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GEORGIAN RESEARCH AND EDUCATIONAL NETWORKING ASSOCIATION

1st European perfSONAR User Workshop

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CNaaS usecase

- CNaaS – Campus Network management as a service: outsourcing network management from end institution to NREN
- CNaaS offers various management services: monitoring, configuration management, wired, wireless…
- NRENs don’t have a lot of staff, so automation is needed
- CNaaS network monitoring includes:
  - Passive network element monitoring
  - Flow monitoring
  - Is this sufficient?

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Estimating QoS and QoE using pS

- There are multiple user groups on the campus (professors, students, admin staff,…)
- User groups have different access (e.g. through different VLANs), access rights and policies,…
- Something might go wrong or be missconfigured. Do all the users have adequate level of service?
- Can we use pS to estimate the QoE all the users in the campus have

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Estimating QoS and QoE using pS

- We want a single small form factor device (small node or VM or software on network element) within the campus network to monitor the service for all user groups:
  - Regular QoS parameters: Latency, jitter, loss of packets
  - Does DNS work for all the users on the campus?
  - Can http/https sites be reached from each of these networks?
- All these tests already exist in perfSONAR, but how convenient it is to setup a test node like this?

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- GRENA has perfSONAR testbed
- Consists of 3 perfSONAR nodes and one VM
- The testbed is configured to use Linux namespaces

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- **Tests configured in testbed include:**
  - **Throughput**
  - **Round Trip Time**
  - **Tracepath**
  - **HTTP**
  - **DNS**
- **These tests were conducted using Linux namespaces**

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➢ Throughput test using namespace v91

```
[pssshuser@pscentral ~]$ pscheduler task --context '{ "schema": 1, "contexts": [ [ { "context": "linuxnns", "data": { "namespace": "v91" } } ], [ { "context": "linuxnns", "data": { "namespace": "v91" } } ] ] }' throughput --source-node 217.147.227.162 --source 217.147.227.138 --dest-node 217.147.227.163 --dest 217.147.227.139
Submitting task...
Task URL:
https://217.147.227.162/pscheduler/tasks/7cddd679-fe8f-4858-a74f-8cb5b8e85641
Running with tool 'iperf3'
Fetching first run...

Next scheduled run:
https://217.147.227.162/pscheduler/tasks/7cddd679-fe8f-4858-a74f-8cb5b8e85641/runs/bcf33544-18c7-4ca3-bd67-095135b46c8a
Starts 2019-05-29T12:43:40Z (~5 seconds)
Ends   2019-05-29T12:43:59Z (~18 seconds)
Waiting for result...

* Stream ID 5
Interval        Throughput      Retransmits     Current Window
0.0 - 1.0       739.68 Mbps     0               10.63 MBytes
1.0 - 2.0       930.88 Mbps     0               10.63 MBytes
2.0 - 3.0       914.57 Mbps     0               10.63 MBytes
3.0 - 4.0       912.26 Mbps     0               10.63 MBytes
4.0 - 5.0       918.97 Mbps     0               10.63 MBytes
5.0 - 6.0       916.01 Mbps     0               10.63 MBytes
6.0 - 7.0       817.91 Mbps     0               11.53 MBytes
7.0 - 8.0       933.23 Mbps     0               11.53 MBytes
8.0 - 9.0       937.91 Mbps     0               11.53 MBytes
9.0 - 10.0      933.84 Mbps     0               11.53 MBytes

Summary
Interval        Throughput      Retransmits
0.0 - 10.0      895.55 Mbps     0
[root@pscentral ~]# ip netns exec v91  vnstat -l -i vlan91
Monitoring vlan91...    (press CTRL-C to stop)

   rx:      356 kbit/s   877 p/s          tx:   933.99 Mbit/s 78963 p/s
```

