EM- 685 (102): SOFTWARE ARCHITECTURE

2016 SPRING SEMESTER

MILESTONE 3

ARCHITECTURE COMPARISON REPORT

Submitted By:

Team Acoustic

Introduction

Product Family: Music Players

Team Members and their Products:

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2. Maithili Parikh– Songbird
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Music has become a fundamental part of life, with it being available from many different sources, in various formats and multiple access mechanisms. With the advance in technology and cheap storage space, digital music has become a much more common occurrence. We can download and store music in players as well. As a result, which Music player preferred is subject to the various features it offers. Music Players vary in functionality, appearance, compatibility and many other features. So, our team has decided to explore VLC, Songbird and Banshee.

These 3 players are designed differently, by different people to perform many different tasks. However, all have common functionality that we will compare. The **Play** feature, this being the feature of the player which allows a User to access and play, whether it is an audio or video file. This feature, being fundamental in Music Players, is present in all 3 players. However, by exploring the architecture of the players, we will aim to establish the differences in the 3 Music players that offer this common functionality. Quality attributes are also compared for each member of the product family,

Some attributes, such as Security, Availability, Maintainability and Scalability may be inapplicable to the product family. Security restrictions are minor or non-existent, Availability of the software is identical across the members, Maintainability is simply the click of a menu item to update the software and Scalability is inapplicable as the product is restricted to a desktop or personal pc system. As a result, the most suited ones to compare the different members of the product family are Usability and Modifiability.

Usability can be defined as the ease with which a user can successfully accomplish a desired task. We chose the task of playing an audio file. We will attempt to explain how simple, or complex it is to accomplish this task using each of the 3 Music players. The Deployment View diagram will be ideal to compare the User interaction, with that needed to perform the specified task.

Modifiability involves trying to establish the inter-dependence of modules, the amount of effort required to make changes to modules within the software, or the software as a whole. In addition, it explores the extent of Cohesion and Coupling between the various components of the software. This will be done by looking at the various modules within the software architecture and then trying to establish the “inter-dependence” using the Module View Diagram.

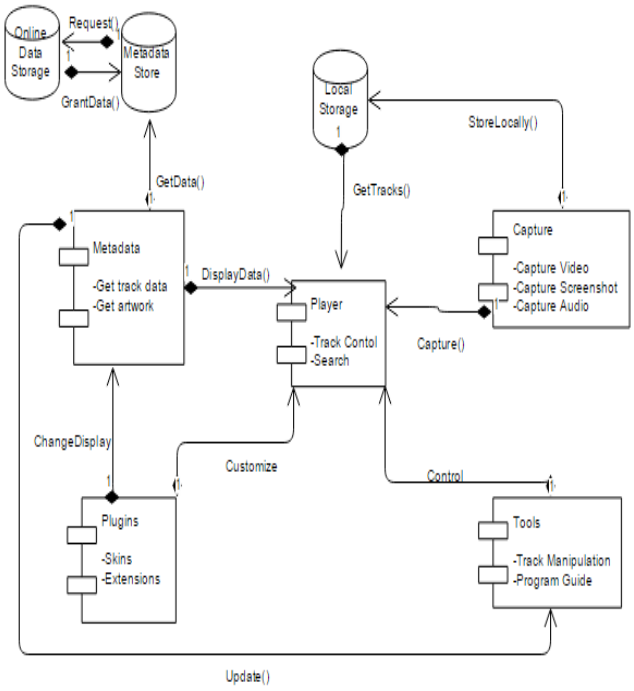
These attributes were chosen by examining the functionality of the Music players, and the architecture used to implement them.

Feature: Play

Overview: This product family comprises of many products, each offering up unique ways to access and play music files stored on the local drive, or online. As a result, the best feature to explore, when comparing the architectures of the various members of the product family is the Play feature. This means, the feature of the Music Player which allows a User to access and play a music file.

Product: VLC

VLC Media Player supports many media files like MP4, WMV, AVI and DIVX video files and it also supports MP3, AAC, WMA and WAV audio files, among others. It also has a built-in Media Library. The Media Library locates all the audio and video files contained by a folder on the user's local system which makes creating or adding to the user's media library a simple process.



You can select the desired media file from the user's library and it allows the player to open and play it. If the folder the user selected contains numerous sub-folders and/or media files it could take a while for all the files to be added to the library.

