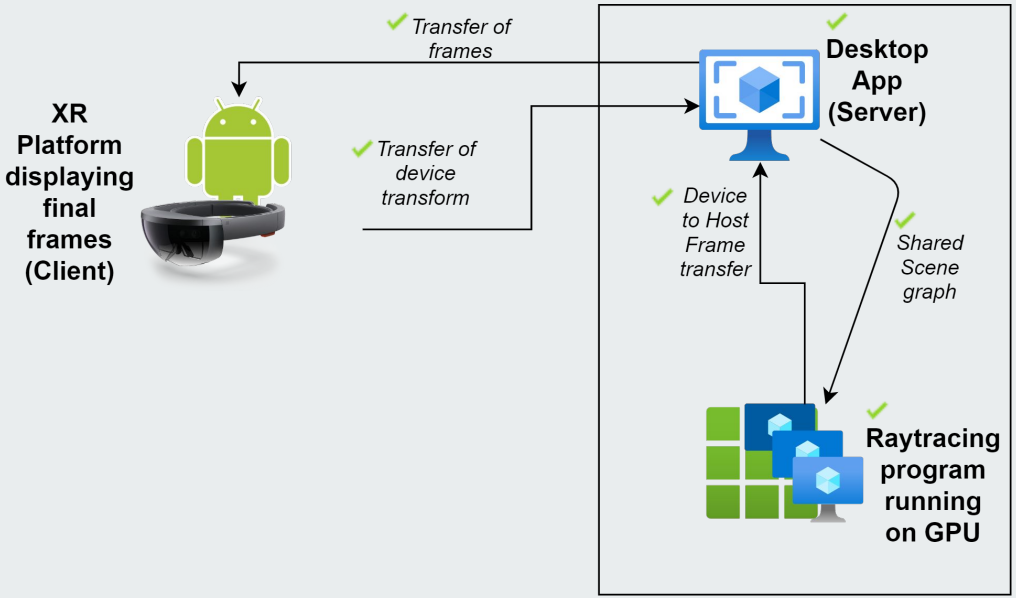
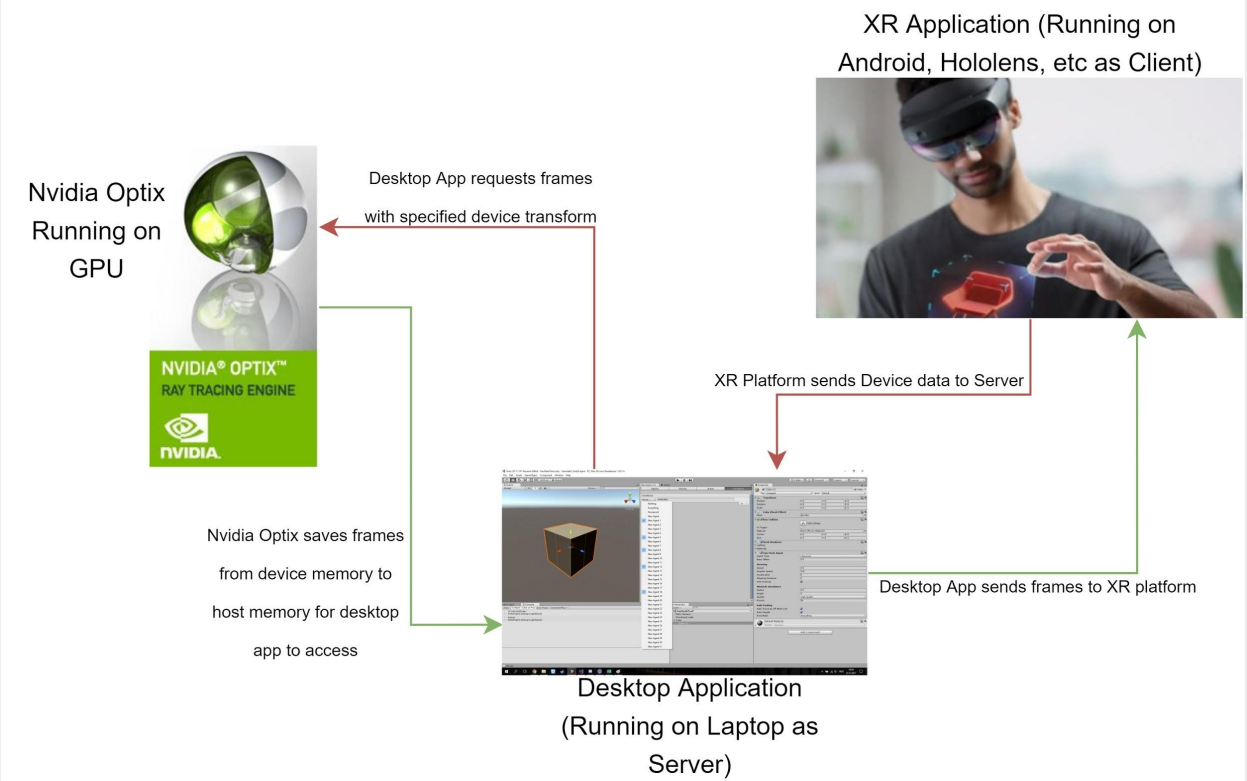
Remote Rendering for XR

