
xleaflet

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The C++ backend for `ipyleaflet`.

`xleaflet` is a C++ backend for the `ipyleaflet` maps visualization library.

`xleaflet` and its dependencies require a modern C++ compiler supporting C++14. The following C++ compilers are supported:

- On Windows platforms, Visual C++ 2015 Update 2, or more recent
- On Unix platforms, gcc 4.9 or a recent version of Clang

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1.1 Installation

1.1.1 Using the conda-forge package

A package for xleaflet is available on the mamba package manager. The package will also pull all the dependencies.

```
mamba install xleaflet -c conda-forge
```

1.1.2 From source with cmake

You can also install xleaflet from source with cmake. On Unix platforms, from the source directory: However, you need to make sure to have the required libraries available on your machine.

```
mkdir build
cd build
cmake -DCMAKE_INSTALL_PREFIX=/path/to/prefix ..
make install
```

On Windows platforms, from the source directory:

```
mkdir build
cd build
cmake -G "NMake Makefiles" -DCMAKE_INSTALL_PREFIX=/path/to/prefix ..
nmake
nmake install
```

1.2 Introduction

xleaflet is the C++ backend for the [leaflet](#) maps visualization library. The Python reference implementation is available in the [ipyleaflet](#) project.

xleaflet depends on [xwidgets](#), each object that you can create in xleaflet is an xwidget instance which is synchronized with one or more views on the frontend. See the [xwidgets](#) documentation for the usage of widgets.

1.3 Basic usage

1.3.1 Default map

The default map can be displayed using Jupyter's display framework.

```
xlf::map map;  
map.display();
```

Changing widget attributes can be done from the model:

```
map.zoom = 15;  
  
// latitude 52.204793, longitude 360.121558  
map.center = std::array<double, 2>({52.204793, 360.121558});
```

Or by interacting directly with the view.

The map widget works with a list of layers. Layers are instances of `tile_layer`, `marker`, `popup`, `wms_layer`, `image_overlay`, `video_overlay`, `polygon`, `rectangle`, `circle_marker`, `circle`, `marker_cluster`, `layer_group` or `geo_json`.

```
#include "xleaflet/xmap.hpp"  
  
xlf::map map;  
  
map.add_layer(marker);  
map.add_layer(circle);  
map.add_layer(layer_group);  
  
map.remove_layer(circle);  
  
map.clear_layers();
```

It is also possible to have a list of controls on the map. Controls are instances of `layers_control`, `split_map_control` or `draw_control`.

```
#include "xleaflet/xmap.hpp"  
  
xlf::map map;  
  
map.add_control(control1);  
map.add_control(control2);  
  
map.remove_control(control1);  
  
map.clear_controls();
```


1.4 Generator classes

Widgets such as `map` may have a large number of attributes that can be set by the user, such as `center`, `zoom`, `min_zoom`, `max_zoom`, `scroll_wheel_zoom`, `bounce_at_zoom_limits`, `inertia`.

Providing a constructor for `map` with a large number of such attributes would make the use of `xleaflet` very cumbersome, because users would need to know all the positional arguments to modify only one value. Instead, we mimic a keyword argument initialization with a method-chaining mechanism.

```
#include "xleaflet/xmap.hpp"

auto map = xlf::map::initialize()
    .center({52.204793, 360.121558})
    .zoom(15)
    .scroll_wheel_zoom(true)
    .inertia(false)
    .finalize();
```

1.5 Special Events

One could want to react on special `map` events like `mousemove`, this can be achieved by using the `on_interaction` method of `map`:

```
#include <iostream>

#include "xleaflet/xmap.hpp"

void print_mouse_position(xeus::xjson event)
{
    if (event["type"] == "mousemove")
    {
        std::cout << "Mouse position: " << event["coordinates"].dump() << std::endl;
    }

    if (event["type"] == "mouseout")
    {
        std::cout << "Mouse out" << std::endl;;
    }
}

xlf::map map;

map.on_interaction(print_mouse_position);
map.display();
```

1.6 XProperty Events

xleaflet relies on the `xproperty` library, so that one could use the `XOBSERVE` function to react on model changes:

```
#include <iostream>

#include "xleaflet/xmap.hpp"

void print_lat_lng(xlf::map& map)
{
    std::string lat = std::to_string(map.center().front());
    std::string lng = std::to_string(map.center().back());

    std::cout << "latitude: " << lat << ", longitude: " << lng << std::endl;
}

xlf::map map;

XOBSERVE(map, center, print_lat_lng);
map.display();
```

