Kyiv Go Meetup, DEC 18 2018

Writing WebGL apps in Go

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3dgrid125.json
3dgrid900.json
beta_fleet_28.json
grid10k.json
grid25.json
net100.json
net300.json
✓ smallworld200.json
Uploaded (125 nodes)
Upload custom...

Graphics: +

Simulation backend:

Host: http://localhost:8084

TTL: 10

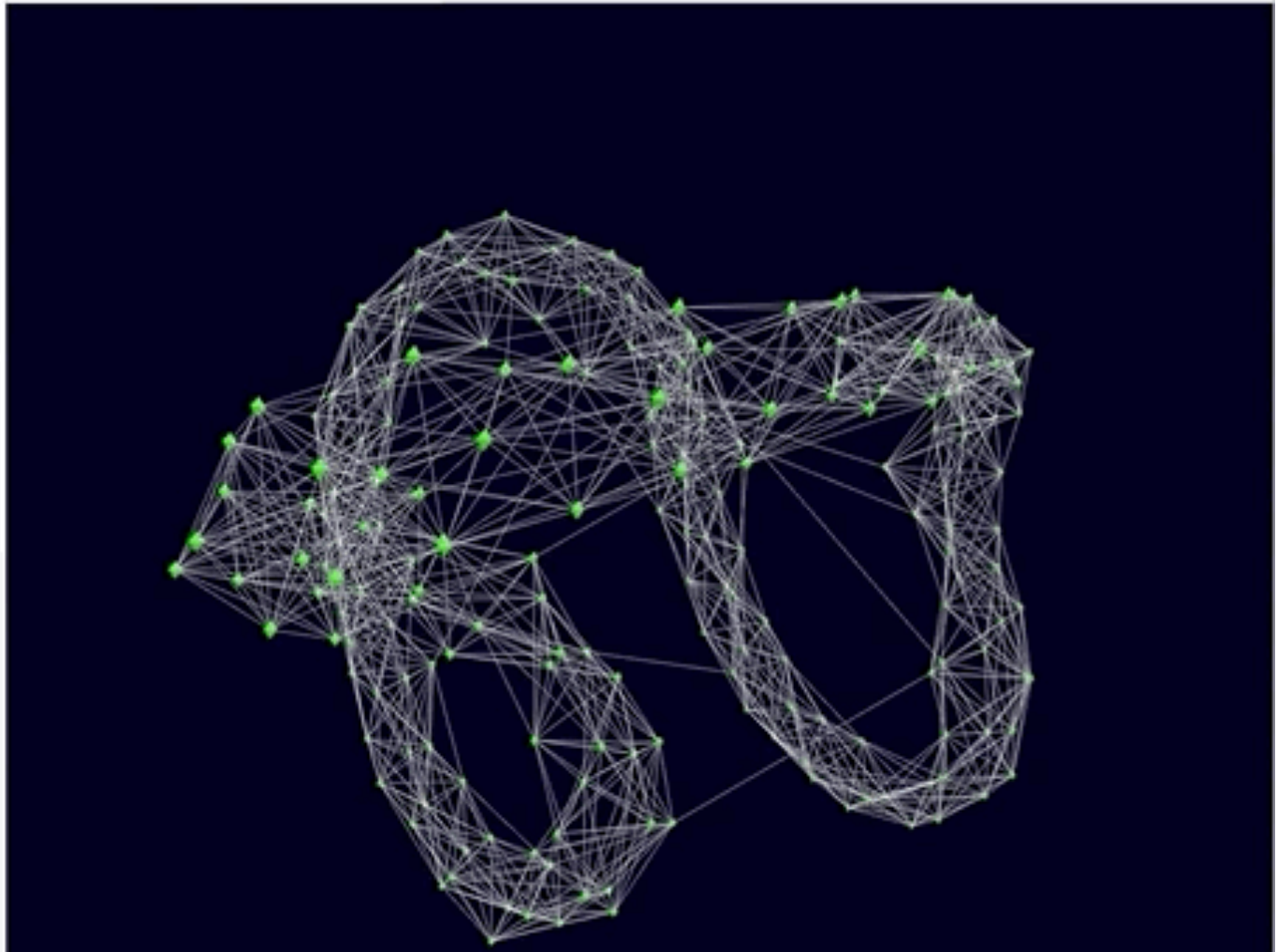
Start simulation | Replay

Time 0

Stats:

Elapsed time:	761ms
Nodes hit:	200
Links hit:	1400

3D view | Stats view | FAQ



A picture is worth a thousand words,

but 3D visualization is worth a thousand pictures.

Native Desktop UI app:

- Compile it for each platform
- Fix issues with Windows
- Create an installer app
- Put installer app online
- User downloads the installer
- User runs the installer
- User clicks "Next" 100 times
- User launches the app

Web UI app:

- Put the app online
- User enters URL and launches the app

Programming Languages you can use:

Native Desktop UI app:

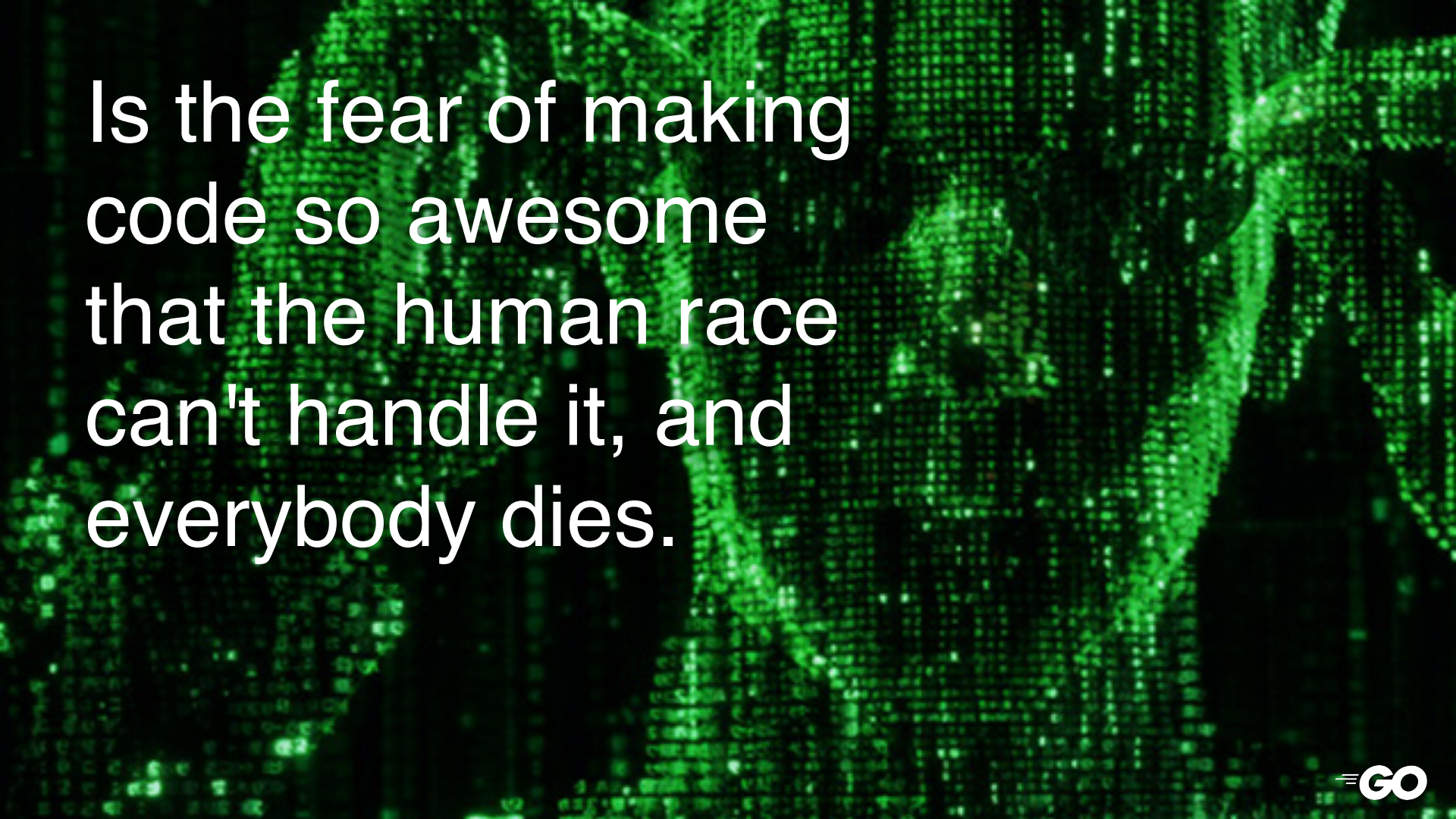
- C++ / Qt
- Swift
- Java
- Python
- C
- TCL
- C#
- VB.Net
- Pascal/Delphi

Web UI app:

- JavaScript

Problems that JS has

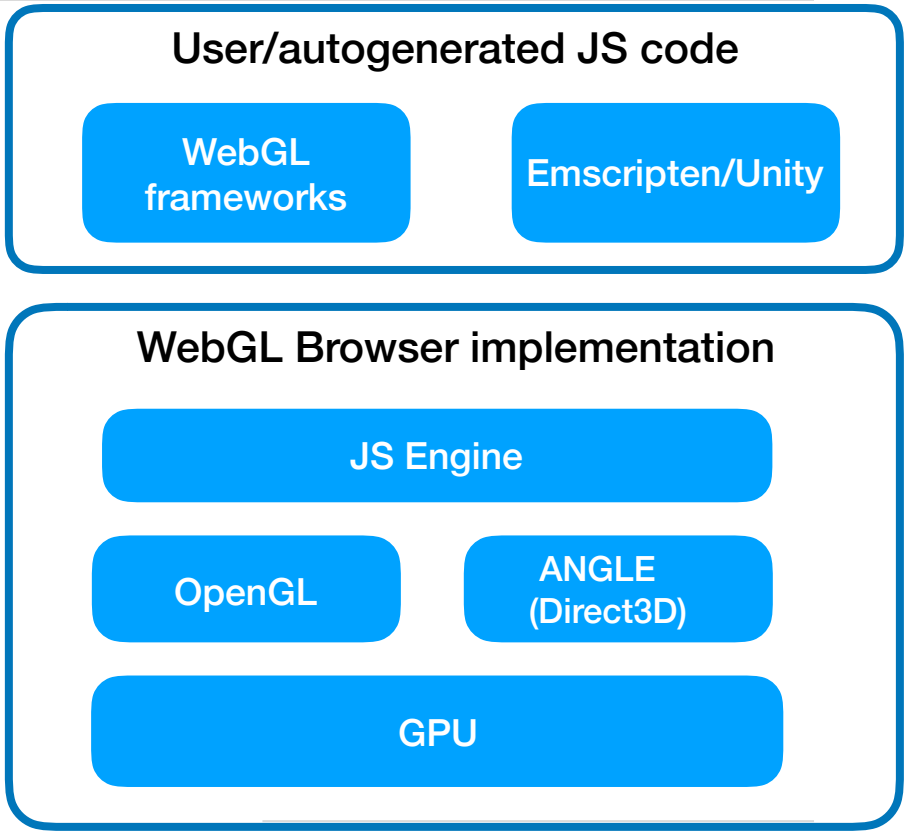
Problems that JS doesn't have


Is the fear of making
code so awesome
that the human race
can't handle it, and
everybody dies.
GO


