

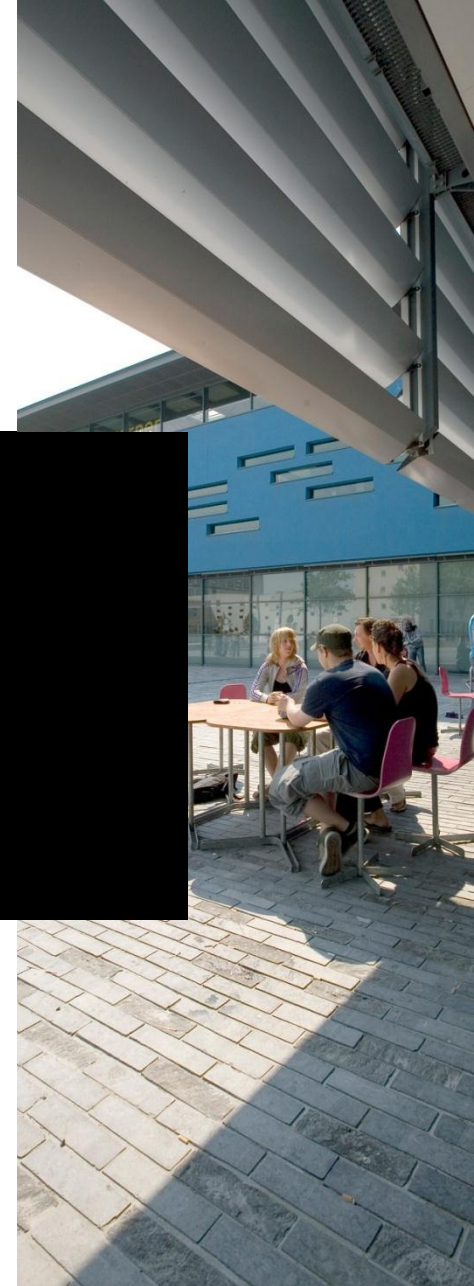
# Globally Accessible Names in Named Data Networking

19-4-2013

Network Architectures and Services

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Dr. ir. Fernando Kuipers



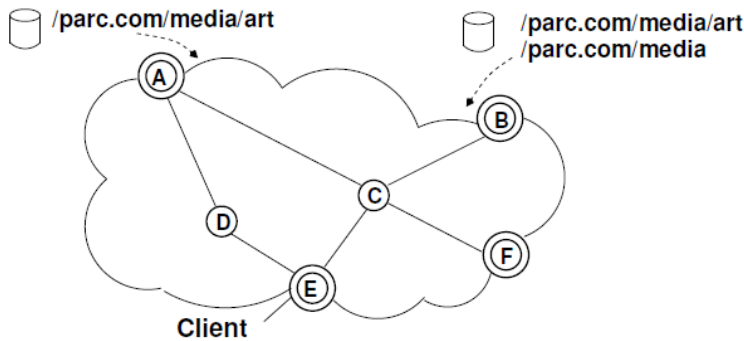
# Outline

- Named Data Networking
- Problem Statement
- Proposal
- Measurements

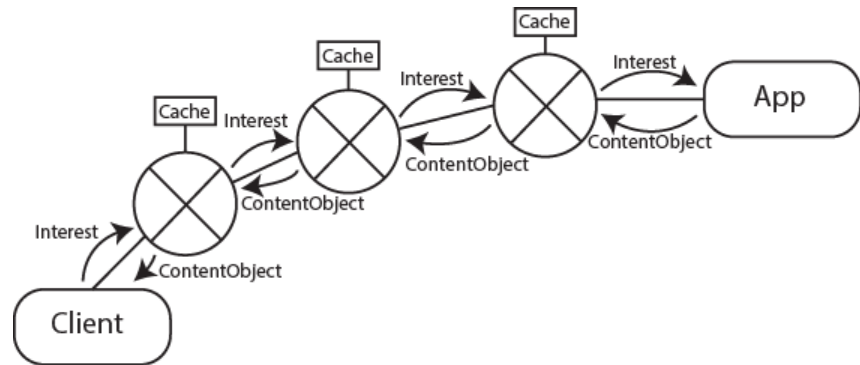
# Named Data Networking

## Introduction

- Route-and-cache by name
- Rely on next hop to either
  - Deliver ContentObject (from cache)
  - Send out Interest to a node closer to the information



/parc.com/media	B
/parc.com/media/art	A,B



V. Jacobson, D. K. Smetters, J. Thornton, M. F. Plass, N. Briggs, and R. Braynard, "Networking Named Content," *CoNEXT 2009*, 2009.

# Problem

## Excessive global routing table size

- 200 million routable domain names
  - Excluding routable subdomains
  - Plus a more expensive string prefix over bit-wise prefix match
- Compare to 450.000 IP subnets over 45.000 ASes
- 500 x complexity increase
- Too large for global routing tables!

