PERSISTENT NAMING FOR P2P WEB HOSTING

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Web Hosting on P2P Networks

- Problems with client/server architecture:
  - Flash crowds
  - Poor scalability even with high end servers and geographically distributed CDNs
  - Human intervention (DNS redirection)
  - Administrative overhead
  - Hosting expenses

Web Hosting on P2P Networks

- Advantages of P2P web hosting
  - No single point-of-failure
  - Self-CHOP (configuring, healing, organizing, protection)
  - In-network caching improves performance
  - Lower cost
  - Freedom of speech
  - Publisher anonymity

Research Challenges for Web Hosting on P2P Networks

- Highly dynamic network structure
- Content dynamism
- Content placement
- No uptime guarantees
- No end-to-end trust framework
- Firewalls and NATs
- …

only to name a few

Our objective:

Provide a persistent naming scheme for web hosting on P2P networks

So What are the Research Challenges for Naming?

- Location and time independent naming
  - Internet: URLs are bound to particular hosts
  - P2P: Any peer with a valid copy can be a source
- Distributed name registration and resolution
  - DNS is not a suitable solution in the P2P context

So What are the Research Challenges for Naming?

- Names must be attached to content
  - Independent of peer
- Flexible and human friendly names
- Persistent hyperlinks or bookmarks

Outline

- Plexus Routing
- pWeb Architecture
- Naming Scheme
- Experimental Results
- Conclusion

