

Session II : Service Chain

나정호 / Ground X

# High Availability Architecture of Klaytn Service Chain



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## Software Engineer, Ground X

- 서비스 체인 개발
- 카카오톡 디지털 지갑 Klip backend 개발

## Division Manager, TmaxData

- RDBMS backend 개발
- Deep learning 기반 data center 관리 시스템 개발
- 올해 3월부터 Ground X에서 Klaytn 개발에 참여하고 있습니다.
- 서비스 체인 개발을 담당하고 있고 최근에는 카카오톡에 들어갈 디지털 지갑 Klip의 backend도 개발하고 있습니다

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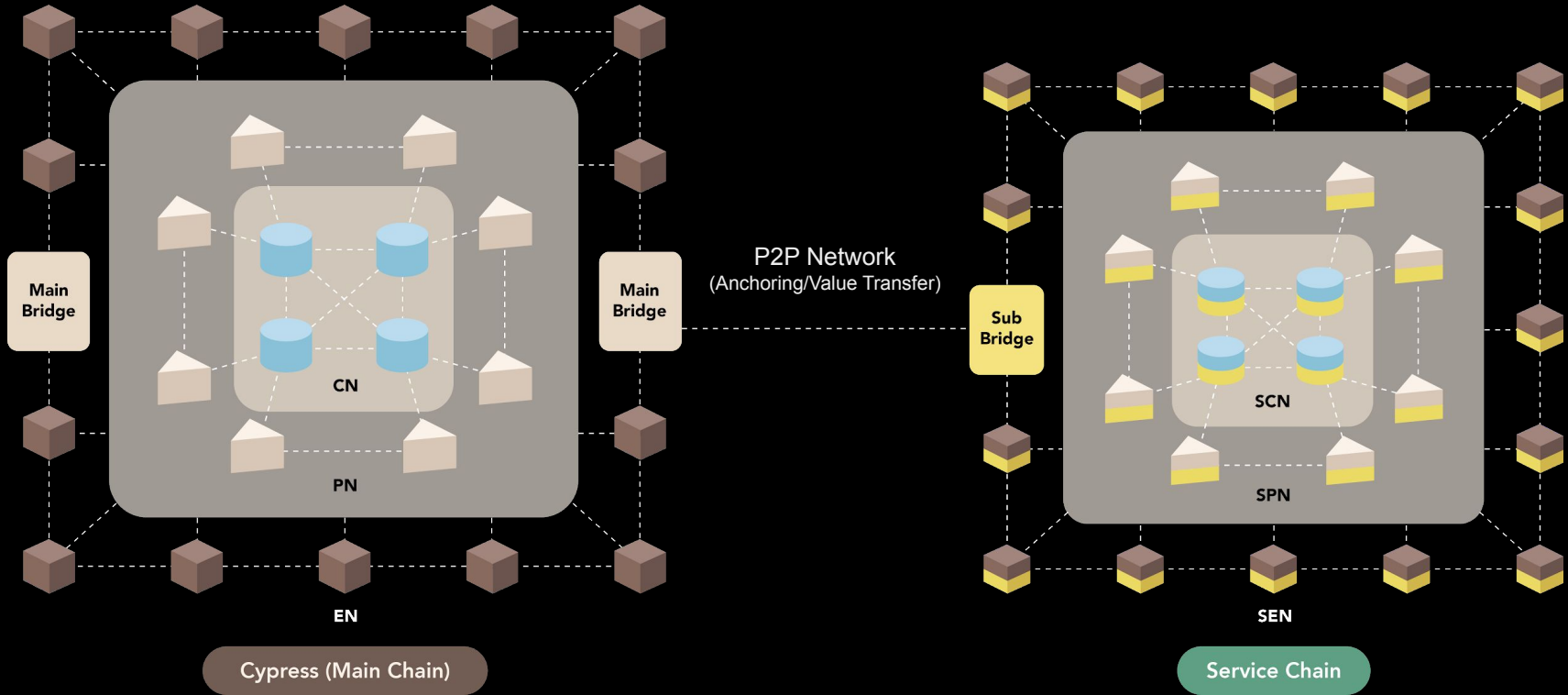
- Service Chain Overview
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# Service Chain Overview

