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Distributed Streaming With Network Diversity

A.Yugandhara Rao, M.Neeraja, G.Sruthi Keerthi, K.Haritha

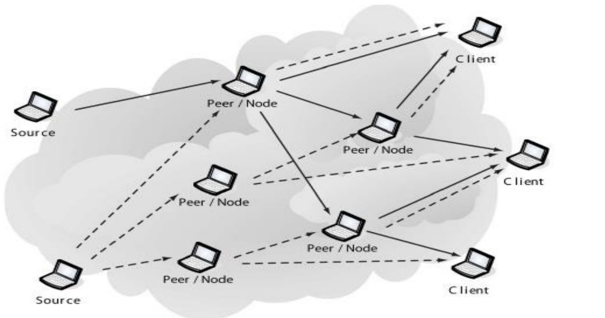
Abstract: today's packet networks including the Internet offer an intrinsic diversity for media distribution in terms of available network paths and servers or information sources. Novel communication infrastructures such as ad hoc or wireless mesh networks use network diversity to extend their reach at low cost. Diversity can bring interesting benefits in supporting resource greedy applications such as media streaming services, by aggregation of bandwidth and computing resources.

Then, the advantages of server or source peer diversity in collaborative streaming solutions are discussed. Lastly, we present an overview of wireless mesh networks and focus on the typical constraints imposed by these novel communication models on media streaming with network diversity.

Keywords: Collaborative media streaming; distributed streaming; media overlay networks; mesh networks; multi path.

I. INTRODUCTION

The past decade has shown the development of novel communication infrastructures, such as ad hoc and mesh networks, and peer-to-peer systems, which present the advantage of low deployment cost.. These packet network architectures typically construct network overlays so that they can compensate the lack of quality of service (QoS) by network diversity due to redundant sources and multiple communication paths to the client, as illustrated in Fig. 1. Network diversity presents several advantages for resource-greedy and delay-constrained services built on multimedia 0. the



Emerging communication systems with network diversity. They open a number of additional issues compared to traditional networks, such as the potentially high number of traversed hops, which may negatively affect the performance of real-time multimedia applications.

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At the same time, peculiar characteristics of mesh networks such as the presence of a potentially large number of densely interconnected nodes might be exploited by distributed streaming solutions to overcome the limitations caused by the unreliability of wireless channels and the highly dynamic behavior of network nodes. Recent research efforts have addressed the numerous challenges posed by wireless mesh networks, like routing, (auto) configuration, and self-healing strategies. However, limitation of the bandwidth, scarcity of wireless channels, and the multi- hop nature of connections still pose severe challenges for ensuring high-quality applications built on interactive multimedia communications.

A.PROBLEM SOLVING:

Distributed delivery architectures represent a scalable and cost-effective alternative to classic media delivery services, which permits to extend the reach of the network in the absence of IP multicast or expensive content distribution networks (CDNs). Their attractiveness mostly resides in their flexibility and self-organization, their inherent bandwidth scalability, and the redundancy in paths and source peers that provide robustness to network failures. Some fundamental differences between centralized infrastructures and distributed architectures such as mesh, adhoc, or peer-to-peer systems, however, need to be addressed in order to offer efficient streaming solutions to media applications On the one hand, typical client–server architectures and CDNs provide the network infrastructure that permits the deployment of generic media applications. In particular, they facilitate the implementation of tools for effective rich media delivery, like error correction, path computation, route choice, and rate adaptation. Such tools are generally built on the centralized computation paradigms that rely on important computational capabilities of streaming servers or proxy servers. On the other hand, distributed systems are in general less reliable but present the advantage of cheap service deployment (especially due to much lower bandwidth costs) and potential resource aggregation through multipath transmission. Distributed architectures lead to a streaming scenario where single receivers connect to multiple network paths.

