Pixel Streaming on the AWS Cloud

with Unreal Engine 4

Deployment Guide

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Overview

This AWS Sample deployment guide provides step-by-step instructions for deploying a Windows-based Unreal Engine 4 Pixel Streaming build on the AWS Cloud.

This sample is for those who use Unreal Engine 4 to build content and wish to deploy this content to an audience via UE4 pixel streams. Content examples include but are not limited to: interactive entertainment, architectural visualization, high fidelity car configurators, or anyone who needs to let users access high quality interactive content via thin clients such as web browsers.

Working with UE4 Pixel Streaming on AWS

Using AWS and Unreal Engine 4's Pixel Streaming solution, developers can create content with Unreal Engine and deploy on AWS so users can engage with the content from any modern Web browser. A build of the UE4 content is run on an Amazon Elastic Compute Cloud (Amazon EC2) G4 instance. G4 instances are GPU instances that are designed for graphics-intensive workloads and offer a powerful, low-cost, pay-as-you-go model which is ideal for on-demand interactive content.

This sample deployment sets up an EC2 environment on AWS that includes the following:

- **Unreal Engine 4 Pixel Streaming** components from your pixel streaming build are installed and run on startup. Components include UE4 Windows build with pixel streaming plug-in executable, Stun Server, Turn Server, and Signaling Web Server.
- **Nice DCV** is installed allowing developers to connect to the G4 instance, for a low latency remote desktop experience that supports resolutions up to 4k. This allows a developer to remote in to test the build and optionally install Unreal Engine 4 directly on the machine.

Costs and Licenses

You are responsible for the cost of the AWS services used while running this reference deployment.

The AWS CloudFormation template for this sample includes configuration parameters that you can customize. Some of these settings, such as instance type, will affect the cost of deployment. For cost estimates, see the pricing pages for each AWS service you will be using. Prices are subject to change.

Architecture

Deploying this sample for a new virtual private cloud (VPC) with **default parameters** builds the following EC2 workstation environment in the AWS Cloud.

