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#1 *Politics after Networks*

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NO MORE WALLED GARDENS? RESPONSE TO SPECTRUM ACCESS AND THE PUBLIC SPHERE

To control information and where it travels is to control the economic and political base of contemporary society. The management and regulation of resources like base stations, servers, satellites, and antennas are central, but none more so than the physical media itself: fibre-optic cables, telephone lines and electromagnetic spectrum.[1] In *Spectrum Access and the Public Sphere*, Beli argues that recent changes to the management of spectrum, coupled with material transformations taking place in mobile network infrastructure, are supporting the development of community-operated mesh networks. These networks in turn might foster an engaged and egalitarian relationship with media that enhance the public sphere beyond the behest of corporate monopolies and/or the state.

Beli's paper hinges on the well-debated position that networked media enhance the public sphere, with the author drawing a familiar contrast between the broadcast and centralised topologies of mass media and the many-to-many topologies of digital networks, where the former is associated with the degradation of real democracy and the latter is thought to support non-hierarchical cooperation and consensus. This often feels deterministic, an ode to the "magic" of Moore's Law and "the very broadening of the public sphere that technology provides", but unlike much of the literature connecting the Internet and the public sphere, Beli also recognises the importance of the material consolidation of the resources that undergird this space. The networked public sphere relies on open platforms and APIs, but also on a 'commons core infrastructure' outside of state or market control.[2] Here, control of the electromagnetic spectrum is a central

1 Spectrum concerns the frequencies used for all wireless and mobile transmissions, from broadcast technologies such as radio and television, through to networks of all kinds today such as cellular, the mobile Internet, sensor networks, smart grids etc.

2 Cp. Yochai Benkler, "Property, Commons and the First Amendment. Towards a Core Commons Infrastructure", *White Paper for the First Amendment Program*, Brennan Centre for Justice; New York, NYU School of Law, 2001.

issue. Because of the growth of mobile data, it is also a highly contested issue in many parts of the world today.

For the most part, Beli's paper concerns the constraints and affordances surrounding the development of a network commons in India. This includes details of expanding unlicensed spectrum, small cell technologies and cognitive radio[3] as these innovations support grassroots networks. At the same time, the author also acknowledges the limitations governing both spectrum access and possibilities for economically disruptive and non-proprietary networks, particularly as these play out in India today. These include radio regulation, forms of IP and manufacturing that prohibit over-the-top services and difficulties with incentivising users as a commons in the context of neoliberal forms of governance and digital policy.

Beli's knowledge of new innovations in community networks and the regulatory geography in India is a fascinating and informative read, and the questions he raises over control and access are very important today. I would like to use my own research to speak to and at times trouble some of the conclusions drawn in this paper. In my response I am not going to debate whether digitally networked media produce a new kind of public sphere or whether mobile devices are effective tools for social movements. These debates have been covered more effectively elsewhere.[4] Instead, I want to engage with what I feel is really the core proposition of the paper – that the rise of sharing and modularity in radio infrastructure could facilitate community-based wireless networks at a greater scale and complexity than previously possible.

WHAT DOES IT MEAN TO BE OPEN TODAY?

This is a vital discussion and one that needs our attention. The changes that we are seeing in the political economy of networks point to a critical transformation of the constituent relations governing network media. Today it is not always clear when new forms of access and openness mix with private markets whether this will have positive effects on the communal structure of networks going forward or simply imply new species of enclosure – no longer a walled garden perhaps, but something even more delimiting. Straightforward distinctions such

3 When Beli refers to people using "intelligent devices possessing an 'etiquette' that allows them to speak to each other and pass each other politely", he describes a cognitive radio, a device that is context aware and able to switch frequencies selectively to void interfering with other radios.

4 See for example the work of Yochai Benkler, Craig Calhoun, Manuel Castells, Peter Dahlgren, Nancy Fraser, Christian Fuchs, Nicholas Garnham, Zizi Papacharissi and Kazys Varnelis.

as 'open = good; closed = bad' are less useful and may even be counterproductive.

