



Mimicking LoLa traffic with TWAMP

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What is LoLa?

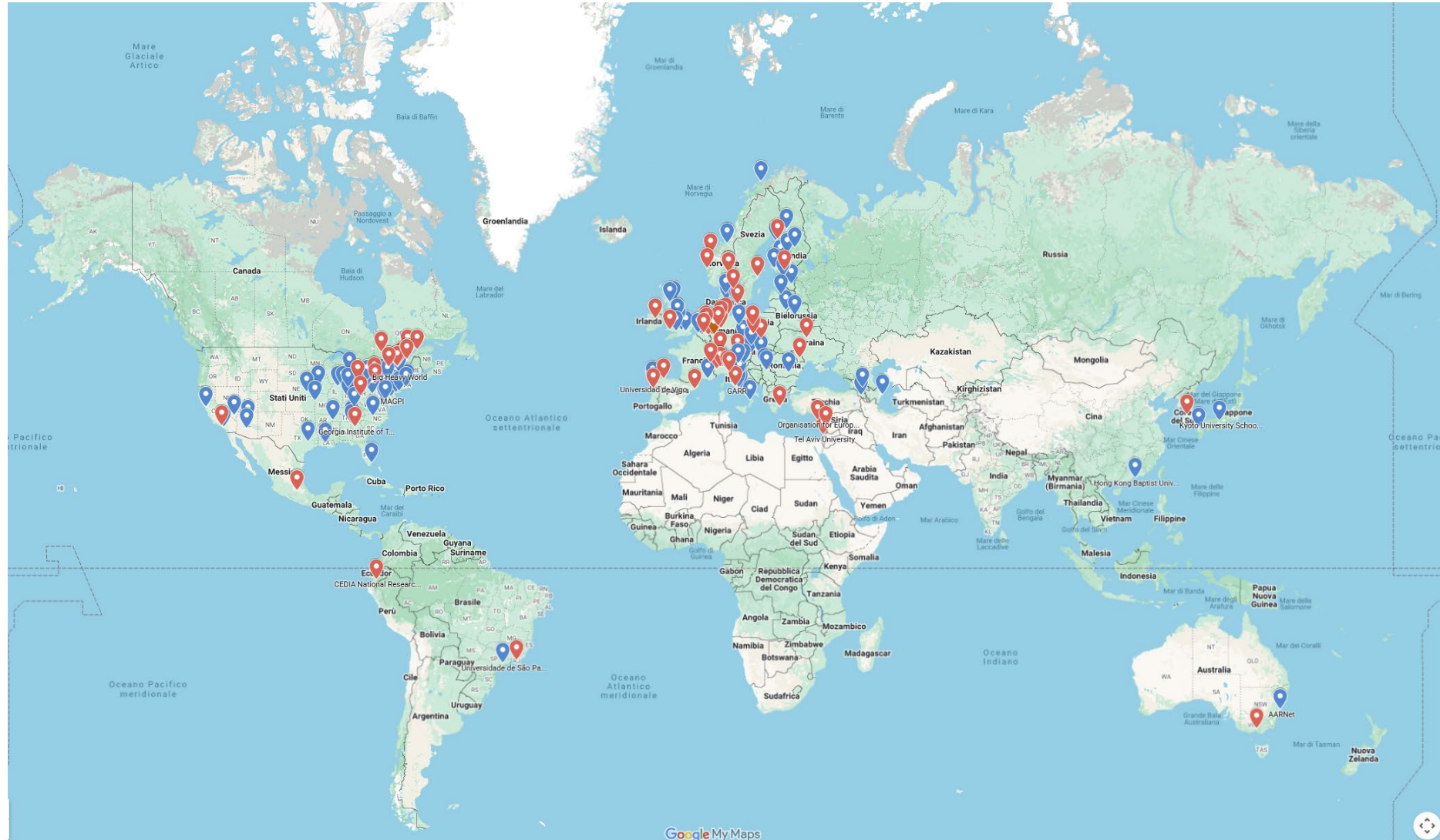
What is LoLa?