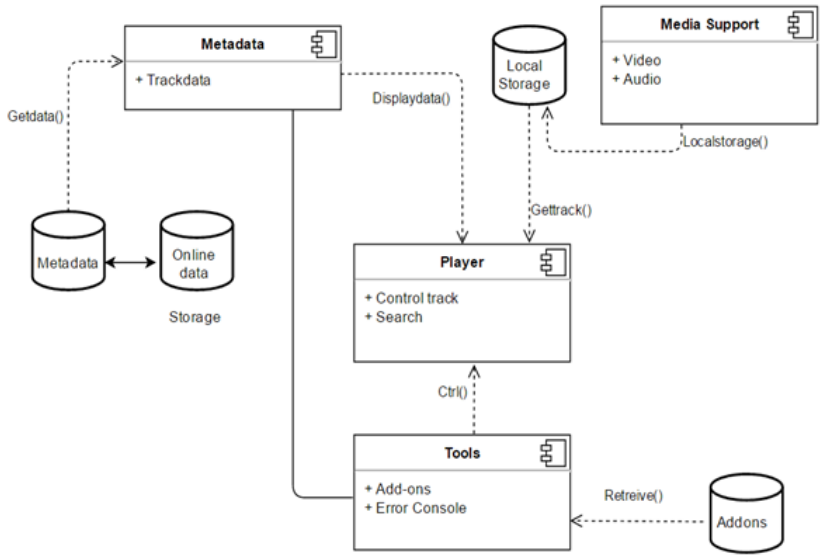
Once the file is being played, various operations and manipulations can be performed on it such as rewind, fast forward, skip, skip to specific time etc. This allows the user to view the content in a way that allows him to be in total control of it.

To facilitate quick and easy navigation (for example during the playback of a movie), the "playback" tab allows the user to even go to a specific title or chapter within the movie. Also, he can bookmark at any point during the playback and refer to it at a later point in time. As seen in the diagram, ease of navigation is easily enabled by using various connectors which at all time represent a quick and reliable flow of data when and where it is needed. By Providing connectors to all aspects of the player, the user has total control of the different functionalities offered by VLC media player.

Product: Songbird

Songbird is the first Web player, to catalyze and champion a diverse, open Media Web. Songbird utilizes the cross-platform frameworks Mozilla XULRunner and GStreamer media framework. Media files stored on pages viewed in the browser show up as playable files in Songbird.

Songbird Music Player is a metadata based player that can edit or dave metadata tags; which retrieves the metadata associated with a particular music file, then stores it in a local database. When a User selects a file, the metadata is used to retrieve the file and then play it.

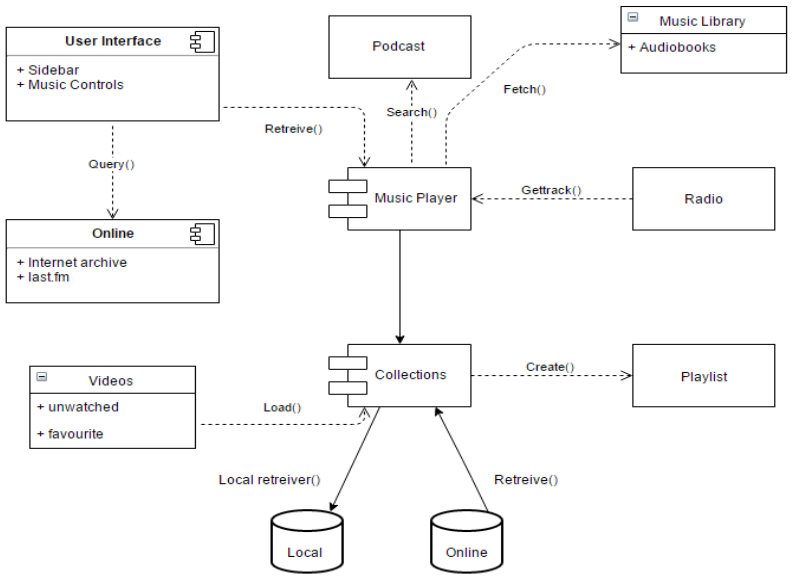


As the component and connector diagram above shows, each component is associated with a connector to provide different functionality. Songbird has unique ability to build custom mixes and subscribe to MP3 blogs as playlists where all the functions are displayed for the user to access. It contains various features like control track, search, etc. User can choose any function according to his or her requirements. All the data is stored in metadata and the player will solve any query using this data. In simple words it is a set of data that

describes and gives information about other data pertaining to the music player. It contains details about all the tracks (songs) in the music player. This is an online database accessed while the player is streaming from the internet. It is connected to the metadata module with the help of getdata() connector. The player can retrieve or access to some add-on features ranging from lyric-fetching tools to plug-ins that scans your music library to let you know which of your favorite bands are playing in your area. LyricsMaster, mashTape, last.fm, 7digital are some of the add-ons that can make Songbird worth your while. Most of the add-ons are already present here and additional add-ons can be added manually by the user. It also contains the error console which is shown if something goes wrong. It has ability to scan the user's computer for all audio files and add them to a local library. Songbird also works as a media server, streaming your media collection to UPnP or DLNA devices on the same local network. Media Support consists of audio and video files which are already there on local storage. The player can get the track from the locally stored music files.

Product: Banshee

Banshee is a cross-platform open-source media player, called Sonance until 2005. Built upon Mono and Gtk#, it uses the GStreamer multimedia platform for encoding and decoding various media formats, including Ogg Vorbis, MP3 and FLAC. Banshee is a Linux-inspired player that helps you to organize your music and interact with other users via scribbling to Last.fm.



