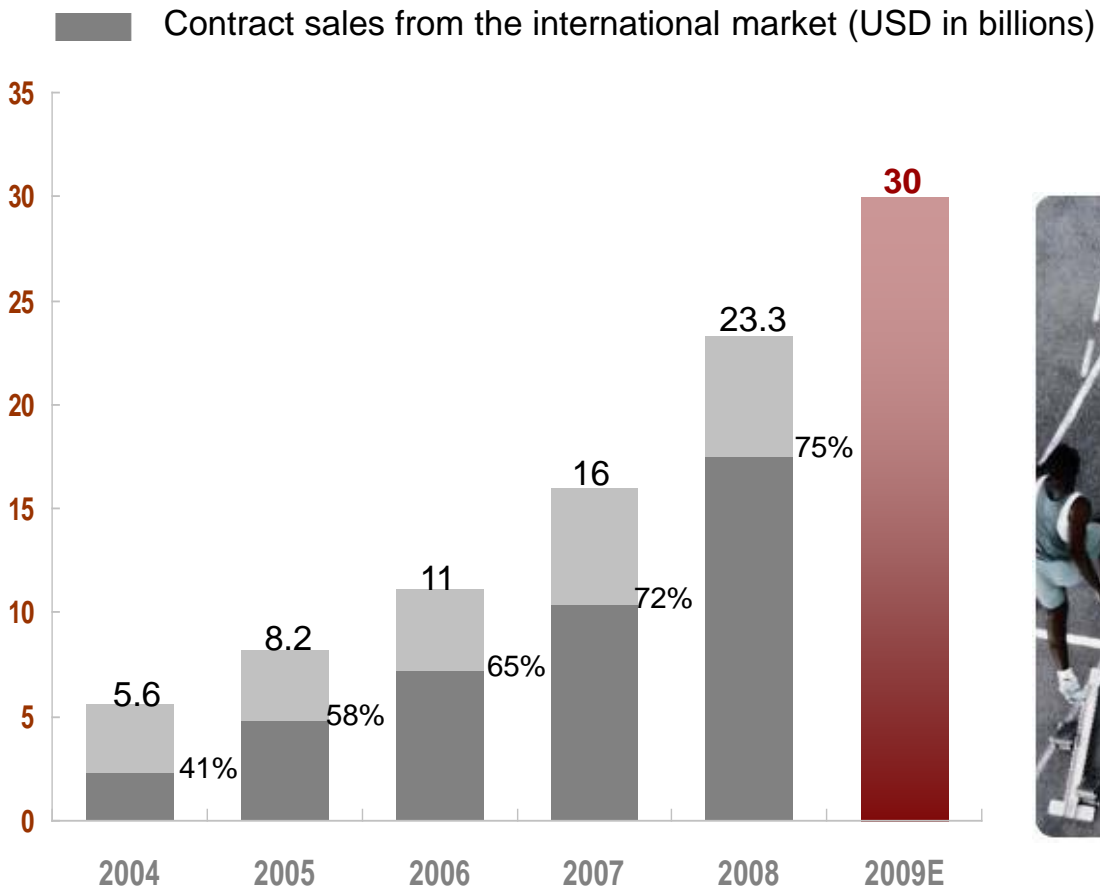# Huawei Corporate
and
IPv6 Network Evolution

www.huawei.com

Contents

- Global Market Progress

- Huawei IPv6 Strategy

- Creating Value for our Customers

Sustainable growth

■ Contract sales from the international market (USD in billions)

HUAWEI

Global operations

HUAWEI TECHNOLOGIES (Headquarters)

Huawei Headquarters

R&D center

Technical support center

22 regional HQ and over **100** branch offices

14 R&D centers, **29** training centers

87,502 employees worldwide

Three-level customer service system (HQ/ regional/ local)

Serving 36 of the world's top 50 operators

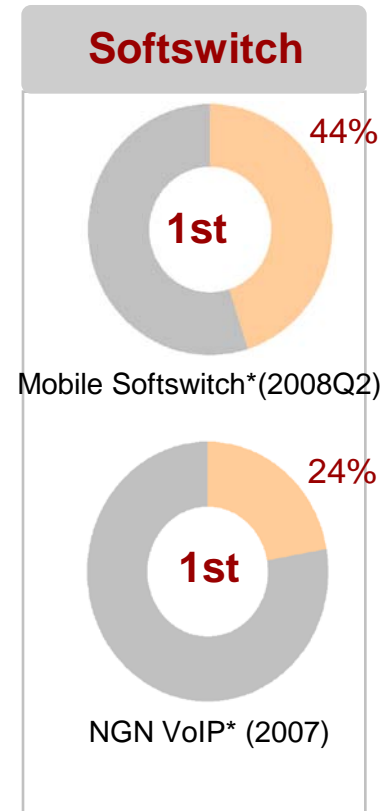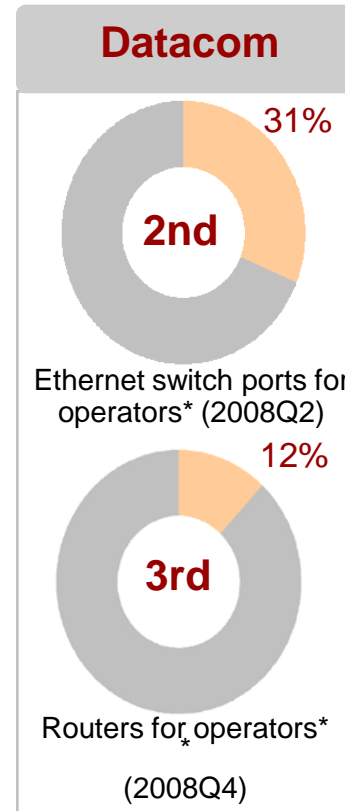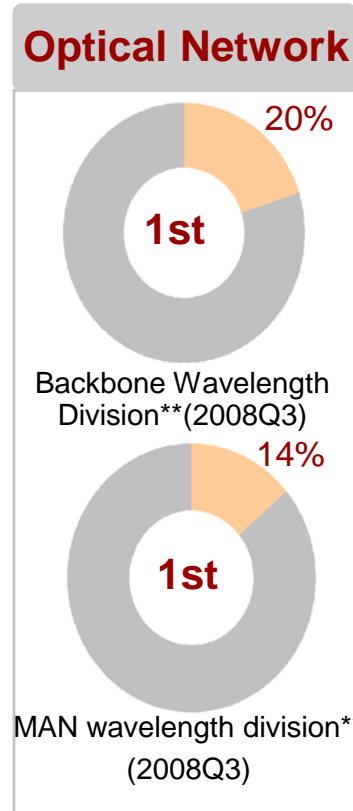| Logo	Description
vodafone	■ Deepen long-term strategy partnership ■ Providing UMTS solutions for Vodafone in Spain, Greece, Hungary, Romania, South Africa, Turkey etc.
Telefónica	■ Strong strategic infrastructure partnership ■ Major GSM/UMTS/HSPA network supplier ■ Major supplier of Broadband, Transmission and Metro Ethernet for the whole group
france telecom / orange	■ Deployed networks in 20+ countries ■ Corporate strategy partner for 2G/3G, FTTx, transition etc
Deutsche Telekom	■ Solely responsible for constructing PS core networks in Germany, Britain, the Netherlands, Austria, and the Czech Republic ■ Deployed GSM network in Czech republic ■ IMS, NG WDM, GPON, Core router, IP Microwave, Femtocell supplier
TELECOM ITALIA	■ Mobile broadband partner for building UMTS/HSPA networks in Italy and Brazil ■ Major FTTx supplier in Italy
TELUS	■ To provide TELUS with LTE-ready HSPA network, which is the first such network in North America
TeliaSonera	■ Chosen by TeliaSonera to deploy the world's first LTE/SAE commercial network in Oslo, Norway, bringing the unique advantages of mobile broadband service

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Huawei mobile market update

UMTS/HSPA	Mobile Softswitch	GSM
128 contracts	**1.2 Bln+ users**	**3 Mln+ TRX**
No.1(contract no.)	**No.1**	**21% (shipment)**

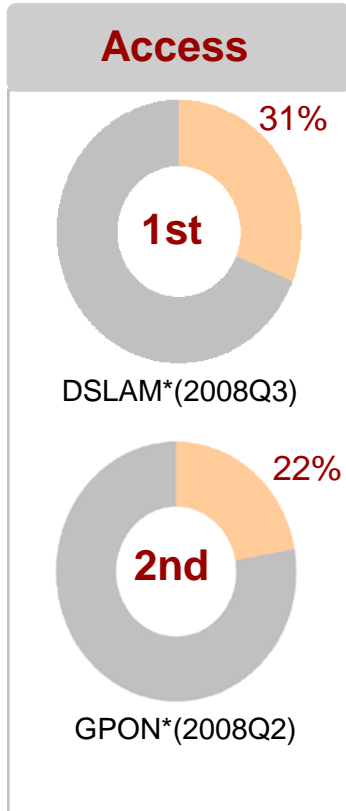| CDMA	WiMAX
0.48Mln+ TRX	**34 contracts**
No.2	
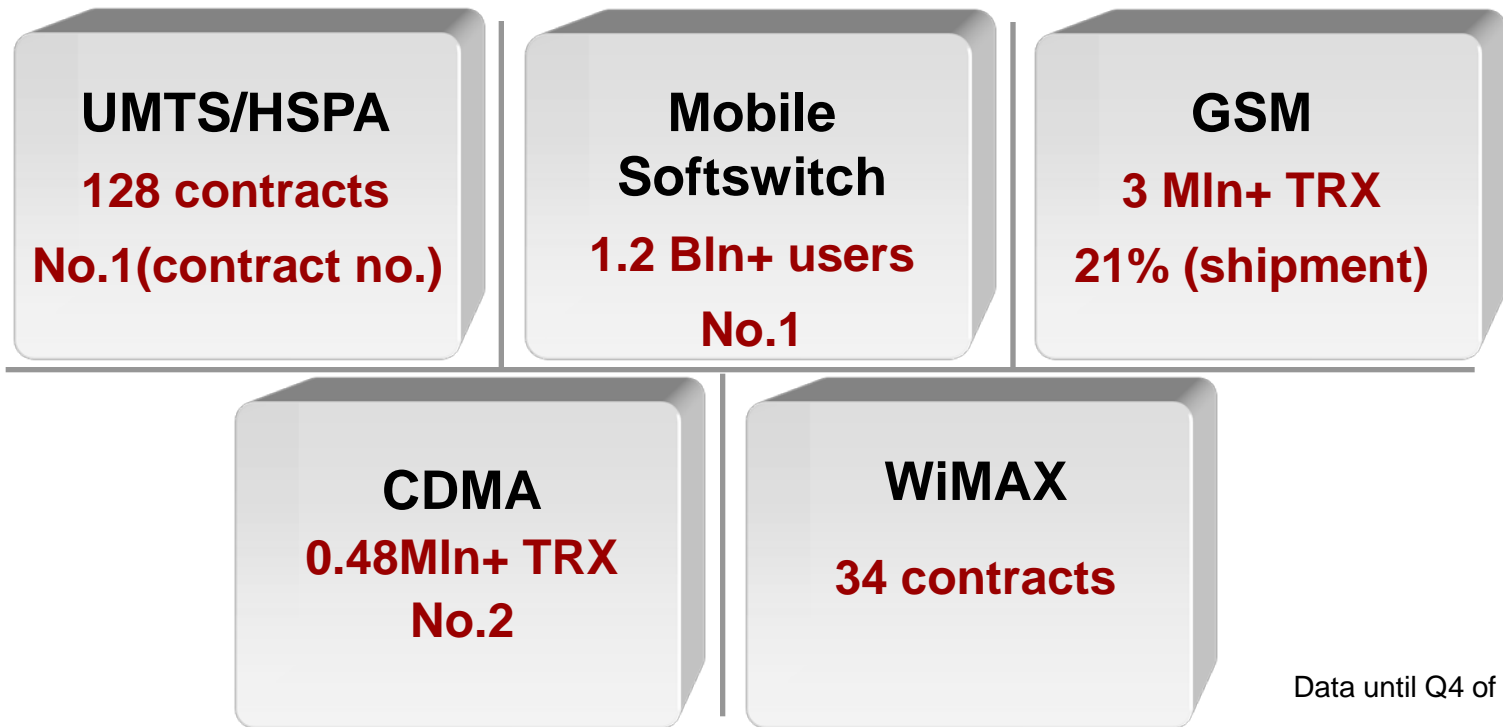
Data until Q4 of 2008