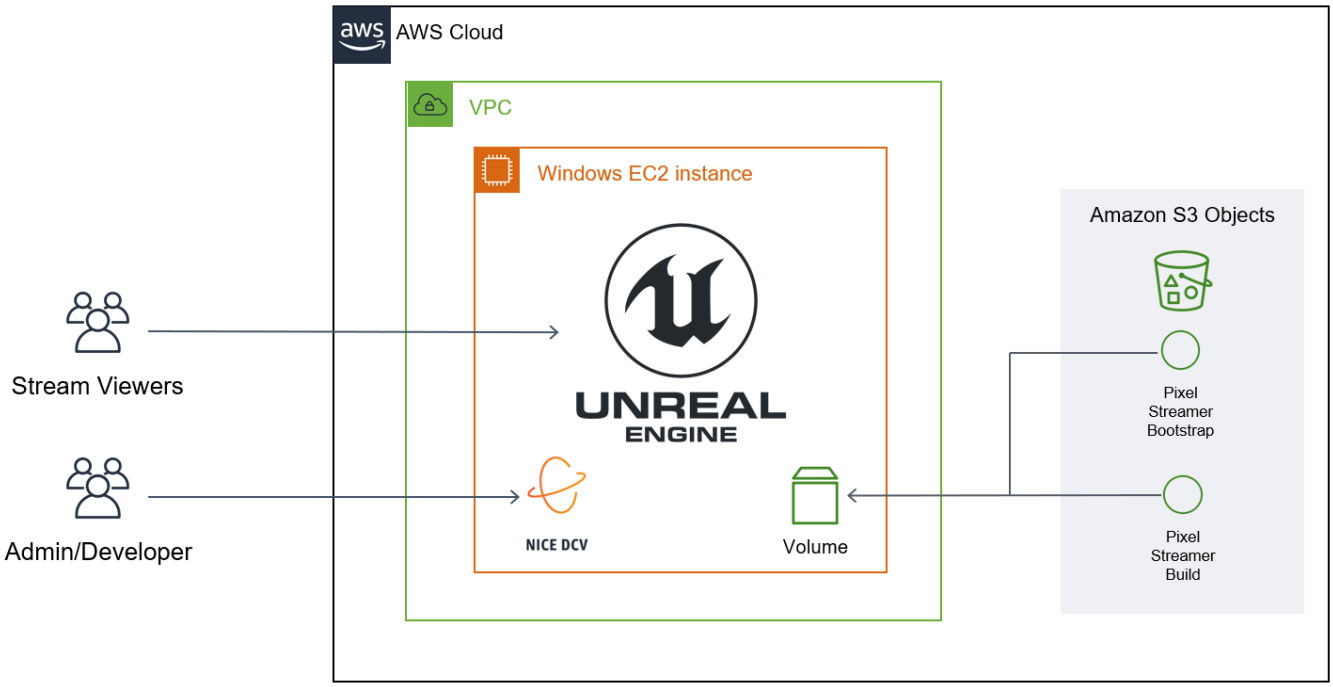


Figure 1: AWS Sample architecture for UE4 Pixel Streamer on AWS

The sample sets up the following:

- A Security Group which opens required ports for UE4 Pixel Streaming components and Nice DCV.

Planning the deployment

Specialized Knowledge

Before you deploy this sample, we recommend that you become familiar with the following AWS services and components. (If you are new to AWS, see Getting Started with AWS.)

- Amazon EC2
- Amazon EC2 G4 instance
- AWS Security Groups

We also recommend that you familiarize yourself with Getting Started with Pixel Streaming from Unreal Engine.

AWS account

If you don't already have an AWS account, create one at https://aws.amazon.com by following the on-screen instructions. Part of the sign-up process involves receiving a phone call and entering a PIN using the phone keypad.

Your AWS account is automatically signed up for all AWS services. You are charged only for the services you use.

Technical requirements

Before you launch the sample, your account must be configured as specified in the following table. Otherwise, deployment might fail.

Key pair	Ensure that at least one Amazon EC2 key pair exists in your AWS account in the Region where you plan to deploy the sample. Make note of the key pair name. You need it during deployment. To create a key pair, follow the instructions in the AWS documentation. For testing or proof-of-concept purposes, we recommend creating a new key pair instead of using one that's already being used by a production instance.
IAM permissions	Before launching the samplet, you must log in to the AWS Management Console with IAM permissions for the resources and actions the templates deploy. The *AdministratorAccess* managed policy within IAM provides sufficient permissions, although your organization may choose to use a custom policy with more restrictions.

Deployment Steps

Step 1. Prepare Your AWS Account

1. Sign in to your AWS account at https://aws.amazon.com with an IAM user role that has the necessary permissions.
2. Use the region selector in the navigation bar to choose the AWS Region where you want to deploy an EC2 workstation environment on AWS.

> **Important** This sample uses G4 instances, which aren't available in all AWS Regions. For more information, see the Amazon EC2 Pricing webpage, choose **Windows**, and check to make sure that the AWS Region you want to use for the deployment supports G4 instances.

3. Create a key pair in your preferred region if you have not done so already.

4. If necessary, request a service limit increase for the Amazon EC2 G4 instance type. You might need to do this if you already have an existing deployment that uses this instance type, and you think you might exceed the default limit with this reference deployment.

Step 2. Create UE4 Pixel Streaming Build

This guide only covers steps to use Unreal Engine 4 to export a Pixel Streaming build to deploy onto AWS, and assumes content has already been built.

1. Review Pixel Streaming Overview documentation on Unreal Engine website, which describes the technology used and connection process.
2. Follow the Getting started with Pixel Streaming documentation to enable Pixel Streaming in your project, build your WindowsNoEditor build, and test your Pixel Streaming server locally.
3. If you are running a version of Unreal Engine before version 4.26 you will need to modify a Windows PowerShell script for Windows Server compatibility:
    a. Open file: Engine\Source\Programs\PixelStreaming\WebServers\SignallingWebServer\Start_AWS_WithTURN_SignallingServer.ps1
    b. Look for "$PublicIp = Invoke-WebRequest" line and add an additional parameter "-UseBasicParsing". An example of this modified line is: $PublicIp = Invoke-WebRequest -Uri "http://169.254.169.254/latest/meta-data/public-ipv4" -UseBasicParsing
4. Compress the WindowsNoEditor folder into a zip file by right clicking on the folder and creating the zip file. Note the zip should extract the contents into a WindowsNoEditor folder.