The possibility for an 'open' or shared physical layer is a recent innovation. While non-proprietary software is one thing, base stations and electromagnetic spectrum tend to be consolidated at a scale and cost that prohibit all but the most powerful actors from accessing these resources. But today we are starting to see changes to the ways that core infrastructure is designed, built, managed and owned. This is for a number of reasons: more affordable electronics and open source hardware innovations in mobile communications; software virtualisations that route around the necessity of expensive hardware; a shift from monolithic resources towards dense small cell networks; next generation networks that require greater flexibility; and changes to regulation in response to mobile congestion that require a greater fluidity of electromagnetic spectrum.

> "Might [these changes] also imply a shift in the balance of control and ownership between individuals and corporations?"

The result could be greater access to spectrum, to base stations – to the physical *stuff* of mobile networks – no more a walled enclave but a community garden you can hack together. In these early stages, it is tempting to speculate, as Beli does, that these changes could support nonmarket and non-proprietary communications networks operating at a scale that facilitates public engagement and cooperation. Let us unpack this a little.

Because of interference between devices, spectrum is often described as a scarce good. For the majority of radio history, spectrum has been regulated in ways that privilege commercial and state actors and largely prohibit communal access. National and international regulatory authorities assign frequencies bands to specific applications such as television or cellular and exclusively allocate portions of these to public services or commercial incumbents through beauty contests or auctions. The exception to this is WiFi[5], which anybody is free to use provided they follow certain protocols. In the past few years, however, there's been a wealth of proposals to expand the amount of unlicensed spectrum and/or to share spectrum in new nonexclusive ways. A number of technological and economic factors now favour an

5 A small amount of unlicensed spectrum already exists and is commonly known as WiFi. In 1985, the FCC authorised the use of these bands of spectrum designated for Industrial, Scientific and Medical services (ISM Bands) for low powered communications devices on a license-exempt or unlicensed basis. The regulation did not specify too many details, but instead prescribed particular limits on the maximum power output of any device operating in the band. This ISM band in turn gave rise to wireless protocols such as WiFi (IEEE 802.11b) Bluetooth and Zigbee (IEEE 802.15).

unlicensed approach to spectrum regulation: the exponential demand for mobile bandwidth produced by an exaflood of Smartphone data, the development of dynamic spectrum access technologies such as cognitive radio, sophisticated multiplexing and smart antennas that allow multiple radiating devices to occupy the same frequencies simultaneously, and the freeing up of additional spectrum in the transfer from analogue to digital television (TV White-space). Today it is fair to say that open spectrum has a currency beyond open source activism, emerging in mainstream digital policy.[6]

And it is not just shared spectrum; we are seeing a general rise in resource sharing and distribution in mobile networks, which, until recently, were leading exhibits of highly centralised and proprietary infrastructure.[7] In early cellular networks, the carrier maintained exclusive control of all the necessary resources. Next generations such as 4G (IMT advanced) and Long Term Evolution (LTE), however, require a greater architectural fluidity compared with legacy networks such as 2G/GSM. Today approaches are emerging that virtualise the network;[8] that support the concept of distributed or multiple points of connection;[9] that share, re-use and redistribute resources;[10] or that cede centralised control of transmissions from the mobile operator to third parties or even to the end user. An example of this is small cell technologies, which Beli specifically mentions. Femtocells and picocells operate as an extension to the carrier's existing network, providing improved coverage in a user's direct vicinity and connecting to a user's existing broadband connection for backhaul.

The outcome is that many of these resources might be shared by a variety of stakeholders. They might become accessible to users and community groups. This could extend, scale and advance the community networks WiFi already affords. Or it could lead to disruptive technologies that operate 'over the top' of existing commercial services.

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6 Several high profile reports published in the last few years indicate this sea change, recommending a paradigm shift from exclusive access to forms of shared and non-exclusive ownership. Cp. Simon Forge et al., "Perspectives on the Value of Shared Spectrum Access", *Final Report for the EC,* February 2012; Richard Thanki, "The Economic Significance of License-exempt Spectrum to the Future of the Internet", *White Paper,* 2012; President's Council of Advisors in Science and Technology (PCAST), "Realizing the Full Potential of Government-held Spectrum to Spur Economic Growth", Washington DC, 2012.

