Flask

web development,
one drop at a time

Flask Documentation

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Part I
用户指南

这部分文档主要介绍了Flask的背景，然后对于Flask的web开发做了一个一步一 步的要点指示.

CHAPTER

ONE

前言

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请在你开始Flask之前读一下这篇文章，希望它回答你一些关于这个项目的初衷和目标，以及何时该用此框架何时不该用。

1.1 “micro”是什么意思？

对我来说,microframework 中的“micro”并不仅仅意味着框架的简单性和轻量性，还意味着明显的复杂度限制和用框架所写出的应用的大小。即使只用一个python文件构成一个应用也是事实。为了变得平易近人和简洁，一个microframwork会选择牺牲一些可能对于大型或者更加复杂的应用来说必不可少的功能。

例如，flask使用内部的本地线程对象从而使你不用为了线程安全而在一个请求中来回的在方法和方法之间传递对象。虽然这是一个简单的方法并且节省了你很多的时间，但是它可能也会在非常大的应用中引发一些问题因为这些本地线程对象可能会在同一线程的任何地方发生变化。

Flask 提供了一些工具来处理着这种方法的缺点，但是它更多的只是一种理论对于更大的应用来说，因为理论上本地县城对象会在同一线程的任何地方被修改。

Flask也是基于配置的，也就是说许多东西会被预先配置。比如说，按照惯例，模板和静态文件会在应用程序的python资源树下的子目录中。

Flask被称为”microframework”的主要原因是保持核心简单和可扩展性的理念。没有数据库抽象层，没有表单验证以及其他的任何已经存在的可以处理它的不同库。但是 flask知道扩展的概念。这样你就可以在你的应用程序中添加这些功能，如果它被引用的话。目前已经有对象关系映射器，表单验证，上传处理，各种开放认证技术等等之类的扩展。

然而flask并没有许多的代码，并且它基于一个非常坚固的基础，这样它就可以非常容易的去适应大型的应用。如果你有兴趣，请查阅 搞大了？！ 章节。

如果你对flask的设计原则感到好奇，请转向 Design Decisions in Flask 章节。

1.2 一个框架和一个例子

Flask 并不仅仅是一个微型框架；它同时也是一个例子。基于Flask，会有一系列的博文来阐述如何创建一个框架。Flask自己就是一种在现有库的基础上实现一个框架的方式。不像大部分的其他微型框架，Flask不会试着实现它自己的任何东西，它直接使用已经存在的代码。

1.3 Web开发是危险的

我并不是在开玩笑。好吧，也许有一小点。如果你写一个web应用，你可能允许用户注册，并且允许他们在你的服务器上留下数据。用户把数据委托给了你。即使你是唯一可能 在你的应用中留下数据的用户，你也会希望那些数据安全的存储起来。

不幸的是，有很多中方法去损害一个Web应用程序的安全性。Flask可以防止一种现代Web 应用中最常见的安全问题：cross-site scripting(XSS).除非你故意的把不安全的HTML 标记为安全的，Flask和潜在的Jinja2模板引擎会把你覆盖掉。但是引发安全问题的方式 还有很多。

这篇文档是要提醒你注意Web开发中需要注意安全问题的方面。这些安全忧患中的一些远 远比人所想到的复杂的多，我们有时候会低估了一个漏洞会被利用的可能性，直到一个聪 明的攻击者指出一种方式来溢出我们的应用。

别以为你的应用程序还没有重要到吸引攻击者的程度， 依靠这种攻击方式，可能会有一些 自动机器人在想方设法在你的数据库中填入垃圾邮件，恶意软件的链接，等等。

1.4 Python 3的状态

目前Python社区正处在一个提高库对Python编程语言的新的迭代过程的支持。不幸的是， Python3 中还有一些问题，像缺少对Python3应该采用哪种WSGI方式的决策。这些问题有 部分原因是Python中的未经审核的变化；一部分原因是每个人都希望参与推动WSGI标准的 野心。

正因为如此，我们推荐不要使用Python3来开发任何Web应用直到WSGI的问题得到解决。 你会发现一部分框架和Web库宣称支持 Python3，但是它们的支持是基于Python3和 Python3.1中过时的WSGI实现，而这个实现很有可能在不久的将来会发生改变。

一旦WSGI的问题得到解决，Werkzeug和Flask将会立刻移植到Python3，并且我们会提供一些有用的提示来把现存的应用更新到 Python3.在那之前，我们强烈推荐在 开发过程中使用激活的Python3 警告python2.6和2.7，以及Unicode文字的 __future__ 功能。

CHAPTER

TWO

安装

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Flask依靠两个外部库， Werkzeug 和 Jinja2. Werkzeug是一个WSGI的工具包， 在web应用和多种服务器之间开发和部署的标准的python 接口。Jinja2呈现模板。

那么如何快速获得你计算机中的一切？在这个章节中会介绍很多种方式，但是最了 不起的要数virtualenv,所以我们第一个先说它。

2.1 virtualenv

当你拥有shell访问权限时，virtualenv 可能是你在开发以及生产环境中想要使用的。

Virtualenv解决了什么问题？如果你像我一样喜欢Python，你可能会不仅想要在基于Flask的Web应用，还包括一些其他的应用中使用它。但是，你拥有的项目越多，你用不同的版本的Python工作的可能性越大，或者至少是不同版本的Python库。面对现实吧；库很经常的破坏向后兼容性，而且想要任何大型的（正经的）应用零依赖是不可能的。那么当你的两个或多个项目有依赖性冲突的话，你要怎么做？

Virtualenv来救援！它从根本上实现了多种并排式的python安装。它实际上并没有安装Python的单独的副本，但它确实提供了一种巧妙的方式，让不同的项目环境中分离出来。

那么让我们来看看Virtualenv是如何工作的！

如果你是在Mac OS X 或者Linux下，那么下面的两条命令将会适合你:

```
$ sudo easy_install virtualenv
```

或者更好的:

```
$ sudo pip install virtualenv
```

任意一个都可以在你的系统中安装virtualenv。它甚至可能在你的包管理中。如果你使用 的是Ubuntu，尝试:

```
$ sudo apt-get install python-virtualenv
```

如果你在Windows平台上并没有 easy_install 命令，你首先必须安装它。查阅 Windows 平台下的 easy_install 章节来获得更多如何做的信息。一旦你安装了它， 运行上述的命令，记得去掉 sudo 前缀。

一旦你装上了virtualenv，请调出shell然后创建你自己的环境变量。我通常会创建 一个包含 env 文件夹的项目文件夹:

```
$ mkdir myproject
$ cd myproject
$ virtualenv env
New python executable in env/bin/python
Installing setuptools.............done.
```

现在，无论何时你想在一个项目上工作，你只需要激活相应的环境。在OS X和Linux上，执行以下操作:

```
$ . env/bin/activate
```

(注意脚本名称和点号之间的空格。该点意味着这个脚本应该运行在当前shell的上下文。 如果这条命令不能在你的shell中正常工作，请试着把点号替换为 `source`)

如果你是一个Windows用户，下面的命令是为你准备的:

```
$ env\scripts\activate
```

无论哪种方式，现在你应该正在使用你的virtualenv（看看你的shell提示已经更改到显示virtualenv）

现在你可以键入下面的命令来激活你virtualenv中的Flask:

```
$ easy_install Flask
```

几秒钟后就准备好了。

2.2 安装到系统全局

这样也可以，但是我确实不推荐它。只需以root权限运行 easy_install

```
$ sudo easy_install Flask
```

(Windows平台下，在管理员Shell下运行,不要 sudo).

2.3 生活在边缘

如果你想要使用最新版本的Flask，有两种方法：你可以使用 easy_insall 拉出开发版本， 或者让它来操作一个git检索。无论哪种方式，推荐你使用virtualenv。

在一个新的Virtualenv中获得git检索,并运行在在开发模式下

```
$ git clone http://github.com/mitsuhiko/flask.git
Initialized empty Git repository in ~/dev/flask/.git/
$ cd flask
$ virtualenv env
$ . env/bin/activate
New python executable in env/bin/python
Installing setuptools.............done.
$ python setup.py develop
...
Finished processing dependencies for Flask
```

这将引入依赖关系和激活Git的头作为在Virtualenv中当前的版本。然后你只需要 `git pull origin` 来获得最新的版本。

如果你不想用git来得到最新的开发版，可以改用下面的命令:

```
$ mkdir flask
$ cd flask
$ virtualenv env
$ . env/bin/activate
New python executable in env/bin/python
Installing setuptools.............done.
$ easy_install Flask==dev
...
Finished processing dependencies for Flask==dev
```

2.4 Windows 平台下的 easy_install

在windows上，安装 easy_install 是有一点的复杂因为在Windows上比在类Unix系统上有一些轻微的不同的规则，但是它并不难。最简单的安装方式是下载 ez_setup.py 文件 然后运行它。运行它最简单的方式是进入到你的下载目录中，然后双击这个文件。

接着，添加 easy_install 命令和其他Python脚本到命令行搜索路径，方法为：添加你python安装目录中的Scripts文件夹到环境变量 PATH 中。添加方法:右键桌面的“我的电脑” 图标或者开始菜单中的“计算机”，然后选在“属性”。之后，在Vista和Win7下，单击“高级系统设置”；在WinXP下，单击“高级”选项。然后，单击“环境变量”按钮，双击“系统变量”中的“path”变量。 在那里添加你的Python解释器的 Scripts文件夹；确保你使用分号将它与现有的值隔开。 假设你在使用默认路径的Python2.6，加入下面的值

```
;C:\Python26\Scripts
```

这样就完成了。要检查它是否正常工作，打开命令提示符然后执行 `easy_install`.如果在Vista 或者Win7下你只有用户控制权限，它应该会要求你获得管理员权限。

CHAPTER

THREE

快速上手

急于开始了吗?本文就如何上手Flask提供了一个很好的介绍. 假定你已经安装好了Flask.如果没有的话, 请参考 安装 这一节.

3.1 一个最小的应用

一个最小的Flask应用程序看起来像是这样:

```
from flask import Flask
app = Flask(__name__)

@app.route('/')
def hello_world():
    return "Hello World!"

if __name__ == '__main__':
    app.run()
```

把它存为 hello.py 或其它相似的文件名, 然后用python解释器运行这个文件. 请确保你的程序名不是叫做 flask.py ,因为这样会和Flask本身发生冲突.

```
$ python hello.py
 * Running on http://127.0.0.1:5000/
```

把浏览器指向 http://127.0.0.1:5000/, 你将看到 你的 hello world的问候.

那么这段代码到底做了什么?

1. 首先我们导入了 `Flask` 类.这个类的一个实例将会是我们的 WSGI程序.
2. 接下来我实们来例化这个类.我们把模块/包的名字传给它,这样Flask就会知道它将要到哪里寻找模板, 静态文件之类的东西.
3. 然后我们使用 `route()` 装饰器告诉Flask哪个网址将会触发 我们的函数.
4. 这个函数还有一个作用是为特定的函数生成网址, 并返回我们想要显示在用户浏览器的信息.

5. 最后我们用 `run()` 函数来运行本地服务器以及我们的应用. `if __name__ == '__main__'`: 确保了服务器只会在直接用Python解释器执行 该脚本的时候运行,而不会在导入模块的时候运行.

要停止服务器，按 Ctrl+C.

外部可见的服务器

当你运行服务器时你可能会注意到该服务器仅能从你自己的电脑访问，网络中的 其它地方都将不能访问.这是因为默认启用的调试模式中，应用程序的用户可以执 行你的电脑上的任意Python代码。如果你禁用了 调试 或者信任你所在的网络 中的用户，你可以使你的服务器公开可访问.

只需要像这样更改 `run()` 方法

```
app.run(host='0.0.0.0')
```

这样告诉了你的操作系统去监听一个公开的IP.

3.2 调试模式

虽然 `run()` 方法很适于启动一个本地的测试服务器,但是你每次修改代码后都得重启它. 这样显然不好,Flask当然可以做得更好. 如果你开启服务器的debug支持,那么每次代码更改后服务器都会自动重启， 如果出现问题的话，还会提供给你一个有用的调试器.

有两种方法来开启debug模式.你可以在application对象上设置标志位

```
app.debug = True
app.run()
```

或者作为run方法的一个参数传入

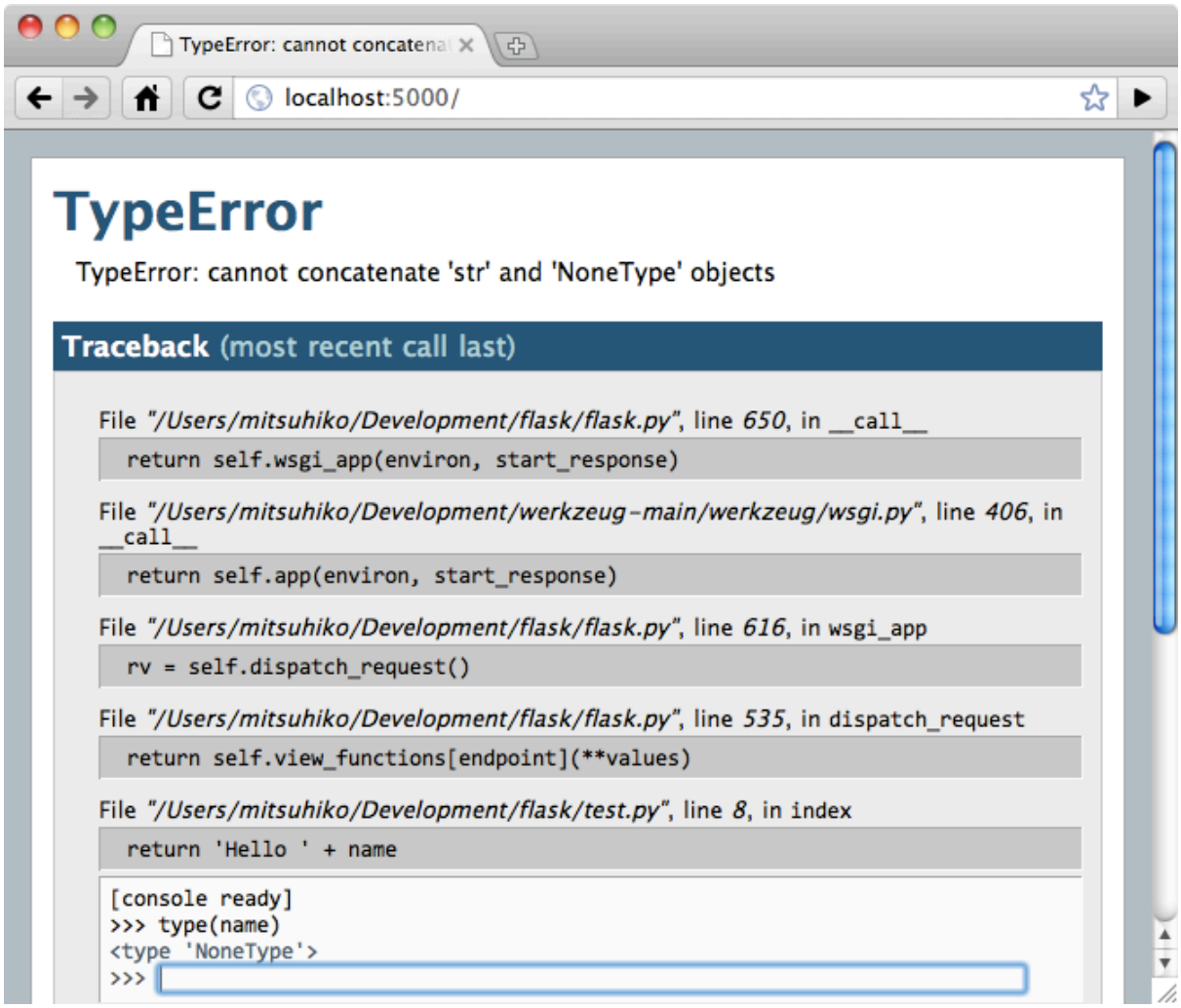
```
app.run(debug=True)
```

两者均有完全相同的效果.

注意事项

交互调试器不能在forking环境下工作，因此很少有可能将它用于产品服务器. 并且调试器仍然可以执行任意的代码，这是一个重大的安全风险， 因此 绝不能用于生产机器.

运行中的调试器的截图:



3.3 路由

正如你看到的，:meth:~flask.Flask.route 装饰器用于绑定一个函数到一个网址. 但是它不仅仅只有这些!你可以构造动态的网址并给函数附加多个规则.

这里是一些例子

```
@app.route('/')
def index():
    return 'Index Page'

@app.route('/hello')
def hello():
    return 'Hello World'
```

3.3.1 变量规则

现代的web应用程序有着一些漂亮的网址.这有助于用户记住网址，尤其是对于那些 来自较慢的网络连接的移动设备的用户显的很贴心.如果用户能直接访问他所想要 的页

面，而不必每次都从首页找起，那么用户可能会更喜欢这个网页，下次更愿意回来.

要向URL中添加变量部分，你可以标记这些特殊的字段为 `<variable_name>`. 然后这个部分就可以作为参数传给你的函数.rule可以指定一个可选的转换器 像这样 `<converter:variable_name>`.这里有一些例子:

```
@app.route('/user/<username>')
def show_user_profile(username):
    # show the user profile for that user
    pass

@app.route('/post/<int:post_id>')
def show_post(post_id):
    # show the post with the given id, the id is an integer
    pass
```

目前有以下转换器存在:

int	接受整数
float	接受浮点数类型
path	和默认的行为类似，但也接受斜线

唯一的网址 / 重定向行为

Flask的网址规则是基于Werkzeug的routing模块.这个模块背后的思想是确保 好看以及唯一的网址，基于Apache和一些创建较早的服务器.

以如下两个规则为例

```
@app.route('/projects/')
def projects():
    pass

@app.route('/about')
def about():
    pass
```

他们看起来相似，不同在于网址 定义 中结尾的斜线.第一种情况是规范网址 projects 端点有一个斜线. 从这种意义上讲，和文件夹有些类似.访问没有 斜线的网址会被Flask重定向到带有斜线的规范网址去.

然而在第二种情况下的网址的定义没有斜线，这种行为类似于访问一个文件， 访问一个带斜线的网址将会是一个404错误.

为什么这样做?用户访问网页的时候可能会忘记了斜线，这样可以使得相关的网 址能继续工作.这种行为和Apache以及其它服务器工作方式类似.另外网址保持唯 一有助于搜索引擎不会索引同一页面两次.

3.3.2 构建URL

如果它能匹配网址，那么从它是否能生成网址呢? 你当然可以! 为一个特定的函数 构建网址，你可以使用 `url_for()` 函数.它接受函数名作为第一个 参数，还有一些关键字

参数，每个对应于网址规则中的一个变量部分.未知的变量 部分将附加到网址后面作为查询参数，这里有一些例子:

```
>>> from flask import Flask, url_for
>>> app = Flask(__name__)
>>> @app.route('/')
... def index(): pass
...
>>> @app.route('/login')
... def login(): pass
...
>>> @app.route('/user/<username>')
... def profile(username): pass
...
>>> with app.test_request_context():
...  print url_for('index')
...  print url_for('login')
...  print url_for('login', next='/')
...  print url_for('profile', username='John Doe')
...
/
/login
/login?next=/
/user/John%20Doe
```

(这里用到了 `test_request_context()` 函数,它主要是告 诉Flask我们正在处理一个request,即使我们不是，我们在一个交互式的Python shell下.更进一步参考 局部上下文).

为什么你想要构建网址，而不是在模板里面硬编码? 这里有三个很好的理由:

1. 反向解析比硬编码网址更具有描述性.而且当你只在一个地方更改网址，而不用满世界的更改网址时，这就显得更重要了.
2. 网址构建过程会自动的为你处理特殊字符和unicode数据转义，这些对你而已都是透明的，你不必面对这一切.
3. 如果你的应用程序位于根路径以外的地方(比如在 `/myapplication` 而不是 `/`), `url_for()` 将妥善的为你处理好这些.

3.3.3 HTTP 方法

HTTP (web应用程序的会话协议) 知道访问网址的不同方法.默认情况下路由只回 应 GET 请求,但是通过 `route()` 装饰器提供的 methods 参数你可以更改这个行为.这里有一些例子:

```
@app.route('/login', methods=['GET', 'POST'])
def login():
    if request.method == 'POST':
        do_the_login()
    else:
        show_the_login_form()
```

如果当前是 GET, HEAD 也会自动的为你添加.你不必处理它.它确保 HEAD 请求按照 HTTP RFC (描述HTTP协议的文档) 要求的那样来处理.所以你可以 完全的忽略这部分 HTTP规范.

你不清楚什么是一个HTTP方法? 没关系，这里对它们做一个快速介绍:

HTTP方法(通常也被称为"动作")告诉服务器,客户端想对请求的页面做的事情.以下 方法很常见:

GET 浏览器告诉服务器: 只要 获取 我那个页面上的信息并将他们发送给我. 这是最常用的方法.

HEAD 浏览器告诉服务器:给我这个信息，但是我只对 消息头 感兴趣，对页面 内容没有兴趣.应用程序期望的行为是像 GET 请求那样被接收，但不传递 实际的内容. 在Flask中你完全不必处理它，底层的Werzeug库很好的为你 处理了它.

POST 浏览器告诉服务器它想 发布 一些信息到那个网址，服务器需确保数据 被存储且只存储了一次.HTML表格通常使用这个方法提交数据到服务器.

PUT 和 POST 类似，但服务器可能触发了多次存储过程，多次把旧的值覆盖掉. 你可能会问这有什么用，当然这是有原因的.传输过程中连接可能会丢失, 浏览器和服务器直接可以安全的发送第二次请求，这不会破坏任何事情. 使用 POST 就可能没法做到了，因为它只被允许触发一次.

DELETE 删除给定地址的信息.

OPTIONS 为请求中的客户端提供了一个快速的方法来得到这个网址支持哪些HTTP方法. 从Flask 0.6开始,自动为你实现了这些.

有趣的是在现在的HTML4和XHTML1中，一个表单可以提交给服务器的方法只有 GET 或者 POST. 但是通过JavaScript和未来的HTML标准你将也可以使用其他方法. 此外 HTTP最近变得相当流行，除了浏览器外还有很多东西现在也使用了HTTP协议. (你的版本控制系统可能也使用了HTTP协议).

3.4 静态文件

动态的web应用程序也需要静态文件.这往往是CSS和JavaScript文件的来源.理想情况 下你的web服务器配置好了为你服务它们，但在开发过程中Flask也可以为你做这些. 只需要在你的包或者模块旁边里创建一个名为 static 的文件夹，它将可以通过 /static 来访问.

要生成这部分的网址，使用特殊的 `'static'` 网址名字

```
url_for('static', filename='style.css')
```

这个文件将位于文件系统的 `static/style.css` 位置.

3.5 模板渲染

从Python生成HTML不好玩也相当麻烦,因为你必须自己做HTML转义以保证应用 程序的安全.因为这个原因，Flask自动为您配置了 Jinja2 模板引擎.

你可以使用 `render_template()` 来渲染模板.所有您需要做的 是提供模板的名字，以及你想要作为参数传给模板引擎的变量.这里是一个如 和渲染模板的简单例子:

```
from flask import render_template

@app.route('/hello/')
@app.route('/hello/<name>')
def hello(name=None):
    return render_template('hello.html', name=name)
```

Flask将会在 templates 文件夹下查找模板.因此如果你的应用程序是一个 模块，这个文件夹在那个模块的旁边，或者如果它实际上是一个包含在您的 包里面的包:

案例 一: 一个模块

```
/application.py
/templates
    /hello.html
```

案例 二: 一个包:

```
/application
    /__init__.py
    /templates
        /hello.html
```

作为模板来讲你可以充分利用Jinja2模板的威力.前往 文档的 模版 章节或者 Jinja2 模板文档 查看更多信息.

这里是一个模版的例子:

```
<!doctype html>
<title>Hello from Flask</title>
{% if name %}
  <h1>Hello {{ name }}!</h1>
{% else %}
  <h1>Hello World!</h1>
{% endif %}
```

在模板内部你可以访问 `request`, `session` 和 `g` [1] 对象,以及 `get_flashed_messages()` 函数.

当使用继承的时候模板显得特别有用.如果你想了解继承是如何工作的，请查看 Template Inheritance 模式文档.基本上模板继承可以使得特定元素在 每个页面上都显示(比如header,navigation和footer).

[1] 不确定 `g` 对象是什么? 它就是你可以用来存储信息的 某个东西,查看对象 (`g`) 和 Using SQLite 3 with Flask 的文档以得到 更多信息.

自动转义默认是开启的，所以如果名字中包含HTML将被自动转义.如果你信任一个 变量并知道它是安全的(例如来自于一个把wiki标记转换为HTML格式的模板),你可以 使用类 `Markup` 或者 模板中的 `|safe` 标签，来标记它是 安全的. 前往Jinja2文档查看更多的例子.

这里就 `Markup` 类如何工作有一个简单的介绍:

```
>>> from flask import Markup
>>> Markup('<strong>Hello %s!</strong>') % '<blink>hacker</blink>'
Markup(u'<strong>Hello &lt;blink&gt;hacker&lt;/blink&gt;!</strong>')
>>> Markup.escape('<blink>hacker</blink>')
Markup(u'&lt;blink&gt;hacker&lt;/blink&gt;')
>>> Markup('<em>Marked up</em> &raquo; HTML').striptags()
u'Marked up \xbb HTML'
```

Changed in version 0.5.

3.6 访问 Request 数据

对web应用程序来说最重要的就是对客户端发送到服务器端的数据做出响应.在 Flask中这个信息由一个全局的 `request` 对象提供.如果你 有一些Python的经验，你可能会奇怪这个对象怎么可能是全局的，并且Flask 怎么还能依然线程安全. 答案是局部上下文.

3.6.1 局部上下文

内幕信息

如果你想理解它是怎么工作的，你怎么用它来做测试,那么继续读下去, 否则跳过这节.

Flask中的某些对象是全局对象,但它不是一个标准的全局对象，实际上是一个 本地对象的代理.听起来真拗口.但实际上却很容易理解.

想象一下正在处理线程的上下文.当一个请求进来，web服务器决定生成一个新的 线程或别的东西时，这个基本对象能够很好的胜任处理其它并发系统不仅仅是线 程.当Flask开始内部的线程处理时，它把当前线程当作活动上下文并把当前应用 程序和WSGI环境绑定到这个上下文(线程).它以一种智能的方式使得在一个应用程序 中能调用另一个应用程序而不会中断.

那么这对你而言意味着什么?除非你在做单元测试或一些不同的东西，基本上你可 以完全忽略这种情况.你将发现依赖于一个request对象的代码会突然挂掉，因为 那里并没有request对象.解决方案就是创建一个request对象并把它绑定到上下文. 在单元测试中最早的解决方案是使用 `test_request_context()` 上下文管理器.结合 with 声明它将绑定一个测试request，以便于你交互.这里 是一个例子:

```
from flask import request

with app.test_request_context('/hello', method='POST'):
    # now you can do something with the request until the
```

```
    # end of the with block, such as basic assertions:
    assert request.path == '/hello'
    assert request.method == 'POST'
```

另一个可能性是传递一个完整的WSGI环境给:meth:~flask.Flask.request_context 方法:

```
from flask import request

with app.request_context(environ):
    assert request.method == 'POST'
```

3.6.2 Request 对象

在API章节对request有着详尽的文档描述，所以我们这里不会深入讲解 (查看 `request`). 这里仅仅提一下一些最常见的操作. 首先你要做的是从 flask 导入它:

```
from flask import request
```

当前的request方法可以通过 `method` 属性获得. 要访问表单数据(由 POST 或者 PUT 请求传递的数据),可以通过 `form` 属性得到.这里有一个关于上诉提到的 两个属性的完整的例子:

```
@app.route('/login', methods=['POST', 'GET'])
def login():
    error = None
    if request.method == 'POST':
        if valid_login(request.form['username'],
                       request.form['password']):
            return log_the_user_in(request.form['username'])
        else:
            error = 'Invalid username/password'
    # this is executed if the request method was GET or the
    # credentials were invalid
```

如果 form 属性中不存在这个键会发生什么?在这种情况下将会抛出 `KeyError`. 你可以像捕捉标准错误一样捕捉它，但如果你不这样做，将会显示给你一个 HTTP 400 Bad Request页面.因此很多情况下你不必处理这个问题.

要访问诸如 (`?key=value`) 之类形式的网址所提交的参数，你可以使用 :attr:~flask.request.args 属性:

```
searchword = request.args.get('q', '')
```

我们推荐使用 get 访问网址参数或者捕捉 KeyError,因为用户可能更改网址，展现给他们一个 400 bad request 页面不够友好.

如果要得到关于该对象的方法和属性的一份全面的列表，查看文档 `request` .

3.6.3 文件上传

用Flask处理文件上传很容易.你只要确保不要忘记在你的HTML表单设置属性 `enctype="multipart/form-data"`，否则浏览器根本不会提交你的文件.

上传的文件储存在内存或者文件系统中的一个临时位置.你可以通过request 对象的 `files` 属性来访问这些文件.每个上传的 文件都储存在那个字典里.它表现的就像一个标准的Python `file` 对象,但它还有一个 `save()` 方法允许你 把文件存储在服务器的文件系统上.这里有一个它如何工作的例子:

```
from flask import request

@app.route('/upload', methods=['GET', 'POST'])
def upload_file():
    if request.method == 'POST':
        f = request.files['the_file']
        f.save('/var/www/uploads/uploaded_file.txt')
    ...
```

如果你想知道客户端把文件上传到你的应用之前时的文件命名,你可以访问 `filename` 属性.但请牢牢记住，这个值 是可以伪造的，永远不要信任这个值.如果你想使用客户端的文件名把文件 存在服务器，你可以把它传递给Werkzeug提供给你的 `secure_filename()` 函数:

```
from flask import request
from werkzeug import secure_filename

@app.route('/upload', methods=['GET', 'POST'])
def upload_file():
    if request.method == 'POST':
        f = request.files['the_file']
        f.save('/var/www/uploads/' + secure_filename(f.filename))
    ...
```

更多例子请查看 Uploading Files 模式.

3.6.4 Cookies

访问cookies你可以使用 `cookies` 属性.这也是 一个字典，包含了客户端传输的所有的cookies.如果你想使用会话而不想 直接使用cookies的话请参考 会话 章节,它在cookies的基础 上增加了一些安全措施.

3.7 跳转和错误

把一个用户跳转到某个地方去你可以使用 `redirect()` 函数,提前 中断一个请求并返回错误码，你可以使用 `abort()` 函数.这里有 一个它们是如何工作的例子:

```
from flask import abort, redirect, url_for

@app.route('/')
def index():
    return redirect(url_for('login'))

@app.route('/login')
def login():
    abort(401)
    this_is_never_executed()
```

这是一个相当没有意义的例子，因为用户将会从首页跳转到一个它不能访问的页面(401意味着禁止访问),但它展示了它们是如何工作的.

默认每个错误码将会显示一个黑白错误信息的页面.如果你想定制错误页面，你可以使用:meth:~flask.Flask.errorhandler 装饰器:

```
from flask import render_template

@app.errorhandler(404)
def page_not_found(error):
    return render_template('page_not_found.html'), 404
```

注意 `render_template()` 调用后的 `404` .它告诉Flask这个页 面的状态码是404，代表没有找到的意思.默认的状态码是200，它的意思是: 一切 顺利.

3.8 会话

除了request对象外，还有一个对象叫做:class:~flask.session 允许你在不同请求 之间储存特定用户信息.这是在cookies基础上实现的并对cookies进行了加密.这意味 着用户可以查看你的cookie的内容，但不能修改它.除非它知道签名的密钥.

要使用会话你需要设置一个密钥.这是会话工作的一个例子:

```
from flask import Flask, session, redirect, url_for, escape, request

app = Flask(__name__)

@app.route('/')
def index():
    if 'username' in session:
        return 'Logged in as %s' % escape(session['username'])
    return 'You are not logged in'

@app.route('/login', methods=['GET', 'POST'])
def login():
    if request.method == 'POST':
        session['username'] = request.form['username']
        return redirect(url_for('index'))
    return '''
```

```
        <form action="" method="post">
            <p><input type=text name=username>
            <p><input type=submit value=Login>
        </form>
    '''

@app.route('/logout')
def logout():
    # remove the username from the session if its there
    session.pop('username', None)
    return redirect(url_for('index'))

# set the secret key.  keep this really secret:
app.secret_key = 'A0Zr98j/3yX R~XHH!jmN]LWX/,?RT'
```

这里提到了 `escape()` 函数，如果你没有使用模板引擎可以用它 来做转义(就像这个例子).

如何生成好的密钥

随机的问题是很难判断是否真正的随机.一个密钥应该做到足够随机.你的操作 系统可以基于密码随机生成器产生一个漂亮的随机值，可以用来做密钥:

```
>>> import os
>>> os.urandom(24)
'\xfd{H\xe5<\x95\xf9\xe3\x96.5\xd1\x01O<!\xd5\xa2\xa0\x9fR"\xa1\xa8'
```

拿下这个东西，复制粘贴到你的代码，然后你就大功告成了.

3.9 消息闪烁

良好的应用程序和用户界面都是基于反馈.如果用户得不到足够的反馈，它可能 最终会憎恨这个应用程序.Flask提供了一个简单的方法来给用户反馈，通过它的 消息闪烁系统.这个消息闪烁系统使得可以在一个request结束时记录一条消息，然后在下一个request(仅能在这个request)中访问它.通常结合模板的布局来 做这件事.

要闪烁一条消息使用 `flash()` 方法，获得消息使用 `get_flashed_messages()`,这个方法也能在模板中使用. 查看 Message Flashing 获得更完整的示例.

3.10 日志记录

New in version 0.3. 有时你可能会遇到一种情况，你要处理的数据应该是正确的，但实际上却不是. 比如你有一些客户端代码发送HTTP请求到服务器，它明显变形了.这可能是因为 用户对数据的加工，或者客户端代码故障.大多数时候，在这种情况下回复 `400 Bad Request` 就可以了,但在一些情况下不这么做，并且代码还得继续 工作下去.

然而你想把一些不对劲的事情记录下来.这时日志记录就派上用场了.从Flask 0.3 开始一个日志记录器已经预先为您配置好了.

这里有一些日志调用的例子:

```
app.logger.debug('A value for debugging')
app.logger.warning('A warning occurred (%d apples)', 42)
app.logger.error('An error occurred')
```

附带的 `logger` 是一个标准的日志类 `Logger`, 因此可以前往官方标准库文档查看更新信息.

3.11 WSGI 中间件集成

如果你想添加一个WSGI中间件到你的应用程序, 你可以封装内部的WSGI应用. 例如你如果享用Werkzeug包中的一个中间件来处理lighttpd的一些bug,你可以 这样做:

```
from werkzeug.contrib.fixers import LighttpdCGIRootFix
app.wsgi_app = LighttpdCGIRootFix(app.wsgi_app)
```

CHAPTER

FOUR

教程

想用Python和Flask来开发网络应用吗？那么你可以通过例子来学习。在这个tutorial里面，我们会创建一个精简的博客程序。它只支持一个用户创建文章，而且不支持feed和评论。虽然很简单，但是这个博客还是包含了你需要开始学习的所有的东西。我们将使用Flask，而数据库则采用SQLite。SQLite包含在python中，所以我们其他什么都不需要了。

如果你想要提前看到全部的源代码，或者来与自己写的做一个比较，可以查看 example source.

