Load Balancing RTP Traffic with Director

Solution Brief

The Director data monitoring switch can be used to load balance traffic to a number of monitoring ports using IP addresses, ports, VLANs, or MAC addresses to direct traffic to each output. For example, this Solution Brief shows how to load balance RTP traffic using the SSRC ID to direct the traffic to the balanced outputs.

In addition to its load balancing capability, other notable features of Director include:

- One-to-one, one-to-many, and many-to-many port mappings
- Dual hot-swappable power supplies, AC or -48VDC
- 12 integrated, fully passive 1 GBE in-line Taps
- DNM cards can be removed from the chassis without taking down attached in-line links
- Easy-to-use Web management interface

Requirements

The requirement is to select the RTP packets from multiple ingress ports and load balance them to four output ports using the two least significant bits of the SSRC ID field to demarcate the four output channels. These requirements are illustrated in Figure 1. The RTP packet structure is shown in Figure 2 on the next page.

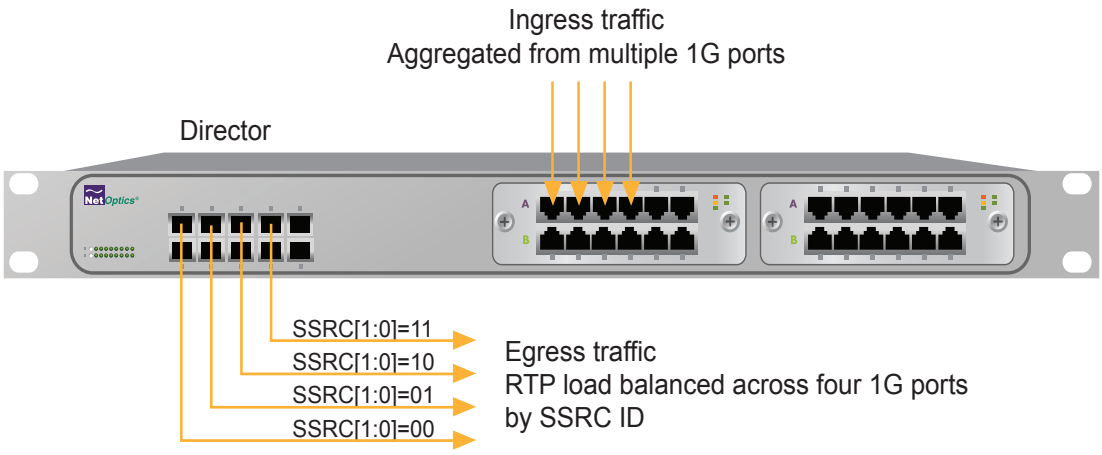

Figure 1: RTP load balancing example

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Solution Brief

Byte	Protocol	Field
1	Eth Type II	Dst MAC
2		
3		
4		
5		
6		
7		Src MAC
8		
9		
10		
11		
12		
13		Ethertype
14		
15	IPv4	Verson …
16		Services
17		Length
18		
19		ID
20		
21		Flags
22		Offset
23		TTL
24		**Protocol=17 (UDP)**
25		Checksum
26		
27		Src address
28		
29		
30		
31		Dst address
32		
33		
34		
Continued next column...		

Byte	Protocol	Field	
...Continued from previous column			
35	UDP	Src port	
36			
37		Dst port	
38			
39		Length	
40			
41		Checksum	
42			
43	RTP	Flags	
44		**Payload Type (Codec)**	1
45		Segment	2
46			3
47		Timestamp	4
48			5
49			6
50			7
51		**SSRC ID**	8
52			9
53			10
54		2 lsb: [1] [0]	11
55		RTP payload	
56			
57			
:			

Load balance by the 2 lsb of the SSRC ID

Payload Type and SSRC are contained in an 11 byrte span

Figure 2: RTP packet structure

The RTP packet structure is shown in Figure 2. RTP normally uses port 5004, so one approach would be to filter for packets on that port. However, in order to accommodate arbitrary ports, the RTP packets will be detected by filtering for the UDP protocol and a Payload Type of the codecs used in the target RTP traffic. This example encompasses two codes:

- ITU-T G.728 – Payload Type = 15 (0x0F)
- ITU-T G.729 – Payload Type = 18 (0x12)

Solution

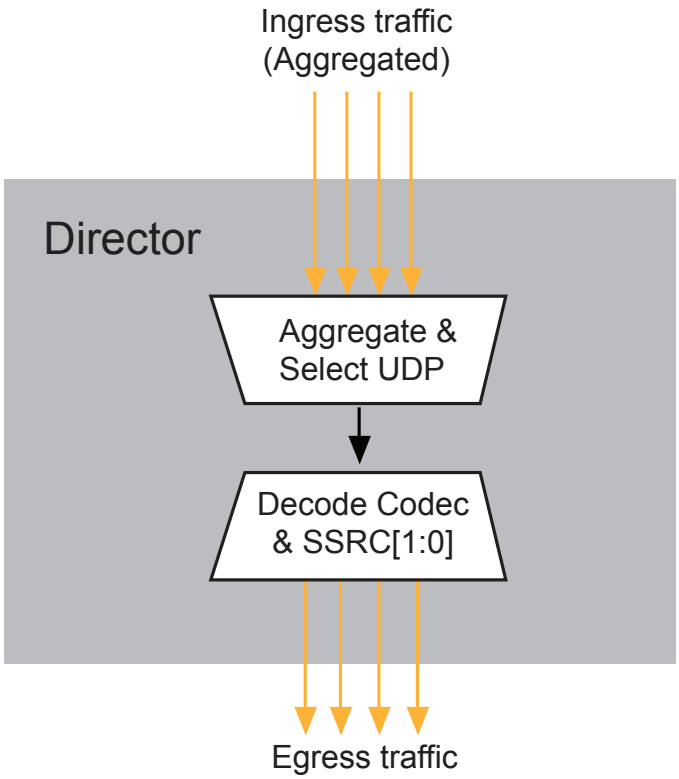
Director can filter directly for the UDP protocol. To decode the Payload Type and SSRC ID, a User Defined Filter (UDF) will be used. The UDF pattern can be as long as 16 bytes; since Payload Type and SSRC ID are contained within 11 bytes, a single UDF pattern can decode both fields (see Figure 3). For each codec, four UDF patterns are needed to decode the four combinations generated by the two lsbs of the SSRC ID. The second codec will require the same four SSRC ID patterns but with a different codec code. Therefore, to support the two codecs in this example, a total of eight UDFs are used.

Byte	Protocol	Field	UDF Value	UDF Mask
35	UDP	Src port	–	00
36				
37		Dst port		
38				
39		Length		
40				
41		Checksum		
42				
43	RTP	Flags	–	00
44		**Payload Type (Codec)**	Codec	FF
45		Segment	–	00
46			–	00
47		Timestamp	–	00
48			–	00
49			–	00
50			–	00
51		**SSRC ID**	–	00
52			–	00
53			–	00
54		2 lsb: [1] [0]	– [1:0]	03
55		RTP payload		

Figure 3: A single UDF pattern decodes the Payload Type and SSRC ID

The overall solution is illustrated in Figure 4. One filter aggregates the input traffic streams and selects the RTP packets. The second set of filters use UDFs to detect the codec and separate traffic by SSRC ID.

Figure 4: Cascading two filters to select RTP, codec, and SSRC



Creating the filters

This section illustrates configuring the filters using the Director CLI to implement the solution.

1. Create the UDP protocol filter (UDP is protocol = 17)

```
Net Optics> filter add in_ports=n1.1-n1.4 ip_protocol=0017 action=redir redir_
ports=t1.1

Net Optics>
```

Traffic entering network ports n1.1 through n1.4 is aggregated and filtered for UDP protocol; all UDP packets are redirected to 10 GBE MAC at port t1.1.

