COMP280: Specialisms in Creative Computing

9: Intro to Computer Graphics

Learning outcomes

- **Recall** the key stages of the graphics pipeline
- **Explain** the differences between a CPU and a GPU
- **Understand** how the graphics pipeline is implemented in UE4

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Graphics and simulation hardware

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  - Optimised for performing the same calculation on several thousand vertices or pixels at once

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- Deep learning

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  - Sony and Nintendo consoles have their own APIs; Microsoft consoles use Direct3D

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- They using have an abstract rendering layer which has concrete implementations of D3D, OpenGL, Vulkan, Metal, Console APIs etc
- This allows the Engine to support multiple platforms
- In addition, this makes it easier to upgrade the engine to support new versions of APIs or newly released APIs

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The 3D graphics pipeline

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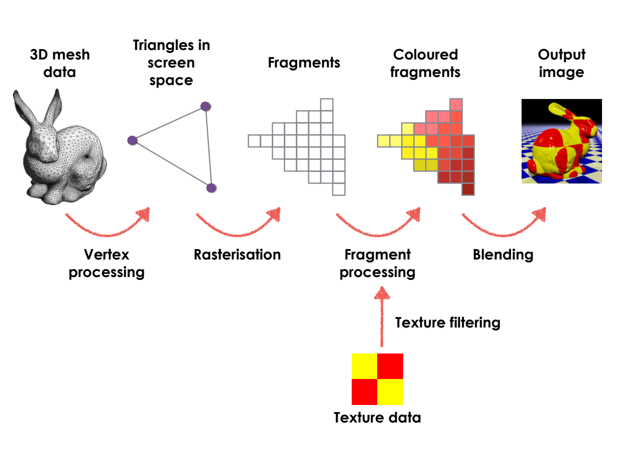
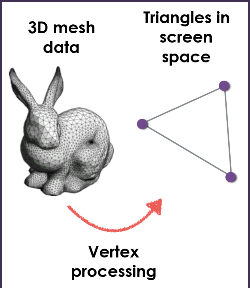


Vertex processing



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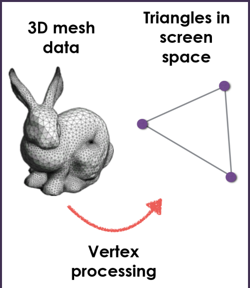

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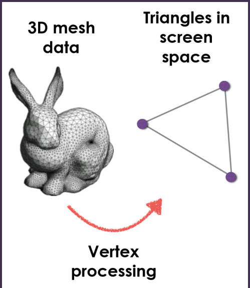

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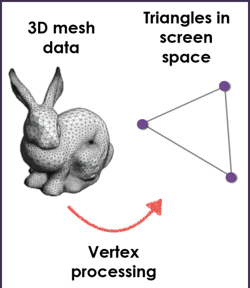

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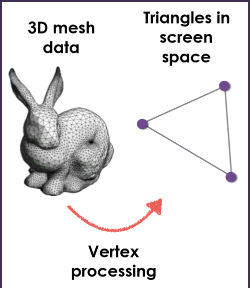

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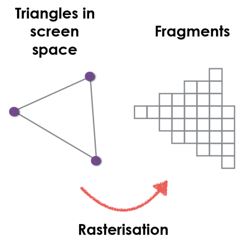
- May also apply particle simulations, skeletal animations or deformations, etc.

Rasterisation



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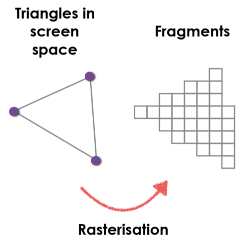

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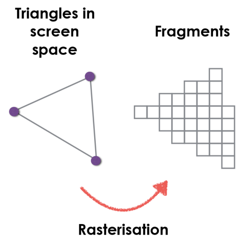

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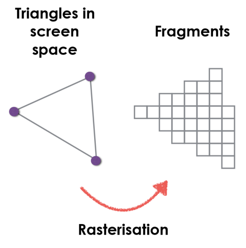

