Adaptive Graphics

A cross-platform Unity 3D Asset by Grig Bilham

Summary

AdaptiveGraphics consists of a camera component, custom editor interface and shaders that improve performance of Unity 3D apps.

The technique used by AdaptiveGraphics works in two steps:

1. Makes the camera render to an off-screen surface with reduced resolution which makes the render faster and also reduces any post-image effects time.
2. Upscales the rendered frame to window size, optionally applying MSAA antialiasing + a custom fast sharpen algorithm, which reduces blur and improves result vs a normal upscale operation.

Features

AdaptiveGraphics also controls pixel light count and quality of shadows per light in the scene depending on current FPS. It will reduce/restore pixel light count as well as reduce or disable shadows if FPS can't be achieved. These options can be enabled/disabled in the AdaptiveGraphics component.

AdaptiveGraphics allows you to choose the proper balance between performance and image quality, providing full control regarding the FPS and quality range.

With AdaptiveGraphics, devices that currently can't tackle your rendering stack or post-processing image effects, will downgrade gracefully, while powerful systems are still allowed to run all the extras.

Quick Start

To use AdaptiveGraphics:

1. Import the AdaptiveGraphics package into your project.
2. Select your main camera and select Component => Rendering => AdaptiveGraphics from the component menu.

Suggested Usage

AdaptiveGraphics is aimed mainly at mobile and HDPI screens (high dot-per-inch screens).

It's important to test the effect of AdaptiveGraphics on the mobile device itself, since usual monitors don't have such DPI and the quality reduction will be more noticeable on the big screens than on mobile.

AdaptiveGraphics addresses less powerful devices and makes products available to more players. With adaptive downsampling, if the device is powerful enough and your FPS requirements are met, AdaptiveGraphics won't affect the image quality of your game.

Downsampling Algorithms

Adaptive Downsampling

Works like Quad Downsampling but you can choose the desired FPS and a quality range and AdaptiveGraphics will dynamically use different off-screen resolutions to match the best FPS according to the quality range specified.

Horizontal Downsampling

This reduction is always applied regardless of the current FPS.

The resolution reduction is applied horizontally. For example, if you choose a 0.5 quality factor, the resolution will be Screen Width / 2 x Screen Height. After rendering the frame, it will be upscaled to full screen resolution. You can choose different ratios, for example, a 0.75 will just reduce the image size by a quarter.

Quad Downsampling

 This reduction is always applied regardless of the current FPS.

The resolution reduction is applied horizontally and vertically. For example, if you choose a 0.5 quality factor, the resolution will be Screen Width / 2 x Screen Height / 2 (remember that after rendering the frame, it will be upscaled to full screen resolution).

Component Parameters

General Settings

Method

Choose one of the three operation modes as described in the *AdaptiveGraphics Algorithms* section above.

Minimum FPS

Your desired target FPS. If current FPS are greater than this value, no image reduction will be applied, ie. AdaptiveGraphics won't affect your image.

Nice FPS

If FPS exceeds this value, AdaptiveGraphics will temporarily be disabled so it does not affect at all to your game performance. For example, if your game already runs on 60 fps, AdaptiveGraphics should not execute. However if FPS drops below this value, AdaptiveGraphics will reactivate automatically.

Quality Management Settings

Adapt Speed Up

In adaptive downsampling, this parameter controls the speed of change between different image quality (ie. image resolution). When FPS drops, AdaptiveGraphics will reduce the image quality in 10%. When FPS increase, AdaptiveGraphics will increase the image quality in 10%. This parameter controls the speed of quality increase, when FPS are above the Minimum FPS parameter. If you want AdaptiveGraphics to increase quality as soon as possible increase this value.

Adapt Speed Down

Controls the speed of quality decrease, which occurs when FPS are below the Minimum FPS parameter.

Minimum Quality

This setting allows you to decide the minimum image resolution that you can afford to use in exchange for the extra FPS. This setting puts you in control of the impact of AdaptiveGraphics in the resulting image quality. You can choose a high value and the image quality won't be much affected, but the gain in FPS will be less. Experiment with different values always on the mobile device itself, never on screen!

Static Camera Quality

This setting is similar to minimum quality and will be used instead when the camera is not moving or rotating. You may set this value equal than the minimum quality parameter or increase it a little bit, so when the player is static in the scene, the image quality can get a little better. It's known that when you need "action", you will want the best FPS but if there's no "action" you will want the best image quality for the best viewing experience – this setting allows you to control that situation.

Reduce Pixel Count

This setting will reduce pixel count in the scene until 1 if desired minimum FPS is not achieved. It will revert back to original value as soon as minimum FPS is obtained.

Manage Shadows

AdaptiveGraphics will monitor all lights in the scene and will switch the quality of its shadows, from soft to hard shadows or even disabling shadows. The control is done per light depending on current FPS goal.

Rendering Settings

Filtering

Specifies the sampling filter used when upscaling the frame, either nearest neighbour (faster, pixelates) or bilinear (smoother, blurs).

Antialias

This slider controls the MSAA quality level. Setting this slider to 2 or more will enable antialias and will dramatically improve the result.

Clear Flags

The clear flags for the AdaptiveGraphics camera. By default it's set to Nothing, but if you experience ghosting artifacts set this to Color or Solid Color-

Render Method

Choose a final compositing method. By default it uses "Simple" option. If you experience problems with this value, try "Second Camera Billboard World Space" option.

Simple Method

Reuses the same camera to draw the upscaled frame. Can cause issues with GUI element scaling (if you use GUI methods on this camera).

Second Camera Billboard World Space

Uses a second camera to draw the upscale frame inside a world space quad.

Second Camera Billboard Overlay

Uses a second camera to draw the upscale frame as an overlay texture.

Second Camera Blit

Uses a second camera and a post-effect to upscale the frame optionally adding a sharpening pass. Can be slower on older devices.

Sharpen Image

Optionally sharpen the upscaled image which brings more details to the resulting image (only available with Second Camera Blit).

Prewarm

Forces AdaptiveGraphics to create the offscreen render buffers during startup, instead of creating them on-demand. Most of the time you won't notice any difference although checking it should reduce any hiccup when changing resolution in Adaptive Downsampling mode on some devices.

Important Considerations

Always control the minimum quality factor

For example, if you want to maximize quality vs FPS, you can set a quality factor high, like 0.7 or 0.8 – or if you want to ensure the best smooth experience in your game in terms of FPS in exchange for quality you could reduce the minimum quality to 0.5 or even 0.3.

"No Rendering Cameras"

You may see a "No Rendering Cameras" message when AdaptiveGraphics is enabled but the option "Simple" is selected. This is normal behaviour. The reason is that the camera is being rendered to a off-screen buffer and blit to the screen directly. Unity 5.4 thinks there are no cameras working but still you can see the image.

Test Your Targets

Remember to test your settings on the real mobile device!