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Reviews on Architecture of Multimedia Services in Ethernet Passive Optical Networks

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Abstract—Peer-to-peer (P2P) applications such as P2P video streaming and internet video calling have gained tremendous popularity and are expected to be vastly increasing in the next few years. However, low-cost large-scale video services have remained an intangible goal. We present here a comprehensive review on architecture which combines the advantages of EPON and P2P architecture to provide scalable Internet Protocol delivery multimedia services and improve quality-of-services. Architecture proposed new optical network unit (ONU) mechanisms, which support traffic redirection communication among ONUs in combination with caching. Thus, it can reduce the resource consumption and add extra downstream bandwidth at the optical line terminal Result analysis will be performed on the basis of overall QoS in terms of end-to-end delay, jitter, system throughput, fairness, and packet dropping rate.

Index Terms—Ethernet passive optical network (EPON), intra-PON traffic, peer-to-peer (P2P) applications, quality of services, REDIRECT DBA scheme, system performance.

I. INTRODUCTION

Passive optical networks (PONs) address the last mile of the communications infrastructure between the service provider's CO, head end, or point of presence (POP) and business or residential customer locations. Also known as the access network or local loop, the last mile consists predominantly, in residential areas, of copper telephone wires or coaxial cable television (CATV) cables. In metropolitan areas, where there is a high concentration of business customers, the access network often includes high-capacity synchronous optical network (SONET) rings, optical T3 lines, and copper-based T1 [1].

THE large amount demand of bandwidth to support multimedia services in the broadband access network and newly evolving services have driven to a new requisite technology that can offer dramatically higher bandwidth. Multimedia applications such as high-definition television (HDTV), IPTV, peer-to-peer (P2P) video streaming, and video-on-demand (VoD) in recent times become one of the most key services for network operators. There is a strong confidence among telecommunication enterprises that this market will increase exponentially in the next few years [2].

In the access network domain, Ethernet Passive Optical Networks (EPONs) is regarded as one of the best solutions for the access networks due to its simplicity, high data rate, and low-cost [3]. An EPON consists of an Optical Line Terminal (OLT) which is located at the central office (CO) and multiple optical network units (ONUs) near the end users sites. The OLT connects a group of associated ONUs over point-to-multipoint topologies to deliver broadband packets and reduces costs relative to maintenance power.

Despite the above mentioned advantages of EPONs, there are still many challenges for providing multimedia services in the EPONs. It might be of how the network operators guarantee the QoS, while accomplishing sufficient profits and revenues. However, more video content will be sent over unicasts, which dramatically increase the bandwidth; and moreover, due to the evolution from HDTV formats towards super HD and ultra HD and 3D formats the demands of the bandwidth are even higher [5].

In the access network domain, optical network is regarded as one of the best solution in the near future to challenge the needs of enormous bandwidth in the access networks, due to a large amount of bandwidth only in one single fiber. Predominantly, most existing optical access networks are based on point-topoint and passive optical networks (PON)

technologies. Recent commercially available PON solutions are based on the time-division multiple access, such as the XGPON, gigabit passive optical network (GPON), and ethernet passive optical network (EPON) standards. Among PON systems, EPON is regarded as one of the best solutions for the access networks due to its simplicity, high data rate, and low cost [4].

reduce bandwidth consumption and load at the server hosting the movie library. Such architectures imply a substantial increase in storage requirements, which is not a negligible factor, given the large size of video files

II. RELATED WORK

Detailed explanation of related work is explained in this section as follows:

S. Choi and J. Park(2010) proposed a new dynamic scheduling algorithm, referred to as cyclic-polling-based dynamic bandwidth allocation with service level agreements (CPBA-SLA), for service differentiation that meets the service level agreements between the OLT and ONUs. The proposed dynamic bandwidth allocation (DBA) scheme provides a constant and predictable average packet delay and an improved delay jitter of the expedited forwarding traffic without the influence of load variations [6].