1.7 Map

1.7.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"

auto map = xlf::map::initialize()
    .layers({xlf::basemap({"NASAGIBS", "ModisTerraTrueColorCR"}, "2017-04-08")})
    .center({52.204793, 360.121558})
    .zoom(4)
    .finalize();
map
```

1.7.2 Attributes

Attribute	Type	Default Value	Doc
layers	<code>std::vector<xlft::Layer></code>	<code>{default_layer}</code>	Vector of layers
controls	<code>std::vector<xlft::Control></code>	<code>{}</code>	Vector of controls
center	<code>std::array<double, 2></code>	<code>{0,0,0.0}</code>	Initial geographic center of the map
zoom	<code>int</code>	12	Initial map zoom level
max_zoom	<code>int</code>	18	
min_zoom	<code>int</code>	1	
dragging	<code>bool</code>	<code>true</code>	Whether the map be draggable with mouse/touch or not
touch_zoom	<code>bool</code>	<code>true</code>	Whether the map can be zoomed by touch-dragging with two fingers on mobile
scroll_wheel_zoom	<code>bool</code>	<code>false</code>	Whether the map can be zoomed by using the mouse wheel
double_click_zoom	<code>bool</code>	<code>true</code>	Whether the map can be zoomed in by double clicking on it and zoomed out by double clicking while holding shift
box_zoom	<code>bool</code>	<code>true</code>	Whether the map can be zoomed to a rectangular area specified by dragging the mouse while pressing the shift key
tap	<code>bool</code>	<code>true</code>	Enables mobile hacks for supporting instant taps
tap_tolerance	<code>int</code>	15	The max number of pixels a user can shift his finger during touch for it to be considered a valid tap
world_copy_jump	<code>bool</code>	<code>false</code>	With this option enabled, the map tracks when you pan to another “copy” of the world and seamlessly jumps to
close_popup_on_click	<code>bool</code>	<code>true</code>	Set it to false if you don't want popups to close when user clicks the map
bounce_at_zoom_limits	<code>bool</code>	<code>true</code>	Set it to false if you don't want the map to zoom beyond min/max zoom and then bounce back when pinch-zooming
keyboard	<code>bool</code>	<code>true</code>	Makes the map focusable and allows users to navigate the map with keyboard arrows and +/- keys
keyboard_pan_offset	<code>int</code>	80	
keyboard_zoom_offset	<code>int</code>	1	
inertia	<code>bool</code>	<code>true</code>	If enabled, panning of the map will have an inertia effect
inertia_deceleration	<code>int</code>	3000	The rate with which the inertial movement slows down, in pixels/second ²
inertia_max_speed	<code>int</code>	1500	Max speed of the inertial movement, in pixels/second
zoom_control	<code>bool</code>	<code>true</code>	
attribution_control	<code>bool</code>	<code>true</code>	
zoom_animation_threshold	<code>int</code>	4	

1.7.3 Methods

Method	Return type	Arguments	Doc
add_layer	void	xlf::layer	Add a new layer to the map
remove_layer	void	xlf::layer	Remove a layer from the map
clear_layers	void		Remove all layers from the map
add_control	void	xlf::control	Add a new control to the map
re- move_control	void	xlf::control	Remove a control from the map
clear_controls	void		Remove all controls from the map
on_interaction	void	std::function<void(xeus::xjson)>	Add a callback on interaction

1.8 Tile layer

1.8.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"

auto map = xlf::map::initialize()
    .center({52.204793, 360.121558})
    .zoom(9)
    .finalize();

auto dark_matter_layer = xlf::basemap({"CartoDB", "DarkMatter"});
map.add_layer(dark_matter_layer);
map
```

1.8.2 Usage

Creating a `tile_layer` is straightforward, a list of basic tile layers is provided. This list of layers can be accessed using the `basemaps` function:

```
#include <iostream>

#include "xleaflet/xbasemaps.hpp"

std::cout << xlf::basemaps().dump(6) << std::endl;
```

A `tile_layer` instance can be created using the `basemap` function, specifying the wanted map (e.g. `{"CartoDB", "DarkMatter"}, {"Strava", "Winter"}, {"NASAGIBS", "ModisTerraTrueColorCR"},...`).