By- Gizem Dal, Dayu Li, Tushar Purang

Source: [HoloLens 2 Azure Remote Rendering in-action]

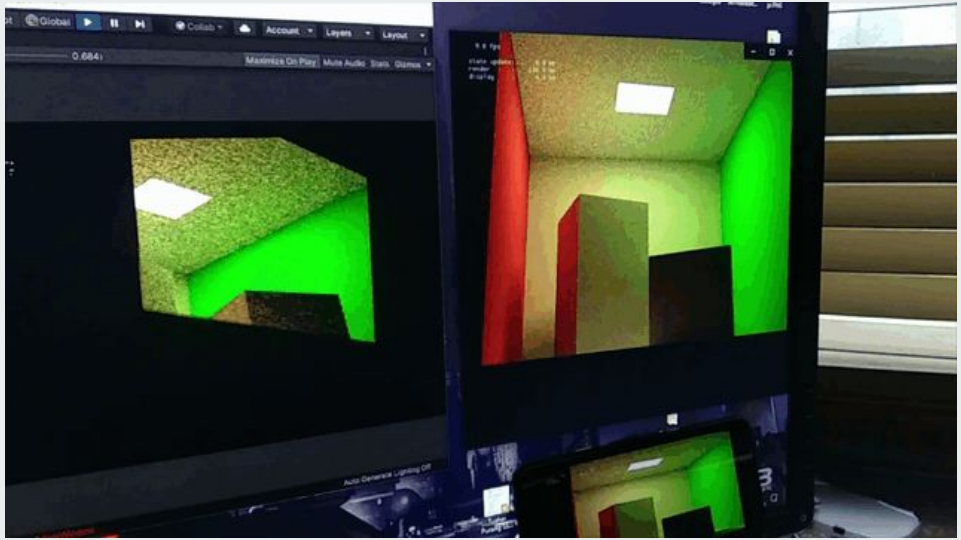


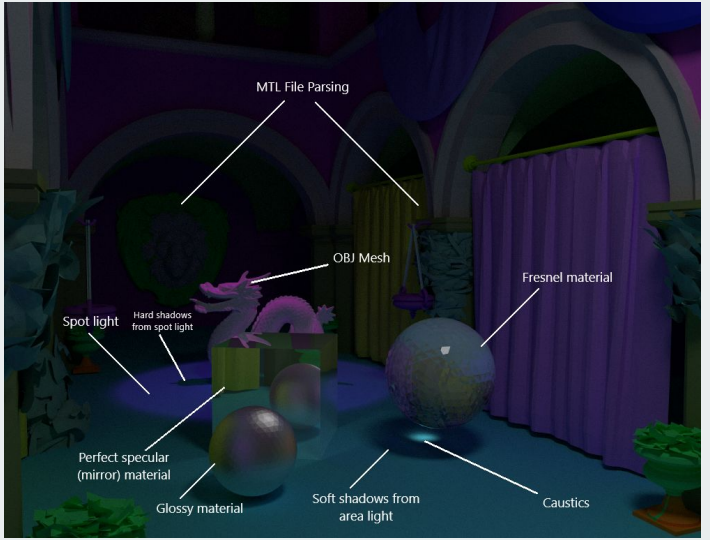
Project Overview



Review: Progress in Milestone 2

- Improve optixPathTracer sample
- Stream ray tracer frames via network





Overview: Milestone 3

Progress in project

- Texture mapping from MTL file
- Scene file parser with file I/O
- Camera synchronization.