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Round Trip Time test using namespace v91

```
[pssshuser@pscentral ~]$ pscheduler task --context '{ "schema": 1, "contexts": [ [ { "context":
 "linuxnns", "data": { "namespace": "v91" } } ] ] }' rtt --dest 8.8.8.8
Submitting task...
Task URL:
https://localhost/pscheduler/tasks/972ffd7f-843c-4746-b9cb-4a919a9f7084
Running with tool 'ping'
Fetching first run...

Next scheduled run:
https://localhost/pscheduler/tasks/972ffd7f-843c-4746-b9cb-4a919a9f7084/runs/d861aa61-e8ee-4644
-8e9e-f6ea230a98e9
Starts 2019-05-29T13:02:28Z (~6 seconds)
Ends   2019-05-29T13:02:39Z (~10 seconds)
Waiting for result...

1       google-public-dns-a.google.com (8.8.8.8)  64 Bytes  TTL 56  RTT  54.5000 ms
2       google-public-dns-a.google.com (8.8.8.8)  64 Bytes  TTL 56  RTT  53.8000 ms
3       google-public-dns-a.google.com (8.8.8.8)  64 Bytes  TTL 56  RTT  53.7000 ms
4       google-public-dns-a.google.com (8.8.8.8)  64 Bytes  TTL 56  RTT  53.4000 ms
5       google-public-dns-a.google.com (8.8.8.8)  64 Bytes  TTL 56  RTT  56.0000 ms

0% Packet Loss  RTT Min/Mean/Max/StdDev = 53.443000/54.344000/56.075000/0.933000 ms
[root@pscentral ~]# tcpdump -nn icmp -i any -e |grep "8.8.8.8"
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
17:02:29.887210 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 217.147.227.138 > 8.8.8.8: ICMP echo request, id 3632, seq 1, length 64
17:02:29.941673  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 8.8.8.8 > 217.147.227.138: ICMP echo reply, id 3632, seq 1, length 64
17:02:30.888823 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 217.147.227.138 > 8.8.8.8: ICMP echo request, id 3632, seq 2, length 64
17:02:30.942635  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 8.8.8.8 > 217.147.227.138: ICMP echo reply, id 3632, seq 2, length 64
17:02:31.890800 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 217.147.227.138 > 8.8.8.8: ICMP echo request, id 3632, seq 3, length 64
17:02:31.944517  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 8.8.8.8 > 217.147.227.138: ICMP echo reply, id 3632, seq 3, length 64
17:02:32.892780 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 217.147.227.138 > 8.8.8.8: ICMP echo request, id 3632, seq 4, length 64
17:02:32.946104  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 8.8.8.8 > 217.147.227.138: ICMP echo reply, id 3632, seq 4, length 64
17:02:33.894515 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 217.147.227.138 > 8.8.8.8: ICMP echo request, id 3632, seq 5, length 64
17:02:33.950474  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 104: vlan 91, p 0, ethe
rtype IPv4, 8.8.8.8 > 217.147.227.138: ICMP echo reply, id 3632, seq 5, length 64
```

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Tracepath test using namespace v91

```
[pssshuser@pscentral ~]$ pscheduler task --context '{ "schema": 1, "contexts": [ [ { "context": "
linuxnns", "data": { "namespace": "v91" } } ] ] }' --tool tracepath trace --dest 217.147.237.154
Submitting task...
Task URL:
https://localhost/pscheduler/tasks/b5289d74-e567-4e3f-9144-9a470e9fef6d
Running with tool 'tracepath'
Fetching first run...

Next scheduled run:
https://localhost/pscheduler/tasks/b5289d74-e567-4e3f-9144-9a470e9fef6d/runs/6d6461c8-ea7f-4d62-a
0a8-e70dc6ddc424
Starts 2019-05-30T07:33:21Z (~7 seconds)
Ends   2019-05-30T07:35:02Z (~100 seconds)
Waiting for result...

1       217.147.227.137 AS20545 1.927 ms mtu 1500 bytes
          GRENA-AS Tbilisi, Georgia, GE
2       217.147.237.154 AS20545 1.841 ms mtu 1500 bytes
          GRENA-AS Tbilisi, Georgia, GE

[root@pscentral ~]# tcpdump -nn -i any -e host 217.147.237.154
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
11:33:14.748237 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 1520: vlan 91, p 0, ether
type IPv4, 217.147.227.138.51219 > 217.147.237.154.44444: UDP, length 1472
11:33:14.750507 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 1520: vlan 91, p 0, ether
type IPv4, 217.147.227.138.51219 > 217.147.237.154.44445: UDP, length 1472
11:33:14.752684 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 1520: vlan 91, p 0, ether
type IPv4, 217.147.227.138.51219 > 217.147.237.154.44446: UDP, length 1472
11:33:14.753284  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 76: vlan 91, p 0, etherty
pe IPv4, 217.147.237.154 > 217.147.227.138: ICMP 217.147.237.154 udp port 44446 unreachable, leng
th 36
11:33:22.880675 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 1520: vlan 91, p 0, ether
type IPv4, 217.147.227.138.45941 > 217.147.237.154.44444: UDP, length 1472
11:33:22.882283 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 1520: vlan 91, p 0, ether
type IPv4, 217.147.227.138.45941 > 217.147.237.154.44445: UDP, length 1472
11:33:22.884259 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 1520: vlan 91, p 0, ether
type IPv4, 217.147.227.138.45941 > 217.147.237.154.44446: UDP, length 1472
11:33:22.885894  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 76: vlan 91, p 0, etherty
pe IPv4, 217.147.237.154 > 217.147.227.138: ICMP 217.147.237.154 udp port 44446 unreachable, leng
th 36
```

