

A*-based pathfinding in Virtual Reality

Project presentation

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Tim Weißker



VR-Systems Group
Bauhaus-Universität Weimar

Pathfinding

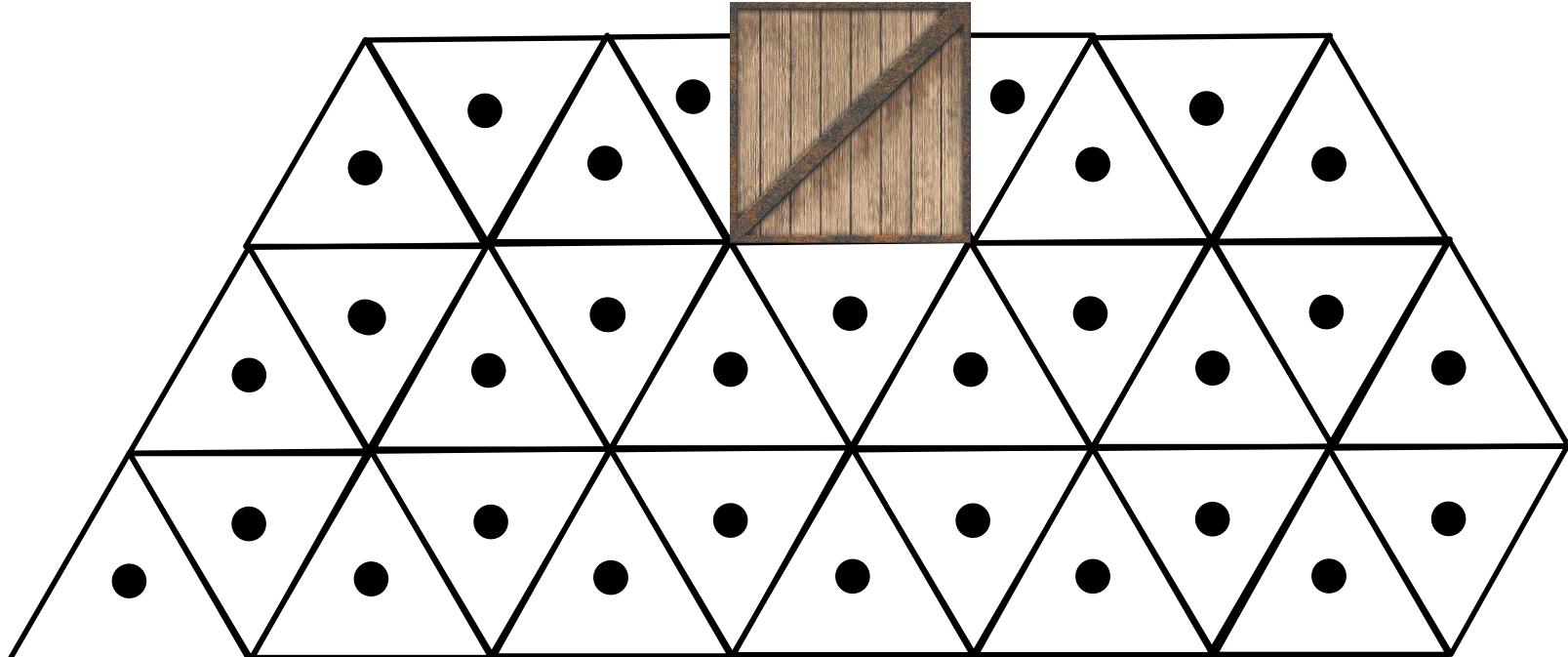


Search problems



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Navigation meshes

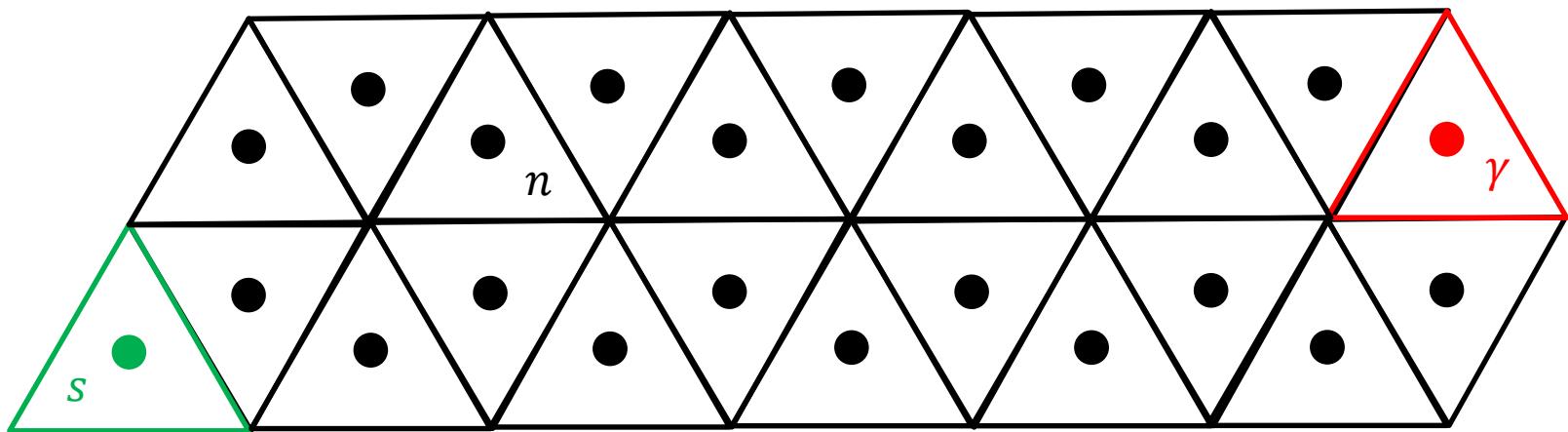


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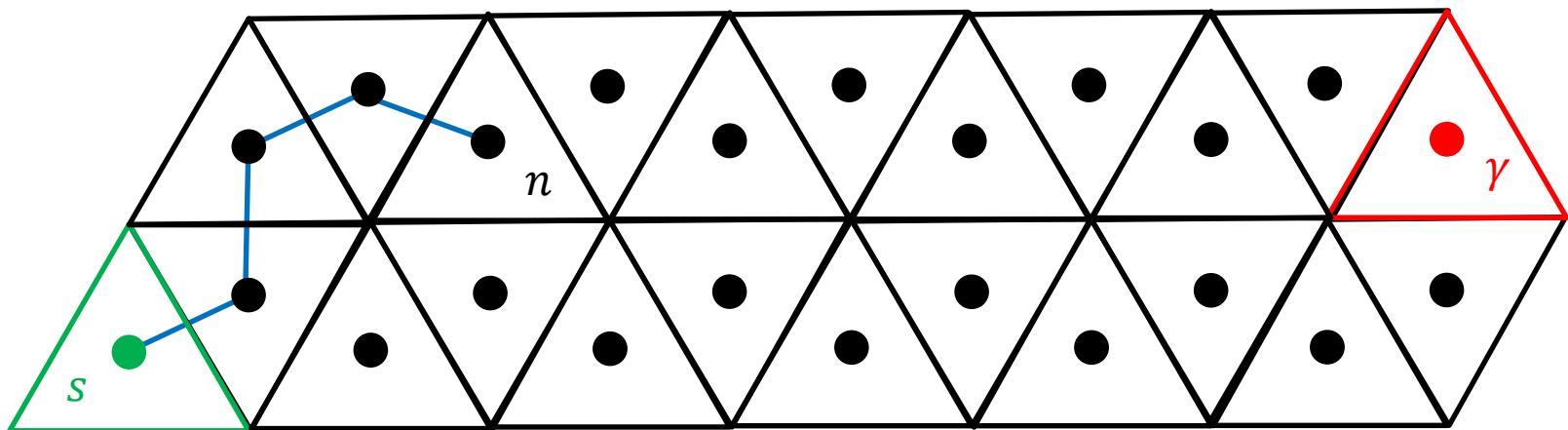
The A* algorithm

$$f(n) = g(n) + h(n)$$



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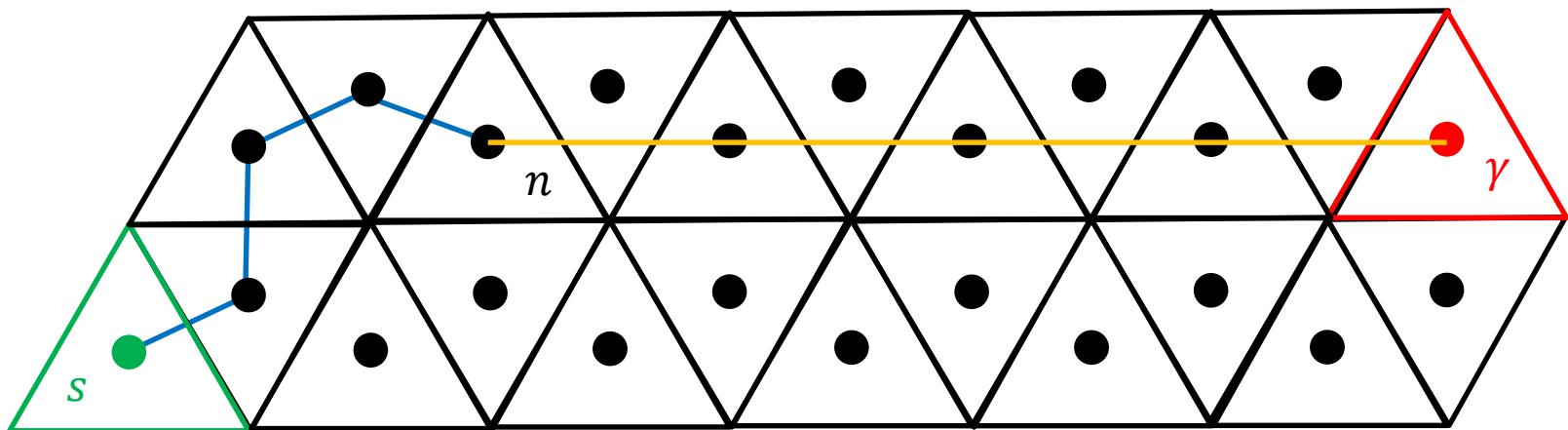


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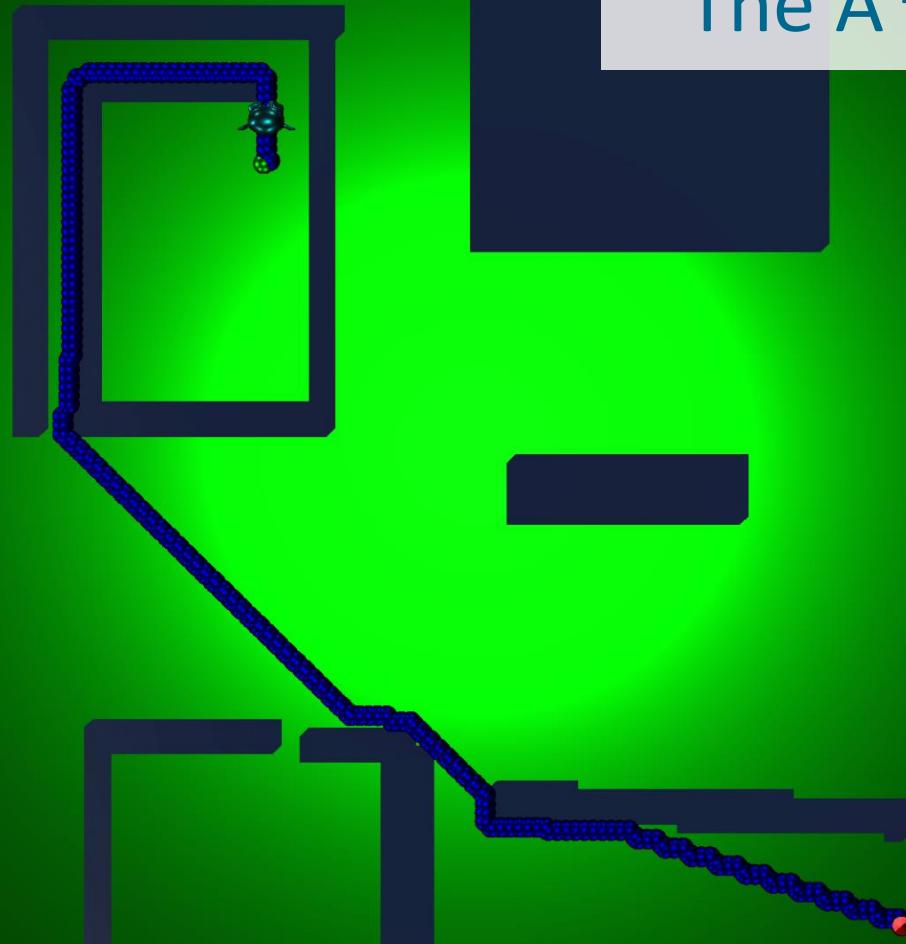
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The A* algorithm

