COMP350: Algorithms & Optimisation

4: GPU Optimisation

Learning outcomes

By the end of today's session, you will be able to:

- **Recall** the key stages of the graphics pipeline
- **Understand** the GPU Debugger
- **Explain** some of the key areas for optimisation

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The 3D graphics pipeline

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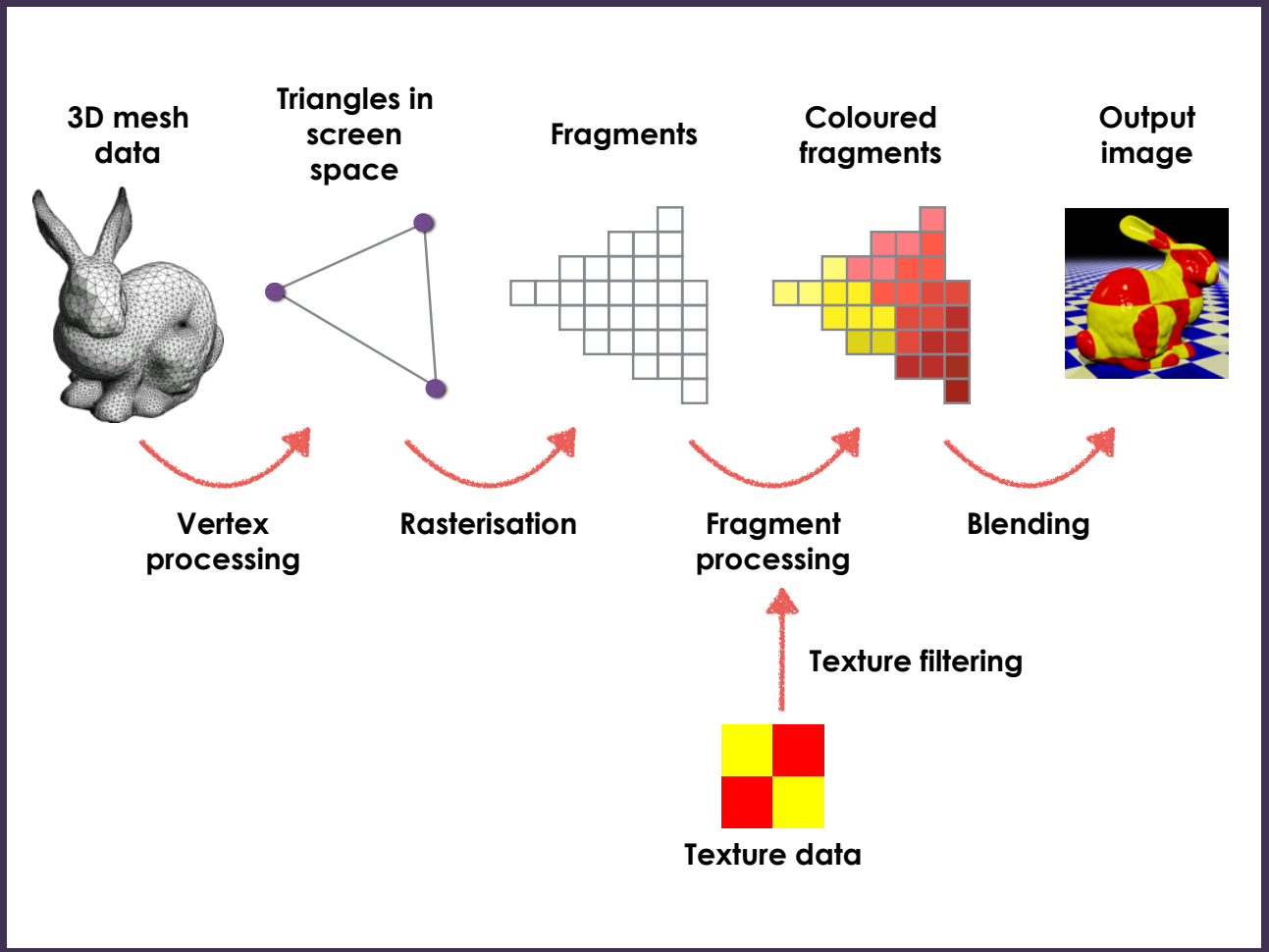
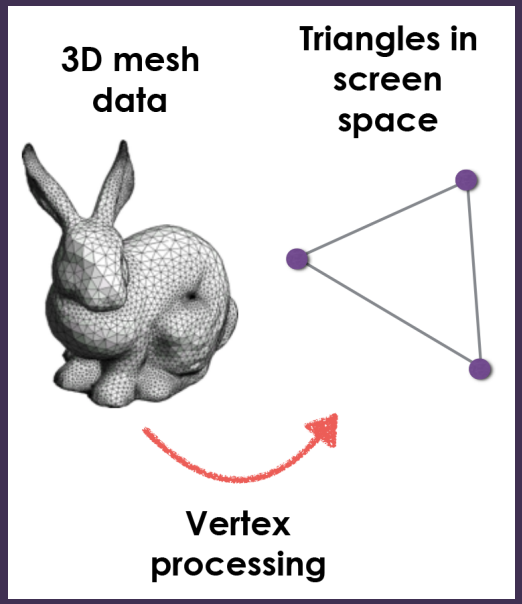


