AWS re:Invent

ARV203

Create digital twins using AWS IoT Core and Amazon Sumerian

Miro Masat

Solutions Architect

Amazon Web Services

Agenda

AR/VR/3D beyond gaming?

Digital twins

Introducing Amazon Sumerian

Integrations

Design considerations

Build

Demo

Lessons learned

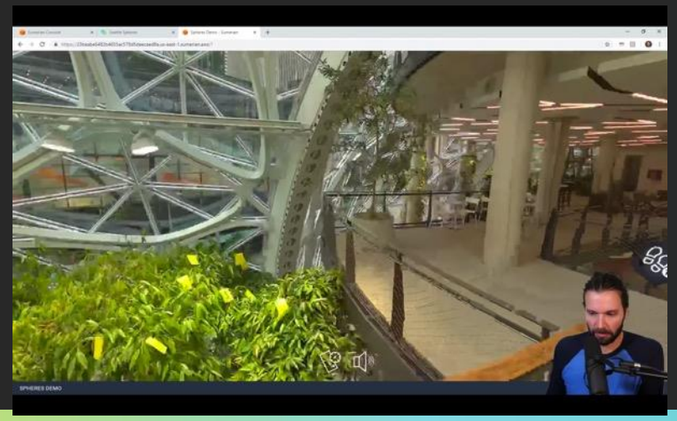
Q&A

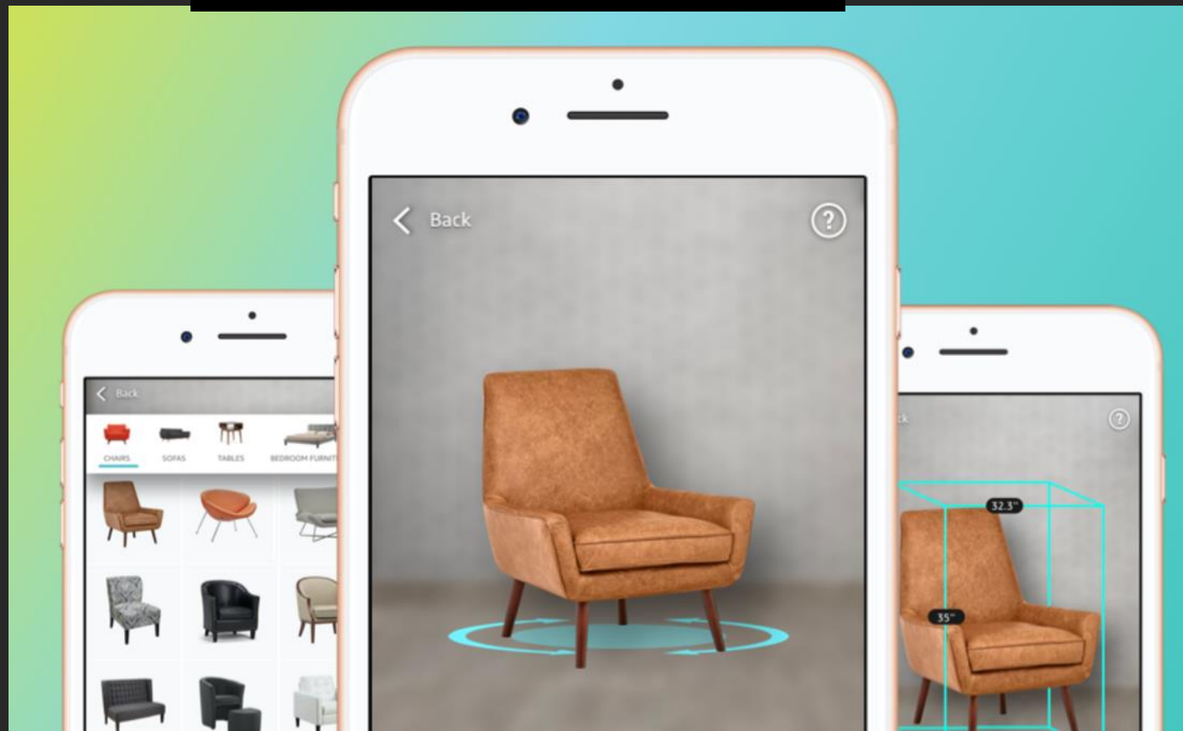
AR/VR/3D beyond gaming?

AR/VR/3D beyond gaming?

