Functional virtual reality: WebVR + Haskell

Nickolay Kudasov

http://github.com/**fizruk/fby-2017-talk**

f(by) 2017, Minsk

About me

- CTO & co-founder GetShop.TV
- Haskell teacher at CMC MSU
- Haskell-enthusiast since 2010


fizruk


crazy_fizruk


GetShopTV

~~Better~~ Virtual Reality

WebVR

- JavaScript API for creating Virtual Reality experiences
- Provides access to sensors and controllers
- Transforms camera
- Allows rendering directly on the connected device (Oculus, Vive)

https://webvr.rocks

WebVR

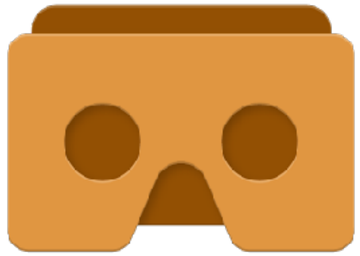






https://webvr.rocks

WebVR

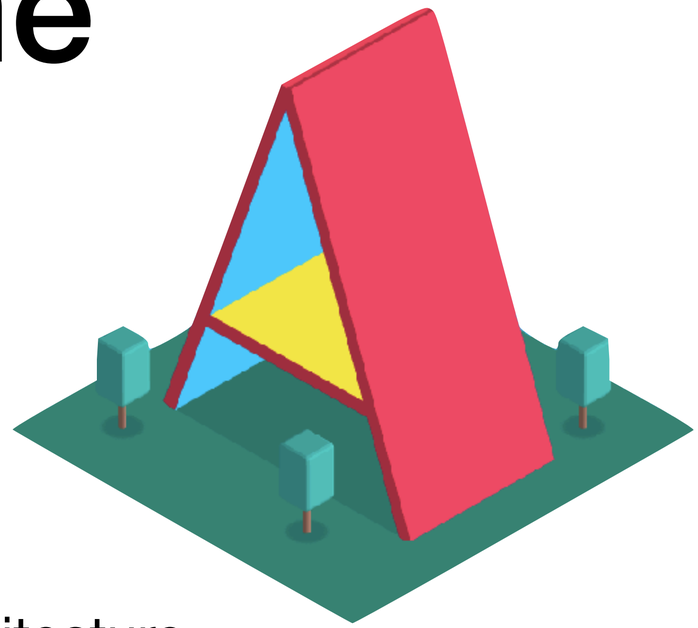


Windows Mixed Reality

Daydream

https://webvr.rocks

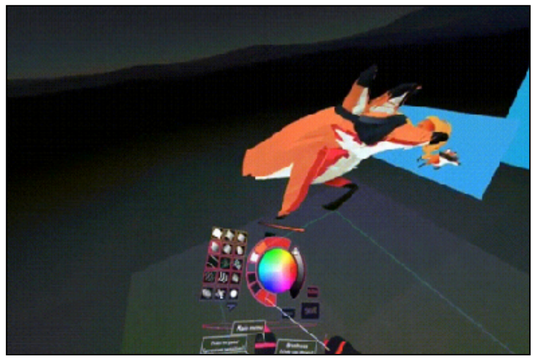
A-Frame

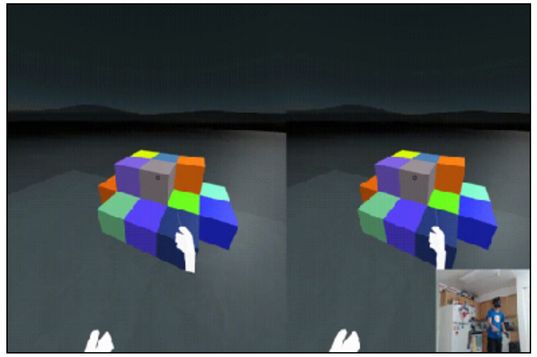


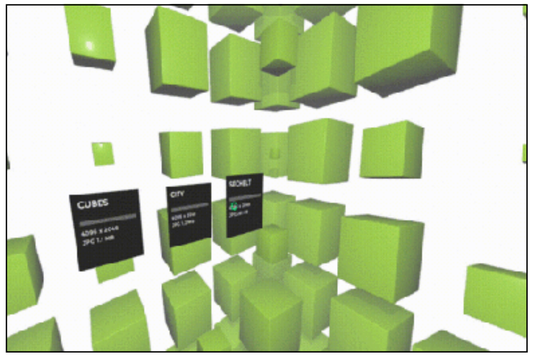
- Web-framework for VR
- Relies on **WebVR** and **three.js**
- Uses **declarative** HTML for VR scenes
