




# IPv6 Deployment Experience in China Telecom

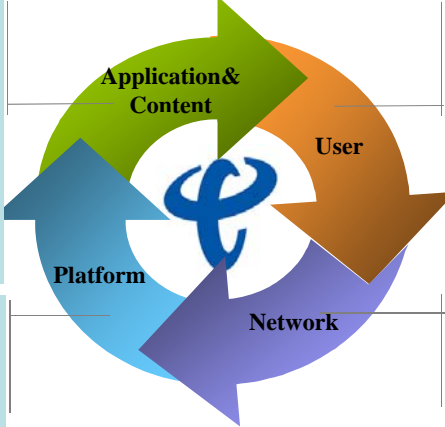
**Zhao Huiling**

**China Telecom**  
2013. 8.28


## Advantages to aggregate the industrial chain

- **Cloud services:**  
Cloud storage, Cloud server
- **Content services:**  
applications store、online video/music/ reading, etc
- **ICT applications:**  
Bestone, government/enterprise applications



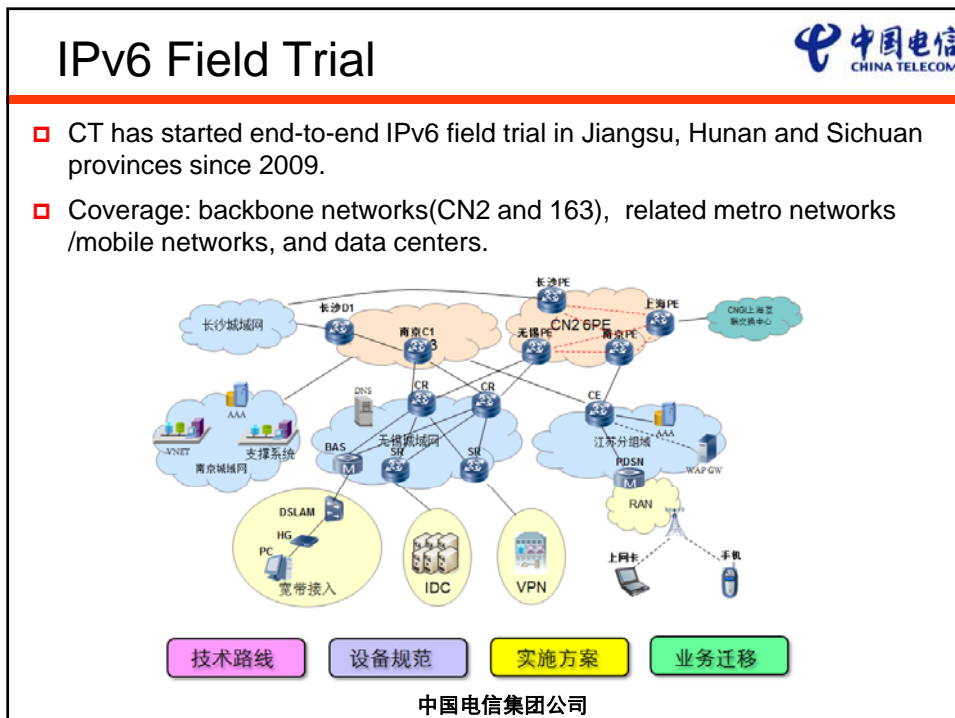
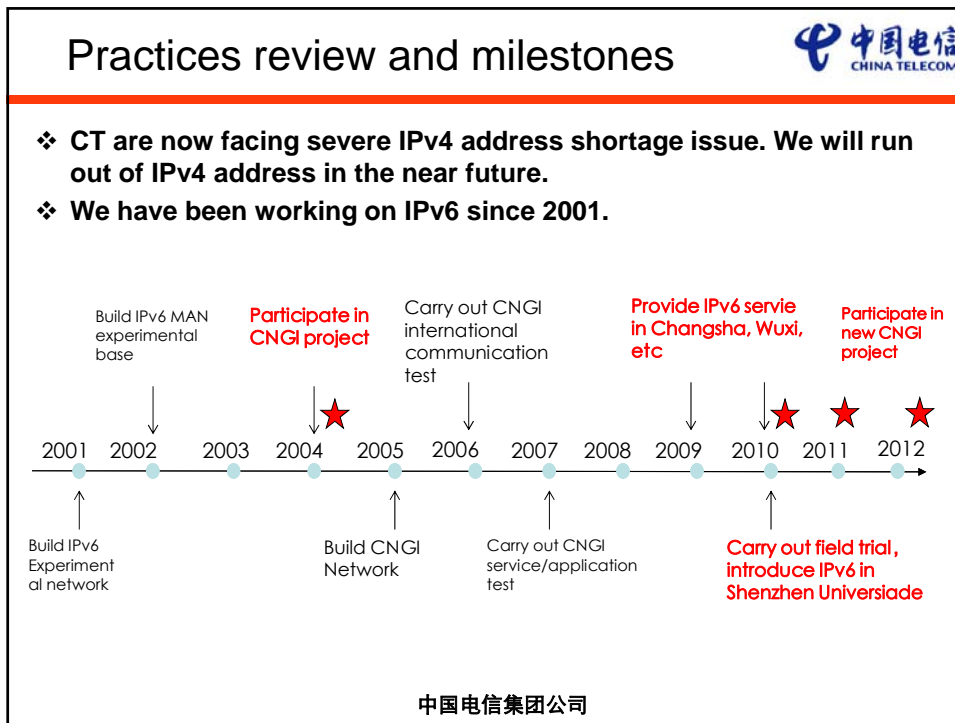
- **Broadband:** more than 90 million
- **Mobile:** more than 160 million, more than 69 million 3G user
- **Fixed line telephone:** 163 million (until end of 2012)