# Problem

## Content availability

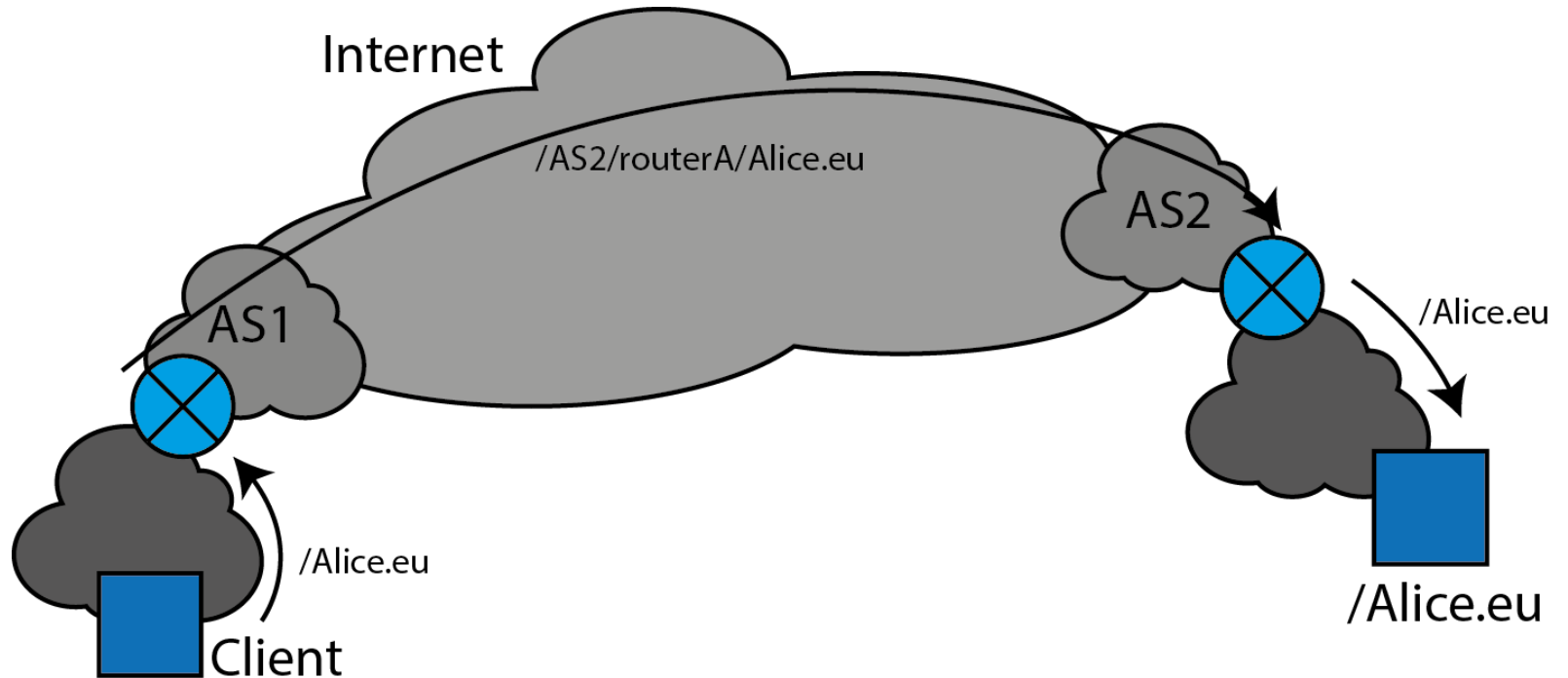
- Compulsory participation in routing discovery to share data
- Difficult due to disconnection of routing scopes
- Too complex for end-users to configure and maintain

# Proposal

Map context-related names to routable names

- Decouple user-registered names from routable names
- Routable names aggregate to underlying topology
- User-registered names translate into location-dependent names
- Receiving sites rename to original names