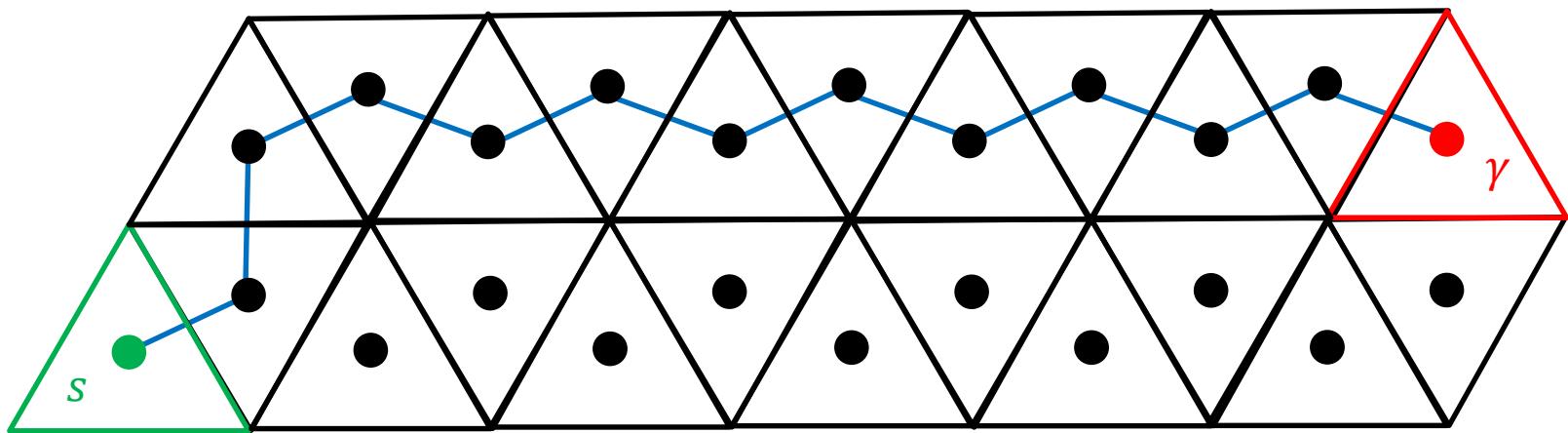
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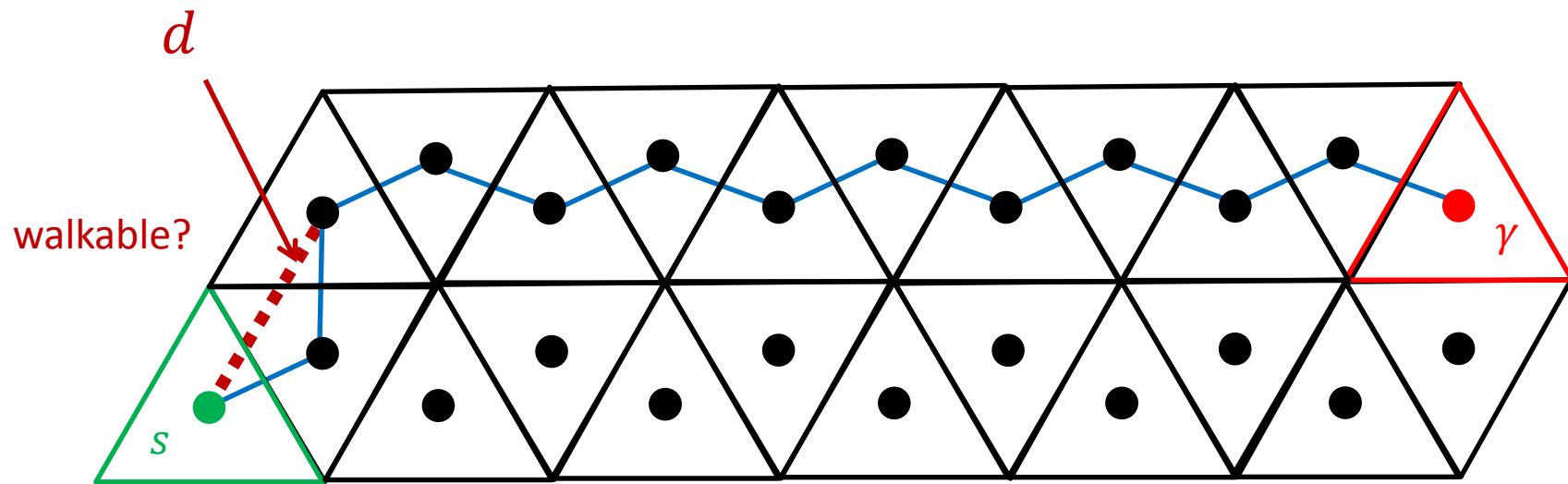
The A* algorithm



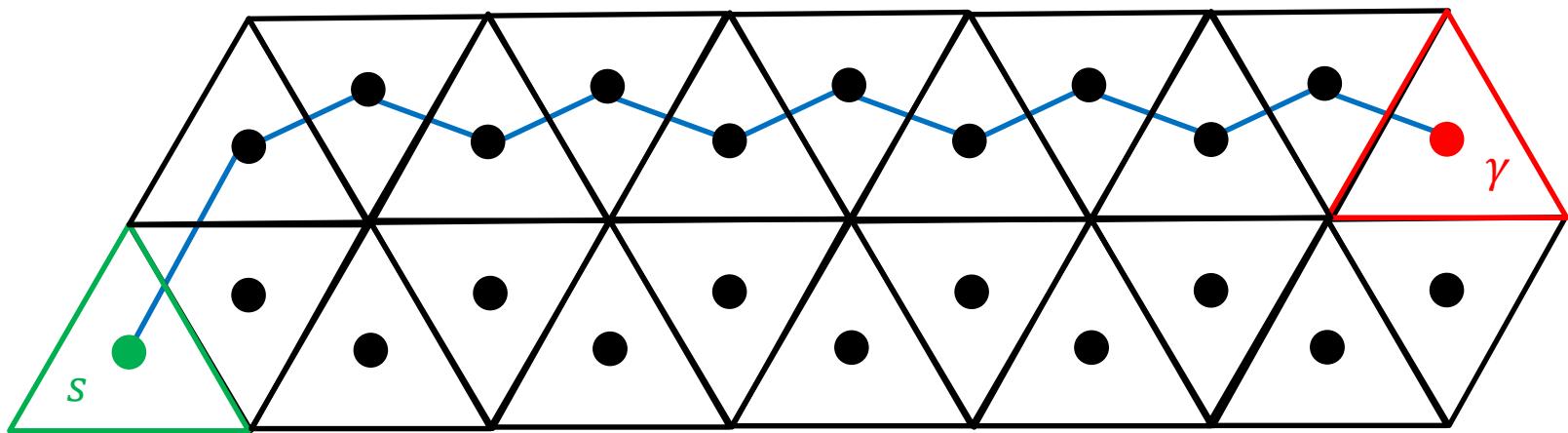
Eliminating unnecessary points



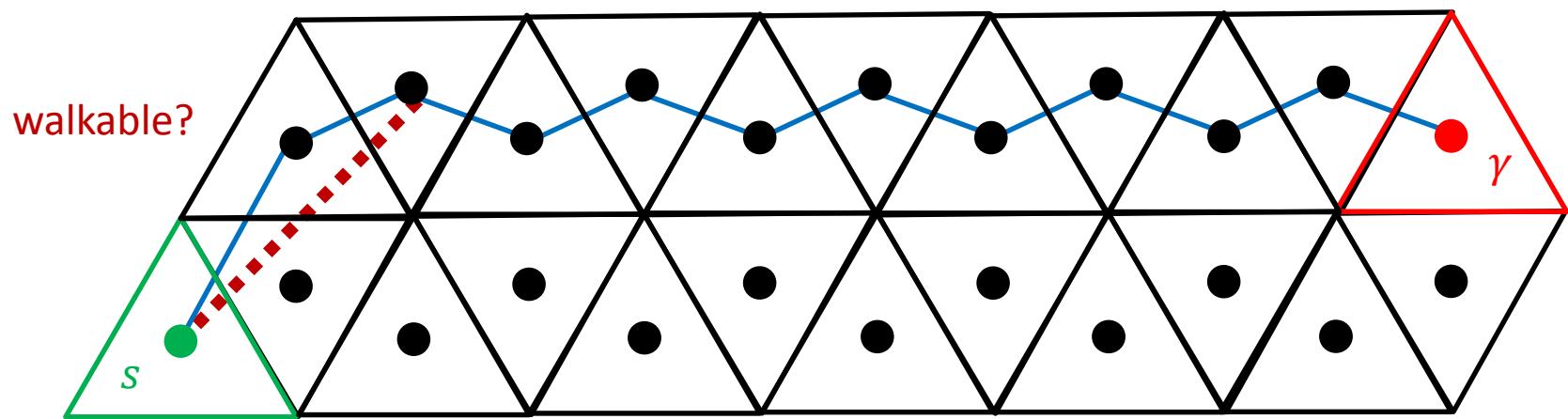
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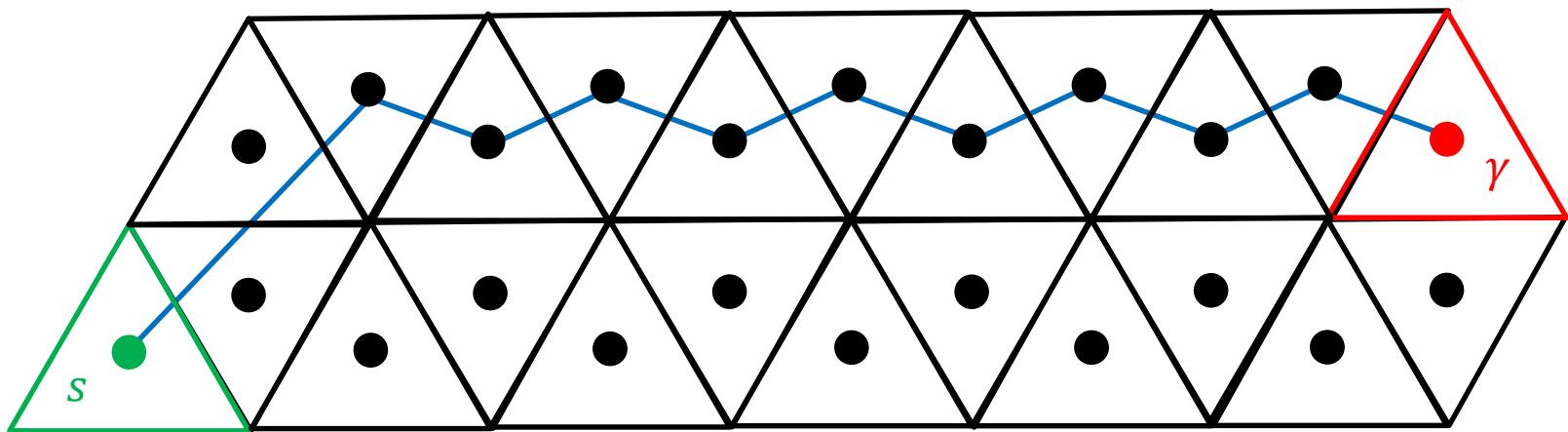
Eliminating unnecessary points



