DYNAMIC BANDWIDTH ALLOCATION IN NETWORK VIRTUALIZATION MODE

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ABSTRACT

Flexibility and high band width capacity with optical access network represents a promising network architecture in most advanced communication system and these abilities made Fibre-Wireless network as a promising network for 5G communication. Especially, network virtualization as an emerging technique provides FiWi with the feasibility for the coordinated bandwidth allocation of wireless access network and optical access network. The evolution of FiWi access network should be not only oriented to the technological breakthrough in regular traffic, but also be supportive of the emerging Data traffic. This project, focus on the resource allocation problem in FiWi access network supporting Data service. Firstly analyzing the dynamics of regular traffic and propose the traffic prediction method based on Q-Learning (mapping algorithm). Then, a virtual network embedding algorithm to map exactly the virtual networks of Data traffic to the idle resource of the virtual networks of regular traffic without degrading the performance of regular traffic is proposing. Thus, the proposed algorithm can improve the resource utilization more effectively. The simulation results demonstrate that the proposed algorithm can achieve a higher acceptance ratio and lower migration ratio of Data traffic.

1.1 INTRODUCTION

The ultimate goal of networks is to provide users with information, no matter what time it is, where users are and what form information is in. To achieve this goal, fiber networks and wireless networks are two key methods. Fiber networks are able to provide a huge amount of available bandwidth and high anti-interfer-ence, but the cost of their deployment is high. On the other hand, wireless networks perform well in terms of cost, flexibility and ubiqui-tous coverage, but they are susceptible to sur-rounding environment's changes. In some degree, fiber networks and wireless networks can be thought of as complementary. With the growth of users' number and their bandwidth demands, fiber networks and wireless net-works are combined together, giving rise to fiber-wireless (FiWi) networks.FiWi networks have a heterogeneous ar-chitecture.

Passive optical networks (PONs) are viewed as the main body of fiber to the home (FTTH), where they interface with a lot of wireless technologies, such as IEEE 802.11, IEEE 802.16 and etc. In FiWi networks' fiber subnetwork, optical line termi-nal (OLT) is laid in the central office (CO) and connected via fiber to several optical network units (ONUs). In their wireless part, a group of wireless routers compose a wireless mesh net-work (WMN) with the ONUs. Users, whether stationary or mobile, connect to OLTs through these routers whose positions are fixed in a WMN.Although FiWi networks are able to phys-ically combine fiber networks with wireless networks together, these two subnetworks are China Communications •

May 20142still relatively independent with each other.

In order to integrate them, radio-over-fiber (RoF) technology is used in physical layer, which provides transparency for up layer proto-cols. Furthermore, FiWi networks are lack of systematically service management. Increasing service number and scale, especially, over the top (OTT) services provided by third part service providers, lead FiWi networks' service management to a chaotic situation, which in directly influences the networking performance of FiWi networks. Network virtualization may be a potential method to cope with this chaotic situation. Network virtualization allows coexistence of multiple virtual networks (VNs) on the same shared physical infrastructures.

Each VN in a network virtualization environment is a collection of virtual nodes and virtual links. Essentially, a VN is actually a subset of under-lying physical network resources. As a new method which may manage diverse service traffic, network virtualization attracts a lot of attention and is studied in many projects, for example, GENI, 4WARD, Planet Lab and etc. The purpose of network virtualization is to de-ossify networks and achieve higher network resource utilization, by means of de-coupling control plane from data plane.

1.2 LITERATURE SURVEY

As a combination of fiber networks and wireless networks, compared to pure fiber networks or pure wireless networks, FiWi networks have more advantages in the aspect of networking. Zhang et al. modeled FiWi net-works and traditional WMNs. Based on these models, they proved that there was a through-put gain in FiWi networks subject to peer to peer (P2P) communications, using WMNs as a comparison. The reason of throughput gain was wireless-fiber-wireless mode introduced by FiWi networks [10].

Kiese et al. evaluated the link availability in a FiWi network in a variety of scenarios, such as end-user to base station, base station to base station and fiber back-end, and studied the influence of various routing strategies like delay aware routing algorithm, dijkstra algorithm and so on[11].In order to maximize the overall FiWi net-works' throughput, with given distribution of wireless mesh routers and P2P communications, Zheng et al. studied where to place K ONUs in FiWi networks[12]. Feng et al. focused on the survivability of FiWi networks. They proposed a cost-effective protection method for FiWi networks that dealt with network element failures in the fiber subnet-works. The maximum protection with mini-mum cost (MPMC) problem was defined and converted to the minimum cost maximum flow (MCMF) problem. At last, an integer linear programming (ILP) model was represented to solve MCMF problem [13]. The topology of FiWi networks was optimized by Filippiniet al. in Ref. [14], considering deployment cost, the specific traffic requirement of residential users and the specific features of technological components.