- **Tele-capability open platform:**  
Open capabilities of SMS/MMS/Voice/Positioning/Payment/Cloud resources
- **Unified supporting services:** unified portal/authentication/management/billing




- The globally largest IP backbone network and CDMA mobile network
- Urban coverage rate of 20M broadband reach more than 80%, general bandwidth is 8M
- The largest scale of IDCs(400 above)

中国电信集团公司



## Objective for IPv6 Commercial Deployment



---

### Overall Objective

- ◆ Provide commercial IPv6 network for Internet services and end users
- ◆ Promote IPv6 transition technologies and the mature of industry chain via large-scale commercial trial

**Phase I :  
Commercial Trial  
2012-2013**

Upgrade all the backbone network, and the middle-east metro network to IPv6 first.

We will have more than 3 million IPv6 subscribers by the end of 2013.

➔


**Phase II :  
Large-scale Deploy  
2014-2015**

All the MANs in the country will be upgraded to IPv6, except for a few MANs in the west and north.

We will have more than 8 millions IPv6 subscribers by the end of 2015.

中国电信集团公司 5

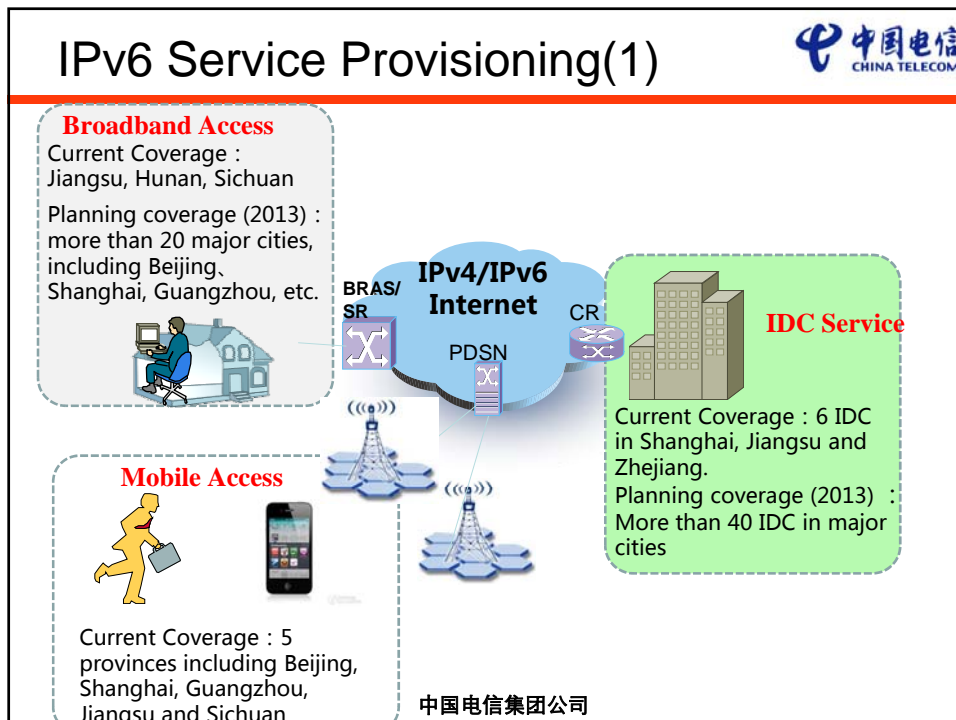
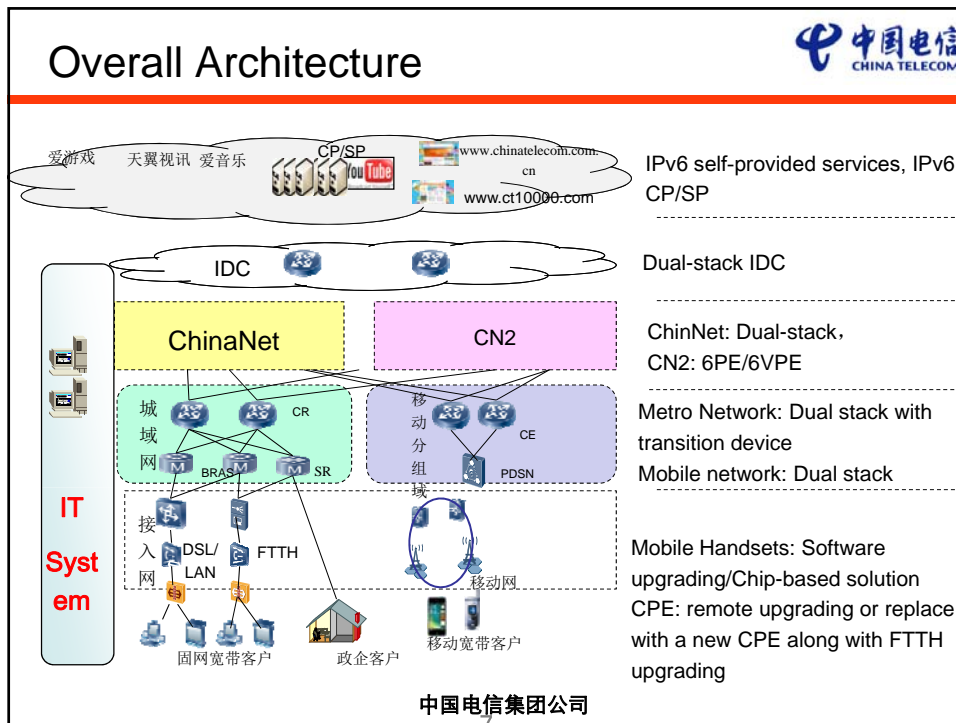
## Transition Requirements to IPv6




