Survey on Traffic Redundancy and Elimination Approach for Reducing Cloud Bandwidth and Costs

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Abstract— Cloud computing is a fast growing field which is arguably a new computing paradigm. In cloud computing, computing resources are provided as services over the internet and users can access resources on based on their payments. Transmission cost plays an important role when trying to minimize cloud cost. However for server specific TRE approach it is difficult to handle the traffic efficiently and it doesn't suites for the cloud environment because of high processing costs. In this paper we give a survey on the new traffic redundancy technique known as novel-TRE also known as receiver based TRE. This novel-TRE has significant features like detecting the redundancy at the client, repeats appear in chains, matches incoming chunks with a previously received chunk chain or local file and sending to the server for predicting the future data and no need of server to continuously maintain client state.

Keywords: Cloud Computing, Lightweight chunking, pay-as-you-go, novel-TRE.

I. INTRODUCTION

Cloud computing is emerging style of delivery in which applications, data and resources are rapidly provisioned as standardized offerings to users with a flexible price. The cloud computing paradigm has achieved widespread adoption in recent years. Its success is due largely to customers' ability to use services on demand with a pay-as-you go [2] pricing model, which has proved convenient in many respects. Low costs and high flexibility make migrating to the cloud compelling. Cloud computing is the long dreamed vision of computing as a utility, where users can remotely store their data into the cloud so as to enjoy the on-demand high quality applications and services from a shared pool of configurable computing resources. By data outsourcing, users can be relieved from the burden of local data storage and maintenance. Traffic redundancy and elimination approach is used for minimizing the cost.

Cloud applications that offer data management services are emerging. Such clouds support caching of data in order to provide quality query services. The users can query the cloud data, paying the price for the infrastructure they use. Cloud management necessitates an economy that manages the service of multiple users in an efficient, but also, resource economic way that allows for cloud profit. Naturally, the maximization of cloud profit given some guarantees for user satisfaction presumes an appropriate price-demand model that enables optimal pricing of query services. The model should be plausible in that it reflects the correlation of cache structures involved in the queries. Optimal pricing is achieved based on a dynamic pricing scheme that adapts to time changes.

Protocol-independent redundancy elimination [3] works on Manber to detect similar, but not necessarily identical, information transfers. In terms of improving Web performance, it has the potential to exceed the benefits of other approaches such as delta coding and duplicate suppression. This is because the similarity algorithms on which it is based include as a subset both exact matches (duplicate suppression) and differences between versions of the same document (delta coding).A distinguishing feature of our system is that it is protocol independent. It makes no assumptions about the syntax or semantics of HTTP. This has two distinct advantages. It is able to identify fine grained sharing, as may be common with dynamically generated or personalized pages, as well as inter-protocol sharing. It does not need to be updated to take advantage of new types of content, such as streaming media, as they emerge or delivery protocols are revised.

II. TRE ENVIRONMRNT IN CLOUD COMPUTING

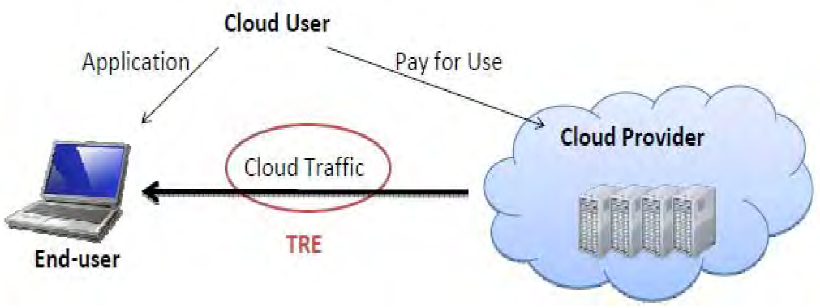

Fig: 1 Cloud TRE Environment

Fig 1 shows how the traffic encounters in the cloud computing between end user and the cloud server by transferring the same content repeatedly. In order to removing redundancy we are using TRE approach. Large amount of popular content is transferred repeatedly across network links in the internet. To transfer the information between the sender and receiver data is divided into chunks. Chunking mechanism helps to improve the efficiency by parallel upload/download of different chunks and each chunk generates a signature to transfer the data in a secure manner.

III. Wide Area Network TRE

Traffic happens between the sender and receiver by transmitting the same information repeatedly, that information may contain files, documents, video's etc. In recent years various TRE techniques have been developed for eliminating the redundant data. Wanax [4] present, Wide-area network (WAN) accelerators operate by compressing redundant network traffic from point-to-point communications, enabling higher effective bandwidth.

