Real Time P2P Voice Chat over the browser
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Proposal

It has never been easier to communicate with one another than it is these days. Internet communications have created a whole new way of interacting with people from afar. However, most of the popular communication apps have centralized servers that direct the traffic (Facebook, Google Hangouts, etc).
This project proposes a decentralized solution for real life communications over the internet, using only one's browser. The advantage of this is that people can have a more secured and trustworthy communication channel over the internet by opening a direct (and possibly secured) stream between their computers.

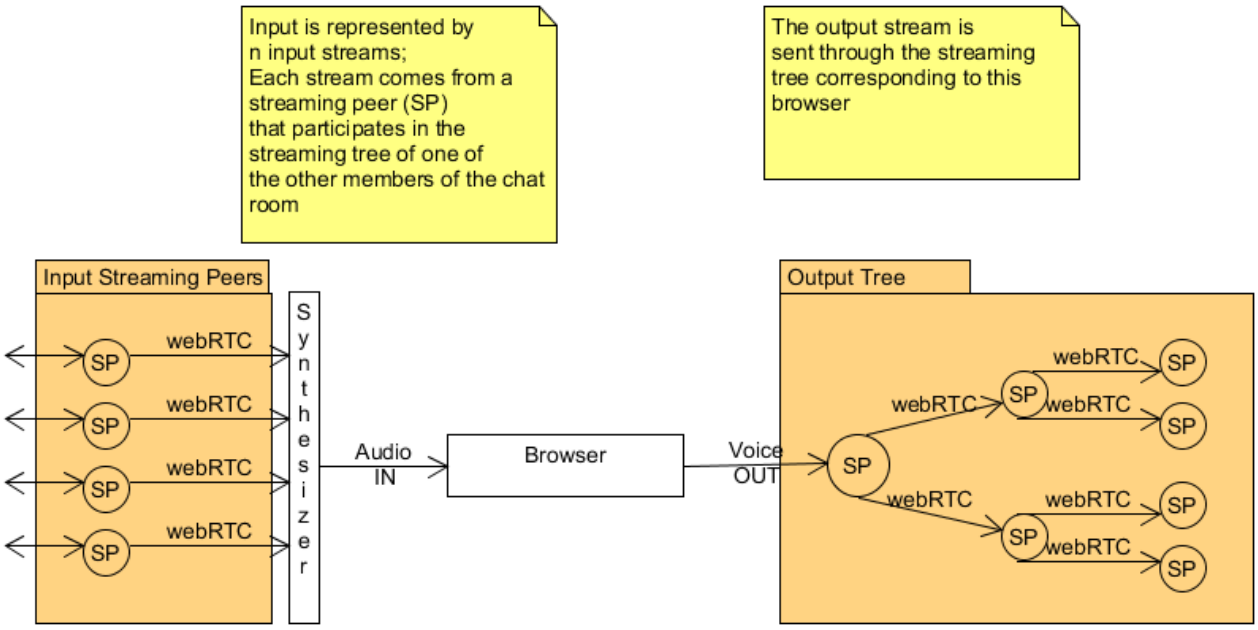
Use Cases

1. P2p communication between two browsers:
   Users should be able to directly contact each other and open a communication stream between one another
2. P2P communication between multiple browsers
   Users should be able to create chat rooms, having direct communication streams between them. There is no “master-user” or chat administrator here. This is just a simple chat room where friends can talk to each other.
3. Ability to custom block certain peers in chat rooms
   Each participant of the chat room can potentially block messages from a different room member. These messages will only be blocked for the blocker, all other members of the chat room can still see them.
4. Traffic rebalancing based on blocked peers (extra)
   This is a potential for further optimizations, where if a certain peer is blocked by multiple peers then traffic could be redistributed in the network s.t. resource waste is minimal.

Architecture

The architecture of this system is based on multiple streaming trees with WebRTC connections between peers.

The proposed peer interaction is presented bellow:



Each chat participant has its own streaming tree to which it publishes its data (Voice OUT). Besides this, it will have 1 node in each of the other participants output trees (SPs). The input to the browser is a combination of all the input streams from the other participants. Involving a Synthesizer component at this point allows for custom voice control for all the other participants in the chat.

Milestones

- W45 – Project proposal and have a working prototype of the WebRTC protocol. At the end of this milestone, the project architecture should be clearly defined, and direct p2p streaming between two browsers should be possible.
- W46 – Add chat room support; streaming between multiple peers should be possible at the end of this milestone.
- W47 – Allow peers to block one another in chat rooms. At the end of this milestone, the system should contain fully functional chat rooms where peers can block certain members of the room at their own free will.
    - If things go well until here, this milestone might include traffic rebalancing based on blocked peers.
- W48/49 – Wrap-up and project report. Bug fixing period, wrap things up for the final presentation and write project report.

Resources:

- Analysis of the Skype p2p protocol: https://arxiv.org/abs/cs/0412017
- RTC over the browser: pdf
    - WebRTC API: https://developer.mozilla.org/en-US/docs/Web/API/WebRTC_API
    - ICE: https://en.wikipedia.org/wiki/Interactive_Connectivity_Establishment
- P2P Meadia streaming with html5 & WebRTC: https://pdfs.semanticscholar.org/3ec3/25bdfeed455976be4e7c14507b15e5340e49.pdf
- Distributed and adaptive HTTP data streaming
- Distributed Streaming patent
- Guardian tree: A single Tree-Based P2P live streaming system (…) ; Emil Stephansen, Kasper Lodahl Flye; Master's Thesis
- Latency Aware multi-tree based P2P live video streaming; Jens Frederik Krogh Holdam, Mathias Glavind Schidt; Master's Thesis