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Procedia Computer Science 89 (2016) 73 – 81

Procedia Computer Science

Twelfth International Multi-Conference on Information Processing-2016 (IMCIP-2016)

A Cache Content Replacement Scheme for Information Centric Network

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Abstract

Nowadays, Information centric networking has tremendous importance in accessing internet based applications. The increasing rate of Internet traffic has encouraged to adapt content centric architectures to better serve content provider needs and user demand of internet based applications. These architectures have built-in network Caches and these properties improves efficiency of content delivery with high speed and great efficiency. By using Information centric architectures, users need not download content from content server despite they can easily access data from nearby caches. User requested content is independent of the location of the data by use of caching approaches and does not rely on storage and transmission methodologies of that content. There has been many researches going on which is based on caching approaches in the Content centric network. Efficient caching is essential to reduce delay and to enhance performance of the network. Along with caching, a good cache replacement scheme is also necessary to decide which content item should reside in the cache and which content should be evicted. So, in this paper, we presented a Cache content replacement (CCR) scheme for information centric network with evaluation of popularity of the content. Performance of CCR scheme will be evaluated in provision of cache hit ratio and Cache load.

Peer-review under responsibility of organizing committee of the Organizing Committee of IMCIP-2016

Keywords: CN; QoS; CCN; PIT; FIB; CS; LRU.

1. Introduction

About 100 years ago,[1] a mathematical foundation was created by Erlang which was used to analyze communication network based on telecommunication. Again 50 years later since that time,[2] a concentric information network comes into account in the area of network research field which was also called as Information centric network (ICN).[27] Information centric network basically a model who focuses more on the content item rather the source of content item where the content is residing. Centric network means, information requested by the client can easily accessed from one of the intermediate routers rather than the end server. This network exhibit data centric communication instead of end to end communication between computers.[28] The Routers in the ICN network carry two functionalities: first caching content data and the second is routing of that content data. ICN supports in cooperation with multicasting, as well as broadcasting. Today, ICN concept can applied and tested easily on[26] Software defined network (SDN),[25] Wireless sensor network (WSN), Network Clouds, Wireless mesh network (WMN), Ad hoc Network etc. Now a days, our world is completely technology dependent. We use the internet for our lot of requirements like education,

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Peer-review under responsibility of organizing committee of the Organizing Committee of IMCIP-2016
doi:10.1016/j.procs.2016.06.011

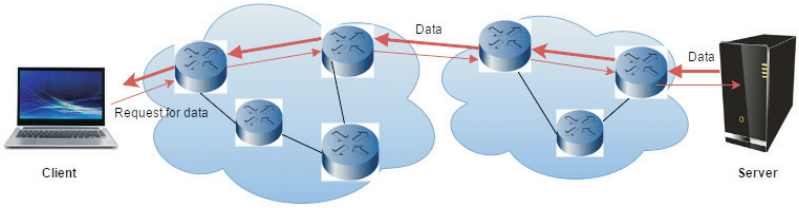

Fig. 1. Host-to-Host Network Architecture Design.

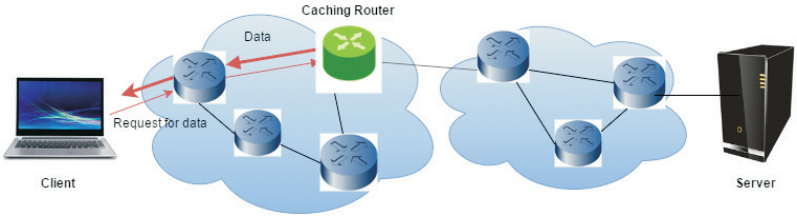

Fig. 2. A Caching Router in ICN.

entertainment, knowledge and all other general purpose needs. These internet access based applications includes Gmail, YouTube, Facebook, Google and other web applications.[3] In this scenario of the real world, it is reported that global internet traffic is increasing rapidly day by day or hour by hour and 70% above people are using internet toady in most of countries in the world. Many social and media applications like HD quality videos, software, Twitter, Facebook are used by user in large growth rate. So to cope up with these large amounts of requirements, Information Centric network has been introduced with many advantages like it does not depend on hop to hop communication. It exhibits the characteristic of communication which lies in receiver based data access methodology.[4,5] The expected benefits of the proposed content centric network over traditional end to end internet network are high efficiency, better scalability with respect to information/bandwidth demand, support of high degree of mobility, high performance in terms of content delivery guarantee and better robustness/reliability in challenging Communication environment. Many innovative architectures are proposed in the field in terms of DONA[6], CCN[7], NetInf[8], PURSUIT[9] and PRISP[10].

There are so many options for making caching in ICN like chunk level caching, packet level caching and object information level caching. Naming of Contents is done by location independent identifying by using two key approaches: Two phase approach and one phase approach. In one phase approach routing of content is done natively in the network, whereas in two phase approach, first mapping is done to the content id locators.[13,22] In node centric design, Sometimes called host to host communication network, same content data are transmitted repeatedly between the nodes and that costs wastage of bandwidth, high traffic with excessive delay. ICN comes into account to overcome these drawbacks of host to host communication network. Figure 1 shows the architecture of Host-to-Host network design. In Fig. 2 showing below, the content data requested by the client is cached by one of intermediate router in the path from client to server. So content item is instantaneously directed by the caching router to client. Each caching router in information centric network maintains three data structure named as: Content store (CS), Pending information table (PIT) and Forwarding information base (FIB). There are two types of information object packets are used for establishing the communication: interest packet, which is created by client for getting services or content data and another one is a data packet.[11] Content store uses to cache content and servers as a local cache. The task of FIB in caching router is mapping of information provided by client for requesting data to the output interfaces. PIT basically keeps records and tracks of incoming interfaces from the requesting interest message were generated/pending. When interest message from requesting client arrives at the caching router as shown in Fig. 2, then caching router checks the extracted information about requests content in its local cache called content store.[12] If the operation is hit i.e. content is matching then it sends that content to the requesting client by using incoming interfaces otherwise caching router further matches the longest prefix of information object in its FIB table to select appropriate path and data source