Disclosing Private Information from Metadata, hidden info and lost data

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Abstract — Documents contain metadata and hidden information that can be used to disclose private data and to fingerprint an organization and its network computers. This document shows what kinds of data can be found, how to extract them and proposes some solutions to the problem stated here.

Index Terms — Metadata, fingerprinting, security, privacy

1 INTRODUCTION

The collaborative work in on documents justifies the need of an extra information attached to the documents, in order to allow coherent and consistent results. In an environment where social networks make the sharing of resources such an important issue, it is necessary to store information about documents authors, the computers used to edit the documents, software versions, printers where they were printed, and so on. Then, if necessary, it will be possible, to prove the authorship of a concrete piece of information, to undo the last changes, to recover a previous version of a document or even to settle responsibilities when authorities want to investigate, for example, the management of the digital rights. The techniques used to attach this extra information to a document, without interfering with its content, are based on Metadata.

The concept of Metadata can be understood as information about the data. But it can also be understood as a structured description, optionally available to the general public, which helps to locate, identify, access and manage objects. Since Metadata are themselves data, it would be possible to define Metadata about Metadata too. This can be very useful, for example, when a given document has been the result of merging two or more previous documents.

The most frequent objective of Metadata is the optimization of Internet searches. The additional information provided by Metadata allows to perform more accurate searches and to simplify the development of filters. Therefore, Metadata emerge as a solution to human-computer communication, describing the content and structure of the data. Furthermore, Metadata facilitate further conversion to different data formats and variable data presentation according to the environment features.

Metadata are classified using two different criteria: content and variability. The first classification is the most widely used. You can easily distinguish among Metadata used to describe a resource and Metadata used to describe the content of the resource. It is possible to split these two groups once more, for example, to separate Metadata used to describe the meaning of the contents from those used to describe the structure of the content; or to separate Metadata used to describe the resource itself from those which describe the life cycle of the resource, and so on. In terms of variability, on the other hand, the Metadata can be mutable or immutable. Obviously, the immutable Metadata do not change, a typical example would be the name of a file.

The generation of Metadata can be manual or automatic. The manual process can be very laborious, depending on the format used for the Metadata and on their desired volume. In the automatic generation, software tools acquire the information they need without external help. However, only in few cases we can have a completely automatic Metadata generation, because some information is very difficult to extract with software tools. The most common techniques use a hybrid generation that starts with the resource generation itself.

If the information changes Metadata must change too. When the modifications are simple enough, they can be carried out automatically. But when the complexity increases, the modifications usually require the intervention of a person. In addition, the destruction of Metadata must be managed. In some cases, it is necessary to eliminate the Metadata along with their correspondent resources; in others, it is reasonable to preserve the Metadata after the resource destruction, for example, to monitor changes in a text document.

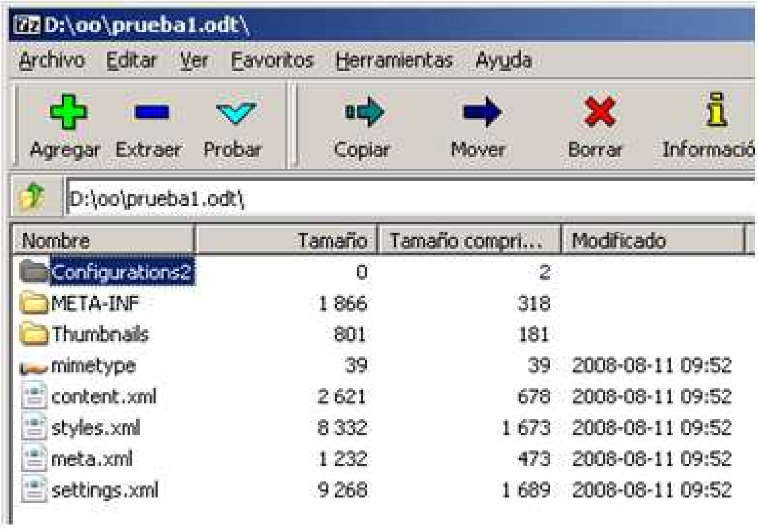
But the most critical situation is the destruction of Metadata when they are related to a final resource version intended for publication. The main contribution of this work is a research about what kind of information stored as Metadata in the public documents on the Internet is not destroyed and how this information can be used as a basis for fingerprinting techniques. We have selected two kinds of documents very usual on the web: Microsoft Office documents and OpenOffice documents.

2 METADATA AND HIDDEN INFORMATION IN OPENOFFICE DOCUMENTS

2.1 ODF FILES

ODF (Open Document Format) is the native file format used by OpenOffice, an open standard format, defined by OASIS and approved by ISO. In ODF, documents are stored as compressed ZIP archives containing a set of XML files with the document contents. If you use compression software to open an ODT document (text file created with OpenOffice Writer) you can find the following files:

- **meta.xml**: Metadata related to the document. This file is not encrypted even if the document is password protected.
- **settings.xml:** Information related to the document configuration and parameters.
- **content.xml**: File with the main content of the document, therefore, the text.



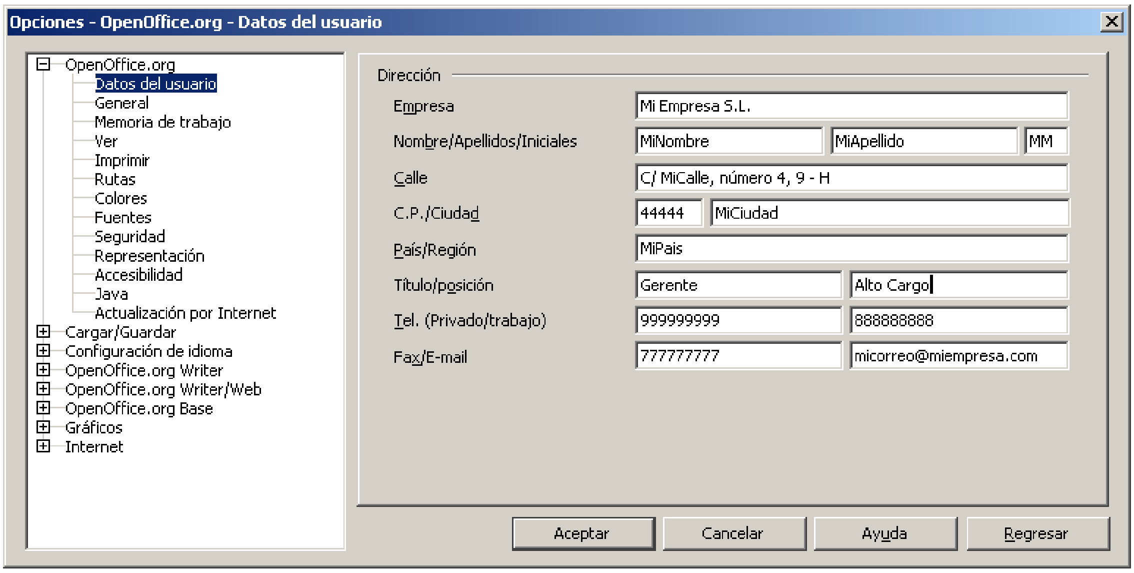
Nombre	Tamaño	Tamaño compri...	Modificado
Configurations2	0	2	
META-INF	1 866	318	
Thumbnails	801	181	
mimetype	39	39	2008-08-11 09:52
content.xml	2 621	678	2008-08-11 09:52
styles.xml	8 332	1 673	2008-08-11 09:52
meta.xml	1 232	473	2008-08-11 09:52
settings.xml	9 268	1 689	2008-08-11 09:52

Figure 1: ODT file contents

Although OpenOffice version 1 uses different file extensions than OpenOffice 2, documents are stored in a similar way in both versions. Do not forget that ODF was built as an evolution of the file formats used in OpenOffice 1.

2.2 PERSONAL DATA

The first metadata generated using OpenOffice are created during the software installation and first execution. The software suite asks the user a set of personal data which, by default, will be attached to the documents created with this software.



Dirección

Empresa	Mi Empresa S.L.		
Nombre/Apellidos/Iniciales	MiNombre	MiApellido	MM
Calle	C/ MiCalle, número 4, 9 - H		
C.P./Ciudad	44444	MiCiudad	
País/Región	MiPais		
Título/posición	Gerente	Alto Cargo	
Tel. (Privado/trabajo)	999999999	888888888	
Fax/E-mail	777777777	micorreo@miempresa.com	

Figure 2: User data modification

Some of these data will be stored within the documents created by OpenOffice. If we create a new text document and afterwards check the contents of the generated meta.xml file, we will find the following information:

```
<?xml version="1.0" encoding="UTF-8" ?>
-<office:document-meta xmlns:office="urn:oasis:names:tc:opendocument:xmlns:office:1.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:meta="urn:oasis:names:tc:opendocument:xmlns:meta:1.0"
xmlns:ooo="http://openoffice.org/2004/office" office:version="1.0">
- <office:meta>
  <meta:generator>OpenOffice.org/2.3$Win32 OpenOffice.org_project/680m5$Build-
9221</meta:generator>
  <meta:initial-creator>MiNombre MiApellido</meta:initial-creator>
  <meta:creation-date>2008-08-11T11:33:23</meta:creation-date>
  <meta:editing-cycles>0</meta:editing-cycles>
  <meta:editing-duration>PT0S</meta:editing-duration>
  <meta:user-defined meta:name="Info 1" />
  <meta:user-defined meta:name="Info 2" />
  <meta:user-defined meta:name="Info 3" />
  <meta:user-defined meta:name="Info 4" />
  <meta:document-statistic meta:table-count="0" meta:image-count="0" meta:object-count="0"
meta:page-count="1" meta:paragraph-count="0" meta:word-count="0" meta:character-count="0" />
  </office:meta>
    </office:document-meta>
```

Figure 3: meta.xml file

We can find information about the OpenOffice version, the operating system, and, within personal data, about the user name. Perhaps we want to show this information or maybe not. A user or a company should decide about it before publishing the document on the Internet, before mailing it or before making it public by any other method.

2.3 PRINTERS

Among the data that can be potentially dangerous, because it reveals information about the company infrastructure, we have printer data. When you print a document with OpenOffice, and after it, you save the document; its settings.xml file stores information about the printer that has been used.

```
...
<config:config-item config:name="ClipAsCharacterAnchoredWriterFlyFrames"
config:type="boolean">false</config:config-item>
  <config:config-item config:name="CurrentDatabaseDataSource" config:type="string" />
  <config:config-item config:name="DoNotCaptureDrawObjsOnPage"
config:type="boolean">false</config:config-item>
  <config:config-item config:name="TableRowKeep" config:type="boolean">false</config:config-
item>
  <config:config-item config:name="PrinterName" config:type="string">EPSON Stylus DX4000
Series</config:config-item>
  <config:config-item config:name="PrintFaxName" config:type="string" />
  <config:config-item config:name="ConsiderTextWrapOnObjPos"
config:type="boolean">false</config:config-item>
  <config:config-item config:name="UseOldPrinterMetrics"
config:type="boolean">false</config:config-item>
...
```

Figure 4: printer information in settings.xml file

This information may be important because it can denounce a forbidden action performed by a user or point directly to a specific user or machine uniquely. In terms of security this information could be even worse if the printer is shared on a server:

```
…
<config:config-item config:name="ClipAsCharacterAnchoredWriterFlyFrames"
config:type="boolean">false</config:config-item>
  <config:config-item config:name="CurrentDatabaseDataSource" config:type="string" />
  <config:config-item config:name="DoNotCaptureDrawObjsOnPage"
config:type="boolean">false</config:config-item>
  <config:config-item config:name="TableRowKeep" config:type="boolean">false</config:config-
item>
  <config:config-item config:name="PrinterName" config:type="string">\\servidor\HP 2000C
</config:config-item>
  <config:config-item config:name="PrintFaxName" config:type="string" />
  <config:config-item config:name="ConsiderTextWrapOnObjPos"
config:type="boolean">false</config:config-item>
  <config:config-item config:name="UseOldPrinterMetrics"
config:type="boolean">false</config:config-item>
  …
```

Figure 5: Printer information described in UNC format in settings.xml file

In this case, the printer appears in UNC format (Universal Naming Service), revealing both the server name and the correspondent resource. These data, for example, could be used by attackers to know the infrastructure of the internal network and to create a list of possible targets.

2.5 TEMPLATES

Templates are used to generate documents with predefined styles and formats. They are widely used because they allow using corporate documents and images comfortably. However, when a document is generated from a template, it stores references to the path location of the template in the meta.xml file:

```
<?xml version="1.0" encoding="UTF-8" ?>
- <office:document-meta xmlns:office="urn:oasis:names:tc:opendocument:xmlns:office:1.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:meta="urn:oasis:names:tc:opendocument:xmlns:meta:1.0"
xmlns:ooo="http://openoffice.org/2004/office" office:version="1.0">
- <office:meta>
  <meta:generator>OpenOffice.org/2.3$Win32 OpenOffice.org_project/680m5$Build-
9221</meta:generator>
```

```
  <dc:title>NuevaPlantilla</dc:title>
  <meta:initial-creator>MiNombre MiApellido</meta:initial-creator>
  <meta:creation-date>2008-08-12T10:02:14</meta:creation-date>
  <meta:editing-cycles>1</meta:editing-cycles>
  <meta:editing-duration>PT0S</meta:editing-duration>
  <meta:template xlink:type="simple" xlink:actuate="onRequest"
xlink:href="../../Datos%20de%20programa/OpenOffice.org2/user/template/NuevaPlan
tilla.ott" xlink:title="NuevaPlantilla" meta:date="2008-08-12T10:02:14" />
  <meta:user-defined meta:name="Info 1" />
  <meta:user-defined meta:name="Info 2" />
  <meta:user-defined meta:name="Info 3" />
  <meta:user-defined meta:name="Info 4" />
  <meta:document-statistic meta:table-count="0" meta:image-count="0" meta:object-count="0"
meta:page-count="1" meta:paragraph-count="1" meta:word-count="0" meta:character-count="9" />
  </office:meta>
</office:document-meta>
```

Figure 6: Path to template in meta.xml file

In the meta.xml file you can see the path to the template relative to the document location. This path may seem harmless and lacking the information that could put the system security at risk. However, if the document is stored in a folder located outside the user's profile, this path offers information about the user account.

```
...
  <meta:template xlink:type="simple" xlink:actuate="onRequest"
xlink:href="../Documents%20and%20Settings/UserAccount/Datos%20de%20programa/OpenOffice
.org2/user/template/NuevaPlantilla.ott" xlink:title="NuevaPlantilla" meta:date="2008-08-
12T10:02:14" />
  <meta:user-defined meta:name="Info 1" />
...
```

Figure 7: Path to template in user's profile in meta.xml file

In this case, the document has been stored in "C: \" and as a result, the path to the template reveals the folder that contains the user's profile in "C: \ Documents and Settings". The name of this folder is usually the name of the user account, in this example "UserAccount." It should be noted that, in certain cases, the name of this folder contains data about the domain to which the user belongs. This information is usually included in the name of the folder with the user's profile with the structure "UserAccount.DomainName" offering critical information to a potential attacker.

Similarly, the document could have been saved on another drive different from the template, obtaining in this case a complete path to identify the disk drive:

```
…
  <meta:template xlink:type="simple" xlink:actuate="onRequest"
xlink:href="/C:/Documents%20and%20Settings/papa/Datos%20de%20programa/OpenOffice.org2/u
ser/template/NuevaPlantilla.ott" xlink:title="NuevaPlantilla" meta:date="2008-08-12T10:02:14" />
  <meta:user-defined meta:name="Info 1" />
…
```

Figure 8: Full path to template in meta.xml file

Examples shown above have all been performed on Windows machines, but the results do not differ much in Linux machines. In this case, paths to templates can contain information about user's $HOME Path:

```
…
  <meta:template xlink:type="simple" xlink:actuate="onRequest" xlink:role="template"
xlink:href="/home/pruebas/.openoffice.org2/user/template/PlantillaNueva.ott"
xlink:title="NuevaPlantilla" meta:date="2008-06-30T09:13:20" />
  <meta:user-defined meta:name="Info 1" />
…
```

Figure 9: Full path to template related to $HOME in meta.xml file

Logically, if the template is located on a network server, the information in UNC format shows the server's name and the shared resource, again allowing a potential attacker to reconstruct the network structure of the organization.

2.6 Embedded and Linked Documents

One of the options provided by almost all of the current office software is linking and embedding documents. In the case of linking files, there is a reference to the linked document in the main document, in the form of a relative path, when it is possible, and as an absolute path when there is no other alternative. If the document is linked on the same computer where the main document is, the result will be, in general, similar the results shown in the last section. Therefore, a potential attacker could disclose sensitive information about user accounts or file locations.

If the linked document is stored on another computer, the information disclosed to the attacker is very useful again:

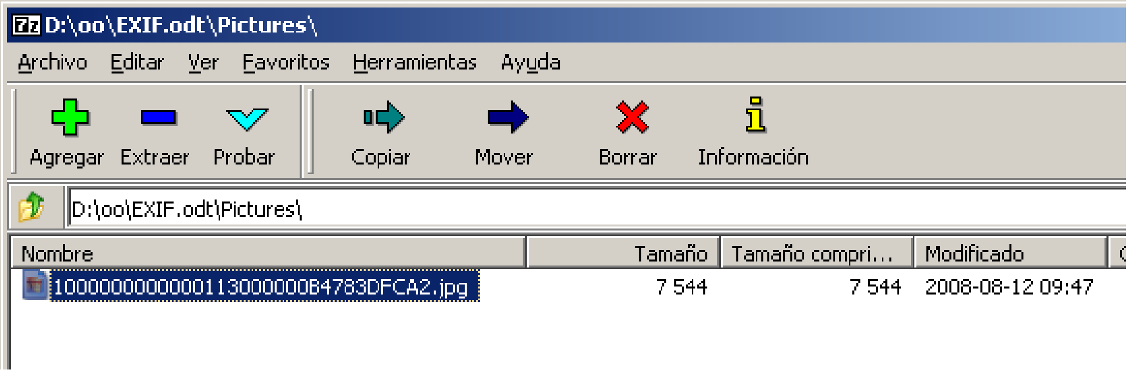
```
…
<text:p text:style-name="Standard">
<draw:frame draw:style-name="fr1" draw:name="gráficos1" text:anchor-type="paragraph"
svg:width="16.999cm" svg:height="6.369cm" draw:z-index="0">
  <draw:image xlink:href="//desktop/confidenciales/Dibujo.bmp" xlink:type="simple"
xlink:show="embed" xlink:actuate="onLoad" draw:filter-name="<Todos los formatos>" />
  </draw:frame>
  </text:p>
…
```

Figure 10: Linked document

When the file is embedded in the document, not linked, there are not routes implied in the process, but we have to face new potential problems of leakage of information, because they may contain metadata and hidden information.

