AI for Network - Practice in iBNG

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iBNG: BNG with Intelligence Provided by AI

A broadband network transforms from an entertainment center to a diversified center

Home broadband
Enterprise broadband
Internet private line

Video conferencing

Cloud game

Spatial video

Stereoscopic video

Image/Text-to-image

Image/Video-to-video

DREAMIX

File download

Web browsing

Intelligent awareness and differentiated assurance are the basis

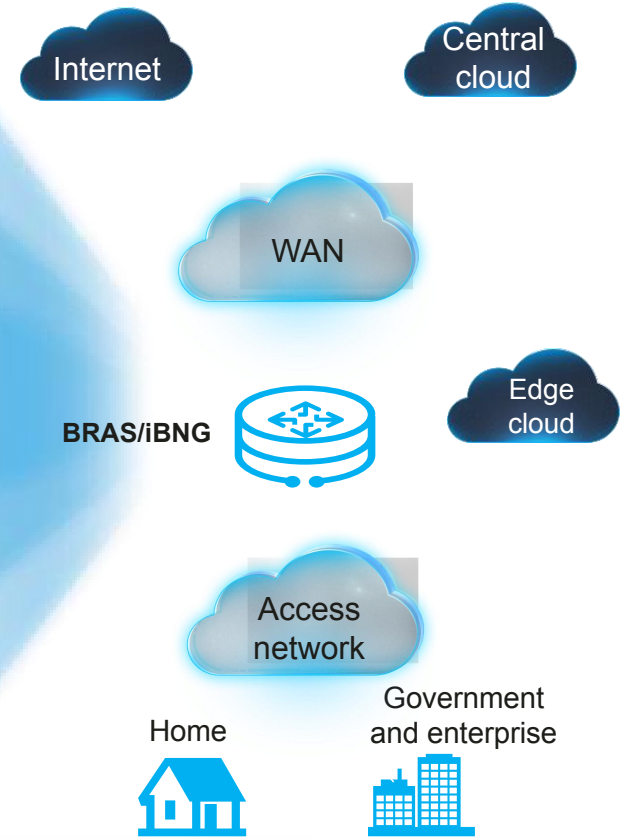
Strong-interaction services
Low traffic rate, sensitive to delay/jitter
Education, office, gaming

Big video services
High traffic rate, large burst, sensitive to packet loss
4K/8K, AR/VR, 360-degree view

Intelligent computing services
High throughput, high flexibility, servitization
Natural language, machine vision, generative AI

Common broadband services
Unordered services, insensitive to network KPIs
Internet access, download, OTT video

A BNG is the key anchor point for intelligent service development

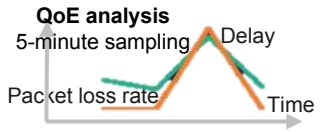


iBNG: Backed by the edge cloud, a BNG is connected to users in the downstream direction and to the Internet in the upstream direction. The intelligent evolution of the BNG directly affects the development of intelligent network services.

Key Technique 1: User Service Quality Tracing Management

Identification: poor-QoE applications/users (accuracy: 90%+)

1. Identify whether applications are poor-QoE ones.



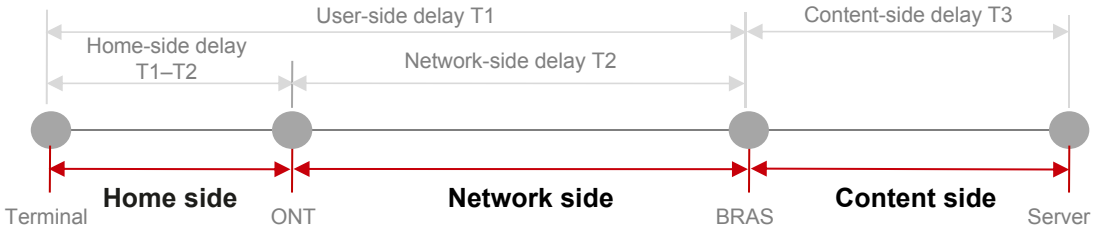
Application 1: poor-QoE or not
Application 2: poor-QoE or not
...
Application n: poor-QoE or not

2. Determine whether users are poor-QoE ones.

- ✓ The proportion of poor-QoE applications in a day is greater than 10%.
- ✓ If the number of poor-QoE days in a week for a user is greater than 4, the user is a heavy poor-QoE user.