As for developing fiber subnetworks and wireless subnetworks as fully integrated net-works, a great number of works have also been done. RoF technology and radio-and-fiber (R&F) are two basic ways. RoF-based net-works used fiber as an analog transmission medium between a CO and one or more ONUs, with the CO being responsible for controlling access to both fiber and wireless media, while R&F networks' access to the fiber and that to wireless media were controlled separately from each other, using different MAC proto-cols in fiber and wireless media, with protocol translation taking place at ONUs[15]. Ghazisaidi et al. proposed a

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two-level frame aggregation scheme in Ref. [16].

Multiple MAC service data units (MSDU) subframes were firstly assembled into a MAC protocol data unit (MPDU) by aggregated MAC service data units (A-MSDU) and then multiple MPDU subframes were assembled into one physical service data unit (PSDU) by aggregated MAC protocol data units (A-MPDU). Zhao et al. proposed a dynamic bandwidth assignment (DBA) scheme, coordinating fiber bandwidth assignment and wireless bandwidth assignment, through the control message among the DBA modules located in OLT, ONU, subscriber station (SS). Note that, in their work, the control modules were coupling with physical devices [17]. The thinking of network virtualization is using VNs, which are able to eliminate the underly-ing characteristics of physical infrastructures, to host multiple services over the same shared physical networks. There are many technologies to realize network virtualization, including virtual private network (VPN), virtual local area network (VLAN), OpenFlow and so on.

Khan et al. argued that there was nothing new in the aspect of theoretical performance and technical capabilities brought by network virtualization, but a new thinking of organizing of networks which possibly be used to solve some practical issues existing in today's networks [8]. Nakauchi et al. tackled the abstraction of heterogeneous wireless networks in order to seamlessly connect wireless networks with wired networks. AMPHIBIA, a platform which enabled end-to-end slicing across wired and wireless networks, was also proposed by them. Their work focused on the wireless network, a cognitive base station was de-signed [18].

Kokku et al. designed a network virtualization substrate (NVS) with a purpose of effective virtualization of physical resources in cellular networks [19]. Lv et al. studied virtual access network embedding for WMNs. A novel channel allocation algorithm was presented by them, in order to exploit partially overlapped channels and further improve resource utilization [20]. Software-defined network (SDN) and OpenFlow principles for FiWi access networks are discussed by Cvi-jetic et al. in Ref. [21].

They experimentally demonstrated the first OpenFlow-based λflow architecture for dynamic 150Mb/s per-cell 4G OFDMA overlays onto 10Gb/s PON. Huang et al. modelled the delivery process for end-to-end services in network virtualization environments. Efficient paths select-ed algorithms which traversed the physical infrastructures and guaranteed quality of service (QoS) level in VNs, and the analysis of both efficiency and effectiveness of these algorithms were also presented [22]. Wang et al. focused on the issue of green networking and three kinds of enhanced green networking schemes based on network virtualization were proposed in Ref. [23]. Dai et al. proposed a general model for the FiWi access network virtualization in Ref. [24].

The existing mod-el decoupled applications from physical net-works and allowed SPs to provide users with services hosted by granular VNs which were composed by the virtual resources allocated by virtual resource manager (VRM). Note that, network virtualization is a new strategy that manages network resources. And SDN is a tool that can be leveraged in order to create network virtualization. OpenFlow is one of many technologies that can implement SDN.

Cloud computing has emerged as a new network paradigm [1]. Built on the success of grid computing applications, cloud computing implements the idea of 'computing as a utility' in a more commercially-oriented vision. Thus, the customer pays per use of computing

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facilities under the conditions stated in a service level agreement (SLA), having dynamic scaling of resources and transparent access to network services, unaware of the location and hardware/software characteristics of the required resources [2]. Apart from high bandwidth, cloud computing applications require the following functionalities from the underlying physical network [1]:

Abstraction:

1.3 MOTIVATION

Different network virtualization techniques exist that mainly have to be configured by hand, such as L2VPN, MPLS, VLANs and tunnelling. Recently, different projects have tried to generate frameworks to manage the creation and termination of point-to-point connections [2–6], but a unique abstract interface for network virtualization management does not exist. In a cloud environment, users should be able to easily describe and create networks to interconnect their resources in a dynamic and autonomous way, independently of the network operator's cloud provider. However, a well-defined uniform interface to manage networks in such away is lacking.