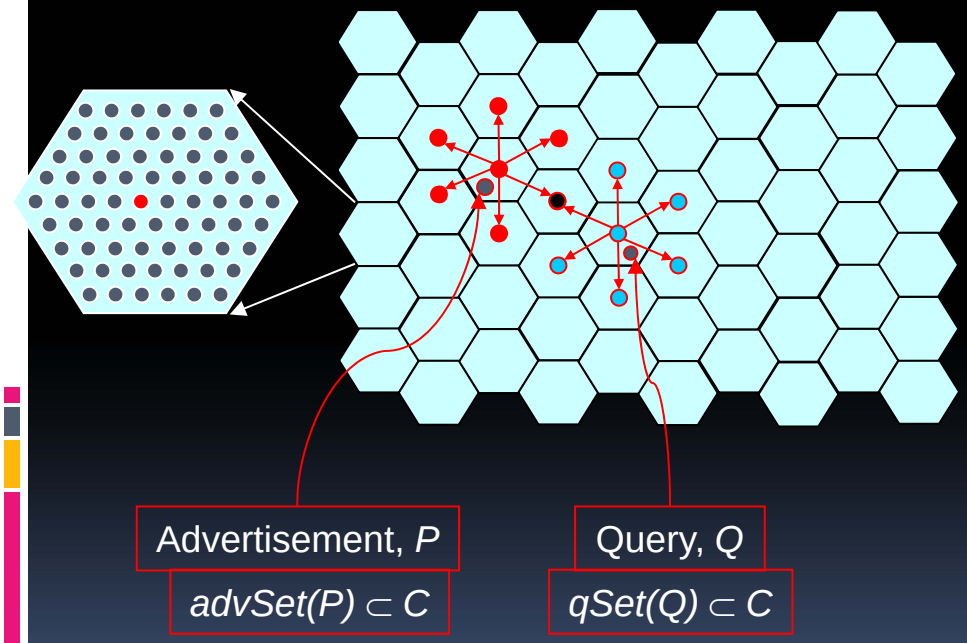
Plexus: Index Clustering

Cluster

Pattern

Cluster head

C = set of cluster heads



$$Q \subseteq P \Rightarrow qSet(Q) \cap advSet(P) \neq \phi$$

Linear code, C <n,k,d>

Cluster head ⇔ *Codeword*

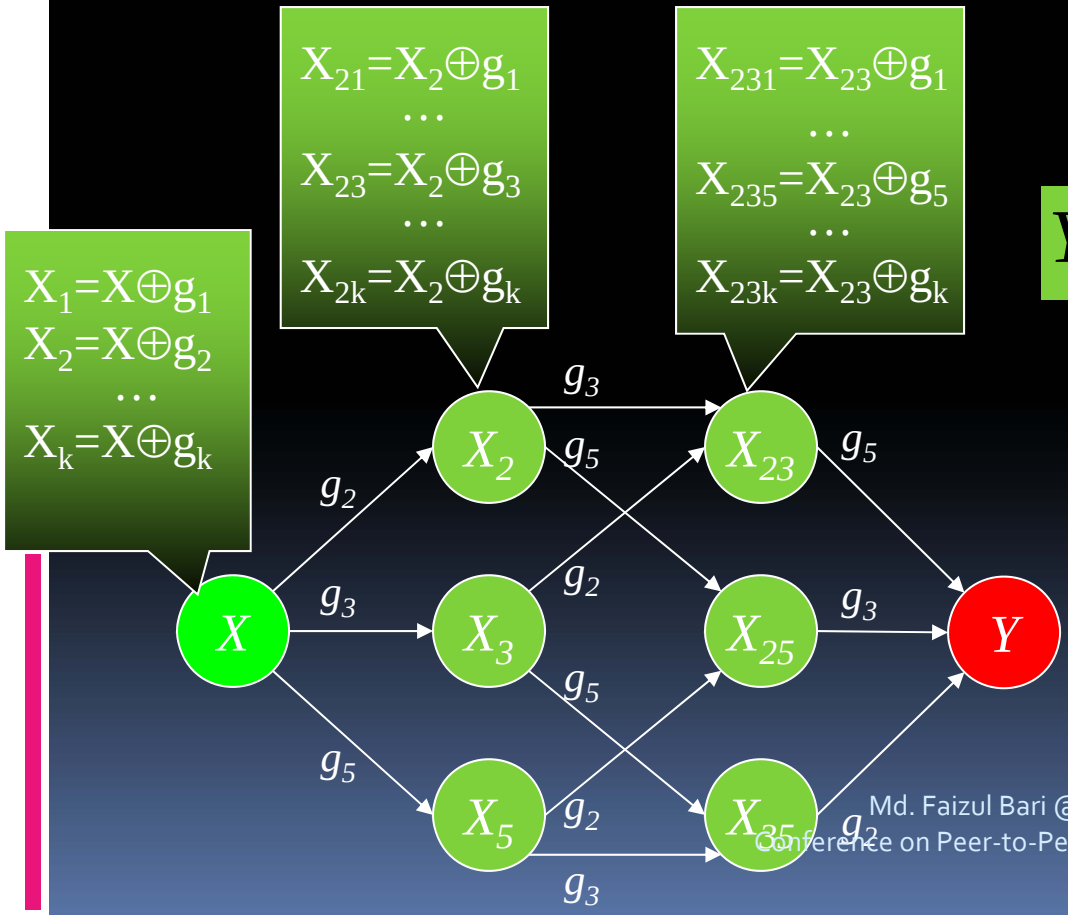
Generator matrix based routing

$$G = \begin{bmatrix} 47 \\ 23 \\ 15 \\ 0E \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

<7, 4, 3> Hamming code

Plexus: Routing

- Observation: *C* is closed under ⊕ operation



Example: Route from X to Y where,

$$Y = \underbrace{X \oplus g_2}_{X_2} \underbrace{\oplus g_3}_{X_{23}} \underbrace{\oplus g_5}_{X_{235}=Y}$$

