HHarbour Digital Twin - a serverside rendering usecase

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Contents

Using serverside rendering to create an immersive experience on mobile devices without hardware constraints by rendering in the cloud and stream content and interaction.

1 Introduction

1.1 Problem domain

- Mobile AR Graphics
- Tradeoff between performance and mobility
- Polycount capabilities of mobile devices (research)

1.2 State of technology - 4th quarter 2020

- Gardner Hype Cyclce
- AR in Commercial Projects
- "AR Is useless" -¿ Techlead Quote

1.3 Use Case "Digital Twin" HHarbour

Since this is a commercial work, the commercial aspect should be mentioned here and dicussed briefly at least.

- Use Case description
- Business Value
- Stakeholder

1.4 Technological challenges

This whole section might be better in the implementation section. However I'll keep it here for now to discuss topics.

1.4.1 Mobile device constraints

- Battery vs. Performance
- Heat
- ARM Chips vs. Rendering

1.4.2 Network

This is especially important for user experience.

I Kept this Section. But more for the sake of disussing the scope of the problem domain and some research but not with the intention to make this a part of this research.

- 5G Testsite at HH Harbour
- WIFI 6
- Software defined Network

1.4.3 Bandwidth

Discuss this and find solutions to mitigate

1.4.4 Packet loss

Is this really a problem? Can this be mitigated?

1.4.5 Server ressources

Discuss this:

- which ressources are really needed
- Kubernetes Cluster
- ...

2 Related Work

- Nvidia and Microsoft Cloud Gaming
- XRchitecture
- ...

2.1 Hypothesis

Underlying questions:

- Is it possible from a UX-Standpoint to create an immersive AR-experience with SSR?
- ...

3 Architecture Backend

3.1 Considerations

- Off-Screen Rendering (Render to texture -¿ Base64 stream)
- Sessions and Access Tokens (Photon Network?)
-

3.2 How to lightweight and fast

3.2.1 nVIDIA Maxine

Encode videostreams with ML to save up to 90% bandwith with equal results.

3.3 Loadbalancing and Containerization

- Kubernetes Cluser
- Every User-Session is dedicated container

4 Architecture Fronend

4.1 Software, SDK, Unity

Discuss topics such as:

- Cross Platform vs. Ecosystems
- External Libraries
- ...
- Rapid changing Hard- and Software environments

4.2 UI/UX

- User Story Considerations
- Wireframing
- Klickdummy
- Create Intriguing Design

5 Implementation

5.1 Code Domains / Work Items

- Serverside: Session Handler, Rendercluster, Nvidia Cloud XR
- Communication Layer: Session Tokens, Data Streams
- Frontend: UI, Render View to Screen, Interaction

5.2 Milestones

Probably nice to have a milestone map and reflect this in restrospect.

6 Evaluation and research

6.1 Define research goals

6.2 User surveys

In order to evaluate UX, HCI aspects have to be considered.

6.3 Technical analysis

7 Conclusion

7.1 Results

7.2 Future Work

7.3 Acknowledgements