Towards the Connected Society: Dynamic Co-Evolution Of TLC Players and Individuals

Alberto Savoldelli[*]   Paola Fantini[*]   Daniela Guarnieri[*]   Claudio Palasciano[*]   Claudio Colmegna[*]

alberto.savoldelli@polimi.it   fantini@mip.polimi.it   daniela.guarnieri@polimi.it   palasciano@mip.polimi.it   colmegna@mip.polimi.it

[*]MIP Politecnico di Milano, Via Garofalo, 39, I 20133 Milano, Italy
Tel. ++39-02-23992820

ABSTRACT

In this paper we will discuss the possible evolution of the European TLC sector in the next fifteen years, taking the research conducted in the EU project CASCADAS as a basis. A twofold analysis will be presented: on the one hand, of the current TCL sector and technological trends, and, on the other hand, of the possible future socio-economic trends. This will allow to us to describe a possible future communication paradigm, the Connected Society, by means of an instantiation of one the most promising emerging technologies, the Autonomic Communication, main research theme of CASCADAS project. Thus, we will point out how and why the future development here described will most likely give rise to more active roles for TLC users and, possibly, new roles and interactions among all the actors in the TLC field. After that, we will describe the current behaviour that anticipates our vision of the Connected Society. Afterwards, we will describe some key aspects that can be foreseen in the prospective TLC field interaction between TLC players' strategies and users' needs and behaviour, interaction that we will model as a dynamic co-evolution. Finally, we will give an account of some actions that TLC providers should add to their business 'toolbox' in the next ten-fifteen years.

1 INTRODUCTION

In this paper we will discuss some key issues regarding the possible evolution of European TLC sector in the next fifteen years, with specific attention to the mutual interaction between TLC players' strategies and users' needs and behaviour. The aim of this paper is, more than giving precise prediction of the future, to provoke analysis in order to discuss and identify the relevant factors and possible technological research directions.

We will base our discussion on the research carried out within the EU funded project CASCADAS, whose main interest is in the Situated Autonomic Communications (SAC), an emerging technology based on intelligent networks of mobile devices capable of autonomous behaviour and reaction to context information (such as location, user's preferences and interests).

2 CURRENT TLC MARKET

The starting point to assess the possible future TLC sector configuration is, of course, the analysis of actual TLC market; the TLC market traditionally regards voice services, data transmission and internet connection. This market is in its maturity lifecycle phase, so the TLC players are looking for new applications, often exceeding market boundaries. This phenomenon, known as TLC convergence, brings uncertainty on the clear market identification because some players have started to sell services traditionally belonging to other industries such as Information Communication Technologies (ICT) and Telecommunications (TLC), Consumer Electronics and media sectors.

The convergence of these sectors has represented in past years one of the "hotter" topics in business literature. In particular, the following trends have been identified as possible paths towards TLC/ICT convergence:
- unification of telephony, Internet, television;
- integration of communication and processing functions in a single device;
- availability and use of multi-functional services.

In these last few years, most of these predictions have not happened because of the great resistance that some economic actors endure in order to defend their competitive advantages and the still not complete compatibility among different technologies [1]; hence every industry has developed its own rules. However, now there is undoubtedly a growing interest of the major players (in ICT and TLC sectors) in the convergence theme. In particular it is possible to witness many partnerships, mergers and acquisitions, as well as joint ventures in specific fields.

With regards to TLC sector demand, on the one hand people are increasingly connected to mobile devices: most likely, in 2008 1/3 of mankind (and 100% of people in western countries) will be mobile connected. People will have more and more possibilities to be always connected to Internet.

On the other hand, in recent years the Average Revenue Per User (ARPU) - that is the average monthly revenue generated by each customer - is decreasing in many European countries and the growth rate of the subscribers' number for mobile services is continuing to fall. For instance Deutsche Telekom reports a variable reduction (between 10% and 20% per year) of the ARPU for the TLC operators in which they are involved [3].

