ICN for the Constrained IoT

Nudging the Limits of Request-Response

Cenk Gündoğan

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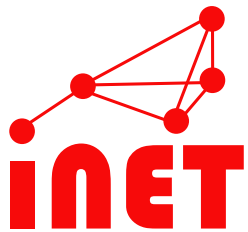
Internet Technologies



July 26, 2017

Agenda

Motivation

Publish-Subscribe Option

Publisher Mobility & Network Partitioning

Wrap Up

Information-Centric Networking for the IoT

Receiver Mobility

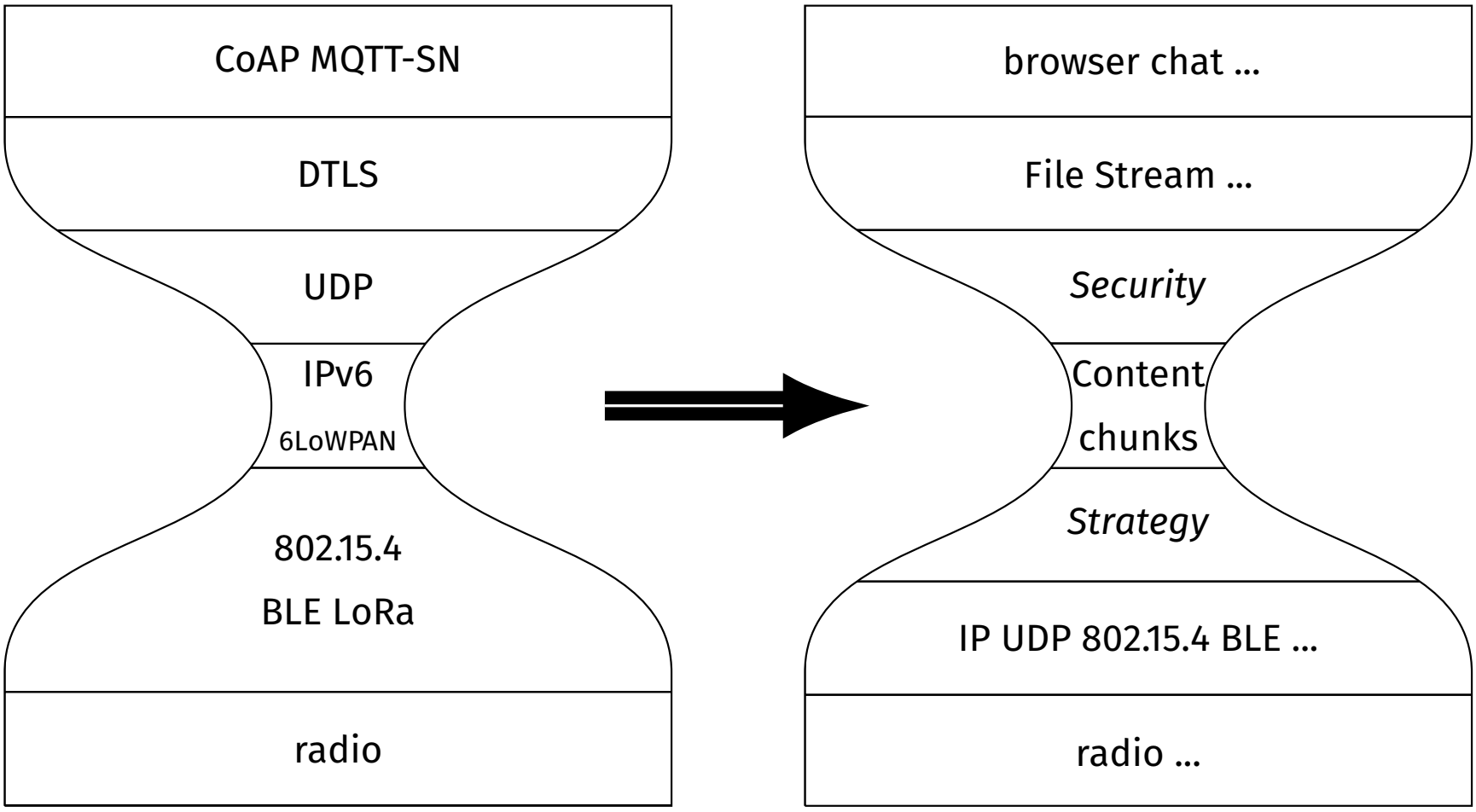
Security at Data Level

Motivation for ICN in IoT

Network Caches

Smaller Memory Footprint

Named Data Networking (NDN)

