

# A Survey on Network Troubleshooting

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## 1. INTRODUCTION

We report the result of a survey conducted during May-June 2012 to 61 subscribers to NANOG<sup>1</sup> mailing list. This survey is to understand the problems administrators face in their networks, the potential causes, and how problems are diagnosed today. The respondents include 12 administrators of small (<1k hosts) networks, 23 of medium (1k-10k hosts) networks, 11 and 12 of large (10k-100k hosts) and very large (>100k hosts) networks. The result reveals several key factors of network debugging today:

## 2. COMPLEXITY

Network administrators face various “symptoms” and “diseases” in their networks. Table 1 demonstrates that “reachability” and “throughput/latency” problems are among those happen most often. Not only the faulty behaviors are diverse, the possible causes are also complex. “Hardware failure”, “switch/router software bug” and “external” are the top 3 causes to network problems. A long tail of other symptoms/causes exists, which complicates the searching space during debugging. The categories are coarse grained so there can be more symptoms/causes that are missed.

## 3. COST

We analyze the cost of network debugging from two angles - the number of network-related tickets per month and the average time consumed to solve one such ticket (Figure 1). The distribution of the number of tickets roughly align with the distribution of the network size. 35% of networks surveyed generate more than 100 tickets per month. 40.4% of respondents estimate that one engineer needs less than 30 minutes to solve one such ticket. But 24.6% of respondents believe it would take longer than one hour.

## 4. TOOLS

We are also interested in the debugging tools that administrators use today (Table 2). ping, traceroute

<sup>1</sup>North American Network Operators’ Group

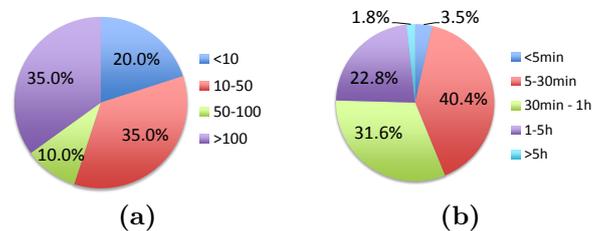
Category	Avg	% of $\geq 4$
Reachability	3.67	56.90%
Security Policy Violation	2.33	17.54%
Router CPU High Utilization	2.87	31.67%
Congestion	2.65	28.07%
Forwarding Loop	1.89	10.71%
Throughput/Latency	3.39	52.54%
Intermittent	3.38	53.45%
Broadcast/Multicast Storm	1.83	9.62%

(a)

Category	Avg	% of $\geq 4$
Protocol Misconfig.	2.29	23.64%
ACL Misconfig.	2.44	20.00%
QoS/TE Misconfig.	1.70	7.41%
Hardware Failure	3.07	41.07%
Switch/Router Software Bug	3.12	40.35%
Host Network Stack Bug	1.98	16.00%
Attack	2.67	29.82%
Software Upgrade	2.35	18.52%
External	3.06	42.37%
Unknown	2.25	17.65%

(b)

**Table 1: Rankings of various network symptoms (a) and causes (b) by administrators (5=most often, 1=least often). Average rankings and percentages of respondents who ranked  $\geq 4$  are shown.**



**Figure 1: Cost of network debugging: administrator-estimated number of network related tickets generated every month (a) and time consumed to solve one problem by one engineer (b).**

Category	Avg	% of $\geq 4$
ping	4.50	86.67%
tracert	4.18	80.00%
netperf/iperf	2.35	17.31%
SNMP	3.83	60.10%
Config. Version Control	2.96	37.50%
sFlow/NetFlow	2.60	26.92%

**Table 2: Rankings of tools usage by administrators (5=most often, 1=least often). Average rankings and percentages of respondents who ranked  $\geq 4$  are shown.**

and SNMP are still the most popular tools. When asked what the ideal tool for network debugging would be, 70.7% of respondents think that automatic test generation to check performance and correctness problems are important. Some of them explicitly write down “long running tests to detect jitter or intermittent issues”, “real-time link capacity monitoring”, “monitoring tools for network state”, etc.

## 5. SUMMARY

In summary, this survey reveals several key factors of network debugging today: network administrators are facing complicated symptoms and causes; the cost of debugging is nontrivial, due to the quantities of problems and the time to solve these problems; classical tools such as ping and tracert are still in heavy use, but administrators desire for newer, more sophisticated tools.