

## 北京邮电大学

Beijing University of Posts and Telecommunications


### A General Model for Hybrid Fiber-Wireless (FiWi) Access Network Virtualization

**Qinglong Dai, Guochu Shou, Yihong Hu, Zhigang Guo**  
**Beijing Laboratory of Network System Architecture and Convergence**  
**School of Information and Communication Engineering**  
**Beijing University of Posts and Telecommunications**  
**Beijing, P.R.China**

**Presenter: Qinglong Dai**  
**Email: dqldqldql@bupt.edu.cn**  
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## Outline




- 1 Introduction
- 2 Related Work
- 3 **FiWi Network Virtualization**
- 4 Model Analysis
- 5 Numerical Results and Conclusions

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<b>1. Introduction</b>	
<ul style="list-style-type: none"><li>■ <b>Fiber-Wireless (FiWi) network: architecture, carrying a huge number of services without systematical management, ossification.</b></li> <li>■ <b>Network virtualization: decoupling services from network infrastructure, Internet service provider (ISP), infrastructure provider (InP), service provider (SP), testbed, multiple virtual networks (VNs) coexistence, and so on.</b></li></ul>	
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<b>1. Introduction</b>	
<ul style="list-style-type: none"><li>■ <b>Main works</b><ul style="list-style-type: none"><li>➤ <b>A general model for hybrid FiWi access network virtualization(components, interaction), optimal resource utilization rate, granular control.</b></li> <li>➤ <b>Analyzing the mapping between the infrastructure resources and the virtual resources, the relationship between virtual resources and services.</b></li></ul></li></ul>	
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## 2. Related Work



- **FiWi access network**
  - The compare of network performance.
  - Networking strategy to obtain higher performance.
  - The convergence of FiWi network's two subnetworks.
- **Network Virtualization**
  - The essence of network virtualization.
  - The abstraction of wireless network.
  - The delivery process for end-to-end services in network virtualization environments.

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## 3. FiWi Network Virtualization



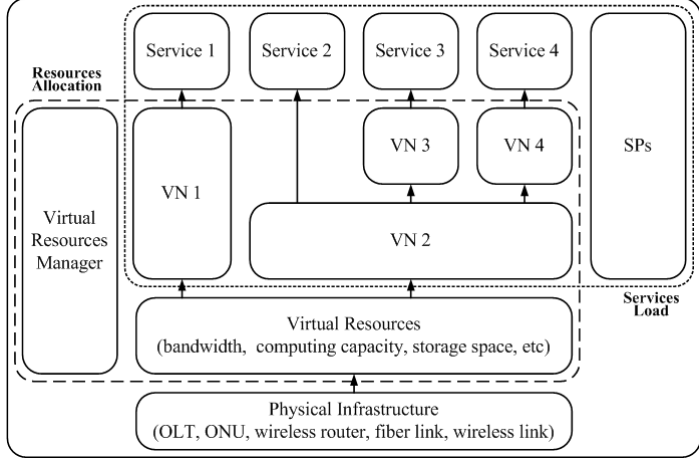
### ■ Network virtualization in FiWi access network

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### 3.FiWi Network Virtualization




**■ The model of the FiWi network virtualization**



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#### 4. Model Analysis



- Selecting the bandwidth of connected link as the object of network virtualization.
- The process of physical resources' virtualization.

$$Bandwidth_v(i) = T(Bandwidth_p(i))$$

- Virtual resources are allocated to form a VN. Each VN can be further allocated.
- Resulting in that several VNs can be carried by a same node.

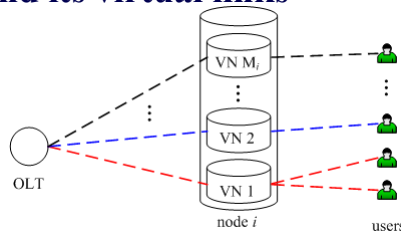
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#### 4. Model Analysis



- Node  $i$  and its virtual links



- VNs are installed on the base of physical resources

$$\sum_{k=1}^{M_i} Bandwidth_v(i, k) \leq Bandwidth_p(i)$$


- For the service flow upon node  $i$

$$flow(i) = \sum_{k=1}^{M_i} flow(i, k)$$

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## Outline



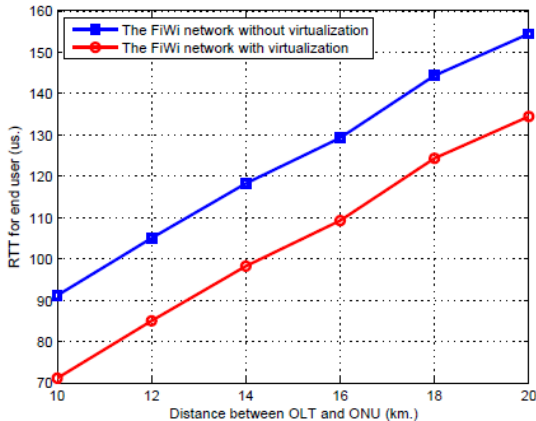
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## 5. Numerical Results and Conclusions

