



SIG-NOC Tools Survey

Maria Isabel Gandía Carriedo, CSUC

19th SIG-NOC Meeting
14 November 2023, HEAnet Offices, Dublin

Ευχαριστώ
 Tack
 Spasibo
 Grazie
 Arigato
 Merci
 Thankyou
 شكرا
 Hvala
 ago
 Danke
 Vinaka
 Maake
 Dank
 Grazas
 Obrigado
 agat
 hAKKa
 Dankon
 谢谢

Previous Work

- 1st Survey: July-October'11, published January'12.
 - NOCs' taxonomy, structures, resources, tools, standards...
 - 14 functions
 - 53 questions, 43 valid responses
 - Open boxes to add feedback
- 2nd Survey: December'15-February'16, published in June'16.
 - Tools, standards
 - 15 functions (14 + DDoS Mitigation)
 - 35 questions (66), 64 valid responses
 - Rating on importance (low/low-mid/mid-high/high) & quality (poor/fair/average/good/excellent)
- 3rd Survey: July-September'19, published in November'19.
 - Tools, standards
 - 16 functions (15 + Orchestration, Automation and Virtualisation)
 - 35 questions (74), 63 valid responses
 - Rating on importance (low/low-mid/mid-high/high) & quality (poor/fair/average/good/excellent)

The 4th SIG-NOC Tools Survey

- May-October'23, published in November'23.
 - Tools, standards
 - 17 functions (16 + Training)
 - 37 questions (82), 65 valid responses (79 responses, not all them valid*)
 - Rating on importance (low/low-mid/mid-high/high) & quality (poor/fair/average/good/excellent)

*What is an invalid response?

- No answers given
- Only a "Yes" in one section (usually monitoring) with no rating for tools
- No valid name / dummy name
- Duplicated (only one institution that answered twice but informed about different departments being responsible for different functions was kept)



Structure of the Survey

For each one of the functions:

- Short definition of <function>
- Is your NOC responsible for <function>?
 - Yes → You were asked the questions below
 - No → Jump to the next function
- What tools do you use for <function>?
 - How important is this tool for your NOC?
 - How would you rate this tool for <function>?



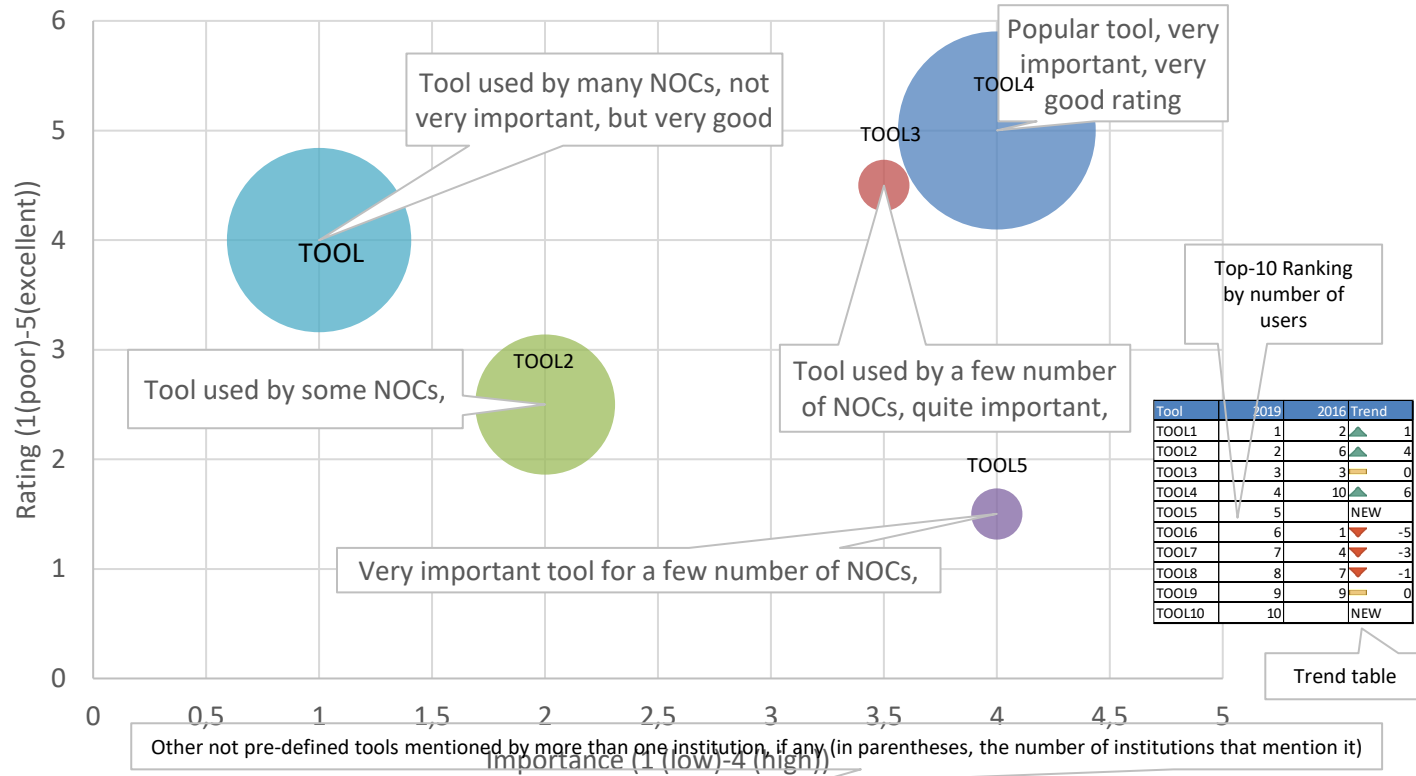
The pre-defined responses in the survey were all the tools that were rated or mentioned by two or more respondents in the 2019 survey



Open boxes allowed adding other tools, including in-house developed solutions, for each function.

The screenshot shows a survey interface for 'SIG-NOC Tools Survey 2019'. The current question is '13. Communication, Coordination & Chat tools'. It asks: 'What tools do you use for Communication, coordination, chat? If you don't rate it, it means that you don't use it.' Below this, there are two columns of questions: '19. How important is this tool for your NOC?' and '20. How would you rate this tool for Communication, coordination, chat?'. Each column has a list of tools with corresponding radio buttons for rating. The tools listed are Audium, E-mail, IM, IRC, JABBER, Landline, MAILING LISTS, Mobile, SKYPE, SLACK, TWITTER, WHATSAPP, and WIKI. Below the lists are two text boxes for 'Other (please specify as many tools as you miss here)'. At the bottom, there is a question '21. In-house developed tool (please specify):' with a text box. Navigation buttons 'Prev' and 'Next' are at the bottom right.

Analysis of the Responses How-To



Other tools: TOOL11 (5), TOOL12 (4), TOOL13(4), TOOL14 (2), TOOL15 (2), TOOL16 (2)

Analysis of the Matrix How-To

- The Matrix contains the number and the institutions that use each tool for each function.
- If you download the matrix and go to each cell with a number, you get the list of institutions that use it and that are ok with publishing the information.

	ANSIBLE	ARBOR	ARS (REMEDY)	ADIUM	BGP FLOWSPEC	BGP MON	BOX	BWCTL	CA SPECTRUM	CACTI
# FUNCTIONALITIES	1	3	1	1	1	2	1	1	1	3
MONITORING		17				20				30
PROBLEM MANAGEMENT										
TICKETING			3							
REPORTING AND STATISTICS		10							4	21
CONFIGURATION MANAGEMENT AND BACKUP										
KNOWLEDGE MANAGEMENT AND DOCUMENTATION							3			



Analysis of the Matrix How-To

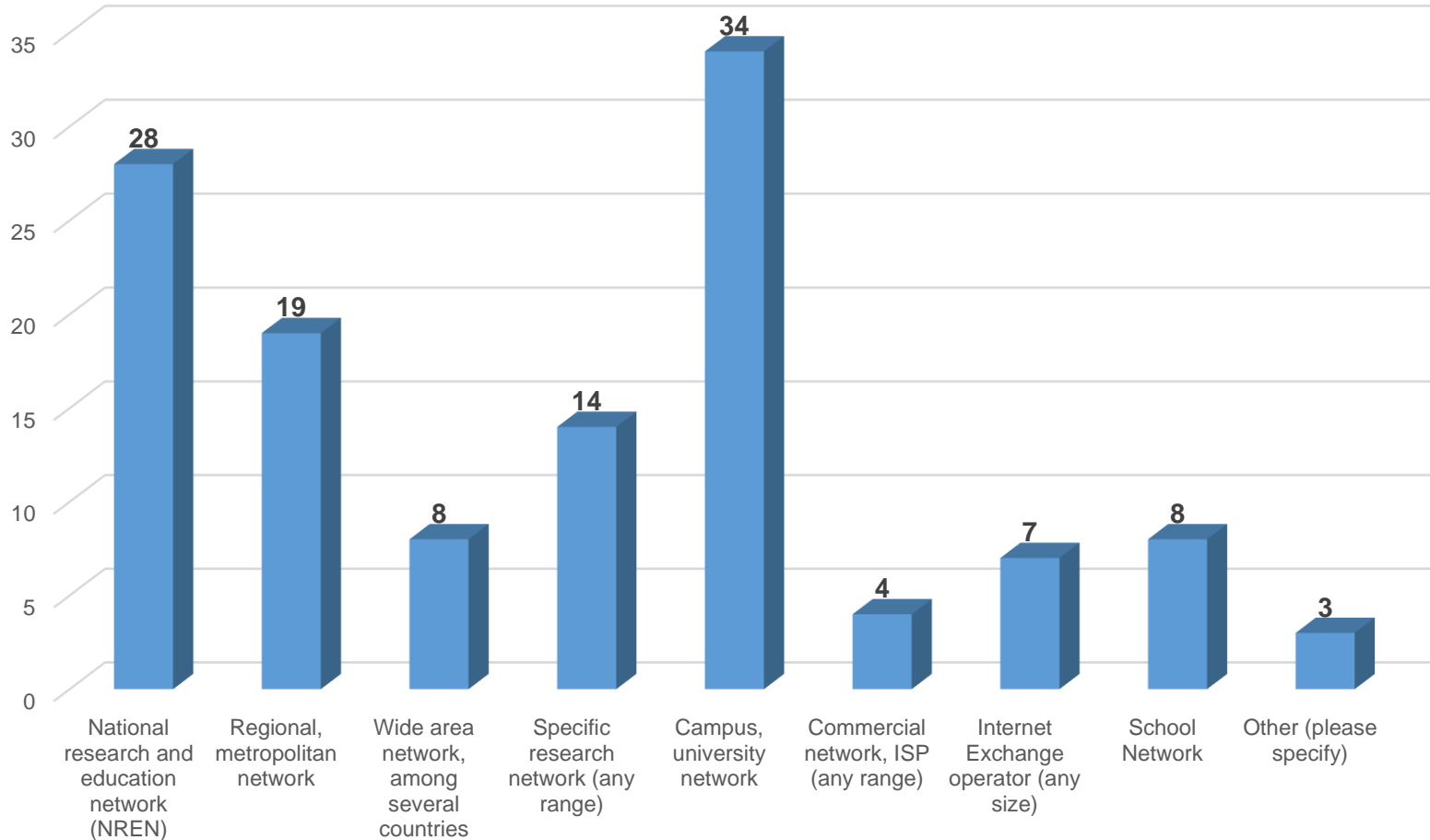
- The Matrix contains the number and the institutions that use each tool for each function.
- If you download the matrix and go to each cell with a number, you get the list of institutions that use it and that are ok with publishing the information.

	ANSIBLE	ARBOR	ARS (REMEDY)	ADIUM	BGP FLOWSPEC	BGP MON	BOX	BWCTL	CA SPECTRUM	CACTI
# FUNCTIONALITIES	1	3	1	1	1	2	1	1	1	3
MONITORING		17				20				30
PROBLEM MANAGEMENT										
TICKETING			3							
REPORTING AND STATISTICS		10							4	21
CONFIGURATION MANAGEMENT AND BACKUP										
KNOWLEDGE MANAGEMENT AND DOCUMENTATION							3			
PERFORMANCE MANAGEMENT								8		
SECURITY MANAGEMENT					10					
INVENTORY MANAGEMENT										
COMMUNICATION, COORDINATION AND CHAT				2						

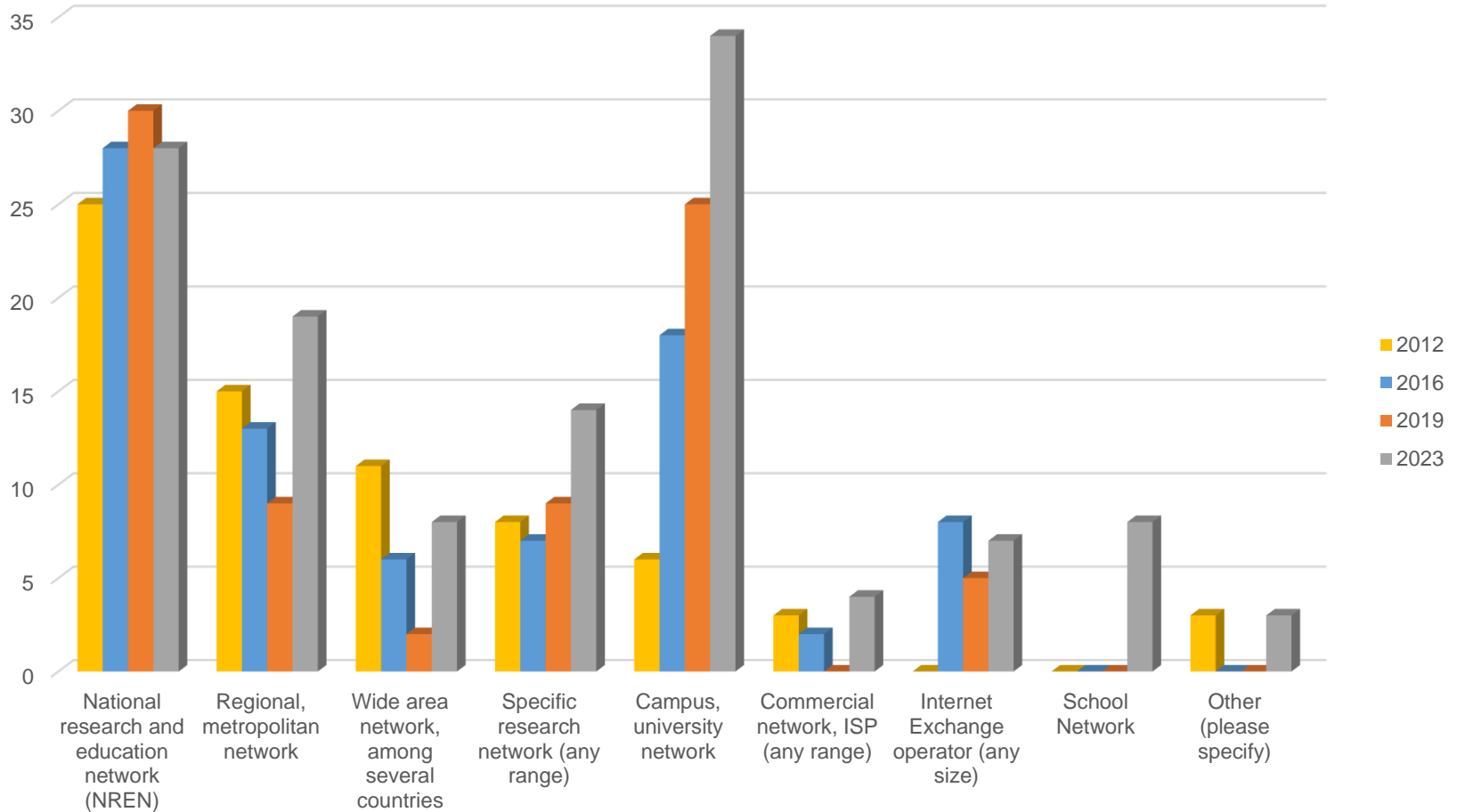
SIG-NOG K4

- Academic and Research Network of Slovenia (ARNES)
- CAR
- CELLS - ALBA Synchrotron
- CSUC
- CYNET
- DFN
- EHU/UPV
- FCT/FCCN
- GEANT
- GRENA
- GRNET
- IIAP NAS RA (ASNET-AM)
- itacyl
- Pompeu Fabra University (UPF)
- RedIRIS
- RENAM
- RNP
- SUNET

















Type (range) of the network that your organization is responsible for



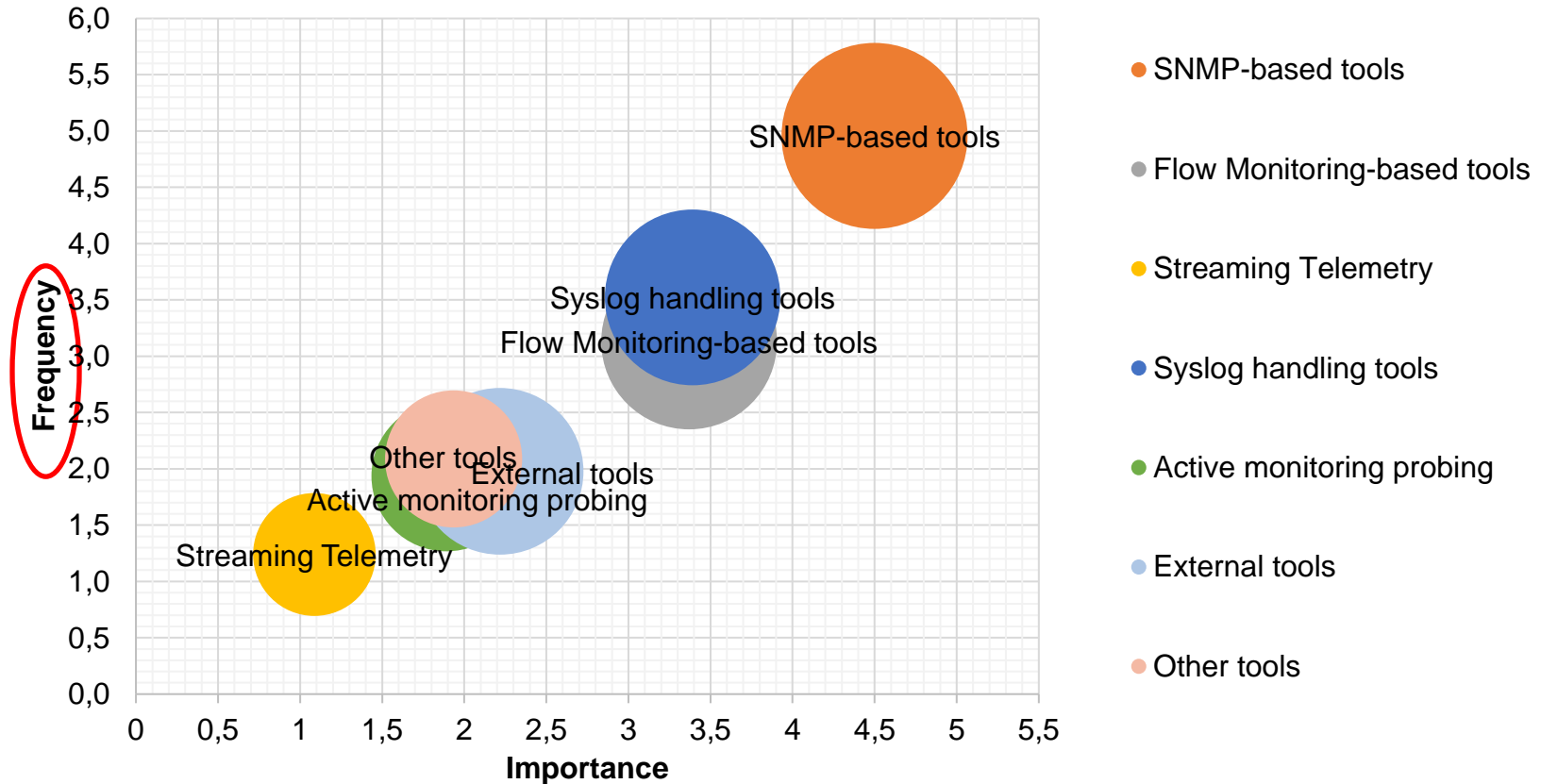
Type (range) of the network that your organization is responsible for



