Real-time Communication between Web Browsers

Pavel Smolka

Declaration

Hereby I declare, that this paper is my original authorial work, which I have worked out by my own. All sources, references and literature used or excerpted during elaboration of this work are properly cited and listed in complete reference to the due source.

Advisor: doc. RNDr. Tomáš Pitner, Ph.D.

Acknowledgement

Thanks to everyone... TODO

Abstract

TODO

Keywords

Contents

Chapter 1

Introduction

Millions, billions, trillions. That many and even more messages are exchanged every day between various people over the world. The Internet created brand new way to communicate and collaborate, even if you are located on the opposite parts of the world. Since the age of Alexander Graham Bell, the accesibility to the communication devices and their simplicity incredibly enhanced. Nowadays, almost 2.5 billion people over the world have access to the Internet and therefore they are able to use almost limitless communication possibilities it provides. [5]

However, the manner of Internet usage essentially changed during the first decade of 21st century. Using the Internet and using the web browser became almost synonyms. People use the web browser as the primary platform to do every single task on the Internet. Sometimes it's not even possible to use the other internet services without visiting certain web page in the web browser and performing the authentication there.[1] Considering the mentioned fact, web browsers became also the basic platform for the communication tools. Even though the purpose of the world wide web and HTTP protocol was completely different at first (displaying single documents connected via hypertext links), it appeared that there is the need of common rich applications running withing web browser - rich internet application. So popular social networks are built on top of the web browser platform and they are used by more than billion people over the world. [4] And the main reason why the social networks are so popular is the real-time stream of news and messages from the other people. By the beginning of the year 2013, I would say that static web is dead - users prefer interactivity.

This thesis embraces the topic of real-time application in web browsers, especially the text communication tools and the technologies being used to develop them. It also describes the problem of "inter-process" communication between various web pages which need to cooperate and exchange information as quickly as possible. Finally, the possibilities of multimedia content transfer (audio and video) and the current options of capturing multimedia directly from the web browser are described as well.

As mentioned above, the web browser became one of the most popular platforms. Celebrio, simple software for the elderly simulating the operating system interface, is typical

---

1. Two examples of such behavior. Wi-fi network in the Student Agency coaches forces the user to visit the entry page in the web browser. The second example, very well known to the students of the Faculty of Informatics at Masaryk University, is the faculty wireless network called wlan_fi. Every user has to open the web browser and log in with her credentials. It's not possible just to open the terminal or e-mail client and start working online.

example of rich internet application. [2] All the topics mentioned in the previous paragraph appeared to be very important in the system. When questioning the elderly people in the Czech Republic, it appeared that almost 90 % of the elderly computer users use the real-time communication applications. [3] Interaction with their loved ones is the most desired benefit they expect from the computer. Therefore, creating real-time application, text messenger supporting video calling, became not only programming challenge but also a business goal.

What's the current state? TODO: Existing IM web messengers, inability to connect from web app to skype.

In the first chapter, there is .... TODO: describe content

The programming part of the thesis comprises the implementation of real-time text chat application, video calling application and simple "inter-process" communication tool for Celebrio.

Chapter 2

Extensible Messaging and Presence Protocol

At first, this chapter should describe the important parts of XMPP protocol (mostly just picking the appropriate references).

Extensible Messaging and Presence Protocol (XMPP) technologies were invented by Jeremie Miller in 1998. [7] It is one of the most widespread technologies for instant messaging (IM),[1] i.e. exchanging the text or multimedia data between several endpoints. The very essence of every instant messaging is bidirectional stream where so that both sides can immediately *push* new data and the other side (or other sides, respectively) is promptly notified without the need to perform any manual *pull* (update) action. The best transport protocol for such use case is Transmission Controll Protocol (TCP) and the "native" implementation of XMPP works right on top of TCP protocol: XMPP endpoint (called client as it represents the first actor in client-server architecture) opens long-lived TCP connection. Then, both the client and the server negotiate and open XML streams so there is one stream in each direction. [7]

When the connection is established, both client and server can push any changes as XML elements to the stream and the other side obtains them immediately. However, such implementation is unavailable when implementing web application, unless HTML5 technology called *WebSockets* is used. That is the reason why the bidirectional stream emulation is frequently used in many rich internet applications in order to assure interactivity and freshness of the data. Such emulation is called BOSH and it is described closely in the Section 2.2.