---

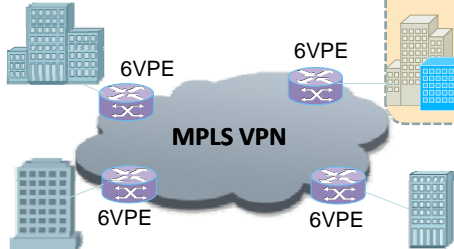
- Solve the IPv4 address shortage issue
- Promote IPv6 deployment and new technologies for the next generation Internet.
- Select matured technology for large-scale deployment
- Support smooth transition from the long term
- Support end-to-end IPv6 service provisioning for content providers.

中国电信集团公司



## IPv6 Service Provisioning(2)






IPv6 VPN Service

Current Coverage : Beijing, Shanghai, Suzhou, Shenzhen  
 Planning coverage (2013) : More than 30 major cities

中国电信集团公司

## China Telecom IPv6 Transition Consideration



- ❑ CT will incrementally upgrade existing network to IPv6 , rather than in a clean-slate way.
- ❑ Different transition mechanisms will be adopted for different scenarios.

Backbone Network: Dual stack  
End-to-end dual-stack field trail has been conducted since 2010.

**MAN Network:**  
**Dual stack**  
**( NAT444/ Tunneling )**  
**based solution**

Upgrade the network to IPv6 in the first step , using tunneling/CGN to support IPv4 service provisioning.

←


→

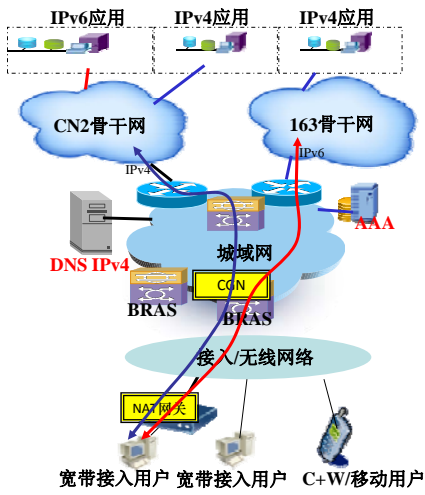
**Data Center/ICP:**  
**Dual stack+ Translation**  
**based solution**

Adopt translation-based solution to support IPv6 users communicating with IPv4 content, and vice versa.

中国电信集团公司

## NAT444(CG) Deployment






The diagram illustrates the NAT444(CG) deployment architecture. At the top, there are three categories of applications: IPv6应用, IPv4应用, and IPv4应用. These connect to two main backbone networks: CN2骨干网 and 163骨干网. The CN2 backbone is associated with IPv4, while the 163 backbone is associated with IPv6. The architecture includes a城域网 (Metropolitan Area Network) containing DNS IPv4, BRAS (Broadband Remote Access Server), and CGN (Carrier Grade NAT) components. Below the city network is the接入/无线网络 (Access/Wireless Network) which includes NAT网关 (NAT Gateway). At the bottom, users are categorized as 宽带接入用户 (Broadband Access Users), 宽带接入用户 (Broadband Access Users), and C+W/移动用户 (Cable/Wireless/Mobile Users).

