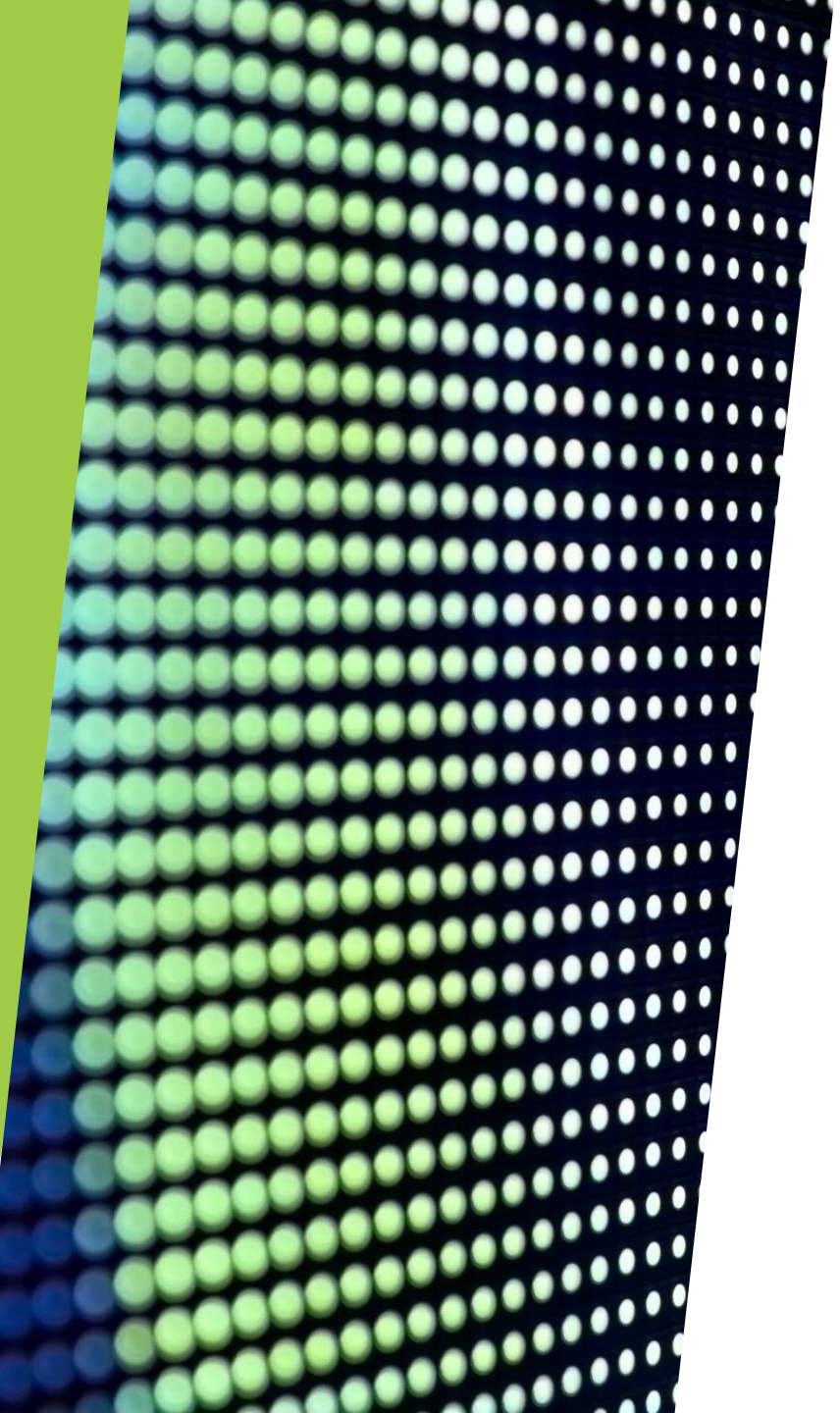

Dynamic Web Sites

COMP 8347

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Dynamic Web Sites

Topics

- Static vs. Dynamic Websites
- HTTP
- HTML
- MVC
- MTV (Django)

