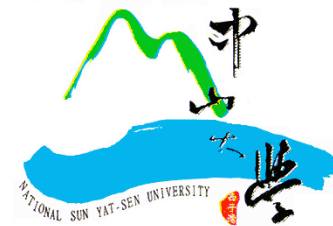


An Embedded Debugging/Performance Monitoring Engine for a Tile-based 3D Graphics SoC Development



Liang-Bi Chen, Tsung-Yu Ho, Jiun-Cheng Ju, Cheng-Lung Chiang, Chung-Nan Lee, and Ing-Jer Huang

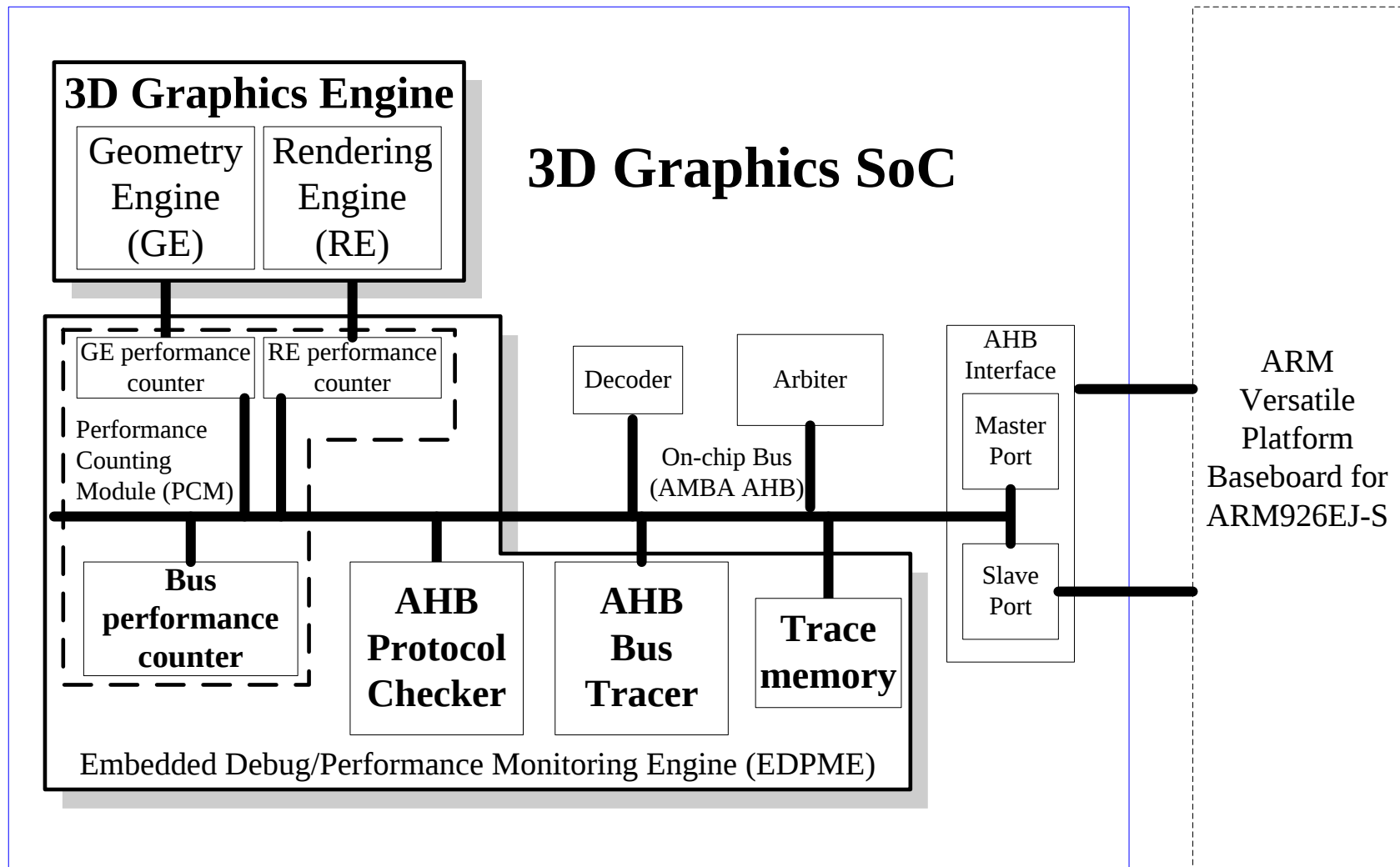


