
KTH – Re-decentralization – A Wicked Problem

Jon Crowcroft, 13.1.2026



Personal Data Localisation: physical v. legal

- Databox/hat/personal data stores < physical
 - Databox principles (human data interaction) at Aarhus 2015
 - Lots of examples (Solid, Bluesky PDS, (Matrix, Mastodon), Estonian digital citizen, EU, open wallet etc)
- Data lakes and data trusts < legal
 - Alternatively, legislate/jurisdictional limits (not just GDPR)
 - Enforcement depends, and tends to be reactive where PDS proactive

Three technical challenges

- Trustworthiness
- Availability
- Deployability
- And one use case

=> *Expectations (convenience) set today by central (cloud) systems*

=> *Claim: we can do better for latency, resilience, sustainability*

Trustworthiness

- Resource pooling between friends
 - How do we know they really are our friends?
 - Identity is key
- ⇒ Trustchain minimized root of trust compared to today
- ⇒ Requires new mechanism for global verifiable timestamps

Availability #1

- Replication and Consistency in heterogenous, assymmetric nets

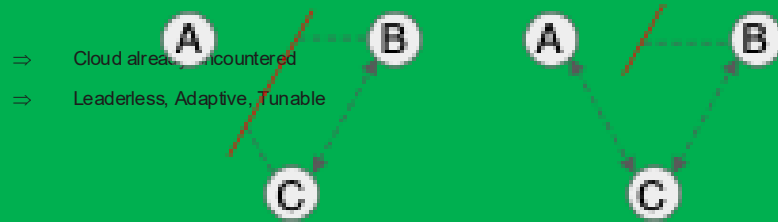
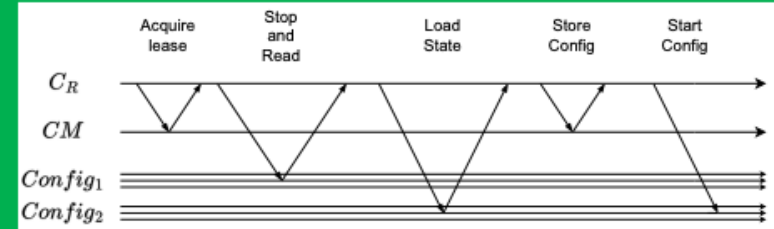
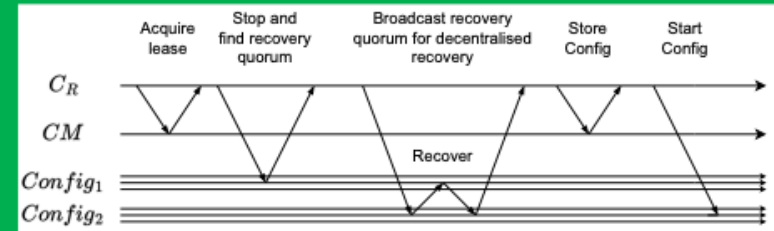


Figure 2. Full (left) vs partial (right) partition.



(a) Centralised recovery.



(b) Decentralised recovery.

