Broadband Quality of Service -- China case study

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2015-10-28

Outline

1 QoS fundamentals

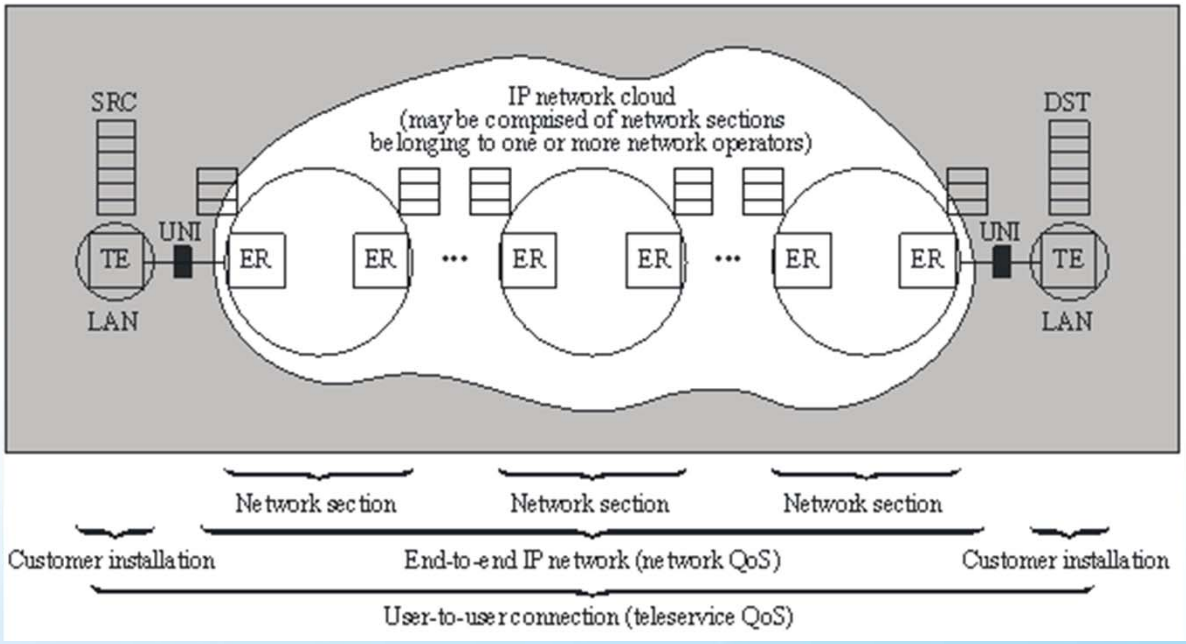
2 Broadband service quality regulation

3 Relevant standards and measurements

4 New service practice in China

QoS Architecture of IP network

- ITU-T Y.1540 IP packet transfer and availability performance parameters
- ITU-T Y.1541 Network performance objectives for IP-based services



China Standard

YD/T 1703-2007

Carrier-class IP QoS Architecture

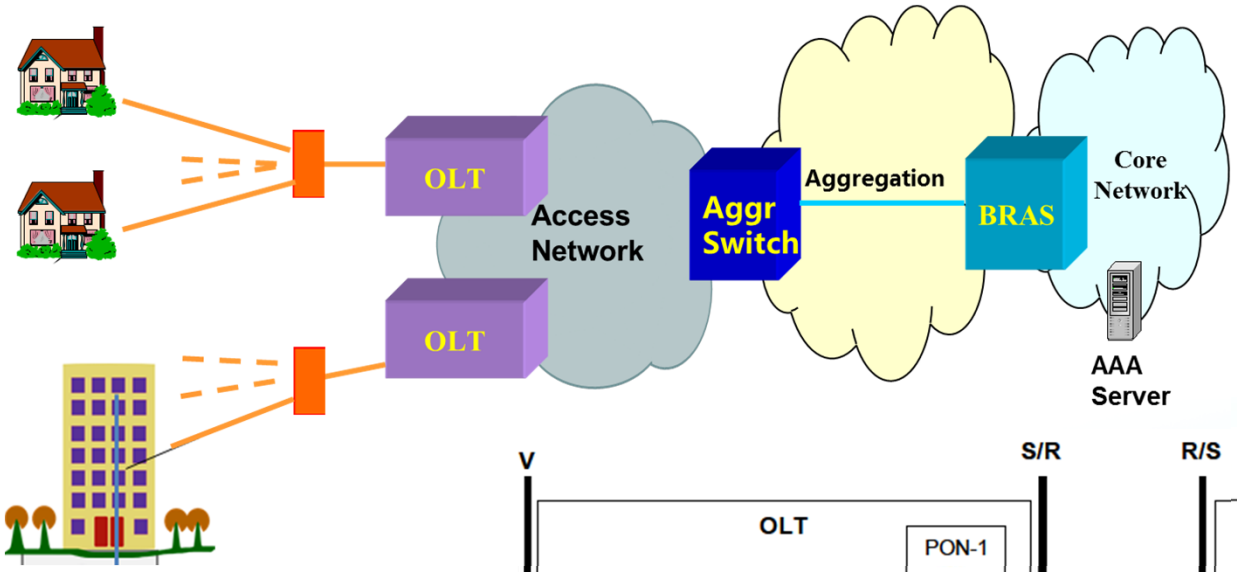
Broadband QoS Metrics

- Download throughput
- Upload throughput
- Delay/Latency
- Delay variation （Jitter)
- Packet loss

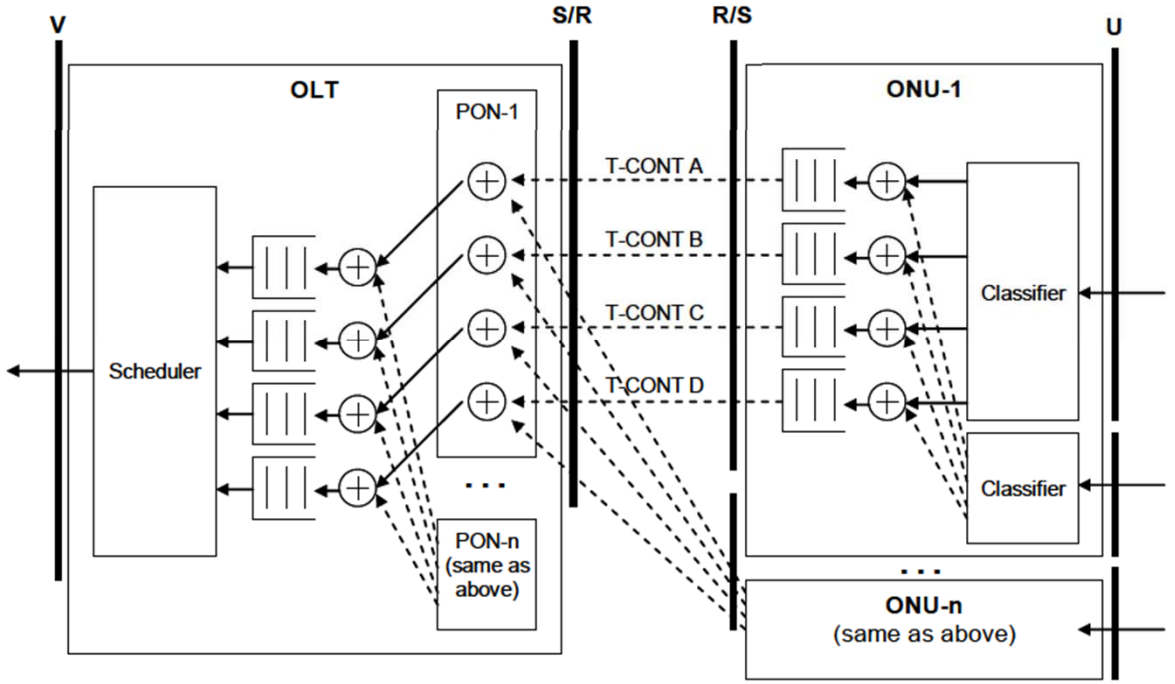
QoS requirements for different services

Service Type	Throughput	Delay	Jitter	Packet Loss Rate
Videoconferencing	High	Very low	Very low	Low and predictable
E-commerce	Medium	Low	Low	Low
Streaming media	High	Low	Low	Low and predictable
Emails and file transfer	Low	Not important	Not important	Not important
HTML web page browsing	Not specific	Medium	Medium	Not important
FTP client/server	Medium	Low	Low	Low

