Digital Sovereignty

Collective + Personal

Autonomy + Control over

Technologies = open hw+sw - study + modify
Bounding complexity = composable + reusable servers

Infrastructure = autonomous + networks

Data = replication for offline access
Sync + merge for collaboration

Algorithms = search + sort + display data

Identities = self-sovereign
Unikernels

specialised single address-space machine images
constructed by
library operating systems
such as
MirageOS (OCaml)

reduced complexity, attack surface, resource footprint
Solo5 - sandboxed execution environment for unikernels

Software layers

Configuration files
Application binary
Language runtime
Parallel threads
User processes
OS kernel
Hypervisor
Hardware

Application code
Mirage runtime
Hypervisor
Hardware
Irmin

distributed database based on the principles of Git
implemented as
OCaml library
for building
mergeable persistent data structure stores
accessible via HTTP and GraphQL
with
Mirage OS compatibility

key-value store - content-addressable block store + mutable tag store
history, branches, trees - like Git
built-in + custom data types + 3-way merge functions
counter, multi-set, set, map — LCRDTs - conflict-free merge
backends: mem, chunk, git
Network Architecture

**Federated servers**
- scalability?
- identities?

**P2P network**
- unstructured e.g. gossip
- structured e.g. DHT

**Two-tier P2P**
- resilient, autonomous infrastructure
- replication
- offline/local use
- opportunistic sync

P2P among local nodes
- P2P among proxy servers
  - pub/sub + data replication
  - search + discovery
  - collaborative filtering
  - news dissemination
- Linbox + storage - encrypted
P2P network

P2P Proxy

encrypted content-addressed object store

DB: sync+pubsub
encrypted access control

Apps: self-contained sandboxed local offline access+search

Local network

User device

Irmin + App GraphQL

DB1

DB2

DB3

PubSub

Proxy

encryption keys

UI

App1

App2

App3
P2P Publish-Subscribe

Podercast

Uniform Random Peer Sampling

CYCLON + URPS

Interest-based clustering

VICINITY + BFPS1

Group dissemination

Ring Cast
P2P Search + Discovery

Personalized
Interest-based

Collaborative Filtering
Tagging, Rating

News Dissemination
Search

user/item profiles
privacy
References

p2pcolab.net
mirage.io
irmin.io
unikernel.org

Technological sovereignty

Review Article:
What does the notion of "sovereignty" mean when referring to the digital?
S. Couture, S. Toupin - 2019

Book:
gitlab.com/sobteclib