Equalizer BOF EG 2009

Performance Optimizations

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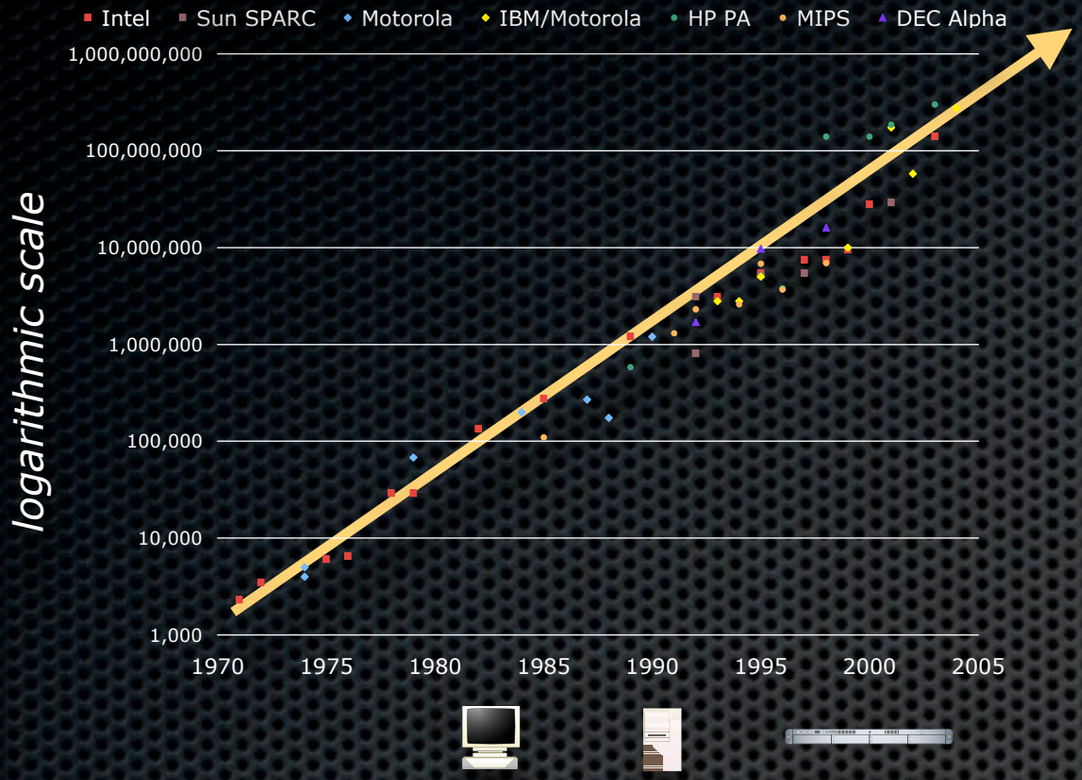
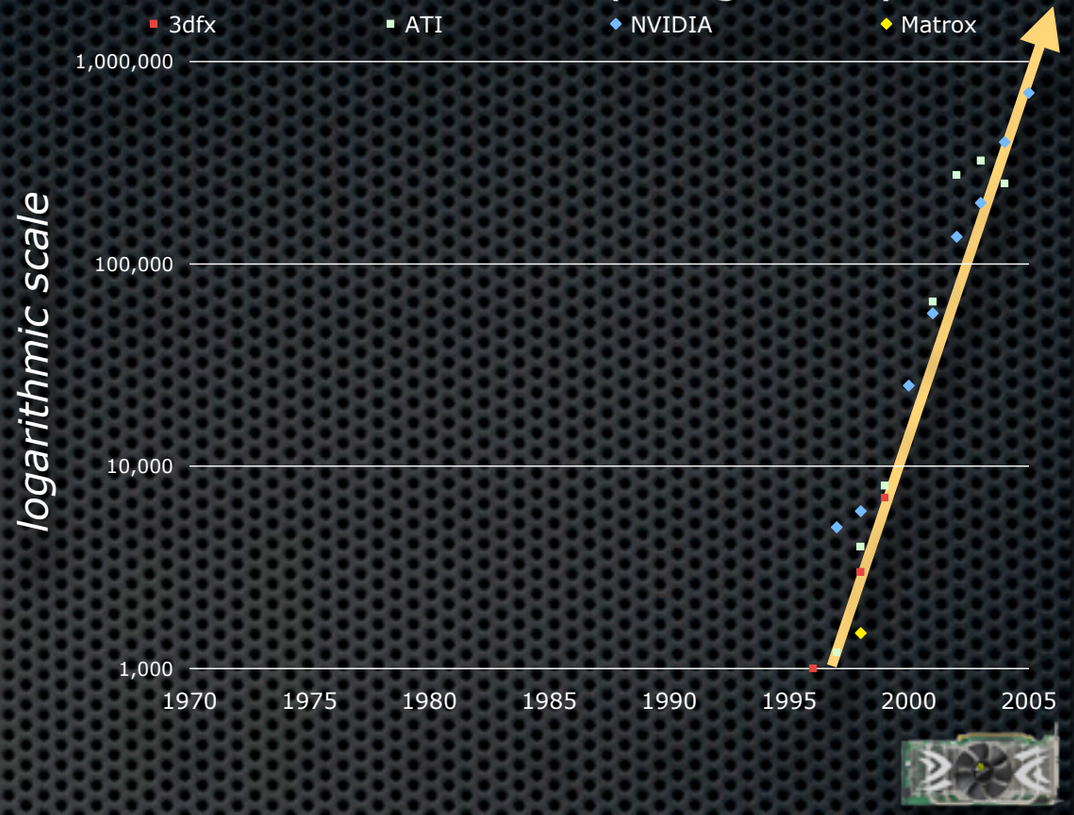
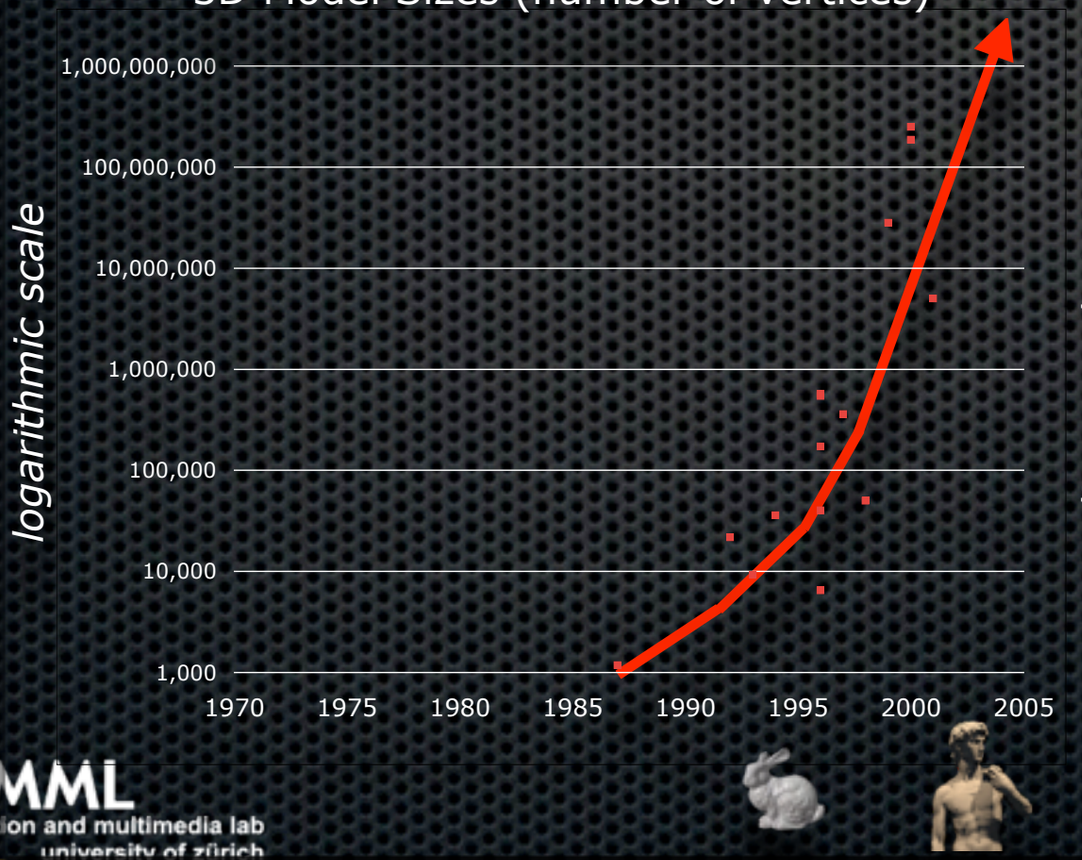
CPU Performance (transistor count)



