



Incoming Exchange Student - Final Degree Project

Erasmus Techno Other (specify):

Degree course: Enginyeria Informàtica Pla 1997

Title: Multimedia in Box: Design and Implementation of real time services based on WebRTC/HTML5

Document: Final Degree Project

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Delivered on (month/year): 01/2015

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THANKS

I would first like to thank the University of Girona welcoming me in its locations.

Thanks Mr Marzo and Mr Pueyo for their heat.

Thanks to my supervisor at IMERIR Institute Dr. Eric Salvat for his time and carefulness.

Thanks to Mrs Claudine SERVATE and Mr XAVIER Pueyo to their exchange between IMERIR and the University of Girona.

Thanks to all the members of the “EPS” administration for their time and patience.

This Erasmus was a great enrichment for me.

Thank you again to Mr Marzo for his teaching and advising on the project on and thank you also to the students in the computer section.

ABSTRACT

Sylvain Leprêtre student in IMERIR **Institut Méditerranéen d'Etude et de Recherche en Informatique et Robotique**. During a period of 4 month I study in Erasmus at the University of Girona.

Under the leadership of Mr Marzo he was entrusted the project to achieve a web interface for recording video, audio, text. I also must file via the web interface bring back, sort and read them. Everything will be in place within a Virtual Machine.

This project will be integrated in Vitam. Vitam is a project of video conferencing developed by students of the University of Girona

I.CHAPTER 1

1. Background:

1. Vitam

i. About

The Broadband Communications and Distributed Systems (BCDS) Laboratory, supervised by Mr Marzo, Has Developed the project Vitam. Vitam is a set of video conferencing tools mainly devised to Health and remote assistant.

It is a project developed by students.

ii. Development Team



iii. Characteristic



* Web page of Vitam site

Simple and Usable Interfaces:

The user's interface is extremely simplified to facilitate at most the use of technology by non-experts.

Multiplatform & Multidevice:

It is multiplatform (Windows, Mac, Android, iOS) and multidevice (PC, laptop, tablet, smartphone).

Easy Integration:

It can be easily integrated in or with other applications through an API, as well as connect with external services (e.g. electronic health record, calendar).

Multi-Party Conferencing:

It offers 1 to 1 videoconferencing and multivideoconferencing in a single and unified interface.

Privacy & Protection Data:

It ensures privacy protection by providing communications and data protection and enables its deployment on certified medical data management servers.

eHealth & Customer Service

It implements two innovative operation modes not available in the market: the online consultation with waiting room and the videoconferencing call centre (coming soon).

2. Project

This project is based on Html5 and WebRTC (Real Time Communication), allowing users to realize videoconferencing in live or recording video conferencing.

2. Purpose:

However it does not exist in **Vitam** a solution to allow users for recording audio or text message to be posted in the inbox of other users. Moreover, it does not exist neither a support to find quickly and ergonomic the videoconferencing recordings.

The aim of this project is to design and integrate in **Vitam** a solution to allow users to recording video, audio or Text File. It will also provide an opportunity to the users to access the different files through an ergonomic and easy to use interface.

3. Scope:

To carry out this project, two web page will be developed using languages compatible with WebRTC than PHP, HTML, JavaScript. The different file recording will be saved in a folder on the WebServer and a data base will save the different information regarding the files (data, file Path).

All programs should be executed in virtual Machines. We will see some characteristics and details about virtual machine.

II. CHAPTER 2

1. Virtualization

3. Introduction

Virtualization operated simultaneously tightly (or not) multiple operating systems on a single physical machine or more.

A virtual machine (VM) is an operating system OS or application environment that is installed on software which imitates dedicated hardware. The end user has the same experience on a virtual machine as they would have on dedicated hardware.

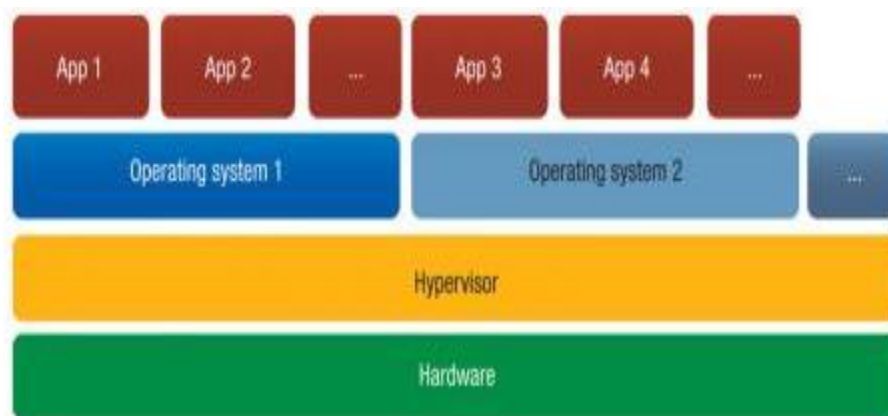
Specialized software called a hypervisor emulates the PC client or server's CPU, memory, hard disk, network and other hardware resources completely, enabling virtual machines to share the resources. The hypervisor can emulate multiple virtual hardware platforms that are isolated from each other, allowing virtual machines to run Linux and Windows server operating systems on the same underlying physical host. Virtualization saves costs by reducing the need for physical hardware systems. Virtual machines more efficiently use hardware, which lowers the quantities of hardware and associated maintenance costs, and reduces power and cooling demand. They also ease management because virtual hardware does not fail. Administrators can take advantage of virtual environments to simplify backups, disaster recovery, new deployments and basic system administration tasks.

4. Types of virtualization

iv. Type 1 hypervisor or bare metal:

Type 1 hypervisor is a tool that stands between the hardware layer and software layer:

- It access to machine components and has its own core, it is above this core, and the OS will be installed.
- It therefore controls the OS from the hardware layer.
- It is administered via an interface for managing virtual machines and it is much more powerful than Type 2 hypervisors



Example type 1 hypervisor:

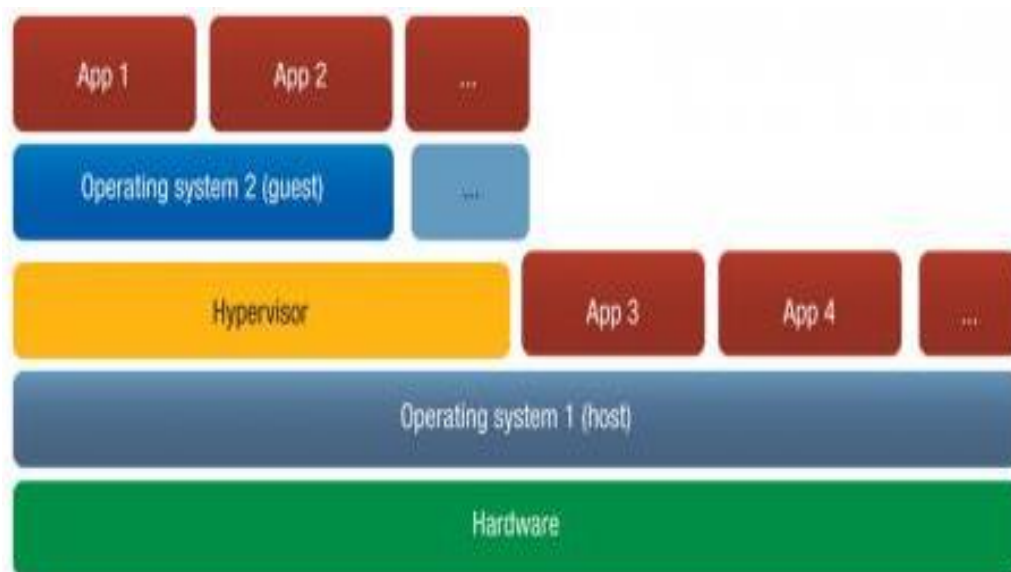
- ***VmWarevSphere***
- ***Microsoft Hyper-V***
- ***XEN***
- ***KVM (open source)***

v. *Type 2 hypervisor:*

The type 2 hypervisor is an application installed on an operating system, the application depends on the operating system.

The performance is reduced in comparison with type 1 hypervisors because access to the hardware (CPU, RAM ...) is via an intermediate layer.

It offers a perfect seal between the systems installed farms.



