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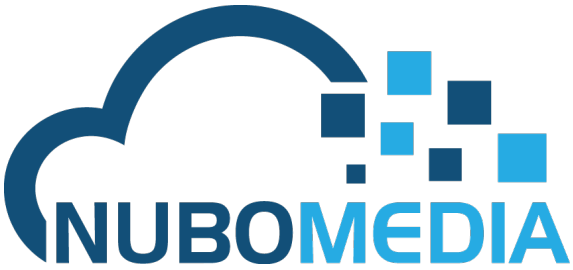


# D6.7: NUBOMEDIA Demonstrators Market Acceptance Report

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| **Project acronym:** | NUBOMEDIA |
| **Project title:** | NUBOMEDIA: an elastic Platform as a Service (PaaS) cloud for interactive social multimedia |
| **Project duration:** | 2014-02-01 to 2017-01-31 |
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**FP7 ICT-2013.1.6. Connected and Social Media**

**DISCLAIMER**

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| 0.1 | 15/11/2016 | Teo Redondo / Paula Collazos | Structure of the document. |
| 1.0 | 30/01/2017 | Boni García | Integration of contributions of industrial partners (LiveU, Telecom Italia, NaevaTec) |

# Table of contents

## Executive summary

The vision and mission of NUBOMEDIA has been validated through the creation of several professional vertical demonstrators. The planned demonstrators at the beginning of the project were the following:

- e-Health advanced communication system (lead by **NAEVATEC**)
- TV Broadcasting Demonstrator (lead by **LIVEU**)
- Computer Vision Enhanced Phone Calls (lead by **TI**)
- Security and video surveillance demonstrator (lead by **VTOOLS**)
- Social horizontal demonstrator (lead by **ZED**)

As specified in *D1.6: Project Review 3 (Report for the period 02/2016 to 01/2017)*, due to different bankruptcy problems, the partners ZED and VTOOLS terminated their participation in the project on Nov. 30th and Sept. 30th 2016 respectively. As a result, ZED and VTOOLS' demonstrators were removed from WP6.

The current deliverable, D6.7, is aimed to provide the evidences showing the acceptance of the demonstrators by users and markets. In the case of demonstrators working with real users, it will specify different metrics of acceptance as well as received comments. A brief description of each demonstrator is the following:

- e-Health Communications Demonstrator is an application, available on Android, iOS and WWW, which is focused on e-Health communication, providing services and capabilities such as multimedia instant messaging or real-time multimedia communications between doctors and patients.
- TV Broadcasting Demonstrator provides an application called NewsRoom, which is a WebRTC-based application with a Room management, user registry and authentication, streaming media to LiveU cloud services.
- Computer Vision Enhanced Phone Calls is a demonstrator which uses NUBOMEDIA outcomes in order to build a novel communication paradigm, in the middle between normal communication and surveillance/control.

In order to validate the objectives and market feedback for each demonstrator, several metrics has been collected:

- Metric 1.3 (capability for adapting to different market segments and scenarios). Due to the fact that only 3 demonstrators were finally completed, this metric is unsuccessful. The motivation of this failure is the removal of 2 industrial partners from the project, as described before.
- Metric 3.1 (functional generalized multimedia): The validation of this metric requires creating an application involving generalized multimedia flows (i.e. flows containing audio + video + multisensory) as well as the recording of that flow into the media repository and its latter rendering using AR capabilities. As depicted in the body of this document, this metric is reasonably successful since 1 demonstrator includes this capability.
- Metric 5.1 (functional novel social groups schemes of communication). This objective of this metric is to provide exchanges among complex social structures in patterns such as nested groups, group-to-group, group-to-person, or groups with different roles. In the light of the results, we conclude that this metric is fully successful since 2 demonstrators use this capability.

# 1 Introduction

## 1.1 e-Health Communications Demonstrator

NaevaTec has achieved along the years a great proficiency in RTC communications. Becoming in the latest years in a worldwide reference in WebRTC technology. NaevaTec and the expertise acquired have played a key role in validating and exploding NUBOMEDIA PaaS an its RTC capabilities, with an identified real use-case scenario focused on **professional unified communication application.** The hypothesis established at the beginning of this project served as starting point for this demonstrator. Along this document the evolvement of the project, results of the hypothesis established and the requested features will be analyzed.

## 1.2 TV Broadcasting Demonstrator

The TVBC – TV Broadcasting Connector developed by LiveU and its demonstration application we call NewsRoom, are the subject of the demonstration of the use case. At LiveU, we are looking for new and novel ways to engage consumers in generating content, and constantly looking to enrich the cover, the richness and the liveness of contents we can bring to our main customers the broadcasters. The Newsroom application is designed to engage the consumers in the news production, our demonstration is not a standalone, and it used the TVBC to connect the contributions streams coming from the public with the back-end systems that LiveU operates and resides on the cloud or on the customer's premises. Using the TVBC shall be possible to application and service providers that engage with LiveU, the Connector exposes standard WebRTC for contributions from clients and proprietary LiveU protocols for signaling and traffic with our backend, the NewsRoom application, allows producers to create public rooms, allows users to join them, and allow producer to redirect a user into a private room, avoiding the noisiness of the public rooms, provide the user with instructions prior to the live broadcast. The newsroom also will in the next version record the content and contributions, and will allow the producer to stream a near live stream to LiveU backend.

## 1.3 Computer Vision Enhanced Phone Calls

In the last few years some Telco Operators have been scouting for new opportunities for deploying Value Added Services, exploiting the improved bandwidth capabilities, optical fiber connection and smarter home gateways which are capable of managing smart environments. One of the most promising markets is the Smart Home, where forecasts show a constant growth till 2020 and over.

In general, Smart Home applications tend to be perceived as a good way to perform customer retention, rather than a way to create the need for more bandwidth, being the data exchange among sensors and actuators quite low, but this is not completely true. There is a number of Smart Home Video-based services, linked to cloud which can be very useful for the final user and which of course require a reasonable amount of bandwidth, both in and outbound.

In this light Telecom Italia is aiming to identify scenarios in which typical Smart Home Applications could compound the Video experience towards novel fruition models where computer vision capabilities can provide new real time intelligent feedbacks based on the real-time analysis of domestic video streams (e.g. face/body/movement recognition, object tracking).

The Computer Vision Enhanced Phone Calls has the ambition of becoming one of the most important parts of Telecom Italia Smart Home Services. As we have stated and recalled in the Business Plan/Exploitation deliverable, Smart Environments are at the moment one of the most promising market sectors, with forecast growing at least until year 2020.

As an operator, Telecom Italia has the objective to sell connectivity and to increase its number of subscribers, the quality of the services offered and the overall customer satisfaction. In these terms, it appears clear that it wouldn't be possible to set direct economic objectives related to the specific demonstrator, both because it is part of a suite, and because it is a Value-added Service. Even setting a target in terms of increased number of customers or customer retained could be interesting but difficult to relate to the demonstrator

# 2 Market validation objectives of the demonstrator

## 2.1 e-Health Communications Demonstrator

NaevaTec aim is to identify a real use-case scenario exploding NUBOMEDIA PaaS, focused on **professional unified communication application.** This service joins all communication needs that users might have, providing the following services and capabilities:

- **Multimedia instant messaging** with push notification capabilities.
- **Real-time multimedia communications**

Given that users may have different accounts associated to different kinds of clients, the services are available through the following platforms:

- Smartphone platforms (Android and iOS)
- WWW interfaces (HTML5 compliant)

These services are not intended to satisfy generic requirements of horizontal social communications. Professional users are the target audience, who have specific requirements, addressing in this case of e-health, a specific vertical market segment.

The objectives and functionality of this demonstrator hava been led by a list of hypothesis and the information captured from stakeholders, through interviews with health professionals from Hospital Niño Jesús de Madrid. Hospital Niño Jesús is the most important children hospital in the Madrid region.

The hypotheses established by NaevaTec in relation to the professional unified communication service developed as NUBOMEDIA demonstrator are the followings:

- *Hypothesis 1: Health professionals could improve their efficiency and quality of service by using IM and RTC services for doctor-to-doctor communications and patient-to-doctor communication.*

- *Hypothesis 2: Health professionals do not currently find such solutions in the market at affordable prices and complying with the functional, non-functional and legal requirements.*
- *Hypothesis 3: Complex group communications with different profiles, roles and permissions are needed for satisfying appropriate health practices.*
- *Hypothesis 4: Computer vision and other deep media analyses techniques can be interesting for helping with the diagnoses of health problems.*
- *Hypothesis 5: Augmented reality features have the capability of making communications more efficient.*
- *Hypothesis 6: No specific assumptions are taken in relation to scalability. However, an open question is issued to health professionals on this respect. We hypothesize that a very large population of users could be interested in the application.*

## 2.2 TV Broadcasting Demonstrator

LiveU is a leading systems and service provider supporting live video gathering from anywhere and anytime mainly for the purpose of news reporting. Our own customers and in general TV newsroom budgets have been declining for many broadcasters forcing the industry to consider alternative supply models. Broadcasters – in particular 24-hour news channels – are constantly searching for new and differentiated content specific to the needs and tastes of their audiences. As part of our efforts and roadmap to enhance broadcasters content freshness and scale as well as reduce the operational costs we have defined in here use cases shown in the following figure that will change the existing paradigm of how news are been gathered and enabling novel solutions for the engagement of new content coming from freelancer and consumers directly to TV broadcasters' news rooms. In order to do so, and meet with the required scale and fast development we are developing our distribution path and technologies within NUBOMEDIA cloud.

