Connection Bitrate Optimization Technique for Multi-Stream Distribution Over IP Networks

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Summary

- Problem description
- New approach: IGMP querier
- What is IGMP querier
- Network optimization diagram
- RIST use case
- ST2110
- QA

Problem description

- Most streaming solutions, send the stream to destination with out knowing or if a recipient is listening on the other side

- Multicast and IGMP was designed to optimize network resources
    - Client are issuing IGMP join/membership reports to receive/consume a multicast stream
    - The network includes means to deliver/route a multicast to the recipient
    - A client may signal a leave/or long nor membership report to signal the end of transmission
    - IGMP Snooping routers and advance protocols are involved in the delivery

- Multicast does not exist on top of open internet

- Most organizations prefer to stick with multicast work flow for ease of use and scalability

- Multicast sender does not know if a recipient is listening, unless RTCP is used
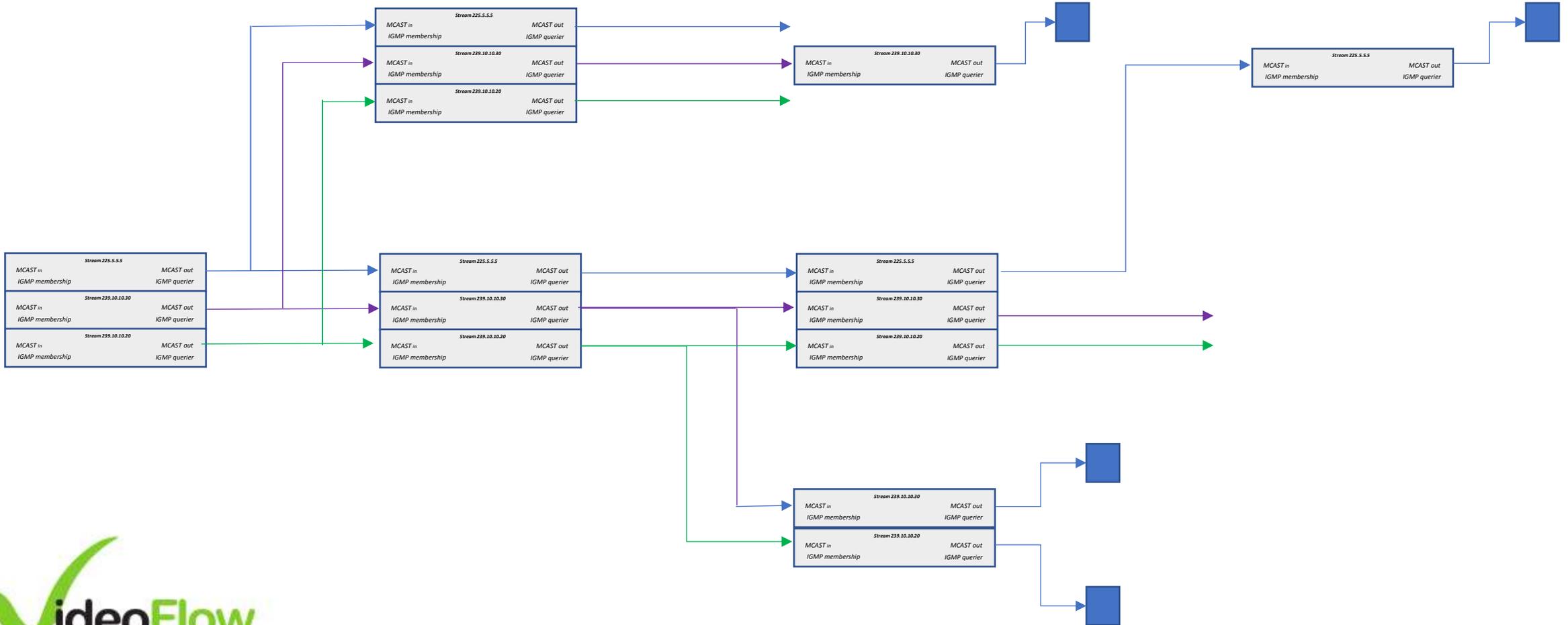
So what is wrong with just streaming?

- Bandwidth is wasted when a stream is sent out, but no actual client is available to receive it

- Extra bandwidth put pressure on networks and network elements in particular – that can contribute to packet loss.