Large-scale adoption of WCDMA by leading operators

WCDMA/HSPA network deployment in Europe, North America and Japan

The industry's first commercial LTE contract in Europe

HUAWEI

All-IP broadband market update

Access

31%
1st
DSLAM*(2008Q3)

22%
2nd
GPON*(2008Q2)

Optical Network

20%
1st
Backbone Wavelength Division**(2008Q3)

14%
1st
MAN wavelength division**
(2008Q3)

Datacom

31%
2nd
Ethernet switch ports for operators* (2008Q2)

12%
3rd
Routers for operators*
(2008Q4)

Softswitch

44%
1st
Mobile Softswitch*(2008Q2)

24%
1st
NGN VoIP* (2007)

* By shipment   ** By market share   Source:Gartner, Infonetics, Dittberner, Ovum and etc.

Global leader in the access and optical fields; Leader in IPTime packet mobile transport

Mobile/NGN bearer network serves over **1.3 billion** subscribers, ranking **No.1** in the world

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Huawei in MENA

Headquarters of 2 sub-regions

- **MENA office being established since year 2000;**
- **One Region and 2 sub-regions: Middle East, Northern Africa**
- **22 branch offices across MENA and active in 33 countries**
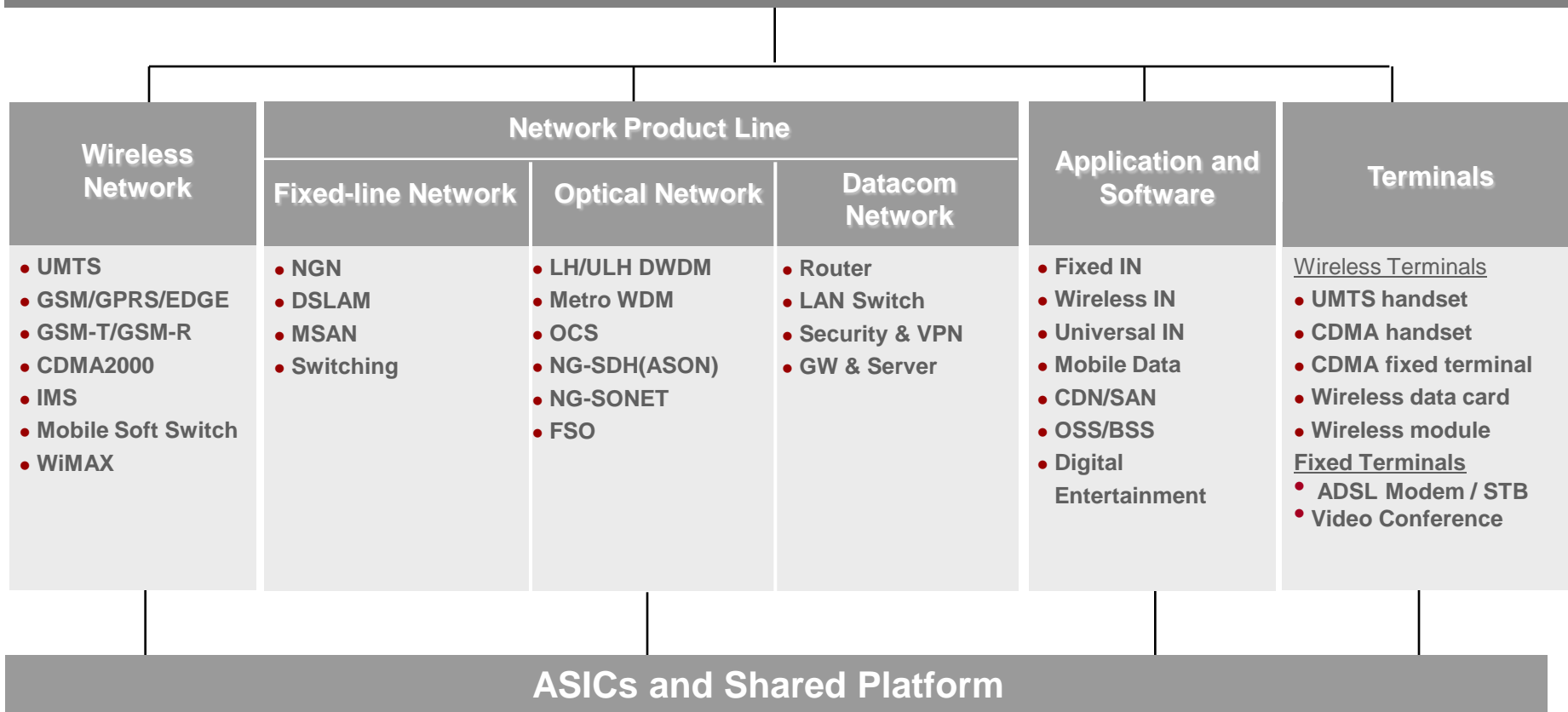- **Over 4,800 employees, 60% of whom are local staffs**

Top 3 Vendor in MENA

Huawei is the top3 vendor in MENA and has established partnerships with 94 operators in the region.

Operator	
STC	→ operation in 7 countries
Etisalat	→ operation in 17 countries
Orascom telecom	→ operation in 12 countries
Zain	→ operation in 22 countries
Maroc Telecom	→ No.1 in Morocco
Qtel	→ No.1 in Qatar
TCI	→ No.1 Mobile operator in Iran
PTCL	→ No.1 Mobile operator in Pakistan
Algeria Telecom	→ No.1 in Algeria
Telecom Egypt	→ No.1 Fixed operator in Egypt

Huawei Product Portfolio

Customized Communications Network Solutions					

Wireless Network	Network Product Line			Application and Software	Terminals
	Fixed-line Network	Optical Network	Datacom Network		
• UMTS • GSM/GPRS/EDGE • GSM-T/GSM-R • CDMA2000 • IMS • Mobile Soft Switch • WiMAX	• NGN • DSLAM • MSAN • Switching	• LH/ULH DWDM • Metro WDM • OCS • NG-SDH(ASON) • NG-SONET • FSO	• Router • LAN Switch • Security & VPN • GW & Server	• Fixed IN • Wireless IN • Universal IN • Mobile Data • CDN/SAN • OSS/BSS • Digital Entertainment	Wireless Terminals • UMTS handset • CDMA handset • CDMA fixed terminal • Wireless data card • Wireless module Fixed Terminals • ADSL Modem / STB • Video Conference

ASICs and Shared Platform

- ISO 9001:2000/TL9000/CMM for quality control
- ISO 14001:2004 for environment management

Your trusted services partner

What we offer

- Network Rollout
- Network Integration
- Customer Support
- Managed Services
- Network Technology Services
- Learning Services