What is LoLa?



LoLa in the world



Why are there issues with the LoLa session?

How can we resolve these issues ASAP?

The blame game 😊

The blame game

- Computer software (Microsoft Windows, Firewall, Defender, Drivers, DPC latency, etc.)
- Computer hardware (BIOS/UEFI, integrated device issues, interrupts, etc.)
- Campus network (Firewall, routing, packet reordering, jitter, etc.)
- NREN network (Firewall, routing, packet reordering, jitter, etc.)
- GÉANT network (Asymmetric routing, packet reordering, jitter, etc.)

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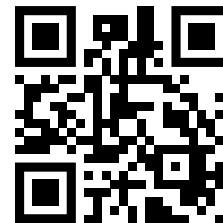
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GÉANT TimeMap



<https://timemap.geant.org/>



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perfSONAR

Testbed setup. perfSONAR machines

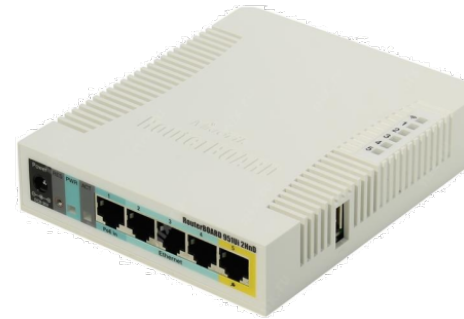
Dell OptiPlex 3040 Micro:

- CPU: Intel Core i5-6500T @ 2.50GHz (4C, 4T)
- RAM: 8 GB (DDR3L)
- HDD: 512 GB SATA
- NIC1: Realtek RTL8111HSD PCI-E GbE (integrated)
- NIC2: ASIX AX88179 USB 3.0 GbE (external)



Testbed setup. Testbed network equipment (need underpowered equipment)

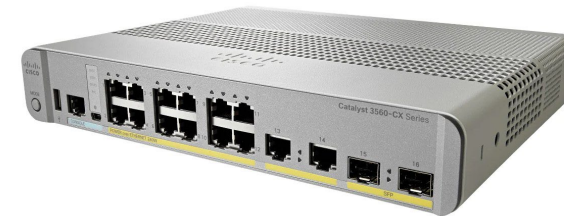
MikroTik RB951G-2HnD router – 2 pcs.



