

Walrus

An Efficient Decentralised Storage Network

Alberto Sonnino

**Distributed
Storage**



+ Incentives



Two Challenges

- Dynamic availability
- Conflate consensus with proof of storage

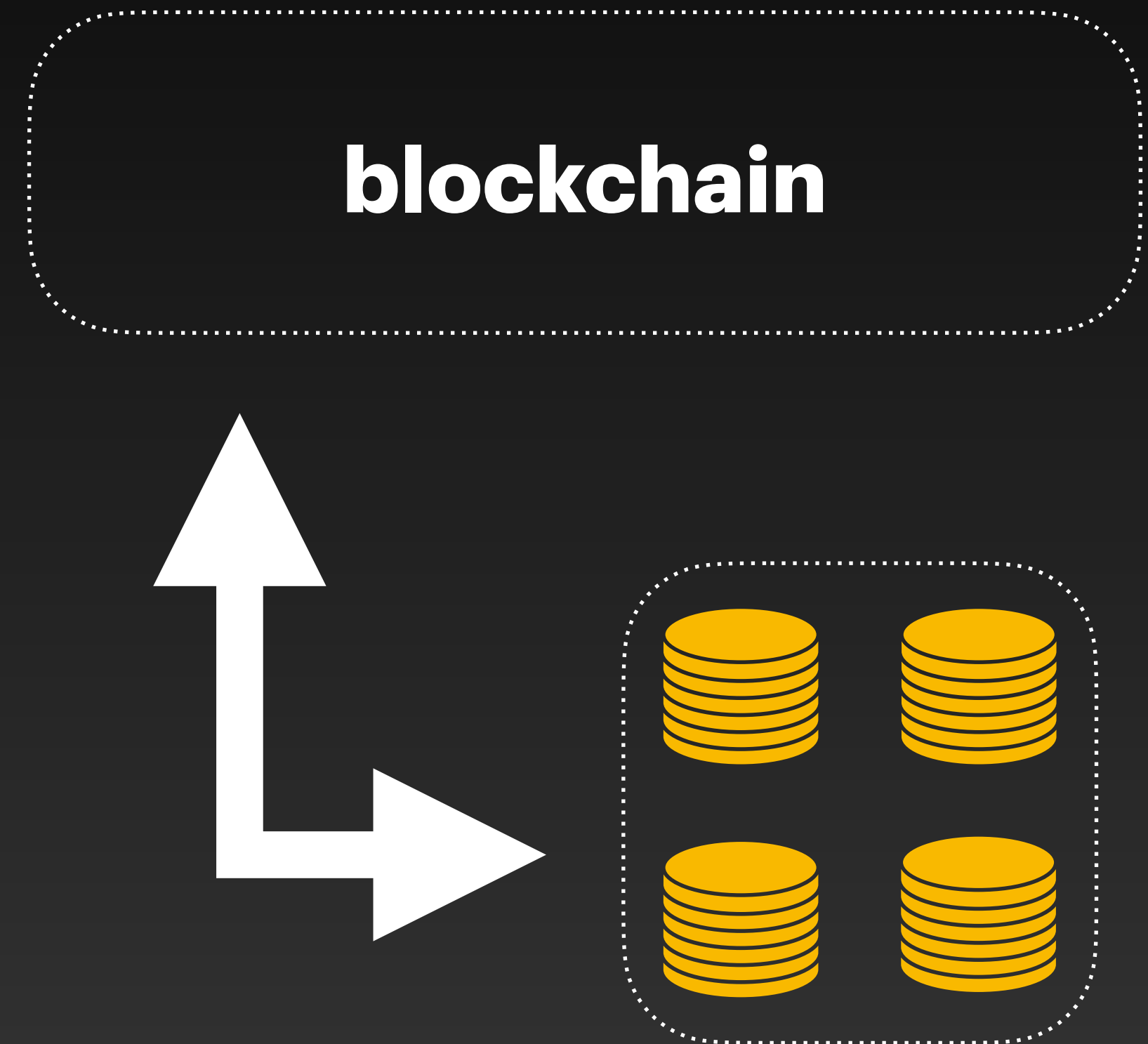
Two Challenges

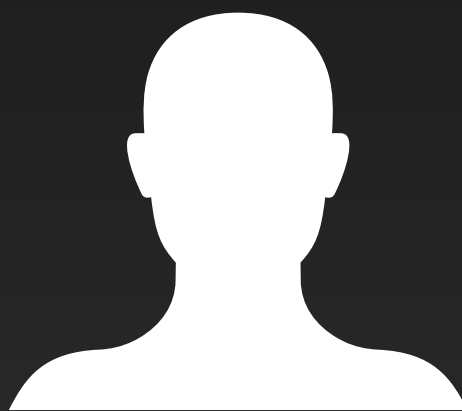
- Dynamic availability
 - Conflate consensus with proof of storage
-
- Slow
 - 90% Junk blocks
 - High replication factor

