

# Push!Music: Intelligent Music Sharing on Mobile Devices

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## ABSTRACT

*Push!Music* is a music sharing application which runs on mobile devices with wireless ad-hoc networking. Here music files take the form of autonomous software agents than take advantage of meta-data to build up a personal identity through other agents that it encounters. They then use this information to move autonomously between the devices of users in the proximity, looking for the environment that suits them best. Users can also make active personal recommendations by collaborative sharing or “pushing” music to other users in the vicinity.

## Keywords

Mobile music, active recommendations, collaborative filtering, media agents, media ecologies

## INTRODUCTION

When people are using media, for instance when listening to a portable MP3-player or listening to digital radio, meta-data is created, such as listening patterns. This data could be used to build a model of the preferences of users, for instance in order to recommend new music that the user was not previously aware of. As personal media devices become networked and can start to communicate with each other, it might be possible to leverage meta-data in new ways. We are exploring systems where music and other media is part of a larger picture, where it moves fluidly between a multitude of different networking devices. What would happen if, rather than the user actively selecting and downloading every piece of music on her device, files were allowed to be more autonomous, inserting themselves into the playlist and even moving between devices within proximity of each other?

With *Push!Music* our aim is to make media, such as music, autonomously find people instead of the other way around. To explain how this may happen, we have introduced the concepts of *media agents* and *media ecologies* [2]. A media agent is an embodied media file, e.g. an mp3-file, combined with a small database that contains contextual information gathered from user behavior – i.e. meta-data. The natural environment the agent inhabits, e.g. an MP3-player with a collection of other music files, is called a media ecology. The media agent can observe its environment and act on it

in certain ways, which includes copying itself to another media ecology – i.e. another device – if it thinks it is a suitable environment.

Preliminary studies [2] showed that many people find making recommendations to others an important part of the music experience. Therefore, we also allow users to directly “push” music to other users. In this case, the music file is sent to another device in the proximity and inserts itself into the user’s playlist. Such actions also generate meta-data that can be used by media agents.

## INTERACTION SCENARIOS

Through ad-hoc networking, *Push!Music* makes it possible to recommend music to other users in the proximity. Sharing can be *collaborative*, as when two or more people mutually swap songs, similar to on-line file sharing. It can also take the form of *pushing*, where the receiver is not necessarily aware that he or she is being sent a song. The following example shows how the latter form of sharing works.

*Delores enters a café to grab a coffee to go. On the screen of her Push!Music player she notices that another user is nearby. At a table sits a cool-looking guy with headphones. Before leaving the café, she decides to send this person her current favorite song! As Johan continues to listen to his playlist he discovers a new song he has not heard before...*

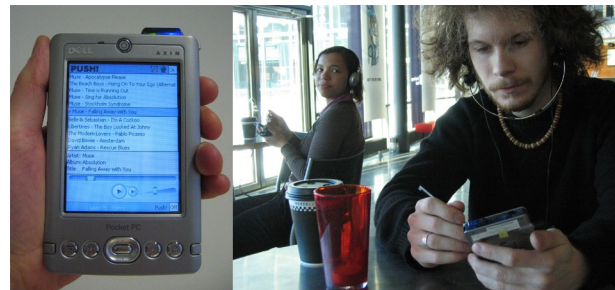


Figure 1: Left: *Push!Music* running on a PDA. Right: Users can actively push music to each other.

Since they are autonomous, they can also act on their own accord. Based on meta-data and knowledge of other devices in the vicinity, they can autonomously move to new users.

*She leaves the café and walks down the street, listening to an album she bought in an online music store. But then comes something else – a new song by an artist she has not heard of. It's a good song, but looking around, she cannot see anybody who could have sent it. It must have moved to her player by itself, because it was similar to the other music on her player.*

#### **METHOD**

In the system, meta-data is gathered from the natural context where users and media agents meet, in this case the playlist. Songs that are played together and are appreciated in that context can feel a stronger sense of “belonging”. This is used together with concepts from collaborative filtering technology [3] to provide a way for media agents to feel similarity towards each other. This makes it possible for agents to sense where other similar agents can be found, and then move or copy themselves to that ecology. Every agent will have to “learn” about itself through the other agents that it meets, rather than relying on a predetermined genre type of preference.

#### **IMPLEMENTATION**

The application runs on Pocket PC devices with WiFi-networking capabilities running Windows CE. The application was written in C++ using the mobile graphics platform *GapiDraw* ([www.gapidraw.com](http://www.gapidraw.com)) and the cross platform audio library *fmod* ([www.fmod.org](http://www.fmod.org)), making it easy to port to other platforms. In the interface, users can select which music to play and see which other users are in the proximity.

From an implementation point of view, each media agent consists of two files. One file is the media primitive, in this case an MP3-file. The other file contains the contextual data associated with the agent. The agents' movements and behavior are determined by a set of rules. For example, media agents continuously compare their own contextual data with agents on other devices in the physical vicinity to find new possible targets to move onto. The agents also have the ability to place themselves in the current user's playlist according to the user preferences. They can also delete themselves to make room for new and more appreciated agents if the memory becomes full.

#### **LEGAL ISSUES**

Digital file sharing is a controversial issue, and many questions of fair use and copyright protection are still not resolved. There is strong industry interest in finding solutions that let users buy and share music legally in mobile settings. In particular, the concept of *super distribution* [4] means that users can share and listen to copyright protected files in a limited manner, but if they want to keep a file for unlimited use they pay a fee. Both the original copyright holder and the middleman receive compensation, so that all users can effectively become licensed resellers of music. Push!Music does not currently contain any copyright management system but this would

be a natural component if the system was turned into a product. Then users would only be able to keep a new file received for a limited time, but would have the option to pay for it to keep it – potentially also giving the previous owner a part of the action.

#### **RELATED WORK**

Several examples of mobile music applications and mobile sharing have been presented. For instance, in *tunA* [1] people were able to “eavesdrop” on the music played by nearby users through a shared radio model. *FolkMusic* [5] was a mobile peer-to-peer file sharing system that allowed people to select music from nearby users using an interface based on set theory. Push!Music advances on these systems by allowing for active recommendations, and by letting music files (in the form of media agents) move autonomously between devices (and the corresponding media ecologies).

#### **CONCLUSIONS AND FUTURE WORK**

Active music recommendations and autonomous sharing raises a number of questions. Will users be frustrated if their machine fills up with music they have actively not chosen? Will the system lead to new contacts or will people try to shut out music from people they don't already know? And most importantly, how useful are the spontaneous recommendations generated by our system? To explore this, our next step will be to evaluate the system with a large user group.

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