HTML
WebGL

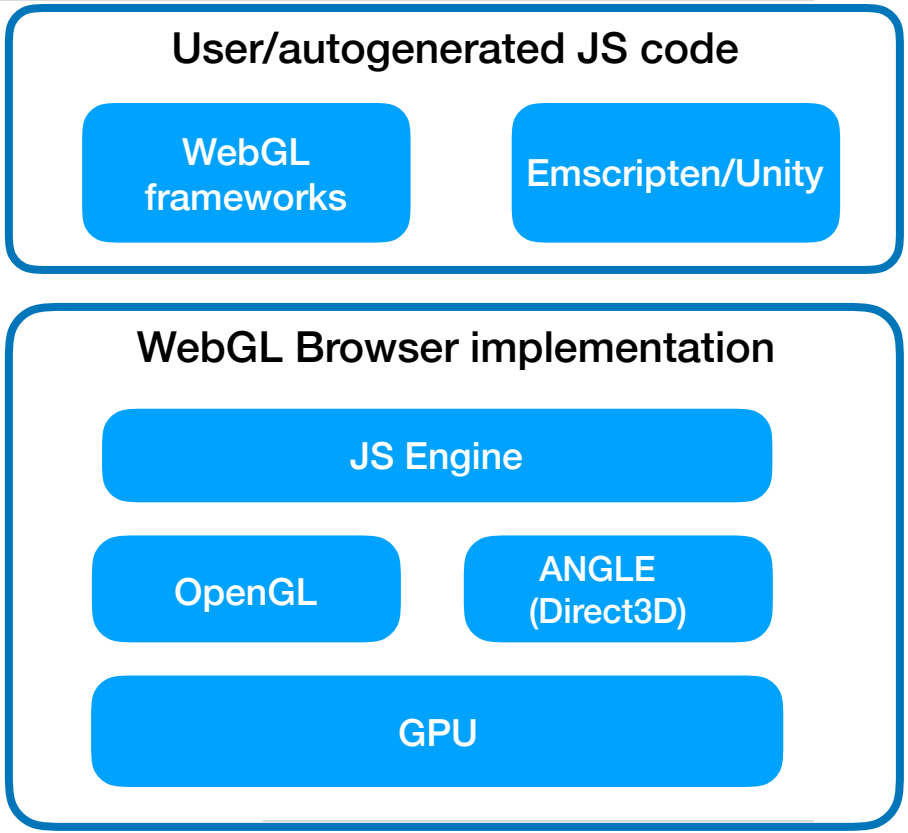
What is WebGL?

- Rasterization engine
- Implemented in Browsers
- Knows how to talk to GPU
- Browser API for GL



What is WebGL?

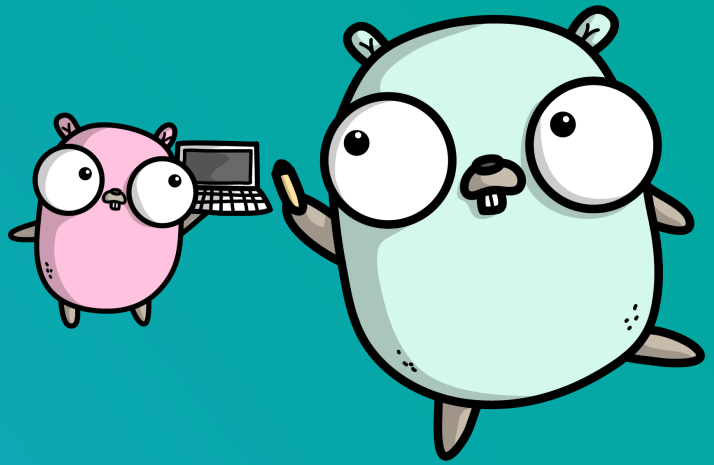
- Rasterization engine
- Implemented in Browsers
- Knows how to talk to GPU
- Browser API for GL
- JS Libraries:
  - Three.js
  - Babylon.js
  - etc




If you want to write interactive 3D app, you're almost forced to use JS and WebGL
GO


Friends don't let friends
write apps in JavaScript
GO

Can we use Go?



