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## Render Recipes

The Render classes are in the [geoscript.render](#) package.

### Creating Maps

*Create a Map with Layers and render to a File.*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
File file = new File("map.png")
map.render(file)
```



Create a Map with Layers and render to a file name.

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
map.render("map.png")
```



*Create a Map with Layers and render to an OutputStream.*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
File file = new File("map.png")
file.withOutputStream { OutputStream outputStream ->
    map.render(outputStream)
}
```



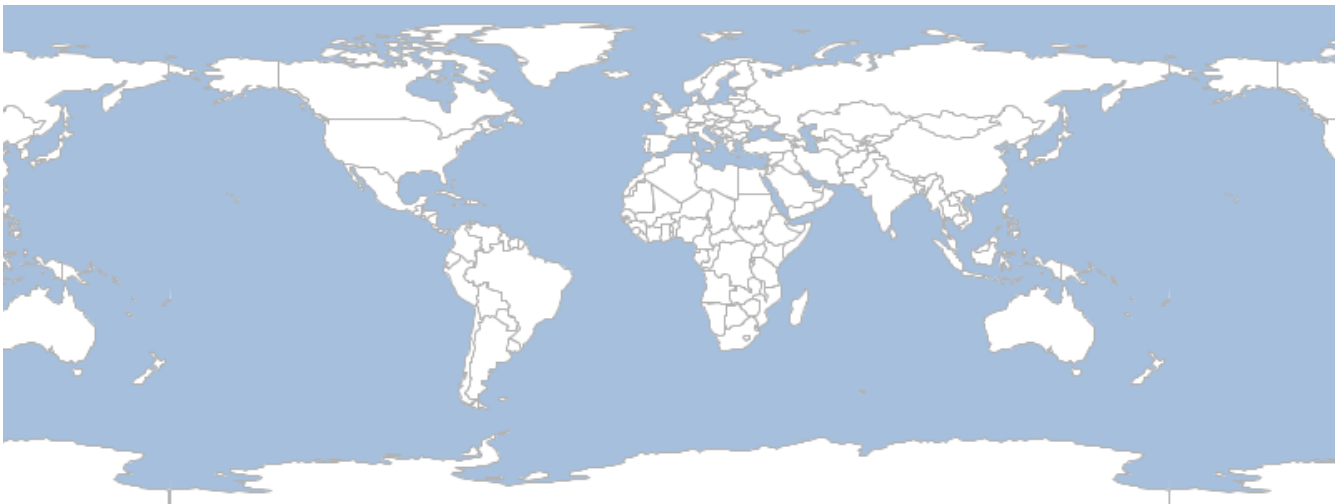
*Create a Map with Layers and render to an BufferedImage.*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
BufferedImage image = map.renderToImage()
```



Create a Map with Layers and render to a Graphics2D object.

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
BufferedImage image = new BufferedImage(800, 300, BufferedImage.TYPE_INT_ARGB)
Graphics2D graphics = image.graphics
map.render(graphics)
graphics.dispose()
```



Create a Map with Layers and display in a simple UI.

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
map.display()
```



## Map Properties

### Get Map properties

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Map map = new Map(
    width: 600,
    height: 600,
    backgroundColor: "#a5bfdd",
    layers: [countries],
    type: "png",
    proj: "EPSG:3857",
    bounds: new Bounds(-180,-85,180,85, "EPSG:4326").reproject("EPSG:3857"),
    fixAspectRatio: false
)
File file = new File("map.png")
map.render(file)
```



### *Get width and height*

```
int width = map.width  
int height = map.height  
println "Width and Height = ${width} x ${height}"
```

Width and Height = 600 x 600

### *Get the Bounds*

```
Bounds bounds = map.bounds  
println "Bounds = ${bounds}"
```

Bounds = (-2.0037508342789244E7,-  
1.997186888040857E7,2.0037508342789244E7,1.9971868880408563E7,EPsg:3857)

### *Get the Projection*

```
Projection projection = map.proj  
println "Projeciton = ${projection}"
```

Projeciton = EPSG:3857

### *Get the Layers*

```
List<Layer> layers = map.layers  
println "Layers:"  
layers.each { Layer layer ->  
    println "    ${layer.name}"  
}
```

Layers:  
countries

### *Get the renderer type*

```
String type = map.type  
println "Type = ${type}"
```

Type = png

*Get whether we are fixing the aspect ratio or not.*

```
boolean shouldFixAspectRatio = map.fixAspectRatio
println "Fix Aspect Ratio = ${shouldFixAspectRatio}"
```

```
Fix Aspect Ratio = false
```

*Get the background color*

```
String backgroundColor = map.backgroundColor
println "Background Color = ${backgroundColor}"
```

```
Background Color = #a5bfdd
```

*Get the scale*

```
double scale = map.scaleDenominator
println "Scale = ${scale}"
```

```
Scale = 2.385417659855862E8
```

## Advanced Properties

*You can set the scale computation to be accurate (the default) or ogc compliant.*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 400,
    height: 300,
    layers: [ocean, countries],
    bounds: new Bounds(-162.070313, 9.968851, -35.507813, 58.995311, "EPSG:4326")
)

map.setScaleComputation("accurate")
File accurateFile = new File("map_accurate.png")
map.render(accurateFile)

map.setScaleComputation("ogc")
File ogcFile = new File("map_ogc.png")
map.render(ogcFile)
```



Accurate



OGC



You can set whether to use advanced projection handling or not. By default this is set to true.

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 400,
    height: 300,
    layers: [ocean, countries],
    bounds: new Bounds(-162.070313, 9.968851, -35.507813, 58.995311, "EPSG:4326")
)

map.setAdvancedProjectionHandling(true)
File trueFile = new File("map_advancedproj_true.png")
map.render(trueFile)

map.setAdvancedProjectionHandling(false)
File falseFile = new File("map_advancedproj_false.png")
map.render(falseFile)
```

Yes



No



You can set whether to use continuous map wrapping. The default is true.

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 200,
    layers: [ocean, countries]
)

map.setContinuousMapWrapping(true)
File trueFile = new File("map_continuouswrapping_true.png")
map.render(trueFile)

map.setContinuousMapWrapping(false)
File falseFile = new File("map_continuouswrapping_false.png")
map.render(falseFile)
```

Yes



No



## Projections

*Create a map in the mercator projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("Mercator")
Bounds bounds = new Bounds(-179.99, -85.0511, 179.99, 85.0511, "EPSG:4326").reproject(
    proj)
Map map = new Map(
    width: 400,
    height: 400,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_mercator.png")
map.render(file)
```



*Create a map in the WGS84 projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("WGS84")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_wgs84.png")
map.render(file)
```



*Create a map in the Equal Earth projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("EqualEarth")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_equalearth.png")
map.render(file)
```



*Create a map in the Mollweide projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("Mollweide")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_mollweide.png")
map.render(file)
```



*Create a map in the Aitoff projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("Aitoff")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_aitoff.png")
map.render(file)
```





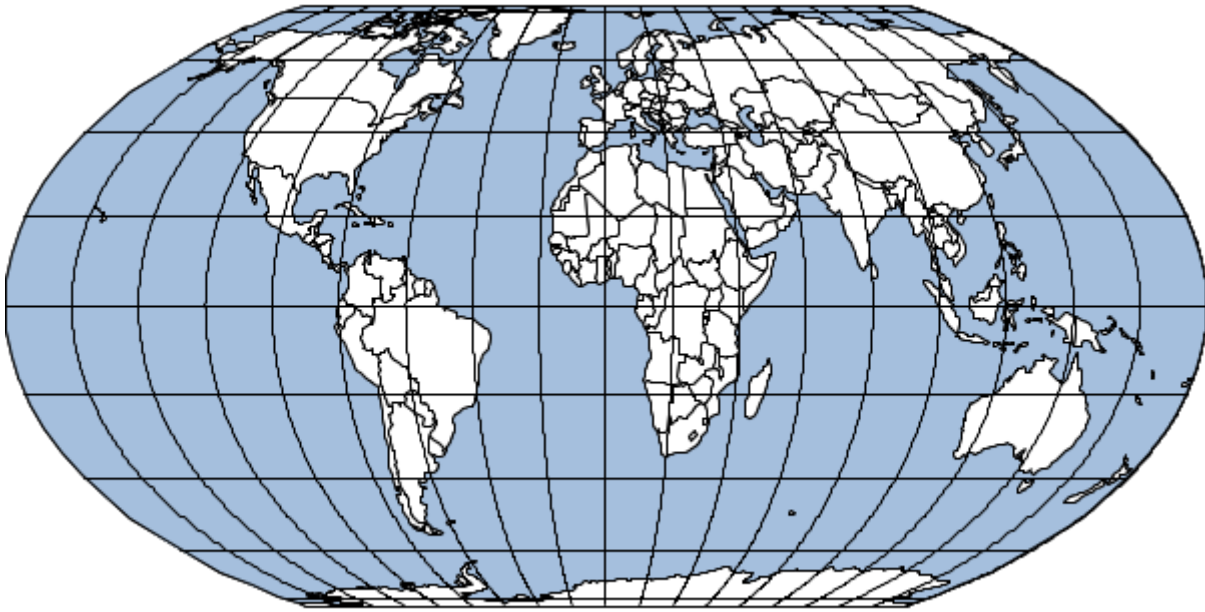
*Create a map in the Eckert IV projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("EckertIV")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_eckertIV.png")
map.render(file)
```



*Create a map in the Wagner IV projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("WagnerIV")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_wagnerIV.png")
map.render(file)
```



*Create a map in the Robinson projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("Robinson")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_robinson.png")
map.render(file)
```



*Create a map in the Winkel Tripel projection*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("WinkelTripel")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_winkeltripel.png")
map.render(file)
```



*Create a map in the World Vander Grinten I projection*

```
Workspace workspace = new Directory('src/main/resources/shapefiles')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("black", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd") + new Stroke("black", 0.5)
Layer graticules = workspace.get("graticules")
graticules.style = new Stroke("black", 0.5)
Projection proj = new Projection("WorldVanderGrintenI")
Bounds bounds = new Bounds(-180, -90, 180, 90, "EPSG:4326").reproject(proj)
Map map = new Map(
    width: 600,
    height: 350,
    proj: proj,
    bounds: bounds,
    layers: [ocean, countries, graticules]
)
File file = new File("map_worldVanderGrintenIMap.png")
map.render(file)
```



## Map Cubes

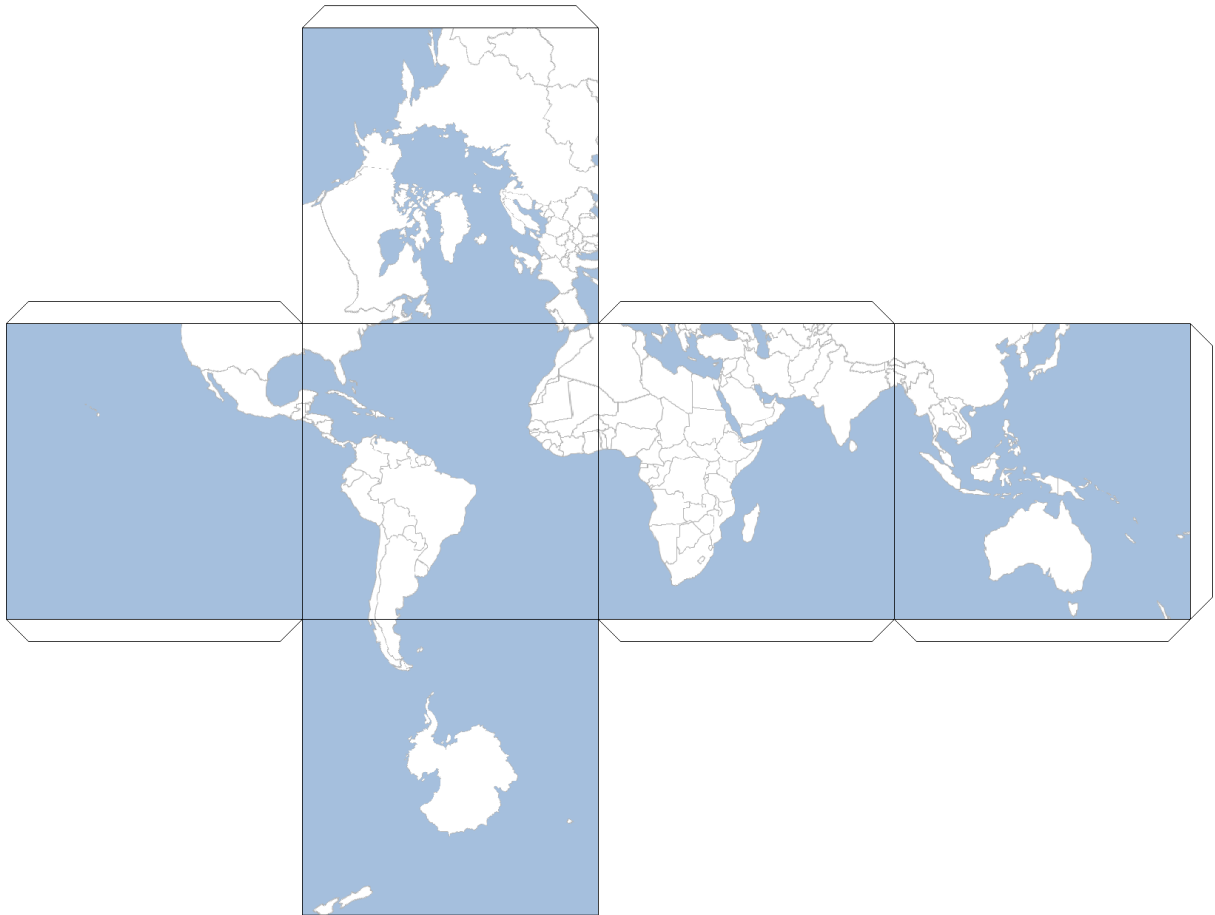
*Create a map cube to a file*