$$X_{k+1} = X \oplus g_1 \oplus g_2 \oplus \cdots \oplus g_k$$

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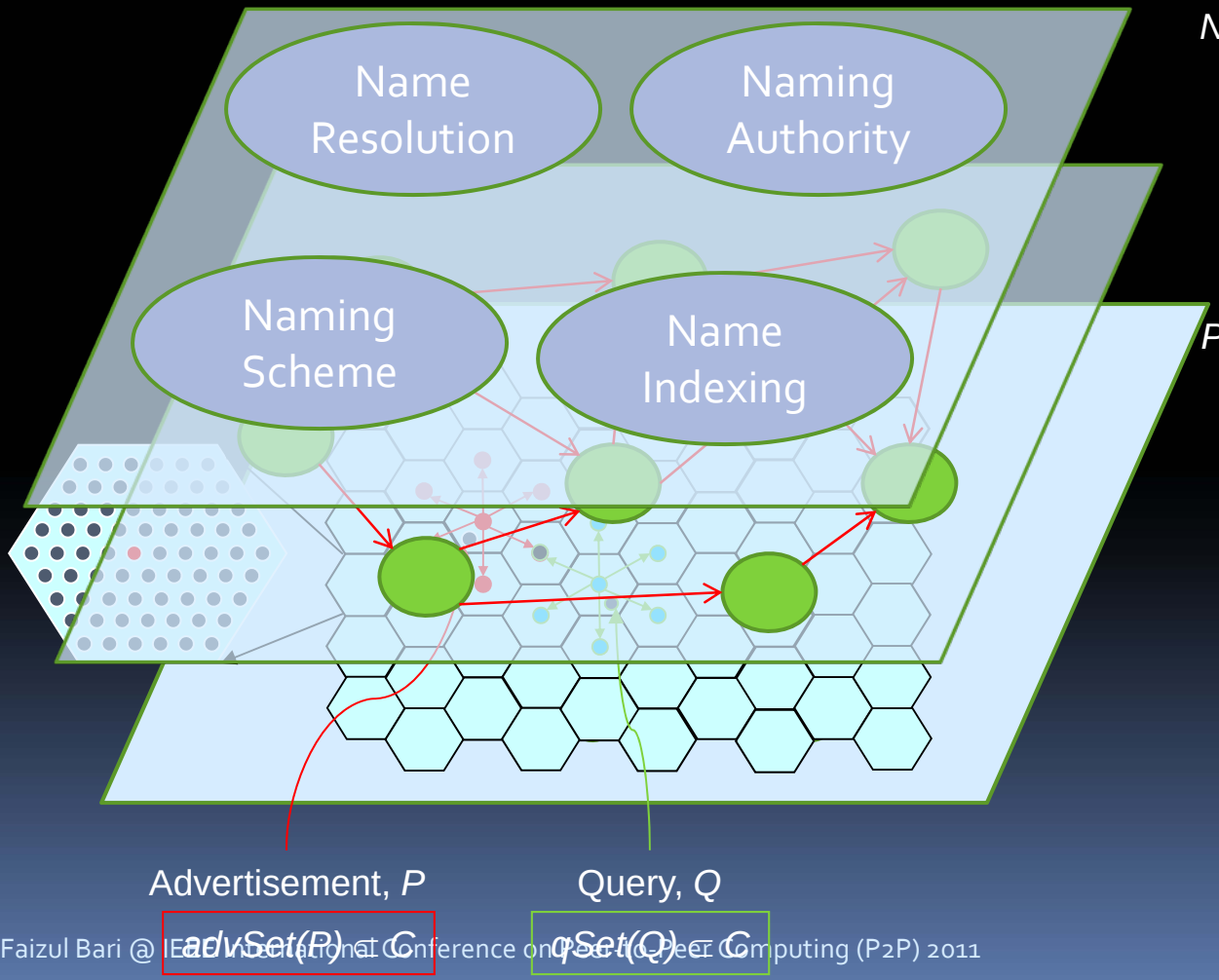
pWeb Architecture