QoS of PON network



- VLAN support
- GPON : GEM / T-CONT



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QoS Classes in LTE networks

QCI	Resource Type	Priority Level	Packet Delay Budget	Packet Error Loss Rate
1	GBR	2	100 ms	10^{-2}
2		4	150 ms	10^{-3}
3		3	50 ms	10^{-3}
4		5	300 ms	10^{-6}
65		0.7	75 ms	10^{-2}
66		2	100 ms	10^{-2}
5	Non-GBR	1	100 ms	10^{-6}
6		6	300 ms	10^{-6}
7		7	100 ms	10^{-3}
8		8	300 ms	10^{-6}
9		9		
69		0.5	60 ms	10^{-6}
70		5.5	200 ms	10^{-6}

Reference : 3GPP TS 23.203

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2 **Broadband service quality regulation**

3 Relevant standards and measurements

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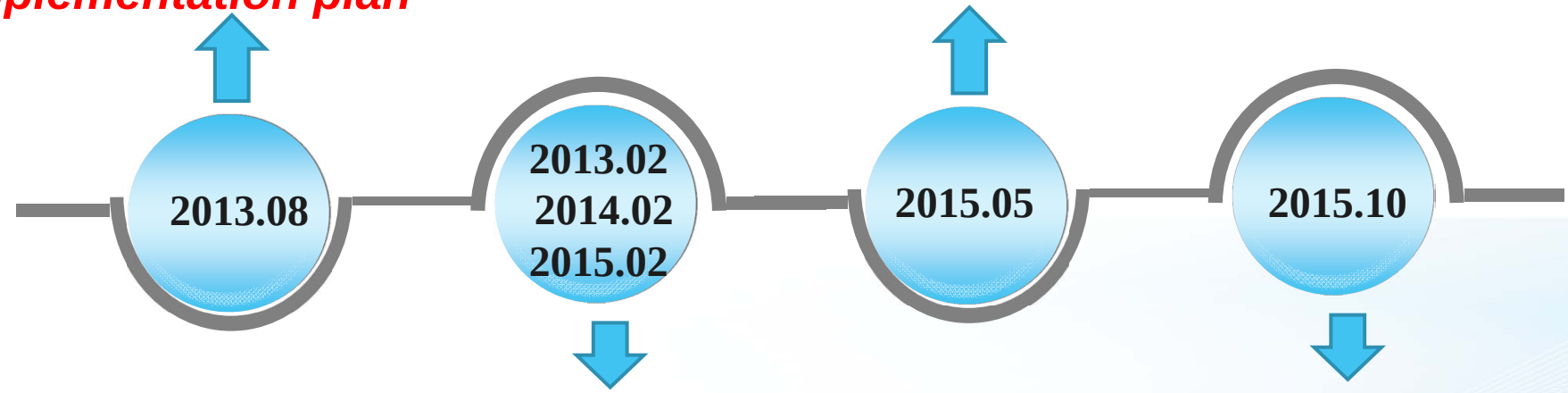
Strategy and Policy

State Council: Broadband China strategy and implementation plan

State Council: Guidance on accelerating broadband network construction

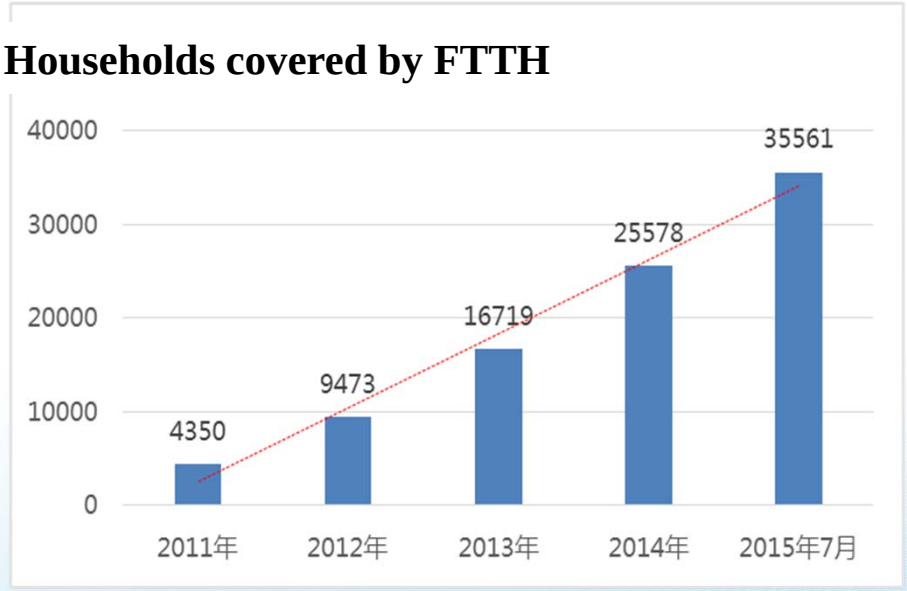


MIIT: Broadband China Action Plan

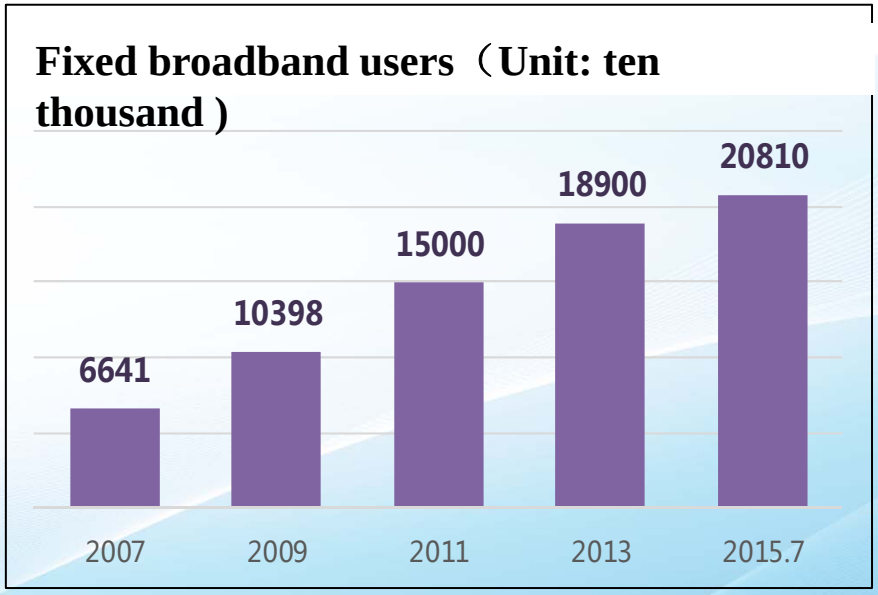
State Council: Set up broadband telecom universal services compensation mechanism

