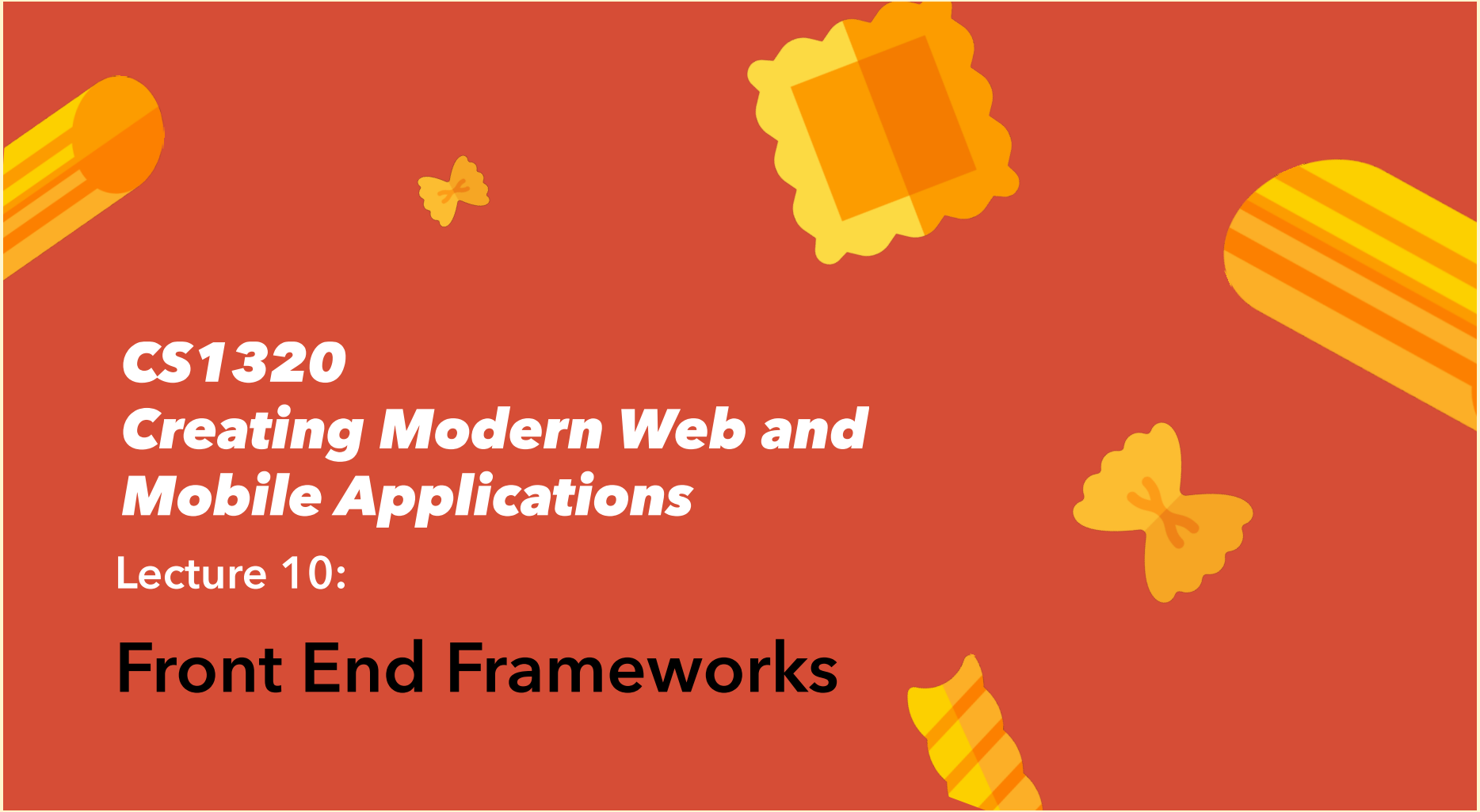


CS1320
Creating Modern Web and Mobile Applications

Lecture 10:

