Videoconferencing Solution: Through Innovation Extension to Attain and Support Pre-Alzheimer Patients in Their Daily Activities

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***Abstract*—The main objective of this paper is to come up with a practical Voice over Internet Protocol approach to support elderly patients affected by Alzheimer disease in their daily activities. This is done by enhancing and integrating the existing Open Source features. The whole development embroiled the integration possibilities of voice, video and instant messaging services in order to improve communication processes between local Session Initial Protocol servers and clients. Part of the proposed work is the remote control tab feature that will be used to control the robot machine and the Living lab framework for knowledge creation and sharing. The preliminary tests and developments have verified that Ekiga softphone running on robot machine can accept and direct orders from Asterisks server in a form of audio and video. The information was gathered through literature review and this was conducted through the use of case studies, white papers, peer-reviewed conference papers and journals.**

Keywords-Ekiga; Videoconferencing; Leaving-Lab.

I. INTRODUCTION

There is a correlation behaviour that elderly patients leave hospital early because of medical expenses, yet they still need additional care at their home to recover from their illness. It is believed that treating a patient at home is less expensive than treating them in hospitals. In this context, there is a need for technological tools that will support and help to deploy the integrated care for elderly and chronic patients. According to Mapundu and Simonnet [6], there are widely acknowledged imperatives for helping elderly patients living at home (semi)-independently for as long as possible. The purpose of this study is to integrate and test the existing Voice over Internet Protocol (VoIP) tools that will help elderly people to have trust relationships and be able to communicate with their family members and caregivers as to avoid loneliness.

One of the tools that will be implemented is a good video quality of Videoconferencing Service that will act as a main communication channel between elderly people, robot companion, family caregivers and medical professionals. An Asterisk Private Branch eXchange (PBX) server solution is implemented and tested in order to manage the communication process between local SIP servers and SIP clients. Session Initial Protocol (SIP) is an application layer signalling protocol for creating, modifying and terminating multimedia session among one or more participants [10]. This paper addresses Videoconferencing Service through identifying different problems concerning the existing VoIP tools and new developments that will be needed, with the aim to accomplish the following objectives : Analyse codec's functions whether problems are resulting from Session Initial Protocol (SIP) servers (Asterisk/ Kamailio), Testing and making new working version of Ekiga that support H261, H263, H263+ and H264, this involves integration and cross-compilation processes for Microsoft Operating Systems and Open Source Operating Systems, Integration possibilities of an Internet Protocol (IP) cameras that will support Real Time Streaming Protocol (RTSP) whereby voice orders can be assigned or dialled to an IP camera and access it using RTSP services and A proposed remote control for the robot machine that will use a 3rd channel support for sending and receiving orders (audio, video, S-command channels data streams).

The intention was to come up with a practical VoIP approach which could be accomplished by integrating and testing the various open source tools that are available as a way forward to achieve the above objectives. The review of Research Questions gave us an understanding of the Research problem as a whole and it gave us a clear reflection of knowing which VoIP tools should be implemented and integrated. The follow section summarises some research questions that we looked at. Does the problem of codec's compression and decompression result from softphone clients, and which tools must be implemented to address such?, Can the IP cameras accept orders from PBX SIP server in a form of audio and videos

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using RTSP services, if possible are there any delays?, For auto-negotiation of 3rd channel support, would it be possible for robot operator to utilize send and receive data streams either in a form video, sound, s-command from private, public SIP servers to the robot machine?, Does Real-time Transport Protocol (RTP) transmits and encapsulates the voice data streams between endpoints for more than one call in a single packet, if possible does it reduce the IP overheard without increases the latency? Do Session Initial Protocol (SIP) servers have a commitment to support latest version of Ekiga clients with modification for Graphical User Interface (GUI) implementation, if so are there more specific technical requirements that might be needed?