GPU Performance (triangles/sec)



3D Model Sizes (number of vertices)



Display Resolution (pixels on display)

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Publications

- Stefan Eilemann, Maxim Makhinya, and Renato Pajarola. **Equalizer: A scalable parallel rendering framework**. *IEEE Transactions on Visualization and Computer Graphics*, 15(3):436–452, May/June 2009.

- Stefan Eilemann and Renato Pajarola. **Direct send compositing for parallel sort-last rendering**. In *Proceedings Eurographics Symposium on Parallel Graphics and Visualization*, pages 29–36, 2007.

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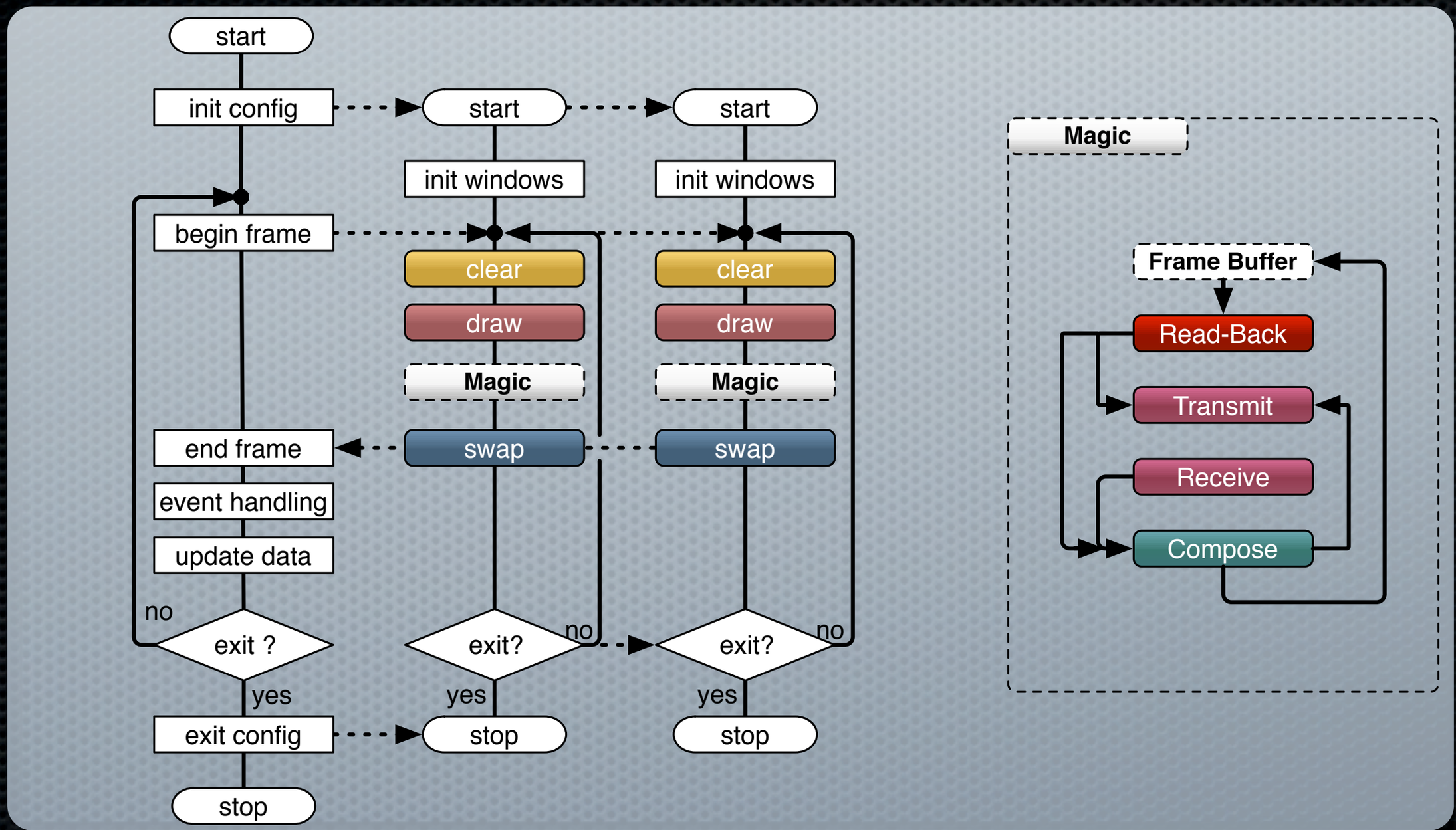
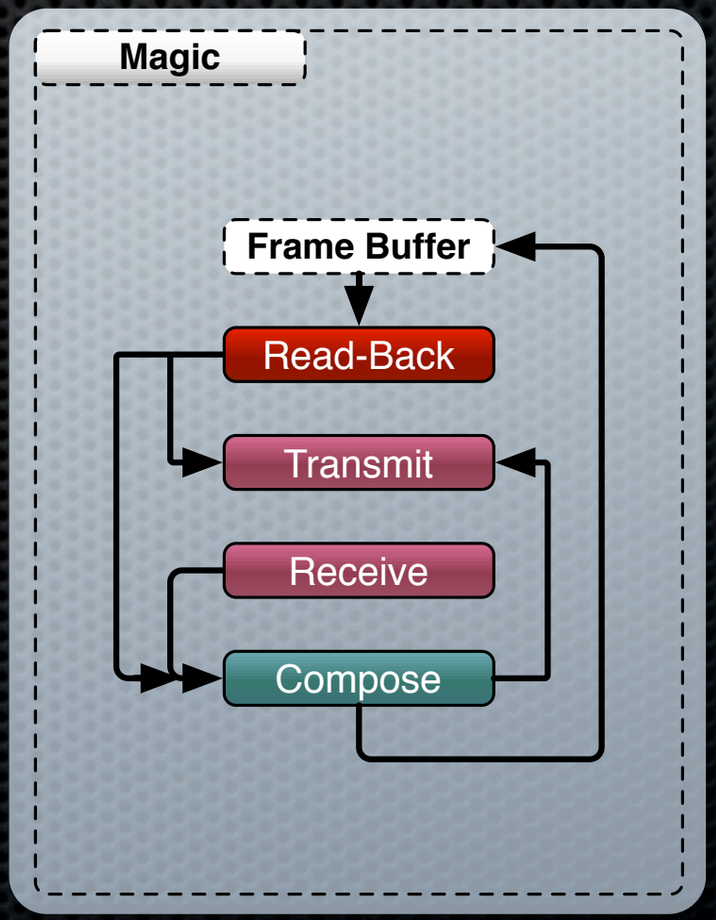
Parallel Rendering with EQ



