The Role of DNS Names in Internet Decentralization

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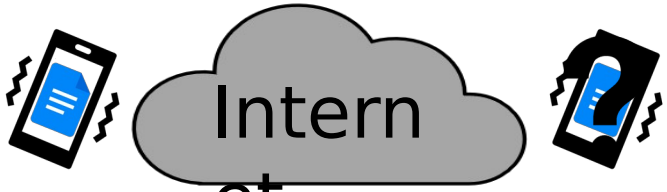
What is the Issue

- (Almost) All today's user apps are provided by / running on the cloud
  - Reliance on / controlled by cloud providers
  - All user data captured by cloud providers
- One way out of this: developing a new generation of apps *controlled by* end users (instead of cloud providers)

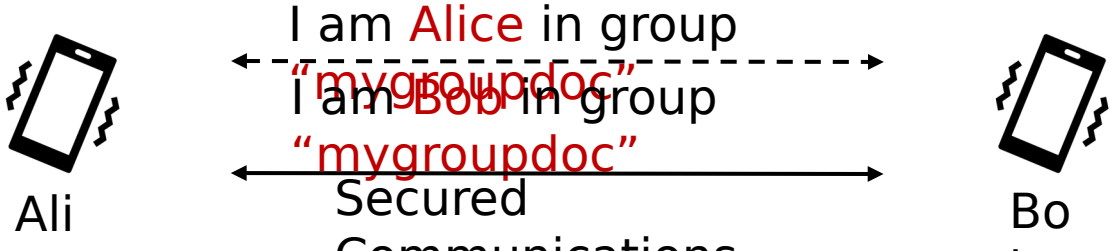
How to Build Such New Apps

- Enabling direct, secure, user-to-user communications (U2U)
- One way to get there
  - Let users get DNS names
    - Users can then authenticate each other using standard security libraries
  - Let users authenticate each other, without reliance on external PKIs
    - Instead, use trust-policies defined by users



Why DNS names for users

- Make usernames *independent* from cloud providers
  - alice@named-data.net, bob@named-data.net
    - Contrast to today: users are identified by their gmail address or Facebook IDs (2 companies control how all users identify themselves in cyberspace)
- Have names directly under users' control
  - DNS name delegation lets one freely create new names under one's own namespace



Establishing trust among users

- Make use of DN name delegation

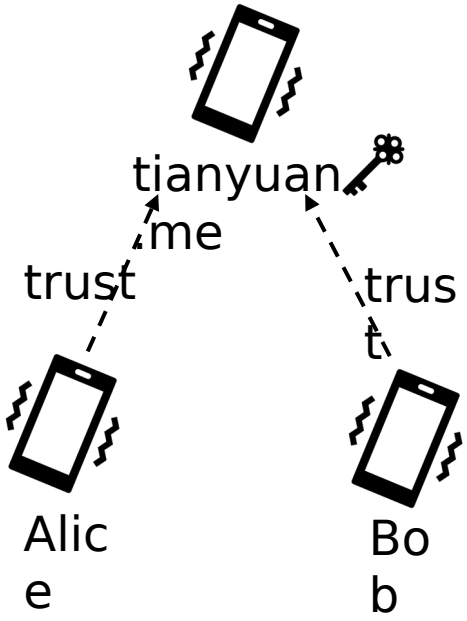
  .tianyuan.me (owner)

  .mygroupdoc.app.tianyuan.me (app)

  .alice.mygroupdoc.app.tianyuan.me (user)

