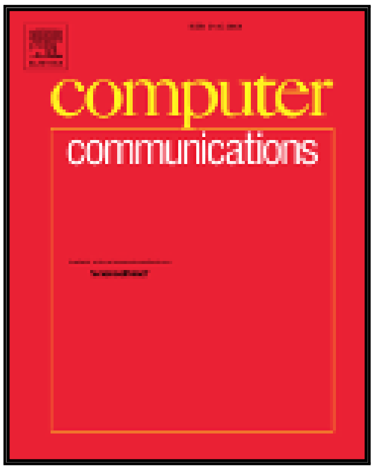
Accepted Manuscript

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PII: S0140-3664(17)30239-6
DOI: 10.1016/j.comcom.2017.10.009
Reference: COMCOM 5583

To appear in: *Computer Communications*

Received date: 29 April 2017
Revised date: 17 August 2017
Accepted date: 9 October 2017

Please cite this article as: Vishal Sharma, Ilsun You, Ravinder Kumar, Resource-based mobility management for video users in 5G using catalytic computing, *Computer Communications* (2017), doi: 10.1016/j.comcom.2017.10.009

# Resource-based mobility management for video users in 5G using catalytic computing

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**Abstract**

The upcoming 5G era emphasizes on a dramatic increase in the transmission rate of smartphone traffic. With more users operating at high rates, the type of data shared over the network is going to be complex and a majority of it will include video traffic. Such complex structure of traffic and heavy load over the components of the network are difficult to control. Further, the mobility of users adds up to this issue and makes it difficult to manage and operate the network without any breakdown. Thus, it important to control traffic as well as manage the mobility of users to provide efficient communication, which can support video traffic at high delivery rates. This paper proposes a novel resource-based mobility management approach for 5G networks comprising video users. A novel resource sharing paradigm, termed as "Catalytic Computing", provides efficient management of user mobility as well as network resources. The proposed approach relies on Homogeneous discrete Markov model for user mobility patterns and a novel n-step algorithm for congestion prediction and selection of optimal routes between the serving terminals. An activation energy based handover mechanism is also presented in this paper, which reduces the handover latency in comparison with the existing solutions. The evaluation presented in the paper suggests that the proposed approach provides a minimum of 5.9 ms, maximum of 9.1 ms and an average of 6.5 ms latency during handoffs.

*Keywords:* 5G, DMM, mobility management, catalytic computing, video users.

## 1. Introduction

The upcoming era of 5G networks aims at providing high-speed communications to users irrespective of their movement. With an increase in the number of devices and the network attaining its peak size, due to dense deployment, it becomes important to manage and control the mobility for efficient communication [1] [2]. Mobility management requires multiple operations at the same instance, which include optimal route selection, mobile anchor support, user pattern identification, and service handoffs [3] [4].

With the provisioning of high data rates, it becomes easy to transmit video messages over the network. But, the mobility of users adds to an issue of selecting an optimal terminal to relay traffic in the network, which is manageable by improving coordination between the users and the serving terminals [5] [6]. An efficient network allows dynamic support for handovers as well as management of network resources. With an appropriate amount of resources, any network can sustain for a longer duration and can guarantee high transmission rate. Along with resource management, identification of network failures, security enhancement, the probability of losses, congestion prediction, and risk assessment can manage the users in the network [7] [8] [9] [10].

Distributed Mobility Management (DMM) is one of the key players in managing network handoffs. Usually, DMM operates in the low mobility scenarios, but recognizing the pattern of user mobility improves its functionality. High scalability, lower delays, identification of non-optimal routes and congestion control are the key advantages of DMM [11]. DMM is usually applied to flat and flexible network architecture, which is also a limitation. Extending DMM to high mobility scenarios requires sufficient use of resources as well as amendments in core architecture. RFC 7429 [12] presents the implementation and standardization of DMM, which augments RFC 7333 [13], and it provides the details on each and every aspect of DMM, research challenges and gaps in implementation.

DMM is operable as a stand-alone facility or in combination with Software Defined Networking (SDN). SDN is capable of exploiting the features of DMM due to novelty in its basic architecture. The controller can act as the brain of DMM and can take all crucial decisions related to network management and control. Reduced signaling overheads and improving handoff latency are the primary aspects of DMM solutions. The majority of the existing solutions such as SDN-based mobility management by Nguyen et al. [14] and Krishna [15] have focused on reducing handover latency in heterogeneous networks. Ko et al. [16] used time-based bloom filter for reducing signaling cost, Han et al. [17] applied the concept over satellite networks, and Ali-Ahmad et al. [18] analyzed reachability during mobility management. The existing approaches are capable of providing efficient control and mobility management by considering

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