MetrANOVA

Ivana Golub, PSNC
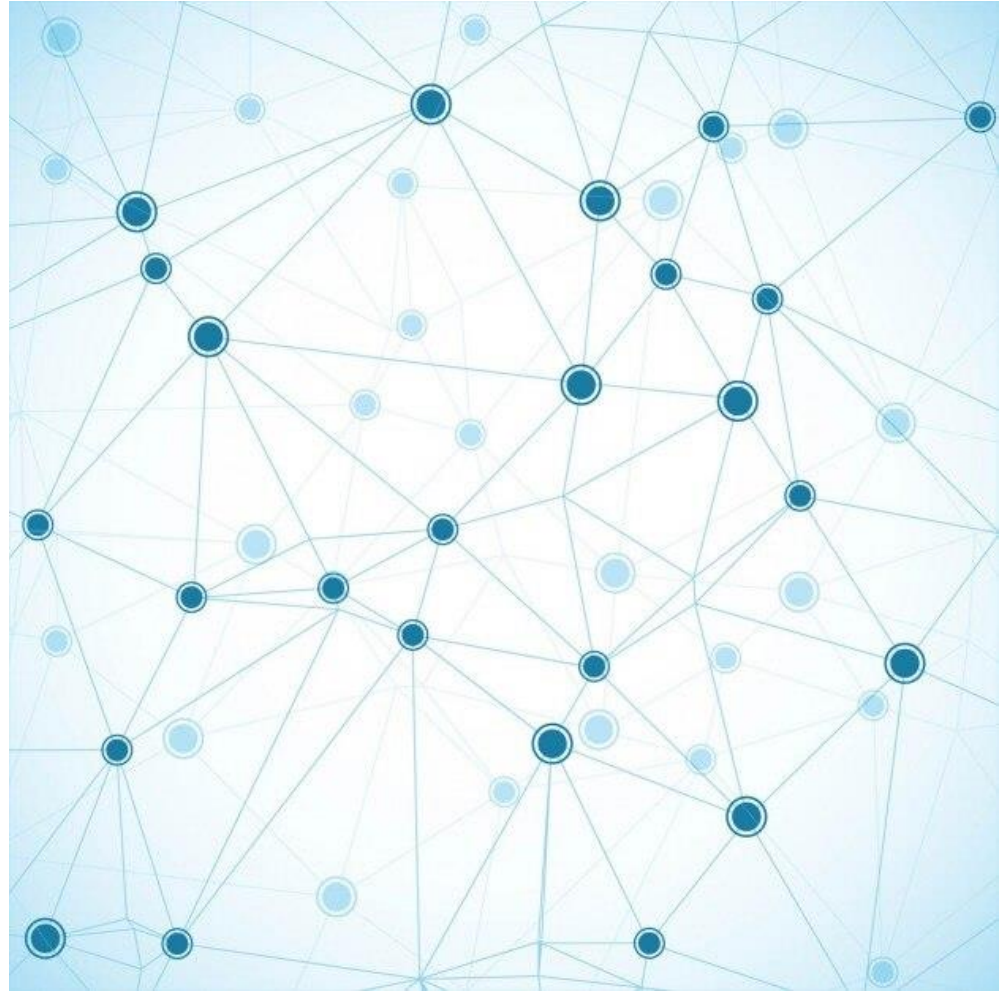
GN5-1 Network Development WP Co-lead

31st Service and Technology Forum

17 April 2024 Brussels, Belgium

GN5-1
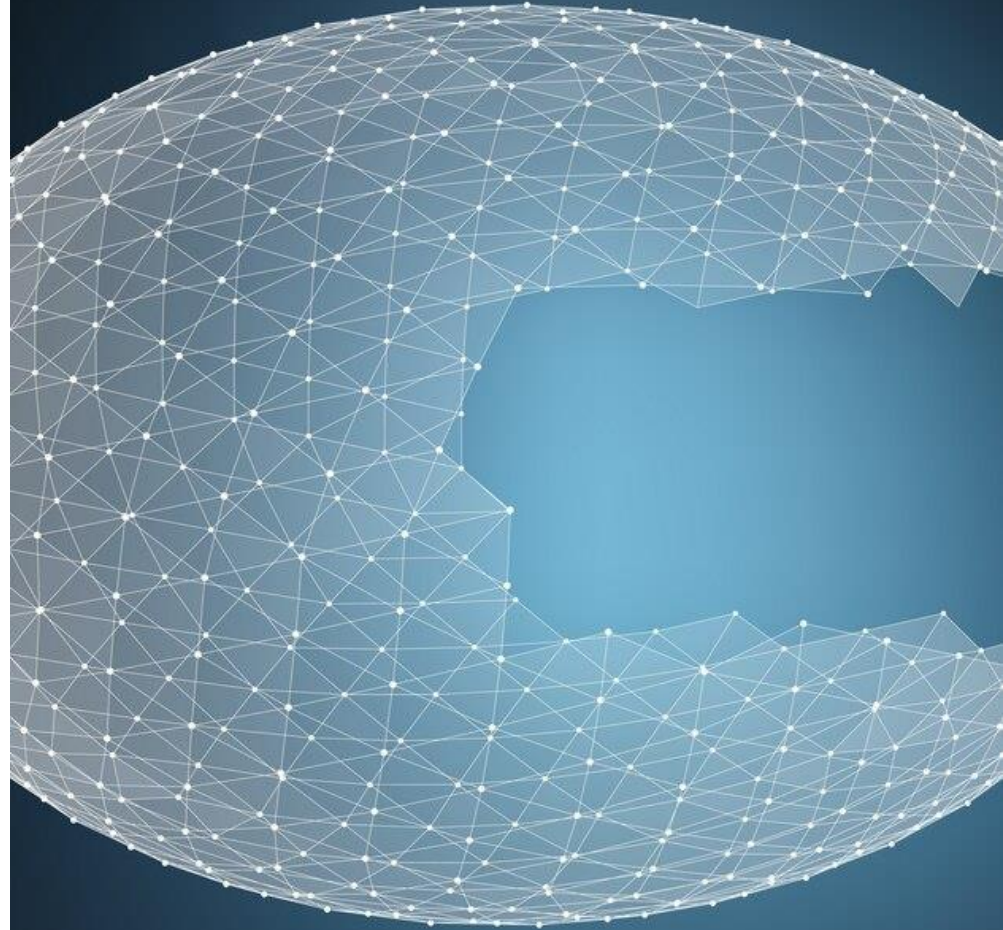
Network visibility

SIG-NOC
Tools Survey
2023

NETDEV
solutions

Other
approaches

**SIG-NOC Tools Survey 2023**

NOC Functions

NOC Functions 2023	2016	2019	2023	Trend	
Monitoring	1	1	1	▬	0
Problem Management	2	2	2	▬	0
Ticketing	3	3	3	▬	0
Knowledge Management and Documentation	8	6	4	▲	2
Reporting and Statistics	5	4	5	▼	-1
Communication, Coordination and Chat	7	10	6	▲	4
Configuration Management and Backup	6	5	7	▼	-2
Performance Management	4	7	8	▼	-1
Inventory Management	12	9	9	▬	0
Resources Management	14	12	10	▲	2
Out-of-band Access Management	10	11	11	▬	0
Change Management	9	13	12	▲	1
Training			13	NEW	
Security Management	11	8	14	▼	-6
Data Aggregation, Representation, Visualization	15	15	15	▬	0
DDoS Mitigation	13	14	16	▼	-2
Orchestration, automation and virtualisation		16	17	▼	-1

