Full-scene Anti-aliasing & Multi-sample Rendering

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September 2000

Agenda

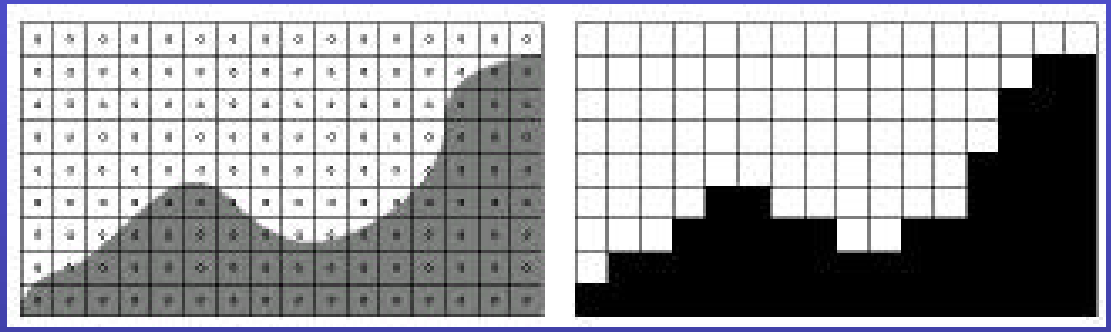
- Full-scene anti-aliasing (FSAA)
- 3dfx multi-sampling
- Special effects
- Future technology

Improving Realism

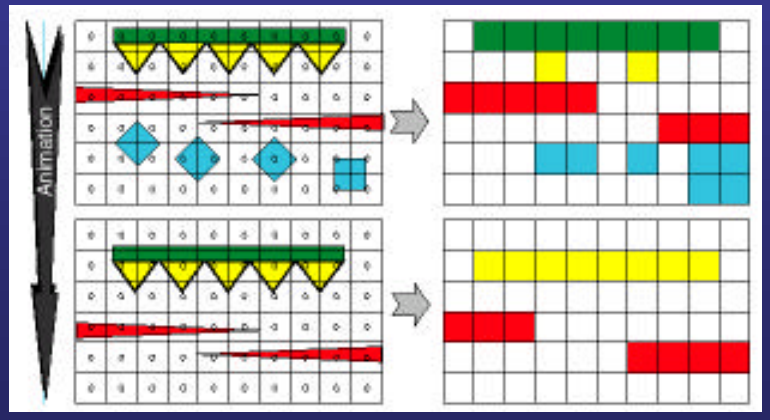
- Immersive 3D
  - High performance
  - Realistic images
- Aliasing: a barrier to image quality

