



ESCUELA SUPERIOR DE INGENIERÍA

**Evaluación de competencias mediante la extracción de indicadores
procedentes de los registros de actividad de los entornos de aprendizaje
virtuales**

Trabajo de Investigación

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3 de octubre de 2013



ESCUELA SUPERIOR DE INGENIERÍA

Itinerario Formativo de Doctorado 7009

Trabajo de Investigación

Evaluación de competencias mediante la extracción de indicadores procedentes de los registros de actividad de los entornos de aprendizaje virtuales

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Notación y formato

Aquí incluiremos los aspectos relevantes a la notación y el formato a lo largo del documento. Para simplificar podemos generar comandos nuevos que nos ayuden a ello, ver `comandos.sty` para más información.

Cuando nos refiramos a un programa en concreto, utilizaremos la notación:

emacs.

Cuando nos refiramos a un comando, o función de un lenguaje, usaremos la notación:

`quicksort`.

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Capítulo 1

Motivación y contexto del proyecto

1.1. Introducción

En este apartado, hay que hacer una pequeña definición del proyecto, de que se pretende con él, y que motivaciones nos han llevado a realizar este proyecto.

Vamos a aprovechar para introducir los elementos tipo `float`. Estos son elementos como imágenes o tablas, que queremos independizar un poco del resto del documento, además de añadirle una referencia propia, una pequeña descripción, o una numeración para que se muestre en los índices.

A continuación se muestran dos imágenes iguales, una colocada directamente con el comando que vimos antes `\includegraphics`, y la siguiente con el entorno apropiado:



Ahora como se debe hacer:



Figura 1.1: Calimero versión libre

Además de que el resultado es igual, ahora podemos referenciar la imagen, usando la referencia definida en el entorno `figure`, de forma `??`.

Si observamos que en **Índice de figuras**, se ha incluido la imagen. Por tanto, a partir de ahora usaremos este entorno.

De forma similar, podemos hacer tablas. Recordemos la tabla del ejemplo básico:

Nombre del grupo	Vocalista	Guitarra	Bajo	Bateria
Metallica	James Hetfield	Kirk Hammet	Robert Trujillo	Lars Ulrich
Guns N' Roses	Axl Rose	Robin Finck	Tommy Stinson	Brian Mantia
Queen	Freddie Mercury (RIP)	Brian May	John Deacon	Roger Taylor
AC/DC	Brian Johnson	Angus y Malcolm Young	Cliff Williams	Phil Rudd
Black Label Society	Zakk Wylde	Zakk Wylde y Nick Catanese	John DeServio	Craig Nunenmacher

Tabla 1.1: Grupos significativos en el Rock, Heavy y Metal

El resultado de la tabla `??` es idéntico. Además como podemos ver, al usar otro entorno, se nos genera en el otro índice, numerándose de forma independiente. Una de las grandes versatilidades de \LaTeX

Capítulo 2

Desarrollo del proyecto

2.1. Organización temporal

En este apartado podemos añadir un diagrama de Gannt, con la planificación temporal que se realizó del proyecto. Para ello podemos usar algún programa libre como por ejemplo *Planner*:

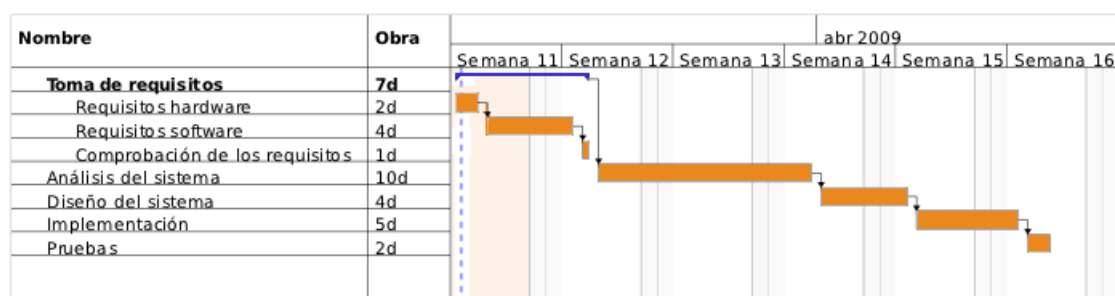


Figura 2.1: Diagrama de Gannt. Desarrollo del proyecto

Observad el código, notareis algo distinto con respecto a las imágenes del capítulo anterior. En este caso utilizo un comando personalizado en `comandos.sty`, donde simplifiqué la creación de una figura, como en la figura 2.1.

