Vue JS tutorial

0. Installation

Compatibility Note

Vue does **not** support IE8 and below, because it uses ECMAScript 5 features that are un-shimmable in IE8. However it supports all **ECMAScript 5 compliant browsers**.

Release Notes

Latest stable version: 2.6.8

Detailed release notes for each version are available on **GitHub**.

Vue Devtools

When using Vue, we recommend also installing the **Vue Devtools** in your browser, allowing you to inspect and debug your Vue applications in a more user-friendly interface.

Direct `<script>` Include

Simply download and include with a script tag. `Vue` will be registered as a global variable.

> Don't use the minified version during development. You will miss out on all the nice warnings for common mistakes!

Development Version With full warnings and debug mode

Production Version Warnings stripped, 33.19KB min+gzip

CDN

For prototyping or learning purposes, you can use the latest version with:

```
<script src="https://cdn.jsdelivr.net/npm/vue"></script>
```

For production, we recommend linking to a specific version number and build to avoid unexpected breakage from newer versions:

```
<script src="https://cdn.jsdelivr.net/npm/vue@2.6.8/dist/vue.js"></script>
```

If you are using native ES Modules, there is also an ES Modules compatible build:

```
<script type="module">
  import Vue from
'https://cdn.jsdelivr.net/npm/vue@2.6.8/dist/vue.esm.browser.js'
</script>
```

You can browse the source of the NPM package at **cdn.jsdelivr.net/npm/vue**.

Vue is also available on **unpkg** and **cdnjs** (cdnjs takes some time to sync so the latest release may not be available yet).
Make sure to read about **the different builds of Vue** and use the **production version** in your published site, replacing `vue.js` with `vue.min.js`. This is a smaller build optimized for speed instead of development experience.

NPM

NPM is the recommended installation method when building large scale applications with Vue. It pairs nicely with module bundlers such as **Webpack** or **Browserify**. Vue also provides accompanying tools for authoring **Single File Components**.

```
# latest stable
$ npm install vue
```

CLI

Vue provides an **official CLI** for quickly scaffolding ambitious Single Page Applications. It provides batteries-included build setups for a modern frontend workflow. It takes only a few minutes to get up and running with hot-reload, lint-on-save, and production-ready builds. See **the Vue CLI docs** for more details.

> The CLI assumes prior knowledge of Node.js and the associated build tools. If you are new to Vue or front-end build tools, we strongly suggest going through **the guide** without any build tools before using the CLI.

Watch a video explanation on Vue Mastery

Explanation of Different Builds

In the `dist/` directory of the NPM package you will find many different builds of Vue.js. Here's an overview of the difference between them:

	UMD	CommonJS	ES Module (for bundlers)	ES Module (for browsers)
Full	vue.js	vue.common.js	vue.esm.js	vue.esm.browser.js
Runtime-only	vue.runtime.js	vue.runtime.common.js	vue.runtime.esm.js	-
Full (production)	vue.min.js	-	-	vue.esm.browser.min.js
Runtime-only (production)	vue.runtime.min.js	-	-	-

Terms

- **Full**: builds that contain both the compiler and the runtime.
- **Compiler**: code that is responsible for compiling template strings into JavaScript render functions.
- **Runtime**: code that is responsible for creating Vue instances, rendering and patching virtual DOM, etc. Basically everything minus the compiler.

- **UMD**: UMD builds can be used directly in the browser via a `<script>` tag. The default file from jsDelivr CDN at **https://cdn.jsdelivr.net/npm/vue** is the Runtime + Compiler UMD build (`vue.js`).
- **CommonJS**: CommonJS builds are intended for use with older bundlers like **browserify** or **webpack 1**. The default file for these bundlers (`pkg.main`) is the Runtime only CommonJS build (`vue.runtime.common.js`).

- **ES Module**: starting in 2.6 Vue provides two ES Modules (ESM) builds:
  - ESM for bundlers: intended for use with modern bundlers like **webpack 2** or **Rollup**. ESM format is designed to be statically analyzable so the bundlers can take advantage of that to perform "tree-shaking" and eliminate unused code from your final bundle. The default file for these bundlers (`pkg.module`) is the Runtime only ES Module build (`vue.runtime.esm.js`).
  - ESM for browsers (2.6+ only): intended for direct imports in modern browsers via `<script type="module">`.
  -

Runtime + Compiler vs. Runtime-only

If you need to compile templates on the client (e.g. passing a string to the `template`option, or mounting to an element using its in-DOM HTML as the template), you will need the compiler and thus the full build:

```
// this requires the compiler
new Vue({
  template: '<div>{{ hi }}</div>'
})

// this does not
new Vue({
  render (h) {
    return h('div', this.hi)
  }
})
```

When using `vue-loader` or `vueify`, templates inside `*.vue` files are pre-compiled into JavaScript at build time. You don't really need the compiler in the final bundle, and can therefore use the runtime-only build.

Since the runtime-only builds are roughly 30% lighter-weight than their full-build counterparts, you should use it whenever you can. If you still wish to use the full build instead, you need to configure an alias in your bundler:

Webpack

```
module.exports = {
  // ...
  resolve: {
    alias: {
      'vue$': 'vue/dist/vue.esm.js' // 'vue/dist/vue.common.js' for webpack 1
    }
  }
}
```

Rollup

```
const alias = require('rollup-plugin-alias')

rollup({
  // ...
  plugins: [
    alias({
      'vue': require.resolve('vue/dist/vue.esm.js')
    })
  ]
})
```

Browserify

Add to your project's `package.json`:

```
{
  // ...
  "browser": {
    "vue": "vue/dist/vue.common.js"
  }
}
```

Parcel

Add to your project's `package.json`:

```
{
  // ...
  "alias": {
    "vue" : "./node_modules/vue/dist/vue.common.js"
  }
}
```

Development vs. Production Mode

Development/production modes are hard-coded for the UMD builds: the un-minified files are for development, and the minified files are for production.

CommonJS and ES Module builds are intended for bundlers, therefore we don't provide minified versions for them. You will be responsible for minifying the final bundle yourself.
CommonJS and ES Module builds also preserve raw checks for `process.env.NODE_ENV`to determine the mode they should run in. You should use appropriate bundler configurations to replace these environment variables in order to control which mode Vue will run in. Replacing `process.env.NODE_ENV` with string literals also allows minifiers like UglifyJS to completely drop the development-only code blocks, reducing final file size.

Webpack

In Webpack 4+, you can use the `mode` option:

```
module.exports = {
  mode: 'production'
}
```

But in Webpack 3 and earlier, you'll need to use **DefinePlugin**:

```
var webpack = require('webpack')

module.exports = {
  // ...
  plugins: [
    // ...
    new webpack.DefinePlugin({
      'process.env': {
        NODE_ENV: JSON.stringify('production')
      }
    })
  ]
}
```

Rollup

Use **rollup-plugin-replace**:

```
const replace = require('rollup-plugin-replace')

rollup({
  // ...
  plugins: [
```

```
    replace({
      'process.env.NODE_ENV': JSON.stringify('production')
    })
  ]
}).then(...)
```

Browserify

Apply a global **envify** transform to your bundle.

```
NODE_ENV=production browserify -g envify -e main.js | uglifyjs -c -m > build.js
```

Also see **Production Deployment Tips**.

CSP environments

Some environments, such as Google Chrome Apps, enforce Content Security Policy (CSP), which prohibits the use of `new Function()` for evaluating expressions. The full build depends on this feature to compile templates, so is unusable in these environments.

On the other hand, the runtime-only build is fully CSP-compliant. When using the runtime-only build with **Webpack + vue-loader** or **Browserify + vueify**, your templates will be precompiled into `render` functions which work perfectly in CSP environments.

Dev Build

Important: the built files in GitHub's `/dist` folder are only checked-in during releases. To use Vue from the latest source code on GitHub, you will have to build it yourself!

```
git clone https://github.com/vuejs/vue.git node_modules/vue
cd node_modules/vue
npm install
npm run build
```

Bower

Only UMD builds are available from Bower.

```
# latest stable
$ bower install vue
```

1. Introduction

What is Vue.js?

Vue (pronounced /vjuː/, like **view**) is a **progressive framework** for building user interfaces. Unlike other monolithic frameworks, Vue is designed from the ground up to be incrementally adoptable. The core library is focused on the view layer only, and is easy to pick up and integrate with other libraries or existing projects. On the other hand, Vue is also perfectly capable of powering sophisticated Single-Page Applications when used in combination with **modern tooling** and **supporting libraries**.

If you'd like to learn more about Vue before diving in, we **created a video** walking through the core principles and a sample project.

If you are an experienced frontend developer and want to know how Vue compares to other libraries/frameworks, check out the **Comparison with Other Frameworks**.
Watch a free video course on Vue Mastery

Getting Started

> The official guide assumes intermediate level knowledge of HTML, CSS, and JavaScript. If you are totally new to frontend development, it might not be the best idea to jump right into a framework as your first step - grasp the basics then come back! Prior experience with other frameworks helps, but is not required.

The easiest way to try out Vue.js is using the **JSFiddle Hello World example**. Feel free to open it in another tab and follow along as we go through some basic examples. Or, you can **create an `index.html` file** and include Vue with:

```
<!-- development version, includes helpful console warnings -->
<script src="https://cdn.jsdelivr.net/npm/vue/dist/vue.js"></script>
```

or:

```
<!-- production version, optimized for size and speed -->
<script src="https://cdn.jsdelivr.net/npm/vue"></script>
```

The **Installation** page provides more options of installing Vue. Note: We **do not**recommend that beginners start with `vue-cli`, especially if you are not yet familiar with Node.js-based build tools.

If you prefer something more interactive, you can also check out **this tutorial series on Scrimba**, which gives you a mix of screencast and code playground that you can pause and play around with anytime.

Declarative Rendering

Try this lesson on Scrimba

At the core of Vue.js is a system that enables us to declaratively render data to the DOM using straightforward template syntax:

```
<div id="app">
  {{ message }}
</div>

var app = new Vue({
  el: '#app',
  data: {
    message: 'Hello Vue!'
  }
})
```

Hello Vue!

We have already created our very first Vue app! This looks pretty similar to rendering a string template, but Vue has done a lot of work under the hood. The data and the DOM are now linked, and everything is now **reactive**. How do we know? Open your browser's JavaScript console (right now, on this page) and set `app.message` to a different value. You should see the rendered example above update accordingly.

In addition to text interpolation, we can also bind element attributes like this:

```
<div id="app-2">
  <span v-bind:title="message">
    Hover your mouse over me for a few seconds
    to see my dynamically bound title!
  </span>
</div>

var app2 = new Vue({
  el: '#app-2',
  data: {
    message: 'You loaded this page on ' + new Date().toLocaleString()
  }
})
```

Hover your mouse over me for a few seconds to see my dynamically bound title!

Here we are encountering something new. The `v-bind` attribute you are seeing is called a **directive**. Directives are prefixed with `v-` to indicate that they are special attributes provided by Vue, and as you may have guessed, they apply special reactive behavior to the rendered DOM. Here, it is basically saying “keep this element’s `title`attribute up-to-date with the `message` property on the Vue instance.”
If you open up your JavaScript console again and enter `app2.message = 'some new message'`, you’ll once again see that the bound HTML - in this case the `title` attribute - has been updated.

