Media Operations Use Case for an Augmented Reality Application on Edge Computing Infrastructure

draft-ietf-mops-ar-use-case-03

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Draft's Table of Contents

Table of Contents

Updates

- In sub-section 3.1, we have added the notion of AR data processing pipeline and the sub-section has been reorganized accordingly.
- We have added section 5 where we summarize the network characteristics of AR application traffic as well as TCP’s interaction with 4G LTE network carrying AR traffic.

The AR Data Processing Pipeline: a brief sketch

- We restructure section 3 around the pipeline of three consecutive subtasks namely tracking, followed by an acquisition of a model of the real world, and finally registration.
  - Tracking: This includes tracking of the three-dimensional coordinates and six-dimensional pose (coordinates and orientation) of objects in the real world [AUGMENTED].
  - The tracked natural features are used to develop an annotated point-cloud based model.
  - Finally, the coordinate systems, brightness, and color of virtual and real objects need to be aligned in a process called registration [REG].

AR Network Traffic and Interaction with TCP

- The uploading of data from an AR device to a remote server for processing dominates the end-to-end latency.
- A lack of visual features in the grid environment can cause increased latencies as the AR device uploads additional visual data for processing to the remote server.
- AR applications tend to have large bursts that are separated by significant time gaps. As a result, the TCP congestion window enters slow start before the large bursts of data arrive increasing the perceived user latency. The study [AR_TRAFFIC] shows that segmentation latency at 4G LTE (Long Term Evolution)’s RAN (Radio Access Network)'s RLC (Radio Link Control) layer impacts TCP's performance during slow-start.

Next Steps

- Many Thanks to Spencer Dawkins and Rohit Abhishek for providing feedback on the mailing list.
- Reviewers and contributors are invited to improve the draft. The Github repo is here (Many Thanks to Kyle Rose) :

https://github.com/ietf-wg-mops/draft-ietf-mops-ar-use-case

Informative references

[AR_TRAFFIC] Apicharttrisorn, K., Balasubramanian, B., Chen, J., Sivaraj, R., Tsai, Y., Jana, R., Krishnamurthy, S., Tran, T., and Y. Zhou, "Characterization of Multi-User Augmented Reality over Cellular Networks", In 17th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON), pp. 1-9. IEEE, 2020.

[AUGMENTED] Schmalstieg, D. and T. Hollerer, "Augmented Reality", Addison Wesley, 2016.

[REG] Holloway, R., "Registration error analysis for augmented reality.", In Presence:Teleoperators and Virtual Environments 6.4, pp. 413-432., 1997.