GopherJS:

- Compiler from Go to JavaScript and WASM
- Started in 2013 (6 years old project!)
- Is awesome
- A lot of bindings to JS libs exist

Three.js bindings:

- https://github.com/Lngramos/three - three.js bindings for GopherJS

```go
package three

import "github.com/gopherjs/gopherjs/js"

type DirectionalLight struct {
    *js.Object
    Position *Vector3 `js:"position"`
}

func NewDirectionalLight(color *Color, intensity float64) *DirectionalLight {
    return &DirectionalLight{
        Object: three.Get("DirectionalLight").New(color, intensity),
    }
}
```

Three.js bindings:

JS:

```
var scene, renderer, light, camera;
camera = new THREE.PerspectiveCamera(70, w/h, 1, 1000 );
camera.position.set( 1000, 50, 1500 );
scene = new THREE.Scene();
renderer = new THREE.WebGLRenderer();
renderer.setSize(w, h);
light = new THREE.AmbientLight( 0xffffff );
scene.add(light);
```

Go:

```
camera := three.NewPerspectiveCamera(70, w/h, 1, 1000)
camera.Position.Set(1000, 50, 1500)
scene := three.NewScene()
renderer := three.NewWebGLRenderer()
renderer.SetSize(w, h, true)
light := three.NewAmbientLight(three.NewColor("white"))
scene.Add(light)
```


Let's write
WebGL Go
"Hello, World"

Start HTML file:

```
<!DOCTYPE html>
<html>
    <head>
        <meta charset=utf-8>
        <title>Go WebGL app</title>
        <style>
            body { margin: 0; }
            canvas { width: 100%; height: 100% }
        </style>
    </head>
    <body>
        <script
src="https://cdnjs.cloudflare.com/ajax/libs/three.js/99/three.min.js"></script>
        <script src="go-webgl-example.js"></script>
    </body>
</html>
```

main.go

```
package main

import (
    "github.com/divan/three"
    "github.com/gopherjs/gopherjs/js"
)

func main() {
}
```

main.go

```
func main() {
    width := js.Global.Get("innerWidth").Float()
    height := js.Global.Get("innerHeight").Float()

    renderer := three.NewWebGLRenderer()
    renderer.SetSize(width, height, true)
    js.Global.Get("document").Get("body").Call("appendChild",
renderer.Get("domElement"))
    ...
}
```

main.go

```
func main() {
    ...
    // setup camera and scene
    camera := three.NewPerspectiveCamera(70, width/height, 1, 1000)
    camera.Position.Set(0, 0, 500)

    scene := three.NewScene()
    ...
}
```

main.go

```
func main() {
    ...
    // lights
    light := three.NewDirectionalLight(three.NewColor("white"), 1)
    light.Position.Set(0, 256, 256)
    scene.Add(light)

    // material
    params := three.NewMaterialParameters()
    params.Color = three.NewColor("blue")
    mat := three.NewMeshLambertMaterial(params)
    ...
}
```

main.go

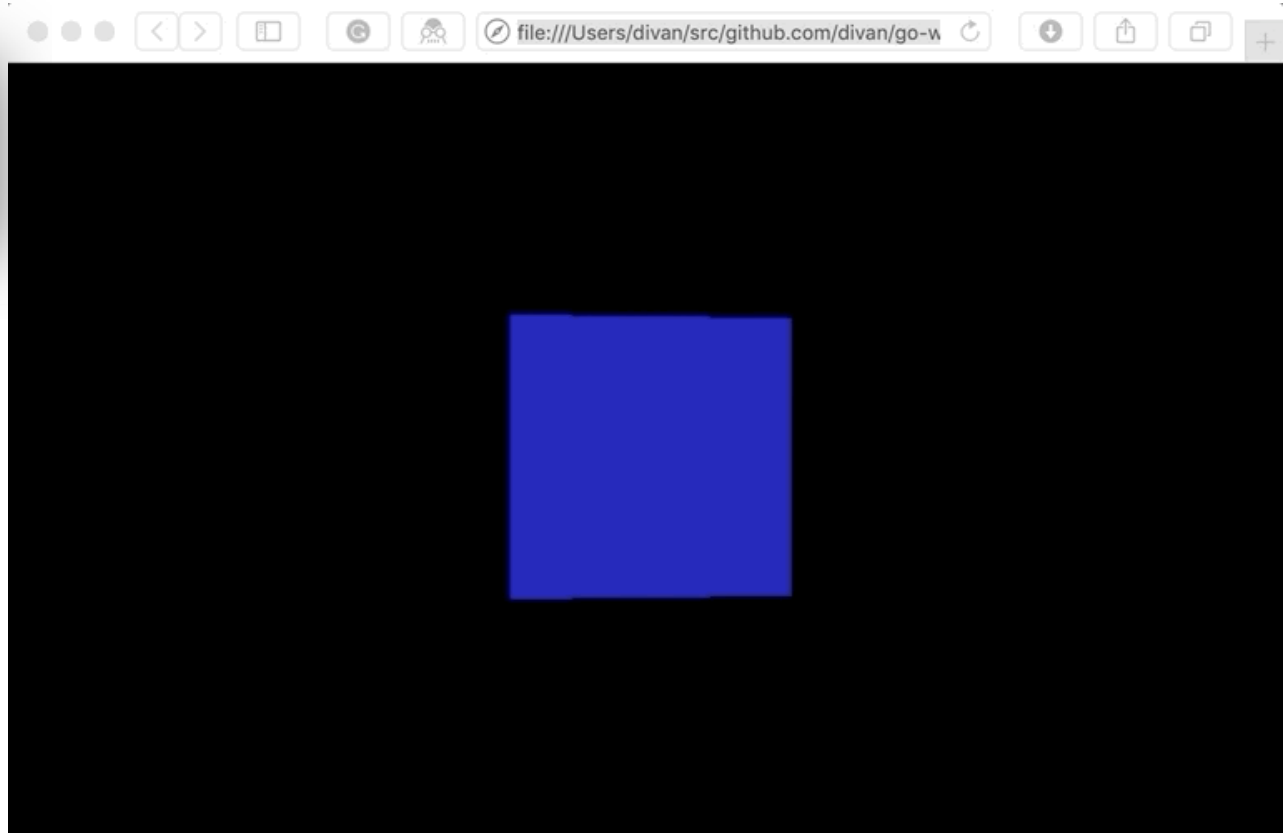
```
func main() {
    ...
    // cube object
    geom := three.NewBoxGeometry(&three.BoxGeometryParameters{
        Width:  200,
        Height: 200,
        Depth:  200,
    })
    mesh := three.NewMesh(geom, mat)
    scene.Add(mesh)
    ...
}
```

main.go

```
func main() {
    ...
    // start animation
    var animate func()
    animate = func() {
        js.Global.Call("requestAnimationFrame", animate)
        mesh.Rotation.Set("y", mesh.Rotation.Get("y").Float()+0.01)
        renderer.Render(scene, camera)
    }
    animate()
}
```