2.2. Análisis del sistema

Si el proyecto se refiere a un sistema software, normalmente procederemos a un análisis y a un diseño del sistema usando notación UML, para organizar correctamente dicho sistema.

L^AT_EX no trae soporte nativo para hacer este tipo de diagramas, y aunque se pueden utilizar paquetes que lo hagan. Sin embargo lo más cómodo es que utilizemos herramientas CASE para ayudarnos a dicha tarea, como pueden ser *Dia* o *Umbrello*, como podemos ver en la figura 2.2.

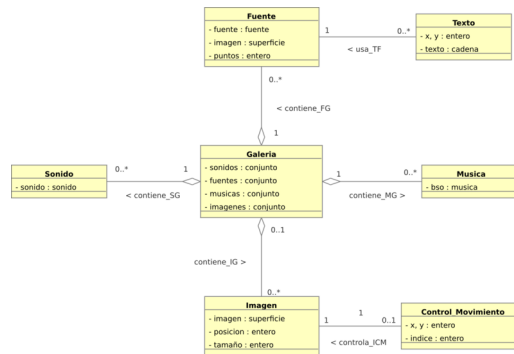


Figura 2.2: UML de ejemplo con Umbrello

Ya que no es el objetivo de este documento trabajar con dichas herramientas, aprovecharé este apartado para mostrar algunas cosas más de las que podemos dotar a nuestro documento \LaTeX .

Sabemos que tenemos un fichero `bibliografia.bib`, para que la herramienta $\text{Bib}\text{\TeX}$ nos genere las referencias bibliográficas. Sin embargo a priori no se mostrarán hasta que nos las referenciemos.

Teniendo en cuenta que todo esto lo tomamos desde la “biblia” de \LaTeX , podemos hacer una referencia a ella [5]. También hay que saber que una guía de referencia online muy buena es la página en wikibooks de \LaTeX [4].

2.3. Base de Datos

Supongamos que en este apartado, queremos incluir un **diagrama Entidad-Relación Extendido**, que modele la base de datos que vamos a utilizar en nuestro proyecto. Una posible herramienta para dibujarla es *Dia*, una herramienta para gráficos vectoriales bastante completa. Una vez hemos hecho el diagrama, podemos importarlo a una imagen en multitud de formatos, o también podemos a código `.tex`.

¿Qué utilidad tiene esto? Pues básicamente lo podremos modificar para refinarlo un poco, añadirle fórmulas matemáticas si quisieramos, o diversas cosas. Además de comprimir bastante en espacio respecto a una imagen. El diagrama ??, está realizado con *Dia* importándolo a \LaTeX :

