

# Hybrid RayTracing in DXR

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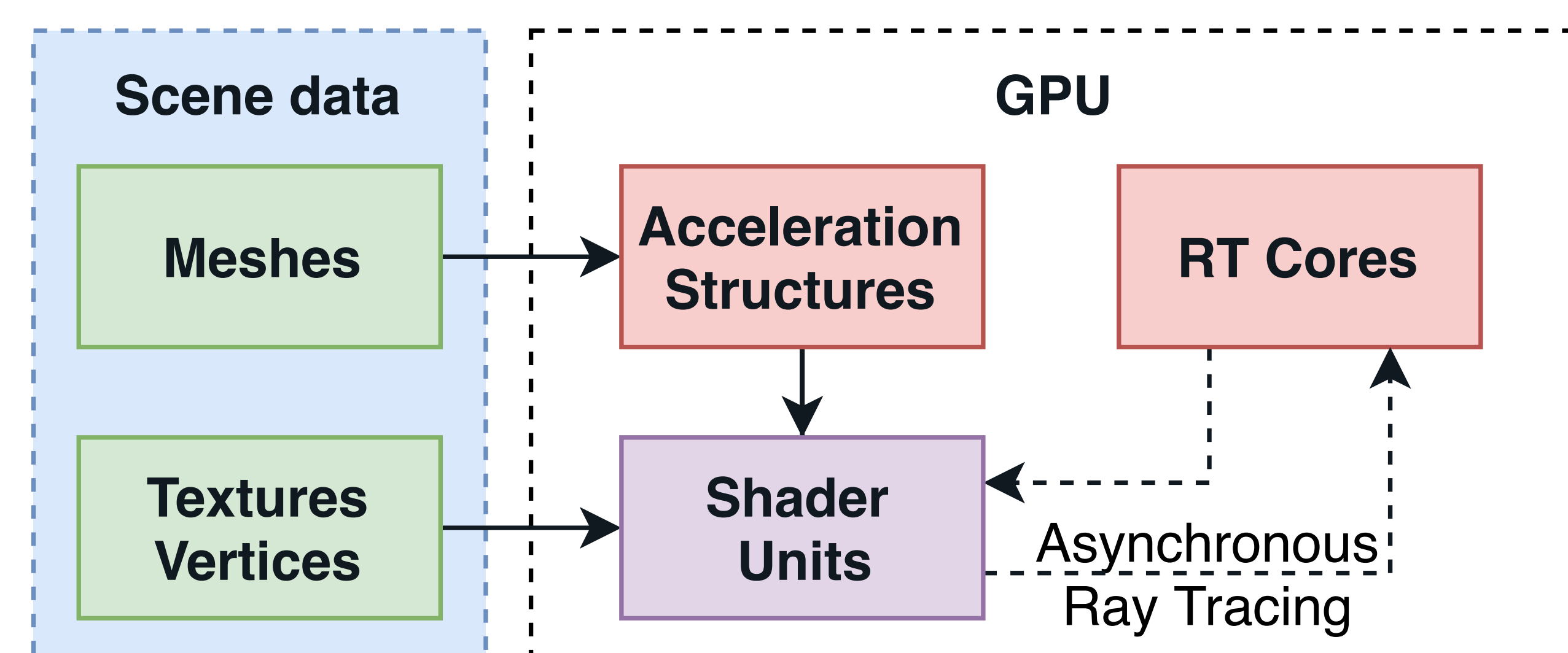
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## State of Rendering

- Realistic visualisation of 3D scenes is necessary for many applications - **computer games**, **movie industry** or **CADs**.
- Contemporary **rasterization** methods are enriched through the use of **ray tracing**, allowing higher fidelity of synthesised images.
- The goal of this thesis was to **determine the usability** of one such method of acceleration – **NVIDIA Turing GPUs** – through experimentation and implementation of **hybrid ray tracing** engine.

