

# “HANDS-ON PERFSONAR ”

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University of South Carolina



NSF Award 1829698

“CyberTraining CIP: Cyberinfrastructure Expertise on High-throughput Networks for Big Science Data Transfers”

# LAB SERIES: PERFSONAR

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# Lab Series: perfSONAR

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- Lab 1: Configuring Admin. Information Using perfSONAR Toolkit GUI
- Lab 2: PerfSONAR Metrics and Tools
- Lab 3: Configuring Regular Tests Using perfSONAR GUI
- **Lab 4: Configuring Regular Tests Using pScheduler CLI Part I**
- **Lab 5: Configuring Regular Tests Using pScheduler CLI Part II**
- Lab 6: Bandwidth-delay Product and TCP Buffer Size
- Lab 7: Configuring Regular Tests Using a pSConfig Template
- **Lab 8: perfSONAR Monitoring and Debugging Dashboard**
- Lab 9: pSConfig Web Administrator
- Lab 10: Configuring pScheduler Limits

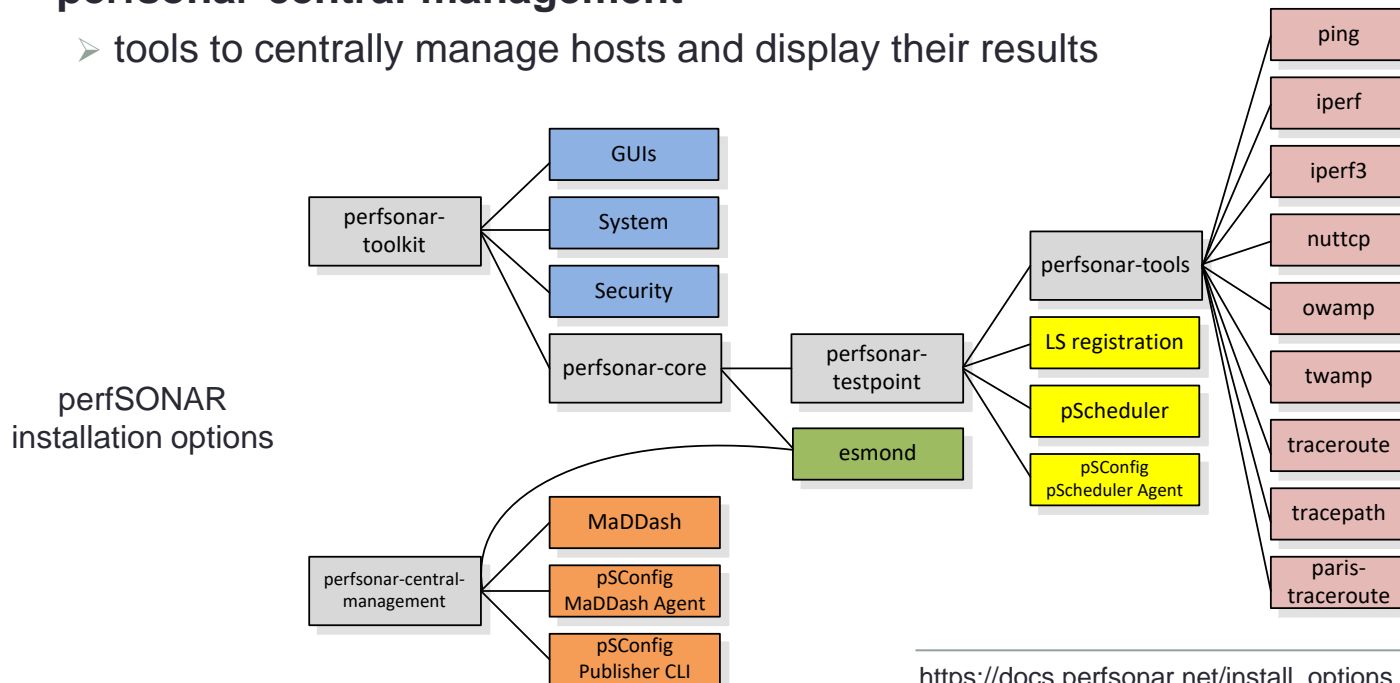
# Organization of Lab Manuals

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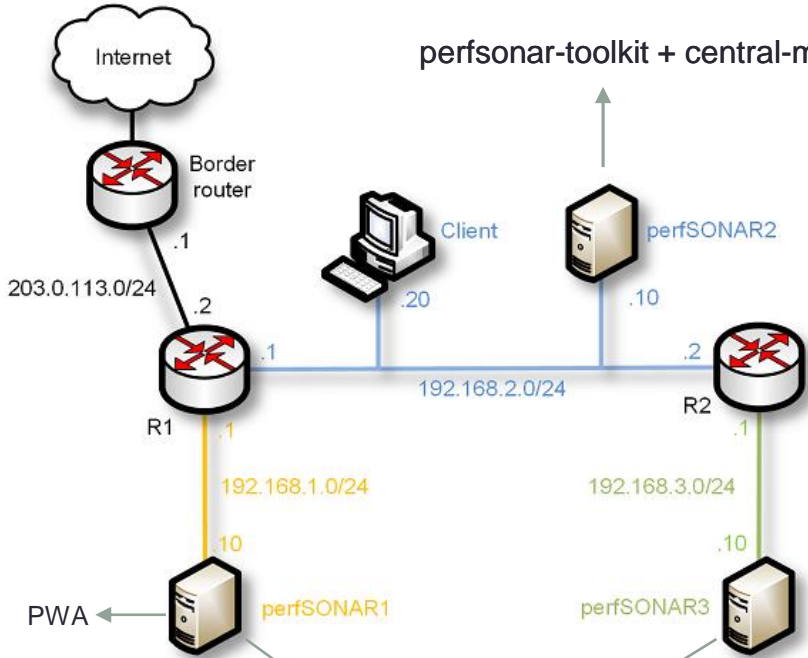
- Each lab starts with a section *Overview*
  - Objectives
  - Lab topology
  - Lab settings: passwords, device names
  - Roadmap: organization of the lab
- *Section 1*
  - Background information of the topic being covered (e.g., fundamentals of TCP congestion control)
  - Section 1 is optional (i.e., the reader can skip this section and move to lab directions)
- *Section 2... n*
  - Step-by-step directions