Sometimes one could want to specify the date of the given images, for instance with NASA images:

```
auto nasa_layer = xlf::basemap({"NASAGIBS", "ModisTerraTrueColorCR"}, "2018-04-08");
map.add_layer(nasa_layer);
```

1.8.3 Attributes

Attribute	Type	Default Value
url	std::string	"https://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png"
min_zoom	int	0
max_zoom	int	18
tile_size	int	256
attribution	std::string	"Map data (c) OpenStreetMap contributors"
detect_retina	bool	false
opacity	float	1.0
visible	bool	true

1.9 Marker

1.9.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xmarker.hpp"

std::array<double, 2> center = {52.204793, 360.121558};

auto map = xlf::map::initialize()
    .center(center)
    .zoom(15)
    .finalize();

auto marker = xlf::marker::initialize()
    .location(center)
    .draggable(false)
    .finalize();
map.add_layer(marker);

map
```

1.9.2 Attributes

Attribute	Type	Default Value	Doc
location	<code>std::array<double, 2></code>	<code>{0.0, 0.0}</code>	
z_index_offset	<code>int</code>	<code>0</code>	
draggable	<code>bool</code>	<code>true</code>	Whether the marker is draggable with mouse/touch or not
keyboard	<code>bool</code>	<code>true</code>	Whether the marker can be tabbed to with a keyboard and clicked by pressing enter
title	<code>std::string</code>	<code>""</code>	Text for the browser tooltip that appear on marker hover (no tooltip by default)
alt	<code>std::string</code>	<code>""</code>	Text for the <i>alt</i> attribute of the icon image (useful for accessibility)
rise_on_hover	<code>bool</code>	<code>false</code>	The z-index offset used for the <i>rise_on_hover</i> feature
opacity	<code>float</code>	<code>1.0</code>	
visible	<code>bool</code>	<code>true</code>	
icon	<code>xlf::icon</code>		The icon for the marker
rotation_angle	<code>int</code>	<code>0</code>	The rotation angle of the marker in degrees
rotation_origin	<code>std::string</code>	<code>""</code>	The rotation origin of the marker
rise_offset	<code>int</code>	<code>250</code>	The z-index offset used for the <i>rise_on_hover</i> feature

1.9.3 Methods

Method	Return type	Arguments	Doc
<code>on_move</code>	<code>void</code>	<code>std::function<void(xeus::xjson)></code>	Adds a callback on move event

1.10 Icon

1.10.1 Example

```
#include <array>

#include "xleaflet/xmap.hpp"
#include "xleaflet/xmarker.hpp"
#include "xleaflet/xicon.hpp"

using size_type = std::array<int, 2>;

std::array<double, 2> center({52.204793, 360.121558});

auto map = xlf::map::initialize()
    .center(center)
    .zoom(10)
    .finalize();

auto icon = xlf::icon::initialize()
```

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```

.icon_url("https://leafletjs.com/examples/custom-icons/leaf-red.png")
.icon_size(size_type({38, 95}))
.icon_anchor(size_type({22, 94}))
.finalize();

auto marker = xlf::marker::initialize()
.location(center)
.icon(icon)
.rotation_angle(0)
.rotation_origin("22px 94px")
.finalize();

map.add_layer(marker);

map

```

1.10.2 Attributes

Attribute	Type	Default Value	Doc
icon_url	std::string	""	url for icon image
shadow_url	std::string	""	url for icon shadow image
icon_size	std::array<int, 2>	{10, 10}	size of the icon, in pixels
shadow_size	std::array<int, 2>	{10, 10}	size of the icon shadow, in pixels
icon_anchor	std::array<int, 2>	{0, 0}	anchor point for the icon
shadow_anchor	std::array<int, 2>	{0, 0}	anchor point for the icon shadow
popup_anchor	std::array<int, 2>	{0, 0}	anchor point for the popup

1.11 Popup

1.11.1 Example

```

#include "xwidgets/xhtml.hpp"

#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xmarker.hpp"
#include "xleaflet/xpopup.hpp"

std::array<double, 2> center = {52.204793, 360.121558};

auto map = xlf::map::initialize()
.center(center)
.zoom(9)
.close_popup_on_click(false)
.finalize();
map.display();

auto marker = xlf::marker::initialize()
.location({52.1, 359.9})
.finalize();

