Situating Network Infrastructure with People, Practices, and Beyond: A Community Building Workshop

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ABSTRACT

Abstract: Our world is now connected and even *entangled* in unprecedented ways through networked technologies. Yet pockets of unequal connectivity persist, and technical infrastructures for connectivity remain difficult to design and build even for experts. In this workshop we aim to bring together a global community of multi- and inter-disciplinary researchers and implementers working on infrastructure development and connectivity to explore the existing design challenges and opportunities for bringing technical dimensions of networked infrastructures in conversation with human-computer interaction (HCI) and the social science of infrastructure. We will share, assess and define research problems and resources for rethinking networked infrastructures from human-, community-, and society-centered perspectives, understanding them to be embedded with human values and biases. We particularly intend our collaborative work to support real-world connectivity initiatives, which have grown in critical importance over the pandemic years—especially projects in support of Global South communities. Concrete deliverables from the workshop will include: (1) an initial shared bibliography to help formalize the state of knowledge in our area, (2) an agenda of shared goals, challenges, and intentions in our field, (3) a compilation of resources to support future work, and (4) social and organizing infrastructures for continued communication and academic collaboration.

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CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; • **Networks**; • **Applied computing** → **Telecommunications**; • **Social and professional topics** → **Computing / technology policy**; • **General and reference** → **Design**;

KEYWORDS

infrastructure studies, networking technology, participatory design, network policy and governance, community networks, merging theory and practice, community building

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1 INTRODUCTION AND GOALS

Our workshop builds on the potential for social-scientific and technology-oriented studies of computer networks to inform each other. New socio-technical theories have emerged from the design, development, use, and regulation of computer networking technologies in diverse contexts around the world and, simultaneously, social-scientific analyses are shaping an array of computer networking infrastructures. Expertise in "network connectivity" is distributed across academic fields, such as Human Computer Interaction (HCI), Information and Communication Technologies

for Development (ICT4D), Computer Communications, Social Sciences of Technology (STS), Information Sciences, and Participatory Design (PD), Public Policy, Law, and Geography, and across non-academic sectors and civil society groups, such as Free/Libre Open Source Software (FLOSS) projects, hackerspaces, community radio activism, and policy advocates. Meanwhile travel restrictions during the global pandemic have both fractured localised academic-practitioner links and prompted new virtual connections. Our workshop aims to foster links to enrich thinking, share resources and build community. It extends discussion over the past six years in special interest workshops/panels on topics ranging from community-based telecoms (e.g.[10]) to socio-ecological implications of escalating 5G and deep-sea cables (e.g.[3]), aiming to integrate other perspectives and agendas such as networked sensing systems (e.g. [2]) and policy advocacy. The enthusiastic response of CSCW 2021 attendees to Josephine Miliza's opening keynote suggests our workshop may also engage researchers who did not previously consider computer networking to be a focus of their work.

2 RELATED WORK

The vast scope of entanglements between social science and computer networking technologies can make it difficult for researchers or practitioners to find the many others with whom there is so much to share. This workshop will provide a framework for making important links between theoretical perspectives and practical experiences by building on relevant clusters of academic work, *e.g.*:

Community Networks (CNs) and radio. A robust body of research examines how communities collaborate to build and maintain their own *community networks* for Internet and digital services [21, 23–25, 28, 54], especially in places where they were formerly inaccessible [31, 33]. Many studies of CNs [22, 29, 37, 40, 42] and community radio projects [41, 43, 45, 52, 57] integrate technical development with community engagement, putting social science in direct conversation with system design and implementation.

Human-centered design of networking technologies. In other network design contexts, researchers have folded social science insights and methods into design processes to explore human-centered issues in network infrastructure [13–16, 26, 27, 30, 32, 35, 49, 50, 56], for example using participant observation within a network architecture design team to uncover embedded values [55]. Social science insights have also informed network technology design supporting community healthcare [18] [4, 17, 59], agricultural data integration [53], optimised environmental sensing [62], and the movement of money and goods [36]. Some studies have served as precursors to design, such as investigations of network traffic characteristics or repair in remote rural communities that reveal their particular needs [38, 39, 60].