# Pod Design

- **perfsnar-tools**
  - command-line clients for on-demand measurements
- **perfsnar-testpoint**
  - tools + scheduler for regular tests + registration to be centrally managed
- **perfsnar-core**
  - perfsnar-testpoint + esmond measurement archive used to store results locally
- **perfsnar-toolkit**
  - perfsnar-core + web interface to manage tests + scripts for tuning and security settings
- **perfsnar-central-management**
  - tools to centrally manage hosts and display their results



# Pod Design

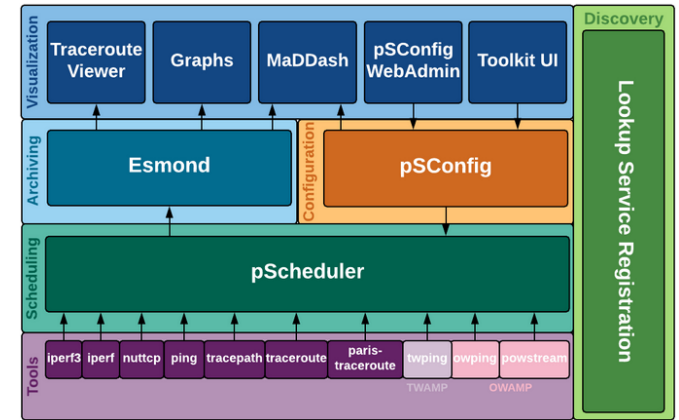


perfsonar-toolkit + central-management

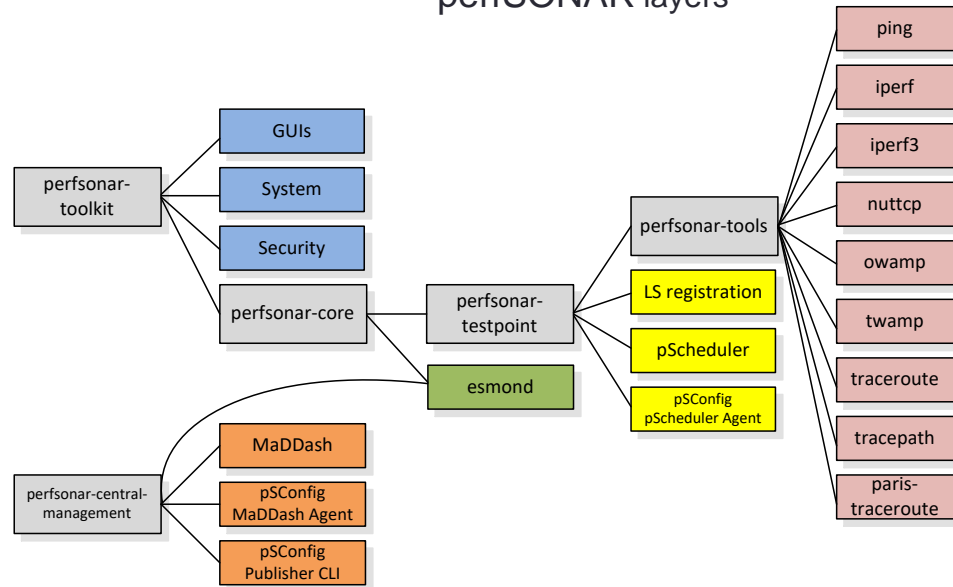
perfsonar-toolkit

Topology

perfSONAR installation options



perfSONAR layers



# DEMO 1

# CONFIGURING REGULAR TESTS

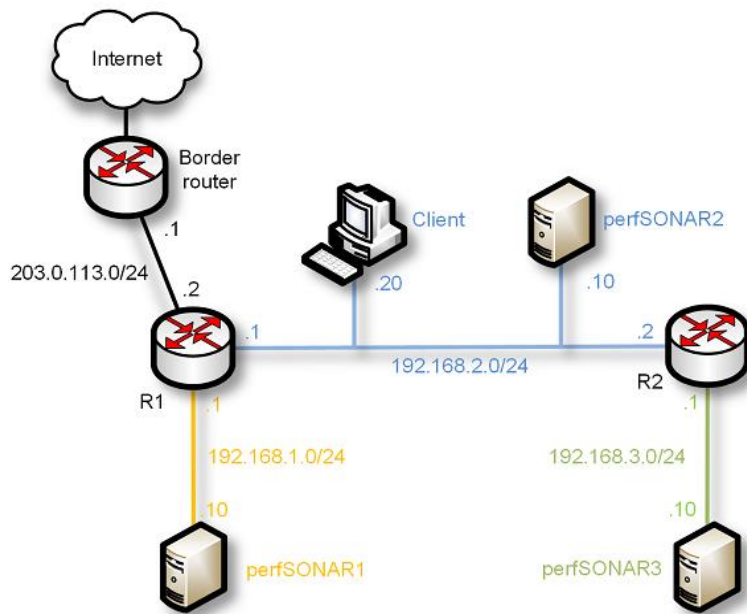
# PSCHEDULER CLI

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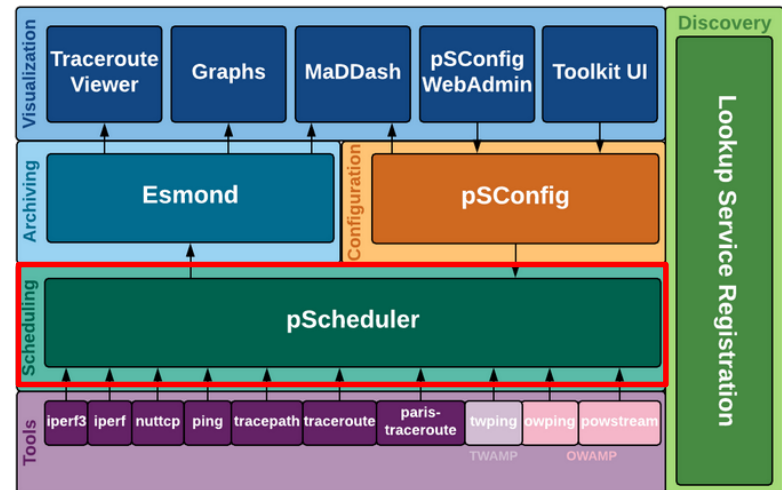
Demo activities are described in Lab 4, 5, , perfSONAR Lab Series

