Fair Strategy for Multi-Rate Multimedia Sessions in DiffServ Networks

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Motivation

Multimedia flows with similar quality requirements will use the same DiffServ service. However the network will not be fair to them, namely because:

- DiffServ networks fairness consist in dividing traffic in different services, considering flows quality requirements;
- Considering the marker and queueing discipline used (RED, RIO), DiffServ networks may not be fair to flows sharing resources in the same service.

Project Goals

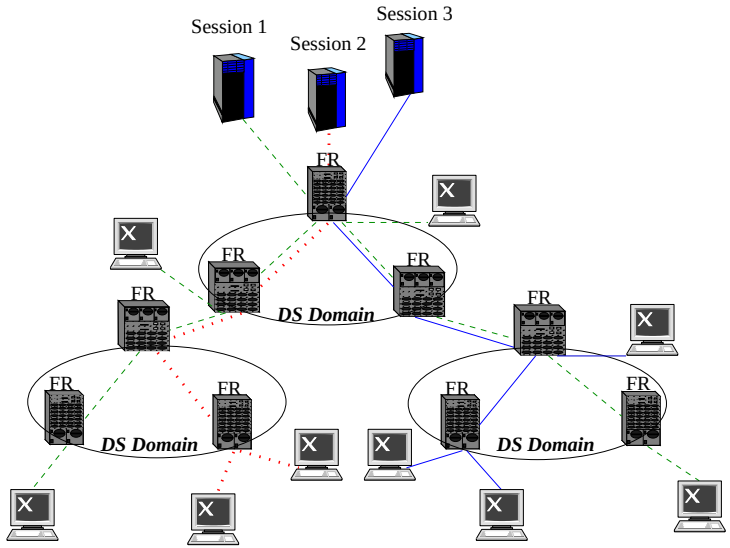
Provide fair distribution of DiffServ “Assured” service resources between multimedia multicast flows considering:

1. The number of receivers in each multicast flow;
2. A maximal utilization of resources;
3. Differential dropping between flows that overpass their share of service resources.

Definition of a multi-layer utilization maximal (MLUM) approach in DiffServ ingress and egress routers.

Multi-Layer Utilization Maximal

In a DiffServ environment each ingress and egress routers can be fair routers (FR) for “Assured” services, using Multi-Layer Utilization Maximal (MLUM).