```
Workspace workspace = new Directory("src/main/resources/shapefiles")
Layer countries = workspace.get("countries")
Layer ocean = workspace.get("ocean")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
ocean.style = new Fill("#a5bfdd")

MapCube mapCube = new MapCube(
    drawOutline: true,
    drawTabs: true,
    tabSize: 30,
    title: "World Cube",
    source: "Nartual Earth",
    imageType: "png"
)
File file = new File("target/map_cube_file.png")
mapCube.render([ocean, countries], file)
```

## World Cube

Natural Earth



Create a map cube to a byte array

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")

MapCube mapCube = new MapCube()
byte[] bytes = mapCube.render([ocean, countries])
```

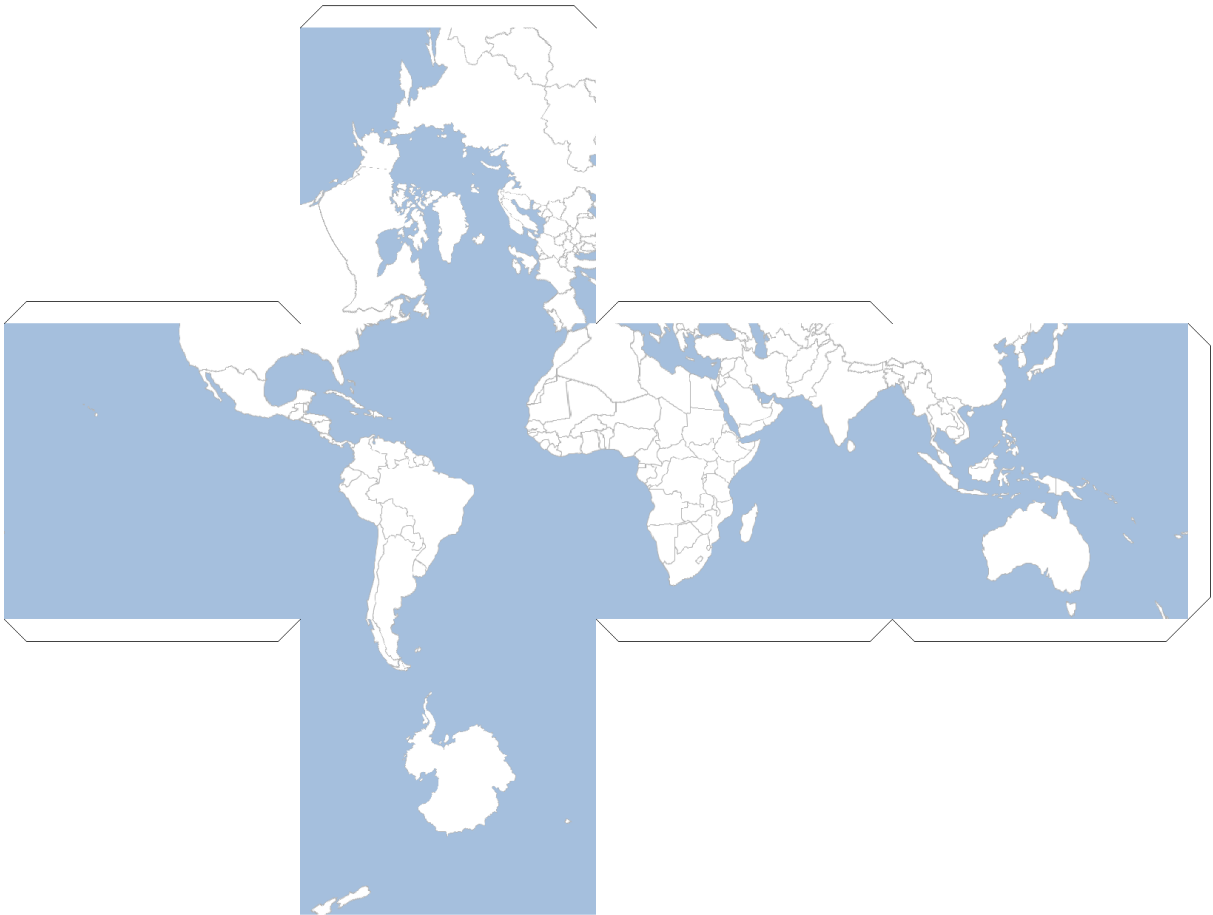


*Create a map cube to a byte array*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")

MapCube mapCube = new MapCube()
File file = new File("target/map_cube_stream.png")
file.withOutputStream { OutputStream outputStream ->
    mapCube.render([ocean, countries], outputStream)
}
```





## Rendering Maps

### Finding Renderers

*Get all Renderers*

```
List<Renderer> renderers = Renderers.list()
renderers.each { Renderer renderer ->
    println renderer.class.simpleName
}
```

ASCII  
Base64  
GeoTIFF  
GIF  
JPEG  
Pdf  
PNG  
Svg

### Get a Renderer

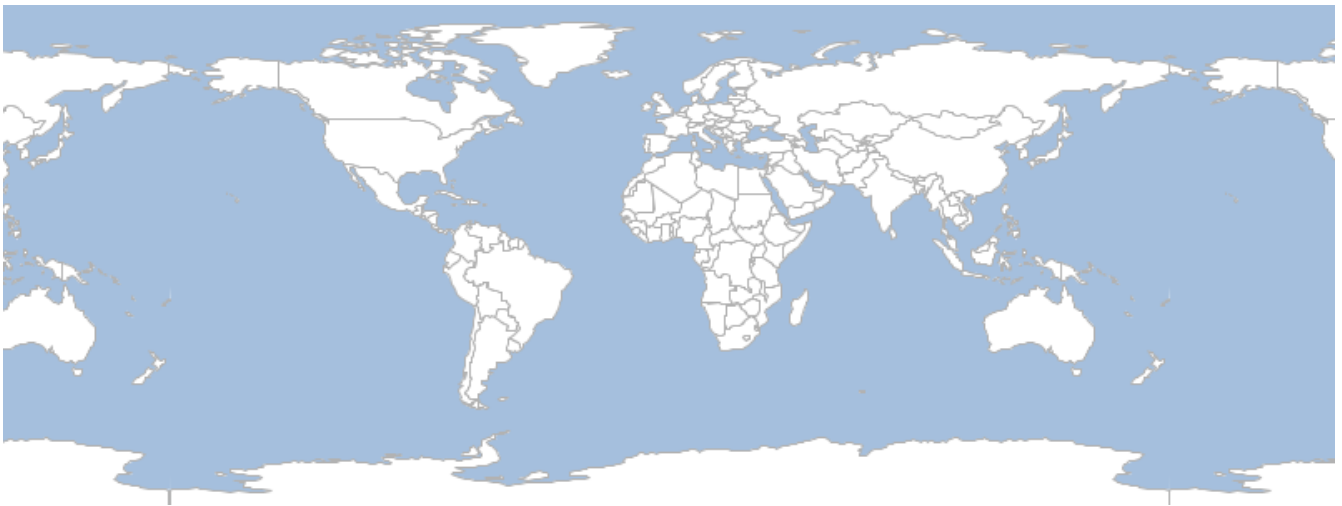
```
Renderer renderer = Renderers.find("png")
println renderer.class.simpleName
```

PNG

## Image

### Render a Map to an image using an Image Renderer

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Image png = new Image("png")
BufferedImage image = png.render(map)
```



### *Render a Map to an OutputStream using the Image Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Image jpeg = new Image("jpeg")
File file = new File("map.jpeg")
FileOutputStream out = new FileOutputStream(file)
jpeg.render(map, out)
out.close()
```



## **PNG**

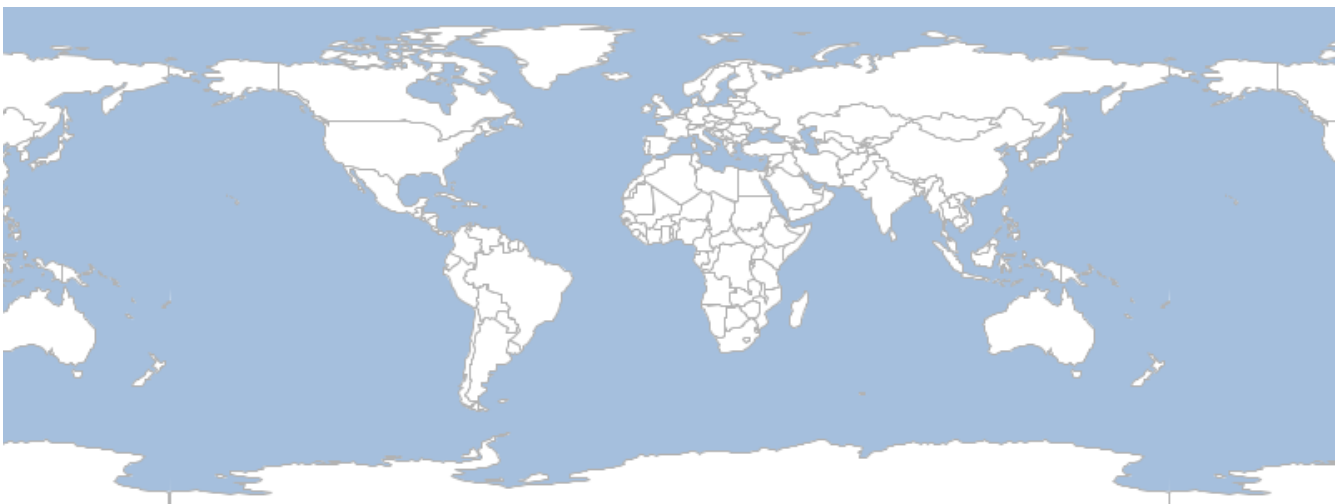
### *Render a Map to an Image using the PNG Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
PNG png = new PNG()
BufferedImage image = png.render(map)
```



*Render a Map to an OutputStream using the PNG Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
PNG png = new PNG()
File file = new File("map.png")
FileOutputStream out = new FileOutputStream(file)
png.render(map, out)
out.close()
```



**JPEG**

### *Render a Map to an Image using the JPEG Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
JPEG jpeg = new JPEG()
BufferedImage image = jpeg.render(map)
```