# The pScheduler Command

- The pScheduler coordinates, executes, and optionally stores network measurements
  - E.g., latency, packet loss rate, throughput
- The pScheduler can be invoked via CLI or GUI



Lab topology



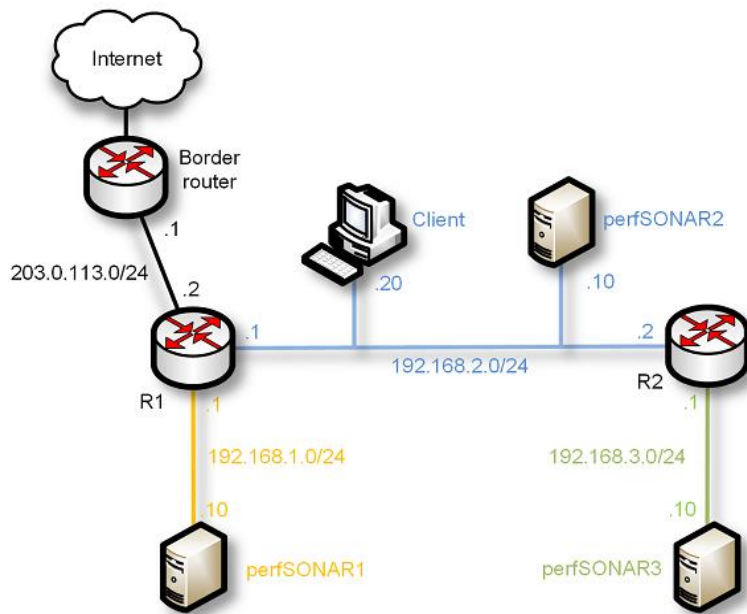
perfSONAR layers



# The pScheduler Command

- The pScheduler command is used to create new tasks
- E.g.,

```
pscheduler task latency --source 192.168.1.10 --dest 192.168.2.10
```



Lab topology

```
[admin@perfsonar1 ~]$ pscheduler task latency --source 192.168.1.10 --dest 192.168.2.10
Submitting task...
Task URL:
https://192.168.1.10/pscheduler/tasks/6e3598ae-aef9-4624-96b1-535a87946560
Running with tool 'owping'
Fetching first run...

Next scheduled run:
https://192.168.1.10/pscheduler/tasks/6e3598ae-aef9-4624-96b1-535a87946560/runs/364a861d-f7e4-45b2-b395-e983c1ec89f9
Starts 2019-07-19T11:43:09Z (~8 seconds)
Ends 2019-07-19T11:43:30Z (~20 seconds)
Waiting for result...

Packet Statistics
-----
Packets Sent ..... 100 packets
Packets Received .... 100 packets
Packets Lost ..... 0 packets
Packets Duplicated ... 0 packets
Packets Reordered ... 0 packets

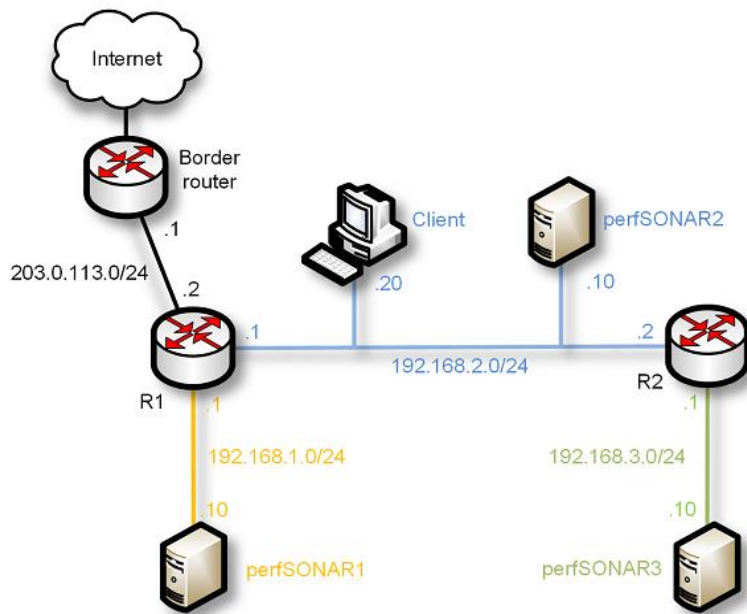
One-way Latency Statistics
-----
Delay Median ..... -3.38 ms
Delay Minimum ..... -3.46 ms
Delay Maximum ..... 6.59 ms
Delay Mean ..... -3.28 ms
Delay Mode ..... -3.38 ms
Delay 25th Percentile ... -3.41 ms
Delay 75th Percentile ... -3.37 ms
Delay 95th Percentile ... -3.32 ms
Max Clock Error ..... 0.0 ms
```

Latency task

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Lab topology

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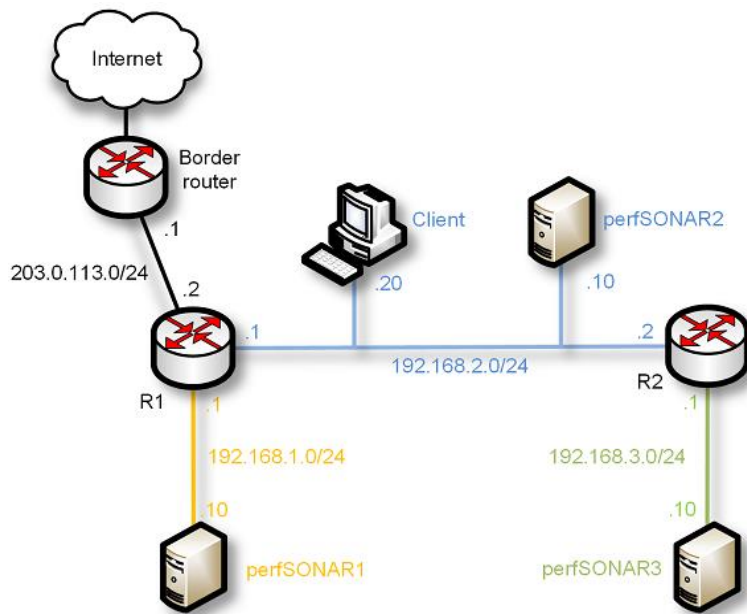
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Latency default tool

