

**Audio Streaming for Windows Based Wireless Devices**

Thesis Proposal

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**Major-Field Approval**-The advisor and the department chairperson

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**A. Title**

Audio Streaming for Windows Based Wireless Devices

**B. Statement of Purpose**

Delivery of media content up to recently has been highly dependent on analog systems. Analog signal quality can be affected by a multitude of interference that requires rather expensive solutions. Introduction of digital circuitry provided an inexpensive medium for processing and transferring information that can be used to transfer signals in digital format. Such signals can be easily transmitted, stored and copied. They can be processed and altered to create new content with little effort. Today, digital content is dominating media distributions with a large base of digital content consumers. The content comes in different flavors including: digital audio and video, instant messaging, personal communications and digital photography. In order to receive and store digital content, information must be coded following specific standardized digital formats. Given the variety of digital content a large number of digital formats are required.

In order to receive digital content, end users must obtain the proper digital device which is suitable for the specific media. Devices need to provide users with capabilities to receive, store, play and generate information. Such devices can be developed for personal, home, or office use depending on users' needs and habits.

With the ubiquitous presence of the Internet, it is even easier to share or access digital media over the network. Moreover, the steady development of wireless networks

creates endless opportunities for people to enjoy digital media on the move. Each person has a choice to either watch live television broadcasts, or listen to live radio or music-on-demand stations on their wireless devices. Network providers use different wireless technologies such as: PRS/GSM (General Packet Radio Service on Global System Mobile networks), 3G (Third Generation of mobile devices) and Wi-Fi (Wireless Ethernet) listed from low to high bandwidth respectively.

Each wireless network can support a range of different traffic bandwidths. In order to handle data transmissions efficiently, a variety of digital formats can be utilized. The decision about the format selection can be a challenging job, especially when one needs to consider the various levels of digital content quality. Quality depends highly on the capability of the wireless network to handle the data transmission.

Live broadcasts require additional attention since its content needs to travel through the network before it is presented to the end user. Also, the time to deliver the content over the network should be reasonable. Such continuous delivery of the content without waiting for all of the data to download before you can play is known as streaming. Streaming media over wireless networks is still in its infancy but the complexity of applications and devices are expected to grow. Because of its mobility, improved and wide spread accessibility, people find streaming mobile technology rewarding.

Streaming on wireless networks requires content to travel in real-time over multiple networks. Because the information traverses multiple networks with the wireless network

at its end, the probability of information distortion is high. Information received incorrectly cannot be resent due to the nature of real-time broadcasts. In order to perform data correction, additional information must be attached to the original content. This might not be favorable for wireless streaming since error-correcting data will increase the overall amount of data that gets transmitted. The delicate balance between extra information and small data size must be maintained.

With this in mind, this research proposes to build a system that will enable users to enjoy real-time audio streaming over wireless networks. The system will be optimized for quality of the broadcasted digital sound within the real time requirements. The conceptual schema of the proposed system is depicted in Figure 1.

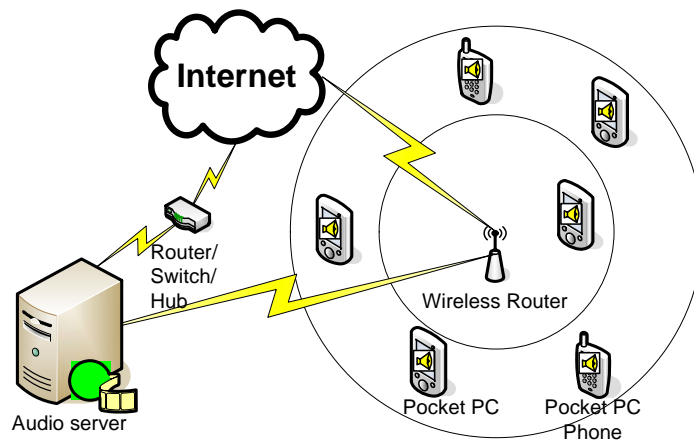


Figure1: Conceptual Schema of Audio Streaming System

### ***C. Literature Review And Current State-Of-The-Art***

Mobile devices usually come with factory preconfigured software. Some configurations include a single media content player. This is the case with the Pocket PC platform that includes Windows Media Player (Microsoft Corporation, 2005). The number of third party media players with streaming capability for a Pocket PC is rather limited. For example [www.ppc4all.com](http://www.ppc4all.com) (PocketPC4all, 2005) lists only three media players that have the capability of streaming. Only one of those is free while the others are commercial with the price range from US\$ 8.99 to US\$ 28.99. In fact a certain number of those listed require proprietary streaming format which might not be broadly accepted.

