SWAP, SWEAR AND SWINDLE: incentive system for swarm and beyond

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September 19, 2016

ethereum

whisper

swarm

Outline

Outline

data out

How to retrieve data stored in the swarm.

data retrieval

- node id, chunk id, function as addresses in the same keyspace

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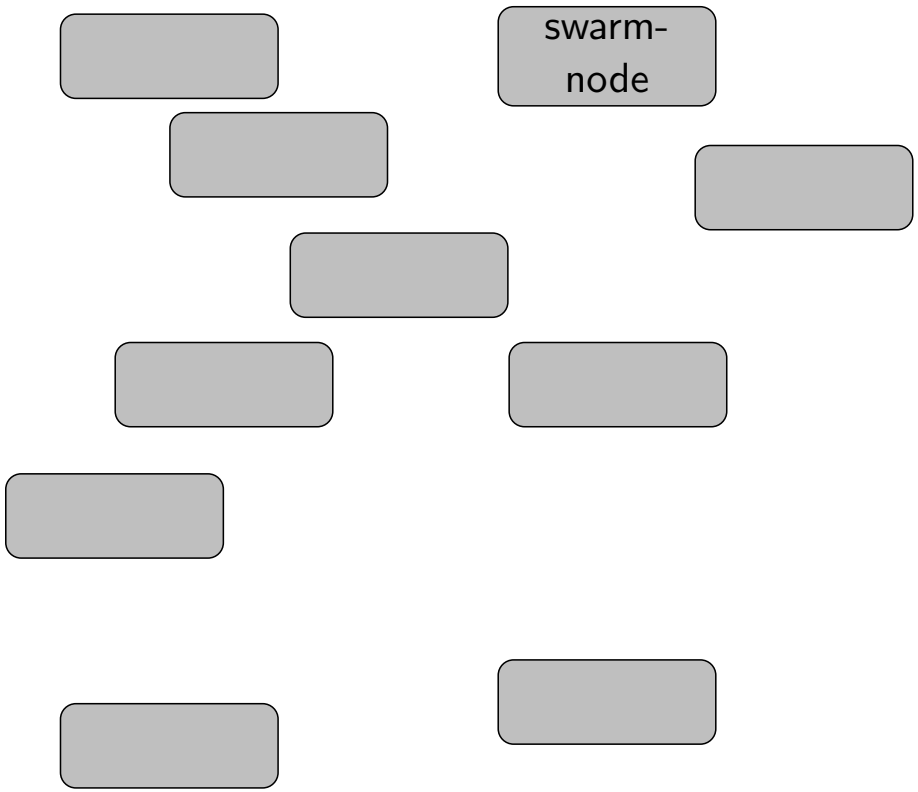
the swarm network:



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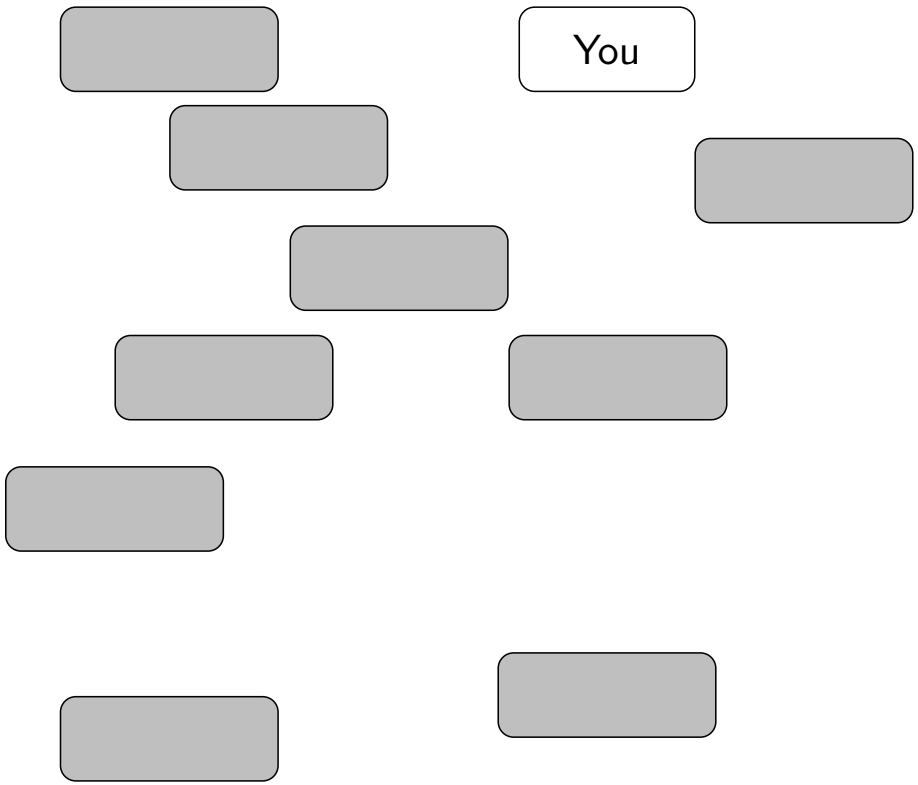

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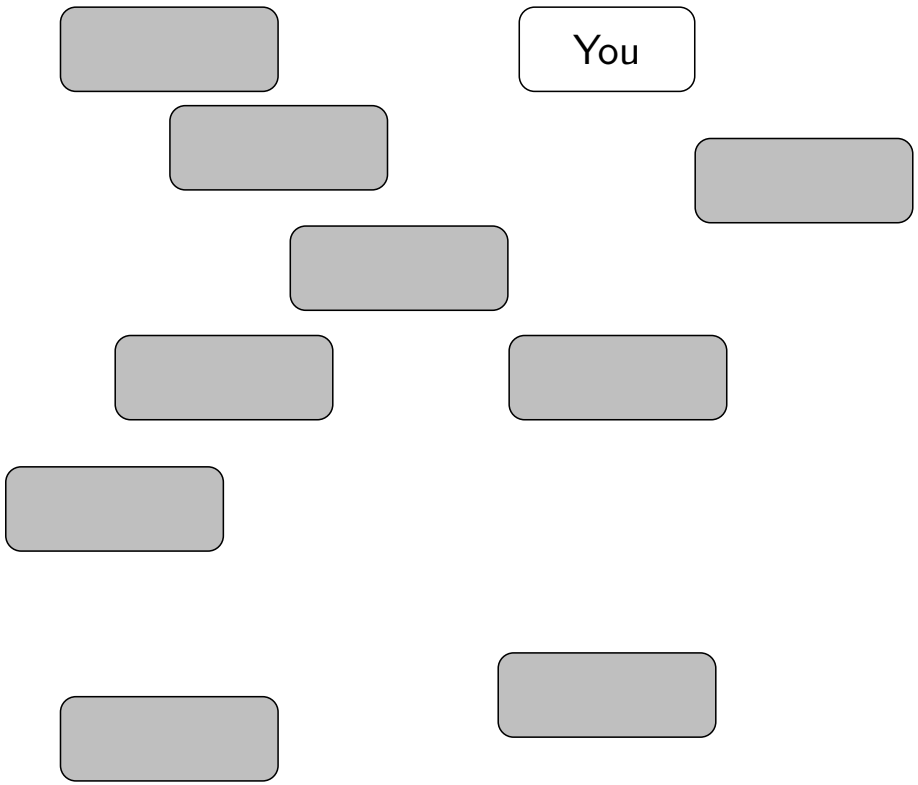

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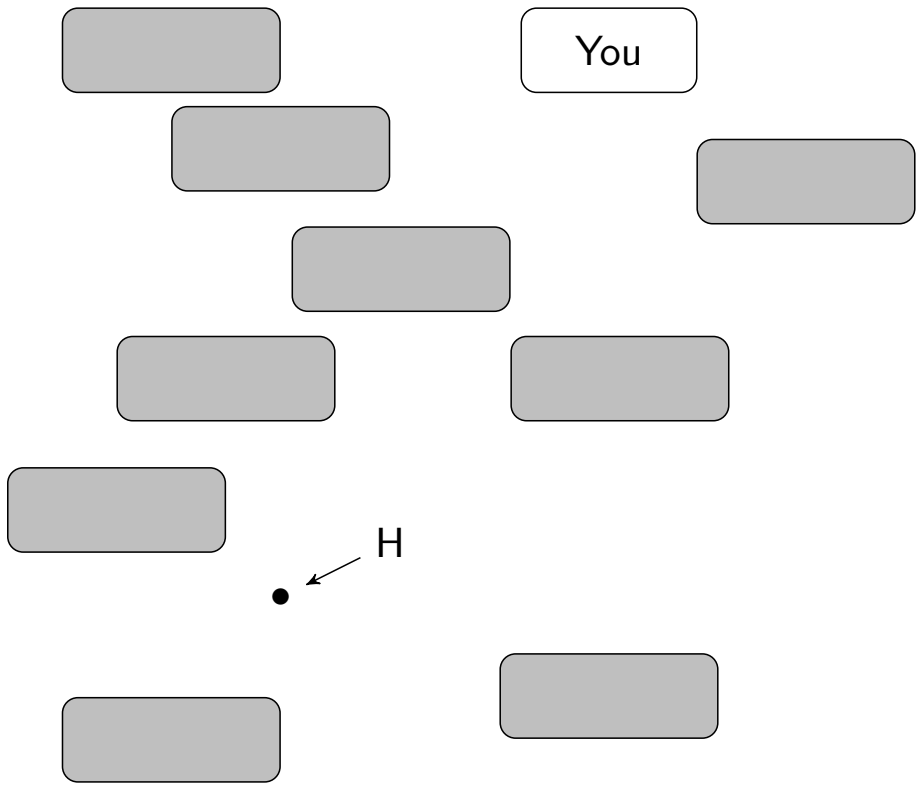

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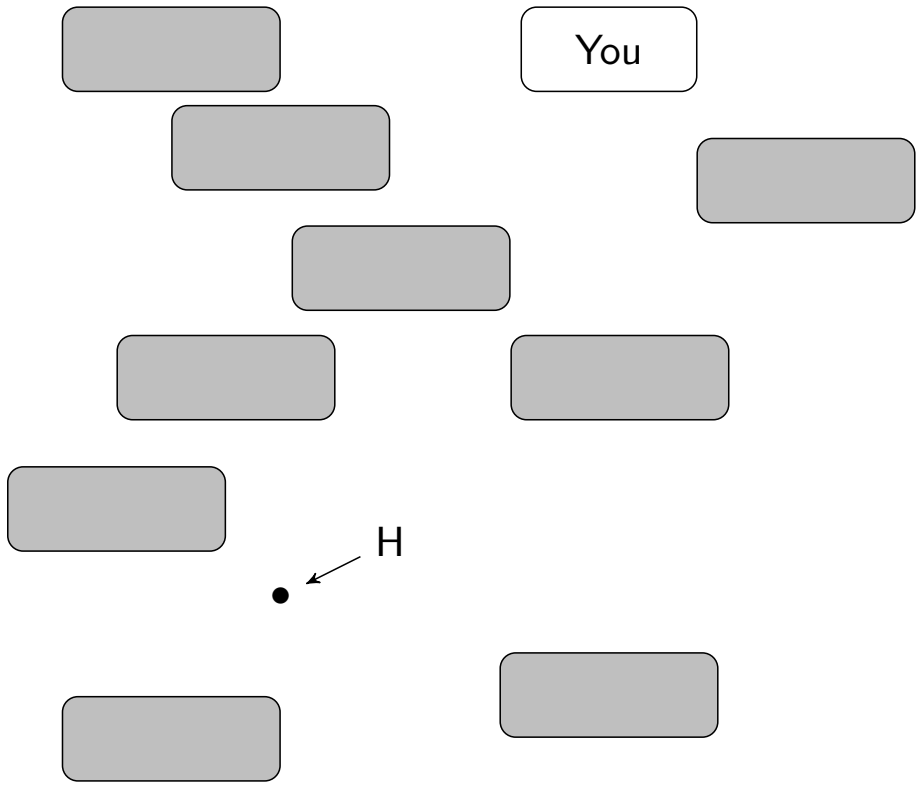

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- swarm's **retrieval process** is responsible for deliviering

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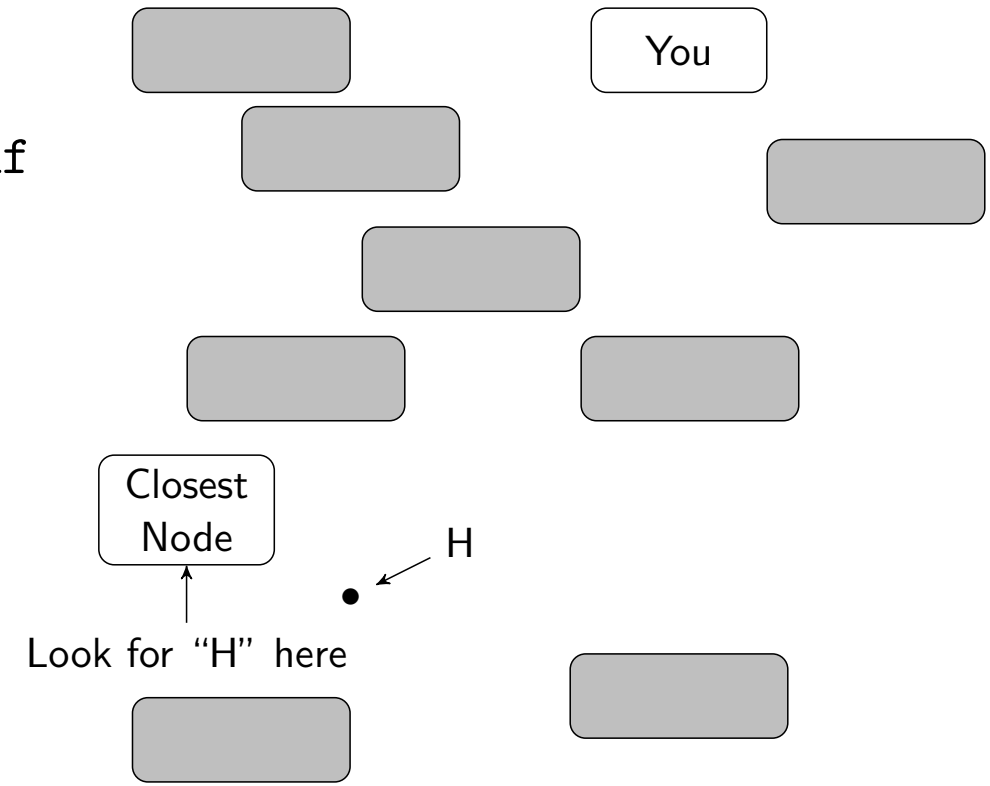

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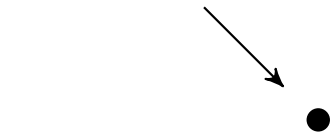

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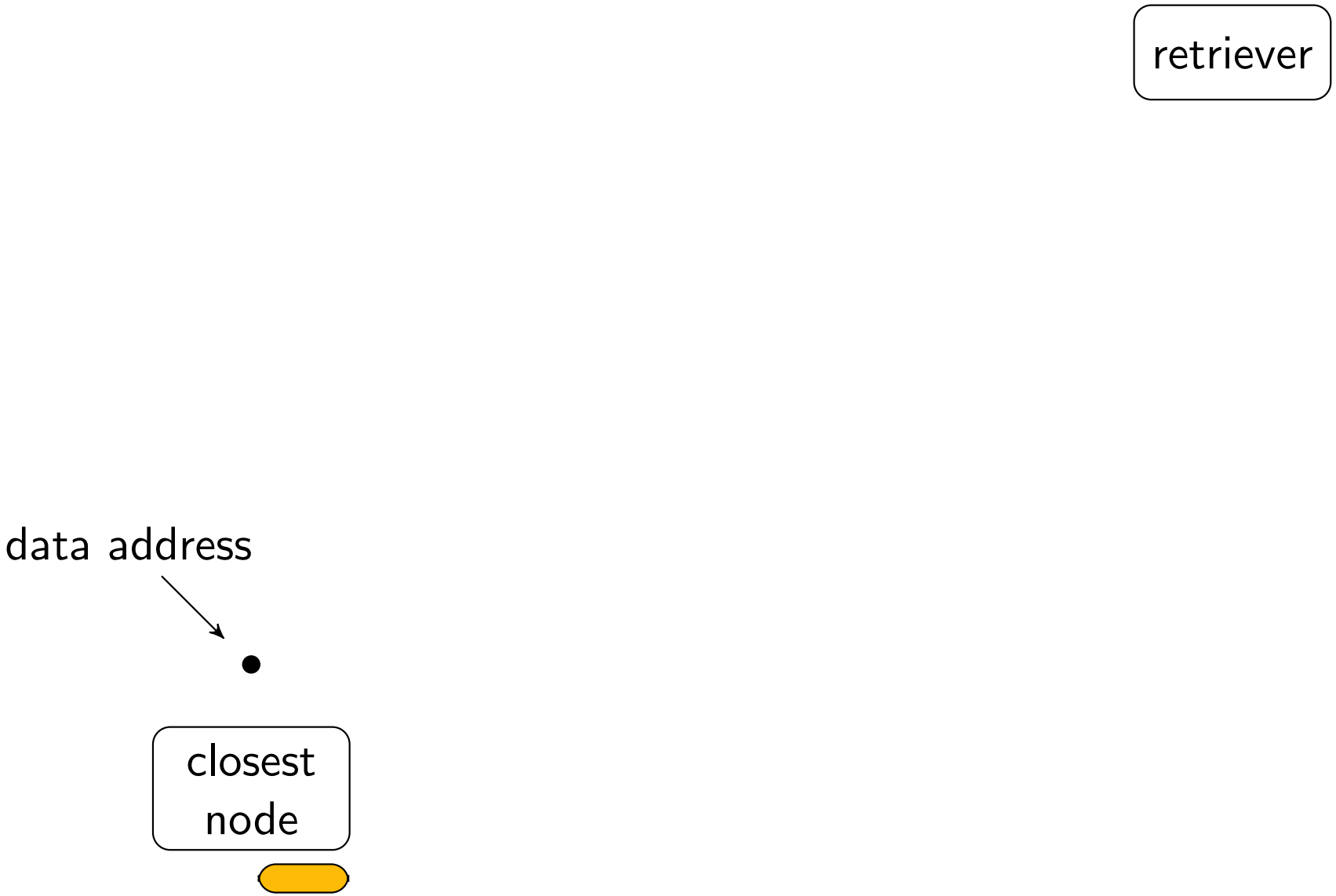