Step 3. Upload Required Files to S3

There are three files needed for this solution which need to be accessible via a http URL from the account you will be running the Pixel Streamer in. You can get the first two from the AWS Samples AWS Sample's GitHub repository, the third is the zip file created in Step 2 above.

- UE4-Pixel-Streamer.json – This is the CloudFormation JSON template used to create the stack. This file must be uploaded to S3.
- UE4-Pixel-Streamer-Bootstrap.ps1 – This is the PowerShell script executed once the server has been launched to setup the Pixel Streamer.

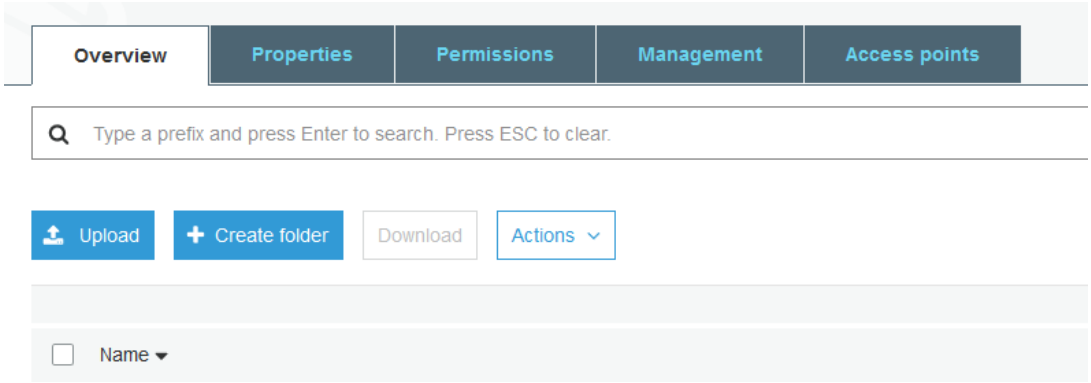
- Zip File – This is the zip file created in step 2, and can be named to identify the build you are using.

Follow the steps below to upload these files:

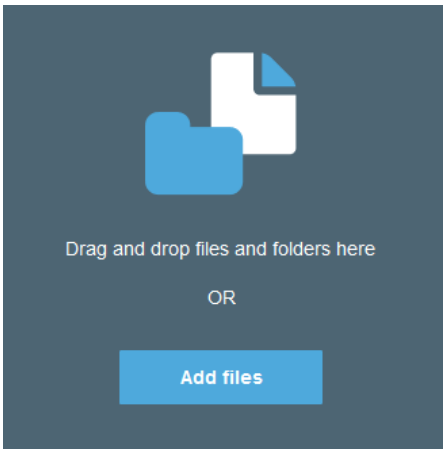
1. Clone the GitHub repository or download the JSON template file and the bootstrap file. You will then upload those two files along with the build zip file following these steps:
    a. From the AWS Services choose **Storage & Content Delivery**, then **S3** to open the Amazon S3 console.
    b. From the Amazon S3 console dashboard, choose **Create Bucket**.
    c. In Create a Bucket, type a bucket name in Bucket Name. Choose a Region then click **Create**.

> **Important** The bucket name you choose must be globally unique across all existing bucket names in Amazon S3 (that is, across all AWS customers). For more information, see Bucket Restrictions and Limitations.