Aliasing Artifacts

- Jaggies



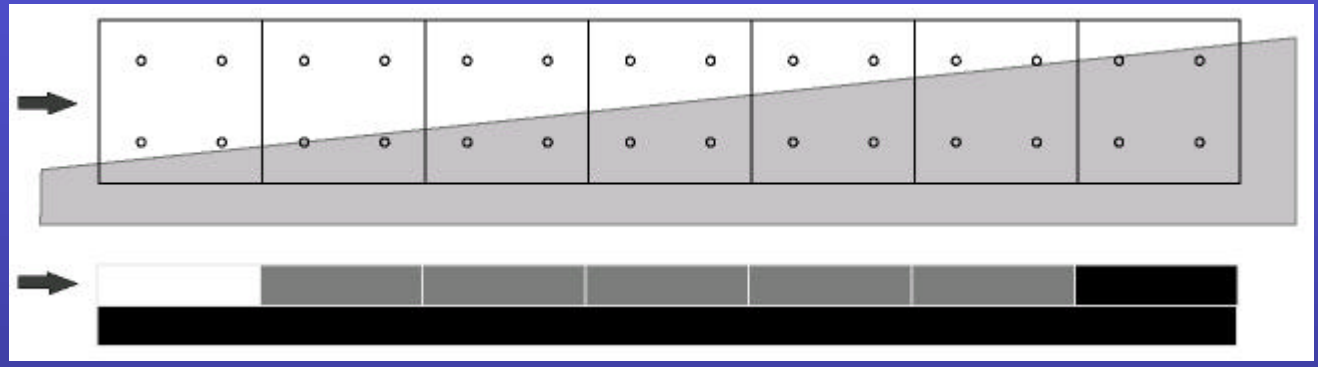
- Pixel popping



Full-scene Spatial Anti-aliasing

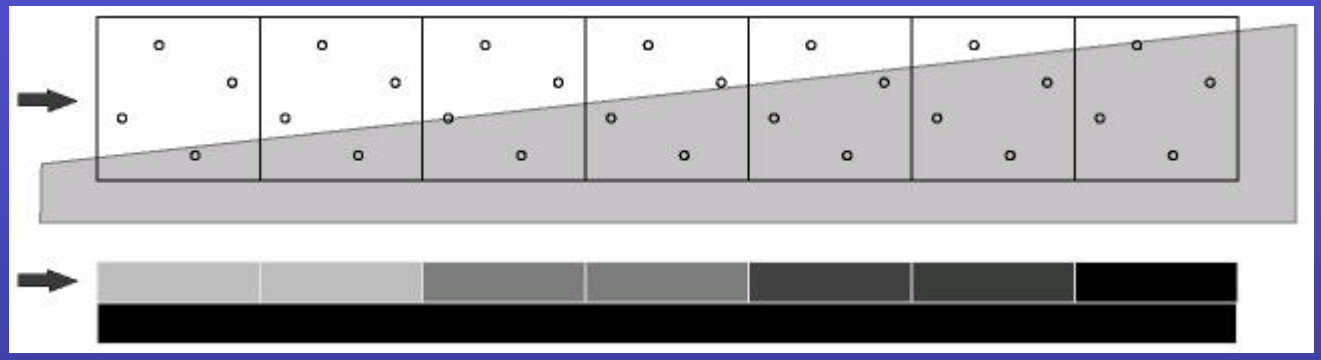
- Commonly referred to as “AA” or “FSAA”
- Take multiple spatial samples per pixel
  - Distinct from multiple samples in time (motion blur)
  - Or multiple samples in focal distance (depth blur)
- Two common algorithms for spatial FSAA:
- Ordered Grid Super-sampling (OGSS)
- Rotated Grid Super-sampling (RGSS)

Ordered Grid Super-sampling



- Extra samples are positioned in an ordered grid
  - Problem: only 3 shades are available for edges near horizontal or vertical
- Can be implemented on any 3D accelerator
  - Used by NV15, Radeon
  - But software can create problems with LFB accesses

