A Shared Memory Architecture for a Hybrid Real-Time Ray Tracing System

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Abstract:
The ability to create interactive applications with high fidelity ray traced visuals, has long been a goal towards which the computer graphics community has strove. However, despite decades of research and advancements in computing technology it remains, for any non-trivial application, beyond the capabilities of modern commercial hardware. Furthermore, recent developments in computer architecture research suggest that performance gains will cease to continue in line with Moore's Law as result of the failure of power density scaling.
Consequently, contemporary thought in computer architecture has turned towards more novel approaches to tackle this problem. Fixed function hardware, which had long ago fallen out of favour with chip designers in favour of general purpose computing cores, has recently seen a return of significant interest. Motivated also in part by the need for power efficiency in mobile processors, this development has led to a rich vein of research into custom ray tracing microarchitectures.
In the near future similar fixed function microarchitectures for ray tracing may find themselves on commercial chips accompanying traditional CPUs and GPUs in a heterogeneous architecture. If this is to become a reality an efficient means of transferring large quantities of data into the custom device will be essential. This project presents an architecture wherein memory is shared between a CPU and custom peripheral. An evaluation of the system shows that this architecture is capable of efficiently delivering data to fixed function hardware without placing undue demand on processor time.