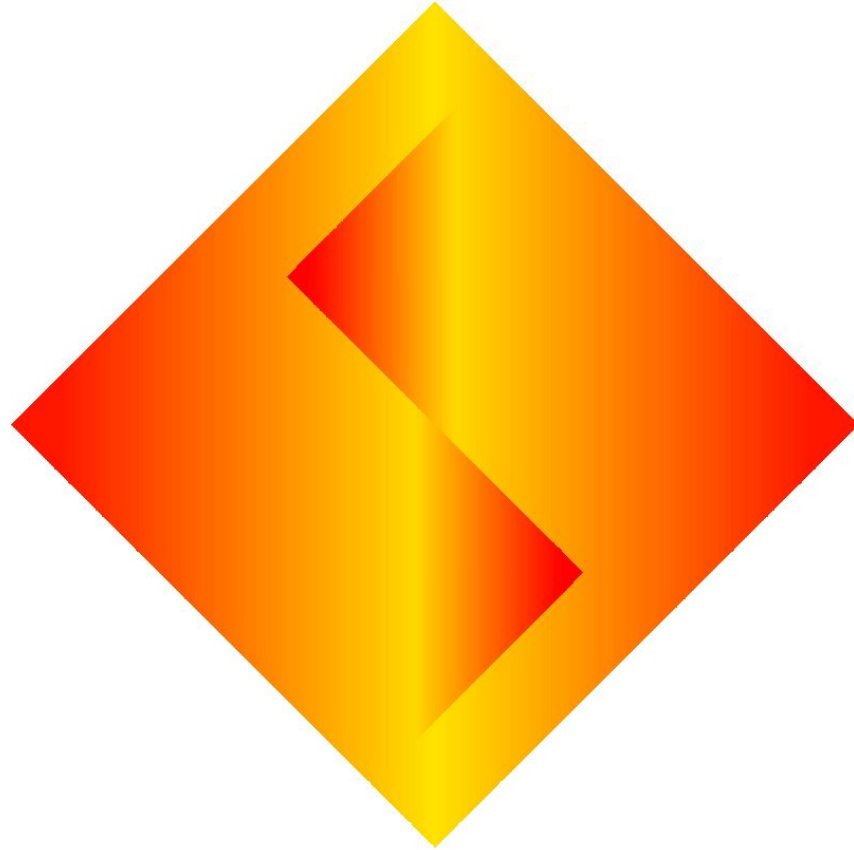


**SONY**



**COMPUTER  
ENTERTAINMENT**

**Dominic Mallinson**

**Director of Technology, R&D**

**Sony Computer Entertainment America**

**Introducing**

**PlayStation®2**



Japanese Launch : 3/4/2000

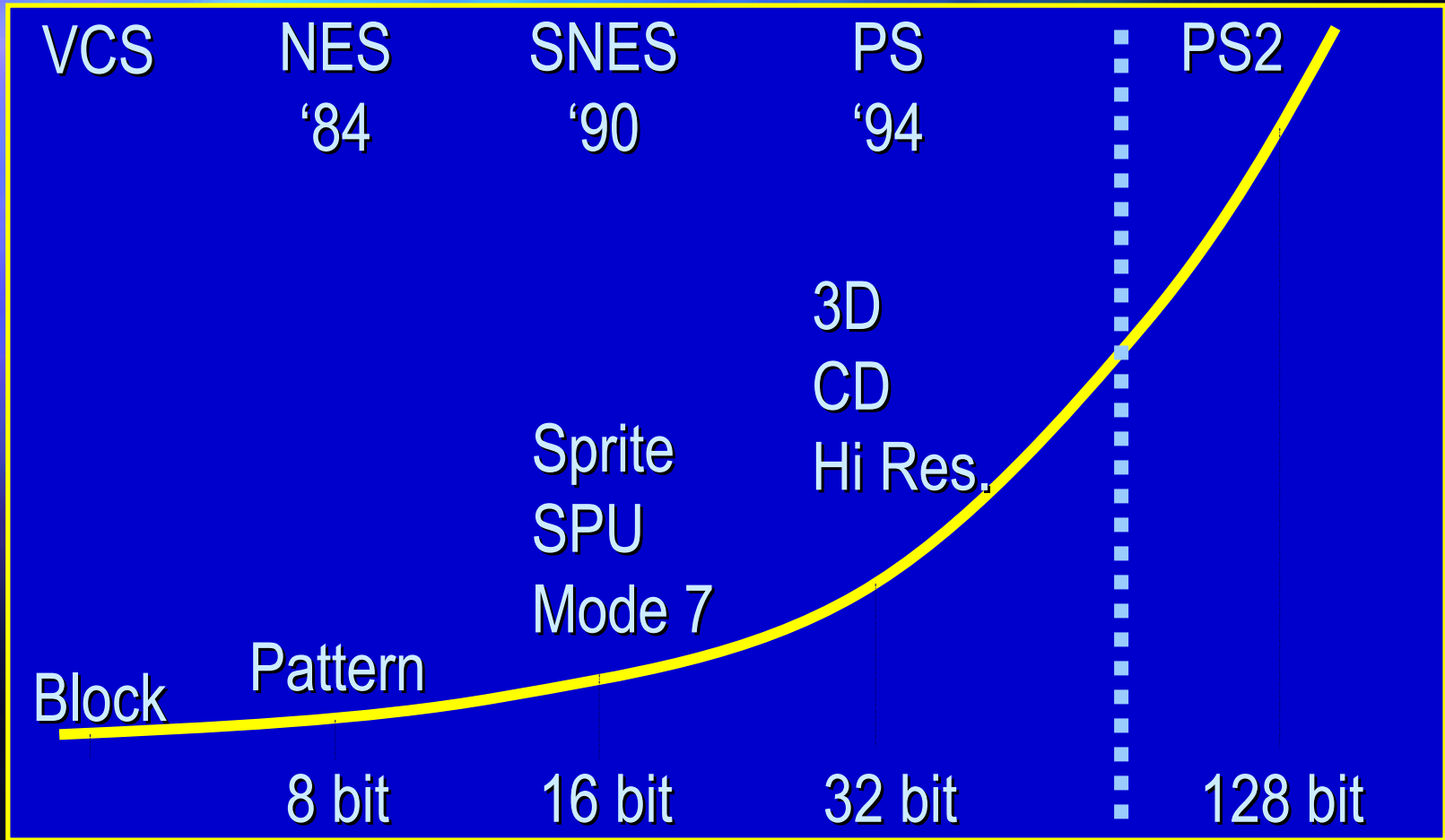
US/Europe: Fall 2000

Japanese Street Price : Y 39,800

# Technology trend

- 1990      Sound Synthesis
- 1995      Graphics Synthesis
- 2000      EMOTION SYNTHESIS

