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# Classification of heterogeneous receivers for video diffusion over the Internet

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Transmission of multimedia flows over multicast channels is confronted with the receivers heterogeneity problem. A multicast transmission, in which all receivers in the multicast group are similar and receive the same packets, can be assimilated to a single unicast transmission, and the feedback of only one receiver is sufficient to estimate the state of all. Unfortunately, it is a matter of fact that receivers in a multicast group are heterogeneous in term of CPU power (or CPU load) and in term of connection characteristics.

Layered transmission has been proposed to cope with receivers heterogeneity. In this approach, the source is represented using a base layer, and several successive enhancement layers refining the quality of the source reconstruction. Each layer is transmitted over a separate multicast group and receivers decide the number of groups to join (or leave) according to the quality of their reception. At the other side, the sender can decide the optimal number of layers and the encoding rate of each layer according to the feedback sent by all receivers.

In fact, the sender does not need reports of each receiver in the multicast group. It rather needs a partition of the receivers into some homogeneous classes. Each layer of the layered coding can be adapted to the characteristics of one (or a group) of these classes. Each class represents a group of homogeneous receivers, for which the sender should take adaptive actions. Classification should be done using feedback of discriminative variables that are related to the subjective quality. These feedbacks could be transmitted using RTCP Receiver Reports (RRs) possibly modified to fit specific application requirements.

Clearly video streaming schemes should be coupled to adaptive control schemes that determine the transmission parameters (redundancy level, source coding rate, type of FEC scheme, etc.) as a function of the state of the multicast channel, to achieve the best subjective quality at receivers. Feedback about quality

degradations sustained by receivers are necessary to make adaptive decisions at the sender side. But multicast channels are highly asymmetric: they are point-to-multipoint in one direction and multipoint-to-point in the other direction. Only one multicast flow gets out of the sender and several feedback flows get into it. To avoid possible feedback implosion in a large group of receivers, the RTP standard specifies that all the RTCP reports sent must not consume more than 5% of the bandwidth assigned for whole the session. So, when the group size increases, the RTCP interval increases resulting in RTCP infrequent feedback reports which may decrease the interest of the feedback.

Multicast transmission are also known to exhibit strong spatial correlations [1, 2]. These spatial correlations are due to the tree structure of multicast routing: losses occurred upstream of a routing node will be observed by all receivers in the attached subtree. Receivers that obtain a multicast flow from the same routing node are more likely to expect similar losses. This has fueled the idea that feedbacks from these receivers can be aggregated into a single compact feedback report.

We show in this paper, that a simple distributed aggregation mechanism can classify receivers and solve by this ways the feedback implosion problem and at the same time provide the sender with a highly compressed and efficient representation of the receivers.

## References

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