

ORACLE  
CloudWorld

# Pixel Streaming on Kubernetes

with Unreal Pixel Streaming on OKE

**LRN3840**

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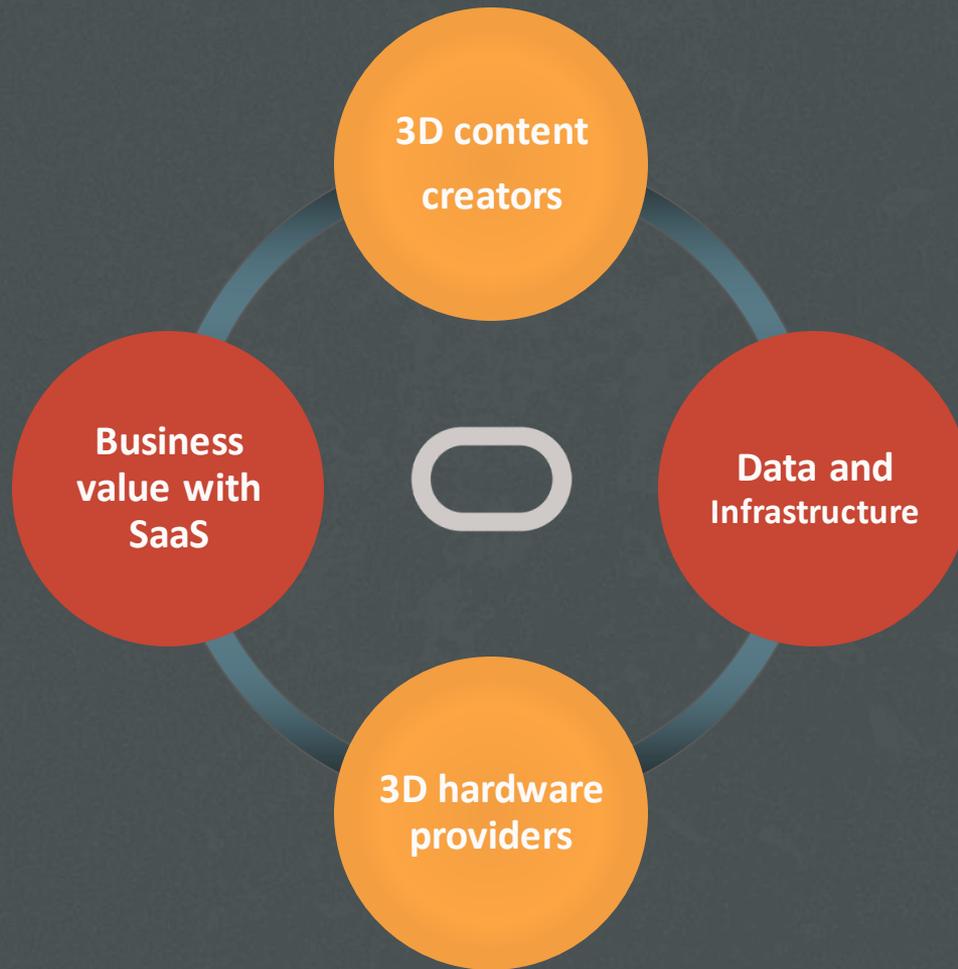


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CEO  
FutureFest.io



# Streaming



# Pixel Streaming

...and alternatives



**UNREAL  
ENGINE**



# Unreal Pixel Streaming and WebRTC



# Unreal Engine in The Cloud

## Epic Games

Interactive entertainment company and **provider** of 3D engine technology

## Unreal Engine

Widely adopted **3D engine**, with use cases for film, architecture, automotive, manufacturing, and simulation

## Pixel Streaming

Unreal Engine feature/plugin enabling the application **runtime** to execute on a remote machine.