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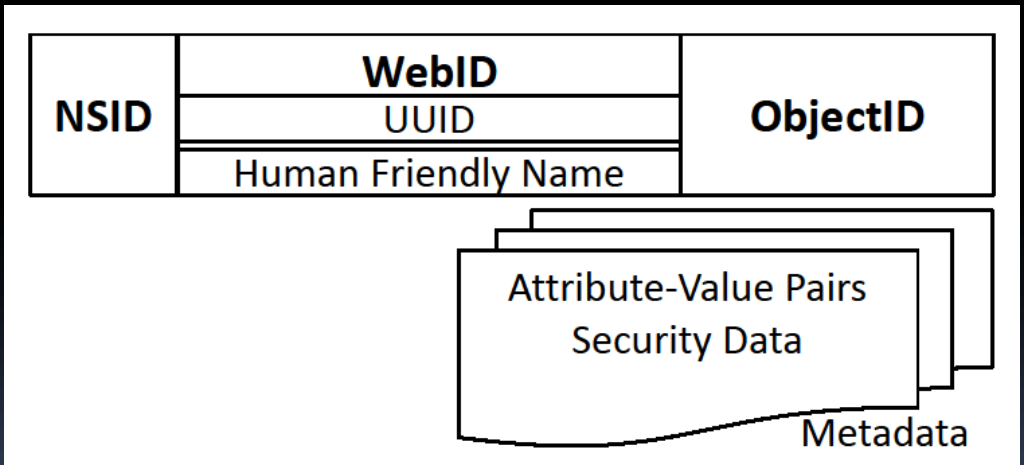
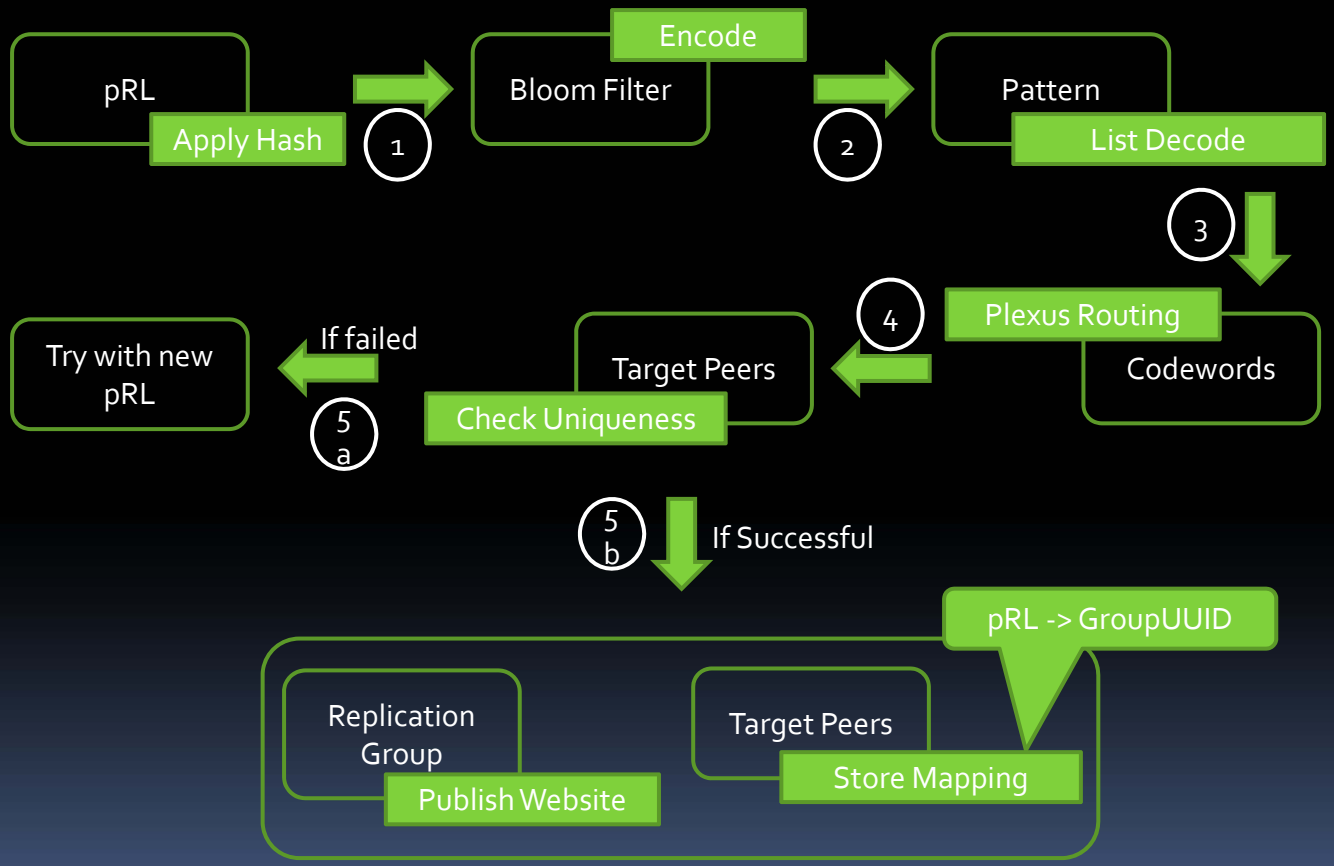
Naming Scheme -> Name Structure