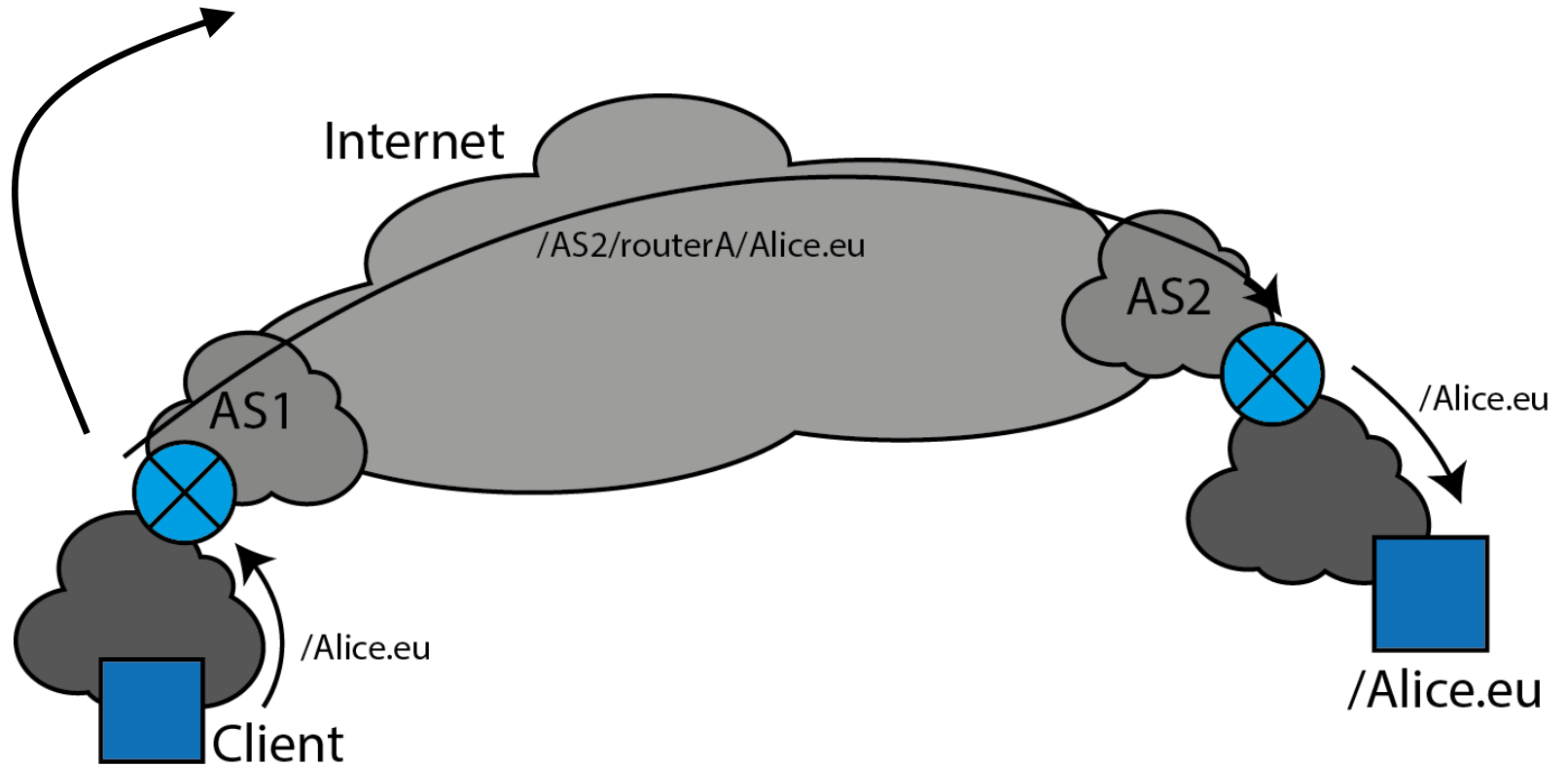
# Mapping



# Mapping

# DNS

```
Alice.eu text = "v=ndn /AS2/routerA"
```

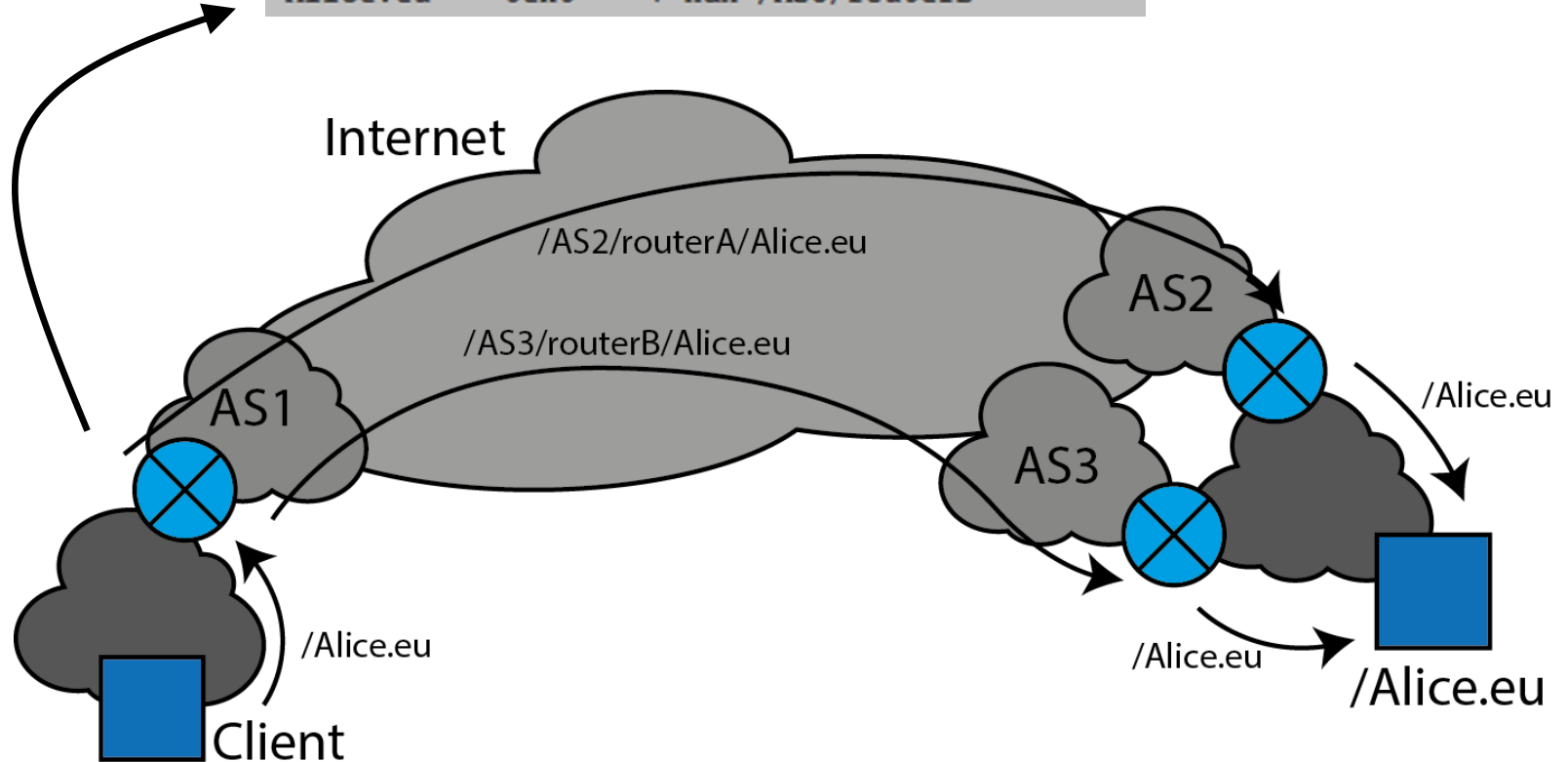




# Mapping

# DNS

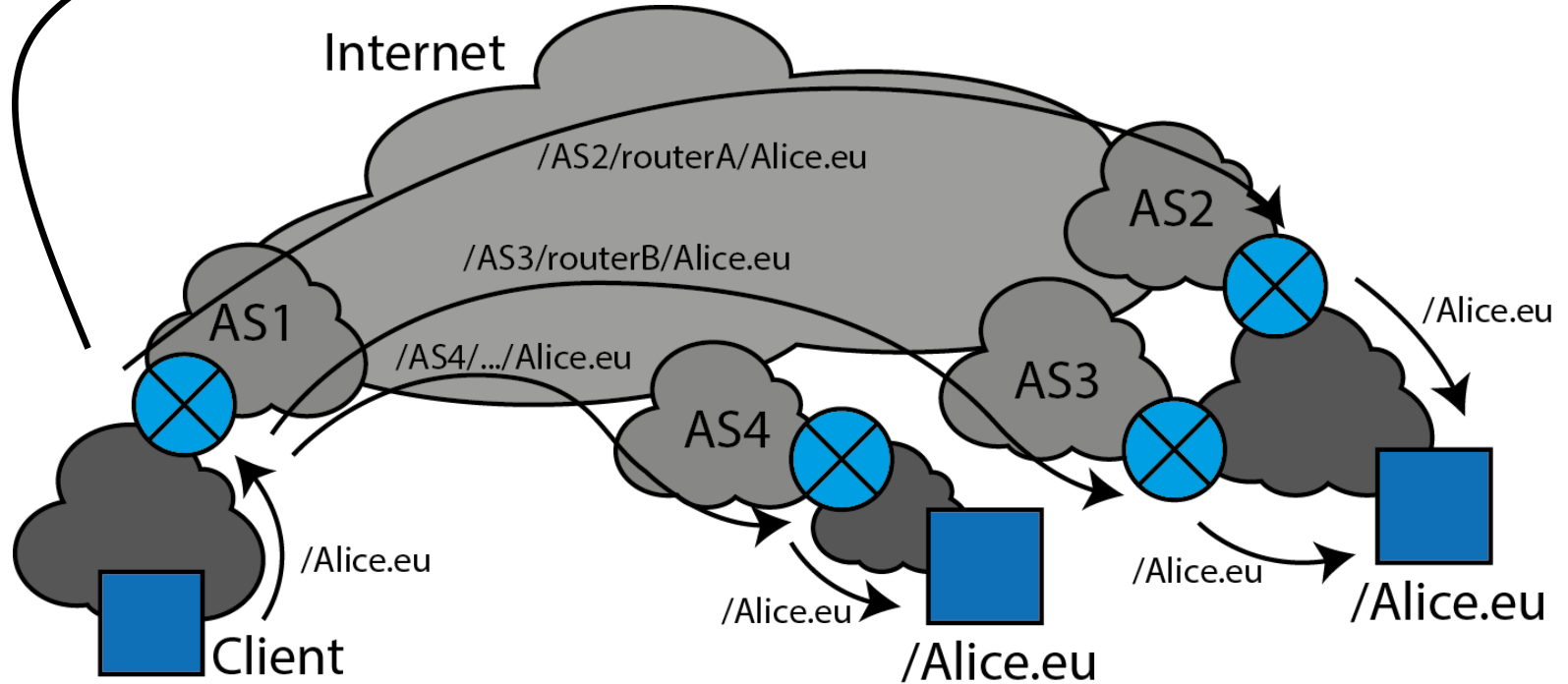
```
Alice.eu text = "v=ndn /AS2/routerA"
