

Upstream Traffic Management in EPONs : A Simulation Based Analysis

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ABSTRACT

An access network architecture using Passive Optical Networks (PON) with Dynamic Bandwidth Allocation (DBA) is currently considered to be one of the most promising solutions to meet increasing traffic demands. Upstream traffic management in PONs is fairly complex, which implies using simulation methods to assess its effectiveness. This paper presents the characteristics of a generic simulation platform that is currently developed in our team to evaluate the performance characteristics of PONs DBAs and to assess the efficiency of their QoS support.

Keywords

Ethernet, Passive Optical Network, polling protocol, medium access control

1. INTRODUCTION

Before deploying PON systems, it is necessary to reach a good understanding of the complex interactions between offered traffic, intra-ONU scheduling policies and centralized arbitration by the DBA. Analytical modelling can only be used to assess global performance indicators such as Mean Queueing Delays, and generally rely on drastic simplifications of the exact model. This makes simulation methods particularly attractive and even mandatory in some cases. The present paper demonstrates how to simulate traffic transport in EPONs.

2. SIMULATING UPTREAM TRAFFIC MANAGEMENT IN EPONS

The simulation platform is based on the popular discrete event based network simulator NS-2[3].

2.1 Inter-ONU Scheduling

Inter-ONU scheduling is the global process used to share transmission opportunities for upstream traffic between all ONUs. In EPON systems, MPCP messages are used by the ONUs to request transmission opportunities, and by the

OLT to grant them. However, we have chosen not to explicitly simulate the MPCP control messages (GATE and REPORT). Instead, we have implemented two procedures, one for evaluating the requirements of each ONU (i.e. by measuring the buffer size of each traffic class, at the beginning or at the end of each ONU's transmission), and the other for controlling transmission (DBA computing). The transmission opportunities in a given polling cycle are computed by the DBA agent using the requirements evaluated during the previous cycle. We have, using this method, implemented several well known DBAs described in [1] which can be used as benchmarks when assessing the performance of our own proposed DBA mechanism[2].

2.2 Intra-ONU Scheduling

Intra-ONU scheduling is the process implemented to simulate how a given ONU uses the transmission opportunities that have been granted. In order to simulate TDM in the upstream direction, we had to design some extensions to the current version of NS-2. We have implemented "BlocQ", a variant of the existing Drop-Tail scheme. With "BlocQ", a queue can be forced to send packets only when it is unblocked. Cascading "BlocQ" mechanisms allows us to simulate various priority based scheduling schemes.

3. CONCLUSION

A simulation platform used to analyze the performance of EPON traffic management policies has been developed. The simulation platform relies on limited modifications of the NS-2 packages. It allows us to assess the performance offered to upstream traffic.

4. ACKNOWLEDGEMENTS

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5. REFERENCES

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