A.Multi Resolution Scheme:

Wanax uses a multi-resolution chunking (MRC) scheme that provides high compression rates and high disk performance for a variety of content, while using much less memory.

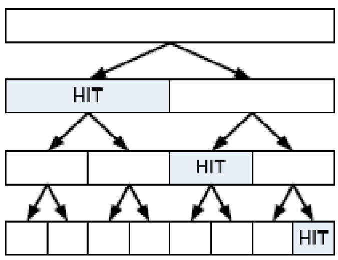

Fig 2: MRC Aligned Chunk Boundaries

Fig [2] shows MRC (multi resolution chunking) operation, here the received data is divided into equal sized chunks. Content fingerprinting (CF) forms the basis for Wanax, since it provides a position-independent and history-independent technique for breaking a stream of data into smaller pieces, or chunks, based only on their content.

To prevent chunks from being too large or too small, minimum and maximum chunk sizes can be specified as well. Since Rabin fingerprinting determines chunk boundaries by content, rather than offset, localized changes in the data stream only affect chunks that are near the changes. Once a stream has been chunked, the WAN accelerator can cache the chunks and pass references to previously cached chunks, regardless of their origin. Wanax approach is based on three-way-handshake technique uses a sender middle-box and receiver middle-box for transmitting data between the sender and the receiver.

B.Disadvantages:

(1) End-to- end encrypted traffic do not cope well middle-boxes.

(2) It creates latency for non cached data and middle-boxes will not improve the performance.

IV. END-REDUNDANCY ELIMINATION TRE

EndRE [5] *end-system redundancy elimination* provides fast, adaptive and parsimonious in memory usage in order to opportunistically leverage resources on end hosts. EndRE is based on two modules server and the client. The server-side module is responsible for identifying redundancy in network data by comparing against a cache of prior data and encoding the redundant data with shorter meta-data. The client-side module consists of a fixed-size circular FIFO log of packets and simple logic to decode the meta-data by "de-referencing" the offsets sent by the server. Thus, most of the complexity in EndRE is mainly on the server side. Therefore it is server specific not able to maintain the full synchronization between client and the server. EndRE uses SampleByte fingerprinting scheme which is quicker than Rabin fingerprinting. EndRE limited for small redundant chunks of the order of 32-64 bytes. Only unique chunks are transmitted between file servers and clients, resulting in lower bandwidth consumption. The basic idea underlying EndRE is that of *content-based naming* where an object is divided into chunks and indexed by computing hashes over chunks.

Comparison with Novel-TRE:

1. It is server specific
2. Chunk size is small.

The paper [6] describes how to get aside with three-way handshake between the sender and the receiver if a full state synchronization is maintained. A method is disclosed for reducing network traffic. At a sender, a data chunk is identified for transmission to a receiver, which is connected to the sender over a communication link. The sender computes a signature of the data chunk and determines whether the date chunk has been previously transmitted by looking up the signature in a sender index table. The sender index table associates the signatures of previously transmitted data chunks with unique index values. A message is transmitted to the receiver, where if the data chunk has previously been transmitted then the message includes an index value from the sender index table that is associated with the signature of the data chunk. At the receiver, the data chunk is located in a receiver cache that stores the previously transmitted data chunks by looking up the index value included in the message in a receiver index table. The receiver index table associates the unique index values with the locations in the receiver cache of the previously transmitted data chunks.

Packet level redundant content elimination [**7**] as a universal primitive on all internet routers, such a universal deployment would immediately reduce link loads everywhere. However, we argue that far more significant network-wide benefits can be derived by redesigning network routing protocols to leverage the universal deployment. The "redundancy-aware" intra- and inter-domain routing algorithms show that they enable better traffic engineering, reduce link usage costs, and enhance ISPs' responsiveness to traffic variations. Disadvantage Of course, deploying redundancy elimination mechanisms on multiple network routers is likely to be expensive to start with. However, we believe that the significant long term benefits of our approaches offer great incentives for networks to adopt them.

V. NOVEL TRE

The novel-TRE approach relies on the power of predictions to eliminate redundant traffic between its end-users and the cloud. In this technique, each receiver observes the incoming stream and tries to match its chunks with a previously received chunk chain or a chunk chain of a local file. Using the long-term chunks' metadata information kept locally, the receiver sends to the server predictions that include chunks' signatures and easy-to-verify hints of the sender's future data. On the receiver side, we propose a new computationally lightweight chunking [1] (fingerprinting) scheme. Lightweight chunking is alternative for Rabin fingerprinting [8] traditionally used by RE applications with high data processing speed.

