



Timed switch implementation over programmable hybrid pipeline

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The problem and the solution

Why is timed switch needed?

Solving Timed switch with programmable hybrid pipeline

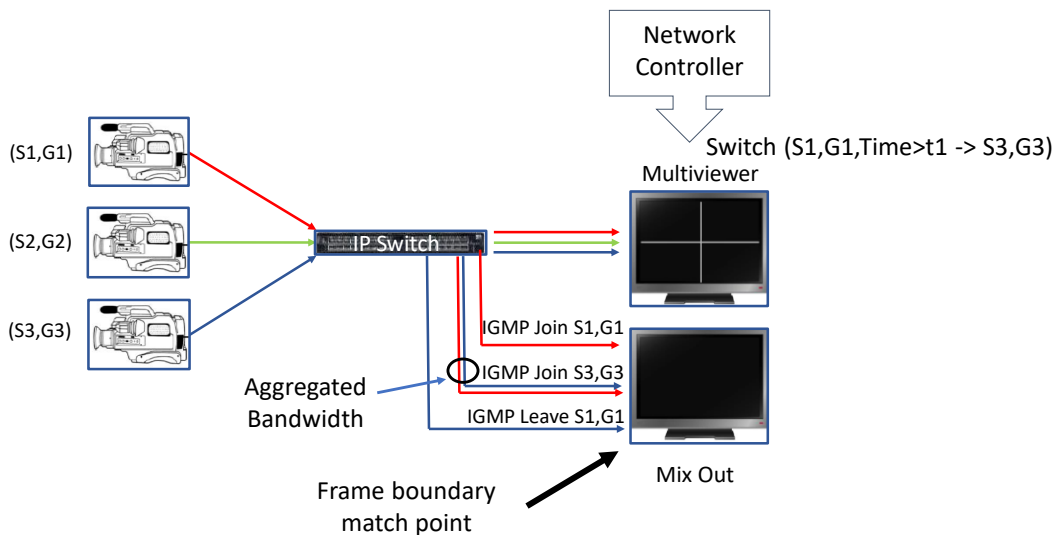
What is salvo use case and why is it a challenge?





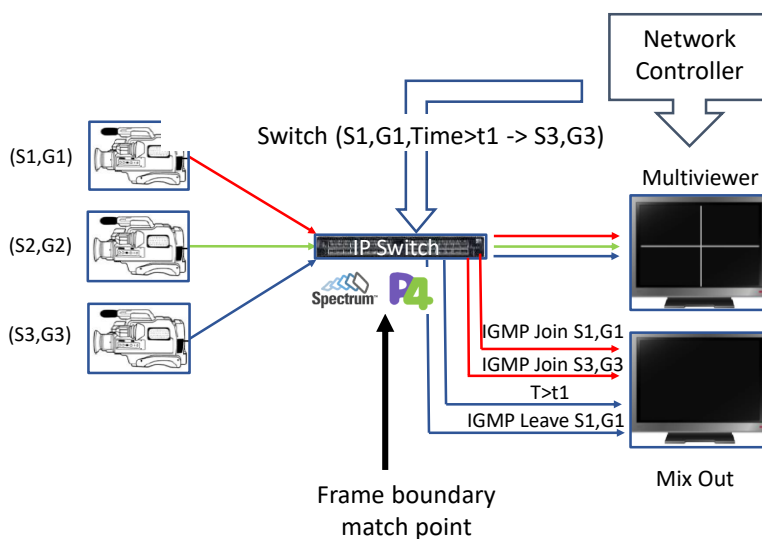
Why is timed switch needed?

Pure IGMP based Solution:



Why is timed switch needed?

IGMP + timed switch Solution:





■ Timed switch control plane principals:

- End points use IGMP to join/ leave media streams based on controller’s request
- Controller sets on the switch/ network (Time, Flows, Downstream interface list)
- New interface for media switch management (should be added to AMWA ISO6 or proprietary controller implementations)

■ Timed switch data plane principals:

- Match on RTP time stamp over SMPTE 2110 media streams
- All media flow time stamps are synchronized/ locked. All packets from the same frame carry the same stamp
- Switch between flows at the new timestamp >= value
- Post event, control plane should revert to legacy IGMP based tables

