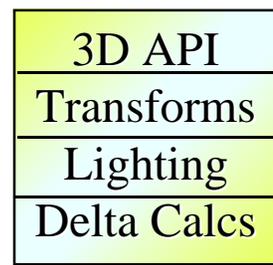


But where's the bottleneck?

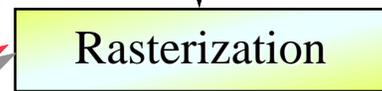
Geometry!

- The fastest Pentium Pro cannot keep PERMEDIA saturated if running the geometry in software

*1K polygons/MHz on a Pentium
Class machine
(90K polygons on a P5/90)*



*70% of the
CPU cycles
spent in setup!*



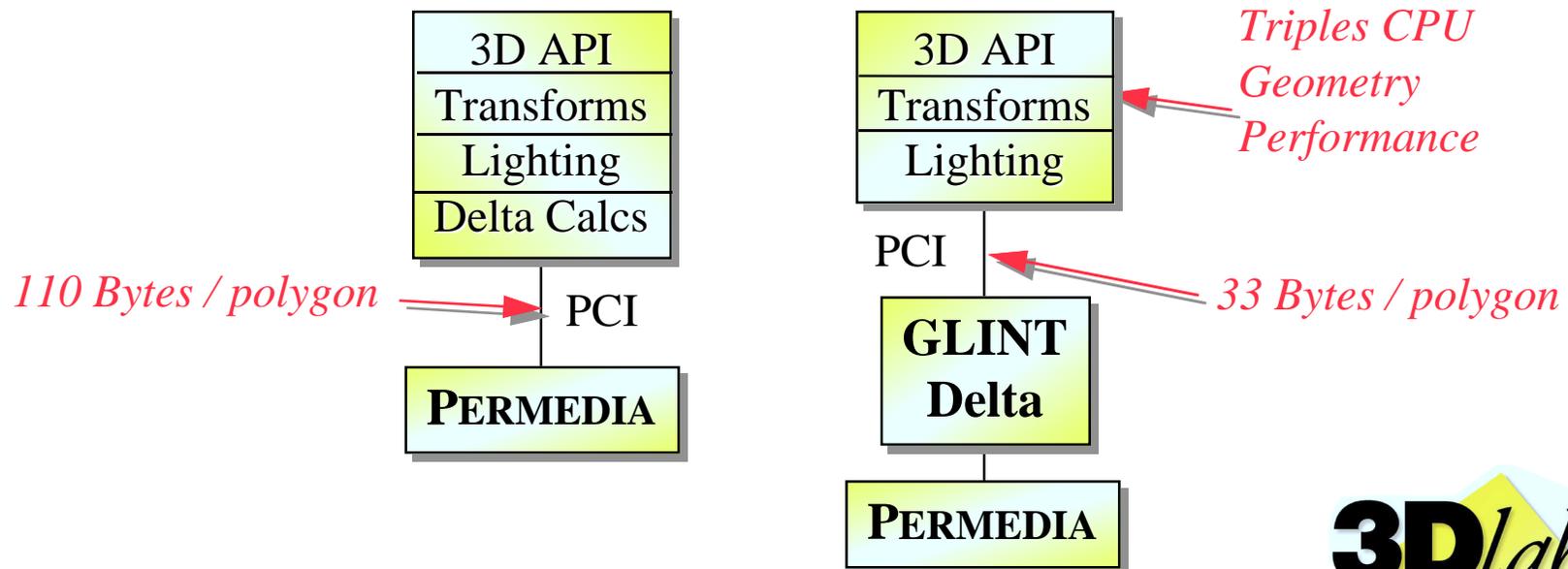
*100% of
Rasterization in
PERMEDIA
silicon*

3Dlabs

GLINT Delta

Breaking the Geometry Bottleneck

- Hardwired 3D Pipeline Processing
 - 1M vertex/sec Vertex Setup Processor
 - Performs all delta calculations and floating point conversions
 - 100 MFlop floating point processor
- Reduces PCI Bandwidth - just passing vertices - no slopes