The stream of data received at the novel-TRE receiver is parsed to a sequence of variable-size, content-based signed chunks [9]. The chunks are then compared to the receiver local storage, termed *chunk store*. If a matching chunk is found in the local chunk store, the receiver retrieves the sequence of subsequent chunks, referred to as a *chain*, by traversing the sequence of LRU chunk pointers that are included in the chunks' metadata. Using the constructed chain, the receiver sends a prediction to the sender for the subsequent data. Part of each chunk's prediction, termed a *hint*, is an easy-to-compute function with a small-enough false-positive value, such as the value of the last byte in the predicted data or a byte-wide XOR checksum of all or selected bytes.

A.*Chunking Mechanism:*

Novel-TRE uses a new *chains* scheme, described in Fig. 3, in which chunks are linked to other chunks according to their last received order.

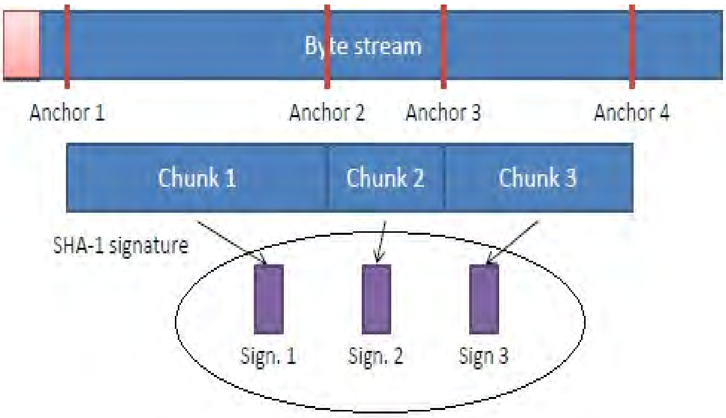

Fig 3: Lightweight Chunking

The novel-TRE receiver maintains a *chunk store*, which is a large size cache of chunks and their associated metadata. Chunk's metadata includes the chunk's signature and a (single) pointer to the successive chunk in the last received stream containing this chunk. When the new data are received and parsed to chunks, the receiver computes each chunk's signature using SHA-1. At this point, the chunk and its signature are added to the chunk store. In addition, the metadata of the previously received chunk in the same stream is updated to point to the current chunk..

B. *Prediction Operation:*

Fig-4 shows how the chunks are predicting in the receiver, upon the arrival of new data the receiver computes the respective signature for each chunk and looks for a match in its local chunk store.

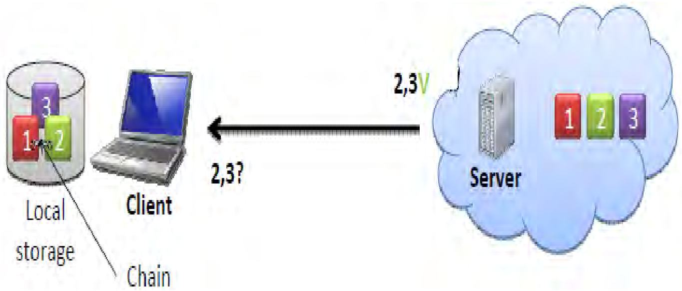

Fig 4: Prediction Operation

If the chunk's signature is found, the receiver determines whether it is a part of a formerly received chain, using the chunks' metadata. If affirmative, the receiver sends a prediction to the sender for several next expected chain chunks. Upon a successful prediction, the sender responds with a PRED-ACK confirmation message. Once the PRED-ACK message is received and processed, the receiver copies the corresponding data from the chunk store to its TCP input buffers, placing it according to the corresponding sequence numbers. At this point, the receiver sends a normal TCP ACK with the next expected TCP sequence number. In case the prediction is false, or one or more predicted chunks are already sent, the sender continues with normal operation, e.g., sending the raw data, without sending a PRED-ACK message. On the other hand, the use of smaller chunks increases the storage index size, memory usage, and magnetic disk seeks. It also increases the transmission overhead of the virtual data exchanged between the client and the server.

VI. CONCLUSION

In this paper, we proposed a novel-TRE approach for eliminating redundancy in the cloud environment. Our proposed scheme has significant features like reduces the transmission cost by predicting chunks, redundancy detection by the client, does not require the server to continuously maintain clients' status. Our receiver based end-to-end TRE suites for cloud environment.

VII. References

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