Web Programming

Server-side programming II.

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Server-side programming

- Part I. handling requests
- Part II. templating
- Part III. MySQL
- Part IV. cookies and sessions

Motivation

- We need to respond to incoming requests by returning HTML content
- Normally, it would mean a lot of print statements and hard-coded strings in Python code

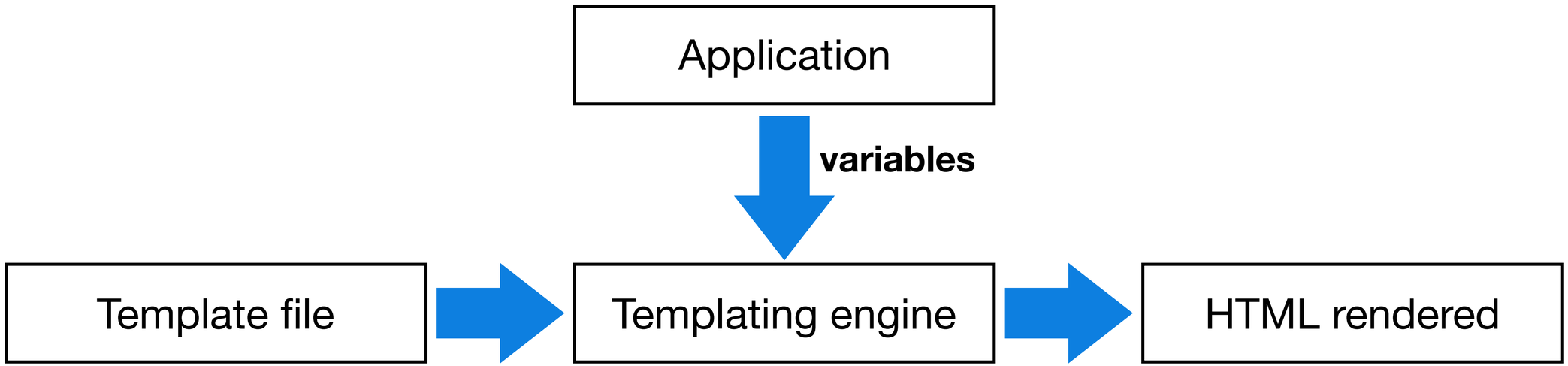
```
HTML_FRAME_TOP = "<!DOCTYPE HTML>\n<html>\n<head>\n<title>My site</title>\n" \
                 "<link rel=\"stylesheet\" href=\"{css}\"/>\n</head>\n<body>\n"
HTML_FRAME_BOTTOM = "</body>\n</html>\n"

@app.route("/")
def index():
    html = HTML_FRAME_TOP.replace("{css}", url_for("static", filename="style.css"))
    html += "<h1>Hello world</h1>"
    html += HTML_FRAME_BOTTOM
    return html
```

Motivation (2)