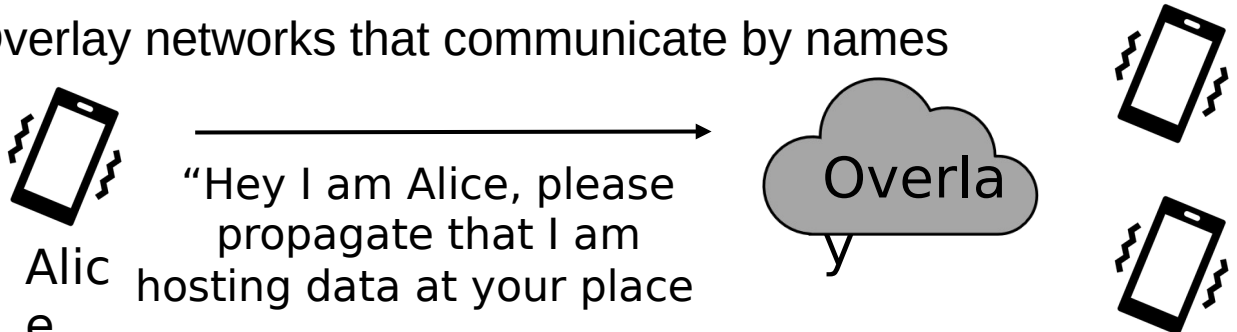
- Users issue certs to others in the trust circle
  - Remove external reliance

Local trust anchor



User named and controlled data

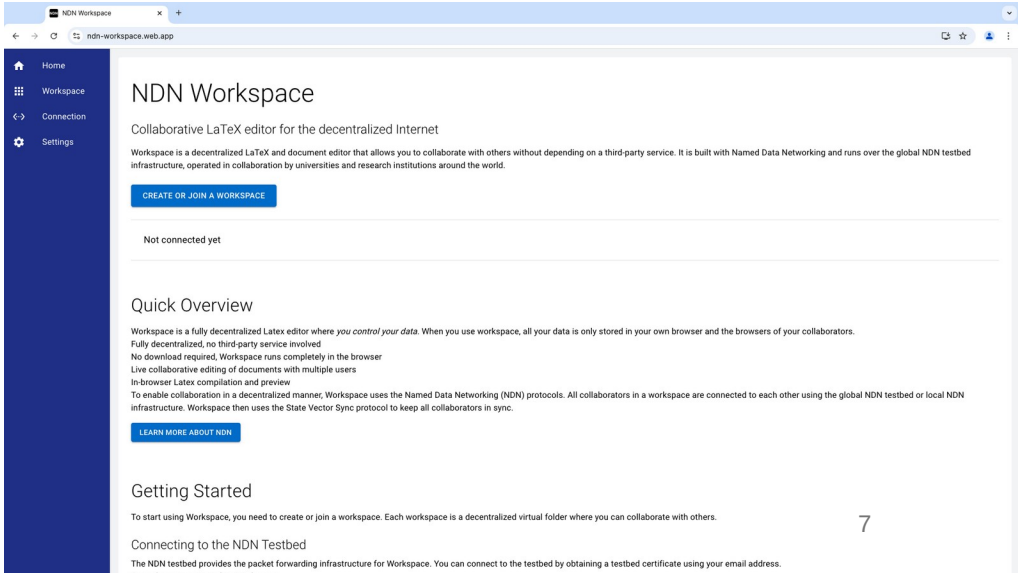
- Users publish named data
  - alice.mygroupdoc.app.tianyuan.me/blog/post/2024-11-06/dinrg
    - Encryption
    - Signed by alice.mygroupdoc.app.tianyuan.me key
- Rest of the story: exchange data
  - Overlay networks that communicate by names