Policy and governance of networked technologies. Other work explores relationships between technical development [53, 58] and governance [6–9, 61] of networking technologies. Research on the material and technical realities of the internet [19, 20] finds structural inequalities are produced through differential modes of access [11, 12, 46–48] and various analyses have prompted recommendations for telecommunications policy change, such as more inclusive FM-radio licensing [9] and wireless spectrum regulation [51] . Earlier discussions (e.g. [10]) reflected on the complex challenges of diverse communities operating their own telecommunications, and how they reconcile local practices with funding and legislation regimes that were not designed to support them. These conversations are especially timely given intensified efforts around the world, due to the pandemic, to bridge gaps in connectivity, and the factors that preclude equitable communications access.

Socio-technical theories of networked technologies. Theoretical insights have also been produced by socio-technical analyses of relations between networking technologies and decolonizing and feminist concerns [5, 7], critical pedagogies [44], and plural and beyond-human onto-epistemologies [22, 34]. For instance, in discussions, about "networking rurality" at 4S [1], STS studies of internet and energy infrastructures illuminated insights about relational onto-epistemologies in remote indigenous communities and prompted conversations about the effect of light emittance of LEO satellite internet infrastructures, such as SpaceX's Starlink, on ways of being, knowing and doing in the Kalahari.

3 WORKSHOP THEMES

We organize our interests into the following provisional interrelated themes, to which workshop attendees may contribute:

(1) **Social scientific analyses in technology design and implementation:** This theme will consider how to apply social science insights/theories in developing network technologies. For example:
   - Integrating local knowledge into environmental sensor networks, *e.g.* monitoring air quality
   - Local languages and interfaces in networked applications
   - Designing decentralized/mesh vs. more centralized network architectures
   - How problem framings in networking research produce and prevent systems of oppression

(2) **Intersections of networking practices with political and economic conditions, and governance:** This theme will analyze organizational, institutional, disciplinary, policy and governance factors that shape infrastructures, exploring how networks are produced at the confluence of technical possibility, cultural/historical context, and political/economic realities. For example:
   - How North American tribal networks are produced to reflect tribal sovereignty
   - How CNs are impacted by radio spectrum and regulatory frameworks
   - Funding policies/programs, financial models, and case studies for Global South networks
   - Other challenges and responses (advocacy, direct action) related to regulations/policies

(3) **Alternative perspectives on networking**: This theme will draw connections between participants' interests in networks in different domains, for different purposes and diverse critical and onto-epistemic perspectives. For example:
   - How to embed critical lenses,(*e.g.* gender/feminist/decolonial) in different areas of inquiry and research methodologies

- CNs as mutual aid, and their intersection with activist and organizing spaces
- Imagining networks from beyond-human/pluriversal/re-worlding/multi-species perspectives

4 LOGISTICS

4.1 Virtual Tools

We will host our workshop on a widely accessible video-conference platform that can support live captioning, chat, and breakout rooms to facilitate synchronous group activities (e.g. Zoom). Before and after the workshop, we will provide different digital channels to promote and support inclusive conversations, including: an email list; a platform for one-on-one chats and parallel discussions (e.g. Discord); and, a Google Drive folder for asynchronous collaboration on shared documents.

The workshop's website will be an information hub, including agenda, goals, tentative schedule, submission instructions, and links to other communications channels. Workshop facilitators will use collaborative editing tools for group activities and shared note-taking (e.g. Miro boards), with designated note-takers and automated captioning throughout group activities supporting accessibility.

4.2 Recruiting Participants

We will recruit ~30 participants interested in network infrastructures and connectivity, publicizing via online channels such as social media and e-mail lists. We will prioritise both relevant research communities (e.g. GAIA, LIMITS, ICTD, COMPASS, and SIGCOMM), practitioners in civic and advocacy groups (e.g. the Association for Progressive Communications, FLOSS communities, community radio and network builders/maintainers around the world), and regional professional groups (e.g. IEEE ComSoc).