Source:
SIG-NOC
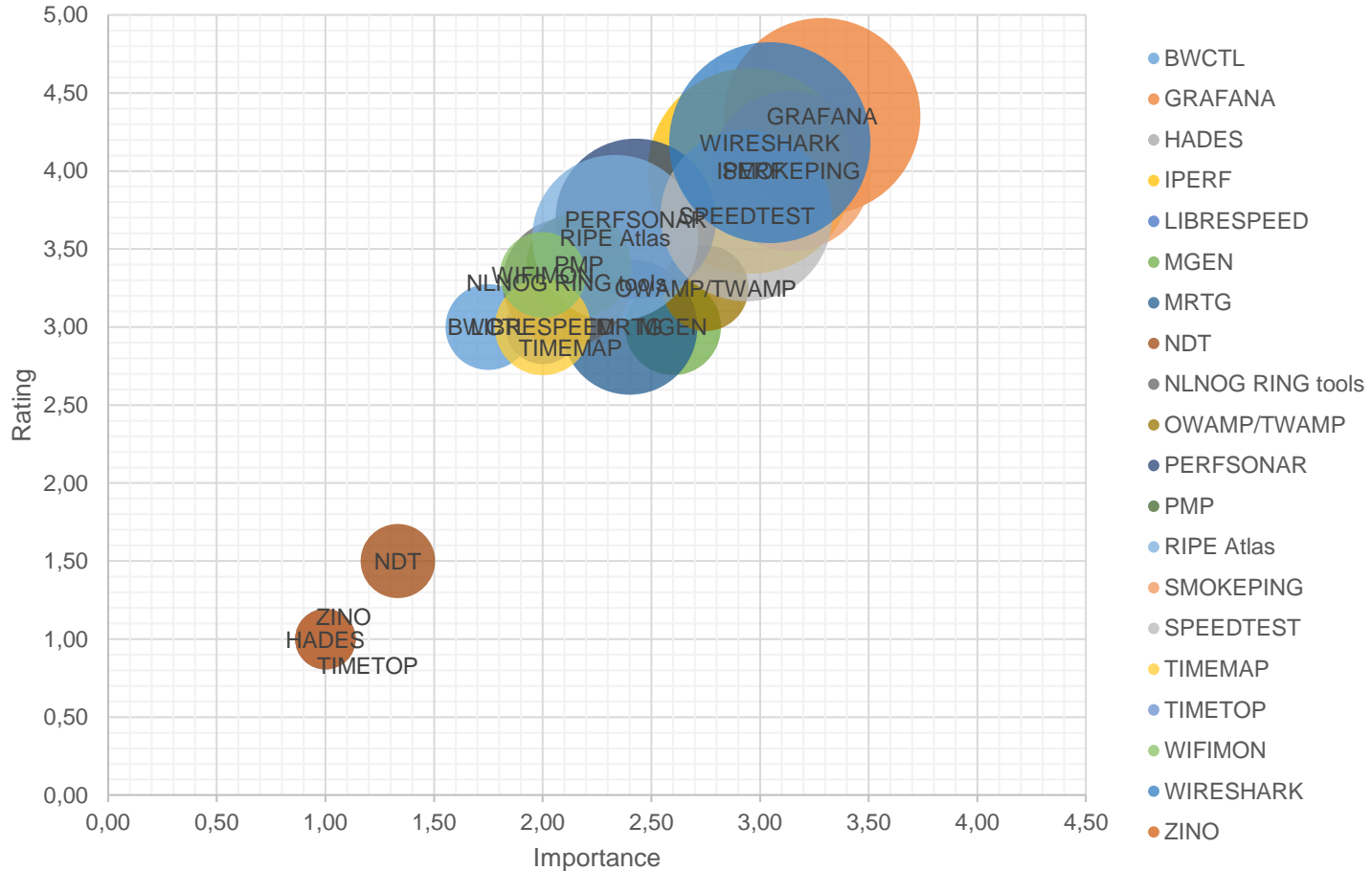Tools Survey
2023

Monitoring Tools
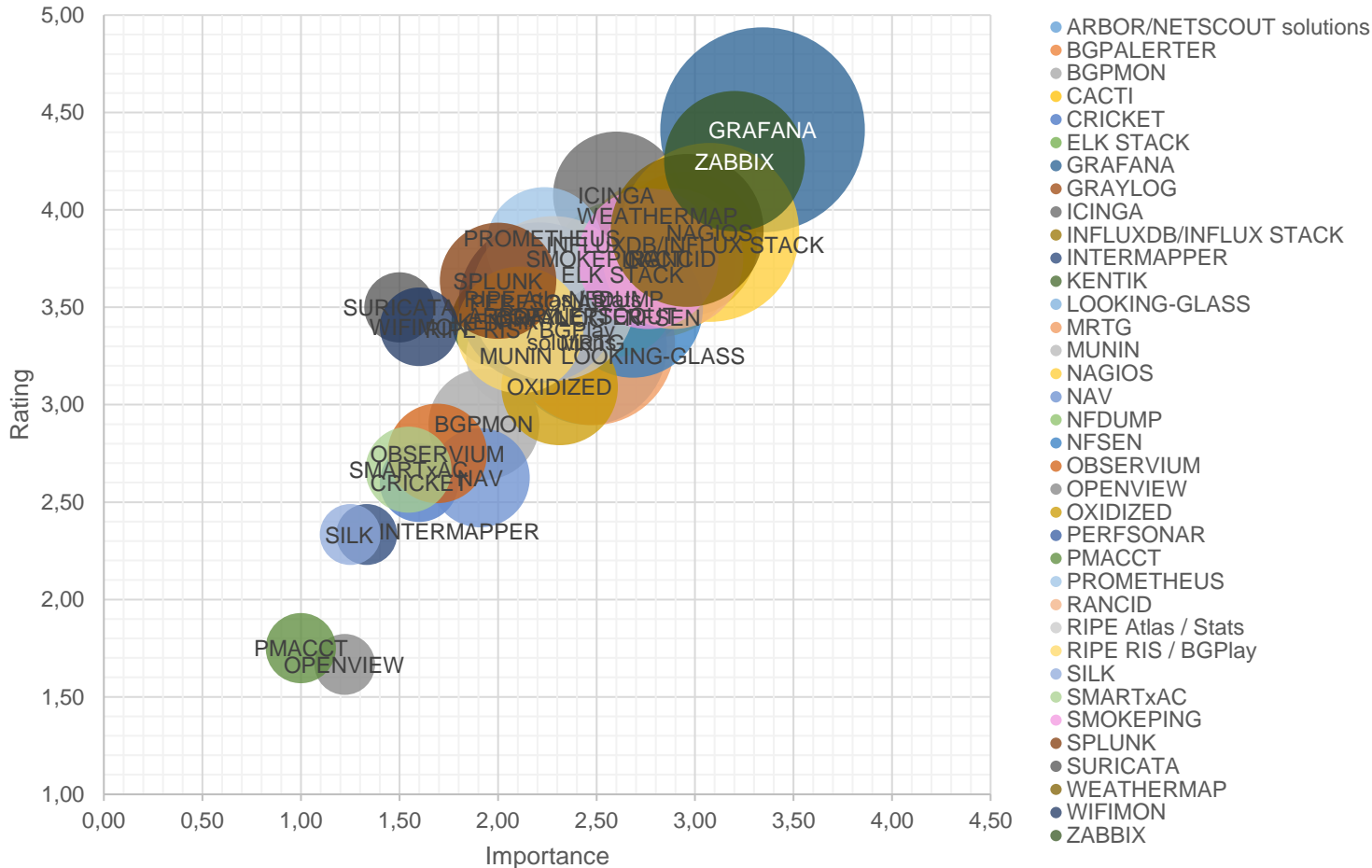
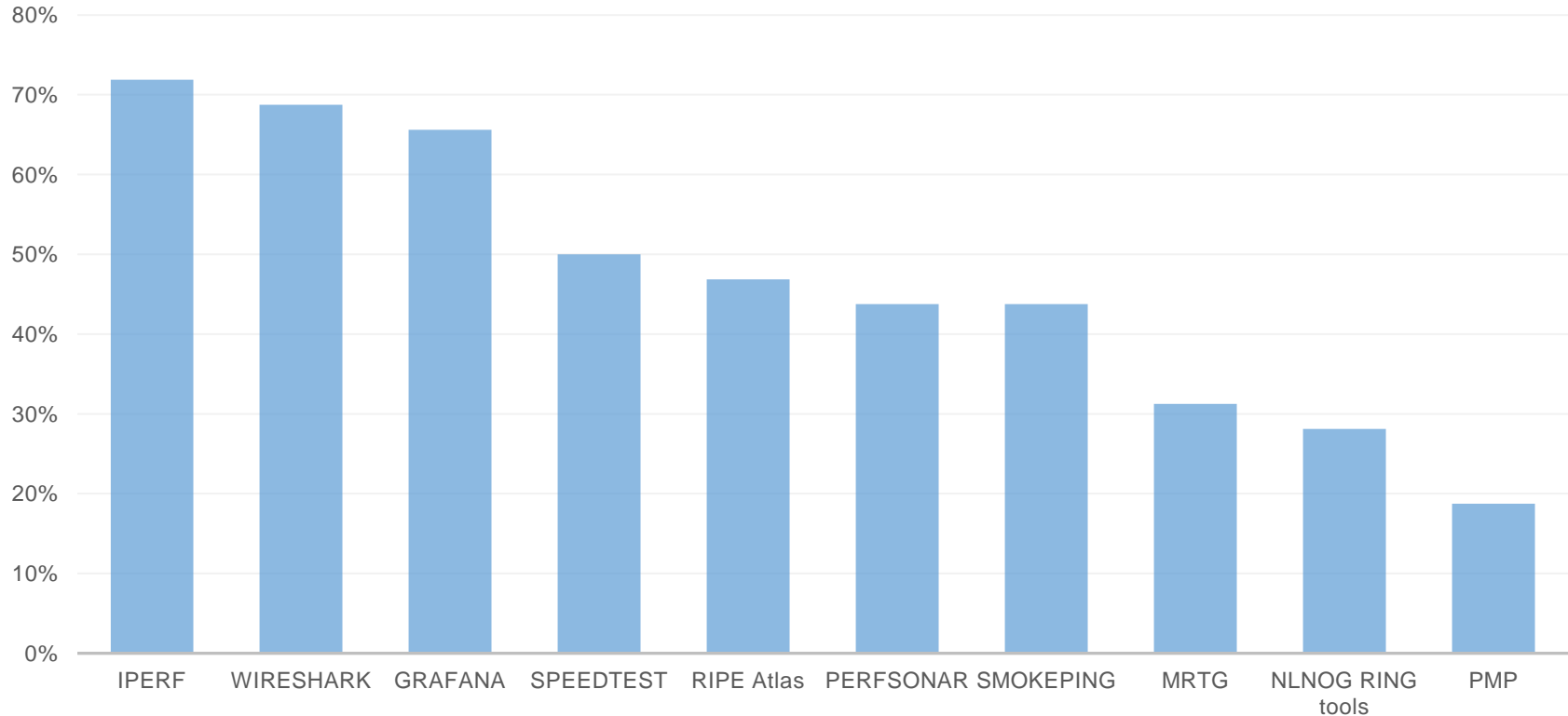# Monitoring: Percentage of Users per Tool (Top-10)
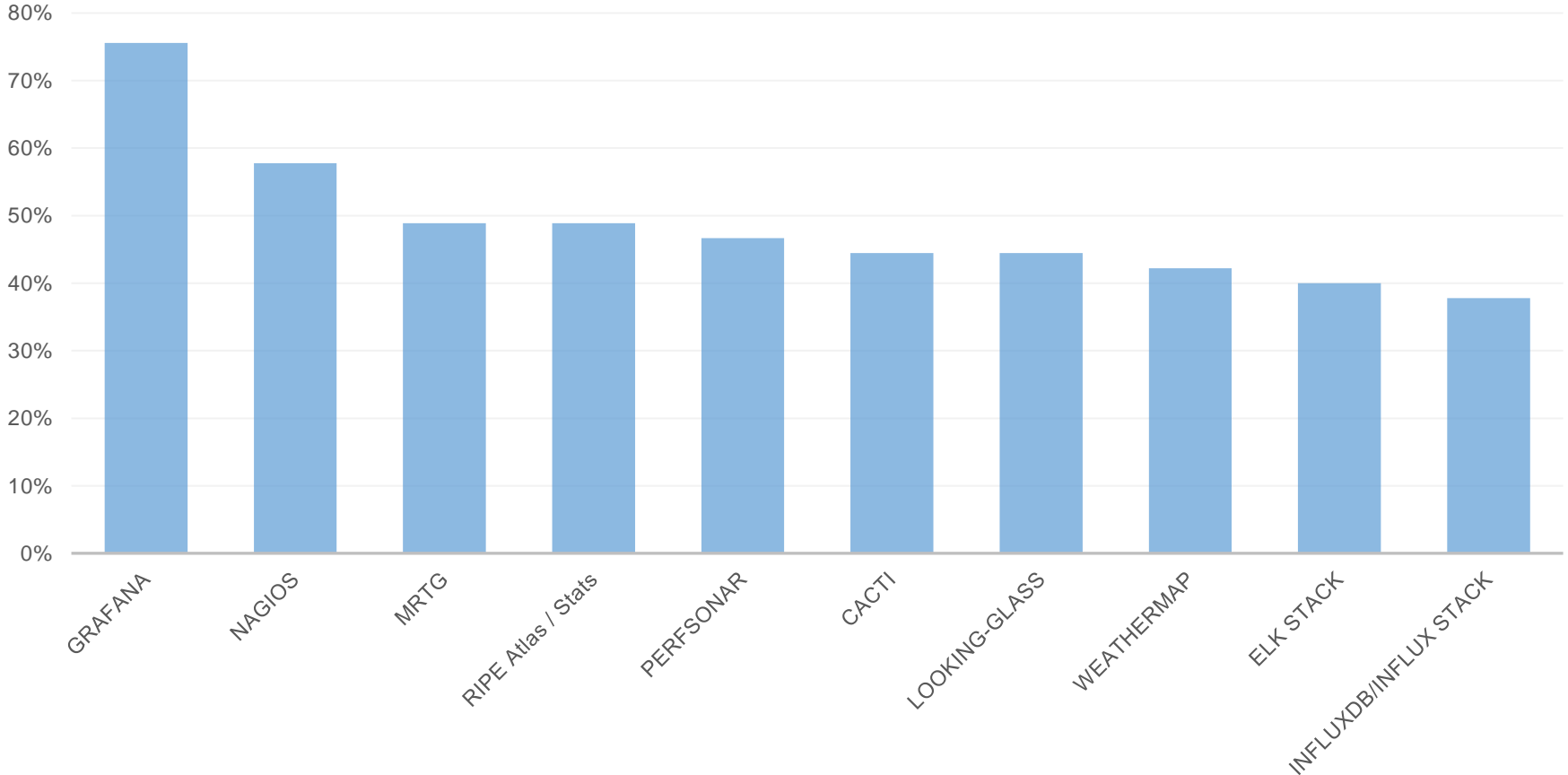
On average, each institution uses 11.5 different tools for monitoring

