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AI Application Practices in Access and Home Networks

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Review of Key use case of G.sup.aiBB draft

Cat	ID	Scenario Name	Compute
AI for Broadband Network	S1	AI-Driven Energy Saving	Lightweight ML
	S2	AI-Enhanced DBA	Low-complexity per T-CONT
	S3	Intelligent O&M Automation	Hundreds of TOPS
	S4	In-Band ODN Monitoring	Moderate complexity
	S5	AI-Enhanced Equalization	Real-time DSP integrated
Broadband Network for AI	S6	Elastic Intelligent Networks	-
	S7	End-Edge-Cloud Computing Bus	-
AI and Broadband Network	S8	2D-to-3D Video Conversion	240-600 TFLOPs total
	S9	AppFlow Service	≥4 TFLOPs

Typical Requirements

OLT:

- 1- Computing/storage enhance with Intelligent service boards : multi-dimensional data analyse (traffic, BER, jitter, temperature, optical module power, ODN sensing)
- 2- Specific target AI fuction(AI DBA\AI Enhanced Equalization etc.)
- 3- Services providing with AI assistant(2D/3D video streams)

ONU/FTTR:

Computing/storage embeded, providing AI enabled services, for example,2D/3D video streams, sensing(WLAN), power saving

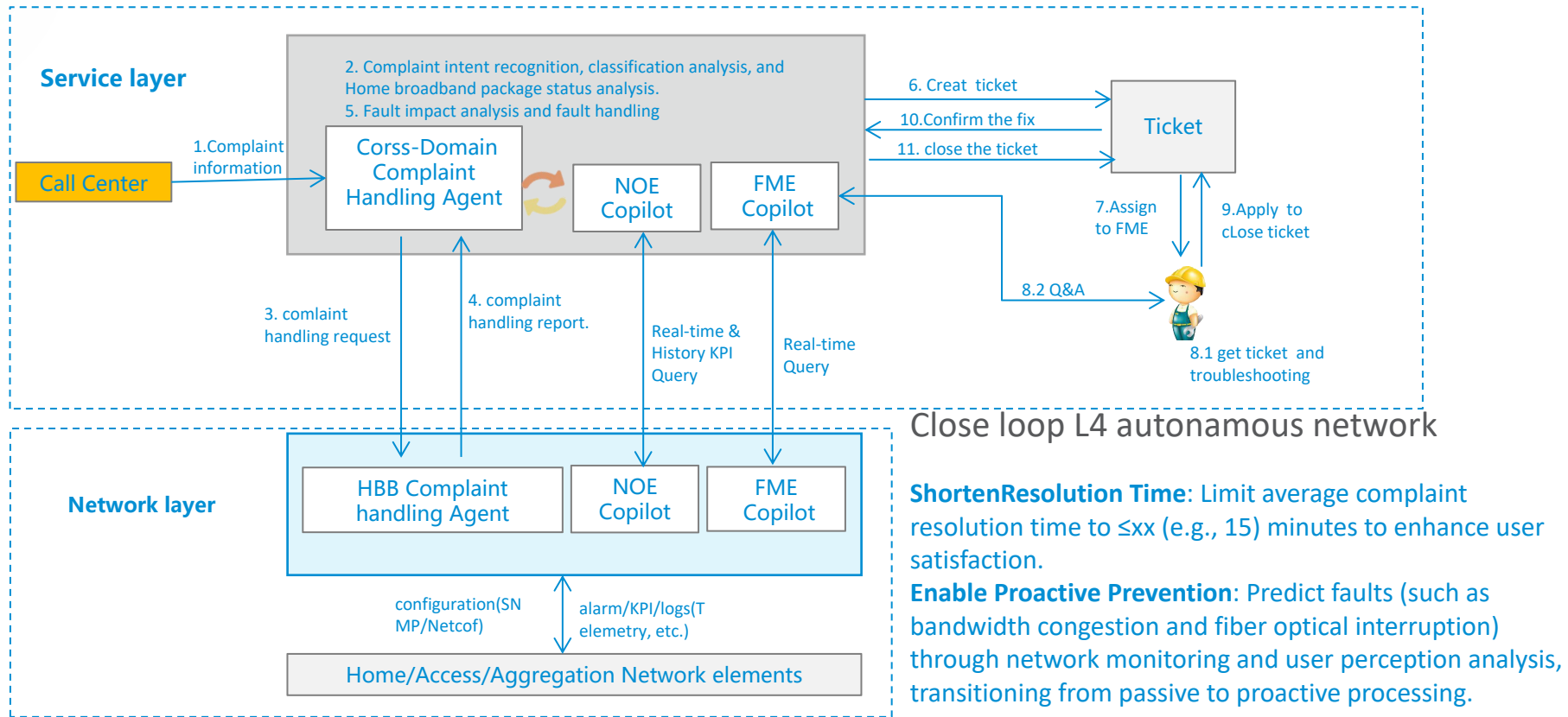
Coordination when distributing AI deployment:

