

CFRU 93.3FM

Campus and Community Radio in Guelph

DIGITAL MUSIC LIBRARY

University of Guelph

CIS*4900: Computer Science Project

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Introduction

Text Formatting

The following character styles have been created to help identify important keywords. Their meanings are described below:

Character Style	Meaning
Key Terms	<ul style="list-style-type: none">• Terms are defined in the glossary, located at the end of the report, before the appendices. If reading a digital copy, clicking on these will take you to the glossary.
URL Hyperlinks	<ul style="list-style-type: none">• Text contains a link to a URL. If reading a digital copy, clicking on these will open the default web browser and direct you to the attached link.
<u>Bookmark Hyperlinks</u>	<ul style="list-style-type: none">• Text contains a link to another page in this document. If reading a digital copy, clicking on these will open the bookmarked page.

About CFRU

Campus and Community Radio in Guelph (CFRU 93.3 FM) is a campus radio station, located in Guelph, Ontario. It is a non-profit organization that offers an alternative to mainstream and public radio for the Guelph community and surrounding areas. CFRU broadcasts more than 70 weekly shows, hosted by a volunteer-driven group of students, community members and staff. Each show is themed around the interest(s) of the host, providing a passionate and creative listening experience.

CFRU has been broadcasting for over 25 years. Throughout this time, they have expanded their collection of music to include thousands of different artists, and it continues to grow on a daily basis



Current Logo. Source: [CFRU Facebook Page](#)

The Problems

Three key problems have been identified that will hinder the expansion of CFRU's music collection:

1. Currently, CFRU's collection is stored primarily on CDs. As their collection is expanding, physical storage space for CDs is becoming limited.
2. Upcoming artists, and record labels are using the internet as a medium for distributing music. CFRU is receiving new music digitally, but lacks the storage space to keep it for the long-term.
3. CFRU does not have the tools required to efficiently organize a large-scale digital music collection.

Motivation

My personal music collection is one of my most valued possessions. Whether I am at my computer, out walking about, or driving in my car, my music is always with me. Each song acts as a reminder of a past memory, complements a current emotion, or provides a link to a future connection with an undiscovered artist. The internet provides a massive web, connecting artists and listeners, from all over the world, in a matter of seconds. In our current digital age—with storage at an affordable cost, and access to a quick internet almost anywhere throughout our daily routine—exploring our musical tastes has never been easier. One of my most enjoyed pleasures in life is going about each day, unaware when a new music discovery will come my way.

When I went for a general orientation tour, for new volunteers at CFRU, I saw the potential for this project when we were introduced to the music collection. I was overwhelmed by the thousands of CDs on shelves throughout the station; it's an amazing site to see. I initially began to ask myself questions: Where would I begin to explore such a massive collection? How is the collection organized? Can it be re-organized? (i.e. What if I want to sort by release year? Or origin of the artist?)

I also thought of the current process involved for sampling music:

1. Remove CD from shelf.
2. Insert into CD player, (wait to load).
3. Sample tracks.
 - a. If I like it, set CD aside - Make a list of which tracks I liked.
 - b. If I don't like it, find where it belongs and place it back on the shelf.

Step 3.b. particularly drew up concern for me. It's a tedious task to locate a CDs location and place it back. For some people, it may be thought of as too time consuming. The thought of having to spend time to put CDs back may deter people from exploring CFRU's collection.

In comparison to the process for sampling music in a digital collection:

1. Find CD (i.e. digital album).
2. Click to play, (minimal wait to load).
3. Sample tracks.
 - a. If I like it, add song to a playlist.

The benefits for sampling in a digital collection are already evident:

- Eliminates the time to physically locate a CD.
- Reduces the load time for sampling songs.
- Eliminates the need to return CDs to their storage location.

Computers excel at tasks that are repetitive and that can be automated. In the case of a digital music library, sorting and sampling tens of thousands of songs is a task that can be transitioned to a computer. A digital music solution can enhance the exploration experience of CFRU's library.

As an aspiring software developer, and music enthusiast, I saw the opportunity to pair two passions of mine together.

A Little About Me

I am currently in my 5th year of undergraduate studies in Software Engineering at the University of Guelph. My primary goal as a software developer is to create software solutions that people will love to use. One way that I see to help me accomplish this goal is to focus on the users by ensuring that I take time to approach the problem from their point-of-view. I will also try to include them as much as possible throughout the development process. I want to work with them to learn more about the problems they face, and to create solutions that are tailored best for them.

Gathering Data

Blue-sky Brainstorm Session

To help determine what the digital library is going to do for CFRU, a **Blue-sky** brainstorm session was conducted with some of the staff members. The key rule of this session was to *not* reject any ideas. Even though some ideas may seem highly ambitious, they may provide insight into the long-term goals of the problem at-hand.

Each staff member was given a pad of self-adhesive notes and a marker to write ideas down. Ideas were collected based on the following three categories:

- 1) Daily Tasks (i.e. Daily responsibilities of staff members and volunteers that they may be automated by, or made easier, by the system)
 - 2) Potential Features (i.e. *What* the system may do)
 - 3) Users (i.e. *Who* will be using the system)

Staff members were asked to write down a single idea on each note and place the note under the matching category, written on a white board. After each idea was categorized, the contributor was asked to explain their idea to the rest of the group to help everyone share an equal understanding. Questions to help clarify ideas were encouraged.



From left to right: Daily Tasks, Potential Features, Users

After the session, thoughts from the Daily Tasks and Potential Features categories were copied into a spreadsheet in Numbers to help formalize the results. From there, thoughts were re-categorized to help illustrate similarities and allow for the prioritization of potential features. Please see [Appendix A](#) for a summary of the data.

Survey

In collaboration with Alexandra Rimmington, the music co-ordinator, a survey was created to collect data from the volunteer community at CFRU. It was created and administered through [Google Form](#), with a one week expiry.

The survey included two open-ended questions to collect more detailed thoughts from volunteers. The data obtained from these questions was copied into a spreadsheet and organized into groups by similarities. A series of rules were documented so that the summarization of these results can be duplicated, if requested, by another source. The data obtained from the summarization was used to create a second set of potential features for the digital music library. In total, one set was identified by staff, and a second, by volunteers.

For a copy of the questions asked through the survey, the results, and the rules for the summarization of the open-ended questions, please see [Appendix B](#).

Users

Use Case Diagram

A **Use Case Diagram** was created to identify key users in the system and to show the most prominent high-level interactions between these users and the system. In the diagram below, each user is represented with an 'Actor' symbol (i.e. stick figure), and the tasks that they will perform are represented with a 'Use Case' symbol (i.e. oval with task written inside). The lines drawn from the actor to the use case show which tasks are performed by the user in the system. A note, the black line from Librarian, to 'Add New Music,' has no significance over the blue lines.



One advantage to the use case diagram is that high-priority features of the system can be identified. They are identified by looking at which tasks have the most lines drawn to them. In this particular instance, the high-priority features are seen as the ability to: review, categorize and sample music, search the library, create playlists, and log play charts. Another advantage is that the diagram identifies the primary users of the system. They are identified by looking at which actors have the most lines drawn from them, indicating those who will be interacting with the system the most. In this system, the primary user is the Librarian.

By identifying the set of users, and the tasks that they will be performing, a high-level graphical representation of the system has been created. From this high-level set of tasks, a more specific list of user interactions with the system were identified, and are outlined in the next section.

Interacting With The System

User Stories

A set of **User Stories** were created to help identify specific responsibilities of the system based on high-priority features. Requested features came from the blue-sky session (see [Appendix A](#)), and the survey results (see [Appendix B](#)).

