ISSN:0975-9646

Efficient Bandwidth Video Multicasting on Heterogeneous Wireless Networks

P.Sailaja , M.Rajeswari , D.L.K Vijai Bharrath

A.P I , Information Technolgoy,
Velammal Institute Of Technology,
Chennai, india

Abstract- In this paper, we propose a new mechanism to select the cells and the wireless technologies for layer-encoded video multicasting in the heterogeneous wireless networks. Different from the previous mechanisms, each mobile host in our mechanism can select a different cell with a different wireless technology to subscribe each layer of a video stream, and each cell can deliver only a subset of layers of the video stream to reduce the bandwidth consumption. We formulate the Cell and Technology Selection Problem (CTSP) to multicast each layer of a video stream as an optimization problem. We use Integer Linear Programming to model the problem and show that the problem is NP-hard. To solve the problem, we propose a distributed algorithm based on Lagrangean relaxation and a protocol based on the proposed algorithm. Our mechanism requires no change of the current video multicasting mechanisms and the current wireless network infrastructures. Our algorithm is adaptive not only to the change of the subscribers at each layer, but also the change of the locations of each mobile host.

Index terms: Optimization, Wireless Techniques, Multicasting…

1. INTRODUCTION

The 21st century has resulted in a large variety of wireless technologies such as second- and third-generation cellulars, satellite, Wi-Fi, and Bluetooth. The heterogeneous wireless networks combine various wireless networks and provide universal wireless access. Users in the heterogeneous wireless networks are usually covered by more than one cell to avoid connection drop and service disruption. In addition, more mobile terminals in the wireless networks are likely to own multiple wireless technologies. Therefore, the heterogeneous wireless networks provide the mobile hosts with many choices for the cell and the wireless technologies to access the Internet.

Video delivery in wireless networks is becoming an important multimedia application due to the proliferation of the Web-based services and the rapid growth of wireless communication devices. For a video stream delivered to a single mobile host, a video server can adaptively adjust the encoder to accommodate the delay, jitter, and packet loss of the networks [1], [2], [3]. For a video stream delivered to multiple mobile hosts with diverse requirements and network conditions, the video stream can be encoded at the highest resolution and divided into layers such that each receiver can decode the stream on the preferred rate and resolution with a set of layers [4]. The most significant layer, that is, the base layer, contains the data representing the most important features of the video, whereas the additional layers, that is, the enhancement layers, contain data that progressively refine the reconstructed video. The layers are distributed to receivers via multicast channels in wireless networks [6].

2. WI-FI

The purpose of Wi-Fi is to provide interoperable wireless access to digital content.This content may include applications, audio and visual media, Internet connectivity, or other data. Wi-Fi generally makes access to information between devices from different manufacturers easier, as it can eliminate some of the physical restraints of wiring, this can be especially true for mobile devices. Wi-Fi also allows connectivity in peer to peer mode, which enables devices to connect directly with each other.

Wi-Fi allows local area networks (LANs) to be deployed without cabling for client devices, typically reducing the costs of network deployment and expansion. Wi-Fi performance decreases roughly quadratically as the range increases at constant radiation levels.

3. CELL AND TECHNOLOGY SELECTION PROBLEM

In this paper, different from the previous works, we focus on the selection of the cells and the wireless technologies to multicast each layer of a video stream in the heterogeneous wireless networks, where each selected cell can deliver only a subset of layers of the video stream to reduce the total bandwidth consumption. In our approach, each mobile host can select a different cell with a different wireless technology to subscribe each layer of a video stream. Consider Fig. 1 as an example, where A, B, C, and D are the mobile hosts. Here, we assume that the bandwidth allocated to each Universal Mobile Telecommunications System (UMTS) and each Wi-Fi cell can support one and two layers of a video stream.

