

itools

Juan David Ibáñez Palomar¹
j david@itaapy.com

January 3, 2005

¹Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. There is a copy of the license at <http://www.gnu.org/copyleft/fdl.html>

Contents

1	Introduction	4
1.1	What is <code>itools</code> ?	4
1.1.1	The resource-handler model	5
1.1.2	eXtensible Markup Language	5
1.1.3	The Simple Template Language	6
1.1.4	Workflow	6
1.1.5	Internationalization and Localization	6
1.1.6	Index and Search	6
1.2	Who is this document for?	6
1.3	Project status	7
1.4	Installation	7
1.5	About this document	7
2	Uniform Resource Identifiers	8
2.1	Syntax	9
2.1.1	Generic URIs	9
2.1.2	Non Generic URIs	10
2.2	Relative references	10
2.2.1	Resolving references	11
2.3	Paths	11
3	Resources	13
3.1	Retrieving resources	13
3.2	File Resources	14
3.3	Folder Resources	15
3.4	Supported schemes	17
3.4.1	The memory storage	17
4	File handlers	18
4.1	Introduction	18
4.1.1	One resource, many handlers	19
4.1.2	Load	19
4.1.3	Save	20
4.1.4	Serialization and de-serialization	20
4.2	The skeleton	21
4.3	Text and binary handlers	22
4.4	Overview of the available handlers	22
4.5	The handler factory	25

4.5.1	The <code>get_handler</code> shorthand	26
5	Folder handlers	27
5.1	The handler tree	28
6	eXtensible Markup Language	30
6.1	XML.Document	30
6.1.1	XML.Element	31
6.2	Namespaces	32
7	Simple Template Language	34
7.1	A descriptive language	34
7.1.1	The template	34
7.1.2	The namespace	35
7.2	Example: an addressbook	35
7.3	Language overview	37
7.3.1	Expressions	38
8	Writing handler classes	39
8.1	Step by step	39
8.2	Example: Addressbook	40
8.2.1	Load and Save	40
9	Internationalization and Localization	44
9.1	Internationalization	44
9.1.1	Naming conventions	44
9.1.2	Template selection	45
9.2	Localization	45
9.2.1	Message extraction	46
9.3	Human translation	47
9.4	Template building	47
10	Addendum	48
10.1	In the real world	48
10.2	Future works	49
10.3	Free Software	49
A	Coding style guide	50
A.1	Language and encoding	50
A.2	Module structure	50
A.2.1	Example	51
A.3	Format rules	52
A.4	Comments	53
A.5	Naming conventions	53
A.5.1	Class names	54
A.5.2	Functions and methods	54
A.5.3	Variables	54
A.5.4	Constants	54

B GNU arch	55
B.1 Keeping track of <code>itools</code>	55
B.1.1 Browsing the sources	55
B.1.2 Check out	55
B.1.3 A session with <code>tla</code> and <code>itools</code>	56
B.1.4 Help	56
B.2 Maintaining private changes	56
B.2.1 Create an archive	57
B.2.2 Create a branch	57
B.2.3 Working with your branch	58
B.2.4 Merging from the main branch	59
B.3 Contributing your work to the main tree	59

Chapter 1

Introduction

This paper is the official documentation of `itools`.

1.1 What is `itools`?

`itools` is a Python¹ package. Originally it was intended to develop web applications, but being low level stuff it is likely to be found useful in other contexts.

It consists of a collection of sub-packages and modules which makes up a coherent set of tools for the developer. A summary of these tools follows:

- `itools.uri` – an API to manage URIs, to identify and locate resources.
- `itools.resources` – an abstraction layer over resources that lets to manage them with a consistent API, independently of where they are stored.
- `itools.handlers` – resource handlers infrastructure (resource handlers are non persistent classes that add specific semantics to resources). This package also includes several handlers *out of the box*.
- `itools.xml` – XML infrastructure, includes resource handlers for XML, XHTML and HTML documents. Plus the **S**imple **T**emplate **L**anguage.
- `itools.i18n` – tools for language negotiation and text segmentation.
- `itools.workflow` – represent workflows as automaton, objects can move from one state to another through transitions, classes can add specific semantics to states and transitions.
- `itools.catalog` – An index and search engine.

One of the criterias behind the `itools` architecture is to reduce the dependencies between the different modules to the minimum, what makes up a flexible set of tools. Think of it as an extension to the Python's Standard Library.

¹<http://www.python.org>

1.1.1 The resource-handler model

Of everything in `itools` I am probably most proud of the the three sub-packages `itools.uri`, `itools.resources` and `itools.handlers`, which make up what I call the *resource-handler* model.

There is a linear relationship of dependency between these modules, `uri` depends on nothing but Python, `resources` depends on `uri`, and `handlers` depends on `resources`.

This allows to use these modules on a flexible way. For example, you can just use `itools.uri` (ignoring the others) to benefit from a higher level API to work with URIs than that provided by the Standard Library (`urlparse`).

Or you may use `itools.resources` if you want to benefit from an abstraction layer over the storage. This is to say, if you want to be able to manipulate many resources stored in different systems and accessed through different protocols with the same, consistent, rich API.

You may even take advantage of `itools.handlers` without fully understanding the model behind. For example, you could use some of the handlers `itools` offers out-of-the-box for standard file formats like CSV, PO or XHTML, to simplify your live if you ever need to work with one of these formats.

But, in order to exploit everything `itools` has to offer to its limit, you may choose to base part or all of your application architecture on the *resource-handler* model, a model heavily influenced by the filesystem and the Web. In this situation the three packages (`uri`, `resources` and `handlers`) show themselves as three different components with a distinct role in the architecture:

- `itools.uri` identifies and locates resources, wherever they are. Altogether with `itools.resources` it effectively enables your information system to be distributed through an heterogeneous base.
- `itools.resources` provides persistency to your data, this is to say, resources are where the data is stored.
- and `itools.handlers` is where the logic lives. The essential characteristic of a resource handler (or handler for short) is that it is non-persistent, instead it is associated with a resource, whose content it is responsible to manage.

The first chapters of this document will cover these sub-packages, `itools.uri`, `itools.resources` and `itools.handlers` with detail.

1.1.2 eXtensible Markup Language

The `itools.xml` package depends on `itools.handlers`, this is its first advantage. It represents an XML document as an DOM like tree. But it also provides support for schemas, what allows to easily build higher level data structures.

The package also provides handlers for specific document types out-of-the-box, most notably XHTML and HTML (even if HTML is not XML, it shares a lot with XHTML).

1.1.3 The Simple Template Language

The Simple Template Language is included in the `itools.xml` package, but it is important enough to deserve its own chapter in the documentation.

Its design goals are:

- Truly separate logic and presentation. Even Python expressions are not allowed within the template.
- Really simple. It can be mastered in half a day.
- Damn fast (easy to achieve through simplicity).
- Secure. Even non-trusted users could write templates without risk, because code is not allowed within the template.

And the key idea behind, is to make it a *descriptive* language.

1.1.4 Workflow

The sub-package `itools.workflow` (once known as *flux*) is the oldest code in `itools`. It does not depend on anything but the Standard Library, and don't puts any restriction on the storage. This makes it very easy to combine with other frameworks.

There is a chapter exclusively dedicated to it.

1.1.5 Internationalization and Localization

The `itools.i18n` package provides a wide range of tools for internationalization and localization of both software and data. From message extraction to language negotiation, through text segmentation, fuzzy matching or algorithms to guess the language a text is written in.

A chapter is devoted to this topic.

1.1.6 Index and Search

The `itools.catalog` sub-package provides an index and search engine. Though still young, it already provides full text indexing, boolean queries and results sorted by weight.

1.2 Who is this document for?

This document is addressed to Python developers. Though it may be useful to software architects in general, as some ideas exposed here could be found interesting².

It is convenient to have some basic skills with the Python programming language to fully understand this document. Probably the best introduction to Python is the official tutorial:

<http://python.org/doc/2.3.4/tut/tut.html>.

²For example, `itools.workflow` inspired XXX to write a similar engine in Java, see <http://XXX>

This document touches many different technologies and standards, such as XML. References will be given in the relevant chapters.

1.3 Project status

Currently `itools` is in alpha stage of development (at the time of this writing the last version available is **0.5**). This means that the API is not yet stable, the documentation is incomplete, and there may be bugs.

However, we have been using it on a daily basis for a long time now. It fuels the iKaaro³ Content Management System, and most of our customer projects.

1.4 Installation

Before going further, be sure your system is correctly setup. First you will need Python 2.3.4 or later.

Then download the last `itools` version from <http://www.ikaaro.org>, unpack it somewhere, and install it; `itools` uses *distutils*, so just type:

```
$ python setup.py install
```

Be sure to have the right permissions.

1.5 About this document

The development keeps ahead of the documentation. I would say the docs cover around 60% of `itools`.

There are also two appendixes, one explaining the coding style `itools` is written in, another one introducing the use of *GNU arch*. Both are specially addressed to those that want to contribute back to the main tree.

³<http://www.ikaaro.org>

Chapter 2

Uniform Resource Identifiers

In the wild Internet, the first challenge we encounter is how to identify and locate the numerous resources that populate it. Well, that's what **Uniform Resource Identifiers** (or just URIs) are for.

The Python Standard Library (batteries included!) provides a module named `urlparse` which is able to split a generic URI into its main parts (scheme, authority, path, query and fragment), to rebuild it, and to resolve relative references.

But there are more things we would like to do with a URI. For example we could go further in the parsing process and split the path into its segments, then split each segment into the name and the parameters if any; we could get the user information, host address and port number from the authority; we could normalize URIs; we could implement other operations beyond just resolving relative references, etc.

This is the purpose of `itools.uri`, to provide a complete API to parse and work with URIs, following the standard as described by **RFC2396**.