Therefore, it is becoming more and more important for TLC providers to concentrate their effort in generating new revenues and optimizing costs.

All TLC players have to seek new market opportunities. In mature markets like the ICT and TLC ones, the only possible strategic choices mergers and acquisitions, and/or segmentation, differentiation and offer enlargement. In this landscape, the convergence of TLC-ICT towards the other sectors is often considered a more attractive opportunity for enterprises to grow, taking advantage of synergies for reducing operational costs.

One critical aspect that should also be taken into account is the European regulatory landscape. Europe, being a union of 27 independent Member States (and soon probably more), tends to have various regulations that are in line with national priorities and in spite of the efforts spent by EC to create and share an advanced regulatory body within all the member states, the process that leads to the overall adoption is often long and time-consuming.

3 FUTURE ECONOMIC SCENARIOS

We need to identify a basic trend of the possible future economy development in order to understand how TLC sector could evolve in the next 10-15 years: the research [2] has identified three scenarios based on different socio-economic conditions that have to be taken into account to explore future user needs and motivations:

1. smooth development: EU economies will be united to provide growth and development, in a fair and managed way that brings prosperity across all 27 members.
2. economic stagnation: the EU economy will slowly decline, as the Japanese economy did between 1988 and 2003. Outputs will gradually shrink and government policy reactions to strong deflation will be unsuccessful or frozen. EU economic growth will fall behind that of Asia.
3. constant change: overall, the economy will follow a moderately positive trend, with ups and downs. Ad hoc growth and recession will occur in parallel in different areas or countries, with stop-go progressions and regressions in specific areas of the EU. However, prosperity will slowly increase for many people in the EU.

4 TLC TECHNOLOGICAL TRENDS AND OPPORTUNITIES

To make an account of the possible TLC technological trends in the future we can refer to Gartner's Hype Cycle for Emerging Technology [9].

Although the Emerging Technologies Hype Cycle covers the entire ICT/TLC spectrum, three key technology themes have been highlighted by the research of CASCADAS project [8] as having been particularly significant in recent years (2005 and 2006):

- Collaboration / Web 2.0;
- Next Generation Architectures and Applications;
- Real World Web.

Here a brief account of these three key themes is presented.

Collaboration and Web 2.0 technologies

A number of key collaboration technologies designed to improve productivity and ultimately to transform business practices are identified.
• Podcasting.

• Peer to Peer (P2P) voice over IP (VoIP).
• Desktop Search.
• Really Simple Syndication (RSS).
• Corporate Blogging.
• Wikis.
• Social Network Analysis (SNA).
• Ajax.
• Collective intelligence.
• Mashup.

Next Generation Architecture and Applications

It's recognised that Next Generation Architectures could constitute the third big era in the IT industry's history, the first having been the hardware era and the second the software one. These emerging technologies will form key pillars of the new architecture and applications.
• Service Oriented Architecture (SOA).
• Web Services-Enabled Business Models.
• Extensible Business Reporting Language (XBRL).
• Business Process Platforms (BPP).
• Event-driven Architecture (EDA).
• Corporate Semantic Web.

Real World Web

Adding networking, sensing and processing to real-world objects and places is creating a "Real-World-Web" of information that will enhance business and personal decision-making.

Three technologies from the Hype Cycle should be highlighted as help to make this vision a reality:
• Location-aware applications/technologies.
• Radio Frequency Identification (Passive).
• Sensor Mesh Networks.

