Access CDN - Novel Architecture for Highly Distributed CDN

2012 Network Lab

HUAWEI

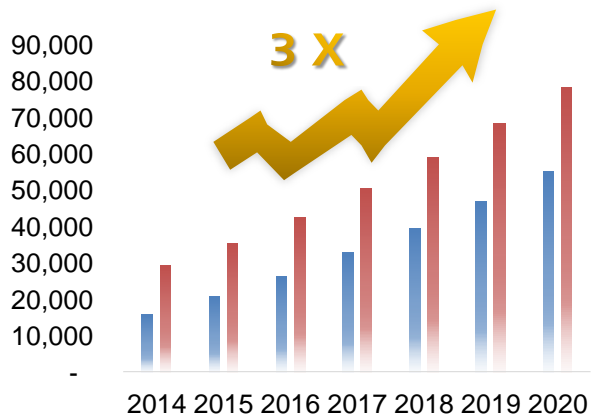# Outline

📖 **Bring CDN to the Edge**

📖 **Access CDN - Novel Architecture for Highly Distributed CDN**

📖 **A Healthier Ecosystem with Access CDN**
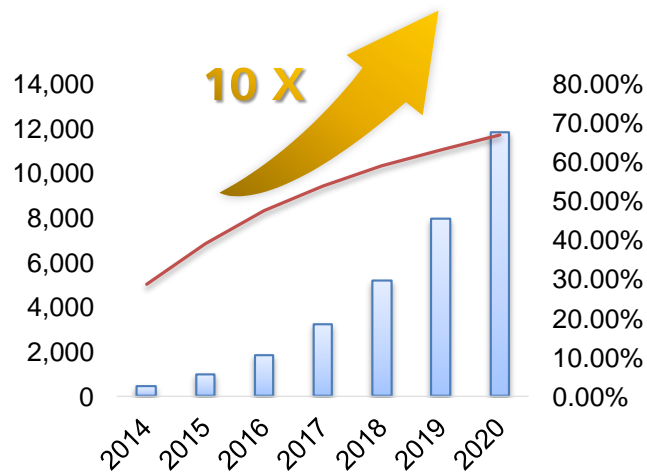
FUTURE VIDEO DEVELOPMENT TREND

Continuous Explosion of Video Traffic

Fixed network video traffic

3 X

90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-

2014 2015 2016 2017 2018 2019 2020

- Video traffic(PB)
- Video traffic per household(MB)

Mobile network video traffic

10 X

14,000 — 80.00%
12,000 — 70.00%
10,000 — 60.00%
8,000 — 50.00%
6,000 — 40.00%
4,000 — 30.00%
2,000 — 20.00%
0 — 10.00%
0.00%

2014 2015 2016 2017 2018 2019 2020

- Video traffic(PB/month)
- Video traffic percentage

Data source：OVUM

Continuous Explosion of 4K/8K/VR Devices

Connected 4K TV Sets (M)

600
500   544
400   399
300   270
200   167
100 90
   38

2015 2016 2017 2018 2019 2020

720p
1280p
4K (Ultra HD)
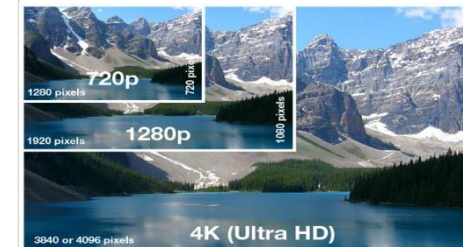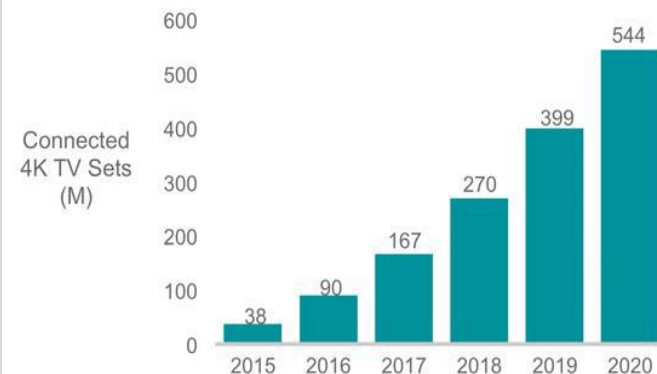
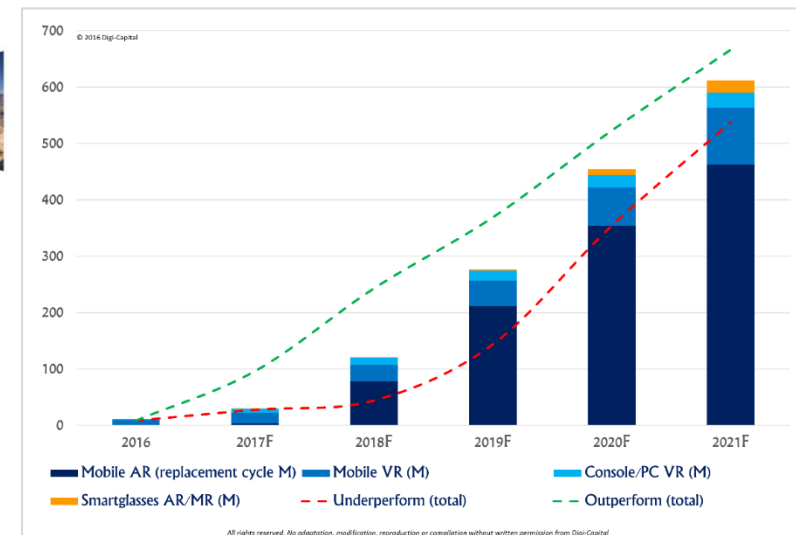**500M families using 4k TV** expected in 2020

36M VR devices in 2017, 600M expected in 2020, 16X↑

Source：Cisco VNI, Digi-Captial

© 2016 Digi-Capital

700
600
500
400
300
200
100
0

2016 2017F 2018F 2019F 2020F 2021F

- Mobile AR (replacement cycle M)
- Mobile VR (M)
- Console/PC VR (M)
- Smartglasses AR/MR (M)
- Underperform (total)
- Outperform (total)

