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TITLE: **SUMMARY OF REQUIREMENTS FOR MULTIMEDIA APPLICATIONS: A PRELIMINARY STUDY**

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ABSTRACT

A summary of multimedia applications requirements based on a previous preliminary study [1] is presented in the format for incorporation into the working document "Wireless Local Area Network Requirements [2]".

SUMMARY OF REQUIREMENTS FOR MULTIMEDIA APPLICATIONS: A PRELIMINARY STUDY

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I. INTRODUCTION

Multimedia application has emerged to be one of the most important applications of the coming decade. Any network that is designed for the future should be able to support multimedia applications. Therefore, characterization of multimedia applications is very important for the design of the wireless local area network protocols that is intended to be a standard for the coming decade and beyond. In a previous contribution [1], a preliminary study of multimedia applications requirements have been presented in detail. The purpose of this contribution is to summarize those requirements and present them in the format for incorporation into the working document " Wireless Local Area Network Requirements [2]".

II. WHAT IS AN APPLICATION ?

An application is defined as a task that requires communication of one or more information streams between two or more parties that are geographically separated. Two of the main attributes of an application [1] are the types of information communicated and their corresponding delivery requirements.

Information Types. In general, information can be classified as time-based and non-time-based. Time-based information is defined as those that must be presented to the user at specific instants to convey its meaning. Typical time-based information are video and audio, while non-time-based information includes still images, graphics, text, etc. An application may include both time-based and non-time-based information. Synchronization of different information types is an important issue when an application involves simultaneous transfer of different information types [3].

Delivery Requirements. Applications can be classified according to its delivery requirements into real-time and non-real-time applications. A real-time application is defined as one that involves information delivery for immediate consumption. In contrast, for non-real-time applications, the information is stored at the receiving party for later consumption. The former requires sufficient bandwidth, while the latter requires sufficient storage. (Conversation on the telephone network is considered real-time applications, while electronic mail across a data network is a non-real-time application.) In other words, communicating parties for a real-time application

participate at the same time, while for a non-real-time application participate at different time.

However, it is important to distinguish between the delivery requirement of the application from the intrinsic time dependency of its information content, which can be time-based or non-time-based. Video conferencing and image browsing are typical examples of real-time applications, while downloading digitized movies and electronic mail belong to non-real-time applications. The examples given for real-time and non-real-time applications have been chosen to include both time-based and non-time-based information types (see Table I). In the case of image browsing for real-time applications, even though the image is itself non-time-based information, to ensure interactive response for the user, a maximum response time constraint is required to satisfy this application. On the other hand, for non-real-time applications like downloading a digitized movie, even though the information content is a time-based, the entire movie can be treated as a single file transfer like electronic mail because the movie is not being displayed in real-time at the receiver. Therefore, the networking capability required to support an application depends on both the information content and the delivery requirements of the application.

Delivery Requirement	Information Types	
	Time-based	Non-Time-based
Real-time	Video conferencing	Distributive Computing
		Collaborative Computing
		Interactive browsing
Non-real-time	Downloading movie	Electronic mail

TABLE I. Examples of applications with various information types and delivery requirements.

III. APPLICATION REQUIREMENTS

The network requirements of a selected set of basic multimedia applications are presented in the following format for incorporation into the working document Wireless Local Area Network Requirements [2]. They were presented previously in [1] under slightly different context. These basic applications assume the scenario of a single two party connection. However, the objective is that more complicated scenarios and different multimedia applications can be constructed based on these basic multimedia applications.

(A) Real Time Delivery of Time-based Information

VIDEO APPLICATIONS	Video Telephony (px64 [4])	VCR Quality Video (MPEG [5])	HDTV [6,7]
Bandwidth for single connection	px64 kbps	1.5 Mbps	20 Mbps
MSDU Size Distribution	Average =0.27 - 8 kBytes	Average = 6.2 kBytes	Average = 83 kBytes
MSDU Arrival Distribution	33 - 100 ms	33 ms	33 ms
Nominal Transfer Delay	150 ms [5]	Depending on application	Depending on application
Transfer Delay Variance*	33 - 100 ms	33 ms	33 ms
MSDU Loss Rate	Under research	Under research	Under research
Service Initiation Time	seconds	seconds	seconds
Station Speed	Pedestrian, Vehicular	Pedestrian	Pedestrian
Destination Distribution	50 %	100 %	100 %