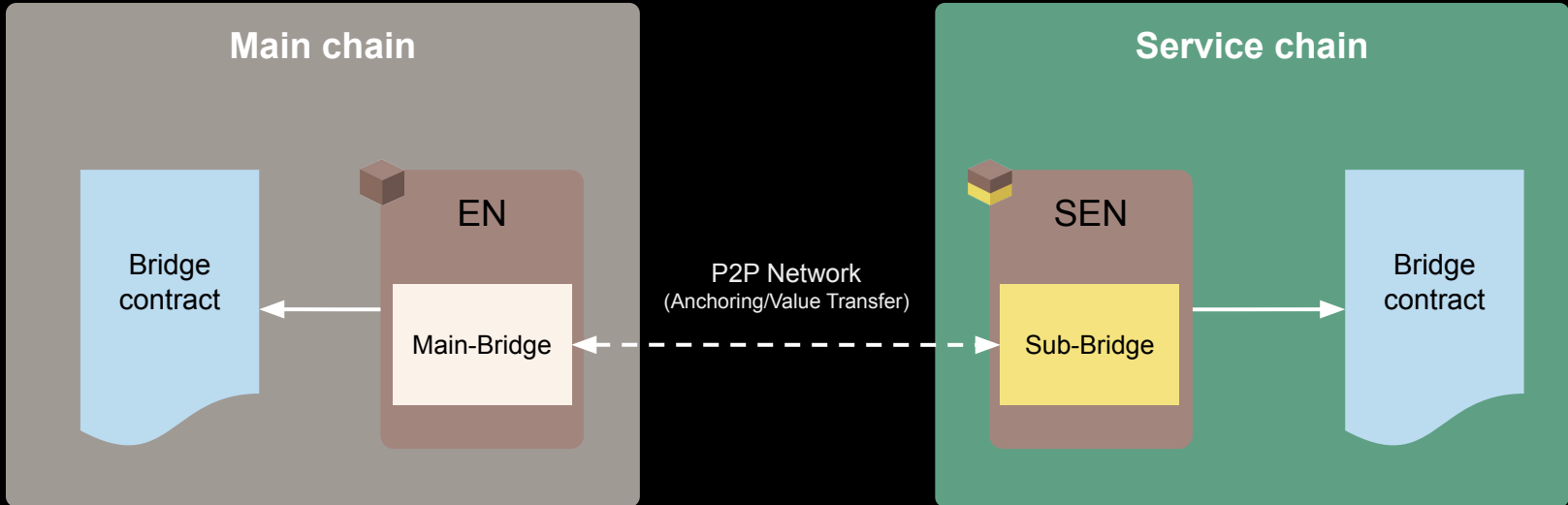
CN : Consensus Node  
SCN: Service Chain Consensus Node

