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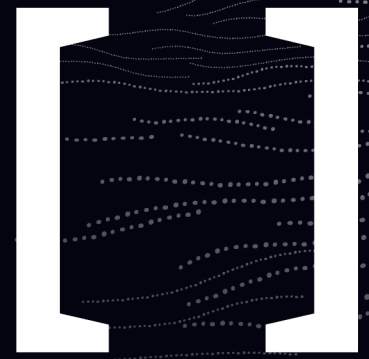

Deploying Unreal Pixel Streaming

on Kubernetes and creating your own virtual universe

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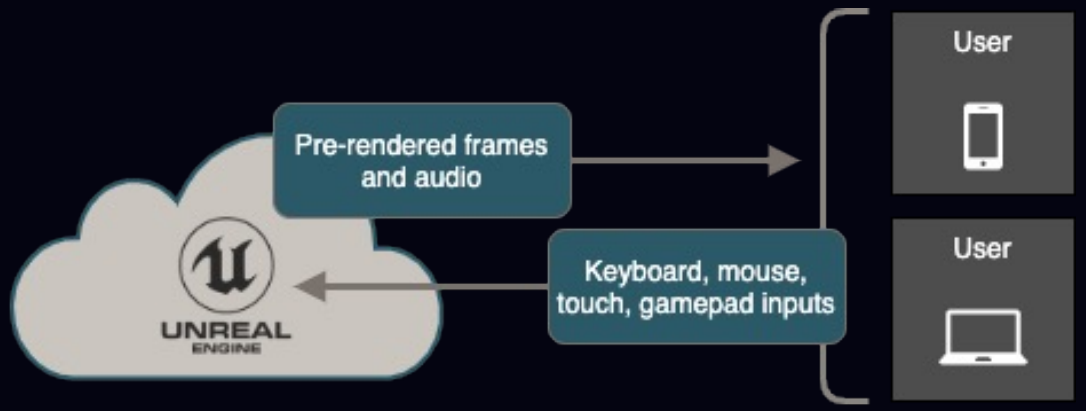
About Unreal Pixel Streaming

Unreal Engine applications in the cloud from Epic Games



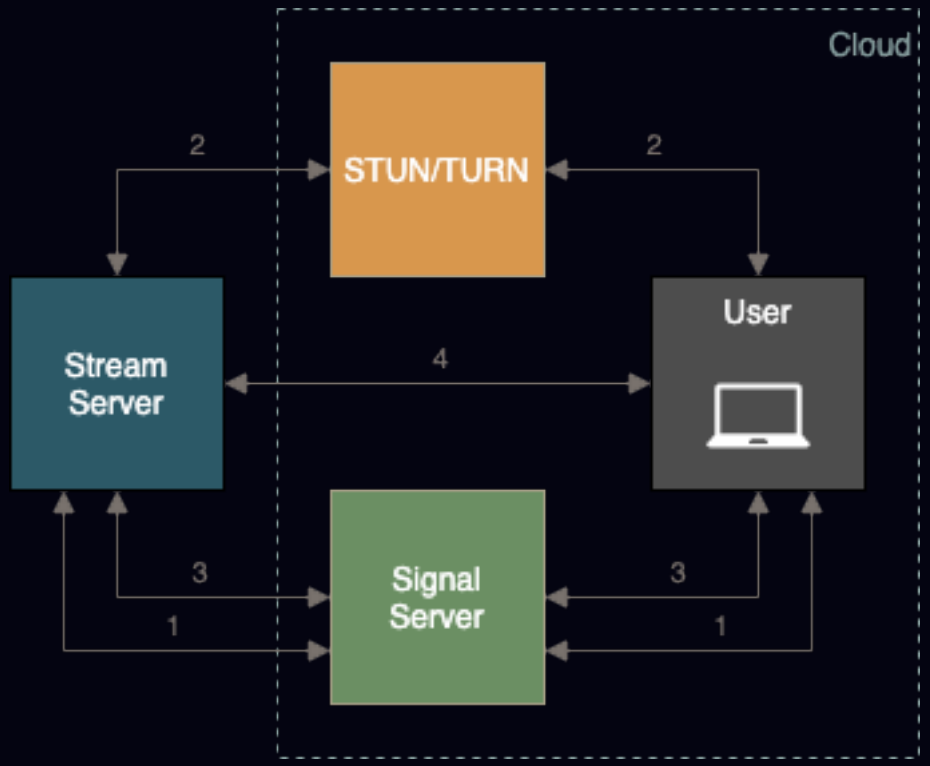
Read more:

- Pixel Streaming

- Unreal Engine is the most popular game development engine on the market
- Continuously encodes rendered output into a media stream, which passes through a lightweight stack of Web services.
- UX like watching a video stream from a media service, except:
  - The stream is playing back the rendered frames and audio generated by Unreal Engine in real time instead of a pre-recorded video clip.
  - Users can control the experience from their browsers, sending keyboard, mouse, and touch events, plus custom events emitted from the player Web page, back to the Unreal Engine.
- Uses the WebRTC peer-to-peer communication framework for the lowest possible latency between the user and the Unreal Engine application
- Avoids large executables and heavy device requirements

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.

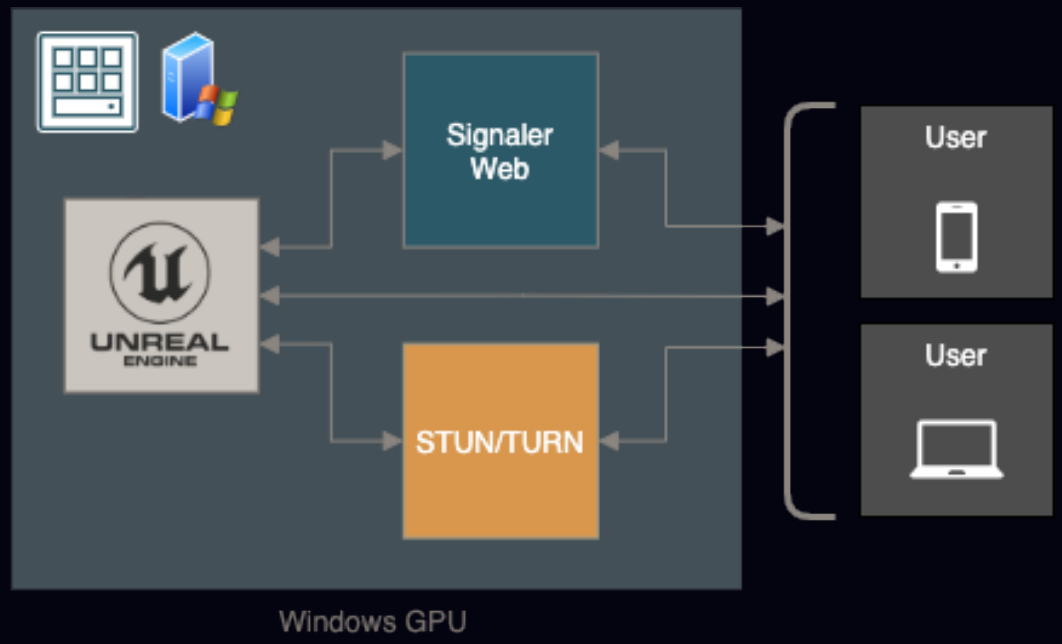
1. Peers register with a signaling server.
2. The network and firewall traversal methods are determined.
3. ICE candidates and session description are exchanged.
4. A peer-to-peer DTLS stream is established.

Read more:

- GCP WebRTC
- webrtc.org
- coturn repo

Pixel Streaming OOTB

Basic cloud solution (pre 4.27)