- Names are called pRL
  - pWeb Resource Locator

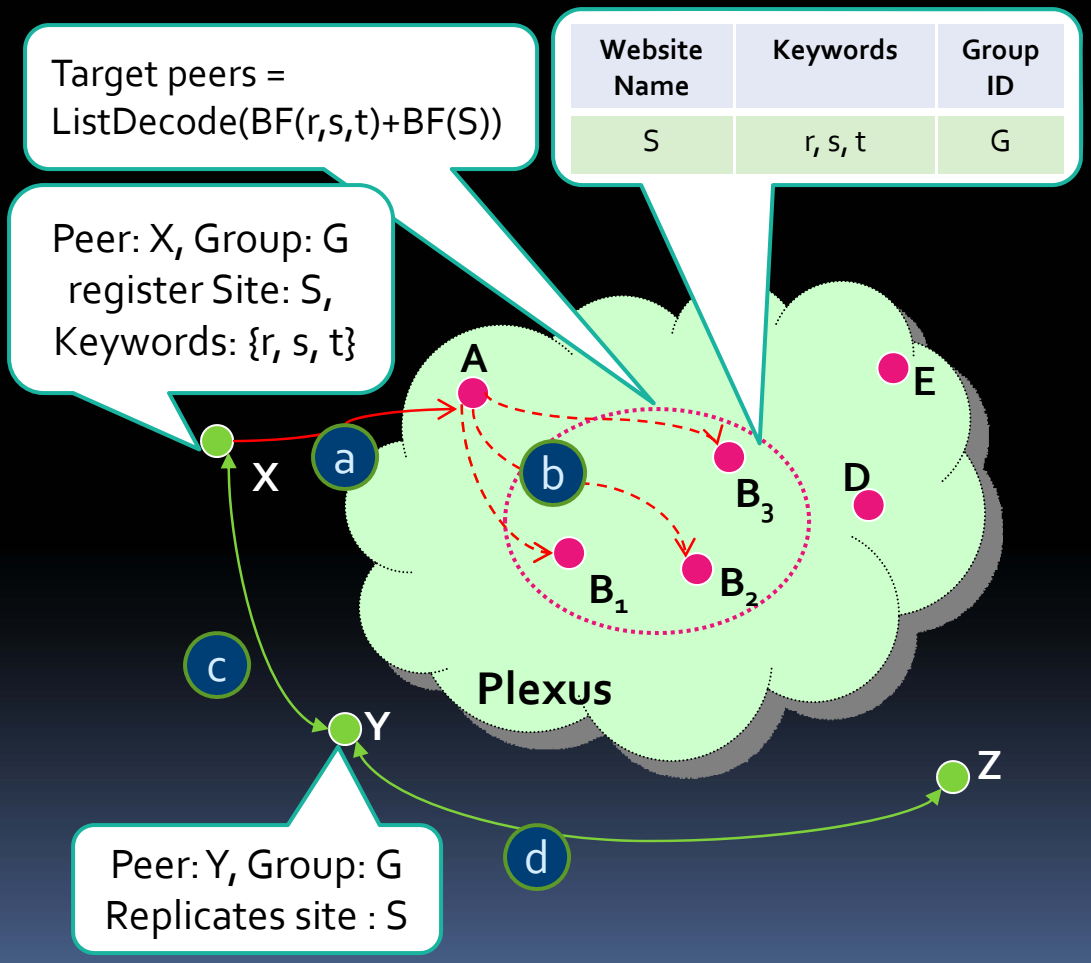


Naming Scheme -> Name Registration



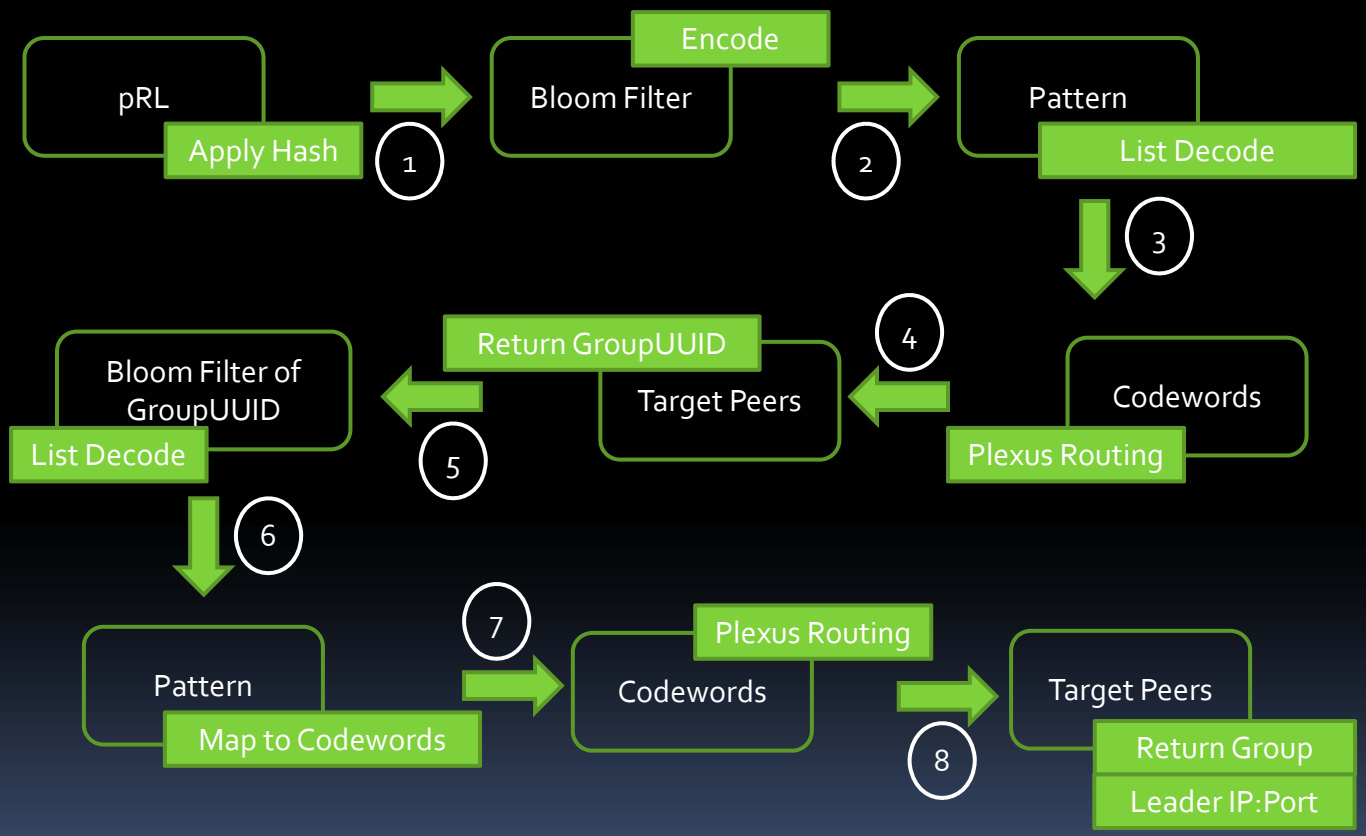
- Apply Hash
- Encode
- List Decode
- Route
- Check Uniqueness
- Publish