PN: Proxy Node  
SPN: Service Chain Proxy Node

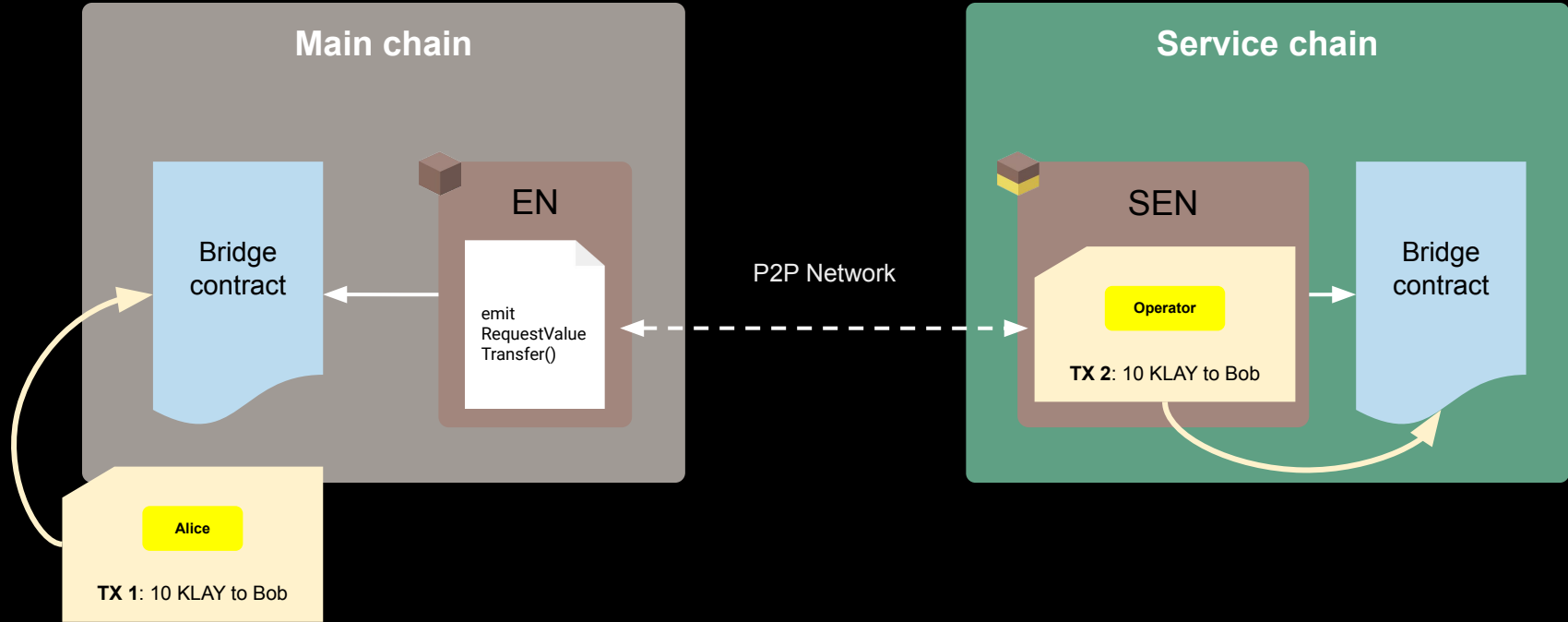
EN: Endpoint Node  
SEN: Service Chain Endpoint Node



