# A Lumigraph Camera for Image Based Rendering

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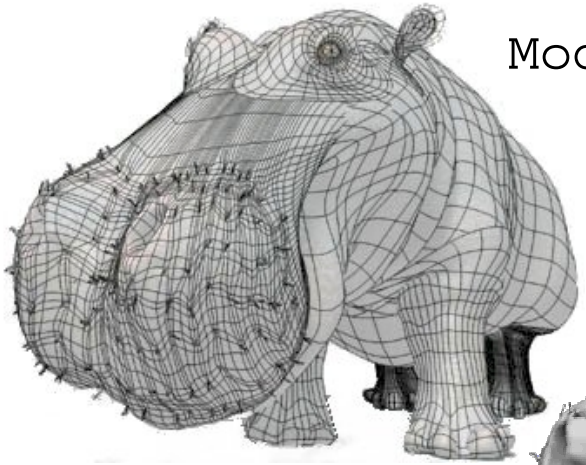
# Overview

- Image Based Rendering
- Video Demo
- System Design
- Obstacles

# Image Based Rendering

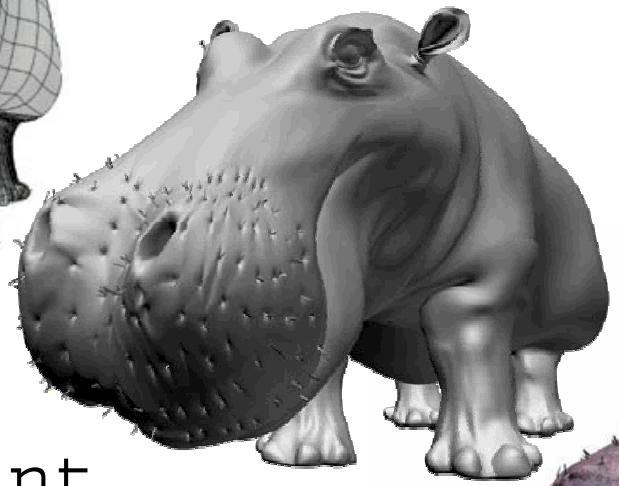
- Motivation
  - Geometry is hard.
  - Textures are easy.
- Light Field Rendering:
  Generate novel views using a database of "rays" from a 2D array of images.