### *Render a Map to an OutputStream using the JPEG Renderer*

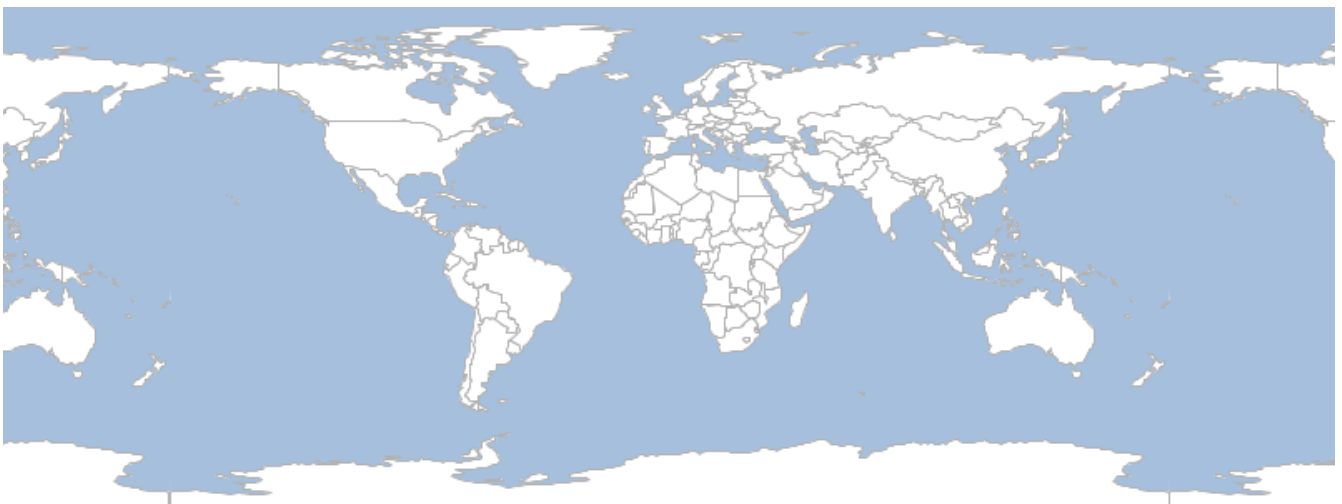
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
JPEG jpeg = new JPEG()
File file = new File("map.jpeg")
FileOutputStream out = new FileOutputStream(file)
jpeg.render(map, out)
out.close()
```



## GIF

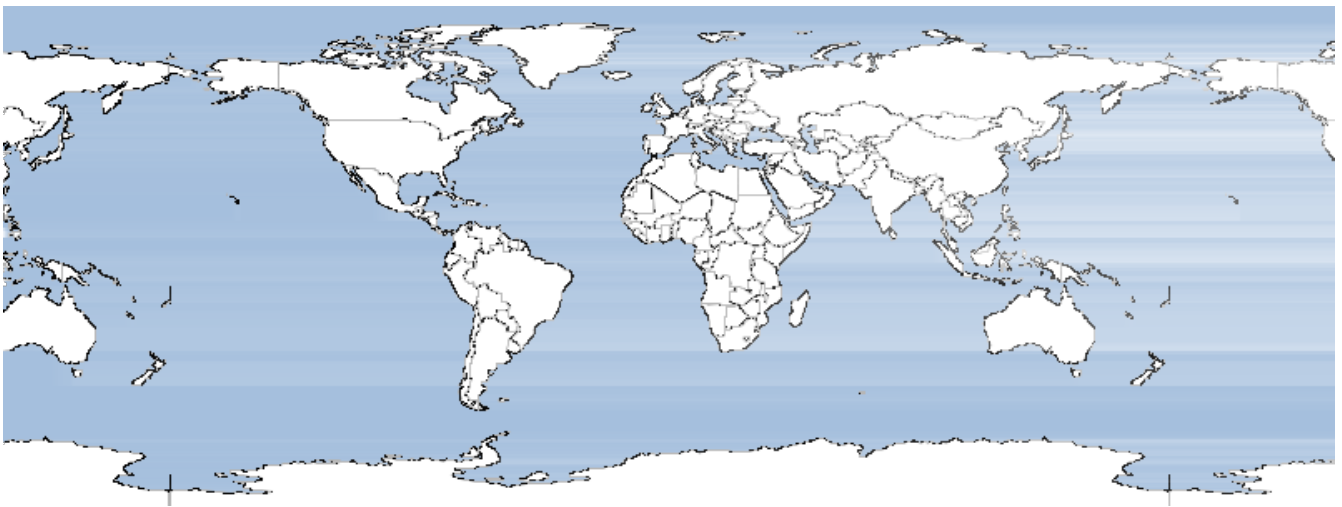
*Render a Map to an Image using the GIF Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
GIF gif = new GIF()
BufferedImage image = gif.render(map)
```



### *Render a Map to an OutputStream using the GIF Renderer*

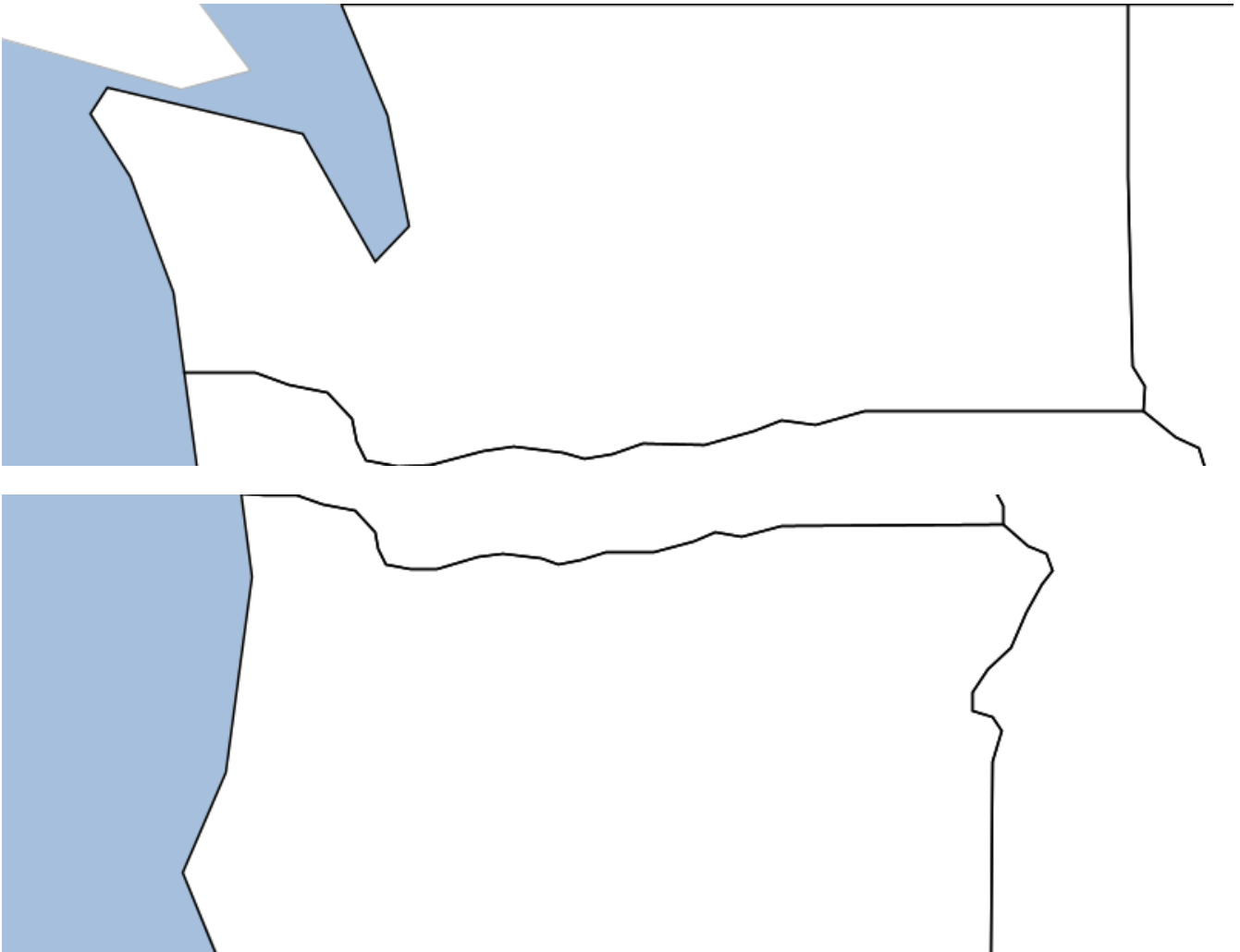
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
GIF gif = new GIF()
File file = new File("map.gif")
gif.render(map, new FileOutputStream(file))
```



## Render a Map to an animated GIF using the GIF Renderer

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer states = workspace.get("states")
states.style = new Fill("") + new Stroke("black", 1.0)
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries, states]
)

GIF gif = new GIF()
List images = ["Washington", "Oregon", "California"].collect { String state ->
    map.bounds = states.getFeatures("name = '${state}')[0].bounds
    def image = gif.render(map)
    image
}
File file = new File("states.gif")
gif.renderAnimated(images, file, 500, true)
```



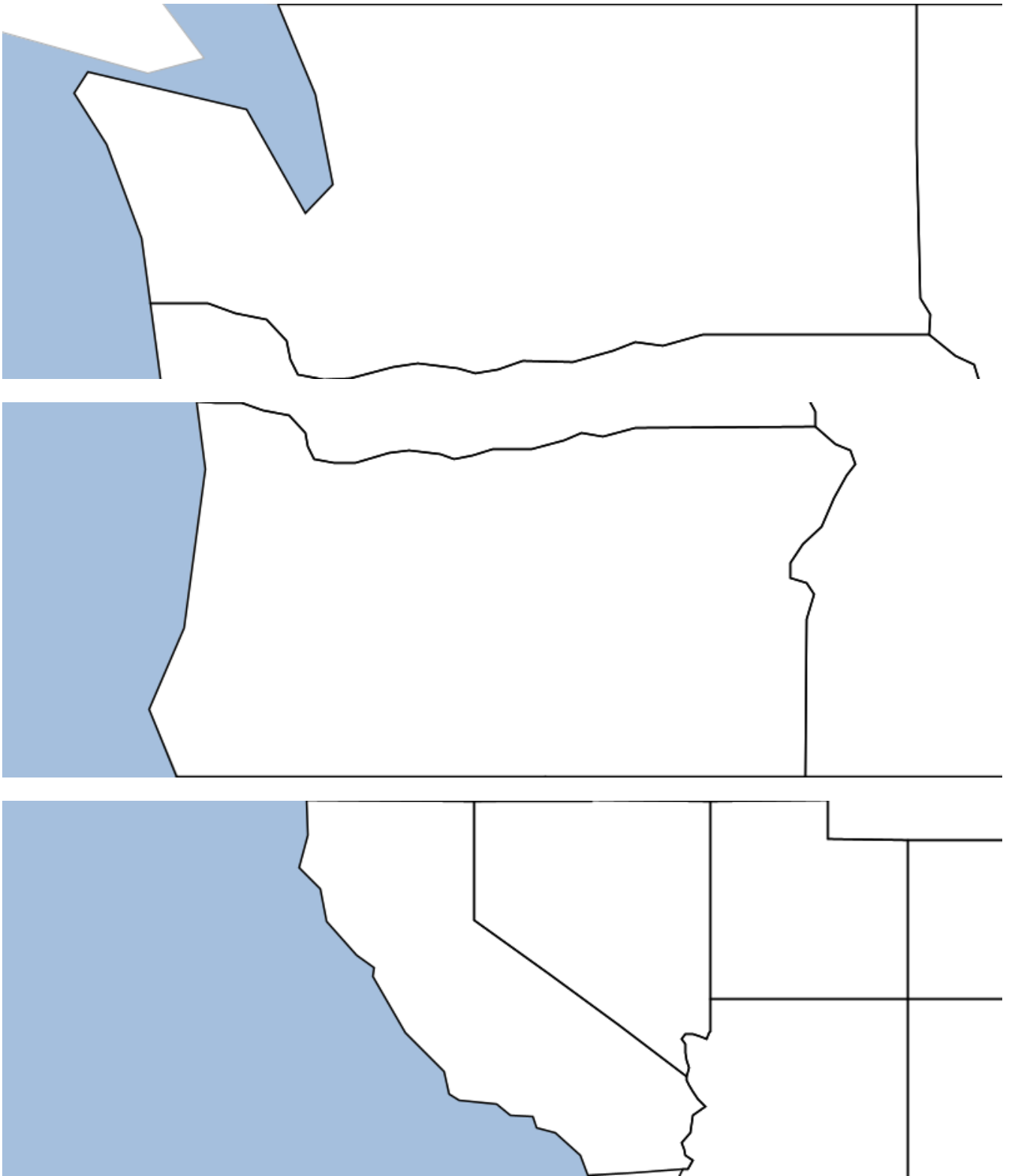




*Render a Map to an animated GIF to a byte array using the GIF Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer states = workspace.get("states")
states.style = new Fill("") + new Stroke("black", 1.0)
Layer countries = workspace.get("countries")
countries.style = new Fill("ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries, states]
)

