

ARM® Mali™-400 MP

The Scalable Multicore Graphics Processing Unit

Under embargo until June 2nd, 2008

Agenda

- Market drivers: consumer and technology changes
- ARM technology and graphics expertise
- ARM launches pioneering Mali-400 MP GPU
- Mali-400 MP scaleable multicore GPU – technical details
- ARM Mali™ graphics – the complete graphics stack








Two Drivers Of Visual Experience

Vision: one day all consumer visual experiences will be enhanced by graphics hardware acceleration



OEMs have placed graphics acceleration at the heart of their multimedia strategies - in the home and on the move

Graphics Key Target Markets

| Applications (Millions of units) | TAM 2012 Units | 2012 GPU uptake* | Drivers and trends |
|-------------------------------------|----------------------|--|---|
| Smartphone | 400 |  | <ul style="list-style-type: none"> •Rich UI, browsing •High-end gaming |
| Featurephone | 600 |  | <ul style="list-style-type: none"> •Casual gaming •Rich UI and some browsing |
| PMP | 200 |  | <ul style="list-style-type: none"> •Rich UI and some browsing •Casual gaming |
| PND | 65 |  | <ul style="list-style-type: none"> •Advanced UI effects assisting navigation •Browsing |
| STB | 231 |  | <ul style="list-style-type: none"> •Post-processing to improve look of content •Rich UI and browsing •Gaming |
| DTV | 113 |  | <ul style="list-style-type: none"> •Rich UI and browsing |
| Multimedia & Navigation | 88 |  | <ul style="list-style-type: none"> •Advanced UI effects assisting navigation •Browsing |

*ARM estimates



Source: Gartner, IMS, Semico, Instat, IDC and ARM estimates



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ARM Technology and Graphics Expertise

- ARM is the semiconductor IP market leader
 - >10 billion ARM CPU processors shipped
 - Leaders in low power and multicore CPU design
- ARM is the leader in graphics IP
 - Mali graphics software (JSR184, JSR226, SVGt) in >50 million handsets
 - Motorola, Samsung, LGE, Amoi and others
 - ARM provide the complete graphics stack
 - Leaders in licensing GPU IP
 - From the world's smallest (Mali55™ GPU = 1mm² at 65nm)...
 - To the highest performance (Mali-400 MP GPU >1 billion pixels/sec)
 - Most widely deployed
 - 11 GPU licensees, 10 Graphics Software licensees



