

EVALUATING THE DEVELOPMENT STEPS BASED ON LIFE-INSPIRED STRATEGIES FOR THE INFORMATION AND COMMUNICATIONS TECHNOLOGIES

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Abstract

The paper presents an evaluation of the role of the prominent trends in the information and communications technologies (ICT) with relevant impact in modeling the information society (IS) development towards life-inspired strategies to face the actual challenges of world evolution.

Taking into account the evolutions of the IS in the last decades, the complexity of the correlations between the ICT and the IS could be better approached with instruments and models that proved performance in the ICT systems development and reveal a deep connection with the legacy values and mechanisms the nature created in the living world.

The paper also emphasizes the specific impact that Network Centric (NC) and Cloud concepts could have on IS and further on Knowledge Based Society (KBS), beyond their force as strategies of ICT, especially by lending their life-inspired features to the education and behavior of mankind, in terms of synchronization, innovation and efficient communication.

Some relevant examples of the NC mechanism action, facing challenges as resources fading and technologies limits, are also analyzed in the paper.

The conclusions point the importance of analyzing and valuing the huge potential of ICT strategical life-inspired development and in the same time propose to further use these elements as a refined knowledge innovating process, where mankind could find the proper way and pace of his evolution.

Keywords: *life-inspired development, network centric, cloud computing, knowledge based society, information and communications systems, green technology*

1. When you are on a hurry, watch your steps

We all know that the last decades reflected an explosive development of all activity fields, of all business and especially of information and communications systems, technologies and services. Except the last 3 years, when the crisis effects were everywhere and we started to ask if our development pace is correct.

Now we all also share the complex state of preoccupation about the future evolutions and the present decisions for all economical, financial and social layers.

It is beyond the paper aim to be attracted on political issues, so we have to come back to our old pillar for bad weather: when nothing goes on, then look back and change the paradigm.

Here the old paradigm is reflected also (but not exclusively) by the Moore' Law, which led for decades the information and communications technologies (ICT), providing every two years doubled performance (speeds, memory etc) and then the amazing diversity of applications, products and services that leveraged the whole industry and society consumption as we know, by the complex impact of ICT on whole information society.

Now is the time that we have to get from ICT not only new products and services, but also some learned lessons from a success story which brighten all the world, and still does it, although their lights are also fading as all mankind and the Earth too are going to run dry its resources, beginning with fossils, water, food etc.

An other essential question comes to temperate our optimism toward finding an easy answer to a very, very difficult problem: why ICT could have good solutions for a diversity of problems that mankind and the society have to face now and in the visible future?

It is sure that ICT could not have all the answers for all the questions, although the artificial intelligence and the robots are more and closer to the man (while they are now running to see life on Planet Mars better than ever).

On the other side we know for sure that the actual Information Society (IS) and the future Knowledge Based Society (KBS) are growing realities which are mainly rising on ICT pillars.

Now it seems we are between agony and ecstasy, because ICT has chances to contain ingredients of a stable future development, but ICT itself is confronted with many of the actual World challenges.

The next simple question is where and how to look for answers, inside of ICT box?

Unfortunately the question is not appropriate, because ICT is not a box.

So, we have to observe that ICT is a mesh sphere where IS and KBS are growing.

As we already have mentioned [3], probably the best description of ICT impact on IS/KBS is its latest evolving form: a network centric (NC) structure filling with "Cloud" (as a service) the IS sphere.

It seems that the steps we are searching are in the way NC and Cloud are actually evolving by learning from life and building life-inspired technologies where people are not only consumers.

2. How ICT are evolving through life-inspired technologies and lessons

Lessons to be learned

It is already a long time since ICT amazing development is not provided exclusively by the technology advance as long as the new services the technology enabled tend to bring benefits much greater than simply using the technology in new products.

For the general development of IS/KBS the lessons to be learned from these evolutions are still far to be so simple, because a useful lesson must include the whole

circle: people needs– life inspired technologies – market products/services – people’s new personality knowledge/needs and so on.