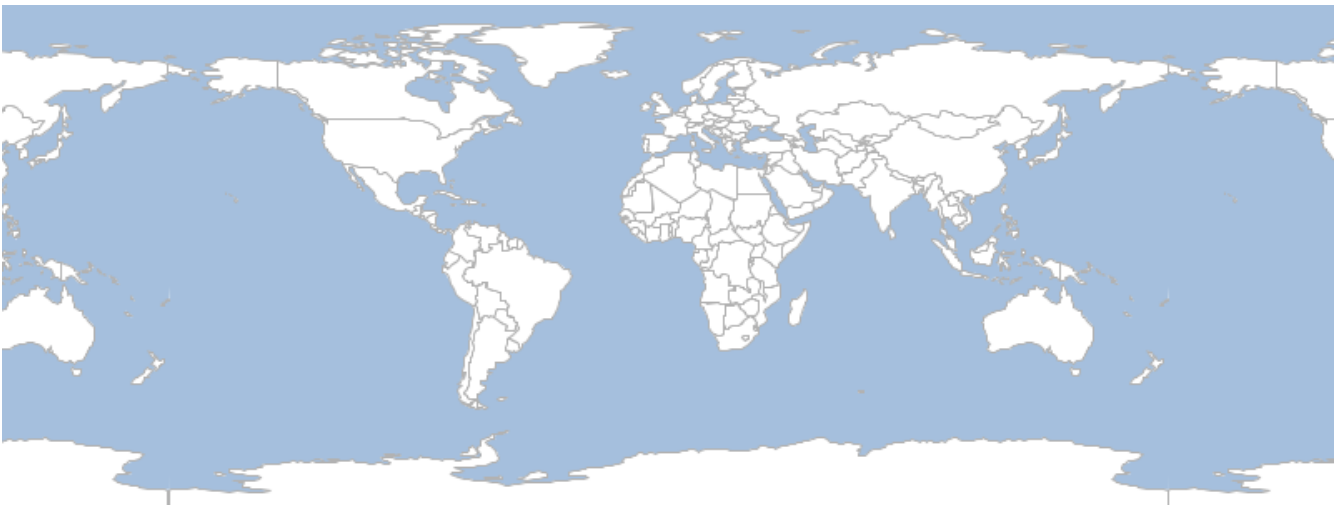
GIF gif = new GIF()
List images = ["Washington", "Oregon", "California"].collect { String state ->
    map.bounds = states.getFeatures("name = '${state}')[0].bounds
    def image = gif.render(map)
    image
}
File file = new File("states.gif")
byte[] bytes = gif.renderAnimated(images, 500, true)
file.bytes = bytes
```



**GeoTIFF**

### *Render a Map to an Image using the GeoTIFF Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
GeoTIFF geotiff = new GeoTIFF()
BufferedImage image = geotiff.render(map)
```



### *Render a Map to an OutputStream using the GeoTIFF Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
GeoTIFF geotiff = new GeoTIFF()
File file = new File("map.tif")
geotiff.render(map, new FileOutputStream(file))
```



## ASCII

*Render a Map to an string using the ASCII Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
ASCII ascii = new ASCII(width: 60)
String asciiStr = ascii.render(map)
println asciiStr
```

```

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```

*Render a Map to an text file using the ASCII Renderer*

```

Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
ASCII ascii = new ASCII(width: 60)
File file = new File("map.txt")
FileOutputStream out = new FileOutputStream(file)
ascii.render(map, out)
out.close()

```

[illegible]

## Base64

### Render a Map to an string using the Base64 Renderer

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfd9")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Base64 base64 = new Base64()
String base64Str = base64.render(map)
println base64Str
```

```
image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAYAAAEsC...
```

### *Render a Map to an text file using the Base64 Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Base64 base64 = new Base64()
File file = new File("map.txt")
base64.render(map, new FileOutputStream(file))
```

```
iVBORw0KGgoAAAANSUhEUgAAAYAAAABEsCAYAAAA7Ldc6AACAAE...
```

## PDF

### *Render a Map to a PDF Document using the PDF Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Pdf pdf = new Pdf()
com.lowagie.text.Document document = pdf.render(map)
```



*Render a Map to a PDF file using the PDF Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Pdf pdf = new Pdf()
File file = new File("map.pdf")
pdf.render(map, new FileOutputStream(file))
```





## SVG

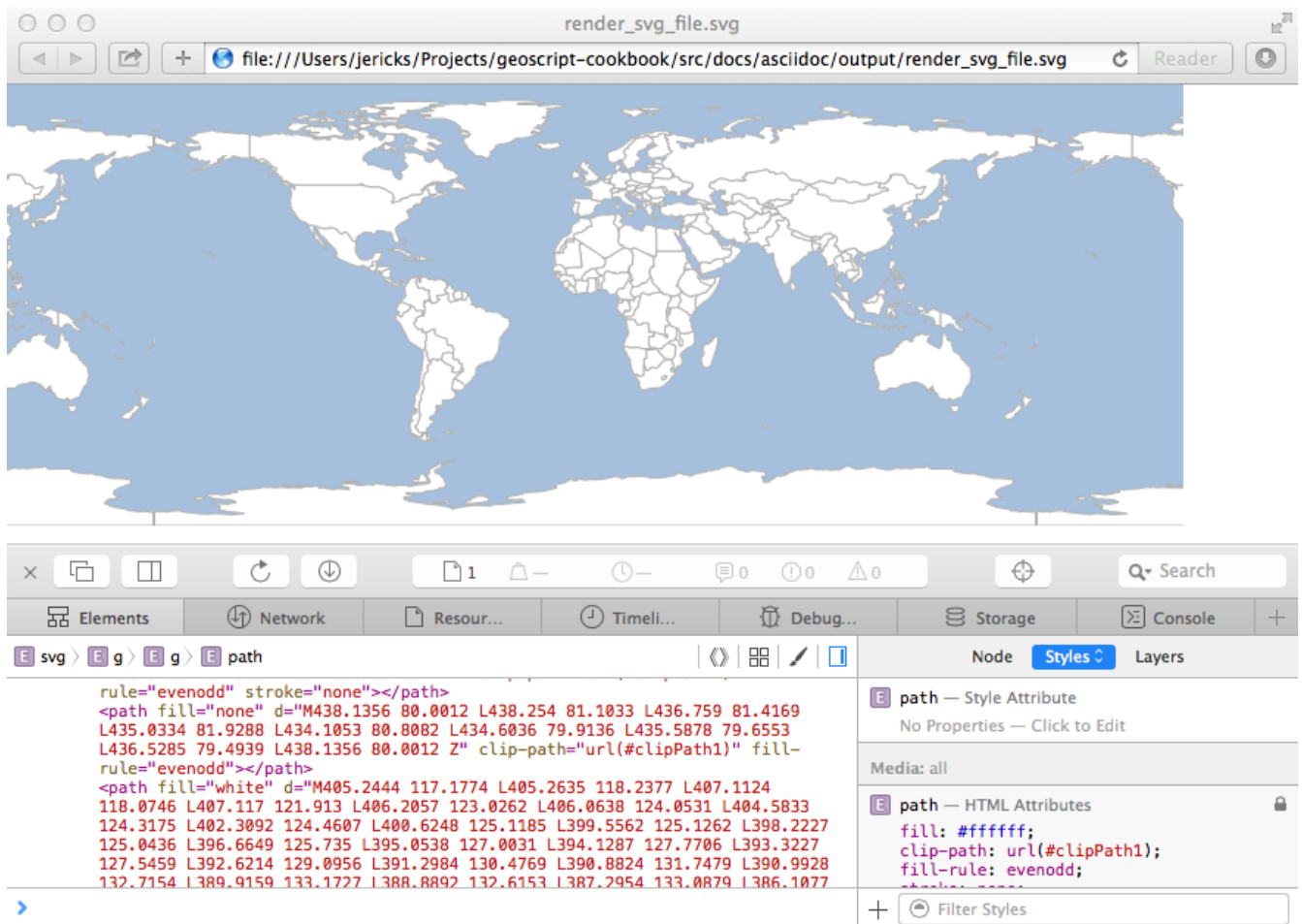
*Render a Map to a SVG Document using the SVG Renderer*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Svg svg = new Svg()
org.w3c.dom.Document document = svg.render(map)
```



### Render a Map to a SVG file using the SVG Renderer

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfff")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Svg svg = new Svg()
File file = new File("map.svg")
FileOutputStream out = new FileOutputStream(file)
svg.render(map, out)
out.close()
```



## Displaying Maps

## Finding Displayers

### Get all Displayers