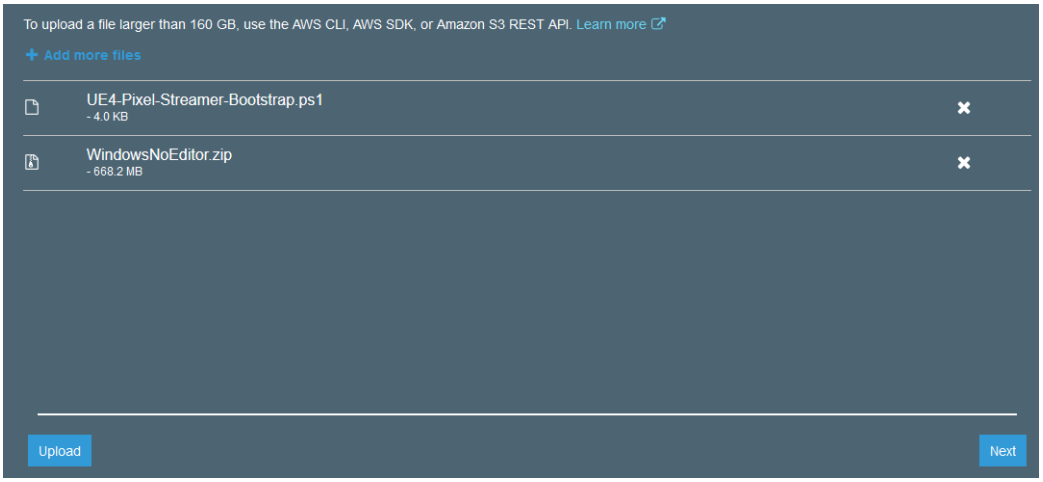
    d. Once at the S3 Bucket page, select the **Upload Button.**



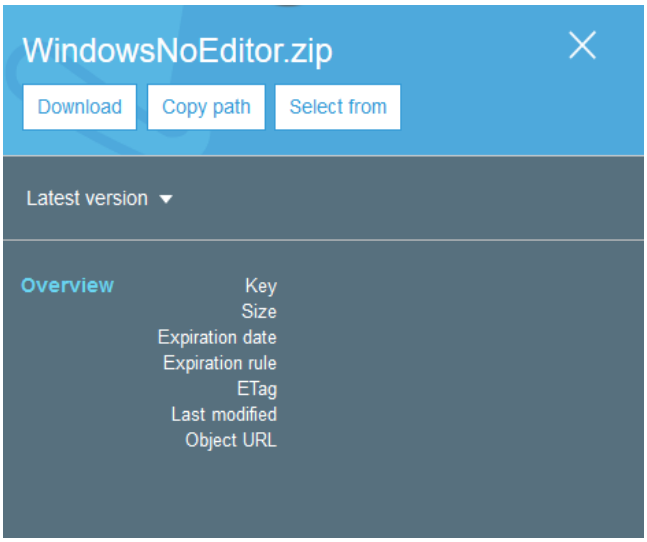
    e. Click on the **Add Files** button and select the files that you want to upload to the S3 Bucket.



f. Once the files have been selected, click **Upload** button.



2. Save the path to your files for future reference by clicking on each file in the S3 bucket and copying the Object URL link in the Overview section. Example path "https://s3-bucket-name.s3-us-west-2.amazonaws.com/Folder/ /WindowsNoEditor.zip"



Step 4. Launch the AWS Sample

> **Note** You are responsible for the cost of the AWS services used while running this sample reference deployment. For full details, see the pricing pages for each AWS service you will be using for this deployment.

1. Navigate to AWS CloudFormation by selecting Services from the top menu and clicking on CloudFormation.
2. Check the region that's displayed in the upper-right corner of the navigation bar and change it if necessary. This is where the network infrastructure for the UE4 Pixel Streaming environment will be built.

> **Important** This sample uses G4 instances, which aren't available in all AWS Regions. For more information, see the Amazon EC2 Pricing webpage, choose **Windows,** and check to make sure that the AWS Region you want to use for the deployment supports G4 instances.

3. Click the "Create stack" button either in the top right or middle of your screen. AWS CloudFormation template into your AWS account. Each deployment will take about 10 minutes to complete.

4. On the **Create Stack** page, paste in the URL for your JSON template file, and choose **Next**.
5. On the **Specify stack details** page, give the stack a name. You will need to assign a Key Pair and location for the build zip file. The bootstrap file is provided to you via GitHub, however you will need to put the path to the build zip file in the build

parameter. For all other parameters, review the default settings and customize them as necessary. When you finish reviewing and customizing the parameters, choose **Next**.