Conditionals and Loops

Try this lesson on Scrimba

It’s easy to toggle the presence of an element, too:

```
<div id="app-3">
  <span v-if="seen">Now you see me</span>
</div>

var app3 = new Vue({
  el: '#app-3',
  data: {
    seen: true
  }
})
```

Now you see me

Go ahead and enter `app3.seen = false` in the console. You should see the message disappear.

This example demonstrates that we can bind data to not only text and attributes, but also the **structure** of the DOM. Moreover, Vue also provides a powerful transition effect system that can automatically apply **transition effects** when elements are inserted/updated/removed by Vue.
There are quite a few other directives, each with its own special functionality. For example, the `v-for` directive can be used for displaying a list of items using the data from an Array:

```
<div id="app-4">
  <ol>
    <li v-for="todo in todos">
      {{ todo.text }}
    </li>
  </ol>
</div>
```

```
var app4 = new Vue({
  el: '#app-4',
  data: {
    todos: [
      { text: 'Learn JavaScript' },
      { text: 'Learn Vue' },
      { text: 'Build something awesome' }
    ]
  }
})
```

1. Learn JavaScript
2. Learn Vue
3. Build something awesome

In the console, enter `app4.todos.push({ text: 'New item' })`. You should see a new item appended to the list.

Handling User Input

Try this lesson on Scrimba

To let users interact with your app, we can use the `v-on` directive to attach event listeners that invoke methods on our Vue instances:

```
<div id="app-5">
  <p>{{ message }}</p>
  <button v-on:click="reverseMessage">Reverse Message</button>
</div>
var app5 = new Vue({
  el: '#app-5',
  data: {
    message: 'Hello Vue.js!'
  },
  methods: {
    reverseMessage: function () {
      this.message = this.message.split('').reverse().join('')
    }
  }
})
```

Hello Vue.js!

Reverse Message

Note that in this method we update the state of our app without touching the DOM - all DOM manipulations are handled by Vue, and the code you write is focused on the underlying logic.

Vue also provides the `v-model` directive that makes two-way binding between form input and app state a breeze:

```
<div id="app-6">
  <p>{{ message }}</p>
  <input v-model="message">
</div>
```

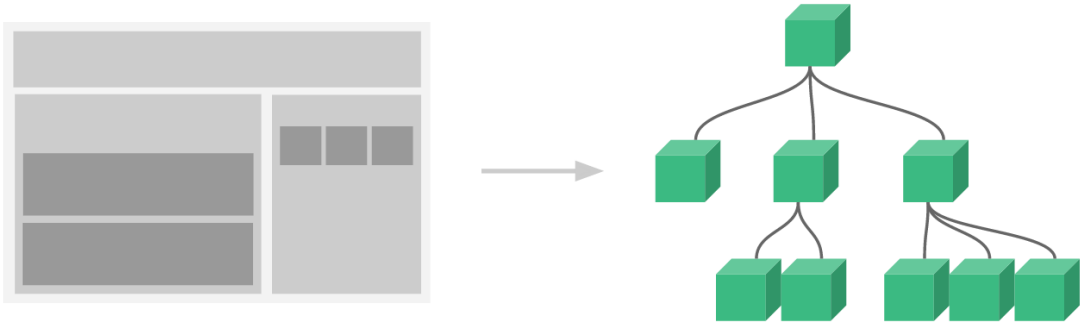
```
var app6 = new Vue({
  el: '#app-6',
  data: {
    message: 'Hello Vue!'
  }
})
```

Hello Vue!

Composing with Components

Try this lesson on Scrimba

The component system is another important concept in Vue, because it's an abstraction that allows us to build large-scale applications composed of small, self-contained, and often reusable components. If we think about it, almost any type of application interface can be abstracted into a tree of components:



In Vue, a component is essentially a Vue instance with pre-defined options. Registering a component in Vue is straightforward:

```
// Define a new component called todo-item
```

```
Vue.component('todo-item', {
  template: '<li>This is a todo</li>'
})
```

Now you can compose it in another component's template:

```
<ol>
  <!-- Create an instance of the todo-item component -->
  <todo-item></todo-item>
</ol>
```

But this would render the same text for every todo, which is not super interesting. We should be able to pass data from the parent scope into child components. Let's modify the component definition to make it accept a **prop**:

```
Vue.component('todo-item', {
  // The todo-item component now accepts a
  // "prop", which is like a custom attribute.
  // This prop is called todo.
  props: ['todo'],
  template: '<li>{{ todo.text }}</li>'
})
```

Now we can pass the todo into each repeated component using `v-bind`:

```
<div id="app-7">
  <ol>
    <!--
      Now we provide each todo-item with the todo object
      it's representing, so that its content can be dynamic.
      We also need to provide each component with a "key",
      which will be explained later.
    -->
    <todo-item
      v-for="item in groceryList"
      v-bind:todo="item"
      v-bind:key="item.id"
    ></todo-item>
  </ol>
</div>
Vue.component('todo-item', {
  props: ['todo'],
  template: '<li>{{ todo.text }}</li>'
})

var app7 = new Vue({
  el: '#app-7',
```

```
  data: {
    groceryList: [
      { id: 0, text: 'Vegetables' },
      { id: 1, text: 'Cheese' },
      { id: 2, text: 'Whatever else humans are supposed to eat' }
    ]
  }
})
```

1. Vegetables
2. Cheese
3. Whatever else humans are supposed to eat

This is a contrived example, but we have managed to separate our app into two smaller units, and the child is reasonably well-decoupled from the parent via the props interface. We can now further improve our `<todo-item>` component with more complex template and logic without affecting the parent app.

In a large application, it is necessary to divide the whole app into components to make development manageable. We will talk a lot more about components **later in the guide**, but here's an (imaginary) example of what an app's template might look like with components:

```
<div id="app">
  <app-nav></app-nav>
  <app-view>
    <app-sidebar></app-sidebar>
    <app-content></app-content>
  </app-view>
</div>
```

Relation to Custom Elements

You may have noticed that Vue components are very similar to **Custom Elements**, which are part of the **Web Components Spec**. That's because Vue's component syntax is loosely modeled after the spec. For example, Vue components implement the **Slot API**and the `is` special attribute. However, there are a few key differences:

1. The Web Components Spec has been finalized, but is not natively implemented in every browser. Safari 10.1+, Chrome 54+ and Firefox 63+ natively support web components. In comparison, Vue components don't require any polyfills and work

consistently in all supported browsers (IE9 and above). When needed, Vue components can also be wrapped inside a native custom element.

2. Vue components provide important features that are not available in plain custom elements, most notably cross-component data flow, custom event communication and build tool integrations.

   Although Vue doesn't use custom elements internally, it has **great interoperability** when it comes to consuming or distributing as custom elements. Vue CLI also supports building Vue components that register themselves as native custom elements.

Ready for More?

We've briefly introduced the most basic features of Vue.js core - the rest of this guide will cover them and other advanced features with much finer details, so make sure to read through it all!

2. The Vue Instance

Creating a Vue Instance

Every Vue application starts by creating a new **Vue instance** with the `Vue` function:

```
var vm = new Vue({
  // options
})
```

Although not strictly associated with the **MVVM pattern**, Vue's design was partly inspired by it. As a convention, we often use the variable `vm` (short for ViewModel) to refer to our Vue instance.

When you create a Vue instance, you pass in an **options object**. The majority of this guide describes how you can use these options to create your desired behavior. For reference, you can also browse the full list of options in the **API reference**.
A Vue application consists of a **root Vue instance** created with `new Vue`, optionally organized into a tree of nested, reusable components. For example, a todo app's component tree might look like this:

```
Root Instance
└─ TodoList
   ├─ TodoItem
   │  ├─ DeleteTodoButton
   │  └─ EditTodoButton
   └─ TodoListFooter
      ├─ ClearTodosButton
      └─ TodoListStatistics
```

We'll talk about **the component system** in detail later. For now, just know that all Vue components are also Vue instances, and so accept the same options object (except for a few root-specific options).

Data and Methods

When a Vue instance is created, it adds all the properties found in its `data` object to Vue's **reactivity system**. When the values of those properties change, the view will "react", updating to match the new values.

```
// Our data object
var data = { a: 1 }
```

```
// The object is added to a Vue instance
var vm = new Vue({
  data: data
})

// Getting the property on the instance
// returns the one from the original data
vm.a == data.a // => true

// Setting the property on the instance
// also affects the original data
vm.a = 2
data.a // => 2

// ... and vice-versa
data.a = 3
vm.a // => 3
```

When this data changes, the view will re-render. It should be noted that properties in `data` are only **reactive** if they existed when the instance was created. That means if you add a new property, like:

```
vm.b = 'hi'
```

Then changes to `b` will not trigger any view updates. If you know you'll need a property later, but it starts out empty or non-existent, you'll need to set some initial value. For example:

```
data: {
  newTodoText: '',
  visitCount: 0,
  hideCompletedTodos: false,
  todos: [],
  error: null
}
```

The only exception to this being the use of `Object.freeze()`, which prevents existing properties from being changed, which also means the reactivity system can't *track*changes.

```
var obj = {
  foo: 'bar'
}

Object.freeze(obj)

new Vue({
  el: '#app',
```

```
  data: obj
})
<div id="app">
  <p>{{ foo }}</p>
  <!-- this will no longer update `foo`! -->
  <button v-on:click="foo = 'baz'">Change it</button>
</div>
```

In addition to data properties, Vue instances expose a number of useful instance properties and methods. These are prefixed with `$` to differentiate them from user-defined properties. For example:

```
var data = { a: 1 }
var vm = new Vue({
  el: '#example',
  data: data
})

vm.$data === data // => true
vm.$el === document.getElementById('example') // => true

// $watch is an instance method
vm.$watch('a', function (newValue, oldValue) {
  // This callback will be called when `vm.a` changes
})
```

In the future, you can consult the **API reference** for a full list of instance properties and methods.

Instance Lifecycle Hooks

Each Vue instance goes through a series of initialization steps when it's created - for example, it needs to set up data observation, compile the template, mount the instance to the DOM, and update the DOM when data changes. Along the way, it also runs functions called **lifecycle hooks**, giving users the opportunity to add their own code at specific stages.