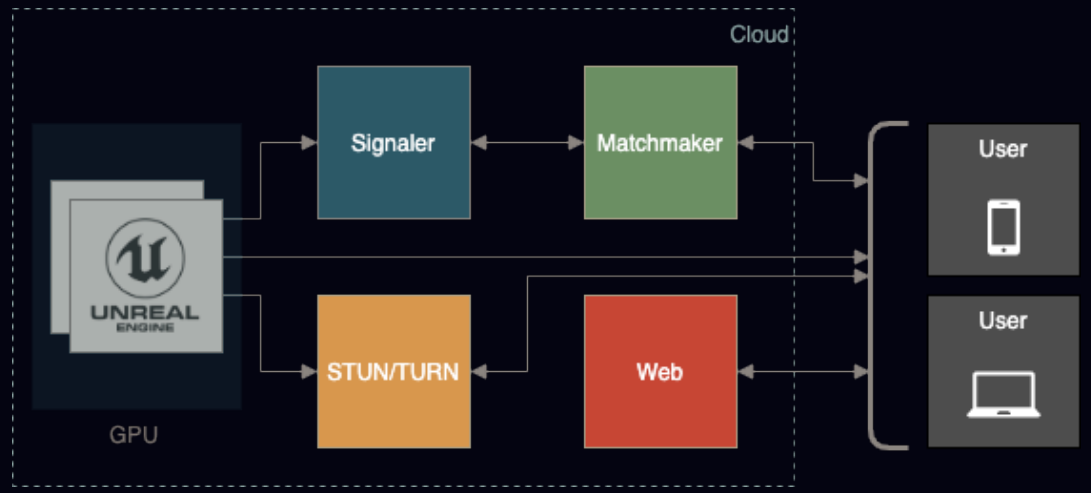


Unreal offers a sample runtime out of the box, with the basic WebRTC components. It is not practical for production for several reasons:

- 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 K8s Architecture

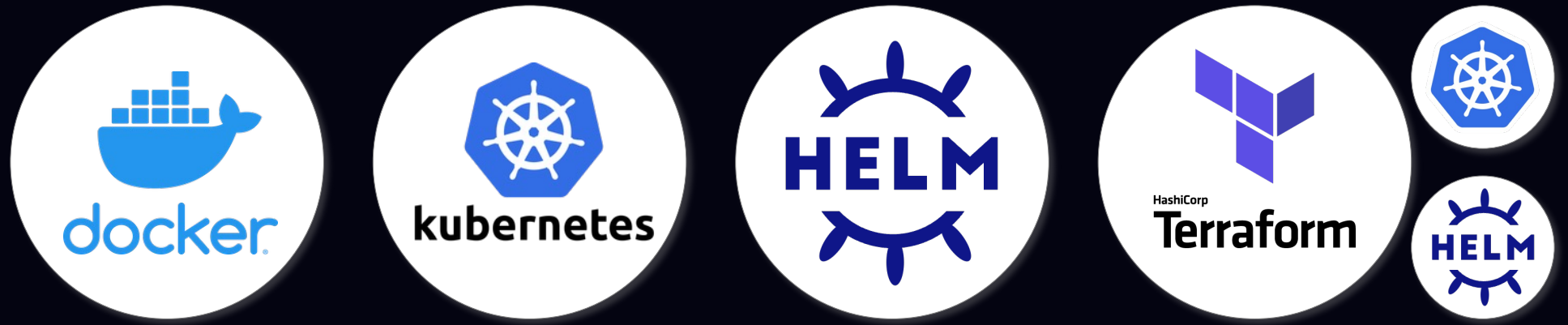
Extrapolating the microservices into Kubernetes involves a bit more work