The above component and connector diagram shows ease of navigation is easily enabled by using various connectors which at all time represent a quick and reliable flow of data when and where it is needed. By providing connectors to all aspects of the player, the user has total control of the different functionalities offered by Banshee. The player can retrieve the tracks from Audiobooks, Radio, Local storage or podcasts. The user selects a music track using the user interface which will be retrieved by the music player from any of the different components available.

As the Component diagram above shows, the User will select a particular Track via the User Interface. This is sent to the Search module via a Query if its online. The Collection module compiles a list of associated metadata from both the local data store and the online data store, and returns this metadata. Following this, the Music Player picks up the song, which retrieves the audio file, and then plays it. Further choices are presented to the User via the User Interface, and the User can select the source of the audio file, choice availability is determined by the list of metadata compiled by the collections module.

Comparison:

The play feature present on the players is essentially used in order to start the media play and allow the user to watch and/or listen to it. It usually consists of fetching the data from a source either through remote access (If it is available on the internet) or from local folders (If it is present on the user's system itself). In the case of Banshee player, the user's retrieve uses metadata to retrieve the file required to be played. It does this by passing the query to the database in order to find, access and retrieves the desired file.
However, in VLC media player, the track can be directly loaded by using queries compatible with the database language used in the development. This does not use meta data as it can be directly loaded. This is done by using the UI to navigate to various files in the system and allow the user to select the one he wants loaded and subsequently played. However, it must be noted that all the other players are also equipped with this functionality as it provides a very user friendly way of selecting the desired file.
In Songbird however, when a request is made for a file, a displaydata and gettrack() queries are passed which returns the metadata required to load the file similar to the way play requests are handled and from the local hard disk. Songbird stands among the others as it also has an inbuilt browser inside it. This is one of the major differences which make it standout. Music can be played by dragging and dropping the music file in Songbird or VLC, But Banshee doesn't support this. User need to personally import the file in order to play it. Once in a while new codec will be released to VLC which help in enhanced encoding and decoding of the media files. Banshee cannot be customized look wise as it doesn't support any skins whereas Songbird and VLC supports them.

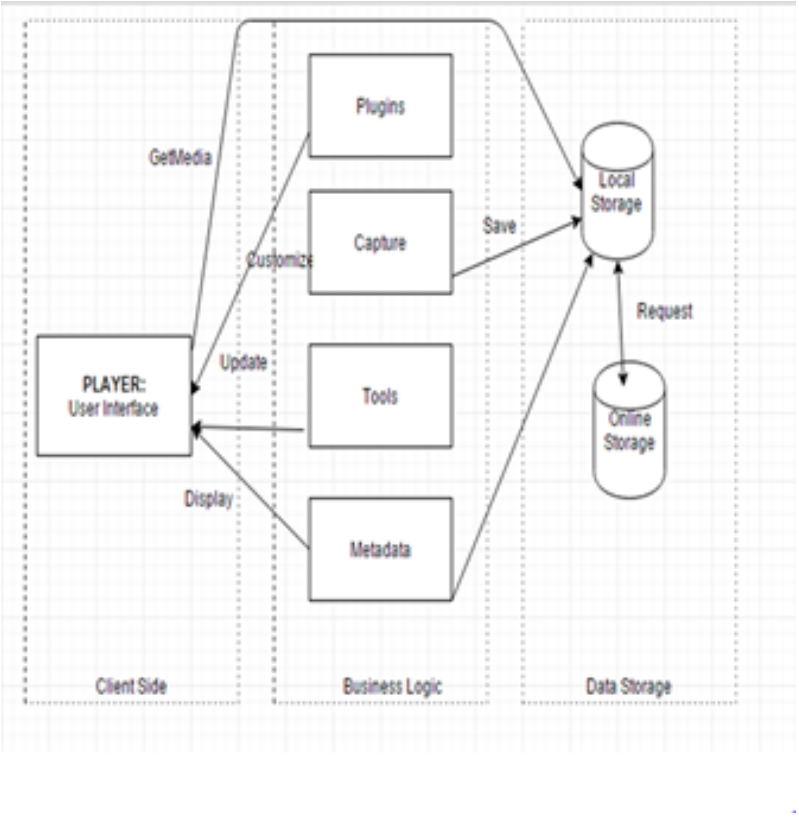
Quality Attribute 1: Usability

Overview: Usability refers to the degree to which human users of a particular software adapt to it and learn how to use it (in minimal time) in such a way that he meets the outcomes expected of the system with much ease. Generally, components like the user interface and speed of the system play a huge role in determining the level of usability.
There are five primary aspects toward what constitutes usability of a software product or system. These are:

- Efficiency of use
- Ease of learning
- Satisfying to use
- Errors
- Memorability.

By gauging the above aspects, we can establish whether a particular product is highly usable or not.

Product: VLC
VLC media player accomplishes most of the key features that a music player should have; such as efficiency of use, ease of learning and a wide range of options with a very friendly interface. It is very to understand and use.