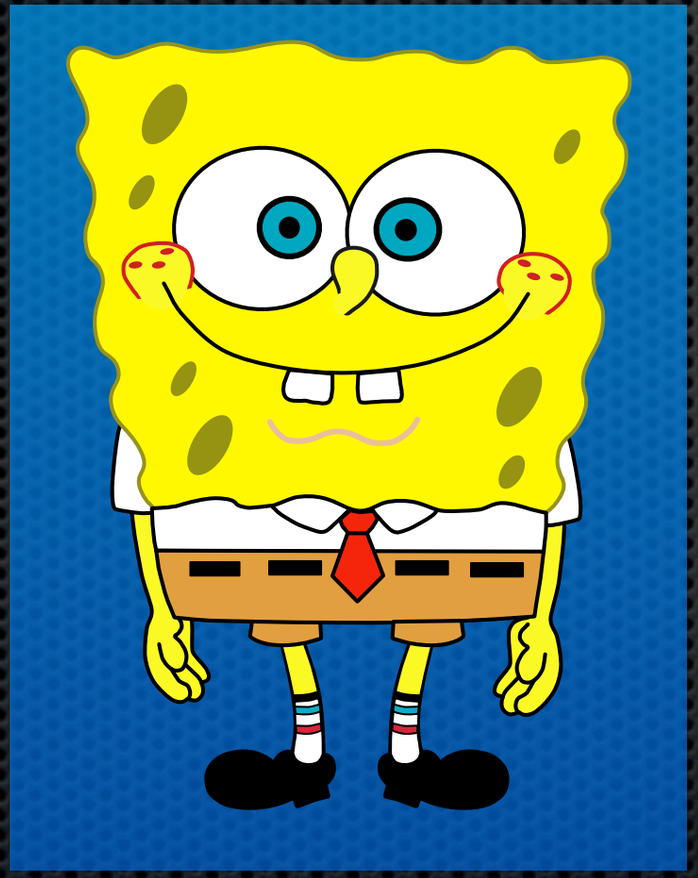
Compositing Performance

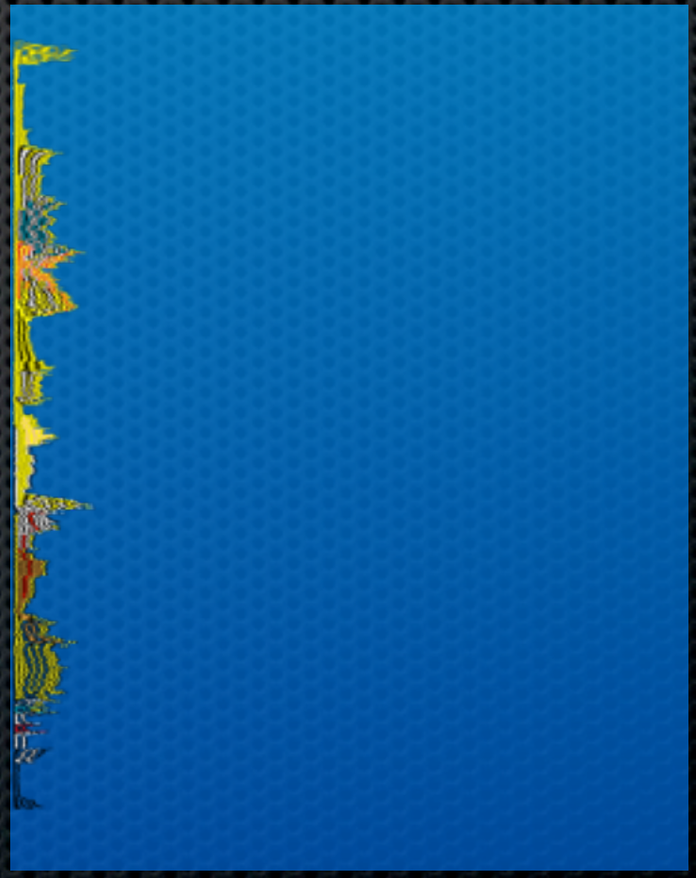
- Major issues:
  - Image transmission
    - compression
    - variable viewports
  - Read-back overhead
    - data formats
    - fast-path
  - Compositing algorithm
    - synchronization points
    - message load