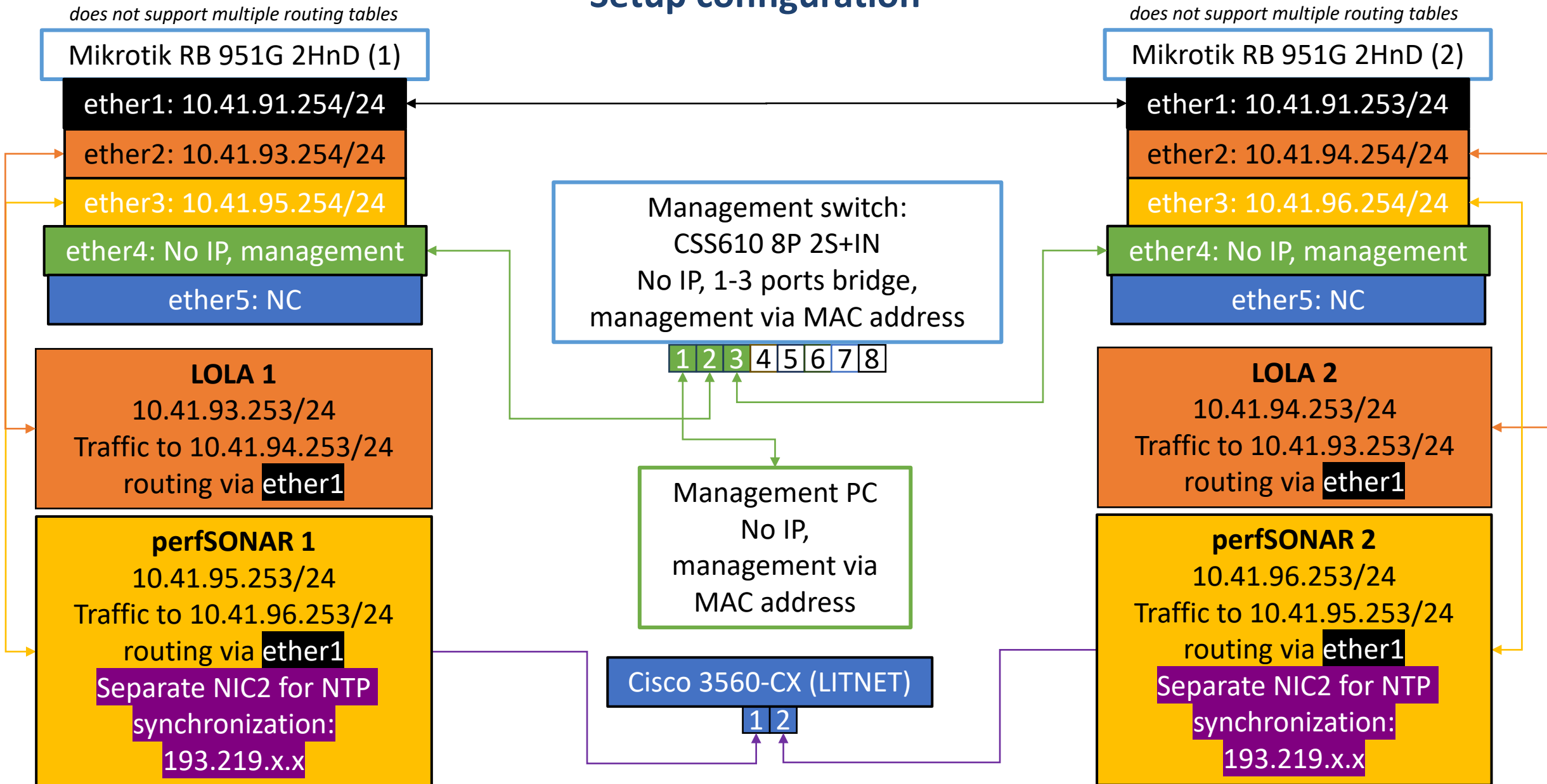
MikroTik CSS610-8P-2S+IN switch – 1 pc.



Cisco Catalyst WS-C3560CX-12PD-S switch – 1 pc.



Setup configuration



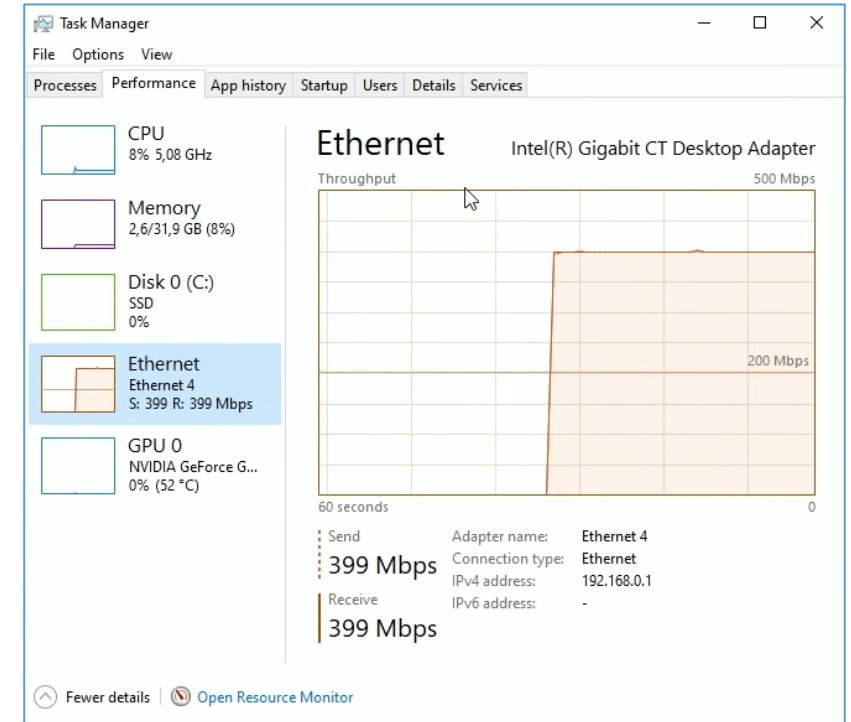
Testbed. What do we want to test?