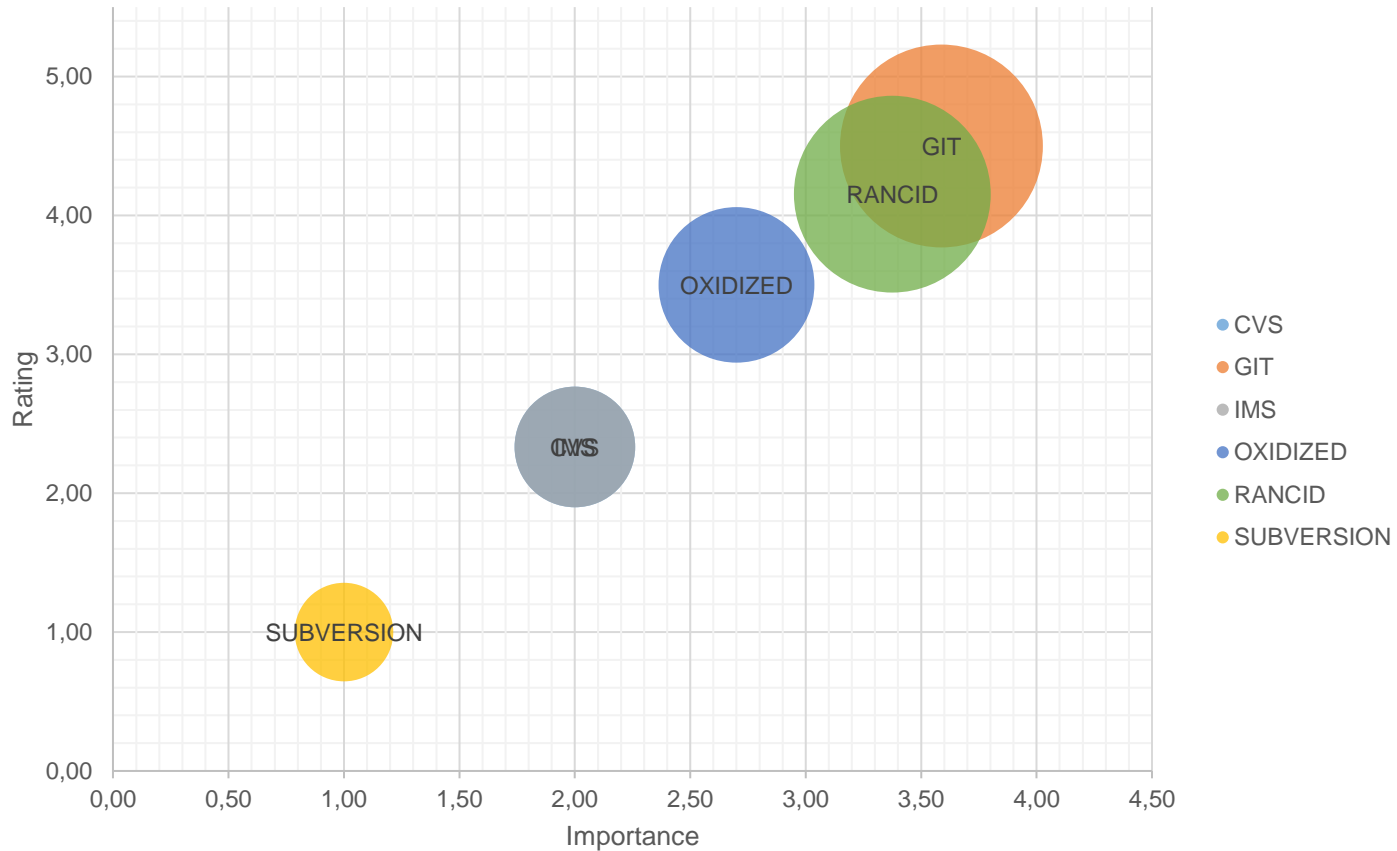# Performance Management Tools

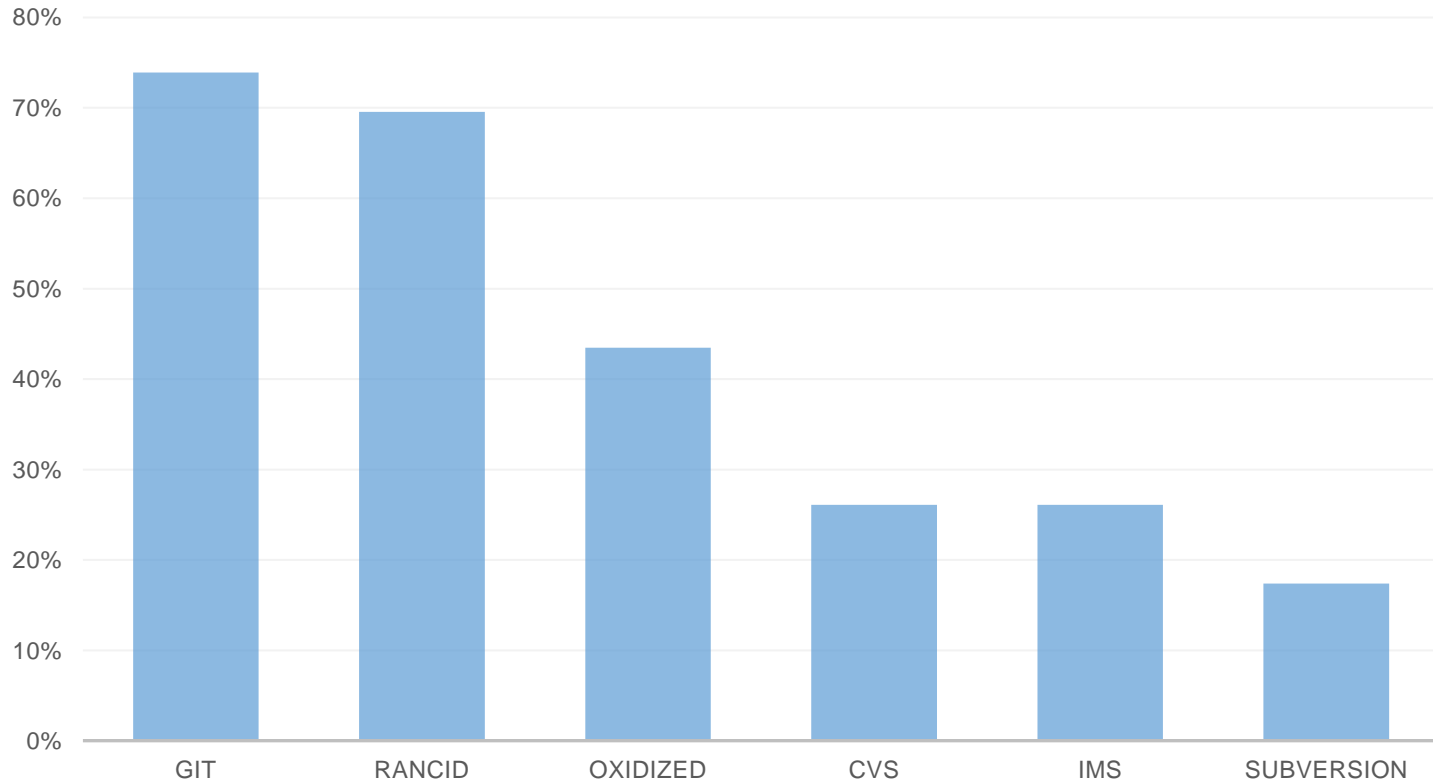# Performance Management: Percentage of Users per Tool (Top-10)

On average, each institution uses 5.7 tools for Performance Management

Configuration Management and Backup Tools

Configuration Management and Backup Tools: Percentage of Users per Tool (Top-6)

On average, each institution uses 2.3 tools for Configuration Management and Backup

