Programming Paradigms, Software Architectural Patterns, and MVC
A *paradigm* can be defined as a set of assumptions, concepts, values, and practices that constitutes a way of viewing reality for the community that shares them, especially in an intellectual discipline.

A *programming paradigm* is often associated with a particular programming language.

- The choice of the language often dictates the paradigm, and vice-versa.
Notable Programming Paradigms

**Functional Programming** (1930s to present): all about the evaluation of mathematical functions. Avoids state changes and mutable data.

**Imperative Programming** (1950s to 1970s): defines computation as statements that change a program state.

**Procedural Programming** focused on *procedures*, also known as “routines”, “subroutines” and “functions”.

**Structured Programming** focused on making programs easier to write, debug, and understand.
Notable Programming Paradigms (cont.)

Declarative Programming defines computational logic without defining its control flow.

Object-Oriented Programming organizes programs as objects: data structures with attributes and methods together with their interactions.

In Automata-Based Programming, a program, or part of a program, is treated as a model of a finite state machine or similar formal automaton.
Event-Driven Programming

In Event-Driven Programming, control flow is determined by events, such as input from sensors or user actions (mouse clicks, key presses, etc.) or messages from other programs or threads.

- The notion is that the application sits, waiting for input from the user — which can come from many directions.

- Event-driven programming is the dominant paradigm for graphical user interfaces and other applications that are centered on performing certain actions in response to user input.
Software Architectural Patterns are reusable approaches or solutions to problems in software design that show up frequently.

- They act like templates on which you base your software.
- Software architectural patterns are conceptual, such as “peer-to-peer networking”.
- Software architectures are actual implementations of a pattern, such as TCP/IP.
Model-View-Controller (MVC) is a software architectural pattern for implementing user interfaces.

- It follows the event-driven paradigm for control flow.
- It divides an application into three interconnected parts in order to separate internal structures from the way they’re presented to the user.

**Model**

- Consists of objects that encapsulate the data specific to the application
- Defines the logic and computations that manipulate and process that data.
**SW Architectural Pattern: Model-View-Controller**

**View**
- Any object in an application that users can see. Main purpose: to display data from the model objects and enable editing of that data.
- View objects know how to draw themselves, and can respond to user actions.
- Provide consistency between applications.
- Multiple views of the same information is possible; for example, a bar chart for management and a table view for finance.

**Controller**
- Acts as an intermediary between view objects and model objects.
- Accepts input and converts it to commands for the model or view.
- Can also perform setup and coordinating tasks for an application and manage the life cycles of objects.
Controller:

- Interprets user actions made in view objects and communicates changes to the model to update the model’s state.
- When model objects change, controller communicates changes to the view to change the view’s presentation.
Model:

- Tells the View when there has been a state change, causing the output from the View to be updated.
- Tells the Controller when there has been a state change, causing the Controller to change the set of commands available.
View:

- Requests information from the model that it uses to generate output to the user
Note that the user never interacts directly with the model.
Model-View-Controller (cont.)

Model-View-Controller is often used in Web applications and Mobile applications.

- The View presents a window with controls to the user.
- Any data that the user enters is sent to the Controller; for example, selecting an item such as “Notifications”.
- The Controller updates the Model (i.e., stores the data in a data structure, updates objects, etc.).
- The Model tells the View to display a different window.
- The Model also tells the Controller that the controls from the previous window no longer work, and there are new ones to pay attention to.