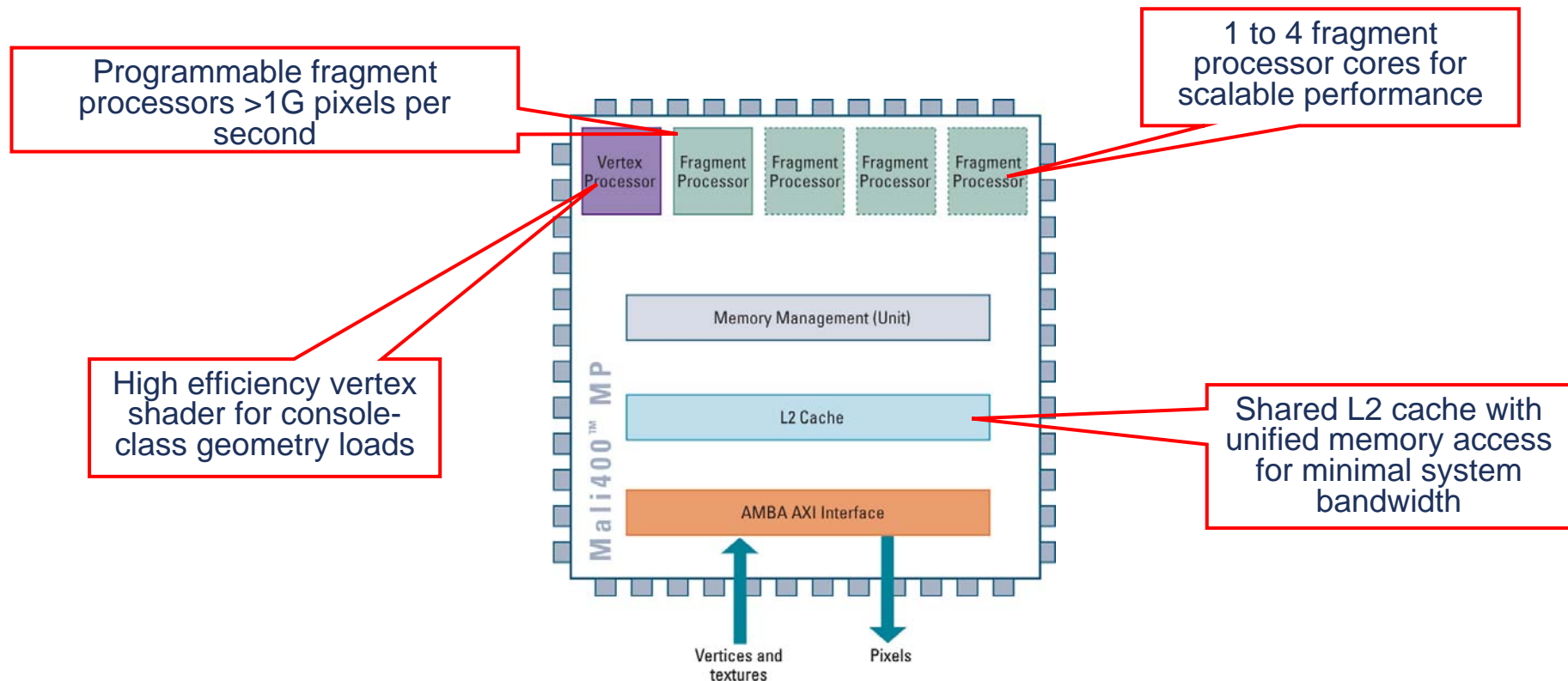
Public licensees of Mali GPU



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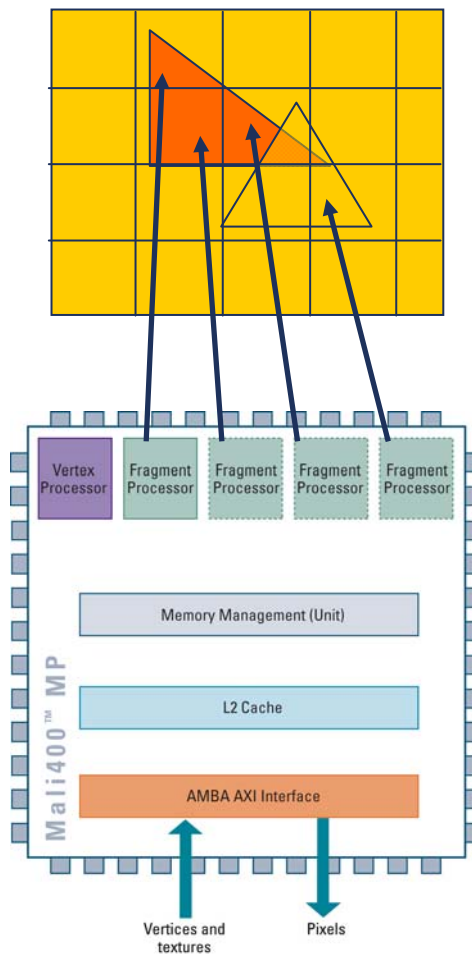
ARM Launches Pioneering Mali-400 MP GPU

- Pioneering Scalable Multicore Processor (MP) GPU
 - Scalable architecture builds on ARM MPCore™ experience
 - Lowest memory bandwidth usage in the industry = lowest power
 - Performance scalability to satisfy future display requirements
 - ...from WVGA feature phone to 1080p HDTV
 - Power and area scale to meet market needs



