REDUNDANT SEARCH CONTROL FOR CONTENT CENTRIC NETWORK

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Abstract- Content Centric Network (CCN) is emerging as the future network concept. Cache inside the infrastructure is necessary to implement CCN. There are many caching concepts such as on-path and off-path, homogenous and heterogeneous caching. On-path caching introduce redundancy in different branches from a path. Off-path caching create redundancy even in neighbor nodes. When there are multiple copies of content stored, the CCN searches the network unnecessarily. In this paper, we propose a cache model to avoid redundancy in cache data. A cache manager keeps track of all the data, and place the information them in the router connecting to outside network. The routers then forward the interest to reach inside or outside the network.

Keywords- Content Centric Network, Caching, Forwarding, Redundancy.

I. INTRODUCTION

In recent years, with the growth of physical bandwidth of the access network for users, the way to use internet has changed significantly. Including social communicating tools, multimedia and cloud storage service, users increasingly apply the internet for content dissemination and sharing. However, the current widely used IP/TCP network architecture is an end-to-end protocol, which has been thought difficult to meet the communication requirements. An evolution architecture Content Centric Network (CCN) proposed, instead of the IP address as the core, CCN makes the content itself become the main unit of the network [1]. In CCN, users do not have to get the IP address but only need to request content by name. When the desired content is retrieved, the reply data is returned to the requestor in accordance with the path information along the routers. In NDN, content packets can be cached in every router [2]. Each router has a cache store which is used to hold the contents with a high request frequency. CCN has two types of packets. An interest packets is sent to the network. For each interest a data packet might be replied, if found in any router or any infrastructure. Each router has three data structure as shown in Figure 1, [3]. A content store (CS) caches frequently used contents. If a router get an Interest and finds a matching data in CS, the router reply the interest. If matching data is not available

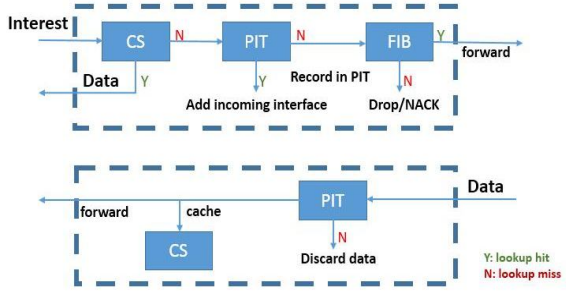


Figure 1: Forwarding progress in CCN

in the CS, router searches another data structure called Pending Interest Table (PIT). The PIT makes an entry for the incoming interest and requesting face. If there is no similar and previous entry then the interest is send to Forwarding Interest Base (FIB). The FIB looks a suitable forwarding path based on the logic designed. It might be flooding or it might be a path based on interface ranking.

The CS and the FIB takes important decision. It is very important to decide which data should be stored in the CS. Many caching algorithms follow the popularity ranking. The problem in popularity ranking is that it denies to store fresh data. Caching in broadly divided into two categories: on-path caching and off-path caching. On-path caching is inherently supported by CCN and is best suitable for sequential caching. The problem in on-path caching is that, two routers with common parents on their path may cache same data. Off-caching avoid the redundancy, but it need a central manager [4].

If router keep same data, an interest will be checked everywhere against same data. So, it will take higher time to find a data from the Internet. In this case, router should know each other's CS. If a matching data in CS or matching entry in PIT is not found, FIB must forward the interest to some destination. Interface ranking is a popular technique to select the forwarding node [5]. But, if the highest-ranking path does not return a data, the FIB may forward to next rank path. For, unpopular data it may take lot of time to get the data. On the other hand, forwarding to every outgoing face may create too many interests in the Internet. If the CS has redundant data, it is wastage of storage space. So CCN must control redundancy among router and reduce the number of nodes to be searched. In this paper, we propose a caching policy that maintain redundancy in caching, and search minimum nodes in a local network.

II. RELATED WORK

The University of California at Los Angeles first proposed the typical research projects CCN (content-centric networking). The CCN architecture is the same as the IP network as shown in Figure 2, [1], but instead of the IP address as the core, CCN makes the content itself become the central unit of the system [6]. Users only need to request their content by name. When the desired content is retrieved, the reply data is returned to the requestor by the "interest packet" path information along the routers.

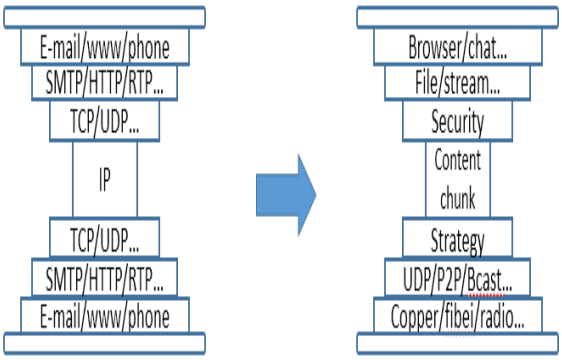


Figure 2: Comparison between IP and CCN

For CCN, the main innovation of efficient content distribution is using a broad range of nodes cache. That is to say; each CCN node can cache the contents with a high request frequency. However, the basic caching policy, also with flooding forwarding strategy [7], could cause an amount of redundant content to be forwarded and cached in CCN. Not only increases the total lookup and decreases the efficiency, but wastes cache resources and reduces cache hits [4] [8].

III. SYSTEM MODEL AND PROPOSED SOLUTION

In this section, we describe our proposed work. The proposed work is divided into two parts: First, we describe a caching scheme that reduces redundancy; second, we describe a forwarding procedure that eliminates CS and PIT search in some intermediate router.

A. Caching policy

Each cache group has a cache manager [9]. The cache manager is responsible to send all the cached information to the routers connecting to other groups (network). When a new data is cached in a node, the information is given to the cache manager. The node with frequent access to that content will store that data.

It is important to decide the frequency of reporting to the cache manager [10]. However, when network load is relatively low, this management information can be exchanged. To avoid, frequent verification with the cache manager, each router can cache data coming from outside network. The caching policy is described in Algorithm 1.

For all incoming content
1. If hop-count > group link length
   a. CACHE
2. If network load < maximum load
   a. Synchronize with manager

Algorithm 1: Caching with no redundancy

B. Forwarding

Note that, each router connecting to an external network have all the information about data cached in the group. Searching the FIB of such a router, is similar to searching the whole group [11]. There are two cases: (1) content is available in the node or in the group, and (2) content is not available in the group. If content is available in the group, the interest is forwarded to the node caching that data. If the content is not available in the node, it should be forwarded to external network [12]. At this time, it is important to find a shortest path from the current node to external network and also to skip CS and PIT search in that shortest path as shown in Algorithm 2.

At each incoming router connecting to external network
1. If content not found
   a. Set NO-LOOK-UP=1
   b. Forward interest in shortest path to external network
2. Each node in shortest path
   a. skip CS check

Algorithm 2: Forwarding

CONCLUSION

CCN is based on the content-centric, which replaces the host centered sending-receiving communication mode in the existing Internet. With the original design in CCN -- caching everywhere and the flooding forwarding strategy [7], resulted in a large amount of redundant content increase the transmission overhead and reduce the transmission efficiency. In this paper we introduce caching procedure to reduce redundancy. We used a central cache manager and describe forwarding that skip CS checking and reduce delay.

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