Client Server Model

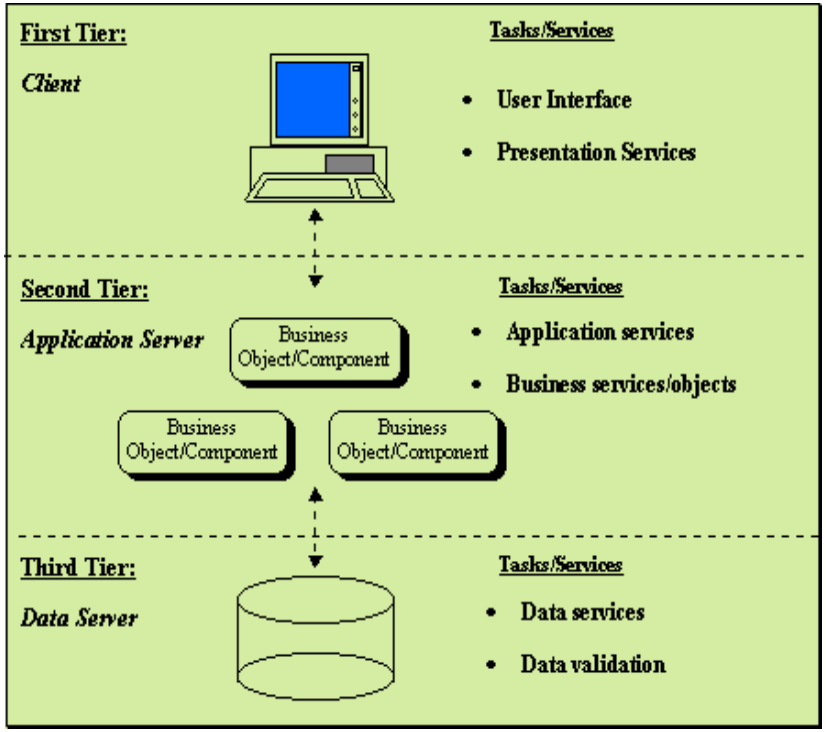


*Fig. taken from [1]

User requests document from the Web server.

Web server fetches and/or generates the necessary document.

The result is returned to the user's browser.

The browser renders the document.

Static vs. Dynamic Web Pages

- *Static web page*: requests to the same URL always return the same information.
  - Content consists of HTML text files stored on the server.
  - URL typically does not contain parameters; simply a ‘path’
  - Primarily informational
  - HTML + CSS + JS
  - Server does not generate dynamic content but perform the hosting
  - Static does not mean the content cannot be changed – JS running in the browser can still change the content
  - Examples: Resume or personal websites

Static vs. Dynamic Web Pages

- *Dynamic web page*: Data returned by a given URL can vary significantly.
  - Generates content and displays it based on actions the users make on the page
  - Functional and informational
  - HTML/XML + some server-side language like PHP or Node JS
  - Server generates dynamic HTML pages on runtime
  - Pages can still be rendered later at browser
  - Examples: Location-based sites, all others ex. Instagram

Static vs. Dynamic Web Pages

Advantages and Disadvantages

- **Static:**

  +Easy creation

  +Easy and faster loading

  +Easy security of static content

  -No flexibility

  -Difficult to manage

- **Dynamic:**

  +Easy maintenance/update

  +Better user experience

  +Greater functionality

  -Performance issues due to large number of instructions

  -Needs more resources

HTTP

- *HTTP*: Hyper-Text Transfer Protocol
  - Encapsulates the process of serving web pages
  - Protocol for client-server communication
  - Current version is HTTP/3.
  - ***A network protocol*:** defines rules and conventions for communication between network devices.
- HTTP is stateless
  - Server maintains no information on past client requests.

HTTP

Application layer protocol

- Client sends request
- Server responds with reply
- Other application layer protocols are FTP, SMTP, POP etc.

Almost always run over TCP

- Uses ‘well known’ port 80 (443 secure)
- Can support multiple request-reply exchanges over a single connection

Uniform Resources Locators

- In the Web, functionality of pointers is provided by Uniform Resource Locators (URLs).
- URL example:

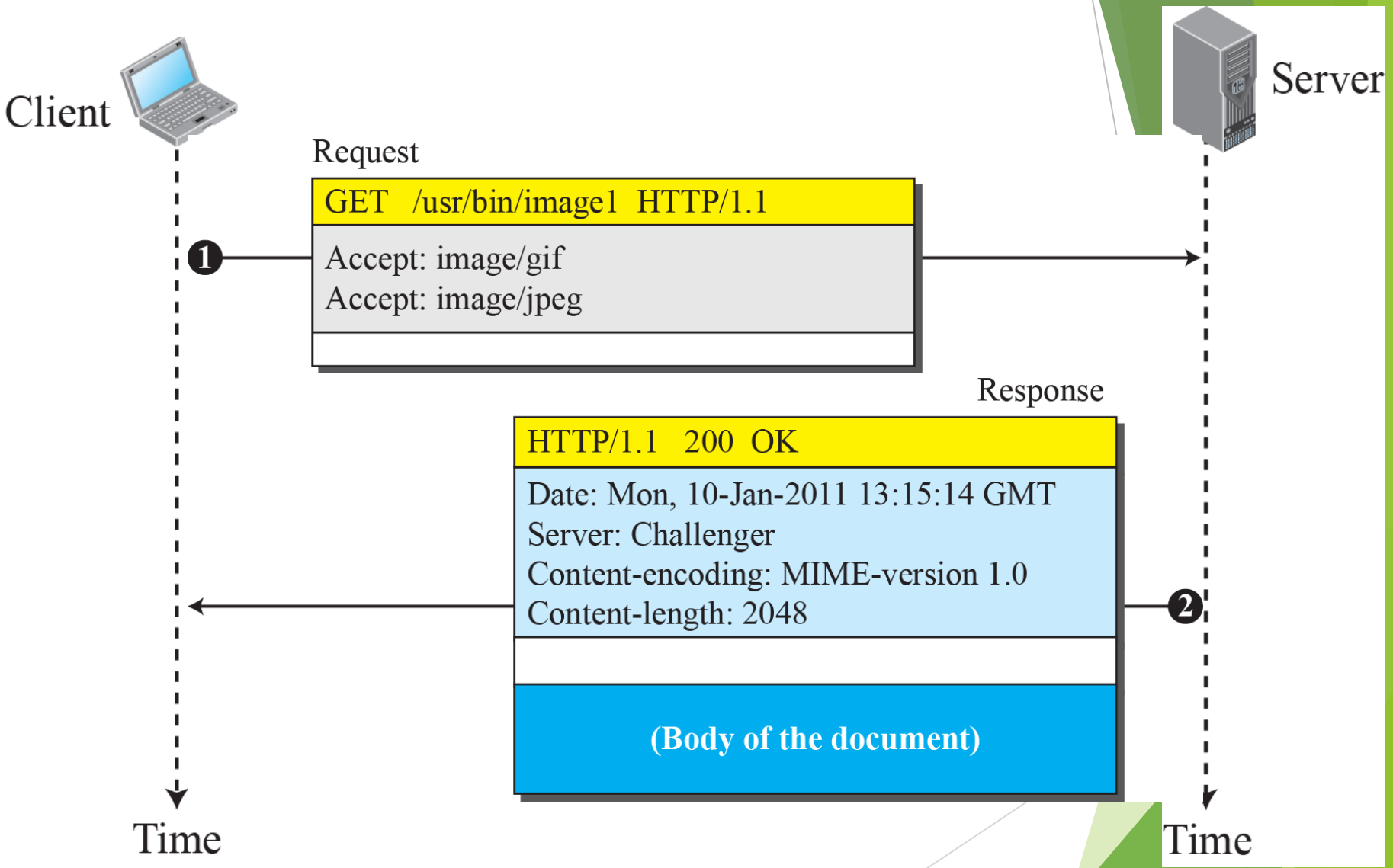
  http://www.acm.org/sigmod

  - The first part indicates how the document is to be accessed
    - "http" indicates that the document is to be accessed using the Hyper Text Transfer Protocol.
  - The second part gives the unique name of a machine on the Internet.
  - The rest of the URL identifies the document within the machine.
- The local identification can be:
  - The path name of a file on the machine, or
  - An identifier (path name) of a program, plus arguments to be passed to the program
    - E.g., http://www.google.com/search?q=silberschatz

HTTP Methods

- GET: Used to retrieve information from the given server using a given URI.
  - should only retrieve data and should have no other effect on the data.
- POST: Used to send data to the server, e.g. customer info, using HTML forms.
- Other methods: PUT, DELETE, TRACE etc

HTTP Requests



HTTP Responses

- Status-Line = HTTP-Version SP Status-Code SP Reason-Phrase CRLF

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
Content-Encoding: MIME- version 1.0
Content-Length: 88
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

Status Codes

- **1xx: Informational**: request received and continuing process.
  - Ex. 102 Processing
- **2xx: Success**: action was successfully received, understood, and accepted.
  - Ex. 200 OK
- **3xx: Redirection**: further action must be taken in order to complete the request.
  - Ex. 307 Temporary redirect

Status Codes

- **4xx: Client Error**: request contains bad syntax or cannot be fulfilled
  - Ex.
  - 403 Forbidden
  - 404 Not Found
- **5xx: Server Error**: server failed to fulfill an apparently valid request
  - Ex. 505 HTTP Version Not Supported

What Is HTML?

