REAL-TIME AUDIO STREAMS SYNCHRONIZING IN MOBILE DEVICES

N. R. Dissanayake[1] and K. Rodrigo[2]

[1] Informatics Institute of Technology, 57, Ramakrishna Road, Colombo - 06, Sri Lanka.
Email: nalakadmnr@gmail.com
[2] Informatics Institute of Technology, 57, Ramakrishna Road, Colombo - 06, Sri Lanka.
Email: u.k.k.rodrigo@gmail.com

ABSTRACT

Real-time audio has been around for some times but applications of it was only used in professional market for transmitting audio via digital data links. Since the advent of smart phones, a new application for this technology is discovered where real-time audio streaming can be used in mobile platforms to create synchronized music playing, where the real-time synchronization is a challenging task. Real-time synchronized playing can be used for sharing the music experience with multiple people, in real-time, thus creating a customized radio station with the clients music. And instead of using one mobile device to play music, by pooling multiple devices in close range can amplifies the audio significantly through the synergy of multiple synchronized playback in multiple devices. We present and discuss – in this paper – an analysis of features of some available products. In our ongoing research we hope to analyze the technologies and concepts available and identify the limitations of real-time synchronous audio playback, hence propose a better solution to overcome the issues in real-time audio synchronization.

***Key words*:** Real-time, Audio Streaming, Synchronization, Mobile

1. INTRODUCTION

With existing technologies such as low latency audio encoding and data distribution systems, real-time audio streaming isn't that complex, since all the primary building blocks required are already present [1]. First a suitable audio source is selected and encoded using a low latency audio codec and then is transported via – preferably a 2.4GHz wireless – network to multiple devices.
For synchronization of the audio transmitted, each receiving device needs using an offset to achieve the effect, this can be said as the default procedure of any real-time audio streaming application [2].

Audio Streaming means, a server constantly transmitting data to some clients. This is achieved using real-time packets, which is a common technique used by the audio and video transmitting applications. The packets are received by the clients and are synced, and audio is reproduced. The complexity of the client's algorithms increases with the number of connected devices to the streaming server, since multiple devices are connected at the same time, thus the network traffic will be increased and buffering will be required to play the audio stream without any loss.

Figure 1 shows an example of a Real-Time Protocol (RTP) [3], it can be used to explain how specifically this is worked out. Incoming packets can be routed to multiple devices using a network protocol, and then the packet is parsed. Its' RTP timestamp is sent to

the synchronizing agent, which in term will provide the perfect offset, which is determined by the source to sync the lag. And then the signal is sent via the format converter, which can be a decoder for a specific coded, which is output via the speaker(s), the Digital to Analog Converter's (DAC) delay is not considered since it's really less.

Real-time is the key in achieving this task, since how quickly the audio might get delivered to multiple devices will not matter if the audio isn't played back in the same time - synchronously, which give the loudness effect; or else it will be rendered as an echo or noise.

There are some methods used for synchronization, but the most used and text book example is; packets, which hold the audio information with a time stamp – sent by the source hardware – with the use of play out delays, hence all the devices can play it synchronously. With the aid of this method, using client-server architecture, we can implement a real-time audio playing platform.

Mobile devices provide a good platform for such systems, where this application is required at locations like beaches and places where convectional devices such as computers cannot be easily operated. The other plus points in using mobile devices are the features like audio, storage, the feature of hosting its own network in any remote situation, which gives the freedom to use this technology virtually anywhere.