1.4 OBJECTIVE

To investigate how a unified abstraction for virtual networks can be developed in order to increase the dynamicity when deploying and/or reconfiguring virtual networks. A network provides on-demand and automated access to resources. Those resources need to be interconnected. The creation of this interconnection needs to be dynamic, in other words, operators of the cloud should not have to be involved in setting up the interconnect, neither in its reconfiguration.

1.5 PROBLEM STATEMENT

Currently, the capacity and coverage of optical systems is advancing at a remarkable speed. On the contrary, the transmission speed of current wireless systems is highly limited by the available bandwidth in the RF spectrum. Therefore, the capacity bottleneck of the hybrid optical fiber-wireless system is the wireless section

1.6 Network virtualization

Network virtualization refers to the creation of different isolated virtual networks on top of a common physical substrate. The isolation feature means that the information transmitted through a particular virtual network cannot be retrieved or affected by other existing virtual networks and the operation of the different virtual networks cannot affect the operation of the physical substrate [16].

Among the main features of network virtualization environments, we found several of the requirements imposed by cloud computing applications, namely, coexistence of different virtual networks, isolation between coexisting virtual networks, programmability, dynamicity, flexibility and heterogeneity [17].

By implementing cloud applications on virtual networks (i.e. one virtual network for each different cloud computing application), several benefits can be identified:

Resource allocation based on maximum load could be avoided, leading to a more cost-effective operation, as the virtual network associated to the cloud application would request just the resources needed for proper operation. Some virtual network environments have even considered the possibility of reconfiguring the virtual network during operation (e.g. exploiting the feature of on-line virtual server migration) to adapt to time-variant requirements from the applications [2, 18].

- Isolation between different cloud applications for access to common physical resources
- Resiliency against node/server failures, due to the server-migration feature of virtualization environments
- Implementation of proprietary non-standard protocols for

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specific cloud applications requirements

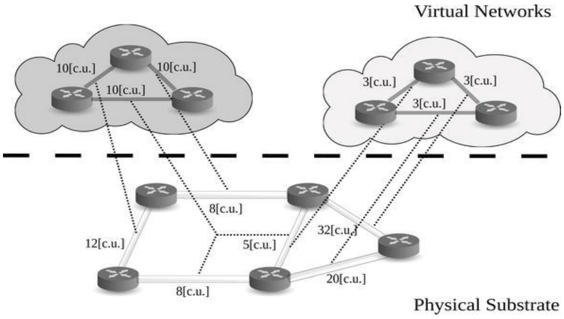

Fig 1-1 Virtual System

1.7 METHODOLOGY

Because of the decoupling of physical infra-structures and services, network virtualization provides a feasible method to solve the chaos of services' management in FiWi networks and indirectly improves network performance. The hierarchical model for FiWi seamless net-working scheme is shown in Fig. 1.The bottom layer is 3FiWi network infrastructures, which are the contents provided by different InPs.

In order to disengage the services from the physical network resources which have complex characteristics, network virtualization is used to abstract the physical infrastructures to virtual resources which are an independently manageable partition of all the physical resources and inherit the same characteristics as the physical resources.

The capacity of the virtual resources is not infinite but bound by the capacity of network physical resources.The middle layer in Fig. 1 is the total virtu-al resources in the FiWi network, from which a portion of virtual resources are allocated to a SP as a form of VN according to its virtual resources requirement. The SP loads the spe-cific service on the allocated virtual resources, which means that different services may be hosted by a same physical node or physical link.

The top layer in Fig. 1 shows three indepen-dent VNs for different kinds of services, VN a and VN b suit for the P2P service and VN c suits for the peer to multiple peers (P2MP) real service. Actually, a VN can be deployed upon another VN. Due to the application of network virtualization, the differences between physical resources in the FiWi network are eliminated, which makes the FiWi network be a tighter network.