Rotated Grid Super-sampling

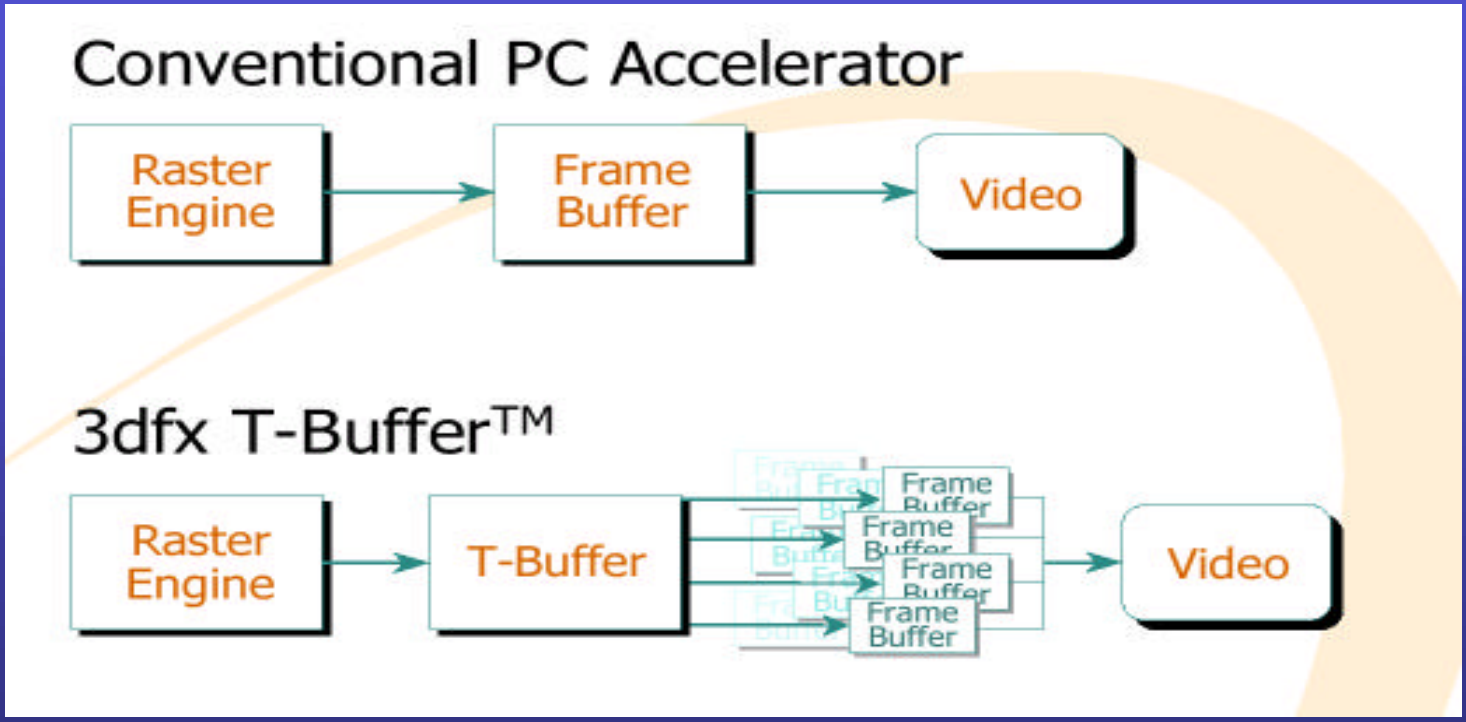


- Extra samples are jittered or shifted off axis
  - Approximates fully random jittered super-sampling
  - Approximate by using a predefined pattern
  - All 5 shades available for edges near horizontal or vertical

Multi-sample Rendering

- Accumulation buffer
  - Elegant solution
  - Expensive solution
- The T-BufferTM
  - Cost-effective solution
  - Better performance

3dfx T-Buffer™

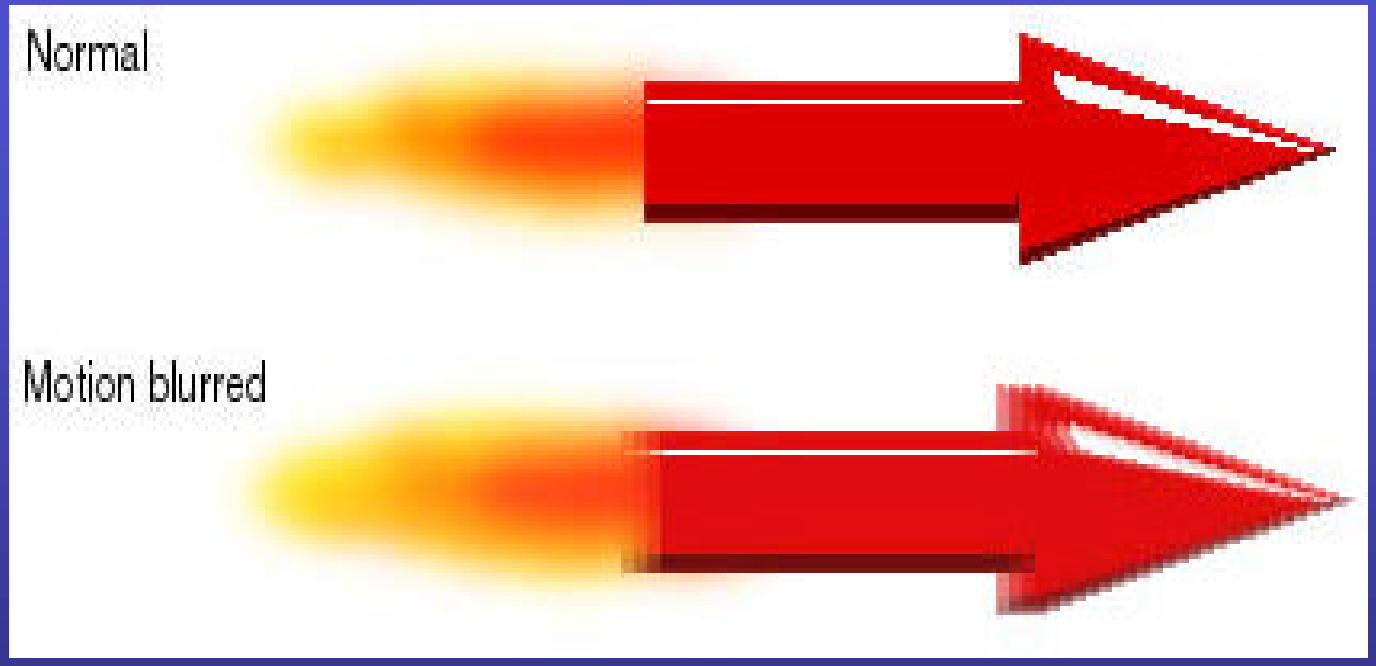


- Video circuitry combines multiple images
  - No accumulate step
  - No copy from accumulation buffer to back buffer
  - LFB access “just works”

