure of network with open AI



AI Agent communication protocols

- Cloud-edge-device collaboration:** apply A2A、MCP protocols in P2MP network “localization” , network resource should also support call of agents
- Enhance security control:** authentication, encryption communication, hack-defense...

A2A: Agent-to-Agent Protocol

Define universal rules between AI agents



MCP: Model Context Protocol

Support LLM access to database, API and user documents

MCP client

Claude Desktop

Tools, Resource request
.....

MCP server

Resend Supabase
Notion
Slack
Upstash

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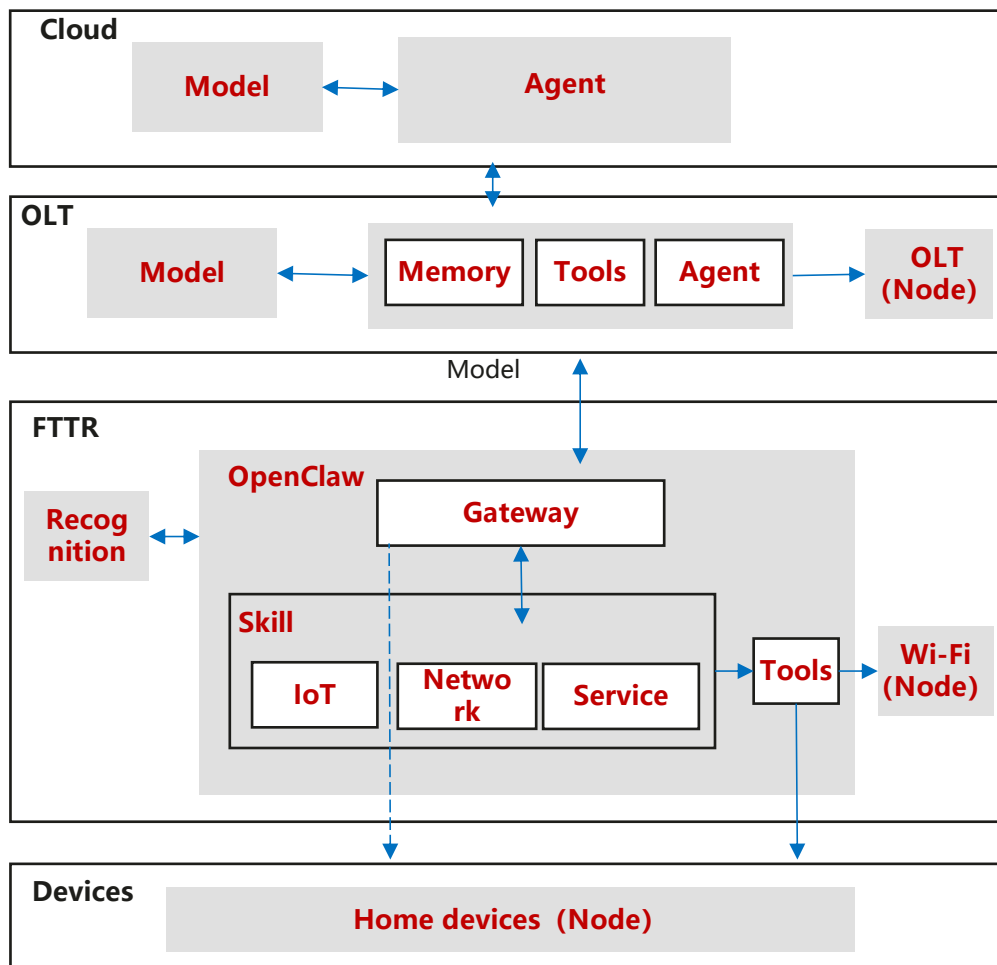
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Use Case 1: FTTR Claw+ AI OLT

Implement OpenClaw in devices to improve intelligent home experience, and improve security guarantee, collaborate with edge and cloud computing capability to support OpenClaw services



Combine AI to build intelligent home entrance

Transfer from "data" to "Token" business mode

Technical solutions

Cloud-edge-device collaboration:

- Based on computing bus to realize cooperation between agents and AI models

Equipment requirement:

- FTTR contains light computility, suitable for small-scale models, such as semantic recognition
- OLT with enhanced CPU/NPU and 100TFlops computility, support FTTR with LLM

