Addressing the Elephant in the Cloudless Sky: Designing A Commonised Mobile Network Infrastructure

Justin Sacks
Imagination
School of Design
Lancaster University
Lancaster, UK, LA1 4YW
j.sacks@lancaster.ac.uk

Paul Coulton
Imagination
School of Design
Lancaster University
Lancaster, UK, LA1 4YW
p.coulton@lancaster.ac.uk

Cloudless Skies: Decentralizing Mobile Interaction Virtual Workshop at MobileHCI 2020, October 5th

Abstract
Whilst the notion of a creating a 'cloudless sky' by moving control and processing to the edge of the network, i.e. mobile devices, provides greater agency to users over the handling of their data, it still exists within a privately controlled networked infrastructure. Infrastructure can thus be considered the elephant in the room or in this case cloudless sky. In this paper, we address the elephant by considering a more radical and perhaps utopian perspective of providing greater user agency over the networked infrastructure itself.

Author Keywords
Commons; commonisation; mobile; network infrastructure.

CSS Concepts
• **Human-centred computing ~ *Collaborative and social computing***; *Collaborative and social computing theory, concepts and paradigms*

Introduction
Mobile interactive systems are fundamentally dependent on mobile network infrastructure. In this paper, the term 'infrastructure' includes physical infrastructure, such as base stations, as well as

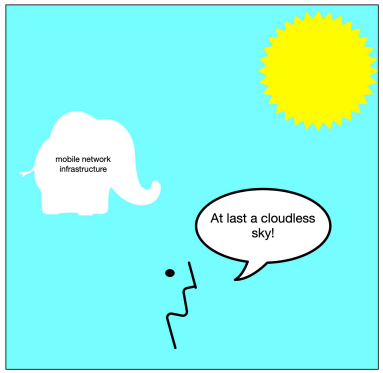

Figure 1. Elephant in our cloudless sky

institutional infrastructure, such as private mobile companies. This mobile network infrastructure is in turn shaped by the economic ideologies where it exists. Most, if not all states, have chosen to nationalise or privatise mobile network infrastructure. In neoliberal capitalist parlance, privatisation is also associated with liberalisation. A third option would be to 'commonise' this infrastructure. To commonise means to treat the infrastructure as a common good that is controlled by its users. This paper considers the potential to commonise mobile network infrastructure and argues that this task is an alternative way to address the aims of this workshop of greater agency for users.

Current mobile network infrastructure

Control over the means of production matters in economics. The means of production for mobile interactive systems is not only the devices and software that enable users to interact but also the infrastructure. Whilst a shift towards edge computing, as opposed to cloud-based computing services, offers considerable advantages in relation to data handling, there is still the fact that if such systems are to be scalable they will still be dependent on mobile network infrastructure. Whilst it is convenient to consider mobile networks as simple 'bit pipes' though which data is transferred unmolested, they are essentially private networks ultimately under the control of their operators and sanctioned by the nation states in which they reside.

To underscore this point, there were at least 196 internet shutdowns in 2019, primarily at the behest of states rather than markets [1]. In India, most of these shutdowns were administered locally rather than nationally, which suggests the type of system (nationalised, privatised, commonised) might be the independent variable rather than blanket decentralisation [2]. China's tightly controlled state mobile network infrastructure is well known, tolerated, and even catered to by open societies like the US. China's successful nationalised mobile network infrastructure also shines as a beacon for aspiring authoritarian states like Russia [3]. In the US, the ongoing battle over net neutrality as well as the very recent scuffle over TikTok illustrates the precariousness of user control over mobile interactive systems. It's easy to imagine a dystopian future in which China ships a compromised infrastructure to other states. But what about a utopian design that benefits citizens?

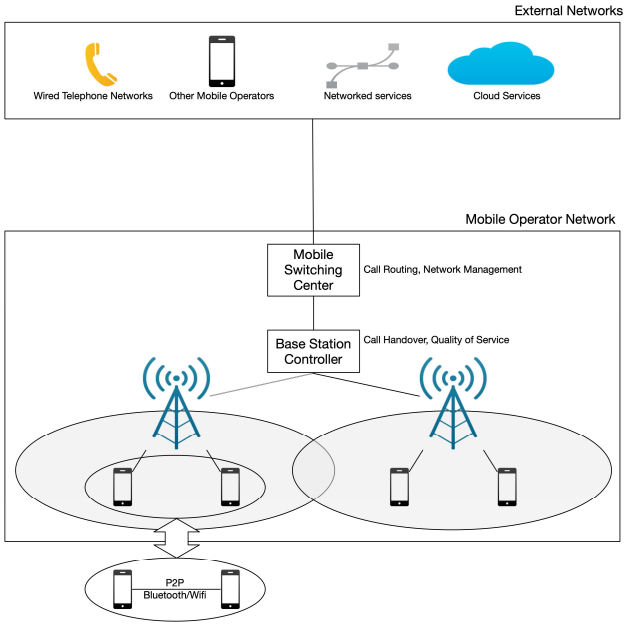

Figure 2 Generalised Mobile Network Infrastructure

1. Define clear group boundaries.

2. Match rules governing use of common goods to local needs and conditions.

3. Ensure that those affected by the rules can participate in modifying the rules.

4. Make sure the rule-making rights of community members are respected by outside authorities.

5. Develop a system, carried out by community members, for monitoring members' behavior.

6. Use graduated sanctions for rule violators.

7.Provide accessible, low-cost means for dispute resolution.

8. Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

Figure 3. Design Principles for Commonses

With respect to decentralisation of commonised systems, most scholarly research is agnostic of the network on which it resides. The most robust research on issues such as user incentives and peer-to-peer (P2P) communication protocols has focused on file sharing sites like Napster [4], knowledge commonses like Wikipedia [5], and emerging blockchain products like Backfeed [6]. The reality is that these P2P services are reliant on mobile infrastructure as even two devices located in the same cell passing data to each other would still be transferred through the network infrastructure as shown in Figure 2. Even if P2P interaction is potentially performed device to device and separated from mobile infrastructure (shown at bottom of the figure) using wireless technologies such as Bluetooth or Direct WiFi, the scalability of such systems is highly problematic. As such it might be considered the elephant in our supposed cloudless sky.

The commons and commonised infrastructure

The dominant approach of states either to nationalise or to privatise their mobile network infrastructures yield pervasive challenges regarding resilience, transparency, and user control. This paper explores a third option, which is to commonise mobile network infrastructure. Successfully commonised resources include natural resources like fisheries, digital resources like Wikipedia, and physical resources like prosthetic limbs. Mobile network infrastructure represents an intersection of natural resources (mobile frequencies), digital resources (system account management), and physical resources (e.g. base stations).

The term commonise is derived from the literature regarding the creation and management of common goods (the commons). Whilst the commons plays an economic role that predates capitalism by millennia, the role of common goods and their governance only received serious scholarly attention from the 1990s, when Ostrom published *Governing the Commons*. Ostrom demonstrated that sometimes natural resources like fisheries and irrigation systems could be better managed by users than by either the market or the state [7]. Scholars have since extended analysis of commons management to the digital realm, such as Wikipedia and blockchain products. While scholars vary in how they situate the commons and commons governance — from a system that is now embedded within capitalism to a competing economic ideology that could displace capitalism as a dominant economic system — the defining feature of a commons is that users govern the resource. Consequently, to commonise an infrastructure means to place it under the control and governance of the users of that infrastructure.

Ostrom identified eight design principles of successful commonses that have endured decades of scholarly examination, shown in Figure 3 [8]. This paper focuses specifically on design principle #4: 'Make sure the rule-making rights of community members are respected by outside authorities'. The logic of this design principle underpins privatisation as much as commonisation. To privatise mobile networks, the rule-making rights (governance) of the community members (the private sector) are respected by the outside authorities (the state). This security of tenure provides the incentive to the private sector to invest in the infrastructure. There is no known example of a state awarding such rule-making rights to citizens or a group of citizens regarding mobile network infrastructure.

A commonised mobile network infrastructure

What would a commonised mobile network infrastructure look like? There are three common goods that comprise this infrastructure:

- Natural, the limited mobile frequencies that can be used;
- Physical, the base stations and other physical infrastructure; and
- Digital, what is created to manage communication and governance.

Within the scope of this short paper, we have chosen to respond to design principle #4 which generates the question: How might the state ensure the rule-making rights of citizens for a commonised mobile network infrastructure? If we created a mobile network infrastructure from scratch, we might dedicate a frequency as a public frequency, in the manner of public broadcasting. A more feasible approach now might be the combination of 'piggybacking' and social policy modeled on affordable housing. Piggybacking is a common practice in which private companies buy space from one of the principal mobile network companies and offer that service under their own brand. For example, in the UK, Tesco Mobile piggybacks on O2 and Virgin Mobile piggybacks on EE. A commonised mobile network infrastructure can piggyback off of the existing operators, but what about ensuring equal quality? A downside of piggybacking is that the primary providers privilege their customers over the piggybacking brands. A design solution to this problem might be modeled on affordable housing policy. In many states, private companies must set aside a proportion of units as affordable housing. This policy is part of a social contract in most capitalist states. In short, all of society has created the opportunity for the private company to make money by creating housing, and in return the private company must create housing for all of society.

Understandably in such a brief paper we have left many questions about how this commonised network can flourish. For example, the general logic of states who privatised mobile frequencies was that market operators would invest in the mobile network infrastructure if they possessed security of possession. We must equally ask this question for commonised infrastructure. If we want to provide incentives for citizens to invest in mobile infrastructure, what security of possession can be offered?

Conclusion

Whilst this paper offers no real solutions, we feel we may at least start the debate of what is the underlying principle we wish to achieve through the promotion of a cloudless sky.

References

[1] Jim Edwards. 30 Jun 2019. All the countries where someone managed to shut down the entire internet — and why they did it. *Business Insider*. Retrieved 7 Aug 2020 from https://www.businessinsider.com/countries-internet-shutdown-statistics-2019-6?r=US&IR=T.

[2] Jeffrey Gettleman, Vindu Goel and Maria Abi-Habib. 17 Dec 2019. India Adopts the Tactic of Authoritarians: Shutting Down the Internet. *New York Times*. Retrieved 6 Aug 2020 from https://www.nytimes.com/2019/12/17/world/asia/india-internet-modi-protests.html.

[3] Charlotte Jee. 21 Mar 2019. Russia wants to cut itself off from the global internet. Here's what that really means. *MIT Technology Review*. Retrieved 7

Aug 2020 from https://www.technologyreview.com/2019/03/21/65940/russia-wants-to-cut-itself-off-from-the-global-internet-heres-what-that-really-means/.

[4] Qingfeng Zhang, Sheng Wang, and Dan Liao. 2015. A game theoretic analysis of public goods allocation in p2p networks. *KSII Transactions on Internet and Information Systems* 9,8: 2854-2874.

[5] Brett M. Frischmann, Michael J. Madison, and Katherine J. Strandburg. 2014. *Governing Knowledge Commons*. Oxford University Press, New York.

[6] Alex Pazaitis, Primavera de Filippi, and Vasilis Kostakis. 2017. Blockchain and value systems in the sharing economy: The illustrative case of Backfeed. *Technological Forecasting & Social Change* 125: 105-115.

[7] Elinor Ostrom. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge UK.

[8] Elinor Ostrom. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge UK.