So the true lesson must bring the new knowledge which will include both the new needs and the innovation in producing greater added values from the same amount of new technology, every time in the cycle.

This new paradigm could be one of the solutions for progress even when the material resources are on fading, but the human resource is rising, as a natural consequence of innovating, every cycle, the new knowledge.

It seems to be a wonderful lesson to apply for finding the way to progress on bad weather – that is nowadays.

The real problem is that this good solution (not so new) must be applied in a very complex manner on very complicate Earth.

As a consequence we should identify first the sensitive conditions that contribute to the “complicate Earth” and then to progressively update the solution, in an appropriate manner, for these conditions.

An alternate way is to identify the main steps and instruments ICT made in the same direction.

This second way looks shorter and more promising because ICT is already the main engine of IS/KBS development and we can see the results still shine, but we also believe that *some corrections must be also made from time to time*.

Some life inspired ICT strategical steps

Now is the moment to point the importance of the above mentioned new paradigm in developing ICT.

In this context life could mean all that we have to learn, now or tomorrow, from the research “products” the nature made as a legacy, in millions of years of evolution.

Examples are so overwhelming, as only few could be enough relevant.

We find the revolutionary communication/computing models and technologies in the human brain. The new cooperative, cognitive and healing network technologies learn from the human genome and the way the live world is self healing and so on.

The toughest lessons are to learn how mankind survived in the Earth difficult époques.

Although it could be surprising, the most complex is the actual époque, when the appearance of apogee in mankind evolution makes less easier the identification of the real state, of decline of many levels of Earth and society.

To face these challenges, ICT adopted and implemented some strategical concepts, as Network Centric and Cloud as a service [4], [3].

The “network centric” (NC) concept evolved in communications and information systems (CIS) from the physical communications network to the integrated communications and information technology (CIT) network (CITN), where Internet became the best example.

Then, due to the huge proved advantages of a such network, the idea was generalized, first (as often happened) in the defense field, as network centric warfare (NCW).

With NCW, the NC got the content the new paradigm will also rely on: to use the features of CITN (**logic, functionality, synchronization and finally the power**) in order to leverage the potential of an organization (as group and individuals).

It is crucial to note that all these *NC features are effective irrespective the application* (i.e. exceeding NCW), *due to their natural and life-inspired way to link and harmonize the people along with the leveraging effects of technologies and services. More than this, the features could enable similar effects even when the technologies are not always implied, due to the fact that, in KBS the people will tend to act as they have learned. They will value and use the innovating attitude, time/ideas sharing, good synchronization and efficient communications skills, as highly priced values in KBS.*

On the other hand, as a technical approach, the cloud concept and “technology” appears to be only a considerable trend to increase the efficiency of CIS services, for the user, as a natural evolution of CIS. That is to concentrate the hard and soft resources in remote centers, as the users (including organizations and individuals) to “buy” exactly the amount of services they need (services on demand), with crucial advantages as reduce cost (with investment and maintenance – total cost of ownership/TCO), keep the pace with state-of-the-art technologies and generally complying with the “green” trend.

As it will be presented bellow, this concepts represent a strategical set of efficient mechanisms which enable better approaches, life-inspired, of the most relevant challenges for the IS/KBS progress.

NC could leverage the complex use of the human creative potential when all other Earth resources are on fading. In the same time, NC is very large approach for the integration of all factors which could influence the IS/KBS development, extended to all Earth ecosystem elements and challenges.

“Cloud as a service” will offer a new technology and a new business model for mankind to exploit ICT with better efficacy compliant with green industry.

But the crucial importance of NC and Cloud is their ability to imply people, by socializing technologies and services, in the creation of new values in science, technique IS/KBS and democracy (with direct impact on social challenges).

The importance of NC as a theoretical approach is based on a natural process, reflected by actual common facts, which could be distributed in a diversity of areas.

The market in general and in the case of ICT in a particular way is generated by human needs nature, which is expressed, from psychological point of view by the Abraham Maslow Pyramid: the needs are growing from base, starting with the physiological ones (eat, drink etc.), continuing with the security, relationship and esteem ones. On top are the personality development ones.