For example, the `created` hook can be used to run code after an instance is created:

```
new Vue({
  data: {
    a: 1
  },
  created: function () {
    // `this` points to the vm instance
```

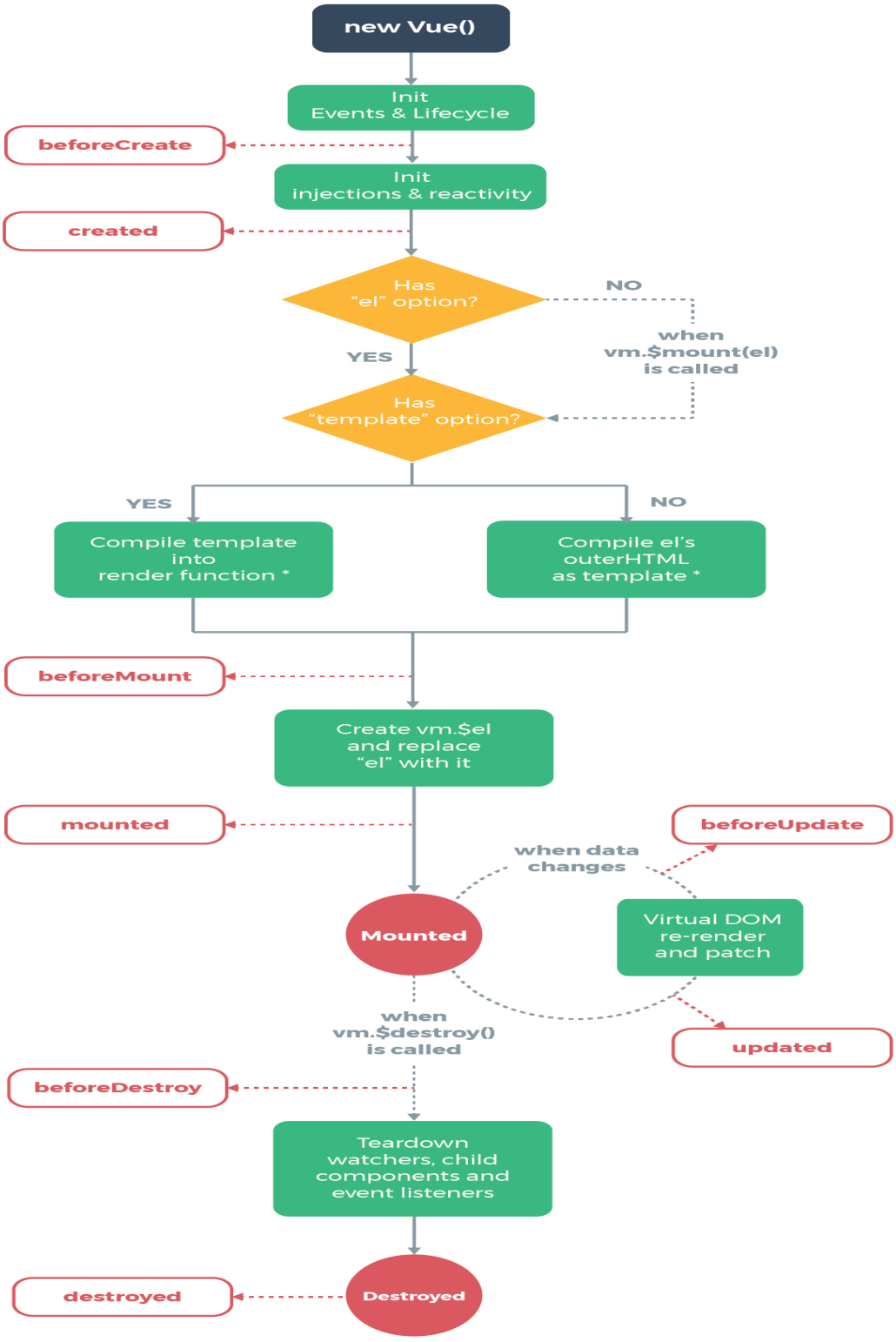
```
    console.log('a is: ' + this.a)
  }
})
// => "a is: 1"
```

There are also other hooks which will be called at different stages of the instance's lifecycle, such as `mounted`, `updated`, and `destroyed`. All lifecycle hooks are called with their `this` context pointing to the Vue instance invoking it.

Don't use **arrow functions** on an options property or callback, such as `created: () => console.log(this.a)` or `vm.$watch('a', newValue => this.myMethod())`. Since an arrow function doesn't have a `this`, `this` will be treated as any other variable and lexically looked up through parent scopes until found, often resulting in errors such as `Uncaught TypeError: Cannot read property of undefined` or `Uncaught TypeError: this.myMethod is not a function`.

Lifecycle Diagram

Below is a diagram for the instance lifecycle. You don't need to fully understand everything going on right now, but as you learn and build more, it will be a useful reference.



* template compilation is performed ahead-of-time if using a build step, e.g. single-file components

3. Template Syntax

Vue.js uses an HTML-based template syntax that allows you to declaratively bind the rendered DOM to the underlying Vue instance's data. All Vue.js templates are valid HTML that can be parsed by spec-compliant browsers and HTML parsers.

Under the hood, Vue compiles the templates into Virtual DOM render functions. Combined with the reactivity system, Vue is able to intelligently figure out the minimal number of components to re-render and apply the minimal amount of DOM manipulations when the app state changes.

If you are familiar with Virtual DOM concepts and prefer the raw power of JavaScript, you can also **directly write render functions** instead of templates, with optional JSX support.

Interpolations

Text

The most basic form of data binding is text interpolation using the "Mustache" syntax (double curly braces):

```
<span>Message: {{ msg }}</span>
```

The mustache tag will be replaced with the value of the `msg` property on the corresponding data object. It will also be updated whenever the data object's `msg`property changes.

You can also perform one-time interpolations that do not update on data change by using the **v-once directive**, but keep in mind this will also affect any other bindings on the same node:

```
<span v-once>This will never change: {{ msg }}</span>
```

Raw HTML

The double mustaches interprets the data as plain text, not HTML. In order to output real HTML, you will need to use the `v-html` directive:

```
<p>Using mustaches: {{ rawHtml }}</p>
<p>Using v-html directive: <span v-html="rawHtml"></span></p>
```

Using mustaches: This should be red.

Using v-html directive: This should be red.

The contents of the `span` will be replaced with the value of the `rawHtml` property, interpreted as plain HTML - data bindings are ignored. Note that you cannot use `v-html` to compose template partials, because Vue is not a string-based templating engine. Instead, components are preferred as the fundamental unit for UI reuse and composition.

> Dynamically rendering arbitrary HTML on your website can be very dangerous because it can easily lead to **XSS vulnerabilities**. Only use HTML interpolation on trusted content and **never** on user-provided content.

Attributes

Mustaches cannot be used inside HTML attributes. Instead, use a **v-bind directive**:

```
<div v-bind:id="dynamicId"></div>
```

In the case of boolean attributes, where their mere existence implies `true`, `v-bind`works a little differently. In this example:

```
<button v-bind:disabled="isButtonDisabled">Button</button>
```

If `isButtonDisabled` has the value of `null`, `undefined`, or `false`, the `disabled`attribute will not even be included in the rendered `<button>` element.

Using JavaScript Expressions

So far we've only been binding to simple property keys in our templates. But Vue.js actually supports the full power of JavaScript expressions inside all data bindings:

```
{{ number + 1 }}

{{ ok ? 'YES' : 'NO' }}

{{ message.split('').reverse().join('') }}

<div v-bind:id="'list-' + id"></div>
```

These expressions will be evaluated as JavaScript in the data scope of the owner Vue instance. One restriction is that each binding can only contain **one single expression**, so the following will **NOT** work:

```
<!-- this is a statement, not an expression: -->
```

```
{{ var a = 1 }}


<!-- flow control won't work either, use ternary expressions -->
{{ if (ok) { return message } }}
```

Template expressions are sandboxed and only have access to a whitelist of globals such as `Math` and `Date`. You should not attempt to access user defined globals in template expressions.

Directives

Directives are special attributes with the `v-` prefix. Directive attribute values are expected to be **a single JavaScript expression** (with the exception of `v-for`, which will be discussed later). A directive's job is to reactively apply side effects to the DOM when the value of its expression changes. Let's review the example we saw in the introduction:

```
<p v-if="seen">Now you see me</p>
```

Here, the `v-if` directive would remove/insert the `<p>` element based on the truthiness of the value of the expression `seen`.

Arguments

Some directives can take an "argument", denoted by a colon after the directive name. For example, the `v-bind` directive is used to reactively update an HTML attribute:

```
<a v-bind:href="url"> ... </a>
```

Here `href` is the argument, which tells the `v-bind` directive to bind the element's `href` attribute to the value of the expression `url`.

Another example is the `v-on` directive, which listens to DOM events:

```
<a v-on:click="doSomething"> ... </a>
```

Here the argument is the event name to listen to. We will talk about event handling in more detail too.

Dynamic Arguments

New in 2.6.0+

Starting in version 2.6.0, it is also possible to use a JavaScript expression in a directive argument by wrapping it with square brackets:

```
<a v-bind:[attributeName]="url"> ... </a>
```

Here `attributeName` will be dynamically evaluated as a JavaScript expression, and its evaluated value will be used as the final value for the argument. For example, if your Vue instance has a data property, `attributeName`, whose value is `"href"`, then this binding will be equivalent to `v-bind:href`.

Similarly, you can use dynamic arguments to bind a handler to a dynamic event name:

```
<a v-on:[eventName]="doSomething"> ... </a>
```

Similarly, when `eventName`'s value is `"focus"`, for example, `v-on:[eventName]` will be equivalent to `v-on:focus`.

Dynamic Argument Value Constraints

Dynamic arguments are expected to evaluate to a string, with the exception of `null`. The special value `null` can be used to explicitly remove the binding. Any other non-string value will trigger a warning.

Dynamic Argument Expression Constraints

> Dynamic argument expressions have some syntax constraints because certain characters are invalid inside HTML attribute names, such as spaces and quotes. You also need to avoid uppercase keys when using in-DOM templates.

For example, the following is invalid:

```
<!-- This will trigger a compiler warning. -->
<a v-bind:['foo' + bar]="value"> ... </a>
```

The workaround is to either use expressions without spaces or quotes, or replace the complex expression with a computed property.

In addition, if you are using in-DOM templates (templates directly written in an HTML file), you have to be aware that browsers will coerce attribute names into lowercase:

```
<!-- This will be converted to v-bind:[someattr] in in-DOM templates. -->
<a v-bind:[someAttr]="value"> ... </a>
```

Modifiers

Modifiers are special postfixes denoted by a dot, which indicate that a directive should be bound in some special way. For example, the `.prevent` modifier tells the `v-on`directive to call `event.preventDefault()` on the triggered event:

```
<form v-on:submit.prevent="onSubmit"> ... </form>
```

You'll see other examples of modifiers later, for `v-on` and for `v-model`, when we explore those features.

Shorthands

The `v-` prefix serves as a visual cue for identifying Vue-specific attributes in your templates. This is useful when you are using Vue.js to apply dynamic behavior to some existing markup, but can feel verbose for some frequently used directives. At the same time, the need for the `v-` prefix becomes less important when you are building a SPA, where Vue manages every template. Therefore, Vue provides special shorthands for two of the most often used directives, `v-bind` and `v-on`:

`v-bind` Shorthand

```
<!-- full syntax -->
<a v-bind:href="url"> ... </a>

<!-- shorthand -->
<a :href="url"> ... </a>

<!-- shorthand with dynamic argument (2.6.0+) -->
<a :[key]="url"> ... </a>
```

`v-on` Shorthand

```
<!-- full syntax -->
<a v-on:click="doSomething"> ... </a>

<!-- shorthand -->
<a @click="doSomething"> ... </a>

<!-- shorthand with dynamic argument (2.6.0+) -->
<a @[event]="doSomething"> ... </a>
```

They may look a bit different from normal HTML, but `:` and `@` are valid characters for attribute names and all Vue-supported browsers can parse it correctly. In addition, they do not appear in the final rendered markup. The shorthand syntax is totally optional, but you will likely appreciate it when you learn more about its usage later.

4. Computed Properties and Watchers

Computed Properties

In-template expressions are very convenient, but they are meant for simple operations. Putting too much logic in your templates can make them bloated and hard to maintain. For example:

```
<div id="example">
  {{ message.split('').reverse().join('') }}
</div>
```

At this point, the template is no longer simple and declarative. You have to look at it for a second before realizing that it displays `message` in reverse. The problem is made worse when you want to include the reversed message in your template more than once.