In order to make formats broadly available, standardized formats are developed. There are multiple standard streaming audio formats that provide high quality sound with small packet size especially developed for broadband networks. Some of the most commonly used streaming audio formats are: Progressive Networks' RealAudio (Real Networks Inc. 2005b), Xing Technology Corp's XingMPEG (Real Networks Inc. 2005a), Voxware's MetaVoice (Microsoft Corporation 2005c) and Shockwave (AtomSockwave Corp 2005). Those formats are also used in wireless networks with various results. Table 1 provides an overview of the format specifications.

To use the listed formats on Mobile wireless devices, many constraints need to be taken into consideration. Such constraints are based on the limited amount of available program memory, slow processor speeds, lack of devoted sound cards and loss of streaming data due to the wireless and mobile features of the devices.

<b>Format</b>	<b>Compression Ratio/ Avg. Contents Size</b>	<b>Pros</b>	<b>Cons</b>	<b>More Info</b>
RealAudio	Compressions for both 14.4 & 28.8 --- 3.6 - 8 Mb/hour	Over 5 million RA Players distributed	Audio often "gaps out" on 14.4-28.8 modem connections	<a href="http://RealAudio.com">RealAudio.com</a>
XingMPEG	Up to 26:1 --- Varies depending upon strength of compression	High compression ratios and good sound quality	Player not as widely distributed	<a href="http://Xingtech.com">Xingtech.com</a>
MetaVoice	Up to 55:1 --- 1 - 4 Mb/hour	Great compression; can be delivered at low 2400 bit rate	Primarily for speech	<a href="http://Voxware.com">Voxware.com</a>
Shockwave	Up to 176:1 --- Varies depending on strength of compression	Widespread plug-in support; great compression and high quality audio at low baud rates (8 – 16 Kbps)	Users must download new plug-in version	<a href="http://Macromedia.com">Macromedia.com</a>

Table 1: Commons Streaming Audio Formats.

The proposed project will focus on Pocket PCs with the Windows Mobile operating system (Microsoft Corporation 2005a). Windows Mobile is a compact operating system based on the Microsoft Win32 Application Programming Interface. Windows Mobile is developed not only for Pocket PCs but also for Smart phones and Portable Media Centers. A typical interface for the Windows Mobile 2003 operating system on a Pocket PC screen is seen in Figure 2.

Today's mobile devices are generally equipped with Wi-Fi and Bluetooth Wireless connectivity. In addition Smart Phones can connect to a wired network by means of General Packet Radio Service (GPRS) or 3G technology. These technologies provide a medium for wireless data streaming possible (Makofsky 2005).



Figure 2: Sample Windows Mobile Today's interface

#### *D. Methodology*

In this project, Microsoft Visual Embedded C++ 4.00 (eVC++), a product freely available to third party application developers will be used (Microsoft Corporation 2005b). eVC++ is an Integrated Development Environment specifically designed for the development and deployment of Windows Mobile based applications. It provides features that allow programmers to target their applications for a specific hardware platform and a number of processors. Supported platforms include: Pocket PCs, Smart Phones and Portable Media Centers. The following processors are supported: ARM, SH3 and MIPS. eVC++ is usually bundled with Microsoft Windows Mobile Software Development Kit (SDK) that provide extra library extensions, more extensive debugging features, and interactive emulators used to test the latest application version on a host PC. Use of emulators eliminates the need to test and download applications to destination Pocket PC device.

In our project we will make use of multi threaded technology with each thread having individual responsibility. In the preliminary phase we will utilize three threads. The first thread will establish a connection to a streaming server. Once the connection is established the thread will proceed with the reception of the streaming data and store the data into buffer. The second one will be responsible for playing the audio stored in the buffer. The last thread will be responsible for Quality of Service: monitoring the established connection and the audio playback, and modifying the whole system for better performance. The performance may be affected by the size of the buffer, client-server communication and audio bit rate. Multiple algorithms for performance improvement will be tested and the most efficient one will be selected for the final application released. The modular diagram of the system is shown in Figure 3.