Front End Frameworks

Frameworks

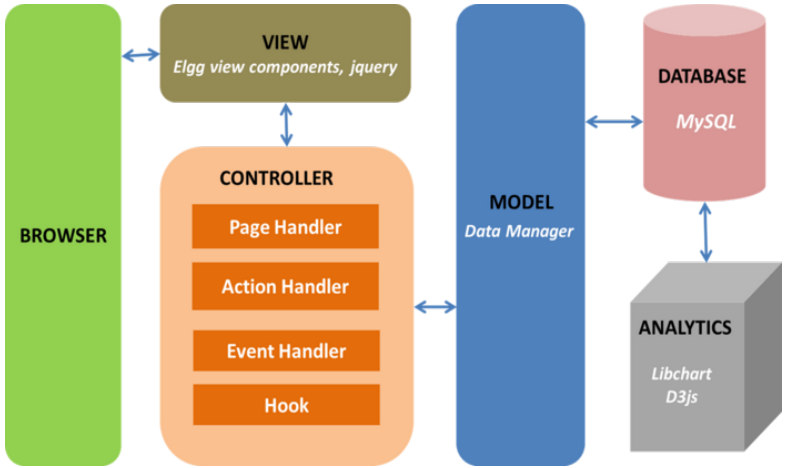
- Web applications are a lot of wo
  - Much of it is busy work
- Routine chores and programmin
  - Administration
  - URL -> command mapping
  - Preparing HTML pages from data
  - Data structure mapping
- Frameworks try to simplify this
  - And a new one is developed every week

Frameworks

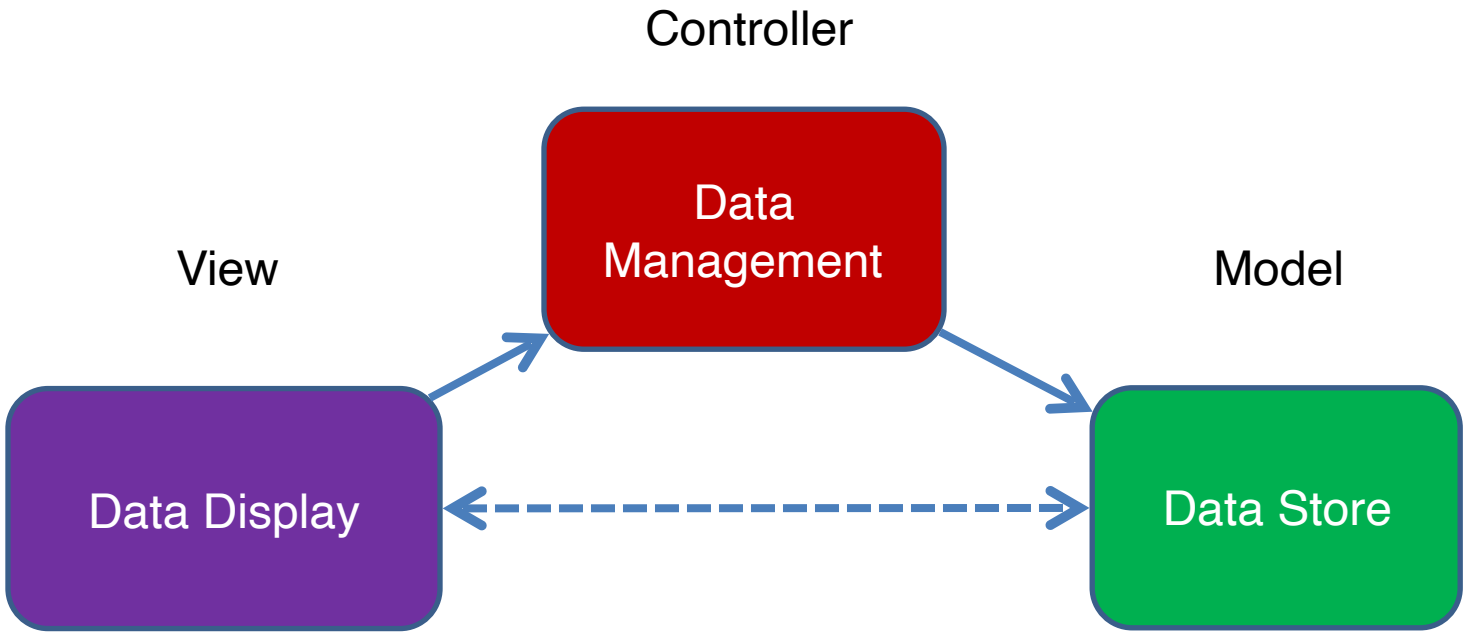
- Front End Frameworks
  - Provide common facilities in the front end
  - Simplify coding the front end
  - VUE, React, Angular
- Back End Frameworks
  - Provide common facilities in the back end
  - Express, Flask, Django, …
- Complete Frameworks
  - Provide integrated facilities for both the front and back end
  - Content management systems
- Mobile Frameworks
  - Provide common facilities for mobile front ends