- HTML is a markup language used to describe webpages.
  - HTML stands for HyperText Markup Language. When a web browser displays a webpage:
    - it is reading and interpreting an HTML document.
  - Used for structuring and presenting content on the World Wide Web.
  - Some related standards include CSS3

Basic Structure

- *DOCTYPE*: Tells browsers *how* to read your document.
  - Forces browsers to use ‘standard mode’.
  - Using standard mode, most browsers will read your document the same way.
- *<head>*: Contains information about your page.
- *<body>*: The actual content of your page.

```
<!DOCTYPE html>
<html>
  <head>
        <title>My first Webpage</title>
  </head>
  <body>
        <h1>This is a Heading</h1>
<p>Hello World!</p>
  </body>
</html>
```

Elements

- HTML elements are marked up using start tags and end tags.
  - Tags are delimited using angle brackets with the tag name in between.
    - End tags include a slash before the tag name.
    - Some elements require only a single tag, e.g. <img>
  - HTML tag names are case insensitive.
    - Recommended: use lowercase.
  - Most elements contain some content
    - e.g. ...
  - Elements may contain attributes
    - Used to set various properties of an element.

Attributes

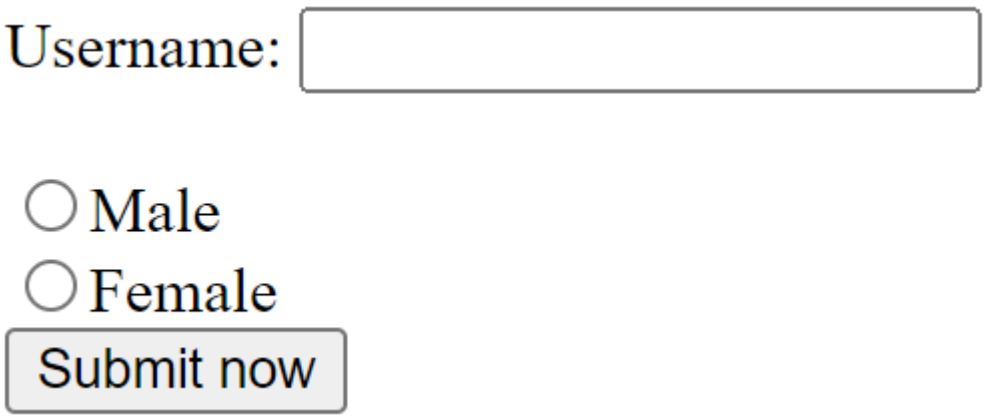
- Attributes: provide additional information about the specific element
  - Always specified in the opening tag.
  - The pattern for writing attributes: attribute="value".
  - Examples:
    - <img src="my-pic.jpg" alt="This is a picture ">
    - ... .
    - This is a link

HTML Forms

- HTML forms are used to collect user input.
  - The **<form>** tag is used to create an HTML form.
  - HTML forms contain **form elements**.
  - The **<input>** element is the most important **form element**.
    - has many variations, depending on the **type** attribute.
    - *Text* Defines normal text input
      - Default width is 20 characters.
    - *Radio* Defines radio button input (for selecting one of many choices)
    - *Submit* Defines a submit button (for submitting the form)
    - Other elements: Reset button, checkbox. dropdown list, time, date, file, image, month, and so on.

HTML Forms - Example

```
<form action="/url_for_processing/" method="post" >
<label for="uname">Username:</label>
<input type="text" name="uname"><br><br>
<input type="radio" name="gender" value="male" >Male<br>
<input type="radio" name="gender" value="female" >Female<br>
<input type="submit" value="Submit now" >
</form>
```



https://www.w3schools.com/tags/tryit.asp?filename=tryhtml_input_value

Web Framework

- *Web framework*: a software framework designed to support development of dynamic websites and services.
  - Alleviate overhead with associated activities
- Frameworks standardize the 'boilerplate' parts.
  - Provide pre-built components so you can focus on unique parts of your project.
  - Repetitive parts handled by framework.
  - Code you use will be well tested, and have less bugs than what you write from scratch.
  - Enforce good development practices.
  - Security features (login, sessions etc) often better implemented in frameworks.
- Limitations:
  - May restrict you in terms of coding paradigms.
  - Steep learning curve.

