CC* Cyberinfrastructure Topics
Introduction to perfSONAR

Jorge Crichigno
University of South Carolina
http://ce.sc.edu/cyberinfra

Minority Serving - Cyberinfrastructure Consortium (MS-CC)
University of South Carolina (USC)

Claflin University
Orangeburg, SC
March 22nd, 2023

Agenda

- Motivation
- Soft Network Failures
- Hard Network Failures
- Network Monitoring
- perfSONAR
- Getting Started with perfSONAR
- Useful Resources

Motivation

- The global Research & Education network ecosystem is comprised of hundreds of international, national, regional, and local-scale resources
- Each of them is owned and operated independently
- This complex, heterogeneous set of networks must operate seamlessly from "end to end" to support science and research collaborations
- Typically, this type of collaboration is distributed globally
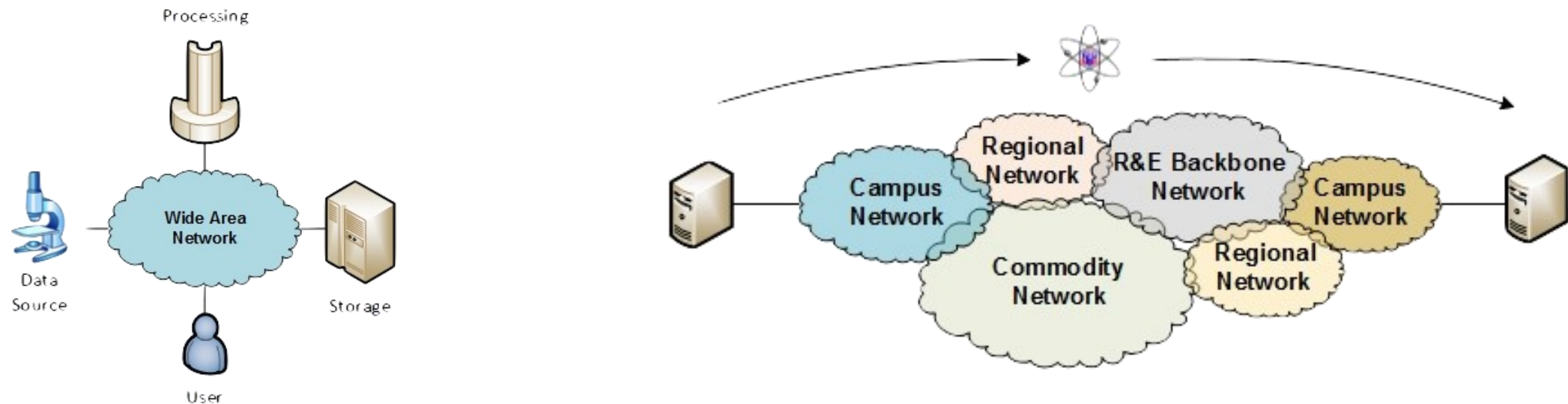
Motivation

- Organizations must understand the behavior of their network by monitoring the performance metrics to ensure that the underlying system is functional
- In large systems, there will be something that will cause performance issues
- We need tools to identify these problems