## Render

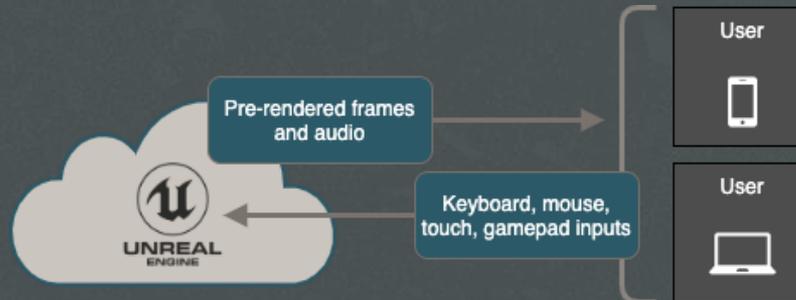
Each Unreal Engine application is continuously rendered according to its specifically designed experience, and user controls

## Encode

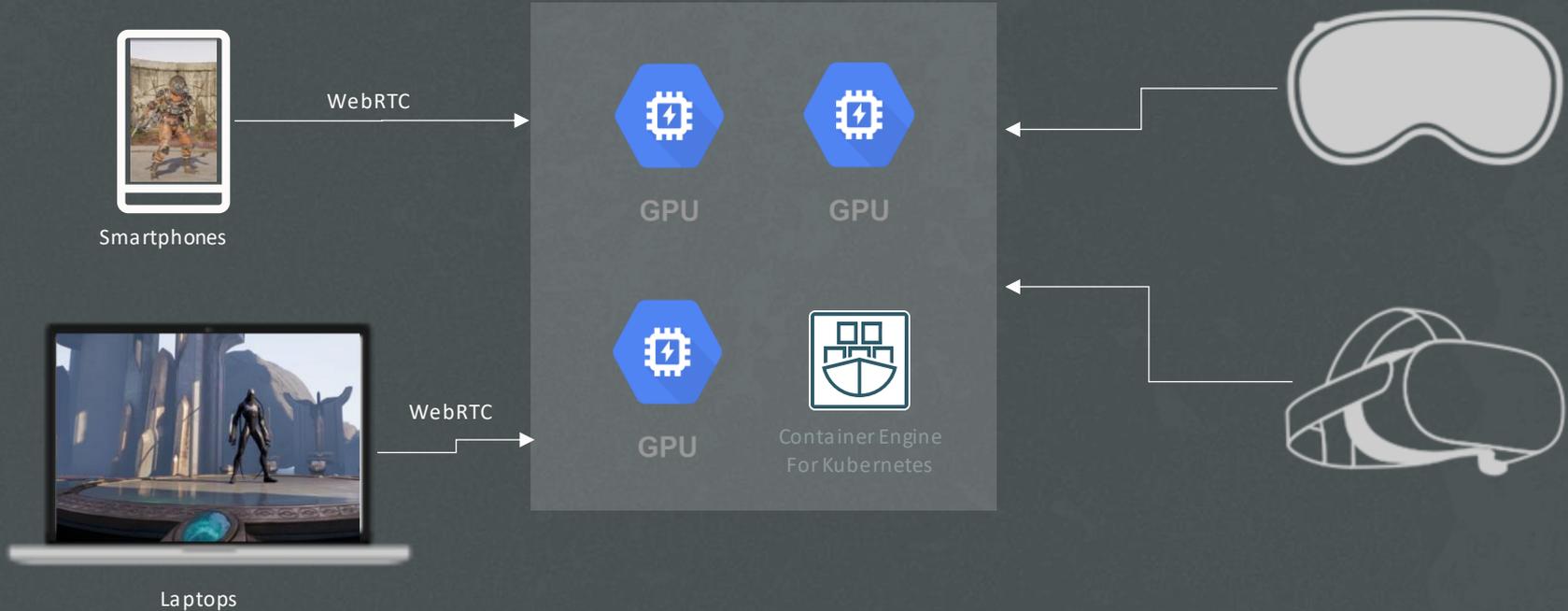
The rendered output is encoded into a configurable real-time audio/video media stream as if it were a pre-recorded video clip

