

IN PURSUIT OF THE 'THOUSAND FACTOR' AND THE DAWN OF A NEW AGE FOR TELECOMS

Green Information and Communication Technology (ICT) is no longer a distant dream. GreenTouch, a global consortium organized by Alcatel-Lucent Bell Labs, is spearheading an initiative to innovate and create technologies that will allow networks to achieve an increase in energy efficiency by a factor of 1000. The hope is that the energy required to power today's communications networks, the internet included, for one day will eventually be enough to last... three years.

When I had the good fortune to be invited to join Alcatel-Lucent in 2008, I was both haunted and inspired by a figure that refused to leave my thoughts. One billion individuals worldwide remain without any form of connection to global communications networks. They want to be invited in and more than ever their very existence depends on it.

Development experts that I count among my relations have assured me that a necessary prelude to growth in less developed regions is the effective implementation of a communications infrastructure, however primitive. Networks are the sine qua non for the transformation of economic laggards. Why? For the simple fact that the rural inhabitant with the means to communicate finds him or herself suddenly in the possession of an invaluable tool of interaction with distant markets and is granted the power to access information on the market conditions for both vendors and consumers of an array of agricultural products. No longer isolated and vulnerable, the farmers become masters of their own economic destiny through the transformative power of telecommunications. These individuals can now access weather forecasts, gain intelligence, and learn new techniques to optimize their production. To be excluded from the knowledge economy has become a handicap, and we have passed the point at which it may have been possible to return to simpler times. Effective communications are an essential ingredient of prosperity and the aspirations of a billion new consumers/entrepreneurs/partners are not open to negotiation.

When a goal as lofty as our dream of absorbing one billion new members on to the global information highway approaches fruition, how are we to ensure that the process proceeds in a manner that is sustainable from an environmental and climate-related perspective? As of today, 300 million tons of CO₂ can be attributed to the ICT sector annually which is equivalent to the emissions of 150 million automobiles. With the explosion of high-speed networks, and the increasing preference shown for video over voice communication, this figure is set to grow exponentially. The need for immediate and drastic action is clear if we are to have any hope of reducing the impact of this trend. Our sector is now responsible for 2 percent of global greenhouse gas emissions and if we fail to act quickly, it will soon double. Clearly a change of tack is in order. For years we have been obsessed with a paradigm that placed all the emphasis on expanding capacity. This line of thinking has outgrown its usefulness and the tunnel vision it promotes should be discarded. In 2011 it has become necessary to replace past assumptions with a new faith, too long neglected, in the power of increased energy efficiency and the effects it could have on our conception of the future of telecommunications networks.

We have found a response to the challenge. [GreenTouch](#) has emerged through an interactive process where Alcatel-Lucent has engaged with its partners across the value chain to produce a program which aims to invent and demonstrate technologies by the year 2015 that will make it possible to multiply by a factor of 1000 the energy efficiency of our telecommunications networks, effectively reducing consumption to 0.1 percent of its current levels. While the figure may sound ludicrous, I am convinced it is attainable, as my recounting of the genesis of this “folly” will make clear.

At the beginning we all shared a common belief. If we were to have any hope of escaping the negative consequences of our predicament, where damage to the environment had reached crisis proportions, we could no longer search for a solution through recycling the tired responses of the past. In other words, the time for being reasonable had passed. To transform the vision of GreenTouch into a reality will require a complete rupture with the past and a quantum leap forward in our approach to the matter of energy efficiency.

We initiated our transformation through a systematic analysis of every component of ICT networks at their most fundamental level: optics, wireless, electronics, processing, routing, and architecture. By seeking guidance from [Claude Shannon's revolutionary theories](#) as developed at Bell Labs half a century ago we addressed the physical limitations of the technologies involved. His ideas rested on the creation of tools to govern the measurement of the capacity of a given system to carry information over its

channels, which in telecommunications can include a path over an electrical wire, an optical fiber, or air. Where his ideas have been of most use to the current situation is when his reasoning has been inverted in order to identify the minimum amount of energy required for transmission over a given channel. Where Shannon used mathematics to demonstrate the maximum amount of information that could be carried by a communications system between two parties, human or machine, we have gone in the other direction. The torch has been passed to Gee Rittenhouse and the GreenTouch teams that are part of this collaborative effort, as they design new ways to minimize energy consumption in the data transmission systems of the networks of the future.

Nevertheless, the limitations of the technology will become painfully apparent if we are unwilling to radically rethink our methods of deployment. Taking the measure of the stakes involved we believe that mere steps to polish the current system, no matter how ingenious, are no longer sufficient for the task that lies before us. We cannot simply take today's network and extend it down but must completely rethink the very foundations of the current system. If we simply apply the same logic to network management, and do not make energy efficiency a priority, our carbon footprint will remain unchanged. When we have reached our goals the network will consume over the course of three years the same energy as it swallows up under the present system in a mere day! I understand that the target we have set is ambitious but the numbers provide a quantifiable roadmap based on scientific analysis as adopted by world-class laboratories and research institutes spread across the globe. The universal approach we have taken has created a multidisciplinary framework that I am convinced will provide a platform for the acceleration of innovation in the paradigm shifting technologies we so desperately need. The pursuit of the 1000 factor will undoubtedly shake things and force a rupture from the many comfortable assumptions of the past.