Example type 2 hypervisor:

- *VmWare Workstation, Fusion, Player*
- *Oracle VirtualBox*
- *Microsoft Virtual PC*
- *QEMU (open source)*

5. WEBRTC + HTML5

i. WEBRTC

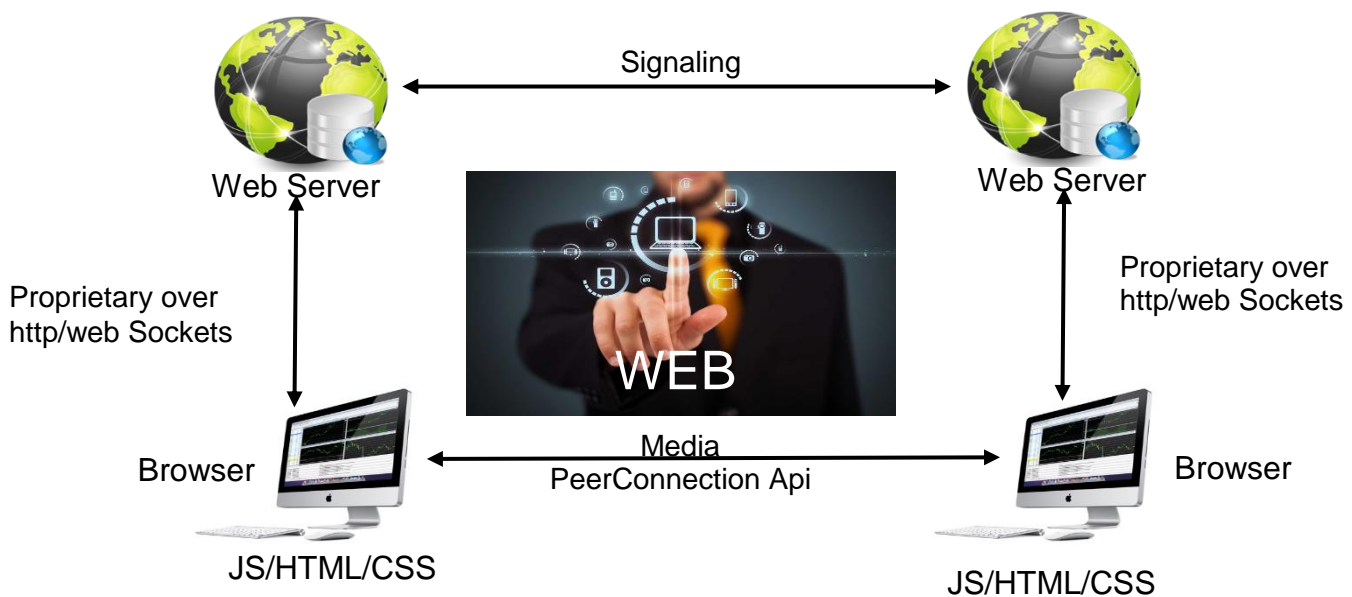
It is a standard which enable a navigator WEB to communicate in Real time (RTC) with simple JavaScript API.

ii. Architecture

WEBRTC basically uses peer to peer architecture; there are two WEBRTC existing architectures:

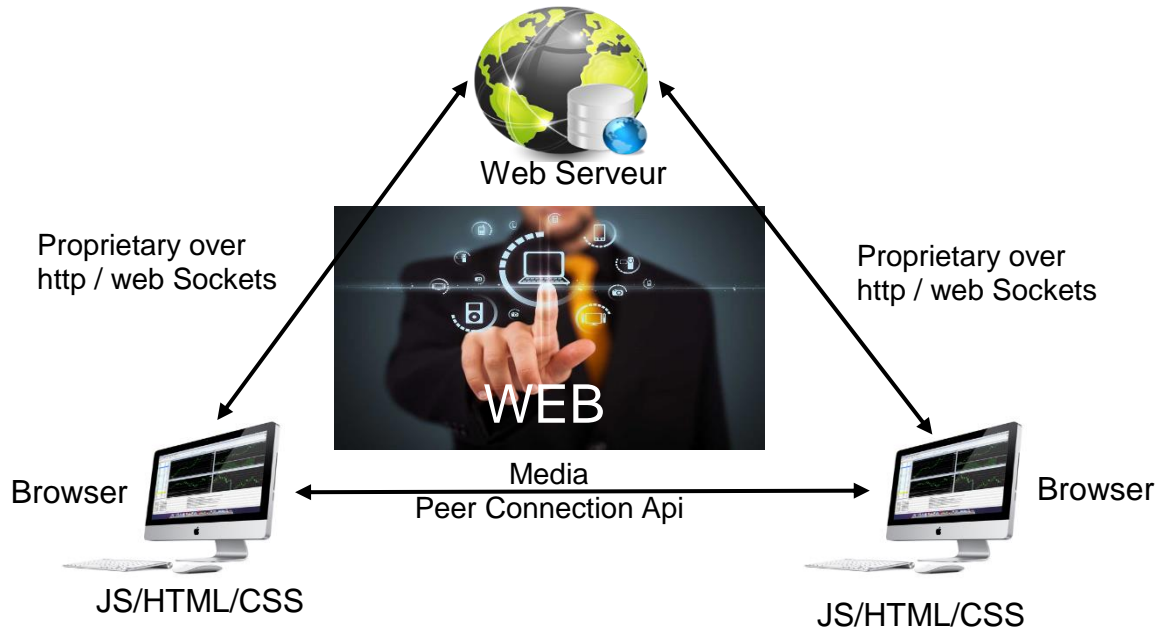
Trapezoid Architecture who inspire of SIP (Session Initial Protocol):

In this architecture, a protocol HTTP OR web socket transport signals messages via web browser, but warm Signaling is not a standard in WEBRTC it's a part of Signaling.

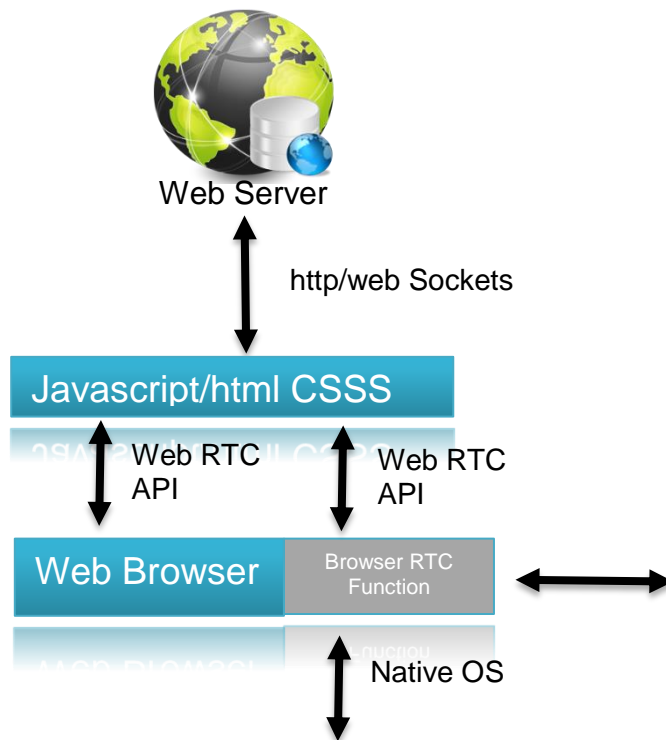


Triangle architecture:

In our case, we chose the triangle Architecture because it is simplicity as only one server is used.



WEBRTC API



WEBRTC API must provide many function, like the following:

- ✓ a connection management (Peer to Peer Mode)
- ✓ Encoding/Decoding negotiation capability
- ✓ Selection and Control
- ✓ Media control
- ✓ Firewall and NAT Network Address Translator

6. HTML5

It is a new version of HTML "HyperText Markup Language 5".

For HTML5 documents, the author must specify the encoding in the XML prolog, but also the content type "application / xhtml + xml".

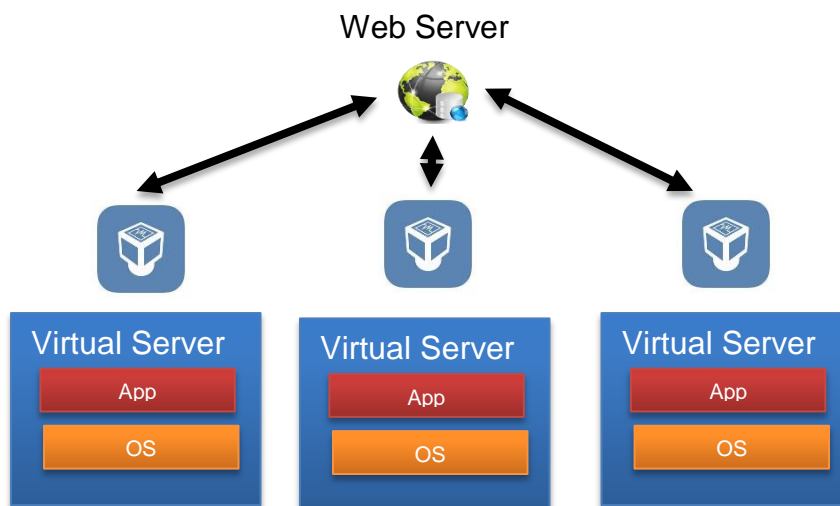
The whole page must conform to the XML syntax. It is possible to add other tags (exemple: <mabalise></ mabalise>);

This extension requires reporting of space for matching names, otherwise the page will cause an error and the browser may not be able to display it. This is the strictest mode that requires having a near perfect syntax.

```
<?xml version="1.0" encoding="UTF-8" ?>
  <!DOCTYPE html>
    <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="fr" lang="fr" dir="ltr">
      <head>
        <title>Exemple</title>
      </head>
      <body>
        <!--Contenu de la page respectant la syntaxe XML. -->
      </body>
    </html>
```

7. Virtualization Server

Virtualization server consists to partitioning a physique server into multiple virtual servers. Each virtual server can have her own operating system and applications.