Fixed broadband development

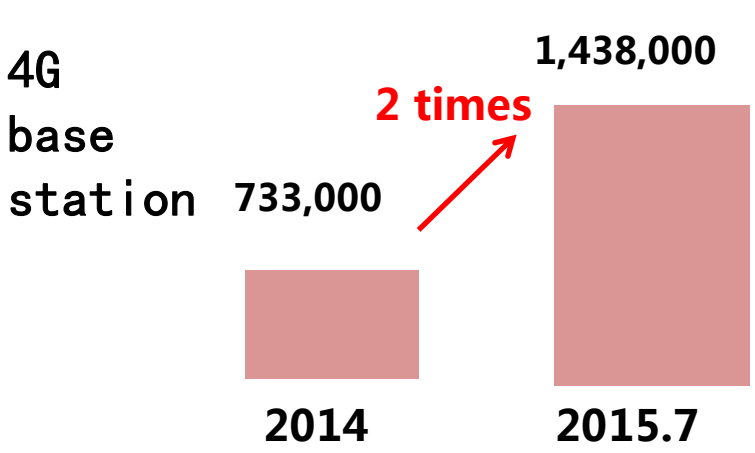
FTTH coverage

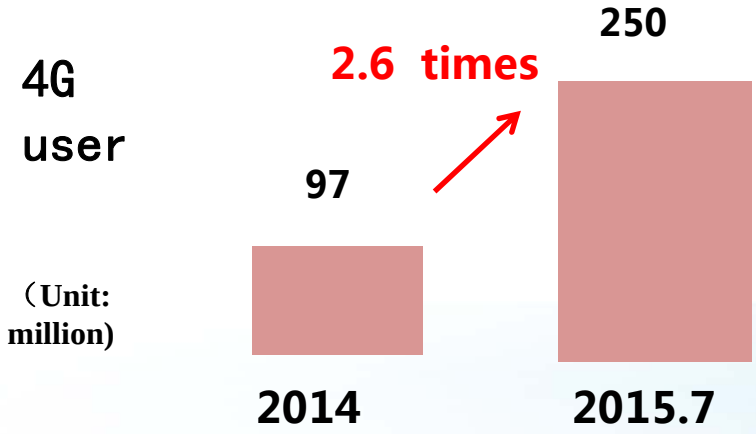


Number of broadband users



Mobile Broadband





- **China has built the world's largest 4G network within a year**
  - **In 2009.01,** 3G licenses was issued.
  - **In 2013.12** , the first LTE license was issued to China Mobile.

Regulatory Specification

- On July 12th, 2013, the Ministry of Industry and Information Technology (MIIT) released

Internet access service specifications

  - It is to regulate the Internet and broadband access services effective as of September 1st, 2013.
  - The specification applies to the Internet access service stipulated in the contracts or service agreements executed between operators and users.

Section 1: Service Quality Requirements

1. Service pre-admission Time

- the average should be within 2 working days, the maximum is within 5 working days.

Section 1: Service Quality Requirements

2. Service Provision / Activation Time

Network infrastructure available

the average should be within 5 working days, all work must be done within 7 working days.

Network infrastructure unavailable

- Urban areas: the average should be within 10 working days, all work must be done within 16 working days.
- Rural areas: the average should be within 15 working days, all work must be done within 20 working days.

Section 1: Service Quality Requirements

3. Fault Repair and Restoration Time

- Urban areas: the average should be within 24 hours，the longest time should less than 48 hours.
- Rural areas: the average should be within 36 hours，the longest time should less than 72 hours.

4. Service Change Time

- the average should be within 12 hours，the longest time should less than 24 hours.

Section 1: Service Quality Requirements

5. Billing Raw Data Keeping Time

- Service providers should provide billing details upon request of customer, including voice, messaging, and data usage.
- All billing raw data should be kept at least for 5 months.

6. Usage reminder

- Service providers should notify customers during each billing cycle when their service usage is close to, or reach, or exceed their plan limits.
- The notification can be in several different ways, such as message, voice, and website.

Section 2: Telecommunication Quality Requirements

1. Connection successful rate (wired access)

   - ≥98%

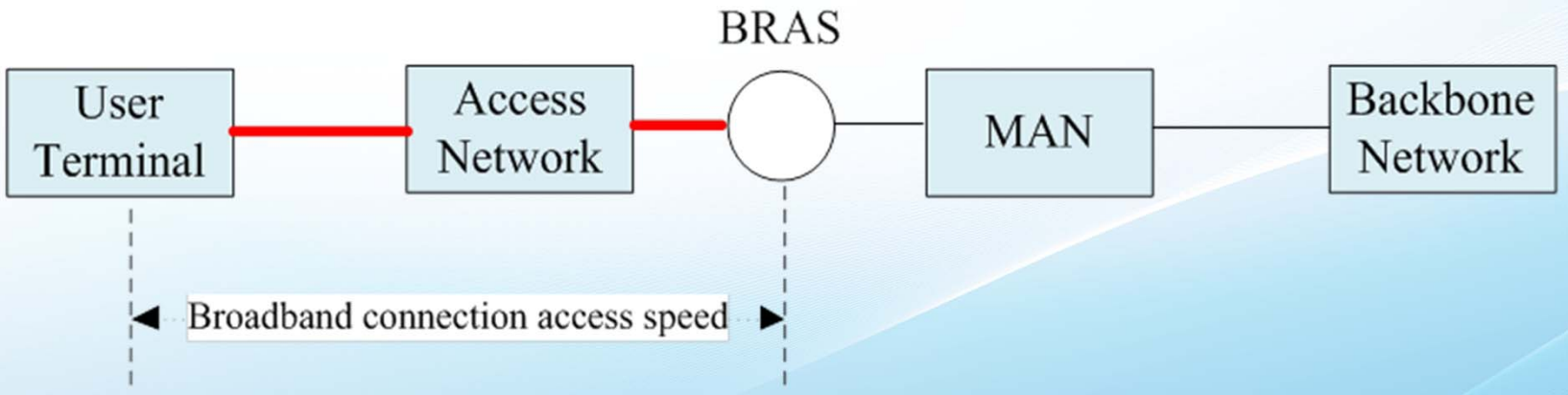
2. Average authentication response time (wired access)

   - ≤8 seconds

Section 2: Telecommunication Quality Requirements

3. Broadband connection speed achieved (wired access)

- Average download speed as a percentage of advertised speed, should not less than 90%



Section 2: Telecommunication Quality Requirements

4. Service availability (wireless access)
   - Greater than 99% of the time, within 90% coverage, the wireless network shall be available to the subscribers.

5. Connection successful rate (wireless access)
   - ≥95%

6. Average authentication response time (wireless access)
   - ≤8 seconds

Section 2: Telecommunication Quality Requirements

7. Service interruption ratio (wireless access)
   - ≤ 5%

8. Billing performance
   - Billing inaccuracy of internet access should ≤ 10^{-4}
   - Billing inaccuracy (error rate) = Inaccurate billing record / Total billing record

Outline

1. QoS fundamentals
2. Broadband service quality regulation
3. **Relevant standards and measurements**
4. New service practice in China

BB Performance Requirements

Fixed BB

- YD/T 2400-2012 Test methods for broadband network-- fixed broadband access
- YD/T 2691-2014 Test methods for broadband network– fixed user experience

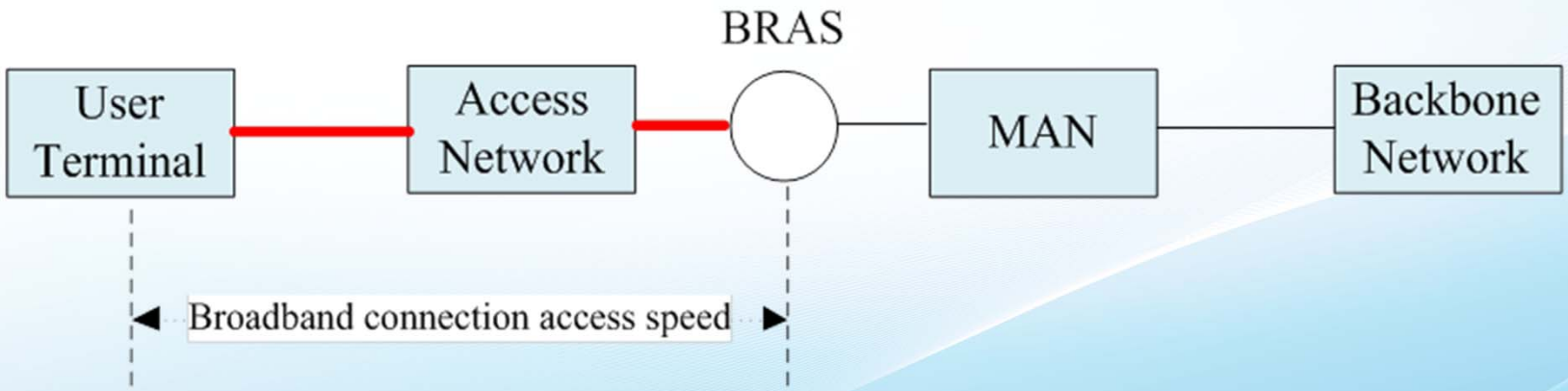
Mobile BB

- YD/T 2690-2014 Test methods for broadband network-- mobile broadband access
- YD/T 2892-2015 Test methods for broadband network– mobile user experience

