The Possibilities of "Ad Hoc" **Decentralised Digital Infrastructure'**

Defining the unique characteristics by which to analyse possibilities and implications of peer-to-peer systems in society

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66 The autonomy of the individual appears to be complemented & enhanced by the movement of the group; while the effectiveness of the group seems to depend on the freedom of the individual.

> **9**9 Hakim Bey, 1991.

Introduction

Peer-to-peer networks, such a public blockchains, are decentralised digital infrastructures that establish new ways to coordinate without relying on a trusted third-party. They do this through unique attributes such as fault tolerance, encryption, and open-source software and hardware. These attributes form "ad hoc" capabilities, which make decentralised digital infrastructure an interesting socio-technical object of enquiry.

The concept of "ad hoc" refers to people combining software and hardware tools to independently set-up peer-to-peer infrastructure "on-the-fly" (Feeney, et al., 2001). It is referred to in 'wireless' or 'mobile' ad-hoc mesh networking, as well as other instances of temporal, networked infrastructure where a central router is not required (Toh, 1997; 2002). This genre of tooling has evolved in terms of usability, security, availability and complexity. It is now being 'permissionlessly' adopted to appear in numerous public settings. One example of the adopted of ad hoc digital infrastructure is use of the 'Telegram' smart phone communications application to disseminate protest information during the Hong Kong 'umbrella movement' protests in 2019 - 2020 (Urman, et al., 2020; Ting, 2020).

It is becoming widely acknowledged that existing, centralised digital platform infrastructure is failing to protect the interests and of people in terms of privacy, security, and agency. For example, technologies such as social media that promise 'freedom to connect' have regressed into tools for behaviour manipulation that undermine the interests of users (Bradshaw & Howard, 2018).

Decentralised platforms offer a technical and ideological alternative to the mis-givings of centralised platforms through transparency, participatory governance mechanisms, and cryptographic privacy and security. The hope of advocates is that decentralised digital technologies can provide more resilient infrastructure for society.

l adopt a working definition of 'sociotechnical resilience' as informational relations, socio-material structures, and anticipatory practices - to understand how technology and people adapt to stimuli (Amir & Kant, 2018). 'Resilience', in terms of the attributes, characteristics, and nature of decentralised digital infrastructure in practice for people remains to be tested. This is a focus of my research (ongoing).

In a step towards socialising ideas in this effort, this piece asserts that "ad hoc" is a key attribute of decentralised digital infrastructure, related to the concept of resilience, as this infrastructure operates in society. "Ad hoc" decentralised digital infrastructure' enables self-organisation and coordination for actors in a network through publicly available, decentralised digital tools.

This piece focuses on the "ad hoc" nature of decentralised digital infrastructure to highlight the promises, optimism, and possibility surrounding decentralised technologies as viable and safer critical public infrastructure for civil society.

Modular, ad hoc, distributed, cryptographically secure networks are being erected, maintained and dismantled by groups to serve specific ideological purposes and meet specific needs that are under-explored in existing research. These adaptive, temporary, technology-enabled economies politically and socially challenge the ideological underpinnings of existing institutions through independence, obfuscation, and subversion (Poblet, 2018). This pattern of "ad hoc" infrastructure offers a site for ethnographic investigation of the societal implications of decentralised digital infrastructure in non-institutional contexts.



Image: 'Hexayurt' Open Source Hardware (http://hexayurt.com). Designed as refugee shelters by Vinay Gupta and Edmund Harriss. Pitched for 'Burning Man'. Photo by Jamem Percy: <u>http://www.gigapan.com/gigapans/218597</u> Online. Accessed Dec. 15, 2020.

Defining key terms

The phrase "ad hoc" decentralised digital infrastructure' refers to digital assemblages that are full-stack, independent, modular, permissionless to access, governed in a participatory fashion, and have direct social implications for how people self-organise, assemble, and disseminate. This infrastructure does not rely on any pre-existing infrastructure.

This occurrence of public, 'permissionless', open-source software and hardware that are designed to enable people to rapidly self-organise, in order to coordinate in a peer-to-peer fashion. It describes the combinations of digital tools to form functional infrastructures for particular social or political contexts, for a common cause, or against a common threat.

The phrase borrows from a number of disciplines in order to construct a theoretical framework for scientific investigation. The concept of ad hoc digital infrastructure originates from a number of scholarly works across Computer Sciences and Media and Communications studies.

On borrowing these terms for an ethnographic analysis, I acknowledge that in distributed computing, 'ad hoc digital infrastructure' is a phrase used to describe mobile communication networks (Yi & Kravets, 2002; Murthy & Manoj, 2004; Leiser, et al., 2017). Within the discipline of computer science, methodologies have been developed to try to explain the generative mechanisms of digital infrastructure evolution to aid IT professionals to manage complex systems (Henfridsson &. Bygstad, 2013). However, in an ethnographic setting, the concept of 'ad hoc digital infrastructure' is being applied to describe how digital tools are used by people as a socio-technical enabler of certain behaviours.

This research pathway of investigated the societal implications of decentralised digital infrastructure builds on the ethnographic theory of the "pop up" blockchain economy (Rennie, 2019).



Observing infrastructure

It is as infrastructures are being built, or decaying, that they become apparent (Star, 1999). Infrastructures are the fundamental substructures that support society. Yet, it is as they fail to function as expected, are not apparent, or break-down that they consciously become essential. Given societies' reliance on digital tools, it is clear that digital infrastructure is, in fact, critical public infrastructure. Conceptualising digital infrastructure as critical public infrastructure has important consequences for how it is approached and assessed in terms of resilience as a socio-technical system.

