Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** **<http://grouper.ieee.org/groups/802/20/>**
Title	**Traffic Model For Audio Streaming Issues**
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Re:	MBWA Call for Contributions for Evaluation Criteria for Section: 4.3.7
Abstract	This document provides information of traffic models for Audio Streaming
Purpose	To discuss and adopt for Section 4.3.7 in Evaluation Criteria Document Version 17 (Eval_Criteria_ver17_81005.doc)
Notice	
Release	
Patent Policy	

Introduction

- This contribution targets the Audio Streaming traffic model section in the Evaluation Criteria document.
- An analysis of existing studies on the subject and how different standards deal with this problem is presented here.
- Audio streaming traffic includes:
    - radio stations;
    - live audio transmissions;
    - jukebox libraries.

Organisation of this Presentation

- Audio traffic over the last few years: some figures.
- Recent increase in amount of radio traffic.
- Audio traffic vs. common Internet traffic (RealAudio case).
- Observed audio traffic data rates and packet sizes.
- Existing similar models: 3GPP, 3GPP2 and 802.16.
- Possible ways forward.

Audio Traffic. Some Figures

- 2003/2004 3 month study of 70 million requests for 5000 URLs over 200 countries [1]:
  - Audio streaming traffic is more popular than video traffic [1].
  - Only 1% of requests analysed in [1] were for video streams.
- 2001 study of 17 million webpages with 30,000 streaming audio and video clips available [2]:
  - 43% of available media clips are audio only.
  - 57% of media clips were video.

Audio Traffic Increase Example

- 1997 study from U.C. Berkeley found no appreciable use of streaming media [3].
- 1999, 18-24% of web traffic entering the University of Washington was continuous media streaming traffic [4].
- March 2000 a study in the University of Wisconsin-Madison showed that 23% of its traffic was due to (the now illegal) Napster [5].

RealAudio Traffic vs. Internet Traffic

- From [6], 1999 analysis of RealAudio traffic for radio station type data. Differences between audio traffic an standard Internet traffic:
    - audio sent at consistent bitrates at medium time-scales (10s of seconds);
    - audio as a bursty on/off source in multiples of 1.8 seconds at smaller time-scales (single seconds);
    - half of the audio flows last more than 45 minutes;
    - highly related to geographic location or time of day;
    - RealAudio uses one or two flows and use multiple protocols:
        - sessions with two flows (70 to 80% of total): use UDP flow for data and TCP for control;
        - sessions with one flow use TCP alone.

RealAudio Traffic Characteristics

- From [6], 1999 analysis of RealAudio traffic for radio station type data. Observed characteristics:
  - highly unidirectional: outbound to inbound byte rate in server is as high as 50 to 1
  - UDP Real Audio traffic has consistent packet lengths and interdeparture regularity;
  - bit rates chosen to suit dial-in users: 16 to 20 kbps;
  - packet lengths measured (UDP): 290/300 or 490/502 bytes corresponding to the 16 and 20 kbps respectively;
  - mean packet interdeparture time: normal distribution but with a long tail. Short bursts separated by gaps.

Streaming Audio Traffic: Data Rates

- 90% of encoded audio bitrates still target old modem connection speeds (28.8 kbps) [2].
- Mean observed rate 20 kbps [2] (2003/2004 study)
- Higher data rates targeting broadband connections can be expected in the near future (MP3 standard bit rates 64, 96, 128, 160 kbps).
- Typical streaming audio speed: 32 kbps (FM radio quality).

Streaming Audio Traffic: Packet Sizes

- Packet size:
  - Packet lengths measured (UDP): 290/300 or 490/502 bytes corresponding to the 16 and 20 kbps respectively [6] (RealAudio).
  - No information has been found for other common media players.
- Packet interarrival time information based on real measurements has not been found.

Similar Existing Models: 3GPP

- No specific audio streaming model.
- Near real time video traffic model, source video rate 64 kbps [7]

Information type	Inter-arrival time between the beginning of each frame	Number of packets (slices) in a frame	Packet (slice) size	Inter-arrival time between packets (slices) in a frame
Distribution	Deterministic (based on 100 fps)	Deterministic	Truncated Pareto (mean = 5 bytes, max = 250 bytes)	Truncated Pareto (mean = 6 ms, max = 12.5 ms)
Distribution Parameters	100 ms	8	K = 40 bytes α = 1.2	K = 2.5 ms α = 1.2

Similar Existing Models: 3GPP2

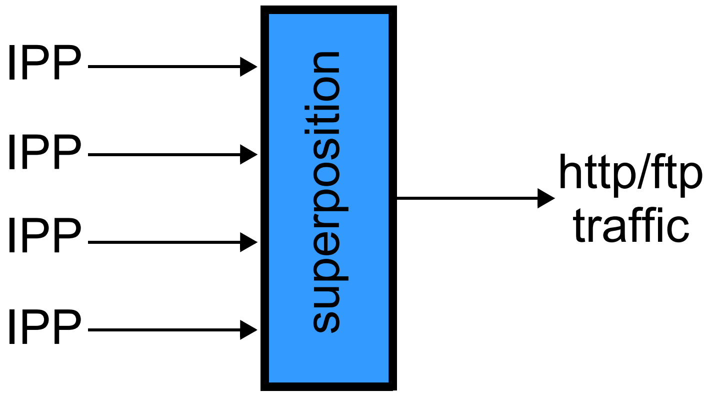
- No specific audio streaming model.
- Near real time video traffic model, source video rate 32 kbps [8]