Alice.eu text = "v=ndn /AS3/routerB"
```



# Mapping

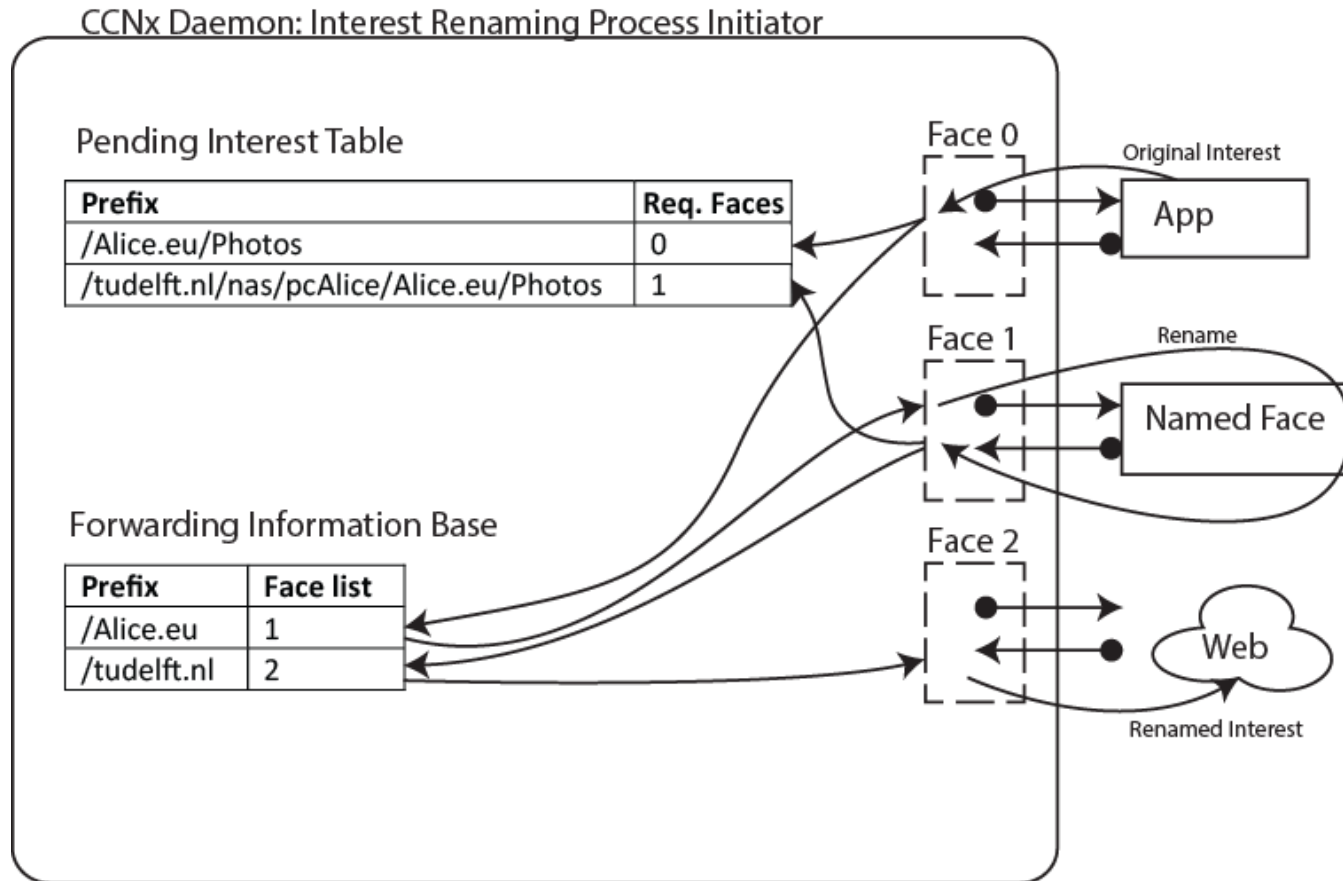
# DNS

```
Alice.eu text = "v=ndn /AS2/routerA"
Alice.eu text = "v=ndn /AS3/routerB"
Alice.eu text = "v=ndn /AS4/planeA/RouterD"
```