The content of this work follows a simplified strategic planning process; it was conducted as a literature review which starts by introducing the current state of VoIP technologies and its interconnection based on articles and continues to research the existing literature in order to discover theories behind interconnections. The experimental scientific research approach with VoIP supporting tools were conducted and applied in order to address the main objectives. This paper starts by describing the overall research background, VoIP establishment, and research results and concludes with some future work.

II. RESEARCH BACKGROUND AND RELATED WORK

European Scientists have found three new major genetic links to pre-Alzheimer, affecting up to 20% of people with brain-wasting disease. It was the most significant such discovery in 15 years. Alzheimer disease affects more than 26 million people globally and it has no cure with any good treatment. The need for effective remedies is pressing on, with the number of cases estimated to go beyond 100 million by 2050 [5]. According to Matos [11], many European projects have focused on support of technologies for elderly are on process, CompanionAble is one of the projects. In response to the problem, Roceries and Simonnet [8], developed, operate and maintain a Telemedicine platform that offers communication and assistance services to patients, especially for elderly people. This platform has two main components, namely a Central Server and Local Equipment for Domestic Internet Gateway (DIG). Both these components use a secured Internet Protocol Network over Internet (Virtual Private Networks). This platform is easy to deploy because all functions and related virtualized servers can be held on one physical server [8]. Actually, the platform is operating at Ecole Supèrieure d'lngènieurs en Èlectronique et Electrotechnique Paris University but the aim is to install it in any hospital that might need it. Each patient at home will have a DIG that provides Internet service and records operational data such as agendas and monitor data to mitigate temporary internet access failure. This platform must integrate the communication process for elderly patients to keep a strong social link with their families or caregivers and doctors, thus a good videoconferencing services will be implemented to provide a high quality of video output with low latency and jitter.

Integration and evaluation have to be conducted in regard to embedded Voice over Internet Protocol solutions by testing the latest developed codec's and diagnose the performance because there are challenges about the quality of the video output. We need to develop and conduct preliminary tests to assess the possibilities of adding a new that will be used to pilot or direct robot machine and it can be replaced by the joystick in future. The choice of the softphone and codec's is critical because the Asterisk does not allow codec translation. This needs that all clients must be compatible. An interface is hard to design due to dialling and meeting process; therefore, it will be difficult to use the same communication channel [8]. The integration procedures on how to stream data (video, audio) in IP Cameras using RTSP services and this communication channel will need to support specific delays.

Healthcare systems face a number of challenges in the coming years. These relate to confidentiality of data, changing demographics and economics of European society [3]. Effective delivery of healthcare in the future is therefore likely to depend on a combination of technological solutions [7]. Human needs are complex and are not necessarily easily met through simple technological fixes, provision of human services (social and health) involving many ingredients, thus some can be supported by the types of functionality provided by technology. According to European Commission Final ICT and Ageing Report [12], there is a risk that too much 'technology' push might result in inappropriate application and negative outcomes, to detriment of those immediately concerned as well as to the longer-term prospects for the community or market. On the other hand, application of technology in human service, delaying or blocking innovations that can provide truly positive benefits for elderly people and their care-givers. However, the potential offered by technology also extends to other domains; this comprises the general social inclusion of elderly people in everyday social life and support for ageing in the context of employment or daily activities [12]. Currently the European Commission is dedicated in providing the health-care support for elderly patients to all European citizens. Not as an advantage, but as a fundamental right for many citizens who lacks the most basic services [11]. To accomplish this goal, both private and public health care sectors have identified Videoconferencing as a strategic tool to improve the health-care delivery and instructive services to elderly patients with the aim of reducing medical care costs. As seen in Figure 1, this is research work collaboration and the collaboration involves academics, private and public sectors with the aim to support elderly patients in their daily activities. Number 8 in Figure 1 is ESIEE Paris University, where the proposed Videoconference solution is being developed.