That's why for any complex logic, you should use a **computed property**.

Basic Example

```
<div id="example">
  <p>Original message: "{{ message }}"</p>
  <p>Computed reversed message: "{{ reversedMessage }}"</p>
</div>
var vm = new Vue({
  el: '#example',
  data: {
    message: 'Hello'
  },
  computed: {
    // a computed getter
    reversedMessage: function () {
      // `this` points to the vm instance
      return this.message.split('').reverse().join('')
    }
  }
})
```

Result:

Original message: "Hello"

Computed reversed message: "olleH"

Here we have declared a computed property `reversedMessage`. The function we provided will be used as the getter function for the property `vm.reversedMessage`:

```
console.log(vm.reversedMessage) // => 'olleH'

vm.message = 'Goodbye'
console.log(vm.reversedMessage) // => 'eybdooG'
```

You can open the console and play with the example vm yourself. The value of `vm.reversedMessage` is always dependent on the value of `vm.message`.

You can data-bind to computed properties in templates just like a normal property. Vue is aware that `vm.reversedMessage` depends on `vm.message`, so it will update any bindings that depend on `vm.reversedMessage` when `vm.message` changes. And the best part is that we've created this dependency relationship declaratively: the computed getter function has no side effects, which makes it easier to test and understand.

Computed Caching vs Methods

You may have noticed we can achieve the same result by invoking a method in the expression:

```
<p>Reversed message: "{{ reverseMessage() }}"</p>

// in component
methods: {
  reverseMessage: function () {
    return this.message.split('').reverse().join('')
  }
}
```

Instead of a computed property, we can define the same function as a method instead. For the end result, the two approaches are indeed exactly the same. However, the difference is that **computed properties are cached based on their dependencies.** A computed property will only re-evaluate when some of its dependencies have changed. This means as long as `message` has not changed, multiple access to the `reversedMessage` computed property will immediately return the previously computed result without having to run the function again.

This also means the following computed property will never update, because `Date.now()` is not a reactive dependency:

```
computed: {
  now: function () {
    return Date.now()
```

```
  }
}
```

In comparison, a method invocation will **always** run the function whenever a re-render happens.

Why do we need caching? Imagine we have an expensive computed property **A**, which requires looping through a huge Array and doing a lot of computations. Then we may have other computed properties that in turn depend on **A**. Without caching, we would be executing **A**'s getter many more times than necessary! In cases where you do not want caching, use a method instead.

Computed vs Watched Property

Vue does provide a more generic way to observe and react to data changes on a Vue instance: **watch properties**. When you have some data that needs to change based on some other data, it is tempting to overuse `watch` - especially if you are coming from an AngularJS background. However, it is often a better idea to use a computed property rather than an imperative `watch` callback. Consider this example:

```
<div id="demo">{{ fullName }}</div>
```

```
var vm = new Vue({
  el: '#demo',
  data: {
    firstName: 'Foo',
    lastName: 'Bar',
    fullName: 'Foo Bar'
  },
  watch: {
    firstName: function (val) {
      this.fullName = val + ' ' + this.lastName
    },
    lastName: function (val) {
      this.fullName = this.firstName + ' ' + val
    }
  }
})
```

The above code is imperative and repetitive. Compare it with a computed property version:

```
var vm = new Vue({
  el: '#demo',
  data: {
```

```
    firstName: 'Foo',
    lastName: 'Bar'
  },
  computed: {
    fullName: function () {
      return this.firstName + ' ' + this.lastName
    }
  }
})
```

Much better, isn't it?

Computed Setter

Computed properties are by default getter-only, but you can also provide a setter when you need it:

```
// ...
computed: {
  fullName: {
    // getter
    get: function () {
      return this.firstName + ' ' + this.lastName
    },
    // setter
    set: function (newValue) {
      var names = newValue.split(' ')
      this.firstName = names[0]
      this.lastName = names[names.length - 1]
    }
  }
}
// ...
```

Now when you run `vm.fullName = 'John Doe'`, the setter will be invoked and `vm.firstName` and `vm.lastName` will be updated accordingly.

Watchers

While computed properties are more appropriate in most cases, there are times when a custom watcher is necessary. That's why Vue provides a more generic way to react

to data changes through the `watch` option. This is most useful when you want to perform asynchronous or expensive operations in response to changing data.

For example:

```
<div id="watch-example">
  <p>
    Ask a yes/no question:
    <input v-model="question">
  </p>
  <p>{{ answer }}</p>
</div>
<!-- Since there is already a rich ecosystem of ajax libraries    -->
<!-- and collections of general-purpose utility methods, Vue core -->
<!-- is able to remain small by not reinventing them. This also   -->
<!-- gives you the freedom to use what you're familiar with. -->
<script
src="https://cdn.jsdelivr.net/npm/axios@0.12.0/dist/axios.min.js"></script>
<script
src="https://cdn.jsdelivr.net/npm/lodash@4.13.1/lodash.min.js"></script>
<script>
var watchExampleVM = new Vue({
  el: '#watch-example',
  data: {
    question: '',
    answer: 'I cannot give you an answer until you ask a question!'
  },
  watch: {
    // whenever question changes, this function will run
    question: function (newQuestion, oldQuestion) {
      this.answer = 'Waiting for you to stop typing...'
      this.debouncedGetAnswer()
    }
  },
  created: function () {
    //  .debounce is a function provided by lodash to limit how
    // often a particularly expensive operation can be run.
    // In this case, we want to limit how often we access
    // yesno.wtf/api, waiting until the user has completely
    // finished typing before making the ajax request. To learn
    // more about the _.debounce function (and its cousin
    // _.throttle), visit: https://lodash.com/docs#debounce
    this.debouncedGetAnswer = _.debounce(this.getAnswer, 500)
```

```
  },
  methods: {
    getAnswer:  function () {
      if (this.question.indexOf('?') === -1) {
        this.answer = 'Questions usually contain a question mark. ;-)'
        return
      }
      this.answer = 'Thinking...'
      var vm = this
      axios.get('https://yesno.wtf/api')
        .then(function (response) {
          vm.answer = _.capitalize(response.data.answer)
        })
        .catch(function (error) {
          vm.answer = 'Error! Could not reach the API. ' + error
        })
    }
  }
})
</script>
```

Result:

Ask a yes/no question:

I cannot give you an answer until you ask a question!

In this case, using the `watch` option allows us to perform an asynchronous operation (accessing an API), limit how often we perform that operation, and set intermediary states until we get a final answer. None of that would be possible with a computed property.

In addition to the `watch` option, you can also use the imperative **vm.$watch API**.

5. Class and Style Bindings

A common need for data binding is manipulating an element's class list and its inline styles. Since they are both attributes, we can use `v-bind` to handle them: we only need to calculate a final string with our expressions. However, meddling with string concatenation is annoying and error-prone. For this reason, Vue provides special enhancements when `v-bind` is used with `class` and `style`. In addition to strings, the expressions can also evaluate to objects or arrays.

Binding HTML Classes

Object Syntax

We can pass an object to `v-bind:class` to dynamically toggle classes:

```
<div v-bind:class="{ active: isActive }"></div>
```

The above syntax means the presence of the `active` class will be determined by the **truthiness** of the data property `isActive`.

You can have multiple classes toggled by having more fields in the object. In addition, the `v-bind:class` directive can also co-exist with the plain `class` attribute. So given the following template:

```
<div
  class="static"
  v-bind:class="{ active: isActive, 'text-danger': hasError }"
></div>
```

And the following data:

```
data: {
  isActive: true,
  hasError: false
}
```

It will render:

```
<div class="static active"></div>
```

When `isActive` or `hasError` changes, the class list will be updated accordingly. For example, if `hasError` becomes `true`, the class list will become `"static active text-danger"`.

The bound object doesn't have to be inline:

```
<div v-bind:class="classObject"></div>
```

```
data: {
  classObject: {
```

```
    active: true,
    'text-danger': false
  }
}
```

This will render the same result. We can also bind to a **computed property** that returns an object. This is a common and powerful pattern:

```
<div v-bind:class="classObject"></div>
```

```
data: {
  isActive: true,
  error: null
},
computed: {
  classObject: function () {
    return {
      active: this.isActive && !this.error,
      'text-danger': this.error && this.error.type === 'fatal'
    }
  }
}
```

Array Syntax

We can pass an array to `v-bind:class` to apply a list of classes:

```
<div v-bind:class="[activeClass, errorClass]"></div>
```

```
data: {
  activeClass: 'active',
  errorClass: 'text-danger'
}
```

Which will render:

```
<div class="active text-danger"></div>
```

If you would like to also toggle a class in the list conditionally, you can do it with a ternary expression:

```
<div v-bind:class="[isActive ? activeClass : '', errorClass]"></div>
```

This will always apply `errorClass`, but will only apply `activeClass` when `isActive`is truthy.

However, this can be a bit verbose if you have multiple conditional classes. That's why it's also possible to use the object syntax inside array syntax:

```
<div v-bind:class="[{ active: isActive }, errorClass]"></div>
```

With Components

This section assumes knowledge of Vue Components. Feel free to skip it and come back later.

When you use the `class` attribute on a custom component, those classes will be added to the component's root element. Existing classes on this element will not be overwritten.

For example, if you declare this component:

```
Vue.component('my-component', {
  template: '<p class="foo bar">Hi</p>'
})
```

Then add some classes when using it:

```
<my-component class="baz boo"></my-component>
```

The rendered HTML will be:

```
<p class="foo bar baz boo">Hi</p>
```

The same is true for class bindings:

```
<my-component v-bind:class="{ active: isActive }"></my-component>
```

When `isActive` is truthy, the rendered HTML will be:

```
<p class="foo bar active">Hi</p>
```

Binding Inline Styles

Object Syntax

The object syntax for `v-bind:style` is pretty straightforward - it looks almost like CSS, except it's a JavaScript object. You can use either camelCase or kebab-case (use quotes with kebab-case) for the CSS property names:

```
<div v-bind:style="{ color: activeColor, fontSize: fontSize + 'px' }"></div>
```

```
data: {
  activeColor: 'red',
  fontSize: 30
}
```

It is often a good idea to bind to a style object directly so that the template is cleaner:

```
<div v-bind:style="styleObject"></div>
```

```
data: {
  styleObject: {
    color: 'red',
    fontSize: '13px'
```

```
    }
}
```

Again, the object syntax is often used in conjunction with computed properties that return objects.

Array Syntax

The array syntax for `v-bind:style` allows you to apply multiple style objects to the same element:

```
<div v-bind:style="[baseStyles, overridingStyles]"></div>
```

Auto-prefixing

When you use a CSS property that requires **vendor prefixes** in `v-bind:style`, for example `transform`, Vue will automatically detect and add appropriate prefixes to the applied styles.

Multiple Values

2.3.0+

Starting in 2.3.0+ you can provide an array of multiple (prefixed) values to a style property, for example:

```
<div v-bind:style="{ display: ['-webkit-box', '-ms-flexbox', 'flex'] }"></div>
```

This will only render the last value in the array which the browser supports. In this example, it will render `display: flex` for browsers that support the unprefixed version of flexbox.

