

# **Life on the Edge: New Abstractions for Edge Network Distributed Computing**

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# Plan

## Motivation for change

the issues with 3rd party centralised services

## It's a jungle out there

challenges of distributed computing at the edge

## Patchwork over the problem

current attempts to build systems for the edge

## The SUD solution

introducing signposts, unanimous and databox



**CHANGE  
AHEAD**

**Motivation  
for change**

# Your digital footprint is huge

- > file & application data synchronisation
- > cloud hosted email
- > social media
- > banking & finance
- > government services & medical records
- > (micro-)blogging platforms
- > instant messaging
- > photo/video hosting
- > online backup & recovery
- > sleep & exercise tracking

# Your digital life is out of control

- > opaque terms of service to minimise legal responsibility.
- > mass government surveillance and censorship.
- > data breaches due to inadequate protection.
- > content manipulation for ads and profit.
- > targeted advertising and data sold to 3rd parties.
- > no service guarantees.
- > share by default mentality.

# There exists no viable alternative

- > network externalities.
- > data lock-in and high switching costs.
- > new payment models needed.
- > limited APIs for interfacing.
- > developing for the edge is hard.

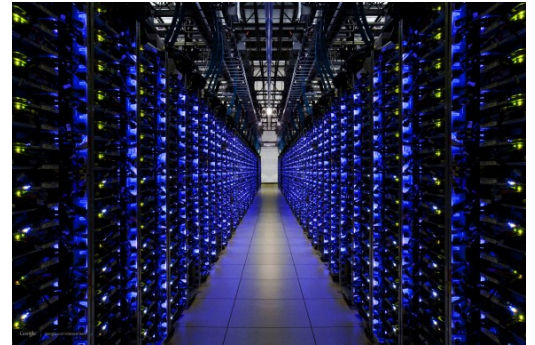


the obsessive - compulsive detective

It's a  
jungle  
out  
there

**MONK**

# Life inside the datacenter



- > homogeneous machines.
- > fixed network topology.
- > well understood link characteristics.
- > no Byzantine failures.
- > network redundancy.
- > wide range of tools for introspection and analysis.
- > extensive research & standard algorithms.
- > uniform & predictable links.
- > single administrative domain.
- > managed by knowledgeable sysadmins

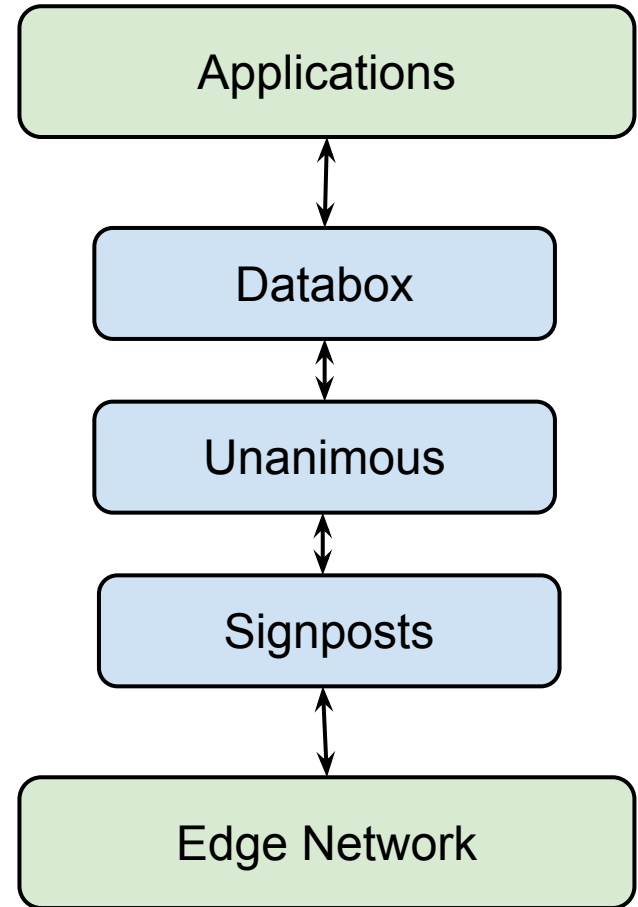


# Life outside the datacenter

- > heterogeneous hosts.
- > mobile hosts.
- > heterogenous network topologies.
- > asymmetric and nontransitive reachability.
- > diverse and unpredictable link characteristics.
- > poorly understood middleboxes.
- > resource constrained & locked down devices.
- > little trust for middleboxes, devices, application, ISPs and trust roots (CAs & DNS root).
- > managed by everyday people.



# The new abstraction for edge network distributed system



# Signposts

**Problem:** establishing authenticated identifies and secure channels between edge network devices.

**Solution:** give every device a user friendly domain name (i.e. `iphone.alice.signpost.io`). Channels are created by relaying traffic through VMs, that enforce traffic policies. These channels are created as a side effect of DNS resolution and devices appears as if local thus supporting legacy devices & applications.

# Unanimous

**Problem:** distributed algorithms are not designed for the edge network environment.

**Solution:** a new distributed consensus algorithm, where configuration parameters are the application needs such as consistency, fault tolerance, caching and dynamic membership.



# Databox

**Problem:** users want to take back control of their personal data

**Solution:** a self-hosted platform to enable people to engage with the collection, management and consumption of personal data



# Discussion Time

want to learn more about this work?

> related publications & blog posts at [www.cl.cam.ac.uk/~hh360](http://www.cl.cam.ac.uk/~hh360)

> come talk to me during the poster session

> email me at [heidi.howard@cl.cam.ac.uk](mailto:heidi.howard@cl.cam.ac.uk)

**Any questions, comments or thoughts?**