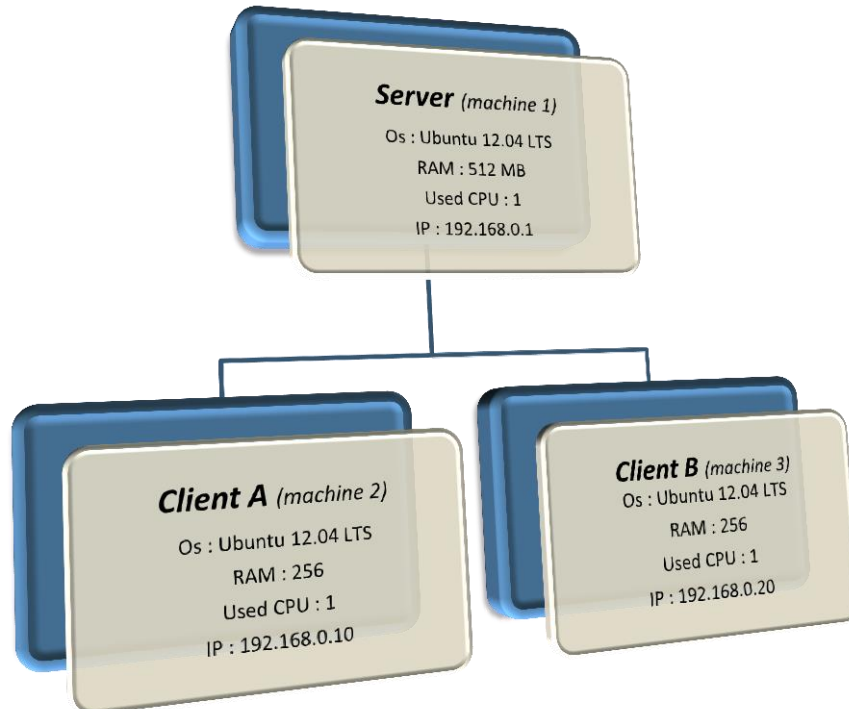


The main benefits of server virtualization:

- ✓ Reduce the number of servers
- ✓ Reduce TCO(Total Cost of Ownership)
- ✓ Improve availability and business continuity
- ✓ Increase the effectiveness of development environments and test

2. Plan of virtualization

Using the type 2 of virtualization, we choose that our configuration will be the following:



1. Operating System

Using Oracle Virtual box, we have installed 3 machines with Ubuntu 12.04 LTS, this version is known for its stability and its huge community of users.

i. Networking

All machines are attached to internal network (No NAT for the moment because of the lack of addresses).

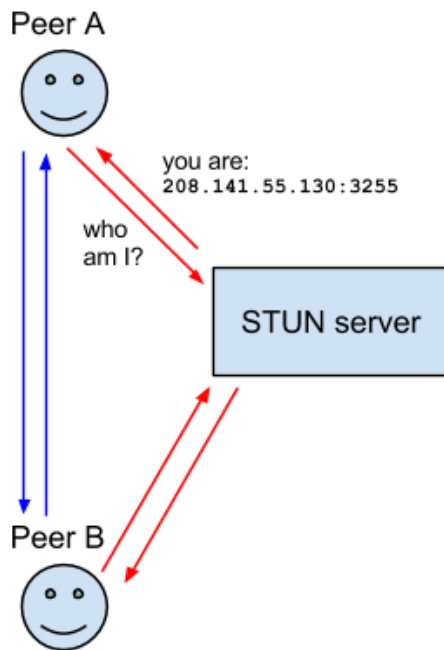
ii. Services and protocols:

Apache : Apache supports a variety of features, many implemented as compiled modules which extend the core functionality.

Mysql: is a popular choice of database for use in web applications, we will certainly need it for our development.

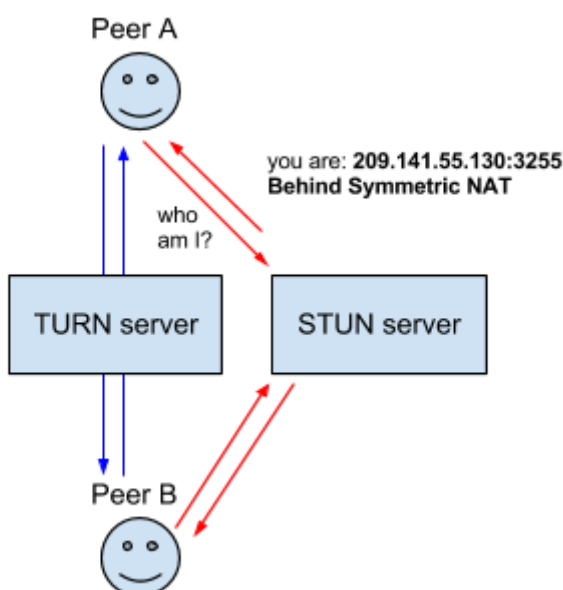
ICE: Interactive Connectivity Establishment (ICE) is a framework to allow your web browser to connect with peers. We'll need to bypass firewalls that would prevent opening connections, so ICE will give us a unique address and relay data through a server if our router doesn't allow you to directly connect with peers.

STUN: Session Traversal Utilities for NAT (STUN) is a protocol to discover our public address and determine any restrictions in the router that would prevent a direct connection with a peer.



NAT: Network Address Translation (NAT) is used to giving our device a public IP address. A router will have a public IP address and every device connected to the router will have a private IP address. Then Requests will be translated from the device's private IP to the router's public IP with a unique port.

TURN: Traversal Using Relays around NAT (TURN) is meant to bypass the Symmetric NAT restriction by opening a connection with a TURN server and relaying all information through that server.



2. Ports:

| Service | Reserved port |
|-----------|--------------------|
| MYSQL | 3306 |
| APACHE | 80/443 |
| STUN/TURN | 80(can be changed) |

3. Issue and problems:

Memory of the server: The server has insufficient memory to support many virtual machines (only 2GB)

Lack of addresses in laboratory: We have not enough addresses to connect all the machines with Ethernet connection

Wi-Fi access : Wi-Fi access in laboratory via BCDS207 turns off and we have to reboot the router every day, otherwise, we haven't receive our student cards yet so we cannot access to the UDG Wireless network.

III. CHAPTER 3

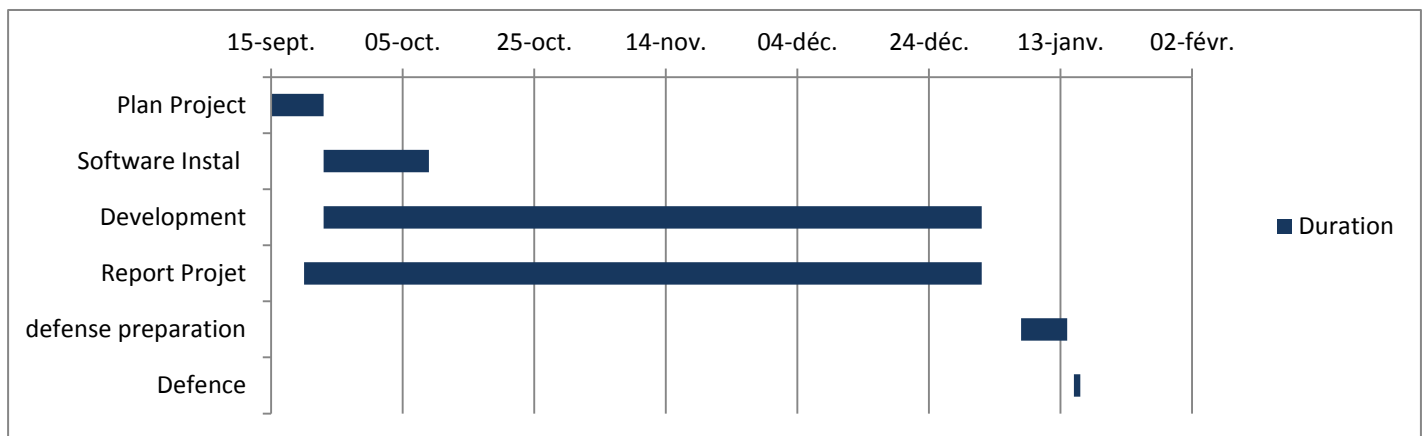
1. Multimedia in BOX

1. Specifications

iii. Human Resource

For this project just one person is assigned.

iv. Schedule



v. Constraints

- ✓ A user may record Video via an HTML page
- ✓ A user may record Audio via an HTML page
- ✓ A user may record Text via an HTML page
- ✓ To record a file a user must choosing "UserName" imposed
- ✓ To record a file a user must choosing "RoomName" imposed

- ✓ A user may select Video File Form server
- ✓ A user may select Text File Form server
- ✓ A user may select Audio File Form server
- ✓ A user may Filter the different file available

2. Language Needed

The development will use there different languages:

- HTML
- Ajax
- jQuery
- PHP
- JavaScript

To save the different file we use MySQL server.

And to record we use Licode (technologies develop by Girona student to record and save file).

i. Some Words about programming language

HTML

HTML ("HyperText Mark-Up Language") is a language called "marking" (from "structuring" or "markup") whose role is to formalize writing a document with formatting tags. The tags allow you to specify how the document should be presented and the links it has with other documents.