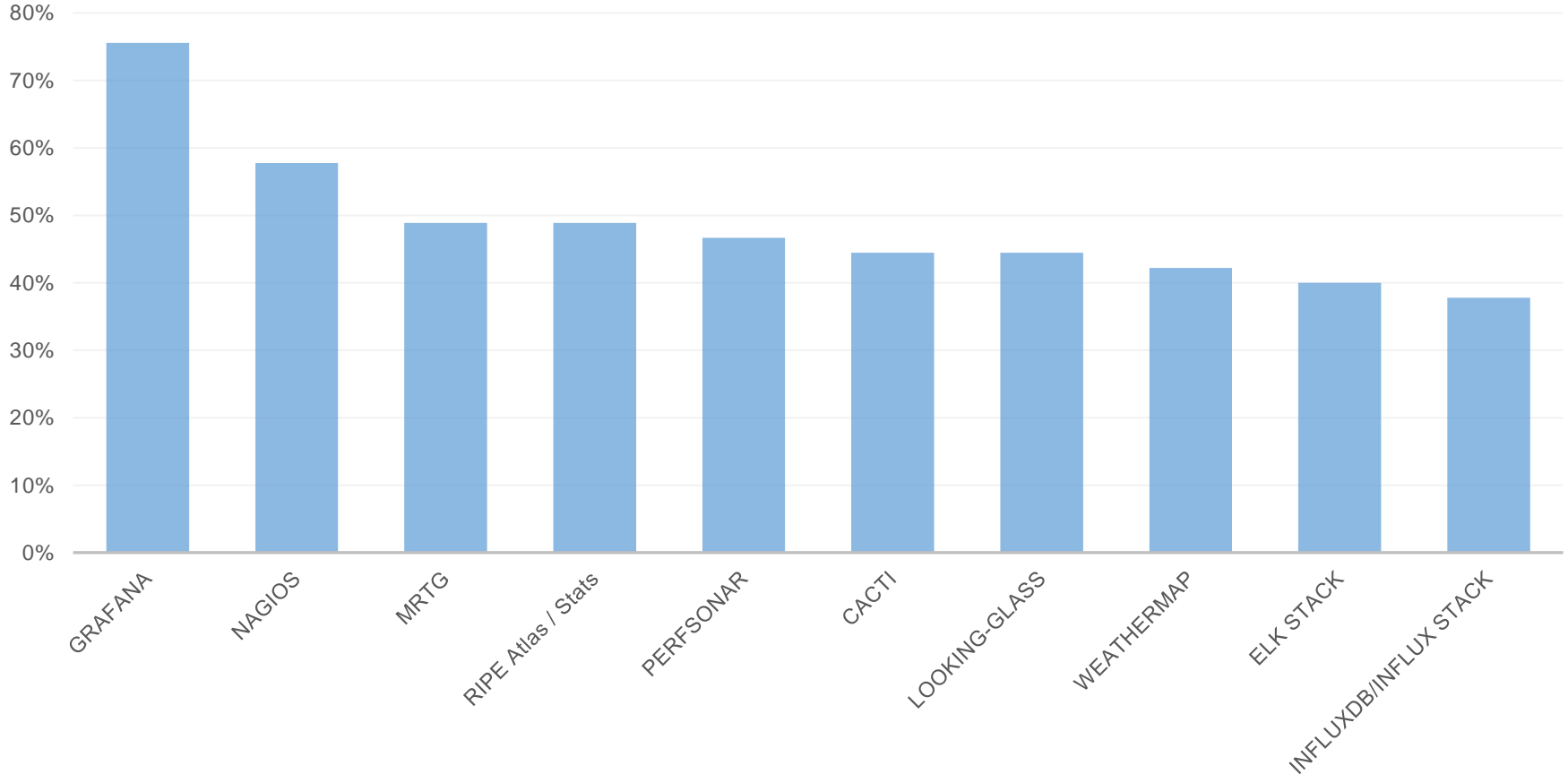
NOC Functions

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

Monitoring Tools: Importance & Frequency for each Type of Methodology



Monitoring: Percentage of Users per Tool (Top-10)



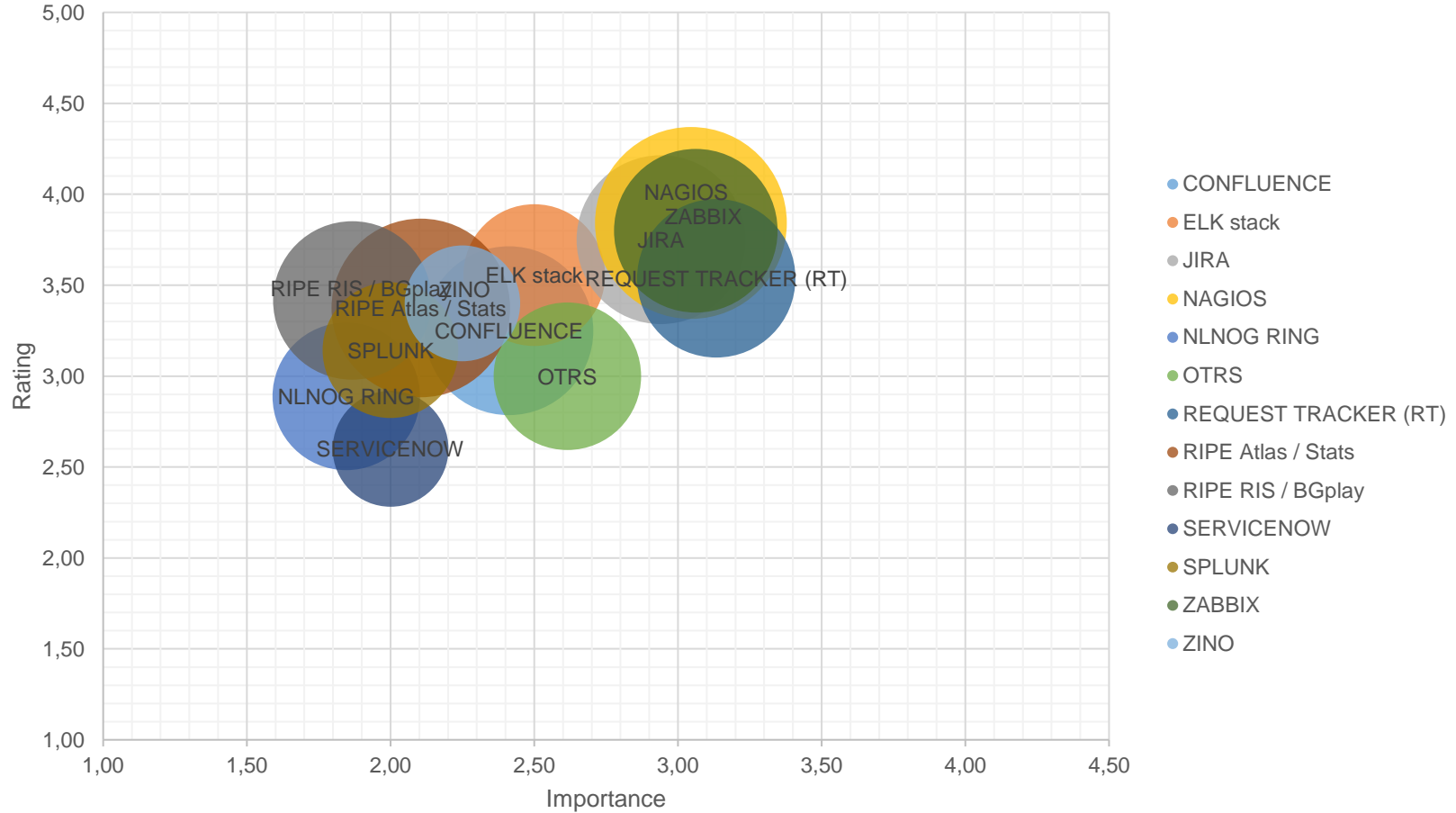
On average, each institution uses 11.5 different tools for monitoring

Trends for Monitoring – Top 10

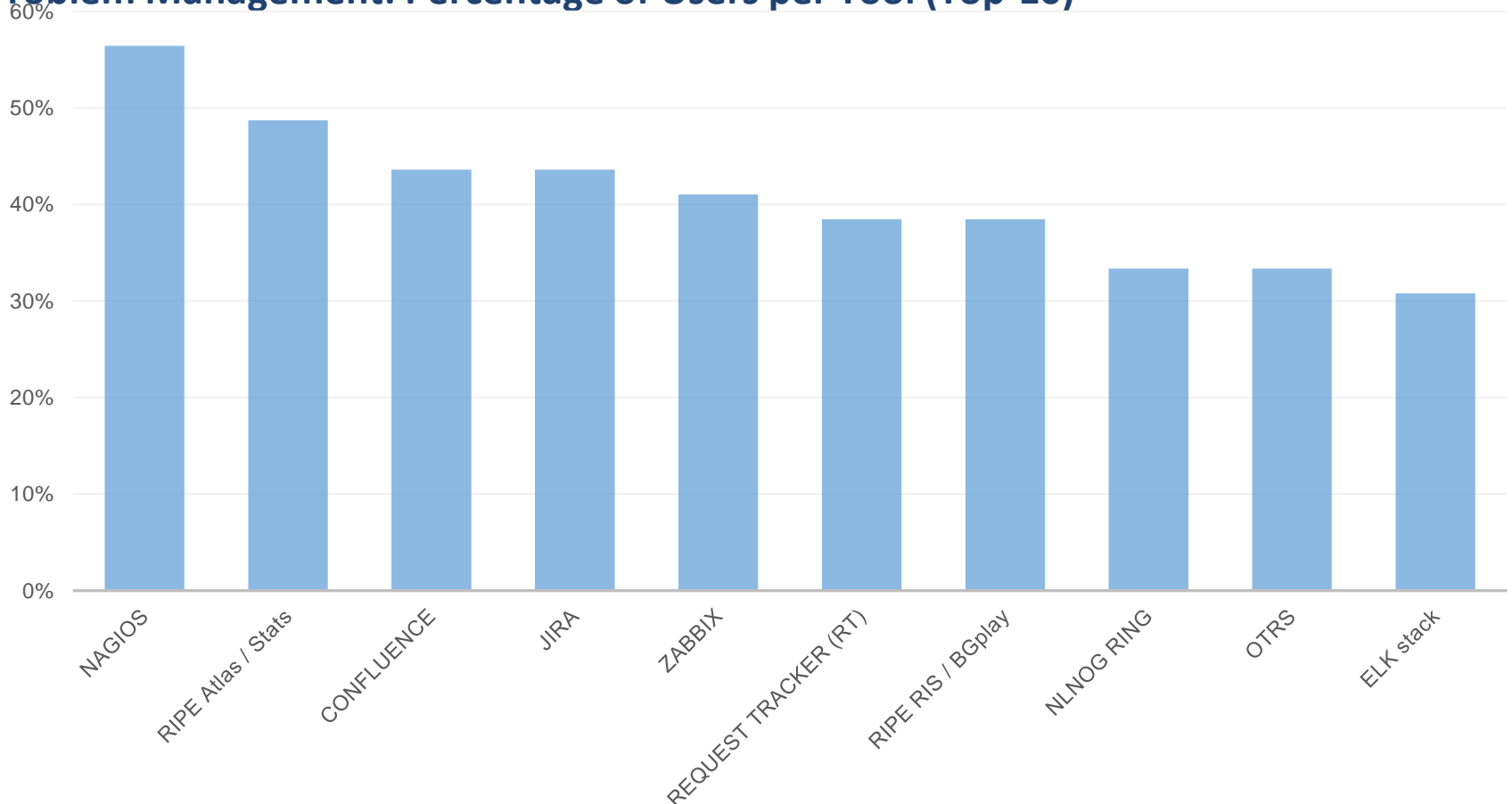
Tool	2016	2019	2023	Trend
GRAFANA			1	NEW
NAGIOS	2	1	2	▼ -1
MRTG	6	6	3	▲ 3
RIPE Atlas / Stats	4	7	4	▲ 3
PERFSONAR	11	12	5	▲ 7
CACTI	1	3	6	▼ -3
LOOKING-GLASS	3	2	7	▼ -5
WEATHERMAP		4	8	▼ -4
ELK STACK		5	9	▼ -4
INFLUXDB/INFLUX STACK			10	NEW
NFSEN		11	11	▬ 0

- First appearance of Grafana, directly to the first position.
- Nagios and Cacti are still popular, with MRTG going up.
- perfSONAR takes off and reaches the Top-10 for the first time.
- Smokeping and NFDUMP disappear from the Top-10 (but they are close)

Problem Management Tools



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



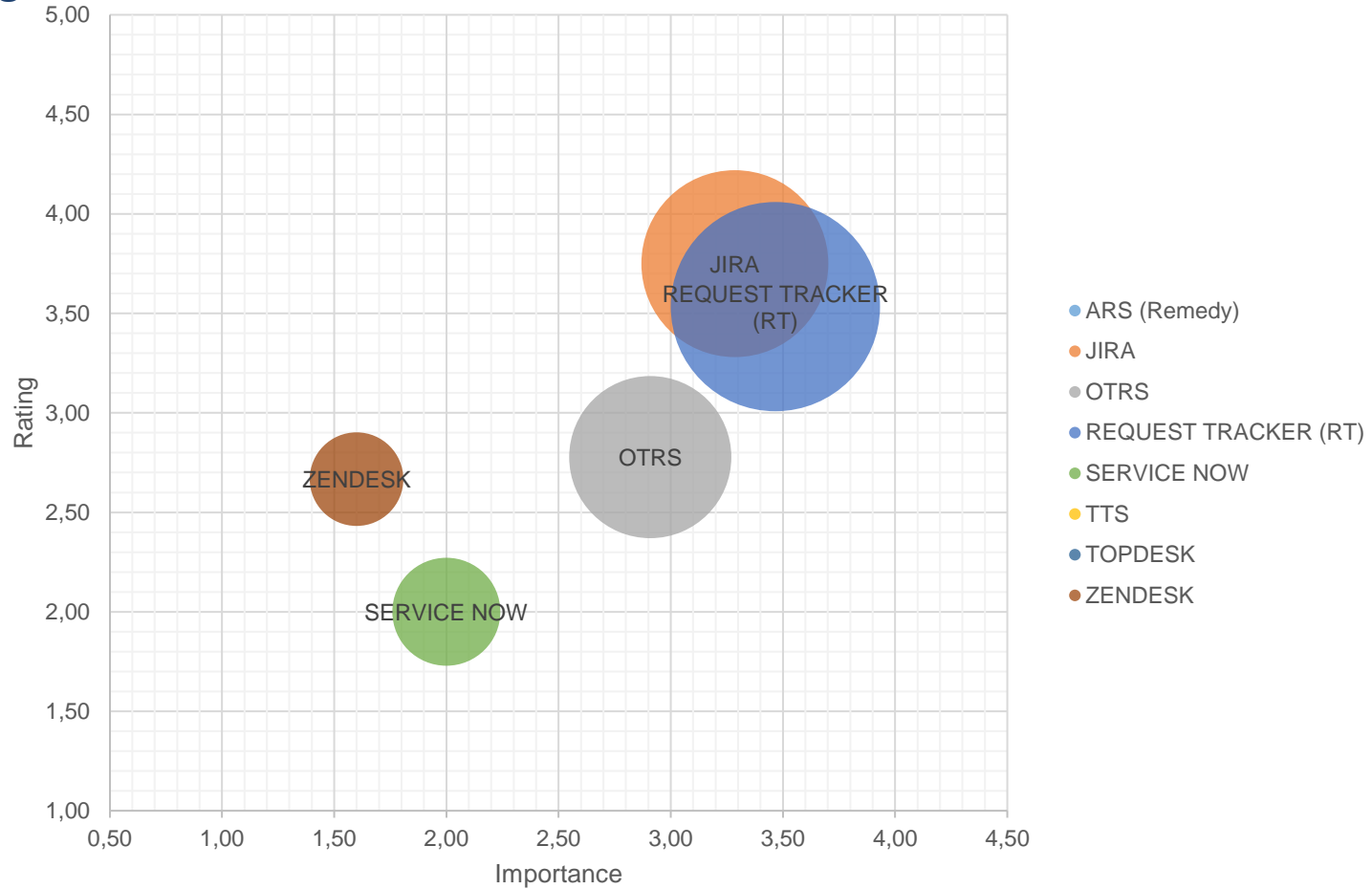
On average, each institution uses 4.7 different tools for problem management

Trends for Problem Management – Top 10

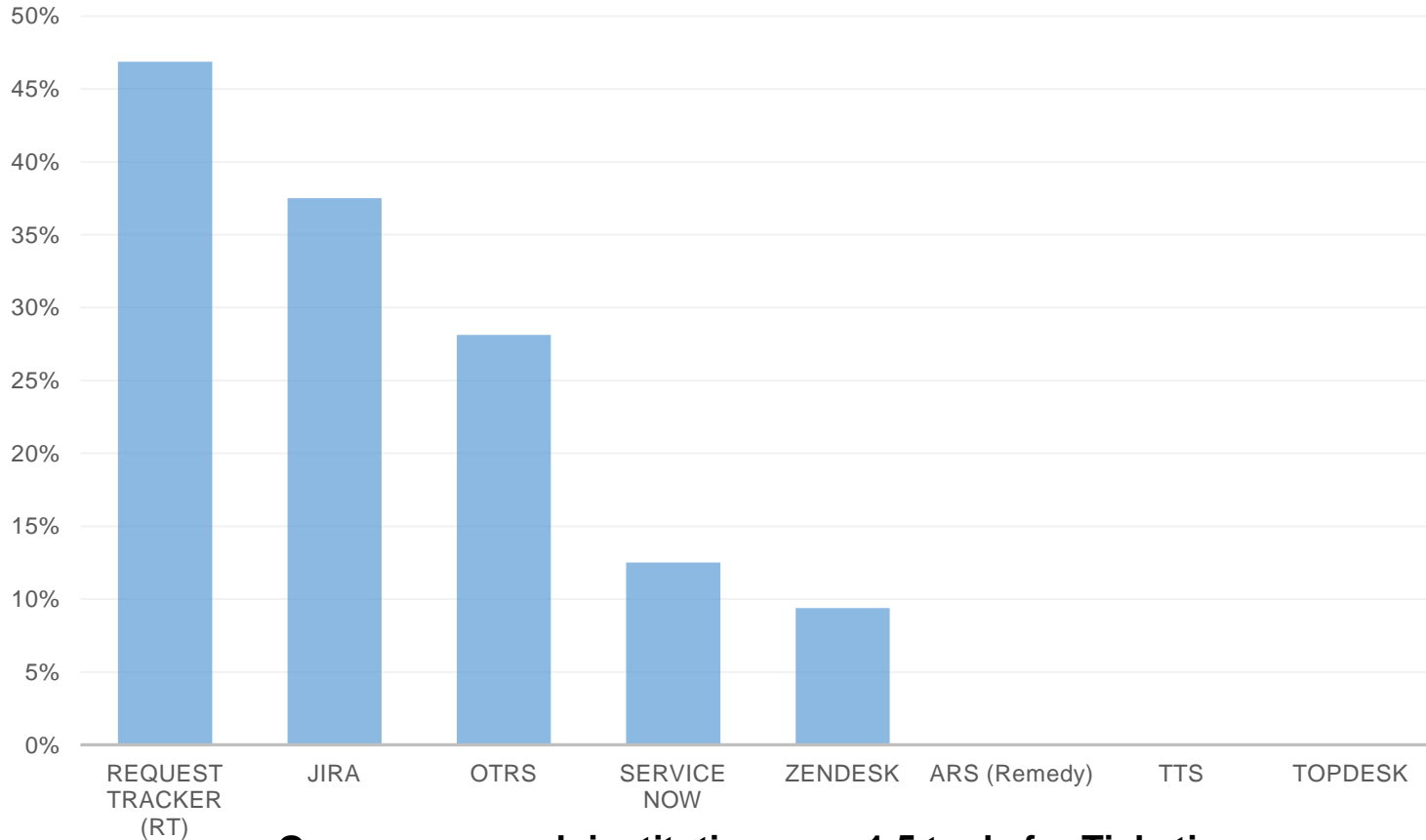
Tool	2016	2019	2023	Trend	
NAGIOS	1	2	1	▲	1
RIPE Atlas / Stats	3	6	2	▲	4
CONFLUENCE		4	3	▲	1
JIRA	11	1	4	▼	-3
ZABBIX	8	5	5	▬	0
REQUEST TRACKER (RT)	2	9	6	▲	3
RIPE RIS / BGplay	5	7	7	▬	0
NLNOG RING	7	10	8	▲	2
OTRS	4	8	9	▼	-1
ELK stack	9	3	10	▼	-7

- Mix of open-source / vendor-based and distributed tools.
- Increasing usage of RIPE Atlas / Stats.
- Jira goes down from the 1st to the 3rd / 4th position.
- Less usage of the ELK stack (but still 31% of the respondents use it)

Ticketing Tools








Ticketing Tools: Percentage of Users per Tool (Top-5)