Different Frameworks

- Many different frameworks are available:
  - ASP.NET using C#, Struts in J2EE, Ruby on Rails, other frameworks using PHP, flask, node js, react, etc
- Django is a high-level Python Web framework
  - Encourages rapid development and clean, pragmatic design.
  - Build high-performing, elegant Web applications quickly.
  - Adhere to DRY (Don't Repeat Yourself) principle.

Django Framework

Web framework for perfectionists with deadlines

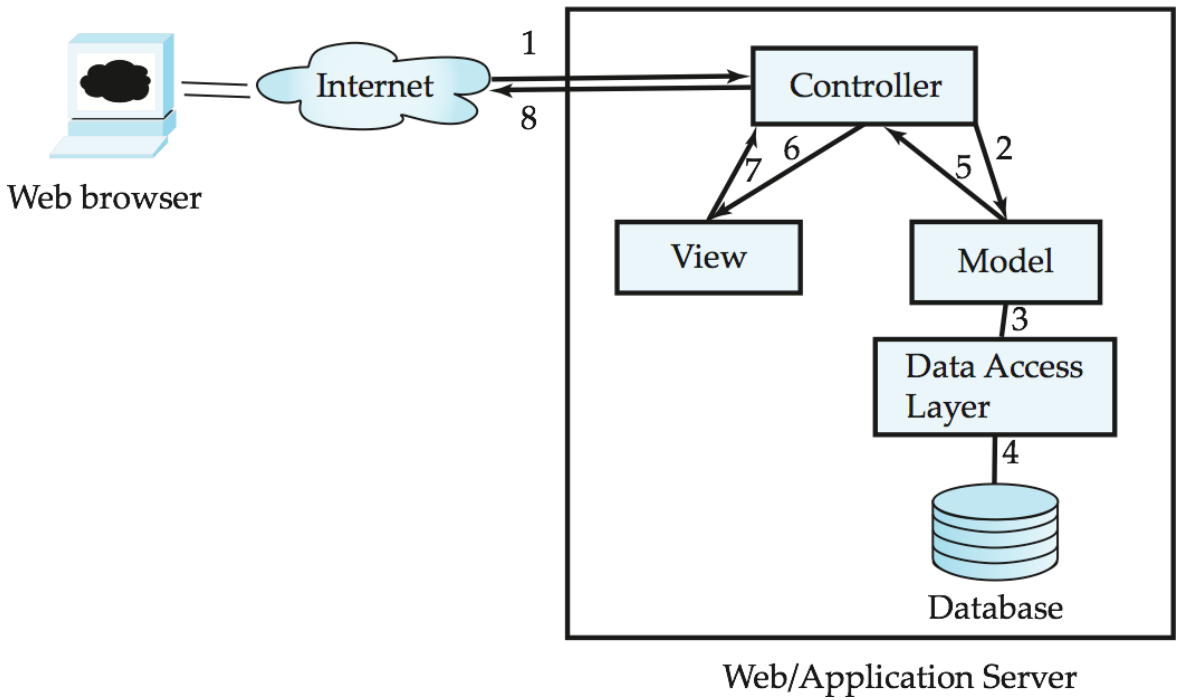
- Main focus
  - Dynamic and database driven websites
- DRY
- Rapid development
- Follow best practices
- Free
- Easy to learn
- Powerful object-relational mapper (ORM)
  - Data models defined entirely in Python
- Automatic admin interface
  - Eliminates tedious work of creating interfaces to add and update content.
- Elegant URL design
  - Flexible URLs

Sites Using Django

- Youtube
- Instagram
- Spotify
- Mozilla Firefox
- National Geographic
- Pinterest