HTML allows the playback of documents on the Internet from different computers, thanks to the HTTP protocol.

PHP

PHP (Hypertext Preprocessor is an interpreted language (a scripting language) executed on the server side (such as CGI scripts, ASP ...) and not on the client side (a script written in JavaScript or Java applet running on your computer ...).It is mainly used for producing dynamic web pages via an HTTP server. The result is sent to the client without that it cannot access the source.

Ajax

Ajax is a combination of Web development technologies used for creating dynamic websites. The letters stand for "Asynchronous JavaScript and XML." Therefore, websites that use Ajax combine JavaScript and XML to display dynamic content.

JavaScript

JavaScript is a scripting language embedded in an HTML document. Historically it is even the first scripting language for the Web. This language is a programming language that allows for improvements to HTML allowing to execute commands on the client side, that is to say at the browser and not the web server.

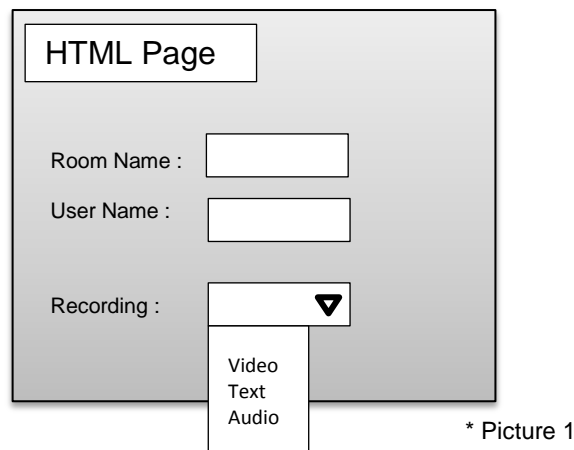
jQuery

jQuery JavaScript Library is a free, multi-platform created to facilitate client-side scripting in the HTML code of web pages.

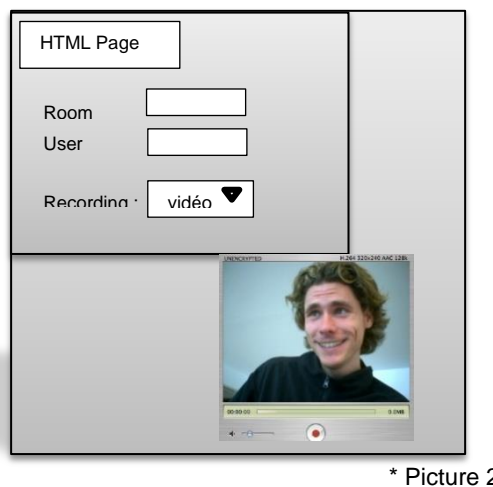
3. Story Board

i. Recording Page

The user after fulfill inquire fields the user can select the type of file to recording with a combo box or radio button (picture 1).



And in the same page an over part appears allow user enter Text or recording audio, video file (ex:picture 2).



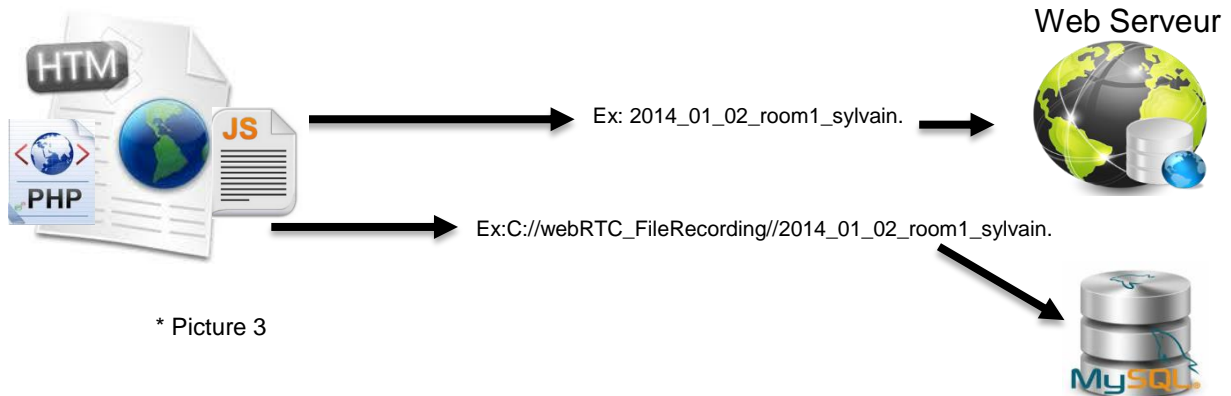
When the user is stopping to recording the file will save on server.

Of course the user will able to see his file recording to restart or to cancel.

If the user cancel the file recording will delete from server.

But if the users validate the recording, the path of file will save on SQL data base (picture 3).

Information: name of file is composing of the date, name room, user name.



ii. Playing Page

This page is designed to read the recording File.

The user will be able to choose the file with a table (picture 4) and he will able to filter the different file.

For the ergonomic of the table all information will able to filer, and the filer will integrate directly in the table.

The table will be based on Kendo UI Grid Component. (Ergonomic & intuitive)

Playing html Page

| Date | Name Room | Name User | Type |
|----------|-----------|-----------|-------|
| 21/02/02 | Room1 | Sylvain | video |
| 21/02/02 | Room2 | Yazid | text |
| 21/02/02 | Room3 | Yassine | audio |

* Picture 4

2. Development

1. Wear Software

i. Apache2

Definition

Apache is the most commonly used Web Server on Linux systems. Web Servers are used to serve Web Pages requested by client computers. Clients typically request and view Web Pages using Web Browser applications such as Firefox, Opera, or Mozilla.

Users enter a Uniform Resource Locator (URL) to point to a Web server by means of its Fully Qualified Domain Name (FQDN) and a path to the required resource. For example, to view the home page of the Ubuntu Web site a user will enter only the FQDN. To request specific information about paid support, a user will enter the FQDN followed by a path.

The most common protocol used to transfer Web pages is the Hyper Text Transfer Protocol (HTTP). Protocols such as Hyper Text Transfer Protocol over Secure Sockets Layer (HTTPS), and File Transfer Protocol (FTP), a protocol for uploading and downloading files, are also supported.

Apache Web Servers are often used in combination with the MySQL database engine, the HyperText Preprocessor (PHP) scripting language, and other popular scripting languages such as Python and Perl. This configuration is termed LAMP (Linux, Apache, MySQL and Perl/Python/PHP) and forms a powerful and robust platform for the development and deployment of Web-based applications.

How Install Apach2

For each Installation you can start with root privileges, so make sure you're logged in as root:

```
sudo su
```

After you need to install the package!

```
apt-get install apache2
```


ii. Php5

Definition

PHP (recursive acronym for "PHP: Hypertext Preprocessor", PHP is originally an acronym for Personal Home Page) is a scripting language mainly used to produce web pages dynamically. It is therefore, in the vast majority of cases, coupled to an HTTP server (like Apache) for communication with the web client.

Producing dynamic web pages that require interaction with a database, PHP is often used in combination with a base management system (DBMS) as MySQL.

How Install Php5

```
apt-get install php5 libapache2-mod-php5
```

Now you must restart apache

```
service apache2 restart
```

You can test if PHP work. You just need to create a simple file php in the default root of the web site:

```
vi/var/www/html
```

And put inside the file : **<?php phpinfo(); ?>**

you should have this result :

| PHP Version 5.5.9-1ubuntu4 | |
|---|--|
| System | Linux server1 2.6.32-opensu-042stab084.17-amd64 #1 SMP Fri Dec 27 17:00:12 MSK 2013 x86_64 |
| Build Date | Apr 9 2014 17:08:00 |
| Server API | Apache 2.0 Handler |
| Virtual Directory Support | disabled |
| Configuration File (php.ini) Path | /etc/php5/apache2 |
| Loaded Configuration File | /etc/php5/apache2/php.ini |
| Scan this dir for additional .ini files | /etc/php5/apache2/conf.d |
| Additional .ini files parsed | /etc/php5/apache2/conf.d/05-opcache.ini, /etc/php5/apache2/conf.d/10-pdo.ini, /etc/php5/apache2/conf.d/20-pool.ini, /etc/php5/apache2/conf.d/20-readline.ini |
| PHP API | 20121113 |
| PHP Extension | 20121212 |
| Zend Extension | 220121212 |
| Zend Extension Build | API20121212.NTS |
| PHP Extension Build | API20121212.NTS |
| Debug Build | no |
| Thread Safety | disabled |
| Zend Signal Handling | disabled |
| Zend Memory Manager | enabled |
| Zend Multibyte Support | provided by mbstring |
| IPv6 Support | enabled |

* Web page of php info()

iii. MySQL

Définition

MySQL is a management system relational database (RDBMS) free, free, powerful, popular, multi-threaded, multi-user

How Install MySQL

Now you need to install MySql and configure php5 to use MySql so start to install MySql :

```
apt-get install mysql-server
```

And to connect at data base you just need to do:

```
mysql -u root -p
```

Now we go to add sql module to php5. Start by write this command in terminal:

```
apt-cache search php5
```

Pick the ones need and install them like this:

```
apt-get install php5-mysql php5-curl php5-gd php5-intl php-pear php5-imagick php5-impa php5-mcrypt php5-memcache php5-ming php5-ps php5-pspell php5-recode php5-snmp php6-sqlite php5-xmlrpc php5-xsl
```

You must restart now apache2 :

```
service apache2 restart
```

Now you can access at MySql by the terminal with this command:

```
mysql -u root -p
```

iv. FFmpeg

Definition

FFmpeg is the leading multimedia framework, able to decode, encode, transcode, mux, demux, stream, filter and play pretty much anything that humans and machines have created. It supports the most obscure ancient formats up to the cutting edge. No matter if they were designed by some standards committee, the community or a corporation.