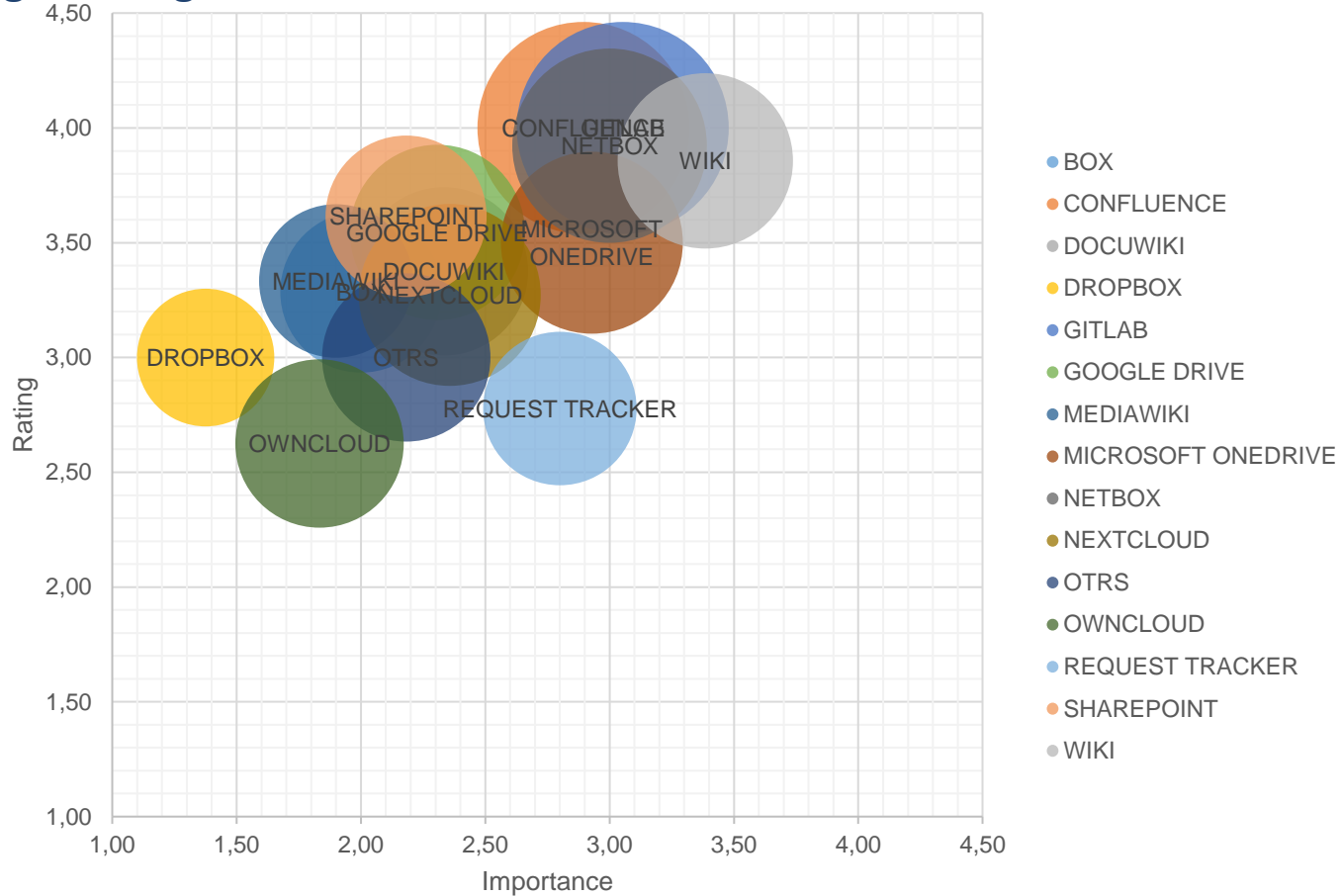
On average, each institution uses 1.5 tools for Ticketing

Trends for Ticketing Tools – Top 5

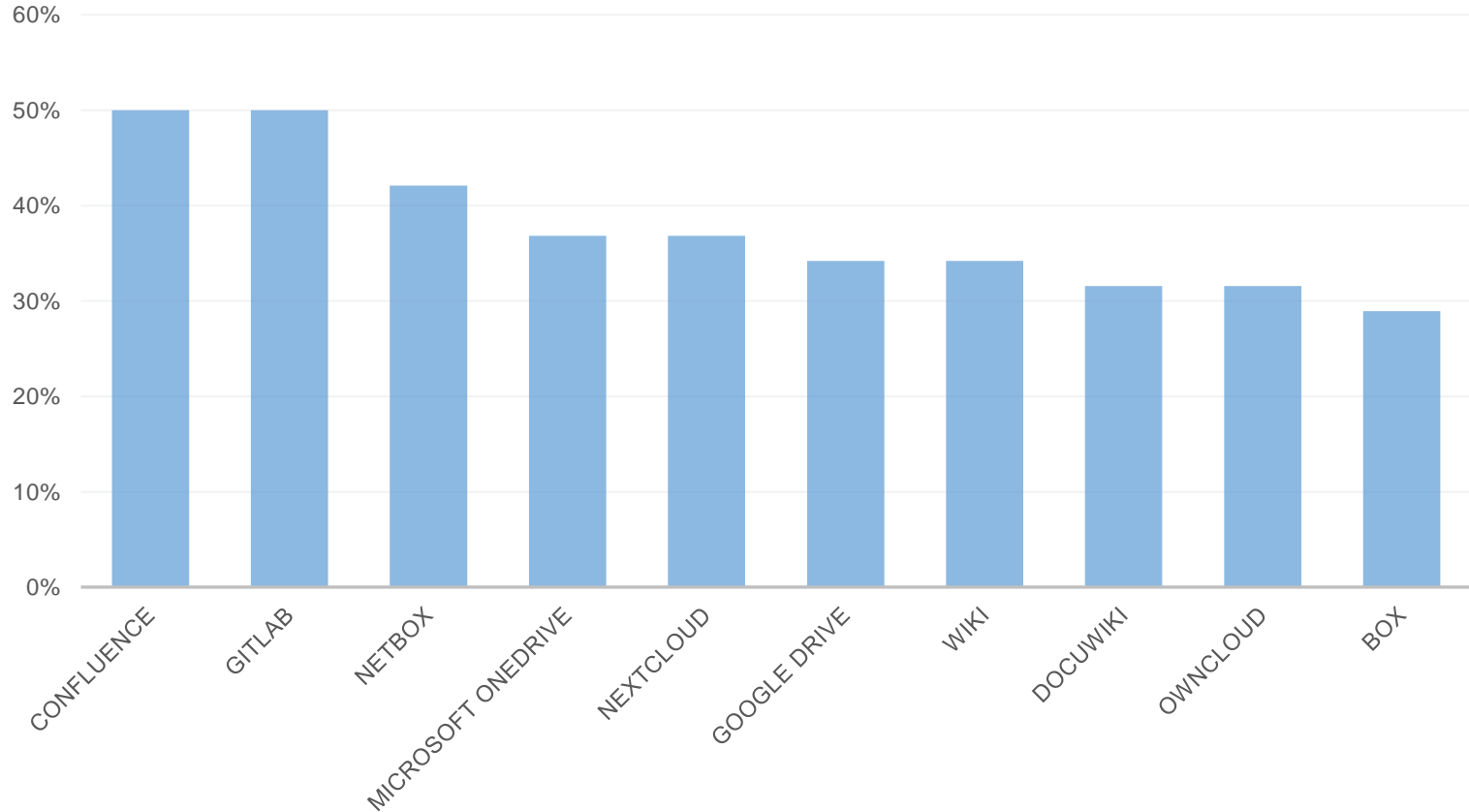
Tool	2016	2019	2023	Trend
REQUEST TRACKER (RT)	1	3	1	 2
JIRA	3	1	2	 -1
OTRS	2	2	3	 -1
SERVICE NOW	5	4	4	 0
ZENDESK		5	5	 0
ARS (Remedy)	4	6		
TTS	6	7		
TOPDESK		8		

- Request tracker goes back to the first position after being replaced by Jira in 2019.
- Not even the most popular tool reaches 50% of the respondents for this question.
- ARS Remedy disappears, but 1 respondent mentions RemedyForce (the cloud version)
- Other tools mentioned once: ProactivaNet and Youtrack.

Knowledge Management and Documentation Tools










Knowledge Management and Documentation Tools: Percentage of Users per Tool (Top-10)



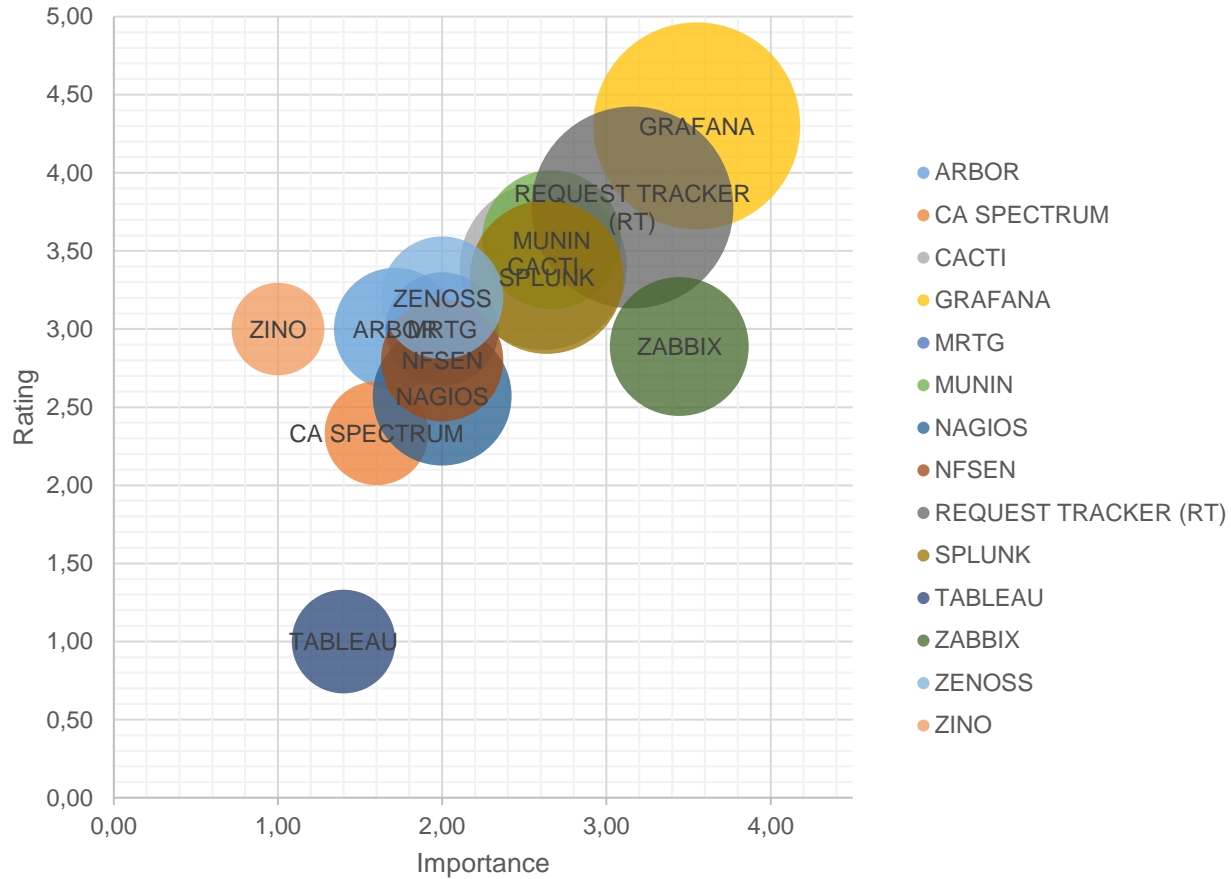
On average, each institution uses 5.2 tools for Knowledge Management

Trends for Knowledge Management and Documentation – Top 10

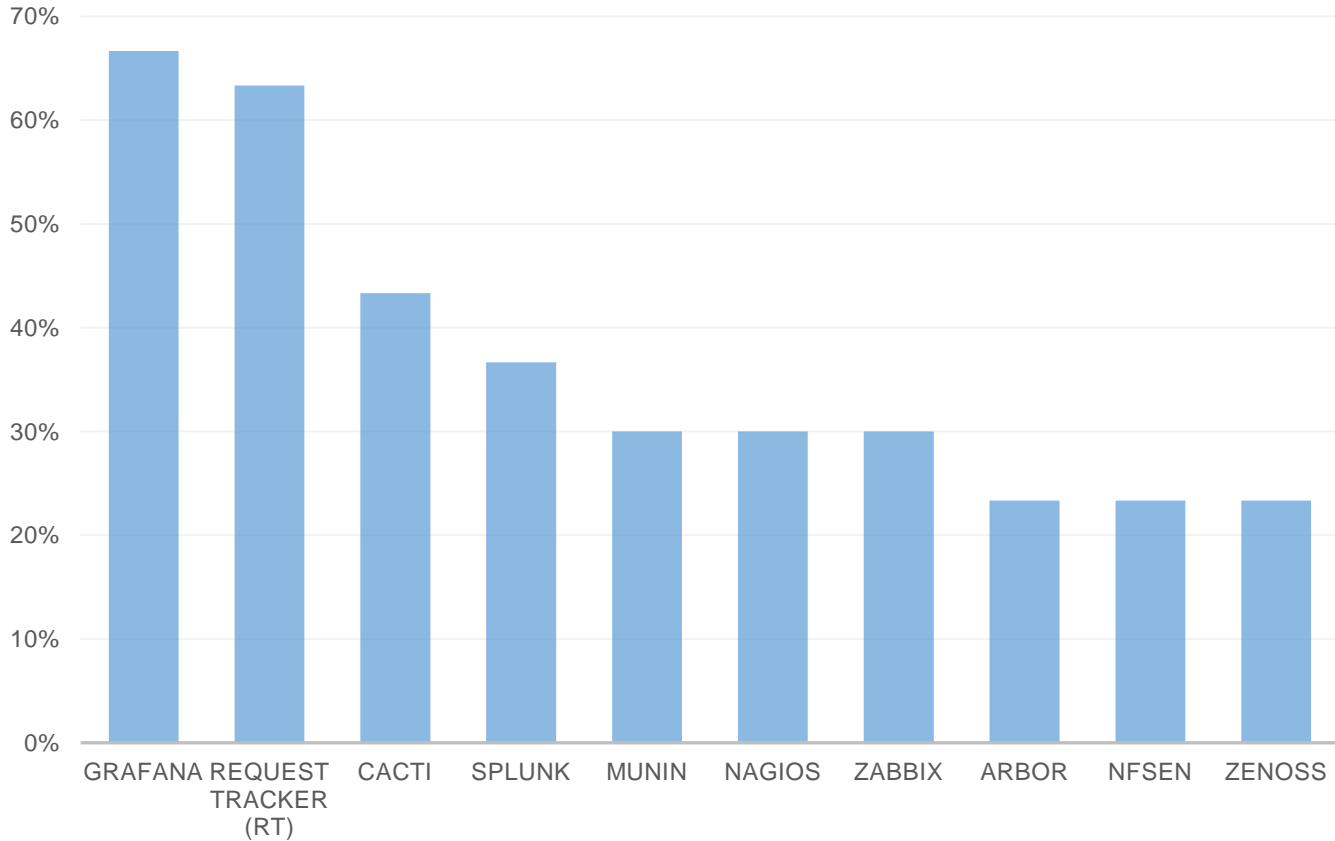
Tool	2016	2019	2023	Trend
CONFLUENCE	5	1	1	 0
GITLAB			2	NEW
NETBOX			3	NEW
MICROSOFT ONEDRIVE	10	4	4	 0
NEXTCLOUD			5	NEW
GOOGLE DRIVE		2	6	 -4
WIKI	1	3	7	 -4
DOCUWIKI	6	7	8	 -1
OWNNCLOUD	9	5	9	 -4
BOX		12	10	 2

- Confluence remains on the first position
- New tools appear in the upper part of the Top-10: Gitlab, Netbox, Nextcloud.
- Several tools going down: Google Drive, Wiki and Owncloud go 4 positions down.
- OTRS, Sharepoint, Mediawiki, Request Tracker and Dropbox disappear from Top-10.

Reporting and Statistics Tools













Reporting and Statistics Tools: Percentage of Users per Tool (Top-10)



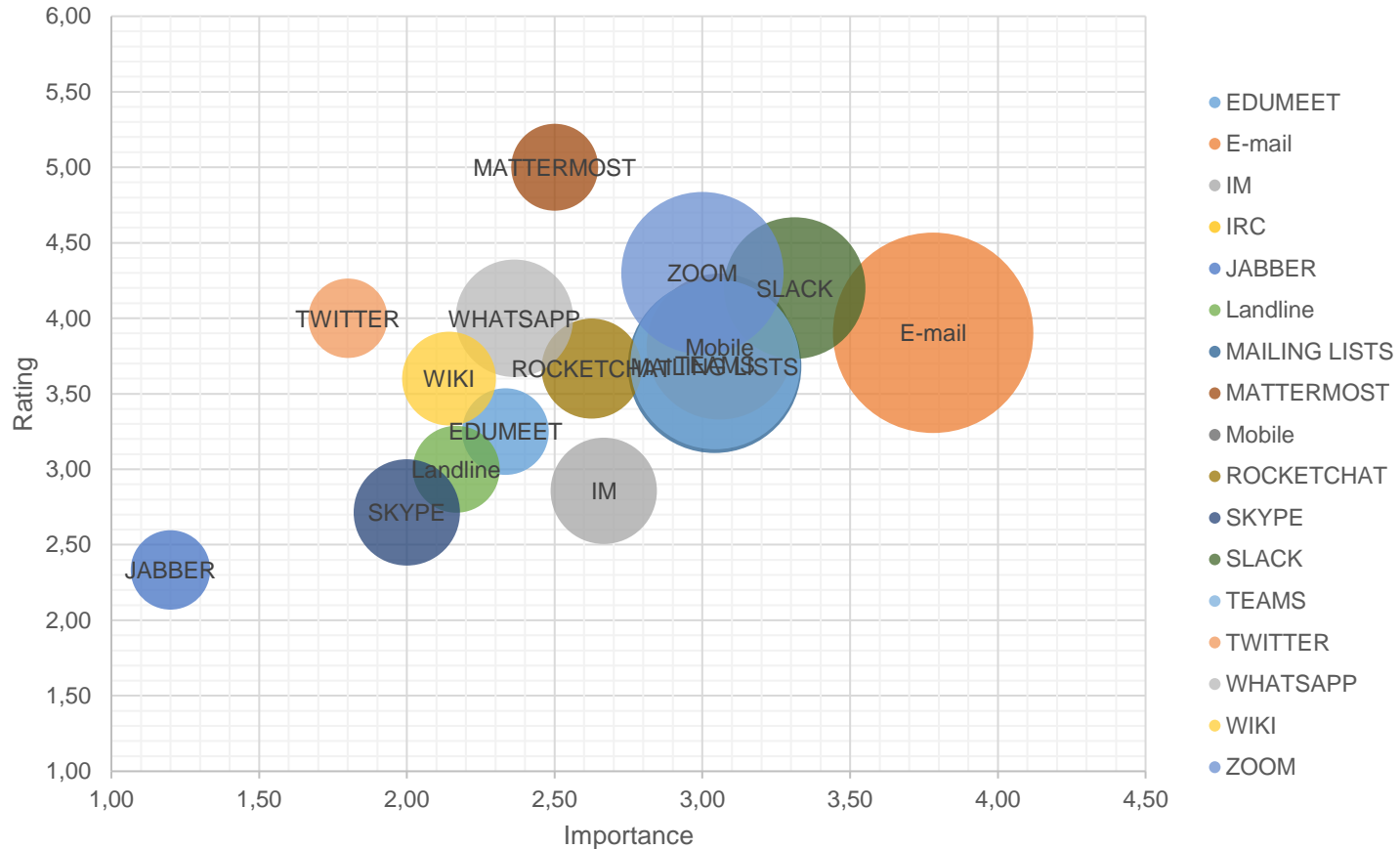
On average, each institution uses 4.4 tools for Reporting and Statistics

Trends for Reporting and Statistics – Top 10

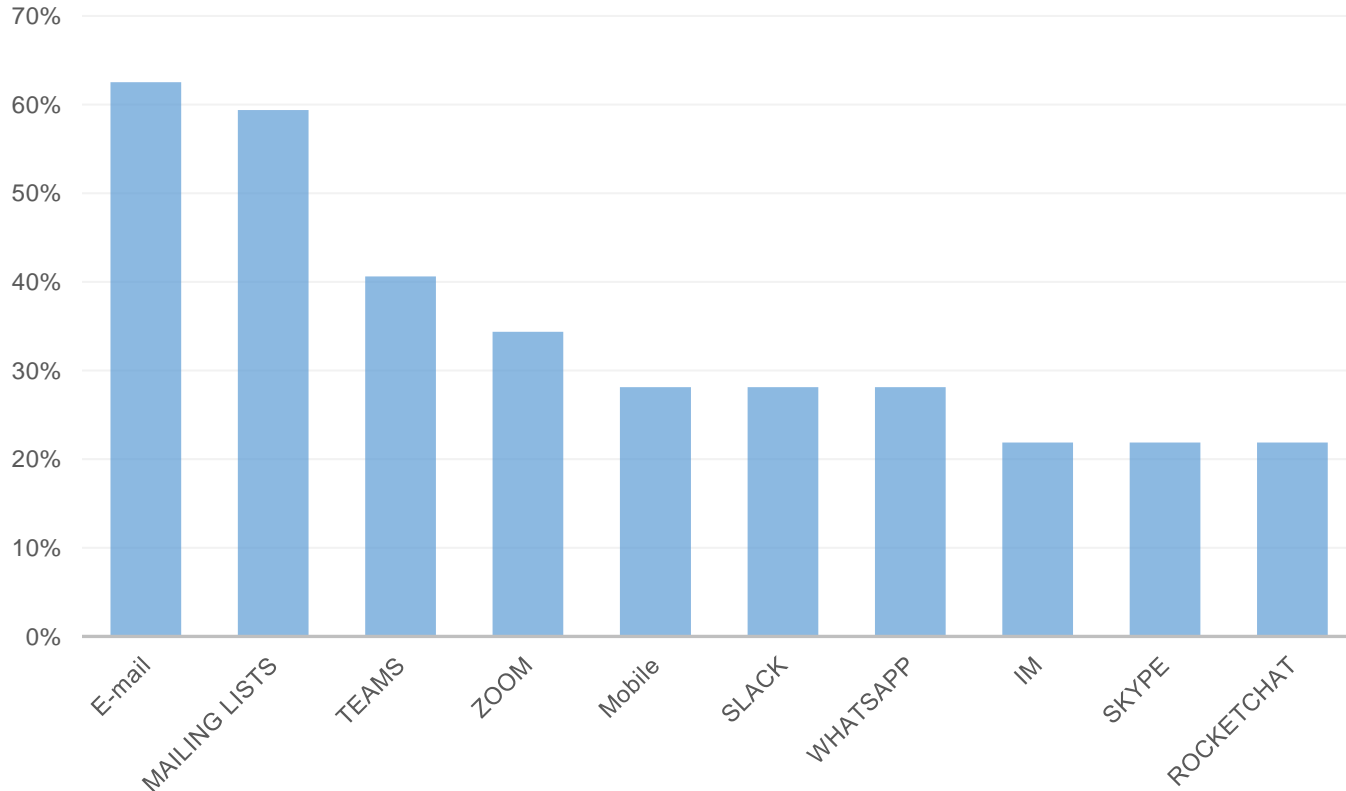
Tool	2016	2019	2023	Trend
GRAFANA	5	1	1	 0
REQUEST TRACKER (RT)	12	9	2	 7
CACTI	1	2	3	 -1
SPLUNK	8	8	4	 4
MUNIN	6	11	5	 6
NAGIOS	3	4	6	 -2
ZABBIX	13	5	7	 -2
ARBOR	7	6	8	 -2
NFSEN	4	7	9	 -2
ZENOSS	9	13	10	 3

- Grafana is again the most popular tool, shortly followed by Request Tracker.
- Increasing usage of Splunk and Munin.