Frameworks

- Most frameworks are based on a Model-View-Controller architecture
- Separation of Concerns
  - Presentation and contents: html and css
  - Data and display: MVC
  - Structure and application specifics

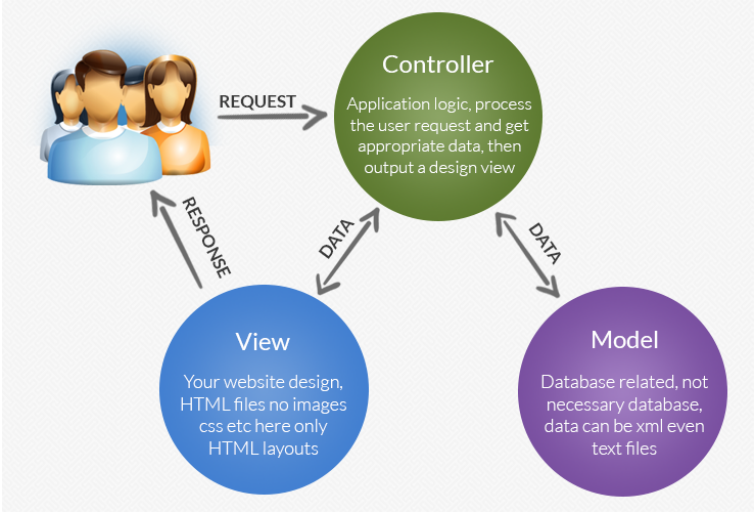


Model-View-Controller

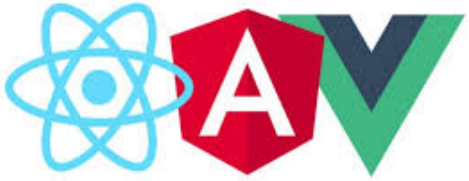


Model-View-Controller

- Basic idea is to separate the display, the data, and the logic
  - Each can be change independent of the others
- Exactly how this is done various from case to case
  - Some do it with a common data abstraction
  - Some do it with callbacks
  - Some automate the controller: MVVM
  - All call themselves MVC
- Different people mean different thi