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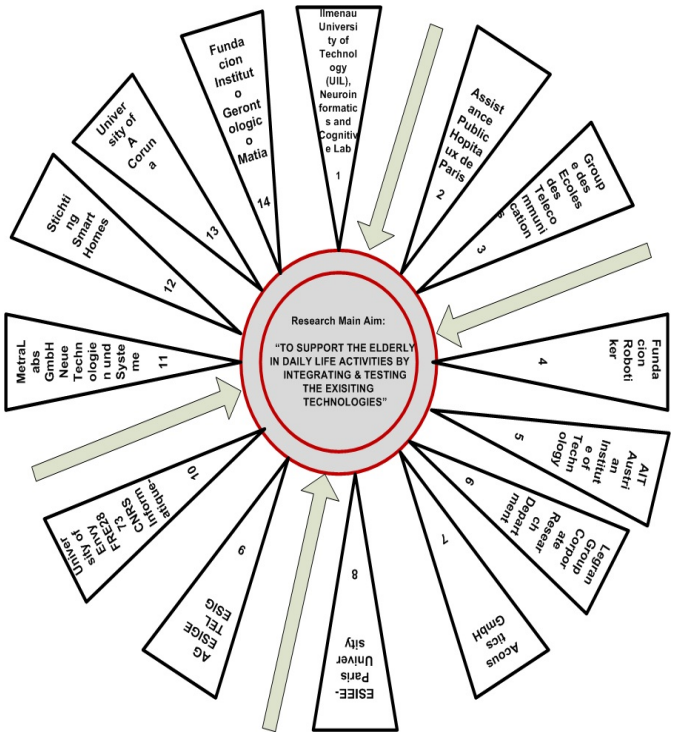

Figure 1. Research Collaboration.

III. ESTABLISHING VOIP CONNECTION WITH SIP CLIENTS AND SIP SERVERS

According to Bley [1], the process of compiling and running Ekiga with its sources normally require tools like a working of C/ C++ compiling environment and it depends on three dependencies that are developed together for compilation process for instance: Ptlib, Opal and Ekiga. According to Boundy [2], the above dependencies are attributes that can be defined in the package stanza files. They allows for defining hardware and software prerequisites and restrictions to be evaluated when executing the compiled, remove, and undo commands on the package [2]. If users want to compile and install a new working version of Ekiga, they should make sure that they don't have dependencies or packages that are already installed in their machines. We managed to follow the relevant steps to compile the Ekiga client on Debian and Ubuntu machine (Open Source OS) and this involve downloading, save the Ekiga packages and compiled them. For Windows Operating Systems (OS), currently it is not possible to build Ekiga for Windows on Windows machine. The current process to build Ekiga for Windows is to generate a 32 bit program (win32) through cross-building on a GNU/Linux system.

The powerful SIP client-server application supports user mobility with two operating modes: Proxy and Redirect. Figure 2 shows a SIP Proxy mode, whereby SIP clients send requests to the proxy server and the proxy server either handles the requests or forwards them to other SIP servers. On the other side of users in VoIP network, the signalling invitations look as if they are coming from the proxy SIP server [3].

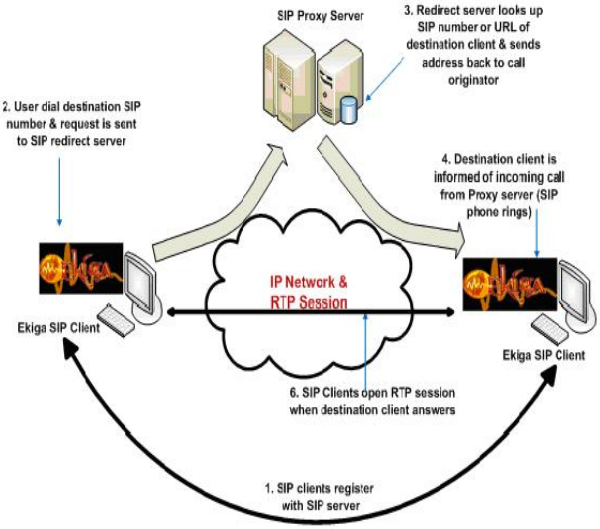

Figure 2. SIP Architecture [7].