The main function provided by `itools.uri` is `get_reference`, a factory to build references:

```
get_reference(reference)
- Parses the given string and returns a reference object.
```

Let's go right to the code:

```
>>> from itools import uri
>>> r1 = uri.get_reference('http://www.w3.org/TR/REC-xml/#sec-intro')
>>> r2 = uri.get_reference('mailto:jdavid@itaapy.com')
>>> r3 = uri.get_reference('http://www.ietf.org/rfc/rfc2616.txt')
>>> r4 = uri.get_reference('http://sf.net/cvs/?group_id=5470')
>>> r5 = uri.get_reference('news:comp.infosystems.www.servers.unix')
```

2.1 Syntax

Before going further, we will give an overview of the URI syntax, something required to understand the rest of this chapter.

A URI is divided in two parts. The first one is the scheme: `http`, `ftp`, `mailto`, etc.. The syntax and semantics of the second part depends on the scheme:

```
uri = <scheme>:<scheme-specific-part>
```

However, many schemes share a similar syntax for the second part, these URIs are known as *generic URIs*.

2.1.1 Generic URIs

The syntax of a generic URI reference is:

```
<scheme>://<authority><absolute path>?<query>#<fragment>
```

Generic URIs are modeled by `uri.Reference`. Following the code at the beginning, we are going to inspect the `r1` object:

```
>>> r1
<itools.uri.Reference object at 0x403ebc4c>
>>> print r1
http://www.w3.org/TR/REC-xml/#sec-intro
>>> print r1.scheme
http
>>> print r1.authority
www.w3.org
>>> print r1.path
/TR/REC-xml/
>>> print r1.query

>>> print r1.fragment
sec-intro
```

Note that there is an attribute for every component: the scheme, the authority, the path, the query and the fragment. Now we are going to quickly describe each of these components:

Scheme Defines the method or protocol to access the resource.

Authority Defines the server address that hosts the resource. Its syntax is:

```
authority = [<userinfo>@]<hostport>
```

Absolute path The path identifies the resource within the scope of the scheme and authority.

It consists of a sequence of segments. A segment has two parts, the name and the parameters, though the parameters are optional. The syntax is:

```
absolute path = /<relative path>
relative path = <segment>[/<relative path>]
segment = <name>[;<parameters>]
```

Query The query is information to be interpreted by the resource. It does not have a pre-defined syntax.

Fragment The fragment is a reference within the resource.

Actually, the fragment does not belong to the URI, as it does not help to identify the resource, however we include it here because it does appear in URI references, what is what we work with.

As the query, the fragment does not have a pre-defined syntax.

2.1.2 Non Generic URIs

Other schemes do not follow the generic syntax. As an example, let's inspect the `r2` object seen before:

```
>>> r2 = uri.get_reference('mailto:jdavid@itaapy.com')
>>> print r2
mailto:jdavi@itaapy.com
>>> r2
<itools.uri.Mailto object at 0x403f45ec>
>>> print r2.scheme
mailto
>>> print r2.username
jdavid
>>> print r2.host
itaapy.com
```

As you see the `r2` is not an instance of `uri.Reference`, but an instance of `uri.Mailto`.

2.2 Relative references

So far the examples we have seen show absolute URIs, but there are relative URI references too. A relative reference is one that lacks, at least, the scheme. There are three types of relative references: network paths, absolute paths, and relative paths:

Network paths Network paths only lack the scheme, they start by a double slash and the authority, followed by the absolute path. They are rarely used.

```
//www.ietf.org/rfc/rfc2396.txt
```

Absolute paths The absolute paths lack both the scheme and the authority. They start by a slash.

```
/rfc/rfc2396.txt
```

Relative paths Relative paths lack the first slash of absolute paths. They can start by the special segment `."`, or by one or more `.."`. Examples are:

```
rfc/rfc2396.txt
./rfc/rfc2396.txt
../rfc2616.txt
```

2.2.1 Resolving references

The most common operation with relative references is to resolve them. That is to say, to obtain (with the help of a base reference) the absolute reference that identifies our resource. This is achieved with the `resolve` method:

```
>>> base = uri.get_reference('http://www.ietf.org/rfc/rfc2615.txt')
>>> print base.resolve('/www.ietf.org/rfc/rfc2396.txt')
http://www.ietf.org/rfc/rfc2396.txt
>>> print base.resolve('/rfc/rfc2396.txt')
http://www.ietf.org/rfc/rfc2396.txt
>>> print base.resolve('rfc2396.txt')
http://www.ietf.org/rfc/rfc2396.txt
```

2.3 Paths

One component that deserves special attention is the path. The path of a generic URI is an instance of the `uri.Path` class:

```
>>> ref = uri.get_reference('http://www.ietf.org/rfc/rfc2616.txt')
>>> ref.path
<itools.uri.Path at 0x403f50a4>
>>> print ref.path
/rfc/rfc2616.txt
```

Paths are iterable:

```
>>> for segment in ref.path:
...     print segment
...
rfc
rfc2616.txt
```

Each component of the path is called a segment. Segments are instances of the class `uri.Segment`. Each segment has two components, the name and the parameter. The code below illustrates this:

```
>>> path = uri.Path('/itaapy;lang=es/team')
>>> for segment in path:
...     print repr(segment)
...     print ' name:', segment.name
...     print ' param:', segment.param
...
<itools.uri.Segment object at 0x404c1acc>
name: itaapy
param: lang=es
```

```
<itools.uri.Segment object at 0x404c1a2c>
  name: team
  param: None
```

The `uri.Path` class also provides an API to manipulate paths:

```
is_absolute()
- Returns True if the path is absolute (i.e. if it starts by an slash),
  False otherwise.
is_relative()
- Returns True if the path is relative (i.e. if it does not start by a
  slash), False otherwise.
get_prefix(path)
- Returns the path that is common to self and to the given path.
resolve(path)
- Returns a new path from a base path (self) and the given path.
  Follows the RFC2396 standard, i.e. takes into account the trailing
  slash.
resolve2(path)
- Same as resolve, but it does not teke into account the trailing
  slash.
get_pathto(path)
- Returns the path needed to go from self to the given path (this
  complements the resolve method).
get_pathtoroot()
- Returns a relative path to the root (something like .././..).
```

Chapter 3

Resources

In the previous chapter we have learned how to work with URIs, objects that identify resources; but how to manipulate the resources themselves?

The problem we face now is the fact that the resources are dispersed, stored in different systems, and accessed through different protocols. In spite of that, it would be nice to be able to manipulate them with a uniform API.

That's the purpose of `itools.resources`, to provide an abstraction layer over resources: doesn't matter where the resources are stored (in the local file system, in a remote web server, etc.), they are handled with the same consistent API.

3.1 Retrieving resources

Of course, the first step, before working with a resource, is to retrieve it, this is done with the function `get_resource`:

```
get_resource(reference)
- From the given URI reference returns a resource object.
```

Let's see a few examples:

```
>>> from itools.resources import get_resource
>>> get_resource('examples/hello.txt')
<itools.resources.file.File instance at 0x402175ac>
>>> get_resource('http://example.com')
<itools.resources.http.File instance at 0x404aadec>
>>> get_resource('examples')
<itools.resources.file.Folder instance at 0x401e568c>
```

These examples show two fundamental aspects of `itools.resources` which we will explore on detail later. First is the support for multiple protocols, in particular the example illustrates the schemes `file` for the local file system, and `http` for the **H**yper**T**ext **T**ransfer **P**rotocol.

The second aspect is the support for two kinds of resources, files and folders. Before looking at each type of resource, files and folders, let's see the API they share:

```
uri
- The URI reference the resource was retrieved from.

get_mimetype()
- Tries to guess the mimetype of the resource and returns it as
a string. Folders are always application/x-not-regular-file.
Returns None if it fails.

get_ctime()
- Returns a datetime object with the time the resource was cre-
ated.

get_mtime()
- Returns a datetime object with the last time the resource was
modified.

get_atime()
- Returns a datetime object with the last time the resource was
accessed.
```

It may happen that a specific scheme does not implements one or more of these methods.

3.2 File Resources

Besides the common methods for files and folders, each resource type has a specific API, the one for file resources is:

```
get_data()
- Returns the resource data as a byte string.

set_data(data)
- Replaces the resource content by the given data (a byte string).

get_size()
- Returns the length (the number of bytes) of the resource data.

__getitem__(index)
- Returns the byte at the given position.

__getslice__(a, b)
- Returns the byte string that goes from a to b.

__setitem__(index, value)
- Sets the given value to the given position (index). Usually value
will be just a byte, but it may be a slice too.

append(data)
- Appends the given data to the resource.
```

As an example of the API let's exercise it with a web page:

```
>>> resource = get_resource('http://example.com')
>>> print resource
<itools.resources.http.File instance at 0x404aadec>
>>> print resource.get_mimetype()
```

```
text/html
>>> print resource.get_size()
438
>>> print resource.get_data()
<HTML>
<HEAD>
  <TITLE>Example Web Page</TITLE>
</HEAD>
<body>
<p>You have reached this web page by typing
...
```

Of course, in this example, we can not modify the resource as we don't have write access to the web server.

The methods `_getitem_`, `_setitem_`, etc. are specially useful to work with binary files, as they allow to read and write data at specific positions within a resource. These methods allow to access the resource with the same syntax used to access lists in Python:

```
>>> import struct
>>> n = struct.pack('>I', 47)
>>> resource[20:24] = n
```

This brief example shows how to write the number 47 at the position 20 of a given resource, encoded as an 32 bits unsigned integer.

For a real example you can look at `itools.catalog`, which makes extensive and systematic use of this approach.

3.3 Folder Resources

The specific API for folders is:

```

get_resource(path)
- Returns the resource in the given path (where path is either an
instance of uri.Path or a string).

get_resource_names(path='.')
- Returns a list with the names of all the resources in the given
path.

get_resources(path='.')
- Returns the resources in the given path (it is a generator).

has_resource(path)
- Returns True if there is a resource in the given path, False oth-
erwise.

set_resource(path, resource)
- Adds the given resource to the given path.

del_resource(path)
- Removes the resource at the given path.

del_resources(paths)
- Removes the resources at the given paths (where paths is a list
of paths).

traverse()
- This method allows to traverse the resource tree below this folder.
It is a generator which returns a resource at a time, starting by this
folder.