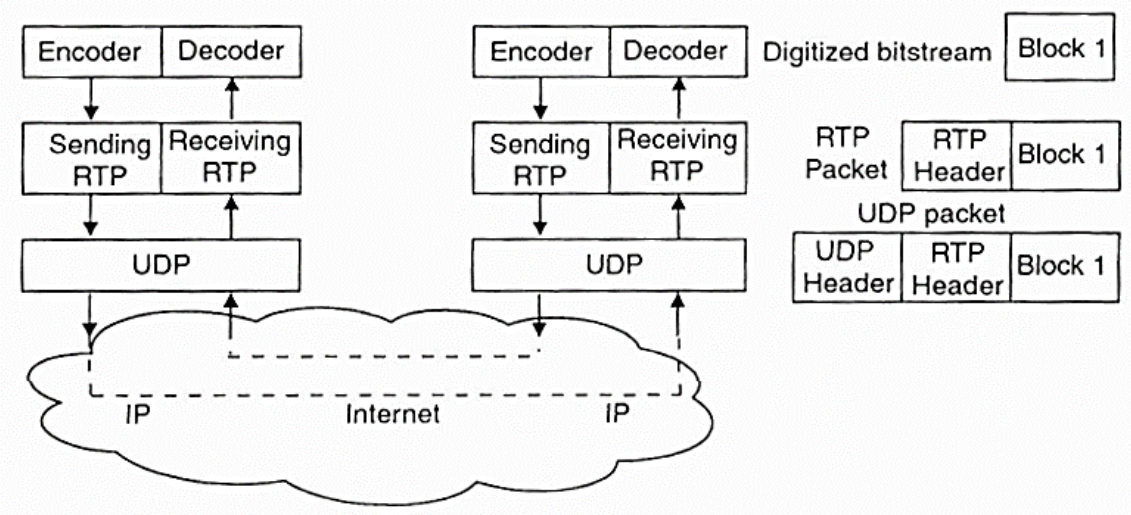

Figure 1: Real-time Transport Protocol [3]

2. METHODOLOGY

This paper discusses the analysis of the literature survey we conducted to gather the knowledge of the available systems for real-time audio playback. The scope of this literature survey was limited to mobile applications and their features, since our main intention is to identify the issues in real-time audio synchronization in mobile environment, which affects the outdoor entertainment facilities utilizing the mobile devices.

The literature survey will be continued to identify and learn the concepts, techniques and technologies used in

available system, their limitations and drawbacks.

We plan to conduct a cross-sectional survey to identify the needs and the popularity of real-time audio synchronizing systems.

Furthermore we will conduct experiments to design and develop mobile based real-time audio playback system, with less latency, less issues in synchronization and other artifacts.

3. DISCUSSION

We came across some products available and identified their core functionalities and features. In this section we present the analysis of these products.

3.1 RELATED PRODUCTS

Tune-Mob [4] [5]

Tune Mob is a mobile application that supports devices running IOS. This application can connect up-to 2 to 7 devices simultaneously using Wi-Fi and Bluetooth to transmit music to connected devices and play the stream in sync with all the devices. Which with the synergy of all device's audio capabilities amplify the audio. A nice feature provided by this application is that it allows multiple sources for the media, such as cloud music storing services.

Due to external circumstances the devices may go out of synch, and the venders suggest to pause and un-pause the audio play to synch back. And venders specify that there can be synching issue across multiple generations of devices [6].

SoundSeeder [7]

Sound Seeder is same as Tune-Mob, and it is free to try in trial basis. The source files can be selected from your phone storage, Windows network shares and other systems. The app allows the user to create a player instance and share it among other devices using Wi-Fi, and supports up to 16 devices. The application supports other platforms like Windows and Linux computers, which allows more devices to be connected, and the mobile application can control the volume of the other devices, overall allowing to take control of the other devices.

SoundSynk [8]

Unlike MusicPool, SoundSeeder and Tune-Mob, this application is a multi-platform, therefore allowing a number of devices running on different platforms to play music in sync. This application is in development by a couple of university students in Exter University UK, The developers confirmed the application will only require Bluetooth and will sync up with a couple of mobile devices on any of the three platforms – Windows mobile, Android and IOS.

MusicPool [9]

Music-Pool doesn't work on the local network, it allows other users to stream the audio via internet. The technologies used for the application aren’t revealed. The user is provided with a client id, which can be entered to the other devices to play the music in sync. The overall UI isn’t much neat and is not user friendly like Tune-Mob. The sole purpose isn’t to amplify audio using multiple devices but to maintain an internet radio station. This allows communications to be from multiple countries, unlike a conventional music

pooling programs, and this allows listeners from different locations to be tuned into a single server.