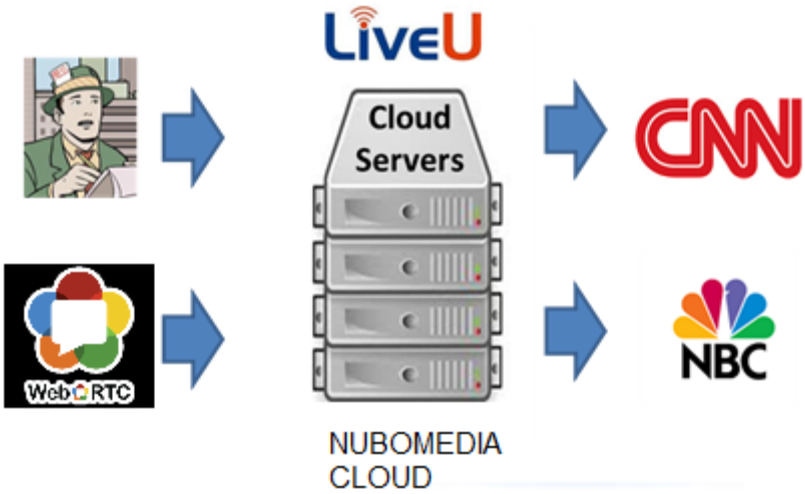


Figure 1 - Engaging Freelancers and Consumers with Broadcasters

LiveU's future offering will be enhanced by NUBOMEDIA infrastructures and with a clear path for exploitation of our work within the project to make new sources of revenues. Our main aim is to enhance the richness and liveness of available content to the broadcasters as well as to the end users, by allowing broader content/live and stored feeds generation models not available today. One important aspect in our future offering will be moving from the old paradigm of Broadcasters creating content for

themselves (i.e. a reporter working for CNN creating content to CNN only) into broader service models as follows:

- Consumers → Broadcasters (main use case) "NewsRoom": this scenario goal is to connect the broadcasters with the consumers in order to increase further the richness and freshness of the content, when an unplanned event with public interest occur, consumers are the first to be there (Service name is "NewsRoom" and in some forms "BeFirst"), LiveU are now developing technologies jointly in NUBOMEDIA and with FP7 COMPEIT project to allow any user using their mobile browser and Web RTC streaming to send video to broadcasters through LiveU cloud services deployed in NUBOMEDIA cloud, this scenario could be seen as a broadened of the first case shifting from professional reporters to armature consumers while supporting of NUBOMEDIA main goals of using open API's and WebRTC while reaching the mass market of consumers and through technology collaboration with brother project.

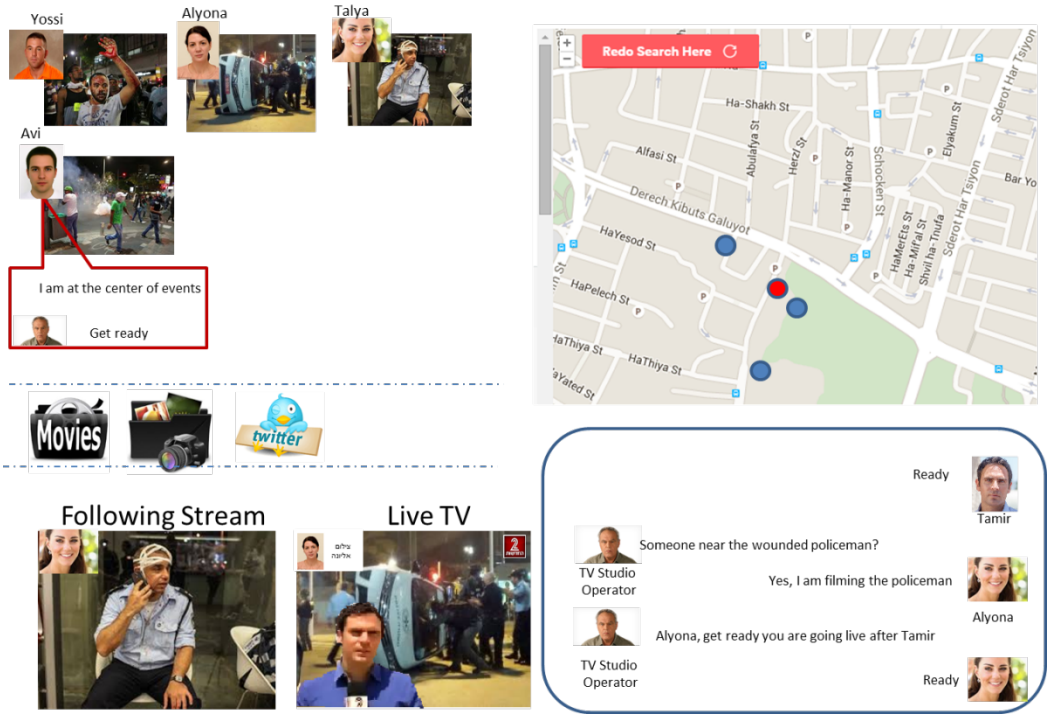


Figure 2 - LiveU's Be First Service

## 2.3 Computer Vision Enhanced Phone Calls

A project like NUBOMEDIA covers a time span of years, which is a relevant time for companies, which tend to change a lot their goals, their strategies and their priorities.

As explained in other deliverables, differently from other partners, we decided to change our demonstrator on track, in order to have it more in line with the company's objective. During the project duration, lots of thing changed in Telecom Italia. We had three different CEOs with three different strategies and subsequently, we decided to change our demonstrator, so to increase the chance of finding internal support, meaning easier exploitation of project results.

At the time of writing WP2 deliverables, whose "hypotheses" are reported here from other partners, our company had a strong focus on Video Services, User Generated

Content and Social Networks, but such focus got lost with the new management which decided to act more as a reseller from the point of view of Video Content, not developing any more specific application on top of this, while Value added services related to smart environments had growing interests inside the company.

For this reason, differently from other partners, we won't report here any of the hypotheses discussed in deliverable D2.1.2, but we will instead report what we stated before we start working on the demonstrator, even if reported here for the first time.

In making hypotheses to validate, we should keep in mind what the main market objectives (which indeed cannot be directly validated at the stage) are: number and quality of users.

For Years Telecom Italia customers, have been paying a monthly fixed fee, with a price set together with the national telecommunication authority for just having a phone line installed. Recently Telecom Italia has decided for commercial reasons to offer a Fixed DSL line access to all of its customers for the same monthly fee (with the exception just of a small number of users in "digital divide conditions", due to geographic condition making impossible to deliver quality services).

At the time of writing, Telecom Italia reports a number of fixed line subscriber of about 11 million. A consistent percentage of these users are not aware of the DSL fixed line which is offered with their fee and they pay the monthly fee just for phone calls. Most of these users are elderly people. The impossibility to exploit completely the services offered by our company is indeed a good reason for these users to switch to another telecommunication provider, not being TI's strategy based on price.

Indeed, the first objective can then be to use VAS, such as the assisted-automatic phone call offered by this demonstrator to activate data-lines where they are still inactive**.** Translating this into something more measurable, we tried to set up some new hypotheses, the first one is to get a "general" approval for the service by those users without a data-connection enabled, while the second and third are more specific: the use case of a mid-age child left alone for a while setting up a communication in an automatic and simple way and a "low-level" security service.

- *Hypothesis 1: The service shall be perceived as useful by customers holding fixed lines without data-connection enabled.*
- *Hypothesis 2: The service shall be perceived helpful for setting up communication easily between a parent and a son left alone for a short while.*
- *Hypothesis 3: The service could work as a "low-level" security monitor.*

Beside this, the Smart Home Service Suite which will be offered by Telecom Italia will for sure be a modular offer with a set of kit/services to enable/disable basing on the user needs. This is important since as we stated in our business plan we also perceive value in get our customer used to multimedia services, exploiting uplink capabilities of our lines and hopefully pushing to fiber upgrades. So, in order to have clear links to other commercial solution, we envision two more hypotheses

- *Hypothesis 4: The service should work both as part of a "modular" solution: a module to enable/disable, or "freestanding"*

The requirements proposed clearly shows that we want the market to accept this solution as something working potentially in different contexts and ways, both from an hardware and software/service point of view

# 3 Market feedback in relation to the demonstrator

## 3.1 e-Health Communications Demonstrator

NaevaTec e-Health Communications Demonstrator has been in used by pediatric palliative care unit at Hospital Niño Jesús de Madrid and intensive care unit at Hospital Niño Jesús de Madrid. Junta de Aragon has shown interest in using this demonstrator for the pediatric palliative care units of that region, where a couple of meetings has been held. Along this section the continuous feedback received related to the demonstrator and the hypothesis established, will be detailed.

- *Hypothesis 1: Health professionals could improve their efficiency and quality of service by using IM and RTC services for doctor-to-doctor communications and patient-to-doctor communication.*

Thanks to the NUBOMEDIA demonstrator, we have found this hypothesis to be true. An informal evaluation estimated a 10% increase in the productivity of the health professionals using the demonstrator with a 20% decrease in the number of required visits to remote patients (i.e. travels of health professionals to patient's homes).