```
List<Display> displays = Displays.list()
displays.each { Display display ->
    println display.class.simpleName
}
```

MapWindow  
Window

### Get a Displayer

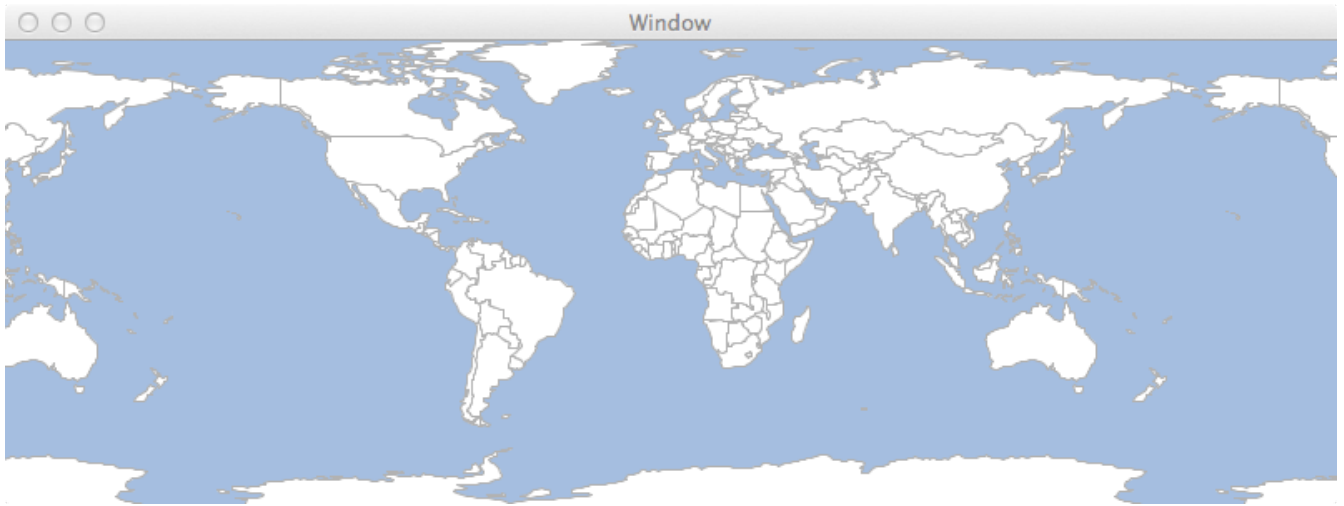
```
Displayer displayer = Displayers.find("window")
println displayer.class.simpleName
```

## Window

## Window

*Display a Map in a simple GUI*

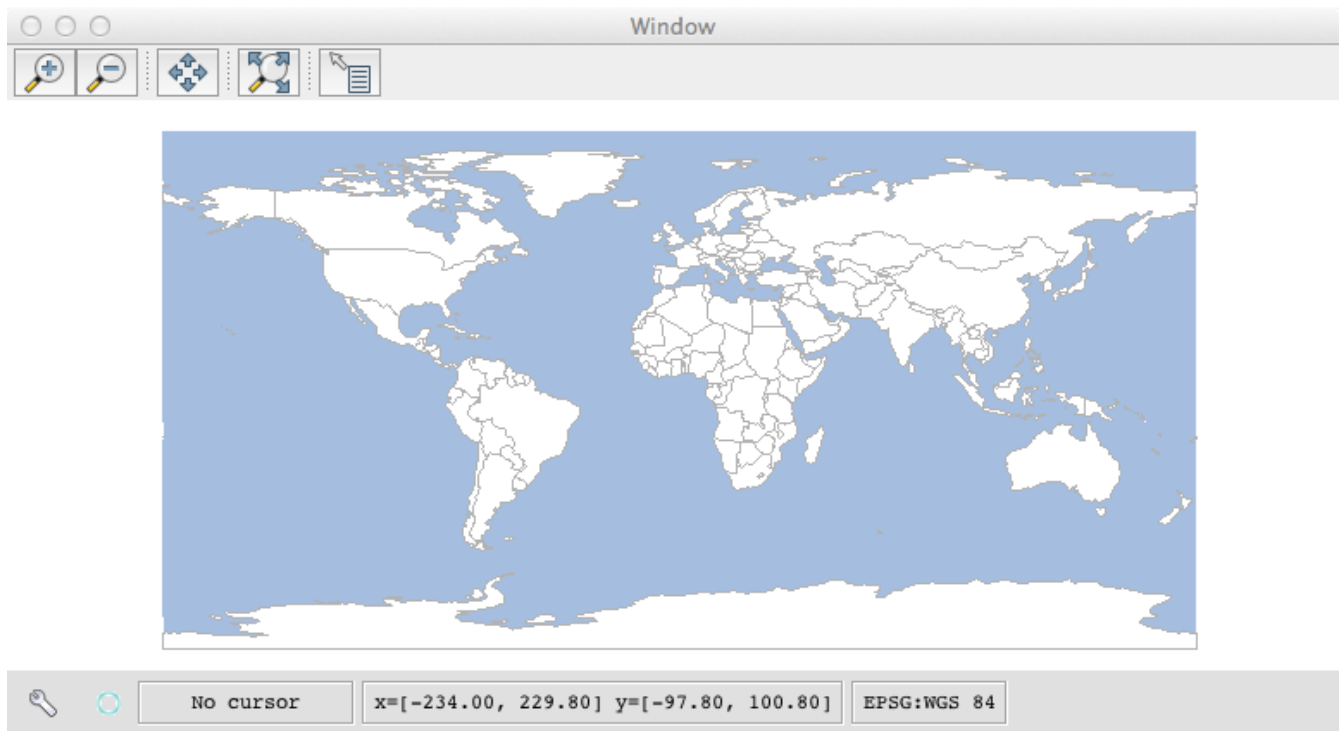
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
Window window = new Window()
window.display(map)
```



## MapWindow

*Display a Map in a interactive GUI*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5)
Layer ocean = workspace.get("ocean")
ocean.style = new Fill("#a5bfdd")
Map map = new Map(
    width: 800,
    height: 300,
    layers: [ocean, countries]
)
MapWindow window = new MapWindow()
window.display(map)
```



## Drawing

The Draw class is an easy way to quickly render a Geometry, a List of Geometries, a Feature, or a Layer to an Image, a File, an OutputStream, or a GUI.

### Drawing to a File or GUI

All of the draw methods take a single required parameter but can also take the following optional parameters:

- style = A Style
- bounds = The Bounds
- size = The size of the canvas ([400,350])
- out = The OutputStream, File, or File name. If null (which is the default) a GUI will be opened.
- format = The format ("jpeg", "png", "gif")
- proj = The Projection

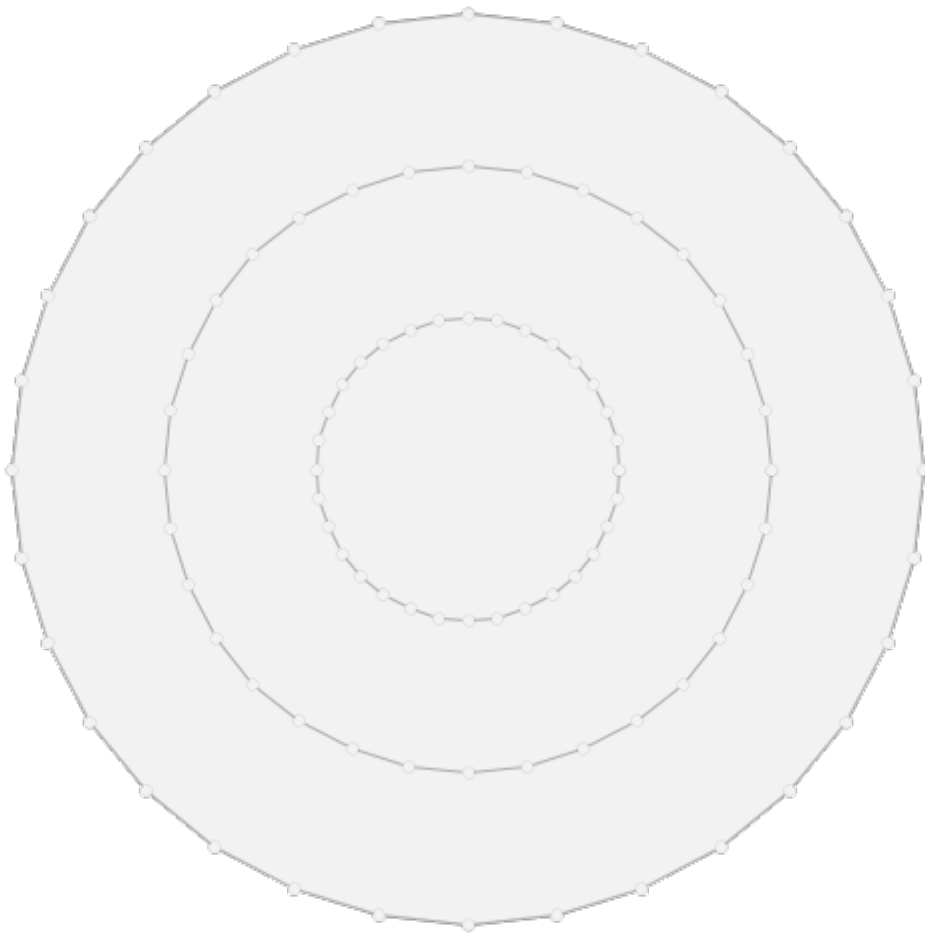
### *Draw a Geometry to a File*

```
File file = new File("geometry.png")
Geometry geometry = new Point(-122.376, 47.587).buffer(0.5)
Draw.draw(geometry,
    style: new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5),
    bounds: new Bounds(-122.876, 47.087, -121.876, 48.087),
    size: [400, 400],
    format: "png",
    proj: "EPSG:4326",
    backgroundColor: "#a5bfdd",
    out: file
)
```



### *Draw a List of Geometries to an OutputStream*

```
Point point = new Point(-122.376, 47.587)
List geometries = [1.5, 1.0, 0.5].collect { double distance ->
    point.buffer(distance)
}
File file = new File("geometries.png")
OutputStream outputStream = new FileOutputStream(file)
Draw.draw(geometries, out: outputStream, format: "png")
outputStream.flush()
outputStream.close()
```



*Draw a Feature to a file name*

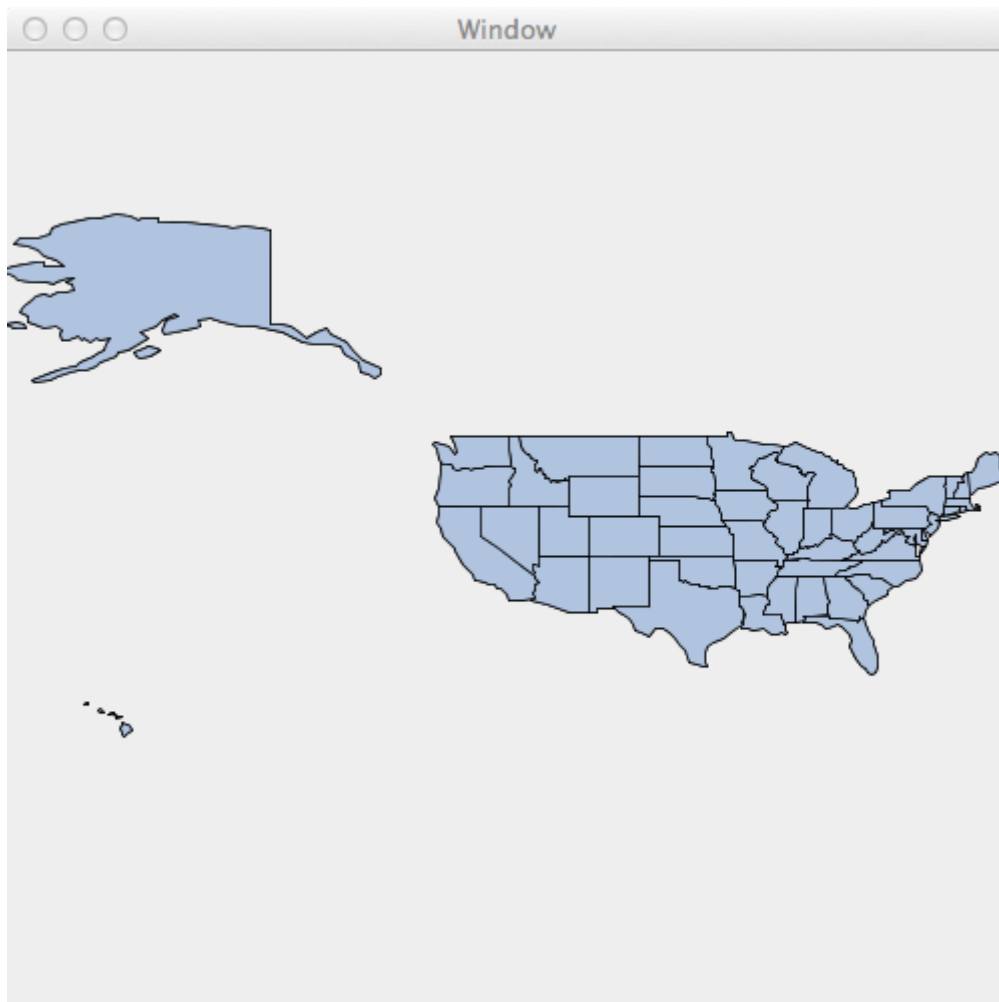
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
Feature feature = layer.first(filter: "name='Washington'")
Draw.draw(feature, bounds: feature.bounds, out: "feature.png")
```



#### *Draw a Layer to a GUI*

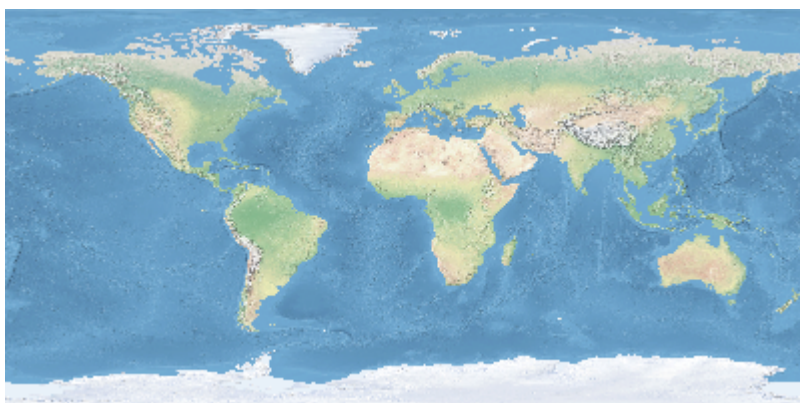
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
layer.style = new Fill("LightSteelBlue") + new Stroke("LightSlateGrey", 0.25)
Draw.draw(layer, bounds: layer.bounds)
```





### *Draw a Raster to a File*