4K/8K/VR VIDEO DELIVERY REQUIRES HIGH THROUGHPUT

❖ **Bandwidth requirement moves from Mbps to Gbps for a single user**

Video type	Video bit rate
SD	1.5Mbps
HD,1080p30	5Mbps
UHD,4Kp24/30	15Mbps
UHD,4Kp60	25Mbps
UHD,4Kp150	60Mbps
UHD,8Kp60	100Mbps

**Network bandwidth requirement
(HD to 8K)**

Video bit rate	2D ROI /360 degree view	3D ROI / 360 degree view	2D ROI BW/ 360 degree view BW	3D ROI BW/ 360 degree view BW
Ultimate VR Experience	2.1/8.4Gbps	2.5/10Gbps	3.2/12.8Gbps	3.8/15.2Gbps
Ideal VR Experience	0.5/2Gbps	0.6/2.4Gbps	0.75/3Gbps	0.9/3.6Gbps
Basic VR Experience	17.9/71.6Mbps	21.5/86Mbps	26.9/107.6Mbps	32.3/129.2Mbps

Network bandwidth requirement of VR

VR/INTERACTIVE STREAMING REQUIRES LOW LATENCY

❖ **E2E latency down to 20ms**

- ~20ms lag (End-2-End) for acceptable quality of experience

- Even smaller E2E latency for serious gamers

❖ **Live streaming has higher demands on concurrency, continuity and interactivity**

- UGC mode: distributed hosts, traditional centralized CDN could cause extra latency, packet loss while contents uploading

- Future live streaming: liveness & interactivity, video lag <2%, traditional centralized CDN fails to meet such requirement

SHIFT IN CDN ARCHITECTURE TO MEET VIDEO REQUIREMENT

❖ **Significant savings on backbone bandwidth for ISP with a distributed architecture**

❖ **Improved QoE for ISP's customers with a distributed architecture that is closer to the user**

Distance between server and end user	"Speed of Light" Network Latency (RTT)	Theoretically fastest possible download time using TCP	Typical Network Latency (RTT)	Typical packet loss rate	Typical download time with specified packet loss rates	Typical Throughput	Quality
Local (100 miles)	1.6 ms	6.4 minutes	4 ms	0.6%	18 minutes	29.63 Mbps	High Definition
Regional (1000 miles)	16 ms	64 minutes	50 ms	0.7%	4 hours	2.22 Mbps	DVD
Cross-continent (3000 miles)	48 ms	3.2 hours	90 ms	1.0%	9 hours	0.99 Mbps	TV
Different continent (6000 miles)	96 ms	9.6 hours	150 ms	1.4%	18.3 hours	0.49 Mbps	Thumbnail
Emerging Markets (BRIC)	96 ms	9.6 hours	300 ms	2.0%	1 day, 1 hour	0.36 Mbps	Thumbnail

Akamai Briefing: Highly Distributed Computing is Key to Quality on the HD Web, Centralized CDNs delivering from far away face download times that can be significantly slower than content delivered locally

CDN SHIFTS TO THE EDGE - CONSENSUS BETWEEN CDN SP & OPERATOR

Akamai

Chinanetcenter (网宿科技)

"CDNs can speed server-to-server communications within their platforms using various route and transport protocol enhancements – optimizing TCP parameters, multiplexing connections, or routing around BGP inefficiencies, for example. These optimizations only work within the CDN platform, however, and don't apply to the data as it travels between the CDN and end user, so having servers close to end users is critical." - *Akamai White Paper "Content Delivery for an Evolving Internet*

"Community Cloud" concept, CDN caches shift to metropolitan networks or even more closer to user

Chinanetcenter : biggest CDN provider in China

BT

"**CDN distributed deployment: Sites number increased by 7 times**"

france telecom

"Future CDN **shifts to today's BNG,** distributed to future DC site (NG-POP)"

CHINA TELECOM (中国电信)
CTNet2025

"CDN caches shift **close to/inside the Access network** of network operators"