The details of this validation are the following:

- IM and RTC services are already used by many health professionals but with no standardized procedures. In particular, IM services based on smartphones are a very popular communication tool for doctor-to-doctor communications both following one-to-one schemes and following group communication schemes. In general, these communications have the objective of getting additional opinions in relation to complex cases or in contacting specialists in relation to problems involving different medical disciplines. A relevant lack in current solutions is the lack of privacy guarantees satisfying legislation on data protection.
- RTC services are rarer, most hospitals have video-conferencing applications but they are not widely used. This is probably due to the lack of mobility of the tools (they often require a PC for establishing them) and to their heterogeneity (there is not a universal application widely accepted by users and most users don't have the ability to install and use the available tools). In relation to RTC, clearly the most extended service is the phone system, which is the most common mechanism for patient-to-doctor communications given their universality. Nevertheless, phone communications have a very limited capability for gathering complex information from patients, who usually cannot describe the appropriate details with the appropriate language when problems emerge.

As one sentence summary, the discussion reinforces the hypothesis showing that multimedia IM and RTC is valuable for doctors and patients as long as services are universal (can work with independence of the platform), mobile (do not require patients

or doctors to be in front of a PC), private, secure and simple to use (do not require complex understanding from users

From the hypothesis, answers and feedback from the doctors, the following developments took place from NaevaTec:

- One iOS and Android application were implemented. Other mobile operating systems were discarded due to their low penetration in the population.

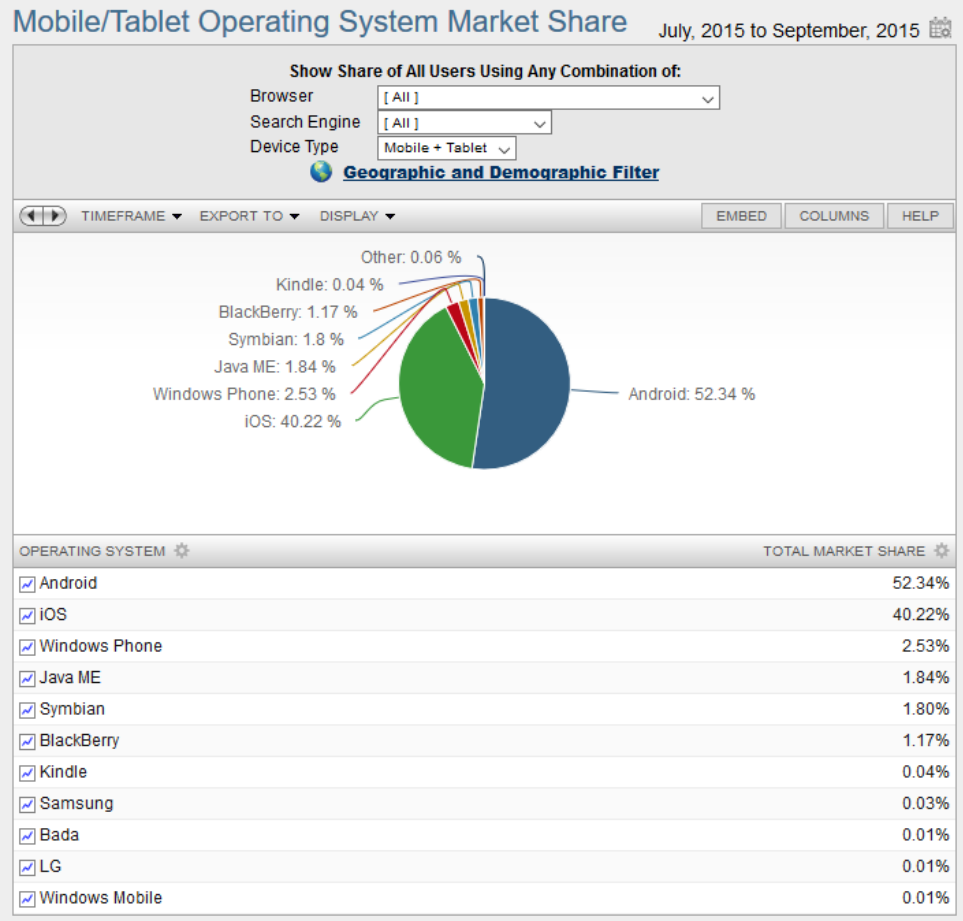


**Figure 3 - Mobile/Tablet Operating System Market Share in third quarter 2015**
**https://www.netmarketshare.com/operating-system-market-share.aspx?qprid=8&qpcustomd=1**

- These mobile applications are published in iOS App Store and Android Play Store, which are the official application distribution channels for these mobile platforms, and moreover, it is where users get their applications from.
- These mobile applications developed, include Instant Messaging capabilities which allow user to send and receive: text, pictures, videos…
- These mobile applications allow to create person to person communication and group communication where users are able to send and receive messages for and from all participants.
- These mobile application interfaces are similar to popular Instant messaging applications like WhatsApp and Skype.
- These mobile applications are able to create one to one and one to many videoconferences.

- A web application using html5 and WebRTC has also been implemented to allow users to establish RTC communication with other users or a group or users through a web browser.
- No plugins are needed to be installed in order to use this web application.

During the usage of the application a number of improvements have been required by the users in order to increase usability of the applications:

- An illustrated step by step user manual was requested and provided to the hospital, to easy installation of the app and usage. Doctors help each other to find and install the application in their phones, while for patients, the printed manual was provided.
- First releases of the application didn't allow to preview messages from the toolbar of the phone. Although new messages were notified through the toolbar notifications, it was necessary to open the application in order to read the new messages. Doctor found the capability of previewing messages from the toolbar, a very useful feature as they could have a quick look to new notifications and when pushing on them, access directly to the corresponding conversation.
- In terms of camera usability, to take and share photos or during a videoconference. The capability of choosing front and rear camera of the phone was necessary in order to easily take a photo of the patient or to establish a videoconference.

Other usage improvements were requested but nor a final solution met the expectations of doctors.

- Doctors requested to be able to toggle the flash of the camera during a video call. This couldn't be accomplished due to WebRTC implementation where the flash is controlled by the camera but WebRTC doesn't have implemented this feature yet.
- Another problem faced, is the capability of erasing contacts or conversations from the mobile phone once stablished a communication with that contact. Due to traceability of all conversations, this conversation is persisted on the server and is never deleted in case a forensic analysis or a supervision want to be held. This fact affected usability because the contact list increases constantly and no maintenance can be done from the mobile.
- It was not possible to get feedback from patients due to privacy of the hospital. No comment was written for the application in any of the App distribution channels.

The result of this hypothesis shows that, once the doctors had installed the application and the user interface was improved, doctors and patients used the application for the intended purposes, but we couldn't determine how often or if they always used it, instead of WhatsApp app when both installed between the participants. Although the most important handicap was that not many people had it installed, probably because only some units of the hospital were included in the project and this service was not available to all patients, just for a few ones. At the end, the number of users to test the application was not very high, this fact does not allow us to have a clear idea of the real interest in this application.

There was a remark from the doctors about RTC capability, instead of using it to gather complex information from patients, they found that not only having audio but watching the doctor on the screen and knowing that the doctor could see them, tend to calm down e patients and family in charge of taking care of the patient, easily. The videoconference was used when there were crisis episodes.

- *Hypothesis 2: Health professionals do not currently find such solutions in the market at affordable prices and complying with the functional, non-functional and legal requirements.*

This hypothesis was validated as true. The following paragraphs provides the details:

- In relation to IM, services such as WhatsApp seem to satisfy most functional requirements for doctor-to-doctor communications. However, they do not satisfy legal requirements given that the exchange of personal health information (such as pictures from patients) is subject to strict privacy constraints, which are not satisfied by those services.
- In relation to IM services such as WhatsApp for doctor-to-doctor communications, it would be desirable to have the ability to access messages time-lines from different devices (e.g. web, tablet, etc.) while now it's only possible from the Smartphone.
- In relation to IM services such as WhatsApp for doctor-to-doctor communications, group management is not fully satisfactory, given that services do not provide the capability of finding out who are the members of a group or to which groups a user is registered.
- In relation to IM services such as WhatsApp for doctor-to-patient communication, some functional requirements are lacking, such as the possibility for doctors to protect their phone number.
- In relation to IM services such as WhatsApp for doctor-to-patient group communications, the problem is completely unsolved given that there are no evident ways of creating groups where different doctors can communicate with different patients without breaking privacy of patients and maintaining private channels for doctors to talk about patients without patients' presence.
- In relation to RTC, there are different video conferencing solutions (e.g. Skype, Facetime) but which are not widely used due to their complexity and lack of mobility (although there are mobile versions of those applications, people are not used to them).
- In relation to RTC services, common applications such as Skype and Facetime are perceived by users as "non-private". Clearly, this is just a psychological effect given that IM applications share the same problem with the same extend.

To address the requirements extracted from this hypothesis, the following features were developed:

- The application server side in charge of handling the communication data, can be installed in NUBOMEDIA PaaS or in a private CPD managed from the hospital IT department to ensure the custody of the data, according to the legislation.
- Users can have the application installed in multiple devices and all of them keep synchronized showing the same data.