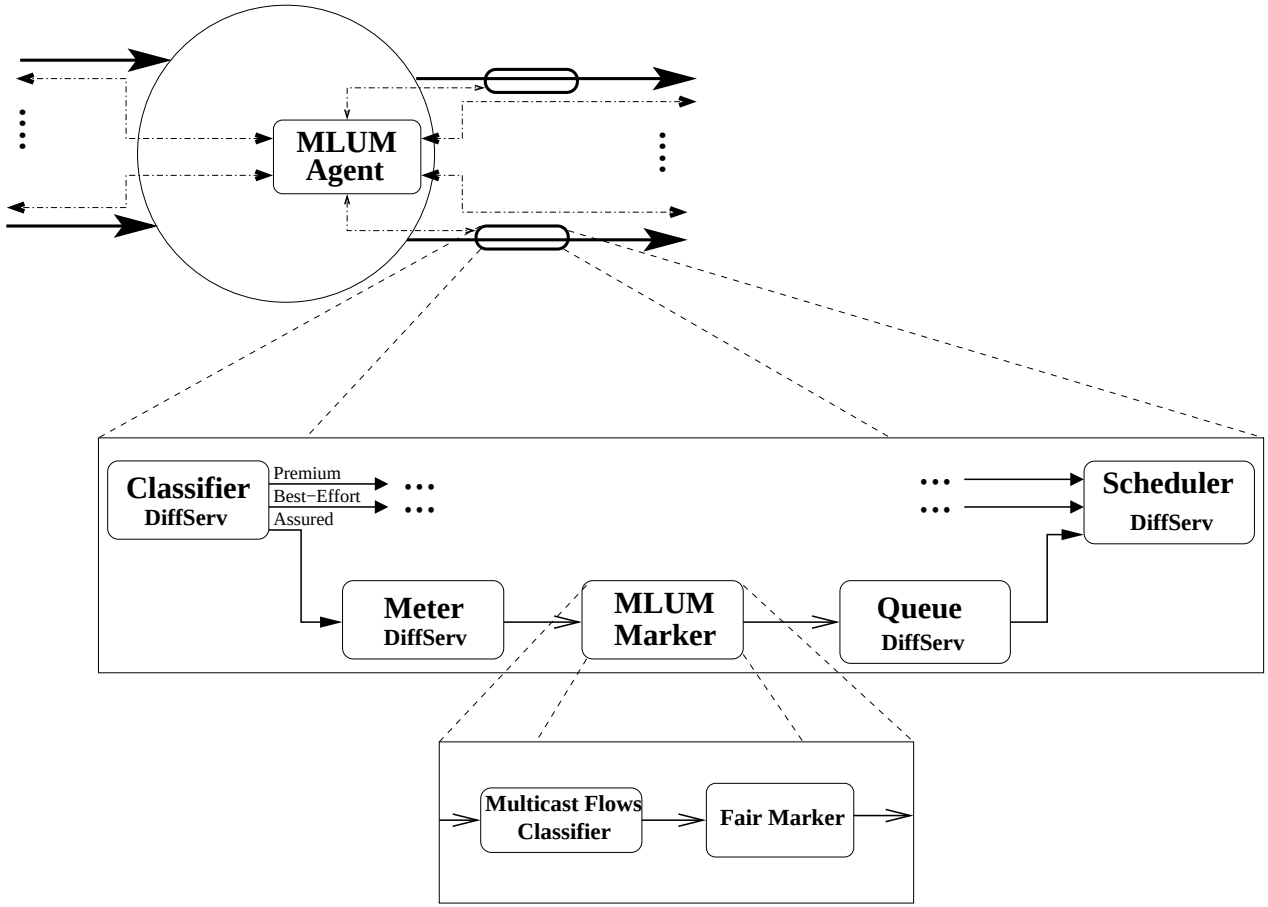
Protocol between MLUM elements

MLUM elements in FR routers will use a protocol to:

- Send, periodically, to immediately upstream (sender direction) neighbors information about flows downstream number of receivers and fair rate;
- Send periodically, to immediately downstream neighbors information about flows fair rate (useful for the implementation of receivers adaptive mechanisms).

Elements in DiffServ edges routers

Ingress and egress Diffserv routers have the following MLUM elements for “Assured” services:



Functionality in DiffServ edges routers

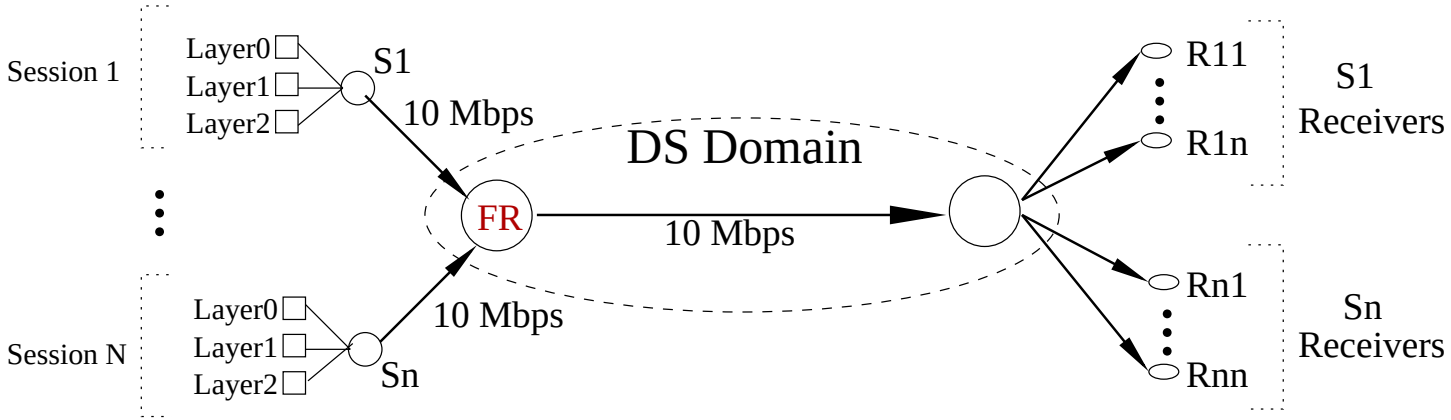
MLUM agent, which estimates:

- Flows fair rates, based upon flows downstream number of receivers and fair rate;
- Flows dropping index, based upon flows fair rate overpass percentage. This index identify and punish unresponsive flows;

MLUM marker, which mark flows considering their fair rates and their dropping index.