```
File file = new File("earth.png")
Raster raster = new geoscript.layer.GeoTIFF(new File('src/main/resources/earth.tif'
)).read()
Draw.draw(raster, bounds: raster.bounds, size: [400,200], out: file)
```



## **Drawing to an Image**

All of the drawToImage methods take a single required parameter but can also take the following optional parameters:

- style = A Style

- bounds = The Bounds
- size = The size of the canvas ([400,350])
- imageType = The format ("jpeg", "png", "gif")
- proj = The Projection

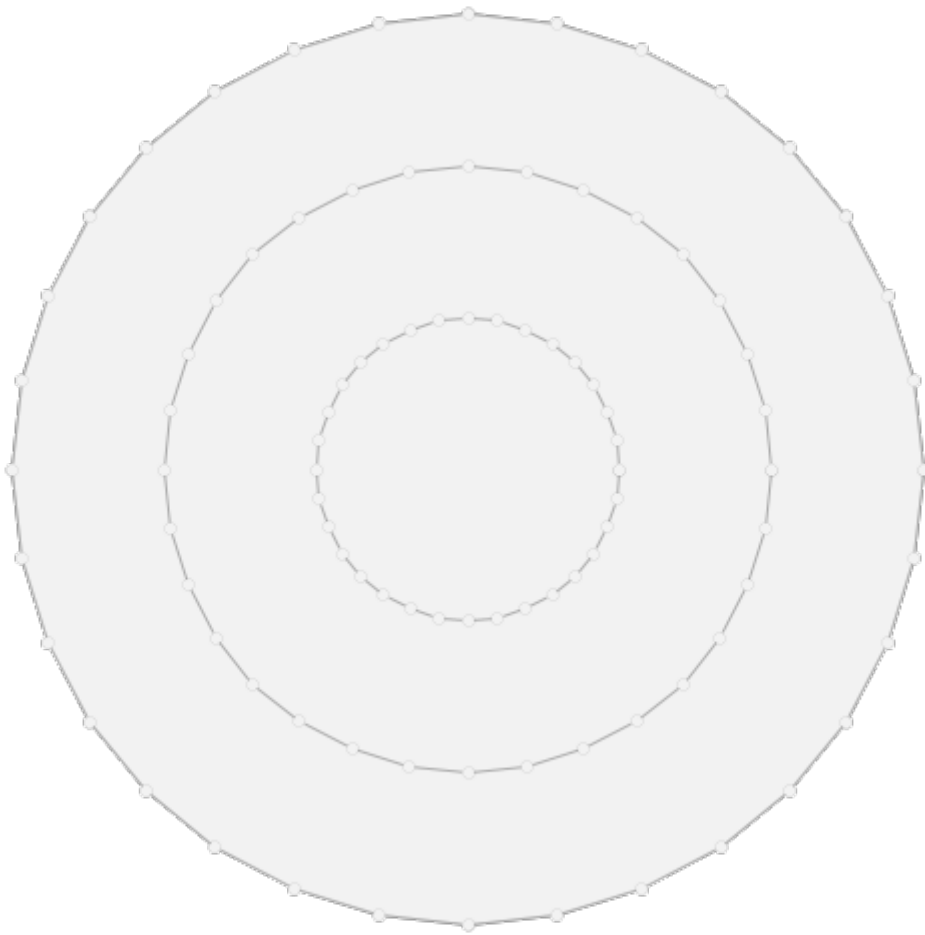
#### *Draw a Geometry to an Image*

```
Geometry geometry = new Point(-122.376, 47.587).buffer(0.5)
BufferedImage image = Draw.drawToImage(geometry,
    style: new Fill("#ffffff") + new Stroke("#b2b2b2", 0.5),
    bounds: new Bounds(-122.876,47.087,-121.876,48.087),
    size: [400,400],
    imageType: "png",
    proj: "EPSG:4326",
    backgroundColor: "#a5bfd9"
)
```



#### *Draw a List of Geometries to an Image*

```
Point point = new Point(-122.376, 47.587)
List geometries = [1.5, 1.0, 0.5].collect { double distance ->
    point.buffer(distance)
}
BufferedImage image = Draw.drawToImage(geometries)
```



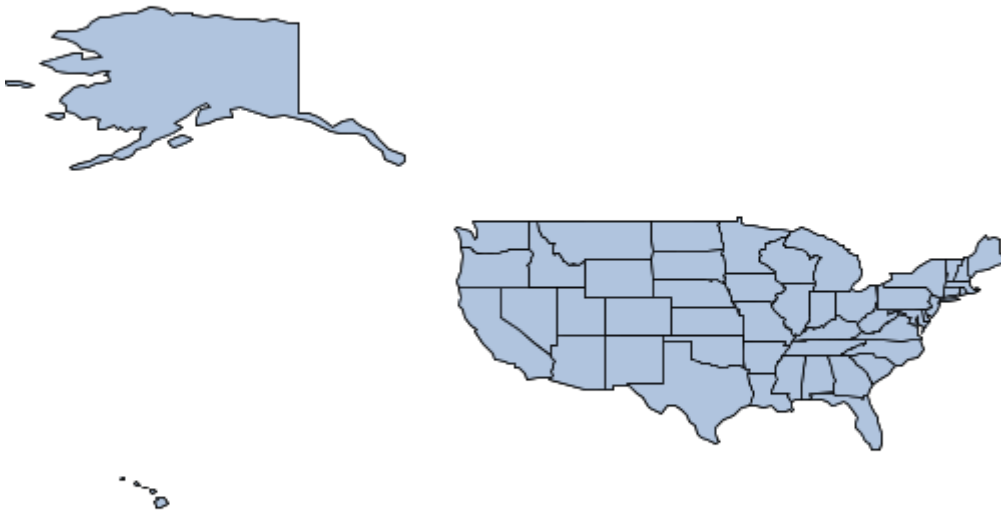
### *Draw a Feature to an Image*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
Feature feature = layer.first(filter: "name='Washington'")
BufferedImage image = Draw.drawToImage(feature, bounds: feature.bounds)
```



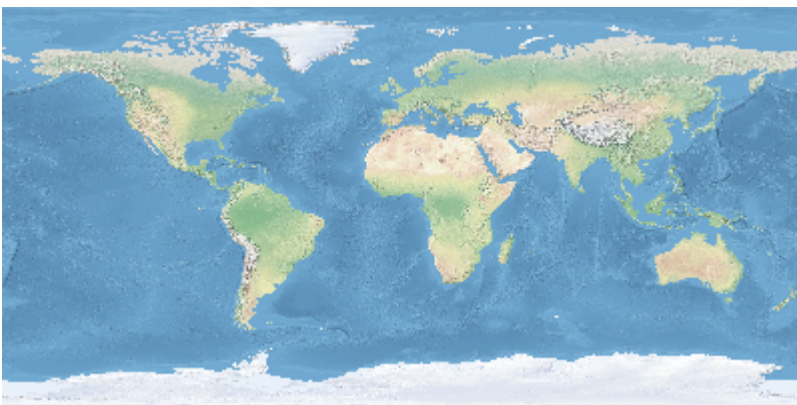
### *Draw a Layer to an Image*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
layer.style = new Fill("LightSteelBlue") + new Stroke("LightSlateGrey", 0.25)
BufferedImage image = Draw.drawToImage(layer, bounds: layer.bounds)
```



*Draw a Raster to an Image*

```
Raster raster = new geoscript.layer.GeoTIFF(new File('src/main/resources/earth.tif')
).read()
BufferedImage image = Draw.drawImage(raster, bounds: raster.bounds, size: [400,200])
```



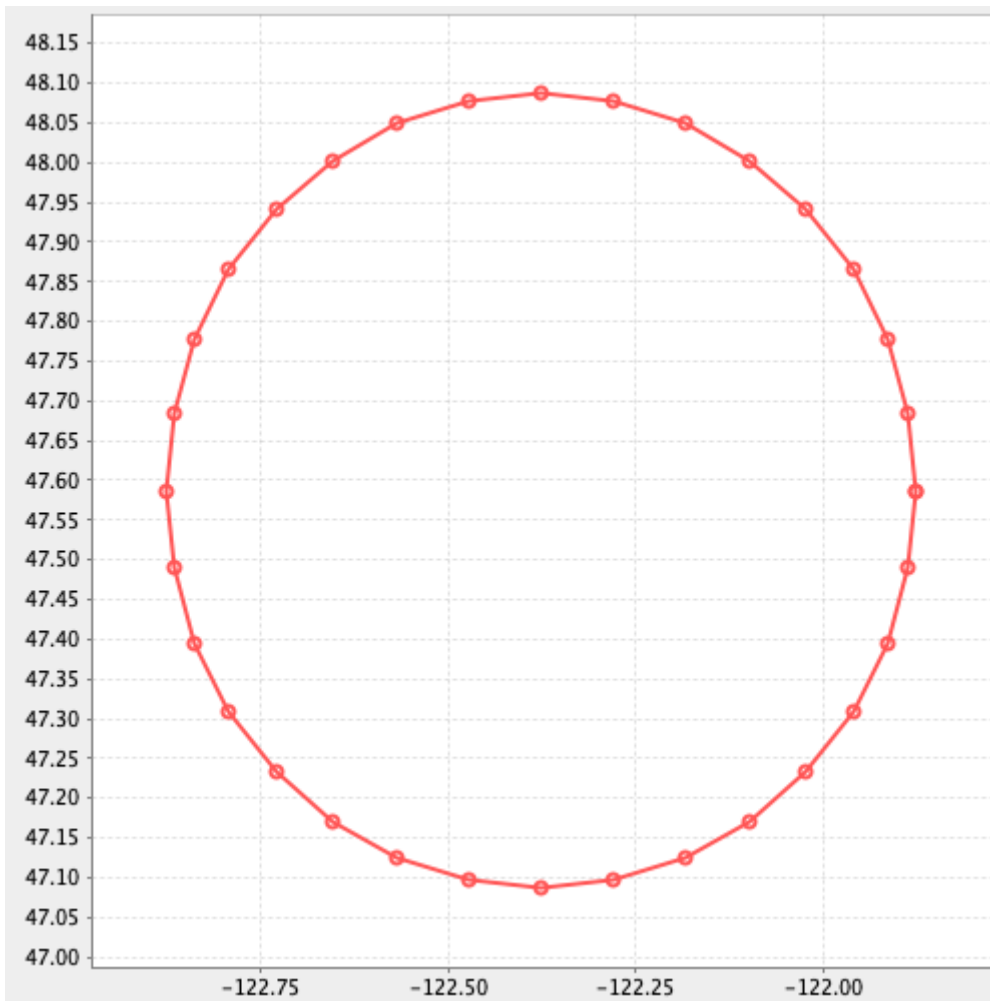
## Plotting

### Plotting to a File or GUI

The Plot module can plot a Geometry, a list of Geometries, a Feature, or a Layer to a File, a File name, an OutputStream, or a simple GUI.

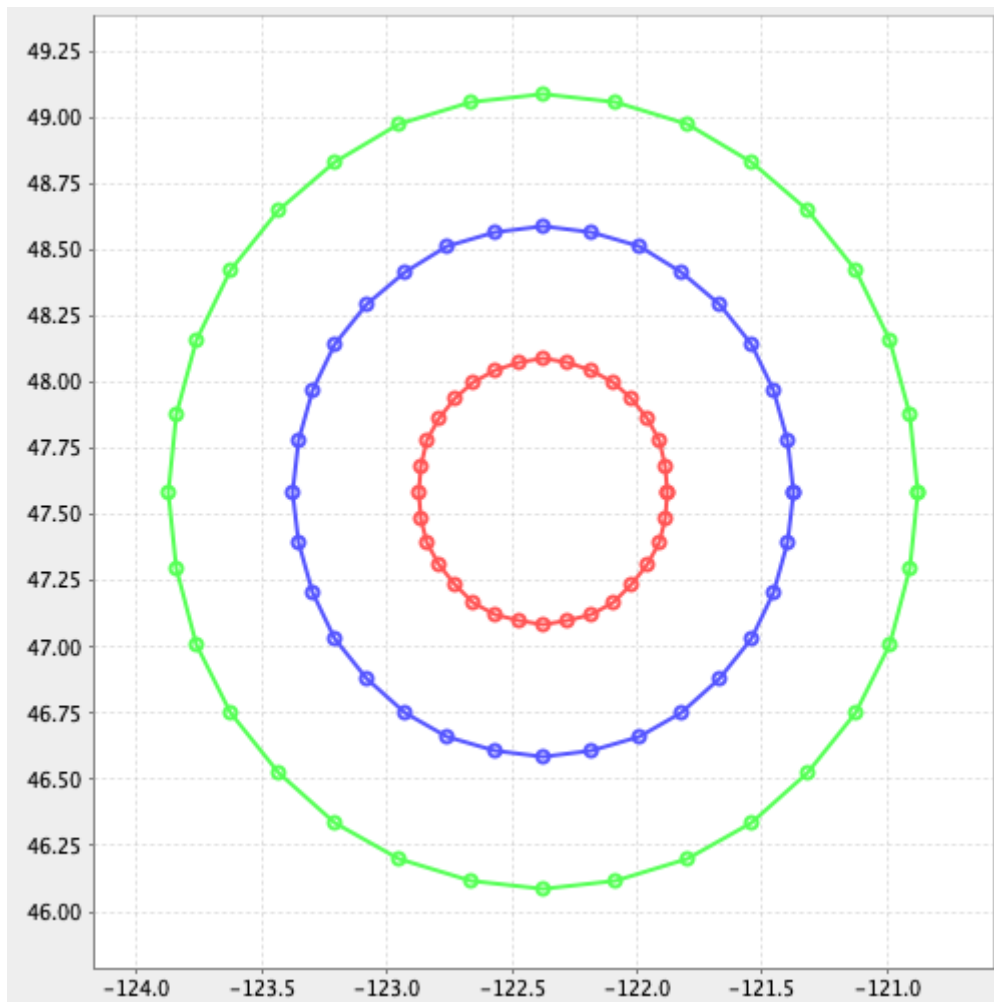
### Plot a Geometry to a File