# State-of-the-art in CG



Model

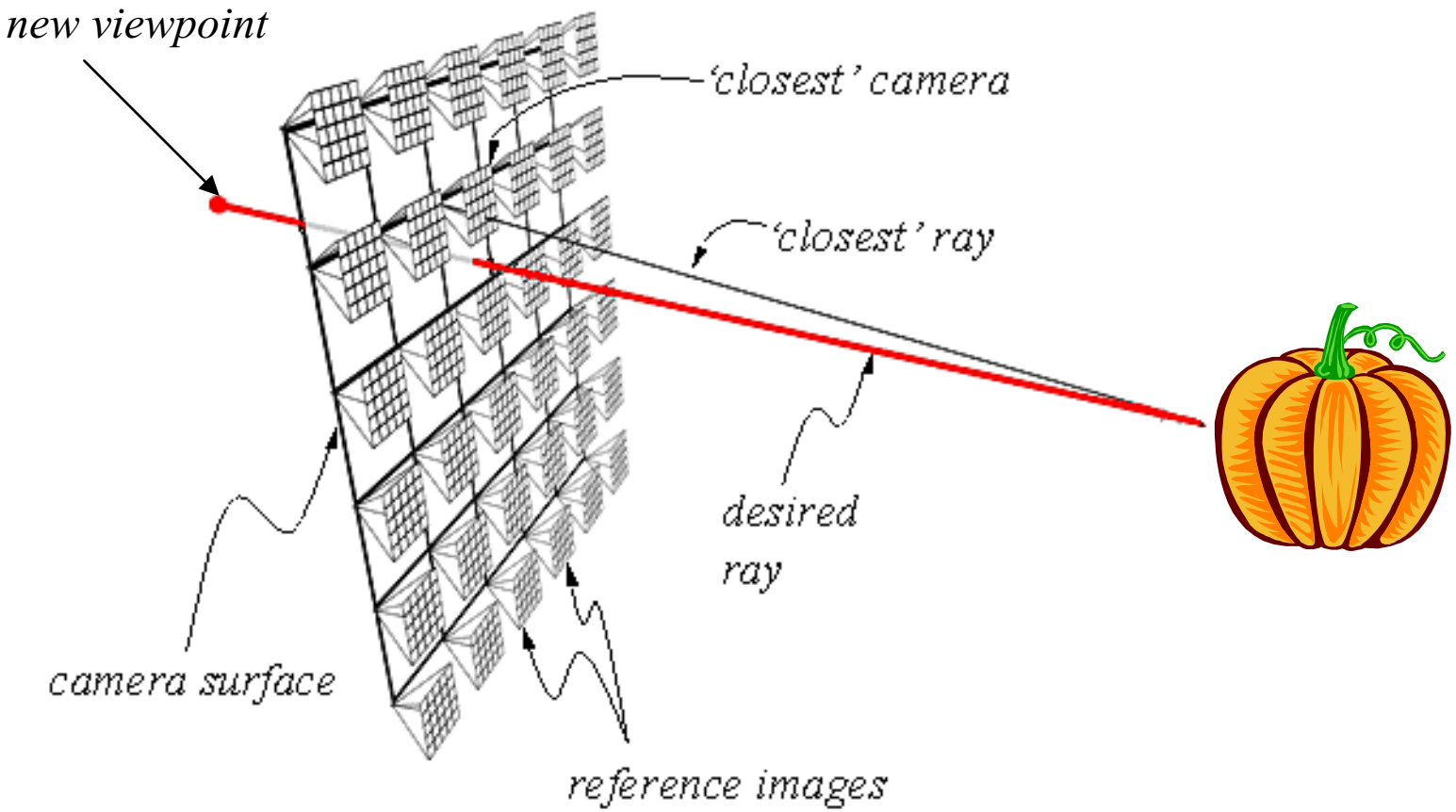
Model + Shading



Model + Shading
+ Textures

At what point
do things start
looking real?