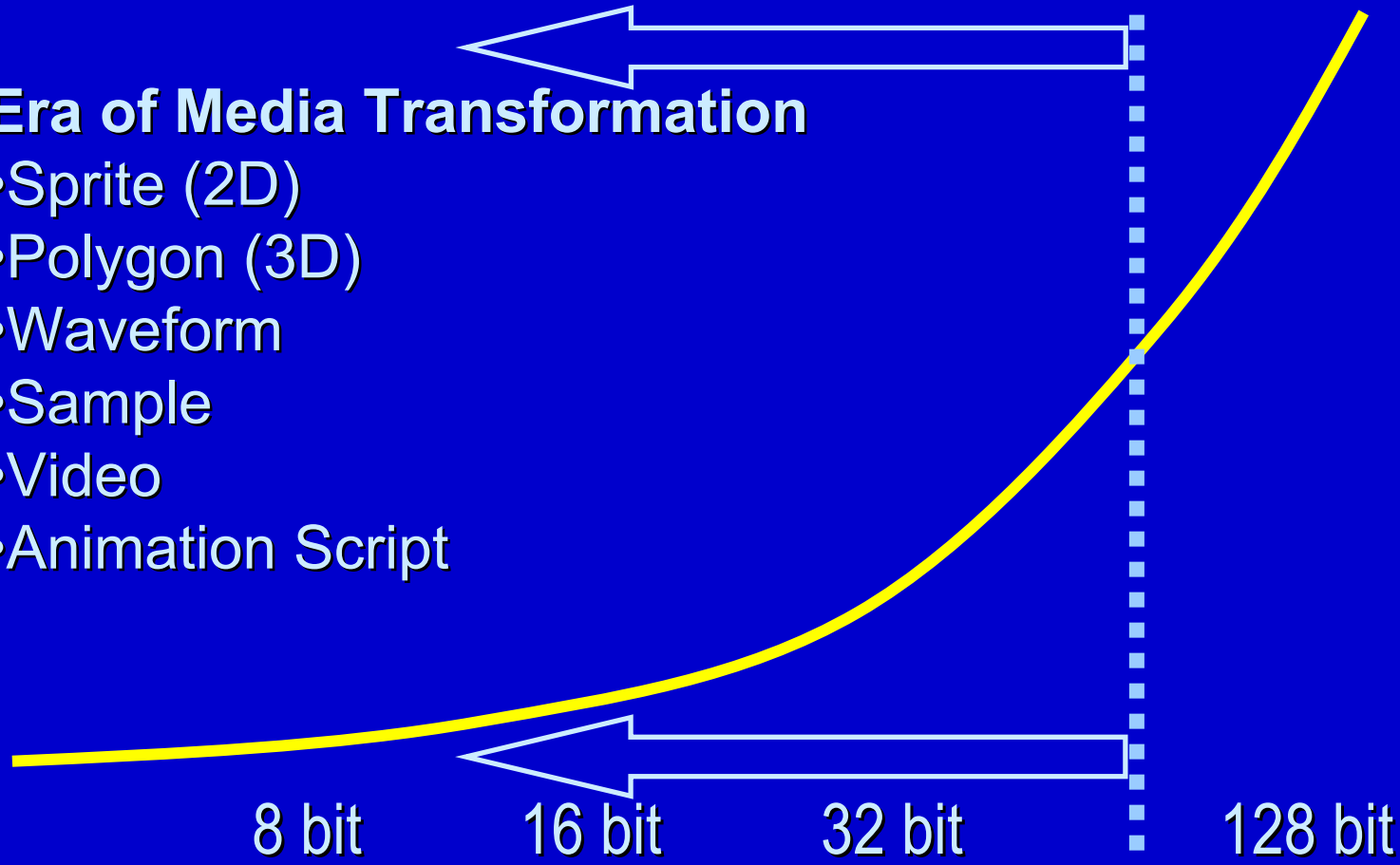
# Technical Trend



# Real-Time Media Trend

## Era of Media Transformation

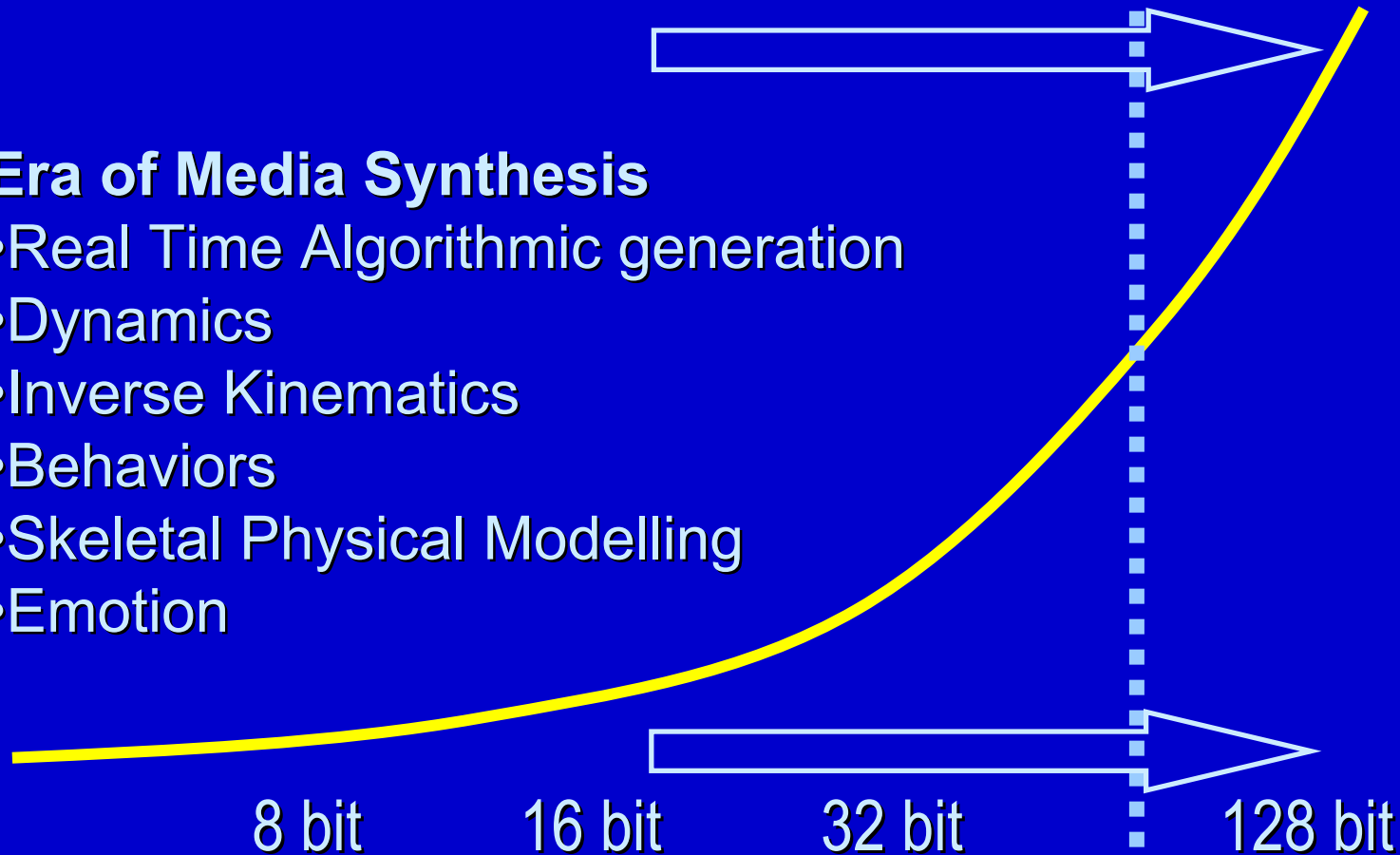
- Sprite (2D)
- Polygon (3D)
- Waveform
- Sample
- Video
- Animation Script