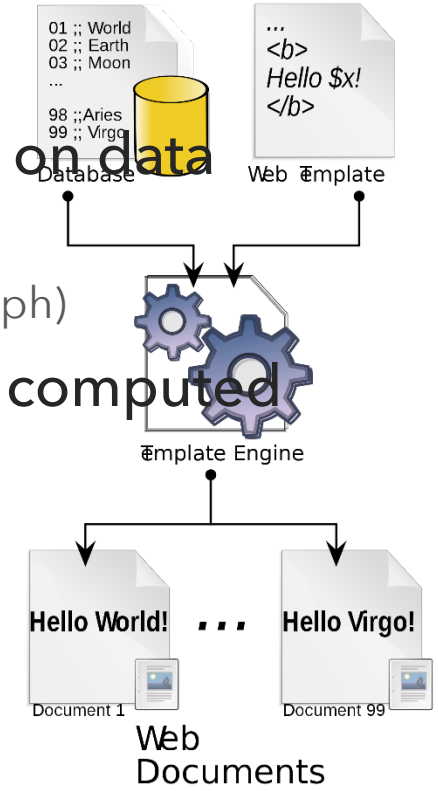
Front End Frameworks



- What are the problems with JavaScript in the front end
  - Need to modify the DOM as the data changes
  - Need to create new HTML/CSS as the data changes
  - Need to change the data as the HTML changes (user inputs)
- Where is the messy, repetitive work
  - Creating the same HTML over and over for new dat
  - Updating the HTML as the data changes
- How can this be simplified

Templating or Scripting

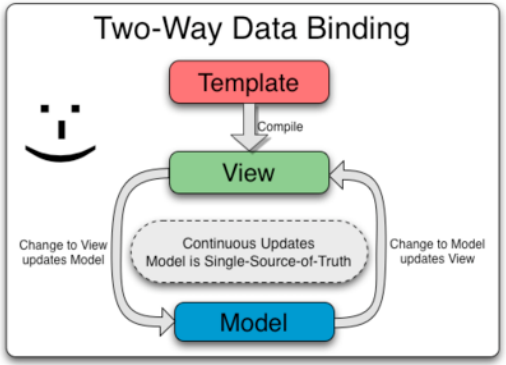
- The content of a dynamic web page will depend on data
  - The results of a search, the set of relevant items
  - How something is displayed may depend on its value (bar graph)
- Want to generate (and modify) a page based on computed values
  - Values might be computed in the front end
  - Values might be passed from the back end to the front end
  - Values might be computed in the back end
- Templating does a lot of this for you



Back End Templating

- The back end needs to generate HTML files
  - These often depend on data
- Templates are html files that are expanded based on data
  - Can use data to replace values
  - Can iterate over data to generate html for each instance
  - Can generate different html based on the data values
- Very convenient way of generating complex data-based pages
- We'll get back to this as we cover the back end
  - Moustache (handlebars)