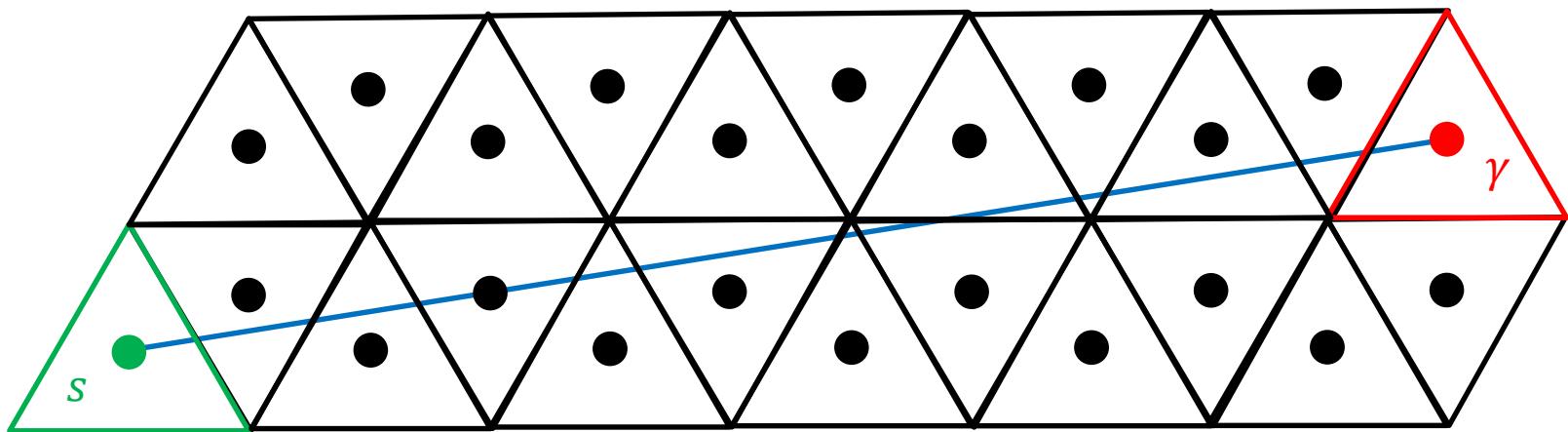
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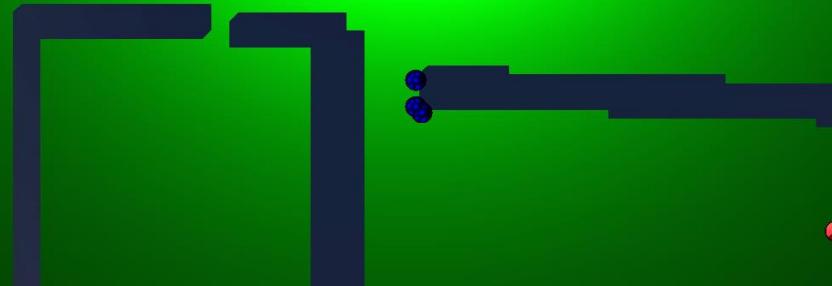
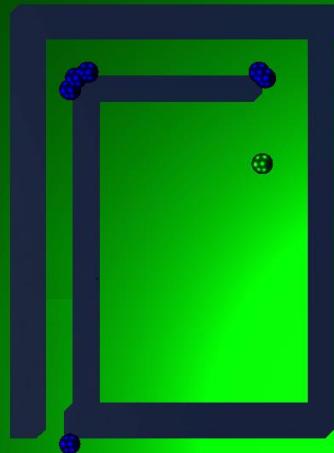
Eliminating unnecessary points



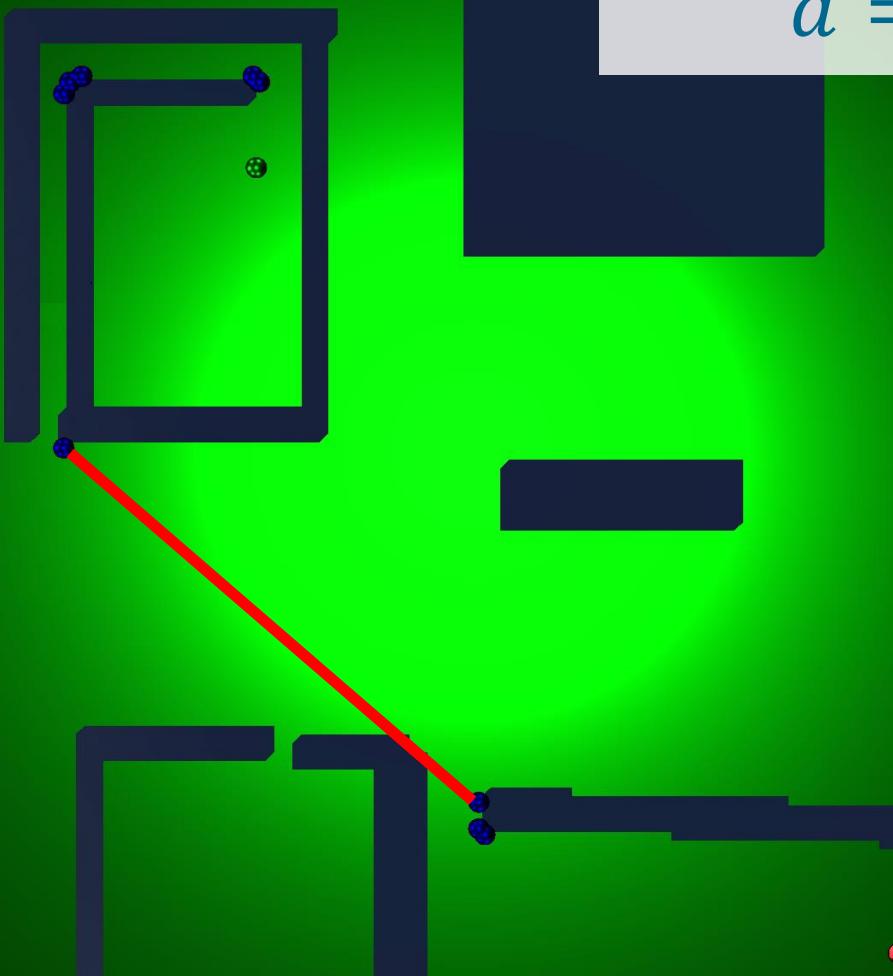
Eliminating unnecessary points



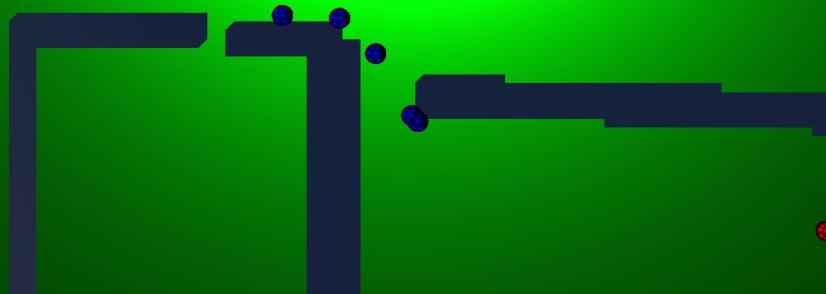
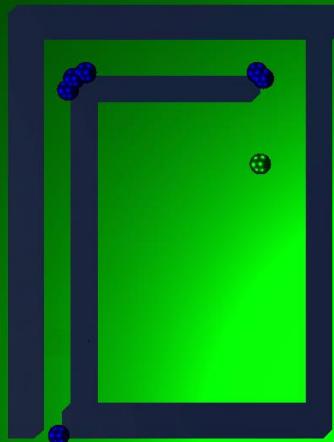
$d = 0.2 \text{ m}$