The minimal set of modules needed for various Asterisk and Kamailio functions was determined based on the minimum requirements and using the requirements makes it possible to develop tests for the target functionalities of these two PBX systems. We managed to configure and install certain services and modules for SIP servers (Asterisk and Kamailio). Primary, we took consideration of minimal requirements thus two sets of requirements, each describing a set of abilities necessary for the project. The first set of requirements pertains to support for SIP based phone calls; we call a minimal Asterisk, Kamailio PBX system meeting the voice call and video requirements. The next set of minimum requirements includes some additional support for voice mail PBX system. Before selecting the packages required, firstly install a database that will store users and generally MySQL is recommended for testing procedures. After the file system has been formatted, the user will be presented with the option to select packages or to use default packages and we followed all the relevant installation steps to configure and setup both Destar Asterisk 1.6.1.0 and Kamailio 3.0.0. Primary for database creation, inside the file /etc/kamailio/kamctlrc the following lines were inserted in the following format:

```
SIP_DOMAIN=soult.esiee.fr
DBENGINE=MYSQL
DBRWUSER=openser
DBRWPW="openserrw"
DBROUSER=openserro
DBROPW=openserro
DBROOTUSER="root"
```

One of the objectives was to activate the RTSP services for an IP camera (SIP client) and Asterisk PBX (SIP server), whereby a call in a form of video and audio (orders) can be dialled and accepted to it and this will provide a means for

choosing delivery channels such as UDP, TCP, RTP mechanisms and etcetera. The AXIS 207W was chosen as an IP camera for this Videoconferencing platform and for installation purposes, we connected the AXIS207W IP camera according to the installation guide then configured the IP address for AXIS 207W camera (the default IP address for this camera was 192.168.0.90 and the SIP client machine was set to 192.168.0.1) and again we configured the Password for AXIS207 camera (when accessing this camera for the first time, the "Configure Root Password" dialog will appear, then we entered a password and re-enter it to confirm. The default user name was 'root', thus it cannot be changed and the password for AXIS 207W camera was set to '1E492'. After the process of compiling and making a working 3.2.6 version of Ekiga, the next step was to modify the Graphical User Interface (GUI) of Ekiga and all the GUI test modification were undertaken in Ubuntu Jaunty 9.0.4, the same machine that Ekiga softphone was compiled. Preliminary tests were conducted by creating and adding two Ekiga tabs, namely, First Tab and robot Control Tab using C, C++ and by editing XML codes with text editor.

IV. RSEARCH OUTCOMES

A. *SIP Clients Running on Windows and Open Source Platform*

The processing of compiling and making a new working version of Ekiga running on Linux and Windows platform is part of our research objectives. The Ekiga softphone was selected as a SIP client for this project, because it's an Open Source application that allows easy modification, unlike other softphones it supports many audio and video codec's selection and is supported both in Open Source & Windows platform [4]. A number of tests were performed for both platforms, and, as seen in Figure 3 and Figure 4, are Ekiga SIP clients that were created.

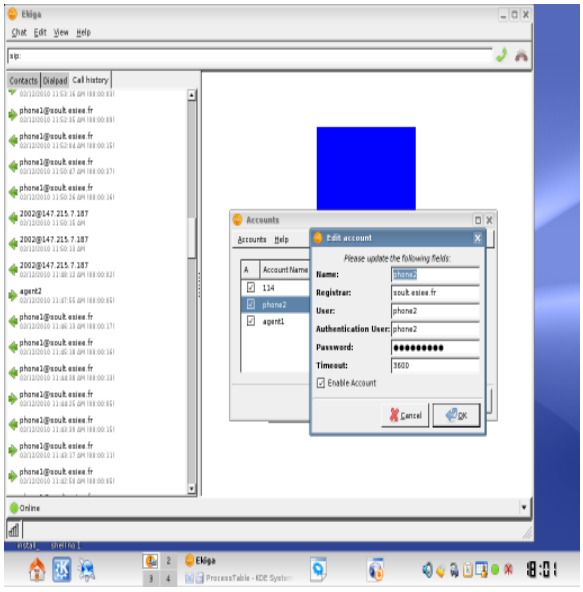

Figure 3. Registering Ekiga client to soult.esiee.fr SIP domain.