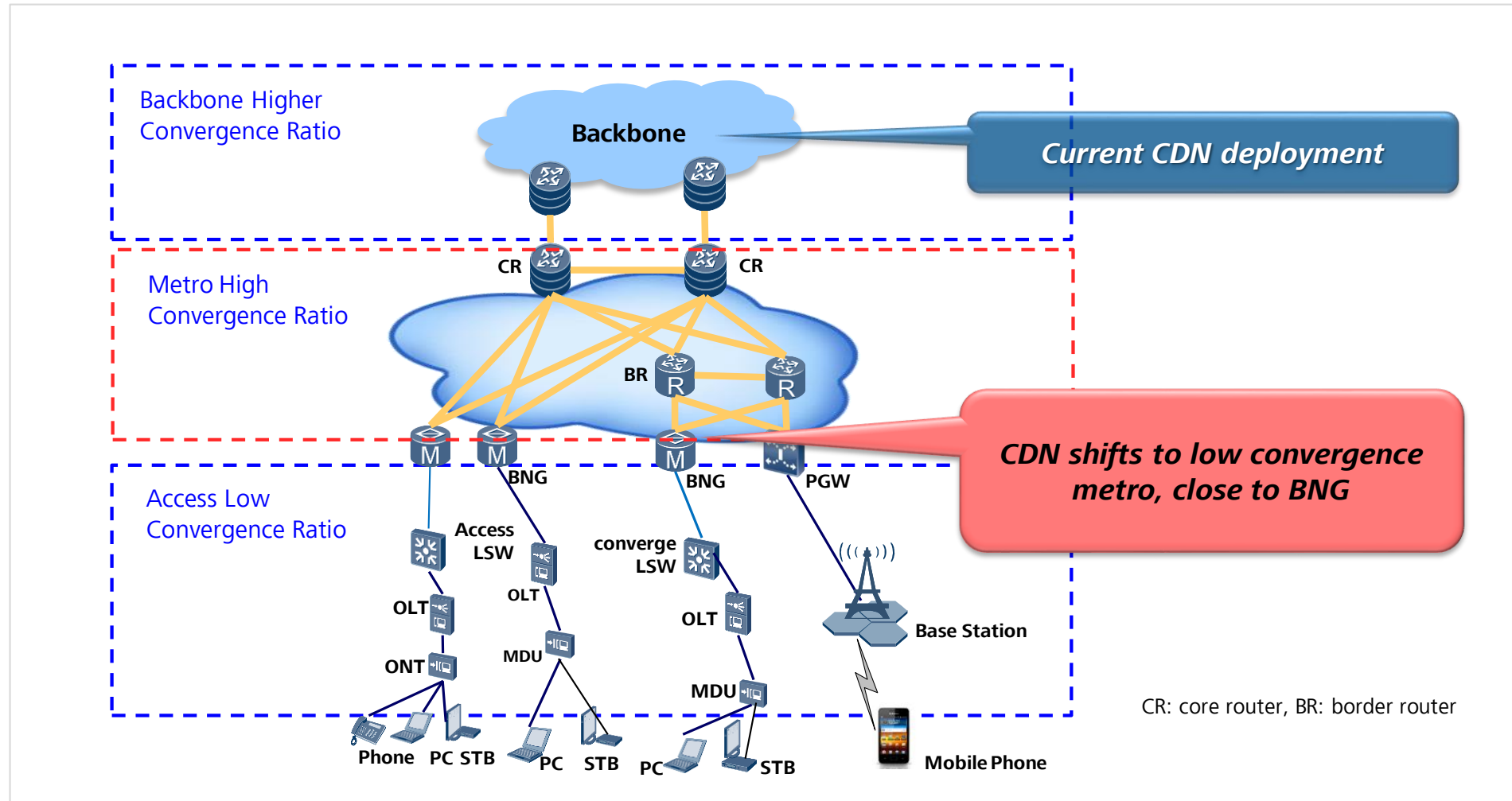BNG: border network gateway

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CDN SHIFTS CLOSE TO LOW-CONVERGENCE METRO BNG

Backbone Higher Convergence Ratio

Backbone

Current CDN deployment

Metro High Convergence Ratio

CR   CR

BR   R   R

Access Low Convergence Ratio

CDN shifts to low convergence metro, close to BNG

M   M   M   PGW

BNG   BNG

Access LSW   converge LSW

OLT   OLT   OLT

ONT   MDU   MDU

Base Station

Phone   PC   STB   PC   STB   PC   STB   Mobile Phone

CR: core router, BR: border router

HIGHLY DISTRIBUTED CDN REQUIRES NEW ARCHITECTURE

❖ **Operator's existing CDN architecture fails to satisfy CDN SP & ICP's needs**

■ **CDN server/software out-of-control**
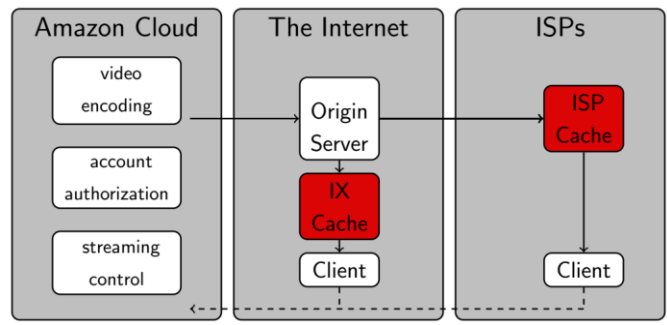
Netflix co-op with ISP: Netflix provide CDN server OCA and SW, ISP provide site and bandwidth

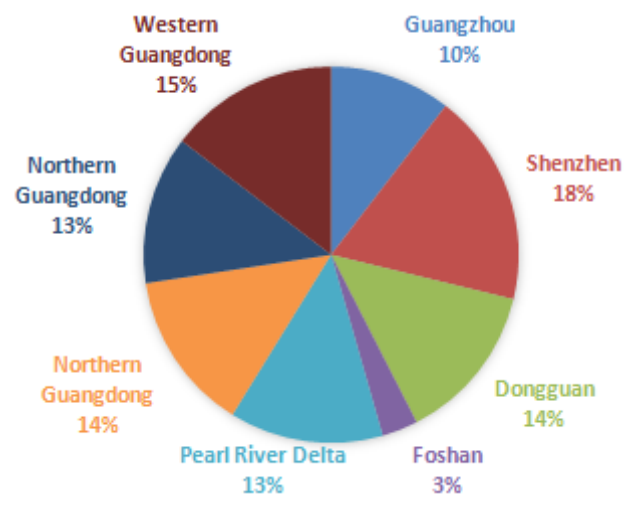■ **Difficult for deployment due to complexity in interfacing**
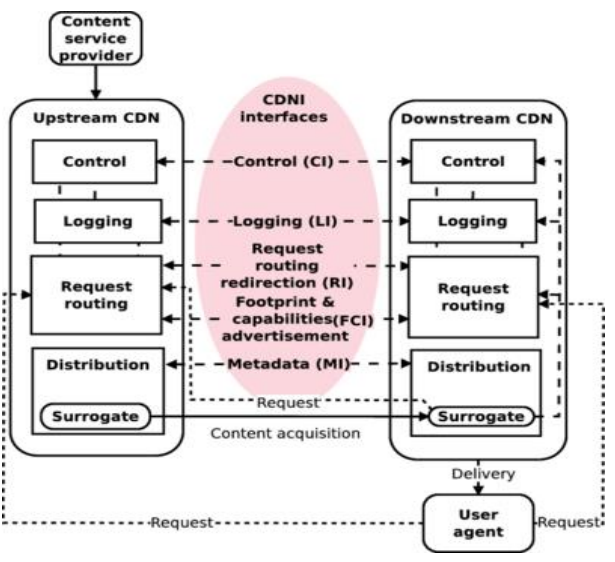
CDNi: Complex technology and interface, lack clear business cooperation model

■ **Difficulty for large-scale commercial deployment**
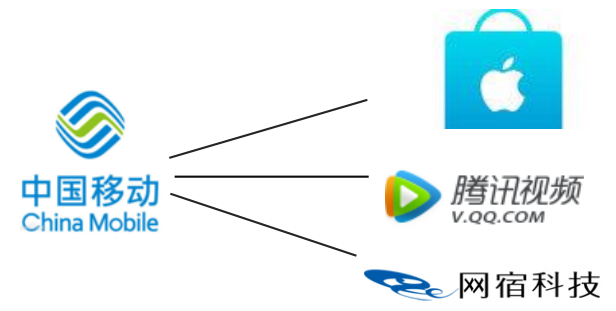
China Mobile co-op with CDN SP/ICP, Operator's CDN need customized dev case by case