```

Let's exercise the API a little:

```

>>> examples = get_resource('examples')
>>> print examples.get_resource_names()
['hello.xhtml~', 'hello.xhtml', 'hello.txt', '.arch-ids']
>>> hello = examples.get_resource('hello.txt')
>>> print hello.get_data()
hello world

```

To copy a web page to the local file system:

```

>>> tmp = get_resource('/tmp')
>>> web_page = get_resource('http://example.com')
>>> tmp.set_resource('example.html', web_page)
>>> copy_of_web_page = tmp.get_resource('example.html')
>>> print web_page
<itools.resources.http.File instance at 0x405e8a2c>
>>> print copy_of_web_page
<itools.resources.file.File instance at 0x405fb64c>

```

To copy a whole tree:

```

>>> from pprint import pprint
>>> talks = get_resource('/home/jdavid/talks')
>>> tmp.set_resource('talks', talks)
>>> pprint(tmp.get_resource_names('talks/EuroPython2004'))
['itools-vfs',

```

```
'Makefile',
'itools-vfs.log',
'itools-vfs.tex',
'itools-vfs.aux',
'itools-vfs.toc',
'itools-vfs.dvi',
'itools-vfs.ps',
'itools-vfs.pdf',
'itools-vfs.tex~']
```

This is more impressive when copying a big tree from one storage to another. For example we use it in the context of the **iKaaro** Content Management System to export and import web sites from the **Zope Object DataBase** to the file system, and back from the file system to the **ZODB**.

3.4 Supported schemes

At the time of this writing the number of supported schemes is pretty short: `itools.file` for the file system, `itools.http` for the HTTP protocol (though the implementation is minimal), and `itools.memory` to store resources in memory. The **iKaaro** CMS provides support to store resources in Zope 2.

3.4.1 The memory storage

The memory storage (`itools.memory`) deserves few lines as it is very handy. It is possible to build a resource from scratch directly calling its constructor:

```
>>> from itools.resources import memory
>>> resource = memory.File('hello world')
>>> resource
<itools.resources.memory.File instance at 0x405e458c>
>>> resource.get_data()
'hello world'
>>> tmp.set_resource('hello.txt', resource)
```

This technique is used internally by resource handlers to build handler instances without passing a resource. They are the object of our next section.

Chapter 4

File handlers

Resources provide persistence to our data, but they lack any knowledge about the structure and the meaning of the information they contain. For example, the resource layer ignores that an XML document has a tree structure, hence it does not provide an API to traverse it; nor it knows how to get the messages and translations from a PO file.

This is the purpose of the *resource handlers*, to add semantics to specific resources.

As with resources, there are two types of handlers, files and folders. This first chapter focuses on file handlers, the next one will analyze the folder handlers.

Several key concepts will be exposed in this chapter, the relationship between resources and handlers, the load (de-serialization) and save (serialization) operations, the handler skeleton, and the handler factory. We will learn to use the file handlers `itools` offers out of the box, and how to write custom handler classes.

4.1 Introduction

To get a feeling, let's start with an example:

1. First we load a resource as seen in the previous chapter:

```
>>> from itools.resources import get_resource
>>> resource = get_resource('http://example.com')
```

2. Now we build a handler for the resource:

```
>>> from itools.xml import HTML
>>> handler = HTML.Document(resource)
>>> print handler
<itools.handlers.HTML.Document object at 0x40647b4c>
>>> print handler.to_str()
<HTML>
<HEAD>
  <TITLE>Example Web Page</TITLE>
</HEAD>
<body>
```

```
<p>You have reached this web page by typing
...
```

There are several things to highlight here. First the way we have built our handler instance, passing a resource to a handler class (`HTML.Document`), later we will see other ways to build handler instances.

Second the `to_str` method (all the file handlers have this method), which serializes the handler, i.e. transforms the handler to a sequence of bytes. This is a key concept to which we will come back later.

3. Now we can start working with the handler:

```
>>> from itools.xml import XML
>>> for node in handler.traverse():
...     if isinstance(node, XML.Element) and node.name == 'title':
...         print node.children
Example Web Page
```

Unlike `to_str`, the method `traverse` is specific to XML documents. Every handler class provides its own API.

4.1.1 One resource, many handlers

The relationship between resources to handlers is 1 to n . While there may be several different handlers associated to the same resource (though it is not obvious how this is useful), a handler is only associated to one resource.

The resource associated to a handler is accessible through the `resource` attribute. Following the example above, the code below checks that the resource we loaded in the first place is exactly the same our handler is associated to:

```
>>> resource
<itools.resources.http.File instance at 0x404aadc>
>>> handler.resource
<itools.resources.http.File instance at 0x404aadc>
>>> resource is handler.resource
True
```

4.1.2 Load

It may happen that the resource (a web page in our example) gets updated, then the handler will keep a data structure on memory that does not correspond anymore to the content of the resource, in other words, the handler would be out-of-date. We can check this by comparing the last modification time of the resource with the timestamp every handler always keeps:

```
>>> print handler.resource.get_mtime()
2004-11-28 19:53:57
>>> print handler.timestamp
2004-12-29 19:31:39.055367
>>> handler.resource.get_mtime() > handler.timestamp
False
```

Ok, the example above shows everything is alright. But what to do if it was not? then we would need to reload the resource, this is done with the `load` method:

```
>>> print handler.timestamp
2004-12-29 19:31:39.055367
>>> handler.load()
>>> print handler.timestamp
2004-12-29 19:51:50.152499
```

You should try it yourself with a resource in the filesystem: start the Python interpreter, build a handler for a resource in the filesystem, modify the resource with another program, see how the resource modification time is more recent than the handler's timestamp, then reload the handler and verify the handler is up-to-date now.

The full prototype of the method `load` follows:

```
load(resource=None)
- Loads the data from the given resource into the handler, if no
resource is given, the one the handler is attached to will be used.
```

As you see the `load` method accepts an optional parameter, a resource. If it is not given the handler will be reloaded from the resource it handles. But if other resource is passed it will be loaded from the given resource. Then we would reach a situation opposite to the one seen before: the resource would be outdated, as the handler would keep a newer version.

4.1.3 Save

Another way to get a handler more recent than the resource it is associated with, is to modify the handler through the API it offers, which depends on the handler class (e.g. the API of an XML handler is different from the API of an image handler).

To update the resource so both resource and handler are in sync again we use the `save` method:

```
save()
- Saves the handler into the resource.
```

So `load` and `save` are two sides of the same coin. The first one reloads the handler with the resource, the second one saves the handler state in the resource.

4.1.4 Serialization and de-serialization

A file resource represents a sequence of bytes. A handler keeps a data structure in memory, and offers an API to inspect and modify this data structure.

Two key concepts in computer science will help to clarify what we have seen up to now:

serialization is the process by which a sequence of bytes is transformed into a data structure.

de-serialization is the process by which a data structure is transformed to a sequence of bytes.

Now it becomes obvious that the `load` method what actually does is to de-serialize the resource and update the handler. And viceversa, the `save` method serializes the handler and updates the resource.

Remember the method `to_str` we saw at the beginning? it is the one responsible for the serialization process. The `save` method calls `to_str` first, and then updates the resource.

4.2 The skeleton

As we have seen the handler constructor expects one parameter: the resource it is meant to handle (and once the handler is built the resource is always accessible with `handler.resource`).

However, it is also possible to build a handler without passing it any parameter; in this case a memory resource will be built on the fly, let's see an example:

```
>>> from itools.xml import HTML
>>> handler = HTML.Document()
>>> handler
<itools.handlers.HTML.Document object at 0x403ee12c>
>>> handler.resource
<itools.resources.memory.File instance at 0x40638e4c>
>>> print handler.to_str()
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
  "http://www.w3.org/TR/html4/loose.dtd">
<html>
  <head>
    <meta content="text/html; charset=UTF-8" http-equiv="Content-Type">
    <title></title>

    <body></body>
  </head></html>
```

The default content of the resource depends on the handler, and it is called the *handler skeleton*. The constructor also accepts arbitrary keyword parameters:

```
>>> handler = HTML.Document(title='Hello World')
>>> print handler.to_str()
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
  <head>
    <meta content="text/html; charset=UTF-8" http-equiv="Content-Type">
    <title>Hello World</title>
  </head>
  <body></body>
</html>
```

The keyword parameters are used to initialize the skeleton; in the example above the `title` parameter defines the HTML document title, which by default is empty. The parameters accepted depend on the handler.

4.3 Text and binary handlers

File handlers split into text and binary handlers. The class `Text` is the base class for all the text handlers.

The key difference is that text handlers represent the resource's content in memory as a unicode string, instead of just a byte string.

When the resource is loaded the text handler tries to guess the character encoding of the resource's content. For some file formats this information is stored within the content itself; for example an XML document starts by an XML declaration that specifies the encoding, if the declaration is missing it is assumed the encoding is UTF-8. When this information is not explicitly indicated, the text handler tries to guess the encoding by brute force.

With the character encoding the text handler decodes and loads the resource's content.

The API of binary and text handlers also differs, compare the one offered by the `File` handler class:

```
to_str()
- Returns the resource data as a byte string (this is similar to the
method handler.resource.get_data()).
```

with the one offered by the `Text` handler class:

```
to_str(encoding='UTF-8')
- Returns the resource data as a byte string, using the given encod-
ing (defaults to UTF-8). Note that this will be different than the
string returned by handler.resource.get_data() if the resource
data is not encoded in UTF-8 in the source.
to_unicode(encoding=None)
- Returns the resource data as an unicode string.
```

Note the `to_str` method for text handlers accepts the encoding as an optional parameter. This not only will return a byte string in the given character encoding, it will also specify the encoding in the byte string for file formats that should include it.

There is also the new method `to_unicode`, which returns the content as a unicode string. This method accepts the encoding parameter too. For file formats that do not include the encoding within the content, the result of `to_unicode` will be the same regardless of the given encoding. But for file formats like XML that should specify the encoding within the content, the returned unicode string will include it.

4.4 Overview of the available handlers

Out of the box `itools` comes with several handlers for different standard file formats. The Figure 4.1 shows an excerpt of the tree of the available handler classes, which express the inheritance relationship between them.

We are not going to see folder handlers here, as they will be studied in the next chapter.