```

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```

map.add_layer(marker);

xw::html message1, message2;
message1.value = "Try clicking the marker!";
message2.value = "Hello <b>World</b>";
message2.placeholder = "Some HTML";
message2.description = "Some HTML";

// Popup with a given location on the map:
auto popup = xlf::popup::initialize()
    .location(center)
    .child(message1)
    .close_button(false)
    .auto_close(false)
    .close_on_escape_key(false)
    .finalize();
map.add_layer(popup);

// Popup associated to a layer
marker.popup = message2;

```

1.11.2 Attributes

Attribute	Type	Default Value	Doc
location	std::array<double, 2>	{0, 0}	
child	xwidget		Content of the popup
max_width	int	300	Max width of the popup, in pixels
min_width	int	50	Min width of the popup, in pixels
max_height	int		If set, creates a scrollable container of the given height inside a popup if its content exceeds it
auto_pan	bool	true	Set it to <i>false</i> if you don't want the map to do panning animation to fit the opened popup
auto_pan_padding	std::array<double, 2>	{5, 5}	
keep_in_view	bool	false	Set it to <i>true</i> if you want to prevent users from panning the popup off of the screen while it is open
close_button	bool	true	Controls the presence of a close button in the popup
close_on_escape_key	bool	true	Set it to <i>false</i> if you want to override the default behavior of the ESC key for closing of the popup
class_name	std::string	""	A custom CSS class name to assign to the popup

1.12 WMS layer

1.12.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xwms_layer.hpp"

auto wms = xlf::wms_layer::initialize()
    .url("https://demo.boundlessgeo.com/geoserver/ows?")
    .layers("nasa:bluemarble")
    .finalize();

auto map = xlf::map::initialize()
    .layers({wms})
    .center({42.5531, -48.6914})
    .zoom(3)
    .finalize();

map
```

1.12.2 Attributes

At-tribute	Type	Default Value	Doc
url	std::string	"https://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png"	
min_zoom	int	0	
max_zoom	int	18	
tile_size	int	256	
attribution	std::string	"Map data (c) OpenStreetMap contributors"	
detect_retina	bool	false	
opacity	float	1.0	
visible	bool	true	
service	std::string	"WMS"	
request	std::string	"GetMap"	
layers	std::string		Comma-separated list of WMS layers to show
styles	std::string		Comma-separated list of WMS styles
format	std::string	"image/jpeg"	WMS image format (use 'image/png' for layers with transparency)
transparent	bool	false	If true, the WMS service will return images with transparency
version	std::string	"1.1"	Version of the WMS service to use
crs	std::string		

1.13 Image overlay and Video overlay

1.13.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xvideo_overlay.hpp"

auto map = xlf::map::initialize()
    .center({25, -115})
    .zoom(4)
    .finalize();

auto video = xlf::video_overlay::initialize()
    .url("https://www.mapbox.com/bites/00188/patricia_nasa.webm")
    .bounds({{13, -130}, {32, -100}})
    .finalize();

map.add_layer(video);
map
```

1.13.2 Attributes

At-tribute	Type	Default Value	Doc
url	std::string	""	Url to the footage
bounds	std::array<std::array<double, 2>, 2>	{{0.0, 0.0}, {0.0, 0.0}}	SW and NE corners of the image

1.14 Polygon

1.14.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xpolygon.hpp"

auto polygon = xlf::polygon::initialize()
    .locations({{42, -49}, {43, -49}, {43, -48}})
    .color("green")
    .fill_color("green")
    .finalize();

auto map = xlf::map::initialize()
    .center({42.5531, -48.6914})
    .zoom(6)
    .finalize();
map.add_layer(polygon);

map
```

1.14.2 Attributes

Attribute	Type	Default Value	Doc
locations	<code>std::vector<std::array<double, 2>></code>	<code>{}</code>	List of points of the polygon
stroke	<code>bool</code>	<code>true</code>	Set it to <i>false</i> to disable borders
color	<code>std::string</code>	<code>"#0033FF"</code>	Color of the stroke
opacity	<code>float</code>	<code>1.0</code>	Opacity of the stroke
weight	<code>int</code>	<code>5</code>	Width of the stroke in pixels
fill	<code>bool</code>	<code>true</code>	Whether to fill the polygon or not
fill_color	<code>std::string</code>	<code>"#0033FF"</code>	
fill_opacity	<code>float</code>	<code>0.2</code>	
dash_array	<code>std::string</code>		
line_cap	<code>std::string</code>	<code>"round"</code>	
line_join	<code>std::string</code>	<code>"round"</code>	