Requested Feature		
ID #	User Story Name	User Story Description(s)
Ability To Playback Music		
1.01	Add Music	A user will be able to add a song to the library. A user will be able to add a group of songs to the library.
1.02	Playback Music	A user will be able to playback music.
1.03	Remove Music	A user will be able to remove a song from the library. A user will be able to remove a group of songs from the library.
Ability To Edit Track Information		
2.01	Edit 'Album'	A user will be able to edit the 'Album' of a song. A user will be able to edit the 'Album' of a group of songs.
2.02	Edit 'Album Artist'	A user will be able to edit the 'Album Artist' of a song. A user will be able to edit the 'Album Artist' of a group of songs.
2.03	Edit 'Artist'	A user will be able to edit the 'Artist' of a song. A user will be able to edit the 'Artist' of a group of songs.
2.04	Edit 'Beats Per Minute (BPM)'	A user will be able to edit the 'BPM' of a song. A user will be able to edit the 'BPM' of a group of songs.
2.05	Edit 'Composer'	A user will be able to edit the 'Composer' of a song. A user will be able to edit the 'Composer' of a group of songs.
2.06	Edit 'Disc Number'	A user will be able to edit the 'Disc Number' of a song. A user will be able to edit the 'Disc Number' of a group of songs.
2.07	Edit 'Genre'	A user will be able to edit the 'Genre' of a song. A user will be able to edit the 'Genre' of a group of songs.
2.08	Edit 'Name'	A user will be able to edit the 'Name' of a song. A user will be able to edit the 'Name' of a group of songs.
2.09	Edit 'Record Label'	A user will be able to edit the 'Record Label' of a song. A user will be able to edit the 'Record Label' of a group of songs.
2.10	Edit 'Track Number'	A user will be able to edit the 'Track Number' of a song. A user will be able to edit the 'Track Number' of a group of songs.
2.11	Edit 'Year'	A user will be able to edit the 'Year' of a song. A user will be able to edit the 'Year' of a group of songs.
Ability To Sort Music By Track Information		
3.01	Sort by 'Album'	A user will be able to sort music alphabetically by 'Album'.
3.02	Sort by 'Album Artist'	A user will be able to sort music alphabetically by 'Album Artist'.
3.03	Sort by 'Artist'	A user will be able to sort music alphabetically by 'Artist'.
3.04	Sort by 'BPM'	A user will be able to sort music alphabetically by 'BPM'.
3.05	Sort by 'Composer'	A user will be able to sort music alphabetically by 'Composer'.
3.06	Sort by 'Genre'	A user will be able to sort music alphabetically by 'Genre'.
3.07	Sort by 'Name'	A user will be able to sort music alphabetically by 'Name'.

3.08	Sort by 'Record Label'	A user will be able to sort music alphabetically by 'Record Label'.
3.09	Sort by 'Year'	A user will be able to sort music alphabetically by 'Year'.
Ability To Define Tags (e.g. Sub-genre, Canadian Content, Female Artist, Etc.)		
4.01	Add Tag(s)	A user will be able to add a tag to a song. A user will be able to add a tag to a group of songs.
4.02	Edit Tag(s)	A user will be able to edit an existing tag to a song. A user will be able to edit an existing tag to a group of songs.
4.03	Remove Tag(s)	A user will be able to remove a tag from a song. A user will be able to remove a tag from a group of songs.
Filter By Tags (e.g. Sub-genre, Canadian Content, Female Artist, Etc.) To Aid Discovery Of New Music		
5.01	Filter by Tag(s)	A user will be able to filter music by a single created tag. A user will be able to filter music by multiple created tags.
Include Album Artwork		
6.01	"Auto-Find" Album Artwork	A user will have the option for whether or not album artwork will automatically be added (if found) from the internet.
6.02	Add Own Album Artwork	A user will be able to add their own album artwork to a song. A user will be able to add their own album artwork to a group of songs.
6.03	Add Multiple Album Artworks	A user will be able to add more than one album artwork to a song. A user will be able to add more than one album artwork to a group of songs.
6.04	Modify Album Artwork	A user will be able to select which album artwork is the default view for a song. A user will be able to select which album artwork is the default view for a group of songs.
6.05	View Album Artwork	A user will be able to view album artwork for music.
6.06	Remove Album Artwork	A user will be able to remove album artwork from a song. A user will be able to remove album artwork from a group of songs.
Building Playlists In Advance To Prepare For A Show		
7.01	Create Playlist	A user will be able to create a list of songs from the library.
7.02	Add to Playlist	A user will be able to add a song to their created list.
7.03	Remove from Playlist	A user will be able to remove a song from their created list. A user will be able to remove a group of songs from their created list.
7.04	Save Playlist	A user will be able to save their created list for later use.
7.05	Name Playlist	A user will be able to name their saved list.
7.06	Edit Name of Playlist	A user will be able to edit the name of their saved list.
7.07	Delete Playlist(s)	A user will be able to delete a saved list. A user will be able to delete a group of saved lists.
Gapless Playback For Compositions		
Share Playlists With Other Users		
Embedded PDF Or Text Box For One-sheet		
"New Releases Section" (i.e. Items Added In The Past 4-5 Months, Once Past This Date, Items Automatically Removed From Section)		
Accessible For Screen Readers		
Individual User Access		
Individual Personal Rating System		
Accessing Playlists On Different Computers In CFRU		
Exporting Files Easily To Use In Production (i.e. Grab Digital Files From Library And Import Into Adobe Audition / Export As MP3)		
Back-up System		

System Requirements

From the set of user stories identified in the previous section and consultation with CFRU staff, a list of **Requirements** was compiled. These requirements outline the functionalities of the Digital Music Library system for CFRU. The requirements have been split up into the following sections: Must, Should, Could, and Won't. Each section contains a table, consistent with the formatting displayed below. A note, the ID number doesn't denote priority (i.e. 1.0 is not ranked higher than 2.0).

ID #	Title
Description	

Must

These requirements are high-priority and are intended to be met upon the first release of the system.

1.0	Network Accessibility
The system must be accessible on the CFRU network, such that, it can be accessed from a minimum of 5 different computers.	
2.0	Compatible with Mac OS X
The system must be compatible on a desktop computer running Mac OS X 10.6 (Snow Leopard), or higher.	
3.0	Compatible with Windows
The system must be compatible on a desktop computer running Windows 7, Service Pack 1, or higher.	
4.0	Audio Files Support
The system must support the playback of audio files, such that, at a minimum it must support MP3 audio files.	
5.0	Display Album Artwork
The system must display album artwork, such that, each is legible from a viewing distance of up to 0.5 meter.	
6.0	Creation of Tags
The system must allow for tags to be created, such that, a tag consists of a minimum of 3 to a maximum of 25 characters.	
7.0	Tag Attachment
The system must allow for a tag to be attached to a single song or group of songs, such that, a group of songs is a minimum of 2.	
8.0	Filter Songs by Single Tag
The system must allow for the filtering of songs by a single tag.	
9.0	Filter Songs by Multiple Tags

The system must allow for the filtering of songs by multiple tags, such that, a minimum of 3 different tags can be selected.	
10.0	New-Release Section
	The system must include a New-Release section, such that, this section only displays songs added within a default of 2 months.
11.0	Time-frame Adjustment for New-Release Section
	The system must allow for the time-frame of the new-release section to be adjusted by a minimum option of monthly intervals.
12.0	Creation of User Accounts
	The system must allow for the creation of user accounts, such that, a user account will give access to the system.
13.0	Minimum User Account Support
	The system must support a minimum of 50 different user accounts.
14.0	Playlist Creation
	The system must allow for the creation of a playlist, such that, a playlist contains a minimum of 1 song.
15.0	Share Playlist With a Single User
	The system must allow for a playlists to be easily shared with another single user, such that, the mouse can be clicked a maximum of 5 times before the task is accomplished.
16.0	Share Playlist with Multiple Users
	The system must allow for a playlist to be easily shared with multiple users.
17.0	Screen Reader Accessibility
	The system must be accessible with screen reader software.
18.0	Import Audio Files to Adobe Audition
	The system must allow for audio files to be imported into Adobe Audition.
19.0	Back-up Solution
	The system must have a back-up solution, such that, a copy of all audio files maintained by the system is stored in a secondary location.

Should

These requirements are medium-priority and will be worked on after the first release of the system.

20.0	Query Artist Information from Websites
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	The system should contain links to websites to provide users with information about artists, such that, a minimum of 1 website can be queried.
21.0	Divisors to Separate Media Content
	The system should contain divisors to separate different media content (e.g. foley/sound effects vs. songs).
22.0	Search by Keyword
	The system should allow users to search by keyword to isolate songs with a matching criteria, such that at a minimum, users can search by artist name.
23.0	Remote Access
	The system should allow for remote access.

Could

These requirements are low-priority. They don't contribute to the core functionality of the system, but, may enhance the user experience. These will be revisited to ensure necessity before they are planned to be implemented.

24.0	Alternate Form-factor
	The system could support another form-factor, for example, a tablet or smart-phone interface.
25.0	Display What Users are Currently Listening To
	The system could display what each user is currently listening to.
26.0	Discussion Board
	The system could include a discussion board for users.

Won't

These requirements are out of the scope of the functionality for this system. They are features that came up in discussion and have been decided to not be included.

27.0	Playlist Synchronization with Other Devices
	The system won't support playlist synchronization between other devices, such as iPods.