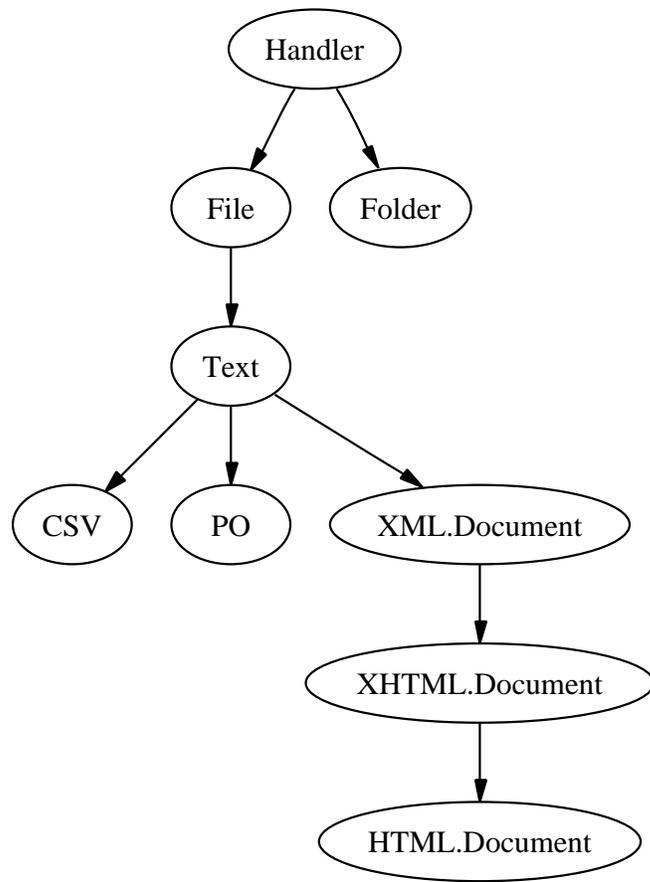


Figure 4.1: The handler tree

We have already seen the difference between binary and text handlers. Now we are going to present some of the higher level file handler classes `itools` includes.

XML.Document This is the default handler for XML documents, which internally are represented as a tree. The API includes the methods already described for the `Text` handler; specific methods of `XML.Document` are:

```
__cmp__(other)
- Lets to compare two XML documents.

get_root_element()
- Returns the root element of this XML document.

traverse()
- This method allows to traverse the XML document, as it has a
tree structure. It is a generator which returns a node at a time,
starting by the document instance.

traverse2()
- As traverse, this method allows to traverse the XML document,
though it is more powerful, and complex. It will be explained in
the XML chapter.
```

XHTML.Document The handler for XHTML documents, it extends the API provided by `XML.Document` API with the methods:

```
get_head()
- Returns the head element.

get_body()
- Returns the body element.

to_text()
- Strips all the XML markup and returns the text content of the
XHTML document. This is useful, for example, to index the doc-
ument.
```

PO The handler to manage PO files, the message catalog of the GNU gettext utilities.

```
get_msgids()
- Returns the list of message ids stored in the catalog.

get_messages()
- Returns the list of messages stored in the catalog, where each
message is represented as an instance of the class PO.Message.

get_msgstr(msgid)
- Returns the message string for the given message id.

set_message(msgid, msgstr=[u''], comments=[u''], references={})
- Adds a message (from the given parameters) to the catalog.
```

4.5 The handler factory

So far we have built a handler instance through a handler class:

```
>>> handler = HTML.Document(resource)
>>> handler
<itools.xml.HTML.Document object at 0x405740cc>
```

This is the standard pattern to build instances. However, if the resource is not an HTML document this procedure would fail. In other words, this procedure is only useful if you already know the kind of resource you are working with.

Another option is to let `itools` to choose which handler class to use. This can be done with the `build_handler` method, which provides the factory pattern.

```
build_handler(resource)
- A class method that identifies the given resource, chooses the
  available handler class that better matches it, and builds and re-
  turns a handler for it.
```

For example, from the `examples` directory type:

```
>>> from itools.resources import get_resource
>>> from itools.handlers.Handler import Handler
>>> from itools import xml
>>>
>>> here = get_resource('.')
>>> for name in here.get_resource_names():
...     resource = here.get_resource(name)
...     handler = Handler.build_handler(resource)
...     print name, handler
...
chapter6 <itools.handlers.Folder.Folder object at 0x40538d4c>
chapter7 <itools.handlers.Folder.Folder object at 0x4032c0cc>
hello.txt <itools.handlers.Text.Text object at 0x40536f4c>
hello.xhtml <itools.xml.XHTML.Document object at 0x4053b70c>
hello.xml <itools.xml.XML.Document object at 0x40538d6c>
```

Note that `build_handler` is a class method. In the example above we have called it through the most abstract handler class: `Handler`, which is the root of the inheritance tree. But it is also possible to call it with another handler class:

```
>>> from itools.xml import XML
>>>
>>> resource = here.get_resource('hello.xhtml')
>>> XML.Document.build_handler(resource)
<itools.xml.XHTML.Document object at 0x405c6ecc>
```

There is an important difference between calling `build_handler` from one or another class: the set of possible handler classes to use is restricted to all the sub-classes of the choosen handler class. For example, if we pass a plain text file to `XML.Document.build_handler`, it will fail:

```
>>> resource = here.get_resource('hello.txt')
>>> XML.Document.build_handler(resource)
Traceback (most recent call last):
  [...]
xml.parsers.expat.ExpatError: syntax error: line 1, column 0
```

4.5.1 The `get_handler` shorthand

There is a short way to load a handler (instead of loading first the resource and then building the handler explicitly), the function `get_handler`:

```
get_handler(uri)
- Loads the resource at the given uri, tries to guess its mimetype by
  different meanings (name extension, etc.), searches for a suitable
  handler class in the registry, builds and returns the handler for the
  resource.
```

Compare the explicit way seen before:

```
>>> from itools.resources import get_resource
>>> from itools.handlers.Handler import Handler
>>>
>>> resource = get_resource('http://example.com')
>>> handler = Handler.build_handler(resource)
```

With the shorthand:

```
>>> from itools.handlers import get_handler
>>>
>>> handler = get_handler('http://example.com')
```

Chapter 5

Folder handlers

A handler that deserves its particular section is the default handler for folders, whose core API is:

```
get_handler(path)
- Returns a handler for the resource at the given path. It will
  use the available handler class that better matches the resource
  mimetype.

get_handler_names(path='.')
- Returns a list with the names of all the handlers in the given
  path.

get_handlers(path='.')
- Returns the handlers in the given path (it is a generator).

has_handler(path)
- Returns True if there is a handler in the given path, False oth-
  erwise.

set_handler(path, handler)
- Adds the given handler to the given path. Actually what is added
  is the resource associated to the handler.

del_handler(path)
- Removes the handler at the given path (i.e. the associated re-
  source).
```

An example will show it better.

1. First we build a handler for the temporary directory:

```
>>> from itools.handlers import get_handler
>>>
>>> tmp = get_handler('/tmp')
>>> tmp
<itools.handlers.Folder.Folder object at 0x40652dec>
>>> tmp.resource
<itools.resources.file.Folder instance at 0x406acacc>
```

2. Second, we create a new HTML handler:

```
>>> from itools.xml import HTML
>>> hello = HTML.Document(title='Hello World')
>>> hello.resource
<itools.resources.memory.File instance at 0x405e49cc>
```

Note that the associated resource is built on the fly and lives in memory.

3. Third, we set the HTML handler to the temporary folder:

```
>>> tmp.set_handler('hello.html', hello)
```

What this actually does is to add the file `hello.resource` (which lives in memory) to the folder `tmp.resource` (which is on the file system); this is to say, it creates a new file in the file system at `/tmp/hello.html`.

4. Finally, we get the handler we just added:

```
>>> hello = tmp.get_handler('hello.html')
>>> hello.resource
<itools.resources.file.File instance at 0x40638c6c>
```

Note that the handler `hello` we have built in these last lines manages a resource that lives in the file system.

5.1 The handler tree

Folders allow to classify files, hence giving a tree structure to our data. Every handler has two attributes, `parent` and `name`, they tell us where the handler is in the handler tree:

```
>>> hello.parent
<itools.handlers.Folder.Folder object at 0x403ebb2c>
>>> hello.name
'hello.html'
>>> hello.parent is tmp
True
>>> print tmp.parent
None
>>> print tmp.name

>>>
```

Based on these two attributes handlers provide the following API:

```
get_abspath()
- Returns the absolute path from the tree root to the self handler.

get_root()
- Returns the handler for the root of the tree.

get_pathroot()
- Returns a relative path from self to the tree root (e.g. ../../.).

get_pathto(handler)
- Returns a relative path from self to the given handler (which is
supposed to be in the same tree), for example: ../.. /zoo/lion.

traverse()
- This method allows to traverse the handler tree below this folder.
It is a generator which returns a handler at a time, starting by this
folder.

acquire(name)
- If the current handler is a folder and contains a resource with
the given name, then return a handler for it; otherwise look at
the parent folder, and recursively to the root tree. This method
actually shows how to implement acquisition.
```

Chapter 6

eXtensible Markup Language

The purpose of this chapter is to explain the XML services provided by `itools`, which can be found in the sub-package `itools.xml`.

6.1 XML.Document

As the reader already knows from the previous chapters, the XML services are built upon the resource-handler model. Hence we are going to start talking about a handler class, the `XML.Document` class:

```
>>> from itools.resources import get_resource
>>> from itools.xml import XML
>>>
>>> resource = get_resource('examples/hello.xml')
>>> doc = XML.Document(resource)
>>>
>>> doc
<itools.xml.XML.Document object at 0x4064466c>
```

The document is represented on memory as a tree of nodes, like the **Document Object Model** standard¹. Though, so far, no effort has been done to develop an API compatible with **DOM**.