Fast Compression

- RLE
  - Removes empty space, not much more; very fast





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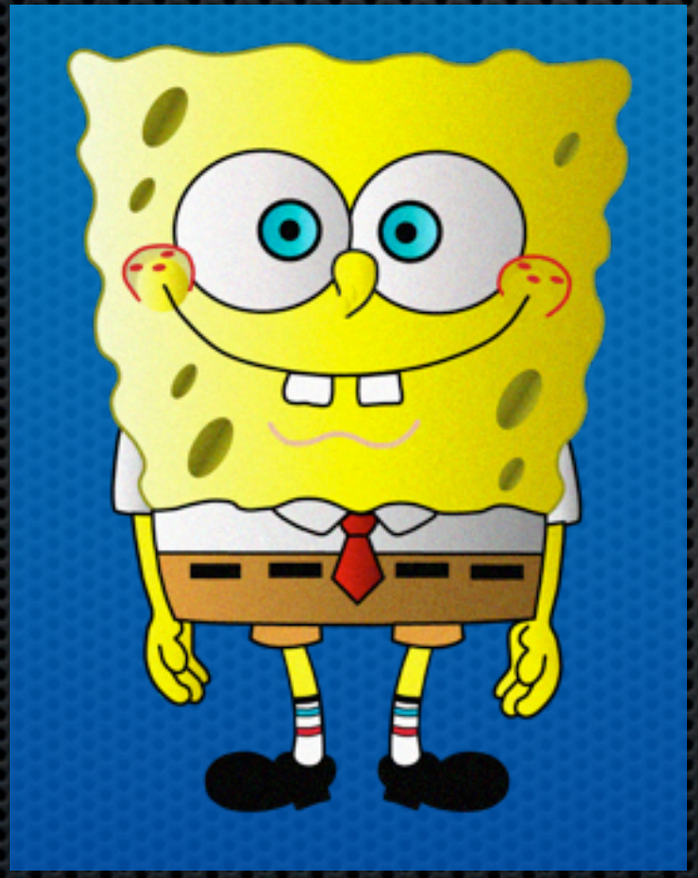
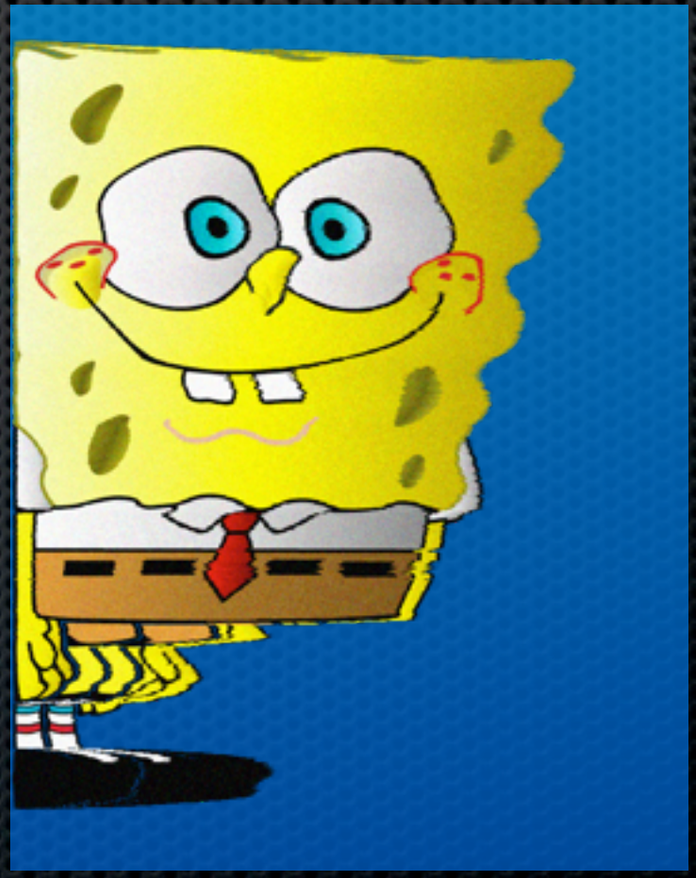
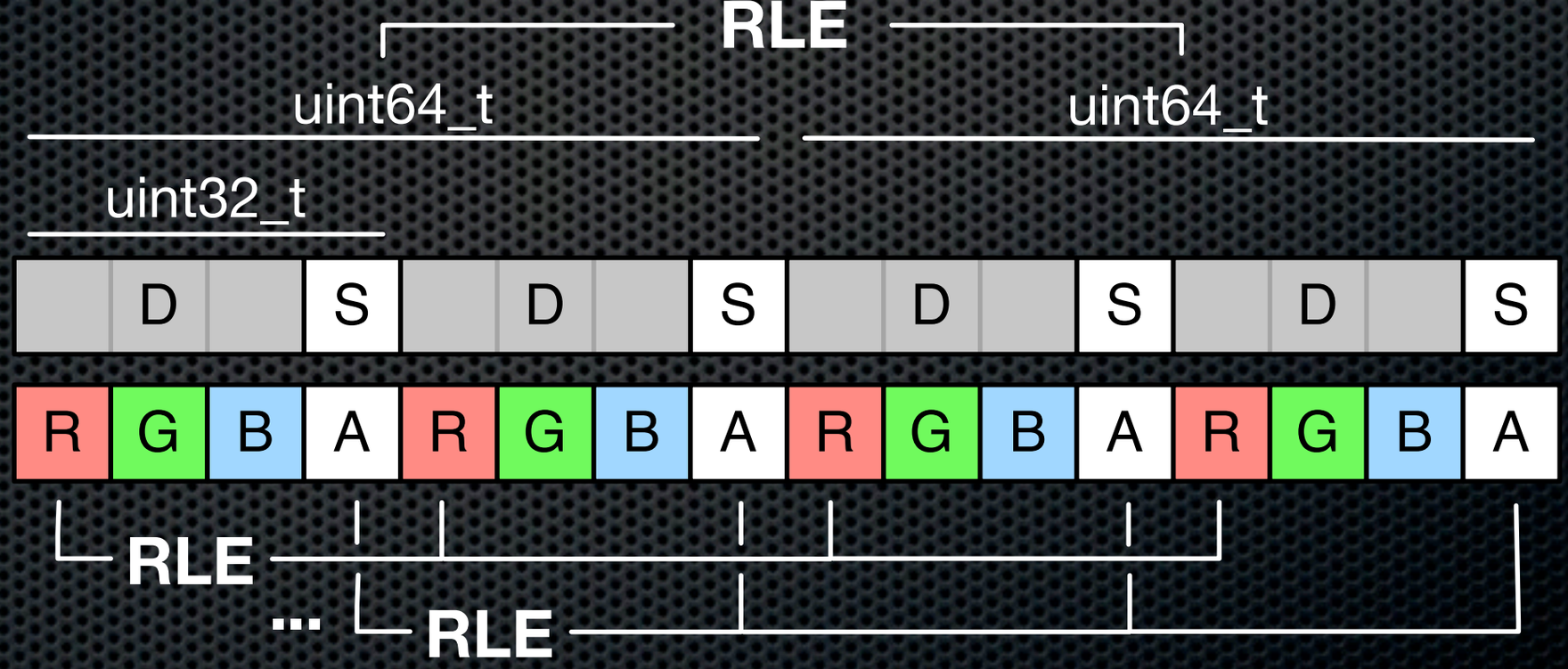




