

# Conversas Hiperligadas: Novo Paradigma de Comunicação e Colaboração, potenciado pela Tecnologia WebRTC

Henrique Lopes Rocha  
email1: henrique.rocha@ist.utl.pt

Instituto Superior Técnico

**Abstract.** In here put your abstract. Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam, eaque ipsa quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt explicabo. Nemo enim ipsam voluptatem quia voluptas sit aspernatur aut odit aut fugit, sed quia consequuntur magni dolores eos qui ratione voluptatem sequi nesciunt. Neque porro quisquam est, qui dolorem ipsum quia dolor sit amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt ut labore et dolore magnam aliquam quaerat voluptatem.

**Keywords:** keywordd1, keywordd2, keywordd3

## 1 Introduction

The need to build a global communications network in an era when almost nobody had access to it, caused that some protocols weren't suitable for a huge increase on the amount of publicly known users. Internet Protocol Version 4 (IPv4) limits the number of public addresses in such a way that today is scarce [5]. One way to overcome this problem was the development of a mechanism that groups multiple address into a single one, the machine that is assigned that address is then responsible to redirect messages to members of its group through their private addresses, each member of the private network is identified publicly by the same Internet Protocol (IP) address but different port, this technique is also known as Network Address Translation (NAT).

Initially NAT offered an alternative for address exhaustion and a false sensation of better security, asymmetric NAT became a vulgar configuration on the web. As a direct result, problems started to appear, the amount of ports that IP disponibilizes is also small compared to our current needs, worse than that, NAT also difficult end-to-end communication, forcing most of applications that follows this model to be implemented ineffectively.

Applications based on multimedia and file sharing were one of the most strained by NAT. Those kind applications require real time communication in order to achieve the best performance. Session Traversal Utilities for NAT (STUN)

and Traversal Using Relays around NAT (TURN) [6] servers are a possible solution to overpass NAT, although, none of those can establish direct connections on multiple level NATs.

Most of client-server applications aren't affected by NAT when the servers are public, but they're inadequate for real time communication between two private endpoints. Clearly this type of communication requires a more expensive infrastructure and, in most cases, more network usage, leading to a worse quality of service. The requirements of video communication makes this kind of model unsuitable.

On the other hand, TURN uses public servers to redirect traffic between private endpoints, it may use a P2P network relay to find the best peer but, after that, the behavior is much like client-server. Direct communication is only achieved by STUN when NAT is a type *full cone*. [\[reference to NAT types\]](#). Interactive Connectivity Establishment (ICE) uses STUN when it's possible and TURN otherwise.

When connection is established, either in a direct or indirect way (via TURN servers), Web Real-Time Communication (WebRTC) comes to simplify how audio and video are transmitted.

Compared to Skype, WebRTC allows web browser real time communications without installing any additional application or plugin.

## 2 Signaling

Signaling is the most important process for applications to exchange connection information about peers and servers, their capabilities and metadata.

WebRTC doesn't implement signaling, different applications may need different protocols, there is no single answer that fits all problems. Amongst multiple options, signaling can be done by using Session Initiation Protocol (SIP), Extensible Messaging and Presence Protocol (XMPP), WebSockets, Socket.io or by implementing a custom protocol.

WebRTC uses Session Description Protocol (SDP) to define peer connection properties, types of supported media, codecs, protocols used and network information.

One of signaling requisites is bi-directional communication over Hypertext Transfer Protocol (HTTP). HTTP works on a request followed by a server response, by other words, follows a unidirectional communication. Sometimes it's required that some informations are obtained in real time, as we saw, some NAT's don't suport callbacks from servers, one technique to overcome this problem is polling.

Polling consists on sending periodic messages that the server responds immediately with empty content or fresh information. Simple polling wastes network bandwith and energy. Long polling consists on making the server wait until there is fresh information or expiring after some time. Long polling returns answers faster than simple polling. Both with simple polling and long polling, requests are sent with HTTP headers, which are data overkill, specially for small messages.

Comparison of the WebSocket protocol with the traditional method like Polling and HTTP long Polling shows the benefits it offers in terms of latency and network utilization.

With polling, the browser sends HTTP requests at regular intervals and immediately receives a response. This technique was the first attempt for the browser to deliver real-time information. Obviously, it looks like a good solution if the exact interval of message delivery is known, because you can synchronize the client request to occur only when information is available on the server. However, real-time data is often not that predictable, making unnecessary requests inevitable and as a result, many connections are opened and closed needlessly in low-message-rate situations.

With long-polling, the browser sends a request to the server and the server keeps the request open for a set period. If a notification is received within that period, a response containing the message is sent to the client. If a notification is not received within the set time period, the server sends a response to terminate the open request. It is important to understand, however, that when you have a high message volume, long-polling does not provide any substantial performance improvements over traditional polling. Here with long polling server doesn't send empty response it holds the request until the message is available or timeout expires.

The WebSocket protocol provides full-duplex, bidirectional communication channel that operates through a single socket over the web and can help build scalable real time web application. Once the connection is upgraded to WebSocket, messages can flow from the server to the browser the moment they arrive.

[BOSH/COMET]

[SIP]

SIP can be used as a signaling method, it allows web browsers to have audio, video and Short Message Service (SMS) capabilities like mobile phones. For instance, it's possible to interoperate web communications with SIP, mobile and fixed phones.

