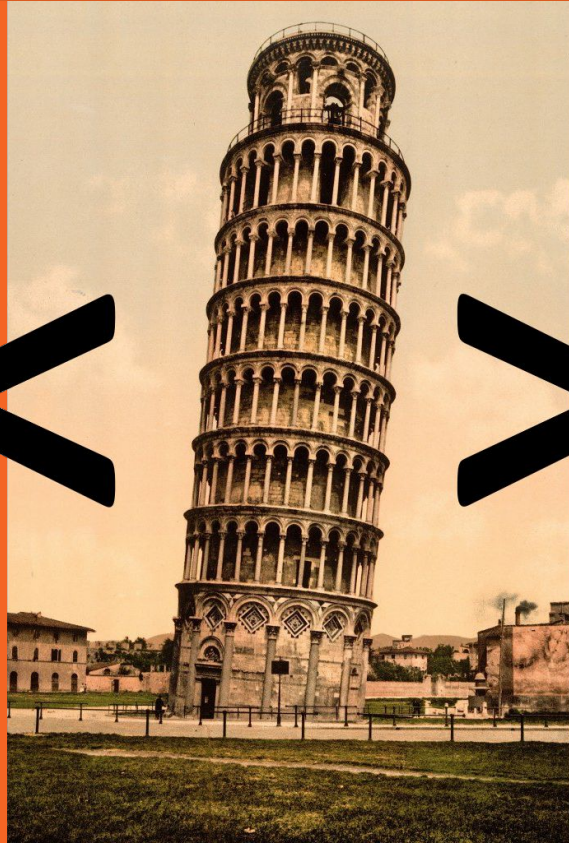


WEB3D 2021 CONFERENCE

**VIA: Visibility-aware
Web-based Virtual Reality**

**Carter Slocum, Jingwen Huang, and Jiasi Chen.
University of California, Riverside**





Carter Slocum: 4th year PhD student



Jingwen Huang: 2nd year Undergrad



Professor Jiasi Chen: Advisor



Presentation Overview:

1. Background
2. Problem, Causes and Solutions
3. Demo
4. Experiments and Results
5. Questions



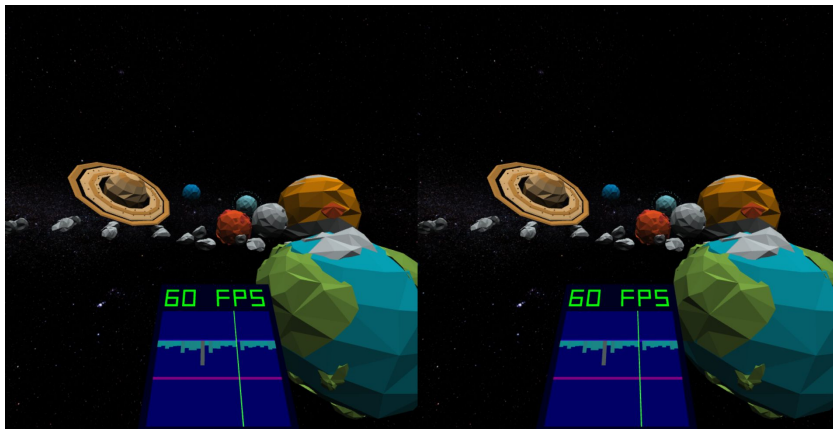
Background

What is WebXR?