Vertex processing



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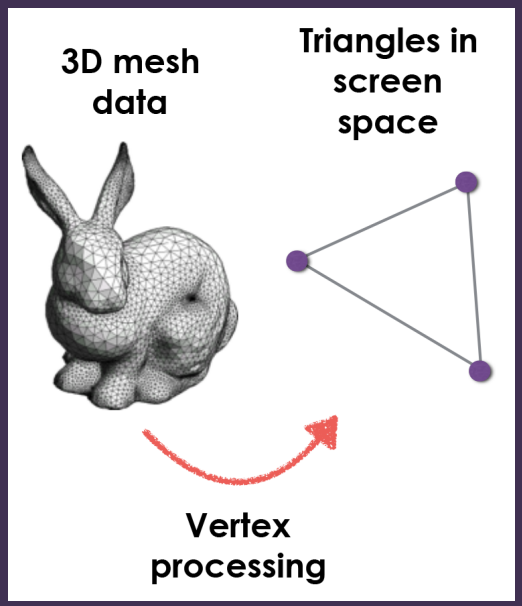

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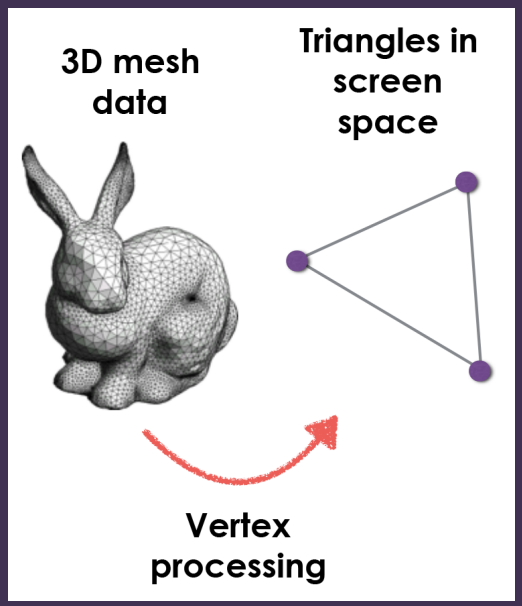

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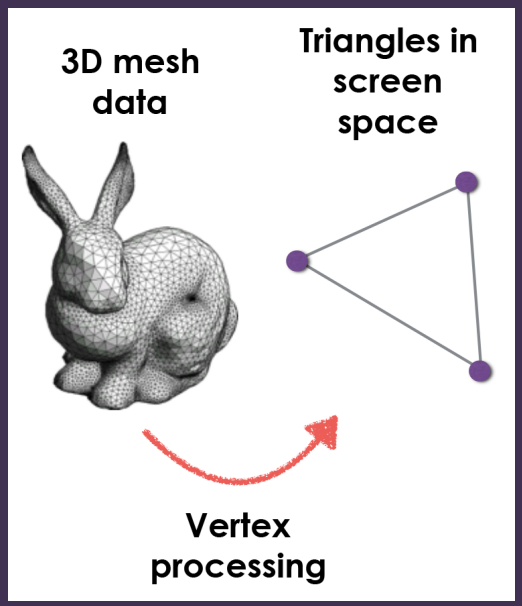

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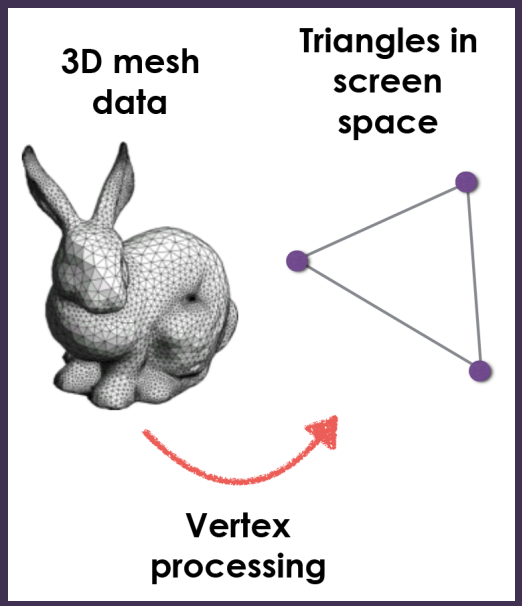