Test Method
-- Fixed BB access

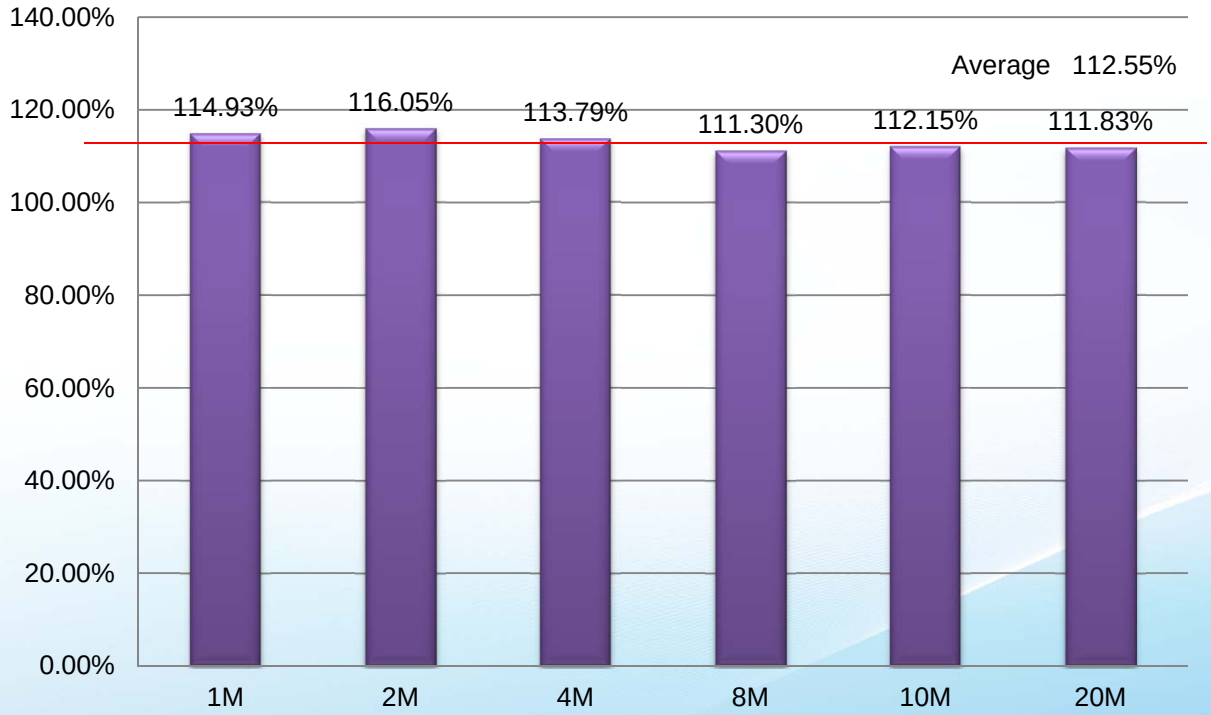
- Fixed broadband download access speed (YD/T 2400-2012)

-- to let customers know what broadband speed they actually have.



Access Speed Conformity

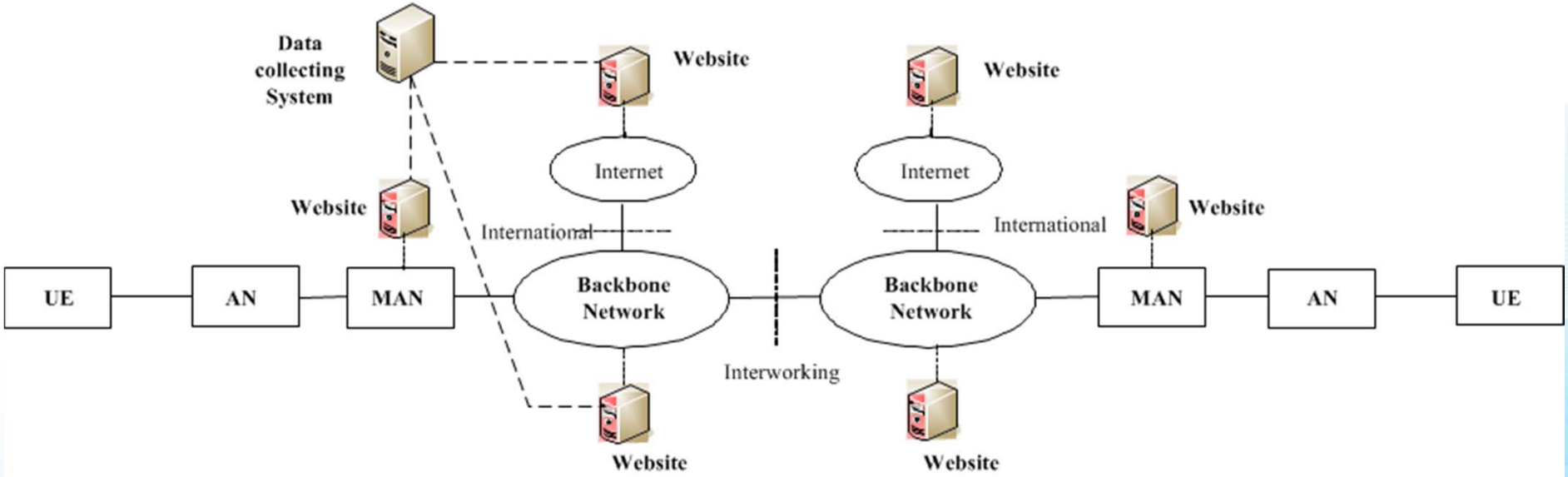
- Access Speed Conformity is percentage ratio of download access speed to advertised speed.
- Testing result of China Telecom，China Mobile and China Unicom users (2015Q2).



Test Method
-- Fixed BB end-to-end experience

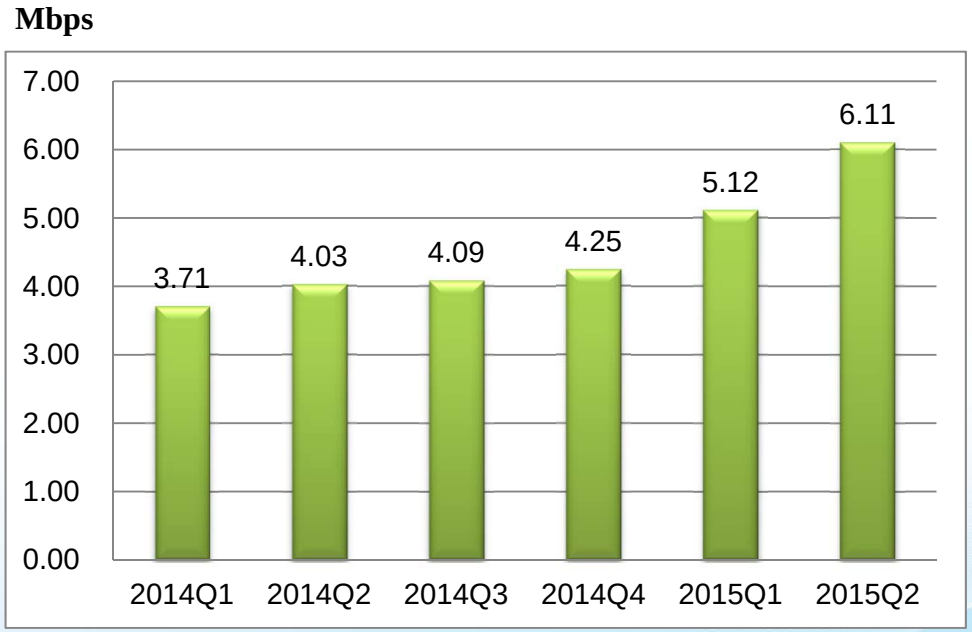
- End-to end performance -- user experience

