Multipoint Alternate Marking method for passive and hybrid performance monitoring

draft-fioccola-ippm-multipoint-alt-mark-00

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Motivations

The Alternate Marking method, as presented in draft-ietf-ippm-alt-mark, seems to be applicable only to point-to-point flows, but this is not true!

- Now the idea is to generalize and expand this methodology to measure any kind of unicast flows: the technique here described is called Multipoint Alternate Marking.

- There are some applications of the alternate marking method where there are a lot of monitored flows and nodes.
  - e.g.: for n measurement points and n monitored flows, the order of magnitude of the packet counters for each time interval is n*n*2.

Multipoint Alternate Marking makes the performance monitoring more flexible

Flow classification (1/2)

An IP monitored flow is identified by all the packets having a set of common characteristics: packet selection rules, that operate on the so called **«Identification Fields» (IFs)** of the packet header.

- IP source, IP destination, Transport Protocol, Source Port, Destination Port and DiffServ field

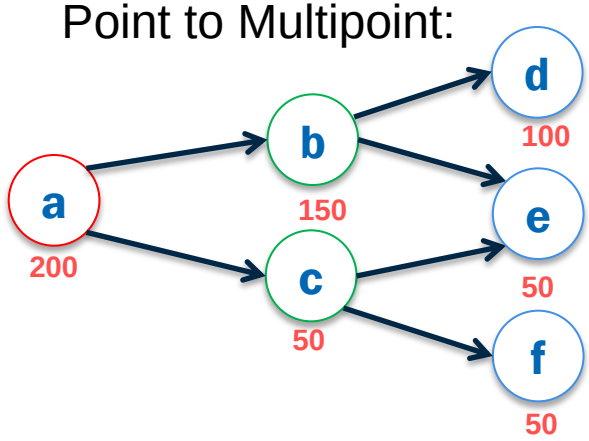
To create the flows to be monitored with alternate marking, we can build selection rules with a subset of IFs identified by a set of values, a range of values, bit masks and so on.

Multipoint Alternate Marking enables the performance monitoring of multipoint flows selected by identification fields without any constraint

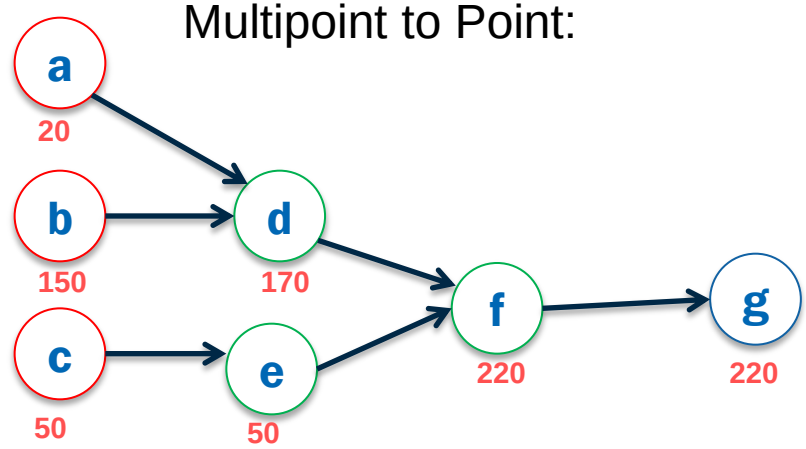
- multiple marking points and multiple exit points can be considered for the same monitored flow.
- even the entire network production traffic can be considered as a single monitored flow.

Flow classification (2/2)

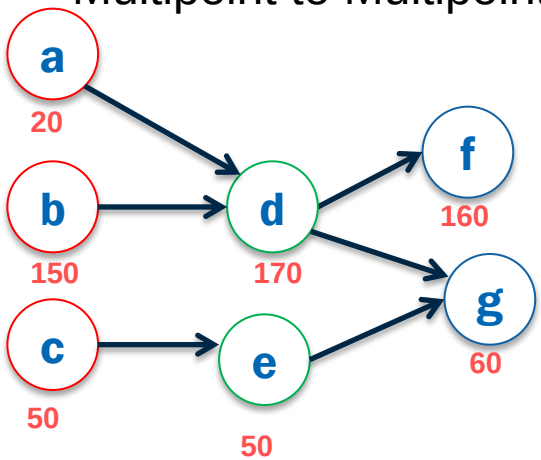
Point to Multipoint:



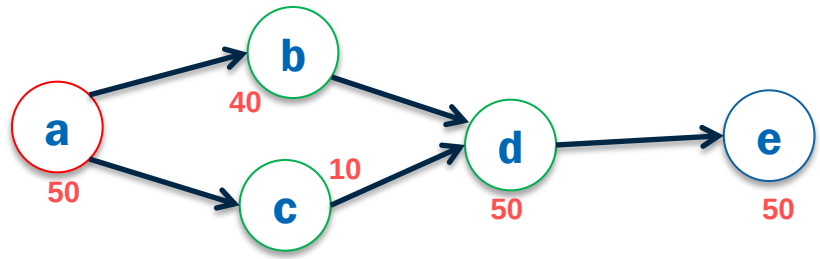
Multipoint to Point:



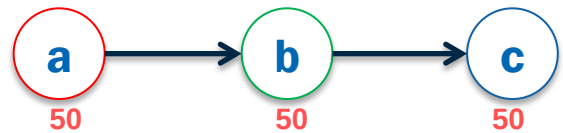
Multipoint to Multipoint:



Point to Point:



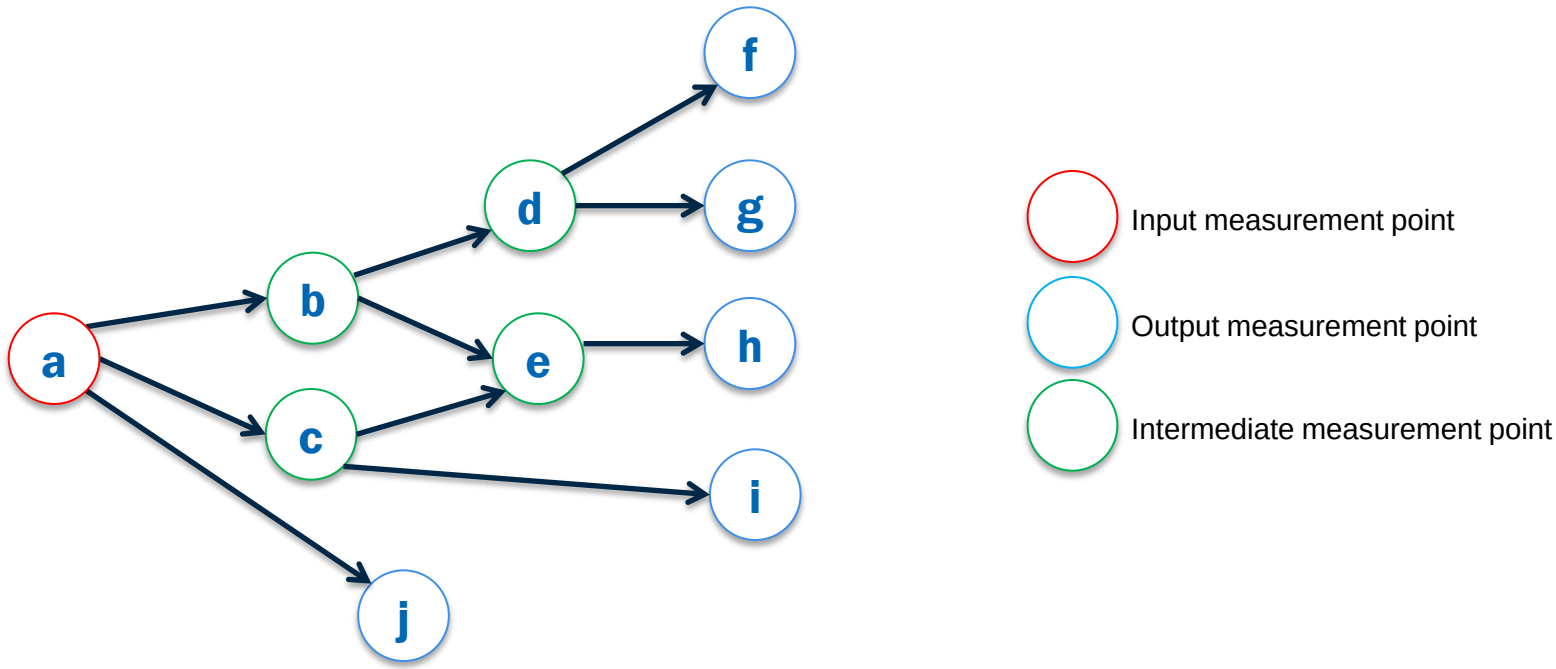
Pont to Point single path:



How Multipoint Alternate Marking operates

The “Monitoring Network” must be built from the more complex Production Network:

- The nodes of the graph, representing a monitored flow, are the measurement points and the links are connections between measurement points.
- The numbers of packets are referred only to a marking period of the monitored flow.



