EGL External Platform management and Wayland implementation as external platform

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OUTLINE

EGL External platform API

- Motivation
- Overview & Structure
- Interactions with libEGL

A practical use case: Wayland

Conclusions

EGL EXTERNAL PLATFORM API

MOTIVATION

Decouple platform drivers from EGL drivers such that anyone writing a new window system can add a platform driver to integrate with existing EGL hardware drivers.

No vendor agreement required to support not-well-established window systems.

Platform code can be **open source** even if EGL drivers are not (less closed source is a win).

One **common platform implementation** improves consistency.

OVERVIEW

Specification of an API for writing EGL platforms and their interactions with modern window systems.

External platforms use application-facing EGL functions…

…leveraging config selection, context creation, and rendering support from lower-level EGL platform implementations (e.g. GBM, EGLDevice), …

…or even other external platforms (e.g. X11, Wayland, Android).

STRUCTURE

EGL implementation → EGL external platform APIs:

- Pure EGL hooks
- Derivatives of EGL functions
- External object validation functions
- Handle translation

EGL external platform → EGL implementation APIs:

- Callbacks

STRUCTURE

Pure EGL hooks

Direct replacement of application-facing EGL functions for resource management.

Examples:

- **eglGetPlatformDisplay()**
- **eglCreatePlatformWindowSurface()**
- **eglSwapBuffers()**

STRUCTURE

Derivatives of EGL functions

Replace sub-parts of application-facing EGL functions.

An example of these is **queryString()** which takes custom ‘name’ tokens to retrieve, for instance, sub-strings of the extensions string.

The external platform manager can use each platform’s extension sub-string to compose the full string provided to applications.

STRUCTURE

External object validation functions

Functions such as **eglGetDisplay(<native_dpy>)**, **eglCreateImage(EGL_WAYLAND_BUFFER_WL)**, or **eglCreateStreamAttrib(EGL_WAYLAND_EGLSTREAM_WL)** require helper functions to determine what external platform should handle those calls.

Examples:

- **isValidNativeDisplay(<native_dpy>)**
- **areStreamAttribsExternal(<attribs>)**

STRUCTURE

External to Internal object translation

Non-externally implemented EGL functions will only understand internal EGL handles.

The external API defines the **getInternalHandle()** function so the internal EGL handle of an EGL external resource can be retrieved and passed along to internal functions.

STRUCTURE

Callbacks

For those operations requiring non-application-facing EGL paths to work, EGL implementations are allowed to register callbacks with the external platform implementations.

An example of these is **setting EGL error codes** to be queried by the application in case of failure in the external platform code.

By calling into **registerCallback(EXTERNAL_CALLBACK_SET_ERROR)**, an EGL implementation will let the external platform know the function to be called to set EGL error codes.

INTERACTIONS WITH LIBEGL

Discovery & Registration of EGL External platforms

Discovery and registration of available EGL external platforms is libEGL's responsibility.