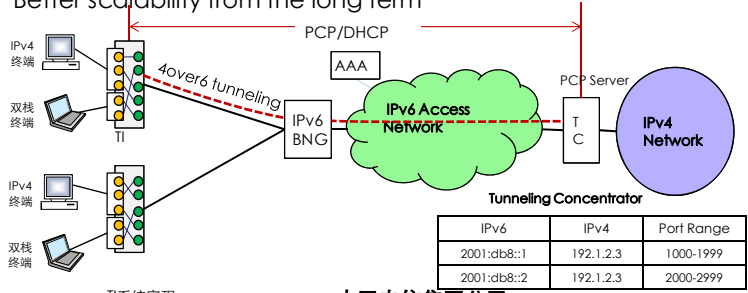
- **NAT444 can greatly alleviate the pressure of IPv4 shortage problem.**
  - Deploy CGN on the edge of IP network
  - Offer IPv4/IPv6 connectivity to end users.
  - Good compatibility with existing CPEs
  - Little impact on end-host upgrading

中国电信集团公司

## Tunneling Technology for IPv6 subscribers



- **Deploy IPv6-based tunneling transition technology for broadband access users.**
  - **DS-Lite:** make use of IPv6 network to provide IPv4 service accessibility
  - **Lightweight 4over6:** extension to DS-Lite to further offload CGN to distributed CPEs.
- **Key feature**
  - No dependency between IPv4 and IPv6 addressing scheme
  - Promote IPv6 upgrading in our network
  - Better scalability from the long term



The diagram shows the tunneling technology for IPv6 subscribers. It includes IPv4终端 (IPv4 Terminals) connected to a TI (Tunneling Interface) system. The TI system is connected to an IPv6 BNG (Broadband Network Gateway) via 4over6 tunneling. The IPv6 BNG is connected to an IPv6 Access Network, which is then connected to a Tunneling Concentrator (T/C). The Tunneling Concentrator is connected to an IPv4 Network. A PCP/DHCP server and AAA server are also shown. A table below the diagram provides mapping information for IPv6, IPv4, and Port Range.

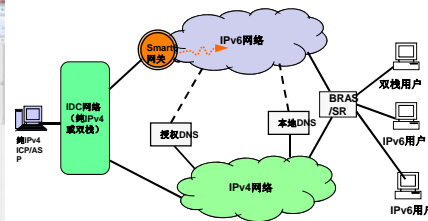
IPv6	IPv4	Port Range
2001:db8::1	192.1.2.3	1000-1999
2001:db8::2	192.1.2.3	2000-2999

TI系统实现  
中国电信集团公司

## Collaboration with content provider



- ❑ CT has upgraded the official website to IPv6.
- ❑ Collaboration with Top-10 content providers, e.g. Tencent, sina, etc. Upgrade the major data centers to IPv6 in the first step.
- ❑ For small-to-media content providers, offer a translation platform (called Smart6) to support IPv6 users to access IPv4 content, and vice versa.



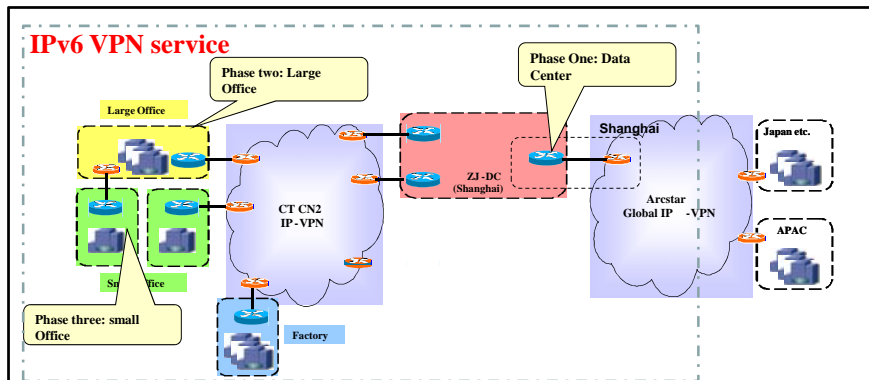
中国电信集团公司

13

## SONY IPv6 VPN




- ❑ CT has provided SONY with IPv6 VPN service in five cities (e.g. Beijing, Shanghai, Changsha, Wuxi, Shenzhen, etc.).
- ❑ 30 more cities will be covered by the end of 2013.





