Trends in Graphics Architecture
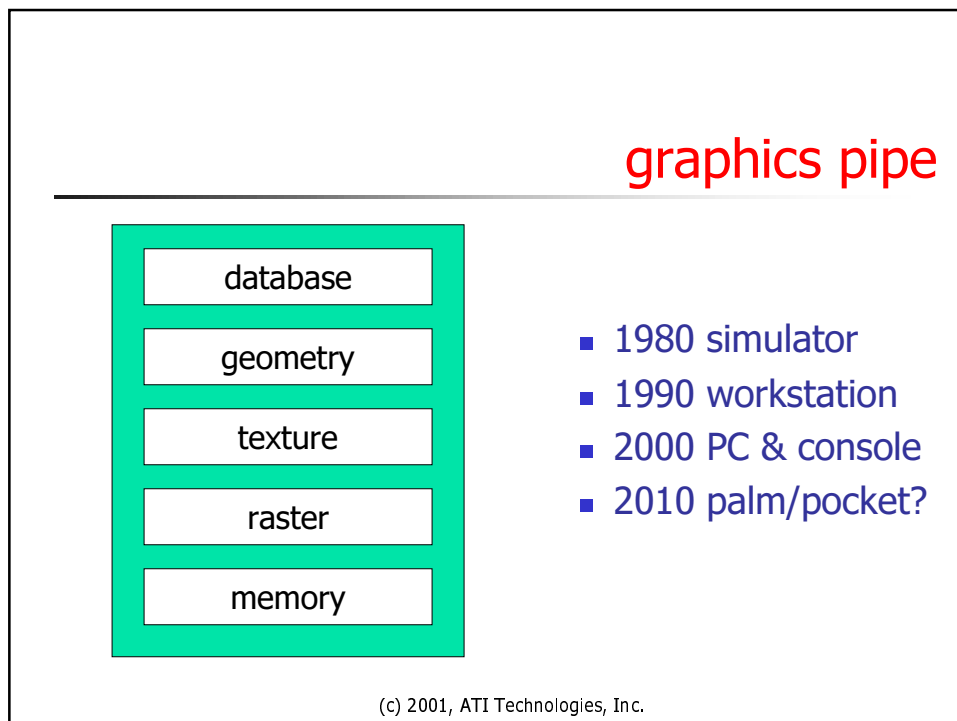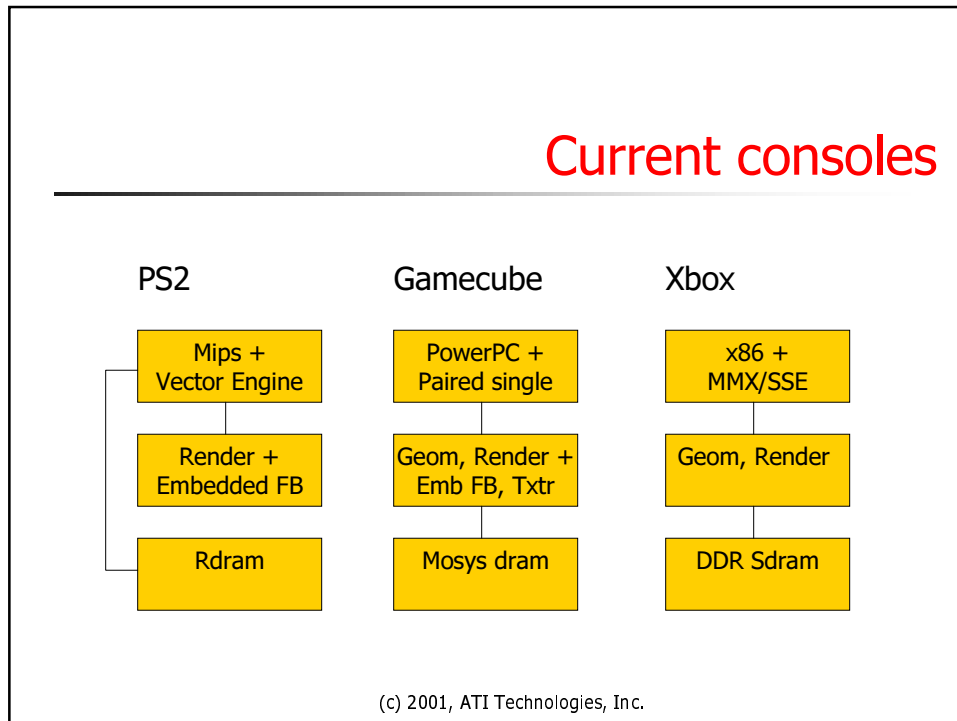
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graphics business