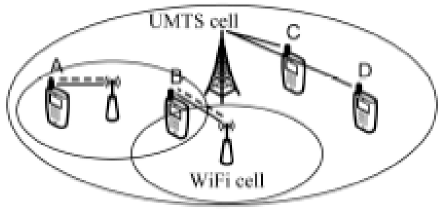

FIG : 1

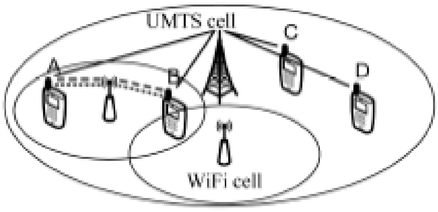

FIG : 2

The solid line connecting a mobile host and a base station represents that the mobile host subscribes Layer 1, the base layer, of a video stream from the cell. The long dash line and the short dash line correspond to Layer 2 and Layer 3, the enhancement layers, of the video stream. For the network operators, each layer consumes less network bandwidth in our approach. The three cells multicast Layer 1 in Fig. 1. In Fig. 2, however, the two Wi-Fi cells do not multicast Layer 1 because mobile hosts A and B subscribe the layer from the UMTS cell. Note that mobile hosts A and B subscribe Layer 2 and 3 from a single Wi-Fi cell to minimize the total bandwidth consumption in Fig. 2. For the users, each mobile host can subscribe more layers in our approach. Mobile hosts A and B subscribe two layers if they subscribe all layers from only the Wi-Fi cells in Fig. 1. On the contrary, mobile hosts A and B subscribe three layers in Fig. 2. They subscribe Layer 1 from the UMTS cell and Layers 2 and 3 from the Wi-Fi cells. Subscribing the layers from the cells with multiple wireless technologies may consume more power. Some mobile hosts are concerned with the video quality but others are concerned with the power consumption. To capture the heterogeneity of users, therefore, the number of wireless technologies allowed to be used by each mobile host.

Explicitly, we formulate in this paper the selection of the cell and the wireless technology to multicast each layer of a video stream as an optimization problem, which is referred as the Cell and Technology Selection Problem (CTSP) in the heterogeneous wireless networks for layer-encoded video mul ticasting. The objective of the problem is to minimize the total bandwidth cost of the selected cells and the wireless technologies. We design a mechanism, lagrange a distributed algorithm, and a network protocol to solve the CTSP.

4. LAGRANGE

Algorithm LAGRANGE can be regarded as a rerouting mechanism. The network may use different cells to multicast each layer of a video stream when the network condition changes. Note that rerouting mechanisms have been designed for unicast communications in circuit switched networks , optical networks , and satellite networks to reduce the total bandwidth consumption. However, designing a rerouting mechanism for layer encoded video multicast in the heterogeneous wireless networks is more difficult. The selection of cells for any two layers is correlated because each mobile host can use only a limited number of cells and wireless technologies.

- We consider the heterogeneity of mobile hosts. Some mobile hosts would like to improve the video quality by subscribing more layers from more cells with proper wireless technologies. Other mobile hosts may concern the power consumption and thereby subscribe a limited number of layers with a single cell.
- For each wireless technology, our mechanism reduces the number of cells to multicast a video stream by clustering the mobile hosts. Therefore, we can reduce the wireless bandwidth consumption even when the operators own only one wireless network
- Our mechanism is transparent to the video multicasting mechanisms. Each mobile host subscribes the video stream with the current video multicasting mechanisms after the mobile host selects the cell and the wireless technology according to our mechanism. We thereby require no modification on the current video multicasting mechanisms.
- Our mechanism requires no modification on the current wireless network infrastructures. The algorithm is implemented in only the mobile hosts, and the mobile hosts cooperatively select the cells and the wireless technologies.
- Our mechanism is adaptive. Our algorithm adapts to the change of the subscribers at each layer of a video stream, the change of locations of each mobile host, and the change of the bandwidth cost of each cell. In addition, our mechanism enables each mobile host to either automatically or manually choose the cell and the wireless technology. For example, when a mobile host manually chooses a cell, other nearby mobile hosts adaptively attach to the cell to reduce the total bandwidth consumption.

The algorithm can be implemented in the distributed manner on only mobile hosts. The algorithm adapts to the change of the subscribers of each layer, the change of the location of each mobile host, and the change of the bandwidth cost of each cell. The mobile hosts in our algorithm cooperatively select the cells and the wireless technologies for each layer of a video stream according to the solutions to the subproblems. The solutions to the subproblems depend on the Lagrange multipliers of the LRP, and we iteratively adjust the multipliers to change the selected cells to iteratively reduce the total bandwidth consumption.

The proposed algorithm LAGRANGE can be implemented in a distributed manner. In this paper, we propose a protocol to implement the algorithm in a distributed manner. The protocol can be implemented in the video subscription software in mobile hosts, and the network operator requires no server to provide the services. In this paper, we assume that the subscription of the layers is controlled in mobile hosts to ensure the scalability to support more members and streams, just like the previous works. Therefore, our protocol informs each mobile host of the identity of the cell and technology for each subscribed layer, and we require no modification on the existing video multicast mechanisms.