The FFmpeg project tries to provide the best technically possible solution for developers of applications and end users alike. To achieve this we combine the best free software options available. We slightly favor our own code to keep the dependencies on other libs low and to maximize code sharing between parts of FFmpeg. Wherever the question of "best" cannot be answered we support both options so the end user can choose.

Security is a high priority and code review is always done with security in mind. Though due to the very large amounts of code touching untrusted data security issues are unavoidable and thus we provide as quick as possible updates to our last stable releases when new security issues are found.

How Install **FFmpeg**

You must install some dependencies :

```
sudo add-apt-repository 'deb http://ppa.launchpad.net/jon-severinsson/ffmpeg/ubuntu "$(cat /etc/*-release | grep "DISTRIB_CODENAME=" | cut -d "=" -f2)" main' && sudo apt-get update
```

Now you can install ffmpeg

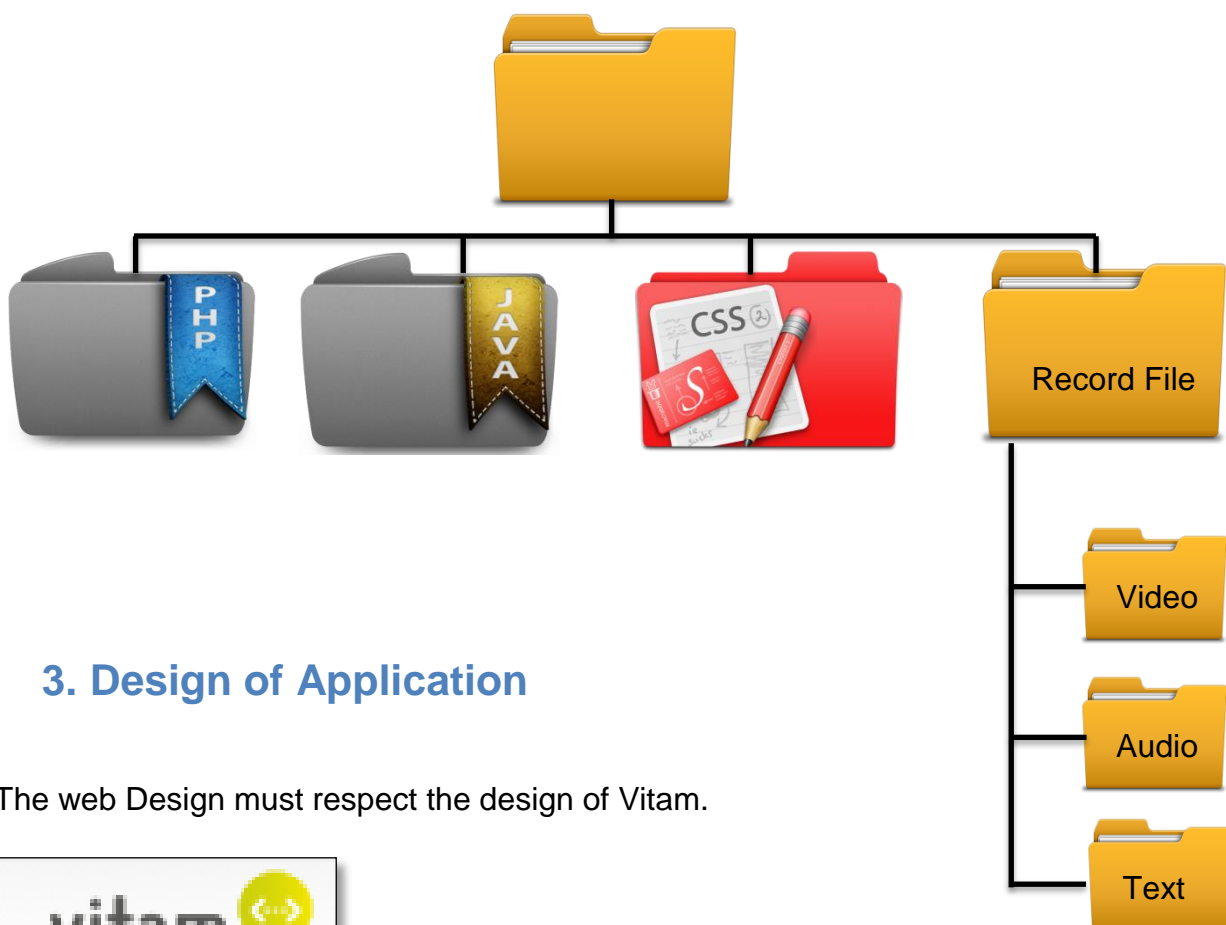
```
sudo apt-get install ffmpeg
```

2. Program Architecture

Good program start by a good architecture.

So during the programming I respect these different points:

- ✓ Each HTML file has its .js file associate, example: index.html & index.js
- ✓ All function used by two or more pages are declared on main.js file!
- ✓ If it is possible all file must be contain one type of language.
- ✓ For a good visibility of the entire program each language File (.html .js ...) will be regrouped in different folders.

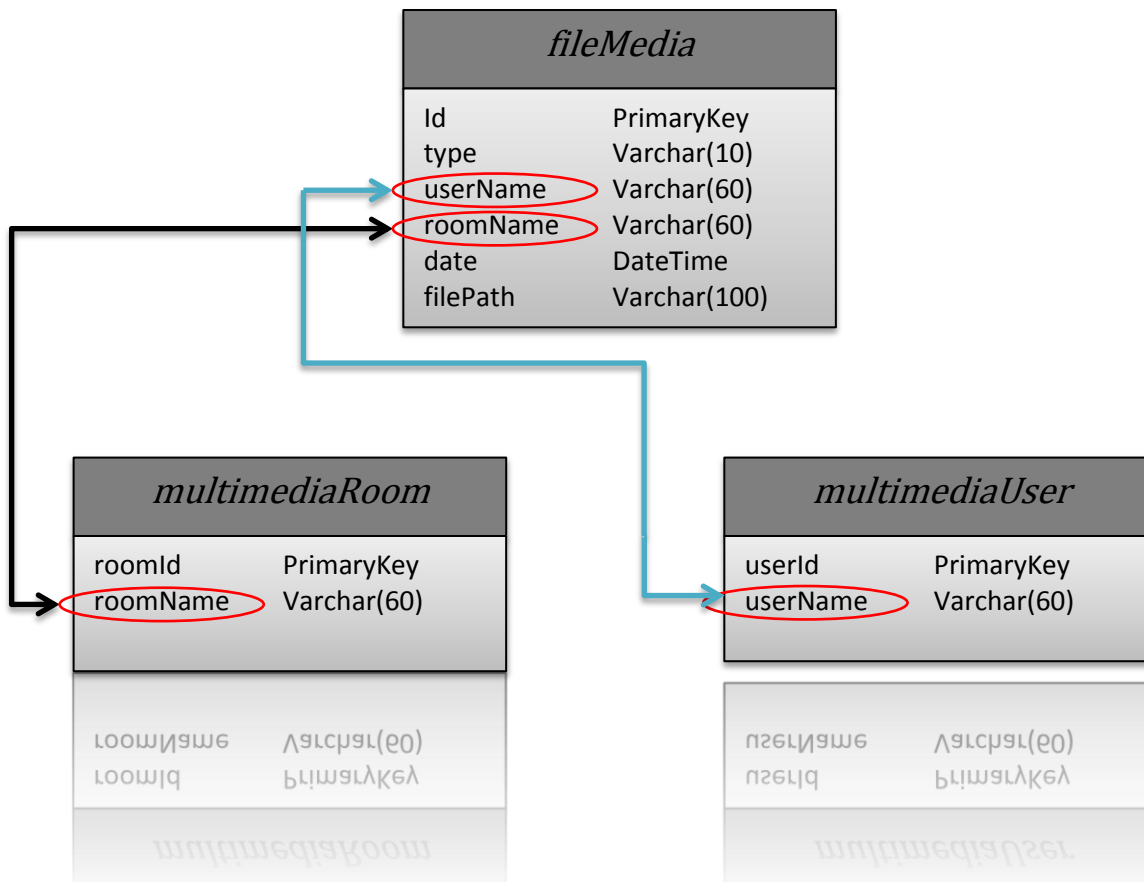


3. Design of Application

The web Design must respect the design of Vitam.