T-BufferTM Technology

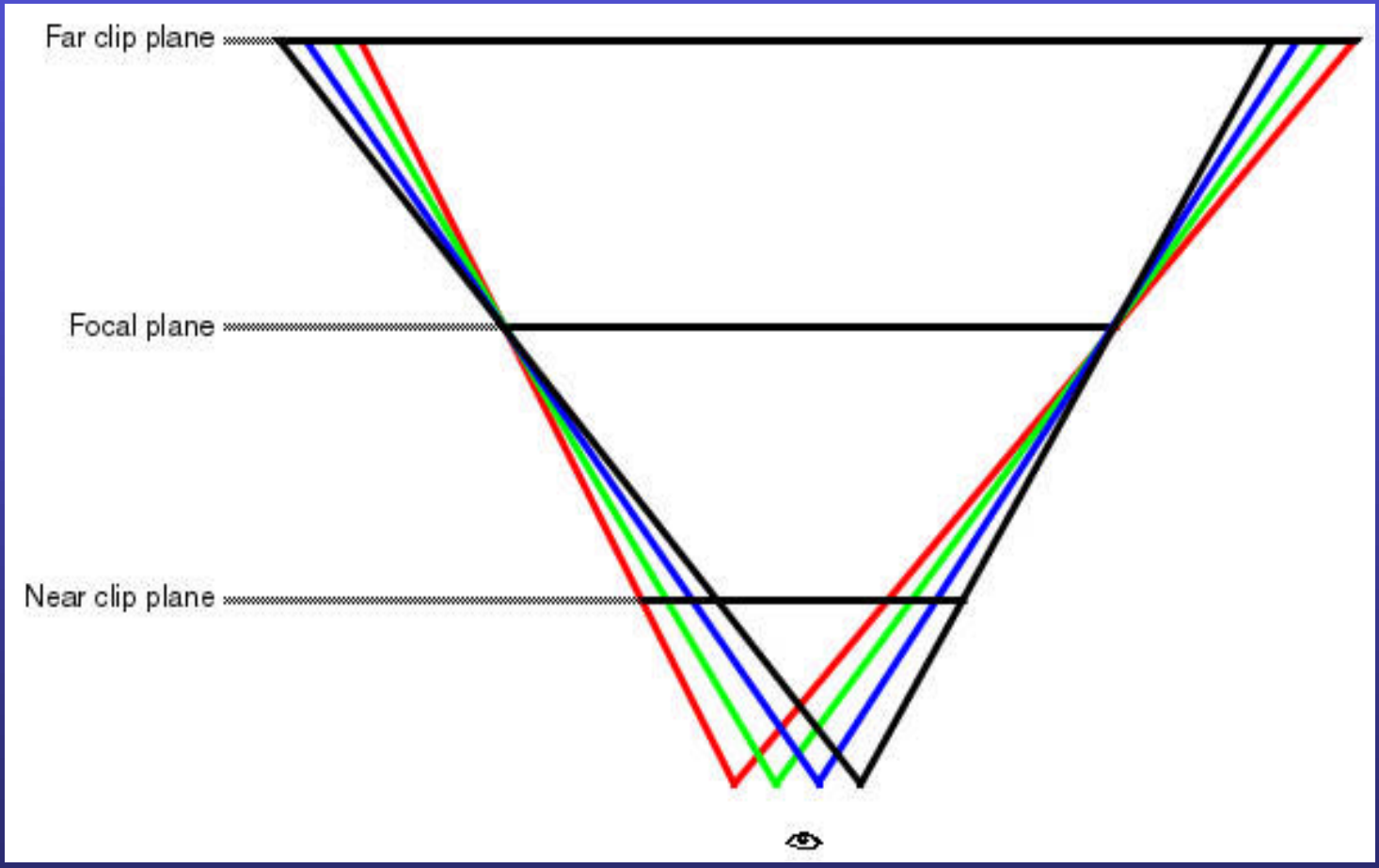
- Full-scene anti-aliasing (FSAA)
- Special effects:
  - Motion blur
  - Depth of field (focal) blur
  - Soft reflectance
- All in real time!