2. Configure the UDF offset and length

```
Net Optics> system set udf_offset=43 udf_length=12
Warning: Changing udf_length or udf_offset may cause existing UDF filter(s)
malfunctioning.
  Do you still want continue? [y/n] - y
Net Optics> commit

Net Optics> system show

                            configure  |  running
                            -----------+---------
      CRC forwarding:          off     |    off
      Jumbo packet:            off     |    off
      Link fault detection:    off     |    off
      UDF offset:               43     |     43
      UDF length:               12     |     12
                            -----------+---------

Net Optics>
```

All UDFs in the system begin at byte 43 and are 12 bytes long.

3. Configure the filters for the first codec

- udf_value= .."12"... indicates Payload Type 0x0F = 15 = ITU-T G.728
- SSRC[1:0] = 2'b00, send to m.1, 2'b01 to m.2, 2'b10 to m.3, 2'b11 to m.4
- udf_mask=007f00000000000000000003 to activate only the Payload Type field and the two lsbs of the SSRC ID field

```
Net Optics> filter add in_ports=t1.1 udf_value=000f00000000000000000000 udf_mask=007f00000000000000000003
action=redir redir_ports=m.01

Net Optics> filter add in_ports=t1.1 udf_value=000f00000000000000000001 udf_mask=007f00000000000000000003
action=redir redir_ports=m.02

Net Optics> filter add in_ports=t1.1 udf_value=000f00000000000000000002 udf_mask=007f00000000000000000003
action=redir redir_ports=m.03

Net Optics> filter add in_ports=t1.1 udf_value=000f00000000000000000003 udf_mask=007f00000000000000000003
action=redir redir_ports=m.04

Net Optics>
```

The filters are created but not activated.

4. Configure the filters for the second codec

- udf_value= .."12"... indicates Payload Type 0x12 = 18 = ITU-T G.729
- SSRC[1:0] = 2'b00, send to m.1, 2'b01 to m.2, 2'b10 to m.3, 2'b11 to m.4
- udf_mask=007f00000000000000000003 to activate only the Payload Type field and the two lsbs of the SSRC field

```
Net Optics> filter add in_ports=t1.1 udf_value=00120000000000000000000 udf_mask=007f00000000000000000003
action=redir redir_ports=m.01

Net Optics> filter add in_ports=t1.1 udf_value=00120000000000000000001 udf_mask=007f00000000000000000003
action=redir redir_ports=m.02

Net Optics> filter add in_ports=t1.1 udf_value=00120000000000000000002 udf_mask=007f00000000000000000003
action=redir redir_ports=m.03

Net Optics> filter add in_ports=t1.1 udf_value=00120000000000000000003 udf_mask=007f00000000000000000003
action=redir redir_ports=m.04

Net Optics>
```

The filters are created but not activated. These filters are logically OR'd with the filters from Step 3 because they have the same **in_ports** and **redir_ports**.

5. Save the filters for future use

```
Net Optics> save rtp_load_balance

Net Optics>
```

The filters and other Director configuration parameters are saved in a file named rtp_load_balance. To reload the filters at another time, enter **load rtp_load_balance**.

6. Activate the filters

```
Net Optics> commit

Net Optics>
```

The filters are activated. RTP traffic with codecs ITU-T G.728 and ITU-T G.729 are now being load balanced to monitor ports m.1, m.2, m.3, and m.4.

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Conclusion

The Director data monitoring switch can easily aggregate traffic from a number of inputs, select the RTP traffic from the aggregated stream, and load balance the resulting RTP packets to a number of monitor ports based on SSRC ID values. The aggregated traffic bandwidth can exceed 10 Gbps without dropping any packets, as long as the output streams do not exceed the 1 Gbps capability of each of the monitor ports.

By extension, it is easy to see that similar load balancing can be performed based on IP addresses, ports, and VLANs.

Director is the keystone of a Monitoring Access Platform (MAP) for integrating data monitoring within the network architecture, for

- Load balancing RTP traffic
- Relieving overburdened monitoring tools by pre-filtering traffic
- Sharing tool resources across groups
- Centralizing monitoring in the NOC

For further information on Load Balancing with Director:

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