Source: ESNet, "*Monitoring end-to-end systems*", [Online]. Available: https://tinyurl.com/4tppsccv
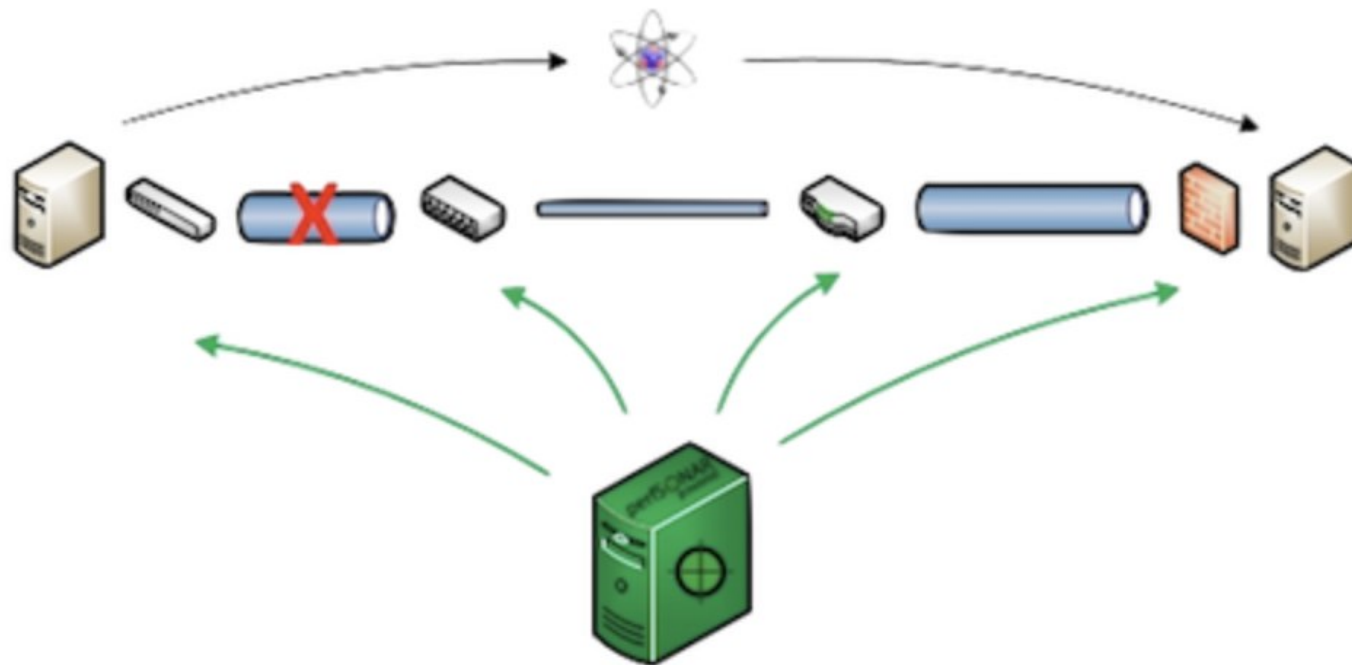
Motivation

- Network issues can have different sources and locations
- Performing local testing will not find the cause of these problems

