Adaptive and Scalable Load Balancing Scheme for Sort-Last Parallel Volume Rendering on GPU Clusters

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Motivation

• **Key issues** for sort-last parallel volume visualization
  – Communication network *throughput* & *latency* : Image compositing
  – *Load balancing* to maximize parallelism

• **Previous static load balancing**

- Simple, **data-unaware** method
- Self-balanced in terms of *task-parallelism*
- **Load unbalanced** in terms of *data-parallelism* due to empty space

- Accelerated method by empty space skipping
- Still **unbalanced load distribution**
Adaptive and Scalable Load Balancing Scheme

- Combination of hierarchical data structures (Octree+BSP tree)

Original Volume Data

Thresholding (low-pass filtering)

Octree partitioning

Empty space skipping

BSP tree generation

Distributing sub-textures & BSP tree to rendering servers

3D clustering & rendering on each server

[3D clustering & rendering on each server by M.J. Berger et al-91']

Rendering & Compositing

Transfer Function

Editing T/F

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Experimental Results & Conclusion

Test Datasets
- Lobster (301x324x56)
- Leg (341x341x93)
- Visible Human Male (430x240x256)

Testing Environment: VGcluster [J. Nonaka-04’]

Comparison of the # of sub-volumes (VHM)

Comparison of the frame rates (512x512 viewport, Leg)

Comparison of consuming time for rendering one frame (Lobster)

Experimental Results & Conclusion

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Volume Graphics
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