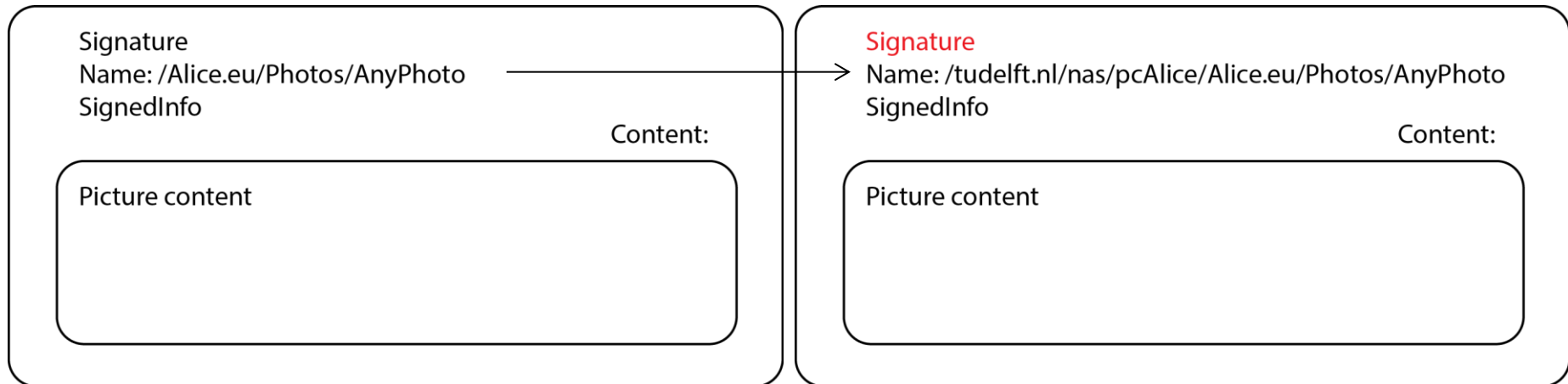
# Mapping

## Functionality of entry-points



# Signing and Authenticity

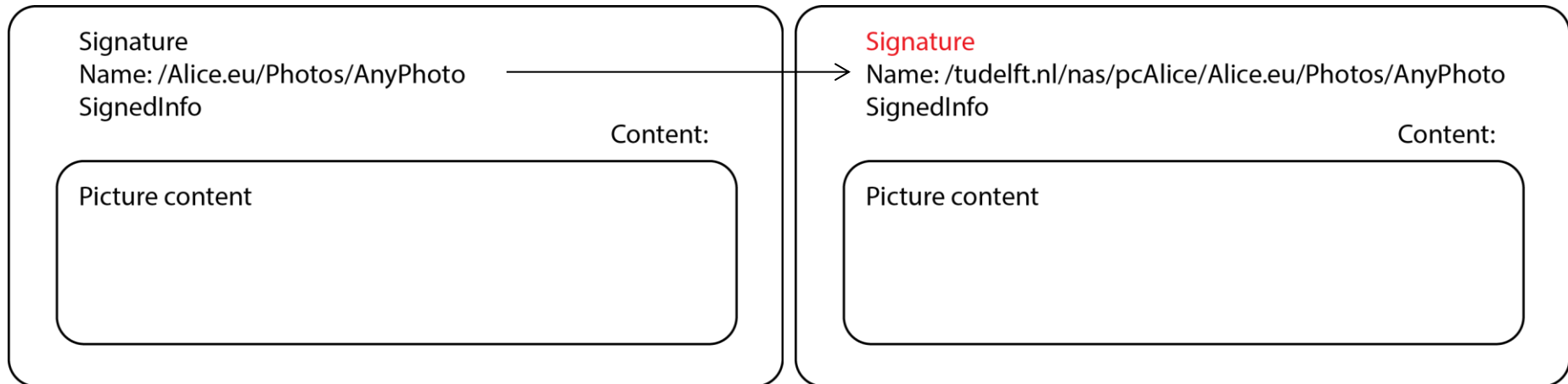
- CCNx / NDN signs each ContentObject
- Changing the name invalidates signature