- Users of an instant messaging group or during a group video conference preserve their privacy (telephone number) from others. This way patients can contact with their doctors without getting to know any phone number.
- During a group video call, multiple patients can be invited in different times so information of the patients keep private from each other and the same group of doctors in the videocall can evaluate different patients in a row. While there's no patient invited in the room all communications between doctors keeps private.
- All participants in a room (videocall) are shown on screen to keep control of existing participants and privacy.

As a conclusion, we claim that Hypothesis 2 is validated and that is corresponds to a real need.

- *Hypothesis 3: Complex group communications with different profiles, roles and permissions are needed for satisfying appropriate health practices.*

This hypothesis was validated to be partially true. Most of the communications (around 95%) are peer-to-peer (i.e. patient-to-professional) and only 5% of the calls were multiparty. However, that 5% of the calls were of critical importance as they involved multi-doctor communications for managing complex cases. Hence, this functionality was considered as essential.

The following relevant information is captured from interviews:

- When dealing with doctor-to-doctor communications, no specific group structure is needed. Plain groups where all members share role and permissions seem to satisfy their requirements both for IM and RTC.
- When dealing with patient-to-doctor communications, a clear distinction among doctors and patients roles emerges. These roles seem somehow to respond to the following set of permissions:
    - An individual patient should be able to communicate to a group of doctors (seen as a Service Unit) without needing to precisely know who the members of the group are. At the same time, doctors on the group should be able to communicate to each other without the patient being aware. In terms of IM, this means somehow private groups inside other groups. In terms of RTC, this means the capability of "reverse-muting" patients (allowing a patient to talk to a group without allowing her to listen to the group).
    - Patients should be grouped through assistance criteria (e.g. patients of "that" Unit) so that IM messages can be send to all of them (e.g. group broadcast) but without patients being able to see each other or to see doctors (i.e. identities are not public for group members). This somehow relates to a notion of "distribution list" of messages.
- In relation to patient-to-doctor communications, the following additional roles and functions are identified
    - In a doctor-to-patient communication (group or individual) roles are not symmetric. Doctor should be able to control the behavior of the patient terminal in different ways. For example, in the case of RTC smartphone communications, the doctor should be able to activate deactivate video, to commute among patient's device cameras, to activate/deactivate flash,

to control which camera is depicted on patient's screen (sometimes the patient should see its own image so that instructions can be provided basing on what doctor sees and sometimes doctors' camera should be depicted, etc.
    - In addition, a role of "Manager" understood as a facilitator of the health assistance, but not dealing directly with health problems is identified. Managers are perceived as "wildcard support services" in charge of tasks such as technical support, agenda management, user management, etc.
- Auditing and monitoring is a must for any eHealth communication service. Auditing basically means that all communications taking place between doctors and patients should be recorded and made available to doctors and managers for further inspection. The ideal way of implementing auditing is through direct integration of the communication into Patient's Electronic Health Records. However, it is not clear how this integration may take place given that there are no appropriate standards for that. In any case, it should be possible to recover specific pictures or clips (exchanged through IM or captured directly in a RTC call) and insert them into electronic medical reports following external procedures (i.e. procedures provided by an external tool other than the professional unified application). Monitoring is considered as less relevant and refers to the capability for doctors and managers to visualize current active communications and to enter into them at wish.

To test Hypothesis 3, a probe of concept with multiple roles for communication was implemented:

- Doctors could have private communication while in a group with patients.
- A group of doctors was shown as a unique department without letting the user know how many participants were on the group.
- A manager could audit the communications but not participate on them.

During this probe of concept, doctors found these features not very useful and difficult to understand all available cases. They expressed their doubts of getting to know what was happening in each group. They discarded this complex model and preferred a more straightforward model where they could know who was on each group or videocall. Finally Probe of context got to and end and was completely removed from the application in favor to have a more user friendly solution.

- *Hypothesis 4: Computer vision and other deep media analyses techniques can be interesting for helping with the diagnoses of health problems.*

Coming to Hypothesis 4, the results are the following:

- In principle, doctors have difficulties in the understanding on how media analysis can be helpful for providing useful information. For this reason, during this part of the interview NaevaTec professionals need to suggest specific features, so that the discussion is concentrated on particular and not abstract aspects.
- Audio analysis seems to be of much interest for doctors. It seems that there are diverse medical studies showing that breathing sounds, speech and crying sounds, cough sounds and others can be used as evidence for some type of

illness. The use of a phonendoscope to capture breath related audio signals seems to be a relevant feature.

- Video analysis seems to be more complex to use, but some possible use cases emerge:
    - Lips color and face color as an indirect mechanism of measuring O2 saturation.
    - Measuring breath rate from chest movements.
    - Characterizing spasms from body movements
    - Characterizing skin rash from size and prevalence of blisters
    - Characterizing heartbeat from skin color.
    - Characterizing walking by body movement

Hence, Hypothesis 4 is only partially validated, being Computer Vision Capabilities a desired feature, but which is not considered as critical and which does not solve any clear identified need previously detected by doctors.

Audio and video analysis is technically feasible through filters developed for Kurento, which is the part of NUBOMEDIA PaaS where all RTC capabilities run. These filters can be developed as OpenCV filter or GStreamer filter and attached to the running services. But real use case scenario where the video and audio inputs are from mobile phones, increased hugely the complexity to implement this kind of filters with reliable results. In this way, doctor expertise works much better even with the video and audio taken from a mobile phone.

- *Hypothesis 5: Augmented reality features have the capability of making communications more efficient.*

The following information emerges during the interview with doctors:

- Having patient-to-doctor videoconferences where the audiovisual flow is complemented with gauges and other widgets showing biometric indications seems a useful feature. In particular, if the system is capable of implementing some of the features described in Hypothesis 4 (computer vision or speech analysis), the results of those analyses could be visually represented as an information layer on top of the video stream.
- Many patient-to-doctor calls or event doctor-to-doctor calls take place asking for support or advice in relation to a complex event. In those scenarios, having a videoconference where the "expert" can visualize complex information (e.g. a machine, a patient, x-ray picture, etc.) is very desirable. On top of this, the information flow could be enriched and accelerated if the expert is able to locate "marks" on top of the video-flow (e.g. putting a red circle on top of a button of a machine, of a stain on a patient body, of a cable, etc.), so that the expert can refer to objects of the image without ambiguity.

As this hypothesis was considered interesting, this demonstrator implements the capability to connect to a pulsioximeter via Bluetooth and a graphic with real time info from this gadget is shown on top of the received video. This feature was considered as a nice to have, but not relevant for the use case of the application in the palliative units, where patients using this application suffer from different kind of crisis and the pulse or

oxygen saturation is not one of the main factors to be considering when a patient has this kind of crisis episodes.

Related with this feature, another obstacle was found by the involved units of the hospital. Users rejected to buy this kind of gadgets, mainly because of the price and because of been a public hospital, patients expected to have them for free, borrowed or partially paid by the hospital. The hospital in this terms, didn't have funding for these gadgets. No analyses of real usage with patients could be ran because of these issues. This hypothesis couldn't be validated.

- *Hypothesis 6: No specific assumptions are taken in relation to scalability. However, an open question is issued to health professionals on this respect. We hypothesize that a very large population of users could be interested in the application.*

In relation to Hypothesis 6, the following comments are relevant

- The Hospital Niño Jesús agrees on implementing a limited trial with the professional unified communication application. This trial would not require more than 20 to 50 simultaneous users, so the scalability requirements are not demanding.
- However, in a scenario where the app is successful in improving health assistance, the app could have a skyrocketing growth up to millions of users in just a few months. One advantage of the app is that it does not require complex integration with IT infrastructures of hospitals, so that doctors and patients could be able to install and use it in a very agile manner.

The validation of Hypothesis 6 shows different possible scenarios with different population sizes where very high scalability could be required if the application were accepted by a non-negligible fraction of health professionals.

As it was expected from the hospital, the application has been used by around 40 people, and no performance issues have been reported. The most relevant problem in performance could happen with the number of concurrent RTC sessions running. As NUBOMEDIA PaaS is not production ready, not further studies in term of scalability has been held. But as explained in the Business model from NaevaTec, during NUBOMEDIA project, a more ambitious objective has been developed, a production ready RTC platform deployed over an IaaS (Amazon Web Services) has been deployed. In this terms, we can assure that the technology used in NUBOMEDIA for RTC using Kurento can achieve productive software readiness and elastic performance.

## 3.2 TV Broadcasting Demonstrator

Within NUBOMEDIA, the NewsRoom demonstration (using the TV Broadcasting Connector) is a service build in work-package 6 on top of technologies developed in work-package 4. The NewsRoom is a service allowing contributors to deliver live video from an event using a mobile phone (iPhone/android) to consumers (viewers) who watch the live video feed on web browsers. This is an added-on service that LiveU developing to be added to a commercial version of "Community" http://www.liveu.tv/community is developed allowing public to send videos to broadcasting companies (not just professionals).

In the first NewsRoom prototype (version 1.0), the contributor runs the LiveU-Smart application that encodes and transmits the video to a cloud server. The video is then transmitted on demand to any web browser viewer. This flow runs with minimum delay and excellent video quality. The LiveU-Smart application can use different broadcasting interfaces for transmission (e.g. wifi, 3G, LTE modems) while adapting the encoding algorithms to keep the best video quality and minimal delay while selecting the best interface combination.