Communication, Coordination and Chat Tools – Bi-directional










Communication, Coordination and Chat Tools (Bi-directional) Tools: Percentage of Users per Tool (Top-10)



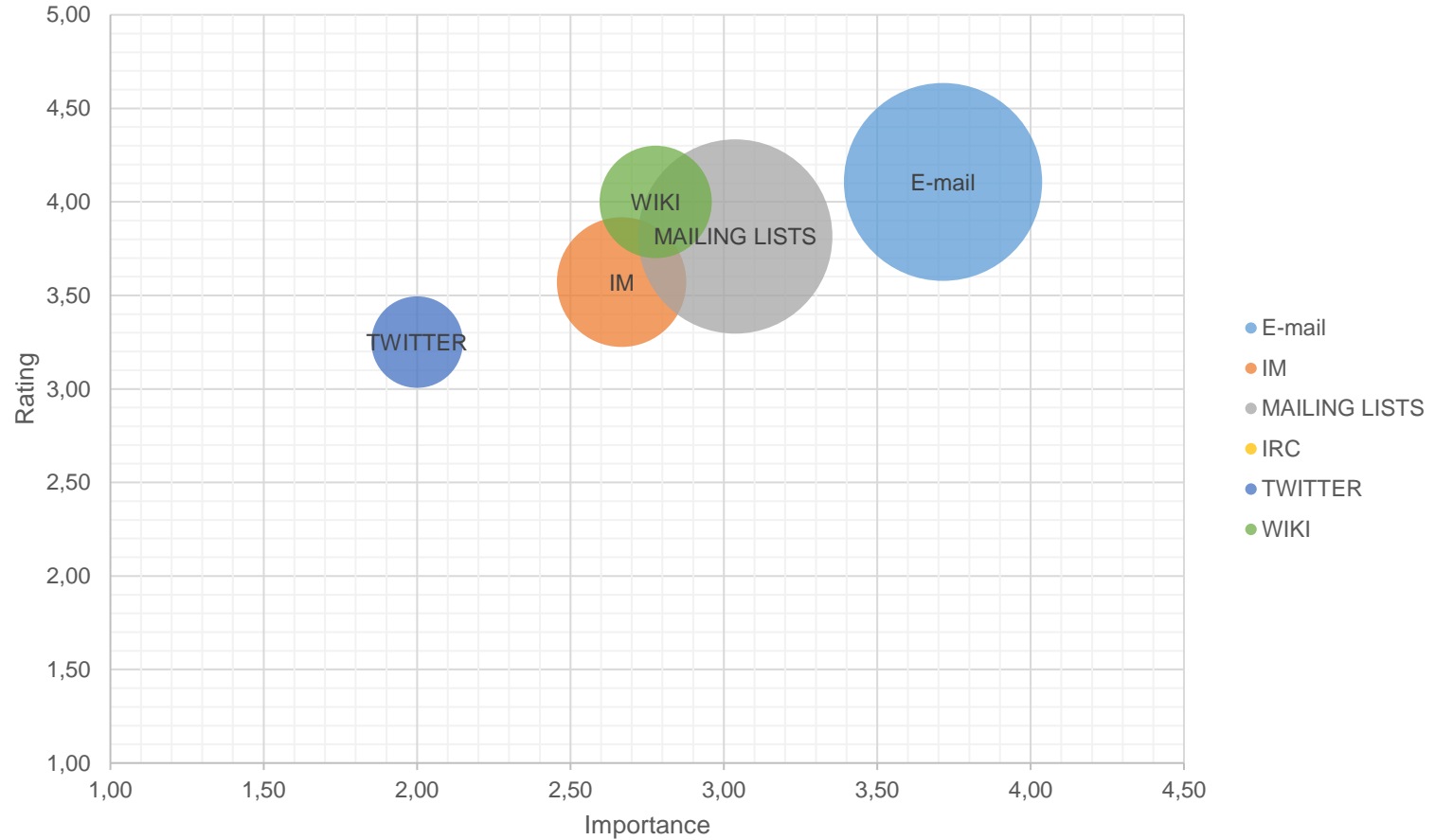
On average, each institution uses around 6.4 tools for Bidirectional Communication, coordination & Chat

Trends for Communication, Coordination and Chat Tools – Bi-directional – Top 10

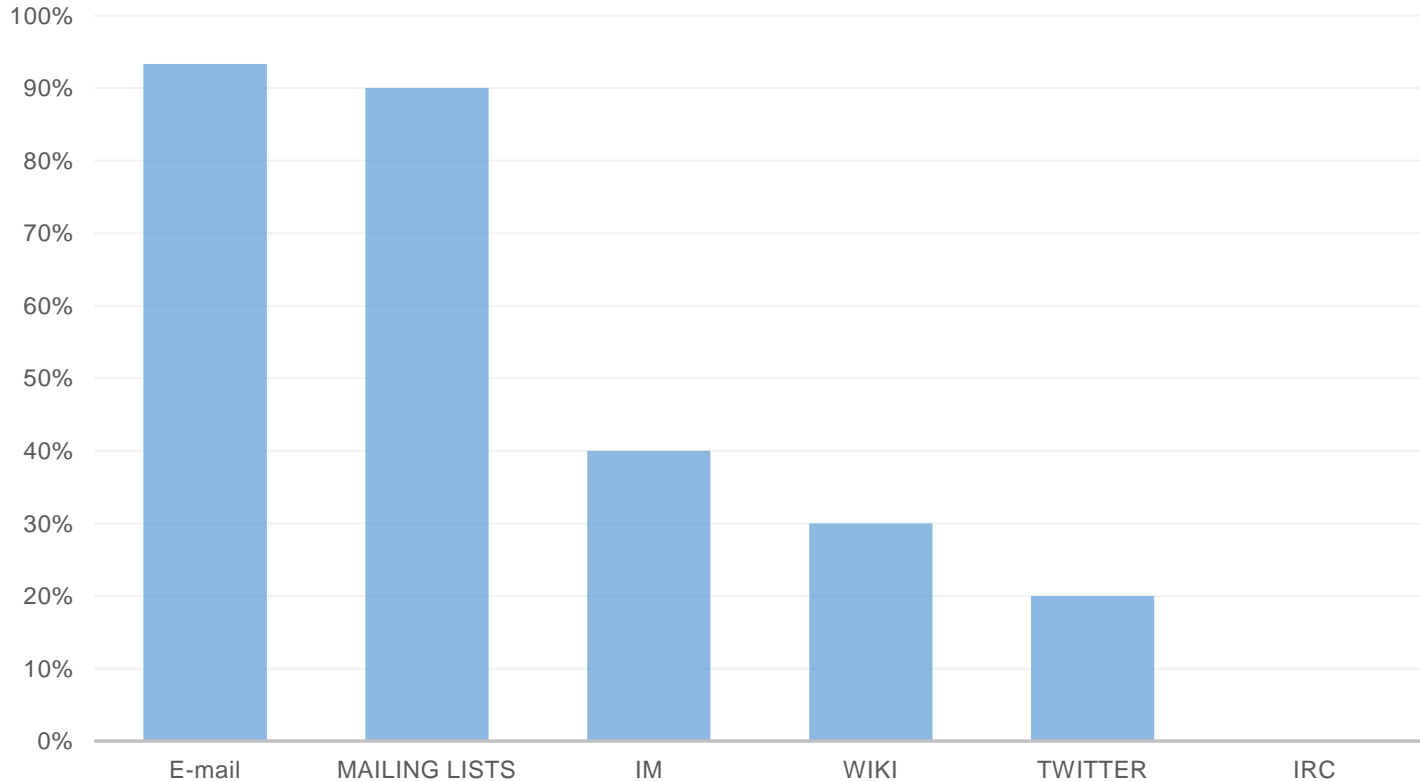
Tool	2016	2019	2023	Trend
E-mail	1	1	1	 0
MAILING LISTS	2	2	2	 0
TEAMS			3	NEW
ZOOM			4	NEW
Mobile	5	3	5	 -2
SLACK	12	8	6	 2
WHATSAPP	10	7	7	 0
IM	7	11	8	 3
SKYPE	4	6	9	 -3
ROCKETCHAT			10	NEW

- We still use traditional e-mail-based tools for communication (E-mail and mailing lists).
- More relevance of asynchronous chat tools.
- Telephone calls are less relevant. Landline is even out of the Top-10.
- Edumeet is on the 12th position.

Communication, Coordination and Chat Tools – Uni-directional









Communication, Coordination and Chat Tools (Uni-directional) Tools: Percentage of Users per Tool (Top-5)



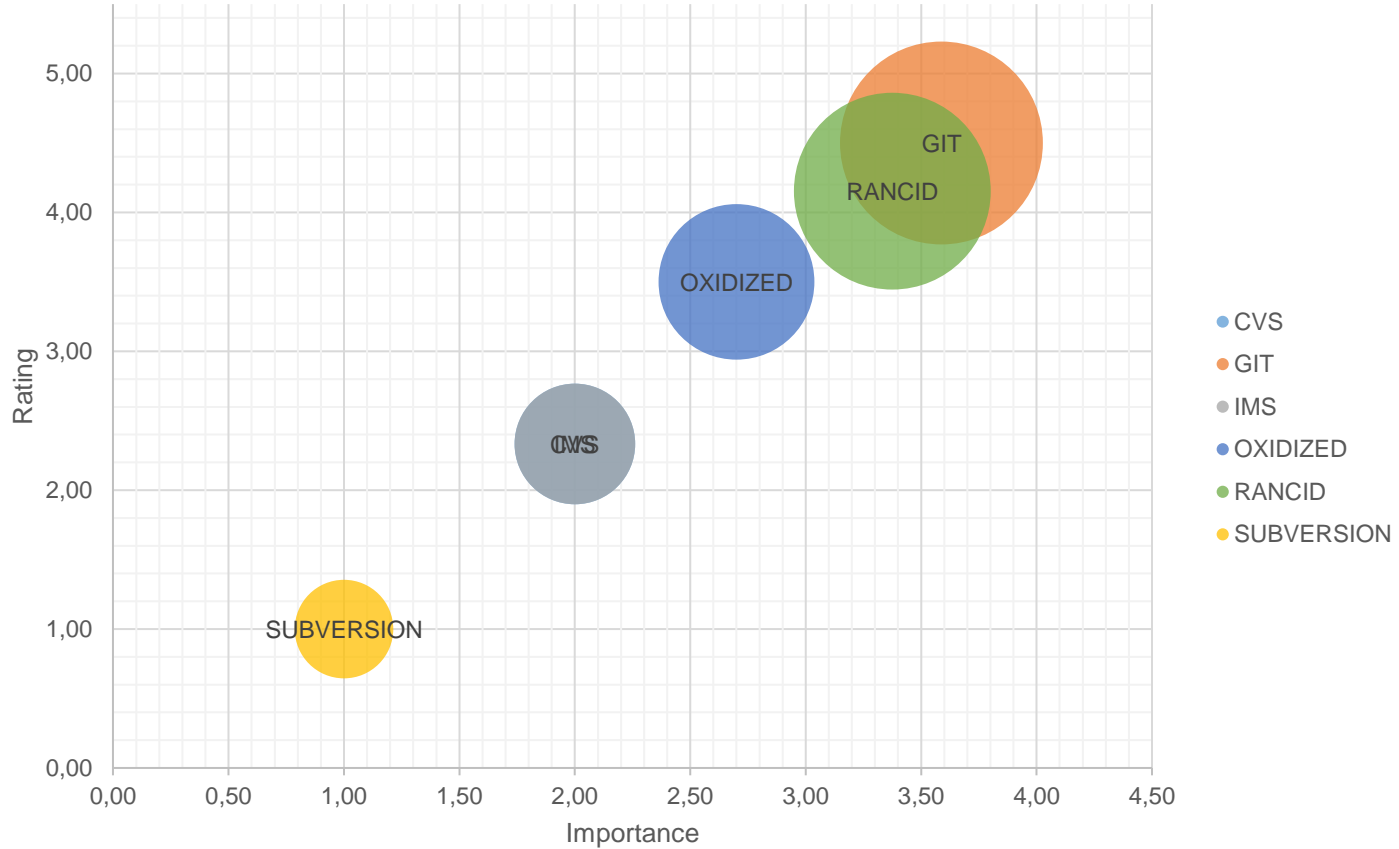
On average, each institution uses around 2.8 tools for Unidirectional Communication, coordination & Chat

Trends for Communication, Coordination and Chat Tools – Uni-directional – Top 5

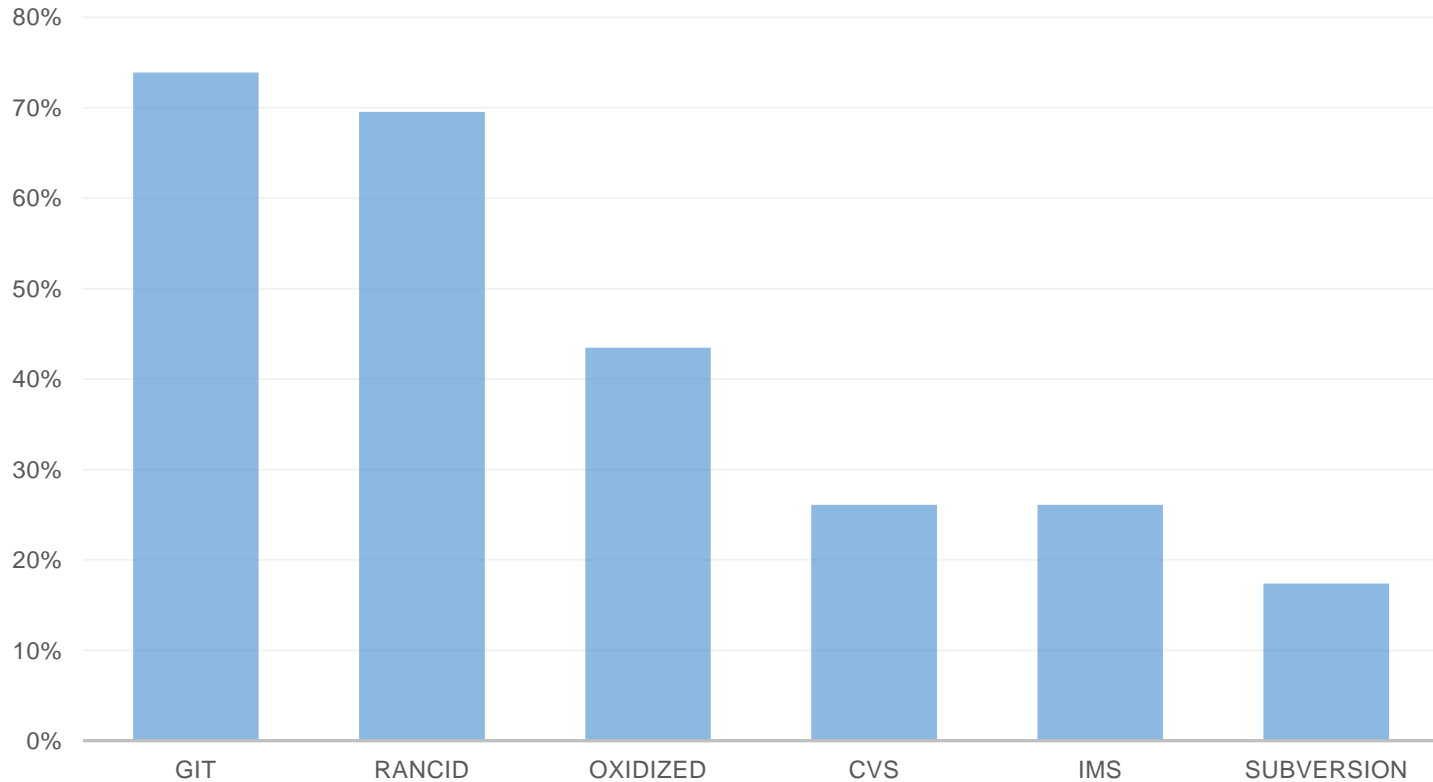
Tool	2016	2019	2023	Trend
E-mail	1	1	1	 0
MAILING LISTS	2	2	2	 0
IM	7	11	3	 8
WIKI	3	5	4	 1
TWITTER	8	10	5	 5
IRC	11	13	6	 7

- We still use traditional e-mail-based tools for communication (E-mail and mailing lists).
- IRC has zero users
- Some organisations use Twitter for unidirectional communication

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

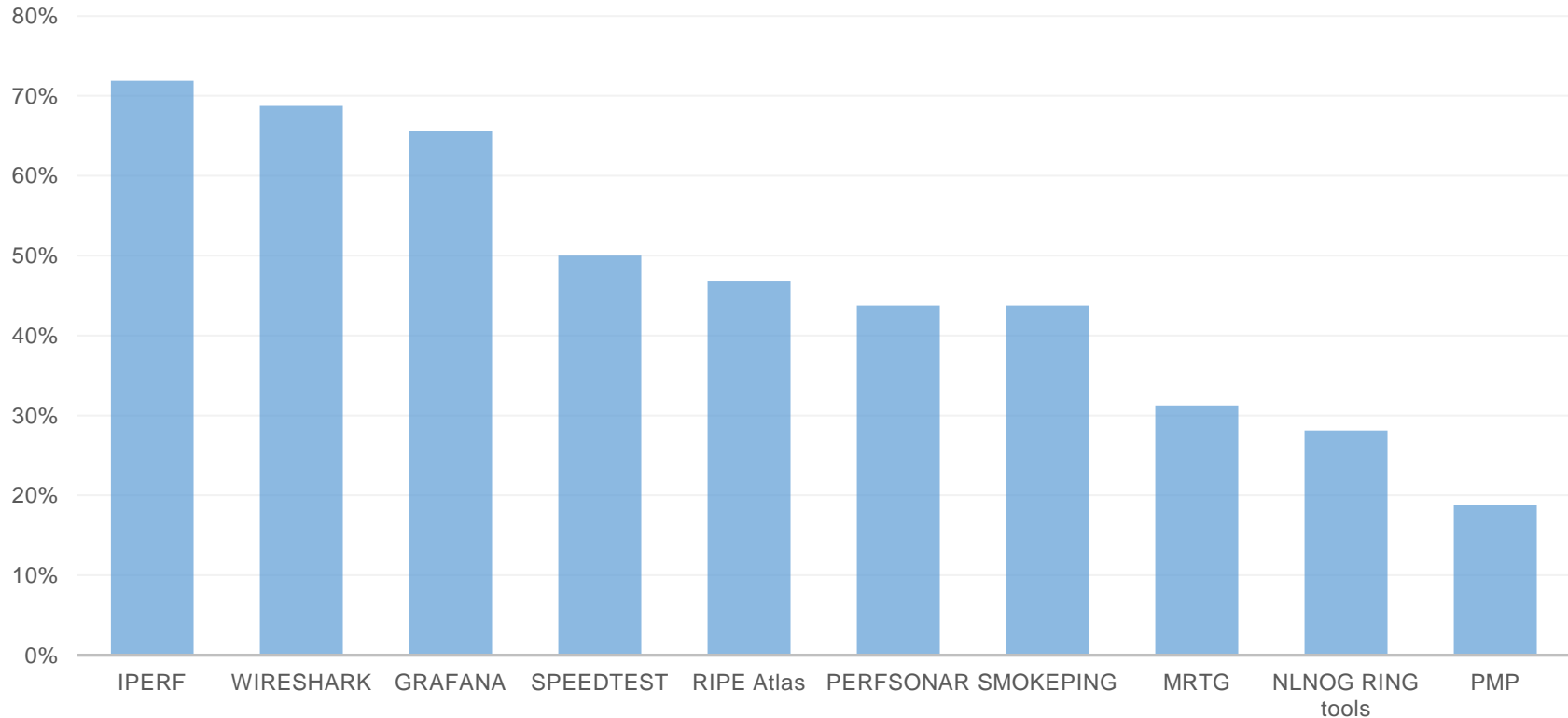
Trends for Configuration Management and Backup Tools– Top 6

Tool	2016	2019	2023	Trend	
GIT	2	2	1	▲	1
RANCID	1	1	2	▼	-1
OXIDIZED	6	5	3	▲	2
CVS	4	3	4	▼	-1
IMS	5	6	5	▲	1
SUBVERSION	3	4	6	▼	-2

{

- Git & Rancid are the most popular tools. The rest are used by less than 50% of respondents
- Subversion goes down in the ranking.

