

UNDERSTANDING TIMEOUTS IN ROOT DNS MEASUREMENTS: CAUSES AND RECOMMENDATIONS

A SIX-MONTH RIPE ATLAS STUDY OF C-ROOT AND K-ROOT



AUTHOR

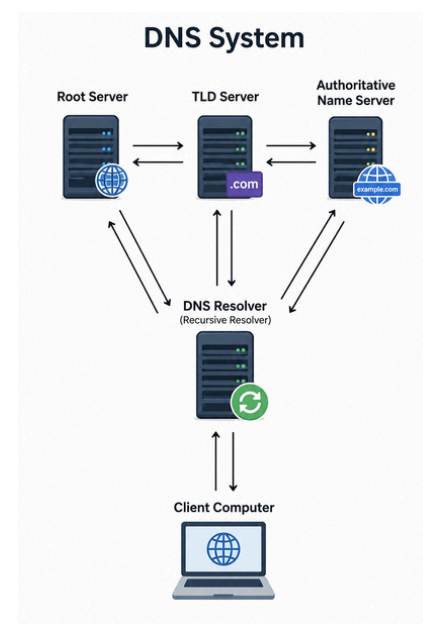
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INTRODUCTION

The Domain Name System (DNS) has been around since the very start of the internet and can be considered one of the most important parts, resolving domain names 24/7 whole year round. This study will focus on the root servers, these sit at the top of the DNS chain and provide a recursive resolver with the IP-addresses for the Top-Level Domain (TLD) servers. These root servers experience timeouts, but why?

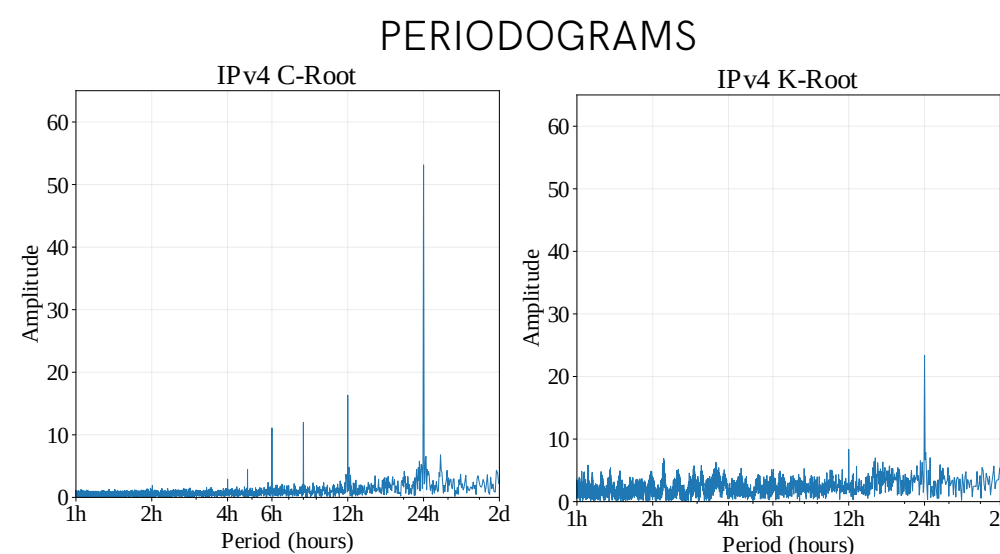
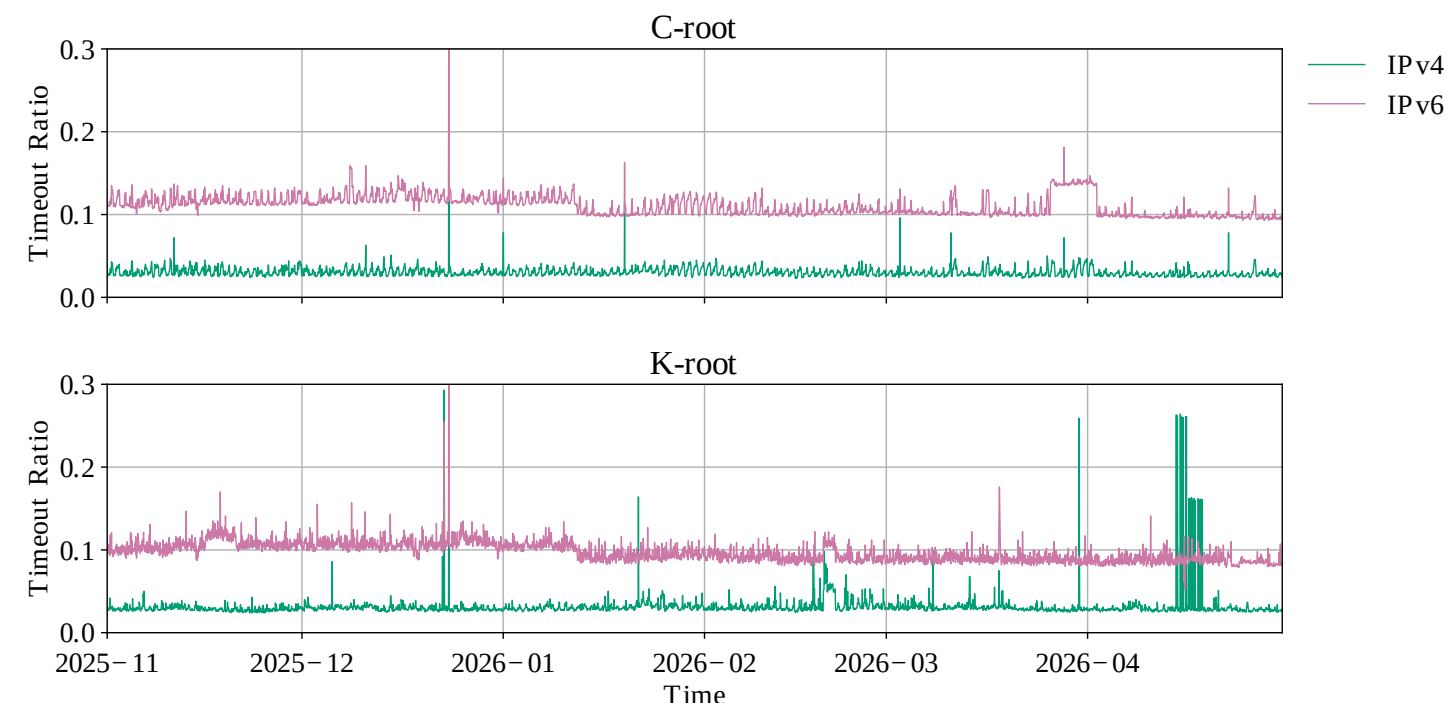


