





Application of Voxel Based Physics Across a Multi-User Network

Team Purified
February 5th, 2020
5 p.m. Section



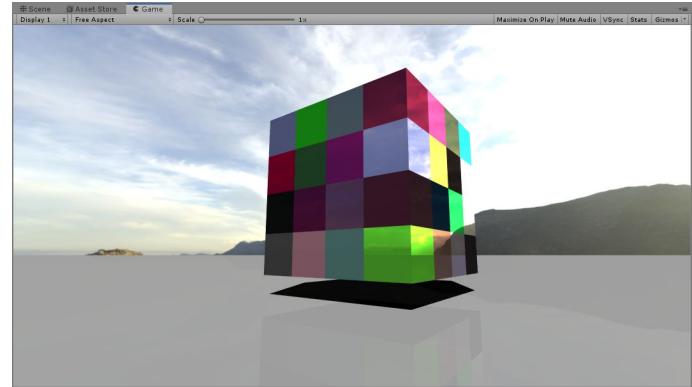
What is our Project?

- Creating a destructible environment through the use of voxels that can be communicated across a multi-user network and experienced through Virtual Reality.
- Graphics
 - Meshing
 - Shaders
- Network
 - Client-Server Architecture
- Virtual Reality
 - Oculus Quest



Compute Shader

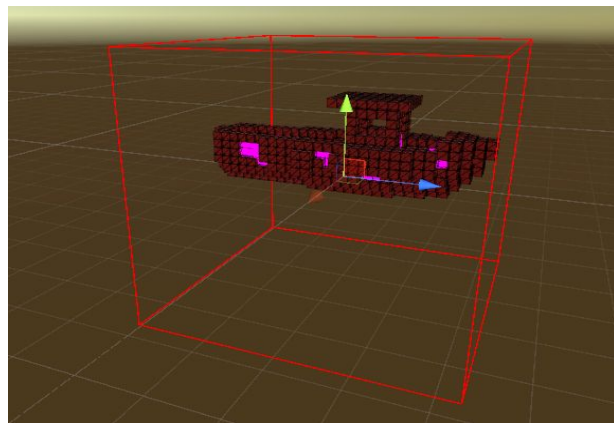
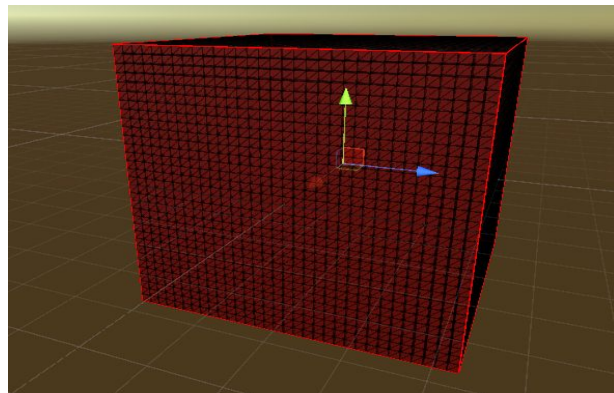
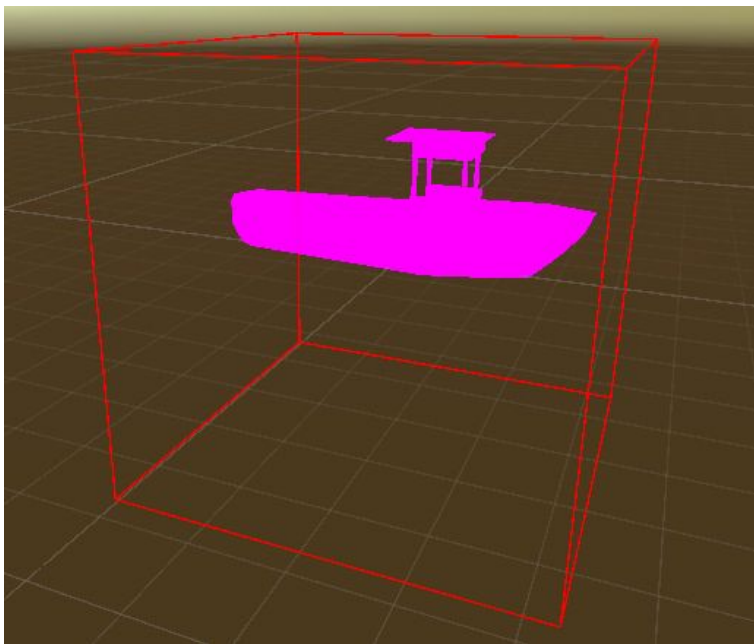
- What is a shader?
 - Shader utilizes a graphics card computational speed to process graphical computations.
- Old Shader incompatible with Oculus Quest
 - Originally for optimized rendering.
 - 64 threads.
- Utilized a lightweight ray tracer to generate lighting, and shadows.
 - Goal was to simulate detailed environments to the best of our abilities.