## Stream

Connect the encoded media stream to clients through a lightweight stack of web services where the user controls the experience through standard input devices

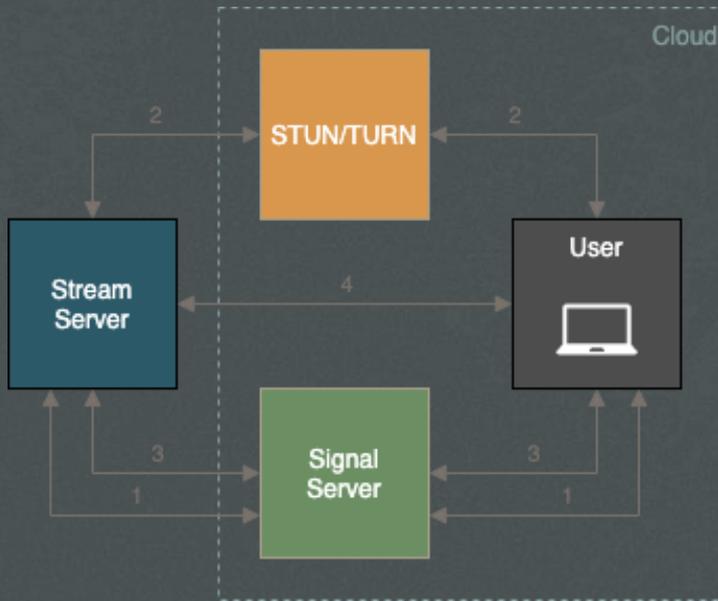


# Unreal Engine in The Cloud



# About WebRTC

## Peer-to-peer real time communication over web



Session Traversal Utilities for NAT (STUN) Traversal Using Relays around NAT (TURN) Datagram Transport Layer Security (DTLS)

WebRTC defines a web peering technology for real-time media and data streaming.

It uses a four-way handshake where the various peer networking configurations and firewalls are traversed.

1. Peers register with a signaling server.
2. The network and firewall traversal methods are determined.
3. ICE candidates and session description are exchanged.
4. A peer-to-peer DTLS stream is established.

Read more:

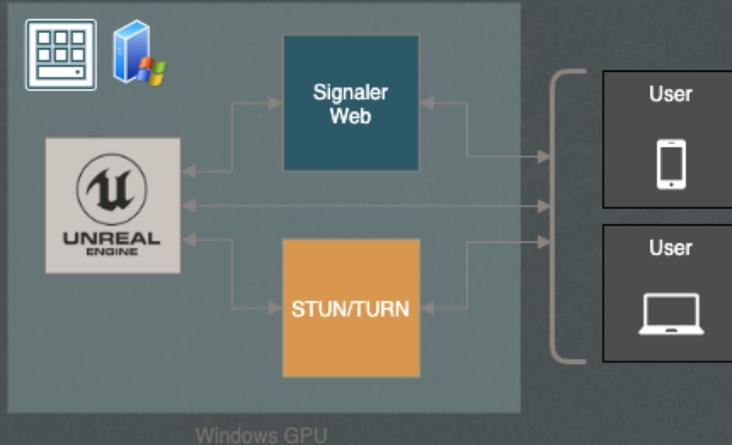
- [CCP WebRTC](#)
- [webrtc.org](#)
- [coturn](#) repo

The top right corner of the slide features a series of overlapping, organic shapes. From top-left to bottom-right, these include: a light blue shape with vertical lines, a red shape with vertical lines, a dark blue shape with a white cross pattern, and a large, textured yellow shape.