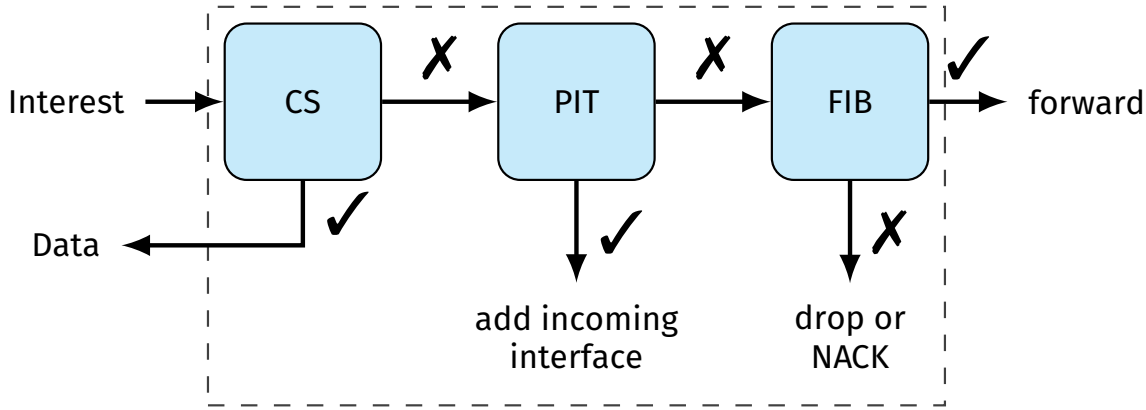


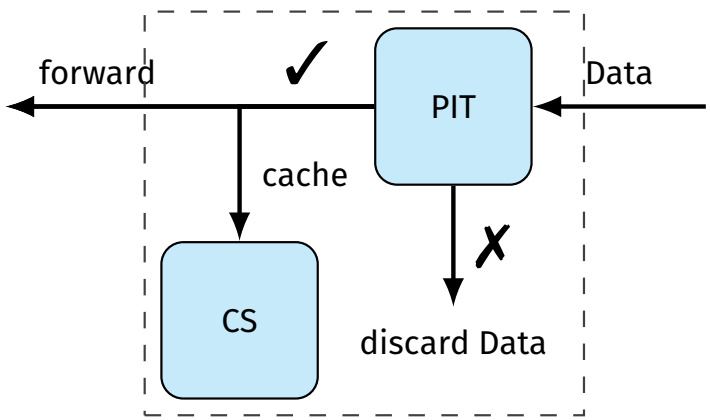
NDN Architecture

CS: Content Store

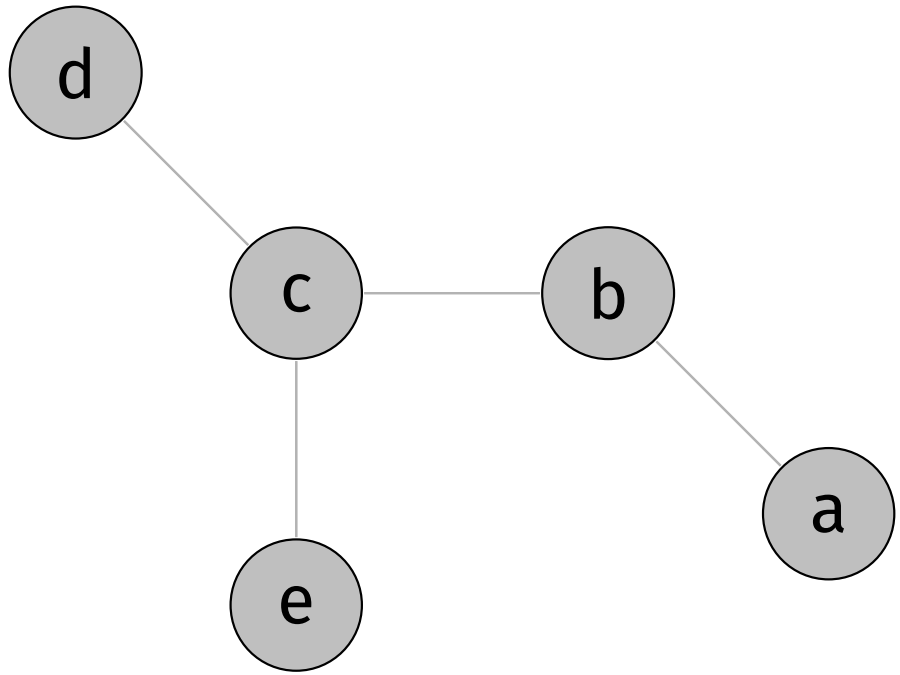
PIT: Pending Interest Table

FIB: Forwarding Information Base





NDN Operation: Interest



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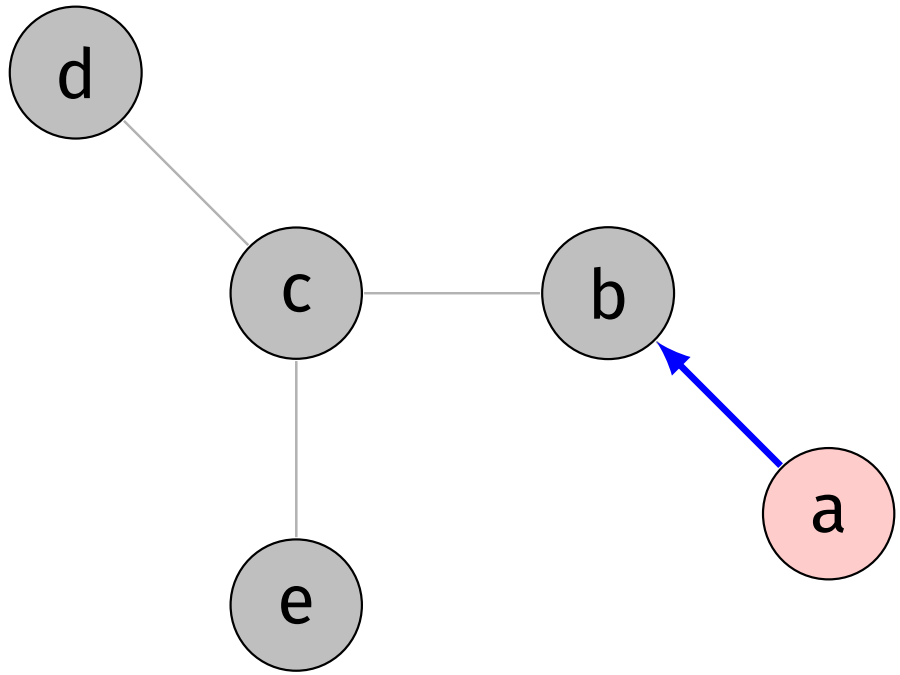

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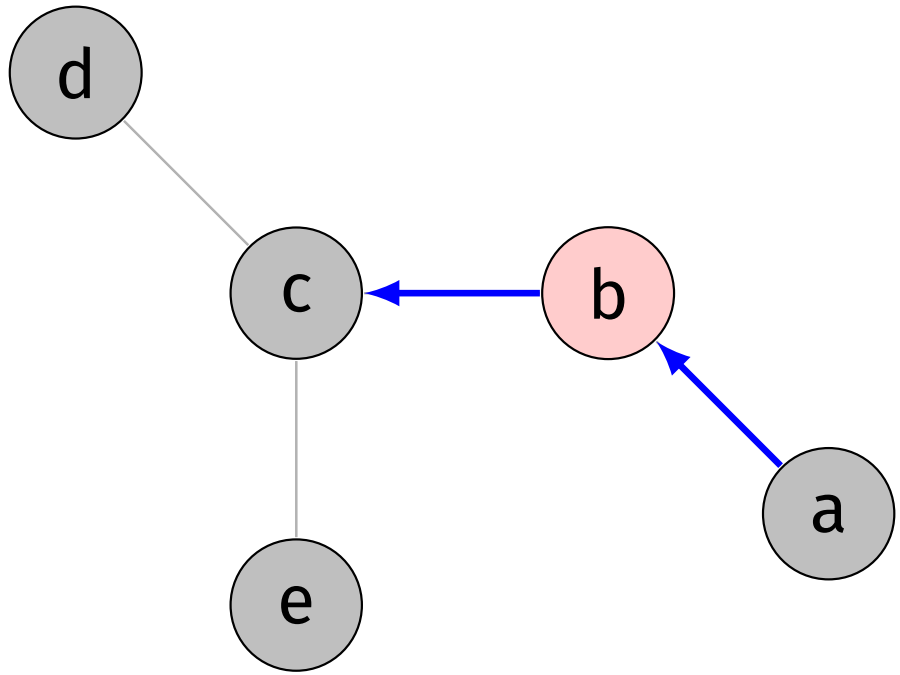

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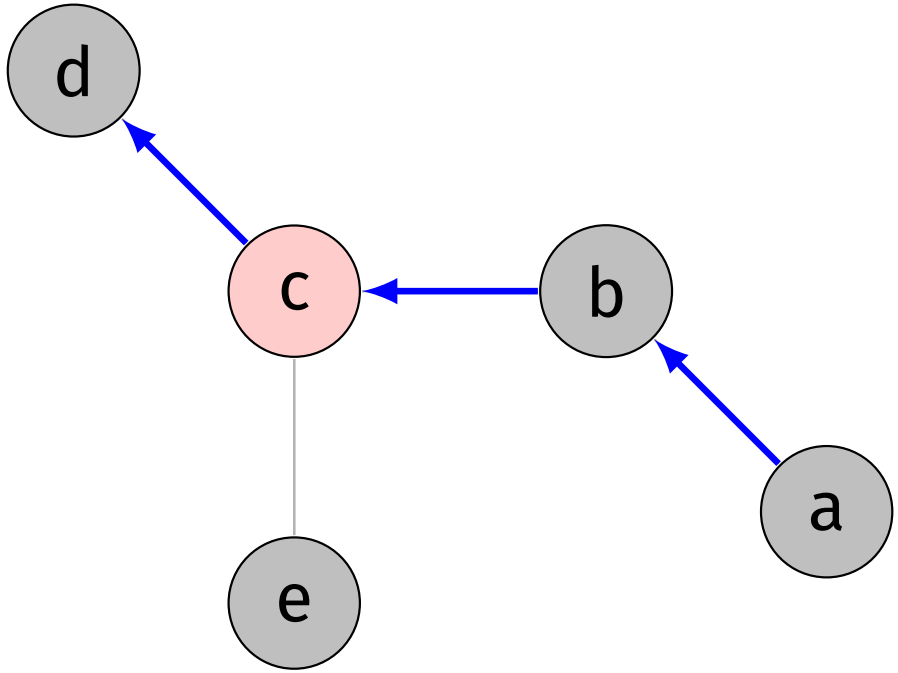

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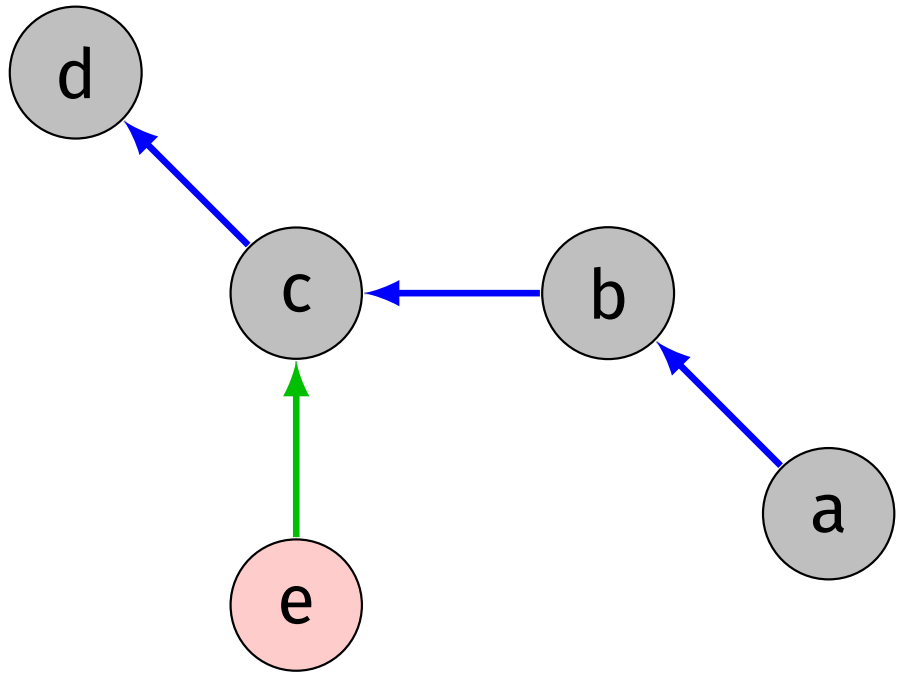