5
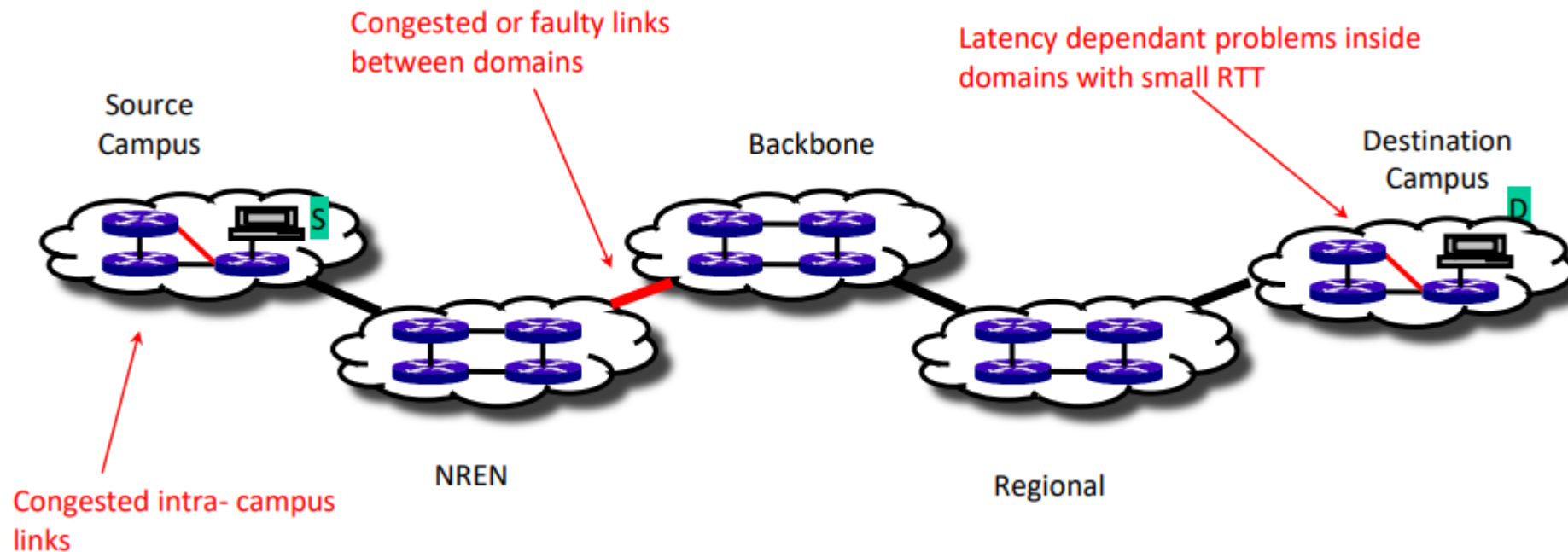
Soft Network Failures

- Soft failures affect basic connectivity functions (e.g., long delays, packet losses)
- High performance is not possible
- For example, TCP was intentionally designed to hide all transmission errors from the user
- Some soft failures only affect high bandwidth long RTT flows
- Soft failures are difficult to detect and fix
- They can be hidden for years and cause resource underutilization

Hard Network Failures

- On the other hand, hard failures are easy to detect & fix
- These types of failures are easy to understand
  - Fiber cut
  - Power failure takes down routers
  - Hardware malfunction
- Classic monitoring systems are good at alerting hard failures
- For example, the network operator visualizes an alert in the system's dashboard

Network Monitoring

- All network operators perform monitoring tasks in their organizations
- These monitoring tasks results in getting insights into the network behavior
- perfSONAR orchestrates and automates regular network measurements

perfSONAR

- perfSONAR is a network measurement tool designed to provide federated coverage of paths and help to achieve end-to-end usage expectations
- The tool facilitates diagnosing, visualizing, and troubleshooting network performance issues
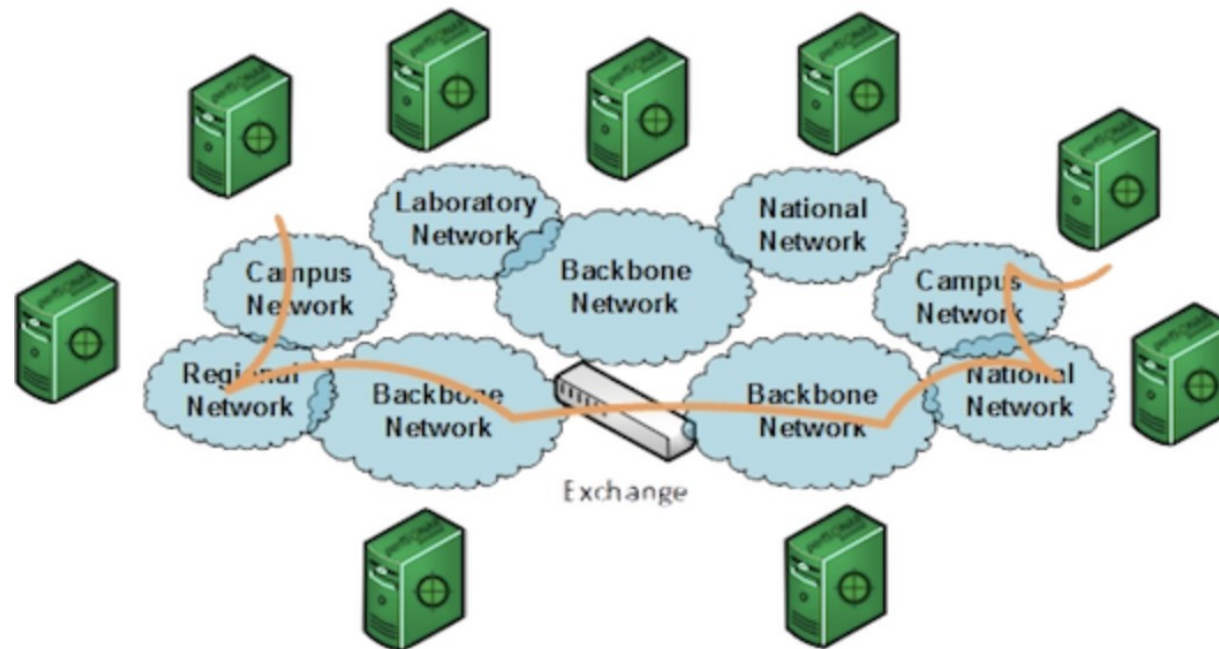
perfSONAR

• perfSONAR aims at providing a snapshot of the network performance to allow researchers to perform large data transfers and enhance collaboration