Customers' values

Fast Time-to-Market

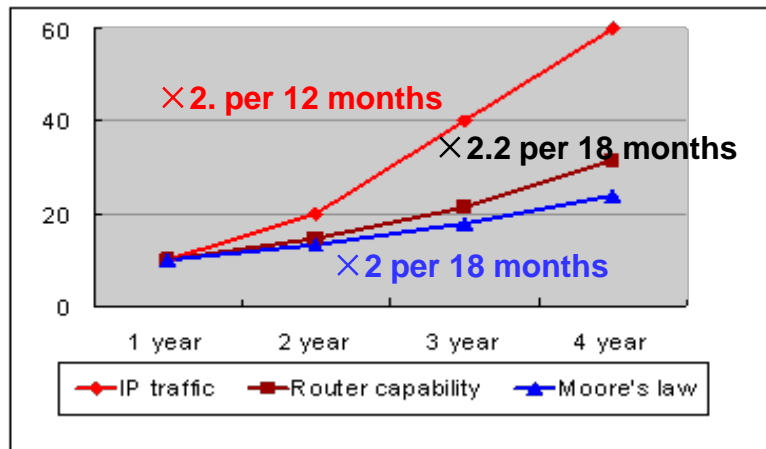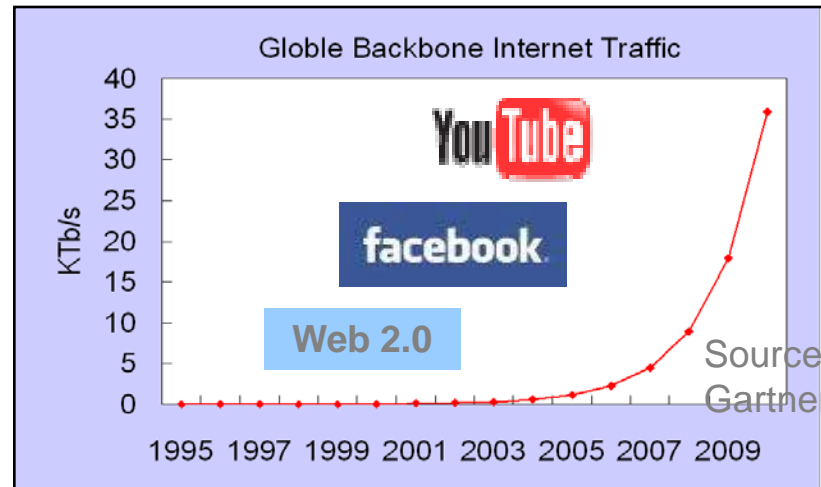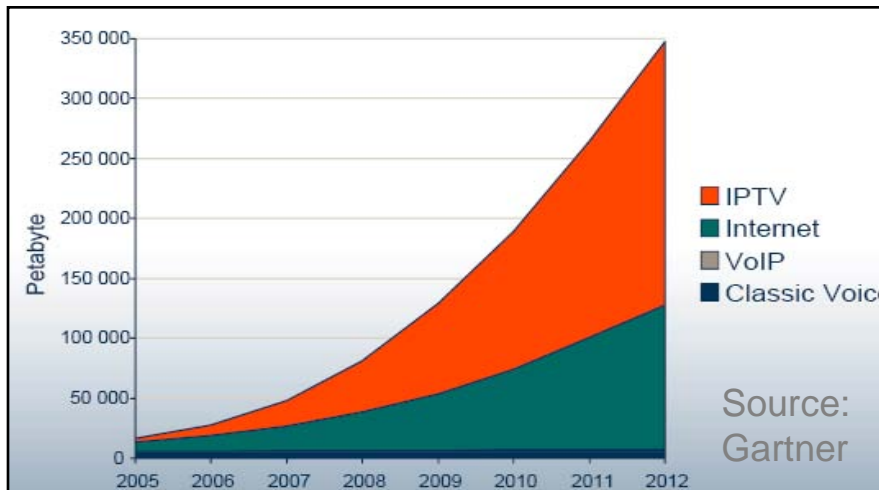**Efficiency Enhancement**

Seamless Evolution

Business Transformation

Huawei attaches strategic importance to Professional Services and provides **24/7** customer service with the support of thousands of employees and engineers across the region.
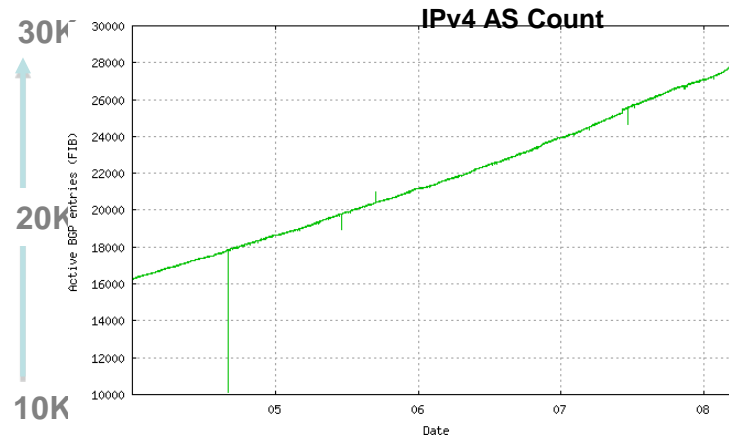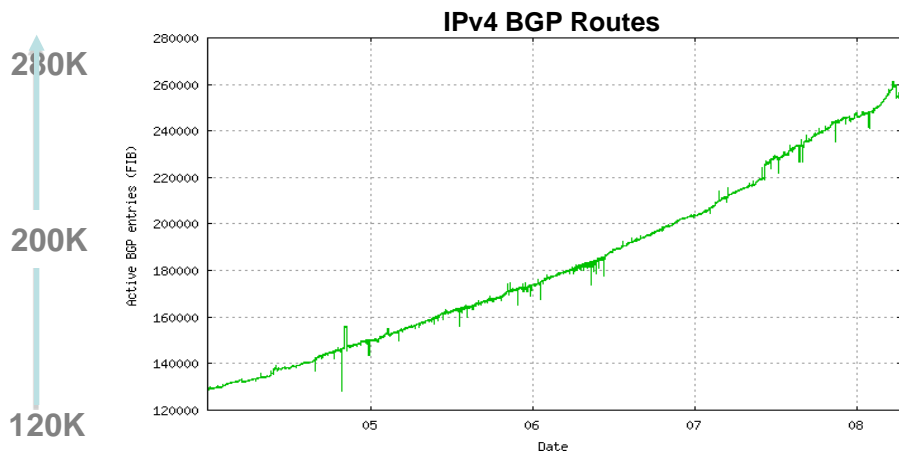
HUAWEI

Contents

- Global Market Progress

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- Creating Value for Our Customers

Booming Internet Traffic

Source: Gartner

Globle Backbone Internet Traffic

Web 2.0

Source: Gartner

×2. per 12 months

×2.2 per 18 months

×2 per 18 months

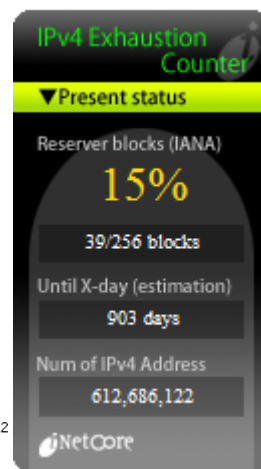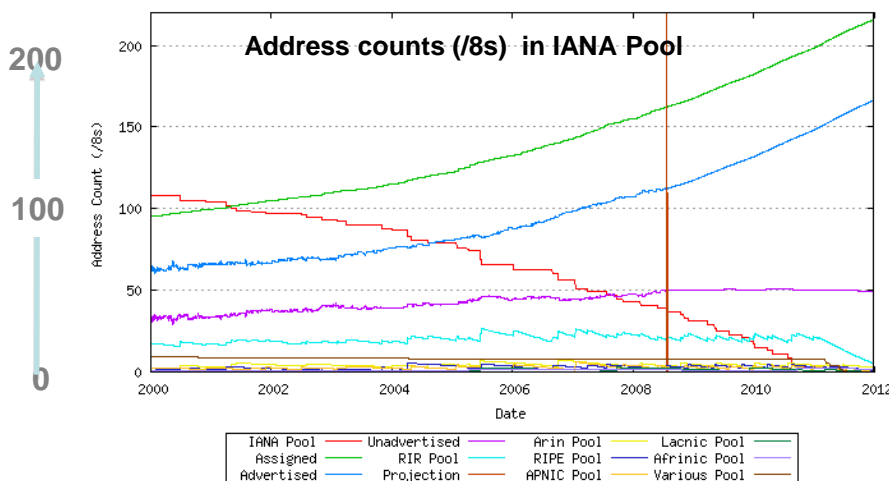- IP traffic
- Router capability
- Moore's law

- **Based on Gartner report, Internet traffic doubles ~ every 12 months**
- **Capacity of an individual equipment cannot keep up with the rapid growth**
- **Network scalability is becoming one of the major challenges**

Route Expansion and Address Exhaustion

IPv4 BGP Routes

280K
200K
120K

IPv4 AS Count

30K
20K
10K

Source: IANA 2008 IPv4 Address Report

Address counts (/8s) in IANA Pool

200
100
0

IPv4 Exhaustion Counter
▼ Present status
Reserver blocks (IANA)
15%
39/256 blocks
Until X-day (estimation)
903 days
Num of IPv4 Address
612,686,122
iNetCore

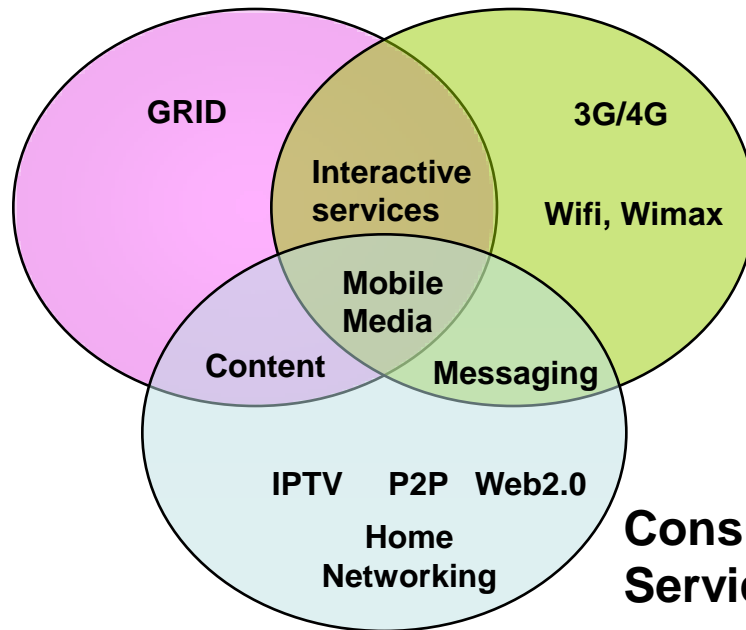- **IANA IPV4 Routes** and **AS Count** increase more than 15% per year**!**
- **IANA IPV4 Pool** will be exhausted before 2012!
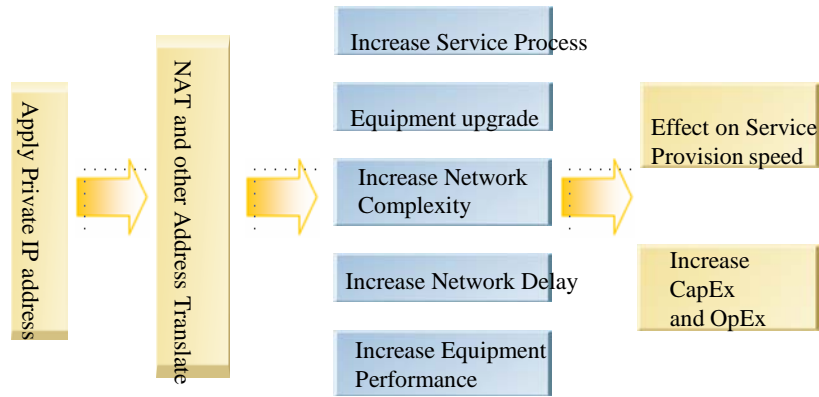
Driving to IPv6