# Real-Time Media Trend

## Era of Media Synthesis

- Real Time Algorithmic generation
- Dynamics
- Inverse Kinematics
- Behaviors
- Skeletal Physical Modelling
- Emotion





# What is Emotion Synthesis?

- Real time generation of:
  - Behaviors, character intelligence
  - Physical simulation, Dynamics
  - Complex real world system simulation
  - Algorithmic generation of content
    - IMAGES, GEOMETRY, ANIMATION
  - Skeletal Physical Modelling
  - Inverse Kinematics

# Design concept

High performance Graphics Synthesizer

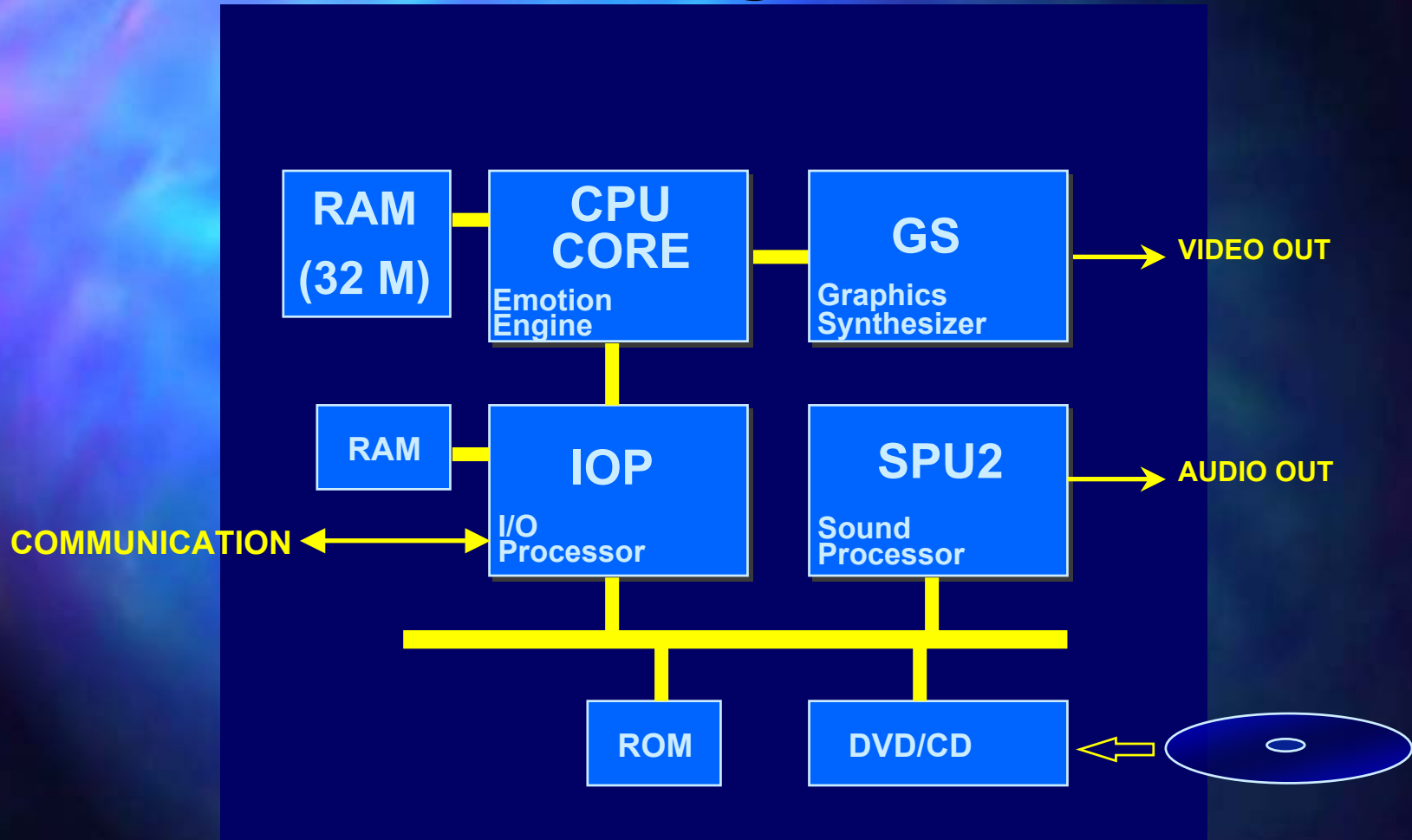
PLUS

Advanced CPU architecture with massive  
Floating Point capability

# System overview

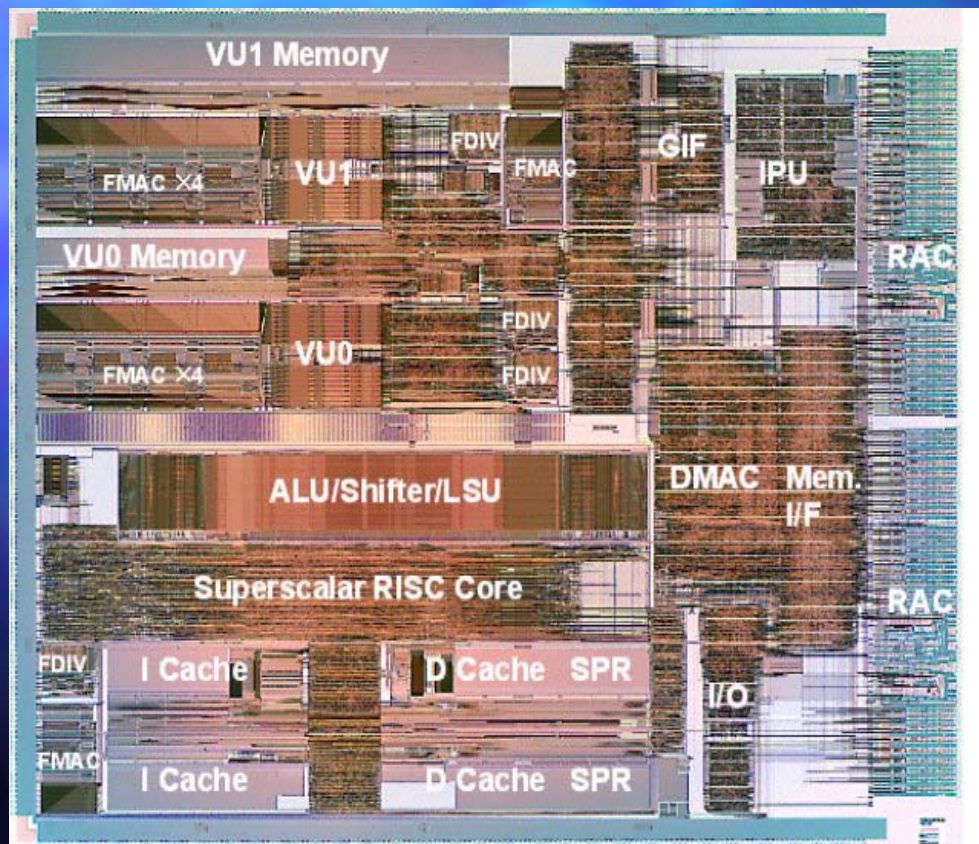
- 128-bit CPU core "Emotion Engine"
- GS "Graphics Synthesizer"
- SPU2 "Dynamic Sound Processor"
- I/O Processor
- DVD/CD ROM disc system
- 32 MB Direct Rambus