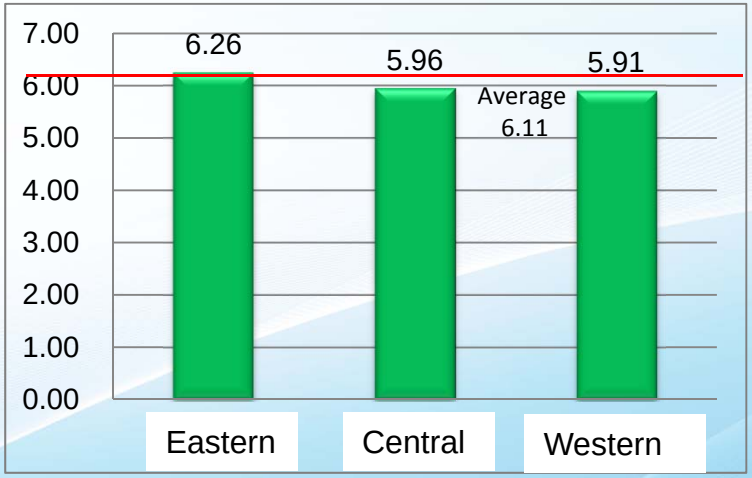
(YD/T 2691-2014)



Fixed broadband network experience -- file download speed

-- In 2015Q2, China's average download speed for fixed broadband networks reached 6.11 Mbit/s.
-- Our analysis is based on both passive test and active test data.

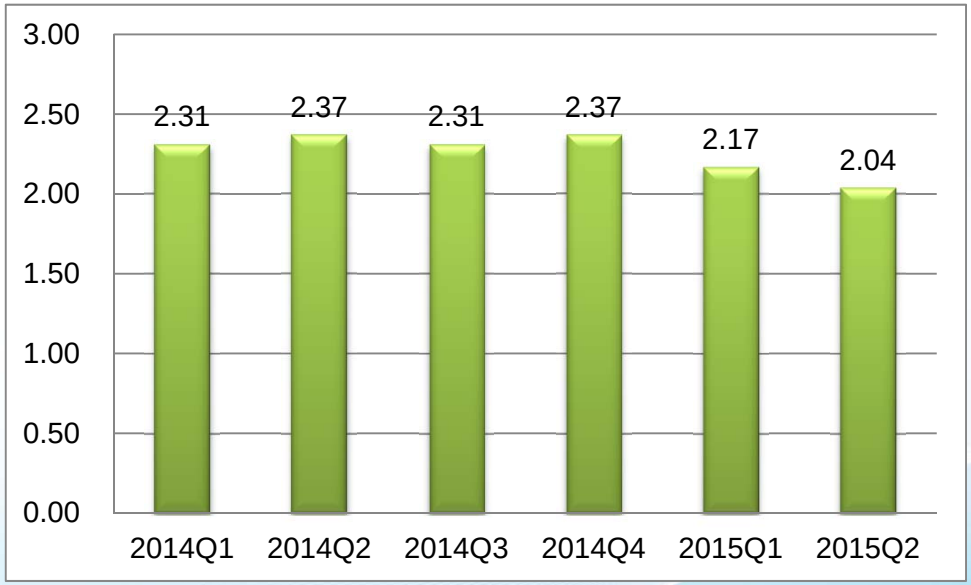




Source：China Broadband Development Alliance

Fixed broadband network experience -- first screen load time

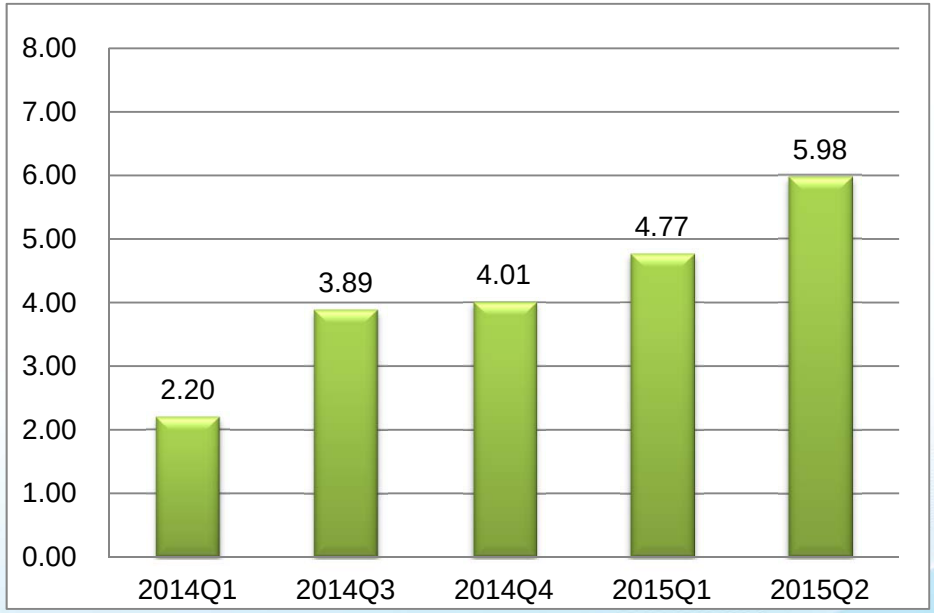
In 2015Q2, China's average first webpage screen load time is 2.04s.



Source：China BDA

Fixed broadband network experience -- video download speed

- **In 2015Q2, China's average video download speed for fixed broadband networks reached 5.98Mbit/s.**



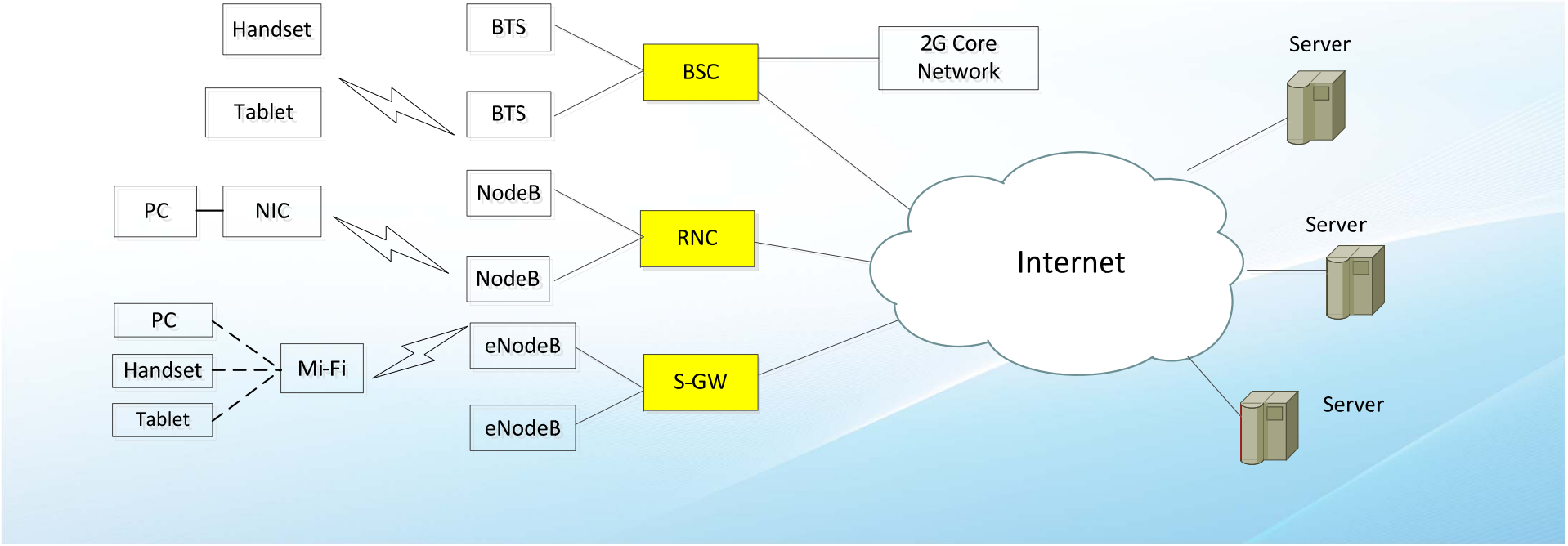
Source: China BDA

- **Among all provinces, municipalities and autonomous regions , Shanghai, Shandong, Beijing, Tianjin, Jiangsu ranked Top 5.**

