Internet Measurement Project Proposal

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1. INTRODUCTION

The measurement of Internet has become increasingly important and challenging due to its complexity, large-scale and variability. A numbers of tools have been proposed to accomplish this task (see Sec. 2 for a complete review). In this project, our primary goal is not to introduce a novel network measurement tool; instead, we adapt existing measurement techniques to characterize the performance of current Internet. We base our work on previous investigations, and try to elucidate the changes in measurement strategies and outcomes. Specifically, the cloud computing service model and mobile computing have re-shaped the Internet in unanticipated ways. The impact of these new models on end-to-end latency and measurement techniques have never been formally studied. We propose the questions listed bellow as motivations for our study.

- How does network latency vary among different kinds of end hosts – generic end users(including mobile/wireless end hosts), regular web servers, and cloud service from data centers?
- How current Internet latency performs in comparison to the speed-of-light limit?
- How wide-area networks and data centers contribute to end-to-end latency experienced by end users?
- How latency is affected by edge caching of content, especially on mobile networks?
- What are the characteristics of time-series analysis for latency on a daily/weekly/yearly basis?

Our initial approach will consist of re-implementing and re-producing previous measurement works in the context of current Internet, following the guidelines outlined in [12]. One major strategy we intend to re-implement is King [3], a technique which leverages the DNS infrastructure to measure end-to-end latency of arbitrary end hosts. To guarantee deliverables, we have a outlined an initial timetable for our study below (see Table. 1).

Period	Task
Late Feburary	Literature review
March	Re-implementation and initial measurements
April	Revision/correction of any possible methodology flaws
Early May	Wrap up and report

Table 1: timeline for project

2. RELATED WORK

In this section we will review the possible tools and methodologies that we hope will prove valuable for our projects.

There are a number of existing tools for Internet measurement; they primarily differ in the network characteristics they measure. To name a few, *ping* is the popular tool used to test reachability and measure round-trip time (RTT). *traceroute* [6] and *tcptraceroute* [16] reveal the routing path as well as the RTT. King [3] measures the end-to-end latency using recursive DNS queries. *pathchar* [5] measures the hop-by-hop bandwidth and [7] reports the available bandwidth of a path. [13] provides dedicated hardware for measurements, only affiliated users can access. Therefore in [15], Spring *et al.* seeks to build a generic platform for ordinary users to conduct measurements from remote vantage points.

On top of these tools, many large Internet monitoring projects (such as pingER [9]) have been built. Furthermore, researchers are also trying to infer Internet performance and security [11] based on measurement results ([2] utilized *pathchar* tool to estimate Internet link characteristics).

With the advent of cloud computing and mobile computing, it becomes important to characterize their performance. [8, 1] analyzes traffic patterns in data center, and [4] is an ongoing project in measuring mobile end-host network performance.

Vern Paxson's work in [14, 10, 12] serves as guidelines in our design and implementation of all measurement experiements.

3. EXPECTED RESULTS

We expect to have results in the form of actual measurement tools and data, as well as analysis tools and reproducible analysis output. The dataset will consist of latency measurements between end hosts along with meta-data (the DNS query, Geo-IP resolution, time of testing, environment of testing, etc.). Our analysis will compare latency to time and physical location, and separate WAN latency from datacenter latency. Various visualizations may be employed in assisting answering the questions in Sec. 1.

4. REFERENCES

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