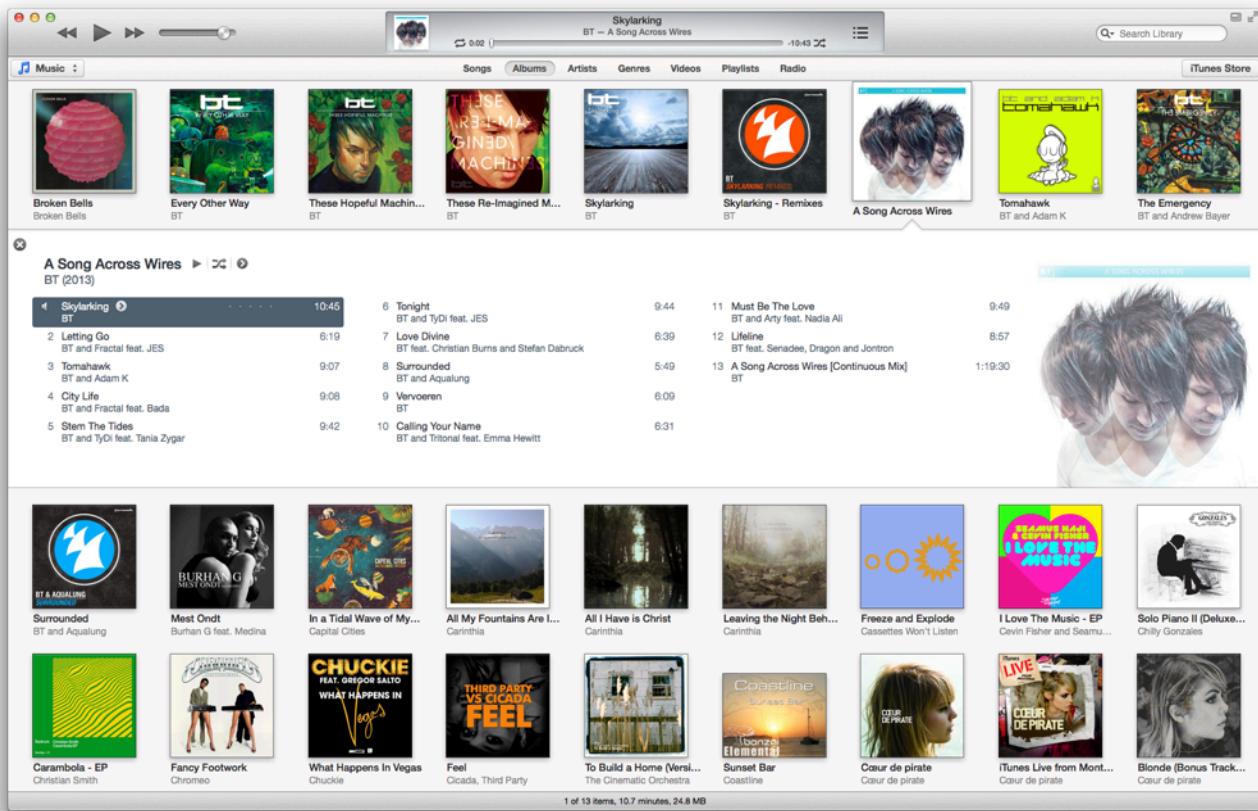
Existing Solutions

A series of existing digital music library management software was reviewed. Each solution was reviewed using my personal collection of music. Solutions reviewed contain a screenshot of the view when the application is first opened and has been populated with my collection. Due to time constraints, only the first three solutions have an in-depth review of their key features. Please refer to the chart below as a guide for how the reviews are presented and the intended interpretation of the information.

Features	Opinion	
• Description	✓	• Helpful for CFRU, feature is implemented well
	—	• Helpful for CFRU, but feature lacks optimized functionality
	✗	• Not helpful for CFRU

The first solution reviewed is on the next page.

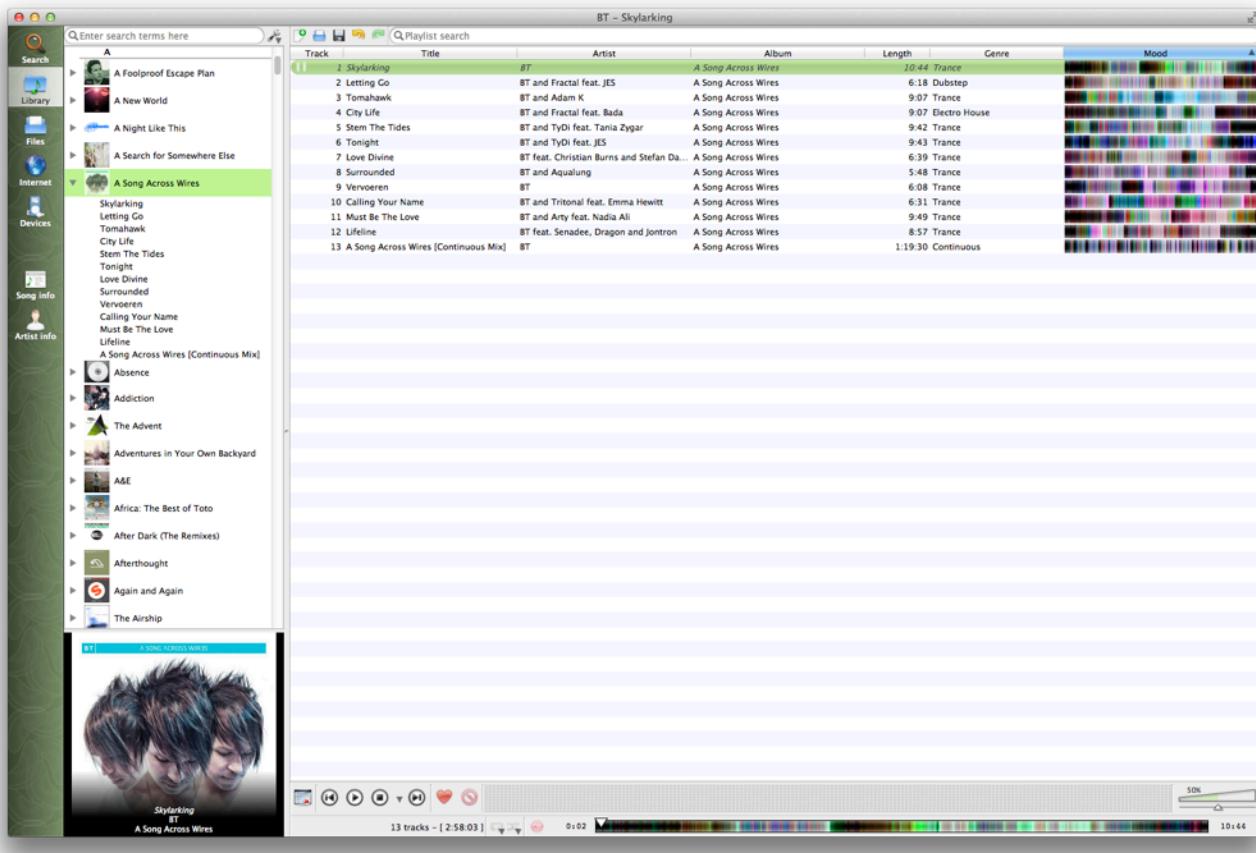
iTunes



Version 11.04 on Mac OS X 10.8.4

Features		Opinion
• 'Songs' and 'List' view: displays a list of all songs in library with selectable columns (e.g. Date Added, Year)	✓	• Best view to help with editing and tagging, and examining library analytics (e.g. play counts, ratings)
• 'Album' and 'Grid' view: displays album artwork images with Album Title and Album Artist underneath; clicking on artwork expands for a larger view and track listing	✓	• Helpful with browsing visually by album artwork
• Home Sharing: allows for multiple users on network to browse the same library	✓	• Helpful for limiting editing privileges to users other than the librarian
• 'Artists' view: displays a column containing a list of all album artists in library and a second column containing albums from the selected artist	—	• Not optimized: no filtering to assist in search query (e.g. highest rated songs)
• 'Genre' view: displays a column containing a list of all genres in library, and a second column containing albums from selected genre	—	• Not optimized: no filtering to assist in search query (e.g. Canadian, 90s)
• iTunes Store: integrated online music store	—	• Helpful with finding reviews, ratings and song popularity within albums, and similar music, but may discourage exploration of CFRU's library

