Motivation

Efficiency of acceleration structures for ray tracing is defined by fast traversal performance, low construction time and small memory footprint. Current state-of-the-art approaches such as kd-trees or Bounding Volume Hierarchies (BVHs) rely on computational expensive construction heuristics (e.g. the Surface Area Heuristic) for fast traversal performance. Grid-based structures are faster to build but consume large amounts of memory or do not adapt well to the underlying scene geometry. Combining concepts of hierarchical grids, kd-trees and BVHs, our approach is based on the idea of nesting 1D-grids and utilizes the merits of the underlying approaches.

The Split Grid is ... 
- traversed using a fast and efficient scheme
- compact in storage
- adaptive to the scene geometry
- Built with a very simplistic scheme – no complex heuristic is necessary to achieve high traversal performance!

Our approach

Our Split Grid is a hierarchical data structure. Initially, it uniformly divides the scene-space along a single axis into a variable number of grid cells of the same size. Recursively, each cell is further subdivided into an 1D-grid, potentially choosing a different split axis.

The Split Grid achieves competitive traversal and construction performance while having the lowest memory footprint averaged over all scenes.