```
File file = new File("geometry.png")
Geometry geometry = new Point(-122.376, 47.587).buffer(0.5)
Plot.plot(geometry, out: file)
```



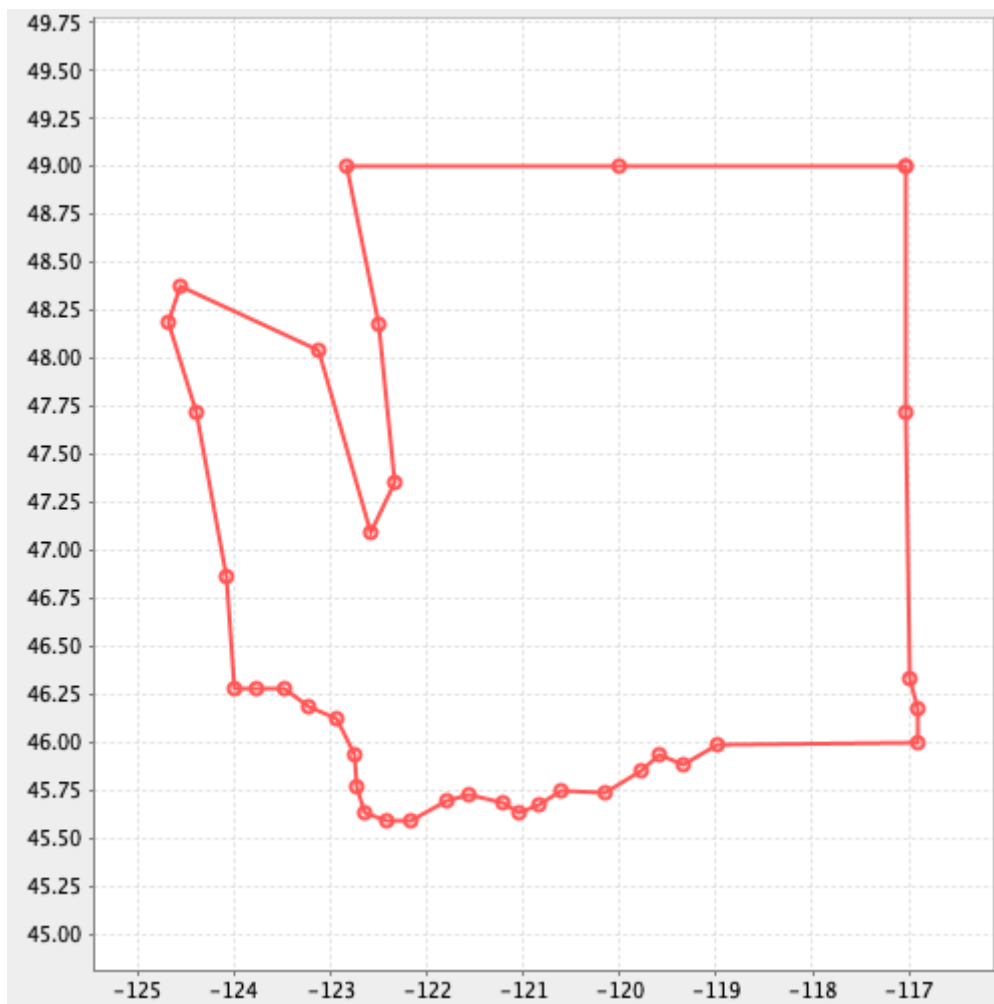
### Plot a List of Geometries to an OutputStream

```
Point point = new Point(-122.376, 47.587)
List geometries = [1.5, 1.0, 0.5].collect { double distance ->
    point.buffer(distance)
}
File file = new File("geometries.png")
OutputStream outputStream = new FileOutputStream(file)
Plot.plot(geometries, out: outputStream)
outputStream.flush()
outputStream.close()
```



*Plot a Feature to a File name*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
Feature feature = layer.first(filter: "name='Washington'")
Plot.plot(feature, out: "feature.png")
```



*Plot a Layer to a GUI*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
Plot.plot(layer)
```



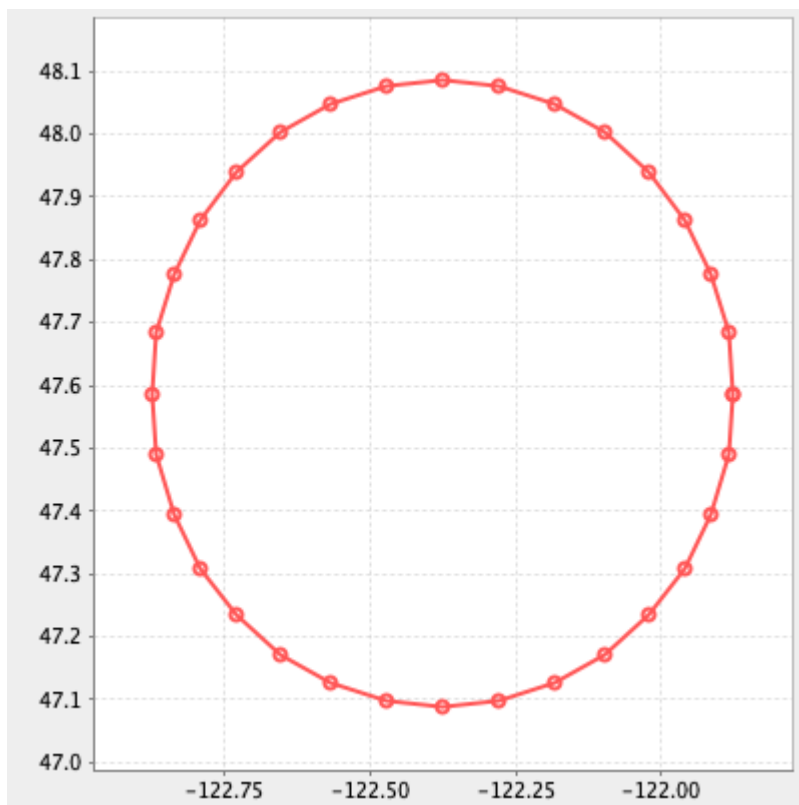


## Plotting to an Image

The Plot module can plot a Geometry, a list of Geometries, a Feature, or a Layer to an image.

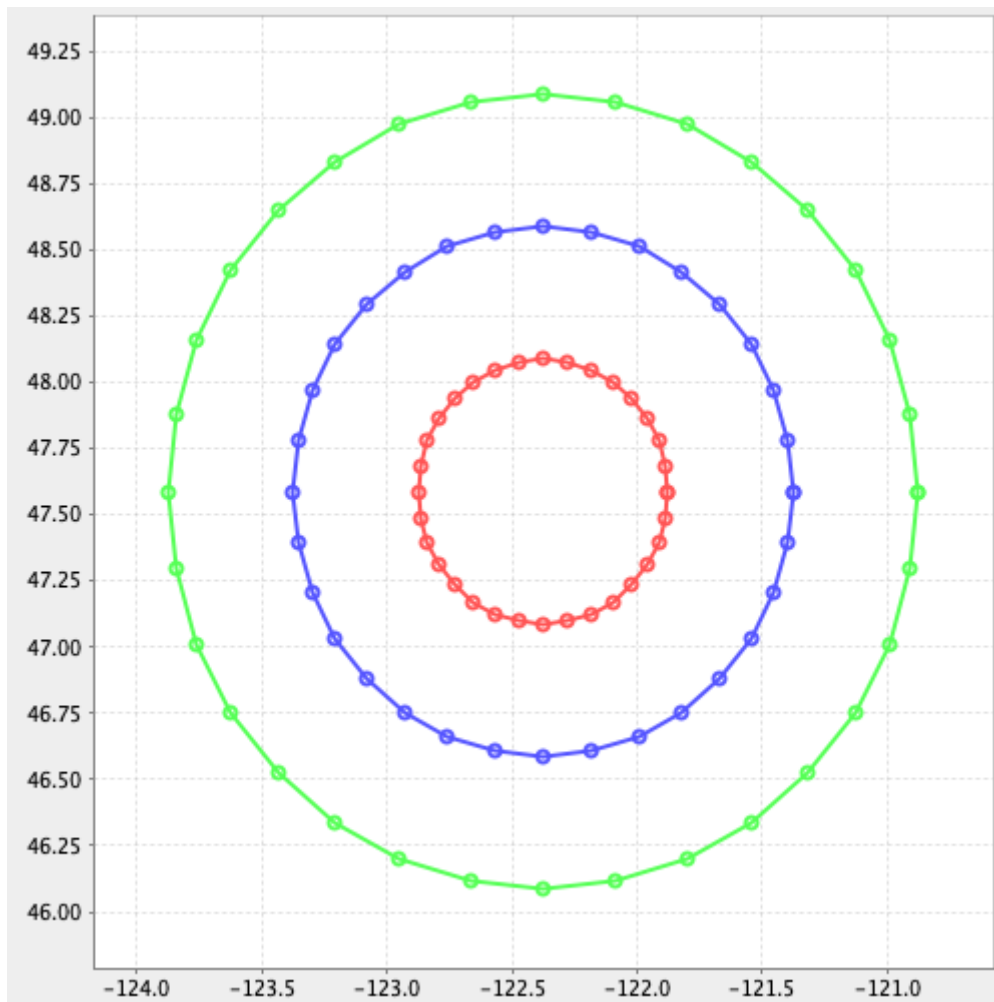
*Plot a Geometry to an Image*