- The Receiving client may not have a listener and the bandwidth is wasted again on the receiving side

New approach: Revers waterfall IGMP query the clients

- The system/network is assumed to be made from point to point peers
- One peer is the sender and the other is the receiver
- Peer receiver can act a sender to multiple other receiver behind it
- Each Stream element includes an IGMP querier to listen to membership reports by on its output network
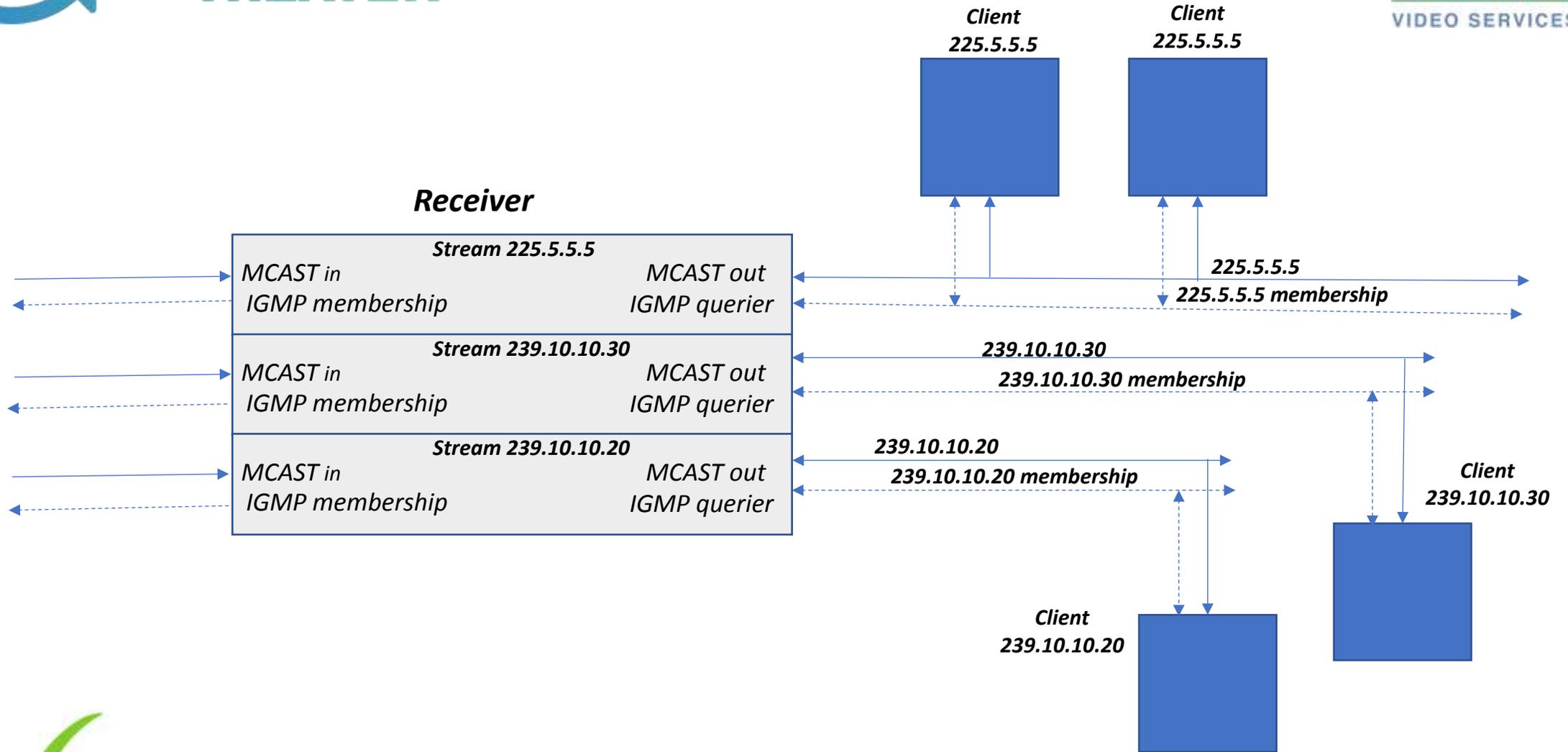
What is an IGMP Querier?

- IGMP is a network layer (Layer 3) protocol used to establish membership in a Multicast group and can register a listener or router to receive specific Multicast traffic.