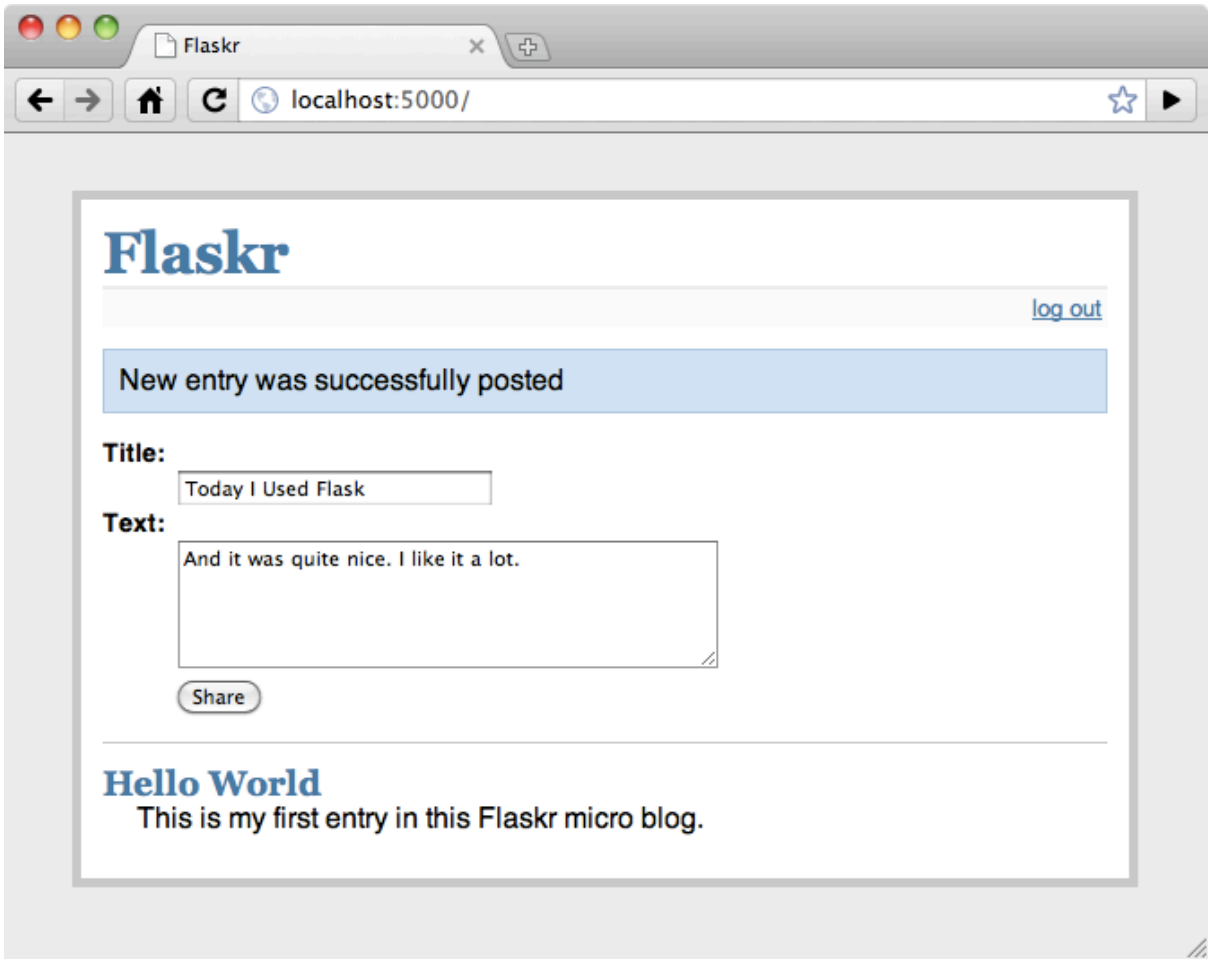
4.1 介绍 Flaskr

这里我们把我们的blog程序叫做flaskr，你可以选一个不那么web 2.0的名字 ;) 基本上我们想让它晚餐如下的功能：

1. 根据配置文件里面的认证信息让用户登陆登出。只支持一个用户
2. 用户登陆后，可以向页面添加文章，题目只能是纯文字，内容可以使用一部分 的HTML语言。这里我们假设用户是可信任的，所以对输入的HTML不会进行处理
3. 页面以倒序的顺序（后发布的在上方），在一个页面中显示所有的文章。用户 登陆后可以添加新文章。

我们为我们的应用选择SQLite3因为它对这种大小的应用足够了。但是更大的应用 就很有必要使用 SQLAlchemy，它更加智能的处理数据库连接，通过它可以一 次连接到不同的关系数据库而且可以做到更多。你也可以考虑使用最流行NoSQL数 据库之一如果你的数据更加适合这类数据库。

这是来自最终应用的一个截图:



继续 初始准备: 创建目录.

4.2 初始准备: 创建目录

在我们开始之前，让我们先创建应用所需的目录

```
/flaskr
    /static
    /templates
```

flask 目录不是python的package，只是我们放文件的地方。我们将要把我们在以后步骤 中用到的数据库模式和主要的模块放在这个目录中。 static 目录可以被网络 上的用户通过 HTTP 访问。css和javascript文件就存放在这个目录下。 Flask在 template 下查找 jinja2 的模版文件。把所有的模版文件放在这个 目录下。

继续 第一步: 数据库模式.

4.3 第一步: 数据库模式

首先我们要创建数据库模式。对于这个应用一个表就足够了，而且我们只需要支持 SQLite，所以很简单。只要把下面的内容放入一个叫 schema.sql 的文件中，这个文件应存放在 flaskr 文件夹中：

```
drop table if exists entries;
create table entries (
  id integer primary key autoincrement,
  title string not null,
  text string not null
);
```

这个模式由一个叫 entries 的表组成，表里面的每一行都有 id title text 字段。 id 是一个自动增加的整数，而且它是主键，其他的两个是字符串，而且不能为null

继续 tutorial-setup.

4.4 第二步: 应用程序构建代码

现在我们已经准备好了模式，终于可以创建应用程序的模块了。让我们把他叫做 flaskr.py，并把它放在 flaskr 目录下。首先，我们把需要的模块和配置导入。如果是小应用的话，可以直接把配置放在主模块里面，就跟我们将要做的一样。但是一个更加清晰的方案是创建一个独立的 .ini 或 .py 文件，然后导入或装载到主模块中。

```
# all the imports
import sqlite3
from flask import Flask, request, session, g, redirect, url_for, \
     abort, render_template, flash

# configuration
DATABASE = '/tmp/flaskr.db'
DEBUG = True
SECRET_KEY = 'development key'
USERNAME = 'admin'
PASSWORD = 'default'
```

下一步我们要创建真正的应用，然后用同一个文件中的配置来初始化:

```
# create our little application :)
app = Flask(__name__)
app.config.from_object(__name__)
```

`from_object()` 会识别给出的对象（如果是一个字符串，它会自动导入这个模块），然后查找所有已定义的大写变量。在我们这个例子里，配置在几行代码前。你也可以把它移动到一个单独的文件中。

从配置文件中读取配置也是一个好方法。:meth:~flask.Config.from_envvar 就是用来做这个事情的:

```
app.config.from_envvar('FLASKR_SETTINGS', silent=True)
```

通过那种方法，就可以设置环境变量 `FLASKR_SETTINGS` 来装载指定的配置文件，装载后会覆盖默认值。silent参数是为了告诉Flask不要报错，即使没有设置环境变量。

我们需要设置 secret_key 来确保客户端Session的安全。合理的设置这个值，而且越复杂越好。Debug标志用来指示是否开启交互debugger。永远不要在生产环境下开始debug标志，因为这样会允许用户在服务器上执行代码！

我们还添加了一个方法来快速的连接到指定的数据库。这个方法不仅可以在有用户请求时打开一个连接,还可以在交互的Python shell和脚本中使用。这对以后会很方便。

```
def connect_db():
    return sqlite3.connect(app.config['DATABASE'])
```

最后如果我们想把那个文件当做一个独立的应用来运行，我们需要在文件的末尾加一行代码来开启服务器

```
if __name__ == '__main__':
    app.run()
```

现在我们应该可以顺利的运行这个应用了。如果你访问服务器，你会得到一个404，页面没有找到的错误，因为我们还没有创建任何视图。但是我们会在后面再提到它。首先，我们应该要先让数据库跑起来。

让服务器可以被外部访问

你想然你的服务器被外部访问吗？查看 externally visible server 部分来获取更多的信息

继续 第三步： 创建一个数据库.

4.5 第三步： 创建一个数据库

我们原来就说过，Flask是一个数据去驱动的应用，更准确的来说，是一个基于关系数据库的应用。这样的系统需要一个模式来决定怎么去存储信息。所以在第一次开启服务器前就把模式创建好很重要。

这个模式可以通过管道的方式把 schema.sql 输入到 sqlite3 命令中，如下所示

```
sqlite3 /tmp/flaskr.db < schema.sql
```

这种方法的缺点是需要安装sqlite3命令，但是并不是每一个系统中都有安装。而且你必须给出数据库的路径，否则就会出错。添加一个函数来对数据库进行初始化是一个不错的想法。

如果你想这么做，首先要从contextlib package中import `contextlib.closing()` 函数。如果你想用Python 2.5，那么还需要开启 with 声明，（从 _future_ 中的import内容要在所以import的最前面）：

```
from __future__ import with_statement
from contextlib import closing
```

下面我们创建一个叫 init_db 的函数来初始化数据库。在这里，我们可以使用前面 定义的 connect_db 函数。只需要把这个函数添加到 connect_db 函数的下面:

```
def init_db():
    with closing(connect_db()) as db:
        with app.open_resource('schema.sql') as f:
            db.cursor().executescript(f.read())
        db.commit()
```

通过 :func: ~contextlib.closing 辅助函数，我们可以在 with 模块中保持数 据库连接。applicationg对象的 `open_resource()` 方法支持也 支持这个功能，所以我们可以在 with 模块中直接使用它。这个函数用来从这个应 用的所在位置（ flaskr 目录）打开一个文件，然后允许你通过它来读取文件。我 们在这里使用这个函数是为了在数据库连接上执行一个脚本。

当你连接到数据库后，我们就得到了一个连接对象（这里我们把它叫做 db ），这 个对象会给我们提供一个指针。这个指针有一个方法可以来执行完整的数据库命令。 最后，我们还要来提交我们对数据库所做的改变。如果你不明确的来提交修改， SQLite3 和其他的事务数据库都不会自动提交这些修改。

现在我们可以打开一个Pythonshell，然后import函数，调用函数。这样就能创建一个数据库了:

```
>>> from flaskr import init_db
>>> init_db()
```

Troubleshooting

如果你得到了一个表无法被找到的异常，检查下，你是否调用了 init_db ， 而 且你表的名字是正确的（单数 复数问题）。

继续 第四步：请求数据库连接

4.6 第四步：请求数据库连接

现在，我们知道了如何来创建一个数据库连接，如何来执行脚本，但是我们如何能优雅的为每一次的请求创建连接？数据库连接在所以的函数中都是需要的，所以能自动在请求之前初始化，请求结束后关闭就显得很有意义。

Flask提供了 `after_request()` 和 `before_request()` 装饰器来让我们做到这一点:

```
@app.before_request
def before_request():
    g.db = connect_db()

@app.after_request
def after_request(response):
```

```
    g.db.close()
    return response
```

用 before_request() 装饰的函数在每次请求之前被调用，它没有参数。用 after_request() 装饰的函数是在每次请求结束后被调用，而且它需要传入response。这类函数必须返回同一个response 对象或者一个不同的response对象。在这里，我们不对response做修改，返回同一个 对象。

我们把当前的数据库连接保存在一个特殊的对象 g 里面，这个对象 flask已经为我们提供了。这个对象只能用来为一个请求保存信息，每一个函数都可以 访问这个对象。不要用其他的对象来保存信息，因为在多线程的环境下会无法工作。 g 对象是一个特殊的对象，它会在后台做一些魔术来确保它能够跟我 们预想的一样执行。

继续 第五步: 视图函数.

4.7 第五步: 视图函数

现在数据库连接已经可以工作了，我们终于可以开始写我们的视图函数了。我们一共需要写4个：

4.7.1 显示文章

这个视图将会显示数据库中所有的文章。它会绑定在应用的根地址，并且从数据库中 查询出文章的标题和内容。最新发表的文章会显示在最上方。从cursor返回的数据是 存放在一个tuple中，而且以select语句中的指定的顺序排序。对我们这个小应用来说 tuple已经满足要求了，但是也许你想把它转换成dict。那么，你可以参考 Easy Querying 的示例。

视图函数会把所有的文章以字典的方式传送给 show_entries.html 模版，然后向浏览器返回render过的:

```
@app.route('/')
def show_entries():
    cur = g.db.execute('select title, text from entries order by id desc')
    entries = [dict(title=row[0], text=row[1]) for row in cur.fetchall()]
    return render_template('show_entries.html', entries=entries)
```

4.7.2 添加一篇新文章

这个视图用来让已登陆的用户发表新文章。它只对以 POST 方式提交的请求回应，实际的表单显示在 show_entries 页面上。如果一切都没有出问题的话，我们用 ~flask.flash 向下一次请求发送一条信息，然后重定向回 show_entries 页面:

```
@app.route('/add', methods=['POST'])
def add_entry():
    if not session.get('logged_in'):
        abort(401)
```

```
    g.db.execute('insert into entries (title, text) values (?, ?)',
                 [request.form['title'], request.form['text']])
    g.db.commit()
    flash('New entry was successfully posted')
    return redirect(url_for('show_entries'))
```

注意，我们在这里检查了用户是否已经登陆（logged_in 键在session中存在，而且值为 True）。

Security Note

Be sure to use question marks when building SQL statements, as done in the example above. Otherwise, your app will be vulnerable to SQL injection when you use string formatting to build SQL statements. See Using SQLite 3 with Flask for more.

4.7.3 登陆和登出

这些函数是用来让用户登陆和注销的。登陆函数会检查用户名和秘密，并和配置文件 中的数据进行比较，并相应的设置session中的 logged_in 键。如果用户登陆成功，那么这个键会被设置成 True，然后用户会被重定向到 show_entries 页面。并且还会flash一条消息来提示用户登陆成功。如果登陆发生 错误,那么模版会得知这一点，然后提示用户重新登陆:

```
@app.route('/login', methods=['GET', 'POST'])
def login():
    error = None
    if request.method == 'POST':
        if request.form['username'] != app.config['USERNAME']:
            error = 'Invalid username'
        elif request.form['password'] != app.config['PASSWORD']:
            error = 'Invalid password'
        else:
            session['logged_in'] = True
            flash('You were logged in')
            return redirect(url_for('show_entries'))
    return render_template('login.html', error=error)
```

注销函数所作的正好相反。它从session中删除 logged_in 键。我们在这里使用的 一个简洁的小技巧：如果你在使用字典的 `pop()` 方法时，给了它第二个 参数（默认），那么这个方法在处理的时候，会先查询是否存在这个键，如果存在， 则删除它，如果不存在，那么什么都不做。这个特性很有用，因为这样我们在处理的 时候，就不需要先检查用户是否已登陆。

```
@app.route('/logout')
def logout():
    session.pop('logged_in', None)
    flash('You were logged out')
    return redirect(url_for('show_entries'))
```

继续 第六步: 模版.

4.8 第六步: 模版

现在我们可以开始制作我们的网页模版了。如果我们现在访问URL，我们会得到一个“Flask无法找到模版文件”的异常。我们的模版将使用 Jinja2 的格式，而且默认是打开自动转义的。这也就是说，除非我们在代码中用 `Markup` 标记一个值，或者在模版中用 `|safe` 过滤器，否则Jinja2会将一些特殊字符，如 `<` 或 `>` 用XML格式来转义。

我们将使用模版继承机制来使所有的页面使用同一个布局。

把以下的模版放在 template 目录下：

4.8.1 layout.html

这个模版包含了HTML的主要结构，标题和一个登陆的链接（或者登出如果用户已经登陆）。它还负责显示flashed messages。 `{% block body %}` 可以被子模版的相同名字（`body`）的结构所替换

`session` 字典在模版中也是可以访问的。所以你可以用session来检查用户是否已登陆。注意在Jinja中，你可以访问对象或字典的未使用过的属性和成员。就如下面的代码一样，即使session中没有 `'logged_in'`：

```
<!doctype html>
<title>Flaskr</title>
<link rel=stylesheet type=text/css href="{{ url_for('static', filename='style.css') }}">
<div class=page>
  <h1>Flaskr</h1>
  <div class=metanav>
  {% if not session.logged_in %}
    <a href="{{ url_for('login') }}">log in</a>
  {% else %}
    <a href="{{ url_for('logout') }}">log out</a>
  {% endif %}
  </div>
  {% for message in get_flashed_messages() %}
    <div class=flash>{{ message }}</div>
  {% endfor %}
  {% block body %}{% endblock %}
</div>
```

4.8.2 show_entries.html

这个模版继承自上面的 layout.html ,来显示文章。 for 循环遍历所有的文章。 我们通过 `render_template()` 来传入参数。我们还告诉表单使用 HTTP 的 POST 方法提交到 add_entry 函数:

```
{% extends "layout.html" %}
{% block body %}
  {% if session.logged_in %}
    <form action="{{ url_for('add_entry') }}" method=post class=add-entry>
      <dl>
        <dt>Title:
        <dd><input type=text size=30 name=title>
        <dt>Text:
        <dd><textarea name=text rows=5 cols=40></textarea>
        <dd><input type=submit value=Share>
      </dl>
    </form>
  {% endif %}
  <ul class=entries>
  {% for entry in entries %}
    <li><h2>{{ entry.title }}</h2>{{ entry.text|safe }}
  {% else %}
    <li><em>Unbelievable.  No entries here so far</em>
  {% endfor %}
  </ul>
{% endblock %}
```

4.8.3 login.html

最后是登陆页面的模版。它仅仅是显示一个表单来允许用户登陆：

```
{% extends "layout.html" %}
{% block body %}
  <h2>Login</h2>
  {% if error %}<p class=error><strong>Error:</strong> {{ error }}{% endif %}
  <form action="{{ url_for('login') }}" method=post>
    <dl>
      <dt>Username:
      <dd><input type=text name=username>
      <dt>Password:
      <dd><input type=password name=password>
      <dd><input type=submit value=Login>
    </dl>
  </form>
{% endblock %}
```

继续 第七步: 添加样式.

4.9 第七步: 添加样式

现在其他的东西都能工作了，是时候来给我们的应用添加一点样式了。 我们先前创建了 static 文件夹，在这里面新建一个css文件 style.css :

```
body            { font-family: sans-serif; background: #eee; }
a, h1, h2       { color: #377BA8; }
h1, h2          { font-family: 'Georgia', serif; margin: 0; }
h1              { border-bottom: 2px solid #eee; }
h2              { font-size: 1.2em; }

.page           { margin: 2em auto; width: 35em; border: 5px solid #ccc;
                  padding: 0.8em; background: white; }
.entries        { list-style: none; margin: 0; padding: 0; }
.entries li     { margin: 0.8em 1.2em; }
.entries li h2  { margin-left: -1em; }
.add-entry      { font-size: 0.9em; border-bottom: 1px solid #ccc; }
.add-entry dl   { font-weight: bold; }
.metanav        { text-align: right; font-size: 0.8em; padding: 0.3em;
                  margin-bottom: 1em; background: #fafafa; }
.flash          { background: #CEE5F5; padding: 0.5em;
                  border: 1px solid #AACBE2; }
.error          { background: #F0D6D6; padding: 0.5em; }
```

继续 附加: 自动测试.

4.10 附加: 自动测试

由于你已经完成了整个应用，而且一切都运行的很完美，所以从将来修改的角度 看，添加自动测试代码也许不是一个好主意。文档:ref:testing 区域中以上 面的应用为例子演示了如何进行自动单元测试。你可以去看看测试Flask应用是 多么简单的一件事。

CHAPTER

FIVE

模版

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Flask使用Jinja2作为默认模版。你可以使用任意其他的模版来替代它，但是Flask要求必须安装Jinja2。这是为了能让Flask使用更多的扩展。而这些扩展依赖于Jinja2.

这篇文章只是简单的介绍了Jinja2是如何与Flask相互配合的。如果你想更多的了解Jinja2这个引擎本身，可以去看 Jinja2模版的官方文档

5.1 Jinja安装

Flask默认的Jinja配置为：

- `.html`, `.htm`, `.xml`, `.xhtml` 文件默认开启自动转义
- 模版文件可以通过 `{% autoescaping %}` 标签来选择是否开启自动转义
- Flask在Jinja2的模版中增加了一些全局变量和辅助方法，它们的值是默认的。

5.2 标准上下文

Jinja2的模版默认存在以下全局变量：

config
: 当前的configuration对象 (`flask.config`) New in version 0.6.

request
: 当前的request对象 (`flask.request`)

session
: 当前的session对象 (`flask.session`)

g
: 用来保存一个request的全局变量（译者：不同的请求有不同的全局变量，g保存的是当前请求的全局变量） (`flask.g`)

url_for()
: `flask.url_for()` 函数

get_flashed_messages()
flask.get_flashed_messages() 函数

在Jinja上下文中的行为

这些变量属于Jinja的上下文变量，而不是普通的全局变量。它们的区别是上下文变量在导入的模版中默认是不可见的。这样做的原因一部分是因为性能的关系，还有一部分是可以让程序更加的清晰。

对使用者来说，这样有什么区别呢？如果你想导入一个宏，它需要访问request对象，那么有两种方法可以实现：

1. 将request对象或request对象的某个属性作为一个参数传给导入的宏。
2. “with context” 的方式来导入宏。

像下面这样导入：

```
{% from '_helpers.html' import my_macro with context %}
```

5.3 标准过滤器

Jinja2含有如下过滤器（包含了Jinja2模版引擎自带的）：

tojson()
这个函数是用来将对象转换成JSON格式。如果你要实时的生成JavaScript，那么这个功能是非常实用的。 要注意不能在 script 标签里面进行转义。所以如果你想在 script 标签里面使用这个函数，要确保用 |safe 来关闭自动转义：

```
<script type=text/javascript>
        doSomethingWith({{ user.username|tojson|safe }});
</script>
```

|tojson 过滤器会自动转义前置的斜杠。

5.4 控制自动转义

自动转义就是自动帮你将特殊的字符替换成转义符号。HTML（或者XML， XHTML）的特殊字符有 &, >, <, ", ' 。因为这些字符在文档中有它自己特殊的含义，所以如果你想在文章中使用这些符号，必须将它替换成转义符号。如果不这样做，不仅用户使用不了这些符号，还会导致安全问题。(更多 Cross-Site Scripting (XSS))

但是有时候你需要在模版中禁用自动转义。如果你想直接将HTML插入页面，比如将markdown语言转换成HTML，那么你就需要这样做了。

有3种方法可以关闭自动转义：

- 在Python文件中进行转义。先在 Markup 对象中进行转义，然后将它传送给模版。一般推荐使用这个方式。

- 在模版文件中进行转义。通过 `|safe` 过滤器来表示字符串是安全的(`{{ myvariable|safe }}`)
- 暂时禁用全局的自动转义功能。

要想在模版中禁用全局自动转义功能，可以用 `{% autoescaping %}` 语句块:

```
{% autoescaping false %}
        <p>autoescaping is disableed here
        <p>{{ will_not_be_escaped }}
{% endautoescape %}
```

在这么做的时候，要语句块中使用到的变量非常小心。

5.5 引入过滤器

如果你想在Jinja2中引入你自己的过滤器，有2种方法可以做到。你可以把他们放在某个应用的 `jinja_env` 对象里面或者用 `template_filter()` 装饰器。

下面的两个例子都把对象的元素颠倒过来

```
@app.template_filter('reverse')
def reverse_filter(s):
    return s[::-1]

def reverse_filter(s):
    return s[::-1]
app.jinja_env.filters['reverse'] = reverse_filter
```

在装饰器里，如果你想用函数的名字来做装饰器的名字，那么装饰器参数可以省略。

5.6 上下文处理器

Flask中的上下文处理器是为了把新的变量自动插入到模版的上下文。上下文处理器在模版被呈现之前运行，它可以把新的值插入到模版中。上下文处理器是一个返回一个字典的函数。字典的键名和键值会与模版中想对应的变量的进行合并

```
@app.context_processor
def inject_user():
        return dict(user=g.user)
```

上面的上下文处理器在模版创建了一个 user 的变量，它的值是 g.user 。这个例子不是很实用，因为 g 变量在模版中总是可以访问的，但是它展示了上下文处理器的使用方法。

CHAPTER

SIX

测试FLASK应用程序

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物未测，必有漏。

这句话其实是我瞎掰的说的不一定对, 不过也没有很超过。未经测试的应用程序的代码很难进行改进，且程序员 经常在未经测试的应用程序上面搞很容易抓狂。如果这个应用程序可以自动测试，你就可以安全的作更改且马上 可以知道哪里出了问题。

Flask提供了一种通过暴露Wekzeug测试 `Client` (客户端)且同时处理本地上下文的方法来 替你测试你的应用程序。然后你可以将其应用在你喜欢的测试方式里。在这个文档里，我们将使用 `unittest` 包，这个包是随着Python一起已经预安装好的。

6.1 要先有应用程序

首先，我们需要一个应用程序来进行测试；我们将使用 教程 作为我们的测试项目。如果你还没有 的话，你可以在 示例项目 里获取代码。

6.2 测试骨架

为了测试这个项目，我们要新增一个模块 (flaskr_tests.py) 。 且在那里建立一个 unittest 的骨架:

```
import os
import flaskr
import unittest
import tempfile

class FlaskrTestCase(unittest.TestCase):

    def setUp(self):
        self.db_fd, flaskr.app.config['DATABASE'] = tempfile.mkstemp()
        flaskr.app.config['TESTING'] = True
        self.app = flaskr.app.test_client()
        flaskr.init_db()
```

```
    def tearDown(self):
        os.close(self.db_fd)
        os.unlink(flaskr.app.config['DATABASE'])

if __name__ == '__main__':
    unittest.main()
```

在 setUp() 方法内的代码会建立一个新的测试客户端并且初始化一个新的数据库。此方法会在测试方法执行前先被调用。为了在测试结束删除建立的数据库，我们选择在 tearDown() 方法内关闭并删除这个数据库文件。此外，在准备过程中配置标记将被激活。他的作用是在处理请求时禁用错误捕捉以便于你能在针对应用程序做测试时得到更详细的错误报告。

该测试客户端会提供一个简易的应用程序交互界面。我们可以通过它向应用程序触发测试请求， 测试客户端则会一手掌控所有信息。

由于SQLite3是一个基于文件系统的数据库形式，所以我们可以十分容易地使用临时文件的形式来建立一个临时的数据库并对其进行初始化。方法 mkstemp() 为我们做了两件事：他返回了一个低级别的文件句柄和一个随机的文件名，后者就是我们使用的数据库文件名。我们只要保持有 db_fd 我们就能使用 os.close() 方法来关闭该文件。

如果我们现在运行测试套件，我们应该可以看到如下的输出结果:

```
$ python flaskr_tests.py

----------------------------------------------------------------------
Ran 0 tests in 0.000s

OK
```

尽管这个测试程序没有执行任何的实际测试，但是从这里我们可以看到我们的flaskr程序没有语法错误，否则在引入应用程序类库时就会抛出异常不再执行了。

6.3 处女测

现在是时候来测试应用程序的功能了。我们现在确认一下如果我们访问应用程序的根节点 (/)，应用程序应显示 “No entries here so far” 。我们在类里添加了一个新的方法来实现这个功能，如下:

```
class FlaskrTestCase(unittest.TestCase):

    def setUp(self):
        self.db_fd, flaskr.app.config['DATABASE'] = tempfile.mkstemp()
        self.app = flaskr.app.test_client()
        flaskr.init_db()

    def tearDown(self):
        os.close(self.db_fd)
        os.unlink(flaskr.DATABASE)
```

```
    def test_empty_db(self):
        rv = self.app.get('/')
        assert 'No entries here so far' in rv.data
```

注意我们的测试方法是以 test 开头的；这会让 unittest 模块自动将此方法作为测试方法来执行。

通过使用 self.app.get 我们可以把一个HTTP GET 请求通过给定的路径发送到应用程序。返回值是一个 response_class 对象。 我们现在可以用 data 属性来对应用程序进行核查。对应这个 例子，我们需要核查 'No entries here so far' 是输出结果的一部分。

再将它执行一次你应该可以看到一次成功的测试结果:

```
$ python flaskr_tests.py
.
----------------------------------------------------------------------
Ran 1 test in 0.034s

OK
```

6.4 日志的输入输出

关于这个应用程序，其绝大部分功能是供给管理员使用的，所以我们需要一个途径来记录应用程序运行。为了达到这个 目的，我们向登录和登出页面发送了一些带有表单数据（用户名和密码）的请求。由于登录登出请求会跳转页面，所以 我们告诉客户端要它 follow_redirects （跟踪跳转）。

在你的 FlaskrTestCase 类里添加如下两个方法:

```
def login(self, username, password):
    return self.app.post('/login', data=dict(
        username=username,
        password=password
    ), follow_redirects=True)

def logout(self):
    return self.app.get('/logout', follow_redirects=True)
```

现在，我们就可以很方便的通过检查日志查看是否有非法登录的情况。在类里添加一个新的测试方法:

```
def test_login_logout(self):
    rv = self.login('admin', 'default')
    assert 'You were logged in' in rv.data
    rv = self.logout()
    assert 'You were logged out' in rv.data
    rv = self.login('adminx', 'default')
    assert 'Invalid username' in rv.data
    rv = self.login('admin', 'defaultx')
    assert 'Invalid password' in rv.data
```

6.5 测试添加功能

我们同时还需要测试添加消息的功能是否正常。再添加一个新的测试方法，像这样:

```
def test_messages(self):
    self.login('admin', 'default')
    rv = self.app.post('/add', data=dict(
        title='<Hello>',
        text='<strong>HTML</strong> allowed here'
    ), follow_redirects=True)
    assert 'No entries here so far' not in rv.data
    assert '&lt;Hello&gt;' in rv.data
    assert '<strong>HTML</strong> allowed here' in rv.data
```

这里，我们测试了HTML语法只能在内容里使用，而标题里不行。结果和预想的一样。

运行测试我们应该可以得到三条通过的测试结果:

```
$ python flaskr_tests.py
...
----------------------------------------------------------------------
Ran 3 tests in 0.332s

OK
```

对于那些更复杂的注入带有头和状态代码的测试，你可以在Flask的源码包里找到 MiniTwit Example 项目，里面有更多更大型的测试用例。

6.6 其他测试技巧

除了使用上述的测试客户端意外，还可以通过使用方法 `test_request_context()` ，将其和 with 语句组合可以产生一个临时的请求上下文。通过此功能你可以像在视图功能里一样访问这些类 `request`, `g` 和 `session` 。这里有一个使用此方法的完整例子:

```
app = flask.Flask(__name__)

with app.test_request_context('/?name=Peter'):
    assert flask.request.path == '/'
    assert flask.request.args['name'] == 'Peter'
```

所有其他上下文约束的对象都可以使用相同的方法。

如果你想要在不同的配置环境下测试应用程序，看起来好像没有什么好办法，可以考虑切换到应用程序工厂模式， (可查阅 Application Factories).

注意不管你是否使用测试请求上下文，方法 `before_request()` 在方法 `after_request()` 被执行之前不一定会被执行。然而方法 `teardown_request()` 在测试方法离开 with 语块时一定会被执行。 如果你 确实希望方法 `before_request()` 也被执行的话，你需要自行调用 `preprocess_request()` 方法:

```
app = flask.Flask(__name__)

with app.test_request_context('/?name=Peter'):
    app.preprocess_request()
    ...
```

在打开数据库连接或做类似的工作时，这一步就显得十分必要。这取决于你是如何设计你的应用程序的。

6.7 保持现场

New in version 0.4. 有时候我们需要触发一个常规的请求后将上下文现场保持一个较长的时间，以便于触发更多的内部检查。有了 Flask 0.4 或以上版本，通过使用方法 `test_client()` 并加上 with 语块就可以做到了:

```
app = flask.Flask(__name__)

with app.test_client() as c:
    rv = c.get('/?tequila=42')
    assert request.args['tequila'] == '42'
```

如果你使用了方法 `test_client()` 但是没有加上 with 语块, assert 语句会报错。这是因为这里的 request 不可用 (因为此操作在在实际请求之外). 不管如何, 记住任何 `after_request()` 方法在此时已经被执行，所以你的数据库连接和 其他所有操作可能已经被关闭了。

CHAPTER

SEVEN

处理应用异常

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New in version 0.3. 应用程序处理失败，服务器处理失败。在你的产品中这些异常迟早会暴露出来，即使你的代码是完全正确的， 你仍然会一次次的面对这些异常。原因？因为所有的一切都有可能失败。在以下的几种情况中，完美的代码 却导致了服务器的错误：

- 当应用系统正在读取传入的数据时，客户端过早的结束了请求。
- 数据库超过负荷，无法处理查询请求。
- 文件系统没有空间了。
- 硬盘挂了。
- 终端服务器超过负荷。
- 你所使用的代码库中存在编程错误。
- 服务器与其他系统的网络连接中断了。

而这只是你所要面对的问题中一些最简单的例子。那我们将如何来解决这些问题呢？在默认的情况下，你的 应用程序在生产模式下运行，Flask将显示一个十分简单的页面并记录这些异常通过使用 `logger` .