7 Cp. Gerard Goggin, *Global Mobile Media*, London, Routledge, 2010, p. 58.

8 Timothy K. Forde et al., "Exclusive Sharing and Virtualization of the Cellular Network", *New Frontiers in Dynamic Spectrum Access Networks (DySPAN), 2011 IEEE Symposium*, IEEE, 2011, pp. 337–348.

9 Linda Doyle, "The Mobile Phones of the Future", April 29, 2011.

10 Mehdi Bennis and Jorma Lilleberg, "Inter Base Station Resource Sharing and Improving the Overall Efficiency of B3G Systems", *Vehicular Technology Conference (VTC-2007 Fall),* IEEE 66th, 2007, pp. 1494–1498.

The New Enclosures in Radio Space

There are a number of issues with this I would like to explore. This increase in sharing and openness is not designed to proliferate communal access to a resource in any lasting or permanent fashion; it is about minimising the costs and risks of roll out for mobile operators. Resources are selectively *open* while they are enclosed in new ways. These enclosures may take the form of new regulatory frameworks prohibiting economically disruptive behaviours, as effectively described in Beli's paper, or increasingly they take what Alex Galloway would call a 'protocological form' that is written into the logic of the radio device itself.[11]

Previously there was a certain opposition between WiFi as an economically disruptive innovation and carriers' traditional business models based on exclusive control of the PTSN network. But this is becoming less of an issue. Today WiFi functions less as a disruptive force and more as a valuable externality for mobile carriers. As mobile network traffic increases, operators offload data from their congested networks into this spectrum 'commons'.[12] Far from discouraging open networks, therefore, operators now recognise integration between licensed and unlicensed as a way to gain the benefits from an open access model while socializing some of the costs of investment in core infrastructure. Up to 90 per cent of smart phone and tablet traffic is now carried by wireless networks[13] with a large proportion of this relying on personal networks as opposed to commercial hotspots.[14] There are even direct partnerships between community networks such as FON and operators like British Telecom and Deutsche Telekom.[15] More recently, incumbents hoping to roll out LTE networks have developed a similar strategy, with LTE-Unlicensed designed to exploit unlicensed frequencies for the transmission of customer data by commercial incumbents who claim ownership to licensed bands elsewhere.[16] Proposals for greater unlicensed spectrum in government

11 Cp. Alex Galloway, *Protocol: How Control Exists after Decentralization*, Cambridge MA, MIT Press, 2004.

12 Cp. Yochai Benkler, "Open Wireless vs. Licensed Spectrum: Evidence from Market Adoption" *Harvard Journal of Law and Technology*, 26(1), 2012, pp. 71–163.

13 Cp. Juniper Research, "Mobile Data Offload and Onload: Wi-Fi, Small Cell and Carrier-grade Strategies 2013–2017", Report, 2013.

14 Cp. Cisco, "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update 2010-2015", 2011.

15 In March 2013, Deutsche Telekom announced that it would partner with FON in providing 2.5 million hotspots by 2016. As Deutsche Telekom CEO René Obermann observed, "[t]he partnership with FON sits perfectly with Telekom's network expansion strategy. Wi-Fi and hotspots can be used to divert heavy data traffic to fixed-line networks and this reduces the load on mobile networks". Sean McGrath, "Deutsche Telekom and FON Deal Points Firmly in the Direction of Wi-Fi Offload", *Wireless Broadband Alliance,* May 3, 2013.

16 Cp. Richard Thanki, "Jury Still Out on LTE-Unlicensed", *Light Reading,* March 12, 2013.

spectrum or the sub 1GHz TV White-spaces illustrate the same trend: the majority of proposals extend sharing to an exclusive cadre of mobile incumbents with little to no provision for general authorised access to the new spectrum commons.[17]

The business model for small cell networks exhibits similar characteristics: femtocells rely on the user's Internet connection for backhaul. Where the operator controls these, the user is effectively billed twice for their network infrastructure. Any attempts to use small cell innovations to scale non-proprietary networks are frustrated by regulations that specifically prohibit these sorts of hacks. Instead, telecommunications companies normally have exclusive licenses from their national regulatory authority for the manufacture and distribution of femtocells.[18] We cannot simply build and implement our own. Beli provides an exhibit of this kind of lock-in, when he describes regulations governing the integration of VoIP and PTSN services in India. Chokepoints are still very much in place wherever communications threaten to overspill or disrupt the value chain.