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Presenter: Liang-Bi Chen

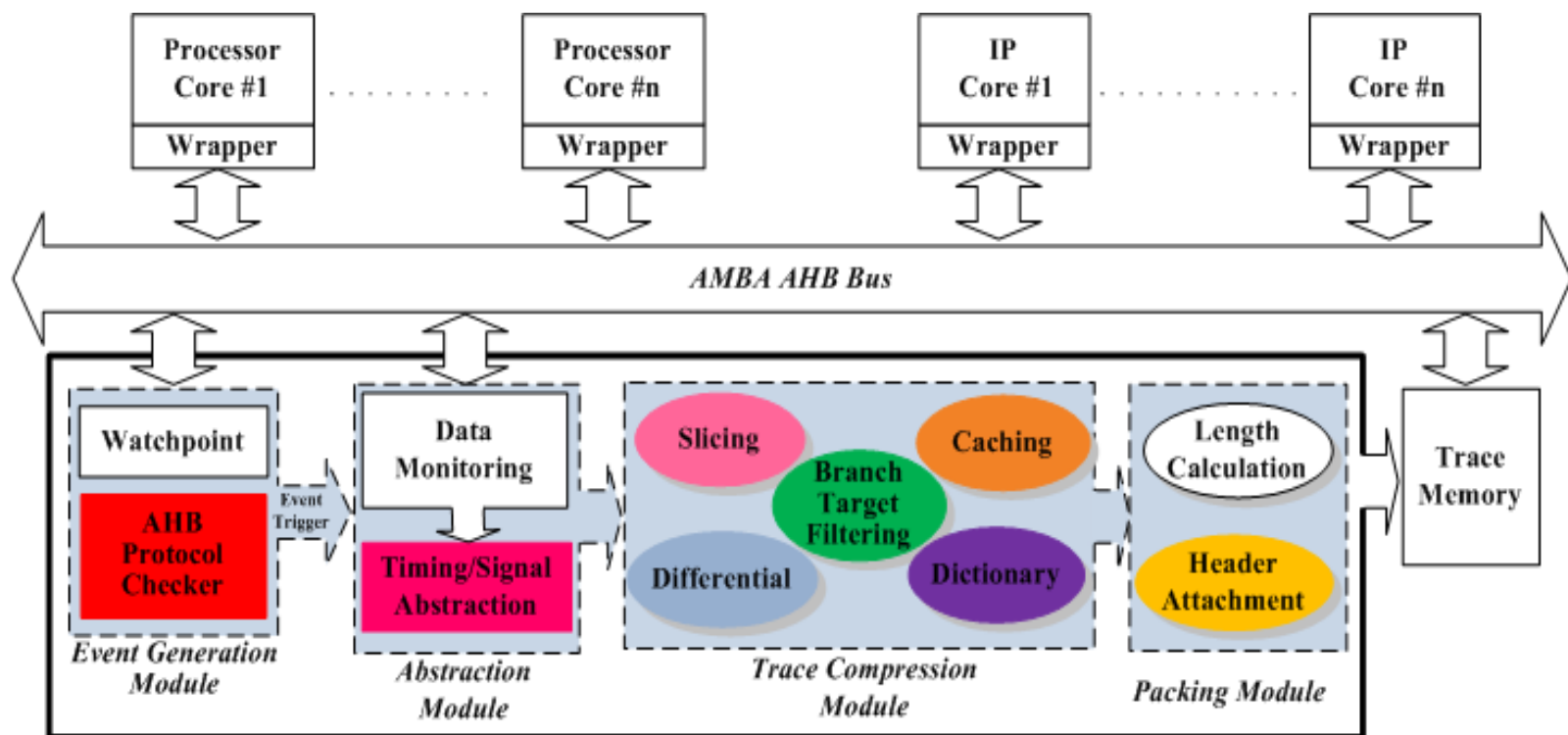


Block diagram of Proposed 3DG SoC



Embedded Debugging Engine

- Event Generation Module
 - Breakpoint unit
 - AHB protocol checker
- Signal Monitoring & Tracing Module
- Trace Compression Module
- Data Packing Module