2.1 Fundamental bulding blocks in XMPP

Mention the terms as stanza, roster, describe the subscription mechanism.

2.2 XMPP and Bidirectional-streams Over Synchronous HTTP

Describe BOSH (http://xmpp.org/extensions/xep-0124.html) and XMPP Over BOSH (http://xmpp.org/e 0206.html).

Later on, description of BOSH extension, including the advantages and limitations. Describe also the connection to HTTP protocol.

---

1. Acutally, the IM client or even the techology itself is sometimes called "Instant Messenger". This term is registered as a trademark by AOL company. [1]

2.3   Jingle

Jingle extension - multimedia.
http://xmpp.org/extensions/xep-0166.html

2.4   Inter-process communication

Pub-sub extensions for inter-process communication.
http://xmpp.org/extensions/xep-0060.html

Chapter 3

Other approaches to RTC

Describe other approaches to RTC in WB than XMPP. Tell why we didn't use them (or that we used - OpenTok).

Mention:

WebSockets

OpenTok

WebRTC (http://www.webrtc.org/)

Google hangouts API

Chapter 4

XMPP client in Javascript

Describe the tools that can be used to implement RTC in WB (and which were used to implement Celebrio Talker)
  Strophe (simple XMPP in Javascript)
  Strophe connecting/attaching - security issues. TODO programming
  Strophe plugins
  Possible server-side implementations (JAXL, XMPPHP, ...)

Chapter 5

Talker

Describe the Talker application in Celebrio.

Mention what we expected from the app (value proposition)

Then, application analysis, design and implmementation.

Describe the architecture and used tools&frameworks: JS + Ember.js, OpenTok, Web-Sockets in new OpenTok

Don't forget to use UML: use case diagram, class diagram (if any), sequence/action diagram

5.1 Ember.js

Describe Javascript client-side MVC frameworks overall, compare, tell why we used Ember

5.1.1 Subsection about Ember...

Chapter 6

Inter-process Communication Framework

Implement and describe framework for inter-process communication in Celebrio.

First, the lightweight one (which we already have), then implement the "heavy" one, if there's enough time.

Chapter 7

Conclusion

conclusion

7.1 Another part of the conclusion

Another part of the conclusion... just to have subchapter here

Bibliography

[1] AOL Inc.: *AOL Trademark List*, 3/15/2011 [retrieved 2/20/2013], from <http://legal.aol.com/trademarks/>. 1

[2] Donko, P. and Kunc, P. and Novák, M. and Smolka, P. and Volmut, J.: *Celebrio System*, 2013 [retrieved 2/19/2013], from <http://www.celebriosoftware.com/celebrio-system>. 1

[3] Smolka, P. and Novák, M.: *Elderly people and the computers*, 2/11/2013 [retrieved 2/19/2013], from <http://infogr.am/Seniori-a-pocitace>. 1

[4] Olanoff, D.: *Facebook Announces Monthly Active Users Were At 1.01 Billion As Of September 30th*, TechCrunch, 10/23/2012 [retrieved 2/19/2013], from <http://techcrunch.com/2012/10/23/facebook-announces-monthly-active-users-were-at-1-01-billion-as-of-septem... 1

[5] Miniwatts Marketing Group: *Internet Users in the World - 2012 Q2*, Internet World Stats, 2/17/2013 [retrieved 2/19/2013], from <http://www.internetworldstats.com/stats.htm>. 1

[6] Ward, J.: *What is a Rich Internet Application?*, 10/17/2007 [retrieved 2/19/2013], from <http://www.jamesward.com/2007/10/17/what-is-a-rich-internet-application/>.

[7] Saint-Andre, P. and Smith, K. and Tronçon, R.: *XMPP: The Definitive Guide*, Sebastopol: O'Reilly, 2009, 978-0-596-52126-4, 310 (7, 16, ...). 2

Index

Appendix A

Screenshots of the application

Some screenshots from Celebrio Talker