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➢ HTTP test using namespace v91

```
[pssshuser@pscentral ~]$ pscheduler task --context '{ "schema": 1, "contexts": [ [ { "context": "linuxnns
", "data": { "namespace": "v91" } } ] ] }' http --url http://www.makler.ge
Submitting task...
Task URL:
https://localhost/pscheduler/tasks/656a4cf4-9900-4017-bb86-d5852907d00f
Running with tool 'psurl'
Fetching first run...

Next scheduled run:
https://localhost/pscheduler/tasks/656a4cf4-9900-4017-bb86-d5852907d00f/runs/bf333654-b6a2-4c0f-9ad8-eed3
ca887796
Starts 2019-05-30T08:55:47Z (~5 seconds)
Ends   2019-05-30T08:55:54Z (~6 seconds)
Waiting for result...

Response Time: PT0.037494S

Status Code: 200

12:55:48.892632 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 80: vlan 91, p 0, ethertype IPv4
 217.147.227.138.46530 > 217.147.225.36.80: Flags [S], seq 3630666356, win 42340, options [mss 1460,sack
K,TS val 76202295 ecr 0,nop,wscale 11], length 0
12:55:48.892964  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 80: vlan 91, p 0, ethertype IPv4
 217.147.225.36.80 > 217.147.227.138.46530: Flags [S.], seq 932726987, ack 3630666357, win 28960, option
 [mss 1460,sackOK,TS val 505283573 ecr 76202295,nop,wscale 7], length 0
12:55:48.893045 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 72: vlan 91, p 0, ethertype IPv4
 217.147.227.138.46530 > 217.147.225.36.80: Flags [.], ack 1, win 21, options [nop,nop,TS val 76202295 e
r 505283573], length 0
12:55:48.893411 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 262: vlan 91, p 0, ethertype IPv
, 217.147.227.138.46530 > 217.147.225.36.80: Flags [P.], seq 1:191, ack 1, win 21, options [nop,nop,TS v
l 76202296 ecr 505283573], length 190: HTTP: GET / HTTP/1.1
12:55:48.893673  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 72: vlan 91, p 0, ethertype IPv4
 217.147.225.36.80 > 217.147.227.138.46530: Flags [.], ack 191, win 235, options [nop,nop,TS val 5052835
3 ecr 76202296], length 0
12:55:48.895332  In 7c:69:f6:c5:33:4b ethertype 802.1Q (0x8100), length 2968: vlan 91, p 0, ethertype IP
4, 217.147.225.36.80 > 217.147.227.138.46530: Flags [.], seq 1:2897, ack 191, win 235, options [nop,nop,
S val 505283573 ecr 76202296], length 2896: HTTP: HTTP/1.1 200 OK
```

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➢ HTTP test using namespace v91

```
[pssshuser@pscentral ~]$ pscheduler task --context '{ "schema": 1, "contexts": [ [ { "context": "linuxnns
", "data": { "namespace": "v91" } } ] ] }' dns --query www.google.com --record a
Submitting task...
Task URL:
https://localhost/pscheduler/tasks/12a415d4-93a7-406a-80a7-83ec84906e97
Running with tool 'dnspy'
Fetching first run...

Next scheduled run:
https://localhost/pscheduler/tasks/12a415d4-93a7-406a-80a7-83ec84906e97/runs/a158e665-e452-447f-9c79-bd9c
399ba805
Starts 2019-05-30T09:02:33Z (~5 seconds)
Ends   2019-05-30T09:02:39Z (~5 seconds)
Waiting for result...

Time ......... PT0.010085S
A ............ 216.58.214.228
```

```
[root@pscentral ~]# tcpdump -nn udp -i any -e | grep www.google.com
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
13:02:34.767893 Out 1c:1b:0d:89:8c:ab ethertype 802.1Q (0x8100), length 80: vlan 91, p 0, ethertype IPv4,
 217.147.227.138.36476 > 217.147.227.67.53: 30792+ A? www.google.com. (32)
```