NDN Workspace

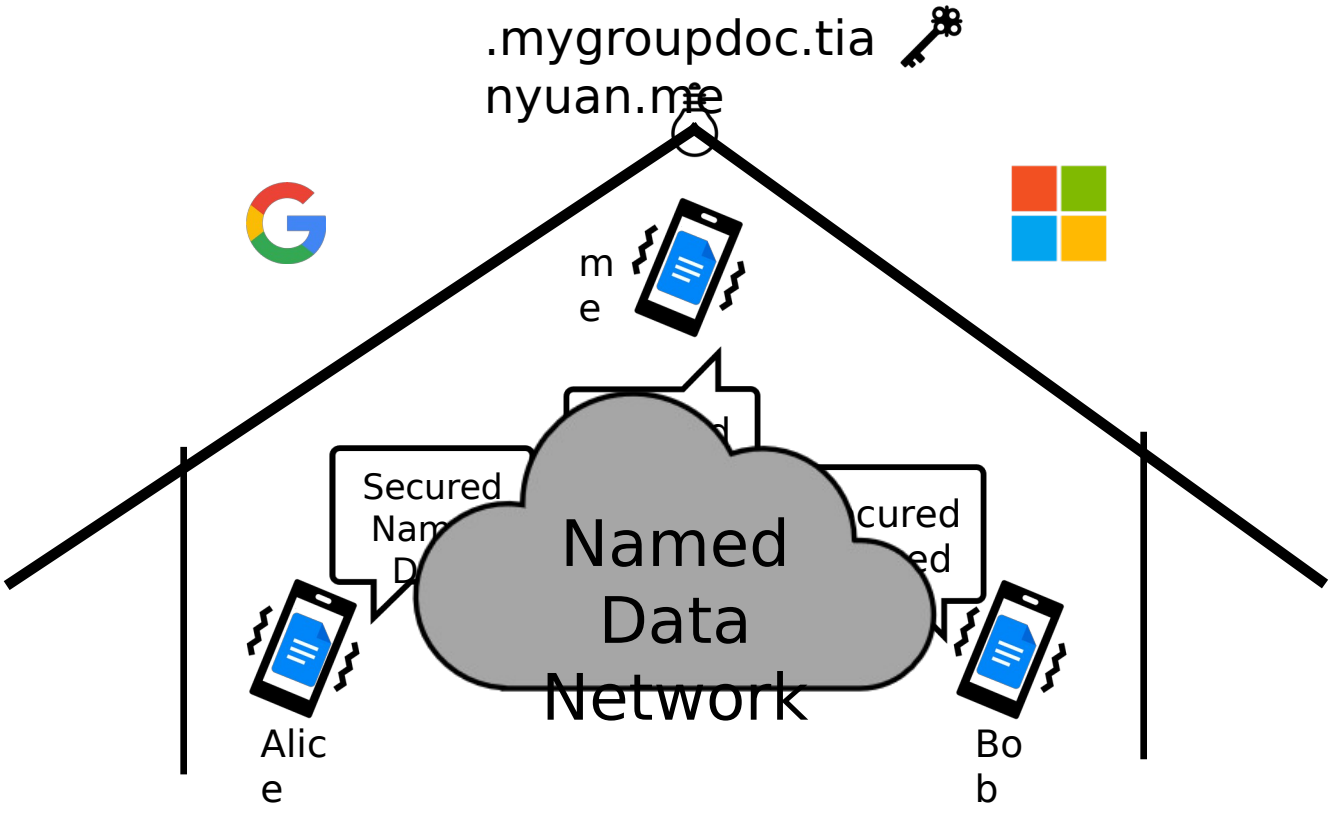
- IETF119 DINRG
  - *Workspace: Local-first Collaborative Editing over NDN*

Decentralizing control back to users!