Suppose that we embed a JPG image (with its metadata in EXIF format) in an ODF document. In the example, one of such EXIF metadata is a miniature that looks different from the embedded image, thus showing that the image has been manipulated.

All the embedded files are included in the master document, so opening the ODT file with a decompressor, you can see that there is a folder called Pictures, and inside it is the embedded image, but under another name.



D:\oo\EXIF.odt\Pictures\

D:\oo\EXIF.odt\Pictures\

Nombre	Tamaño	Tamaño compri...	Modificado	C
10000000000001130000000B4783DFCA2.jpg	7 544	7 544	2008-08-12 09:47	

Figure 11: Embedded image in Pictures folder

If this image is extracted and analyzed, it has all the original image’s metadata attached and, of course, the thumbnail that shows its original state. It´s possible to use any EXIF reader tool to analyze the thumbnail attached to the pictured to prove this as can be seen in Figure 12.

Figure 6 ***EXIF Metadata from an embedded image***

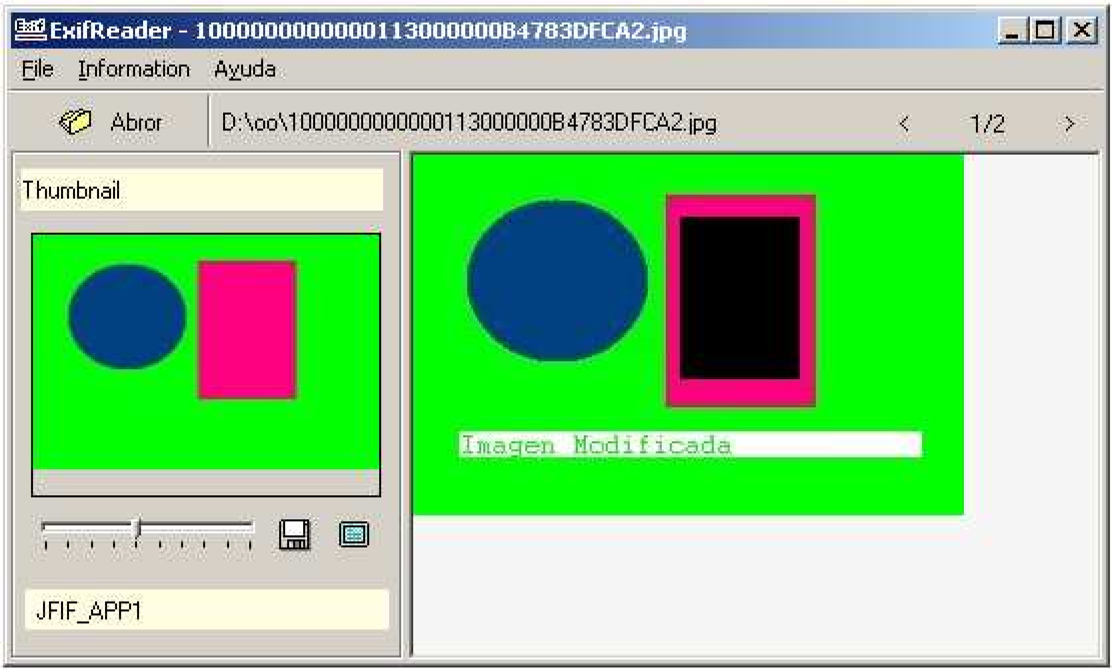
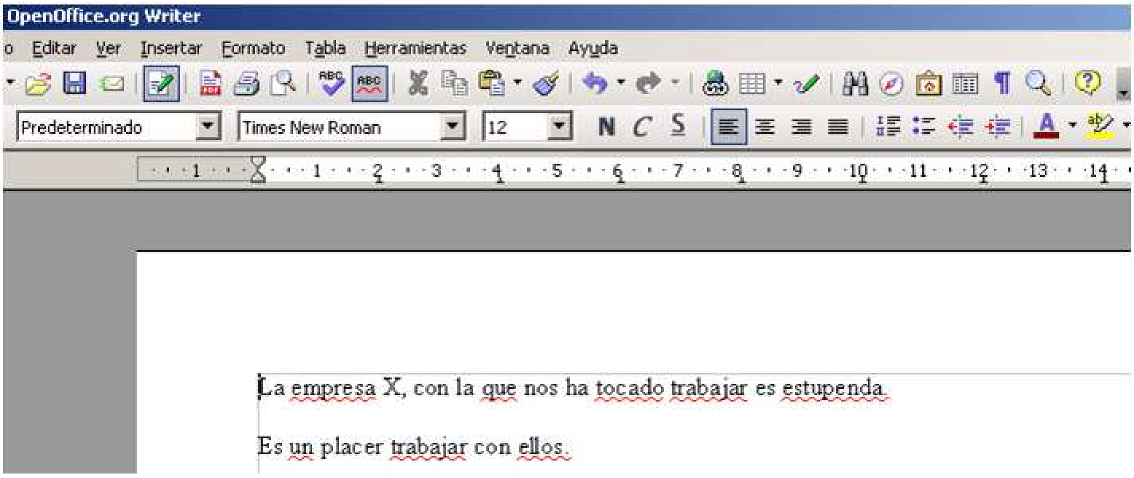

ExifReader - 10000000000000113000000B4783DFCA2.jpg
File Information Ayuda
Abror
D:\oo\10000000000000113000000B4783DFCA2.jpg
1/2
Thumbnail
JFIF_APP1
Imagen Modificada

Figure 12: Original thumbnail discover image's manipulations

2.7 Modifications

One of the features offered by OpenOffice Writer is to track changes in documents. This is useful when a document is being developed by multiple users or when you want to log all the modifications. The submenu "modification" of the Edit menu can activate this feature, as well as make visible or hide the changes.

A user can work on a document with this option activated, even by negligence, so that if the document is published without eliminating its history, anyone can guess if something has been removed or added, and by whom, and when these changes were made.

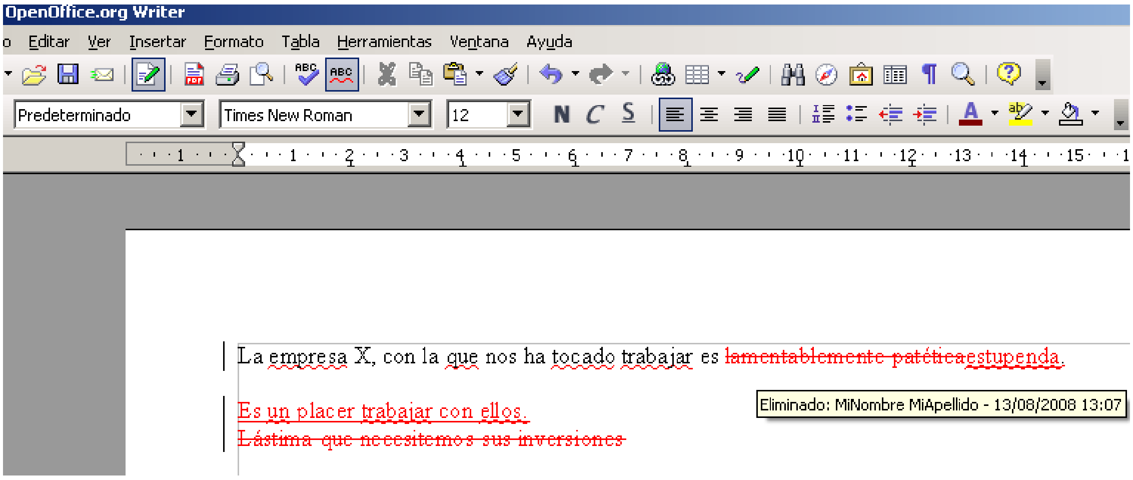

OpenOffice.org Writer
o Editar Ver Insertar Formato Tabla Herramientas Ventana Ayuda
Predeterminado
Times New Roman
12

La empresa X, con la que nos ha tocado trabajar es estupenda.

Es un placer trabajar con ellos.

Figure 13: Changes aren´t displayed

Figure 14 shows that if you left the cursor on a change in the document for a few moments, there is a message indicating who made it and when.


OpenOffice.org Writer
Editar Ver Insertar Formato Tabla Herramientas Ventana Ayuda
Predeterminado
Times New Roman
12
N C S

La empresa X, con la que nos ha tocado trabajar es ~~lamentablemente patética~~estupenda.

Es un placer trabajar con ellos.
~~Lástima que necesitemos sus inversiones~~

Eliminado: MiNombre MiApellido - 13/08/2008 13:07

Figure 14: Changes are displayed

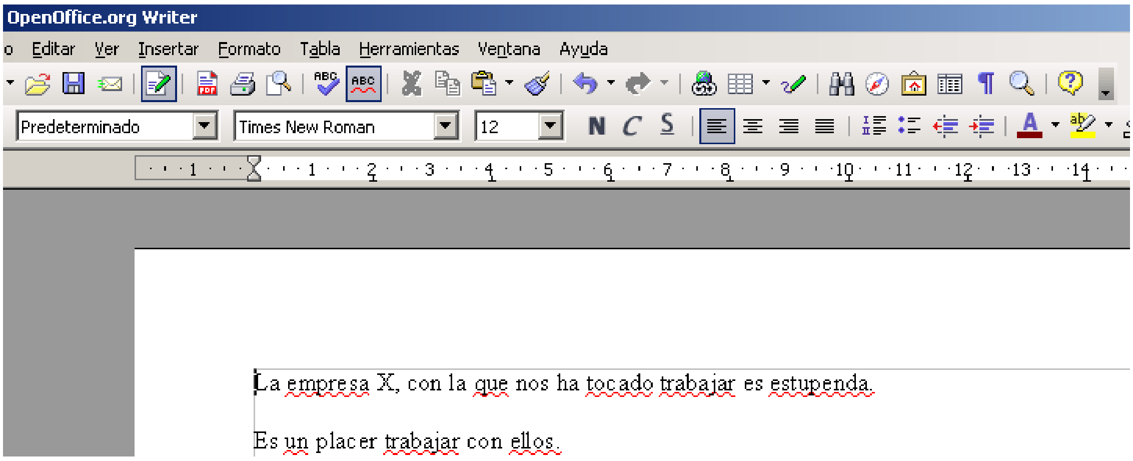
All of this information about the change history is stored in the file content.xml:

```
…
<text:tracked-changes>
 <text:changed-region text:id="ct110732472">
 <text:deletion>
 <office:change-info>
  <dc:creator>MiNombre MiApellido</dc:creator>
  <dc:date>2008-08-13T13:07:00</dc:date>
  </office:change-info>
  <text:p text:style-name="Standard">lamentablemente patética</text:p>
  </text:deletion>
  </text:changed-region>
…
```

2.8 HIDDEN PARAGRAPHS

Another option offered by OpenOffice is to hide text or paragraphs. This functionality allows working on a document in a display with hidden paragraphs, ready to print, and in another display, with all the paragraphs visible, for example, with the information for editing the document. This feature is activated including a special field in the paragraph:

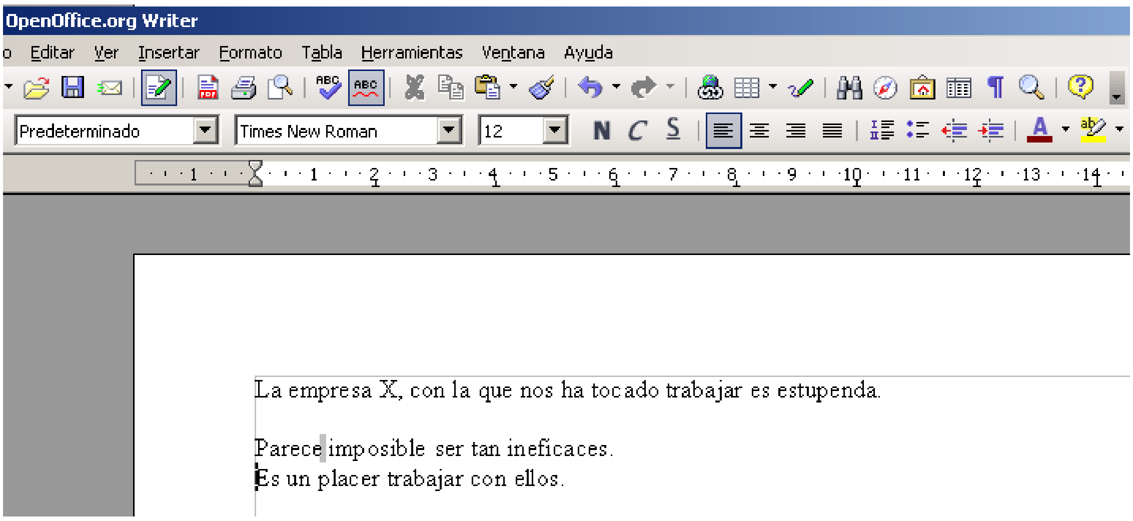
We can turn on or turn off the display of hidden text using the corresponding menu item "View". So, if we have a document with hidden paragraphs, but we do not have the option of seeing them, we are working with a display that does not show all the information that the document has.


OpenOffice.org Writer
Editar Ver Insertar Formato Tabla Herramientas Ventana Ayuda
Predeterminado
Times New Roman
12
N C S

La empresa X, con la que nos ha tocado trabajar es estupenda.

Es un placer trabajar con ellos.

Figure 15 Document with hidden paragraphs



La empresa X, con la que nos ha tocado trabajar es estupenda.

Parece imposible ser tan ineficaces.
Es un placer trabajar con ellos.

OpenOffice.org Writer
Editar Ver Insertar Formato Tabla Herramientas Ventana Ayuda
Predeterminado
Times New Roman
12

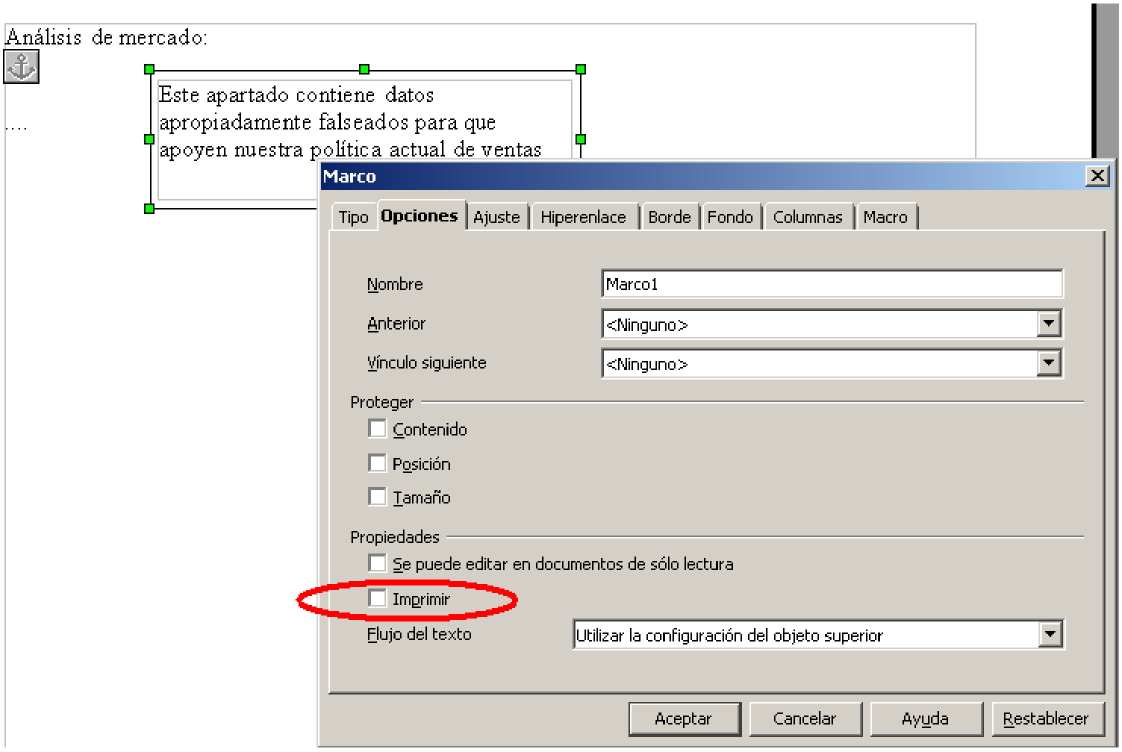
Figure 16: Document displaying hidden paragraphs

2.9 Hidden information due to the format

Another type of hidden text or content is the one that is not visible due to the document format: for example, other content, such as an image, overlaps with it or the text is in the same color that the document background. Of course, this kind of content should be carefully reviewed before publishing the document.

2.10 Notes, headers, footnotes and comments

In an OpenOffice document there are a number of places where you can enter information that may go unnoticed in subsequent revisions. For example, in headers and footnotes, online annotations or comments, that can be entered using the "Notes" option in the "Insert" menu. These notes, unless you specify it, are not included when the document is printed or exported, for example, to PDF format, so it is easy to forget this information in the reviews. It has to be considered that some elements can be defined as "not printable"; therefore, a detailed revision of a document should not be limited to reading a printed version.