Naming Scheme -> Name Registration



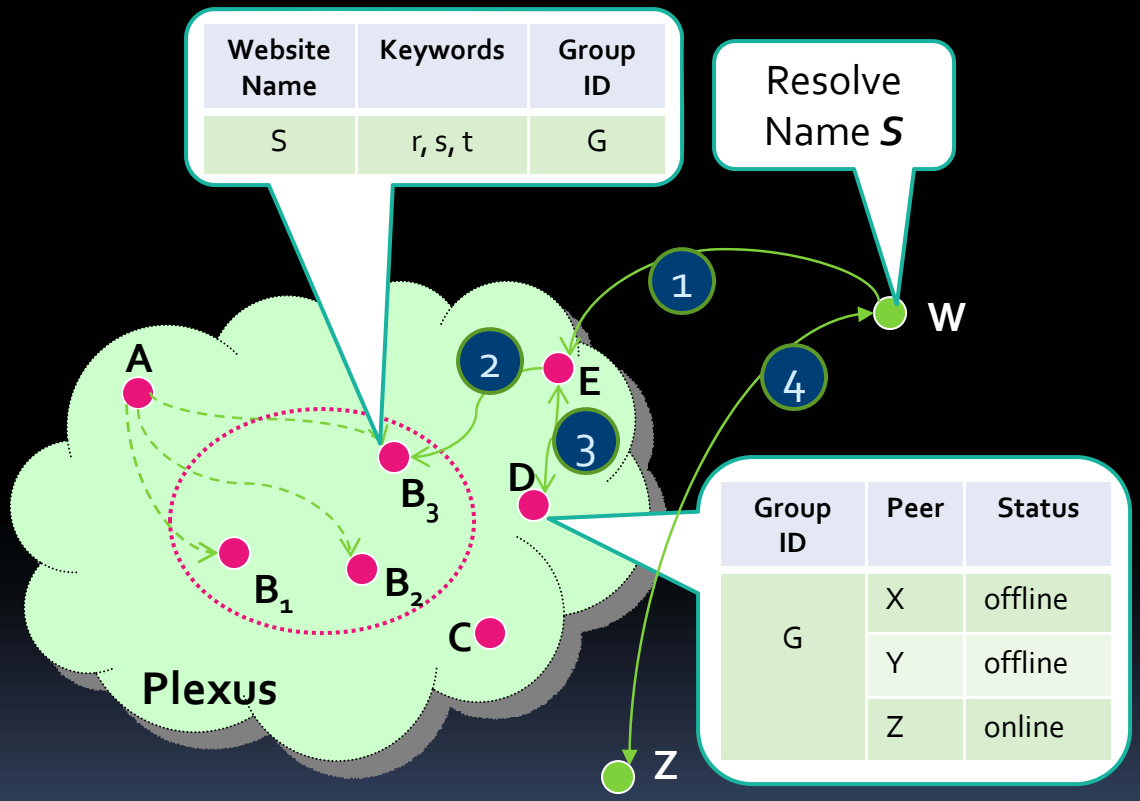
- Apply Hash
- Encode
- List Decode
- Route
- Check Uniqueness
- Publish
- Replicate

Naming Scheme -> Name Resolution



- Apply Hash
- Encode
- List Decode
- Route
- Return GroupUUID
- List Decode
- Map to Codewords
- Route
- Group Leader's IP:port