As complex systems, combinations of digital tools to form self-configuring, "ad hoc" infrastructure enables adaptive, 'rhizome' networks that shape and form new frontiers of human possibility. This decentralised approach to human-machine organisation diverges from the traditional, hierarchical models which people have organised by since industrialisation. This infrastructure takes a 'local-first' approach, not just for data ownership, but for participation in code, consensus, and governance. In "ad hoc" decentralised digital infrastructure, participatory governance is necessary, possible and right.

While most scholarship on peer-to-peer protocols focuses on the technical attributes of privacy through cybersecurity in software, this research begins from the premise that decentralised digital infrastructure operates in society as a full-stack, socio-technical construct. This means that all layers of social, software, and infrastructure (i.e. underlying hardware) must be considered in order to understand the macro-social implications of these structures (Tong, et al., 2018). Thus, indicators of resilience include technical guarantees of privacy and security, as well as user intentions and threats.

'Resilience', in this setting, is interpreted in the community resilience sense to encapsulate a socio-technical approach. This includes availability (in terms of technical 'up-time' and user access), capacity to evolve, adapt and recover in an 'anti-fragile' manner from disruption, and participation of a community of peers (Taleb, 2014; McAslan, 2010). This aligns with the ethnographic lines of enquiry on the concepts of 'continuity' and 'improvisation' (Yoko & Pink, 2014; Yoko, et al., 2018).

Questions to answer

Star describes digital substructures as the "invisible" tools that take on meaning when used (1999). By following the actors in these decentralised networks (Latour, 2007), it is possible to investigate how, where and why decentralised technologies are being developed and 'permissionlessly' adopted. The research aims to understand the social and political consequences of these public, socio-technical, macro-social level assemblages.

The question that this project answers is: 'is decentralised digital infrastructure resilient?'.

To do this, it will explore the original intent and early visions of decentralised technologies, and what tools are being built now, and for what uses. Ethnographic data will then be collected to understand how, where, and why decentralised digital infrastructures are being adopted and for what purposes. Furthermore, it will explore the societal and political implications of this ability for technology enabled 'ad hoc' coordination through decentralised infrastructure, including if and how initial intentions are being fulfilled in practice.

The 'ad hoc' characteristics of decentralised digital infrastructure is an important attribute to emphasise in this exploration, as it defines one of the ways in which decentralised digital infrastructure could be different to existing digital tools for people, as well as beginning an exploration of the necessary conditions for this infrastructure to manifest.

'Possibilities' of what is enabled

The purpose of exploring the "ad hoc" nature of decentralised digital infrastructure is to investigate how it is being used and what it enables in society.

The availability of 'crypto tools' raises questions about values and practices in an information-based society (Denning, 1990). Cryptocurrency applications, as one example, are evolving from origins in the lofty ideas of the cypherpunk discourse, into full-stack, autonomous networks for coordination and independence through an active community of researchers and developers (Nakamoto, 2009; Wood, 2014). The functionalities and uses of this technology include cryptocurrency transactions, communication, social media, governance, and automation, on top of independent (or 'open') hardware. Denning argued that Tim May's crypto anarchy is neither inevitable, nor desirable, and was in favour of the responsible use of these tools so they do not lead to societal disorder (Denning, 2001).

The types of uses that this research is most interested in are broader, societal cases of adopted, beyond the immediate context of software development communities.

Exit, "Choice" and Loyalty

One potential hypothesis of the capabilities that "ad hoc" decentralised digital infrastructure' might enable in society is "exit, choice, and loyalty".

Hirshmann authored the well-known text "Exit, Voice and Loyalty", which was influential in shaping early thinking towards cyberspace to describe an option-space for dissatisfaction with firms, organisations or states (1972).

In the digital economy of today, existing lock-in, 'walled garden' digital infrastructures such as social media corporates do not offer users the option to "voice" their disquiet. Furthermore, there is little recourse or accountability for malpractice in the administration or objectives of a system (Zuboff, 2019).

Decentralised architecture offers a potential alternative in the face of dissatisfaction, by affording users with the "choice" to become participants in the platforms they depend on. This opens up the possibility for new forms of citizenship in cyber and terrestrial space, with greater optionality and choice for people to port between digital infrastructures, and thus "institutions" in society.

The notion of "choice" is taken to its extreme in the values of cyber-libertarians. Hakim Bey, also influential in cypherpunk discourse, proposed the notion of "Temporary Autonomous Zones" (TAZs) to describe the manifestation of semi-nomad pirate culture in the digital realm as an outcome of autonomous, encrypted, permissionless, "ad hoc" digital infrastructure in action (2008).

The actuality of this possibility in practice today remains to be investigated throughout the course of this research.



Endnotes

The socio-technical construct of peer-to-peer digital infrastructures are a "new and important object of social enquiry", which is relevant to economic, political and social life (Hayes, 2019). As well as a technical solution to the economic problem of coordination with untrusted third-parties, decentralised digital infrastructure extends the ethos of open-source software and hardware, to offer an ideological alternative to the failures of existing, centralised digital platform. If digital infrastructure is critical public infrastructure in society, it is imperative to investigate 'resilience' for participants in these systems and the social outcomes of these technologies as they manifest 'permissionlessly'.

End.

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