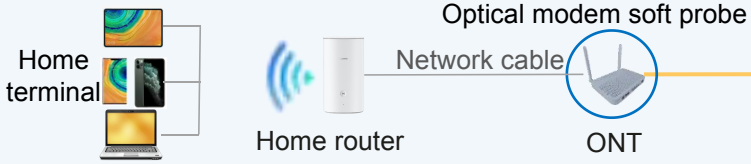
Demarcation: poor QoE

- Measure the **TCP pipe-level delay** of each user every 5 minutes and perform segment-based demarcation based on the **proportion of the number of exceptions**.

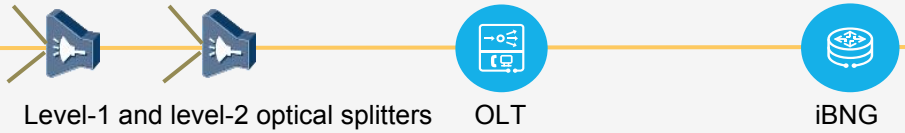


Location: root cause of poor QoE

Poor-QoE home locating



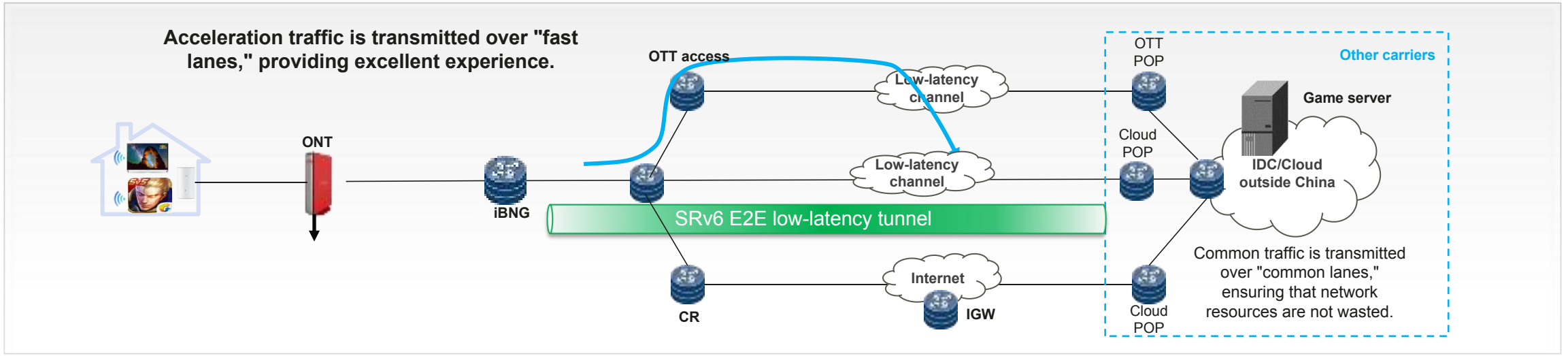
Poor-QoE ODN and NE locating



Poor-QoE content locating

Key Technique 2: Intelligent Service Identification and Acceleration

- The iBNG's application identification technology inherits 5-tuple identification and further analyzes the signatures of Layer 4 to Layer 7 protocols carried in data packets.
- Based on application identification, the iBNG uses multiple technologies — such as application tag and application path selection — to accelerate applications, achieving deterministic user and application experience and improving home broadband users' satisfaction.



Signatures of Layer 4 to Layer 7 protocols

Traffic behavior analysis

Fingerprint identification of encrypted applications

Asymmetric traffic protocol identification

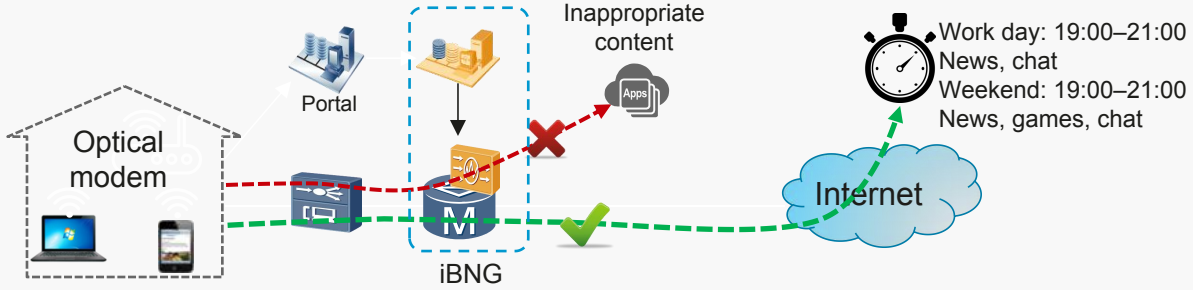
Key Technique 3: Security Protection

Three Aspects of Security Protection:

- Provide the parental control service to filter pornography- and violence-related websites.
- Defend against DDoS attacks.
- Prevent malicious viruses and software.