- 1- AI offloading among network elements/device with compute power.
- 2- Elastic intelligent network provide establish dedicated forwarding channel for AI services

Intelligent O&M:

providing Antomous network managment/control, proactive fault prevent and performace degrade

AI for Network - Complaint handling



AI for Network - Optical module health prediction/Rogue ONU

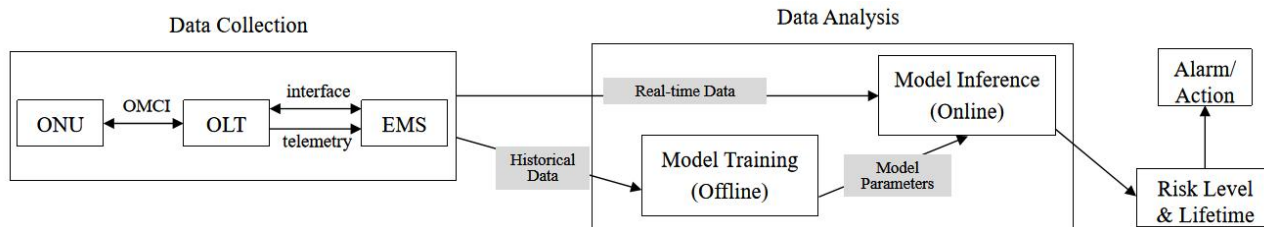
AI Assistance Optical module health prediction

1. Offline-trained

based on XGBoost model

2. Running on OLT compute board(Trail), **precision~83%**

3. The training dataset will improve continuously and the precision will be improve either

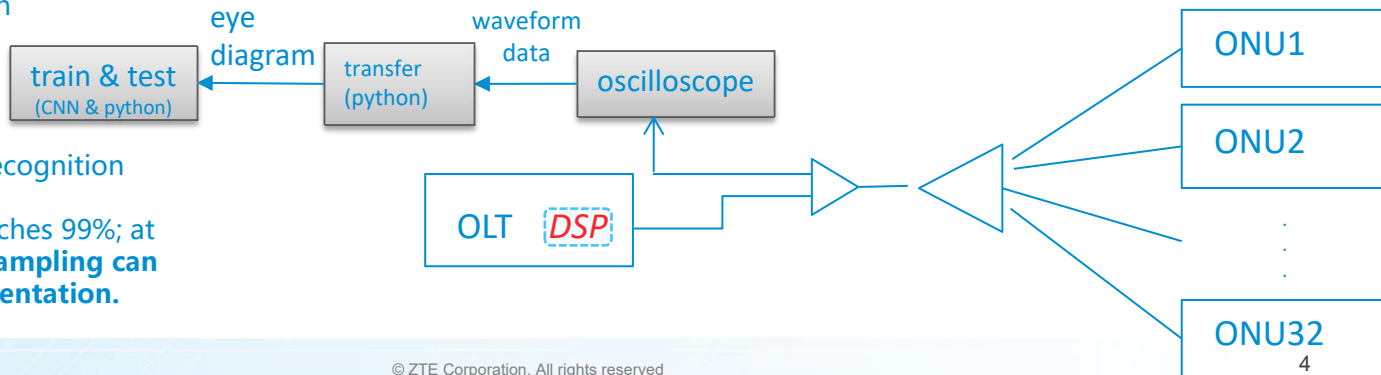


AI Rogue ONU: Eye diagram based Identification

1, The signal could be identify when an ONU signal is **interfered with and by whom**.