In the following table, parameters are listed by category.

CloudFormation Template Parameters:

Parameter label (name)	Default	Description
Host Operating System (OsVersion)	*Windows Server 2019*	Specify the version of Windows(Windows Server 2019) OS to use. Valid values are "WindowsServer2019", "WindowsServer2016", or "WindowsServer2012R2".
Credentials (UserPasswd)	*Ch4ng3M3!*	Windows Administrator password used for logging into EC2 via Nice DCV or other administration.
Host Instance Type (InstanceType)	g4dn.4xlarge	Amazon EC2 instance type for the pixel streaming server. Size should be smallest instance size that achieves required performance.
EBS Volume size for EC2 instance (DiskSize)	30	Volume size for the host, in GB.
Key Pair Name (KeyPairName)	*Requires input*	Name of AWS EC2 Key Pair. This is not used when logging into machine, but needed to secure instance on VPC.
Pixel Streamer Bootstrap Location (PixelStreamerBootstrapLocation)	*Requires input*	Specify the location of bootstrap file in S3 which is executed upon initial launch of EC2 instance which configures firewall rules and adds startup tasks needed to run UE4 Pixel Streamer. AWS developed bootstrap can be used, or customized as needed.
UE4 Pixel Streamer Build (PixelStreamerBuildLocation)	*Requires input*	Specify the location of UE4 Pixel Streamer build zip file in S3. Build file was created in Step 2 of this guide following UE4 Getting Started with Pixel Streaming documentation.
Pixel Streamer Access CIDR (PixelStreamingAccessCIDR)	0.0.0.0/0	IP address range, as an access CIDR, of pixel stream viewers.
Nice DCV Access CIDR (NiceDCVAccessCIDR)	0.0.0.0/0	IP address range, as an access CIDR, of admins and developers to access server via Nice DCV.

6. On the options page, you can specify tags (key-value pairs) for resources in your stack and set advanced options. When you're done, choose **Next**.
7. On the **Review** page, review and confirm the template settings. Under **Capabilities**, select the check boxe to acknowledge that the template creates IAM resources.
8. Choose **Create stack** to deploy the stack.
9. Monitor the status of the stack. When the status is **CREATE_COMPLETE**, the UE4 Pixel Streaming stack is ready.

10. Use the URL or IP address displayed in the **Outputs** tab for the stack, as shown in Figure 2, to view the resources that were created. You can also manage the EC2 directly from the Instance Id.

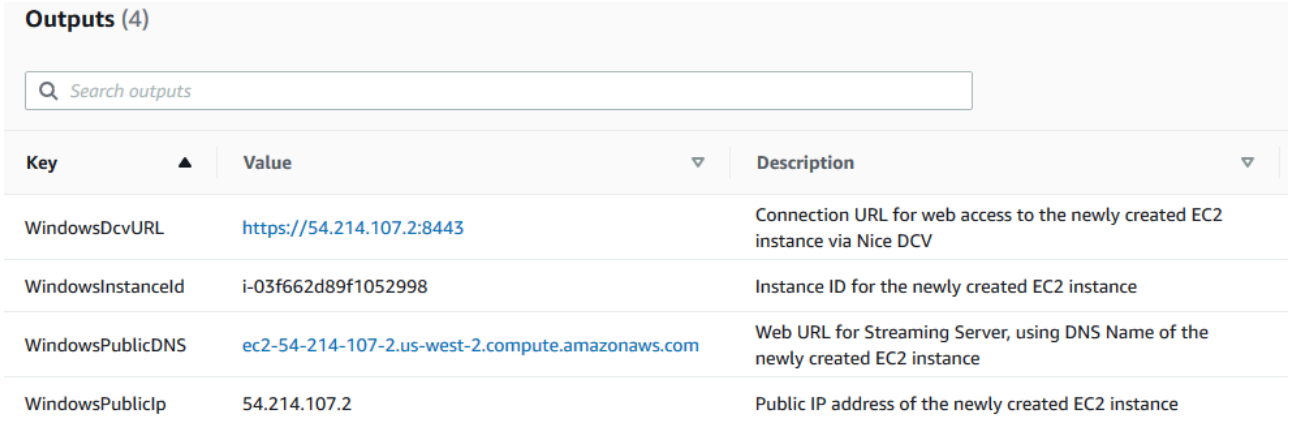


Figure 2: CloudFormation Sample Outputs Tab

Step 5. Test Pixel Streaming Instance.

