Assessment of impacts of Autonomic and Cognitive Networking

1102C, 28/09/2010 (09:00-10:30)

Autonomic and cognitive networking technologies can help achieve efficiencies through better exploitation of resources and reduced human involvement.

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An autonomic network could be define as a network capable of performing self-management (and other self-* capabilities), so that to hide complexities to Users and Operators (this would mean in principle saving costs). This definition is very similar to the concept of a cognitive network: as defined by D. Clark [1] "a network that can assemble itself given high level instructions, reassemble itself as requirements change, automatically discover when something goes wrong, and automatically fix a detected problem or explain why it cannot do so". A more recent definition has also been provided [2]: "a cognitive network is a network with a cognitive process that can perceive current network conditions, and then plan, decide and act on those conditions. The network can learn from these adaptations and use them to make future decisions, all while taking into account end-to-end goals."

Looking at these definitions of **Autonomic and Cognitive networking** (ACN), one is expecting that to make a network autonomic and cognitive it is necessary to exploit a knowledge plane or some autonomic cognitive processes (for instance, based on reasoning, learning, etc).

As usual, we need to face the dilemma on costs/benefits: What is the "price of the feature"? What are the (capex, opex) savings?

Research and development into autonomic and cognitive networking needs to be built on measurable results. This approach would certainly be appreciated by an industry looking for solutions to save expenditure and generate revenue. This is more important than ever, given that the large-scale adoption of processing, storage and communication services will make future networks increasingly complex and heterogeneous.

ACN technologies can help achieve optimal exploitation and use of resources; improve management by reducing human involvement; and exploit different service models so that operators can select the best one.

This session will look at methodologies for assessing the potential impact of ACN for future network evolutions.

Agenda

- How Autonomic and Cognitive Networking Technology is Reshaping the Economy by M. Ulieru (The University of New Brunswick - Canada)
- Autonomic and Cognitive Networking for networks and services management: the Operator's view C. Destre (France Telecom)
- The multiple facets of autonomic systems' impact by L. Ciavaglia (Alcatel-Lucent)
- Transient Ownership of Resources in Cognitive Networks by L. A. DaSilva (Trinity College Dublin)

Abstract and Short Bio

- How Autonomic and Cognitive Networking Technology is Reshaping the Economy by M. Ulieru (The University of New Brunswick - Canada)

1. The weaving of intelligent communication networks into our lives unravels the industrial society by melting our rigid institutional and governance structures, dissolving borders and organizational boundaries and decentralizing critical infrastructures. In light of these developments governments and companies alike are being faced with the need to abandon the present measurement of growth in favor of a frame that can account for the unaccounted for 'wealth-of-networks' that seamlessly increases the quality of life and work while boosting productivity and performance in the digital economy. We will point to clear strategies for defining new indicators that can capture the reality of today's sources of value not directly observable on our balance sheets. Through simple yet eloquent and powerful examples we will shed light on the blind spots hidden beneath the fundamental transformations by which the Autonomic Cognitive Networks Revolution is reshaping our lives and the world. The large share of economic value created by the 'non-market transactions' enabled calls for a whole new way of thinking about fundamental concepts from markets to productivity and wealth creation – which we need to embrace to master the crucial aspects of a digital advantage. We will explore the core elements needed to encourage sustainable change as these new communication systems are introduced and grounded in the practice environment. Motivational factors, incentives to embrace the change as well as alignment with the societal needs will be underlined.
2. Short bio: Professor Mihaela Ulieru has held the Canada Research Chair in Adaptive Information Infrastructures for the e-Society since 2005 when she also established (with Canada Foundation for Innovation funding) and leads the Adaptive Risk Management Laboratory (ARM Lab) researching complex networks as control paradigm for complex systems to develop evolvable architectures for resilient e-networked applications and holistic security ecosystems. In 2007 she was appointed to the Science, Technology and Innovation Council of Canada by the Minister of Industry, to advise the government and provide foresight on innovation issues related to the ICT impact on Canada's economic development and social well-being against international standards of excellence. Professor Ulieru has a PhD in Diagnostics and Controls of Dynamical Systems from Darmstadt University of Technology in Germany (1995) and was postdoctoral fellow in the Intelligent Robotics and Manufacturing Group led by Professor William Gruver at Simon Fraser University, Canada (1996-1998). She was on Faculty at Brunel University in London, UK and at the University of Calgary in Canada where she held the Junior Nortel Chair in Intelligent Manufacturing and founded the Emergent Information Systems Lab. As a member of the governing board (AdCom) of the IEEE Industrial Electronics Society, Professor Ulieru founded the international Industrial Informatics research community and its two major forums: the IEEE Industrial Informatics Conferences and the IEEE-IES Industrial Agents Technical Committee. In 2008 she founded the IT Revolutions Forum and was General Chair of its first conference held in Venice, Italy in December 2008. She has held and holds appointments on several international S&T advisory boards and review panels, among which are the Science and