1.15 Rectangle

1.15.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xrectangle.hpp"

auto terrain = xlf::basemap({"Stamen", "Watercolor"});

auto map = xlf::map::initialize()
    .layers({terrain})
    .center({53, 354})
    .zoom(5)
    .finalize();

auto rectangle = xlf::rectangle::initialize()
    .bounds({{52, 354}, {53, 360}})
    .finalize();

map.add_layer(rectangle);

map
```

1.15.2 Attributes

Attribute	Type	Default Value	Doc
bounds	std::array<std::array<double, 2>, 2>	{}	SW and NE corners of the rectangle
stroke	bool	true	Set it to <i>false</i> to disable borders
color	std::string	"#0033FF"	Color of the stroke
opacity	float	1.0	Opacity of the stroke
weight	int	5	Width of the stroke in pixels
fill	bool	true	Whether to fill the polygon or not
fill_color	std::string	"#0033FF"	
fill_opacity	float	0.2	
dash_array	std::string		
line_cap	std::string	"round"	
line_join	std::string	"round"	

1.16 Circle

1.16.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xcircle.hpp"

auto terrain = xlf::basemap({"Stamen", "Watercolor"});

auto map = xlf::map::initialize()
    .layers({terrain})
    .center({53, 354})
    .zoom(5)
    .finalize();

auto circle = xlf::circle::initialize()
    .location({50, 354})
    .radius(50000)
    .color("green")
    .fill_color("green")
    .finalize();

map.add_layer(circle);

map
```

1.16.2 Attributes

Attribute	Type	Default Value	Doc
location	std::array<double, 2>	{0.0, 0.0}	Location of the circle
radius	int	1000	Radius of the circle, in meters
stroke	bool	true	Set it to <i>false</i> to disable borders
color	std::string	"#0033FF"	Color of the stroke
opacity	float	1.0	Opacity of the stroke
weight	int	5	Width of the stroke in pixels
fill	bool	true	Whether to fill the circle or not
fill_color	std::string	"#0033FF"	
fill_opacity	float	0.2	
dash_array	std::string		
line_cap	std::string	"round"	
line_join	std::string	"round"	

1.17 Circle Marker

1.17.1 Example

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xcircle_marker.hpp"

auto terrain = xlf::basemap({"Stamen", "Watercolor"});

auto map = xlf::map::initialize()
    .layers({terrain})
    .center({53, 354})
    .zoom(5)
    .finalize();

auto circle_marker = xlf::circle_marker::initialize()
    .location({55, 360})
    .radius(50)
    .color("red")
    .fill_color("red")
    .finalize();

map.add_layer(circle_marker);

map
```

1.17.2 Attributes

Attribute	Type	Default Value	Doc
location	std::array<double, 2>	{0.0, 0.0}	Location of the circle
radius	int	10	Radius of the circle, in pixels
stroke	bool	true	Set it to <i>false</i> to disable borders
color	std::string	"#0033FF"	Color of the stroke
opacity	float	1.0	Opacity of the stroke
weight	int	5	Width of the stroke in pixels
fill	bool	true	Whether to fill the circle or not
fill_color	std::string	"#0033FF"	
fill_opacity	float	0.2	
dash_array	std::string		
line_cap	std::string	"round"	
line_join	std::string	"round"	

1.18 Marker Cluster

1.18.1 Example

```

#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xmarker.hpp"
#include "xleaflet/xmarker_cluster.hpp"

auto map = xlf::map::initialize()
    .center({50, 354})
    .zoom(5)
    .finalize();

auto marker1 = xlf::marker::initialize()
    .location({50, 354})
    .finalize();
auto marker2 = xlf::marker::initialize()
    .location({52, 356})
    .finalize();
auto marker3 = xlf::marker::initialize()
    .location({48, 352})
    .finalize();

auto marker_cluster = xlf::marker_cluster::initialize()
    .markers({marker1, marker2, marker3})
    .finalize();

map.add_layer(marker_cluster);

map

```

1.18.2 Attributes

Attribute	Type	Default Value	Doc
markers	std::vector<xlf::marker>	{}	Array of markers

1.19 Heatmap

1.19.1 Example

