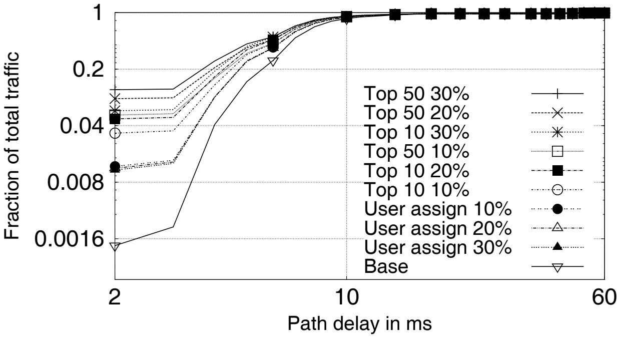
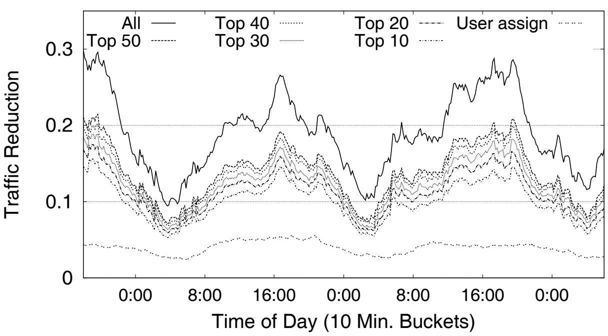
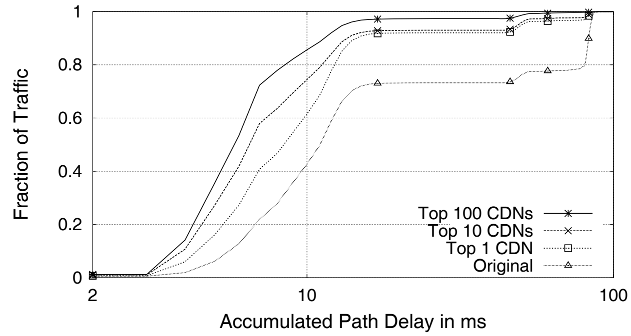


(a) Reduction in user-server delay by NetPaaS.

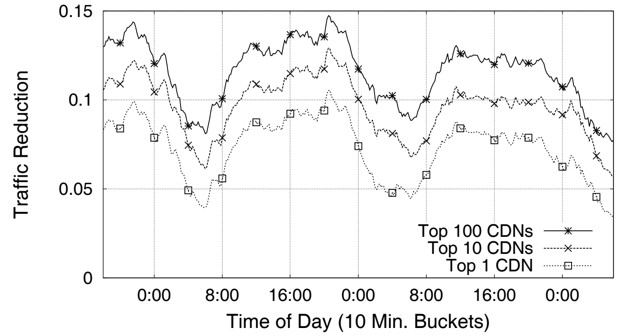


(b) Total traffic reductions by NetPaaS (30% CDN traffic).

Figure 10: Joint service deployment with NetPaaS.



(a) Reduction in user-server delay for top 1, 10, and 100 CDNs.



(b) Total network traffic reduction for top 1, 10, and 100 CDNs.

Figure 11: Improvements with NetPaaS when considering the top 1, 10, and 100 CDNs.

total traffic, the top 10 CDNs are responsible for more than 40% and the top 100 CDNs for more than 67% respectively. Most of the large CDNs have deployed distributed infrastructure, located in a number of networks [55]. Figure 11 shows the improvements in user-server delay as well as the total traffic reduction achieved by NetPaaS. For the largest CDN most of the traffic can be served from close-by servers and as a result the total traffic can be reduced by up to 10%. When turning our attention to the top 10 and top 100 CDNs, we observe that NetPaaS is able to further increase the improvements, but with diminishing returns. With the top 10 CDNs the traffic is reduced by up to 13% and with the top 100 CDNs 15% respectively. We conclude that by utilizing NetPaaS for the top 10 CDNs, it is possible to achieve most of the reduction in user-server delay and total traffic. We present a larger set of results for the top CDNs and an evaluation for a number of optimization goals under various network topologies in [31].

6. CONCLUSION

Motivated by recent CDN and ISP alliances we revisit the problem of CDN-ISP collaboration from a systems perspective. We identify two major enablers, namely informed user-server assignment and in-network server allocation. Today, there is no system to support CDN-ISP collaboration. To that end we design and implement a system for CDN-ISP collaboration, called NetPaaS, that incorporates the above enablers. We perform the first-of-its-kind evaluation of CDN-ISP collaboration based on traces from the largest commercial CDN and a large tier-1 ISP using NetPaaS. We report on the benefits for CDNs, ISPs, and end-users. Our results show that with NetPaaS, CDN-ISP collaboration leads to a win-win situation with regards to the deployment and operation of servers within the network, and significantly improves end-user performance. A key observation is that agile and online placement of servers inside the network closer to the source of demand is the key to improve content delivery and address traffic engineering, while some benefits are also possible with the already deployed server infrastructure. We believe that NetPaaS can be widely used in the new landscape of joint CDN-ISP server deployment inside the network and act as a catalyst for innovative solutions towards improving network operation, reducing content delivery cost and enabling new applications inside the network.

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