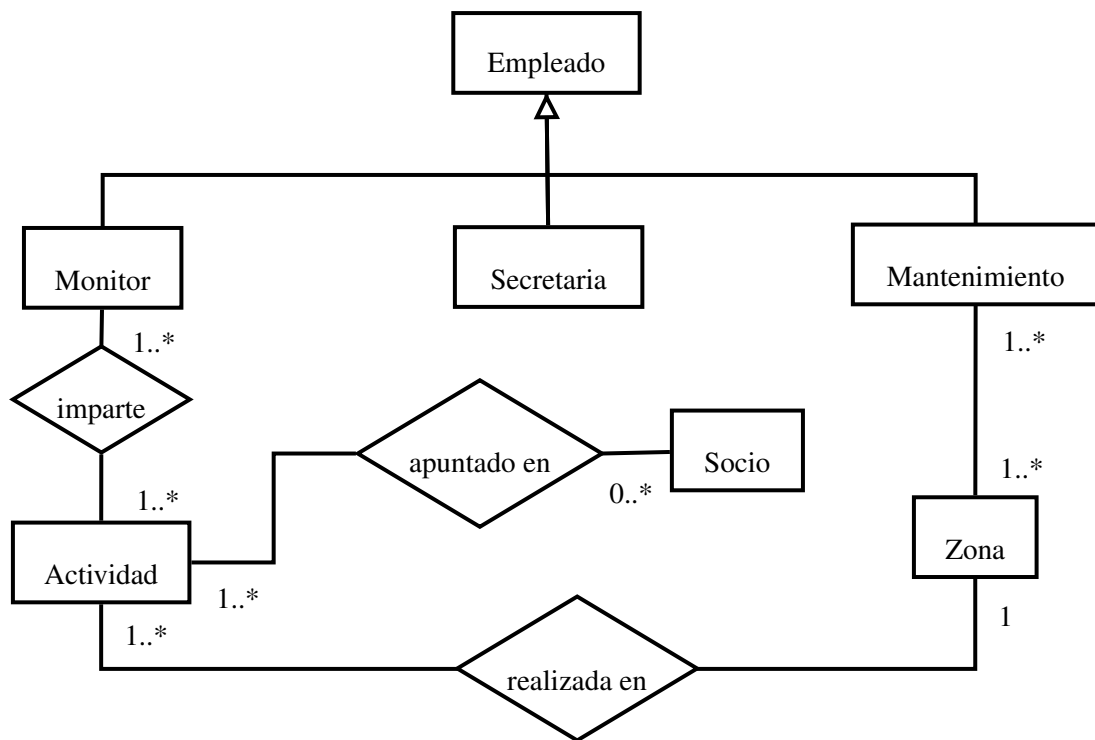


Figura 2.3: Diagrama ERe de ejemplo

2.4. Código fuente

En \LaTeX tenemos varias maneras de colocar nuestro código fuente, pero vamos a mostrar dos básicas.

2.4.1. Entorno `Verbatim`

Este entorno, nos permite incluir dentro de él **cualquier** código, y nos respetará espacios, saltos de líneas, tabuladores... es decir, el compilador de \LaTeX no procesará ese entorno y lo dejará tal cual está. Veamos un ejemplo con el clásico programa *Hola mundo* en C++:

```

/*Clásico programa en su versión C++*/

#include <iostream>

using namespace std;

int main()
{
    cout << "¡Hola, mundo!" << endl;
    return 0; //No hace falta, pero en fin
}

```

Vemos, que queda un poco “soso”: no remarca palabras del lenguaje, le da igual lo que es comentario y lo que es texto, y claro, a la hora de tener un código relativamente amplio, pues es incomodo verlo tan plano. Hay alternativas como `fncyverbatim`, en la cual podemos formatearlo algo, añadiendo

números de líneas, remarcando palabras del lenguaje y más opciones, pero quizás la siguiente opción sea más completa:

2.4.2. Entorno `listing`

Si vemos en el fichero `comandos.sty`, podemos ver varios estilos definidos para este entorno. ¿En qué consiste? Pues realmente este entorno, sabiendo de que lenguaje le estamos pasando el código (admitiendo gran variedad como C, C++, Java, \TeX , SQL, ADA, Python y muchísimos más), y ciertas opciones, podemos formatear el código.

Este entorno podemos llamarlo de dos formas distintas, la primera es utilizando un entorno propiamente dicho, con sus `\begin` y `\end` dentro del cual copiamos el código, y otra usando el comando `\lstinputlisting`, pasándole de parámetro el propio fichero. Veamos de las dos formas:

```
1  /*Clasico programa en su version C++*/
2
3  #include <iostream>
4
5  using namespace std;
6
7  int main()
8  {
9      cout << "Hola, mundo!" << endl;
10     return 0; //No hace falta, pero en fin
11 }
```