Análisis de mercado:

Este apartado contiene datos apropiadamente falseados para que apoyen nuestra política actual de ventas

Marco

Nombre: Marco1
Anterior: <Ninguno>
Vínculo siguiente: <Ninguno>

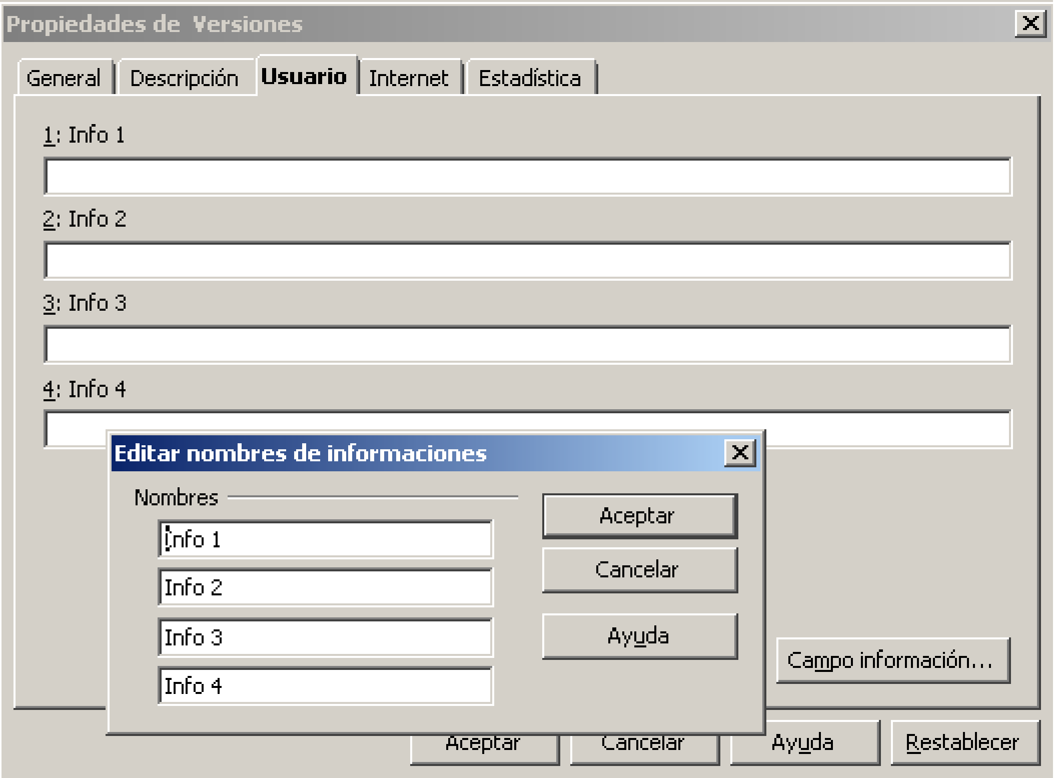
Proteger
□ Contenido
□ Posición
□ Tamaño

Propiedades
□ Se puede editar en documentos de sólo lectura
□ Imprimir
Flujo del texto: Utilizar la configuración del objeto superior

Figure 17: Defining a document as printable or not printable (Spanish version, what a great language!)

2.11 CUSTOMIZED METADATA

Metadata, as it was discussed in the introduction of this document, are not harmful themselves, and on the contrary, they can be very useful for certain applications. In OpenOffice, the user is able to include customized Metadata in his/her documents and to add information to the document using the "Properties" option from the File menu. In addition to the customized Metadata, the document may store information if it is created from another previous document, inherited from this one.



Info 1
Info 2
Info 3
Info 4

Figure 18: Customized metadata

Sometimes, this customized information is used as a working tool in the process of document elaboration and may include corporate or personal opinions, more or less politically correct, identifications and other personal data or references to documentary sources. Of course, all this information must be reviewed before the document publication.

2.12 DATABASES

The combination of documents with databases must be considered too. One of the most important functionalities provided by Office applications nowadays is the ability to generate models that, combined with databases, allow customized and automatic documents generation. These models, designed from mail merging, deserve a special consideration, since they contain information that allows describing the database they are taking the information from. All the information related to the database can be found in the settings.xml file. There is information about the name of the database and about the table used for the combination.

```
<config:config-item config:name="CurrentDatabaseDataSource"
config:type="string">Referencias</config:config-item>
<config:config-item config:name="CurrentDatabaseCommandType" config:type="int">0</config:config-
item>
<config:config-item config:name="CurrentDatabaseCommand"
config:type="string">Contactos</config:config-item>
<config:config-item config:name="PrintDrawings" config:type="boolean">true</config:config-item>
```

Figure 19: Information related to database in settings.xml

And in content.xml file we can find the name of the database, the table and the fields:

```
…
<text:p text:style-name="Standard">
<text:database-display text:table-name="Contactos" text:table-type="table" text:column-
name="nombre" text:database-name="Referencias"><nombre></text:database-display>
</text:p>
<text:p text:style-name="Standard">
<text:database-display text:table-name="Contactos" text:table-type="table" text:column-
name="direccion" text:database-name="Referencias"><direccion></text:database-display>
</text:p>
<text:p text:style-name="Standard">
<text:database-display text:table-name="Contactos" text:table-type="table" text:column-
name="clave" text:database-name="Referencias"><clave></text:database-display>
…
```

Figure 20: Information related to database in content.xml

However, information regarding the connection to the database is not in the ODF document. This information could show the path to a database file or the credentials to access a server, and is stored in a user's profile file called DataAccess.xcu, that should be especially protected by the user.

```
C:\Documents and Settings\USER_ACCOUNT\Program data\
\OpenOffice.org2\user\registry\data\org\openoffice\Office\DataAccess.xcu
```

Although connection's credentials to database are not published, the information stored with the document may be enough to help a potential attacker to prepare his attacks to the database, directly or through SQL Injection techniques on the company's website.

2.13 VERSIONS OF DOCUMENTS

Like other Office packages, OpenOffice allows saving different versions of the same document. This feature is extremely useful in collaborative work environments, allowing the evaluation of the document changes and, if necessary, restoring the previous state after a mishandling. In the File menu, the "Versions" option is to save the current version of the document, and to save a new version of the document every time.

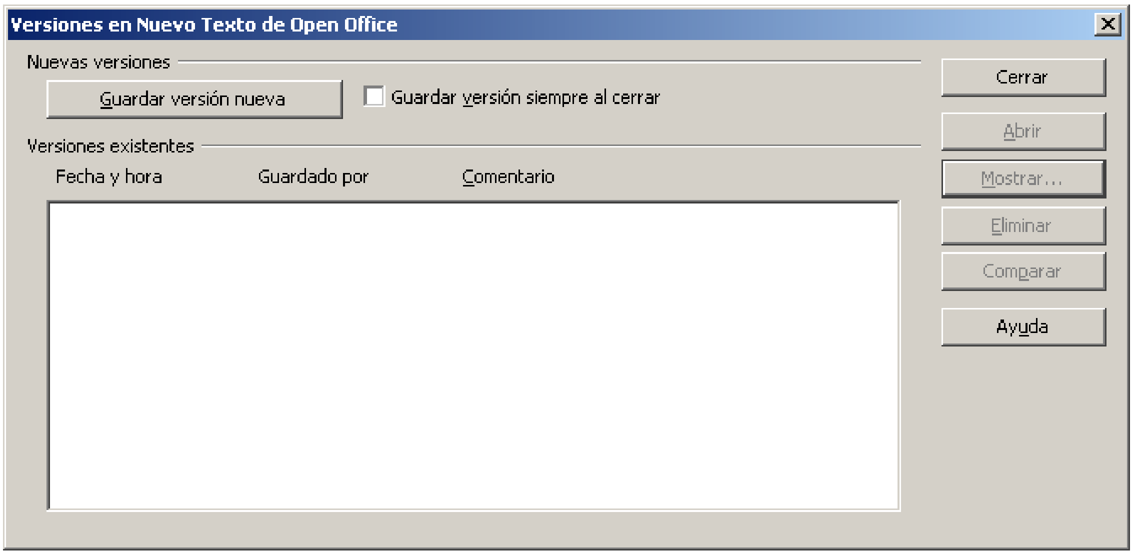


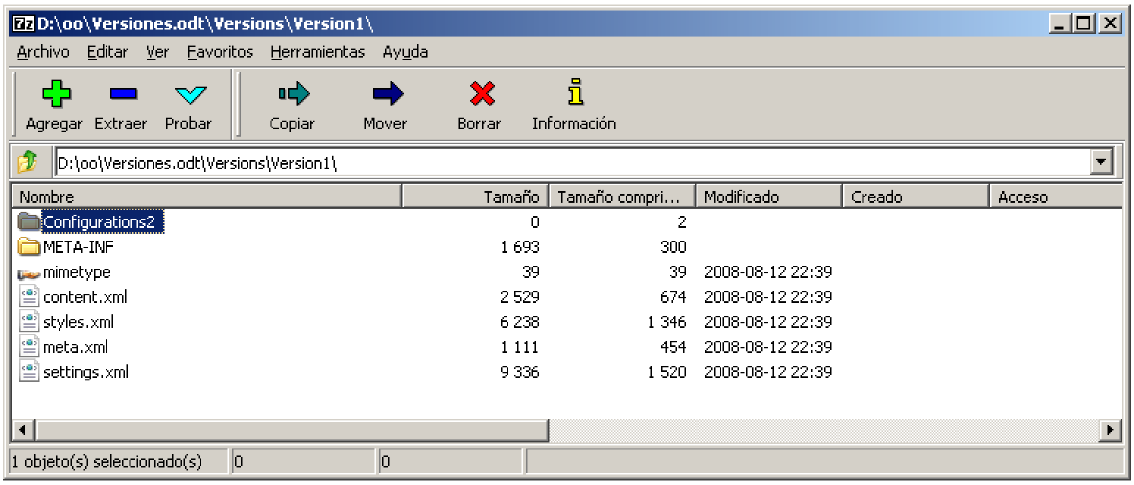
Figure 21: Document's versions (Software in Spanish)

Within an ODF document that contains different versions we can find important information. First of all, a file called VersionList.xml with information about who saved each different version and when:

```
<?xml version="1.0" encoding="UTF-8" ?>
<VL:version-list xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:VL="http://openoffice.org/2001/versions-list">
<VL:version-entry VL:title="Version1" VL:comment="Versión guardada automáticamente"
VL:creator="MiNombre MiApellido" dc:date-time="2008-08-13T00:39:22" />
<VL:version-entry VL:title="Version2" VL:comment="Versión guardada automáticamente"
VL:creator="MiNombre MiApellido" dc:date-time="2008-08-13T00:41:53" />
…
</VL:version-list>
```

Figure 22: VersionList.xml

Secondly, all the different versions of the document are stored in a folder called "Versions". For each of them, we can find the complete structure of a document in OpenOffice, ODF, that is, each version contains the files meta.xml, settings.xml, content.xml, etc...



Nombre	Tamaño	Tamaño compri...	Modificado	Creado	Acceso
Configurations2	0	2			
META-INF	1 693	300			
mimetype	39	39	2008-08-12 22:39		
content.xml	2 529	674	2008-08-12 22:39		
styles.xml	6 238	1 346	2008-08-12 22:39		
meta.xml	1 111	454	2008-08-12 22:39		
settings.xml	9 336	1 520	2008-08-12 22:39		

1 objeto(s) seleccionado(s) 0 0

Figure 23: Versions folder

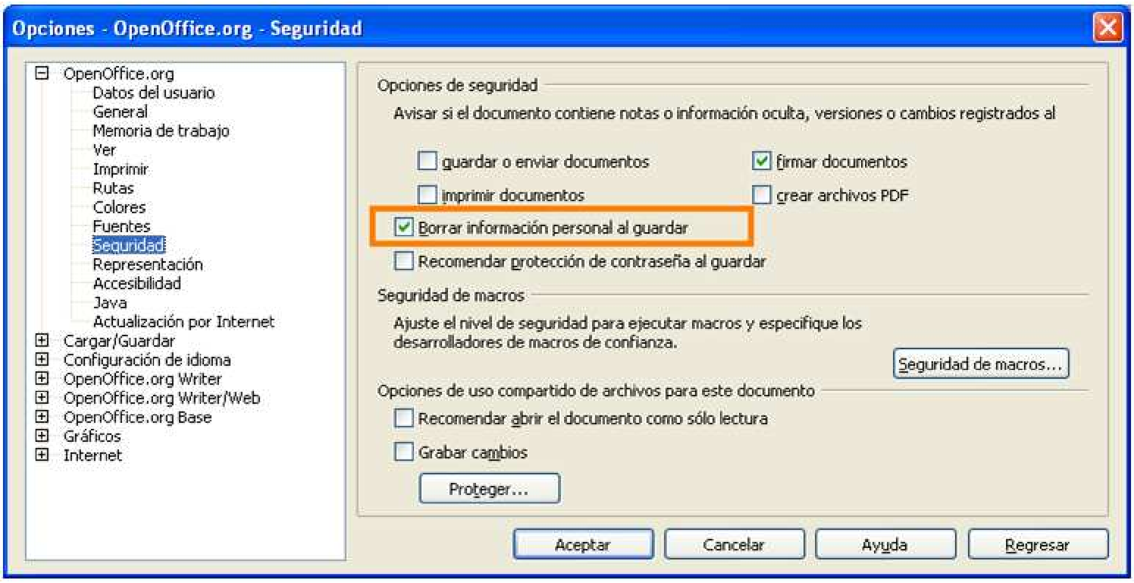
2.13 ANALYSIS AND CLEANING TOOLS

There are some tools to analyze and remove Metadata in OpenOffice, such as 3BOpenDoc or 3BClean, but these tools only remove the file meta.xml, leaving the information about printers, possible internal servers and data connections to databases in the files settings.xml and content.xml.

It is true that the meta.xml file is especially important because, as the documentation says, this file is not going to be encrypted even when you save the file as password protected, but in terms of security the rest of the Metadata is equal.

Therefore it is very important to have a tool capable of analyzing all the information stored in these files and providing a convenient and user-friendly environment for all users in an organization to clean al the Metadata files in OpenOffice.

OpenOffice itself offers the option to "Remove personal information when you leave," but this option does not remove the information from the operating system, printers, the version of the product, the path to the template. And we have seen that this information can show hidden routes or addresses from internal servers and of course, connection information to databases



Opciones de seguridad

Avisar si el documento contiene notas o información oculta, versiones o cambios registrados al

□ guardar o enviar documentos ☑ firmar documentos

□ imprimir documentos □ crear archivos PDF

☑ Borrar información personal al guardar

□ Recomendar protección de contraseña al guardar

Seguridad de macros

Ajuste el nivel de seguridad para ejecutar macros y especifique los desarrolladores de macros de confianza.

Opciones de uso compartido de archivos para este documento

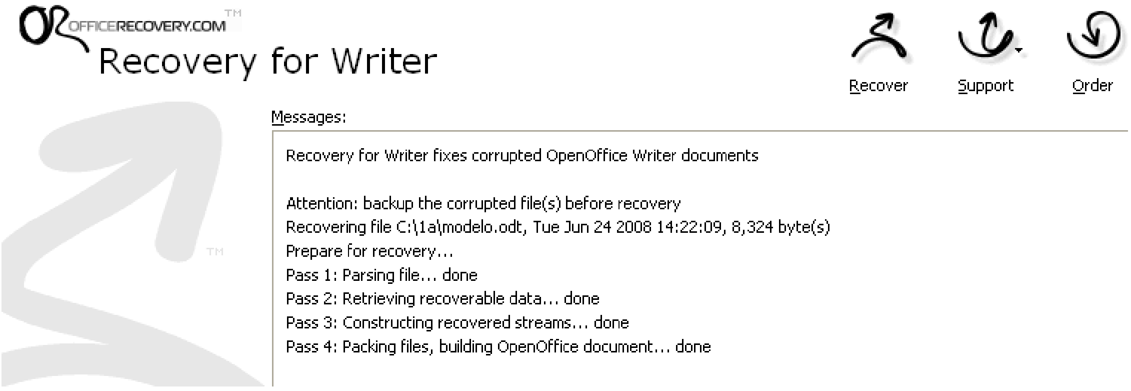
□ Recomendar abrir el documento como sólo lectura

□ Grabar cambios

Figure 24: Delete all personal information when save the document (Software in Spanish)

As a conclusion, the "Delete all personal information" option and the use of the available tools eliminate some metadata but not all the hidden information within an OpenOffice document.

A last alternative is to use tools to recover damaged documents. Using the Recovery for Writer, for example, the information stored in the meta.xml and settings.xml files, disappears. However, the information about the structure of the database and the connection in the content.xml file does not disappear, and in documents created with templates, the look of the document may change. Therefore, it is not a definitive solution.



```
Recovery for Writer fixes corrupted OpenOffice Writer documents

Attention: backup the corrupted file(s) before recovery
Recovering file C:\1a\modelo.odt, Tue Jun 24 2008 14:22:09, 8,324 byte(s)
Prepare for recovery...
Pass 1: Parsing file... done
Pass 2: Retrieving recoverable data... done
Pass 3: Constructing recovered streams... done
Pass 4: Packing files, building OpenOffice document... done
```

Figure 25: Recovery for Writter

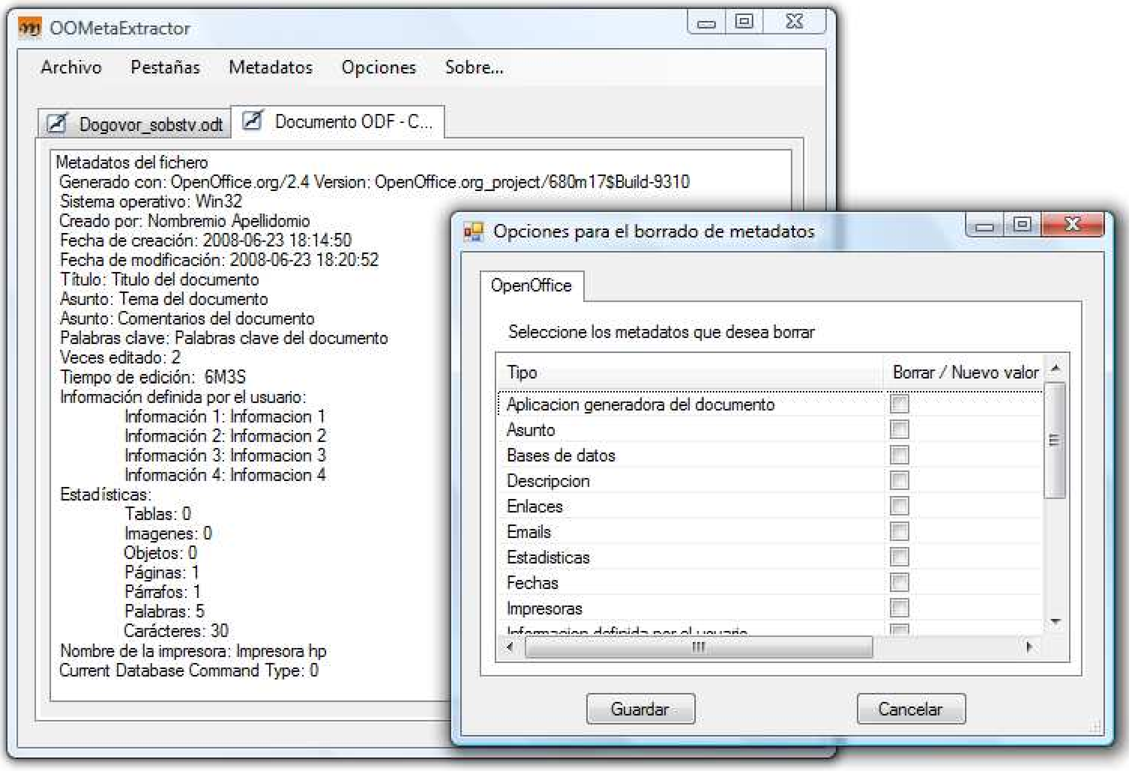
2.14 OOMetaExtractor

As a better solution we conclude to develop a tool to extract and clean metadata and hidden info in OpenOffice documents. This tool is available under a Microsoft Public License in Codeplex web site. It has been developed in .Net so it needs .NET Framework and it has been tested only in Microsoft Windows operating systems.