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Lab topology

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Next scheduled run:
https://192.168.1.10/pscheduler/tasks/6e3598ae-aef9-4624-96b1-535a87946560/runs/364a861d-f7e4-45b2-b395-e983c1ec89f9
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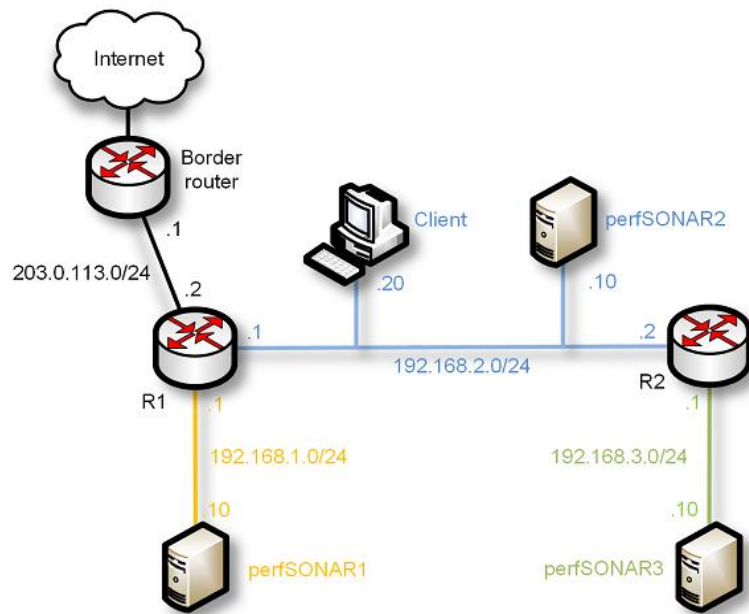
One-way Latency Statistics
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Delay Maximum ..... 6.59 ms
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Delay Mode ..... -3.38 ms
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Packet statistics

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Lab topology

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[admin@perfsonar1 ~]$ pscheduler task latency --source 192.168.1.10 --dest 192.168.2.10
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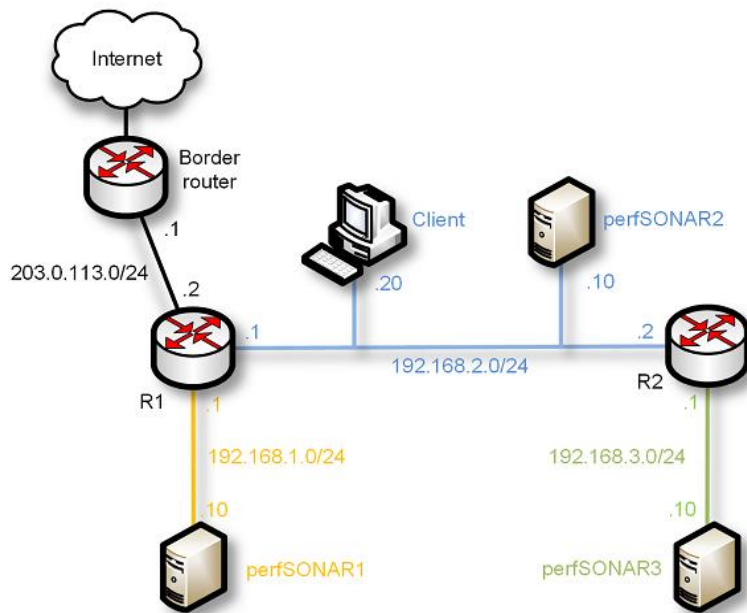
One-way Latency Statistics
-----
Delay Median ..... -3.38 ms
Delay Minimum ..... -3.46 ms
Delay Maximum ..... 6.59 ms
Delay Mean ..... -3.28 ms
Delay Mode ..... -3.38 ms
Delay 25th Percentile ... -3.41 ms
Delay 75th Percentile ... -3.37 ms
Delay 95th Percentile ... -3.32 ms
Max Clock Error ..... 0.0 ms
```

Packet statistics

# The pScheduler Command

- The pScheduler command is used to create new tasks
- E.g.,

```
pscheduler task throughput --source 192.168.1.10 --dest 192.168.2.10
```



Lab topology

```

[admin@perfsonar1 ~]$ pscheduler task throughput --source 192.168.1.10 --dest 192.168.2.10
Submitting task...
Task URL:
https://192.168.1.10/pscheduler/tasks/396795a3-abad-4fc8-ba64-66c304bc2247
Running with tool 'iperf3'
Fetching first run...

Next scheduled run:
https://192.168.1.10/pscheduler/tasks/396795a3-abad-4fc8-ba64-66c304bc2247/runs/1f09ecf0-3875
fa4-f9adc8cc4a17
Starts 2019-07-27T21:22:37Z (~7 seconds)
Ends 2019-07-27T21:22:56Z (~18 seconds)
Waiting for result...