In fact, the API is rather simple:

```
get_root_element()
- Returns the root element.
traverse()
- It is a generator that traverses the XML tree in pre-order, and
returns each time a node.
```

The `examples/hello.xml` file's content is:

¹<http://www.w3.org/DOM/>

```

<?xml version="1.0" encoding="UTF-8"?>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
    <title>Hello world</title>
    <!-- Changed by: , 02-Jun-2004 -->
  </head>
  <body>
  </body>
</html>

```

The method `traverse` lets us to easily inspect the tree nodes:

```

>>> for node in doc.traverse():
...     print repr(node)
...
<itools.xml.XML.Document object at 0x405ea38c>
<itools.xml.XML.XMLDeclaration object at 0x405e0f8c>
<itools.xml.XML.Raw object at 0x4064408c>
<itools.xml.XML.Element object at 0x4065248c>
<itools.xml.XML.Raw object at 0x406528ec>
<itools.xml.XML.Element object at 0x40652a6c>
<itools.xml.XML.Raw object at 0x406525ac>
<itools.xml.XML.Element object at 0x406526ac>
<itools.xml.XML.Raw object at 0x40652d0c>
<itools.xml.XML.Element object at 0x406527cc>
<itools.xml.XML.Raw object at 0x40652dac>
<itools.xml.XML.Raw object at 0x4065284c>
<itools.xml.XML.Comment object at 0x40652f4c>
<itools.xml.XML.Raw object at 0x40652e6c>
<itools.xml.XML.Raw object at 0x40652e8c>
<itools.xml.XML.Element object at 0x40652e4c>
<itools.xml.XML.Raw object at 0x40652eac>
<itools.xml.XML.Raw object at 0x40652f8c>
<itools.xml.XML.Raw object at 0x40652ecc>

```

This example shows the different types of nodes that make up the document tree: elements, comments, text nodes, etc.

6.1.1 XML.Element

Lets to stop and look at the API of the most important node type, `XML.Element`:

```

parent
- It is the element's parent.

attributes
- The element's attributes, it is a mapping from attribute names
to XML.Attribute objects.

get_elements(name=None)
- Returns a list with all the element nodes whose name is the given
name; if the parameter name is not given, then return all the ele-
ment nodes.

traverse()
- As with XML.Document, this method is a generator that traverses
the element children in pre-order, and returns each time a node.

copy()
- Returns a copy of the element, including all its children; but with
the attribute parent set to None.

append_child(node)
- Appends the given node to the element children, the current ele-
ment will be the node's parent.

```

6.2 Namespaces

One very important concept of XML are the *namespaces*.

An XML document may contain many different elements and attributes, if there is not any XML declaration these elements and attributes will be instances of the XML.Element and XML.Attribute classes, with the standard API and none specific semantics.

But if there are namespace declarations, `itools.xml` will be able to build specific objects that add some special semantics. To see it we are going to load the file `examples/hello.xhtml`, whose content is:

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
    <title>Hello world</title>
    <!-- Changed by: , 02-Jun-2004 -->
  </head>
  <body>
  </body>
</html>

```

The only two differences between this file and the example we saw at the beginning (`examples/hello.xml`) are the *document type* declaration and, what interests us now, the XML namespace declaration:

```
xmlns="http://www.w3.org/1999/xhtml"
```

What this sentence says is that all the elements and attributes within the document belong to the XHTML namespace. This information lets the `itools` XML parser to build a more “intelligent” tree:

```
>>> resource = get_resource('examples/hello.xhtml')
>>> doc = XML.Document(resource)
>>>
>>> doc
<itools.xml.XML.Document object at 0x405ea38c>
>>>
>>> for node in doc.traverse():
...     print repr(node)
...
<itools.xml.XML.Document object at 0x405ea38c>
<itools.xml.XML.XMLDeclaration object at 0x403eb82c>
<itools.xml.XML.Raw object at 0x406514ac>
<itools.xml.XML.DocumentType object at 0x406515cc>
<itools.xml.XML.Raw object at 0x406516cc>
<itools.xml.XHTML.Element object at 0x40651d2c>
<itools.xml.XML.Raw object at 0x406517ec>
<itools.xml.XHTML.Element object at 0x40651d0c>
<itools.xml.XML.Raw object at 0x40651e0c>
<itools.xml.XHTML.Element object at 0x4065186c>
<itools.xml.XML.Raw object at 0x40651eac>
<itools.xml.XHTML.Element object at 0x40651f6c>
<itools.xml.XML.Raw object at 0x40651f8c>
<itools.xml.XML.Raw object at 0x40651bec>
<itools.xml.XML.Comment object at 0x40651c0c>
<itools.xml.XML.Raw object at 0x40651fec>
<itools.xml.XML.Raw object at 0x4065180c>
<itools.xml.XHTML.Element object at 0x40651dec>
<itools.xml.XML.Raw object at 0x405e0eac>
<itools.xml.XML.Raw object at 0x405e0eec>
```

Now, the element nodes are not any more instances of `XML.Element`, but instances of `XHTML.Element`, which extends the generic API with the methods:

<pre>is_inline() - Returns True if the element is an inline element, False otherwise. is_block() - Returns True if the element is a block element, False otherwise.</pre>

Ok, not too much², but enough to give an idea of the power of `itools.xml`. In the next chapter we will see a much more compelling example of what can be done with `itools.xml`, the **Simple Template Language**.

²These two methods, `is_inline` and `is_block`, are actually really useful. They are used by the message extraction algorithm, a fundamental brick of the internationalization and localization services provided by `itools`.

Chapter 7

Simple Template Language

STL is a template language. It is implemented as an XML namespace handler, taking advantage of the underlying infrastructure provided by `itools.xml`.

STL process and transforms XML files. It is aimed at presentation, for example to produce the web pages that make up the user interface of a web application.

7.1 A descriptive language

Unlike other template languages in the Python world, **STL** does not mix Python code within the template. The **STL** statements only describe the transformations to be performed on the template.

This way the logic and the presentation are really separated.

There are always two sides: the *template*, which represents the presentation side; and the *namespace*, the logic side.

In five words: **STL** is a *descriptive* language.

7.1.1 The template

For example, look at the template below (`examples/chapter6/template.xml`):

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html
  PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml"
  xmlns:stl="http://xml.itools.org/namespaces/stl">
  <head></head>
  <body>
    <h1 stl:content="title" />
  </body>
</html>
```

Note the declaration of the *stl* namespace, it is mandatory.

When this template will be processed, the content of the `<h1>` tag will be replaced by the value of the variable `title`. But, where will we find `title`? Solution: in the namespace.

7.1.2 The namespace

In order to process an **STL** template, you need to pass it a Python namespace (a dictionary for example). But first we have to load the template as a handler:

```
>>> from itools.handlers import get_handler
>>> from itools import xml
>>>
>>> template = get_handler('template.xml')
>>>
>>> template
<itools.xml.XML.Document object at 0x405ea38c>
```

Note that so far nothing delates the **STL** presence, but inspecting the `template` object shows that the `stl` namespace handler has been loaded:

```
>>> template.stl
<itools.xml.STL.STL object at 0x406516cc>
```

Ok, it is time to build the namespace and process the template:

```
>>> namespace = {'title': 'hello world'}
>>> print template.stl(namespace)
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html
  PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns:stl="http://xml.itools.org/namespaces/stl"
  xmlns="http://www.w3.org/1999/xhtml">
  <head></head>
  <body>
    <h1>hello world</h1>
  </body>
</html>
```

As this example shows, the value of the variable `title` is looked within the namespace passed as parameter to `template.stl`.

7.2 Example: an addressbook

Let's go with a more complex example. The template below shows a simple addressbook (see `examples/chapter6/addressbook_view.xml`):

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html
  PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml"
  xmlns:stl="http://xml.itools.org/namespaces/stl">
  <head></head>
  <body>
    <h3>Addressbook</h3>
    <ul>
      <li stl:repeat="address addressbook">
```

```

        <stl:block content="address/last_name" />,
        <stl:block content="address/first_name" />:
        <stl:block content="address/telephone" />
    </li>
</ul>
</body>
</html>

```

The first new thing this example shows is the `repeat` statement. While `stl:content` expects a string as the value, `stl:repeat` expects a sequence. When this template is processed, the XML output will contain as many `` elements as items are in the `addressbook` variable. Within the element, in each iteration over the `addressbook` sequence, the variable `address` will be the respective item of the list.

The second new thing we see is the `<stl:block>` element. When the template is processed the `<stl:block>` tags are automatically removed.

Finally, look at the expression `address/last_name`, it shows the *slash* operator, which lets to traverse namespaces. So the variable `address` is expected to be a mapping (e.g. a dictionary), and `last_name` a key in that mapping, whose value is a string.

The Python side

Now let's see the Python code (see `examples/chapter6/addressbook.py`), this time as a class which keeps the addressbook information, with a method that process the template to produce an HTML page that shows the addressbook.

```

# Import from itools
from itools.handlers import get_handler
from itools import xml

class Addressbook(object):
    def __init__(self):
        self.addresses = []

    def add_address(self, last_name, first_name, telephone):
        address = {'last_name': last_name,
                  'first_name': first_name,
                  'telephone': telephone}
        self.addresses.append(address)

    def view(self):
        # Load the STL template
        template = get_handler('addressbook_view.xml')

        # Build the namespace
        namespace = {'addressbook': self.addresses}

        # Process the template and return the output
        return template.stl(namespace)

```

The end of the module creates an `Addressbook` instance, fills it with a couple of entries and prints the result of the view method:

```
if __name__ == '__main__':
    # Create the addressbook
    addressbook = Addressbook()
    addressbook.add_address('Jordan', 'Robert', '0606060606')
    addressbook.add_address('Buendia', 'Aureliano', '0612345678')

    # Output the addressbook content
    print addressbook.view()
```

The output of running this program is:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html
  PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns:st1="http://xml.itools.org/namespaces/st1"
  xmlns="http://www.w3.org/1999/xhtml">
  <head></head>
  <body>
    <h3>Addressbook</h3>
    <ul>
      <li>
        Jordan,
        Robert:
        0606060606
      </li><li>
        Buendia,
        Aureliano:
        0612345678
      </li>
    </ul>
  </body>
</html>
```

7.3 Language overview

So far we have seen `st1:content` and `st1:repeat`. Below is the summary with all the **STL** statements:

<p>content="expression" - Replaces the element's content by the result of evaluating the given STL expression.</p> <p>attributes="name expression[; name expression]*" - For every pair "name: expression", replace the the value of the attribute <i>name</i> by the result of evaluating <i>expression</i>.</p> <p>if="[not]expression" - If the given expression evaluates to True, do nothing; if evaluates to False, remove the XML element.</p> <p>repeat="name expression" - The given expression is expected to be a sequence or an iterator. For every item in <i>expression</i>, create an element and add the item to the namespace stack before processing the element.</p>

7.3.1 Expressions

The **STL** expressions are pretty simple, their syntax is:

name[/name]*

That is, a sequence of names separated by slashes. The semantics is:

1. Look the first name in the namespace stack.
2. If there are more names left, the last value found must be a namespace, then look the next name in that namespace.
Iterate until the last name is consumed.
3. Once the end of the sequence is reached, we will have a value. If the value is callable, then call it to get a new value.
4. Finally, we should have a value that is either a string, a boolean or a sequence, depending on which statement (**content**, **repeat**, etc.) the expression is being used with.