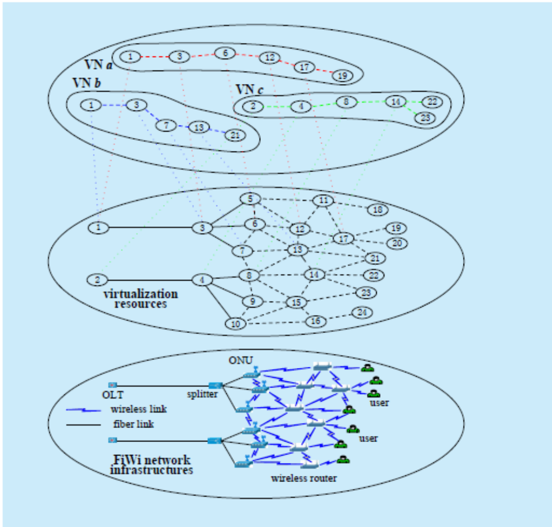

Fig 1-2 Network Virtualization Model

The service model for FiWi seamless networking scheme is shown in Fig. 2. In service model, physical infrastructures provided by multiple InPs are collected together and abstracted into virtual resources which are managed by VRM. OLTs, ONUs, wireless routers, fiber links, wireless links and so forth all belong to the area of physical infrastructures. In FiWi networks, some services may be sensitive to delay, throughput and etc. One or more indexes may be selected as virtual resources. Then, these abstracted virtual resources will be allocated to SPs by VRM, according to SPs hosted services' characteristic. Allocated virtual resources are used to host different services by assembling as logically isolated VNs over the same shared physical FiWi infrastructures.

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Algorithm 1 DBA algorithm in FiWi network

1. If $B_{ij}^{req} < B_{ij}^{ava}$ //Phase 1;
2. Refuse the request;
3. Else
4. Assign B_{ij}^{req} to j;
5. Add j to set ACP_i;
6. Update B_i^{req};
7. If $B_i^{req} < B_{ONU}^{avg}$ //Phase 2;
8. Assign B_i^{req} to ONU i;
9. $B^{exc} = B^{exc} + B_i^{avg} - B_i^{req}$;
10. Else
11. Assign B_i^{g} to ONU i;
12. END
13. END

1.8PROPOSED METHODOLOGY

In basic terms, DYANMIC BANDWIDTH is based on the proportional share scheduling mechanism that allocates network resources to each virtual interface in proportion to its weight. Each virtual interface, called vif ,is owned by its VM and behaves like an actual network interface with in the VM. DYANMIC BANDWIDTH operates in the driver domain of the Xen hypervisor, particularly in the back-end driver that plays the role of the communication channel between the hardware device driver and VMs, as depicted in Figure 2.

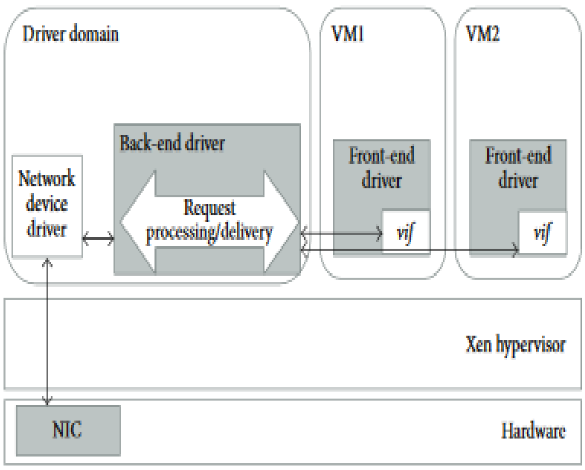

Table 1.1 Dynamic band width virtual machines

DYANMIC BANDWIDTH processes the network operation requests of VMs in a round-robin manner, checking whether a vif has sufficient resource allocation to possess the network resources. For this purpose, DYANMIC BANDWIDTH uses the credit concept [18, 19] to represent the amount of resource allocation. While network resources are being used, every vif consumes its credit according tothe requested size; the credit value of a vif is recharged regularly in proportion to its weight.