中国电信集团公司

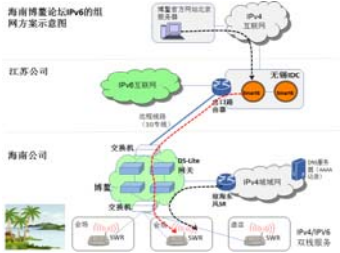
## Important IPv6 Activities



- ❑ We have deployed IPv6 in Shanghai World Expo, Shenzhen Universiade , etc.
- ❑ In 2013 Boao Forum for Asia, Smart6 and DS-Lite have been applied to offer IPv6 network access.






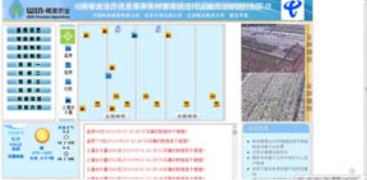


中国电信集团公司


## M2M Applications




- ❑ Explore the M2M application in IPv6.
  - Launched the first IPv6 M2M application in Hunan Province : Smart agriculture monitoring system.
  - More M2M applications: traffic monitoring、 smart environmental protection, etc.




Agriculture Monitoring



Environmental Protection



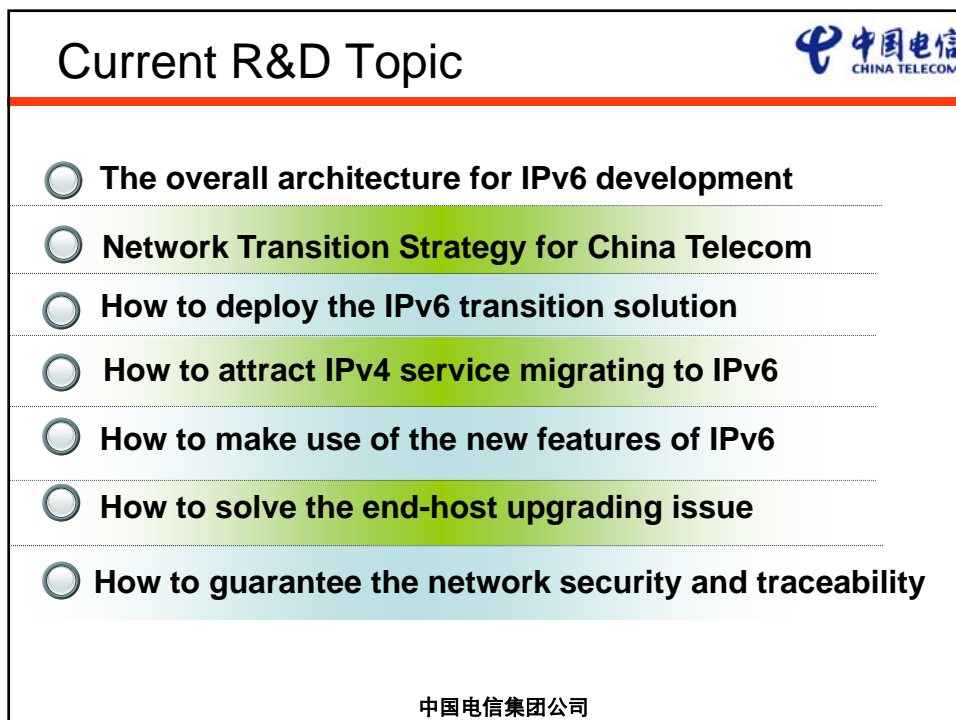
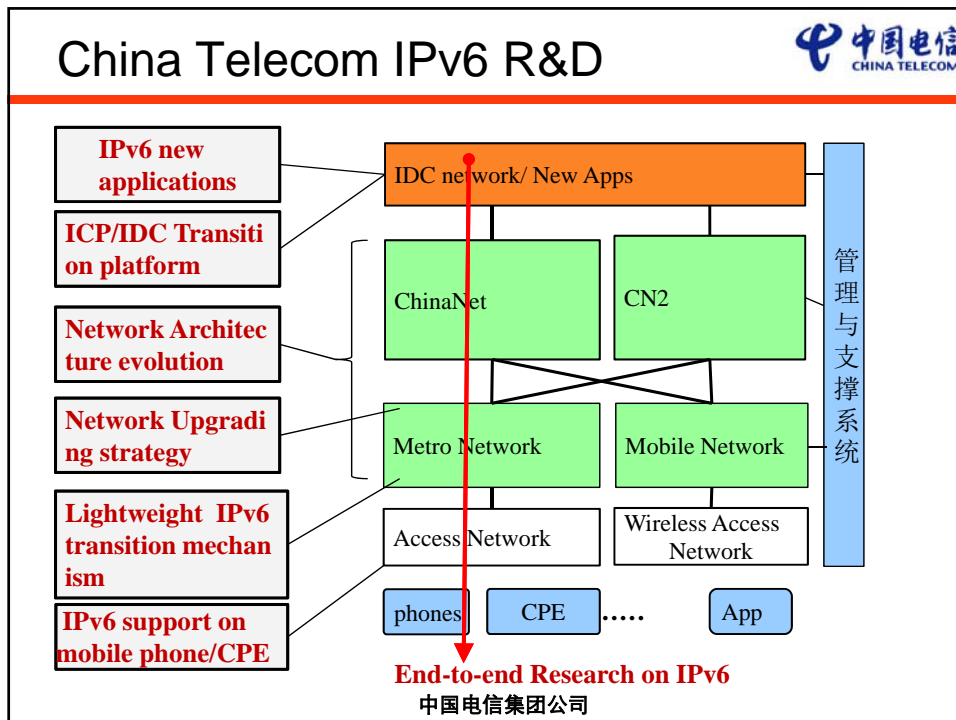
Traffic Mining