Interested attendees will submit a Google form including: name, affiliation(s), short bio (100 words), time zone, accessibility needs, and the workshop themes that their work/interests relate to including new ones they would like to explore. Prospective participants will also submit an image that represents their interest in networks (with captions for accessibility), and a visualisation (poster/slide/other) around which they will briefly present their interests at the workshop.

5 WORKSHOP STRUCTURE

5.1 Pre-workshop

We will make our digital channels available at least 2-3 weeks before the workshop, so that participants may socialize and begin online conversations.

5.2 Format and Program

We propose a program that enables participation in different time zones, and will work with the CSCW conference organizers to achieve a format that can allow participants to attend other workshops. We suggest two 3-hour sessions, with different content, repeated twice with different groups based on time zone. We will schedule sessions to accommodate participants' preferred times.

5.3 Tentative Schedule

5.3.1 Session A.

- 00:00 - 00:15: Icebreakers A
- 00:15 - 00:45: Lightning talks A
- 00:45 - 01:00: Social Break
- 01:00 - 02:00: Discussion A
- 02:00 - 02:15: Social Break
- 02:15 - 02:45: Exercise A
- 02:45 - 03:00: Wrap up and reflection

5.3.2 Session B.

- 00:00 - 00:15: Icebreakers B
- 00:15 - 00:45: Lightning talks B
- 00:45 - 01:00: Social Break
- 01:00 - 02:00: Discussion B
- 02:00 - 02:15: Social Break
- 02:15 - 02:45: Exercise B
- 02:45 - 03:00: Wrap up and reflection

5.4 Activity Descriptions

5.4.1 Icebreakers. In breakout rooms participants will show-and-tell around their submitted visuals 4.2. This activity will be repeated in both sessions with different mixes of participants.

5.4.2 Lightning Talks. Participants will present their interests (during either Session A or B) for 2 minutes, including a core concept from their research or practice and themes they wish to discuss.

5.4.3 Discussions. During Session A, we will discuss all 3 (or more) workshop themes (3) in breakout rooms from the direction of "how social science can inform networking research." We will distribute participants initially according to their interests and re-shuffle breakout rooms part-way through to enable participants to engage with different topics and people. In Session B, we will encourage participants to reflect on their discussions in new groups from the direction of "how networking technology research and designs can inform social science analyses and theory." We will then return to the whole group to share highlights and takeaways.

5.4.4 Exercises. The exercises aim to collaboratively compile shared resources. In Session A, we will discuss making our research and practice area explicit. We will first identify problem spaces and research questions and their real-world relevance, foundational related works, venues and sub-disciplines, and contribute to a shared repository of scholarly and practitioner resources. Then we will seed a bibliography in interest groups. In Session B, we will start to consolidate resources and indicate next steps. This includes identifying resources that people may have or need to pursue their networking interests, such as funding, connections to advocacy or developer groups, *etc.* For each exercise, we will have small group discussions in breakout rooms.

6 CALL FOR PARTICIPATION

This workshop, spread across two days in time-zone convenient sessions, aims to foster a global community of researchers and practitioners with technical and social science expertise in computer networks. We aim to expand upon and build links between different conversations, and support these with relevant resources .

The workshop will discuss: applying social scientific analyses to technology and implementation; social-scientific analysis of the production and governance of networking infrastructure; alternative perspectives on networking; and, intersections of networking practices with political and economic conditions.

The workshop will produce: (1) a shared, extensible bibliography to make the state of the art explicit and inclusive, (2) a compilation of resources to support future work, (3) an agenda of shared goals, challenges, and intentions, and (4) social and organizing infrastructures for continued communication and collaboration.

We especially intend for workshop outputs and collaborations to engage with real-world connectivity initiatives, particularly in support of marginalized groups and Global South communities.