SIP is used in Voice Over IP (VoIP) applications due to its compatibility with Public Switched Telephone Network (PSTN). Service providers are disponibilizing access to their SIP infrastructures through WebSockets. Frameworks like jsSIP, QoffeeSIP and sipML5 are used on client side to parse and encode SIP messages, making SIP accessible to web based applications universe.

[XMPP]

XMPP's bi-directional communication is achieved through Bidirectional-streams Over Synchronous HTTP (BOSH), which basically consists on long polling.

### 3 Hypermedia

Since the early days of video technology, one of the problems that raised with it consisted of how to add more information onto it without generating multiple versions. Some implementations like [4] added hypermedia information to empty

space present on Moving Picture Experts Group (MPEG) frames in order to provide interactive television, the MPEG coder and decoder were changed in order to handle hypermedia content.

The need to translate movies, raised the problem whether it is appropriate to change the original video or audio. For example subtitles should be an entity independent from the video, in order to be personalized or replaced easily.

Amongst multiple formats for subtitles, Synchronized Accessible Media Interchange (SAMI), and SubRip Text (SRT) are used by video players that support them. Although those formats have styling available, they are quite limited to text.

Hypervideo is a kind of video that contains links to any kind of hypermedia, including links to skip part of it. An example of hypermedia application could be a search engine over hypermedia content, like subtitles, in order to jump to a specific point in time. HyperCafe [7] was an experimental project to expose hypervideo concepts that consisted on an interactive film by switching between conversations inside a cafe.

Detail-on-demand is a subset of hypervideo that allow us to obtain additional information about something that appears along the video, like obtaining information about a painting that appears in a particular segment. Hyper-Hitchcock[8] is an editor and player of detail-on-demand video.

In order to navigate through a dynamic video, one must be aware of time synchronization and the multiple time flows, it's important that all time, causality and behavior rules are well defined.

HyVAL[10] is an eXtensible Markup Language (XML) based language that was proposed for modeling composition, synchronization and interaction of video, the structure of HyVAL is derived from traditional video, which divides video into segments, scenes, shots and frames hierarchically. This approach is quite limitative if we want to apply hypervideo concepts to videos that don't follow this structure.

Synchronized Multimedia Integration Language (SMIL)[1] was introduced to describe temporal behavior of multimedia, for instance, it could be used to overlay subtitles on films. With SMIL it's possible to synchronize multiple sections of video, either in parallel or in sequence, reproduce a different audio track, overlay user interface elements with hyperlinks, amongst multiple other functionalities.

In order to create a multimedia rich hypercall, SMIL fits our goals, but it lacks on browser compatibility. Ambulant [2] was one of the SMIL players that were developed for browsers, although this player implements most of SMIL 3.0 [9] specifications, it needs to be installed on browsers as a plugin.

SmilingWeb [3] attempts to implement SMIL 3.0 with javascript and jQuery, which doesn't need to be installed and shouldn't have incompatibility issues. But SmilingWeb isn't fully implemented yet and their scheduler engine loads the SMIL file only once, which could raise problems when leading with SMIL changes in real time.

Scalable Vector Graphics (SVG) is a format that incorporates the animation feature of SMIL. Currently SVG allow us to add movement and animate at-

tributes of elements. When embedded on HyperText Markup Language (HTML), it allows dynamic changes to inner content in real time, besides that, it also allows to call javascript functions on events such as animation end, mouse over and mouse click.

Video functionalities are already embedded in HTML5, like SVG it is also possible to bind javascript functions for different kinds of events over videos.

By using technologies that relies only on web standards, like Cascading Style Sheets (CSS), HTML5, Javascript and SVG, it's possible to raise communications to a new level. For example, with Application Programming Interface (API)s like WebGL, it is now possible to manipulate a three dimensional environment in the context of a hypercall. Another example would be a collaborative spreadsheet using WebRTC. With this, hypercalls are not limited to only audio, image, text and video, but also interaction with complex graphical user interfaces that changes over time.

In this project our goal is to enrich hypercalls with no limits, every user should be free to choose how it wants to be contacted and it wants to share its contents.

In order to give users a personalized communication channel, each user must have a personal web page where its available plugins could be downloaded from other peers, after that they can talk in the same language whatever it is.

Collaboration is the basis for joint value creation. With increasing complexity of tasks to conduct in business, science, and administration, efficient team collaboration has become a crucial success factor.

Software tools for collaboration typically support the exchange of data and centralized storage of information, for instance in shared workspaces. Only in recent years, technology became available allowing real-time collaboration via the web-browser. This enables team partners to edit a document concurrently and let others see changes instantly.

[Local Storage]

[Video Recording]

[Video Playback - Past and Present]

<b>3.1</b>	<b>Context</b>
<b>3.2</b>	<b>Problem Statement / Solution Statement</b>
<b>3.3</b>	<b>Thesis Contributions</b>
<b>3.4</b>	<b>Article Structure</b>
<b>3.5</b>	<b>Methodology</b>
<b>3.6</b>	<b>Planned Schedule</b>
<b>4</b>	<b>Conclusions</b>
<b>4.1</b>	<b>Summary</b>
<b>5</b>	<b>Conclusions</b>

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