4.1 SAC (Situated and Autonomic Communication) technology.

In order to continue our discussion on the possible new communication scenarios in the future we can refer again to the Gartner's Hype Cycle for Emerging Technology framework, choosing one of the so-defined 'technology trigger' technologies, i.e. one that will probably gain mainstream adoption in ten or more years and then imagine how, at that time, this technology will interact with the customers' needs.
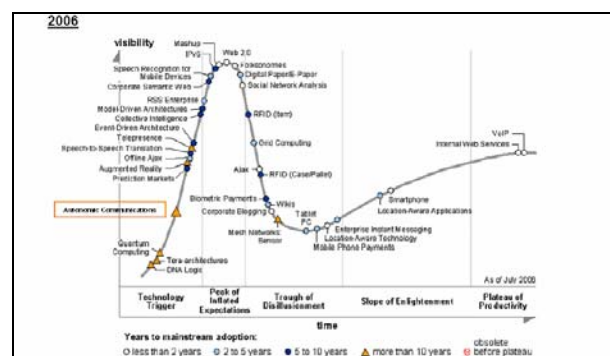

Figure 1 - AC positioning in the Hype Cycle for emerging technologies

The CASCADAS project has identified as main research issue one of the most promising technology at present-day, the Autonomic Communication technology. See figure above, that points out the position (as per CASCADAS research) of the Autonomic Communication technology in the Hype Cycle as 'technology trigger'.

The CASCADAS project studies the individual network element (ACE) in its interaction with the other ACEs [7]. Autonomic Communication is a paradigm in which the applications and the services are not ported onto a pre-existing network, but where the network itself grows out of the applications and the services that end users want . In other words, Autonomic Communication has a broad scope, addressing all aspects of communication by empowering network elements to best fit communication intentions, to observe and to react in future networking and networked business by self-organisation to context changes without explicit user interaction [12]. We can identify this AC network as a Pervasive Autonomic Communication Environment (PACE).

In general, a "PACE" (see the following figure) is characterised by the individual and collective awareness of the current state of communication system and additionally by the incremental adaptation to the system dynamics [10].
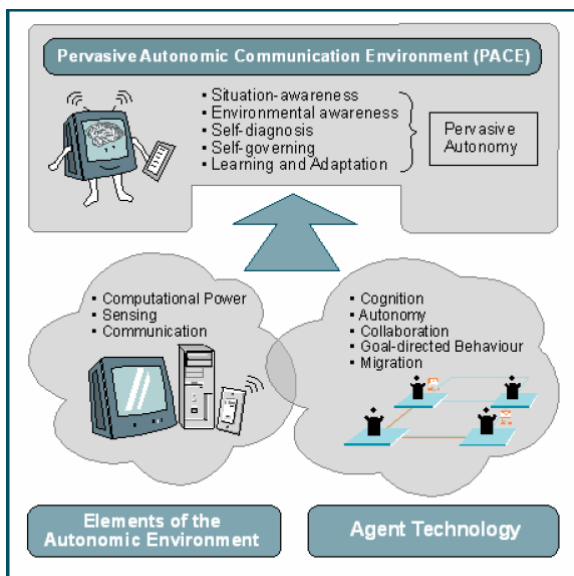

Figure 2 - PACE environment

For the scope of this paper we do not need to go into the details of the Autonomic Communication paradigm, whereas we focus on the basic types of 'autonomic' activities of the ACEs within the PACE, that are:
• negotiation for resources, access rights, permission grants, etc.
• subscription and notification for events from peer elements
• classification and prioritization of system events
• making choices to resolve a conflict situation
• forcing human interaction/alarm triggering to resolve and learn from new situations

Making a combined analysis of the above-mentioned technological trends related to years 2005 and 2006, it's possible to notice that some of them can be considered as points of departure for future developments based on Situated and Autonomic Communications technology. For example:
• the possible realization of a Real World Web in which environment changes are measured and objects/people localisation are taken into account;
• the availability of tools and technologies to users for sharing knowledge and information and interacting together;
• the formation of Internet business models in which users will directly create service contents (beyond Internet phase);
• the development of information architectures and applications favouring the flexibility and personalisation of services offered to customers.