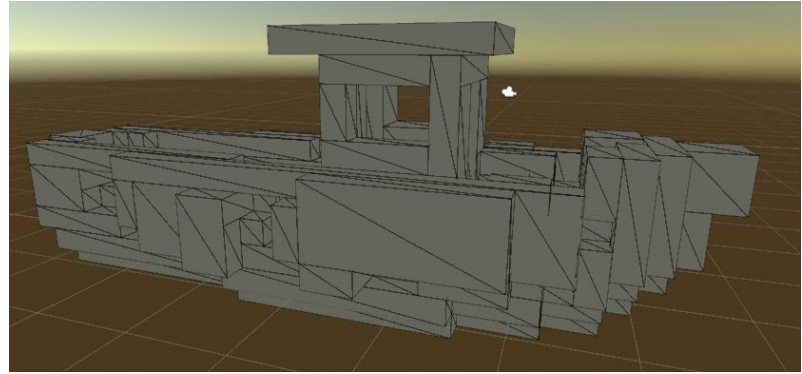
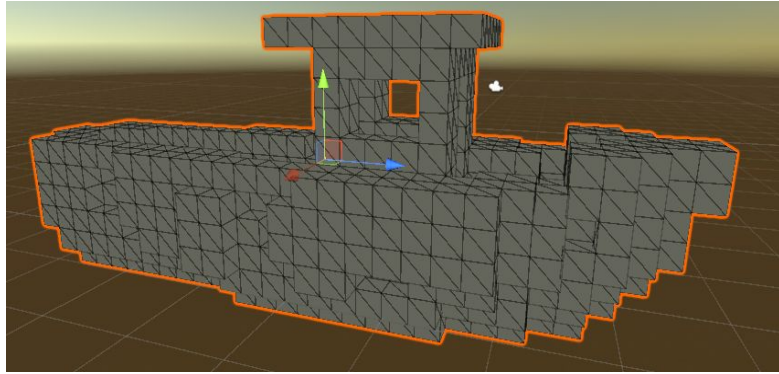
Compute Shader Moving Forward

- Don't want to scrap it. Instead, it will be repurposed.
- Move shader to the server
 - Removes the responsibility from the client(oculus quest).
 - Several added benefits such as security and reliability.
- Utilize shader server to simulate physics.
 - Our voxel environment could use physics where hundreds of voxels are affected, we would need the 10-100x improved computational speed to process it.
 - Can take advantage of some of Unity's basic physics to expedite this part of our project.
- What about rendering?
 - For now, this will be on the back burner until we have a sure solution.

Model Building

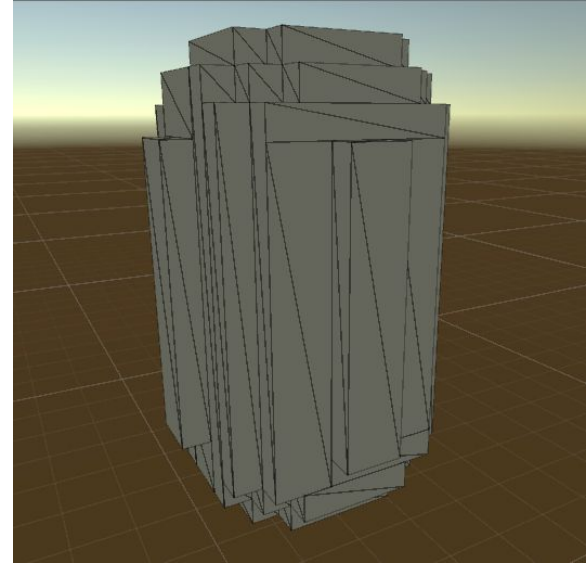


Model Building



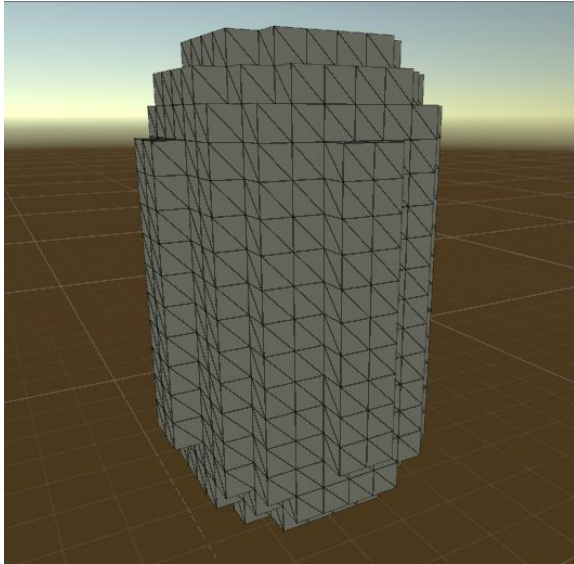
Greedy Mesh

- A more efficient mesh
 - Significantly better than “stupid” algorithm
 - Substantially better than culled mesh
 - Reduces rendering costs & network traffic