Chapter 8

Writing handler classes

In previous chapters we have seen some of the handlers `itools` provides out of the box, and how they help us to work with resources (e.g. XML documents).

This chapter explains how to build your own handler classes, which will let you to add support for file formats either standard or defined by yourself. The explanation will be driven by an example.

Following up the previous chapter, we will extend our addressbook, which will become a handler class. This means that the list of addressess (each one with its last name, first name and telephone number) will be stored in a resource, hence giving persistence to our addressbook.

8.1 Step by step

The process to write a handler class can be splitted in several steps, these are:

1. First the file format must be choosen or designed. If there is an standard file format that matches our requirements it could be wise to use it. Other option is to design our own.

For example, if, in the context of a multilingual application, we want to have a catalog that keeps sentences in one language and its translations to another language, then there are two obvious options, the PO file format from GNU `gettext` and the TMX standard (Translation Memory eXchange¹).

In other situations we may want to design our own format, this is the case we will illustrate in this chapter with the new version of the addressbook.

2. The second step is to choose the handler class to use as base class.

For instance, if we're going to write a handler for TMX the base handler class should be `XML.Document`. If we want to write a handler for Comma Separated Value files, then our class should inherit from `Text`.

3. Usually we will implement the method `_load`, which is the responsible to parse the resource data and to build the data structure we want in memory.

¹<http://www.lisa.org/tmx>

4. Next is to write the method `to_str`, which serializes the handler and lets to save it into the resource.
5. It is likely we will also write the method `get_skeleton()` which must return the default content of a resource.
6. Finally we will develop the specific API that will enable us to work with our handler.

8.2 Example: Addressbook

An addressbook could be stored in a resource using different file formats, we are going to use an XML based one, below is an example (which can be found in `examples/chapter7/addressbook.xml`):

```
<?xml version="1.0" encoding="UTF-8"?>
<addressbook>
  <address>
    <lastname>Jordan</lastname>
    <firstname>Robert</firstname>
    <telephone>0606060606</telephone>
  </address>
  <address>
    <lastname>Buendia</lastname>
    <firstname>Aureliano</firstname>
    <telephone>0612345678</telephone>
  </address>
</addressbook>
```

Being an XML document, it is clear our handler class should inherit from `XML.Document`:

```
from itools.xml import XML

class Addressbook(XML.Document):
    ...
```

8.2.1 Load and Save

If you remember the previous chapter, the addressbook was stored on memory as a list of dictionaries. We are going to keep the same data structure.

Our goal is to be able to:

1. Load the resource data, which we will use to feed the handler data structure with it.
2. Modify the handler (add, edit or remove addresses).
3. Save the changes on the resource.

Our focus now are the *load* and *save* operations.

Load

The method responsible to load the resource, and which we must implement, is `_load`:

```
class Addressbook(XML.Document):
    def _load(self, resource):
        # Load the XML tree
        XML.Document._load(self, resource)
        # Initialize data structure
        self.addresses = []
        # Load addressbook
        addressbook_element = self.get_root_element()
        for address_element in addressbook_element.get_elements():
            # Initialize address record with default values
            address = {'last_name': '',
                      'first_name': '',
                      'telephone': ''}
            # Load values from the XML resource
            for element in address_element.get_elements():
                if element.name == 'lastname':
                    address['last_name'] = unicode(element.children)
                elif element.name == 'firstname':
                    address['first_name'] = unicode(element.children)
                elif element.name == 'telephone':
                    address['telephone'] = unicode(element.children)
            # Add to the list of addresses
            self.addresses.append(address)
        # Clean the unneeded XML tree
        del self.children
```

Note that the `__init__` method has been removed, this method is provided by the `itools.handlers.File.File`, and should never be implemented in our custom handler classes.

Now let's test our handler class:

```
>>> from pprint import pprint
>>> from itools.resources import get_resource
>>> from addressbook import Addressbook
>>>
>>> r = get_resource('addressbook.xml')
>>> addressbook = Addressbook(r)
>>> addressbook
<addressbook.Addressbook object at 0x4058004c>
>>>
>>> pprint(addressbook.addresses)
[{'first_name': u'Robert',
  'last_name': u'Jordan',
  'telephone': u'0606060606'},
 {'first_name': u'Aureliano',
  'last_name': u'Buendia',
  'telephone': u'0612345678'}]
```

What we have done is to load the data contained in a file resource on an easy to use data structure on memory, this process is also known as de-serialization (to transform a byte string to a data structure).

Save

Now we are going to do the opposite, to transform the data structure to a byte string (the process known as serialization). This way we will be able to save the changes we do to our the handler instance.

The method we are going to implement is `to_unicode`, which must return a unicode string representing the data contained by the handler:

```
class Addressbook(XML.Document):
    def _load(self, resource):
        ...

    def to_unicode(self, encoding='UTF-8'):
        # XML declaration
        data = u'<?xml version="1.0" encoding="%s"?>\n' % encoding
        # Open root element
        data += u'<addressbook>\n'
        # Addresses
        pattern = u' <address>\n' \
            u' <lastname>%s</lastname>\n' \
            u' <firstname>%s</firstname>\n' \
            u' <telephone>%s</telephone>\n' \
            u' </address>\n'
        for address in self.addresses:
            data += pattern % address
        # Close root element
        data += u'</addressbook>'
        # Return as a byte string
        return data
```

Note that it accepts the encoding parameter, and that the returned unicode string starts by the XML declaration which specifies the encoding.

To test it type the code below:

```
>>> from itools.resources import get_resource
>>> from addressbook import Addressbook
>>>
>>> r = get_resource('addressbook.xml')
>>> addressbook = Addressbook(r)
>>>
>>> print addressbook
<?xml version="1.0" encoding="UTF-8"?>
<addressbook>
  <address>
    <lastname>Jordan</lastname>
    <firstname>Robert</firstname>
    <telephone>0606060606</telephone>
  </address>
  <address>
    <lastname>Buendia</lastname>
    <firstname>Aureliano</firstname>
    <telephone>0612345678</telephone>
  </address>
</addressbook>
```

As you see the output is similar to the original resource, because we did not modify the handler. Now we are going to add a new entry:

```
>>> addressbook.add_address('Bonaparte', 'Napoleon', '')
>>> print addressbook
<?xml version="1.0" encoding="UTF-8"?>
<addressbook>
  <address>
    <lastname>Jordan</lastname>
    <firstname>Robert</firstname>
    <telephone>0606060606</telephone>
  </address>
  <address>
    <lastname>Buendia</lastname>
    <firstname>Aureliano</firstname>
    <telephone>0612345678</telephone>
  </address>
  <address>
    <lastname>Bonaparte</lastname>
    <firstname>Napoleon</firstname>
    <telephone></telephone>
  </address>
</addressbook>
```

Now we have modified the handler, but look at the resource `examples/chapter7/addressbook.xml`, it still keeps the original two entries. What we have now is that the handler and the resource it manages are out of sync, the resource has not been updated with the changes made to the handler. To update the resource the method `save` must be used:

```
>>> addressbook.save()
```

If now you look at the resource you will see the new address.

Load and Save

The code above has showed how a resource may be outdated as it does not contains the changes made to the handler, and how to sync it with the method `save`.

But the opposite may happen too, if you build a handler for a resource, then you go and modify the resource with another application (e.g. *vi* or *emacs*), then your handler will be outdated as it won't contain the changes made to the resource. As maybe you have already guessed, the method to update the handler is `load`.

In summary the API is:

<pre>load(resource=None) - Loads the data from the given resource into the handler, if no resource is given, the one the handler is attached to will be used. save() - Saves the handler into the resource.</pre>

Chapter 9

Internationalization and Localization

Or the art of developing multilingual applications. Let's start with the concepts¹:

Internationalization the operation by which a program, or a set of programs turned into a package, is made aware of and able to support multiple languages. This is a generalization process, by which the programs are untied from calling only English strings or other English specific habits, and connected to generic ways of doing the same, instead.

Localization the operation by which, in a set of programs already internationalized, one gives the program all needed information so that it can adapt itself to handle its input and output in a fashion which is correct for some native language and cultural habits. This is a particularisation process, by which generic methods already implemented in an internationalized program are used in specific ways.

We are going to illustrate both processes, in the context of `itools`, by extending the `addressbook` example.

9.1 Internationalization

What must be internationalized is the user interface, what in our example is reduced to the template `addressbook_view.xml`.

9.1.1 Naming conventions

The technique we use with `itools` requires to have one template per language, being english the master language. Each template must have a distinct name, we will achieve it by appending the language code to the end of the file:

```
addressbook_view.xml.en  
addressbook_view.xml.es
```

¹Definitions take from the GNU `gettext` documentation.

```
addressbook_view.xml.fr
...
```

So the first thing to do is to rename the file `addressbook_view.xml` to `addressbook_view.xml.en`.

Note that only the template in English belongs to the source, the others will be automatically built with the help of `itools`.

9.1.2 Template selection

The method `view` also must be modified, so the right template is used:

```
def view(self, language='en'):
    # Load the STL template
    resource_name = 'addressbook_view.xml.%s' % language
    resource = get_resource(resource_name)
    template = XML.Document(resource)

    ...
```

What remains to explain is how the application chooses the language the user wants to see the addressbook in. This topic is out of the scope of this chapter.