O de la segunda forma:

```
1  /*
2   * This program is free software: you can redistribute it and/or modify
3   * it under the terms of the GNU General Public License as published by
4   * the Free Software Foundation, either version 3 of the License, or
5   * any later version.
6
7   * This program is distributed in the hope that it will be useful,
8   * but WITHOUT ANY WARRANTY; without even the implied warranty of
9   * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
10   * GNU General Public License for more details.
11
12   * You should have received a copy of the GNU General Public License
13   * along with this program. If not, see <http://www.gnu.org/licenses/>.
14
15   * Copyright (C) 2009 Pablo Recio Quijano - pablo.recioquijano@alum.uca.es
16  */
17
18  /*Clasico programa en su version C++*/
19
20  #include <iostream>
21
22  using namespace std;
23
24  int main()
25  {
26      cout << "Hola, mundo!" << endl;
```

```
27     return 0; //No hace falta, pero en fin
28 }
```

Notar que uso el estilo C++ porque ya lo tengo definido en el fichero mencionado anteriormente, pero se pueden añadir varios más, modificando los colores, si queremos o no número de líneas, o por ejemplo comandos de consola:

```
g++ hola_mundo.cpp -o hola_mundo
```

Desde luego, es bastante más agradable para la vista, lo cual facilita si lectura. Sin embargo, si usamos esta última opción probablemente tengamos problemas con los caracteres españoles, acentos y demás, debido a las diferencias de codificación entre ISO Latin-1 y UTF8. Hay que tener cuidado en tenerlo todo en UTF8 para que el compilador “entienda” los caracteres.

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- [4] Wikibooks. The Book of LaTeX. <http://en.wikibooks.org/wiki/LaTeX>.
- [5] Frank Mittelbach y Michel Goossens. *The LaTeX Companion*. Addison-Wesley, 2004.

Software utilizado

Es usual en un PFC referenciar que software has usado para la realización del mismo. Aprovecharé este apartado para que conozcas alguna herramienta que puede serte de ayuda para realizar tus documentos en \LaTeX

Emacs + AucTeX

Emacs es uno de los programas de edición más usados por desarrolladores de software, ya que es bastante versátil admitiendo gran cantidad de “plugins” o extensiones que permiten ampliar aun más sus funcionalidades.

Uno de estos plugins es AucTeX[3], el cual incluye rutas para ciertos comandos, resaltado de sintaxis, previsualización del documento, menú matemático en el cual podemos acceder e insertar la gran mayoría de los símbolos matemáticos, para no tener que memorizarlos. Podemos ver un ejemplo de Emacs + AucTeX en la figura 2.4

Por ejemplo, para cerrar un entorno `\begin()`, con su respectivo `\end()`, utilizaremos el atajo `C-C M-]`, para añadir un `\item`, tenemos el atajo `C-C C-j`, y así unos cuantos, que una vez que nos habituamos a ellos, son bastante cómodos.

Además, es bastante configurable, con indentado automático, corrector ortográfico y demás. El fichero adjunto a este documento, *conf_emacs* incluye una configuración con varias de estas opciones.

Doxygen

Realmente, *Doxygen* [1] no es una herramienta que vayamos a utilizar para realizar documentos \LaTeX directamente. Sin embargo, para la documentación de código si es bastante útil.

Esta herramienta realiza una documentación automática de código fuente. Es decir, para nuestro PFC, podemos utilizar para generar la documentación de las APIs de nuestras librerías y demás. Puede generar esta documentación en varios formatos, y entre ellos, \LaTeX , de forma que podemos utilizar ese código generado en nuestra memoria de forma automática.

GNU Make

GNU Make es el programa de recompilación y de control de dependencias por excelencia. Se puede utilizar para compilar proyectos software en diversos códigos, o como en el caso de este documento, para compilar documentos \LaTeX con diversas opciones.

Para más información [2]

Dia

Dia es un editor de gráficos vectoriales el cual incluye distintas plantillas para distintos tipos de gráficos, como pueden ser UML, ERe, diagramas de flujo, esquemas Cisco de red y un larguísimo etcétera. Podemos ver el interfaz en la figura [2.5](#)

Estos diagramas podemos exportarlos a diversos formatos de imagen (.png, .eps, ...) o a formato .tex, como vimos anteriormente.

