Computer Graphics

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Short Introduction to (Desktop) OpenGL

What is OpenGL?

- Stands for “Open Graphics Library”
- Managed by non-profit industry consortium Khronos
- Not a library, but an “API specification”
- Drivers implemented by graphics hardware vendors (“OpenGL implementation”)
- Cross-platform API for rendering interactive 3D graphics scenes
  - No platform-dependent APIs – window management, UI handling, etc.
  - No high level APIs – image load/save, scene graph management, etc.
- Client-server model (CPU-GPU)
- Low-level API (cf: OpenSceneGraph, Three.js, etc.)

What is OpenGL? (cont’d)

- A big state machine ("a very large struct with a great many different fields") → OpenGL context (“an object that holds all of OpenGL”)
- Latest version – ver. 4.6 released on July 31, 2017.
- Derivatives – OpenGL ES, WebGL, etc.
- Vulkan: Successor of OpenGL
- Must-read: https://paroj.github.io/gltut/Basics/Intro%20What%20is%20OpenGL.html

Modern OpenGL

- OpenGL 3.0 – Deprecation mechanism introduced
- OpenGL 3.1 and later → called “modern OpenGL”
  - Deprecated functions are removed
  - Core vs. compatibility profiles
- Some important changes
  - Heavily relies on shaders – It’s all about “shaders” now!
  - No immediate rendering mode – via buffers only
  - No lighting-relevant functions – More things to do for programmers
  - No transformation stacks for hierarchical transformations – Additional library required