B.DISTRIBUTED ST REAMING USING NETWORK DIVERSITY

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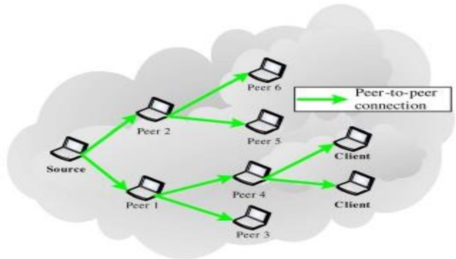
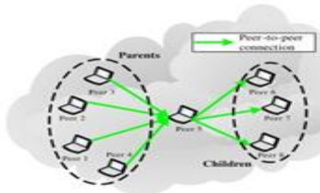


On the one hand, typical client–server architectures and CDNs provide the network infrastructure that permits the deployment of generic media applications. In particular, they facilitate the implementation of tools for effective rich media delivery, like error correction, path computation, route choice, and rate adaptation. Such tools are generally built on the centralized computation paradigm that relies on important computational capabilities of streaming servers or proxy servers. Distributed architectures lead to a streaming scenario where a single receiver connects to multiple network paths. The media packets are sent from different servers over (partially) disjoint separate network paths to a single client running at the receiver, as illustrated in Fig. 1. The client reconstructs the media stream with the packets that are received correctly from multiple sources and improves the quality of service thanks to the diversity of network re-sources.

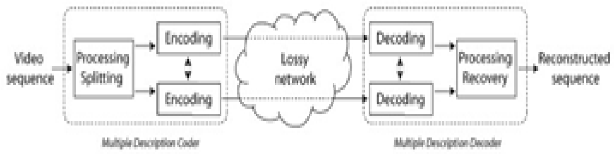
C.CODING FOR NETWORK DIVE RSITY

Multiple Description Coding

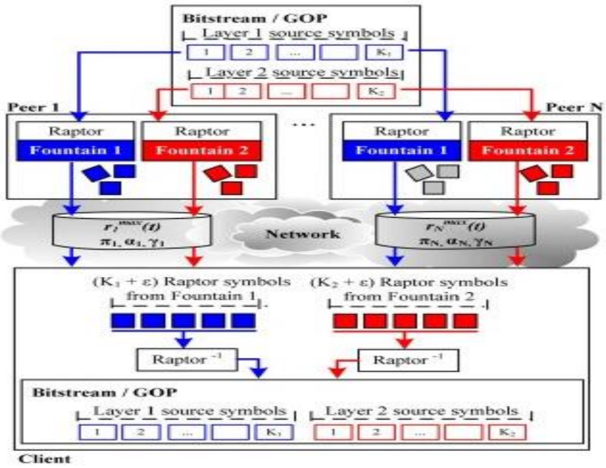
Many of the adaptive streaming techniques in the literature [4] can be elegantly combined with the diversity provided by distributed delivery architectures in terms of sources, paths, and channels. For example, scalable coding similar to the solution proposed in the recent MPEG SVC standard [5] are particularly adapted to streaming with network diversity. The best signal reconstruction is obtained when all descriptions are correctly received, while the correct reception of a single description already provides a reasonable quality [8].Since the initial works on MDC for reliable communication over the telephone network [9], many interesting results have been reported in the information theory community that determine the multiple description rate distortion region, which is the set of simultaneously achievable rates and distortions in MDC [10]–[12]. In image communication applications, MDC operates in the temporal, spatial, or frequency domain. In [13], the author proposes the multiple state video coding schemes, where the input video is split into sequences of odd and even frames. Each new sequence constitutes a description that is independently coded with its own prediction process (see Fig. 4).



One description is sufficient to decode the stream at a reduced frame rate, and temporal error concealment can efficiently mask transmission errors. However, this scheme is penalized by a reduced coding efficiency due to the high redundancy between images in both coding threads. This is even exacerbated when the number of descriptions increases since the correlation between successive frames in the same description decreases. Alternatively, multiple description video coding can be based on spatial splitting [14] or on the multiple description scalar quantization framework proposed in [15].



Another important set of solutions resides in the application of unequal error protection coding for the generation of equivalent descriptions or media packets [16]. In fact, any layered coding can be converted into MDC by bundling the base layer with different enhancement layers while paying attention to the inter-layer dependencies. In general, ensuring synchronicity between the encoder and decoder states in case of loss is not a trivial issue in multiple description video coding, due to motion estimation. Some effective solutions based on distributed coding principles have however been proposed recently for MDC with reduced error propagation in the decoded video sequence [17]. A comprehensive overview of multiple description coding of video information is provided in [18], which also describes the benefits of MDC in multipath networks.