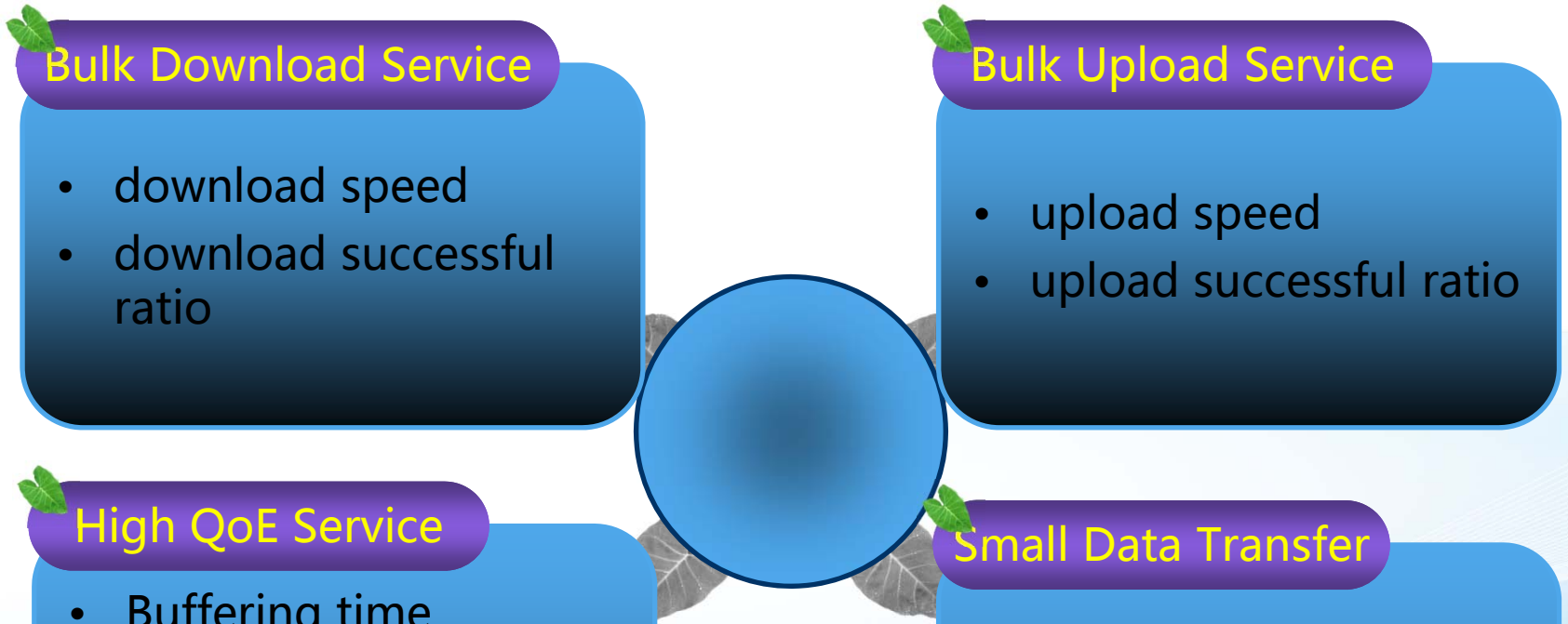
Shanghai	7.49 Mbps
Shandong	6.85 Mbps
Beijing	6.40 Mbps
Tianjin	6.34 Mbps
Jiangsu	6.29 Mbps

Test Method
-- Mobile BB end-to-end experience

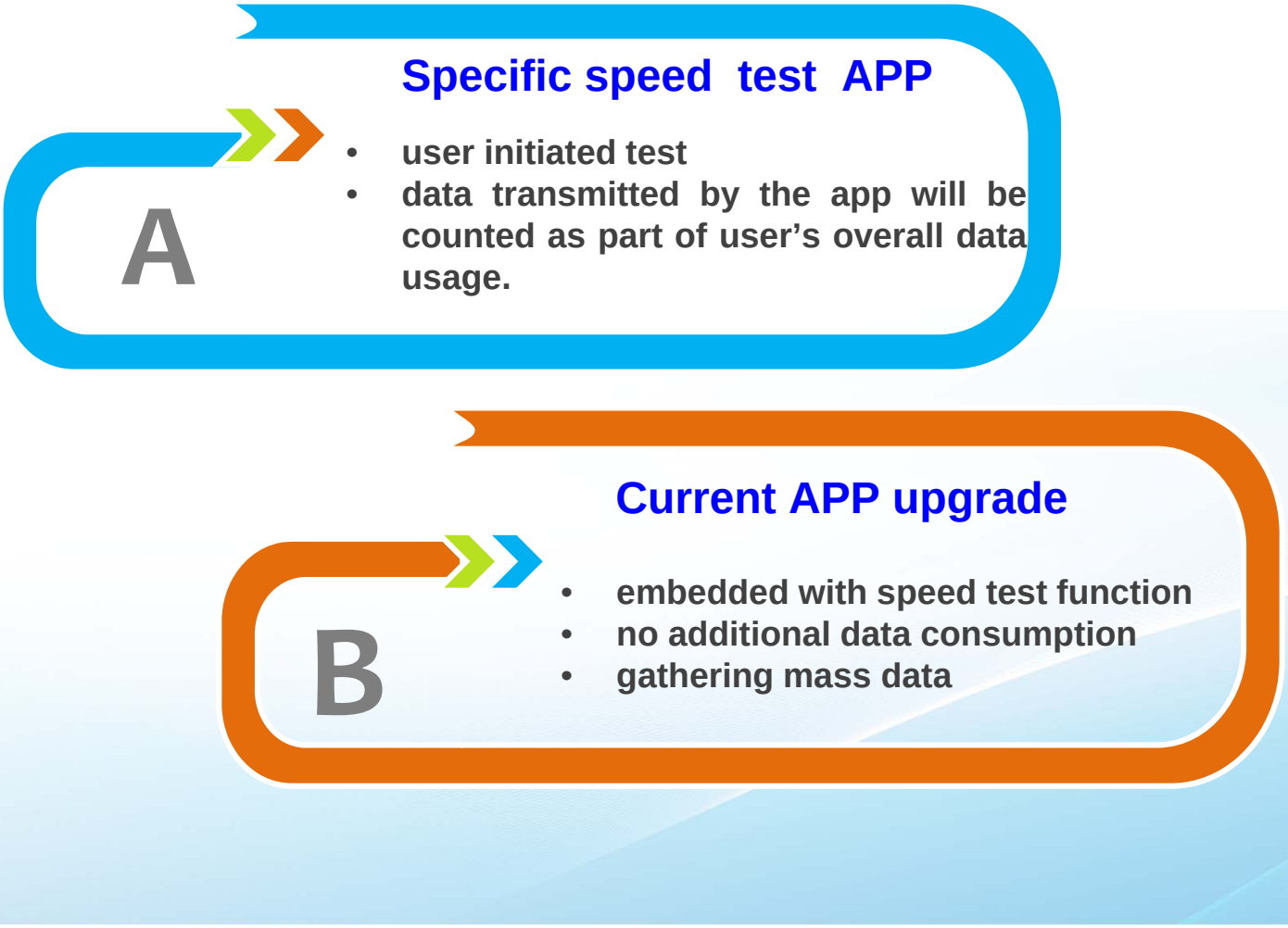
- End-to end download speed -- user experience (YD/T 2892-2015)