Naming Scheme -> Name Resolution



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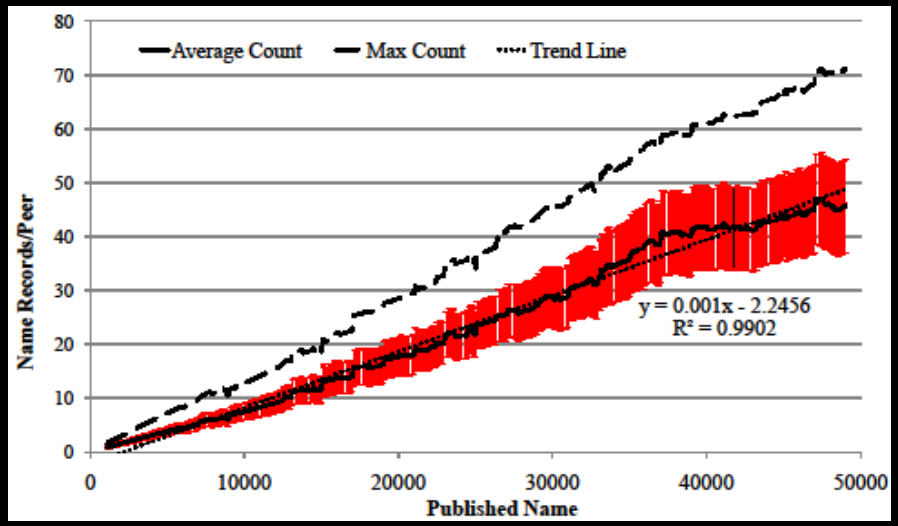
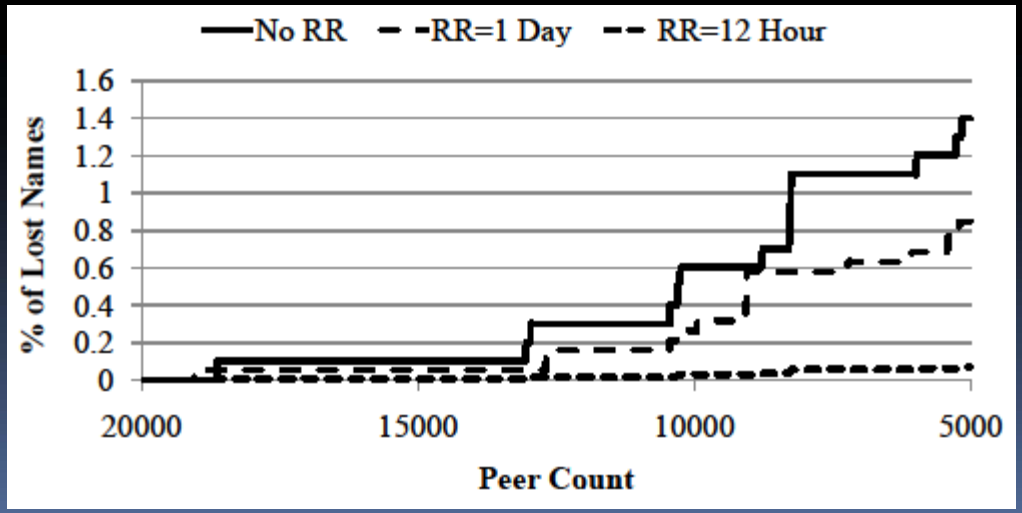
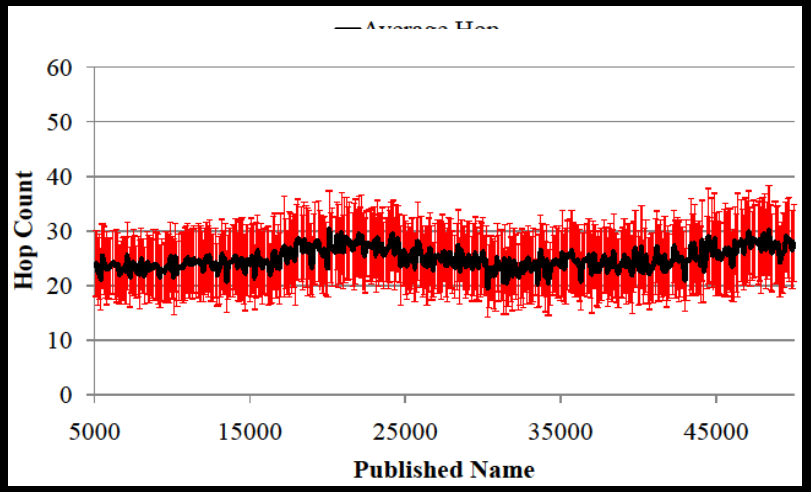


