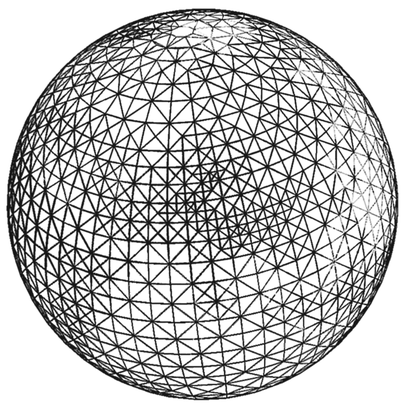
New meshing capabilities for efficient and quality navigation on a virtual globe

Javier Sánchez[1], José Pablo Suárez[2]
Agustín Trujillo[1], Modesto Castrillón[1]
[1]Computer Science Department
[1]Cartography and Graphic Engineering Department
University of Las Palmas of Gran Canaria

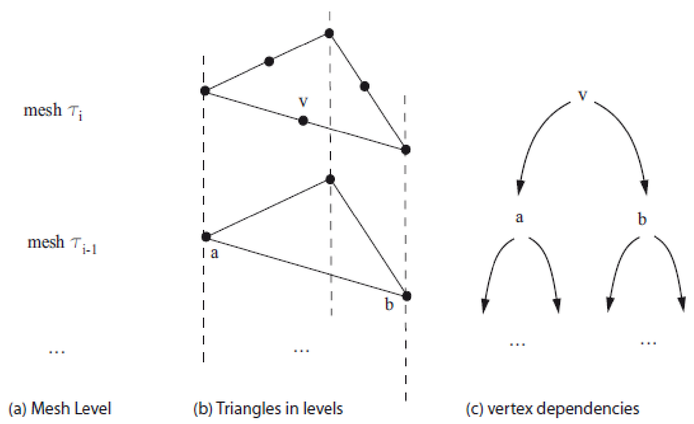


Abstract

Polygonal meshes are powerful structures to represent geometric information of the Earth's surface. In particular, triangle meshes have been massively used as a reliable way to efficiently represent the land surface with real time responses in virtual navigation. In this work we present new ideas for the underlying treatment of a mesh that improve efficiency and quality in the navigation. We explore critical issues such as on-the-fly refinement, smoothness of the mesh and partition methods for the refinement operations. We test the proposed capabilities inside an open source virtual globe and compare with other implementations. The proposed model is a view-dependent level of detail strategy that is classified as a binary triangle tree approach. We study how to increase the accuracy of the mesh by splitting the triangles by their longest edge and propagating the splits to the surrounding neighbors. This binary triangle tree naturally avoids the cracks on the terrain. This approach allows a high frame rate and the frame-to-frame coherence is maintained thanks to the split and merge policy. In this application, the textures and meshes of the terrain are obtained progressively from a remote server using standard protocols.

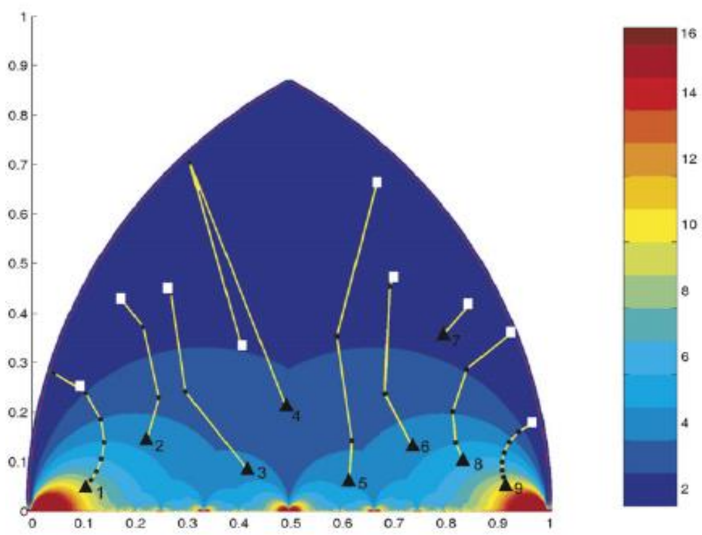
Meshing strategy

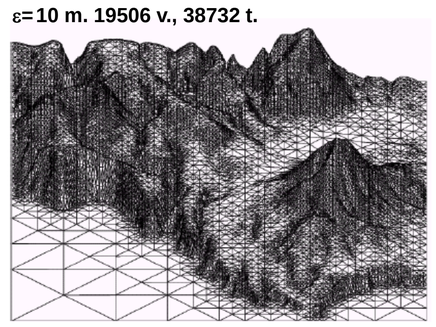
The proposed model is a view-dependent level of detail strategy that is classified as a binary triangle tree approach

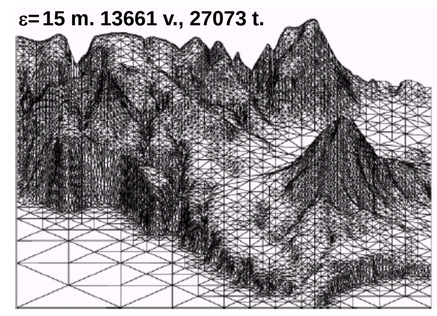


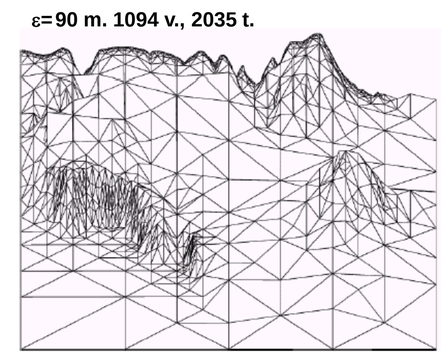
(a) Mesh Level (b) Triangles in levels (c) vertex dependencies

The mesh is constructed by splitting the triangles by their longest edge and propagating the splits to the surrounding neighbors. A map diagram provides a convenient way to visualize the evolution and migration of element shapes leading to a better understanding of the improvement process and the recursive subdivision schemes [2]









Adapted meshes for the view-dependent strategy, [3].

Acknowledgements

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References

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[3] J. P. Suárez, A. Plaza, Four-triangles adaptive algorithms for RTIN terrain meshes . Mathematical and Computer Modelling,49, (5-6), (2009), 1012-1020