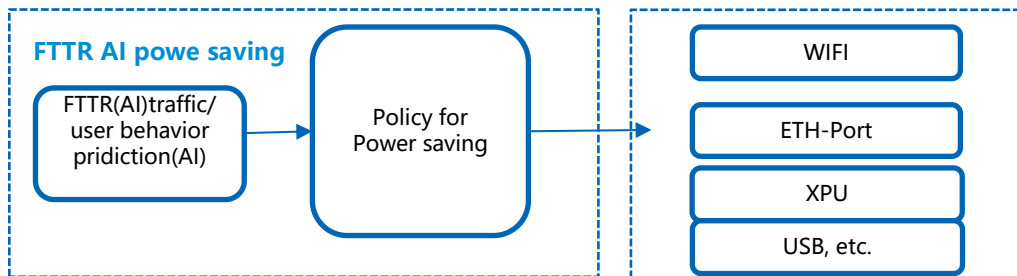
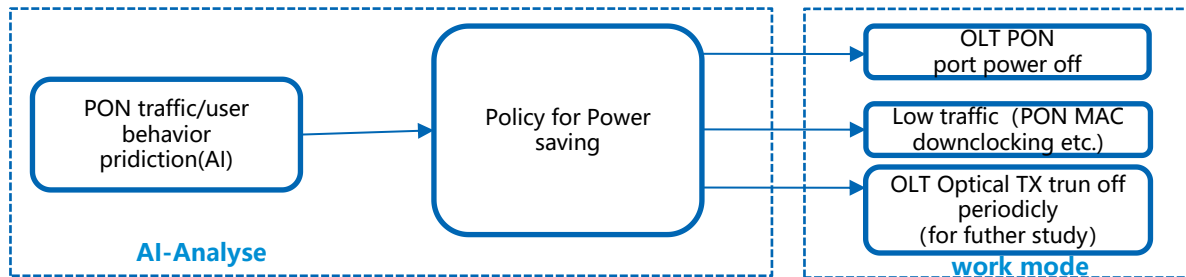
2, Model needs to be **continuously updated** to ensure recognition accuracy

3, At 4x sampling rate, precision reaches 99%; at 1x sampling rate: reaches 92%; **1x sampling can use the OLT's built-in DSP implementation**.



AI for Network: Power saving

- OLT adjusts the model based on user data and behavior, such as the tidal effect of user data
- OLT built-in computing power, generate power saving policy according AI analyse



Mechnism	Power saved
CPU: downclocking, 8 Core-> 2 core. WiFi: 4T4R -> 1T1R, TX power reduce (For example:70%). LAN : 2.5G->GE, 4GE->4×100M USB: swtich off	for example: about 1.8w

Solution:

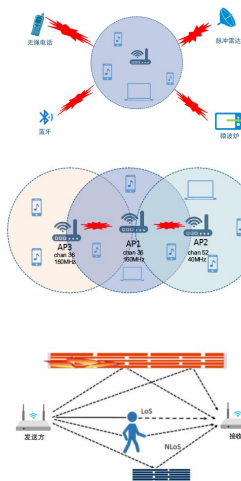
- Identification low traffic time and prediction traffic according to time
- Generating power saving policy

AI interference mitigation+channel optimization of WLAN

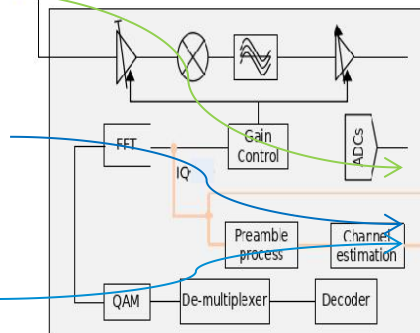
Intelligently identify and avoid interference to ensure stable connectivity

