DISTRIBUTION OF MULTIMEDIA DATA OVER A WIRELESS NETWORK: AN INTRODUCTION

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Abstract: This paper presents the introduction of the distribution multimedia data over a wireless network. Providing quality of service (QoS) guarantees is an important requirement for multimedia data in wireless environment. Most components of multimedia such as word processor files, graphics, and images require data or file transfer, sometimes isochronous with audio or video information that means data should arrive in time. There are several issues that must be addressed when investigating multimedia data delivery; hardware, network, network design, software and protocol issues. These applications are time-critical and may have many different QoS requirements. The paper concludes with a brief view of related issues in wireless environment.

Keywords: Quality of Service (QoS), Multimedia data, Wireless network

INTRODUCTION

The introduction of wireless communication is dramatically changing our lives from time to time. This recent technologies that allowed us to communicate at anytime, anywhere increases the quality of lives and improves our business productivity. For example, wireless videoconferencing will connect us with family members and business partners as well. Interactive games include video and graphics with remote users over the world will add new dimensions not only to our leisure but also to provisioning of an effective remote learning environment.

Wireless Network

Why do we need a wireless network? This wireless evolution has brought an easy real-time access for on site consultants or anybody who like to move from one place to another place. The Institute of Electrical and Electronics (IEEE) 802.11b protocol is a set of rule that lets users with wireless modem to access the wireless network.

By extending the range of connectivity between a network backbone and computers, Wireless LAN (WLAN) grows without the expense of wiring. Those in occupations that require constant movement become more productive and organizations benefit from network flexibility because of improved communication. For example in corporate settings, network managers can minimize costs by using the WLAN technology.

Wireless network is an alternative infrastructure to the hospitals or clinics. Telemedicine is a means of delivering medical services to any place, no matter how remote, thereby removing the limitations of space and time that exist in today's health-care settings. The simplest and smallest devices such as Personal Digital Assistant (PDA) and palmtops can assist doctors for instant information sharing and looking for a certain diseases or treatment in the short time.

Multimedia Applications

Multimedia applications such as streaming video, streaming audio, interactive multimedia messaging, gaming, MP3 music download online shopping, file sharing and transfer, entertainment and a lot more are widely exist in wired network. To run these applications on wireless network, we need high speed network and larger bandwidth to support the delivery of graphics, richer contents and vivid colors. When the wireless network can support Quality of Service (QoS), the applications can improve interactively, reduce jitter and continuous video and voice applications.

Video and Audio Streaming: Video and audio streaming provides the delivery of entertainment, news, documentary and many more. The best example of television providers of streaming video in United States are DirecTV (www.directv.com) and Dish Networks (www.dishnetworks.com). Streaming video is most important in wireless world because users need to access enough connection capacity to download large multimedia files quickly. The competitive streaming technologies are RealAudio, RealVideo, Micrsoft Media Player and QuickTime.

Email and Multimedia Messaging: The most and widely communication use in this era is messaging. Email and multimedia messaging has many consumers especially business people and teenagers. The customers like to send messages, pictures, graphics and video files to each other. Companies such as SpotLife (www.spotlife.com) develop video communities for wireless carriers. Customers will be able to view and send personal video content to other customers. Cell phones that equipped with cameras will be able to capture live video images.

Wireless Gaming: The wide success of handheld gaming devices such as GameBoy and Cybiko has demonstrated the vitality of games being played on small devices in addition to large-screen televisions and personals computers. Companies such as Sega, Nintendo and Disney have started to target mobile wireless devices as an important part of their game development strategy.

Quality of Service

There are a number of factors and components that affect the performance of multimedia application such as users, host machine, application and network. Users are the one who utilize the multimedia applications. Users' perception can influence the evaluation of the multimedia application performance. On the other hand, host machine is the device that operates the multimedia application which consists of processors, media storage, display devices and operating systems. The applications are built in the multimedia application, for example the codec is used in video compression. The network components that transport the multimedia contents between the two host machines i.e. source and destination. The example of network hardware components are switches, routers, network interface cards, gateways and firewalls. Figure 1 below shows a simplified diagram of communication system that includes all the components discussed above.

