

Note: this section is really really out of date. It will be updated someday, but meanwhile, this tutorial will probably be frustrating to follow, since it was written a long time ago.

This guide is about creating modules for Odoo's web client.

To create websites with Odoo, see [Building a Website \(website.html\)](#); to add business capabilities or extend existing business systems of Odoo, see [Building a Module \(backend.html\)](#).

⚠ Warning

This guide assumes knowledge of:

Javascript basics and good practices

jQuery (<http://jquery.org>).

Underscore.js (<http://underscorejs.org>).

It also requires [an installed Odoo \(../setup/install.html#setup-install\)](#), and [Git \(http://git-scm.com\)](http://git-scm.com).

A Simple Module

Let's start with a simple Odoo module holding basic web component configuration and letting us test the web framework.

The example module is available online and can be downloaded using the following command:

```
$ git clone http://github.com/odoo/petstore
```

This will create a **petstore** folder wherever you executed the command. You then need to add that folder to Odoo's [addons_path \(../reference/cmdline.html#cmdoption-odoo-bin-addons-path\)](#), create a new database and install the **oepetstore** module.

If you browse the **petstore** folder, you should see the following content:

```

oepetstore
|-- images
|   |-- alligator.jpg
|   |-- ball.jpg
|   |-- crazy_circle.jpg
|   |-- fish.jpg
|   |-- mice.jpg
|-- __init__.py
|-- oepetstore.message_of_the_day.csv
|-- __manifest__.py
|-- petstore_data.xml
|-- petstore.py
|-- petstore.xml
`-- static
    |-- src
    |   |-- css
    |   |   |-- petstore.css
    |   |-- js
    |   |   |-- petstore.js
    |   |-- xml
    |       |-- petstore.xml

```

The module already holds various server customizations. We'll come back to these later, for now let's focus on the web-related content, in the **static** folder.

Files used in the "web" side of an Odoo module must be placed in a **static** folder so they are available to a web browser, files outside that folder can not be fetched by browsers. The **src/css**, **src/js** and **src/xml** sub-folders are conventional and not strictly necessary.

oepetstore/static/css/petstore.css

Currently empty, will hold the CSS (<http://www.w3.org/Style/CSS/Overview.en.html>), for pet store content

oepetstore/static/xml/petstore.xml

Mostly empty, will hold QWeb ([../reference/qweb.html#reference-qweb](http://reference.qweb.html#reference-qweb)), templates

oepetstore/static/js/petstore.js

The most important (and interesting) part, contains the logic of the application (or at least its web-browser side) as javascript. It should currently look like:

```

odoo.oepetstore = function(instance, local) {
    var _t = instance.web._t,
        _lt = instance.web._lt;
    var QWeb = instance.web.qweb;

    local.HomePage = instance.Widget.extend({
        start: function() {
            console.log("pet store home page loaded");
        },
    });

    instance.web.client_actions.add(
        'petstore.homepage', 'instance.oepetstore.HomePage');
}

```

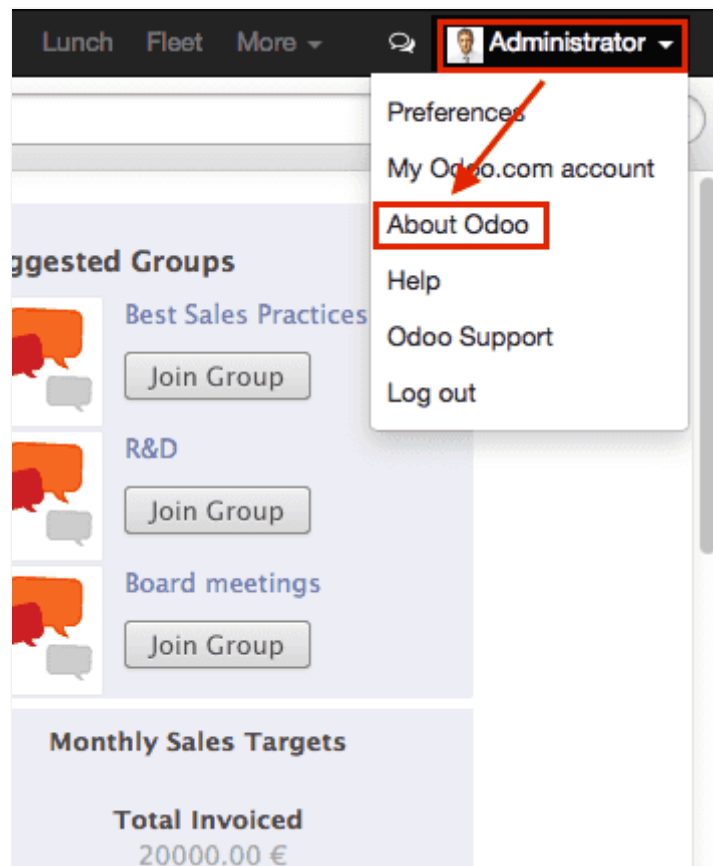
Which only prints a small message in the browser's console.

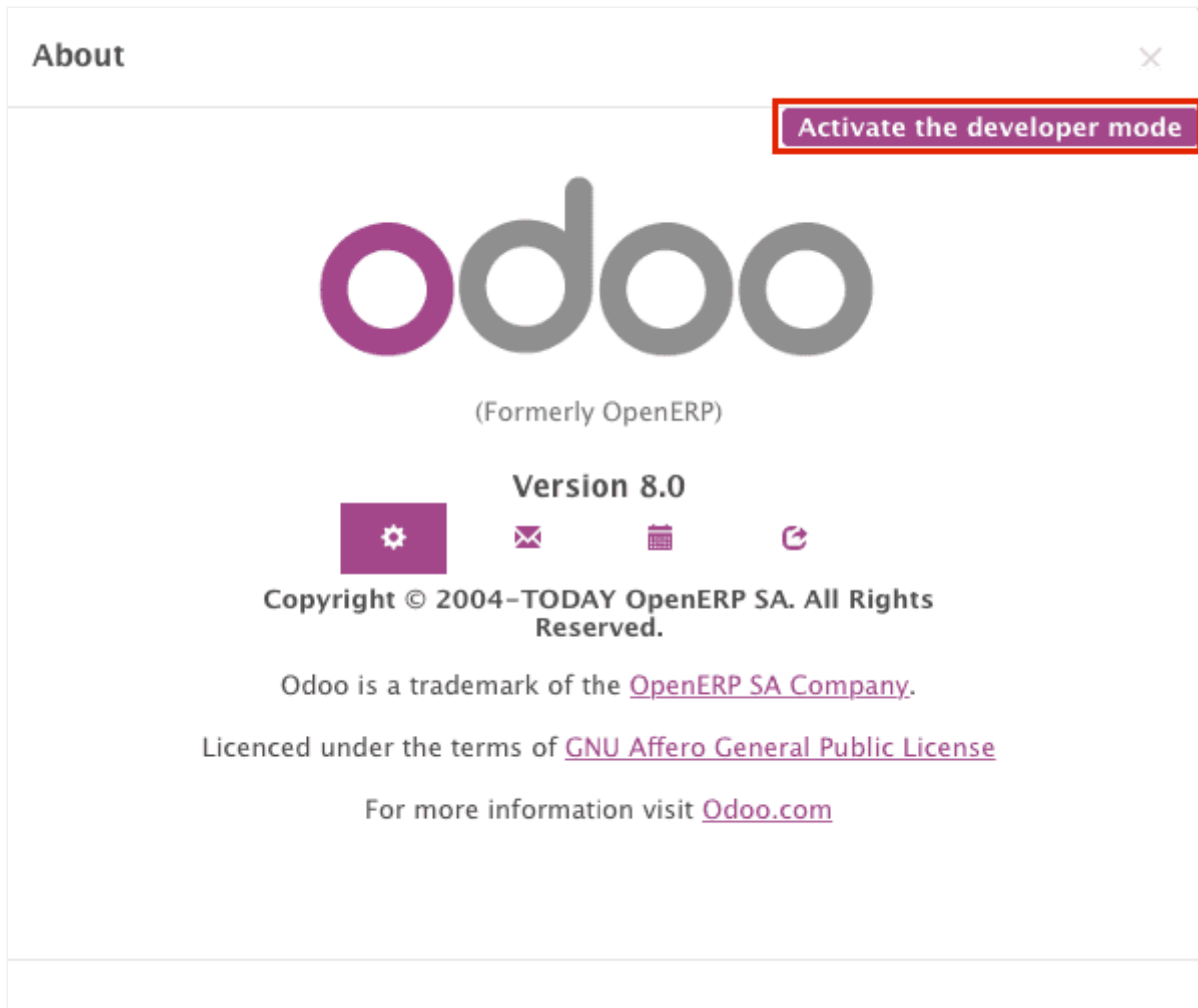
The files in the **static** folder, need to be defined within the module in order for them to be loaded correctly. Everything in **src/xml** is defined in **__manifest__.py** while the contents of **src/css** and **src/js** are defined in **petstore.xml**, or a similar file.

▲ Warning

All JavaScript files are concatenated and **minified** ([./glossary.html#term-minified](https://www.odoo.com/documentation/14.0/glossary.html#term-minified)) to improve application load time.

One of the drawback is debugging becomes more difficult as individual files disappear and the code is made significantly less readable. It is possible to disable this process by enabling the “developer mode”: log into your Odoo instance (user *admin* password *admin* by default) open the user menu (in the top-right corner of the Odoo screen) and select About Odoo then Activate the developer mode:





This will reload the web client with optimizations disabled, making development and debugging significantly more comfortable.