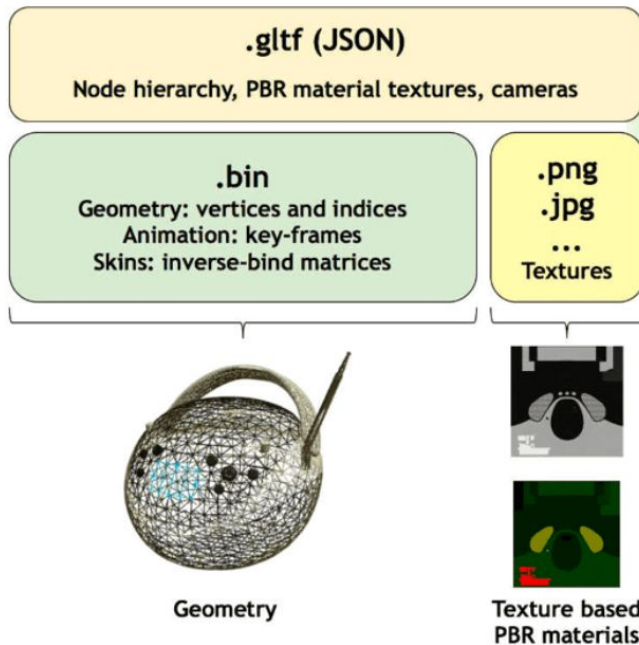


WebXR

- Built on top of WebGL to enable VR and AR on the web
- Uses the glTF 2.0 format to transfer Graphics information



What is glTF?



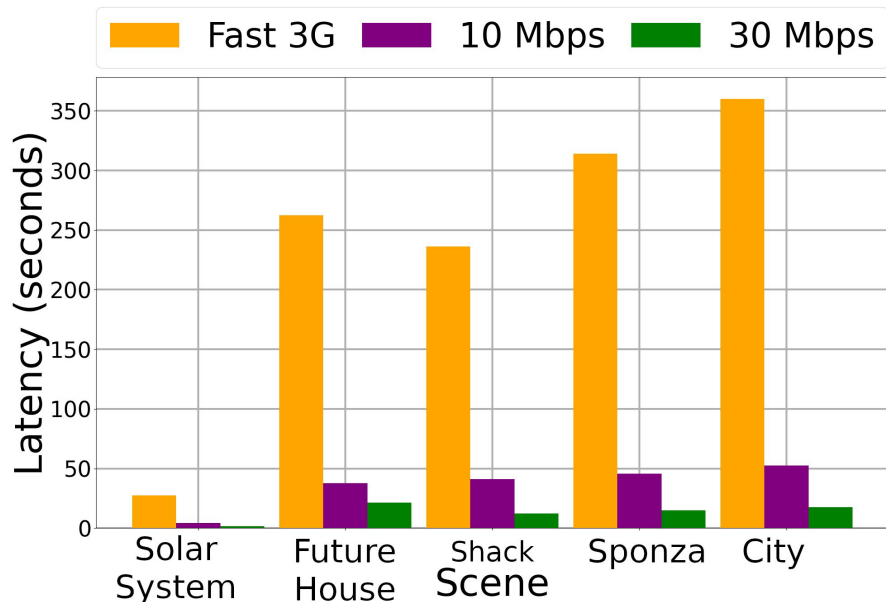
- Stores 3D graphics info in images, raw binary, and JSON-like description File

