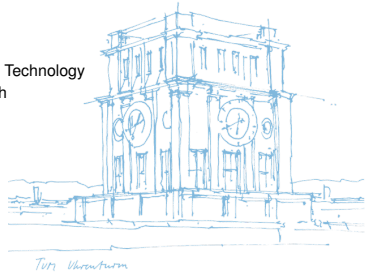


Bridging the Gap: Decentralized Grassroots Networks for Disaster Relief and Education

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Motivation

- Lacking internet infrastructure in disaster zones
- Censorship restricts Self-organized, egalitarian and democratic communication
- Keep schedule for children despite chaos
- Provide a way to communicate with loved ones

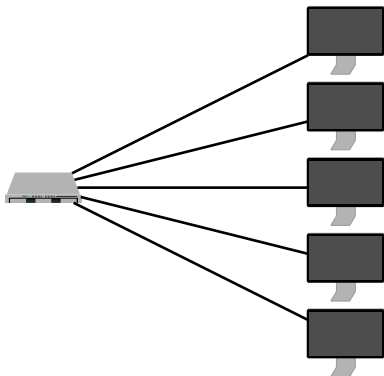


Figure 1: Client-Server

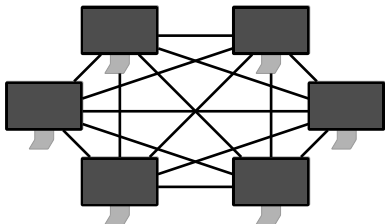


Figure 2: Distributed Grassroots Network

- Wireless mesh networks
- Grassroots networking (SPANs, multi-hop, p2p)
- CRDTs
- Cordial dissemination

Author	Year	Title
Project SPAN	2017	Smart Phone Ad-hoc networking
Project Briar	2018	Briar
M.R. Albrecht, J. Blasco, R.B. Jensen, L. Mareková	2021	Mesh Messaging
P.S. Almeida, E. Shapiro	2024	The Blocklace
E. Shapiro	2024	Grassrots Systems: Concept ...
I. Keidar, O. Naor, E. Shapiro	2022	Cordial Miners

1. Use SPAN to realize grassroots distributed system based on mobile hotspots
2. Communicate with network peers
3. Access content from peers within the network
4. Optionally, enable external connectivity when available

1. **RQ1:** How do blocklace-based CRDTs degrade on (offline) wireless mesh networks as a function of peer density?
2. **RQ2:** What are the key factors that influence the goodput of a grassroots social network implemented using the blocklace?

1. **RQ1 Storage:** What do existing distributed social networks use for storage of the distributed ledger (DLT)?
 - 1.1 **Methodology:** Evaluate existing projects from legacy p2p systems to modern distributed networks and blockchains.
 - 1.2 **Goal:** Build an argument for using a specific data structure, based on an iterative interaction analysis, from storing elementary p2p relations to complex interactions as feed building.
2. **RQ2 Consensus:** What type of consensus is needed for distributed social networks?
 - 2.1 **Methodology:** Analyze current consensus methods and explore cheaper alternatives to the classic 50% + 1 vote.
 - 2.2 **Goal:** Build an argument for using a specific consensus algorithm (e.g., PoW, PoS, PoA, (p)BFT, Raft, Paxos).
3. **RQ3 Communication:** How are messages broadcast in a distributed network?
 - 3.1 **Methodology:** Investigate the efficiency of traditional p2p unicast communication and explore multipoint communication alternatives.
 - 3.2 **Goal:** Enhance network resilience to faults and improve efficiency in terms of latency, storage, and bandwidth.

Architecture

Key components

- **Protocol** Smartphone-compatible mesh protocol (optionally supported by both iOS and Android)
- **Content Distribution** Propagate content and routing info using cordial dissemination, enabling self-healing and (valid) data recovery
- **UI**: tools to access network peers (optional)

- **Protocols** Use networking testbed to test ad-hoc wireless protocols
- **Storage** Use Blocklace-supported storage to store network information and content
- **Prototyping** Develop a prototype app to set up and test the mesh network
- **Testing** Test in a controlled environment, conduct field tests
- **Evaluation** Measure latency, throughput, reliability, node discovery time and power consumption

- Create infrastructure for grassroots, information-centric networking
- Enable large-scale offline communication
- Facilitate access to education contents in areas without centralized infrastructure

That's it!

Questions?