4. Data base SQL



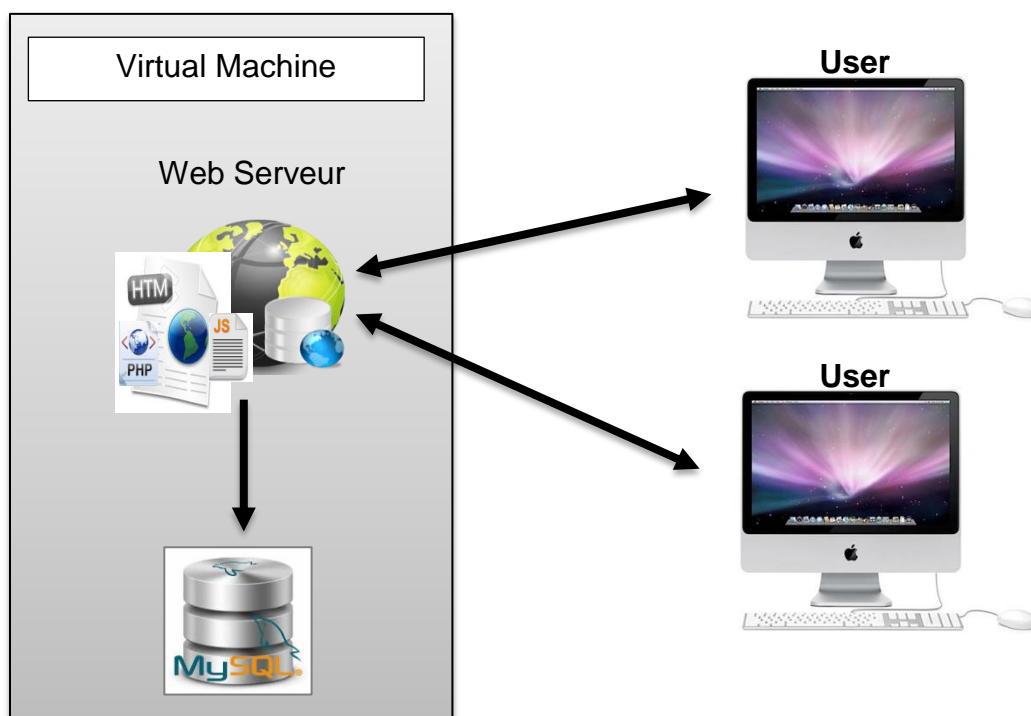
5. Programing

Some reminder before to start the programing of this project.

The Server is implemented on virtual Machine, and a space will be free for different tasks.

During the development all users could connect at the Site to record File or a file recorded without password or over security.

The Server interacts with SQL database via queries written in PHP.



In addition, the video file will be converted to MP4 before saving in the server and audio file will be converted to MP3.

We will see in the pages below what is it the converting MP3 and MP4 and why we must do this.

v. Converting

Aim of Converting

Is very simple, the aim of the conversion is it to reduce the size of the file, to allow a maximum storage file.

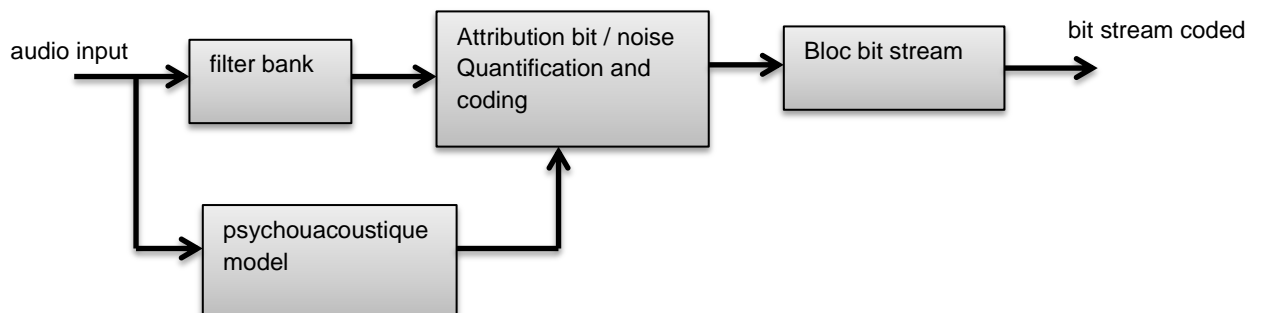
Converting MP3

MP3 compression process can be divided into three stages. First, the audio input element through a filter bank which divides the frequency subband signal.

Simultaneously, it passes through a psychouacoustique model* that uses the concept of auditory mask to determine what can or can not be heard in each sub-band.

The bit allocation block reduces to a minimum the audibility of the noise.

Finally, the bit stream block accumulates all the information and processes. that block out comes an encoded bit stream.



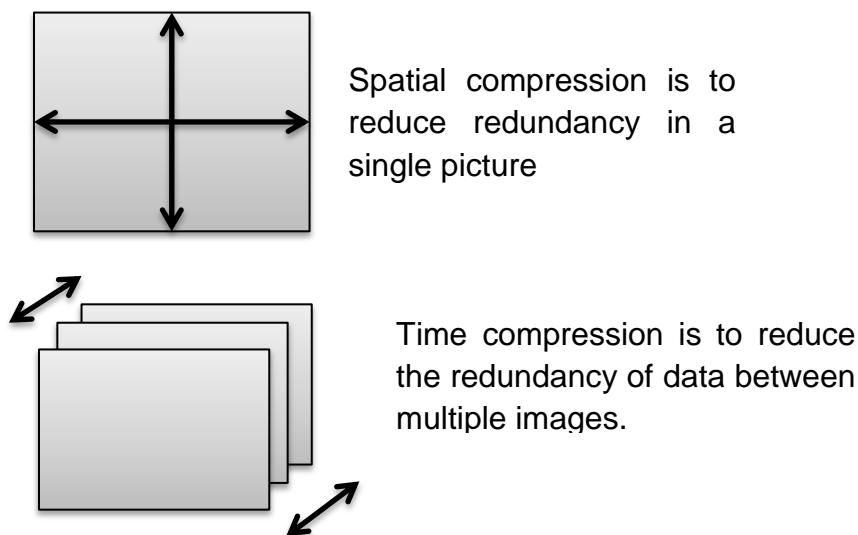
*psychouacoustique model: Psychoacoustics is the branch of psychophysics that connects the auditory sensations of the human sounds that reach his ears.

Converting MP4

The MP4 format is a standard video compression format. MP4 files can be up to 10 times smaller than the original files of the cameras.

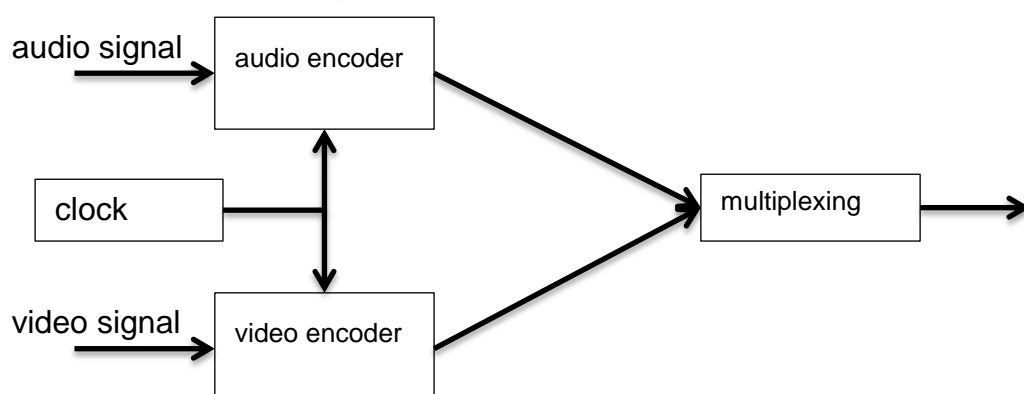
The fundamental principle of video compression is to minimize duplication of information in the data, without of course this being blatantly visible to the human eye. The difficulty is there in the balance between compression ratio is improving along the image quality becomes poor.

- ✓ The spatial redundancy
- ✓ Temporal redundancy. The goal is then to store only what is changed when moving from one image to another.



***Figure 1 - spatial compression and temporal compression**

Finally, we must not forget that a video does not only consist of images, but also sound. So there has to manage two streams: the video stream and the audio stream. Video compression standards therefore have three parts: a video portion, an audio portion, and a part that handles the system integration of the first two. Encoders / video and audio decoders working independently of one another, the system part is to solve the problem of multiplexing.



vi. Record File

Scope



The scope of this web page is to allow at different user to record a file audio, video or text.