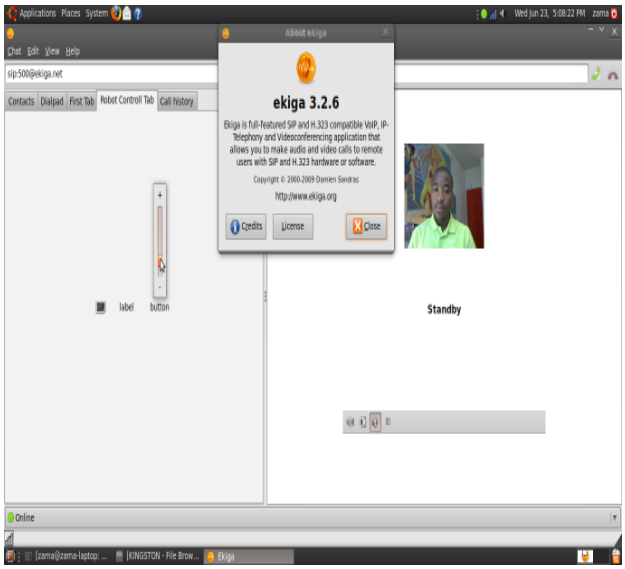

Figure 4. Ekiga SIP client with modified tabs.

Mapundu and Simonnet [6], used Glade interface designer to create the proposed remote control prototype as seen in Figure 5. The intension was to test the possibilities of modifying the GUI of Ekiga with the aim of adding the proposed Remote Control to direct the robot machine and in future it can be replaced by the joystick.

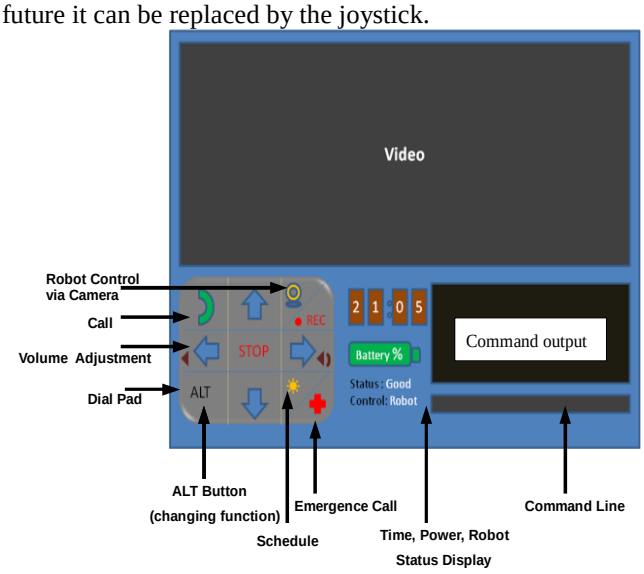

Figure 5. Proposed remote control prototype [6].

After successfully integrating the RTSP services for an IP camera, then the image captured by the camera was displayed as seen on Figure 6, this is an image that was captured by AXIS207W (selected IP camera) at ESIEE Paris test lab environment. Practically you can display the live view page on separate window by issuing the following command: FFplay (in the web link) and you should be on Linux terminal.