BFT Quorum

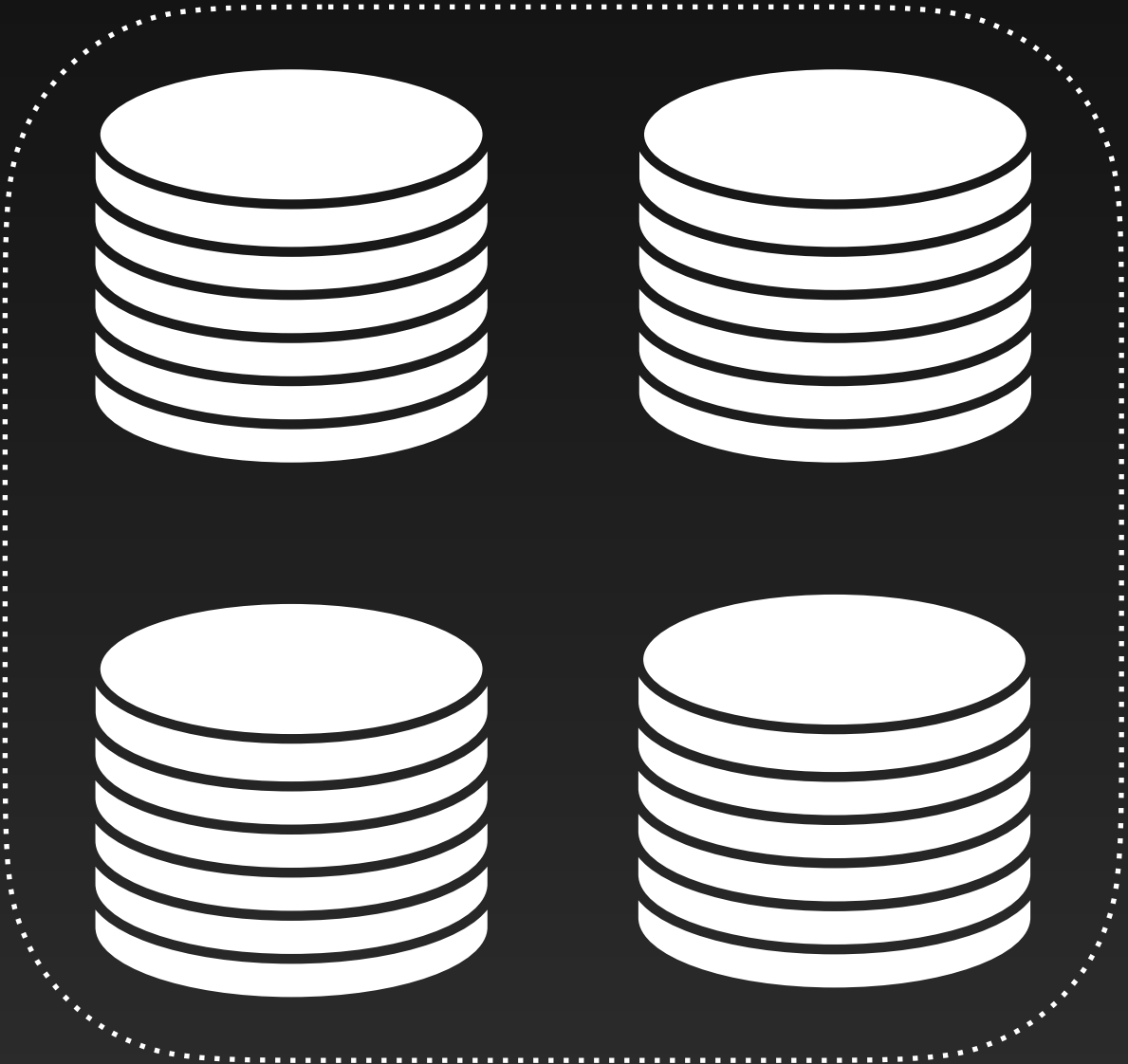


External Chain





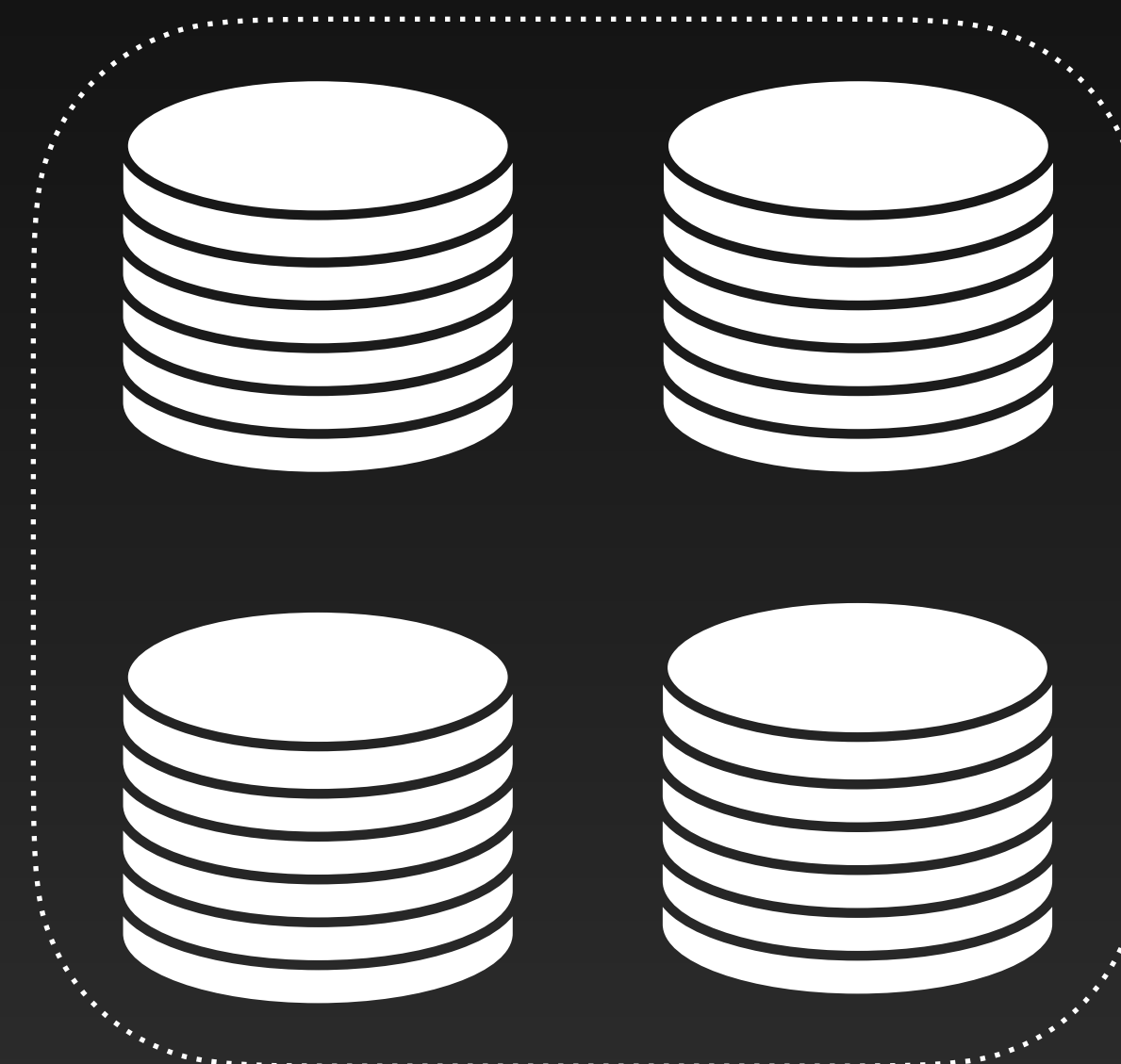
user



Walrus



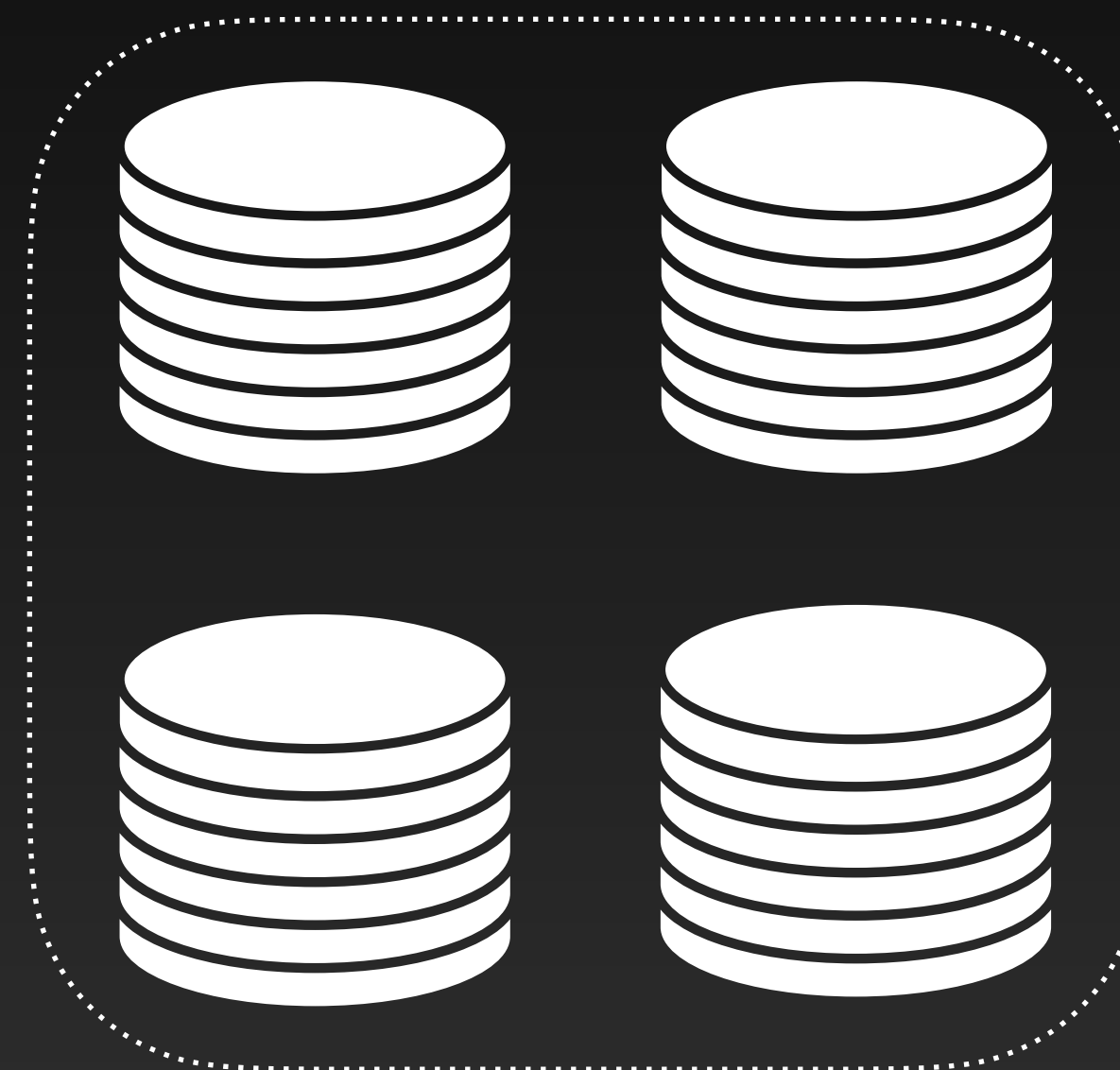
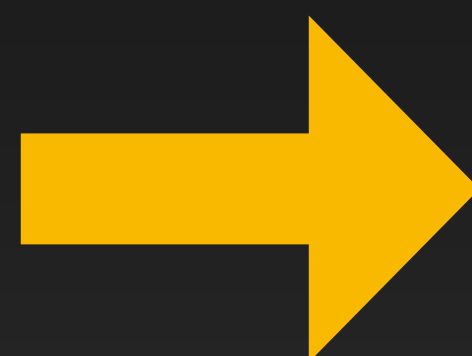
user