Security protection solution

Protection solution



The iBNG controls access to websites and applications. All home terminals can be controlled.

- **Comprehensive protection:** The URL category database covers categories of harmful websites and supports continuous update.
- **Remote strong control:** The performance of home routers and terminals is not affected, and uninstallation, bypassing, and cracking cannot be performed.
- **Easy operation:** Users can customize Internet access policies (through apps/portals) at any time.
- **Flexible policies:** Users can flexibly customize Internet access policies based on website categories and time ranges.

Security protection Example

Help parents prevent children's access to pornography- and violence-related websites. Assist parents in limiting children's online duration and network applications, providing guidance for children to utilize the network properly.

- Pornography
- illegality
- Violence

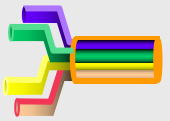
- News
- Reading
- Entertainment

(Time + parental control)

Work day: 19:00–21:00
News

Work day: 19:00–21:00
Games, chat

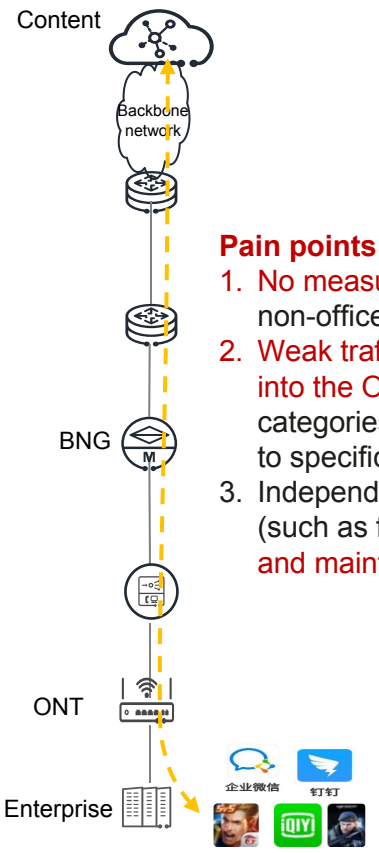
Weekend: 19:00–21:00
News, games, chat



(Time + parental control)