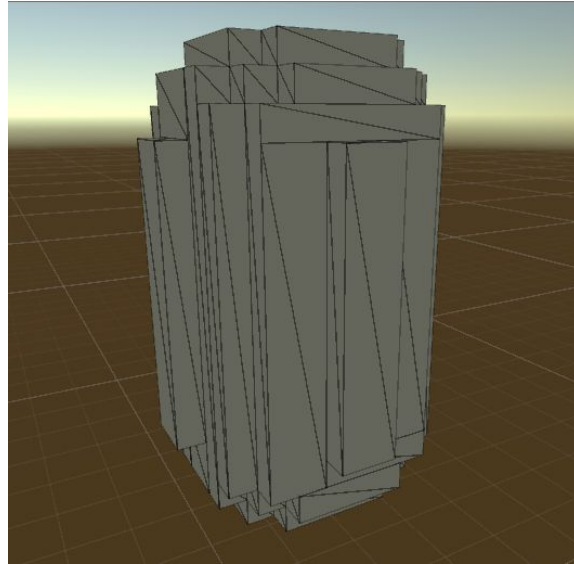


	“Stupid” Mesh	Culled Mesh	Greedy Mesh
Vertices	7,744	2,848	584
Triangles	11,616	1,424	292

Greedy Mesh



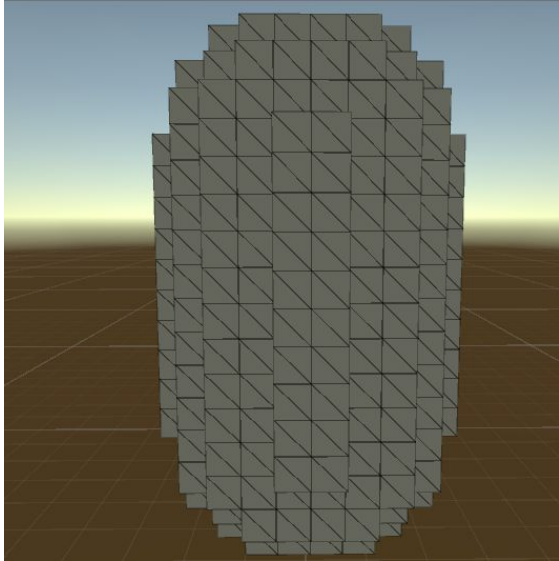
Capsule Vertices & Triangles: 2848, 1424