```

#include <random>
#include <array>
#include <vector>

#include "xleaflet/xmap.hpp"
#include "xleaflet/xheatmap.hpp"

auto map = xlf::map::initialize()
    .center({37.58, 261.65})
    .zoom(5)
    .finalize();

std::random_device rd;
std::mt19937 mt(rd());
std::uniform_real_distribution<double> rd_latitude(34.0, 40.0);
std::uniform_real_distribution<double> rd_longitude(255.0, 265.0);
std::uniform_real_distribution<double> rd_intensity(0.0, 1000.0);

std::vector<std::array<double, 3>> heatmap_points;

for (std::size_t i = 0; i < 100; ++i)
{
    heatmap_points.push_back({rd_latitude(mt), rd_longitude(mt), rd_intensity(mt)});
}

auto heatmap = xlf::heatmap::initialize()
    .locations(heatmap_points)
    .finalize();

map.add_layer(heatmap);

map

```

1.19.2 Attributes

Attribute	Default Value	Doc
locations	[]	List of center locations
min_opacity	0.05	Minimum opacity the heat will start at
max_zoom	18	Zoom level where max intensity is reached
max	1.0	Maximum point intensity
radius	25.0	Radius of each “point” of the heatmap
blur	15.0	Amount of blur
gradient	{0.4: ‘blue’, 0.6: ‘cyan’, 0.7: ‘lime’, 0.8: ‘yellow’, 1.0: ‘red’}	Color gradient config

1.20 Velocity

1.20.1 Example

```

#include <fstream>

#include "nlohmann/json.hpp"

#include "xleaflet/xmap.hpp"
#include "xleaflet/xvelocity.hpp"

auto map = xlf::map::initialize()
    .center({0, 0})
    .zoom(1)
    .finalize();

auto base_layer = xlf::basemap({"CartoDB", "DarkMatter"});
map.add_layer(base_layer);

std::ifstream file("velocity_data.json");
nlohmann::json data;
file >> data;

auto velocity = xlf::velocity::initialize()
    .data(data)
    .velocity_scale(0.01)
    .max_velocity(20)
    .display_options(R"({
        "velocityType": "Global Wind",
        "displayPosition": "bottomleft",
        "displayEmptyString": "No wind data"
    })")
    .finalize();

map.add_layer(velocity);

map

```


1.20.2 Attributes

Attribute	Default Value	Doc
data	Null JSON objectdataset	Underlying dataset
units	None	Units
display_values	True	Display velocity data on mouse hover
display_options	{}	Display options
min_velocity	0.0	Used to align color scale
max_velocity	10.0	Used to align color scale
velocity_scale	0.005	Modifier for particle animations
color_scale	Empty std::vector of html colors	Array of hex/rgb colors for user-specified color scale.

1.21 Layer Group

1.21.1 Example

```

#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xlayer_group.hpp"
#include "xleaflet/xcircle.hpp"
#include "xleaflet/xmarker.hpp"
#include "xleaflet/xrectangle.hpp"

auto toner = xlf::basemap({"Stamen", "Toner"});

auto map = xlf::map::initialize()
    .layers({toner})
    .center({50, 354})
    .zoom(5)
    .finalize();

// Create some layers
auto marker = xlf::marker::initialize()
    .location({50, 354})
    .finalize();
auto circle = xlf::circle::initialize()
    .location({50, 370})
    .radius(50000)
    .color("yellow")
    .fill_color("yellow")
    .finalize();
auto rectangle = xlf::rectangle::initialize()
    .bounds({{54, 354}, {55, 360}})
    .color("orange")
    .fill_color("orange")
    .finalize();

// Create layer group
auto layer_group = xlf::layer_group::initialize()
    .layers({marker, circle})
    .finalize();

map.add_layer(layer_group);

```

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```

layer_group.add_layer(rectangle);

layer_group.remove_layer(circle);

map

```

1.21.2 Attributes

Attribute	Type	Default Value	Doc
layers	std::vector<xlf::layer>	{}	Array of layers

