Chapter 5

P2P Video Streaming over MANET

Nobal Bikram Niraula
University of Memphis, USA

Anis Laouiti
Telecom SudParis, France

ABSTRACT

Video streaming in Mobile Ad hoc NETwork (MANET) is a real challenge due to frequent changes in network topology, and sensitiveness of radio links. Recent approaches make use of Peer-to-Peer (P2P) technologies to combat these challenges because the technologies have been already found to be effective for content delivery on the Internet. However, as the Internet and MANET operate differently, the P2P technologies used in Internet need modifications before employing to MANET. In this chapter, the authors discuss the recent P2P approaches, the adaptations to be made, and the major challenges to be faced while using P2P approaches in MANETs.

INTRODUCTION

With the proliferation of wireless and pervasive communication technologies, the number of mobile devices such as mobile phones, laptops, PDAs etc. is growing by each day. These devices can be used to form Mobile Ad Hoc Networks (MANETs). As a result research communities saw the potential use of MANETs. MANETs are special as they don’t need any infrastructure for communication and thus have potential use in emergency scenarios such as military and disaster relief operations. The recent research (Kristiansen et al., 2010) trend in MANET is towards streaming that allows playing multimedia while it is downloading. Unlike file sharing systems, streaming requires continuous data delivery. Each data packet should be delivered within a strict deadline to guarantee a smooth playback. This is very challenging in a MANET because of frequent changes in topology that take place due to node mobility, high transmission errors due to channel fading and interference, and network partitioning.

P2P networks are developed by different communities from MANETs. They are highly successful in the Internet due to their special
P2P Video Streaming over MANET

characteristics such as decentralization, distributed design etc. These make them very popular for bandwidth intensive tasks such as video streaming. Thousands of users can simultaneously watch live broadcasts of popular TV programs using Peer-to-Peer (P2P) technologies (Hei et al., 2006). Despite the fact that they originated from different communities, MANET and P2P share many similarities. By seeing this, the obvious research question is whether we can use a P2P approach for streaming applications in MANET. Applying off-the-shelf P2P approaches to MANET is not efficient as Internet operate differently from MANET. The physical topology must be taken into consideration while using P2P in MANET. There are many other challenges and issues to be dealt with before employing P2P approaches to MANET. Video coding, network coding and cross-layers are the main issues to be considered.

The chapter is organized as follows: we start by giving a short overview of the P2P networks and we remind the reader the basic concepts of MANET in the next section. In the following Section, we introduce video streaming, its types and requirements. We also discuss several approaches used for video streaming over MANET with examples. We then talk about P2P architectures used for video streaming and explain some research works for P2P based video streaming in MANET. Following that, we talk about the challenges of P2P video streaming over MANET. Adaptations and issues are then discussed. We provide future research directions before concluding remarks. References and additional reading sections are given at the end of this chapter.

MANET AND P2P

In this section we review the basic concepts of P2P networks like their organization and functioning, then we present the MANETs and their characteristics, before discussing the convergence issues between these two technologies.

Peer to Peer (P2P) Networks

The birth of Napster paved the way for exponential growth of the Peer-to-Peer (P2P) technology (Brosnan et al., 2011). Consequently, Internet users have benefitted from many decentralized P2P file-sharing programs like Kazaa, Limewire, iMesh and so on. Its popularity and repercussions motivated researchers to conduct a lot of research not only in file sharing but also in telephony applications. For example, Skype is a well known Internet telephony application which uses P2P network to deliver telephony services (Baset & Schulzrinne, 2006). These P2P applications generate the majority of IP traffic in the Internet (Eberspächer et al., 2004).

Unlike traditional server/client based network where some nodes (servers) are responsible for serving others (clients), P2P consists of a network of nodes in which each node has equal responsibilities. It means each node in a P2P network can start request like a client as well as serve to other peers like a server. Thus, peer node is often called “servent”, meaning server plus client. Due to these peculiar characteristics, P2P applications do not limit only to file-sharing applications. Content distribution and streaming applications use P2P network. One such example is P2PTV. It is an application designed to redistribute video streams or files on a P2P network. Similarly, BitTorrent ¹ based applications such as QTorrent, µTorrent, FlashGet etc. are very popular for distributing contents among a large number of users.

P2P networks can be classified as unstructured and structured (Eberspächer et al., 2004). In structured P2P networks, the topology of the network and location of the content is determined by the employed P2P protocol. In other words, the P2P protocols determine how a peer is connected to other(s) in overlay network and distribution of content among the peers. In unstructured P2P networks, nodes and contents are randomly distributed. Searching is conducted using flooding. Thus, searching for nodes and contents is difficult
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