As seen above, the player's 3-tier architecture allows the user to get data from various aspects associated with the player such as the online and local storage. The data transfer is seamless at a rapid pace which facilitates the user with almost non-existent time waiting for his operations to be performed by the player without any lagging.

VLC media player has its own uniqueness while still providing the general usability with familiar functions. That means the users who are familiar with the dynamics of other media players can use it very easily. Even newer users to the system can understand the interface and layout as each button on the UI, when hovered over with the mouse, gives the function of that button. There is also a comprehensive and easy to understand user manual available. This enables even experienced users to get troubleshooting help in case they require it.

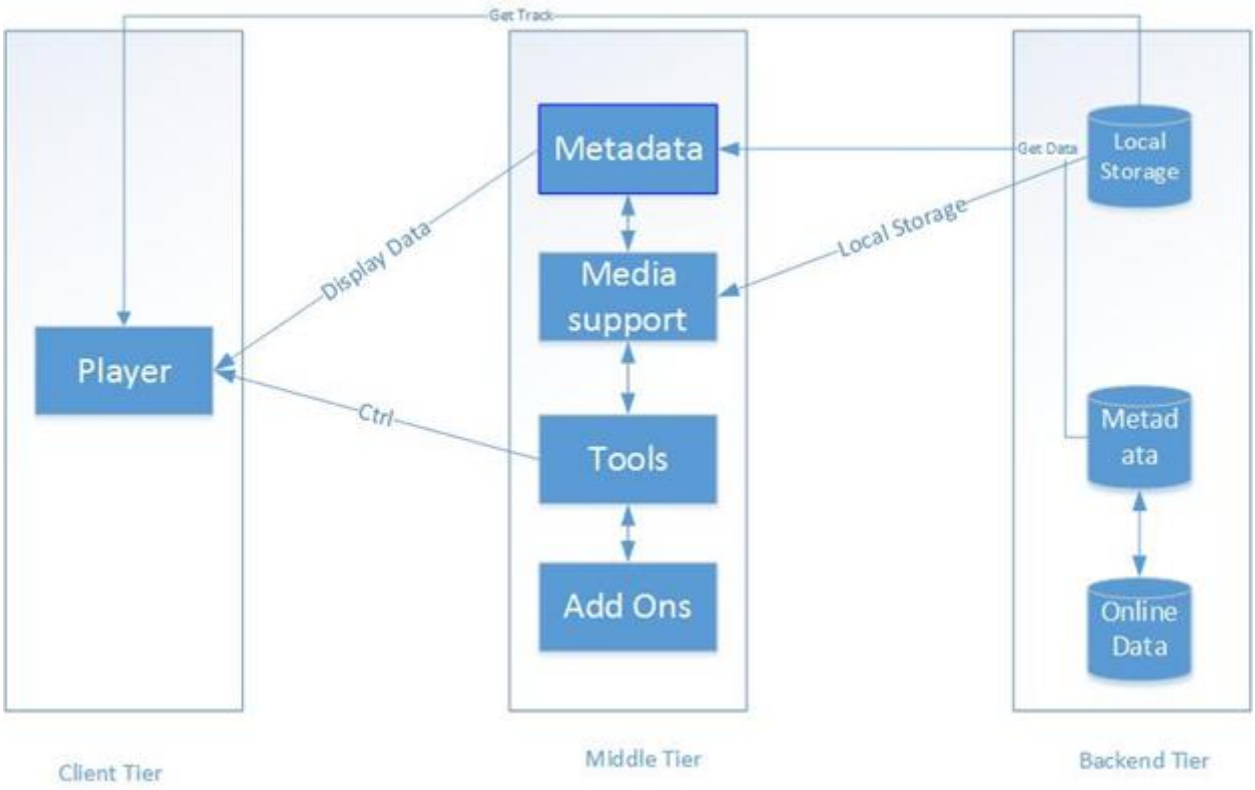
The tabs present on the top of the interface provide a wide categorical division of the functions that can be performed by the player based on his needs such as media manipulation (open file, save file, stream, convert etc.), playback options (play, stop, pause, rewind, skip etc.), audio control (increase/decrease volume, equalizer etc.), video manipulation (zoom, full screen etc.), adding subtitles, using audio/visual effects and help content. This way, the user knows exactly where to navigate in order to get the information he requires.

However, over the years there have been numerous complaints by users about the usability. However, as these complaints only arise when the software is being used for purposes other than the basic intent as used by novice users for simple tasks, there is no reason to consider VLC as anything other than a highly usable product. The complaints include:

- When cloning video for two monitors, full screen mode is not available.
- The VLC plugin for Chrome and Firefox does not have the ability to play files behind a password protected source as it does not give the option to enter credentials.
- Update download shuts down software and currently playing music. Updates could be set to install after program is closed.
- Update on Windows creates a VideoLAN start menu folder without asking the user if they wish to have one created.
- Hard-to-guess shortcuts to operate with the movie. E.g. shift+arrows to rewind. Simply using only the arrow keys would improve the usability.

