

Demonstrating V-PCC Bitstream Transcoding

Motivation

- Large scale distribution of Point Cloud Content in Adaptive Bitrate (ABR) streaming **requires to encode content at multiple quality levels** [1, 2].
- **On-the-fly** transcoding allows to store only a high-rate representation to reduce storage requirements.
- V-PCC encoded content can be **directly transcoded** by only **re-encoding underlying video sub-streams** [3].

Demo

Media Server:

- Point cloud sequences [4], **pre-encoded with V-PCC** [5] at **high-rate** setting.
- The sequence is looped for playback.

Transcoder:

- Transcoder for V-PCC encoded point cloud sequences based on RABBIT [3]:
 - **Extract video sub-streams** from the bitstream.
 - **Transcode video sub-streams directly** through video transcoding.
 - Combine transcoded sub-streams into a new representation.

Client:

- Streams the point cloud video segments.
- **User adjustment** of the coding configuration:
 - geometryQP: Quality of the geometry video.
 - attributeQP: Quality of the attribute video.
- Decoding with an optimized decoder implementation [6].

Project Goals

Testbed for Volumetric Streaming:

- Deployment of a System for **HTTP Adaptive Streaming of Point Clouds**.
- Implementation of a **containerized** and **scalable transcoding service**.

Experiments:

- Streaming experiments with N clients under varying transcoding settings.
- Measurement of quantitative streaming metrics.

References

- [1] Van der Hooft, J., Wauters, T., De Turck, F., Timmerer, C., & Hellwagner, H. (2019). Towards 6DoF HTTP adaptive streaming through point cloud compression. In *Proceedings of the 27th ACM International Conference on Multimedia* (pp. 2405-2413). ACM.
- [2] Hosseini, M., & Timmerer, C. (2018). Dynamic adaptive point cloud streaming. In *Proceedings of the 23rd Packet Video Workshop* (pp. 25-30). ACM.
- [3] Rudolph, M., Schneegass, S., & Rizk, A. (2023). Rabbit: Live transcoding of V-PCC point cloud streams. In *Proceedings of the 14th Conference on ACM Multimedia Systems* (pp. 97-107). ACM.
- [4] d'Eon, E., Harrison, B., Myers, T., & Chou, P. A. (2017). 8i voxelized full bodies—a voxelized point cloud dataset. ISO/IEC JTC1/SC29 Joint WG11/WG1 (MPEG/JPEG) input document WG11M40059/WG1M74006, 7(8), 11.
- [5] <https://github.com/MPEGGroup/mpeg-pcc-tmc2>
- [6] <https://github.com/benclmnt/tmc2-rs/tree/main>

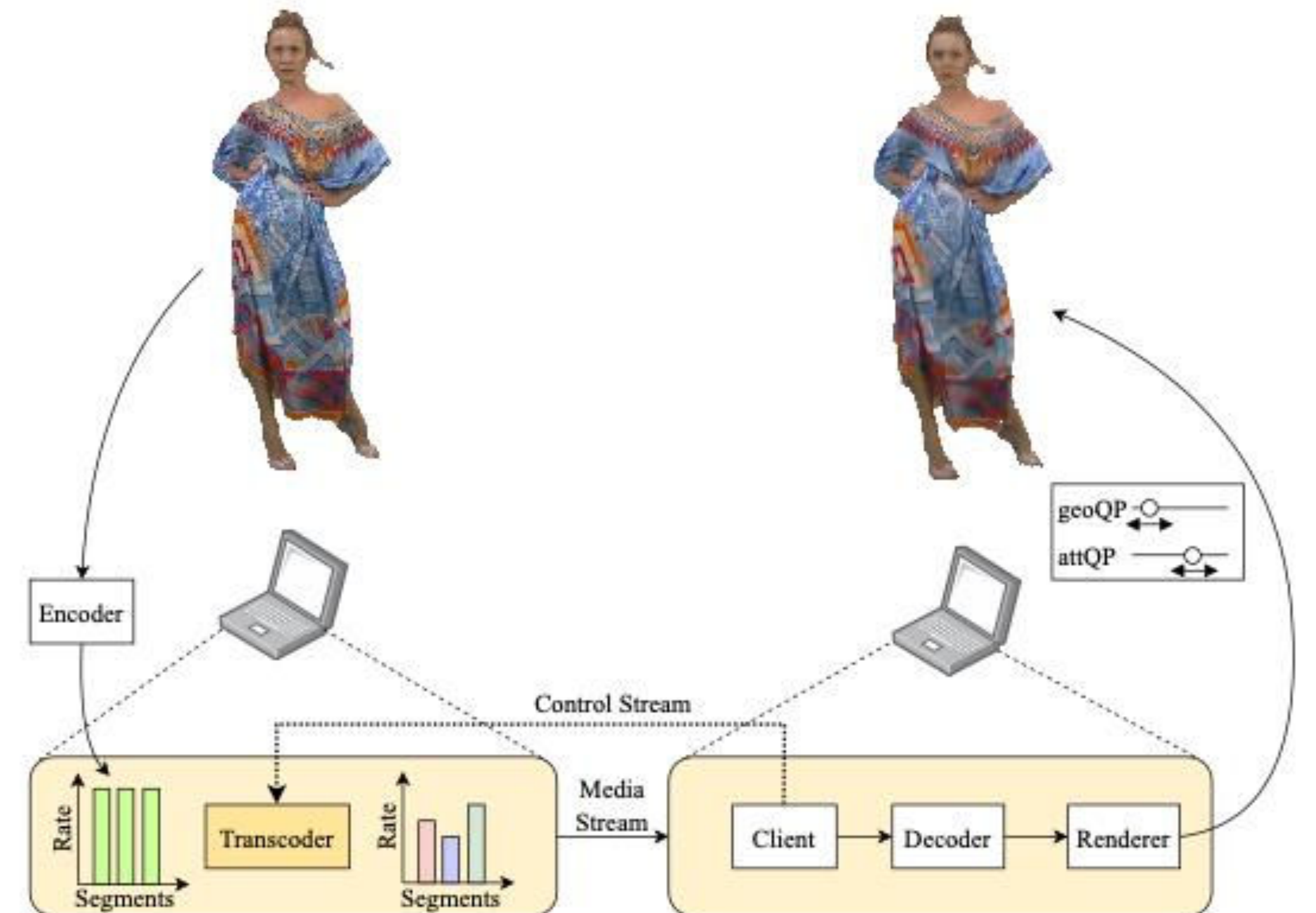


Fig 1.: Demo Setup. A user can select the quality of geometry and attribute transcoding, receiving the transcoded media stream.

Test Variable	Conditions	Performance Metrics
Transcoding Settings	- Video Encoder Implementation	- Latency - Rate-Distortion
Number of Clients	- Video Encoder Implementation - Video Encoder Presets - Constant Bandwidth, Bandwidth Traces	Client: - Latency - Stall frequency - Stall duration - Buffer status Server: - Energy consumption - Encoding Queue status - Encoding Latency
Number of available Representations	- Video Encoder Implementation - Video Encoder Presets - Constant Bandwidth, Bandwidth Traces	Client: - Latency - Stall frequency - Stall duration - Buffer status Server: - Energy consumption - Encoding Queue status - Encoding Latency

Tab 1.: Experiment Plan for the Project. After identifying suitable transcoding configurations, we will evaluate the scalability of the system with respect to the number of clients and number of available representations.

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