This tool allows users to analyze not only an ODF document but also a complete folder full of ODF documents in ODT, ODS or ODP formats. All metadata and hidden info are shown and can be exported in a text file. Moreover, this tool cleans all documents, even templates, links to documents, printer configuration and customized metadata.

In order to create a company’s policy with metadata this tool has an option to set up a template for metadata. This means, what to do whit some kind of metadata. For instance, it would be desirable set up company’s name in company metadata, or a fixed author for all documents.

This can be done easily with OOMetaExtractor. This tool is available for download along with its source code at http://www.codeplex.com/oometaextractor



```
Metadatos del fichero
 Generado con: OpenOffice.org/2.4 Version: OpenOffice.org_project/680m17$Build-9310
 Sistema operativo: Win32
 Creado por: Nombremio Apellidomio
 Fecha de creación: 2008-06-23 18:14:50
 Fecha de modificación: 2008-06-23 18:20:52
 Título: Titulo del documento
 Asunto: Tema del documento
 Asunto: Comentarios del documento
 Palabras clave: Palabras clave del documento
 Veces editado: 2
 Tiempo de edición:  6M3S
 Información definida por el usuario:
          Información 1: Informacion 1
          Información 2: Informacion 2
          Información 3: Informacion 3
          Información 4: Informacion 4
 Estadísticas:
          Tablas: 0
          Imagenes: 0
          Objetos: 0
          Páginas: 1
          Párrafos: 1
          Palabras: 5
          Carácteres: 30
 Nombre de la impresora: Impresora hp
 Current Database Command Type: 0
```

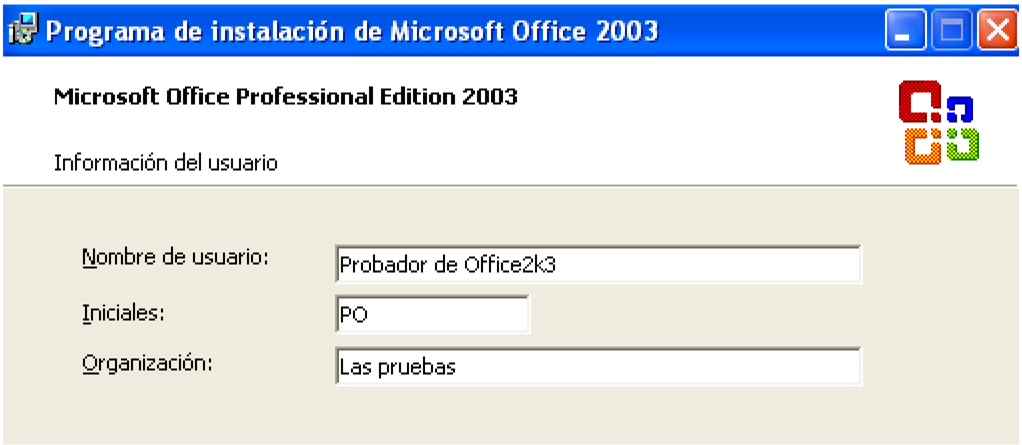
Seleccione los metadatos que desea borrar

Tipo	Borrar / Nuevo valor
Aplicacion generadora del documento	□
Asunto	□
Bases de datos	□
Descripcion	□
Enlaces	□
Emails	□
Estadisticas	□
Fechas	□
Impresoras	□
Informacion definida por el usuario	□

Figure 26: OOMetaExtractor (yes, it´s in Spanish)

3 METADATA AND HIDDEN INFORMATION INSIDE MICROSOFT OFFICE DOCUMENTS

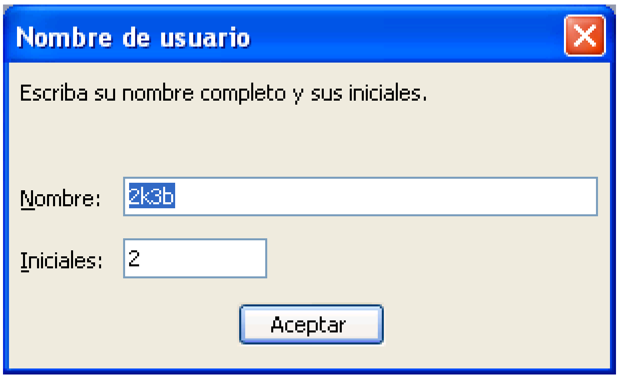
During the Microsoft Office installation, a dialog lets the user input information about him or her. From that moment on, the information the user provided will be added to each and every document created, or edited, by that user with this software.


Programa de instalación de Microsoft Office 2003
Microsoft Office Professional Edition 2003
Información del usuario

Nombre de usuario:	Probador de Office2k3
Iniciales:	PO
Organización:	Las pruebas

Figure 27: User Information in Microsoft Office 2003

In multi-user environments, the same product is often used by different users on the same computer. When a user runs an Office application for the first time, a new dialog appears asking for information about him or her. And, again, this information will be added to every document the user edits o creates.



Nombre de usuario

Escriba su nombre completo y sus iniciales.

Nombre: 2k3b

Iniciales: 2

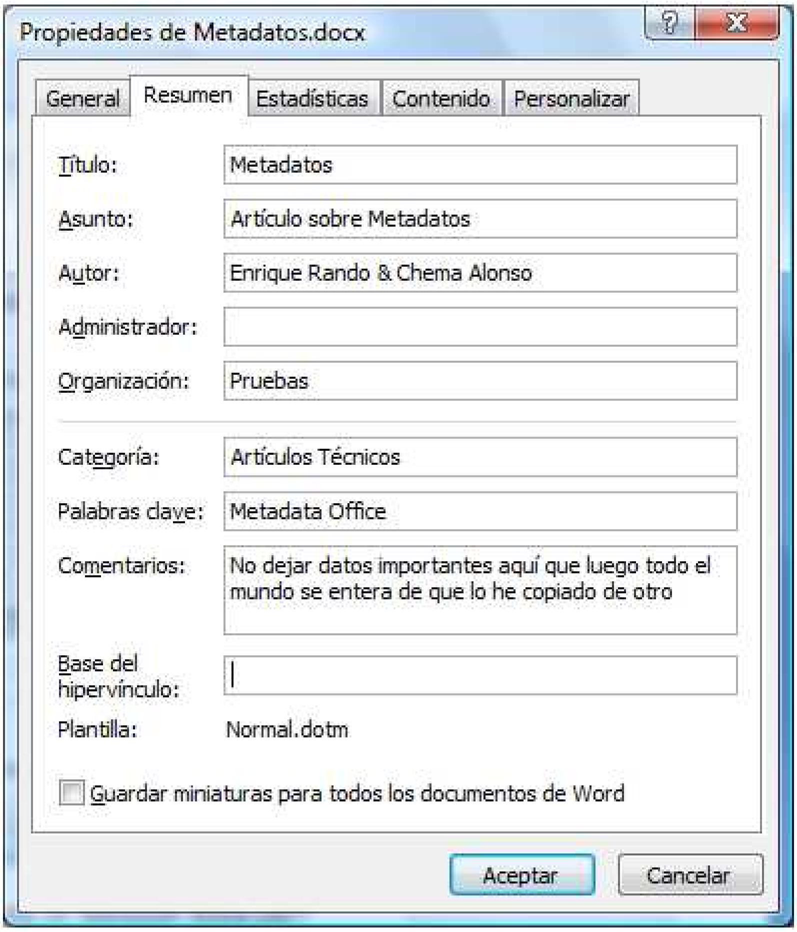
Figure 27: Another User stars Microsoft Office 2003

And this information can pose a risk, above all because the default value for the "Name" field is the user account name.

3.1 DOCUMENT PROPERTIES

Upon document creation, authors can explicitly assign metadata to it, that is, creator can introduce a short description, keywords, and their department o whatever that may be suitable or useful. This data gets stored indefinitely inside the document file. When a document containing metadata is used as a template in order to create new documents, these ones will inherit this information.

Document metadata is customizable, so they may contain any attribute and value the author could add. This must be kept into account when publishing documents created in corporative environments, because an inappropriate metadata can damage the organization image.



Propiedades de Metadatos.docx

Título: Metadatos

Asunto: Artículo sobre Metadatos

Autor: Enrique Rando & Chema Alonso

Administrador:

Organización: Pruebas

Categoría: Artículos Técnicos

Palabras clave: Metadata Office

Comentarios: No dejar datos importantes aquí que luego todo el mundo se entera de que lo he copiado de otro

Base del hipervínculo:

Plantilla: Normal.dotm

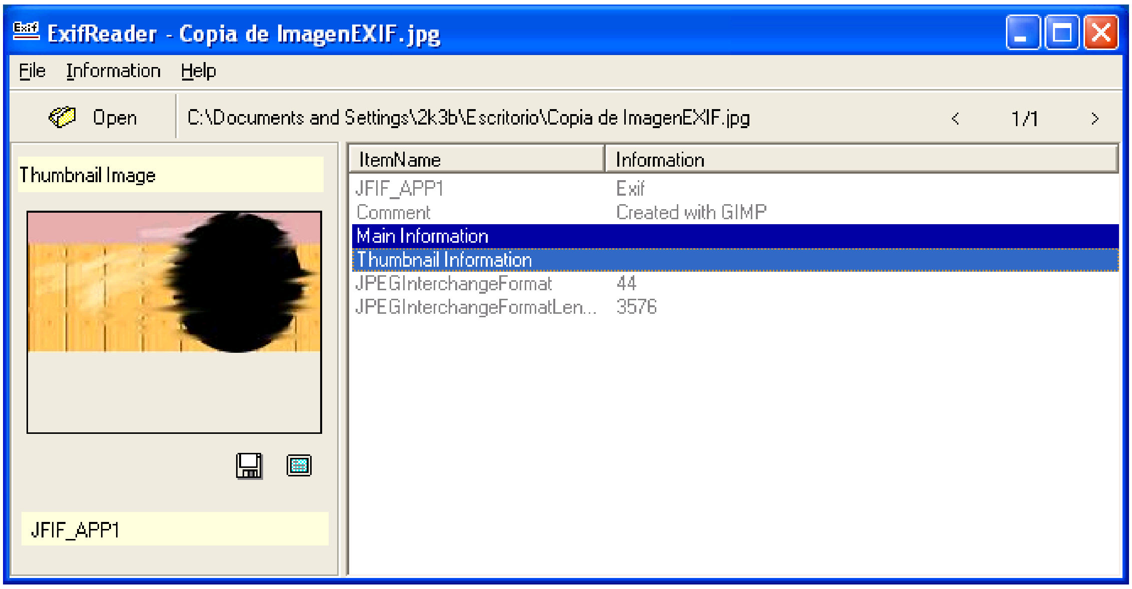
□ Guardar miniaturas para todos los documentos de Word

Figure 28: Document´s properties (all in Spanish….)

3.2 EMBEDDED FILES

Microsoft Office allows users to embed images and other documents into the documents they create. These embedded documents may contain their own metadata, thus being a potential source for information leaks.

The next example shown an image file created with GIMP, a graphic document creation program. That image contains EXIF information, readable with any EXIF extraction tool. It may be seen that the image has a metadata attribute showing the program used. It also has a thumbnail for the image inside the same file.


ExifReader - Copia de ImagenEXIF.jpg
File
Information
Help
Open
C:\Documents and Settings\2k3b\Escritorio\Copia de ImagenEXIF.jpg
<
1/1
>
Thumbnail Image
JFIF_APP1

ItemName	Information
JFIF_APP1	Exif
Comment	Created with GIMP
Main Information	
Thumbnail Information	
JPEGInterchangeFormat	44
JPEGInterchangeFormatLen...	3576

Figure 29: EXIF Metadata in an embedded image

Let's embed this image inside a Microsoft Word 97 document, using the "Insert Image" option from the "File" menu. Then, using a hexadecimal editor, the image metadata can be read.

3.3 EXTRACTING EMBEDDED FILES

It is easy to extract these embedded files from Microsoft Word DOC, Excel XLS or PowerPoint PPT files. Just by saving the document in HTML (web page) format, these programs extract embedded files and store them as independent files.

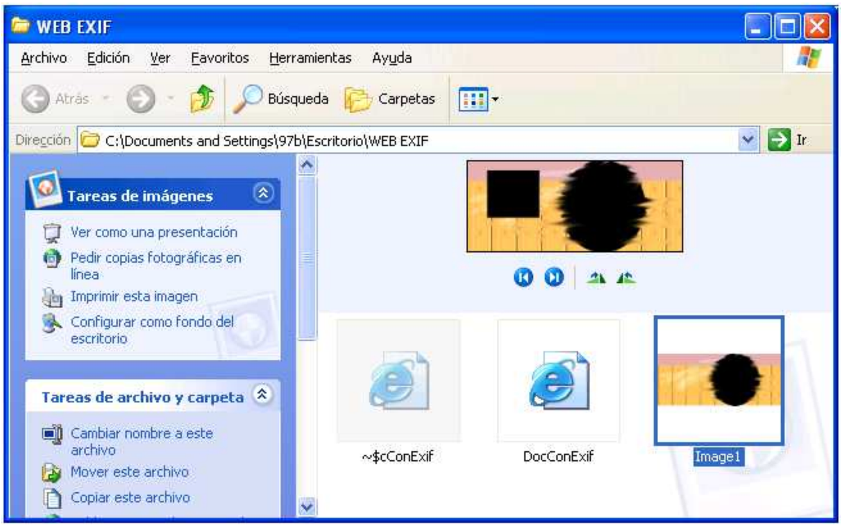
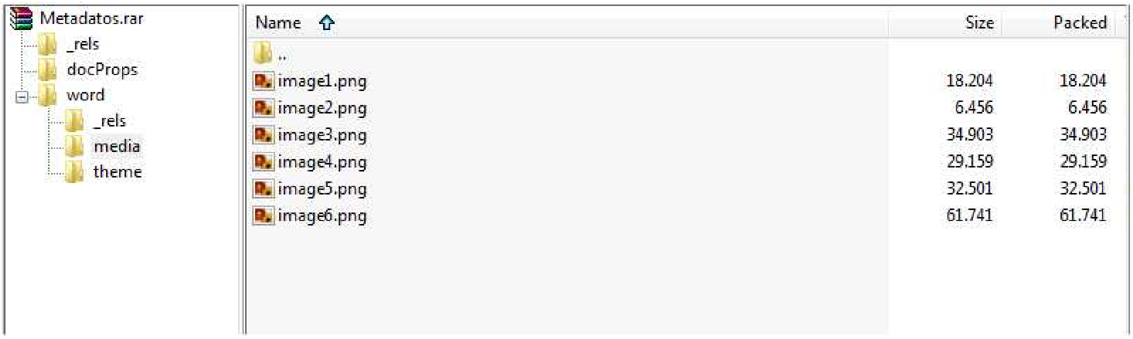

WEB EXIF
Archivo
Edición
Ver
Favoritos
Herramientas
Ayuda
Atrás
Búsqueda
Carpetas
Dirección
C:\Documents and Settings\97b\Escritorio\WEB EXIF
Ir
Tareas de imágenes
Ver como una presentación
Pedir copias fotográficas en línea
Imprimir esta imagen
Configurar como fondo del escritorio
Tareas de archivo y carpeta
Cambiar nombre a este archivo
Mover este archivo
Copiar este archivo
~$cConExif
DocConExif
Image1

Figure 30: Extracting embedded files

It can be seen that EXIF information has not been modified. In this example, the thumbnail looks different from the image, showing that some editing work has been made on it.

This metadata preserving behavior can be found in Microsoft Office versions. They don't modify EXIF information unless the author uses the "Modify Image" option and then, saves the document.

Microsoft Office 2007 introduces a new file format, called OOXML which will become to ISO DIS 29500 in next Microsoft Office versions. DOCX, XLSX, and PPTX files are ZIP compressed archives in which embedded files are stored as independent items. These items can also be easily extracted.



Metadatos.rar
- _rels
- docProps
- word
  - _rels
  - media
  - theme

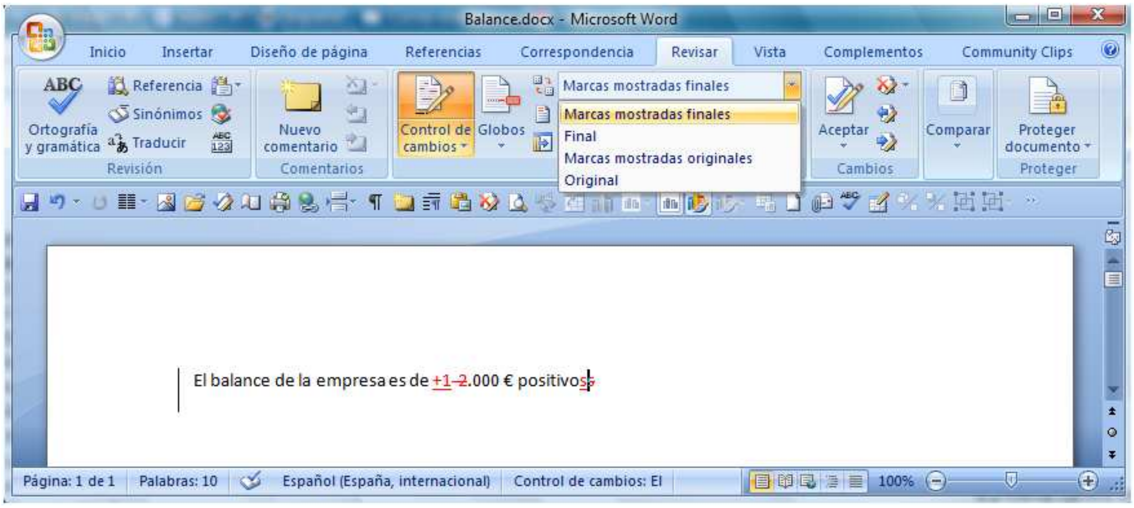
Name	Size	Packed
..		
image1.png	18.204	18.204
image2.png	6.456	6.456
image3.png	34.903	34.903
image4.png	29.159	29.159
image5.png	32.501	32.501
image6.png	61.741	61.741

Figure 31: Files inside an OOXML file

3.4 Revisions y Modifications

Users involved in document sharing and workflows find Microsoft Office "Revision" feature especially useful. This feature allows more than one user to work on the same document, while keeping track of who made each change, so that previous document states can be recovered.