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



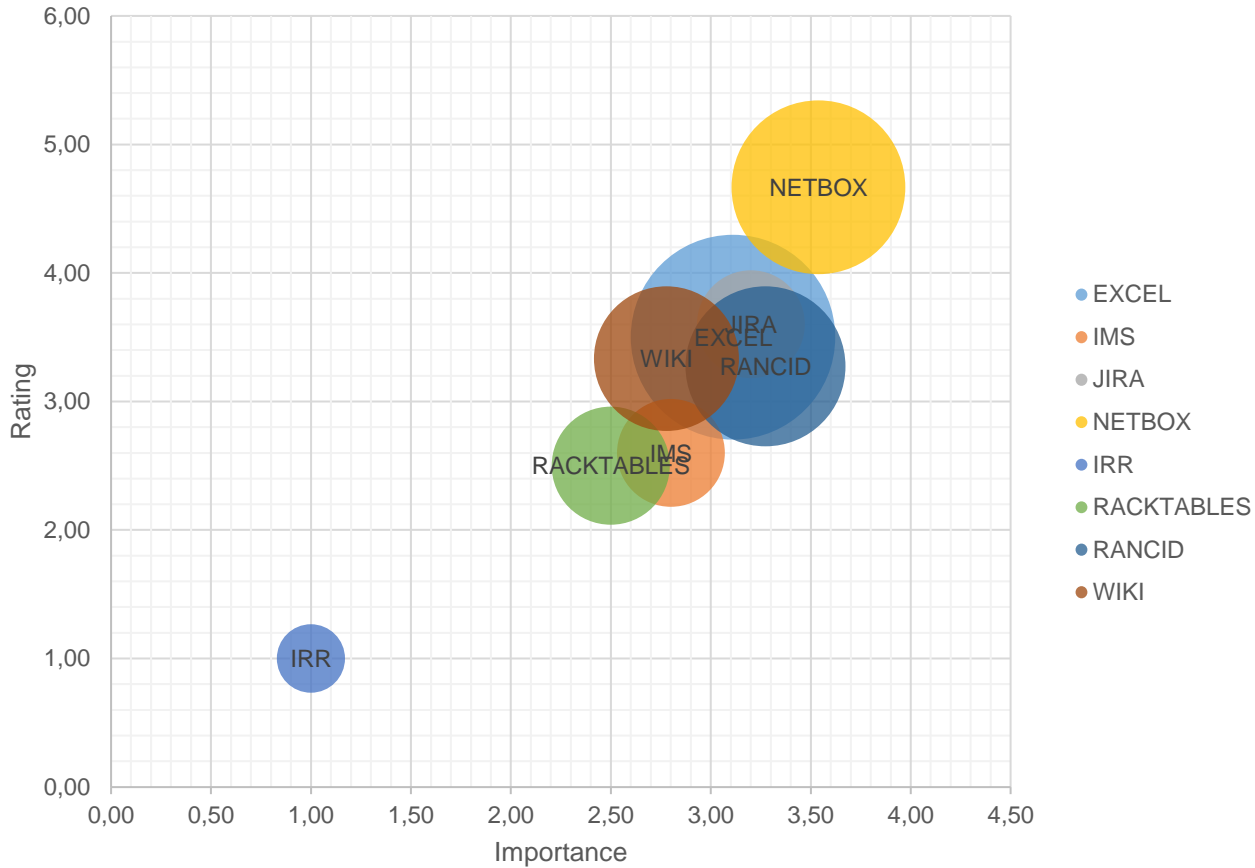
On average, each institution uses 5.7 tools for Performance Management

Trends for Performance Management Tools – Top 10

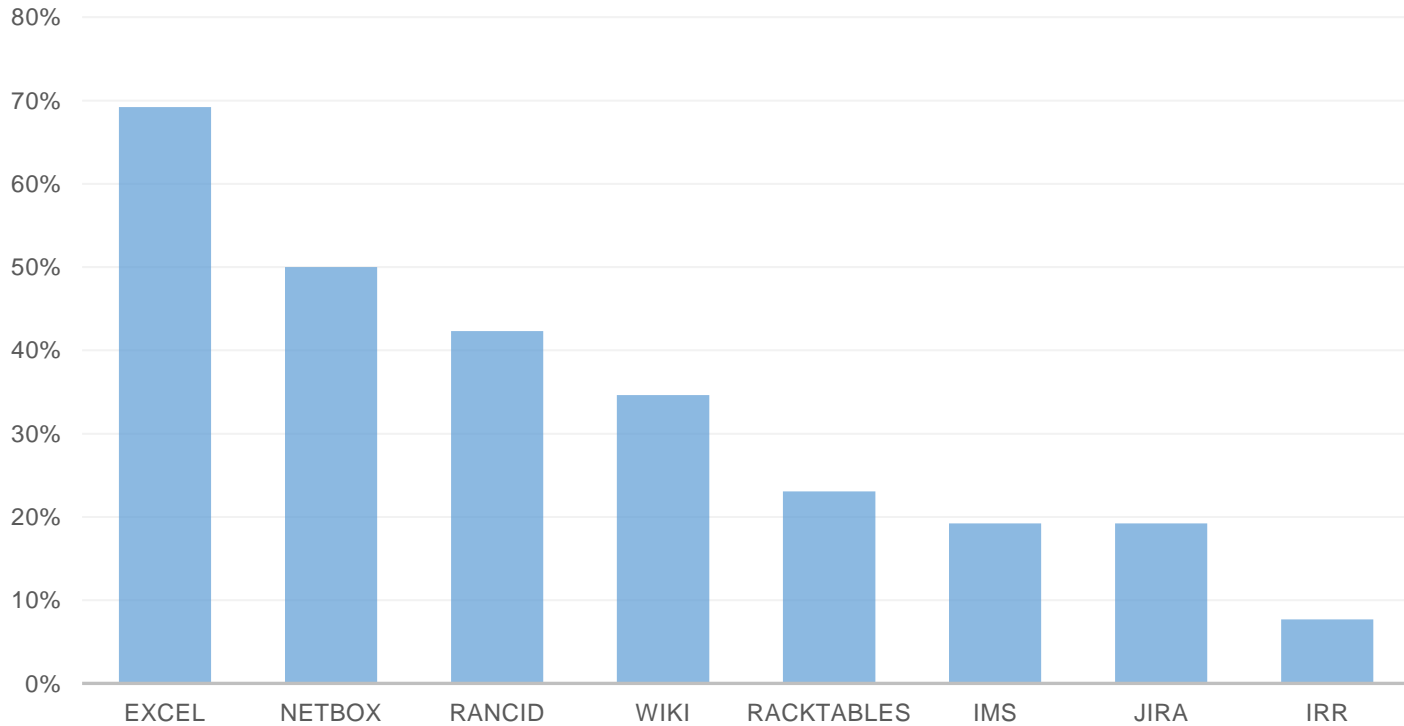
Tool	2016	2019	2023	Trend
IPERF	1	1	1	0
WIRESHARK	2	2	2	0
GRAFANA			3	NEW
SPEEDTEST			4	NEW
RIPE Atlas	6	6	5	1
PERFSONAR	4	4	6	-2
SMOKEPING	5	5	7	-2
MRTG	3	3	8	-5
NLNOG RING tools	9	9	9	0
PMP			10	NEW

- IPERF and Wireshark remain in the first positions.
- Grafana and Speedtest appear for the first time and go directly to the top of the table.
- MRTG is more popular for monitoring than for performance management.
- NDT goes from the 8th position to the 17th.

Inventory Tools









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



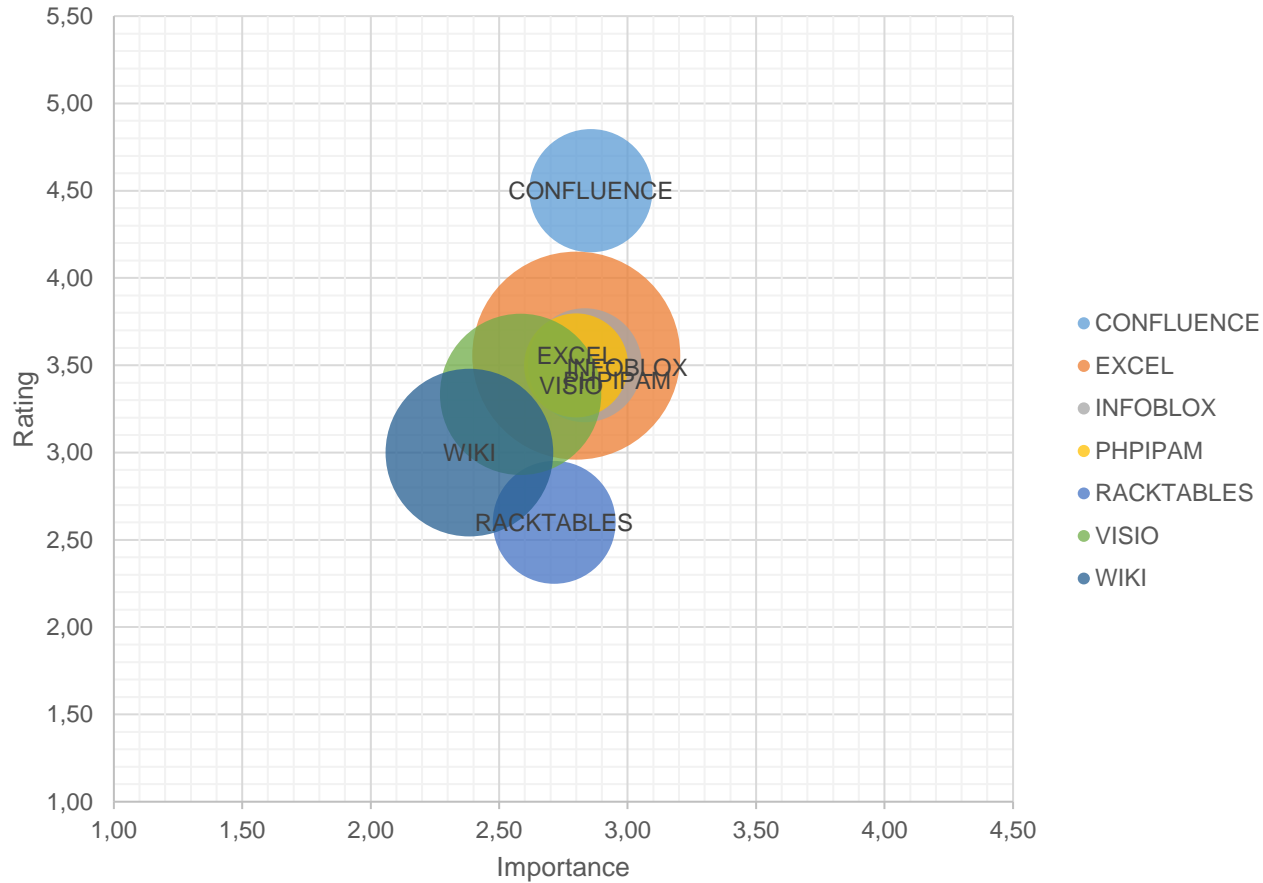
On average, each institution uses 2.6 tool for Inventory Management

Trends for Inventory Management Tools – Top 8

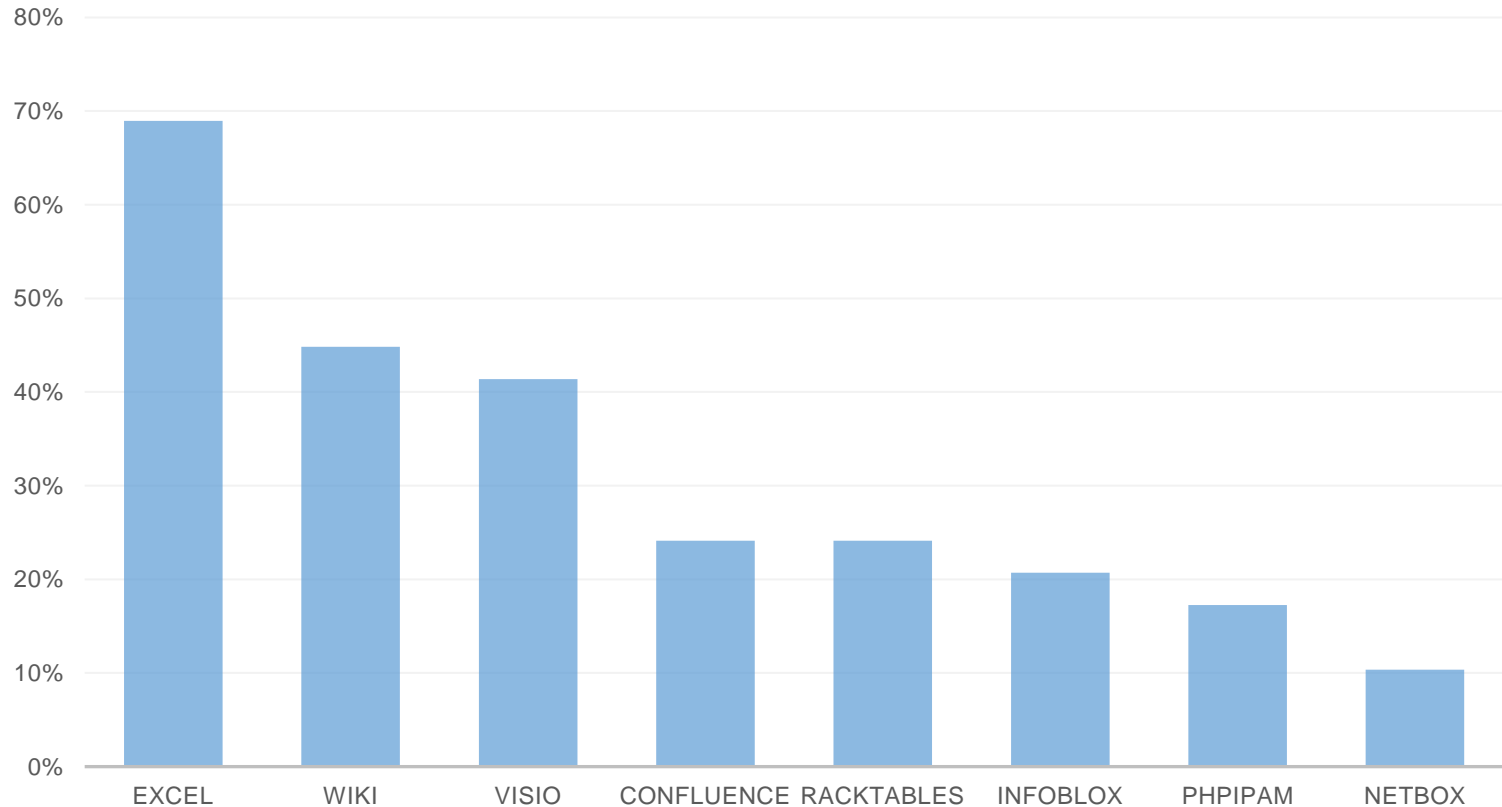
Tool	2016	2019	2019	Trend
EXCEL	1	1	1	 0
NETBOX			2	NEW
RANCID	2	3	3	 0
WIKI	3	2	4	 -2
RACKTABL	6	4	5	 -1
IMS	4	5	6	 -1
JIRA			7	NEW
IRR		6	8	 -2

- Excel remains the most popular tool.
- Netbox is the 2nd in number of users but the best Rated tool for Inventory Management.

Resources Management Tools









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



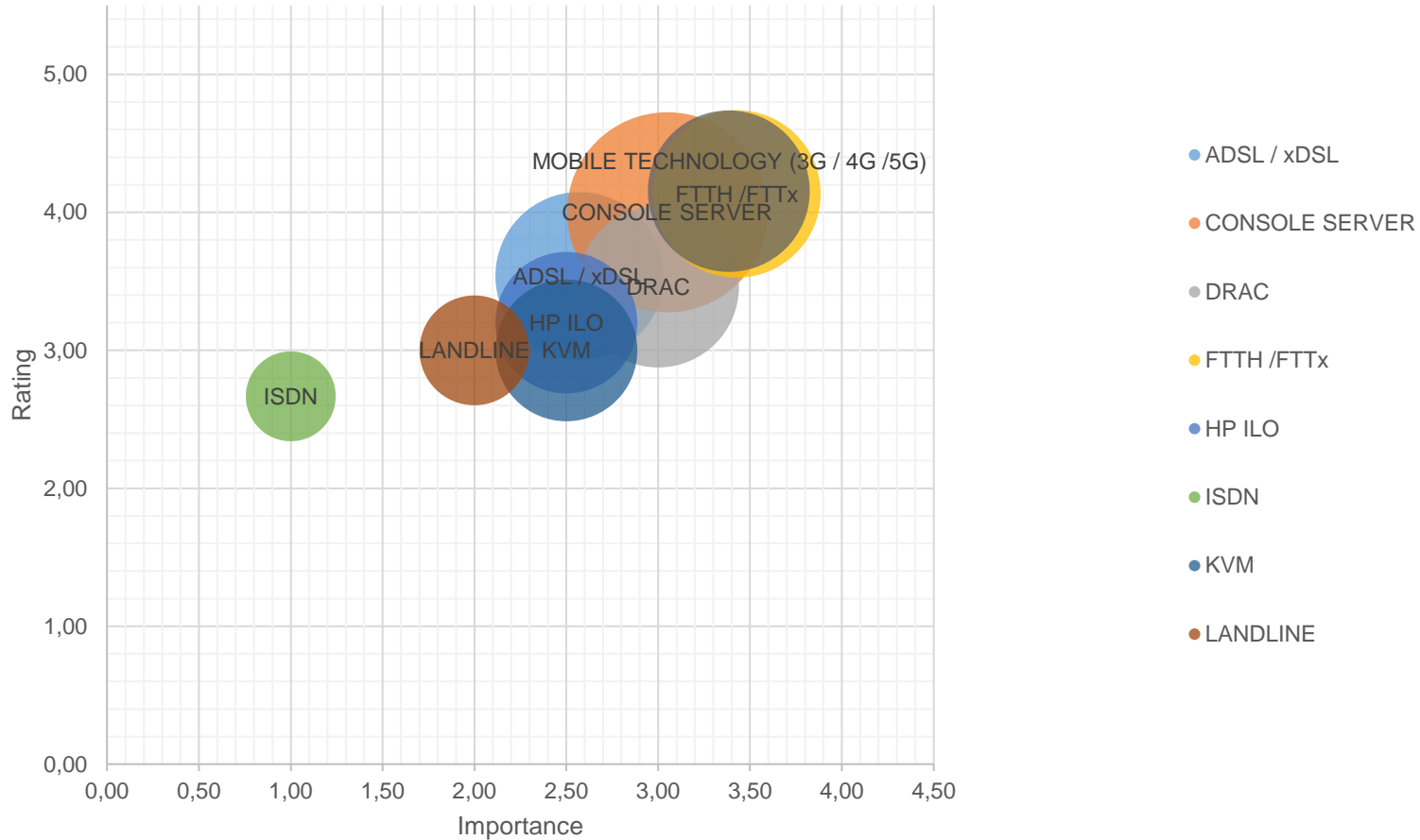
On average, each institution uses 2.4 tools for Resources Management

