

CONTEXT-AWARE COMMUNICATIONS AND IT – A NEW PARADIGM FOR THE OPTIMIZATION OF THE INFORMATION SOCIETY TOWARDS THE KNOWLEDGE BASED SOCIETY (Part 2)

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Abstract

The paper continue the analysis (made in Part1) of an emergent field of the information and communications technologies (ICT), the context-aware communications and information technology (CACIT).

Important results of the analysis include the identification of the main CACIT development purposes/applications as expansions/ additions for human senses (including vision, hearing, smell, taste, touch and sensation of temperature, gravity, acceleration , magnetic/electric field, approach of environment objects), health (vital signs, health parameters, mood, schedule, habitus etc.) or social relations (available relations/persons, group activity, communication etc.). Results refer also to the most important and dynamic fields for IS/KBS, where CACIT applications will continue to be extended with the exponential pace of ICT, will include available interesting applications context (hot spots, emergency, health, commercial, financial, entertainment etc.).

The paper also presents CACIT main evolution steps, starting from the early human context-aware communications based on the five senses and ends to the most complex applications where the borders between CACIT and ICT are blurring, as the added information they collect from environment (context) dramatically improves this way the force (efficiency) and the development potential of the original CIT resource.

The main conclusion reveals the improvement of humankind perception by the smart behaviour in any nature context or activity, enabling adaptation, intelligence and efficiency, but, on the other hand, shows that CACIT has a huge potential to improve intrinsic ICT applications, as communications or computing-aware systems.

Keywords: context-aware communications and information technology, humankind perception, sensors, information society, knowledge based society, Internet of Things.

JEL Classification: L63, L86, M15, O13, O33

1. Learning from context-aware communications and information technology development steps

After we have gauged the actual amazing premises of developing the information and communications technologies (ICT) in the Part 1 of the article, now a further and deeper analysis of the context-aware communications and information technologies (CACIT) may be done, having in mind the purpose to reveal CACIT dimensions and perspectives of leveraging the potential of ICT to drive the information society (IS) toward knowledge based society (KBS), based on the incommensurable expansion force of digital space [6].

In the middle of '80-s I used to tell to my students that the evolving technologies forecast a World where every cm^3 (on land or water, in air or underwater) could be known and controlled, including non-military purposes.

Now we are living in a World where people may communicate from any place, on land or water, accessing a diversity of powerful ICT services which are exponentially developing with continuously expanding limits. As we already analyzed the complex context of ICT development from this point of view [8], it is necessary to understand which are the long time perspective and possible optimization mechanisms of the associated processes, first aiming CACIT.

More than this, we recall [12] that ICT key developing concepts (including Network Centric) extend their impact on IS/KBS in a diversity of processes outside ICT and strongly contribute to people's education and generally improve their lives and creation potential.

That is why it is worth to observe some of the main components of CACIT development, starting from simple communications and IT objectives and identifying future sophisticated applications.

Initially, CACIT purpose was to use the changing information which is associated with people's context (location, environment, timing etc.) in order to facilitate people's interactions.

To be more clear, in this case the „interactions” refer to the communications (including equipments and services), as the location information has long been used as a way to route voice calls, for example at Xerox PARC and Olivetti Research Labs for routing telephone calls [3].

Besides, the CACIT early applications included addressing individuals or groups in terms of identity/availability, in order to improve communications by context data. Eventually such applications included context data acquisition and communication added measures.

A major step in CACIT objectives and applications evolution was adding a diversity of context data referring to persons by using the amazing advances in sensors technology.

The complex integration of sensors in CACIT provides access to new context based fields of applications as[5]:

- complete physical context data (location, time, speed, acceleration etc.);
- environmental context data (weather, lighting, sound, air, radiations, electromagnetic field etc.);
- personal context data (vital signs, health parameters, mood, schedule, habitus etc.);
- social context data (available relations/persons, group activity, communication etc.);
- available interesting applications context (hot spots, emergency, health, commercial, entertainment etc.).