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- **pscheduler task --repeat PT2M --max-runs 30 --archive @archive_btest.json throughput --source 217.147.227.162 --dest 217.147.227.163**

- ```
{
"archiver": "http",
"data": {
        "schema": 2,
        "_url": "http://217.147.236.179:9200/perfsonar_123/btest/",
        "op": "post",
        "_headers": {
                "Content-Type": "application/json“
         }
}
}
```
```

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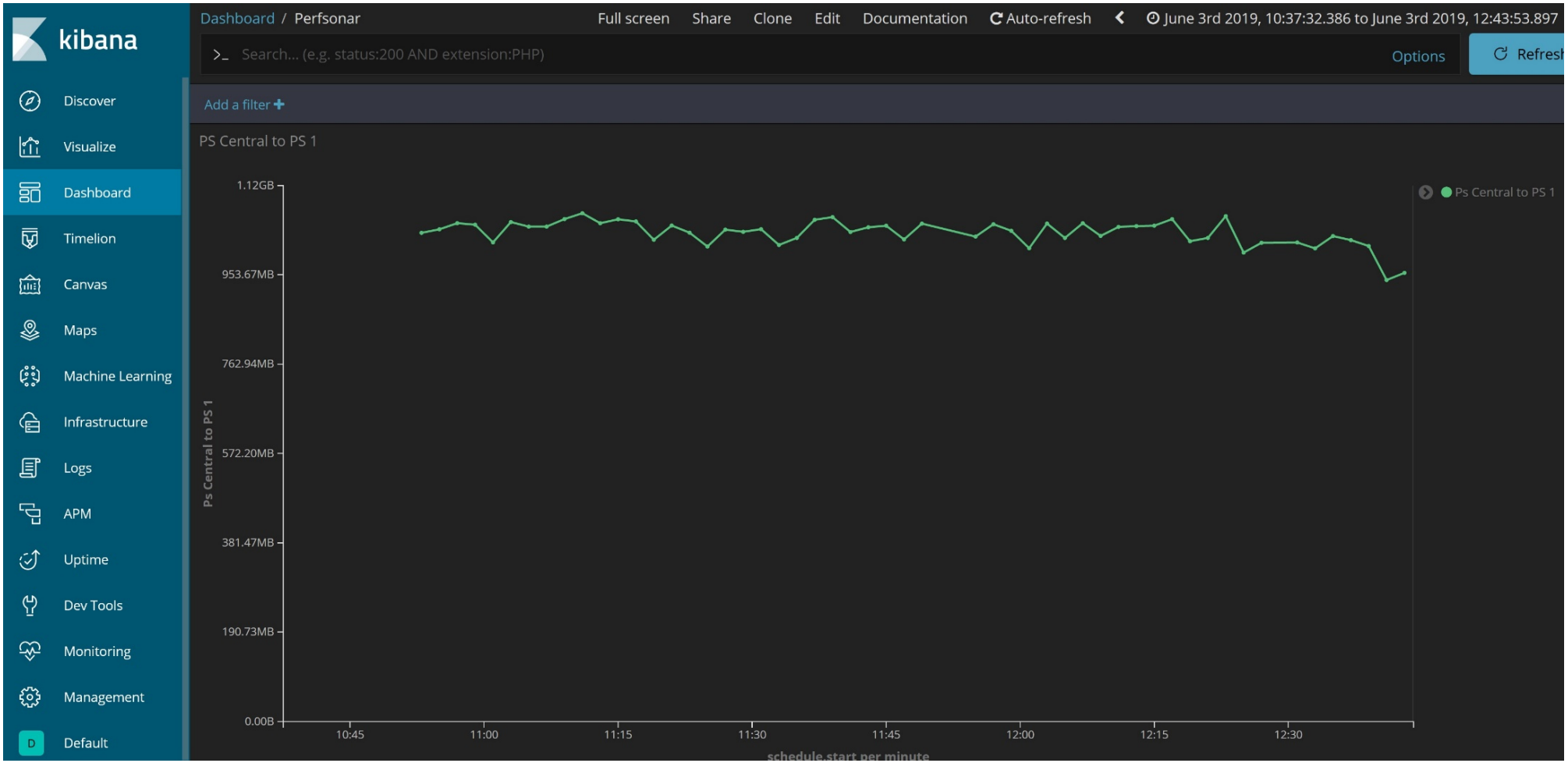
Elasticsearch with Kibana



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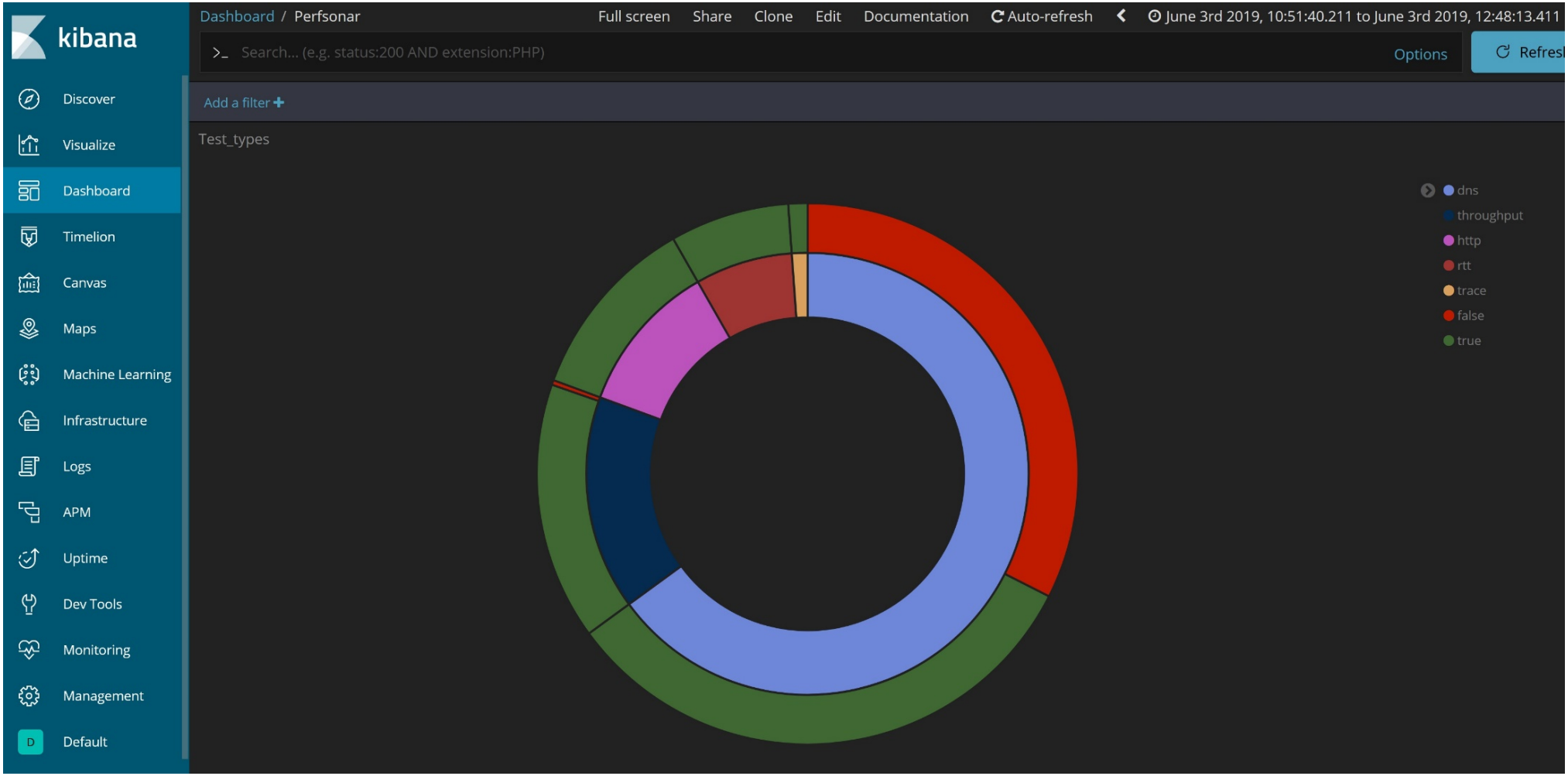

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Thank you for your attention!

5 - 6 June 2019, London, UK