* Stream ID 5
Interval      Throughput      Retransmits      Current Window
0.0 - 1.0    6.01 Gbps      156              800.74 KBytes
1.0 - 2.0    5.51 Gbps      283              773.23 KBytes
2.0 - 3.0    5.75 Gbps      211              495.22 KBytes
3.0 - 4.0    5.77 Gbps      0                773.23 KBytes
4.0 - 5.0    5.69 Gbps      22              722.55 KBytes
5.0 - 6.0    5.67 Gbps      0                896.31 KBytes
6.0 - 7.0    5.20 Gbps      69              600.92 KBytes
7.0 - 8.0    5.23 Gbps      136             868.00 KBytes
8.0 - 9.0    5.18 Gbps      178             786.26 KBytes
9.0 - 10.0   5.59 Gbps      27              991.88 KBytes

Summary
Interval      Throughput      Retransmits
0.0 - 10.0    5.56 Gbps      1082

No further runs scheduled.
[admin@perfsonar1 ~]$

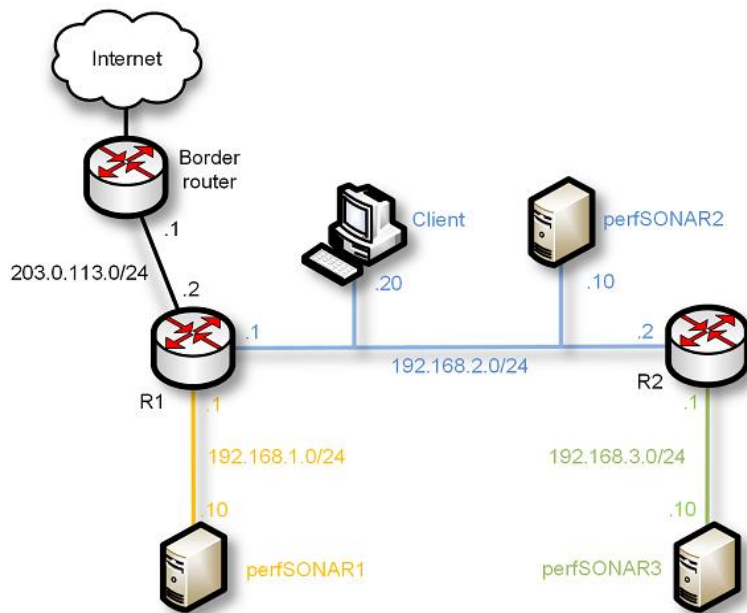
```

Throughput task

# The pScheduler Command

- The pScheduler command is used to create new tasks
- E.g.,

```
pscheduler task throughput --source 192.168.1.10 --dest 192.168.2.10
```



Lab topology

```

admin@perfsonar1 ~]$ pscheduler task throughput --source 192.168.1.10 --dest 192.168.2.10
Submitting task...
Task URL:
https://192.168.1.10/pscheduler/tasks/396795a3-abad-4fc8-ba64-66c304bc2247
Running with tool iperf3
Fetching first run...

Next scheduled run:
https://192.168.1.10/pscheduler/tasks/396795a3-abad-4fc8-ba64-66c304bc2247/runs/1f09ecf0-3875
fa4-f9adc8cc4a17
Starts 2019-07-27T21:22:37Z (~7 seconds)
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Interval      Throughput      Retransmits      Current Window
0.0 - 1.0    6.01 Gbps      156              800.74 KBytes
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3.0 - 4.0    5.77 Gbps      0                773.23 KBytes
4.0 - 5.0    5.69 Gbps      22              722.55 KBytes
5.0 - 6.0    5.67 Gbps      0                896.31 KBytes
6.0 - 7.0    5.20 Gbps      69              600.92 KBytes
7.0 - 8.0    5.23 Gbps      136             868.00 KBytes
8.0 - 9.0    5.18 Gbps      178             786.26 KBytes
9.0 - 10.0   5.59 Gbps      27              991.88 KBytes

Summary
Interval      Throughput      Retransmits
0.0 - 10.0    5.56 Gbps      1082

No further runs scheduled.
admin@perfsonar1 ~]$

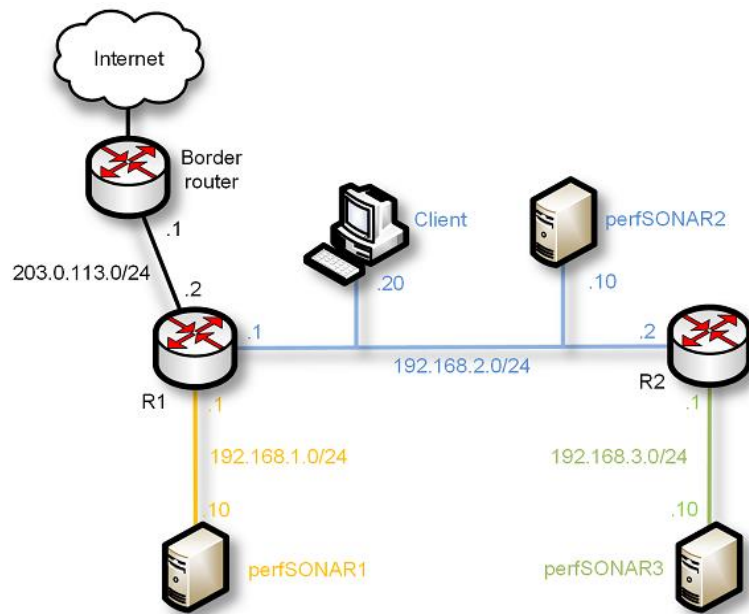
```

Throughput tool

# The pScheduler Command

- The pScheduler command is used to create new tasks
- E.g.,

```
pscheduler task throughput --source 192.168.1.10 --dest 192.168.2.10
```



Lab topology

```

admin@perfsonar1 ~]$ pscheduler task throughput --source 192.168.1.10 --dest 192.168.2.10
Submitting task...
Task URL:
https://192.168.1.10/pscheduler/tasks/396795a3-abad-4fc8-ba64-66c304bc2247
Running with tool 'iperf3'
Fetching first run...