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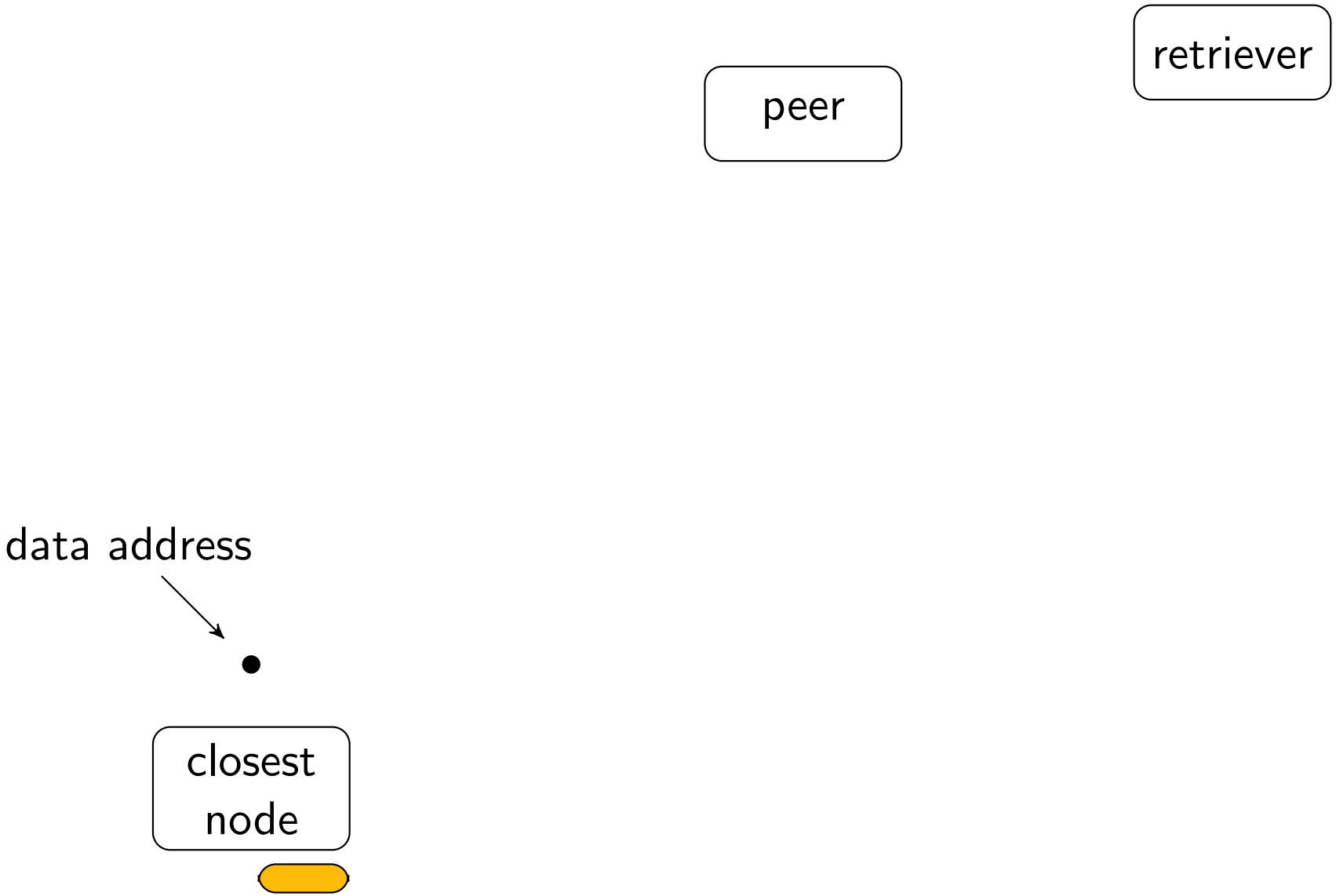

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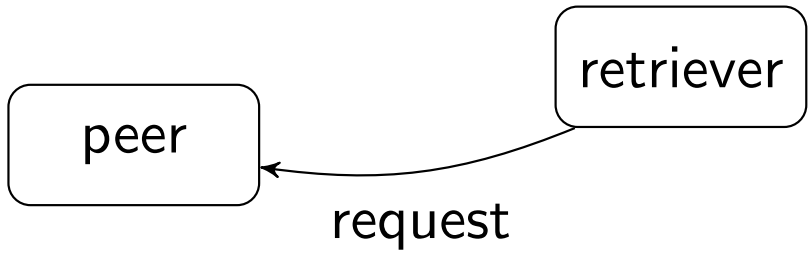

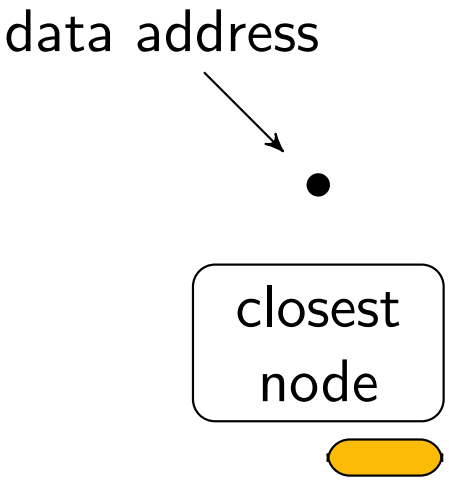

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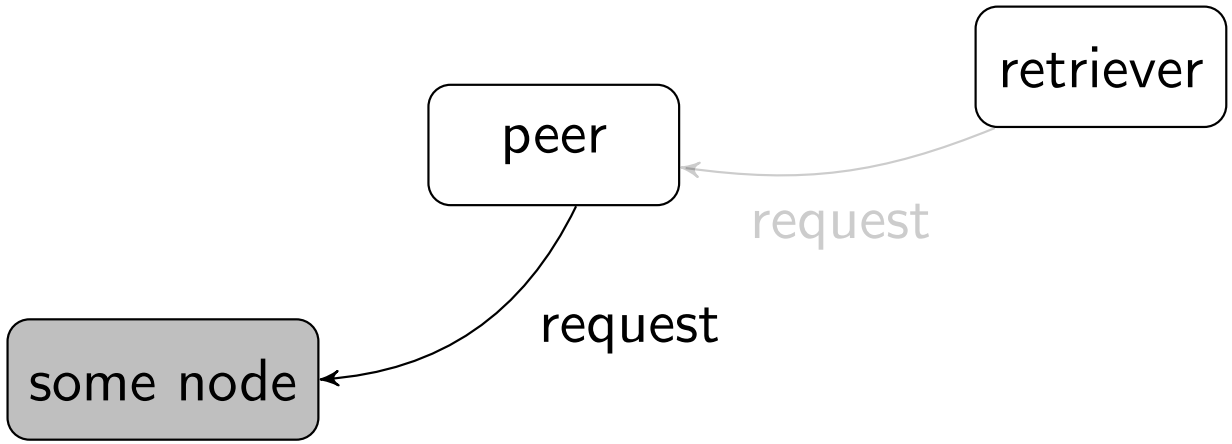

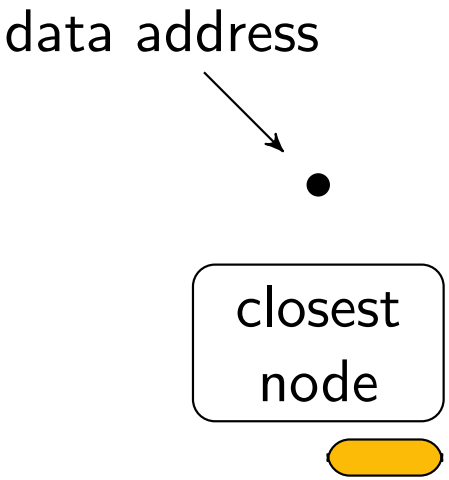

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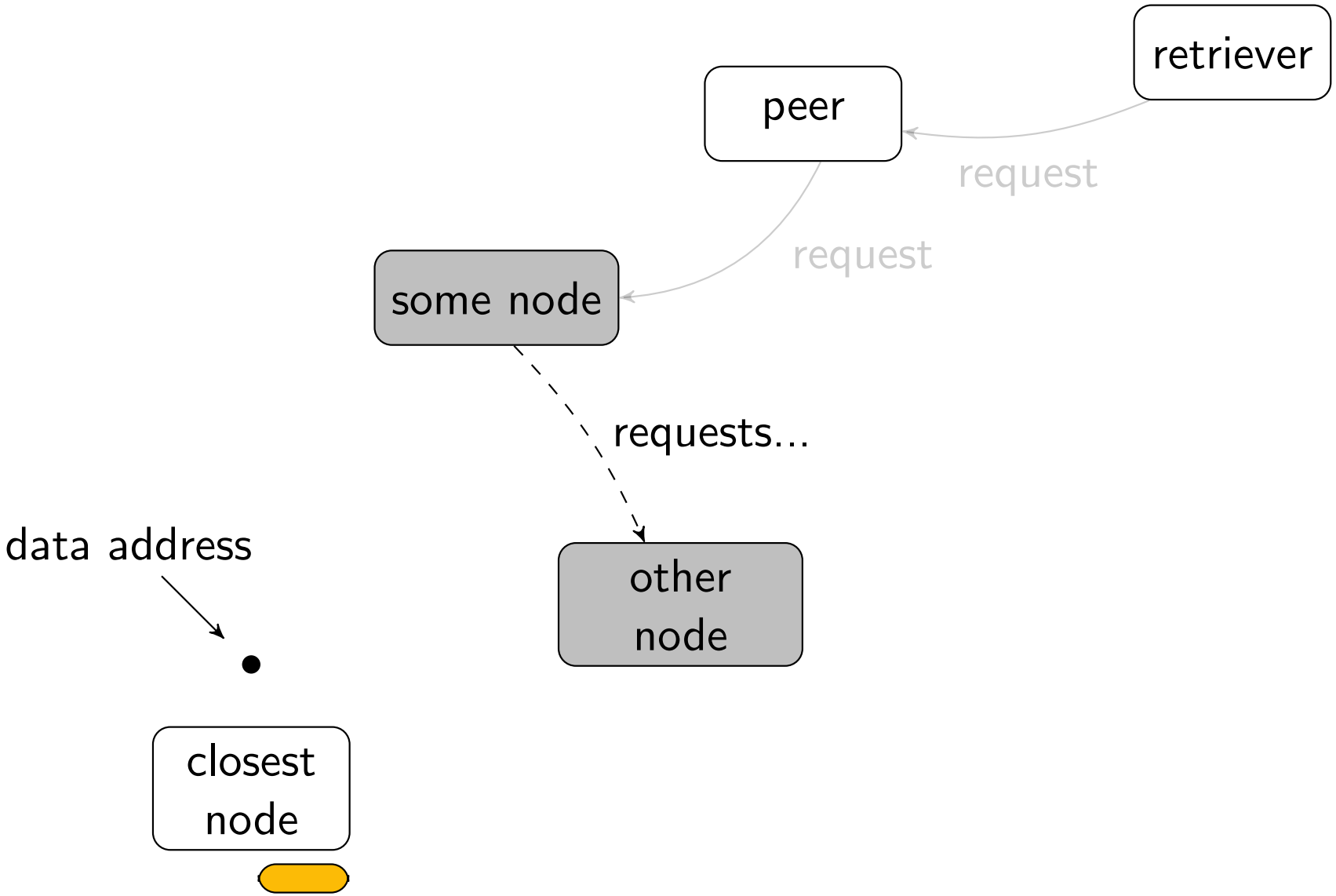

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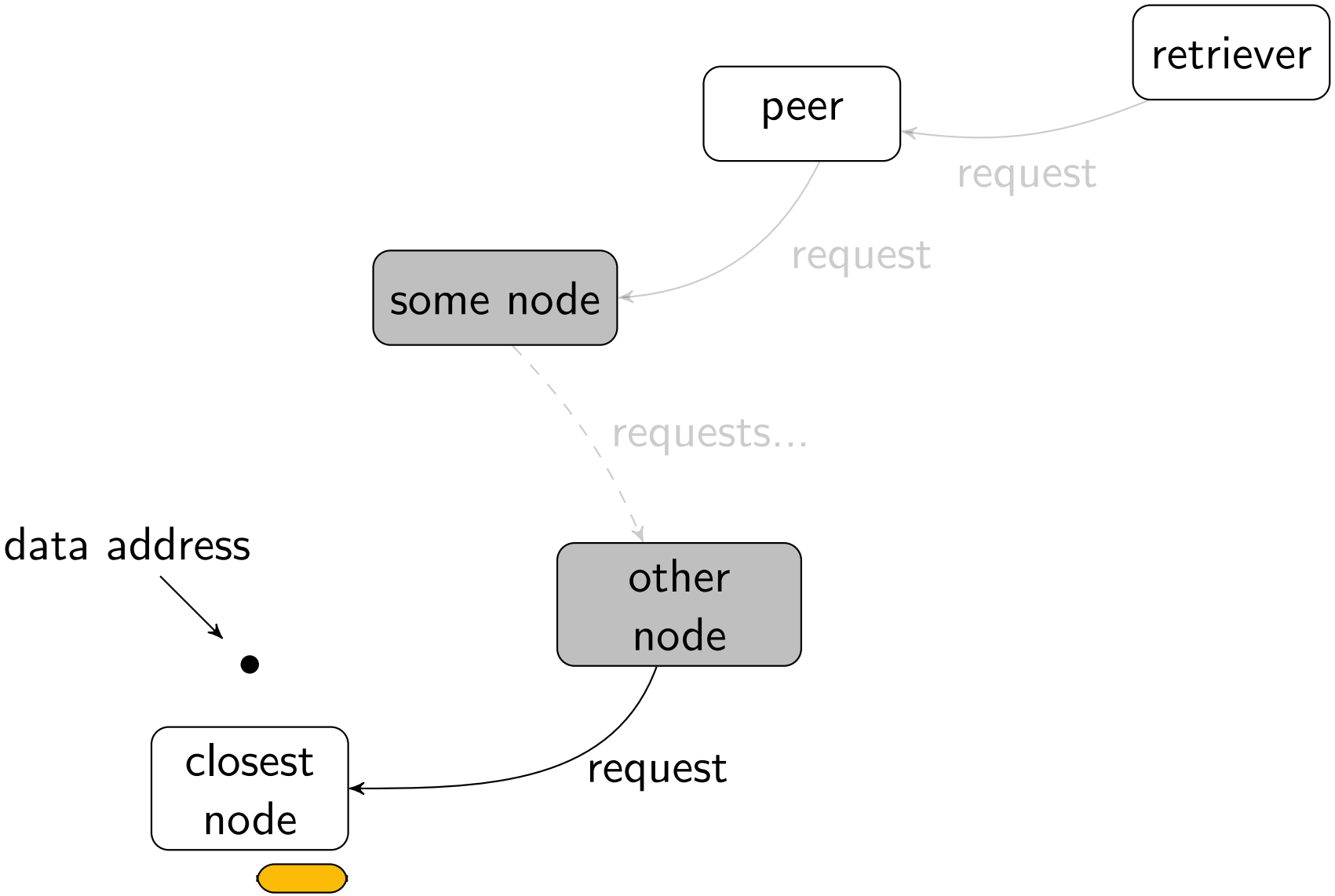

