An Efficient Filter-based Addressing Protocol for Autoconfiguration of Mobile Ad Hoc Networks

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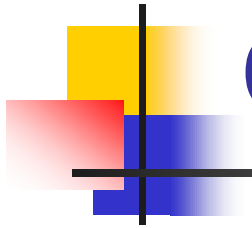
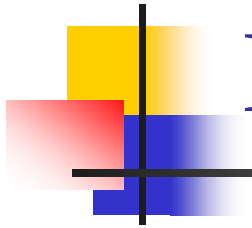
Presented by Hsi-Min Lin

7/2, 2009



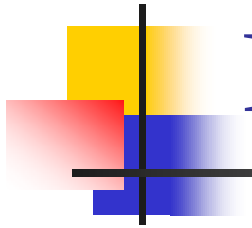
OUTLINE

- INTRODUCTION
- RELATED WORK
- FILTER-BASED ADDRESSING PROTOCOL (FAP)
  - Sequence Filters
  - Bloom Filters
  - Procedures of FAP
- ANALYSIS
- SIMULATION
- CONCLUSIONs



INTRODUCTION

- Address allocation problem in ad hoc network
  - Auto-configures address
  - Distributed
  - Address collision problem
  - Address allocation delay problem
  - Partitions problem
  - Control overhead constraint
    - Life time of nodes
    - Available bandwidth to send data
  - Storage constraint

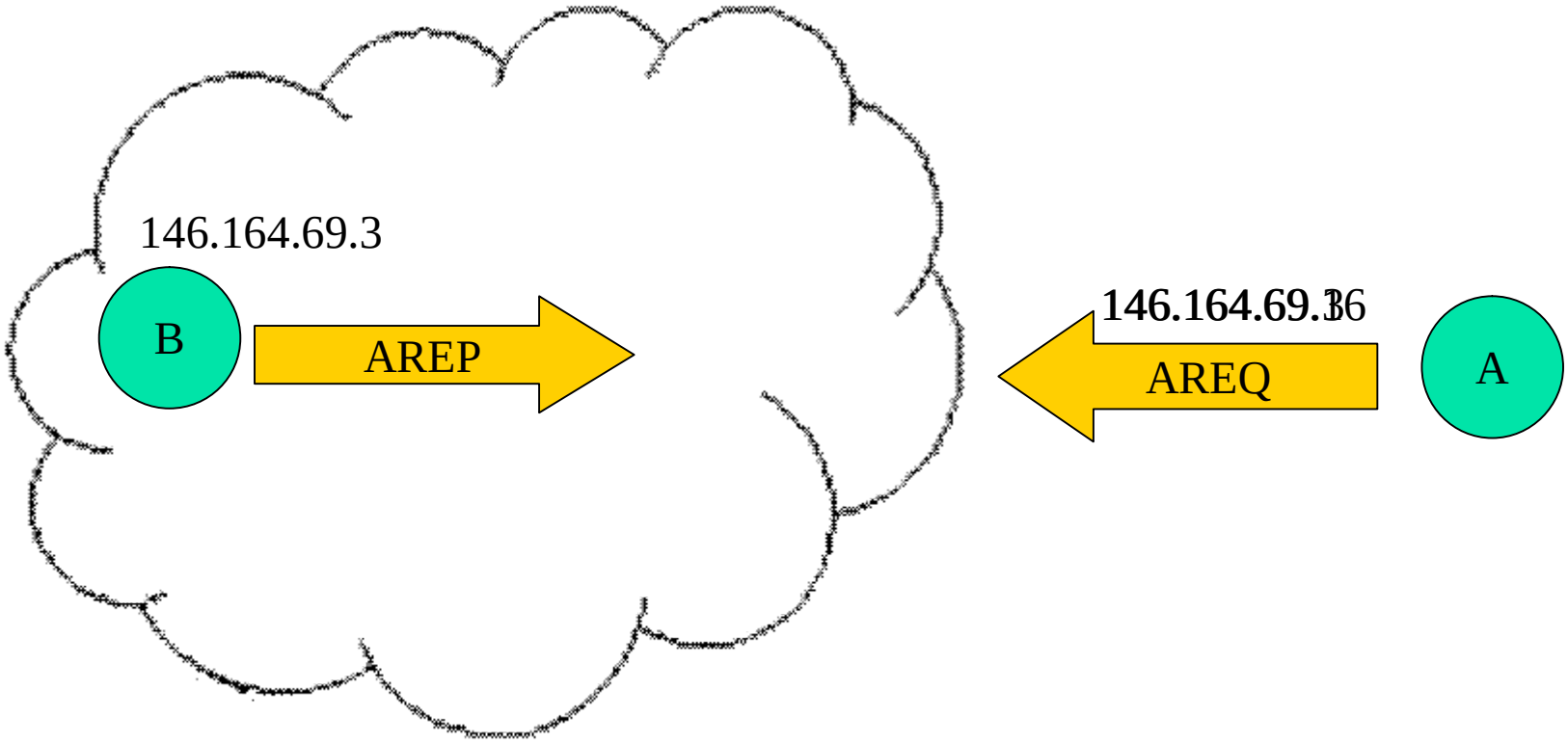


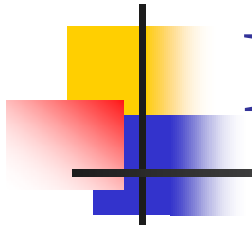
RELATED WORK

- Duplicate Address Detection (DAD)
  - Randomly chooses an address
  - **Address Request message (AREQ)**
    - For allocated address
  - **Address Reply message (AREP)**
    - Handle address collision
  - Does not handle network partitions

RELATED WORK

- Duplicate Address Detection (DAD)





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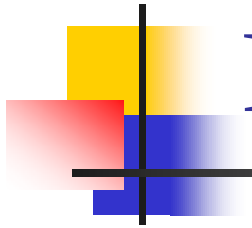
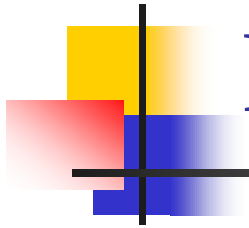


RELATED WORK

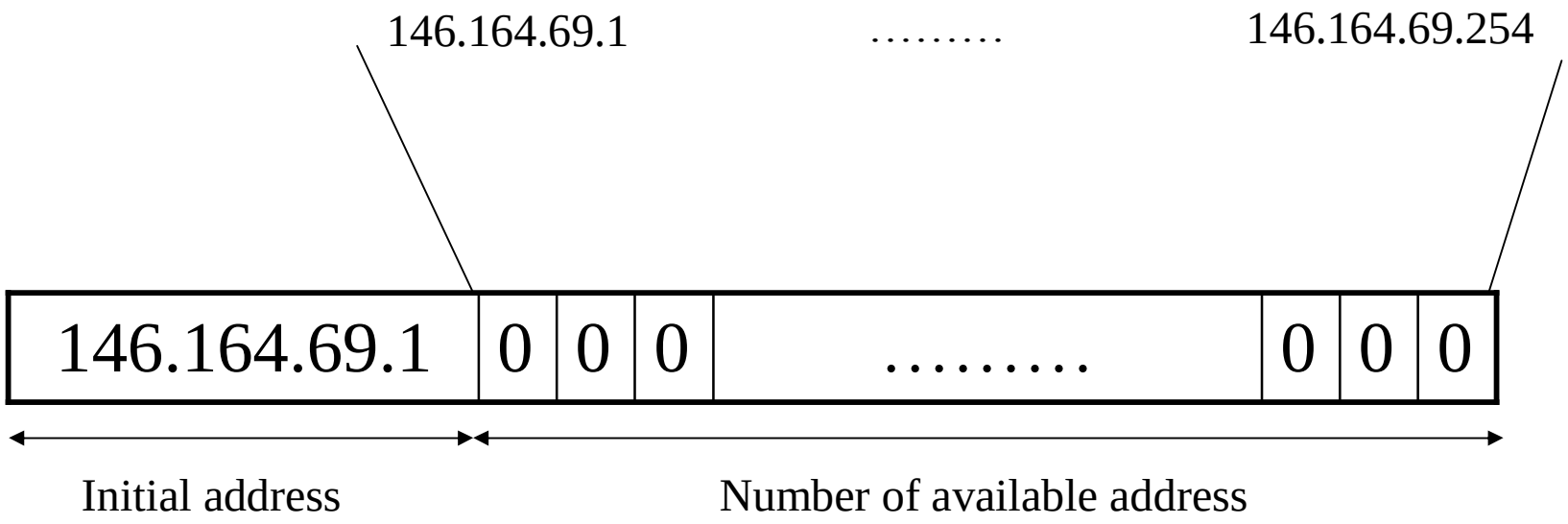
- Fan and Subramani propose a protocol based on DAD
  - Called FS in this paper
  - Use Hello messages
  - Use **random numbers** as network identifiers to detect network merging
- Fazio et al. also propose a protocol
  - Based on network identifiers
  - Works in a reactive fashion
- MANETconf
  - Allocated IP list and allocated-pending list
  - Partition detection depends on periodic flooding
  - Large number of control messages and required to have a high storage capacity.
- Dynamic Address assignment Protocol (DAP)
  - High control load required to have a high storage capacity.