Value-added Service: High-Quality Office Private Line

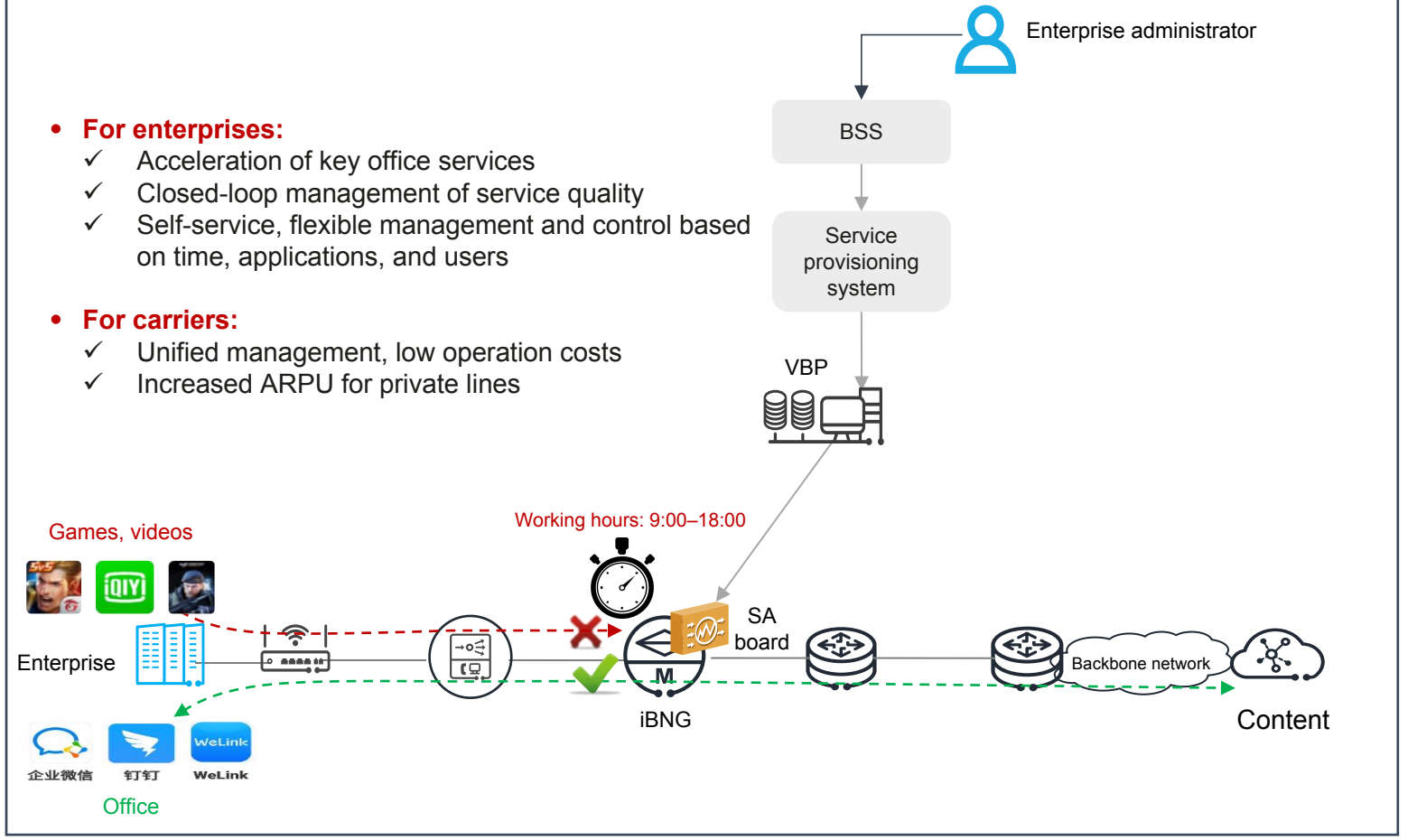
Before
Internet private line



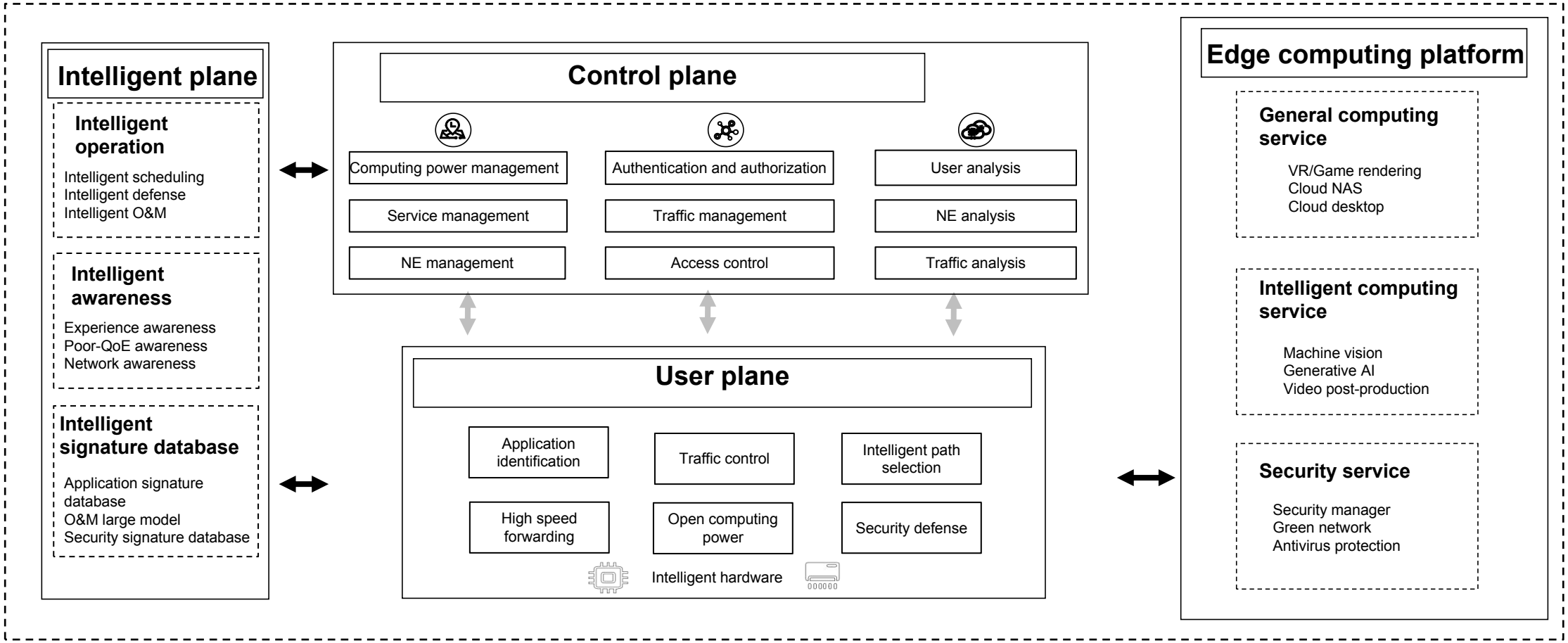
Pain points of SME private lines:

1. No measures for limiting traffic of non-office applications
2. Weak traffic identification integrated into the ONT, low accuracy, fewer categories, inability to be accurate to specific applications
3. Independent flow control devices (such as firewalls), high purchase and maintenance costs

- **For enterprises:**
  - ✓ Acceleration of key office services
  - ✓ Closed-loop management of service quality
  - ✓ Self-service, flexible management and control based on time, applications, and users
- **For carriers:**
  - ✓ Unified management, low operation costs
  - ✓ Increased ARPU for private lines



iBNG "three planes+one platform" architecture

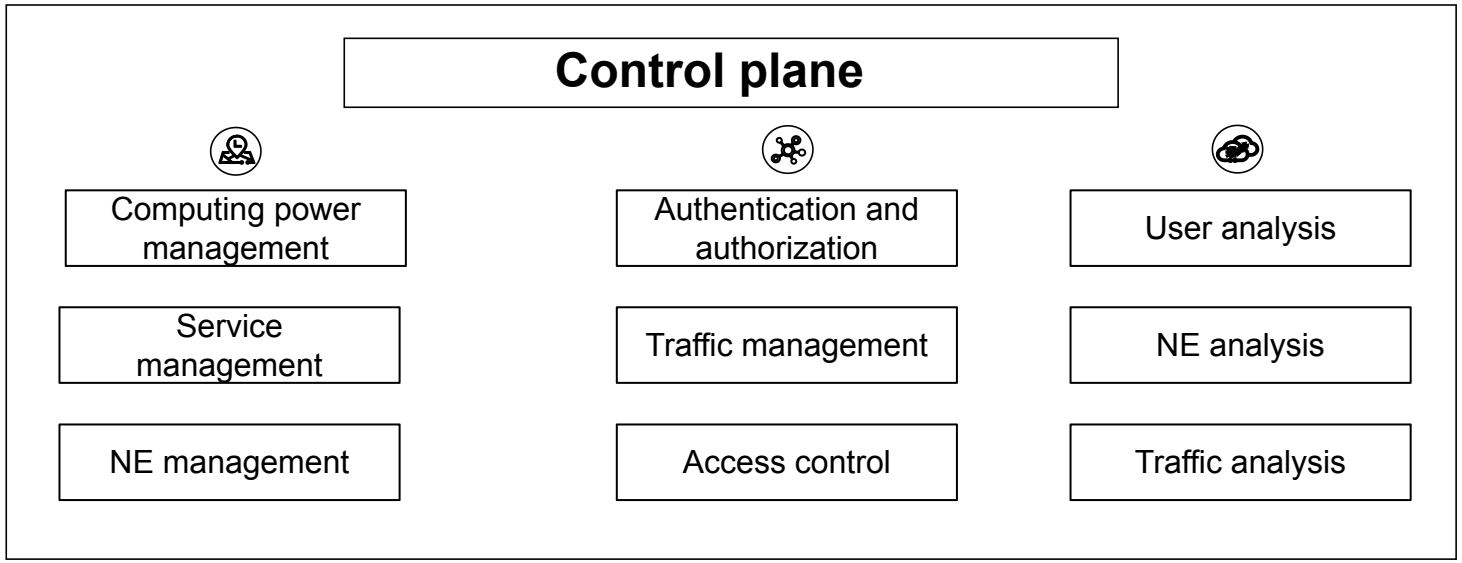


- **Intelligent identification and scheduling technology:** intelligent application identification and route selection, attack identification and defense, and differentiated network SLA assurance.
- **Computing first network recommendation and transport technology:** intelligent recommendation of computing power, elastic transport of AI services, and differentiated computing services.