Therefore, providing an intelligent and autonomous support to human activities, SAC technology could most likely be an effective opportunity for TLC players to achieve their strategic goals, such as in the table below:

Table.1 - SAC enabled opportunities for TLC players

SAC enabled opportunities	TLC market impacts
Offer new services based on Autonomic Communication technology and/or enter in new markets	Higher revenues
Refresh existing services taking advantage of SACs' technological properties to create services which best meet users' needs	
Make more effective technological infrastructures through a new design network and service layers in the architecture	Costs optimisation
Overcome current technology bottlenecks in the network/service layers, caused by high traffic	

5 PROSPECTIVE COMMUNICATION NEEDS OF EU CITIZENS

A new technology design and its consequent introduction in the market are not supposed to be based only on supply-side needs or technology trends, but also on the customers' needs and expectations. One of the objectives of socio-economic research in CASCADAS project is precisely to pick out customers' needs and hence identify the future demand towards specific technologies.

CASCADAS research has identified that in ten to fifteen years the socio-economic conditions, on the basis of the three economic scenarios identified in section 3 could be:

Smooth development scenario:
• knowledge work for 80% of population;
• high disposable income per person;
• spread of distance working;
• most people's waking/working day is spent using some form of communication or processing;

- increased move towards single parent families, single person households.
- growing needs for welfare, healthcare, education, entertainment (and relating support services with good level of service / cost ratio;.
- Increasing people awareness of free time value;
- increasing of machine to machine communications (M2M) for instance in support of Supply Chain collaboration between enterprises;

Economic stagnation
- White collar employment continues to fall, accelerated by off-shoring of the most mundane business processes;
- The total EU active employment gradually falls from its already low 2002 level;
- EU citizens simplify their life style;
- basic trading activities (such as bartering) spread and relevant support services are needed;
- all enterprises focus on efficiency;
- Small and Medium Enterprises (SME) look for standard & low-cost services.

Constant change
- economic output changes with ups and downs, often in parallel in different geographic markets, but moderately positive overall;
- people attempt to find jobs abroad and/or in different sectors;
- SMEs are the key to growth, employing 85% of the active population with 95% of the new jobs;
- communications are essential to stay in touch with families and friends at home and in multiple regional centres, and to search for new jobs;
- basic, low cost and reliable services are needed, such as secure financial transactions.

5.1 Estimated traffic according to the economic scenarios

More in detail, according to the research [2], Figure 3 shows the total estimated traffic1 for each of the three scenarios.

Analysis of the results of the research shows that between 2010 and 2015 the differences between the scenarios are relatively small. It is only after 2015 that big differences in traffic volumes become apparent. An increase in the number of users from 2015 is supported by evidences such as the consolidation of an European internal market for mobile services, the expansion of M2M communication or the fact that consumers will be familiar with and will demand mobile broadband services.

It should be also noted that growth may have different origins. In 'Smooth Development', huge growth comes from individual consumers, whereas in 'Constant Change', growth from consumers is steadier, most of the growth resulting from increasing use by enterprises. In the 'Stagnation Scenario', consumer traffic is almost stable indeed and almost all of the traffic results from enterprise use.
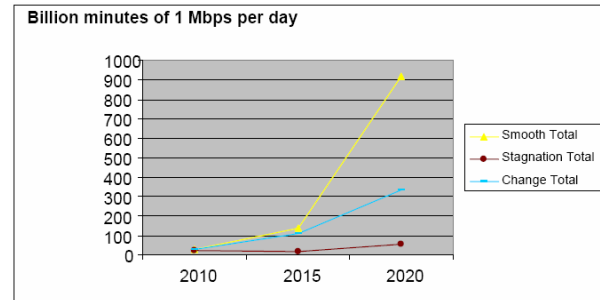

Figure 3 – Total traffic estimations for the three Main Scenarios.

To sum up, Figure 3 shows that the 'Smooth Development' scenario may require the highest amount in terms of traffic in 2020: the spread of the SAC services in the market could reach both consumer and business markets. This scenario should therefore be considered the most interesting for us, as it is most likely the one in which the full potential of the new technology SAC will be unleashed.