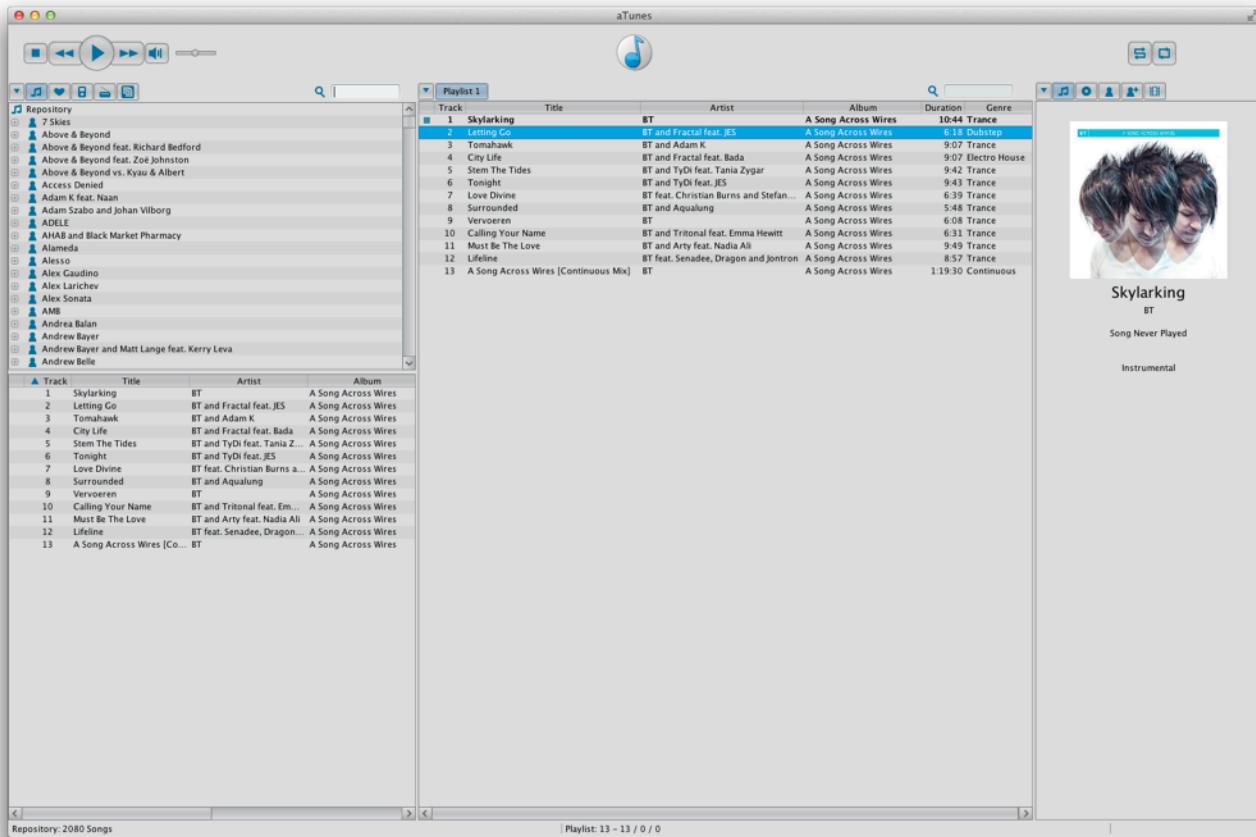
Clementine



Version 1.1 on Mac OS X 10.8.4

Features		Opinion
• 'Song Info' tab: displays lyrics (if found) from online sources	✓	<ul style="list-style-type: none"> Helpful with developing a deeper understanding of a song, checking for explicit lyrics
• 'Artist Info' tab: displays Artist Tags, Similar Artists, and biography information from different online sources such as, Wikipedia and Last.fm	✓	<ul style="list-style-type: none"> Helpful for learning about artists without having to navigate to separate websites in a web browser
• 'Internet' tab: allows for connecting to online streaming services (may require login), such as, Spotify, Last.fm	—	<ul style="list-style-type: none"> Helpful for discovering new music on the web, but may discourage exploration of CFRU's collection
• 'Search' tab: allows keyword search, e.g. genre, song title	—	<ul style="list-style-type: none"> Limited: only good for specific searches (i.e. exact song is known), not helpful with multiple keywords, e.g. Canadian, Indie, Rock
• 'Files' tab: allows for navigating folders on local computer	✗	<ul style="list-style-type: none"> Unnecessary for average user, may add duplicate or unwanted items
• Mood Bar: unsure of purpose	✗	<ul style="list-style-type: none"> Not helpful, unnecessary feature

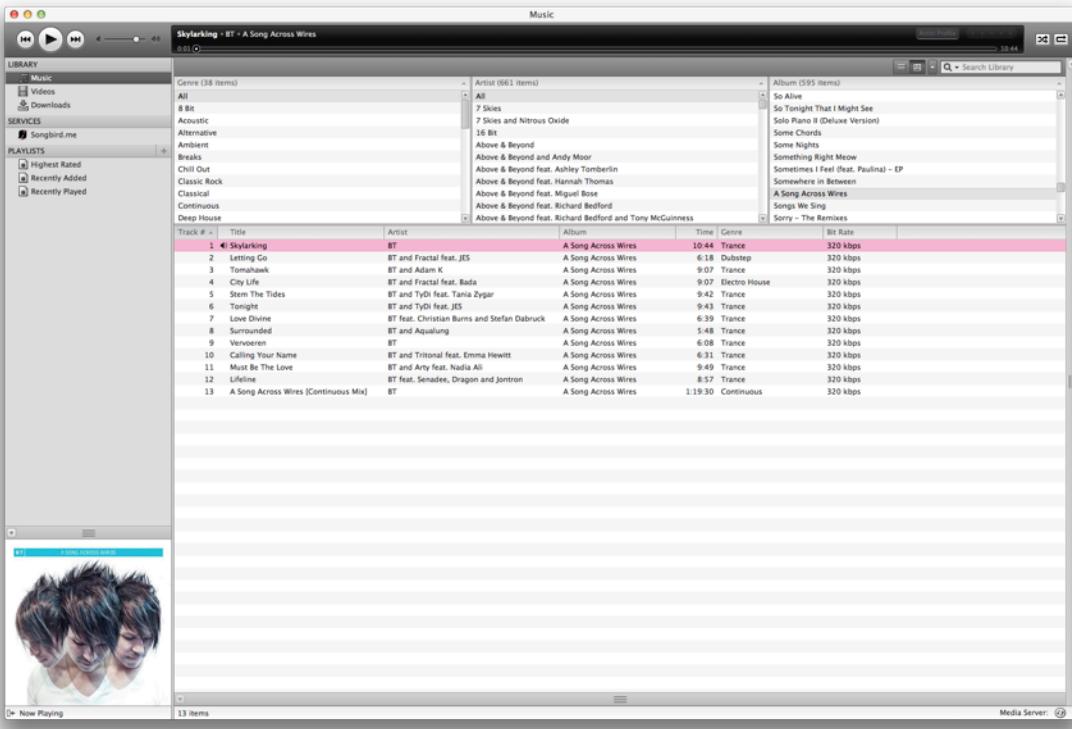
aTunes



Version 3.1.1 on Mac OS X 10.8.4. Requires [MPlayerX](#) - available from Mac App Store; free

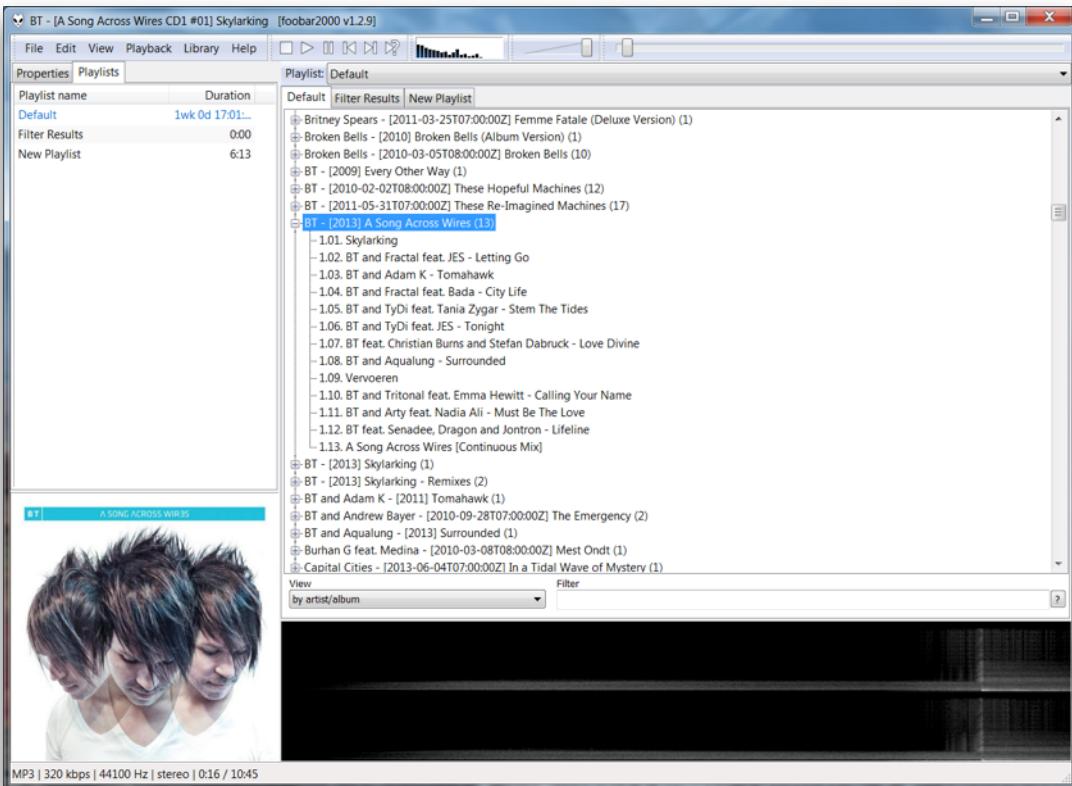
Features		Opinion
• Last.Fm integration: displays artist biographical information, as well as, similar artists from Last.fm query	✓	• Helpful for learning about artists without having to navigate to separate websites in a web browser
• 'Repository' tab: displays a list of library contents by Artists, Albums, Genres, Years or Folders. Contents from items in the Repository are then displayed below.	—	• Text heavy, unable to browse by album artwork. Selection may be overwhelming (e.g. Sort by genre, 1000+ Singer/Songwriter songs, unable to further narrow search)
• 'Favorites' tab: displays a list of favorited artists, albums and songs	—	• Would be nice to see which items are favourited by the CFRU community, but lacks individual user preferences
• 'Devices' tab: displays a list of connected portable devices, such as, MP3 players, external hard drives, to assist in transferring files	✗	• Not useful for CFRU because a concern of the digital music library is piracy. This tab may encourage easy transfer of files from CFRU's library.
• 'Radio' tab: displays a list of online radio stations added from the Radio Browser window	✗	• Not useful for CFRU because the idea of the digital music library is to encourage exploration of CFRU's collection.
• 'Podcast feeds' tab: displays a list of podcasts subscribed to from the Add Podcast Feed window	✗	• Not useful for CFRU because the idea of the digital music library is to encourage exploration of CFRU's collection.