FILTER-BASED ADDRESSING PROTOCOL (FAP)

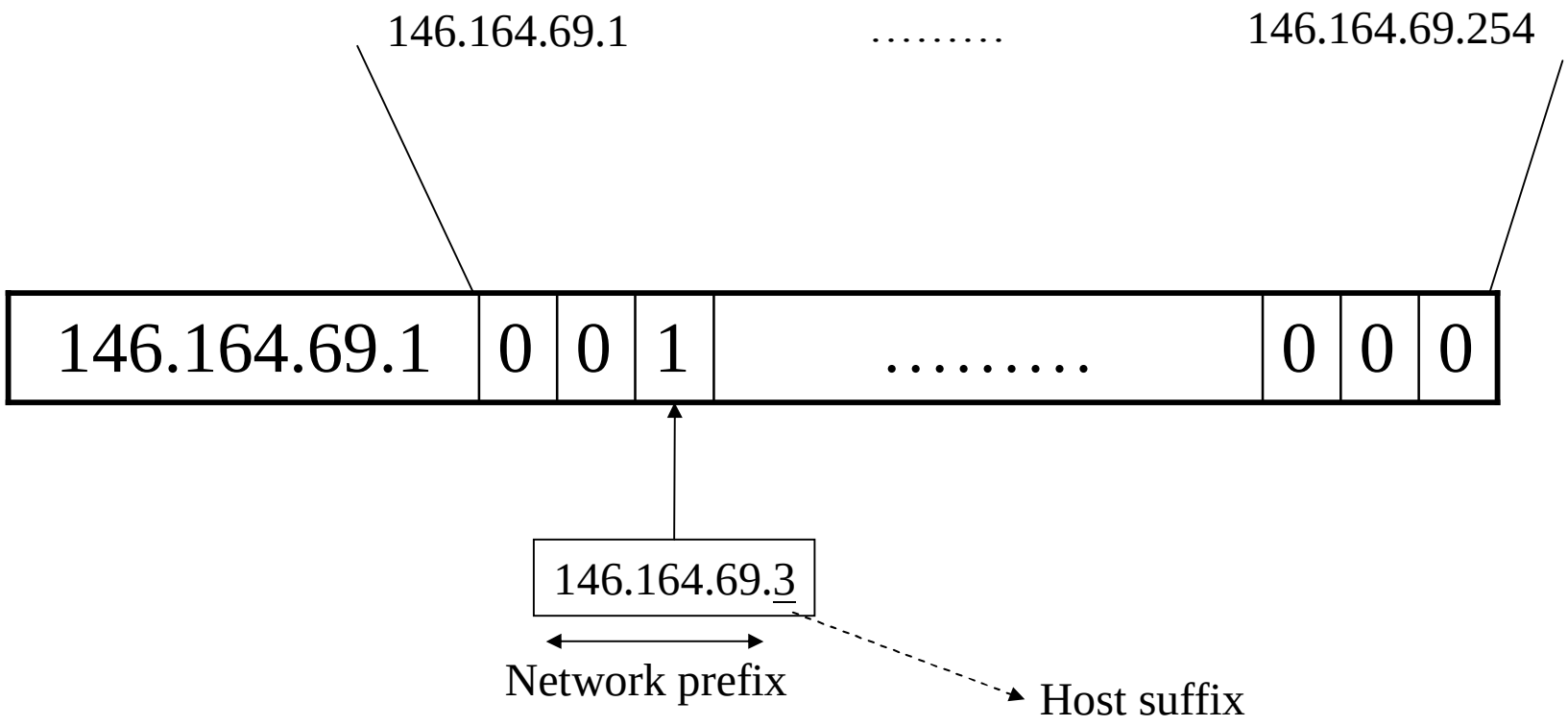


- Aims
  - Dynamically autoconfigure addresses, identifying and solving addresses collisions with a low control load
- Filters
  - Represent the current set of allocated addresses.
  - Hash of the filter (filter signature) as a partition identifier.

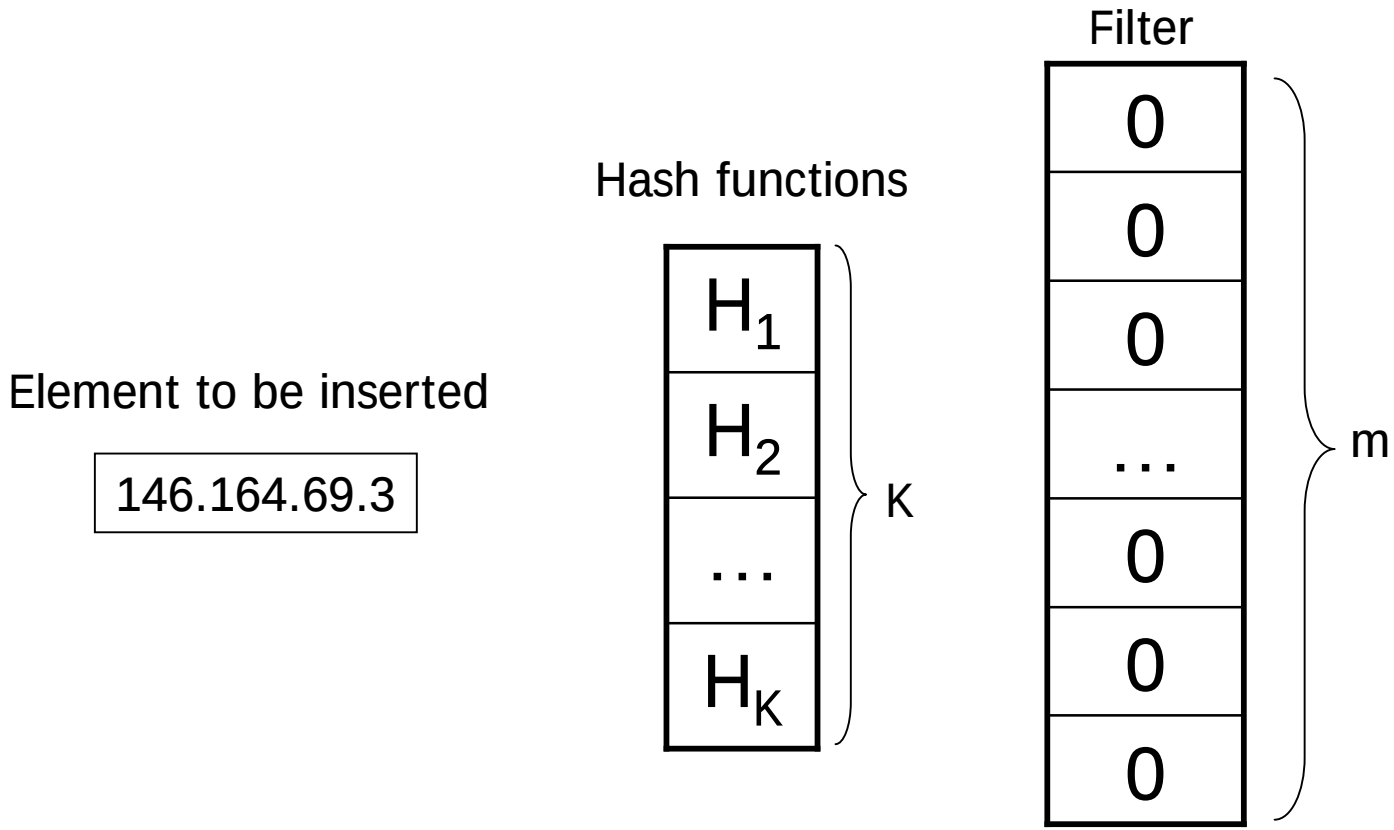
Sequence Filters



Sequence Filters



Bloom Filters



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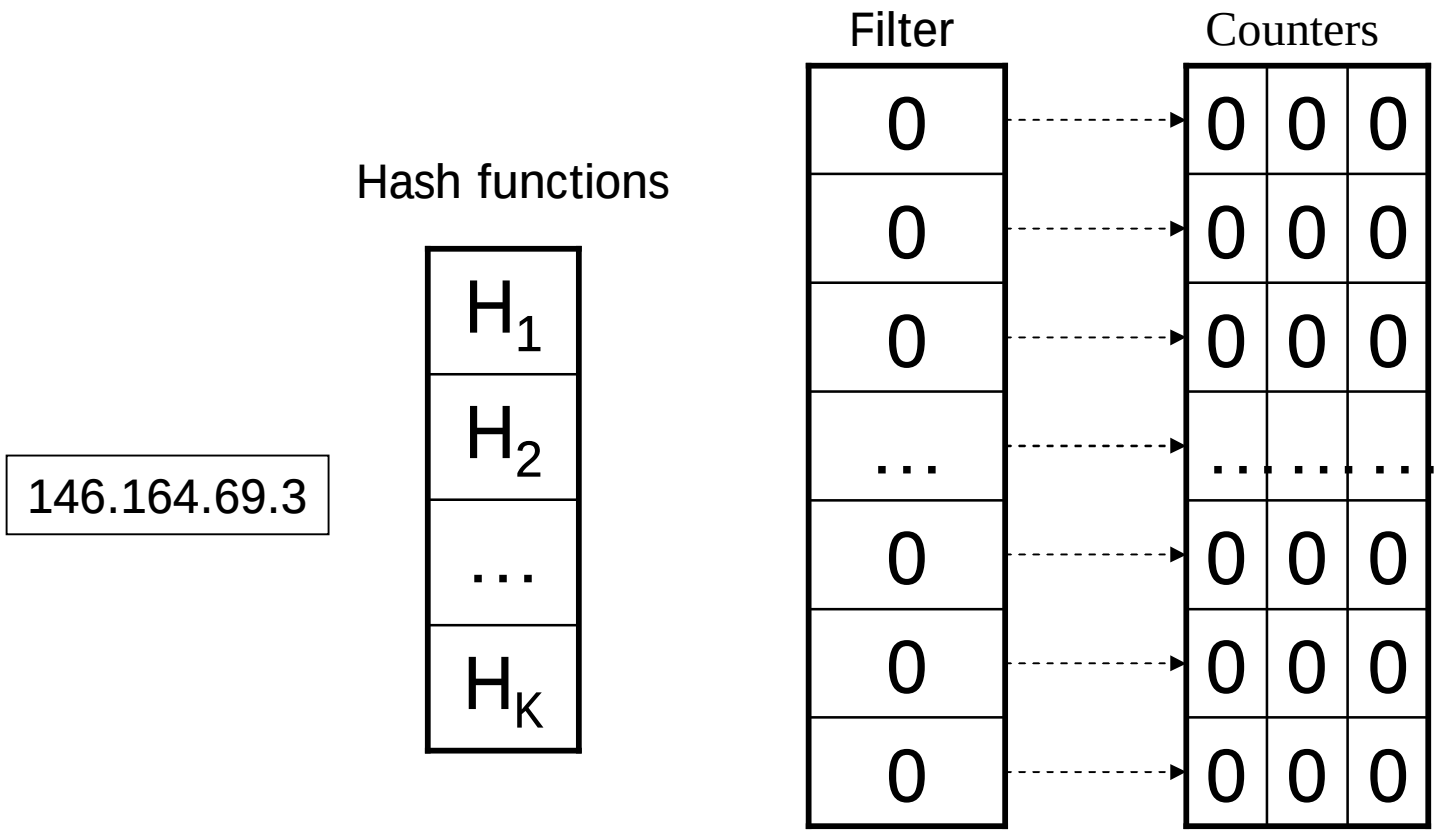