6. Conditional Rendering

v-if

The directive `v-if` is used to conditionally render a block. The block will only be rendered if the directive's expression returns a truthy value.

```
<h1 v-if="awesome">Vue is awesome!</h1>
```

It is also possible to add an "else block" with `v-else`:

```
<h1 v-if="awesome">Vue is awesome!</h1>
<h1 v-else>Oh no ☹</h1>
```

Conditional Groups with `v-if` on `<template>`

Because `v-if` is a directive, it has to be attached to a single element. But what if we want to toggle more than one element? In this case we can use `v-if` on a `<template>` element, which serves as an invisible wrapper. The final rendered result will not include the `<template>` element.

```
<template v-if="ok">
  <h1>Title</h1>
  <p>Paragraph 1</p>
  <p>Paragraph 2</p>
</template>
```

v-else

You can use the `v-else` directive to indicate an "else block" for `v-if`:

```
<div v-if="Math.random() > 0.5">
  Now you see me
</div>
<div v-else>
  Now you don't
</div>
```

A `v-else` element must immediately follow a `v-if` or a `v-else-if` element - otherwise it will not be recognized.

v-else-if

New in 2.1.0+

The `v-else-if`, as the name suggests, serves as an "else if block" for `v-if`. It can also be chained multiple times:

```
<div v-if="type === 'A'">
  A
</div>
<div v-else-if="type === 'B'">
  B
</div>
<div v-else-if="type === 'C'">
  C
</div>
```

```
<div v-else>
  Not A/B/C
</div>
```

Similar to `v-else`, a `v-else-if` element must immediately follow a `v-if` or a `v-else-if` element.

Controlling Reusable Elements with `key`

Vue tries to render elements as efficiently as possible, often re-using them instead of rendering from scratch. Beyond helping make Vue very fast, this can have some useful advantages. For example, if you allow users to toggle between multiple login types:

```
<template v-if="loginType === 'username'">
  <label>Username</label>
  <input placeholder="Enter your username">
</template>
<template v-else>
  <label>Email</label>
  <input placeholder="Enter your email address">
</template>
```

Then switching the `loginType` in the code above will not erase what the user has already entered. Since both templates use the same elements, the `<input>` is not replaced - just its `placeholder`.

Check it out for yourself by entering some text in the input, then pressing the toggle button:

Username

Toggle login type

This isn't always desirable though, so Vue offers a way for you to say, "These two elements are completely separate - don't re-use them." Add a `key` attribute with unique values:

```
<template v-if="loginType === 'username'">
  <label>Username</label>
  <input placeholder="Enter your username" key="username-input">
</template>
<template v-else>
  <label>Email</label>
  <input placeholder="Enter your email address" key="email-input">
</template>
```

Now those inputs will be rendered from scratch each time you toggle. See for yourself:

Username

Toggle login type

Note that the `<label>` elements are still efficiently re-used, because they don't have `key` attributes.

`v-show`

Another option for conditionally displaying an element is the `v-show` directive. The usage is largely the same:

```
<h1 v-show="ok">Hello!</h1>
```

The difference is that an element with `v-show` will always be rendered and remain in the DOM; `v-show` only toggles the `display` CSS property of the element.

Note that `v-show` doesn't support the `<template>` element, nor does it work with `v-else`.

`v-if` vs `v-show`

`v-if` is "real" conditional rendering because it ensures that event listeners and child components inside the conditional block are properly destroyed and re-created during toggles.

`v-if` is also **lazy**: if the condition is false on initial render, it will not do anything - the conditional block won't be rendered until the condition becomes true for the first time.

In comparison, `v-show` is much simpler - the element is always rendered regardless of initial condition, with CSS-based toggling.

Generally speaking, `v-if` has higher toggle costs while `v-show` has higher initial render costs. So prefer `v-show` if you need to toggle something very often, and prefer `v-if` if the condition is unlikely to change at runtime.

`v-if` with `v-for`

Using `v-if` and `v-for` together is **not recommended**. See the style guide for further information.

When used together with `v-if`, `v-for` has a higher priority than `v-if`. See the list rendering guide for details.

7. List Rendering

Mapping an Array to Elements with `v-for`

We can use the `v-for` directive to render a list of items based on an array. The `v-for`directive requires a special syntax in the form of `item in items`, where `items` is the source data array and `item` is an **alias** for the array element being iterated on:

```
<ul id="example-1">
  <li v-for="item in items">
    {{ item.message }}
  </li>
</ul>
var example1 = new Vue({
  el: '#example-1',
  data: {
    items: [
      { message: 'Foo' },
      { message: 'Bar' }
    ]
  }
})
```

Result:

- Foo
- Bar

Inside `v-for` blocks we have full access to parent scope properties. `v-for` also supports an optional second argument for the index of the current item.

```
<ul id="example-2">
  <li v-for="(item, index) in items">
    {{ parentMessage }} - {{ index }} - {{ item.message }}
  </li>
</ul>
var example2 = new Vue({
  el: '#example-2',
  data: {
    parentMessage: 'Parent',
    items: [
      { message: 'Foo' },
      { message: 'Bar' }
    ]
  }
```

```
})
```

Result:

- Parent - 0 - Foo
- Parent - 1 - Bar

You can also use `of` as the delimiter instead of `in`, so that it is closer to JavaScript's syntax for iterators:

```
<div v-for="item of items"></div>
```

`v-for` with an Object

You can also use `v-for` to iterate through the properties of an object.

```
<ul id="v-for-object" class="demo">
  <li v-for="value in object">
    {{ value }}
  </li>
</ul>
```

```
new Vue({
  el: '#v-for-object',
  data: {
    object: {
      firstName: 'John',
      lastName: 'Doe',
      age: 30
    }
  }
})
```

Result:

- John
- Doe
- 30

You can also provide a second argument for the key:

```
<div v-for="(value, key) in object">
  {{ key }}: {{ value }}
</div>
```

firstName: John
lastName: Doe
age: 30

And another for the index:

```
<div v-for="(value, key, index) in object">
  {{ index }}. {{ key }}: {{ value }}
</div>
```

0. firstName: John
1. lastName: Doe
2. age: 30

When iterating over an object, the order is based on the key enumeration order of `Object.keys()`, which is **not** guaranteed to be consistent across JavaScript engine implementations.

key

When Vue is updating a list of elements rendered with `v-for`, by default it uses an "in-place patch" strategy. If the order of the data items has changed, instead of moving the DOM elements to match the order of the items, Vue will patch each element in-place and make sure it reflects what should be rendered at that particular index. This is similar to the behavior of `track-by="$index"` in Vue 1.x.

This default mode is efficient, but only suitable **when your list render output does not rely on child component state or temporary DOM state (e.g. form input values)**.

To give Vue a hint so that it can track each node's identity, and thus reuse and reorder existing elements, you need to provide a unique `key` attribute for each item. An ideal value for `key` would be the unique id of each item. This special attribute is a rough equivalent to `track-by` in 1.x, but it works like an attribute, so you need to use `v-bind` to bind it to dynamic values (using shorthand here):

```
<div v-for="item in items" :key="item.id">
  <!-- content -->
</div>
```

It is recommended to provide a `key` with `v-for` whenever possible, unless the iterated DOM content is simple, or you are intentionally relying on the default behavior for performance gains.

Since it's a generic mechanism for Vue to identify nodes, the `key` also has other uses that are not specifically tied to `v-for`, as we will see later in the guide.

Don't use non-primitive values like objects and arrays as `v-for` keys. Use string or numeric values instead.

Array Change Detection

Mutation Methods

Vue wraps an observed array's mutation methods so they will also trigger view updates. The wrapped methods are:

- `push()`
- `pop()`
- `shift()`
- `unshift()`
- `splice()`
- `sort()`
- `reverse()`

You can open the console and play with the previous examples' `items` array by calling their mutation methods. For example: `example1.items.push({ message: 'Baz' })`.

Replacing an Array

Mutation methods, as the name suggests, mutate the original array they are called on. In comparison, there are also non-mutating methods, e.g. `filter()`, `concat()` and `slice()`, which do not mutate the original array but **always return a new array**. When working with non-mutating methods, you can replace the old array with the new one:

```
example1.items = example1.items.filter(function (item) {
  return item.message.match(/Foo/)
})
```

You might think this will cause Vue to throw away the existing DOM and re-render the entire list - luckily, that is not the case. Vue implements some smart heuristics to maximize DOM element reuse, so replacing an array with another array containing overlapping objects is a very efficient operation.

Caveats

Due to limitations in JavaScript, Vue **cannot** detect the following changes to an array:

1. When you directly set an item with the index, e.g. `vm.items[indexOfItem] = newValue`
2. When you modify the length of the array, e.g. `vm.items.length = newLength`

For example:

```
var vm = new Vue({
  data: {
    items: ['a', 'b', 'c']
  }
})
vm.items[1] = 'x' // is NOT reactive
vm.items.length = 2 // is NOT reactive
```

To overcome caveat 1, both of the following will accomplish the same as `vm.items[indexOfItem] = newValue`, but will also trigger state updates in the reactivity system:

```
// Vue.set
Vue.set(vm.items, indexOfItem, newValue)

// Array.prototype.splice
vm.items.splice(indexOfItem, 1, newValue)
```

You can also use the **`vm.$set`** instance method, which is an alias for the global `Vue.set`:

```
vm.$set(vm.items, indexOfItem, newValue)
```

To deal with caveat 2, you can use `splice`:

```
vm.items.splice(newLength)
```

Object Change Detection Caveats

Again due to limitations of modern JavaScript, **Vue cannot detect property addition or deletion**. For example:

```
var vm = new Vue({
  data: {
    a: 1
  }
})
// `vm.a` is now reactive


vm.b = 2
// `vm.b` is NOT reactive
```

Vue does not allow dynamically adding new root-level reactive properties to an already created instance. However, it's possible to add reactive properties to a nested object using the `Vue.set(object, key, value)` method. For example, given:

```
var vm = new Vue({
  data: {
    userProfile: {
      name: 'Anika'
    }
```

```
  }
})
```

You could add a new `age` property to the nested `userProfile` object with:

```
Vue.set(vm.userProfile, 'age', 27)
```

You can also use the `vm.$set` instance method, which is an alias for the global `Vue.set`:

```
vm.$set(vm.userProfile, 'age', 27)
```

Sometimes you may want to assign a number of new properties to an existing object, for example using `Object.assign()` or `_.extend()`. In such cases, you should create a fresh object with properties from both objects. So instead of:

```
Object.assign(vm.userProfile, {
  age: 27,
  favoriteColor: 'Vue Green'
})
```

You would add new, reactive properties with:

```
vm.userProfile = Object.assign({}, vm.userProfile, {
  age: 27,
  favoriteColor: 'Vue Green'
})
```

Displaying Filtered/Sorted Results

Sometimes we want to display a filtered or sorted version of an array without actually mutating or resetting the original data. In this case, you can create a computed property that returns the filtered or sorted array.

For example:

```
<li v-for="n in evenNumbers">{{ n }}</li>
```

```
data: {
  numbers: [ 1, 2, 3, 4, 5 ]
},
computed: {
  evenNumbers: function () {
    return this.numbers.filter(function (number) {
      return number % 2 === 0
    })
  }
}
```

In situations where computed properties are not feasible (e.g. inside nested `v-for`loops), you can use a method:

```
<li v-for="n in even(numbers)">{{ n }}</li>
```

```
data: {
```

```
  numbers: [ 1, 2, 3, 4, 5 ]
},
methods: {
  even: function (numbers) {
    return numbers.filter(function (number) {
      return number % 2 === 0
    })
  }
}
```

`v-for` with a Range

`v-for` can also take an integer. In this case it will repeat the template that many times.

```
<div>
  <span v-for="n in 10">{{ n }} </span>
</div>
```

Result:
1 2 3 4 5 6 7 8 9 10

`v-for` on a `<template>`

Similar to template `v-if`, you can also use a `<template>` tag with `v-for` to render a block of multiple elements. For example:

```
<ul>
  <template v-for="item in items">
    <li>{{ item.msg }}</li>
    <li class="divider" role="presentation"></li>
  </template>
</ul>
```

`v-for` with `v-if`

> Note that it's **not** recommended to use `v-if` and `v-for` together. Refer to style guide for details.