T-Buffer™ - Motion Blur



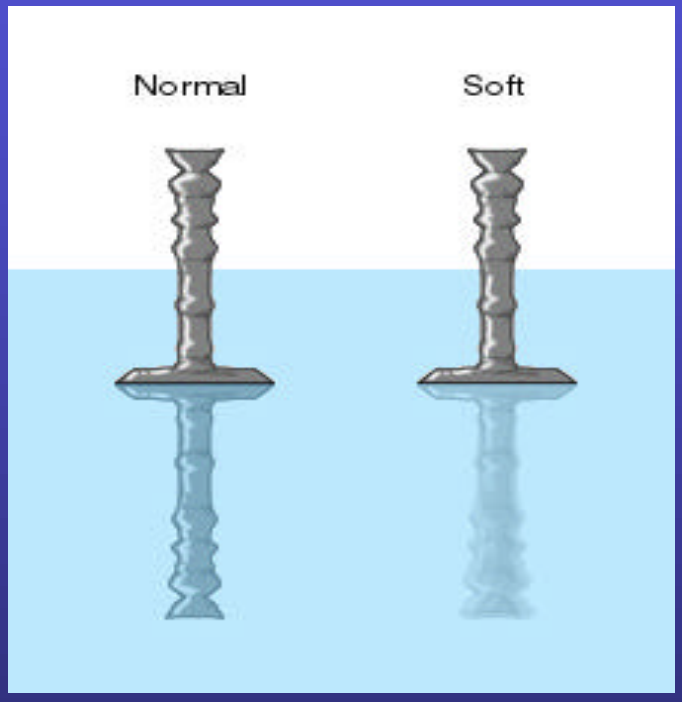
- Simulates blurring found in film and television pictures
- Depends on both object motion and camera motion

T-Buffer™ - Depth of Field



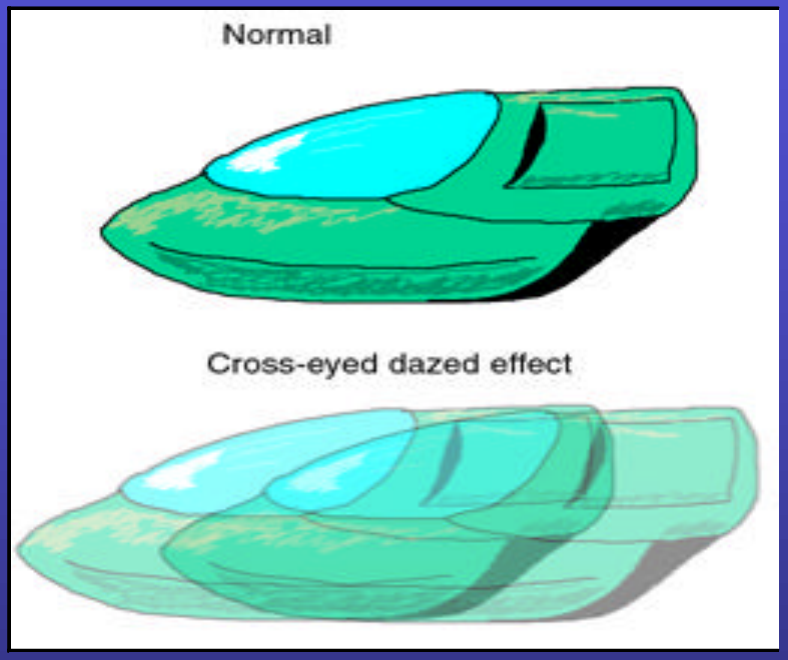
- Used by film directors to draw attention
- Games currently display the entire scene in focus

T-Buffer™ - Soft Reflectance



- Soft reflectance more realistic for many materials (e.g. plastics)

T-Buffer™ - Other Effects



- Transitions
- Dazed effect
  - Can be useful when player gets attacked/shot

Conclusions

- FSAA improves image quality
- VSA-100 brings affordable real-time FSAA to the PC for the first time
- Seeing is Believing!
- (www.3dfx.com/3dfxTechnology/SSAA-Analyzed.PDF)