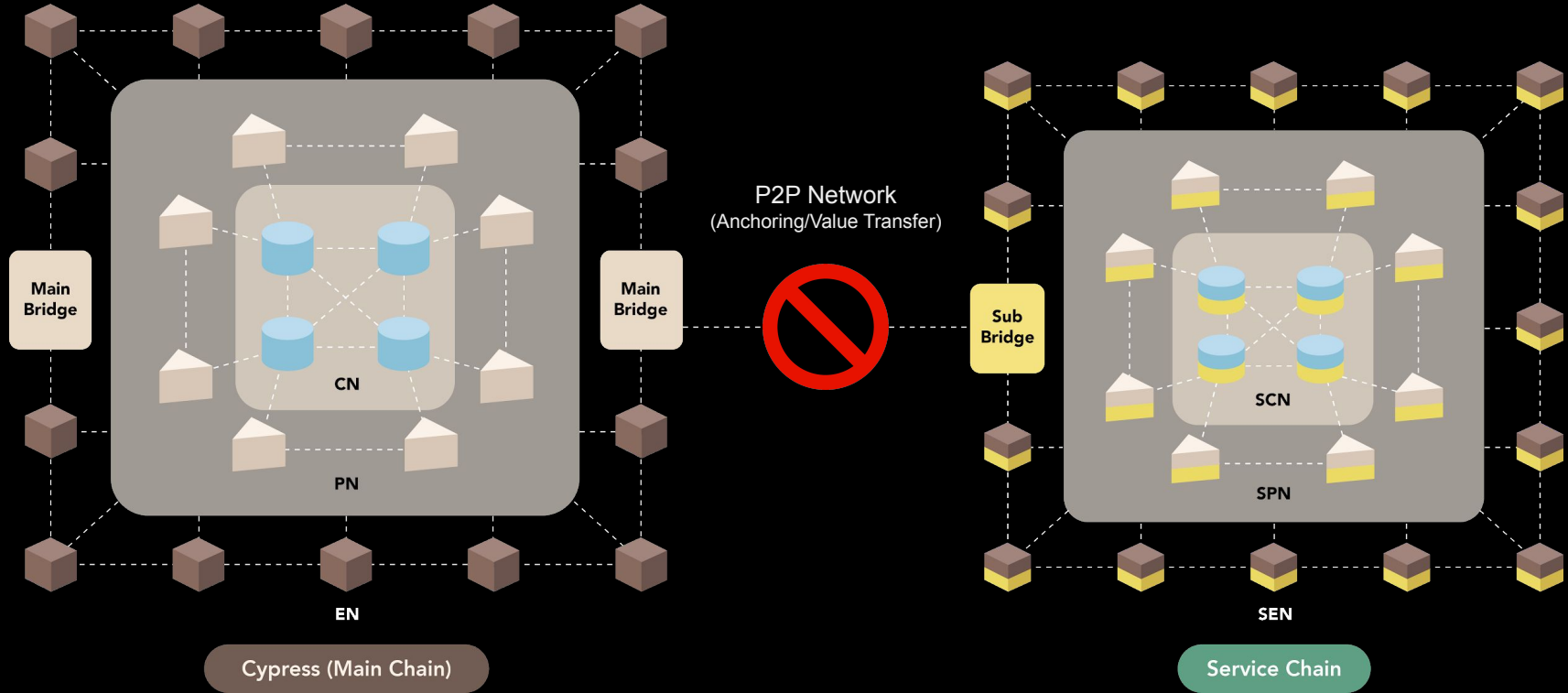
# Service Chain Overview



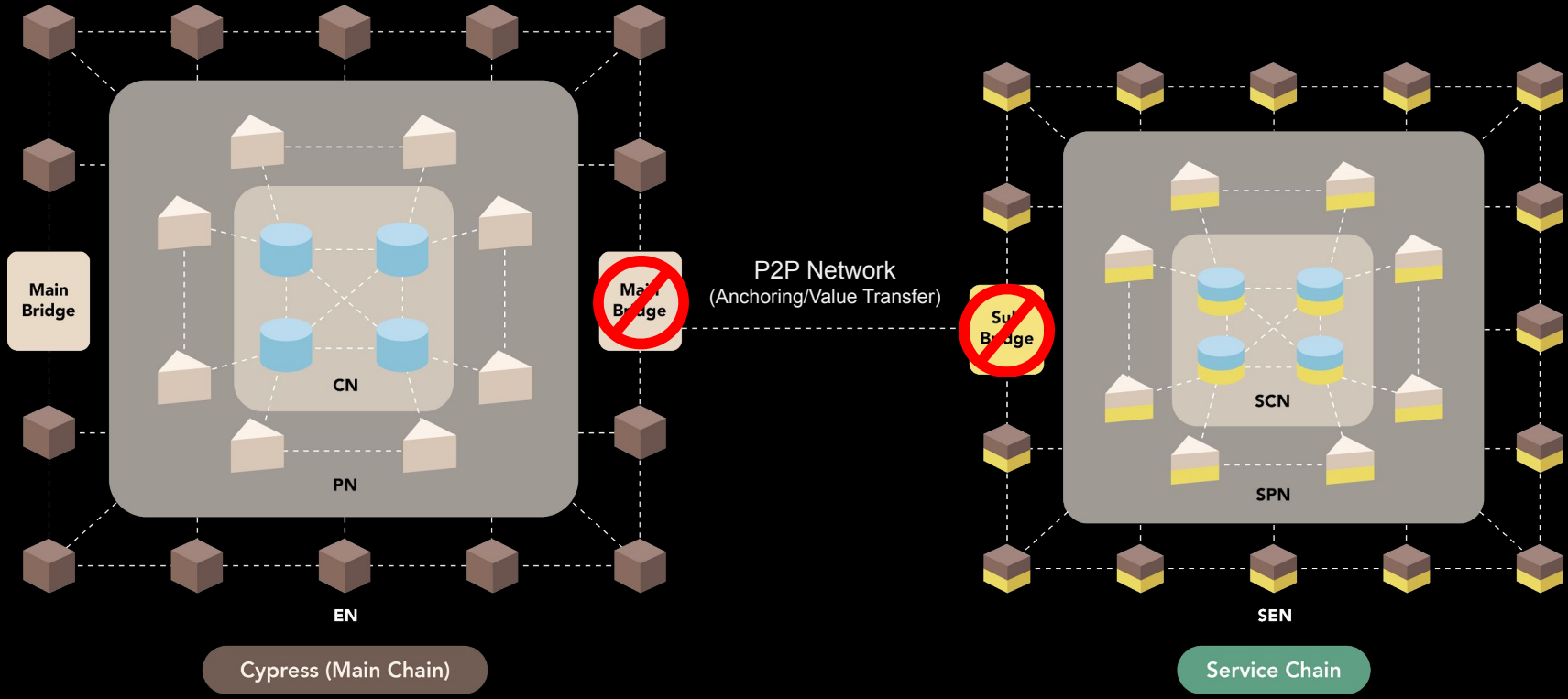