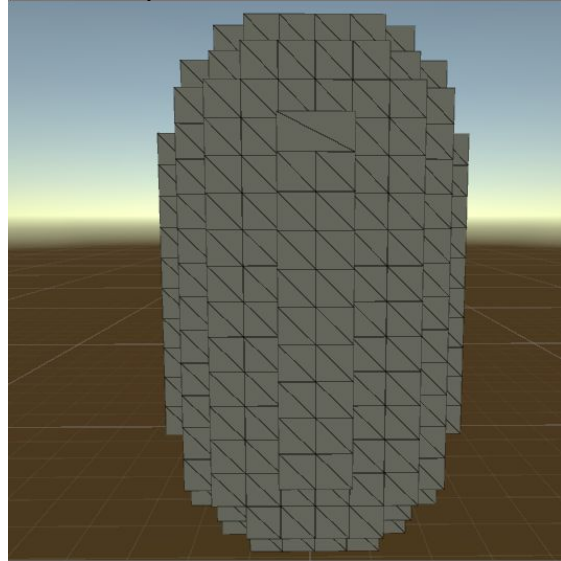
Capsule Vertices & Triangles: 584, 292

Greedy Mesh: Step by step

Step 0: Culled Mesh

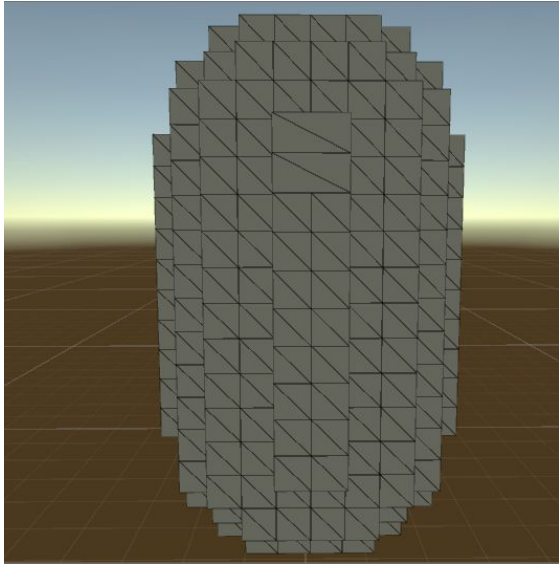


Step 1: Mesh Row

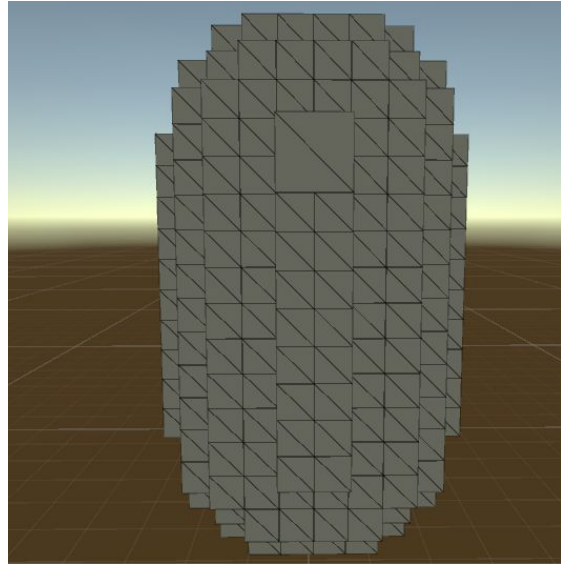


Greedy Mesh: Step by step

Step 2: Mesh next row

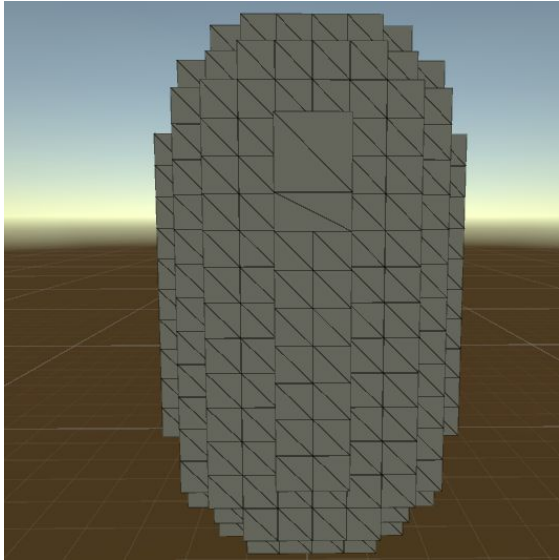


Step 3: Mesh column

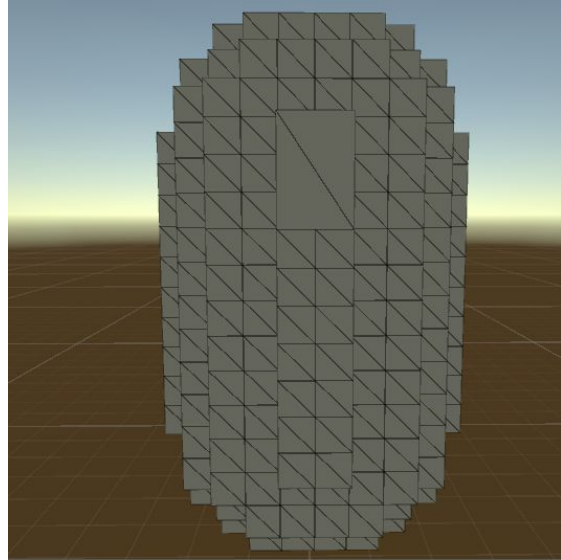


Greedy Mesh: Step by step

Step 4: Mesh next row

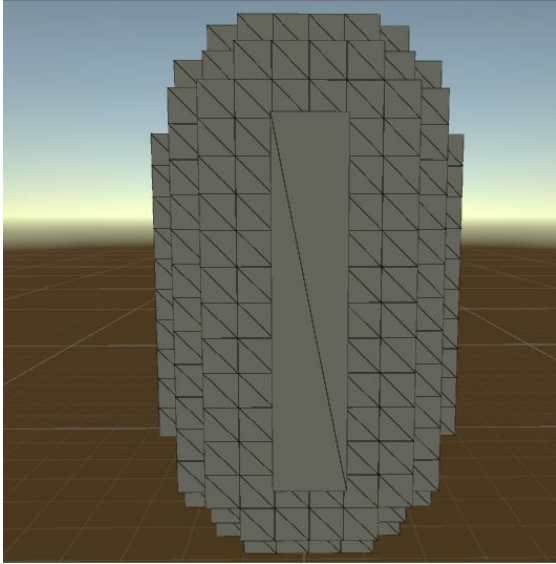


Step 5: Mesh next column

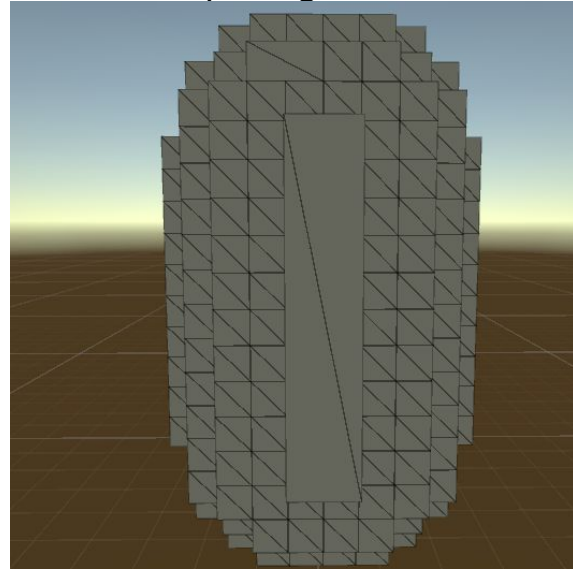


Greedy Mesh: Step by step