D. Distributed Coding

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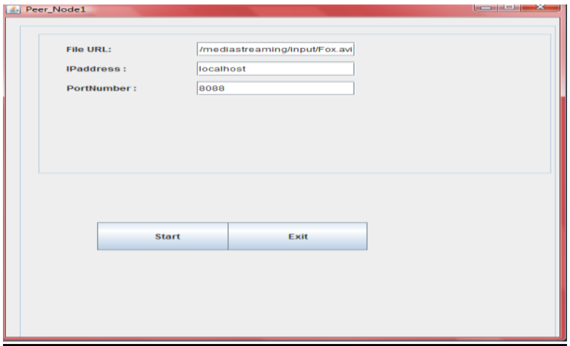
In scenarios with distributed collaborative servers, the key for efficient media communication strategies resides in the effective control of the redundancy between the different sources. Hence, the inherent problem in the use of multiple sources to send the same stream to a media client becomes the coordination between servers. In order not to waste resources with redundant data packets, servers have to carefully coordinate their packet scheduling strategies [19], generally with the help of the receiver.

As a result, such distributed streaming systems may become overly complex and cumbersome, especially if conditions change on one of the source–client paths.

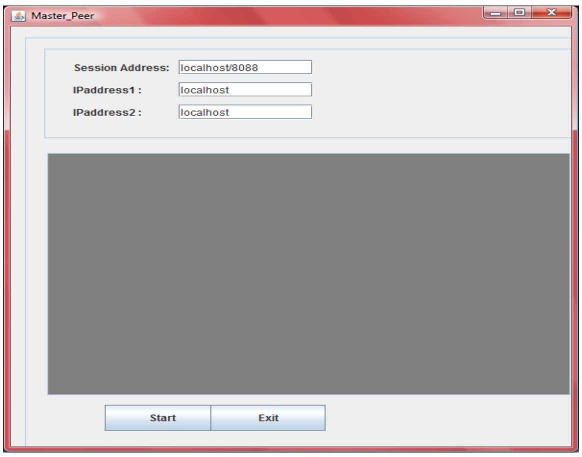
Therefore, the receiving client merely needs to retrieve k þ symbols on aggregate from all available serving peers in order to decode the corresponding video segment. In particular, it is proposed in [21] to create one fountain per layer and per GOP of the original bit stream, as depicted in Fig. 5. The servers encode a set of source symbols whose size depends on the encoding rate of each layer and eventually send different packets to the client. The scheduling problem from the servers becomes trivial, since all packets in the same fountain have the same importance. The rate allocation problem consists in determining the optimal number of symbols to be sent from each server, such that the overall number of packets received at the client is maximized [21], [26]. Note that such a solution offers low decoding complexity and provides, along the way, a universal channel code for the transmitted stream.

II. RESULTS

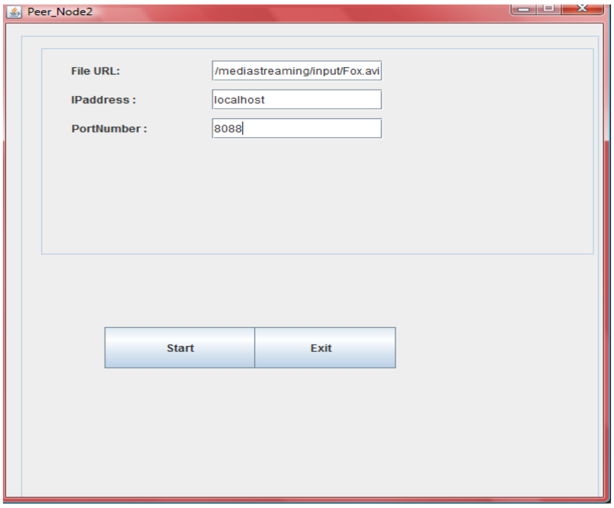
A. IMPLEMENTATION OF PEER_NODE 1



B.IMPLEMENTATION OF MASTER NODE



C.IMPLEMENTATION OF PEER_NODE 2



III. CONCLUSION

The rapid development of novel delivery architectures has recently opened interesting research problems for the distributed delivery of multimedia streams. Novel delivery architectures such as wireless mesh networks permit one to easily extend the reach of the network and to provide increased streaming performance by resource aggregation.

The diversity offered by such infrastructures however raises a number of interesting questions in the coding of the media information, the routing and rate allocation on multipath networks, or the collaborative streaming from distributed server peers.

Finally, security still represents a crucial problem in highly distributed delivery systems and probably remains an important factor that slows down the deployment of rich media applications over uncontrolled network environments.

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