# Rendering Process

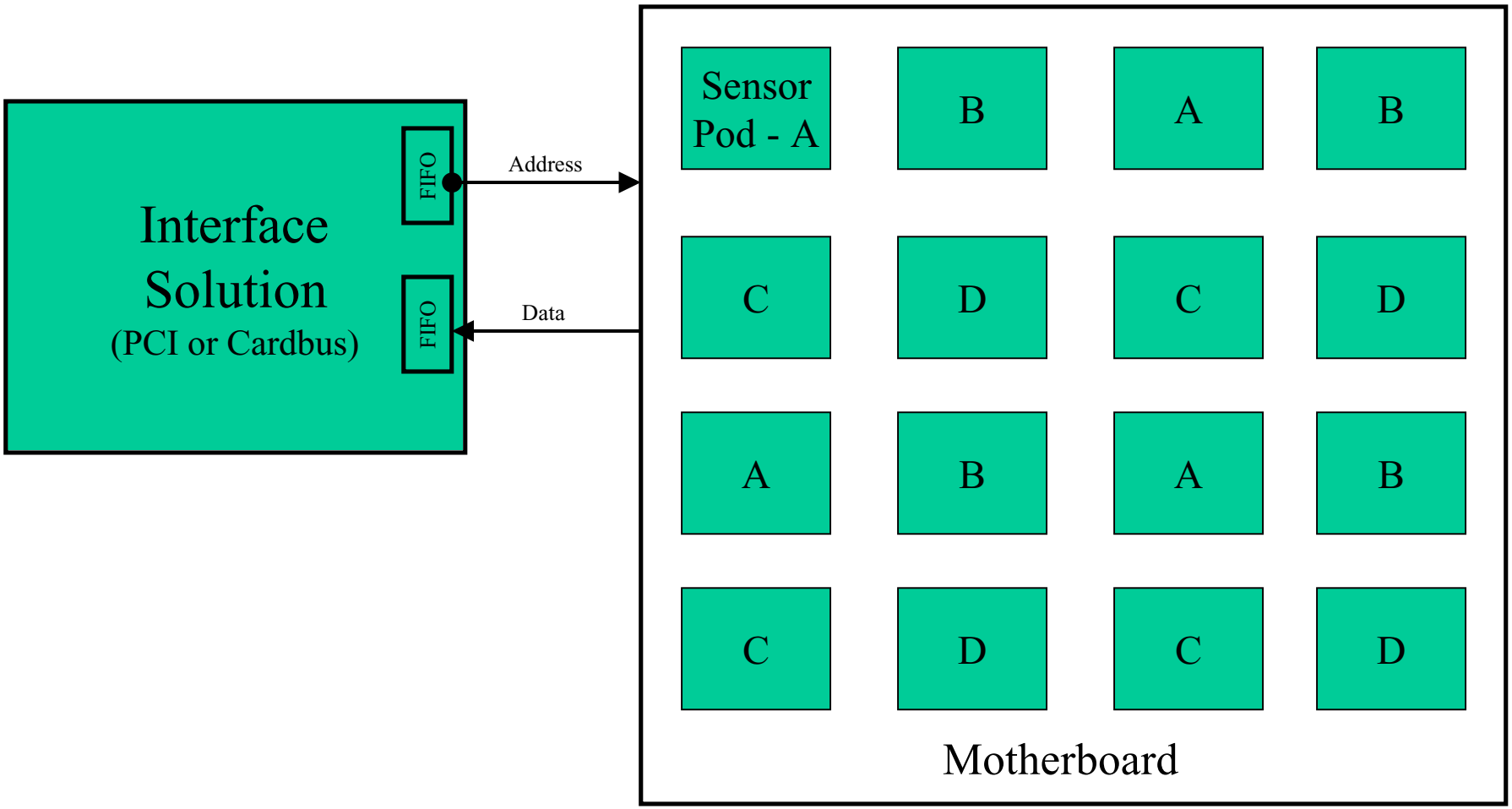


# Demo System

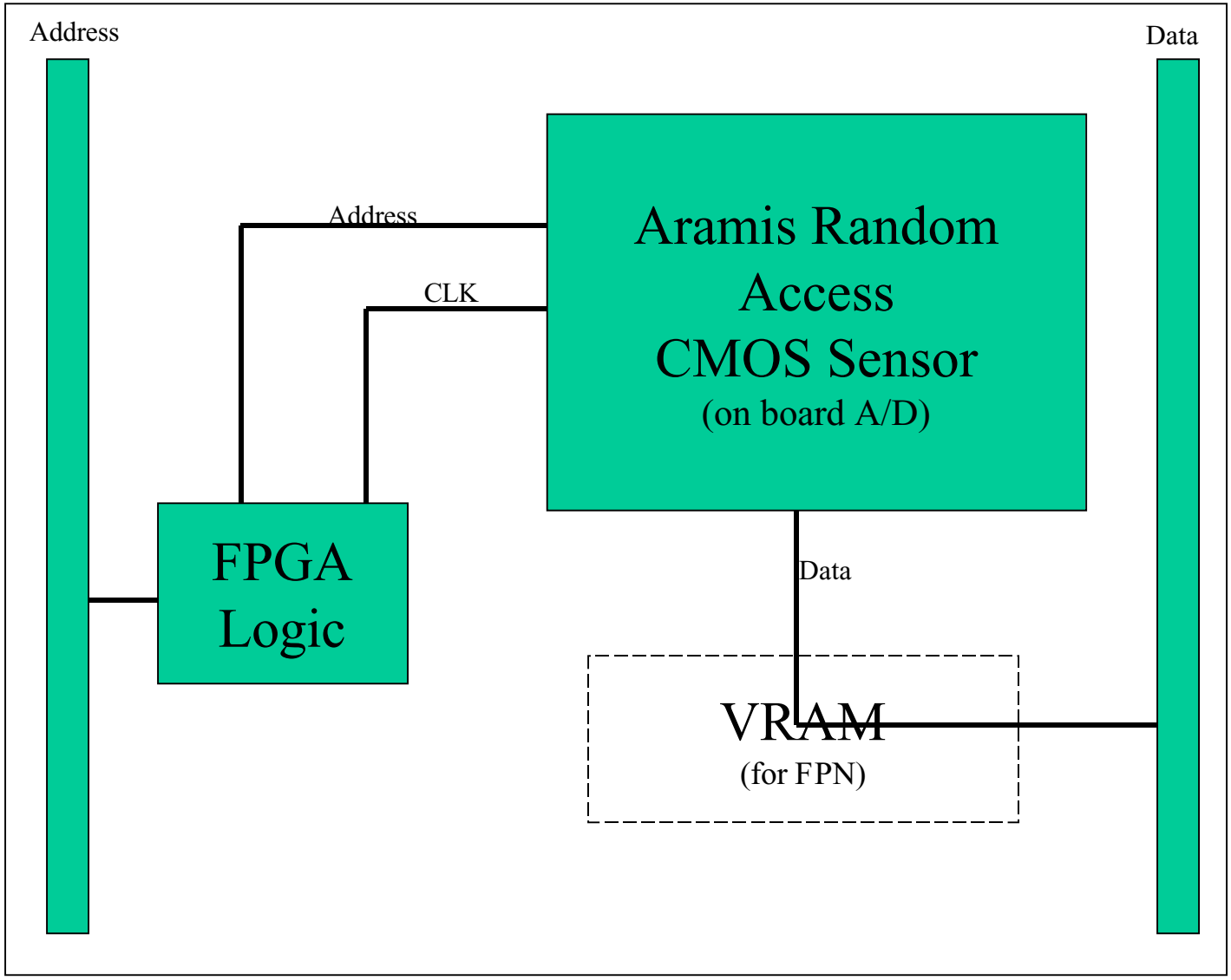
# Goals

- Real Time Camera System
- Off the shelf components
- Desired frame rate:
  30 frames per second