AUDIO APPLICATIONS	Voice Telephony	CD Quality Stereo (MPEG [8])
Bandwidth for single connection	16 kbps	256 kbps
MSDU Size Distribution	Average = d x 8 Bytes; d = packetization delay in ms allowed	Average = d x 96 Bytes d = packetization delay in ms allowed
MSDU Arrival Distribution	d ms, where should be less than about 10 ms	d ms, where d depends on buffer size at receiver available for smoothing
Nominal Transfer Delay	150 ms	Depending on application
Transfer Delay Variance	10 ms	d ms
MSDU Loss Rate	Under research	Under research
Service Initiation Time	seconds	seconds
Station Speed	Pedestrian, Vehicular	Pedestrian, Vehicular
Destination Distribution	50 %	100 %

* Depending on buffer size available for smoothing.

(B) Non-real-time delivery of time-based information

VIDEO APPLICATIONS	VCR Quality Video		HDTV	
Delivery time	15 mins	8 hrs	15 mins	8 hrs
Bandwidth for single connection	12 Mbps	0.375 Mbps	160 Mbps	5 Mbps
MSDU Size Distribution	Depending on transport protocol used for file transfer, typically use the maximum allowed packet size			
MSDU Arrival Distribution	Maximum packet size/Bandwidth			
Nominal Transfer Delay	Small relative to delivery time			
	seconds	minutes	seconds	minutes
Transfer Delay Variance*	Flexible			
MSDU Loss Rate	Similar to traditional file transfer			
Service Initiation Time	seconds	seconds	seconds	seconds
Station Speed	Pedestrian,	Pedestrian	Pedestrian	Pedestrian
Destination Distribution	100 %	100 %	100 %	100 %

(C) Delivery of non-time-based information (real-time and non-real-time)

IMAGE TRANSFER	Photos (1K x 1K x 24 bit)	X-rays (2K x 2K x 12 bit)
MSDU Size Distribution	60 - 300 KBytes (JPEG lossy compression)	3 MBytes (JPEG lossless compression)
MSDU Arrival Distribution	Random	Random
Nominal Transfer Delay	Fast response: 0.1 seconds Delayed response: mins-hrs	Fast response: 0.1 seconds Delayed response: mins-hrs
Transfer Delay Variance	less than the response time	less than the response time
MSDU Loss Rate	Similar to traditional file transfer	
Service Initiation Time	seconds	seconds
Station Speed	Pedestrian, Vehicular	Pedestrian
Destination Distribution	Close to 100 %	100 %

* Depending on buffer size available for smoothing.

IV. CONCLUSION

A summary of multimedia applications requirements was presented, based on the preliminary study of a previous contribution [1]. This is intended to be a starting point of discussion, and further research is needed to fully understand all the requirements of multimedia applications, as well as the implications for wireless network protocol to support such applications.

REFERENCE

[1] T. Kwok, " Communications Requirements of Multimedia Applications: A Preliminary Study," IEEE P802.11/91-130.

[2] K. Biba (ed.), et. al, " Wireless Local Area Network Requirements," IEEE P802.11/91-108.

[3] T. Little, A. Ghafoor, " Network Considerations for Distributed Multimedia Object Composition and Communication," IEEE Network Magazine, Nov 1990, pp. 32-49.

[4] M. Liou, " Overview of the p x 64 kbit/s Video Coding Standard," Communications of the ACM, vol. 34, no. 4, April 1991, pp. 59-63.

[5] D. Le Gall, " MPEG: A Video Compression Standard for Multimedia Applications," Communications of the ACM, vol. 34, no. 4, April 1991, pp. 46-58.

[6] R. Jurgen," The challenges of digital HDTV," IEEE Spectrum Magazine, April 1991, pp. 28-30, 71-73.

[7] W. Luplow, " Digital High-Definition Television Takes Off," IEEE Spectrum Magazine, January 1991, pp. 65-68.

[8] H. Musmann," The ISO Audio Coding Standard," IEEE Globecom 1990, pp. 511-517.