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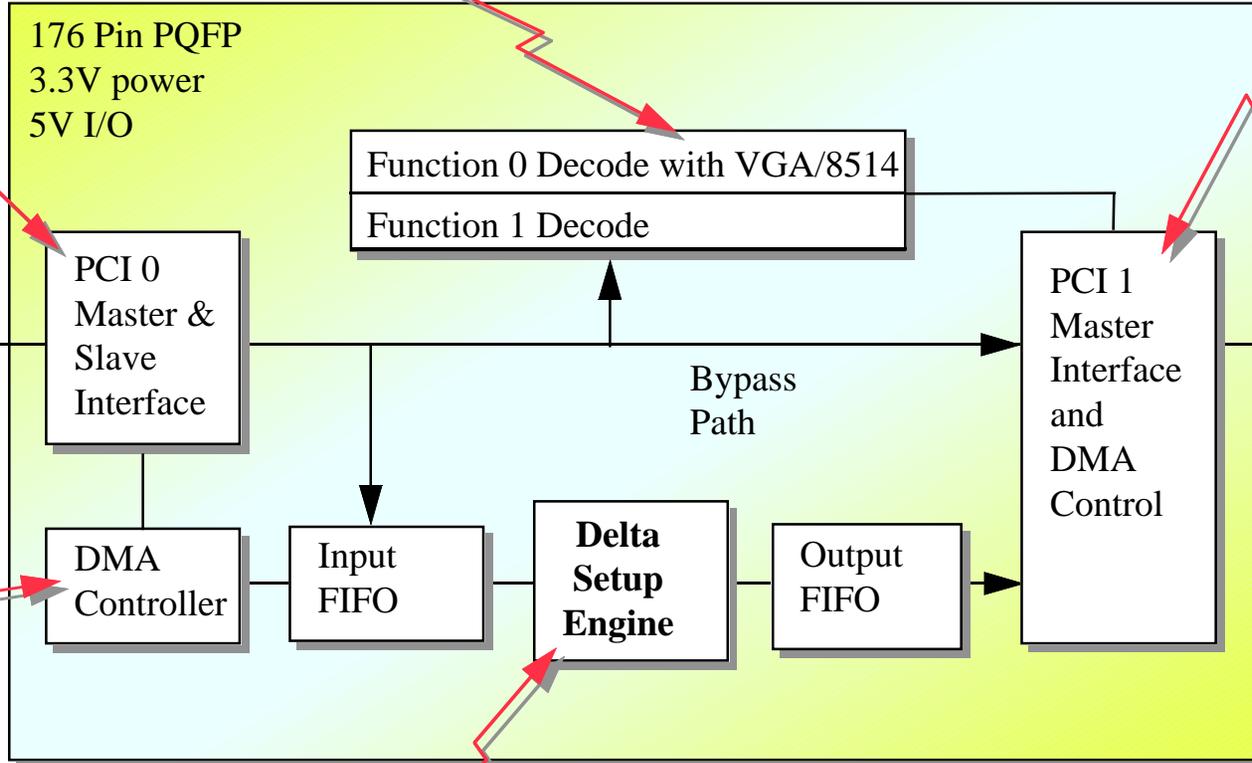
GLINT Delta