■ Advantages

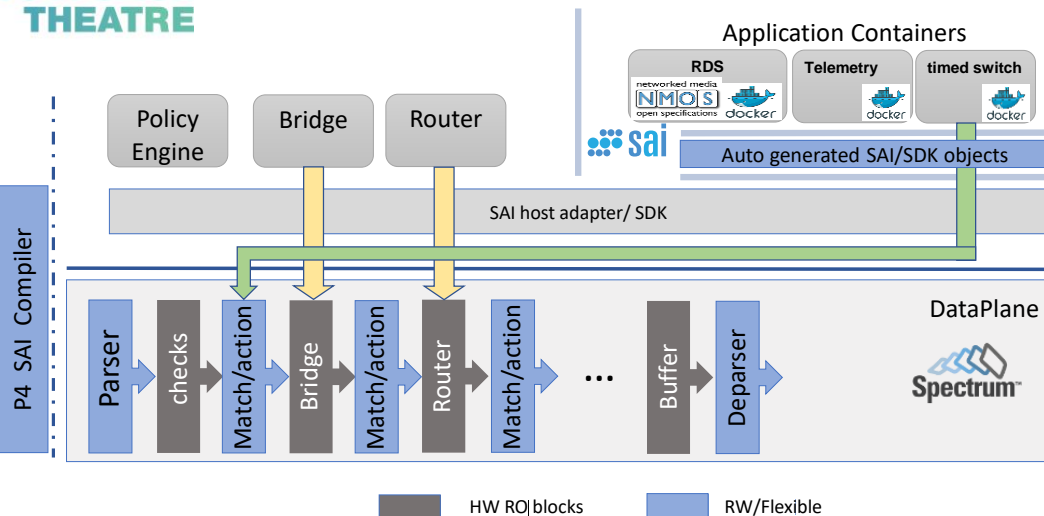
- Programmable hybrid pipeline: All the legacy protocols (IGMP/ PTP/ PIM/...) are operational along the per flow timed switch implementation
- Network/endpoint links carries only relevant data i.e. link can be utilized to carry more streams
- Reduced frame buffer and latency at the endpoints



User programs



timedswitch.p4



- Hybrid – the integration between legacy (switch router) and programmable pipeline
- NOS (ONIX) and user applications run in parallel



P4 timed switch/ salvo program

```

table table_timestamp {
  key = {
    headers.rtp.timestamp : range;
  }
  actions = (set_range_bitmap);
  size = 256;
}

table table_ip_mc_forward{
  key = {
    standard_metadata.METADATA_REG : ternary;
    headers.ip.v4.dst_addr : exact;
    headers.ip.v4.src_addr : exact;
  }
  actions = (to_ports);
  size = 256;
}

// pipe
apply{
  table_timestamp.apply();
  table_udp_port.apply();
  table_ip_mc_forward.apply();
}

control control_in_rif(inout Headers_t headers, inout metadata_t meta, inout standard_metadata_t standard_metadata){
  apply{}
}

control control_out_rif(inout Headers_t headers, inout metadata_t meta, inout standard_metadata_t standard_metadata){
  apply{}
}

control control_out_port(inout Headers_t headers, inout metadata_t meta, inout standard_metadata_t standard_metadata){
  apply{}
}

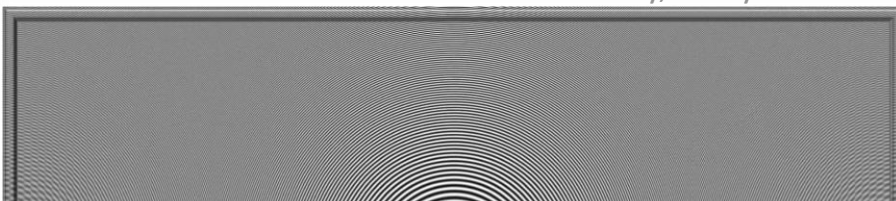
SpectrumSwitch(
  SalvoParser(),
  control_in_port(),
  control_in_rif(),
  control_out_rif(),
  control_out_port(),
  SalvoParser()
) main;

```



Timed Switch Demo

Switch between 2 streams on frame boundary, every 5 seconds

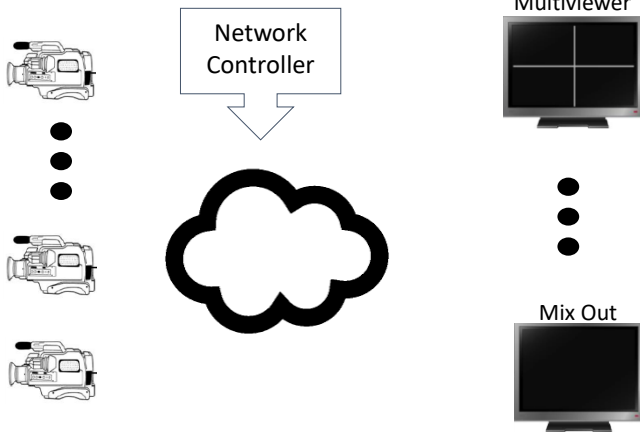




The Salvo Use Case

Same as timed switch, but multiple flows are switched simultaneously

- Switch multiple flows at once
- Timed switch can be applied to multiple flows across multiple network devices (switches), at the same frame boundary
- Full SDN solution is preferred over IGMP based
- Millisecond data plane 'notice'



Thank You

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