Current Work

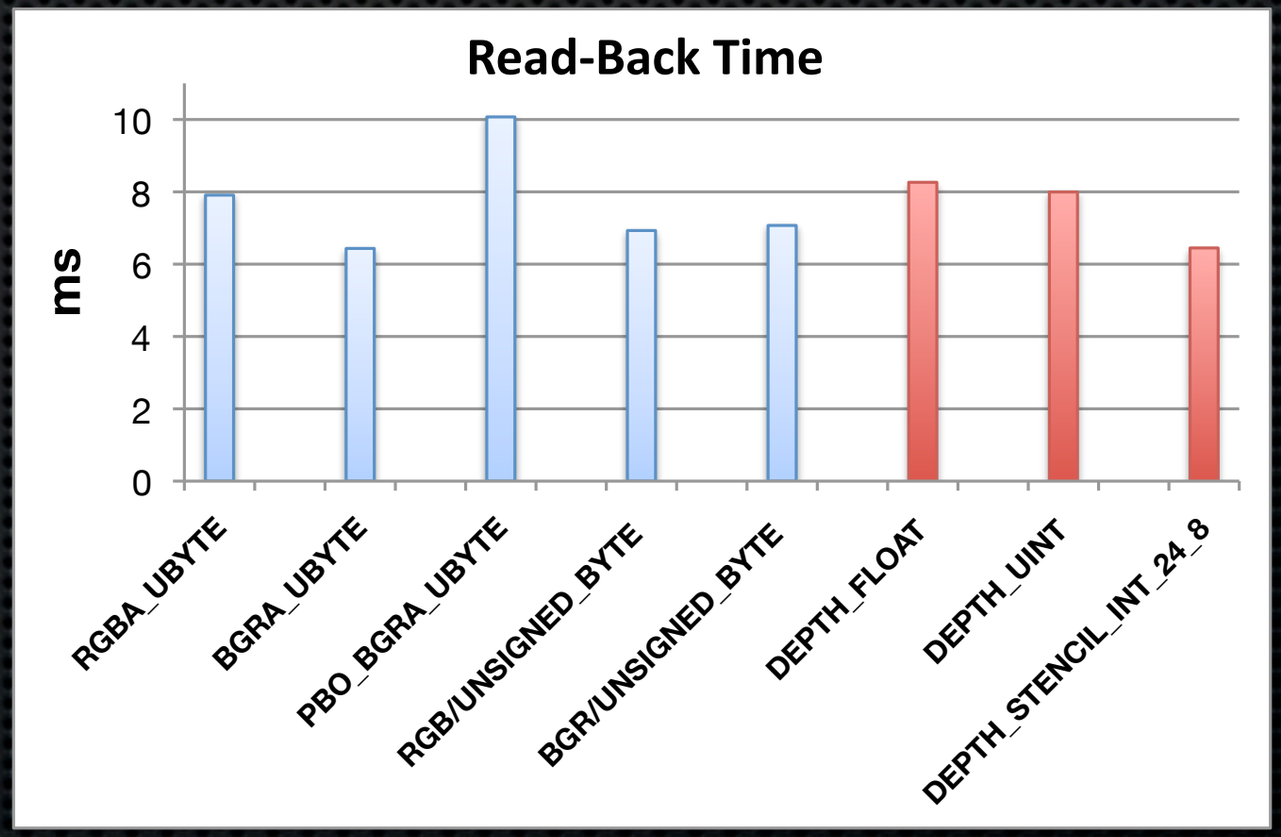
- Per-component RLE

- Better compression
- Short Marker



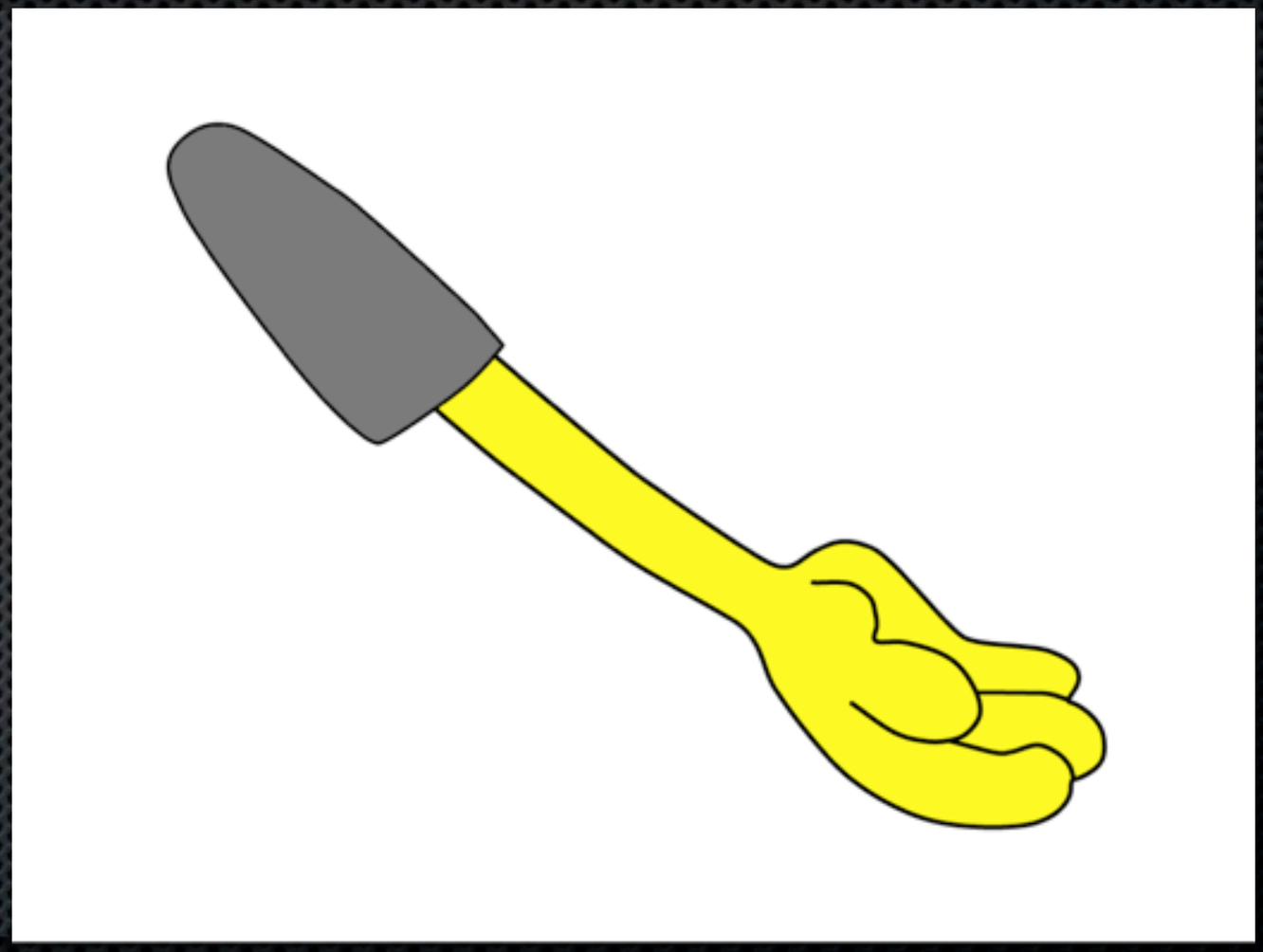
Fast Path Read Back

- Use fast path on GPU to read back frame data
  - BGRA for color; packed depth-stencil for depth
  - Use Parallel PBO download (no success so far)