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2.0 - 3.0    5.75 Gbps       211               495.22 KBytes
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Summary
Interval      Throughput      Retransmits
0.0 - 10.0    5.56 Gbps       1082

No further runs scheduled.
admin@perfsonar1 ~]$

```

Throughput tool

# DEMO 5

## VISUALIZING PERFORMANCE METRICS ON MADDASH

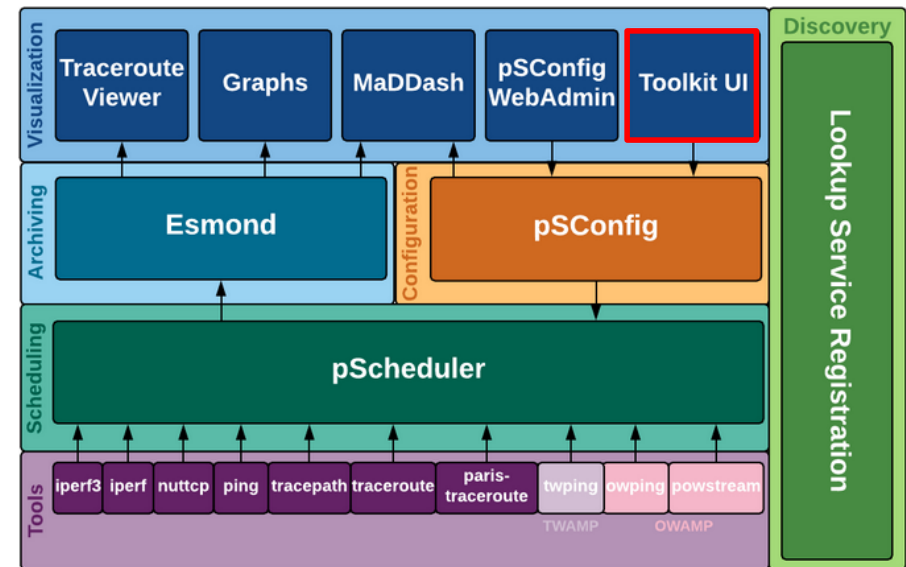
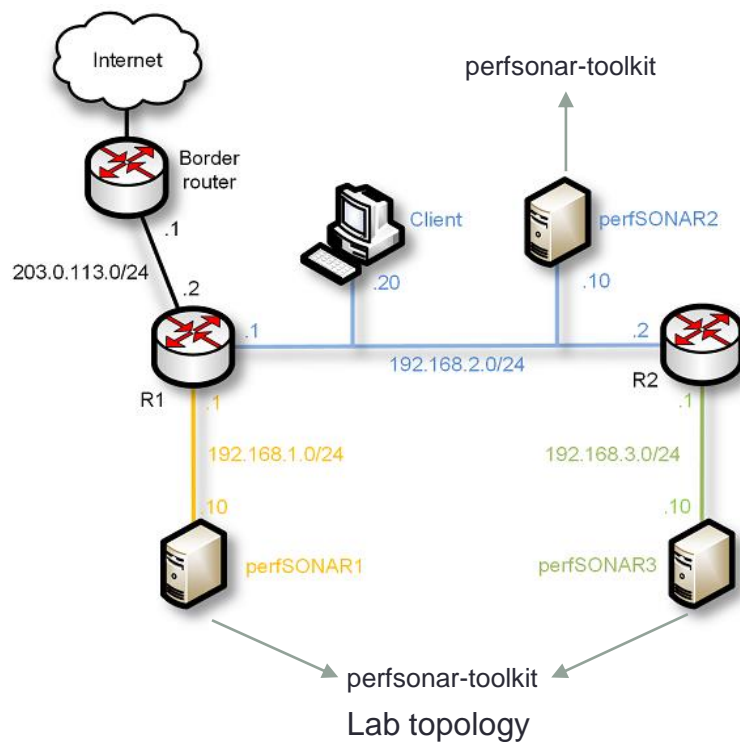
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Demo activities are described in Lab 8, perfSONAR Lab Series



# perfSONAR Toolkit UI

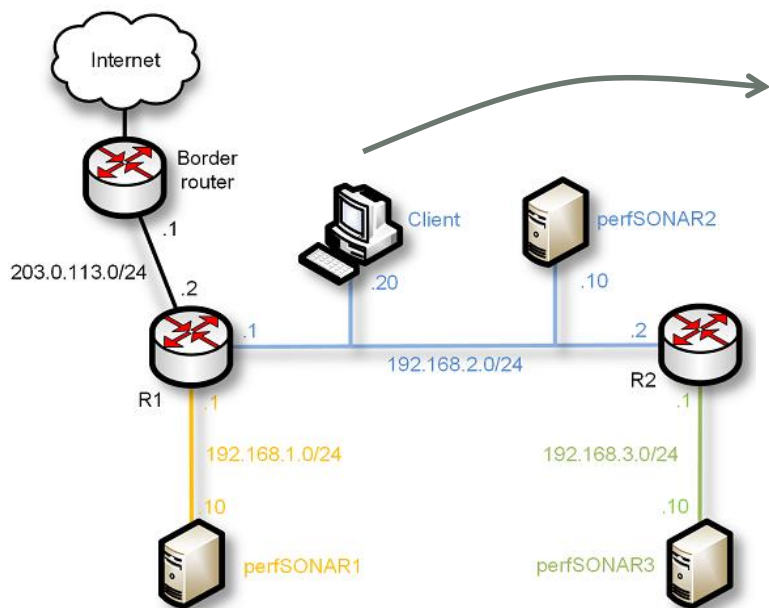
- perfSONAR Toolkit UI allows the user to add administrative information about a perfSONAR node



perfSONAR layers

# perfSONAR Toolkit UI

- perfSONAR Toolkit UI allows the user to add administrative information about a perfSONAR node
  - E.g., organization name, node location, administrator information, services and host information



Lab topology

The screenshot shows a web browser interface for the perfSONAR Toolkit. The address bar displays <https://192.168.1.10/toolkit/auth/>. The page title is "perfSONAR Toolkit on perfSONAR-Toolkit". The main content area displays the following information:

- Organization:** University of South Carolina