- Hololens head movement synchronization with raytracer camera

Researches and Studies

- Mesh loading & Texture mapping in Optix.
- Hololens gesture & spatial mapping APIs.
- Physically Based Rendering: From Theory to Implementation online textbook
- Image-Based Bidirectional Scene Reprojection

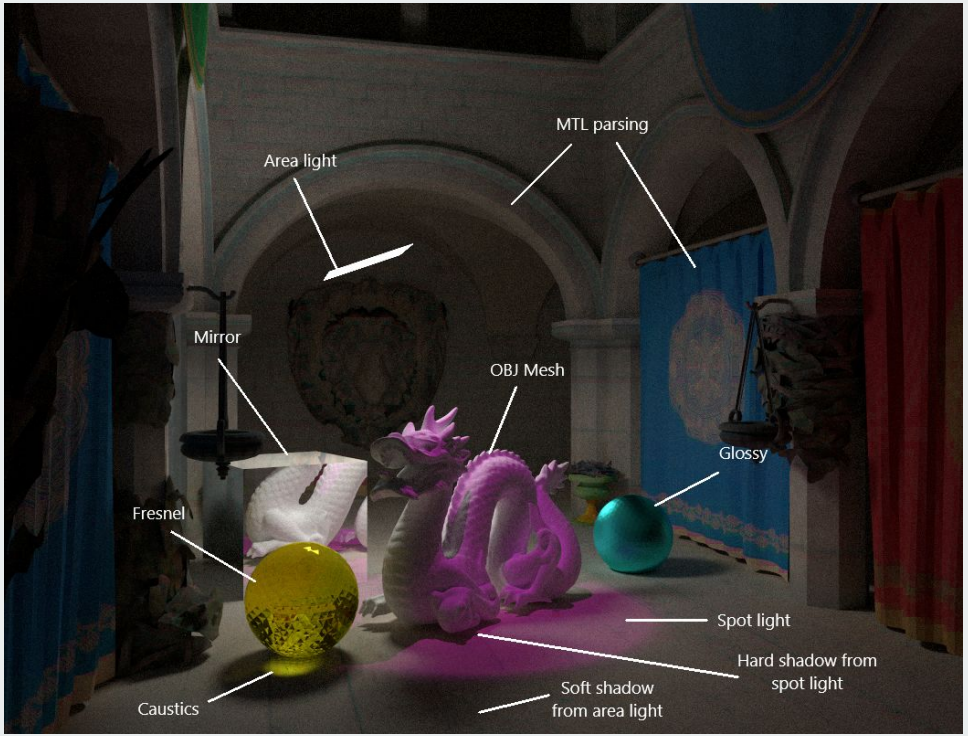
Tasks completed in milestone 3

- Texture Mapping based on obj & mtl parser.
  - Generate optix texture objects.