Indices of Mobile BB end-to-end experience



Mobile BB experience measurement



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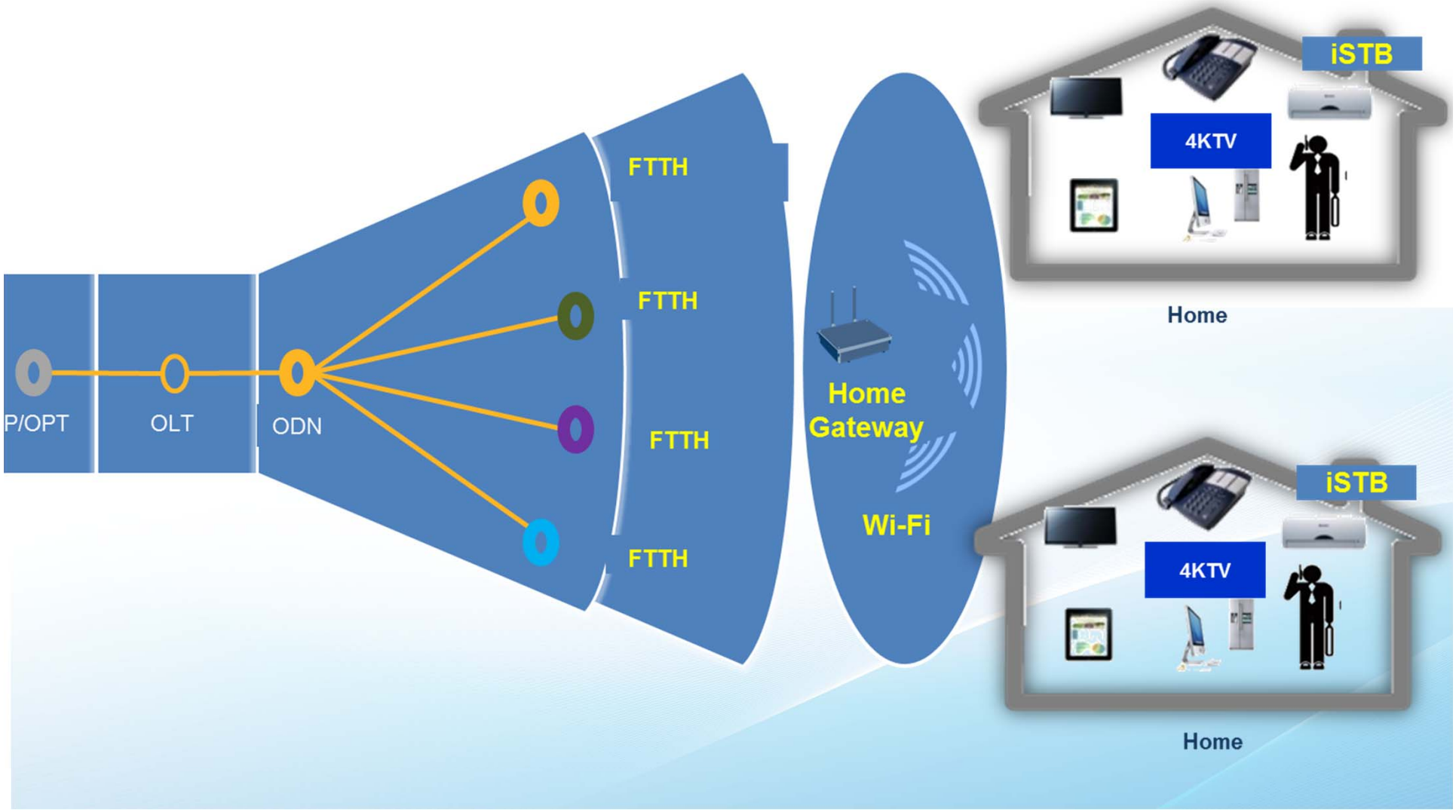
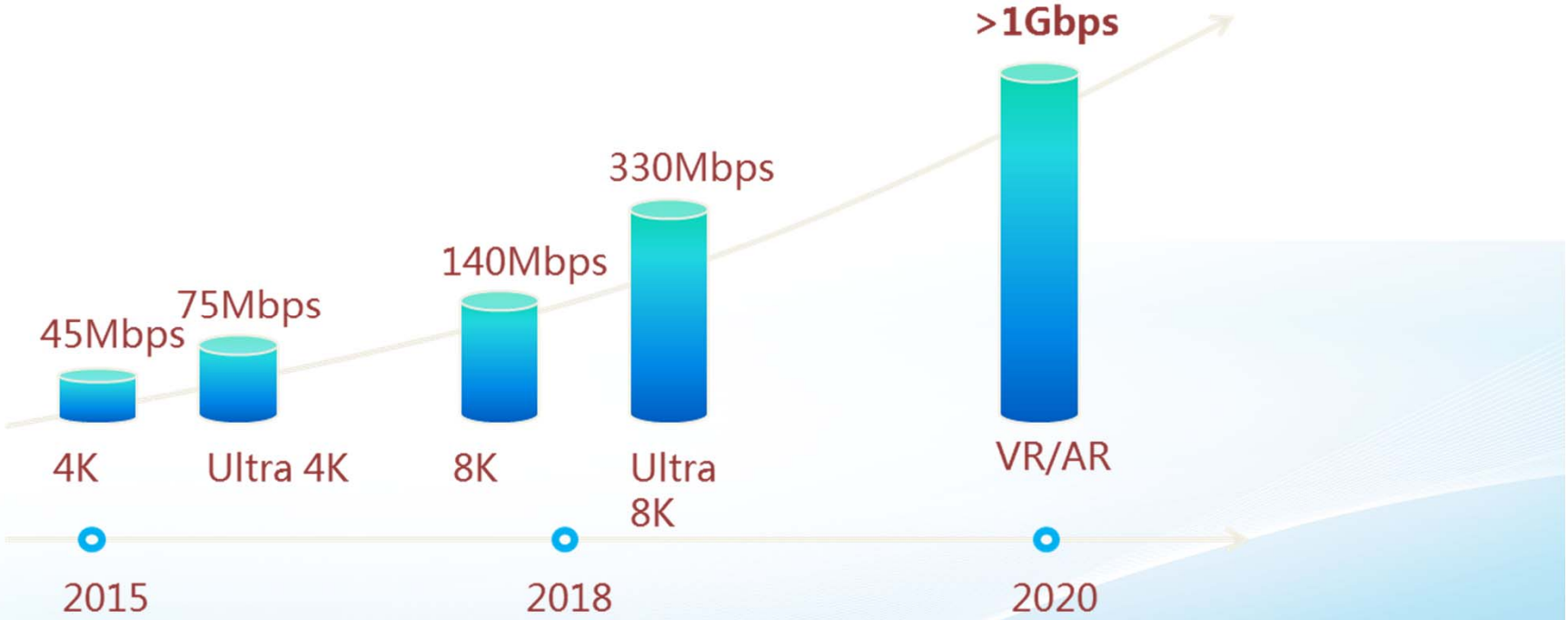
4K IPTV service

- In Dec. 2014, China Telecom Sichuan launched a commercial 4K ultra-HD iTV service.
- It is the first commercial 4K network service in China.