- **Quality analysis and assurance technology:** AI-based intelligent O&M, closed-loop management of user quality and network quality, and stable and reliable network running.

iBNG - Intelligent Plane

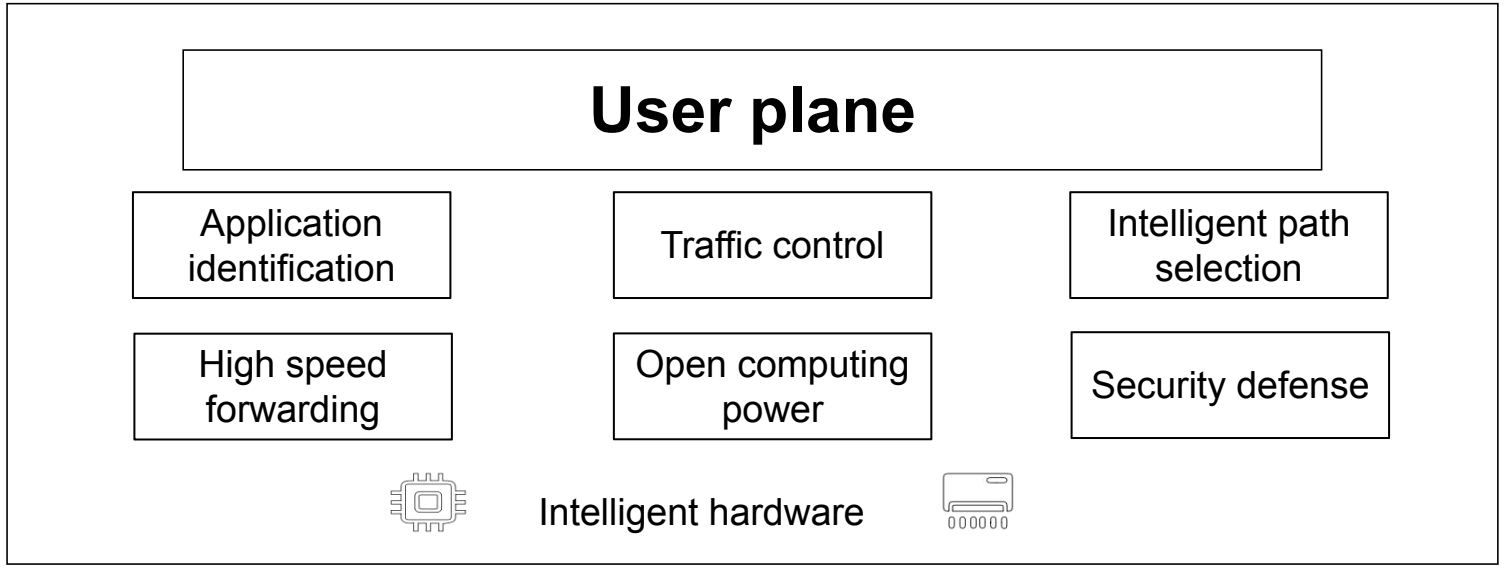
- **Intelligent operation**
  - Intelligent scheduling: implement collaboration between edge computing power and central computing power, ensuring balanced scheduling of computing resources.
  - Intelligent defense: enables intelligent defense, dynamically delivers network defense policies
  - intelligent O&M: closed-loop management of user quality and network quality analysis
- **Intelligent awareness**
  - Application experience analysis based on large data models and AI training and inference capabilities
  - Poor-QoE analysis based on operation data
  - Closed-loop network quality improvement based on automatic E2E closed-loop mechanism
- **Intelligent signature database**
  - AI knowledge center of iBNG
  - Multiple knowledge databases: guide intelligent awareness and intelligent operation