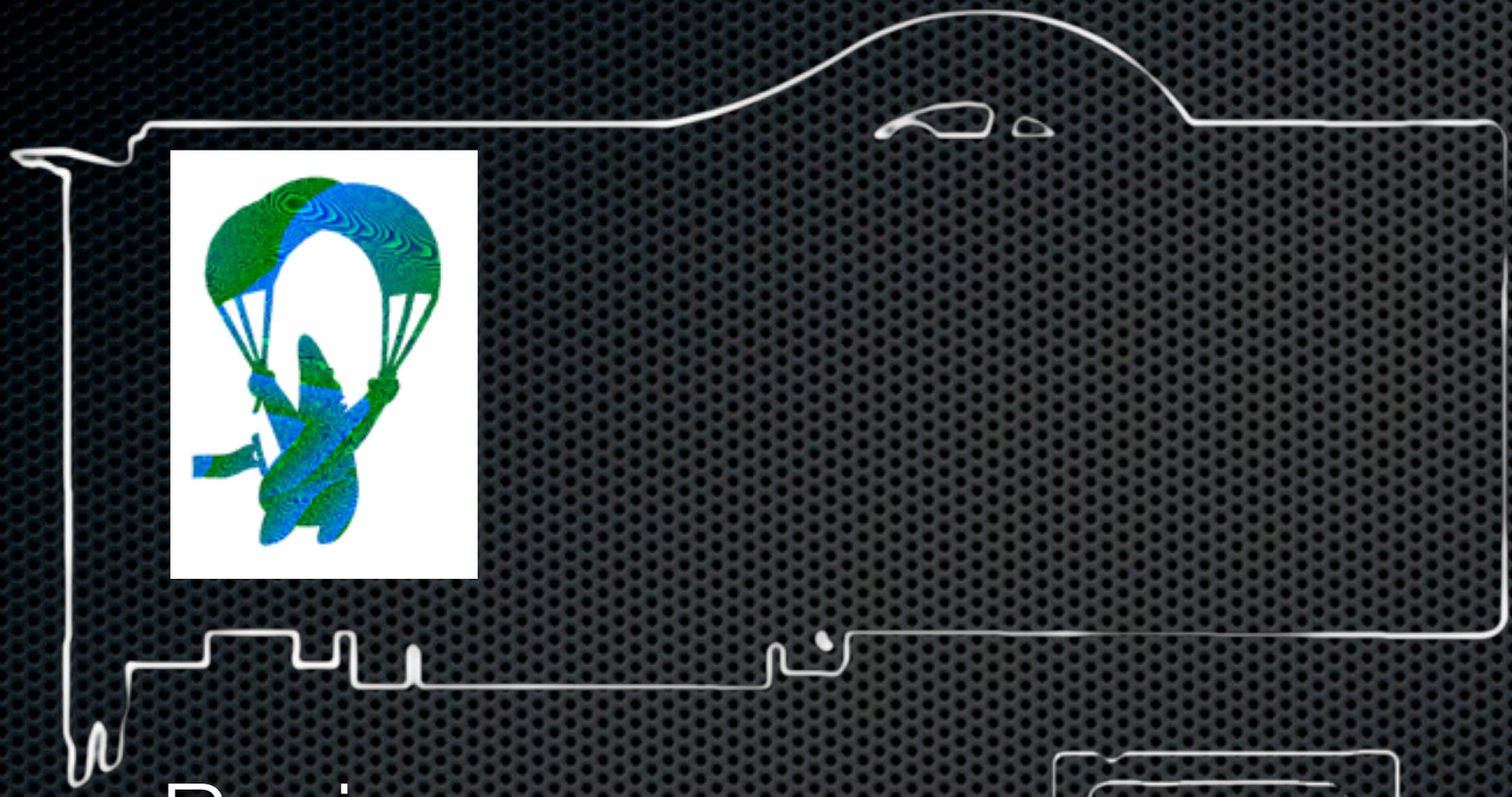


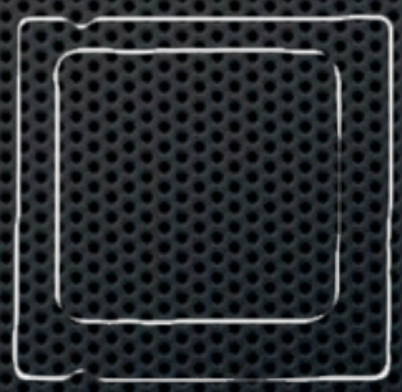
Reduce Compositing to ROI

- Use bounding box?