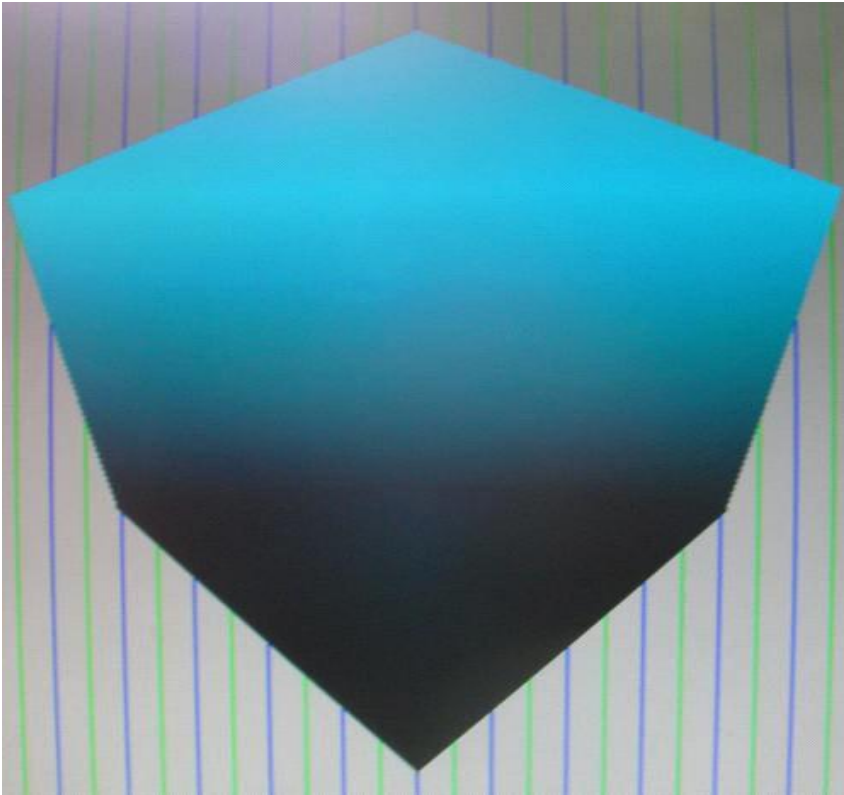


Embedded Debug Engine

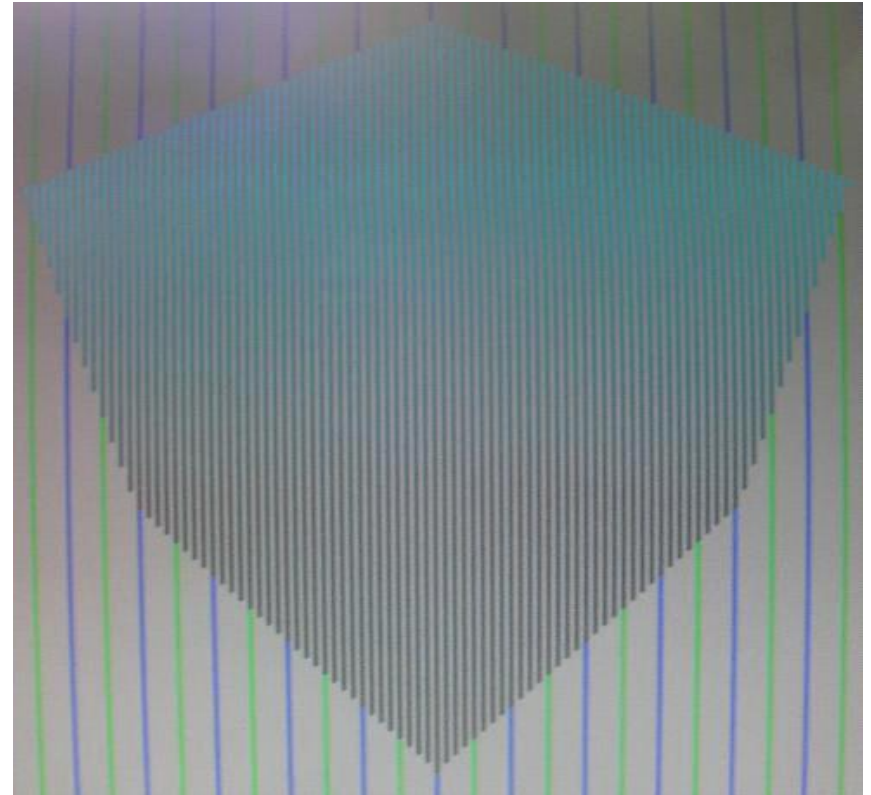
IEEE/ACM ASP-DAC'10@Taipei, TAIWAN, Jan 18-21 2010