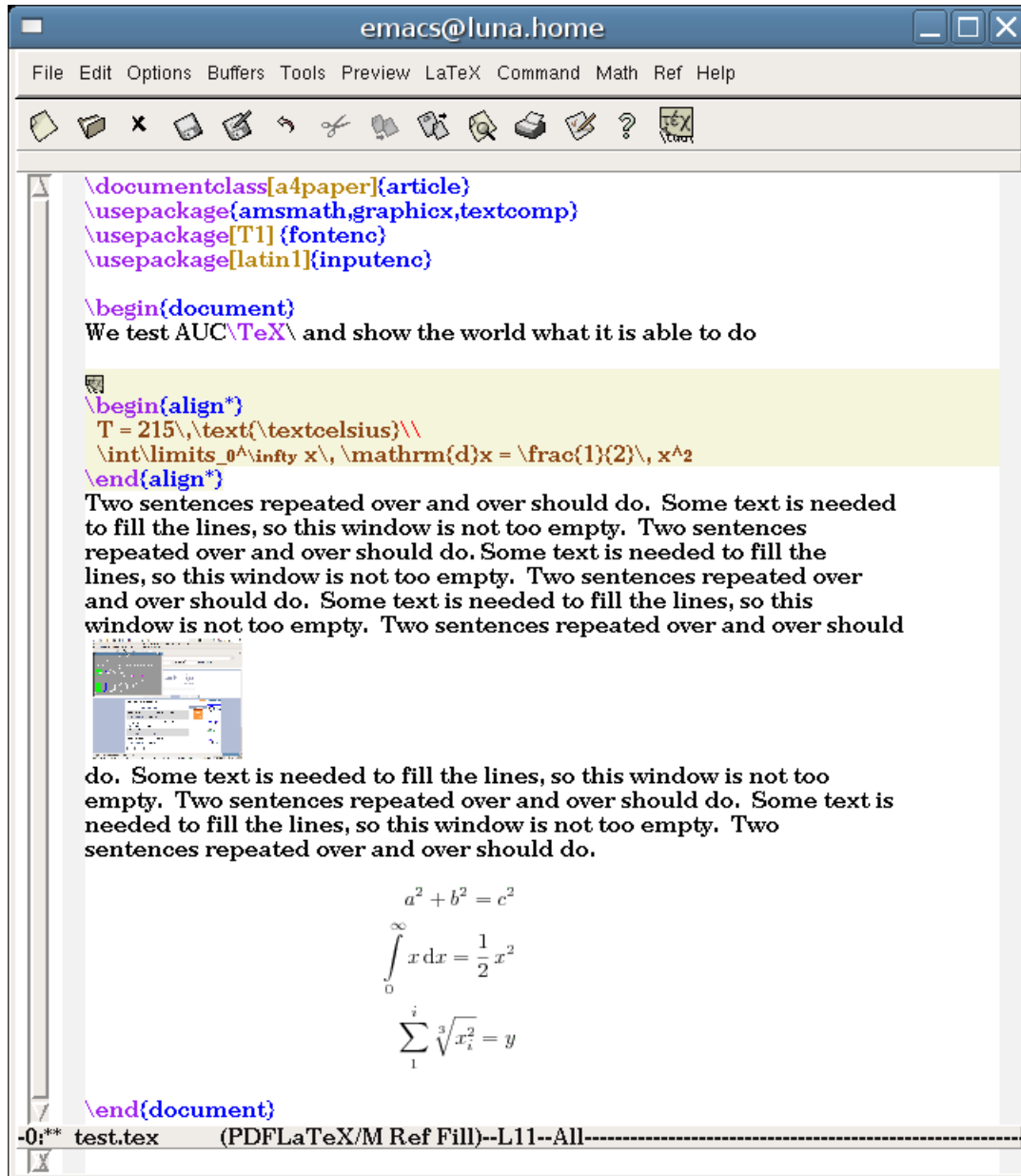


Figura 2.4: Emacs + AucTeX

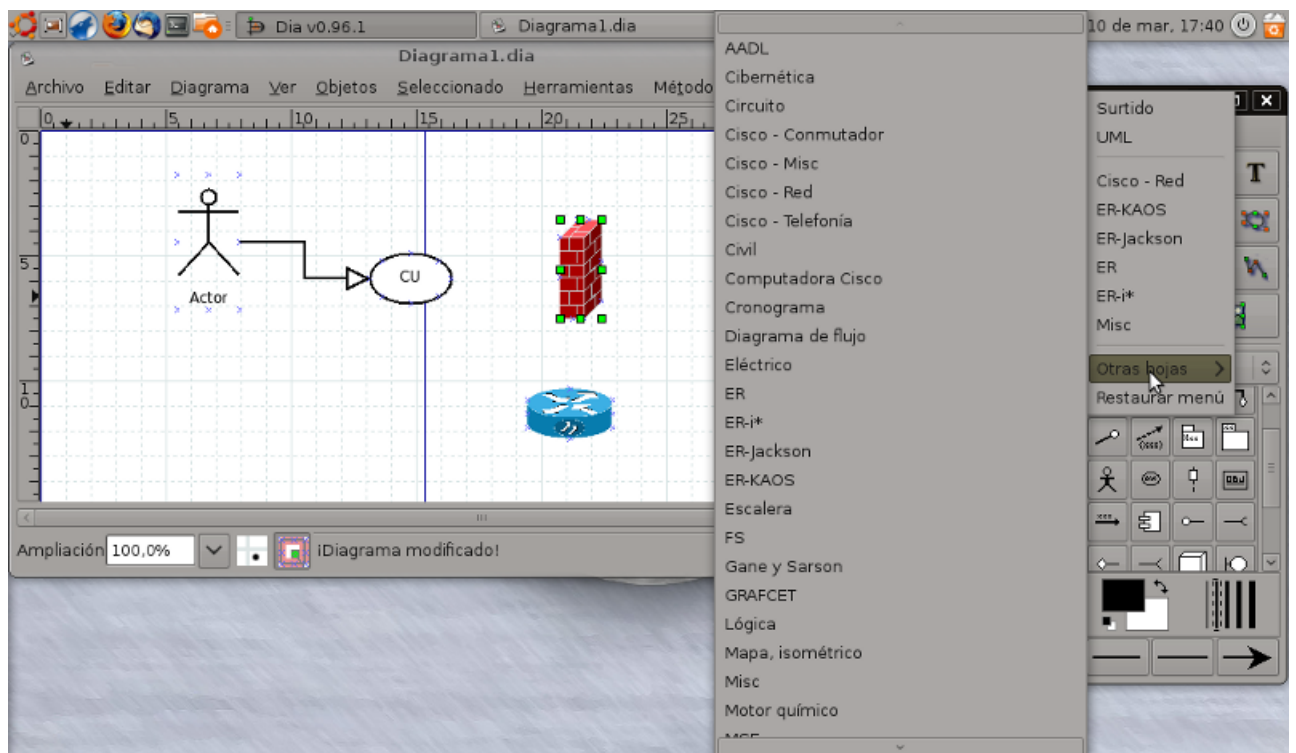


Figura 2.5: Interfaz de Dia

Instalación de L^AT_EX

Veamos que tenemos que hacer para instalar L^AT_EX con todas sus capacidades en un sistema basado en Debian, como Ubuntu. Primero hay que tener en cuenta que L^AT_EX es relativamente pesado con respecto a otros compiladores.

Nosotros vamos a utilizar la distribución de L^AT_EX incluida en los repositorios de Ubuntu llamada *texlive*. Si la buscas en tu gestor de paquetes, encontrarás infinidad de paquetes aparte del principal. Existen otras distribuciones como Te_X

Si instalas solo los básicos, es decir instalas *texlive* y los programas necesarios para él, no podrás compilar este documento, ya que faltarían paquetes tales como *supertabular* y varios. Por eso, si no tienes problema de espacio en el disco duro te recomiendo que instales el paquete *texlive-full*, que instala **todos** los paquetes de *texlive*, incluyendo documentación en todos los idiomas disponibles. Si buscas no tener problemas de dependencias, este es tu método.

```
sudo apt-get install texlive-full
```

En caso de querer ser un poco más concreto, en principio puedes trabajar con la más básica (*texlive* y sus dependencias) y en función de los paquetes que te vayan faltando, los instalas.

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