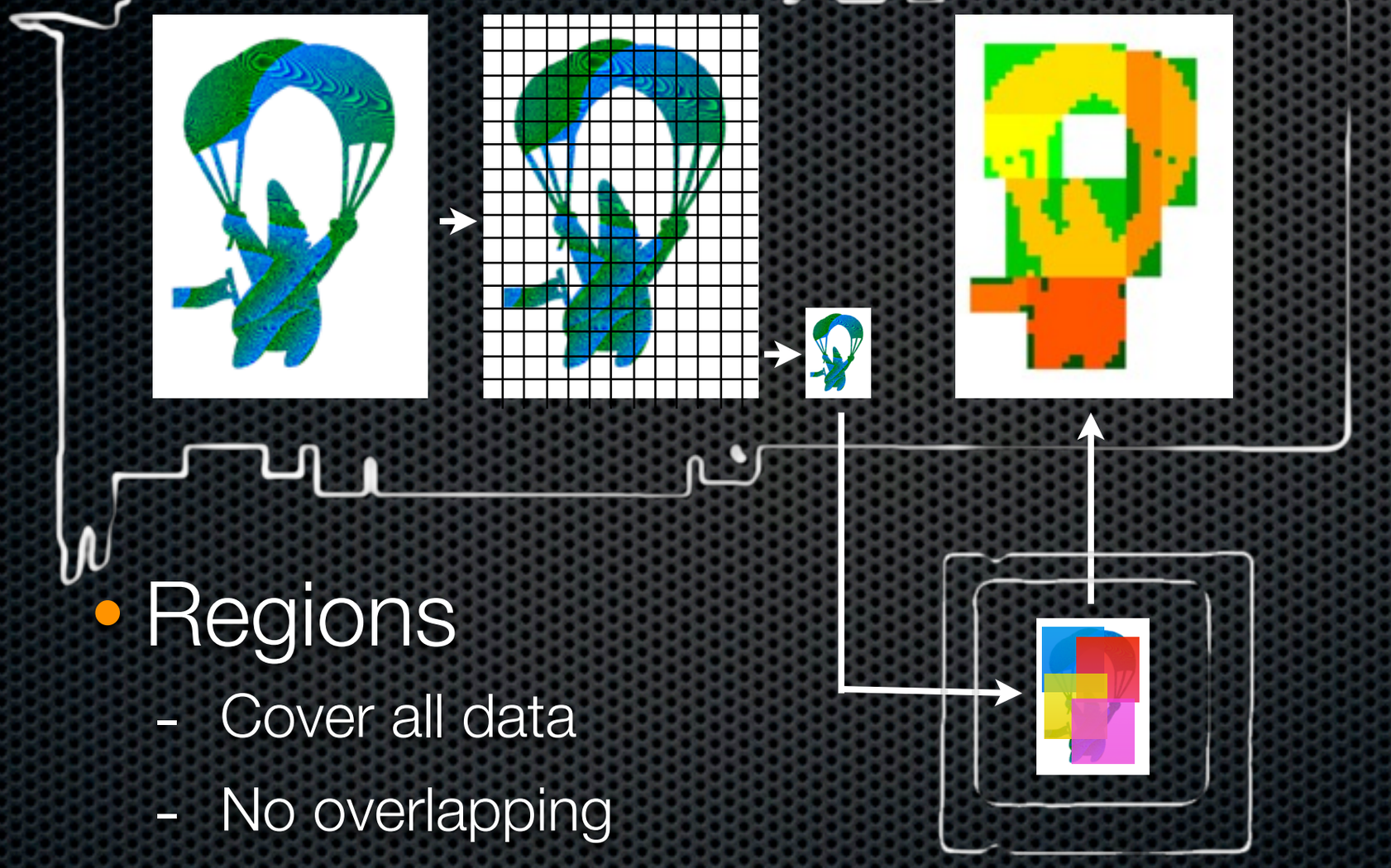
Multiple ROIs





- Regions
  - Cover all data
  - No overlapping
  - Smallest total area

Multiple ROIs



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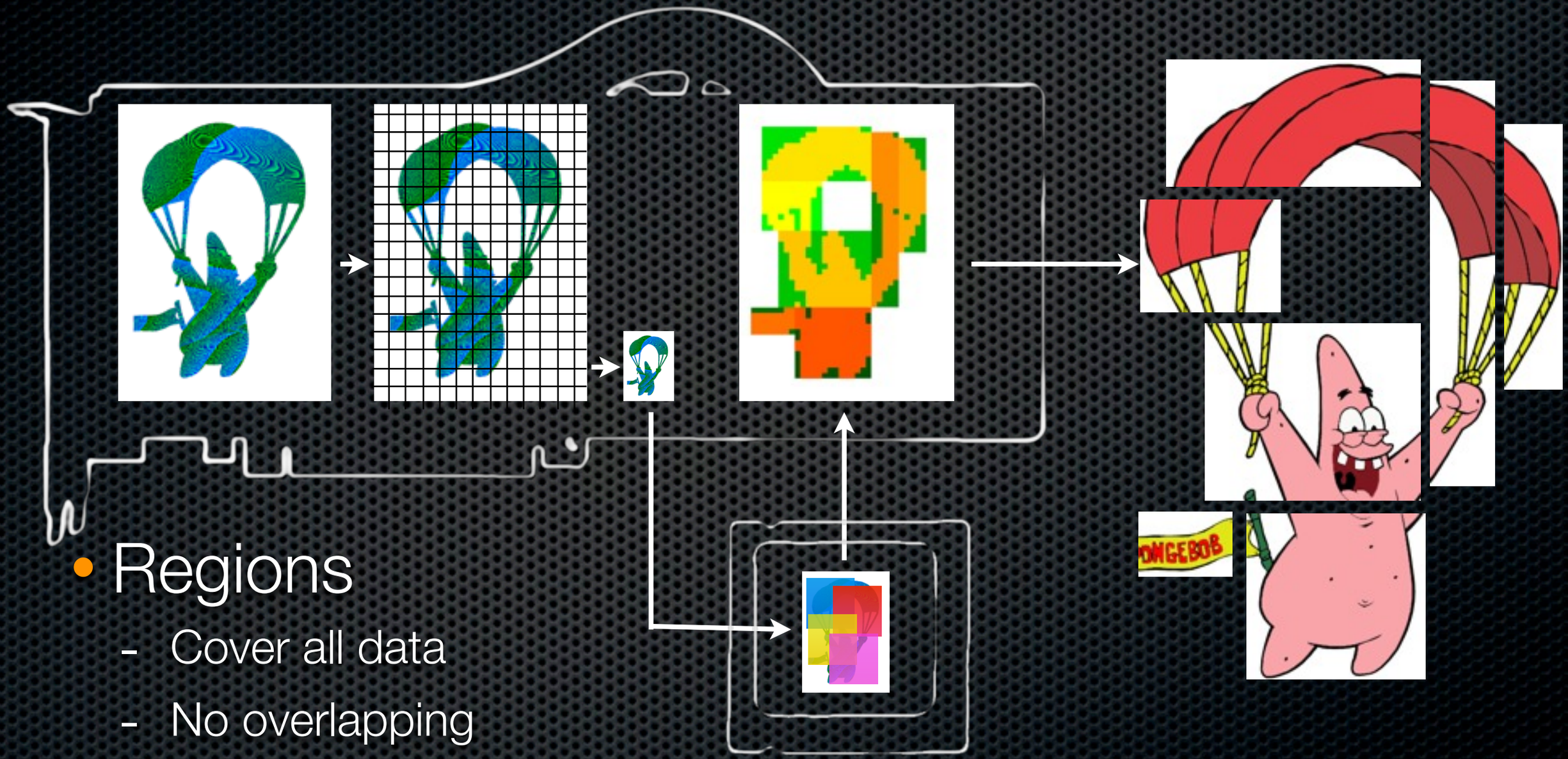

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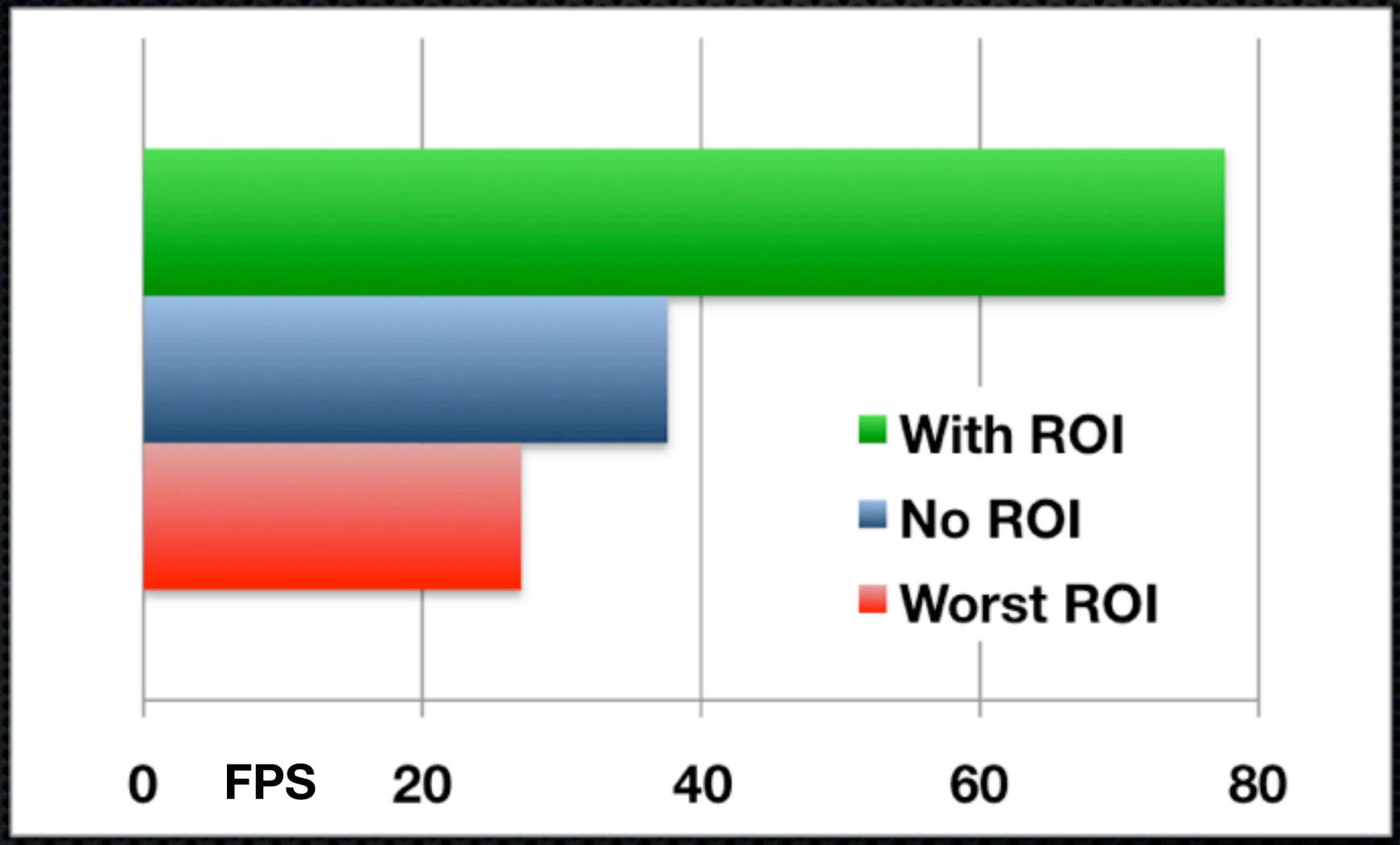
Current Work