但是你可以做得更多，并且我们将会讨论几种更好的方案来处理这些异常。

7.1 报错邮件

如果应用程序以生产模式运行（通常在服务器上你会这么做)，在默认情况下你不会看见任何的日志信息。 这是为什么呢？因为Flask是一个零配置框架，而如果没有配置的话，框架又应该把日志文件放到哪里去 呢？依靠假设并不是一个很好的方法，因为总是会存在各种不同的可能，也许那个我们假设放置日志的地方 用户并没有权限访问。另外，对于大多数小型的应用程序来说也不会有人去关注他的日志。

实际上，我可以向你保证即使你为你的程序配置了放置错误信息的日志文件，你也永远不会去查看他，除非 当你的用户向你报告了一个事件而你需要去排查错误的时候。你所需要的只是，当异常第二次发生时接收到 一封报警邮件，然后你在针对其中的情况进行处理。

Flask使用了python内置的日志系统，并且他会在你需要是向你发生关于异常的邮件。这里是一个关于如何 配置Flask的日志以向你发送异常邮件的例子:

```
ADMINS = ['yourname@example.com']
if not app.debug:
    import logging
    from logging.handlers import SMTPHandler
    mail_handler = SMTPHandler('127.0.0.1',
                               'server-error@example.com',
                               ADMINS, 'YourApplication Failed')
    mail_handler.setLevel(logging.ERROR)
    app.logger.addHandler(mail_handler)
```

这是如何操作的呢？我们创建了一个新的类 `SMTPHandler` ， 他 将通过 `127.0.0.1` 的邮件服务器向所有的 ADMINS 用户发送标题为 “YourApplication Failed” 邮件，并且将发件地址配置为 server-error@example.com 。此外，我们还提供了对 需要证书的邮件服务器的支持，关于这部分的文档，请查看 `SMTPHandler` 。

邮件处理器只会发送异常和错误的信息，因为我们并不希望通过邮件获取警告信息或其他一些处理过程中 产生的没有用的日志。

当你在产品中使用它们的时候，请务必查看 日志格式 以使得报错邮件中包含更多的信息。这 些信息将为你解决很多的烦恼。

7.2 日志文件

即使你已经有了报错邮件，你可能仍然希望能够查看到警告信息。为了排查问题，尽可能的保存更多的 信息不失为一个好主意。请注意，Flask的系统核心本身并不会去记录任何警告信息，因此编写记录那 些看起来不对劲的地方的代码将是你的责任。

这里提供了几个处理类，但对于基本的记录错误日志而言他们并不是总是那么的有用。而其中最值得我们 注意的是以下几项:

- `FileHandler` - 将日志信息写入文件系统中
- `RotatingFileHandler` - 将日志信息写入文件系统中，并且 当日志达到一定数量时会滚动记录最新的信息。
- `NTEventLogHandler` - 将日志发送到windows系统的日 志事件中。如果你的系统部署在windows环境中，那么这正是你想要的。
- `SysLogHandler` - 将日志发送到UNIX的系统日志中。

一旦你选择了你的日志处理类，你就可以向上文中配置SMTP处理类一样的来配置它们，唯一需要注意的 是使用更低级别的设置（我这里使用的是 WARNING ）:

```
if not app.debug:
    import logging
    from logging.handlers import TheHandlerYouWant
    file_handler = TheHandlerYouWant(...)
    file_handler.setLevel(logging.WARNING)
    app.logger.addHandler(file_handler)
```

7.3 日志格式

在默认情况下，处理器只会将日志信息写入文件或是用邮件发送给你。而日志应该记录更多的信息，你必须 配置你的日志，使它能够让你更方便的知道发生了什么样的错误，以及更重要的是告诉你哪里发生了错误。

格式处理器（formatter）可以让你获取格式化的字符串。你需要知道是日志的连接是自动进行的，你不需要 将它包含在格式处理器的格式化字符串中。

这里有几个例子：

7.3.1 电子邮件

```
from logging import Formatter
mail_handler.setFormatter(Formatter('''
Message type:       %(levelname)s
Location:           %(pathname)s:%(lineno)d
Module:             %(module)s
Function:           %(funcName)s
Time:               %(asctime)s

Message:

%(message)s
'''))
```

7.3.2 日志文件

```
from logging import Formatter
file_handler.setFormatter(Formatter(
    '%(asctime)s %(levelname)s: %(message)s '
    '[in %(pathname)s:%(lineno)d]'
))
```

7.3.3 复杂的日志格式

这里是一系列用户格式化字符串的变量。这里的列表并不完整，你可以通过查看官方文档的 `logging` 部分来获取完整的列表。

格式	描述
%(levelname)s	日志等级。 ('DEBUG', 'INFO', 'WARNING', 'ERROR', 'CRITICAL').
%(pathname)s	调用日志的源文件的全路径（如果可用）
%(filename)s	文件名。
%(module)s	模块名。
%(funcName)s	方法名。
%(lineno)d	调用日志的代码所在源文件中的行号。（如果可用）
%(asctime)s	创建日志的可阅读时间。默认的格式是 "2003-07-08 16:49:45,896" (逗号后的时间是毫秒）。可以通过复写 formatTime() 方法来修改它
%(message)s	日志信息。同 msg % args

如果你需要更多的定制化格式，你可以实现格式处理器（formatter）的子类。它有以下三个有趣的方法:

format(): 处理实际的格式。它需要接收一个 LogRecord 对象，并返回一个被格式话的字符串。

formatTime(): 调用 asctime 进行格式化。如果你需要不同的时间格式，可以复写这个方法。

formatException() 调用异常格式化。它接收一个 exc_info 元组并返回一个字符串。通常它会很好的运行，你并不需要复写它。

获取更多的信息，请查看官方文档。

7.4 其他代码库

目前为止，我们只配置了你的程序自身的日志。而其他的代码库同样可以需要记录日志。比如，SQLAlchemy 使用了很多日志。使用 logging 包可以一次性的配置所有的日志，当我并不推荐那样做。因为当多个程序在同一个Python解释器上运行是，你将无法单独的对他们进行配置。

相对的，我推荐你只对你所关注的日志进行配置，通过 getLogger() 方法获取所有的日志处理器，并通过迭代获取他们:

```
from logging import getLogger
loggers = [app.logger, getLogger('sqlalchemy'),
           getLogger('otherlibrary')]
for logger in loggers:
    logger.addHandler(mail_handler)
    logger.addHandler(file_handler)
```

CHAPTER

EIGHT

CONFIGURATION HANDLING

New in version 0.3. Applications need some kind of configuration. There are different things you might want to change like toggling debug mode, the secret key, and a lot of very similar things.

The way Flask is designed usually requires the configuration to be available when the application starts up. You can hardcode the configuration in the code, which for many small applications is not actually that bad, but there are better ways.

Independent of how you load your config, there is a config object available which holds the loaded configuration values: The `config` attribute of the `Flask` object. This is the place where Flask itself puts certain configuration values and also where extensions can put their configuration values. But this is also where you can have your own configuration.

8.1 Configuration Basics

The `config` is actually a subclass of a dictionary and can be modified just like any dictionary:

```
app = Flask(__name__)
app.config['DEBUG'] = True
```

Certain configuration values are also forwarded to the `Flask` object so that you can read and write them from there:

```
app.debug = True
```

To update multiple keys at once you can use the `dict.update()` method:

```
app.config.update(
    DEBUG=True,
    SECRET_KEY='...'
)
```

8.2 Builtin Configuration Values

The following configuration values are used internally by Flask:

DEBUG	enable/disable debug mode
TESTING	enable/disable testing mode
PROPAGATE_EXCEPTIONS	explicitly enable or disable the propagation of exceptions. If not set or explicitly set to None this is implicitly true if either TESTING or DEBUG is true.
PRESERVE_CONTEXT_ON_EXCEPTION	By default if the application is in debug mode the request context is not popped on exceptions to enable debuggers to introspect the data. This can be disabled by this key. You can also use this setting to force-enable it for non debug execution which might be useful to debug production applications (but also very risky).
SECRET_KEY	the secret key
SESSION_COOKIE_NAME	the name of the session cookie
PERMANENT_SESSION_LIFETIME	the lifetime of a permanent session as datetime.timedelta object.
USE_X_SENDFILE	enable/disable x-sendfile
LOGGER_NAME	the name of the logger
SERVER_NAME	the name and port number of the server. Required for subdomain support (e.g.: 'localhost:5000')
MAX_CONTENT_LENGTH	If set to a value in bytes, Flask will reject incoming requests with a content length greater than this by returning a 413 status code.

More on **SERVER_NAME**

The SERVER_NAME key is used for the subdomain support. Because Flask cannot guess the subdomain part without the knowledge of the actual server name, this is required if you want to work with subdomains. This is also used for the session cookie.

Please keep in mind that not only Flask has the problem of not knowing what subdomains are, your web browser does as well. Most modern web browsers will not allow cross-subdomain cookies to be set on a server name without dots in it. So if your server name is 'localhost' you will not be able to set a cookie for 'localhost' and every subdomain of it. Please chose a different server name in that case, like 'myapplication.local' and add this name + the subdomains you want to use into your host config or setup a local bind.

New in version 0.4: LOGGER_NAMENew in version 0.5: SERVER_NAMENew in version 0.6: MAX_CONTENT_LENGTHNew in version 0.7: PROPAGATE_EXCEPTIONS, PRESERVE_CONTEXT_ON_EXCEPTION

8.3 Configuring from Files

Configuration becomes more useful if you can configure from a file, and ideally that file would be outside of the actual application package so that you can install the package with distribute (Deploying with Distribute) and still modify that file afterwards.

So a common pattern is this:

```
app = Flask(__name__)
app.config.from_object('yourapplication.default_settings')
app.config.from_envvar('YOURAPPLICATION_SETTINGS')
```

This first loads the configuration from the yourapplication.default_settings module and then overrides the values with the contents of the file the `YOURAPPLICATION_SETTINGS` environment variable points to. This environment variable can be set on Linux or OS X with the export command in the shell before starting the server:

```
$ export YOURAPPLICATION_SETTINGS=/path/to/settings.cfg
$ python run-app.py
 * Running on http://127.0.0.1:5000/
 * Restarting with reloader...
```

On Windows systems use the set builtin instead:

```
>set YOURAPPLICATION_SETTINGS=\path\to\settings.cfg
```

The configuration files themselves are actual Python files. Only values in uppercase are actually stored in the config object later on. So make sure to use uppercase letters for your config keys.

Here is an example configuration file:

```
DEBUG = False
SECRET_KEY = '?\xbf,\xb4\x8d\xa3"<\x9c\xb0@\x0f5\xab,w\xee\x8d$0\x13\x8b83'
```

Make sure to load the configuration very early on so that extensions have the ability to access the configuration when starting up. There are other methods on the config object as well to load from individual files. For a complete reference, read the `Config` object's documentation.

8.4 Configuration Best Practices

The downside with the approach mentioned earlier is that it makes testing a little harder. There is no one 100% solution for this problem in general, but there are a couple of things you can do to improve that experience:

1. create your application in a function and register blueprints on it. That way you can create multiple instances of your application with different configurations attached which makes unittesting a lot easier. You can use this to pass in configuration as needed.

2. Do not write code that needs the configuration at import time. If you limit yourself to request-only accesses to the configuration you can reconfigure the object later on as needed.

8.5 Development / Production

Most applications need more than one configuration. There will at least be a separate configuration for a production server and one used during development. The easiest way to handle this is to use a default configuration that is always loaded and part of version control, and a separate configuration that overrides the values as necessary as mentioned in the example above:

```
app = Flask(__name__)
app.config.from_object('yourapplication.default_settings')
app.config.from_envvar('YOURAPPLICATION_SETTINGS')
```

Then you just have to add a separate config.py file and export `YOURAPPLICATION_SETTINGS=/path/to/config.py` and you are done. However there are alternative ways as well. For example you could use imports or subclassing.

What is very popular in the Django world is to make the import explicit in the config file by adding an `from yourapplication.default_settings import *` to the top of the file and then overriding the changes by hand. You could also inspect an environment variable like `YOURAPPLICATION_MODE` and set that to production, development etc and import different hardcoded files based on that.

An interesting pattern is also to use classes and inheritance for configuration:

```
class Config(object):
    DEBUG = False
    TESTING = False
    DATABASE_URI = 'sqlite://:memory:'

class ProductionConfig(Config):
    DATABASE_URI = 'mysql://user@localhost/foo'

class DevelopmentConfig(Config):
    DEBUG = True

class TestingConfig(Config):
    TESTING = True
```

To enable such a config you just have to call into `from_object()`:

```
app.config.from_object('configmodule.ProductionConfig')
```

There are many different ways and it's up to you how you want to manage your configuration files. However here a list of good recommendations:

- ☒ keep a default configuration in version control. Either populate the config with this default configuration or import it in your own configuration files before

overriding values.

- use an environment variable to switch between the configurations. This can be done from outside the Python interpreter and makes development and deployment much easier because you can quickly and easily switch between different configs without having to touch the code at all. If you are working often on different projects you can even create your own script for sourcing that activates a virtualenv and exports the development configuration for you.
- Use a tool like fabric in production to push code and configurations separately to the production server(s). For some details about how to do that, head over to the Deploying with Fabric pattern.

CHAPTER

NINE

SIGNALS

New in version 0.6. Starting with Flask 0.6, there is integrated support for signalling in Flask. This support is provided by the excellent blinker library and will gracefully fall back if it is not available.

What are signals? Signals help you decouple applications by sending notifications when actions occur elsewhere in the core framework or another Flask extensions. In short, signals allow certain senders to notify subscribers that something happened.

Flask comes with a couple of signals and other extensions might provide more. Also keep in mind that signals are intended to notify subscribers and should not encourage subscribers to modify data. You will notice that there are signals that appear to do the same thing like some of the builtin decorators do (eg: `request_started` is very similar to `before_request()`). There are however difference in how they work. The core `before_request()` handler for example is executed in a specific order and is able to abort the request early by returning a response. In contrast all signal handlers are executed in undefined order and do not modify any data.

The big advantage of signals over handlers is that you can safely subscribe to them for the split of a second. These temporary subscriptions are helpful for unittesting for example. Say you want to know what templates were rendered as part of a request: signals allow you to do exactly that.

9.1 Subscribing to Signals

To subscribe to a signal, you can use the `connect()` method of a signal. The first argument is the function that should be called when the signal is emitted, the optional second argument specifies a sender. To unsubscribe from a signal, you can use the `disconnect()` method.

For all core Flask signals, the sender is the application that issued the signal. When you subscribe to a signal, be sure to also provide a sender unless you really want to listen for signals of all applications. This is especially true if you are developing an extension.

Here for example a helper context manager that can be used to figure out in a unittest which templates were rendered and what variables were passed to the template:

```
from flask import template_rendered
from contextlib import contextmanager

@contextmanager
def captured_templates(app):
    recorded = []
    def record(sender, template, context):
        recorded.append((template, context))
    template_rendered.connect(record, app)
    try:
        yield recorded
    finally:
        template_rendered.disconnect(record, app)
```

This can now easily be paired with a test client:

```
with captured_templates(app) as templates:
    rv = app.test_client().get('/')
    assert rv.status_code == 200
    assert len(templates) == 1
    template, context = templates[0]
    assert template.name == 'index.html'
    assert len(context['items']) == 10
```

All the template rendering in the code issued by the application app in the body of the with block will now be recorded in the templates variable. Whenever a template is rendered, the template object as well as context are appended to it.

Additionally there is a convenient helper method (`connected_to()`). that allows you to temporarily subscribe a function to a signal with is a context manager on its own. Because the return value of the context manager cannot be specified that way one has to pass the list in as argument:

```
from flask import template_rendered

def captured_templates(app, recorded):
    def record(sender, template, context):
        recorded.append((template, context))
    return template_rendered.connected_to(record, app)
```

The example above would then look like this:

```
templates = []
with captured_templates(app, templates):
    ...
    template, context = templates[0]
```

Blinker API Changes

The `connected_to()` method arrived in Blinker with version 1.1.

9.2 Creating Signals

If you want to use signals in your own application, you can use the blinker library directly. The most common use case are named signals in a custom `Namespace`.. This is what is recommended most of the time:

```
from blinker import Namespace
my_signals = Namespace()
```

Now you can create new signals like this:

```
model_saved = my_signals.signal('model-saved')
```

The name for the signal here makes it unique and also simplifies debugging. You can access the name of the signal with the `name` attribute.

For Extension Developers

If you are writing a Flask extension and you to gracefully degrade for missing blinker installations, you can do so by using the `flask.signals.Namespace` class.

9.3 Sending Signals

If you want to emit a signal, you can do so by calling the `send()` method. It accepts a sender as first argument and optionally some keyword arguments that are forwarded to the signal subscribers:

```
class Model(object):
    ...

    def save(self):
        model_saved.send(self)
```

Try to always pick a good sender. If you have a class that is emitting a signal, pass self as sender. If you emitting a signal from a random function, you can pass `current_app._get_current_object()` as sender.

Passing Proxies as Senders

Never pass `current_app` as sender to a signal. Use `current_app._get_current_object()` instead. The reason for this is that `current_app` is a proxy and not the real application object.

9.4 Decorator Based Signal Subscriptions

With Blinker 1.1 you can also easily subscribe to signals by using the new `connect_via()` decorator:

```
from flask import template_rendered

@template_rendered.connect_via(app)
def when_template_rendered(sender, template, context):
    print 'Template %s is rendered with %s' % (template.name, context)
```

9.5 Core Signals

The following signals exist in Flask:

`flask.`**`template_rendered`**

This signal is sent when a template was successfully rendered. The signal is invoked with the instance of the template as template and the context as dictionary (named context).

Example subscriber:

```
def log_template_renders(sender, template, context):
    sender.logger.debug('Rendering template "%s" with context %s',
                        template.name or 'string template',
                        context)

from flask import template_rendered
template_rendered.connect(log_template_renders, app)
```

`flask.`**`request_started`**

This signal is sent before any request processing started but when the request context was set up. Because the request context is already bound, the subscriber can access the request with the standard global proxies such as `request`.

Example subscriber:

```
def log_request(sender):
    sender.logger.debug('Request context is set up')

from flask import request_started
request_started.connect(log_request, app)
```

`flask.`**`request_finished`**

This signal is sent right before the response is sent to the client. It is passed the response to be sent named response.

Example subscriber:

```
def log_response(sender, response):
    sender.logger.debug('Request context is about to close down.  '
                        'Response: %s', response)

from flask import request_finished
request_finished.connect(log_response, app)
```

flask.**got_request_exception**

This signal is sent when an exception happens during request processing. It is sent before the standard exception handling kicks in and even in debug mode, where no exception handling happens. The exception itself is passed to the subscriber as exception.

Example subscriber:

```
def log_exception(sender, exception):
    sender.logger.debug('Got exception during processing: %s', exception)

from flask import got_request_exception
got_request_exception.connect(log_exception, app)
```

flask.**request_tearing_down**

This signal is sent when the request is tearing down. This is always called, even if an exception is caused. Currently functions listening to this signal are called after the regular teardown handlers, but this is not something you can rely on.

Example subscriber:

```
def close_db_connection(sender):
    session.close()

from flask import request_tearing_down
request_tearing_down.connect(close_db_connection, app)
```

CHAPTER

TEN

PLUGGABLE VIEWS

New in version 0.7. Flask 0.7 introduces pluggable views inspired by the generic views from Django which are based on classes instead of functions. The main intention is that you can replace parts of the implementations and this way have customizable pluggable views.

10.1 Basic Principle

Consider you have a function that loads a list of objects from the database and renders into a template:

```
@app.route('/users/')
def show_users(page):
    users = User.query.all()
    return render_template('users.html', users=users)
```

This is simple and flexible, but if you want to provide this view in a generic fashion that can be adapted to other models and templates as well you might want more flexibility. This is where pluggable class based views come into place. As the first step to convert this into a class based view you would do this:

```
from flask.views import View

class ShowUsers(View):

    def dispatch_request(self):
        users = User.query.all()
        return render_template('users.html', objects=users)

app.add_url_rule('/users/', ShowUsers.as_view('show_users'))
```

As you can see what you have to do is to create a subclass of `flask.views.View` and implement `dispatch_request()`. Then we have to convert that class into an actual view function by using the `as_view()` class method. The string you pass to that function is the name of the endpoint that view will then have. But this by itself is not helpful, so let's refactor the code a bit:

```
from flask.views import View

class ListView(View):

    def get_template_name(self):
        raise NotImplementedError()

    def render_template(self, context):
        return render_template(self.get_template_name(), **context)

    def dispatch_request(self):
        context = {'objects': self.get_objects()}
        return self.render_template(context)

class UserView(ListView):

    def get_template_name(self):
        return 'users.html'

    def get_objects(self):
        return User.query.all()
```

This of course is not that helpful for such a small example, but it's good enough to explain the basic principle. When you have a class based view the question comes up what self points to. The way this works is that whenever the request is dispatched a new instance of the class is created and the `dispatch_request()` method is called with the parameters from the URL rule. The class itself is instanciated with the parameters passed to the `as_view()` function. For instance you can write a class like this:

```
class RenderTemplateView(View):
    def __init__(self, template_name):
        self.template_name = template_name
    def dispatch_request(self):
        return render_template(self.template_name)
```

And then you can register it like this:

```
app.add_url_rule('/about', view_func=RenderTemplateView.as_view(
    'about_page', template_name='about.html'))
```

10.2 Method Hints

Pluggable views are attached to the application like a regular function by either using `route()` or better `add_url_rule()`. That however also means that you would have to provide the names of the HTTP methods the view supports when you attach this. In order to move that information to the class you can provide a `methods` attribute that has this information:

```
class MyView(View):
    methods = ['GET', 'POST']

    def dispatch_request(self):
        if request.method == 'POST':
            ...
        ...

app.add_url_rule('/myview', view_func=MyView.as_view('myview'))
```

10.3 Method Based Dispatching

For RESTful APIs it's especially helpful to execute a different function for each HTTP method. With the `flask.views.MethodView` you can easily do that. Each HTTP method maps to a function with the same name (just in lowercase):

```
from flask.views import MethodView

class UserAPI(MethodView):

    def get(self):
        users = User.query.all()
        ...

    def post(self):
        user = User.from_form_data(request.form)
        ...

app.add_url_rule('/users/', view_func=UserAPI.as_view('users'))
```

That way you also don't have to provide the `methods` attribute. It's automatically set based on the methods defined in the class.

CHAPTER

ELEVEN

THE REQUEST CONTEXT

This document describes the behavior in Flask 0.7 which is mostly in line with the old behavior but has some small, subtle differences.

One of the design ideas behind Flask is that there are two different "states" in which code is executed. The application setup state in which the application implicitly is on the module level. It starts when the `Flask` object is instantiated, and it implicitly ends when the first request comes in. While the application is in this state a few assumptions are true:

- the programmer can modify the application object safely.
- no request handling happened so far
- you have to have a reference to the application object in order to modify it, there is no magic proxy that can give you a reference to the application object you're currently creating or modifying.

On the contrast, during request handling, a couple of other rules exist:

- while a request is active, the context local objects (`flask.request` and others) point to the current request.
- any code can get hold of these objects at any time.

The magic that makes this works is internally referred in Flask as the "request context".

11.1 Diving into Context Locals

Say you have a utility function that returns the URL the user should be redirected to. Imagine it would always redirect to the URL's `next` parameter or the HTTP referrer or the index page:

```
from flask import request, url_for

def redirect_url():
    return request.args.get('next') or \
```

```
            request.referrer or \
            url_for('index')
```

As you can see, it accesses the request object. If you try to run this from a plain Python shell, this is the exception you will see:

```
>>> redirect_url()
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
AttributeError: 'NoneType' object has no attribute 'request'
```

That makes a lot of sense because we currently do not have a request we could access. So we have to make a request and bind it to the current context. The `test_request_context` method can create us a `RequestContext`:

```
>>> ctx = app.test_request_context('/?next=http://example.com/')
```

This context can be used in two ways. Either with the with statement or by calling the `push()` and `pop()` methods:

```
>>> ctx.push()
```

From that point onwards you can work with the request object:

```
>>> redirect_url()
u'http://example.com/'
```

Until you call pop:

```
>>> ctx.pop()
```

Because the request context is internally maintained as a stack you can push and pop multiple times. This is very handy to implement things like internal redirects.

For more information of how to utilize the request context from the interactive Python shell, head over to the Working with the Shell chapter.

11.2 How the Context Works

If you look into how the Flask WSGI application internally works, you will find a piece of code that looks very much like this:

```
def wsgi_app(self, environ):
    with self.request_context(environ):
        try:
            response = self.full_dispatch_request()
        except Exception, e:
            response = self.make_response(self.handle_exception(e))
        return response(environ, start_response)
```

The method `request_context()` returns a new `RequestContext` object and uses it in combination with the with statement to bind the context. Everything that is called

from the same thread from this point onwards until the end of the with statement will have access to the request globals (`flask.request` and others).

The request context internally works like a stack: The topmost level on the stack is the current active request. `push()` adds the context to the stack on the very top, `pop()` removes it from the stack again. On popping the application's `teardown_request()` functions are also executed.

11.3 Callbacks and Errors

What happens if an error occurs in Flask during request processing? This particular behavior changed in 0.7 because we wanted to make it easier to understand what is actually happening. The new behavior is quite simple:

1. Before each request, `before_request()` functions are executed. If one of these functions return a response, the other functions are no longer called. In any case however the return value is treated as a replacement for the view's return value.
2. If the `before_request()` functions did not return a response, the regular request handling kicks in and the view function that was matched has the chance to return a response.
3. The return value of the view is then converted into an actual response object and handed over to the `after_request()` functions which have the chance to replace it or modify it in place.
4. At the end of the request the `teardown_request()` functions are executed. This always happens, even in case of an unhandled exception down the road.

Now what happens on errors? In production mode if an exception is not caught, the 500 internal server handler is called. In development mode however the exception is not further processed and bubbles up to the WSGI server. That way things like the interactive debugger can provide helpful debug information.

An important change in 0.7 is that the internal server error is now no longer post processed by the after request callbacks and after request callbacks are no longer guaranteed to be executed. This way the internal dispatching code looks cleaner and is easier to customize and understand.

The new teardown functions are supposed to be used as a replacement for things that absolutely need to happen at the end of request.

11.4 Teardown Callbacks

The teardown callbacks are special callbacks in that they are executed at at different point. Strictly speaking they are independent of the actual request handling as they are bound to the lifecycle of the `RequestContext` object. When the request context is popped, the `teardown_request()` functions are called.

This is important to know if the life of the request context is prolonged by using the test client in a with statement of when using the request context from the command line:

```
with app.test_client() as client:
    resp = client.get('/foo')
    # the teardown functions are still not called at that point
    # even though the response ended and you have the response
    # object in your hand

# only when the code reaches this point the teardown functions
# are called.  Alternatively the same thing happens if another
# request was triggered from the test client
```

It's easy to see the behavior from the command line:

```
>>> app = Flask(__name__)
>>> @app.teardown_request
... def teardown_request(exception=None):
...     print 'this runs after request'
...
>>> ctx = app.test_request_context()
>>> ctx.push()
>>> ctx.pop()
this runs after request
>>>
```

11.5 Notes On Proxies

Some of the objects provided by Flask are proxies to other objects. The reason behind this is that these proxies are shared between threads and they have to dispatch to the actual object bound to a thread behind the scenes as necessary.

Most of the time you don't have to care about that, but there are some exceptions where it is good to know that this object is an actual proxy:

- The proxy objects do not fake their inherited types, so if you want to perform actual instance checks, you have to do that on the instance that is being proxied (see _get_current_object below).
- if the object reference is important (so for example for sending Signals)

If you need to get access to the underlying object that is proxied, you can use the `_get_current_object()` method:

```
app = current_app._get_current_object()
my_signal.send(app)
```

11.6 Context Preservation on Error

If an error occurs or not, at the end of the request the request context is popped and all data associated with it is destroyed. During development however that can be problematic as you might want to have the information around for a longer time in case an exception occurred. In Flask 0.6 and earlier in debug mode, if an exception occurred, the request context was not popped so that the interactive debugger can still provide you with important information.

Starting with Flask 0.7 you have finer control over that behavior by setting the `PRESERVE_CONTEXT_ON_EXCEPTION` configuration variable. By default it's linked to the setting of `DEBUG`. If the application is in debug mode the context is preserved, in production mode it's not.

Do not force activate `PRESERVE_CONTEXT_ON_EXCEPTION` in production mode as it will cause your application to leak memory on exceptions. However it can be useful during development to get the same error preserving behavior as in development mode when attempting to debug an error that only occurs under production settings.

CHAPTER

TWELVE

MODULAR APPLICATIONS WITH BLUEPRINTS

New in version 0.7. Flask uses a concept of blueprints for making application components and supporting common patterns within an application or across applications. Blueprints can greatly simplify how large applications work and provide a central means for Flask extensions to register operations on applications. A `Blueprint` object works similarly to a `Flask` application object, but it is not actually an application. Rather it is a blueprint of how to construct or extend an application.

12.1 Why Blueprints?

Blueprints in Flask are intended for these cases:

- Factor an application into a set of blueprints. This is ideal for larger applications; a project could instantiate an application object, initialize several extensions, and register a collection of blueprints.
- Register a blueprint on an application at a URL prefix and/or subdomain. Parameters in the URL prefix/subdomain become common view arguments (with defaults) across all view functions in the blueprint.
- Register a blueprint multiple times on an application with different URL rules.
- Provide template filters, static files, templates, and other utilities through blueprints. A blueprint does not have to implement applications or view functions.
- Register a blueprint on an application for any of these cases when initializing a Flask extension.

A blueprint in Flask is not a pluggable app because it is not actually an application -- it's a set of operations which can be registered on an application, even multiple times. Why not have multiple application objects? You can do that (see Application Dispatching), but your applications will have separate configs and will be managed at the WSGI layer.

Blueprints instead provide separation at the Flask level, share application config, and can change an application object as necessary with being registered. The downside is that you cannot unregister a blueprint once application without having to destroy the whole application object.

12.2 The Concept of Blueprints

The basic concept of blueprints is that they record operations to execute when registered on an application. Flask associates view functions with blueprints when dispatching requests and generating URLs from one endpoint to another.

12.3 My First Blueprint

This is what a very basic blueprint looks like. In this case we want to implement a blueprint that does simple rendering of static templates:

```
from flask import Blueprint, render_template, abort
from jinja2 import TemplateNotFound

simple_page = Blueprint('simple_page', __name__)

@simple_page.route('/', defaults={'page': 'index'})
@simple_page.route('/<page>')
def show(page):
    try:
        return render_template('pages/%s.html' % page)
    except TemplateNotFound:
        abort(404)
```

When you bind a function with the help of the `@simple_page.route` decorator the blueprint will record the intention of registering the function show on the application when it's later registered. Additionally it will prefix the endpoint of the function with the name of the blueprint which was given to the `Blueprint` constructor (in this case also `simple_page`).

12.4 Registering Blueprints

So how do you register that blueprint? Like this:

```
from flask import Flask
from yourapplication.simple_page import simple_page

app = Flask(__name__)
app.register_blueprint(simple_page)
```

If you check the rules registered on the application, you will find these:

```
[<Rule '/static/<filename>' (HEAD, OPTIONS, GET) -> static>,
 <Rule '/<page>' (HEAD, OPTIONS, GET) -> simple_page.show>,
 <Rule '/' (HEAD, OPTIONS, GET) -> simple_page.show>]
```

The first one is obviously from the application ifself for the static files. The other two are for the show function of the `simple_page` blueprint. As you can see, they are also prefixed with the name of the blueprint and separated by a dot (.).

Blueprints however can also be mounted at different locations:

```
app.register_blueprint(simple_page, url_prefix='/pages')
```

And sure enough, these are the generated rules:

```
[<Rule '/static/<filename>' (HEAD, OPTIONS, GET) -> static>,
 <Rule '/pages/<page>' (HEAD, OPTIONS, GET) -> simple_page.show>,
 <Rule '/pages/' (HEAD, OPTIONS, GET) -> simple_page.show>]
```

On top of that you can register blueprints multiple times though not every blueprint might respond properly to that. In fact it depends on how the blueprint is implemented if it can be mounted more than once.

12.5 Blueprint Resources

Blueprints can provide resources as well. Sometimes you might want to introduce a blueprint only for the resources it provides.

12.5.1 Blueprint Resource Folder

Like for regular applications, blueprints are considered to be contained in a folder. While multiple blueprints can origin from the same folder, it does not have to be the case and it's usually not recommended.

The folder is infered from the second argument to `Blueprint` which is ususally __name__. This argument specifies what logical Python module or package corresponds to the blueprint. If it points to an actual Python package that package (which is a folder on the filesystem) is the resource folder. If it's a module, the package the module is contained in will be the resource folder. You can access the `Blueprint.root_path` property to see what's the resource folder:

```
>>> simple_page.root_path
'/Users/username/TestProject/yourapplication'
```

To quickly open sources from this folder you can use the `open_resource()` function:

```
with simple_page.open_resource('static/style.css') as f:
    code = f.read()
```

12.5.2 Static Files

A blueprint can expose a folder with static files by providing a path to a folder on the filesystem via the static_folder keyword argument. It can either be an absolute path or one relative to the folder of the blueprint:

```
admin = Blueprint('admin', __name__, static_folder='static')
```

By default the rightmost part of the path is where it is exposed on the web. Because the folder is called `static` here it will be available at the location of the blueprint + `/static`. Say the blueprint is registered for `/admin` the static folder will be at `/admin/static`.

The endpoint is named blueprint_name.static so you can generate URLs to it like you would do to the static folder of the application:

```
url_for('admin.static', filename='style.css')
```

12.5.3 Templates

If you want the blueprint to expose templates you can do that by providing the template_folder parameter to the `Blueprint` constructor:

```
admin = Blueprint('admin', __name__, template_folder='templates')
```

As for static files, the path can be absolute or relative to the blueprint resource folder. The template folder is added to the searchpath of templates but with a lower priority than the actual application's template folder. That way you can easily override templates that a blueprint provides in the actual application.

So if you have a blueprint in the folder `yourapplication/admin` and you want to render the template `'admin/index.html'` and you have provided `templates` as a template_folder you will have to create a file like this: `yourapplication/admin/templates/admin/index.html`.

12.6 Building URLs

If you want to link from one page to another you can use the `url_for()` function just like you normally would do just that you prefix the URL endpoint with the name of the blueprint and a dot (.):

```
url_for('admin.index')
```

Additionally if you are in a view function of a blueprint or a rendered template and you want to link to another endpoint of the same blueprint, you can use relative redirects by prefixing the endpoint with a dot only:

```
url_for('.index')
```

This will link to `admin.index` for instance in case the current request was dispatched to any other admin blueprint endpoint.

CHAPTER

THIRTEEN

WORKING WITH THE SHELL

New in version 0.3. One of the reasons everybody loves Python is the interactive shell. It basically allows you to execute Python commands in real time and immediately get results back. Flask itself does not come with an interactive shell, because it does not require any specific setup upfront, just import your application and start playing around.

There are however some handy helpers to make playing around in the shell a more pleasant experience. The main issue with interactive console sessions is that you're not triggering a request like a browser does which means that `g`, `request` and others are not available. But the code you want to test might depend on them, so what can you do?

This is where some helper functions come in handy. Keep in mind however that these functions are not only there for interactive shell usage, but also for unittesting and other situations that require a faked request context.

Generally it's recommended that you read the The Request Context chapter of the documentation first.

13.1 Creating a Request Context

The easiest way to create a proper request context from the shell is by using the `test_request_context` method which creates us a `RequestContext`:

```
>>> ctx = app.test_request_context()
```

Normally you would use the with statement to make this request object active, but in the shell it's easier to use the `push()` and `pop()` methods by hand:

```
>>> ctx.push()
```

From that point onwards you can work with the request object until you call pop:

```
>>> ctx.pop()
```

13.2 Firing Before/After Request

By just creating a request context, you still don't have run the code that is normally run before a request. This might result in your database being unavailable if you are connecting to the database in a before-request callback or the current user not being stored on the `g` object etc.

This however can easily be done yourself. Just call `preprocess_request()`:

```
>>> ctx = app.test_request_context()
>>> ctx.push()
>>> app.preprocess_request()
```

Keep in mind that the `preprocess_request()` function might return a response object, in that case just ignore it.

To shutdown a request, you need to trick a bit before the after request functions (triggered by `process_response()`) operate on a response object:

```
>>> app.process_response(app.response_class())
<Response 0 bytes [200 OK]>
>>> ctx.pop()
```

The functions registered as `teardown_request()` are automatically called when the context is popped. So this is the perfect place to automatically tear down resources that were needed by the request context (such as database connections).

13.3 Further Improving the Shell Experience

If you like the idea of experimenting in a shell, create yourself a module with stuff you want to star import into your interactive session. There you could also define some more helper methods for common things such as initializing the database, dropping tables etc.

Just put them into a module (like shelltools and import from there):

```
>>> from shelltools import *
```

CHAPTER

FOURTEEN

PATTERNS FOR FLASK

Certain things are common enough that the chances are high you will find them in most web applications. For example quite a lot of applications are using relational databases and user authentication. In that case, chances are they will open a database connection at the beginning of the request and get the information of the currently logged in user. At the end of the request, the database connection is closed again.

There are more user contributed snippets and patterns in the Flask Snippet Archives.

14.1 Larger Applications

For larger applications it's a good idea to use a package instead of a module. That is quite simple. Imagine a small application looks like this:

```
/yourapplication
    /yourapplication.py
    /static
        /style.css
    /templates
        layout.html
        index.html
        login.html
        ...
```

14.1.1 Simple Packages

To convert that into a larger one, just create a new folder yourapplication inside the existing one and move everything below it. Then rename yourapplication.py to __init__.py. (Make sure to delete all .pyc files first, otherwise things would most likely break)

You should then end up with something like that:

```
/yourapplication
    /yourapplication
        /__init__.py
```

```
        /static
            /style.css
        /templates
            layout.html
            index.html
            login.html
            ...
```

But how do you run your application now? The naive `python yourapplication/__init__.py` will not work. Let's just say that Python does not want modules in packages to be the startup file. But that is not a big problem, just add a new file called runserver.py next to the inner yourapplication folder with the following contents:

```
from yourapplication import app
app.run(debug=True)
```

What did we gain from this? Now we can restructure the application a bit into multiple modules. The only thing you have to remember is the following quick checklist:

1. the Flask application object creation has to be in the __init__.py file. That way each module can import it safely and the __name__ variable will resolve to the correct package.
2. all the view functions (the ones with a `route()` decorator on top) have to be imported when in the __init__.py file. Not the object itself, but the module it is in. Import the view module after the application object is created.