5. JAVA MEDIA FRAMEWORK

The Java Media Framework (JMF) is a Java library that enables audio, video and other time-based media to be added to Java applications and applets. This optional package, which can capture, playback, stream, and transcode multiple media formats extends the Java Platform, Standard Edition (Java SE) and allows development of cross-platform multimedia applications.

The current version ships with four JAR (file format) files, and shell scripts to launch four JMF-based applications:

- JMStudio - A simple player GUI
- JMFRegistry - A GUI for managing the JMF "registry," which manages preferences, plug-ins, etc.
- JMFCustomizer - Used for creating a JAR file that contains only the classes needed by a specific JMF application, which allows developers to ship a smaller application.
- JMFInit

  JMF abstracts the media it works with into DataSources (for media being read into JMF) and DataSinks (for data being exported out). It does not afford the developer significant access to the particulars of any given format; rather, media is represented as sources (themselves obtained from URL's) that can be read in and played, processed, and exported (though not all codecs support processing and transcoding).

A Manager class offers static methods that are the primary point-of-contact with JMF for applications.

6. EXPECTED OUTPUT:

The Simulation is carried out with UMTS, WIFI and Mobile Hosts. The input given to the UMTS is the Video. This video is splitted into audio and video and transferred to the mobile hosts where both audio and video merged to get the original video file.

INPUT

OUTPUT

7. CONCLUSION

In this paper, we propose a new mechanism to select the cells and the wireless technologies for layer-encoded video multicasting in heterogeneous wireless networks. Each mobile host in our mechanism can select a different cell to subscribe each layer of the video stream, and each cell can multicast only a subset of layers of the video stream to reduce the bandwidth consumption. We formulate CTSP in the heterogeneous wireless networks as an optimization problem. Algorithm LAGRANGE iteratively converges toward the optimal solutions and can be implemented in the distributed manner in only the mobile hosts. Our mechanism requires no change of the current video multicasting mechanisms and the current wireless network infrastructures. Our algorithm is adaptive to the change in the subscribers at each layer and the change of the location of each mobile host. Our algorithm is flexible such that network operators can balance the load of the wireless cells with the same or different wireless technologies.

REFERENCES:

1. J. Huusko et al., “Cross-layer architecture for scalable video transmission in wireless network,” IEEE J. Selected Areas in Signal Processing: Image Communication 22 (2007) 317–330.
2. M. Chen and A. Zakhor, “Rate Control for Streaming Video over Wireless,” IEEE Wireless Comm., vol. 12, no. 4, pp. 32-41, Aug. 2005.
3. Y. Liang and B. Girod, “Network-Adaptive Low-Latency Video Communication over Best-Effort Networks,” IEEE Trans. Circuits and Systems for Video Technology, vol. 16, no. 1, pp. 72-81, Jan. 2006.
4. B. Vickers, C. Albuquerque, and T. Suda, “Source-Adaptive Multilayered Multicast Algorithms for Real-Time Video Distribution,” IEEE/ACM Trans. Networking, vol. 8, no. 6, pp. 720-733, Dec. 2000.
5. X. Yong, D. Harrison, S. Kalyanaraman, K. Ramachandran, and A. Venkatesan, “Accumulation-Based Congestion Control,” IEEE/ ACM Trans. Networking, vol. 13, no. 1, pp. 69-80, Feb. 2005.
6. Paschalidis and Y. Liu, “Pricing in Multiservice Loss Networks: Static Pricing, Asymptotic Optimality and Demand Substitution Effects,” IEEE/ACM Trans. Networking, vol. 10, no. 3, pp. 425-438, June 2002.
7. Jiangchuan Liu, “Dynamic Layering and Bandwidth Allocation for Multi-Session Video Broadcasting with General Utility Functions” Hong Kong University of Science and Technology.
8. K. Pahlavan et al., “Handoff in Hybrid Mobile Data Networks,” IEEE Personal Comm., vol. 7, no. 2, pp. 34-47, Apr. 2000.
9. C. Beard and V. Frost, “Prioritized Resource Allocation for Stressed Networks,” IEEE/ACM Trans. Networking, vol. 9, no. 5, pp. 618-633, Oct. 2001.
10. M. Chiang, “Balancing Transport and Physical Layers in Wireless Multihop Networks: Jointly Optimal Congestion Control and Power Control,” IEEE J. Selected Areas in Comm., vol. 23, no. 1, pp. 104-116, Jan. 2005.