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SA8T2 Internal Deliverable
WebRTC in UC - an Architecture Overview

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Abstract
This report documents an assessment of the impact of WebRTC on Unified Communication in R&E. The technology scout was conducted by the Service Activity 8 (SA8, Real Time Communication and Media), Task 2 (WebRTC) team as part of the GN4-1 project. This report should, as such, be read in context of the related work produced by GN4-1 SA8-T2.

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1 Introduction

1.1 About this document

This report documents an assessment of the impact of WebRTC on Unified Communication in R&E.

The technology scout was undertaken as part of the Geant4 Phase 1 project by the WebRTC Task 2 (T2); one of three tasks of the Real Time Communication and Media activity (SA8). This report should, as such, be read in context of the related work produced by GN4-1 SA8-T2.

The WebRTC task ran from 1 May 2015 to 30 April 2016.

1.1.1 Target audience

This document targets technical management and specialists, in particular those working in the fields of real time communications, eLearning and eResearch.

1.1.2 About the author(s)

Stefan Otto (UNINETT) had the lead on this tech scout. Jan Meijer (UNINETT) and Simon Skrødal (UNINETT) were the document editors.

1.2 Background

Unified Communication (UC) is sufficiently mature to replace telephone systems at R&E institutions. Solutions from Microsoft and Cisco, in particular, are offered at very favourable conditions to the R&E community, complemented with cloud delivery models that lower deployment costs significantly.

Different national communities are at different points in this transition. While the Norwegian NREN (UNINETT) seems to be at one end of the spectrum, with a shared community service for Microsoft Skype for Business, institutions in other countries are just now starting to discuss the transition to UC. The benefits of real-time communication, tightly integrated with features such as email and calendaring, are too valuable to the core business processes of R&E to ignore them.

Extrapolating the trends in this field leads to the conclusion that in a few years, perhaps five, most European R&E institutions will have deployed a UC solution to all of their end users. These UC solutions will likely absorb current solutions for videoconferencing.

1.3 Rationale

If we assume that UC solutions will be present at most institutions in European R&E some years from now, they will represent the legacy technology WebRTC solutions are most likely to meet. At the moment, both UC and WebRTC solutions are being developed and deployed. This makes it very timely to investigate how the two play together and whether there are smart moves that R&E institutions should make now to support a smooth and effective RTC infrastructure in the near future.

1.4 Tech scout objectives and methodology

The objective for this tech scout was to assess the impact of WebRTC on Unified Communication in R&E, as well as to assess the consequences for video conferencing rooms.

The work builds on the practical experience of and national observations made by UNINETTs real time communication team, responsible for providing a national SIP-based real time communication infrastructure and a shared national Unified Communication solution based on Microsoft Skype for Business to the Norwegian R&E community.

2 WebRTC & UC

2.1 WebRTC in Unified Communication

Unified Communication, which has been around for a long time, promises to unify all important kinds of electronic communication in a convenient way. This includes real-time communication such as phone and video calls, video-conferences and presence as well as asynchronous communication such as email and chat. With WebRTC entering the stage, many predict that it will be added to UC and improve integration and tear down the barriers preventing UC in the web browser. Other predictions suggest WebRTC will change the whole UC-marked in a disruptive way and destroy existing business models.

2.2 UC fails when it comes to collaboration

When people work together (creating documents, analysing research data, looking at design diagrams, learning and teaching together) they need to communicate and work at the same time as well as asynchronously. Research and education is a global undertaking with people (staff, researchers, students) from many independent organisations working together across organisational and national boundaries in patterns that cannot be pre-determined or predicted. When it comes to communication across such borders, UC fails.

2.3 Can WebRTC solve communication for collaboration?

The formation of communication islands which cannot communicate with each other, besides the traditional channels (phone and email), is an annoying and common obstacle in collaboration. The question is therefore: *can this problem be solved with WebRTC enabled unified communication*?