(a) Name record count

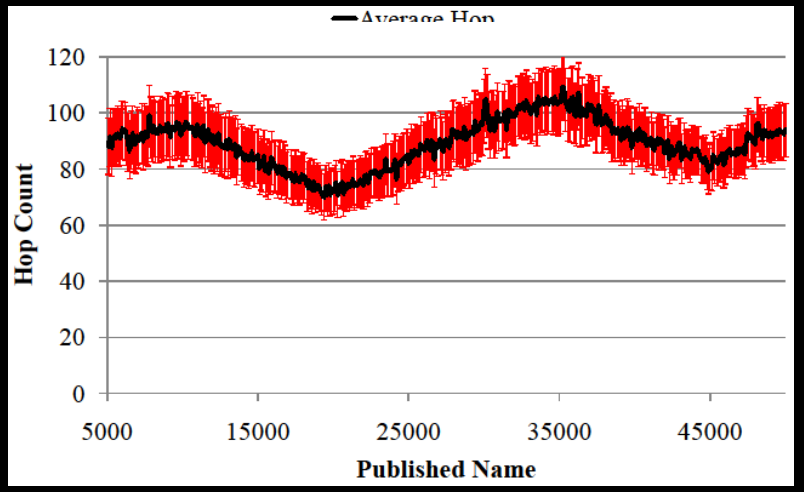


(b) Percentage of lost names

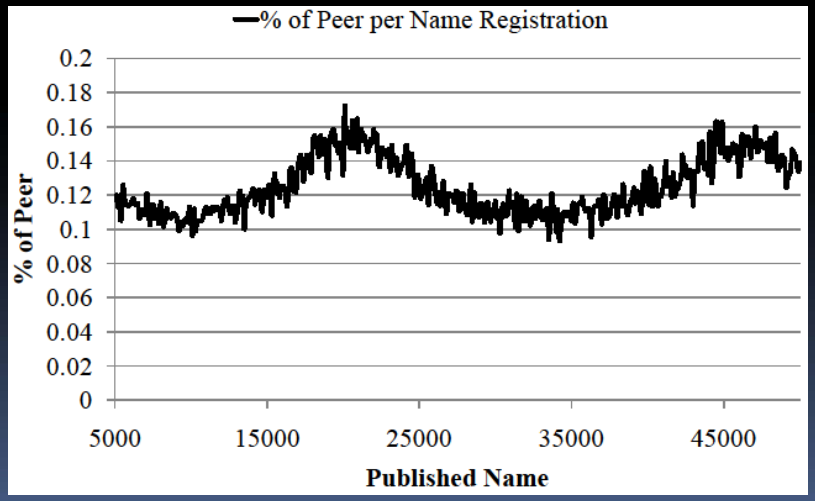
Experimental Results



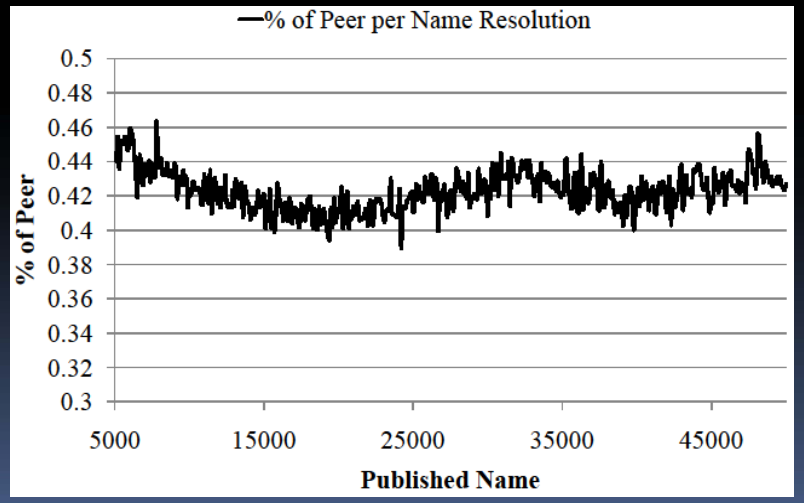
(a) Worst case name registration hop count



(b) Worst case name resolution hop count



(c) % of peer accessed/registration



(d) % of peer accessed/resolution

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Related Work

- Information Centric Networks
  - NetInf
  - DONA
  - CCN
- P2P Networks
  - BitTorrent: Hash of file chunk

Summary

- We have proposed a naming scheme
  - That is
    - Distributed
    - Persistent
    - Scalable and
    - Fault-tolerant
- It provides a flat namespace with support for both Human friendly and secure distribute names