Front End Templating

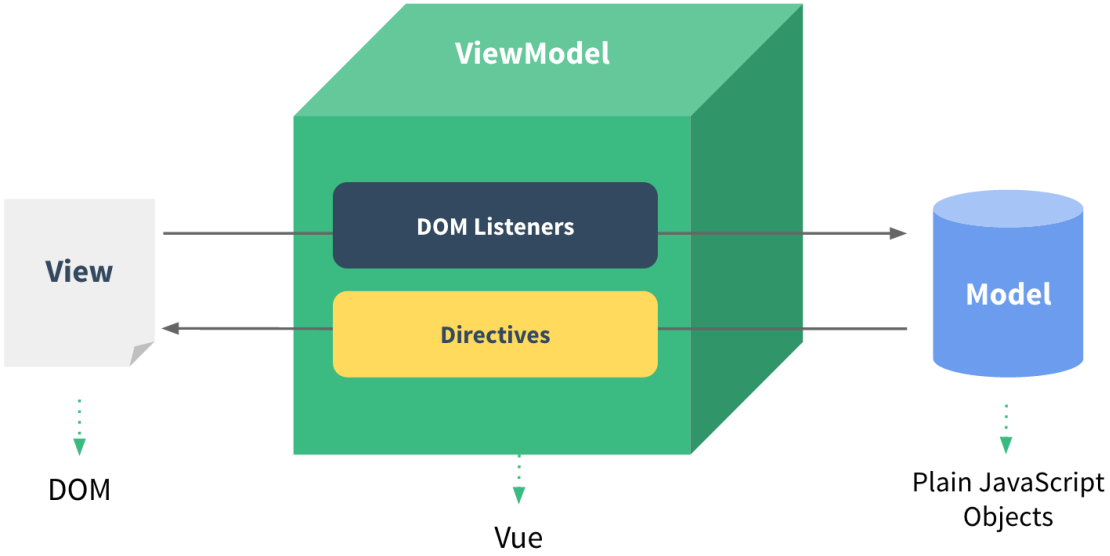


- We can do the same thing in the front en
  - Values might change based on user input
  - New or changed values might be obtained from the back end
  - In either case we want to update the current page (DOM) accordingly
- Different approaches to this
  - REACT – programming model that generates HTML
  - Angular – HTML with inserts that are replaced & templating constructs
  - VUE – HTML with inserts that are replaced & templating constructs

VUE

- HTML-centric framework
- Simple approach to inserting data values into HTML dynamically
- MVVM model to handle automatic updates to the DOM as values change
- Notion of components to allow easier creation of complex HTML
  - Component is a DOM tree structure that can be filled in
  - Language for creating these (requires a preprocessor)
- Extensions for animation, mixins, routing, …
  - It can do a lot, but basic VUE is generally good enough

MVVM (Model-View, View-Model)



VUE Example

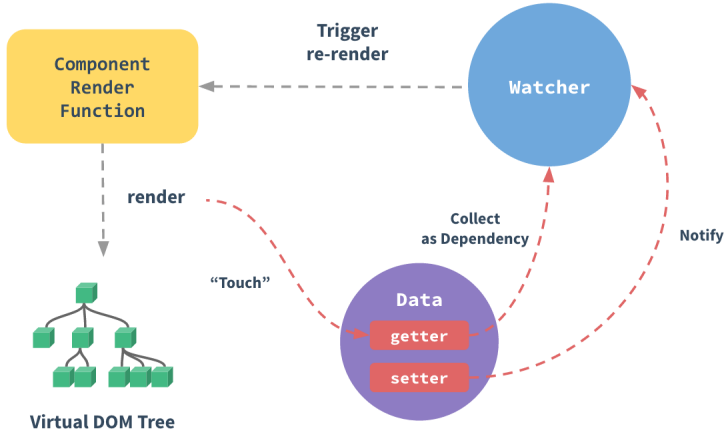
- vueex.html demo

VUE Basics

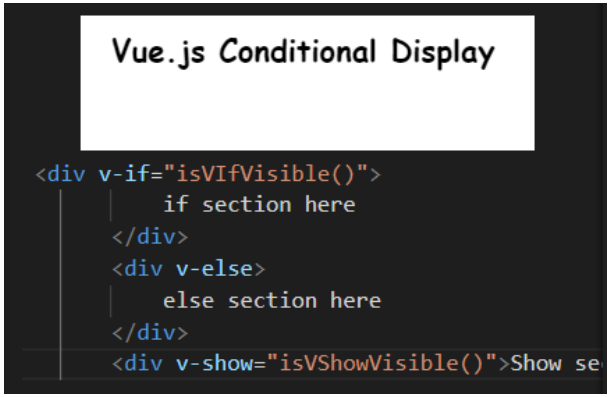
- Write the HTML, have VUE fill in values
  - {{ message }}
  - {{ <expression> }} is replaced by the value <expression>
  - Where <expression> is computed against a particular context
- VUE works in the front end
  - let app = new Vue({
    - el : '#app',
    - data: { message: 'Hello World' }
    - methods: { … } … });
  - EL – selector of the element this applies to
  - DATA – context for evaluating expressions
  - METHODS – methods that can be used in the HTML
- Can access and set the data
  - app.message = 'Good Night'
  - Will change the DOM automatically

VUE Binding

- {{ expr }} is the simplest binding
- Can also bind using v-bind prefi
  - … </spa
  - Use instead of title='{{message}}'
  - Short cut :title
- v-bind is a VUE directive
  - VUE directives start with v-
  - Other VUE directives provide additional facilities



