S4aV230086
Shared viewing experiences in FS_HEVC_Profiles

3GPP SA4 Video SWG Telco (Nov 28th, 2023)

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Context

S4-231790 presented during SA4126

- Some questions were raised about:
  - Complexity and dynamicity
  - Test material / Sequences
- Document was noted, with updates expected on next telcos

This presentation provides:

- More details on implementation aspects
- More details on testing framework
- Example of how test material can be generated
- A proposed way forward for shared viewing experiences in FS_HEVC_Profiles

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University campus with XR-equipped classrooms

User-centric story:

- Students arrive in the classroom
- They pick the AR glasses at the entrance
- The session starts
- Teachers is showing them AR elements
- As the AR glasses shall be affordable and light, rendering is offloaded to the cloud

Problem :

1. **RAN congestion**
2. **High computation requirements on the cloud**

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Approach: A single MV stream is multicasted, each user additional views are sent in unicast

Each user subscribes to the right multicast stream + its unicast stream

Reasonable encoding and decoding complexity

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Example of viewers clustering and optimized transmission

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Simulation setup

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Generation of test material

Blender-based

What you need is publicly available blender 3D assets

- https://www.blender.org/download/demo-files/
- We used the Cube Diorama CC0 material for our test

How we rendered the viewports:

- 1440x1600p per eye
- Note: Everything can be configured in blender scripts

Cube Diorama

by Blender Studio

11MB – CC0

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Test conditions for the tests

Reference:

- 2-views MV-HEVC
  - Distortion: average L/R PSNR
  - Rate = rate(L)+rate(R)

Tested against:

- 3-views MV-HEVC aligning reference views' QP with test conditions
  - Distortion: average L/R PSNR
  - Rate = rate(L)+rate(R) + rate(S/N)
  - Note: slight RPS changes in config file to handle this 3-views structure

Coding with HTM-16.3 QP={25,30,35,40}, dQP=+3

Performance measurement with BD-rate

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Simulation results : static cluster config #1 + central view

N = 54 students, 1m space between each, with 1m elevation per row of student

Clustering #1

3D object

-47.88%	-46.86%	-26.72%	-23.72%	-48.21%	-24.90%	-20.84%	-45.71%	-36.24%
-44.78%	-89.74%	-35.35%	-27.40%	-86.11%	-30.34%	-26.00%	-88.37%	-36.28%
-19.55%	-32.85%	-24.30%	-10.80%	-30.42%	-13.86%	-14.82%	-28.76%	-17.66%
-19.84%	-25.35%	-12.85%	-10.19%	-14.70%	-7.69%	-6.90%	-14.27%	-14.71%
-36.03%	-87.82%	-24.75%	-15.71%	-83.04%	-14.07%	-8.44%	-88.70%	-22.72%
-9.79%	-10.36%	-3.50%	-0.64%	-5.13%	-1.02%	-2.38%	-7.56%	-1.40%

- **-28.30% saving for the L/R views**
- **-17.24% for complete transmission (with static views)**

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Simulation results : on a more realistic configuration

N = 90 students, .5m space between each, .5m elevation per row, 1m between row

Clustering #1

-43.5%	-53.3%	-46.9%	-35.6%	-25.0%	-24.1%	-37.3%	-50.6%	-37.2%	-23.2%	-19.2%	-28.9%	-43.9%	-45.6%	-31.2%
-41.4%	-56.5%	-87.5%	-52.0%	-33.5%	-28.5%	-42.4%	-85.8%	-46.8%	-30.0%	-23.0%	-38.7%	-86.9%	-44.6%	-28.6%
-22.8%	-28.7%	-35.8%	-37.6%	-24.3%	-13.1%	-20.4%	-34.7%	-23.7%	-15.0%	-12.2%	-29.4%	-29.7%	-20.8%	-17.6%
-20.6%	-28.9%	-28.3%	-21.6%	-15.2%	-11.3%	-17.8%	-18.4%	-13.7%	-8.6%	-8.5%	-13.9%	-19.0%	-22.2%	-15.3%
-32.5%	-51.0%	-88.3%	-45.5%	-19.9%	-17.2%	-31.7%	-83.7%	-31.2%	-15.7%	-8.0%	-27.1%	-85.9%	-35.9%	-18.4%
-12.2%	-13.4%	-13.7%	-13.1%	-3.9%	-1.7%	-3.7%	-8.4%	-5.8%	-1.8%	-2.8%	-12.8%	-8.0%	-5.9%	-2.3%

- **-28.9% saving for the L/R views only only**
- **-22.5% for complete transmission (with static views)**

3D object

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Conclusion

- Shared viewing experience is expected to happen for various type of applications, including education, entertainment or enterprise
- Bandwidth saving can be achieved by leveraging common views between multiple users, using MV-HEVC.
- A testing methodology based on open-source tools has been proposed, as well as a way of generating content from publicly available 3D assets
- Proposed way forward:
  - Include the scenario as described in pCR S4-231790 in FS_HEVC_Profiles
  - Document the performance evaluation

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