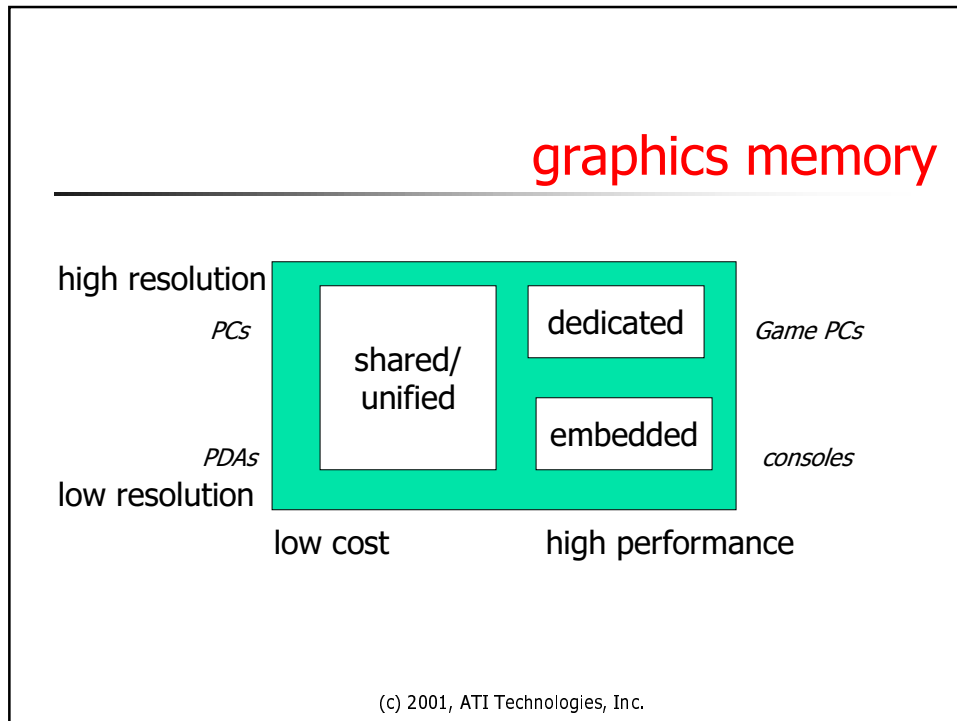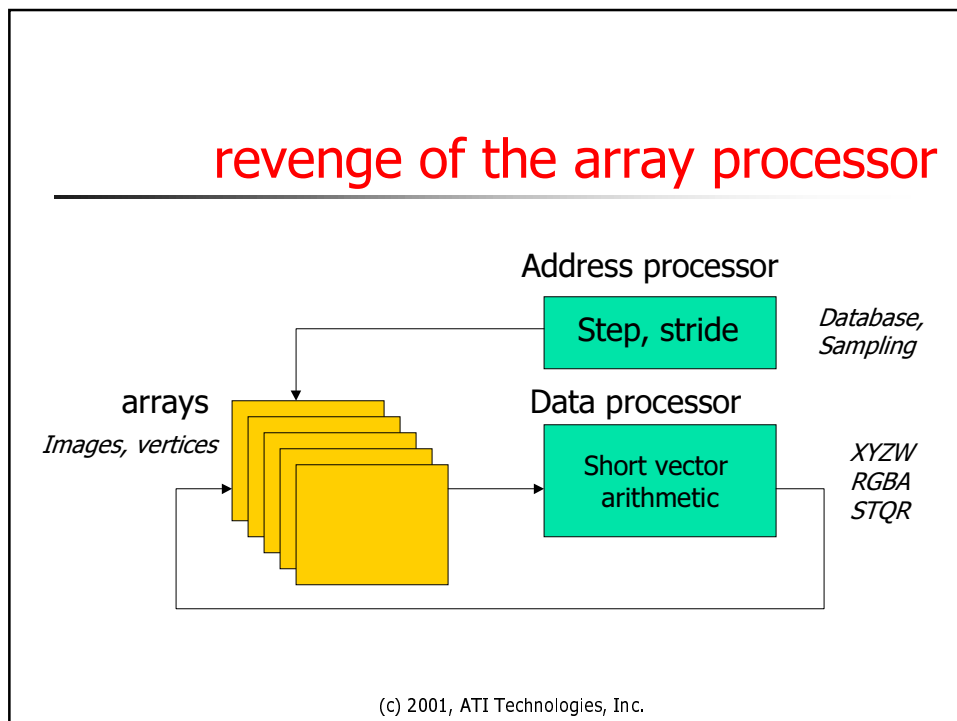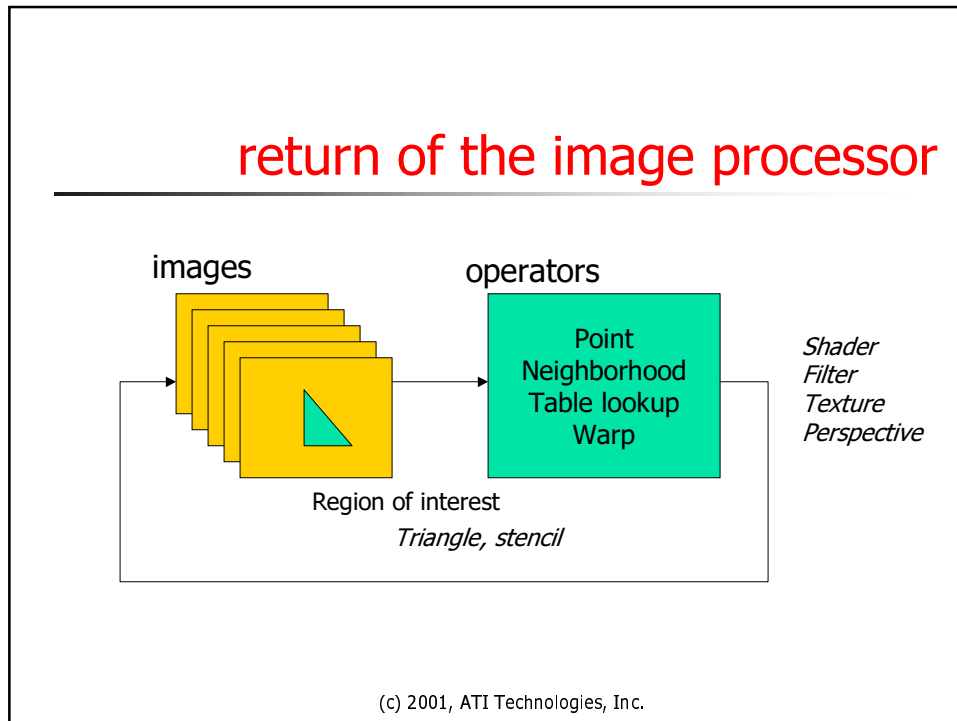
- ~$20M to develop a graphics chip
- Lucky to net ~$10 a chip
- Only game platforms have enough volume
  - Novelty supercedes fidelity
- PC's offer many design win opportunities
  - But model and API velocity limit lifecycle
- Consoles live long and prosper
  - But only 2.5 design wins per cycle