But when the document is made available to the public, this data is no longer useful and can turn into compromising information.



El balance de la empresa es de +1~~-2~~.000 € positivos

Figure 32: Changes can be seen (Image in Spanish)

As the image shows, older contents are shown in red color. Final document view gives a positive result, while the older one gave a negative one. This could be seen by any user, only by selecting the "see original document".

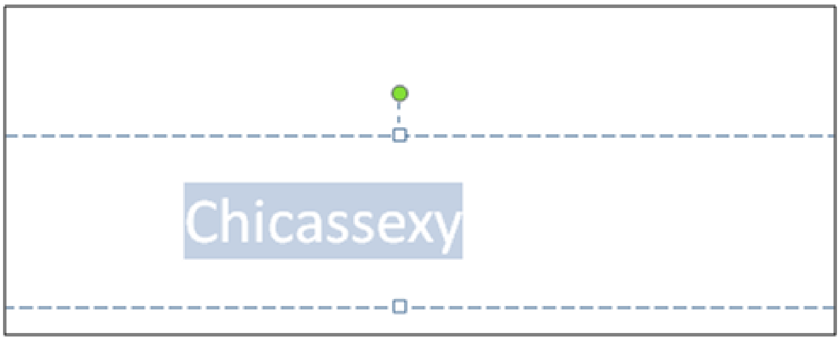
3.5 NOTES, HEADERS AND PAGE FOOTINGS

There are other places where non intended information may appear, such as notes and page headers and footers, or presentation annotations. They can contain reference codes used inside the organization, names of users that worked on the document or file paths. All this information must be taken into account before the document is published.

3.6 ELEMENTS HIDDEN BY THEIR FORMAT

In a Microsoft Office document, an image can be hidden by other ones above it. Template elements may contain undesired data that afterwards can be hidden by document text or images. Some text can be of the same color than the background. All these items are not visible, but they remain within the document and therefore can be use to extract information.

Errors and negligent or malicious behaviors may cause this kind of data be part of the documents the organization publishes or send out.

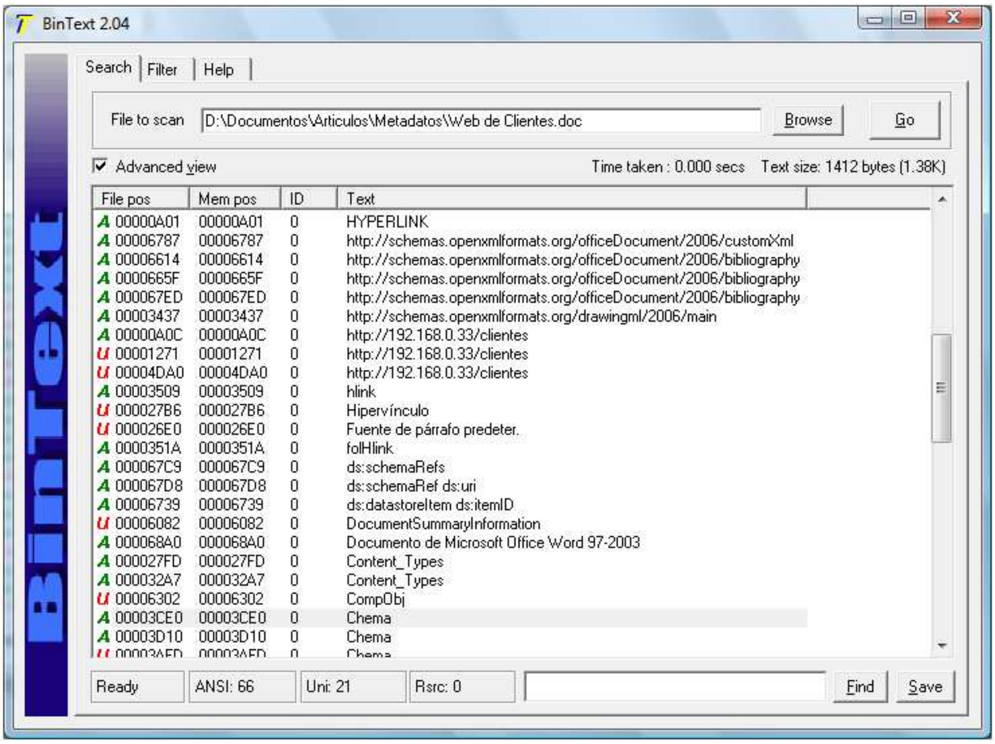


Chicassexy

Figure 33: Data hidden by document's format

3.7 OTHER PLACES WHERE TO LOOK FOR DATA

The list of places where undesired data may appear is very long: comments, style sheets, hyperlinks to Intranet servers, or even parameters or variable names in VBScript macros… All this data can be easily retrieved using a hexadecimal editor or a string extraction program.



File to scan: D:\Documentos\Articulos\Metadatos\Web de Clientes.doc

☑ Advanced view

Time taken : 0.000 secs   Text size: 1412 bytes (1.38K)

File pos	Mem pos	ID	Text
A 00000A01	00000A01	0	HYPERLINK
A 00006787	00006787	0	http://schemas.openxmlformats.org/officeDocument/2006/customXml
A 00006614	00006614	0	http://schemas.openxmlformats.org/officeDocument/2006/bibliography
A 0000665F	0000665F	0	http://schemas.openxmlformats.org/officeDocument/2006/bibliography
A 000067ED	000067ED	0	http://schemas.openxmlformats.org/officeDocument/2006/bibliography
A 00003437	00003437	0	http://schemas.openxmlformats.org/drawingml/2006/main
A 00000A0C	00000A0C	0	http://192.168.0.33/clientes
U 00001271	00001271	0	http://192.168.0.33/clientes
U 00004DA0	00004DA0	0	http://192.168.0.33/clientes
A 00003509	00003509	0	hlink
U 000027B6	000027B6	0	Hipervínculo
U 000026E0	000026E0	0	Fuente de párrafo predeter.
A 0000351A	0000351A	0	folHlink
A 000067C9	000067C9	0	ds:schemaRefs
A 000067D8	000067D8	0	ds:schemaRef ds:uri
A 00006739	00006739	0	ds:datastoreItem ds:itemID
U 00006082	00006082	0	DocumentSummaryInformation
A 000068A0	000068A0	0	Documento de Microsoft Office Word 97-2003
A 000027FD	000027FD	0	Content_Types
A 000032A7	000032A7	0	Content_Types
U 00006302	00006302	0	CompObj
A 00003CE0	00003CE0	0	Chema
A 00003D10	00003D10	0	Chema
U 00003AFD	00003AFD	0	Chema

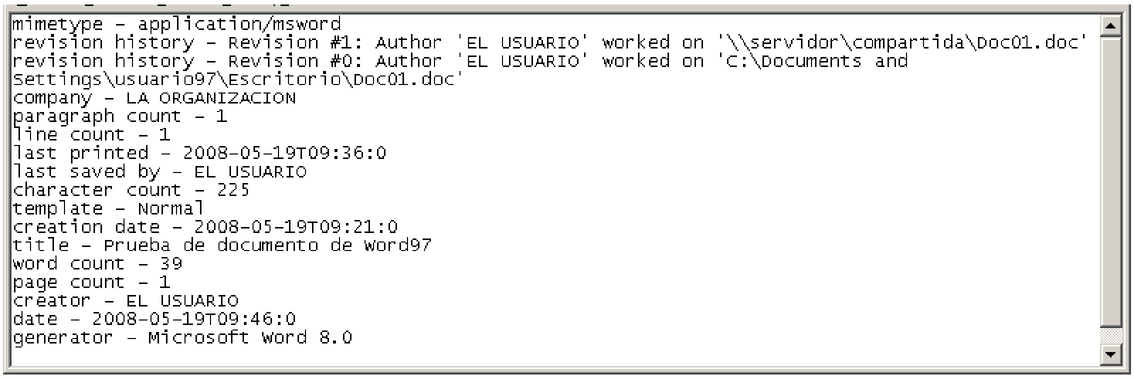
Ready   ANSI: 66   Uni: 21   Rsrc: 0

Figure 34: Strings extracted from an OOXML file using bintext

3.8 HIDDEN METADATA

So far, this part about Microsoft Office has dealt with metadata and information easily accessible, and sometimes editable, by the user. But there is another kind of data that is stored inside documents and is not available to the user.

These metadata are used by Microsoft Office in order to perform its own tasks. And they may contain compromising information such as software versions, authors, revision history, the last person who edited it and when he did it, the last time the document was printed, which printer was used, total editing time for the document, information about e-mail messages including e-mail addresses, and even, in some earlier versions of Office, a Global Unique ID that identifies the computer on which the document was edited.

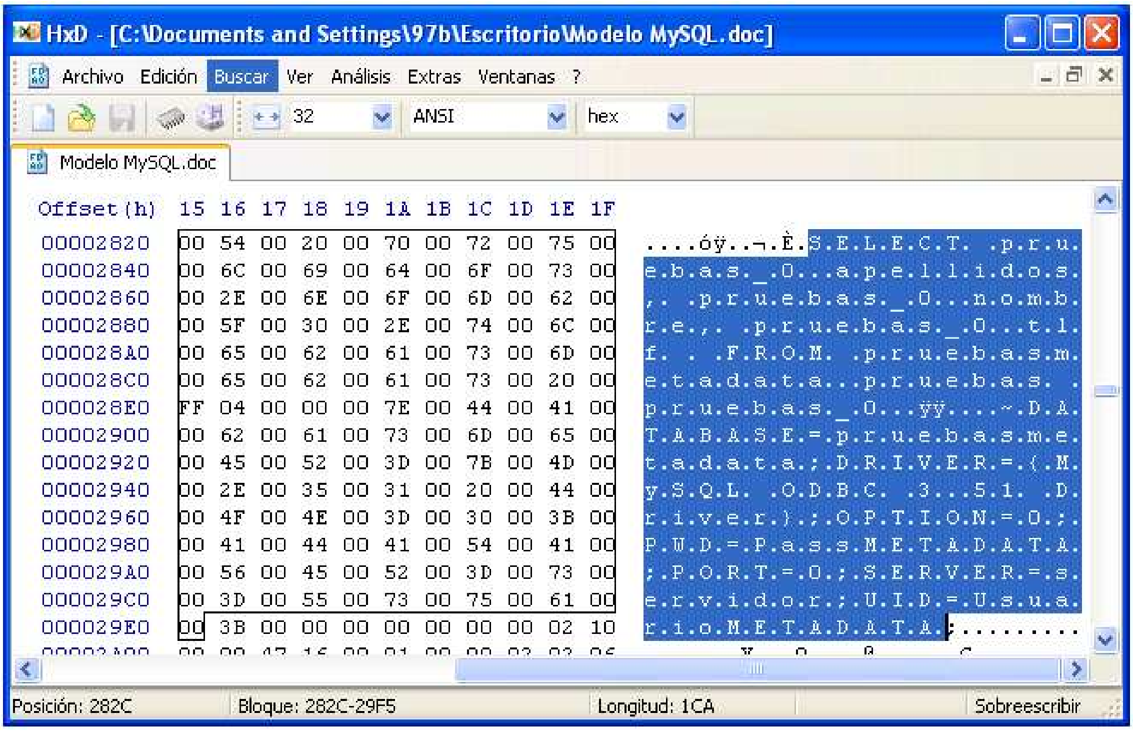


```
mimetype - application/msword
revision history - Revision #1: Author 'EL USUARIO' worked on '\\servidor\compartida\Doc01.doc'
revision history - Revision #0: Author 'EL USUARIO' worked on 'C:\Documents and
Settings\usuario97\Escritorio\Doc01.doc'
company - LA ORGANIZACION
paragraph count - 1
line count - 1
last printed - 2008-05-19T09:36:0
last saved by - EL USUARIO
character count - 225
template - Normal
creation date - 2008-05-19T09:21:0
title - Prueba de documento de Word97
word count - 39
page count - 1
creator - EL USUARIO
date - 2008-05-19T09:46:0
generator - Microsoft Word 8.0
```

Figure 35: Extracted document's metadata using Libextractor

3.9 DATABASE CONNECTIONS

Information stored in a particular file depends on the Microsoft Office version used and the file format. Sometimes, if document is using an external source to be constructed even information about databases and ODBC drivers can be retrieved. The following image shows a SELECT query, configured ODBC drivers, the database server, database itself and the password too.



```
Offset(h) 15 16 17 18 19 1A 1B 1C 1D 1E 1F

00002820  00 54 00 20 00 70 00 72 00 75 00   ....óÿ..¬.È.S.E.L.E.C.T. .p.r.u.
00002840  00 6C 00 69 00 64 00 6F 00 73 00   e.b.a.s._.0...a.p.e.l.l.i.d.o.s.
00002860  00 2E 00 6E 00 6F 00 6D 00 62 00   ,. .p.r.u.e.b.a.s._.0...n.o.m.b.
00002880  00 5F 00 30 00 2E 00 74 00 6C 00   r.e.,. .p.r.u.e.b.a.s._.0...t.l.
000028A0  00 65 00 62 00 61 00 73 00 6D 00   f. . .F.R.O.M. .p.r.u.e.b.a.s.m.
000028C0  00 65 00 62 00 61 00 73 00 20 00   e.t.a.d.a.t.a...p.r.u.e.b.a.s. .
000028E0  FF 04 00 00 00 7E 00 44 00 41 00   p.r.u.e.b.a.s._.0...ÿÿ....~.D.A.
00002900  00 62 00 61 00 73 00 6D 00 65 00   T.A.B.A.S.E.=.p.r.u.e.b.a.s.m.e.
00002920  00 45 00 52 00 3D 00 7B 00 4D 00   t.a.d.a.t.a.;.D.R.I.V.E.R.=.{.M.
00002940  00 2E 00 35 00 31 00 20 00 44 00   y.S.Q.L. .O.D.B.C. .3...5.1. .D.
00002960  00 4F 00 4E 00 3D 00 30 00 3B 00   r.i.v.e.r.}.;.O.P.T.I.O.N.=.0.;.
00002980  00 41 00 44 00 41 00 54 00 41 00   P.W.D.=.P.a.s.s.M.E.T.A.D.A.T.A.
000029A0  00 56 00 45 00 52 00 3D 00 73 00   ;.P.O.R.T.=.0.;.S.E.R.V.E.R.=.s.
000029C0  00 3D 00 55 00 73 00 75 00 61 00   e.r.v.i.d.o.r.;.U.I.D.=.U.s.u.a.
000029E0  00 3B 00 00 00 00 00 00 00 02 10   r.i.o.M.E.T.A.D.A.T.A.;.........
```

Posición: 282C | Bloque: 282C-29F5 | Longitud: 1CA | Sobreescribir

Figure 36: Database info

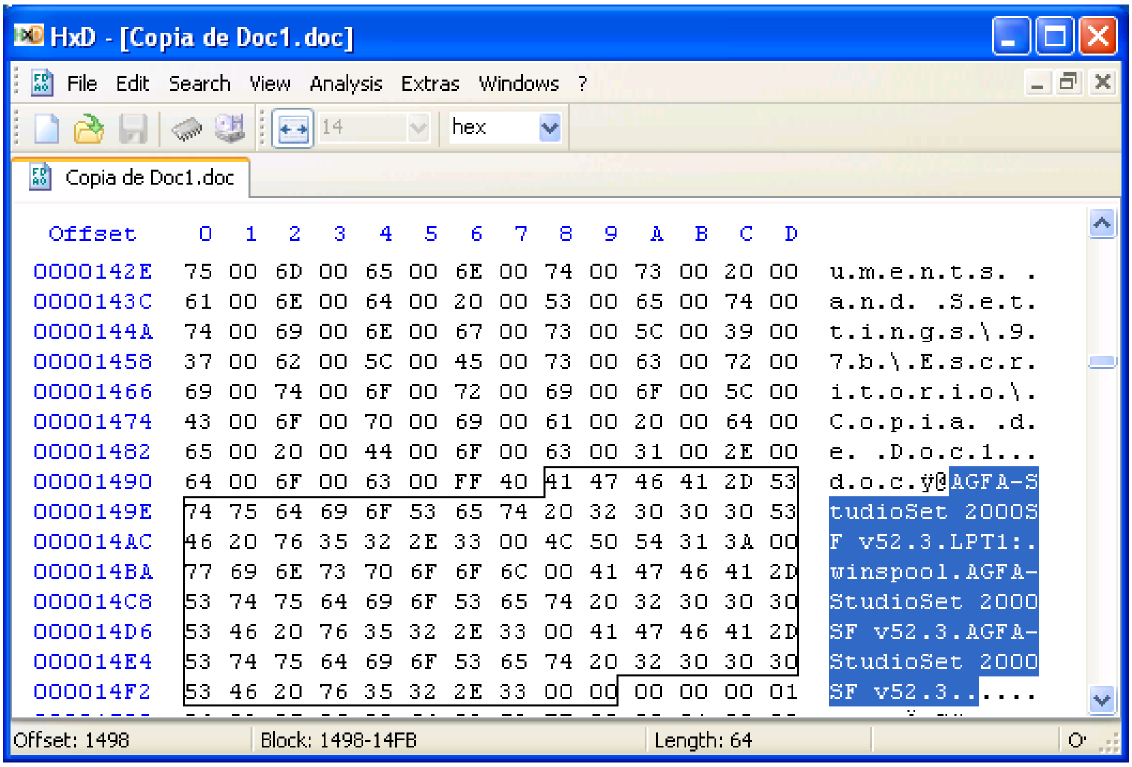
Putting it in clear text in figure 36, we have:

SELECT pruebas_0.apellidos, pruebas_0.nombre, pruebas_0.tlf FROM
pruebasmetadata.pruebas pruebas_0
DATABASE=pruebasmetadata
DRIVER={MySQL ODBC 3.51 Driver} OPTION=0
PWD=PassMETADATA
PORT=0 SERVER=servidor
UID=UsuarioMETADATA

A hexadecimal editor is, again, all it takes to read this data from a document. As can be seen, this is a special document created to generate documents changing some special parts which are coming from a database repository.

3.10 PRINTERS

As it was seen before, revision history provides information about user accounts and paths that may relate to server names and shared resources. Another compromising hidden piece of information that can be found inside documents is printer data.