- Uses **Entity-Component-System** Architecture
- Fairly simple to use (at least for simple projects)
- Very performant

https://aframe.io

A-Frame



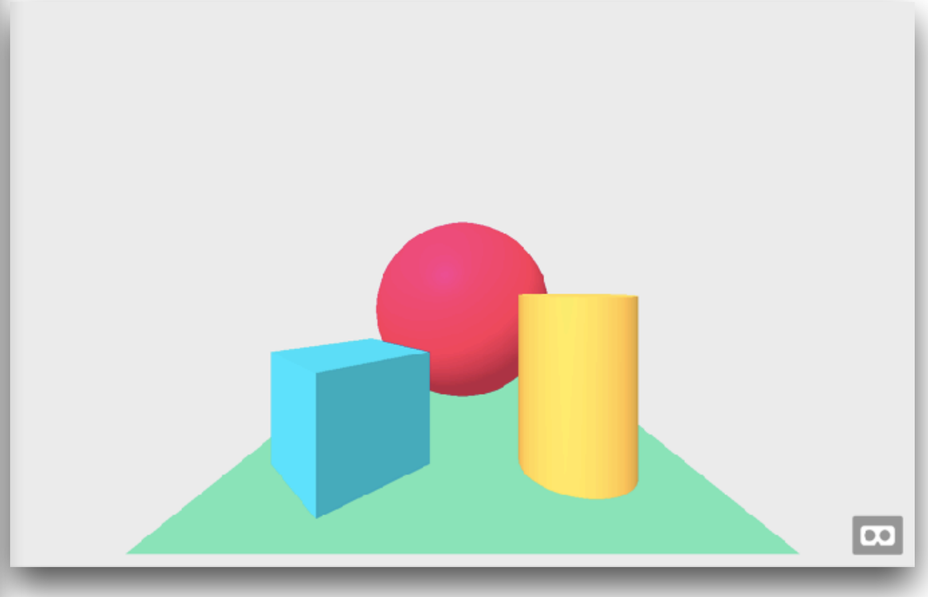




https://aframe.io

A-Frame
Declarative HTML

```
<html>
  <head>
    <script src="https://aframe.io/releases/0.7.0/aframe.min.js">
    </script>
  </head>
  <body>
    <a-scene>
      <a-box
          position="-1 0.5 -3"
          rotation="0 45 0"
          color="#4CC3D9"></a-box>
      <a-sphere
          position="0 1.25 -5"
          radius="1.25"
          color="#EF2D5E"></a-sphere>
      <a-cylinder
          position="1 0.75 -3"
          radius="0.5"
          height="1.5"
          color="#FFC65D"> </a-cylinder>
      <a-plane
          position="0 0 -4"
          rotation="-90 0 0"
          width="4"
          height="4"
          color="#7BC8A4"> </a-plane>
      <a-sky color="#ECECEC"></a-sky>
    </a-scene>
  </body>
</html>
```