Songbird



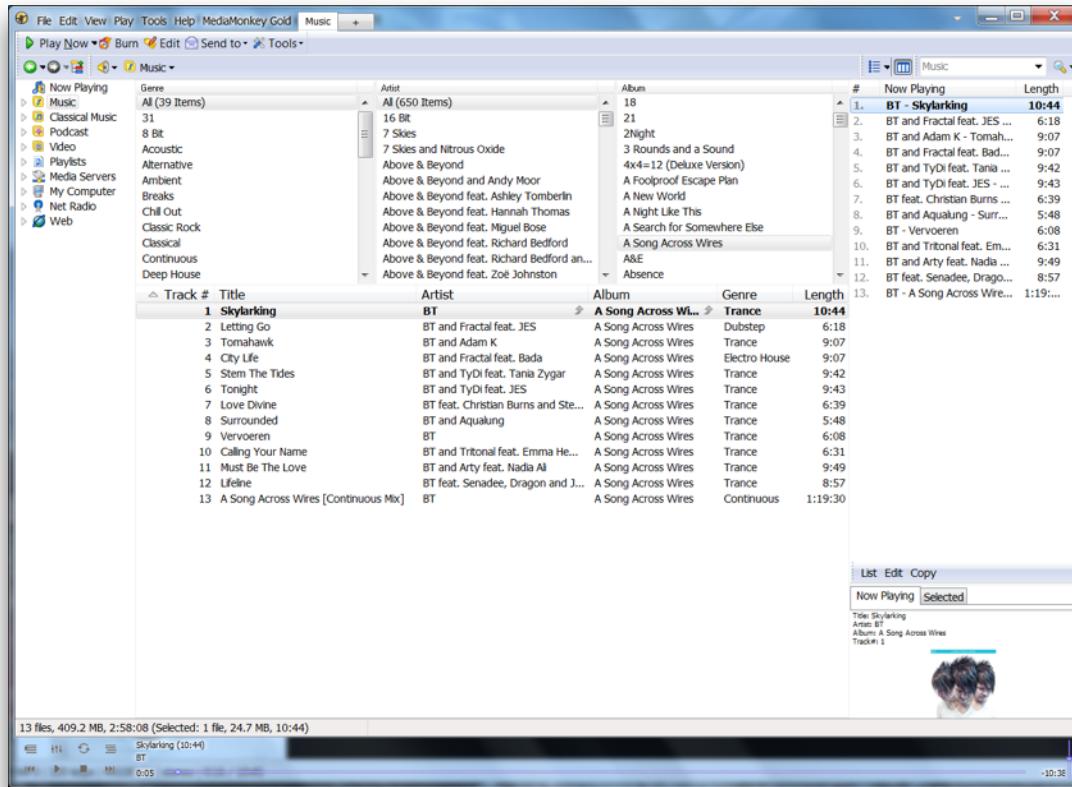
Version 2.2.0 on Mac OS X 10.8.4

foobar2000



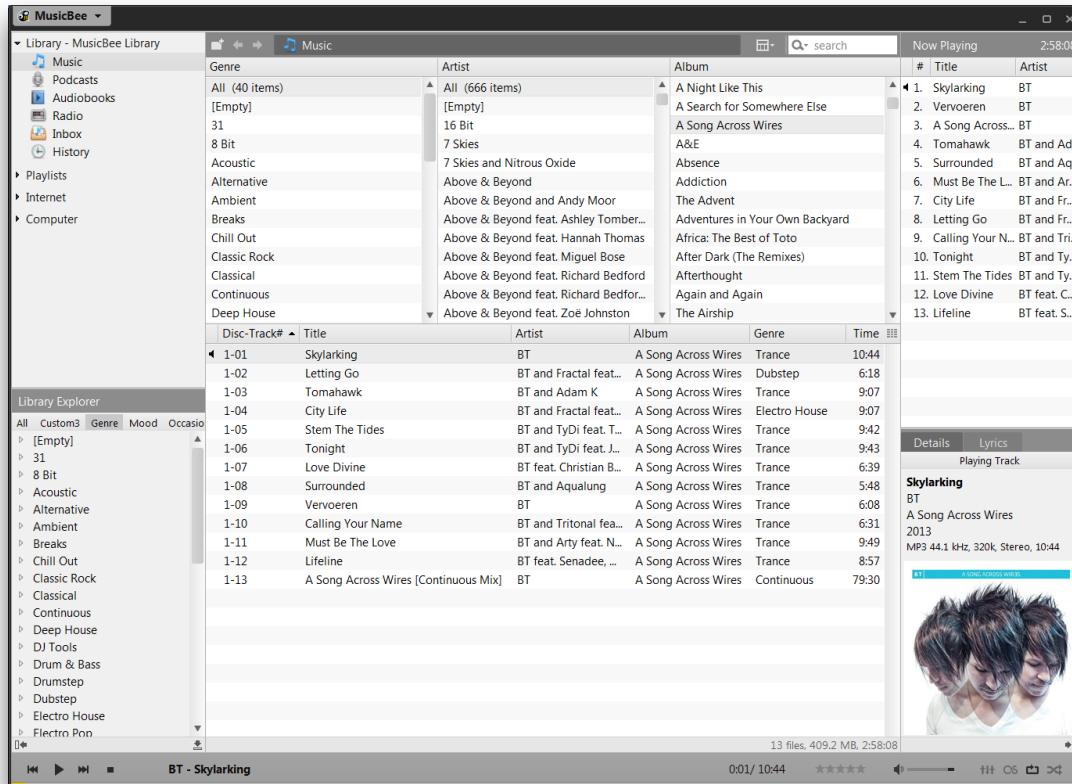
Version 1.2.9 on Windows 7 Professional, Service Pack 1

MediaMonkey



Version 4.0.7.1511 on Windows 7 Professional, Service Pack 1

MusicBee



Version 2.1.4924 on Windows 7 Professional, Service Pack 1

Recommendation

From my first impressions with each of the existing solutions that I've looked at, I feel most comfortable recommending the use of iTunes as a trial for the organization of a digital music library at CFRU. Some key helpful features that make it a good fit are outlined below:

- Compatible with both Windows and Mac operating systems; accessible on any computer within the station.
- Home Share will allow for easy sharing of the library over the CFRU network.
- Home Share will limit the ability for users, other than the librarian, to edit track information, ensuring consistency in track listing format and allow for control over cataloguing.
- Easy creation and edit of Smart Playlists to help autonomously organize content (e.g. New Releases: define a period of time at which newly added songs are catalogued as a New Release. As a smart playlist, all songs that match the criteria will be added automatically).
- Easy to edit details of multiple songs at once (e.g. album, title, artist, etc.); helpful for tagging songs.
- Easy and intuitive playlist creation with click-and-drag from any of the assorted views.
- Clean and minimalistic User Interface makes browsing enjoyable.
- Not bloated with unnecessary features and preferences making music more easily accessible.
- Familiar: 76% of survey respondents selected iTunes as their primary media player; low learning curve.