As it turns out, although WebRTC breaks down several barriers by enabling plugin-less communication in the web-browser, it does not solve the problem — it makes it worse! While it makes it easier to enter the communication islands, it becomes more difficult to go the other way around. In other words, it is easy to invite someone to your personal meeting room with audio, video and chat, but afterwards, how can you call this person back? This is one-way communication, and you need an out of band communication channel to agree to a new session; this is not effective communication. Thus, the original problem of federated contacts and presence remains. WebRTC does, however, enable collaboration platforms to integrate real-time communication on their

platforms in a much better way than UC. Not only does this appliy to collaboration platforms, but also to messaging platforms. This is why a major part of communication will take place outside traditional UC channels. Dean Bubley from Disruptive Analysis calls this "Dis-Unified Communications";

http://disruptivewireless.blogspot.com.au/2015/01/dis-unified-communications-webrtc.html.

Dis-Unified Communications will be increasingly important because it is better integrated and more effective. This is already evident in the current market; Facebook, Google, Snapchat and many more integrate real-time audio/video calls inside their products — mostly based on WebRTC technology. It is a lot easier to implement and, to the user, it works out of the box without hurdles or the need of an additional communication-client. The communication is "in context" and exactly there where you need it. An obvious drawback, though, is that the communication is dis-unified.

2.4 Focus changing for UC-platforms

In result, WebRTC technology catalysts the rise of new types of communication islands that compete with UC. WebRTC will open up UC platforms for all outside users by plugin-less real-time communication accessible in the web browser. A logical conclusion for UC-platforms is to change the focus from unified communication to integrate on other platforms and glue it all together to provide a basic communication client. The main role for such a communication client would be to keep track of all the dis-unified communications, manage your communication channels and buddy lists and provide searching on a minimalistic basis. The main functionality of a UC-client is thus reduced to messaging and presence only. This is what enterprise messaging platforms, such as Slack, do. As Tsahi Levent-Levi points out in his blog-article "*Why enterprise messaging will gobble up Unified Communications*", enterprise messaging platforms could be the new way to communicate for businesses — especially when it comes to collaboration (https://bloggeek.me/enterprise-messaging-gobble-unified-communications/). It is easier to agree on a (free) third party neutral collaboration platform and embed real-time communication, such as appear.in, inside of it. Should the project grow, you can later decide to go for a paid pricing model with more features, such as integrated real-time communication or video conferencing.

The real challenge for UC-platforms is working federation of presence and messaging across borders. This is, however, an already existing problem that has yet to be solved (likely due to reason of commercial interests). Only if UC-vendors resolve this issue can they survive in the changing market.

2.5 Video conferencing

2.5.1 Physical equipment and room systems

Good and integrated video conferencing is a special showpiece for UC, where high investments have been made. According to one market analyst, Infonetics, the endpoint and tele-presence market is growing (http://www.infonetics.com/pr/2016/1Q16-Enterprise-Telepresence-Highlights.asp) and Global Industry Analysts Inc. informs us that future predictions are also optimistic

http://www.slideshare.net/GlobalIndustryAnalystsInc/video-conferencing-systems-a-global-strategic-business-report).

Driving factors include the need to reduce travel costs, as well as to increase productivity in a collaboration-driven business world. Another supporting factor is the rapidly growing number of WebRTC-enabled endpoints (desktops, smartphones, tablets, BYOD). With new cloud and software-based solutions, it is now possible to deploy interoperable, big, flexible and cost effective video conferencing.

2.5.2 Virtual meeting room systems

The concept of the virtual meeting room as a user-customisable online collaboration space that interconnect several different video systems, including WebRTC browsers, shifts video conferencing from being a management tool to a tool for everyone. Collaboration no longer depends on expensive equipment or policies for installation of additional software. Vendors for such systems include Acano (https://www.acano.com/) and Pexip (http://www.pexip.com/).

2.5.3 Legacy equipment

There are many reasons to keep legacy video equipment, and they have a number of advantages when compared to WebRTC endpoints:

- Maturity (standard-based functional technology)
- Quality (high quality cameras, microphones and speakers)
- Already existing high investment installations (room systems, hardware MCUs)
- Existing infrastructure (eduConf, workflows, qualified staff)

There is, in other words, no reason to discontinue using them. By linking them with virtual meeting room systems, such as Acano and Pexip, as well as utilising synergies with WebRTC integrations, both worlds may coexist and be used at the same time. The future will tell if legacy equipment will still be reasonable to use.