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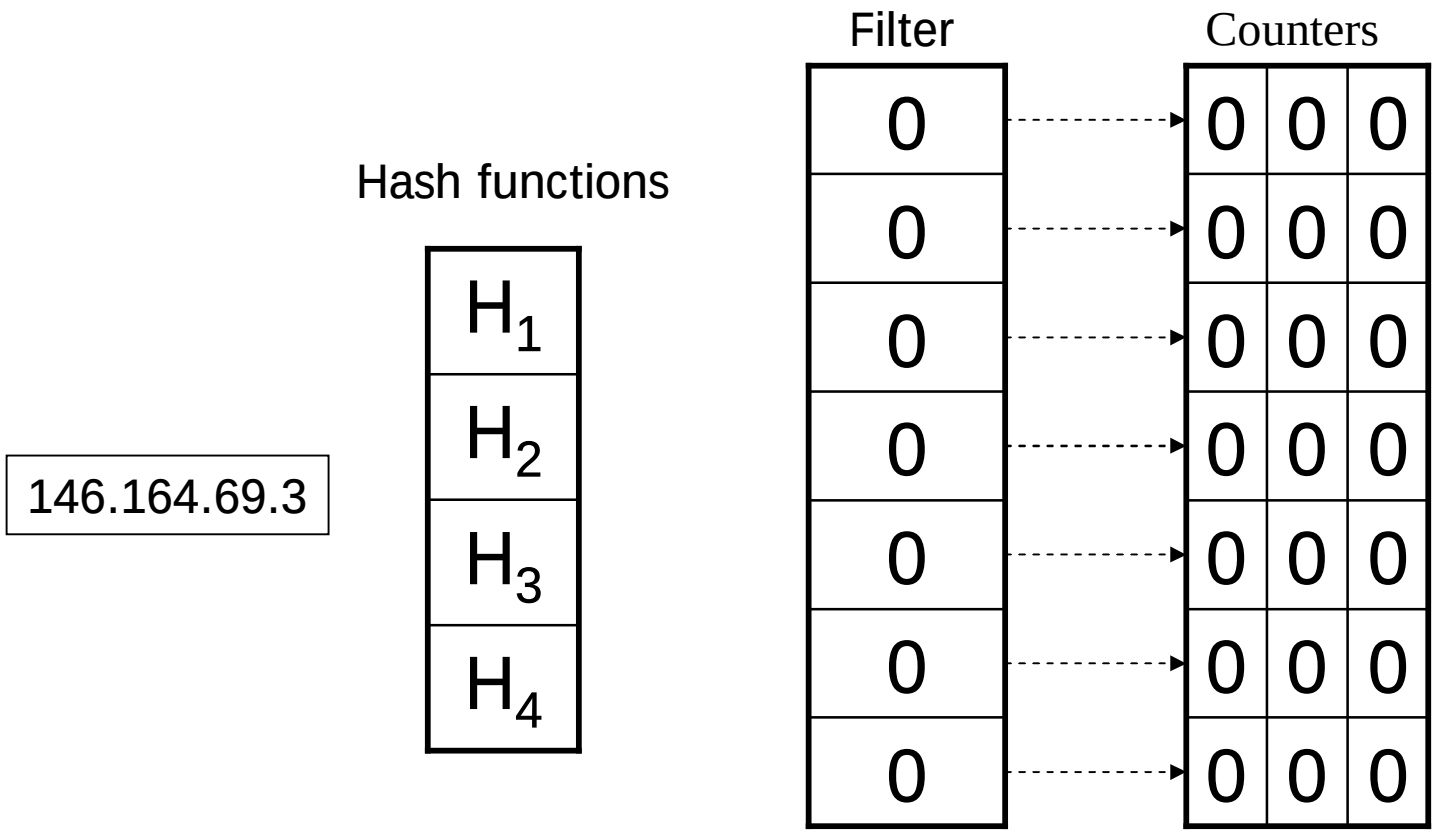

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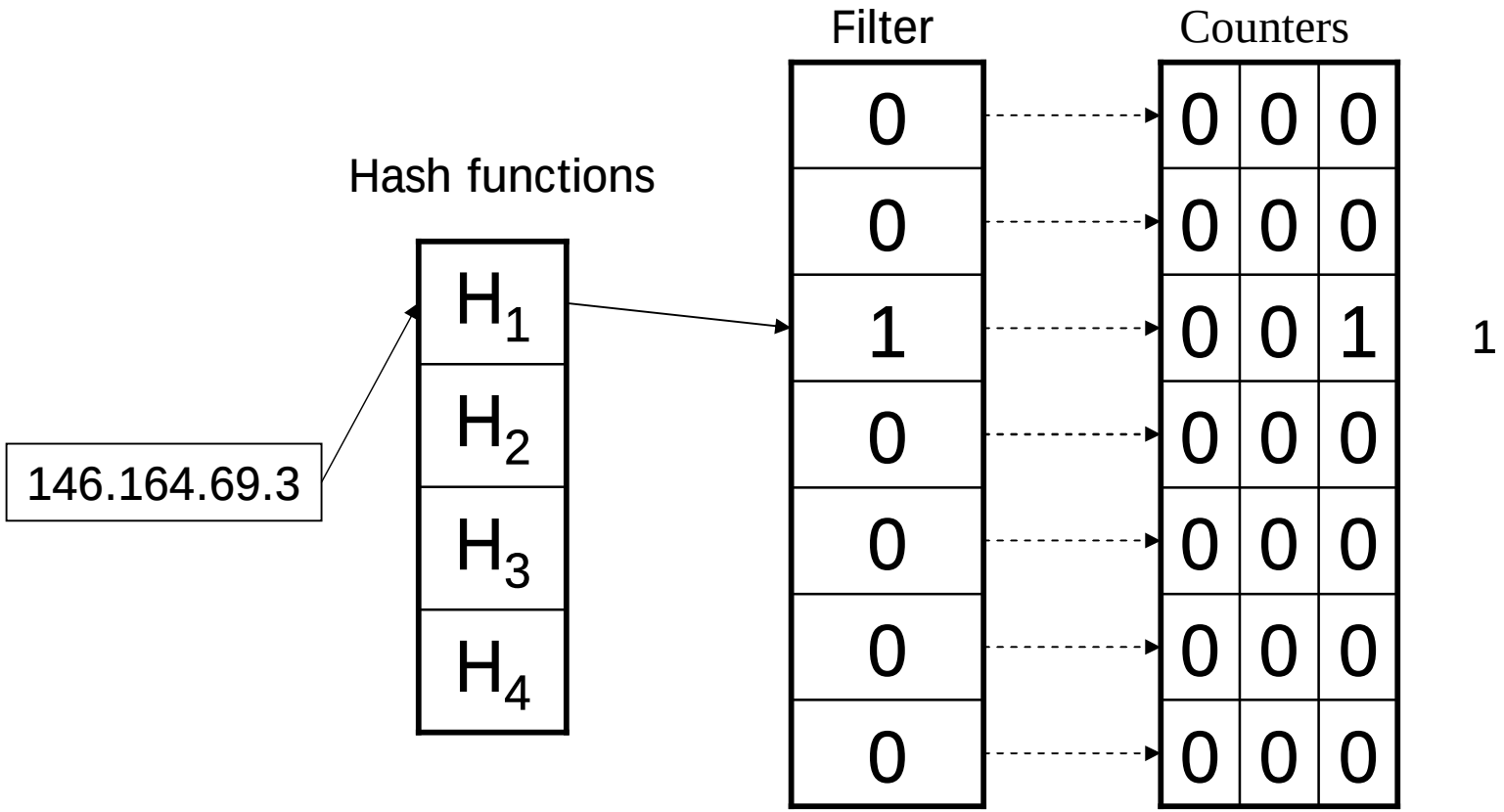