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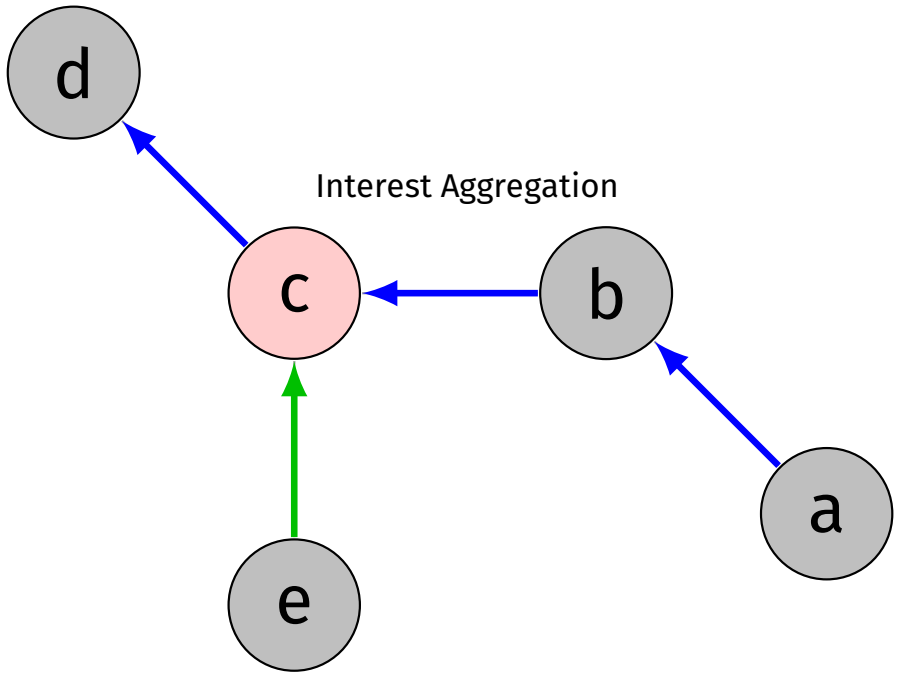

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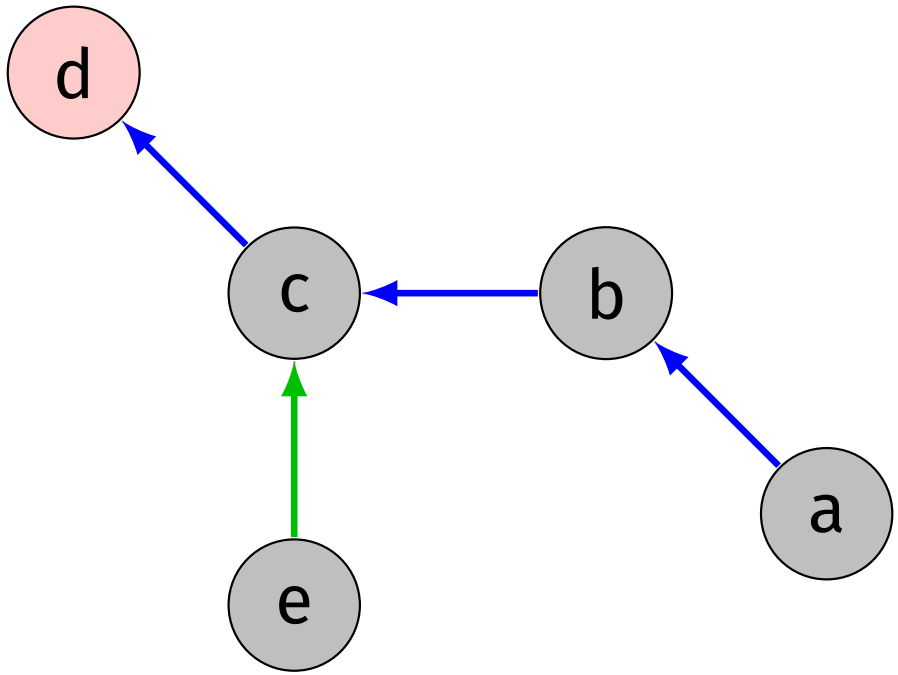
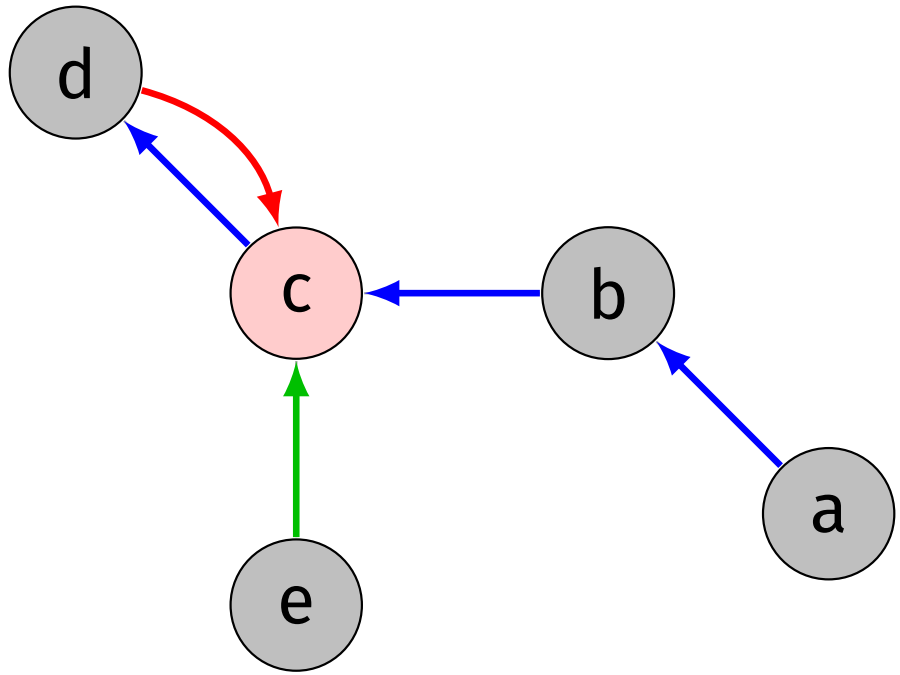


NDN Operation: Data



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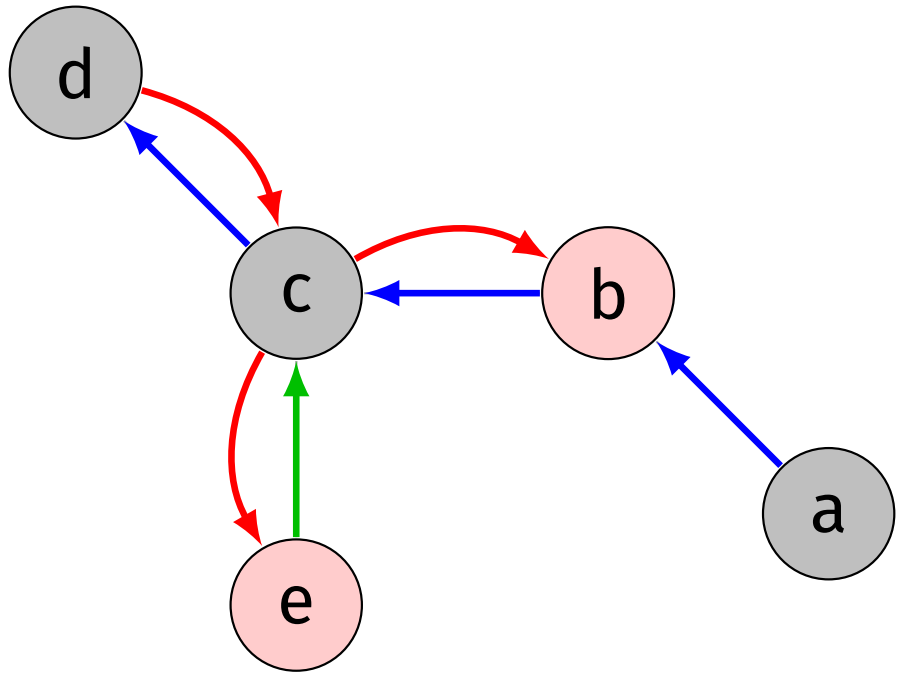

