Commentary on
"Tools and technologies for equitable access"

by Alberto Escudero-Pascual

Carlos Afonso, June 2008[1]

[1] This is a commentary on the issue paper Tools and technologies for equitable access, by Alberto Escudero-Pascual. It is part of a series on equitable access to ICT infrastructure commissioned by APC for an event on equitable access which took place in Rio de Janeiro in November 2007. The papers and commentaries can be found at: www.apc.org/en/pubs/research

These comments seek to add to Alberto Escudero-Pascual's paper, *Tools and technologies for equitable access*, by focusing mostly on some extra-technical issues which influence technical choices confronting local communities in leveraging information and communications technologies (ICTs) for human development. The internet has brought a uniquely fast lane to universal information and communication, as is well known. Of equal significance is the notion that this process is still in its infancy – like a supernova in the first few seconds of its explosion.

We are witnessing the birth of technologies unimaginable just a few years ago in the fields of signal processing, digital radio, image manipulation and rendering, as well as data compression, coupled with rapid advances in data transmission capacity. All of this is affecting traditional ICTs, in a move to a future of convergence whose implications are not quite clear – not only technically, but also regarding national regulation, transborder implications, national and international governance, and individual rights and security.

Another crucial aspect is that, as these technologies[2] quickly become available as household appliances, the network extends at its edges in an intensive and extensive manner. If there is a problem here, it is not of control – as we should advocate more and more power or autonomy at the edges of the net as a basis for preserving and enhancing electronic democracy – but of quality and reliability. Millions of "mini-nets" – or local networks built from homes, in many cases open to communities – are being assembled using unlicensed spectrum, and are putting additional stress on the suppliers of broadband connections who do not expect end-users to consume on the average more than 10-20% of the nominal bandwidth agreed in their service level contracts. Even the internet protocol (IP) addressing system is reaching limits unexpected a little more than a decade ago.

The numeric format for addressing internet machines currently in use seemed like it would last for many decades, and the proposal to expand on the magnitude of the format was just theory. At the time IPv6 was conceived, the network was far from technically ready to run it, and until today researchers have difficulty in establishing the best transition procedures. This move is still anything but trivial, given the growing complexity of the net. Many millions of devices at the edge are stressing the need for a transition to the new numeric format, and address translation technologies (which bridge local networks to the internet using a single real IP) do not do the job. Just the huge networks of managed cable modems (demanding three real IP numbers per modem pair) are already putting a lot of pressure on the pool of addresses available to the largest cable operators. All this means backbone operators and providers of broadband services drastically limit the

[2] Off-the-shelf communication gadgets such as access points, repeaters, bridges and so on, some already with the capability of assembling together in a redundant communication environment known as "mesh networking".

number of real IP addresses available to the final user – including whole community networks.
At the same time, digital radio technologies at the edge are showing their limits. The number of simultaneous connections to a radio-base station is limited by the width of the authorised (licensed or unlicensed) spectrum. Massive deployment of broadband through the cellular network – using general packet radio service (GPRS), EDGE, and, more recently, higher-speed third generation (3G) technologies – is taking operators to the negotiation table with telecommunications regulators. Besides more radio channels to serve the same areas, they simply need more spectrum. Users expected fixed

monthly charges from broadband providers with new technologies such as 3G (as was the case, within certain limits, with landline broadband), but this is not going to happen. To the contrary, charging criteria will continue to be based on how much data the user exchanges with the net, limiting (economically) heavier use resulting from multimedia applications.

In short, digital radio technology (terrestrial or via satellite) is not future-proof regarding data transmission capacity, and it has environmental drawbacks (it is vulnerable to common environmental conditions like heavy rain, lightning, interference from other devices, etc.). Pressure from business interests also force promising but experimental technologies to be deployed (like WiMax, which moved from a fixed to a mobile technology as it was being rolled out, creating havoc, just when more stable technologies were also being deployed, such as 3G). So far, the only future-proof technology is optical fibre, as the physical fibre does not need to be replaced to achieve leaps in bandwidth capacity (technically, it is just a matter of upgrading the exciters and signal processors at its edges). However, its deployment is not only more expensive than, for example, a backbone using dual-band radios, but, unlike community WiFi networks, it also involves arrangements with local authorities (including right-of-pass rules).