# Block Diagram





# Emotion Engine



128bit CPU  
3.2GB/sec. Bandwidth

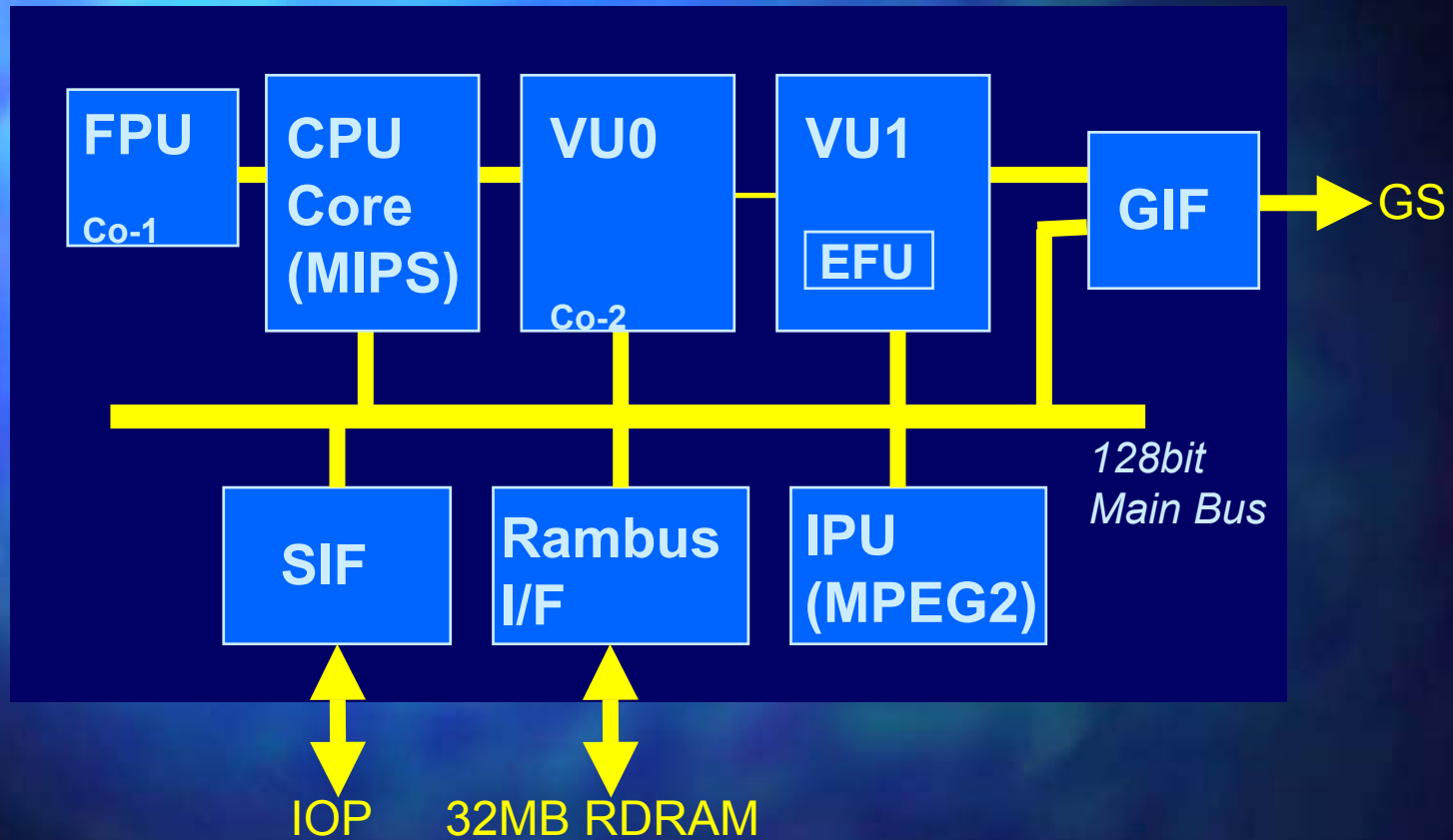
6.2GFLOPS  
Vector Units and FPU

IPU : MPEG-2 Decode

17.0×14.1mm  
10.5 million  
transistors

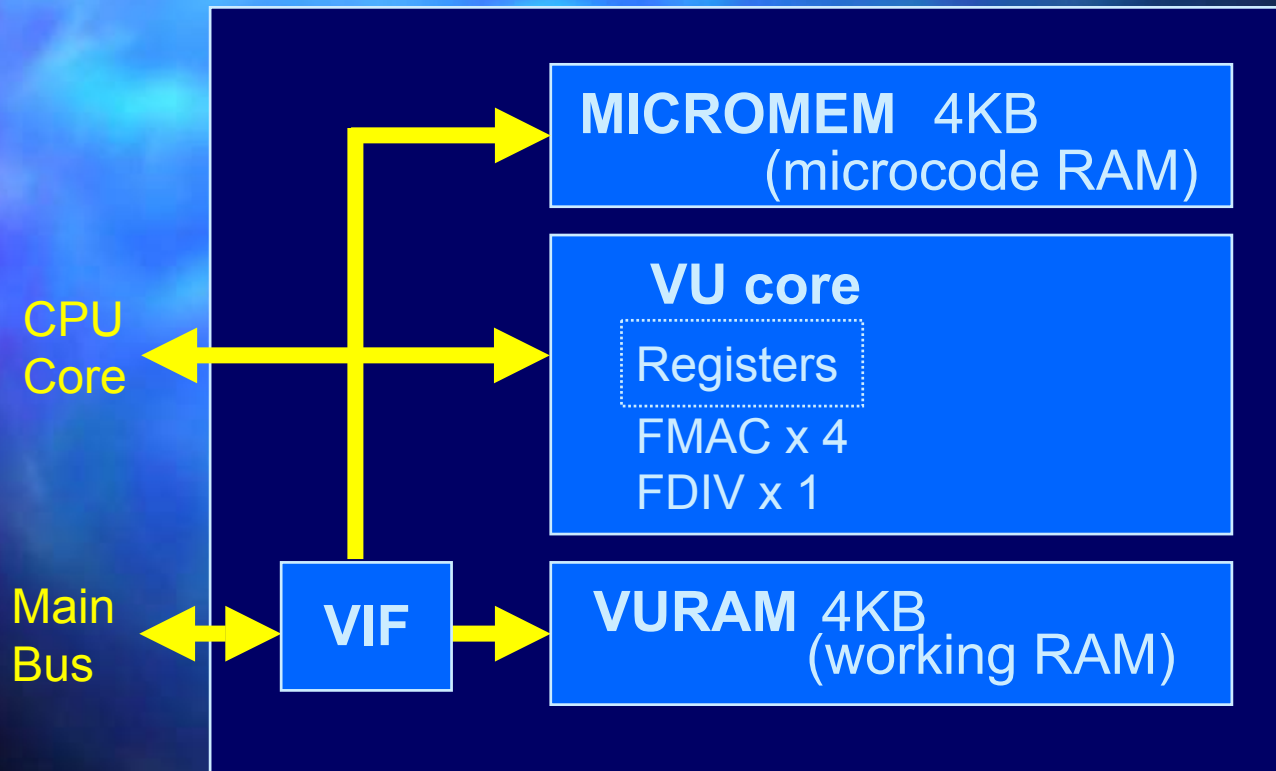
0.25um(gate:0.18um)  
15W @1.8V  
4 metal layers  
540 pin PBGA