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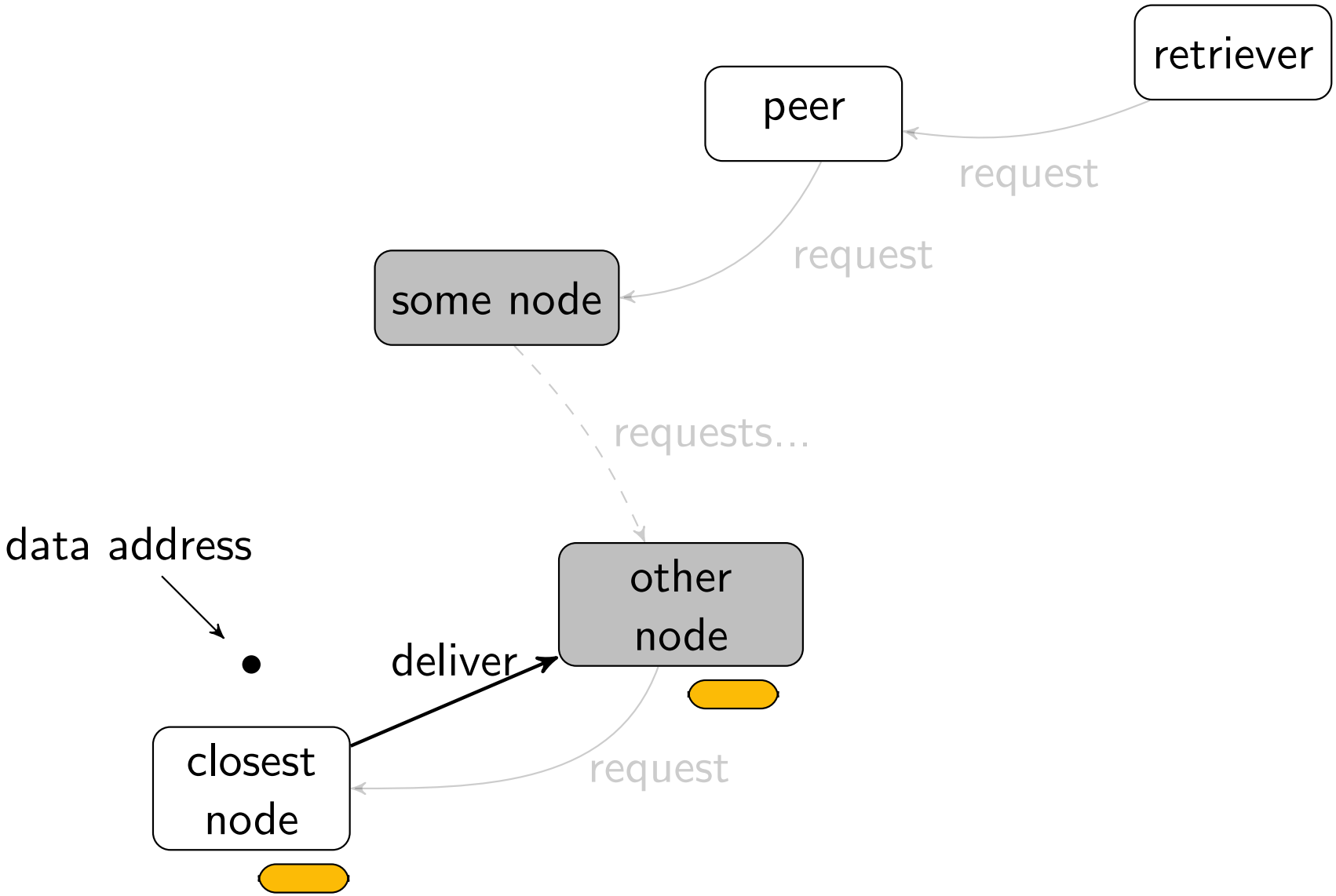

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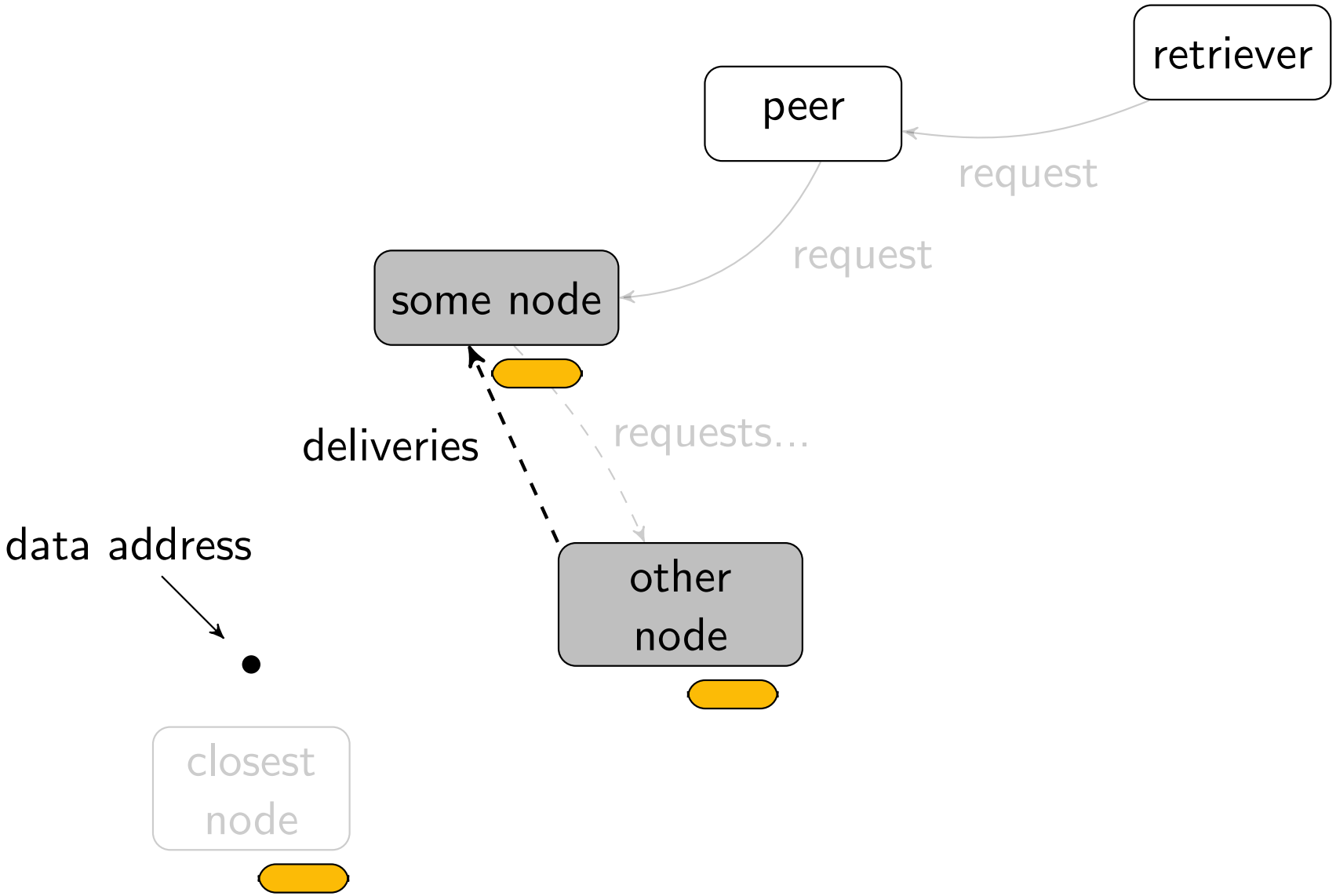

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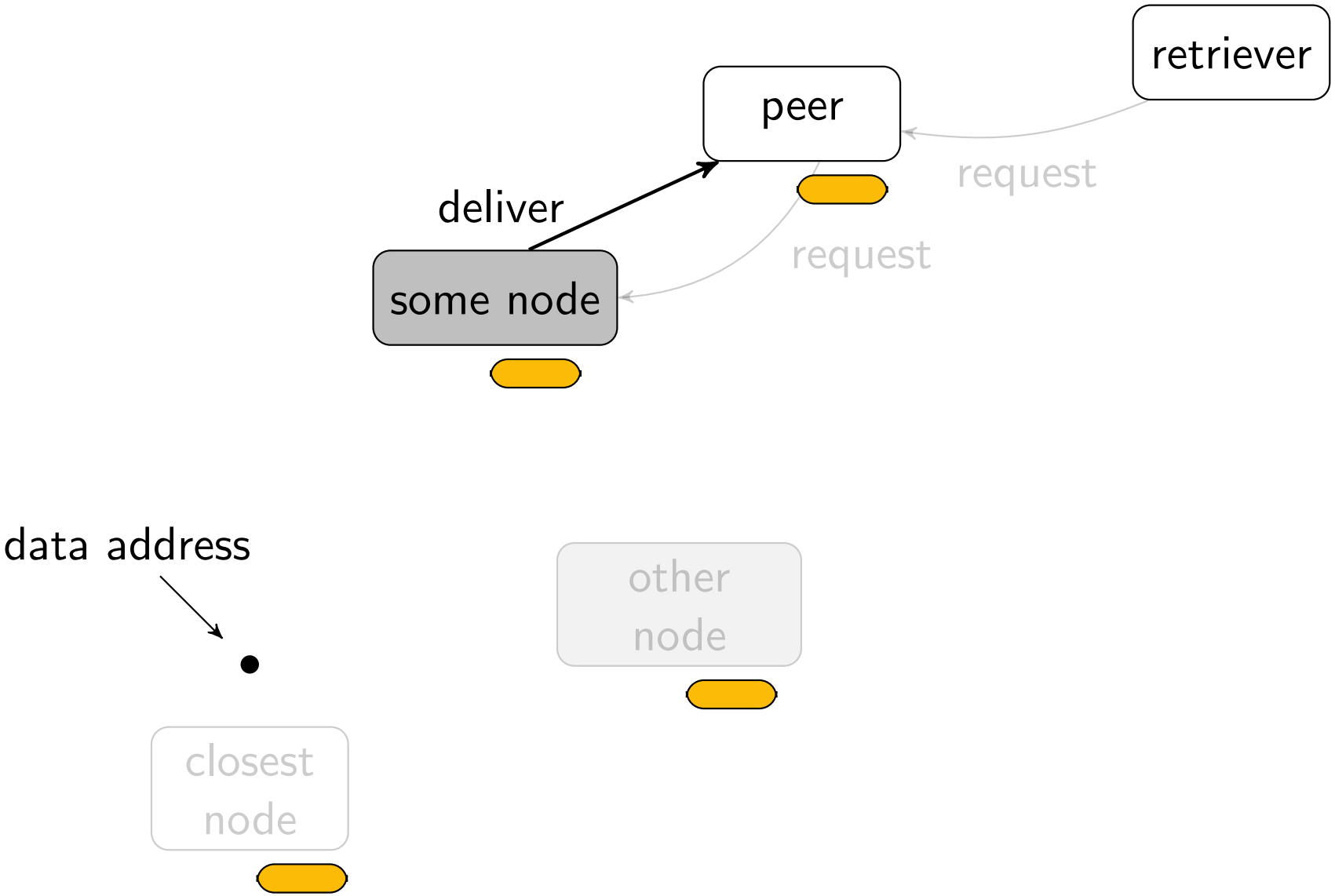

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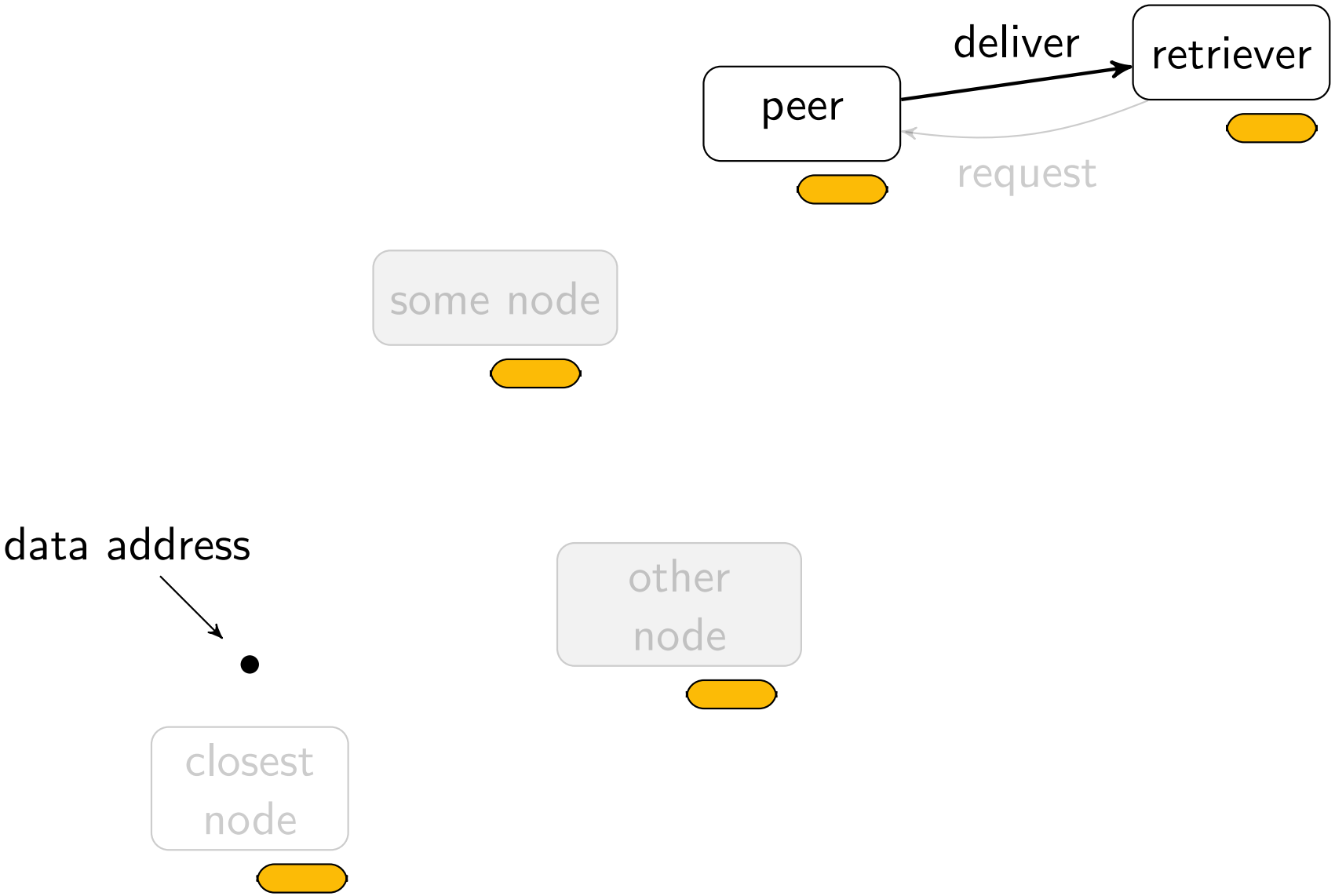

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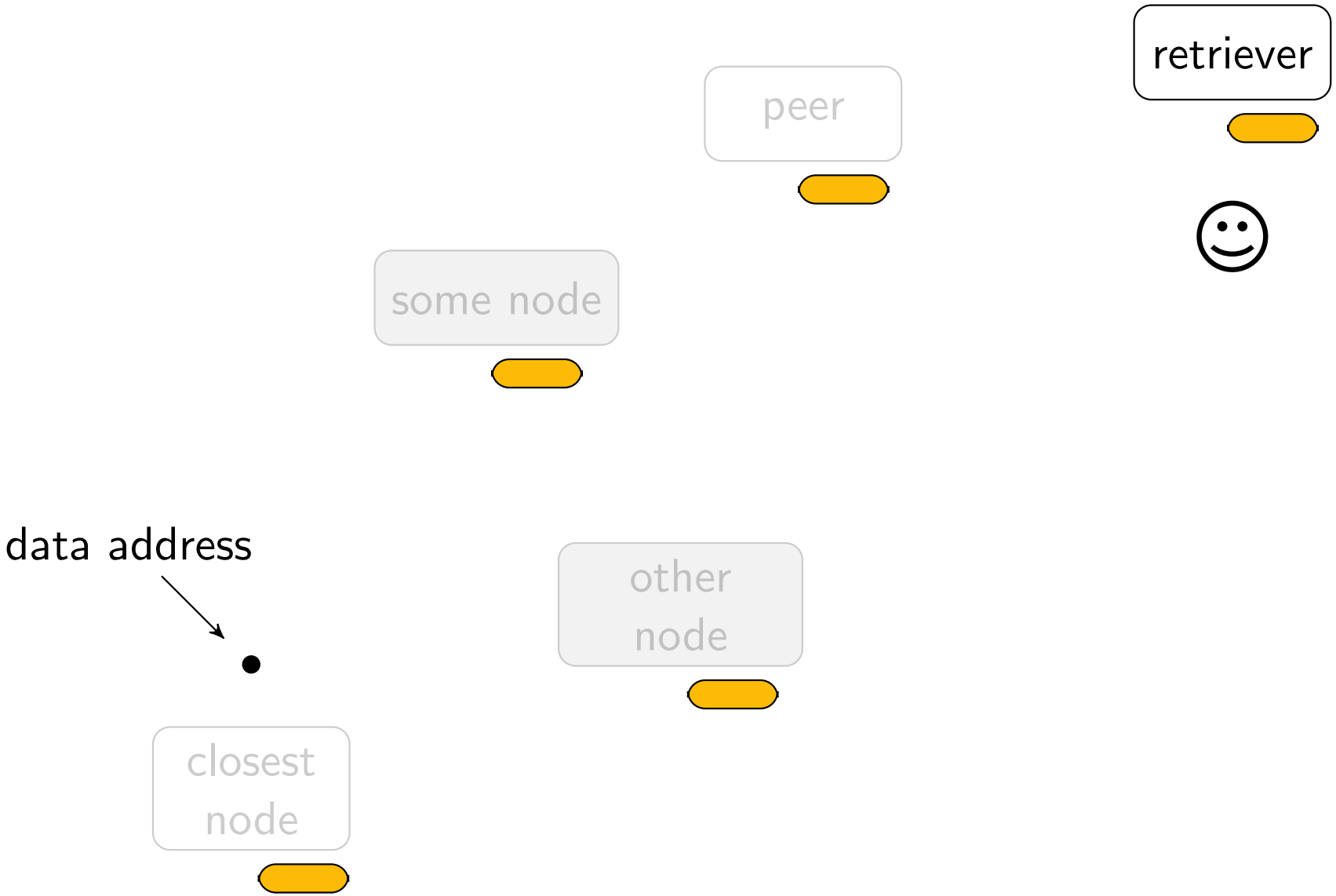