5.2 Prospective communication needs

Taking 'Smooth Development' scenario as a reference, for the reason we stated in previous subsection, it is possible to devise the following list of European citizen's prospective communication needs in 15 years:

- availability of communication and content services reacting locally on customers' interest and environment context changes;
- freedom of movement during the use of communication and content services;
- possibility to access to personalized services;
- simplification of human life;
- overall stability of services;
- easy and quick access to any service, anytime, anywhere;
- security and trustworthiness of communication systems;
- Ubiquity and pervasivity, in multiple and dynamic contexts, up to virtual network of people.

Finally, we can assume that, in the most favourable economic scenario, being reliably and securely connected anywhere and anytime will be a strategic communication need for most EU citizens in the medium term and the future services' properties should be of necessity the right ones to achieve an overall simplification of human life.

6 THE CONNECTED SOCIETY

If the trends evidenced in the previous sections continue, it will be likely that people's communication needs and TLC players' strategic goals will meet, giving life to a new kind of society that can be called the 'Connected Society

We can imagine that the Connected Society could be entire world of individuals, pervaded by ubiquitous communication facilities (specifically, the ACEs), that, while making services available to people in every place and every moment of the day, will be capable of self-organising and self-preserving behaviour without any direct human intervention. Precisely these characteristics will meet people's ultimate desire, that is, simplification of life.

At present, there is a clear separation between the physical world of things (principally devices, environment and people) and the virtual world of information. People are in contact with the environment in which a specific person lives in and

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1 Traffic through wireless and mobile Internet network, measured in Mbps (Megabit per second).

can come into contact with the information either directly or thanks to devices support (PCs or, more and more, mobile devices).

In the vision of the Connected Society, thanks to the opportunity of being connected to the Internet all the time and everywhere, the union between communication and mobility will be fully achieved. With the continuous improvement of ACEs and their diffusion, people will have services more and more in arm's reach, flexible and personalised.

Ultimately, continuing with this trend during the next fifteen years, there will be a shift at the intersection of the physical world of people, objects and places, with the virtual world of information [6] coming to the Connected Society: the clear separation line between physical world and information will no longer exist (see figure below).
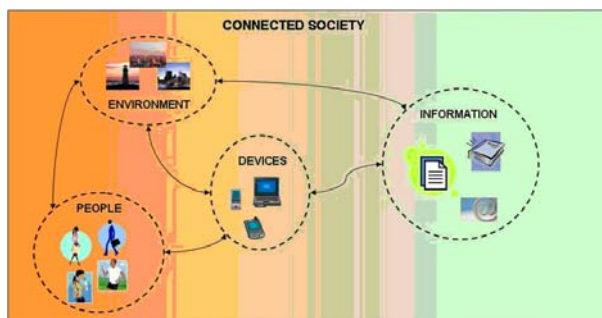

Figure 4 - Connected society vision

The main feature of the communication paradigm of Connected Society will be the ability of the ACEs to adapt to evolving situations, where new resources can become available, administrative domains can change and economic models can vary accordingly [7]. This means that one of the principal research trends will be context awareness and the final goal will be enabling the user to build his personal services through all the available devices, ultimately simplifying his life.
In Connected Society vision, humans are not required to be in the loop except for the initial action of injecting the service components needed in the systems. Yet, service developers, system managers, as well as end-users, would of course retain the capability of overriding any decisions made on their behalf, via proper tools which dynamically intervene on the system or on specific services, without stopping them but simply forcing some goal-directed self-reorganization in it.