Walrus



user



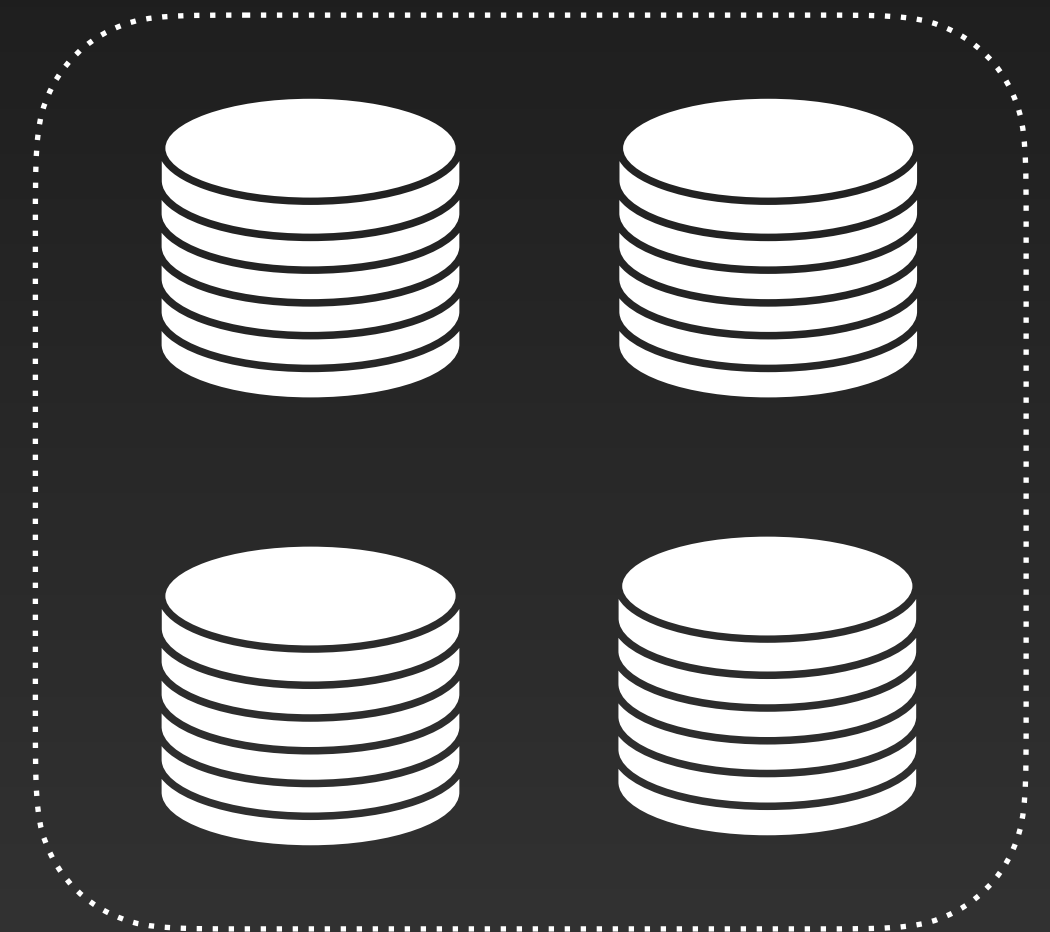
Walrus



id



blockchain

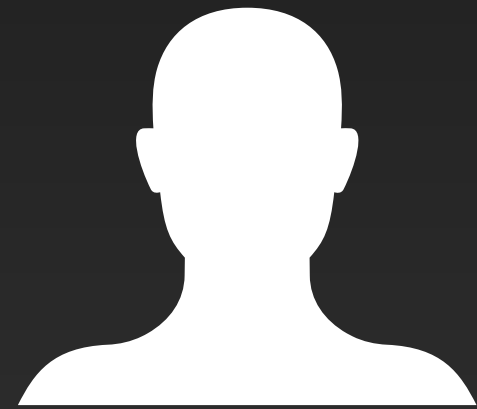


id



blockchain

sync

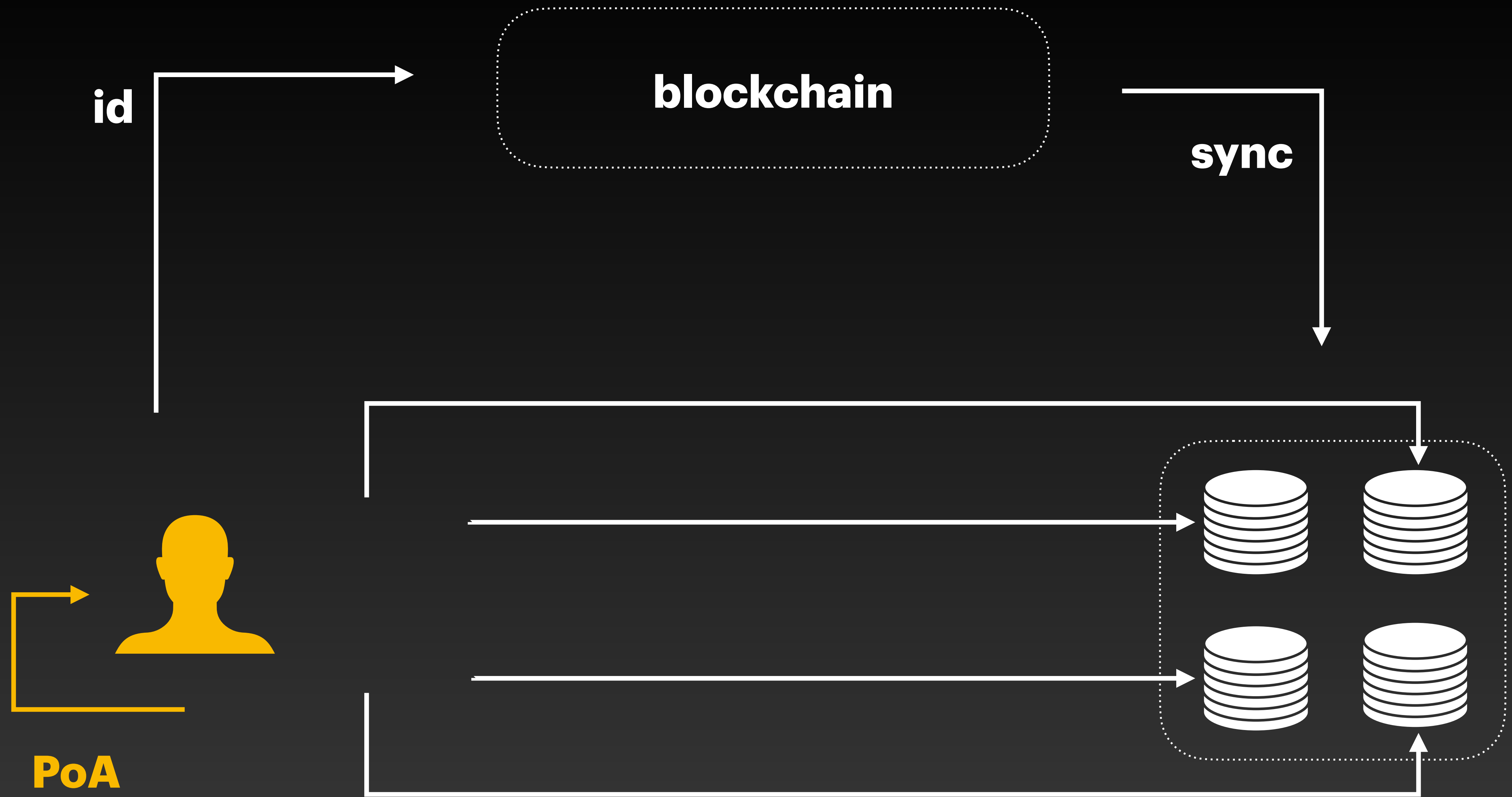


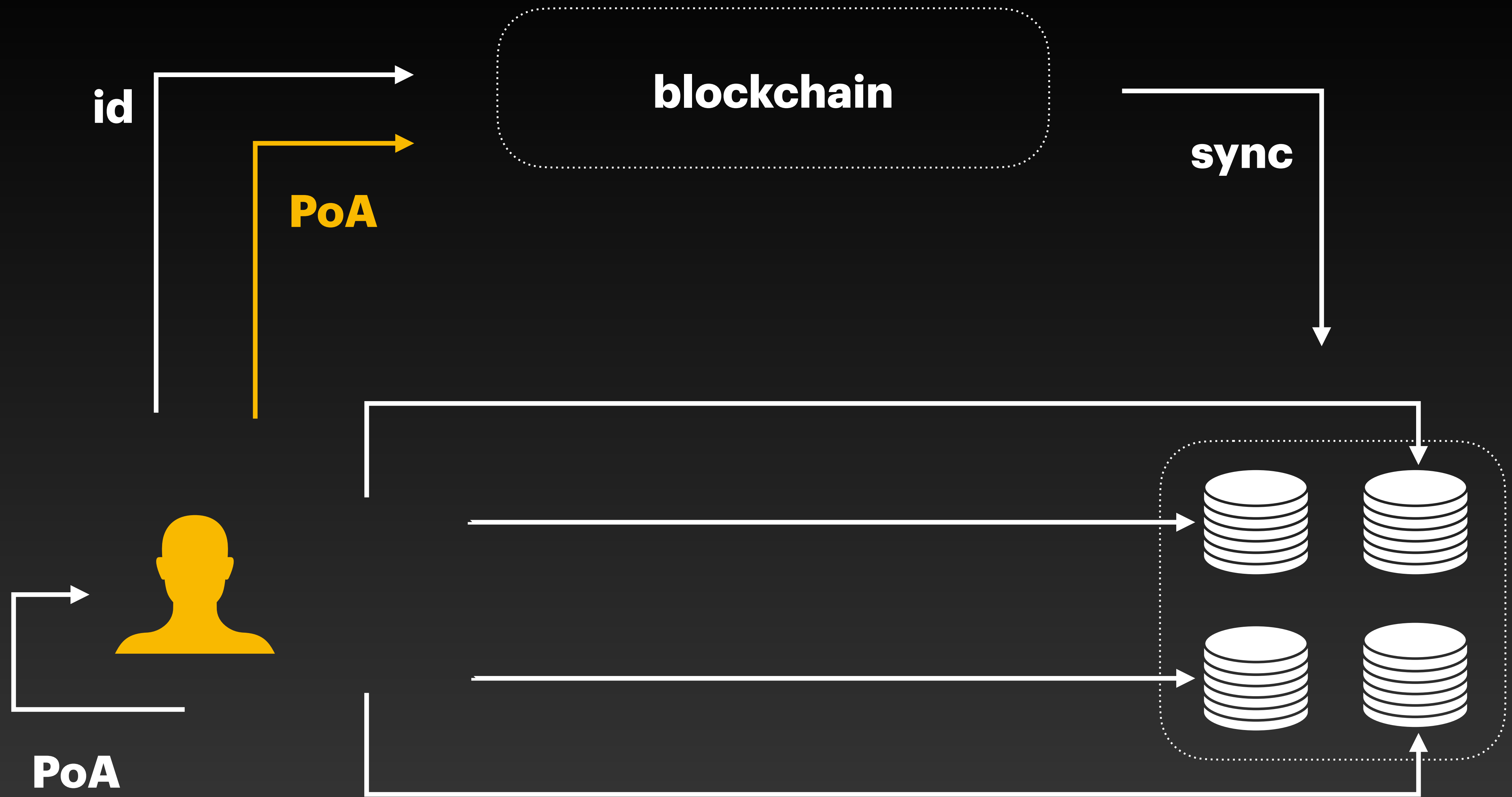
id

blockchain

sync