  640 x 480 resolution

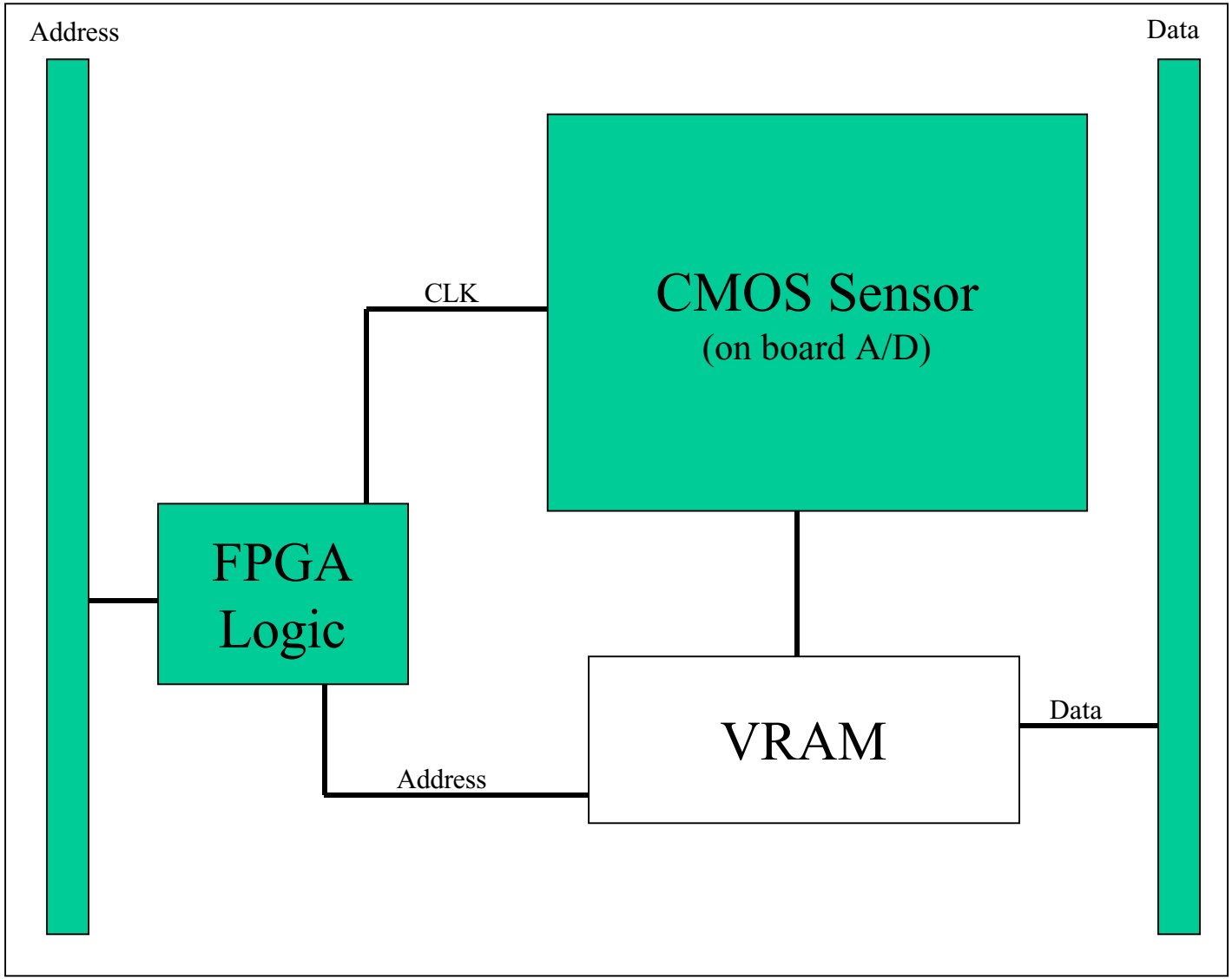
# Overall Design



# Sensor Pod


Address
Data
Address
CLK
Aramis Random Access CMOS Sensor
(on board A/D)
FPGA Logic
Data
VRAM
(for FPN)