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per-peer bandwidth accounting

keeps track of all data retrieved
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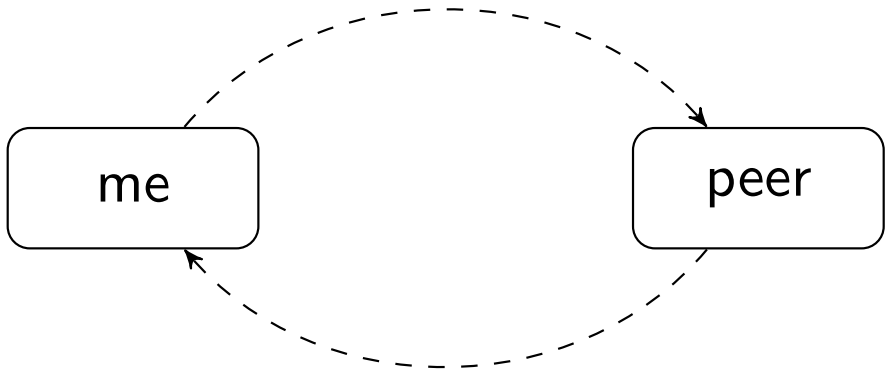

SWAP: swarm accounting protocol

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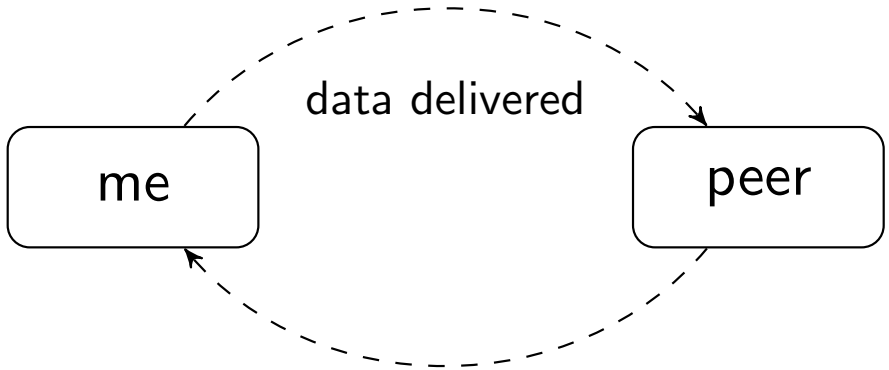

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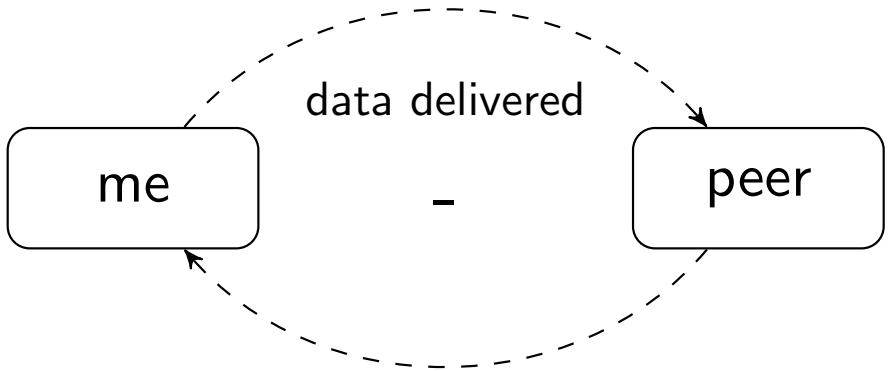

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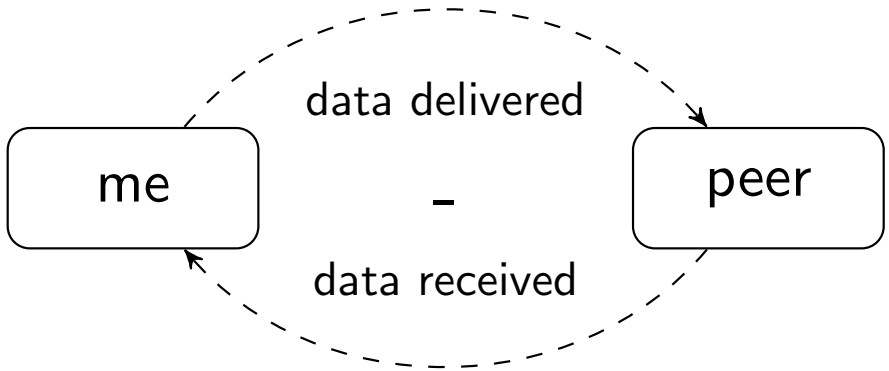
settlement

service for service or tally too imbalanced $\rightarrow$ a *payment* is initiated



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SWAP will soon also be usable via *payment channels* (see Raiden).

chequebook vs payment channel

chequebook

pro:

- offchain payments
- low barrier to entry (pay anyone)

con:

- cheques can bounce (payment not guaranteed)

channel

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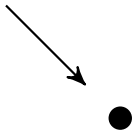
SWARM + SWAP demonstrates

- programmable incentives
- drive towards low latency retrieval
- auto-scaling delivery network

swarm CDN is auto-scaling

data address



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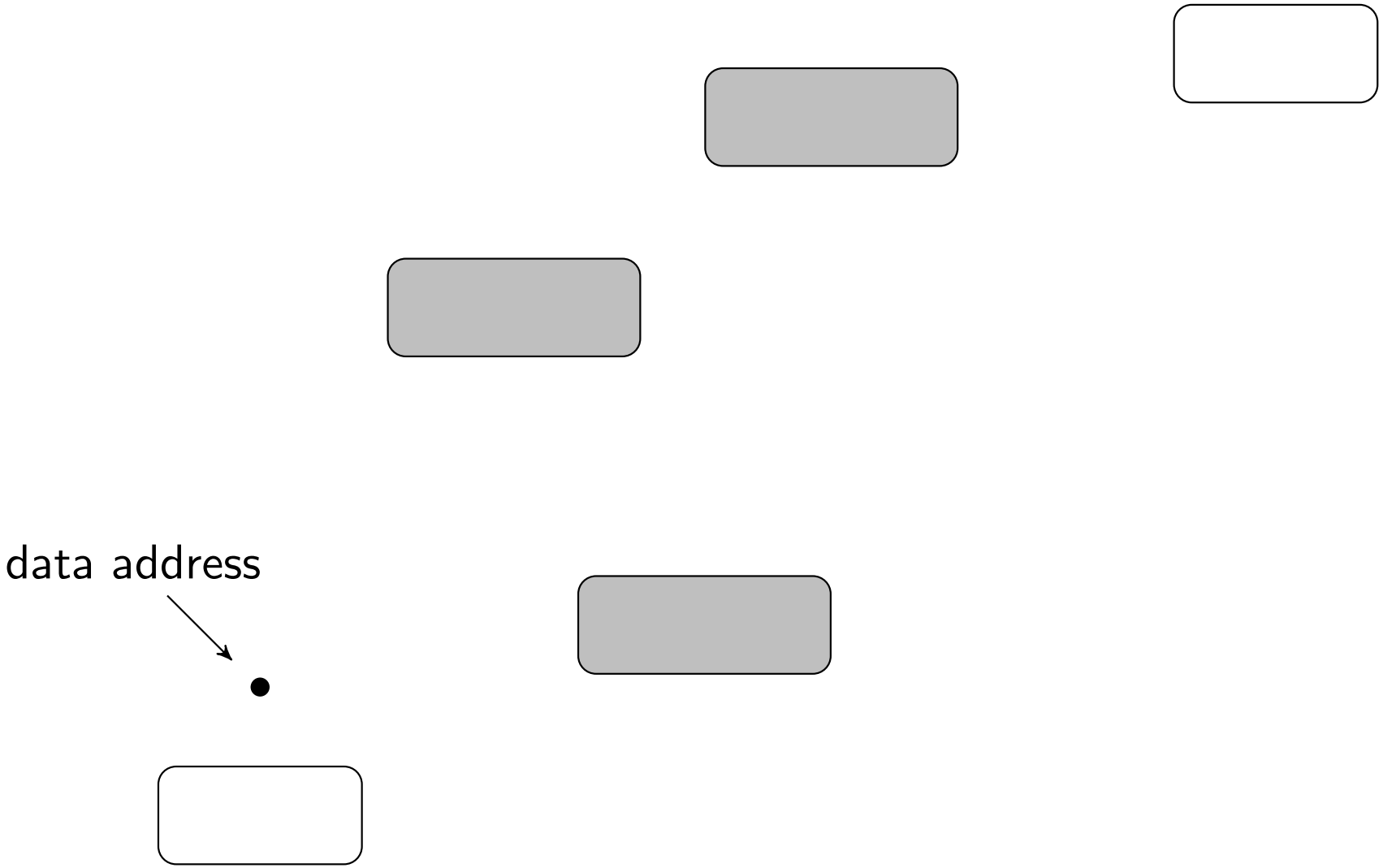

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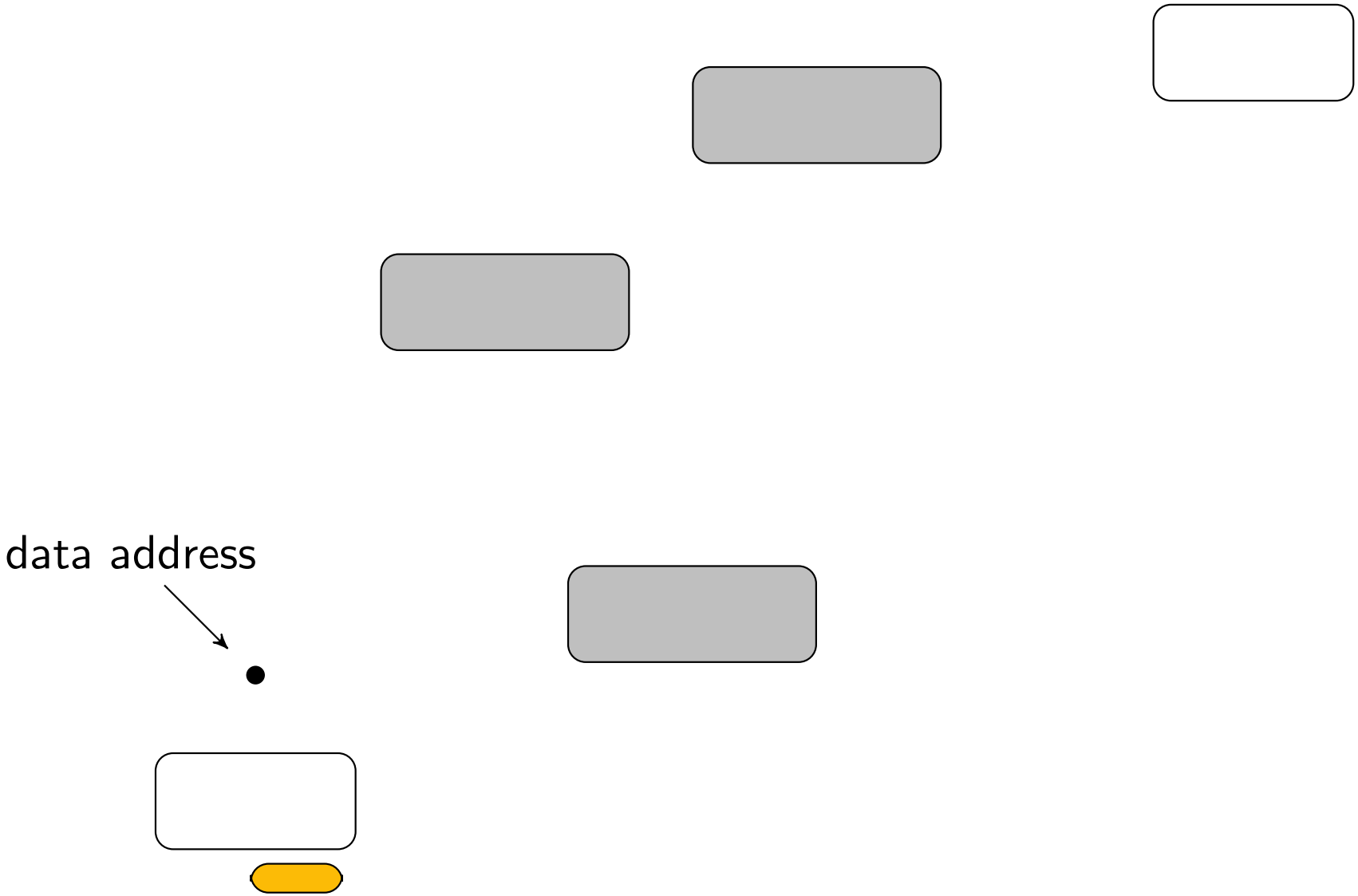

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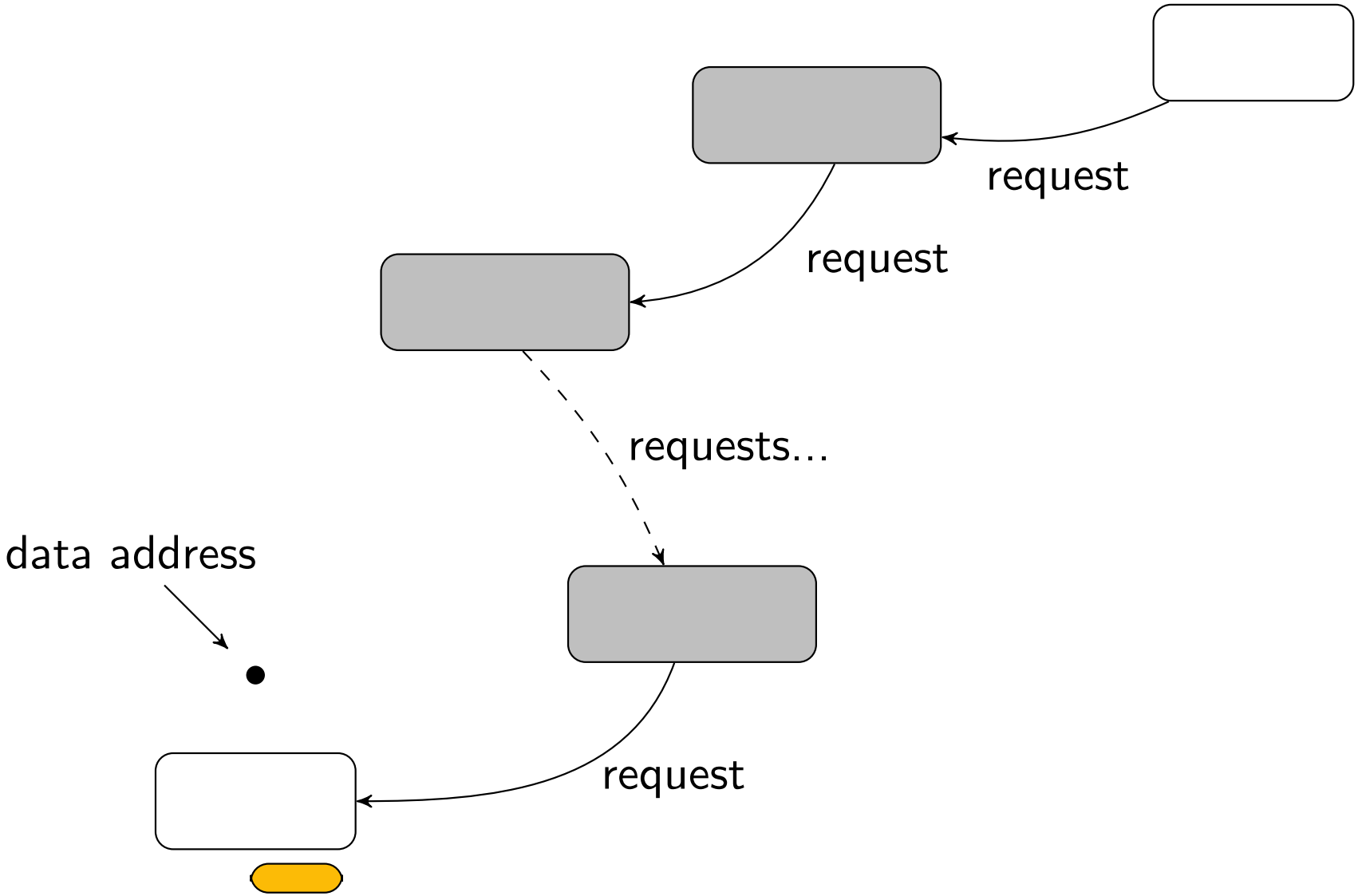