In the second version of the NewsRoom we connected it to the NUBOMEDIA cloud and developed a full path WebRTC streaming from the browser. Using NUBOMEDIA Room API's for the distribution. Some points to have in mind:

- The real use case: TV broadcaster in commercial environment uses it to get overall view of the event by combining the views from all media creators, and gather better understanding of the event. They can select a stream from the public and distribute it to their own system.
- For the prototype review we opened a setup access to dedicated LiveU experts, we have gathered feedback from real broadcasters, but didn't release yet the system to them to test at this stage.

The main functionalities and Hypothesis we had D2.1.2 are described and their implementation status is provided in Figure 4.

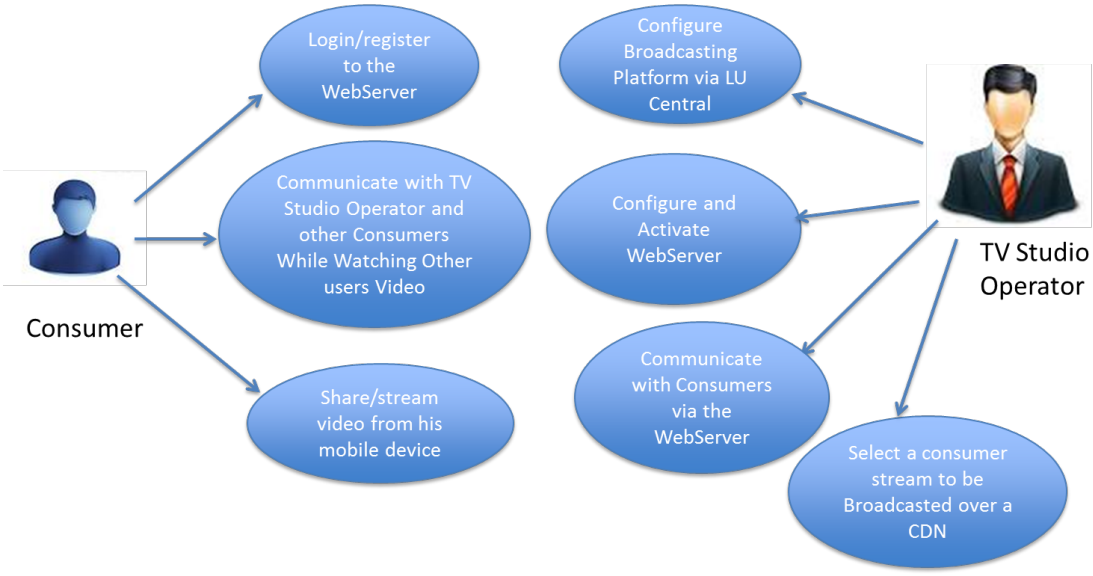


**Figure 4 - TV Broadcasting UML use case diagram**

In the following table, we can see a short description about the different use cases which have been previously comment.

| Use Case | Description | Status |
|---|---|---|
| ***Configure Broadcasting Platform*** | TV broadcaster/studio operator shall be able to configure the service including the distribution path to many MMH units (using the LU-Central) | Done |
| ***Configure and Activate WebServer*** | TV broadcaster/studio operator shall be able to configure the "NewsRoom" web service and to activate it to allow the consumers join the service. | Done |

| | | |
|---|---|---|
| ***Communicate with the consumers*** | TV broadcaster/studio operator shall be able to chat and talk with voice with the consumers in the "NewsRoom" wenservice | Done |
| ***Select & broadcast consumer stream*** | TV broadcaster/studio operator shall be able to browse and select a consumer preview stream and to broadcast it to the broadcaster CDN in high quality. | Done |
| ***Login to web server*** | A Consumer/Reporter shall be able to login to the webserver to join the "NewsRoom" service | Done |
| ***Communicate with TV Studio operator and other consumers*** | Each consumer in the news room shall be able to communicate via chat and voice with the TV Studio operator and the other logged in consumers/reporters. | Done |
| ***Share/stream video*** | Consumers shall be able to broadcast their video and share it with the "NewsRoom" service running on the webserver. | Done |

Table 1 - TV Broadcasting use cases description

### 3.2.1 Setup

The Setup consist of the Content Exchange platform/NewsRoom, the Broadcaster Application named – Central, the Media Distribution Network – LiveU component , the TV Broadcasting connector and the mobile browser to contribute content.

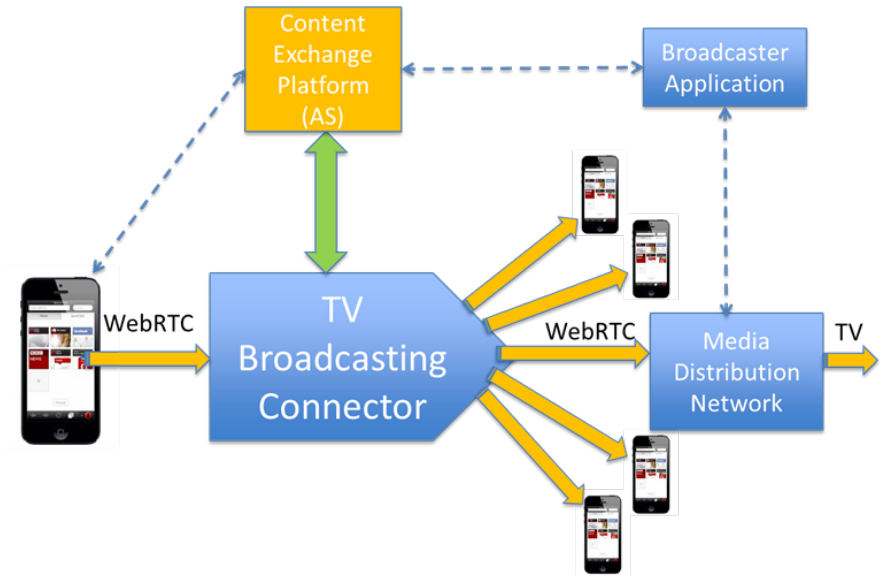


Figure 5 - The setup of the pilot study.

### 3.2.2 Two Tasks for two perspectives

The test included 2 user experience scenarios:

***Scenario 1: Media creator with NewsRoom service.***

A group of media creators looked on the ease of documenting events in real time. They have been sending live video streams from place of occurrence (e.g. a football game, concert in the park). They grade the convenience to capture live video during an event relative to their experience at home and with TV broadcasters.

Figure 6 - Transmit screen

### *Scenario 2: Broadcasters Perspective*

Media viewer used both the NewsRoom and the central interfaces (via web browser) for:

- NewsRoom Interface including the Map for locating the WebRTC users, and available devices near the event. In this screen the user has filters and zoom button to easily locate transmissions from requested events. The producer can select streams and forward them to the Central.

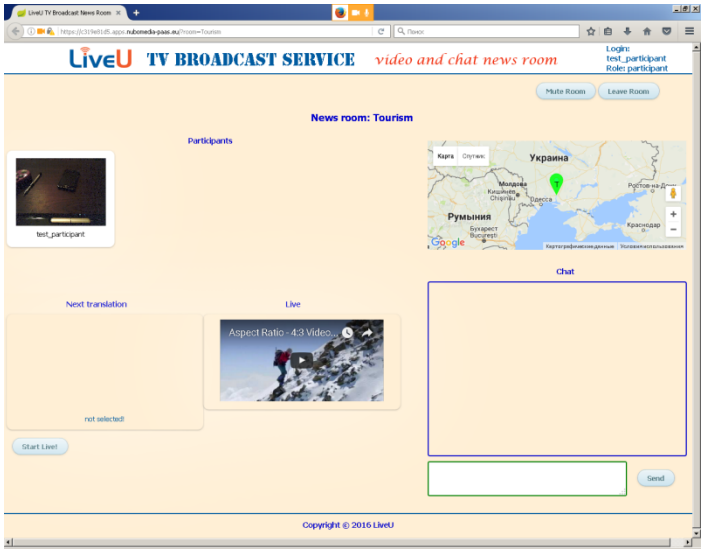


Figure 7 - Online and active devices on the map

- At the Central, the Video matrix display of all streams currently transmitting it can show up to 8 videos. In case there are more servers there are filters and scroll keys to help the viewer.