# Sensor Pod

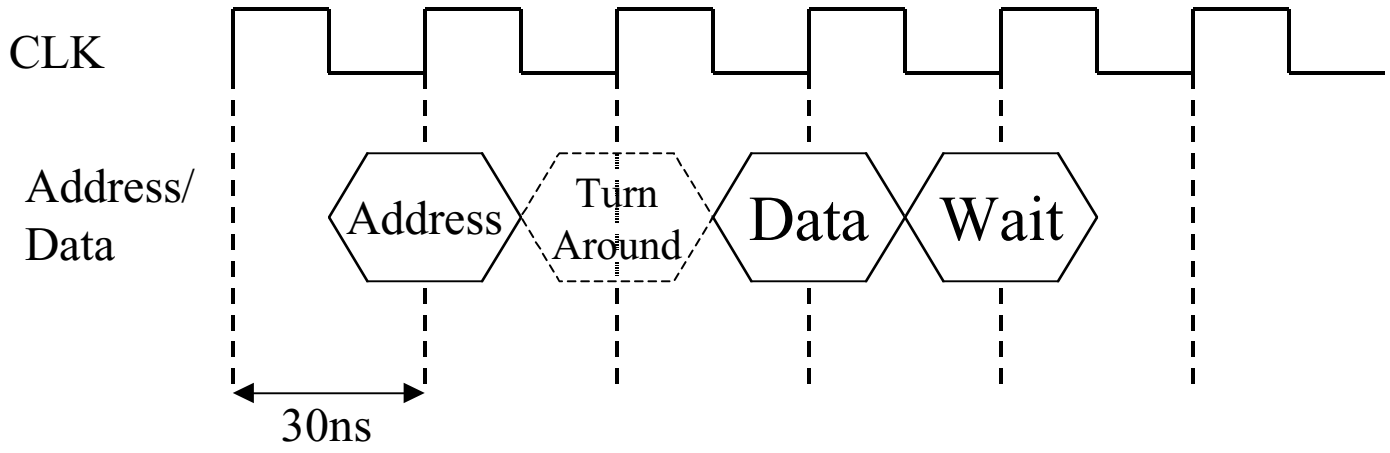

Address
Data
CMOS Sensor
(on board A/D)
CLK
FPGA
Logic
VRAM
Data
Address

# Major Hurdle

- Ideal frame rate is not achievable
  -Best Frame rate: 7fps
- Bottlenecks:
  - PCI bus
  - Turnaround time for one pixel
- Potential Solution:
  - Interleaving
  - FIFOs