Nearly all industries now

- Media/Entertainment
- Retail
- Construction
- Travel/Mobility





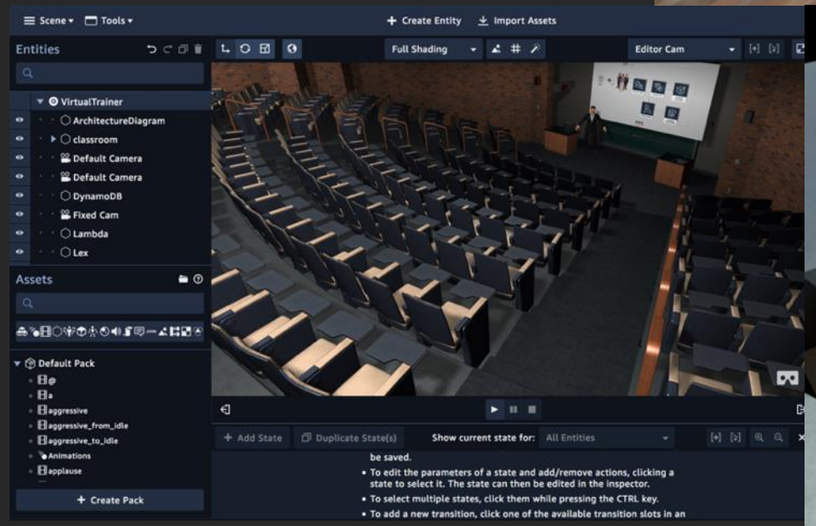
AR/VR/3D beyond gaming?

Nearly all industries now

- Media/Entertainment
- Retail
- Construction
- Travel/Mobility

But also

- Education
- Automotive
- Manufacturing
- Healthcare
- Life Sciences



Digital twins

"A **digital twin** is a digital replica of a living or non-living physical entity. By bridging the physical and the virtual world, data is transmitted seamlessly allowing the virtual entity to exist simultaneously with the physical entity."

"Digital Twin," Wikipedia

Conventional AR/VR/3D for digital twins

- Digital replica?
- Living/nonliving?
- Physical properties?
- Bridging worlds?
- Simultaneous behavior?
- Symbiotic?

Simple digital twins?

Conventional AR/VR/3D for digital twins

- Digital replica?
- Living/nonliving?
- Physical properties?
- Bridging worlds?
- Simultaneous behavior?
- Symbiotic?

Most common digital twins

Nearly all industries now

- Media/Entertainment
- Retail
- **Construction**
- Travel/Mobility

But also

- Education
- **Automotive**
- **Manufacturing**
- Healthcare
- Life Sciences

Introducing Amazon Sumerian

AWS re:Invent

aws

Introducing Amazon Sumerian

Sumerian lets you create **VR, AR, and 3D** applications quickly and easily **without any specialized programming or 3D graphics expertise**. You can build highly immersive and interactive scenes **that run on VR, web, and mobile devices**.

Introducing Amazon Sumerian

VR, AR, and 3D without any specialized programming or 3D graphics expertise that run on VR, web, and mobile devices.