7 SAC DEMONSTRATION APPLICATIONS

It is obviously difficult to make forecast over a time span of fifteen years, considering also the complexity of factors involved. In order to better understand the future Connected Society vision, CASCADAS research has identified some families of services that could be enabled by SAC, such as (just to mention some):

- eApplications,
- Pervasive gaming,
- Pervasive content and communication services,
- Personal advertisement and content push on interactive TV/devices,

In CASCADAS research, SAC could be an important technology approach in order to make the Connected Society

real: the above-mentioned SAC enabled services could precisely be the ones that, in the future, will meet both the people's strategic needs and TLC players strategic goals identified in the previous sections.

To make the above listed families of SAC enabled services clearer, let's imagine a picture of a specific instance of the future Connected Society: John is going back home from work by train. John has a PDA enabled by an ACE. The PDA, after having paid the train ticket and having understood that he will have spare time for half an hour, according to John's interests, connects to another ACE put on the train. This second ACE searches for the contents suitable for John and proposes him a Mandarin language lesson with an eLearning service (eApplication) or a Second Life surfing session (Pervasive gaming).
John chooses the Mandarin lesson and joins it. After that, at home, he will be able to continue attending to his lesson on his home PC (Pervasive content and communication).

After having had a glimpse of a possible instantiation of SAC technology in the Connected Society, in order to understand more in detail how SAC could modify providers' business models in the future, let's take into account one among CASCADAS' 'demonstration applications', Personal Behavioural Advertisement (PBA)' that could be an example of a Personal advertisement and content push in interactive TV/devices service.

The demo application PBA considers a modern exhibition centre (like a museum or stadium) in which it's possible to find pervasive infrastructure of embedded services, (such as WIFI connections or RFID tags). The centre is equipped with 'smart' advertising screens that can be used to display to the visitors information about the exhibition itself as well as commercial advertisements: moreover, it's realistic to assume that visitors have PDAs or smart phones by which they can transfer via wireless network content to/from the screens.

In PBA, a 'smart' service devoted to decide what information to display could exploit the availability of contextual information to adaptively decide what information to show on the basis of the visitors' preferences, interest and activities, acquired by the service e.g. from the visitors' PDAs. This service would be based on the concept of time slot that is the temporal window given to each single information showed on the screen. The sale of each time slot happens through an auction; in fact the time slot in which a visitor is in front of the screen could be really brief and an automated auction constitutes the unique innovative system that could enable the transaction.

In order to understand which actors are involved in PBA 'demo application', and how, it's useful to refer to the following value chain map, that shows the business relationships among the PBA actors. Each map square doesn't necessarily identify a precisely defined group of economic subjects, or a business role; a single economic subject can assume more than one role (as we'll see later in this section) or can belong to more than one sector.
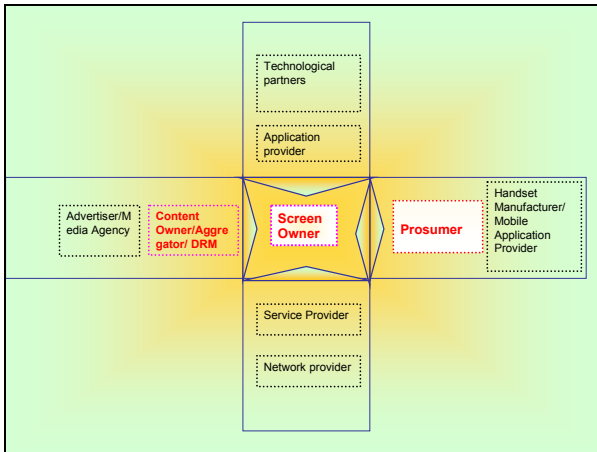
Figure 5 - PBA value chain map

The value chain from left to right represents how the content is created, collected, processed and delivered to the target visitors (which we will name here prosumers as we will explain later).

The value chain from top to bottom represents how the hardware/software resources are integrated into applications and then supplied to the screen owner.

The value chain from right to left represents how the handset/mobile applications are supplied to the prosumers.

Finally, the value chain from bottom to top represents how the networking resources are supplied to the screen owner: that directly involves TLC actors.