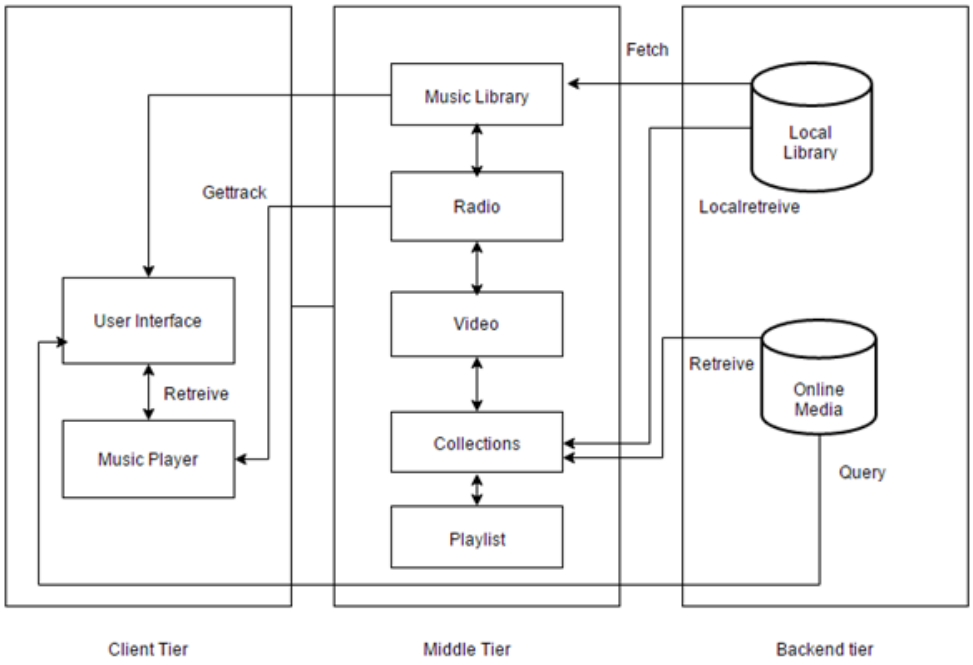
However, VLC does make an effort to solve many of these. Previous complaints such as videos not playing from previous stopping point, unavailability of Blu-ray menu, simple preferences and many more have been resolved. This shows the efforts made by the VLC developers to cater to the needs of the customers.

Product: Songbird



In terms of usability, Songbird is a great player. It is very simple to perform some basics actions such as searching and playing the music which the user wants. The browsing and surfing through the files and the internet makes it very efficient for the user. The options available are very easily visible so that the user can access them without any worries. The diagram above shows how Songbirds 3- tier architecture helps the user to get data from sources such as the internet of the local files. The above diagram shows very basic operation where a user inputs in the search bar for the song he wants to listen and once the request is received through the Songbird's search bar the logic searches for the request in the local library or it goes online on various sources such as spotify, SomaFM etc to search the requested file. Once found it adds it to the playlist of the music player. This way all the files either it is from an online source or it is from a local library everything is saved under the same playlist. This makes it easier for the user to play it the next time. Each time a song is played the mood bar saves a visual representation corresponding to that particular song and displays every time that song is played. The Songbird application is very easy to learn for anyone because of its simple user interface. Because of which it is very satisfying to use right from basic functions to the advanced functions. The design of Songbird is mostly error free. So, Songbird is a music player with very high usability mainly because of its efficiency and easiness.

Product: Banshee



Banshee hosts a simple User Interface, which attempts to display all the features which are possible in a simple way. This means, no extra menus or tabs will need to be opened to accomplish a majority of the tasks, and the few that require setup only need the User to do it for the first time. This means, a User can access a majority of the possible features simply and easily, without having to delve deep into menus or options. This also means that the layout is rather intuitive and uses the universal symbols for Play, Pause, Skip etc. ensuring that even new Users will be able to complete tasks successfully. Furthermore, the selection of sources is displayed with a simple icon, which indicated whether the source is local or online, thus even a novice can use the Player as they wish without any confusion. Similarly, the icons and symbols throughout the Interface ensure that the way to access functionality is memorable. Furthermore, Banshee Music Player provides the best possible solutions to Search queries in terms of quality, while in turn required very little input or sophistication from the point of the User. Thus, in terms of satisfaction (Utility) this program rates highly.
Lastly, there is little scope for errors occurring while using the Interface. Each feature has a workaround, ensuring that a catastrophic error does not occur. For example, Online sources are only displayed if the PC is connected to the Internet and Tracks only added to the library if they are of a recognized format. This leaves very little room for a situation in which the User causes an interaction which the program cannot recognize.

As this deployment view diagram indicates, the various features available in Banshee, are present mainly in the Internal Tier. This means, the User has absolutely no interaction with the inner workings of the software. The User input is then recorded via the Client Tier. In terms of usability, this means that all the interactions possible by the User are displayed via the Interface (sub-modules provide functions such as Search, Settings and Play), then these are used to interact with the software within the boundaries of what is possible. Thus, this program provides a simple interface, and hides the complex workings behind it. This makes the software highly usable.