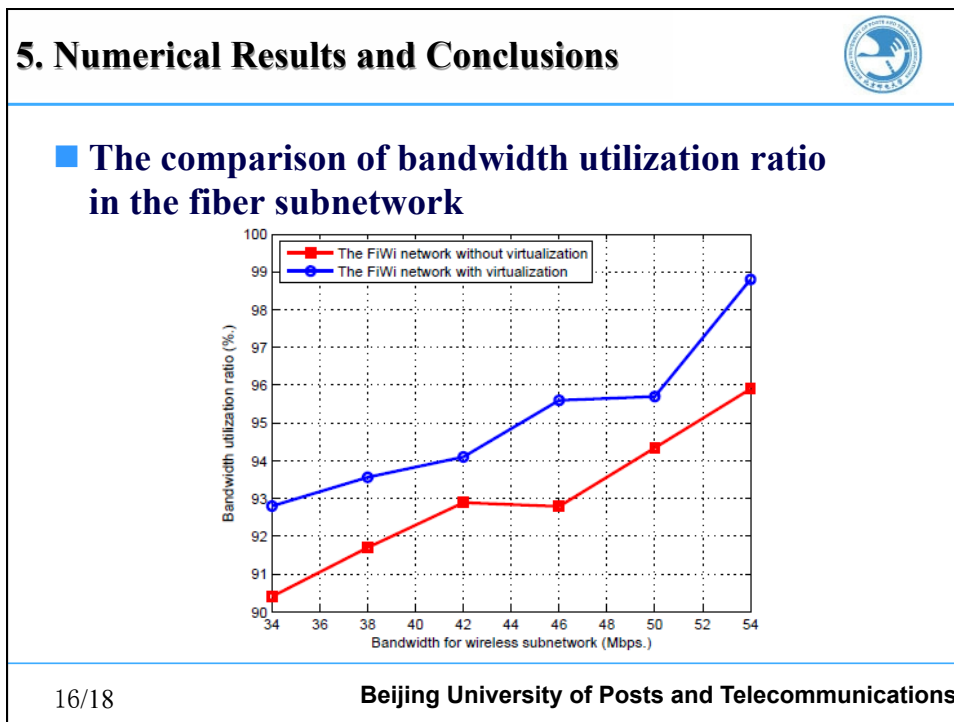
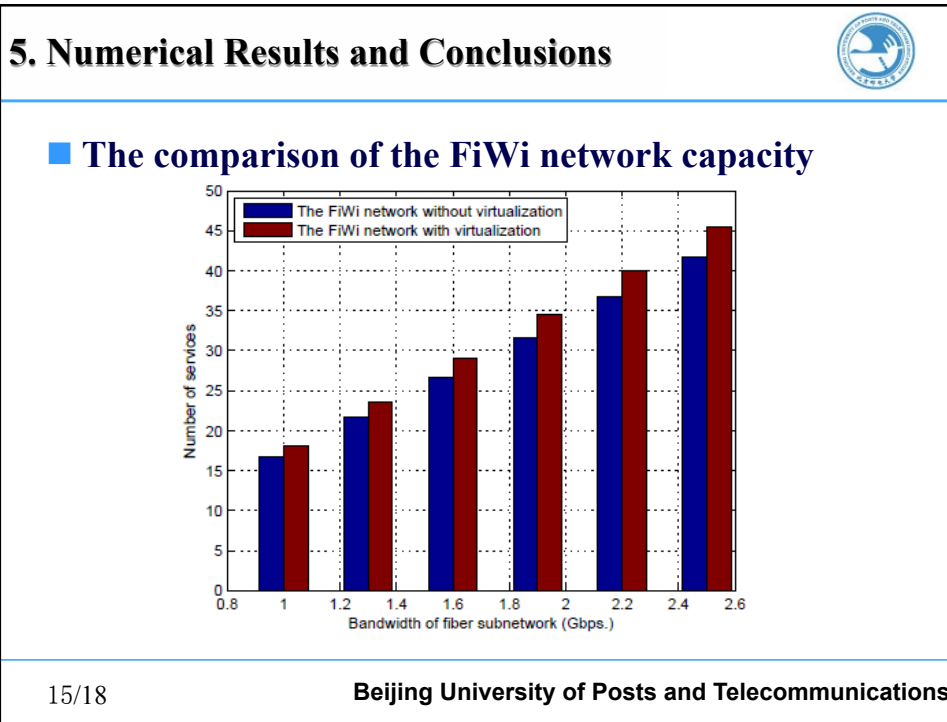


### ■ The comparison of round-trip time (RTT)



Distance between OLT and ONU (km.)	The FiWi network without virtualization (us.)	The FiWi network with virtualization (us.)
10	92	72
12	105	85
14	118	98
16	130	110
18	145	125
20	155	135

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## 5. Numerical Results and Conclusions



- **The proposed model decouples application from network infrastructure and allows SPs to provide users with services carried by granular VNs which are composed by the virtual resources allocated by InPs.**
- **The application of network virtualization in FiWi network effectively improves the resource utilization rate and achieve the granular control of services via the VN.**
- **In our future work, we will deal with the virtual resources allocation algorithm and the interaction between virtual resources and the SPs in the FiWi network environment.**

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Thank you!

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