- Packet loss
- *Jitter*

Testbed. Defining baseline

LOLA machines, connected directly:

- a) Bandwidth: ~400 Mbps (~50k pps, 1008 byte)
LOLA application is working fine



Testbed. Defining baseline

perfSONAR machines, connected directly:

Machine limitation:

1. `twping -c x0000 -i 0.0004 x.x.x.x`
(~2 Mbps, ~2,5k pps, 64 byte)
2. `twping -c x0000 -i 0.0005 -s 1008 x.x.x.x`
(~16 Mbps, ~2k pps, 1008 byte)
3. `pscheduler task latency -p 1008 -i 0.000048 -c x000000 --source x.x.x.x --dest x.x.x.x`
(~168 Mbps, ~20k pps, 1008 byte)

All CPU's is set to high performance mode

Testbed. Testing with Mikrotiks

LOLA machines, connected via Mikrotiks:

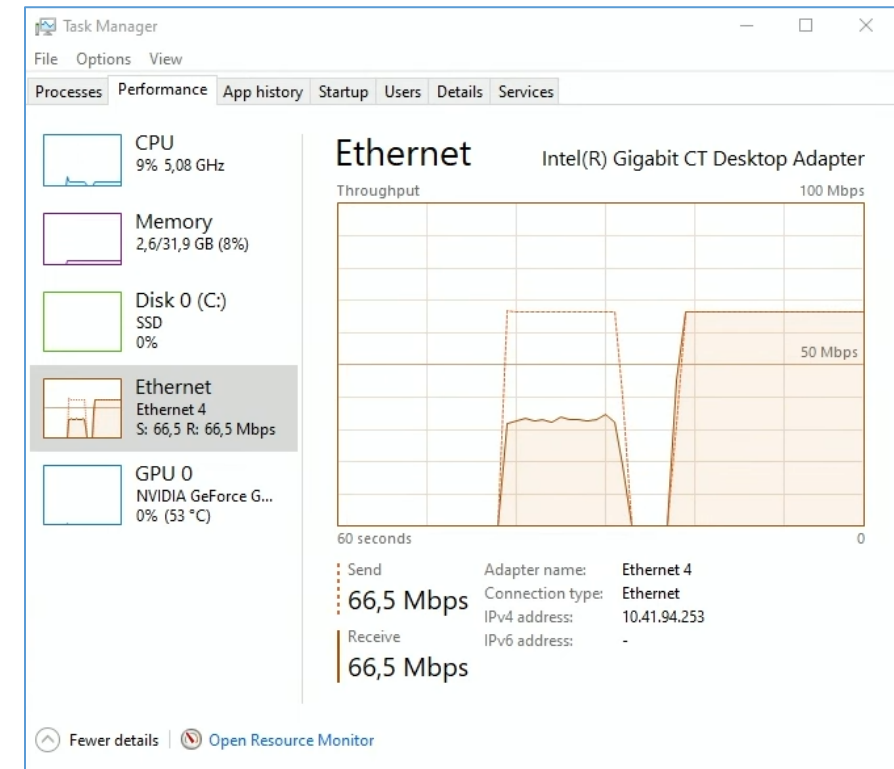
a) Bandwidth: ~400 Mbps (~50k pps, 1008 byte)

LOLA application traffic is basically errors

.....

x) Bandwidth: ~66 Mbps (~7k pps, 1008 byte)

LOLA application is working fine



Interesting findings: After a session of approximately 10 minutes using MikroTik devices, the LoLa session/tester always started producing many errors — about a tenfold increase.

Restarting the session reset this behavior for another 10 minutes.