Setup Processing in a PCI Bridge

Allows transparent use of VGA and 8514 behind bridge

Full Bus Master

Primary PCI Bus



Provides setup-fetch overlap

DMA to GLINT or PERMEDIA

Secondary PCI Bus

Slope and Setup Calculations for GLINT and Permedia

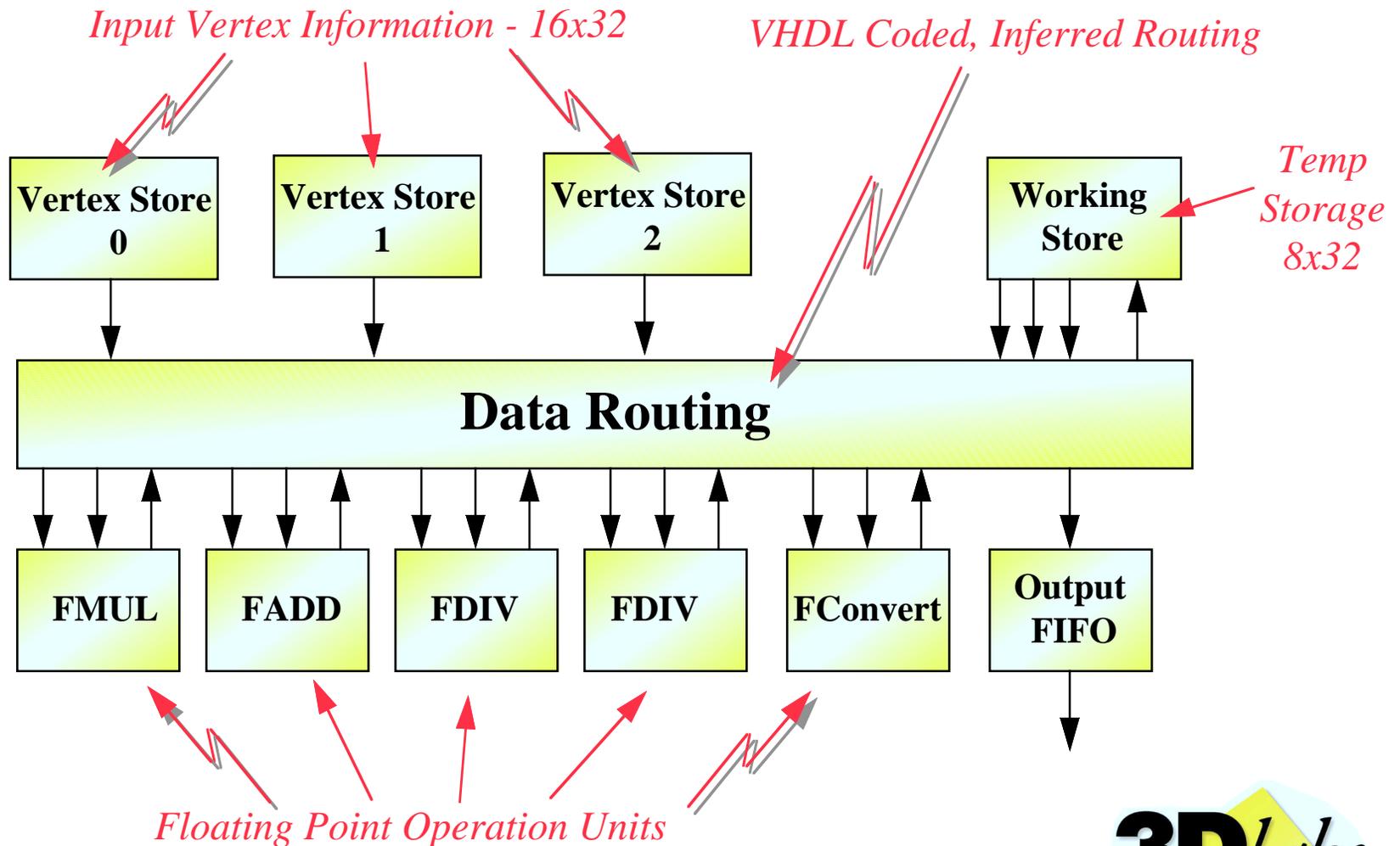
GLINT Delta

Setup Engine Functionality

- Follows the message passing architecture of PERMEDIA
 - Delta is just another unit in front of the rasterizer
- API neutral - low-level functionality
- Triangle primitive setup (AA and non-AA)
- Line primitive setup (AA and non-AA)
- Interpolation Parameters - XYZ, RGBA, F, STQ, Ks, Kd
- Accepts floating point (IEEE SP) or fixed point inputs
- Texture coordinate auto normalization
- Optional input value clamping
- High precision sub-pixel correction

GLINT Delta Setup Engine

Hardwired processing



GLINT Delta Calculations

Floating Point improves robustness and visual quality

- Input parameter score-boarding
- All internal calculations in custom floating point format
 - Less dynamic range, but more precision than IEEE
- RGBAZ triangle set-up involves:
 - 41 floating point add or subtract
 - 27 floating point multiplies
 - 5 floating point divides
 - plus.. compares, clamping, fixed point/floating point conversions
- Main floating point operators are:
 - One multiplier (one pipeline stage, single cycle).
 - One adder/subtractor (single cycle)
 - Two dividers (5 cycle iterative, autonomous)
 - Four comparators
 - Float to fixed point conversion with clamping