Data Aggregation, Representation and Visualisation Tools
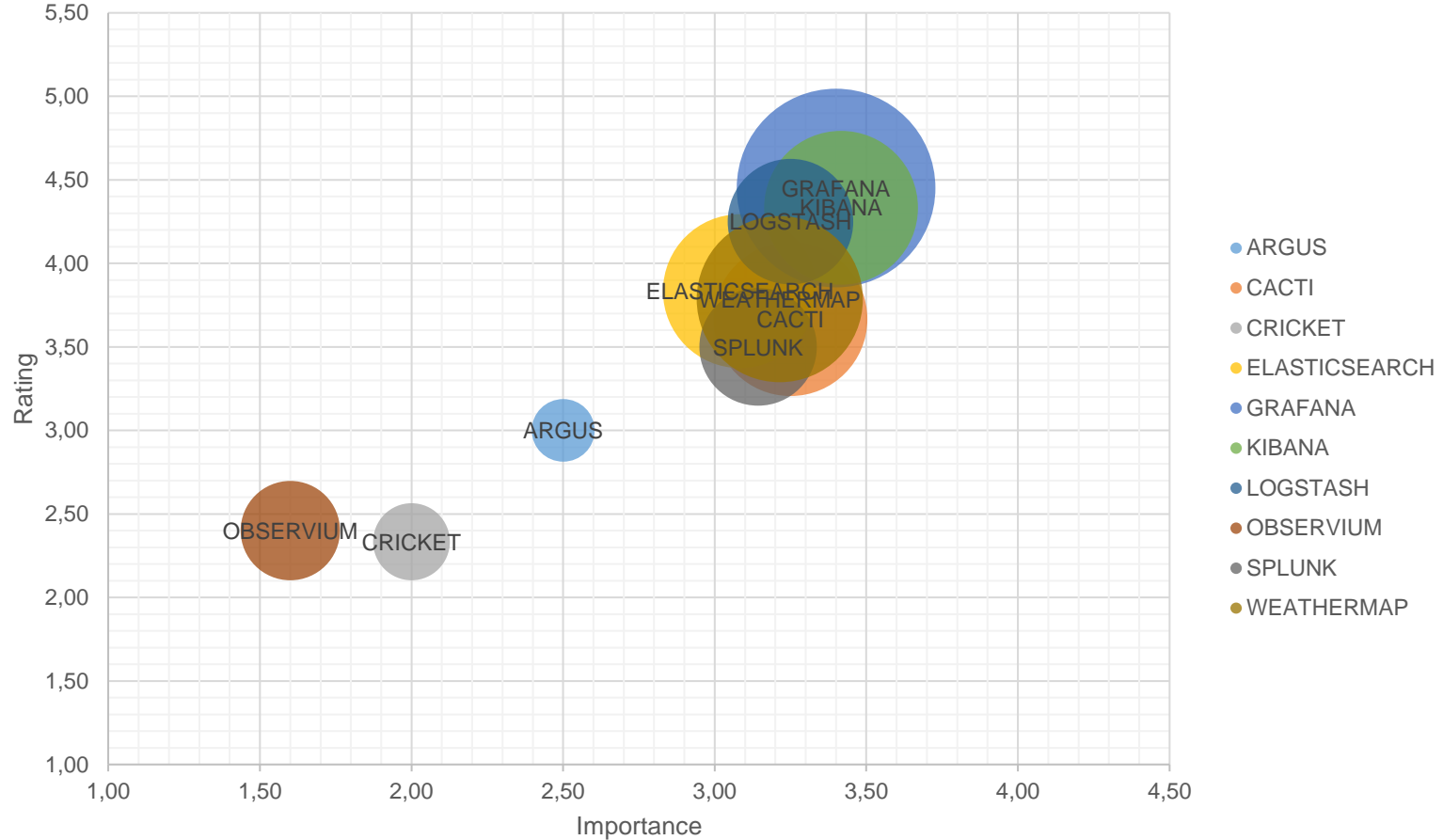
Data Aggregation, Representation and Visualisation: Percentage of Users per Tool (Top-10)
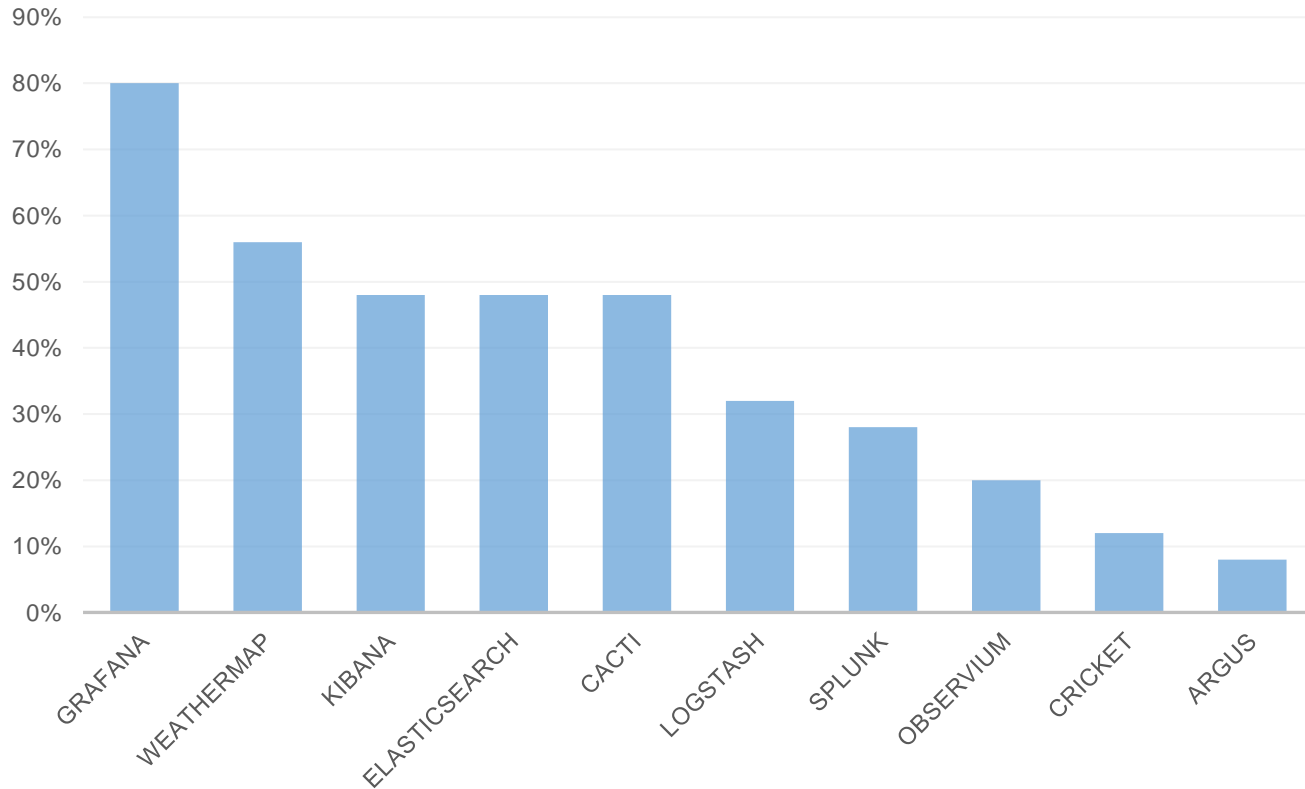
On average, each institution uses 3.8 tools for Data Aggregation, Representation and Visualisation

Reporting and Statistics Tools
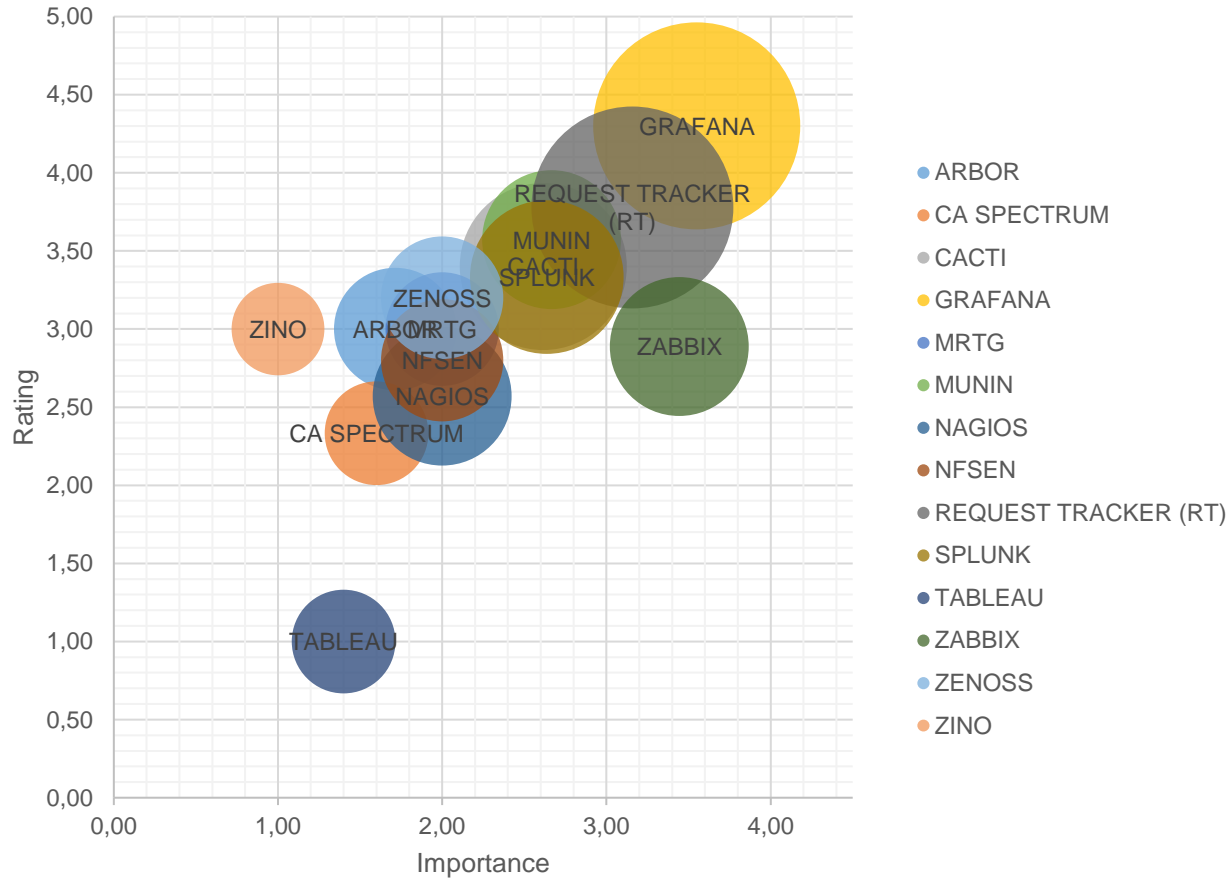
Reporting and Statistics Tools: Percentage of Users per Tool (Top-10)
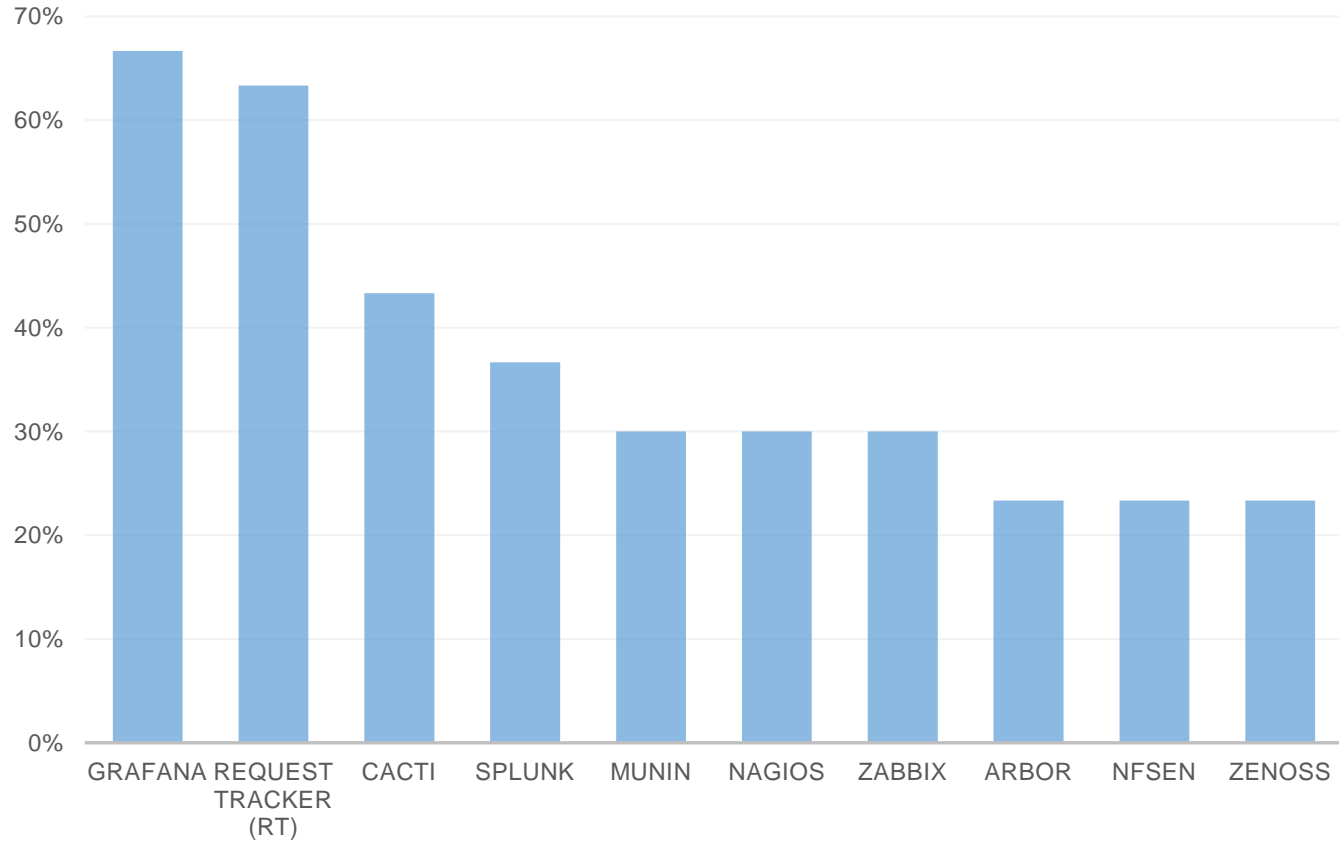
On average, each institution uses 4.4 tools for Reporting and Statistics

