Wavelet-Based Multiresolution for Mobile Graphics

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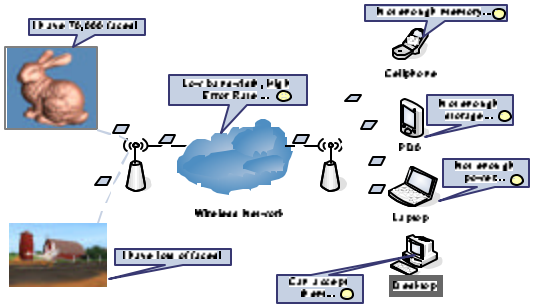
Objective

How to render meshes or images on mobile device with best quality.

Motivations



- Storage (Memory, Disk…)
- Transmission (Bandwidth…)
- Power
- Encoding/Decoding
- Rendering

→ ***Wavelet-based Multiresolution***

Def.: Encoding that permits transmission and rendering pieces by pieces

Wavelet-based Multiresolution Analysis

Wavelets Transformation

$$P^{j+1} = \begin{bmatrix} P & Q \end{bmatrix} \begin{bmatrix} P^j \\ d^j \end{bmatrix}$$

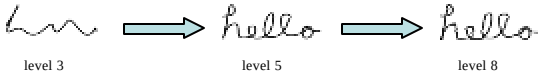
Where P are low pass filter, Q are high pass filter, d^j are the wavelet coefficients at level j

Multiresolution Representation M_j

= **Base M_0** + **Sum of correction terms (wavelet coefficients)**

20 coefficients — 200 coefficients — 16,000 coefficients

2D Image



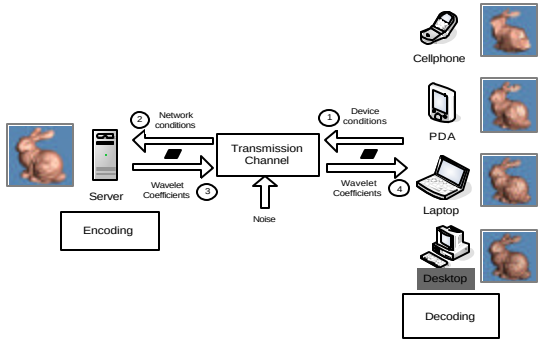
level 3 — level 5 — level 8

Curve

base M_0

3D Mesh

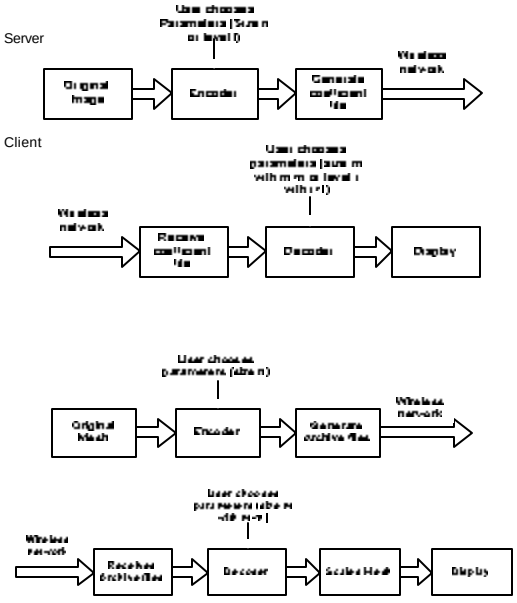
Proposed Method



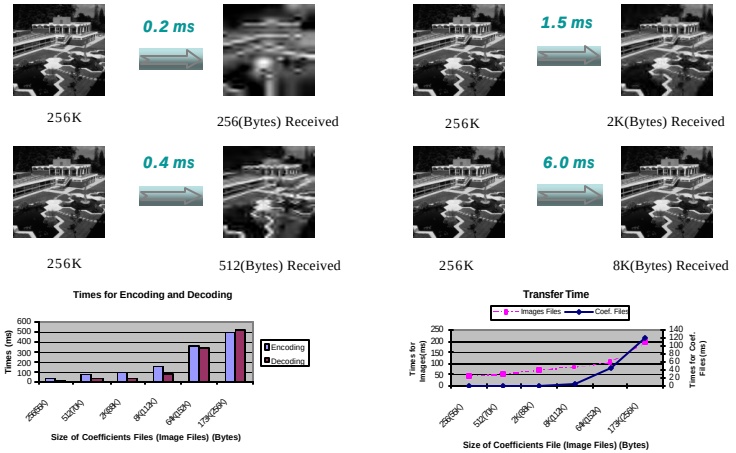
- Monitoring/Optimize mobile parameters
  - ❖On mobile device
    - Memory
    - Battery Power
    - Encoding/Decoding Speed
  - ❖Wireless network
    - Bandwidth
    - Error rate

→ **Which level or how much wavelet coefficients will be sent to the mobile device and reconstructed**

Implementation



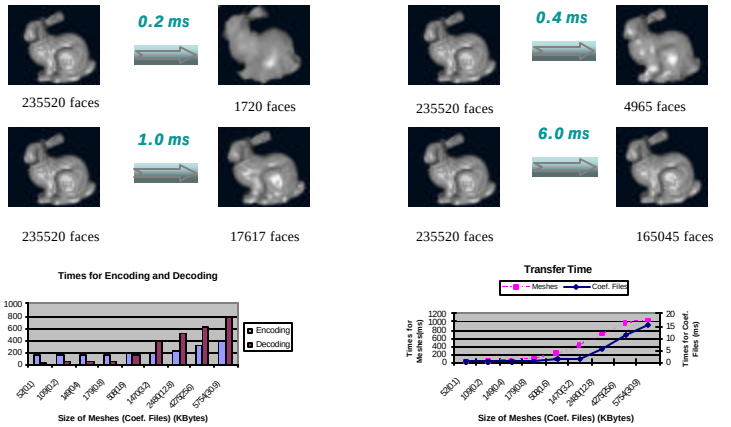
Experimental Results on 2D Image and 3D Mesh



Server *CPU: P4 2.8GHz, RAM: 504MB*

Client *CPU: Celeron 1.0GHz, RAM: 256MB*

Wireless network speed is 11 Mbps



Server *CPU: P4 2.8GHz, RAM: 504MB*

Client *CPU: Celeron 1.0GHz, RAM: 256MB*

Wireless network speed is 11 Mbps

Conclusion

- Wavelet-based multiresolution is a good solution that permits piece-wise transmission and rendering of graphics models. To transfer wavelet coefficient files is easier to transfer original file and the decoding time is also acceptable.
- Reduce decoding time
  - Reduce the complexity of decoding algorithm
  - Render the mesh with lower resolution
- Distribute the work loads between server and client by choosing different parameters (m,n), regarding the conditions of wireless network and clients.

Future Work

- Error Calculating and Comparing
  - L^2 Object Space Error
  - Image Space Error
- Establish a framework which can deal with the wavelet transform for 2D image or 3D mesh.
- Implementation of wavelet transform on GPU.