ROLE OF PLACEMENT SCHEMES ON THE INTERACTION BETWEEN NETWORK AND CONTENT DELIVERY

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ABSTRACT

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A placement strategy determines the locations at which content is placed in a network. An effective placement strategy improves availability of content in presence of failures, and makes judicious use of available resources, such as storage and bandwidth, to reduce the latency of content accesses.

While effective placement is known to improve content delivery in the Internet, this thesis studies the impact of placement strategies on the objectives of the underlying network. Our work is closely related to prior research on the interaction between network and content delivery. To our knowledge, this is the first effort to study how placement strategies shape this interaction and affect the objectives of networks and content delivery systems. We study this interaction in three scenarios: an Internet service provider (ISP) network in which all content is placed at a

small number of randomly chosen locations, an ISP that controls both the underlying network and content delivery on its network and therefore has full flexibility in designing placement strategies, and a datacenter of a content delivery network (CDN) whose goal is energy-minimization, and makes both placement and routing decisions to that end. Based on experiments with real ISP and datacenter topologies and content access traces from a leading CDN, we show that content placement is a powerful factor in shaping the network traffic and that simple placement strategies are effective in improving cost-, performance- and energy-related metrics for networks and content delivery systems.

Several applications today generate dynamic content such as stock prices, weather information, and status updates posted on social media websites. Placement of dynamic content is a challenging problem due to a fundamental cost-vs.-performance trade-off: dynamic content replication at multiple locations improves latency of content accesses but increases update propagation costs. We design and implement Auspice, a system for placement of dynamic content across geo-distributed data centers. Auspice infers pockets of high demand for a name and uses a heuristic placement strategy to provide low request latency, low update cost, and high availability. An application suited for Auspice is a global name service to store name-to-address mappings of mobile devices. We extensively evaluate Auspice for an expected workload of such a global name service and show that it significantly outperforms both commercial managed DNS services as well as DHT-based replication alternatives to DNS.

TABLE OF CONTENTS