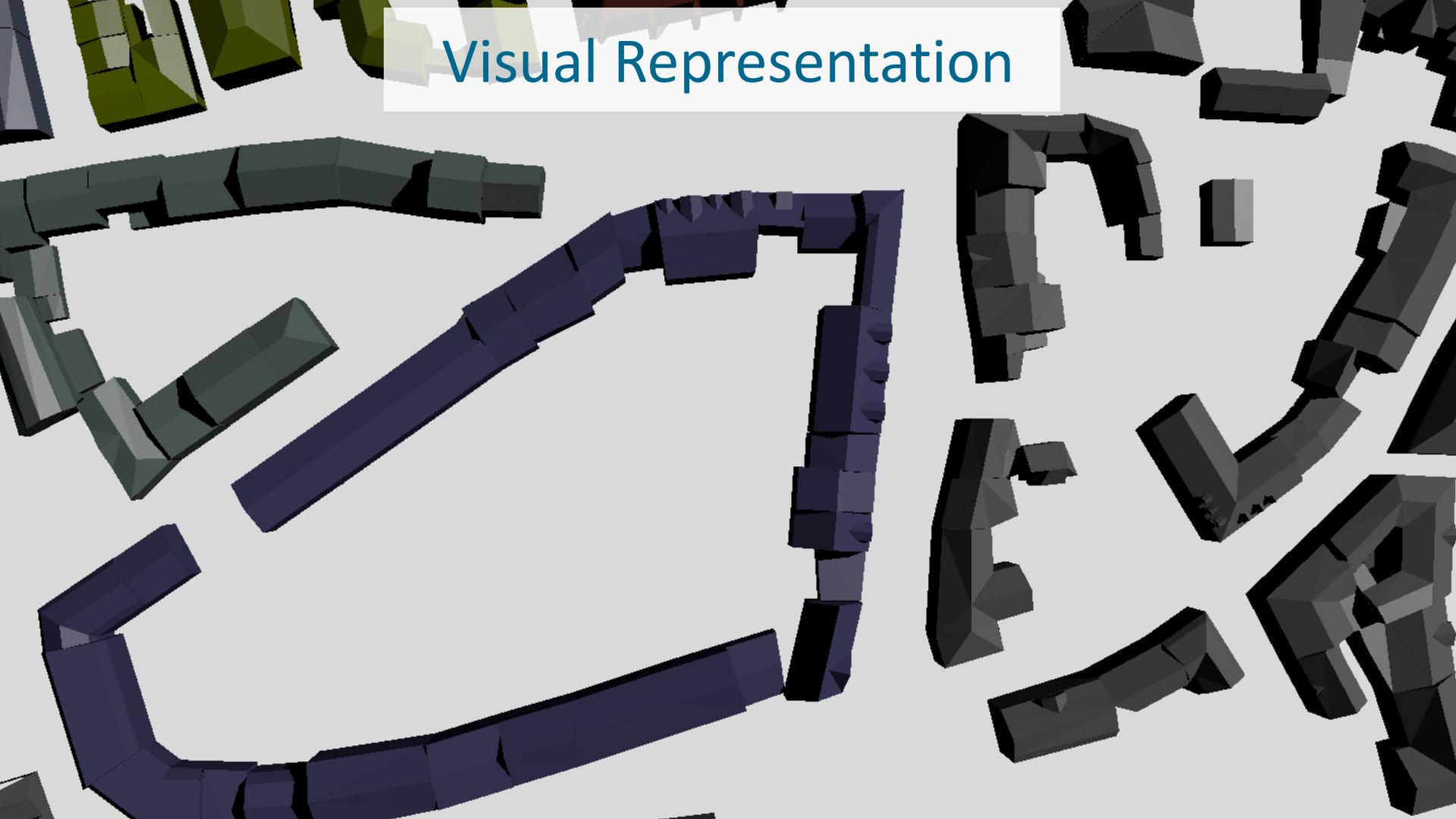
$d = 0.2 \text{ m}$



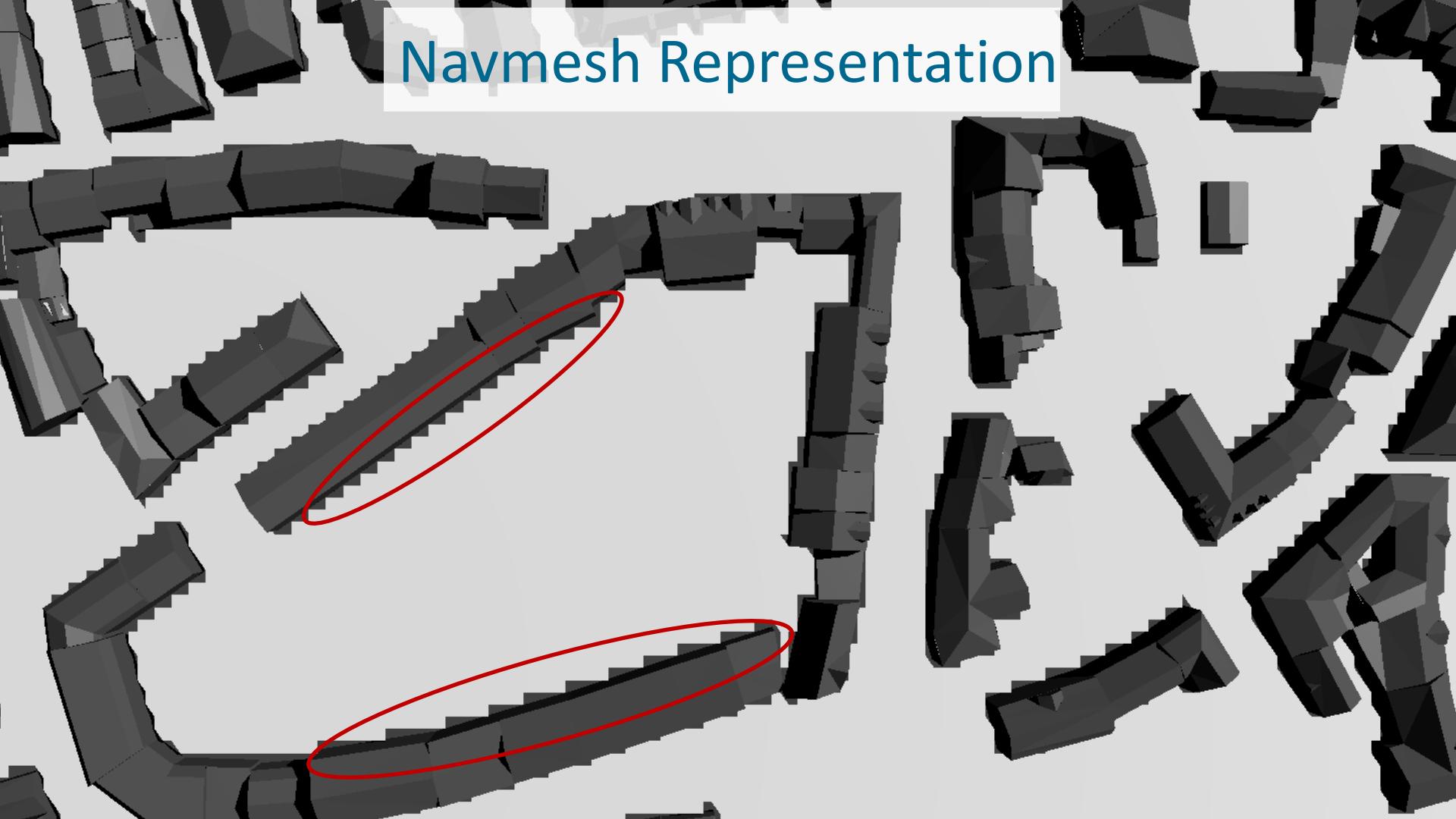
$d = 0.01 \text{ m}$



Visual Representation



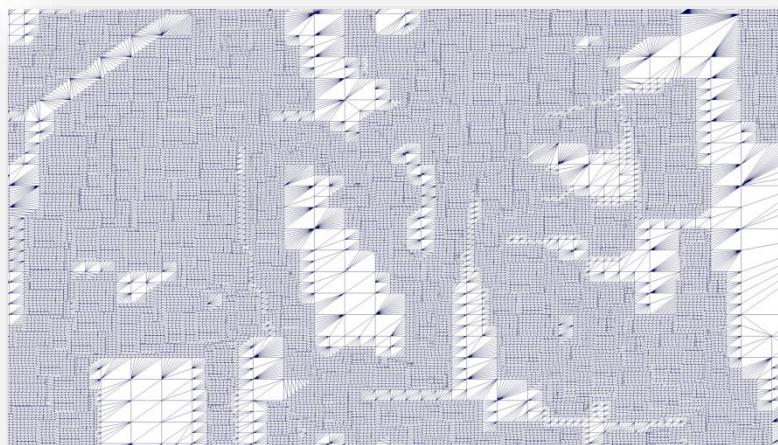
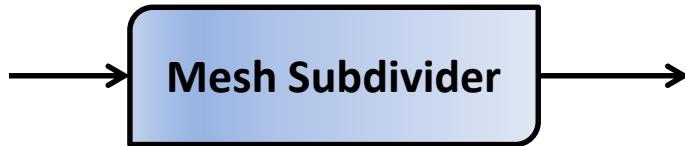
Navmesh Representation



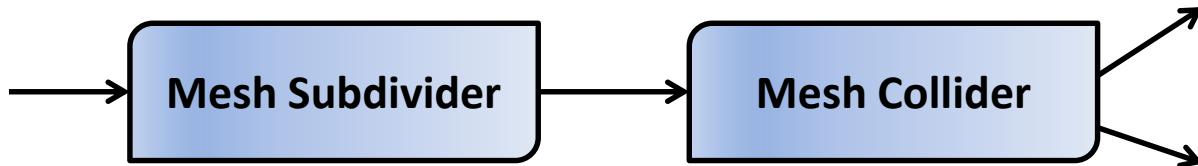
Mesh Preprocess Toolchain



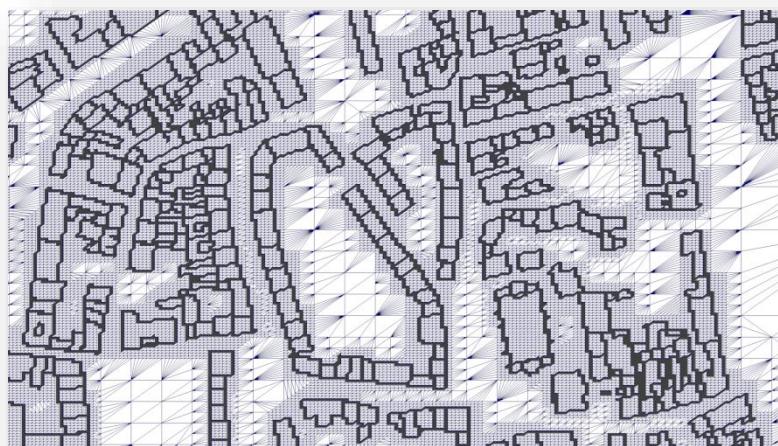
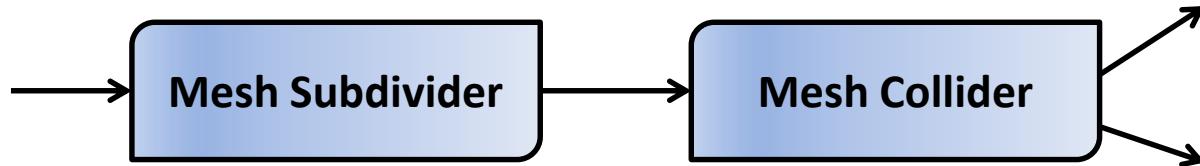
Mesh Preprocess Toolchain



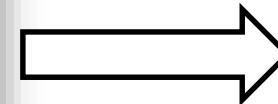
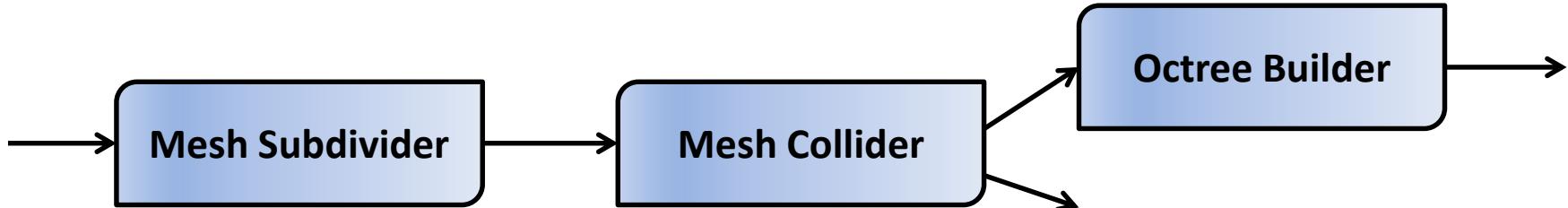
Mesh Preprocess Toolchain



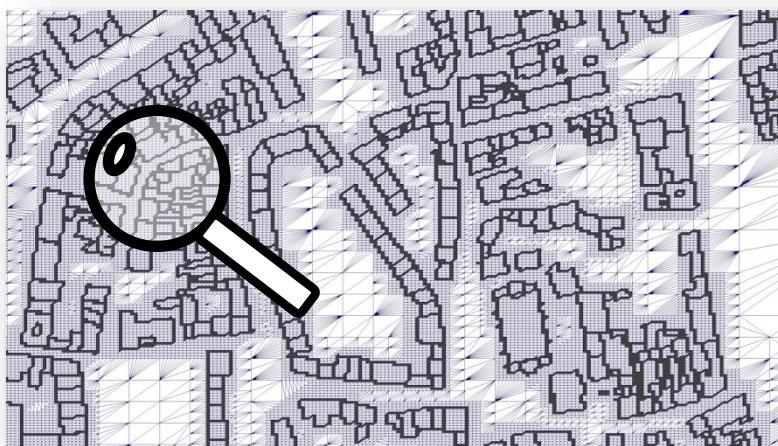
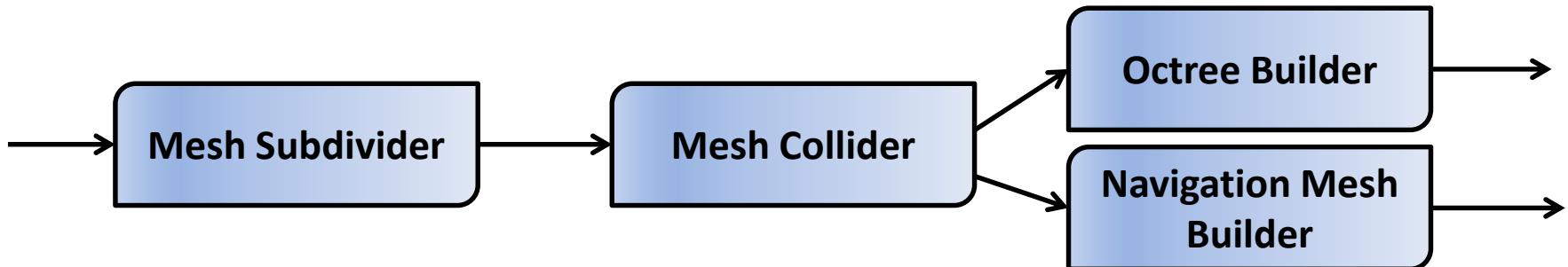
Mesh Preprocess Toolchain