Network architecture

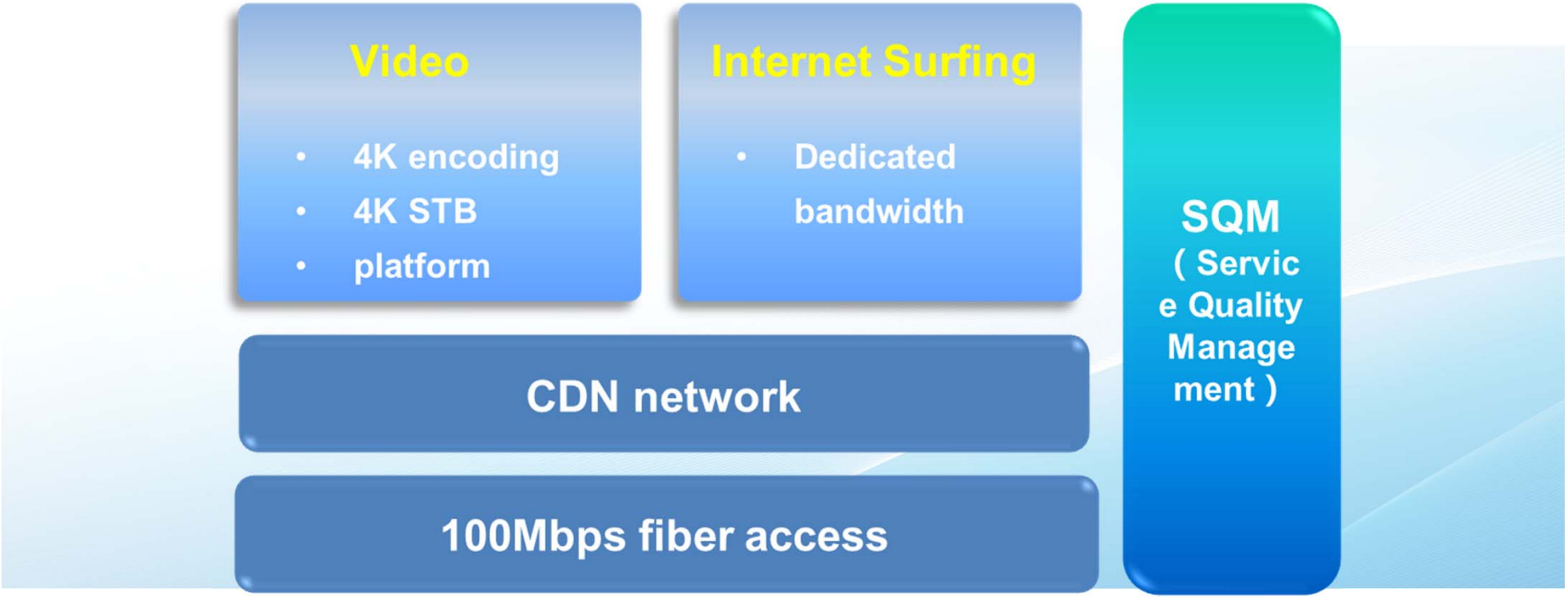


Bandwidth requirement

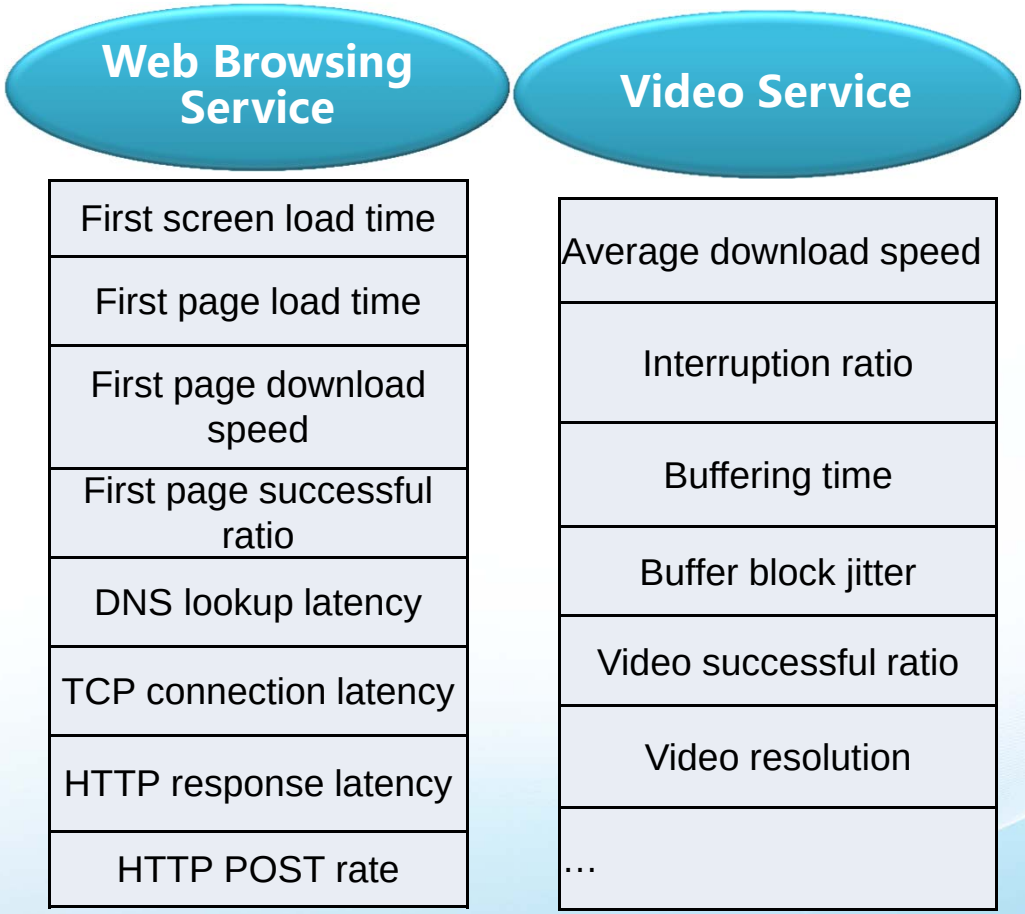


Measures to ensure QoE

- End to end solution to guarantee smooth experience of 4K video.
- Smart acceleration of speed

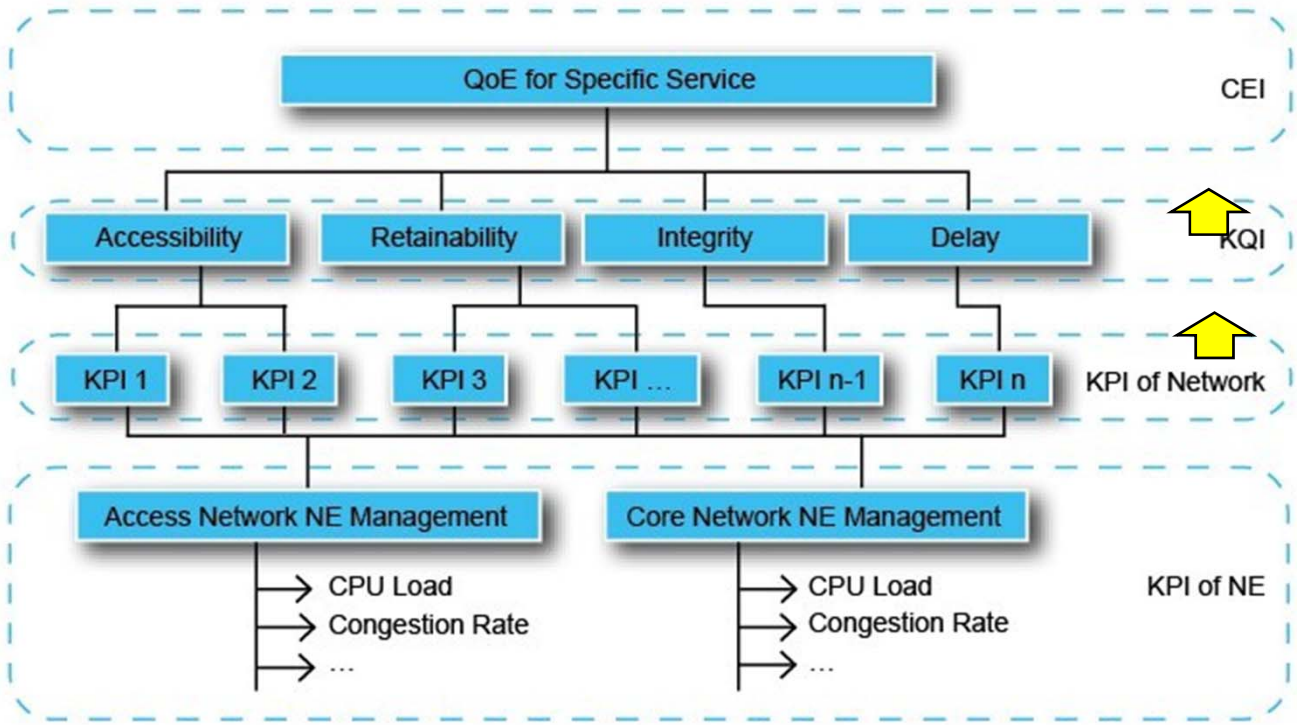


KQIs and QoE



- Service Providers define KQI parameters for main services.
- QoE is calculated from KQI indexes, which is given different weight.

QoE management in era of Experience Economy



- Customer experience indicator (CEI) provides an objective measurement of customer experience.

- KPIs for each layer of network, such as AN, RAN, CN, and IP bearer networks.
- KPI is he data basis for the CEI and KQI.

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