Comparison:

VLC provides a wide range of skins as compared to other two music players which gives a great look and feel to its users. It offers various user friendly interface by providing various keyboard shortcuts which has proven to be very convenient for the users to perform various operations such as fast forward, rewind, play and pause.

Banshee on the other hand is very simple in its UI design. It provides a lot of ease in terms of usage with its simple format. Since Banshee also runs with internet, the user needs to be connected to internet for the most efficient use of it.

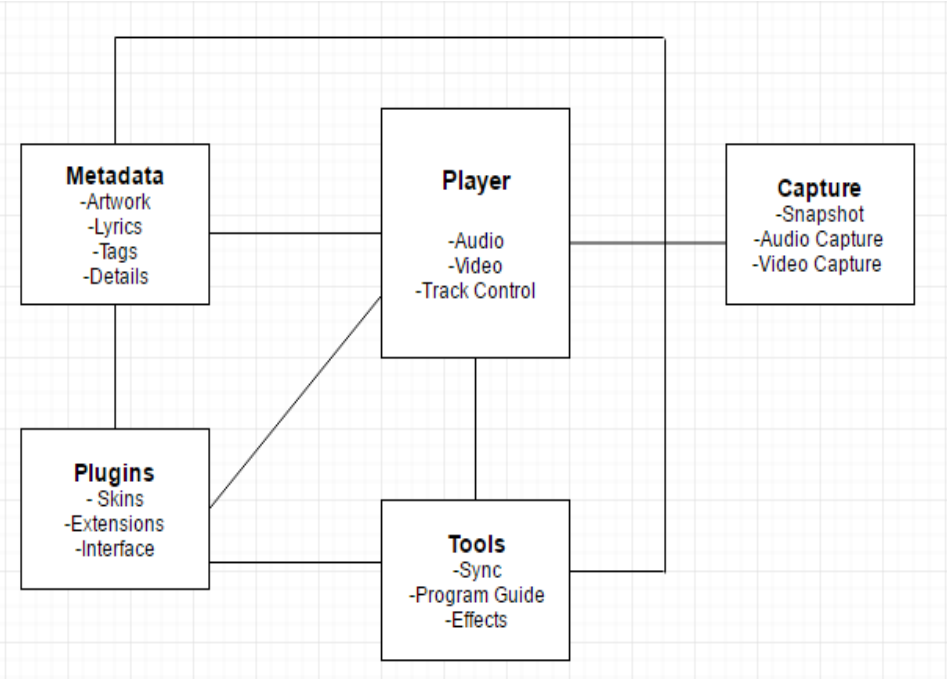
Songbird too is very easy to use. As songbird lets the user browse for music online, it gives the user the freedom to choose from a large variety. It is important to note that the music file is only played when it saved in the playlist (local library of Songbird).

Quality Attribute 2: Modifiability

Overview: Modifiability refers to the ability to change various aspects of the system in part to better suit the requirements of the user in question. Varying degrees of modifiability are present as the system developers may choose to allow restricted access to modifiable components. This is an important aspect as the degree of modifiability determines how much or how little users of the system have over the layout and architecture of the software. Furthermore, the modifiability is directly related to the cohesiveness, and coupling of the various components that make up the product. Thus, in a case where modifiability is not directly restricted, the cost and difficulty associated with modifying parts of the program can be accurately gauged by comparing the cohesion and coupling of the components.

Product: VLC

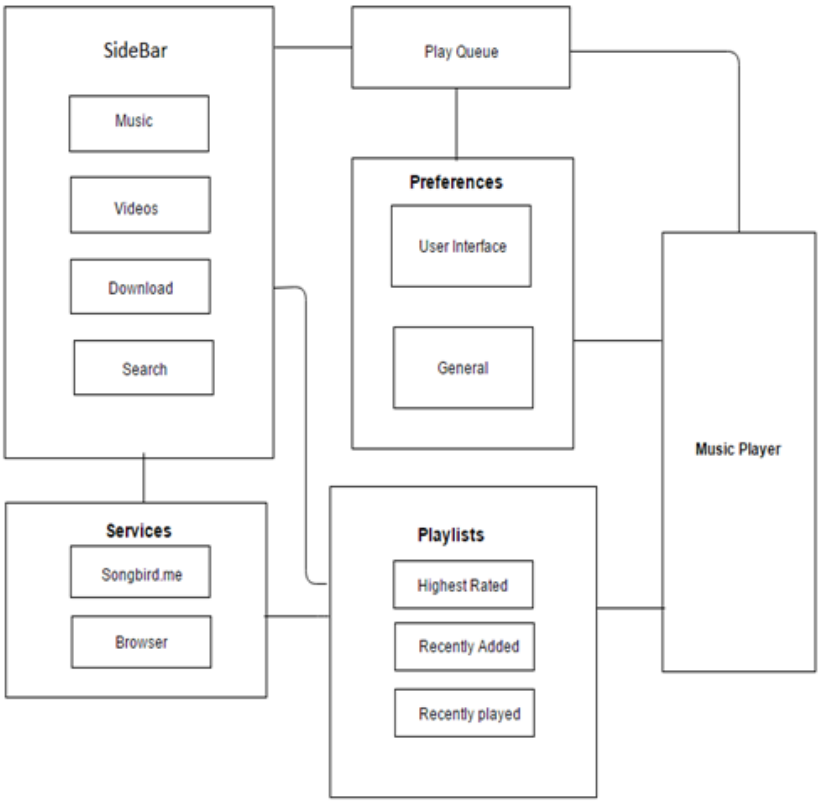
There are various aspects in VLC which can be modified. The skins editor allows a user to change the look and feel of the software by enabling the UI design to change based on user preference. A few built in skins are present whereas most of the ones not included can be downloaded for free from the VLC media player skins website. This aspect of VLC enables users to be in control of how they want the player to look and goes a long way in customer preference and customizability.