Case Study

- Capture RM Error by using Bus Trace and Protocol Checker on Versatile

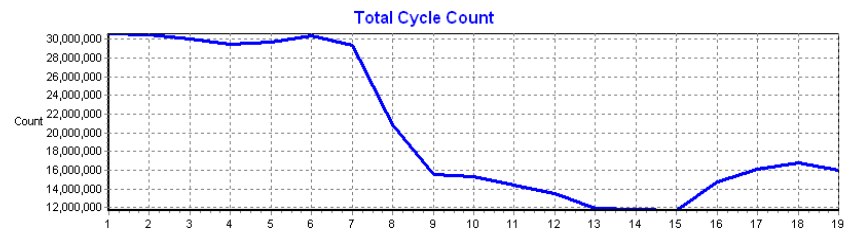
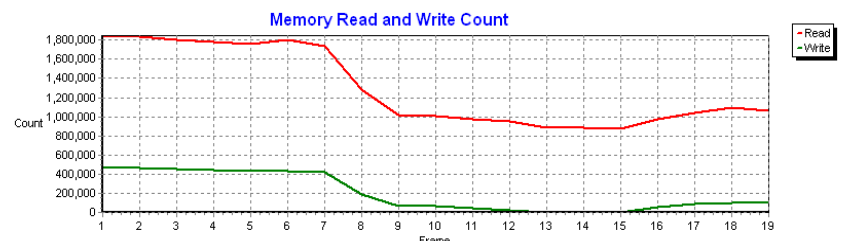
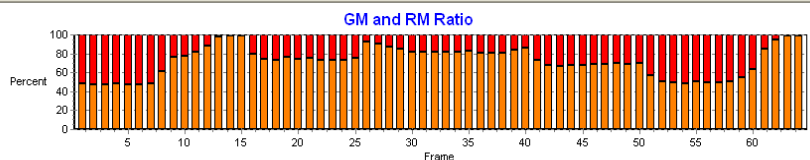
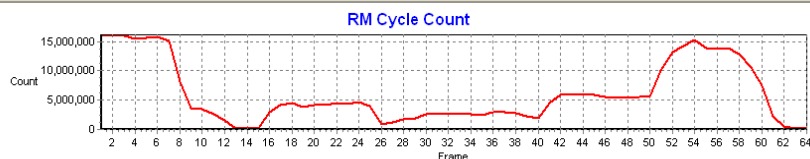
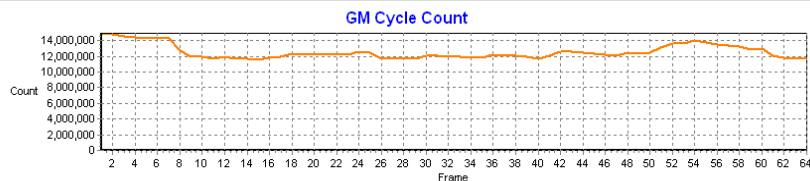
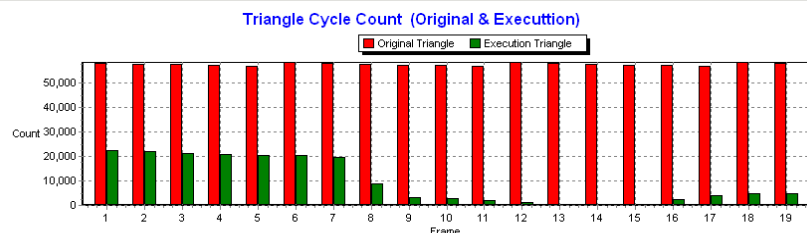
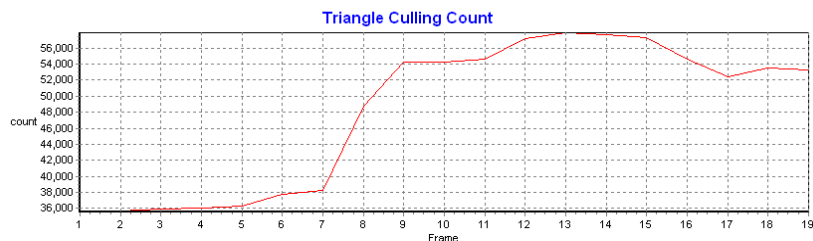