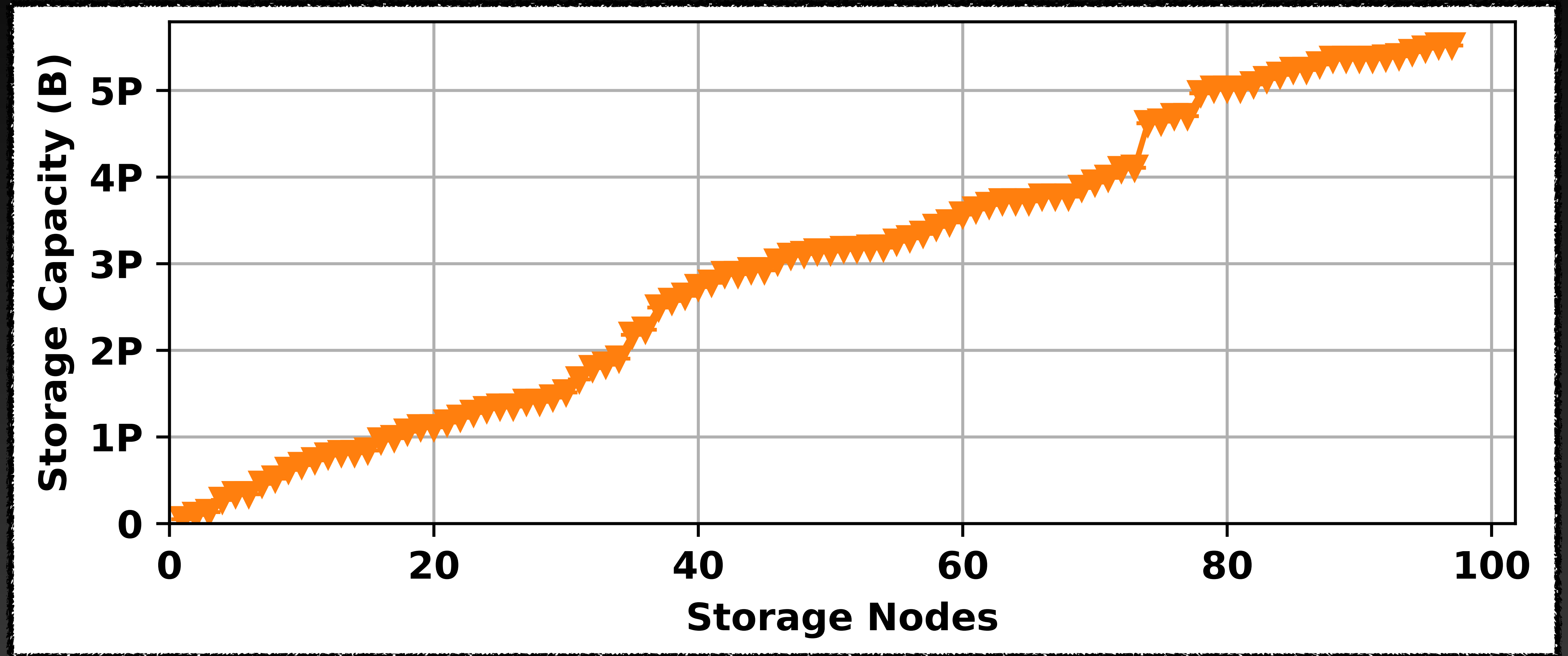


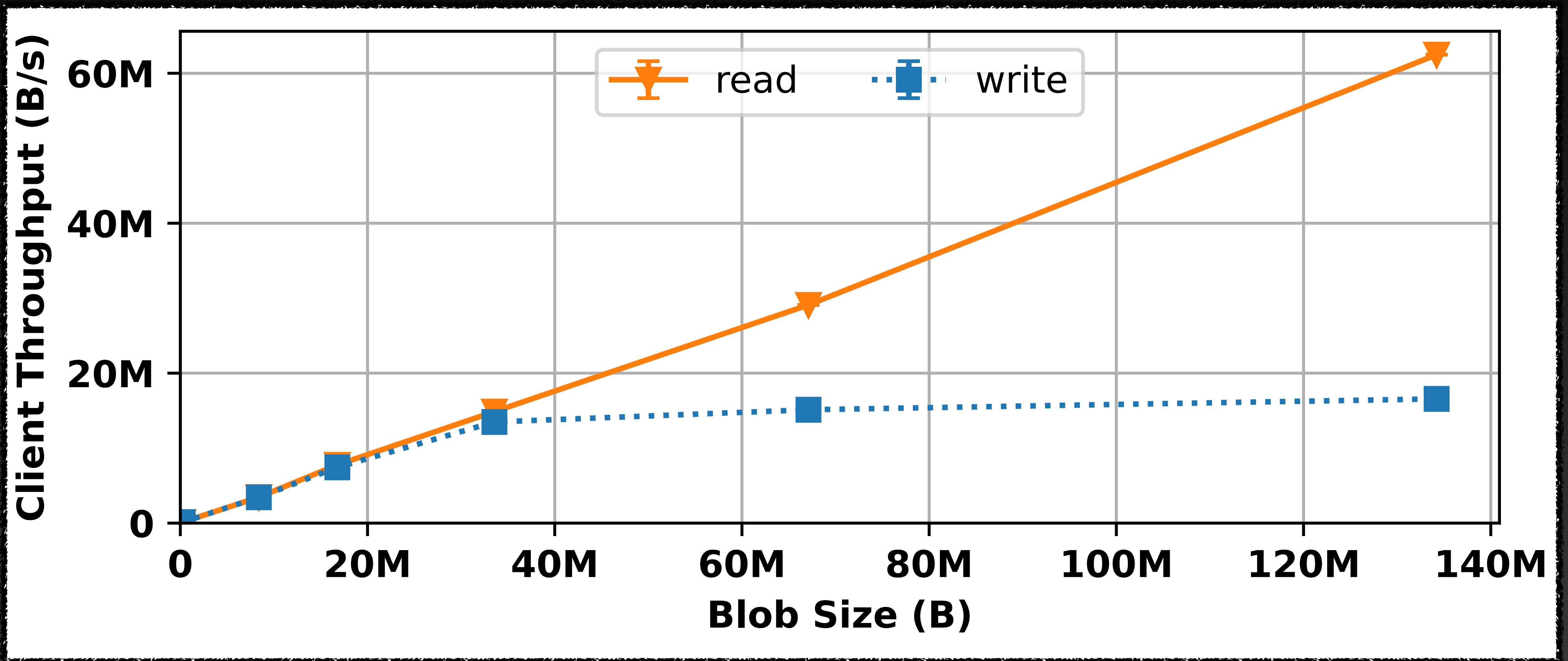


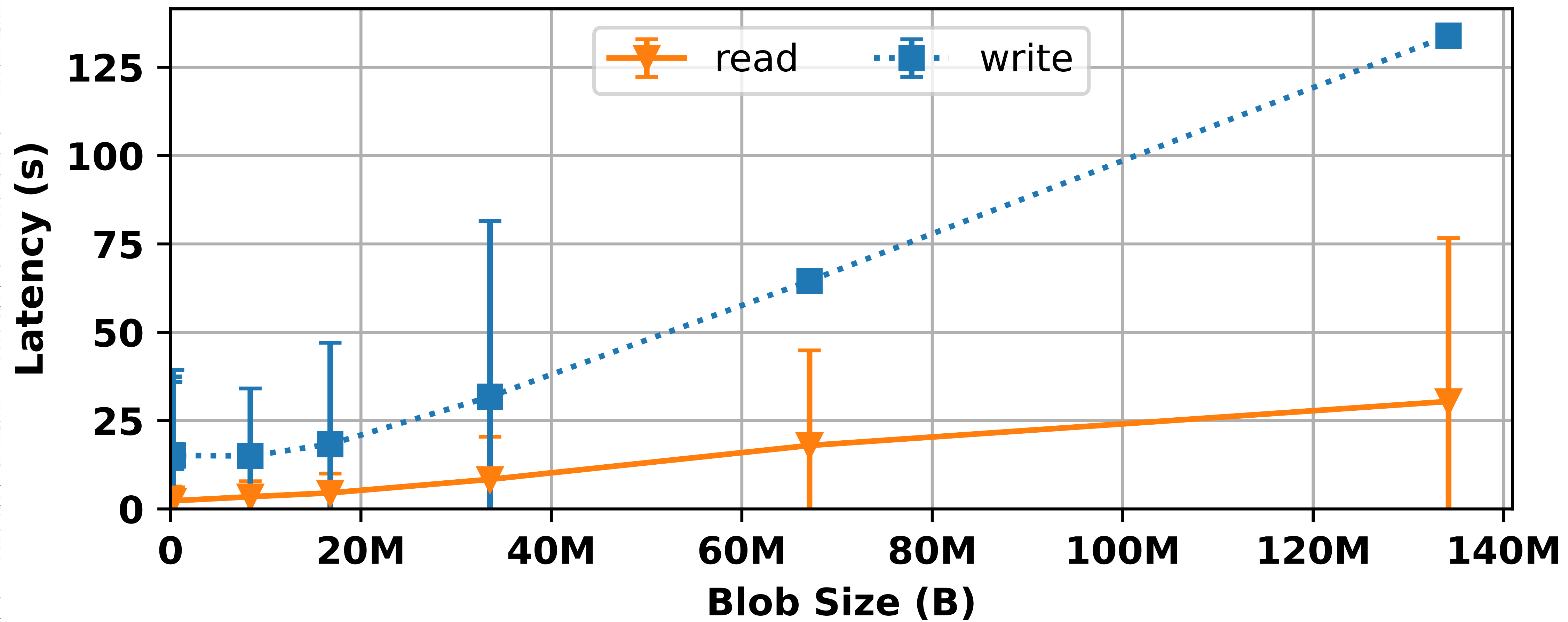
Properties

- Honest writer can obtain a **PoA**
- If honest writer writes **B**, then honest reader can read **B**