## Accelerated raytracing

**NVIDIA Turing GPUs** used as the ray tracing acceleration units allow asynchronous ray casting into user specified virtual scene.



- Accessible through **DirectX 12 RayTracing** or **Vulkan RayTracing**.
- Full hardware acceleration on **NVIDIA Turing RTX GPUs**.
- Partial, software based acceleration, on **series 900 GTX and higher** through the use of compute shaders.

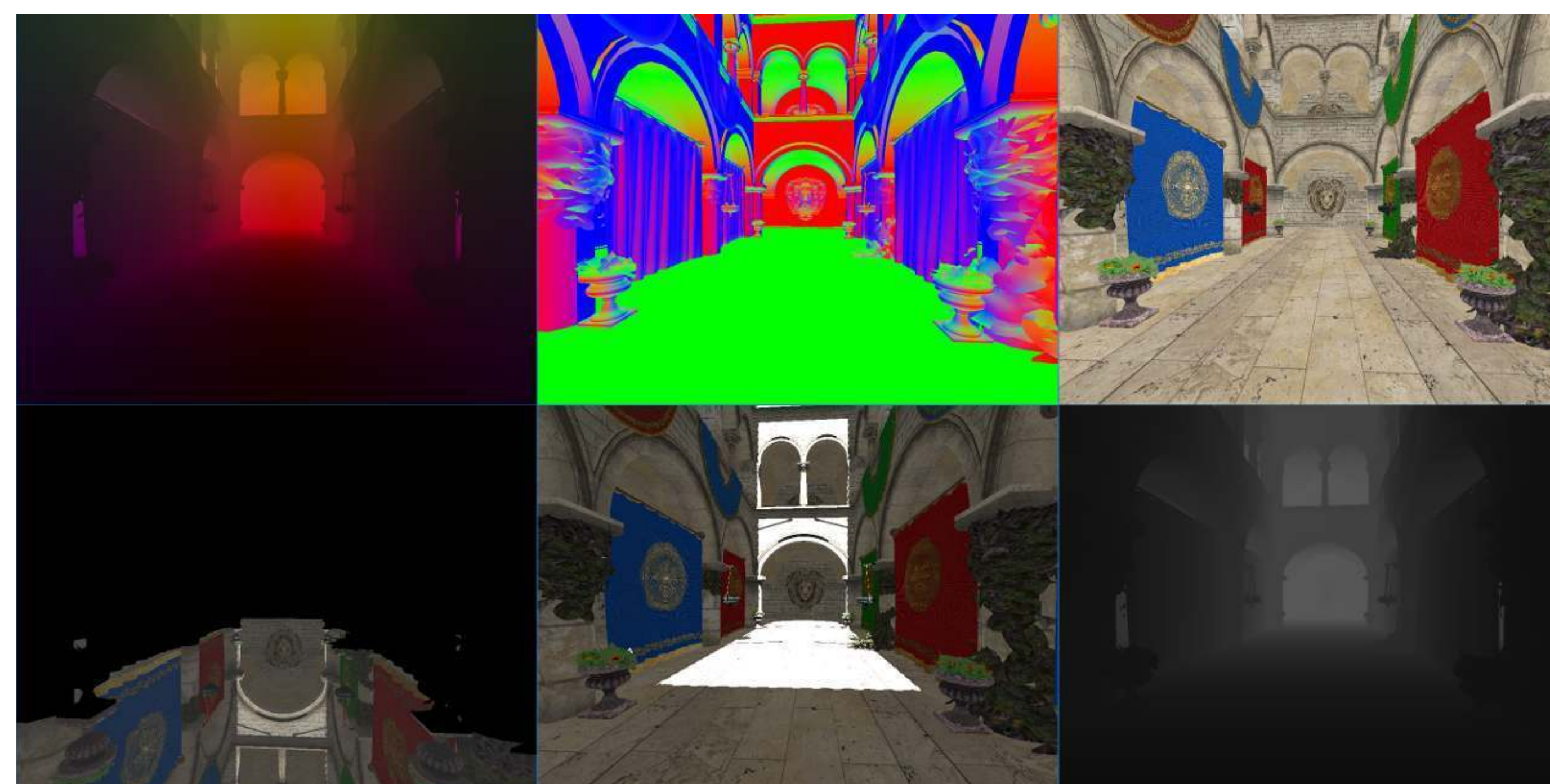
## Hybrid rendering approach

Hybrid rendering approach allows the combination of **rasterization** and **ray tracing**, while preserving advantages of both techniques. This approach is then used in implementation of hybrid rendering engine **Quark**, the main advantage of which is the real-time speed of rendering, while utilizing advanced graphical effects.



The primary idea behind the hybrid rendering technique is:

1. Prepare both rasterization and ray tracing resources: scene data, textures etc.
2. Simultaneous rendering using **standard rasterization** techniques and **custom ray tracing** pass:



3. Resolving the final synthesised image through combination of both outputs; left: **pure rasterization**, right: **hybrid approach**:



## Experiments

	PC1			PC2		
Rays/pixel	FT <sub>Rt</sub>	GR/s	FT <sub>Ra</sub>	FT <sub>Rt</sub>	GR/s	FT <sub>Ra</sub>
25.7	7.04	12.82	0.47	434.78	0.55	0.66
12.7	8.13	5.50	0.53	401.13	0.59	0.85
66.0	32.26	7.09	1.86	4937.72	0.04	3.44
64.0	35.71	6.25	1.86	3372.54	0.08	3.44

- Integration of the hybrid rendering approach in real-world game engine at **Hangar13**.
- Experimentation was performed on two systems: **RTX 2080 Ti** and **GTX 970**.
- For full record of the 8 total testing categories and their results, please see the **paper**.

## Conclusions

- The proposed method of hybrid rendering works very well, and is always comparable in performance to the pure rasterization.
- In conclusion, the technology of accelerated ray tracing is fully usable, even despite its shortcomings in terms of difficult implementation and restrictive scene representation.

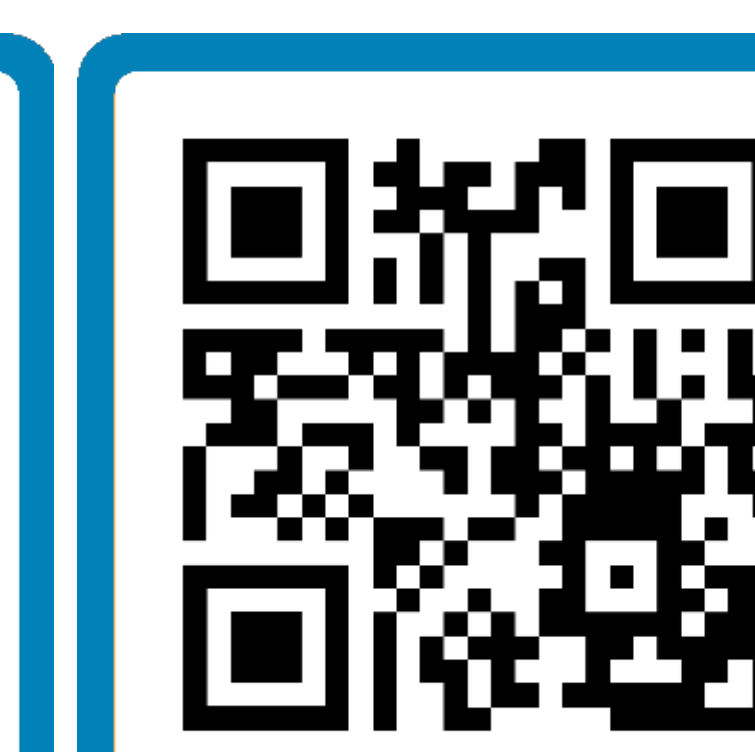
## Media



Repository



Paper



Video