C. A. Chan, M. Attygalle, and A. Nirmalathas (2011) proposed a novel local-traffic-prediction-based dynamic bandwidth assignment (LT-DBA) mechanism applicable in a remote-repeater-based EPON system with active forwarding. The LT-DBA aims to improve the bandwidth utilization and average packet delay performance of EPON in upstream transmission in comparison to conventional bandwidth assignment techniques such as static bandwidth assignment (SBA) and the interleaved polling algorithm (IPACT), leading to a more efficient PON system [7].

S. R. Sherif, A. Hadjiantonis, G. Ellinas, C. Assi, and M. A. Ali(2004) proposed novel distributed EPON architectures, and in the process proved that these distributed networking architectures and the associated bandwidth allocation algorithms and protocols have characteristics that make them far better suited for provisioning quality of service (QoS) schemes necessary for properly handling data, voice, video, and other real-time streaming advanced multimedia services over a single line [8].

Specifically in [8] proposed a novel ethernet over star coupler-based PON architecture that uses a fully distributed time-division multiple-access (TDMA) arbitration scheme. Supported by the decentralized scheme, this paper proposes several QoS-based dynamic bandwidth allocation (DBA) algorithms in which the OLT is excluded from the implementation of the time slot assignment. In contrast with the mainstream centralized EPON architectures that combine priority queuing [intra-optical network unit (ONU) scheduling] with DBA schemes (inter-ONU scheduling), the proposed distributed EPON architecture supports differentiated services through the integration of both scheduling mechanisms at the ONU (intra-ONU scheduling). The introduction of this integration feature that can only be supported by a decentralized architecture provides better QoS guarantees [8].

To cope with aforementioned facts, recently studied in PONs have tried to localize the traffic in order to reduce the resource consumption in the server. In [17], the proposed architecture is to localize the traffic using active forwarding remote repeater node. This architecture works better on the large amount of local traffic such as on-demand video and P2P networking for video distribution. However, despite using an active component which will increase the operating and maintenance cost, they still have not addressed the Differentiated Service (DiffServ). Moreover, the works that related to our architecture had been

TABLE I CISCO VISUAL NETWORKING INDEXES IN 2010

Type	Traffic Share
Data	28.05%
Online Video	26.15%
Data Communications	0.28%
Voice and Video Communication	1.71%
P2P File Sharing	24.85%
Other File Sharing	18.69%
Gaming Consoles	0.16%
PC Gaming	0.65%

proposed in [18] and [19]. They proposed a distributed architecture, which support ONU-to-ONU communication by designing a passive star coupler (SC). It supports Diffserv through the integration of both scheduling mechanisms at the ONU (intra-ONU scheduling).

In [18], each ONU has equal fixed timeslots to communicate their status and exchange signaling and control message information with one another. Although this approach improves the QoS, it increases the ONU complexity since the DBA module needs to be implemented at the ONU.

III. PROPOSED SYSTEM

In this section, a video multimedia services architecture based on the combination of P2P streaming scheme and EPONs is proposed. In this architecture, we consider not only direct communication among ONUs (i.e., intra-PON), but also patching and caching at ONUs for saving the bandwidth in the feeder fiber.