- 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*

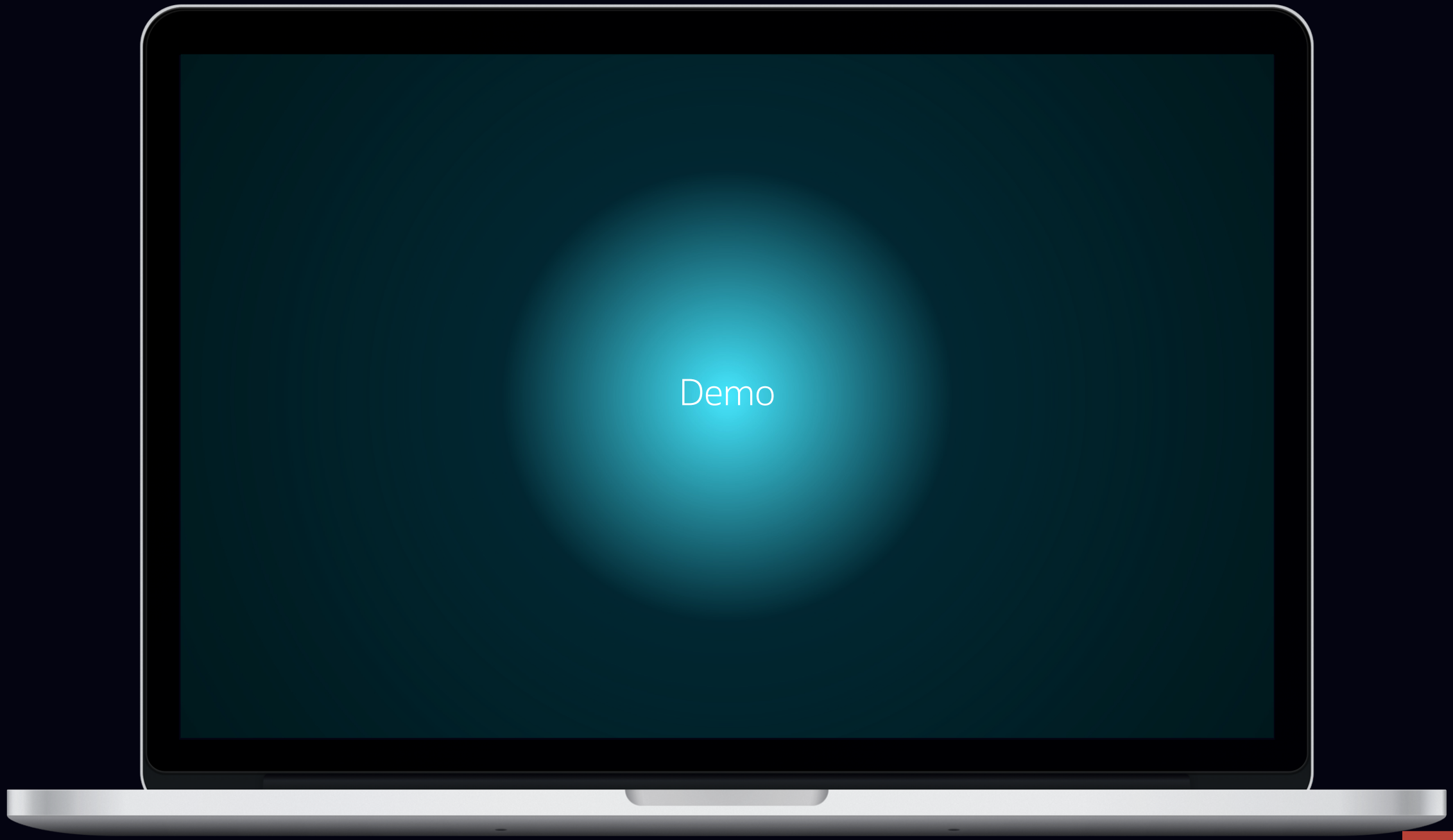
Minimum Kubernetes 1.22

Deployment

Deploying Solution



Manual ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▶ Fully Automated



Meet TensorWorks

Building comprehensive architecture for pixel streaming at scale

- TensorWorks founder Dr. Adam Rehn is the Epic Games (Unreal Engine) contributor of Linux/container support – among other things.
- Identified a skill gap between game development and cloud deployment and proposed the SPS project as a comprehensive solution.
- Broader use case considerations
  - Multipoint conferencing unit (MCU)
  - Selective forwarding unit (SFU)
  - WebRTC vs HLS vs DASH
- Solution is functional complete, with work underway for cloud provider marketplace offerings (AWS initial)

TensorWorks

Scalable Pixel Streaming
By TensorWorks

Admiral
By TensorWorks

- Has WIP Consortium proposal under Linux Foundation – Cloud Native Engine Consortium (CNEC)
  - AWS, Microsoft, Google listed as potential founding members. Oracle placeholder

References

Quickstart

- GitHub Repo:
  - https://github.com/oracle-quickstart/oke-unreal-pixel-streaming

Unreal

- Pixel Streaming:
  - https://docs.unrealengine.com/4.27/en-US/SharingAndReleasing/PixelStreaming/PixelStreamingOverview/

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