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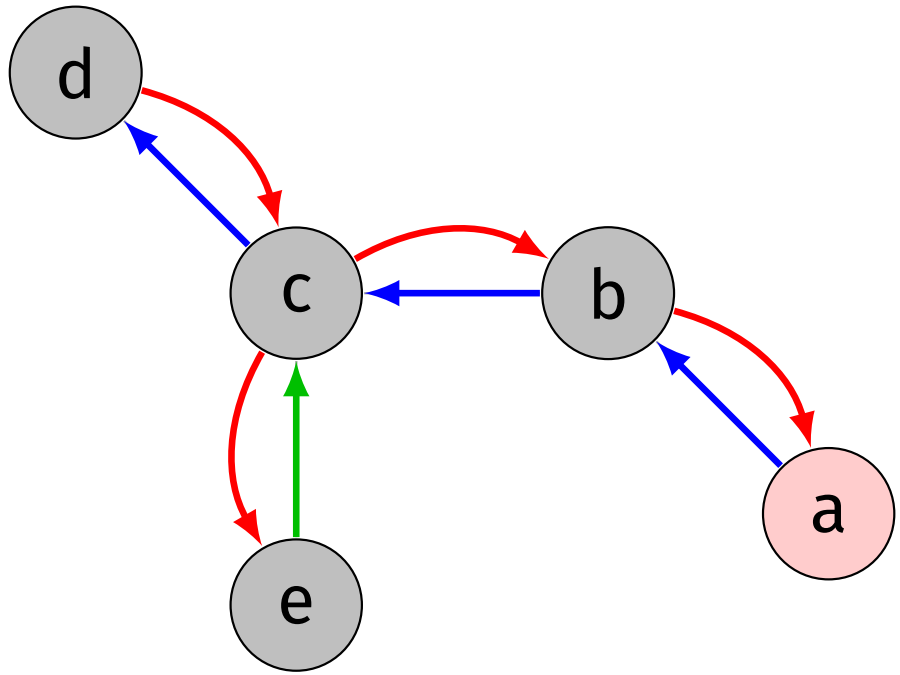
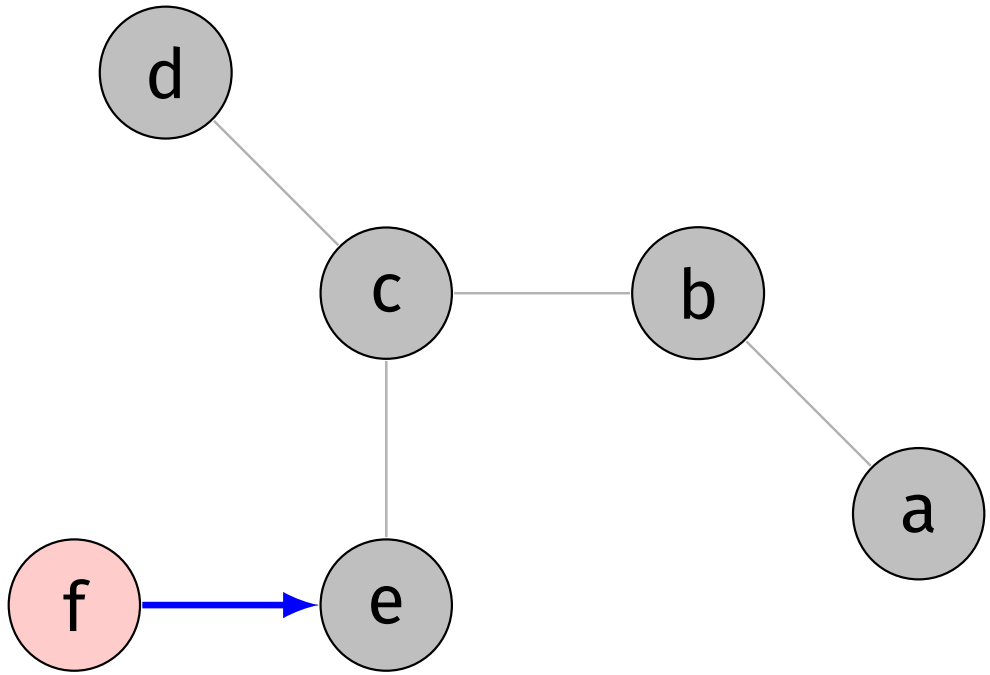


NDN Operation: In-Network Caching



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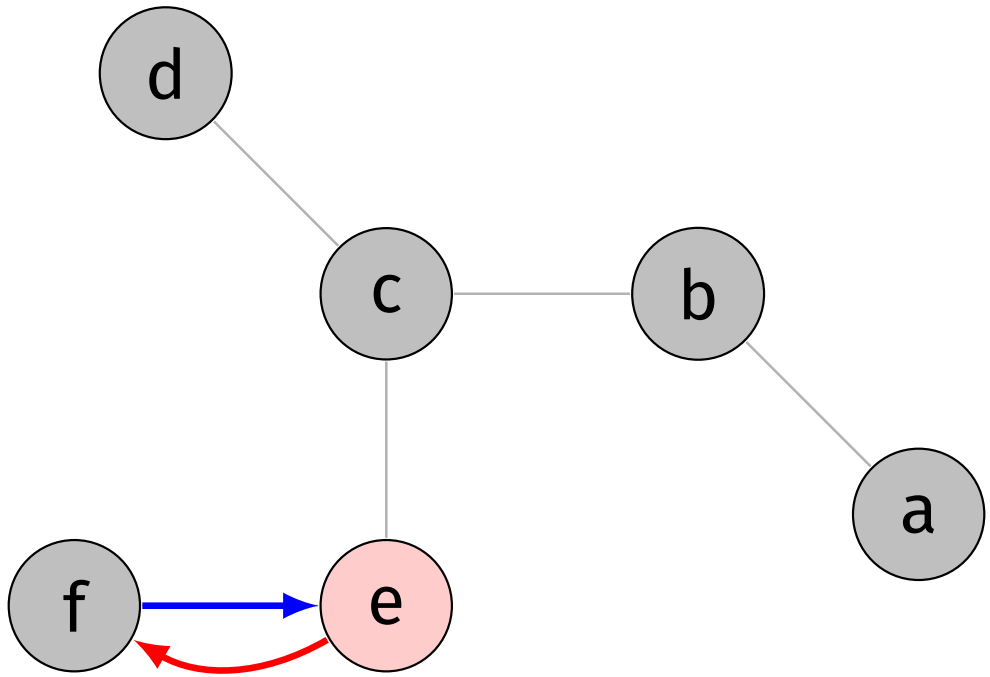


I3: Information-Centric Networks for the Industrial Internet

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Freie Universität Berlin

MSA
The Safety Company

I3
- Security
- Standardization
- Robustness

iNET

Scenarios

Scenario I: Data Retrieval

- semi-portable gas leak sensors
- portable sensors attached to workers
- mission protocols and logs

Scenario II: Alarm Propagation

- alarm notifications to nearby workers
- high priority traffic

Shortcomings of NDN

Scenario I: Data Retrieval

- No Propagation from N Producers to 1 Consumer
- No *multicast* Interest
  - $\Rightarrow$ extensive unicast polling
  - $\Rightarrow$ waking sleepy devices

Scenario II: Alarm Propagation

- No *PUSH* support
- No mechanism to deliver unsolicited data

Problem: Data Propagation

Push is bad (in ICN)

- breaks flow balance
- cache poisoning
- complicates popularity-based cache placement strategies
- DoS

We should preserve the NDN request response scheme!

But: How do we get data from sensor to consumers?