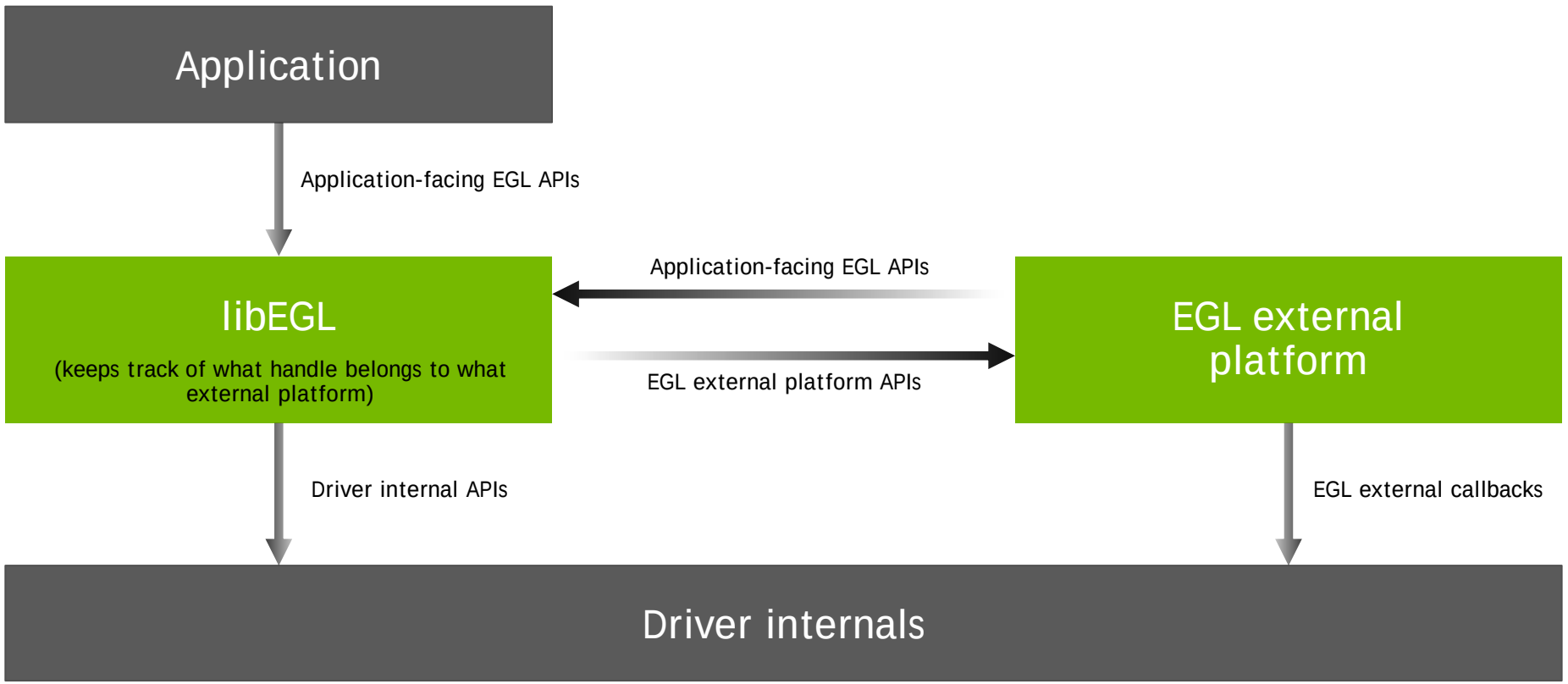
A portable and fully configurable discovery mechanism is advisable (e.g. JSON loader).

loadExternalPlatform(<major>,<minor>) function:

- Initial libEGL→ EGL external platform interaction
- Fills an EGL external platform exports table
- Lets libEGL select what API version to use

INTERACTIONS WITH LIBEGL

EGL calls dispatch



A PRACTICAL USE CASE: WAYLAND

WAYLAND EXTERNAL PLATFORM

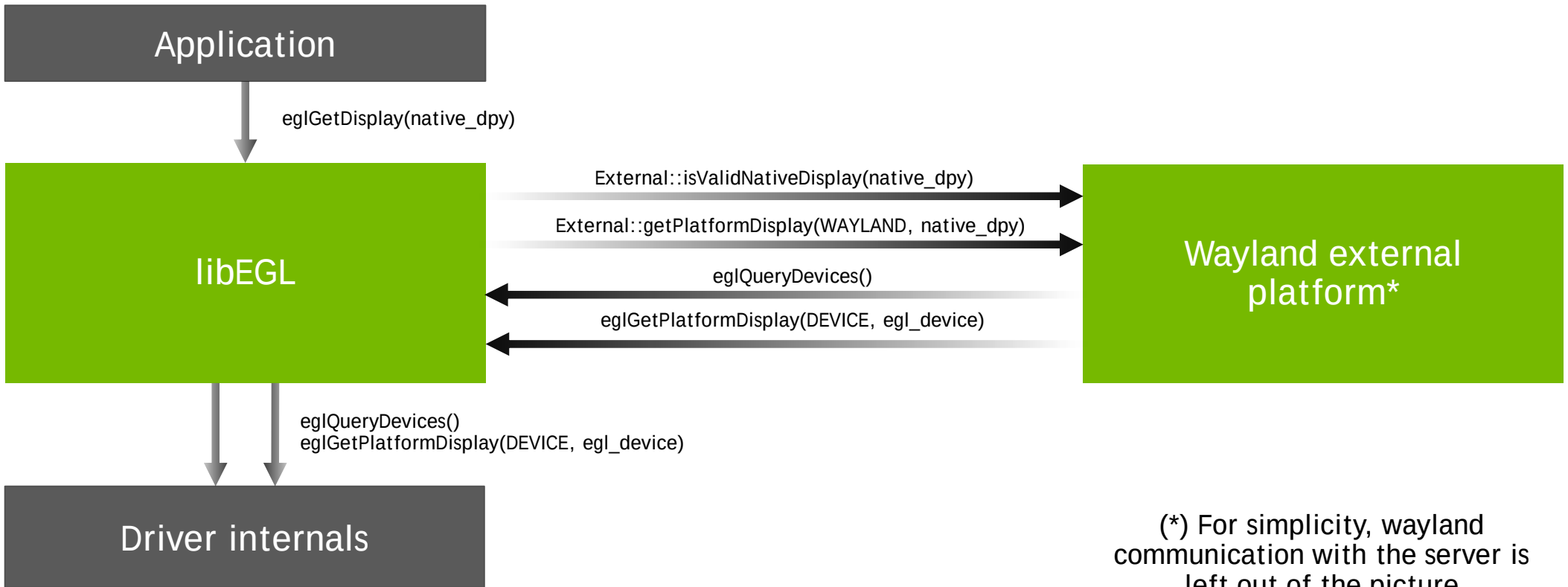
NVIDIA's Wayland platform is implemented on top of the EGLDevice and EGLStream families of extensions.