9.2 Localization

To illustrate the example we will use Spanish as the second language.

The issue is, from the template `addressbook_view.xml.en` we must produce a template named `addressbook_view.xml.es`, where the translatable messages will be in Spanish instead of English.

In our case there is only one translatable message, the word `Addressbook`. While the English template contains the header:

```
<h3>Addressbook</h3>
```

the Spanish one must have:

```
<h3>Libro de direcciones</h3>
```

The localization process is splitted in three stages:

1. Message extraction.
2. Human translation.
3. Template re-construction.

Through the whole process we will use GNU `gettext`², which is the standard in the Free Software world for software internationalization and localization; and the script `igettext.py` provided by `itools`.

The Figure 9.1 shows the localization process.

²<http://www.gnu.org/software/gettext/>

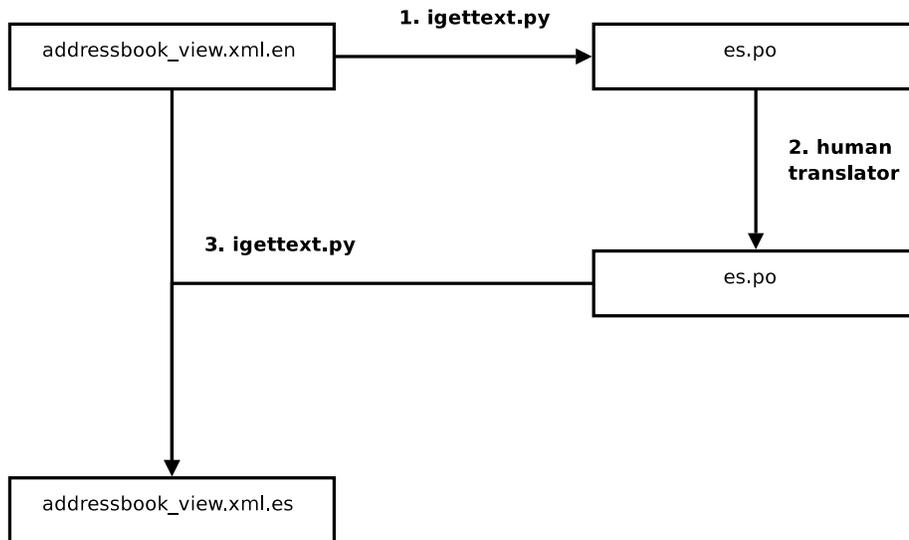


Figure 9.1: The localization process

9.2.1 Message extraction

This step consists on the parsing of the templates that define the user interface (in our case the file `addressbook_view.xml.en`), the extraction of the translatable messages they contain, and the building of a *PO* file which will be the input for the human translator.

This all is done with the `igettext.py` script:

```
$ python igettext.py --pot addressbook_view.xml.en > es.po
```

The result is the `es.po` file, whose content will be:

```
msgid ""
msgstr ""
"Project-Id-Version: PACKAGE VERSION\n"
"POT-Creation-Date: 2004-10-28 17:10+CET\n"
"PO-Revision-Date: YEAR-MO-DA HO:MI+ZONE\n"
"Last-Translator: FULL NAME <EMAIL@ADDRESS>\n"
"Language-Team: LANGUAGE <LL@li.org>\n"
"MIME-Version: 1.0\n"
"Content-Type: text/plain; charset=UTF-8\n"
"Content-Transfer-Encoding: 8bit\n"

#: addressbook_view.xml.en:0
msgid "Addressbook"
msgstr ""
```

The file consist of a header and the translatable messages that have been found, in our case just the word `Addressbook`. This file is the one the translator will work with.

9.3 Human translation

The human translator receives the PO file, and must return the same PO file, but including the translations for every message. In our example he should return the file (excluding the header):

```
#: addressbook_view.xml.en:0
msgid "Addressbook"
msgstr "Libro de direcciones"
```

To do his work he may use a simple text editor like *vi* or *emacs*. But typically he will use one of the PO graphic editors available, for example:

- KBabel, <http://www.kde.org>
- poedit, <http://poedit.sourceforge.net>

9.4 Template building

To close the process, we must generate the template `addressbook_view.xml.es` from the master template (`addressbook_view.xml.en`) and from the translated PO file (`es.po`). This is done with the script `igettext.py`:

```
$ igettext.py --xhtml addressbook_view.xml.en es.po \  
> addressbook_view.xml.es
```

And that's it, now we have the two templates, one in English and one in Spanish.

Chapter 10

Addendum

This documentation is work in progress. It has covered only about half the packages provided by `itools`. It remains to look at the workflow engine from `itools.workflow` and the index and search possibilities offered by `itools.catalog`.

And the topics we have talked about have only been exposed on the surface. The API provided by the different classes is actually bigger than what this document shows. The examples are minimal, and leave most possibilities to the reader's imagination. We haven't seen all the available handlers in detail.

Anyway, I hope you have found these tools interesting enough to get a closer look.

If you didn't, I have still a few words to add.

10.1 In the real world

In spite of the youth of `itools` (version 0.5 at the time of this writing), it is already being used in real production projects. Specially, it is the foundation of the **iKaaro**¹ Content Management System.

Some of the advantages it provides include:

- The whole web site data is stored as a tree of human readable files, instead of opaque persistent Python objects. It is possible to export a web site to the file system, to inspect and manipulate the tree, to make a tarball, to import it back to the ZODB.
- This approach encourages the use of standards, every time we need a new feature we look first if there is already a standard file format. The result is a highly portable, standards compliant application, easy to interact with other applications.
- It is possible to seamlessly integrate content from foreign sources and to make it appear as if they were in our web site. We are just at the surface of the possibilities.

But the most important, it provides a simple, high-productive framework to build our applications on, to reduce the development time to the minimum.

¹<http://www.ikaaro.org>

10.2 Future works

Some of the stuff waiting on the pipe. . .

- Schemas. Not only for XML documents (XML Schema² support is on the works), but also other handlers, specially folders.
- Many handlers for standard file formats: iCal, vCard, TMX, XLIFF, etc.
- Make `itools.uri` 100% compliant with the RFC2396, maybe write a **P**ython **E**xtension **P**roposal to get it in the Standard Library.
- Support for new schemes, protocols and storages for `itools.resources`.
- Add the last bricks to `itools.i18n` to get an engine able to power high end translation memory systems.

10.3 Free Software

And, last but not least, `itools` is free software, released to the world under the terms and conditions of the GNU Lesser General Public License³, developers own the copyright of the code they write, contributions are very welcomed.

²<http://www.w3.org/XML/Schema>

³<http://www.gnu.org/copyleft/lesser.html>

Appendix A

Coding style guide

This chapter describes the coding conventions used to write `itools`. If you ever contribute a patch to `itools`, be sure your code adheres to these rules.

Sometimes this guide contradicts the *PEP 8*¹ recommendations; in these cases this guide applies, in the context of `itools`.

A.1 Language and encoding

Code must be written in english. The preferred encoding is *UTF-8*, though others encodings are allowed.

A.2 Module structure

Each module is splitted in six sections:

1. encoding statement;
2. copyright notice;
3. license reference;
4. the module documentation string;
5. import statements;
6. the code itself.

Here we are going to describe the module's header, made up of the first five sections. The style for the code itself will be described in the rest of this chapter.

The encoding

It is only required if it is any other encoding than ASCII. Example:

```
# -*- coding: UTF-8 -*-
```

¹<http://www.python.org/peps/pep-0008.html>

The Copyright

After the encoding comes the copyright, whose structure is:

```
# Copyright (C) <years> <author name> <email>
    <years> <author name> <email>
    ...
```

The License

Right after the copyright statement comes a reference to the license. For `itools` it is the *LGPL*.

The module's documentation string

There should be a documentation string explaining what the module does (though it is better to have none than a dummy one).

The explanation about how to write a documentation string is out of the scope of this chapter, it is covered by the *PEP 257*².

Imports

The imports statements are at the top of the file (just after the legal statements and the module docstrings), though there may be imports within a function or method to avoid circular references.

Imports should be grouped, with the order being:

1. standard library imports
2. `itools` imports
3. other package package imports

Every group should be preceded by an introductory comment, like:

```
# Import from the Standard Library
...

# Import from itools
...
```

A.2.1 Example

For example, at the time of this writing the module `itools.handlers.Handler` starts by:

```
# -*- coding: ISO-8859-1 -*-
# Copyright (C) 2003-2004 Juan David Ibáñez Palomar <jdavid@itaapy.com>
#
# This library is free software; you can redistribute it and/or
# modify it under the terms of the GNU Lesser General Public
# License as published by the Free Software Foundation; either
# version 2.1 of the License, or (at your option) any later version.
```

²<http://www.python.org/peps/pep-0257.html>

```

#
# This library is distributed in the hope that it will be useful,
# but WITHOUT ANY WARRANTY; without even the implied warranty of
# MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU
# Lesser General Public License for more details.
#
# You should have received a copy of the GNU Lesser General Public
# License along with this library; if not, write to the Free Software
# Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

"""
This module provides the abstract class which is the root in the
handler class hierarchy.
"""

# Import from the Standard Library
import datetime

# Import from itools
from itools import uri
from itools.resources import base

```

A.3 Format rules

Indentation: 4 spaces

Each indentation level must have four (4) spaces. Never use tabs.

Maximum line length: 80 characters

Lines should be 80 characters wide at most.

The preferred way of wrapping long lines is by using Python's implied line continuation inside parentheses, brackets and braces. If necessary, you can add an extra pair of parentheses around an expression, but usually using a backslash looks better. Make sure to indent the continued line appropriately.

One line, one statement

Don't put more than one statement on the same line:

	Good	Bad
1	<pre> if x is True: do_something() </pre>	<pre> if x is True: do_something() </pre>
2	<pre> do_one() do_two() do_three() </pre>	<pre> do_one(); do_two(); do_three() </pre>
3	<pre> def get_area(x, y): return x * y </pre>	<pre> def get_area(x, y): return x * y </pre>

Blank lines

Separate classes with three blank lines. Separate methods and functions with two blank lines. There is also a blank line between the class definition and the first method definition.