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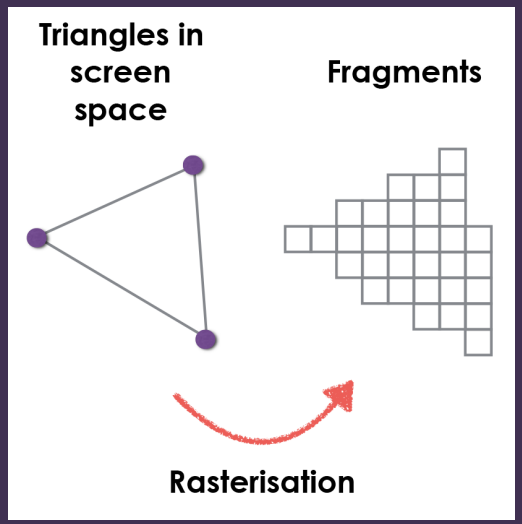
- May also apply particle simulations, skeletal animations or deformations, etc.

Rasterisation



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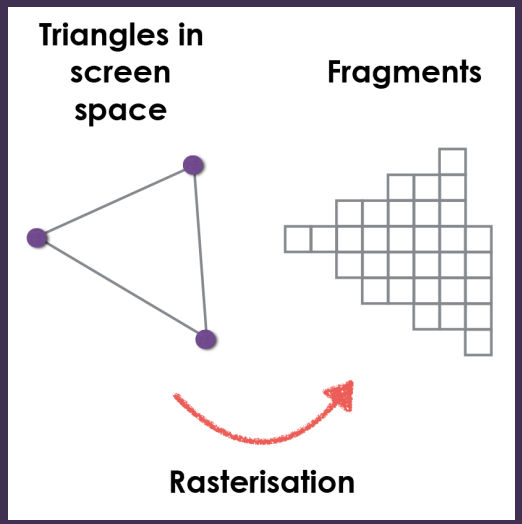

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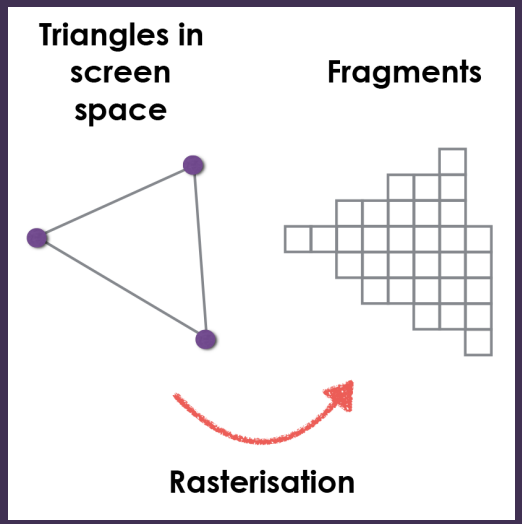

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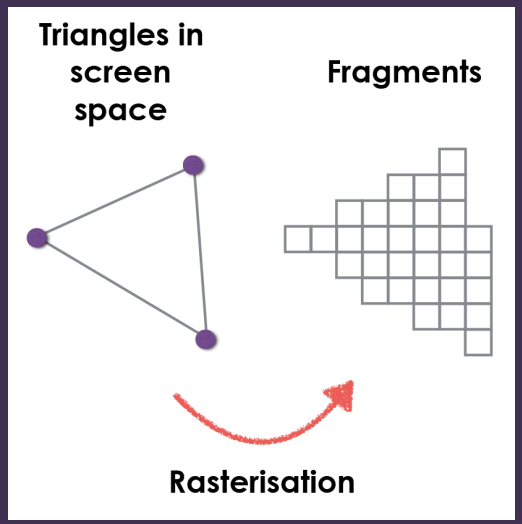