Distributed Computing

Wireless Mobility

GRID

3G/4G

Interactive services

Wifi, Wimax

Mobile Media

Content

Messaging

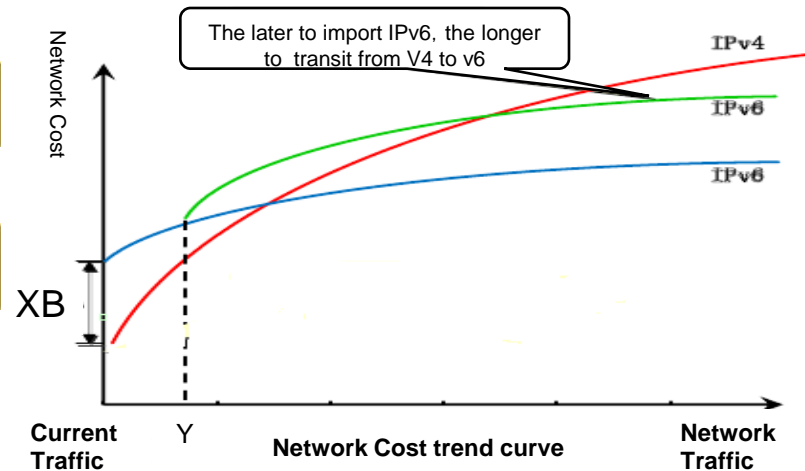IPTV   P2P   Web2.0

Home Networking

Consumer Services

- **This despite increasingly intense conservation efforts**
  - NAT (network address translation)
  - CIDR (classless inter-domain routing)
  - PPP / DHCP address sharing
- **Theoretical limit of 32-bit space: ~4 billion devices**
- **Practical limit of 32-bit space: ~250 million devices (RFC 3194)**

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IPv6 is the ultimate solution

Increase Service Process

Equipment upgrade

Increase Network Complexity

Increase Network Delay

Increase Equipment Performance

Apply Private IP address

NAT and other Address Translate

Effect on Service Provision speed

Increase CapEx and OpEx

XB

If apply IPv4 Private Address, service provision speed will be affected and network cost will increase.

Network Cost

The later to import IPv6, the longer to transit from V4 to v6

IPv4

IPv6

IPv6

Current Traffic   Y   Network Cost trend curve   Network Traffic

---

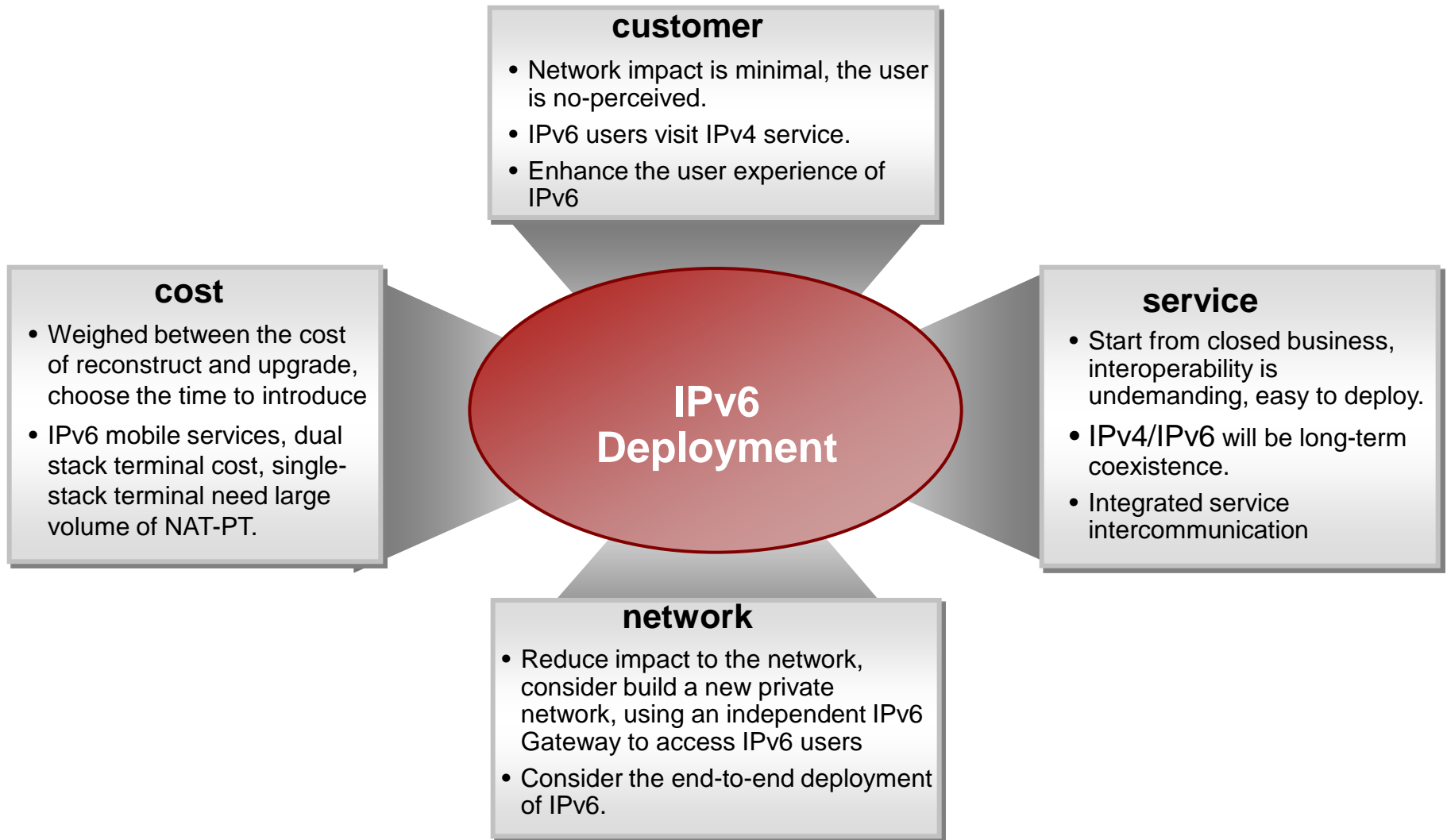➢**NAT can slow down the consumption of IPv4 address, but not a permanent solution**

- Destruct end-to-end connectivity, NAT and ALG etc.postpone business cycle.
- Private network address space is limited, Increase the complexity of deployment.
- Reduce performance, it is difficult to deployed on a large-scale.
- Increase network cost of the long term.

➢**Later deployment of IPv6, the total cost is higher.**

- At present, IPv6 transformation costs x billion. IPv4 networks need more intercommunion cost, and total cost higher than IPv6 network (blue line)
- IPv6 transformation more later, the total cost more higher and the transformation cycle more longer. (green line)

IPv6 is the ultimate to solve the shortage of IP address, it has reached consensus to deploy IPv6 globally.
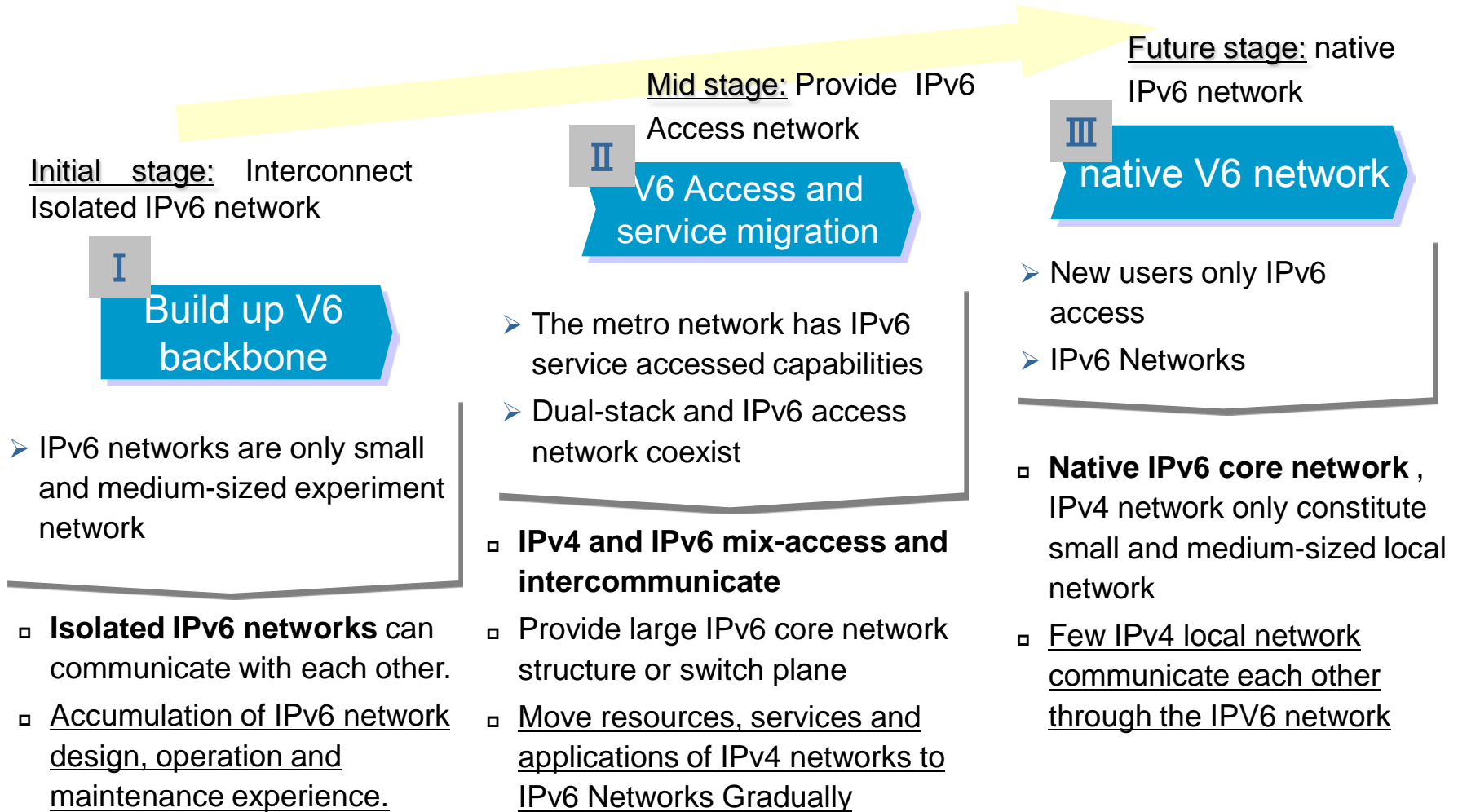
Main considerations of IPv6 deployment

customer
- Network impact is minimal, the user is no-perceived.
- IPv6 users visit IPv4 service.
- Enhance the user experience of IPv6

cost
- Weighed between the cost of reconstruct and upgrade, choose the time to introduce
- IPv6 mobile services, dual stack terminal cost, single-stack terminal need large volume of NAT-PT.