Use blank lines in functions, sparingly, to indicate logical sections.

Whitespace in expressions and statements

Surround operators with one white space. Arithmetics operators may be the exception, for them it is possible to use either one space or none, whatever reads better. But never use more than one space.

Well, there is another exception, the sign “=” used in keyword arguments should not be surrounded by spaces. Type `Document(title="hello")` instead of `Document(title = "hello")`.

Never add spaces neither before nor after parentheses, brackets or braces. The only exception is for list comprehensions, where it is allowed to add a space after the opening bracket, and another space before the closing bracket.

The comma and colon must be followed by a space (or a new line), but never put a space before. The only exception is for one element tuples, where the comma must be immediately followed by the closing parentheses. The semicolon should never be used.

A.4 Comments

Comments must describe the code that follows them, and must be indented to the same level of that code. Inline comments are not allowed; this is to say, a comment always starts a new line.

A comment starts by a single `#` character followed by a space.

Comments must be written in good english (as good as the developer can write it). This means, for example, that the first letter must be capitalized.

A.5 Naming conventions

The names of *variables*, *classes*, *functions*, *methods* and *constants* are written with one or more english words. Most of the words used are *nouns*, *verbs*, and *adjectives*.

Abbreviations may be used, but in general it is preferred the complete word, for example, `language` instead of `lang`. When an abbreviation is not obvious, its meaning should be explained with a comment.

The allowed naming conventions are three:

lower_case_with_underscores All words are in lowercase and separated by an underscore. This convention is used for *variables*, *functions* and *methods*.

UPPER_CASE_WITH_UNDERSCORES All words are in uppercase and separated by an underscore. Used only for *constants*.

CapitalizedWords All words start by an uppercase, with the rest of the word in lowercase. Words are not separated by any character, the uppercase

letters serve to visually distinguish when a new word starts. Used only for *classes*.

A.5.1 Class names

Class names are written in capitalized words. Typically they are made of nouns and/or adjectives.

A.5.2 Functions and methods

Functions and methods are written in lowercase with underscores.

They must start by a verb, and they should be followed by a complement that clarifies what the function does. For example, it is better to spell `set_object` than just `set`.

A.5.3 Variables

Variables are written in lowercase with underscores. Most of the time they are nouns with or without adjectives.

One letter variables may be used in mathematical expressions, for sequence indexes, or in comprehensive lists:

```
>>> public_handlers = [x for x in handlers if x.state == 'public']
```

A.5.4 Constants

Constants are written in uppercase with underscores.

Appendix B

GNU arch

A control version system is a tool that keeps track of changes made in the code, when a change was made, by whom. It helps multiple developers to work on the same project, to merge the different changes they made in the same code base.

*GNU arch*¹ (also known as *tla*) is a modern and advanced control version system. It is the one we use to manage the *itools* source code.

There are many ways to work with *tla*, this appendix explains the one we use for *itools*.

The exposition is organized in three sections that detail:

1. How to keep track of the development of *itools*.
2. How to maintain private changes.
3. How to contribute your changes back to the main development tree.

B.1 Keeping track of *itools*

You may want to have the last bleeding edge features from *itools* in your system as soon as they are written, or to track how the development is going on. Then this section is for you.

B.1.1 Browsing the sources

To browse the *itools* archive tree through the web, just go the url below:

```
http://in-girum.net/cgi-bin/archzoom.cgi/jdavid@itaapy.com--public
```

B.1.2 Check out

To check out *itools* from the archive you need to install *tla*. Most distributions include it, for example, if you use Gentoo² just type:

```
$ sudo emerge tla
```

Once *tla* is installed, follow the steps described below.

¹<http://www.gnu.org/software/gnu-arch/>

²<http://www.gentoo.org>

Set your id

```
$ tla my-id "Toto Bonaparte <toto@example.com>"
$ tla my-id
Toto Bonaparte <toto@example.com>
```

Register the official itools archive

```
$ tla register-archive j david@itaapy.com--public \
    http://in-girum.net/~j david/archives/public
$ tla archives
j david@itaapy.com--public
    http://in-girum.net/~j david/archives/public
```

Check out itools

```
$ cd ~/sandboxes
$ tla get j david@itaapy.com--public/itools--main--0.6 itools-0.6
$ cd itools-0.6
$ tla tree-version
j david@itaapy.com--public/itools--main--0.6
```

B.1.3 A session with *tla* and itools

Now, whenever you want to see if something has changed in *itools*, just type:

```
$ cd ~/sandboxes/itools-0.6
$ tla missing --summary
patch-80
    use Python's documentation to profile the catalog
patch-81
    fix XML error handling (hence better STL message errors)
```

The output shows the new patches available (if your code is up-to-date the output will be empty). Say you want to apply the patches, type:

```
$ tla update
[...]
```

B.1.4 Help

The Table B.1 summarizes the *tla* commands seen in this section. To learn about other commands use `tla help`, and for details about a command type:

```
$ tla <command> --help
```

B.2 Maintaining private changes

Now maybe you want to make some changes to *itools*. The wisest to do in this situation is to create a branch of *itools*, this will let you to easily update to the last version while keeping your changes.

The first step is to setup an archive (if you have already one you can skip to the next subsection).

```

tla my-id
- Print or change your id.

tla register-archive
- Change an archive location registration.

tla archives
- Report registered archives and their locations.

tla get
- Construct a project tree for a revision.

tla tree-version
- Print the default version for a project tree.

tla missing
- Print patches missing from a project tree.

tla update
- Update a project tree to reflect recent archived changes.

tla help
- Provide help with arch.

```

Table B.1: Basic *tla* commands

B.2.1 Create an archive

```

$ mkdir ~/{archives}
$ mkdir ~/{archives}/public
$ tla make-archive toto@example.com--public ~/{archives}/public
$ tla archives
j david@itaapy.com--public
    http://in-girum.net/~j david/archives/public
toto@example.com--public
    /home/toto/{archives}/public

```

Make it your default archive:

```

$ tla my-default-archive toto@example.com--public
$ tla my-default-archive
toto@example.com--public

```

B.2.2 Create a branch

With your own archive, it is time to create a branch of *itools*:

```

$ tla tag -S j david@itaapy.com--public/itools--main--0.6 itools--toto--0.6
* creating category toto@example.com--public/itools
* creating branch toto@example.com--public/itools--toto
* creating version toto@example.com--public/itools--toto--0.6
* Archive caching revision

```

So now you can replace the check-out from the main tree with a one from your own branch:

```

$ cd ~/sandboxes
$ rm -rf itools-0.6
$ tla get toto@example.com--public/itools--toto--0.6 itools-0.6
$ cd itools-0.6
$ tla tree-version
toto@example.com--public/itools--toto--0.6

```

B.2.3 Working with your branch

So, now you modify `itools` to add a new feature. Every change made to a file will be automatically detected by `tla`, but if your work includes new files or directories, or you have removed, renamed or moved a file or a directory, then you must tell `tla` about these changes, to do so use the commands below:

```

$ tla add <filename>
[...]
$ tla delete <filename>
[...]
$ tla move <old filename> <new filename>
[...]

```

Maybe you forgot to add a file, before committing is a very good idea to verify it with the command `tree-lint`:

```

$ tla tree-lint
[...]

```

This command looks at your project tree and tells you about files suspected to be source code that have non been added yet.

Ok, so you have finished working on this new cool feature and are willing to check it in your branch of `itools`. First, verify what you have changed:

```

$ tla changes
[...]

```

This command shows which files (and folders) have been modified, removed, added or moved. For a more detailed description, try:

```

$ tla changes --diffs | less

```

Take your time to examine the changes, maybe you forgot to remove a print statement? a close look at the output of `tla changes --diffs` will tell you.

Once you are sure everything is alright, it came the time to commit. First you have to write a log message:

```

$ vi 'tla make-log'

```

Within the editor, you should introduce a title that describes the changes you have done, and optionally a longer description. Once you are done, left the editor and type:

```

$ tla commit
$ tla revisions
[...]
patch-1
    add feature XXX

```

B.2.4 Merging from the main branch

Ok, so now the upstream version of `itools` is modified, how to merge the changes in your tree? easy:

```
$ cd ~/sandboxes/itools-0.6
$ tla star-merge -t j david@itaapy.com--public/itools--main--0.6
[...]
```

Beware, there may be conflicts that you must resolve.

Now, your project tree contains the changes from the upstream archive, you must commit them in your own archive. The log is written automatically by typing:

```
$ tla log-for-merge >> 'tla make-log'
$ vi 'tla make-log'
```

Within the editor there will be a description detailing the patches that have been applied. So you just have to add the subject, something like “merging from the main tree”. Once this is done just commit as usual:

```
$ tla commit
```

Summary

See the Table B.2 for a summary of the `tla` commands seen in this section.

B.3 Contributing your work to the main tree

To contribute your changes back to the main development branch you must make your branch available through internet. We assume the archive you have set-up is your local computer, so you have to create a mirror of your archive from your local computer to an internet server:

```
$ tla make-archive --listing --mirror toto@example.com--public \
  sftp://example.com/home/toto/{archives}/public
```

You must be sure your mirror can be accessed through an internet protocol, like HTTP or FTP. So other developers will be able to merge from your branch.

Now, whenever you make and commit a change, to share that change with the community, you have to synchronize your mirror:

```
$ tla archive-mirror
[...]
```

See the Table B.3 for a summary of the commands seen in this section.

<pre>tla make-archive - Create a new archive directory. tla my-default-archive - Print or change your default archive. tla tag - Create a continuation revision (aka tag or branch). tla add - Add an explicit inventory id. tla delete - Remove an explicit inventory id. tla move - Move an explicit inventory id. tla tree-lint - Audit a source tree. tla changes - Report about local changes in a project tree. tla make-log - Initialize a new log file entry. tla commit - Archive a changeset-based revision. tla revisions - List the revisions in an archive version. tla star-merge - Merge mutually merged branches. tla log-for-merge - Generate a log entry body for a merge.</pre>
--

Table B.2: Maintaining private changes: summary

<pre>tla archive-mirror - Update an archive mirror.</pre>

Table B.3: Maintaining private changes: summary