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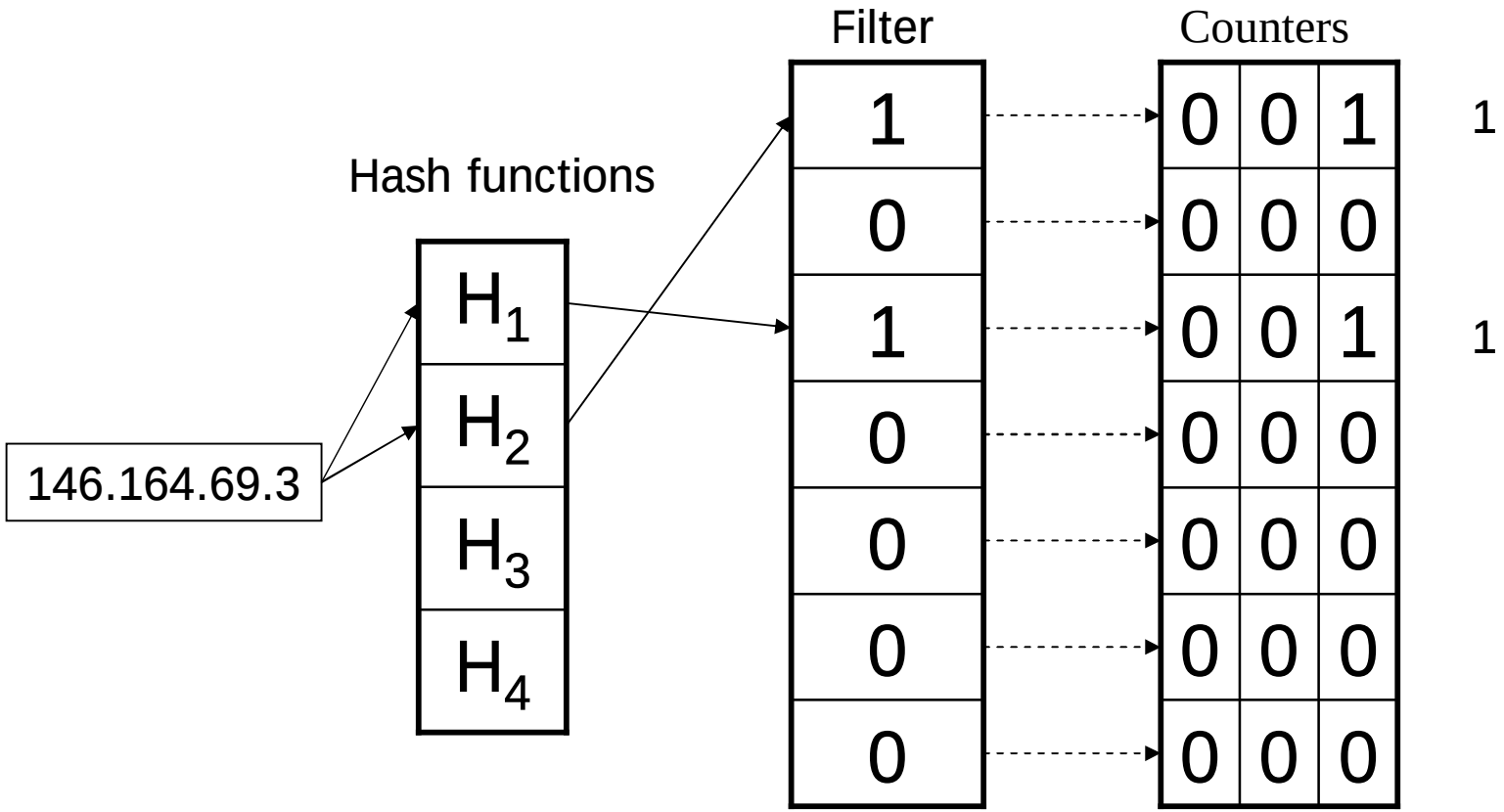

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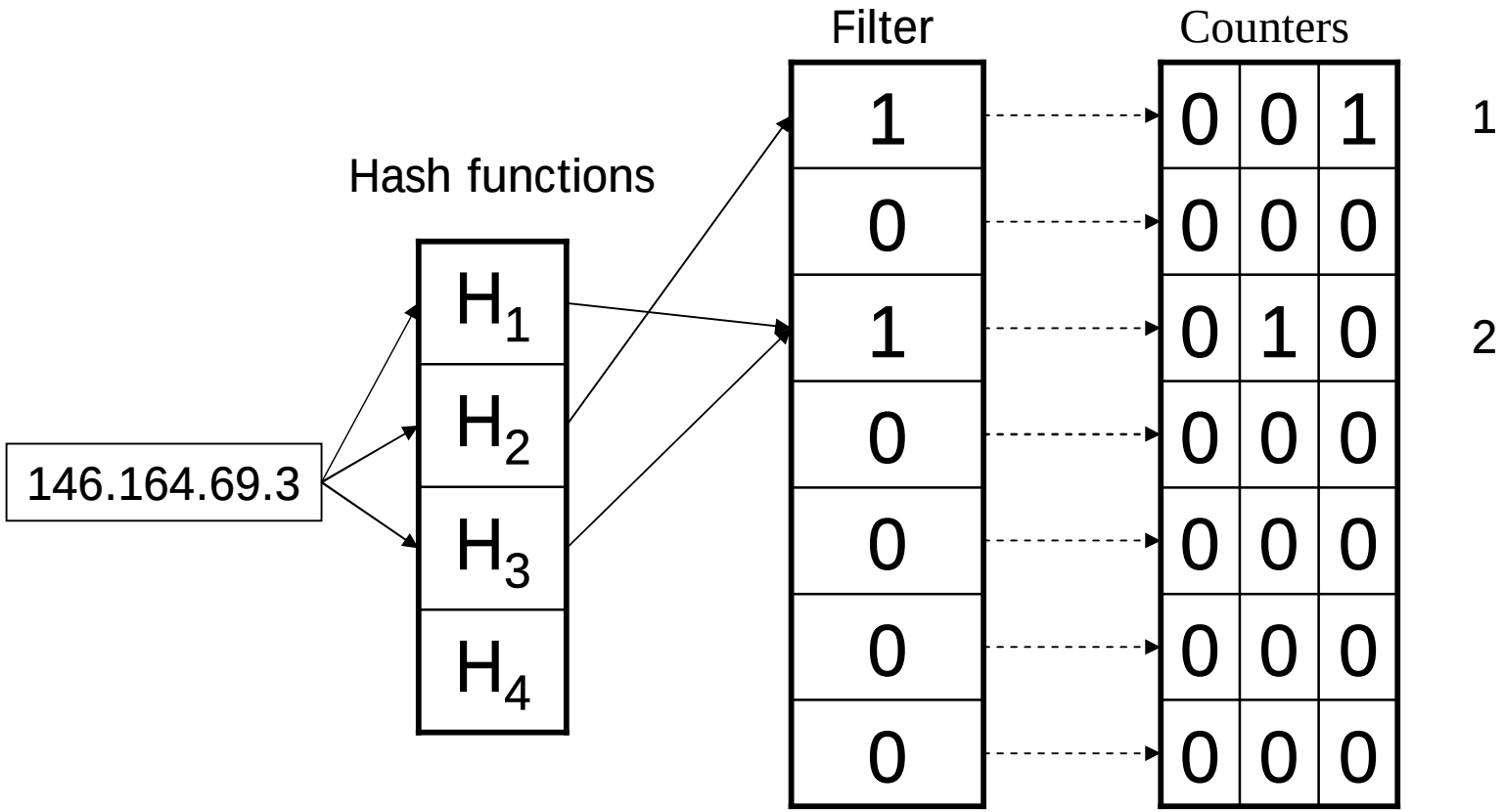