(a) Correct Picture



(b) Wrong Picture

Performance Monitoring Engine



Available 3D graphics application characteristics

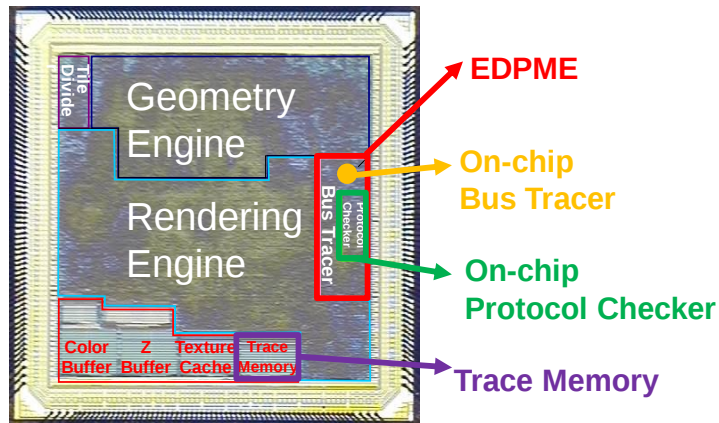
Geometry engine

1. GM original triangle count
2. GM triangle count (via culling)
3. GM memory read count
4. TDM read count
5. TDM write count
6. TDM memory space count
7. GE cycle count

Rendering engine

1. RE pre-fragment pixel count
2. RE post-fragment pixel count
3. RE cycles count
4. RE bus read count
5. RE bus write count
6. RE processed triangle count
7. RE processed tile count

Chip specification and characteristics



Chip Spec.	Process Technology	TSMC 0.18 μ m CMOS 1P6M
	Supply Voltage	1.8V for Core 3.3V for I/O Cells
	Power Consumption	476.6mW (core power)
	Gate Count	986.5K gates for 3DG Engine IP 87K gates for the EDPME with trace memory
	Die Size	3.96 $\times$ 3.96mm ²
	Package	PBGA 256 pin
	Operating Frequency	139MHz
EDPME	Bus Tracer	Provide 4 signal/timing abstraction levels Real-time compression
	Protocol Checker	Rule-based AHB protocol checker, total 73 rules
	Performance Counting Module	Provide GE/RE/System bus performance information, include triangle rate, pixel rate, bus idle/utilization/transfer rate

Conclusion

- We have proposed an embedded debug/performance monitoring engine (called EDPME) and its related GUI tools.
- The EDPME can be facilitated on-chip bus integration, real time profiling, debugging and performance measurement/tuning with up to 98% trace compression ratio.