https://ndn-workspace.web.app/

Workspace: A Local-First App Prototype



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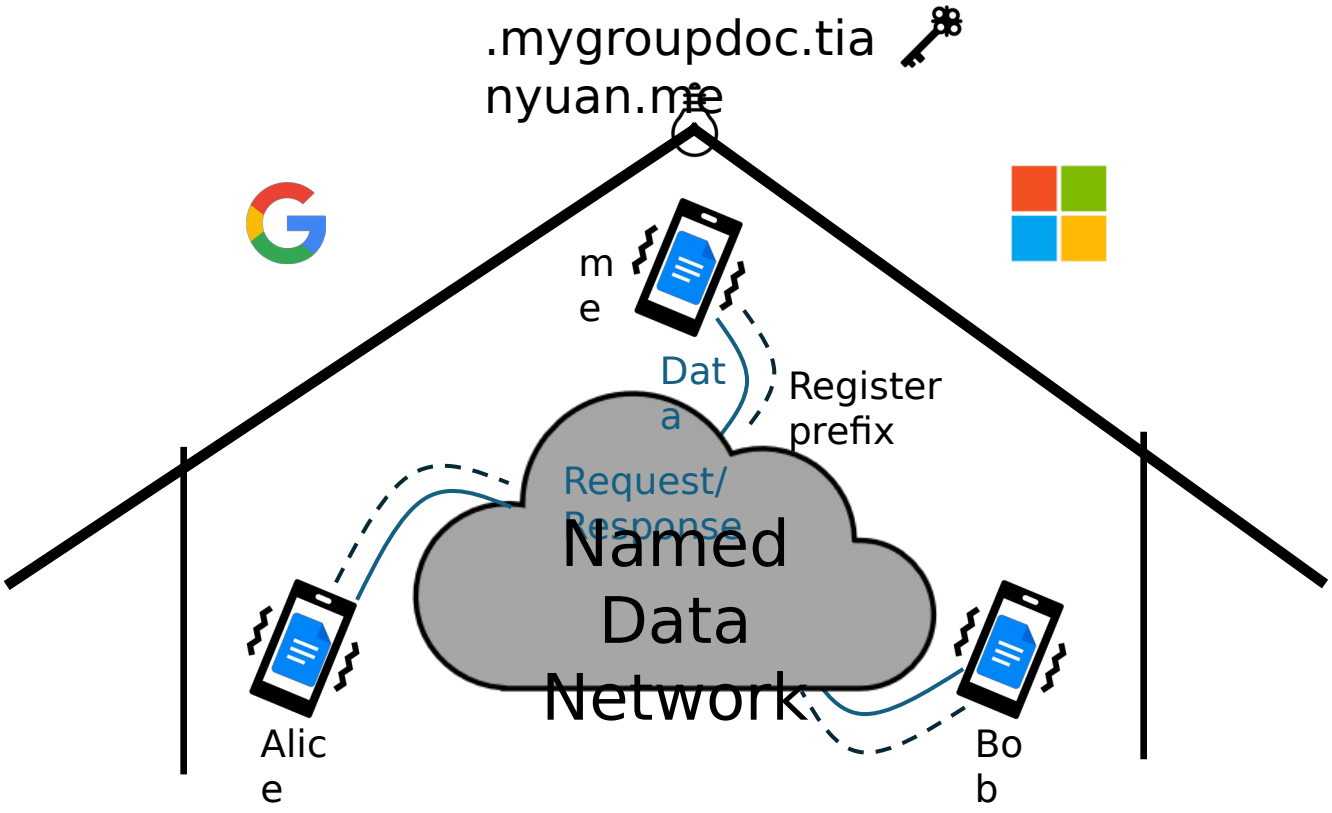
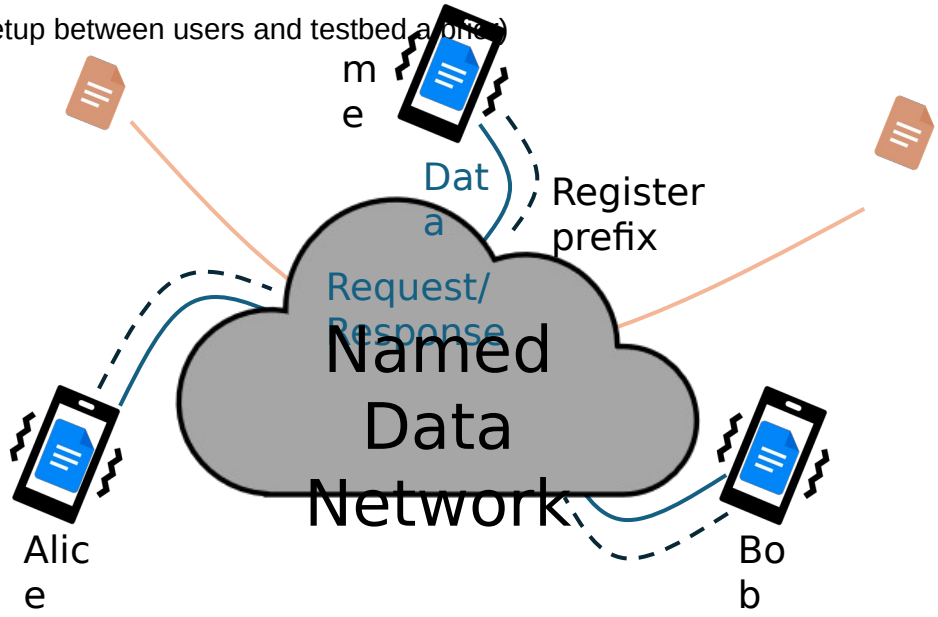