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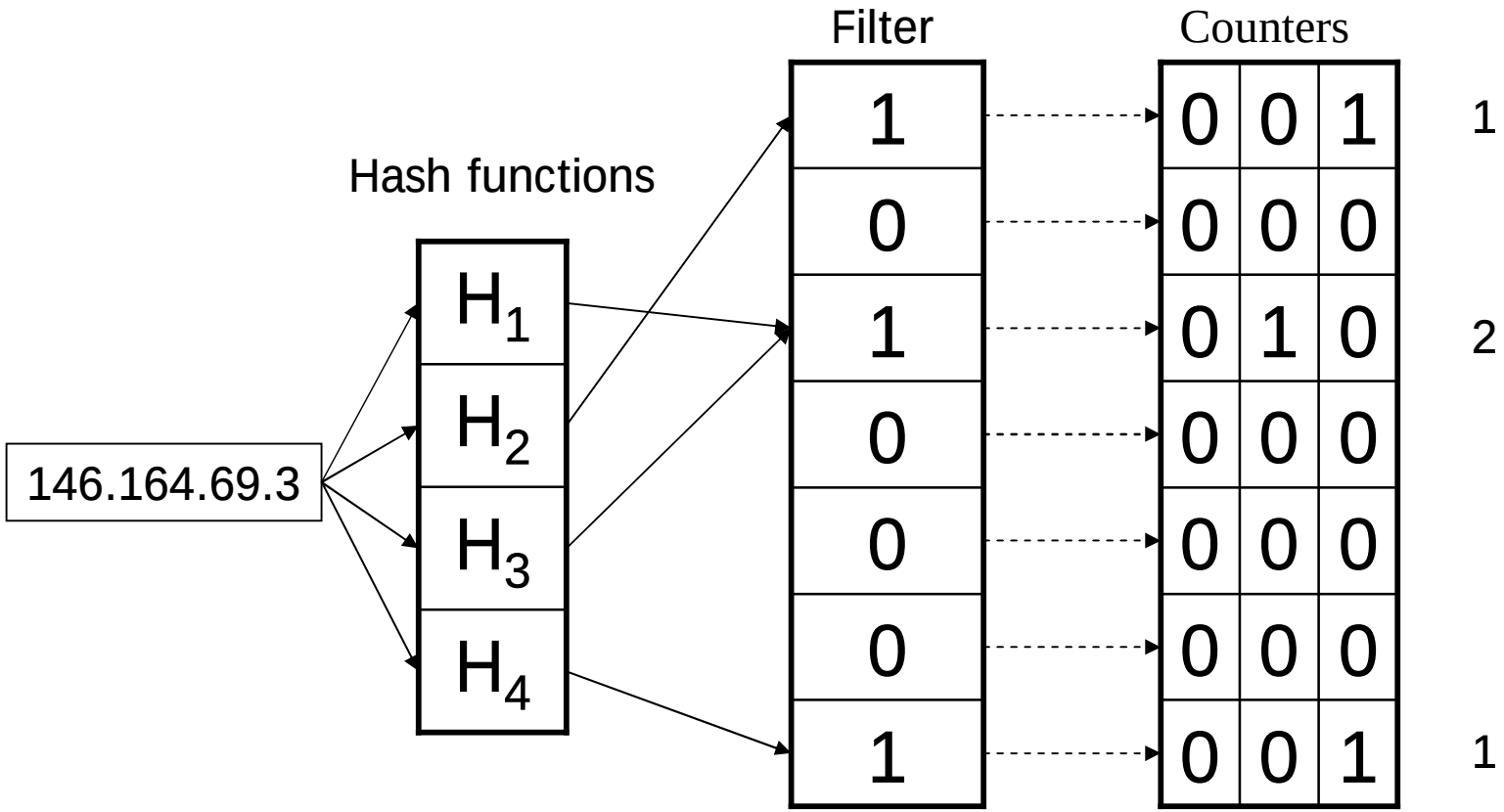
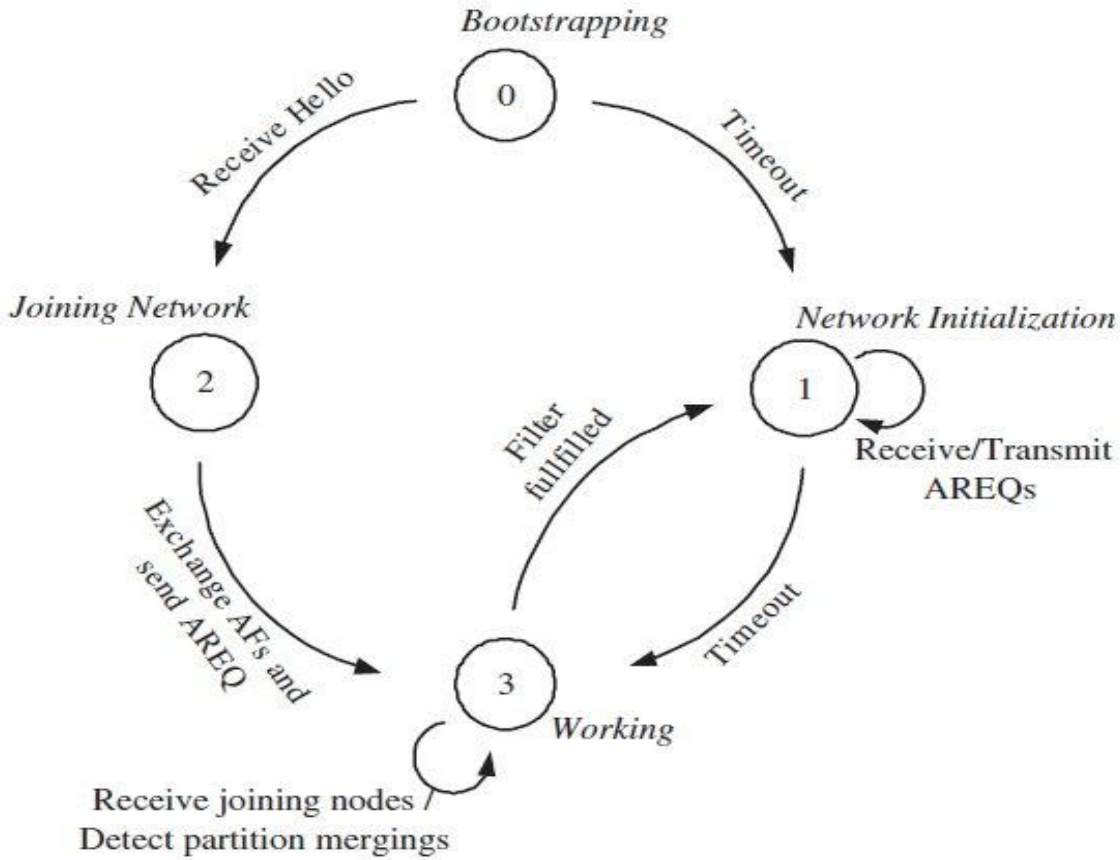


Procedures of FAP



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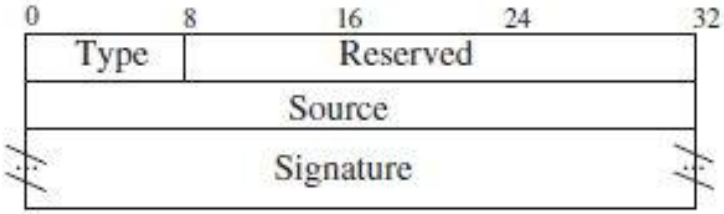
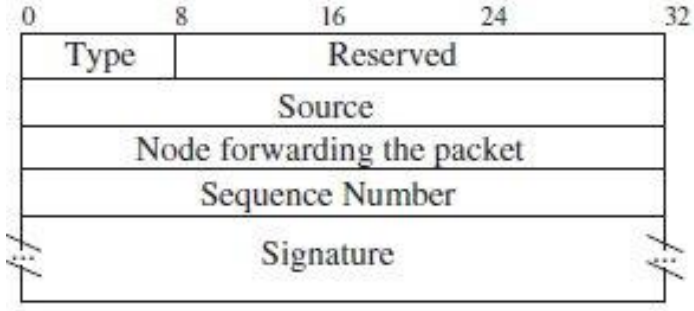
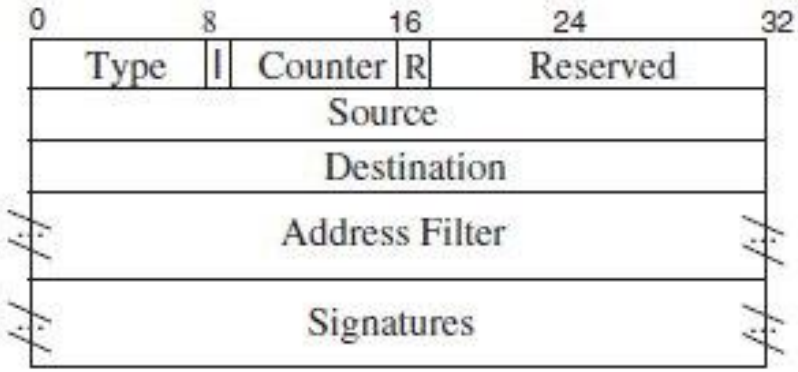


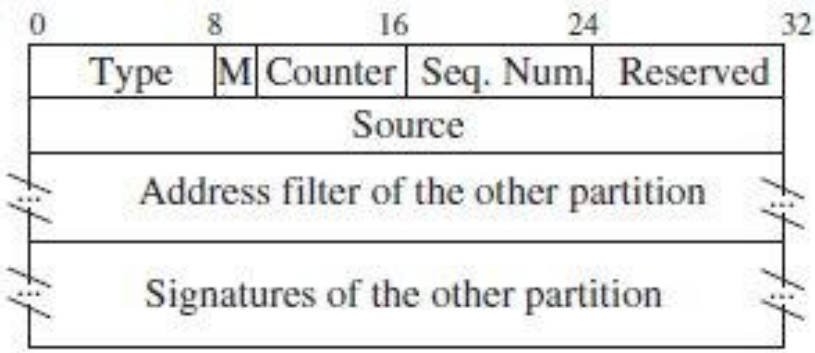
(a) Hello.



(b) Address Request (AREQ).