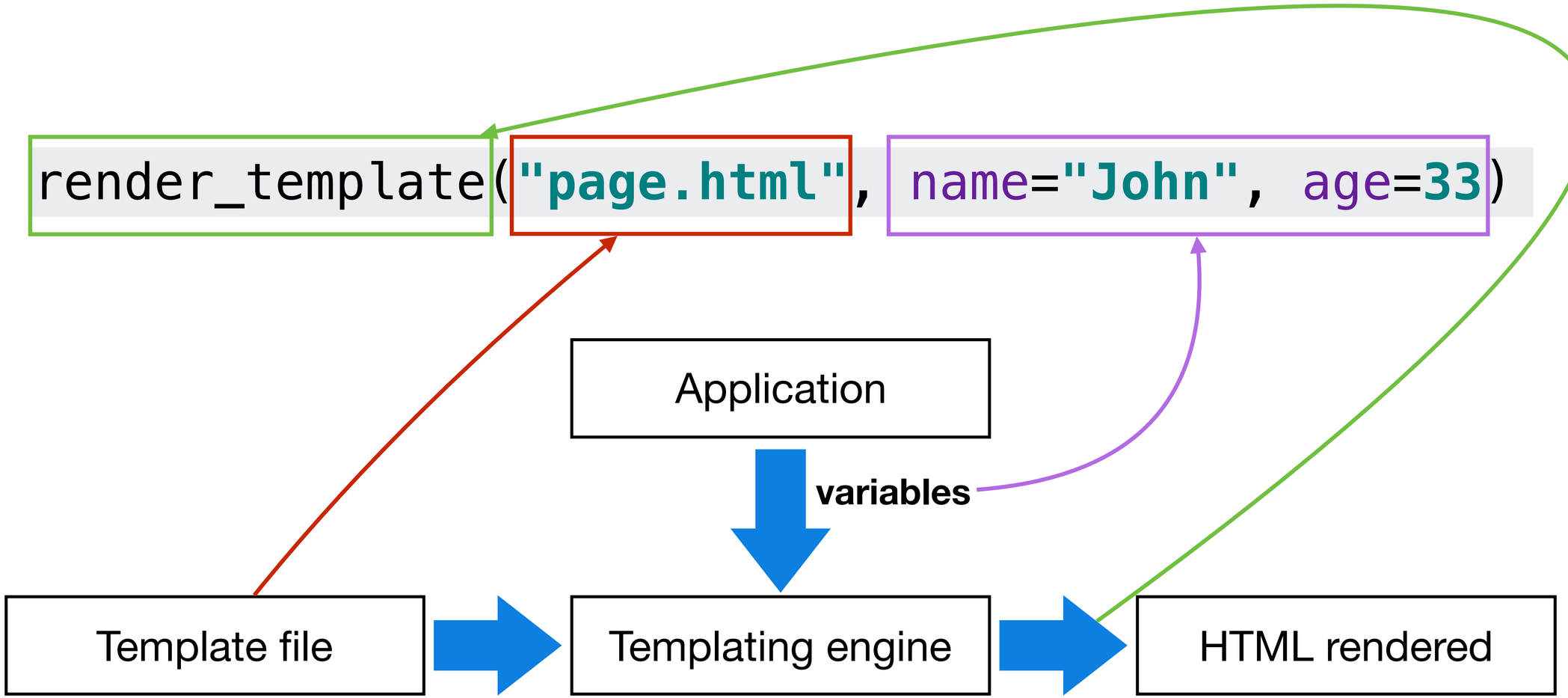
- Instead: separate business logic from presentation
  - Programmers and designers/site builders can work on the same page at once
  - The design can be changed without touching the code
- Idea: make HTML documents and add markup to identify areas that should be replaced

Templating

- A template is a HTML file that contains **variables** and **expressions**, which get replaced with values when the template is rendered



Templating


render_template("page.html", name="John", age=33)
Application
variables
Template file
Templating engine
HTML rendered

Jinja2

- Full-featured template engine for Python
- Documentation: http://jinja.pocoo.org/docs/2.10/templates/

Example

app.py

```
@app.route("/test")
def test():
    return render_template("page.html", value="123")
```

templates/page.html

```
…
<p>Value given {{ value }}</p>
…
```

HTML rendered

http://127.0.0.1:5000/test

```
…
<p>Value given 123</p>
…
```

Templating

- A template is a HTML file that contains **variables** and **expressions**, which get replaced with values when the template is rendered
- **`{{ … }}`** expressions (variables)
- **`{% … %}`** statements (for, if, include, …)
- **`{# … #}`** comments

Expressions

- Variables

```
{{ value }}
```

- You can calculate with values

```
{{ value * 2 }}
```

- Use logic statements to combine multiple expressions

```
{{ "even" if value % 2 == 0 else "odd" }}
```

Filters

- Variables can be modified by **filters**
  - Filters are separated by the variable by a pipe symbol | and may have optional parameters **`{{ var|filter }}`**
  - Filters may be chained **`{{ var|filter1|filter2(params) }}`**

Filters (2)

- There is a risk that a variable will include characters that affect the resulting HTML. Content **escaping** is needed.
- Automatic escaping (default in Flask)
  - Everything is escaped automatically, except for values that are explicitly marked as safe

```
{{ my_variable|safe }}
```

- Manual escaping
  - Convert < > & “ etc. characters to HTML-safe sequences

```
{{ my_variable|e }}
```