Odoo JavaScript Module

Javascript doesn't have built-in modules. As a result variables defined in different files are all mashed together and may conflict. This has given rise to various module patterns used to build clean namespaces and limit risks of naming conflicts.

The Odoo framework uses one such pattern to define modules within web addons, in order to both namespace code and correctly order its loading.

`oepetstore/static/js/petstore.js` contains a module declaration:

```
odoo.oepetstore = function(instance, local) {
    local.xxx = ...;
}
```

In Odoo web, modules are declared as functions set on the global `odoo` variable. The function's name must be the same as the addon (in this case `oepetstore`) so the framework can find it, and automatically initialize it.

When the web client loads your module it will call the root function and provide two parameters:

the first parameter is the current instance of the Odoo web client, it gives access to various capabilities defined by the Odoo (translations, network services) as well as objects defined by the core or by other modules.

the second parameter is your own local namespace automatically created by the web client. Objects and variables which should be accessible from outside your module (either because the Odoo web client needs to call them or because others may want to customize them) should be set inside that namespace.

Classes

Much as modules, and contrary to most object-oriented languages, javascript does not build in *classes*¹ although it provides roughly equivalent (if lower-level and more verbose) mechanisms. For simplicity and developer-friendliness Odoo web provides a class system based on John Resig's [Simple JavaScript Inheritance](http://ejohn.org/blog/simple-javascript-inheritance/) (<http://ejohn.org/blog/simple-javascript-inheritance/>).

New classes are defined by calling the **extend()** method of **odoo.web.Class()** :

```
var MyClass = instance.web.Class.extend({
  say_hello: function() {
    console.log("hello");
  },
});
```

The **extend()** method takes a dictionary describing the new class's content (methods and static attributes). In this case, it will only have a **say_hello** method which takes no parameters.

Classes are instantiated using the **new** operator:

```
var my_object = new MyClass();
my_object.say_hello();
// print "hello" in the console
```

And attributes of the instance can be accessed via **this** :

```
var MyClass = instance.web.Class.extend({
  say_hello: function() {
    console.log("hello", this.name);
  },
});

var my_object = new MyClass();
my_object.name = "Bob";
my_object.say_hello();
// print "hello Bob" in the console
```

Classes can provide an initializer to perform the initial setup of the instance, by defining an **init()** method. The initializer receives the parameters passed when using the **new** operator:

```

var MyClass = instance.web.Class.extend({
  init: function(name) {
    this.name = name;
  },
  say_hello: function() {
    console.log("hello", this.name);
  },
});

var my_object = new MyClass("Bob");
my_object.say_hello();
// print "hello Bob" in the console

```

It is also possible to create subclasses from existing (used-defined) classes by calling **extend()** on the parent class, as is done to subclass **Class()** :

```

var MySpanishClass = MyClass.extend({
  say_hello: function() {
    console.log("hola", this.name);
  },
});

var my_object = new MySpanishClass("Bob");
my_object.say_hello();
// print "hola Bob" in the console

```

When overriding a method using inheritance, you can use **this._super()** to call the original method:

```

var MySpanishClass = MyClass.extend({
  say_hello: function() {
    this._super();
    console.log("translation in Spanish: hola", this.name);
  },
});

var my_object = new MySpanishClass("Bob");
my_object.say_hello();
// print "hello Bob \n translation in Spanish: hola Bob" in the console

```

▲ Warning

_super is not a standard method, it is set on-the-fly to the next method in the current inheritance chain, if any. It is only defined during the *synchronous* part of a method call, for use in asynchronous handlers (after network calls or in **setTimeout** callbacks) a reference to its value should be retained, it should not be accessed via **this** :

```
// broken, will generate an error
say_hello: function () {
    setTimeout(function () {
        this._super();
    }.bind(this), 0);
}

// correct
say_hello: function () {
    // don't forget .bind()
    var _super = this._super.bind(this);
    setTimeout(function () {
        _super();
    }.bind(this), 0);
}
```

Widgets Basics

The Odoo web client bundles [jQuery](http://jquery.org) (<http://jquery.org>) for easy DOM manipulation. It is useful and provides a better API than standard [W3C DOM](http://www.w3.org/TR/DOM-Level-3-Core/) (<http://www.w3.org/TR/DOM-Level-3-Core/>)¹², but insufficient to structure complex applications leading to difficult maintenance.

Much like object-oriented desktop UI toolkits (e.g. [Qt](http://qt-project.org) (<http://qt-project.org>), [Cocoa](https://developer.apple.com/technologies/mac/cocoa.html) (<https://developer.apple.com/technologies/mac/cocoa.html>) or [GTK](http://www.gtk.org) (<http://www.gtk.org>)), Odoo Web makes specific components responsible for sections of a page. In Odoo web, the base for such components is the **Widget()** class, a component specialized in handling a page section and displaying information for the user.

Your First Widget

The initial demonstration module already provides a basic widget:

```
local.HomePage = instance.Widget.extend({
    start: function() {
        console.log("pet store home page loaded");
    },
});
```

It extends **Widget()** and overrides the standard method **start()**, which — much like the previous **MyClass** — does little for now.

This line at the end of the file:

```
instance.web.client_actions.add(
    'petstore.homepage', 'instance.oepetstore.HomePage');
```

registers our basic widget as a client action. Client actions will be explained later, for now this is just what allows our widget to be called and displayed when we select the Pet Store ► Pet Store ► Home Page menu.

▲ Warning

because the widget will be called from outside our module, the web client needs its “fully qualified” name, not the local version.

Display Content

Widgets have a number of methods and features, but the basics are simple:

- set up a widget
- format the widget's data
- display the widget

The **HomePage** widget already has a **start()** method. That method is part of the normal widget lifecycle and automatically called once the widget is inserted in the page. We can use it to display some content.

All widgets have a **\$el** which represents the section of page they're in charge of (as a [jQuery](http://jquery.org) (<http://jquery.org>) object). Widget content should be inserted there. By default, **\$el** is an empty **<div>** element.

A **<div>** element is usually invisible to the user if it has no content (or without specific styles giving it a size) which is why nothing is displayed on the page when **HomePage** is launched.

Let's add some content to the widget's root element, using jQuery:

```
local.HomePage = instance.Widget.extend({
    start: function() {
        this.$el.append("<div>Hello dear Odoo user!</div>");
    },
});
```

That message will now appear when you open Pet Store ► Pet Store ► Home Page

to refresh the javascript code loaded in Odoo Web, you will need to reload the page. There is no need to restart the Odoo server.

The **HomePage** widget is used by Odoo Web and managed automatically. To learn how to use a widget “from scratch” let's create a new one:

```
local.GreetingsWidget = instance.Widget.extend({
    start: function() {
        this.$el.append("<div>We are so happy to see you again in this menu!</div>");
    },
});
```

We can now add our **GreetingsWidget** to the **HomePage** by using the **GreetingsWidget**'s **appendTo()** method:


```

local.HomePage = instance.Widget.extend({
    start: function() {
        this.$el.append("<div>Hello dear Odoo user!</div>");
        var greeting = new local.GreetingsWidget(this);
        return greeting.appendTo(this.$el);
    },
});

```

HomePage first adds its own content to its DOM root

HomePage then instantiates **GreetingsWidget**

Finally it tells **GreetingsWidget** where to insert itself, delegating part of its **\$el** to the **GreetingsWidget**.

When the **appendTo()** method is called, it asks the widget to insert itself at the specified position and to display its content. The **start()** method will be called during the call to **appendTo()**.

To see what happens under the displayed interface, we will use the browser's DOM Explorer. But first let's alter our widgets slightly so we can more easily find where they are, by **adding a class to their root elements**:

```

local.HomePage = instance.Widget.extend({
    className: 'oe_petstore_homepage',
    ...
});
local.GreetingsWidget = instance.Widget.extend({
    className: 'oe_petstore_greetings',
    ...
});

```

If you can find the relevant section of the DOM (right-click on the text then Inspect Element), it should look like this:

```

<div class="oe_petstore_homepage">
  <div>Hello dear Odoo user!</div>
  <div class="oe_petstore_greetings">
    <div>We are so happy to see you again in this menu!</div>
  </div>
</div>

```

Which clearly shows the two **<div>** elements automatically created by **Widget()**, because we added some classes on them.

We can also see the two message-holding divs we added ourselves

Finally, note the **<div class="oe_petstore_greetings">** element which represents the **GreetingsWidget** instance is *inside* the **<div class="oe_petstore_homepage">** which represents the **HomePage** instance, since we appended

Widget Parents and Children

In the previous part, we instantiated a widget using this syntax:

```
new local.GreetingsWidget(this);
```

The first argument is **this**, which in that case was a **HomePage** instance. This tells the widget being created which other widget is its *parent*.

As we've seen, widgets are usually inserted in the DOM by another widget and *inside* that other widget's root element. This means most widgets are "part" of another widget, and exist on behalf of it. We call the container the *parent*, and the contained widget the *child*.