Scenarios

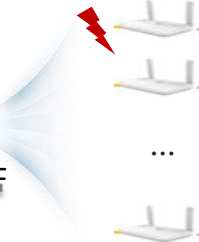
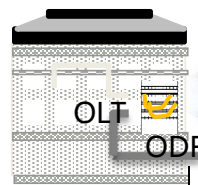
- IoT device control:**
On/off control of home devices
- Network control:**
FTTR connection、APP access time
- Experience guarantee based on user purpose**

Use Case 2: Embedded agent for auto-maintenance

Challenges for network maintenance

- ❑ Customer report based maintenance: long recovery time
- ❑ Million of equipment on field, consume lots of resources

Platform Line card

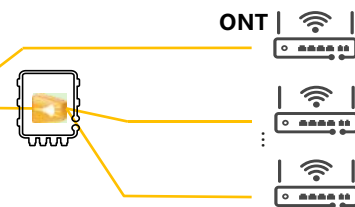
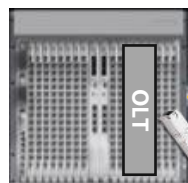


Optical modules

- ❑ Multifunction analysis based on human experience

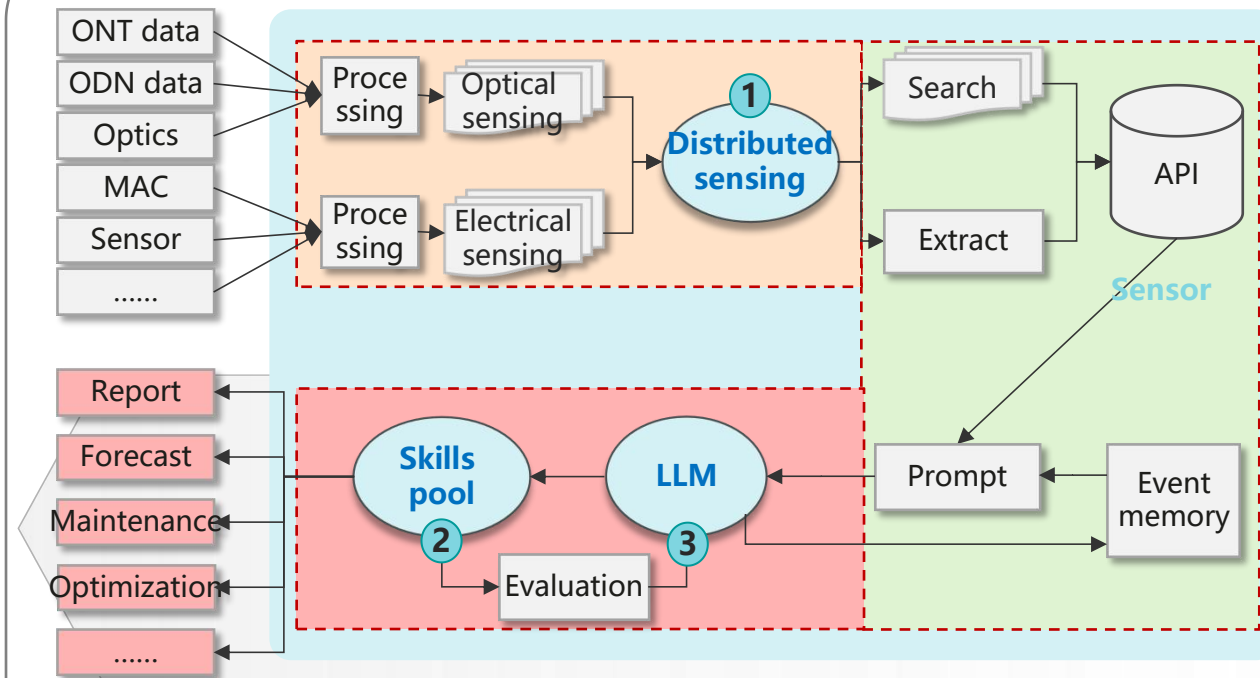


Feeder fiber or dropper fiber?