iBNG - Control Plane



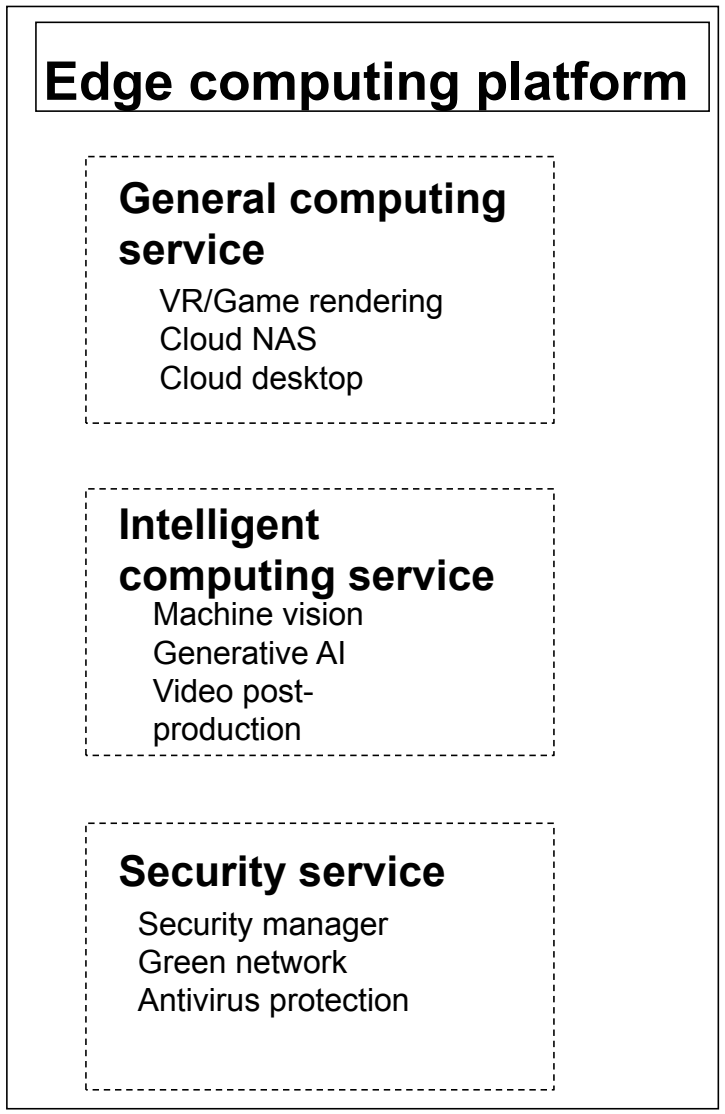
- **NE management**
  - Traditional management capabilities: device configurations, alarms, performance, links, and QoS
  - Automated E2E service provisioning capabilities for traditional networks
- **Access control**
  - Functions related to access control: access control, user management, AAA, address management, UP management, traffic management, and forwarding policy management for iBNG access users
- **NE analysis**
  - Analysis function: real-time data collection, status perception, in-depth analysis, and intelligent prediction capabilities for NE traffic and performance
  - proactively identifies faults on NEs and potential risks and proactively generates alarms

iBNG - User Plane



- **Application identification**
  - obtaining better service experience and ensuring differentiated SLA transport of user applications
- **Intelligent scheduling**
  - Based on application identification results and differentiated SLA transport requirements, the iBNG user plane uses technologies such as G-SRv6 and slicing to select paths for applications
- **Traffic control**
  - AI used to provide flexible traffic control capabilities, mark application traffic and carry application tags to downstream devices, or limit the rate and limit connections of applications
- **Security defense**
  - analyzes threat traffic in real time, reports the traffic to the security knowledge database, and executes security defense policies delivered by the management and control system in real time

iBNG - Edge Computing Platform



The iBNG computing platform can be deployed independently on the edge cloud or integrated with the iBNG to provide edge computing services for iBNG access users

- **General computing service**
  - storage and computing power: VR/game rendering, cloud NAS, and cloud desktop
- **Intelligent computing service**
  - various intelligent computing services: machine vision, generative AI, and video post-production
- **Security service**
  - various security functions: security manager, green network, and antivirus protection
  - Users do not need to purchase security devices separately

Summary and Future Work

- Potential Related Area
  - OPS Area, Art Area
- Protocol extension and Interface Definition
- Laboratory test and large scale pilot deployment

Thank you!