Pic 2: Components of a glTF file



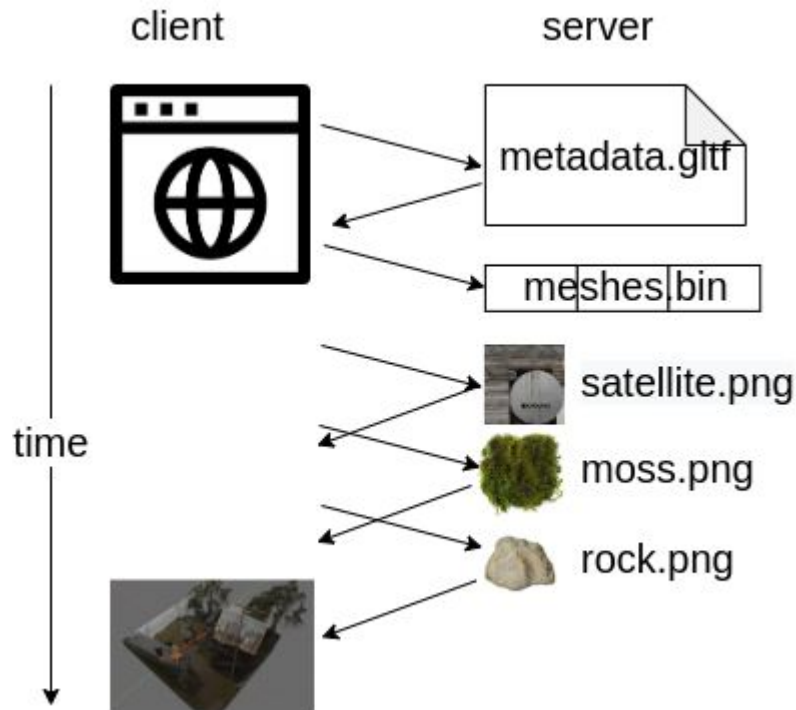
Problems, Causes, and Solutions

Problem: Long loading Times for WebXR



- Load Times for WebXR scenes are incredibly long for mobile networks.
- Web page downloads sequence of objects (from glTF metadata)

Cause 1: Geometry data contained in monolithic resource files

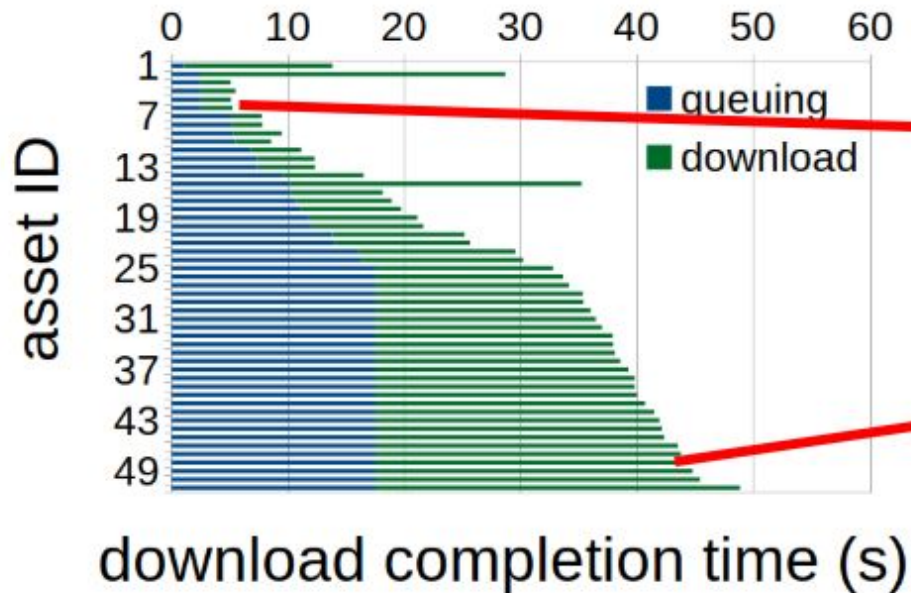


- Monolithic Resource Files (.bin) for 3D scenes must be downloaded before any object may be rendered
- Typically 1 .bin and many image files

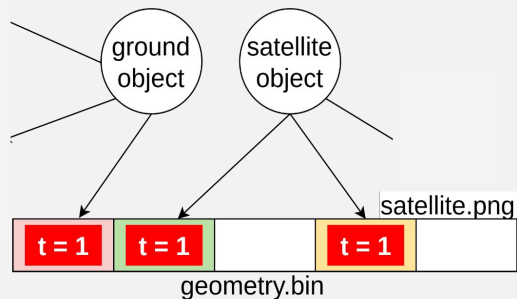
Cause 2: Arbitrary download order of textures



- Texture files are downloaded in arbitrary order



General Approach

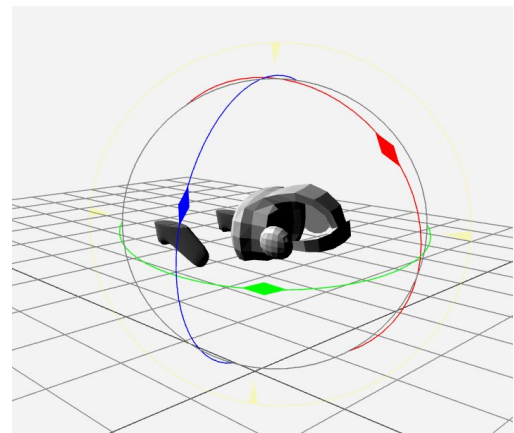
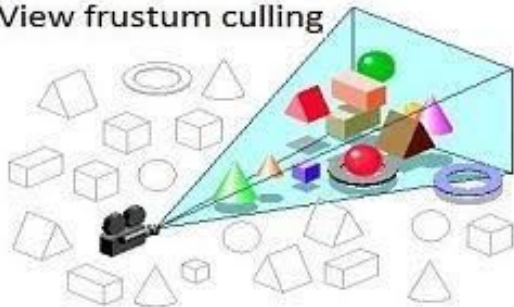