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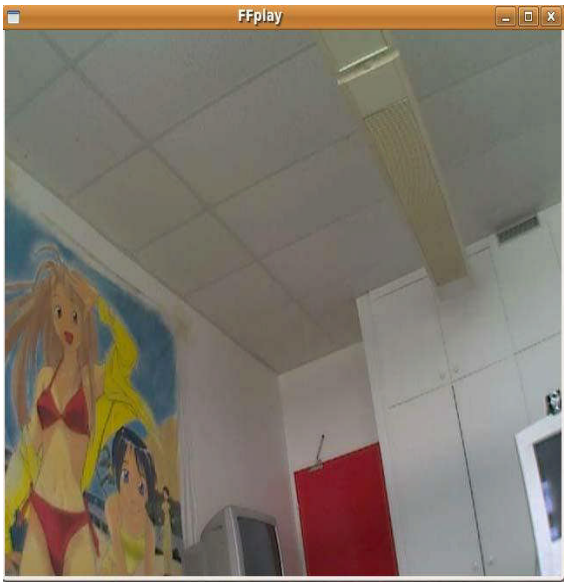

Figure 6. Proposed remote control prototype.

As seen in Figure 7, is DeStar/Asterisk and, in Figure 8, is Kamailio SIP domain, Mapundu and Simonnet [6], managed to configure and install both SIP servers. Before starting Ekiga clients, they need to have a SIP registrar server for communication connectivity of which in this scenario we configured: soult.esiee.fr acting as a Registrar Server and it is possible to issue SIP calls.

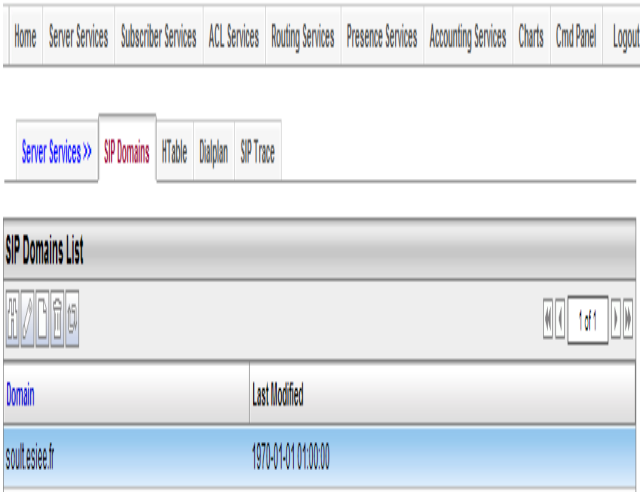

Figure 7. Soult.esiee.fr SIP domain..

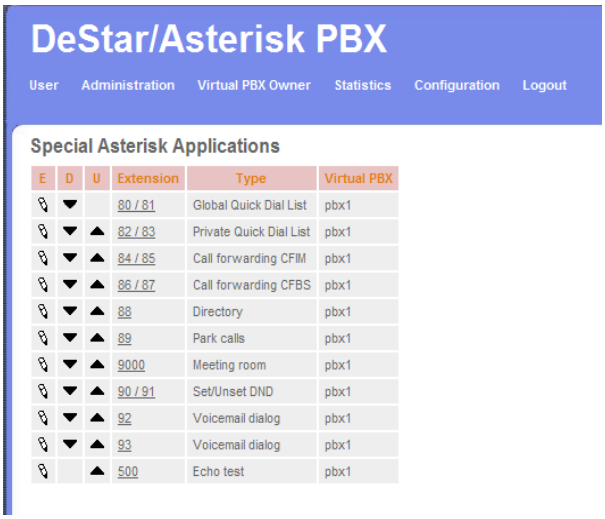

Figure 8. Soult.esiee.fr SIP domain..

After successfully installing the SIP servers, as seen in Table 1, summaries both Kamailio and Asterisk PBX comparison findings.