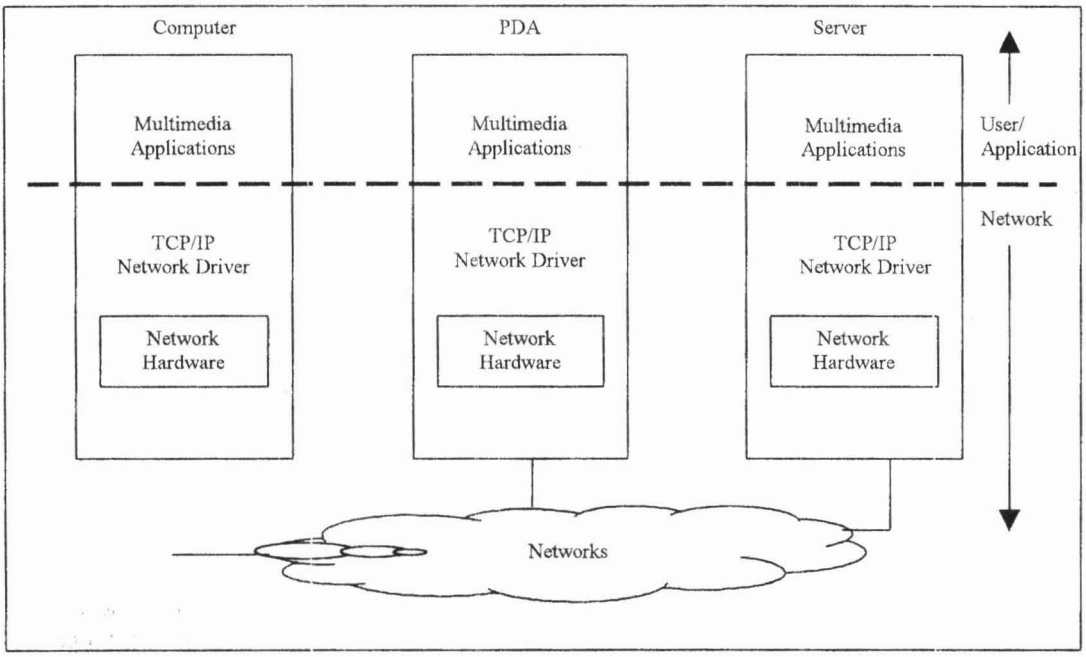

Figure 1: Diagram of communication system

Multimedia support issues can be presented by using the Quality of Service (QoS) term, which is an overloaded term with various meanings and perspectives. In the networking context, QoS refers to the service quality or service level that the network offers to applications or users in terms of network QoS parameters. These parameters include latency of packet traveling across the network, reliability of packet transfer and throughput. However in application context, QoS generally refers to the application quality as perceived by the user that is the presentation quality of the video, the responsiveness of interactive voice, and the sound quality of streaming audio.

QoS Parameters

There are four QoS parameters that relevant to the multimedia applications, throughput or bandwidth, delay or latency, delay variation and loss or error rate.

From the application perspective, throughput refers to the data rate generated by the applications. It is measured in the number of bits per second or sometimes it is called bandwidth. For example, in a streaming video application, different video properties generate different throughput, where a user can select the video quality by the frame size, frame rate, color depth and compression.

Real time applications require the delivery of information from source to destination within a certain period of time. Long delays may cause incidents such as losing a data, which in turn may cause user frustration during the interactive applications. Delay may cause by the network delay, transmission delay, protocol delay, source processing delay and destination processing delay.

On the other hand, delay variation is a QoS metric that refers to the variation in the delay introduced by the components along the communication path. Since each packet in the network travel in a different path, then the network condition for each packet can be different too.

Packet loss directly affects the perceived quality of the application. At the network level, packet loss can be caused by network congestion, which results in dropped packets. Another cause of loss is caused by bit errors that occur due to a noisy communication channel. Such loss will most likely occur in a wireless network.

DISCUSSION

Wireless network has a role in the effectiveness of the application delivery. If the network can support QoS, then the applications can improve interactivity, reduce jitter and provide good quality of video and voice experience.

QoS mechanisms that can support IEEE 802.11 are traffic classification, channel access and packet scheduling. A traffic classification provides a tool that set a distinct priority relative to other data to transmit over the wireless medium. Whereas, the MAC function in Data Link layer include both channel access and packet scheduling.

A study of Hutchens, R and Singh, S. [1] brings the important of network topology in supporting the mobility of wireless connections. Their strategies was developing a planar network for analyzing issues that relevant to handoff and reserving bandwidth connections that might occurs during the movement. However, at the end of this study, they had preferred to work on developing an adaptive bandwidth reservation algorithm as their future work. This solution is able to accommodate different network topologies and adapt the changes in the usage patterns without requiring the mobility of certain individuals.

Most of the researchers are focusing on the usage of the bandwidth in wireless multimedia network. Kwon et al [2], proposed the adaptive framework and redefined a QoS parameter i.e. *the cell overload probability* from the viewpoint of the adaptive multimedia networking. Then they were also proposed a distribution call admission control algorithm and bandwidth adaptation algorithm to minimize the cell overload probability.

The paper by Aly and Youssef provides mechanism to remedy video loss and to restore synchronization between video and audio streams via a quick estimated reconstruction of lost video frames and their injection at appropriate locations without the need for retransmission or any extra data. They developed a decision system to determine the best technique to be used in the estimation of missing frames.

As a conclusion, the evaluation of a system that provides QoS is application specific because the quality is application dependent. The monitoring of bandwidth gain, delay, loss or jitter requirements of applications can be studied using simulations or experiments based on the implementation in a real environment.

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