Communication over the Public Internet

- NDN Testbed
  - an overlay, NDN-speaking nodes connected by tunnels (with its own trust anchor)
  - Accepting routing announcements after authenticating the name prefix ownership

    (trust relation setup between users and testbed admin)



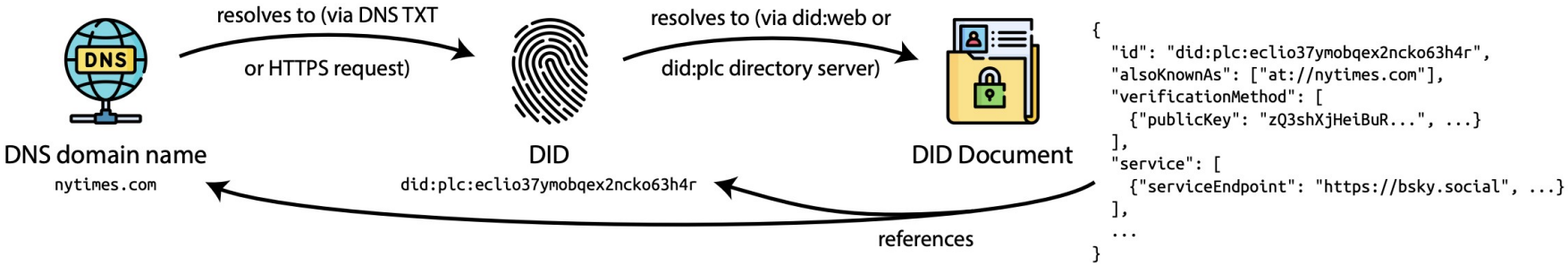
Giving DNS Names to End-users

- Shared idea with multiple other efforts
  - DANE Authentication for Network Clients Everywhere (DANCE)
    - TLS clients with X.509 certificate
    - draft-ietf-dance-architecture-07
      - 4.1.7 Domain users

        “Domains who publish TLSA records for a CA under a _user name underneath their domain allow the validation of user identities as mentioned in a certificate as TLS client or peer identities.”

Another Use Case Along the Same Direction

- Bluesky
  - Binding a Decentralized Identity (DID) to a DNS name



Adapted from Martin Kleppmann et al., *Bluesky and the AT Protocol: Usable Decentralized Social Media*, DIN '24

The Trend of Moving Toward Name-based Networking

A new Internet Architecture

- We've moved from end-to-end peer netwo… …t/server asymmetric networks
- We've repla… …to replicated ser…
- Clie… …a unique public IP address – clients are i… …are uniquely identified only in a local context
- Individual services aren't identified with a unique public IP address – services are identified in the DNS

We've moved from address-based networks to name-based services

Adapted from Geoff Huston, *Whatever Happened to IPv6*, NANOG 92

Naming in Networking

- Naming is the first and most important thing in networking
  - Host name, service name, data name, username, etc.
- Networking today is based on DNS names (albert at higher level)
- Giving users DNS names enables direct U2U (assisted by name-based forwarding), which enables user-controlled apps, an effective step walking away from further centralization