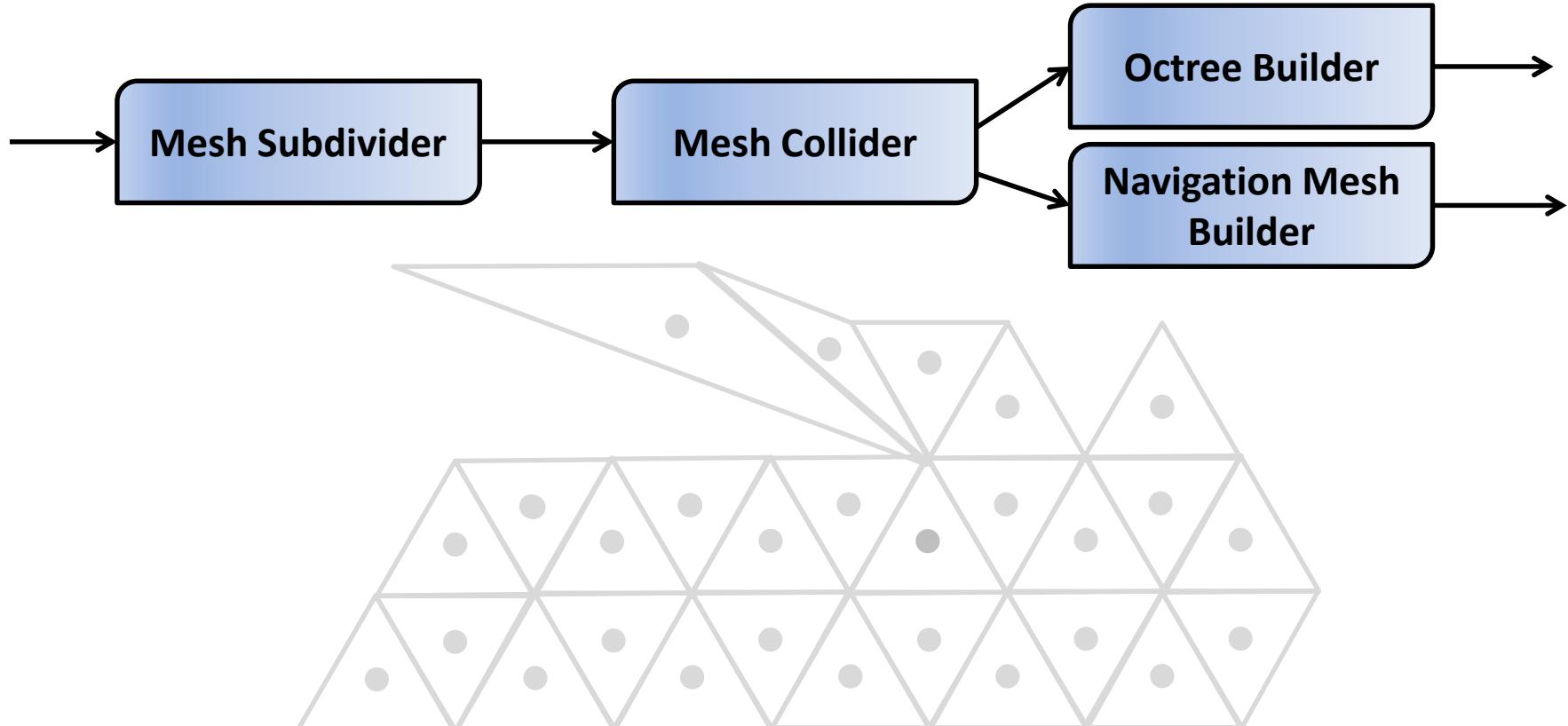
Mesh Preprocess Toolchain



Mesh Preprocess Toolchain



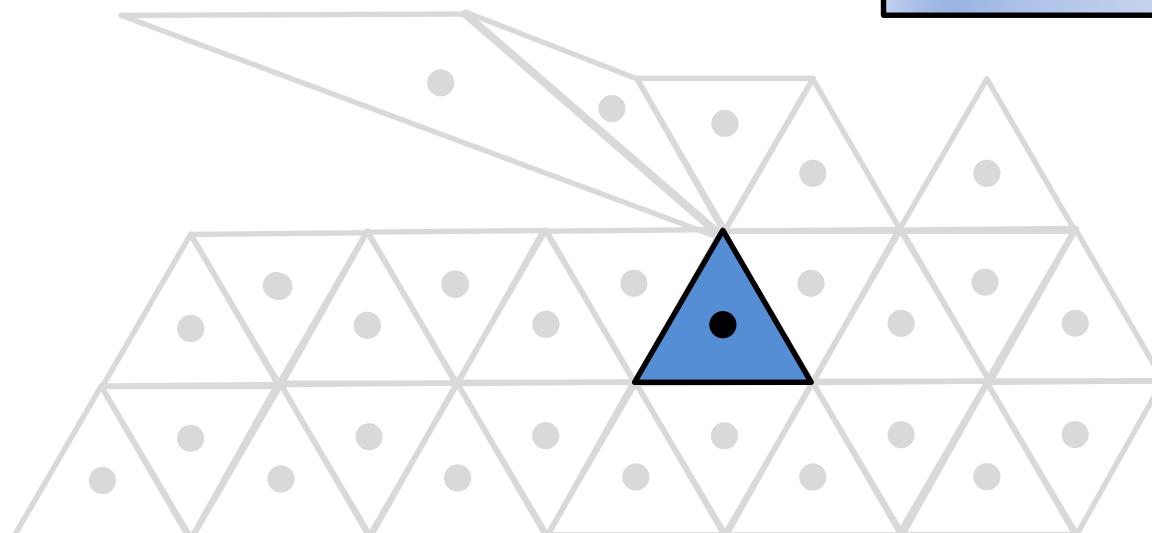
Mesh Preprocess Toolchain



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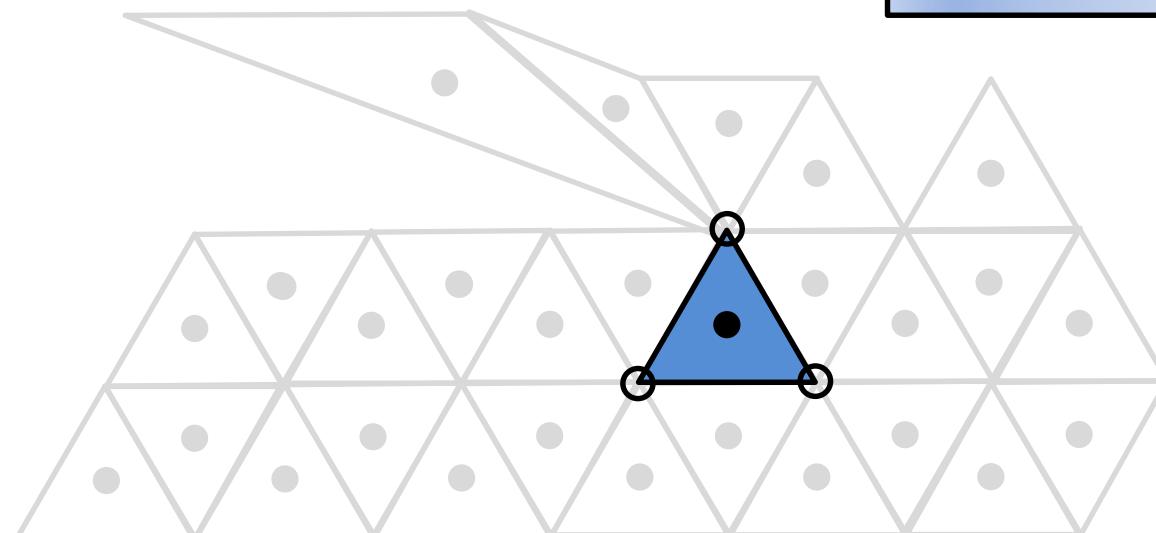
Mesh Preprocess Toolchain



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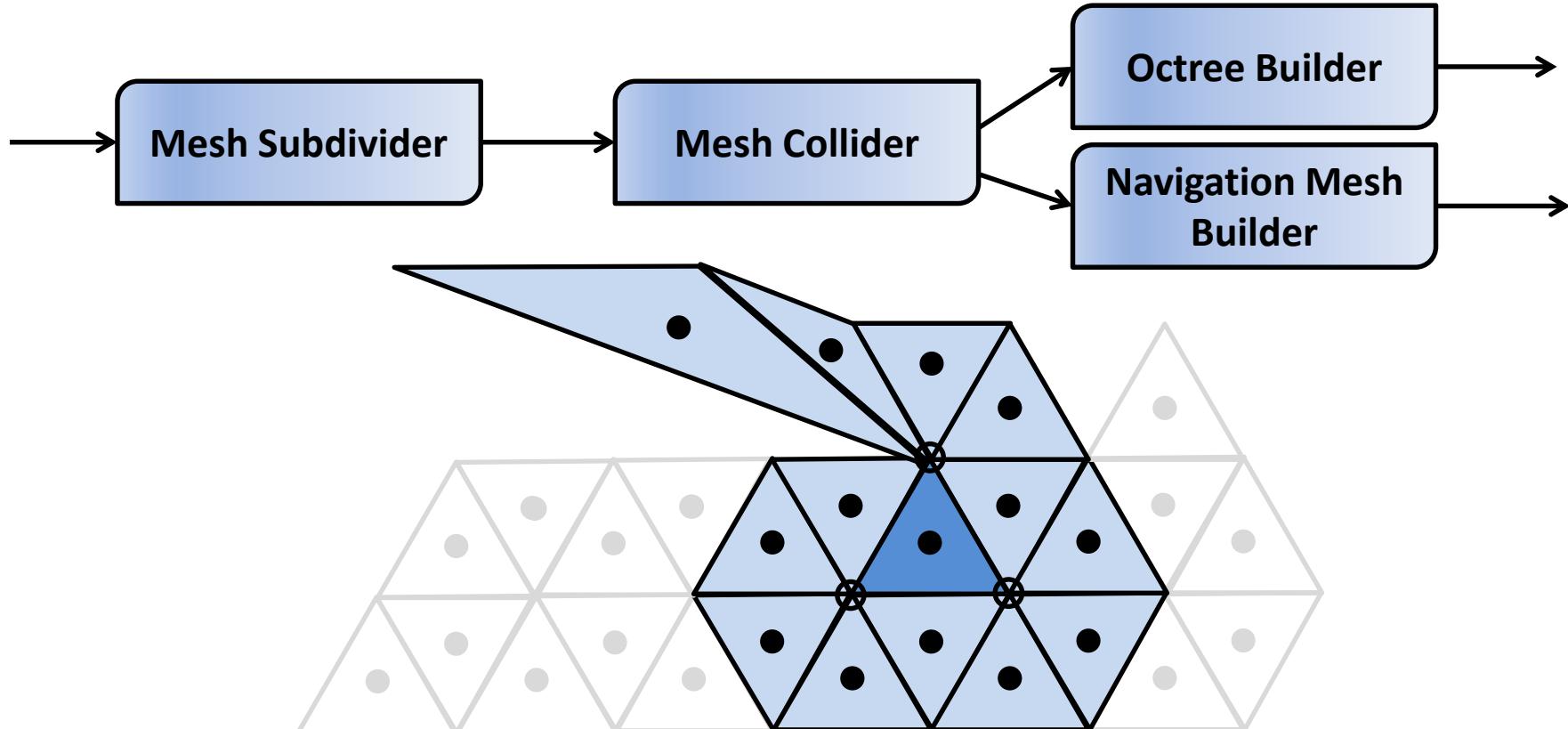
Mesh Preprocess Toolchain