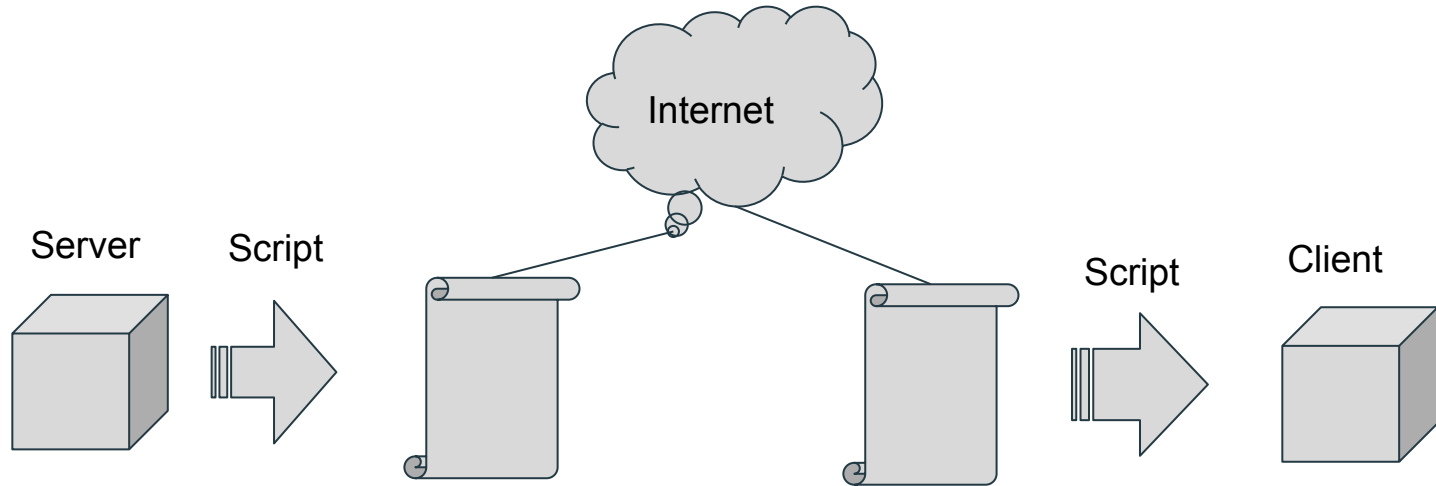
Once the edge is finished



Next Layer Begins



Mesh Breakdown & Rebuild



Achievements & Goals

- Offer our project to local VR Arcades
 - Simulated
- Unity Developer Events
 - “Coming soon to a city near you”



Project Timeline

Stage 1 - done by 02/13

- Optimize graphics environment
- Optimize Client/server communication

Stage 2 - done by 02/20

- Basic Physics interaction with environment

Stage 3 - done by 03/19

- Finalize graphics and physics

Stage 4 - done by 04/10

- Optimization of project
- Finalization of all tasks