Hello, world

```
$ gopherjs build
$
```




We
need more
structure
GO

VECTY

Vecty - a frontend toolkit for GopherJS

https://github.com/gopherjs/vecty

Vecty:

- Write frontend app in Go
- Share frontend and backend code
- Create reusable components as Go packages

```go
type MyComponent struct {
    vecty.Core
    // additional component fields (state or properties)
}

func (c *MyComponent) Render() vecty.ComponentOrHTML {
    //  construct DOM/HTML here
}
```

Vecty Hello, world:

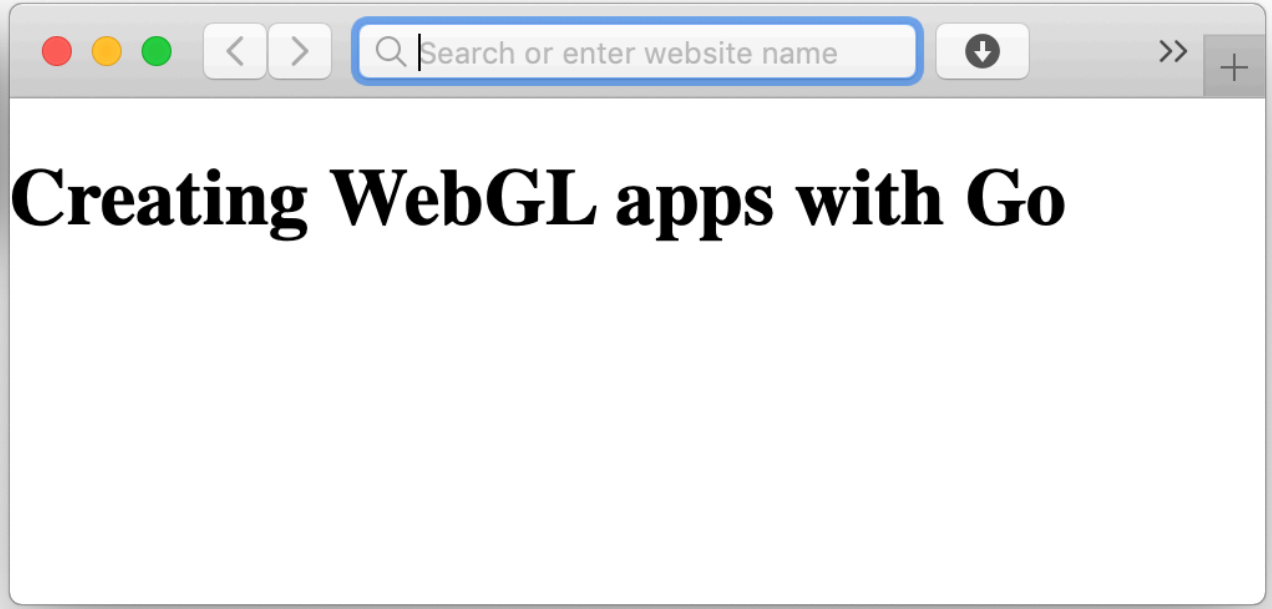
```go
package main

import (
    "github.com/gopherjs/vecty"
    "github.com/gopherjs/vecty/elem"
)

// Page is a top-level app component.
type Page struct {
    vecty.Core
    article string
}

// Render implements vecty.Component for Page.
func (p *Page) Render() vecty.ComponentOrHTML {
    return elem.Body(
        elem.Div(
            elem.Heading1(
                vecty.Text(p.article),
            ),
        ),
    )
}
```

```go
package main

import "github.com/gopherjs/vecty"

func main() {
    page := &Page{article: "WebGL with Go",}
    vecty.SetTitle("Hello world")
    vecty.AddStylesheet(/* ... add your css... */)
    vecty.RenderBody(page)
}
```

```html
<!DOCTYPE html>
<html>
    <head> <meta charset=utf-8>
      <title>Vecty Hello World</title>
    </head>
    <body>
      <script src="vecty-demo.js"></script>
    </body>
</html>
```