# EE Block Diagram



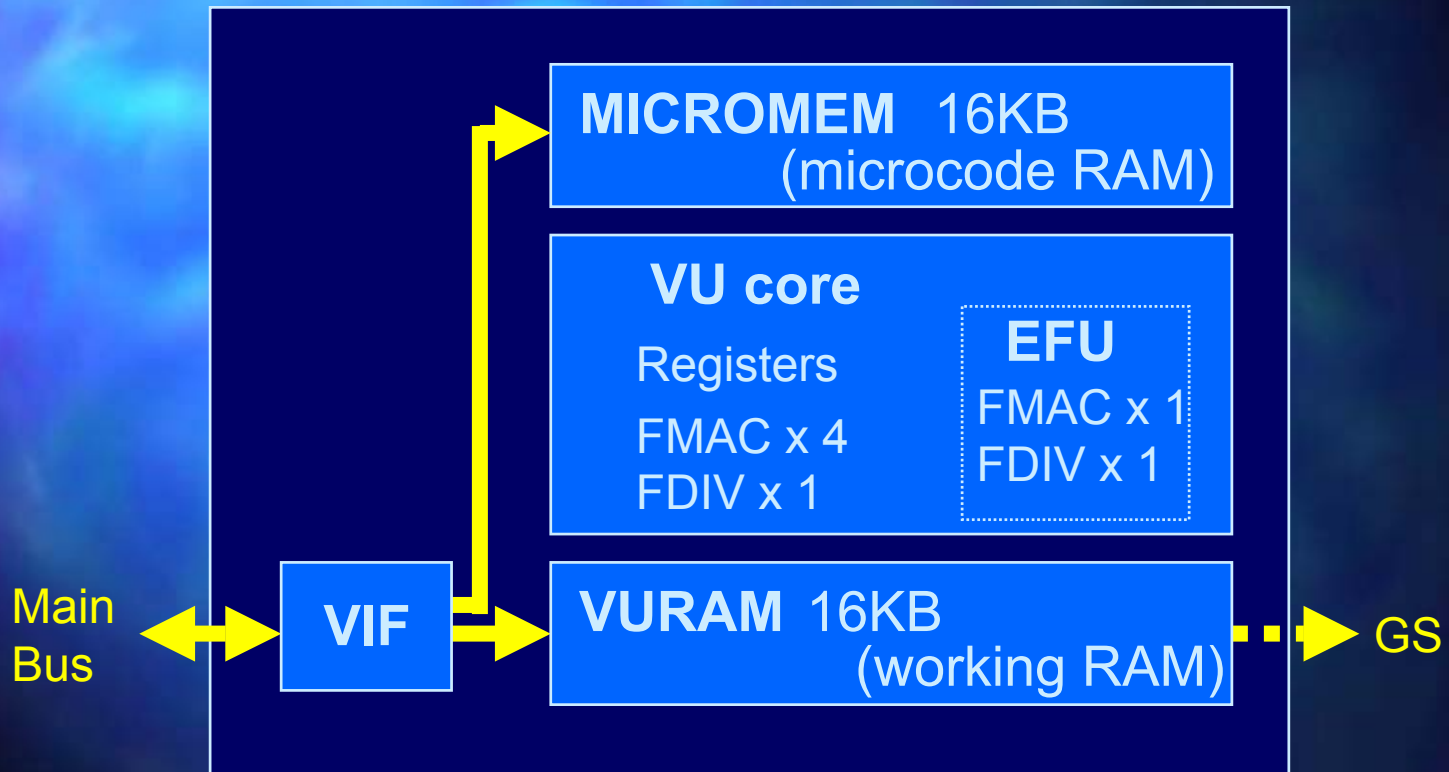
# Vector Unit 0

Co-processor 2 to CPU



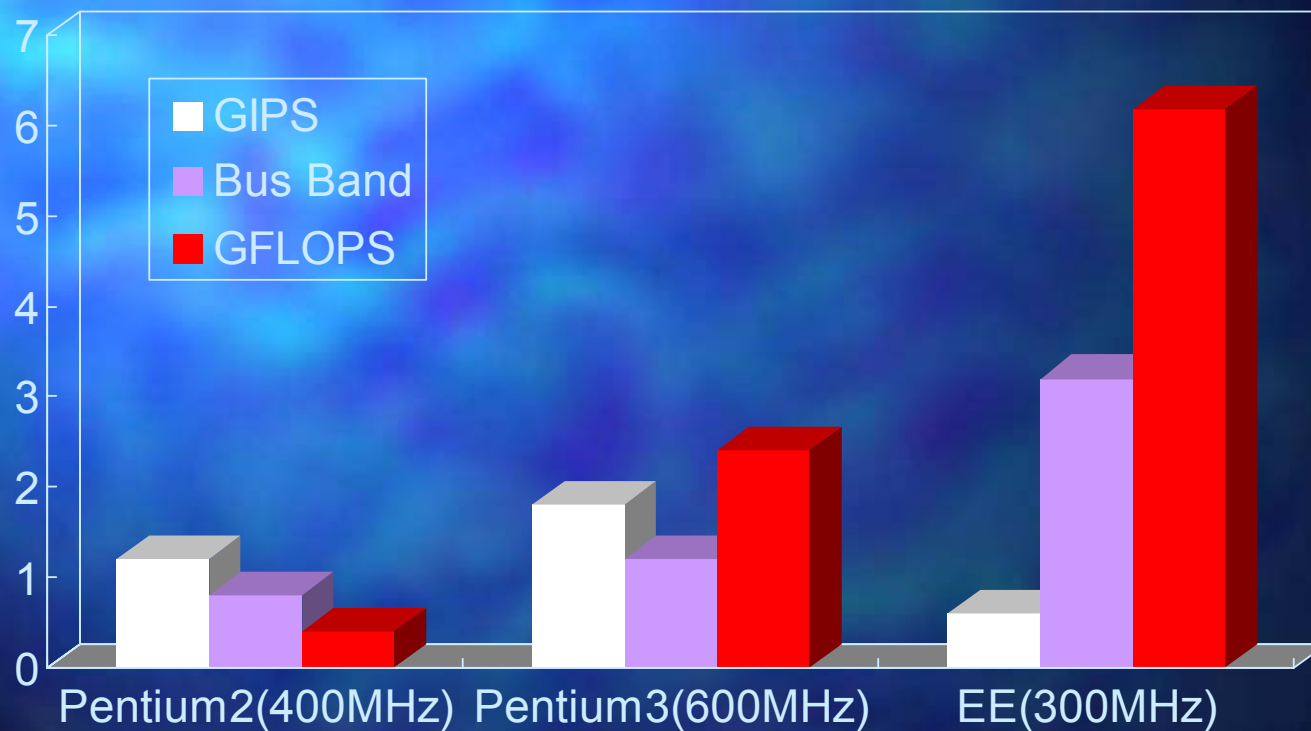
# Vector Unit 1

Independent processor, direct bus to GS

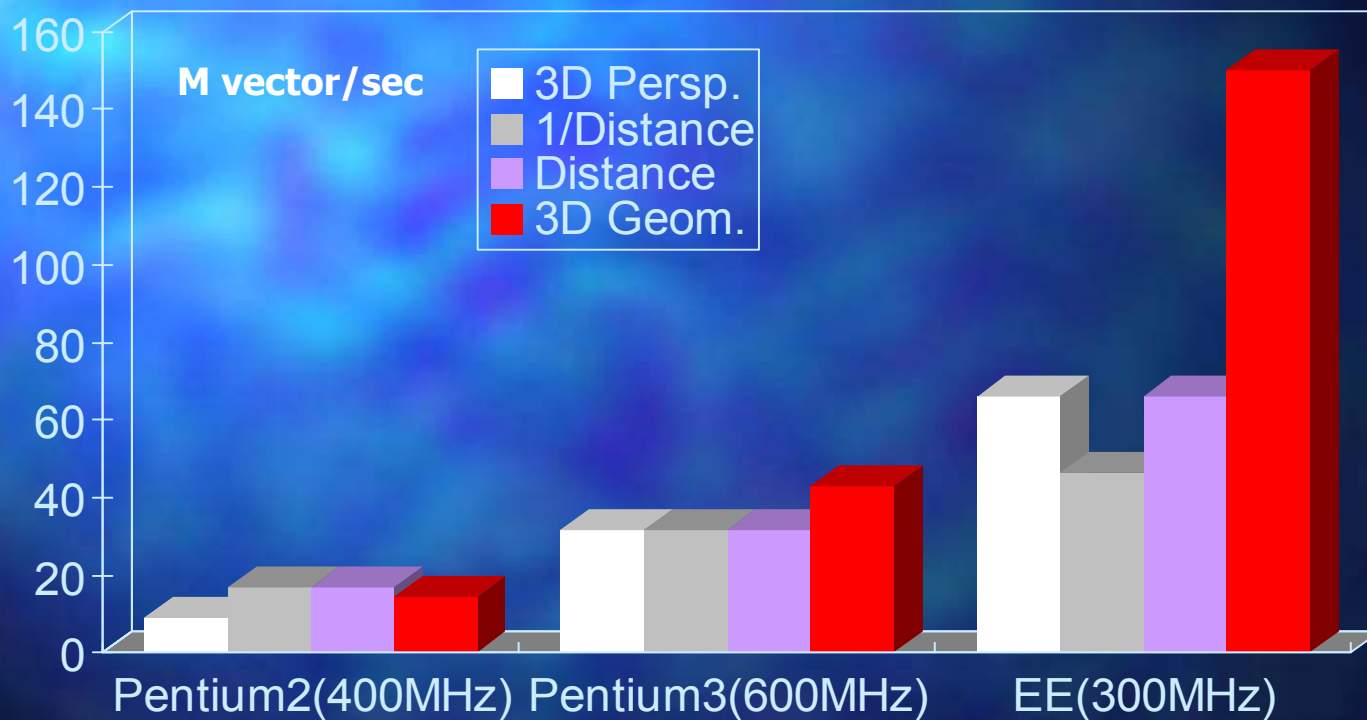




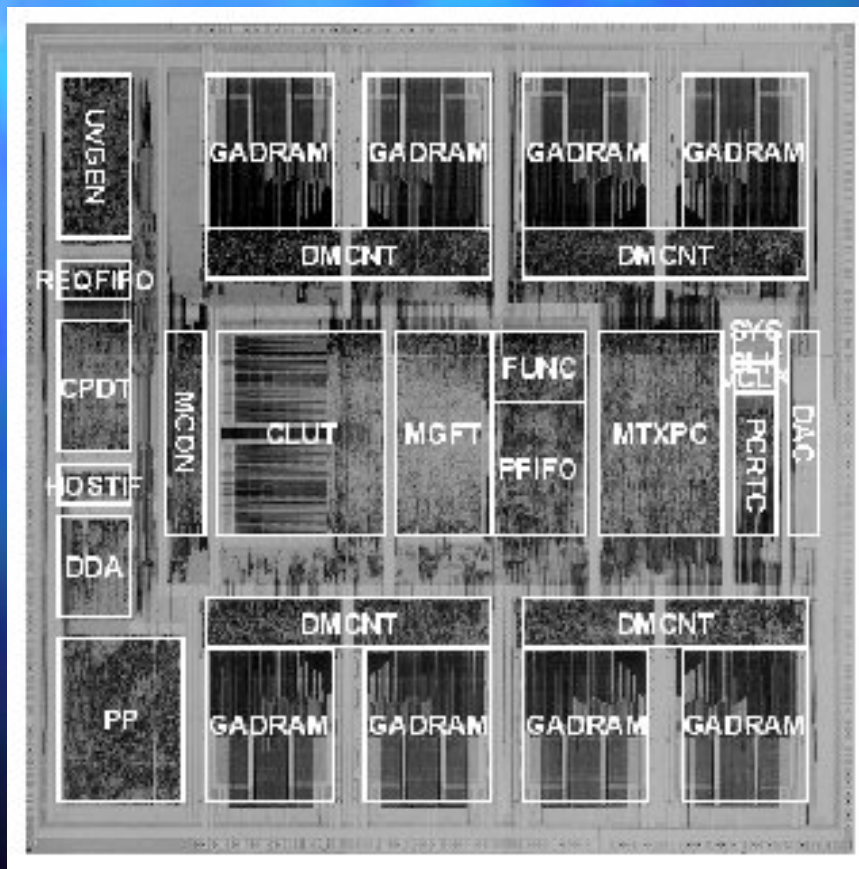
# Peak Performance



# Floating Point Vector Calculations



# Graphics Synthesizer



75 Million polygon/sec.  
2.4 G Pixel/sec Fill rate

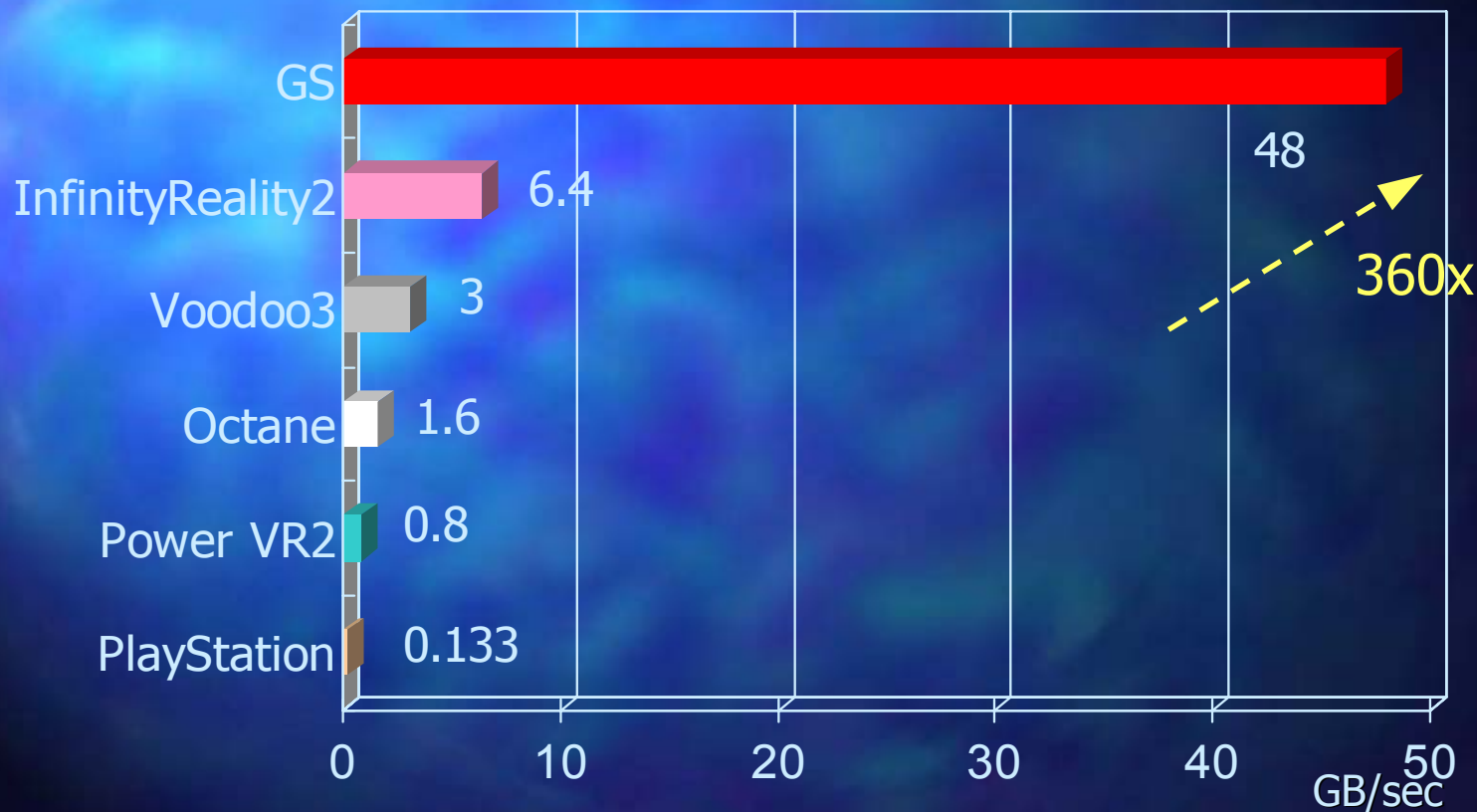