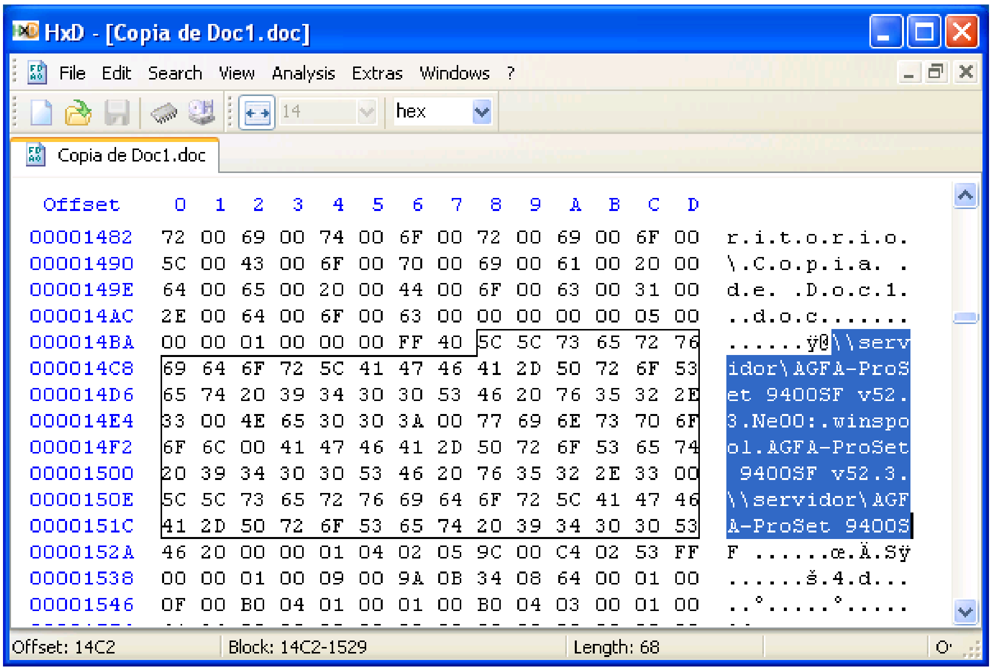
```
Offset    0  1  2  3  4  5  6  7  8  9  A  B  C  D

0000142E  75 00 6D 00 65 00 6E 00 74 00 73 00 20 00  u.m.e.n.t.s. .
0000143C  61 00 6E 00 64 00 20 00 53 00 65 00 74 00  a.n.d. .S.e.t.
0000144A  74 00 69 00 6E 00 67 00 73 00 5C 00 39 00  t.i.n.g.s.\.9.
00001458  37 00 62 00 5C 00 45 00 73 00 63 00 72 00  7.b.\.E.s.c.r.
00001466  69 00 74 00 6F 00 72 00 69 00 6F 00 5C 00  i.t.o.r.i.o.\.
00001474  43 00 6F 00 70 00 69 00 61 00 20 00 64 00  C.o.p.i.a. .d.
00001482  65 00 20 00 44 00 6F 00 63 00 31 00 2E 00  e. .D.o.c.1...
00001490  64 00 6F 00 63 00 FF 40 41 47 46 41 2D 53  d.o.c.ÿ@AGFA-S
0000149E  74 75 64 69 6F 53 65 74 20 32 30 30 30 53  tudioSet 2000S
000014AC  46 20 76 35 32 2E 33 00 4C 50 54 31 3A 00  F v52.3.LPT1:.
000014BA  77 69 6E 73 70 6F 6F 6C 00 41 47 46 41 2D  winspool.AGFA-
000014C8  53 74 75 64 69 6F 53 65 74 20 32 30 30 30  StudioSet 2000
000014D6  53 46 20 76 35 32 2E 33 00 41 47 46 41 2D  SF v52.3.AGFA-
000014E4  53 74 75 64 69 6F 53 65 74 20 32 30 30 30  StudioSet 2000
000014F2  53 46 20 76 35 32 2E 33 00 00 00 00 00 01  SF v52.3......
```

Offset: 1498 | Block: 1498-14FB | Length: 64

Figure 37: Information about printer

As in ODF documents, sensitivity of this information depends on the way printer had been configured. When the printer is shared on a server, it can appear in UNC format, thus providing a server name and a shared resource and even the server's IP address, revealing the way the internal network has been addressed.

Although this is quite important by itself it is giving more information to a potential attacker just because if document´s creator is using that printer then it means that user has access to that resource so, of course, that user is a valid one in server's. Hence, at the end, it´s also possible to discover information about network's ACLs.


HxD - [Copia de Doc1.doc]
File Edit Search View Analysis Extras Windows ?
14
hex
Copia de Doc1.doc

```
 Offset    0  1  2  3  4  5  6  7  8  9  A  B  C  D
00001482  72 00 69 00 74 00 6F 00 72 00 69 00 6F 00  r.i.t.o.r.i.o.
00001490  5C 00 43 00 6F 00 70 00 69 00 61 00 20 00  \.C.o.p.i.a. .
0000149E  64 00 65 00 20 00 44 00 6F 00 63 00 31 00  d.e. .D.o.c.1.
000014AC  2E 00 64 00 6F 00 63 00 00 00 00 00 05 00  ..d.o.c.......
000014BA  00 00 01 00 00 00 FF 40 5C 5C 73 65 72 76  ......ÿ@\\serv
000014C8  69 64 6F 72 5C 41 47 46 41 2D 50 72 6F 53  idor\AGFA-ProS
000014D6  65 74 20 39 34 30 30 53 46 20 76 35 32 2E  et 9400SF v52.
000014E4  33 00 4E 65 30 30 3A 00 77 69 6E 73 70 6F  3.Ne00:.winspo
000014F2  6F 6C 00 41 47 46 41 2D 50 72 6F 53 65 74  ol.AGFA-ProSet
00001500  20 39 34 30 30 53 46 20 76 35 32 2E 33 00   9400SF v52.3.
0000150E  5C 5C 73 65 72 76 69 64 6F 72 5C 41 47 46  \\servidor\AGF
0000151C  41 2D 50 72 6F 53 65 74 20 39 34 30 30 53  A-ProSet 9400S
0000152A  46 20 00 00 01 04 02 05 9C 00 C4 02 53 FF  F ......œ.Ä.Sÿ
00001538  00 00 01 00 09 00 9A 0B 34 08 64 00 01 00  ......š.4.d...
00001546  0F 00 B0 04 01 00 01 00 B0 04 03 00 01 00  ..°.....°.....
```

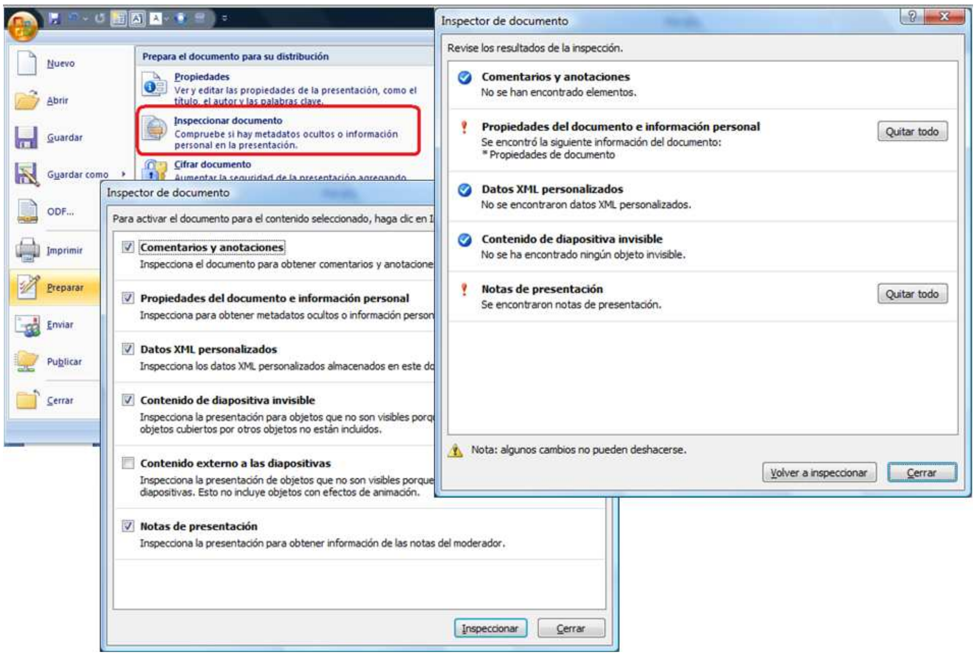
Offset: 14C2 | Block: 14C2-1529 | Length: 68

Figure 38: Printer in UNC format

Microsoft Office versions prior to Office 97 seldom include this information into document metadata. But all versions do update it if they find it, changing its value to the name of the printer currently in use, even if the document is not printed: a simple edition and saving is all it takes. Hence, documents which have been used by the organization since those old Office 97 times must be carefully inspected for printer data.

3.11 Document analysis and cleaning

Cleaning Microsoft Office documents before sending or publishing them is a must, since they may contain huge amounts of undesired data. The ultimate tool for accomplishing this task is the “Inspect Document” option available in Office 2007. It searches for all metadata and hidden information, including printer data or revision history, and gives the user the option to remove it all from the document. No matter what version of Microsoft Office was used no create and edit the document, “Inspect Document” will clean it with only a few clicks.



Prepara el documento para su distribución

Propiedades
Ver y editar las propiedades de la presentación, como el título, el autor y las palabras clave.

Inspeccionar documento
Compruebe si hay metadatos ocultos o información personal en la presentación.

Cifrar documento
Aumentar la seguridad de la presentación agregando

Inspector de documento

Para activar el documento para el contenido seleccionado, haga clic en I

☑ Comentarios y anotaciones
Inspecciona el documento para obtener comentarios y anotacione

☑ Propiedades del documento e información personal
Inspecciona para obtener metadatos ocultos o información person

☑ Datos XML personalizados
Inspecciona los datos XML personalizados almacenados en este do

☑ Contenido de diapositiva invisible
Inspecciona la presentación para objetos que no son visibles porq
objetos cubiertos por otros objetos no están incluidos.

□ Contenido externo a las diapositivas
Inspecciona la presentación de objetos que no son visibles porque
diapositivas. Esto no incluye objetos con efectos de animación.

☑ Notas de presentación
Inspecciona la presentación para obtener información de las notas del moderador.

Inspeccionar | Cerrar

Inspector de documento

Revise los resultados de la inspección.

✓ Comentarios y anotaciones
No se han encontrado elementos.

! Propiedades del documento e información personal — Quitar todo
Se encontró la siguiente información del documento:
* Propiedades de documento

✓ Datos XML personalizados
No se encontraron datos XML personalizados.

✓ Contenido de diapositiva invisible
No se ha encontrado ningún objeto invisible.

! Notas de presentación — Quitar todo
Se encontraron notas de presentación.

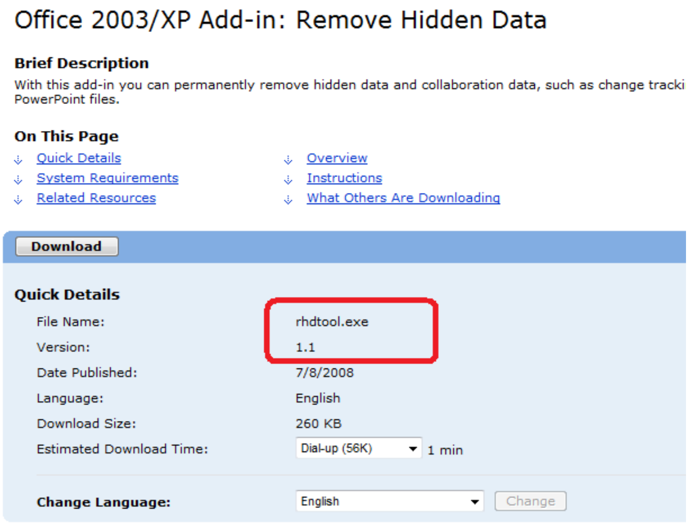
Nota: algunos cambios no pueden deshacerse.

Volver a inspeccionar | Cerrar

Figure 39: Preparing document in Microsoft Office 2007 (yes, it´s Spanish)

Previous versions of Microsoft Office didn't provide this option. For that reason, Microsoft released a plug-in to improve software with cleaning options. This tool is known as RHDTool and it´s available for downloading in the following URL:

http://www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=144e54ed-d43e-42ca-bc7b-5446d34e5360



Office 2003/XP Add-in: Remove Hidden Data

Brief Description

With this add-in you can permanently remove hidden data and collaboration data, such as change tracki PowerPoint files.

On This Page

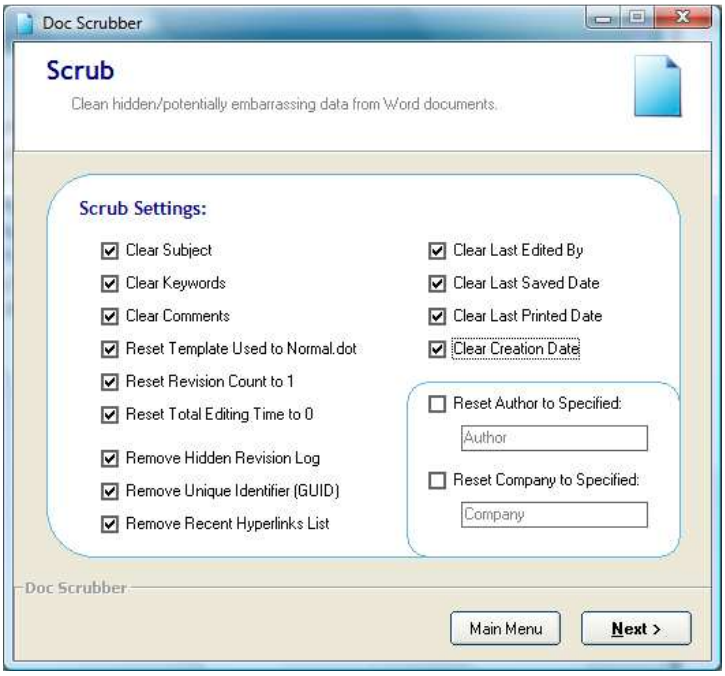
Quick Details

File Name:	rhdtool.exe
Version:	1.1
Date Published:	7/8/2008
Language:	English
Download Size:	260 KB
Estimated Download Time:	Dial-up (56K) 1 min
Change Language:	English

Figure 40: RHDTool

Also, Microsoft has published some guides to help users to minimize the amount of metadata in their documents (their URLs are in the References section of this paper).

Another option is using third party tools, like Metadata Extractor o Doc Scrubble. It must be said, anyway, that from the tests made it can be deduced that sometimes these tools don't clean all metadata and hidden information. For example, the following image shows DocScrubble options, and, for instance, although a document was cleaned using DocScrubble, it keeps containing printer data.



Doc Scrubber

Scrub

Clean hidden/potentially embarrassing data from Word documents.

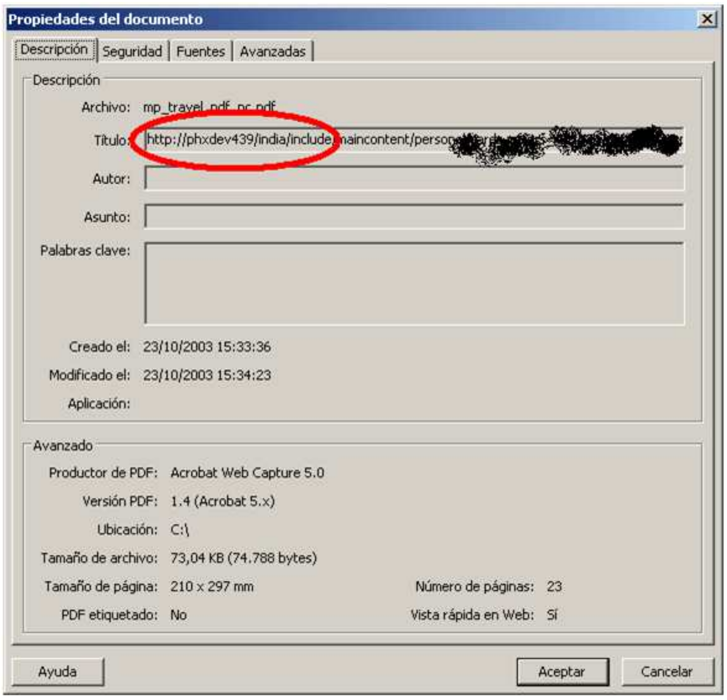
Scrub Settings:

☑ Clear Subject
☑ Clear Keywords
☑ Clear Comments
☑ Reset Template Used to Normal.dot
☑ Reset Revision Count to 1
☑ Reset Total Editing Time to 0
☑ Remove Hidden Revision Log
☑ Remove Unique Identifier (GUID)
☑ Remove Recent Hyperlinks List
☑ Clear Last Edited By
☑ Clear Last Saved Date
☑ Clear Last Printed Date
☑ Clear Creation Date
☐ Reset Author to Specified: Author
☐ Reset Company to Specified: Company

Figure 41: Printer info remains inside the file

It has been said that converting Microsoft Office to other formats may be a solution to the problems stated in this article, in particular, converting them to PDF format. But PDF files store information too, both in the "Data Dictionary" and in XMP streams.

These metadata may include user accounts, file paths, URLs pointing to Intranet servers, e-mail message headers including e-mail addresses, information about the Operating System and more.



Descripción

Archivo: mp_travel_pdf_pc.pdf

Título: http://phxdev439/india/include/maincontent/person[redacted]

Autor:

Asunto:

Palabras clave:

Creado el: 23/10/2003 15:33:36

Modificado el: 23/10/2003 15:34:23

Aplicación:

Avanzado

Productor de PDF: Acrobat Web Capture 5.0

Versión PDF: 1.4 (Acrobat 5.x)

Ubicación: C:\

Tamaño de archivo: 73,04 KB (74.788 bytes)

Tamaño de página: 210 x 297 mm

Número de páginas: 23

PDF etiquetado: No

Vista rápida en Web: Sí

Figure 42: PDF Metadata including Intranet references

But even converting documents to TXT format may not be enough, even if they contain no metadata at all. When a document is published in the corporate web, it becomes available to web search engines, as Google, MSN Search or Yahoo. And this search engines create new metadata about them: they give them a title, provide an abstract of their content as part of the results and store a cached version.

As that search engine generated metadata is created based upon the document content, any lost data that the document contains may turn into metadata.