- If **PoA** exists, two honest readers either both read **B** or both read \perp

Each node adds ~55 TB



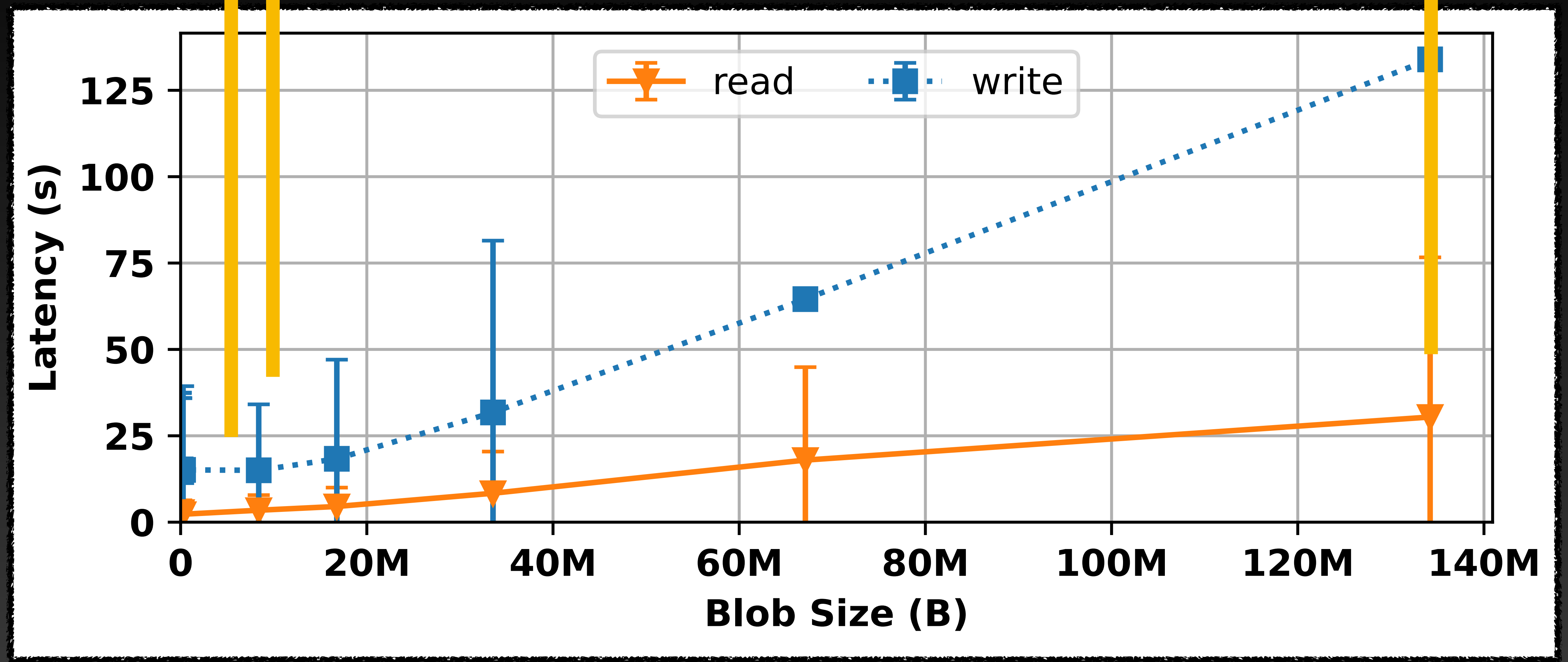




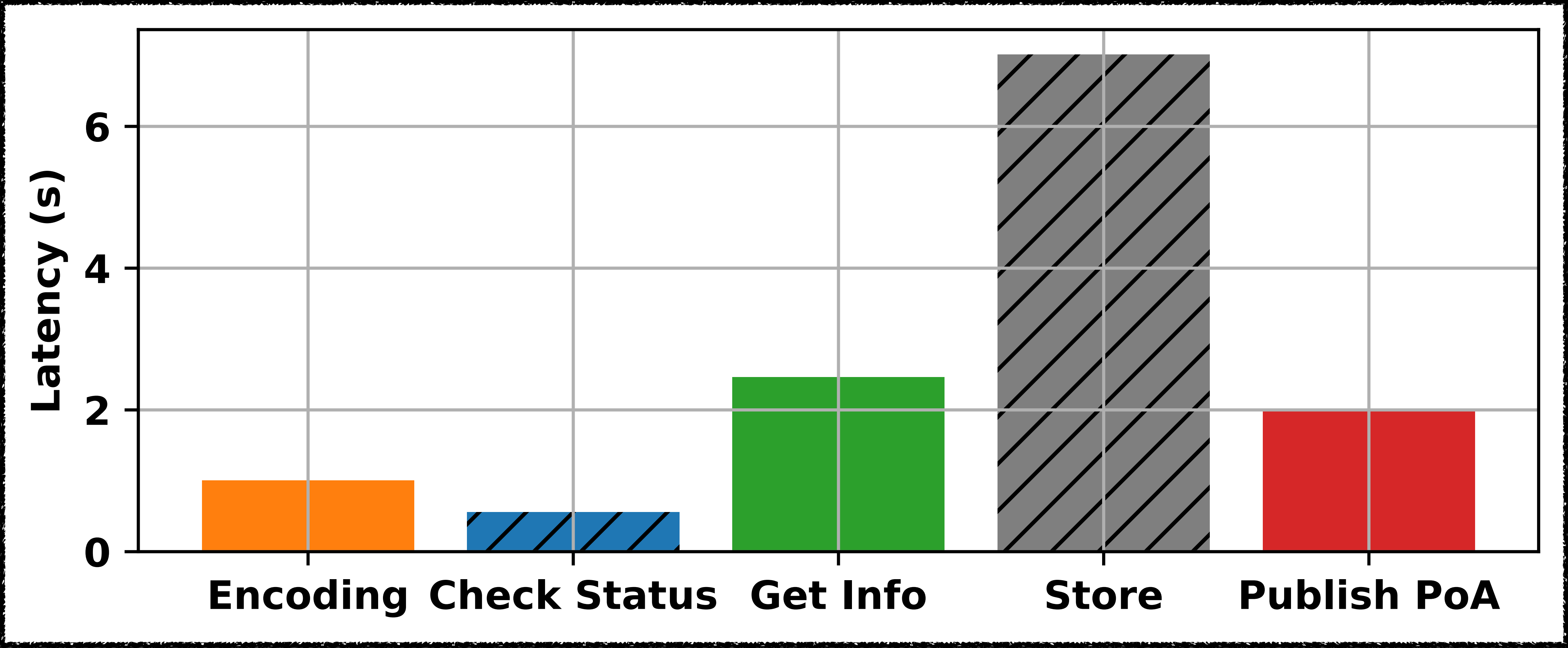
Instagram

TikTok

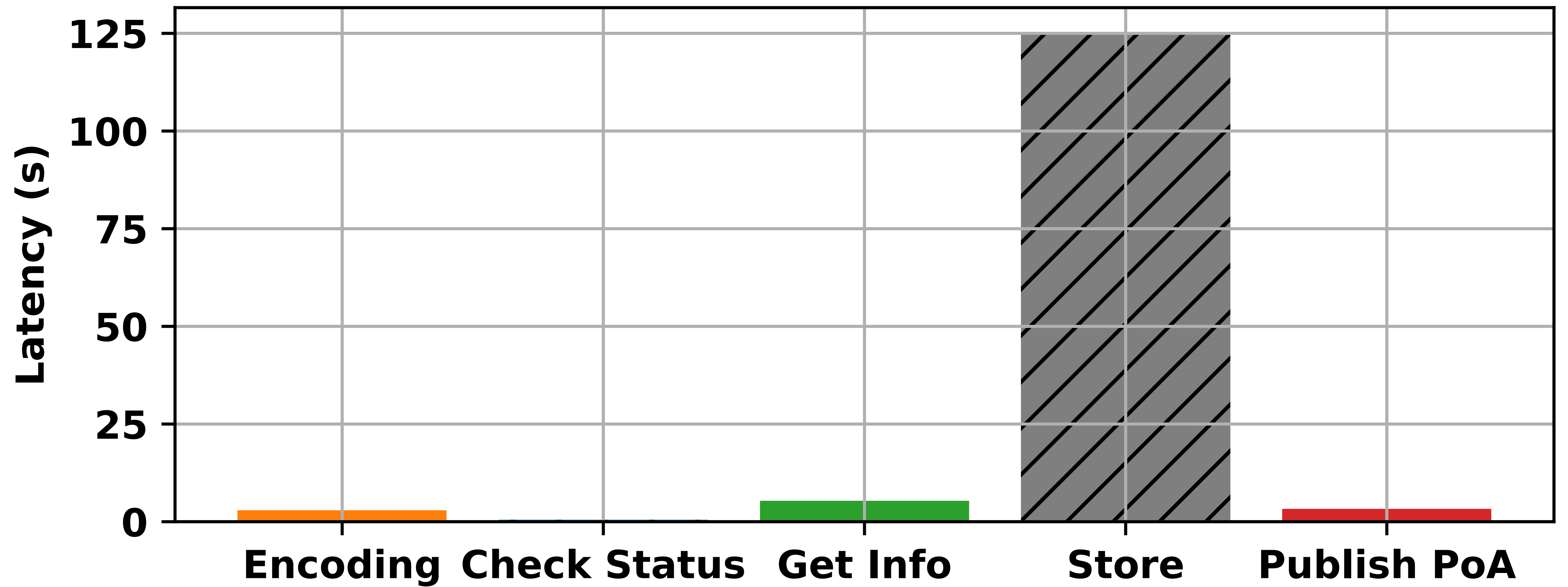
YouTube (5 min)