• Key metrics such as throughput, latency, and packet losses are collected by perfSONAR nodes and displayed in a dashboard
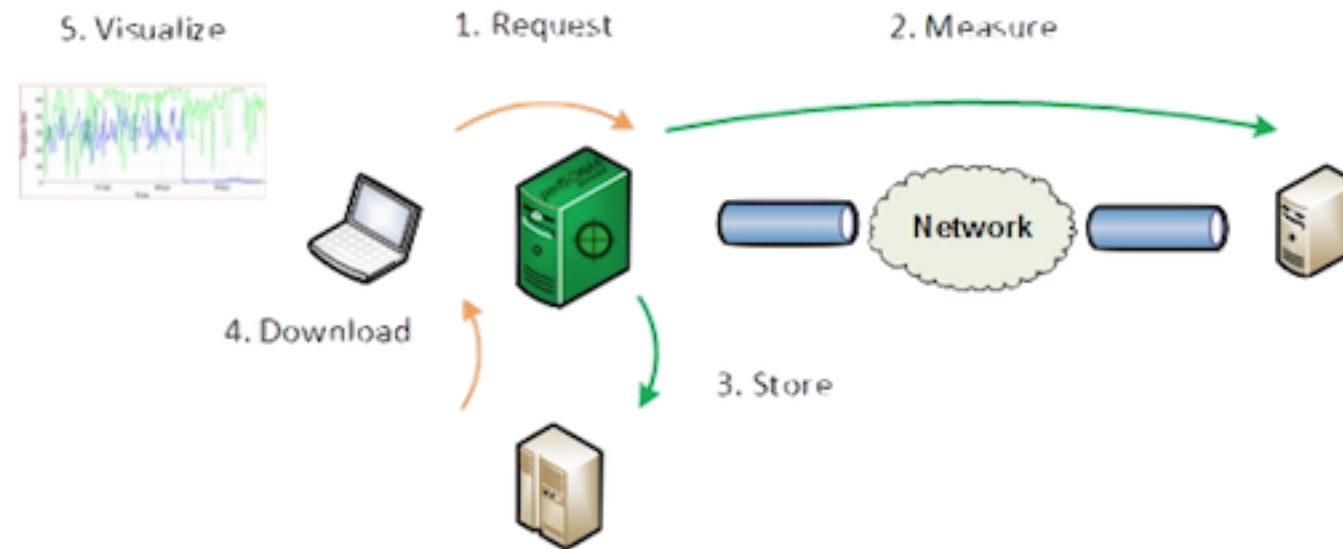
perfSONAR

• perfSONAR provides a set of resources to orchestrate regular tests using open-source tools such as ping, traceroute, iperf3, and others
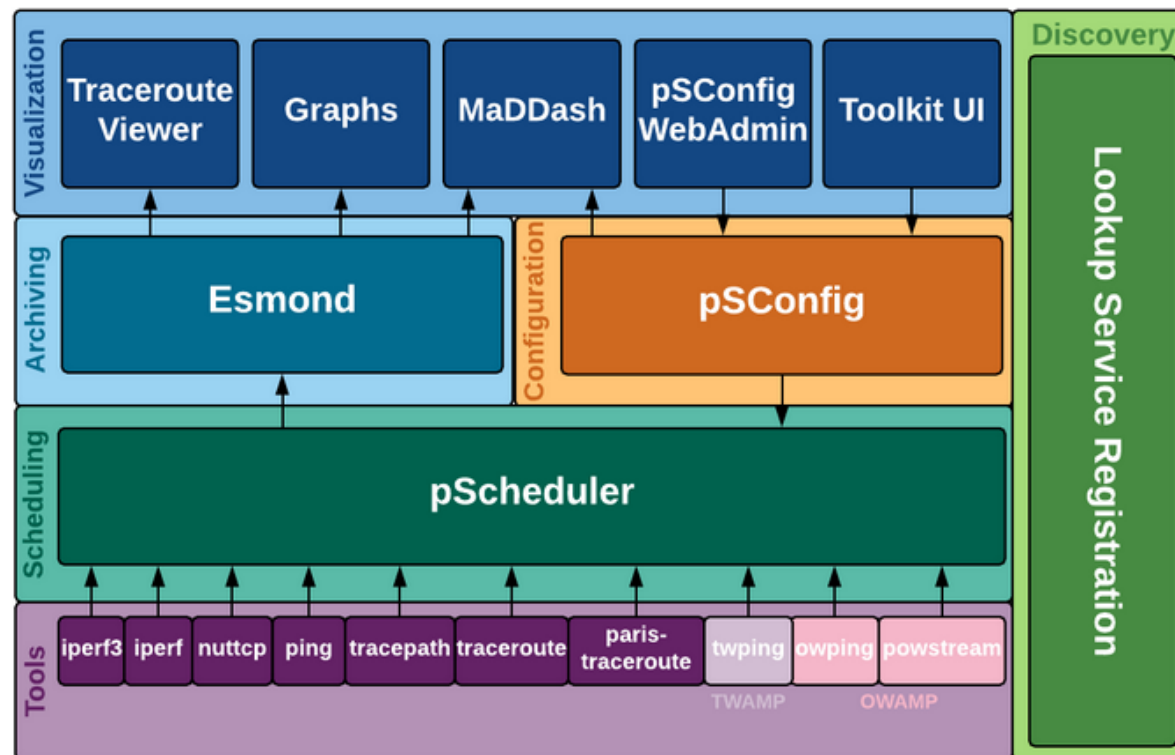
perfSONAR layers