Agenda

Motivation

Publish-Subscribe Option

Publisher Mobility & Network Partitioning

Wrap Up

Publish-Subscribe Option

Key Features

- Data immediately propagated towards content proxy
- Data is not pushed

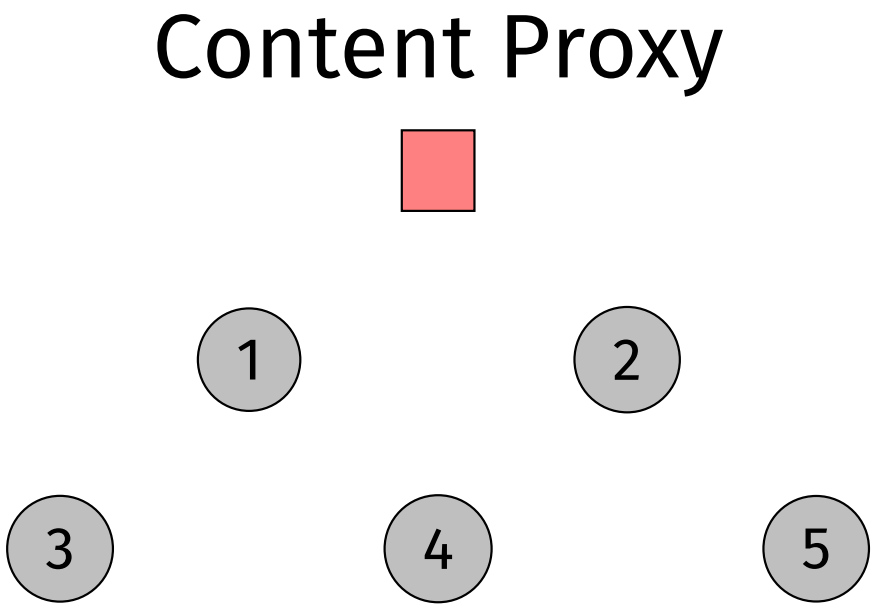
Control Plane

- Name advertisements
  - link-local signaling

Data Plane

- Data is replicated hop-wise
  - standard NDN Interest-Data scheme

Build & Maintain Routing Topology



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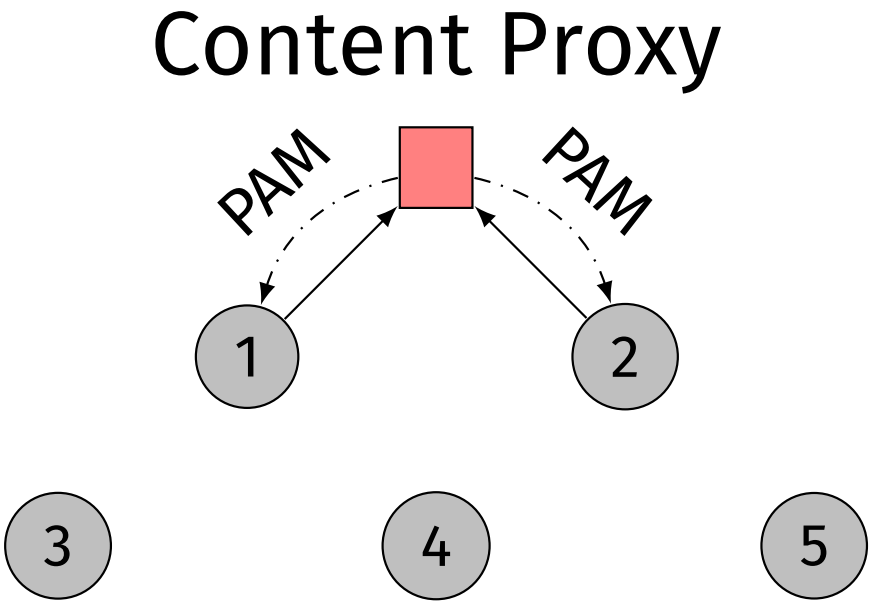


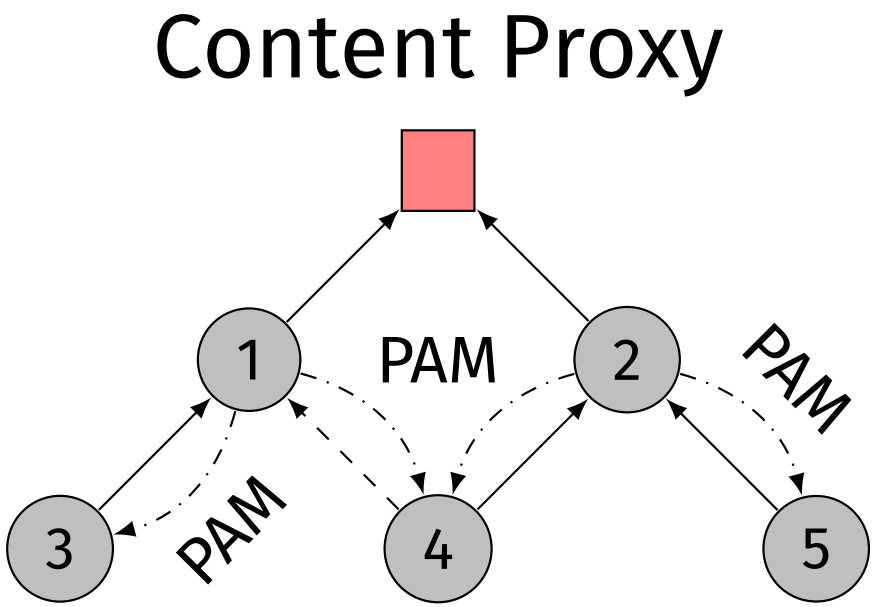
FIB

Prefix	Face
$/\rho$	f_i

PAM: Prefix Advertisement Message

broadcast, link-local

Build & Maintain Routing Topology



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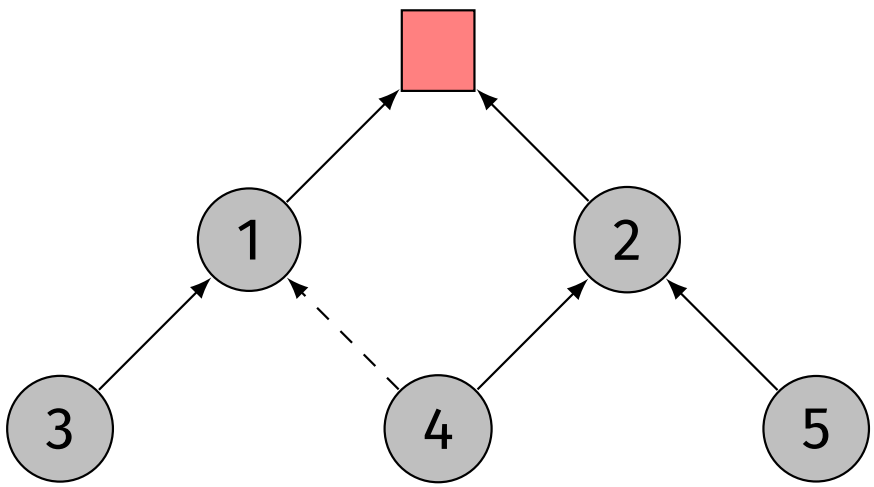

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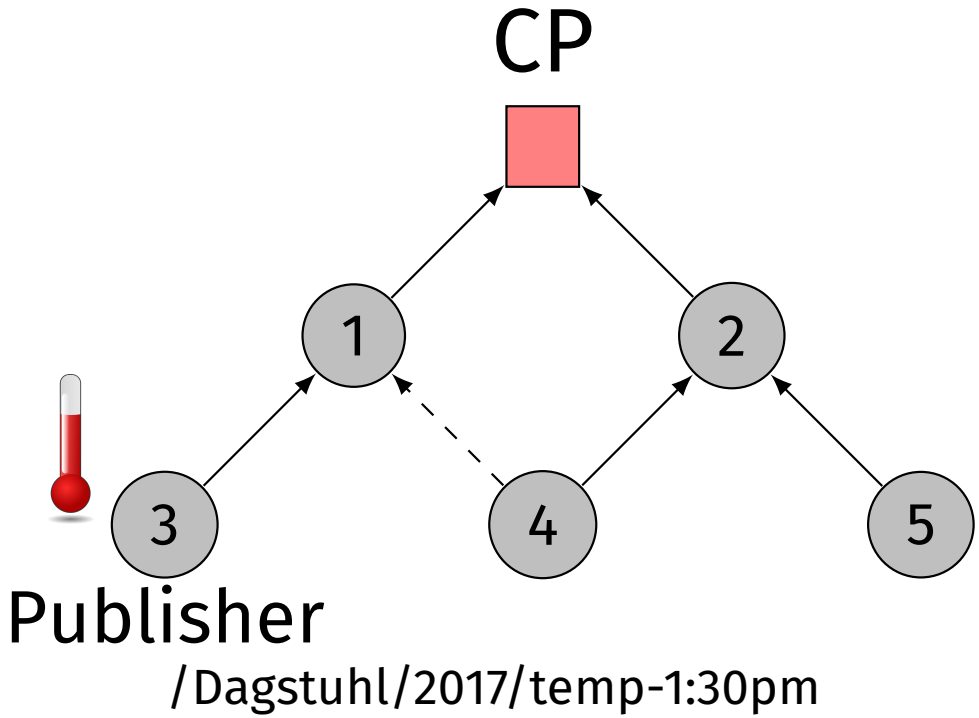

