# NVISION 08
THE WORLD OF VISUAL COMPUTING

INFOTAINMENT: Benchmarking In-Car Graphics Systems

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Evolution of In-Car Graphics Systems

- Increasing amount of digital instrumentation inside car
  - OpenGL, OpenGL ES 1.x and 2.0 from Khronos for rendering backend of digital instrumentation
  - Sophisticated, real-time rendered, high-quality content
  - Renderer implementation is the critical component
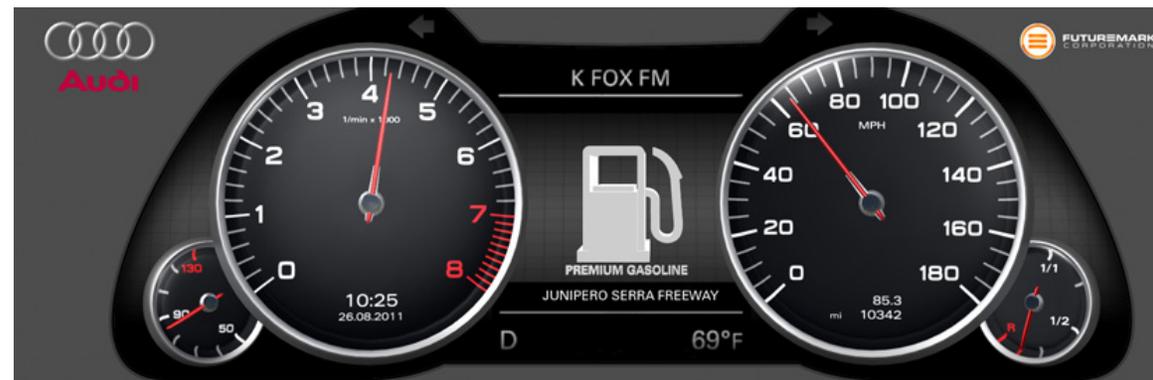
Source: Audi 3GMM Concept Study Demo, created by Futuremark

Purpose of the Benchmark

- Produce a valid objective numerical value to:
  - Compare similar solutions to each others
  - Compare devices/platforms against certain criteria
  - Help in deciding between different solutions
- Produce a sensible results for wide area of applications
- Fine-tune performance of the renderer implementation in R&D phase
- Use real-life test workloads

Why Are Benchmarks Needed

- Performance and usability matters

- Performance vs. Power Consuption

- Open platforms are becoming to norm in in-car graphics

- Recent technology development enable rich and unique graphics content and rendered applications

- Approaches:
  - System vs. Component
  - Application vs. Synthetic
  - Real-world vs. Theoretic

In-Car Graphics System Benchmarking Areas

Performance of rendering API implementation

Realistic automotive application tests:

1. Dashboard /Cluster
2. Navigation
3. Infotainment
4. Theoretical tests

Instrument panel

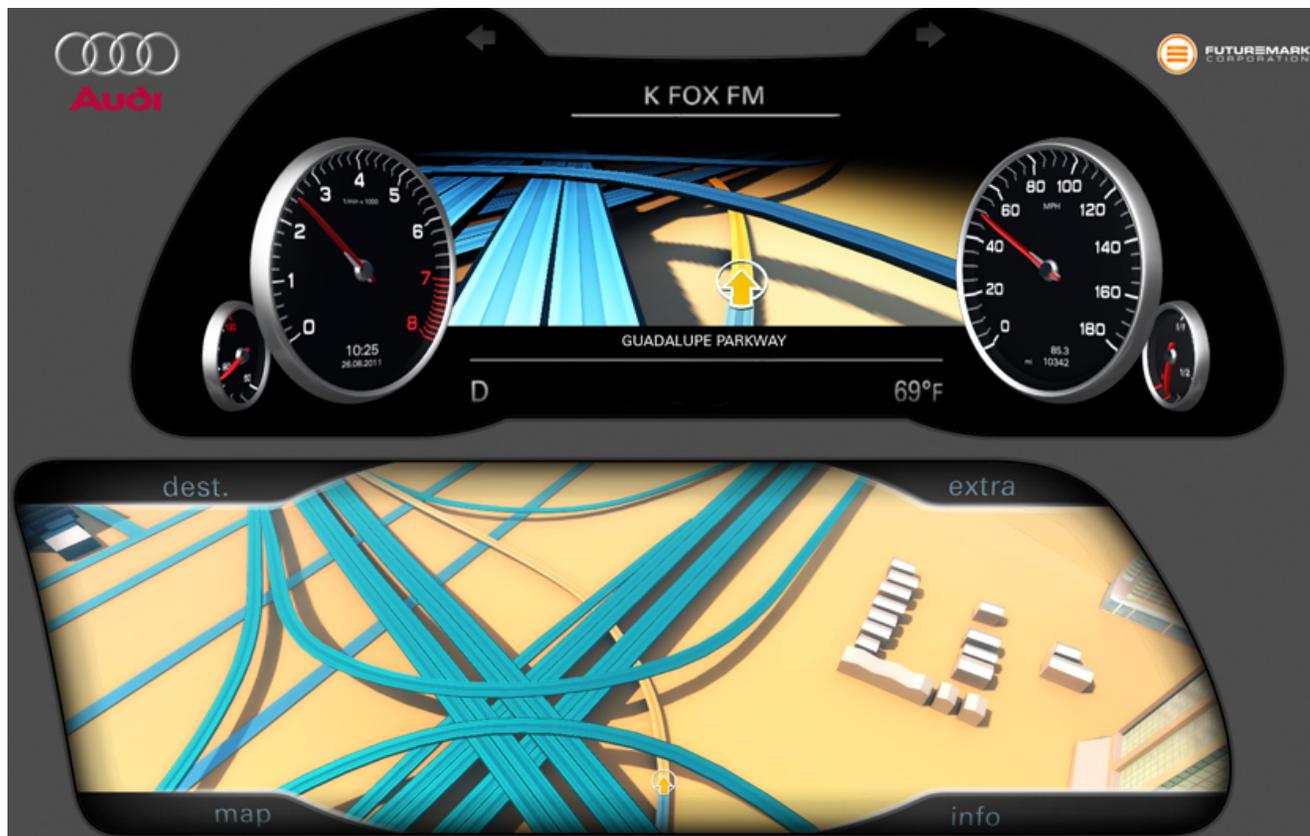Navigation / control console
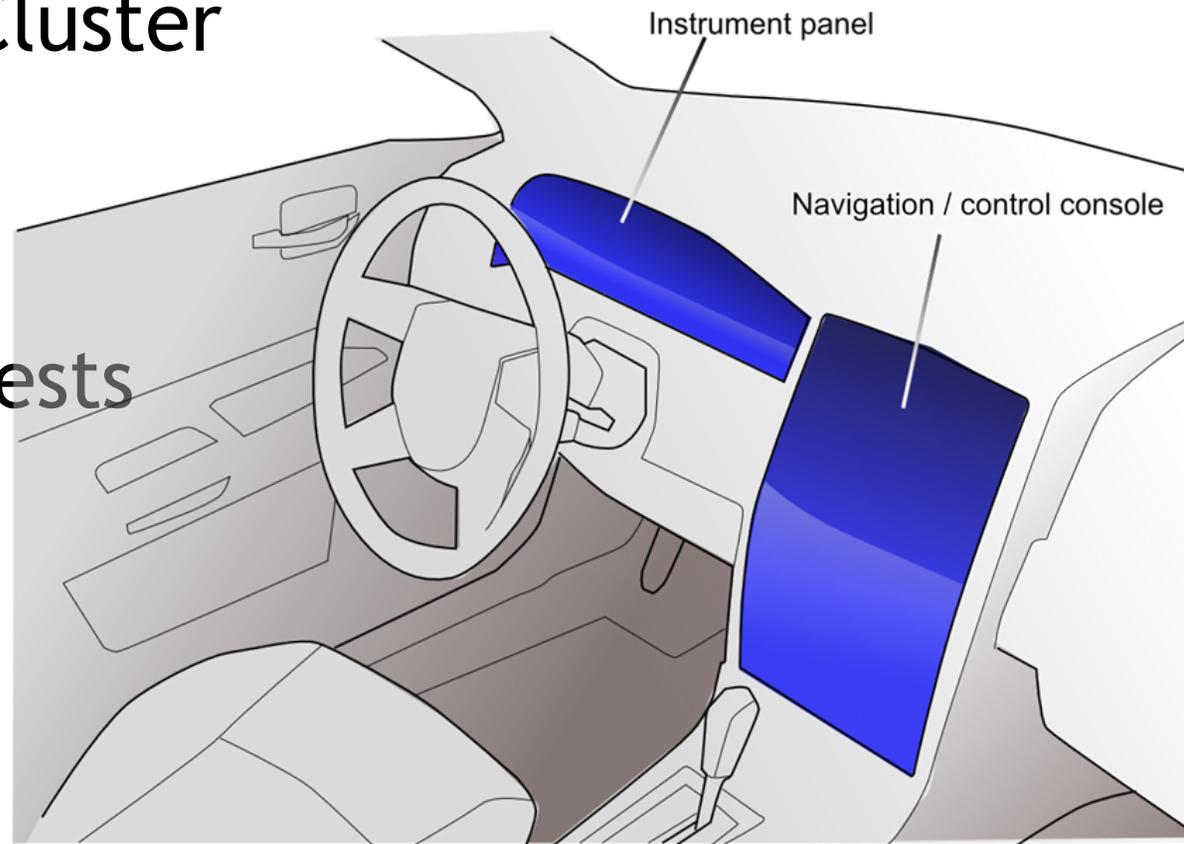
Dashboard / Cluster

