A Design Routing Algorithm for Management of Traffic in Content-Centric Network

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Abstract. Content-Centric Network (CCN) is next generation internet communication technology to provide existing internet communication paradigm as content based communication for efficient use various information in the Internet. Therefore, unlike existing internet communication technology, which focus on host based communication process, all of resource is defined as contents in CCN. Moreover it focuses on purpose of communication for using information. CCN communicate with between routers through broadcast flooding method in their network environments. This characteristic of CCN is not considering increasing network traffic about each of CCN routers. Therefore, when the requesters are rapidly increased to particular CCN router, network congestion may be occurred by broadcast traffic. Moreover, this characteristic of CCN has low turnaround time about user request due to reducing performance of network system. To resolve this problem, this paper proposes a design routing algorithm for management of traffic in CCN.

Keywords: Traffic, Content-Centric Network, Routing, Protocol, Congestion Avoidance.

1 Introduction

CCN is next generation internet communication technology to change existing internet communication paradigm as content based communication for efficient use various information in the Internet [1]. Therefore, unlike existing internet communication technology, which focus on host based communication process, all of resource is defined as contents in CCN. Moreover it focus on purpose of communication for using information. For the change of theses communication purpose, CCN communicate with each CCN router via name based routing method.
and contents is saved in each CCN router. Therefore, CCN has different communication method existing internet communication technology. CCN communicate through the Interest packet and the Data packet. The Interest packet is used to when requester request contents to publisher. And the Data packet is used to when publisher response contents to requester [2]. However, existing CCN is not considering increasing network traffic about each of CCN routers [3]. Therefore, when the requester requests are rapidly increased to particular CCN router, network congestion may be occurred by broadcast traffic. To resolve this problem, this paper proposes a design routing algorithm for management of traffic in CCN.

2 Related Work

Unlike existing internet communication method, the CCN communicate through name of contents instead of IP address. Therefore, in the CCN, contents name is eased to search via prefix matching due to contents name is designed as hierarchy. In addition, CCN communication through the Interest packet and Data packet. The Interest packet is used to when requester request contents to publisher and it has requested information such as content name and requester information. The Data packet is used to when publisher response contents to requester and it has contents name, information about verification, and direct data.

Figure 1 shows structure of CCN router. As shown in figure 1, CCN router has three of structure such as Content Store (CS), Pending Interest Table (PIT), and Forwarding Information Base (FIB).

**Fig. 1.** Router architecture for CCN
In the CCN, which has an above structure, it is not provided efficient data service due to CCN do not considered traffic of nodes in case of network traffic is rapidly increasing. To resolve this problem, this paper proposes a traffic aware routing protocol for congestion avoidance in CCN. The proposed routing protocol considers rapidly increasing traffic in the situation and establishes another routing path to avoid increasing traffic problem in CCN.

3 Proposed Routing Algorithm

In this section, we introduced the proposed routing algorithm. Table 1 list the symbols used in the proposed routing algorithm.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Definitions</th>
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<tbody>
<tr>
<td>n(FACE)</td>
<td>Number of current FACE</td>
</tr>
<tr>
<td>Interest</td>
<td>Interest packet</td>
</tr>
<tr>
<td>Random</td>
<td>Probability of generated random between 0 to 1</td>
</tr>
<tr>
<td>$\omega_i^{T_{delay}}$</td>
<td>The delay time that is proportional to the average queue length</td>
</tr>
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</table>

In the proposed routing algorithm, establishing of route is started via broadcasting of the Interest packet to find contents, which are requested from request, as similar existing CCN routing. Therefore, relay nodes, which received the Interest packet, transmit the Interest packet until destination node and establish of response routing path to PIT of themselves.

In this process, the relay nodes, which receive the Interest packet, can participate to establishing of route through delay of the Interest packet or discarding of the Interest packet based on traffic condition of themselves. All of nodes calculate average queue length of own queue for establishing of routing path when the Interest packet is arrived. The table 2 show procedure when interest packet is arrived.

<table>
<thead>
<tr>
<th>Table 2. The definition of routing method symbols</th>
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<tbody>
<tr>
<td>1. if $avg_i/a &lt; \min_{th}$ then</td>
</tr>
<tr>
<td>2. for $n(FACE)$ send Interest</td>
</tr>
<tr>
<td>3. else if $\min_{th} &lt; avg_i/a &lt; \max_{th}$ then</td>
</tr>
<tr>
<td>4. if $random_{\rho} &lt; P_{drop}^i$ then</td>
</tr>
<tr>
<td>5. for $n(FACE)$ send Interest</td>
</tr>
<tr>
<td>6. else if $random_{\rho} &gt; P_{drop}^i$ then</td>
</tr>
<tr>
<td>7. wait($T_{delay}^i$)</td>
</tr>
</tbody>
</table>
8. for $n(\text{FACE})$ send $\text{Interest}$
9. end if
10. else if $\text{avg}_q > \text{max}_{\text{th}}$ then
11. if $\text{random}_p < P^i_{\text{drop}}$ then
12. wait($\text{avg}_q \cdot T^i_{\text{delay}}$)
13. for $n(\text{FACE})$ send $\text{Interest}$
14. else if $\text{random}_p > P^i_{\text{drop}}$ then
15. $\text{Interest}$ is dropped
16. end if
17. end if

Line 2-10 describe routing method when condition of $\text{Ni}$ is become under$\text{Ni}$. And line 3-9 describe routing method when condition of $\text{Ni}$ is become in$\text{Ni}$. Routing method when condition of $\text{Ni}$ is become over$\text{Ni}$ is described in line 10 to 17.

4 Conclusion

In this paper, we proposed routing algorithm for avoidance in congestion when traffic is rapidly increased in the CCN. The proposed routing algorithm decides participation about establishing path of route according to condition of average queue length. However, the completed Interest packet, which was used for responding of contents, still remains in the network. Therefore, increasing of traffic still exists. Future research will include distinction of the completed Interest packet.

References