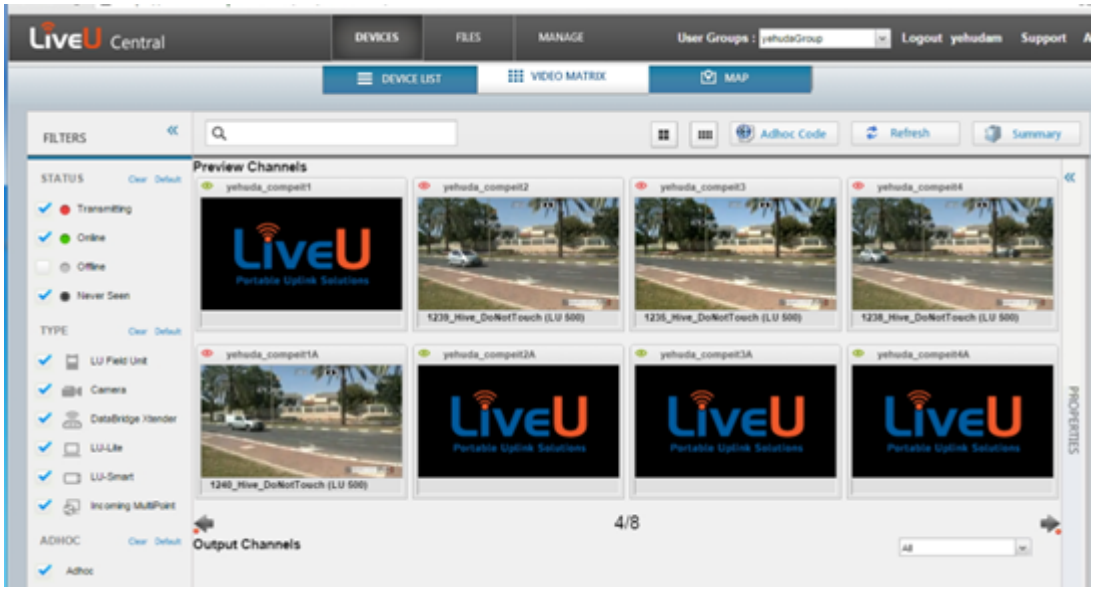


Figure 8 - Video matrix screen can show up to 8 videos

### 3.2.3 Participants

LiveU Professional services Group is responsible for supporting the TV broadcasters using the LiveU products. This include training and problem solving for LU-central and for contributors using LU-smart. Eight engineers from LiveU Professional Services are recruited to take both perspectives. Engineers were selected because they have much experience supporting customers and recording event.

### 3.2.4 The Experiment

The participants have measured connectedness simplicity of usage. Normal scenario of commercial usage includes 2 separated user groups: contributors and broadcasters. In the review a more connected scenario will be used. Each participant in the review have used both the NewsRoom clients for transmitting live video from the field (playing as contributor) and at the same time use the LU-central to see and hear his/her "connected friends" and watch their location on the map (playing as broadcaster). Measuring simplicity of usage while the interaction is bidirectional (see others and response in real time) while maintaining video quality and delay for exporting the information (live video) to TV broadcast is the challenge of this review. The responses of the experts using LiveU products in a more connected scenario than usual was collected and summarized.

### 3.2.5 Some Initial Feedback during the tests and our mitigation solutions

Engineers from LiveU Professional services team that helped build the setup already had some comments:

1) TV broadcast personal that use both High-End field equipment and LU-smart, are used to be connected to the group of their servers only. When someone needs to work with many consumer clients he needs to be able to do that as easy as possible.

This is why we separated the NewsRoom from the central to a different platform perhaps with a different controller, allowing the Central to operate client in his normal way of operation.

2) On the NewsRoom when there can be many streams on the same time (video

contributions from the same event independently). The management mechanism might be less convenient we shall add a layer of organizing the streams and how many videos can be collected from an event. This is why we added some control mechanisms

3) From the contributors, a person needs to transmit video, and to be listening to the group chat at the same time it needs a web browser for seeing other video or the map with others users' location. This does not stand for simplicity of usage. As results of that, we added a private room, that the producer takes the contributor on 1:1 prior to send his video live.

## 3.3 Computer Vision Enhanced Phone Calls

In order to validate our five hypotheses, we tried to involve different stakeholders, getting feedbacks from them to understand the degree of accordance between our ideas and the market.

We basically involved three kinds of people:

- **Real Users:** The first preliminary action we did with real user was a "focus Group", driven by psychologists, discussing about the overall suite of services to include in a Smart Home offer. Two discussion groups were formed, Group 1 was composed of 12 people of age between 25 and 40 (5 Women, 7 Men), Group 2 was composed of 10 people over 40 (8 Men, 2 Women).
- **Technical Feedbacks:** After the user focus reported above, we tried to disseminate internally to our research center the activity and testing results. Moreover, we contacted some of our suppliers related to manufacturing consumer electronics.
- **Feedback from Marketing B.U:** We decided to have specific sessions with our marketing business unit to grab also their feedbacks about the overall prototype.

Below, we shortly report the feedback obtained in these three cases.

### 3.3.1 Real user feedback

Concerning real user feedbacks, these were the main feedbacks achieved:

- In group one, more than 8 participants over 12 found the proposed services useful
- Specifically, most of the 8 people, stated that it was useful to avoid mid-age children to need a direct phone call for communicating and for monitoring
- In group 2 just 3 over 10 found the service useful
- The 3 people in group 2 had elderly parents and according to their opinion, in optimal condition, that would be a good way to monitor their parents and a simple way to set up a communication.

The message behind this first set of feedbacks was quite clear and at least for phase 1, unexpected. The proposed demonstrator is attractive for people having difficulties in setting up the communication channel considered "regular" from most of the people, specifically mid-age children and elderly people.

After this first high level evaluation phase (which covered also a number of other services to be included in the Smart Home offer), we found 15 other users of all ages to directly test the application.

We considered the possibility to test the application on children and old people, but at least for the children it would have been quite too delicate to do, also for the limitations and procedures imposed by Italian law.

The story told to the user was the one of an "evolved" webcam with microphone and speakers, allowing to communicate with an external "caregiver", however the test was actually made with a laptop, setting up a phone call after face recognition.

The testers provided useful feedbacks:

- A point of attention is timing: most of the testers noticed that the latency between the moment in which they started standing in front of the cam and the moment in which the call was set-up was a bit to high, which is indeed something to consider.
- Quality of communication and latency were considered good by most of the testers which said it was a "natural Communication".
- Some users pointed their attention on the "experience Feedback", imagining an evolved webcam, they said it could be difficult to position their selves exactly in the right position to have their face recognized, so they suggested to have a small screen in order to have a position feedback.
- Some testers were concerned about the possibility of having phone call starting automatically while they were just passing in front of the cam. As a solution, they suggested to have an "on-off" physical key in the panel of the evolved webcam.
- Another suggestion was to simulate as much as possible the sounds of a traditional phone call when calling the care-giver.
- Privacy concerns were raised about the possibility of having the caregiver able to monitor the house without any specific consent from the home inhabitant, which could eventually be fine for children, but not for old people.

Even if the number of user is probably not so high. In general the test gave encouraging feedbacks, with precious indication on the market target to address.

### 3.3.2 Technical feedbacks

As mentioned above, we had discussion also with internal people and with some of Telecom Italia suppliers which was also included in the development of the Smart Home Service Suite, being under evaluation for creating Telecom Italia's Smart Home Gateway.

After an interesting discussion with the supplier and a number of discussions with technical leaders inside our company we get interesting feedbacks and ideas:

- Suppliers said that the object we have in mind can be created and it has a cost which is compatible with our business plan
- Technical people put into evidence some specific technical issues about the object which we have to keep in mind, the main issues were:
    - Camera Angle, which should be large enough to get both a child and an adult person's face, without optical deformation.

    - Mounting Issues: It should be clearly stated at which height-range the product should be installed.
    - Light Condition: Testing should be performed in order to understand if everything works fine in difficult light conditions.
- The supplier suggested to put the object in a "bundle solution" in which this object contains also the smart home gateway.
- Some doubts were raised about the configuration phase. The object could support both Wi-Fi and Ethernet. And if one case is simple the other could be not. A solution with a "mobile app" for configuration was proposed.

Beside this, TI made several marketing and technical meetings with URMET (http://www.urmetdomus.it/urmet_web/en/home.html). URMET is an Italian company established in 1937. It designs, develops and sells building automation products and systems. A communication and security specialist, the company stands out for its flair for innovation and for the development of kits that speed up installation and simplify function management, for residential, office and industrial buildings.

Urmet has an extensive and reliable service network. Customers also enjoy the benefits of Urmet's sales network, which has a widespread presence on the territory with several sales offices nationwide.

The idea has been integrating TIM demonstrator with URMET advanced Intercom solution. When a face is detected (later possibly recognized) on the video stream generated by the intercom system a call is automatically issued as defined in TIM NUBOMEDIA's use case.

The fact that by means of its demonstrator TIM has been able to start a potential marketing collaboration with URMET on the Italian market has to be considered a tremendous success.

The main issues, as always happens in the smart home Scenario are related to User Interface and Usability.

### 3.3.3 Feedback from Marketing B.U.

The discussion was not easy, but in the end, it was very useful:

- Our marketing confirmed the need to perform customer retention action on elderly people, which is indeed one of the most promising targets for such a solution.
- The "children/family" target sounded less attractive from the point of view, being this a target covered by many other different things, so a bit "over-populated" in terms of VAS, however, not being the only target it was stated as fine.
- An additional B2B approach were proposed by our marketing: adding a SIM module inside on board of the object to avoid configuration problems and increase the number of subscribers. Even if a bit out of scope it is a good idea, but it should be accompanied by a (difficult) good pricing strategy.

### 3.3.4 Hypothesis validation

Given the feedback received, we would now like to pass through all our hypothesis and see which of them are fully or partially validated and which are instead completely out of real market scope.

*Hypothesis 1: The service shall be perceived as useful by customers holding fixed lines without data-connection enabled.*

According to the Feedbacks grabbed especially from real users and marketing B.U, this hypothesis does not seem to be fully validated. In fact, customers having fixed lines without data connection enabled are mostly elderly people, tending to under-estimate the value of the service. However, the target we envisioned was not completely wrong. People having elderly relatives is interested in such a service in order both to have a "silent" monitoring point for their relatives and to offer a simple way to communicate. Indeed, privacy and user interaction issues have to be treated with care.