Due to multiple technical and conceptual reasons, it is necessary for a widget to know who is its parent and who are its children.

getParent()

can be used to get the parent of a widget:

```
local.GreetingsWidget = instance.Widget.extend({
  start: function() {
    console.log(this.getParent().$el );
    // will print "div.oe_petstore_homepage" in the console
  },
});
```

getChildren()

can be used to get a list of its children:

```
local.HomePage = instance.Widget.extend({
  start: function() {
    var greeting = new local.GreetingsWidget(this);
    greeting.appendTo(this.$el);
    console.log(this.getChildren()[0].$el);
    // will print "div.oe_petstore_greetings" in the console
  },
});
```

When overriding the **init()** method of a widget it is *of the utmost importance* to pass the parent to the **this._super()** call, otherwise the relation will not be set up correctly:

```
local.GreetingsWidget = instance.Widget.extend({
  init: function(parent, name) {
    this._super(parent);
    this.name = name;
  },
});
```

Finally, if a widget does not have a parent (e.g. because it's the root widget of the application), **null** can be provided as parent:

```
new local.GreetingsWidget(null);
```

Destroying Widgets

If you can display content to your users, you should also be able to erase it. This is done via the **destroy()** method:

```
greeting.destroy();
```

When a widget is destroyed it will first call **destroy()** on all its children. Then it erases itself from the DOM. If you have set up permanent structures in **init()** or **start()** which must be explicitly cleaned up (because the garbage collector will not handle them), you can override **destroy()**.

⚠ Danger

when overriding **destroy()**, **_super()** *must always* be called otherwise the widget and its children are not correctly cleaned up leaving possible memory leaks and “phantom events”, even if no error is displayed

The QWeb Template Engine

In the previous section we added content to our widgets by directly manipulating (and adding to) their DOM:

```
this.$el.append("<div>Hello dear Odoo user!</div>");
```

This allows generating and displaying any type of content, but gets unwieldy when generating significant amounts of DOM (lots of duplication, quoting issues, ...)

As many other environments, Odoo’s solution is to use a template engine

(http://en.wikipedia.org/wiki/Web_template_system). Odoo’s template engine is called QWeb (<http://reference.qweb.html#reference-qweb>).

QWeb is an XML-based templating language, similar to Genshi

([http://en.wikipedia.org/wiki/Genshi_\(templating_language\)](http://en.wikipedia.org/wiki/Genshi_(templating_language))), Thymeleaf

(<http://en.wikipedia.org/wiki/Thymeleaf>) or Facelets (<http://en.wikipedia.org/wiki/Facelets>). It has the following characteristics:

- It’s implemented fully in JavaScript and rendered in the browser

- Each template file (XML files) contains multiple templates

- It has special support in Odoo Web’s **widget()**, though it can be used outside of Odoo’s web client (and it’s possible to use **widget()** without relying on QWeb)

The rationale behind using QWeb instead of existing javascript template engines is the extensibility of pre-existing (third-party) templates, much like Odoo **views** (<http://reference/views.html#reference-views>).

Most javascript template engines are text-based which precludes easy structural extensibility where an XML-based templating engine can be generically altered using e.g. XPath or CSS and a tree-alteration DSL (or even just XSLT). This flexibility and extensibility is a core characteristic of Odoo, and losing it was considered unacceptable.

Using QWeb

First let's define a simple QWeb template in the almost-empty

`oepestore/static/src/xml/petstore.xml` file:

```
<?xml version="1.0" encoding="UTF-8"?>
<templates xml:space="preserve">
  <t t-name="HomePageTemplate">
    <div style="background-color: red;">This is some simple HTML</div>
  </t>
</templates>
```

Now we can use this template inside of the **HomePage** widget. Using the **Qweb** loader variable defined at the top of the page, we can call to the template defined in the XML file:

```
local.HomePage = instance.Widget.extend({
  start: function() {
    this.$el.append(Qweb.render("HomePageTemplate"));
  },
});
```

Qweb.render() looks for the specified template, renders it to a string and returns the result.

However, because **widget()** has special integration for QWeb the template can be set directly on the widget via its **template** attribute:

```
local.HomePage = instance.Widget.extend({
  template: "HomePageTemplate",
  start: function() {
    ...
  },
});
```

Although the result looks similar, there are two differences between these usages:

- with the second version, the template is rendered right before **start()** is called

- in the first version the template's content is added to the widget's root element, whereas in the second version the template's root element is directly *set as* the widget's root element. Which is why the "greetings" sub-widget also gets a red background

▲ Warning

templates should have a single non- **t** root element, especially if they're set as a widget's **template**. If there are multiple "root elements", results are undefined (usually only the first root element will be used and the others will be ignored)

QWeb Context

QWeb templates can be given data and can contain basic display logic.

For explicit calls to **Qweb.render()**, the template data is passed as second parameter:

```
Qweb.render("HomePageTemplate", {name: "Klaus"});
```

with the template modified to:

```
<t t-name="HomePageTemplate">
  <div>Hello <t t-esc="name"/></div>
</t>
```

will result in:

```
<div>Hello Klaus</div>
```

When using **widget()** 's integration it is not possible to provide additional data to the template. The template will be given a single **widget** context variable, referencing the widget being rendered right before **start()** is called (the widget's state will essentially be that set up by **init()**):

```
<t t-name="HomePageTemplate">
  <div>Hello <t t-esc="widget.name"/></div>
</t>
```

```
local.HomePage = instance.Widget.extend({
  template: "HomePageTemplate",
  init: function(parent) {
    this._super(parent);
    this.name = "Mordecai";
  },
  start: function() {
  },
});
```

Result:

```
<div>Hello Mordecai</div>
```

Template Declaration

We've seen how to *render* QWeb templates, let's now see the syntax of the templates themselves. A QWeb template is composed of regular XML mixed with QWeb *directives*. A QWeb directive is declared with XML attributes starting with **t-**.

The most basic directive is **t-name**, used to declare new templates in a template file:

```
<templates>
  <t t-name="HomePageTemplate">
    <div>This is some simple HTML</div>
  </t>
</templates>
```

t-name takes the name of the template being defined, and declares that it can be called using **Qweb.render()**. It can only be used at the top-level of a template file.

Escaping

The **t-esc** directive can be used to output text:

```
<div>Hello <t t-esc="name"/></div>
```

It takes a Javascript expression which is evaluated, the result of the expression is then HTML-escaped and inserted in the document. Since it's an expression it's possible to provide just a variable name as above, or a more complex expression like a computation:

```
<div><t t-esc="3+5"/></div>
```

or method calls:

```
<div><t t-esc="name.toUpperCase()"/></div>
```

Outputting HTML

To inject HTML in the page being rendered, use **t-raw**. Like **t-esc** it takes an arbitrary Javascript expression as parameter, but it does not perform an HTML-escape step.

```
<div><t t-raw="name.link(user_account)"/></div>
```

▲ Danger

t-raw *must not* be used on any data which may contain non-escaped user-provided content as this leads to **cross-site scripting** (http://en.wikipedia.org/wiki/Cross-site_scripting) vulnerabilities

Conditionals

QWeb can have conditional blocks using **t-if**. The directive takes an arbitrary expression, if the expression is falsy (**false**, **null**, **0** or an empty string) the whole block is suppressed, otherwise it is displayed.

```
<div>
  <t t-if="true == true">
    true is true
  </t>
  <t t-if="true == false">
    true is not true
  </t>
</div>
```

QWeb doesn't have an "else" structure, use a second **t-if** with the original condition inverted. You may want to store the condition in a local variable if it's a complex or expensive expression.

Iteration

To iterate on a list, use **t-foreach** and **t-as**. **t-foreach** takes an expression returning a list to iterate on **t-as** takes a variable name to bind to each item during iteration.

```
<div>
  <t t-foreach="names" t-as="name">
    <div>
      Hello <t t-esc="name"/>
    </div>
  </t>
</div>
```

t-foreach can also be used with numbers and objects (dictionaries)

Defining attributes

QWeb provides two related directives to define computed attributes: **t-att-name** and **t-attf-name**. In either case, *name* is the name of the attribute to create (e.g. **t-att-id** defines the attribute **id** after rendering).

t-att- takes a javascript expression whose result is set as the attribute's value, it is most useful if all of the attribute's value is computed:

```
<div>
  Input your name:
  <input type="text" t-att-value="defaultName"/>
</div>
```

t-attf- takes a *format string*. A format string is literal text with interpolation blocks inside, an interpolation block is a javascript expression between **{{** and **}}**, which will be replaced by the result of the expression. It is most useful for attributes which are partially literal and partially computed such as a class:

```
<div t-attf-class="container {{ left ? 'text-left' : '' }} {{ extra_class }}">
  insert content here
</div>
```

Calling other templates

Templates can be split into sub-templates (for simplicity, maintainability, reusability or to avoid excessive markup nesting).

This is done using the **t-call** directive, which takes the name of the template to render:

```

<t t-name="A">
  <div class="i-am-a">
    <t t-call="B"/>
  </div>
</t>
<t t-name="B">
  <div class="i-am-b"/>
</t>

```

rendering the **A** template will result in:

```

<div class="i-am-a">
  <div class="i-am-b"/>
</div>

```

Sub-templates inherit the rendering context of their caller.

To Learn More About QWeb

For a QWeb reference, see [QWeb \(../reference/qweb.html#reference-qweb\)](#).

Exercise

Exercise

Usage of QWeb in Widgets

Create a widget whose constructor takes two parameters aside from **parent** : **product_names** and **color** .

product_names should an array of strings, each one the name of a product

color is a string containing a color in CSS color format (ie: **#000000** for black).

The widget should display the given product names one under the other, each one in a separate box with a background color with the value of **color** and a border. You should use QWeb to render the HTML. Any necessary CSS should be in **oepetstore/static/src/css/petstore.css** .