# Architectures

# Pixel Streaming OOTB

## Basic cloud solution (prior versions)

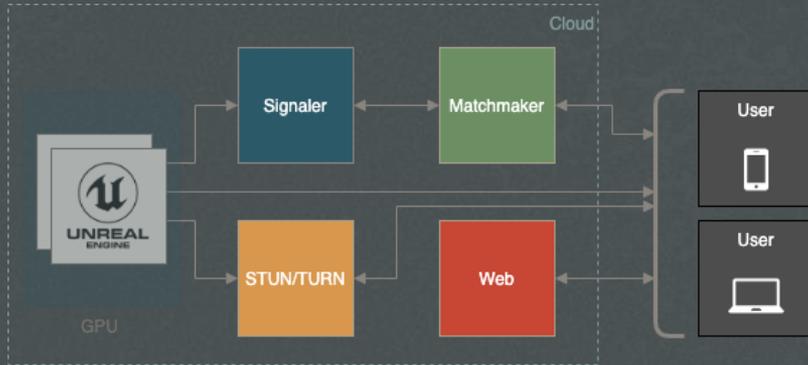


Unreal offers a sample runtime out of the box, with the basic WebRTC components. It is not practical for production for several reasons:

- Requires several custom installations
- Assumes the signal server and stun server reside on the same machine
- Runs entirely in a public subnet
- Does not scale easily
- Difficult to employ service discovery
- Costly to operate

# Pixel Streaming Basic Architecture

## Microservice design



The August release of UE 4.27 brought support for runtimes on Linux GPU. Better still, they published base images for containers (albeit in a private ghcr registry).

With these additions, a microservice deployment of Pixel Streaming became more realistic, and a few separations seemed logical

- Static webserver (HTML/CSS/JS player)
- Matchmaker (stream reservation system)
- Standalone TURN services
- Signaler and UE App as before

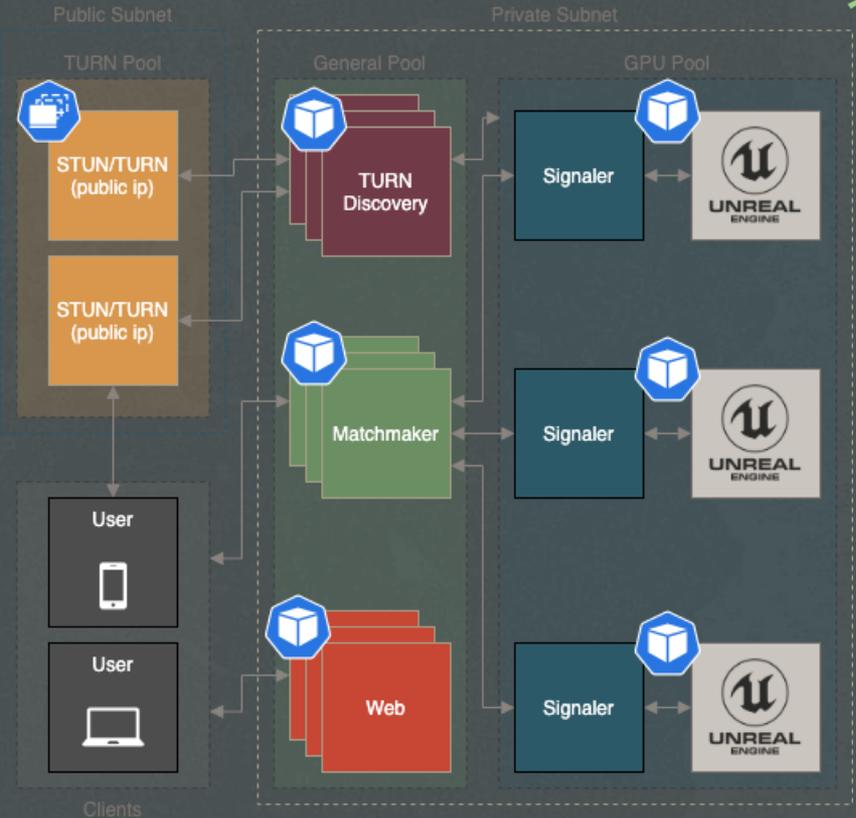
Read more:

- [Hosting Guide](#)