Small Blob (1kB)



Large Blob (135MB)



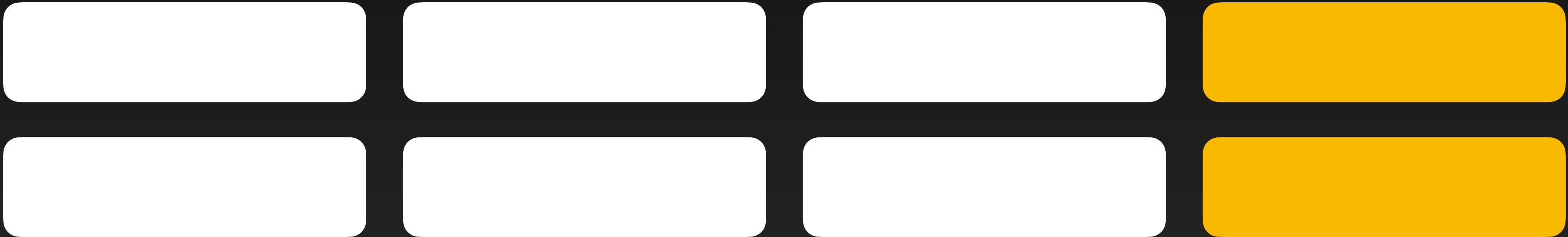
2D Erasure Codes

Easy Recovery

- Clients can fail
- Nodes can be Byzantine
- Epoch change



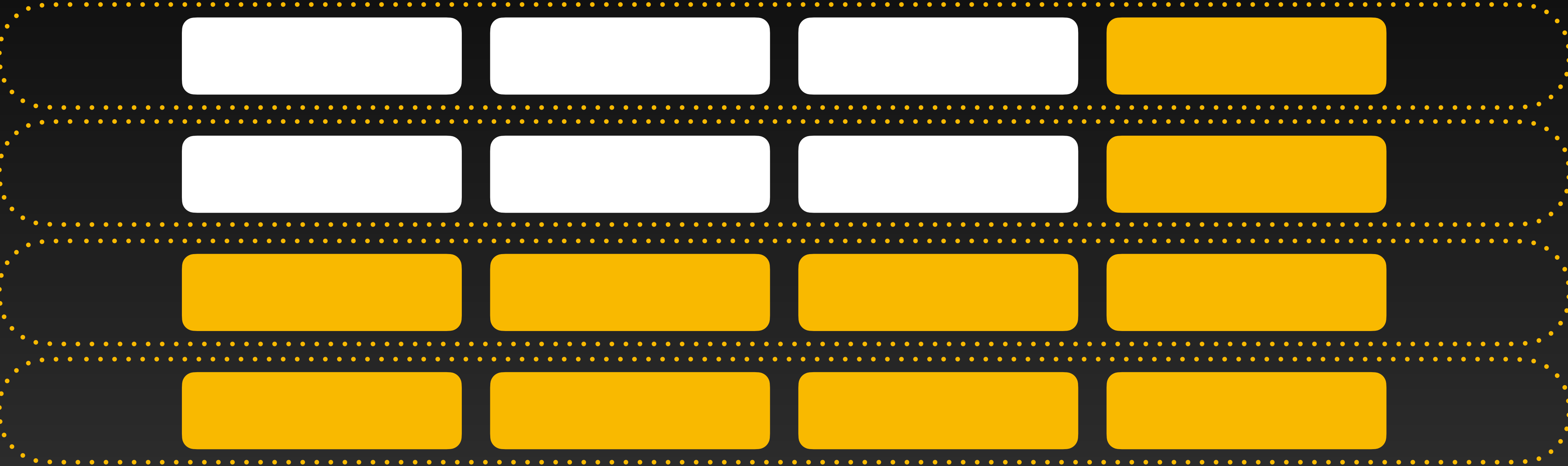
from $2f+1$ to n



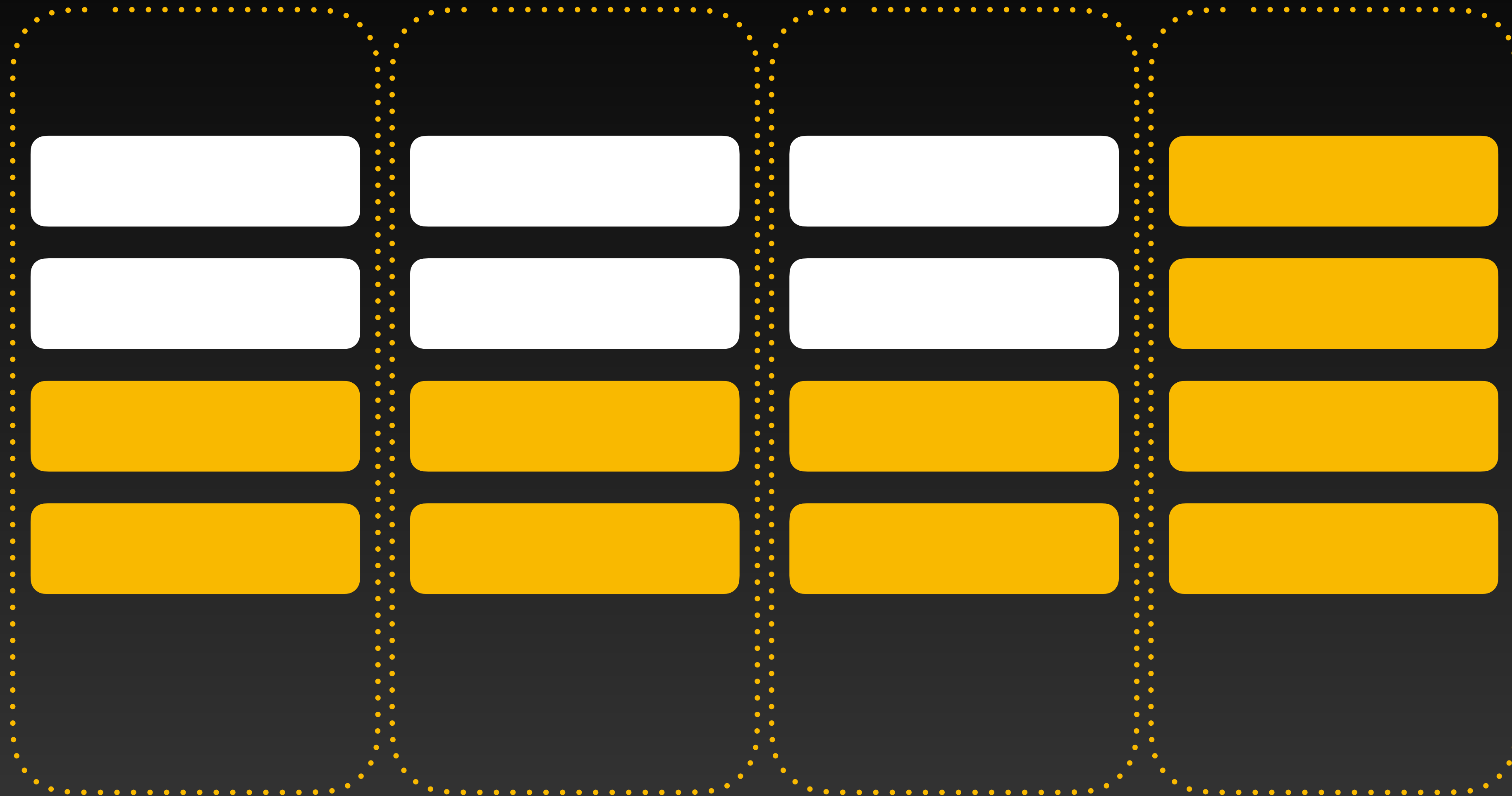
from $f+1$ to n



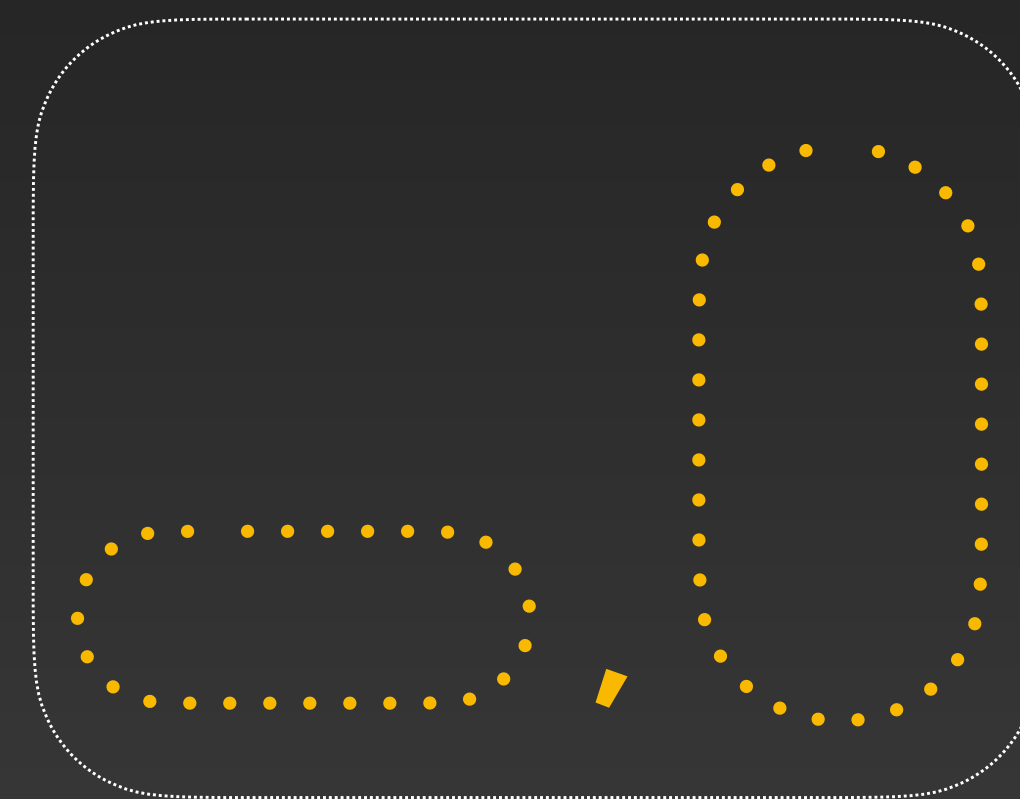
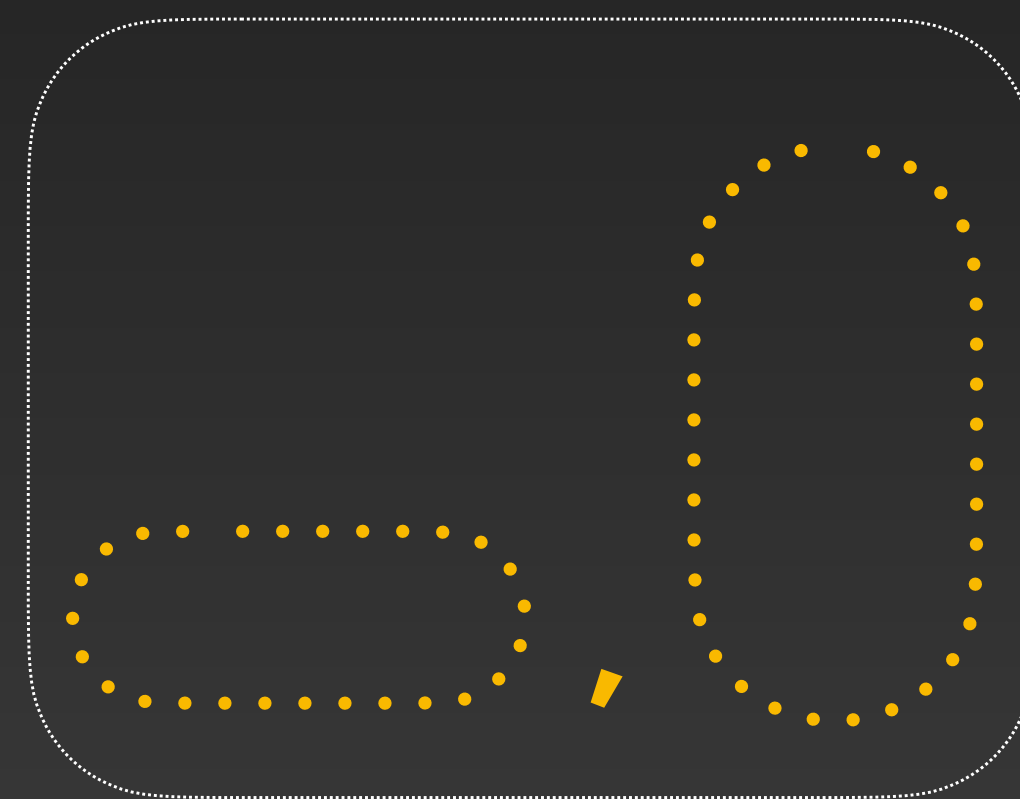
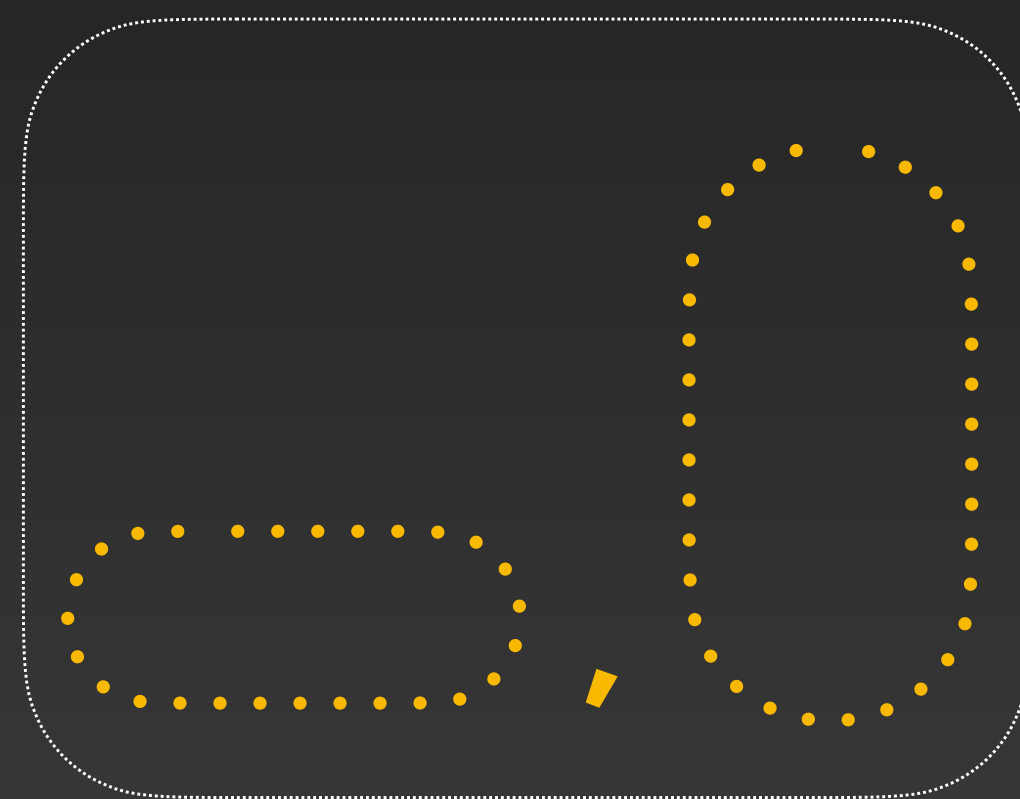
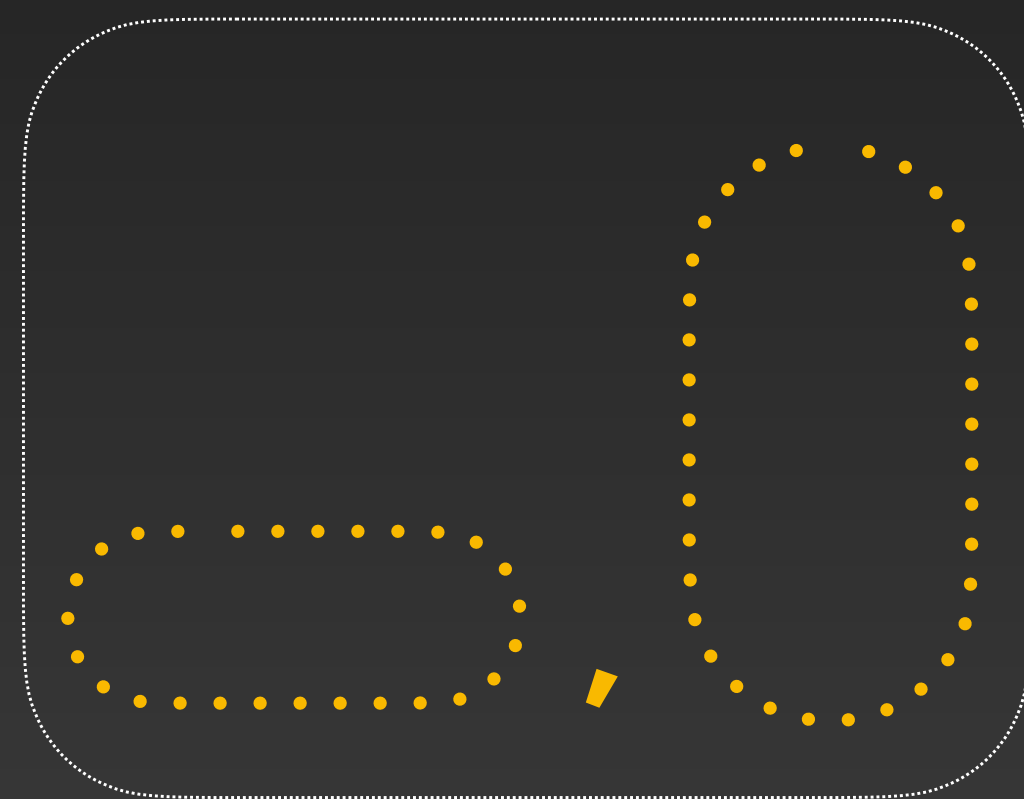
primary slivers