4MB eDRAM  
2,560 bit bus

32 bit ARGB pixel  
32 bit Z Buffer

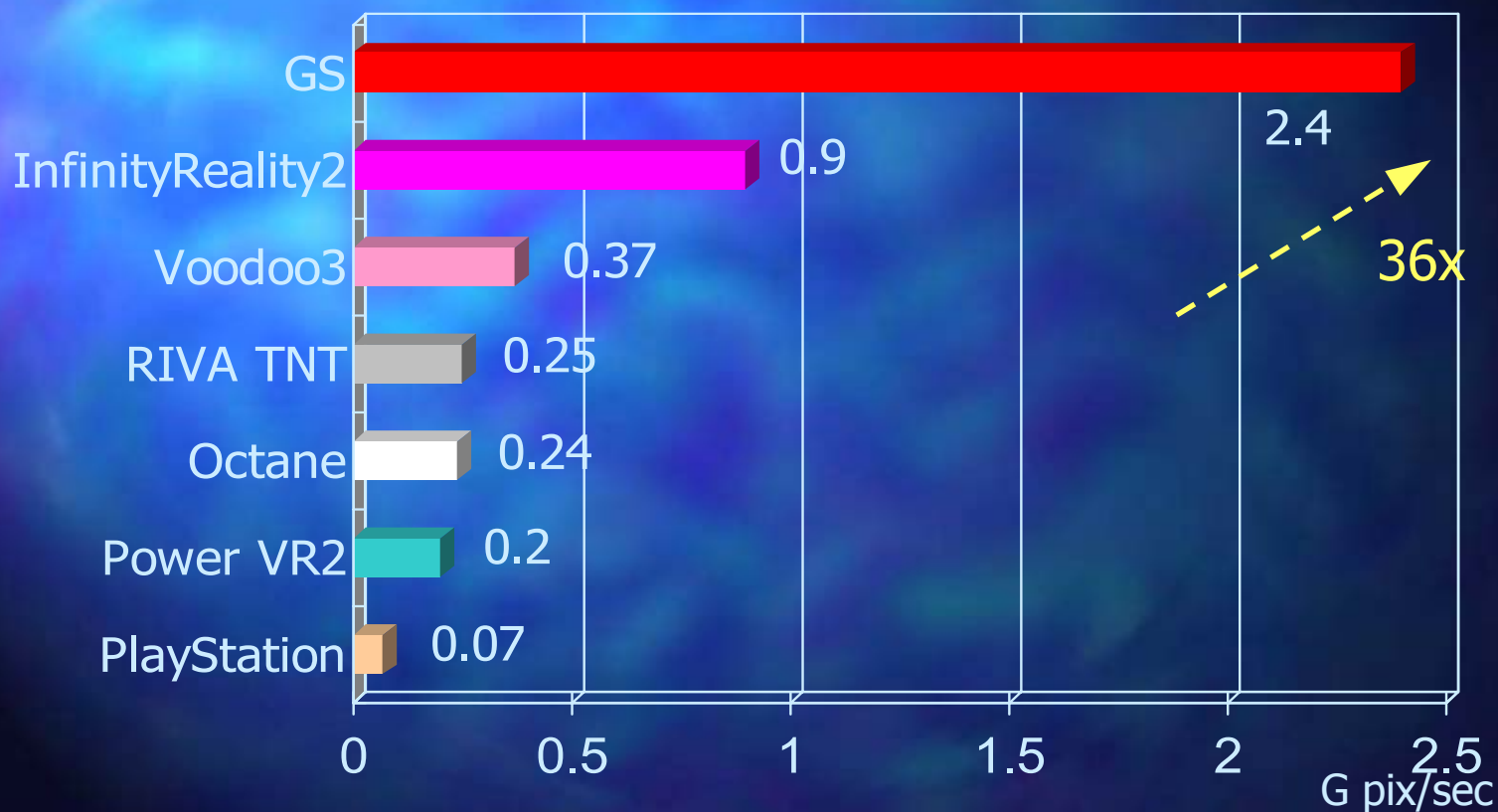
279 mm<sup>2</sup>  
42.7 million transistors

0.25um(0.25um/gate)  
10W @1.8V  
5 metal layers  
384 pin BGA

# VRAM Bandwidth



# Pixel Fill Rate



# GS function

- DRAWING PRIMITIVES
  - Polygon (triangle)
  - Mesh (strip, fan)
  - Sprite (decal)
  - Line draw (single, poly line)
  - Point

# GS Function

## ■ EFFECTS

- Anti-aliasing