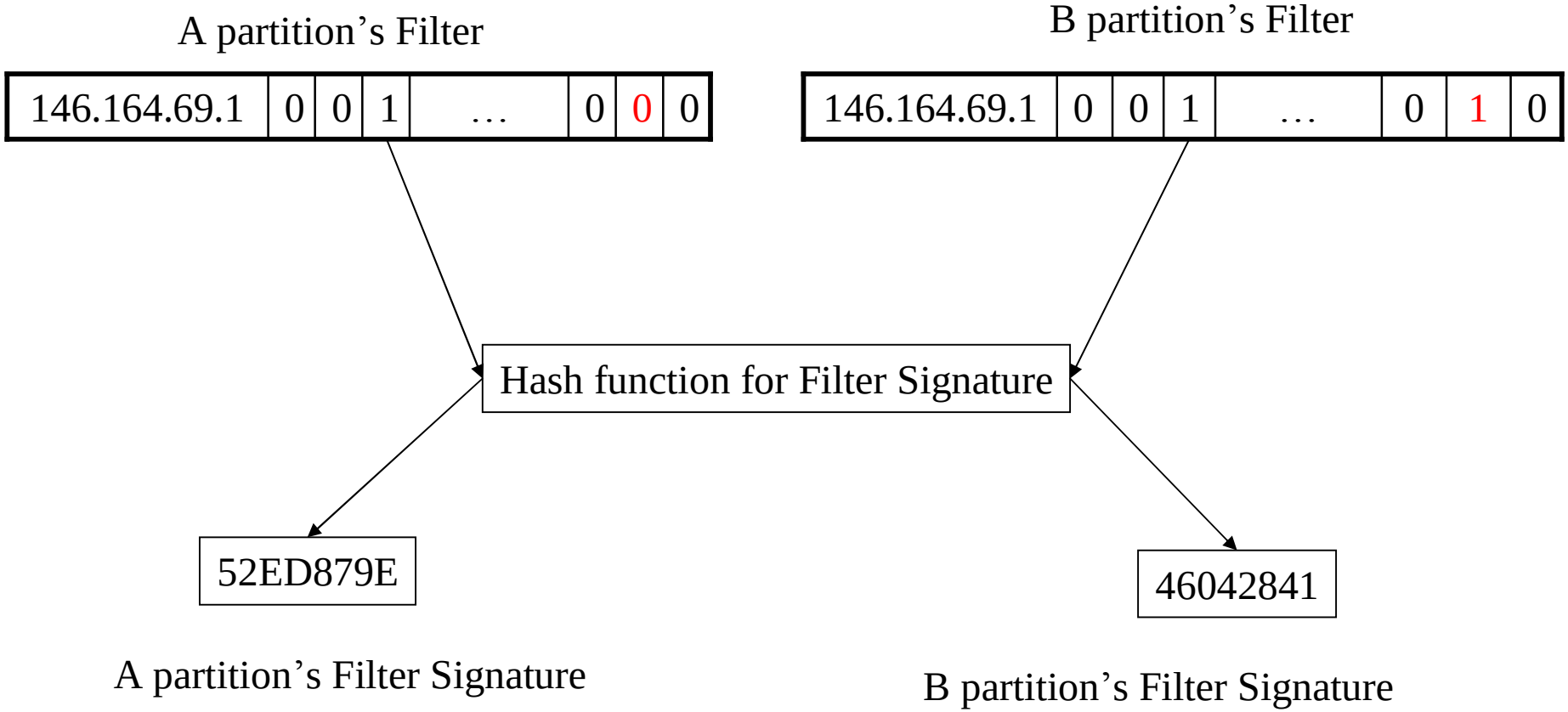


(c) Address Filter (AF).



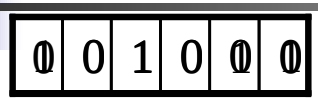
(d) Partition.

Procedures of FAP



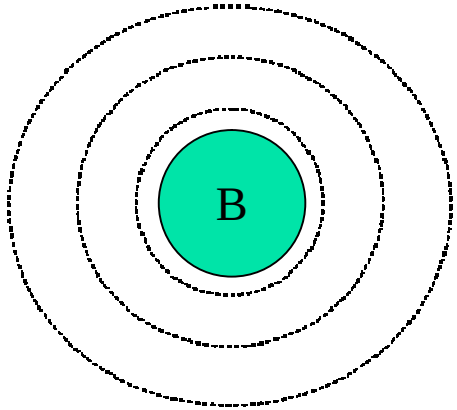
Procedures of FAP

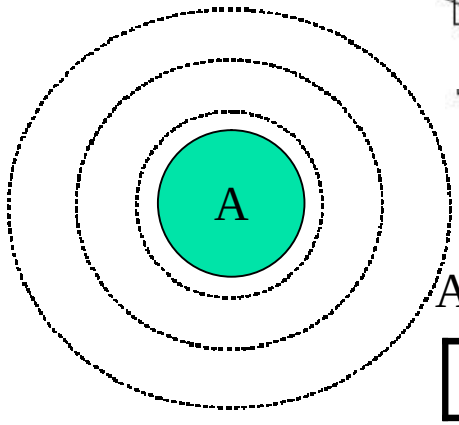
Network Initialization

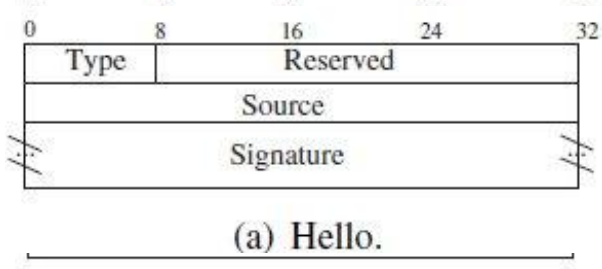


B: 5

Flood N_R times



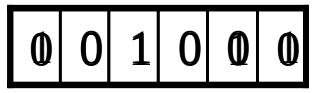


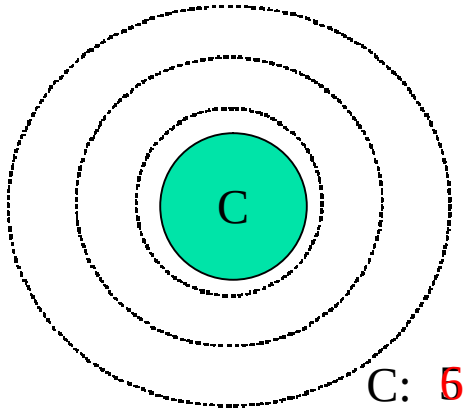


(a) Hello.

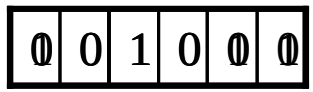
(b) Address Request (AREQ).