# Value Transfer Example



# Problems To Solve - Network Failure

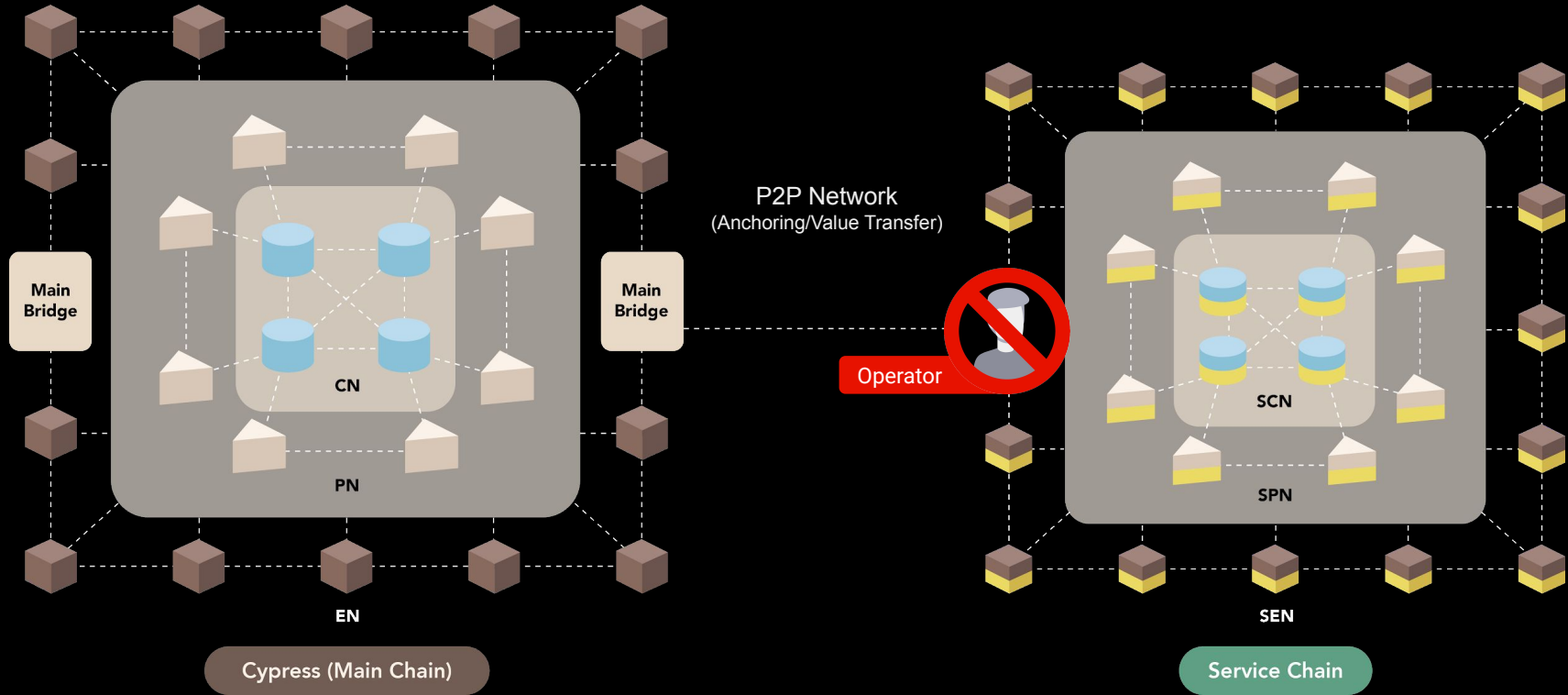