Current consoles

PS2   Gamecube   Xbox

| Mips +
Vector Engine | PowerPC +
Paired single | x86 +
MMX/SSE |

| Render +
Embedded FB | Geom, Render +
Emb FB, Txtr | Geom, Render |

| Rdram | Mosys dram | DDR Sdram |

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graphics pipe

| database |
| geometry |
| texture |
| raster |
| memory |

- 1980 simulator
- 1990 workstation
- 2000 PC & console
- 2010 palm/pocket?

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graphics memory

high resolution

PCs

dedicated Game PCs
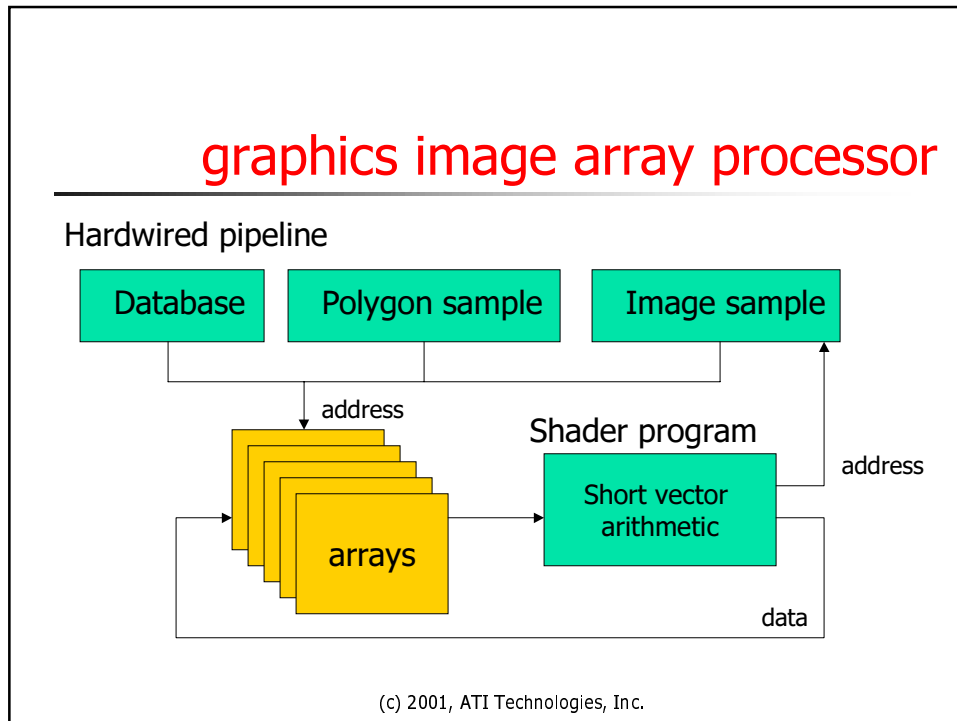
shared/
unified

embedded

PDAs consoles

low resolution

low cost high performance

graphics programmability

- CPU
  - Less than compelling 3D
- 80's bitslice, DSP, sundry
  - Lag in clock speed, software
- 90's CPU plus simd coprocessor
  - Lag in memory throughput, addressing
- 00's standalone simd coprocessor ('shader')
  - TBD

return of the image processor

images

operators

Point
Neighborhood
Table lookup
Warp

Shader
Filter
Texture
Perspective

Region of interest
Triangle, stencil

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revenge of the array processor

Address processor

Step, stride

Database,
Sampling

arrays
Images, vertices

Data processor

Short vector
arithmetic

XYZW
RGBA
STQR

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graphics image array processor

Hardwired pipeline

Database	Polygon sample	Image sample

address

Shader program
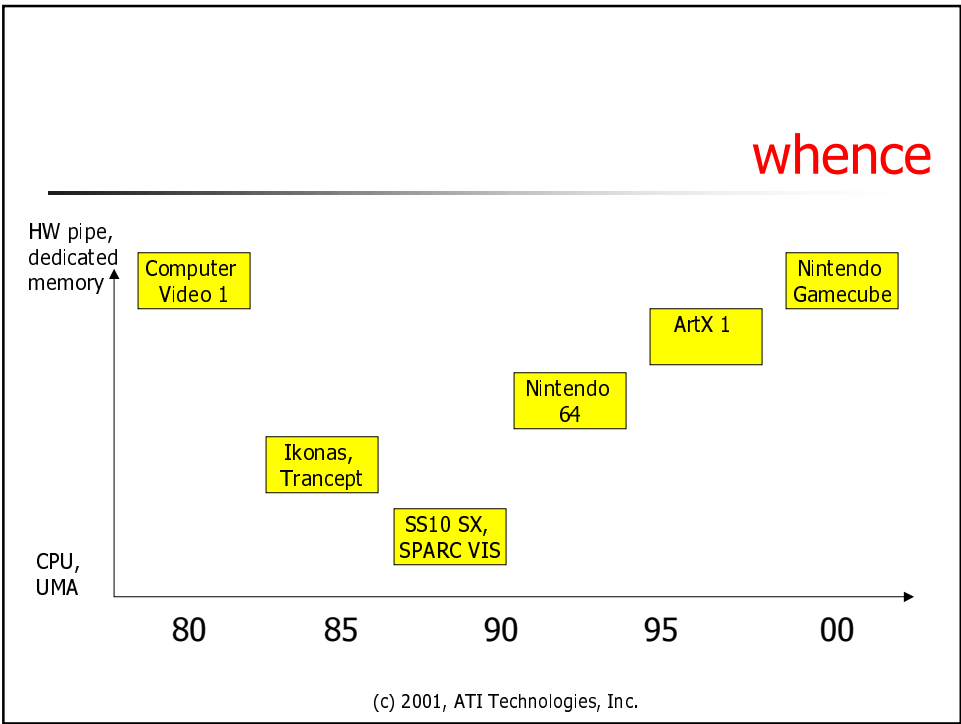
arrays

Short vector arithmetic

address

data

whither

- **Generalization is likely**
  - Addressing, branching, threading, virtual memory
- **Cheap fast things devour big complex ones**
  - Unit growth in pocket/palm entertainment
- **But programmability can be scalable**
  - Perhaps SOC CPU + simd + database/samplers
- **And business overpowers technologies**

denial

- Global illumination is very useful
    - Simply enable shadows, reflection, refraction
- Global illumination is very hard
    - Sort violates the pipe
- So circulate lots of images, arrays
    - Novelty supercedes fidelity

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whence

HW pipe,
dedicated
memory

Computer Video 1

Nintendo Gamecube

ArtX 1

Nintendo 64

Ikonas, Trancept

SS10 SX, SPARC VIS

CPU,
UMA

80   85   90   95   00

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why

- De-evolutionary optimization
  - Direct to icon to symbol and back
- Evolutionary light prosthesis
  - Compensation for our visual asymmetry
- An instrument
  - Enable the top of the pyramid

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