The ICT answers to the needs are starting with the facilities from the “intelligent home”, continuing with the communications services/products (mobile or not) and perhaps ending with the “endless” range of the scientific, technical, cultural or entertainment applications (including more than “multimedia”).

On the other hand, ICT development is inspired by life. Starting from the “multiplication logic” present in the cell-based structures and the electromagnetic model of the nervous system, the new CIT approaches tend to lend models and achieve features similar with the brain – senses system (as the faculty through which the external world is

apprehended) and other. Soon we will have devices/services that will help us to be aware (i.e. to have direct signals, data etc.) about environmental processes we are interested in.

One of the prominent mechanism of the way NC influences the IS is for sure the power/speed/capacity of the chips (processors, storage etc.) challenges.

The power consumption (and then CO₂ generation) is the way the “green ITC” could strongly contribute to world CO₂ reduction, by the systemic mechanism of NC (notice that the processors and generally the ITC components are present in all industries and more! They are everywhere, from smart phones, cars to toys).

The computers speed and especially the supercomputers speed is driving, again through NC mechanisms, many important scientific research, industry, medicine (and other) fields. Some prominent examples could be the human genome decoding, the Large Hadron Collider (Geneve) and the the creation of climate models that can accurately predict weather patterns in the global climate changes context.

The JUROPA supercomputer at Jülich Supercomputing Center in Germany, currently the 14th fastest computer in the world, consists of a cluster of about 15,000 processor cores [8].

The Intel future exa-scale systems could be comprised of as many as 10 million cores - a major challenge in terms of power consumption and data communication amongst all the cores.

On this way Intel has launched three new research centers (including Jülich Center) focused on different aspects of the same challenge: developing supercomputers with Exa-scale performance levels (a billion billion computations per second). This means, for example, that if ~6.9 billion people on Earth would solve math problems at a rate of one per second, it would still take over four and a half years to calculate what an Exa-scale supercomputer could do in a single second.

Last but not the least, the **integration capacity** on the chip (and then storage capacity) that must face the “data deluge” we have already mentioned, is also a challenge, not independent but quite (technological) linked with speed and power.

Now the scientists [1] have the goal to create the complete map of human brain circuitry (about 1 000 000 mm³), but 1mm³ will request about 1 petabyte (1000 terabytes), so eventually about 1000 exabytes.

The expectations for Internet traffic in a couple of years count also exabytes and are exponentially growing.

Thus we are going to an “exadata” age, starting in 2011 with 3 Billion Internet users and reaching more than 10 Billion connected devices in 2016.

As a global impact, in 2016 the needed capacity of networking and computing must increase 20 times.

Now is quite shocking to realize that most of this progress is depending, through NC mechanisms, mainly on the Intel research on developing VLSI structures up to the physical limits of 10nm channel, foreseen after 2015 (in 2011: 22nm). But beyond? Perhaps a technological (bio-inspired) will be the future solution.

All these innovations will be in fact “knowledge based” and will influence the world (KBS) by information changes (cooperation) between “connected” people and entities (NC mechanisms).

This way the ICT progress will influence all the fields from the “social impact class”: home working; e-Health; e-Learning; e-Government; Social networking etc.

The NC mechanism, by ubiquitous communications and IT will develop a large diversity of remote services or mobile/distributed systems (e-government, home working, e-learning, e-health, intelligent home, cloud computing etc).

A special contribution will also have, by their mass spreading (NC), the cognitive, context aware and man-machine direct communications systems, medical micro-devices, genetic engineering and other technologies which will enable a diversity of facilities for the people to use devices that bring the technology, the information and generally the knowledge close to them.

Among the above, a very important field is **home working**, which will radically influence the development of KBS, because individuals, companies and governments will use software/communications as remote services which will enable (by NC mechanisms) not only distant-work, but many of the social activities and needs, including health care and e-learning – which could strongly leverage the mankind (body and soul) progress, in a future KBS.