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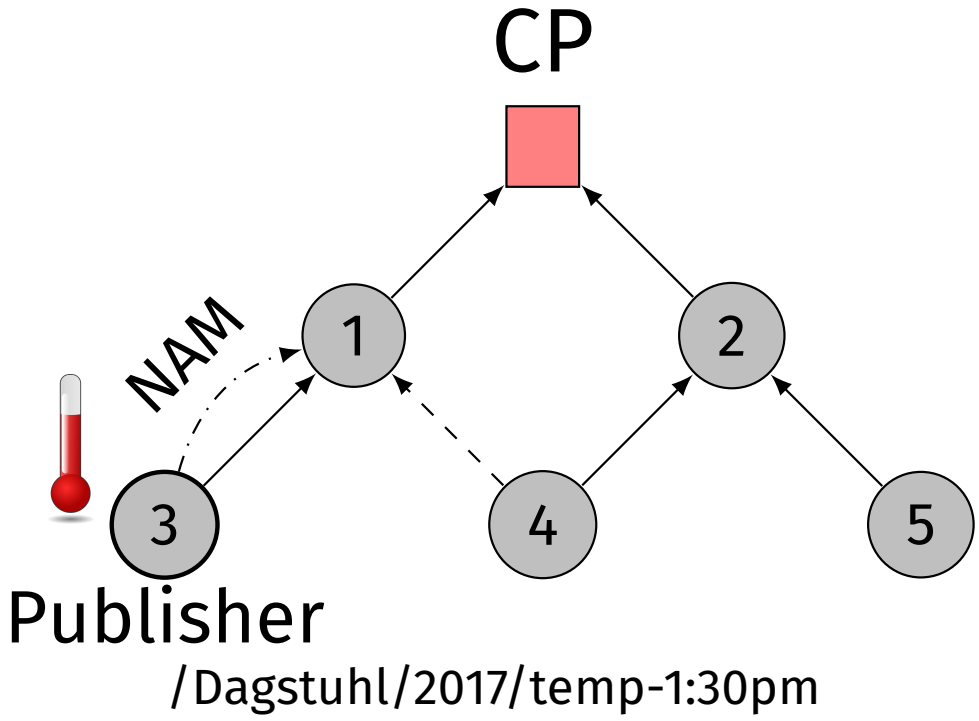
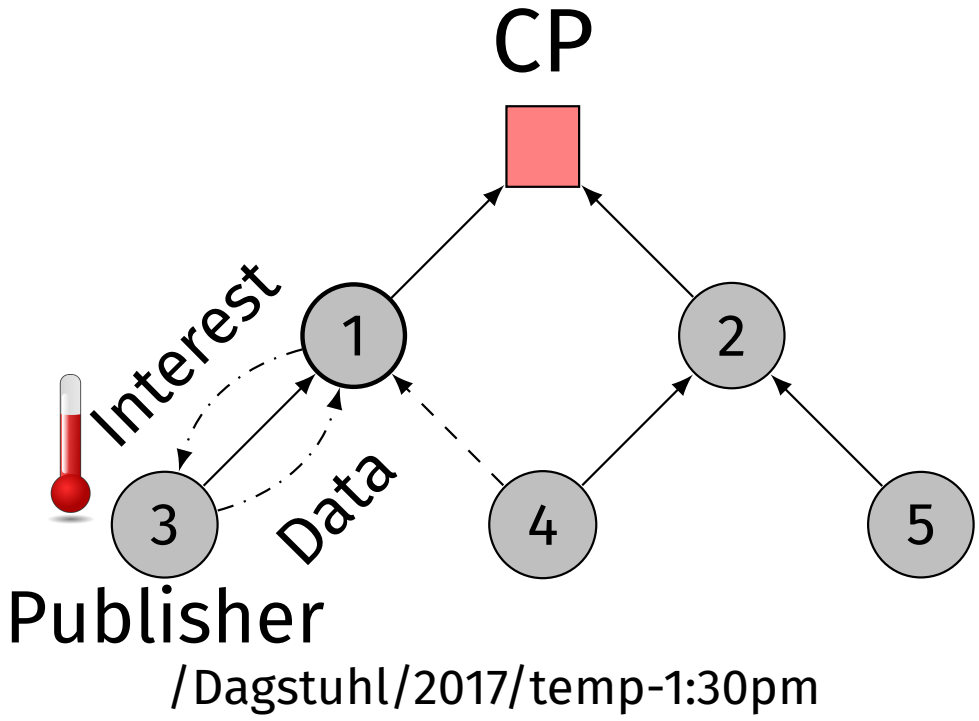


NAM: Name Advertisement Message

unicast to upstream parent

Publish



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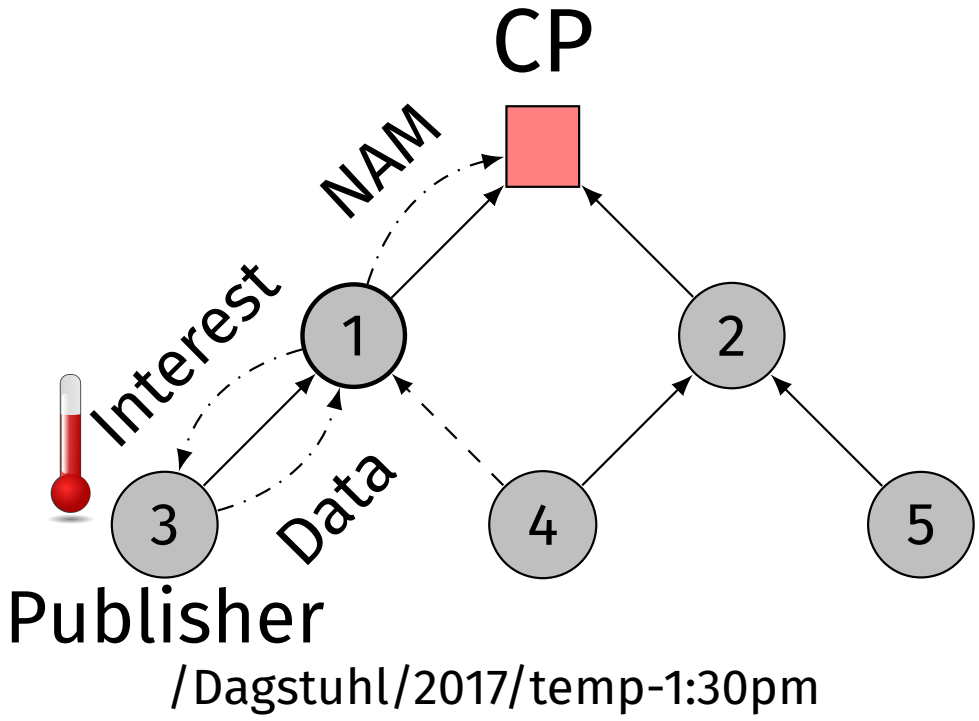

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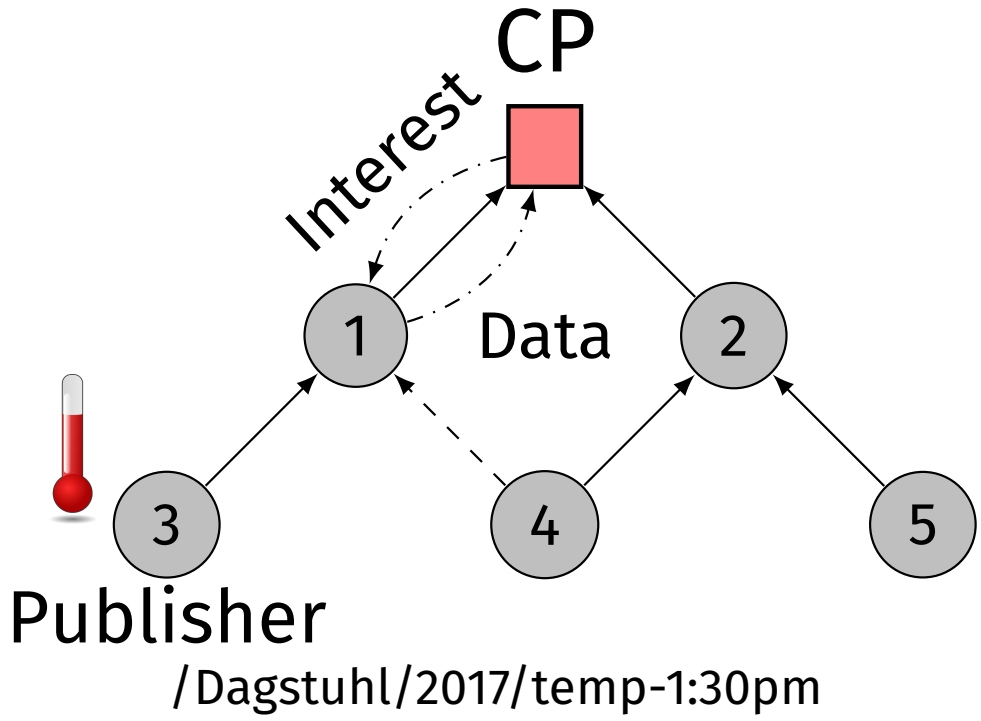