PBA actors' roles and sectors are summarised in the following table:

Table 2 – PBA actors' roles and sectors

Actor	Role	Sector
Software house	Provides s/w resources to application provider	IT
Hardware vendor	Provides h/w resources to application provider	IT
Application provider	Provides remote service application to screen owner	IT/TLC
Network operator	Provides networking services to service provider	TLC
Service provider	Responsible of the connection (WIFI, Internet) for screen owner	TLC
Digital right manager (DRM)	Gives content providers control over redistribution and access to material	TLC
Screen owner	Provides commercials on video screen or on visitors' PDAs for content/owner aggregator	MIXED
Media agency	Content provider	Media
Content owner / aggregator	Content provider, can be author (in full or in part) of content	Media
Advertiser	Promotes his/her product/service by means of media agency	ANY
Visitor/Prosumer	Can assume various roles (see text)	

The main interesting point in the PBA demo application is that it shows some new emerging roles, as we will see in the following paragraphs.

Firstly, the prosumer can assume a variety of roles: he/she can be (alternatively or at the same time):

- simple **consumer**, who reads the information from the advertising screen in front of him/her;
- **content aggregator** (he could transfer content to other people) or **content owner** if he could also (with appropriate software) process the information received from the screen and create new content: this way our visitor is at the same time passive consumer and active producer**.**

The term prosumer has been first devised by futurist Alvin Toffler [4]: the word stands most likely for 'producer-consumer', definition that perfectly fits with the multi-faceted role that we have depicted above.

Secondly, another key role is the one of the **screen owner,** seen as a link between prosumers and advertisers (see the horizontal value chains in the PBA value chain map). In fact, on the one hand, the visitors of the exhibition, thanks to new SAC technologies, can assume an active role, on the other hand, the value chain of the screen owner and of the advertiser could change, even if the exhibition visitors remains passive in front of the screen. In fact, the screen owner could sell not only time slot based exposition to generic public, but personalized messages to precise targets, that is the specific individuals who are in front of the screen. Releasing information about himself/herself, the visitor becomes a fundamental part of the advertisement value chain.

Most likely, SAC's technology could modify the business models of all the actors included in our PBA demo application with the possible exception of IT actors, whose interaction is limited to the screen owner.
Anyway, it must be taken into account that the active role that can be assumed by the prosumers can spread on all the value chains of our demo application, because any visitor, besides being a prosumer, might be involved as a professional in one of the other roles, i.e. a software developer, a content aggregator, etc.
This innovative flow that springs out from the prosumer role has been represented in the PBA value chain map as a spiral.

Of course, this PBA is only a basic demonstration application that might be enriched with many other features, such as facial expression recognition capabilities, that could be exploited as a source of data for an advanced Customer Relationship Management system. Anyway, even in its simplicity, the PBA demo application has allowed us to make an example of how it could be possible that the single actors involved in the TLC market could change their roles because of the new technologies available and each actor's value chain could interact with the others' in different and unpredictable ways, as a consequence both of technology and the configuration of the overall value chain network. Moreover, the PBA has allowed us to draw a less abstract picture of the future Connected Society.

8 CURRENT EVIDENCE
We started the discussion of this paper from the present situation and then we have identified possible future technological and social trends, specifically driving the world to the 'Connected Society'. In this section we shall give an account of some behaviour already existing in our society, seen as seed of the future Connected Society. In a broader view, most likely, the future 'proactive consumer' role takes

its roots from the already existing advanced customers' behaviour.

For instance, Sony, after the release of his Play Station Portable game console, soon discovered that clever customers had modified the console, devising new 'not authorized' functionalities such as an internet browser [14] and a streaming music player [15]. Response from Sony was immediate express disapproval, and now, when a customer connects to Sony's web site to download new games and/or expansions, any 'modified' firmware is erased from the console and the new functions are no longer available.