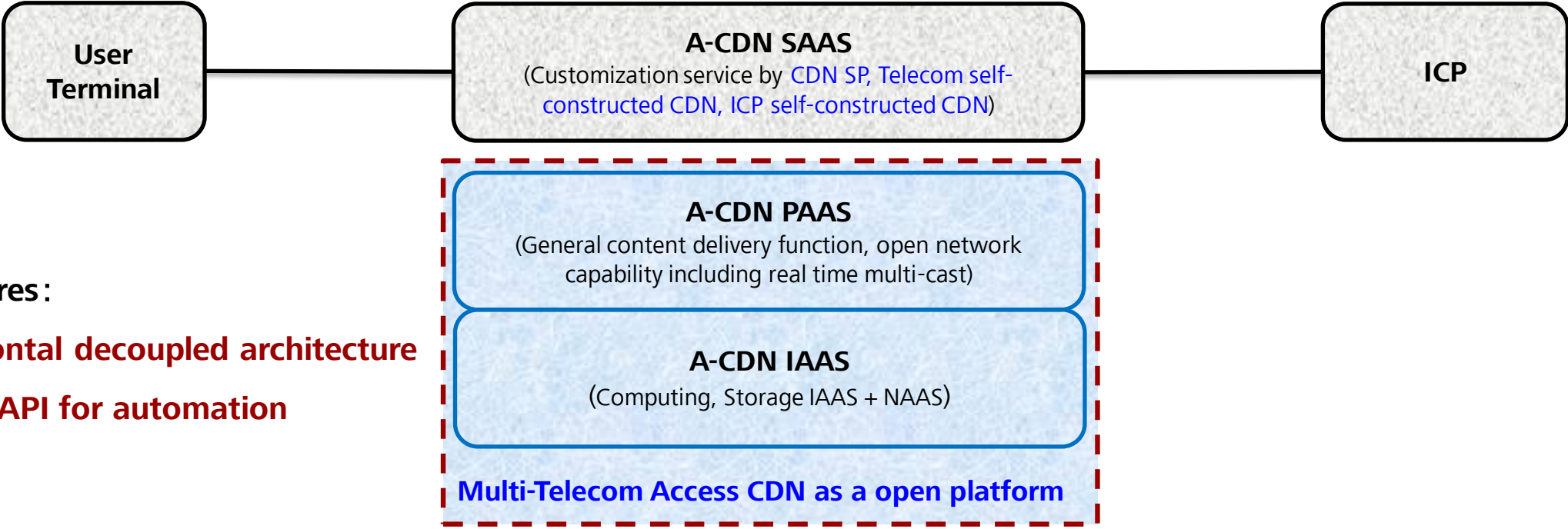■ **High network transmission cost due to disordered flows**

Metro traffic localization statistics by China Telecom in 2015: less than 20% of local traffic flow

HIGHLY DISTRIBUTED CDN REQUIRES NEW ARCHITECTURE

❖ **Decouple common functions and customized service**

- ▪ Operator provides general content delivery functions to support CDN SP & ICP's basic requirement

- ▪ Operator opens network capabilities for CDN SP & ICP's using

- ▪ CDN SP & ICP provides customized services to meet customers' requirements

# ACCESS CDN: NOVEL ARCHITECTURE FOR HIGHLY DISTRIBUTED CDN

User Terminal

A-CDN SAAS
(Customization service by CDN SP, Telecom self-constructed CDN, ICP self-constructed CDN)

ICP

A-CDN PAAS
(General content delivery function, open network capability including real time multi-cast)

A-CDN IAAS
(Computing, Storage IAAS + NAAS)

Multi-Telecom Access CDN as a open platform

Key Features :

- **Horizontal decoupled architecture**

- **Open API for automation**

❖ **Technological innovation**

- Decoupling general function & customization service

- Open network resource and capability,

- Supporting large-scale CDN virtualization & automation

❖ **Biz model innovation**

- Tight co-work between CDN service providers and operators for win-win relationship