4 METADATA EXTRACTION TOOLS

There are several tools to retrieve metadata from documents, depending on their format. Maybe, *libextractor* is the best known of them all. It features a library of functions to access document's properties and a standalone program, called "*extract*" which parses and extracts metadata from several file formats, including Microsoft Office documents, ODT, PDF and many more. The support for Microsoft Word DOC files includes extraction of the revision history, being one of the few tools freely available to accomplish this task.

Metagoofil is a program that downloads documents from web sites and afterwards extracts metadata from them using *extract* tool, making the process of fingerprinting corporate networks easier.

Exiftool is another open source metadata extraction tool. Originally designed to extract EXIF information from image files, it can process a huge amount of file formats, including again Microsoft Office Documents. When present, it can retrieve GUID information from old versions Microsoft Word files. Another remarkable feature of Exiftool is the way it deals with PDF documents, being able to extract both Data Dictionary and XMP metadata. It has an option that allows in deep scanning for XMP metadata even if it has been disassociated from the PDF file main tree structure. Both *extract* and *exiftool* are command line utilities.

There are tools to extract metadata through a GUI, like *ExifReader*. Anyway, this kind of programs tends to be less flexible and powerful than their command line alternatives.

But all these programs deal mostly with metadata and don't pay much attention to hidden information, with the exception of *extract* and its revision history processing. Neither printer information, templates paths, nor database information can be obtained by them. To solve this problem, new tools have to be made. And that's why the FOCA tool was created.

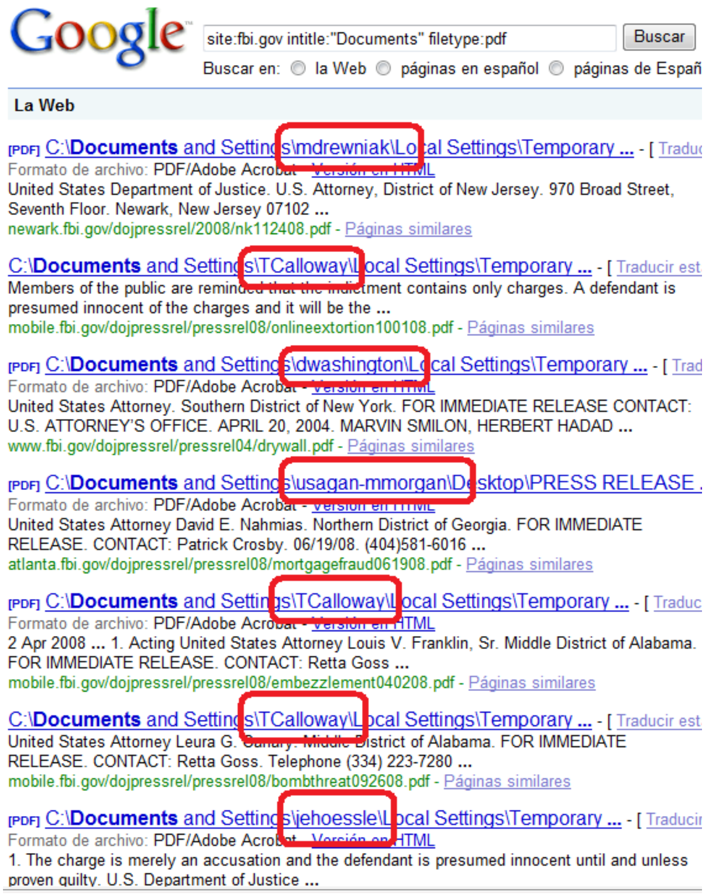
FOCA uses web search engines to locate documents, download them and extracts metadata and hidden information from them. It can retrieve information from several file formats, including Microsoft Office documents, ODF, Word Perfect files and more, and the range of information obtained is wider that the one achieved with any other tool mentioned here.

5 Search engines

When a document is published in the corporate web, it becomes available to web search engines, such as Google, Live Search or Yahoo. These search engines create new metadata about them: they give them a title, provide an abstract of their content as part of the results and store a cached version.

As that search-engine-generated metadata is created based upon document's content, any lost data document contains may turn into metadata. That is even worse if document does not contain title or customized metadata helping search engines to create a short description of it.

With a little Google Hacking work, addressing metadata fields as the "title" through using searching options as "intitle", compromising information can be retrieved. There is no need for even downloading documents hence organizations may not even notice someone is accessing sensitive data.



site:fbi.gov intitle:"Documents" filetype:pdf

Buscar en: ○ la Web ○ páginas en español ○ páginas de Españ

La Web

[PDF] C:\Documents and Settings\mdrewniak\Local Settings\Temporary ... - [Traduc
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
United States Department of Justice. U.S. Attorney, District of New Jersey. 970 Broad Street, Seventh Floor. Newark, New Jersey 07102 ...
newark.fbi.gov/dojpressrel/2008/nk112408.pdf - Páginas similares

C:\Documents and Settings\TCalloway\Local Settings\Temporary ... - [Traducir est
Members of the public are reminded that the indictment contains only charges. A defendant is presumed innocent of the charges and it will be the ...
mobile.fbi.gov/dojpressrel/pressrel08/onlineextortion100108.pdf - Páginas similares

[PDF] C:\Documents and Settings\dwashington\Local Settings\Temporary ... - [Trad
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
United States Attorney. Southern District of New York. FOR IMMEDIATE RELEASE CONTACT: U.S. ATTORNEY'S OFFICE. APRIL 20, 2004. MARVIN SMILON, HERBERT HADAD ...
www.fbi.gov/dojpressrel/pressrel04/drywall.pdf - Páginas similares

[PDF] C:\Documents and Settings\usagan-mmorgan\Desktop\PRESS RELEASE .
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
United States Attorney David E. Nahmias. Northern District of Georgia. FOR IMMEDIATE RELEASE. CONTACT: Patrick Crosby. 06/19/08. (404)581-6016 ...
atlanta.fbi.gov/dojpressrel/pressrel08/mortgagefraud061908.pdf - Páginas similares

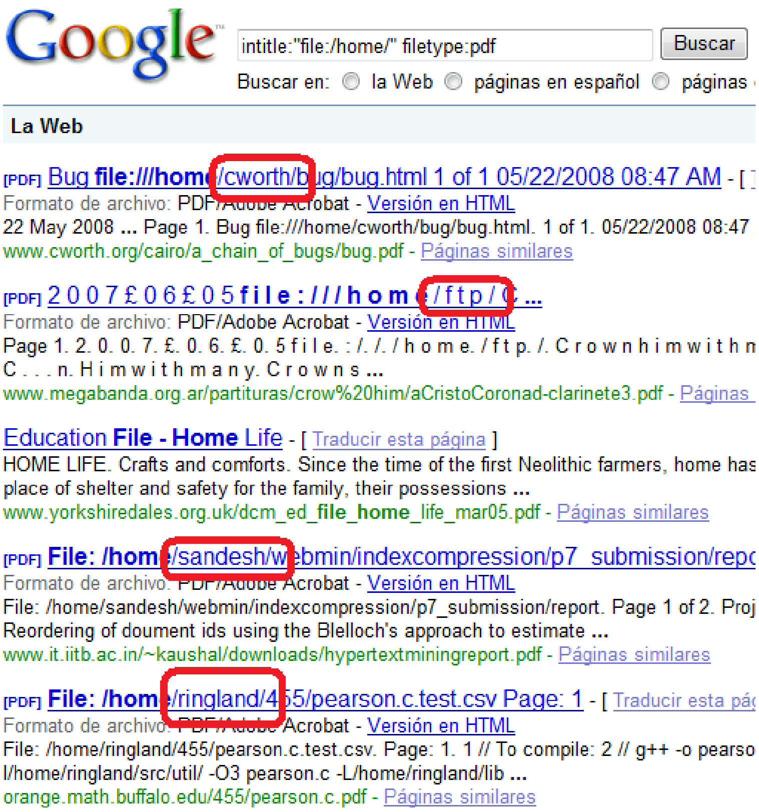
[PDF] C:\Documents and Settings\TCalloway\Local Settings\Temporary ... - [Traduc
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
2 Apr 2008 ... 1. Acting United States Attorney Louis V. Franklin, Sr. Middle District of Alabama. FOR IMMEDIATE RELEASE. CONTACT: Retta Goss ...
mobile.fbi.gov/dojpressrel/pressrel08/embezzlement040208.pdf - Páginas similares

C:\Documents and Settings\TCalloway\Local Settings\Temporary ... - [Traducir est
United States Attorney Leura G. Canary. Middle District of Alabama. FOR IMMEDIATE RELEASE. CONTACT: Retta Goss. Telephone (334) 223-7280 ...
mobile.fbi.gov/dojpressrel/pressrel08/bombthreat092608.pdf - Páginas similares

[PDF] C:\Documents and Settings\jehoessle\Local Settings\Temporary ... - [Traducir
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
1. The charge is merely an accusation and the defendant is presumed innocent until and unless proven guilty. U.S. Department of Justice ...

Figure 43: Fbi.gov users gathered by Google

Of course, this kind of data can be found in documents created or edited on Linux, and all Unix flavors, systems too:



intitle:"file:/home/" filetype:pdf

La Web

[PDF] Bug file:///home/cworth/bug/bug.html 1 of 1 05/22/2008 08:47 AM - [
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
22 May 2008 ... Page 1. Bug file:///home/cworth/bug/bug.html. 1 of 1. 05/22/2008 08:47
www.cworth.org/cairo/a_chain_of_bugs/bug.pdf - Páginas similares

[PDF] 2007£06£05file:///home/ftp/C ...
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
Page 1. 2. 0. 0. 7. £. 0. 6. £. 0. 5file. :/. /. /home. /ftp. /. Crownhimwithn
C. . . n. Himwithmany. Crowns ...
www.megabanda.org.ar/partituras/crow%20him/aCristoCoronad-clarinete3.pdf - Páginas

Education File - Home Life - [Traducir esta página]
HOME LIFE. Crafts and comforts. Since the time of the first Neolithic farmers, home has
place of shelter and safety for the family, their possessions ...
www.yorkshiredales.org.uk/dcm_ed_file_home_life_mar05.pdf - Páginas similares

[PDF] File: /home/sandesh/webmin/indexcompression/p7_submission/repo
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
File: /home/sandesh/webmin/indexcompression/p7_submission/report. Page 1 of 2. Proj
Reordering of doument ids using the Blelloch's approach to estimate ...
www.it.iitb.ac.in/~kaushal/downloads/hypertextminingreport.pdf - Páginas similares

[PDF] File: /home/ringland/455/pearson.c.test.csv Page: 1 - [Traducir esta pá
Formato de archivo: PDF/Adobe Acrobat - Versión en HTML
File: /home/ringland/455/pearson.c.test.csv. Page: 1. 1 // To compile: 2 // g++ -o pearso
I/home/ringland/src/util/ -O3 pearson.c -L/home/ringland/lib ...
orange.math.buffalo.edu/455/pearson.c.pdf - Páginas similares

*Figure 44: *NIX users*

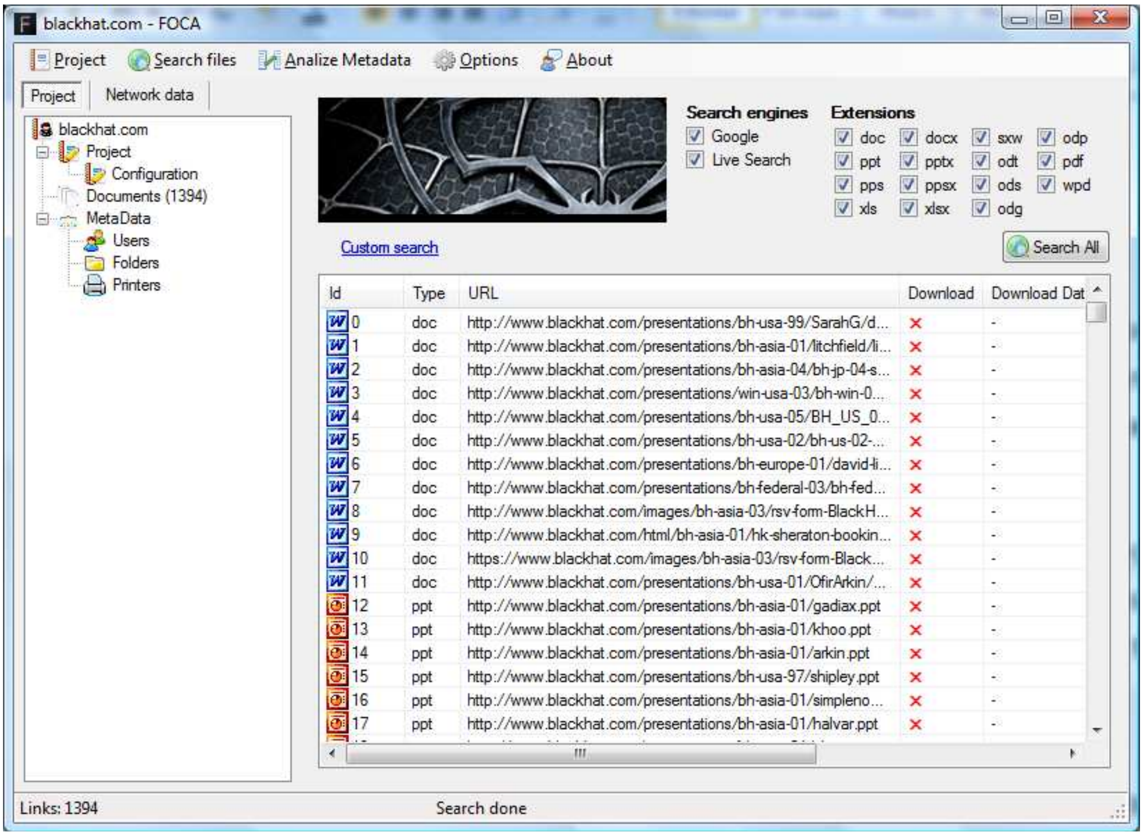
All this information becomes available to anyone who has Internet access. And it may remain available even after documents were modified or removed from web site due to the cache feature most web search engines provide.

Cached copies from documents may appear tagged with the words “Cache” or “HTML version”, and they are stored by the search engine systems themselves, thus giving little control to website owners and administrators on their contents and access rights. Of course, search engines companies provide tools which allow webmasters to remove contents from their indexes, but those tools may be useless for massive document management. Besides, monitoring accesses through search engine caches is, at least, a taught task for organizations and website administrators.

6. FOCA

Just as a proof of concept, FOCA is been developed. FOCA, which stands for “Fingerprinting Organization with Collected Archives” is an automated tool for downloading documents published in websites, extracting metadata and analyzing data. Now it´s an on growth project which is being improved day by day.

FOCA searches for links to documents using Google and Microsoft Live Search engines. This tool is not using any special Google key to access the API, so if Google or Microsoft Live asks for a CAPTHA value then FOCA will stop and show up the CAPTCAH, waiting for it to continue.



Search engines

☑ Google
☑ Live Search

Extensions

☑ doc ☑ docx ☑ sxw ☑ odp
☑ ppt ☑ pptx ☑ odt ☑ pdf
☑ pps ☑ ppsx ☑ ods ☑ wpd
☑ xls ☑ xlsx ☑ odg

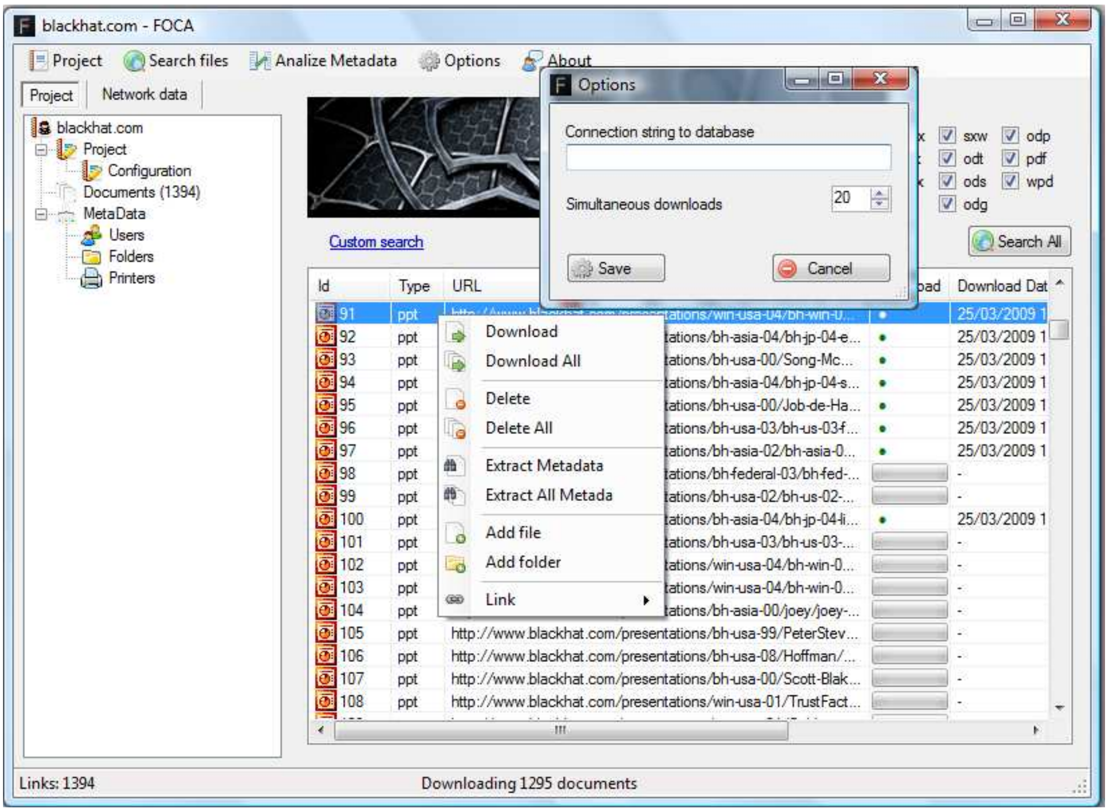
Id	Type	URL	Download	Download Dat
0	doc	http://www.blackhat.com/presentations/bh-usa-99/SarahG/d...	✗	-
1	doc	http://www.blackhat.com/presentations/bh-asia-01/litchfield/li...	✗	-
2	doc	http://www.blackhat.com/presentations/bh-asia-04/bh-jp-04-s...	✗	-
3	doc	http://www.blackhat.com/presentations/win-usa-03/bh-win-0...	✗	-
4	doc	http://www.blackhat.com/presentations/bh-usa-05/BH_US_0...	✗	-
5	doc	http://www.blackhat.com/presentations/bh-usa-02/bh-us-02-...	✗	-
6	doc	http://www.blackhat.com/presentations/bh-europe-01/david-li...	✗	-
7	doc	http://www.blackhat.com/presentations/bh-federal-03/bh-fed...	✗	-
8	doc	http://www.blackhat.com/images/bh-asia-03/rsv-form-BlackH...	✗	-
9	doc	http://www.blackhat.com/html/bh-asia-01/hk-sheraton-bookin...	✗	-
10	doc	https://www.blackhat.com/images/bh-asia-03/rsv-form-Black...	✗	-
11	doc	http://www.blackhat.com/presentations/bh-usa-01/OfirArkin/...	✗	-
12	ppt	http://www.blackhat.com/presentations/bh-asia-01/gadiax.ppt	✗	-
13	ppt	http://www.blackhat.com/presentations/bh-asia-01/khoo.ppt	✗	-
14	ppt	http://www.blackhat.com/presentations/bh-asia-01/arkin.ppt	✗	-
15	ppt	http://www.blackhat.com/presentations/bh-usa-97/shipley.ppt	✗	-
16	ppt	http://www.blackhat.com/presentations/bh-asia-01/simpleno...	✗	-
17	ppt	http://www.blackhat.com/presentations/bh-asia-01/halvar.ppt	✗	-

Links: 1394

Search done

Figure 45: 1394 office documents published in Blackhat web site

A big website can store between three and five thousand Office documents so, in a normal search for links maybe between zero and five CAPTCHAs can be required (depending on the Google and Microsoft security policies in that moment). After collecting all the links, all documents can be downloaded using a multi thread engine to retrieve all of them as fastest as possible.