The Marketing B.U. feedbacks also confirm that even if reached in a different way, elderly people is indeed a promising target in a scenario where activation of new data lines is getting more and more difficult

*Hypothesis 2: The service shall be perceived helpful for setting up communication easily between a parent and a son left alone for a short while*

This hypothesis seems to be fully valid. Real User feedbacks confirm that there is space for such a service and they have shown interests about this, an idea confirmed also by marketing B.U inside our company.

Some technical concerns were raised about hardware capabilities and positioning issues, beside some privacy issues, but all these things can be tackled.

*Hypothesis 3: The service could work as a "low-level" security monitor*

This hypothesis instead is not valid. According to feedback, no one seemed to perceive the service as a "security" service. The perception of this service by users is closer to ambient assisted living scenarios. Possibly, existing security cameras could some way be used for the service, but for the time being, the two worlds seem to be fully separated. This is probably due to the fact that a "monitoring" solution with an accessible "active" webcam, placed into a house, seems a bit challenging in terms of privacy. Also, the Marketing business unit did not show a specific interest on targeting a "security" scenario, focusing instead on customer retention and upgrades.

*Hypothesis 4: The service should work both as part of a "modular" solution: a module to enable/disable, or "freestanding"*

The discussion with makers and internal experts seems to validate this part. This deals with the architecture of the overall service. Experts gave feedbacks about hardware, about having the solution as the central point of the architecture and other alternatives. This means that even if the overall architecture of TI Smart Home platform is not clear, it is clear that there are possibilities.

# 4 Project metrics

## 4.1 Metric 1.3: Capability for adapting to different market segments and scenarios

For metric 1.3, at least 5 demonstrators must be created for different market segments with disparate requirements and using different capabilities. The success indicator in the number of demonstrators created satisfying requirements gathered in WP2. The success criteria for this metric is the following:

- Metric fully successful: 5 working demonstrators fulfilling the requirements of their specific market segments.
- Metric reasonably successful: 4 working demonstrators fulfilling the requirements of their specific market segments.
- Metric unsuccessful: less than 4 working demonstrators fulfilling the requirements of their specific market segments.

The following table shows a summary of the fulfillment of this metric:

| Demonstrator | **Fulfilling the requirements of its specific market segment** |
|---|---|
| **Security and video surveillance demonstrator (VTOOLS)** | No |
| **e-Health advanced communication system (NAEVATEC)** | Yes |
| **Content exchange platform for TV broadcasting (LIVEU)** | Yes |
| **Video-Call System: Computer Vision Enabled Smart Environments (TI)** | Yes |
| **Social horizontal demonstrator (ZED)** | No |

Table 2 - Metric 1.3 summary

In the lights of the results, unfortunately metric 1.3 is unsuccessful. We have implemented 3 out the 5 planned demonstrators. The reason of this breakdown is two industrial partners (VTools and Zed) left the consortium before the project ends due to bankruptcy problems. The following sub-sections describes the rest of demonstrators.

### 4.1.1 e-Health Communications Demonstrator

This demonstrator is considered to fulfill the requirements of the specific market segment, at least due to the following facts:

- In terms of Scalability, although the average concurrent usage of the application has been around 25 to 40 people, the application has not shown performance issues in any case. Considering this situation and with the experience achieved with elasticRTC from NaevaTec, which is a production ready RTC elastic solution over IaaS developed with the same technologies from Kurento, which is the enabler for NUBOMEDIA RTC capabilities. We can consider this application can scale more over 50 simultaneous users without a problem.
- The requirement of sending photos of more than 2Mepixels through instant messaging is also achieved.
- Compliance with the legal regulation for private data of the patients

- The interest shown from doctors to have improvements in the interface of the application, can be considered as an indicator of intentionality to keep on using the service
- RTC benefits remarked by doctors, to be an effective way to calm down patients easily. This fact is a clear improvement for patients and doctors to deal with crisis episodes.
- The service can be used from different platforms, even at the same time.
- Hospital Niño Jesús is currently using this application and is showing it to other hospitals and related palliative units. That is the case of Junta de Aragon who are in conversations with NaevaTec to use this service, which not only can be used as within the region or the hospital, in addition, as a collaboration tool with Hospital Niño Jesus de Madrid, which is the reference institution in children palliative care unit in Spain.

### 4.1.2 TV Broadcasting Demonstrator

We were able to test the scalability and the point to multipoint tree distributions in a setting with up to 30 contributors each also got the video to test the P2MP requirement (described in D6.4), the performance was acceptable on a single machine when was connected to a very fast internet. The current application in terms of GUI and support is not allowing more than 30 participants on a single PC, taking into consideration the scalability test of NUBOMEDA PaaS to 200 PCs we can conclude a success in this test of scalability. The tests where done locally on an installation we had internal in LiveU premises. Overall, we are happy with the performance knowing that a single PC can support up to 30 participants (for comparison, the legacy LiveU solution was supporting up to 6), so we see that as a great improvement.

### 4.1.3 Computer Vision Enhanced Phone Calls

As it was explained previously, while validating hypotheses above, the demonstrator can address this metric being able, exploiting the face recognition capability, to be attractive both for old people and mid-age children alone at home for a short time.

The number of applications into a Smart Home platform are many and could include also both elderly people and kid communication facilities.

More complex scenarios can be envisioned with a tighter integration with object inside the home, or exploiting better dedicated hardware.

## 4.2 Metric 3.1: Functional generalized multimedia

The validation of this metric requires creating an application involving generalized multimedia flows (i.e. flows containing audio + video + multisensory) as well as the recording of that flow into the media repository and its latter rendering using AR capabilities. The most appropriate success metric is the number of demonstrators involving this capability. The success criteria of metric 3.1 is the following:

- Metric is fully successful: 2 or more demonstrators include this capability.
- Metric is reasonably successful: 1 demonstrator includes this capability.
- Metric is unsuccessful: no demonstrator is capable of including this.

The fulfillment of metric 3.1 is depicted in Table 3:

| Demonstrator | **Involving generalized multimedia flows (i.e. flows containing audio + video + multisensory)** | **Recording of that flow into the media repository** | **Using AR capabilities** |
|---|---|---|---|
| **Security and video surveillance demonstrator (VTOOLS)** | No | No | No |
| **e-Health advanced communication system (NAEVATEC)** | Yes | Yes | Yes |
| **Content exchange platform for TV broadcasting (LIVEU)** | No | No | No |
| **Video-Call System: Computer Vision Enabled Smart Environments (TI)** | No | No | No |
| **Social horizontal demonstrator (ZED)** | No | No | No |

Table 3 - Metric 3.1 summary

In the light of these results, we can conclude that metric 3.1 is reasonably successful. The next sub-section 4.2.1gives more details about the demonstrator implementing the generalized multimedia media, i.e. the e-Health Communications by NaevaTec.

### 4.2.1 e-Health Communications Demonstrator

Augmented reality is used for presenting the readings from a pulseoximeter as an overlay layer on top of the RTC video. The readings from the pulseoximeter are obtained via Bluetooth from the gadget. This data is represented in a graph that helps spot any variation.