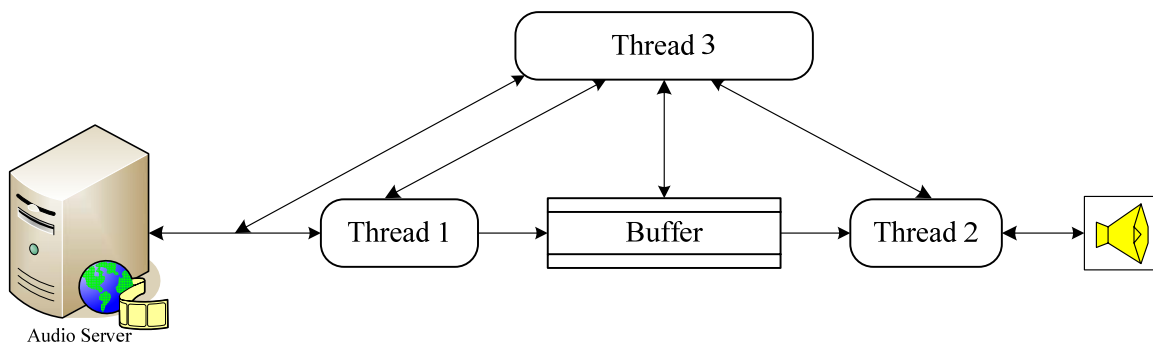


Figure 3: System's Modular Interaction Diagram

The application will allow user to enter a web address of an audio server and will attempt to connect and play online audio content. The user will be presented with the following menu:

The *File* menu will include the following menu items:

- *Open*: will be used to open a new audio web server address.
- *Close*: will be used to close the current connection to audio web server.
- *Info*: will be used to provide the information of current streaming audio data.

The *Bandwidth* menu will include the following menu items:

- *Automatic*: will be used to let the application automatically detect the bandwidth when selected.
- *Select*: will be used to let a user open a dialog box where list of bandwidths can be chosen.

The *Favorites* menu will be used to let a user add audio web server URL to the list and let them select those URLs.

The *Stats* menu will be used to provide detail statistics of audio streaming data, data transmission speed and so on.

The *Help* menu will include the following items:

- *About Application*: will be used to display necessary properties of the application such as copyrights, version and the application website link.
- *Content*: will be used to open the help dialog box.

Additional functionalities will be considered given the complexity of the final version of our application and my audio frequency an equalizer, a frequency sound monitor, an audio recording tool and an automated update of the software.

A snapshot of a preliminary application has been taken and is shown in Figure 5.

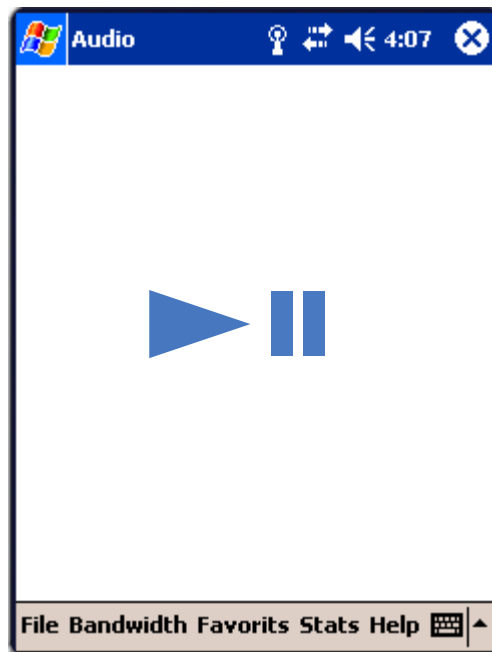


Figure 5: Snapshot of a Preliminary Application with Menus

### ***E. Contributions***

The goal of this project is to develop a quality audio player that is specifically tailored for wireless mobile users. Given the limited number of such players available, our player is expected to be well received by the wireless mobile community.

This application will provide users with better control over audio streaming content by regulating the quality of streaming network traffic and audio playback. In order to improve the quality, the application will balance the available resources to optimize a user's audio experience.

Given the flexibility of our system, we will be able to test and the modify behavior of the application. The test results will be collected and reported within the thesis. We expect that the result will provide better insight in properties of mobile streaming audio players. This will lead to development of better audio player.

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