A-Frame
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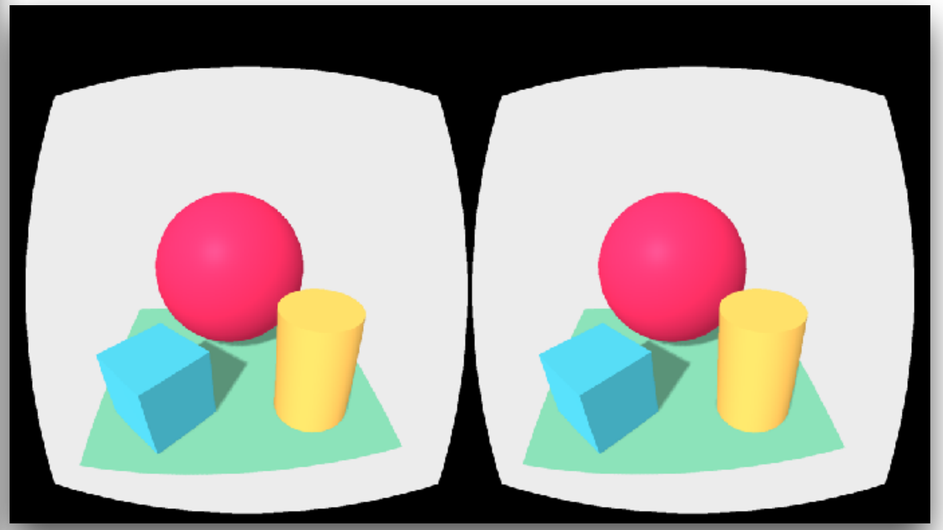
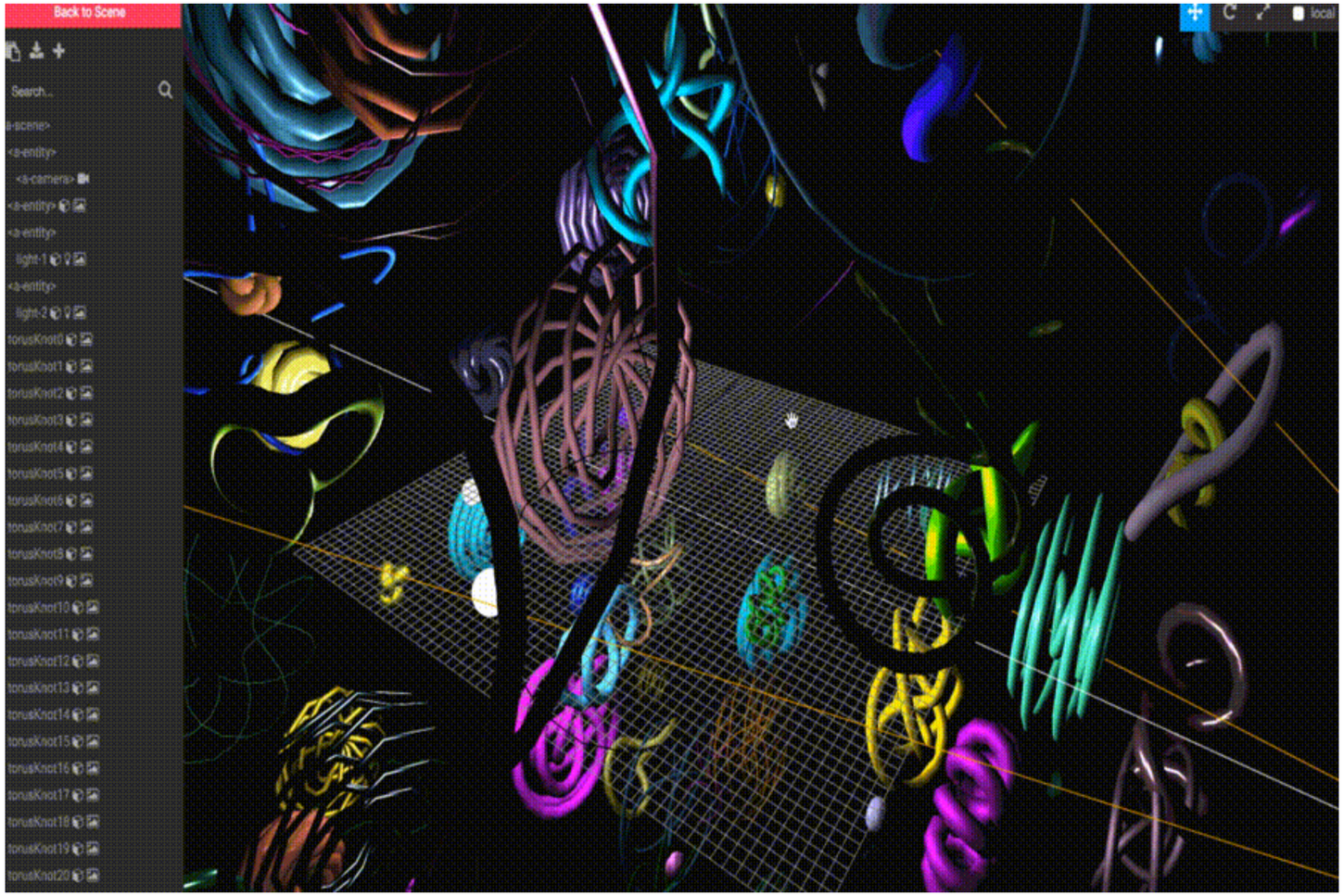