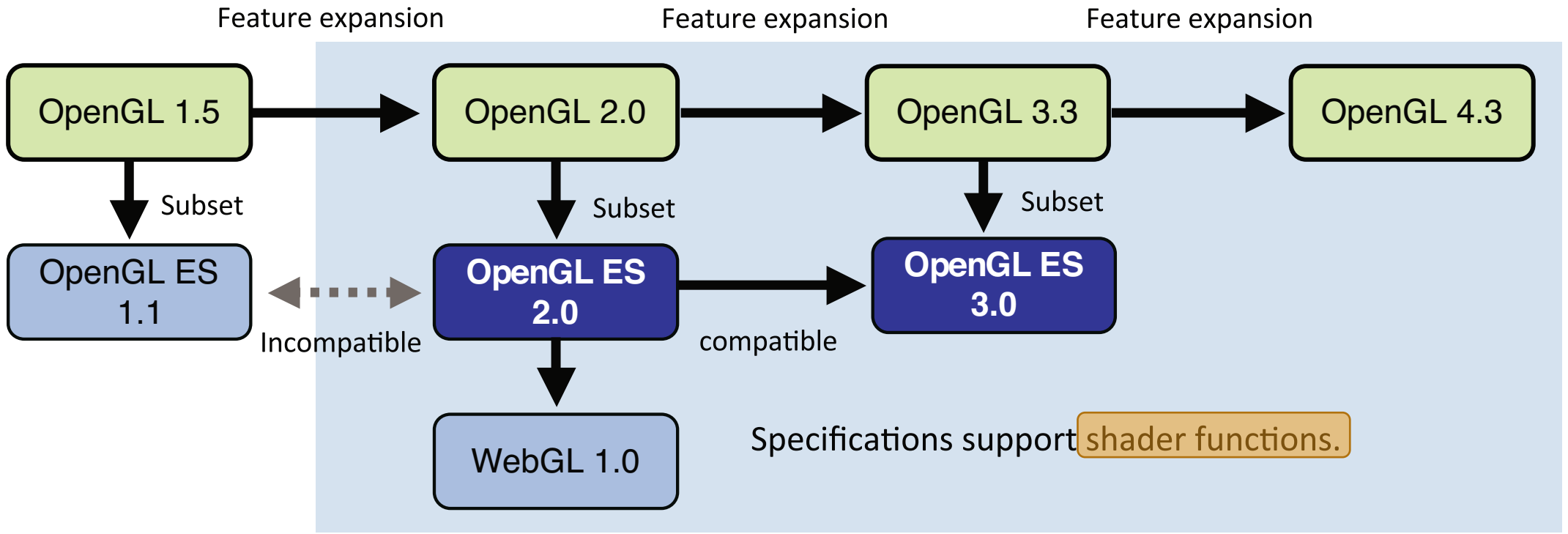
Chapter 1: Overview of WebGL

Advantages of WebGL

- JavaScript + HTML5 → interactive web pages
- WebGL (JavaScript + HTML5 + GLSL) → 3D interactive web pages
- Predecessors: VRML, X3D, etc.
- Pros
  - Simpler development environment (web browser + text editor)
    - Browser support check: http://webglreport.com
  - Cross-platform, easy to distribute
  - Leverages browser functionality – UI, menus, media, etc.
  - Lots of materials available for OpenGL
- Cons
  - Slower (than desktop OpenGL apps) – It's JavaScript!
  - Smaller feature sets
  - Debugging
  - Source codes exposed

Origins of WebGL

- Direct3D & OpenGL
- WebGL is derived from OpenGL ES (Embedded Systems)



Structure of WebGL Applications

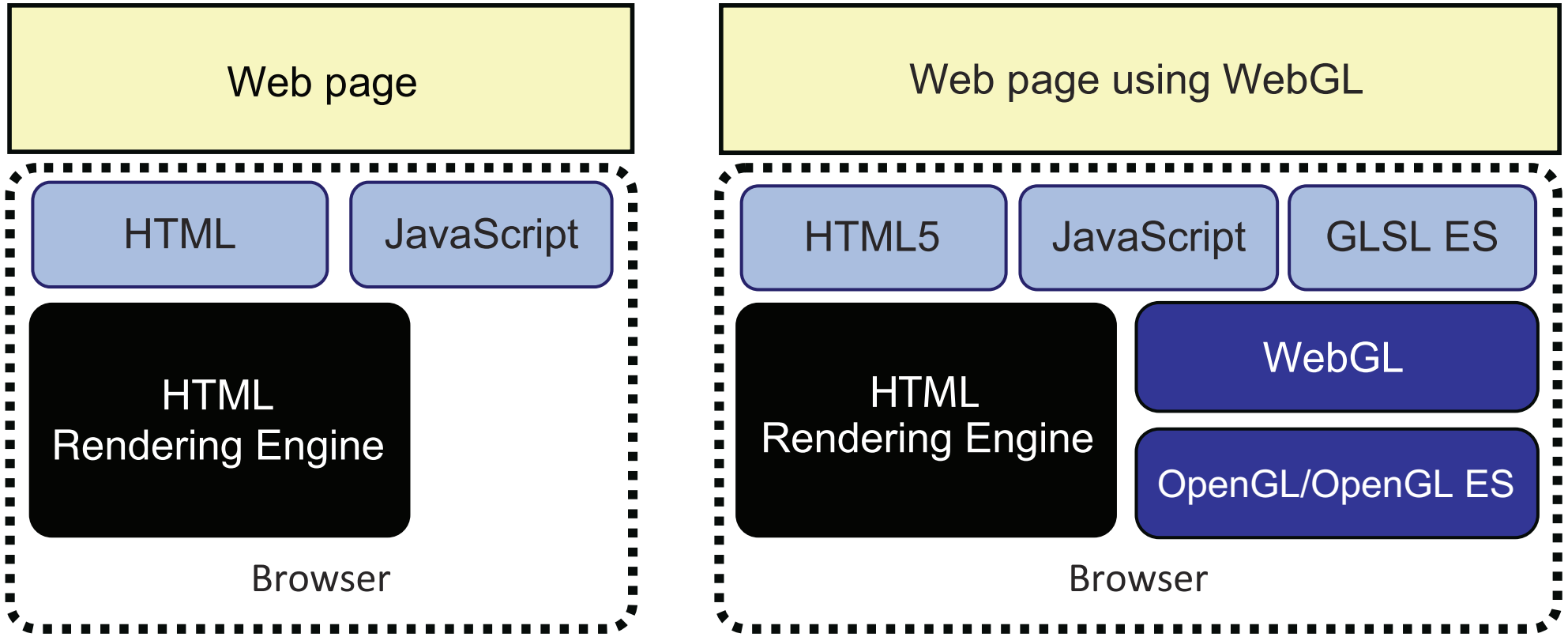


Figure 1.5 The software architecture of dynamic web pages (left) and web pages using WebGL (right)