Here's an example __init__.py:

```
from flask import Flask
app = Flask(__name__)

import yourapplication.views
```

And this is what views.py would look like:

```
from yourapplication import app

@app.route('/')
def index():
    return 'Hello World!'
```

You should then end up with something like that:

```
/yourapplication
    /yourapplication
        /__init__.py
        /views.py
        /static
            /style.css
        /templates
            layout.html
            index.html
```

```
login.html
...
```

Circular Imports

Every Python programmer hates them, and yet we just added some: circular imports (That's when two modules depend on each other. In this case views.py depends on __init__.py). Be advised that this is a bad idea in general but here it is actually fine. The reason for this is that we are not actually using the views in __init__.py and just ensuring the module is imported and we are doing that at the bottom of the file.

There are still some problems with that approach but if you want to use decorators there is no way around that. Check out the 搞大了？！ section for some inspiration how to deal with that.

14.1.2 Working with Blueprints

If you have larger applications it's recommended to divide them into smaller groups where each group is implemented with the help of a blueprint. For a gentle introduction into this topic refer to the Modular Applications with Blueprints chapter of the documentation.

14.2 Application Factories

If you are already using packages and blueprints for your application (Modular Applications with Blueprints) there are a couple of really nice ways to further improve the experience. A common pattern is creating the application object when the blueprint is imported. But if you move the creation of this object, into a function, you can then create multiple instances of this and later.

So why would you want to do this?

1. Testing. You can have instances of the application with different settings to test every case.
2. Multiple instances. Imagine you want to run different versions of the same application. Of course you could have multiple instances with different configs set up in your webserver, but if you use factories, you can have multiple instances of the same application running in the same application process which can be handy.

So how would you then actually implement that?

14.2.1 Basic Factories

The idea is to set up the application in a function. Like this:

```
def create_app(config_filename):
    app = Flask(__name__)
    app.config.from_pyfile(config_filename)

    from yourapplication.views.admin import admin
    from yourapplication.views.frontend import frontend
    app.register_blueprint(admin)
    app.register_blueprint(frontend)

    return app
```

The downside is that you cannot use the application object in the blueprints at import time. You can however use it from within a request. How do you get access to the application with the config? Use `current_app`:

```
from flask import current_app, Blueprint, render_template
admin = Blueprint('admin', __name__, url_prefix='/admin')

@admin.route('/')
def index():
    return render_template(current_app.config['INDEX_TEMPLATE'])
```

Here we look up the name of a template in the config.

14.2.2 Using Applications

So to use such an application you then have to create the application first. Here an example run.py file that runs such an application:

```
from yourapplication import create_app
app = create_app('/path/to/config.cfg')
app.run()
```

14.2.3 Factory Improvements

The factory function from above is not very clever so far, you can improve it. The following changes are straightforward and possible:

1. make it possible to pass in configuration values for unittests so that you don't have to create config files on the filesystem
2. call a function from a blueprint when the application is setting up so that you have a place to modify attributes of the application (like hooking in before / after request handlers etc.)
3. Add in WSGI middlewares when the application is creating if necessary.

14.3 Application Dispatching

Application dispatching is the process of combining multiple Flask applications on the WSGI level. You can not only combine Flask applications into something larger but any WSGI application. This would even allow you to run a Django and a Flask application in the same interpreter side by side if you want. The usefulness of this depends on how the applications work internally.

The fundamental difference from the module approach is that in this case you are running the same or different Flask applications that are entirely isolated from each other. They run different configurations and are dispatched on the WSGI level.

14.3.1 Working with this Document

Each of the techniques and examples below results in an `application` object that can be run with any WSGI server. For production, see Deployment Options. For development, Werkzeug provides a builtin server for development available at `werkzeug.serving.run_simple()`:

```
from werkzeug.serving import run_simple
run_simple('localhost', 5000, application, use_reloader=True)
```

Note that `run_simple` is not intended for use in production. Use a full-blown WSGI server.

14.3.2 Combining Applications

If you have entirely separated applications and you want them to work next to each other in the same Python interpreter process you can take advantage of the `werkzeug.wsgi.DispatcherMiddleware`. The idea here is that each Flask application is a valid WSGI application and they are combined by the dispatcher middleware into a larger one that dispatched based on prefix.

For example you could have your main application run on / and your backend interface on /backend:

```
from werkzeug.wsgi import DispatcherMiddleware
from frontend_app import application as frontend
from backend_app import application as backend

application = DispatcherMiddleware(frontend, {
    '/backend':     backend
})
```

14.3.3 Dispatch by Subdomain

Sometimes you might want to use multiple instances of the same application with different configurations. Assuming the application is created inside a function and you can call that function to instanciate it, that is really easy to implement. In order to develop your application to support creating new instances in functions have a look at the Application Factories pattern.

A very common example would be creating applications per subdomain. For instance you configure your webserver to dispatch all requests for all subdomains to your application and you then use the subdomain information to create user-specific instances. Once you have your server set up to listen on all subdomains you can use a very simple WSGI application to do the dynamic application creation.

The perfect level for abstraction in that regard is the WSGI layer. You write your own WSGI application that looks at the request that comes and and delegates it to your Flask application. If that application does not exist yet, it is dynamically created and remembered:

```
from threading import Lock

class SubdomainDispatcher(object):

    def __init__(self, domain, create_app):
        self.domain = domain
        self.create_app = create_app
        self.lock = Lock()
        self.instances = {}

    def get_application(self, host):
        host = host.split(':')[0]
        assert host.endswith(self.domain), 'Configuration error'
        subdomain = host[:-len(self.domain)].rstrip('.')
        with self.lock:
            app = self.instances.get(subdomain)
            if app is None:
                app = self.create_app(subdomain)
                self.instances[subdomain] = app
            return app

    def __call__(self, environ, start_response):
        app = self.get_application(environ['HTTP_HOST'])
        return app(environ, start_response)
```

This dispatcher can then be used like this:

```
from myapplication import create_app, get_user_for_subdomain
from werkzeug.exceptions import NotFound

def make_app(subdomain):
    user = get_user_for_subdomain(subdomain)
    if user is None:
```

```
        # if there is no user for that subdomain we still have
        # to return a WSGI application that handles that request.
        # We can then just return the NotFound() exception as
        # application which will render a default 404 page.
        # You might also redirect the user to the main page then
        return NotFound()

    # otherwise create the application for the specific user
    return create_app(user)

application = SubdomainDispatcher('example.com', make_app)
```

14.3.4 Dispatch by Path

Dispatching by a path on the URL is very similar. Instead of looking at the Host header to figure out the subdomain one simply looks at the request path up to the first slash:

```
from threading import Lock
from werkzeug.wsgi import pop_path_info, peek_path_info

class PathDispatcher(object):

    def __init__(self, default_app, create_app):
        self.default_app = default_app
        self.create_app = create_app
        self.lock = Lock()
        self.instances = {}

    def get_application(self, prefix):
        with self.lock:
            app = self.instances.get(prefix)
            if app is None:
                app = self.create_app(prefix)
                if app is not None:
                    self.instances[prefix] = app
            return app

    def __call__(self, environ, start_response):
        app = self.get_application(peek_path_info(environ))
        if app is not None:
            pop_path_info(environ)
        else:
            app = self.default_app
        return app(environ, start_response)
```

The big difference between this and the subdomain one is that this one falls back to another application if the creator function returns None:

```
from myapplication import create_app, default_app, get_user_for_prefix

def make_app(prefix):
    user = get_user_for_prefix(prefix)
    if user is not None:
        return create_app(user)

application = PathDispatcher('example.com', default_app, make_app)
```

14.4 Using URL Processors

New in version 0.7. Flask 0.7 introduces the concept of URL processors. The idea is that you might have a bunch of resources with common parts in the URL that you don't always explicitly want to provide. For instance you might have a bunch of URLs that have the language code in it but you don't want to have to handle it in every single function yourself.

URL processors are especially helpful when combined with blueprints. We will handle both application specific URL processors here as well as blueprint specifics.

14.4.1 Internationalized Application URLs

Consider an application like this:

```
from flask import Flask, g

app = Flask(__name__)

@app.route('/<lang_code>/')
def index(lang_code):
    g.lang_code = lang_code
    ...

@app.route('/<lang_code>/about')
def about(lang_code):
    g.lang_code = lang_code
    ...
```

This is an awful lot of reptition as you have to handle the language code setting on the `g` object yourself in every single function. Sure, a decorator could be used to simplify this, but if you want to generate URLs from one function to another you would have to still provide the language code explicitly which can be annoying.

For the latter, this is where `url_defaults()` functions come in. They can automatically inject values into a call for `url_for()` automatically. The code below checks if the language code is not yet in the dictionary of URL values and if the endpoint wants a value named `'lang_code'`:

```
@app.url_defaults
def add_language_code(endpoint, values):
    if 'lang_code' in values or not g.lang_code:
        return
    if app.url_map.is_endpoint_expecting(endpoint, 'lang_code'):
        values['lang_code'] = g.lang_code
```

The method `is_endpoint_expecting()` of the URL map can be used to figure out if it would make sense to provide a language code for the given endpoint.

The reverse of that function are `url_value_preprocessor()`s. They are executed right after the request was matched and can execute code based on the URL values. The idea is that they pull information out of the values dictionary and put it somewhere else:

```
@app.url_value_preprocessor
def pull_lang_code(endpoint, values):
    g.lang_code = values.pop('lang_code', None)
```

That way you no longer have to do the lang_code assigment to `g` in every function. You can further improve that by writing your own decorator that prefixes URLs with the language code, but the more beautiful solution is using a blueprint. Once the `'lang_code'` is popped from the values dictionary and it will no longer be forwarded to the view function reducing the code to this:

```
from flask import Flask, g

app = Flask(__name__)

@app.url_defaults
def add_language_code(endpoint, values):
    if 'lang_code' in values or not g.lang_code:
        return
    if app.url_map.is_endpoint_expecting(endpoint, 'lang_code'):
        values['lang_code'] = g.lang_code

@app.url_value_preprocessor
def pull_lang_code(endpoint, values):
    g.lang_code = values.pop('lang_code', None)

@app.route('/<lang_code>/')
def index():
    ...

@app.route('/<lang_code>/about')
def about():
    ...
```

14.4.2 Internationalized Blueprint URLs

Because blueprints can automatically prefix all URLs with a common string it's easy to automatically do that for every function. Furthermore blueprints can have per-blueprint URL processors which removes a whole lot of logic from the `url_defaults()` function because it no longer has to check if the URL is really interested in a `'lang_code'` parameter:

```
from flask import Blueprint, g

bp = Blueprint('frontend', __name__, url_prefix='/<lang_code>')

@bp.url_defaults
def add_language_code(endpoint, values):
    values.setdefault('lang_code', g.lang_code)

@bp.url_value_preprocessor
def pull_lang_code(endpoint, values):
    g.lang_code = values.pop('lang_code')

@bp.route('/')
def index():
    ...

@bp.route('/about')
def about():
    ...
```

14.5 Deploying with Distribute

distribute, formerly setuptools, is an extension library that is commonly used to (like the name says) distribute Python libraries and extensions. It extends distutils, a basic module installation system shipped with Python to also support various more complex constructs that make larger applications easier to distribute:

- support for dependencies: a library or application can declare a list of other libraries it depends on which will be installed automatically for you.
- package registry: setuptools registers your package with your Python installation. This makes it possible to query information provided by one package from another package. The best known feature of this system is the entry point support which allows one package to declare an "entry point" another package can hook into to extend the other package.
- installation manager: easy_install, which comes with distribute can install other libraries for you. You can also use pip which sooner or later will replace easy_install which does more than just installing packages for you.

Flask itself, and all the libraries you can find on the cheeseshop are distributed with either distribute, the older setuptools or distutils.

In this case we assume your application is called yourapplication.py and you are not using a module, but a package. Distributing resources with standard modules is not supported by distribute so we will not bother with it. If you have not yet converted your application into a package, head over to the Larger Applications pattern to see how this can be done.

A working deployment with distribute is the first step into more complex and more automated deployment scenarios. If you want to fully automate the process, also read the Deploying with Fabric chapter.

14.5.1 Basic Setup Script

Because you have Flask running, you either have setuptools or distribute available on your system anyways. If you do not, fear not, there is a script to install it for you: distribute_setup.py. Just download and run with your Python interpreter.

Standard disclaimer applies: you better use a virtualenv.

Your setup code always goes into a file named setup.py next to your application. The name of the file is only convention, but because everybody will look for a file with that name, you better not change it.

Yes, even if you are using distribute, you are importing from a package called setuptools. distribute is fully backwards compatible with setuptools, so it also uses the same import name.

A basic setup.py file for a Flask application looks like this:

```
from setuptools import setup

setup(
    name='Your Application',
    version='1.0',
    long_description=__doc__,
    packages=['yourapplication'],
    include_package_data=True,
    zip_safe=False,
    install_requires=['Flask']
)
```

Please keep in mind that you have to list subpackages explicitly. If you want distribute to lookup the packages for you automatically, you can use the find_packages function:

```
from setuptools import setup, find_packages

setup(
    ...
    packages=find_packages()
)
```

Most parameters to the setup function should be self explanatory, include_package_data and zip_safe might not be. include_package_data tells distribute

to look for a MANIFEST.in file and install all the entries that match as package data. We will use this to distribute the static files and templates along with the Python module (see Distributing Resources). The zip_safe flag can be used to force or prevent zip Archive creation. In general you probably don't want your packages to be installed as zip files because some tools do not support them and they make debugging a lot harder.

14.5.2 Distributing Resources

If you try to install the package you just created, you will notice that folders like static or templates are not installed for you. The reason for this is that distribute does not know which files to add for you. What you should do, is to create a MANIFEST.in file next to your setup.py file. This file lists all the files that should be added to your tarball:

```
recursive-include yourapplication/templates *
recursive-include yourapplication/static *
```

Don't forget that even if you enlist them in your MANIFEST.in file, they won't be installed for you unless you set the include_package_data parameter of the setup function to True!

14.5.3 Declaring Dependencies

Dependencies are declared in the install_requires parameter as list. Each item in that list is the name of a package that should be pulled from PyPI on installation. By default it will always use the most recent version, but you can also provide minimum and maximum version requirements. Here some examples:

```
install_requires=[
    'Flask>=0.2',
    'SQLAlchemy>=0.6',
    'BrokenPackage>=0.7,<=1.0'
]
```

I mentioned earlier that dependencies are pulled from PyPI. What if you want to depend on a package that cannot be found on PyPI and won't be because it is an internal package you don't want to share with anyone? Just still do as if there was a PyPI entry for it and provide a list of alternative locations where distribute should look for tarballs:

```
dependency_links=['http://example.com/yourfiles']
```

Make sure that page has a directory listing and the links on the page are pointing to the actual tarballs with their correct filenames as this is how distribute will find the files. If you have an internal company server that contains the packages, provide the URL to that server there.

14.5.4 Installing / Developing

To install your application (ideally into a virtualenv) just run the setup.py script with the install parameter. It will install your application into the virtualenv's site-packages folder and also download and install all dependencies:

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

If you are developing on the package and also want the requirements to be installed, you can use the develop command instead:

```
$ python setup.py develop
```

This has the advantage of just installing a link to the site-packages folder instead of copying the data over. You can then continue to work on the code without having to run install again after each change.

14.6 Deploying with Fabric

Fabric is a tool for Python similar to Makefiles but with the ability to execute commands on a remote server. In combination with a properly set up Python package (Larger Applications) and a good concept for configurations (Configuration Handling) it is very easy to deploy Flask applications to external servers.

Before we get started, here a quick checklist of things we have to ensure upfront:

- ☒ Fabric 1.0 has to be installed locally. This tutorial assumes the latest version of Fabric.
- ☒ The application already has to be a package and requires a working setup.py file (Deploying with Distribute).
- ☒ In the following example we are using mod_wsgi for the remote servers. You can of course use your own favourite server there, but for this example we chose Apache + mod_wsgi because it's very easy to setup and has a simple way to reload applications without root access.

14.6.1 Creating the first Fabfile

A fabfile is what controls what Fabric executes. It is named fabfile.py and executed by the fab command. All the functions defined in that file will show up as fab subcommands. They are executed on one or more hosts. These hosts can be defined either in the fabfile or on the command line. In this case we will add them to the fabfile.

This is a basic first example that has the ability to upload the current sourcecode to the server and install it into a pre-existing virtual environment:

```
from fabric.api import *

# the user to use for the remote commands
```

```
env.user = 'appuser'
# the servers where the commands are executed
env.hosts = ['server1.example.com', 'server2.example.com']

def pack():
    # create a new source distribution as tarball
    local('python setup.py sdist --formats=gztar', capture=False)

def deploy():
    # figure out the release name and version
    dist = local('python setup.py --fullname', capture=True).strip()
    # upload the source tarball to the temporary folder on the server
    put('dist/%s.tar.gz' % dist, '/tmp/yourapplication.tar.gz')
    # create a place where we can unzip the tarball, then enter
    # that directory and unzip it
    run('mkdir /tmp/yourapplication')
    with cd('/tmp/yourapplication'):
        run('tar xzf /tmp/yourapplication.tar.gz')
        # now setup the package with our virtual environment's
        # python interpreter
        run('/var/www/yourapplication/env/bin/python setup.py install')
    # now that all is set up, delete the folder again
    run('rm -rf /tmp/yourapplication /tmp/yourapplication.tar.gz')
    # and finally touch the .wsgi file so that mod_wsgi triggers
    # a reload of the application
    run('touch /var/www/yourapplication.wsgi')
```

The example above is well documented and should be straightforward. Here a recap of the most common commands fabric provides:

- run - executes a command on a remote server
- local - executes a command on the local machine
- put - uploads a file to the remote server
- cd - changes the directory on the serverside. This has to be used in combination with the with statement.

14.6.2 Running Fabfiles

Now how do you execute that fabfile? You use the fab command. To deploy the current version of the code on the remote server you would use this command:

```
$ fab pack deploy
```

However this requires that our server already has the `/var/www/yourapplication` folder created and `/var/www/yourapplication/env` to be a virtual environment. Furthermore are we not creating the configuration or .wsgi file on the server. So how do we bootstrap a new server into our infrastructure?

This now depends on the number of servers we want to set up. If we just have one application server (which the majority of applications will have), creating a command in the fabfile for this is overkill. But obviously you can do that. In that case you would probably call it setup or bootstrap and then pass the servername explicitly on the command line:

```
$ fab -H newserver.example.com bootstrap
```

To setup a new server you would roughly do these steps:

1. Create the directory structure in `/var/www`:

   ```
   $ mkdir /var/www/yourapplication
   $ cd /var/www/yourapplication
   $ virtualenv --distribute env
   ```

2. Upload a new application.wsgi file to the server and the configuration file for the application (eg: application.cfg)
3. Create a new Apache config for yourapplication and activate it. Make sure to activate watching for changes of the .wsgi file so that we can automatically reload the application by touching it. (See mod_wsgi (Apache) for more information)

So now the question is, where do the application.wsgi and application.cfg files come from?

14.6.3 The WSGI File

The WSGI file has to import the application and also to set an environment variable so that the application knows where to look for the config. This is a short example that does exactly that:

```
import os
os.environ['YOURAPPLICATION_CONFIG'] = '/var/www/yourapplication/application.cfg'
from yourapplication import app
```

The application itself then has to initialize itself like this to look for the config at that environment variable:

```
app = Flask(__name__)
app.config.from_object('yourapplication.default_config')
app.config.from_envvar('YOURAPPLICATION_CONFIG')
```

This approach is explained in detail in the Configuration Handling section of the documentation.

14.6.4 The Configuration File

Now as mentioned above, the application will find the correct configuration file by looking up the YOURAPPLICATION_CONFIG environment variable. So we have to put the configuration in a place where the application will able to find it. Configuration

files have the unfriendly quality of being different on all computers, so you do not version them usually.

A popular approach is to store configuration files for different servers in a separate version control repository and check them out on all servers. Then symlink the file that is active for the server into the location where it's expected (eg: `/var/www/yourapplication`).

Either way, in our case here we only expect one or two servers and we can upload them ahead of time by hand.

14.6.5 First Deployment

Now we can do our first deployment. We have set up the servers so that they have their virtual environments and activated apache configs. Now we can pack up the application and deploy it:

```
$ fab pack deploy
```

Fabric will now connect to all servers and run the commands as written down in the fabfile. First it will execute pack so that we have our tarball ready and then it will execute deploy and upload the source code to all servers and install it there. Thanks to the setup.py file we will automatically pull in the required libraries into our virtual environment.

14.6.6 Next Steps

From that point onwards there is so much that can be done to make deployment actually fun:

- Create a bootstrap command that initializes new servers. It could initialize a new virtual environment, setup apache appropriately etc.
- Put configuration files into a separate version control repository and symlink the active configs into place.
- You could also put your application code into a repository and check out the latest version on the server and then install. That way you can also easily go back to older versions.
- hook in testing functionality so that you can deploy to an external server and run the testsuite.

Working with Fabric is fun and you will notice that it's quite magical to type `fab deploy` and see your application being deployed automatically to one or more remote servers.

14.7 Using SQLite 3 with Flask

In Flask you can implement the opening of database connections at the beginning of the request and closing at the end with the `before_request()` and `teardown_request()` decorators in combination with the special `g` object.

So here is a simple example of how you can use SQLite 3 with Flask:

```
import sqlite3
from flask import g

DATABASE = '/path/to/database.db'

def connect_db():
    return sqlite3.connect(DATABASE)

@app.before_request
def before_request():
    g.db = connect_db()

@app.teardown_request
def teardown_request(exception):
    g.db.close()
```

14.7.1 Connect on Demand

The downside of this approach is that this will only work if Flask executed the before-request handlers for you. If you are attempting to use the database from a script or the interactive Python shell you would have to do something like this:

```
with app.test_request_context()
    app.preprocess_request()
    # now you can use the g.db object
```

In order to trigger the execution of the connection code. You won't be able to drop the dependency on the request context this way, but you could make it so that the application connects when necessary:

```
def get_connection():
    db = getattr(g, '_db', None)
    if db is None:
        db = g._db = connect_db()
    return db
```

Downside here is that you have to use `db = get_connection()` instead of just being able to use `g.db` directly.

14.7.2 Easy Querying

Now in each request handling function you can access g.db to get the current open database connection. To simplify working with SQLite, a helper function can be useful:

```
def query_db(query, args=(), one=False):
    cur = g.db.execute(query, args)
    rv = [dict((cur.description[idx][0], value)
               for idx, value in enumerate(row)) for row in cur.fetchall()]
    return (rv[0] if rv else None) if one else rv
```

This handy little function makes working with the database much more pleasant than it is by just using the raw cursor and connection objects.

Here is how you can use it:

```
for user in query_db('select * from users'):
    print user['username'], 'has the id', user['user_id']
```

Or if you just want a single result:

```
user = query_db('select * from users where username = ?',
                [the_username], one=True)
if user is None:
    print 'No such user'
else:
    print the_username, 'has the id', user['user_id']
```

To pass variable parts to the SQL statement, use a question mark in the statement and pass in the arguments as a list. Never directly add them to the SQL statement with string formatting because this makes it possible to attack the application using SQL Injections.

14.7.3 Initial Schemas

Relational databases need schemas, so applications often ship a schema.sql file that creates the database. It's a good idea to provide a function that creates the database based on that schema. This function can do that for you:

```
from contextlib import closing

def init_db():
    with closing(connect_db()) as db:
        with app.open_resource('schema.sql') as f:
            db.cursor().executescript(f.read())
        db.commit()
```

You can then create such a database from the python shell:

```
>>> from yourapplication import init_db
>>> init_db()
```

14.8 SQLAlchemy in Flask

Many people prefer SQLAlchemy for database access. In this case it's encouraged to use a package instead of a module for your flask application and drop the models into a separate module (Larger Applications). While that is not necessary, it makes a lot of sense.

There are four very common ways to use SQLAlchemy. I will outline each of them here:

14.8.1 Flask-SQLAlchemy Extension

Because SQLAlchemy is a common database abstraction layer and object relational mapper that requires a little bit of configuration effort, there is a Flask extension that handles that for you. This is recommended if you want to get started quickly.

You can download Flask-SQLAlchemy from PyPI.

14.8.2 Declarative

The declarative extension in SQLAlchemy is the most recent method of using SQLAlchemy. It allows you to define tables and models in one go, similar to how Django works. In addition to the following text I recommend the official documentation on the declarative extension.

Here the example database.py module for your application:

```
from sqlalchemy import create_engine
from sqlalchemy.orm import scoped_session, sessionmaker
from sqlalchemy.ext.declarative import declarative_base

engine = create_engine('sqlite:////tmp/test.db', convert_unicode=True)
db_session = scoped_session(sessionmaker(autocommit=False,
                                         autoflush=False,
                                         bind=engine))
Base = declarative_base()
Base.query = db_session.query_property()

def init_db():
    # import all modules here that might define models so that
    # they will be registered properly on the metadata.  Otherwise
    # you will have to import them first before calling init_db()
    import yourapplication.models
    Base.metadata.create_all(bind=engine)
```

To define your models, just subclass the Base class that was created by the code above. If you are wondering why we don't have to care about threads here (like we did in the SQLite3 example above with the `g` object): that's because SQLAlchemy does that for us already with the `scoped_session`.

To use SQLAlchemy in a declarative way with your application, you just have to put the following code into your application module. Flask will automatically remove database sessions at the end of the request for you:

```
from yourapplication.database import db_session

@app.teardown_request
def shutdown_session(exception=None):
    db_session.remove()
```

Here is an example model (put this into models.py, e.g.):

```
from sqlalchemy import Column, Integer, String
from yourapplication.database import Base

class User(Base):
    __tablename__ = 'users'
    id = Column(Integer, primary_key=True)
    name = Column(String(50), unique=True)
    email = Column(String(120), unique=True)

    def __init__(self, name=None, email=None):
        self.name = name
        self.email = email

    def __repr__(self):
        return '<User %r>' % (self.name)
```

To create the database you can use the init_db function:

```
>>> from yourapplication.database import init_db
>>> init_db()
```

You can insert entries into the database like this:

```
>>> from yourapplication.database import db_session
>>> from yourapplication.models import User
>>> u = User('admin', 'admin@localhost')
>>> db_session.add(u)
>>> db_session.commit()
```

Querying is simple as well:

```
>>> User.query.all()
[<User u'admin'>]
>>> User.query.filter(User.name == 'admin').first()
<User u'admin'>
```

14.8.3 Manual Object Relational Mapping

Manual object relational mapping has a few upsides and a few downsides versus the declarative approach from above. The main difference is that you define tables and

classes separately and map them together. It's more flexible but a little more to type. In general it works like the declarative approach, so make sure to also split up your application into multiple modules in a package.

Here is an example database.py module for your application:

```
from sqlalchemy import create_engine, MetaData
from sqlalchemy.orm import scoped_session, sessionmaker

engine = create_engine('sqlite:////tmp/test.db', convert_unicode=True)
metadata = MetaData()
db_session = scoped_session(sessionmaker(autocommit=False,
                                         autoflush=False,
                                         bind=engine))
def init_db():
    metadata.create_all(bind=engine)
```

As for the declarative approach you need to close the session after each request. Put this into your application module:

```
from yourapplication.database import db_session

@app.teardown_request
def shutdown_session(exception=None):
    db_session.remove()
```

Here is an example table and model (put this into models.py):

```
from sqlalchemy import Table, Column, Integer, String
from sqlalchemy.orm import mapper
from yourapplication.database import metadata, db_session

class User(object):
    query = db_session.query_property()

    def __init__(self, name=None, email=None):
        self.name = name
        self.email = email

    def __repr__(self):
        return '<User %r>' % (self.name, self.email)

users = Table('users', metadata,
    Column('id', Integer, primary_key=True),
    Column('name', String(50), unique=True),
    Column('email', String(120), unique=True)
)
mapper(User, users)
```

Querying and inserting works exactly the same as in the example above.

14.8.4 SQL Abstraction Layer

If you just want to use the database system (and SQL) abstraction layer you basically only need the engine:

```
from sqlalchemy import create_engine, MetaData

engine = create_engine('sqlite:////tmp/test.db', convert_unicode=True)
metadata = MetaData(bind=engine)
```

Then you can either declare the tables in your code like in the examples above, or automatically load them:

```
users = Table('users', metadata, autoload=True)
```

To insert data you can use the insert method. We have to get a connection first so that we can use a transaction:

```
>>> con = engine.connect()
>>> con.execute(users.insert(name='admin', email='admin@localhost'))
```

SQLAlchemy will automatically commit for us.

To query your database, you use the engine directly or use a connection:

```
>>> users.select(users.c.id == 1).execute().first()
(1, u'admin', u'admin@localhost')
```

These results are also dict-like tuples:

```
>>> r = users.select(users.c.id == 1).execute().first()
>>> r['name']
u'admin'
```

You can also pass strings of SQL statements to the `execute()` method:

```
>>> engine.execute('select * from users where id = :1', [1]).first()
(1, u'admin', u'admin@localhost')
```

For more information about SQLAlchemy, head over to the website.

14.9 Uploading Files

Ah yes, the good old problem of file uploads. The basic idea of file uploads is actually quite simple. It basically works like this:

1. A `<form>` tag is marked with `enctype=multipart/form-data` and an `<input type=file>` is placed in that form.
2. The application accesses the file from the `files` dictionary on the request object.
3. use the `save()` method of the file to save the file permanently somewhere on the filesystem.

14.9.1 A Gentle Introduction

Let's start with a very basic application that uploads a file to a specific upload folder and displays a file to the user. Let's look at the bootstrapping code for our application:

```
import os
from flask import Flask, request, redirect, url_for
from werkzeug import secure_filename

UPLOAD_FOLDER = '/path/to/the/uploads'
ALLOWED_EXTENSIONS = set(['txt', 'pdf', 'png', 'jpg', 'jpeg', 'gif'])

app = Flask(__name__)
```

So first we need a couple of imports. Most should be straightforward, the `werkzeug.secure_filename()` is explained a little bit later. The UPLOAD_FOLDER is where we will store the uploaded files and the ALLOWED_EXTENSIONS is the set of allowed file extensions. Then we add a URL rule by hand to the application. Now usually we're not doing that, so why here? The reasons is that we want the webserver (or our development server) to serve these files for us and so we only need a rule to generate the URL to these files.

Why do we limit the extensions that are allowed? You probably don't want your users to be able to upload everything there if the server is directly sending out the data to the client. That way you can make sure that users are not able to upload HTML files that would cause XSS problems (see Cross-Site Scripting (XSS)). Also make sure to disallow .php files if the server executes them, but who has PHP installed on his server, right? :)

Next the functions that check if an extension is valid and that uploads the file and redirects the user to the URL for the uploaded file:

```
def allowed_file(filename):
    return '.' in filename and \
           filename.rsplit('.', 1)[1] in ALLOWED_EXTENSIONS

@app.route('/', methods=['GET', 'POST'])
def upload_file():
    if request.method == 'POST':
        file = request.files['file']
        if file and allowed_file(file.filename):
            filename = secure_filename(file.filename)
            file.save(os.path.join(UPLOAD_FOLDER, filename))
            return redirect(url_for('uploaded_file',
                                    filename=filename))
    return '''
    <!doctype html>
    <title>Upload new File</title>
    <h1>Upload new File</h1>
    <form action="" method=post enctype=multipart/form-data>
      <p><input type=file name=file>
         <input type=submit value=Upload>
```

```
    </form>
    '''
```

So what does that `secure_filename()` function actually do? Now the problem is that there is that principle called "never trust user input". This is also true for the filename of an uploaded file. All submitted form data can be forged, and filenames can be dangerous. For the moment just remember: always use that function to secure a filename before storing it directly on the filesystem.

Information for the Pros

So you're interested in what that `secure_filename()` function does and what the problem is if you're not using it? So just imagine someone would send the following information as filename to your application:

```
filename = "../../../../home/username/.bashrc"
```

Assuming the number of `../` is correct and you would join this with the UPLOAD_FOLDER the user might have the ability to modify a file on the server's filesystem he or she should not modify. This does require some knowledge about how the application looks like, but trust me, hackers are patient :)

Now let's look how that function works:

```
>>> secure_filename('../../../../home/username/.bashrc')
'home_username_.bashrc'
```

Now one last thing is missing: the serving of the uploaded files. As of Flask 0.5 we can use a function that does that for us:

```
from flask import send_from_directory

@app.route('/uploads/<filename>')
def uploaded_file(filename):
    return send_from_directory(app.config['UPLOAD_FOLDER'],
                               filename)
```

Alternatively you can register uploaded_file as build_only rule and use the `SharedDataMiddleware`. This also works with older versions of Flask:

```
from werkzeug import SharedDataMiddleware
app.add_url_rule('/uploads/<filename>', 'uploaded_file',
                 build_only=True)
app.wsgi_app = SharedDataMiddleware(app.wsgi_app, {
    '/uploads':  UPLOAD_FOLDER
})
```

If you now run the application everything should work as expected.

14.9.2 Improving Uploads

New in version 0.6. So how exactly does Flask handle uploads? Well it will store them in the webserver's memory if the files are reasonable small otherwise in a temporary location (as returned by `tempfile.gettempdir()`). But how do you specify the maximum file size after which an upload is aborted? By default Flask will happily accept file uploads to an unlimited amount of memory, but you can limit that by setting the `MAX_CONTENT_LENGTH` config key:

```
from flask import Flask, Request

app = Flask(__name__)
app.config['MAX_CONTENT_LENGTH'] = 16 * 1024 * 1024
```

The code above will limited the maximum allowed payload to 16 megabytes. If a larger file is transmitted, Flask will raise an `RequestEntityTooLarge` exception.

This feature was added in Flask 0.6 but can be achieved in older versions as well by subclassing the request object. For more information on that consult the Werkzeug documentation on file handling.

14.9.3 Upload Progress Bars

A while ago many developers had the idea to read the incoming file in small chunks and store the upload progress in the database to be able to poll the progress with JavaScript from the client. Long story short: the client asks the server every 5 seconds how much it has transmitted already. Do you realize the irony? The client is asking for something it should already know.

Now there are better solutions to that work faster and more reliable. The web changed a lot lately and you can use HTML5, Java, Silverlight or Flash to get a nicer uploading experience on the client side. Look at the following libraries for some nice examples how to do that:

- Plupload - HTML5, Java, Flash
- SWFUpload - Flash
- JumpLoader - Java

14.9.4 An Easier Solution

Because the common pattern for file uploads exists almost unchanged in all applications dealing with uploads, there is a Flask extension called Flask-Uploads that implements a full fledged upload mechanism with white and blacklisting of extensions and more.

14.10 Caching

When your application runs slow, throw some caches in. Well, at least it's the easiest way to speed up things. What does a cache do? Say you have a function that takes some time to complete but the results would still be good enough if they were 5 minutes old. So then the idea is that you actually put the result of that calculation into a cache for some time.

Flask itself does not provide caching for you, but Werkzeug, one of the libraries it is based on, has some very basic cache support. It supports multiple cache backends, normally you want to use a memcached server.