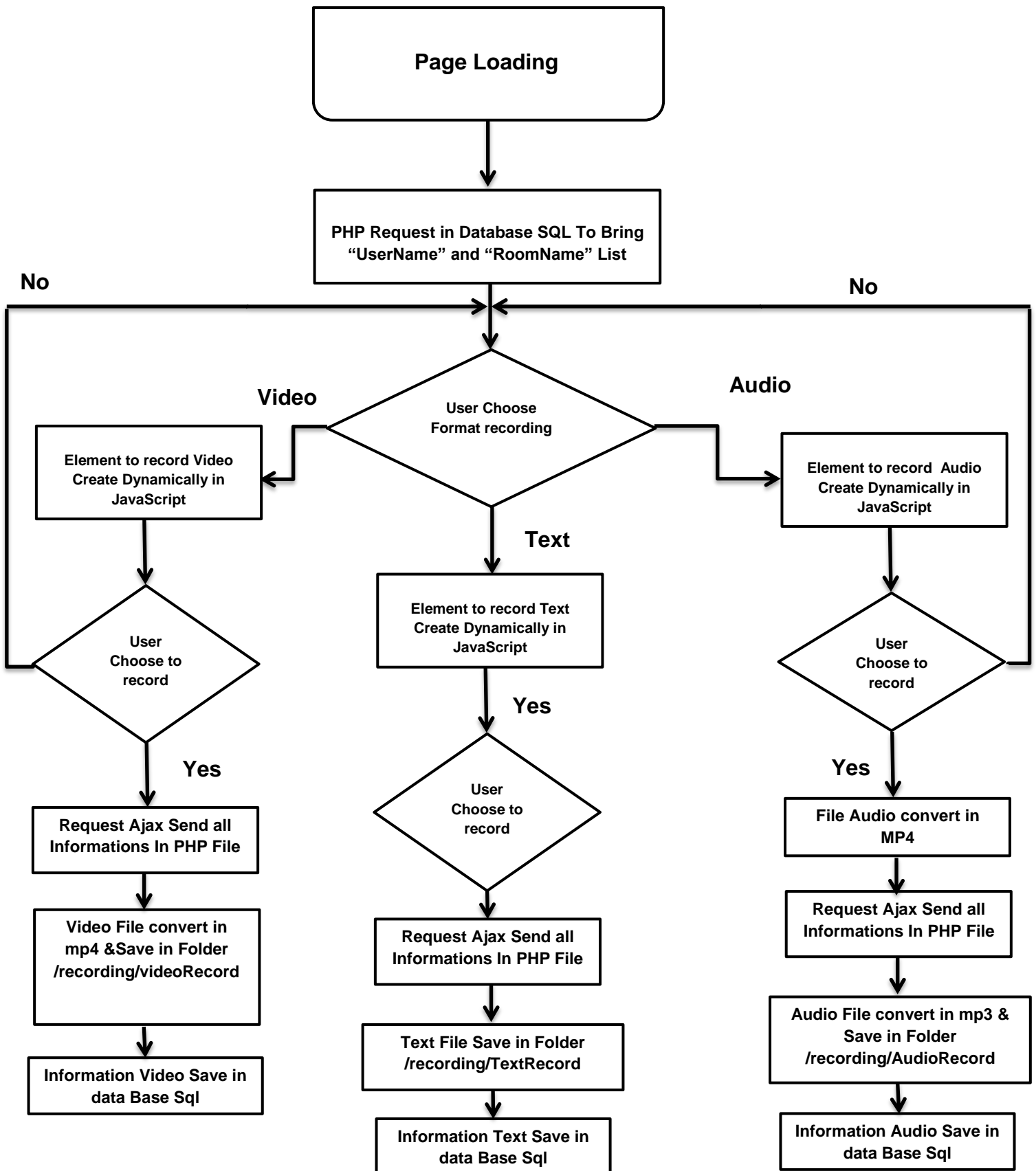
Development

So to Start Programming we need to fix the different points that we must absolutely respect:

- ✓ User name and Room name must be selectable, so their information must be bringing to the data Base.
- ✓ To an increased loading of the page, as we have different choice of recording file. The different element to record it is different file will be created dynamically
- ✓ As PHP is a language interpreted by the server, it will be used minimal to avoid an increased loading of the page.

How it works

We'll see how running the Recording HTML page through this graph.



Explications

So to reminder the aim to the page is to record audio, text or video File.

When the page loading the different variables are initialize and after to loading HTML components!

So during the loading phase of the HTML page, a “GET” request in Ajax it is sent to the file PHP whom deals with the request to the SQL database.

Two requests SQL will be executing on the page loading, one to bring the different “roomName” and an over to bring the “userName”.

After that the user is able to record a file.

When the user select an type of File: video, audio, text; with JavaScript the different components to allow user to record file are creating dynamically and deleted dynamically when user chose an over type of File.

We will see how recording the different file

Text File

The user can write the text on a “TextArea”. When the user clicks on button “Recording Text” a “POST” requests its send to php file in Ajax. At this moment two thing are executed.

First the file it is recording in folder “**recording /TextRecord**” and the name of the file it is compose to the roomName and timeStamp to be sure to have a unique file.

Second part is to save the different information’s concerning the file “roomName, type,date, filePath” in the database SQL.

Audio File

After choose to record audio file the user must be allowing the program to user her/his mike.

Two buttons will be creating dynamically in JavaScript to start and stop recording. When the user choose to start recording audio, different function are lunch to record each buffer (stream).

And when the user chooses to stop the recording, all data are converted in MP3 with a library javascript and two things are executed.

First the file it is recording in folder “**recording /AudioRecord**” and the name of the file it is compose to the roomName and TimeStamp to be sure to have a unique file.

Second part is to save the different information’s concerning the file “roomName, type,date, filePath” in the database SQL.

Video File

After choosing to record audio file the user must be allowing the program to user her/his mike & camera.

Two buttons will be creating dynamically in JavaScript to start, stop recording and in the same time the image of camera will be visible.

And when the user choose to stop the recording, all data are convert in MP4 with script & FFmpeg and two thing are executed.

First the file it is recording in folder “**recording /VideoRecord**” and the name of the file is compose to the roomName and TimeStamp to be sure to have a unique file.

Second part is to save the different information’s concerning the file “roomName, type,date, filePath” in the database SQL.

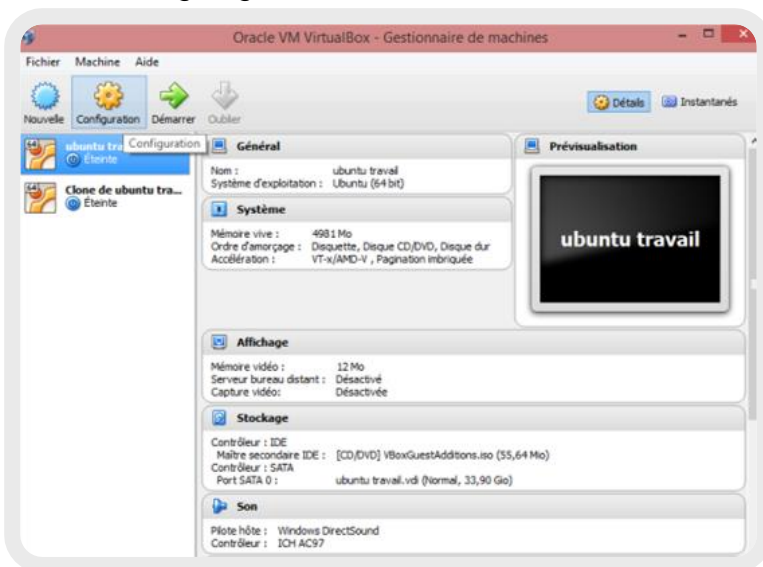
Encountered problem

During the programming development I have encountered a big problem, with a virtual machine I could not receive image from my WebCam. After some research in the net, after to have consulting an expert in this field within the university.

Solution

The only solution we have found. It's to continue to develop in virtual machine. But to test the program, I should put my code on the server I test with an external pc.

We are going to see how to connect virtual machine to the host machine.



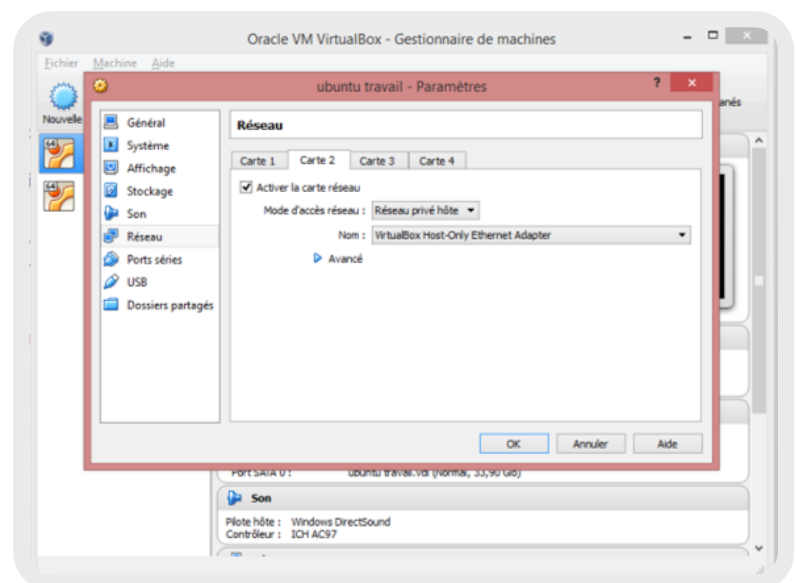
The first step it is to opening virtual box in select your virtual machine and click on “configuration”.