Inventory Tools
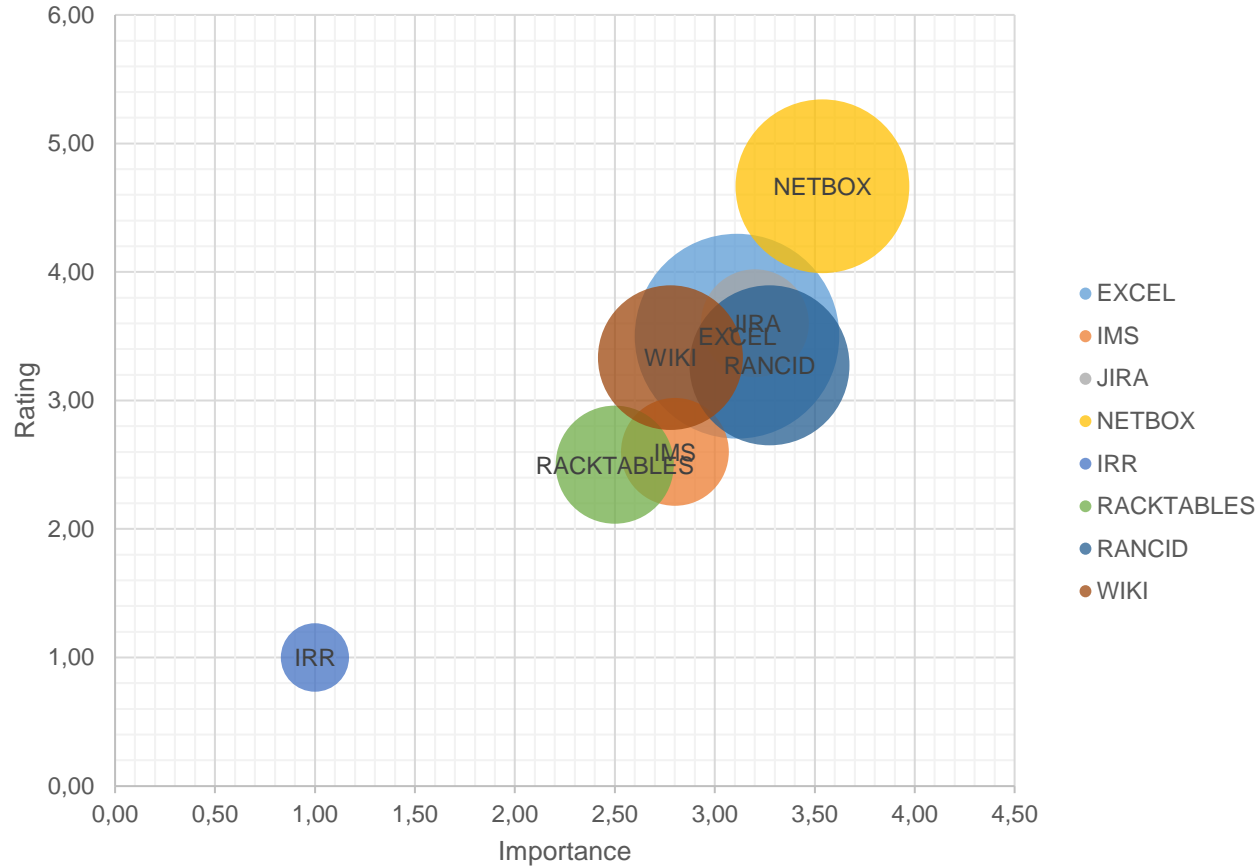
Inventory: Percentage of Users per Tool (Top-8)

On average, each institution uses 2.6 tool for Inventory Management

Resources Management Tools

Resources Management : Percentage of Users per Tool (Top-8)

On average, each institution uses 2.4 tools for Resources Management

On average, each institution uses **11.5** different tools for monitoring

On average, each institution uses **4.7** different tools for problem management

On average, each institution uses **1.5** tools for Ticketing

On average, each institution uses **5.2** tools for Knowledge Management

On average, each institution uses **4.4** tools for Reporting and Statistics

On average, each institution uses around **6.4** tools for Bidirectional Communication

On average, each institution uses around **2.8** tools for Unidirectional Communication

On average, each institution uses **2.3** tools for Configuration Management and Backup

On average, each institution uses **5.7** tools for Performance Management

On average, each institution uses **2.6** tool for Inventory Management

On average, each institution uses **2.4** tools for Resources Management

On average, each institution uses **3.4** tools for Out-of-Band Access Management