THE GOAL

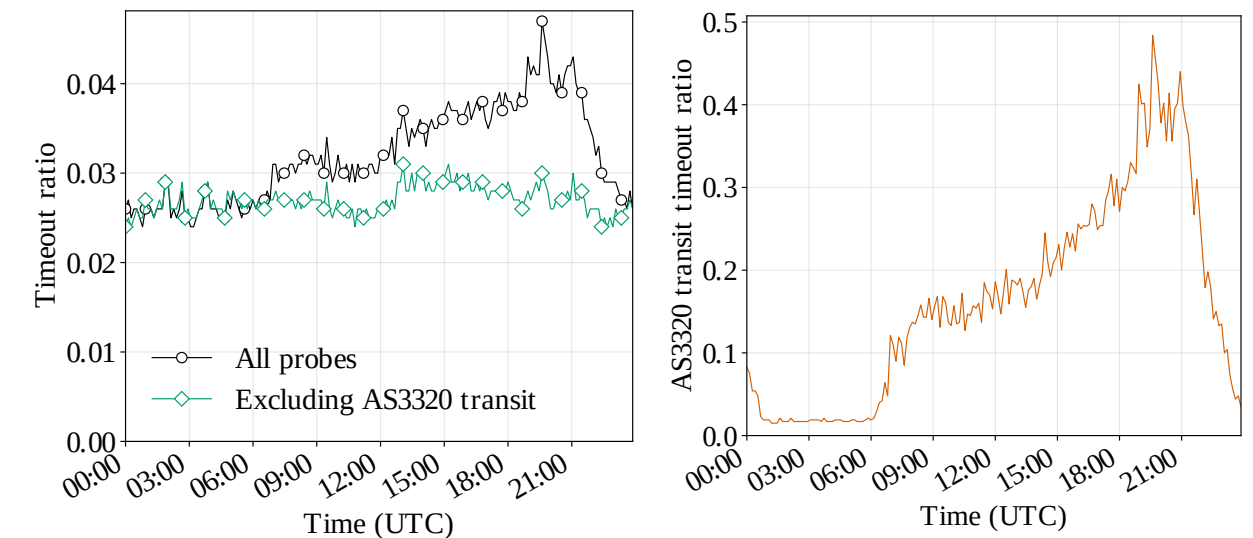
- Identifying primary causes for timeouts involving C-Root and K-Root.
- The findings are used to give recommendations to root server operators, RIPE Atlas users, and RIPE Atlas operators.

Main RQ: What are the primary causes of timeouts involving root DNS servers, and how can these insights improve the reliability of the root DNS servers?

ANALYSIS



- General stability:**
- K-Root is more erratic than C-Root
 - A substantial share of timeouts is due to broken or misconfigured probes
 - Both servers experience timeout events (e.g. spikes)
- Periodicity:**
- Both roots have daily periodicity
 - Periodicity is more pronounced for C-Root = subject for one case study



- Case study 1:**
- AS3320 (Deutsche Telekom) is largely responsible for the periodic pattern on C-Root
 - Most plausibly due to the policing of traffic on the interconnection between AS3320 and AS174 (Cogent)
- Case study 2:**
- Transit ASes cause timeout spikes on K-Root
 - Details and figures can be found in the research paper corresponding to this poster

METHODOLOGY

- RIPE Atlas probes** perform CHAOS queries and traceroutes on C-root and K-root.
- Data:** CHAOS and traceroute measurements over a 6-month period (Nov 2025 - Apr 2026)
- Probe timeout rate:** proportion of probes with ≥ 1 timeout per 8-minute bin.
- AS path derivation:** IP-addresses in traceroutes are mapped to AS numbers; silent hops are discarded.

RESULTS

- Measurement artifacts cause a substantial share of timeouts
- Daily periodicity on both root servers, but more pronounced on C-Root
- The more pronounced periodicity for C-Root is caused by AS3320, plausibly through interconnection policing
- Transit ASes cause timeout spikes on K-Root

CONCLUSIONS

- Timeouts are caused by both measurement artifacts (broken/misconfigur probes) and network-level failures, ranging from interconnection policing to unresolved transit-AS degradation.
- The results translate into concrete recommendations for root server operators, RIPE Atlas users and, RIPE Atlas operators, found in the paper.
- A common thread through this study is the need for decomposing the timeout rate on the AS-level.