Use the widget in **HomePage** with half a dozen products.


```

odoo.oepetstore = function(instance, local) {
    var _t = instance.web._t,
        _lt = instance.web._lt;
    var QWeb = instance.web.qweb;

    local.HomePage = instance.Widget.extend({
        start: function() {
            var products = new local.ProductsWidget(
                this, ["cpu", "mouse", "keyboard", "graphic card", "screen"], "#00FF
            products.appendTo(this.$el);
        },
    });

    local.ProductsWidget = instance.Widget.extend({
        template: "ProductsWidget",
        init: function(parent, products, color) {
            this._super(parent);
            this.products = products;
            this.color = color;
        },
    });

    instance.web.client_actions.add(
        'petstore.homepage', 'instance.oepetstore.HomePage');
}

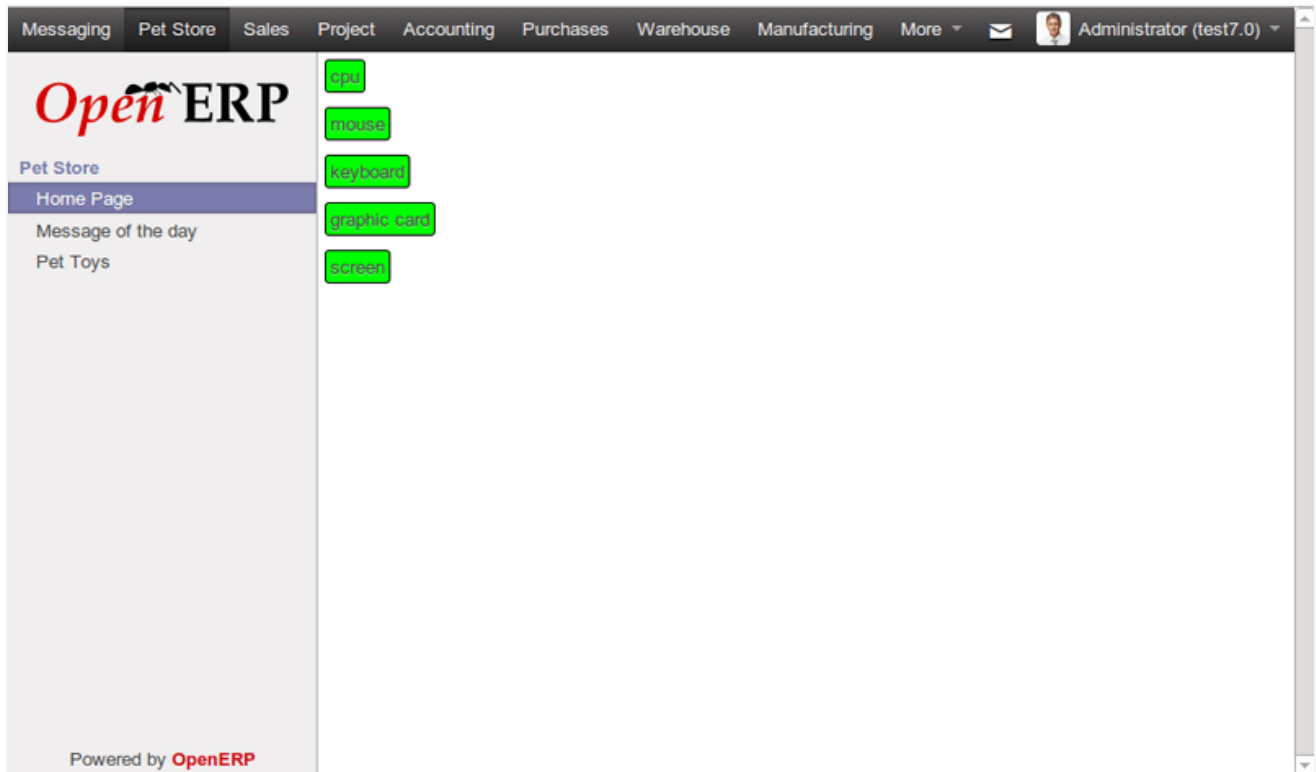
```

```

<?xml version="1.0" encoding="UTF-8"?>
<templates xml:space="preserve">
    <t t-name="ProductsWidget">
        <div>
            <t t-foreach="widget.products" t-as="product">
                <span class="oe_products_item"
                    t-attf-style="background-color: {{ widget.color }};">
                    <t t-esc="product"/>
                </span>
                <br/>
            </t>
        </div>
    </t>
</templates>

.oe_products_item {
    display: inline-block;
    padding: 3px;
    margin: 5px;
    border: 1px solid black;
    border-radius: 3px;
}

```



(../_images/qweb.png)

Widget Helpers

Widget's jQuery Selector

Selecting DOM elements within a widget can be performed by calling the **find()** method on the widget's DOM root:

```
this.$el.find("input.my_input")...
```

But because it's a common operation, **widget()** provides an equivalent shortcut through the **\$()** method:

```
local.MyWidget = instance.Widget.extend({
    start: function() {
        this.$("input.my_input")...
    },
});
```

▲ Warning

The global jQuery function **\$()** should *never* be used unless it is absolutely necessary: selection on a widget's root are scoped to the widget and local to it, but selections with **\$()** are global to the page/application and may match parts of other widgets and views, leading to odd or dangerous side-effects. Since a widget should generally act only on the DOM section it owns, there is no cause for global selection.

Easier DOM Events Binding

We have previously bound DOM events using normal jQuery event handlers (e.g. `.click()` or `.change()`) on widget elements:

```
local.MyWidget = instance.Widget.extend({
  start: function() {
    var self = this;
    this.$(".my_button").click(function() {
      self.button_clicked();
    });
  },
  button_clicked: function() {
    ..
  },
});
```

While this works it has a few issues:

- 1 it is rather verbose
- 2 it does not support replacing the widget's root element at runtime as the binding is only performed when `start()` is run (during widget initialization)
- 3 it requires dealing with `this` -binding issues

Widgets thus provide a shortcut to DOM event binding via `events` :

```
local.MyWidget = instance.Widget.extend({
  events: {
    "click .my_button": "button_clicked",
  },
  button_clicked: function() {
    ..
  }
});
```

`events` is an object (mapping) of an event to the function or method to call when the event is triggered:

the key is an event name, possibly refined with a CSS selector in which case only if the event happens on a selected sub-element will the function or method run: `click` will handle all clicks within the widget, but `click .my_button` will only handle clicks in elements bearing the `my_button` class

the value is the action to perform when the event is triggered

It can be either a function:

```
events: {
  'click': function (e) { /* code here */ }
}
```

or the name of a method on the object (see example above).

In either case, the **this** is the widget instance and the handler is given a single parameter, the jQuery event object (<http://api.jquery.com/category/events/event-object/>), for the event.

Widget Events and Properties

Events

Widgets provide an event system (separate from the DOM/jQuery event system described above): a widget can fire events on itself, and other widgets (or itself) can bind themselves and listen for these events:

```
local.ConfirmWidget = instance.Widget.extend({
  events: {
    'click button.ok_button': function () {
      this.trigger('user_chose', true);
    },
    'click button.cancel_button': function () {
      this.trigger('user_chose', false);
    }
  },
  start: function() {
    this.$el.append("<div>Are you sure you want to perform this action?</div>" +
      "<button class='ok_button'>Ok</button>" +
      "<button class='cancel_button'>Cancel</button>");
  },
});
```

This widget acts as a facade, transforming user input (through DOM events) into a documentable internal event to which parent widgets can bind themselves.

trigger() takes the name of the event to trigger as its first (mandatory) argument, any further arguments are treated as event data and passed directly to listeners.

We can then set up a parent event instantiating our generic widget and listening to the **user_chose** event using **on()** :

```
local.HomePage = instance.Widget.extend({
  start: function() {
    var widget = new local.ConfirmWidget(this);
    widget.on("user_chose", this, this.user_chose);
    widget.appendTo(this.$el);
  },
  user_chose: function(confirm) {
    if (confirm) {
      console.log("The user agreed to continue");
    } else {
      console.log("The user refused to continue");
    }
  },
});
```

on() binds a function to be called when the event identified by **event_name** is. The **func** argument is the function to call and **object** is the object to which that function is related if it is a method. The bound function will be called with the additional arguments of **trigger()** if it has any. Example:

```
start: function() {
    var widget = ...
    widget.on("my_event", this, this.my_event_triggered);
    widget.trigger("my_event", 1, 2, 3);
},
my_event_triggered: function(a, b, c) {
    console.log(a, b, c);
    // will print "1 2 3"
}
```

Triggering events on an other widget is generally a bad idea. The main exception to that rule is **odoo.web.bus** which exists specifically to broadcasts events in which any widget could be interested throughout the Odoo web application.

Properties

Properties are very similar to normal object attributes in that they allow storing data on a widget instance, however they have the additional feature that they trigger events when set:

```
start: function() {
    this.widget = ...
    this.widget.on("change:name", this, this.name_changed);
    this.widget.set("name", "Nicolas");
},
name_changed: function() {
    console.log("The new value of the property 'name' is", this.widget.get("name"));
}
```

set() sets the value of a property and triggers **change:propname** (where *propname* is the property name passed as first parameter to **set()**) and **change**

get() retrieves the value of a property.