Vecty Hello, world:

```
$ gopherjs build
$
```

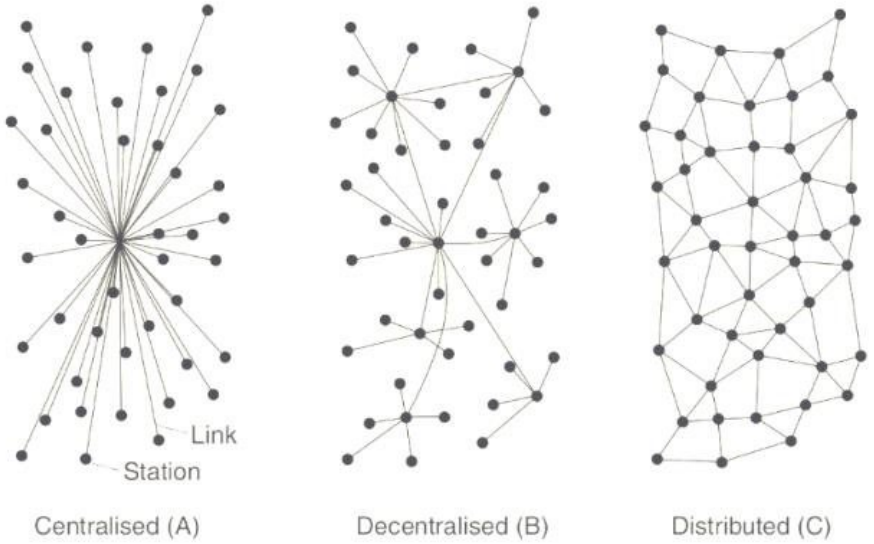


Let's compare with modern React "hello world"

Real project example

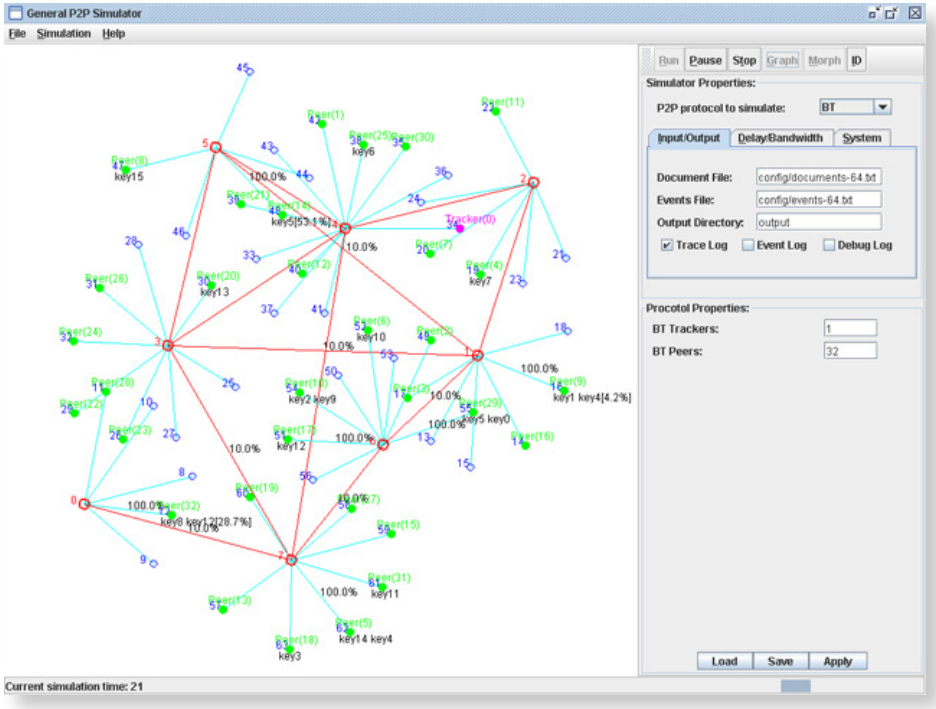
The problem

- P2P messaging protocols - Whisper
- No central point of observation
- No data
- No intuition about its behaviour



The problem

- You can't change the code and collect new data
- But we can run simulations in controlled network
- Existing p2p simulators require to rewrite peer's code for it



Whisper Simulator

This simulator shows message propagation in the Whisper network.

Network graph:

beta_fleet_28.json

Layout forces: -

Gravity: -10.0000

Spring: 0.0500

Length: 10.0000

Drag: 0.0200

Steps: 100

Apply

Graphics: -

FPS

60 30 20 15

Render throttler

Blink: 236

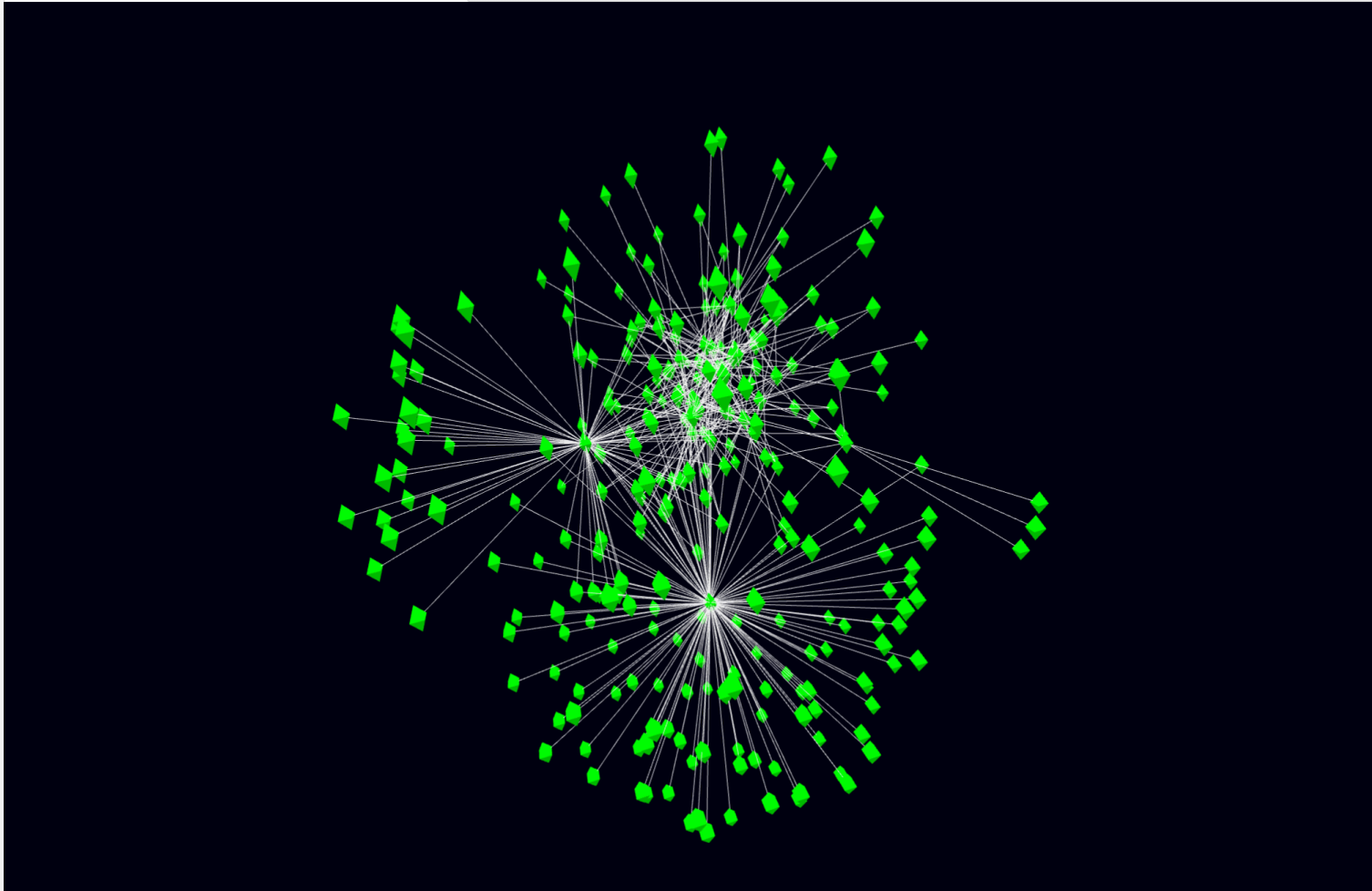
Simulation backend:

Host: http://localhost:8084

TTL: 10

Start simulation

3D view | Stats view | FAQ

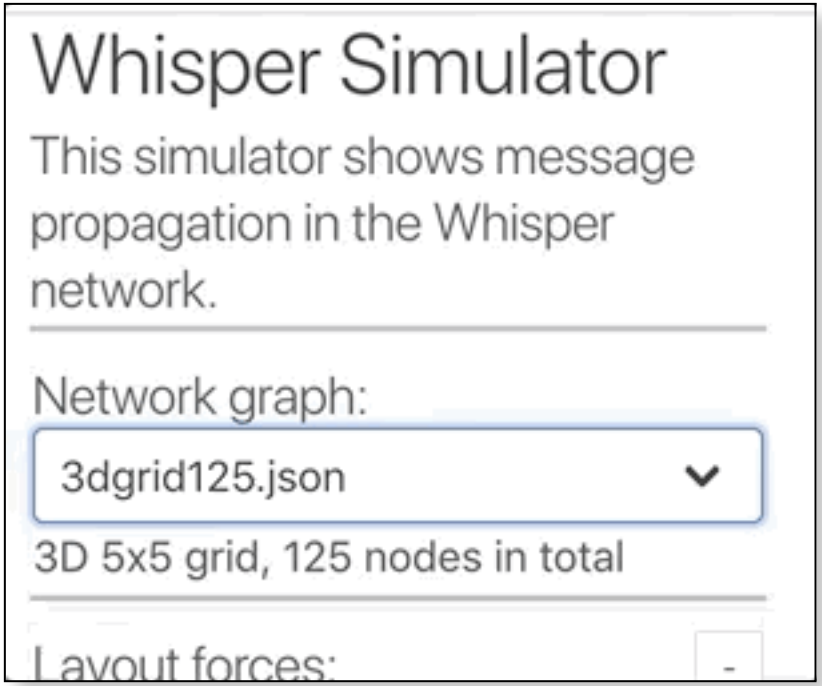


UI Widgets:

- UI needs number of widgets and controls
- Each one is just a vecty component

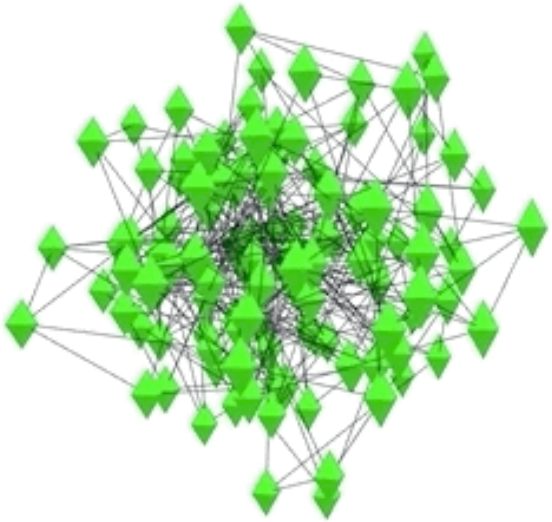
UI Widgets:

```
// Render implements the vecty.Component interface for NetworkSelector.
func (n *NetworkSelector) Render() vecty.ComponentOrHTML {
    return Widget(
        Header("Network graph:"),
        elem.Div(
            vecty.Markup(
                vecty.Class("select", "is-fullwidth"),
                event.Change(n.onChange),
            ),
            elem.Select(
                vecty.Markup(
                    event.Change(n.onChange),
                ),
                n.networkOptions(),
                elem.Option(
                    vecty.Markup(
                        vecty.Property("value", "upload"),
                        vecty.Property("selected", n.isCustom),
                    ),
                    vecty.Text("Upload custom..."),
                ),
            ),
        ),
        n.descriptionBlock(),
        vecty.If(n.isCustom, n.upload),
    )
}
```