# Signing and Authenticity

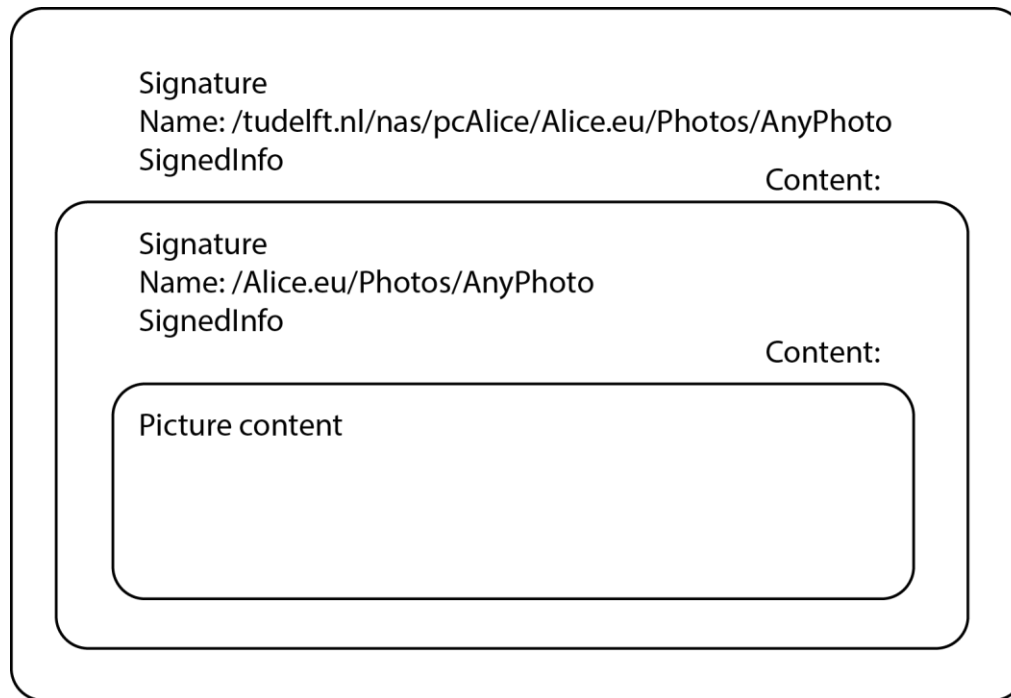
- CCNx / NDN signs each ContentObject
- Changing the name invalidates signature

## 1. Ignore signatures while renamed



# Signing and Authenticity

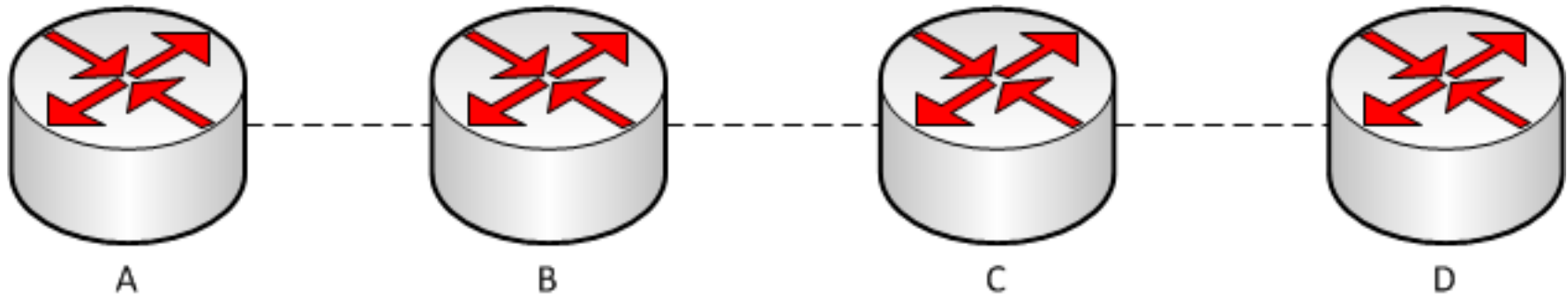
## 2. Encapsulate ContentObject into a new one



# Renaming and Signing Cost

## Experiments

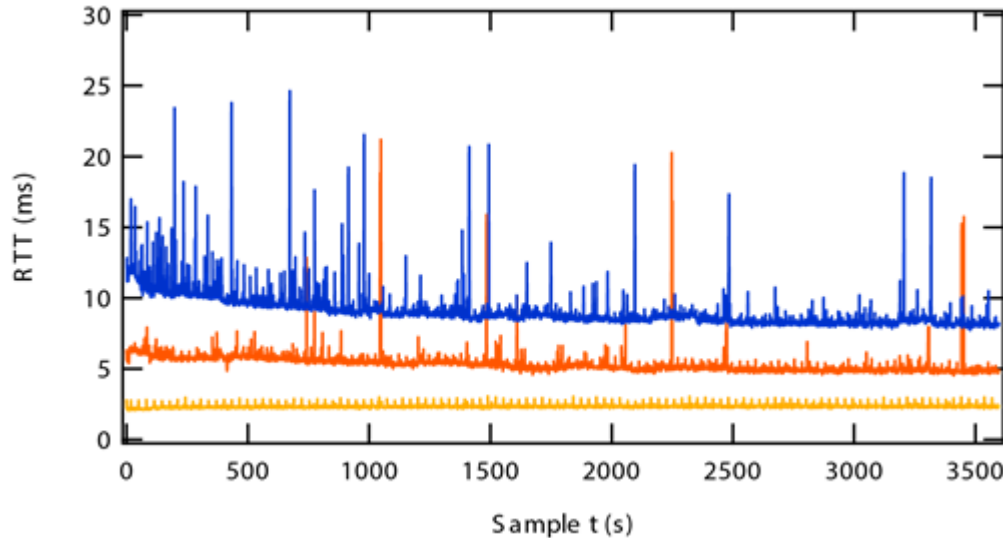
- Measured 3.600 RTTs using *ccnping*<sup>1</sup>
  - Regular CCNx
  - Renaming CCNx
  - Encapsulating and re-signing CCNx