On average, each institution uses **2.4** tools for Change Management

On average, each institution uses **6** tools for Security Management

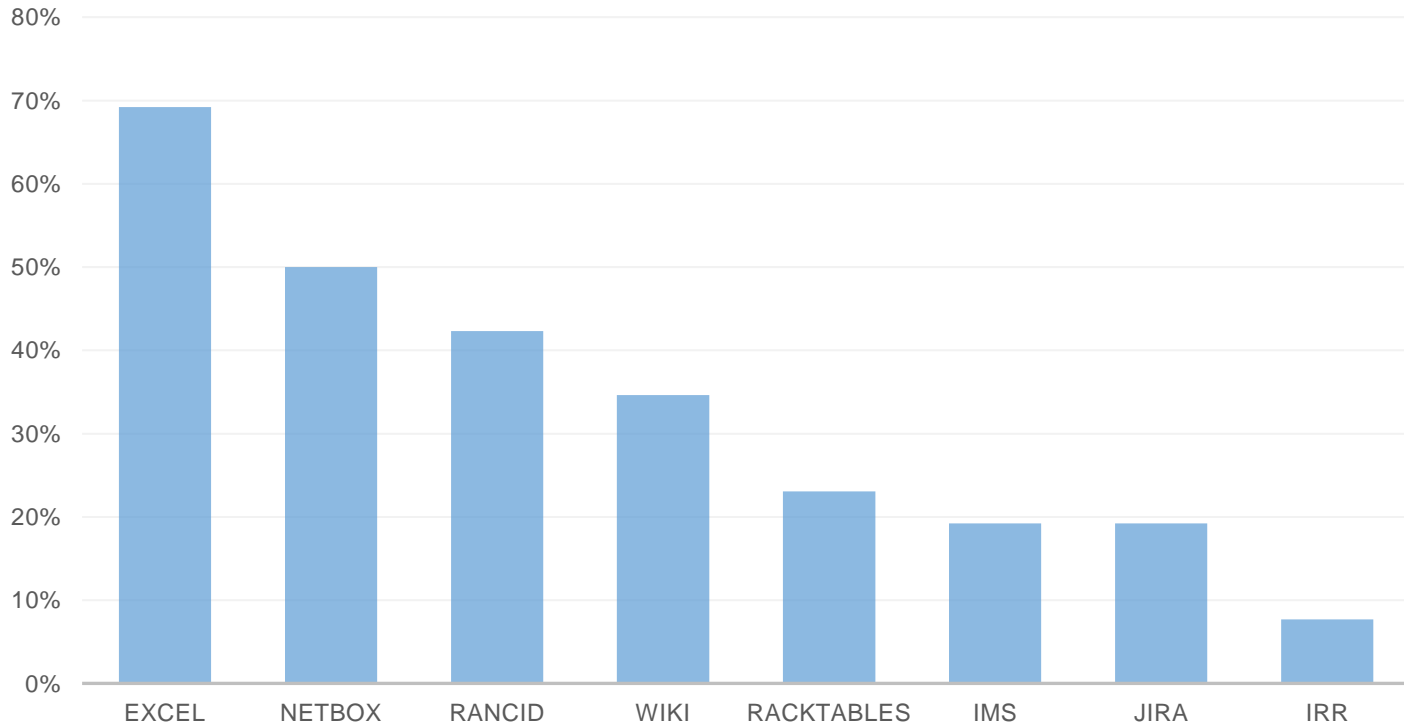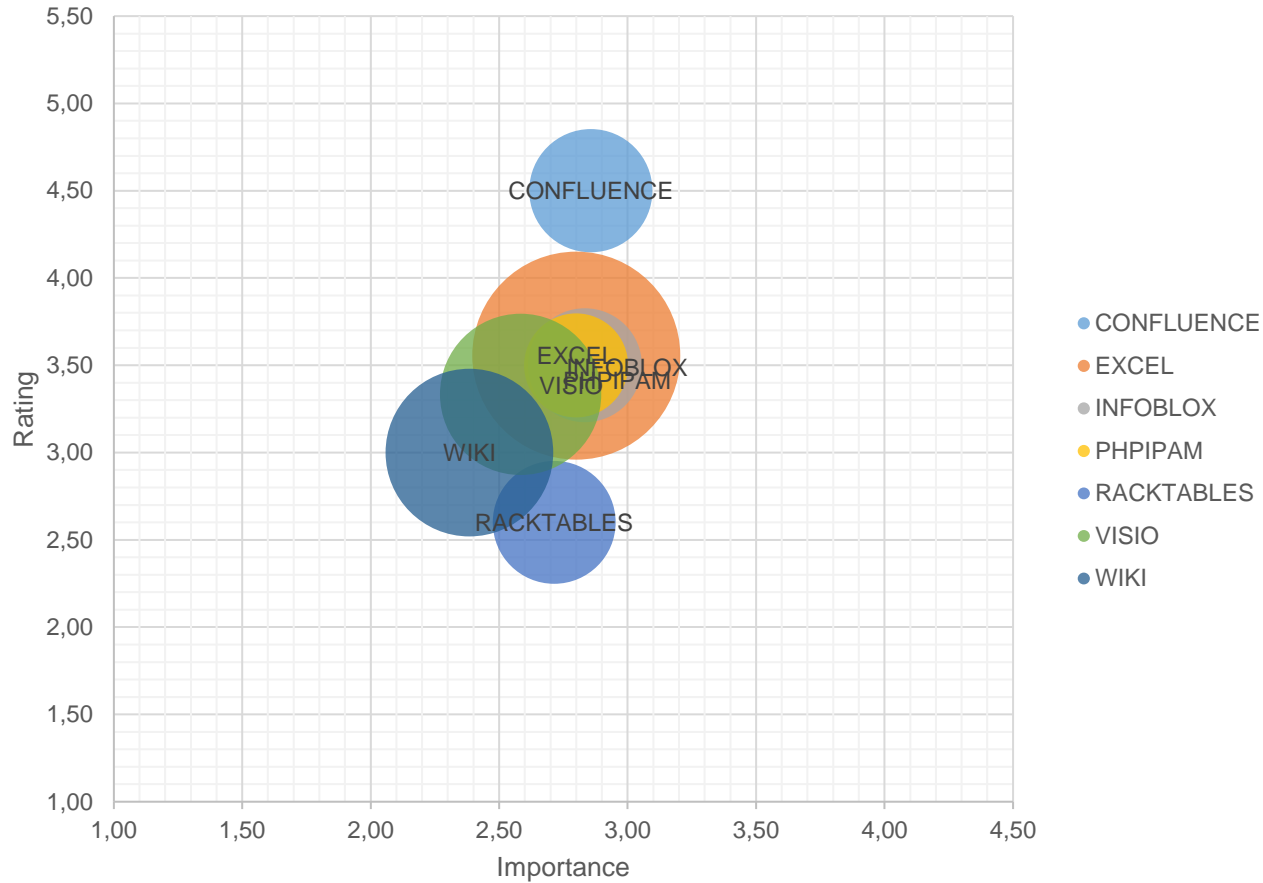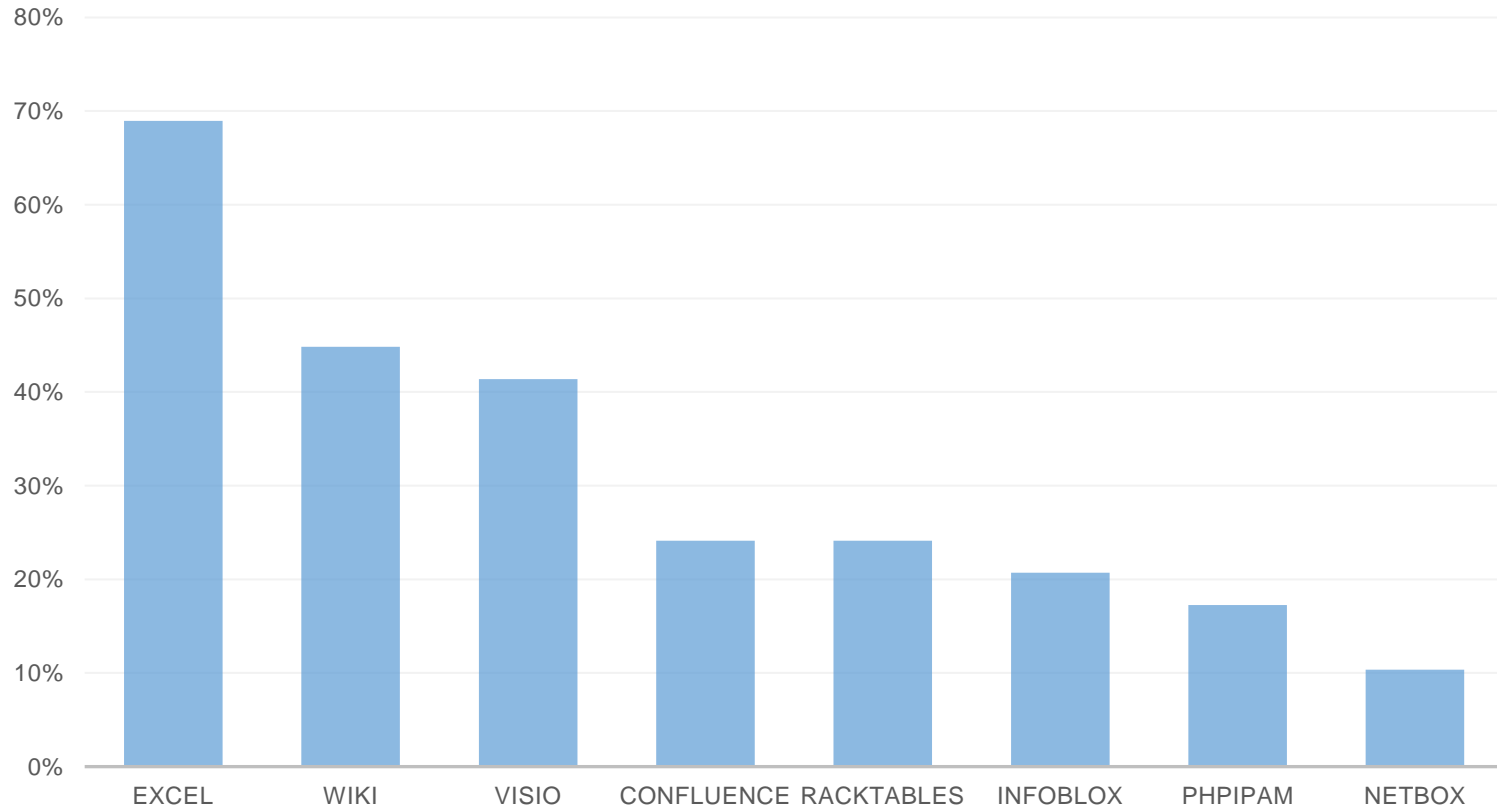On average, each institution uses **3.8** tools for Data Aggregation, Representation and Visualisation

NETDEV
Network Monitoring and Management Solutions

perfSONAR

Open-source, modular, flexible architecture for IPv4 and IPv6 active network measurement and monitoring

Some GÉANT's recents contributions:
- Lookup Service dashboards
- Microdep integration with perfSONAR
- On-demand perfSONAR Graphical User Interface (psGUI)
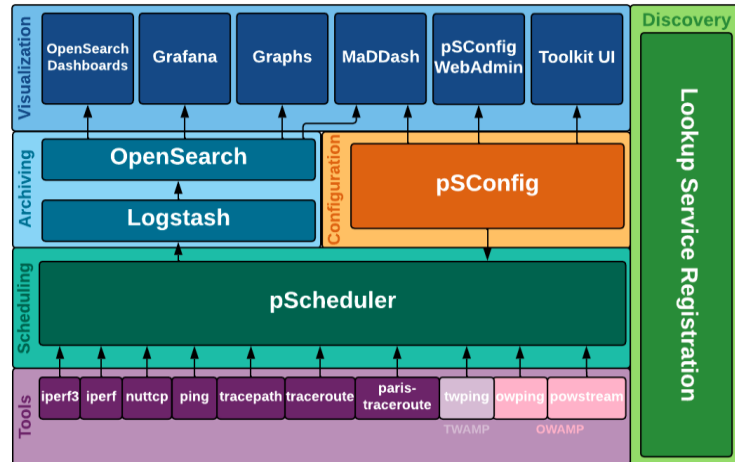
perfsonar@lists.geant.org

ESnet

perfS⊕NAR

https://www.perfsonar.net/

GÉANT   IU   INTERNET2®   RNP ORGANIZAÇÃO SOCIAL DO MCTI

Over 2000 registered hosts in more than 1000 organisations around the world

Supported on **Ubuntu 20**
More OSs to follow in early summer
(EL8, EL9, Ubuntu 22, Debian 11)

Performance Measurement Platform - PMP

> **Exploring the performance of the GÉANT backbone while experiencing perfSONAR on small nodes**

- Low-cost hardware nodes with pre-installed perfSONAR software and deployed in GÉANT collaborating organisations in Europe and Africa.
- Central components including a central Measurement Archive (MA) and a Dashboard.
- Measurement points in the GÉANT backbone network

- PMP data analysis for new service report using AI/ML
- In green: Countries with the PMP service coverage in Europe

Dashboard: https://pmp-central.geant.org/maddash-webui/
Contact: perfsonar-smallnodes@lists.geant.org

TimeMap

Per-segment latency and jitter monitoring tool

Based on TWAMP (RFC 5357)

Easy and quick modular installation

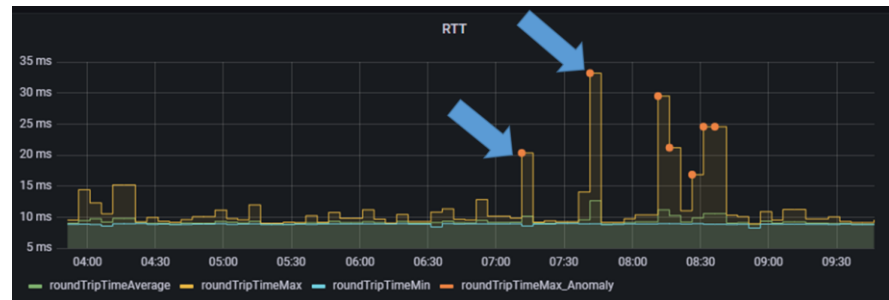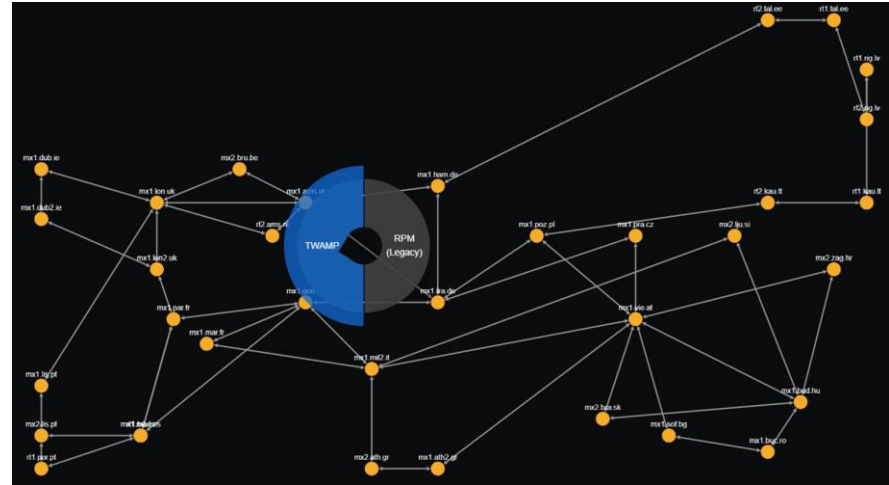Initial AI-based anomaly detection implemented