The simplest application work flow looks like:

Let's see how the three functions above are implemented in the Wayland external platform and backed by EGLDevice and EGLStream operations.

WAYLAND EXTERNAL PLATFORM

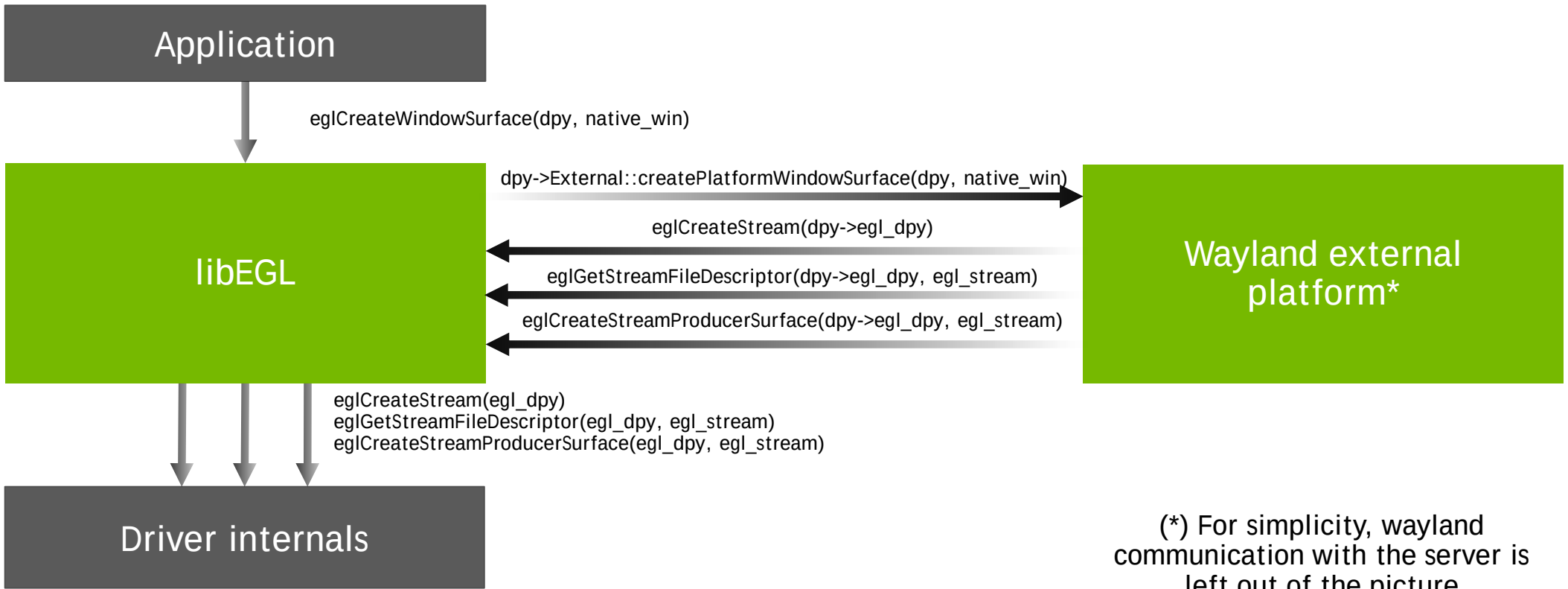
eglGetDisplay()