IPv6 Deployment

service
- Start from closed business, interoperability is undemanding, easy to deploy.
- IPv4/IPv6 will be long-term coexistence.
- Integrated service intercommunication

network
- Reduce impact to the network, consider build a new private network, using an independent IPv6 Gateway to access IPv6 users
- Consider the end-to-end deployment of IPv6.

Evolution of IPv6 E2E Solution

IPv6 is a step-by-step evolution, IPv4/IPv6 will co-exist in a very long time
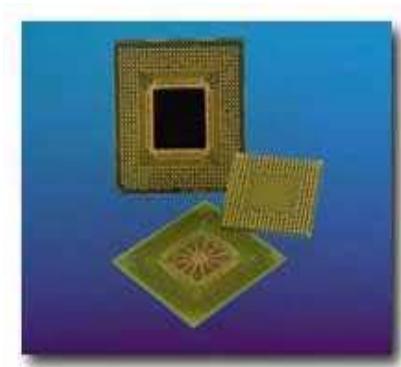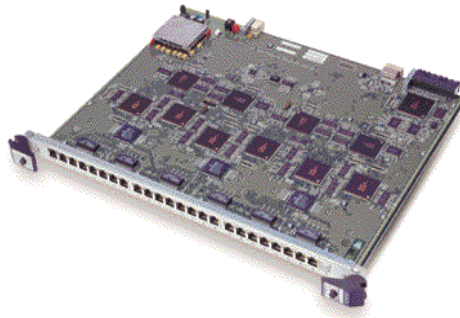

All Nodes will evolve to IPv6
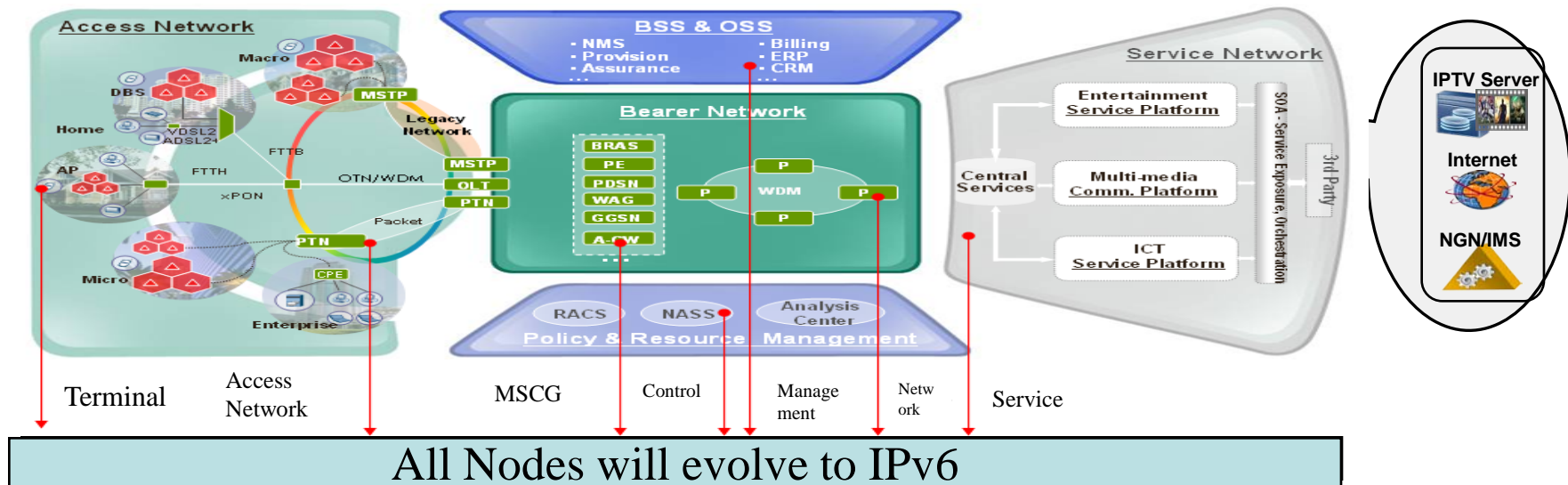
➢ The parts of IPv6 E2E evolution:
  ➢ the network nodes, including the access, metro, backbone, management, terminals and services.
➢ The objectives of IPv6 E2E evolution :
  ➢ upgrade the whole network to IPv6.
➢ The State of IPv6 network:
  ➢ Chips and external components of the main vendor equipments support IPv6 well, can be upgraded to support IPv6 natively.
  ➢ Main vendors support IPv6 routing, VPN and other basic protocols well; IPv6 access, interoperability waiting for standardization.

IPv6 Network Evolution Steps

Initial stage: Interconnect Isolated IPv6 network

Ⅰ

Build up V6 backbone

- ➤ IPv6 networks are only small and medium-sized experiment network

- ❑ **Isolated IPv6 networks** can communicate with each other.
- ❑ Accumulation of IPv6 network design, operation and maintenance experience.

Mid stage: Provide IPv6 Access network

Ⅱ

V6 Access and service migration

- ➤ The metro network has IPv6 service accessed capabilities
- ➤ Dual-stack and IPv6 access network coexist

- ❑ **IPv4 and IPv6 mix-access and intercommunicate**
- ❑ Provide large IPv6 core network structure or switch plane
- ❑ Move resources, services and applications of IPv4 networks to IPv6 Networks Gradually

Future stage: native IPv6 network

Ⅲ

native V6 network

- ➤ New users only IPv6 access
- ➤ IPv6 Networks

- ❑ **Native IPv6 core network** , IPv4 network only constitute small and medium-sized local network
- ❑ Few IPv4 local network communicate each other through the IPV6 network

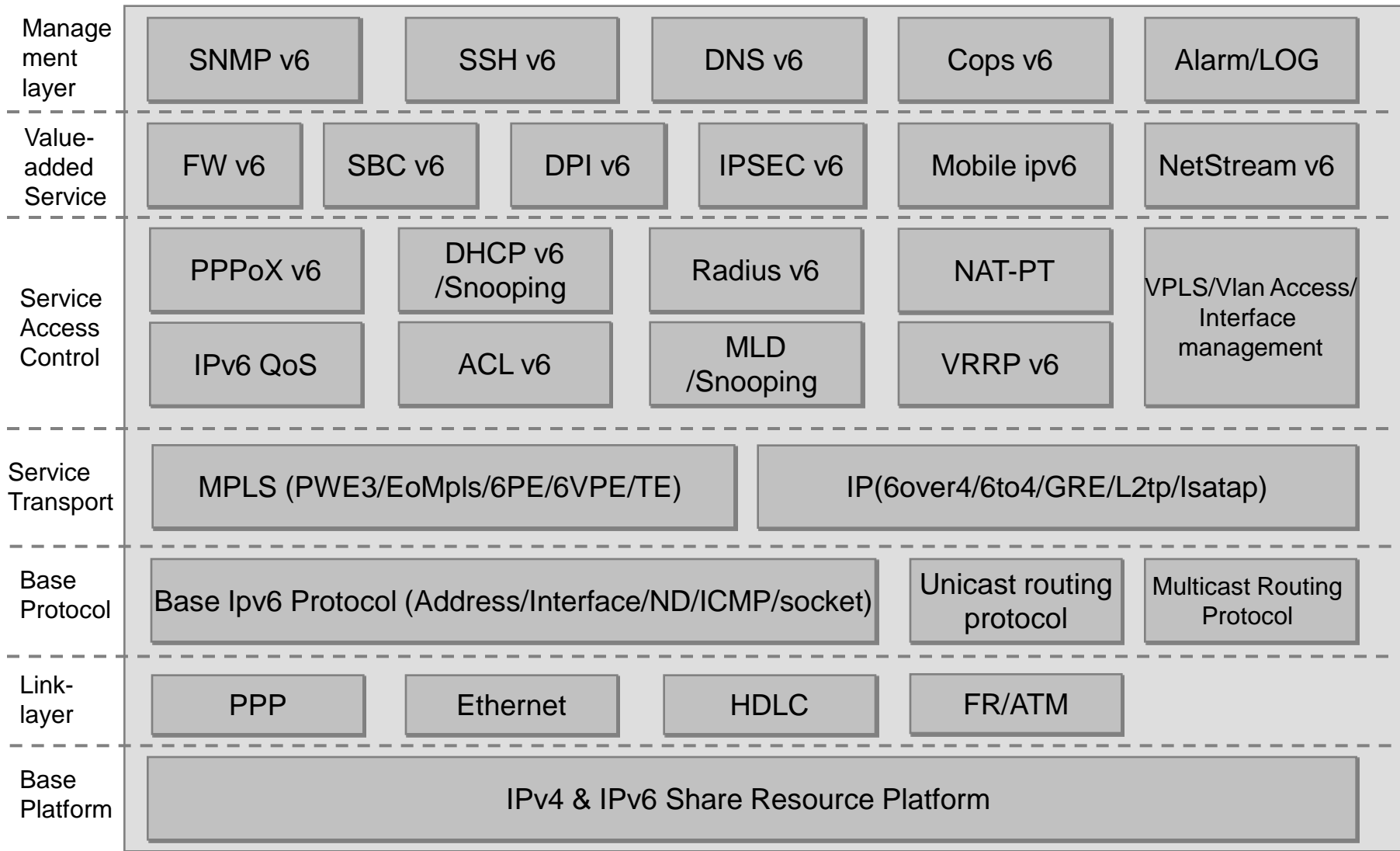# Continuous innovation - independent research and development of the IPv6 core chips