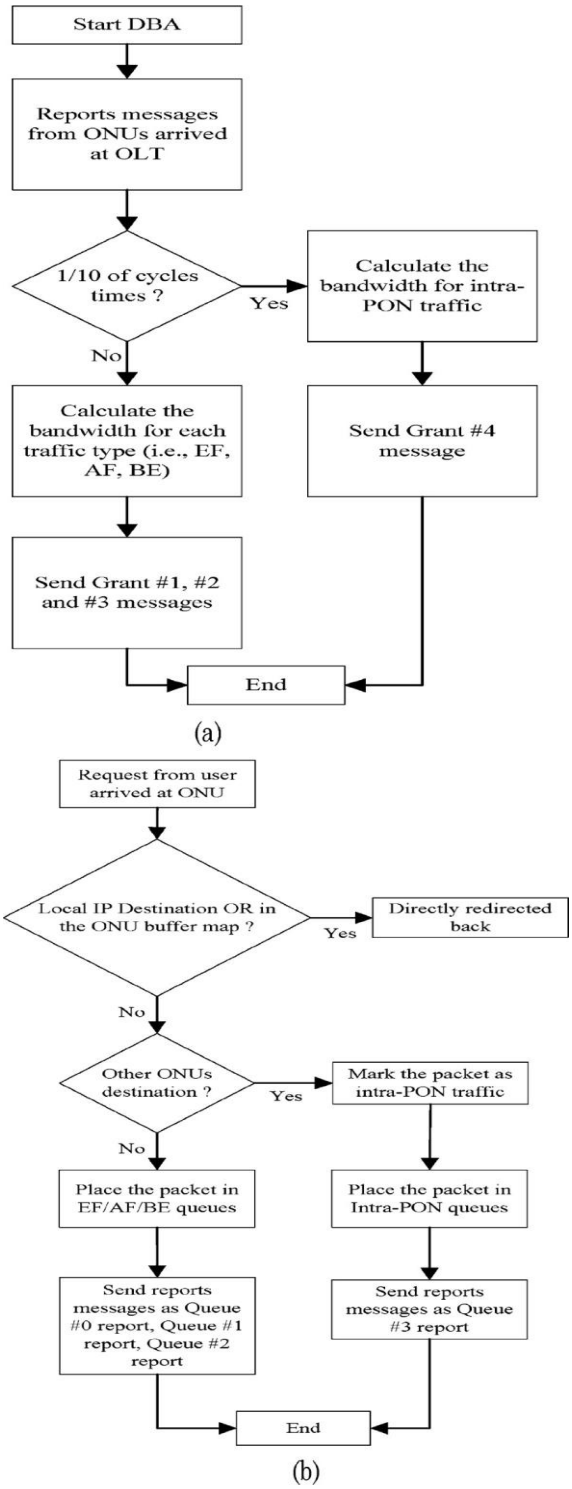

Fig. 3. (a) Proposed REDIRECT DBA scheme flowchart for grant message. (b) Proposed REDIRECT DBA scheme flowchart for report message.

IV. CONCLUSION

We have presented a comprehensive review a new architecture with novel ONU mechanisms that can improve the overall performance of EPON for supporting multimedia services, particularly video streaming. To support our architecture, we will developed the REDIRECT DBA mechanism with four priorities queues, which separates the intertraffic and intra-PON traffic. Simulation results showed that the architecture with the associated REDIRECT DBA

scheme has characteristics that suited for provisioning multimedia services. Although the extra receiver in ONU is required and bandwidth waste still might happen; however, our proposed architecture can maintain the video traffic delay below 5 ms and improved the FBA system throughputs. Finally, we concluded that both requests routing and content allocations are important mechanisms for video services in EPON since it can reduce the overall end-to-end delay, notably for video traffic.

REFERENCES

[1] "Cisco visual networking index: Forecast and methodology, 2011-2016," White Paper. San Jose, CA, May 2012, Cisco [Online]. Available: http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360.pdf

[2] P. Chanclou, A. Cui, F. Geilhardt, H. Nakamura, and D. Nesset, "Network operator requirements for the next generation of optical access networks," *IEEE Netw.*, vol. 26, no. 2, pp. 8–14, Mar./Apr. 2012.

[3] S. Choi and J. Park, "SLA-Aware Dynamic Bandwidth Allocation for QoS in EPONs," IEEE/OSA Journal of Optical Communications and Networking, vol. 2, issue 9, pp. 773-781, Sept. 2010.

[4] I. Tomkos, L. Kazovsky, and K. I. Kitayama, "Next-generation optical access networks: Dynamic bandwidth allocation, resources use optimization, and QoS improvements," *IEEE Netw.*, vol. 26, no. 2, pp. 4–6, Mar./Apr. 2012.

[5] I-Shyan Hwang, Andrew Tanny Liem," A MULTIMEDIA SERVICES ARCHITECTURE SUPPORTING LOCAL TRAFFIC REDIRECTION IN PASSIVE OPTICAL NETWORK", Optical Communications and Networks (ICOCN), 2012 11th International Conference ,IEEE 2012.