- To optimize multicast traffic an IGMP snooping is used to fine tune and direct multicast traffic to nodes that issues a membership report to join/listen to the multicast. IGMP snooping operation usually requires a router that generates IGMP membership query and solicit interested nodes to respond.

- Each multicast listener must issue IGMP join/leave/membership report to notify its desire to receive the multicast.
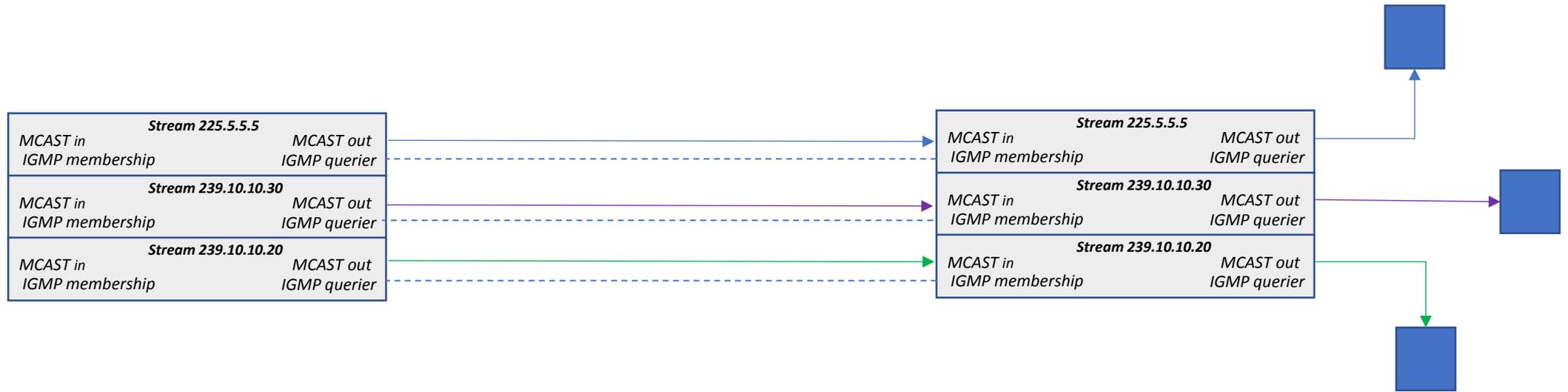
How does the IGMP querier works

- Each output stream is attached with an associated IGMP querier

- The IGMP querier sends IGMP query packet asking who is listening to its associated multicast to learn who is still receiving its multicast

- Each multicast listener must issue a response to the IGMP query to notify that it is still listening to the Multicast

- When no report is detected, the receiver is able to signal to disable its input stream and notify the source by way of stopping the issue of IGMP to it multicast source (sender).

- When a client is detected, a new IGMP membership message is forwarded across the network and a stream is forwarded between the elements to the client

IGMP querier in action

```
ddr 230.0.0.1]
02:17:48.076086 IP 10.13.1.202 > 230.0.0.1: igmp v2 report 230.0.0.1
02:17:49.077509 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga          ◄----------  query
ddr 230.0.0.1]
02:17:49.079151 IP 10.13.1.202 > 230.0.0.1: igmp v2 report 230.0.0.1        ◄----------  response
02:17:50.080553 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga      ◄----------  query
ddr 230.0.0.1]
02:17:50.083189 IP 10.13.1.202 > 230.0.0.1: igmp v2 report 230.0.0.1        ◄----------  
02:17:51.084546 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga                    response
ddr 230.0.0.1]
02:17:51.086307 IP 10.13.1.202 > 230.0.0.1: igmp v2 report 230.0.0.1                            ◄----------  query
02:17:52.087605 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga
ddr 230.0.0.1]
02:17:52.089368 IP 10.13.1.202 > 230.0.0.1: igmp v2 report 230.0.0.1
02:17:53.089812 IP 10.13.1.202 > 224.0.0.2: igmp leave 230.0.0.1                                ◄----------  leave
02:17:53.090736 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga              ◄----------  query
ddr 230.0.0.1]
02:17:54.092044 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga              ◄----------  query
ddr 230.0.0.1]
02:17:55.093519 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga              ◄----------  No response
ddr 230.0.0.1]
02:17:56.094863 IP 10.13.1.106 > 230.0.0.1: igmp query v3 [max resp time 0s] [ga
ddr 230.0.0.1]
```