# Actual Frame Rate

- To reach desired 30fps we need: 37MBs
- Maximum Random Access on PCI: 33MBs



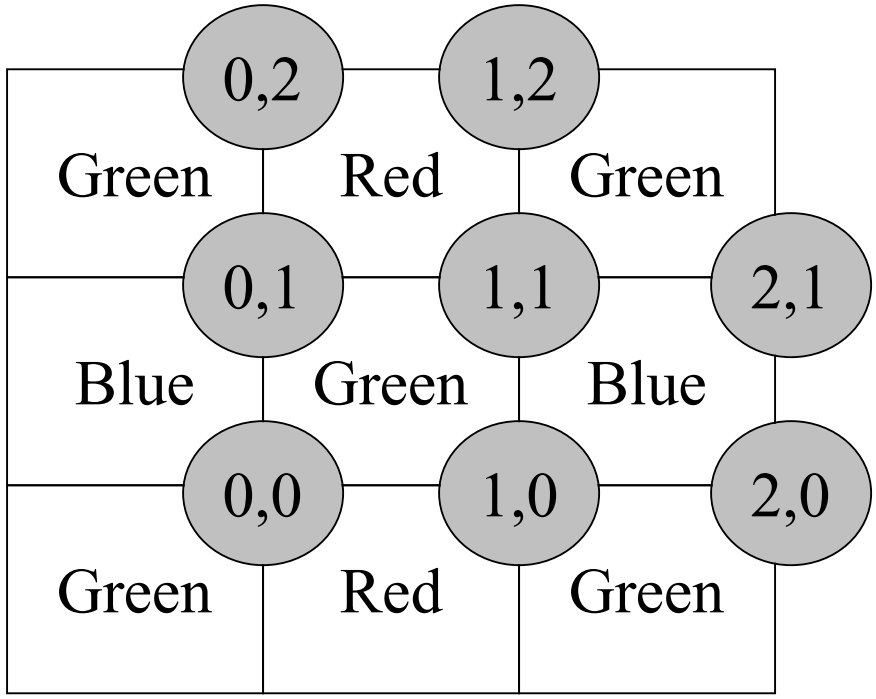

- Turn around time (time to access pixel from camera) is not one clock cycle!

# Virtual vs. Physical Pixels

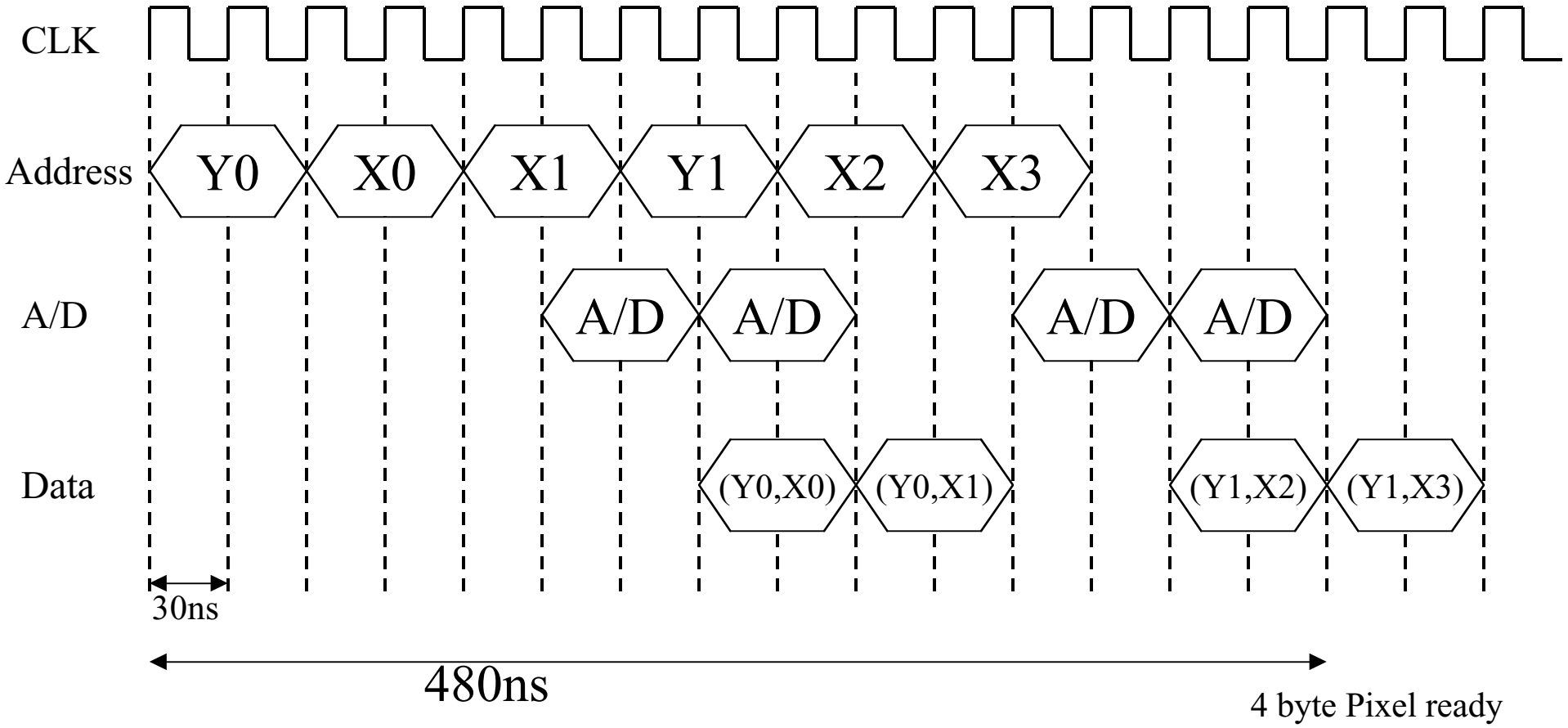
When the host requests a pixel it is actually a virtual pixel as indicated by the circles.