A-Frame Entity-Component-System

```
<a-entity geometry="primitive: sphere; radius: 1.5"
          light="type: point; color: white; intensity: 2"
          material="color: white; shader: flat; src: glow.jpg"
          position="0 0 -5"></a-entity>
```

- **Entities** are container objects into which components can be attached
- **Components** are data containers, responsible for some part of entity
- **Systems** provide global control and services for classes of components

A-Frame
Visual Inspector



A-Frame Problems

- **"Stringly"**-typed
- Runtime errors (if you're lucky)
- JavaScript
- Mixins & Templating

```
position="-1 0.5 -3"
rotation="0 45 0"
color="#4CC3D9"
```

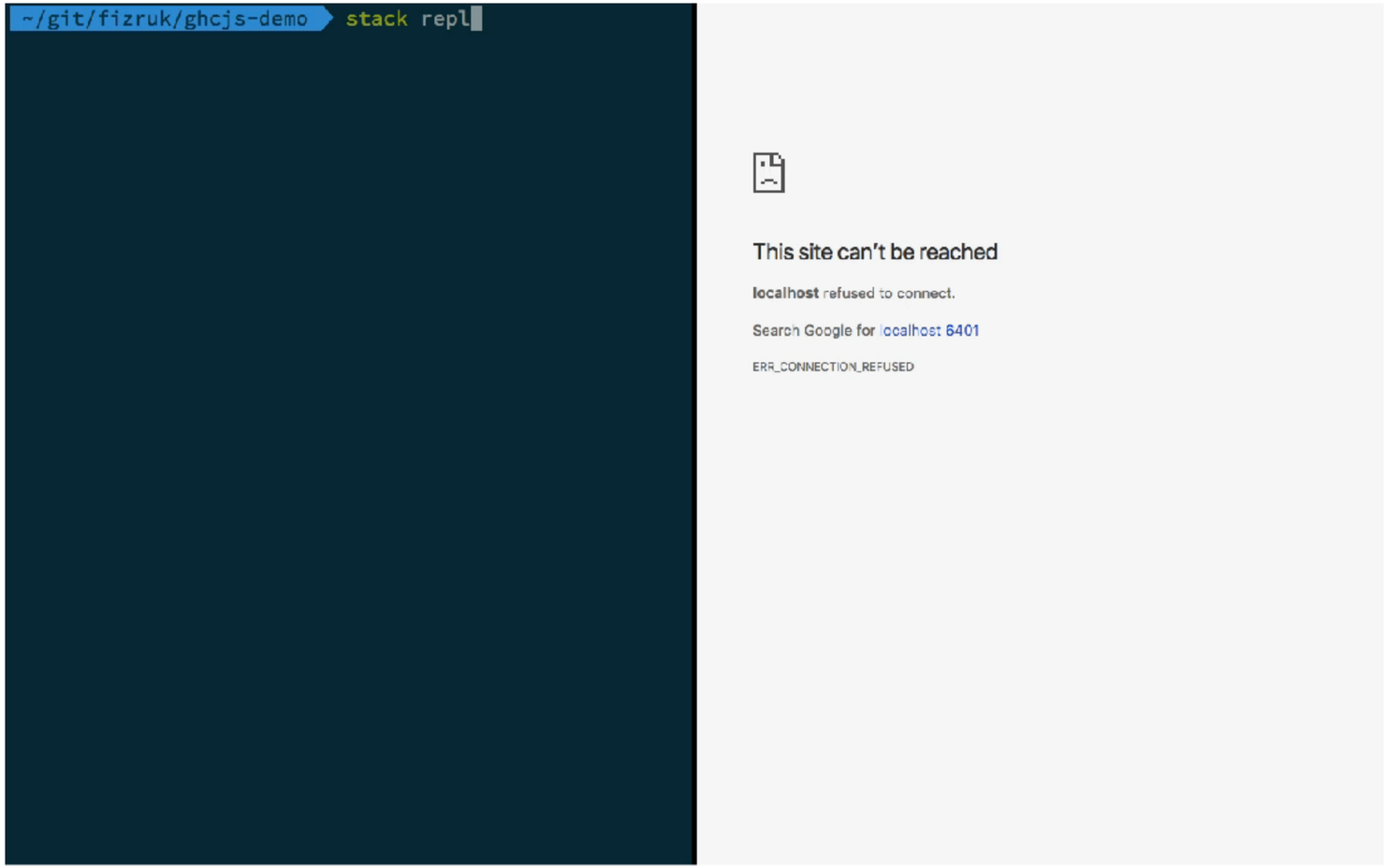

Haskell


JS

Haskell → JavaScript
GHCJS

- Compiler from Haskell to JavaScript based on GHC
- FFI to call JavaScript from Haskell
- Green threads, STM and other goodies of Haskell
- Uses node.js for builds and for Template Haskell

Haskell → JavaScript
GHCJSi and browser



Haskell → JavaScript Frontend frameworks

- **Reflex** — powerful framework, based on ideas of functional reactive programming