These advances open a new era in optimizing CIT on one hand and all humankind activities, leveraging education and creative potential in IS/KBS, on the other hand.

Here we have to remark the exploding volume and potential of the applications with impact on humankind everyday lives, including their power to induce subtle consequences on people's education, skills, ways of thinking and generally to perceive, react and use the environmental reality and generally the information/knowledge – as concrete features of living in the IS/KBS [11].

It is also important to observe that the development of these features are based on complex processes of learning, deliberately or not, from the algorithms and logical approaches CACIT/ICT applications bring indirectly along with their offered services and products.

Perhaps the most relevant CACIT example is again the smartphone, which evolved from a simple communication tool to a complex device including now almost all PC features, but bringing amazing facilities for GPS services, emergency, weather, transportation, commerce, banking, entertainment etc.

With a little imagination effort we could observe that along with every above mentioned facility, ***our daily friend (the smartphone) is changing our life and our***

personality by the way it educates us to think about, understand and use not only every one of its features, but the logical skills and **added knowledge to approach the reality**.

2. Beyond context-aware communications and information technology

One of the most important features of CACIT is their exponential development pace, as a legacy from mother ICT, but here we have to observe that interesting similarity with the genealogical tree.

The observation has deep implications because this way we may understand one of the reasons ICT is such an amazing phenomenon in IS/KBS.

As we already have mentioned [10], the IT fundamental feature is its „multiplication” structure and operation, which build new hardware, software or functions by combining „modules” and exploit their „perfect” digital rules.

Coming back, it is now obvious how ICT benefit from perfect „multiplications” of their ”branches” in a planetary „tree”.

The news CACIT bring come from the added information they collect from environment (context), improving this way the force (efficiency) and the development potential of the original CIT resource.

We have just arrived this way to an interesting image and conclusion, which will be useful for understanding one of the present factors and future solutions to develop ICT in the apogee/decline scenario we already have mentioned [8].

The „added information” we just have mentioned above could be compared with the new roots we may observe in the vegetal world at the most lively and „expansive” plants, which spread their branches all over the land and when they find good terrain, they „implant” a new root to extract more resources as the distant origine root could not supply the whole potential development of the „giant” tree!

This natural but impressive „comparison” not only illustrates the actual case of CACIT, but it is a brilliant example of the way ICT development challenges could find solutions **learning from the mother nature’s million years „research”, as we already have mentioned [4] and it is also confirmed by other authors [1]:**

„The nature is ahead of us: We should develop our new technologies by learning from nature (Antonio Manzalini)”.

Considering the above premises and the emerging evolutions of CACIT, along with other prominent fields of ICT like cognitive networks and cloud computing, it is difficult to

forecast the edges or perceive the limits of CACIT/ICT applications, but some „iceberg tips” could be seen.

As a main trend of CACIT general development is the integration of all available information, on an application demand basis, but globally the research effort is to cover as many fields/purposes as the technology and regulations permit.

This way the purposes, applications and technologies draw an impressive „picture” of present or emergent CACIT „tree”.

First, as a humankind perception oriented field, as we above mentioned, CACIT will leverage the smart behavior in any nature context or activity, enabling adaptation, intelligence and efficiency [2].

The perception will include expansions/ additions for human senses, including vision, hearing, smell, taste, touch and sensation of temperature, gravity, acceleration, magnetic/electric field, approach of environment objects (including water, snow etc.), body parts position etc.

CACIT will continue to extend applications for major purposes like health (vital signs, health parameters, mood, schedule, habitus etc.) or social relations (available relations/persons, group activity, communication etc.).

For IS/KBS development, the most important and dynamic fields where CACIT applications will continue to be extended with the exponential pace of ICT will include available interesting applications context (hot spots, emergency, health, commercial, financial, entertainment etc.).

Of course, last but not least, for ICT itself, CACIT (as communications or computing-aware systems) will be a relevant branch in connection with cognitive and cooperative communications, aiming electromagnetic spectrum efficiency and network costs reduction, but not only.