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Client
225.5.5.5

Client
225.5.5.5

Receiver

Stream 225.5.5.5
MCAST in   MCAST out
IGMP membership   IGMP querier

225.5.5.5
225.5.5.5 membership

Stream 239.10.10.30
MCAST in   MCAST out
IGMP membership   IGMP querier

239.10.10.30
239.10.10.30 membership

Stream 239.10.10.20
MCAST in   MCAST out
IGMP membership   IGMP querier

239.10.10.20
239.10.10.20 membership

Client
239.10.10.30

Client
239.10.10.20

VideoFlow

IP SHOWCASE THEATER AT NAB – APRIL 8-11, 2019

Stream 225.5.5.5
MCAST in   MCAST out
IGMP membership   IGMP querier

Stream 239.10.10.30
MCAST in   MCAST out
IGMP membership   IGMP querier

Stream 239.10.10.20
MCAST in   MCAST out
IGMP membership   IGMP querier

Stream 225.5.5.5
MCAST in   MCAST out
IGMP membership   IGMP querier

Stream 239.10.10.30
MCAST in   MCAST out
IGMP membership   IGMP querier

Stream 239.10.10.20
MCAST in   MCAST out
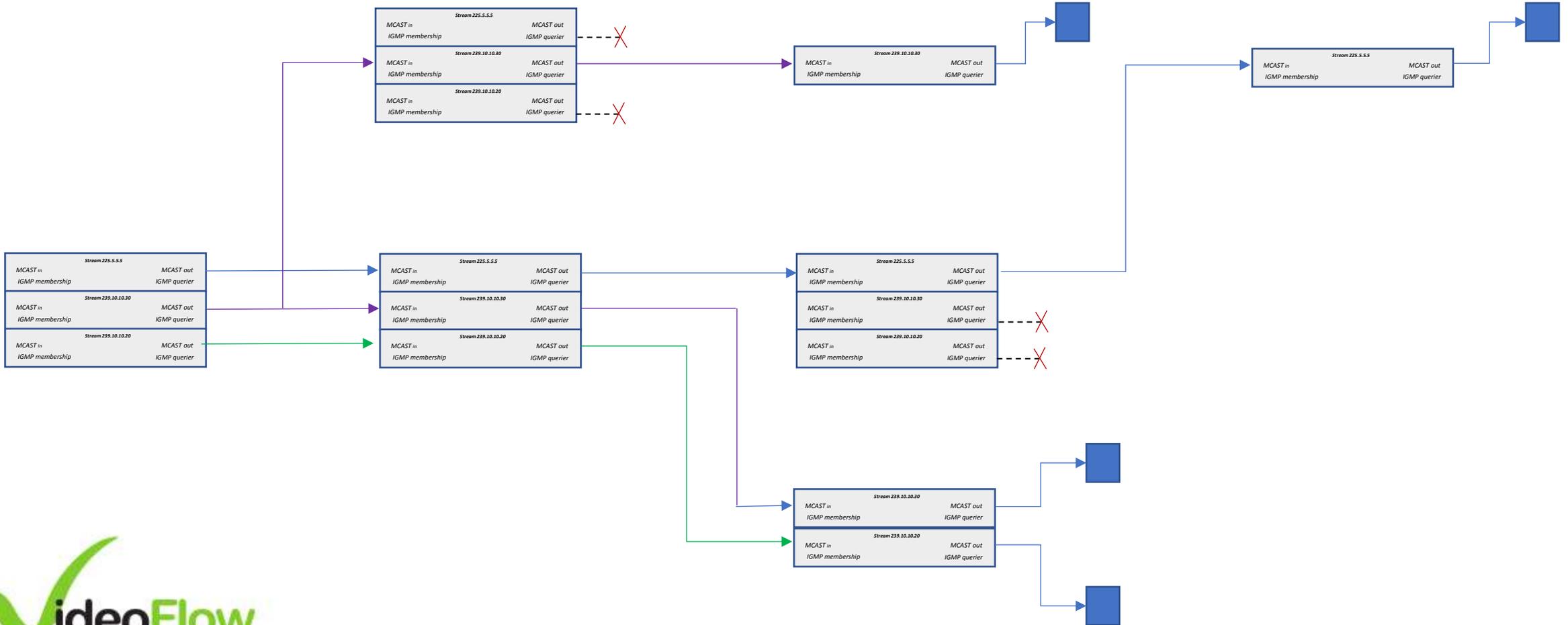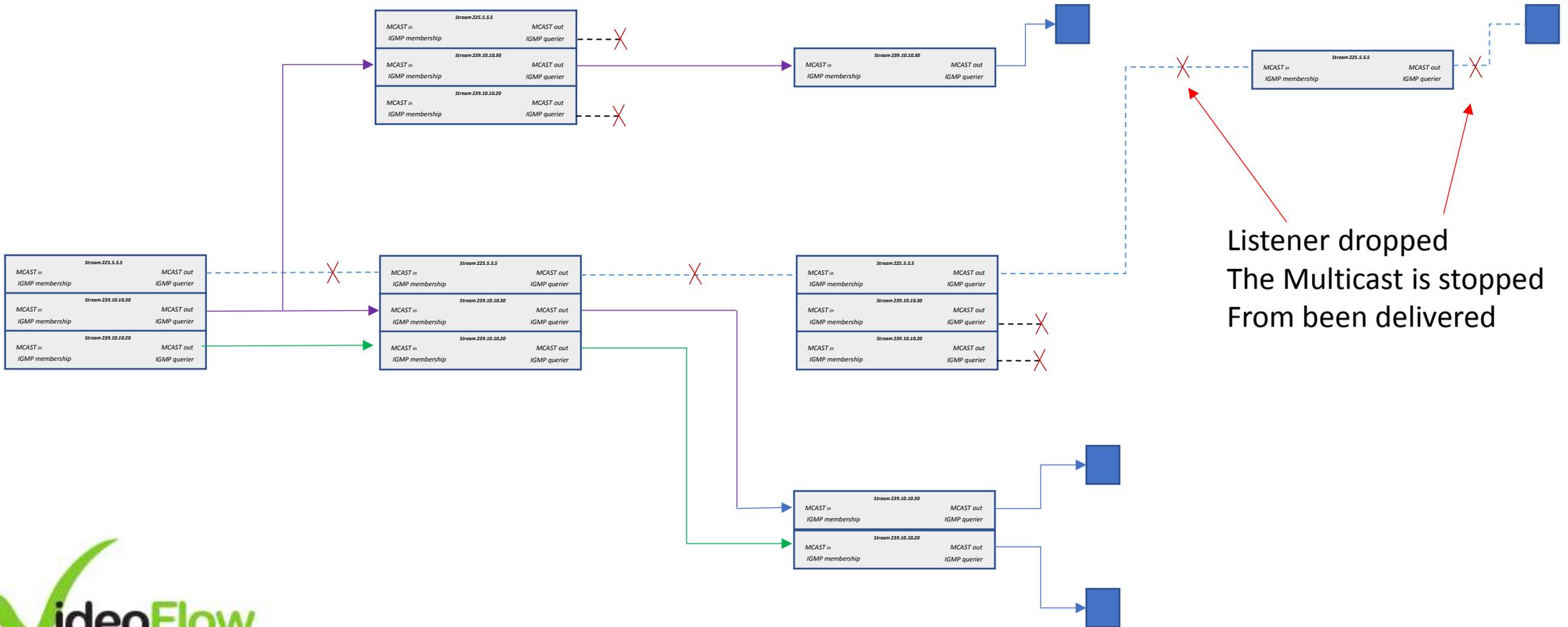IGMP membership   IGMP querier

The network optimization is achieved

- The reduction of traffic reduces the pressure on the IP networks and elements

- Unclaimed streams are reduced or introduced upon client engagement

- The technique is smaller scale implementation of a multicast network.

Listener dropped
The Multicast is stopped
From been delivered

RIST implementation

- The RIST enhanced profile includes the IGMP/MLD section. The simple IGMP membership technique, can easily be adopted by RIST running on top of VPN.

- If IGMP is not supported by the underlined network (e.g open internet), RIST TR can include "IGMP membership message" in RTCP message.

ST2110 use case

- Most ST2110 are multicasts or tunneled multicast in case of ST2110 over WAN.
- If IGMP query technique can reduce unused feeds or backup feeds from running and wasting percious bandwidth across the WAN.

Real time application example

- IPTV delivery – optimize the delivery based on user engagement

- 5G common channel use

- Save backup links, when not consumed

Thank You

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