If the credit value that a vif has is less than the requested size, DYANMIC BANDWIDTH does not process its requests. The vif must then wait for the next credit value to be allocated. Therefore, the amount of credit a vif has determines the network bandwidth of the corresponding VM. The amount of credits allocated is calculated by the configured performance policy of each VM

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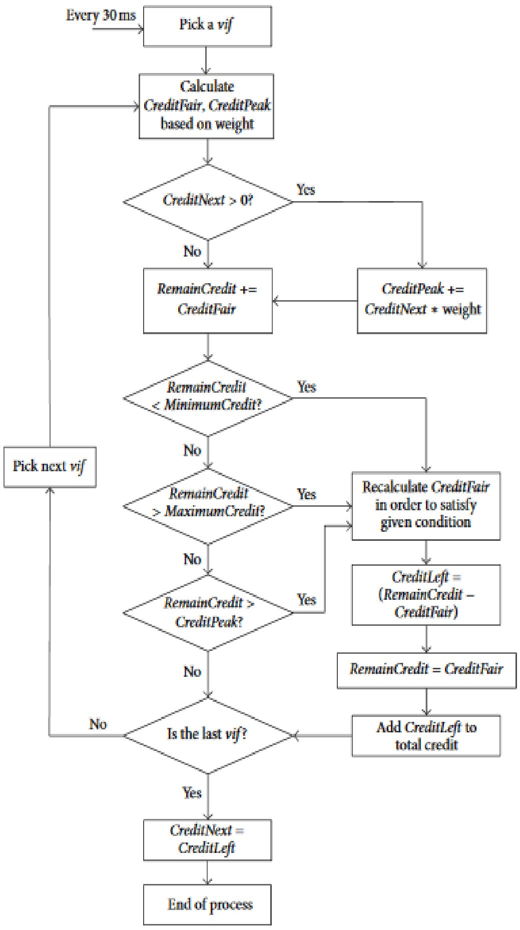

Fig 1-3 Flow chart

1.9 RESULTS & DISCUSSION

RESULTS

We assume that the number of OLT is 1, the number of ONUs is 8, the splitting ratio of splitter is 1:8, the number of wireless routers connected to each ONU is 50, the distance between OLT and users is 21km (the maximum distance from OLT to ONU, 20km, plus the maximum coverage of ONU, 1km), the bandwidth of fiber link is Gbps-level, the maximum communication distance for a wire-less router is 250m. ONU has a build-in wire-less communication module, interconnecting wireless subnetwork and fiber subnetwork.