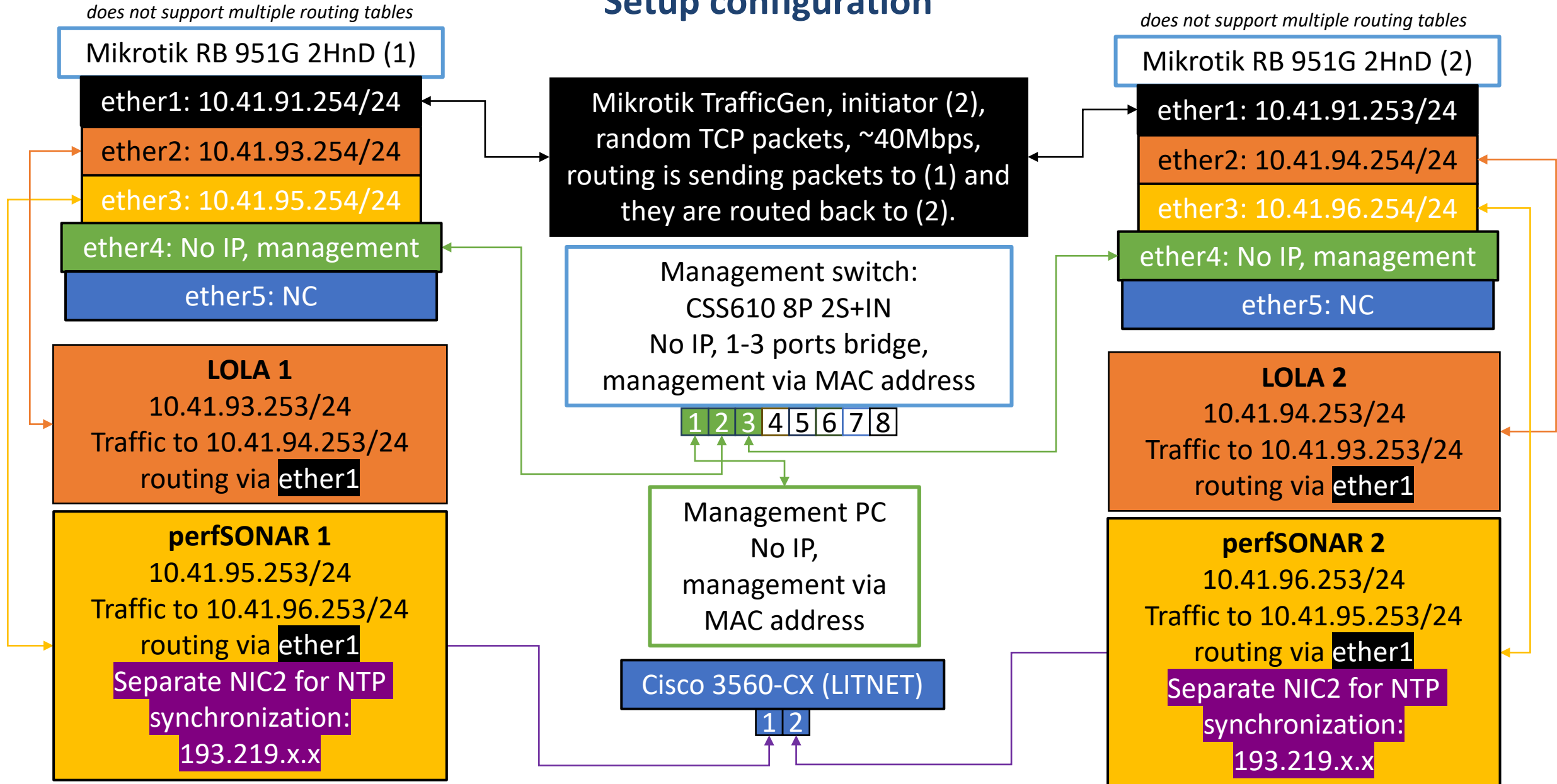
Testbed. Testing with Mikrotiks

perfSONAR machines, connected via Mikrotiks:

1. `twping -c x0000 -i 0.0004 x.x.x.x`
(~2 Mbps, ~2,5k pps, 64 byte)
Working fine
2. `twping -c x0000 -i 0.0005 -s 1008 x.x.x.x`
(~16 Mbps, ~2k pps, 1008 byte)
Working fine
3. `pscheduler task latency -p 1008 -i 0.000048 -c x000000 --source x.x.x.x --dest x.x.x.x`
(~168 Mbps, ~20k pps, 1008 byte)
A lot of missing packets
4. `pscheduler task latency -p 1008 -i 0.000065 -c x000000 --source x.x.x.x --dest x.x.x.x`
(~124 Mbps, ~15k pps, 1008 byte)
Working fine

All CPU's is set to high performance mode

Setup configuration



Testbed. Testing with Mikrotiks and Traffic generator

CPU usage: ~56%

MikroTik RB951G-2HnD



Quick Start (Running)														
Test ID: 0													Start	
Stream: str2													Stop	
Port: dynamic0													Close	
Interface: ether1													New Window	
Packet Size:														
PPS:														
Mbps:														
Tx Template:														
Seq	ID	Tx Packets	Tx Rate	Rx Packets	Rx Rate	Lost Packets	Lost Rate	Lost Ratio	Lat. Min.	Lat. A...	Lat. M...	Jitter		
281	0	10 001	40.9 Mbps	10 001	40.9 Mbps	0	0 bps	0.000%	51.2us	129.us	3.45ms	3.39ms		
282	0	9 998	40.9 Mbps	9 998	40.9 Mbps	0	0 bps	0.000%	50.3us	97.1us	1.84ms	1.79ms		
283	0	10 002	40.9 Mbps	10 002	40.9 Mbps	0	0 bps	0.000%	51.1us	131.us	1.89ms	1.84ms		
284	0	10 000	40.9 Mbps	9 999	40.9 Mbps	1	4.0 kbps	0.010%	51.2us	135.us	3.59ms	3.53ms		
285	0	10 001	40.9 Mbps	9 999	40.9 Mbps	2	8.1 kbps	0.020%	51.2us	121.us	1.90ms	1.85ms		
286	0	9 999	40.9 Mbps	9 999	40.9 Mbps	0	0 bps	0.000%	50.7us	124.us	1.86ms	1.81ms		
287	0	10 001	40.9 Mbps	9 999	40.9 Mbps	2	8.1 kbps	0.020%	51.3us	131.us	3.50ms	3.45ms		
288	0	9 998	40.9 Mbps	9 997	40.9 Mbps	1	4.0 kbps	0.010%	50.9us	121.us	2.13ms	2.08ms		
289	0	10 001	40.9 Mbps	10 000	40.9 Mbps	1	4.0 kbps	0.010%	51.6us	123.us	2.14ms	2.09ms		
290	0	9 999	40.9 Mbps	9 998	40.9 Mbps	1	4.0 kbps	0.010%	51.2us	137.us	2.15ms	2.09ms		
291	0	10 002	40.9 Mbps	10 000	40.9 Mbps	2	8.1 kbps	0.020%	50.1us	155.us	2.62ms	2.57ms		
292	0	9 998	40.9 Mbps	9 996	40.9 Mbps	2	8.1 kbps	0.020%	51.3us	171.us	2.80ms	2.75ms		
293	0	10 002	40.9 Mbps	9 999	40.9 Mbps	3	12.2 kbps	0.030%	50.9us	161.us	1.88ms	1.83ms		
294	0	10 000	40.9 Mbps	10 002	40.9 Mbps	-2	8.1 kbps	-0.020%	51.1us	123.us	1.86ms	1.81ms		
295	0	9 999	40.9 Mbps	9 999	40.9 Mbps	0	0 bps	0.000%	51.3us	115.us	1.86ms	1.81ms		
296	0	10 000	40.9 Mbps	10 000	40.9 Mbps	0	0 bps	0.000%	51.3us	122.us	2.18ms	2.13ms		
297	0	10 000	40.9 Mbps	10 000	40.9 Mbps	0	0 bps	0.000%	51.3us	116.us	1.85ms	1.80ms		
20 items														

Testbed. Testing with Mikrotiks and Traffic generator

LOLA machines, connected via Mikrotiks:

Bandwidth: ~66 Mbps (~7k pps, 1008 byte)

LoLa traffic on the edge, produces errors,
almost unusable. Like bad network line
between two points.