Introducing Amazon Sumerian

Editor & API

Visual and programmatic access

Multi-platform

Build once, deploy everywhere

Integrations

Plug-in ML, IoT, database, and hundreds of others

Global

One click, skip app stores

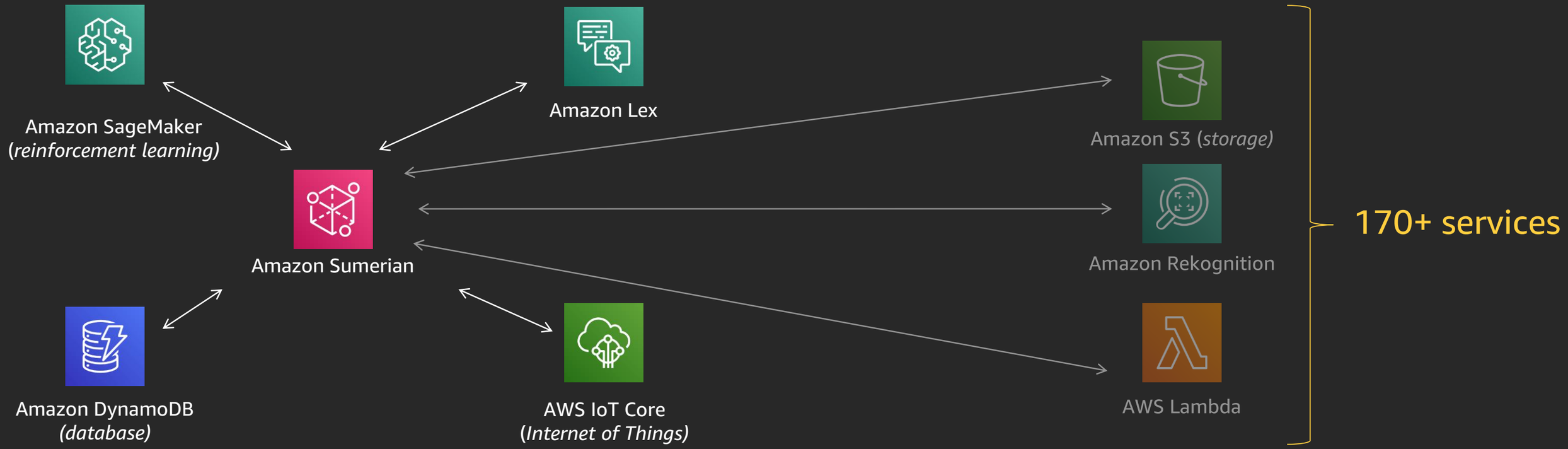
Asset library

Tap into existing asset library

Integrations

Integrations

- AWS offers more than 170 services (December 2019)
- Several services can support the concept of digital twins.
- Sumerian can interact with all AWS services supported by the AWS JavaScript SDK.



Integrations: AWS IoT Core

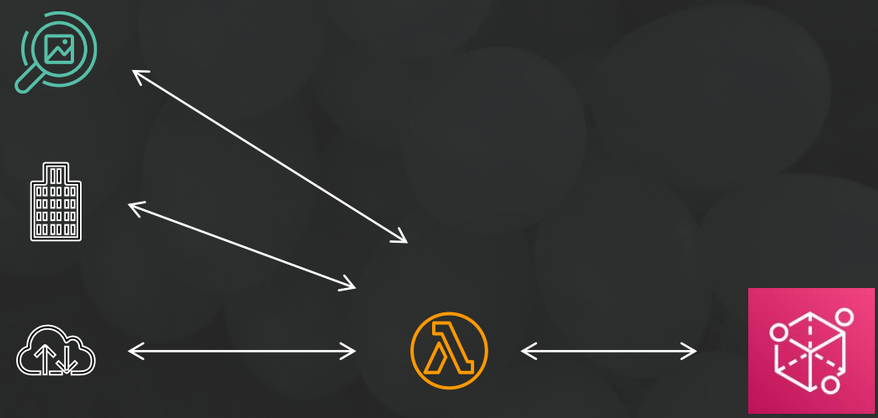
- Managed IoT message broker
- Integration through IoT shadow document
  - MQTT
  - JSON
  - Publish/subscribe
- Useful for keeping a consistent state between the physical and a digital twin


```
{
    "state" : {
        "desired" : {
          "color" : "RED",
          "sequence" : [ "RED", "GREEN", "BLUE" ]
        },
        "reported" : {
          "color" : "GREEN"
        }
    },
    "metadata" : {
        "desired" : {
            "color" : {
                "timestamp" : 12345
            },
            "sequence" : {
                "timestamp" : 12345
            }
        },
        "reported" : {
            "color" : {
                "timestamp" : 12345
            }
        }
    },
    "version" : 10,
    "clientToken" : "UniqueClientToken",
    "timestamp": 123456789
}
```


Integrations: AWS Lambda

- Managed compute
- Extending Sumerian to both AWS services and external services/APIs
  - Event/scheduled triggers
  - Ability to pass parameters
- Useful for extending AR/VR/3D with scalable and serverless compute

```
def my_handler(event, context):
    message = 'Hello {} {}!'.format(event['first_name'],
                                    event['last_name'])
    return {
        'message' : message
    }
```