In the Outputs tab click on WindowsPublicDNS value in a new tab to create a session on your UE4 Pixel Streaming server. You can use either the WindowsPublicIp or URL from the outputs tab to create sessions with the Pixel Streaming server.

Step 5a. Optionally Install Nice DCV for Remote Desktop Access

In order to connect to your instance, you'll need to download and install the Nice DCV client software to your local computer.

1. To connect to your session, you can use either an HTML5 compatible web-browser using the WindowsDcvURL in the outputs tab or download the native client application from the DCV download page to connect.
2. When using the Nice DCV client, enter the IP address of the server and click Connect.
3. DCV is set up with a self-signed certificate. You have to trust this certificate on your preferred browser in order to proceed to the login form.
4. To access the instance, you use the username "Administrator" with the password you provided as a parameter on the CloudFormation template.

Security

There are several security-related aspects of the architecture in this sample. The solution is deployed into the default VPC. It creates a security group that allows fine-grained control of traffic in and out of the EC2 hosting the Pixel Streaming server.

You can limit access to IP addresses that need to access the host by changing the access CIDR properties from their defaults. NiceDCVAccessCIDR will limit IP addresses that can access the remote desktop via Nice DCV, and PixelStreamingAccessCIDR will limit the IP addresses of viewers who can access the streaming server. It is recommended that you limit Nice DCV access as much as possible, and open the pixel streaming CIDER to IPs for your viewers. (This helps keep the host protected from malicious attacks and helps protect the data (UE4 Pixel Streaming build, in this case).

Troubleshooting

Q. My CloudFormation stack has been stuck on 'WindowsInstanceWaitCondition' with a status of 'CREATE_IN_PROGRESS' for more than 10 minutes or longer then fails. What went wrong?

A. This typically means that the Windows instance failed to reboot after the bootstrap was executed. If the stack is still running after 10 minutes attempt to connect to the server IP address in a web browser. If it succeeds, go into the EC2 console and manually reboot the instance.

Q. When I go to connect to the streaming server via a browser, I click on the play button but no content loads. What might be happening?

A. This can be caused by a local VPN blocking the direct connection to the streaming server from your computer. Disable VPN or firewalls and check or connect from a different machine.

Q. I encountered a CREATE_FAILED error when I launched the CloudFormation stack.

A. If AWS CloudFormation fails to create the stack, we recommend that you relaunch the template with **Rollback on failure** set to **No**. (This setting is under **Advanced** in the AWS CloudFormation console, **Options** page.) With this setting, the stack's state will be retained and the instance will be left running, so you can troubleshoot the issue. You may be able to connect to the instance with Nice DCV, and if not then Microsoft Remote Desktop. (Look at the log files in `%ProgramFiles%\Amazon\EC2ConfigService` and `C:\cfn\log`.)

> **Important** When you set **Rollback on failure** to **No**, you'll continue to incur AWS charges for this stack. Please make sure to delete the stack when you've finished troubleshooting.

For additional information, see Troubleshooting AWS CloudFormation on the AWS website.

Additional Resources

AWS services

- Amazon EC2
  https://docs.aws.amazon.com/AWSEC2/latest/WindowsGuide/
- AWS CloudFormation
  https://aws.amazon.com/documentation/cloudformation/

Unreal Engine documentation

- UE4 Pixel Streaming Documentation
  https://docs.unrealengine.com/en-US/Platforms/PixelStreaming/index.html

Document Revisions

Date	Change	In sections
August 2020	Initial publication	—

Notices

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