Exercise

Exercise

Widget Properties and Events

Create a widget **ColorInputWidget** that will display 3 `<input type="text">`. Each of these `<input>` is dedicated to type a hexadecimal number from 00 to FF. When any of these `<input>` is modified by the user the widget must query the content of the three `<input>`, concatenate their values to have a complete CSS color code (ie: `#00FF00`) and put the result in a property named **color**. Please note the jQuery **change()** event that you can bind on any HTML `<input>` element and the **val()** method that can query the current value of that `<input>` could be useful to you for this exercise.

Then, modify the `HomePage` widget to instantiate `ColorInputWidget` and display it. The `HomePage` widget should also display an empty rectangle. That rectangle must always, at any moment, have the same background color as the color in the `color` property of the `ColorInputWidget` instance.

Use `QWeb` to generate all HTML.

```
odoo.oepetstore = function(instance, local) {
    var _t = instance.web._t,
        _lt = instance.web._lt;
    var QWeb = instance.web.qweb;

    local.ColorInputWidget = instance.Widget.extend({
        template: "ColorInputWidget",
        events: {
            'change input': 'input_changed'
        },
        start: function() {
            this.input_changed();
            return this._super();
        },
        input_changed: function() {
            var color = [
                "#",
                this.$(".oe_color_red").val(),
                this.$(".oe_color_green").val(),
                this.$(".oe_color_blue").val()
            ].join('');
            this.set("color", color);
        },
    });

    local.HomePage = instance.Widget.extend({
        template: "HomePage",
        start: function() {
            this.colorInput = new local.ColorInputWidget(this);
            this.colorInput.on("change:color", this, this.color_changed);
            return this.colorInput.appendTo(this.$el);
        },
        color_changed: function() {
            this.$(".oe_color_div").css("background-color", this.colorInput.get("col
        },
    });

    instance.web.client_actions.add('petstore.homepage', 'instance.oepetstore.HomePa
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<templates xml:space="preserve">
  <t t-name="ColorInputWidget">
    <div>
      Red: <input type="text" class="oe_color_red" value="00"></input><br />
      Green: <input type="text" class="oe_color_green" value="00"></input><br />
      Blue: <input type="text" class="oe_color_blue" value="00"></input><br />
    </div>
  </t>
  <t t-name="HomePage">
    <div>
      <div class="oe_color_div"></div>
    </div>
  </t>
</templates>
```

```
.oe_color_div {
  width: 100px;
  height: 100px;
  margin: 10px;
}
```

Modify existing widgets and classes

The class system of the Odoo web framework allows direct modification of existing classes using the `include()` method:

```
var TestClass = instance.web.Class.extend({
  testMethod: function() {
    return "hello";
  },
});

TestClass.include({
  testMethod: function() {
    return this._super() + " world";
  },
});

console.log(new TestClass().testMethod());
// will print "hello world"
```

This system is similar to the inheritance mechanism, except it will alter the target class in-place instead of creating a new class.

In that case, `this._super()` will call the original implementation of a method being replaced/redefined. If the class already had sub-classes, all calls to `this._super()` in sub-classes will call the new implementations defined in the call to `include()`. This will also work if some instances of the class (or of any of its sub-classes) were created prior to the call to `include()`.

Translations

The process to translate text in Python and JavaScript code is very similar. You could have noticed these lines at the beginning of the `petstore.js` file:

```
var _t = instance.web._t,  
    _lt = instance.web._lt;
```

These lines are simply used to import the translation functions in the current JavaScript module. They are used thus:

```
this.$el.text(_t("Hello user!"));
```

In Odoo, translations files are automatically generated by scanning the source code. All piece of code that calls a certain function are detected and their content is added to a translation file that will then be sent to the translators. In Python, the function is `_()`. In JavaScript the function is `_t()` (and also `_lt()`).

`_t()` will return the translation defined for the text it is given. If no translation is defined for that text, it will return the original text as-is.

To inject user-provided values in translatable strings, it is recommended to use `_.str.sprintf` (<http://gabceb.github.io/underscore.string.site/#sprintf>) with named arguments *after* the translation:

```
this.$el.text(_.str.sprintf(  
    _t("Hello, %(user)s!"), {  
        user: "Ed"  
    }));
```

This makes translatable strings more readable to translators, and gives them more flexibility to reorder or ignore parameters.

`_lt()` ("lazy translate") is similar but somewhat more complex: instead of translating its parameter immediately, it returns an object which, when converted to a string, will perform the translation.

It is used to define translatable terms before the translations system is initialized, for class attributes for instance (as modules are loaded before the user's language is configured and translations are downloaded).

Communication with the Odoo Server

Contacting Models

Most operations with Odoo involve communicating with *models* implementing business concern, these models will then (potentially) interact with some storage engine (usually PostgreSQL (<http://en.wikipedia.org/wiki/PostgreSQL>)).

Although jQuery (<http://jquery.org>) provides a `$.ajax` (<http://api.jquery.com/jquery.ajax/>) function for network interactions, communicating with Odoo requires additional metadata whose setup before every call would be verbose and error-prone. As a result, Odoo web provides higher-level communication primitives.

To demonstrate this, the file `petstore.py` already contains a small model with a sample method:

```
class message_of_the_day(models.Model):
    _name = "oepetstore.message_of_the_day"

    @api.model
    def my_method(self):
        return {"hello": "world"}

    message = fields.Text(),
    color = fields.Char(size=20),
```

This declares a model with two fields, and a method `my_method()` which returns a literal dictionary.

Here is a sample widget that calls `my_method()` and displays the result:

```
local.HomePage = instance.Widget.extend({
    start: function() {
        var self = this;
        var model = new instance.web.Model("oepetstore.message_of_the_day");
        model.call("my_method", {context: new instance.web.CompoundContext()}).then(func
            self.$el.append("<div>Hello " + result["hello"] + "</div>");
            // will show "Hello world" to the user
        });
    },
});
```

The class used to call Odoo models is `odoo.Model()`. It is instantiated with the Odoo model's name as first parameter (`oepetstore.message_of_the_day` here).

`call()` can be used to call any (public) method of an Odoo model. It takes the following positional arguments:

name

The name of the method to call, `my_method` here

args

an array of positional arguments (<https://docs.python.org/2/glossary.html#term-argument>), to provide to the method. Because the example has no positional argument to provide, the `args` parameter is not provided.

Here is an other example with positional arguments:

```
@api.model
def my_method2(self, a, b, c): ...

model.call("my_method", [1, 2, 3], ...
// with this a=1, b=2 and c=3
```

kwargs

a mapping of keyword arguments (<https://docs.python.org/2/glossary.html#term-argument>), to pass. The example provides a single named argument **context** .

```
@api.model
def my_method2(self, a, b, c): ...

model.call("my_method", [], {a: 1, b: 2, c: 3, ...
// with this a=1, b=2 and c=3
```

call() returns a deferred resolved with the value returned by the model's method as first argument.

CompoundContext

The previous section used a **context** argument which was not explained in the method call:

```
model.call("my_method", {context: new instance.web.CompoundContext()})
```

The context is like a “magic” argument that the web client will always give to the server when calling a method. The context is a dictionary containing multiple keys. One of the most important key is the language of the user, used by the server to translate all the messages of the application. Another one is the time zone of the user, used to compute correctly dates and times if Odoo is used by people in different countries.

The **argument** is necessary in all methods, otherwise bad things could happen (such as the application not being translated correctly). That's why, when you call a model's method, you should always provide that argument. The solution to achieve that is to use

```
odoo.web.CompoundContext() .
```

CompoundContext() is a class used to pass the user's context (with language, time zone, etc...) to the server as well as adding new keys to the context (some models' methods use arbitrary keys added to the context). It is created by giving to its constructor any number of dictionaries or other **CompoundContext()** instances. It will merge all those contexts before sending them to the server.

```
model.call("my_method", {context: new instance.web.CompoundContext({'new_key': 'key_valu
```



```
@api.model
def my_method(self):
    print self.env.context
    // will print: {'lang': 'en_US', 'new_key': 'key_value', 'tz': 'Europe/Brussels', 'u
```

You can see the dictionary in the argument **context** contains some keys that are related to the configuration of the current user in Odoo plus the **new_key** key that was added when instantiating **CompoundContext()**.

Queries

While **call()** is sufficient for any interaction with Odoo models, Odoo Web provides a helper for simpler and clearer querying of models (fetching of records based on various conditions):

query() which acts as a shortcut for the common combination of **search()**.

([./reference/orm.html#odoo.models.Model.search](#)) and : **read()**.

([./reference/orm.html#odoo.models.Model.read](#)). It provides a clearer syntax to search and read models:

```
model.query(['name', 'login', 'user_email', 'signature'])
    .filter([[ 'active', '=', true], ['company_id', '=', main_company]])
    .limit(15)
    .all().then(function (users) {
    // do work with users records
});
```

versus:

```
model.call('search', [[ 'active', '=', true], ['company_id', '=', main_company]], {limit:
    .then(function (ids) {
        return model.call('read', [ids, ['name', 'login', 'user_email', 'signature']]);
    })
    .then(function (users) {
        // do work with users records
    });
```

query() takes an optional list of fields as parameter (if no field is provided, all fields of the model are fetched). It returns a **odoo.web.Query()** which can be further customized before being executed

Query() represents the query being built. It is immutable, methods to customize the query actually return a modified copy, so it's possible to use the original and the new version side-by-side. See **Query()** for its customization options.

When the query is set up as desired, simply call `all()` to execute it and return a deferred to its result. The result is the same as `read()` ([../reference/orm.html#odoo.models.Model.read](https://reference/orm.html#odoo.models.Model.read))'s, an array of dictionaries where each dictionary is a requested record, with each requested field a dictionary key.