Trends for Resources Management Tools – Top-8

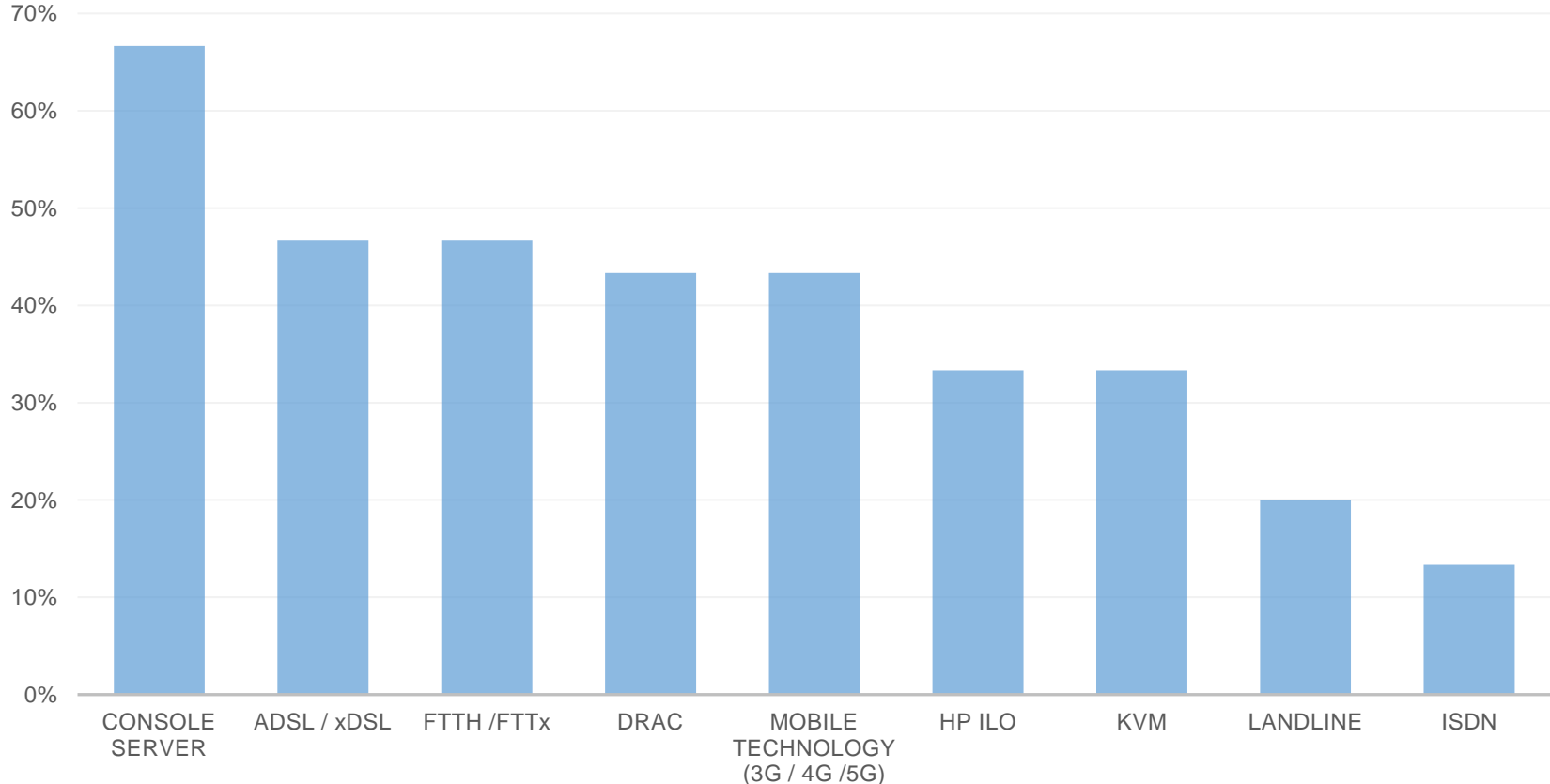
Tool	2016	2019	2023	Trend
EXCEL	2	1	1	 0
WIKI	3	3	2	 1
VISIO	1	2	3	 -1
CONFLUENCE	5	4	4	 0
RACKTABLES	4	5	5	 0
INFOBLOX	9	6	6	 0
PHPIPAM			7	NEW
NETBOX			8	NEW

- Again, Excel remains the most popular tool.
- Most of the tools are in the middle of the table (medium rating and importance).
- Confluence is the best rated, but it is only used by 24% of the respondents.
- Netbox was mentioned by 3 respondents in “Other”.

Out-of-band Access Management Tools








Out-of-Band Access Management : Percentage of Users per Tool (Top-9)



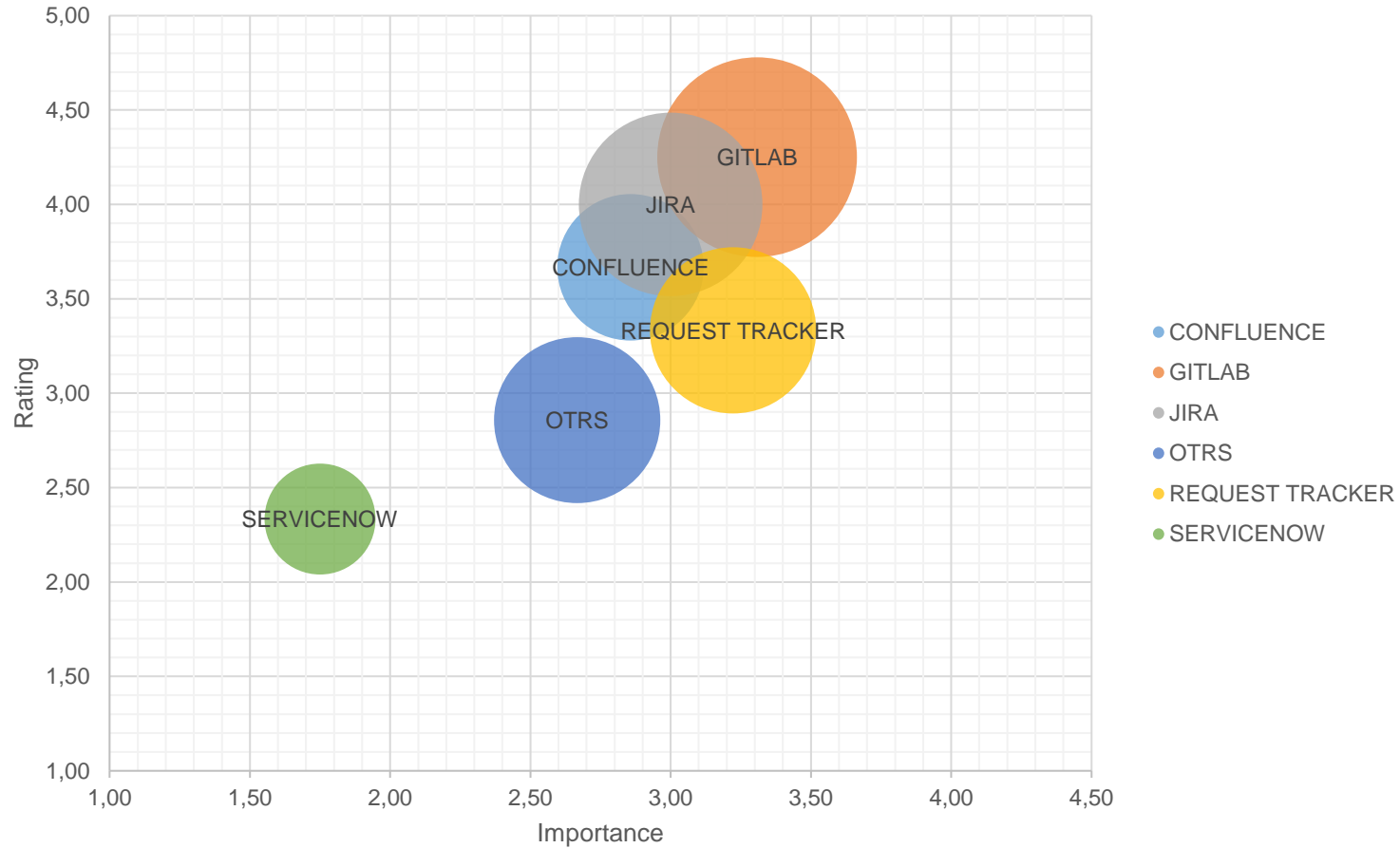
On average, each institution uses 3.4 tools for Out-of-Band Access Management

Trends for Out-of-Band Access Management Tools/Technologies – Top-9

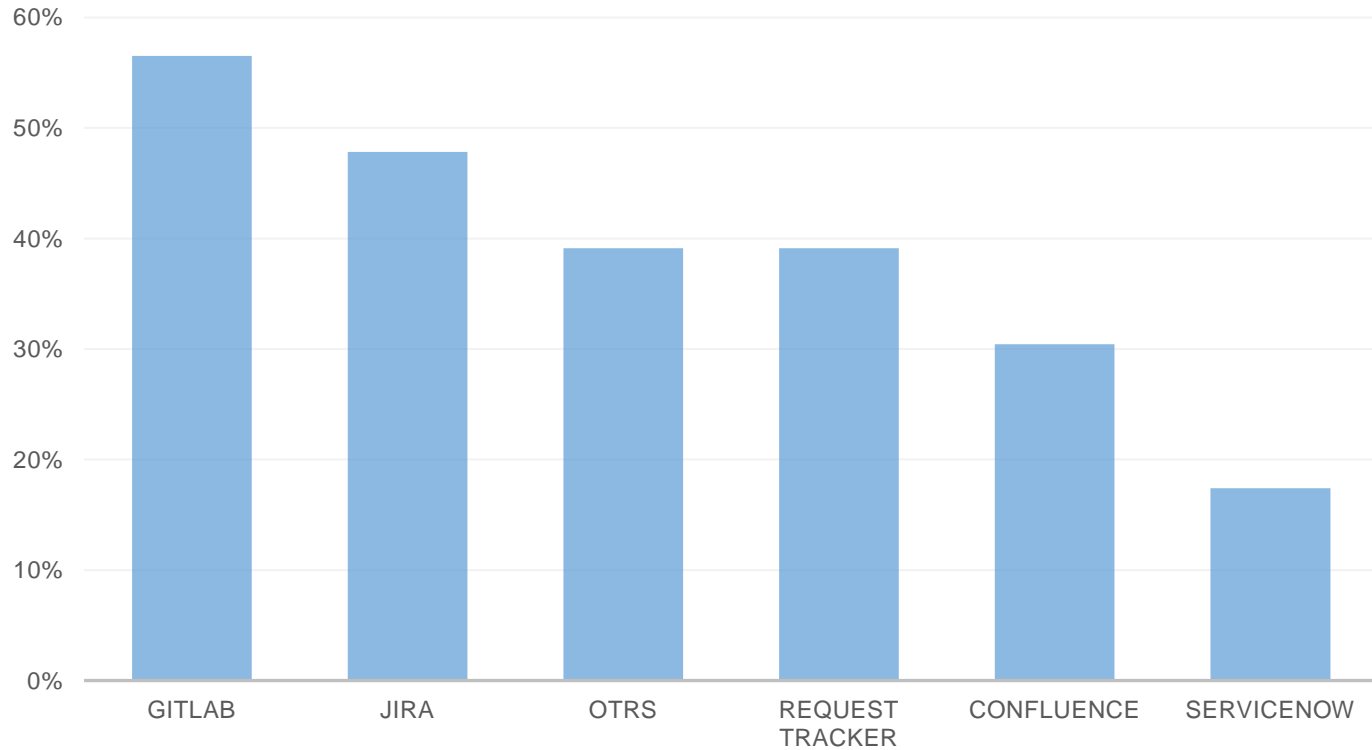
Tool	2016	2023	Trend
CONSOLE SERVER	1	1	 0
{ ADSL / xDSL	2	2	 0
		3	NEW
{ DRAC	3	4	 -1
	MOBILE TECHNOLOGY (3G / 4G /5G)	7	5
{ HP ILO	4	6	 -2
	KVM	6	7
LANDLINE	5	8	 -3
ISDN		9	NEW

- There were no results in 2019. This comparison is against results from 2016.
- Still Console servers are the most popular for OOB access.
- Mobile Technologies go up and Landlines go down.
- FTTH goes directly to the 3rd position.

Change Management Tools



Change Management : Percentage of Users per Tool (Top-6)



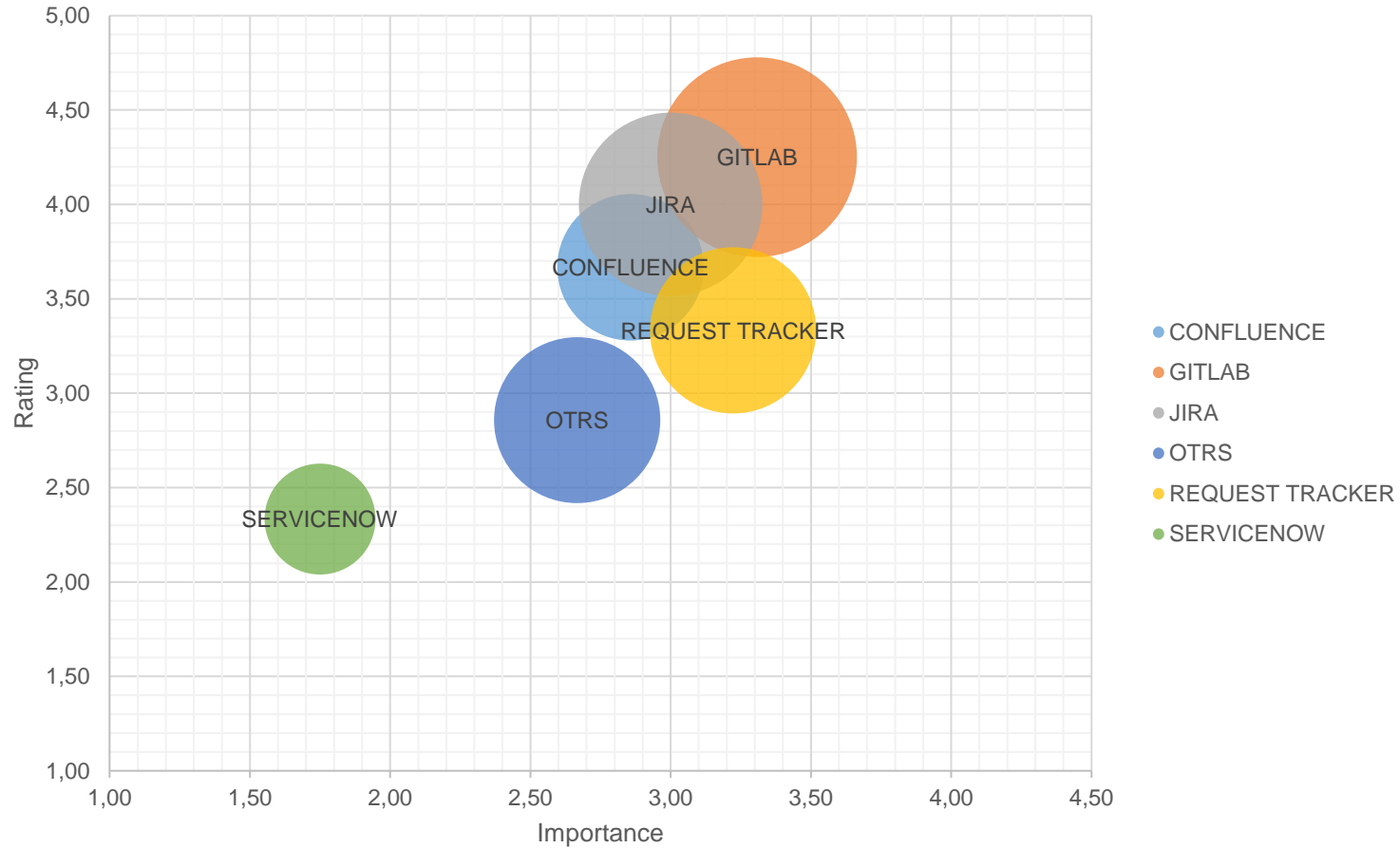
On average, each institution uses 2 tools for Change Management

Trends for Change Management Tools – Top-6

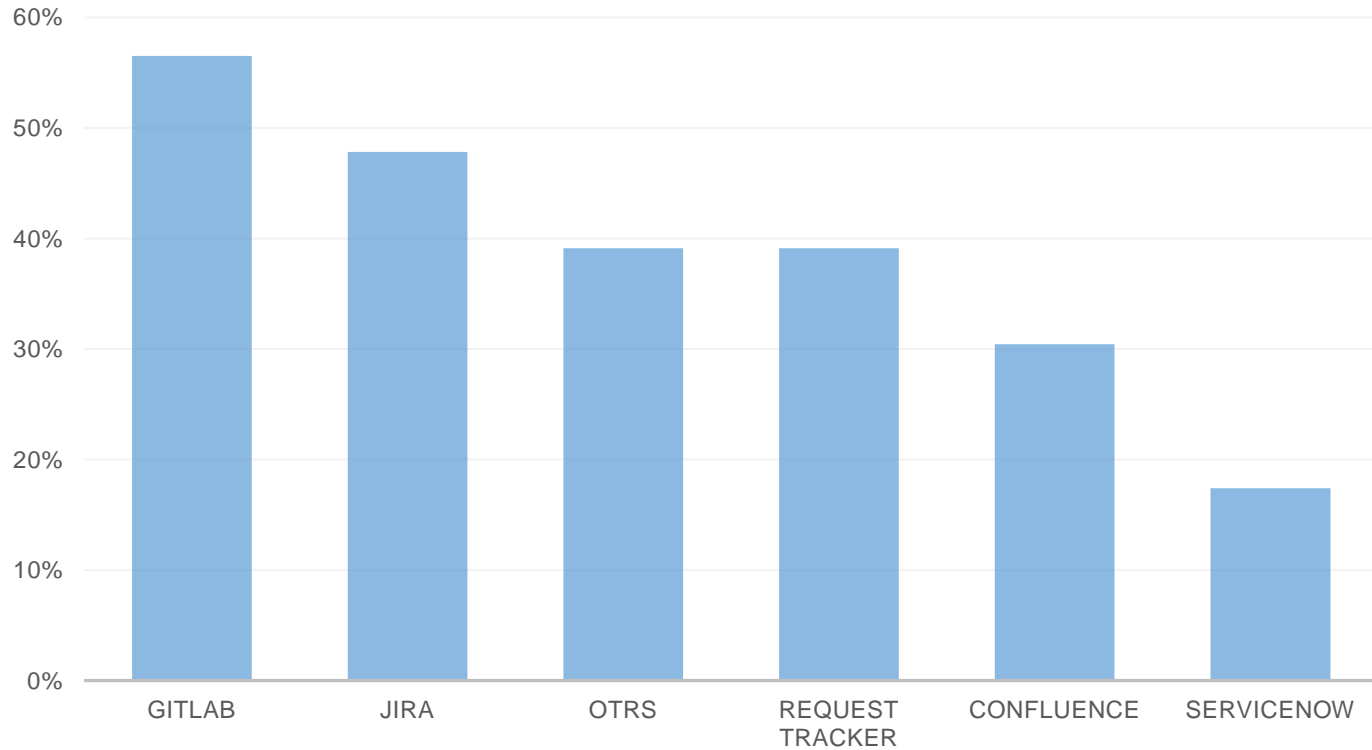
Tool	2016	2019	2023	Trend	
GITLAB	5	2	1	▲	1
JIRA	3	1	2	▼	-1
OTRS	2	4	3	▲	1
	1	5	4	▲	1
REQUEST TRACKER					
CONFLUENCE	4	3	5	▼	-2
SERVICENOW			6	NEW	

- Gitlab becomes the most popular tool, it is used by more than 50% of the respondents and it is the best rated.
- Jira and Confluence go down in number of users, but they have good ratings.