14.10.1 Setting up a Cache

You create a cache object once and keep it around, similar to how `Flask` objects are created. If you are using the development server you can create a `SimpleCache` object, that one is a simple cache that keeps the item stored in the memory of the Python interpreter:

```
from werkzeug.contrib.cache import SimpleCache
cache = SimpleCache()
```

If you want to use memcached, make sure to have one of the memcache modules supported (you get them from PyPI) and a memcached server running somewhere. This is how you connect to such an memcached server then:

```
from werkzeug.contrib.cache import MemcachedCache
cache = MemcachedCache(['127.0.0.1:11211'])
```

If you are using App Engine, you can connect to the App Engine memcache server easily:

```
from werkzeug.contrib.cache import GAEMemcachedCache
cache = GAEMemcachedCache()
```

14.10.2 Using a Cache

Now how can one use such a cache? There are two very important operations: `get()` and `set()`. This is how to use them:

To get an item from the cache call `get()` with a string as key name. If something is in the cache, it is returned. Otherwise that function will return None:

```
rv = cache.get('my-item')
```

To add items to the cache, use the `set()` method instead. The first argument is the key and the second the value that should be set. Also a timeout can be provided after which the cache will automatically remove item.

Here a full example how this looks like normally:

```
def get_my_item():
    rv = cache.get('my-item')
    if rv is None:
        rv = calculate_value()
        cache.set('my-item', rv, timeout=5 * 60)
    return rv
```

14.11 View Decorators

Python has a really interesting feature called function decorators. This allow some really neat things for web applications. Because each view in Flask is a function decorators can be used to inject additional functionality to one or more functions. The `route()` decorator is the one you probably used already. But there are use cases for implementing your own decorator. For instance, imagine you have a view that should only be used by people that are logged in to. If a user goes to the site and is not logged in, they should be redirected to the login page. This is a good example of a use case where a decorator is an excellent solution.

14.11.1 Login Required Decorator

So let's implement such a decorator. A decorator is a function that returns a function. Pretty simple actually. The only thing you have to keep in mind when implementing something like this is to update the __name__, __module__ and some other attributes of a function. This is often forgotten, but you don't have to do that by hand, there is a function for that that is used like a decorator (`functools.wraps()`).

This example assumes that the login page is called `'login'` and that the current user is stored as g.user and None if there is no-one logged in:

```
from functools import wraps
from flask import g, request, redirect, url_for

def login_required(f):
    @wraps(f)
    def decorated_function(*args, **kwargs):
        if g.user is None:
            return redirect(url_for('login', next=request.url))
        return f(*args, **kwargs)
    return decorated_function
```

So how would you use that decorator now? Apply it as innermost decorator to a view function. When applying further decorators, always remember that the `route()` decorator is the outermost:

```
@app.route('/secret_page')
@login_required
def secret_page():
    pass
```

14.11.2 Caching Decorator

Imagine you have a view function that does an expensive calculation and because of that you would like to cache the generated results for a certain amount of time. A decorator would be nice for that. We're assuming you have set up a cache like mentioned in Caching.

Here an example cache function. It generates the cache key from a specific prefix (actually a format string) and the current path of the request. Notice that we are using a function that first creates the decorator that then decorates the function. Sounds awful? Unfortunately it is a little bit more complex, but the code should still be straightforward to read.

The decorated function will then work as follows

1. get the unique cache key for the current request base on the current path.
2. get the value for that key from the cache. If the cache returned something we will return that value.
3. otherwise the original function is called and the return value is stored in the cache for the timeout provided (by default 5 minutes).

Here the code:

```
from functools import wraps
from flask import request

def cached(timeout=5 * 60, key='view/%s'):
    def decorator(f):
        @wraps(f)
        def decorated_function(*args, **kwargs):
            cache_key = key % request.path
            rv = cache.get(cache_key)
            if rv is not None:
                return rv
            rv = f(*args, **kwargs)
            cache.set(cache_key, rv, timeout=timeout)
            return rv
        return decorated_function
    return decorator
```

Notice that this assumes an instantiated cache object is available, see Caching for more information.

14.11.3 Templating Decorator

A common pattern invented by the TurboGears guys a while back is a templating decorator. The idea of that decorator is that you return a dictionary with the val-

ues passed to the template from the view function and the template is automatically rendered. With that, the following three examples do exactly the same:

```
@app.route('/')
def index():
    return render_template('index.html', value=42)

@app.route('/')
@templated('index.html')
def index():
    return dict(value=42)

@app.route('/')
@templated()
def index():
    return dict(value=42)
```

As you can see, if no template name is provided it will use the endpoint of the URL map with dots converted to slashes + `'.html'`. Otherwise the provided template name is used. When the decorated function returns, the dictionary returned is passed to the template rendering function. If None is returned, an empty dictionary is assumed, if something else than a dictionary is returned we return it from the function unchanged. That way you can still use the redirect function or return simple strings.

Here the code for that decorator:

```
from functools import wraps
from flask import request

def templated(template=None):
    def decorator(f):
        @wraps(f)
        def decorated_function(*args, **kwargs):
            template_name = template
            if template_name is None:
                template_name = request.endpoint \
                    .replace('.', '/') + '.html'
            ctx = f(*args, **kwargs)
            if ctx is None:
                ctx = {}
            elif not isinstance(ctx, dict):
                return ctx
            return render_template(template_name, **ctx)
        return decorated_function
    return decorator
```

14.11.4 Endpoint Decorator

When you want to use the werkzeug routing system for more flexibility you need to map the endpoint as defined in the `Rule` to a view function. This is possible with this decorator. For example:

```
from flask import Flask
from werkzeug.routing import Rule

app = Flask(__name__)
app.url_map.add(Rule('/', endpoint='index'))

@app.endpoint('index')
def my_index():
    return "Hello world"
```

14.12 Form Validation with WTForms

When you have to work with form data submitted by a browser view code quickly becomes very hard to read. There are libraries out there designed to make this process easier to manage. One of them is WTForms which we will handle here. If you find yourself in the situation of having many forms, you might want to give it a try.

When you are working with WTForms you have to define your forms as classes first. I recommend breaking up the application into multiple modules (Larger Applications) for that and adding a separate module for the forms.

Getting most of WTForms with an Extension

The Flask-WTF extension expands on this pattern and adds a few handful little helpers that make working with forms and Flask more fun. You can get it from PyPI.

14.12.1 The Forms

This is an example form for a typical registration page:

```
from wtforms import Form, BooleanField, TextField, validators

class RegistrationForm(Form):
    username = TextField('Username', [validators.Length(min=4, max=25)])
    email = TextField('Email Address', [validators.Length(min=6, max=35)])
    password = PasswordField('New Password', [
        validators.Required(),
        validators.EqualTo('confirm', message='Passwords must match')
    ])
    confirm = PasswordField('Repeat Password')
    accept_tos = BooleanField('I accept the TOS', [validators.Required()])
```

14.12.2 In the View

In the view function, the usage of this form looks like this:

```
@app.route('/register', methods=['GET', 'POST'])
def register():
    form = RegistrationForm(request.form)
    if request.method == 'POST' and form.validate():
        user = User(form.username.data, form.email.data,
                    form.password.data)
        db_session.add(user)
        flash('Thanks for registering')
        return redirect(url_for('login'))
    return render_template('register.html', form=form)
```

Notice that we are implying that the view is using SQLAlchemy here (SQLAlchemy in Flask) but this is no requirement of course. Adapt the code as necessary.

Things to remember:

1. create the form from the request `form` value if the data is submitted via the HTTP POST method and `args` if the data is submitted as GET.
2. to validate the data, call the `validate()` method which will return True if the data validates, False otherwise.
3. to access individual values from the form, access form.<NAME>.data.

14.12.3 Forms in Templates

Now to the template side. When you pass the form to the templates you can easily render them there. Look at the following example template to see how easy this is. WTForms does half the form generation for us already. To make it even nicer, we can write a macro that renders a field with label and a list of errors if there are any.

Here's an example _formhelpers.html template with such a macro:

```
{% macro render_field(field) %}
  <dt>{{ field.label }}
  <dd>{{ field(**kwargs)|safe }}
  {% if field.errors %}
    <ul class="errors">
    {% for error in field.errors %}<li>{{ error }}{% endfor %}
    </ul>
  {% endif %}
  </dd>
{% endmacro %}
```

This macro accepts a couple of keyword arguments that are forwarded to WTForm's field function that renders the field for us. The keyword arguments will be inserted as HTML attributes. So for example you can call `render_field(form.username, class='username')` to add a class to the input element. Note that WTForms returns standard Python unicode strings, so we have to tell Jinja2 that this data is already HTML escaped with the |safe filter.

Here the register.html template for the function we used above which takes advantage of the _formhelpers.html template:

```
{% from "_formhelpers.html" import render_field %}
<form method="post" action="/register">
  <dl>
    {{ render_field(form.username) }}
    {{ render_field(form.email) }}
    {{ render_field(form.password) }}
    {{ render_field(form.confirm) }}
    {{ render_field(form.accept_tos) }}
  </dl>
  <p><input type=submit value=Register>
</form>
```

For more information about WTForms, head over to the WTForms website.

14.13 Template Inheritance

The most powerful part of Jinja is template inheritance. Template inheritance allows you to build a base "skeleton" template that contains all the common elements of your site and defines blocks that child templates can override.

Sounds complicated but is very basic. It's easiest to understand it by starting with an example.

14.13.1 Base Template

This template, which we'll call `layout.html`, defines a simple HTML skeleton document that you might use for a simple two-column page. It's the job of "child" templates to fill the empty blocks with content:

```
<!doctype html>
<html>
  <head>
    {% block head %}
    <link rel="stylesheet" href="{{ url_for('static', filename='style.css') }}">
    <title>{% block title %}{% endblock %} - My Webpage</title>
    {% endblock %}
  </head>
<body>
  <div id="content">{% block content %}{% endblock %}</div>
  <div id="footer">
    {% block footer %}
    &copy; Copyright 2010 by <a href="http://domain.invalid/">you</a>.
    {% endblock %}
  </div>
</body>
```

In this example, the `{% block %}` tags define four blocks that child templates can fill in. All the block tag does is to tell the template engine that a child template may override those portions of the template.

14.13.2 Child Template

A child template might look like this:

```
{% extends "layout.html" %}
{% block title %}Index{% endblock %}
{% block head %}
  {{ super() }}
  <style type="text/css">
    .important { color: #336699; }
  </style>
{% endblock %}
{% block content %}
  <h1>Index</h1>
  <p class="important">
    Welcome on my awesome homepage.
{% endblock %}
```

The `{% extends %}` tag is the key here. It tells the template engine that this template "extends" another template. When the template system evaluates this template, first it locates the parent. The extends tag must be the first tag in the template. To render the contents of a block defined in the parent template, use `{{ super() }}`.

14.14 Message Flashing

Good applications and user interfaces are all about feedback. If the user does not get enough feedback they will probably end up hating the application. Flask provides a really simple way to give feedback to a user with the flashing system. The flashing system basically makes it possible to record a message at the end of a request and access it next request and only next request. This is usually combined with a layout template that does this.

14.14.1 Simple Flashing

So here is a full example:

```
from flask import flash, redirect, url_for, render_template

@app.route('/')
def index():
    return render_template('index.html')

@app.route('/login', methods=['GET', 'POST'])
```

```
def login():
    error = None
    if request.method == 'POST':
        if request.form['username'] != 'admin' or \
           request.form['password'] != 'secret':
            error = 'Invalid credentials'
        else:
            flash('You were successfully logged in')
            return redirect(url_for('index'))
    return render_template('login.html', error=error)
```

And here the `layout.html` template which does the magic:

```
<!doctype html>
<title>My Application</title>
{% with messages = get_flashed_messages() %}
  {% if messages %}
    <ul class=flashes>
    {% for message in messages %}
      <li>{{ message }}</li>
    {% endfor %}
    </ul>
  {% endif %}
{% endwith %}
{% block body %}{% endblock %}
```

And here the index.html template:

```
{% extends "layout.html" %}
{% block body %}
  <h1>Overview</h1>
  <p>Do you want to <a href="{{ url_for('login') }}">log in?</a>
{% endblock %}
```

And of course the login template:

```
{% extends "layout.html" %}
{% block body %}
  <h1>Login</h1>
  {% if error %}
    <p class=error><strong>Error:</strong> {{ error }}
  {% endif %}
  <form action="" method=post>
    <dl>
      <dt>Username:
      <dd><input type=text name=username value="{{
          request.form.username }}">
      <dt>Password:
      <dd><input type=password name=password>
    </dl>
    <p><input type=submit value=Login>
  </form>
```

```
{% endblock %}
```

14.14.2 Flashing With Categories

New in version 0.3. It is also possible to provide categories when flashing a message. The default category if nothing is provided is `'message'`. Alternative categories can be used to give the user better feedback. For example error messages could be displayed with a red background.

To flash a message with a different category, just use the second argument to the `flash()` function:

```
flash(u'Invalid password provided', 'error')
```

Inside the template you then have to tell the `get_flashed_messages()` function to also return the categories. The loop looks slightly different in that situation then:

```
{% with messages = get_flashed_messages(with_categories=true) %}
  {% if messages %}
    <ul class=flashes>
    {% for category, message in messages %}
      <li class="{{ category }}">{{ message }}</li>
    {% endfor %}
    </ul>
  {% endif %}
{% endwith %}
```

This is just one example of how to render these flashed messages. One might also use the category to add a prefix such as `<strong>Error:</strong>` to the message.

14.15 AJAX with jQuery

jQuery is a small JavaScript library commonly used to simplify working with the DOM and JavaScript in general. It is the perfect tool to make web applications more dynamic by exchanging JSON between server and client.

JSON itself is a very lightweight transport format, very similar to how Python primitives (numbers, strings, dicts and lists) look like which is widely supported and very easy to parse. It became popular a few years ago and quickly replaced XML as transport format in web applications.

If you have Python 2.6 JSON will work out of the box, in Python 2.5 you will have to install the simplejson library from PyPI.

14.15.1 Loading jQuery

In order to use jQuery, you have to download it first and place it in the static folder of your application and then ensure it's loaded. Ideally you have a layout template that

is used for all pages where you just have to add a script statement to the bottom of your <body> to load jQuery:

```
<script type=text/javascript src="{{
  url_for('static', filename='jquery.js') }}"></script>
```

Another method is using Google's AJAX Libraries API to load jQuery:

```
<script src="//ajax.googleapis.com/ajax/libs/jquery/1.6.1/jquery.js"></script>
<script>window.jQuery || document.write('<script src="{{
  url_for('static', filename='jquery.js') }}">\x3C/script>')</script>
```

In this case you have to put jQuery into your static folder as a fallback, but it will first try to load it directly from Google. This has the advantage that your website will probably load faster for users if they went to at least one other website before using the same jQuery version from Google because it will already be in the browser cache.

14.15.2 Where is My Site?

Do you know where your application is? If you are developing the answer is quite simple: it's on localhost port something and directly on the root of that server. But what if you later decide to move your application to a different location? For example to `http://example.com/myapp`? On the server side this never was a problem because we were using the handy `url_for()` function that could answer that question for us, but if we are using jQuery we should not hardcode the path to the application but make that dynamic, so how can we do that?

A simple method would be to add a script tag to our page that sets a global variable to the prefix to the root of the application. Something like this:

```
<script type=text/javascript>
  $SCRIPT_ROOT = {{ request.script_root|tojson|safe }};
</script>
```

The `|safe` is necessary so that Jinja does not escape the JSON encoded string with HTML rules. Usually this would be necessary, but we are inside a script block here where different rules apply.

Information for Pros

In HTML the script tag is declared CDATA which means that entities will not be parsed. Everything until `</script>` is handled as script. This also means that there must never be any `</` between the script tags. `|tojson` is kind enough to do the right thing here and escape slashes for you (`{{ "</script>"|tojson|safe }}` is rendered as `"<\/script>"`).

14.15.3 JSON View Functions

Now let's create a server side function that accepts two URL arguments of numbers which should be added together and then sent back to the application in a JSON object.

This is a really ridiculous example and is something you usually would do on the client side alone, but a simple example that shows how you would use jQuery and Flask nonetheless:

```
from flask import Flask, jsonify, render_template, request
app = Flask(__name__)

@app.route('/_add_numbers')
def add_numbers():
    a = request.args.get('a', 0, type=int)
    b = request.args.get('b', 0, type=int)
    return jsonify(result=a + b)

@app.route('/')
def index():
    return render_template('index.html')
```

As you can see I also added an index method here that renders a template. This template will load jQuery as above and have a little form we can add two numbers and a link to trigger the function on the server side.

Note that we are using the `get()` method here which will never fail. If the key is missing a default value (here `0`) is returned. Furthermore it can convert values to a specific type (like in our case int). This is especially handy for code that is triggered by a script (APIs, JavaScript etc.) because you don't need special error reporting in that case.

14.15.4 The HTML

Your index.html template either has to extend a layout.html template with jQuery loaded and the $SCRIPT_ROOT variable set, or do that on the top. Here's the HTML code needed for our little application (index.html). Notice that we also drop the script directly into the HTML here. It is usually a better idea to have that in a separate script file:

```
<script type=text/javascript>
  $(function() {
    $('a#calculate').bind('click', function() {
      $.getJSON($SCRIPT_ROOT + '/_add_numbers', {
        a: $('input[name="a"]').val(),
        b: $('input[name="b"]').val()
      }, function(data) {
        $("#result").text(data.result);
      });
      return false;
    });
  });
</script>
<h1>jQuery Example</h1>
<p><input type=text size=5 name=a> +
```

```
    <input type=text size=5 name=b> =
    <span id=result>?</span>
<p><a href=# id=calculate>calculate server side</a>
```

I won't got into detail here about how jQuery works, just a very quick explanation of the little bit of code above:

1. `$(function() { ... })` specifies code that should run once the browser is done loading the basic parts of the page.
2. `$('selector')` selects an element and lets you operate on it.
3. `element.bind('event', func)` specifies a function that should run when the user clicked on the element. If that function returns false, the default behaviour will not kick in (in this case, navigate to the # URL).
4. `$.getJSON(url, data, func)` sends a GET request to url and will send the contents of the data object as query parameters. Once the data arrived, it will call the given function with the return value as argument. Note that we can use the $SCRIPT_ROOT variable here that we set earlier.

If you don't get the whole picture, download the sourcecode for this example from github.

14.16 Custom Error Pages

Flask comes with a handy `abort()` function that aborts a request with an HTTP error code early. It will also provide a plain black and white error page for you with a basic description, but nothing fancy.

Depending on the error code it is less or more likely for the user to actually see such an error.

14.16.1 Common Error Codes

The following error codes are some that are often displayed to the user, even if the application behaves correctly:

404 Not Found The good old "chap, you made a mistake typing that URL" message. So common that even novices to the internet know that 404 means: damn, the thing I was looking for is not there. It's a very good idea to make sure there is actually something useful on a 404 page, at least a link back to the index.

403 Forbidden If you have some kind of access control on your website, you will have to send a 403 code for disallowed resources. So make sure the user is not lost when they try to access a forbidden resource.

410 Gone Did you know that there the "404 Not Found" has a brother named "410 Gone"? Few people actually implement that, but the idea is that resources that previously existed and got deleted answer with 410 instead of 404. If you are

not deleting documents permanently from the database but just mark them as deleted, do the user a favour and use the 410 code instead and display a message that what they were looking for was deleted for all eternity.

500 Internal Server Error Usually happens on programming errors or if the server is overloaded. A terrible good idea to have a nice page there, because your application will fail sooner or later (see also: 处理应用异常).

14.16.2 Error Handlers

An error handler is a function, just like a view function, but it is called when an error happens and is passed that error. The error is most likely a `HTTPException`, but in one case it can be a different error: a handler for internal server errors will be passed other exception instances as well if they are uncaught.

An error handler is registered with the `errorhandler()` decorator and the error code of the exception. Keep in mind that Flask will not set the error code for you, so make sure to also provide the HTTP status code when returning a response.

Here an example implementation for a "404 Page Not Found" exception:

```
from flask import render_template

@app.errorhandler(404)
def page_not_found(e):
    return render_template('404.html'), 404
```

An example template might be this:

```
{% extends "layout.html" %}
{% block title %}Page Not Found{% endblock %}
{% block body %}
  <h1>Page Not Found</h1>
  <p>What you were looking for is just not there.
  <p><a href="{{ url_for('index') }}">go somewhere nice</a>
{% endblock %}
```

14.17 Lazily Loading Views

Flask is usually used with the decorators. Decorators are simple and you have the URL right next to the function that is called for that specific URL. However there is a downside to this approach: it means all your code that uses decorators has to be imported upfront or Flask will never actually find your function.

This can be a problem if your application has to import quick. It might have to do that on systems like Google's App Engine or other systems. So if you suddenly notice that your application outgrows this approach you can fall back to a centralized URL mapping.

The system that enables having a central URL map is the `add_url_rule()` function. Instead of using decorators, you have a file that sets up the application with all URLs.

14.17.1 Converting to Centralized URL Map

Imagine the current application looks somewhat like this:

```
from flask import Flask
app = Flask(__name__)

@app.route('/')
def index():
    pass

@app.route('/user/<username>')
def user(username):
    pass
```

Then the centralized approach you would have one file with the views (views.py) but without any decorator:

```
def index():
    pass

def user(username):
    pass
```

And then a file that sets up an application which maps the functions to URLs:

```
from flask import Flask
from yourapplication import views
app = Flask(__name__)
app.add_url_rule('/', view_func=views.index)
app.add_url_rule('/user/<username>', view_func=views.user)
```

14.17.2 Loading Late

So far we only split up the views and the routing, but the module is still loaded upfront. The trick to actually load the view function as needed. This can be accomplished with a helper class that behaves just like a function but internally imports the real function on first use:

```
from werkzeug import import_string, cached_property

class LazyView(object):

    def __init__(self, import_name):
        self.__module__, self.__name__ = import_name.rsplit('.', 1)
        self.import_name = import_name
```

```
    @cached_property
    def view(self):
        return import_string(self.import_name)

    def __call__(self, *args, **kwargs):
        return self.view(*args, **kwargs)
```

What's important here is is that __module__ and __name__ are properly set. This is used by Flask internally to figure out how to name the URL rules in case you don't provide a name for the rule yourself.

Then you can define your central place to combine the views like this:

```
from flask import Flask
from yourapplication.helpers import LazyView
app = Flask(__name__)
app.add_url_rule('/',
                 view_func=LazyView('yourapplication.views.index'))
app.add_url_rule('/user/<username>',
                 view_func=LazyView('yourapplication.views.user'))
```

You can further optimize this in terms of amount of keystrokes needed to write this by having a function that calls into `add_url_rule()` by prefixing a string with the project name and a dot, and by wrapping view_func in a LazyView as needed:

```
def url(url_rule, import_name, **options):
    view = LazyView('yourapplication.' + import_name)
    app.add_url_rule(url_rule, view_func=view, **options)

url('/', 'views.index')
url('/user/<username>', 'views.user')
```

One thing to keep in mind is that before and after request handlers have to be in a file that is imported upfront to work properly on the first request. The same goes for any kind of remaining decorator.

14.18 MongoKit in Flask

Using a document database rather than a full DBMS gets more common these days. This pattern shows how to use MongoKit, a document mapper library, to integrate with MongoDB.

This pattern requires a running MongoDB server and the MongoKit library installed.

There are two very common ways to use MongoKit. I will outline each of them here:

14.18.1 Declarative

The default behaviour of MongoKit is the declarative one that is based on common ideas from Django or the SQLAlchemy declarative extension.

Here an example app.py module for your application:

```
from flask import Flask
from mongokit import Connection, Document

# configuration
MONGODB_HOST = 'localhost'
MONGODB_PORT = 27017

# create the little application object
app = Flask(__name__)
app.config.from_object(__name__)

# connect to the database
connection = Connection(app.config['MONGODB_HOST'],
                        app.config['MONGODB_PORT'])
```

To define your models, just subclass the Document class that is imported from MongoKit. If you've seen the SQLAlchemy pattern you may wonder why we do not have a session and even do not define a init_db function here. On the one hand, MongoKit does not have something like a session. This sometimes makes it more to type but also makes it blazingly fast. On the other hand, MongoDB is schemaless. This means you can modify the data structure from one insert query to the next without any problem. MongoKit is just schemaless too, but implements some validation to ensure data integrity.

Here is an example document (put this also into app.py, e.g.):

```
def max_length(length):
    def validate(value):
        if len(value) <= length:
            return True
        raise Exception('%s must be at most %s characters long' % length)
    return validate

class User(Document):
    structure = {
        'name': unicode,
        'email': unicode,
    }
    validators = {
        'name': max_length(50),
        'email': max_length(120)
    }
    use_dot_notation = True
    def __repr__(self):
        return '<User %r>' % (self.name)
```

```
# register the User document with our current connection
connection.register([User])
```

This example shows you how to define your schema (named structure), a validator for the maximum character length and uses a special MongoKit feature called use_dot_notation. Per default MongoKit behaves like a python dictionary but with use_dot_notation set to True you can use your documents like you use models in nearly any other ORM by using dots to separate between attributes.

You can insert entries into the database like this:

```
>>> from yourapplication.database import connection
>>> from yourapplication.models import User
>>> collection = connection['test'].users
>>> user = collection.User()
>>> user['name'] = u'admin'
>>> user['email'] = u'admin@localhost'
>>> user.save()
```

Note that MongoKit is kinda strict with used column types, you must not use a common str type for either name or email but unicode.

Querying is simple as well:

```
>>> list(collection.User.find())
[<User u'admin'>]
>>> collection.User.find_one({'name': u'admin'})
<User u'admin'>
```

14.18.2 PyMongo Compatibility Layer

If you just want to use PyMongo, you can do that with MongoKit as well. You may use this process if you need the best performance to get. Note that this example does not show how to couple it with Flask, see the above MongoKit code for examples:

```
from MongoKit import Connection

connection = Connection()
```

To insert data you can use the insert method. We have to get a collection first, this is somewhat the same as a table in the SQL world.

```
>>> collection = connection['test'].users
>>> user = {'name': u'admin', 'email': u'admin@localhost'}
>>> collection.insert(user)
```

print list(collection.find()) print collection.find_one({‘name’: u’admin’})

MongoKit will automatically commit for us.

To query your database, you use the collection directly:

```
>>> list(collection.find())
[{u'_id': ObjectId('4c271729e13823182f000000'), u'name': u'admin', u'email': u'admin@localhost'}]
>>> collection.find_one({'name': u'admin'})
{u'_id': ObjectId('4c271729e13823182f000000'), u'name': u'admin', u'email': u'admin@localhost'}
```

These results are also dict-like objects:

```
>>> r = collection.find_one({'name': u'admin'})
>>> r['email']
u'admin@localhost'
```

For more information about MongoKit, head over to the website.

14.19 Adding a favicon

A "favicon" is an icon used by browsers for tabs and bookmarks. This helps to distinguish your website and to give it a unique brand.

A common question is how to add a favicon to a flask application. First, of course, you need an icon. It should be 16 6 pixels and in the ICO file format. This is not a requirement but a de-facto standard supported by all relevant browsers. Put the icon in your static directory as `favicon.ico`.

Now, to get browsers to find your icon, the correct way is to add a link tag in your HTML. So, for example:

```
<link rel="shortcut icon" href="{{ url_for('static', filename='favicon.ico') }}">
```

That's all you need for most browsers, however some really old ones do not support this standard. The old de-facto standard is to serve this file, with this name, at the website root. If your application is not mounted at the root path of the domain you either need to configure the webserver to serve the icon at the root or if you can't do that you're out of luck. If however your application is the root you can simply route a redirect:

```
app.add_url_rule('/favicon.ico',
                 redirect_to=url_for('static', filename='favicon.ico'))
```

If you want to save the extra redirect request you can also write a view using `send_from_directory()`:

```
import os
from flask import send_from_directory

@app.route('/favicon.ico')
def favicon():
    return send_from_directory(os.path.join(app.root_path, 'static'),
                               'favicon.ico', mimetype='image/vnd.microsoft.icon')
```

We can leave out the explicit mimetype and it will be guessed, but we may as well specify it to avoid the extra guessing, as it will always be the same.

The above will serve the icon via your application and if possible it's better to configure your dedicated web server to serve it; refer to the webserver's documentation.

14.19.1 See also

- The Favicon article on Wikipedia

CHAPTER

FIFTEEN

DEPLOYMENT OPTIONS

Depending on what you have available there are multiple ways to run Flask applications. You can use the builtin server during development, but you should use a full deployment option for production applications. (Do not use the builtin development server in production.) Several options are available and documented here.

If you have a different WSGI server look up the server documentation about how to use a WSGI app with it. Just remember that your `Flask` application object is the actual WSGI application.

15.1 mod_wsgi (Apache)

If you are using the Apache webserver, consider using mod_wsgi.

Watch Out

Please make sure in advance that any `app.run()` calls you might have in your application file are inside an `if __name__ == '__main__':` block or moved to a separate file. Just make sure it's not called because this will always start a local WSGI server which we do not want if we deploy that application to mod_wsgi.

15.1.1 Installing mod_wsgi

If you don't have mod_wsgi installed yet you have to either install it using a package manager or compile it yourself. The mod_wsgi installation instructions cover source installations on UNIX systems.

If you are using Ubuntu/Debian you can apt-get it and activate it as follows:

```
# apt-get install libapache2-mod-wsgi
```

On FreeBSD install mod_wsgi by compiling the www/mod_wsgi port or by using pkg_add:

```
# pkg_add -r mod_wsgi
```

If you are using pkgsrc you can install mod_wsgi by compiling the www/ap2-wsgi package.

If you encounter segfaulting child processes after the first apache reload you can safely ignore them. Just restart the server.

15.1.2 Creating a .wsgi file

To run your application you need a yourapplication.wsgi file. This file contains the code mod_wsgi is executing on startup to get the application object. The object called application in that file is then used as application.

For most applications the following file should be sufficient:

```
from yourapplication import app as application
```

If you don't have a factory function for application creation but a singleton instance you can directly import that one as application.

Store that file somewhere that you will find it again (e.g.: /var/www/yourapplication) and make sure that yourapplication and all the libraries that are in use are on the python load path. If you don't want to install it system wide consider using a virtual python instance.

15.1.3 Configuring Apache

The last thing you have to do is to create an Apache configuration file for your application. In this example we are telling mod_wsgi to execute the application under a different user for security reasons:

```
<VirtualHost *>
    ServerName example.com

    WSGIDaemonProcess yourapplication user=user1 group=group1 threads=5
    WSGIScriptAlias / /var/www/yourapplication/yourapplication.wsgi

    <Directory /var/www/yourapplication>
        WSGIProcessGroup yourapplication
        WSGIApplicationGroup %{GLOBAL}
        Order deny,allow
        Allow from all
    </Directory>
</VirtualHost>
```

For more information consult the mod_wsgi wiki.

15.1.4 Troubleshooting

If your application does not run, follow this guide to troubleshoot:

Problem: application does not run, errorlog shows SystemExit ignored You have a `app.run()` call in your application file that is not guarded by an `if __name__ == '__main__':` condition. Either remove that `run()` call from the file and move it into a separate run.py file or put it into such an if block.

Problem: application gives permission errors Probably caused by your application running as the wrong user. Make sure the folders the application needs access to have the proper privileges set and the application runs as the correct user (`user` and `group` parameter to the WSGIDaemonProcess directive)

Problem: application dies with an error on print Keep in mind that mod_wsgi disallows doing anything with `sys.stdout` and `sys.stderr`. You can disable this protection from the config by setting the WSGIRestrictStdout to `off`:

```
WSGIRestrictStdout Off
```

Alternatively you can also replace the standard out in the .wsgi file with a different stream:

```
import sys
sys.stdout = sys.stderr
```

Problem: accessing resources gives IO errors Your application probably is a single .py file you symlinked into the site-packages folder. Please be aware that this does not work, instead you either have to put the folder into the pythonpath the file is stored in, or convert your application into a package.

The reason for this is that for non-installed packages, the module filename is used to locate the resources and for symlinks the wrong filename is picked up.

15.1.5 Support for Automatic Reloading

To help deployment tools you can activate support for automatic reloading. Whenever something changes the .wsgi file, mod_wsgi will reload all the daemon processes for us.

For that, just add the following directive to your Directory section:

```
WSGIScriptReloading On
```

15.1.6 Working with Virtual Environments

Virtual environments have the advantage that they never install the required dependencies system wide so you have a better control over what is used where. If you want to use a virtual environment with mod_wsgi you have to modify your .wsgi file slightly.

Add the following lines to the top of your .wsgi file:

```
activate_this = '/path/to/env/bin/activate_this.py'
execfile(activate_this, dict(__file__=activate_this))
```

This sets up the load paths according to the settings of the virtual environment. Keep in mind that the path has to be absolute.

15.2 CGI

If all other deployment methods do not work, CGI will work for sure. CGI is supported by all major servers but usually has a sub-optimal performance.

This is also the way you can use a Flask application on Google's App Engine, where execution happens in a CGI-like environment.

Watch Out

Please make sure in advance that any `app.run()` calls you might have in your application file are inside an `if __name__ == '__main__':` block or moved to a separate file. Just make sure it's not called because this will always start a local WSGI server which we do not want if we deploy that application to CGI / app engine.

15.2.1 Creating a .cgi file

First you need to create the CGI application file. Let's call it yourapplication.cgi:

```
#!/usr/bin/python
from wsgiref.handlers import CGIHandler
from yourapplication import app

CGIHandler().run(app)
```

15.2.2 Server Setup

Usually there are two ways to configure the server. Either just copy the .cgi into a cgi-bin (and use mod_rewrite or something similar to rewrite the URL) or let the server point to the file directly.

In Apache for example you can put a like like this into the config:

```
ScriptAlias /app /path/to/the/application.cgi
```

For more information consult the documentation of your webserver.

15.3 FastCGI

FastCGI is a deployment option on servers like nginx, lighttpd, and cherokee; see uWSGI and Other Servers for other options. To use your WSGI application with any of them you will need a FastCGI server first. The most popular one is flup which we will use for this guide. Make sure to have it installed to follow along.

Watch Out

Please make sure in advance that any `app.run()` calls you might have in your application file are inside an `if __name__ == '__main__':` block or moved to a separate file. Just make sure it's not called because this will always start a local WSGI server which we do not want if we deploy that application to FastCGI.

15.3.1 Creating a .fcgi file

First you need to create the FastCGI server file. Let's call it yourapplication.fcgi:

```
#!/usr/bin/python
from flup.server.fcgi import WSGIServer
from yourapplication import app

if __name__ == '__main__':
    WSGIServer(app).run()
```

This is enough for Apache to work, however nginx and older versions of lighttpd need a socket to be explicitly passed to communicate with the FastCGI server. For that to work you need to pass the path to the socket to the `WSGIServer`:

```
WSGIServer(application, bindAddress='/path/to/fcgi.sock').run()
```

The path has to be the exact same path you define in the server config.

Save the yourapplication.fcgi file somewhere you will find it again. It makes sense to have that in /var/www/yourapplication or something similar.

Make sure to set the executable bit on that file so that the servers can execute it:

```
# chmod +x /var/www/yourapplication/yourapplication.fcgi
```

15.3.2 Configuring lighttpd

A basic FastCGI configuration for lighttpd looks like that:

```
fastcgi.server = ("/yourapplication.fcgi" =>
    ((
        "socket" => "/tmp/yourapplication-fcgi.sock",
        "bin-path" => "/var/www/yourapplication/yourapplication.fcgi",
```

```
        "check-local" => "disable",
        "max-procs" -> 1
    ))
)

alias.url = (
    "/static/" => "/path/to/your/static"
)

url.rewrite-once = (
    "^(/static.*)$" => "$1",
    "^(/.*)$" => "/yourapplication.fcgi$1"
```

Remember to enable the FastCGI, alias and rewrite modules. This configuration binds the application to /yourapplication. If you want the application to work in the URL root you have to work around a lighttpd bug with the `LighttpdCGIRootFix` middleware.