```
Geometry geometry = new Point(-122.376, 47.587).buffer(0.5)
BufferedImage image = Plot.plotToImage(geometry, size: [400,400],)
```



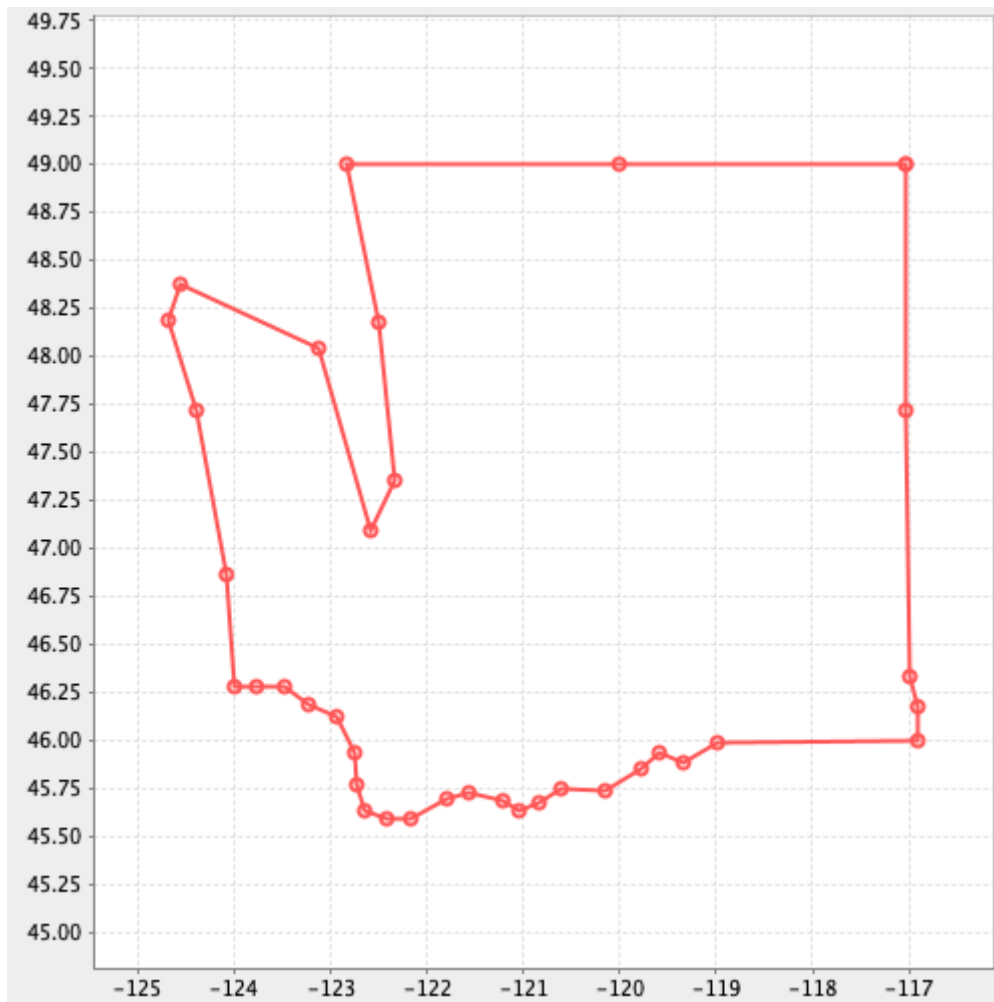
*Plot a List of Geometries to an Image*

```
Point point = new Point(-122.376, 47.587)
List geometries = [1.5, 1.0, 0.5].collect { double distance ->
    point.buffer(distance)
}
BufferedImage image = Plot.plotToImage(geometries)
```



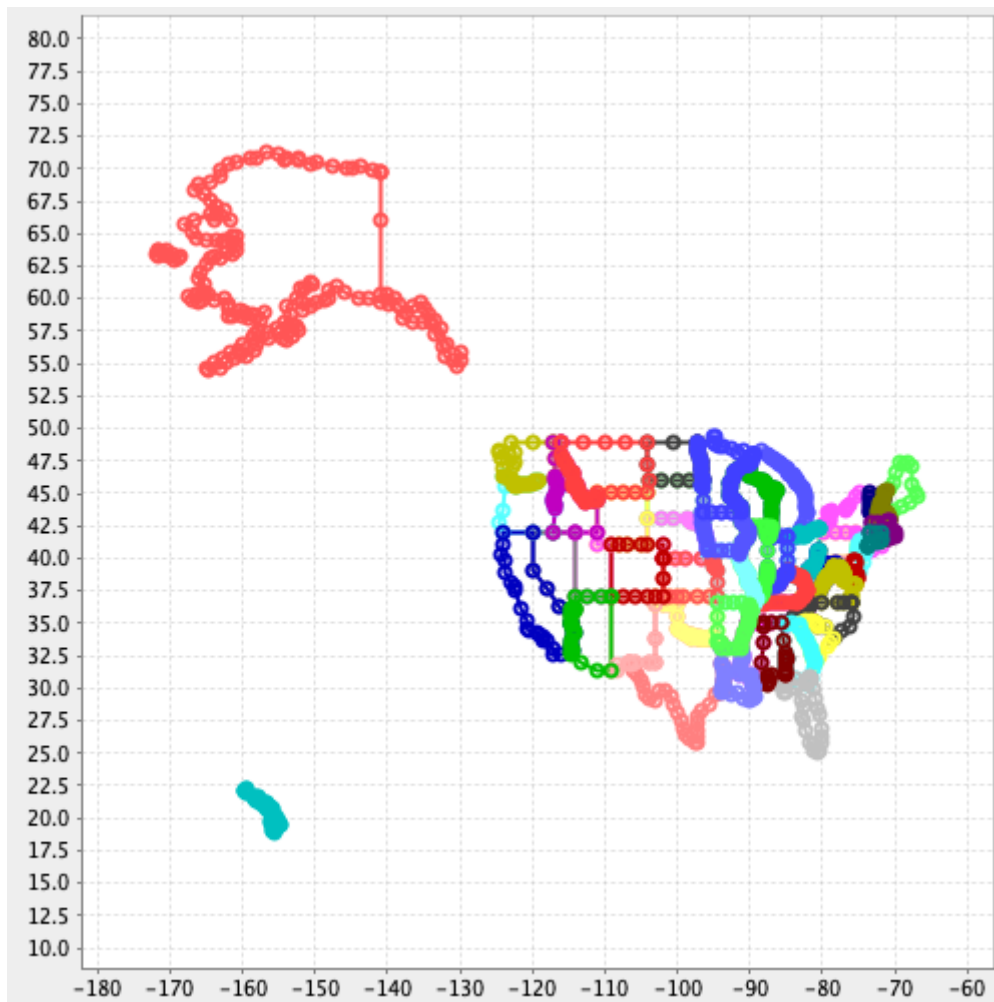
*Plot a Feature to an Image*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
Feature feature = layer.first(filter: "name='Washington'")
BufferedImage image = Plot.plotToImage(feature, bounds: feature.bounds)
```



*Plot a Layer to an Image*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer layer = workspace.get("states")
BufferedImage image = Plot.plotToImage(layer, bounds: layer.bounds)
```



## Reading Maps

The IO module can read Maps from JSON or XML documents.

### Finding Map Readers

*List all Map Readers*

```
List<MapReader> readers = MapReaders.list()
readers.each { MapReader reader ->
    println reader.name
}
```

```
xml
json
yaml
```

*Find a Map Reader*

```
MapReader reader = MapReaders.find("json")
println reader.name
```

## JSON

### *JSON Map Format*

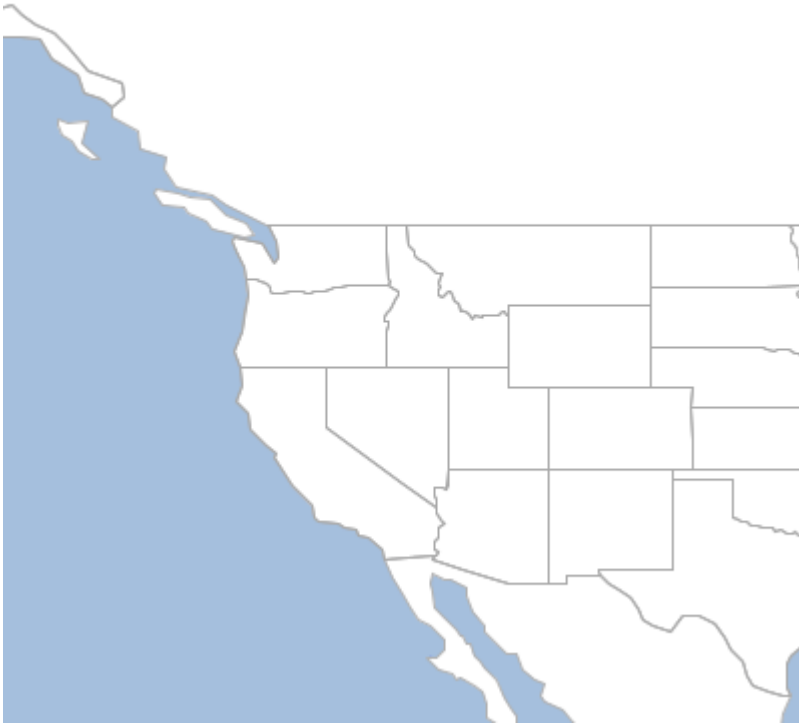
```
{
  "width": 400,
  "height": 400,
  "type": "png",
  "backgroundColor": "blue",
  "fixAspectRatio": true,
  "proj": "EPSG:4326",
  "bounds": {
    "minX": -135.911779,
    "minY": 36.993573,
    "maxX": -96.536779,
    "maxY": 51.405899
  },
  "layers": [
    {"layertype": "layer", "file": "shps/states.shp"}
  ]
}
```

- **width** = The map width is optional and defaults to 600.
- **height** = The map height is optional and defaults to 400.
- **type** = The image type (png, jpeg, gif) is optional and defaults to png.
- **backgroundColor** = The map background color is optional and transparent by default.
- **fixAspectRatio** = Whether to fix the aspect ratio or not. It is optional and the default is true.
- **proj** = The optional map projection. The default is determined by the layers or the bounds.
- **bounds** = The optional map bounds. The default is the full extent of the layers.
- **layers** = The only required property. A list of layer configurations.
  - **layertype** = The layer type is required. Values can be layer (vector), raster, or tile.
  - **layername** = The name of the layer is optional and defaults to first layer.
  - **style** = The layer style is optional but can be a SLD or CSS file.

### Read a Map from a JSON String.

```
String json = ""{
  "width": 400,
  "height": 400,
  "type": "png",
  "backgroundColor": "blue",
  "proj": "EPSG:4326",
  "bounds": {
    "minX": -135.911779,
    "minY": 36.993573,
    "maxX": -96.536779,
    "maxY": 51.405899
  },
  "layers": [
    {
      "layertype": "layer",
      "dbtype": "geopkg",
      "database": "src/main/resources/data.gpkg",
      "layername": "ocean",
      "style": "src/main/resources/ocean.sld"
    },
    {
      "layertype": "layer",
      "dbtype": "geopkg",
      "database": "src/main/resources/data.gpkg",
      "layername": "countries",
      "style": "src/main/resources/countries.sld"
    },
    {
      "layertype": "layer",
      "dbtype": "geopkg",
      "database": "src/main/resources/data.gpkg",
      "layername": "states",
      "style": "src/main/resources/states.sld"
    }
  ]
}
""

MapReader mapReader = new JsonMapReader()
Map map = mapReader.read(json)
BufferedImage image = map.renderToImage()
```



**XML**



```
String xml = ""<map>
<width>400</width>
<height>400</height>
<type>png</type>
<proj>EPSG:4326</proj>
<backgroundColor>blue</backgroundColor>
<fixAspectRatio>true</fixAspectRatio>
<layers>
  <layer>
    <layertype>layer</layertype>
    <dbtype>geopkg</dbtype>
    <database>src/main/resources/data.gpkg</database>
    <layername>ocean</layername>
    <style>src/main/resources/ocean.sld</style>
  </layer>
  <layer>
    <layertype>layer</layertype>
    <dbtype>geopkg</dbtype>
    <database>src/main/resources/data.gpkg</database>
    <layername>countries</layername>
    <style>src/main/resources/countries.sld</style>
  </layer>
  <layer>
    <layertype>layer</layertype>
    <dbtype>geopkg</dbtype>
    <database>src/main/resources/data.gpkg</database>
    <layername>states</layername>
    <style>src/main/resources/states.sld</style>
  </layer>
</layers>
<bounds>
  <minX>-135.911779</minX>
  <minY>36.993573</minY>
  <maxX>-96.536779</maxX>
  <maxY>51.405899</maxY>
</bounds>
</map>
""

MapReader mapReader = new XmlMapReader()
Map map = mapReader.read(xml)
BufferedImage image = map.renderToImage()
```