When they exist on the same node, `v-for` has a higher priority than `v-if`. That means the `v-if` will be run on each iteration of the loop separately. This can be useful when you want to render nodes for only *some* items, like below:

```
<li v-for="todo in todos" v-if="!todo.isComplete">
  {{ todo }}
</li>
```

The above only renders the todos that are not complete.
If instead, your intent is to conditionally skip execution of the loop, you can place the `v-if` on a wrapper element (or `<template>`). For example:

```
<ul v-if="todos.length">
  <li v-for="todo in todos">
    {{ todo }}
  </li>
</ul>
<p v-else>No todos left!</p>
```

`v-for` with a Component

This section assumes knowledge of Components. Feel free to skip it and come back later.

You can directly use `v-for` on a custom component, like any normal element:

```
<my-component v-for="item in items" :key="item.id"></my-component>
```

In 2.2.0+, when using `v-for` with a component, a `key` is now required.

However, this won't automatically pass any data to the component, because components have isolated scopes of their own. In order to pass the iterated data into the component, we should also use props:

```
<my-component
  v-for="(item, index) in items"
  v-bind:item="item"
  v-bind:index="index"
  v-bind:key="item.id"
></my-component>
```

The reason for not automatically injecting `item` into the component is because that makes the component tightly coupled to how `v-for` works. Being explicit about where its data comes from makes the component reusable in other situations.

Here's a complete example of a simple todo list:

```
<div id="todo-list-example">
  <form v-on:submit.prevent="addNewTodo">
    <label for="new-todo">Add a todo</label>
    <input
      v-model="newTodoText"
      id="new-todo"
      placeholder="E.g. Feed the cat"
    >
    <button>Add</button>
  </form>
  <ul>
    <li
      is="todo-item"
      v-for="(todo, index) in todos"
```

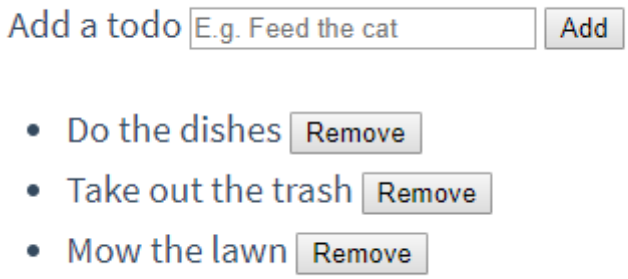
```
      v-bind:key="todo.id"
      v-bind:title="todo.title"
      v-on:remove="todos.splice(index, 1)"
    ></li>
  </ul>
</div>
```

Note the `is="todo-item"` attribute. This is necessary in DOM templates, because only an `<li>` element is valid inside a `<ul>`. It does the same thing as `<todo-item>`, but works around a potential browser parsing error. See **DOM Template Parsing Caveats** to learn more.

```
Vue.component('todo-item', {
  template: '\
    <li>\
      {{ title }}\
      <button v-on:click="$emit(\'remove\')">Remove</button>\
    </li>\
  ',
  props: ['title']
})

new Vue({
  el: '#todo-list-example',
  data: {
    newTodoText: '',
    todos: [
      {
        id: 1,
        title: 'Do the dishes',
      },
      {
        id: 2,
        title: 'Take out the trash',
      },
      {
        id: 3,
        title: 'Mow the lawn'
      }
    ],
    nextTodoId: 4
  },
  methods: {
    addNewTodo: function () {
```

```
      this.todos.push({
        id: this.nextTodoId++,
        title: this.newTodoText
      })
      this.newTodoText = ''
    }
  }
})
```



8. Event Handling

Listening to Events

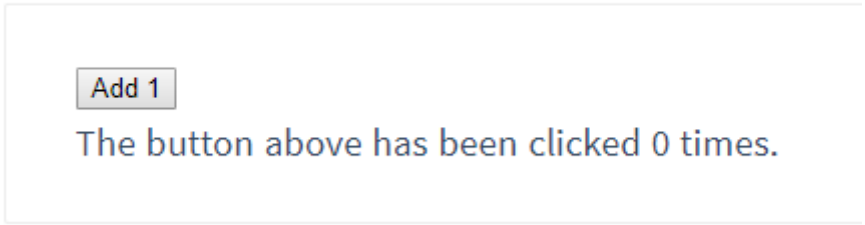
We can use the `v-on` directive to listen to DOM events and run some JavaScript when they're triggered.

For example:

```
<div id="example-1">
  <button v-on:click="counter += 1">Add 1</button>
  <p>The button above has been clicked {{ counter }} times.</p>
</div>
```

```
var example1 = new Vue({
  el: '#example-1',
  data: {
    counter: 0
  }
})
```

Result:



The button above has been clicked 0 times.

Method Event Handlers

The logic for many event handlers will be more complex though, so keeping your JavaScript in the value of the `v-on` attribute isn't feasible. That's why `v-on` can also accept the name of a method you'd like to call.

For example:

```
<div id="example-2">
  <!-- `greet` is the name of a method defined below -->
  <button v-on:click="greet">Greet</button>
```

```
</div>
var example2 = new Vue({
  el: '#example-2',
  data: {
    name: 'Vue.js'
  },
  // define methods under the `methods` object
  methods: {
    greet: function (event) {
      // `this` inside methods points to the Vue instance
      alert('Hello ' + this.name + '!')
      // `event` is the native DOM event
      if (event) {
        alert(event.target.tagName)
      }
    }
  }
})


// you can invoke methods in JavaScript too
example2.greet() // => 'Hello Vue.js!'
```

Greet

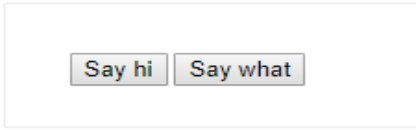
Result:

Methods in Inline Handlers

Instead of binding directly to a method name, we can also use methods in an inline JavaScript statement:

```
<div id="example-3">
  <button v-on:click="say('hi')">Say hi</button>
  <button v-on:click="say('what')">Say what</button>
</div>
new Vue({
  el: '#example-3',
  methods: {
    say: function (message) {
      alert(message)
    }
  }
})
```

Result:



Sometimes we also need to access the original DOM event in an inline statement handler. You can pass it into a method using the special `$event` variable:

```
<button v-on:click="warn('Form cannot be submitted yet.', $event)">
  Submit
</button>

// ...
methods: {
  warn: function (message, event) {
    // now we have access to the native event
    if (event) event.preventDefault()
    alert(message)
  }
}
```

Event Modifiers

It is a very common need to
call `event.preventDefault()` or `event.stopPropagation()` inside event handlers. Although we can do this easily inside methods, it would be better if the methods can be purely about data logic rather than having to deal with DOM event details.
To address this problem, Vue provides **event modifiers** for `v-on`. Recall that modifiers are directive postfixes denoted by a dot.

- `.stop`
- `.prevent`
- `.capture`
- `.self`
- `.once`
- `.passive`

```
<!-- the click event's propagation will be stopped -->
<a v-on:click.stop="doThis"></a>

<!-- the submit event will no longer reload the page -->
<form v-on:submit.prevent="onSubmit"></form>

<!-- modifiers can be chained -->
```

```
<a v-on:click.stop.prevent="doThat"></a>


<!-- just the modifier -->
<form v-on:submit.prevent></form>


<!-- use capture mode when adding the event listener -->
<!-- i.e. an event targeting an inner element is handled here before being
handled by that element -->
<div v-on:click.capture="doThis">...</div>


<!-- only trigger handler if event.target is the element itself -->
<!-- i.e. not from a child element -->
<div v-on:click.self="doThat">...</div>
```

Order matters when using modifiers because the relevant code is generated in the same order. Therefore using `v-on:click.prevent.self` will prevent **all clicks** while `v-on:click.self.prevent` will only prevent clicks on the element itself.

New in 2.1.4+

```
<!-- the click event will be triggered at most once -->
<a v-on:click.once="doThis"></a>
```

Unlike the other modifiers, which are exclusive to native DOM events, the `.once`modifier can also be used on **component events**. If you haven't read about components yet, don't worry about this for now.

New in 2.3.0+

Vue also offers the `.passive` modifier, corresponding to `addEventListener`'s `passive` **option**.

```
<!-- the scroll event's default behavior (scrolling) will happen -->
<!-- immediately, instead of waiting for `onScroll` to complete  -->
<!-- in case it contains `event.preventDefault()`                -->
<div v-on:scroll.passive="onScroll">...</div>
```

The `.passive` modifier is especially useful for improving performance on mobile devices.

Don't use `.passive` and `.prevent` together, because `.prevent` will be ignored and your browser will probably show you a warning. Remember, `.passive` communicates to the browser that you *don't* want to prevent the event's default behavior.

Key Modifiers

When listening for keyboard events, we often need to check for specific keys. Vue allows adding key modifiers for `v-on` when listening for key events:

```
<!-- only call `vm.submit()` when the `key` is `Enter` -->
```

```
<input v-on:keyup.enter="submit">
```

You can directly use any valid key names exposed via `KeyboardEvent.key` as modifiers by converting them to kebab-case.

```
<input v-on:keyup.page-down="onPageDown">
```

In the above example, the handler will only be called if `$event.key` is equal to `'PageDown'`.

Key Codes

> The use of `keyCode` events **is deprecated** and may not be supported in new browsers.

Using `keyCode` attributes is also permitted:

```
<input v-on:keyup.13="submit">
```

Vue provides aliases for the most commonly used key codes when necessary for legacy browser support:

- `.enter`
- `.tab`
- `.delete` (captures both “Delete” and “Backspace” keys)
- `.esc`
- `.space`
- `.up`
- `.down`
- `.left`
- `.right`

> A few keys (`.esc` and all arrow keys) have inconsistent `key` values in IE9, so these built-in aliases should be preferred if you need to support IE9.

You can also **define custom key modifier aliases** via the global `config.keyCodes`object:

```
// enable `v-on:keyup.f1`
Vue.config.keyCodes.f1 = 112
```

System Modifier Keys

New in 2.1.0+

You can use the following modifiers to trigger mouse or keyboard event listeners only when the corresponding modifier key is pressed:

- `.ctrl`
- `.alt`
- `.shift`
- `.meta`

Note: On Macintosh keyboards, meta is the command key (⌘). On Windows keyboards, meta is the windows key (⊞). On Sun Microsystems keyboards, meta is marked as a solid diamond (◆). On certain keyboards, specifically MIT and Lisp machine keyboards and successors, such as the Knight keyboard, space-cadet keyboard, meta is labeled "META". On Symbolics keyboards, meta is labeled "META" or "Meta".

