

1. What is the problem?

- 1) Hypergiants and thousands of servers deployed inside networks change the structure of the Internet. Previous efforts to study them have relied on proprietary data or specialized per-Hypergiant measurement techniques that neither scale nor generalize.
- 2) Try to measure Hypergiant Off-nets, to track the expansion of the Hypergiants inside other networks.
- 3) It is impossible to identify the server as belonging to the HG using traditional techniques such as inspecting BGP feeds.

2. What are the contributions of the paper?

- 1) They develop a generic methodology to infer all HGs' off-net footprints by analyzing the corpora of scanned certificates.
- 2) They found that the number of ASes that host HG off-net installations has tripled. They correctly uncovered 89-95% of ASes hosting their off-nets
- 3) Their research reveals that the large majority host at least one of the four largest HGs.
- 4) Their analysis unveils different strategies by HGs.

3. What are the conclusions in the paper and how do the authors support their conclusions (for example using measurement study, experimentation, analysis, modeling, etc).

HGs have been expanding their infrastructures towards and into eyeball networks, including via off-net servers inside those networks, to be as close as possible to the end-users. However, as these Hypergiants grew in importance, their serving infrastructures become less and less visible to traditional measurement techniques, and mapping their expansions was an unmet challenge.

They develop a methodology that uses TLS certificate scans as a building block, supplementing them with techniques.

4. What did you like about the paper (or what is the one new/cool thing you learned from the paper)

- 1) The structure of the paper is very clear, especially the plots are very informative.
- 2) They develop a methodology themselves and validate the results thoroughly.

5. What did you not like about the paper? Is there something you don't agree with within the paper? (or how can you improve the paper)

- 1) Their methodology relies on the fact that HGs include company information in their TLS certificates to help establish their identities to users, thus the results could not be perfect when in terms of HGs.

How do you think you can use the techniques described in the paper to solve another problem in a different domain?

- 1) These large Hypergiants can serve large fractions of the world's Internet users directly from within the users' networks. Our study opens interesting research directions on Internet privatization, content delivery, and security practices.