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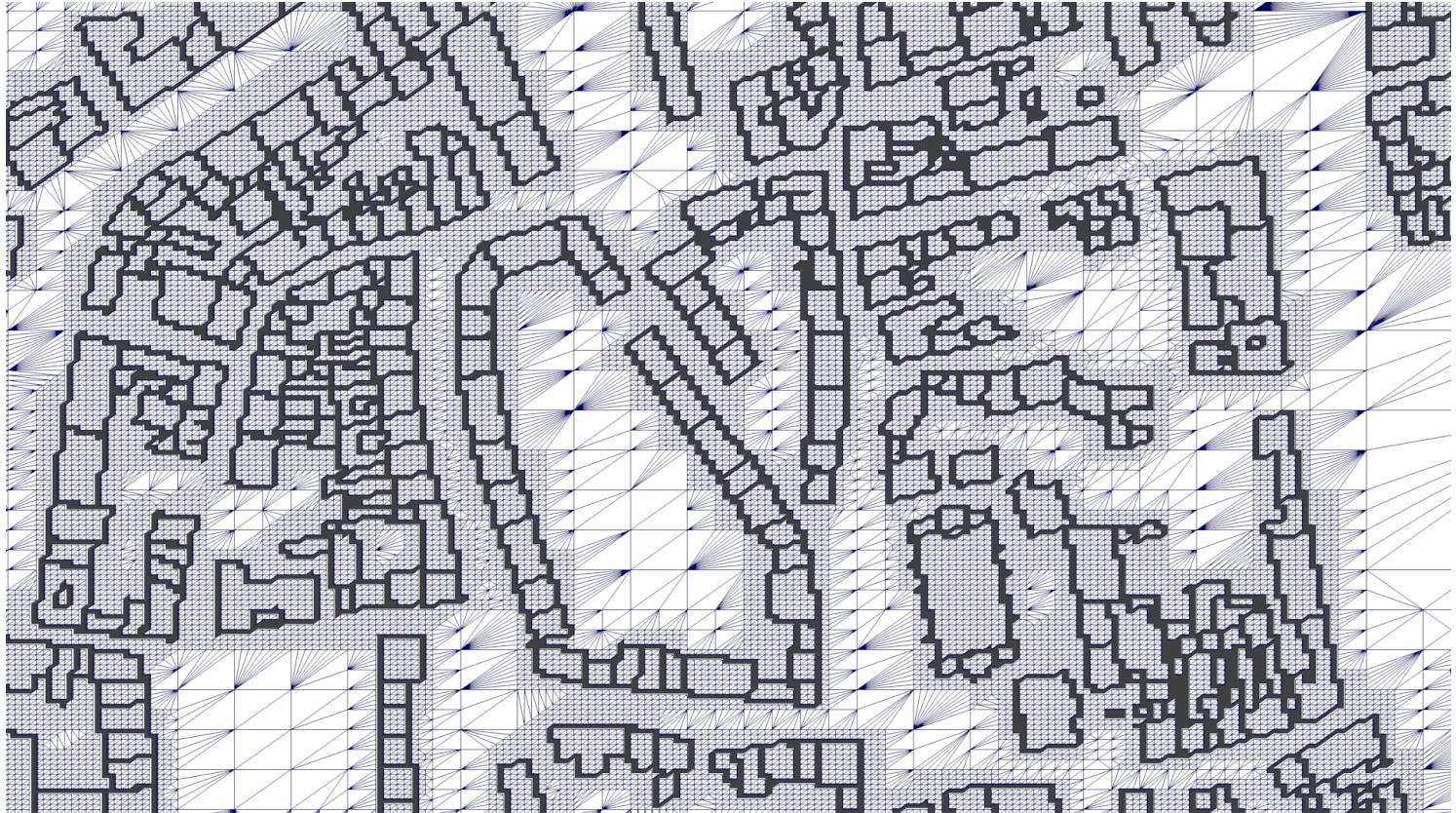
Mesh Preprocess Toolchain



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Point-Sample Acceleration

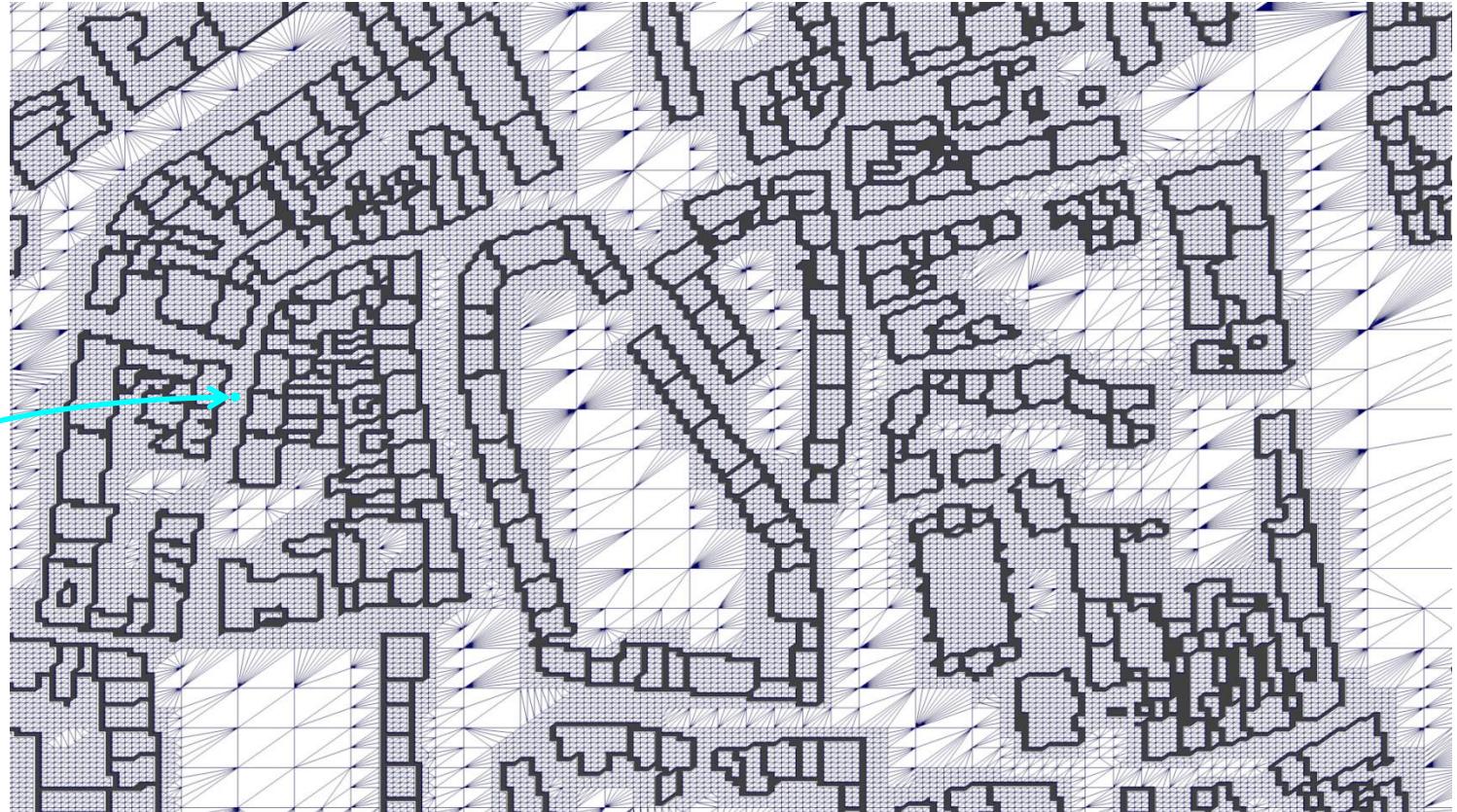


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Point-Sample Acceleration

intersect hit point
with navigation
mesh



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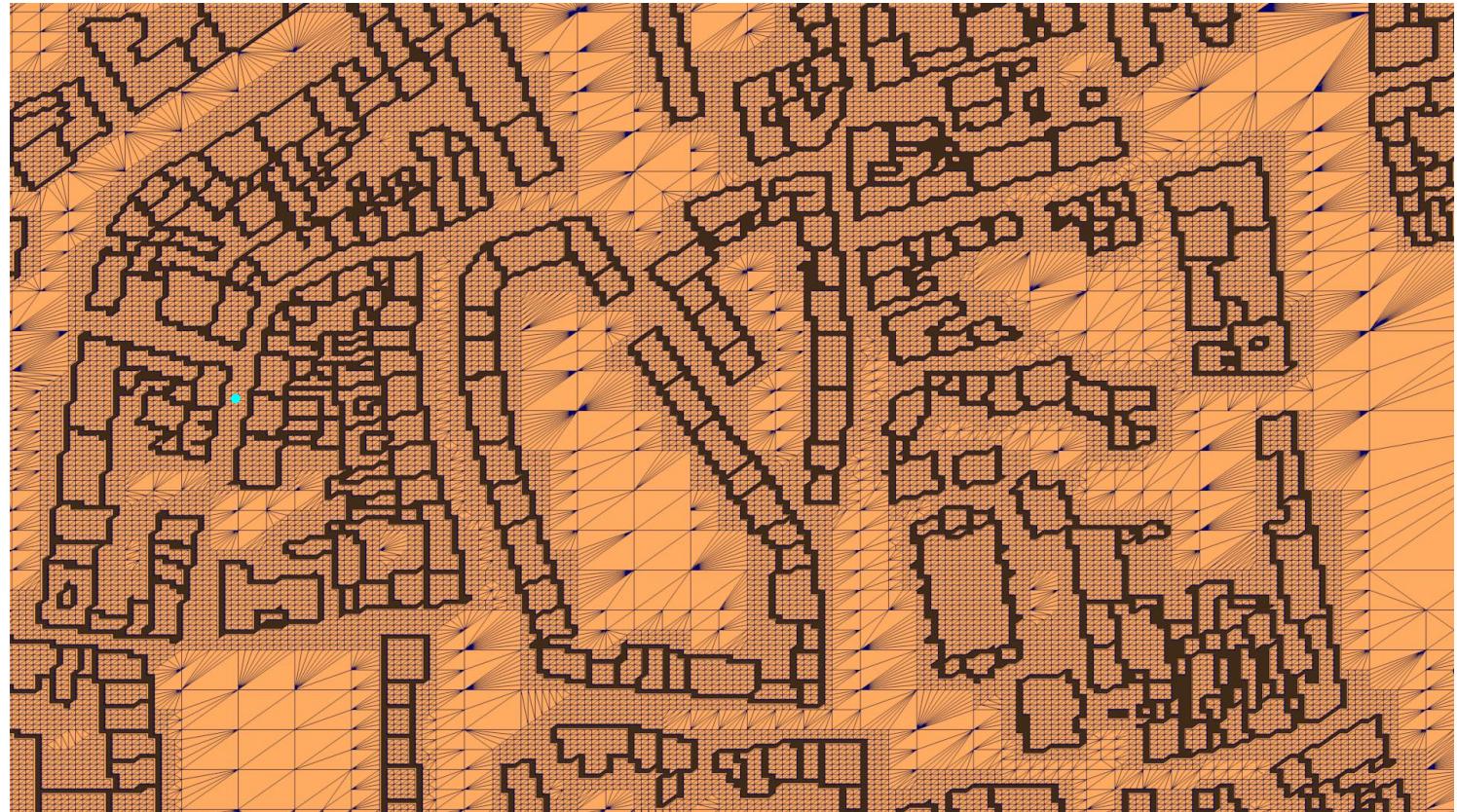
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Point-Sample Acceleration