This way an emergent industry will integrate all devices and services which are associated with the model machine-to-machine (M2M), by connecting them via Internet or other networks and covering applications areas as manufacturing, logistics, automotive, insurance, healthcare, intelligent home, utilities, government, retail.

Soon, M2M will become a parallel collectivity, without people, just devices (not necessary robots) with their jobs doing and services consuming, but of course helping people and organizations with high efficiency and reliability, using GPS and GIS features.

The social networking has probably the highest pace and impact, reflecting the essence of NC mechanism, on KBS and generally on people activity and education.

Notice that, as we already have mentioned, the social networking and NC has a two-way action.

Usually only the Network-People way is sensed and wide-spread, but the future KBS will greatly benefit from the reverse way: People-Network.

Here we must point that the reverse way has a crucial importance to stimulate useful “knowledge” creation and spreading.

As a relevant example, the Intel initiative of *joining President Obama as he announced a national science, technology, engineering and math (STEM) education initiative, called the “Educate to Innovate” campaign. This is the first time a president has made this level of commitment to math and science education. At Intel, math and science education has been a focus of more than \$1 billion of investment and the catalyst to train more than 6 million teachers.*

So the huge force of NC will be the return of investments, from people to organizations, as ideas, work, knowledge or any intellectual creation. All these contributions will be used, refined and again distributed, by ICT products and services or knowledge (NC mechanisms), to the people (closing a knowledge creation circle – via the added value). Our competitiveness will depend on “how” we invest in people.

Examples could continue and range from the wide concept of “context aware” technologies and services (with clear applications in NGN – next generation networks, sensors networks and cognitive systems), to the approach of “collective intelligence” and M2M.

Designing “collective intelligence” and “network centric” strategies we have to learn from the “intelligence” collected from each person, every part of the human body and more from any part of life on Earth (and beyond).

So, we have to identify the most efficient ways to create the necessary knowledge for the optimal development of both ICT and KBS, by better use of the human potential and its updated ethical values and keeping in mind that knowledge is the main factor of KBS stable progress.

Conclusions

The identification of the systemic trends of ICT development revealed the importance of analyzing and valuing the huge potential of ICT prominent life-inspired strategies and in the same time proposes to further use these elements as a refined knowledge innovating process, where mankind could find the proper way and pace of his evolution.

From all these new steps of ICT we have to learn the useful knowledge and to innovate every day, but we have to add perhaps **the last ingredient ICT don't have and mankind too many times forget: the wisdom of the pace – the balance with the people, the environment and especially with our soul - the legacy of generations: “Festina lente!”**

REFERENCES

- [1] Paul McFedries, *The coming data deluge*, IEEE Spectrum, feb.2011.
- [2] Abdulaziz S. Almazayad and Farooqui N.K., *Towards Knowledge Based Society*, Proceedings of the World Congress on Engineering and Computer Science 2009 Vol II, WCECS 2009, October 20-22, 2009, San Francisco, USA
- [3] Victor GREU, *The network centric and cloud - a new paradigm for the optimization of the technical and human information systems*, Romanian Distribution Committee Magazine Volume 4, Issue 4, 2011.
- [4] David S. Alberts, John J. Garstka, Frederick P. Stein, *Network centric warfare : developing and leveraging information superiority*, CCRP publication series, 2nd Edition (Revised) CIP, August 1999/Second printing February 2000.
- [5] *** Towards a knowledge based Europe The European Union and the information society, European Commission Directorate General Press and Communication, October 2002
- [6] Glen Anderson et al , *Power Efficiency and Sustainable Information Technology*, Intel Technology Journal, dec.2008

[7] Stephen Harper, *The European Union Takes the Next Step in Realizing the Energy Efficiency Potential of ICT*, February 26, 2010, <http://www.smart2020.org>

[8] Sean Koehl, *The Exa-scale Supercomputer of 2020*, Intel European Research and Innovation Conference, September, 2010, www.intel.com.