COORDINATION BETWEEN A-CDN P/F AND UNDERLAY NETWORK
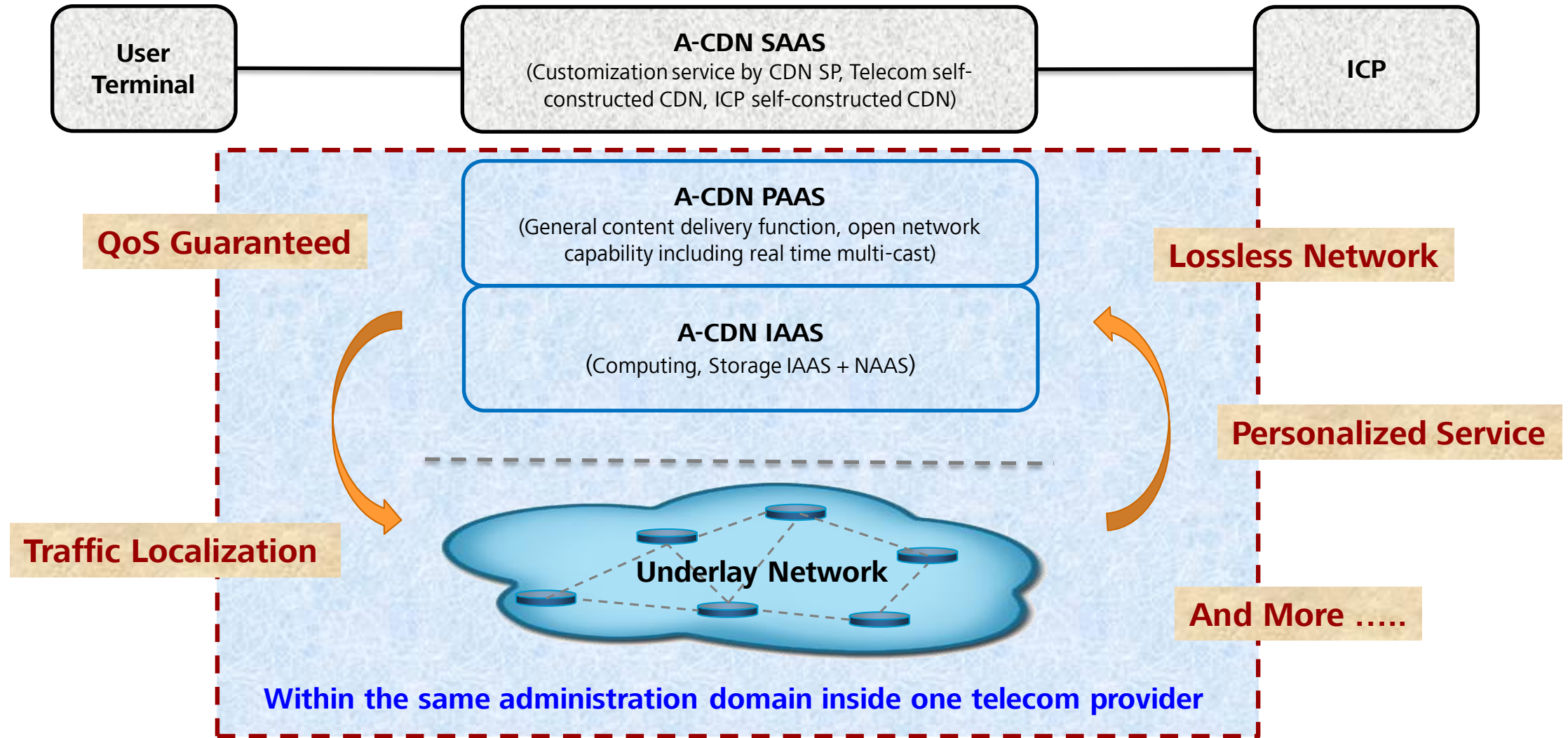
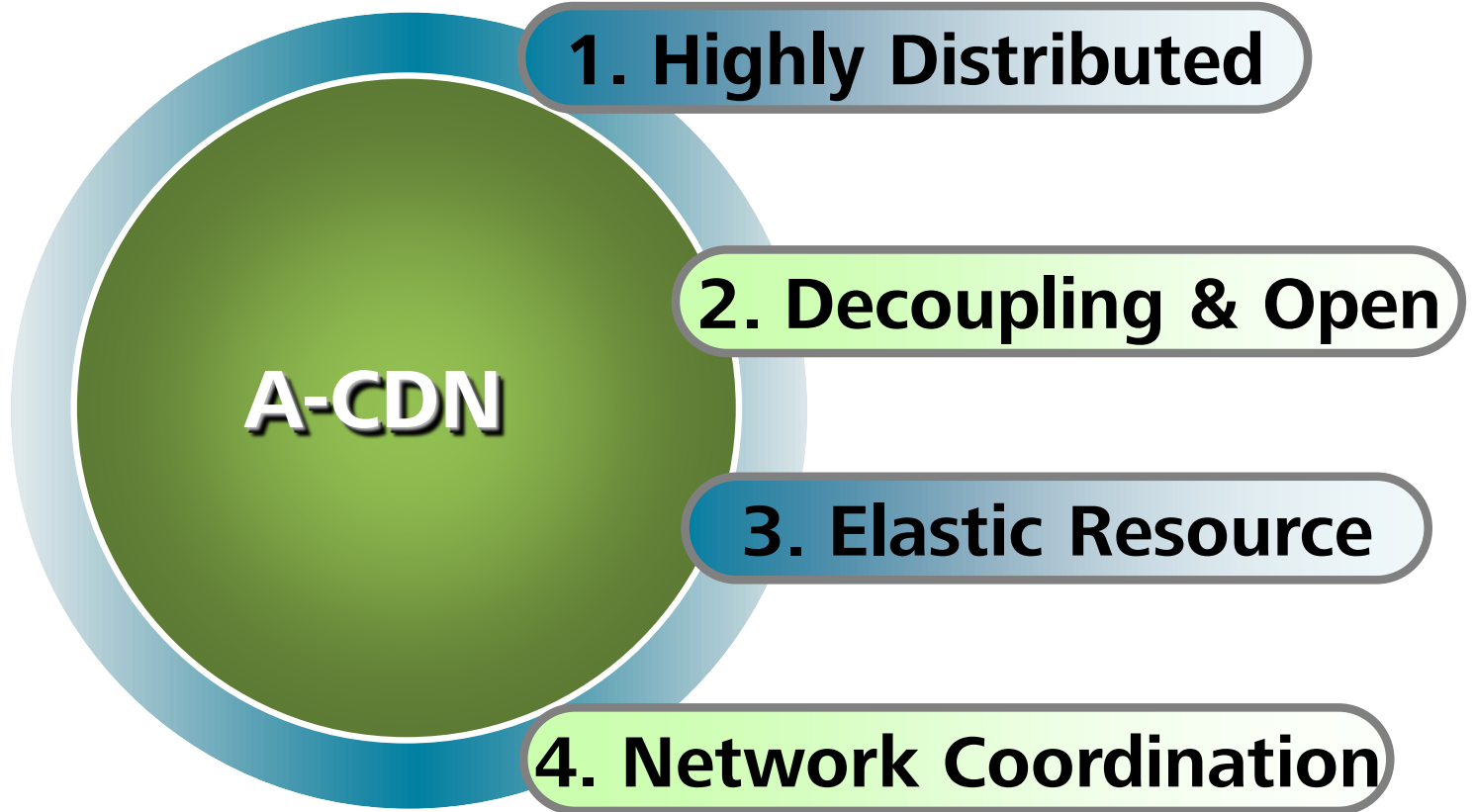# ACCESS CDN - KEY FEATURES