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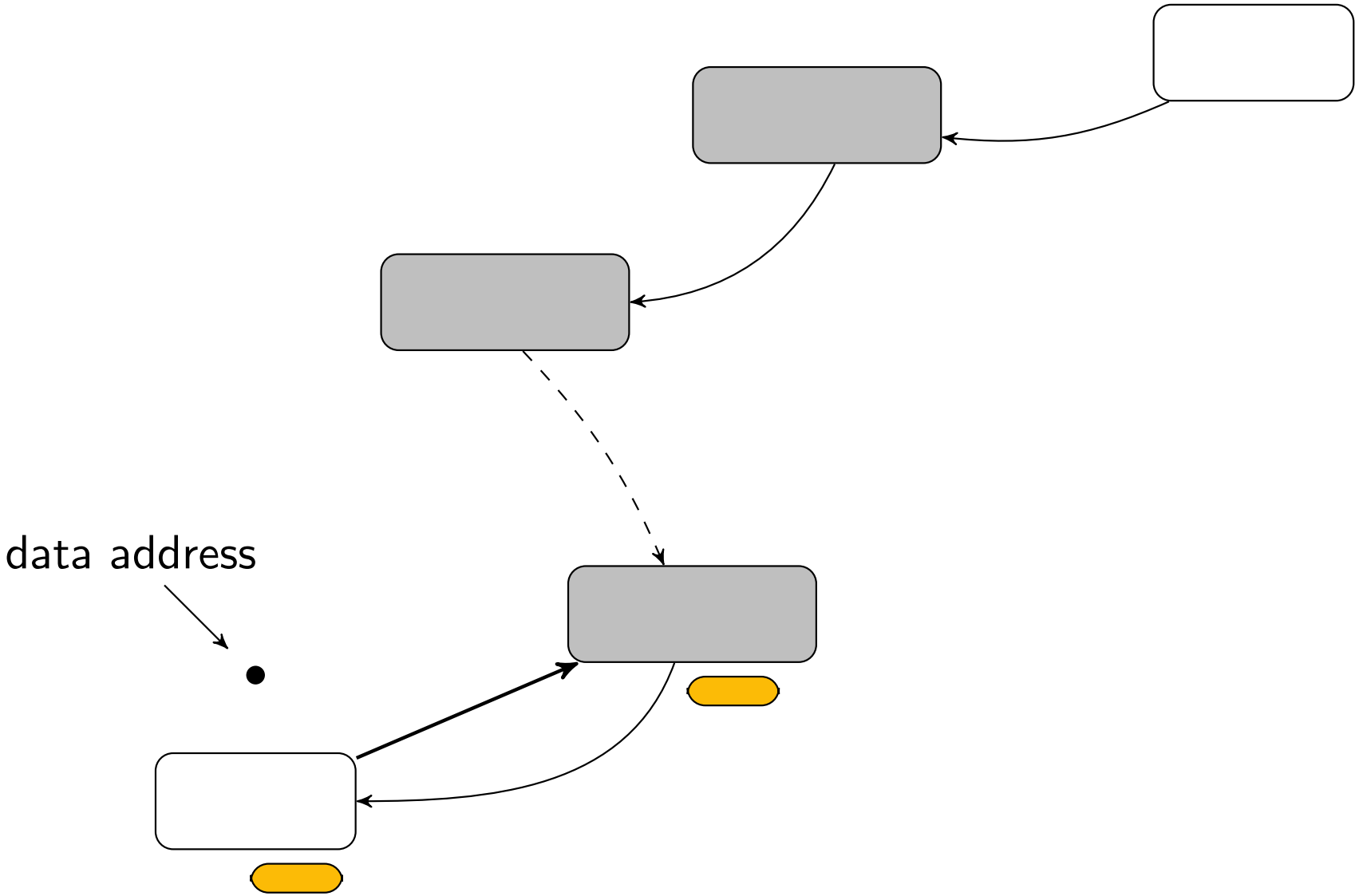

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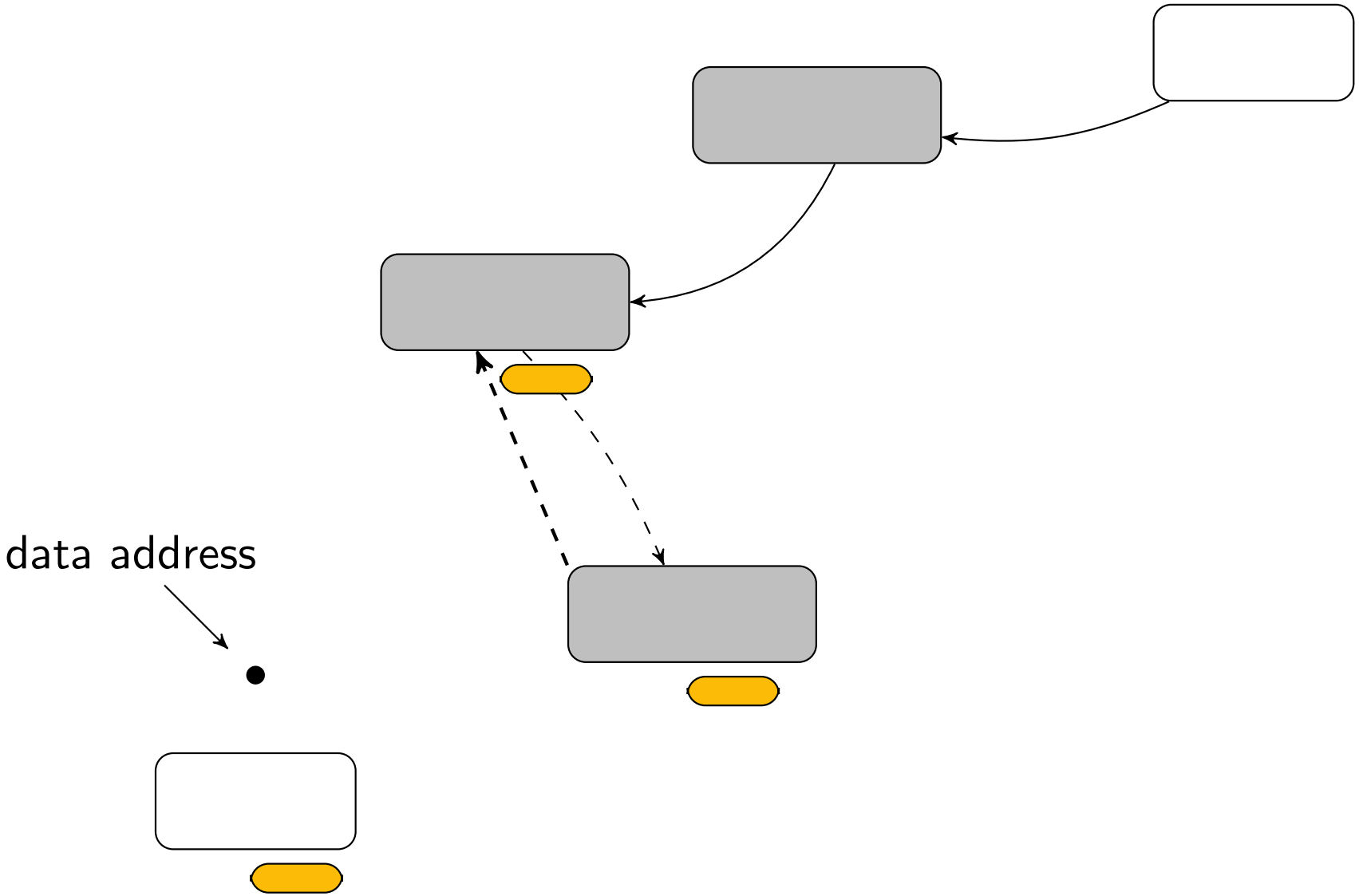

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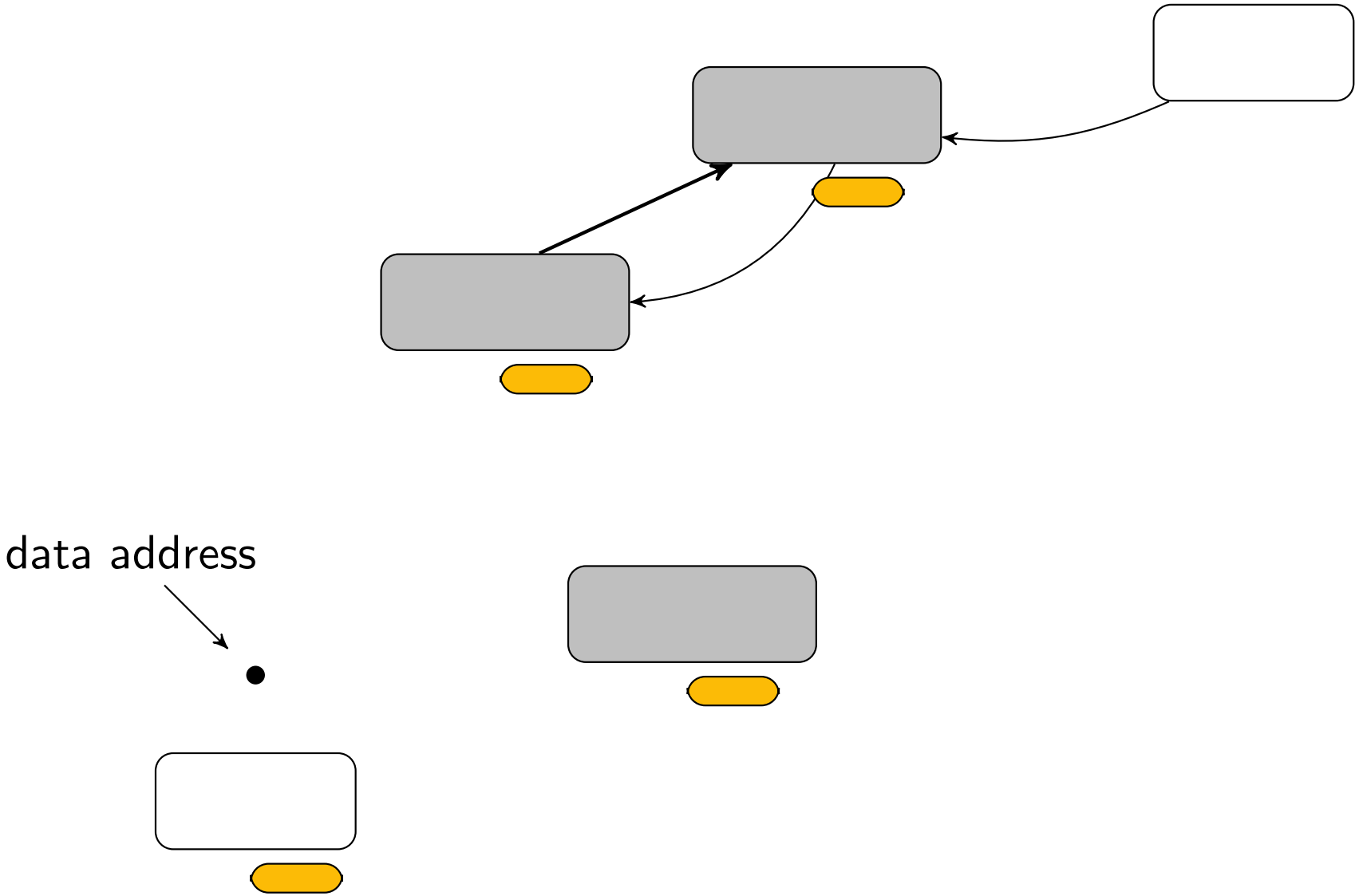

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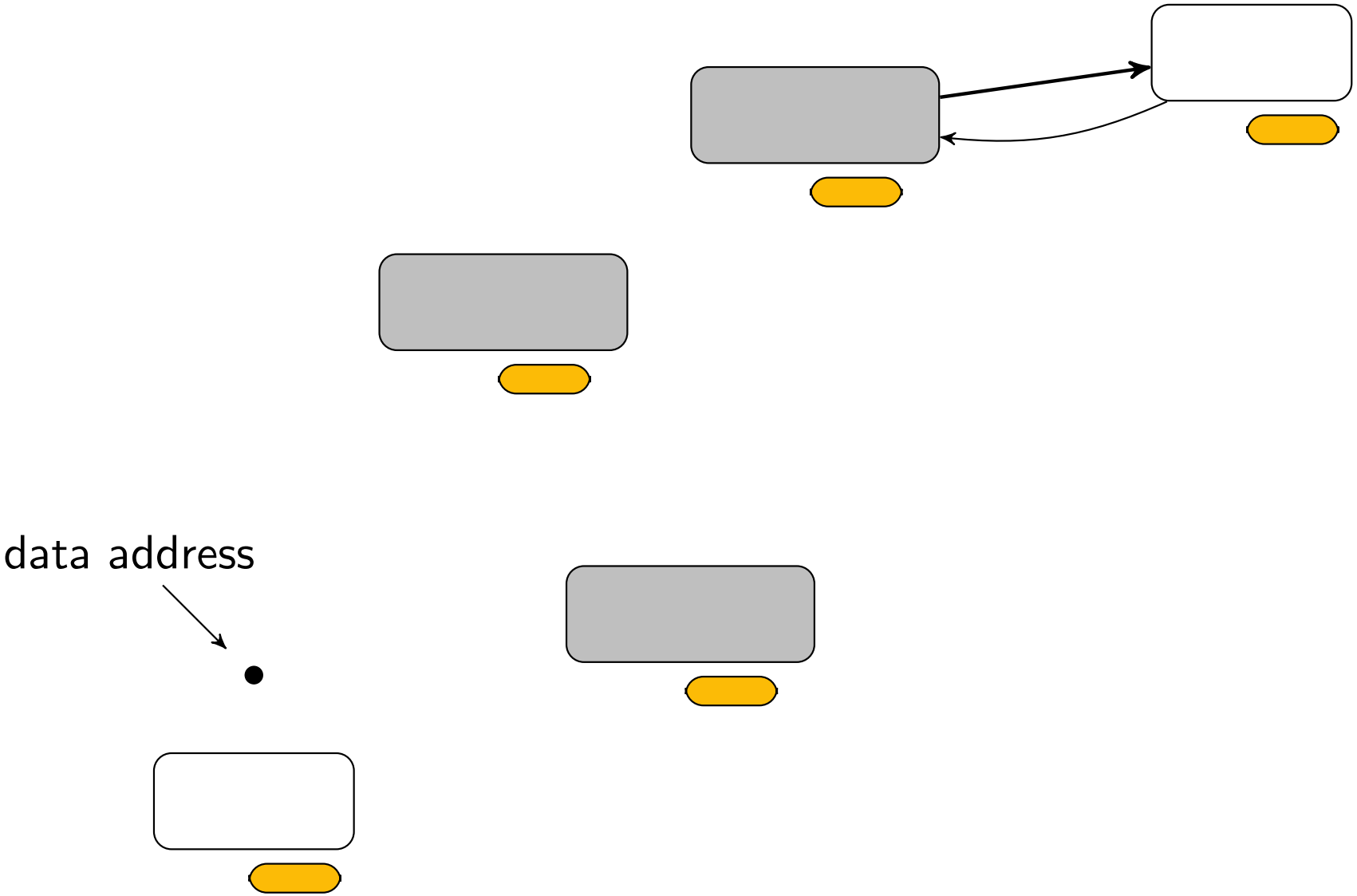