Engineering Research Council of Singapore, the Scientific Council of the EU Proactive Initiative on Pervasive Adaptation (PERADA) and the EU Network of Excellence in Intelligent Manufacturing (IPROMS), the Natural Science and Engineering Research Council of Canada's Advisory Panel on International Strategy and as expert on its ICT and Security review panels as well as the US NSF Cyber-Systems and several EU FP7 expert panels. To capitalize on her achievements and expertise in distributed intelligent systems by making information communication technologies an integrated component of policy making targeting a safe, sustainable and innovation-driven world, Professor Ulieru recently founded the IMPACT (Innovation Management and Policy Accelerated by Communication Technologies) Institute for the Digital Economy for which she currently acts as President.

- Autonomic and Cognitive Networking for networks and services management: the Operator's view C. Destre (France Telecom)

    1. Abstract: Benefits from Autonomic and Cognitive Networking could be classified in two main categories (in order to simplify human interactions with IT). On the first hand, networks and services operations improvement. Management of networks and services are more and more complex: increase of the number of devices to manage and players relationships, NGN and network convergence based on IP resulting in a lot of issues regarding configuration and reconfiguration, End to End, customers' Quality of Experience management. These issues raise the need for a kind of process automation which can be consistently implemented using autonomic concepts. On the other hand, enabling new added-value business. Trends towards the internet of things, M2M, social networks call for an evolution of networks and the way we design them. This evolution must offer solution with zero management and adapted services for customers.

    2. Short bio: Christian Destré is a Orange Labs project leader concerning OAM/OSS evolutions including End to End NGN VoIP assurance improvement since 2005. He is also responsible of Autonomic Networking related works, especially for Self-Management of Networks and Services.

- The multiple facets of autonomic systems' impact by L. Ciavaglia (Alcatel-Lucent)

    1. Abstract: The OPEX reduction is a key challenge for existing and future networks. The introduction of autonomic features is the mainstream approach promoted to address this challenge. The adoption of these advanced functions in the industry is rising and we can legitimately ask ourselves how to measure the real impact(s) of autonomic technologies. This presentation will analyze the different domains and types of impacts generated by these new techniques and will propose ways to move their adoption to the next level.
    2. Short bio: Laurent Ciavaglia is currently working at Alcatel-Lucent Bell Labs France, in a team specialized in autonomic systems. He is vice-chair of the ETSI AFI group, working on the definition of standards for self-managing networks. Laurent is also active at the IETF for the MPLS and Pseudowire technologies and is involved in

several European research projects dealing with the control and management of carrier-grade networks.

- Transient Ownership of Resources in Cognitive Networks by L. A. DaSilva (Trinity College Dublin)
    1. Abstract: A key promise of cognitive radios is that more efficient utilization of resources will benefit both providers, through lower operating and capital expenditures, and users, through higher quality of experience. A new way of thinking about network resources is one of the enablers of this improvement in efficiency. The new model is less about the traditional ownership of infrastructure and spectrum, and more about the autonomous deployment of wireless access equipment and the opportunistic use of currently-underutilized frequency bands. Examples of this shift in resource ownership models include dynamic spectrum access, open-access femto-cells, and multi-hop extensions to mobile networks. There is also increased focus on interference tolerance rather than interference avoidance, which in turn will require more sophisticated power control, signal sculpting and interference cancellation techniques. With the paradigm shift to transient ownership of resources comes the need to manage an increasingly decentralized network of autonomous agents – in other words, the need to manage complexity. In this presentation, we discuss how cognitive networks enable new business and technical models of resource ownership and what the main challenges in operating in this environment are.

- Short bio: Prof. Da Silva is Stokes Professor in Telecommunications at Trinity College Dublin.
    - Also a faculty member at Virginia Tech
    - Research focus on wireless networks, networks of cognitive radios, application of game theory
    - Current FP7 projects: CREW and COGEU
    - Other current projects funded by Science Foundation Ireland, National Science Foundation (US)

References

[1] D. D. Clark, C. Partridge, J. C. Ramming, and J. T. Wroclawski, “A knowledge plane for the Internet,” in Proc. of SIGCOMM ’03;
[2] R. W. Thomas, L. A. DaSilva, and A. B. Mackenzie, “Cognitive networks,” in Proc. of IEEE DySPAN 2005, pp. 352–360, Nov. 2005;

Networking Session **Technical description**

Web site: **http://www.telecomfuturecentre.com/**

Other Links and Documents

Paper accepted at Future Networks and Mobile Summit 2010 (191 KB)

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