From the above diagram it is observed that the various customizable aspects of the player such as the plugins, skins, extensions and interfaces allows the user to control how he

interacts visually as well as (to some extent) functionally with the player. This goes a long way in improving the experience of the player.
There are numerous other ways in which the software can be modified. In the customize interface menu users can add or remove buttons and icons present in the default interface. The user can drag and drop desired icons, remove buttons, add or rearrange. Thus, a great amount of control over how minimalistic or not he wants the UI to look is made available to the user. The preferences menu allows a huge amount of features to be enabled or disabled based on user preference. Full screen preferences, instance preferences and native/default UI can be modified.
In addition to all of these modifiable features, plugins and extensions are a great way to improve the experience of VLC media player. By clicking on the "Tools" tab, users can find the Plugins and extensions menu which allows them access to a wide range of plugins which can be downloaded from the server as well as extensions such as skins, playlist parsers, services (such as radio and other streaming services), interfaces, art and meta fetchers. The "plugins manager" adds extra functionality to the player and include various plugins like 10 band EQ, compressor, lyrics finder, sustainer bands, etc.

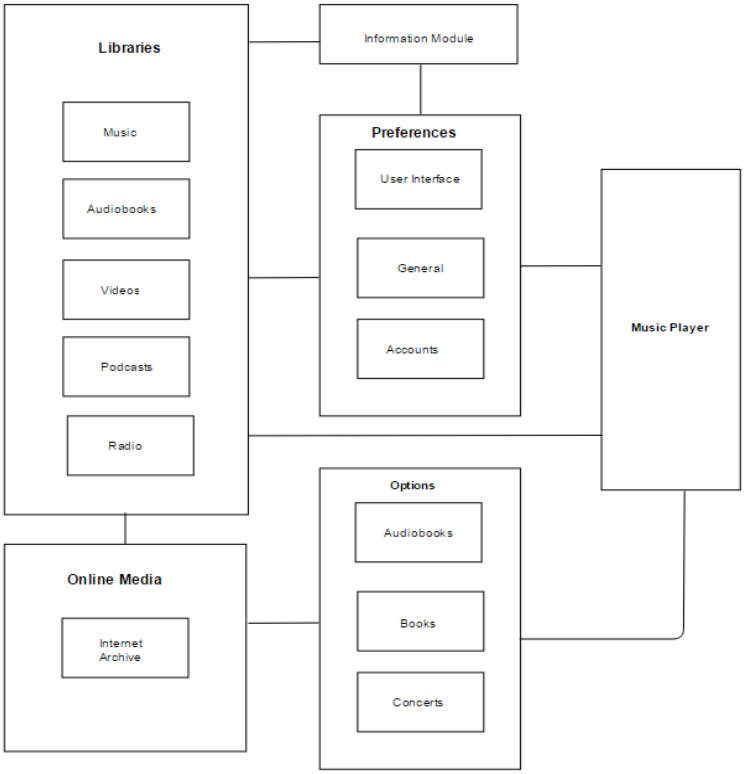
Product: Songbird



The Music Player is an essential module of the application which retrieves data from the source and plays it based on how the user wants it. The degree of modifiability associated with any software architecture varies from module to module. Some modules are restricted to modify while some modules are highly modifiable. The Playlists module is highly modifiable in the sense that it allows for added sub modules to be added easily to increase or decrease the number of playlists in the music player during runtime. Similarly, the Services module allows the addition or removal of sub modules to change the number of services which are connected to the music player. User Interface can be changed along with addition of different internet providers. It has a configurable and collapsible graphical user interface. The playlists and services make the music player interactive. There are a lot of themes already installed in the music player but it gives an option to modify these themes and the look of the player by changing the theme of the desktop. The user interface can be changed to make the player more appealing and user-friendly. However, the other modules like Sidebar and Queues modules do not allow easy modification. Search, videos, download, music are the features in the Sidebar. The sidebar module can be considered to have high cohesion as each sub modules perform a separate task and all these modules are interrelated. This results in a high expense to modify any of these modules. These modules are highly coupled, which means they are highly inter-dependent and thus a small change to one, may lead to necessary changes in the rest. Even the player module becomes highly modifiable as it allows the users to edit the tags for each song and also add charts to display if they wish to. In addition to all of these modifiable features, plugins and extensions are a great way to improve the experience of Songbird.