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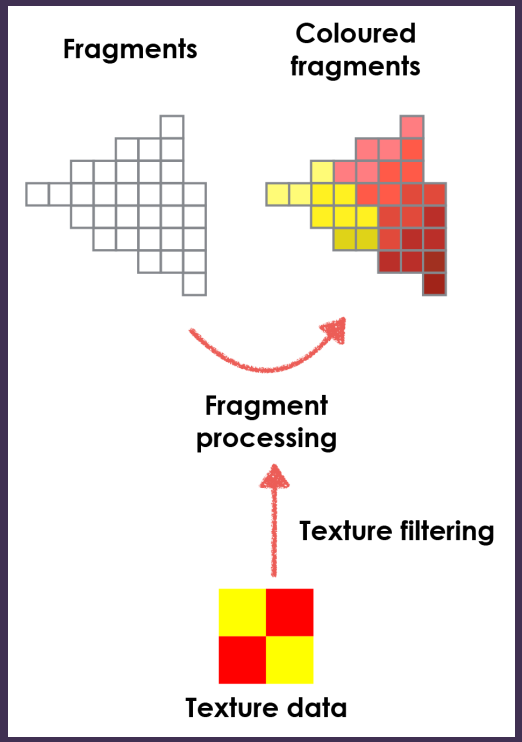
- In practical terms, "fragment" = "pixel"
- Vertex processor can associate **data** with each vertex; this is **interpolated** across the fragments

Fragment processing



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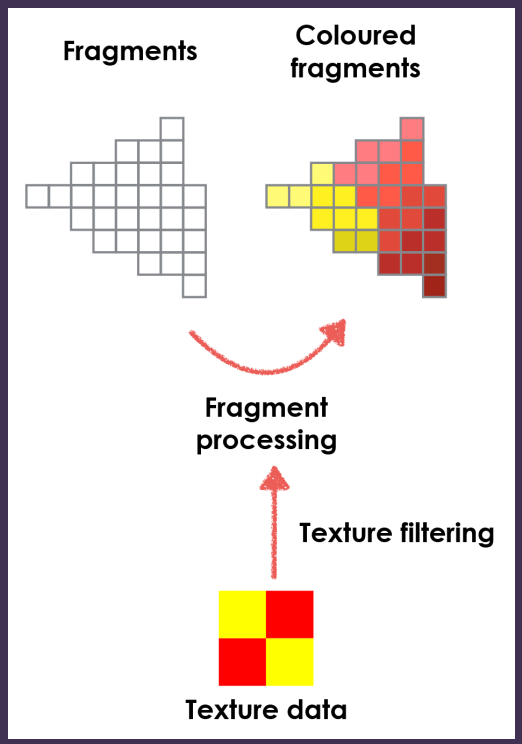

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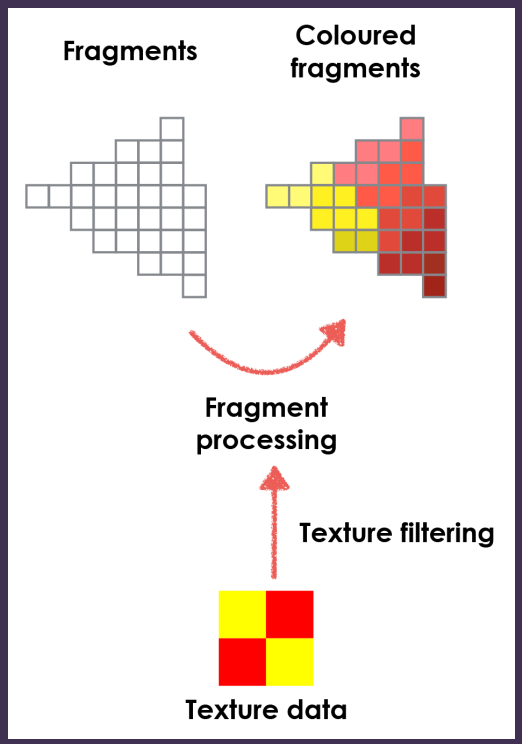

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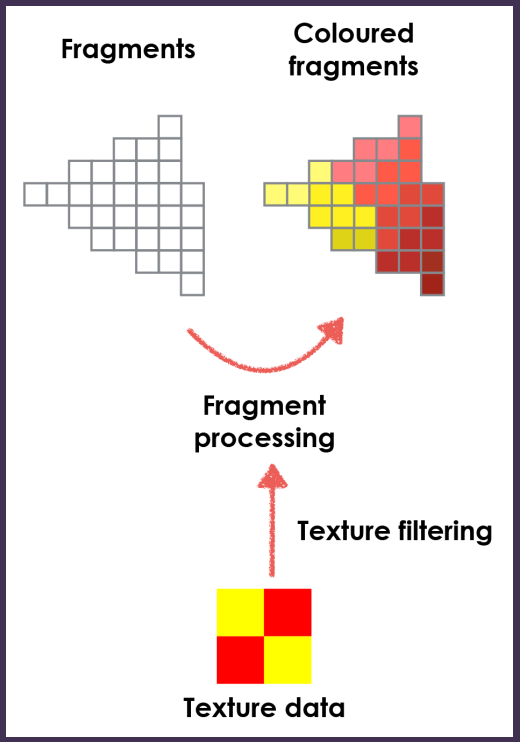