Hard-Wired Processing

Cost-effective floating point performance

- Control is a VHDL state machine.
 - No RAM or ROM for program storage (less gates)
 - No program sequencer or instruction set (less gates)
 - No program fetch (less memory bandwidth)
- Data paths are inferred directly from VHDL
 - No general purpose routing costs
- No software maintenance
- 35 cents / MFlop

GLINT Delta

Physical Characteristics

- Low cost device - 176 pin PQFP
- .45 μ , 40MHz, 3 layer metal
- Shipping now
- Performance
 - 1M Meshed Shaded, Z buffered triangles/sec
 - 2M 2D polylines/sec

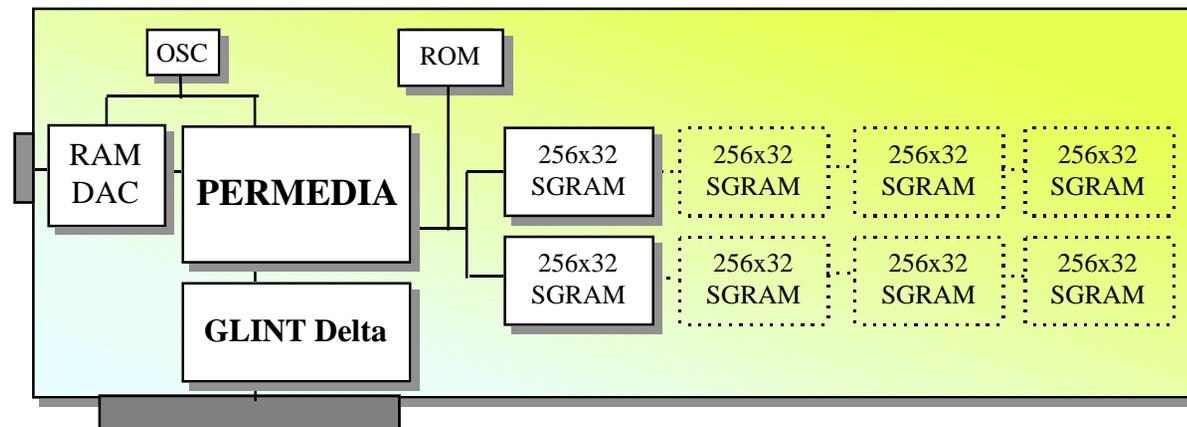


3Dlabs

Combined Board Design

Delta and PERMEDIA

- Matched Geometry and Rasterization performance
- High performance Arcade machines, VR/simulation engines, entry-level desktop OpenGL acceleration
- Sub \$350 street price



GLINT Delta

Measured Performance Increases

Tspeed3 V3.0 OpenGL	No Delta	With Delta	X Faster With Delta
Meshed Triangles (Z, Shaded) 50 Pixel per second	155,146	238,997	1.54
Meshed Triangles (Z, flat) 50 Pixel per second	205,870	321,247	1.56
Meshed Triangles (Z, Shaded) 25 Pixel per second	180,744	427,242	2.36
Meshed Triangles (Z, flat) 25 Pixel per second	232,398	573,212	2.47
Meshed Triangles (Z, Shaded) Small Triangles per second	187,454	599,762	3.20
Meshed Triangles (Z, flat) Small Triangles per second	249,629	586,527	2.35
Meshed Triangles (Z, Shaded) Single Pixel Triangles per second	187,454	600,476	3.20
Meshed Triangles (Z, flat) Single Pixel Triangles per second	249,629	586,527	2.35
Meshed Triangles (No Z, Shaded) 50 Pixel per second	182,048	277,016	1.52
Meshed Triangles (No Z, flat) 50 Pixel per second	223,155	365,412	1.64
Meshed Triangles (No Z, Shaded) 25 Pixel per second	199,290	514,781	2.58
Meshed Triangles (No Z, flat) 25 Pixel per second	272,531	585,847	2.15
Meshed Triangles (No Z, Shaded) Small Triangles per second	200,159	646,607	3.23
Meshed Triangles (No Z, flat) Small Triangles per second	271,068	586,527	2.16
Meshed Triangles (No Z, Shaded) Single Pixel Triangles per second	200,079	646,607	3.23
Meshed Triangles (No Z, flat) Single Pixel Triangles per second	271,214	586,527	2.16