To the same extent, Apple's launch of its new iPhone in 2007 has already given the occasion to the 'advanced customers' to modify the iPhone 'closed' platform in order to permit connection with telephone SIM cards different from the one that Apple has chosen as the only allowed, supplied by ATT [11].

Along with Sony's and Apple's attempts to defend at all costs their business models, two interesting examples of 'collaborative' value chain modifications can be found in the Lego Mindstorms experience [5] and BMW's sharing of vehicle's software resources [13].

One of the first prosumer communities was originated from Lego's Mindstorms construction set, by which customers can build robots in virtually infinite types, using standard plastic Lego bricks and special programmable bricks connected to motors and sensors. When the Lego Mindstorms construction set was launched, in 1998, within three weeks several users groups built up and the programmable bricks and sensors were broken down, put together again and reprogrammed.

So Lego discovered that their product had reached market segments absolutely different from what they had thought. When the Lego Mindstorms fans sent their innovative proposals to Lego, Lego initially threatened them to take them to the court. Afterwards, Lego discovered that the Lego 'fans' indeed had given added value to its product and opened the doors to a fruitful collaboration between Lego's researchers and the Lego fans.

In 2006 a new Lego Mindstorms product, called Nxt, saw the light. Some of the 'home built' sensors devised by the fans are now included in the new set. Now Lego uses its web site mindstorms.lego.com to encourage users to manipulate the Lego software for experimental purposes. The web site offers a free software development kit and Lego users can publish there their personal creations, uploading all the instructions, software and Lego components needed to build their robots.

Our second example of business model open to customers' experimentation is given by BMW, that has given customers' access to its software resources and information, so that, for instance, they can even replace sensors and parts of their cars, having access to the information of the BMW part databases.

9 CONCLUSIONS

In this paper, we have focused our attention on the interaction between the prospective social and communication needs of the EU citizens and the technological trends in the future fifteen years. Taking SAC emerging technology as our main issue, we have drawn a picture of the future Connected Society, developing an instance of this new communication paradigm by means of a demonstration application based on a SAC enabled family of new services.

This analysis has allowed us to detect new potential roles in the overall TLC value chains and its results have been validated against some innovative behaviour that is currently emerging in the ITC/TLC sector.

In summary, the prospective studies on the Connected Society, report the following key aspects:

- there will be a reciprocal interaction and co-evolution between customers' communication needs and behaviour on the one hand and innovation in the offer of TLC services on the other hand;
- TLC service offer will be influenced by TLC providers' strategic goals and new technology opportunities, while communication needs will be, in turn, heavily influenced by socio-economical scenarios;
- the roles of the actors in the TLC sector will change or new roles will appear (for instance due to ownership or management of SAC devices).
- In particular, as seen in section 7 and 8, TLC services users could evolve to 'prosumers' and become part of the production/distribution process of content and, more in general, of the overall Connected Society innovation process. Customers won't any longer be the last element in the TLC value chain: TLC providers should be well aware of the fact that prosumers could participate to the creation, development and distribution of new and (possibly unthinkable now) products and services/solutions.

We can sum up the above aspects by calling up the complex relationship just evidenced between TLC players and individuals 'dynamic co-evolution'.

Finally, thanks to our model of 'dynamic co-evolution', some recommended actions for the TLC providers to be added to their business 'toolbox' in the next ten-fifteen years can be devised:

- knocking down all obstacles to the Connected Society (favour interoperability through standards adoption);
- supporting research on new ICT design principles to manage the complexity of the ACEs;
- making the appropriate choices between interoperability and 'closed platforms' in order to maximize their competitive advantage, depending on the specific case;
- creating business intelligence systems well suited to monitoring the new complex TLC actors' networks in order to follow the evolution of the actors' roles and behaviour;
- supplying new product/services and spreading knowledge on new technologies to prosumers, in order to favour their active role;
- developing internal competences in order to integrate any new actor's skill in their value chain and devise the new value added services requested to nourish the Connected Society growth.

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