# Problems To Solve - Node Failure

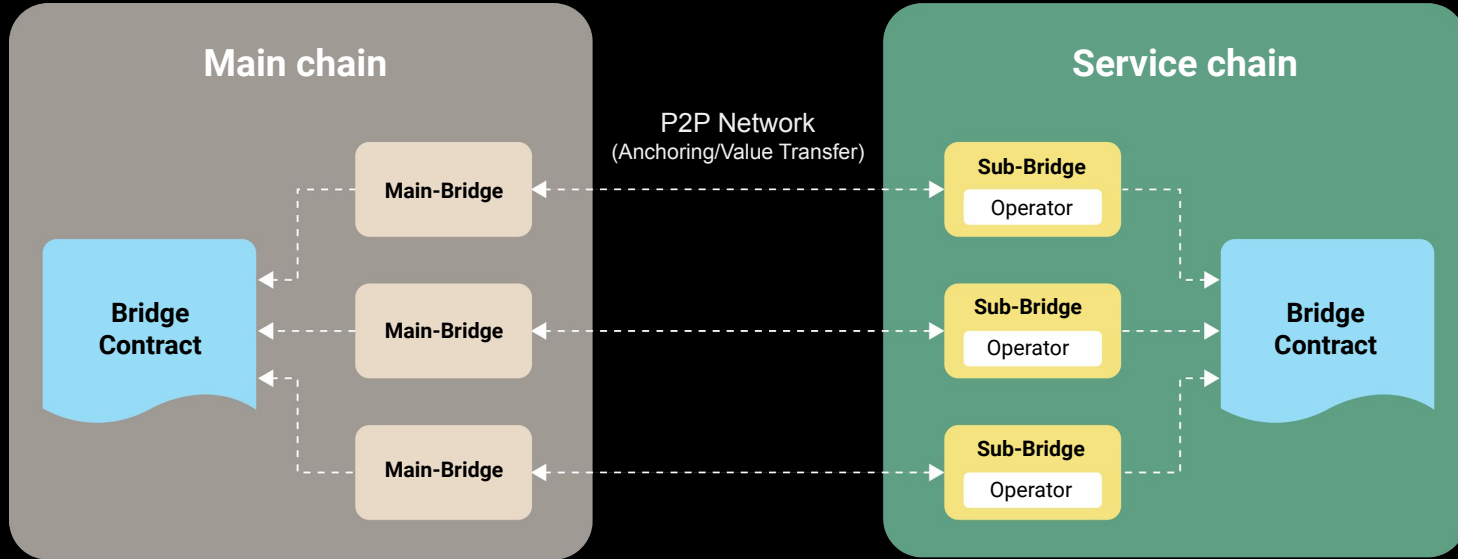