(*) For simplicity, wayland communication with the server is left out of the picture

WAYLAND EXTERNAL PLATFORM

eglCreateWindowSurface()



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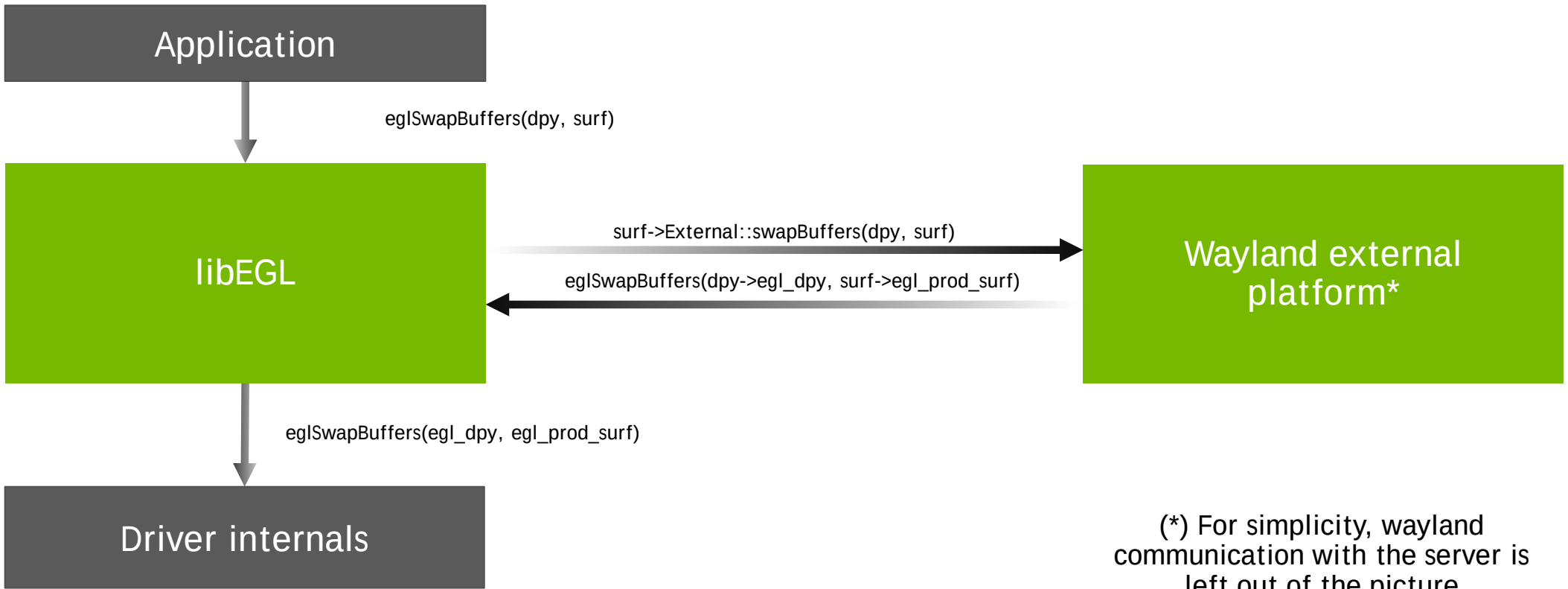
WAYLAND EXTERNAL PLATFORM

eglSwapBuffers()