TABLE I. DESTAR/ASTERISK SIP SERVER VS KAMAILIO SIP SERVER

Function/Specification Support	**Asterisk SIP Server** Supported Status (Yes or No)	**Kamailio SIP Server** Supported Status (Yes or No)
Modelling and Integration	Yes	Yes
SIP support	Yes	Yes
PSTN function	Yes	Yes
Voicemail	Yes	Not Yet
IVR (interactive Voice Response)	Yes	Not Yet
Database Support	Yes	Yes
IP authentication and security	Yes	Yes
Presence Message	Not Yet	Yes
Text Message	Yes	Yes
Interface Management	Yes, AGI	Yes, MI
NAT Support	Yes	Yes
Packet Route	Not yet, some challenges when working with multi-domains	Yes, more used for load balancing and multi-domain support
Multi-domain	Not yet	Yes

V. FUTURE WORK

According to Conklin et al. [13], the development of assisted living and Tele-Health applications requires domain oriented interdisciplinary research as a result there will be a prerequisite for a Living Lab. A Living Lab is an innovative approach to deal with community driven in real life improvement context and it is motivated by knowledge creation, sharing, collaboration and experimenting in open real environments [9]. This approach offers its client group with an opportunity to expand much deeper perceptive of how various mechanisms in their useful locations function and interconnect. According to Jacobus and Zaaiman [9] define living labs as “The Living Lab is a system and

environment for building a future economy in which real-life user centric innovation will be the normal co-creation technique for new products, services and community infrastructure". The impression at the starting point of a Living Lab is to turn clients from being considered as merely subjects to whom new products or services are simple proposed into dynamic players contributing to the co-creation and experimentation of emerging ideas, breakthrough scenarios and innovative concepts [13]. Part of our recommendation in devising a plan of action for Europe, is to pursue the development of Tele-health Living Lab Framework. As seen in Figure 9, this is a Community Living Lab Factory Framework that is developed by [9] and it can be utilised for resource sharing as well as creative and innovation thinking.

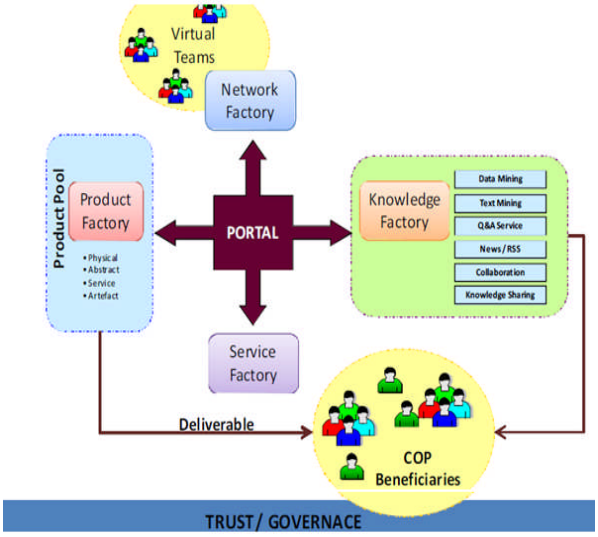

Figure 9. Community Living Lab Framework [9].

In addition to future work in devising action plan for European Countries is to come up with Knowledge Brokers (KBs). The implementation of Knowledge Brokers will promote mutual understanding that gives Researchers, Decision makers and Caregivers a better understanding of each other's environments and this will help to spread the awareness together with adoption of innovations [13]. It should be noted however that the trade off between audio, video quality and throughput performance of this Videoconferencing tool is still ongoing issues.

VI. CONCLUSION

Integrate and test the existing VoIP tools that will help elderly people to have trust relationships with their family or caregivers and one of the tools that was proposed is the implementation of Videoconferencing service (VoIP Tool) that will act as a main communication channel between elderly people, robot Companion, family caregivers and medical professionals. Both assessments from SIP client and SIP server side has been conducted successful but there are still some limitations in regard to some communication services, hence there are some developments with latest versions of Ekiga soft phones and Asterisk PBX systems that are currently examined by VoIP engineers. All this work should be done through The Living Lab approach umbrella; this is an approach that will provide its user group (researchers, community, students, industry, academics and etcetera) with an opportunity to develop much deeper understanding of how various components in their functional environment operate and interrelate [3].

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