3dfx Products

AA & T-Buffer™ Enabled

Voodoo5™ 6000*
128MB AGP
1.33-1.47 Gigapixels/sec
~$599

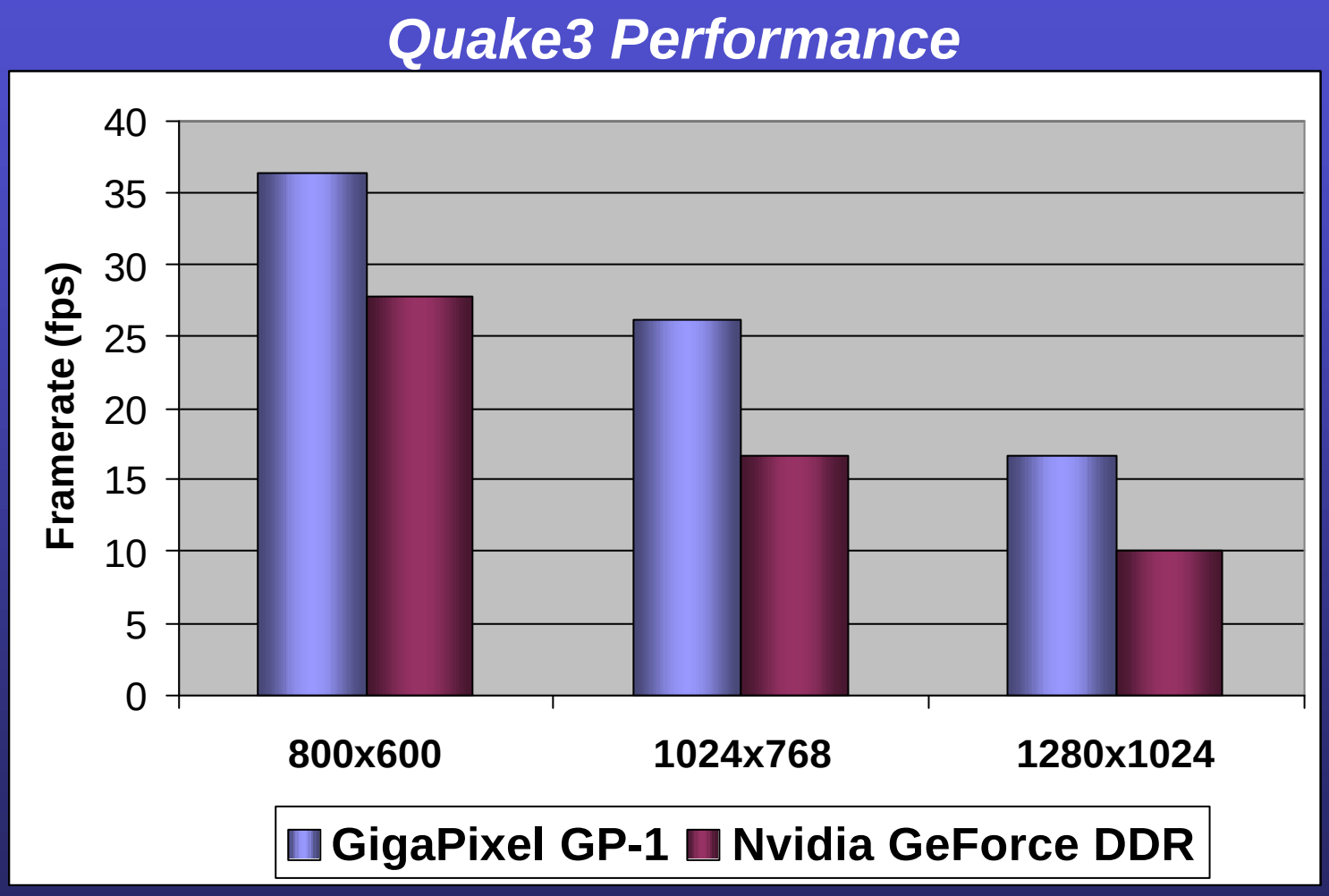
Voodoo5™ 5500
64MB AGP
667-733 Megapixels/sec
~$299