To participate, please fill in the Google form on our website (https://cscwnetworks.wordpress.com) by September 1, 2022. Along with your name and short biography we would like you to upload an image that represents your interest in networks, and a visualisation (poster/slide/other) around which you can talk about your interests for 2 minutes. Please send any questions to cscwnetworks@gmail.com.

7 ORGANIZERS

Esther Jang is a PhD student in Computer Science at the University of Washington. Her research on CNs in rural and urban contexts focuses on how communities of practice can build and sustain technical infrastructures. She helped install CNs in the Philippines, Mexico, Tanzania, and the US; is a lead organizer and installer for the Seattle Community Network; and a Director at the Local Connectivity Lab, a nonprofit that supports CNs through technology research, deployment, and teaching.

Nic Bidwell is associate professor at Aalborg University and adjunct professor at the International University of Management, Namibia. Her research, on contexts marginalized by technogeopolitics, includes rural Australia, Namibia, South Africa, Mozambique, Kenya, Uganda, Indonesia, Argentina, Mexico and India. Nic's ethnographically informed co-design set the stage for South Africa's first community owned ISP. Her analyses of relations between regulation and participation in CNs and radio have informed advocacy for policy change. She has been active in the African CN movement since its launch, co-founded AfriCHI, is a member of Digital-Environment System Coalition and Chairs SIGCHI EC's Sustainability Committee.

Jen Liu is a PhD student in Information Science at Cornell University. Her research investigates the ecological, social, and political implications of computing technologies and infrastructures. Jen has worked on topics including land politics in digital agriculture and knowledge production in environmental sensing. Her dissertation is on the impact of climate change on networked infrastructures in the American South.

Phoebe Sengers is a professor in Information Science and STS at Cornell. Her work integrates ethnographic and historical analysis of the social implications of technology with design methods to suggest alternative future possibilities, with a focus on the effects of rural infrastructure. She currently leads the NSF project, "Understanding and Improving the Social Impact of High-Bandwidth Farm Networking Infrastructure" which integrates networking research, sociology of agriculture, and research through design to develop design and policy recommendations for new on-farm networking infrastructure. At Cornell, she is a member of the Graduate Field of Computer Science, associate faculty with the Department of Art, and a member of the Cornell Initiative for Digital Agriculture.

Naveen Bagalkot is a design researcher, educator and facilitator at the intersections of HCI, PD and community-based care. As a co-founder of Design Beku collective, he facilitatates collaborative design and critical making for and with grassroots community organizations (e.g. MAYA Health, Enable India). As teaching faculty at Srishti Manipal Institute of Art, Design and Technology, he teaches across undergraduate and graduate programs in HCI.

Nervo Verdezoto is a senior lecturer at Cardiff University, with expertise in ethnographically informed, user-centred and participatory design, physical computing and evaluating socio-technical systems with particular focus on Digital Health and Sustainability. He has investigated invisible work and infrastructures across multiple care settings with recent work explores how care infrastructures and socio-technical and cultural practices influence maternal and child health in the Global South.

Melissa Densmore is associate professor at the University of Cape Town, where she leads the HCI Lab and the Hasso Plattner Institute Research School at UCT in ICT4D. Her research looks at community-based digital innovation for maternal and child health and CNs. The award-winning iNethi project is an open-source platform for enabling community-based wireless hosting of local content and services.

Morgan Vigil-Hayes is an assistant professor at Northern Arizona University. Her research examines the nexus of last-mile network connectivity and uses of networks for community good, most recently on how new architectures and services can enhance the goals of tribal communities in the American Southwest to promote Nation-building. Morgan's 2022 NSF CAREER award will characterize how communities collaborate around measuring the Internet and co-design a platform to facilitate Internet activism.

Shaddi Hasan is an assistant professor of computer science at Virginia Tech, where his research addresses scale and flexibility challenges faced by service provider networks, especially in rural and developing regions, such as architectures that can support diverse network operators. Shaddi has worked with CNs in Indonesia, Mexico, the Philippines and the USA, was previously with Facebook Connectivity and was a co-founder at Endaga, a startup that built tools for community-run cellular networks.

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