Make sure to apply it only if you are mounting the application the URL root. Also, see the Lighty docs for more information on FastCGI and Python (note that explicitly passing a socket to run() is no longer necessary).

15.3.3 Configuring nginx

Installing FastCGI applications on nginx is a bit different because by default no FastCGI parameters are forwarded.

A basic flask FastCGI configuration for nginx looks like this:

```
location = /yourapplication { rewrite ^ /yourapplication/ last; }
location /yourapplication { try_files $uri @yourapplication; }
location @yourapplication {
    include fastcgi_params;
    fastcgi_split_path_info ^(/yourapplication)(.*)$;
    fastcgi_param PATH_INFO $fastcgi_path_info;
    fastcgi_param SCRIPT_NAME $fastcgi_script_name;
    fastcgi_pass unix:/tmp/yourapplication-fcgi.sock;
}
```

This configuration binds the application to /yourapplication. If you want to have it in the URL root it's a bit simpler because you don't have to figure out how to calculate PATH_INFO and SCRIPT_NAME:

```
location / { try_files $uri @yourapplication; }
location @yourapplication {
    include fastcgi_params;
    fastcgi_param PATH_INFO $fastcgi_script_name;
    fastcgi_param SCRIPT_NAME "";
    fastcgi_pass unix:/tmp/yourapplication-fcgi.sock;
}
```

15.3.4 Running FastCGI Processes

Since Nginx and others do not load FastCGI apps, you have to do it by yourself. Supervisor can manage FastCGI processes. You can look around for other FastCGI process managers or write a script to run your .fcgi file at boot, e.g. using a SysV `init.d` script. For a temporary solution, you can always run the `.fcgi` script inside GNU screen. See `man screen` for details, and note that this is a manual solution which does not persist across system restart:

```
$ screen
$ /var/www/yourapplication/yourapplication.fcgi
```

15.3.5 Debugging

FastCGI deployments tend to be hard to debug on most webservers. Very often the only thing the server log tells you is something along the lines of "premature end of headers". In order to debug the application the only thing that can really give you ideas why it breaks is switching to the correct user and executing the application by hand.

This example assumes your application is called application.fcgi and that your webserver user is www-data:

```
$ su www-data
$ cd /var/www/yourapplication
$ python application.fcgi
Traceback (most recent call last):
  File "yourapplication.fcgi", line 4, in <module>
ImportError: No module named yourapplication
```

In this case the error seems to be "yourapplication" not being on the python path. Common problems are:

- Relative paths being used. Don't rely on the current working directory
- The code depending on environment variables that are not set by the web server.
- Different python interpreters being used.

15.4 uWSGI

uWSGI is a deployment option on servers like nginx, lighttpd, and cherokee; see FastCGI and Other Servers for other options. To use your WSGI application with uWSGI protocol you will need a uWSGI server first. uWSGI is both a protocol and an application server; the application server can serve uWSGI, FastCGI, and HTTP protocols.

The most popular uWSGI server is uwsgi, which we will use for this guide. Make sure to have it installed to follow along.

Watch Out

Please make sure in advance that any `app.run()` calls you might have in your application file are inside an `if __name__ == '__main__':` block or moved to a separate file. Just make sure it's not called because this will always start a local WSGI server which we do not want if we deploy that application to uWSGI.

15.4.1 Starting your app with uwsgi

uwsgi is designed to operate on WSGI callables found in python modules.

Given a flask application in myapp.py, use the following command:

```
$ uwsgi -s /tmp/uwsgi.sock --module myapp --callable app
```

Or, if you prefer:

```
$ uwsgi -s /tmp/uwsgi.sock myapp:app
```

15.4.2 Configuring nginx

A basic flask uWSGI configuration for nginx looks like this:

```
location = /yourapplication { rewrite ^ /yourapplication/; }
location /yourapplication { try_files $uri @yourapplication; }
location @yourapplication {
  include uwsgi_params;
  uwsgi_param SCRIPT_NAME /yourapplication;
  uwsgi_modifier1 30;
  uwsgi_pass unix:/tmp/uwsgi.sock;
}
```

This configuration binds the application to /yourapplication. If you want to have it in the URL root it's a bit simpler because you don't have to tell it the WSGI SCRIPT_NAME or set the uwsgi modifier to make use of it:

```
location / { try_files $uri @yourapplication; }
location @yourapplication {
    include uwsgi_params;
    uwsgi_pass unix:/tmp/uwsgi.sock;
}
```

15.5 Other Servers

There are popular servers written in Python that allow the execution of WSGI applications as well. These servers stand alone when they run; you can proxy to them from

your web server.

15.5.1 Tornado

Tornado is an open source version of the scalable, non-blocking web server and tools that power FriendFeed. Because it is non-blocking and uses epoll, it can handle thousands of simultaneous standing connections, which means it is ideal for real-time web services. Integrating this service with Flask is a trivial task:

```
from tornado.wsgi import WSGIContainer
from tornado.httpserver import HTTPServer
from tornado.ioloop import IOLoop
from yourapplication import app

http_server = HTTPServer(WSGIContainer(app))
http_server.listen(5000)
IOLoop.instance().start()
```

15.5.2 Gevent

Gevent is a coroutine-based Python networking library that uses greenlet to provide a high-level synchronous API on top of libevent event loop:

```
from gevent.wsgi import WSGIServer
from yourapplication import app

http_server = WSGIServer(('', 5000), app)
http_server.serve_forever()
```

15.5.3 Gunicorn

Gunicorn 'Green Unicorn' is a WSGI HTTP Server for UNIX. It's a pre-fork worker model ported from Ruby's Unicorn project. It supports both eventlet and greenlet. Running a Flask application on this server is quite simple:

```
gunicorn myproject:app
```

Gunicorn provides many command-line options -- see `gunicorn -h`. For example, to run a Flask application with 4 worker processes (`-w 4`) binding to localhost port 4000 (`-b 127.0.0.1:4000`):

```
gunicorn -w 4 -b 127.0.0.1:4000 myproject:app
```

15.5.4 Proxy Setups

If you deploy your application using one of these servers behind an HTTP proxy you will need to rewrite a few headers in order for the application to work. The two prob-

lematic values in the WSGI environment usually are REMOTE_ADDR and HTTP_HOST. Werkzeug ships a fixer that will solve some common setups, but you might want to write your own WSGI middleware for specific setups.

The most common setup invokes the host being set from X-Forwarded-Host and the remote address from X-Forwarded-For:

```
from werkzeug.contrib.fixers import ProxyFix
app.wsgi_app = ProxyFix(app.wsgi_app)
```

Please keep in mind that it is a security issue to use such a middleware in a non-proxy setup because it will blindly trust the incoming headers which might be forged by malicious clients.

If you want to rewrite the headers from another header, you might want to use a fixer like this:

```
class CustomProxyFix(object):

    def __init__(self, app):
        self.app = app

    def __call__(self, environ, start_response):
        host = environ.get('HTTP_X_FHOST', '')
        if host:
            environ['HTTP_HOST'] = host
        return self.app(environ, start_response)

app.wsgi_app = CustomProxyFix(app.wsgi_app)
```

CHAPTER

SIXTEEN

搞大了？！

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你的应用程序越搞越大越来越复杂了？如果你某天猛然意识到基于这种方式的Flask编程对于 你的应用程序已经不够给力怎么办？别慌，Flask还是搞得定！

Flask基于Werkzeug和Jinja2技术，这两套类库已经广泛应用于许多正在运行的大型网站系统， 而Flask则将二者有机的融合在一起。作为一个微型的框架，Flask除了整合已有的类库外其他 没有瞎掺和 - 代码不是特别多啦。 就是说项目即使搞大了也可以非常方便地将自己的代码抽出 然后封装到某一个新应用程序的模块里且加以扩展。

Flask在设计初时就考虑到了扩展和修改的可能性，可以用下列方法来搞定这个问题：

- Flask 扩展. 你可以针对大量可重复利用的代码功能进行扩展，之后在整个Flask环境内 就会产生很多附带信号和回调功能的钩子可供使用。
- 子类化. 大多数的功能都能通过创建 `Flask` 的子类和重载 针对此目的方法来进行个性改装。
- 开分舵. 如果实在没办法搞定你还可以在Flask的代码库的指定的位置选择一些源码(文件) 复制/粘贴到你的应用程序(目录)中然后进行修改。Flask在设计时已经考虑到你可能会这么 干所以一定会让你干的很爽。你要做的仅仅是选定几个包然后复制到应用程序代码文件（文件夹） 里，并且对其重命名（例如‘framework‘）。然后你可以在那里对代码做进一步的修改。

16.1 干嘛要开分舵?

Flask的主要代码是由Werkzeug和Jinja2组成的。这两个类库搞定了绝大部分的工作。Flask只是负责粘贴并且将二者紧密联系在一起。自古对于许多项目来说存在这么一个观点，那就是底层框架“卖艺不卖身”，往往感觉像是个鸡肋（基于假定初始开发人员碰到这个问题）。这样看来允许开“分舵”形式的产生就很自然而然了，因为如果不这么干，框架就会变得非常复杂很难入手，会造成框架的学习曲线十分陡峭，许多使用者信心大减等不和谐的问题。

这个问题不是Flask独有的。许多人通过对它们的框架打补丁或更新版本来弥补不足。这个概念在Flask的授权协议里也有体现。你在决定并更改已经属于你应用程序一部分的“分舵”框架时，无需向我们提交任何“保护费”（信息）。

开“分舵”当然也有他的缺点，那就是Flask“总舵”的更新可能会变更导入命名，这样会使得大多数的Flask扩展不能使用。此外，与“总舵”的新版本整合可能是一个非常复杂的过程，这个要根据更新的数量进行估算。总之，“开分舵”应该是最后一招，不得已而为之的。

16.2 像大师一样游刃有余

对于许多Web应用程序来说，代码的复杂度和处理响应多到爆的用户或数据请求相比，简直是小巫见大巫。 Flask自身仅根据你的应用程序代码，你使用的数据存储方式，Python的执行效率和你挂载的Web服务器 的不同而受到限制。

好的延展性举例说明就是如果你将你的服务器的数量翻倍，你马上获得了双倍的运行表现。相对的，差的 延展性就是即使你买了新的服务器也不能给你带来什么帮助或者你的应用程序根本不支持多服务器负载。

在Flask只有一个限制因素与延展有关，那就是上下文本地代理（context local proxies）。他们基于 Flask里那些被定义为线程，进程或者greenlet（python的一个扩展模块）的上下文。如果你的服务器进 行用某种不是基于线程或者greenlets的并发处理时，Flask不会支持这些全局代理。然而大多数服务器只 能通过使用线程，greenlet或者独立进程来实现并发，且底层的Werkzeug类库对这些方法都提供了很好 的支持。

16.3 通过网络社区进行交流

Flask的开发人员一直认为大家开发的爽就是自己爽，所以一旦你碰到任何因为Flask导致的问题，不要憋着， 通过邮件列表发邮件或者上IRC频道炮轰我们吧。这也是促使编写Flask和Flask扩展的程序员提高，把应用程 序搞得更大的最佳途径。

Part II

API 参考

If you are looking for information on a specific function, class or method, this part of the documentation is for you.

CHAPTER

SEVENTEEN

API

This part of the documentation covers all the interfaces of Flask. For parts where Flask depends on external libraries, we document the most important right here and provide links to the canonical documentation.

17.1 Application Object

class `flask.`**`Flask`**(import_name, static_path=None, static_url_path=None, static_folder='static', template_folder='templates')

The flask object implements a WSGI application and acts as the central object. It is passed the name of the module or package of the application. Once it is created it will act as a central registry for the view functions, the URL rules, template configuration and much more.

The name of the package is used to resolve resources from inside the package or the folder the module is contained in depending on if the package parameter resolves to an actual python package (a folder with an __init__.py file inside) or a standard module (just a .py file).

For more information about resource loading, see `open_resource()`.

Usually you create a `Flask` instance in your main module or in the __init__.py file of your package like this:

```
from flask import Flask
app = Flask(__name__)
```

About the First Parameter

The idea of the first parameter is to give Flask an idea what belongs to your application. This name is used to find resources on the file system, can be used by extensions to improve debugging information and a lot more.

So it's important what you provide there. If you are using a single module, __name__ is always the correct value. If you however are using a package, it's usually recommended to hardcode the name of your package there.

For example if your application is defined in yourapplication/app.py you should create it with one of the two versions below:

```
app = Flask('yourapplication')
app = Flask(__name__.split('.')[0])
```

Why is that? The application will work even with __name__, thanks to how resources are looked up. However it will make debugging more painful. Certain extensions can make assumptions based on the import name of your application. For example the Flask-SQLAlchemy extension will look for the code in your application that triggered an SQL query in debug mode. If the import name is not properly set up, that debugging information is lost. (For example it would only pick up SQL queries in yourapplicaiton.app and not yourapplication.views.frontend)

New in version 0.5: The static_path parameter was added.

Parameters

- import_name -- the name of the application package
- static_path -- can be used to specify a different path for the static files on the web. Defaults to `/static`. This does not affect the folder the files are served from.

add_url_rule(rule, endpoint=None, view_func=None, **options)

Connects a URL rule. Works exactly like the `route()` decorator. If a view_func is provided it will be registered with the endpoint.

Basically this example:

```
@app.route('/')
def index():
    pass
```

Is equivalent to the following:

```
def index():
    pass
app.add_url_rule('/', 'index', index)
```

If the view_func is not provided you will need to connect the endpoint to a view function like so:

```
app.view_functions['index'] = index
```

Changed in version 0.2: view_func parameter added.Changed in version 0.6: OPTIONS is added automatically as method.

Parameters

- rule -- the URL rule as string
- endpoint -- the endpoint for the registered URL rule. Flask itself assumes the name of the view function as endpoint

- view_func -- the function to call when serving a request to the provided endpoint
- options -- the options to be forwarded to the underlying `Rule` object. A change to Werkzeug is handling of method options. methods is a list of methods this rule should be limited to (GET, POST etc.). By default a rule just listens for GET (and implicitly HEAD). Starting with Flask 0.6, OPTIONS is implicitly added and handled by the standard request handling.

after_request(f)
Register a function to be run after each request. Your function must take one parameter, a `response_class` object and return a new response object or the same (see `process_response()`).

As of Flask 0.7 this function might not be executed at the end of the request in case an unhandled exception ocurred.

after_request_funcs
A dictionary with lists of functions that should be called after each request. The key of the dictionary is the name of the blueprint this function is active for, None for all requests. This can for example be used to open database connections or getting hold of the currently logged in user. To register a function here, use the `after_request()` decorator.

before_request(f)
Registers a function to run before each request.

before_request_funcs
A dictionary with lists of functions that should be called at the beginning of the request. The key of the dictionary is the name of the blueprint this function is active for, None for all requests. This can for example be used to open database connections or getting hold of the currently logged in user. To register a function here, use the `before_request()` decorator.

blueprints
all the attached blueprints in a directory by name. Blueprints can be attached multiple times so this dictionary does not tell you how often they got attached. New in version 0.7.

config
The configuration dictionary as `Config`. This behaves exactly like a regular dictionary but supports additional methods to load a config from files.

context_processor(f)
Registers a template context processor function.

create_global_jinja_loader()
Creates the loader for the Jinja2 environment. Can be used to override just the loader and keeping the rest unchanged. It's discouraged to override this function. Instead one should override the `create_jinja_loader()` function instead.

The global loader dispatches between the loaders of the application and the individual blueprints. New in version 0.7.

create_jinja_environment()
Creates the Jinja2 environment based on `jinja_options` and `select_jinja_autoescape()`. Since 0.7 this also adds the Jinja2 globals and filters after initialization. Override this function to customize the behavior. New in version 0.5.

create_url_adapter(request)
Creates a URL adapter for the given request. The URL adapter is created at a point where the request context is not yet set up so the request is passed explicitly. New in version 0.6.

debug
The debug flag. Set this to True to enable debugging of the application. In debug mode the debugger will kick in when an unhandled exception ocurrs and the integrated server will automatically reload the application if changes in the code are detected.

This attribute can also be configured from the config with the DEBUG configuration key. Defaults to False.

debug_log_format
The logging format used for the debug logger. This is only used when the application is in debug mode, otherwise the attached logging handler does the formatting. New in version 0.3.

default_config
Default configuration parameters.

dispatch_request()
Does the request dispatching. Matches the URL and returns the return value of the view or error handler. This does not have to be a response object. In order to convert the return value to a proper response object, call `make_response()`. Changed in version 0.7: This no longer does the exception handling, this code was moved to the new `full_dispatch_request()`.

do_teardown_request()
Called after the actual request dispatching and will call every as `teardown_request()` decorated function. This is not actually called by the `Flask` object itself but is always triggered when the request context is popped. That way we have a tighter control over certain resources under testing environments.

enable_modules
Enable the deprecated module support? This is active by default in 0.7 but will be changed to False in 0.8. With Flask 1.0 modules will be removed in favor of Blueprints

endpoint(endpoint)
A decorator to register a function as an endpoint. Example:

```
@app.endpoint('example.endpoint')
def example():
    return "example"
```

Parameters endpoint -- the name of the endpoint

error_handler_spec

A dictionary of all registered error handlers. The key is None for error handlers active on the application, otherwise the key is the name of the blueprint. Each key points to another dictionary where they key is the status code of the http exception. The special key None points to a list of tuples where the first item is the class for the instance check and the second the error handler function.

To register a error handler, use the `errorhandler()` decorator.

errorhandler(code_or_exception)

A decorator that is used to register a function give a given error code. Example:

```
@app.errorhandler(404)
def page_not_found(error):
    return 'This page does not exist', 404
```

You can also register handlers for arbitrary exceptions:

```
@app.errorhandler(DatabaseError)
def special_exception_handler(error):
    return 'Database connection failed', 500
```

You can also register a function as error handler without using the `errorhandler()` decorator. The following example is equivalent to the one above:

```
def page_not_found(error):
    return 'This page does not exist', 404
app.error_handler_spec[None][404] = page_not_found
```

Setting error handlers via assignments to `error_handler_spec` however is discouraged as it requires fidling with nested dictionaries and the special case for arbitrary exception types.

The first None refers to the active blueprint. If the error handler should be application wide None shall be used. New in version 0.7: One can now additionally also register custom exception types that do not necessarily have to be a subclass of the :class:~‘werkzeug.exceptions.HTTPException‘ class.

Parameters code -- the code as integer for the handler

extensions

a place where extensions can store application specific state. For example this is where an extension could store database engines and similar

things. For backwards compatibility extensions should register themselves like this:

```
if not hasattr(app, 'extensions'):
    app.extensions = {}
app.extensions['extensionname'] = SomeObject()
```

The key must match the name of the flaskext module. For example in case of a "Flask-Foo" extension in flaskext.foo, the key would be `'foo'`. New in version 0.7.

full_dispatch_request()
Dispatches the request and on top of that performs request pre and post-processing as well as HTTP exception catching and error handling. New in version 0.7.

handle_exception(e)
Default exception handling that kicks in when an exception occours that is not caught. In debug mode the exception will be re-raised immediately, otherwise it is logged and the handler for a 500 internal server error is used. If no such handler exists, a default 500 internal server error message is displayed.

handle_http_exception(e)
Handles an HTTP exception. By default this will invoke the registered error handlers and fall back to returning the exception as response.

handle_user_exception(e)
This method is called whenever an exception occurs that should be handled. A special case are `HTTPException`s which are forwarded by this function to the `handle_http_exception()` method. This function will either return a response value or reraise the exception with the same traceback. New in version 0.7.

has_static_folder
This is True if the package bound object's container has a folder named `'static'`. New in version 0.5.

init_jinja_globals()
Deprecated. Used to initialize the Jinja2 globals. New in version 0.5.Changed in version 0.7: This method is deprecated with 0.7. Override `create_jinja_environment()` instead.

inject_url_defaults(endpoint, values)
Injects the URL defaults for the given endpoint directly into the values dictionary passed. This is used internally and automatically called on URL building. New in version 0.7.

jinja_env
The Jinja2 environment used to load templates.

jinja_loader
The Jinja loader for this package bound object. New in version 0.5.

jinja_options

Options that are passed directly to the Jinja2 environment.

logger

A `logging.Logger` object for this application. The default configuration is to log to stderr if the application is in debug mode. This logger can be used to (surprise) log messages. Here some examples:

```
app.logger.debug('A value for debugging')
app.logger.warning('A warning ocurred (%d apples)', 42)
app.logger.error('An error occoured')
```

New in version 0.3.

logger_name

The name of the logger to use. By default the logger name is the package name passed to the constructor. New in version 0.4.

make_default_options_response()

This method is called to create the default OPTIONS response. This can be changed through subclassing to change the default behaviour of OPTIONS responses. New in version 0.7.

make_response(rv)

Converts the return value from a view function to a real response object that is an instance of `response_class`.

The following types are allowed for rv:

`response_class`	the object is returned unchanged
`str`	a response object is created with the string as body
`unicode`	a response object is created with the string encoded to utf-8 as body
`tuple`	the response object is created with the contents of the tuple as arguments
a WSGI function	the function is called as WSGI application and buffered as response object

Parameters rv -- the return value from the view function

open_resource(resource)

Opens a resource from the application's resource folder. To see how this works, consider the following folder structure:

```
/myapplication.py
/schema.sql
/static
    /style.css
/templates
    /layout.html
    /index.html
```

If you want to open the schema.sql file you would do the following:

```
with app.open_resource('schema.sql') as f:
    contents = f.read()
    do_something_with(contents)
```

Parameters resource -- the name of the resource. To access resources within subfolders use forward slashes as separator.

open_session(request)

Creates or opens a new session. Default implementation stores all session data in a signed cookie. This requires that the `secret_key` is set.

Parameters request -- an instance of `request_class`.

permanent_session_lifetime

A `timedelta` which is used to set the expiration date of a permanent session. The default is 31 days which makes a permanent session survive for roughly one month.

This attribute can also be configured from the config with the PERMANENT_SESSION_LIFETIME configuration key. Defaults to `timedelta(days=31)`

preprocess_request()

Called before the actual request dispatching and will call every as `before_request()` decorated function. If any of these function returns a value it's handled as if it was the return value from the view and further request handling is stopped.

This also triggers the `url_value_processor()` functions before the actualy `before_request()` functions are called.

preserve_context_on_exception

Returns the value of the PRESERVE_CONTEXT_ON_EXCEPTION configuration value in case it's set, otherwise a sensible default is returned. New in version 0.7.

process_response(response)

Can be overridden in order to modify the response object before it's sent to the WSGI server. By default this will call all the `after_request()` decorated functions. Changed in version 0.5: As of Flask 0.5 the functions registered for after request execution are called in reverse order of registration.

Parameters response -- a `response_class` object.

Returns a new response object or the same, has to be an instance of `response_class`.

propagate_exceptions

Returns the value of the PROPAGATE_EXCEPTIONS configuration value in case it's set, otherwise a sensible default is returned. New in version 0.7.

register_blueprint(blueprint, **options)

Registers a blueprint on the application. New in version 0.7.

register_error_handler(code_or_exception, f)
Alternative error attach function to the `errorhandler()` decorator that is more straightforward to use for non decorator usage. New in version 0.7.

register_module(module, **options)
Registers a module with this application. The keyword argument of this function are the same as the ones for the constructor of the `Module` class and will override the values of the module if provided. Changed in version 0.7: The module system was deprecated in favor for the blueprint system.

request_class
The class that is used for request objects. See `Request` for more information.

request_context(environ)
Creates a `RequestContext` from the given environment and binds it to the current context. This must be used in combination with the with statement because the request is only bound to the current context for the duration of the with block.

Example usage:

```
with app.request_context(environ):
    do_something_with(request)
```

The object returned can also be used without the with statement which is useful for working in the shell. The example above is doing exactly the same as this code:

```
ctx = app.request_context(environ)
ctx.push()
try:
    do_something_with(request)
finally:
    ctx.pop()
```

Changed in version 0.3: Added support for non-with statement usage and with statement is now passed the ctx object.

Parameters environ -- a WSGI environment

response_class
The class that is used for response objects. See `Response` for more information.

route(rule, **options)
A decorator that is used to register a view function for a given URL rule. Example:

```
@app.route('/')
def index():
    return 'Hello World'
```

Variables parts in the route can be specified with angular brackets (`/user/<username>`). By default a variable part in the URL accepts any string with-

out a slash however a different converter can be specified as well by using `<converter:name>`.

Variable parts are passed to the view function as keyword arguments.

The following converters are possible:

int	accepts integers
float	like int but for floating point values
path	like the default but also accepts slashes

Here some examples:

```
@app.route('/')
def index():
    pass

@app.route('/<username>')
def show_user(username):
    pass

@app.route('/post/<int:post_id>')
def show_post(post_id):
    pass
```

An important detail to keep in mind is how Flask deals with trailing slashes. The idea is to keep each URL unique so the following rules apply:

1. If a rule ends with a slash and is requested without a slash by the user, the user is automatically redirected to the same page with a trailing slash attached.
2. If a rule does not end with a trailing slash and the user request the page with a trailing slash, a 404 not found is raised.

This is consistent with how web servers deal with static files. This also makes it possible to use relative link targets safely.

The `route()` decorator accepts a couple of other arguments as well:

Parameters

- rule -- the URL rule as string
- methods -- a list of methods this rule should be limited to (GET, POST etc.). By default a rule just listens for GET (and implicitly HEAD). Starting with Flask 0.6, OPTIONS is implicitly added and handled by the standard request handling.
- subdomain -- specifies the rule for the subdomain in case subdomain matching is in use.
- strict_slashes -- can be used to disable the strict slashes setting for this rule. See above.

- options -- other options to be forwarded to the underlying `Rule` object.

run(host='127.0.0.1', port=5000, **options)

Runs the application on a local development server. If the `debug` flag is set the server will automatically reload for code changes and show a debugger in case an exception happened.

If you want to run the application in debug mode, but disable the code execution on the interactive debugger, you can pass `use_evalex=False` as parameter. This will keep the debugger's traceback screen active, but disable code execution.

Keep in Mind

Flask will suppress any server error with a generic error page unless it is in debug mode. As such to enable just the interactive debugger without the code reloading, you have to invoke `run()` with `debug=True` and `use_reloader=False`. Setting `use_debugger` to True without being in debug mode won't catch any exceptions because there won't be any to catch.

Parameters

- host -- the hostname to listen on. set this to `'0.0.0.0'` to have the server available externally as well.
- port -- the port of the webserver
- options -- the options to be forwarded to the underlying Werkzeug server. See `werkzeug.run_simple()` for more information.

save_session(session, response)

Saves the session if it needs updates. For the default implementation, check `open_session()`.

Parameters

- session -- the session to be saved (a `SecureCookie` object)
- response -- an instance of `response_class`

secret_key

If a secret key is set, cryptographic components can use this to sign cookies and other things. Set this to a complex random value when you want to use the secure cookie for instance.

This attribute can also be configured from the config with the SECRET_KEY configuration key. Defaults to None.

select_jinja_autoescape(filename)

Returns True if autoescaping should be active for the given template name. New in version 0.5.

send_static_file(filename)
Function used internally to send static files from the static folder to the browser. New in version 0.5.

session_cookie_name
The secure cookie uses this for the name of the session cookie.

This attribute can also be configured from the config with the SESSION_COOKIE_NAME configuration key. Defaults to `'session'`

teardown_request(f)
Register a function to be run at the end of each request, regardless of whether there was an exception or not. These functions are executed when the request context is popped, even if not an actual request was performed.

Example:

```
ctx = app.test_request_context()
ctx.push()
...
ctx.pop()
```

When `ctx.pop()` is executed in the above example, the teardown functions are called just before the request context moves from the stack of active contexts. This becomes relevant if you are using such constructs in tests.

Generally teardown functions must take every necesary step to avoid that they will fail. If they do execute code that might fail they will have to surround the execution of these code by try/except statements and log ocurring errors.

teardown_request_funcs
A dictionary with lists of functions that are called after each request, even if an exception has occurred. The key of the dictionary is the name of the blueprint this function is active for, None for all requests. These functions are not allowed to modify the request, and their return values are ignored. If an exception occurred while processing the request, it gets passed to each teardown_request function. To register a function here, use the `teardown_request()` decorator. New in version 0.7.

template_context_processors
A dictionary with list of functions that are called without argument to populate the template context. The key of the dictionary is the name of the blueprint this function is active for, None for all requests. Each returns a dictionary that the template context is updated with. To register a function here, use the `context_processor()` decorator.

template_filter(name=None)
A decorator that is used to register custom template filter. You can specify a name for the filter, otherwise the function name will be used. Example:

```
@app.template_filter()
def reverse(s):
```

```
    return s[::-1]
```

Parameters name -- the optional name of the filter, otherwise the function name will be used.

test_client(use_cookies=True)

Creates a test client for this application. For information about unit testing head over to 测试Flask应用程序.

The test client can be used in a with block to defer the closing down of the context until the end of the with block. This is useful if you want to access the context locals for testing:

```
with app.test_client() as c:
    rv = c.get('/?vodka=42')
    assert request.args['vodka'] == '42'
```

Changed in version 0.4: added support for with block usage for the client.New in version 0.7: The use_cookies parameter was added as well as the ability to override the client to be used by setting the `test_client_class` attribute.

test_client_class

the test client that is used with when test_client is used. New in version 0.7.

test_request_context(*args, **kwargs)

Creates a WSGI environment from the given values (see `werkzeug.create_environ()` for more information, this function accepts the same arguments).

testing

The testing flask. Set this to True to enable the test mode of Flask extensions (and in the future probably also Flask itself). For example this might activate unittest helpers that have an additional runtime cost which should not be enabled by default.

If this is enabled and PROPAGATE_EXCEPTIONS is not changed from the default it's implicitly enabled.

This attribute can also be configured from the config with the TESTING configuration key. Defaults to False.

update_template_context(context)

Update the template context with some commonly used variables. This injects request, session, config and g into the template context as well as everything template context processors want to inject. Note that the as of Flask 0.6, the original values in the context will not be overriden if a context processor decides to return a value with the same key.

Parameters context -- the context as a dictionary that is updated in place to add extra variables.

url_default_functions
A dictionary with lists of functions that can be used as URL value preprocessors. The key None here is used for application wide callbacks, otherwise the key is the name of the blueprint. Each of these functions has the chance to modify the dictionary of URL values before they are used as the keyword arguments of the view function. For each function registered this one should also provide a `url_defaults()` function that adds the parameters automatically again that were removed that way. New in version 0.7.

url_defaults(f)
Callback function for URL defaults for all view functions of the application. It's called with the endpoint and values and should update the values passed in place.

url_map
The `Map` for this instance. You can use this to change the routing converters after the class was created but before any routes are connected. Example:

```
from werkzeug.routing import BaseConverter

class ListConverter(BaseConverter):
    def to_python(self, value):
        return value.split(',')
    def to_url(self, values):
        return ','.join(BaseConverter.to_url(value)
                        for value in values)

app = Flask(__name__)
app.url_map.converters['list'] = ListConverter
```

url_rule_class
The rule object to use for URL rules created. This is used by `add_url_rule()`. Defaults to `werkzeug.routing.Rule`. New in version 0.7.

url_value_preprocessor(f)
Registers a function as URL value preprocessor for all view functions of the application. It's called before the view functions are called and can modify the url values provided.

url_value_preprocessors
A dictionary with lists of functions that can be used as URL value processor functions. Whenever a URL is built these functions are called to modify the dictionary of values in place. The key None here is used for application wide callbacks, otherwise the key is the name of the blueprint. Each of these functions has the chance to modify the dictionary New in version 0.7.

use_x_sendfile
Enable this if you want to use the X-Sendfile feature. Keep in mind that the server has to support this. This only affects files sent with the `send_file()` method. New in version 0.2. This attribute can also be configured from the config with the USE_X_SENDFILE configuration key. Defaults to False.

view_functions
A dictionary of all view functions registered. The keys will be function names which are also used to generate URLs and the values are the function objects themselves. To register a view function, use the `route()` decorator.

wsgi_app(environ, start_response)
The actual WSGI application. This is not implemented in __call__ so that middlewares can be applied without losing a reference to the class. So instead of doing this:

```
app = MyMiddleware(app)
```

It's a better idea to do this instead:

```
app.wsgi_app = MyMiddleware(app.wsgi_app)
```

Then you still have the original application object around and can continue to call methods on it. Changed in version 0.7: The behavior of the before and after request callbacks was changed under error conditions and a new callback was added that will always execute at the end of the request, independent on if an error ocurred or not. See Callbacks and Errors.

Parameters

- environ -- a WSGI environment
- start_response -- a callable accepting a status code, a list of headers and an optional exception context to start the response

17.2 Module Objects

class `flask.`**Module**(import_name, name=None, url_prefix=None, static_path=None, subdomain=None)
Deprecated module support. Until Flask 0.6 modules were a different name of the concept now available as blueprints in Flask. They are essentially doing the same but have some bad semantics for templates and static files that were fixed with blueprints. Changed in version 0.7: Modules were deprecated in favor for blueprints.

add_url_rule(rule, endpoint=None, view_func=None, **options)
Like `Flask.add_url_rule()` but for a blueprint. The endpoint for the `url_for()` function is prefixed with the name of the blueprint.

after_app_request(f)
Like `Flask.after_request()` but for a blueprint. Such a function is executed after each request, even if outside of the blueprint.

after_request(f)
Like `Flask.after_request()` but for a blueprint. This function is only executed after each request that is handled by a function of that blueprint.

app_context_processor(f)
Like `Flask.context_processor()` but for a blueprint. Such a function is executed each request, even if outside of the blueprint.

app_errorhandler(code)
Like `Flask.errorhandler()` but for a blueprint. This handler is used for all requests, even if outside of the blueprint.

app_url_defaults(f)
Same as `url_defaults()` but application wide.

app_url_value_preprocessor(f)
Same as `url_value_preprocessor()` but application wide.

before_app_request(f)
Like `Flask.before_request()`. Such a function is executed before each request, even if outside of a blueprint.

before_request(f)
Like `Flask.before_request()` but for a blueprint. This function is only executed before each request that is handled by a function of that blueprint.

context_processor(f)
Like `Flask.context_processor()` but for a blueprint. This function is only executed for requests handled by a blueprint.

endpoint(endpoint)
Like `Flask.endpoint()` but for a blueprint. This does not prefix the endpoint with the blueprint name, this has to be done explicitly by the user of this method. If the endpoint is prefixed with a . it will be registered to the current blueprint, otherwise it's an application independent endpoint.

errorhandler(code_or_exception)
Registers an error handler that becomes active for this blueprint only. Please be aware that routing does not happen local to a blueprint so an error handler for 404 usually is not handled by a blueprint unless it is caused inside a view function. Another special case is the 500 internal server error which is always looked up from the application.