Change Management Tools



Change Management : Percentage of Users per Tool (Top-6)



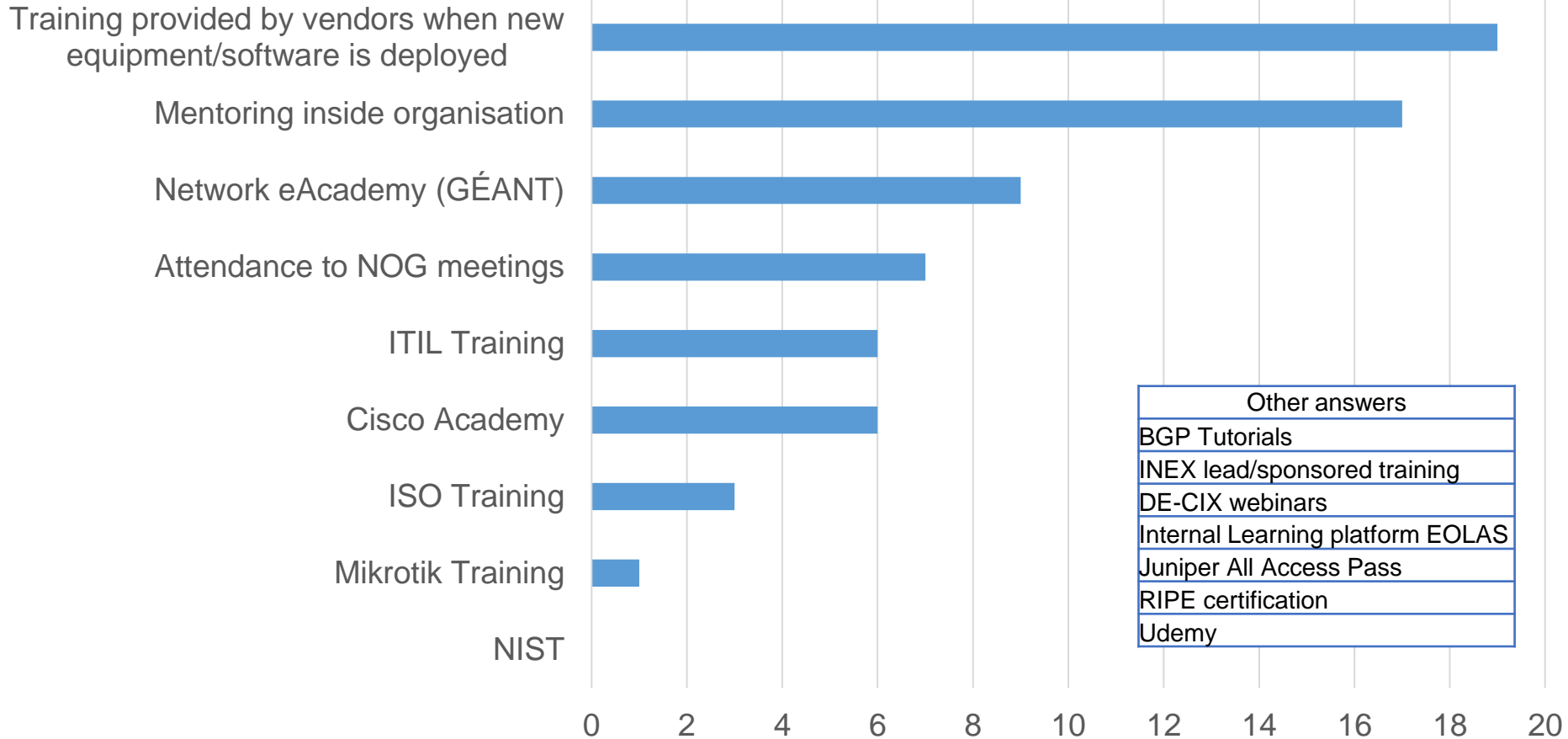
On average, each institution uses 2.4 tools for Change Management

Trends for Change Management Tools – Top-6

Tool	2016	2019	2023	Trend	
GITLAB	5	2	1	▲	1
JIRA	3	1	2	▼	-1
OTRS	2	4	3	▲	1
	1	5	4	▲	1
REQUEST TRACKER					
CONFLUENCE	4	3	5	▼	-2
SERVICENOW			6	NEW	

- Gitlab becomes the most popular tool, it is used by more than 50% of the respondents and it is the best rated.
- Jira and Confluence go down in number of users, but they have good ratings.

Training: What technical training is provided to your NOC personnel?



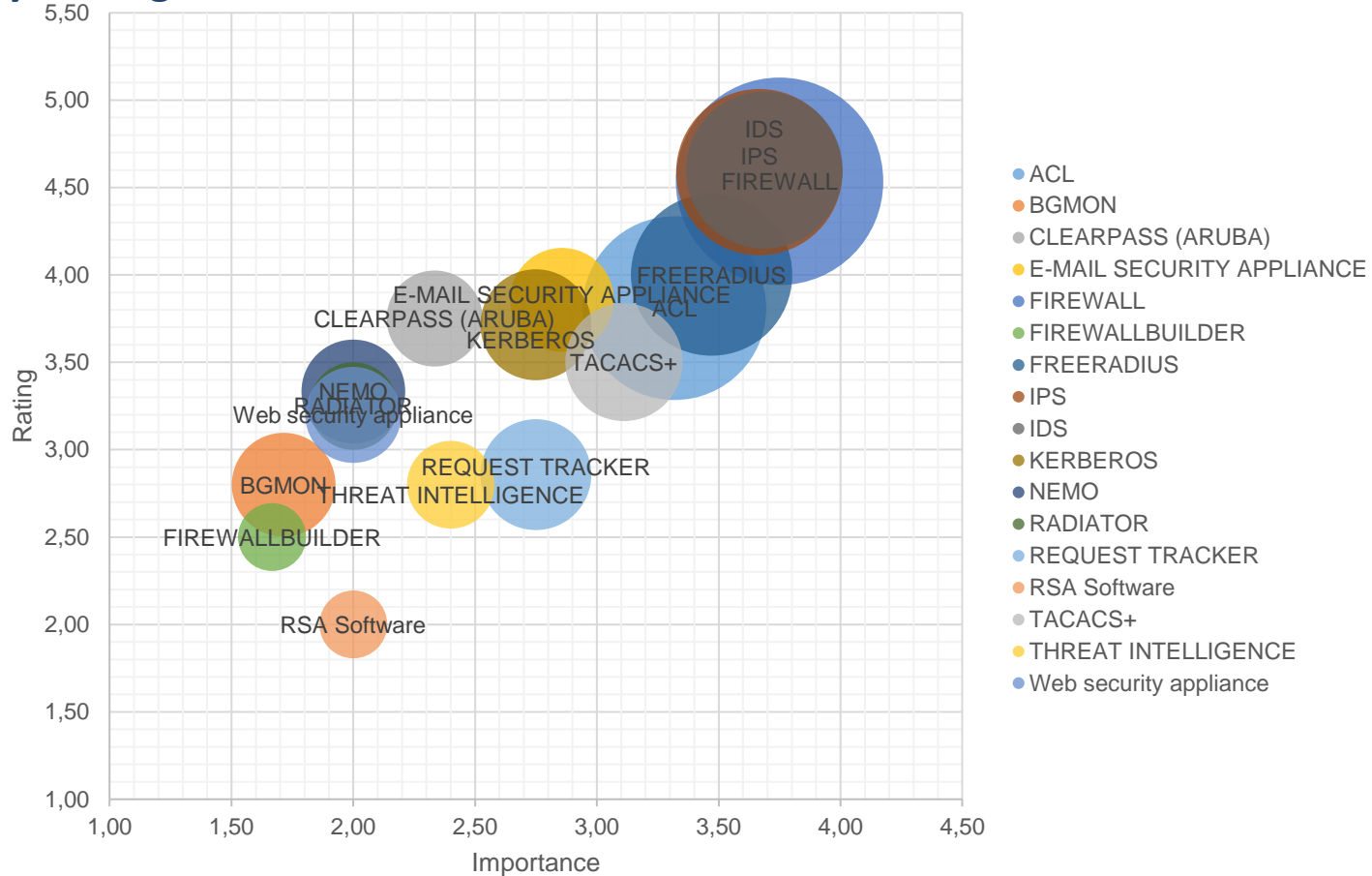
Training: What Tools Do You Use for Training?

Coffee - lots
EOLAS
EVE-NG
GÉANT e-academy
GITLAB
Hands on experience
Internal training
JIRA
Miro
Moodle
NOC Tools
Powerpoint
Teams
udemy
VISUAL STUDIO CODE
Webinars
Wiki
Zoom

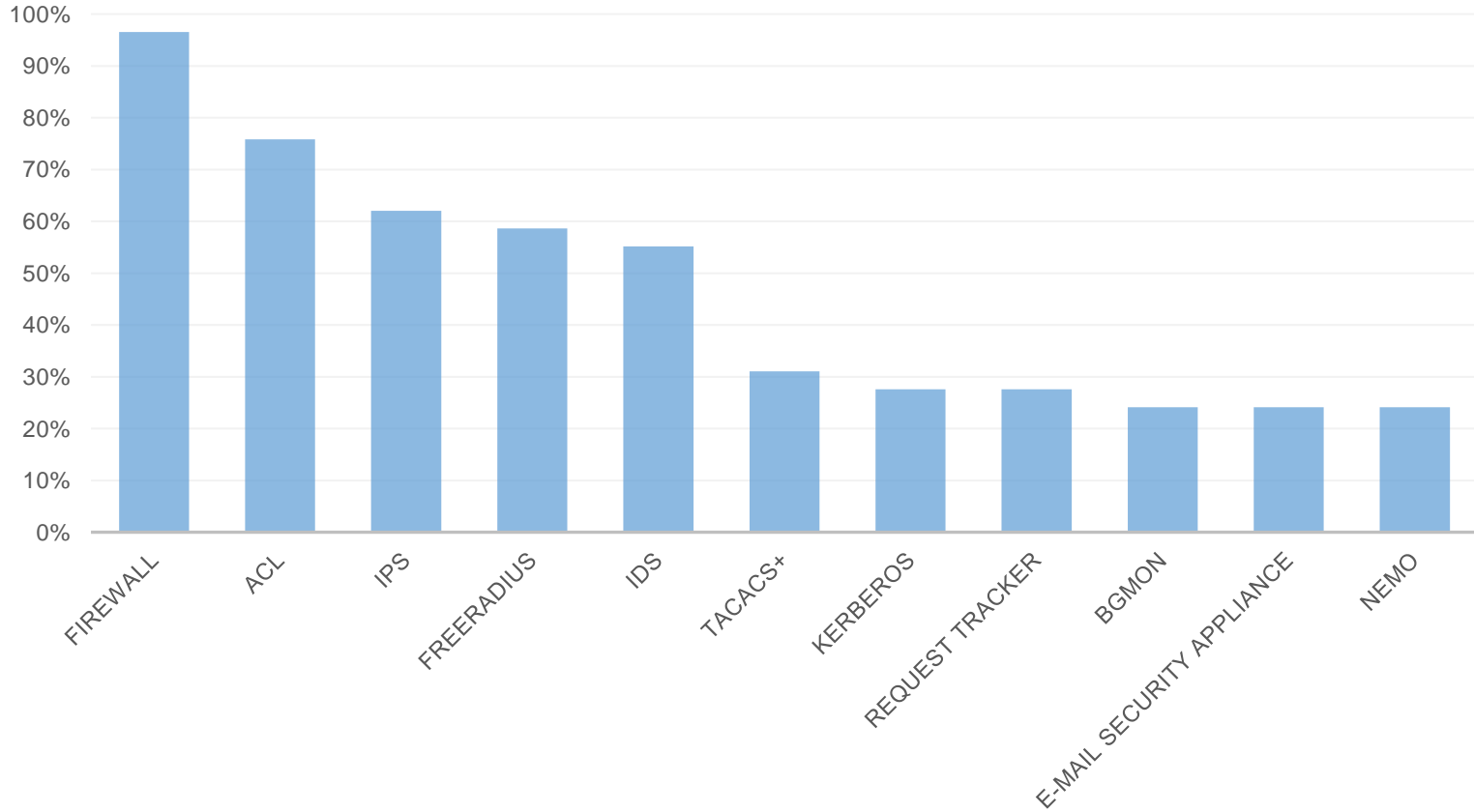
Training: What Training Portals Do You Use for Training?

Angeles
Axelos
GÉANT e-academy
Infinera
Infoblox
Linkedin Learning
Moodle
Nokia
Openwebinars
TM Forum
Udemy
Vendor portals

Security Management Tools



Security Management : Percentage of Users per Tool (Top-10/11)



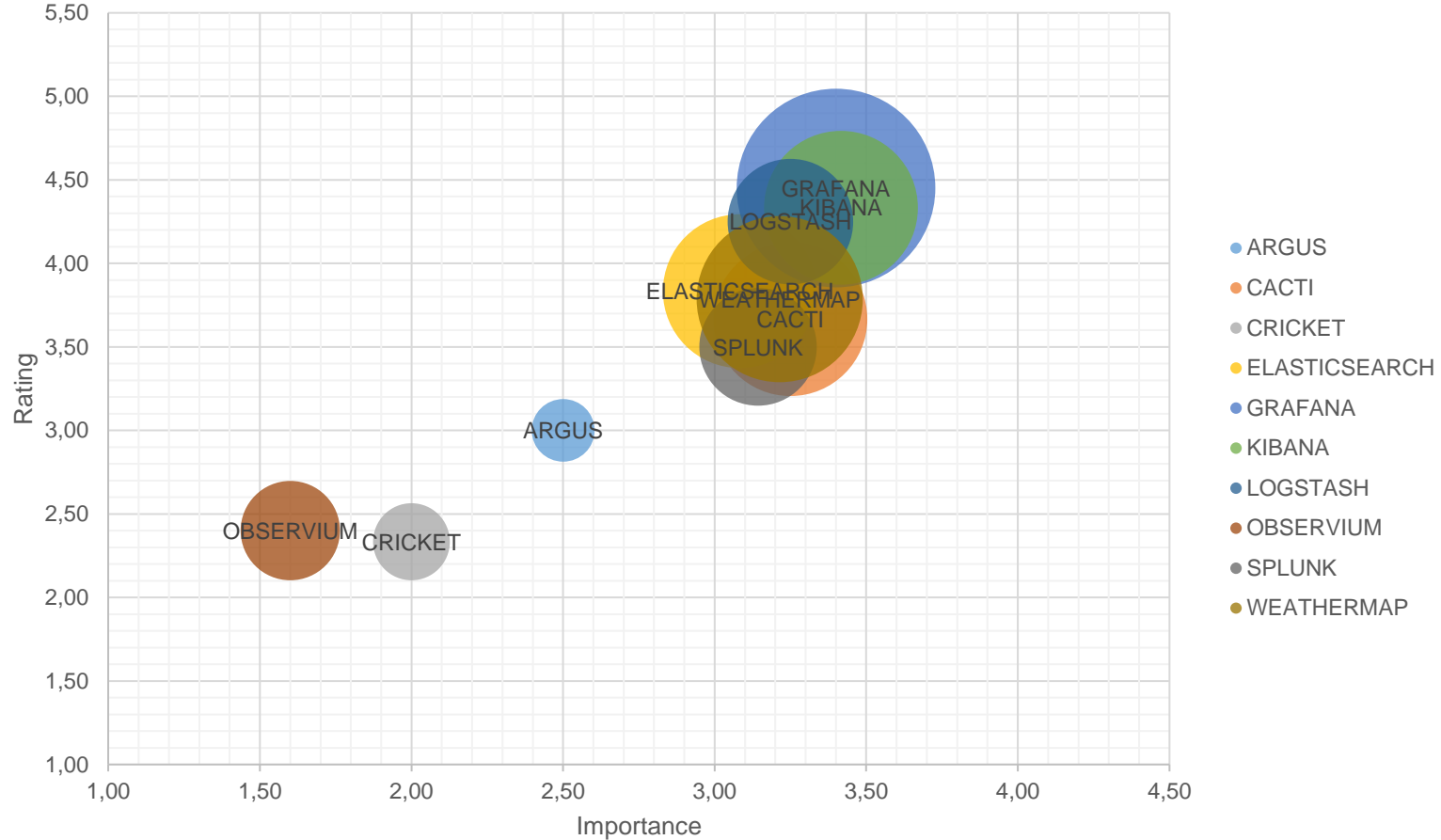
On average, each institution uses 6 tools for Security Management

Trends for Security Management Tools – Top-10/11

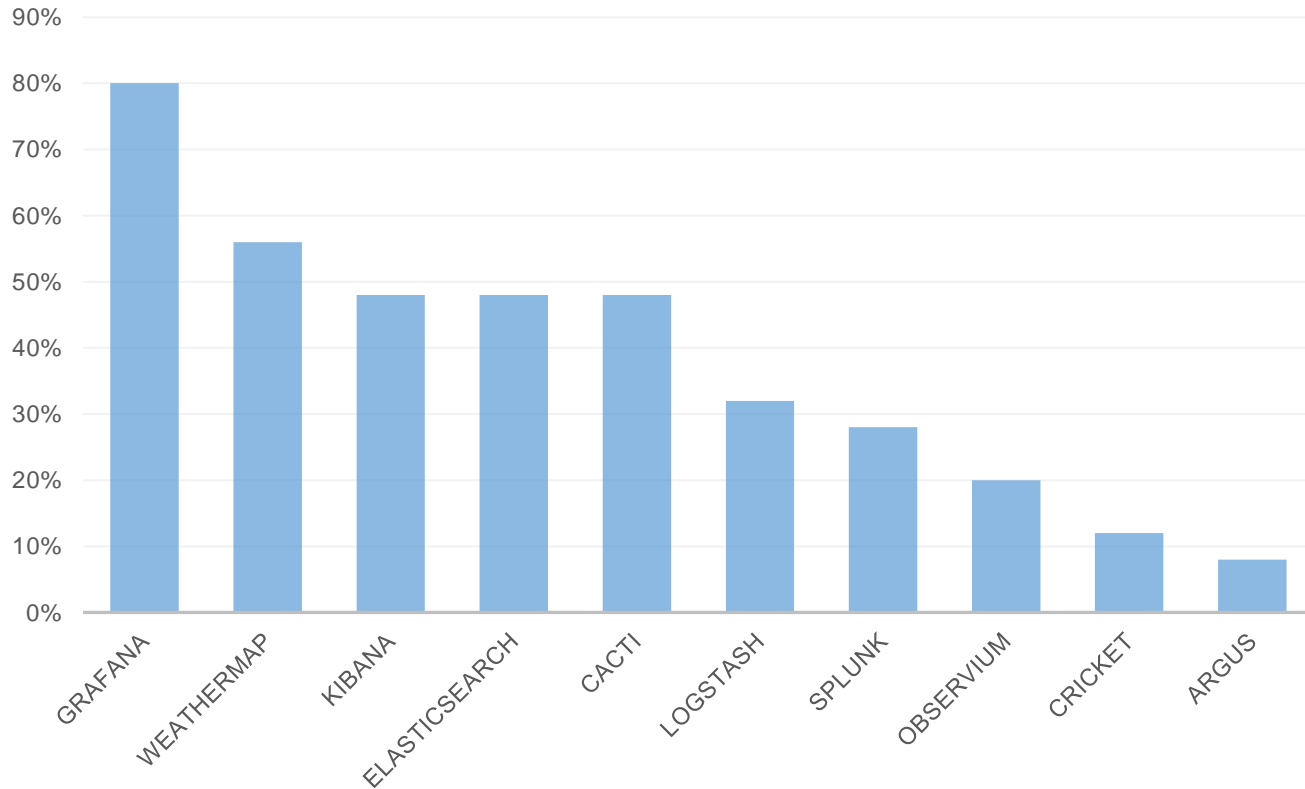
Tool	2016	2019	2023	Trend
FIREWALL	1	1	1	0
ACL	2	2	2	0
IPS		4	3	1
FREERADIUS		3	4	-1
IDS		5	5	0
TACACS+		7	6	1
{ KERBEROS	8	11	7	4
{ REQUEST TRACKER	4	14	8	6
{ BGMON		8	9	-1
{ E-MAIL SECURITY APPLIANCE		6	10	-4
{ NEMO			11	NEW

- The percentage of NOCs who feel responsible for Security Management decreased (from 63% to 45%).
- A 97% of the respondents are using a Firewall.
- 80% of them also use ACLs.

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

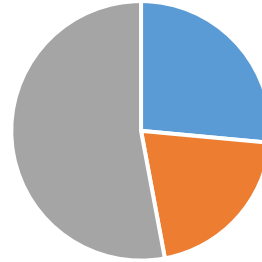
Trends for Data Aggregation, Representation and Visualisation Tools – Top-10

Tool	2016	2019	2023	Trend
GRAFANA		1	1	 0
WEATHERMAP	2	2	2	 0
KIBANA	5	5	3	 2
ELASTICSEARCH	3	4	4	 0
CACTI	1	3	5	 -2
LOGSTASH	4	6	6	 0
SPLUNK	6	7	7	 0
OBSERVIUM			8	NEW
CRICKET			9	NEW
ARGUS			10	NEW

- Grafana is the most popular and the best valued tool.
- Kibana, Elasticsearch and Cacti have the same number of users, but Kibana is better rated.
- Kentik is mentioned twice.
- Not many users for the newly incorporated tools.