# Pixel Streaming Kubernetes Architecture

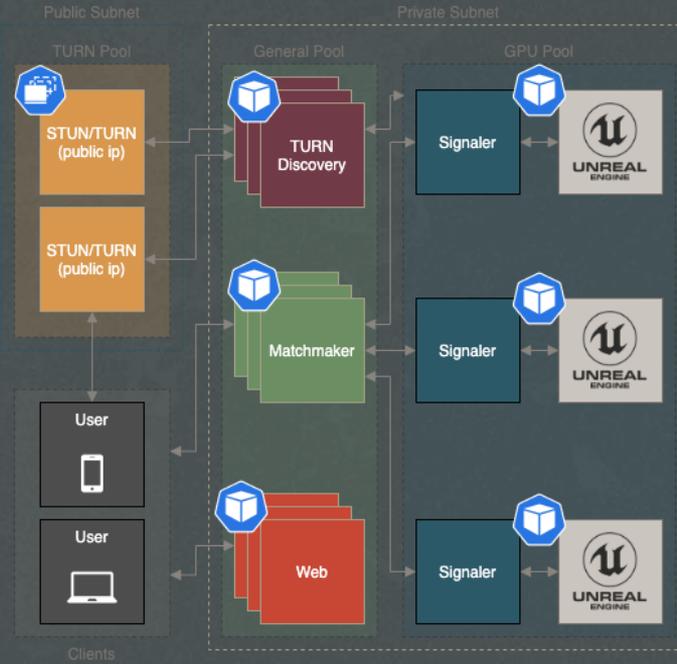
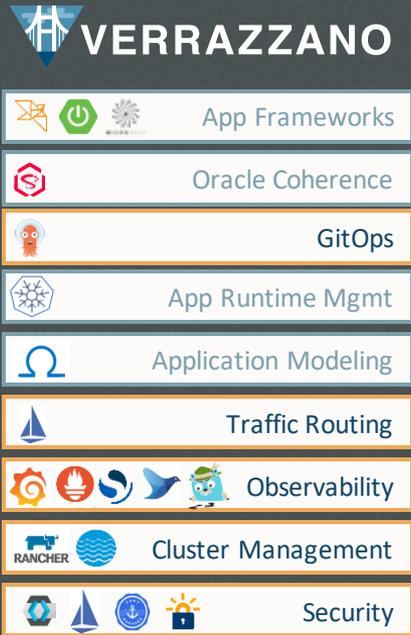
Extrapolating the microservices into Kubernetes involves a bit more work

- Dedicated STUN/TURN pool with host networking and coturn DaemonSet
- A TURN discovery/aggregator service
- Custom metrics and Prometheus Adapter
- Service Account RBAC for system heuristics
  - Node tainting
  - Node discovery
  - Pod deletion cost annotation\*