Who really benefits from the new forms of sharing? This is not an expansion of the commons, but a further expansion of the market, a mode of exploitation cloaked in the watchwords of the sharing economy. The real tragedy of the commons today is that, more often than not, the market simply absorbs potentially disruptive activities. The new mesh networking protocols and grassroots networks Beli draws our attention to are worth considering, but we also need to be aware of the new ways in which these are enclosed and co-opted.

We are also seeing new forms of enclosure where automated management is starting to replace regulation. Shared spectrum requires new dynamic techniques to prevent interference, but with these comes much more insidious models of control.[19] New proposals for spectrum sharing specify the introduction of centralised databases and clearinghouses to manage cooperative devices. Devices are tethered to

17 Today there are controversies between a two-tiered and a three-tiered model for spectrum sharing, where a two-tiered model of sharing limits sharing to a discrete group of mobile operator, while a three-tiered model also provisions some form of general authorised access to spectrum by smaller actors such as users. Cp. Mike Dano, "The Looming Conflict Over Spectrum Sharing", *FierceWireless,* June 21, 2013.

18 AT&T, "Letter to the FCC Re: Amendment of parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage through the Use of Signal Boosters", 2012.

19 While there is not a lot of literature on this yet, these proposed systems take their direction from the regulatory protocols designed for TV White Spaces. Cp. European Computer Manufacturers Associations (ECMA), "Mac and Phy Operation in TV White Space", Standard ECMA-392, 2012; H.R. Karimi, "Geolocation Databases for White Space Devices in the UHF TV Bands: Specification of Maximum Permitted Emission Levels", *New Frontiers in Dynamic Spectrum Access Networks* IEEE, 2011, pp. 443–454; Office of Communications (Ofcom), "Implementing Geolocation: Summary of Consultation Response and Next Steps", Ofcom, 2011; William Webb, "White Space Databases: A Guidance Note for Regulators and Others", 2012.

their network and must contact the database frequently to provide information about their location and activity. This allows the database to provide the radio with information about frequencies that are currently occupied or off-limits, a useful capacity. But is also allows a device to be controlled and accessed remotely.[20] Again, this amounts to a shift not from closed spectrum to the spectrum commons, but one of external juridical regulation to a system where some central authority now has the power to remotely monitor and even permanently disable a device. And this power is no longer law; it is engineered in the protocol of the device itself. Networked media now facilitates the forms of distributed organisation associated with openness and commons-based peer production, while they also make way for the surveillance, aggregation and control of distributed free agents.

COMMONING FOR THE NETWORK COMMONS

I think a failure to understand the ways in which the commons coalesces with the market in the political economy of communications also extends to how the author discusses challenges, incentives and disincentives for the production of commons core infrastructure going forward. Ultimately it is problematic to think that we can rely on a market-based system to effectively provision a social good. Beli approaches this question from a perspective that is firmly positioned inside of a neoliberal economic framework – i.e. that a withdrawal of the state and an even greater deregulation of mobile communications might facilitate a network commons. Even as the author points to a mode of collective governance outside of the state and the market, therefore, the coordinates of the problem are always already structured in relation to self-interested competitive subjects operating in the face of scarce and materially finite resources that are best provisioned through a pricing system. The use of Hardin's *Tragedy of the Commons* is a case in point here and illustrates a failure to really engage with what a network commons might mean. It is not just a case of access, or of incentivising selfish individuals. Commoning, whether of natural resources or digital networks has to begin from a very different subjectivity and a different relationship to resources that are difficult to grasp or imagine in the context of liberal economics and public vs. private modes of governance. And it takes more than tools or technologies to produce this. There is no killer app.

Beli's is vital research, and the networks he describes could well be core components in the future development of a democratic public sphere in India, but alongside the technological innovations and modes

20 Cp. Commerce Spectrum Management Advisory Committee, "CSMAC Unlicensed Subcommittee Final Report", July 24, 2012.

of resistance detailed in *Spectrum Access and the Public Sphere*, we need new ways of conceptualising the struggles for control over communications, and we need to find ways to bridge this work with other social struggles against privatisation and enclosure.