

CDN analysis sheds light on internet evolution

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CDNs have greatly improved our online experience. The CDN-H project has studied its implications for the internet's structure and the relationship between stakeholders.

Google has recently announced that page speed would now be a factor in mobile search ranking. This is the most recent event in a long series of changes that has been not only changing our online experience for the better, but also has allowed for content delivery networks (CDNs) to thrive.

Although completely seamless, CDN is indeed a full-blown paradigm shift that changed how [internet](#) users access their content. Before CDN existed, connecting to a website meant downloading content from the server it was stored on until everything was properly displayed on screen. Now, this content is spread across multiple locations, and is typically downloaded by the server closest to the user, making page loading much faster. About 50 % of internet content is delivered through a CDN.

This success, however, is progressively driving the technology into a corner, as Prof. Georgios Smaragdakis of TU Berlin explains: "As more and

more applications need to deliver voluminous [traffic](#) to potentially billions of [internet users](#), more companies are expected to build their own CDN or rely on third-party ones. This increased usage of CDN poses challenges to transit network providers who rely on cross-network traffic to make profit, as well as network operators who lose control over how the traffic of their users is being redirected.'

It's a bit of a tug-of-war: CDNs dynamically map end-users to appropriate servers without being fully aware of the network conditions within an ISP or end-user location; whilst ISPs struggle to cope with rapid traffic shifts caused by the dynamic server selection policies of the CDNs.

Studying the spectrum of current and upcoming CDN solutions, Prof. Smaragdakis and his team soon realised that there was actually room for common ground. With funding under the CDN-H project, they could identify architectures where a CDN and a network provider can coordinate to reach a win-win situation.

"Our analysis showed that because of its global reach, a CDN is a unique vantage point to track the evolution of network protocols, peering strategies, performance characteristics, as well as the online activity at a global scale," Prof. Smaragdakis explains. "We showed that due to the increased CDN activity, the server-to-server traffic is now a significant part of the internet traffic and that indeed, many user connections are now terminated at close CDN servers. We also showed that an increasing number of peering points providing advanced peering options are now available across the world and that the utilisation of such peering points can significantly improve content delivery performance as well as reduce internet congestion. The insights from this study are valuable for researchers to improve our understanding of the internet's structure and for regulators to better inform internet policy."

Among the project's most notable contributions were the use of CDN data to capture the pulse of the internet over the years, as well as the development of novel techniques to infer where and how a CDN and a network operator exchange traffic. "The developed techniques significantly expand existing maps of the internet and have practical value, for example, for locating the physical location of attacks, congestion, and vulnerabilities, as well as modeling the business relationships between CDNs and network operators," says Prof. Smaragdakis.

The papers presenting these two contributions were awarded, and Prof. Smaragdakis indicates that the measurement methods developed under the project could eventually be integrated with the operational products of CDNs to improve their efficiency and accuracy. Concurrently, the team will continue to use CDNs to better understand the state of the internet, possibly inferring large-scale cyberattacks and [network](#) outages, as well as estimating what fraction of connected devices are vulnerable to security threats.

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