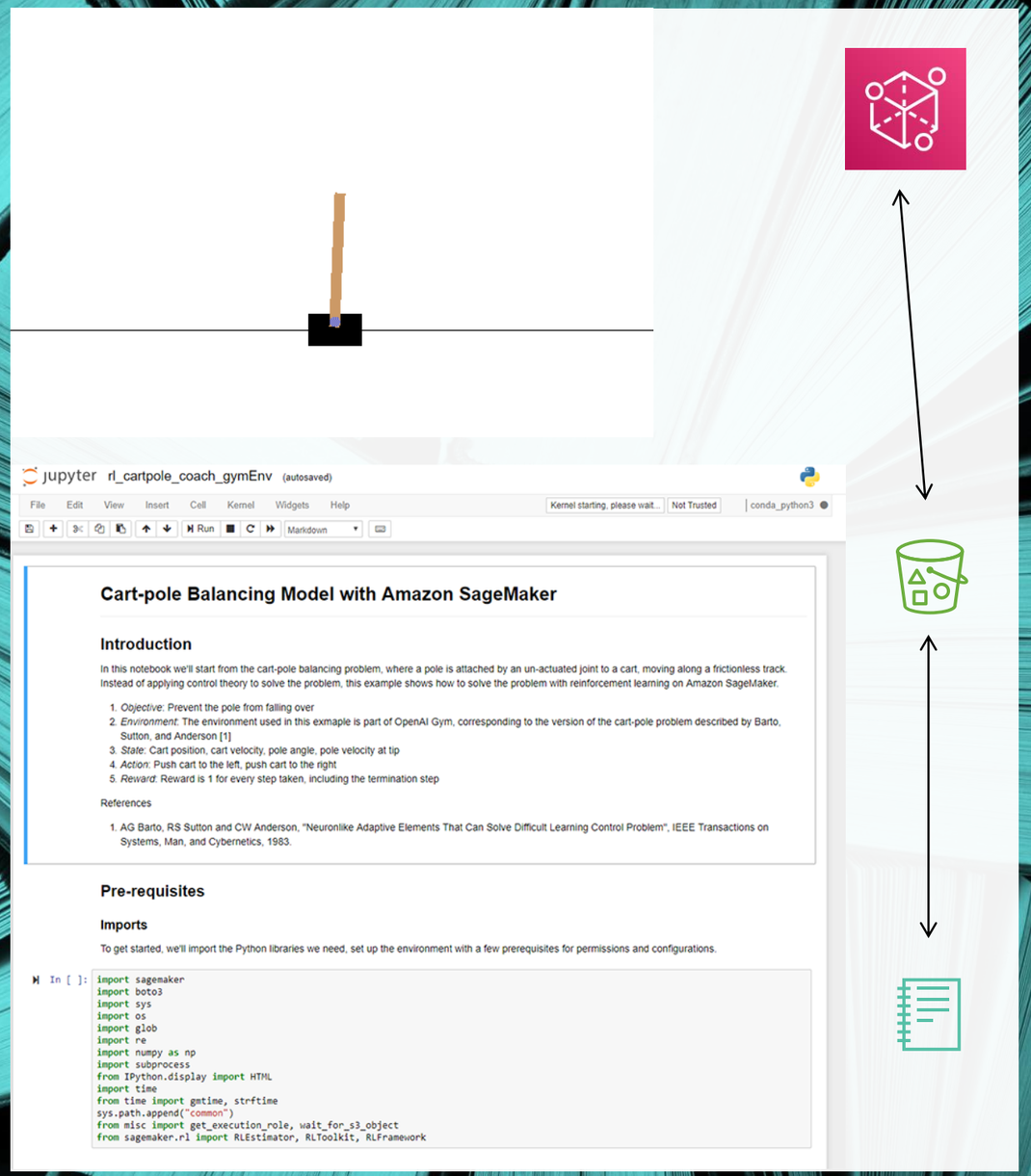
Integrations: AWS DynamoDB

- Managed key-value database
- Provides persistent storage layer
  - Tables with unique keys
  - Performant PUT/GET
  - JSON/JS notation
- Useful for coordinating the experience, retrieving the state of the scene or AR/VR/3D analytics

```
dynamodb = boto3.resource("dynamodb", region_name='us-west-2')

table = dynamodb.Table('Movies')

title = "The Big New Movie"
year = 2015

try:
    response = table.get_item(
        Key={
            'year': year,
            'title': title
        }
    )
except ClientError as e:
    print(e.response['Error']['Message'])
else:
    item = response['Item']
    print("GetItem succeeded:")
    print(json.dumps(item, indent=4, cls=DecimalEncoder))
```

Integrations: Amazon SageMaker

- Managed ML development notebooks
  - Integrated with Gym JS training suite
  - Providing familiar ML development experience
- Providing managed ML inference endpoints
- Useful for reinforcement learning, anomaly detection, and predictive maintenance



Design considerations

Design considerations

- Do you have your 2D/3D assets or do you need to bring them in?
- How do you want your experiences to be consumed? AR/VR/3D/combination?
- Do you require any anchoring or precise positioning of the experience?
- Do you need your experience to be collaborative?
- What other services do you require?