Product: Banshee

As the overview mentioned, there are degrees of modifiability associated with any software architecture. In the Banshee architecture, the levels of modifiability vary depending on the module that one wishes to modify. Different modules are highly modifiable, while some modules are restricted. The Online module, for example, is highly modifiable in the sense that it allows for added sub-modules to be added easily to increase the number of sources available to the Music player during runtime. Similarly, the Library module also allows addition or removal of sub-modules to change the number of resources the software connects to. However, the other modules, namely Preferences, Information Module and Options, do not allow for easy modification.



This can easily be explained by the terms cohesion and coupling. Firstly, the Cohesiveness of the modules involved in successful operation of Banshee is very high. This means, that all components in a single module perform a similar task and thus are complementary in function. This is the reason that the Social and Streaming modules allow for easy modification, namely because the sub-module all perform a task and together make the app more “Social”.

Secondly, there is also very high coupling for some modules, and very low coupling for others. The Online and Library modules have low coupling with an API, which performs communications regardless of the number of sub-modules involved. On the other hand, the individual modules are very highly coupled, which means they are highly inter-dependent and thus a small change to one, may lead to necessary changes in the rest thus making modifying a very expensive process.

Comparison

One will notice a common theme amongst all the architectures above. First, that no architecture is entirely modifiable nor is any architecture entirely unmodifiable. What seems to be the case, is that all the architectures are modifiable to certain degrees i.e. they possess a degree of modifiability. What makes these software's fundamentally different though, is which modules and features can be modified and which cannot.

Firstly, both Songbird and VLC offer modification to the User Interface sub-module (Skins sub-module in VLC). This is accomplished by simply changing the Graphical Layouts, while still maintaining the same communication methodologies (Play, Pause etc.) while changing any graphics. This strategy means that "Theming" of the User Interface is very easy, thus making this sub-module highly modifiable. Conversely, Banshee does not allow any change to the User Interface. In fact, the User Interface is so tightly coupled with the other modules, that changing any aspects of the UI, would mean a total overhaul of the software. This means, that the dependence on the UI is very high thus making its modifiability very low.

Secondly, VLC allow using of plug-ins and extensions to handle many different formats not provided natively with the software. This means, that the User can then add support for other plug-ins manually. Similarly, to the UI, this is accomplished by transcoding the new format to an old recognized format and then playing it like usual. This conversion means that regardless of what new format is added, the player core essentially remains unchanged. The player then acts as an API, thus rendering the plug-in modules to be highly modifiable. Songbird only supports plugins in this case. Again, this is not the case on Banshee. Banshee does not allow any changes to the Player module, and as it lacks any overlaying layer to behave as a common communication interface, new formats cannot be supported.

Moreover, VLC allow for more streaming sources to be added to their structure. This means, the Streaming module for both of these software's is modifiable, is can be modified relatively easily whereas VLC cannot handle the same number of sources or streaming services. It is restricted to "open channels" but cannot be modified to handle more sources. Banshee has only two streaming website which it allows users to access.

Lastly, in terms of modifiability, VLC has a unique option. It allows management of Hardware Devices, add a new device and manage the device library. This hardware module is modifiable, and allows adding of more sub-modules depending on the type of hardware etc. iPhone, USB etc. Similarly, Songbird has a inbuilt browser in it, which helps to plays music and browse the internet at the same time. This is also a unique feature. VLC does not possess these, and they cannot be added to the source code easily.

Conclusion:

The three players that we have chosen: VLC media player, Songbird and Banshee and all differ in many ways. As seen, perhaps the way in which they differ the most is their user interface and the way in which they designed their player to appeal to users and how they are intended to be used.

VLC has very intuitive icons allowing the user to manipulate the media being played easily and without too much conscious effort on his part. Banshee's simple UI with icons and symbols allows the user to use it with no confusion.

Both Songbird and VLC offer modification to the User Interface while Banshee has a very simple interface. We have observed that Songbird has an inbuilt browser inside it. This is one of the major differences which make it standout. Music can be played by dragging and dropping the music file in Songbird or VLC, But Banshee doesn't support this. User need to personally import the file in order to play it.

We have also seen that all these players differ in how they fetch data to play a music file or rather the process of playing a desired file is different in their own way.

All these music players have their unique features yet they are mostly similar in the service provided to the user. Though features like these are not a must, incorporating such friendly features enables these players to mark their uniqueness.

Each product has various advantages as well as disadvantages for each product feature. They also may be similar or differ based on the usability attributes which we have taken into regard: Usability and Modifiability. All the products mentioned allow the user to have as much ease of use as possible in order to maintain their good standing in the user's point of view. However, the way in which they do this is different.