- All instruments rendered in 3D view

- Traditional cluster look and feel
  - Geometry load ~100k / frame

- High needle FPS is necessary

Source: Audi 3GMM Concept Study Demo, created by Futuremark

Navigation

- Street map view with 3D buildings
- Average FPS to be measured… FPS >30 necessary for smooth usability

Source: Audi 3GMM Concept Study Demo, created by Futuremark

Infotainment / User Interface

- Test renders a hypothetical UI showing vehicle info system and environmental controls that are manipulated.

  - Average FPS measured

*Source: Audi 3GMM Concept Study Demo, created by Futuremark*

Theoretical Tests

- Fillrate to render complex scene: many polygons with overdrawn and a simple shader

- Polygon throughput: many polygons, no overdrawn and a simple shader

- CPU specific test workload: ? (Comments)
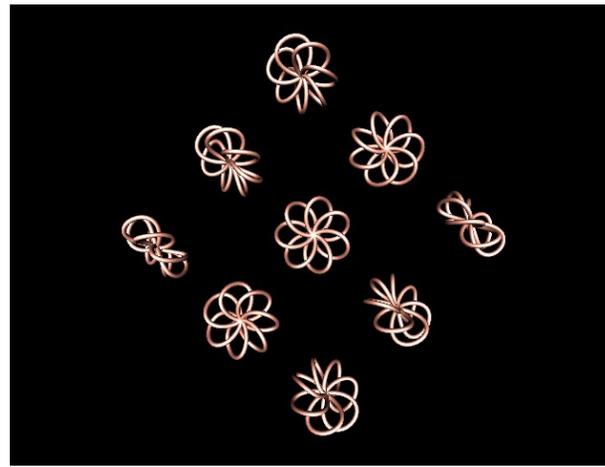
Automotive Benchmarking Targets

- Car models / concept cars
- Cars / concepts under development
- Early / reference designs
- Semiconductor boards
- FPGAs / Simulators
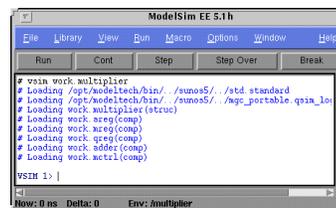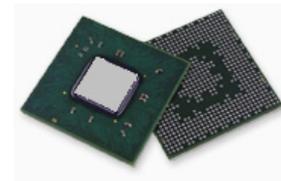
Value of Benchmarking in Automotive Industry

Focus Group	Benefits
Car Manufacturers	• Evaluate and compare various suppliers' systems • Evaluate and compare various suppliers' chips • Make your design choices based on verifiable performance data that can be trusted
System suppliers	• Evaluate and compare various suppliers' chips • Make your design choices based on verifiable performance data that can be trusted • Assure that no performance-degrading bugs slip through with each revision • Be prepared with your product submission
Semiconductor companies, IP and technology providers	• Test your system, chip or technology with realistic workloads • Assure that no performance-degrading bugs slip through with each revision of the silicon or the driver • Be prepared with your product submission

Futuremark Automotive Benchmark

- Purpose build to measure both component and system performance by experts
  - Application and theoretical performance
- Objective
- Real-world application workloads
- Assist to find possible performance bottlenecks in renderer solution
- Source code access to licensee
- Futuremark benchmarks are already used by all leading IP and semiconductor companies

Now I'm Thirsty !

Questions?

Futuremark Automotive Benchmark Licensing Available Now!

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