# ICN 기반 네트워크를 위한 선택적 콘텐츠 캐싱 방식

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# A Selective Content Caching Scheme for the ICN-based Networks

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## Abstract

Content exchange through the Internet is increasing at a rapid volume, and an efficient mechanism is necessary for faster content delivery. The Information-Centric Networking (ICN) paradigm focuses on the name of the content for locating and delivering the requested information. A prominent variation of this ICN concept is Content-Centric Networking (CCN), and although it has a faster content delivery capability, the original version of this mechanism incorporates a basic caching scheme. In this paper, we propose a new variant of the caching scheme for the ICN-based networks that assists to selectively store the retrieved contents instead of caching all the interacted contents. Furthermore, we introduce a testbed-based performance evaluation procedure and show that the proposed scheme outperforms the current Internet and the basic CCN in terms of content delivery time.

## I. Introduction

Internet data traffic is growing in numbers, and the forecast estimates that as high as 400 Exabytes of data will be exchanged per month [1]. Storing this vast amount of data is a massive task, and often than not, cache overflows occur due to insufficient storage space. The Content-Centric Networking (CCN) [2] paradigm promises to provide a faster content delivery capability, basic consumer mobility support, packet-level content security, and inherent caching mechanisms by focusing on the name of the content itself instead of the location of that content. However, the principle of its caching mechanism is to cache every content that passes through every node, and it creates duplicate contents that makes the cache overflow happen regularly. To eradicate this problem, we propose a new caching scheme that caches the contents selectively according to a content popularity ranking. We have tested the proposed scheme in a testbed environment rather than using virtual simulations.

## II. Proposed Caching Scheme

In-network caching is an essential feature of the latest Internet architecture, and the original CCN paradigm implements a cache of everything policy. Therefore, contents need to be replaced frequently due to the lack of enough space at the repositories. We propose to store the retrieved contents selectively using the following equation 1. The formula seeks out the content that is expected to be requested by the user time and again. Thus, the probability of a cache miss reduces, and average content delivery time for all the requests of a particular node decreases. In the equation, the number of requests for a content is given the highest priority, and it is expressed by $R$. Additionally, we have considered the type of a content $T$, and if the content type is video, we assigned a higher weight than a content that is audio or text. Moreover, the expected remaining lifetime, which is estimated as the opposite of the duration that the content is active in the network, is also utilized in the formula as lifetime, $L$. These parameters are used to determine the eligibility $E$ for a content $C$ to be cached at a node $N$, using the following equation. $E_{NC} = \alpha * R + \beta * T + \gamma * L$ (1)

Here, α, β, and ɣ are tunable parameters with values of 0.5, 0.35, and 0.15, respectively. Content $C$ is cached at a node $N$ based on the calculated value of $E_{NC}$. Based on this formula, frequently requested contents are stored in the repositories, and this ensures that the servers are not overwhelmed with many other replicated contents. Furthermore, this procedure also dictates that the contents which are requested repeatedly are cached at a nearer node to the user. For the performance evaluation, a random number of clients requested for a random number of contents from an environment consisting of a random number of server repositories. The size of the contents was increased gradually. For a fixed size of contents, the average content delivery time for all requested contents by all the users was measured for the current Internet architecture, the basic CCN environment, and using the proposed mechanism in the modified CCN framework as shown in the following Figure 1.

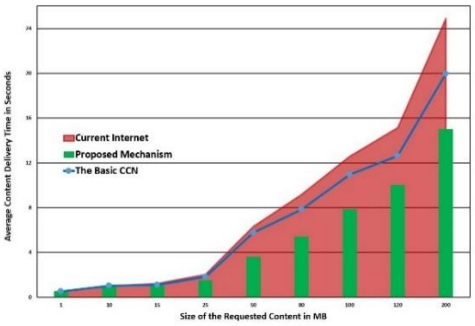


Figure 1. Performance Results' Graph

## III. Concluding Remarks

In this paper, we proposed a new caching scheme that caches the contents selectively based on the popularity ranking of the contents that pass through the ICN-based network. The performance results' graph depicts that the proposed mechanism has a better achievement in terms of content delivery time than the basic CCN and the current Internet.

### Acknowledgment

This research was financially supported by the Ministry of Trade, Industry, and Energy (MOTIE) and Korea Institute for Advancement of Technology (KIAT) through the International Cooperative R&D program.

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