ABOUT THE VISUALIZATION PIPELINE

P. A. Vasev, A. V. Svalukhin
N.N. Krasovskii Institute of Mathematics and Mechanics
Ural Branch of the Russian Academy of Sciences, Ekaterinburg

The visualization pipeline is quite well studied, for example see [1,2,3]. However, we have not seen studies that would show reasonably why there are certain stages in that pipeline.

Our analysis showed the following:

1. The computational program generates the data. These include data obtained both as a result of the program, and during its operation. These are the results of both calculations and the internal state of the program.
2. The data actually represents computational entities, that is, mathematical objects associated with the computational problem.
3. For the aims of a visualization some extra transformations might be required. This results in new computational entities. This stage sometimes called filtering, filling in gaps, postprocessing, sampling, etc.
4. "The view" is a next stage. The view translates computational entities and creates visual entities. An example of visual entity is a point cloud. An example of view is a "show the grid as a point cloud".
5. The visual entities are then transformed into calls (commands) to the graphics library API. For example, in OpenGL this might be commands to draw a set of vertices. This stage is usually called rendering.
6. Also the rendering stage includes rasterization - the work of the graphics library to generate images suitable for output device.
7. The resulting images can also be transformed. For example, they may be partial and should be combined in case of parallel rendering.
8. Images are presented to the user on the screen (or another output device).

The user interacts with with the visualization pipeline and can control any of it's stages (including all transformations, connections and also the computational program).

The calculation flow of any particular visualization task can be more complex, contain more connections and transformations. At the same time, we assume that any of these transformations will correspond to the above stages.

References

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