1. Cheng Yi, "ccnping", On-line: <https://github.com/NDN-Routing/ccnping>

# Renaming and Signing Cost

## Results



- Ping RTT

- CCNx:
- CCNx Renaming
- CCNx Encapsulation and re-signing

Sample t (s)

Averages:

Penalty:

2.338 ms

5.327 ms

9.031 ms

+2.989

+3.704

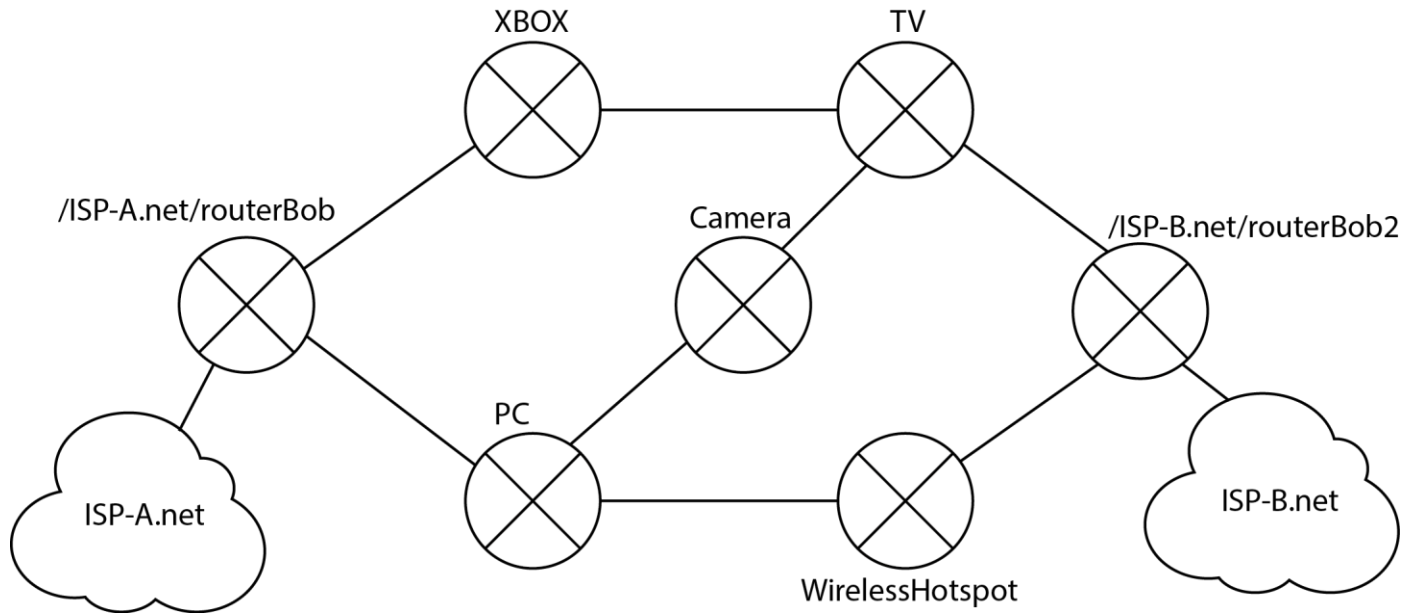


# Take-home message

- Decreased global routing table complexity
  - From 200 million to 45.000 forwarding entries
  - Compared to 450.000 entries in IP
- Enabled content sharing using context-related names
  - Without the necessity to apply routing discovery
- Both by applying mapping and renaming of context-related names to routable names