For example:

```
<!-- Alt + C -->
<input @keyup.alt.67="clear">


<!-- Ctrl + Click -->
<div @click.ctrl="doSomething">Do something</div>
```

Note that modifier keys are different from regular keys and when used with `keyup` events, they have to be pressed when the event is emitted. In other words, `keyup.ctrl` will only trigger if you release a key while holding down `ctrl`. It won't trigger if you release the `ctrl` key alone. If you do want such behaviour, use the `keyCode` for `ctrl` instead: `keyup.17`.

`.exact` Modifier

New in 2.5.0+

The `.exact` modifier allows control of the exact combination of system modifiers needed to trigger an event.

```
<!-- this will fire even if Alt or Shift is also pressed -->
<button @click.ctrl="onClick">A</button>


<!-- this will only fire when Ctrl and no other keys are pressed -->
<button @click.ctrl.exact="onCtrlClick">A</button>


<!-- this will only fire when no system modifiers are pressed -->
<button @click.exact="onClick">A</button>
```

Mouse Button Modifiers

New in 2.2.0+

- `.left`

- `.right`
- `.middle`

These modifiers restrict the handler to events triggered by a specific mouse button.

Why Listeners in HTML?

You might be concerned that this whole event listening approach violates the good old rules about “separation of concerns”. Rest assured - since all Vue handler functions and expressions are strictly bound to the ViewModel that’s handling the current view, it won’t cause any maintenance difficulty. In fact, there are several benefits in using `v-on`:

1. It’s easier to locate the handler function implementations within your JS code by skimming the HTML template.

2. Since you don’t have to manually attach event listeners in JS, your ViewModel code can be pure logic and DOM-free. This makes it easier to test.

3. When a ViewModel is destroyed, all event listeners are automatically removed. You don’t need to worry about cleaning it up yourself.

9. Form Input Bindings

Basic Usage

You can use the `v-model` directive to create two-way data bindings on form input, textarea, and select elements. It automatically picks the correct way to update the element based on the input type. Although a bit magical, `v-model` is essentially syntax sugar for updating data on user input events, plus special care for some edge cases.

> `v-model` will ignore the initial `value`, `checked` or `selected` attributes found on any form elements. It will always treat the Vue instance data as the source of truth. You should declare the initial value on the JavaScript side, inside the `data` option of your component.

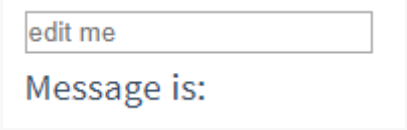
`v-model` internally uses different properties and emits different events for different input elements:

- text and textarea elements use `value` property and `input` event;
- checkboxes and radiobuttons use `checked` property and `change` event;
- select fields use `value` as a prop and `change` as an event.

> For languages that require an IME (Chinese, Japanese, Korean etc.), you'll notice that `v-model` doesn't get updated during IME composition. If you want to cater for these updates as well, use `input` event instead.

Text

```
<input v-model="message" placeholder="edit me">
<p>Message is: {{ message }}</p>
```



Multiline text

```
<span>Multiline message is:</span>

<p style="white-space: pre-line;">{{ message }}</p>

<br>
<textarea v-model="message" placeholder="add multiple lines"></textarea>
```

Interpolation on textareas (`<textarea>{{text}}</textarea>`) won't work. Use `v-model` instead.

Checkbox

Single checkbox, boolean value:

```
<input type="checkbox" id="checkbox" v-model="checked">
<label for="checkbox">{{ checked }}</label>
```

☐ false

Multiple checkboxes, bound to the same Array:

```
<div id='example-3'>
  <input type="checkbox" id="jack" value="Jack" v-model="checkedNames">
  <label for="jack">Jack</label>
  <input type="checkbox" id="john" value="John" v-model="checkedNames">
  <label for="john">John</label>
  <input type="checkbox" id="mike" value="Mike" v-model="checkedNames">
  <label for="mike">Mike</label>
  <br>
  <span>Checked names: {{ checkedNames }}</span>
</div>
new Vue({
  el: '#example-3',
  data: {
    checkedNames: []
  }
})
```

☐ Jack ☐ John ☐ Mike

Checked names: []

Radio

```
<input type="radio" id="one" value="One" v-model="picked">
<label for="one">One</label>
<br>
```

```
<input type="radio" id="two" value="Two" v-model="picked">
<label for="two">Two</label>
<br>
<span>Picked: {{ picked }}</span>
```

One

Two

Picked:

Select

Single select:

```
<select v-model="selected">
  <option disabled value="">Please select one</option>
  <option>A</option>
  <option>B</option>
  <option>C</option>
</select>
<span>Selected: {{ selected }}</span>
```

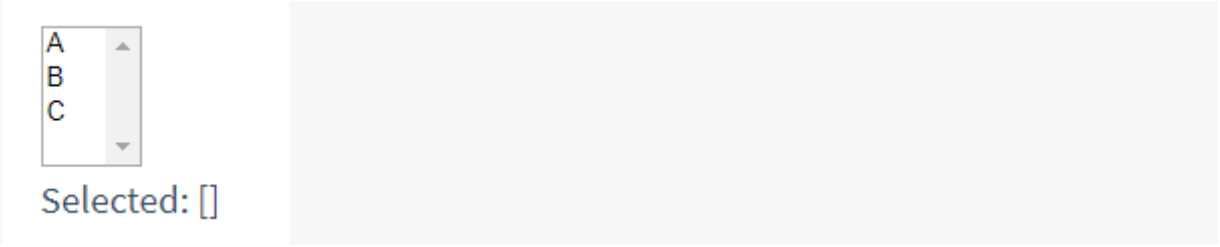
```
new Vue({
  el: '...',
  data: {
    selected: ''
  }
})
```

Please select one Selected:

> If the initial value of your `v-model` expression does not match any of the options, the `<select>` element will render in an “unselected” state. On iOS this will cause the user not being able to select the first item because iOS does not fire a change event in this case. It is therefore recommended to provide a disabled option with an empty value, as demonstrated in the example above.

Multiple select (bound to Array):

```
<select v-model="selected" multiple>
  <option>A</option>
  <option>B</option>
  <option>C</option>
</select>
<br>
<span>Selected: {{ selected }}</span>
```



Dynamic options rendered with `v-for`:

```
<select v-model="selected">
  <option v-for="option in options" v-bind:value="option.value">
    {{ option.text }}
  </option>
</select>
<span>Selected: {{ selected }}</span>
```

```
new Vue({
  el: '...',
  data: {
    selected: 'A',
    options: [
      { text: 'One', value: 'A' },
      { text: 'Two', value: 'B' },
      { text: 'Three', value: 'C' }
    ]
  }
})
```

Value Bindings

For radio, checkbox and select options, the `v-model` binding values are usually static strings (or booleans for checkbox):

```
<!-- `picked` is a string "a" when checked -->
<input type="radio" v-model="picked" value="a">

<!-- `toggle` is either true or false -->
<input type="checkbox" v-model="toggle">

<!-- `selected` is a string "abc" when the first option is selected -->
<select v-model="selected">
  <option value="abc">ABC</option>
</select>
```

But sometimes we may want to bind the value to a dynamic property on the Vue instance. We can use `v-bind` to achieve that. In addition, using `v-bind` allows us to bind the input value to non-string values.

Checkbox

```
<input
  type="checkbox"
  v-model="toggle"
  true-value="yes"
  false-value="no"
>
// when checked:
vm.toggle === 'yes'
// when unchecked:
vm.toggle === 'no'
```

> The `true-value` and `false-value` attributes don't affect the input's `value`attribute, because browsers don't include unchecked boxes in form submissions. To guarantee that one of two values is submitted in a form (e.g. "yes" or "no"), use radio inputs instead.

Radio

```
<input type="radio" v-model="pick" v-bind:value="a">
// when checked:
vm.pick === vm.a
```

Select Options

```
<select v-model="selected">
  <!-- inline object literal -->
  <option v-bind:value="{ number: 123 }">123</option>
</select>
// when selected:
typeof vm.selected // => 'object'
vm.selected.number // => 123
```

Modifiers

`.lazy`

By default, `v-model` syncs the input with the data after each `input` event (with the exception of IME composition as **stated above**). You can add the `lazy` modifier to instead sync after `change` events:

```
<!-- synced after "change" instead of "input" -->
<input v-model.lazy="msg" >
```

`.number`

If you want user input to be automatically typecast as a number, you can add the `number` modifier to your `v-model` managed inputs:

```
<input v-model.number="age" type="number">
```

This is often useful, because even with `type="number"`, the value of HTML input elements always returns a string. If the value cannot be parsed with `parseFloat()`, then the original value is returned.

`.trim`

If you want whitespace from user input to be trimmed automatically, you can add the `trim` modifier to your `v-model`-managed inputs:

```
<input v-model.trim="msg">
```

`v-model` with Components

If you're not yet familiar with Vue's components, you can skip this for now.

HTML's built-in input types won't always meet your needs. Fortunately, Vue components allow you to build reusable inputs with completely customized behavior. These inputs even work with `v-model`! To learn more, read about **custom inputs** in the Components guide.

10. Components Basics

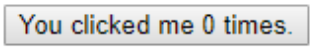
Base Example

Here's an example of a Vue component:

```
// Define a new component called button-counter
Vue.component('button-counter', {
  data: function () {
    return {
      count: 0
    }
  },
  template: '<button v-on:click="count++">You clicked me {{ count }} times.</button>'
})
```

Components are reusable Vue instances with a name: in this case, `<button-counter>`. We can use this component as a custom element inside a root Vue instance created with `new Vue`:

```
<div id="components-demo">
  <button-counter></button-counter>
</div>
new Vue({ el: '#components-demo' })
```

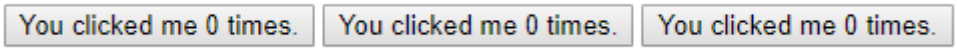


Since components are reusable Vue instances, they accept the same options as `new Vue`, such as `data`, `computed`, `watch`, `methods`, and lifecycle hooks. The only exceptions are a few root-specific options like `el`.

Reusing Components

Components can be reused as many times as you want:

```
<div id="components-demo">
  <button-counter></button-counter>
  <button-counter></button-counter>
  <button-counter></button-counter>
</div>
```



Notice that when clicking on the buttons, each one maintains its own, separate `count`. That's because each time you use a component, a new **instance** of it is created.

`data` Must Be a Function

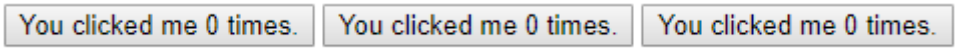
When we defined the `<button-counter>` component, you may have noticed that `data` wasn't directly provided an object, like this:

```
data: {
  count: 0
}
```

Instead, **a component's `data` option must be a function**, so that each instance can maintain an independent copy of the returned data object:

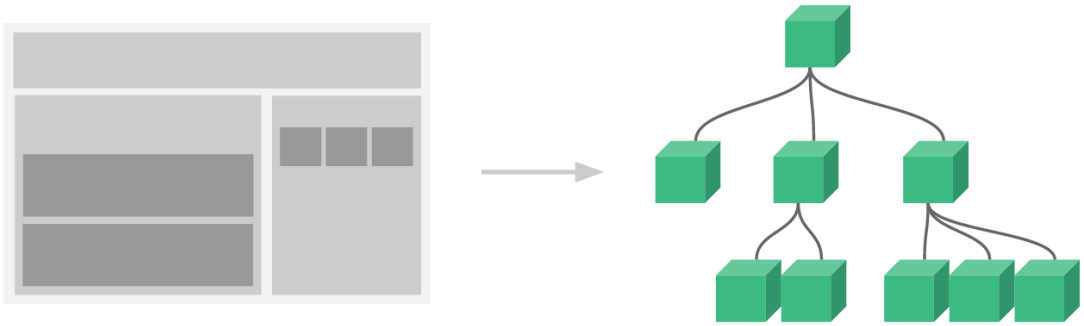
```
data: function () {
  return {
    count: 0
  }
}
```

If Vue didn't have this rule, clicking on one button would affect the data of *all other instances*, like below:



Organizing Components

It's common for an app to be organized into a tree of nested components:



For example, you might have components for a header, sidebar, and content area, each typically containing other components for navigation links, blog posts, etc.
To use these components in templates, they must be registered so that Vue knows about them. There are two types of component registration: **global** and **local**. So far, we've only registered components globally, using `Vue.component`:

```
Vue.component('my-component-name', {
  // ... options ...
})
```

Globally registered components can be used in the template of any root Vue instance (`new Vue`) created afterwards – and even inside all subcomponents of that Vue instance's component tree.

