P2P WebRTC Video Chat

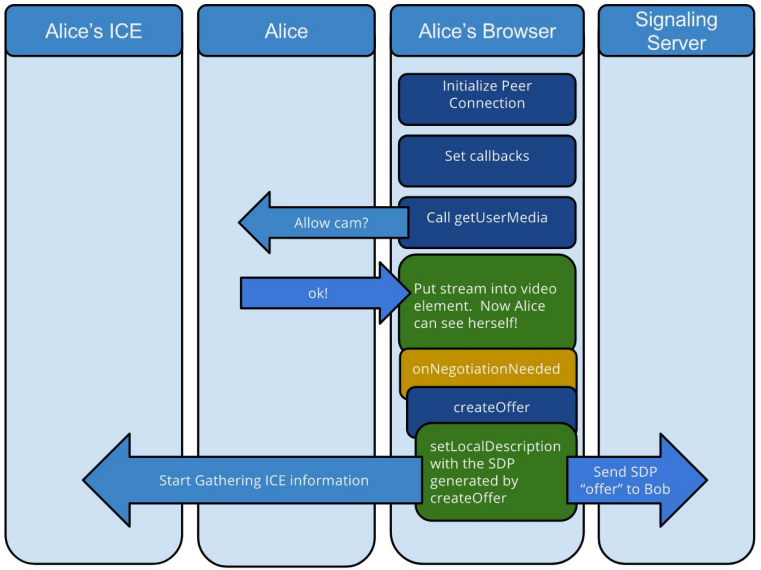
Stefan Prisca

WebRTC

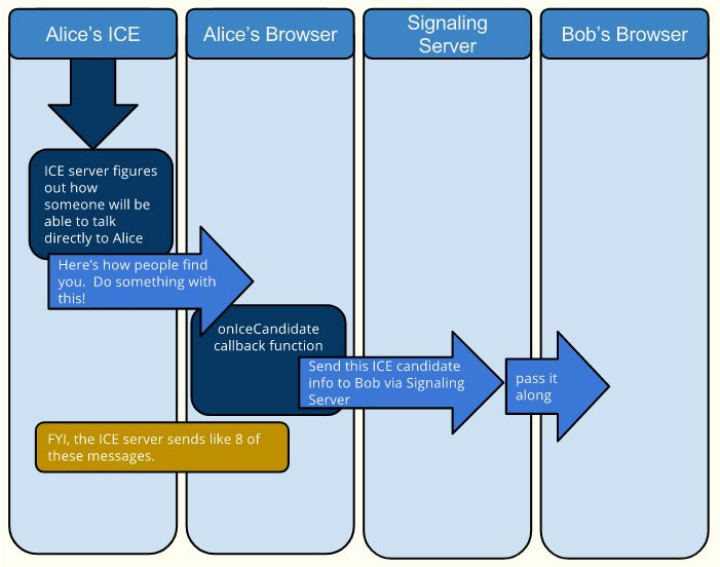
- P2P Real Time Communication for the browser
- Built into most of the modern browsers
  - No need for any libraries / plugins
- Requires no server! (more or less)
  - P2P communication channel between two browsers
  - But it requires a signaling step for setting up the connection
- Only accepts HTTPS connections
  - Secure and safe
- Built for video/voice streaming

WebRTC - Establishing the Connection

SDP



ICE



https://www.pkcsecurity.com/untangling-webrtc-flow.html

WebRTC - SDP & ICE

- **Session Description Protocol**
  - describes the media
    - How the video is going to look like
    - Encryption data
    - Bandwidth
- Consists of an offer/answer being exchanged between the peers

- **Internet Connectivity Establishment**
  - resolves the path
    - How the peers will connect to each other
    - Resolves NAT and Firewall traversals
- Consists of a bunch of ICE candidates (possible connection routes) being exchanged

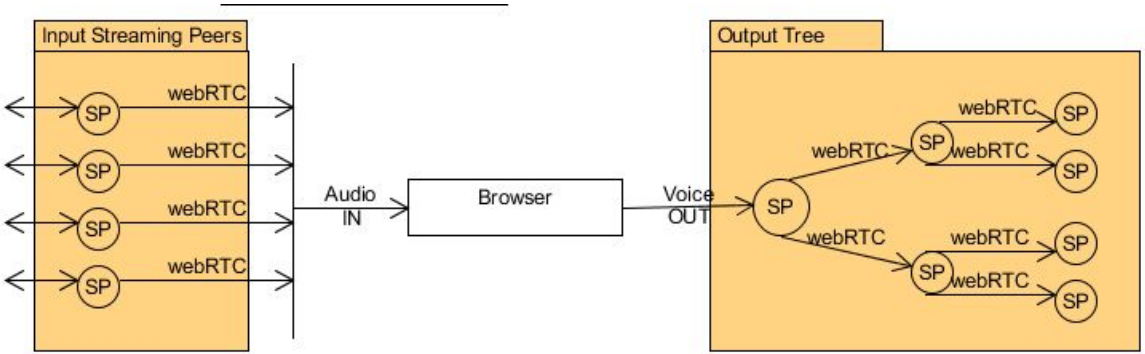
WebRTC - Signaling

- SDP and ICE packages need to be sent between the peers to establish the proper connection
- This is where the server part comes in…
  - Simple message routing server that just forwards these messages to the peers
  - E.g. SocketIO

Video Chats & WebRTC

- Most video chats have a mesh like architecture:
  - All peers send data to all the others
  - All peers receive data from all the others
- this does not scale well for peers with low bandwidth
  - Having to stream and receive data from 10 other people is quite expensive
- Alternative: Streaming Tree architecture
  - Send your stream to some peers
    - They will forward it
  - Receive a stream from all other peers

Streaming Trees in Video Chats



- You don’t have to communicate with all other peers
- Trees structure can be modified:
  - Peers with lower bandwidth can stream less (leaves)
  - Peers with higher bandwidth can do more work
- Disadvantage:
  - Re-build after peer leaves

WebRTC with Streaming Trees

- Everything can be done during signaling
- Simple routing algorithm to route messages based on the tree structures
- Disadvantage:
  - Needs more state and logic on the server side
  - Rebalance trees when peer leaves
- Advantage:
  - Re-configure trees based on peer capabilities
  - Peers have to stream less data than in a pure mesh-based architecture

Live demo

- Visit : https://52.28.20.194/
  - Amazon server running in Frankfurt. Trust it!
- Preferably from Google Chrome on the Desktop