Edge Cache-based Intelligent Content Delivery in Information-Centric Wireless Networks

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***Abstract*—As mobile data traffic increases explosively, content delivery issue in the Internet is a growing concern. In order to fundamentally solve this problem, information-centric networking has recently been proposed and applied to wireless networks. However, the influence of edge caches and related decision schemes on the performance of content delivery is largely ignored in the existing works. In this poster, we propose an edge cache-based intelligent content delivery solution to improve network performance in information-centric wireless networks, where a smart router makes caching decisions by analyzing the information of content popularity, users' mobility and social relation, and its connected access points update cache status of network contents according to the adopted decisions.**

***Index Terms*—Edge cache, smart router, content delivery, information-centric wireless networks.**

I. Introduction

According to the Cisco Visual Networking Index 2018 [1], global mobile Internet traffic will increase sevenfold with a compound annual growth rate of 47 percent between 2016 and 2021, reaching 49 exabytes per month by 2021. Moreover, more than three-fourths of the world's mobile network contents will be video by 2021.

In order to fundamentally cope with the rapid increase of mobile traffic, information-centric networking (ICN) has been proposed and applied to wireless networks [2]–[6]. Based on extensively deployed in-network caches of ICN, Arifuzzaman*et al.* [7] use game theory to formulate the caching decision problem to share cost input and increase network revenue among game players. Douros *et al.* propose to deploy a cache in an ISP, and make the ISP and content providers (CPs) cooperate to share deployment cost and additional profit [8].

Considering that edge cache can provide an effective approach to alleviate the heavy burden on backhaul links, as well as lower delays and deployment costs, nowadays researchers pay more attention to caching solutions at the wireless edge [9]. To deliver content of a CP over the edge network of an ISP, Mitra *et al.* explore pricing and capacity decisions for bandwidths and caches, and model the ISP-CP interaction [10]. Zhao *et al.* design a small-cell caching system composed of one small base station and several CPs, where CPs utilize its deployed cache to improve the efficiency of content delivery [11].

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Although these excellent works exploit the thought of in-network caching to improve content transmission efficiency, the influence of edge caches and related decision schemes on the performance of content delivery is largely ignored in the current solutions. In this poster, therefore, we propose an edge cache-based intelligent content delivery solution to improve content transmission efficiency and reduce network delay in information-centric wireless networks, where smart routers are deployed at the network edge and make content placement decisions by considering the impact of several factors, e.g., users' mobility and social relation, content popularity, and so on.

II. Network Architecture

Fig. 1 provides an overview of information-centric wireless network architecture in our solution, where only access points (APs) can cache network contents according to the caching decisions made by smart routers. Obviously, except for the forwarding function content routers in ICN have, smart routers can make optimal caching decisions by comprehensively analyzing some important factors, including popularity of network contents, movement patterns and social behaviors of mobile clients. In our solution, the following two key problems must be solved to realize the above design goal.

A. Location Choice of Smart Routers

As shown in Fig. 1, smart routers can be deployed in three locations: APs, access routers connected to APs, content routers connected to the Internet. The closer their positions are to mobile users, the more smart routers are needed in information-centric wireless networks. Therefore, if smart routers are placed in the APs, the most deployed equipments are required, which will lead to more cost input. Therefore, a closer deployment location means a lower network and decision delay. In our solution, smart routers are located in the access routers, which can make a tradeoff between cost inputs and network performance requirements.

B. Design Principle of Smart Routers

Fig. 2 presents the workflow of smart routers, where the core problem is how they make caching decisions for the connected

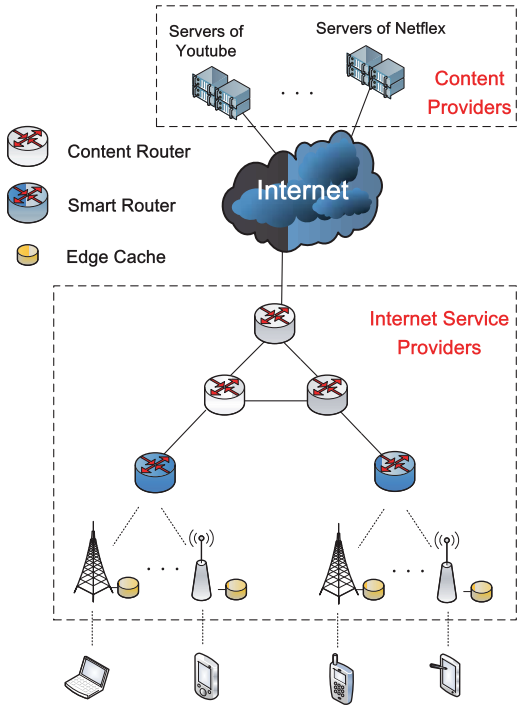

Fig. 1. Overview of the information-centric wireless network architecture in our solution. Each AP has a caching capability, and content requests of a mobile client are satisfied either by buffered contents of edge caches or by the servers of CPs.

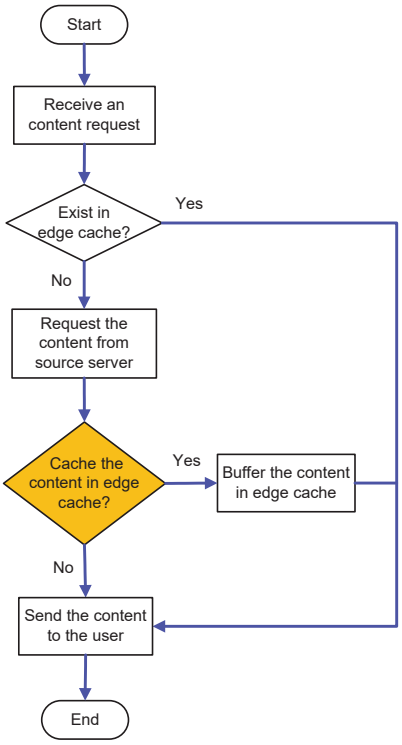

Fig. 2. Workflow of smart routers.

edge networks. Our scheme focus on the combined influence of content popularity, users' mobility and social relation on the decision process. For example, a smart router can construct the precise popularity model of contents flowing through it by periodically counting the access frequency of requested contents over a period of time. Then, the caching status of network contents at the network edge can be updated timely according to the statistical content popularity. Moreover, if a smart router can predict the next AP that the moving user will connect to, it can transmit the previously requested and unsatisfied content to the destination by modifying its routing table. Therefore, the content can be quickly obtained by the mobile user after it resends the same content request.

III. Conclusions

In this poster, we propose an edge cache-based intelligent content delivery solution in information-centric wireless networks, which can effectively improve content transmission efficiency and reduce network delay by deploying smart routers and caches at the network edge. In future, we will extend our work about cooperative decision and caching. Moreover, we will design a more elaborate control logic in our proposed solution to realize intelligent content delivery. We will evaluate our solution in the heterogeneous network environments.

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