Deployed in the GÉANT backbone network

Documentation
- TimeMap
- Code and documentation
- TimeMap page

TimeMap

timemap@lists.geant.org

WiFiMon

A WiFi network monitoring and performance verification system

wifimon-ops@lists.geant.org

WiFiMon is a WiFi network monitoring and performance verification system. It is capable of detecting performance issues, visualising the achievable throughput of a wireless network for each user, and providing technical information about a WiFi network (e.g., signal strength, link quality, bit rate, etc.). **WiFiMon** leverages well-known performance verification tools (e.g., Akamai Boomerang and Speedtest) and in addition uses data from the WiFi physical layer in order to gather a comprehensive set of WiFi network performance metrics.

WiFiMon Operation Modes

WiFiMon can operate in two different modes which can be used either separately or together

Software Crowdsourced Measurements

Hardware Probe Measurements

WiFiMon

Technology and vendor agnostic

WiFiMon can be deployed on any WiFi network as it monitors the performance on the network layer. It can also provide additional benefits in 802.1x enabled networks including eduroam in which case users can make various performance analyses per access point, per user, etc.

Fine grained information on network performance

WiFiMon shows the end-user (mobile client) behaviour on a network, its perception about the responsiveness of the network and the speed of web resource downloads, correlation of the performance data with end-user data, and data analysis with an effective query builder.

Easy to deploy

WiFiMon is a software image (also available as a Docker Image) and can be easily deployed on an NREN/University network on hardware or software probes.

Active monitoring with low network overhead

WiFiMon active measurements are not significantly invasive and do not use any significant bandwidth. One **WiFiMon** measurement is comparable to one average web-page download (load speed).

NMaaS - Network Management as a Service

A portfolio of network management applications run as dedicated, cloud-based per-user instance

28 applications available, easy to add new tools

Use cases:

- Network/Equipment Management for Small/Medium size networks/ institutions
- Project-owned equipment
- NMaaS Virtual Lab

How to use NMaaS?

- Managed service
  - Production NMaaS instance: https://nmaas.eu
  - Sandbox instance: https://nmaas.geant.org
- Self-hosted
  - On your own NMaaS instance: https://docs.nmaas.eu/install-guide
  - On a local machine: https://docs.nmaas.eu/local-vm

NMaaS

nmaas.eu
nmaas@lists.geant.org

26
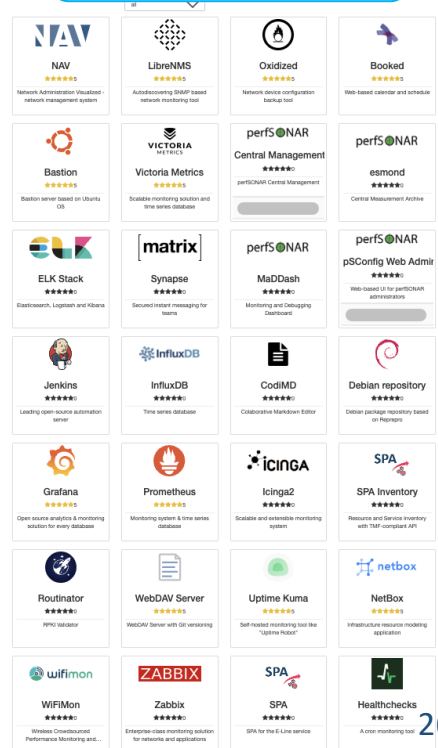
An alarm aggregation and correlation tool

- A single unified dashboard and notification system for aggregated incidents from all monitoring applications
- Based on the CNaaS use case
- In production in Sikt and SUNET
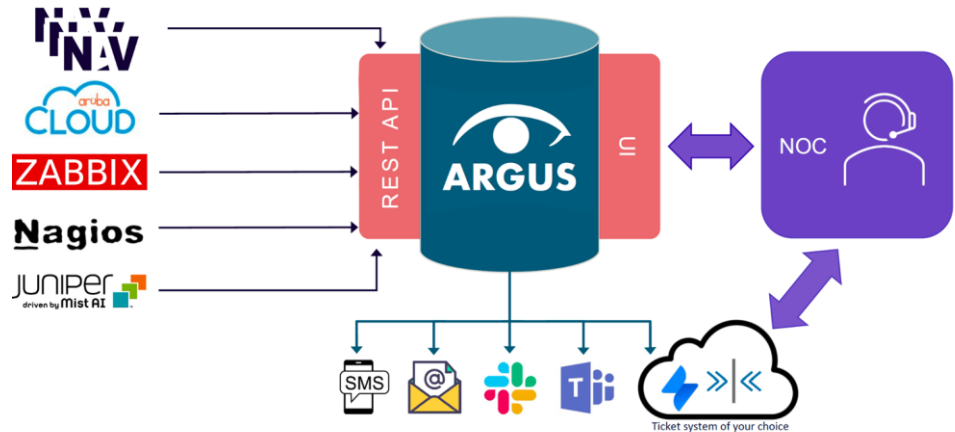- A production service since Sept 2022

https://wiki.geant.org/display/netdev/argus

argus@lists.geant.org

Other Approaches

NetSage

https://netsage.io/

"An open privacy-aware network measurement, analysis, and visualization service

designed to address the needs of today's international networks."

Flow Data:

- What are the top sources/destinations of flows?
- What are the top flows by organization?
- What do individual flows between sites look like?
- What are the top flows by country?
- What are the top flows by science discipline?
- What are the top flows by project?
- Who are the top talkers over time?
- What are the usage patterns by science discipline?
- What are the current flow data summary statistics?

SNMP Data:

- What is the current usage on the network?
- What are the bandwidth usage patterns for each link?

The Engagement and Performance Operations Center (EPOC) Supports US Domestic NetSage Deployments

Front Range GigaPop
(FRGP): https://frgp.netsage.io

Great Plains Network
(GPN): https://gpn.netsage.io

Lonestar Education and Research Network
(LEARN): https://learn.netsage.io

Southern Crossroads **(SoX)**:
https://sox.netsage.io

Sun Corrdidor
(SCN): https://suncorridor.netsage.io

Texas Advanced Computing Center **(TACC):**
https://tacc.netsage.io

All EPOC NetSage Data: https://epoc.netsage.io

and the **ACCESS** project:
https://access.netsage.io

What are the top flows by science discipline?

example

Disciplines | Enter variable value | **Sensors** | All ⌄ | **Scope** | All ⌄

☐ Selected (1)
☑ All

☐ BIO.General
☐ BIO.Genomics and Bioinformatics
☐ BIO.Medical
☐ CS.Intelligent Systems
☐ CS.Network Testing and Monitoring
☐ GEO.Atmospheric
☐ MPS.Astronomy
☐ MPS.Physics
☐ MPS.Physics.High Energy
☐ Multi-Science Facility

Science Discipline Patterns

This dashboard shows heatmaps for the flow data by science discipline.
The horizontal axis represents days and the vertical axis represents time of day.
Darker squares show higher data transmission rates at those hours.
All times are displayed in browser local time.

BIO.Genera

00:00
02:00
04:00
06:00
08:00
10:00

MPS.Physics.High Energy

04/04 05/04 06/04 07/04 08/04 09/04 10/04 11/04 12/04 13/04 14/04 15/04 16/04

https://sox.netsage.io/grafana/d/ufIS9W7Zk/08d16a29-ef95-5969-bfe3-9737ecc971d5?orgId=1

Stardust
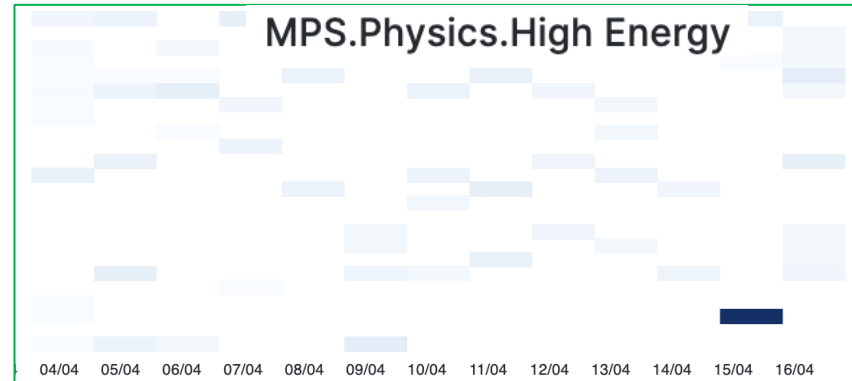
https://public.stardust.es.net/   https://my.es.net/

This is a space where ESnet shares public Grafana dashboards of targeted data sets. It complements the data found at the my.es.net portal. The data comes primarily from ESnet's Stardust system and provides a flexible way to show interesting views of the data.

