Internet Outages: How much of a problem are they?

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Detecting Internet outages is vital

As our reliance upon the Internet increases, so does the need for a reliable Internet. However, Internet reliability is threatened by a variety of events that can lead to Internet outages, such as natural disasters, cable-cuts, power outages, government censorship, cyber-attacks, and misconfigurations. Currently, our understanding of Internet outages, including their frequency, duration, and scope, is incomplete.

Given the potential impact of Internet outages, there is a pressing need for techniques that can accurately detect and characterize them and disseminate findings publicly so that diverse stakeholders including providers, regulators, end users, and researchers can benefit. Outage detection techniques will help with diagnosis and remediation efforts in the short-term, and with uncovering trends and patterns in Internet reliability in the long-term.

Barriers to outage detection

The size, diversity, and distributed nature of the Internet and the various causes of outage events present massive challenges in obtaining empirical and accurate data about Internet outages. Detecting potentially rare outage events that can exhibit diurnal and seasonal variation requires *longitudinal* measurement. With continuing Internet uptake, monitoring even a fraction of worldwide Internet connections continuously to detect potentially rare outage events is no small feat. Adding to the complexity, outages can vary in scope from affecting neighborhoods to affecting entire countries; techniques therefore need the sensitivity to detect outages of varying scope. The heterogeneity of Internet access methods presents another major challenge—cable connections differ in their properties from DSL connections, which in turn differ from satellite connections.

Collaborative activities that can benefit from NSF support

Given the barriers and challenges that thwart accurate outage detection, we need support for a variety of tools and techniques that can perform long-term measurements and that can remain accurate even as technologies evolve.

Researchers have thus far tackled outage detection challenges by developing several complementary techniques that each has partial coverage. Probing based techniques send active probes (such as pings) to various destinations and interpret responses to detect outages [4, 2, 3]. Passive techniques use privileged vantage points that observe Internet traffic from around the world to detect outages when traffic levels fall below expected levels [1, 5]. Measurement agents deployed at user premises, in hardware [7, 10, 6] and software [9, 8], offer additional lenses into Internet outages. While each of these technologies lack visibility into some aspects of outages, the combined perspectives help fill gaps in our understanding of Internet outages.

As Internet technologies continue to evolve, it is critical to develop, update, and continue the collection of Internet outage datasets, in order to track the evolution of Internet reliability. The ability to sustain and store longitudinal measurements will enable detailed comparisons of Internet reliability across geographic areas, Internet Service Providers, media-types, and service tiers, at various times. Such analyses will lead to fundamental improvements in our understanding of Internet outages and reliability.

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