Unifying the brightest minds on the planet through the creation of networks of innovators from laboratories, businesses, and universities will allow us to face the global challenge by creating a sense of purpose that exceeds the narrow interests of political, nationalist, or corporatist expediency and ensures all are working toward reaching the same revolutionary goal: to transform the nature, constitution, indeed the very DNA of our current networks. The GreenTouch framework will promote a model of open innovation encouraging not only an exchange of intellectual capacities but of the individual ecosystem under which each team operates creating a formidable fountain of knowledge. In addition to the work of research teams at Alcatel-Lucent, there are an [additional 34 partners from some of the worlds most prestigious organizations.](#) Included in this group are leaders in the telecoms industry (e.g. China Mobile,

Swisscom, and KT), electronics giants (Freescale and Samsung), and leading global research centers (e.g. Inria, CEA-LETI, Columbia University, University of Melbourne, and Cambridge University). Bringing together such distinguished company has ensured that beating at the heart of GreenTouch is the largest and most diverse consortium ever assembled in the history of telecommunications. Each will bring their own unique experience to the table using insights gained from their area of specialization such as traditional and wireless voice services, connectors, fiber optics, etc.

With the goal of creating an entirely new point reference network architecture by the year 2015, GreenTouch will lay its foundations for holistic and universal optimization on the principle that networks represent a unified whole made up of interdependent parts. Gains in energy efficiency are not expected to be uniform and will vary depending on network type or location. As much as it will be possible to reach and largely surpass the 1000 factor over fixed line networks it will be equally arduous to achieve this kind of efficiency over wireless networks due to their dispersed nature and the amount of energy it requires to reach consumers in the less densely populated areas they serve. Additional headaches could arise as while routers and connectors are achieving gains in energy efficiency of 20 percent annually, the points filtering access are far more difficult to optimize. To use an example, if a cellular telephone were only activated when receiving a wireless tower signal, would this promote optimal energy efficiency better than through a permanent connection to the network? In order to achieve our 1000 factor it may be necessary to curb the current habit of “always connected” with regulations permitting a “connected when necessary” mode. By thinking outside the box in this manner, our current expectations and assumptions surrounding systems can be reframed and there would be no need to sacrifice either quality or diversity of service to achieve our energy efficiency goals.

The green economy and energy conservation are both powerful engines for research and development. It may come as a surprise that it is in the work of our teams operating in China that I have noted a particular emphasis placed on the creation of concrete solutions. Their sense of urgency has sent an unmistakable signal that the country has succeeded in initiating a quiet revolution in the way it views itself in relation to its natural environment.

One question that emerges in any discussion of the GreenTouch consortium is how so many competing groups have been able to cooperate to the point of sharing vital research when operating in one of the most competitive industries on the planet. For me this is to create a problem where none exists. Our teams would cease to be effective if

they operated in an atmosphere of secrecy and suspicion and our goals can only be achieved if the channels of exchange remain open. GreenTouch is an initiative with a vision stretching far out to the future and has been insulated from the markets by design, freeing our participant from the constraints of industrial and commercial competition. We have created a safe platform for exchange where each member advances through the perspicacity of his or her colleagues and we expect the benefits will reverberate outwards to the wider society. Competition will resume, as the model matures and new technologies begin to emerge, becoming an integral component in the long term health of our endeavor.

For the initial five years of our project, we have chosen to privilege a model for network growth corresponding to the needs and capacities of the most advanced industrialized nations over those of emerging markets, which is not to say that we will completely neglect the latter. The consortium will host an event in February 2011 that will be dedicated at presenting where we are after one year. Before 2015, GreenTouch will provide a comprehensive vision and be capable of demonstrating the essential components required to transform the current models of network architecture. Our operating methods will undoubtedly produce some surprises along the way and it is highly likely that new technologies, indeed entire industries, will emerge over the indicated time frame. It goes without saying that the adventure on which we are about to embark will have implications stretch beyond those of Alcatel-Lucent. The entire ICT ecosystem (service providers, semiconductor manufacturers, and software developers, etc.) will all be invited to the party. GreenTouch aims to achieve results that exceed the sum of its parts and embarking on such a historic undertaking requires a unity of purpose from the entire spectrum of the value chain. To achieve results will demand that all the wheels of this fascinating machine that has yet to be constructed are rolling in the same direction.

We have before us the epic task to think and act as the irrepressible champion of sporting legend who promises to break all the records in the books without ever asking what they are ...or whether such a feat is even possible. On one point, our team is clear: in theory, ICT networks could achieve efficiencies 10,000 times greater than what is possible today. GreenTouch could be just the beginning.

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