MVC

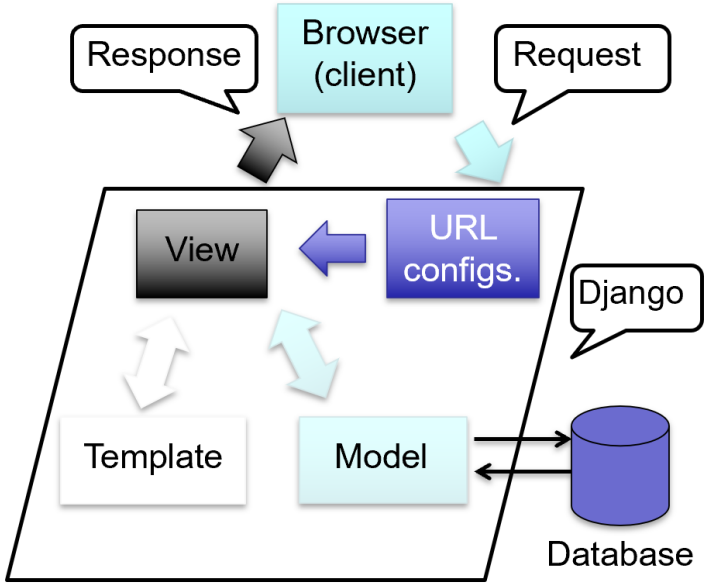
- **Model-View-Controller (MVC)** architecture
  - **model**: business logic
  - **view**: presentation of data, depends on display device
  - **controller**: receives events, executes actions, and returns a view to the user
  - **business-logic** layer
  - **data access** layer
    - interfaces between business logic layer and the underlying database
    - provides mapping from object model of business layer to relational model of database



Application Architecture

Django's MTV Architecture

- MVC → MTV
- *Model*:
  - Deals with data representation/access.
- *Template*:
  - Describes **how** data is represented.
  - Same as 'view' in MVC
- *View*:
  - Describes **which** data is presented.
  - Same as 'controller' in MVC.



Project Directory

Create a new Django project:

outer mysite/
- container for project; can be renamed.

manage.py
- command-line utility to interact with your project.

inner mysite/
- actual python package for project

__init.py__
- empty file, indicates this dir is a package

settings.py
- settings/configuration for the project

urls.py
- URL declarations for the project

wsgi.py
- entry-point for WSGI-compatible web servers to serve your project

Settings

- Settings.py: Python module with variables for Django settings.
  - update DATABASES ‘default’ item
  - ‘ENGINE’ : 'django.db.backends.sqlite3‘
    - 'django.db.backends.postgresql_psycopg2',
    - ‘django.db.backends.mysql', or
    - 'django.db.backends.oracle‘
- By default, following apps are installed
  - django.contrib.admin – The admin site.
  - django.contrib.auth – An authentication system.
  - django.contrib.contenttypes – A framework for content types.
  - django.contrib.sessions – A session framework.
  - django.contrib.messages – A messaging framework.
  - django.contrib.staticfiles – A framework for managing static files.

References

[1] http://edn.embarcadero.com/article/10343

[2] www.tutorialspoint.com/http/

[3] Python web development with Django by Jeff Forcier, Paul Bissex and Wesley Chun. Addison Wesley 2009.

[4] https://flatworldbusiness.wordpress.com/flat-education/previously/web-1-0-vs-web-2-0-vs-web-3-0-a-bird-eye-on-the-definition/

[5] Database Systems Concepts, 6th Edition

[6] Data Communications and Networking, 5th Edition

[7] https://www.w3schools.com/html/default.asp

[8] https://techvidvan.com/tutorials/django-project-structure-layout/

[9] https://www.w3schools.com/html/html_forms.asp

[10] Lectures from Dr. Arunita and Dr. Saja

Extra Slides for Lab 3

Extra Slides for the Lab: Field Type – Textual Data

Field	Example Values
CharField	"Product Name"
TextField	"To elaborate on my point…"
EmailField	george@site.com
URLField	www.example.com

Extra Slides for the Lab: Field Type – Numeric and Miscellaneous Data

Field	Example Values
IntegerField	-1, 0, 1, 20
DecimalField	0.5, 3.14

Field	Example Values
BooleanField	True, False
DateTimeField	datetime(1960, 1, 1, 8, 0, 0)

Extra Slides for the Lab: Field Type – Null, Blank, and Many to Many

null

If **True**, Django will store empty values as **NULL** in the database. Default is **False**.

blank

If **True**, the field is allowed to be blank. Default is **False**.

```
models.CharField(max_length=10, blank=True)
```

- For Many to Many relationships, visit:

https://docs.djangoproject.com/en/4.1/topics/db/examples/many_to_one/