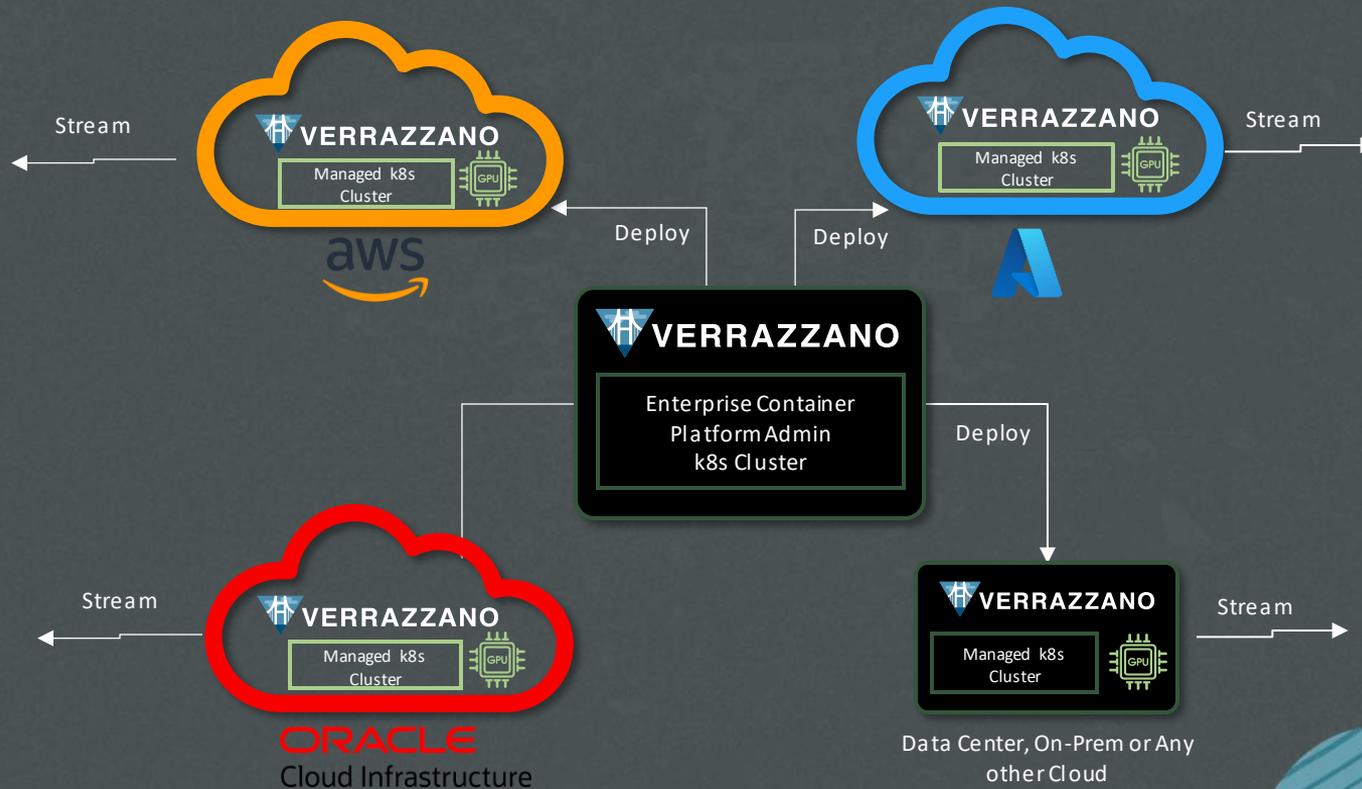
# Pixel Streaming Kubernetes Architecture