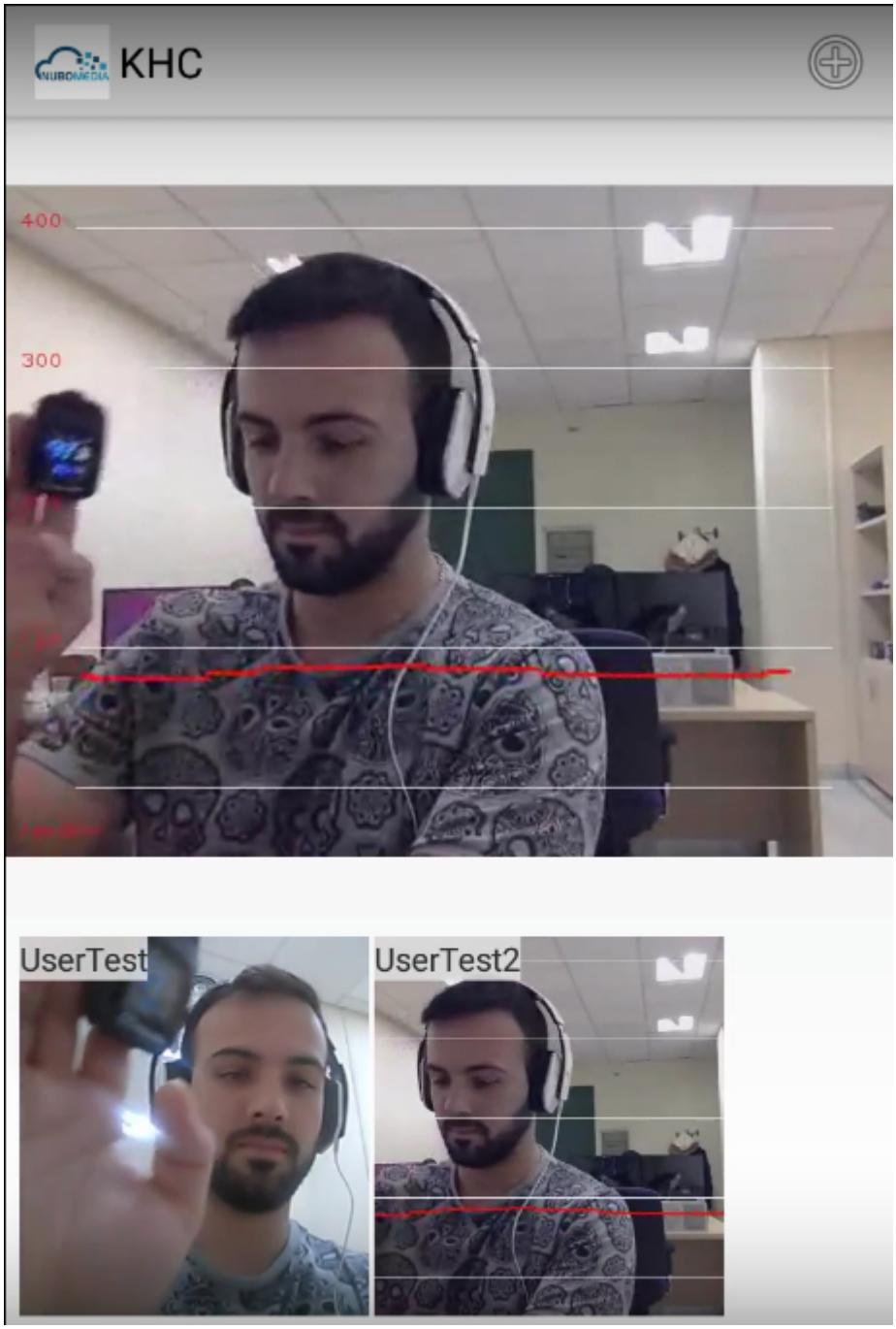


Figure 9 - RTC communication where AR shows data from Bluetooth pulseoximeter

## 4.3 Metric 5.1: Functional novel social groups schemes of communication

This objective of metric 5.1. is to provide exchanges among complex social structures in patterns such as nested groups, group-to-group, group-to-person, or groups with different roles. A reasonable success indicator is the fact of having working demonstrators using this capability. The success criteria for this metrics is the following:

- Metric is fully successful: 2 or more demonstrators use this capability.
- Metric is reasonably successful: 1 demonstrator includes uses it.
- Metric is unsuccessful: no demonstrator is capable of including it.

Table 4 shows a matrix of the fulfillment of metric 5.1 for each demonstrator.

| Demonstrator | Exchanges in nested groups | Exchanges in group-to-group | Exchanges in group-to-person | Exchanges in groups with different roles |
|---|---|---|---|---|
| **Security and video surveillance demonstrator (VTOOLS)** | No | No | No | No |
| **e-Health advanced communication system (NAEVATEC)** | Yes | Yes | Yes | Yes |
| **Content exchange platform for TV broadcasting (LIVEU)** | Yes | Yes | Yes | Yes |
| **Video-Call System: Computer Vision Enabled Smart Environments (TI)** | No | No | No | No |
| **Social horizontal demonstrator (ZED)** | No | No | No | No |

Table 4 - Metric 5.1 summary

In the light of these results, metric 5.1 can be considered as fully successful, since two demonstrators uses complex communications patterns provided by NUBOMEDIA. Next sub-sections provide more information about these demonstrators.

### 4.3.1 e-Health Communications Demonstrator

This demonstrator implements instant messaging service as part of the unified communication application. The instant messaging allows to exchange messages and media files between a pair of users and between a group of users, where all the members of the group received the same message or content.

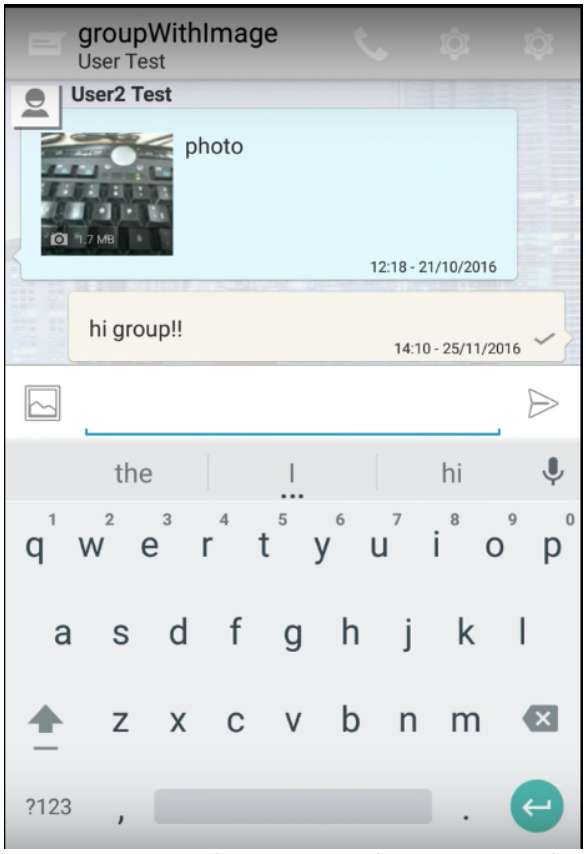


Figure 10 - Group Instant messaging screen showing text and multimedia messages

### 4.3.2 TV Broadcasting Demonstrator

This demonstrator uses the social communication capabilities, using the Room API we easily created many to many service, where many can contribute text, video, audio to the room, we also created different roles, such as producer, and participants, and allowed private and public rooms. Our experience with the social communication capabilities is that it's really helpful and saving time for the developers. We have tested the scalability with 30 participants.

# 5 Conclusions

## 5.1 e-Health Communications Demonstrator

Although the hypothesis established for a professional unified communication application in the specific segment of e-Health seemed very reasonable from a logical point of view. The real use case has shown different results.

When designing the application, we focused on RTC communication and left as a less relevant feature, instant messaging. This decision was based on the interest of exploding the RTC capabilities of NUBOMEDIA PaaS. This situation conducted the application to a failed first attempt of real usage. Although the doctors agreed in their interest in RTC capabilities, they assumed a useful and reliable instant messaging service was mandatory to start using the application. That situation lead us to improve a lot the instant messaging solution, not in terms of technical capabilities, like sharing multimedia files, because those features were already implemented. Doctors were expecting a friendlier user interface for the features of instant messaging. Once this was solved, RTC took relevance for this demonstrator.

A similar situation happened with RTC and complex role models. Users (doctors and patients) were expecting an easy to use application, when we tried a probe of concept with more complex communication capabilities, users were unsure of what they were doing. This situation lead us to keep the simplest use cases found in many popular instant messaging application like WhatsApp.

Augmented reality, although being considered a nice to have feature, didn't have a chance to be proved due to the price of the gadgets and not having budget at the hospital for this kind of gadgets.

According to technology, using NUBOMEDIA RTC features provided by Kurento in the PaaS, implied during the development stages, the opportunity to avoid dealing with the complexity of multiplatform RTC.

After doing a retrospective of the demonstrator, taking into account all the feedback provided by doctors, we can conclude that although some hypotheses weren't fully validated, we have implemented an application that is starting to be used within different units in hospital Niño Jesús de Madrid. That has been recommended from this hospital to others hospitals in different regions of Spain and these have shown interest in using it. And the fact remarked by doctors where RTC helps to calm down patients and the family when a they are suffering a crisis. These positive feedbacks can let us think, that we are in the good track to achieve successful application for a vertical segment based on NUBOMEDIA features. Where NUBOMEDIA PaaS is a feasible

solution for this kind of markets and applications, when it achieves production ready status.

## 5.2 TV Broadcasting Demonstrator

With accordance to the feedback we gathered from our professional team, the demonstration was successful in terms that we could support up to 30 concurrent streams over single PC, in that respect this is 5 times higher than our legacy system can support, in terms of the usability, we still need to improve the feeling of connectedness among the participants, however, the feedback that we have gathered was useful, and we have improved and still improving our system since then.

Our marketing teams are excited to pilot this with real users once the usability and design will be improved, we are working on these points at that moment, and we will keep on until the review and beyond.

From initial discussions, we held with 2 close broadcasters, came up issues of usability, and also validation of the appropriate content, they are still having a fear to allow consumers to deliver in live, we might need to implement a 10 second delay to the path (outside the flow of the NewsRoom, i.e. at the central), they really liked the idea of recording the content, and at later stage stream it live, these features will be added soon.

## 5.3 Computer Vision Enhanced Phone Calls

According to the feedback achieved and presented in this deliverable, the demonstrator proposed by Telecom Italia in the NUBOMEDIA project can be attractive for different market sectors and it also has found the right vehicle to go to the market. Briefly, we can conclude that:

- The solution proposed is a VAS solution, which cannot probably generate money if sold as “freestanding” but it has potential if included in a suite of services
- The main potential of the solution is not to make money directly it is rather to perform customer retention also addressing market targets uncovered by data-related services
- The main market targets identified are elderly people unfamiliar with communication technologies and mid-aged children, autonomous enough to be left at home for short times. People interested in security/monitoring is a secondary target
- The delivery of this service through a specific object to be mounted on the wall is possible and it is cost-effective, but particular attention has to be paid to User interaction topics
- Sim based solution should be an alternative, even if a bit out of scope

Testing activity also showed the critical point of latency in face recognition. The fact that by means of its demonstrator TIM has been able to start a potential marketing collaboration with URMET on the Italian market has to be considered a tremendous success. As explained above, the technological flexibilities of the demonstrator based on NUBOMEDIA, led us to identify potential exploitations of this technology beyond what was the initial proposal.