Scalability From 200M To >1G Pixels/S

Mali-400 MP performance scales linearly with number of cores



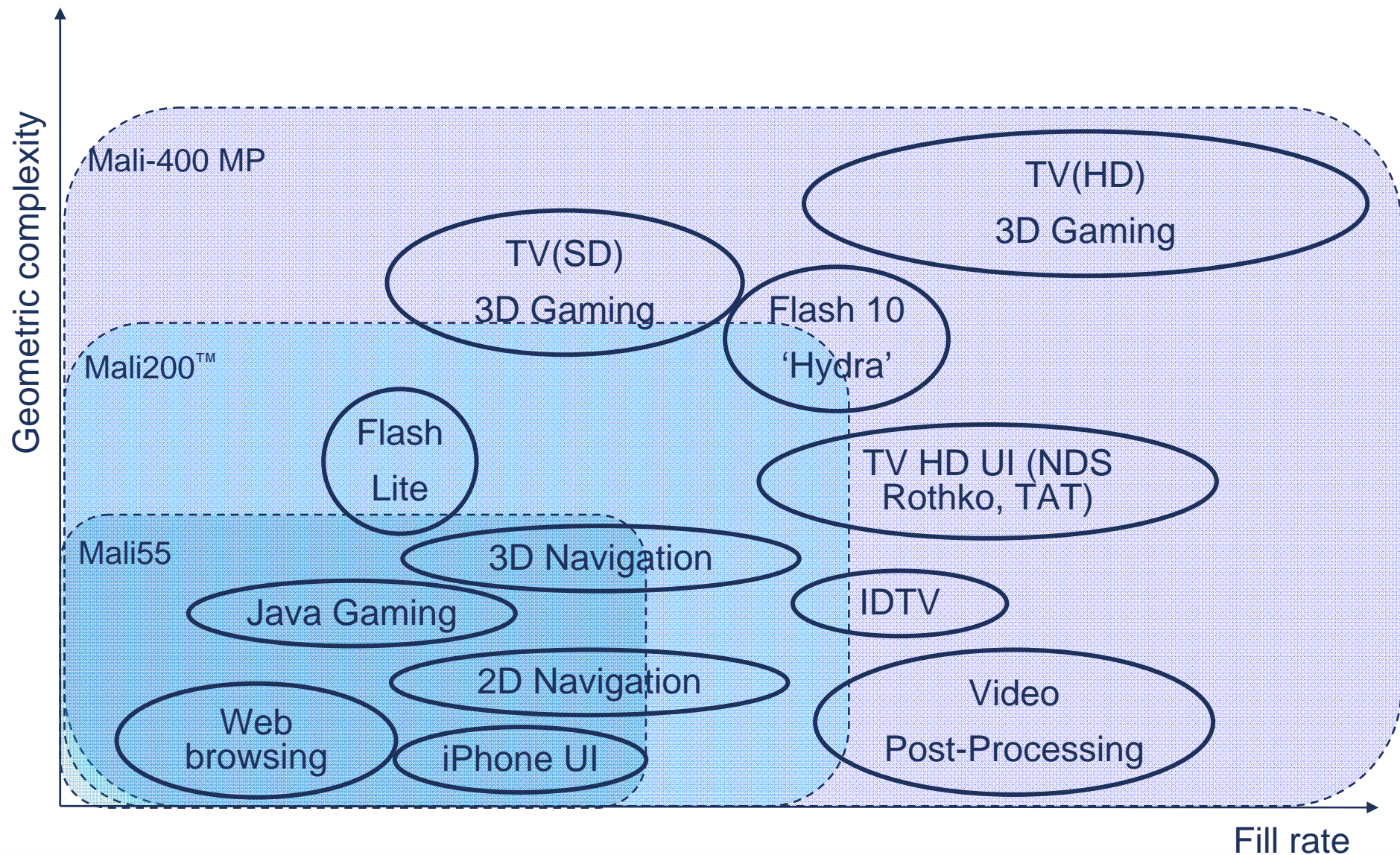
| # Fragment Processors | Fill rate at 275MHz |
|-----------------------|---------------------|
| 1 | 275Mpix |
| 2 | 550Mpix |
| 3 | 825Mpix |
| 4 | >1Gpix |