Problem:

- 1: **Coexistence interference** from non-Wi-Fi signals such as Bluetooth and radar
- 2: In commercial environments, Wi-Fi **interference sources are dynamic and variable**, static network parameters hard to adapt to time-varying interference.
- 3: **Signal obstruction** due to human movement



Solution: AI-assisted interference identification, channel state identification; generate optimization solutions to ensure stable connection

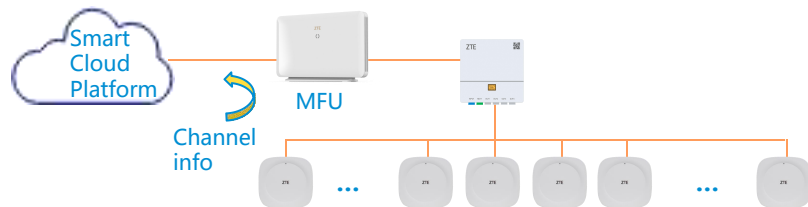


Identification of inference type(bluetooth\ Radar, etc)

Channel status- interference identification

Generating solution: Channel switch/Tx power/etc.

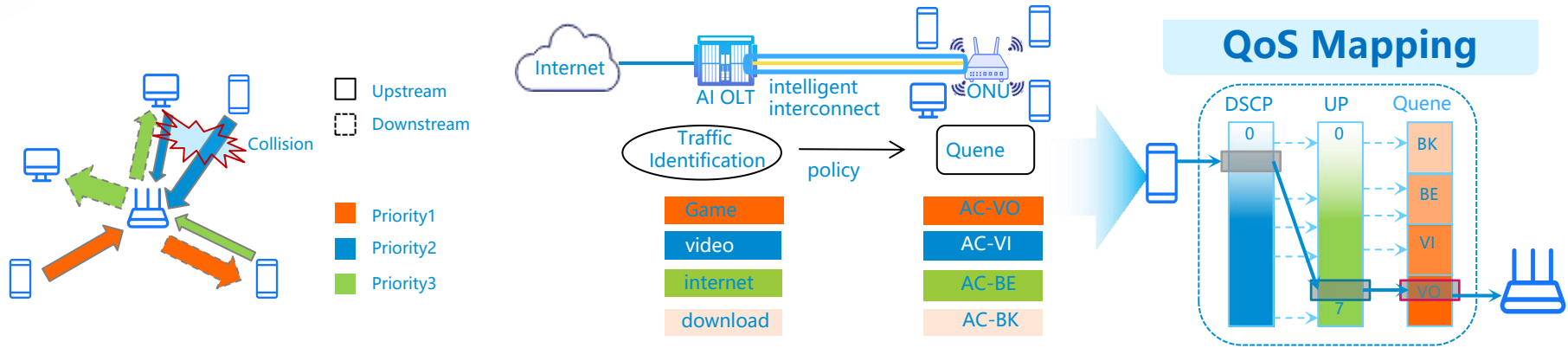
Intelligently channels and TX power adjujtion to maximize network throughput



Problem: Co-channel Interference etc.

Solution: One key optimization, Optimize channel, power, bandwidth, and other parameters collaboratively with the goal of maximizing the overall network throughput.