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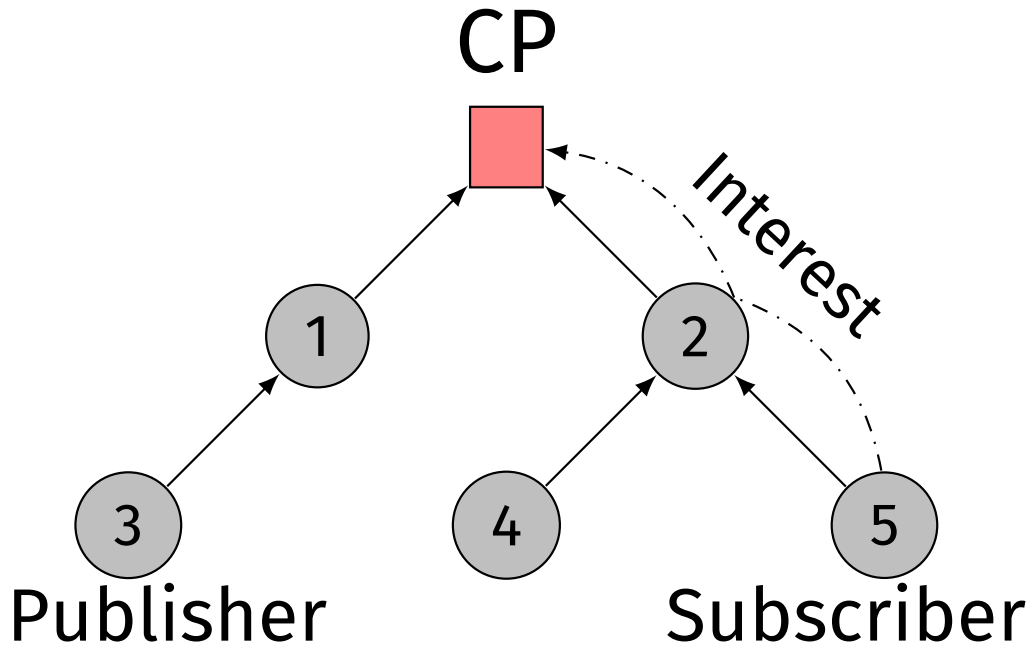
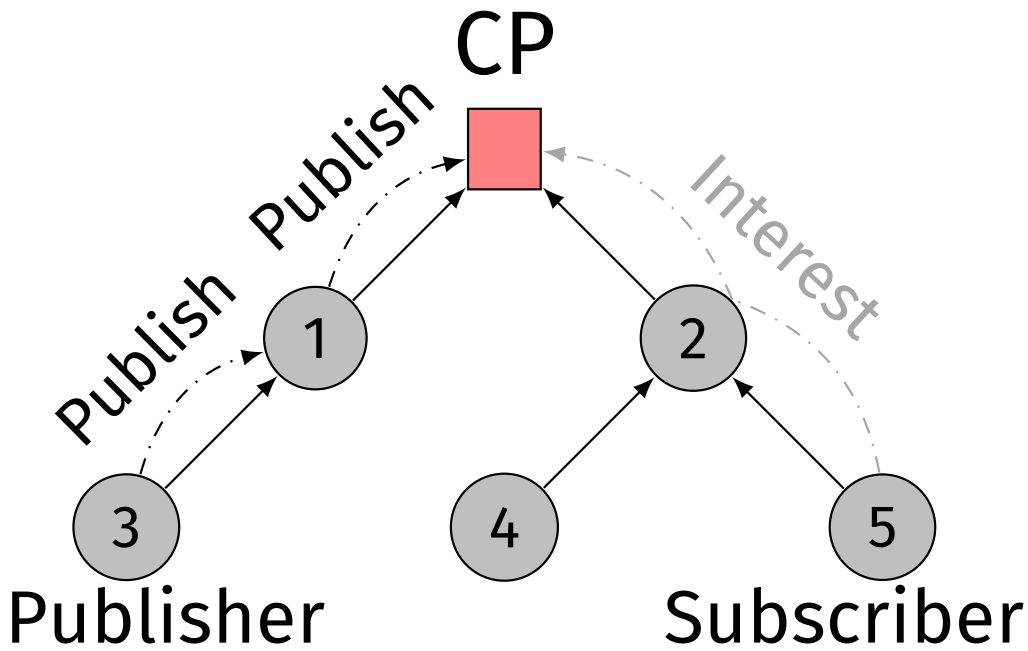


Subscribe

$$\texttt{Publish} = \texttt{NAM} \rightarrow \texttt{Interest} \rightarrow \texttt{Data}$$



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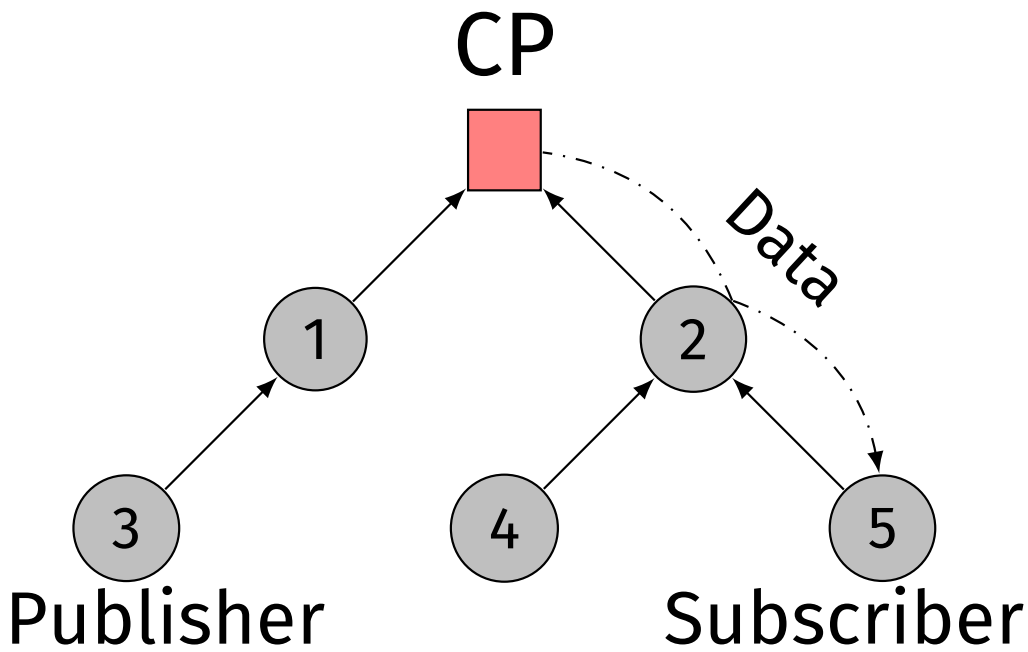

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Wrap Up

Publisher Mobility

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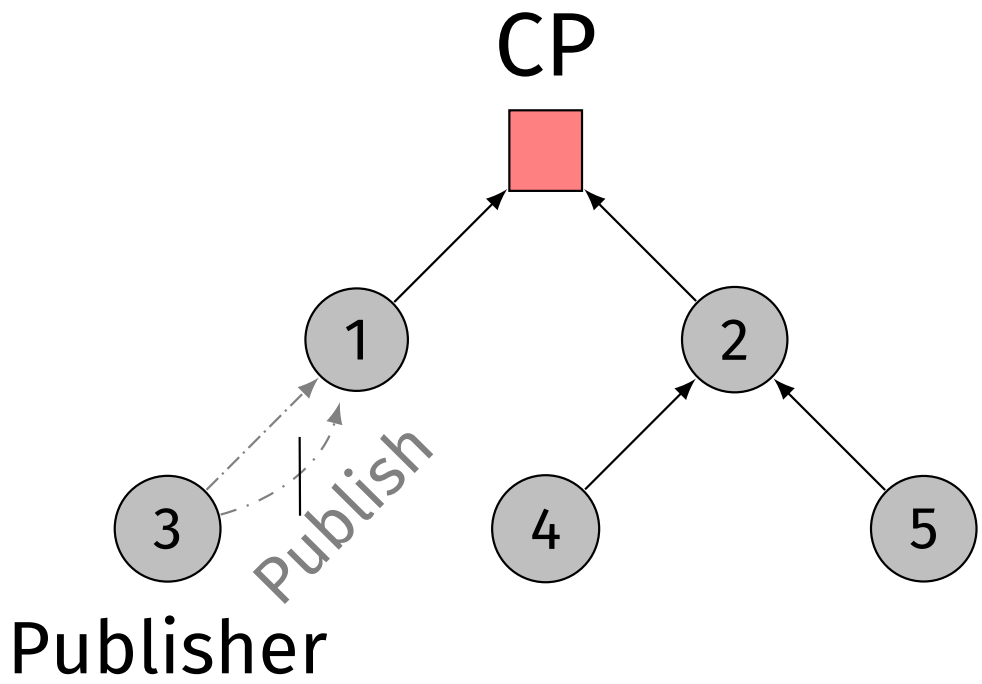

