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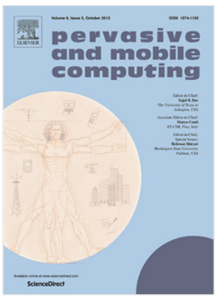

Robust control in cloud assisted peer to peer live streaming systems

Maria Efthymiopoulou, Nikolaos Efthymiopoulos,
Konstantinos Deltouzos, Athanasios Christakidis

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Robust control in cloud assisted peer to peer live streaming systems

Maria Efthymiopoulou*, Nikolaos Efthymiopoulos*, Konstantinos Deltouzos*, Athanasios Christakidis*

*Department of Electrical and Computer Engineering

University of Patras

Patras, Greece

Email: {mefthymiop, nefthymiop, deltouzos, schristakidis}@ece.upatras.gr

Abstract— **Existing live video streaming systems can be classified as server (cloud) based or as peer-to-peer (P2P). The client-server approach promises stability and (Quality of Service) QoS by incurring expensive bandwidth provision cost on the server. On the other hand, P2P architecture is scalable with low bandwidth and maintenance cost. Here we propose a cloud assisted P2P live streaming architecture which is scalable and stable. In order to achieve this we have developed: i) a scalable gossip protocol that monitors dynamically the total available bandwidth resources of the participating peers, ii) a control strategy that dynamically allocates the bandwidth that is required.**

The first step towards this direction is to create a theoretical model that captures the dynamic relationship between the total bandwidth surplus - deficit and peers' bandwidth utilization in order to be able to apply a control theoretical approach. Moreover, we quantify the impact of monitoring inaccuracies and peers' dynamic bandwidth changes and we calculate analytically, as a function of them, the minimum amount of bandwidth overprovision that ensures the undisturbed distribution of the stream. System is evaluated through a detailed simulator of a complete P2P live streaming system and testified the uninterrupted and complete stream delivery even in very adverse bandwidth changes.

Keywords—peer to peer (P2P), live streaming, scalable monitoring, robust control, bandwidth allocation

I. INTRODUCTION

Live video streaming over Internet has already become a major application due to users' growing demand and extraordinary growth of internet technologies. However, live streaming applications exert great pressure on video servers and the Internet. P2P networks provide an attractive solution due to their low cost and high scalability. Recently, several P2P streaming systems (e.g. [6],[16],[17],[18] and [19]) have been deployed towards live and on-demand video streaming services on the Internet at low server cost. The primary objective is to achieve a better trade-off between the bandwidth costs and the quality of the video distribution, without constituting problematic stability and scalability. Consequently, we can derive the basic requirements from a P2P live streaming system which are:

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