- Solve cause 1 by partitioning files by object
- Solve cause 2 by prioritizing object files in view.

Object Prioritization Heuristics



View frustum culling

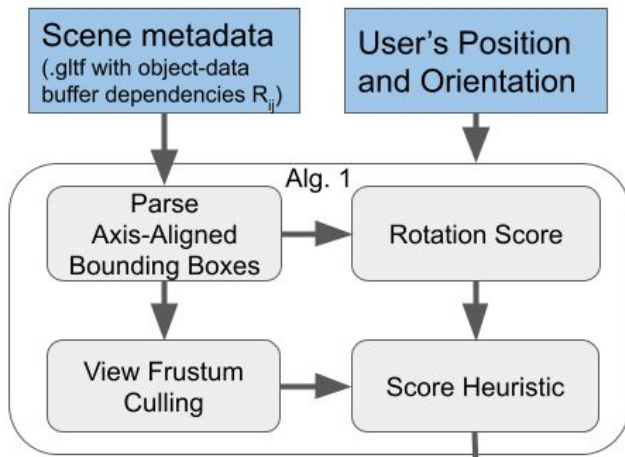


- Heuristic 1: View Frustum Culling
 - Prioritize downloading objects in the field of view.
- Heuristic 2: Look-At-Rotation Penalty
 - Prioritize downloading objects that only require smaller rotations to look at.

VIA System Architecture Overview



Object Scoring (§V-B)