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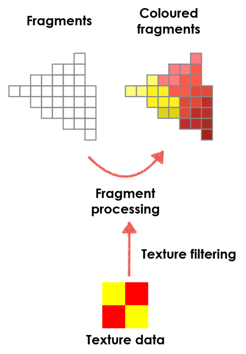
- Vertex processor can associate **data** with each vertex; this is **interpolated** across the fragments

Fragment processing



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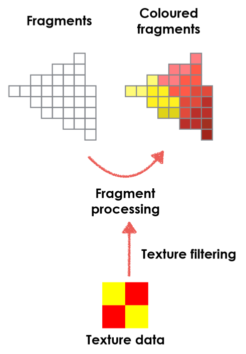

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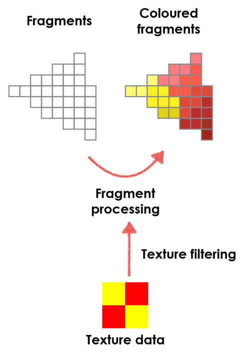

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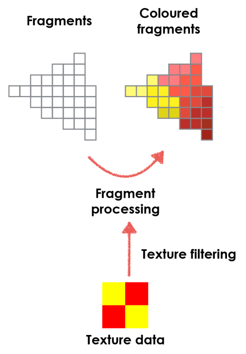

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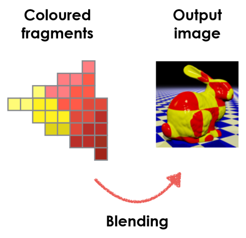
- Colour is calculated based on **texture**, **lighting** and other properties of the surface being rendered (e.g. shininess, roughness)

Blending



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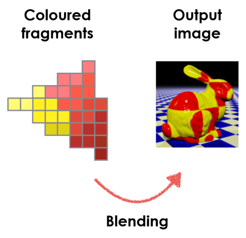

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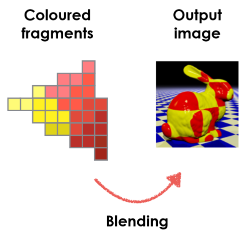

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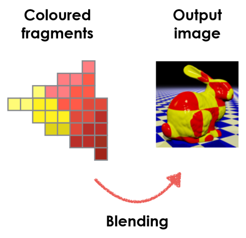

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- **Alpha blending**: combine the old and new colours for a semi-transparent appearance

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- In addition, materials fit onto an Artists workflow

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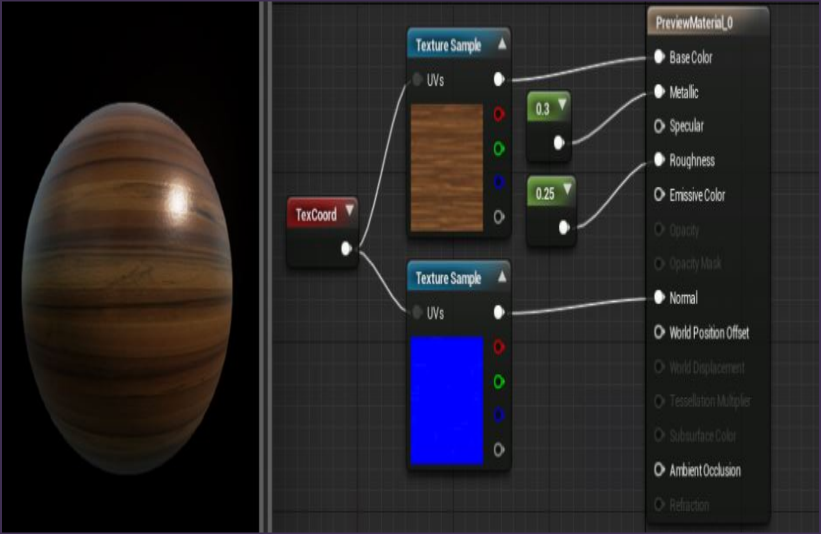

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- This allows you to build up a complex effect by chaining nodes together