## Application Support and Observability

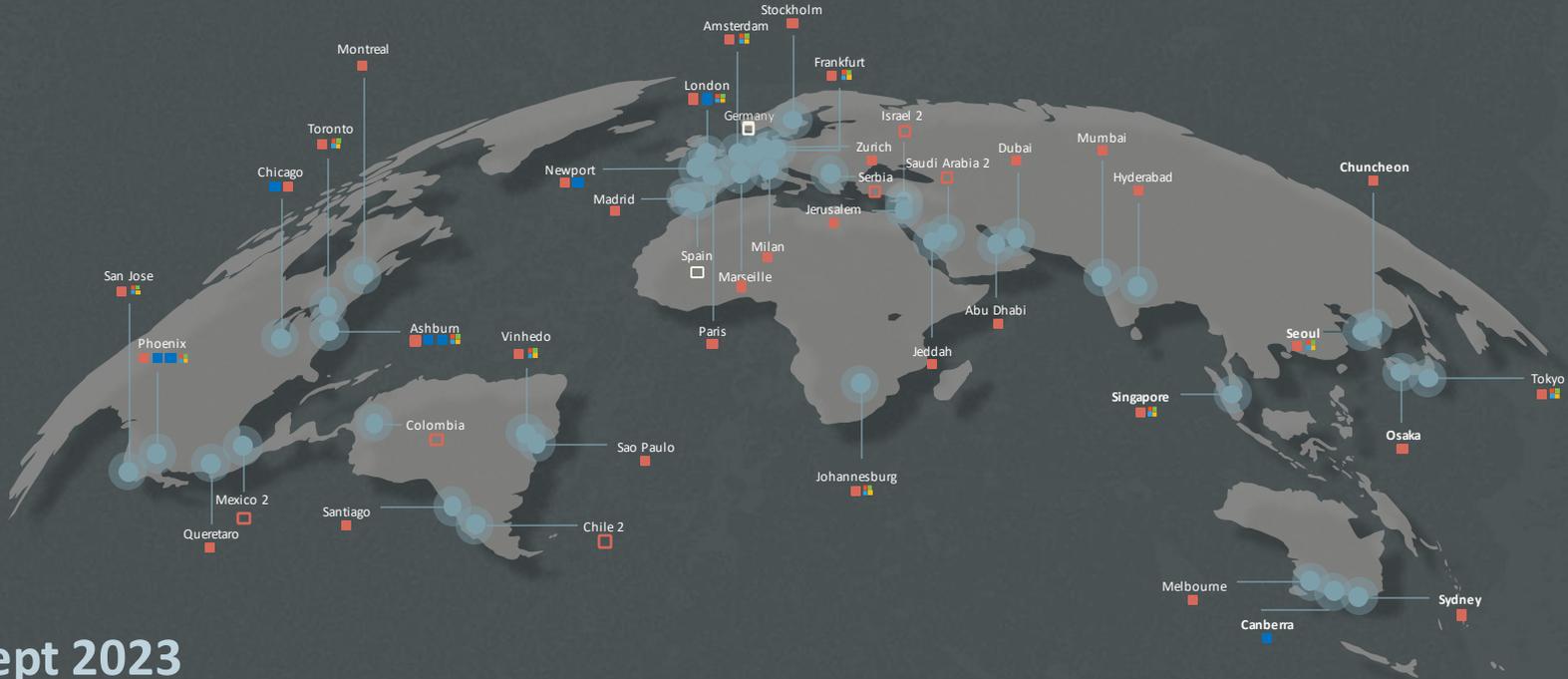


# Pixel Streaming Kubernetes Architecture

## Multi Cluster and Multi Cloud



# We've built our business for the cloud



Sept 2023

45 Oracle Cloud Regions + 7 planned

12 Interconnect for Azure regions

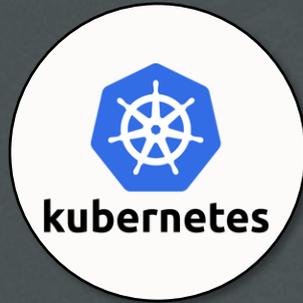


# Deployment

Deploying the infrastructure to OCI  
using Terraform



# Deploying the Solution



Manual



Fully Automated



# Demo



# Customer Use case

Using GPUs on the Cloud to Stream Virtual Worlds



# Oracle loves open source

Open source enables innovation, security, and flexibility for our customers

## Leading

 Java	 GraalVM.	 MySQL
 Linux	 helidon.io	 VERRAZZANO Enterprise Container Platform
 Oracle PaaS	 Coherence CE	 ORACLE JET
 TRUFFLE RUBY	 Tribuo	 ORACLE NoSQL Database

- 500+ projects
- Linux Kernel #1 contributor with 91K+ lines of code
- Leads development of globally strategic technologies
- Contributions from bug fixes to entire solutions

## Contributing to

 argo	 Cloud Custodian	 HYPERLEDGER
 fluentd	 Grafana	 Falco
 kafka	 KEYCLOAK	 HELM
 OpenSearch	 SPARK	 Terraform

- Packaged and deployable anywhere
- Certified & secure
- Open-source solutions as OCI services
- Any Open-source can run on OCI

## Participating in

 W3C	 THE APACHE SOFTWARE FOUNDATION	 CLOUD NATIVE COMPUTING FOUNDATION
 ECLIPSE FOUNDATION	 CSA cloud security alliance	 Java Community Process Executive Committee Member
 OPEN CONTAINER INITIATIVE	 ISO	 FinOps Foundation
 THE LINUX FOUNDATION	 PCI Security Standards Council	 ANSI