The actual pixels requested are the color photocells on the imager.

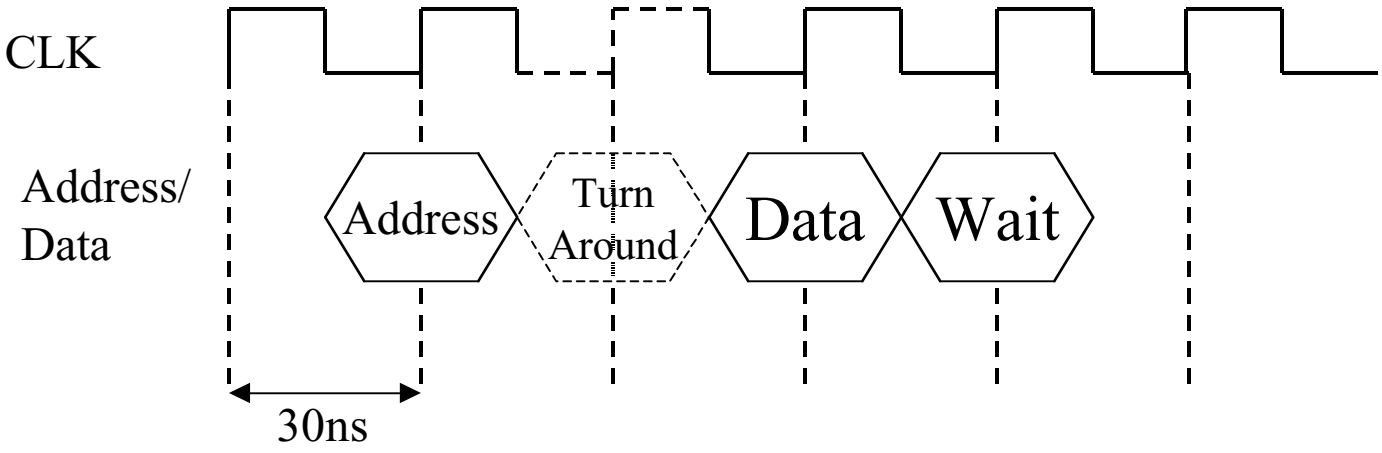
Each virtual pixel request will return a four byte group of color values.