Crytek Sponza Mesh

Tasks completed in milestone 3

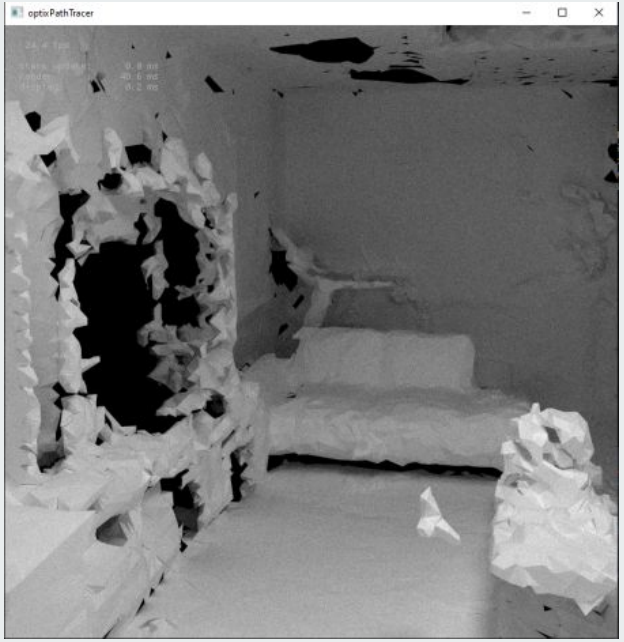
- Scene file (.txt format) parser
  - Camera
  - Geometry
  - Material



[Crytek Sponza & Dragon Mesh]

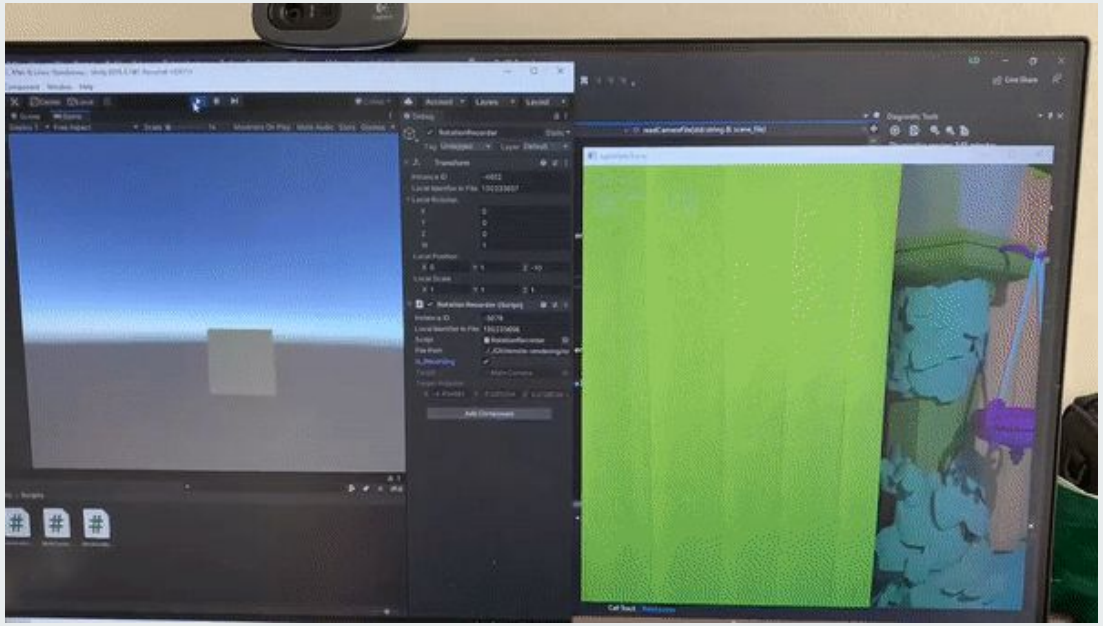
Tasks completed in milestone 3

- Adding Spatial Mapping to the ray tracer.