- **Miso** — a new framework, based on TEA (The Elm Architecture)

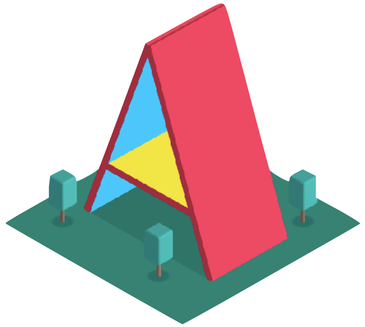
Haskell → JavaScript
Miso

- Inspired by TEA (The Elm Architecture)
- Arguably easier to learn than Reflex
- "Isomorphic" framework (can work without JS)

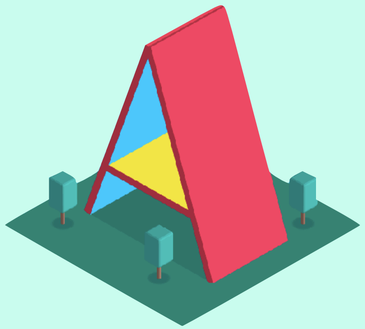
Miso A-Frame

- Miso provides structure for
  - application model and logic
  - scene layout
- A-Frame provides
  - graphics and VR environment
  - local component logic
  - handling controllers

+

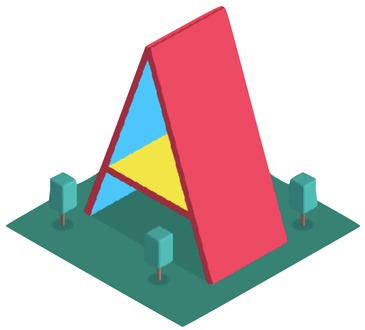


Live Demo



More A-Frame Components

- A-Frame Weekly Blog — **https://aframe.io/blog/**
- https://github.com/aframevr/awesome-aframe/



Problems

- GHCJS lags behind GHC (7.10 vs 8.2)
- GHCJSi is very experimental
  (unstable on some programs)
- Miso does not let you to implement local component logic
  (but, perhaps, for the better)

What's next?

- More types for miso-aframe
- Component registration from Haskell
- High-level DSL to work with A-Frame ECS
- Cool VR-apps written in Haskell :)

Thank you!

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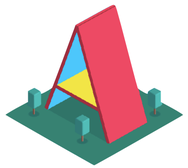

https://aframe.io

https://haskell-miso.org