Voodoo5™ 5000*
32MB PCI
667-733 Megapixels/sec
~$229

Voodoo4™ 4500
32MB AGP & PCI
333-367 Megapixels/sec
~$179

* Shipping Soon

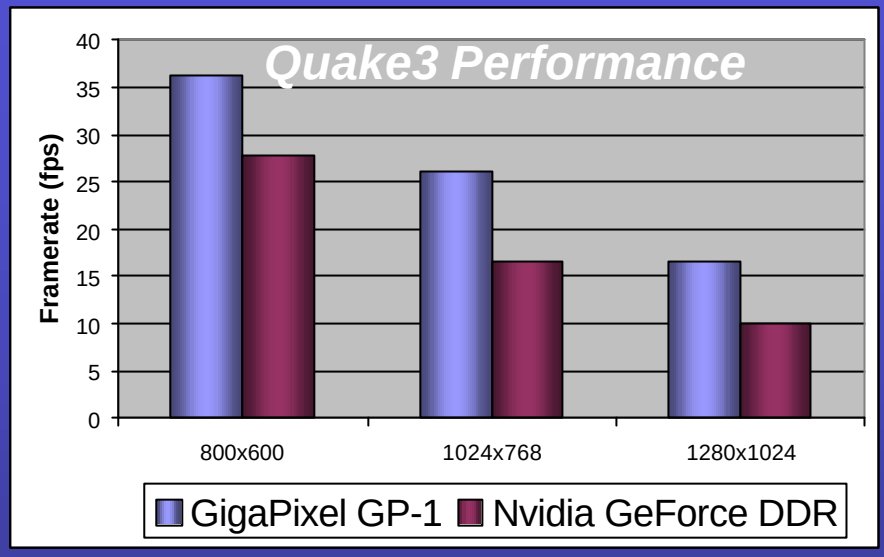
The “Disruptive” GigaPixel 3D Technology



#1: Superior performance to Nvidia GeForce DDR!

Test Conditions: Quake 3 Timedemo1, High quality, 4X FSAA, 600MHz PIII, 100MHz memory clock for GP-1, 166MHz memory clock for GeForce

The “Disruptive” GigaPixel 3D Technology



Nvidia GeForce DDR

~15M 3D Transistors

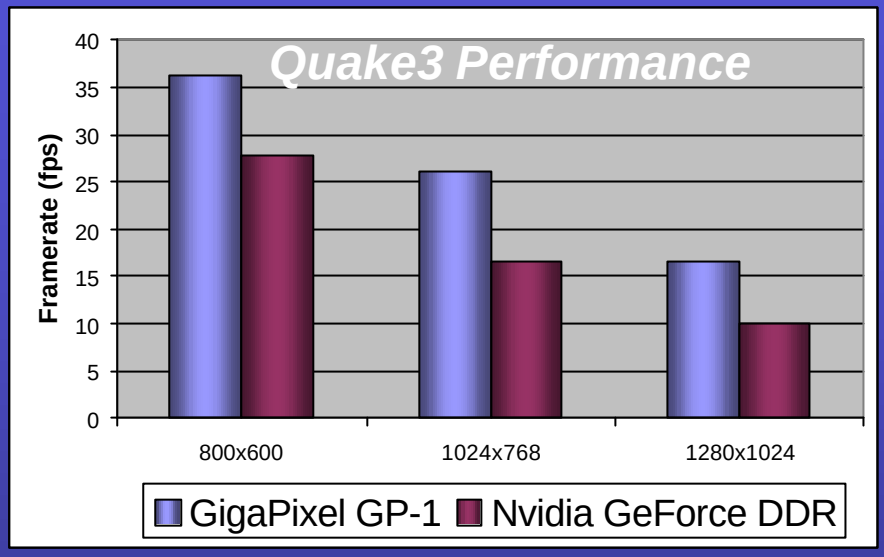
- **Reduced transistors**
- **Reduced die size**
- **Reduced power**