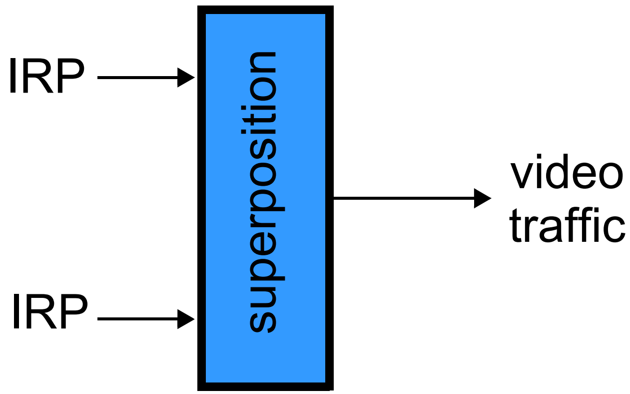
Information type	Inter-arrival time between the beginning of each frame	Number of packets (slices) in a frame	Packet (slice) size	Inter-arrival time between packets (slices) in a frame
Distribution	Deterministic (based on 100 fps)	Deterministic	Truncated Pareto (mean = 5 bytes, max = 125 bytes)	Truncated Pareto (mean = 6 ms, max = 12.5 ms)
Distribution Parameters	100 ms	8	K = 20 bytes $\alpha = 1.2$	K = 2.5 ms $\alpha = 1.2$

- Audio only is considered a special case of multimedia streaming service [9].

Existing Models: 802.16

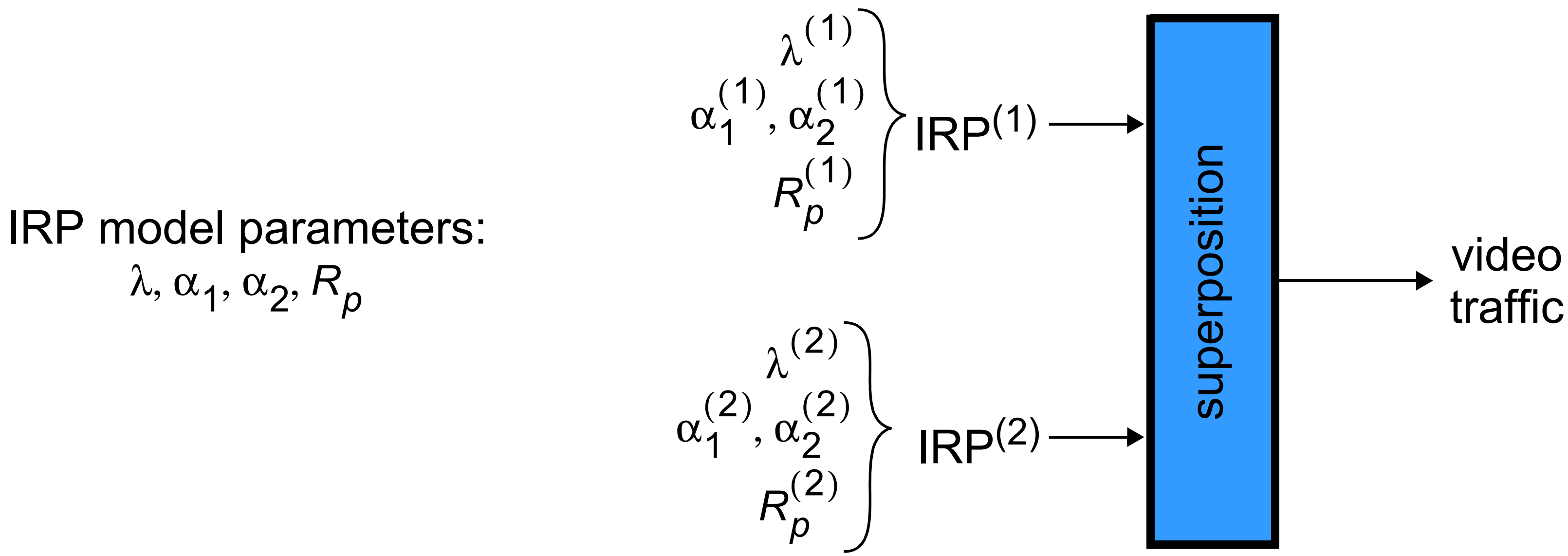
- No specific audio streaming model in [10].
- Three basic models are defined:
  - Interrupted Poisson Process (IPP);
  - Interrupted Discreet Process (IDP);
  - Interrupted Renewal Process (IRP).
- These are mixed to generate different types of traffic, for example:





Existing Models: 802.16

- Different parameters are given to each of the processes to generate the traffic model. For example, in the video traffic:



- Much simpler model to implement than those from 3GPP/3GPP2
- Not as accurate

Possible Ways Forward

- Ignore an audio specific traffic model:
    - make use of existing video model for audio streaming:
        - leave it as is;
        - modify parameters;
    - possibly rename video model as multimedia streaming traffic.

- Perform further investigations, i.e. more proposals.

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