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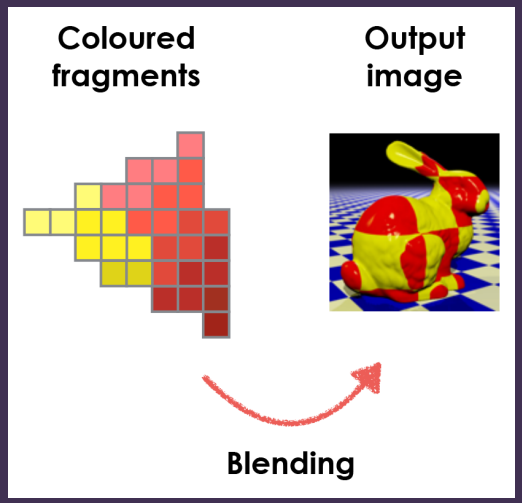
- **Textures** are 2D images that can be **wrapped** onto a 3D object
- Colour is calculated based on **texture**, **lighting** and other properties of the surface being rendered (e.g. shininess, roughness)

Blending



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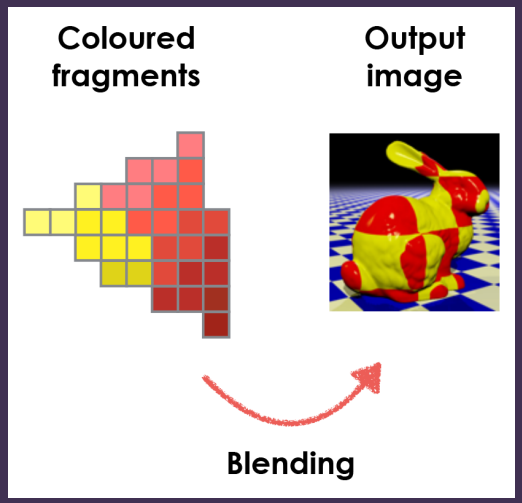

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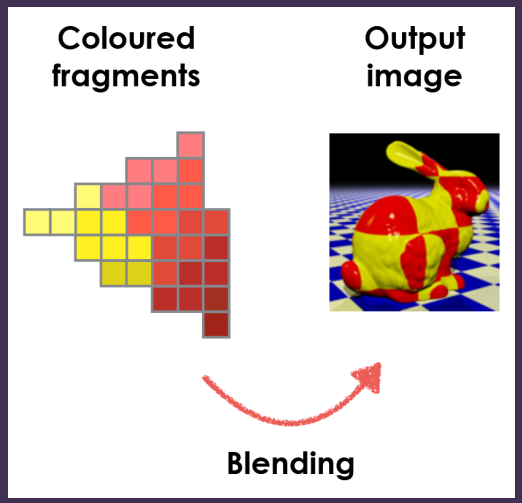

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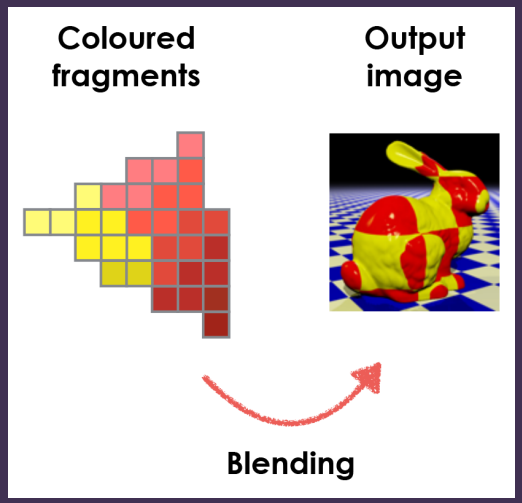

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- **Alpha blending**: combine the old and new colours for a semi-transparent appearance

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- **Fragment shader**: responsible for the visual appearance of the surface
- Vertex shader and fragment shader are separate programs, but the vertex shader can pass arbitrary values through to the fragment shader

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GPU Profiling

Live Demo

Live Demo

- Render Doc

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- Unity

Live Demo

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- Attempt to use a texture atlas to manage your textures

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  - OpenGL: Have only a few larger VBOs

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  - Prefer static branching over dynamic
  - With static branching, the loop can be evaluated at compile time