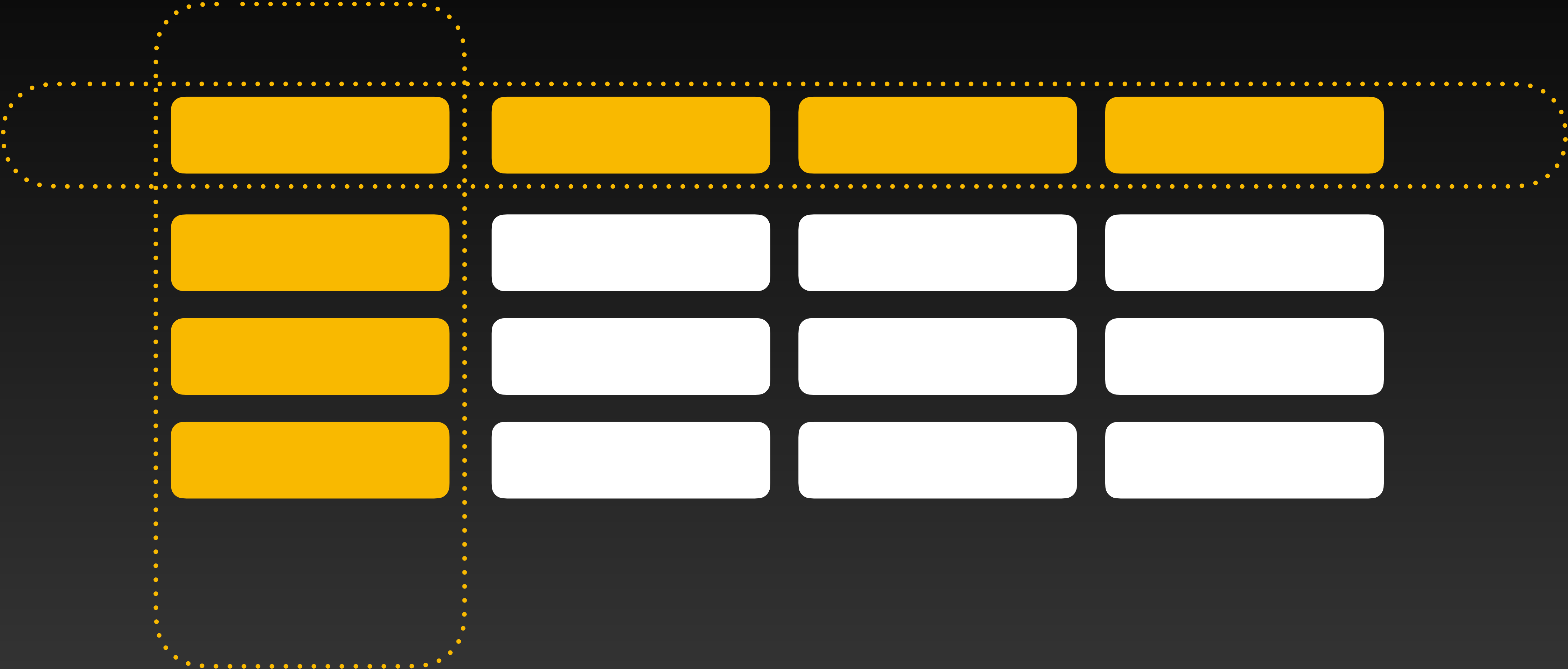
secondary slivers



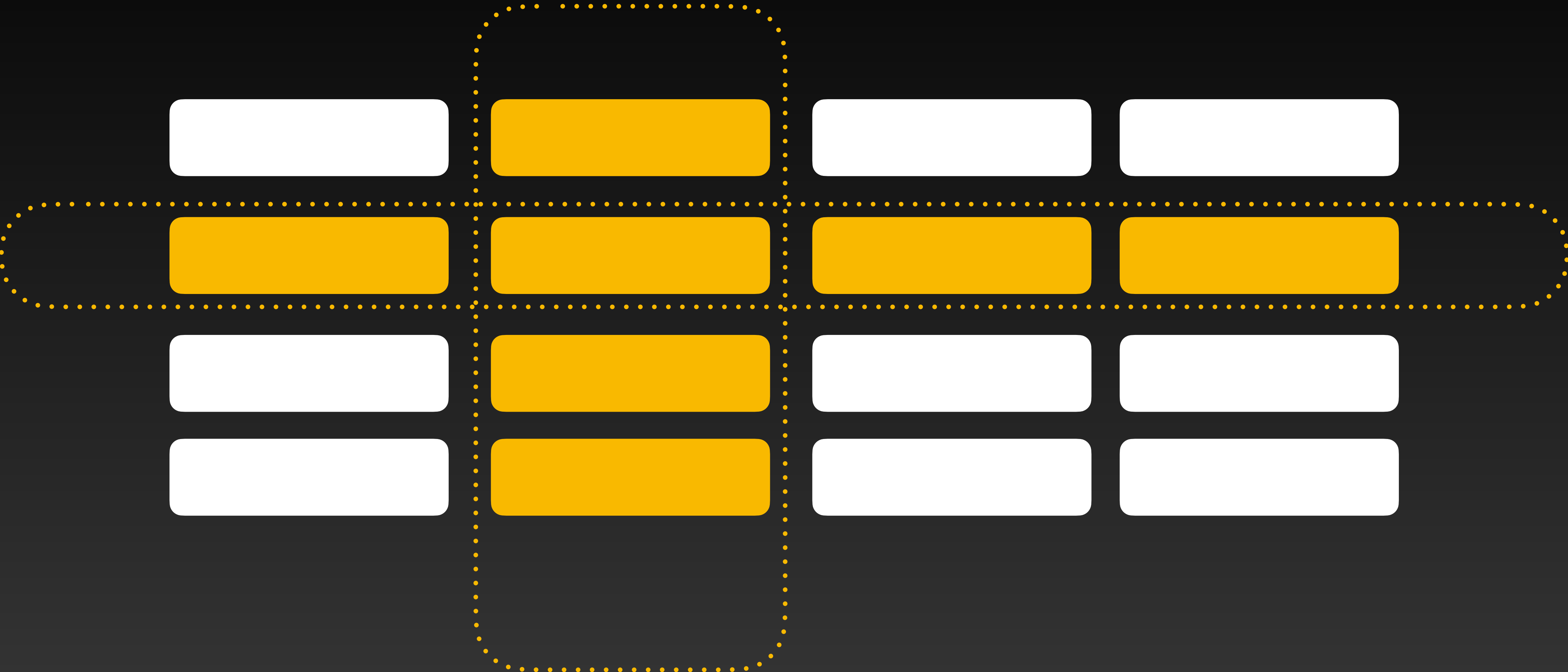
Blob id



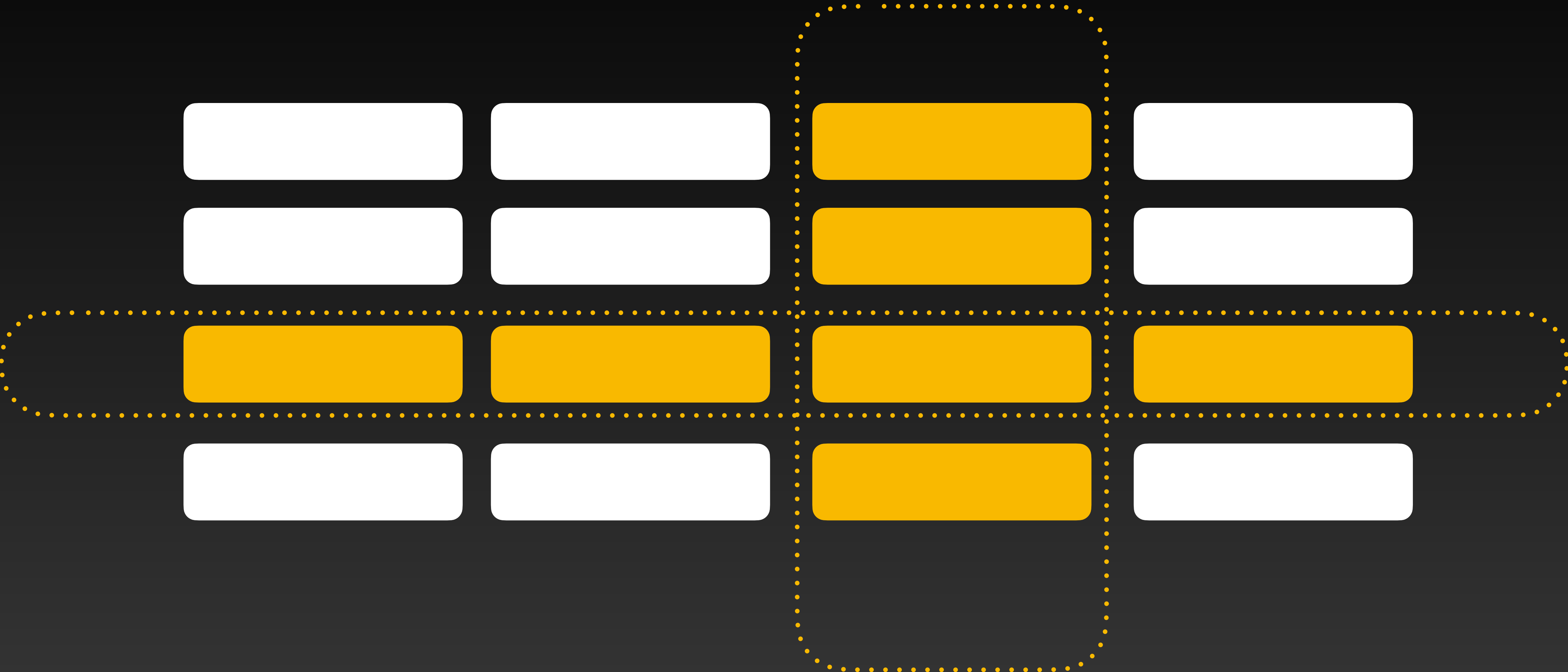
node 1



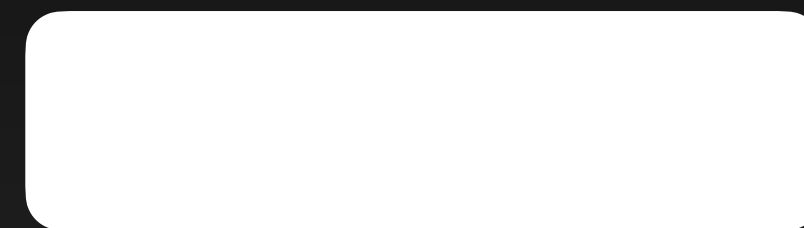
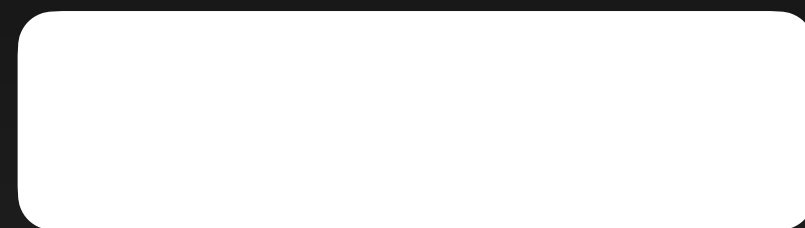
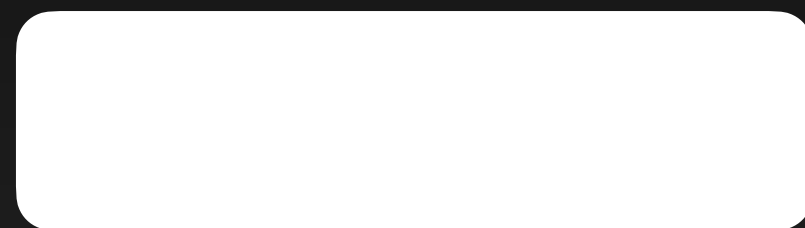
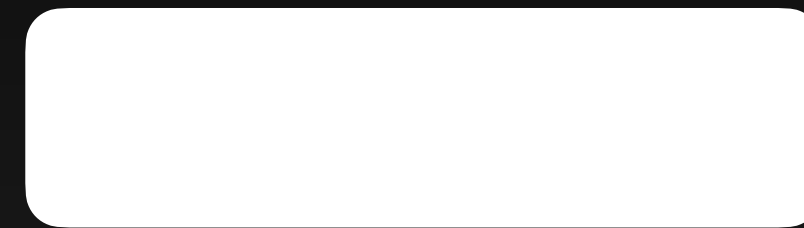
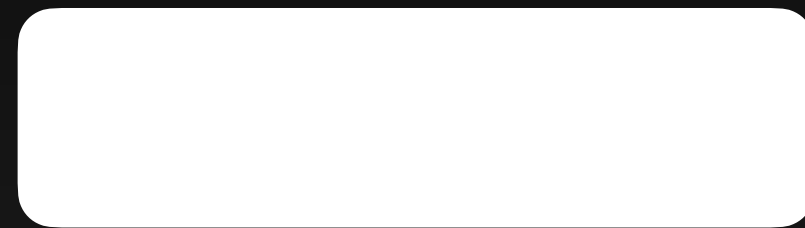
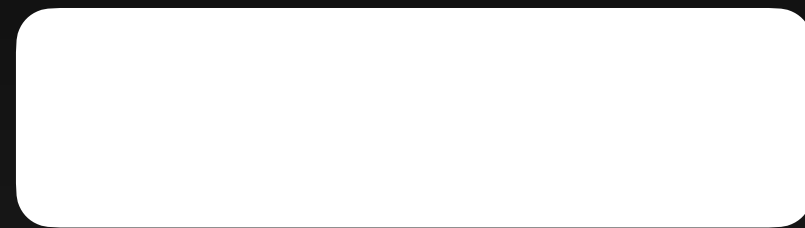
node 2