[6] S. Choi and J. Park, "SLA-aware dynamic bandwidth allocation for QoS in EPONs," *IEEE/OSA J. Opt. Commun. Netw.*, vol. 2, no. 9, pp. 773–781, Sep. 2010.

[7] C. A. Chan, M. Attygalle, and A. Nirmalathas, "Local-traffic-redirection-based dynamic bandwidth assignment scheme for EPON with active forwarding remote repeater node," *IEEE/OSA J. Opt. Commun. Netw.*, vol. 3, no. 3, pp. 245–253, Mar. 2011.

[8] S. R. Sherif, A. Hadjiantonis, G. Ellinas, C. Assi, and M. A. Ali, "A novel decentralized ethernet-based PON access architecture for provisioning differentiated QoS," *J. Lightw. Technol.*, vol. 22, no. 11, pp. 2483–2497, Nov. 2004.

[9] *Media Access Control Parameters, Physical Layers and Management Parameters for Subscriber Access Networks*, IEEE Draft P802.3ah/D1. 0TM, Aug. 2002.

[10] "Cisco Visual Networking Index: Usage," White Paper Cisco. San Jose, CA, Oct. 2010 [Online]. Available: http://www. cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ Cisco_VNI_Usage_WP.html

[11] F. Thouin and M. Coates, "Video-on-demand networks: Design approaches and future challenges," *IEEE Netw.*, vol. 21, no. 2, pp. 42–48, Mar./Apr. 2007.

[12] A. Nafaa, S. Murphy, and L. Murphy, "Analysis of a large-scale VOD architecture for broadband operators: A P2P-based solution," *IEEE Commun. Mag.*, vol. 46, no. 12, pp. 47–55, Dec. 2008.

[13] G. Kramer, B. Mukherjee, and G. Pesavento, "Interleaved polling with adaptive cycle time (IPACT): A dynamic bandwidth distribution scheme in an optical access network," *Photon. Netw. Commun.*, vol. 4, no. 1, pp. 89–107, Jan. 2002.

[14] I. S. Hwang, J. Y. Lee, K. R. Lai, and A. T. Liem, "Generic QoSaware interleaved dynamic bandwidth allocation in scalable EPONs," *IEEE/OSA J. Opt.Commun.Netw.*,vol.4,no.2,pp.99–107, Feb.2012.

[15] M. McGarry, M. Maier, and M. Reisslein, "Ethernet PONs: A survey of dynamic bandwidth allocation (DBA) algorithms," *IEEE Commun. Mag.*, vol. 42, no. 8, pp. S8–S15, Aug. 2004.

[16] Y. Luo and N. Ansari, "Bandwidth allocation for multiservice access on EPON," *IEEE Commun. Mag.*, vol. 43, no. 2, pp. S16–S21, Feb. 2005.

[17] C. M. Assi, Y. Ye, S. Dixit, and M. A. Ali, "Dynamic bandwidth allocation for quality-of-service over ethernet PONs," *IEEE J. Sel. Areas Commun.*, vol. 21, no. 9, pp. 1467–1477, Nov. 2003.

[18] J. Chen, B. Chen, and L. Wosinska, "Joint bandwidth scheduling to support differentiated services and multiple service providers in 1 G and 10 G EPONs," *IEEE/OSA J. Opt. Commun. Netw.*, vol. 1, no. 4, pp. 343–351, Sep. 2009.

[19] E. Wong and C.-J. Chae, "Customer-controlled dynamic bandwidth allocation scheme for differentiated services in passive optical networks," *J. Opt. Netw.*, vol. 5, no. 7, pp. 541–553, Jul. 2006.

[20] N. U. Kim and M. Kang, "Traffic share-based multicast scheduling for broadcast video delivery in shared-WDM-PONs," *J. Lightw. Technol.*, vol. 25, no. 9, pp. 2814–2827, Sep. 2007.