Simulations

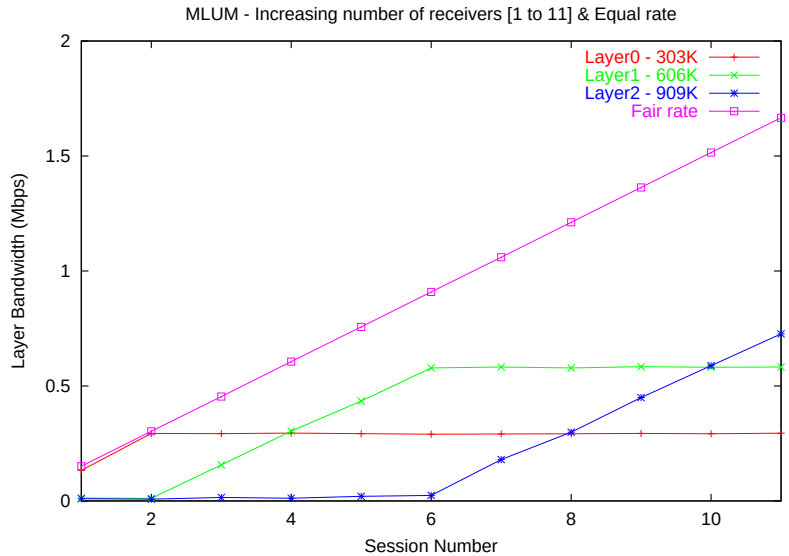
Evaluation of MLUM performance in one congested link scenario, using RIO and MLUMQ as queueing discipline.



MLUMQ has the same results has RIO, without RIO's configuration complexity.

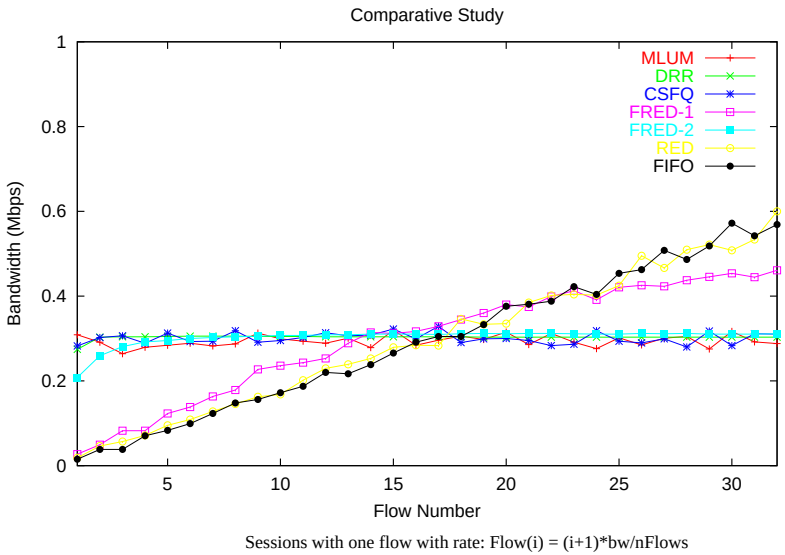
Fairness results

Example: 11 sessions and increasing number of receivers (session 1 to 11). Each session has three layers with rates of: 303Kps to the base layer and 606Kps and 909Kps to the enhanced layers.



MLUM and other approaches

Approaches: FIFO, RED, FRED, DRR and CSFQ;
Simulations in a uni-layer, uni-receivers scenario (only MLUM works in a multi-layer, multi-receiver scenario);



Future Work

1. MLUM generalization to be used with multiple stream per source;
2. Simulation in more than one congested link;
3. Implementation in Linux routers;
4. Functionality tests in a lab environment;
5. Scalability tests in a large network environment.