- Traditional sensor: lost detailed information
- limited resolution, lack of diagnose accuracy

AI Agent for maintenance



① Distributed sensor

- Device, Module, Link distributed sensing, full status control
- ms-level reaction sensor, for real-time diagnose

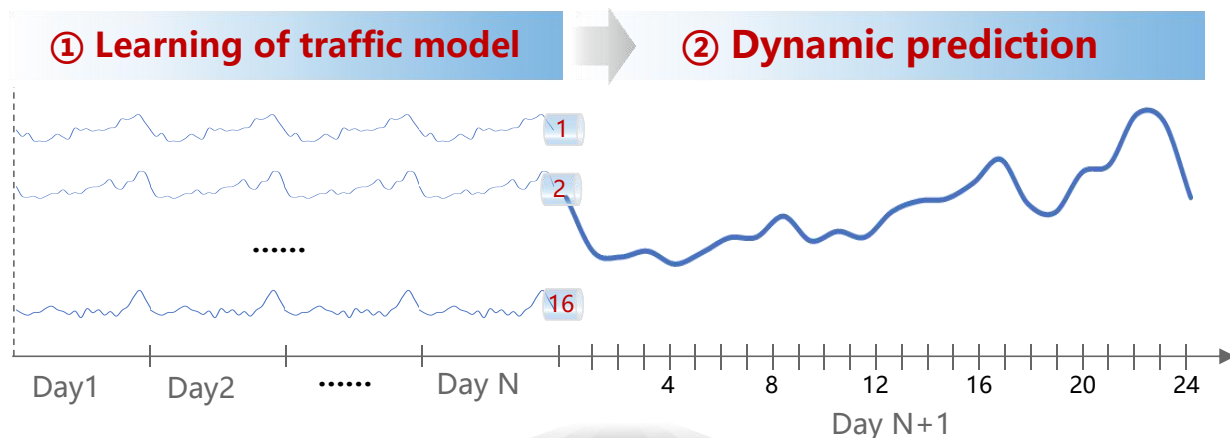
② Skills pool

- Agents for automatic network diagnose
- For complex scenarios, deep learning, realize comprehensive analysis and auto-optimization

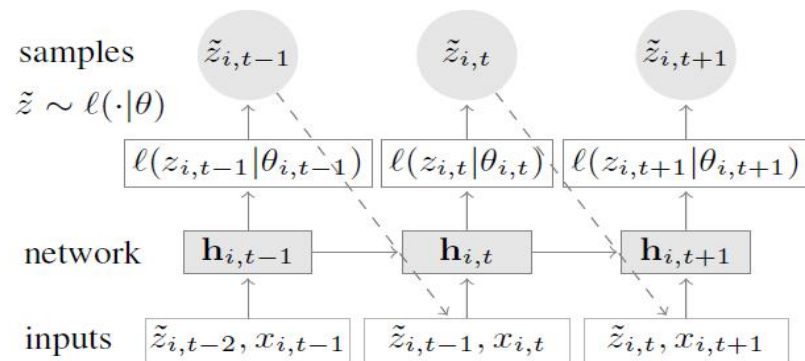
③ maintenance LLM

- Enhanced vertical LLM for better understanding and conducting tasks
- Connection between devices, data and skill for higher efficiency

Use Case 3: Dynamic energy saving

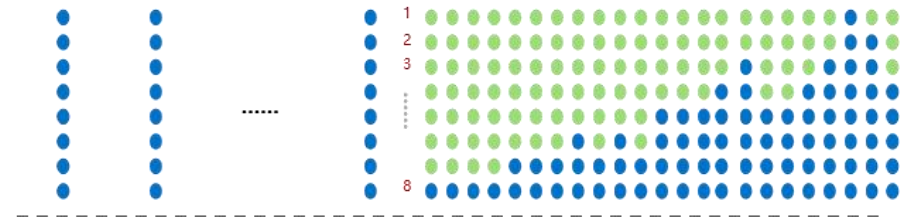


Prediction model: neural network



- Based on the existing historical data, together with other variables (e.g. quipment model) to accurately predict the future data traffic

Solution1: Dynamically control SerDes on and off



- Improve the reliability of interfaces, to realize fast disconnect and reconnect

Solution2: Dynamically switch the working channels



- Coordination between management software and the equipment, to realize the dynamic channel switch
- Could be further considered in G.sup.PONcoop

- **AI technologies and applications are developing rapidly, driving optical access networks to evolve toward AI integrated computing and communication networks, enabling efficient carrying of all-scenario AI services with intelligent collaboration**
- **For the edge-device computing bus protocols, we can consider the optical-layer OAM for reduced cost and better deterministic, reliable processing**
- **AI applications are driving OAN evolution towards agent embeded architecture, it is necessary to explore an AI OAN development path from technical structure, protocol standards to equipment requirements**

Thank you!