Event Distribution and Image Delivery for Cluster-based Remote Visualization

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Motivations

- Graphics as a Remote Service
  - Enabling better use of available resources
  - Providing graphics to a variety of users
  - Transparent to the end user
  - Ability to adapt to the user’s capabilities
Event Distribution

- App
  - Tilesort
- App
  - Tilesort
    - ...
    - ...
- App
  - Tilesort
- Server
  - Readback
  - Pack
- Server
  - Render
  - Readback
  - Pack
- Event Server
  - SendEvent
Event Distribution

- CRUT: An API for sending events
  - Completely abstracted from the rendering context
  - Responsible for configuration and sending events

- Client Library
  - Callback Registration
  - Main Loop / Event retrieval
Event Distribution

- Server side flexibility
  - Can be written using any toolkit
  - API takes care of distributing events

- Client side flexibility
  - Don’t bind the application to using a main loop
Event Distribution

- Simple sampling technique to process only the most important events.

Event Queue

- Mouse Motion Events
- Other Events
Image Delivery

- Allows use over low-bandwidth connections

200x200 Image

117 KB

1.4 KB
Image Delivery

- Determining maximum RMS Error

![Graph showing RMS Error vs. Quality Setting]

- RMS Error: Visually Noticeable
- RMS Error: Not Visually Noticeable
Image Delivery

- Choosing quality and GOP size
Image Delivery - Issues

- Framebuffer readback
- Conversion from RGB interleaved to YUV planar

\[
Y = ((66 \times R + 129 \times G + 25 \times B + 128) >> 8) + 16 \\
U = ((-38 \times R - 74 \times G + 112 \times B + 128) >> 8) + 128 \\
V = ((112 \times R - 94 \times G - 18 \times B + 128) >> 8) + 128
\]
Other Compression Options

- Compression within the packer/unpacker
  - gzip/zlib or other compression library
  - Deering’s geometry compression (SIGGRAPH ’95)
The Missing Pieces

- Resource Sharing and Allocation
  - Allowing for multiple users with varying needs

- An Adaptable Graphics System
  - Adjust system parameters to best suit the needs of the users
Questions?