One can conclude that even in professional deployments, all digital technologies have limitations; all the more so in a period in which the ensemble of technologies which constitute the internet have not yet reached enough maturity to ensure common (hopefully open) standards, universal access with reliability, and low cost and quality of service for any service to billions of people. Regulations are also far behind in coping with the speed of this process and will only (hopefully) reach international consensus once the challenges of convergence and technical evolution level out.

This is a glimpse of the overall panorama against which local communities seek solutions to fulfilling what has become essential: the need for good and reliable access to the internet, coupled with the need to understand and be able to use its services in full. This has become so essential that many countries today regard it as part of essential services, which should be covered (in several forms) by national public policy. However, in less developed countries, this public policy objective remains mostly wishful thinking, or an uncoordinated effort.

In most countries, at least in principle, the mission to connect every household to the internet has been left to a state telecommunications company or to "the market" – in both cases usually meaning an incumbent monopoly for the whole country or a cartel of regional monopolies. "The market" basically condemns whole regions and areas of larger cities to eternal un-connectivity (as it is unprofitable). National regulation in many cases limits the incumbent contract requirements to the universalisation of basic telephony services, considering internet components as "value-added", which translates as "beyond regulation".

The telecommunications cartels seem not to care when a community organises to redistribute a broadband connection through a WiFi network. But when a whole town decides to create its own community network, they certainly react, although the services involved are "beyond regulation". This reaction comes in several ways. In one example, Duas Barras, a town in the state of Rio de Janeiro, Brazil, decided to build its own community net (combining its own fibre and WiFi), and contracted a 2Mb/s dedicated link with a local backbone provider at a certain monthly price. Soon they needed to double capacity, and could not afford to foot the bill for 4Mb/s at four times the original price. Since this is unregulated, the telco tried to kill the initiative by economically strangling their transit to the internet. But they can become even nastier, resorting to economic and political leverage with policy-makers, or to lawsuits, to block the attempts by cities to build their own networks. This happened in major cities in the US when major operators sued municipalities over their community network projects.

Another potential obstacle to community efforts to build their own alternatives resides in their own capacity (or lack thereof) to build strong alliances, which result in funding, technical expertise, infrastructural support, and good local governance, amongst other things. These make sure the initiative can operate reliably, can withstand increasing demand, and has the appropriate means of sustainability – maybe worse than not getting connected is to get connected for a while, and then become unconnected. Piraí, another municipality in the state of Rio de Janeiro, is an uncommon example of building a strong partnership with multiple stakeholders to create and maintain its own network. It involves the state government (which provides internet transit through its own backbone), the municipality (providing infrastructure and resources to deploy landlines, full connectivity to local government buildings, WiFi access to homes, as well as connectivity and infrastructure for community telecentres and schools), local entrepreneurs, equipment providers, the university, and local non-profit organisations.

Technical activists should strive as much as possible to push for the most reliable technologies in designing community networks. This is obviously constrained by cost, available expertise, and local institutional arrangements (which affect the possibility of deploying physical or radio links in the affected area), besides the chances of establishing a reasonable transit agreement with a backbone operator. RITS, an ICT non-governmental organisation (NGO), has participated in some experiments in running so-called “mesh networks”. Some activists defend this approach to extend the net over a community with the goal of spreading a “viral network” in which users themselves install additional routing points on a voluntary basis. The major problems include ensuring that radio routers are installed in secure places and that outreach is carefully planned. The more routing points, the more points of failure. At the same time, whatever the reliability of a mesh, it must transit to the internet, and the available bandwidth will be limited – so much for viral expansion, as far as access to the net is concerned.

Technical activists also have the necessary technology background to take on the struggle for better regulation, which is frequently carried out by politicians and lawyers more than by technical experts. But this front is frequently disregarded by activists. Annoying as it is, it is extremely relevant to try to participate in public consultations, in lobbying for new rules with well-backed technical arguments, and so on. Recently, in Brazil, as a result of a steady advocacy effort by NGOs, some local governments and the academic community, a special form of licensing for local networks was approved by the telco regulator, Anatel. This allowed municipalities to legally build and run their own networks on a non-profit basis. Before this new rule, local governments had to create a local for-profit business to purchase a commercial licence, which in the case of most municipalities is not an option.