- Board member
- Sponsor
- Community advocacy

# Use the technologies, tools, and skills you already know

Managed open source services in OCI

 <b>kubernetes</b> MANAGED CONTAINERS	 <b>docker</b> CONTAINERS	 <b>Terraform</b> INFRASTRUCTURE AS CODE	 AUTONOMOUS LINUX
 <b>MySQL</b> DATABASE	 <b>hadoop</b> BIG DATA	 <b>SPARK</b> ANALYTICS ENGINE	 <b>redis</b> CACHING DATABASE
 <b>fluentd</b> DATA COLLECTION	 <b>cloudevents</b> EVENT DELIVERY	 <b>kafka</b> STREAMING	 DATABASE
 <b>fn</b> SERVERLESS PLATFORM	 <b>HYPERLEDGER FABRIC</b> BLOCKCHAIN PLATFORM	 <b>OpenSearch</b> SEARCH AND ANALYTICS	 <b>OPEN API INITIATIVE</b> INTERFACE DEFINITION

Run the technologies you already use

 Red Hat Oracle Linux Ubuntu CentOS Debian SUSE LINUX OS	 Microsoft WINDOWS SERVER OS	 vmware® VIRTUAL ENVIRONMENT
 <b>Java</b> PROGRAMMING LANGUAGE	 <b>OpenJDK</b> PROGRAMMING LANGUAGE	 <b>GraalVM</b> PROGRAMMING LANGUAGE
 <b>mongoDB</b> DATABASE	 <b>cassandra</b> NOSQL DATABASE	 <b>helidon.io</b> APPLICATION FRAMEWORK
 <b>HYPERLEDGER</b> APPLICATION FRAMEWORK	 <b>HYPERLEDGER</b> BLOCKCHAIN	 <b>PyTorch</b> MACHINE LEARNING FRAMEWORK

Native integrations with the dev tools you're used to

 GitHub DEV-OPS	 AUTOMATION
 DEV-SEC-OPS	 ANSIBLE AUTOMATION
 <b>kubernetes</b> CONTAINER MANAGEMENT	 <b>HELM</b> PACKAGE MANAGEMENT
 <b>Terraform</b> INFRASTRUCTURE AS CODE	 <b>ATLASSIAN</b> TEAM COLLABORATION
 RISK MANAGEMENT	



# Build and Deploy

<https://github.com/oracle-quickstart/oke-unreal-pixel-streaming>

The screenshot shows the GitHub repository page for `oracle-quickstart/oke-unreal-pixel-streaming`. The repository is public and has 6 watchers, 2 forks, and 4 stars. The main branch is `main` with 1 branch and 0 tags. The repository contains several files and folders, including `assets`, `deploy`, `src`, `.gitignore`, `CONTRIBUTING.md`, `LICENSE`, `README.md`, `THIRD_PARTY_LICENSES.txt`, and `docker-compose.yml`. The repository description is "Unreal Engine Pixel Streaming Quickstart on OKE". The repository is categorized under `streaming`, `gaming`, `pixel`, `unreal`, `unrealengine`, `oci`, `unreal-engine`, `epic`, `epic-games`, `oracle-cloud-infrastructure`, and `oke`. The repository is also categorized under `oracle-kubernetes-engine`. The repository has 4 stars, 6 watchers, and 2 forks. The repository is categorized under `streaming`, `gaming`, `pixel`, `unreal`, `unrealengine`, `oci`, `unreal-engine`, `epic`, `epic-games`, `oracle-cloud-infrastructure`, and `oke`. The repository is also categorized under `oracle-kubernetes-engine`. The repository has 4 stars, 6 watchers, and 2 forks. The repository is categorized under `streaming`, `gaming`, `pixel`, `unreal`, `unrealengine`, `oci`, `unreal-engine`, `epic`, `epic-games`, `oracle-cloud-infrastructure`, and `oke`. The repository is also categorized under `oracle-kubernetes-engine`. The repository has 4 stars, 6 watchers, and 2 forks.





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Thank you





# Session Survey

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