Scalable Routing for Content Centric Network

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***Abstract*—In Content Centric Network, name-based routing may not scale because the number of content names will be orders of magnitude higher than IP prefixes. To address the scalability problem, we propose routing schemes that exploits the autonomous system numbers and domain names. For intra-domain routing, routers use the splitted routing table by using hashed value of domain names. For inter-domain routing, autonomous system number will be attached to domain name of interest packet. By exploiting this number, packet will be forwarded to destination.**

I. Introduction

Current Internet architecture is basically focused on host-to-host communication because early stage Internet applications, such as remote login and file transfer, focused on host-to-host design[1]. is to share computing resource. However, the vast majority of Internet usage is to acquire data(i.e. contents)[2]. Users only care about 'what to receive', not 'from where'. It means that current Internet architecture has a inherent discrepancies between its structural design and real usage.

Content centric network (CCN) has emerged as a clean slate approach to tackle these problems[3]. Instead of locator-based routing, CCN proposal considers name-based routing. However, name-based routing has a great scalability problem because the number of content names will be orders of magnitude higher than IP prefixes.

In this paper, we investigate that routing schemes splitting the routing table entry for intra-domain routing and using autonomous system number for inter-domain routing.

II. Routing Schemes

A. Intra-domain routing

First, we assume that a content name has a domain part (i.e. publisher name, e.g. /snu.ac.kr), which is a fully qualified. Our basic idea for intra-domain routing is that the some specific routers of an autonomous system (AS) has the splitted routing table. This accountable routers (AR) maintains its own accountable domains. Each domain in the content name is hashed to a fixed-length value (say, 32bits) and this value determines which AR the interest packet should be forwarded to.

Let us illustrate how it works in Figure 1. We illustrate that the four accountable routers exist in an AS. AR00 is accountable for all domain names starting with hashed prefix 00 and so on. It means that AR00 knows destination of all the contents whose hashed prefix starting with 00. So any interest packets staring with hashed prefix 00 should be forwarded to AR00 first. That is, interest packet should drop by appropriate AR because appropriate AR knows where the destination is. In figure 1, when AR01 receives the interest packet starting with hashed prefix 00, AR01 forwards this interest packet to AR00. then, AR00 finally forwards the interest packet to destination.

In this way, every router maintains routing entries for all the domain names that belong to the local AS. If there are N accountable router in an AS, each router needs to maintain only 1/N of the all domains that belong to local AS.

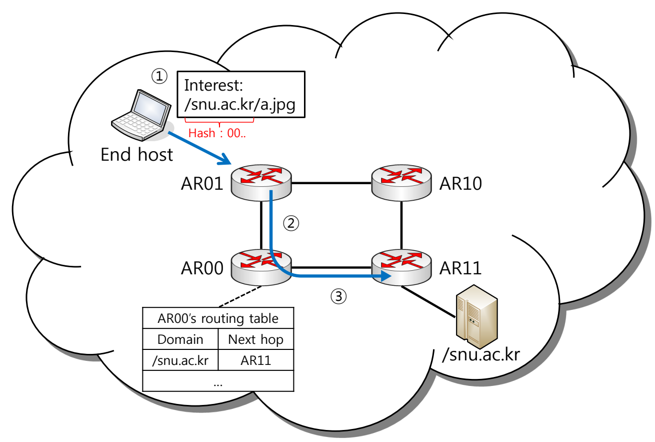

Fig. 1. Routing interest packet in intra-domain routing

B. Inter-domain routing

If the requested content doesn't exists in local AS, interest packet should be forwarded to other ASes. Our basic idea for inter-domain routing is that interest packet has additional information to go through other ASes.

If specific interest packet arrives at appropriate AR and AR has no entry for that interest packet, the AR looks up the autonomous system number (ASN) that hosts domain name of interest packet. We assume that this operations can work with a global scale mapping service(e.g. DNS). The result of DNS query can be attached to content name. That is, AR concatenates the ASN and content name with special delimiter. Finally, Interest packet with ASN can be forwarded to the destination AS.

Let us illustrate how it works in Figure 2. The incoming interest packet arrives at AR01 and it forwards this packet to appropriate AR10 because the incoming packet's hashed value starts with 10. However, AR10 has no routing table entry for that interest packet because publisher that has a domain name in content name doesn't exist in local AS. Therefore, AR10 looks up the ASN that hosts domain name of interest packet. AR10 now concatenates the ASN and content name. The interest packet containing the ASN can be forwarded to destination AS through several intermediate ASes.

When the interest packet arrives at destination AS, the border router of AS can detect that incoming interest packet belongs to AS itself. ASN is automatically removed by border router and will be forwarded to inner of destination AS by exploiting intra-domain routing explained above.

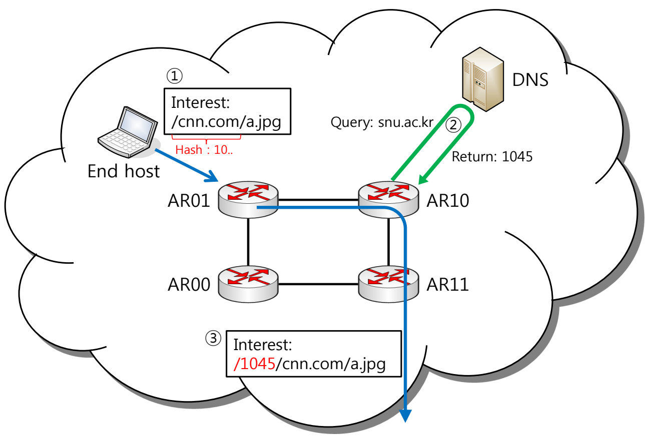

Fig. 2. Routing interest packet in intra-domain routing

III. Discussion and Future work

As we supplement CCN with these schemes, there are several problem to solve. First, all interest and content should visit the specific AR and routing stretch is longer than shortest path. Second, when some accountable router has failed due to several reasons, there is no alternative way to recover it. Third, CCN insists that CCN router can basically cache the content along the reverse path. However, by using above explained routing schemes, the specific AR can only specific caches. It cause cache inefficiency among the ARs. We will just try to solve these issues.

References

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