- Address:** Columbia, SC 29201 US ([map](#))
- Administrator:** Jose Gomez ([gomezgaj@email.sc.edu](mailto:gomezgaj@email.sc.edu))

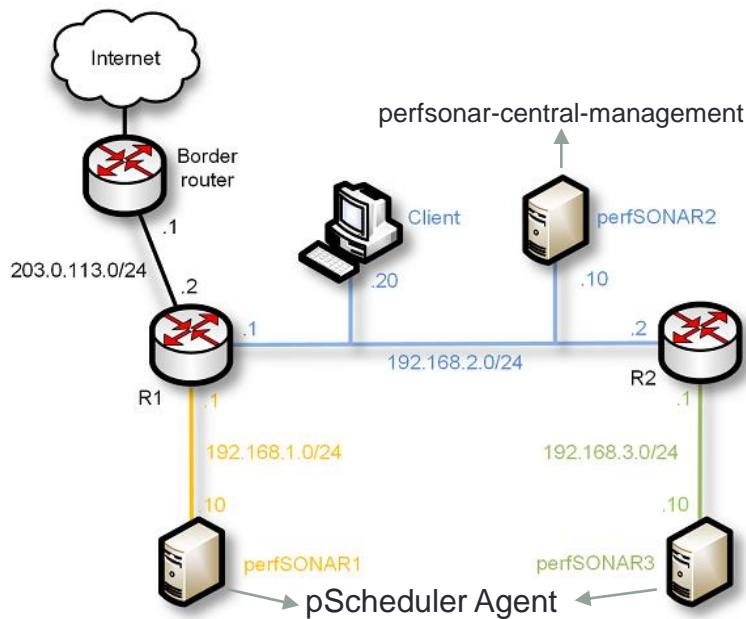
Below this information is a table titled "Services" with the following columns: SERVICE, STATUS, VERSION, PORTS, and SERVICE LOGS.

SERVICE	STATUS	VERSION	PORTS	SERVICE LOGS
<a href="#">esmond</a>	Running	2.1.3-1.el7		<a href="#">View</a>
<a href="#">lsregistration</a>	Running	4.1.6-1.el7		<a href="#">View</a>
<a href="#">owamp</a>	Running	3.5.8-1.el7	861	<a href="#">View</a>
<a href="#">pscheduler</a>	Running	1.1.6-2.el7		<a href="#">View</a>
<a href="#">psconfig</a>	Running	4.1.6-1.el7		<a href="#">View</a>
<a href="#">twamp</a>	Running	3.5.8-1.el7	862	<a href="#">View</a>

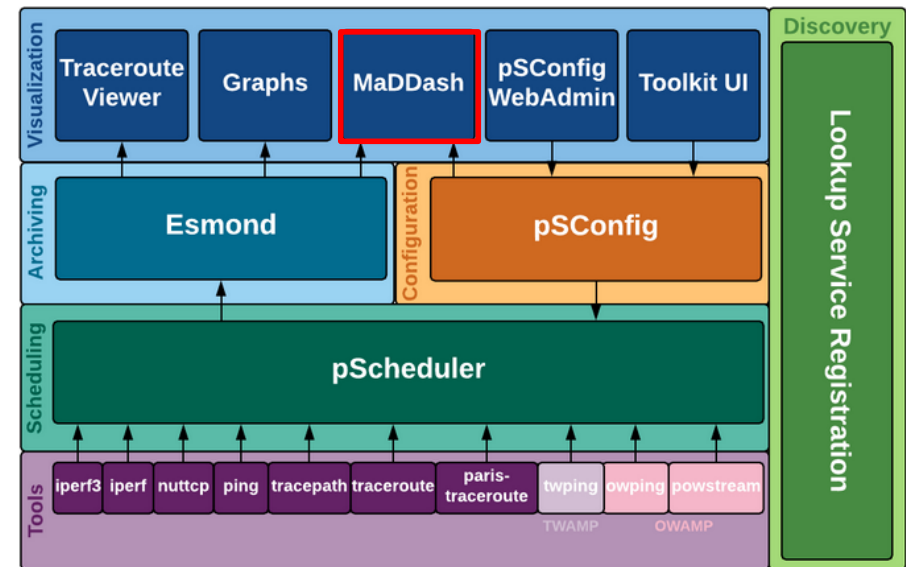
perfSONAR toolkit UI

# MaDDash

- MaDDash collects and presents two-dimensional monitoring data as a set of grids referred to as a dashboard



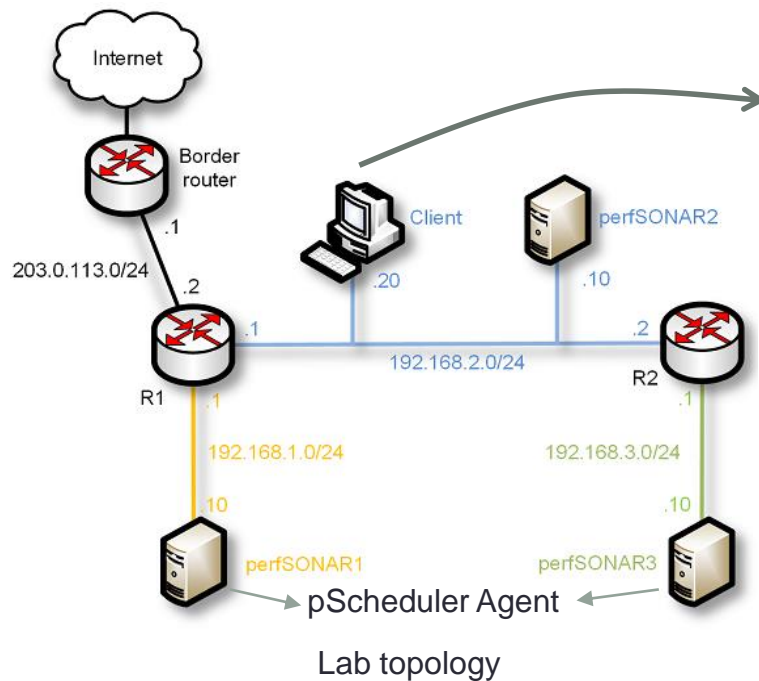
Lab topology



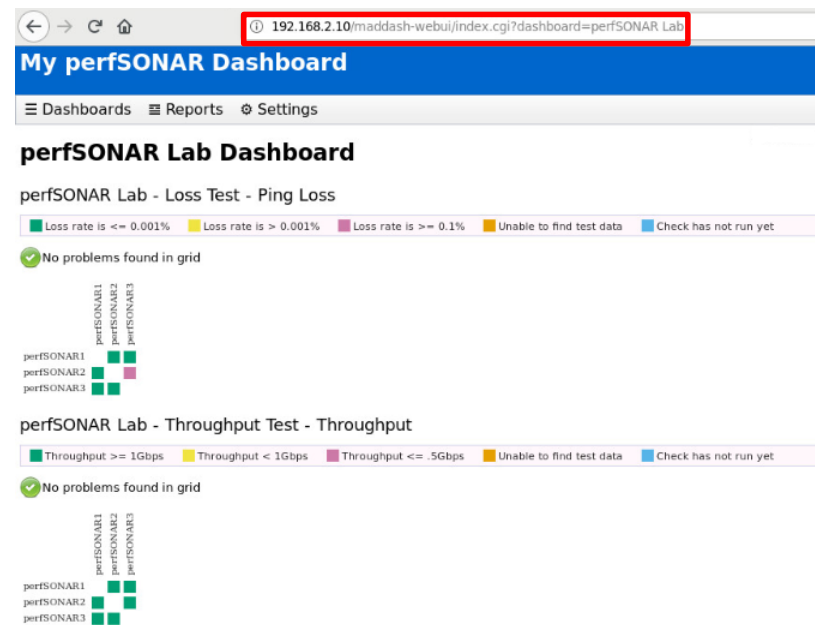
perfSONAR layers

# MaDDash

- MaDDash collects and presents two-dimensional monitoring data as a set of grids referred to as a dashboard



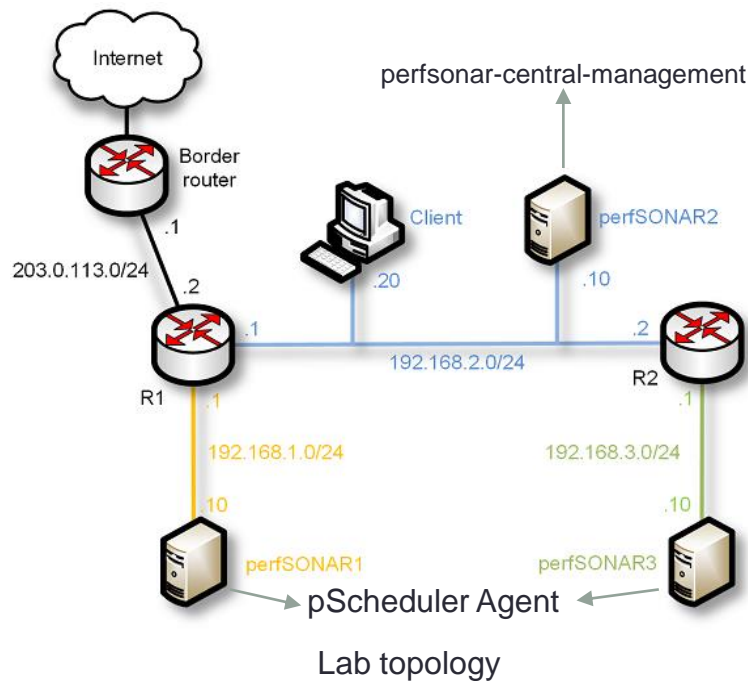
Lab topology



Dashboard

