A 3D collaborative editor using WebGL and WebRTC

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Online collaborative 3D design

Collaborative design environments share 3D scenes across the network. 3D scenes or models are very likely to be constructed and reviewed by more than one person, particularly in the context of 3D scientific visualization [1], CAD (Computer Aided Design) [2] or BIM (Building Information Modeling) [3] solutions with various architectures [4] [5].

Objectives

- pluginless visualization of 3D scenes on the web,
- exclusive use of client resources for communication,
- message broadcasting: asynchronous and granular,
- real-time collaboration across the network with shared access to 3D models.

Question

What architecture is the best suited in online 3D collaborative design environments for small teams using exclusively browser’s resources?

Our hybrid architecture for 3D web-based collaboration

Web-based editor

Client visualization, interaction and edition.

The 3D interface integrates a viewport and provides:
- the list of contributors,
- basic transformations tools (CRUD),
- and viewport informations.

WebRTC and DataChannels

WebRTC (Web Real-Time Protocol) allows DataChannel protocol for P2P connections between web browsers to exchange any raw data in real-time[6].

Auto-management of the P2P full mesh network of users (designed for small teams).

PeerJS library bootstraps WebRTC API for compatibility reasons.

P2P communication

Granularity of the data transmission depends on the actions (ID, transformation matrix, materials, meshes). Each client is responsible to broadcast its own messages (to direct neighbors in P2P and to DB).

Qualitative evaluation and results

We focused on the user experience in the experiments:

Criteria for the evaluation:
- appreciation of the interface and features,
- quality of the collaboration mechanisms (feedbacks, robustness and latency)

Goal To assemble collaboratively the parts of a scene to match a given picture with the editor and real-time information.

The system offers a good robustness and resilience in case of browser’s crash.

User interface Reports about a lack of visual feedbacks on collaborative object prehension.

Object manipulation Good evaluation except at the reception of a new model (not optimized).

User charge The variation has not altered (from 4 to 7 people) rendering and networking quality.

Global evaluation Satisfied of the collaborative and visual results: goals are reached.

The quality of the collaboration has been considered as real-time more than interactive.

References