w/o
acceleration
structure



intersection
test with
sample point



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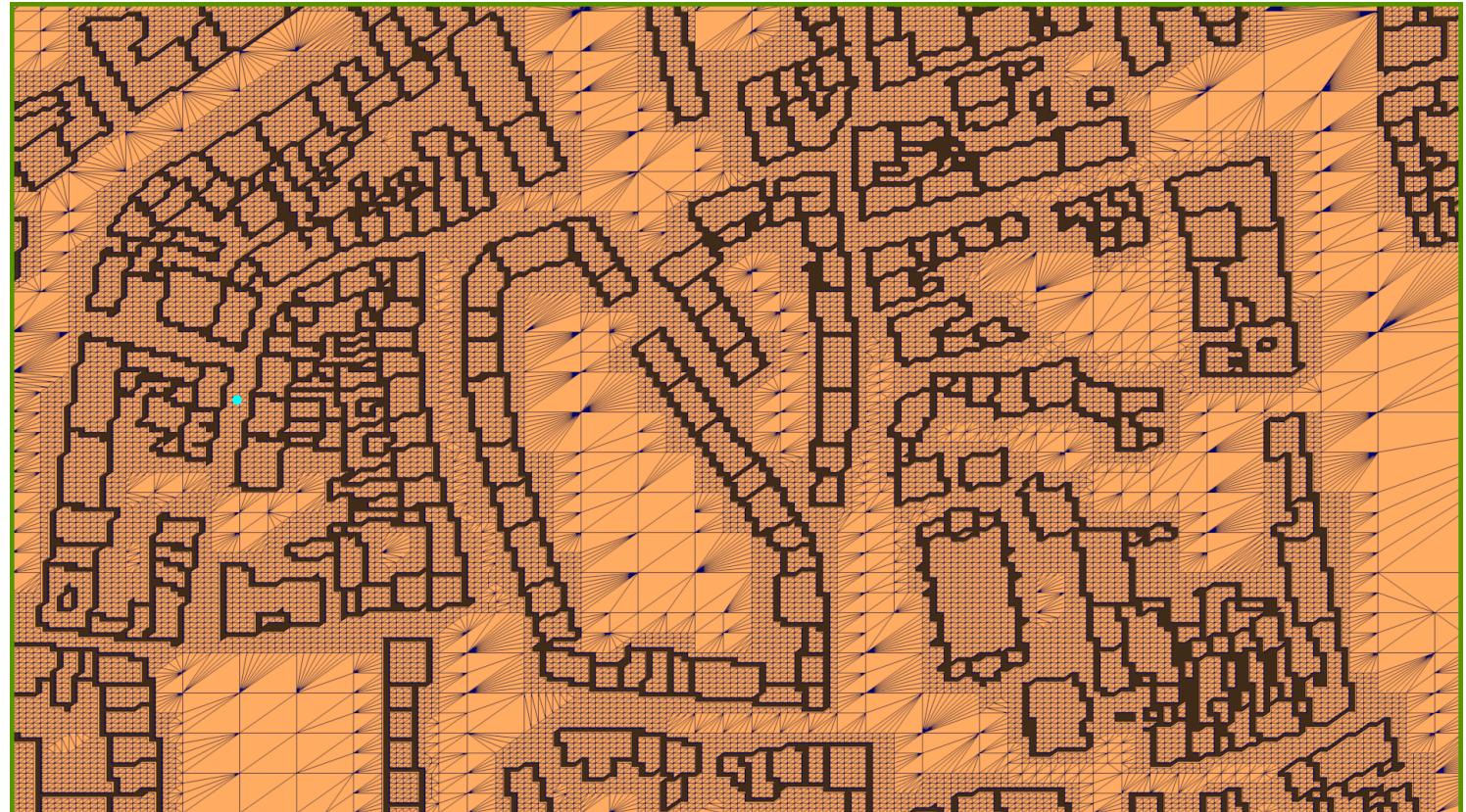
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Point-Sample Acceleration

octree
depth 0



intersection
test with
sample point



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Point-Sample Acceleration

octree
depth 1



intersection
test with
sample point



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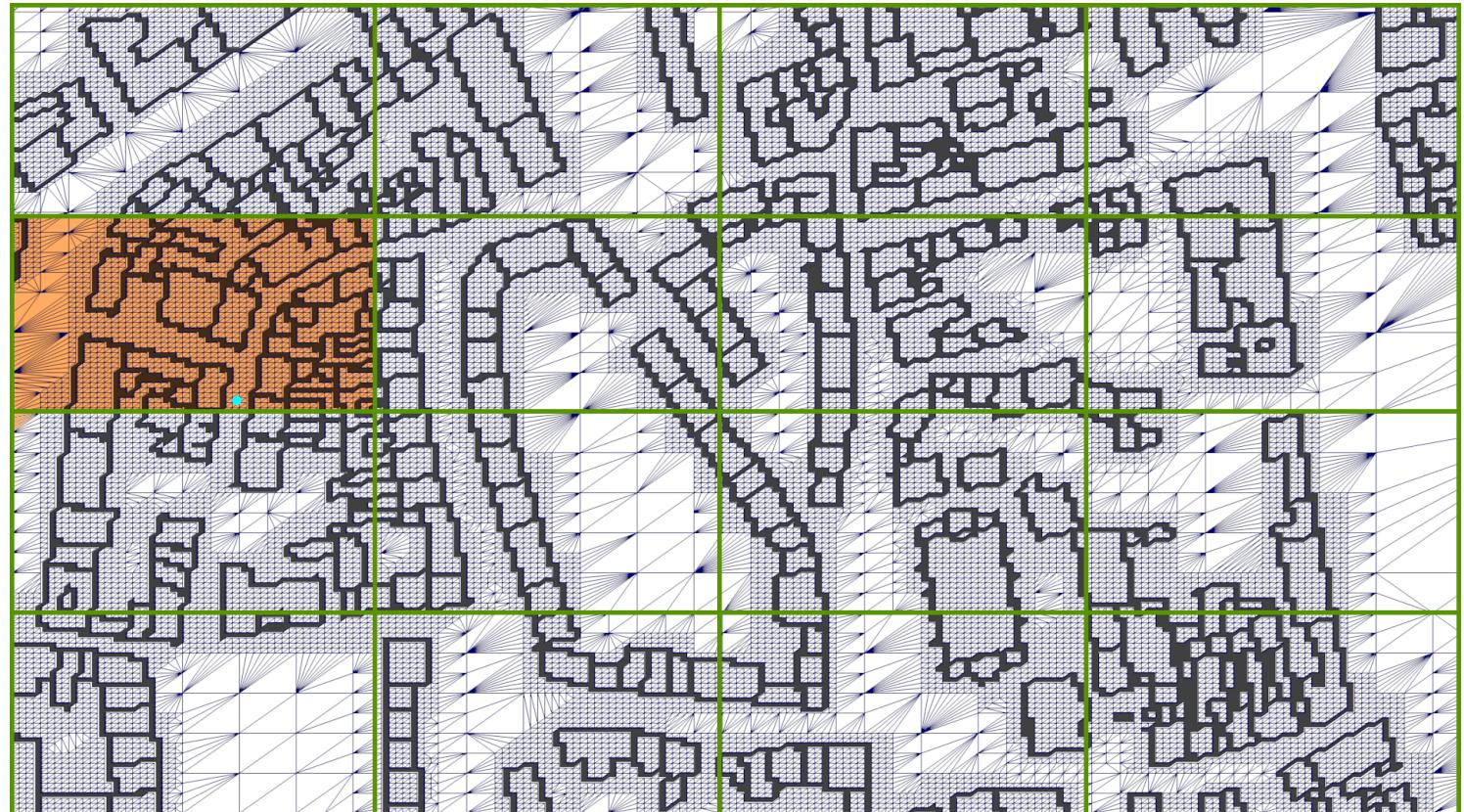
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Point-Sample Acceleration

octree
depth 2



intersection
test with
sample point



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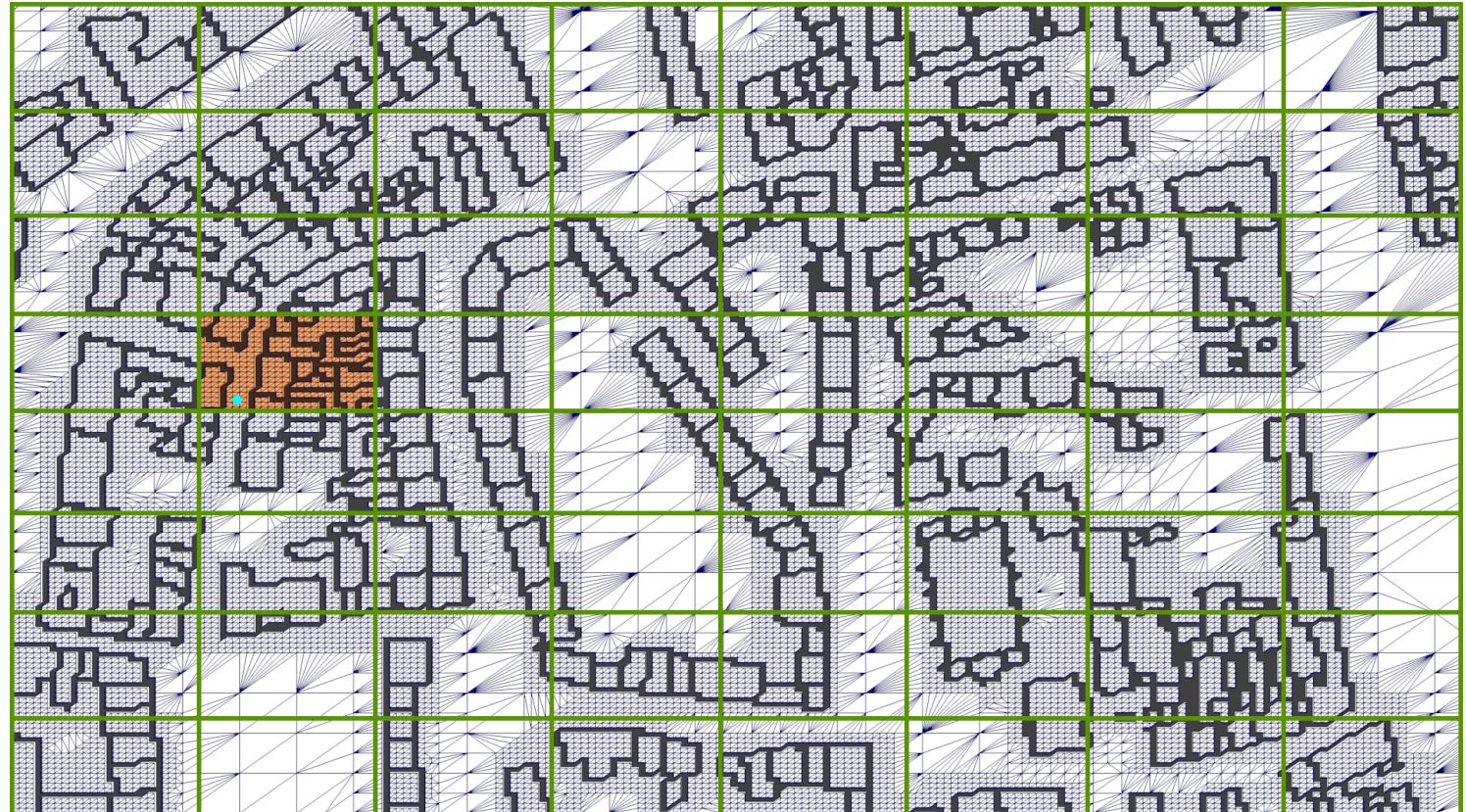
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Point-Sample Acceleration