Connection string to database

Simultaneous downloads 20

☑ sxw ☑ odp
☑ odt ☑ pdf
☑ ods ☑ wpd
☑ odg

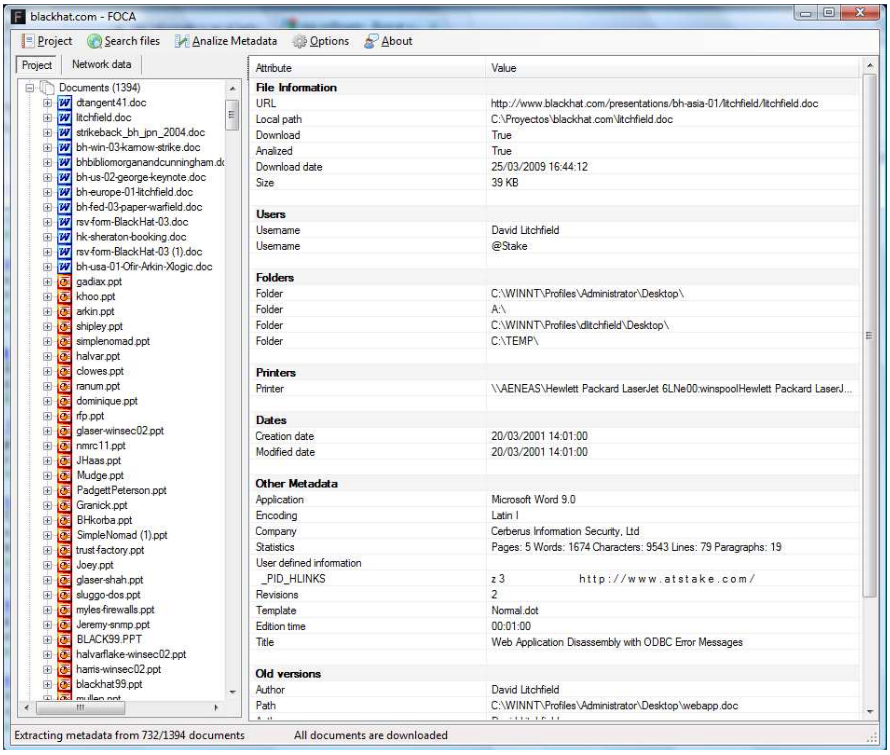
Id	Type	URL	Download	Download Dat
91	ppt	http://www.blackhat.com/presentations/win-usa-04/bh-win-U...	●	25/03/2009 1
92	ppt	ations/bh-asia-04/bh-jp-04-e...	●	25/03/2009 1
93	ppt	ations/bh-usa-00/Song-Mc...	●	25/03/2009 1
94	ppt	ations/bh-asia-04/bh-jp-04-s...	●	25/03/2009 1
95	ppt	ations/bh-usa-00/Job-de-Ha...	●	25/03/2009 1
96	ppt	ations/bh-usa-03/bh-us-03-f...	●	25/03/2009 1
97	ppt	ations/bh-asia-02/bh-asia-0...	●	25/03/2009 1
98	ppt	ations/bh-federal-03/bh-fed-...		-
99	ppt	ations/bh-usa-02/bh-us-02-...		-
100	ppt	ations/bh-asia-04/bh-jp-04-li...	●	25/03/2009 1
101	ppt	ations/bh-usa-03/bh-us-03-...		-
102	ppt	ations/win-usa-04/bh-win-0...		-
103	ppt	ations/win-usa-04/bh-win-0...		-
104	ppt	ations/bh-asia-00/joey/joey-...		-
105	ppt	http://www.blackhat.com/presentations/bh-usa-99/PeterStev...		-
106	ppt	http://www.blackhat.com/presentations/bh-usa-08/Hoffman/...		-
107	ppt	http://www.blackhat.com/presentations/bh-usa-00/Scott-Blak...		-
108	ppt	http://www.blackhat.com/presentations/win-usa-01/TrustFact...		-

Links: 1394

Downloading 1295 documents

Figure 46: FOCA downloading files

Once retrieved, FOCA allows extracting metadata from all documents. Today FOCA supports DOC, XLS, PPT, PPS, DOCX, PPTX, PPSX, XLSX, SWX, ODT, ODS, ODP, PDF, and WPD documents. In the following image the metadata extracted from a public document is shown. In this case, the document is a (great) David Litchfiled work.



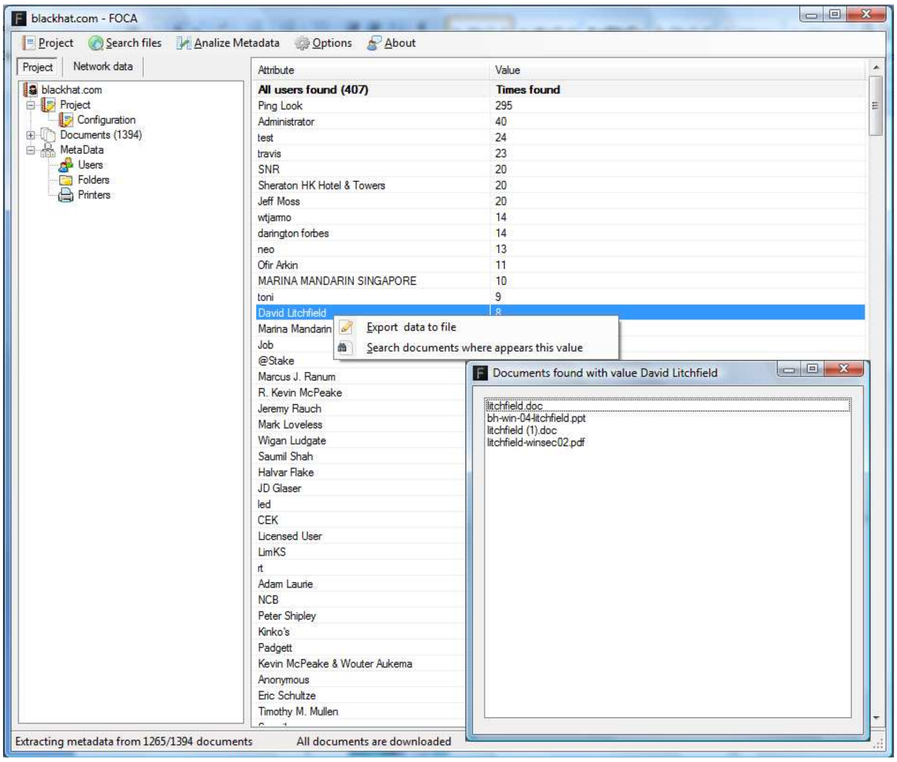
Documents (1394)
- dtangent41.doc
- litchfield.doc
- strikeback_bh_jpn_2004.doc
- bh-win-03-kamow-strike.doc
- bhbibliomorganandcunningham.dc
- bh-us-02-george-keynote.doc
- bh-europe-01-litchfield.doc
- bh-fed-03-paper-warfield.doc
- rsv-form-BlackHat-03.doc
- hk-sheraton-booking.doc
- rsv-form-BlackHat-03 (1).doc
- bh-usa-01-Ofir-Arkin-Xlogic.doc
- gadiax.ppt
- khoo.ppt
- arkin.ppt
- shipley.ppt
- simplenomad.ppt
- halvar.ppt
- clowes.ppt
- ranum.ppt
- dominique.ppt
- rfp.ppt
- glaser-winsec02.ppt
- nmrc11.ppt
- JHaas.ppt
- Mudge.ppt
- PadgettPeterson.ppt
- Granick.ppt
- BHkorba.ppt
- SimpleNomad (1).ppt
- trust-factory.ppt
- Joey.ppt
- glaser-shah.ppt
- sluggo-dos.ppt
- myles-firewalls.ppt
- Jeremy-snmp.ppt
- BLACK99.PPT
- halvarflake-winsec02.ppt
- harris-winsec02.ppt
- blackhat99.ppt
- mullen.ppt

Attribute	Value
File Information	
URL	http://www.blackhat.com/presentations/bh-asia-01/litchfield/litchfield.doc
Local path	C:\Proyectos\blackhat.com\litchfield.doc
Download	True
Analized	True
Download date	25/03/2009 16:44:12
Size	39 KB
Users	
Usemame	David Litchfield
Usemame	@Stake
Folders	
Folder	C:\WINNT\Profiles\Administrator\Desktop\
Folder	A:\
Folder	C:\WINNT\Profiles\dlitchfield\Desktop\
Folder	C:\TEMP\
Printers	
Printer	\\AENEAS\Hewlett Packard LaserJet 6LNe00:winspoolHewlett Packard LaserJ...
Dates	
Creation date	20/03/2001 14:01:00
Modified date	20/03/2001 14:01:00
Other Metadata	
Application	Microsoft Word 9.0
Encoding	Latin I
Company	Cerberus Information Security, Ltd
Statistics	Pages: 5 Words: 1674 Characters: 9543 Lines: 79 Paragraphs: 19
User defined information	
_PID_HLINKS	z3 http://www.atstake.com/
Revisions	2
Template	Normal.dot
Edition time	00:01:00
Title	Web Application Disassembly with ODBC Error Messages
Old versions	
Author	David Litchfield
Path	C:\WINNT\Profiles\Administrator\Desktop\webapp.doc

Extracting metadata from 732/1394 documents All documents are downloaded

Figure 47: Metadata stored in a Microsoft Doc published at Blackhat.com (in English)

Once all documents are analyzed FOCA will collect three special lists. First one with discovered users, second one with paths to files and the last one with printers. Besides, using FOCA is easy to track where the metadata is stored in order to analyze deeply a real environment.



Attribute	Value
All users found (407)	**Times found**
Ping Look	295
Administrator	40
test	24
travis	23
SNR	20
Sheraton HK Hotel & Towers	20
Jeff Moss	20
wtjarno	14
darington forbes	14
neo	13
Ofir Arkin	11
MARINA MANDARIN SINGAPORE	10
toni	9
David Litchfield	8
Marina Mandarin	
Job	
@Stake	
Marcus J. Ranum	
R. Kevin McPeake	
Jeremy Rauch	
Mark Loveless	
Wigan Ludgate	
Saumil Shah	
Halvar Flake	
JD Glaser	
led	
CEK	
Licensed User	
LimKS	
rt	
Adam Laurie	
NCB	
Peter Shipley	
Kinko's	
Padgett	
Kevin McPeake & Wouter Aukema	
Anonymous	
Eric Schultze	
Timothy M. Mullen	

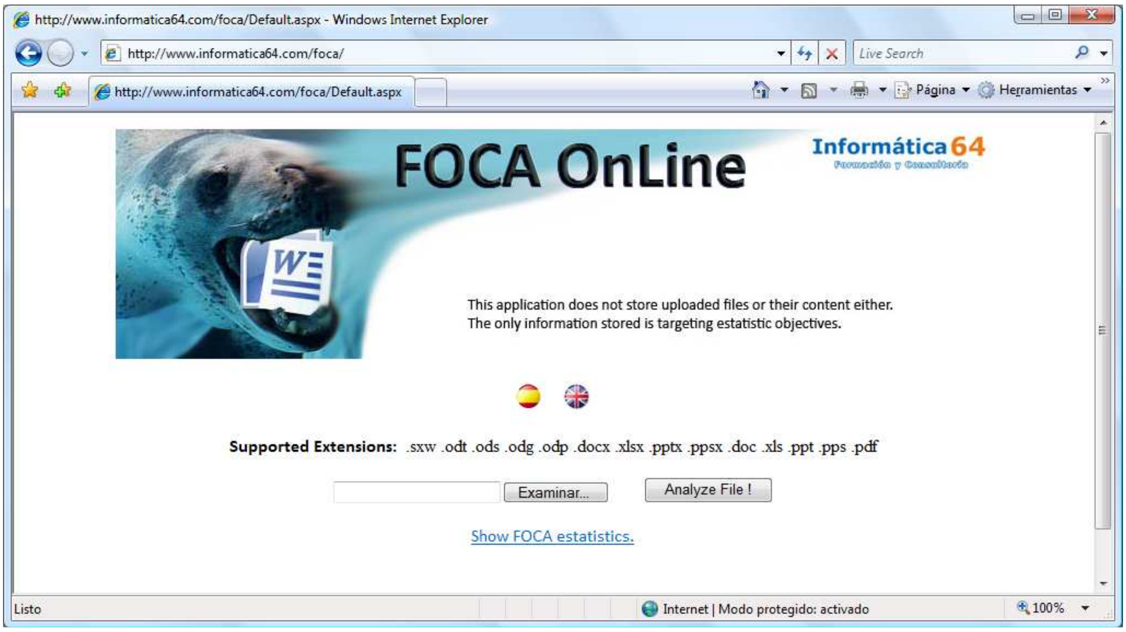
litchfield.doc
bh-win-04-litchfield.ppt
litchfield (1).doc
litchfield-winsec02.pdf

Extracting metadata from 1265/1394 documents All documents are downloaded

Figure 48: Tracking Metadata in files

FOCA will also search for new servers in the domain name server using Google Sets and Wikipedia categories based in the server names found and at the end, a view more or less complete depending in the amount of data obtained will be printed.

There is an on-line version of FOCA which can be used by anyone in the following URL: http://www.informatica64.com/FOCA.


http://www.informatica64.com/foca/Default.aspx - Windows Internet Explorer
http://www.informatica64.com/foca/
Live Search
http://www.informatica64.com/foca/Default.aspx
Página
Herramientas
FOCA OnLine
Informática 64
Formación y Consultoría
Examinar...
Analyze File !
Show FOCA estatistics.
Listo
Internet | Modo protegido: activado
100%

This application does not store uploaded files or their content either.
The only information stored is targeting estatistic objectives.

Supported Extensions: .sxw .odt .ods .odg .odp .docx .xlsx .pptx .ppsx .doc .xls .ppt .pps .pdf

Figure 49: FOCA, on-line version

7 SECURE WEB PUBLISHING

Removing metadata from documents is not an easy task. As far as users can not be relied on to ensure document security and the volume of published information increases faster and faster, organizations must find ways to make it automatically.

Among the systems involved in document security, web servers play a fundamental role, as they are the logical boundary between Internet and the organization. MetaShield Protector is a solution for sanitizing documents on the fly as they are served to users by IIS web servers. It replaces document metadata so that they contribute to security and offer a normalized public image of the organization.

CONCLUSIONS

Any document can have associated metadata that contain lost information or hidden data. In particular, Microsoft Office and OpenOffice documents may contain data about the internal network, its user accounts and machines, shared resources, services provided, operating systems, and more.

Organizations must take this information into account before publishing documents on the web or sending them by e-mail. Cleaning these documents is a must, as it is taking care of how web search engines index them.

Keep an eye in the information you know you published and the one you maybe publish without knowing it.

REFERENCES

EXIF [Exchangeable Image File Format]
http://en.wikipedia.org/wiki/Exif
IPTC [International Press Telecommunications Council]
http://en.wikipedia.org/wiki/IPTC
XMP [Extensible Metadata Platform]
http://en.wikipedia.org/wiki/Extensible_Metadata_Platform
WD97: Cómo minimizar metadatos en documento de Microsoft Word
http://support.microsoft.com/kb/223790
Cómo minimizar metadatos en documentos de Microsoft Word 2000
http://support.microsoft.com/kb/237361
How to minimize metadata in Word 2002
http://support.microsoft.com/default.aspx?scid=kb;EN-US;290945
Cómo minimizar metadatos en Word 2003
http://support.microsoft.com/kb/825576/
How to minimize metadata in Microsoft Excel workbooks
http://support.microsoft.com/default.aspx?scid=kb;EN-US;223789
Ppt97: Cómo minimizar metadatos en presentaciones de Microsoft PowerPoint
http://support.microsoft.com/kb/223793/
PPT2000: How to Minimize Metadata in Microsoft PowerPoint Presentations
http://support.microsoft.com/default.aspx?scid=kb;EN-US;314797
How to minimize the amount of metadata in PowerPoint 2002 presentations
http://support.microsoft.com/kb/314800/EN-US/
Microsoft Word bytes Tony Blair in the butt
http://www.computerbytesman.com/privacy/blair.htm
Word list generation for bruteforce cracking
http://www.reversing.org/node/view/9

Utilidades

ExifReader
http://www.takenet.or.jp/~ryuuji/minisoft/exifread/english/
Wlgen
http://www.reversing.org/node/view/8
OOMetaExtractor
http://www.codeplex.com/oometaextractor
DocScrubber
http://www.javacoolsoftware.com/docscrubber/index.html
Metadata Extraction Tool
http://www.drewnoakes.com/code/exif/releases/
Libextractor
http://gnunet.org/libextractor/
Bintext
http://www.foundstone.com/us/resources/proddesc/bintext.htm
Metagoofil
http://www.edge-security.com/metagoofil.php
Foca Online
http://www.informatica64.com/foca