Demo

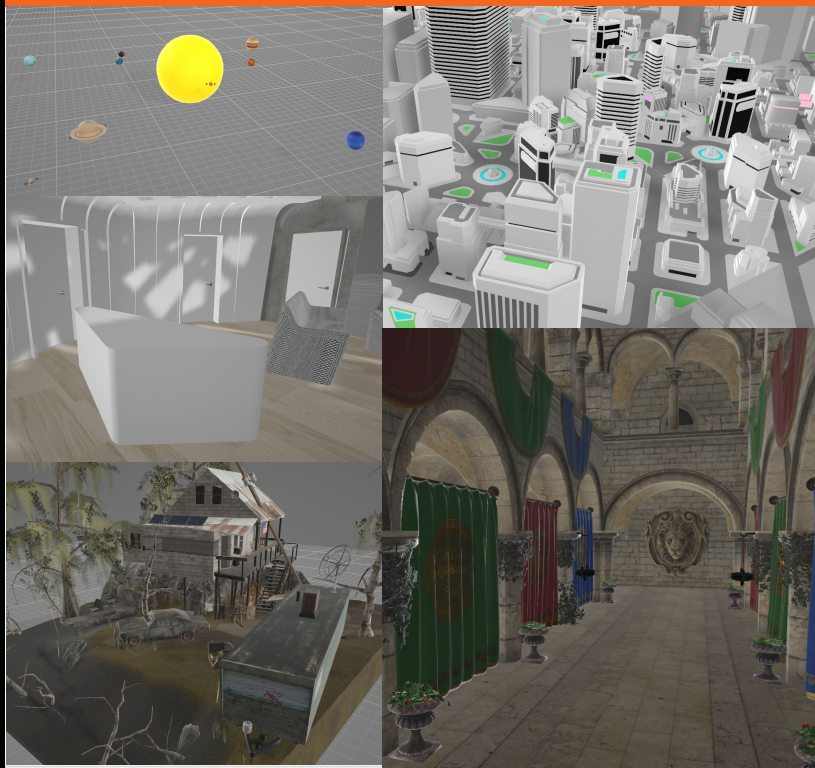


Experiments & Results

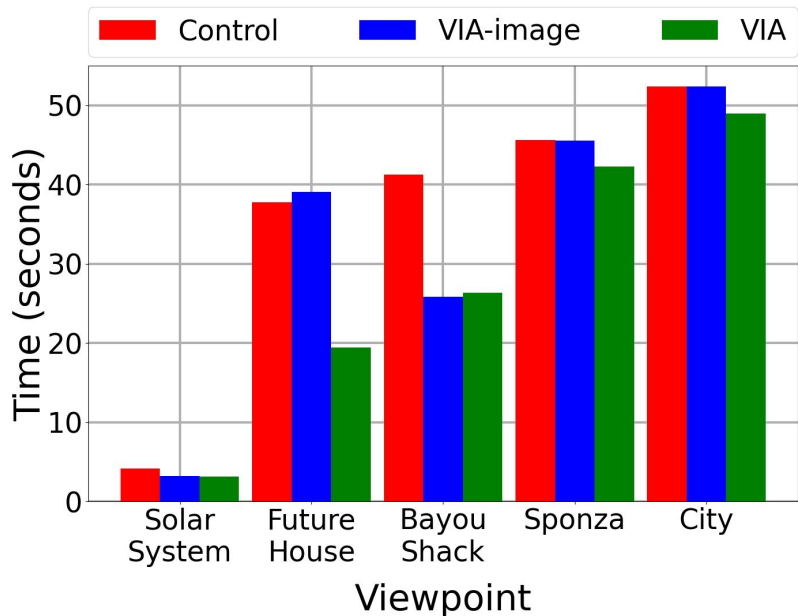
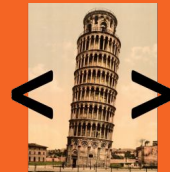
Experiment Setup



- 5 test scenes.
- Control, VIA, and VIA-Image (VIA but only image sorting)
- 3 different Network bandwidths covering typical mobile network conditions.

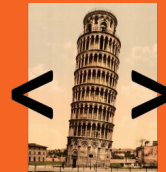


Experiment Results



- VIA has strictly lower latency than Control, especially on slower networks.
- Occasionally VIA-Image has similar benefit as full VIA.

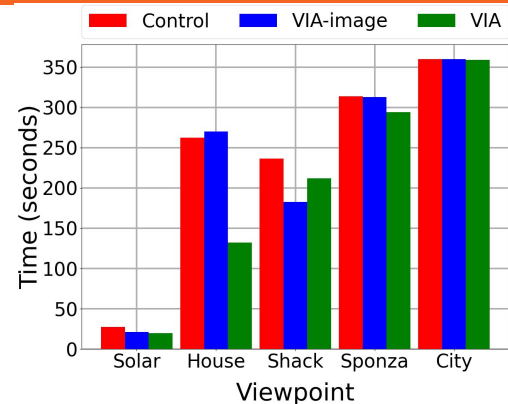
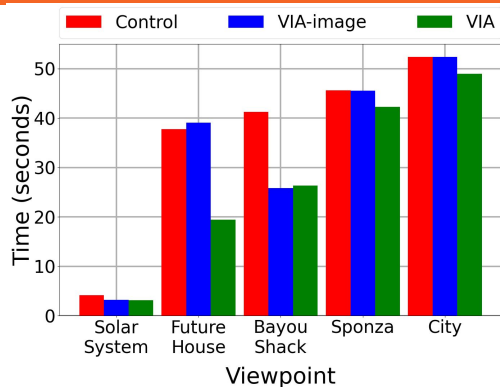
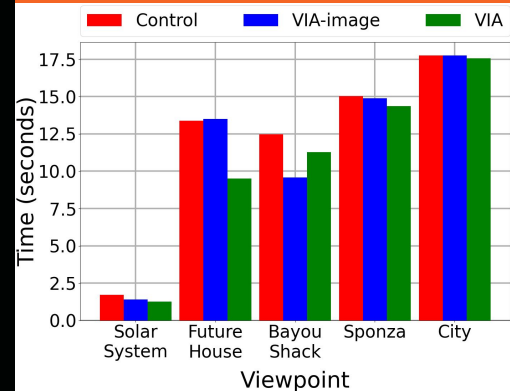
Network Dependence