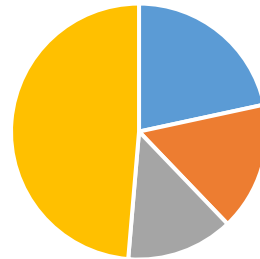
DDoS Detection and Mitigation Methods

DDoS Detection Solutions



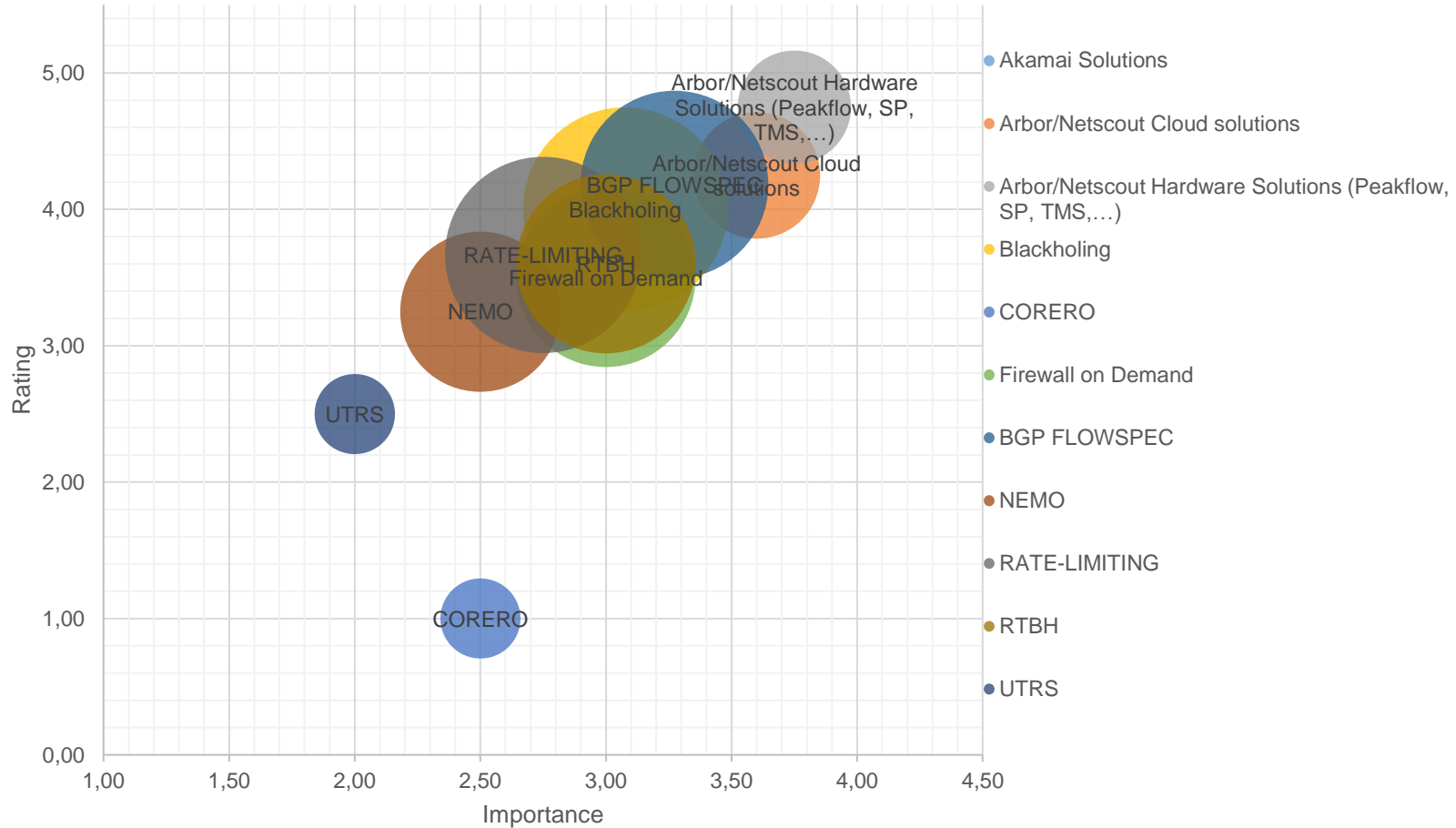
■ Threat intelligence ■ DNS solution ■ Netflow-based tools

DDoS Mitigation Solutions

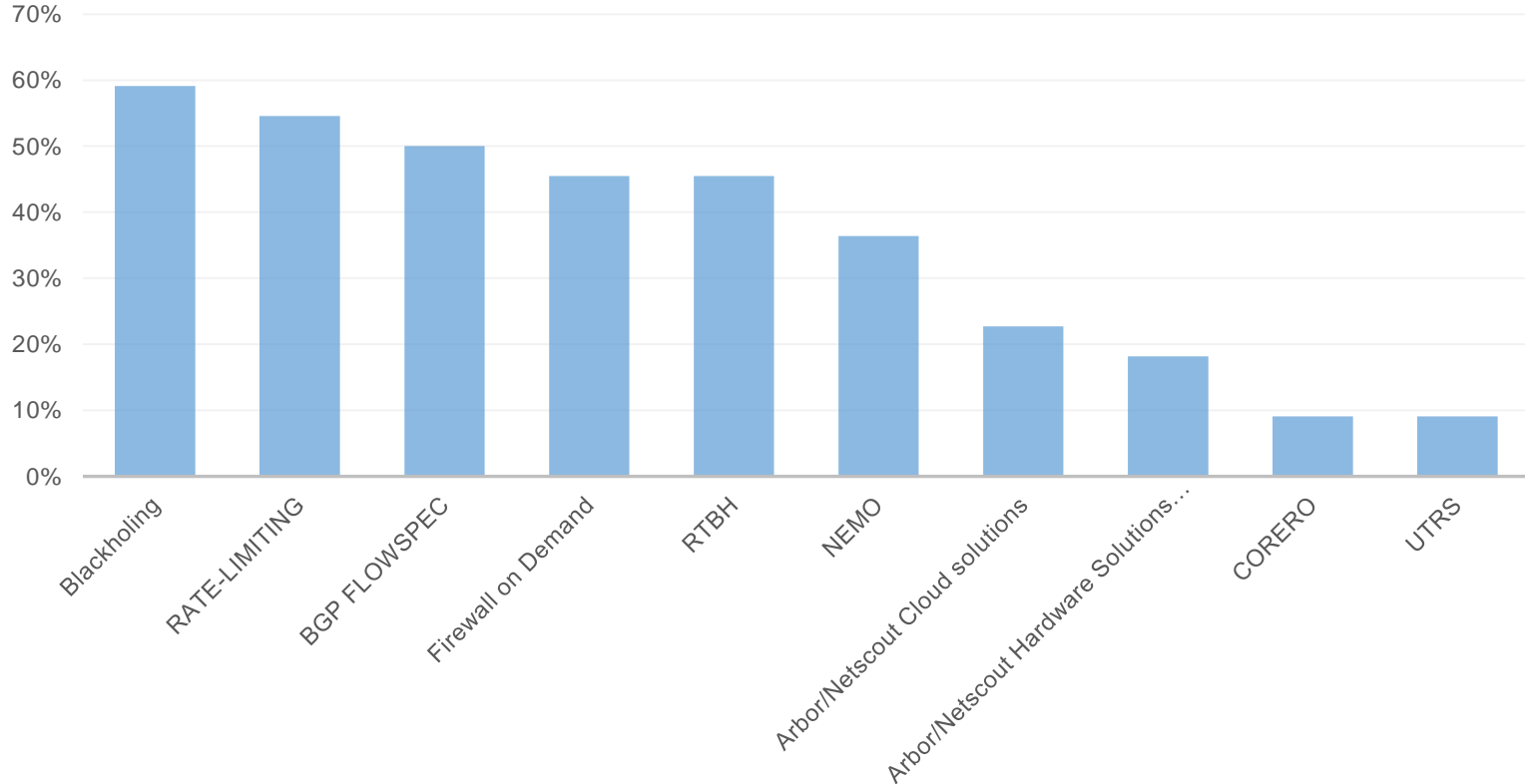


■ Hardware platforms on-site in-line ■ Hardware platforms on-site off-line
■ Cloud solutions ■ Blackholes, ACLS, etc

DDoS Mitigation Tools



DDoS Mitigation: Percentage of Users per Tool (Top-10)



On average, each institution uses 3.5 tools for DDoS Mitigation

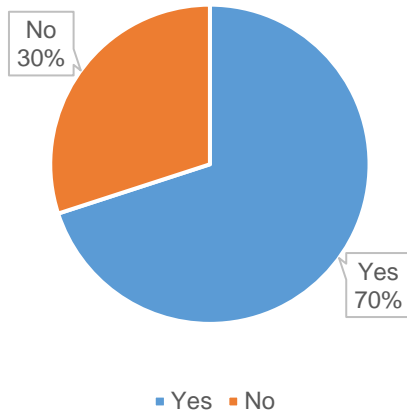
Trends for DDoS Mitigation Tools – Top-10

Tool	2016	2019	2023	Trend
Blackholing	2	2	1	▲ 1
RATE-LIMITING	3	4	2	▲ 2
BGP FLOWSPEC	5	3	3	▬ 0
Firewall on Demand	4	1	4	▼ -3
RTBH			5	NEW
NEMO			6	NEW
Arbor/Netscout Cloud solutions		6	7	▼ -1
Arbor/Netscout Hardware Solutions (Peakflow, SP, TMS,...)	6	5	8	▼ -3
CORERO			9	NEW
UTRS	9	7	10	▼ -3

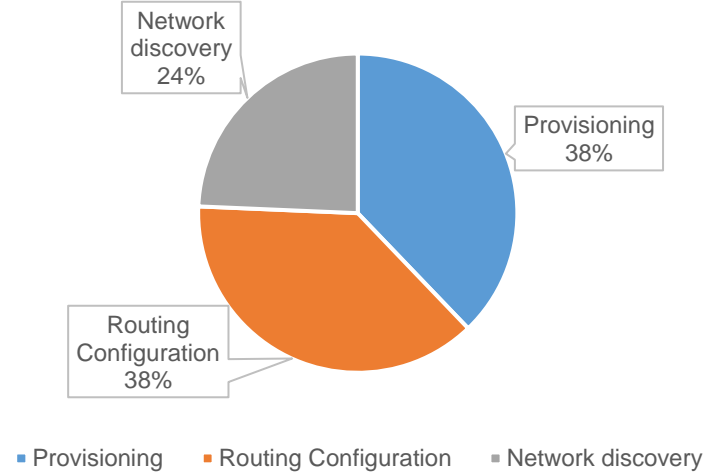
- Akamai solutions has no users.
- Blackholing and Rate-limiting go up, whereas Arbor solutions go down.
- RTBH (mentioned last year), NEMO and COREO appear for the first time.

Orchestration, Automation and Virtualisation

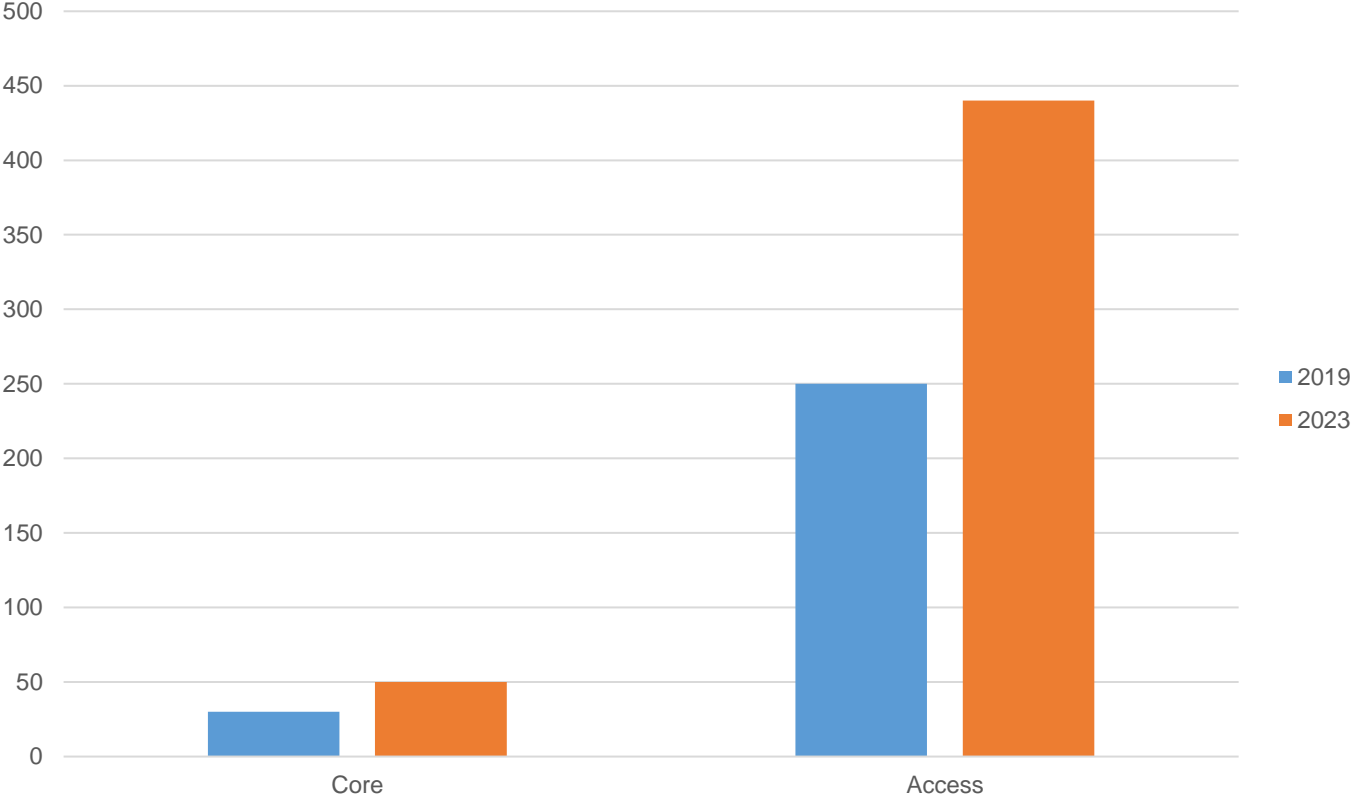
Automated tasks



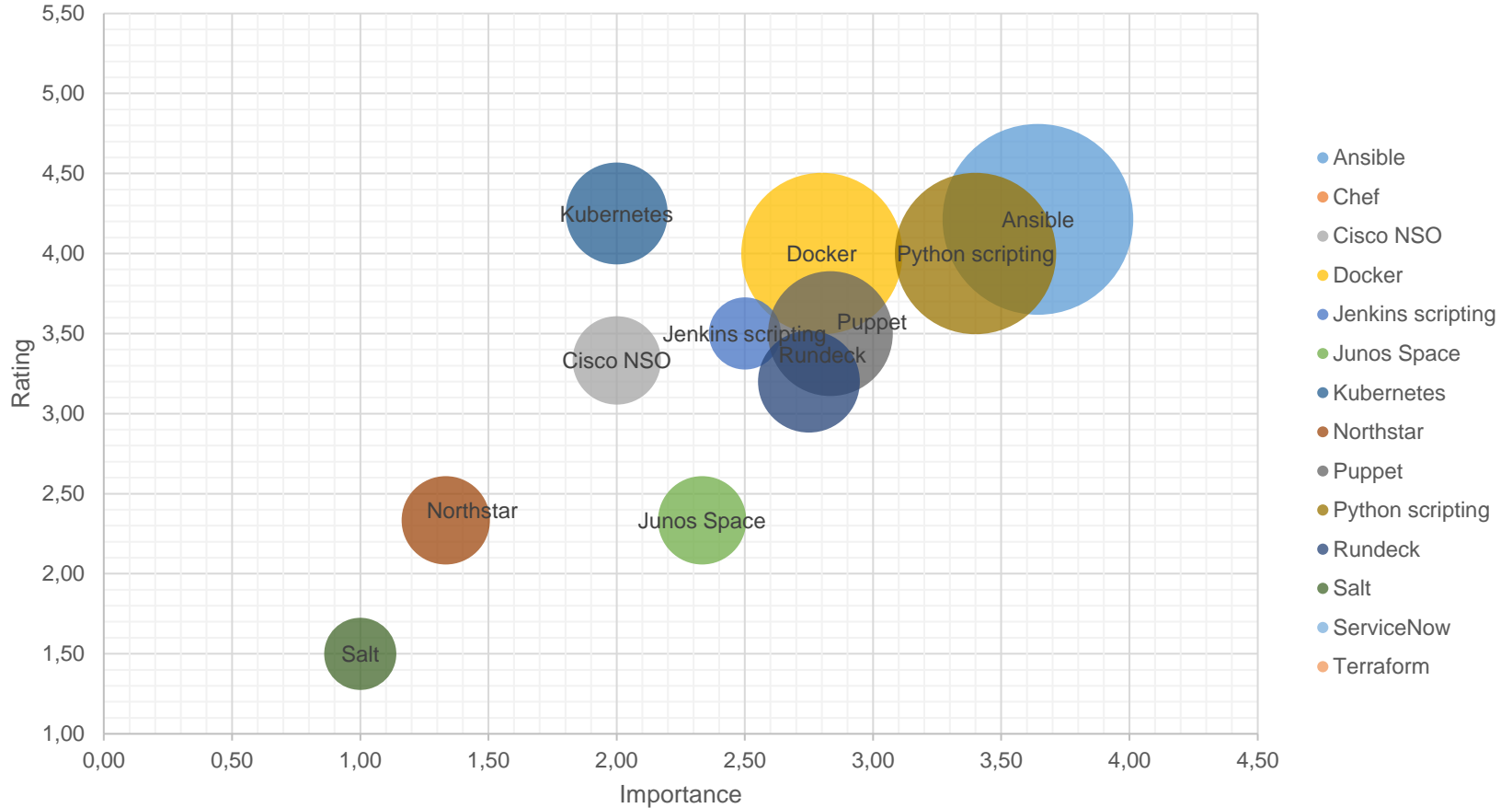
Automated tasks



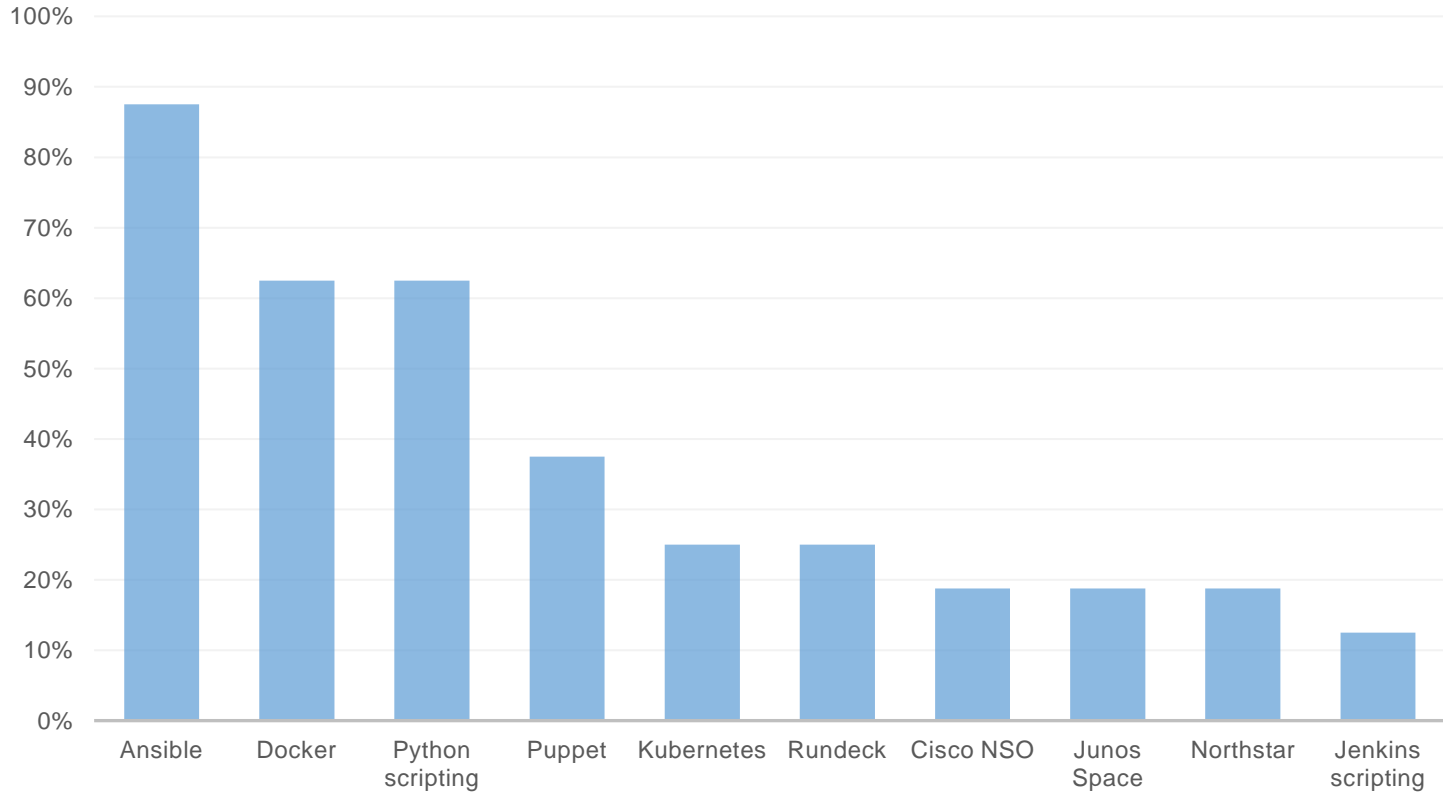
Median Number of devices with Automation



Orchestration, Automation, and Virtualisation Tools












Orchestration, Automation, and Virtualisation: Percentage of Users per Tool (Top-10)



On average, each institution uses 4 tools for Orchestration, Automation, and Virtualisation

Trends for Orchestration, Automation and Virtualisation Tools – Top-10

Tool	2019	2023	Trend
Ansible	1	1	 0
{ Docker		2	NEW
{ Python scripting	2	3	 -1
Puppet	9	4	 5
{ Kubernetes	5	5	 0
{ Rundeck	10	6	 4
{ Cisco NSO	7	7	 0
{ Junos Space	4	8	 -4
Northstar	8	9	 -1
Jenkins scripting	6	10	 -4

- More institutions automating and in more devices than in 2019.
- Still the less functionality the NOC feel responsible for.
- Ansible is the most popular tool.
- Puppet disappears from the Top-10 and Terraform and ServiceNow have no users.



Thank you!

netdev@lists.geant.org