VUE Conditionals



- Can control HTML based on values
  -
    - This HTML only exists if seen is true
    - <span v-else>This HTML only exists if seen is false
    -
  - let app = new Vue({ el: '#app', data: { seen : true } });
- Can change app.seen
  - Causes the HTML to change accordingly

VUE Loops

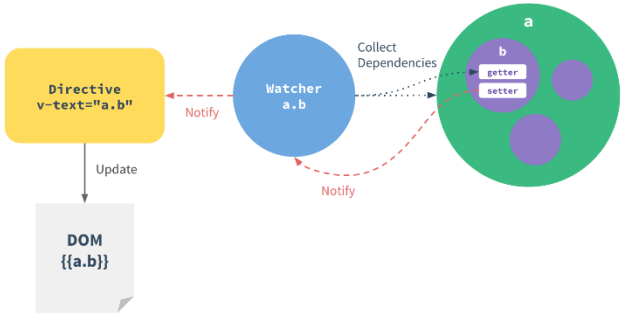
- Can create HTML for each element of a collection
  - <li v-for='todo in todos'>{{ todo.text }}
  - let app = new Vue({ el: 'app',
    - data: { todos : ["Lab 1", "Prelab 2", "Assignment 1", "Project Meeting"] } })
- This will generate a li element for each element of the todos array
- Changing the todos array will update the HTML accordingly
  - Add a new element, remove an element

VUE Events

- Can tie HTML actions to methods on the VUE object
- {{msg}}
  <button v-on:click='reverse'>Reverse</button>
  - Short cut: @click
  - v-on:event.modifier
- let app=new Vue({el: '#app',
  data: { msg: 'Hello World' },
  methods: { reverse: function() {
  this.msg = this.msg.split('').reverse().join('') } } })
- v-on directive ties click to the appropriate method in the VUE object

VUE Model

- Can also tie input fields to VUE variables directly
- {{msg}} <input v-model='msg'>
  - The input field maps to and from the variable msg
- let app = new Vue({ el: '#app', data: { });
  - Typing in the input field changes msg
  - Changing msg changes the displayed paragrap



VUE Components

- Can create HTML macros with encapsulated methods
- Vue.component('name', {
  - props: [list of bound variables]
  - methods: { … }, data: { … }
  - template: <html as a string> });
- Use this as <name></name>
- Can be combined
  - <name v-for='t in array' v-bind:var='t' v-bind:key='t.id'></name>
- Doesn't work in all contexts (e.g. tables,…)
  - <tr is='name' …></tr>

VUE Example

- vuesimple.html as the design
- vueex.html as the result – look at the code
- vueex1.html as the result with components – look at the code

REACT

- A JavaScript-centric front end frame
- You write JavaScript and embed the HTML into it
- Requires a preprocessor
  - Generally run in the back end
  - Generates both HTML and JavaScript

Creating Dynamic HTML Pages

- We now have multiple approaches
  - Doing most of the work in the back end (generate templated page)
    - Once we have a back end
  - Doing most of the work in the front end (generate page based on data)
    - Single page application
- All require some control of the HTML from JavaScript
  - Can use JavaScript directly
    - Best for simple things – hide and show elements, changing classes, styles
  - Using jQuery
    - Useful if you are doing this a lot or there are multiple elements
  - Using VUE
    - Useful if the changes are complex and data dependent

What to Use

- Will depend on the overall application
  - We will get back to this once we have a better understanding of
    - The back end
    - Communication between the front and back end
    - What types of interaction to support
  - Discussing Web Application Architectures
- For now
  - Become familiar with the basics (JavaScript or jQuery)
  - Become familiar with front end templating (VUE)
  - Understand their capabilities and limits so you can make a wise choice later

Next Time

- Lab 3: Front End Frameworks
- Homework:
  - PreLab 3: to familiarize yourself with JavaScript

Model-View-Controller