Exercises

Exercise

Message of the Day

Create a `MessageOfTheDay` widget displaying the last record of the `oepetstore.message_of_the_day` model. The widget should fetch its record as soon as it is displayed.

Display the widget in the Pet Store home page.

```
odoo.oepetstore = function(instance, local) {
    var _t = instance.web._t,
        _lt = instance.web._lt;
    var QWeb = instance.web.qweb;

    local.HomePage = instance.Widget.extend({
        template: "HomePage",
        start: function() {
            return new local.MessageOfTheDay(this).appendTo(this.$el);
        },
    });

    instance.web.client_actions.add('petstore.homepage', 'instance.oepetstore.HomePa

    local.MessageOfTheDay = instance.Widget.extend({
        template: "MessageOfTheDay",
        start: function() {
            var self = this;
            return new instance.web.Model("oepetstore.message_of_the_day")
                .query(["message"])
                .order_by('-create_date', '-id')
                .first()
                .then(function(result) {
                    self.$(".oe_mywidget_message_of_the_day").text(result.message);
                });
        },
    });
}
```

```

<?xml version="1.0" encoding="UTF-8"?>
<templates xml:space="preserve">
  <t t-name="HomePage">
    <div class="oe_petstore_homepage">
    </div>
  </t>
  <t t-name="MessageOfTheDay">
    <div class="oe_petstore_motd">
      <p class="oe_mywidget_message_of_the_day"></p>
    </div>
  </t>
</templates>

.oe_petstore_motd {
  margin: 5px;
  padding: 5px;
  border-radius: 3px;
  background-color: #F0EEEE;
}

```

✍ Exercise

Pet Toys List

Create a **PetToysList** widget displaying 5 toys (using their name and their images).

The pet toys are not stored in a new model, instead they're stored in **product.product** using a special category *Pet Toys*. You can see the pre-generated toys and add new ones by going to Pet Store ► Pet Store ► Pet Toys. You will probably need to explore **product.product** to create the right domain to select just pet toys.

In Odoo, images are generally stored in regular fields encoded as **base64** (<http://en.wikipedia.org/wiki/Base64>), HTML supports displaying images straight from base64 with ``

The **PetToysList** widget should be displayed on the home page on the right of the **MessageOfTheDay** widget. You will need to make some layout with CSS to achieve this.

```

odoo.oepetstore = function(instance, local) {
    var _t = instance.web._t,
        _lt = instance.web._lt;
    var QWeb = instance.web.qweb;

    local.HomePage = instance.Widget.extend({
        template: "HomePage",
        start: function () {
            return Promise.all([
                new local.PetToysList(this).appendTo(this.$('.oe_petstore_homepage_1
                new local.MessageOfTheDay(this).appendTo(this.$('.oe_petstore_homepa
            ]));
        }
    });
    instance.web.client_actions.add('petstore.homepage', 'instance.oepetstore.HomePa

    local.MessageOfTheDay = instance.Widget.extend({
        template: 'MessageOfTheDay',
        start: function () {
            var self = this;
            return new instance.web.Model('oepetstore.message_of_the_day')
                .query(["message"])
                .order_by('-create_date', '-id')
                .first()
                .then(function (result) {
                    self.$(".oe_mywidget_message_of_the_day").text(result.message);
                });
        }
    });

    local.PetToysList = instance.Widget.extend({
        template: 'PetToysList',
        start: function () {
            var self = this;
            return new instance.web.Model('product.product')
                .query(['name', 'image'])
                .filter([['categ_id.name', '=', 'Pet Toys']])
                .limit(5)
                .all()
                .then(function (results) {
                    _(results).each(function (item) {
                        self.$el.append(QWeb.render('PetToy', {item: item}));
                    });
                });
        }
    });
}

```

```
<?xml version="1.0" encoding="UTF-8"?>

<templates xml:space="preserve">
  <t t-name="HomePage">
    <div class="oe_petstore_homepage">
      <div class="oe_petstore_homepage_left"></div>
      <div class="oe_petstore_homepage_right"></div>
    </div>
  </t>
  <t t-name="MessageOfTheDay">
    <div class="oe_petstore_motd">
      <p class="oe_mywidget_message_of_the_day"></p>
    </div>
  </t>
  <t t-name="PetToysList">
    <div class="oe_petstore_pettoyslist">
    </div>
  </t>
  <t t-name="PetToy">
    <div class="oe_petstore_pettoy">
      <p><t t-esc="item.name"/></p>
      <p></p>
    </div>
  </t>
</templates>
```

```
.oe_petstore_homepage {
    display: table;
}

.oe_petstore_homepage_left {
    display: table-cell;
    width : 300px;
}

.oe_petstore_homepage_right {
    display: table-cell;
    width : 300px;
}

.oe_petstore_motd {
    margin: 5px;
    padding: 5px;
    border-radius: 3px;
    background-color: #F0EEEE;
}

.oe_petstore_pettoyslist {
    padding: 5px;
}

.oe_petstore_petttoy {
    margin: 5px;
    padding: 5px;
    border-radius: 3px;
    background-color: #F0EEEE;
}
```

Existing web components

The Action Manager

In Odoo, many operations start from an [action](#) ([../reference/actions.html#reference-actions](#)): opening a menu item (to a view), printing a report, ...

Actions are pieces of data describing how a client should react to the activation of a piece of content. Actions can be stored (and read through a model) or they can be generated on-the fly (locally to the client by javascript code, or remotely by a method of a model).

In Odoo Web, the component responsible for handling and reacting to these actions is the *Action Manager*.

Using the Action Manager

The action manager can be invoked explicitly from javascript code by creating a dictionary describing [an action](#) ([../reference/actions.html#reference-actions](#)), of the right type, and calling an action manager instance with it.

do_action() is a shortcut of **widget()** looking up the “current” action manager and executing the action:

```
instance.web.TestWidget = instance.Widget.extend({
    dispatch_to_new_action: function() {
        this.do_action({
            type: 'ir.actions.act_window',
            res_model: "product.product",
            res_id: 1,
            views: [[false, 'form']],
            target: 'current',
            context: {},
        });
    },
});
```

The most common action **type** is **ir.actions.act_window** which provides views to a model (displays a model in various manners), its most common attributes are:

res_model

The model to display in views

res_id (optional)

For form views, a preselected record in **res_model**

views

Lists the views available through the action. A list of **[view_id, view_type]**, **view_id** can either be the database identifier of a view of the right type, or **false** to use the view by default for the specified type. View types can not be present multiple times. The action will open the first view of the list by default.

target

Either **current** (the default) which replaces the “content” section of the web client by the action, or **new** to open the action in a dialog box.

context

Additional context data to use within the action.

Exercise

Jump to Product

Modify the **PetToysList** component so clicking on a toy replaces the homepage by the toy's form view.

```

local.PetToysList = instance.Widget.extend({
    template: 'PetToysList',
    events: {
        'click .oe_petstore_pettoy': 'selected_item',
    },
    start: function () {
        var self = this;
        return new instance.web.Model('product.product')
            .query(['name', 'image'])
            .filter([[ 'categ_id.name', '=', 'Pet Toys' ]])
            .limit(5)
            .all()
            .then(function (results) {
                _(results).each(function (item) {
                    self.$el.append(QWeb.render('PetToy', {item: item}));
                });
            });
    },
    selected_item: function (event) {
        this.do_action({
            type: 'ir.actions.act_window',
            res_model: 'product.product',
            res_id: $(event.currentTarget).data('id'),
            views: [[false, 'form']],
        });
    },
});

<t t-name="PetToy">
    <div class="oe_petstore_pettoy" t-att-data-id="item.id">
        <p><t t-esc="item.name"/></p>
        <p></p>
    </div>
</t>

```

Client Actions

Throughout this guide, we used a simple **HomePage** widget which the web client automatically starts when we select the right menu item. But how did the Odoo web know to start this widget? Because the widget is registered as a *client action*.

A client action is (as its name implies) an action type defined almost entirely in the client, in javascript for Odoo web. The server simply sends an action tag (an arbitrary name), and optionally adds a few parameters, but beyond that *everything* is handled by custom client code.

Our widget is registered as the handler for the client action through this:

```
instance.web.client_actions.add('petstore.homepage', 'instance.oe_petstore.HomePage');
```

instance.web.client_actions is a **Registry()** in which the action manager looks up client action handlers when it needs to execute one. The first parameter of **add()** is the name (tag) of the client action, and the second parameter is the path to the widget from the Odoo web client root.

When a client action must be executed, the action manager looks up its tag in the registry, walks the specified path and displays the widget it finds at the end.

a client action handler can also be a regular function, in which case it'll be called and its result (if any) will be interpreted as the next action to execute.