# MaDDash

- perfSONAR nodes run measurement tests
- Tests are specified in the pSConfig template in the central management

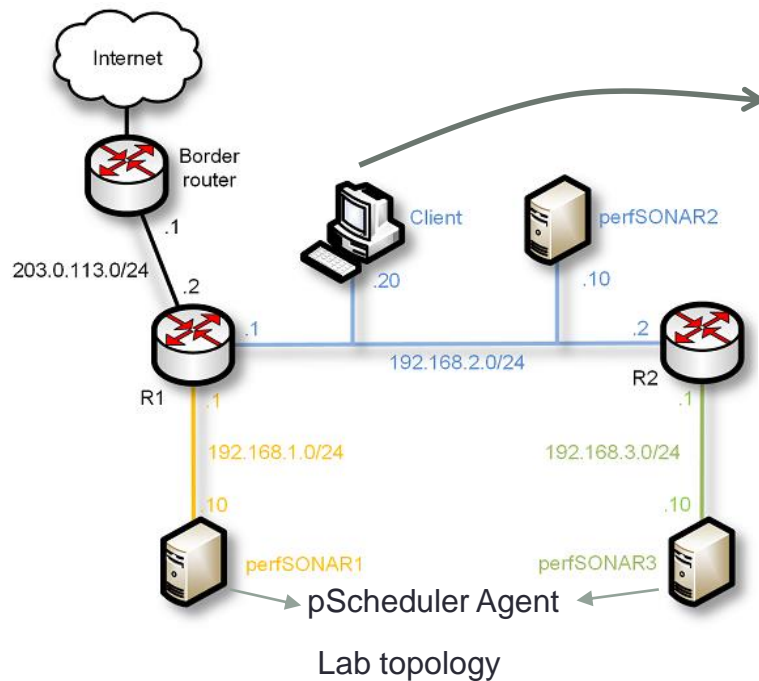


```
admin@perfsonar2 ~1$ cat /home/template.json
{
  "_meta": {
    "display-name": "perfSONAR Lab"
  },
  "archives": {
    "esmond_archive_1": {
      "archiver": "esmond",
      "data": {
        "measurement-agent": "{% scheduled_by_address %}",
        "url": "https://192.168.2.10/esmond/perfsonar/archive/"
      }
    }
  },
  "addresses": {
    "perfSONAR1": { "address": "192.168.1.10" },
    "perfSONAR2": { "address": "192.168.2.10" },
    "perfSONAR3": { "address": "192.168.3.10" }
  },
  "groups": {
    "loss_group": {
      "type": "mesh",
      "addresses": [
        { "name": "perfSONAR1" },
        { "name": "perfSONAR2" },
        { "name": "perfSONAR3" }
      ]
    },
    "throughput_group": {
      "type": "mesh",
      "addresses": [
        { "name": "perfSONAR1" },
        { "name": "perfSONAR2" },
        { "name": "perfSONAR3" }
      ]
    }
  }
}
```

Dashboard

# MaDDash

- The measurement results are collected by perfSONAR2 and displayed on a dashboard and a timing graph
- The user can see the results of a pair of nodes clicking on a square in the dashboard



Timing Graph