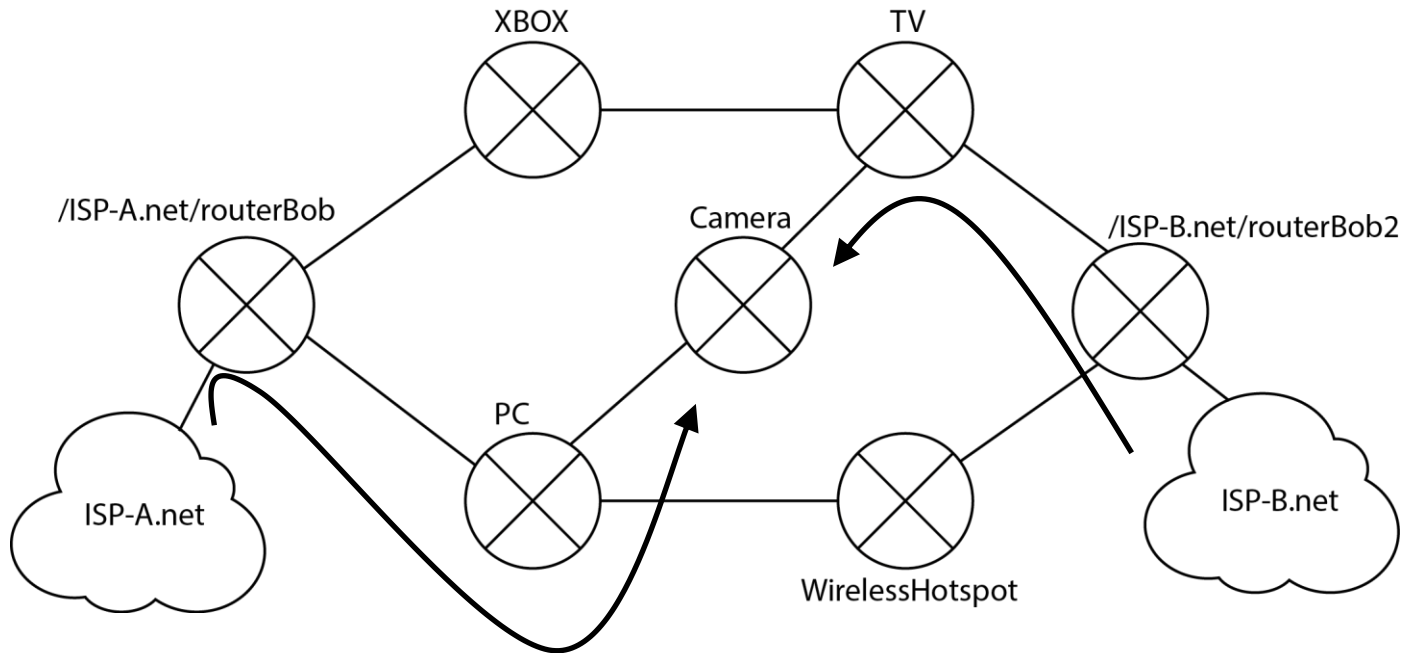
# Recursive Name Generation

By applying path-vector routing discovery



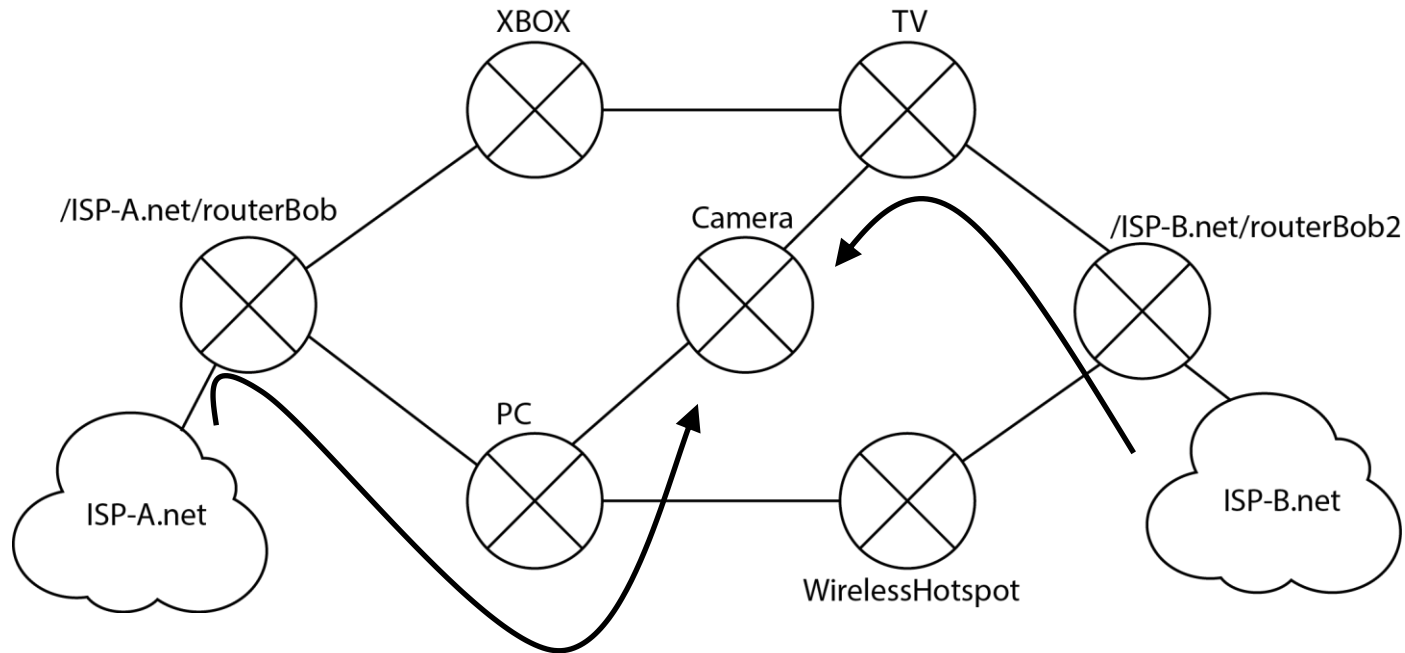
# Recursive Name Generation

By applying path-vector routing discovery



# Recursive Name Generation

By applying path-vector routing discovery



/ISP-A.net/routerBob/PC/Camera

/ISP-B.net/routerBob2/TV/Camera

# Implementation Online

github

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Features

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**Delft University of  
Technology -  
Network  
Architectures and  
Services**  
TUDelftNAS

📍 Delft

✉ [n.l.m.vanadrichem@tudelft.nl](mailto:n.l.m.vanadrichem@tudelft.nl)

🌐 <http://www.nas.ewi.tudelft.nl/>

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**CCNx-RenamingFaces**

Renaming Faces for CCNx

Last updated 4 months ago



**CCNx-DNSRelay**

DNS Relay for CCNx

Last updated 5 months ago



**CCNx-DHCNGP**

A Dynamic Host Configuration and Name Generation Protocol for CCNx

Last updated 5 months ago

<https://github.com/TUDelftNAS>