Build

Build

- Start small
  - Use primitives instead of 3D models
  - Demonstrate value over the graphics
  - Build connected worlds rather than isolated islands
- Understand the use of the original: Improve the digital twin
- Keep an eye on the volume and complexity
- Test with different humans and devices

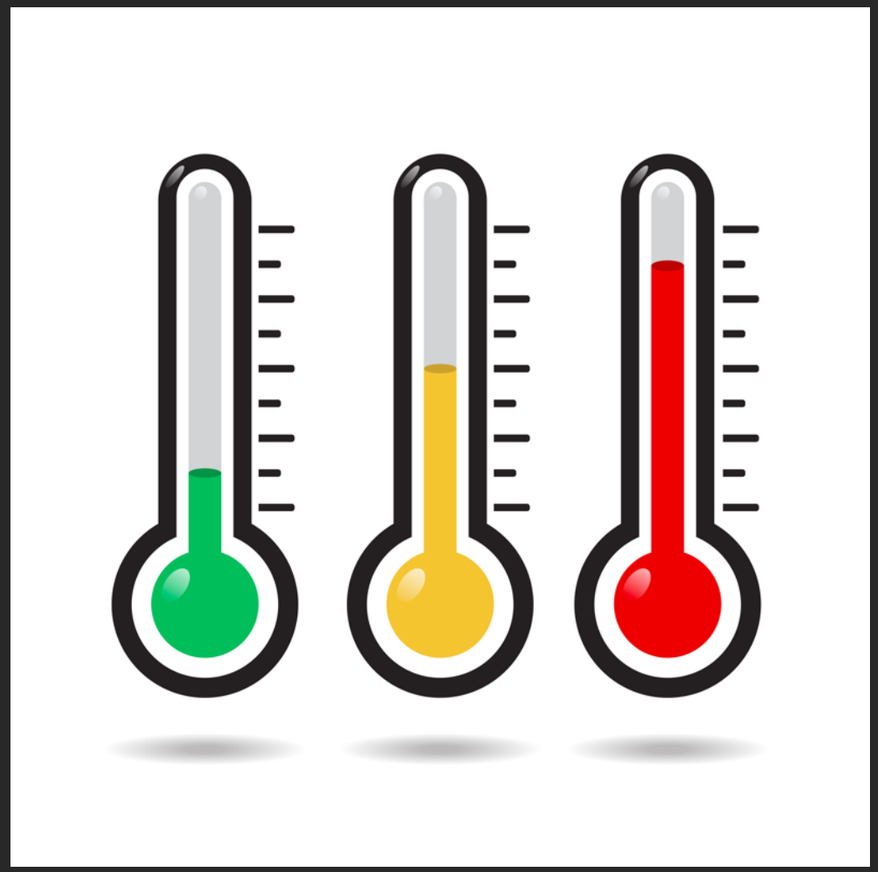
Demo

Lessons learned

Lessons learned

Polygons are enemies

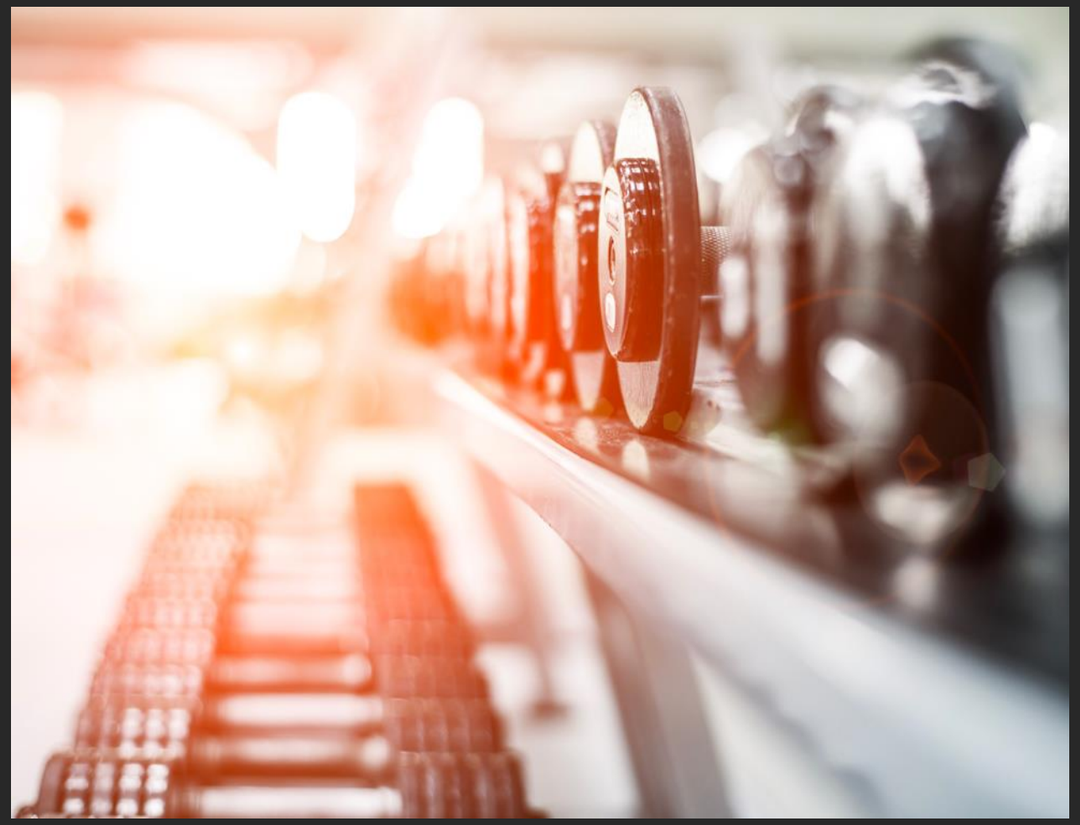
Colors/animations/effects are friends



Lessons learned

Don’t include it all

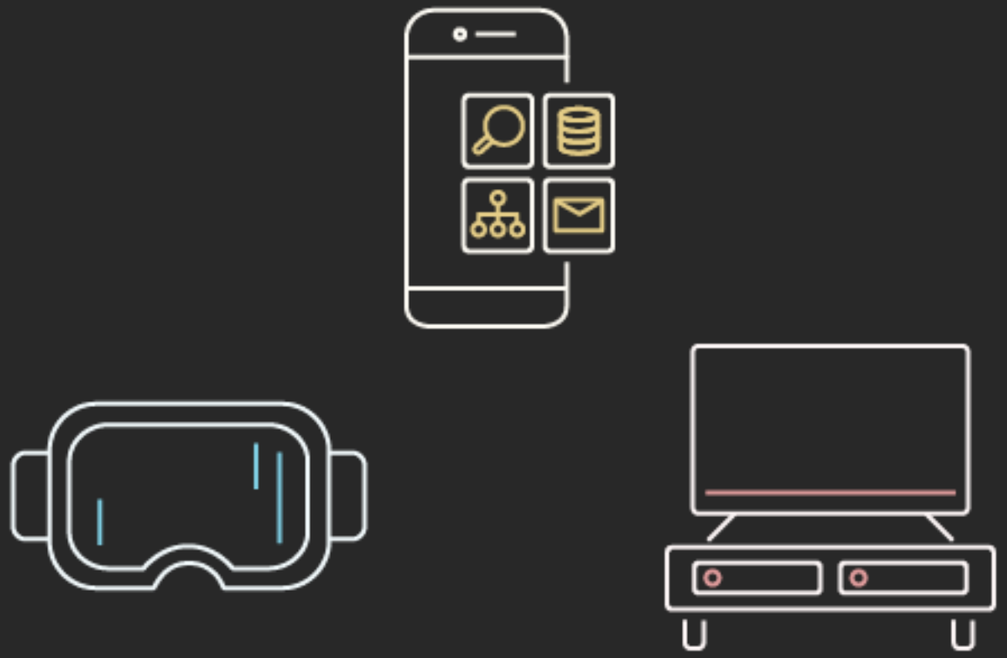
Use physics



Lessons learned

Screen aspect ratios matter