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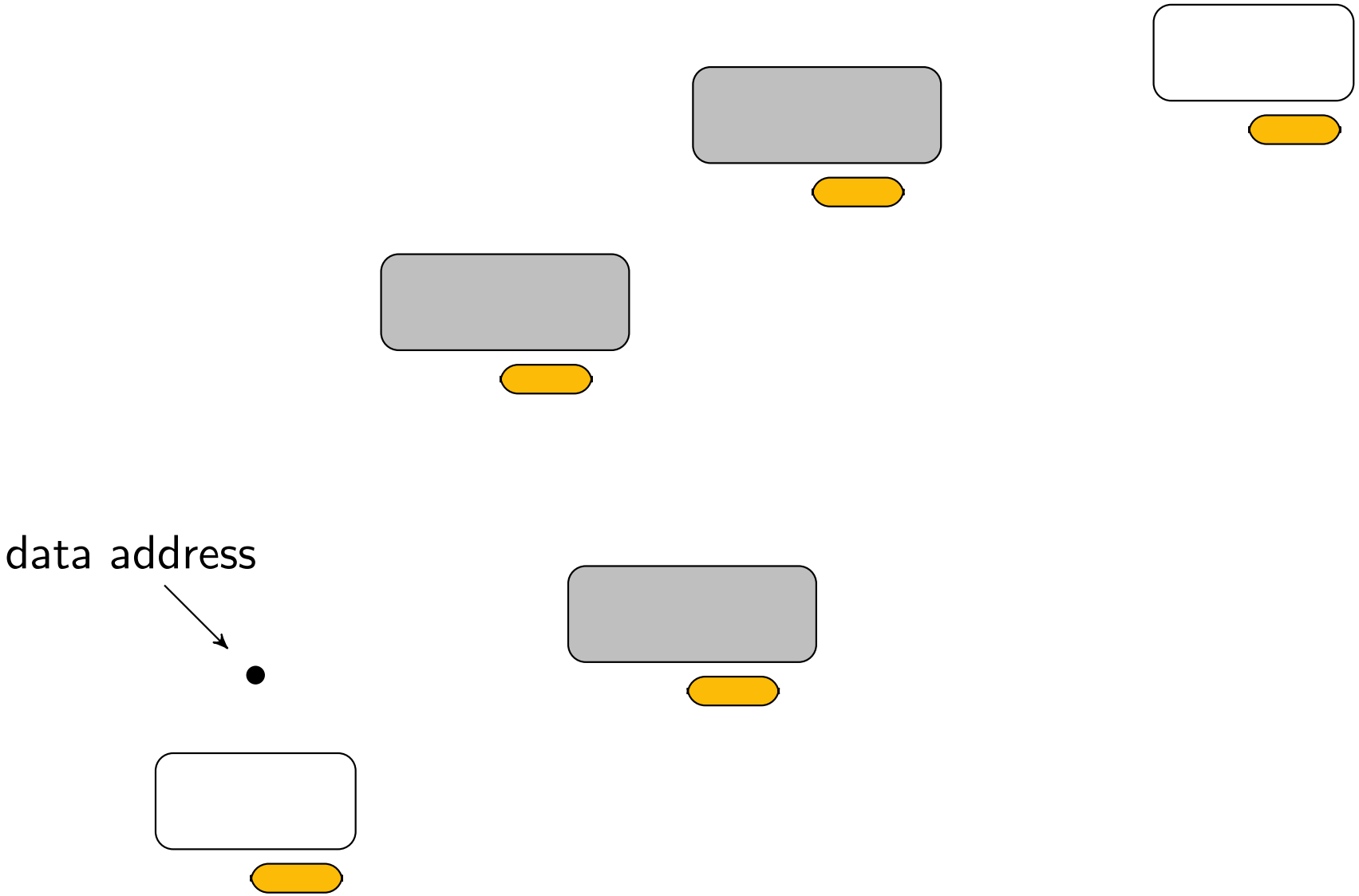

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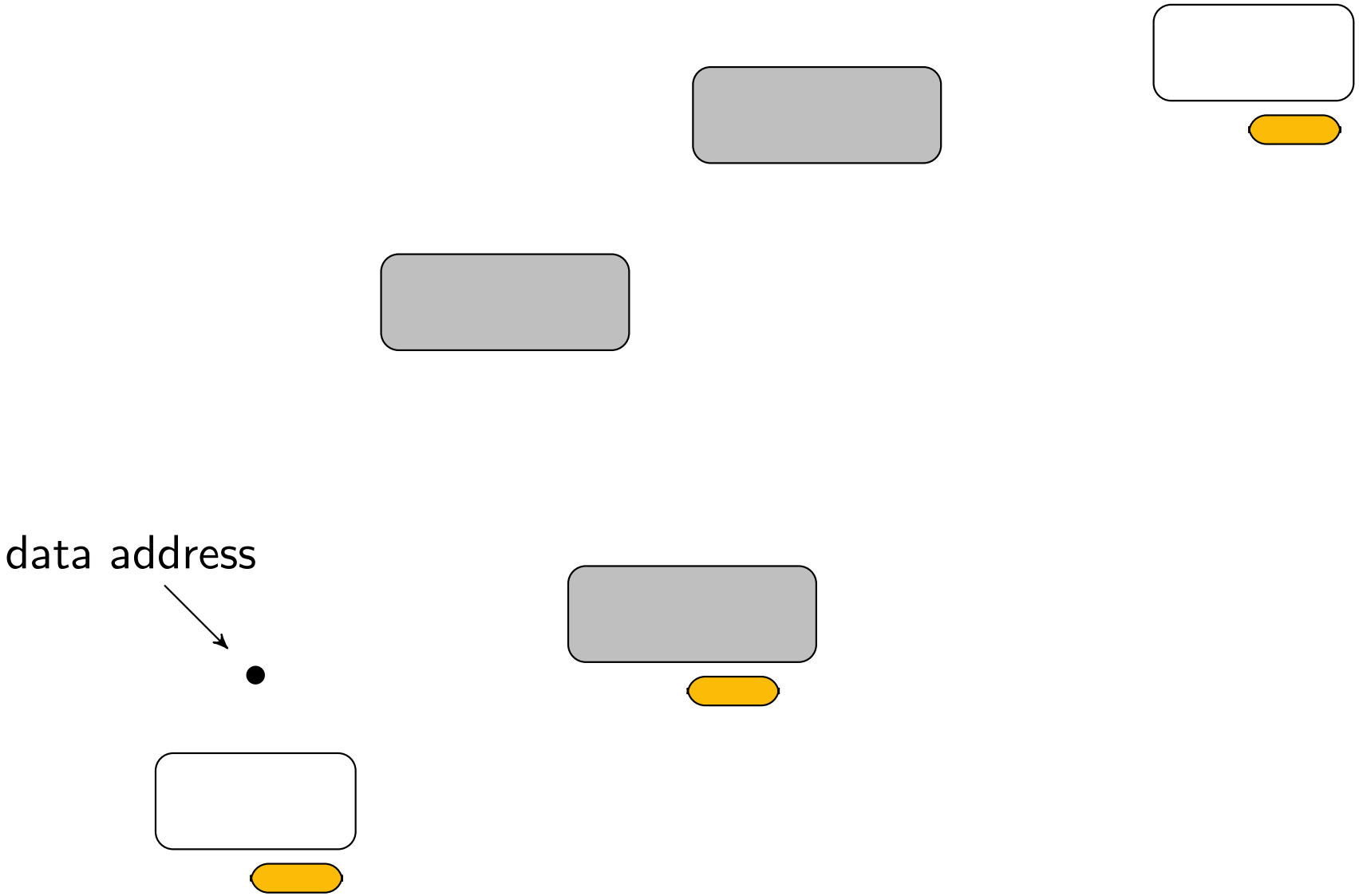

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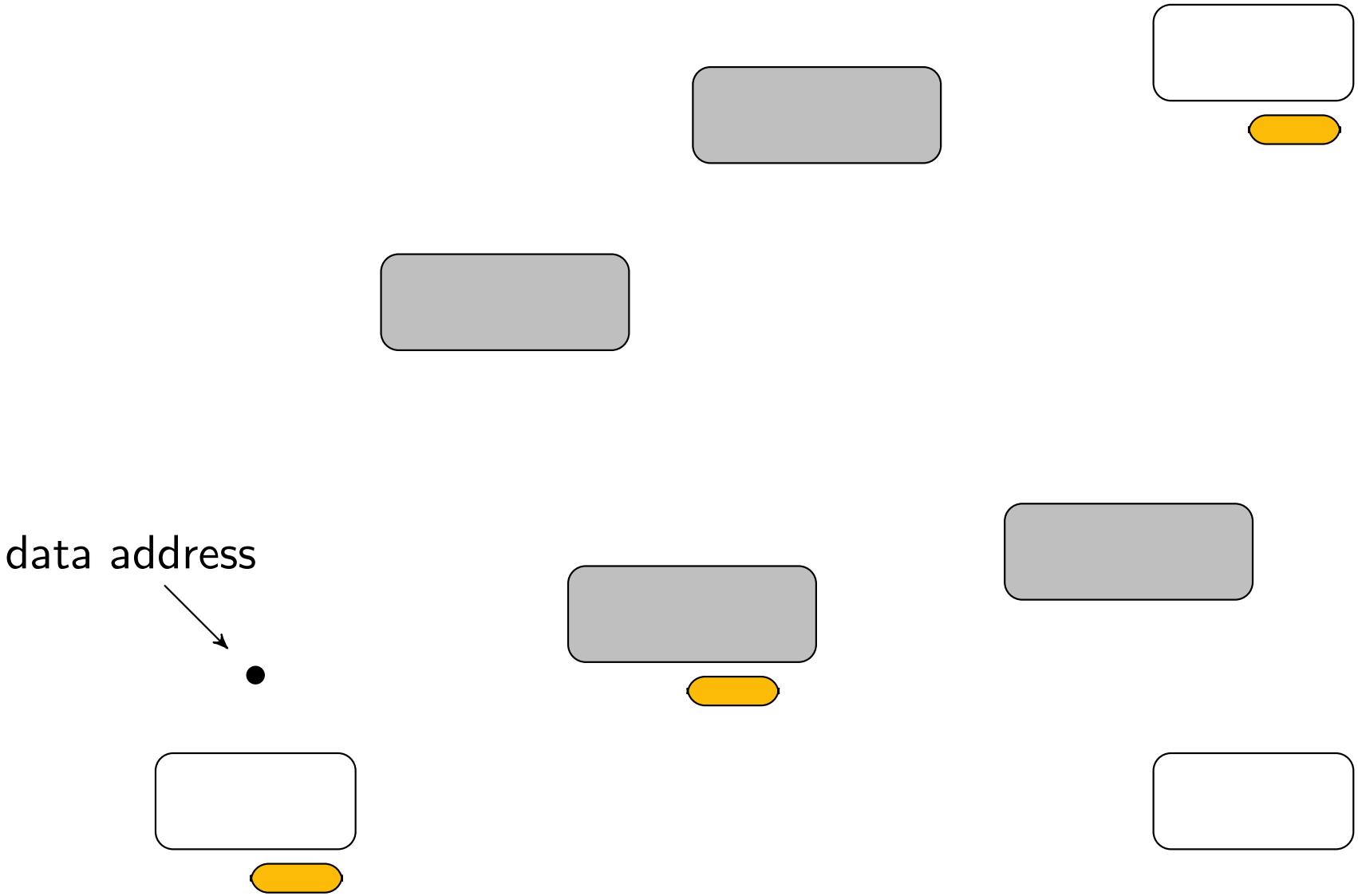

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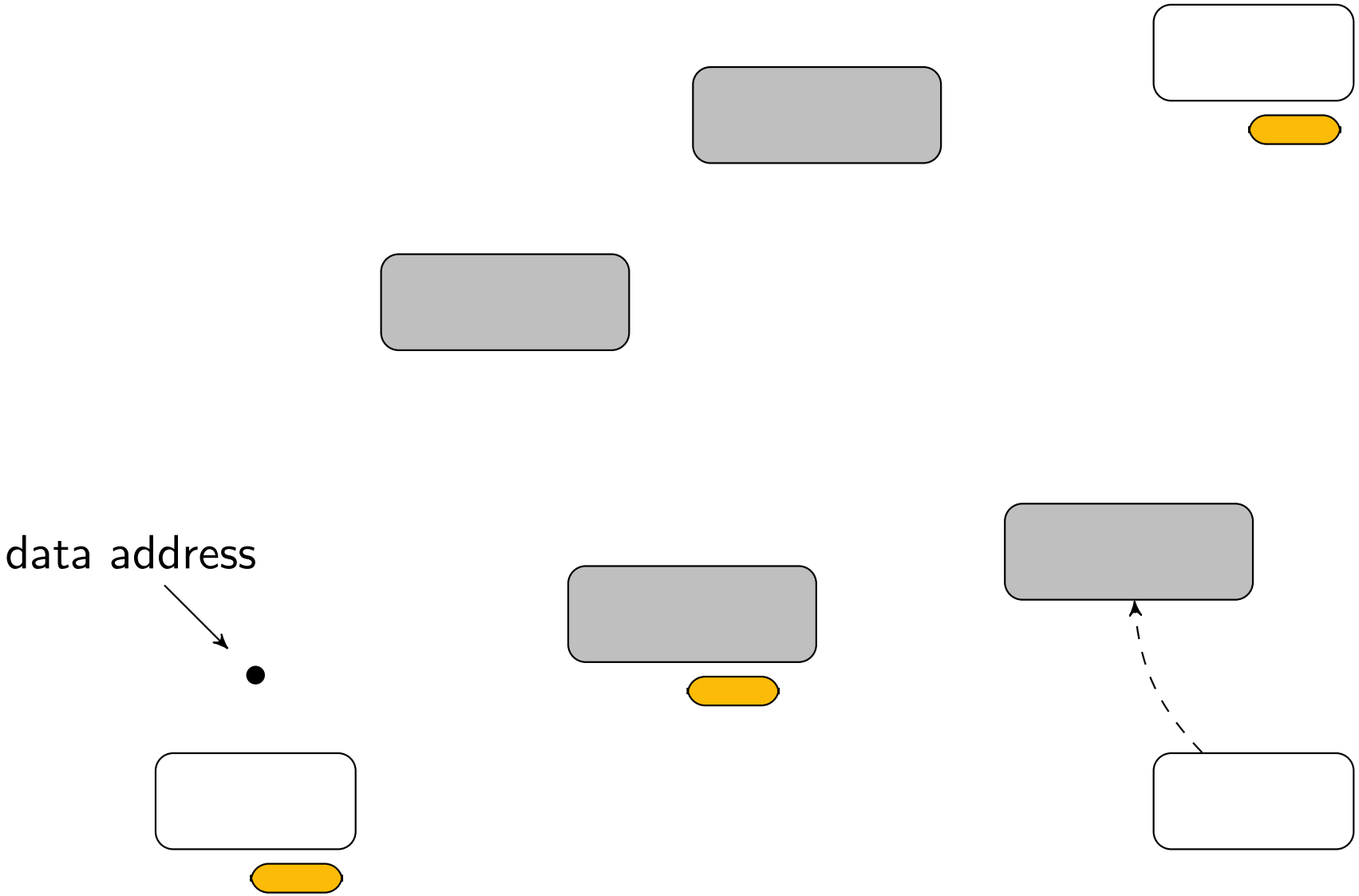

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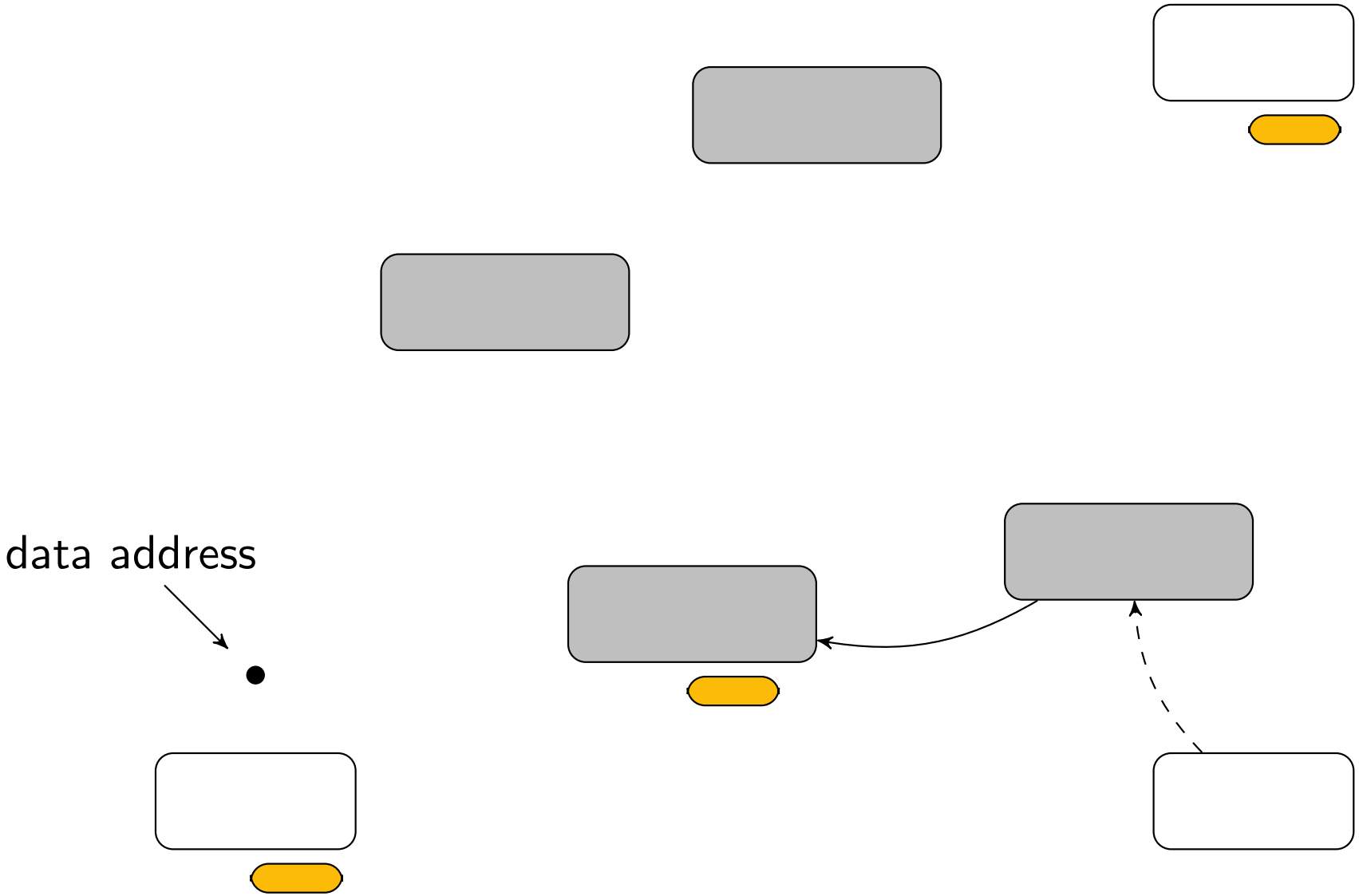