In Tab networks select new connection.

And select private network and host only.

In advanced setting “promiscuous mode”, select all allow.

Now switch on you virtual machine, and in terminal right “ifconfig”. Take the ip address and put the ip on the web browser of your host machine.



vii. Playing File

Scope



The scope of this page is to upload the different file saved in data base Sql and to read it.

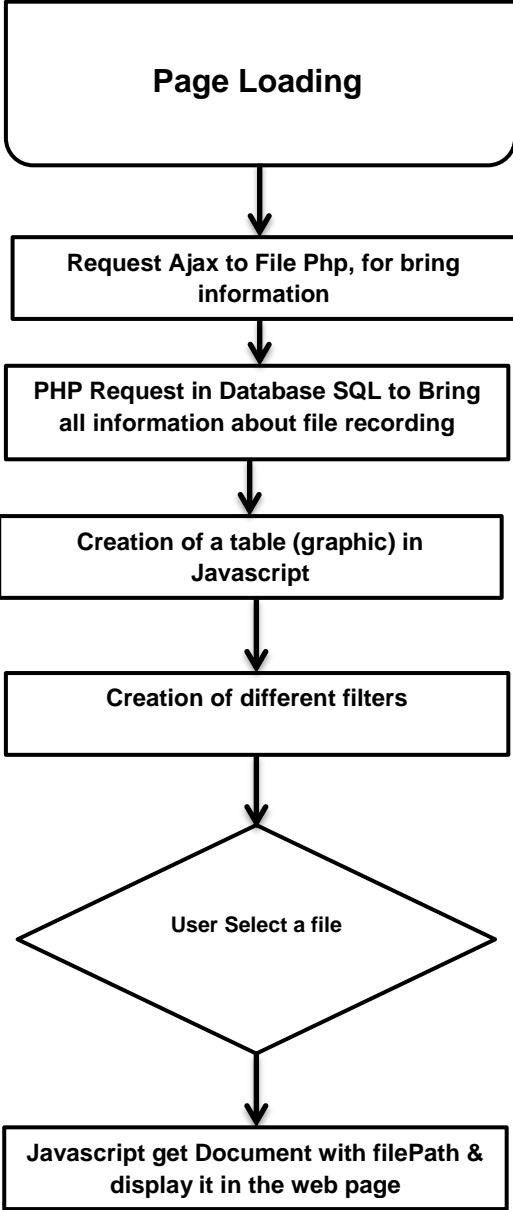
Development

So to Start Programming we need to fix the different points that we must absolutely respect:

- ✓ All Data must input in a table
- ✓ All Dada must be filterable
- ✓ All file selected must be displayed.

How it works

We'll see me running the Recording HTML page through this graph



Explications

So to reminder the aim to the page is to get the file record (audio, text or video File).

At the loading of the HTML page, a "GET" request in Ajax it is send to the file PHP whom deals with the request to the SQL database.

This request must be bringing the different information's about the different file recording. Once all recovered data, there injected in table. This table is component and libraries develop by KendoUI. All process is in JavaScript.

At this moment the user is able to select a file in the table and I same time, is able to filter all information's (Filter developing in JavaScript an implement when the table is created).

Now we will see what's happen when the different file a selected.

Text File

When the user click on the line that contain Text File, a function in JavaScript search the information of the "filePath" contain in the object selected and a "GET" request in Ajax it is send to the file PHP with the "filePath". And with a function php we bring the information of the text file.

All text is returned and show on the HTML page.

Audio File

For the audio file is very simple as the text file when the user click on the line whom contain Text File, a function in JavaScript search the information of the "pathFile" contain in the object selected but this time we can show the audio directly with HTML audio element (<audio></audio>) using the file path.

Video File

The Video file is very simple also is the same process than audio File but this time we use an HTML video element (<video></video>) to show the video.

IV. CHAPTER 4

1. Integration in VITAM

1. Description

The integration in VITAM will be easy. We will see the different step:

- ✓ Data Base SQL:
 - Add a database multimediaBase with the Command:
"CREATE DATABASE multimediaBase;"
Or change the name of the database in the DataBaseRequest.php to connect in the SQL database.
 - Change the password in the DataBaseRequest.php to connect in the SQL database.
 - Add the table "multimediaUser" with this command:
"CREATE TABLE multimediaUser(userId INT NOT NULL AUTO_INCREMENT,userName VARCHAR(60),PRIMARY KEY(userId));"
 - Add the table "multimediaRoom" with this command:
"CREATE TABLE multimediaRoom (roomId INT NOT NULL AUTO_INCREMENT,roomName VARCHAR(60),PRIMARY KEY(roomId));"
 - Add the table "" with this command:
"CREATE TABLE fileMedia(id INT NOT NULL AUTO_INCREMENT,userName VARCHAR(60), roomName VARCHAR(60), type VARCHAR(10), filePath VARCHAR(100), date DATETIME,PRIMARY KEY(id));"
- ✓ Integrate the program in VITAM:
 - This operation is very easy, you just need to take all content of the main directory of the project and put on the directory of VITAM.
 - Add a like to VITAM to go on the the recording.php and playing.php.
 - Change the navbar of the recording.php and playing.php and put the VITAM navigation bar. (index.php will be deleted)
 - If the different page php or directory must move on VITAM, don't forget to change the file path of the source or library on the different file.

To help you can find below all file with references correspondents.

2. Reference's files

| File | Source/Library/file path |
|--------------|--|
| record.php | <script src="js/main.js"></script> |
| | <script src="js/record.js"></script> |
| | <script src="js/recordmp3.js"></script> |
| | <script src="js/getUserMedia.js"></script> |
| | <script src="js/bootstrap.min.js"></script> |
| | <link rel="stylesheet" href="css/bootstrap.min.css"></link> |
| | <script src="js/dataBaseRequest.js"></script> |
| | <style id="holderjs-style" type="text/css"></style> |
| | <link rel="stylesheet" href="css/site.css"></link> |
| | <script src="js/kendo/jquery.min.js"></script> |
| playing.php | <link rel="stylesheet" href="css/bootstrap.min.css"></link> |
| | <link rel="stylesheet" href="css/site.css"></link> |
| | <style id="holderjs-style" type="text/css"></style> |
| | <link href="css/kendo/kendo.common.min.css" rel="stylesheet" /> |
| | <link href="css/kendo/kendo.default.min.css" rel="stylesheet" /> |
| | <link href="css/kendo/kendo.dataviz.min.css" rel="stylesheet" /> |
| | <link href="css/kendo/kendo.dataviz.default.min.css" rel="stylesheet" /> |
| | <script src="js/kendo/jquery.min.js"></script> |
| | <script src="js/kendo/kendo.all.min.js"></script> |
| | <script src="js/kendo/kendo.grid.min.js"></script> |
| | <script src="js/playing.js"></script> |
| | <script src="js/bootstrap.min.js"></script> |
| Recordmp3.js | var WORKER_PATH = 'js/recorderWorker.js'; |
| | var encoderWorker = new Worker('js/mp3Worker.js'); |
| mp3Worker.js | importScripts('libmp3lame.min.js'); |

V. CHAPTER 5

2. Conclusion

About the project all the constraints and demand realization we arrive. Users can register via an interface text files, audio, video. It can also interface via another web retrieve saved files and sort lire.

The entire code and architecture was designed to enable the implementation of the project in VITAM easily as possible.

For me this project was very interesting, I had never worked on the development of such a project, and more with the constraint can implement my work, my code in another project.

So I was able to discover and work on technologies that I did not know such as virtualization, video file recording, audio and converting them if in another format such as MP3, MP4. I have also been able to improve my skills in the field of web, databases, and the handling and programming on the ubuntu operating system.

This project really helped me broaden my skills in the field of computer engineering.

I wanted once again to thank the university for UDG accepting me and welcomed as Erasmus.

Encore also thank you Mr Marzo and Pueyo for their welcomes. And a big thanks you to Mr Marzo and his students for their support.

3. Further Work

1. Implement code in the VITAM project. For this it will just make sure to include in the navigation bar vitam project web pages and ensure that different link libraries and JavaScript code pages are upright and still valid following the implementation of these and Parents records.
2. Concerning the data to record a "roomname" and "UserName" file. These data should be automatically recovered and not through what the user enters. Once the project is implemented within the given VITAM "UserName" will be the connected user, and the data "roomname" will automatically be selected by VITAM.

4. Glossary

JavaScript : object-oriented computer programming language

PHP : originally derived from Personal Home Page Tools, now stands for PHP: Hypertext Preprocessor

FFmpeg: is a free software project that produces libraries and programs for handling multimedia data

eHealth: Health with internet

Html: Hypertext Markup Language

WebRTC: Real Time Communication

VM: Virtual Machine

CPU: central processing unit

OS: Operative System

HTTP: Hyper Text Transfer Protocol

FTP: File Transfer Protocol

SIP: Session Initial Protocol

RAM: random access memory

Apache: is a freely available Web server

ICE: Interactive Connectivity Establishment

STUN: Session Traversal Utilities for NAT

NAT: Network Address Translator

TURN: Traversal Using Relays around NAT

API: application programming interface

SQL: Structured Query Language

