

Web Frameworks

CSC 342 - Web Technologies

Software Frameworks

- A *framework* provides generic functionality that can be selectively changed by additional user-written code
- Characteristics of frameworks:
 - *Inversion of control*: the control flow of the program is dictated by the framework, not the caller
 - *Extensibility*: the user can add code to provide specific functionality
 - *Non-modifiable framework code*: the framework code is not intended to be modified but accepts user-implemented extensions

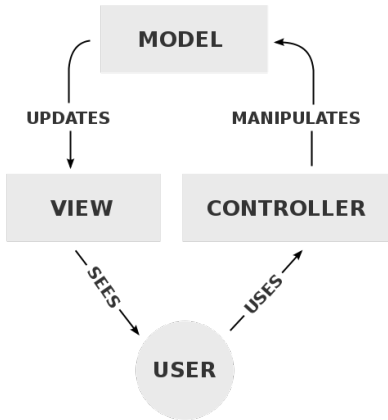
Web Frameworks

- A *web framework* is a software framework designed to support the development of web applications including web services, web resources, and web APIs
- Types of web framework architectures:
 - Model-view-controller (MVC)
 - Three-tier organization

Model-View-Controller (MVC)

- The MVC architecture divides a given application into three interconnected parts in order to separate concerns:
 - *Model*: manages the data, logic, and rules of the application
 - *View*: is an output representation of the information
 - *Controller*: accepts input and converts it to commands for the model or view
- Types of MVC architectures:
 - *Push-based*: use actions that do processing and then “push” the data to the view layer
 - *Pull-based*: the view layer can “pull” data from multiple controllers as needed

Model-View-Controller (MVC)



Three-tier architecture

- The *three-tier architecture* is a client-server software pattern divides the application into independent layers:
 - *Presentation tier*: displays information to the user
 - *Application tier*: controls the application's functionality
 - *Data tier*: provides data persistence mechanisms and a data access layer with an API for the application tier

Features of Web Frameworks

- Web template system
- Caching
- Security
- Database access, mapping and configuration
- Scaffolding
- URL Mapping
- Ajax
- Web services
- Web resources

Web Template System

- A *web template system* uses a template processor to combine web templates to form finished web pages
- A web template system is composed of the following components:
 - *Template engine*: the processing component
 - *Content resource*: the input streams
 - *Template resource*: the template specified according to a template language
- Web template systems are used to separate the business logic from the presentation logic

Kinds of Web Template Systems

- Template systems are classified based on when the assembly happens:
 - *Server-side*: run-time substitution happens on the web server
 - *Client-side*: run-time substitution happens in the web browser
 - *Edge-side*: run-time substitution happens on a proxy between the web server and browser
 - *Outside server*: static web pages are produced offline and uploaded to the server
 - *Distributed*: run-time substitution happens on multiple servers

Web Cache

- A *web cache* is a technology used for temporarily storing web documents to reduce bandwidth usage and server load
- HTTP provides three mechanisms for controlling caches:
 - *Freshness*: allows a response to be used without re-checking on the origin server
 - *Validation*: can be used to check whether a cached response is still good after it becomes stale
 - *Invalidation*: cached responses can be invalidated as a side effect of another request, such as a POST, PUT, or DELETE request

Security

- Some web frameworks provide functionality for authentication and authorization that enable the web server to identify users of the application and restrict access to functionality based on some defined criteria

Data Access, Mapping and Configuration

- Many web frameworks provide a unified API to a database backend enabling a web application to work with a variety of databases
- Web frameworks in object oriented languages typically provide an object-relational mapping (ORM) the maps objects to tuples

Scaffolding

- Scaffolding is a technique used in some MVC frameworks in which the programmer can specify how the application database may be used
- The specification, along with pre-defined code templates, is used to generate the code that the application can use to perform CRUD operations

URL Mapping

- The URL Mapping or routing facility is the mechanism by which the framework interprets URLs
- In MVC frameworks the URL mapping system routes a URL to the appropriate controller
- URL mapping systems can interpret URLs in different ways:
 - *Pattern matching*: match the provided URL against predetermined patterns using regular expressions
 - *Rewriting techniques*: translate the URL into a form that the underlying engine will recognize
 - *Graph traversal*: decompose the URL in steps that traverse an object graph of models and views