Telecom self-constructed CDN   CDN SP   ICP self-constructed CDN

Core CDN: advanced service strongly related to content

**Access CDN:** general content delivery function & open network capability

A-CDN

1. **Highly Distributed**

2. **Decoupling & Open**

3. **Elastic Resource**

4. **Network Coordination**

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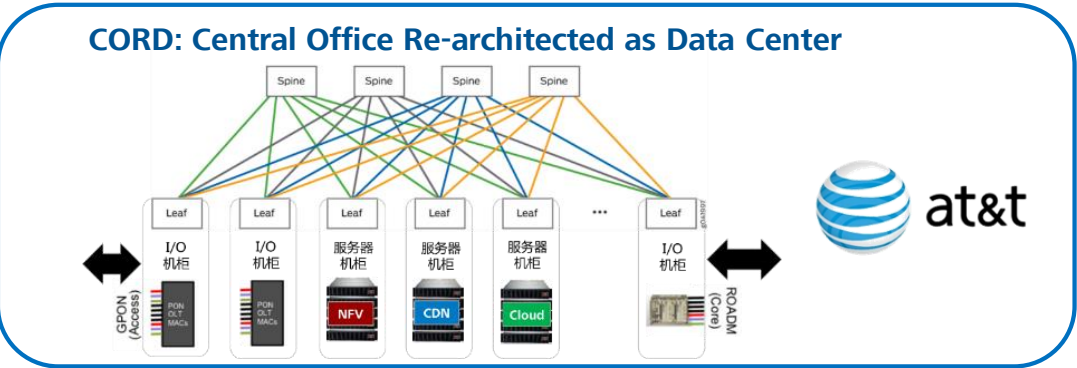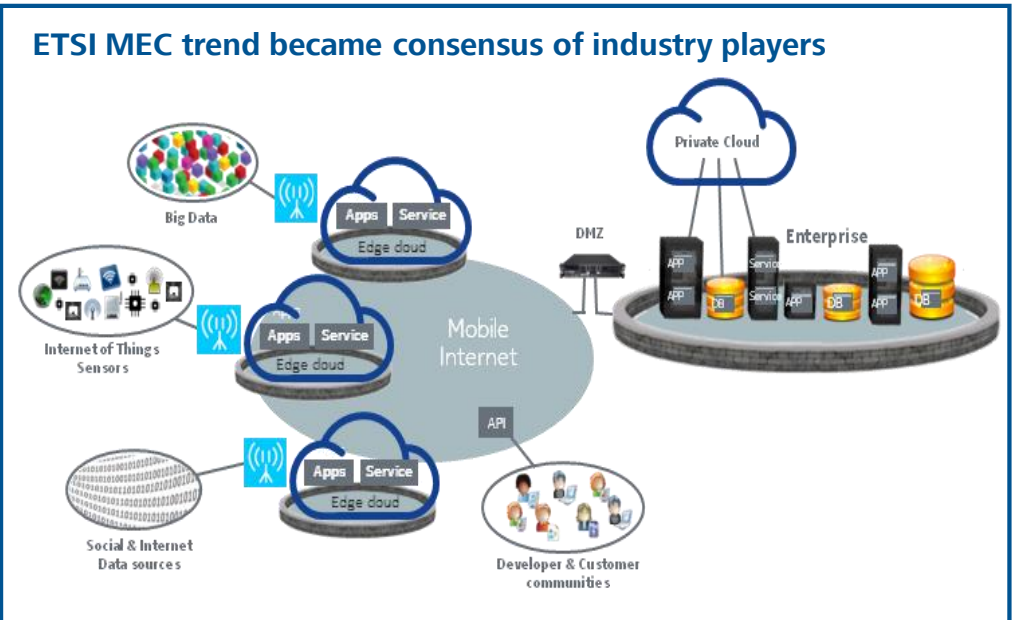
ACCESS CDN: INDUSTRIAL VALUE

❖ **From a closed-loop system to a decoupled open platform, enlarging CDN industry space**