2.5.4 Going a step further

WebRTC also powers new platforms that do not care about legacy equipment and classical video conferencing at all. These services focus solely on new possibilities of browser-based real-time communication and integration. Platforms such as Tokbox (https://tokbox.com/), Lynckia (http://lynckia.com/) and mashme.tv (https://www.mashme.tv/) have full control over their clients, and can build entirely different solutions where video conferencing is only one of many use cases. Disregarding legacy video system gives way to systems that can scale up, without having to re-encode video streams, by using Selective Forwarding Units (SFU) that require significantly less CPU than MCUs. This allows great flexibility, e.g. to allow dynamically adding/removing several video streams, or changing the type of a video meeting from many2many to few2many or one2many or to not a video meeting at all; the use cases for these kinds of platforms are limitless. An example from an e-learning context could be to extend online streaming of lectures to allow remote guest presenters, or promote questions from lecture theatres by chat (and upgrade individuals to audio/video), embed surveys, a Kahoot (https://getkahoot.com/) or any other content.

2.5.5 Video conferencing integrated into other platforms

In-context real-time communication is important — perhaps more so for video conferencing. In a classical document writing collaboration case, e.g. with Google Docs or Etherpad, it makes sense to add audio and video communication inside the writing service. Since there could be more than 5 participants, a multi-party video conferencing function is needed, and it should be in-context. Small live video windows above each writing cursor could be a good solution in this scenario. Using a legacy video system to achieve this would realistically be completely unworkable, technical nearly impossible to implement and out of context at all. It is difficult to say if integrating video conferencing functions from UC-platforms to collaboration platforms is a future model. Technically it will work, but it is more likely that collaboration platforms vendors integrate a real time functionality that is not linked to UC-platforms.

2.6 How does all this apply to UC in R&E area?

In our R&E area there are different worlds/islands that do not necessarily play well together. It is not possible to create one UC solution for all R&E institutions in a country/EU/global. All institutions in EU will at some time in the near future replace their internal telephone solutions with UC, likely leading to a handful of different UC solutions in use. In European R&E this means that we will be able to talk to each other with a varying degree of success.

We have a very heterogeneous environment in R&E; different institutions and NRENs choose different solutions and this is simply a reality we have to deal with. Even in Norway, where a national Skype for Business in the cloud recently appeared for the R&E sector, it is not clear whether all institutions will be subscribing to this service rather than using their own premise Skype for Business solution.

There are a number of video room systems around, some linked together with eduConf. However, they all share significant interoperability problems, they are not accessible by the mass of users and consequently integration with UC-platforms is not done.

A number of non-UC tools do a better job in their specific area, including the communication part, e.g. Google Docs for working on shared documents with Google Hangouts integration, Etherpad with WebRTC integration and Slack in messaging with appear.in integration. All these tools are web based!

Turning things around — solving the “original problem” with WebRTC; WebRTC is NOT the solution to all problems. It will NOT deliver a single tool, but rather provide an open standards-based technology to allow two points to communicate with each other. Services like Google Hangouts add multi-part conferencing functionality.

While there will not be one Unified Communication platform in our R&E community, our Federated Identity platform (eduGAIN) could be utilised in combination with WebRTC. A simple WebRTC Media API to provide basic WebRTC real-time services, combined with eduGAIN integration, could be used to develop:

a) a simple communication client

b) a video-conferencing service

c) examples how to integrate these services into your own web-application

Based on these components, an infrastructure could be established on which the R&E community can develop and serve new solutions that are somewhat unified (i.e. the backend has access to user data and can provide communication across services). The basic communication client could keep track of communication metadata from any service running on the same infrastructure and provide presence and messaging across.

2.6.1 Presence and federation

This is not necessarily a WebRTC problem, or a problem solved by WebRTC, but it should be taken care of. It is unlikely that we will have a unified presence in the near future. Presence will be scattered on various islands (e.g. Facebook, Google, WhatsApp, Snapchat, UC solutions) and to interconnect these will be challenging. We have to focus in which direction the market is moving and evaluate if it makes sense to support interconnecting platforms (using e.g. Matrix, http://www.matrix.org/, which try to solve this problem).