Otherwise works as the `errorhandler()` decorator of the `Flask` object.

has_static_folder
This is True if the package bound object's container has a folder named `'static'`. New in version 0.5.

jinja_loader
The Jinja loader for this package bound object. New in version 0.5.

make_setup_state(app, options, first_registration=False)
Creates an instance of `BlueprintSetupState()` object that is later passed to the register callback functions. Subclasses can override this to return a subclass of the setup state.

open_resource(resource)

Opens a resource from the application's resource folder. To see how this works, consider the following folder structure:

```
/myapplication.py
/schema.sql
/static
    /style.css
/templates
    /layout.html
    /index.html
```

If you want to open the schema.sql file you would do the following:

```
with app.open_resource('schema.sql') as f:
    contents = f.read()
    do_something_with(contents)
```

Parameters resource -- the name of the resource. To access resources within subfolders use forward slashes as separator.

record(func)
Registers a function that is called when the blueprint is registered on the application. This function is called with the state as argument as returned by the `make_setup_state()` method.

record_once(func)
Works like `record()` but wraps the function in another function that will ensure the function is only called once. If the blueprint is registered a second time on the application, the function passed is not called.

register(app, options, first_registration=False)
Called by `Flask.register_blueprint()` to register a blueprint on the application. This can be overridden to customize the register behavior. Keyword arguments from `register_blueprint()` are directly forwarded to this method in the options dictionary.

route(rule, **options)
Like `Flask.route()` but for a blueprint. The endpoint for the `url_for()` function is prefixed with the name of the blueprint.

send_static_file(filename)
Function used internally to send static files from the static folder to the browser. New in version 0.5.

teardown_app_request(f)
Like `Flask.teardown_request()` but for a blueprint. Such a function is executed when tearing down each request, even if outside of the blueprint.

teardown_request(f)
Like `Flask.teardown_request()` but for a blueprint. This function is only executed when tearing down requests handled by a function of that blueprint. Teardown request functions are executed when the request context is popped, even when no actual request was performed.

url_defaults(f)
Callback function for URL defaults for this blueprint. It's called with the endpoint and values and should update the values passed in place.

url_value_preprocessor(f)
Registers a function as URL value preprocessor for this blueprint. It's called before the view functions are called and can modify the url values provided.

17.3 Incoming Request Data

class flask.**Request**(environ, populate_request=True, shallow=False)
The request object used by default in Flask. Remembers the matched endpoint and view arguments.

It is what ends up as `request`. If you want to replace the request object used you can subclass this and set `request_class` to your subclass.

class flask.**request**
To access incoming request data, you can use the global request object. Flask parses incoming request data for you and gives you access to it through that global object. Internally Flask makes sure that you always get the correct data for the active thread if you are in a multithreaded environment.

The request object is an instance of a `Request` subclass and provides all of the attributes Werkzeug defines. This just shows a quick overview of the most important ones.

form
A `MultiDict` with the parsed form data from POST or PUT requests. Please keep in mind that file uploads will not end up here, but instead in the `files` attribute.

args
A `MultiDict` with the parsed contents of the query string. (The part in the URL after the question mark).

values
A `CombinedMultiDict` with the contents of both `form` and `args`.

cookies
A `dict` with the contents of all cookies transmitted with the request.

stream
If the incoming form data was not encoded with a known mimetype the data is stored unmodified in this stream for consumption. Most of the time it is a better idea to use `data` which will give you that data as a string. The stream only returns the data once.

data
Contains the incoming request data as string in case it came with a mimetype Flask does not handle.

files
: A `MultiDict` with files uploaded as part of a POST or PUT request. Each file is stored as `FileStorage` object. It basically behaves like a standard file object you know from Python, with the difference that it also has a `save()` function that can store the file on the filesystem.

environ
: The underlying WSGI environment.

method
: The current request method (`POST`, `GET` etc.)

path

script_root

url

base_url

url_root
: Provides different ways to look at the current URL. Imagine your application is listening on the following URL:

```
http://www.example.com/myapplication
```

And a user requests the following URL:

```
http://www.example.com/myapplication/page.html?x=y
```

In this case the values of the above mentioned attributes would be the following:

path	`/page.html`
script_root	`/myapplication`
base_url	`http://www.example.com/myapplication/page.html`
url	`http://www.example.com/myapplication/page.html?x=y`
url_root	`http://www.example.com/myapplication/`

is_xhr
: True if the request was triggered via a JavaScript XMLHttpRequest. This only works with libraries that support the `X-Requested-With` header and set it to XMLHttpRequest. Libraries that do that are prototype, jQuery and Mochikit and probably some more.

json
: Contains the parsed body of the JSON request if the mimetype of the incoming data was application/json. This requires Python 2.6 or an installed version of simplejson.

17.4 Response Objects

class `flask.`**`Response`**`(`response=None, status=None, headers=None, mimetype=None, content_type=None, direct_passthrough=False`)`

The response object that is used by default in Flask. Works like the response object from Werkzeug but is set to have an HTML mimetype by default. Quite often you don't have to create this object yourself because `make_response()` will take care of that for you.

If you want to replace the response object used you can subclass this and set `response_class` to your subclass.

`headers`

A `Headers` object representing the response headers.

`status_code`

The response status as integer.

`set_cookie``(`key, value='', max_age=None, expires=None, path='/', domain=None, secure=None, httponly=False`)`

Sets a cookie. The parameters are the same as in the cookie Morsel object in the Python standard library but it accepts unicode data, too.

Parameters

- key -- the key (name) of the cookie to be set.
- value -- the value of the cookie.
- max_age -- should be a number of seconds, or None (default) if the cookie should last only as long as the client's browser session.
- expires -- should be a datetime object or UNIX timestamp.
- domain -- if you want to set a cross-domain cookie. For example, `domain=".example.com"` will set a cookie that is readable by the domain `www.example.com`, `foo.example.com` etc. Otherwise, a cookie will only be readable by the domain that set it.
- path -- limits the cookie to a given path, per default it will span the whole domain.

`data`

The string representation of the request body. Whenever you access this property the request iterable is encoded and flattened. This can lead to unwanted behavior if you stream big data.

This behavior can be disabled by setting `implicit_sequence_conversion` to False.

mimetype
The mimetype (content type without charset etc.)

17.5 Sessions

If you have the `Flask.secret_key` set you can use sessions in Flask applications. A session basically makes it possible to remember information from one request to another. The way Flask does this is by using a signed cookie. So the user can look at the session contents, but not modify it unless he knows the secret key, so make sure to set that to something complex and unguessable.

To access the current session you can use the `session` object:

class `flask.`**session**
The session object works pretty much like an ordinary dict, with the difference that it keeps track on modifications.

The following attributes are interesting:

new
True if the session is new, False otherwise.

modified
True if the session object detected a modification. Be advised that modifications on mutable structures are not picked up automatically, in that situation you have to explicitly set the attribute to True yourself. Here an example:

```
# this change is not picked up because a mutable object (here
# a list) is changed.
session['objects'].append(42)
# so mark it as modified yourself
session.modified = True
```

permanent
If set to True the session life for `permanent_session_lifetime` seconds. The default is 31 days. If set to False (which is the default) the session will be deleted when the user closes the browser.

17.6 Application Globals

To share data that is valid for one request only from one function to another, a global variable is not good enough because it would break in threaded environments. Flask provides you with a special object that ensures it is only valid for the active request and that will return different values for each request. In a nutshell: it does the right thing, like it does for `request` and `session`.

flask.**g**

Just store on this whatever you want. For example a database connection or the user that is currently logged in.

17.7 Useful Functions and Classes

flask.**current_app**

Points to the application handling the request. This is useful for extensions that want to support multiple applications running side by side.

flask.**url_for**(endpoint, **values)

Generates a URL to the given endpoint with the method provided.

Variable arguments that are unknown to the target endpoint are appended to the generated URL as query arguments. If the value of a query argument is None, the whole pair is skipped. In case blueprints are active you can shortcut references to the same blueprint by prefixing the local endpoint with a dot (.).

This will reference the index function local to the current blueprint:

```
url_for('.index')
```

For more information, head over to the Quickstart.

Parameters

- endpoint -- the endpoint of the URL (name of the function)
- values -- the variable arguments of the URL rule
- _external -- if set to True, an absolute URL is generated.

flask.**abort**(code)

Raises an `HTTPException` for the given status code. For example to abort request handling with a page not found exception, you would call `abort(404)`.

Parameters code -- the HTTP error code.

flask.**redirect**(location, code=302)

Return a response object (a WSGI application) that, if called, redirects the client to the target location. Supported codes are 301, 302, 303, 305, and 307. 300 is not supported because it's not a real redirect and 304 because it's the answer for a request with a request with defined If-Modified-Since headers. New in version 0.6: The location can now be a unicode string that is encoded using the `iri_to_uri()` function.

Parameters

- location -- the location the response should redirect to.
- code -- the redirect status code. defaults to 302.

flask.**make_response**(*args)

Sometimes it is necessary to set additional headers in a view. Because views

do not have to return response objects but can return a value that is converted into a response object by Flask itself, it becomes tricky to add headers to it. This function can be called instead of using a return and you will get a response object which you can use to attach headers.

If view looked like this and you want to add a new header:

```
def index():
    return render_template('index.html', foo=42)
```

You can now do something like this:

```
def index():
    response = make_response(render_template('index.html', foo=42))
    response.headers['X-Parachutes'] = 'parachutes are cool'
    return response
```

This function accepts the very same arguments you can return from a view function. This for example creates a response with a 404 error code:

```
response = make_response(render_template('not_found.html'), 404)
```

Internally this function does the following things:

- if no arguments are passed, it creates a new response argument
- if one argument is passed, `flask.Flask.make_response()` is invoked with it.
- if more than one argument is passed, the arguments are passed to the `flask.Flask.make_response()` function as tuple.

New in version 0.6.

`flask.`**`send_file`**`(`filename_or_fp, mimetype=None, as_attachment=False, attachment_filename=None, add_etags=True, cache_timeout=43200, conditional=False`)`

Sends the contents of a file to the client. This will use the most efficient method available and configured. By default it will try to use the WSGI server's file_wrapper support. Alternatively you can set the application's `use_x_sendfile` attribute to `True` to directly emit an X-Sendfile header. This however requires support of the underlying webserver for X-Sendfile.

By default it will try to guess the mimetype for you, but you can also explicitly provide one. For extra security you probably want to send certain files as attachment (HTML for instance). The mimetype guessing requires a filename or an attachment_filename to be provided.

Please never pass filenames to this function from user sources without checking them first. Something like this is usually sufficient to avoid security problems:

```
if '..' in filename or filename.startswith('/'):
    abort(404)
```

New in version 0.2.New in version 0.5: The add_etags, cache_timeout and conditional parameters were added. The default behaviour is now to attach

etags.Changed in version 0.7: mimetype guessing and etag support for file objects was deprecated because it was unreliable. Pass a filename if you are able to, otherwise attach an etag yourself. This functionality will be removed in Flask 1.0

Parameters

- filename_or_fp -- the filename of the file to send. This is relative to the `root_path` if a relative path is specified. Alternatively a file object might be provided in which case X-Sendfile might not work and fall back to the traditional method. Make sure that the file pointer is positioned at the start of data to send before calling `send_file()`.
- mimetype -- the mimetype of the file if provided, otherwise auto detection happens.
- as_attachment -- set to True if you want to send this file with a `Content-Disposition: attachment` header.
- attachment_filename -- the filename for the attachment if it differs from the file's filename.
- add_etags -- set to False to disable attaching of etags.
- conditional -- set to True to enable conditional responses.
- cache_timeout -- the timeout in seconds for the headers.

`flask.`**`send_from_directory`**`(`directory, filename, **options`)`

Send a file from a given directory with `send_file()`. This is a secure way to quickly expose static files from an upload folder or something similar.

Example usage:

```
@app.route('/uploads/<path:filename>')
def download_file(filename):
    return send_from_directory(app.config['UPLOAD_FOLDER'],
                               filename, as_attachment=True)
```

Sending files and Performance

It is strongly recommended to activate either X-Sendfile support in your webserver or (if no authentication happens) to tell the webserver to serve files for the given path on its own without calling into the web application for improved performance.

New in version 0.5.

Parameters

- directory -- the directory where all the files are stored.
- filename -- the filename relative to that directory to download.

- options -- optional keyword arguments that are directly forwarded to `send_file()`.

`flask.`**`escape`**`(S)`

Convert the characters &, <, >, ‘ and ” in string s to HTML-safe sequences. Use this if you need to display text that might contain such characters in HTML. Marks return value as markup string.

class `flask.`**`Markup`**

Marks a string as being safe for inclusion in HTML/XML output without needing to be escaped. This implements the __html__ interface a couple of frameworks and web applications use. `Markup` is a direct subclass of unicode and provides all the methods of unicode just that it escapes arguments passed and always returns Markup.

The escape function returns markup objects so that double escaping can’t happen.

The constructor of the `Markup` class can be used for three different things: When passed an unicode object it’s assumed to be safe, when passed an object with an HTML representation (has an __html__ method) that representation is used, otherwise the object passed is converted into a unicode string and then assumed to be safe:

```
>>> Markup("Hello <em>World</em>!")
Markup(u'Hello <em>World</em>!')
>>> class Foo(object):
...  def __html__(self):
...   return '<a href="#">foo</a>'
...
>>> Markup(Foo())
Markup(u'<a href="#">foo</a>')
```

If you want object passed being always treated as unsafe you can use the `escape()` classmethod to create a `Markup` object:

```
>>> Markup.escape("Hello <em>World</em>!")
Markup(u'Hello &lt;em&gt;World&lt;/em&gt;!')
```

Operations on a markup string are markup aware which means that all arguments are passed through the `escape()` function:

```
>>> em = Markup("<em>%s</em>")
>>> em % "foo & bar"
Markup(u'<em>foo &amp; bar</em>')
>>> strong = Markup("<strong>%(text)s</strong>")
>>> strong % {'text': '<blink>hacker here</blink>'}
Markup(u'<strong>&lt;blink&gt;hacker here&lt;/blink&gt;</strong>')
>>> Markup("<em>Hello</em> ") + "<foo>"
Markup(u'<em>Hello</em> &lt;foo&gt;')
```

classmethod **`escape`**`(S)`

Escape the string. Works like `escape()` with the difference that for sub-

classes of `Markup` this function would return the correct subclass.

unescape()
Unescape markup again into an unicode string. This also resolves known HTML4 and XHTML entities:

```
>>> Markup("Main &raquo; <em>About</em>").unescape()
u'Main \xbb <em>About</em>'
```

striptags()
Unescape markup into an unicode string and strip all tags. This also resolves known HTML4 and XHTML entities. Whitespace is normalized to one:

```
>>> Markup("Main &raquo;  <em>About</em>").striptags()
u'Main \xbb About'
```

17.8 Message Flashing

flask.**flash**(message, category='message')
Flashes a message to the next request. In order to remove the flashed message from the session and to display it to the user, the template has to call `get_flashed_messages()`.

Parameters

- message -- the message to be flashed.
- category -- the category for the message. The following values are recommended: `'message'` for any kind of message, `'error'` for errors, `'info'` for information messages and `'warning'` for warnings. However any kind of string can be used as category.

flask.**get_flashed_messages**(with_categories=False)
Pulls all flashed messages from the session and returns them. Further calls in the same request to the function will return the same messages. By default just the messages are returned, but when with_categories is set to True, the return value will be a list of tuples in the form `(category, message)` instead.

Example usage:

```
{% for category, msg in get_flashed_messages(with_categories=true) %}
  <p class=flash-{{ category }}>{{ msg }}
{% endfor %}
```

Changed in version 0.3: with_categories parameter added.

Parameters with_categories -- set to True to also receive categories.

17.9 Returning JSON

`flask.`**`jsonify`**`(*args, **kwargs)`

Creates a `Response` with the JSON representation of the given arguments with an application/json mimetype. The arguments to this function are the same as to the `dict` constructor.

Example usage:

```
@app.route('/_get_current_user')
def get_current_user():
    return jsonify(username=g.user.username,
                   email=g.user.email,
                   id=g.user.id)
```

This will send a JSON response like this to the browser:

```
{
    "username": "admin",
    "email": "admin@localhost",
    "id": 42
}
```

This requires Python 2.6 or an installed version of simplejson. For security reasons only objects are supported toplevel. For more information about this, have a look at JSON Security. New in version 0.2.

`flask.`**`json`**

If JSON support is picked up, this will be the module that Flask is using to parse and serialize JSON. So instead of doing this yourself:

```
try:
    import simplejson as json
except ImportError:
    import json
```

You can instead just do this:

```
from flask import json
```

For usage examples, read the `json` documentation.

The `dumps()` function of this json module is also available as filter called `|tojson` in Jinja2. Note that inside script tags no escaping must take place, so make sure to disable escaping with `|safe` if you intend to use it inside script tags:

```
<script type=text/javascript>
    doSomethingWith({{ user.username|tojson|safe }});
</script>
```

Note that the `|tojson` filter escapes forward slashes properly.

17.10 Template Rendering

flask.**render_template**(template_name, **context)

Renders a template from the template folder with the given context.

Parameters

- template_name -- the name of the template to be rendered
- context -- the variables that should be available in the context of the template.

flask.**render_template_string**(source, **context)

Renders a template from the given template source string with the given context.

Parameters

- template_name -- the sourcecode of the template to be rendered
- context -- the variables that should be available in the context of the template.

flask.**get_template_attribute**(template_name, attribute)

Loads a macro (or variable) a template exports. This can be used to invoke a macro from within Python code. If you for example have a template named _cider.html with the following contents:

```
{% macro hello(name) %}Hello {{ name }}!{% endmacro %}
```

You can access this from Python code like this:

```
hello = get_template_attribute('_cider.html', 'hello')
return hello('World')
```

New in version 0.2.

Parameters

- template_name -- the name of the template
- attribute -- the name of the variable of macro to acccess

17.11 Configuration

class flask.**Config**(root_path, defaults=None)

Works exactly like a dict but provides ways to fill it from files or special dictionaries. There are two common patterns to populate the config.

Either you can fill the config from a config file:

```
app.config.from_pyfile('yourconfig.cfg')
```

Or alternatively you can define the configuration options in the module that calls `from_object()` or provide an import path to a module that should be loaded. It is also possible to tell it to use the same module and with that provide the configuration values just before the call:

```
DEBUG = True
SECRET_KEY = 'development key'
app.config.from_object(__name__)
```

In both cases (loading from any Python file or loading from modules), only uppercase keys are added to the config. This makes it possible to use lowercase values in the config file for temporary values that are not added to the config or to define the config keys in the same file that implements the application.

Probably the most interesting way to load configurations is from an environment variable pointing to a file:

```
app.config.from_envvar('YOURAPPLICATION_SETTINGS')
```

In this case before launching the application you have to set this environment variable to the file you want to use. On Linux and OS X use the export statement:

```
export YOURAPPLICATION_SETTINGS='/path/to/config/file'
```

On windows use set instead.

Parameters

- root_path -- path to which files are read relative from. When the config object is created by the application, this is the application's `root_path`.
- defaults -- an optional dictionary of default values

from_envvar(variable_name, silent=False)

Loads a configuration from an environment variable pointing to a configuration file. This is basically just a shortcut with nicer error messages for this line of code:

```
app.config.from_pyfile(os.environ['YOURAPPLICATION_SETTINGS'])
```

Parameters

- variable_name -- name of the environment variable
- silent -- set to True if you want silent failure for missing files.

Returns bool. True if able to load config, False otherwise.

from_object(obj)

Updates the values from the given object. An object can be of one of the following two types:

- a string: in this case the object with that name will be imported
- an actual object reference: that object is used directly

Objects are usually either modules or classes.

Just the uppercase variables in that object are stored in the config. Example usage:

```
app.config.from_object('yourapplication.default_config')
from yourapplication import default_config
app.config.from_object(default_config)
```

You should not use this function to load the actual configuration but rather configuration defaults. The actual config should be loaded with `from_pyfile()` and ideally from a location not within the package because the package might be installed system wide.

Parameters obj -- an import name or object

from_pyfile(filename, silent=False)

Updates the values in the config from a Python file. This function behaves as if the file was imported as module with the `from_object()` function.

Parameters

- filename -- the filename of the config. This can either be an absolute filename or a filename relative to the root path.
- silent -- set to True if you want silent failure for missing files.

New in version 0.7: silent parameter.

17.12 Useful Internals

flask.**_request_ctx_stack**

The internal `LocalStack` that is used to implement all the context local objects used in Flask. This is a documented instance and can be used by extensions and application code but the use is discouraged in general.

The following attributes are always present on each layer of the stack:

app the active Flask application.

url_adapter the URL adapter that was used to match the request.

request the current request object.

session the active session object.

g an object with all the attributes of the `flask.g` object.

flashes an internal cache for the flashed messages.

Example usage:

```
from flask import _request_ctx_stack

def get_session():
```

```
ctx = _request_ctx_stack.top
if ctx is not None:
    return ctx.session
```

Changed in version 0.4. The request context is automatically popped at the end of the request for you. In debug mode the request context is kept around if exceptions happen so that interactive debuggers have a chance to introspect the data. With 0.4 this can also be forced for requests that did not fail and outside of DEBUG mode. By setting `'flask._preserve_context'` to True on the WSGI environment the context will not pop itself at the end of the request. This is used by the `test_client()` for example to implement the deferred cleanup functionality.

You might find this helpful for unittests where you need the information from the context local around for a little longer. Make sure to properly `pop()` the stack yourself in that situation, otherwise your unittests will leak memory.

17.13 Signals

New in version 0.6.

`flask.`**`signals_available`**
: True if the signalling system is available. This is the case when blinker is installed.

`flask.`**`template_rendered`**
: This signal is sent when a template was successfully rendered. The signal is invoked with the instance of the template as template and the context as dictionary (named context).

`flask.`**`request_started`**
: This signal is sent before any request processing started but when the request context was set up. Because the request context is already bound, the subscriber can access the request with the standard global proxies such as `request`.

`flask.`**`request_finished`**
: This signal is sent right before the response is sent to the client. It is passed the response to be sent named response.

`flask.`**`got_request_exception`**
: This signal is sent when an exception happens during request processing. It is sent before the standard exception handling kicks in and even in debug mode, where no exception handling happens. The exception itself is passed to the subscriber as exception.

class `flask.signals.`**`Namespace`**
: An alias for `blinker.base.Namespace` if blinker is available, otherwise a dummy class that creates fake signals. This class is available for Flask extensions that want to provide the same fallback system as Flask itself.

signal(name, doc=None)

Creates a new signal for this namespace if blinker is available, otherwise returns a fake signal that has a send method that will do nothing but will fail with a `RuntimeError` for all other operations, including connecting.

Part III
其它事项

Design notes, legal information and changelog are here for the interested.

CHAPTER

EIGHTEEN

DESIGN DECISIONS IN FLASK

If you are curious why Flask does certain things the way it does and not differently, this section is for you. This should give you an idea about some of the design decisions that may appear arbitrary and surprising at first, especially in direct comparison with other frameworks.

18.1 The Explicit Application Object

A Python web application based on WSGI has to have one central callable object that implements the actual application. In Flask this is an instance of the `Flask` class. Each Flask application has to create an instance of this class itself and pass it the name of the module, but why can't Flask do that itself?

Without such an explicit application object the following code:

```
from flask import Flask
app = Flask(__name__)

@app.route('/')
def index():
    return 'Hello World!'
```

Would look like this instead:

```
from hypothetical_flask import route

@route('/')
def index():
    return 'Hello World!'
```

There are three major reasons for this. The most important one is that implicit application objects require that there may only be one instance at the time. There are ways to fake multiple applications with a single application object, like maintaining a stack of applications, but this causes some problems I won't outline here in detail. Now the question is: when does a microframework need more than one application at the same time? A good example for this is unittesting. When you want to test something it can be very helpful to create a minimal application to test specific behavior. When the application object is deleted everything it allocated will be freed again.

Another thing that becomes possible when you have an explicit object lying around in your code is that you can subclass the base class (`Flask`) to alter specific behaviour. This would not be possible without hacks if the object were created ahead of time for you based on a class that is not exposed to you.

But there is another very important reason why Flask depends on an explicit instantiation of that class: the package name. Whenever you create a Flask instance you usually pass it __name__ as package name. Flask depends on that information to properly load resources relative to your module. With Python's outstanding support for reflection it can then access the package to figure out where the templates and static files are stored (see `open_resource()`). Now obviously there are frameworks around that do not need any configuration and will still be able to load templates relative to your application module. But they have to use the current working directory for that, which is a very unreliable way to determine where the application is. The current working directory is process-wide and if you are running multiple applications in one process (which could happen in a webserver without you knowing) the paths will be off. Worse: many webservers do not set the working directory to the directory of your application but to the document root which does not have to be the same folder.

The third reason is "explicit is better than implicit". That object is your WSGI application, you don't have to remember anything else. If you want to apply a WSGI middleware, just wrap it and you're done (though there are better ways to do that so that you do not lose the reference to the application object `wsgi_app()`).

Furthermore this design makes it possible to use a factory function to create the application which is very helpful for unittesting and similar things (Application Factories).

18.2 One Template Engine

Flask decides on one template engine: Jinja2. Why doesn't Flask have a pluggable template engine interface? You can obviously use a different template engine, but Flask will still configure Jinja2 for you. While that limitation that Jinja2 is always configured will probably go away, the decision to bundle one template engine and use that will not.

Template engines are like programming languages and each of those engines has a certain understanding about how things work. On the surface they all work the same: you tell the engine to evaluate a template with a set of variables and take the return value as string.

But that's about where similarities end. Jinja2 for example has an extensive filter system, a certain way to do template inheritance, support for reusable blocks (macros) that can be used from inside templates and also from Python code, uses Unicode for all operations, supports iterative template rendering, configurable syntax and more. On the other hand an engine like Genshi is based on XML stream evaluation, template inheritance by taking the availability of XPath into account and more. Mako on the other hand treats templates similar to Python modules.

When it comes to connecting a template engine with an application or framework

there is more than just rendering templates. For instance, Flask uses Jinja2's extensive autoescaping support. Also it provides ways to access macros from Jinja2 templates.

A template abstraction layer that would not take the unique features of the template engines away is a science on its own and a too large undertaking for a microframework like Flask.

Furthermore extensions can then easily depend on one template language being present. You can easily use your own templating language, but an extension could still depend on Jinja itself.

18.3 Micro with Dependencies

Why does Flask call itself a microframework and yet it depends on two libraries (namely Werkzeug and Jinja2). Why shouldn't it? If we look over to the Ruby side of web development there we have a protocol very similar to WSGI. Just that it's called Rack there, but besides that it looks very much like a WSGI rendition for Ruby. But nearly all applications in Ruby land do not work with Rack directly, but on top of a library with the same name. This Rack library has two equivalents in Python: WebOb (formerly Paste) and Werkzeug. Paste is still around but from my understanding it's sort of deprecated in favour of WebOb. The development of WebOb and Werkzeug started side by side with similar ideas in mind: be a good implementation of WSGI for other applications to take advantage.

Flask is a framework that takes advantage of the work already done by Werkzeug to properly interface WSGI (which can be a complex task at times). Thanks to recent developments in the Python package infrastructure, packages with dependencies are no longer an issue and there are very few reasons against having libraries that depend on others.

18.4 Thread Locals

Flask uses thread local objects (context local objects in fact, they support greenlet contexts as well) for request, session and an extra object you can put your own things on (`g`). Why is that and isn't that a bad idea?

Yes it is usually not such a bright idea to use thread locals. They cause troubles for servers that are not based on the concept of threads and make large applications harder to maintain. However Flask is just not designed for large applications or asynchronous servers. Flask wants to make it quick and easy to write a traditional web application.

Also see the 搞大了？！ section of the documentation for some inspiration for larger applications based on Flask.

18.5 What Flask is, What Flask is Not

Flask will never have a database layer. It will not have a form library or anything else in that direction. Flask itself just bridges to Werkzeug to implement a proper WSGI application and to Jinja2 to handle templating. It also binds to a few common standard library packages such as logging. Everything else is up for extensions.

Why is this the case? Because people have different preferences and requirements and Flask could not meet those if it would force any of this into the core. The majority of web applications will need a template engine in some sort. However not every application needs a SQL database.

The idea of Flask is to build a good foundation for all applications. Everything else is up to you or extensions.

CHAPTER

NINETEEN

HTML/XHTML FAQ

The Flask documentation and example applications are using HTML5. You may notice that in many situations, when end tags are optional they are not used, so that the HTML is cleaner and faster to load. Because there is much confusion about HTML and XHTML among developers, this document tries to answer some of the major questions.

19.1 History of XHTML

For a while, it appeared that HTML was about to be replaced by XHTML. However, barely any websites on the Internet are actual XHTML (which is HTML processed using XML rules). There are a couple of major reasons why this is the case. One of them is Internet Explorer's lack of proper XHTML support. The XHTML spec states that XHTML must be served with the MIME type application/xhtml+xml, but Internet Explorer refuses to read files with that MIME type. While it is relatively easy to configure Web servers to serve XHTML properly, few people do. This is likely because properly using XHTML can be quite painful.

One of the most important causes of pain is XML's draconian (strict and ruthless) error handling. When an XML parsing error is encountered, the browser is supposed to show the user an ugly error message, instead of attempting to recover from the error and display what it can. Most of the (X)HTML generation on the web is based on non-XML template engines (such as Jinja, the one used in Flask) which do not protect you from accidentally creating invalid XHTML. There are XML based template engines, such as Kid and the popular Genshi, but they often come with a larger runtime overhead and, are not as straightforward to use because they have to obey XML rules.

The majority of users, however, assumed they were properly using XHTML. They wrote an XHTML doctype at the top of the document and self-closed all the necessary tags (`<br>` becomes `<br/>` or `<br></br>` in XHTML). However, even if the document properly validates as XHTML, what really determines XHTML/HTML processing in browsers is the MIME type, which as said before is often not set properly. So the valid XHTML was being treated as invalid HTML.

XHTML also changed the way JavaScript is used. To properly work with XHTML, programmers have to use the namespaced DOM interface with the XHTML namespace to query for HTML elements.

19.2 History of HTML5

Development of the HTML5 specification was started in 2004 under the name "Web Applications 1.0" by the Web Hypertext Application Technology Working Group, or WHATWG (which was formed by the major browser vendors Apple, Mozilla, and Opera) with the goal of writing a new and improved HTML specification, based on existing browser behaviour instead of unrealistic and backwards-incompatible specifications.

For example, in HTML4 `<title/Hello/` theoretically parses exactly the same as `<title>Hello</title>`. However, since people were using XHTML-like tags along the lines of `<link />`, browser vendors implemented the XHTML syntax over the syntax defined by the specification.

In 2007, the specification was adopted as the basis of a new HTML specification under the umbrella of the W3C, known as HTML5. Currently, it appears that XHTML is losing traction, as the XHTML 2 working group has been disbanded and HTML5 is being implemented by all major browser vendors.

19.3 HTML versus XHTML

The following table gives you a quick overview of features available in HTML 4.01, XHTML 1.1 and HTML5. (XHTML 1.0 is not included, as it was superseded by XHTML 1.1 and the barely-used XHTML5.)

	HTML4.01	XHTML1.1	HTML5
`<tag/value/` == `<tag>value</tag>`	✓ [1]	✗	✗
` ` supported	✗	✓	✓ [2]
`<script/>` supported	✗	✓	✗
should be served as text/html	✓	✗ [3]	✓
should be served as application/xhtml+xml	✗	✓	✗
strict error handling	✗	✓	✗
inline SVG	✗	✓	✓
inline MathML	✗	✓	✓
`<video>` tag	✗	✗	✓
`<audio>` tag	✗	✗	✓
New semantic tags like `<article>`	✗	✗	✓

[1] This is an obscure feature inherited from SGML. It is usually not supported by browsers, for reasons detailed above.

[2] This is for compatibility with server code that generates XHTML for tags such as `<br>`. It should not be used in new code.

19.4 What does “strict” mean?

HTML5 has strictly defined parsing rules, but it also specifies exactly how a browser should react to parsing errors - unlike XHTML, which simply states parsing should abort. Some people are confused by apparently invalid syntax that still generates the expected results (for example, missing end tags or unquoted attribute values).

Some of these work because of the lenient error handling most browsers use when they encounter a markup error, others are actually specified. The following constructs are optional in HTML5 by standard, but have to be supported by browsers:

- Wrapping the document in an `<html>` tag
- Wrapping header elements in `<head>` or the body elements in `<body>`
- Closing the `<p>`, `<li>`, `<dt>`, `<dd>`, `<tr>`, `<td>`, `<th>`, `<tbody>`, `<thead>`, or `<tfoot>` tags.
- Quoting attributes, so long as they contain no whitespace or special characters (like `<`, `>`, `'`, or `"`).
- Requiring boolean attributes to have a value.

This means the following page in HTML5 is perfectly valid:

```
<!doctype html>
<title>Hello HTML5</title>
<div class=header>
  <h1>Hello HTML5</h1>
  <p class=tagline>HTML5 is awesome
</div>
<ul class=nav>
  <li><a href=/index>Index</a>
  <li><a href=/downloads>Downloads</a>
  <li><a href=/about>About</a>
</ul>
<div class=body>
  <h2>HTML5 is probably the future</h2>
  <p>
    There might be some other things around but in terms of
    browser vendor support, HTML5 is hard to beat.
  <dl>
    <dt>Key 1
    <dd>Value 1
    <dt>Key 2
    <dd>Value 2
  </dl>
</div>
```

[3] XHTML 1.0 is the last XHTML standard that allows to be served as text/html for backwards compatibility reasons.

19.5 New technologies in HTML5

HTML5 adds many new features that make Web applications easier to write and to use.

- The `<audio>` and `<video>` tags provide a way to embed audio and video without complicated add-ons like QuickTime or Flash.
- Semantic elements like `<article>`, `<header>`, `<nav>`, and `<time>` that make content easier to understand.
- The `<canvas>` tag, which supports a powerful drawing API, reducing the need for server-generated images to present data graphically.
- New form control types like `<input type="date">` that allow user agents to make entering and validating values easier.
- Advanced JavaScript APIs like Web Storage, Web Workers, Web Sockets, geolocation, and offline applications.

Many other features have been added, as well. A good guide to new features in HTML5 is Mark Pilgrim's soon-to-be-published book, Dive Into HTML5. Not all of them are supported in browsers yet, however, so use caution.

19.6 What should be used?

Currently, the answer is HTML5. There are very few reasons to use XHTML considering the latest developments in Web browsers. To summarize the reasons given above:

- Internet Explorer (which, sadly, currently leads in market share) has poor support for XHTML.
- Many JavaScript libraries also do not support XHTML, due to the more complicated namespacing API it requires.
- HTML5 adds several new features, including semantic tags and the long-awaited `<audio>` and `<video>` tags.
- It has the support of most browser vendors behind it.
- It is much easier to write, and more compact.

For most applications, it is undoubtedly better to use HTML5 than XHTML.

CHAPTER

TWENTY

SECURITY CONSIDERATIONS

Web applications usually face all kinds of security problems and it's very hard to get everything right. Flask tries to solve a few of these things for you, but there are a couple more you have to take care of yourself.

20.1 Cross-Site Scripting (XSS)

Cross site scripting is the concept of injecting arbitrary HTML (and with it JavaScript) into the context of a website. To remedy this, developers have to properly escape text so that it cannot include arbitrary HTML tags. For more information on that have a look at the Wikipedia article on Cross-Site Scripting.

Flask configures Jinja2 to automatically escape all values unless explicitly told otherwise. This should rule out all XSS problems caused in templates, but there are still other places where you have to be careful:

- generating HTML without the help of Jinja2
- calling `Markup` on data submitted by users
- sending out HTML from uploaded files, never do that, use the Content-Disposition: attachment header to prevent that problem.
- sending out textfiles from uploaded files. Some browsers are using content-type guessing based on the first few bytes so users could trick a browser to execute HTML.