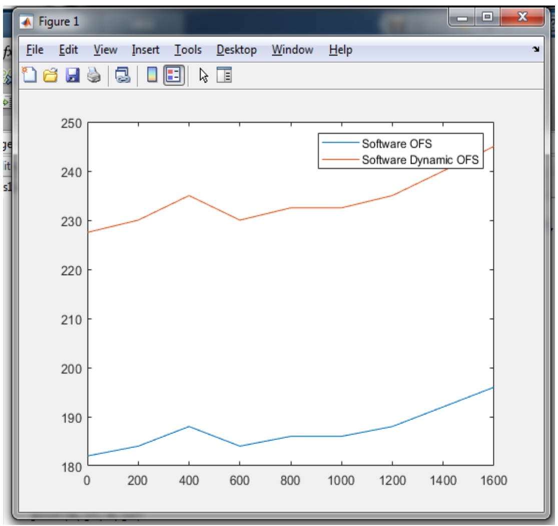

Figure 0-2 ROUND TRIP TIME

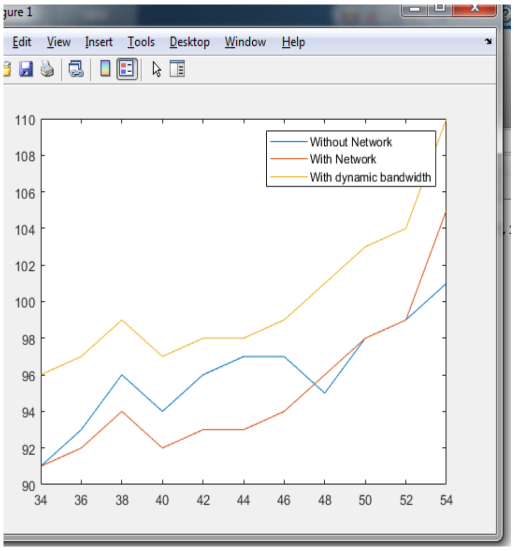

Figure 0-3 Band width utilization ratio

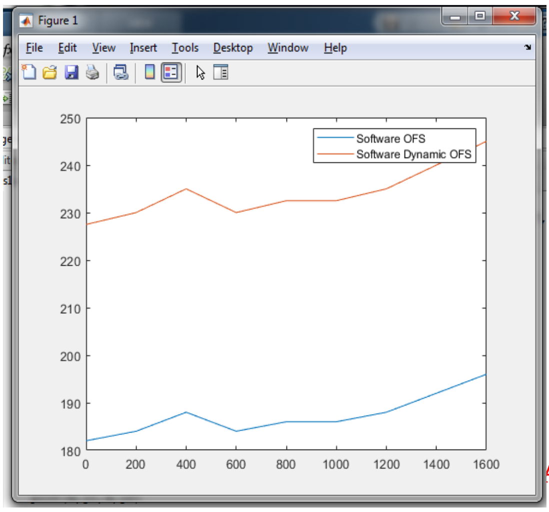

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Figure 0-4 Throughput

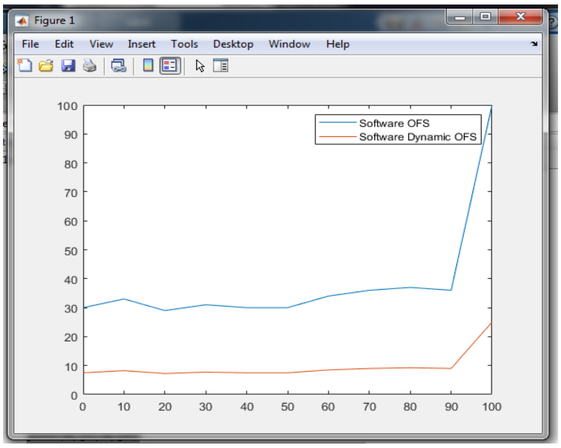

Figure 0-5 Delay

Besides, all the nodes are grid-like distributed. We choose round-trip time (RTT) to reflect that the application of network virtualization makes the FiWi

network be a tighter one. RTT is the time it takes for a signal to be sent plus the time it takes for an acknowledgment of that signal to be received. Fig.5.1 shows the comparison of RTT for end users in FiWi net-works. In Fig.5.1, we assume that the bandwidth of fiber is 1Gbps, the test packet has a constant length and the end user connects to ONU via one wireless router.As is shown in Fig. 5, with the distance between OLT and ONU increases, RTT for end user with network virtualization and that without network virtualization are both on the rise. And the RTT in the FiWi network without network virtualization is obviously larger than that with network virtualization, no matter what the distance between OLT and ONU

CONCLUSION

In this paper, we propose a network virtual-ization based seamless networking scheme for FiWi networks, including hierarchical model, service model, service implementation and DBA. Then, we evaluate the performance changes after network virtualization is introduced. Then, throughput for nodes, bandwidth for links and overheads leaded by network virtualization are analyzed. At last, the performance of our proposed networking scheme is evaluated by simulation and real implementations. It remains future work to investigate the virtual resources allocation strategy for different VNs and mapping algorithm for allocated VNs

REFERENCES

[1]GHAZISAIDI N, MAIER M, ASSI C. Fiber-wireless (FiWi) access networks: A survey[J]. IEEE Com-munications Magazine, 2009, 47(2): 160-167.

[2]RONG B, QIAN Y, GUIAGOUSSOU M, KADOCH M. Improving Delay and Jitter Performance in Wireless Mesh Networks for Mobile IPTV Services[J]. IEEE Transactions on Broadcasting, 2009, 55(3): 642-651.

[3]GHAZISAIDI N, MAIER M. Fiber-Wireless (FiWi) Networks: A Comparative Techno-Economic Analysis of EPON and WiMAX[C]// Proceedings of 2009 IEEE Global Telecommunications Con-ference (GLOBECOM'09): November 30-Decem-ber 4, 2009. Hawaii, USA, 2009: 1-6.

[4]SARKAR S, DIXIT S, MUKHERJEE B. Hybrid Wireless-Optical Broadband-Access Network (WOBAN): A Review of Relevant Challenges[J]. Journal of Lightwave Technology, 2007, (25)11: 3329-3340.