I think a tagging and filtration system is essential to keeping the digital music library well organized and easily navigated by users. Although iTunes doesn't directly support such a system, an alternative solution with similar results, can be achieved through the use of Smart Playlists. Other solutions, like MediaMonkey and MusicBee, offer more flexibility with their implementation of a tagging and filtration system, but it's a more complex, and not very user-friendly.

Conclusion

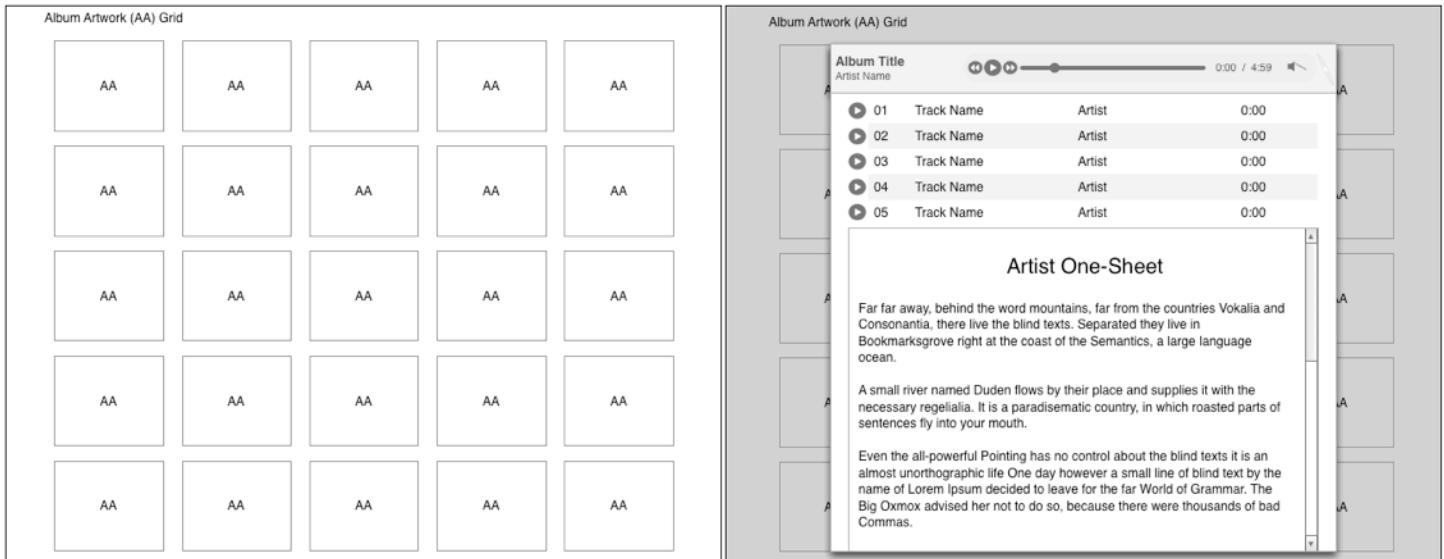
After the evaluations, it is evident that over half of the proposed features for a digital music library at CFRU are not available in existing solutions. Since the features identified are not available, I think that the appropriate solution is to build a new system, that is customized for CFRU. Please See [Appendix C](#) for a full feature comparison between the existing solutions reviewed and the feature set identified for the proposed solution for CFRU.

A sample interface for a custom solution is presented in the next section.

Custom Solution

Sample Wireframe

A sample **wireframe**, illustrating how album artwork, and an artist one-sheet, may appear in the user interface for a custom-built solution is below.



For a larger view of the images, please see [Appendix D](#).

In this scenario, a clean and simplistic grid of images, representing album artwork, is displayed. The images could be the result of a filtered search by tags, only showing those that match the requested criteria, or it could be a view of the entire library, sorted alphabetically by such fields as album title or artist name. Upon clicking one of the images, the window could fade and a separate window could be placed on top; the fading will help to focus attention on the new window. Here, a user may sample songs that appear in the album, as well as, read information contained in the Artist One-Sheet. The Artist One-Sheet area could be an embedded PDF or text box, depending on the file format of the One-Sheet. When the user is finished sampling songs, they can click anywhere in the faded area and return to the previous window, containing the grid of album artwork images.

For future development of a custom solution, more wireframes will be designed to show how features are planned to be implemented. Consultation with staff members and volunteers will provide feedback to help identify likes, and dislikes, of the wireframe. Feedback will be used to alter the design of the wireframe to provide a better solution. Changes to the system are encouraged most during this phase of development because the cost of time is lowest.

Glossary

Blue-sky

A method of brainstorming where the goal for participants is to think of limitless possibilities.

Requirements

A single, irreducible statement, outlining a functionality of the system.

Use Case

A detailed list of steps, outlining the interactions between the system and a user, or the system and an external system.

Use Case Diagram

A high-level overview of the system and the users within it. It portrays a set of users and the tasks that they will perform while using the system.

User Story

A sentence in everyday english that describes a single task that a user is able to accomplish while using the system.

Wireframe

An inexpensive solution to help visualize how features may appear before development.

Appendix A: Blue-sky Summary

Fill Colour	Priority	Approximate Iteration
	High	1 st - 2 nd
	Medium	2 nd - 3 rd
	Low	3 rd +
<i>Organization</i>		
Include album artwork.		
Ability to define tags (e.g. sub-genre, Canadian content, female artist, etc.).		
Filter by tags (e.g. location, sub-genre, instrumental) to aid discovery of new music.		
Embedded PDF or text box for one-sheet.		
“New Releases Section” (i.e. items added in the past 4-5 months, once past this date, items automatically removed from section)		
Search for individual songs on a theme to illustrate / develop a story or thought.		
Links to websites about artist info.		
Library divisions for different types of media (e.g. foley / sound effects, ads and PSAs).		
“Home Page” [i.e. area to feature / highlight content (e.g. new releases, charting music, upcoming Guelph shows, link playlists to check out)].		
<i>Creating Playlists</i>		
Building playlists in advance to prepare for a show.		
Share playlists with other users.		
Integrate playlists with Public Service Announcements (PSAs) / ad scheduling.		
Automated playlist creation (i.e. overnight / fill-in automation).		
<i>Accessibility</i>		
Individual user access.		
Accessible for screen readers.		
Accessing playlists on different machines in CFRU.		
Remote access (e.g. from home).		
<i>Other</i>		
Ability to playback music.		
Exporting files easily to use in production (i.e. grab digital files from library and import into Adobe Audition / export as MP3).		
Back-up system.		
Generating tags / metadata for podcasts on play-out.		
Discussion board [i.e. place to post reviews / room to comment for volunteers (e.g. on an album or artist)].		
Listening stations [i.e. touch-screen browsing of album artwork (e.g. tablet application)].		
Auto Google search bar for artist information.		
Ability to load playlist onto a CD/network player (rather than played on a computer).		

Logging Playback

Automated programming log (i.e. interaction between digital library and filemaker log-sheet program).

Import appropriate data for each track played into proper fields on log-sheet (e.g. artist, album, song, label, Canadian content, instrumental, etc.)

Playback tracking (i.e. seeing what other programmers are currently playing / have played / will play).

Integration with RDS (over-the-air-text).

Third-Party Integration

Access to public domain collection [i.e. expired copyright / audio available for free public use (e.g. specifically, Guelph)].

Integrate access with Ontario Independent Music Archive (OIMA) [i.e. pull files from OIMA (e.g. new album / file)].

Artist donations made easy (i.e. queue for submitting new music to CFRU by artists).

Play out with virtual DJ or similar software, with an option of a hardware controller.

Appendix B: Survey and Results

Questions

CFRU Digital Music Library Survey

Would you be interested in using a digital music library at CFRU?

Yes
 No

Which of the following items do you find helpful when browsing through CFRU's current music library.
Select all that apply.

Album Artwork
 Liner Notes
 Lyrics
 Promotional One Sheet
 Tags (e.g. artist's hometown, subgenre)
 Other:

What are some of the things that you look for when browsing music that is new to you?
Select all that apply.

Album Artwork
 Release Date
 Genre
 Record Label
 Canadian Content
 Other:

What online resources do you use to find information about artists?
Select all that apply.

AllMusic
 CBC Radio 3
 Facebook
 Last.fm
 Myspace
 Other:

What is your preferred digital audio format?

Lossy Compressed (e.g. MP3)
 Lossless Compressed (e.g. FLAC)
 Uncompressed (e.g. WAV)

Which of the following types of user interfaces would you use to interact with a digital music library for CFRU?

Select all that apply.

- Graphical User Interface (i.e. standalone application for use on a desktop or notebook computer)
- Touchscreen (i.e. smart phone or tablet application)
- Web-based (i.e. access through a web browser)

Which application do you primarily use to organize your personal digital music library?