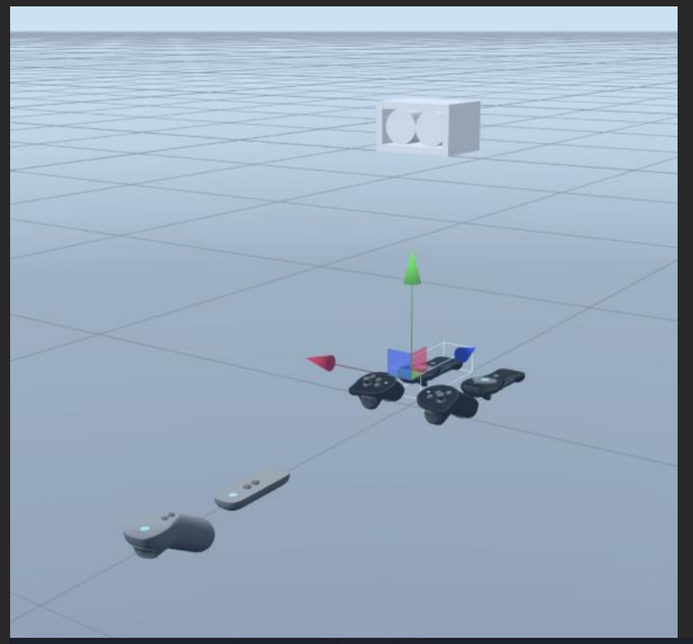
Devices should not



Lessons learned

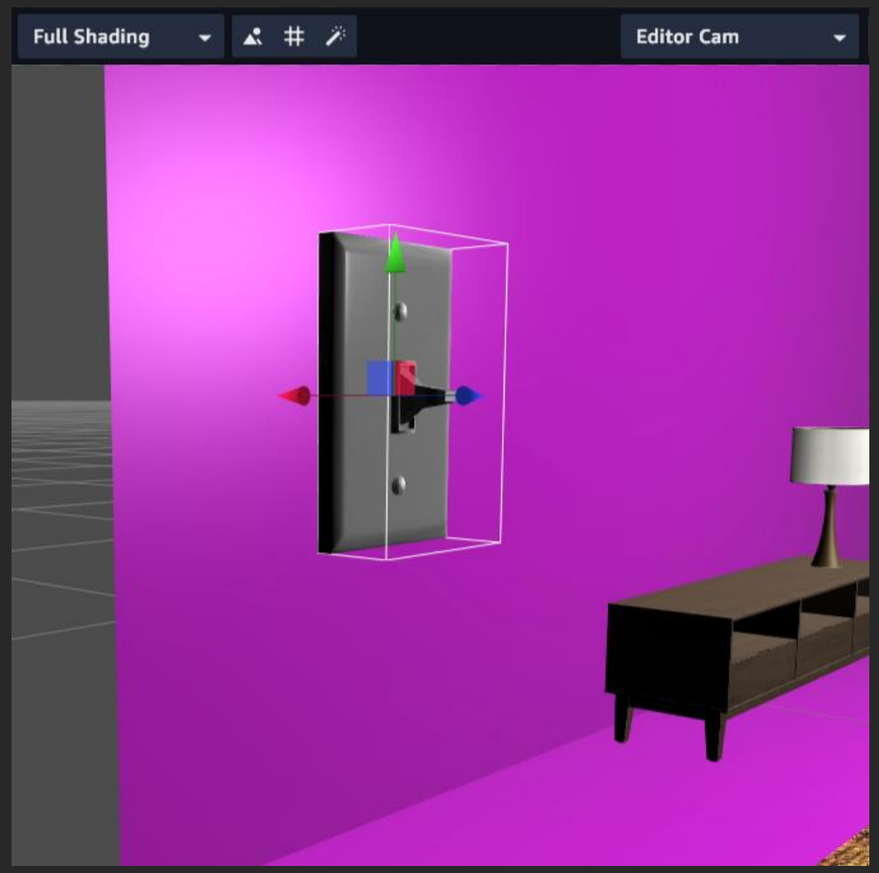
2D is fine, too

Controls are yours to invent



Lessons learned

Interface back



Things can be changed

Lessons learned

Collaboration will be big

Keep your bundles lean

Scene size

~ 31.438 MB
(uncompressed)