Another thing that is very important are unquoted attributes. While Jinja2 can protect you from XSS issues by escaping HTML, there is one thing it cannot protect you from: XSS by attribute injection. To counter this possible attack vector, be sure to always quote your attributes with either double or single quotes when using Jinja expressions in them:

```
<a href="{{ href }}">the text</a>
```

Why is this necessary? Because if you would not be doing that, an attacker could easily inject custom JavaScript handlers. For example an attacker could inject this piece of HTML+JavaScript:

```
onmouseover=alert(document.cookie)
```

When the user would then move with the mouse over the link, the cookie would be presented to the user in an alert window. But instead of showing the cookie to the user, a good attacker might also execute any other JavaScript code. In combination with CSS injections the attacker might even make the element fill out the entire page so that the user would just have to have the mouse anywhere on the page to trigger the attack.

20.2 Cross-Site Request Forgery (CSRF)

Another big problem is CSRF. This is a very complex topic and I won't outline it here in detail just mention what it is and how to theoretically prevent it.

If your authentication information is stored in cookies, you have implicit state management. The state of "being logged in" is controlled by a cookie, and that cookie is sent with each request to a page. Unfortunately that includes requests triggered by 3rd party sites. If you don't keep that in mind, some people might be able to trick your application's users with social engineering to do stupid things without them knowing.

Say you have a specific URL that, when you sent POST requests to will delete a user's profile (say http://example.com/user/delete). If an attacker now creates a page that sends a post request to that page with some JavaScript they just has to trick some users to load that page and their profiles will end up being deleted.

Imagine you were to run Facebook with millions of concurrent users and someone would send out links to images of little kittens. When users would go to that page, their profiles would get deleted while they are looking at images of fluffy cats.

How can you prevent that? Basically for each request that modifies content on the server you would have to either use a one-time token and store that in the cookie and also transmit it with the form data. After receiving the data on the server again, you would then have to compare the two tokens and ensure they are equal.

Why does Flask not do that for you? The ideal place for this to happen is the form validation framework, which does not exist in Flask.

20.3 JSON Security

ECMAScript 5 Changes

Starting with ECMAScript 5 the behavior of literals changed. Now they are not constructed with the constructor of `Array` and others, but with the builtin constructor of `Array` which closes this particular attack vector.

JSON itself is a high-level serialization format, so there is barely anything that could cause security problems, right? You can't declare recursive structures that could

cause problems and the only thing that could possibly break are very large responses that can cause some kind of denial of service at the receiver's side.

However there is a catch. Due to how browsers work the CSRF issue comes up with JSON unfortunately. Fortunately there is also a weird part of the JavaScript specification that can be used to solve that problem easily and Flask is kinda doing that for you by preventing you from doing dangerous stuff. Unfortunately that protection is only there for `jsonify()` so you are still at risk when using other ways to generate JSON.

So what is the issue and how to avoid it? The problem are arrays at top-level in JSON. Imagine you send the following data out in a JSON request. Say that's exporting the names and email addresses of all your friends for a part of the user interface that is written in JavaScript. Not very uncommon:

```
[
    {"username": "admin",
     "email": "admin@localhost"}
]
```

And it is doing that of course only as long as you are logged in and only for you. And it is doing that for all GET requests to a certain URL, say the URL for that request is `http://example.com/api/get_friends.json`.

So now what happens if a clever hacker is embedding this to his website and social engineers a victim to visiting his site:

```
<script type=text/javascript>
var captured = [];
var oldArray = Array;
function Array() {
  var obj = this, id = 0, capture = function(value) {
    obj.__defineSetter__(id++, capture);
    if (value)
      captured.push(value);
  };
  capture();
}
</script>
<script type=text/javascript
  src=http://example.com/api/get_friends.json></script>
<script type=text/javascript>
Array = oldArray;
// now we have all the data in the captured array.
</script>
```

If you know a bit of JavaScript internals you might know that it's possible to patch constructors and register callbacks for setters. An attacker can use this (like above) to get all the data you exported in your JSON file. The browser will totally ignore the `application/json` mimetype if `text/javascript` is defined as content type in the script tag and evaluate that as JavaScript. Because top-level array elements are allowed (albeit useless) and we hooked in our own constructor, after that page loaded the data from the JSON response is in the captured array.

Because it is a syntax error in JavaScript to have an object literal (`{...}`) toplevel an attacker could not just do a request to an external URL with the script tag to load up the data. So what Flask does is to only allow objects as toplevel elements when using `jsonify()`. Make sure to do the same when using an ordinary JSON generate function.

CHAPTER

TWENTYONE

UNICODE IN FLASK

Flask like Jinja2 and Werkzeug is totally Unicode based when it comes to text. Not only these libraries, also the majority of web related Python libraries that deal with text. If you don't know Unicode so far, you should probably read The Absolute Minimum Every Software Developer Absolutely, Positively Must Know About Unicode and Character Sets. This part of the documentation just tries to cover the very basics so that you have a pleasant experience with Unicode related things.

21.1 Automatic Conversion

Flask has a few assumptions about your application (which you can change of course) that give you basic and painless Unicode support:

- the encoding for text on your website is UTF-8
- internally you will always use Unicode exclusively for text except for literal strings with only ASCII character points.
- encoding and decoding happens whenever you are talking over a protocol that requires bytes to be transmitted.

So what does this mean to you?

HTTP is based on bytes. Not only the protocol, also the system used to address documents on servers (so called URIs or URLs). However HTML which is usually transmitted on top of HTTP supports a large variety of character sets and which ones are used, are transmitted in an HTTP header. To not make this too complex Flask just assumes that if you are sending Unicode out you want it to be UTF-8 encoded. Flask will do the encoding and setting of the appropriate headers for you.

The same is true if you are talking to databases with the help of SQLAlchemy or a similar ORM system. Some databases have a protocol that already transmits Unicode and if they do not, SQLAlchemy or your other ORM should take care of that.

21.2 The Golden Rule

So the rule of thumb: if you are not dealing with binary data, work with Unicode. What does working with Unicode in Python 2.x mean?

- as long as you are using ASCII charpoints only (basically numbers, some special characters of latin letters without umlauts or anything fancy) you can use regular string literals (`'Hello World'`).
- if you need anything else than ASCII in a string you have to mark this string as Unicode string by prefixing it with a lowercase u. (like `u'Hel und Gretel'`)
- if you are using non-Unicode characters in your Python files you have to tell Python which encoding your file uses. Again, I recommend UTF-8 for this purpose. To tell the interpreter your encoding you can put the `# -*- coding: utf-8 -*-` into the first or second line of your Python source file.
- Jinja is configured to decode the template files from UTF-8. So make sure to tell your editor to save the file as UTF-8 there as well.

21.3 Encoding and Decoding Yourself

If you are talking with a filesystem or something that is not really based on Unicode you will have to ensure that you decode properly when working with Unicode interface. So for example if you want to load a file on the filesystem and embed it into a Jinja2 template you will have to decode it from the encoding of that file. Here the old problem that text files do not specify their encoding comes into play. So do yourself a favour and limit yourself to UTF-8 for text files as well.

Anyways. To load such a file with Unicode you can use the built-in `str.decode()` method:

```
def read_file(filename, charset='utf-8'):
    with open(filename, 'r') as f:
        return f.read().decode(charset)
```

To go from Unicode into a specific charset such as UTF-8 you can use the `unicode.encode()` method:

```
def write_file(filename, contents, charset='utf-8'):
    with open(filename, 'w') as f:
        f.write(contents.encode(charset))
```

21.4 Configuring Editors

Most editors save as UTF-8 by default nowadays but in case your editor is not configured to do this you have to change it. Here some common ways to set your editor to store as UTF-8:

- Vim: put `set enc=utf-8` to your `.vimrc` file.
- Emacs: either use an encoding cookie or put this into your `.emacs` file:

```
(prefer-coding-system 'utf-8)
(setq default-buffer-file-coding-system 'utf-8)
```

- Notepad++:
  1. Go to Settings -> Preferences ...
  2. Select the “New Document/Default Directory” tab
  3. Select “UTF-8 without BOM” as encoding

  It is also recommended to use the Unix newline format, you can select it in the same panel but this is not a requirement.

CHAPTER

TWENTYTWO

FLASK EXTENSION DEVELOPMENT

Flask, being a microframework, often requires some repetitive steps to get a third party library working. Because very often these steps could be abstracted to support multiple projects the Flask Extension Registry was created.

If you want to create your own Flask extension for something that does not exist yet, this guide to extension development will help you get your extension running in no time and to feel like users would expect your extension to behave.

22.1 Anatomy of an Extension

Extensions are all located in a package called `flaskext.something` where "something" is the name of the library you want to bridge. So for example if you plan to add support for a library named simplexml to Flask, you would name your extension's package `flaskext.simplexml`.

The name of the actual extension (the human readable name) however would be something like "Flask-SimpleXML". Make sure to include the name "Flask" somewhere in that name and that you check the capitalization. This is how users can then register dependencies to your extension in their setup.py files.

The magic that makes it possible to have your library in a package called `flaskext.something` is called a "namespace package". Check out the guide below how to create something like that.

But how do extensions look like themselves? An extension has to ensure that it works with multiple Flask application instances at once. This is a requirement because many people will use patterns like the Application Factories pattern to create their application as needed to aid unittests and to support multiple configurations. Because of that it is crucial that your application supports that kind of behaviour.

Most importantly the extension must be shipped with a setup.py file and registered on PyPI. Also the development checkout link should work so that people can easily install the development version into their virtualenv without having to download the library by hand.

Flask extensions must be licensed as BSD or MIT or a more liberal license to be enlisted on the Flask Extension Registry. Keep in mind that the Flask Extension Registry is a

moderated place and libraries will be reviewed upfront if they behave as required.

22.2 "Hello Flaskext!"

So let's get started with creating such a Flask extension. The extension we want to create here will provide very basic support for SQLite3.

There is a script on github called Flask Extension Wizard which helps you create the initial folder structure. But for this very basic example we want to create all by hand to get a better feeling for it.

First we create the following folder structure:

```
flask-sqlite3/
    flaskext/
        __init__.py
        sqlite3.py
    setup.py
    LICENSE
```

Here's the contents of the most important files:

22.2.1 flaskext/__init__.py

The only purpose of this file is to mark the package as namespace package. This is required so that multiple modules from different PyPI packages can reside in the same Python package:

```
__import__('pkg_resources').declare_namespace(__name__)
```

If you want to know exactly what is happening there, checkout the distribute or setuptools docs which explain how this works.

Just make sure to not put anything else in there!

22.2.2 setup.py

The next file that is absolutely required is the setup.py file which is used to install your Flask extension. The following contents are something you can work with:

```
"""
Flask-SQLite3
-------------

This is the description for that library
"""
from setuptools import setup
```

```
setup(
    name='Flask-SQLite3',
    version='1.0',
    url='http://example.com/flask-sqlite3/',
    license='BSD',
    author='Your Name',
    author_email='your-email@example.com',
    description='Very short description',
    long_description=__doc__,
    packages=['flaskext'],
    namespace_packages=['flaskext'],
    zip_safe=False,
    platforms='any',
    install_requires=[
        'Flask'
    ],
    classifiers=[
        'Environment :: Web Environment',
        'Intended Audience :: Developers',
        'License :: OSI Approved :: BSD License',
        'Operating System :: OS Independent',
        'Programming Language :: Python',
        'Topic :: Internet :: WWW/HTTP :: Dynamic Content',
        'Topic :: Software Development :: Libraries :: Python Modules'
    ]
)
```

That's a lot of code but you can really just copy/paste that from existing extensions and adapt. This is also what the wizard creates for you if you use it.

22.2.3 flaskext/sqlite3.py

Now this is where your extension code goes. But how exactly should such an extension look like? What are the best practices? Continue reading for some insight.

22.3 Initializing Extensions

Many extensions will need some kind of initialization step. For example, consider your application is currently connecting to SQLite like the documentation suggests (Using SQLite 3 with Flask) you will need to provide a few functions and before / after request handlers. So how does the extension know the name of the application object?

Quite simple: you pass it to it.

There are two recommended ways for an extension to initialize:

initialization functions: If your extension is called helloworld you might have a function called `init_helloworld(app[, extra_args])` that initializes the extension for

that application. It could attach before / after handlers etc.

classes: Classes work mostly like initialization functions but can later be used to further change the behaviour. For an example look at how the OAuth extension works: there is an OAuth object that provides some helper functions like OAuth.remote_app to create a reference to a remote application that uses OAuth.

What to use depends on what you have in mind. For the SQLite 3 extension we will use the class based approach because it will provide users with a manager object that handles opening and closing database connections.

22.4 The Extension Code

Here's the contents of the flaskext/sqlite3.py for copy/paste:

```
from __future__ import absolute_import
import sqlite3

from flask import _request_ctx_stack

class SQLite3(object):

    def __init__(self, app):
        self.app = app
        self.app.config.setdefault('SQLITE3_DATABASE', ':memory:')
        self.app.teardown_request(self.teardown_request)
        self.app.before_request(self.before_request)

    def connect(self):
        return sqlite3.connect(self.app.config['SQLITE3_DATABASE'])

    def before_request(self):
        ctx = _request_ctx_stack.top
        ctx.sqlite3_db = self.connect()

    def teardown_request(self, exception):
        ctx = _request_ctx_stack.top
        ctx.sqlite3_db.close()

    def get_db(self):
        ctx = _request_ctx_stack.top
        if ctx is not None:
            return ctx.sqlite3_db
```

So here's what these lines of code do:

1. The `__future__` import is necessary to activate absolute imports. Otherwise we could not call our module sqlite3.py and import the top-level sqlite3 module which actually implements the connection to SQLite.

2. We create a class for our extension that requires a supplied app object, sets a configuration for the database if it's not there (`dict.setdefault()`), and attaches before_request and teardown_request handlers.
3. Next, we define a connect function that opens a database connection.
4. Then we set up the request handlers we bound to the app above. Note here that we're attaching our database connection to the top request context via _request_ctx_stack.top. Extensions should use the top context and not the g object to store things like database connections.
5. Finally, we add a get_db function that simplifies access to the context's database.

So why did we decide on a class based approach here? Because using our extension looks something like this:

```
from flask import Flask
from flaskext.sqlite3 import SQLite3

app = Flask(__name__)
app.config.from_pyfile('the-config.cfg')
manager = SQLite3(app)
db = manager.get_db()
```

You can then use the database from views like this:

```
@app.route('/')
def show_all():
    cur = db.cursor()
    cur.execute(...)
```

Opening a database connection from outside a view function is simple.

```
>>> from yourapplication import db
>>> cur = db.cursor()
>>> cur.execute(...)
```

22.5 Adding an init_app Function

In practice, you'll almost always want to permit users to initialize your extension and provide an app object after the fact. This can help avoid circular import problems when a user is breaking their app into multiple files. Our extension could add an init_app function as follows:

```
class SQLite3(object):

    def __init__(self, app=None):
        if app is not None:
            self.app = app
            self.init_app(self.app)
        else:
            self.app = None
```

```
    def init_app(self, app):
        self.app = app
        self.app.config.setdefault('SQLITE3_DATABASE', ':memory:')
        self.app.teardown_request(self.teardown_request)
        self.app.before_request(self.before_request)

    def connect(self):
        return sqlite3.connect(app.config['SQLITE3_DATABASE'])

    def before_request(self):
        ctx = _request_ctx_stack.top
        ctx.sqlite3_db = self.connect()

    def teardown_request(self, exception):
        ctx = _request_ctx_stack.top
        ctx.sqlite3_db.close()

    def get_db(self):
        ctx = _request_ctx_stack.top
        if ctx is not None:
            return ctx.sqlite3_db
```

The user could then initialize the extension in one file:

```
manager = SQLite3()
```

and bind their app to the extension in another file:

```
manager.init_app(app)
```

22.6 End-Of-Request Behavior

Due to the change in Flask 0.7 regarding functions that are run at the end of the request your extension will have to be extra careful there if it wants to continue to support older versions of Flask. The following pattern is a good way to support both:

```
def close_connection(response):
    ctx = _request_ctx_stack.top
    ctx.sqlite3_db.close()
    return response

if hasattr(app, 'teardown_request'):
    app.teardown_request(close_connection)
else:
    app.after_request(close_connection)
```

Strictly speaking the above code is wrong, because teardown functions are passed the exception and typically don't return anything. However because the return value is

discarded this will just work assuming that the code in between does not touch the passed parameter.

22.7 Learn from Others

This documentation only touches the bare minimum for extension development. If you want to learn more, it's a very good idea to check out existing extensions on the Flask Extension Registry. If you feel lost there is still the mailinglist and the IRC channel to get some ideas for nice looking APIs. Especially if you do something nobody before you did, it might be a very good idea to get some more input. This not only to get an idea about what people might want to have from an extension, but also to avoid having multiple developers working on pretty much the same side by side.

Remember: good API design is hard, so introduce your project on the mailinglist, and let other developers give you a helping hand with designing the API.

The best Flask extensions are extensions that share common idioms for the API. And this can only work if collaboration happens early.

22.8 Approved Extensions

Flask also has the concept of approved extensions. Approved extensions are tested as part of Flask itself to ensure extensions do not break on new releases. These approved extensions are listed on the Flask Extension Registry and marked appropriately. If you want your own extension to be approved you have to follow these guidelines:

1. An approved Flask extension must provide exactly one package or module inside the flaskext namespace package.
2. It must ship a testing suite that can either be invoked with `make test` or `python setup.py test`. For test suites invoked with `make test` the extension has to ensure that all dependencies for the test are installed automatically, in case of `python setup.py test` dependencies for tests alone can be specified in the setup.py file. The test suite also has to be part of the distribution.
3. APIs of approved extensions will be checked for the following characteristics:
   - ☒ an approved extension has to support multiple applications running in the same Python process.
   - ☒ it must be possible to use the factory pattern for creating applications.
4. The license must be BSD/MIT/WTFPL licensed.
5. The naming scheme for official extensions is Flask-ExtensionName or ExtensionName-Flask.
6. Approved extensions must define all their dependencies in the setup.py file unless a dependency cannot be met because it is not available on PyPI.

7. The extension must have documentation that uses one of the two Flask themes for Sphinx documentation.
8. The setup.py description (and thus the PyPI description) has to link to the documentation, website (if there is one) and there must be a link to automatically install the development version (`PackageName==dev`).
9. The `zip_safe` flag in the setup script must be set to `False`, even if the extension would be safe for zipping.
10. An extension currently has to support Python 2.5, 2.6 as well as Python 2.7

CHAPTER

TWENTYTHREE

POCOO STYLEGUIDE

The Pocoo styleguide is the styleguide for all Pocoo Projects, including Flask. This styleguide is a requirement for Patches to Flask and a recommendation for Flask extensions.

In general the Pocoo Styleguide closely follows PEP 8 with some small differences and extensions.

23.1 General Layout

Indentation: 4 real spaces. No tabs, no exceptions.

Maximum line length: 79 characters with a soft limit for 84 if absolutely necessary. Try to avoid too nested code by cleverly placing break, continue and return statements.

Continuing long statements: To continue a statement you can use backslashes in which case you should align the next line with the last dot or equal sign, or indent four spaces:

```
this_is_a_very_long(function_call, 'with many parameters') \
    .that_returns_an_object_with_an_attribute

MyModel.query.filter(MyModel.scalar > 120) \
             .order_by(MyModel.name.desc()) \
             .limit(10)
```

If you break in a statement with parentheses or braces, align to the braces:

```
this_is_a_very_long(function_call, 'with many parameters',
                    23, 42, 'and even more')
```

For lists or tuples with many items, break immediately after the opening brace:

```
items = [
    'this is the first', 'set of items', 'with more items',
    'to come in this line', 'like this'
]
```

Blank lines: Top level functions and classes are separated by two lines, everything else by one. Do not use too many blank lines to separate logical segments in code. Example:

```
def hello(name):
    print 'Hello %s!' % name


def goodbye(name):
    print 'See you %s.' % name


class MyClass(object):
    """This is a simple docstring"""

    def __init__(self, name):
        self.name = name

    def get_annoying_name(self):
        return self.name.upper() + '!!!!111'
```

23.2 Expressions and Statements

General whitespace rules:

- ☒ No whitespace for unary operators that are not words (e.g.: -, ~ etc.) as well on the inner side of parentheses.
- ☒ Whitespace is placed between binary operators.

Good:

```
exp = -1.05
value = (item_value / item_count) * offset / exp
value = my_list[index]
value = my_dict['key']
```

Bad:

```
exp = - 1.05
value = ( item_value / item_count ) * offset / exp
value = (item_value/item_count)*offset/exp
value=( item_value/item_count ) * offset/exp
value = my_list[ index ]
value = my_dict ['key']
```

Yoda statements are a no-go: Never compare constant with variable, always variable with constant:

Good:

```
if method == 'md5':
    pass
```

Bad:

```
if 'md5' == method:
    pass
```

Comparisons:

- ☒ against arbitrary types: `==` and `!=`
- ☒ against singletons with `is` and `is not` (eg: `foo is not None`)
- ☒ never compare something with True or False (for example never do `foo == False`, do `not foo` instead)

Negated containment checks: use `foo not in bar` instead of `not foo in bar`

Instance checks: `isinstance(a, C)` instead of `type(A) is C`, but try to avoid instance checks in general. Check for features.

23.3 Naming Conventions

- ☒ Class names: `CamelCase`, with acronyms kept uppercase (`HTTPWriter` and not `HttpWriter`)
- ☒ Variable names: `lowercase_with_underscores`
- ☒ Method and function names: `lowercase_with_underscores`
- ☒ Constants: `UPPERCASE_WITH_UNDERSCORES`
- ☒ precompiled regular expressions: `name_re`

Protected members are prefixed with a single underscore. Double underscores are reserved for mixin classes.

On classes with keywords, trailing underscores are appended. Clashes with builtins are allowed and must not be resolved by appending an underline to the variable name. If the function needs to access a shadowed builtin, rebind the builtin to a different name instead.

Function and method arguments:

- ☒ class methods: `cls` as first parameter
- ☒ instance methods: `self` as first parameter
- ☒ lambdas for properties might have the first parameter replaced with `x` like in `display_name = property(lambda x: x.real_name or x.username)`

23.4 Docstrings

Docstring conventions: All docstrings are formatted with reStructuredText as understood by Sphinx. Depending on the number of lines in the docstring, they are laid out differently. If it's just one line, the closing triple quote is on the same line as the opening, otherwise the text is on the same line as the opening quote and the triple quote that closes the string on its own line:

```
def foo():
    """This is a simple docstring"""


def bar():
    """This is a longer docstring with so much information in there
    that it spans three lines.  In this case the closing triple quote
    is on its own line.
    """
```

Module header: The module header consists of an utf-8 encoding declaration (if non ASCII letters are used, but it is recommended all the time) and a standard docstring:

```
# -*- coding: utf-8 -*-
"""
    package.module
    ~~~~~~~~~~~~~~

    A brief description goes here.

    :copyright: (c) YEAR by AUTHOR.
    :license: LICENSE_NAME, see LICENSE_FILE for more details.
"""
```

Please keep in mind that proper copyrights and license files are a requirement for approved Flask extensions.

23.5 Comments

Rules for comments are similar to docstrings. Both are formatted with reStructuredText. If a comment is used to document an attribute, put a colon after the opening pound sign (#):

```
class User(object):
    #: the name of the user as unicode string
    name = Column(String)
    #: the sha1 hash of the password + inline salt
    pw_hash = Column(String)
```

CHAPTER

TWENTYFOUR

UPGRADING TO NEWER RELEASES

Flask itself is changing like any software is changing over time. Most of the changes are the nice kind, the kind where you don't have to change anything in your code to profit from a new release.

However every once in a while there are changes that do require some changes in your code or there are changes that make it possible for you to improve your own code quality by taking advantage of new features in Flask.

This section of the documentation enumerates all the changes in Flask from release to release and how you can change your code to have a painless updating experience.

If you want to use the easy_install command to upgrade your Flask installation, make sure to pass it the `-U` parameter:

```
$ easy_install -U Flask
```

24.1 Version 0.7

In Flask 0.7 we cleaned up the code base internally a lot and did some backwards incompatible changes that make it easier to implement larger applications with Flask. Because we want to make upgrading as easy as possible we tried to counter the problems arising from these changes by providing a script that can ease the transition.

The script scans your whole application and generates an unified diff with changes it assumes are safe to apply. However as this is an automated tool it won't be able to find all use cases and it might miss some. We internally spread a lot of deprecation warnings all over the place to make it easy to find pieces of code that it was unable to upgrade.

We strongly recommend that you hand review the generated patchfile and only apply the chunks that look good.

If you are using git as version control system for your project we recommend applying the patch with `path -p1 < patchfile.diff` and then using the interactive commit feature to only apply the chunks that look good.

To apply the upgrade script do the following:

1. Download the script: flask-07-upgrade.py
2. Run it in the directory of your application:

   ```
   python flask-07-upgrade.py > patchfile.diff
   ```

3. Review the generated patchfile.
4. Apply the patch:

   ```
   patch -p1 < patchfile.diff
   ```

5. If you were using per-module template folders you need to move some templates around. Previously if you had a folder named `templates` next to a blueprint named `admin` the implicit template path automatically was `admin/index.html` for a template file called `templates/index.html`. This no longer is the case. Now you need to name the template `templates/admin/index.html`. The tool will not detect this so you will have to do that on your own.

Please note that deprecation warnings are disabled by default starting with Python 2.7. In order to see the deprecation warnings that might be emitted you have to enabled them with the `warnings` module.

If you are working with windows and you lack the patch command line utility you can get it as part of various Unix runtime environments for windows including cygwin, msysgit or ming32. Also source control systems like svn, hg or git have builtin support for applying unified diffs as generated by the tool. Check the manual of your version control system for more information.

24.1.1 Bug in Request Locals

Due to a bug in earlier implementations the request local proxies now raise a `RuntimeError` instead of an `AttributeError` when they are unbound. If you caught these exceptions with `AttributeError` before, you should catch them with `RuntimeError` now.

Additionally the `send_file()` function is now issuing deprecation warnings if you depend on functionality that will be removed in Flask 1.0. Previously it was possible to use etags and mimetypes when file objects were passed. This was unreliable and caused issues for a few setups. If you get a deprecation warning, make sure to update your application to work with either filenames there or disable etag attaching and attach them yourself.

Old code:

```
return send_file(my_file_object)
return send_file(my_file_object)
```

New code:

```
return send_file(my_file_object, add_etags=False)
```

24.1.2 Upgrading to new Teardown Handling

We streamlined the behavior of the callbacks for request handling. For things that modify the response the `after_request()` decorators continue to work as expected, but for things that absolutely must happen at the end of request we introduced the new `teardown_request()` decorator. Unfortunately that change also made after-request work differently under error conditions. It's not consistently skipped if exceptions happen whereas previously it might have been called twice to ensure it is executed at the end of the request.

If you have database connection code that looks like this:

```
@app.after_request
def after_request(response):
    g.db.close()
    return response
```

You are now encouraged to use this instead:

```
@app.teardown_request
def after_request(exception):
    g.db.close()
```

On the upside this change greatly improves the internal code flow and makes it easier to customize the dispatching and error handling. This makes it now a lot easier to write unit tests as you can prevent closing down of database connections for a while. You can take advantage of the fact that the teardown callbacks are called when the response context is removed from the stack so a test can query the database after request handling:

```
with app.test_client() as client:
    resp = client.get('/')
    # g.db is still bound if there is such a thing

# and here it's gone
```

24.1.3 Manual Error Handler Attaching

While it is still possible to attach error handlers to `Flask.error_handlers` it's discouraged to do so and in fact deprecated. In generaly we no longer recommend custom error handler attaching via assignments to the underlying dictionary due to the more complex internal handling to support arbitrary exception classes and blueprints. See `Flask.errorhandler()` for more information.

The proper upgrade is to change this:

```
app.error_handlers[403] = handle_error
```

Into this:

```
app.register_error_handler(403, handle_error)
```

Alternatively you should just attach the function with a decorator:

```
@app.errorhandler(403)
def handle_error(e):
    ...
```

(Note that `register_error_handler()` is new in Flask 0.7)

24.1.4 Blueprint Support

Blueprints replace the previous concept of "Modules" in Flask. They provide better semantics for various features and work better with large applications. The update script provided should be able to upgrade your applications automatically, but there might be some cases where it fails to upgrade. What changed?

- Blueprints need explicit names. Modules had an automatic name guesssing scheme where the shortname for the module was taken from the last part of the import module. The upgrade script tries to guess that name but it might fail as this information could change at runtime.
- Blueprints have an inverse behavior for `url_for()`. Previously `.foo` told `url_for()` that it should look for the endpoint foo on the application. Now it means "relative to current module". The script will inverse all calls to `url_for()` automatically for you. It will do this in a very eager way so you might end up with some unnecessary leading dots in your code if you're not using modules.
- Blueprints do not automatically provide static folders. They will also no longer automatically export templates from a folder called templates next to their location however but it can be enabled from the constructor. Same with static files: if you want to continue serving static files you need to tell the constructor explicitly the path to the static folder (which can be relative to the blueprint's module path).
- Rendering templates was simplified. Now the blueprints can provide template folders which are added to a general template searchpath. This means that you need to add another subfolder with the blueprint's name into that folder if you want `blueprintname/template.html` as the template name.

If you continue to use the Module object which is deprecated, Flask will restore the previous behavior as good as possible. However we strongly recommend upgrading to the new blueprints as they provide a lot of useful improvement such as the ability to attach a blueprint multiple times, blueprint specific error handlers and a lot more.

24.2 Version 0.6

Flask 0.6 comes with a backwards incompatible change which affects the order of after-request handlers. Previously they were called in the order of the registration, now they are called in reverse order. This change was made so that Flask behaves more like people expected it to work and how other systems handle request pre- and postprocessing. If you depend on the order of execution of post-request functions, be sure to change the order.

Another change that breaks backwards compatibility is that context processors will no longer override values passed directly to the template rendering function. If for example request is as variable passed directly to the template, the default context processor will not override it with the current request object. This makes it easier to extend context processors later to inject additional variables without breaking existing template not expecting them.

24.3 Version 0.5

Flask 0.5 is the first release that comes as a Python package instead of a single module. There were a couple of internal refactoring so if you depend on undocumented internal details you probably have to adapt the imports.

The following changes may be relevant to your application:

- autoescaping no longer happens for all templates. Instead it is configured to only happen on files ending with `.html`, `.htm`, `.xml` and `.xhtml`. If you have templates with different extensions you should override the `select_jinja_autoescape()` method.
- Flask no longer supports zipped applications in this release. This functionality might come back in future releases if there is demand for this feature. Removing support for this makes the Flask internal code easier to understand and fixes a couple of small issues that make debugging harder than necessary.
- The create_jinja_loader function is gone. If you want to customize the Jinja loader now, use the `create_jinja_environment()` method instead.

24.4 Version 0.4

For application developers there are no changes that require changes in your code. In case you are developing on a Flask extension however, and that extension has a unittest-mode you might want to link the activation of that mode to the new `TESTING` flag.

24.5 Version 0.3

Flask 0.3 introduces configuration support and logging as well as categories for flashing messages. All these are features that are 100% backwards compatible but you might want to take advantage of them.

24.5.1 Configuration Support

The configuration support makes it easier to write any kind of application that requires some sort of configuration. (Which most likely is the case for any application out there).

If you previously had code like this:

```
app.debug = DEBUG
app.secret_key = SECRET_KEY
```

You no longer have to do that, instead you can just load a configuration into the config object. How this works is outlined in Configuration Handling.

24.5.2 Logging Integration

Flask now configures a logger for you with some basic and useful defaults. If you run your application in production and want to profit from automatic error logging, you might be interested in attaching a proper log handler. Also you can start logging warnings and errors into the logger when appropriately. For more information on that, read 处理应用异常.

24.5.3 Categories for Flash Messages

Flash messages can now have categories attached. This makes it possible to render errors, warnings or regular messages differently for example. This is an opt-in feature because it requires some rethinking in the code.

Read all about that in the Message Flashing pattern.

CHAPTER

TWENTYFIVE

FLASK CHANGELOG

Here you can see the full list of changes between each Flask release.

25.1 Version 0.6

Release date to be announced, codename to be decided.

- after request functions are now called in reverse order of registration.
- OPTIONS is now automatically implemented by Flask unless the application explictly adds 'OPTIONS' as method to the URL rule. In this case no automatic OPTIONS handling kicks in.
- static rules are now even in place if there is no static folder for the module. This was implemented to aid GAE which will remove the static folder if it's part of a mapping in the .yml file.
- the `config` is now available in the templates as config.
- context processors will no longer override values passed directly to the render function.
- added the ability to limit the incoming request data with the new `MAX_CONTENT_LENGTH` configuration value.
- the endpoint for the `flask.Module.add_url_rule()` method is now optional to be consistent with the function of the same name on the application object.
- added a `flask.make_response()` function that simplifies creating response object instances in views.
- added signalling support based on blinker. This feature is currently optional and supposed to be used by extensions and applications. If you want to use it, make sure to have blinker installed.
- refactored the way url adapters are created. This process is now fully customizable with the `create_url_adapter()` method.

25.2 Version 0.5.2

Bugfix Release, released on July 15th 2010

- fixed another issue with loading templates from directories when modules were used.

25.3 Version 0.5.1

Bugfix Release, released on July 6th 2010

- fixes an issue with template loading from directories when modules where used.

25.4 Version 0.5

Released on July 6th 2010, codename Calvados

- fixed a bug with subdomains that was caused by the inability to specify the server name. The server name can now be set with the SERVER_NAME config key. This key is now also used to set the session cookie cross-subdomain wide.
- autoescaping is no longer active for all templates. Instead it is only active for `.html`, `.htm`, `.xml` and `.xhtml`. Inside templates this behaviour can be changed with the `autoescape` tag.
- refactored Flask internally. It now consists of more than a single file.
- `flask.send_file()` now emits etags and has the ability to do conditional responses builtin.
- (temporarily) dropped support for zipped applications. This was a rarely used feature and led to some confusing behaviour.
- added support for per-package template and static-file directories.
- removed support for create_jinja_loader which is no longer used in 0.5 due to the improved module support.
- added a helper function to expose files from any directory.

25.5 Version 0.4

Released on June 18th 2010, codename Rakia

- added the ability to register application wide error handlers from modules.
- `after_request()` handlers are now also invoked if the request dies with an exception and an error handling page kicks in.

- test client has not the ability to preserve the request context for a little longer. This can also be used to trigger custom requests that do not pop the request stack for testing.
- because the Python standard library caches loggers, the name of the logger is configurable now to better support unittests.
- added TESTING switch that can activate unittesting helpers.
- the logger switches to DEBUG mode now if debug is enabled.

25.6 Version 0.3.1

Bugfix release, released on May 28th 2010

- fixed a error reporting bug with `flask.Config.from_envvar()`
- removed some unused code from flask
- release does no longer include development leftover files (.git folder for themes, built documentation in zip and pdf file and some .pyc files)

25.7 Version 0.3

Released on May 28th 2010, codename Schnaps

- added support for categories for flashed messages.
- the application now configures a `logging.Handler` and will log request handling exceptions to that logger when not in debug mode. This makes it possible to receive mails on server errors for example.
- added support for context binding that does not require the use of the with statement for playing in the console.
- the request context is now available within the with statement making it possible to further push the request context or pop it.
- added support for configurations.

25.8 Version 0.2

Released on May 12th 2010, codename Jrmeister

- various bugfixes
- integrated JSON support
- added `get_template_attribute()` helper function.

- `add_url_rule()` can now also register a view function.
- refactored internal request dispatching.
- server listens on 127.0.0.1 by default now to fix issues with chrome.
- added external URL support.
- added support for `send_file()`
- module support and internal request handling refactoring to better support pluggable applications.
- sessions can be set to be permanent now on a per-session basis.
- better error reporting on missing secret keys.
- added support for Google Appengine.

25.9 Version 0.1

First public preview release.

CHAPTER

TWENTYSIX

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