- From closed-loop vertical IPTV CDN to open platform for operators

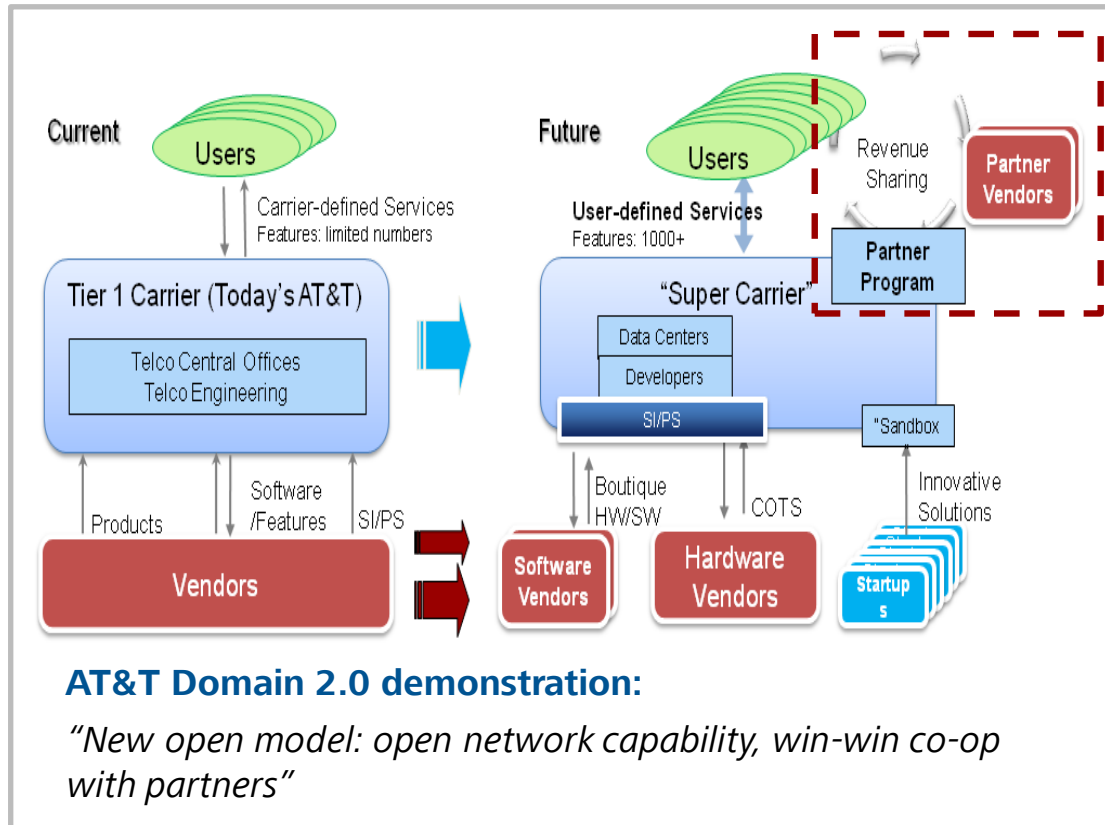- Enhance performance, keeping core strength for OTT
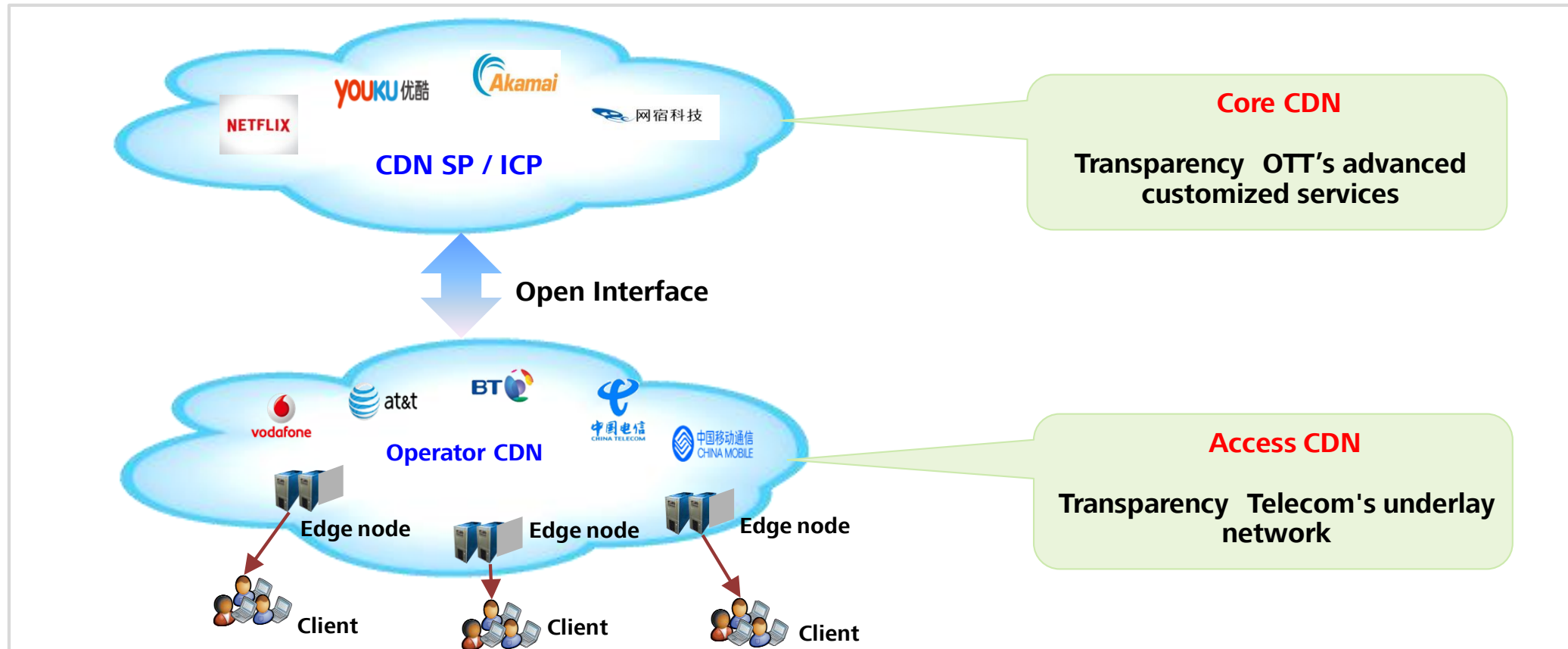
ACCESS CDN: ACCELERATE TELECOM NETWORK RE-ARCHITECTURE

❖ **Access CDN expected to accelerate telecom network re-architect as a application scenario**

❖ **CDN to the edge conforms to CO cloudization, deployment cost could be reused**

ETSI MEC trend became consensus of industry players

CORD: Central Office Re-architected as Data Center

Network Re-architecture Strategy

Passive network → **Active/Quick /Flexible** for adapt to internet app	Traditional vertical multi network → **Horizontal One** China Telecom	Hierarchical CO based network → **DC as core** network

2017 China Mobile NFV Planning
"Core cloud (ISM/BRAS/5G CP, province/ regional center, 50~100, IDC resource reuse) + edge cloud (CDN/vCPE/BRAS/5G UP, metro,1K~3K) +AP (1Million) "

ACCESS CDN: BENEFIT FOR TELECOM

❖ **New business opportunity via open CDN capabilities**

❖ **Reduce backbone bandwidth expansion cost via traffic offload to edge**

❖ **Enhance broadband user stickiness by contents enriched and UE enhanced**

AT&T Domain 2.0 demonstration:

"New open model: open network capability, win-win co-op with partners"

Closed Conservative

• Weak competitiveness compared with OTT in terms of content

• Loss of broadband users risk

Open Cooperative

• Enrich content and enhance user experience

• To attract more broadband users

ACCESS CDN: BENEFIT FOR CDN SP

❖ **Significantly reduce assets cost by fundamental resources sharing and on-demand application**