# Time to Access a Pixel



# Actual Transfer Rate

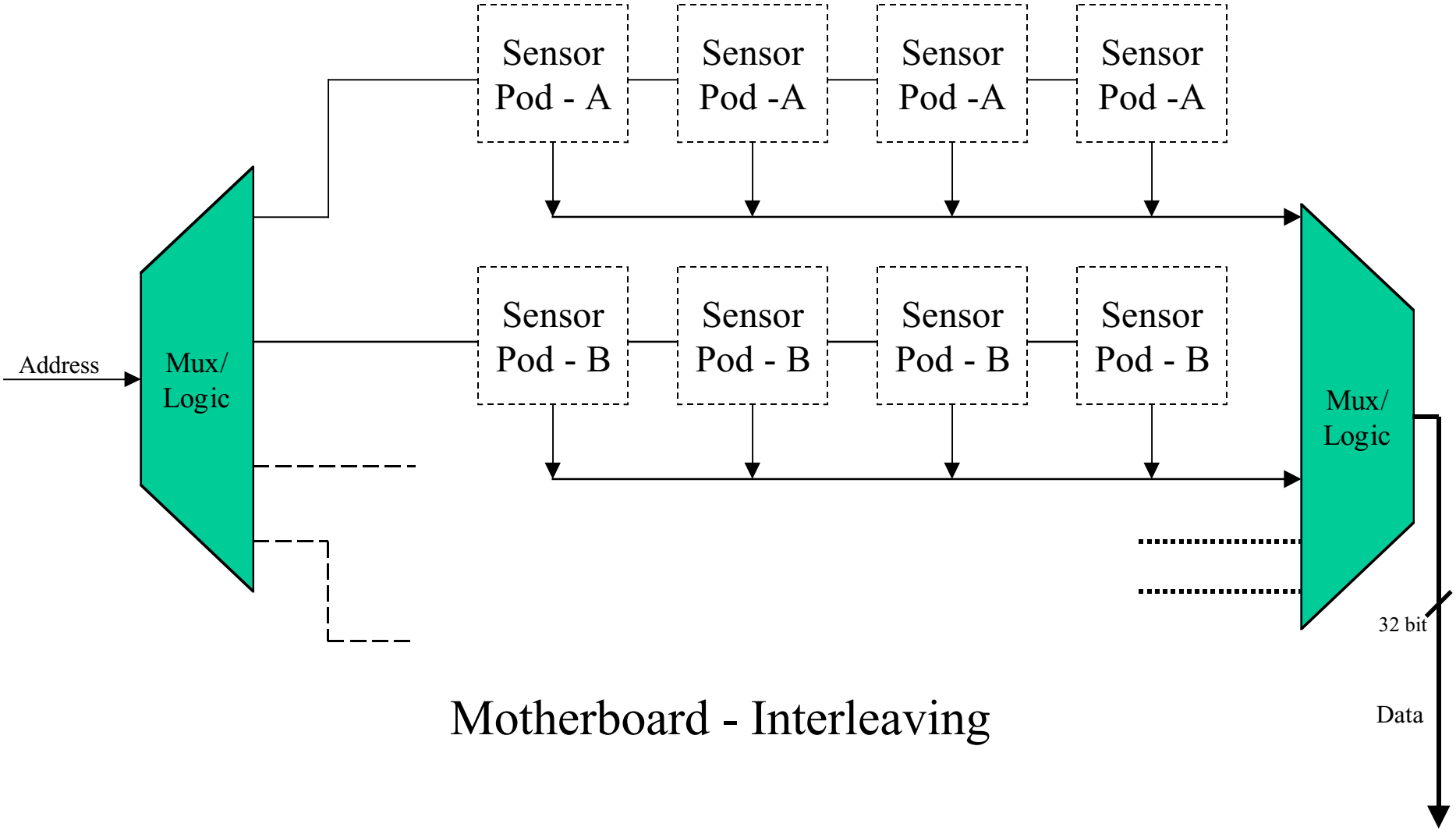



<Address> + <Access> + <Data> + <Wait>

30ns + 450ns + 30ns + 30ns = 540ns

540ns/pixel => 7fps @ 640x480

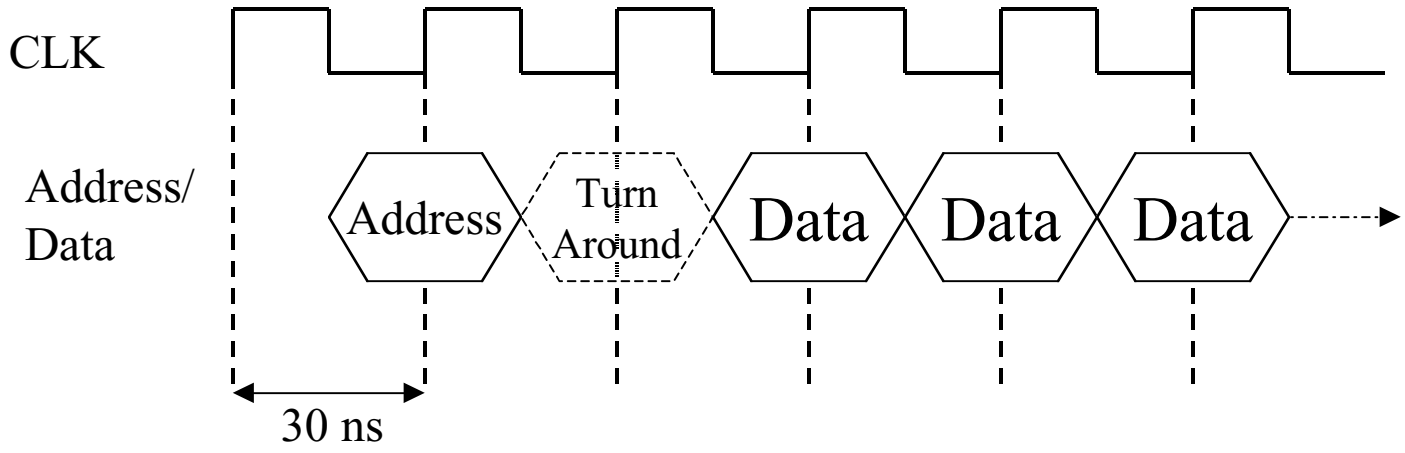
# Optimizations




Motherboard - Interleaving

# Use PCI Burst Mode

- PCI burst mode can achieve 133MBs




- Idea: Use FIFOs to store Addresses and Data

# Conclusion

- Tradeoffs
- Technological Needs
  - Random Access CMOS imagers
  - Faster imagers
  - Faster bus protocols