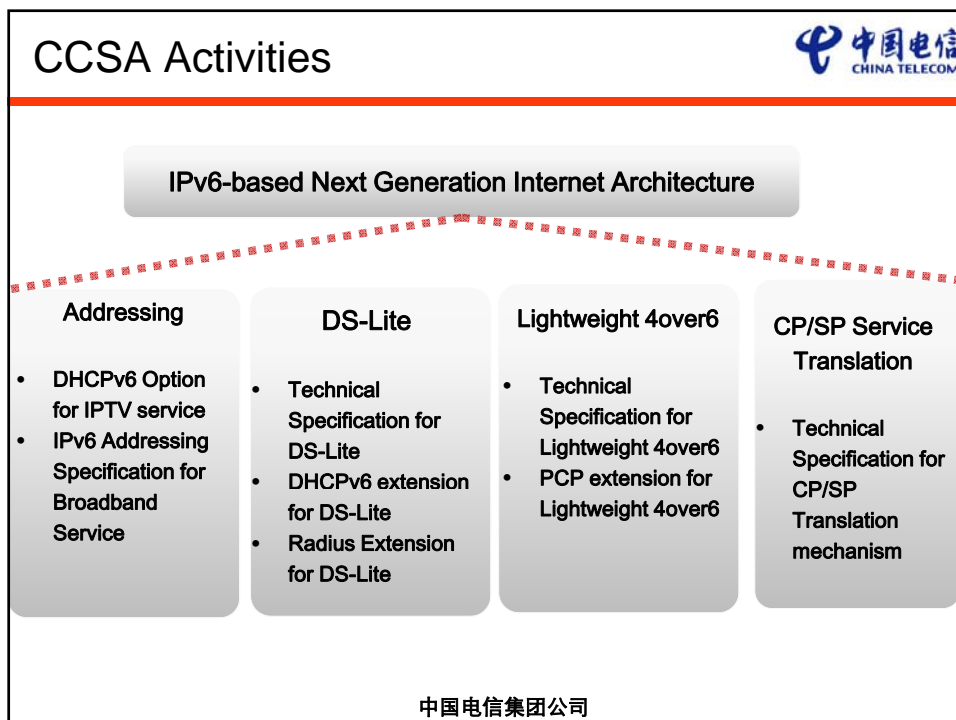
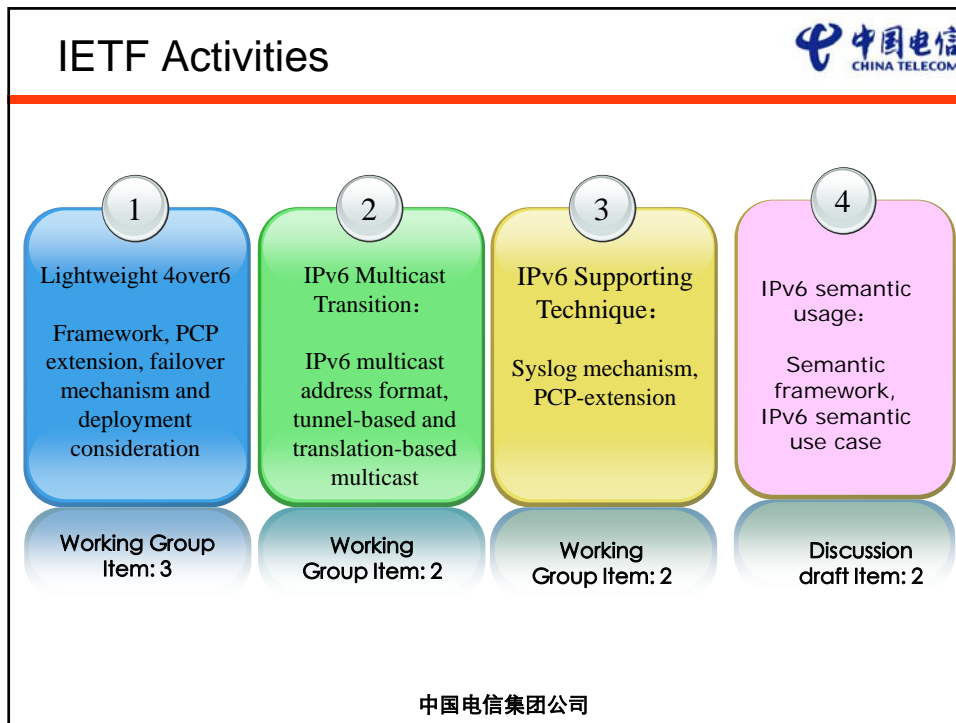