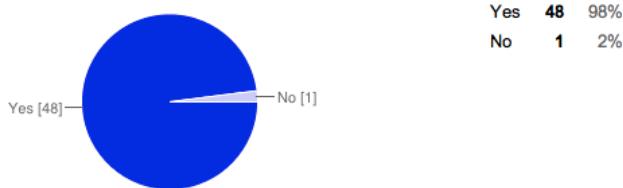
- foobar2000
- iTunes
- Songbird
- Winamp
- Windows Media Player
- Other:

From the previous question, describe one feature of that application you find most helpful.

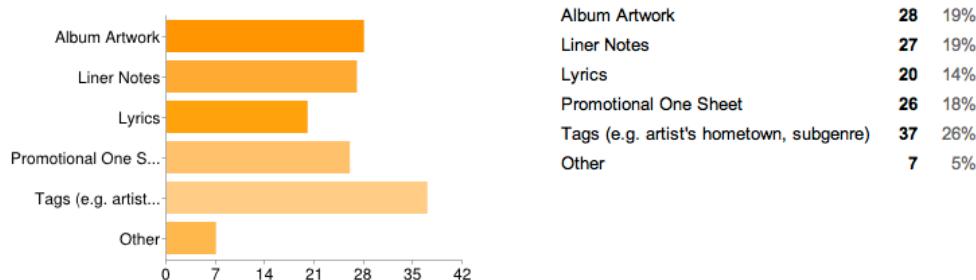
What difficulties (if any) do you foresee with using a digital music library at CFRU?

Results

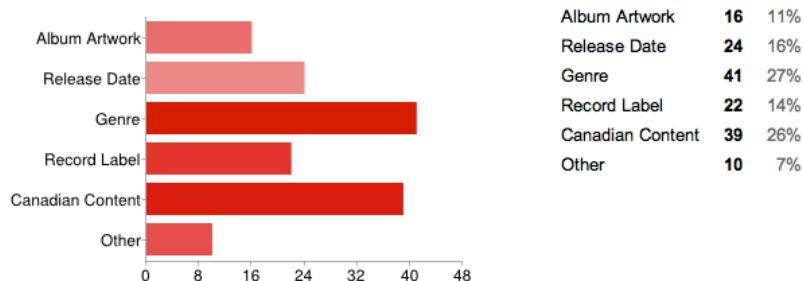
Would you be interested in using a digital music library at CFRU?



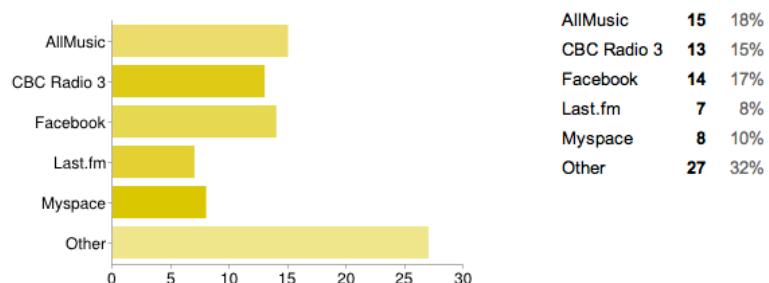
Which of the following items do you find helpful when browsing through CFRU's current music library.



What are some of the things that you look for when browsing music that is new to you?



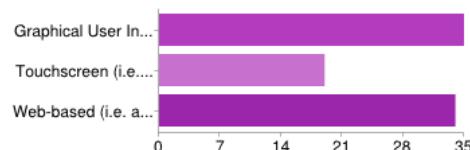
What online resources do you use to find information about artists?



What is your preferred digital audio format?

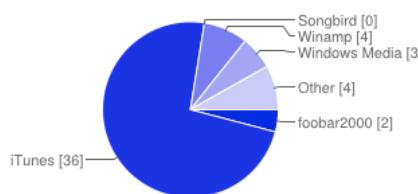


Which of the following types of user interfaces would you use to interact with a digital music library for CFRU?



Graphical User Interface (i.e. standalone application for use on a desktop or notebook computer)	35	40%
Touchscreen (i.e. smart phone or tablet application)	19	22%
Web-based (i.e. access through a web browser)	34	39%

Which application do you primarily use to organize your personal digital music library?



foobar2000	2	4%
iTunes	36	73%
Songbird	0	0%
Winamp	4	8%
Windows Media Player	3	6%
Other	4	8%

From the previous question, describe one feature of that application you find most helpful.

Always used The ability to choose how to organize the music, genre, artist etc. It's neat! actually I use Audacity to copy iTunes to MP3. I am most familiar with Windows Media Player Visually briwsad by album cover Re-organize by artist, album, year, genre, etc. I find it helpful being able to track down music by simply typing in the name of the artist or song and searching. As well, it's very helpful to keep all my music well organized down a list in iTunes in different categories. personal rating system ease of use Easy to organize, new version has many improvements. iTunes used to operate as a simple and accessible database to find and sort music and to build and edit playlists. They've recently changed their interface for the worse and I find it to be a convoluted and frustrating experience using it to program these days. iTunes is an atrocity, but I was given an ipod a few years ago as a gift and seems to be the only thing that can get music on to the thing. I also use Winamp, and it seems ok. Nothing in particular. Just a default option for me. I'm not too picky the ability to create playlists Winamp can play all music files Wide range of format support, including flac Gapless playback (important for classical recordings) Good handling of metadata Winamp lines up tracks in desired fashion organizational layout with column of artists listed alphabetically Being able to search a word(s) and get a list of every artist and/or song title that has that word in it Searching my musical archive Organization, speed, keyboard controls I hate the damn thing. Recently Added Display of song details, searching capabilities and ability to edit start and end times. It's so hard to give only one reason. So here are some in order of importance... 1.) Works on macs (and PCs) 2.) Allows me to upload either either entire shows or edited playlists to my ipod for playback on the air 3.) Amazing editor for id3 tags (and easily fetches or uploads track information even after importing tracks) 4.) Intuitive GUI that is visually based and allows browsing by cover art AND other fields and create playlists 5.) Plays many formats including AAC 6.) Integrates with megaseg DJ / Broadcast software 7.) handles a large library and works with remote library access clients like zumocast. ability to edit track information concerning artist genre album etc multi-format support. vlc is the best for this, of course. very easy to create a playlist/show easy to get music from itunes store Easy to edit information and arrange albums in order. I would like to know if it's instrumental or not Easy to sync with ipod. Very organized The ability to update image artwork and re-categorize songs and albums using "Get Info". Also, the ability to make playlists. Shows artist albums and songs all at once. Doesn't convert songs to MP3 unless specified. Easier to sort through bands discographies than itunes. Generally nicer than itunes.

What difficulties (if any) do you foresee with using a digital music library at CFRU?

my incompetence with technology generally individuals trying to personalize the library. System crash and no one has access or all the music is lost. Otherwise it seems like a good idea! Managing and copying the current physical library into MP3 format. Losing the experience of picking up a physical album to see everything that the band wanted to express in the album art, liner notes, etc. How do I find what's new, who's local, who's coming to town, or specific songs that I haven't heard of before. How do I make and get recommendations from other programmers? How do I know if a song has already been used for a PSA, ad, show promo, or story? How do I collaborate with other show contributors to share playlists, divide production tasks, and import files into Audition or other editors? An overly complicated interface would suck. Mass pirating of independent music. Eventual obsolescence of the librarian. Possibility of servers going down? organizing a play list in advance of a show or even during the show. will it be possible to organize a play list before your show? If so, how will it be saved and accessed later? Filters for easy searching. Inability for people to properly catalog genres none, sounds great Categorization, misspellings None Could be time consuming. n/a Some low volume recordings don't have info listed on internet databases. Must manually enter data. Classical music catalog must be organized in a different manner. It needs to be composer oriented. A robust search function would alleviate this problem I'm really excited for this! Difficulty accessing and downloading the music from different computers. none Wading through lots of tracks. Could I search or browse from home? You'd have to be able to browse through the system in another room, not in the on-air studio. Also there you would need to be able to make a list of albums or create playlists or something that can then be sent to the on-air computer Corruption of files, people moving files without changing the pathways, people unintentionally deleting files. Basically all the standard issues regarding the storage of a large amount of audio files on a computer. Playback, is it separate from a search within the music library or being done at the same time if someone is in a different room doing some research? It could be slow to load or organize into a playlist. I think it could work, but I worry just the lack of dependability that seems to accompany most computer based systems. Could we access it from home? The size of the library will be huge and it may not be updated as much as users would like it to. It takes time to rip CD's and it is possible that many things will be left out of the digital library. None really. My show is all digital these days. I currently import music from CDs into my library for future airplay supplementing that with music I receive from artists in digital format. I don't see ANY. ;) Learning how! I can't think of anything, as long as it is well designed and isn't always buffering it should work fine for me. would be good to be able to have searches to find what you want (ie. be able to search for "female members" or "canadian content" or "punk rock" to find new things maybe...!) not sure if it will be set up this way Perhaps it might be more difficult to use the library if all will be only accessed through computer, because computers are not always available to use. As well, a digital library might be a little more complex to understand if you don't know too much about technology. Otherwise, a digital library might be a nice new way to go with music at CFRU

Rules For Summarizing Answers From Open-ended Questions

Please reference the included Excel or Numbers data file, "CFRU_Digital-Music-Library_Survey-Responses." Examples cited are in the format (Row, Column).