Network Packet Loss (1 flow, 1 period)

Packet Loss Property (unicast packets): «In a packet network, the number of lost packets is the number of input packets minus the number of output packets».

Monitored Network Packet Loss with n input nodes and m output nodes (multipoint flow):

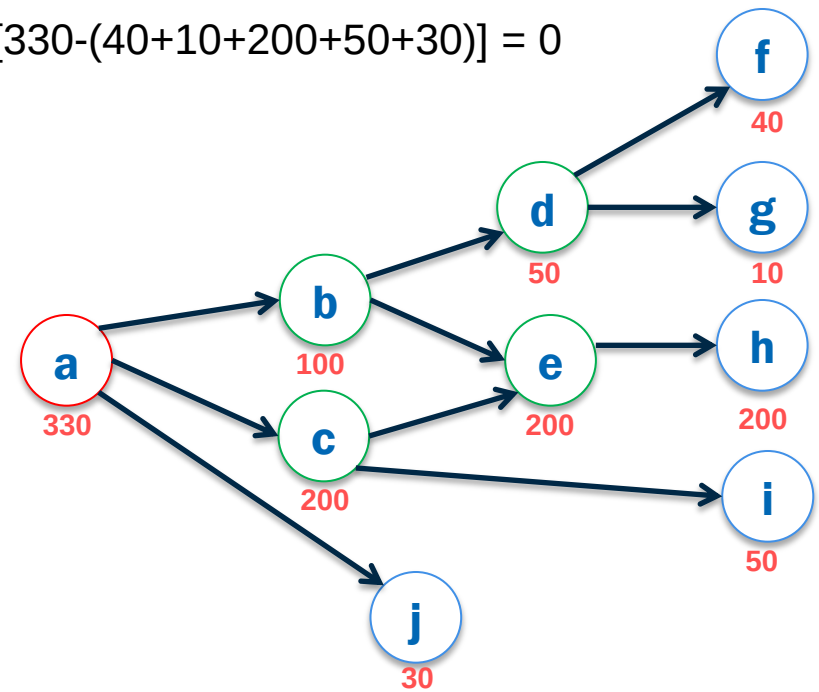
$PL = \Sigma_{i=1,n} IPi - \Sigma_{j=1,m} OPj$

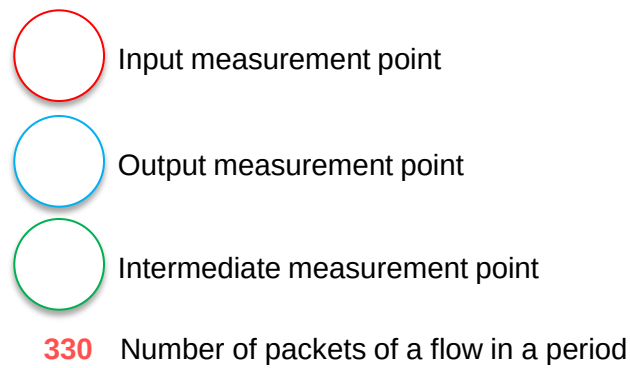
PL: Network Packet Loss (number of lost packets)