On the server side, we had simply defined an **ir.actions.client** action:

```
<record id="action_home_page" model="ir.actions.client">
  <field name="tag">petstore.homepage</field>
</record>
```

and a menu opening the action:

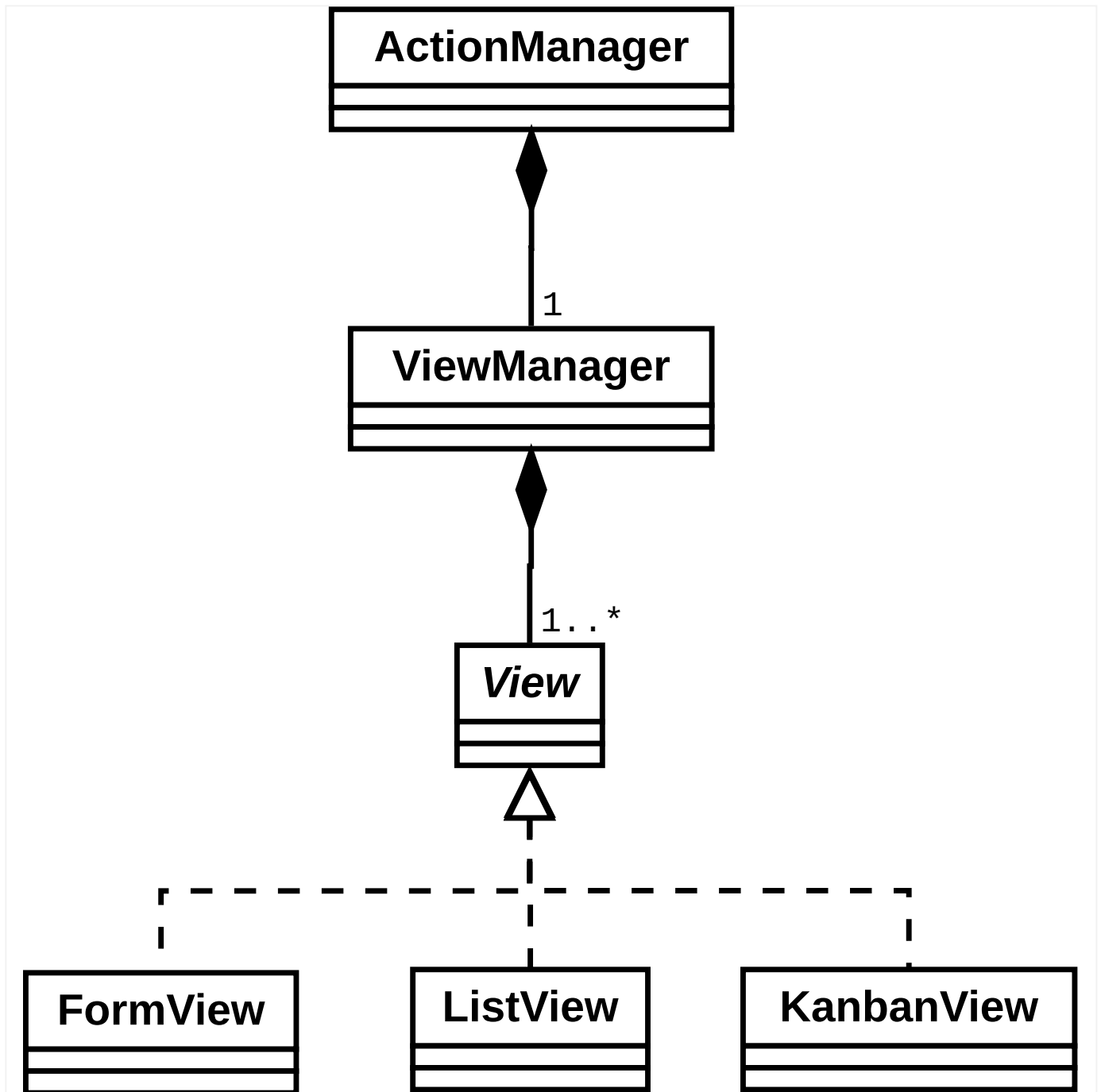
```
<menuitem id="home_page_petstore_menu" parent="petstore_menu"
  name="Home Page" action="action_home_page"/>
```

Architecture of the Views

Much of Odoo web's usefulness (and complexity) resides in views. Each view type is a way of displaying a model in the client.

The View Manager

When an **ActionManager** instance receive an action of type **ir.actions.act_window**, it delegates the synchronization and handling of the views themselves to a *view manager*, which will then set up one or multiple views depending on the original action's requirements:



(../images/viewarchitecture.svg).

The Views

Most [Odoo views](#) ([../reference/views.html#reference-views](#)) are implemented through a subclass of `odoo.web.View()` which provides a bit of generic basic structure for handling events and displaying model information.

The *search view* is considered a view type by the main Odoo framework, but handled separately by the web client (as it's a more permanent fixture and can interact with other views, which regular views don't do).

A view is responsible for loading its own description XML (using `fields_view_get` ([../reference/orm.html#odoo.models.Model.fields_view_get](http://reference.odoo.com/orm.html#odoo.models.Model.fields_view_get))) and any other data source it needs. To that purpose, views are provided with an optional view identifier set as the `view_id` attribute. Views are also provided with a `DataSet()` instance which holds most necessary model information (the model name and possibly various record ids). Views may also want to handle search queries by overriding `do_search()`, and updating their `DataSet()` as necessary.

The Form View Fields

A common need is the extension of the web form view to add new ways of displaying fields. All built-in fields have a default display implementation, a new form widget may be necessary to correctly interact with a new field type (e.g. a [GIS](http://glossary.odoo.com/term-gis) ([../glossary.html#term-gis](http://glossary.odoo.com/term-gis)) field) or to provide new representations and ways to interact with existing field types (e.g. validate `Char` ([../reference/orm.html#odoo.fields.Char](http://reference.odoo.com/orm.html#odoo.fields.Char)) fields which should contain email addresses and display them as email links).

To explicitly specify which form widget should be used to display a field, simply use the `widget` attribute in the view's XML description:

```
<field name="contact_mail" widget="email"/>
```

the same widget is used in both “view” (read-only) and “edit” modes of a form view, it's not possible to use a widget in one and an other widget in the other
and a given field (name) can not be used multiple times in the same form
a widget may ignore the current mode of the form view and remain the same in both view and edit modes

Fields are instantiated by the form view after it has read its XML description and constructed the corresponding HTML representing that description. After that, the form view will communicate with the field objects using some methods. These methods are defined by the `FieldInterface` interface. Almost all fields inherit the `AbstractField` abstract class. That class defines some default mechanisms that need to be implemented by most fields.

Here are some of the responsibilities of a field class:

The field class must display and allow the user to edit the value of the field.

It must correctly implement the 3 field attributes available in all fields of Odoo. The `AbstractField` class already implements an algorithm that dynamically calculates the value of these attributes (they can change at any moment because their value change according to the value of other fields). Their values are stored in *Widget Properties* (the widget properties

were explained earlier in this guide). It is the responsibility of each field class to check these widget properties and dynamically adapt depending of their values. Here is a description of each of these attributes:

required : The field must have a value before saving. If **required** is **true** and the field doesn't have a value, the method **is_valid()** of the field must return **false** .

invisible : When this is **true** , the field must be invisible. The **AbstractField** class already has a basic implementation of this behavior that fits most fields.

readonly : When **true** , the field must not be editable by the user. Most fields in Odoo have a completely different behavior depending on the value of **readonly** . As example, the **FieldChar** displays an HTML **<input>** when it is editable and simply displays the text when it is read-only. This also means it has much more code it would need to implement only one behavior, but this is necessary to ensure a good user experience.

Fields have two methods, **set_value()** and **get_value()** , which are called by the form view to give it the value to display and get back the new value entered by the user. These methods must be able to handle the value as given by the Odoo server when a **read()** is performed on a model and give back a valid value for a **write()** . Remember that the JavaScript/Python data types used to represent the values given by **read()** and given to **write()** is not necessarily the same in Odoo. As example, when you read a many2one, it is always a tuple whose first value is the id of the pointed record and the second one is the name get (ie: **(15, "Agrolait")**). But when you write a many2one it must be a single integer, not a tuple anymore. **AbstractField** has a default implementation of these methods that works well for simple data type and set a widget property named **value** .

Please note that, to better understand how to implement fields, you are strongly encouraged to look at the definition of the **FieldInterface** interface and the **AbstractField** class directly in the code of the Odoo web client.

Creating a New Type of Field

In this part we will explain how to create a new type of field. The example here will be to re-implement the **FieldChar** class and progressively explain each part.

Simple Read-Only Field

Here is a first implementation that will only display text. The user will not be able to modify the content of the field.

```

local.FieldChar2 = instance.web.form.AbstractField.extend({
    init: function() {
        this._super.apply(this, arguments);
        this.set("value", "");
    },
    render_value: function() {
        this.$el.text(this.get("value"));
    },
});

instance.web.form.widgets.add('char2', 'instance.oepetstore.FieldChar2');

```

In this example, we declare a class named **FieldChar2** inheriting from **AbstractField**. We also register this class in the registry **instance.web.form.widgets** under the key **char2**. That will allow us to use this new field in any form view by specifying **widget="char2"** in the **<field/>** tag in the XML declaration of the view.

In this example, we define a single method: **render_value()**. All it does is display the widget property **value**. Those are two tools defined by the **AbstractField** class. As explained before, the form view will call the method **set_value()** of the field to set the value to display. This method already has a default implementation in **AbstractField** which simply sets the widget property **value**. **AbstractField** also watch the **change:value** event on itself and calls the **render_value()** when it occurs. So, **render_value()** is a convenience method to implement in child classes to perform some operation each time the value of the field changes.

In the **init()** method, we also define the default value of the field if none is specified by the form view (here we assume the default value of a **char** field should be an empty string).

Read-Write Field

Read-only fields, which only display content and don't allow the user to modify it can be useful, but most fields in Odoo also allow editing. This makes the field classes more complicated, mostly because fields are supposed to handle both editable and non-editable mode, those modes are often completely different (for design and usability purpose) and the fields must be able to switch between modes at any moment.