A: 3



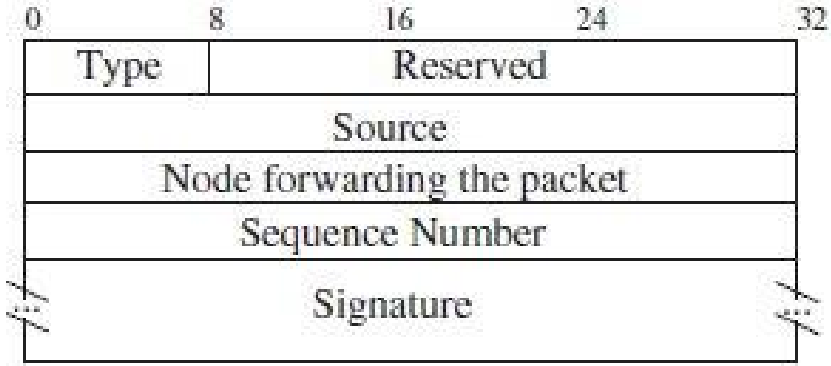


C: 5



Procedures of FAP

Join Network



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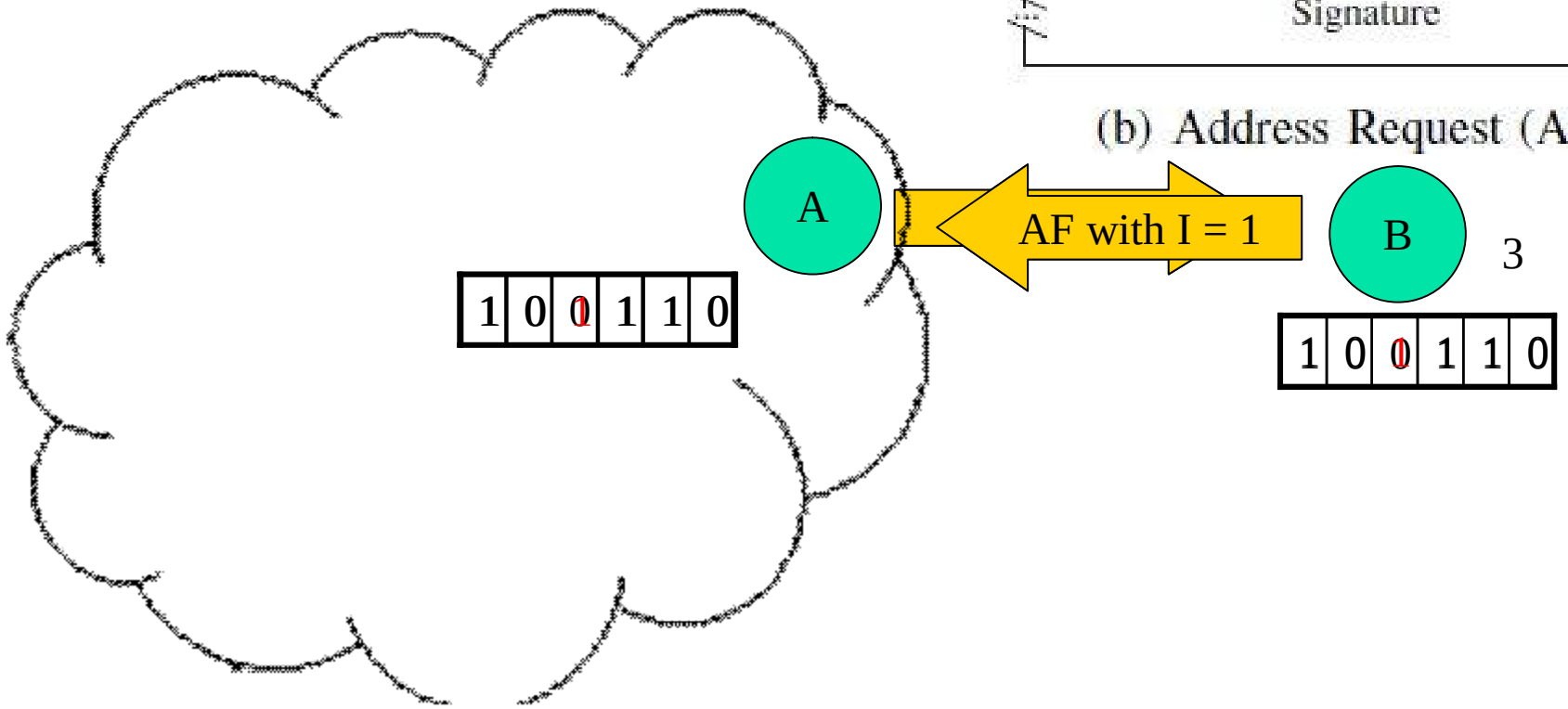
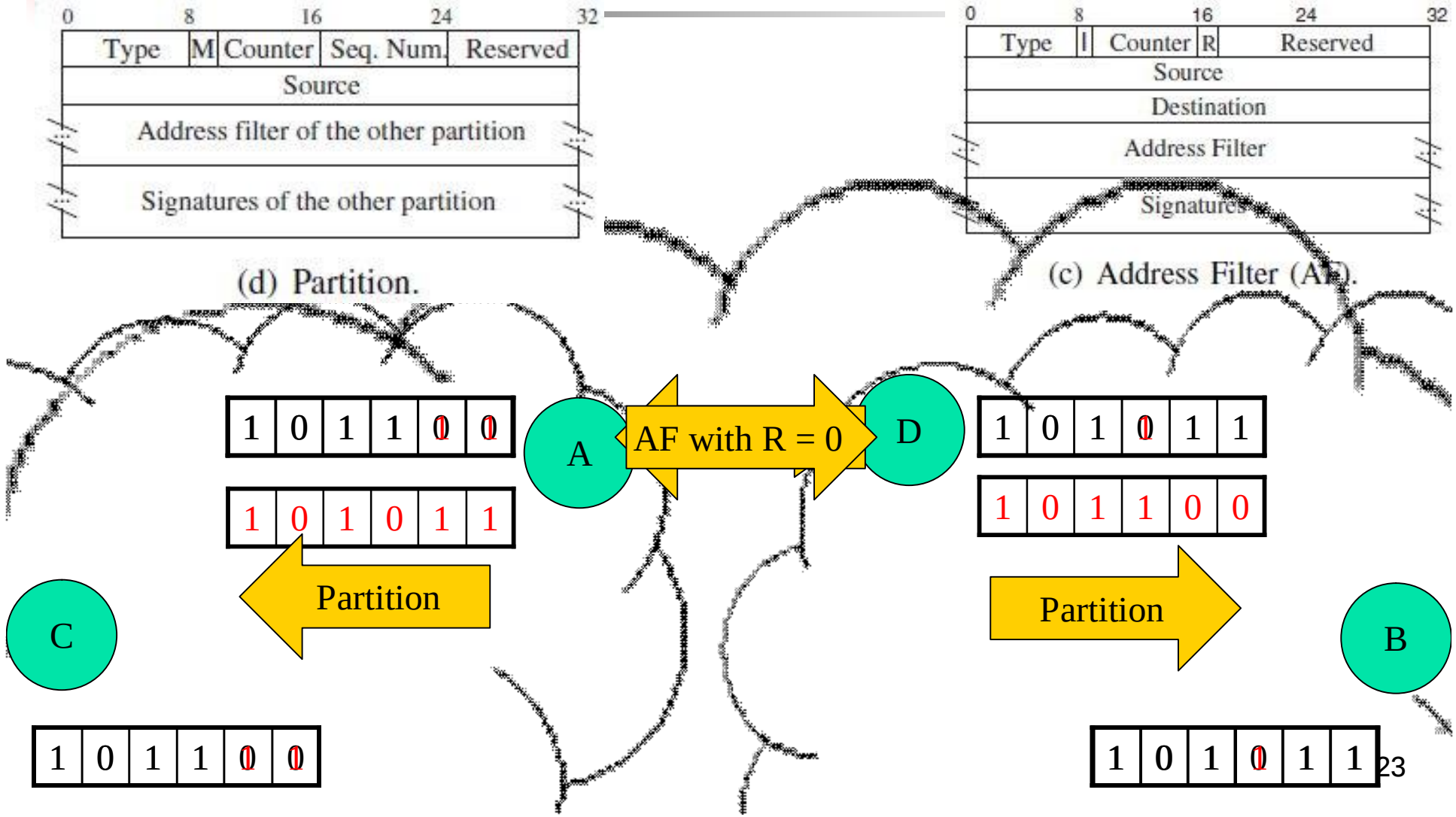


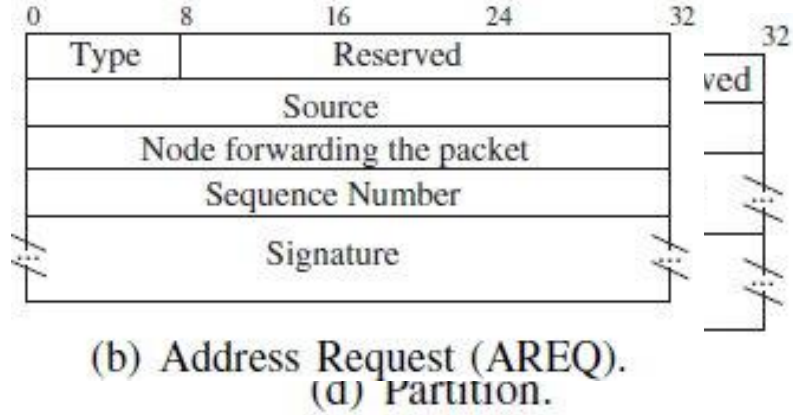
Procedures of FAP

Partition merging



Procedures of FAP

Partition merging (with collision)



(b) Address Request (AREQ).
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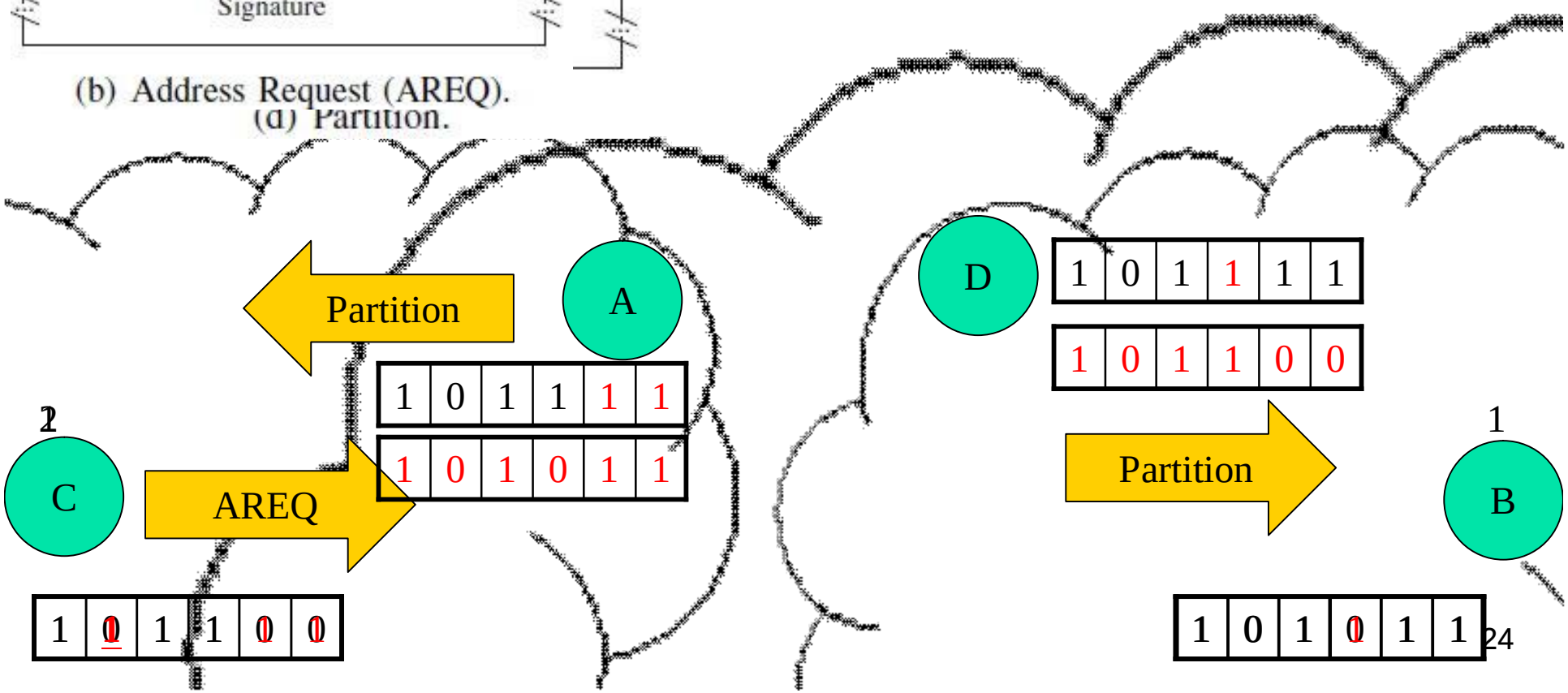
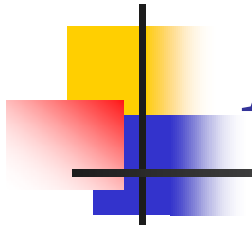