1.21.3 Methods

Method	Return type	Arguments	Doc
add_layer	void	xlf::layer	Add a new layer to the group
remove_layer	void	xlf::layer	Remove a layer from the group
clear_layers	void		Remove all layers from the group

1.22 GeoJSON

1.22.1 Example

```

#include <fstream>

#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xgeo_json.hpp"

auto black_and_white = xlf::basemap({"OpenStreetMap", "BlackAndWhite"});

auto map = xlf::map::initialize()
    .layers({black_and_white})
    .center({34.6252978589571, -77.34580993652344})
    .zoom(10)
    .finalize();

// Load a local file
std::ifstream file("geo.json");
xeus::xjson geo_data;
file >> geo_data;

auto geo_json = xlf::geo_json::initialize()
    .data(geo_data)
    .finalize();
map.add_layer(geo_json);

map

```

1.22.2 Attributes

Attribute	Type	Default Value	Doc
data	xeus::xjson		Data dictionary
style	xeus::xjson		Style dictionary
hover_style	xeus::xjson		Hover style dictionary

1.22.3 Methods

Method	Return type	Arguments	Doc
on_click	void	std::function<void(xeus::xjson)>	Adds a callback on click event
on_hover	void	std::function<void(xeus::xjson)>	Adds a callback on hover event

1.23 Fullscreen Control

The `fullscreen_control` allows one to display a selector on the top left of the map in order to display the map in fullscreen.

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xfullscreen_control.hpp"

auto map = xlf::map::initialize()
    .center({51.64, -76.52})
    .zoom(5)
    .finalize();

map.add_control(xlf::fullscreen_control());

map
```

1.24 Layers Control

The `layers_control` allows one to display a selector on the top right of the map in order to select which tile layer to display on the map.

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xtile_layer.hpp"
#include "xleaflet/xwms_layer.hpp"
#include "xleaflet/xlayers_control.hpp"

auto map = xlf::map::initialize()
    .center({50, 354})
    .zoom(4)
    .finalize();

auto nasa_layer = xlf::basemap({"NASAGIBS", "ModisTerraTrueColorCR"}, "2018-03-30");
map.add_layer(nasa_layer);
```

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```

auto wms = xlf::wms_layer::initialize()
    .url("https://demo.boundlessgeo.com/geoserver/ows?")
    .layers("nasa:bluemarble")
    .name("nasa:bluemarble")
    .finalize();
map.add_layer(wms);

map.add_control(xlf::layers_control());

map

```

1.25 Split Map Control

1.25.1 Example

```

#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xleaflet/xsplit_map_control.hpp"

auto map = xlf::map::initialize()
    .center({42.6824, 365.581})
    .zoom(5)
    .finalize();

auto right_layer = xlf::basemap({"NASAGIBS", "ModisTerraTrueColorCR"}, "2017-11-11");
auto left_layer = xlf::basemap({"NASAGIBS", "ModisAquaBands721CR"}, "2017-11-11");

auto control = xlf::split_map_control::initialize()
    .left_layer(left_layer)
    .right_layer(right_layer)
    .finalize();
map.add_control(control);

map

```

1.25.2 Attributes

Attribute	Type	Default Value	Doc
left_layer	xlf::layer		Left layer
right_layer	xlf::layer		Right layer

1.26 Measure Control

1.26.1 Example

```
#include <iostream>
#include <string>

#include "xleaflet/xmap.hpp"
#include "xleaflet/xmeasure_control.hpp"
#include "xleaflet/xbasemaps.hpp"

auto water_color = xlf::basemap({"Stamen", "Watercolor"});

auto map = xlf::map::initialize()
    .layers({water_color})
    .center({50, 354})
    .zoom(5)
    .finalize();

auto measure_control = xlf::measure_control::initialize()
    .finalize();

map.add_control(measure_control);

map
```

1.26.2 Attributes

Attribute	Default Value	Doc
position	"topright"	Position of the control on the Map, possible values are topleft, topright, bottomleft or bottomright
primary_length_unit	"feet"	Primary length unit, possible values are feet, meters, miles, kilometers or any user defined length unit
secondary_length_unit	None	Secondary length unit, possible values are None, feet, meters, miles, kilometers or any user defined length unit
primary_area_unit	"acres"	Primary area unit, possible values are acres, hectares, sqfeet, sqmeters, sqmiles or any user defined area unit
secondary_area_unit	None	Secondary area unit, possible values are None, acres, hectares, sqfeet, sqmeters, sqmiles or any user defined area unit
active_color	"#ABE67E"	Color of the currently drawn area
completed_color	"#C8F2BE"	Color of the completed areas
popup_options	{ "className": "leaflet-measure-resultpopup", "autoPanPadding": [10, 10] }	
capture_z_index	10000	Z-index of the marker used to capture measure clicks. Set this value higher than the z-index of all other map layers to disable click events on other layers while a measurement is active.

1.27 Widget control

1.27.1 Example