By linking eduGAIN in the Media API, it is possible to build an R&E internal federation and presence that could be used by all platforms that leverage the Media API. Linking in external ID-providers, such as Facebook and Google, and using their APIs for messaging and presence could solve the federation and presence problems. Other guest users could be integrated by automated email backed logins and use the web based communication client for presence and messaging.

3 Conclusions

If you look at the world through UC glasses, WebRTC is just another additional and useful feature. It will enable UC vendors to create native web based clients with full functionality which are easy to use, easy to deploy and any users may be invited by just sending a link.

Looking at the bigger picture, WebRTC has the potential to disrupt the UC market. Users move to the communication tools that best get their jobs done; smooth contextual communication in (collaborative) services trumps talking through a dedicated UC solution. This is an undesirable situation, as you lose the unified aspect of communication. Users no longer have control over where and when they can be reached. One would expect UC vendors to act on this.

Opportunities for UC are in the propagation of presence information to the contextual communication implementations, providing a "single point of entry" for a user's presence information and for being the single integration point with any other type of communication infrastructure or third party value-adding solution, e.g. recording, buddy lists, etc.

UC solutions are often silos, an approach that creates suboptimal results when researchers and educators want to communicate across organisational boundaries. This situation is made worse when considering contextual communication.

To address this, a shared Media API solution for European R&E can be developed, as a meeting point for presence and catalogue (buddy list) information from various UC solutions deployed in the R&E community, services with contextual communication features and other infrastructures like the R&E authentication infrastructure via eduGAIN.

To ensure the upcoming change in distance-bridging services and solutions also can be used in physical rooms, the investment budget for distance-bridging technology in physical meeting rooms needs to be shifted from appliances dedicated to one solution to generic equipment supporting any solution based on WebRTC. Generic hardware that supports a web browser is a good place to start.

Appendix A Unified Communication technology

A.1 Typical components of UC

Presence:

Knowing whether a person is available or not is important to make the right choice for how you want to communicate with that person: chat, audio call, video call etc. This usually integrates with a user's calendar information.

Federation:

Federation in UC allows for the exchange of presence information between different instances UC platforms, so across administrative domains. This usually only works between instances of the same vendor and needs to be enabled at each location.

Instant messaging:

In UC, instant messaging is real time chat functionality. Usually it is client or server based, persistent and searchable. The functionality is typically integrated in the UC-client. There are instant messaging platforms providing Unified Messaging: the integration of different types of messages (fax, email, SMS, voicemail, etc.) into one unified interface. Examples of this are fax2message integration, calling your voice box with your UC-client and getting SMS notification for incoming messages in your Inbox when offline, etc.

Conferencing (audio and video):

Video conferencing is a real-time video and audio session between at least 2 participants. It is a fundamental functionality of today's UC-platforms and typically consists of the client or user interface, central components for signalling, registering, control and media. Video-conferencing between more than 2 point is realised by Multipoint Control Units which receive all video-streams and mix them together before broadcasting those multiplexed signals back to all participants. Most platforms try to avoid unnecessary central load by connecting one2one calls directly together, forwarding streams selectively if bandwidth is good enough and clients understands the same media codecs.

Collaboration:

Some UC-platforms integrate collaboration tools with their communication tools. An example ofthis is Microsoft's Office 365 platform.

Common big UC Vendors:

Cisco, Polycom, Microsoft, Avaya, Alcatel-Lucent, IBM, Oracle.

A.2 Actual state: UC in R&E

There are several NRENs that provide a national SIP network for R&E. They typically provide a central SIP trunk for routing calls to and from the PSTN in order to reduce cost. They register telephone numbers in DNS via NRENUM as an alternative to the dying ENUM concept and enable world-wide cost-free IP calls in the R&E sector.

In addition to the GÉANT eduConf service there are efforts to establish national registering of video equipment into DNS and protect them by a central SIP-proxy.