Lola - Network Monitor

Audio
Port: 19788
Frame Size (byte): 256
Packet Size (byte): 1066
Sent Frames: 42133

Video
Port: 19798
Frame Size (byte): 230400
Packet Size (byte): 1000
Sent Frames: 1527

Local FpS settings: 25.00
Local window FpS: 25.00
Sent FpS: 9.00

	Session 1	Session 2	
Send to / Receive from	Not Connected	Not Connected	
Started at	07:51:10	(not available)	
Audio RX frames	42041	0	
Audio Incomplete packets	0	0	
Audio Dropped packets	36	0	
Audio Realigned buffers	30	0	
Video RX frames	1442	0	
Video Dropped frames	64	0	
Video Dropped start_frames	20	0	
Video Orphans sub_frames	4736	0	
Video Dropped sub_frames	198	0	
Video Remote FpS settings	25.00	0.00	
Video Remote Window FpS	9.00	0.00	
Video Received FpS	9.00	0.00	

Threads
☐ Stop Audio Tx ☐ Stop Audio Rx ☐ Stop Video Tx ☐ Stop Video Rx

Send Info

Reset Info

Close

Testbed. Testing with Mikrotiks and Traffic generator

perfSONAR machines, connected via Mikrotiks with Traffic generator:

1. `twping -c x000000 -i 0.0005 x.x.x.x`
 (~1 Mbps, ~2k pps, 64 byte)
 Missing small amount of packets
2. `twping -c x000000 -i 0.0005 -s 1008 x.x.x.x`
 (~16 Mbps, ~2k pps, 1008 byte)
 Missing small amount of packets
3. `pscheduler task latency -p 1008 -i 0.000065 -c x000000 --source x.x.x.x --dest x.x.x.x`
 (~124 Mbps, ~15k pps, 1008 byte)
 Missing small amount of packets

```
1000000 sent, 12 lost (0.001%), 0 send duplicates, 0 reflect duplicates
round-trip time min/median/max = 0.105/4.1/61 ms, (err=1.11 ms)
send time min/median/max = 1.5/1.8/12.9 ms, (err=0.556 ms)
reflect time min/median/max = -1.49/2.3/59.4 ms, (err=0.556 ms)
reflector processing time min/max = 0.00191/0.231 ms
two-way jitter = 13.6 ms (P95-P50)
send jitter = 0.1 ms (P95-P50)
reflect jitter = 13.7 ms (P95-P50)
send hops = 2 (consistently)
reflect hops = 2 (consistently)
```

```
Packet Statistics
-----
Packets Sent ..... 1000000 packets
Packets Received ..... 1000000 packets
Packets Lost ..... 0 packets
Packets Duplicated ... 0 packets
Packets Reordered .... 0 packets

One-way Latency Statistics
-----
Delay Median ..... 1.05 ms
Delay Minimum ..... 1.04 ms
Delay Maximum ..... 2.83 ms
Delay Mean ..... 1.05 ms
Delay Mode ..... 1.05 ms
Delay 25th Percentile ... 1.05 ms
Delay 75th Percentile ... 1.05 ms
Delay 95th Percentile ... 1.06 ms
Max Clock Error ..... 0.81 ms
Common Jitter Measurements:
  P95 - P50 ..... 0.01 ms
  P75 - P25 ..... 0.00 ms
  Variance ..... 0.00 ms
  Std Deviation .... 0.01 ms
```

Testbed. Conclusion

perfSONAR, potentially, can help users find issues in network,
where low-latency AV applications (e.g. LOLA) has errors.



Thank You

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