IPi: Number of packets flowed through the i-th Input node in this period

OPj: Number of packets flowed through the j-th Output node in this period

PL = [330-(40+10+200+50+30)] = 0



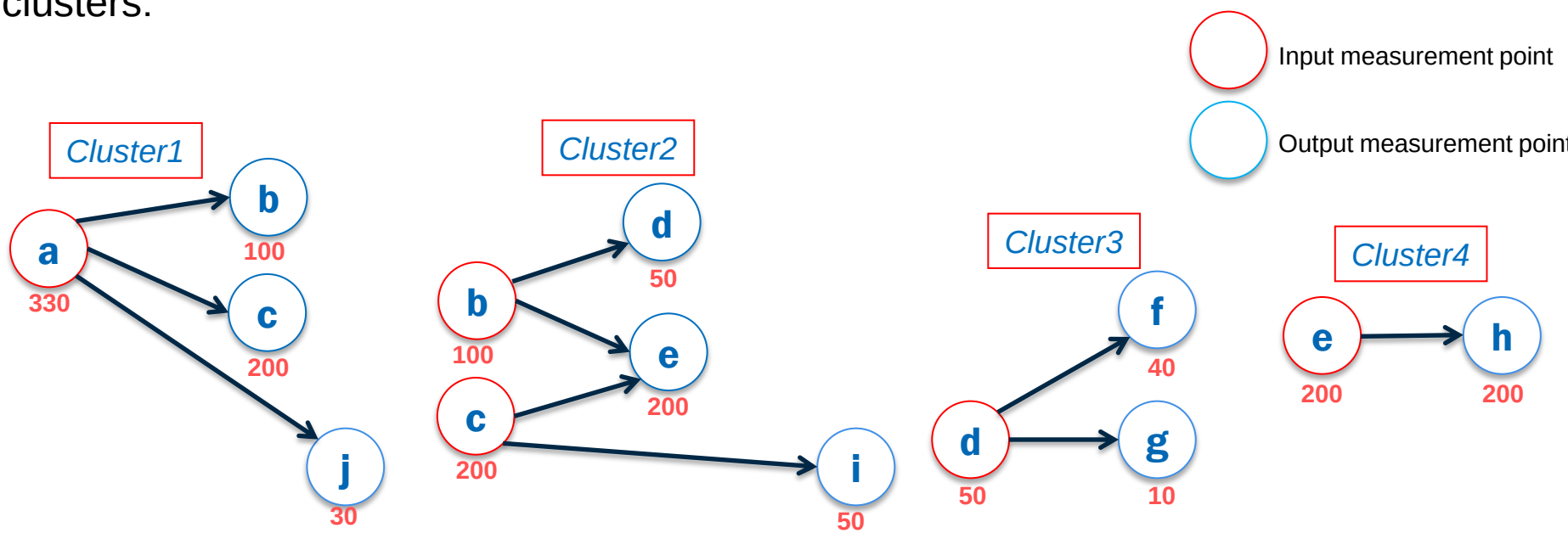


***NB**: It works if there is no loop in the network*

Clusters

How we can localize the losses: the monitoring network can be split in the smallest subnetworks, maintaining the packet loss property for each subnetwork.

These subnetworks are called Clusters. In our monitoring network example we have 4 clusters:



We have clusters with more than 2 nodes and two-nodes clusters:

- In the two-nodes clusters the loss is on the link (Cluster 4).
- In more-than-2-nodes clusters the loss is on the cluster but we cannot know in which link (Cluster 1, 2, 3).

Network Mean Delay one-way (1 flow, 1 period)

Mean delay and jitter measurements can also be generalized to the case of multipoint flows.

It is possible to compute the mean one-way delay of packets in a cluster or in the entire monitored network.

The mean delay can be measured as the difference between the weighted averages of the average timestamps of the sets of output and input nodes in a synchronized network.

$$ADow = \frac{\Sigma_{i=1,m} (OATi * OPi)}{\Sigma_{i=1,m} OPi} - \frac{\Sigma_{j=1,n} (IATj * IPj)}{\Sigma_{j=1,n} IPj}$$

ADow: Monitored Network Average Delay one-way

OATi: Average Timestamp of the i-th Output node

IATj: Average Timestamp of the j-th Input node

OPi: Number of packets flowed through the i-th Output node

IPj: Number of packets flowed through the j-th Input node

Summary and Next Steps

This document adds a new point of view to the alternate marking method:

- A Controller can calibrate Performance Measurements. It can start with the entire Network;
- In case of necessity, the filtering criteria could be specified more in order to perform a Cluster or a point-to-point flow detailed analysis.

See also draft-mizrahi-ippm-multiplexed-alternate-marking for marking methods strengths and weaknesses

Next Version:

- More details on Cluster algorithm will be added.
- More details on Delay Measurement for the Multipoint Monitoring.

Inputs and Comments always welcome