- Huawei high-level ASIC chip full support for IPv6 features,
- Greatly enhance the T-bit core router brand competitiveness

Continuous innovation - a comprehensive operating system support for IPv6 network
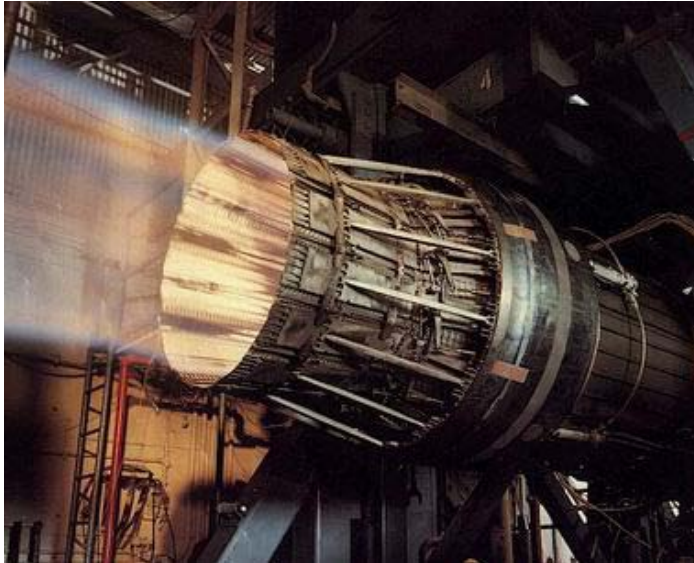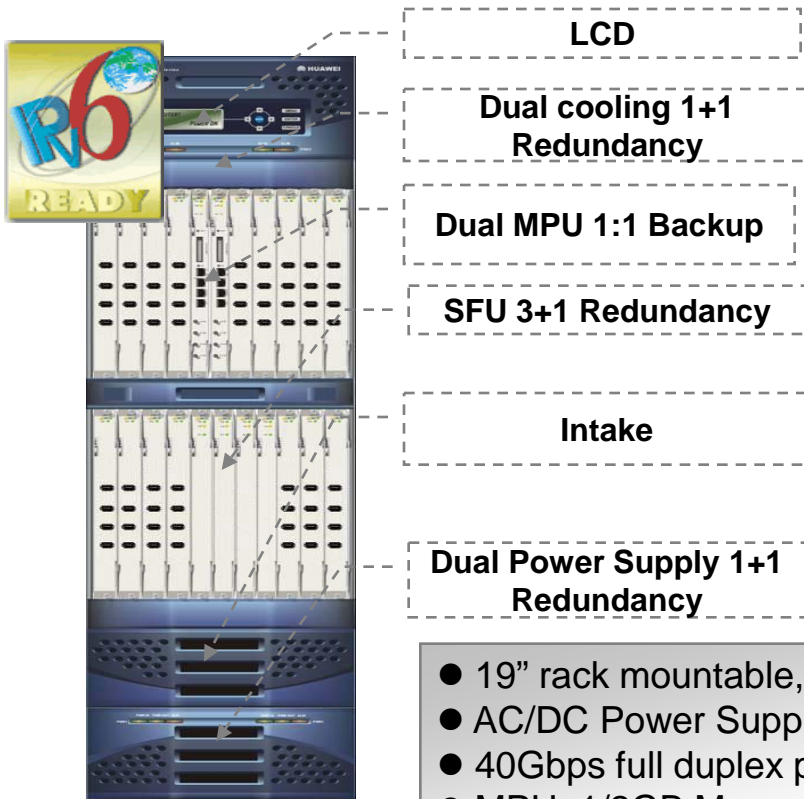

- VRP OS ® (Versatile Routing Platform) is a generic Huawei software platform IP products, VRP5 full support for IPv6
- Huawei's participation of the standard / draft more than 20, involving IPv6 multicast, mobility, security, network management, etc.; Huawei IPv6 related fields in more than 60 patents

Huawei IPv6 Architecture

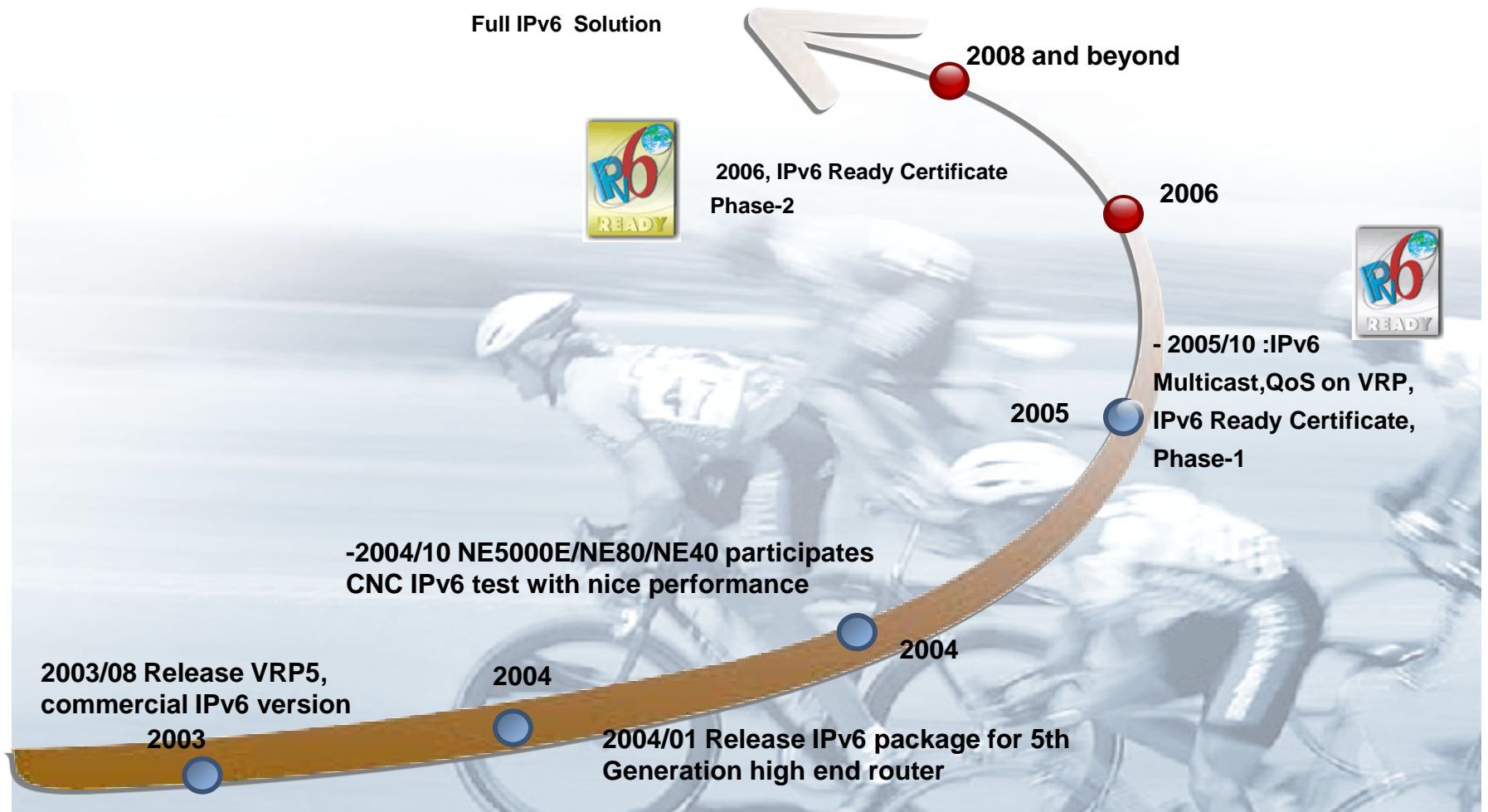|					
Management layer	SNMP v6	SSH v6	DNS v6	Cops v6	Alarm/LOG
Value-added Service	FW v6	SBC v6	DPI v6	IPSEC v6	Mobile ipv6 · NetStream v6

Service Access Control

PPPoX v6	DHCP v6 /Snooping	Radius v6	NAT-PT	VPLS/Vlan Access/ Interface management
IPv6 QoS	ACL v6	MLD /Snooping	VRRP v6	

Service Transport

MPLS (PWE3/EoMpls/6PE/6VPE/TE)	IP(6over4/6to4/GRE/L2tp/Isatap)

Base Protocol

Base Ipv6 Protocol (Address/Interface/ND/ICMP/socket)	Unicast routing protocol	Multicast Routing Protocol

Link-layer

PPP	Ethernet	HDLC	FR/ATM

Base Platform

IPv4 & IPv6 Share Resource Platform

HUAWEI

NE5000E Single Chassis

LCD

Dual cooling 1+1 Redundancy

Dual MPU 1:1 Backup

SFU 3+1 Redundancy

Intake

Dual Power Supply 1+1 Redundancy

Item	Specification
Backplane Capacity	**4 Tbps**
Switching Capacity	**2.56 Tbps**
Port Capacity (bidirectional)	**1.28 Tbps**
Forwarding Performance	**1600 Mpps**

- 19" rack mountable, H x W x D = 160 x 44.2 x 66.9 cm
- AC/DC Power Supply; Max Power Consumption: 5KWatt
- 40Gbps full duplex per slot
- MPU: 1/2GB Memory, scalable to 4GB; 512M Compact Flash Card
- 16 LPU: 512MB CPU Memory, 256MB packet buffer
- 4 SFU: Non-blocking crossbar switching fabric, 640Gbps per SFU,3+1 redundancy

NE5000E fully supports IPv6 commercial use, and got IPv6 golden authentication

Huawei Contributions to IPv6

Full IPv6 Solution

2008 and beyond

2006, IPv6 Ready Certificate Phase-2

2006

- 2005/10 :IPv6 Multicast,QoS on VRP, IPv6 Ready Certificate, Phase-1

2005

-2004/10 NE5000E/NE80/NE40 participates CNC IPv6 test with nice performance

2004

2003/08 Release VRP5, commercial IPv6 version
2003

2004

2004/01 Release IPv6 package for 5th Generation high end router

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Huawei IPv6 Solution Highlights

- ***Comprehensive IPv6 Support***

  - Support RIPng, OSPFv3, BGP4+, ISISv6 and ISIS multi topology

  - Support of IPV6 Multicast and IPV6 security in all the core routers.