1. Copy rows 3 to 52 from columns I and J into separate blank spreadsheets. May also copy column H for reference.
2. Delete test data, "It's neat!" (3, I) and "I don't see ANY. ;)" (3, J).
3. Delete blank rows.
4. Edit comments for correct grammar to increase readability and format consistency.
5. Split 'multi-thought' comments into 'single-thought' comments; single-thought comments each get one row.
 - multi-thought comment e.g. "The ability to update image artwork and re-categorize songs..." (45, I).
 - single-thought comment e.g. "The ability to update image artwork."
e.g. "The ability to re-categorize songs using 'Get Info.'"
6. Remove any numbered priority comments; details are most important.
 - e.g. "...So here are some in order of importance..." (36, I)
7. Remove irrelevant comments.
 - unrelated to question asked e.g. "iTunes is an atrocity..." (52, I).
 - vague e.g. "I hate the damn thing." (19, I).

Summarized Answers From Open-ended Questions

Helpful Features

Fill Colour	Priority	Approximate Iteration
	High	1 st - 2 nd
	Medium	2 nd - 3 rd
	Low	3 rd +
Primary Application	Feature(s) found to be most helpful.	
<i>Organization</i>		
foobar2000	The ability to choose how to organize the music, genre, artist, etc..	
iTunes	Easy to arrange albums in order.	
iTunes	Easy to edit information.	
iTunes	The ability to create playlists.	
iTunes	As well, it's very helpful to keep all my music well organized down a list in iTunes in different categories.	
iTunes	Easy to organize.	
iTunes	Recently Added.	
iTunes	Organizational layout with column of artists listed alphabetically.	
iTunes	Re-organize by artist, album, year, genre, etc..	
Jango	I would like to know if it's instrumental or not.	
Windows Media Player	Personal rating system.	
<i>Graphical User Interface (GUI)</i>		
iTunes	Display song details.	
Zune	Shows artist albums and songs all at once.	
iTunes	Intuitive GUI that visually allows browsing by cover art and other fields.	
iTunes	Intuitive GUI for creating playlists.	
iTunes	Visually browse by album cover.	
iTunes	Very easy to create a playlist/show.	
<i>Editing Library Content</i>		
iTunes	Amazing editor for ID3 tags.	
iTunes	Re-categorize songs and albums using "Get Info".	
iTunes	The ability to update album artwork.	
iTunes	Ability to edit track information concerning artist, genre, album etc..	
iTunes	Ability to edit start and end times.	
<i>Other Devices / Software Support / Compatibility</i>		
iTunes	Works on Mac and PC.	
iTunes	Works with remote library access clients like ZumoCast. "Remote Access"	
iTunes	Integrates with MegaSeg Mac DJ / Broadcast software.	
<i>Other</i>		
foobar2000	Gapless playback (important for classical recordings).	
iTunes	Easily fetches or uploads track information even after importing tracks.	
iTunes	Keyboard controls.	
Zune	Doesn't convert songs to MP3 unless specified.	
<i>Search</i>		
iTunes	Searching my musical archive	
iTunes	I find it helpful being able to track down music by simply typing in the name of the artist or song and searching.	

iTunes	Searching capabilities.
iTunes	Being able to search a word(s) and get a list of every artist and/or song title that has that word in it.
Zune	Easier to sort through bands' discographies than iTunes.
<i>File Compatibility</i>	
foobar2000	Wide range of format support, including FLAC.
Miro	Multi-format support.

Potential Problems

Fill Colour	Priority	Approximate Iteration
	High	1 st - 2 nd
	Medium	2 nd - 3 rd
	Low	3 rd +
<i>Organization</i>		
Wading through lots of tracks.		
How do I find what's new, who's local, who's coming to town, or specific songs that I haven't heard of before?		
Organizing a playlist in advance of a show or even during the show.		
Sending playlists to the on-air computer.		
Some low volume recordings don't have info listed on internet databases. Must manually enter data.		
Classical music catalog must be organized in a different manner. It needs to be composer oriented.		
How do I know if a song has already been used for a PSA, ad, show promo, or story?		
<i>Navigation</i>		
Filters for easy searching.		
Would be good to be able to have searches to find what you want (i.e. be able to search for "female members," or "canadian content," or "punk rock," to find new things maybe...!).		
<i>Performance</i>		
How will playlists be saved and accessed later?		
Gapless playback for compilations.		
Playback, is it separate from a search within the music library or being done at the same time if someone is in a different room doing some research? It could be slow to load or organize into a playlist.		
<i>Other</i>		
An overly complicated interface would suck.		
Losing the experience of picking up a physical album to see everything that the artist wanted to express in the album art, liner notes, etc..		
Mass pirating of independent music.		
<i>Accessibility</i>		
Difficulty accessing and downloading the music from different computers.		
Could we access it from home?		
<i>Learning Curve</i>		
Learning how!		
A digital library might be a little more complex to understand if you don't know too much about technology.		
<i>Collaboration</i>		
How do I collaborate with other show contributors to share playlists, divide production tasks, and import files into Audition or other editors?		
How do I make and get recommendations from other programmers?		

Appendix C: Existing Solutions Feature Comparison

	iTunes	Clementine	aTunes	Songbird	foobar2000	MediaMonkey	MusicBee	Custom
Initial Release	2001	2006	2011	2006	2002	2003	2008	2014
Windows	✓	✓	✓	✓	✓	✓	✓	✓
Mac OS X	✓	✓	✓	✓	✗	✗	✗	✓
Cost	Free	Free	Free	Free	Free	Free	Free	TBD
Last Updated	2013	2013	2012	2013	*2013	*2012	*2012	N/A
Music Playback	✓	✓	✓	✓	✓	✓	✓	✓
Edit Track Information	✓	✓	✓	✓	✓	✓	✓	✓
Sort Music By Track Information	✓	✓	✓	✓	✓	✓	✓	✓
Album Artwork	✓	✓	✓	✓	✓	✓	✓	✓
Playlist Creation	✓	✓	✓	✓	✓	✓	✓	✓
Gapless Playback	✓	✗	✗	✗	✓	✓	—	✓
Screen Reader Accessible	✓	✓	✓	✓	✓	✓	✓	✓
New Release Section	—	—	—	—	—	—	—	✓
CFRU Network Accessible	✓	—	—	—	—	—	—	✓
Back-up System	—	—	—	—	—	—	—	✓
Define Tags	✗	✗	✗	✗	✗	—	—	✓
Filter By Tags	✗	✗	✗	✗	✗	—	—	✓
Easily Share Playlists With Others	✗	✗	✗	✗	✗	✗	✗	✓
Accessible From Home	✗	✗	✗	✗	✗	✗	✗	✓
Export Files Easily For Production Use	✗	✗	✗	✗	✗	✗	✗	✓
Embedded One-sheet	✗	✗	✗	✗	✗	✗	✗	✓
Personalized Individual User Access	✗	✗	✗	✗	✗	✗	✗	✓
Individual User Song Ratings	✗	✗	✗	✗	✗	✗	✗	✓
Customization With Plug-ins	✗	—	✗	✓	—	✓	✓	✓
Control Of Additional Features	✗	✗	✗	✗	✗	✗	✗	✓

* Core software, does not include last updated for plug-ins

TBD To Be Determined

N/A Not Applicable

✓ Feature is supported

— Feature is supported, but is *not* easy-to-use for the average user

✗ Feature is *not* supported

Appendix D: Wireframe Screenshots



Album Artwork (AA) Grid

01	Track Name	Artist	0:00
02	Track Name	Artist	0:00
03	Track Name	Artist	0:00
04	Track Name	Artist	0:00
05	Track Name	Artist	0:00

Artist One-Sheet

Far far away, behind the word mountains, far from the countries Vokalia and Consonantia, there live the blind texts. Separated they live in Bookmarksgrove right at the coast of the Semantics, a large language ocean.

A small river named Duden flows by their place and supplies it with the necessary regelialia. It is a paradesemic country, in which roasted parts of sentences fly into your mouth.

Even the all-powerful Pointing has no control about the blind texts it is an almost unorthographic life One day however a small line of blind text by the name of Lorem Ipsum decided to leave for the far World of Grammar. The Big Oxmox advised her not to do so, because there were thousands of bad Commas.