

A Novel Approach for Cloud Bandwidth Reduction and Cost Reduction Using PACK

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Abstract: *The PACK (Predictive ACKs), a novel end-to-end traffic redundancy elimination (TRE) system, designed for cloud computing customers. Cloud-based TRE needs to apply a judicious use of cloud resources so that the bandwidth cost reduction combined with the additional cost of TRE computation and storage would be optimized. PACK's main advantages' its capability of offloading the cloud-server TRE effort to end clients, thus minimizing the processing costs induced by the TRE algorithm. Unlike previous solutions, PACK does not require the server to continuously maintain clients' status. The PACK is suitable for pervasive computation environments that combine client mobility and server migration to maintain cloud elasticity. PACK is based on a novel TRE technique, which allows the client to use newly received chunks to identify previously received chunk chains, which in turn can be used as reliable predictors to future transmitted chunks. And a fully functional PACK implementation, transparent to all TCP-based applications and network devices.*

Keyword: cloud computing, traffic redundancy elimination, quality of service, caching, network optimization.

1. Introduction

Cloud Computing, that is providing computer resources as a service, is a technology revolution offering flexible IT usage in a cost efficient and pay-per-use way. Cloud customers pay only for the actual use of computing resources, storage, and bandwidth, according to their changing needs, utilizing the cloud's scalable and elastic computational capabilities. In particular, data transfer costs (i.e., bandwidth) is an important issue when trying to minimize costs. Cloud customers applying a judicious use of the cloud's resources are motivated to use various traffic reduction techniques, in particular traffic redundancy elimination (TRE), for reducing bandwidth costs. Traffic redundancy stems from common end-users' activities, such as repeatedly accessing, downloading, uploading (i.e. backup), distributing, and modifying the same or similar information items. TRE is used to eliminate the transmission of redundant content and, therefore, to significantly reduce the network cost. In most common TRE solutions, both the sender and the receiver examine and compare signatures of data chunks, parsed according to the data content, prior to their transmission. When redundant chunks are detected, the sender replaces the transmission of each redundant chunk with its strong signature. While proprietary middle-boxes are popular point solutions within enterprises, they are not as attractive in a cloud environment.. The rise of "on-demand" work spaces, meeting rooms, and work-from-home solutions detaches the workers from their offices. In such a dynamic work environment, fixed-point solutions that require a client-side and a server-side middle-box pair become ineffective. Current end-to-end TRE solutions are sender-based. In the case where the cloud server is the sender, these solutions require that the server continuously maintain clients' status. Clearly, a TRE solution that puts most of its computational effort on the cloud side may turn to be less cost-effective than the one that leverages the combined client-side capabilities. The sender-based end-to-end TRE solutions add a considerable load to the servers, which may eradicate the cloud cost saving addressed by the TRE and it require to maintain end-to-end synchronization that may degraded TRE

efficiency. Here make use of an novel receiver-based end-to-end TRE solution that relies on the power of predictions to eliminate redundant traffic between the cloud and its end-users.

2. Related Work

2.1 A low-bandwidth network file system

The LBFS is a network file system designed for low-bandwidth networks. LBFS exploits similarities between files or versions of the same file to save bandwidth. It avoids sending data over the network when the same data can already be found in the server's file system or the client's cache. Using this technique in conjunction with conventional compression and caching, LBFS consumes over an order of magnitude less bandwidth than traditional network file systems on common workloads.

2.2 SmartRE: An architecture for coordinated network-wide redundancy elimination

SmartRE, a practical and efficient architecture for network-wide RE. They show that SmartRE can enable more effective utilization of the available resources at network devices by reducing the wide-area footprint, and by improve end-to-end application performance. Therefore SmartRE can magnify the overall benefits of network-wide RE. SmartRE is naturally suited to handle heterogeneous resource constraints and traffic patterns and for incremental deployment.

2.3 Redundancy in network traffic: Findings and implications

The *protocol-independent redundancy elimination*, are used to improve network link performance by removing duplicate strings from within arbitrary network flows, has emerged as a powerful technique to improve the efficiency of network links in the face of repeated data. Many vendors offer such redundancy elimination middle boxes to improve the effective bandwidth of enterprise, data center and ISP links.

2.4 EndRE: An end-system redundancy elimination service for enterprises

EndRE, is an alternative approach where redundancy elimination (RE) is provided as *an end system service*. Unlike middle boxes, such an approach benefits both end-to-end encrypted traffic as well as traffic on last-hop wireless links to mobile devices. EndRE uses a new fingerprinting scheme called SampleByte that is much faster than Rabin fingerprinting while delivering similar compression gains. Unlike Rabin fingerprinting, SampleByte can also adapt its CPU usage depending on server load. End-to-end latencies by up to 30%, and translates bandwidth savings into equivalent energy savings on mobile smart phones.

3. Conclusion

The proposed PACK is a receiver-based, cloud-friendly, end-to-end TRE that is based on novel speculative principles that reduce latency and cloud operational cost. PACK does not require the server to continuously maintain clients' status, thus enabling cloud elasticity and user mobility while preserving long-term redundancy. Moreover, PACK is capable of eliminating redundancy based on content arriving to the client from multiple servers without applying a three-way handshake.

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