Publisher Mobility

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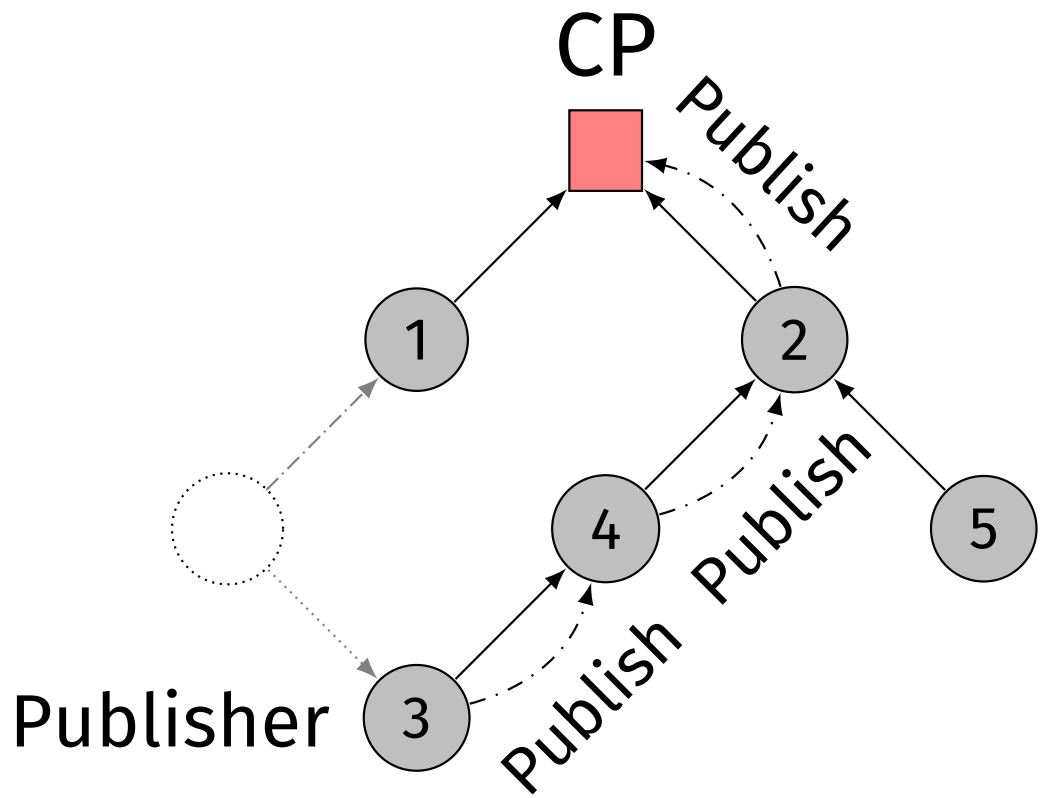

Network Partitioning

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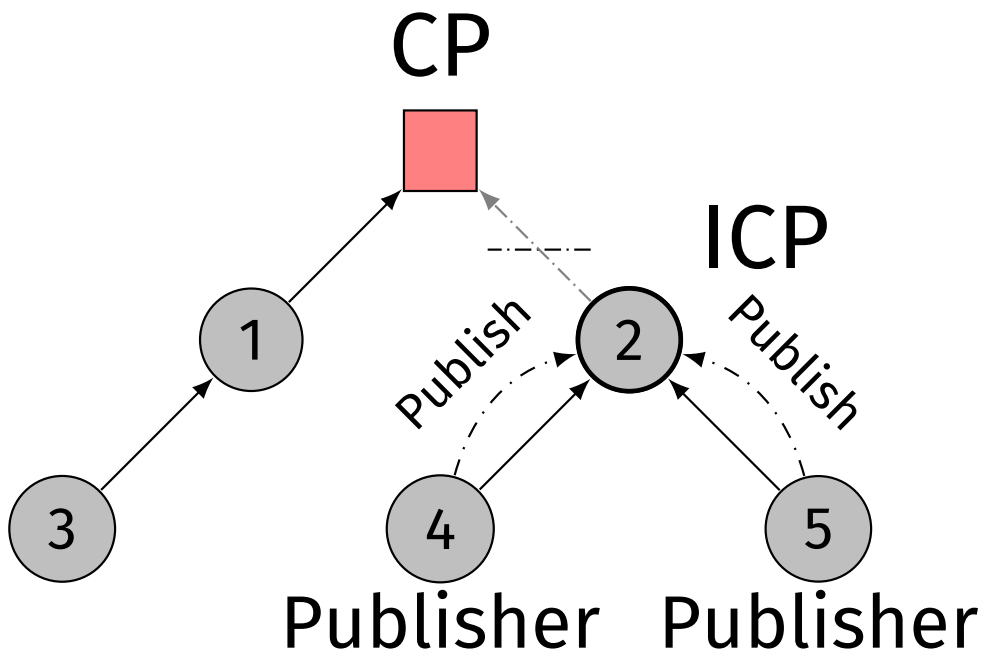

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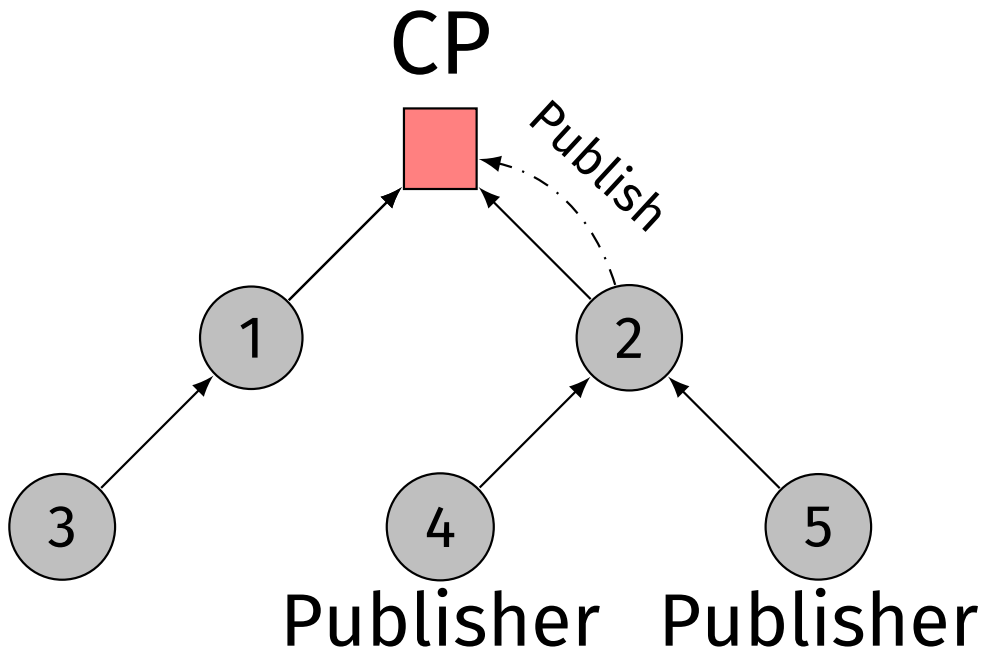

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Wrap Up

Wrap Up

Summarized highlights

- Hop-wise data replication without push
- Decoupling (space, time, synchronicity)
- Data producer mobility
- Resilience in partitioned networks
- Minimal FIB state

Experimental Evaluation

- RIOT & CCN-lite in IoT-Lab testbed
- Large-scale experiments with > 300 constrained devices

Discussion

Questions

1. Philosophical: should there be signaling in ICN?
2. Design of link-local signaling:
   - Reuse Interest-Data?
   - Use new messaging orthogonal to Interest-Data?
3. How to map between topics and names?

Backup: How to Build a Publisher in NDN?

No Support for Unsolicited Data in NDN

Proposals:

- Interest Polling
- Interest Notification
- Long-Lived Interest
- *PUSH* Message