❖ **Enhances service quality and UE, ready for large bandwidth video service deployment**
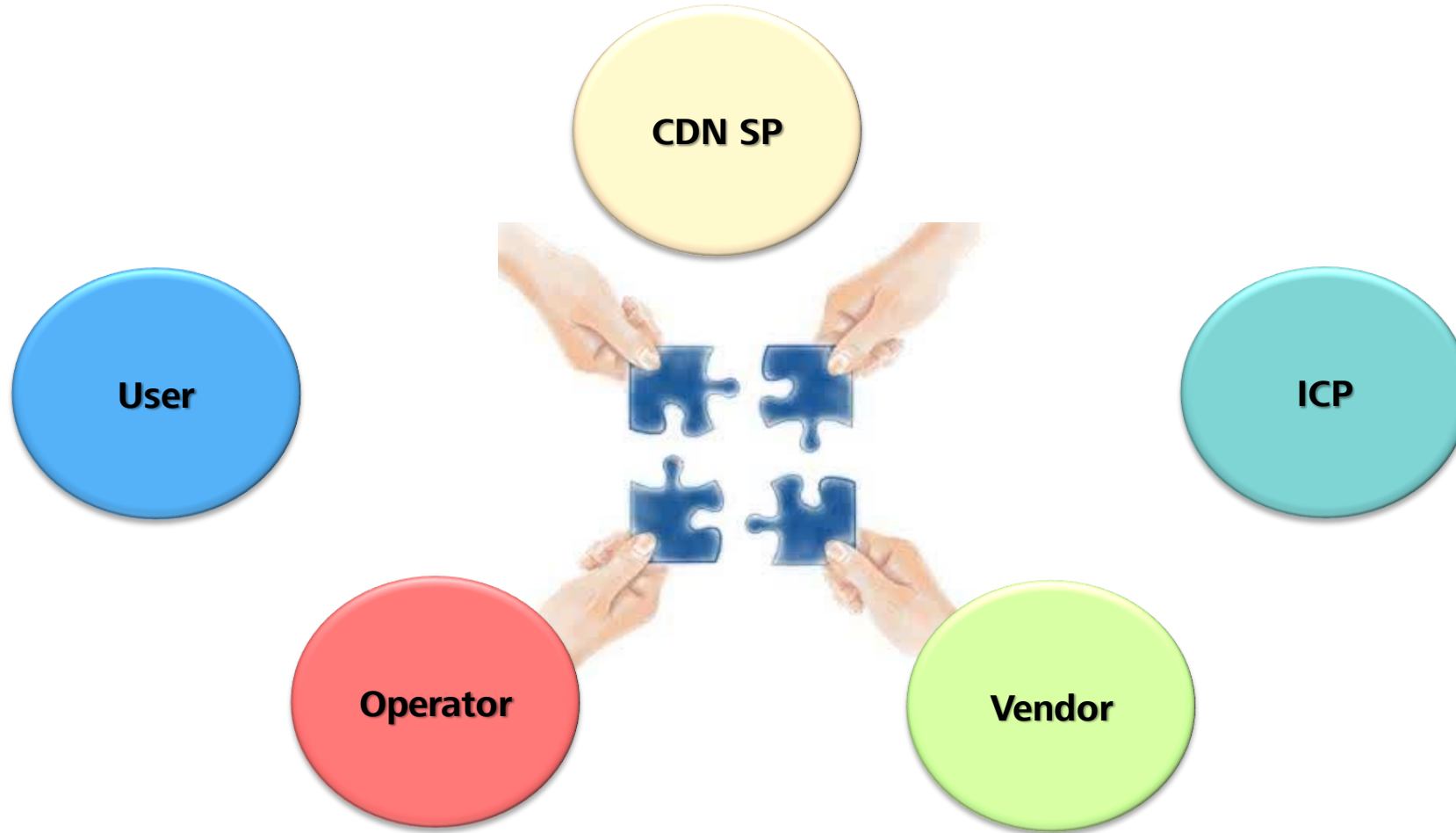
Traditional CDN node

• Self-construction

• Highly placed at backbone network

• Connect to ISP via peering or deploy HW &SW

in ISP access network

Highly distribution virtual CDN node

• Resources sharing with ISP

• On-demand application

• More distributed

• Closer to end user

PARTNERSHIP BETWEEN CO-OP FOR A HEALTHIER ECOSYSTEM

BEYOND CDN AIMS FOR FUTURE TELOCOM INFRASTUCTURE

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(General content delivery function, open network capability including real time multi-cast)

A-CDN IAAS
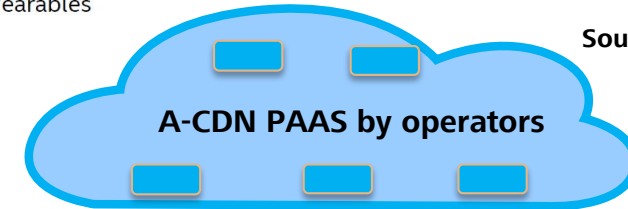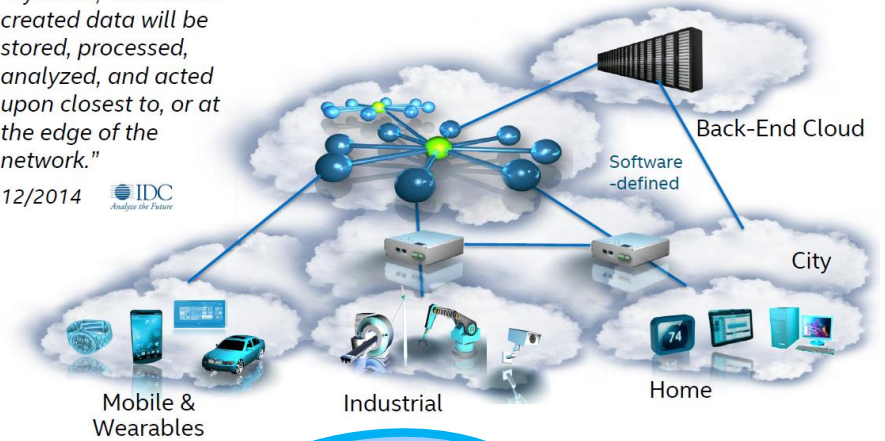(Computing, Storage IAAS + NAAS)

Convergence to be future telecom infrastructure

Underlay Network
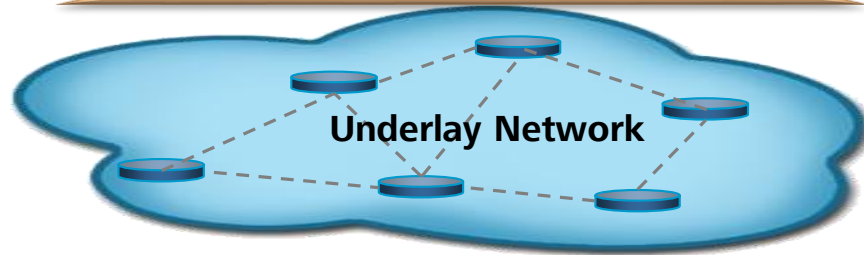
❖ **The video expected to occupy 90% of internet traffic, A-CDN capability should be key part of infrastructure**

Data Inversion Problem: IoT Edge data flows upstream
Cloud functionality migrating to be more proximate to the data

"By 2018, 40% of IoT-created data will be stored, processed, analyzed, and acted upon closest to, or at the edge of the network."

12/2014 IDC *Analyze the Future*

Back-End Cloud

Software-defined

City

Home

Mobile & Wearables

Industrial

Source: Intel & IDC

A-CDN PAAS by operators

❖ **The general content delivery capability of A-CDN is expected to be basic telecom platform for IoT**

Thank you

www.huawei.com