Smart mining


中国电信集团公司








## IPv6 and Smart Pipe




- ▣ **Fine-grained management -- user level**
  - Apply different policies for end users according to different types of IP addresses.
- ▣ **Multidimensional awareness -- application level**
  - Apply differentiated QoS policy for applications, based on different application traffic patterns and transition technologies
- ▣ **On-demand guarantee -- user and application level**
  - According to different end-user IP addresses, transition technologies and traffic pattern, apply unified QoS policy and deployment strategy for both end users and service platform



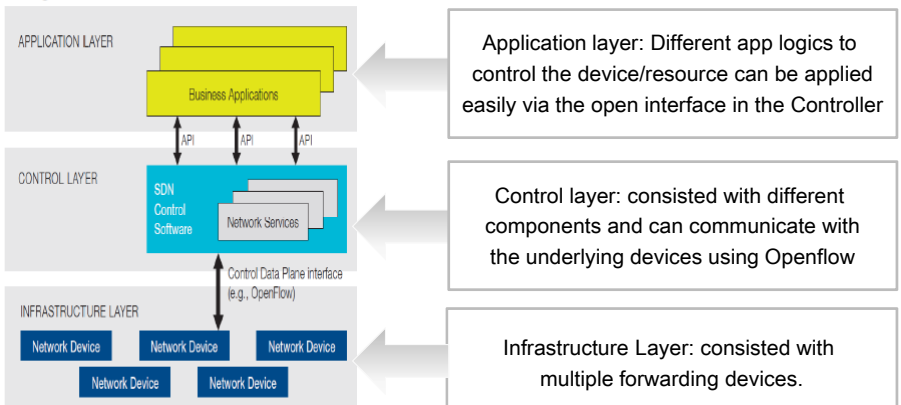
中国电信集团公司

## How SDN can help



- ▣ **Software-defined networking (SDN) is an approach to computer networking which abstracts the hardware of the system, the control plane and the data plane.**

Figure 1 Software-Defined Network Architecture



Application layer: Different app logics to control the device/resource can be applied easily via the open interface in the Controller

Control layer: consisted with different components and can communicate with the underlying devices using Openflow

Infrastructure Layer: consisted with multiple forwarding devices.

Application layer: Different app logics to control the device/resource can be applied easily via the open interface in the Controller

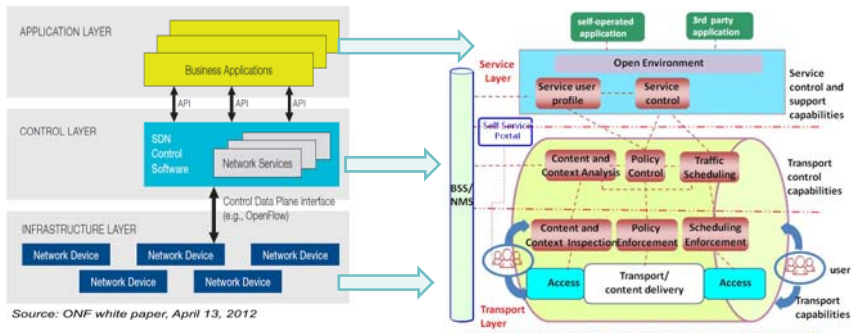
Control layer: consisted with different components and can communicate with the underlying devices using Openflow

Infrastructure Layer: consisted with multiple forwarding devices.