30Mbit

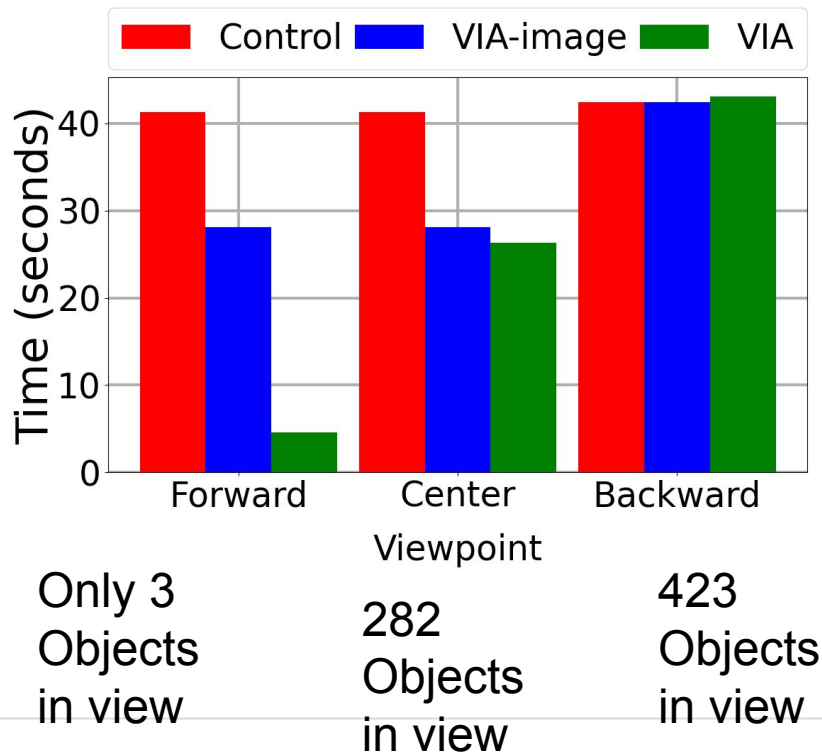
10Mbit

Fast 3G



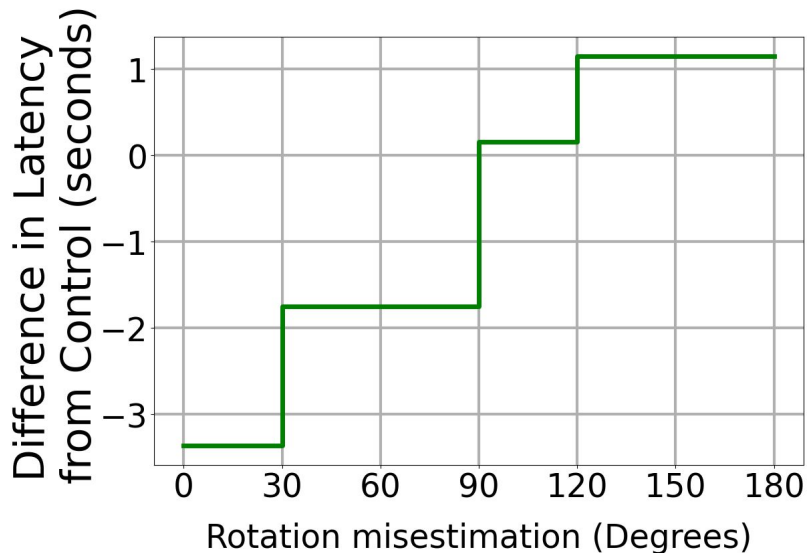
- Larger improvement over Control on slower networks.
- VIA introduces extra Round Trip Time from all the extra requests

View Dependence



- Improvement of VIA over control is highly dependant on initial Viewpoint.
- Initial views with less objects had the largest improvement.

View Mis-estimation



- How well does VIA perform if the assumed initial view is off from the actual initial view?
- Good as long as it's within 90 degrees.



Thank You!
Questions?