Fibbing in action: On-demand load-balancing for better video delivery

Olivier Tilmans*, Stefano Vissicchio*, Laurent Vanbever†, Jennifer Rexford‡
* Université catholique de Louvain, † ETH Zürich, ‡ Princeton University

Flash crowds cause service disruption

Video delivery services require good network performance and suffer from flash crowds [1]: transient, localized, surges of traffic.

- Protecting the services at the network level against these surges is hard due to their short-lived nature:
  1. Traditional traffic engineering techniques [2] perform poorly,
  2. Over-provisioning is expensive.

Fibbing lets networks handle flash crowds

- Fibbing [2] can change the behavior of networks within a single IGP convergence.
- Fibbing provides the two required primitives to implement the optimal solution to the min-max link utilization problem [4]:
  1. Programming multiple paths on a per-destination basis;

Programming ECMP to decrease the maximal link load using Fibbing

The chosen IGP metrics cause the shortest paths starting at router A and B to overlap along B→R2→C.

For a high enough demand, the data-plane traffic from the servers to the clients could overload these links.

By augmenting the topology with fake elements, Fibbing creates additional equal-cost paths towards the clients.

The traffic uses all paths, causing uneven load-balancing at router A and decreasing the maximal link load.

Experiment setup

- We initially have 1 video stream from S1 to D1.
  - At time \( t = 15 \text{s} \), we start 30 new streams from S1 to D1.
  - At time \( t = 35 \text{s} \), we start 30 streams from S2 to D2.
- Servers notify the controller when they start/stop serving a new stream to a client.

Controller behavior

- The controller detects flash crowds using SNMP queries.
- The controller adds a new equal-cost path towards each client prefix such that:
  1. The new path is the shortest link-disjoint path;
  2. The splitting ratio is set to decrease the maximal link load.

- Additional links are used in response to the traffic increase.
- Introducing uneven load-balancing at router A causes all links to have a similar load.
- The video playbacks on the clients are smooth.