node 3



node 4



Recovery

node 1

node 2

node 3

node 4

node 1

node 2

node 3

node 4

node 1

node 2

node 3

node 4

node 1

node 2

node 3

node 4

node 1

node 2

node 3

node 4

node 1

node 2

node 3

node 4

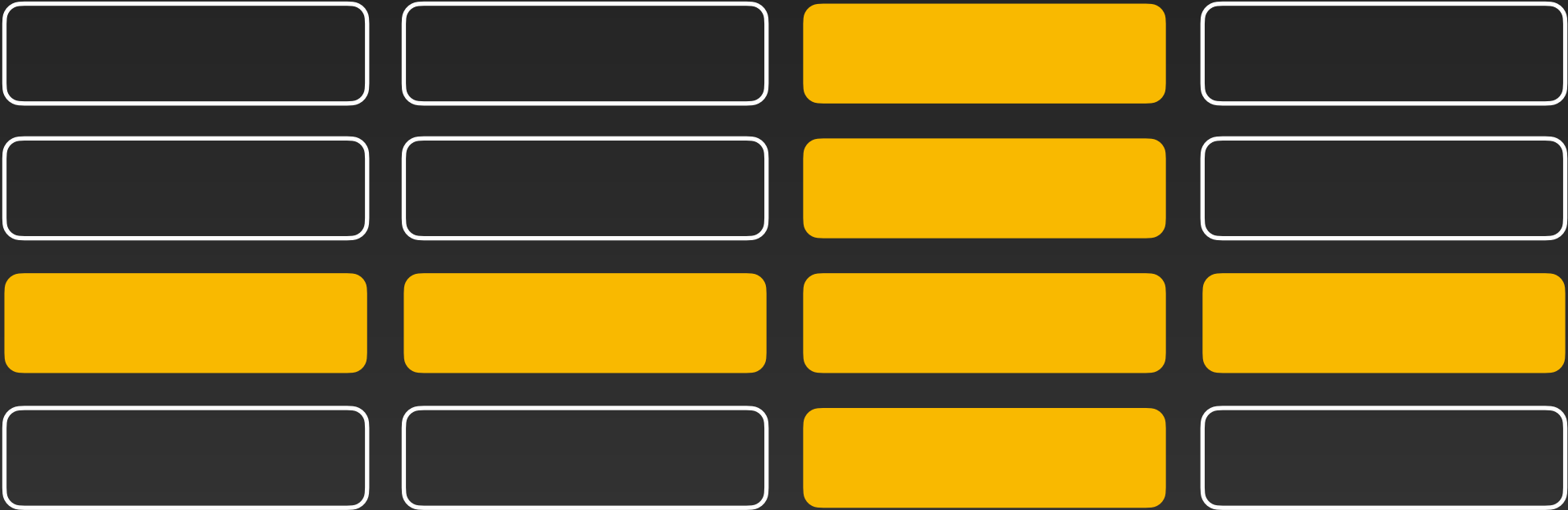
node 1



node 2



node 3



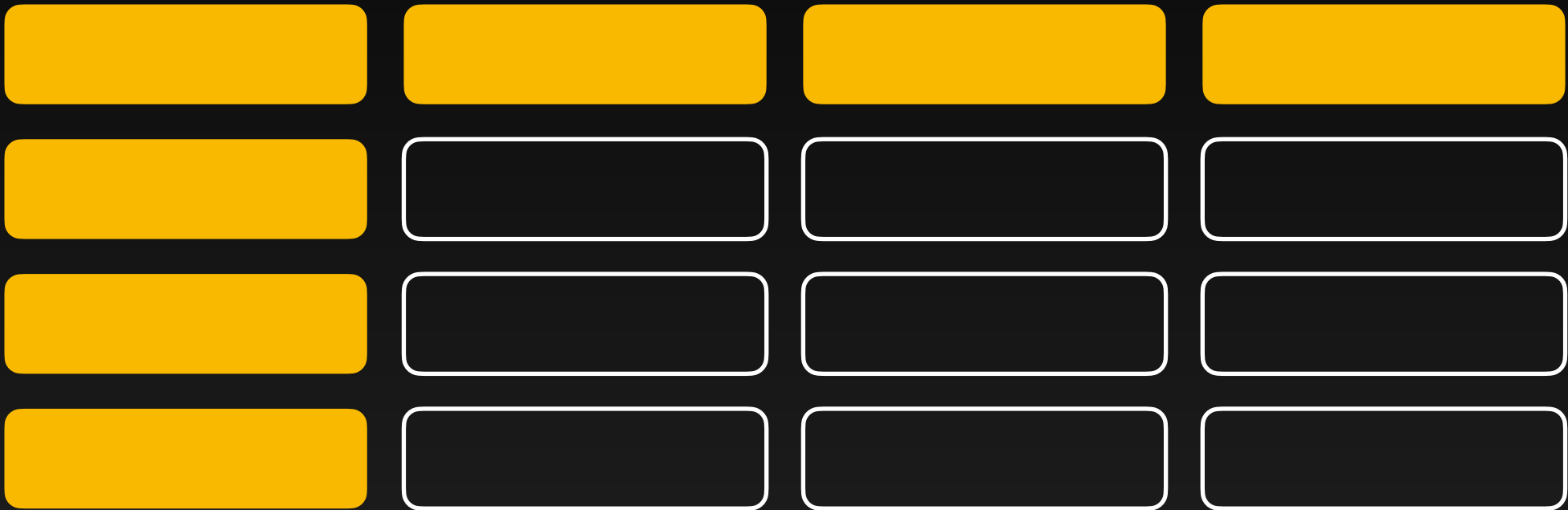
node 4



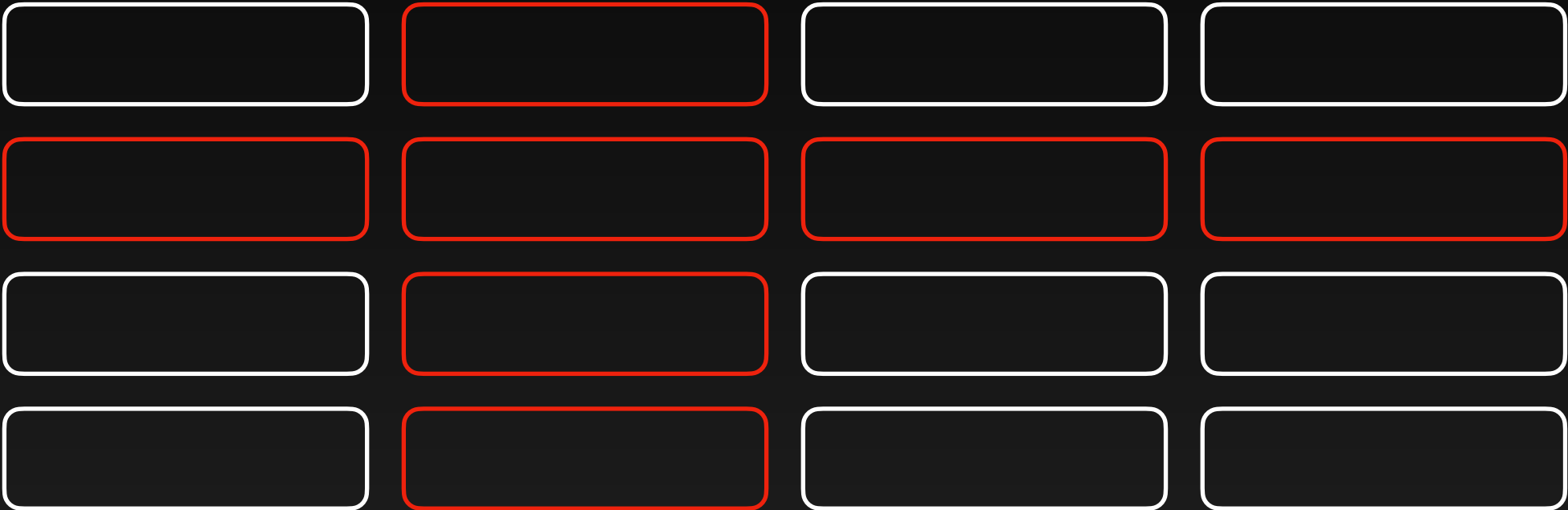
f+1



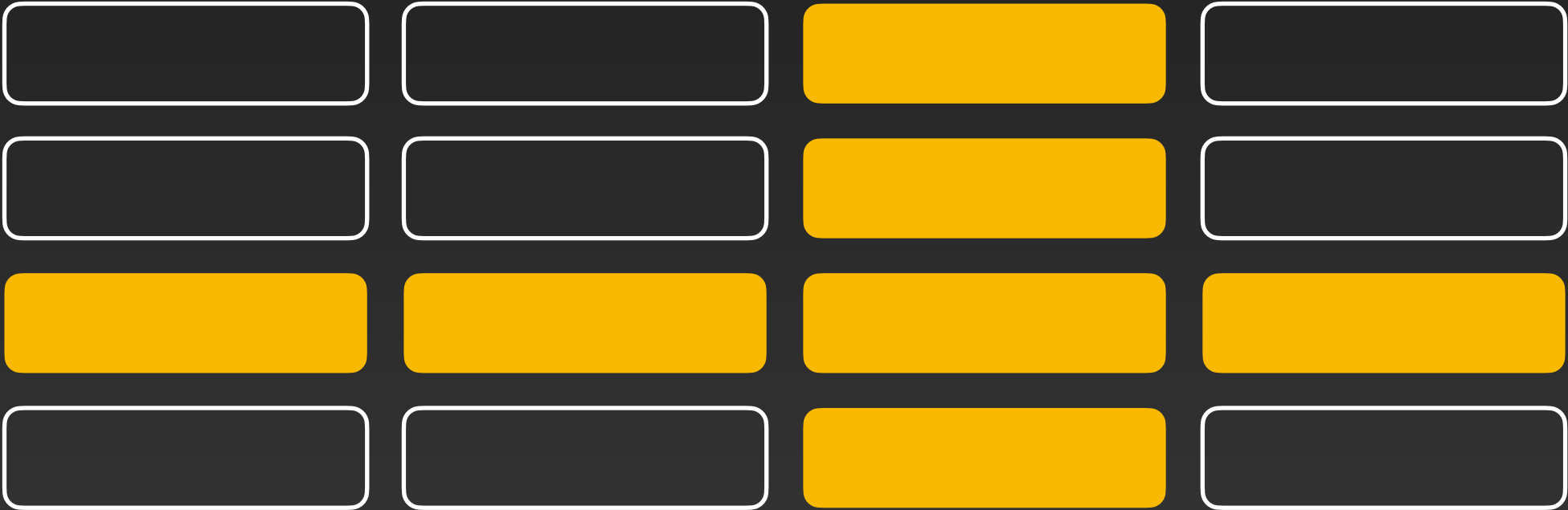
node 1



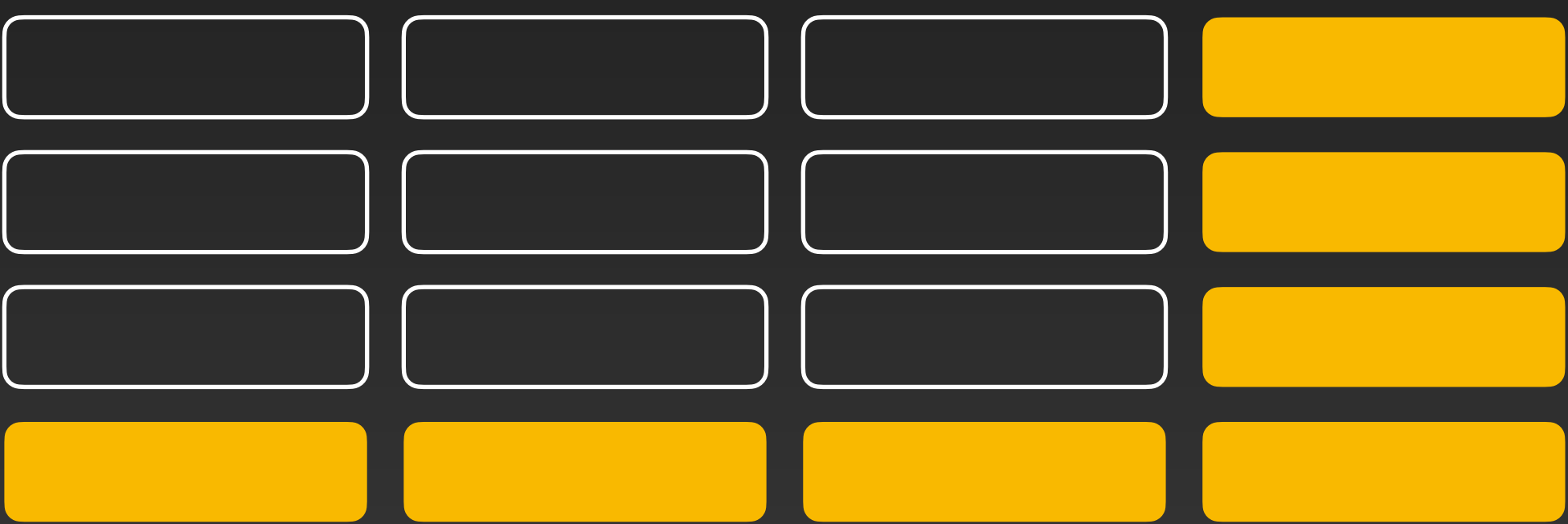
node 2



node 3



node 4



$2f+1$

Storage Optimisation

node 1

node 2

node 3

node 4

node 1

node 2

node 3

node 4

alberto@mystenlabs.com