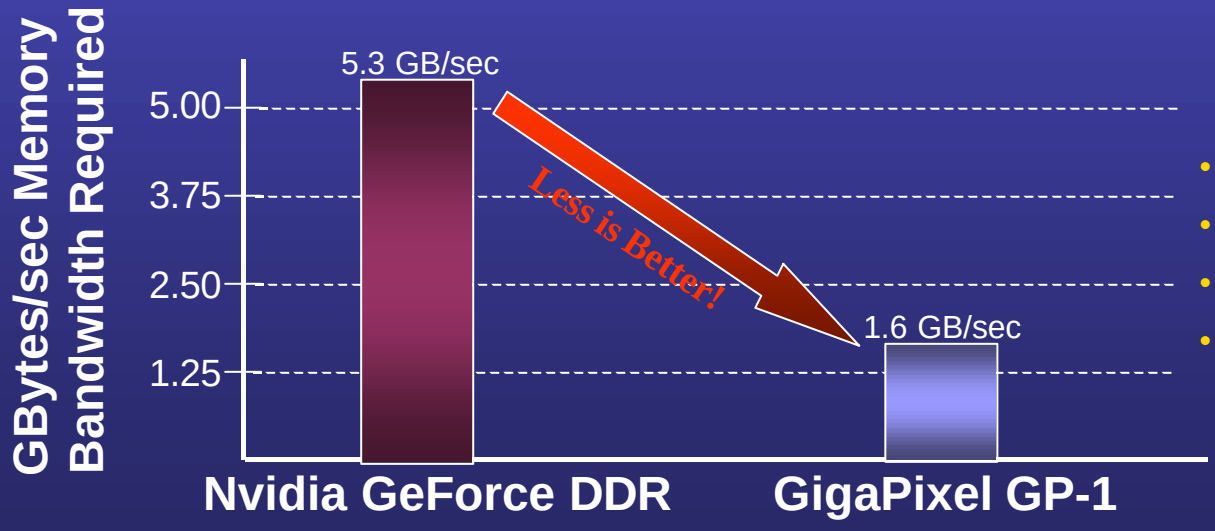
GigaPixel GP-1

~3M 3D Transistors

#2: Superior performance at 20% the die size!

The “Disruptive” GigaPixel 3D Technology



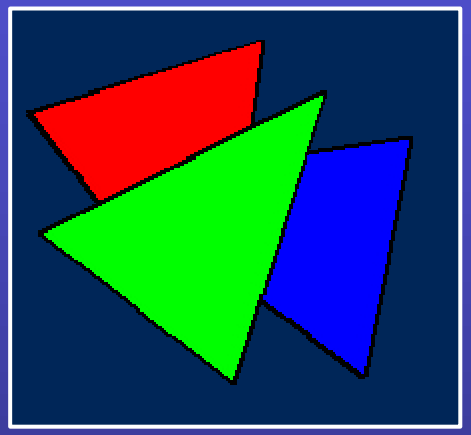


- Reduced memory speed
- Reduced memory cost
- Reduced package pins
- Reduced power

#3: Superior performance at ~30% the bandwidth!

GigaPixel “Disruptive” 3D Technology

Traditional 3D Architecture



Step 1: Draw blue triangle

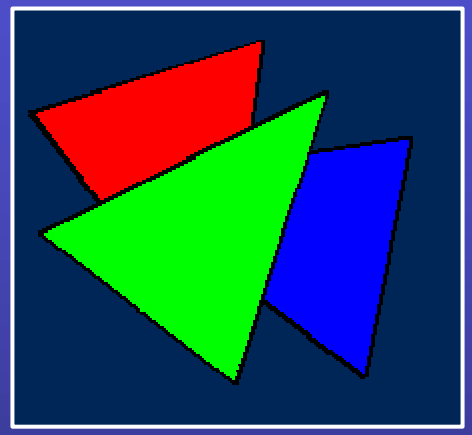
Step 2: Draw red triangle

Step 3: Draw green triangle

Problem: Time wasted rendering pixels which are not visible in the final image

4x Improved Efficiency

Gigapixel 3D Technology



Single Step: Draw only visible pixels for all triangles

Solution: Architectural breakthrough which greatly improves 3D efficiency

GigaPixel “Disruptive” 3D Technology

Gigapixel 3D technology breakthrough	Benefit
• Pixel visibility efficiency	• Higher 3D performance
• On-chip, tiled rendering	• Higher 3D performance • Enhanced image quality
• Reduced memory bandwidth requirements	• Lower solution cost
• Reduced gate count	• Lower cost • Lower power

Conclusions

- Voodoo4 & 5 bring affordable real-time FSAA to the PC for the first time
- FSAA improves image quality
- T-Buffer effects improve game play
- Disruptive technology to change the rules!

www.3dfx.com