3.2 ANALYSIS OF THE FEATURES OF THE AVAILABLE PRODUCTS

Here we analyze the features of the products we discussed above, in the context of our ongoing research, to design and develop a concept to play synchronized audio in a local area network, to have the effect of amplification.

The main drawbacks we noticed in the available products are the platform support and the limitation in the number of devices connected. MusicPool has overcome these drawbacks but it operates via internet instead in a local area network. To understand the technical aspects of these drawbacks, we need to touch the internal specifications of these systems, which are not available in the public domain.
However the common architecture, which is used by these systems consists with a server who is responsible for playing the audio, and clients who can connect to this audio streaming server and play the stream synchronously. The number of clients, which can be handled by the server depends on the server resources. The efficiency of the synchronization depends on multiple factors, like the architecture, the RTP and the algorithms used in the client.

4. CONCLUSION AND FUTURE WORK

In this paper we have presented an analysis of a literature survey, discussing the features of a collection of work available, for real-time synchronized audio streaming. We have noted some limitations and drawbacks in these product, which are worthy to be looked in deep.

In future we plan to analyze these products in a technical aspects and also to do benchmarking of these programs on their performance, with more cross platform solutions appearing on the market, which makes the scope of the research wider. Through the benchmarking and analyses we hope to highlight the limitations and the issues in the domain, in much more deeper technical aspect.

And we hope to conduct experiments to test solutions for the limitations identified, especially in synchronization, since the latency can introduce a great issues, when it comes to synchronous audio playback [10]. And we hope to come up with better solutions to provide efficient synchronized playback – with less limitations – for real-time audio in mobile platforms.

5. REFERENCES

[1] A. Xu and J. Cooperstock, *"Real Time Streaming of Multi-channel Audio Data over Internet,"* in AES 108th Convention, Paris, 2000.

[2] J. Elson, L. Girod and D. Estrin, *"Fine-grained network time synchronization using reference broadcasts,"* in Proceedings of the 5th symposium on Operating systems design and implementation, Boston, 2002.

[3] A. Durresi and R. Jain, *"RTP, RTCP, and RTSP - Internet Protocols for Real-time Multimedia Communication,"* in The Industrial Information Technology Handbook, CRC Press LLC, 2005, pp. 28-1, 28-11

[4] TuneMob, *"TuneMob Play Music in Sync on Multiple Devices via Bluetooth and WiFi Tune Mob Simple Sharing,"* TuneMob, [Online]. Available: https://itunes.apple.com/us/app/tunemob-play-music-in-sync/id680664826?mt=8. [Accessed 02 03 2015].

[5] "Tune Mob," TuneMob, 2014. [Online]. Available: http://www.tune-mob.com/. [Accessed 02 03 2015].

[6] TuneMob, "TuneMob," TuneMob, 08 2014. [Online]. Available: http://tune-mob.com/TuneMob_more.html. [Accessed 02 03 2015].

[7] J. Dennis, "Play Music From Multiple Android Devices At Once With SoundSeeder," 03 09 2013. [Online]. Available: http://www.makeuseof.com/tag/play-music-from-multiple-android-devices-at-once-with-soundseeder/. [Accessed 02 03 2015].

[8] Vinayak, "SoundSynk: Students Develop App To Play Same Music Syncing Multiple Phones," 18 07 2013. [Online]. Available: http://www.gizbot.com/apps-software/soundsynk-students-develop-app-play-same-music-syncing-multiple-phones-012986.html. [Accessed 02 03 2015].

[9] J. Lee, "Use Music Pool To Broadcast Music Across Multiple Devices [Android]," 08 03 2013. [Online]. Available: http://www.makeuseof.com/tag/use-music-pool-to-broadcast-music-across-multiple-devices-android/. [Accessed 02 03 2015].

[10] A. Keltz, "Opening Pandora’s Box? The “L” word - latency and digital audio systems," 2015. [Online]. Available: http://whirlwindusa.com/support/tech-articles/opening-pandoras-box/. [Accessed 02 03 2015].