That's all you need to know about registration for now, but once you've finished reading this page and feel comfortable with its content, we recommend coming back later to read the full guide on **Component Registration**.

Passing Data to Child Components with Props

Earlier, we mentioned creating a component for blog posts. The problem is, that component won't be useful unless you can pass data to it, such as the title and content of the specific post we want to display. That's where props come in.
Props are custom attributes you can register on a component. When a value is passed to a prop attribute, it becomes a property on that component instance. To pass a title to our blog post component, we can include it in the list of props this component accepts, using a `props` option:

```
Vue.component('blog-post', {
  props: ['title'],
  template: '<h3>{{ title }}</h3>'
})
```

A component can have as many props as you'd like and by default, any value can be passed to any prop. In the template above, you'll see that we can access this value on the component instance, just like with `data`.

Once a prop is registered, you can pass data to it as a custom attribute, like this:

```
<blog-post title="My journey with Vue"></blog-post>
<blog-post title="Blogging with Vue"></blog-post>
<blog-post title="Why Vue is so fun"></blog-post>
```

My journey with Vue

Blogging with Vue

Why Vue is so fun

In a typical app, however, you'll likely have an array of posts in `data`:

```
new Vue({
  el: '#blog-post-demo',
  data: {
    posts: [
      { id: 1, title: 'My journey with Vue' },
      { id: 2, title: 'Blogging with Vue' },
```

```
      { id: 3, title: 'Why Vue is so fun' }
    ]
  }
})
```

Then want to render a component for each one:

```
<blog-post
  v-for="post in posts"
  v-bind:key="post.id"
  v-bind:title="post.title"
></blog-post>
```

Above, you'll see that we can use `v-bind` to dynamically pass props. This is especially useful when you don't know the exact content you're going to render ahead of time, like when **fetching posts from an API**.

That's all you need to know about props for now, but once you've finished reading this page and feel comfortable with its content, we recommend coming back later to read the full guide on **Props**.

A Single Root Element

When building out a `<blog-post>` component, your template will eventually contain more than just the title:

```
<h3>{{ title }}</h3>
```

At the very least, you'll want to include the post's content:

```
<h3>{{ title }}</h3>
<div v-html="content"></div>
```

If you try this in your template however, Vue will show an error, explaining that **every component must have a single root element**. You can fix this error by wrapping the template in a parent element, such as:

```
<div class="blog-post">
  <h3>{{ title }}</h3>
  <div v-html="content"></div>
</div>
```

As our component grows, it's likely we'll not only need the title and content of a post, but also the published date, comments, and more. Defining a prop for each related piece of information could become very annoying:

```
<blog-post
  v-for="post in posts"
  v-bind:key="post.id"
```

```
  v-bind:title="post.title"
  v-bind:content="post.content"
  v-bind:publishedAt="post.publishedAt"
  v-bind:comments="post.comments"
></blog-post>
```

So this might be a good time to refactor the `<blog-post>` component to accept a single `post` prop instead:

```
<blog-post
  v-for="post in posts"
  v-bind:key="post.id"
  v-bind:post="post"
></blog-post>
```

```
Vue.component('blog-post', {
  props: ['post'],
  template: `
    <div class="blog-post">
      <h3>{{ post.title }}</h3>
      <div v-html="post.content"></div>
    </div>
  `
})
```

> The above example and some future ones use JavaScript's **template literal** to make multi-line templates more readable. These are not supported by Internet Explorer (IE), so if you must support IE and are not transpiling (e.g. with Babel or TypeScript), use **newline escapes** instead.

Now, whenever a new property is added to `post` objects, it will automatically be available inside `<blog-post>`.

Listening to Child Components Events

As we develop our `<blog-post>` component, some features may require communicating back up to the parent. For example, we may decide to include an accessibility feature to enlarge the text of blog posts, while leaving the rest of the page its default size:

In the parent, we can support this feature by adding a `postFontSize` data property:

```
new Vue({
  el: '#blog-posts-events-demo',
  data: {
```

```
    posts: [/* ... */],
    postFontSize: 1
  }
})
```

Which can be used in the template to control the font size of all blog posts:

```
<div id="blog-posts-events-demo">
  <div :style="{ fontSize: postFontSize + 'em' }">
    <blog-post
      v-for="post in posts"
      v-bind:key="post.id"
      v-bind:post="post"
    ></blog-post>
  </div>
</div>
```

Now let's add a button to enlarge the text right before the content of every post:

```
Vue.component('blog-post', {
  props: ['post'],
  template: `
    <div class="blog-post">
      <h3>{{ post.title }}</h3>
      <button>
        Enlarge text
      </button>
      <div v-html="post.content"></div>
    </div>
  `
})
```

The problem is, this button doesn't do anything:

```
<button>
  Enlarge text
</button>
```

When we click on the button, we need to communicate to the parent that it should enlarge the text of all posts. Fortunately, Vue instances provide a custom events system to solve this problem. The parent can choose to listen to any event on the child component instance with `v-on`, just as we would with a native DOM event:

```
<blog-post
  ...
  v-on:enlarge-text="postFontSize += 0.1"
></blog-post>
```

Then the child component can emit an event on itself by calling the built-in **`$emit`** **method**, passing the name of the event:

```
<button v-on:click="$emit('enlarge-text')">
  Enlarge text
</button>
```

Thanks to the `v-on:enlarge-text="postFontSize += 0.1"` listener, the parent will receive the event and update `postFontSize` value.

Emitting a Value With an Event

It's sometimes useful to emit a specific value with an event. For example, we may want the `<blog-post>` component to be in charge of how much to enlarge the text by. In those cases, we can use `$emit`'s 2nd parameter to provide this value:

```
<button v-on:click="$emit('enlarge-text', 0.1)">
  Enlarge text
</button>
```

Then when we listen to the event in the parent, we can access the emitted event's value with `$event`:

```
<blog-post
  ...
  v-on:enlarge-text="postFontSize += $event"
></blog-post>
```

Or, if the event handler is a method:

```
<blog-post
  ...
  v-on:enlarge-text="onEnlargeText"
></blog-post>
```

Then the value will be passed as the first parameter of that method:

```
methods: {
```

```
  onEnlargeText: function (enlargeAmount) {
    this.postFontSize += enlargeAmount
  }
}
```

Using `v-model` on Components

Custom events can also be used to create custom inputs that work with `v-model`.

Remember that:

```
<input v-model="searchText">
```

does the same thing as:

```
<input
  v-bind:value="searchText"
  v-on:input="searchText = $event.target.value"
>
```

When used on a component, `v-model` instead does this:

```
<custom-input
  v-bind:value="searchText"
  v-on:input="searchText = $event"
></custom-input>
```

For this to actually work though, the `<input>` inside the component must:

- Bind the `value` attribute to a `value` prop
- On `input`, emit its own custom `input` event with the new value

Here's that in action:

```
Vue.component('custom-input', {
  props: ['value'],
  template: `
    <input
      v-bind:value="value"
      v-on:input="$emit('input', $event.target.value)"
    >
  `
})
```

Now `v-model` should work perfectly with this component:

```
<custom-input v-model="searchText"></custom-input>
```

That's all you need to know about custom component events for now, but once you've finished reading this page and feel comfortable with its content, we recommend coming back later to read the full guide on Custom Events.

Content Distribution with Slots

Just like with HTML elements, it's often useful to be able to pass content to a component, like this:

```
<alert-box>
  Something bad happened.
</alert-box>
```

Which might render something like:

Error! Something bad happened.

Fortunately, this task is made very simple by Vue's custom `<slot>` element:

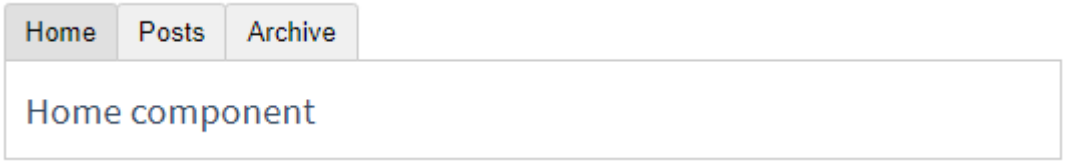
```
Vue.component('alert-box', {
  template: `
    <div class="demo-alert-box">
      <strong>Error!</strong>
      <slot></slot>
    </div>
  `
})
```

As you'll see above, we just add the slot where we want it to go – and that's it. We're done!

That's all you need to know about slots for now, but once you've finished reading this page and feel comfortable with its content, we recommend coming back later to read the full guide on **Slots**.

Dynamic Components

Sometimes, it's useful to dynamically switch between components, like in a tabbed interface:



The above is made possible by Vue's `<component>` element with the `is` special attribute:

```
<!-- Component changes when currentTabComponent changes -->
<component v-bind:is="currentTabComponent"></component>
```

In the example above, `currentTabComponent` can contain either:

- the name of a registered component, or
- a component's options object

See **this fiddle** to experiment with the full code, or **this version** for an example binding to a component's options object, instead of its registered name.

That's all you need to know about dynamic components for now, but once you've finished reading this page and feel comfortable with its content, we recommend coming back later to read the full guide on **Dynamic & Async Components**.

DOM Template Parsing Caveats

Some HTML elements, such as `<ul>`, `<ol>`, `<table>` and `<select>` have restrictions on what elements can appear inside them, and some elements such as `<li>`, `<tr>`, and `<option>` can only appear inside certain other elements.

This will lead to issues when using components with elements that have such restrictions. For example:

```
<table>
  <blog-post-row></blog-post-row>
</table>
```

The custom component `<blog-post-row>` will be hoisted out as invalid content, causing errors in the eventual rendered output. Fortunately, the `is` special attribute offers a workaround:

```
<table>
  <tr is="blog-post-row"></tr>
</table>
```

It should be noted that **this limitation does *not* apply if you are using string templates from one of the following sources**:

- String templates (e.g. `template: '...'`)
- **Single-file (`.vue`) components**
- **`<script type="text/x-template">`**

That's all you need to know about DOM template parsing caveats for now – and actually, the end of Vue's *Essentials*. Congratulations! There's still more to learn, but first, we recommend taking a break to play with Vue yourself and build something fun.

Once you feel comfortable with the knowledge you've just digested, we recommend coming back to read the full guide on **Dynamic & Async Components**, as well as the other pages in the Components In-Depth section of the sidebar.