Procedures of FAP

Nodes Departure

- Address should become available
  - The nodes could floods the network with a notification to release it's address (removal of its address of the address filter of each network node)
  - Otherwise, the address remains allocated on the filters

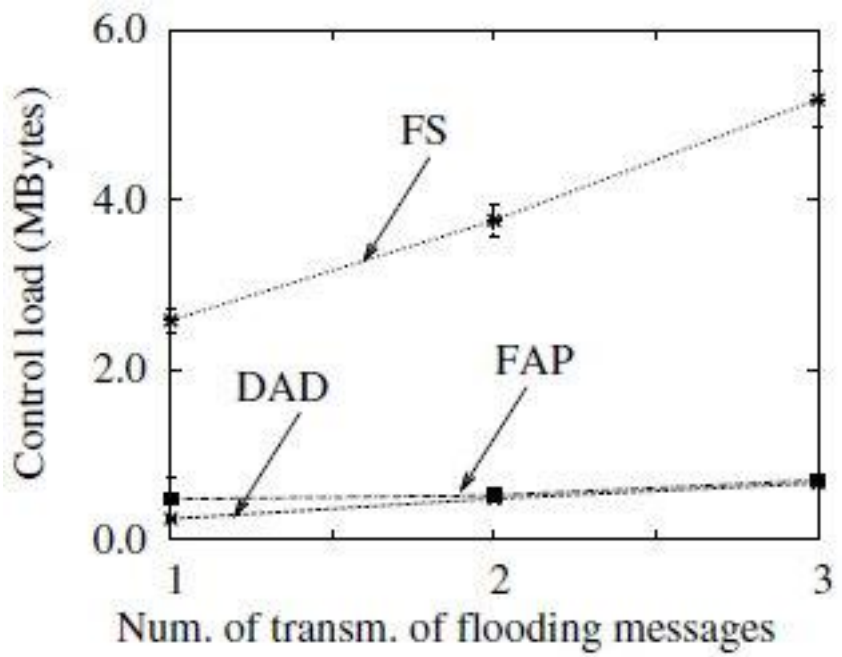


ANALYSIS

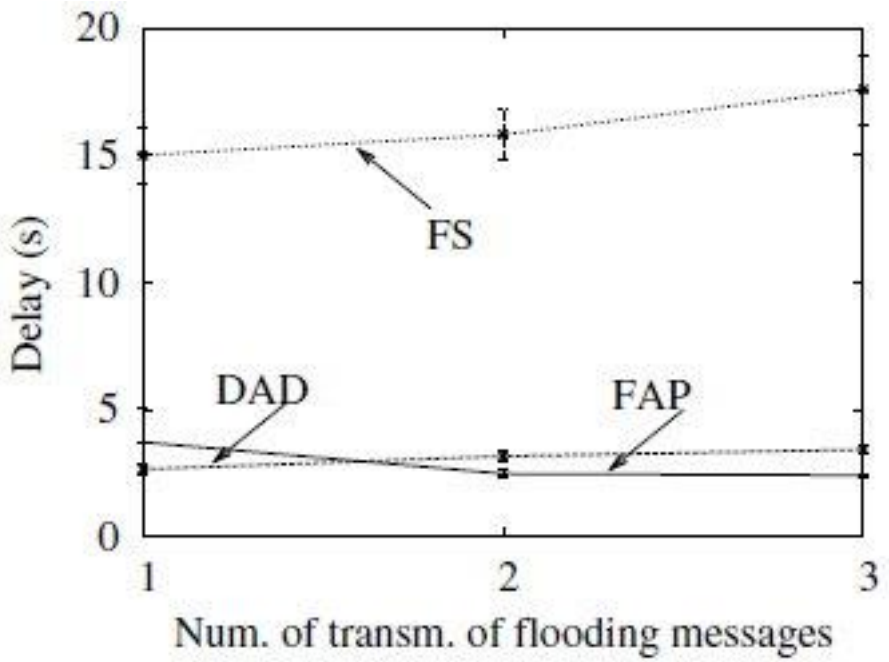
- The available addresses scarce after many departures
- Message loss
- Two different nodes generate Address Requests (AREQs) with the same address and the same sequence number
- Two isolated partitions have exactly the same filters and try to merge

SIMULATION

Initialization control load

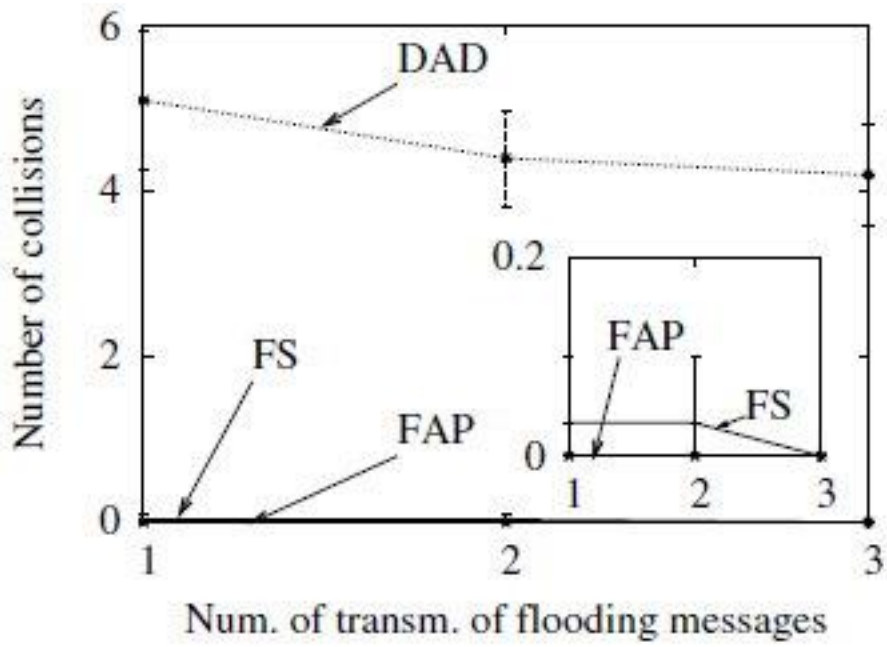


Delay to allocate an address on the initialization

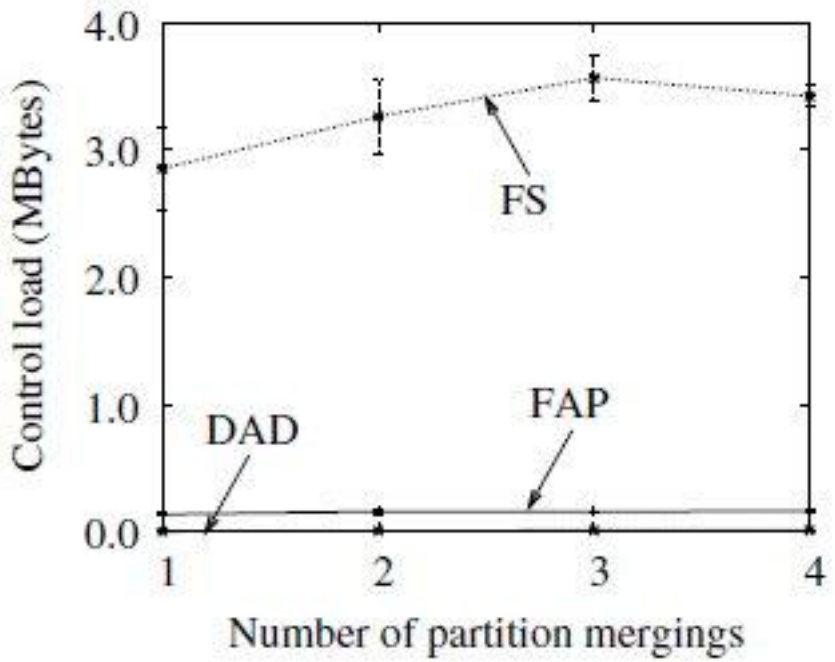


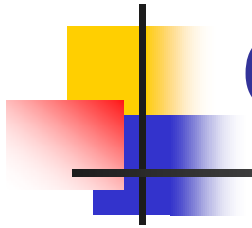
SIMULATION

Number of address collisions
with 50 nodes on a partition merging.



Control load with 50 nodes on partition mergings
and two transmissions of flooding messages.





CONCLUSIONs

- Filter-based Addressing protocol (FAP)
  - Handles nodes joining/leaving the network and partition mergings in a distributive way
  - Uses address filters to allocate addresses
    - Reduce the control load
    - Reduce the delay
    - Accurate partition merging detection
    - Increase the protocol **robustness**
      - Robust to messages losses