  - IPv6 ready on all line cards and interfaces with vigorous testing

  - Support all main steam transition technologies

- ***Wire Speed IPv6 Performance***

  - Only vendor with wire speed 10G POS forwarding at 60 bytes .

- ***Leading Migration Solution***

  - Leading IPv6 application experience, An absolutely dominate share on CNGI

  - Distributed and hardware based Tunnel processing at wire speed

  - Only vendor with wire speed Gigabit NAT-PT capability

- ***NP based 5th generation implementation***

  - Combine both the advantage of ASIC performance & CPU flexibilities.

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Industry IPv6 Deployment Status

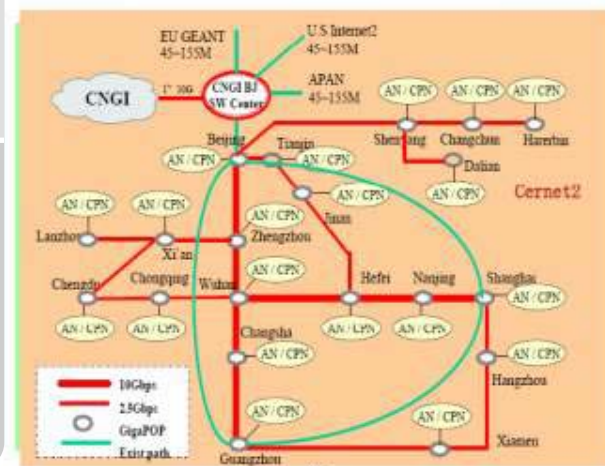| China Telecom	2009 deploy Experimental IPv6 network, in 2010 try to be commercial. 2008-2009, the critical period to argue IPv6 service deployment, the Telecommunications Research Institute draft guidance of large-scale IPv6 introduction, Hunan Telecom starts IPv6 test point. In 2010 Shanghai World Expo and Guangzhou Asian Games will consider to display IPv6.
China mobile	3G mobile broadband deploy IPV6, to resolve the limitation of private network address space. The original IPv4 reserve is very limited, the mobile broadband has more requirements. During 2010, China mobile will deploy 3G IPv6 commercial services.
China Unicom	2010 commercial-scale test users will reach at least 20,000, China unicom will build a new type IPv6 access network, the users will be at least 15,000; upgrade existing broadband IPv4 access network, develop IPv6 end-users at least 5000.
France Telecom	2009 Q2-Q3 FT will deploy Enterprise IPV6, in 2009 tests the family and the mobile service, in 2010 deploy the family IPv6 Livebox, the Core network maintains IPv4 temporarily. Poland subnet has strong interest, actively discusses the deployment of IPv6 solution, requests the current network equipments support dual-stack.
Japan	IPv6 large-scale commercial from 2005, package the new concept of next-generation network, provide high-speed network services based on IPv6, leveraging next-generation network evolution, and promote various IPV6 new technologies and new services.
America	The U.S. government required government and Defense departments migrate telecommunication network into IPv6 platform before the summer of 2008. It led that the United States new applied IPv6 addresses reached 14,729 pieces, the world's ranking jumped from No. 11 to No. 1.

CERNET2 in China

Background

- CERNET---China Education and Research Network, built since 1994.
- CERNET2--- The world's largest pure IPv6 network, built in Dec. 2004.
- Connecting 200+ Universities and 100+ Research Institutes in China at 1Gbps-10Gbps

Huawei Solution

- CERNET2 backbone connecting 15-20 Giga POPs at 2.5G-10Gbps;
- Multicast, E2E performance monitoring, Middleware and Advanced Applications;
- **Over 80% of the key equipments that CERNET2 network used are from Huawei**
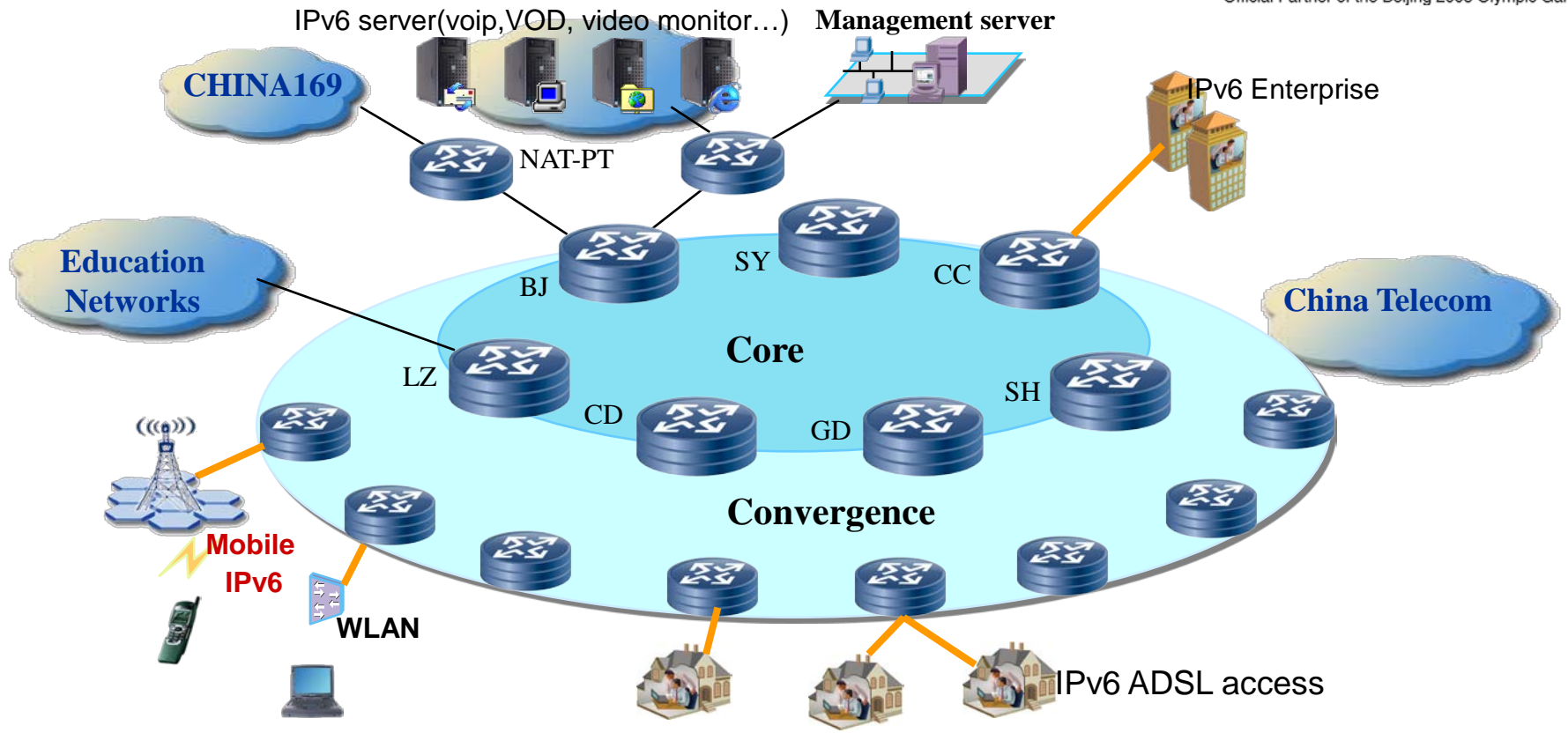
How Benefited

- Provide services for education and research , also for international collaboration;
- Lay solid foundation for education development
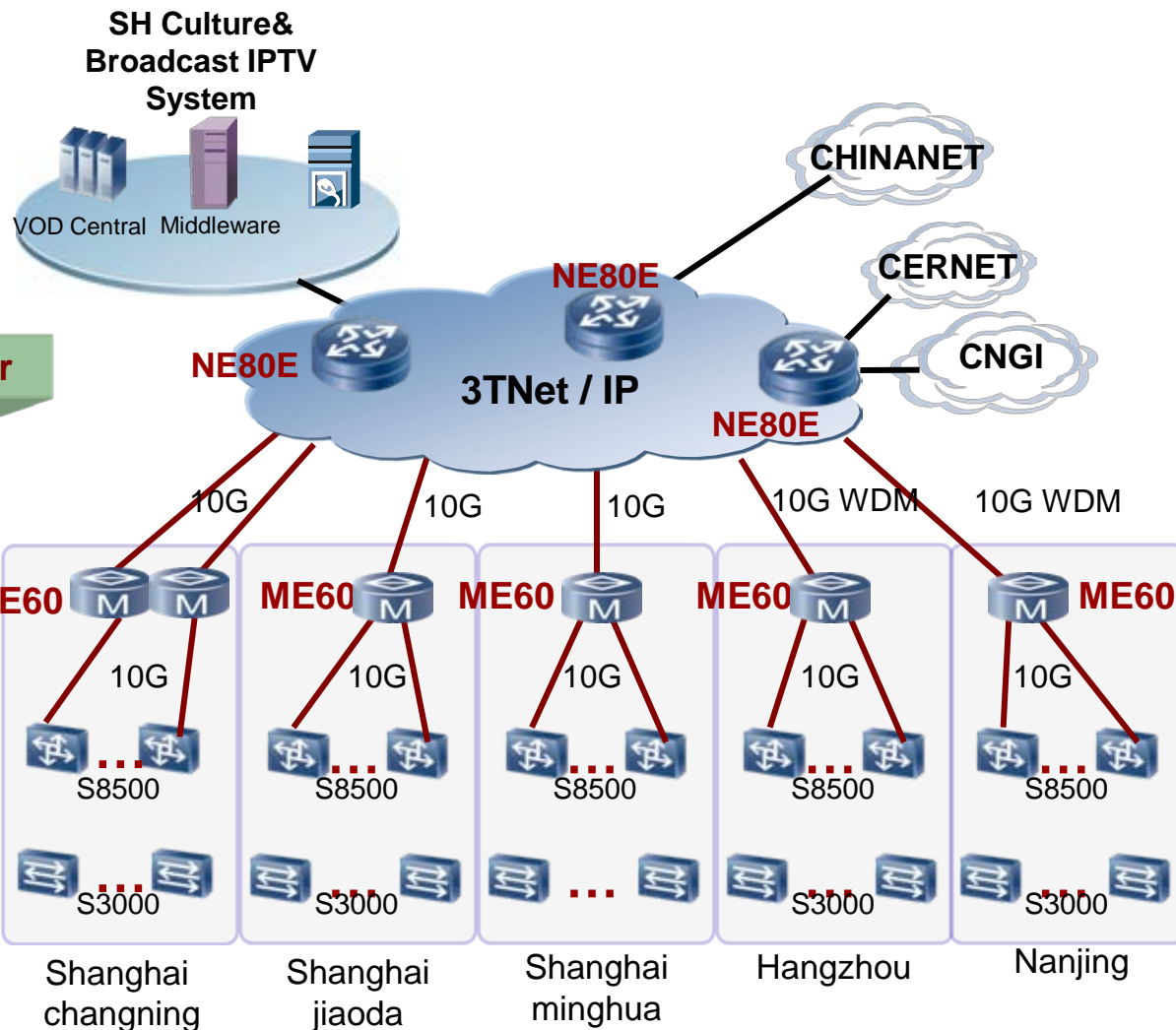
China Netcom CNGI IP Backbone

IPv6 server(voip,VOD, video monitor…) **Management server**

CHINA169   NAT-PT   IPv6 Enterprise

Education Networks   BJ   SY   CC   China Telecom

Core

LZ   CD   GD   SH

Convergence

Mobile IPv6   WLAN   IPv6 ADSL access

➢Network Service： VOIP, VOD, video monitor, IPV6 adsl access, Olympics applications etc.