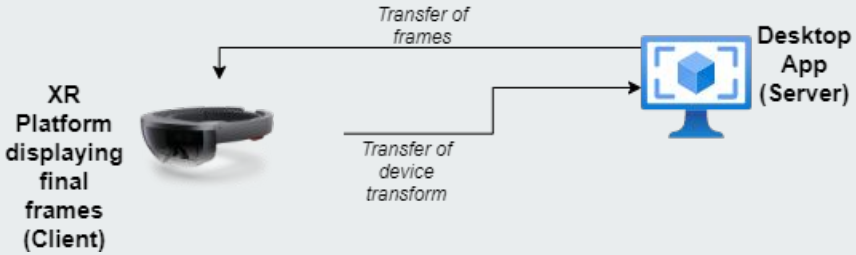
Tasks completed in milestone 3

- Control the ray tracer camera with external data.
  - File I/O
  - A denoiser of camera changes



Tasks completed in milestone 3

- Synchronization of headset orientation with camera orientation in raytracer
- Streaming frames from raytracer to Hololens 2

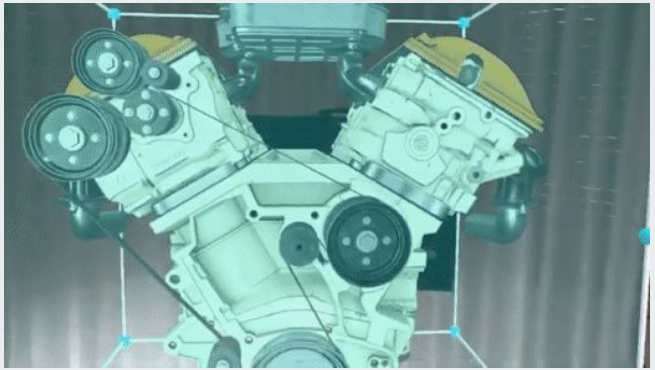


(Rendering FOV and Recording FOV are different for hololens)

Tasks planned for final submission

- Modify the ray tracer result with hand interaction and gestures
- Optimize streaming frame rate
- Finish late stage reprojection
- Fetch spatial map OBJ from Unity and update it in ray tracer periodically

Image-space bidirectional scene reprojection (SIGGRAPH Asia 2011)



Source: Azure Remote Rendering + MRTK Demo Hololens 2

Schedule

Milestone 1 – Nov 18th:

- Basic Desktop app (Control Panel) + Hololens app + GPU networking + basic realtime raytracer

Milestone 2 – Nov 30th:

- (Still in progress) Hybrid Rendering (Scene + UI)
- Real time ray tracing + Material parser + Texture mapping

Milestone 3 – Dec 7th:

- (Still in Progress) Optimizing streaming frame rate
- (Still in Progress) Late Stage Reprojection for Hololens
- Real time ray tracing in XR

Final – Dec 13:

- Bug fixings and optimizations
- Performance analysis

Resources

1. About Azure Remote Rendering
   https://docs.microsoft.com/en-us/azure/remote-rendering/overview/about

2. CPU-GPU Algorithms for Triangular Surface Mesh Simplification
   https://imr.sandia.gov/papers/imr21/Shontz.pdf

3. A Positional Timewarp Accelerator for Mobile Virtual Reality Devices
   https://escholarship.org/content/qt96r870gs/qt96r870gs_noSplash_4abbeba6bd4266514b1d56cbdd9dc5d7.pdf

4. Differential Irradiance Caching for Fast High-Quality Light Transport Between Virtual and Real Worlds
   https://publik.tuwien.ac.at/files/PubDat_220665.pdf

5. Dynamic Diffuse Global Illumination with Ray-Traced Irradiance Fields
   http://jcgt.org/published/0008/02/01/paper-lowres.pdf

6. High-Quality Real-Time Global Illumination in Augmented Reality
   https://www.ims.tuwien.ac.at/projects/rayengine

7. Nvidia Optix SDK
   https://developer.nvidia.com/optix

8. A Streaming-Based Solution for Remote Visualization of 3D Graphics on Mobile Devices
   https://www.researchgate.net/publication/3411346_A_Streaming-Based_Solution_for_Remote_Visualization_of_3D_Graphics_on_Mobile_Devices