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CONCLUSIONS

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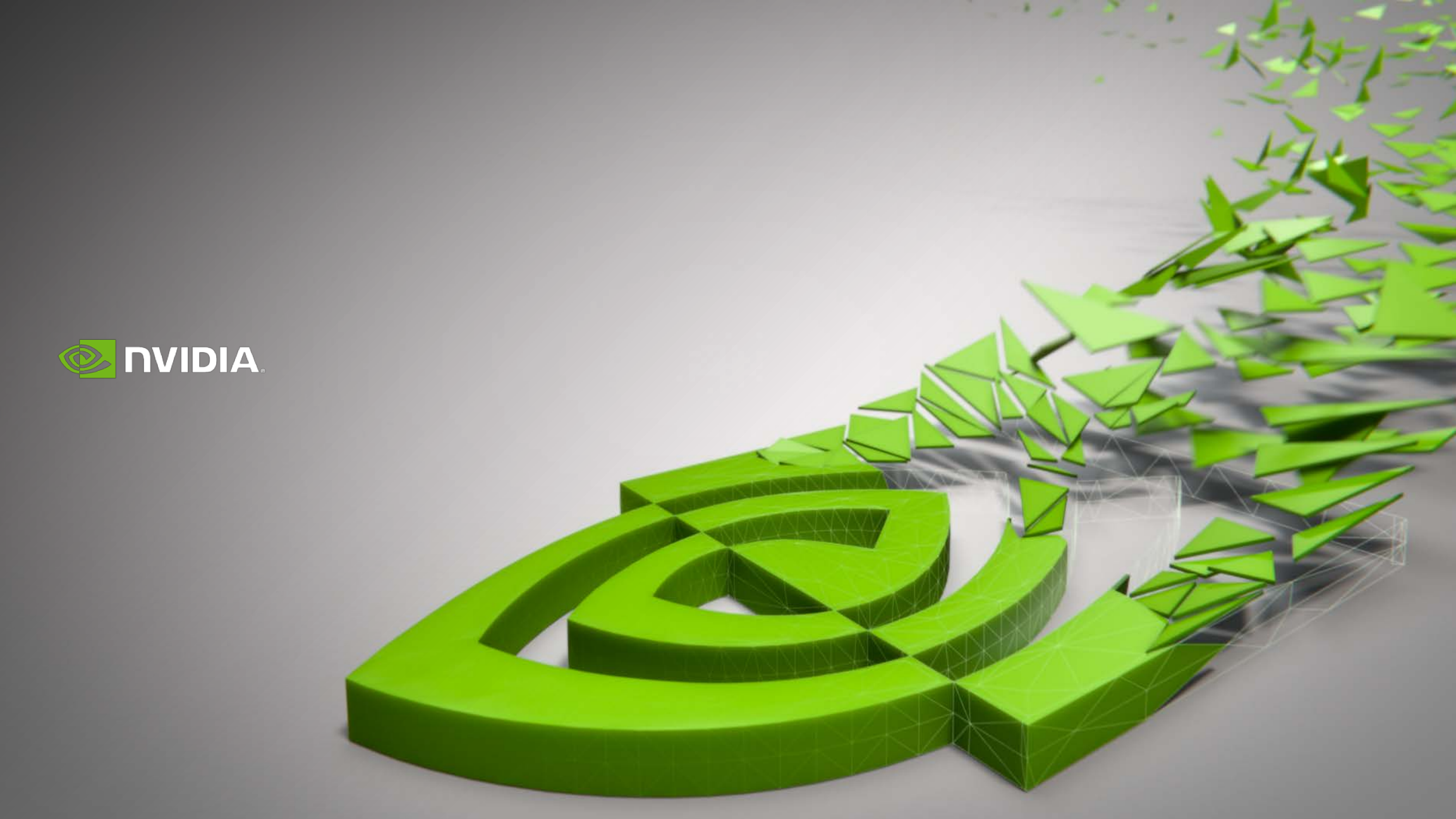
Introduced an EGL external platform API to **decouple platform drivers** from EGL drivers.

Successfully added **Wayland support as an external platform** on top of the EGLDevice and EGLStream families of extensions.

We will soon **open source** both the EGL External platform API and the Wayland implementation.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EXTRA: EGL EXTERNAL API

```
struct ExternalEglExports {
    registerCallback;

    isValidNativeDisplay;
    bindDisplays;
    unbindDisplays;
    getPlatformDisplay;
    initialize;
    terminate;
    chooseConfig;
    getConfigAttrib;

    [...]
```

```
    [...]

    createPlatformWindowSurface;
    destroySurface;
    swapBuffers;
    swapInterval;

    areStreamAttribsExternal;
    createStreamAttrib;

    queryString;
    queryNativeResource;

    getInternalHandle;
};
```