Shanghai 3TNET broadband multimedia network

SH Culture& Broadcast IPTV System

VOD Central   Middleware

CHINANET

CERNET

NE80E

CNGI

NE80E

3TNet / IP

NE80E

Minimum 40Mbps per user

- IPTV, internet, game service, VoIP in the future

- IPv4, IPv6 Dual stack

- 2006 December check and accept

- http://www.3tnet.com.cn

10G   10G   10G   10G WDM   10G WDM

ME60   ME60   ME60   ME60   ME60

10G   10G   10G   10G   10G

S8500   S8500   S8500   S8500   S8500

... S3000   S3000   ... S3000   S3000   S3000

Shanghai   Shanghai   Shanghai   Hangzhou   Nanjing
changning   jiaoda   minghua

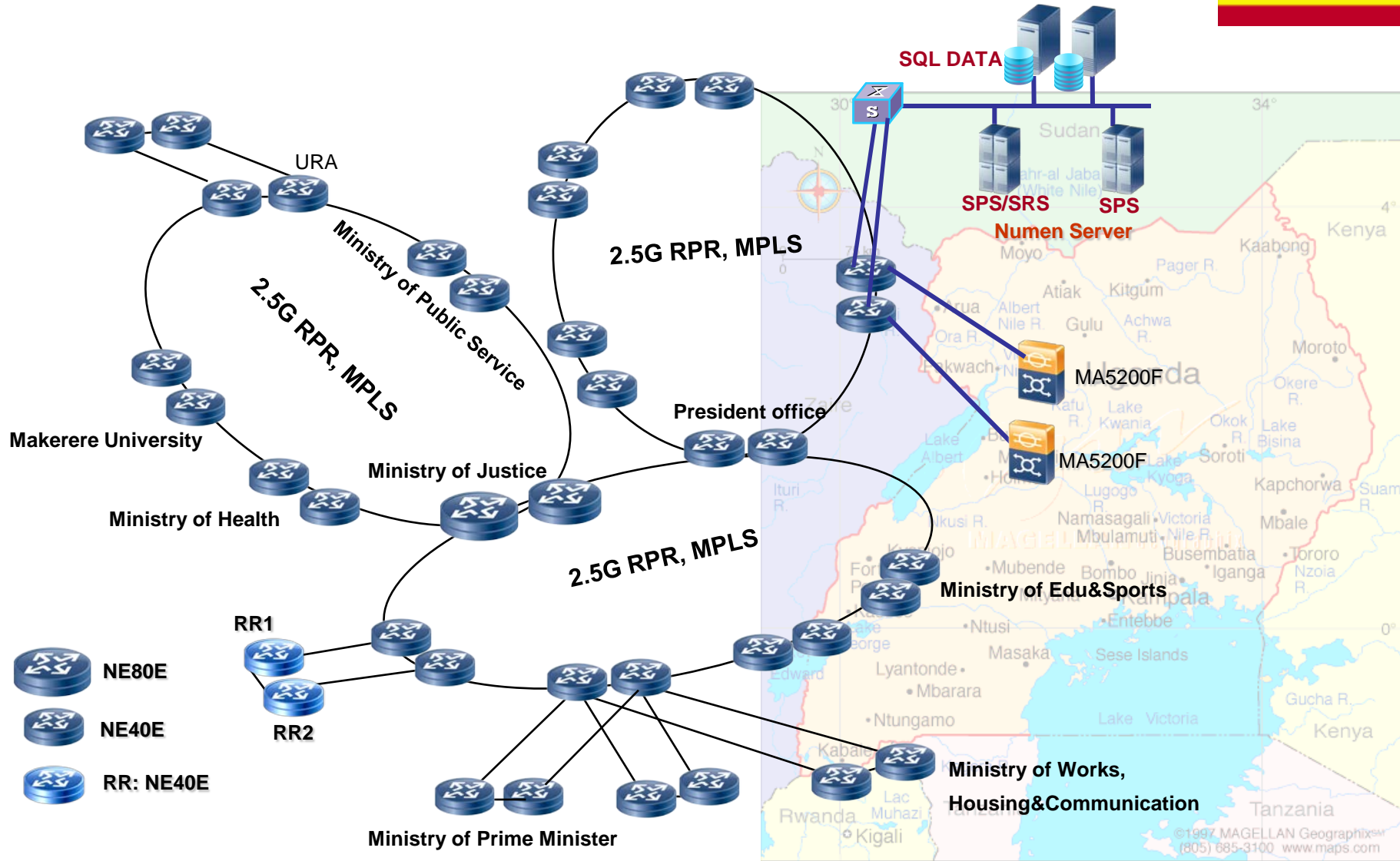IPTV: 30k subscriber, 101 IPTV channels, 2000 VOD channels

Senegal Backbone Network Topology
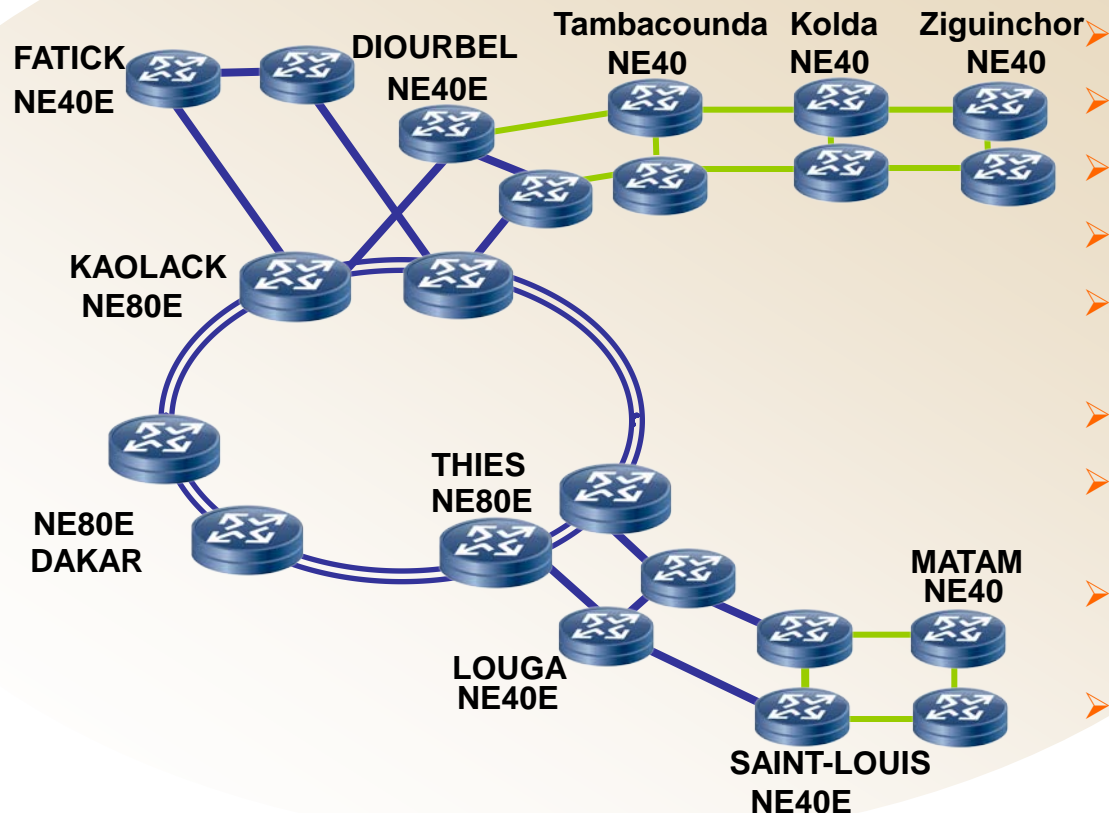
- 11 regions
- 40 ministries
- Up to 60,000 users
- 3 core nodes in 2.5G RPR ring
- 4 cities covered by 2.5G optical transmission
- 4 cities covered by microwave
- Each nodes has 2 routers for redundancy
- VoIP, Videoconference, Data services
- Data center

Legend:
- :2.5G RPR
- :pos2.5G
- :Micro-wave(FE)

Node labels: FATICK NE40E, DIOURBEL NE40E, Tambacounda NE40, Kolda NE40, Ziguinchor NE40, KAOLACK NE80E, NE80E DAKAR, THIES NE80E, LOUGA NE40E, MATAM NE40, SAINT-LOUIS NE40E

Uganda e-Government

SQL DATA

SPS/SRS SPS
Numen Server

2.5G RPR, MPLS

URA

Ministry of Public Service

2.5G RPR, MPLS

Makerere University

President office

Ministry of Justice

Ministry of Health

MA5200F

MA5200F

2.5G RPR, MPLS

Ministry of Edu&Sports

RR1

NE80E

NE40E

RR2

RR: NE40E

Ministry of Works,
Housing&Communication

Ministry of Prime Minister

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Thank you

www.huawei.com