Source: ONF white paper, April 13, 2012

中国电信集团公司

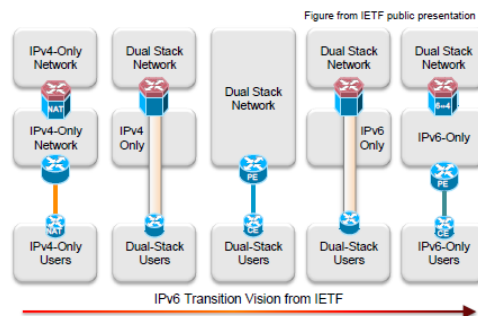
## SDN use case for Telecom Intelligence



- NICE is enhanced NGN network architecture (ITU-T)
- SDN can help improve the intelligence in the network, offering more flexibility for applications
- SDN can reduce the cost for operators when launching new services.
- S-NICE scheme has been approved in the ITU-T SG13 meeting, and is under researching.

中国电信集团公司

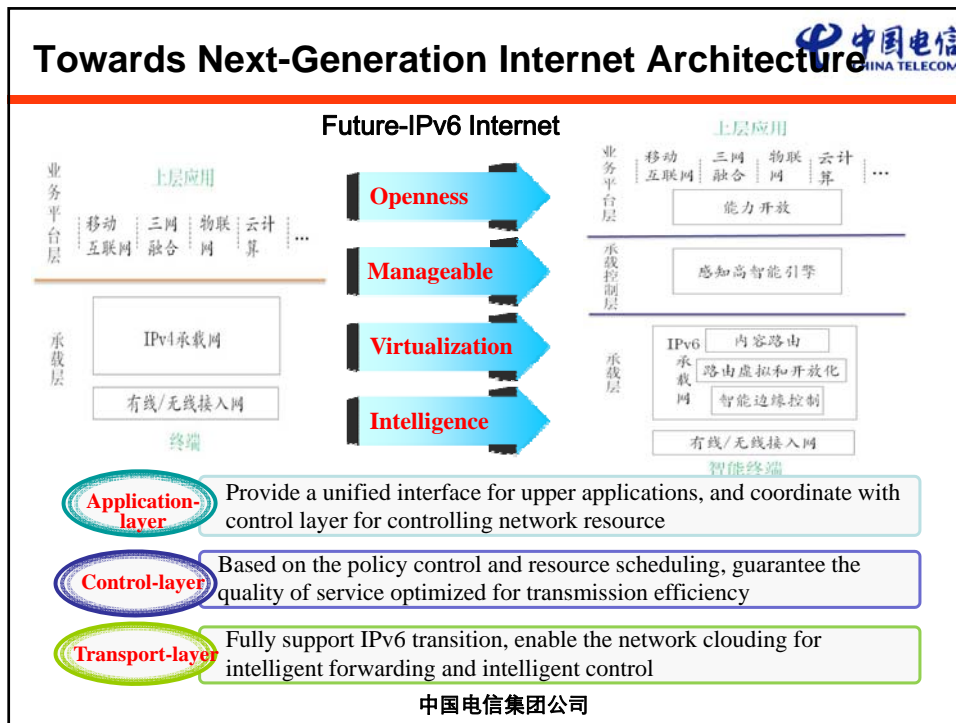
## SDN use case for IPv6 transition



- A variety of technologies and equipments are used during different IPv6 transition stages
- IPv6 transition tools exist but introduce new issues: no unified technology and equipment can support all the IPv6 transition technologies during the whole IPv6 transition period

**SDN can be used to tackle the complexity of unifying existing IPv6 transition technologies, making better use of address/port resources, and achieve resource flexibility.**

中国电信集团公司



## Outline

- ❑ Current Practice in China Telecom
- ❑ Roadmap for IPv6 Transition
- ❑ **Suggestions and Conclusions**

中国电信集团公司

1

## Challenges



### End-to-End Network Upgrading

- Different networks and services have distinct requirements in IPv6 upgrading. We need to select proper transition solutions for different scenarios.
- More than 2000 devices, over 180 systems need to be evaluated, upgraded or replaced in our network.

### Lacking of IPv6 End-host devices

- Most existing CPEs can not support IPv6. It will cost a lot for operators to replace them one by one.
- CDMA mobile handsets are still lack of IPv6 support.

### IPv6 Contents Shortage

- There are still very few IPv6 contents. It is difficult to attract IPv6 users with limited IPv6 contents.

中国电信集团公司

## Lessons learnt



- IPv6 migration is a systematic project, which need to cooperation among different components and the whole industry chain.
- Although there are different solutions to solve IPv4 address shortage problem, IPv6-centric transition will bring benefit to promote IPv6 development.
- For IPv6 service provisioning, supporting system should be flexible enough to deal with different scenarios.
- To reduce the risk of IPv6 upgrading at the beginning, cooperation between ISP and ICP should be encouraged.

中国电信集团公司

## Conclusion



### □ We believe IPv6 is the future

- Reduce the cost for CGN in the long term
- More scalable, automatic
- Prepare for the future Internet of Everything

### □ IPv6 Migration is in the way

- Faster, Smoother, Easier

### □ We need to work together for the future



中国电信集团公司



Thank you !