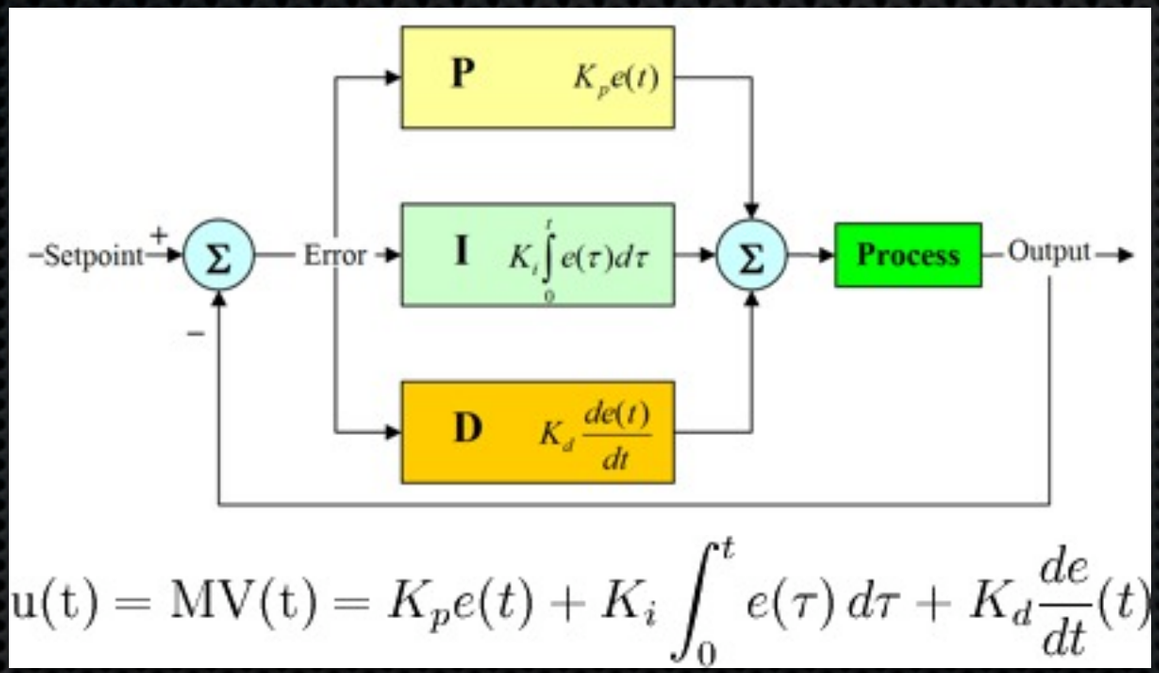


2-Pipes.DB.PBuffer

Dynamic Load Balancing

- Distribute work load among available resources
  - Optimize resource utilization
  - Maximize throughput and performance
- Concerns
  - Task partitioning / resource allocation
  - Locality / synchronization / communication
  - Dependency

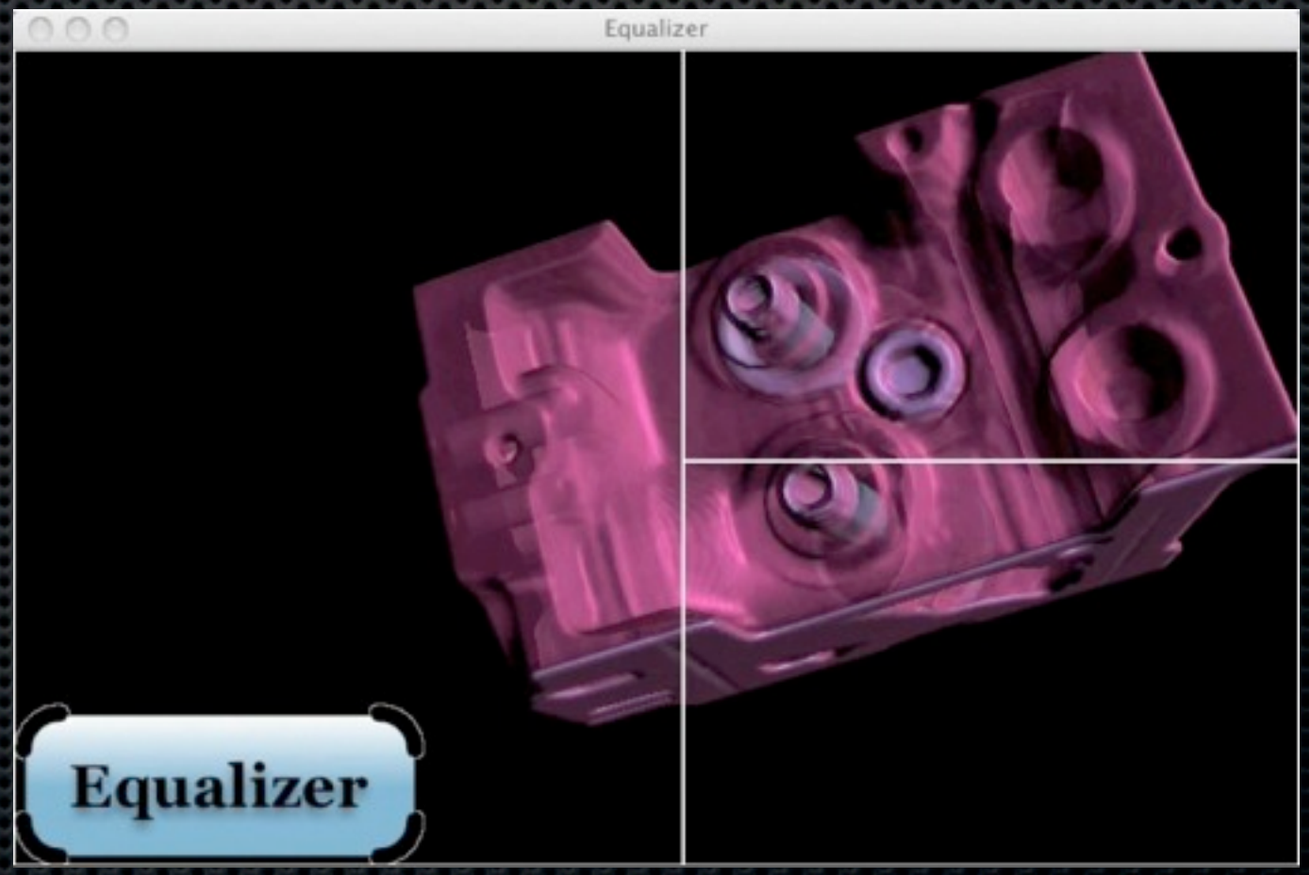
PID Controller



- Control loop feedback mechanism to control output of a system
- Use (P)roportional, (I)ntegral and (D)erivative of errors to drive the system to approach target
  - Error = Set Target - Actual Measured Output

Current Load Balancing

- Hierarchical load balancing
- Current implementation modes
  - 2D/DB/DPLEX/DFR



Current Work

- What to balance?
  - Rendering - GPUs
  - Processing for de/composition, de/compression - CPUs&GPUs
  - I/O for network/data readback/streaming
- How to balance?
  - Modes - 2D/DB/DPLEX/DFR, etc...
  - Accurate estimations
  - Resource<->Task matching
    - power, topology, content, locality

Current Work

- What to achieve?
  - Interface to provide/collect data
    - API for application, or functionality in eqServer
      - Statistics, cost querying for tasks, estimation mechanisms (PID)
    - Config file
      - Hints about data
  - Balancing algorithms
    - Dynamically plug-able methods, heuristics, data filters
    - Configurable

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