Assured Horizon – An Efficient Framework for Service Differentiation in Optical Burst Switched Networks

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ABSTRACT

While traffic management is believed to be best implemented in the IP layer e.g. by GMPLS, an evolving question in the context of IP-over-photonics is whether the optical layer can provide service differentiation as a service to the IP layer. As a positive answer to that question, the *assured Horizon* framework was recently published.

Keywords: IP-over-photonics, OBS, service differentiation, scheduling, burst assembly, reservation mechanism

Optical burst switching (OBS) is a promising candidate in the context of IP-over-photonics with a granularity between circuit switching and packet switching supporting one service class. When enhancing OBS to support service differentiation, three major challenges are faced. (i) There is only limited time for burst header processing in the core, (ii) there are no buffers beyond fiber delay lines (FDLs) available for scheduling and (iii) one-pass reservation lacks to send any feedback about the state of the core to the edges. OBS-QoS mechanisms available in literature apply different approaches to overcome these challenges. However, none of them efficiently overcomes all of them. Therefore, *assured Horizon*[1] was published as a framework that combines burst assembly and reservation as well as the communication between them.

The basic idea of *assured Horizon* is the introduction of a coarse-grained (or static) bandwidth reservation r_i for every forwarding equivalent class (FEC) between ingress and egress. This corresponds to a ’weight’ of a ’weighted scheduler’ in the electrical domain. The burst assembler – which works on a time-triggered basis – marks bursts as *compliant* (C) or *non-compliant* (NC), dependent on a burst conforming to r_i. Hereby, an algorithm compromises between the proportion of non-compliant bursts and the waiting time in the assembly buffer. The greater the allocation factor $f_i = r_i / m_i$ (with mean rate m_i) the greater the proportion of bursts marked as compliant. Thus, policing is carried out by burst assemblers at the edges in a distributed way. In order to allow for multiplexing gain, the enforcement of this policing is performed centrally by a dropper in front of each core node. Dependent on the number of allocated wavelengths, the dropper is either in regular state where no burst is dropped, or in congestion state, where all non-compliant bursts are dropped.

Performance evaluations are carried out in a scenario of a core node with 8 wavelengths and a feedback FDL that receives bursts from 10 edge nodes with 2 service classes each. Bursts of high priority class 0 (share 0.3) and low priority class 1 are assembled from self-similar IP traffic. The allocated rate of class 1 is determined by $r_1 = (1 - 0.3 \cdot f_0) \cdot m_1 / 0.7$. Fig. 1 depicts the resulting mean burst length for both classes. From Fig. 2, the magnitude of differentiation can be determined for an offered load of 0.6. Furthermore, it shows that the burst loss probability follows the share of non-compliant bursts. Finally, for $f_0 = 1.6$, Fig. 3 shows that service differentiation can be controlled, also for higher offered load.

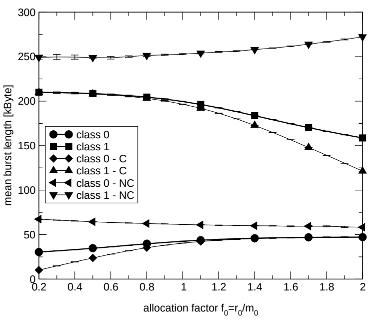

Figure 1: Mean burst length

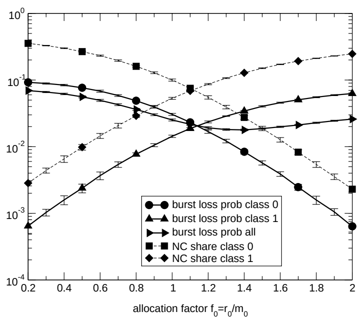

Figure 2: Impact of allocation

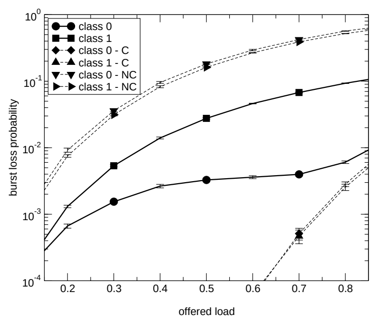

Figure 3: Impact of offered load

1. K. Dolzer, "Assured Horizon – A new combined framework for burst assembly and reservation in optical burst switched networks", Proc. 7th European Conference on Networks & Optical Communications (NOC), Darmstadt, Germany, June 18-21, 2002.

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