AI OLT: Intelligent traffic identification, Guarantee high priority service



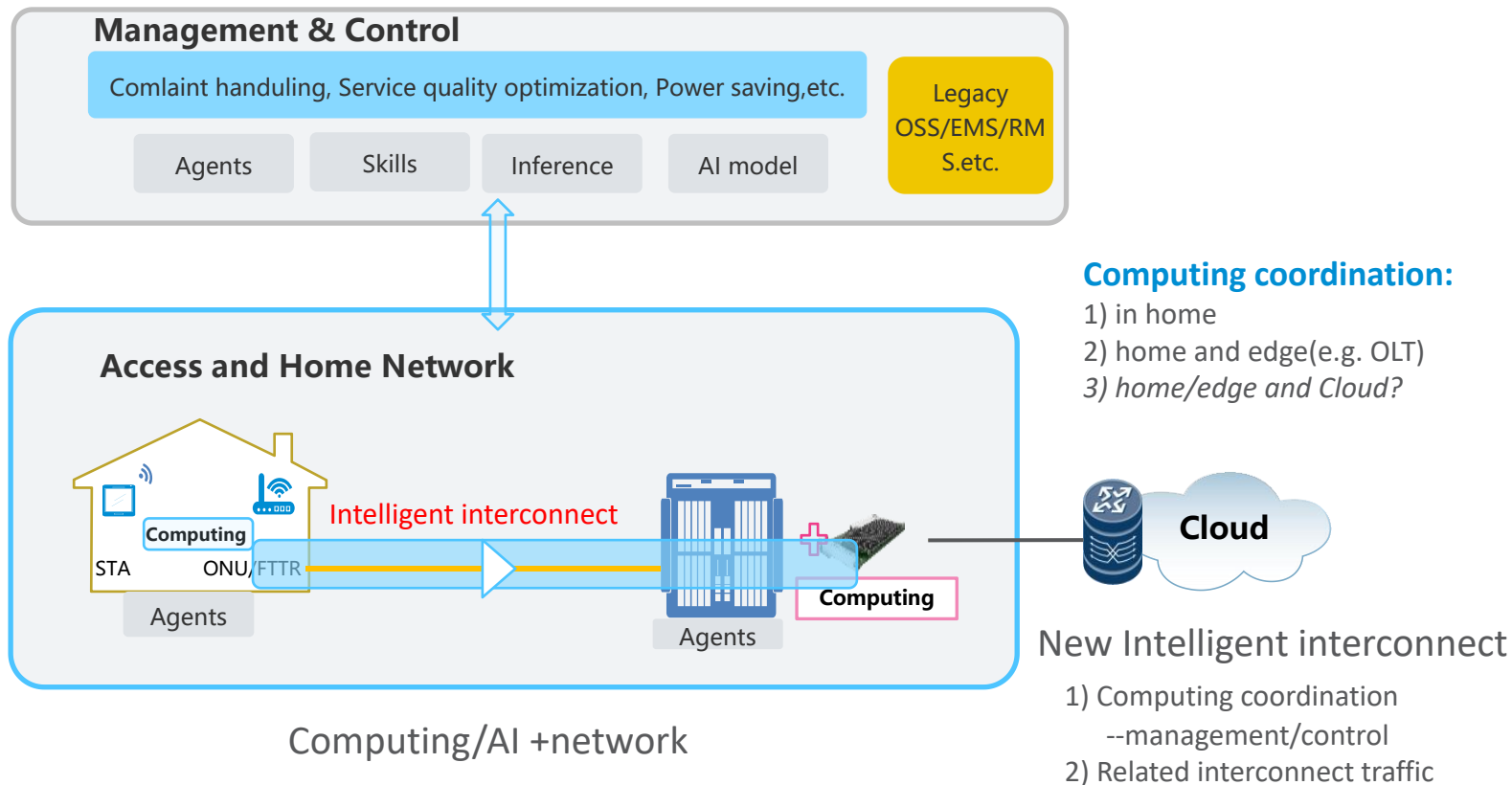
Problems:

- **Traffic congestion**
Channel access collision introduce latency or package loss.
- **QoS guarantee**
The QoS traffic is not identified.

Solution with AI assistance:

- **AI OLT** identified traffic type and network condition, generating scheduling policy according analyse traffic requirments
- **Policy: OLT:** Mapping the Queue and traffic in downstream, **STA:** modify or add DSCP, and mapping traffic to upstream Queue accordingly.
- **Improvement:** Guarantee high priority service without hardware upgrade of ONU/RG.

Architecture Agentic Access and Home Network



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THANK YOU