Fill rate measured using 4xFSAA, without overdraw assumptions

>1 Billion
pixels per
second

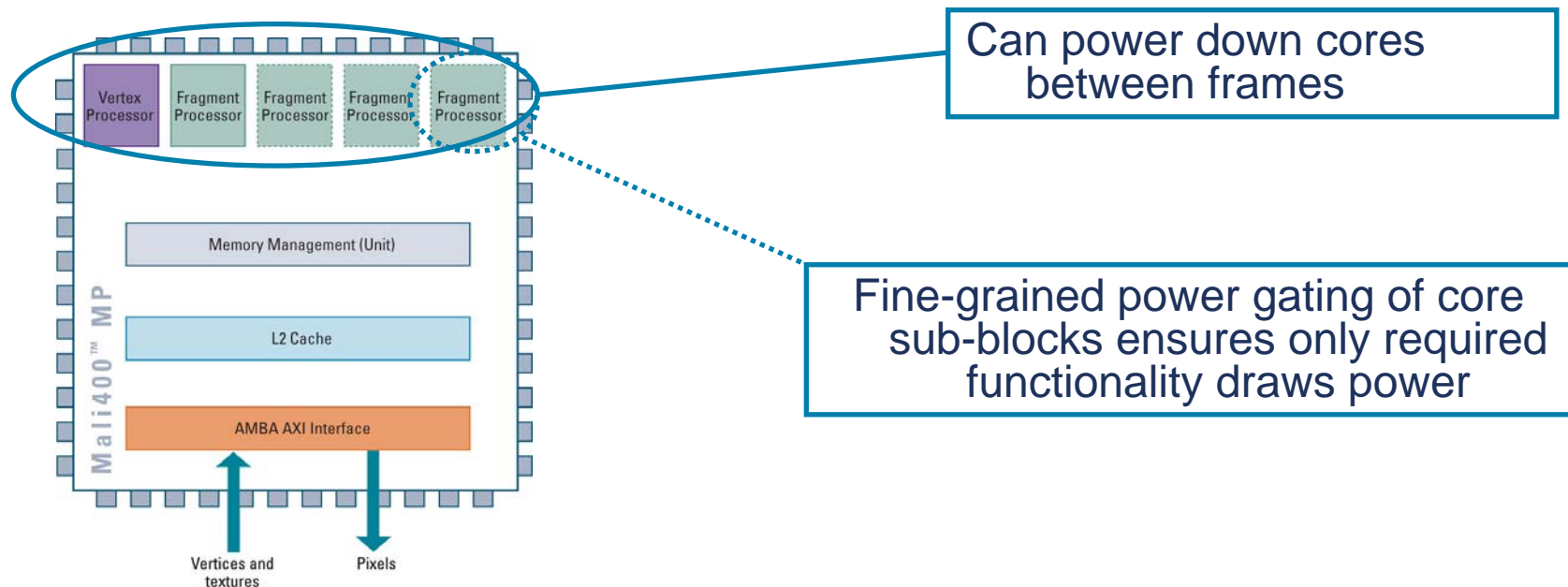
- Mali driver reduces complexity
 - Same driver for all configurations
 - Hardware detail hidden from developers
 - Cores work autonomously on different parts of framebuffer in parallel
 - Rendering distributed for optimal load balancing & bandwidth efficiency

Performance Scalable to 1G Pixel / s



Mali-400 MP - Power-efficient Graphics

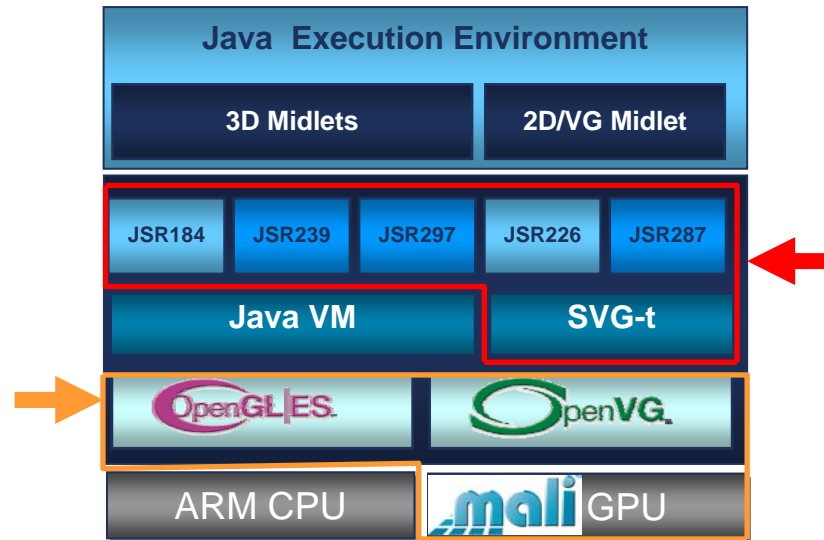
- Memory bandwidth is the #1 power drain in graphics
- Mali-400 MP GPU reduces memory bandwidth and lowers power
 - Combines best of immediate-mode and tile-based rendering
 - Shared L2 cache with unified memory access
 - Multiple levels of power gating supported



Complete Graphics Stack from ARM

Mali GPU + Drivers

- Licensed to SiPs:
 - Pre-verified
 - Simple Integration
 - SoC perspective



Mali Middleware

- Licensed to OEM:
 - Understand need
 - Build better GPUs
 - System perspective

1. System & SoC perspective: requirements from silicon to OEM to developer
2. Out of box experience: tight integration of CPU, GPU, drivers and middleware

Reduce time to market, lower costs, lower risk

Summary

- Graphics acceleration at heart of OEM multimedia strategies
 - In the home and on the move
- ARM Launches Mali-400 MP
 - Pioneering scalable multicore processor GPU
 - Modelled on the proven ARM MPCore technology CPU designs
 - Scalable performance to over 1 billion pixels per second
 - Lowest memory bandwidth usage in industry = lowest power
 - The Complete Graphics Stack - drivers, middleware and tools
- Availability
 - Mali-400 MP GPU is available for license now

**One day all consumer visual experiences will be enhanced by
graphics hardware acceleration**