Stardust

Informat

- SNMP

- Flow

LHC Data Challenge Overview

Menu: **Overview** | Interfaces | Sites | Regionals | Transatlantic | LHCOPN

This dashboard shows an overview of statistics relevant to the LHC data challenge. It containes a combination of SNMP and flow statistics from ESnet's Stardust measurement system. Use the navigation menu above this text or

› **SNMP Statistics**   *(8 panels)*
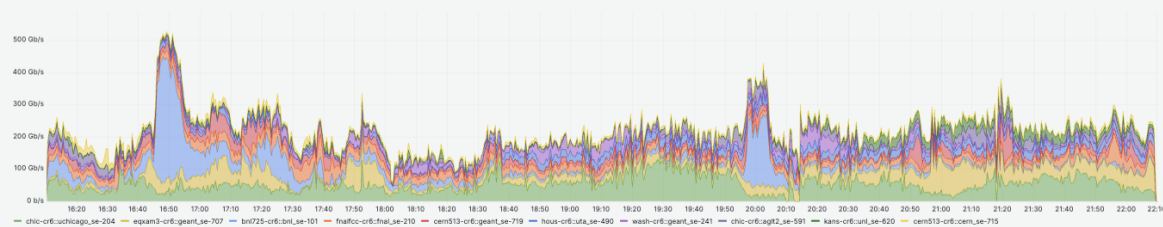
› **Flow Statistics**   *(4 panels)*

Stardust

LHC Data Challenge Overview

Menu: **Overview** | Interfaces | Sites | Regionals | Transatlantic | LHCOPN

This dashboard shows an overview of statistics relevant to the LHC data challenge. It contains a combination of SNMP and flow statistics from ESnet's Stardust measurement system. Use the navigation menu above this text or

› **SNMP Statistics**   *(8 panels)*

› **Flow Statistics**   *(4 panels)*

SNMP statistics

- Top 10 Interfaces by Incoming/Outgoing Rate (SNMP)

- Top Interfaces by Incoming /Outgoing Volume (SNMP)
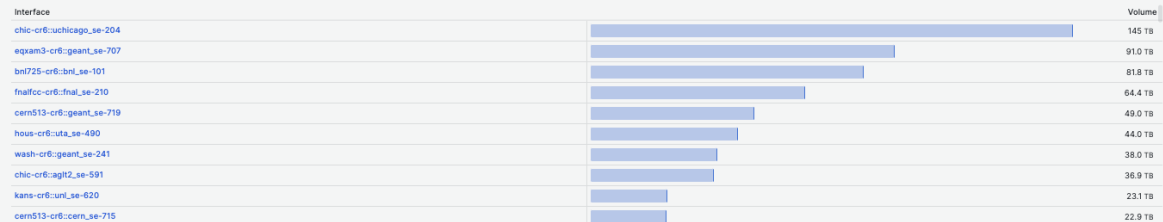
- Total Europe to US Traffic (SNMP) on Transatlantic Links

- Total US to Europe Traffic (SNMP) on Transatlantic Links

- Total Traffic CERN to US on LHCOPN Circuits

- Total Traffic US to CERN on LHCOPN Circuits

Flow statistics

- Top Site Pairs Over Time By Rate (Flow)

- Top Site Pairs By Volume (Flow)

- Top AS Pairs By Volume (Flow)

MetrANOVA

New Consortium MetrANOVA to Create a Measurement and Analysis Toolbox for Research and Education Networks Worldwide

MetrANOVA

A neutral, trusted and open consortium for
Advancing **N**etwork **O**bservation, **V**isualization, and **A**nalysis.

3 key aspects

- **Sharing** approaches / models / architectures / components / patterns / best practices…
- **Collaboration** on effective use of network measurements for network advancement
- **Education** and growth opportunities for students and staff

https://github.com/MetrANOVA

MetrANOVA Goals

Provide tools, tactics and techniques to the community

Develop and share open architectures, technical components, design patterns, best practices, and policy recommendations to create effective network measurement systems.

Facilitate the ability to generate multi-data source composite views of R&E cyberinfrastructure

- Educating the R&E community to enable effective use of network measurements for operations, engineering, planning, and outreach.
- Creating learning and growth opportunities
- As appropriate, coordinating with other community and industry efforts
- Providing the technical and policy primitives to support controlled sharing

MetrANOVA

Section 1 of 4

2024 Community Survey

B *I* <u>U</u> 🔗 T̶

This for is intended to help us better understand the state of Network Measurement and Monitoring within the Research and Education Networking community.   This data will be used to help us determine consortium priorities over the next year and beyond.   It will be shared with the community at a later date in aggregate form.

If you are interested in participating in this process directly, feel free to include your contact information but that is not required to take this survey.

Additional details on the consortium can be found here:
https://github.com/MetrANOVA

If you know anyone else who you feel should take this survey feel free to share this link.

https://tinyurl.com/57zewzde

MetrANOVA Survey

https://tinyurl.com/57zewzde

What organization are you from?

Your answer

What type of organization? *

◯ University or Campus Network

◯ Regional Network

◯ NREN

◯ Other Service Provider (including NOCs)

◯ Research Lab or Facility

◯ Other:

What are your roles? *

☐ Student

☐ Help Desk

☐ Software Engineer

☐ Security Engineer

☐ System Engineer

☐ Network Engineer

☐ User

☐ Network Researcher

☐ Leadership

☐ Other:

MetrANOVA Survey

https://tinyurl.com/57zewzde

Do you run perfSONAR to collect loss and latency measurements? *

○ Yes

○ No

○ Not sure

Is Network Flow data collected and used for analysis (IPFIX, sflow, etc) *

○ Yes

○ No

○ Not sure

Do you collect BGP peering / route feeds as a source of measurement? *

○ Yes

○ No

○ Not sure

Do you collect port level counters and stats as a source of measurement? *

○ Yes

○ No

○ Not Sure

Do you collect measurements from your Optical Systems (light levels, etc) *

○ Yes

○ No

○ Not Sure

○ Not Applicable

Do you collect host level or application level metrics (from web services, processes, etc) *

○ Yes

○ No

○ Not Sure

○ Not Applicable

MetrANOVA Survey

https://tinyurl.com/57zewzde

How many different systems are used within your organization to collect various measurements

○ All in 1 system

○ between 2 and 4 (up to one per type of data)

○ 5 or more (possibly having multiple systems collecting the same data)

How many different teams within your org collect network measurements *

○ 1 group does all of this

○ multiple groups are responsible

○ its complicated... and distributed

MetrANOVA Survey　　　　https://tinyurl.com/57zewzde

Do you have separate monitoring and measurement systems?　　　　　　　*

In this context measurement is defined as the act of collecting, ingesting, storing and possibly reporting on network measurements, where monitoring is defined as continually evaluating a set of measurement looking for those that deviate from policy and communicating that deviation often to network operators and engineers.

○ No, our monitoring functions are part of our measurment platform

○ Yes, though thats not deliberate

○ Yes, we do that for resiliency and separation

○ Yes, we do it deliberately for non-technical reasons

MetrANOVA Survey　　　　https://tinyurl.com/57zewzde

Describe your measurement technical stack in elevator pitch level of detail. List of products perfectly fine at this point.

*

Ex. We run everything on prem in VMs running Ubuntu and we rely on the Telegraph, Influx, Chronograf + Solarwinds for flow.

Long answer text

How would you describe your organization's data sharing policy in your own words (again elevator pitch level of detail)?

*

ex. We have a well defined policy, its hard for us to share outside the org but we can do so with a written agreement.

ex. We are pretty casual, generally we share interface stats externally, and avoid sharing flow. To do so would probably require something in writing but there is no precedent.

Long answer text

MetrANOVA Survey

https://tinyurl.com/57zewzde

How are the collected measurements used in the design and operations of your network today? (try to touch on biggest use cases for each source of measurement)

ex. we use SNMP data to track link usage and up down status, we have traffic map that this feeds on our web page and our monitoring system generates alarms on link down.

Long answer text

What does visualization and analysis look like at your organization?

ex. we use Grafana for various network dashboards and there are a few cron jobs that generate monthly reports.

Long answer text

MetrANOVA Survey

https://tinyurl.com/57zewzde

Do any of your systems today combine multiple sources of data or augment your
measurements with metadata from a source of truth type database?   *

*ex. yeah in our Grafana dashboards we fuse our perfSONAR and sFlow data to create a
composite view of test performance while also overlaying key port stats. This display is
organized by our customer information which is imported from our NetBox instace.*

Long answer text

⋮⋮⋮

What are your measurement pain points? What do you wish you had which is currently   *
missing?

Long answer text

MetrANOVA Survey

https://tinyurl.com/57zewzde

How would you rate the following possible development areas for the consortium? *

	Less value for me	more value for me
Data sharing policy guidance	○	○
Technical building blocks	○	○
Online content: design patterns,...	○	○
Technical assessments including ...	○	○
Training for community develop...	○	○
The creation of nearly turnkey ...	○	○

Which features / possibilities related to network measurement, monitoring, analysis and visualization would you like to have?

MetrANOVA Survey

https://tinyurl.com/57zewzde

Does any of the above sound like something you or your organization might be interesting working with MetrANOVA on?
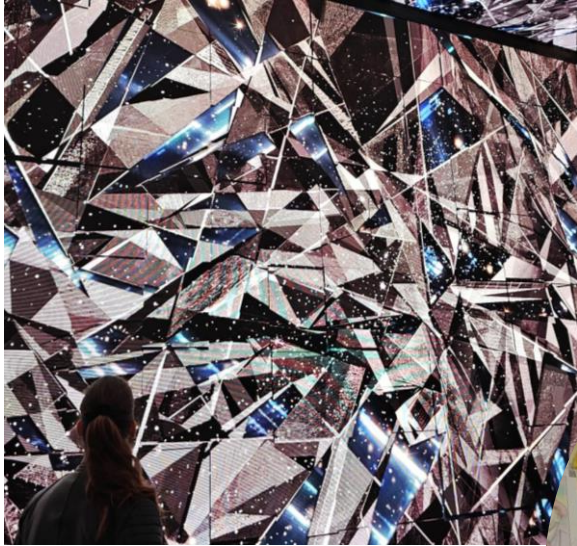
If yes, can please share contact info, or email ebalas@es.net separately

Short answer text

Is there anything else you might want to share not already covered?

Long answer text

Next Steps for MetrANOVA

Survey results analysis

Next Steps for MetrANOVA

- Considering
    open architectures, technical components, design patterns, best
    practices, and policy recommendations
based on
    existing systems, expertise and experience from the Consortium partners

- Dissemination activities:

    - Presentation at TNC24

    - Other events

NETDEV Incubator

NETDEV Incubator

A mechanism to include new work during the project

A simple proposal procedure following simple rules

A proposed project MUST be:

Relevant to the NETDEV project (GN5-1 WP6)

SMART: *Specific, Measurable, Achievable, Resource- and Time-bound*

With evident interest for the results from the community

Incubator projects so far:

- Optical Time and Frequency Networks - *finished*

- Fibre Sensing focus group – *finished*

- Workflow Orchestrator Telemetry Module – *ongoing*

- AI ChatBot for the Network Automation eAcademy - *proposed*

https://wiki.geant.org/display/NETDEV/NETDEV+Incubator

Events

Forthcoming Events

April

- 18 April, <u>OAV Architecture Workshop</u> (Brussels, Belgium)

May

- 7-8 May, <u>20th SIG-NOC Meeting</u> (Helsinki, Finland)
- 14-16 May, <u>4th European perfSONAR User Workshop</u>
  (Trondheim, Norway)

June

- 10-14 June, <u>TNC24</u> (Rennes, France)
  - NETDEV, perfSONAR, RARE, nmaas, GP4L,
  - GNA-G, MetrANOVA
  - … and more

Thank You!

netdev@lists.geant.org

Co-funded by
the European Union