In the same field of communications or computing-aware systems, a promising application for „green” ITC is going to be the simultaneous wireless transfer of information and (low) energy, which could benefit from using context information in order to increase power transfer efficiency.

Even a short approach of CACIT development would be superficial without observing the influence of probably the most dramatic actual trend of ICT, which will affect not only humankind but the entire image of IS/KBS.

In fact it is about one of the fundamental trend of IS/KB, actually called „Internet of Things” (IOT).

We consider the name of this phenomenon only „actual” because the future will probably change it in „World of Things”.

Of course, IOT would be the topic of an other paper, but shortly it is worth to observe that people are no longer the main users/actors of Internet, as billion of „things”, other than smartphones (security devices, drones, robots, actuators, intelligent machines etc.), are connected and their number will exponentially increase every year.

The consequence is that CACIT will not be used only by the people, but by the „things” too, as generally the communications systems already are used.

For the accomplishment of the above purposes and features, CACIT will more and more benefit from the amazing advances in sensors technology and their integration in ICT devices and systems.

The typically sensors cover almost all useful domains: electromagnetic field, proximity, light, GPS, acceleration, temperature, pressure, chemistry etc.

A very special interest and perhaps the most impressive development has the health field, which could be implemented only with special technologies, including ICT and sensors. Here the context information includes health care, prevention, emergency etc.

Obviously, even a „short” analysis of CACIT/ICT is always far from being complete, but it is worth to reveal a trend that could provide a general frame for the complex processes of ICT development.

This trend could easily be associated with the term „integration” and CACIT is also a „branch” that may be seen in an integration process inside ICT.

The interesting feature here is just the fact that CACIT present one of the most relevant examples for the mentioned trend, i.e. a such deep and complex integration of CACIT in the ICT networks, as the borders between CACIT and the rest of the network are progressively fading.

This observation is in fact only the „iceberg tip”, as many other examples present the same trend, situation being similar with the above „tree” picture, as increasing the number of branches it is more difficult to distinguish them (each of other).

Again we could analyze the smartphone, as initially it was a „mobile phone” in a communications system, but now it is perhaps the most complex device integrated in ICT and soon it will almost „eat” the laptop and the tablet too.

We have already and many times [10] mentioned that IT and Communications Technology convergence is the most important process and the fundamental feature of ICT in

the last decades, with dramatic consequences for the IS/KBS and generally for humankind and planet Earth.

Now, on one hand, this convergence (borders blurring) is more and more confirmed, but on the other hand, starting from CACIT basics, the general ICT „branches” convergence will lead [9] to **the new concept of „ambient reality”, where information and ICT devices/services (and more!) will be „everywhere” around us!**

3. Conclusions

The high technological level of CACIT along with their complex and fast spreading applications include knowledge and learning steps useful for humankind, as generally the ICT key developing concepts extend their impact on IS/KBS in a diversity of processes outside ICT and strongly contribute to people’s education and generally improve their lives and creation potential.

After a deeper analysis, the paper identified some relevant features of CACIT, including the improvement of humankind perception by the smart behavior in any nature context or activity, enabling adaptation, intelligence and efficiency.

The analysis led to the main CACIT development purposes/applications as expansions/ additions for human senses (including vision, hearing, smell, taste, touch and sensation of temperature, gravity, acceleration , magnetic/electric field, approach of environment objects), health (vital signs, health parameters, mood, schedule, habitus etc.) or social relations (available relations/persons, group activity, communication etc.).

The most important and dynamic fields for IS/KBS, where CACIT applications will continue to be extended with the exponential pace of ICT, will include available interesting applications context (hot spots, emergency, health, commercial, financial, entertainment etc.) and intrinsic ICT applications, as communications or computing-aware systems.

Finally, but probably most important from an economic/financial point of view, CACIT will be influenced by IOT because people are no longer the main users/actors of Internet, as billion of „things” are already connected.

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