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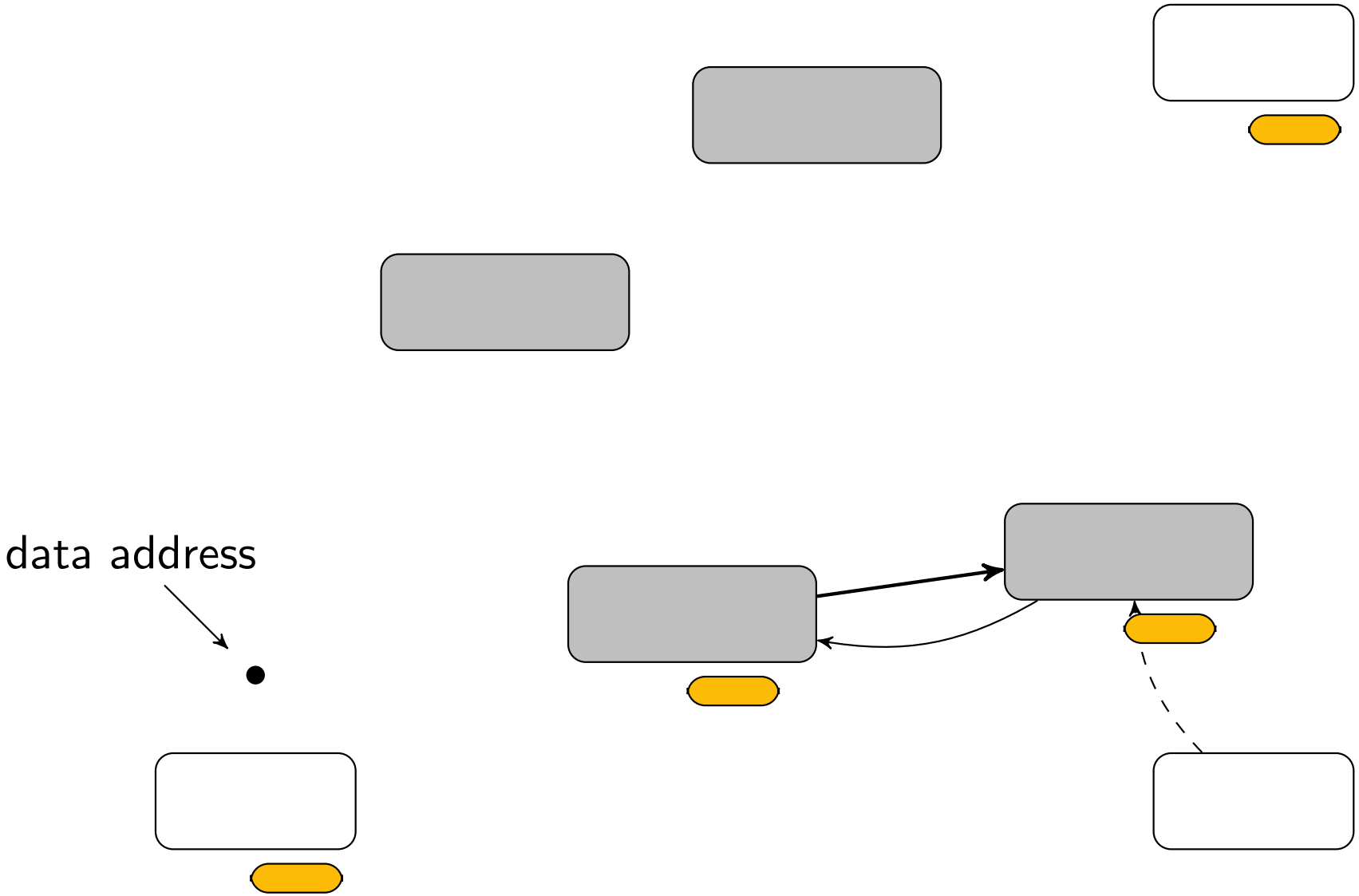

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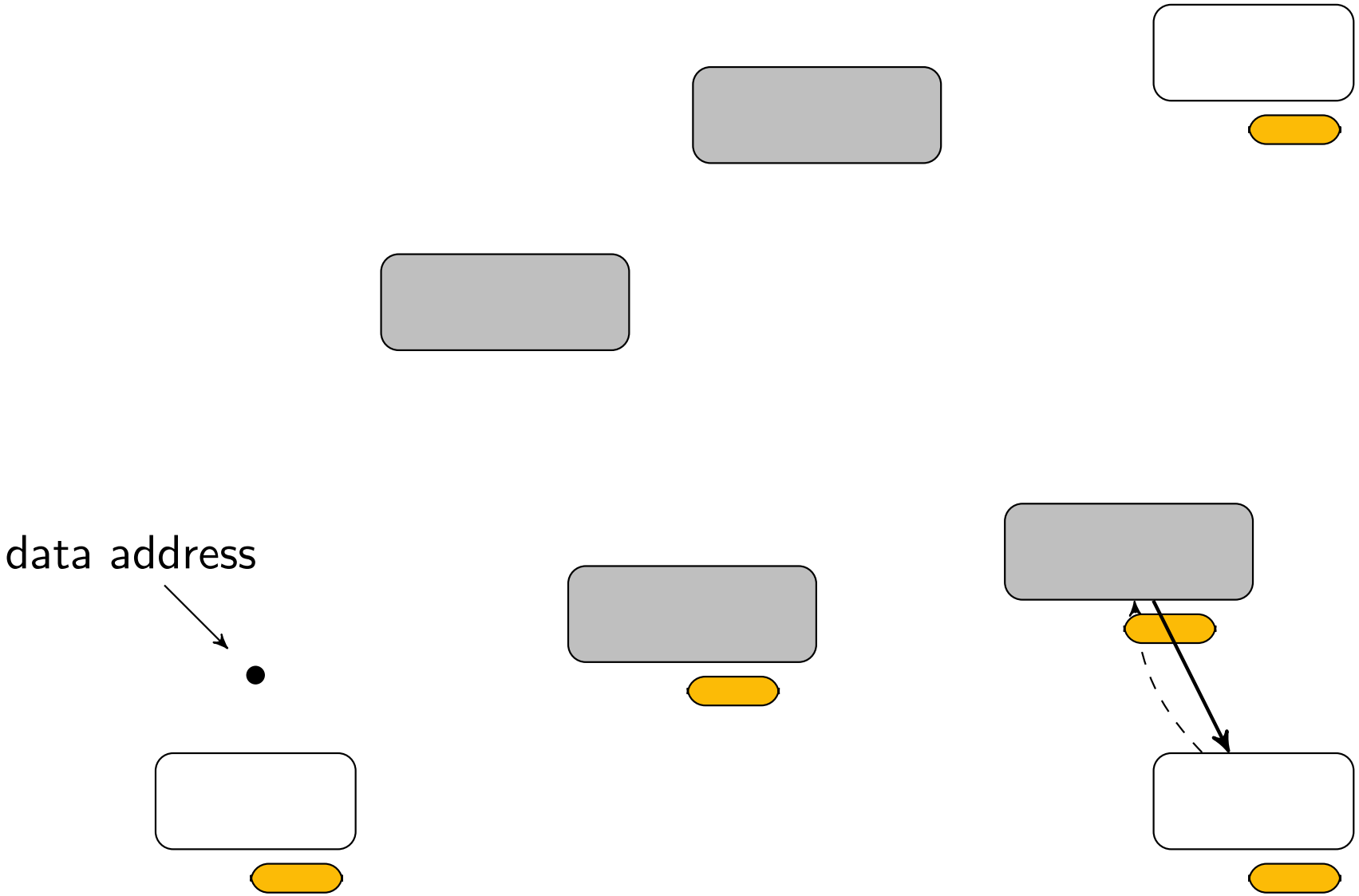

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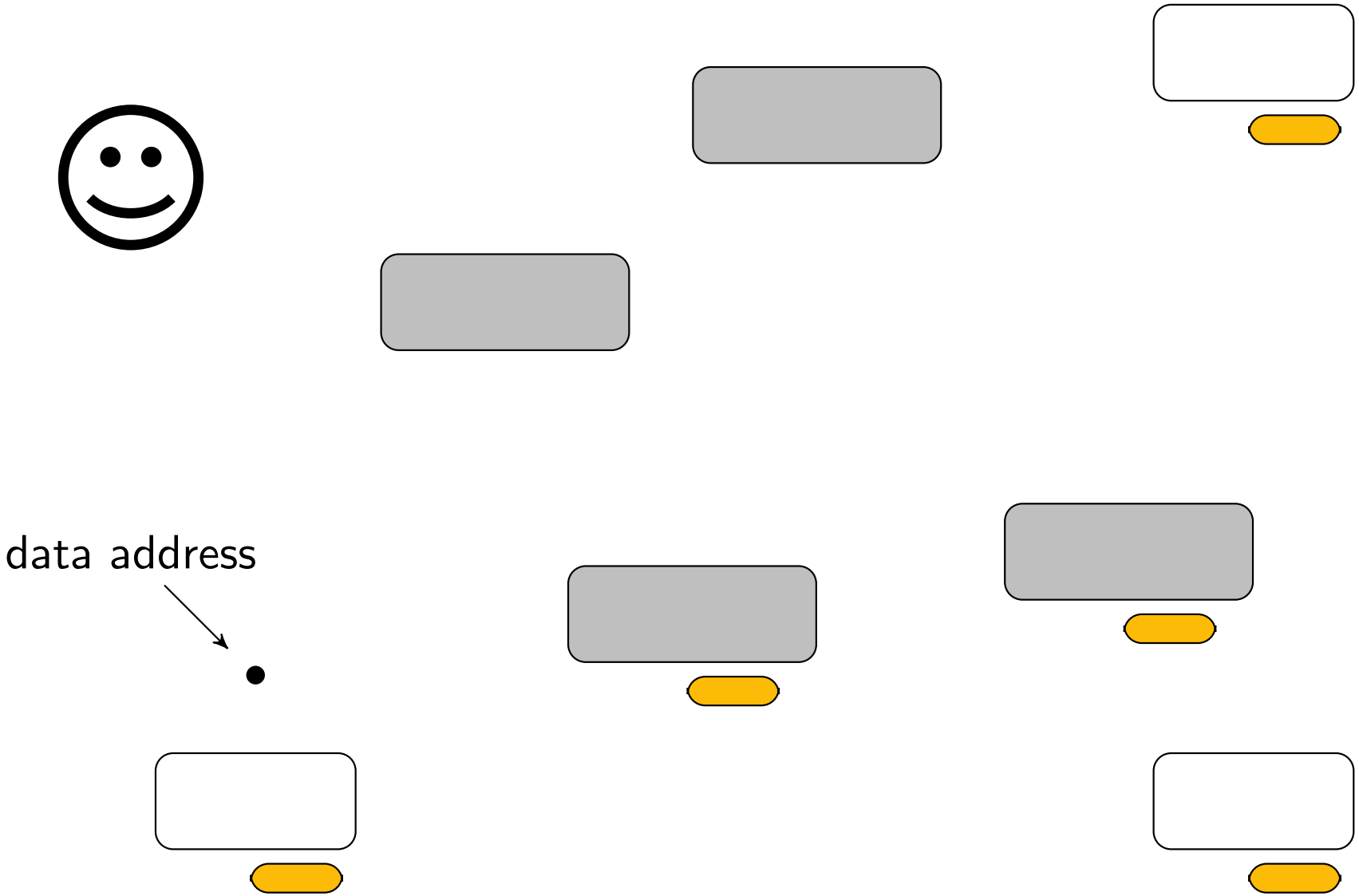


Outline

SWAP allows for speedy retrieval of *popular content*, but there is **no guarantee that less popular content will remain available**. Whatever is not accessed for a long time is likely to be deleted.

The first step: change the swarm's incentives by **paying nodes to store your content**.

payment for proof-of-custody

The basic idea:

1. commit in advance to paying for data to be available in the swarm.
2. over time, challenge the swarm to provide proof that the data is still available: request *proof-of-custody*.
3. every valid proof-of-custody releases the next payment installment to the storing nodes.

Remember:

The **proof-of-custody** here is a small message - a single hash - which cryptographically proves that the issuer has access to the data.

proof of custody + payment channel

These deferred payments constitute a **conditional escrow**: payment is made up-front, payment is held (escrow) and is only released when a valid proof-of-custody is received (condition).

This procedure can be handled off-chain and can be directly **integrated into the payment channels.** All you need is a payment-channel *judge contract* that can understand swarm storage receipts.

If data goes missing...

If data goes missing nodes will lose potential revenue for no longer being able to generate proofs-of-custody, but there are *no further consequences* (yet).

Therefore, to complete the storage incentive scheme, we introduce an *insurance system* the can **punish offending nodes for not keeping their storage promises**.

SWEAR: **sw**arm **e**nforcement of **a**rchiving **r**ules

SWEAR to store

SWEAR is a smart contract that allows nodes to register as long-term storage nodes by posting a **security deposit**.

Registered nodes can sell promissory notes guaranteeing long-term data availablilty – essentially insurance against deleting.