[5]GUILLORY J, MEYER S, SIANUD I, ULMER-MOLL A, CHARBONNIER B,

PIZZINAT A, ALGANI C. Radio-Over-Fiber Architectures[J]. IEEE Vehicular Technology Magazine, 2010, 5(3): 30-38.
[6]CHOWDHURY N M, BOUTABA R. A survey of network virtualization[J]. Computer Networks, 2010, 54(5): 862-876.
[7]WANG A, IYER M, DUTTA R, et al. Network Virtualization: Technologies, Perspectives, and Frontiers[J]. Journal of Lightwave Technology, 2013, 31(4): 523-537.
[8]KHAN A, ZUGENMAIER A, JURCA D, et al. Net-work virtualization: a hypervisor for the Inter-net?[J]. IEEE Communications Magazine, 2012, 50(1): 136-143.
[9]CHOWDHURY N M, BOUTABA R. Network virtualization: state of the art and research challenges[J]. IEEE Communications Magazine, 2009, 47(7): 20-26.[10]ZHENG Z, WANG J, WANG J. A study of net-work throughput gain in optical-wireless (FiWi) networks subject to peer-to-peer communica-tions[C]// Proceeding of 2009 IEEE International Conference on Communications (ICC'09): June 14-18, 2009. Dresden, Germany, 2009: 1-6.
F. Dan, W. Xiaojing, Z. Wei, T. Wei, and L. Jingning, "VSuit: QoS-oriented scheduler in network virtualization," in Proceedings of the 26th IEEE International Conference on Advanced Information Networking and Applications Workshops (WAINA '12), pp. 423–428, Fukuoka, Japan, March 2012.
H. Tan, L. Huang, Z. He, Y. Lu, and X. He, "DMVL: an I/O bandwidth dynamic allocation method for virtual networks," Journal of Network and Computer Applications, vol. 39, no. 1, pp. 104–116, 2014.
S. Lee, H. Kim, J. Ahn, K. Sung, and J. Park, "Provisioning service differentiation for virtualized network devices," in Proceedings of the the International Conference on Networking and Services (ICNS '11), pp. 152–156, 2011. View at: Google Scholar
W. Xiaojing, Y. Wei, W. Haowei, D. Linjie, and Z. Chi, "Evaluation of traffic control in virtual environment," in Proceedings of the 11th International Symposium on Distributed Computing and Applications to Business, Engineering and Science (DCABES '12), pp. 332–335, Guilin, China, October 2012. View at: Publisher Site | Google Scholar
L. Cherkasova, D. Gupta, and A. Vahdat, "Comparison of the three CPU schedulers in Xen," ACM SIGMETRICS Performance Evaluation Review, vol. 35, no. 2, pp. 42–51, 2007. View at: Publisher Site | Google Scholar
 K. Fraser, S. Hand, R. Neugebauer, I. Pratt, A. Warfield, and M. Williamson, "Safe hardware access with the Xen virtual machine monitor," in Proceedings of the 1st Workshop on Operating System and Architectural Support for the on Demand IT Infrastructure (OASIS '04), pp. 3–7, October 2004. View at: Google Scholar
 W. Almesberger, "Linux network traffic control-implementation overview," in Proceedings of the 5th Annual Linux Expo LCA-CONF- 1999-012, pp. 153–164, Raleigh, NC, USA, 1999. View at: Google Scholar
 K. Mathew, P. Kulkarni, and V. Apte, "Network bandwidth configuration tool for Xen virtual machines," in Proceedings of the 2nd International Conference on COMmunication Systems and NETworks (COMSNETS '10), pp. 1–2, IEEE, Bangalore, India, January 2010. View at: Publisher Site | Google Scholar
 C.-H. Hong, Y.-P. Kim, H. Park, and C. Yoo, "Synchronization support for parallel applications in virtualized clouds," The Journal of Supercomputing, 2015. View at: Publisher Site | Google Scholar
 A. Tirumala, F. Qin, J. Dugan, J. Ferguson, and K. Gibbs, "Iperf: The TCP/UDP bandwidth measurement tool," http://software.es.net/iperf/. View at: Google Scholar

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Vol-11 Issue-01 2021

- R. Jones, NetPerf: A Network Performance Benchmark, Information Networks Division, Hewlett-Packard Company, 1996.
- K. Jang, J. Sherry, H. Ballani, and T. Moncaster, “Silo: predictable message latency in the cloud,” in Proceedings of the 2015 ACM Conference on Special Interest Group on Data Communication, pp. 435–448, ACM, 2015. View at: Google Scholar
- H. Jayathilaka, C. Krintz, and R. Wolski, “Response time service level agreements for cloud-hosted web applications,” in Proceedings of the 6th ACM Symposium on Cloud Computing, pp. 315–328, ACM, Kohala Coast, Hawaii, August 2015. View at: Publisher Site | Google Scholar