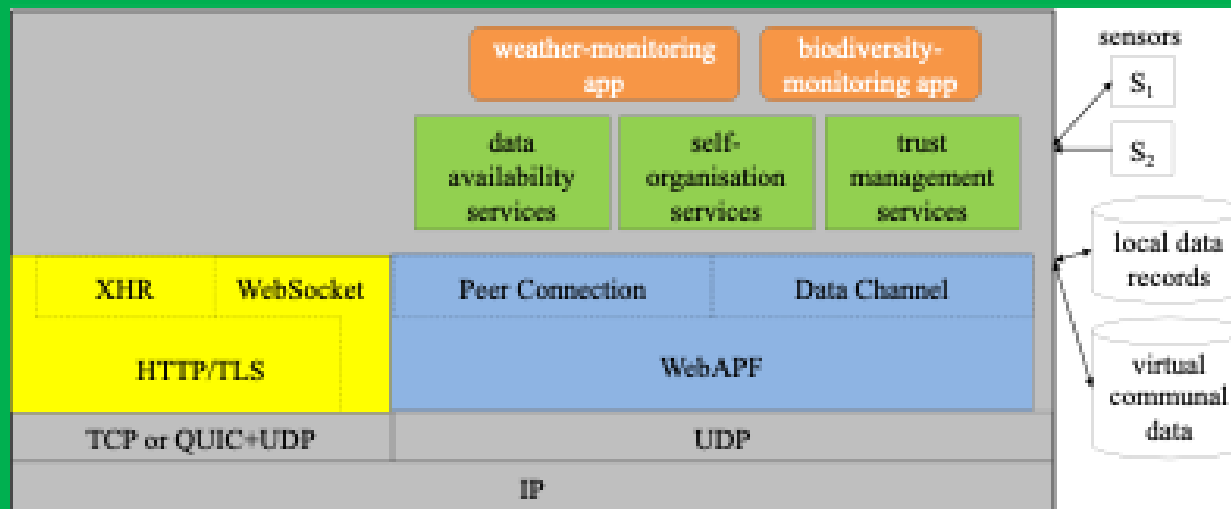
Availability #2

- Replica update convergence
 - Form DAG between (large) connected components, with fastest edges
 - Use these for majority consensus
 - Trickle updates to edges..
- Hybrid with CRDTs & Append only data for common cases...
- Tooling to pick right replica mech/param

Deployability #1

- **Browser extensions** WebAPF Analogous to WebRTC
 - Enormously successful getting video tools (zoom, teams) deployed
 - Cross platform
 - Offers security hooks (isolation/verification)
 - Offers Other use cases (FL = the Flower project)
- Brave/Chrome
 - Use standards (AP or AT protocol, DIDs etc)

Deployability #2



a) A browser extended with the Vmily platform.



b) Devices (nodes) of a Vmily-based application.

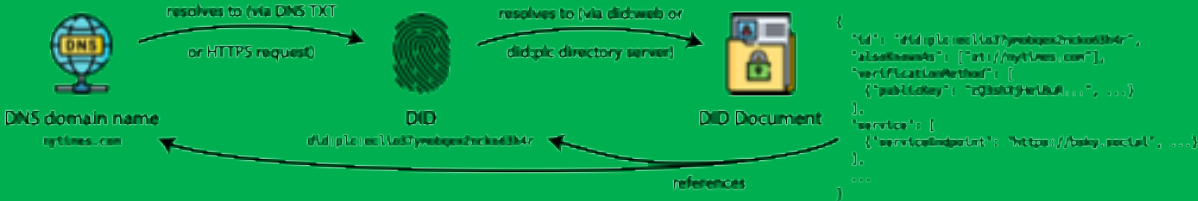


Figure 2: A handle resolves to a DID, and a DID resolves to a DID document, which in turn references the handle, DID, and the user's public key. Icons from Flaticon.com.

Use case

– Biodiversity crowdsensing

Various novel Privacy Concerns

No (especial) profit motive

Gain empirical data

=>Experiment with choice of algorithm

=>And parameter tuning/adaptation

=>5 apps with a million users, versus

=>1 million apps with 5 users



Trustworthiness

- **Key management**
 - Who creates & stores keys
- **Exfiltration detection and redress**
 - Spotting bad actors can be hard – maybe inference
- **Redress?**
 - Ostracism was a thing in medieval society®

Reflections on Distrusting Decentralization

- **Why trust CryptoBros?**

- Don't trust anyone. Unsurprisingly, we shouldn't trust them – toxic eco-systems

- **Why trust Real Decentralized (aka community) networks?**

- There is no “thing” - trust in decentralized systems is a social construct.

- **Can you trust a commons (to persist?)**

- Ostrim wrote 8 useful rules for such a society to last (also antonidadis& martignoni)

Usability

- Federation v. Decentralisation

FL is not decentralised

- Coordination

But FL or DL both need coordination which is hard.

- Flower et al

FL platforms need to somewhat decentralise for scale anyhow 😊

License models (and Governance)

- Both software and governance can be licenses

You want multiple implementations (c.f. IETF)

- BSD v. GPL

For profit tend (but not 100%) avoid GPL – so why not just mit/bsd/ etc?

- Free Ride v. No Ride?

For profit sometimes take it and run (can give evidence☹) interfere with dual governance model

Towards Governance 2.0

- Whereby public infrastructure

Somehow, the Internet exists – why did that work?

- Wherefore profit/non-profit

They didn't just fence and steal the commons. They stole your personal data..

- Sustainability

Retaking and Retaining decentralised ownership is going to be hard☺

Governance 2.0 Challenges

- Asymmetric Power

Hyperscalers are larger than countries/regulators; capture is almost total

- Asymmetric Expertise

- Without the expertise how is the lay person supposed to even understand..

- Asymmetry of Motive

As the Ais increase in agency, even their owners/keepers will cease to comprehend☺

Governance 2.0 is a Wicked Problem

- Unpredictable growth rates

Bluesky AT Protocol use, for example

- Adversaries

- at state actor scale..

- Political

- e.g. just look at Open Wallet Foundation & Global Digital Collaboration

Questions?