  - Remove HTML tags

```
{{ my_variable|striptags }}
```

Filters (3)

- Provide default value if the variable is undefined

```
{{ my_variable|default('my_variable is not defined') }}
```

- Convert the value to lower/uppercase

```
{{ my_variable|lower }}
```

```
{{ my_variable|upper }}
```

- Truncate string at a specified length

```
{{ my_variable|truncate(9) }}
```

- Turn URL string into a clickable link

```
{{ my_url|urlize }}
```

Filters (4)

- Replace occurrences of substrings

```
{{ my_variable|replace("john", "nicole") }}
```

- Round a number to a given precision

```
{{ my_variable|round }}
```

- Sum a sequence of numbers
  - also possible to sum only certain attributes

```
Total: {{ items|sum(attribute='price') }}
```

- See the full list here: http://jinja.pocoo.org/docs/2.9/templates/#builtin-filters

Statements: for loop

app.py

```
@app.route("/test")
def test():
    return render_template("page.html", users=["john", "liza", "mary"])
```

templates/page.html

```
<h1>Members</h1>
<ul>
{% for user in users %}
  <li>{{ user }}</li>
{% endfor %}
</ul>
```

Statements: for loop

- Special variables that are accessible inside a for loop
  - **`loop.index`** — current iteration (indexed from 1)
  - **`loop.index0`** — current iteration (indexed from 0)
  - **`loop.first`** — true if first iteration
  - **`loop.last`** — true if last iteration
  - **`loop.length`** — number of items in the sequence
  - **`loop.cycle`** — helper function to cycle between a list of sequences

```
{% for row in rows %}
    <li class="{{ loop.cycle('odd', 'even') }}">{{ row }}</li>
{% endfor %}
```

Empty sequences

- A default block can be rendered for empty sequences (when no iteration takes place) using **`{% else %}`**

```
<ul>
{% for user in users %}
    <li>{{ user.username|e }}</li>
{% else %}
    <li><em>no users found</em></li>
{% endfor %}
</ul>
```

Statements: if

app.py

```
@app.route("/test")
def test():
    return render_template("page.html", kenny={"sick": False, "dead": False})
```

templates/page.html

```
{% if kenny.sick %}
    Kenny is sick.
{% elif kenny.dead %}
    You killed Kenny!
{% else %}
    Kenny looks okay — so far
{% endif %}
```

Statements: if

- Check if variable is defined

```
{% if amount is defined %}
  Do something with {{ amount }}
{% else %}
  …
{% endif %}
```

Exercises #1-#3

github.com/dat310-spring20/course-info/tree/master/
exercises/python/flask2

Avoid repetitive content

- **`{% include "filename.html" %}`** includes the contents of the given file

```
{% include "header.html" %}
    Body
{% include "footer.html" %}
```

Template inheritance

- A **base** “skeleton” **template** contains all the common elements of the site and defines **blocks** that child templates can override

app.py

```
@app.route("/")
def index():
    return render_template(“index.html")
```

templates/index.html

```
{% extends "base.html" %}

{% block content %}
    <h1>Index</h1>
    <p class="important">
      Welcome to my awesome homepage.
    </p>
{% endblock %}
```

templates/base.html

```
<!DOCTYPE html>
<html>
<head> […] </head>
<body>

<div id="content">{% block content %}
default content{% endblock %}</div>

</body>
</html>
```

Template inheritance

- A **base** “skeleton” **template** contains all the common elements of the site and defines **blocks** that child templates can override

app.py

```
@app.route("/")
def
```

The **{% extends %}** tag tells the template engine that this template “extends” another template. This should be the first tag in the template!

templates/

```
{% extends "base.html" %}

{% block content %}
    <h1>Index</h1>
    <p class="important">
      Welcome to my awesome homepage.
    </p>
{% endblock %}
```

templates/base.html

```
<!DOCTYPE html>
<html>
<head> […] </head>
<body>

<div id="content">{% block content %}
default content{% endblock %}</div>

</body>
</html>
```

Exercises #4, #4b

github.com/dat310-spring20/course-info/tree/master/
exercises/python/flask2