Project Plan for Degree Projects
Department of Computer Science

General Information

Title:	Reel-time communication using a peer-to-peer network in the web
External company:	Name of the company (if you do your degree project at an external company)

Persons involved

Student 1:	Henry Pap	hp222fq@student.lnu.se
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Supervisor:	Mauro Caporuscio *mauro.caporuscio@lnu.se*
External supervisor:	Your supervisor at the company (if you do your degree project at an external company)

Background

Real-time communication (RTC) [1] is a term describing live communication between two or more mediums with no or very low response time. In the context of networking this means distributed clients (geographically) can communicate with each other on a low latency. Today we either use client-server or peer-to-peer architectures that both come with their own pros and cons. Peer-to-peer (P2P) systems in the accepted definition by Theotokis et al. [2] are pure and loose P2P systems, where pure refers to total distribution meaning no use of central servers and loose being something in between of pure P2P and client-server without relying to much on centralized servers.

Web technology offers three main methods for communication (native to the web-browsers):

1. HTTP
2. WebSockets
3. webRTC

But only WebSockets and webRTC is considered fast enough for RTC, WebSockets uses what is called a push and receive service meaning that a server also can send messages to clients. But only the "newly" API webRTC supports peer-to-peer communication as it resolves finding the direct communication-link between two peers. Using the web browser comes with drawbacks, it can not handle to much peers and thus the recommended number of connected peers to one client is 6. To overcome this issue a specific P2P topology is required, by smart routing and use of super-nodes (client that acts like servers) an virtual network will then be formed.

Problem formulation

Peer-to-peer RTC networks is a challenging problem on itself that has been solved multiple times, but doing this entirely in the web is not very common. This thesis will focus on multiplayer game networking and trying to extend the limit of peer connections in the web using the webRTC API. By investigating and using different peer-to-peer topologies that helps extend the peer-connections of a web browser while still keeping a low latency potential solutions for real-time multiplayer game will be evaluated.

Motivation

As mentioned in the problem formulation, peer-to-peer real time communication using the web is not something that has been solved on a higher level (i.e. having scalability and low latency). From a economical view point this helps the game creator to not spend money on a expensive server that handles multiple connections. From a scientific point of view, as more and more application is integrated into the web browsers due to its broad availability to almost all platforms we need better ways for real-time communication using only the web browser as a toolbox.

Objectives

O1	How to achieve scalability for real-time peer-to-peer network in the web.
O2	Determine the most suitable peer-to-peer topology.
O3	Achieving low latency for real time multiplayer games.

Method

A systematic literature review will be conducted in order to gather background knowledge about peer to peer network topologies. For determine the most suitable peer-to-peer network topology a comparative study has to be done thus ranking the topologies. And by experimentation on them with their corresponding settings, achieving the best topology based on both low latency and scalability.

From the experiment-results, picking the most suitable topology and implementing it using webRTC API and then verify and validate it.

Methods used

1. Systematic Literature Review
2. Comparative study
3. Controlled Experiment
4. Verification and Validation

Time plan

Date	Milestone
2019-02-15	Systematic Literature Review for background knowledge (SLR)
2019-02-19	Degree project plan finished
2019-03-08	Reading and gather the information generated from the SLR
2019-03-10	selecting 5 peer-to-peer topologies
2019-03-17	Writing the peer-to-peer background part based on the selected topologies
2019-03-20	Exploring the webRTC API by both reading the specs and testing with simple implementations
2019-03-23	Finishing the background with webRTC
2019-03-25	Writing the motivation and aim (re-using this document with some retouching)
2019-03-27	Starting with the (method?) and result
2019-04-05	Experiment with the different topologies to achieve low latency and scalability
2019-04-15	Implement the most suitable topology into web environment using the webRTC API
2019-04-20	Verifying and validating the implementation
2019-04-22	Discussing the results based on the evaluation
2019-04-23	Discuss the picking of the 5 topologies
2019-04-27	Finish the conclusion
2019-05-01	Finalizing the thesis
2019-05-03	Preparing the presentation

References

[1] What is real-time communications (rtc)? - definition from techopedia. Accessed 19 Feb. 2019. [Online]. Available: https://www.techopedia.com/definition/24426/real-time-communications-rtc

[2] S. Androutsellis-Theotokis and D. Spinellis, "A survey of peer-to-peer content distribution technologies," *ACM Comput. Surv.*, vol. 36, no. 4, pp. 335–371, Dec. 2004. [Online]. Available: http://doi.acm.org/10.1145/1041680.1041681