```

#include "xleaflet/xmap.hpp"
#include "xleaflet/xbasemaps.hpp"
#include "xwidgets/xslider.hpp"
#include "xwidgets/xnumeral.hpp"
#include "xwidgets/xlink.hpp"
#include "xleaflet/xwidget_control.hpp"

std::array<double, 2> center = {52.204793, 360.121558};

auto map = xlf::map::initialize()
    .center(center)
    .zoom(4)
    .close_popup_on_click(false)
    .finalize();
map.display();

auto button1 = xw::slider<double>::initialize()
    .min(1.0)
    .max(9.0)
    .value(4.0)
    .orientation("horizontal")
    .finalize();

auto popup2 = xlf::widget_control::initialize()
    .widget(button1)
    .position("bottomright")
    .finalize();
map.add_control(popup2);

xw::numeral<double> numeral;
auto popup4 = xlf::widget_control::initialize()
    .widget(numeral)
    .position("topright")
    .finalize();
map.add_control(popup4);

auto l = xw::link(numeral, "value", map, "zoom");
auto m = xw::link(button1, "value", map, "zoom");
<div style = "height:30px;"> </div>

```

1.27.2 Attributes

Attribute	Type	Default Value	Doc
widget	xwidget		Content of the widget
position	string		Position of the widget

1.28 Draw Control

The `draw_control` allows one to draw shapes on the map such as rectangle circle or lines.

```
#include "xleaflet/xmap.hpp"
#include "xleaflet/xdraw_control.hpp"
#include "xleaflet/xbasemaps.hpp"

auto water_color = xlf::basemap({"Stamen", "Watercolor"});

auto map = xlf::map::initialize()
    .layers({water_color})
    .center({50, 354})
    .zoom(5)
    .finalize();

xeus::xjson polyline_options = {
    {"shapeOptions", {
        {"color", "#6bc2e5"},
        {"weight", 8},
        {"opacity", 1.0}
    }}
};

// Set some options for draw control
xeus::xjson polygon_options = {
    {"shapeOptions", {
        {"fillColor", "#6be5c3"},
        {"color", "#6be5c3"},
        {"fillOpacity", 1.0}
    }},
    {"drawError", {
        {"color", "#dd253b"},
        {"message", "Oups!"}
    }},
    {"allowIntersection", false}
};

xeus::xjson circle_options = {
    {"shapeOptions", {
        {"fillColor", "#efed69"},
        {"fillOpacity", 1.0},
        {"color", "#efed69"}
    }}
};

xeus::xjson rectangle_options = {
    {"shapeOptions", {
        {"fillColor", "#fca45d"},
        {"fillOpacity", 1.0},
        {"color", "#fca45d"}
    }}
};

auto draw_control = xlf::draw_control::initialize()
    .polyline(polyline_options)
    .polygon(polygon_options)
```

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```
.circle(circle_options)
.rectangle(rectangle_options)
.finalize();
map.add_control(draw_control);

map
```

1.29 Releasing xleaflet

1.29.1 Releasing a new version

From the master branch of xleaflet

- Make sure that you are in sync with the master branch of the upstream remote.
- In file `xleaflet_config.hpp`, set the macros for `XLEAFLET_VERSION_MAJOR`, `XLEAFLET_VERSION_MINOR` and `XLEAFLET_VERSION_PATCH` to the desired values.
- Update the readme file w.r.t. dependencies on xleaflet
- Stage the changes (`git add`), commit the changes (`git commit`) and add a tag of the form `Major.minor.patch`. It is important to not add any other content to the tag name.
- Push the new commit and tag to the main repository. (`git push`, and `git push --tags`)
- Release the new version on conda
- Update the stable branch to point to the new tag