perfSONAR

- perfSONAR allows scheduling measurements, storage of data in uniform formats, and methods to retrieve data and generate visualizations
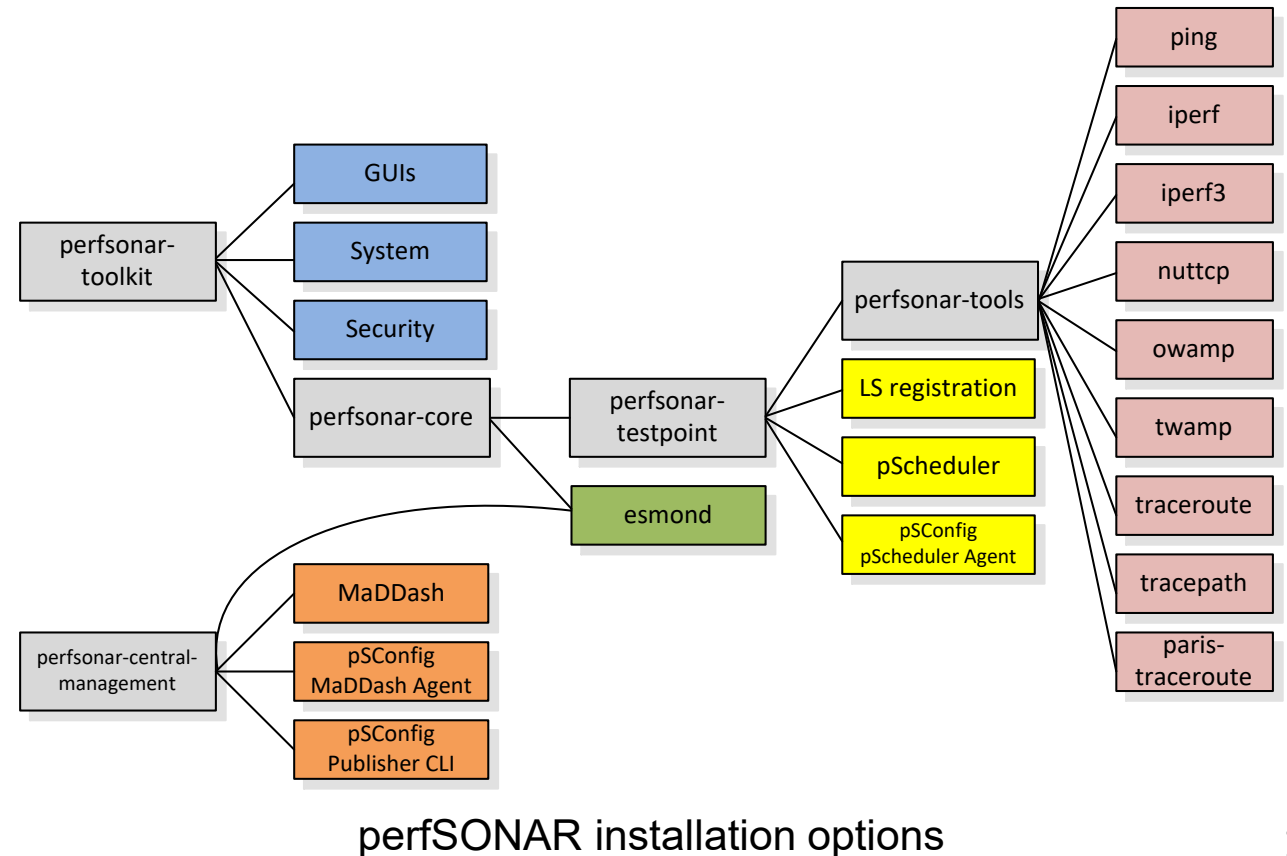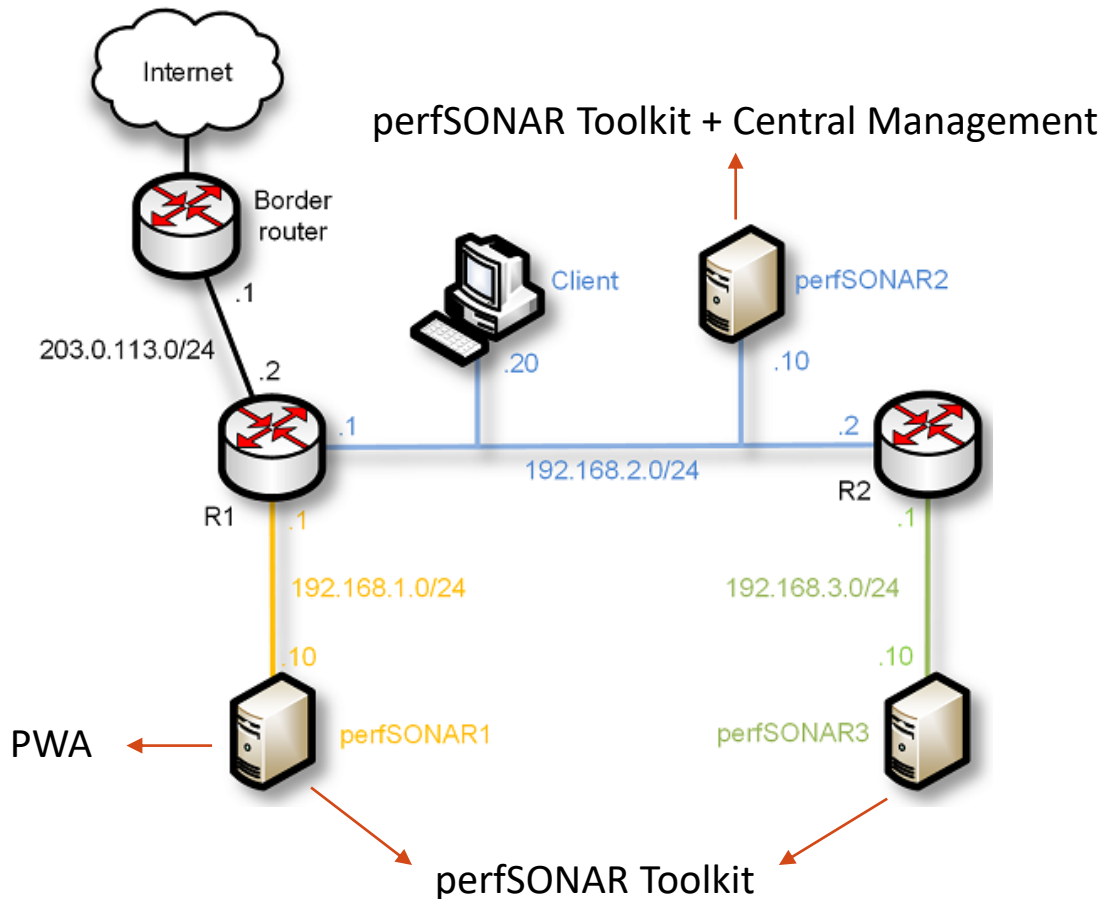

perfSONAR Toolkit GUI

perfSONAR test results

Getting Started with perfSONAR

- The CI-Lab at the University of South Carolina (USC) developed a set of hands-on labs that navigate through the components of perfSONAR

perfSONAR Toolkit + Central Management

PWA

perfSONAR Toolkit

perfSONAR installation options

Useful Resources

- perfSONAR official website
  - ➢URL: https://www.perfsonar.net/gtk_whatis.html

- perfSONAR documentation
  - ➢URL: https://docs.perfsonar.net/

- ESNet website
  - ➢URL: https://www.es.net/network-r-and-d/perfsonar/

- The CI-Lab website
  - ➢URL: http://ce.sc.edu/cyberinfra/cybertraining.html