octree
depth 3



intersection
test with
sample point



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Point-Sample Acceleration

octree
depth 4



intersection
test with
sample point



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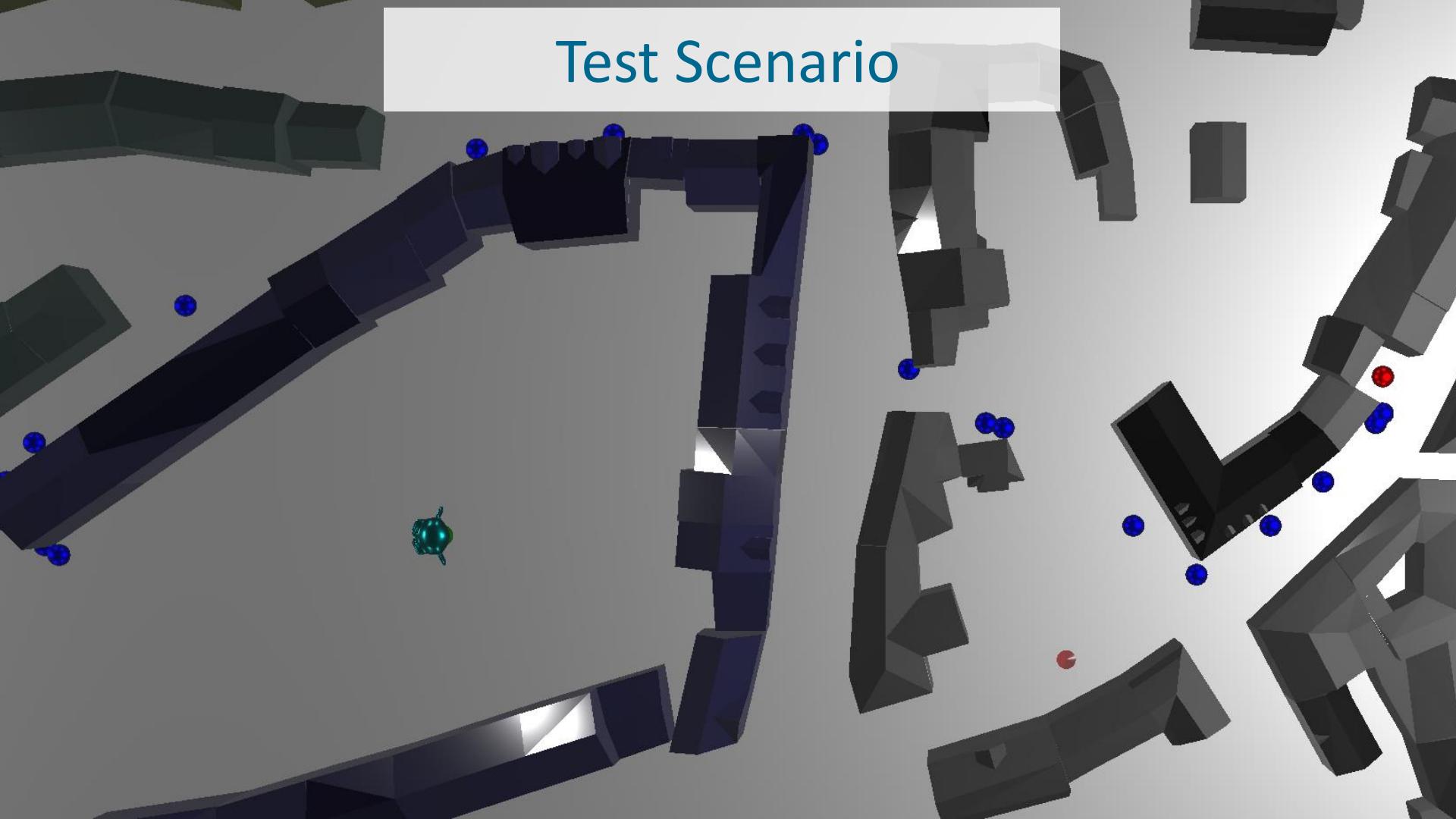
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Octree Results

octree depth	max # triangles	# nodes in tree	tree build time in s	tree file size in mb
0	158,994	1	0.7	6.5
2	53,066	73	6.1	21.1
4	21,316	3,361	22.5	25.8
6	4,018	63,905	48.3	41.7
8	389	537,225	84.4	81.3
10	50	2,285,617	130.2	214.9



Test Scenario

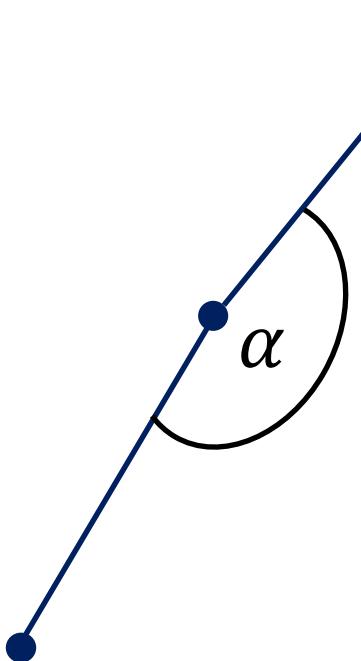


Test Scenario

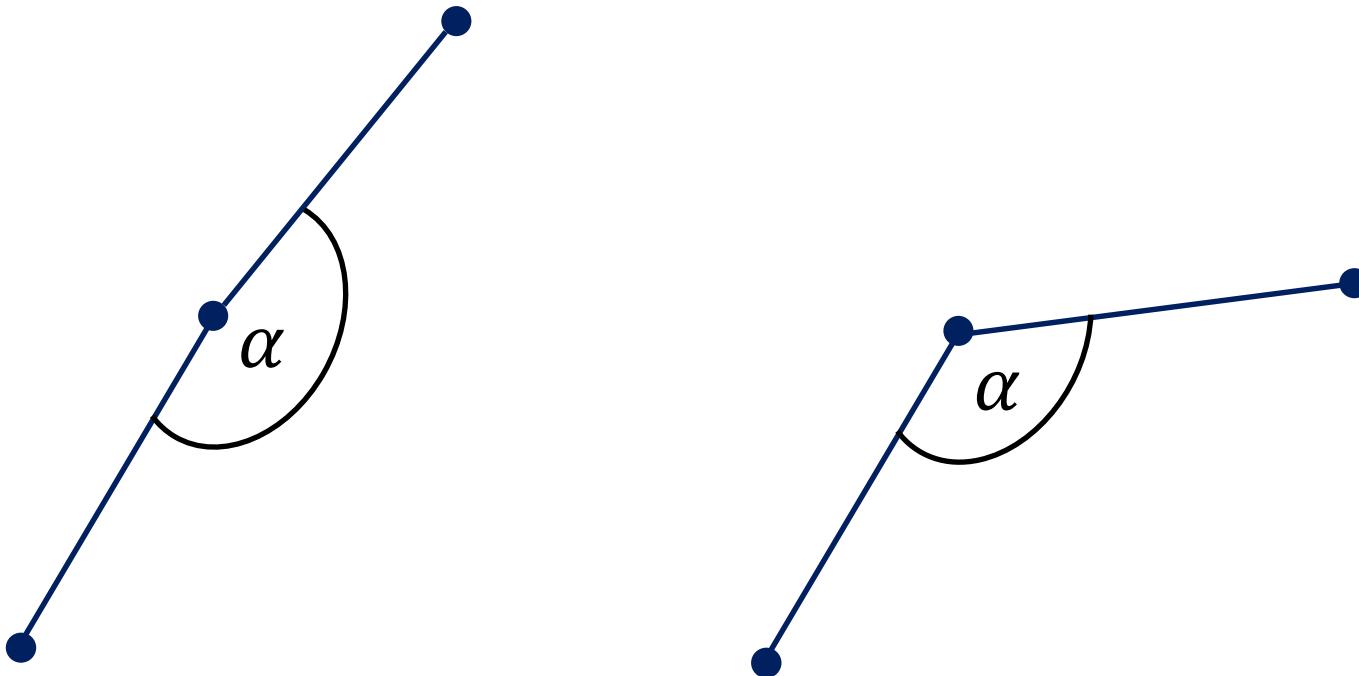
- 174 triangles in unsmoothed path
- smoothing with approx. 155,000 sampling points

path calculation time in seconds	brute force sampling	sampling in octree
	233.57	0.04

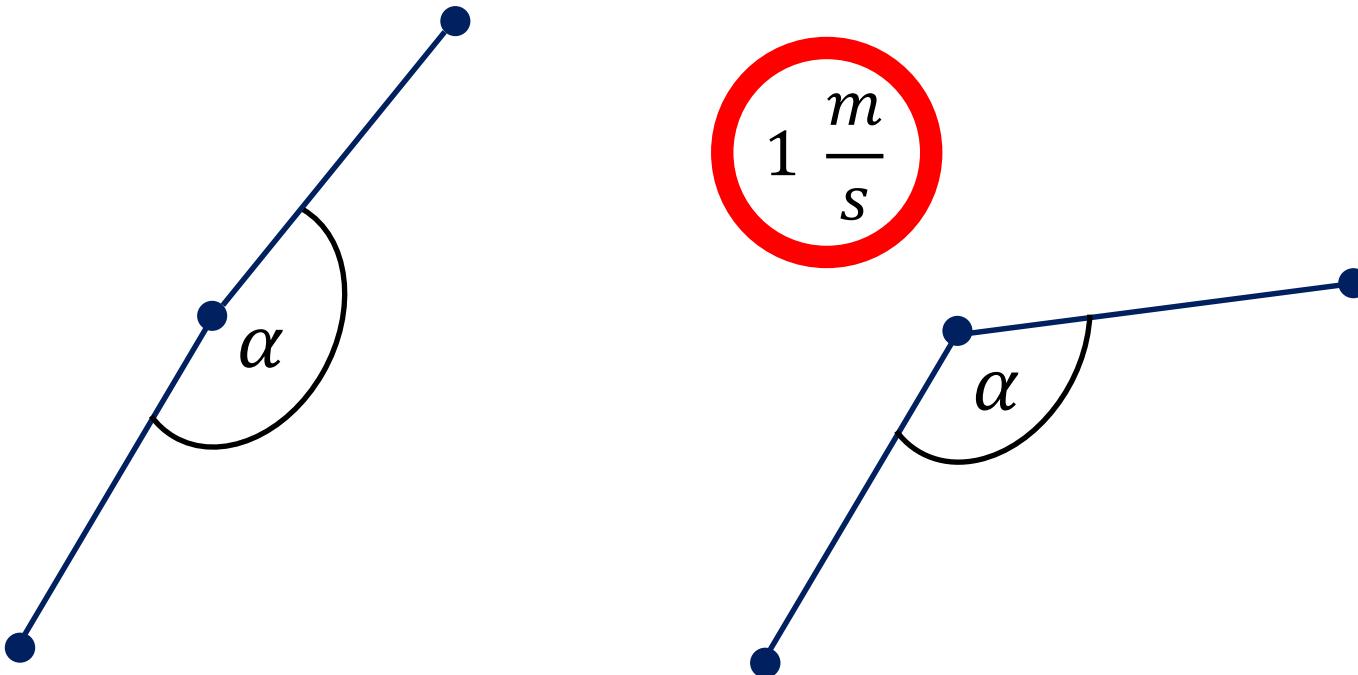
Path animation



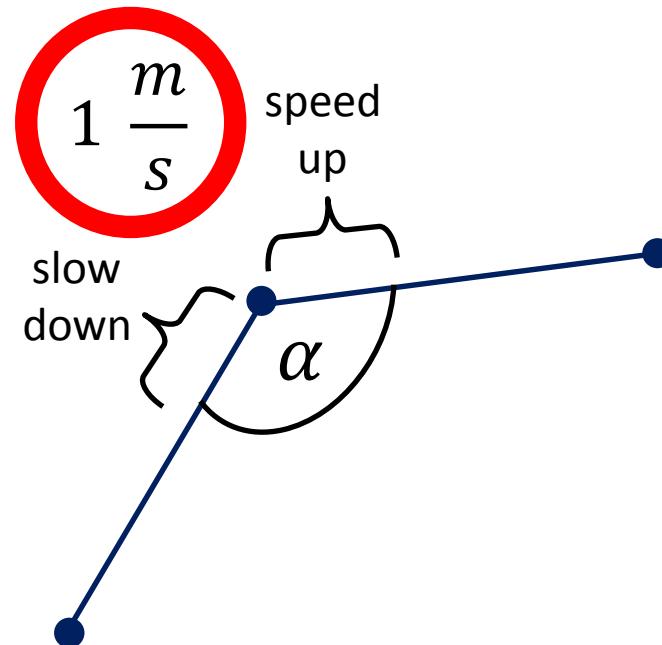
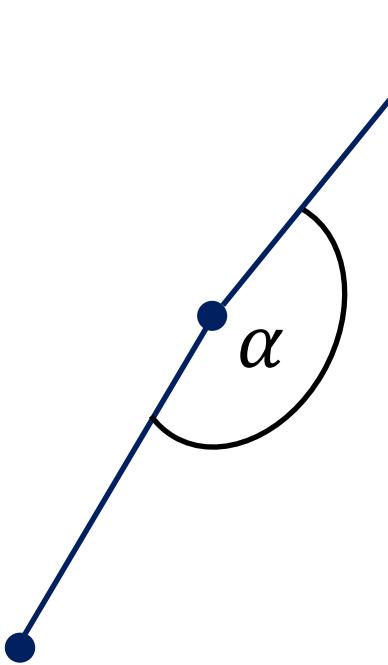
Path animation



Path animation



Path animation



Future work

- sneaking along walls
- more realistic animation sequences
- application to multi-user 3D scenarios
- further speed optimizations
- fully automate preprocessing



Demonstration

Interactive path planning in Weimar