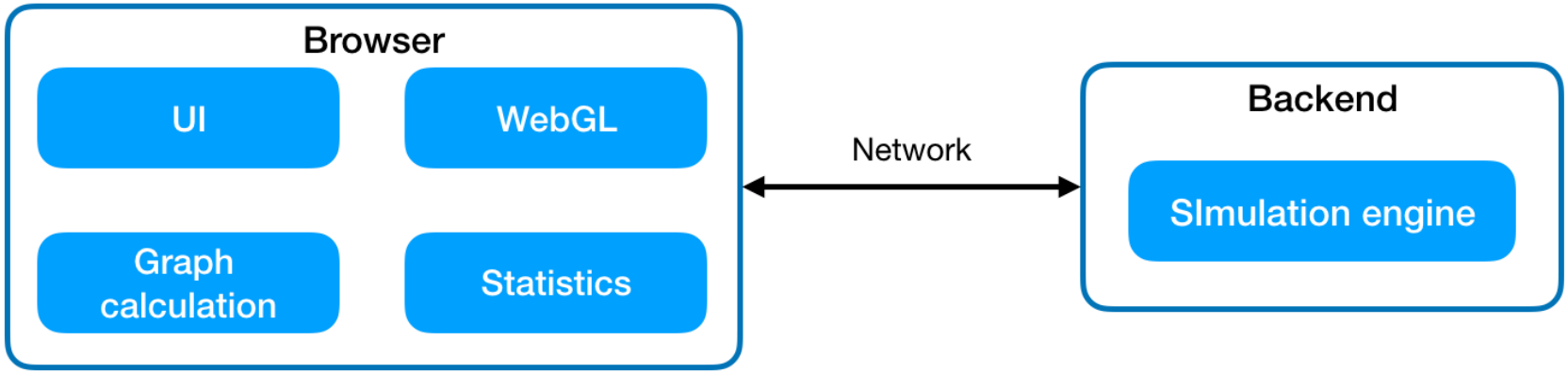
Network graph:

- Force-directed graph
  - place nodes pseudo-randomly
  - apply repelling force between all nodes
  - apply spring force between linked nodes
  - repeat simulation till system reaches stable energy state
- Used existing code in Go



Simulation:

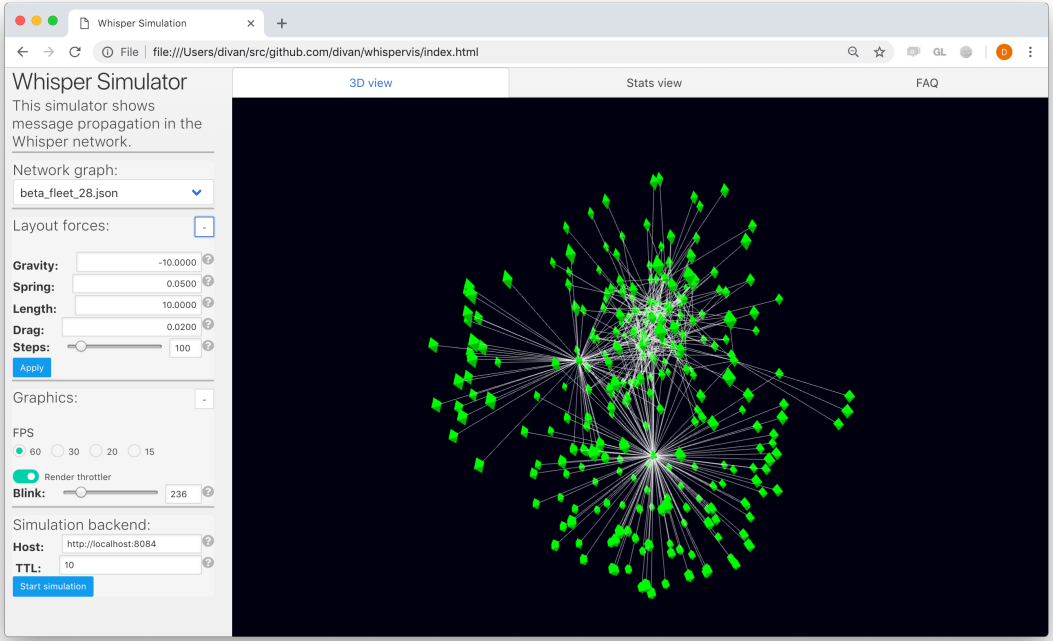
- In-memory sImulation is too heavy to run in the browser
- So it's been offloaded to the "backend"
- Frontend talk to it via network and visualizes the result



Demo

https://www.youtube.com/watch?v=m5BwbkCxeLo

https://divan.github.io/whispervis/



Conclusions

Conclusions:

- Still experimental land
- But simple frontend are 100% real with Go
- Even for WebGL ❤️
- Much simpler and easier to work with

Conclusions:

- Of course, everybody wait for WASM
- Both GopherJS and Vecty have experimental WASM port
- Future of GopherJS and Go in the browser
- This talk as an article

Thank you

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