- Fogging
- Alpha blending
- Multi-pass texture function/filtering

# GS Function

## ■ TEXTURE MAPPING

- Perspective correction
- Modulation (Gouraud)
- MIPMAP
- Bi- and Tri-Linear sampling
- Zero penalty texture + alpha blend
- Color depth 4, 8, 16, 24 and 32 bit
- CLUT



# COMMUNICATION

# I/O Processor

- CONTAINS CURRENT PS CPU CORE
- 32 bit R3000, 37 MHz
- 2 MB DRAM
- Controls:
  - SPU2 Sound Processor
  - CD/DVD drive
  - External I/O and Peripherals
  - DIGITAL INTERFACES

# Digital Interfaces

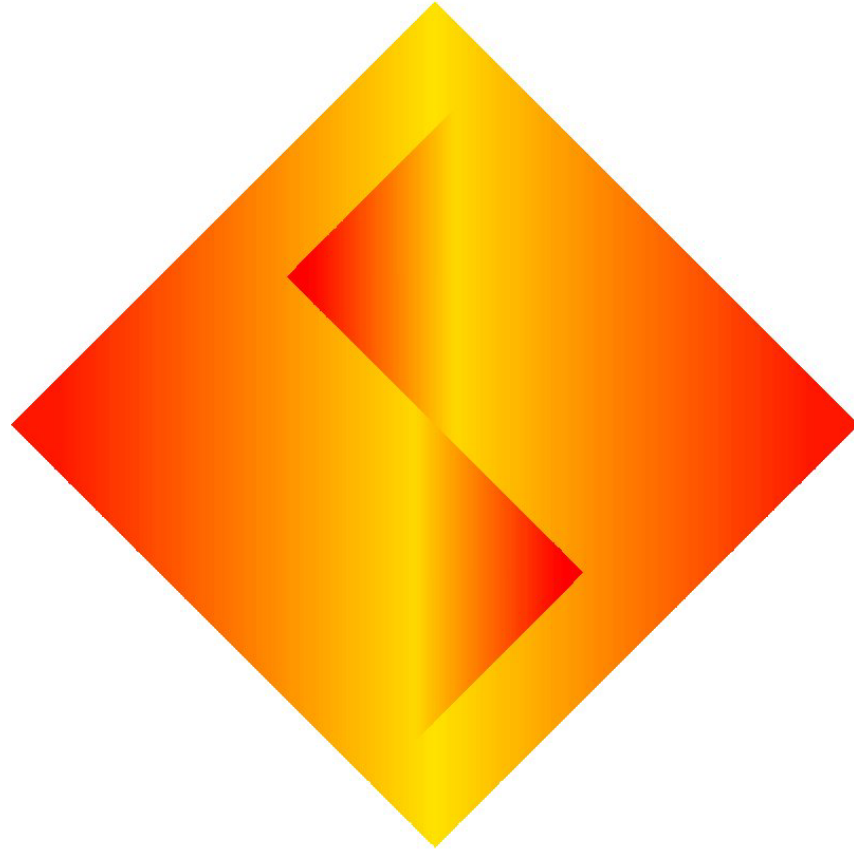
- IEEE1394
- Universal Serial Bus (USB)
- PC-Card (PCMCIA)
- Data communication handled by dedicated I/O processor

# Sound Processor Unit

- ADPCM, 48 Voice system
- plus dynamic software definable voices
- 44.1KHz or 48KHz (selectable)
- 2MB Sound RAM (4:1 compression)

Demo time...

**SONY**



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