Implementation: swarm syncing process with added receipts.

insured upload to swarm

syncing

insured upload to swarm

syncing

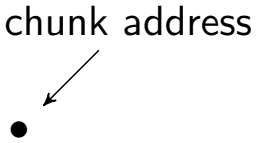
owner

insured upload to swarm

syncing

- chunks to be stored at the nodes whose address is closest to the chunk ID

owner



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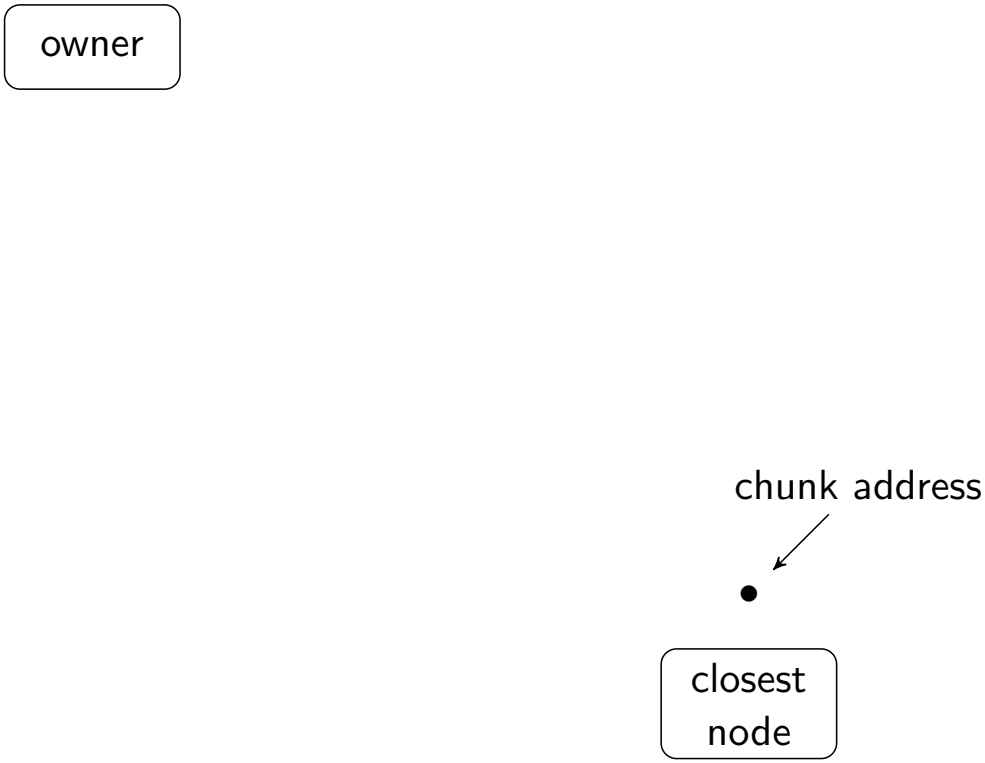

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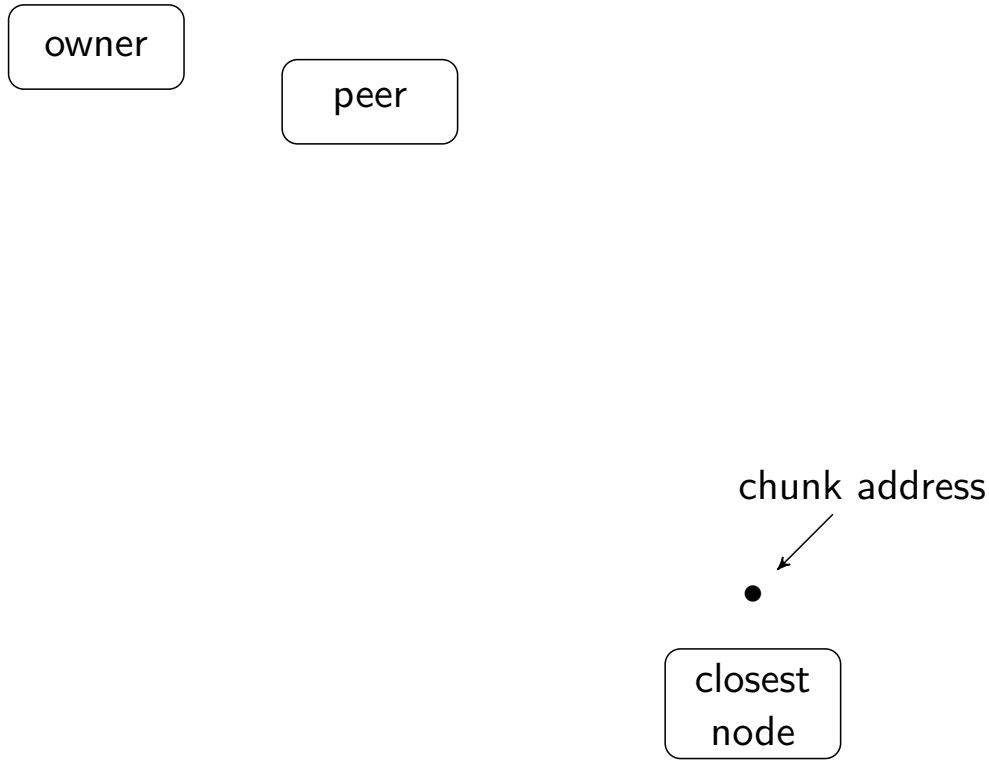
- relaying: syncing



insured upload to swarm

syncing

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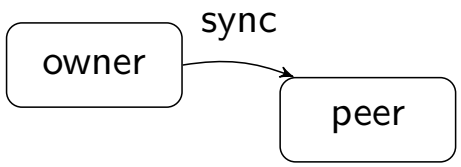

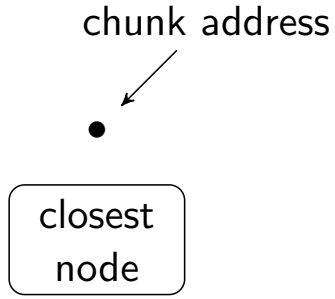

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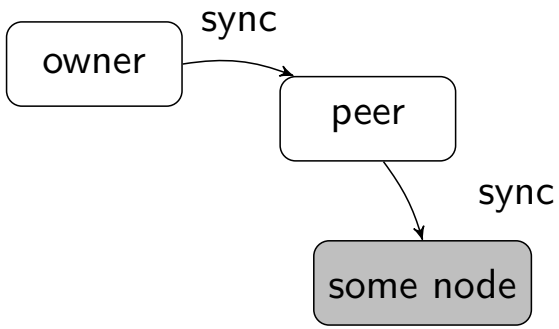
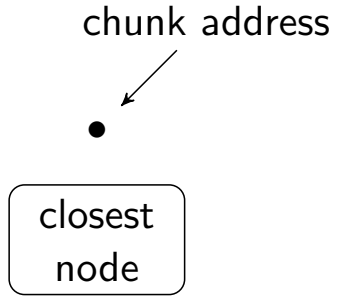
- data is passed on from node to node





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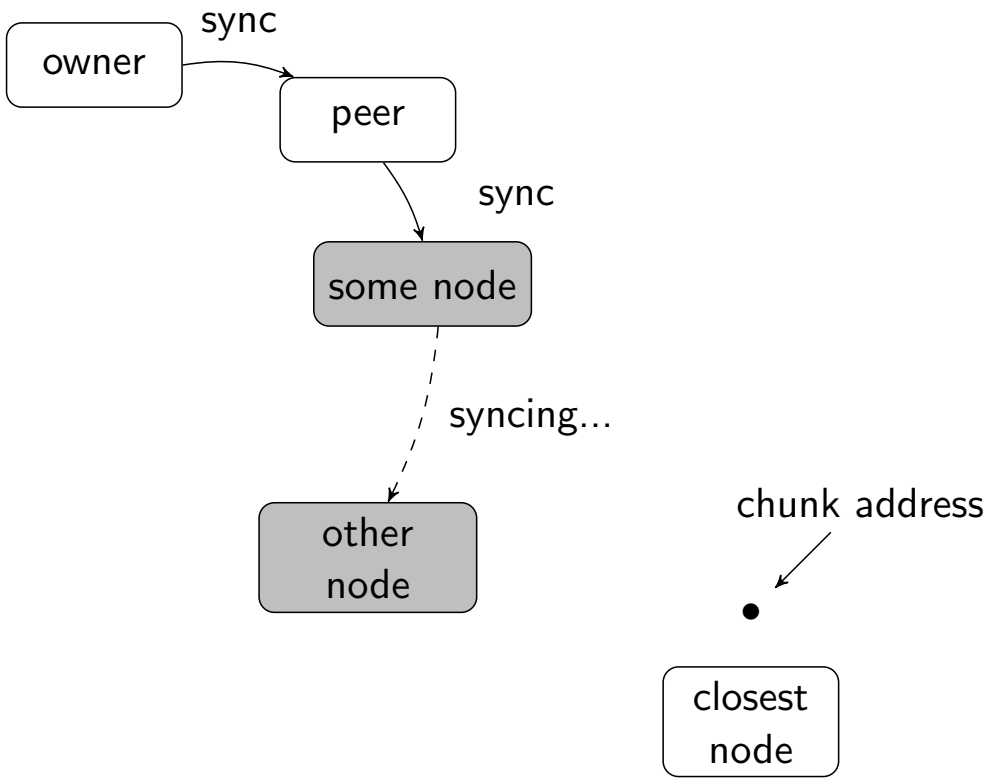

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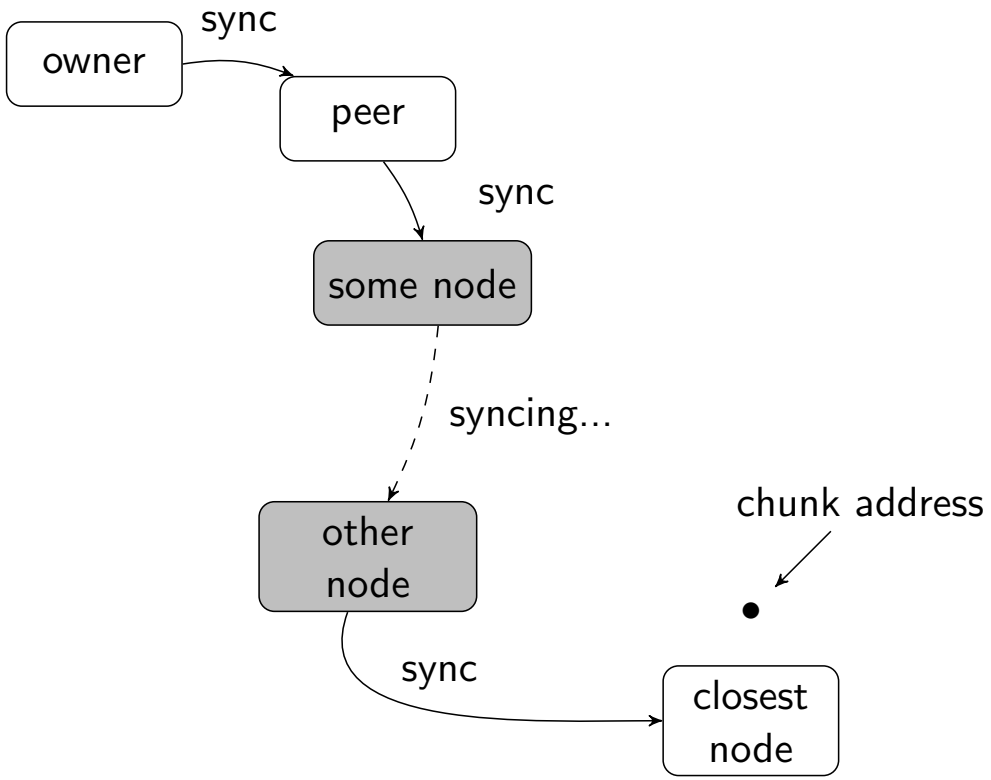

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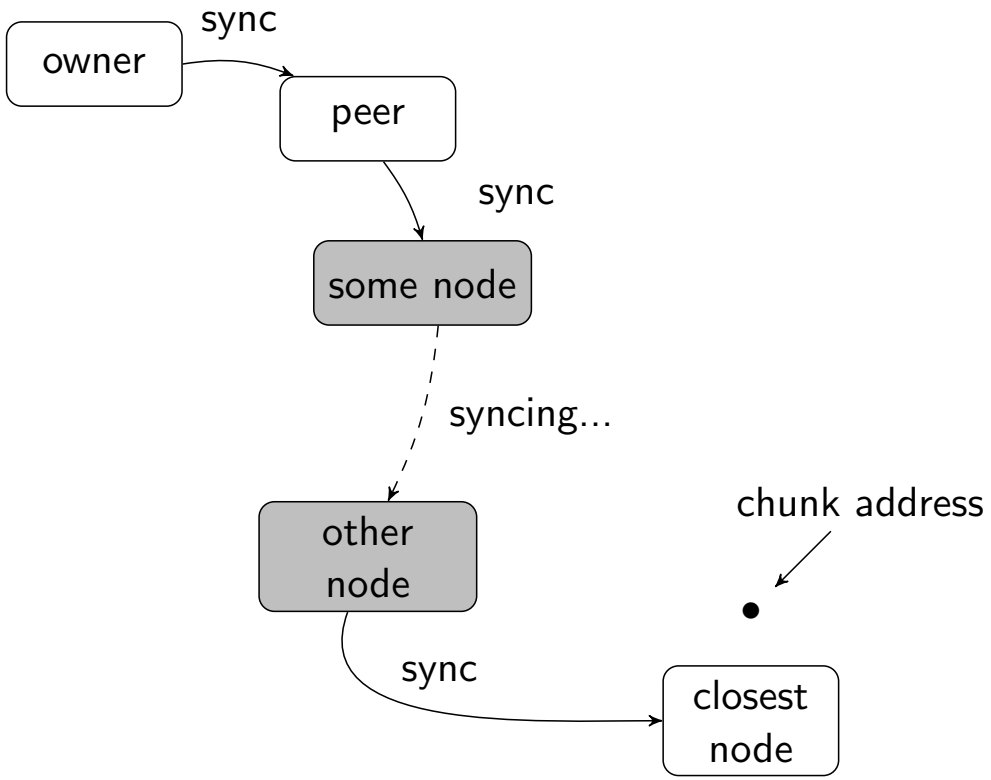

insured upload to swarm

insured storage

syncing via registered nodes with each swap receipted.

insured storage:

- owner passes data to a registered peer and receives an insurance receipt
- relaying: syncing
- all receipts are accounted and paid for

insured upload to swarm

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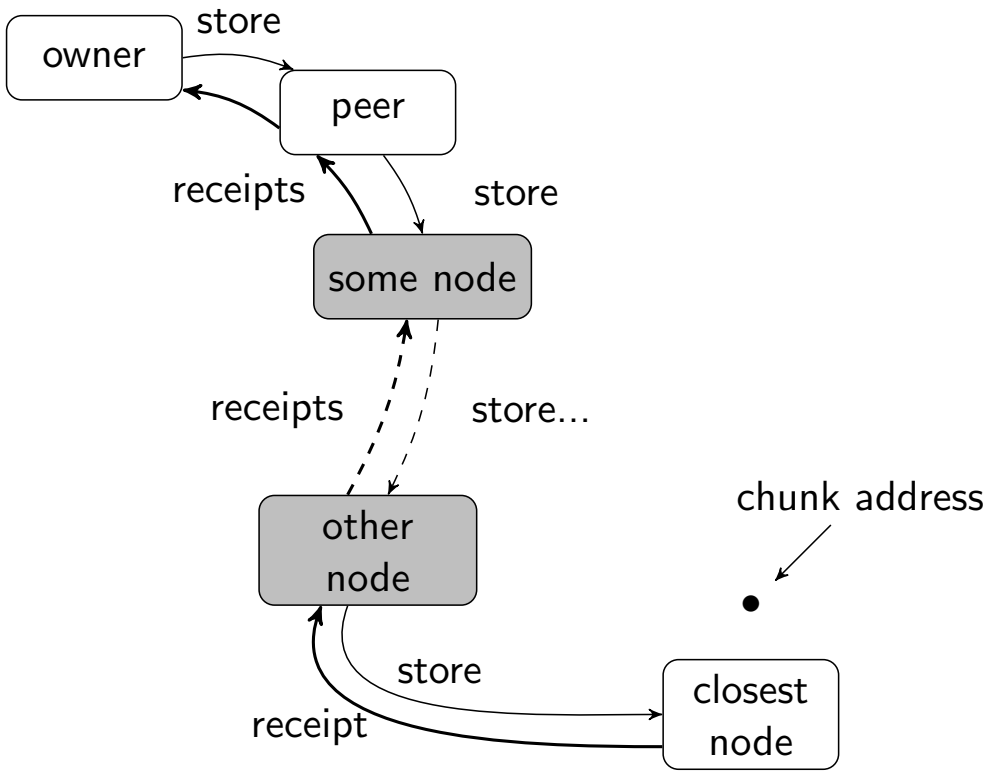

SWINDLE: **s**torage **w**ith **in**surance **d**eposit, **l**itigation and **e**scrow

SWINDLE

TL;DR

if insured data is lost, the storers lose their deposit

litigation upon data loss

if insured data is not found

litigation by challenge

defense by providing

- proof-of-custody of the data (eventually the data itself)
- a storage receipt for the data, shifting the blame and implicating another node as the culprit.

upload and disappear

- swear to sync and receipting → immediate settlement with the peer at upload
- finger-pointing along chain of receipts → correct accountability of storer thereafter

SWAP • SWEAR • SWINDLE

ethersphere orange paper series

Viktor Trón, Aron Fischer, Dániel Nagy A and Zsolt Felföldi, Nick Johnson: swap, swear and swindle: incentive system for swarm. May 2016

Viktor Trón, Aron Fischer, Nick Johnson: smash-proof: auditable storage for swarm secured by masked audit secret hash. May 2016

swarm: status and usage

what is the development status of swarm?

1. golang implementation: proof-of-concept iteration 2 release 4, code has been merged to go-ethereum develop branch
2. Microsoft Azure hosting a testnet of 100+ nodes over 3 regions
3. expanding team, come join or contribute

how can swarm be used?

- bzzd - swarm daemon, communicates with ethereum via IPC, so any ethereum client works
- APIs: JSON RPC (via websockets, http, or ipc), http proxy, cli, fuse driver (planned)
- API bindings: web3.js and CLI

join us

contact and contribute

swarm channel: `gitter.im/ethereum/swarm`

swarm info page & orange papers: `swarm-gateways.net`

swarm gateway: `swarm-gateways.net web3.download`

- Daniel Nagy A., Nick Johnson, Viktor Trón, Zsolt Felföldi (core team)
- Aron Fischer & Ethersphere orange lounge group
- Ram Devish, Bas van Kervel, Alex van der Sande (Mist integration)
- Felix Lange (integration, devp2p)
- Alex Beregszaszi (git, mango)
- Igor Shadurin (file manager dapp)
- Nick Johnson, Alex van der Sande (Ethereum Name Service)
- Gavin Wood, Vitalik Buterin, Jeffrey Wilcke (visionaries)