Composition Breakdown

Json	3.57 Mb	11.4%
Mesh	21.05 Mb	67.0%
Image	6.82 Mb	21.7%

Recalculate

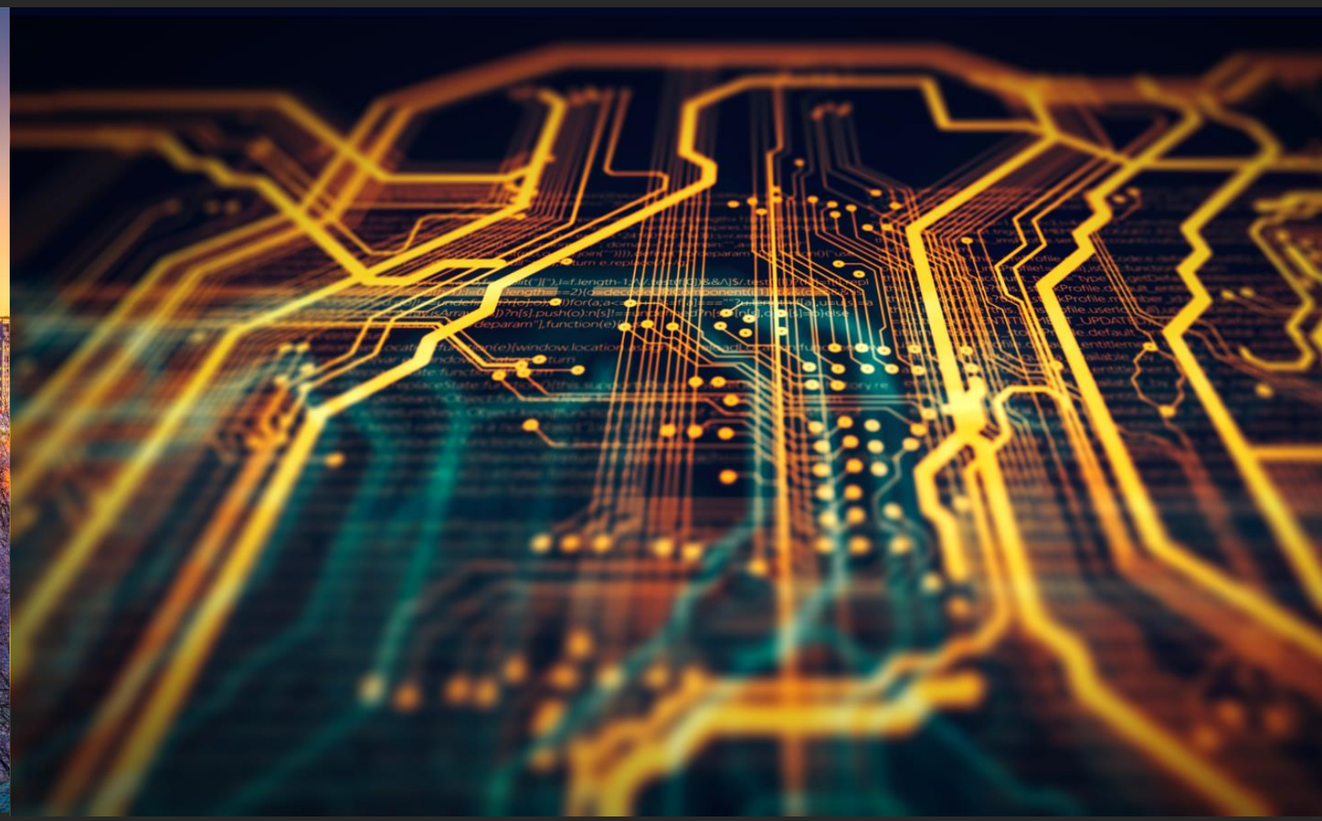
Scene stats

	Current	Max
FPS	55.2	91.6
Draw Calls	25	26
Entities	376	376
Lights	3	3
Shadow Casters	0	0
Shaders	21	21
Texture Size	281.34	281.34
Triangles	35,686	35,686

Lessons learned

Learn from fractals

Connect the dots



Call to action

Learn

- docs.sumerian.amazonaws.com/
- youtube.com/c/AmazonSumerian
- twitch.tv/aws/

Talk

- slack.sumerian.world

Build

- docs.sumerian.amazonaws.com/tutorials/create/intermediate/iot-thing-shadow-script/
- docs.sumerian.amazonaws.com/articles/training-digital-twin/
- pages.awscloud.com/Create-a-Digital-Asset-with-Amazon-Sumerian-and-AWS-IoT_2019_0612-AVR_OD.html

Download free book

Amazon Sumerian by Tutorials

Are you ready to develop 3D immersive experiences with Amazon Sumerian? The raywenderlich.com tutorial team wrote this book to help you get started.

You do not need to be a programmer or a 3D whiz kid. You just need some free time and a modern web browser.

Use the QR code
to download today!

Q&A

Thank you!

Miro Masat

@miromasat

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