To know in which mode the current field should be, the **AbstractField** class sets a widget property named **effective_readonly**. The field should watch for changes in that widget property and display the correct mode accordingly. Example:

```

local.FieldChar2 = instance.web.form.AbstractField.extend({
    init: function() {
        this._super.apply(this, arguments);
        this.set("value", "");
    },
    start: function() {
        this.on("change:effective_readonly", this, function() {
            this.display_field();
            this.render_value();
        });
        this.display_field();
        return this._super();
    },
    display_field: function() {
        var self = this;
        this.$el.html(QWeb.render("FieldChar2", {widget: this}));
        if (! this.get("effective_readonly")) {
            this.$("input").change(function() {
                self.internal_set_value(self.$("input").val());
            });
        }
    },
    render_value: function() {
        if (this.get("effective_readonly")) {
            this.$el.text(this.get("value"));
        } else {
            this.$("input").val(this.get("value"));
        }
    },
});

instance.web.form.widgets.add('char2', 'instance.oepetstore.FieldChar2');

<t t-name="FieldChar2">
    <div class="oe_field_char2">
        <t t-if="! widget.get('effective_readonly')">
            <input type="text"></input>
        </t>
    </div>
</t>

```

In the **start()** method (which is called immediately after a widget has been appended to the DOM), we bind on the event **change:effective_readonly**. That allows us to redisplay the field each time the widget property **effective_readonly** changes. This event handler will call **display_field()**, which is also called directly in **start()**. This **display_field()** was created specifically for this field, it's not a method defined in **AbstractField** or any other class. We can use this method to display the content of the field depending on the current mode. From now on the conception of this field is typical, except there is a lot of verifications to know the state of the **effective_readonly** property:

In the QWeb template used to display the content of the widget, it displays an `<input type="text" />` if we are in read-write mode and nothing in particular in read-only mode.

In the `display_field()` method, we have to bind on the `change` event of the `<input type="text" />` to know when the user has changed the value. When it happens, we call the `internal_set_value()` method with the new value of the field. This is a convenience method provided by the `AbstractField` class. That method will set a new value in the `value` property but will not trigger a call to `render_value()` (which is not necessary since the `<input type="text" />` already contains the correct value).

In `render_value()`, we use a completely different code to display the value of the field depending if we are in read-only or in read-write mode.

Exercise

Create a Color Field

Create a `FieldColor` class. The value of this field should be a string containing a color code like those used in CSS (example: `#FF0000` for red). In read-only mode, this color field should display a little block whose color corresponds to the value of the field. In read-write mode, you should display an `<input type="color" />`. That type of `<input />` is an HTML5 component that doesn't work in all browsers but works well in Google Chrome. So it's OK to use as an exercise.

You can use that widget in the form view of the `message_of_the_day` model for its field named `color`. As a bonus, you can change the `MessageOfTheDay` widget created in the previous part of this guide to display the message of the day with the background color indicated in the `color` field.

```

local.FieldColor = instance.web.form.AbstractField.extend({
    events: {
        'change input': function (e) {
            if (!this.get('effective_readonly')) {
                this.internal_set_value($(e.currentTarget).val());
            }
        },
    },
    init: function() {
        this._super.apply(this, arguments);
        this.set("value", "");
    },
    start: function() {
        this.on("change:effective_readonly", this, function() {
            this.display_field();
            this.render_value();
        });
        this.display_field();
        return this._super();
    },
    display_field: function() {
        this.$el.html(QWeb.render("FieldColor", {widget: this}));
    },
    render_value: function() {
        if (this.get("effective_readonly")) {
            this.$(".oe_field_color_content").css("background-color", this.get("value"));
        } else {
            this.$("input").val(this.get("value") || "#FFFFFF");
        }
    },
});
instance.web.form.widgets.add('color', 'instance.oepetstore.FieldColor');

```

```

<t t-name="FieldColor">
    <div class="oe_field_color">
        <t t-if="widget.get('effective_readonly')">
            <div class="oe_field_color_content" />
        </t>
        <t t-if="! widget.get('effective_readonly')">
            <input type="color"></input>
        </t>
    </div>
</t>

```

```

.oe_field_color_content {
    height: 20px;
    width: 50px;
    border: 1px solid black;
}

```

The Form View Custom Widgets

Form fields are used to edit a single field, and are intrinsically linked to a field. Because this may be limiting, it is also possible to create *form widgets* which are not so restricted and have less ties to a specific lifecycle.

Custom form widgets can be added to a form view through the **widget** tag:

```
<widget type="xxx" />
```

This type of widget will simply be created by the form view during the creation of the HTML according to the XML definition. They have properties in common with the fields (like the **effective_readonly** property) but they are not assigned a precise field. And so they don't have methods like **get_value()** and **set_value()**. They must inherit from the **FormWidget** abstract class.

Form widgets can interact with form fields by listening for their changes and fetching or altering their values. They can access form fields through their **field_manager** attribute:

```
local.WidgetMultiplication = instance.web.form.FormWidget.extend({
  start: function() {
    this._super();
    this.field_manager.on("field_changed:integer_a", this, this.display_result);
    this.field_manager.on("field_changed:integer_b", this, this.display_result);
    this.display_result();
  },
  display_result: function() {
    var result = this.field_manager.get_field_value("integer_a") *
                 this.field_manager.get_field_value("integer_b");
    this.$el.text("a*b = " + result);
  }
});

instance.web.form.custom_widgets.add('multiplication', 'instance.oepetstore.WidgetMultip
```

FormWidget is generally the **FormView()** itself, but features used from it should be limited to those defined by **FieldManagerMixin()**, the most useful being:

get_field_value(field_name)() which returns the value of a field.

set_values(values)() sets multiple field values, takes a mapping of **{field_name: value_to_set}**

An event **field_changed:field_name** is triggered any time the value of the field called **field_name** is changed

✍ Exercise

Show Coordinates on Google Map

Add two fields to **product.product** storing a latitude and a longitude, then create a new form widget to display the latitude and longitude of a product's origin on a map

To display the map, use Google Map's embedding:

```
<iframe width="400" height="300" src="https://maps.google.com/?ie=UTF8&ll=XXX,YY"
</iframe>
```

where **xxx** should be replaced by the latitude and **yyy** by the longitude.

Display the two position fields and a map widget using them in a new notebook page of the product's form view.

```
local.WidgetCoordinates = instance.web.form.FormWidget.extend({
  start: function() {
    this._super();
    this.field_manager.on("field_changed:provider_latitude", this, this.display_
    this.field_manager.on("field_changed:provider_longitude", this, this.display
    this.display_map();
  },
  display_map: function() {
    this.$el.html(QWeb.render("WidgetCoordinates", {
      "latitude": this.field_manager.get_field_value("provider_latitude") || 0
      "longitude": this.field_manager.get_field_value("provider_longitude") ||
    }));
  }
});

instance.web.form.custom_widgets.add('coordinates', 'instance.oepetstore.WidgetCoord
```

```
<t t-name="WidgetCoordinates">
  <iframe width="400" height="300"
    t-attf-src="https://maps.google.com/?ie=UTF8&ll={{latitude}},{{longitude}}
  </iframe>
</t>
```

✎ Exercise

Get the Current Coordinate

Add a button resetting the product's coordinates to the location of the user, you can get these coordinates using the **javascript geolocation API** (<http://diveintohtml5.info/geolocation.html>).

Now we would like to display an additional button to automatically set the coordinates to the location of the current user.

To get the coordinates of the user, an easy way is to use the geolocation JavaScript API. **See the online documentation to know how to use it** (http://www.w3schools.com/html/html5_geolocation.asp).

Please also note that the user should not be able to click on that button when the form view is in read-only mode. So, this custom widget should handle correctly the **effective_readonly** property just like any field. One way to do this would be to make the button disappear when **effective_readonly** is true.

```

local.WidgetCoordinates = instance.web.form.FormWidget.extend({
  events: {
    'click button': function () {
      navigator.geolocation.getCurrentPosition(
        this.proxy('received_position'));
    }
  },
  start: function() {
    var sup = this._super();
    this.field_manager.on("field_changed:provider_latitude", this, this.display_
    this.field_manager.on("field_changed:provider_longitude", this, this.display_
    this.on("change:effective_readonly", this, this.display_map);
    this.display_map();
    return sup;
  },
  display_map: function() {
    this.$el.html(QWeb.render("WidgetCoordinates", {
      "latitude": this.field_manager.get_field_value("provider_latitude") || 0
      "longitude": this.field_manager.get_field_value("provider_longitude") ||
    }));
    this.$("button").toggle(! this.get("effective_readonly"));
  },
  received_position: function(obj) {
    this.field_manager.set_values({
      "provider_latitude": obj.coords.latitude,
      "provider_longitude": obj.coords.longitude,
    });
  },
});

instance.web.form.custom_widgets.add('coordinates', 'instance.oepetstore.WidgetCoord

```

```

<t t-name="WidgetCoordinates">
  <iframe width="400" height="300"
    t-attf-src="https://maps.google.com/?ie=UTF8&ll={{latitude}},{{longitude}}
  </iframe>
  <button>Get My Current Coordinate</button>
</t>

```

[1] as a separate concept from instances. In many languages classes are full-fledged objects and themselves instance (of metaclasses) but there remains two fairly separate hierarchies between classes and instances

[2] as well as papering over cross-browser differences, although this has become less necessary over time