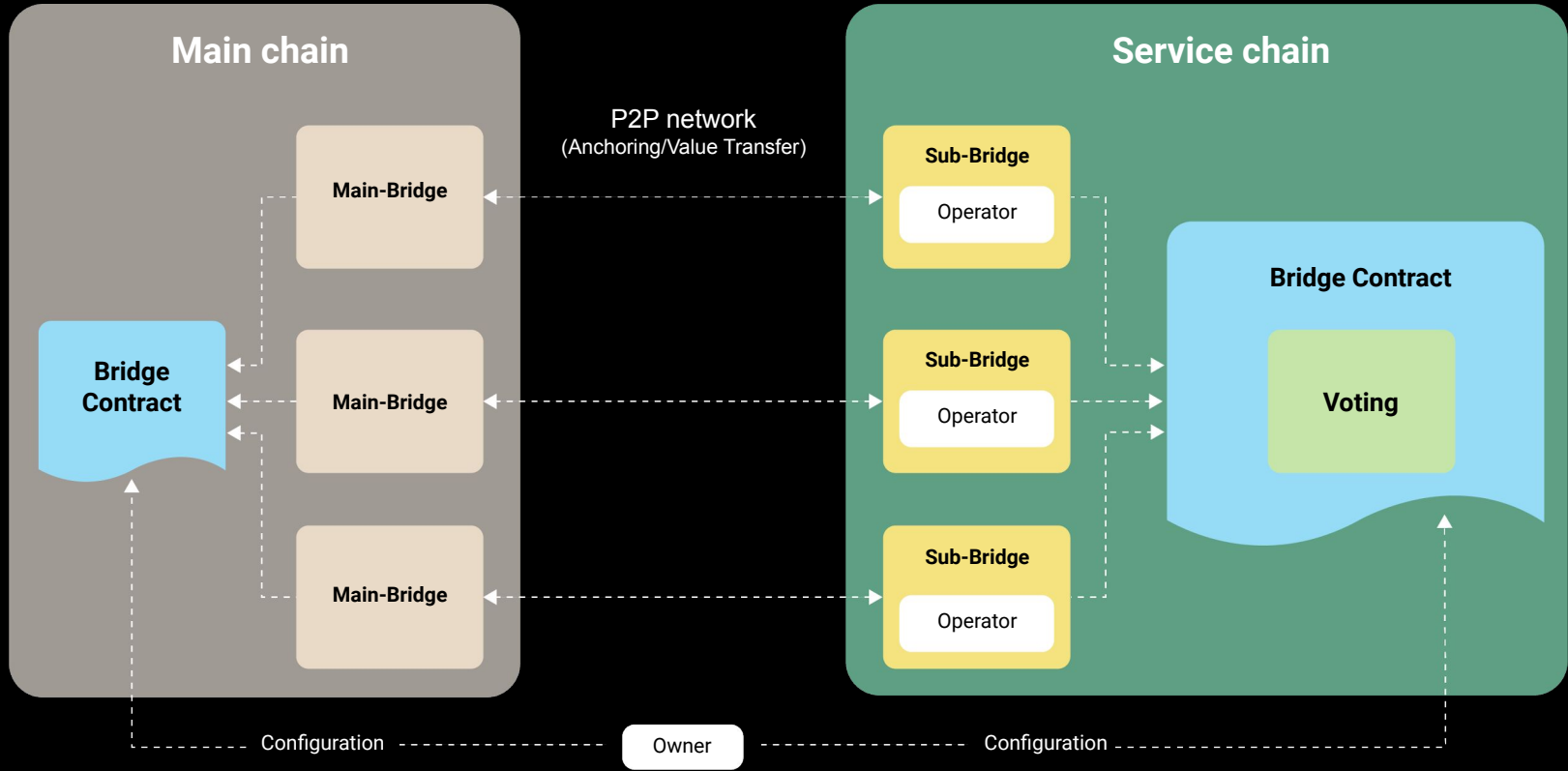
# Problems To Solve - Security of Operator Key



# Multi-Bridge Architecture

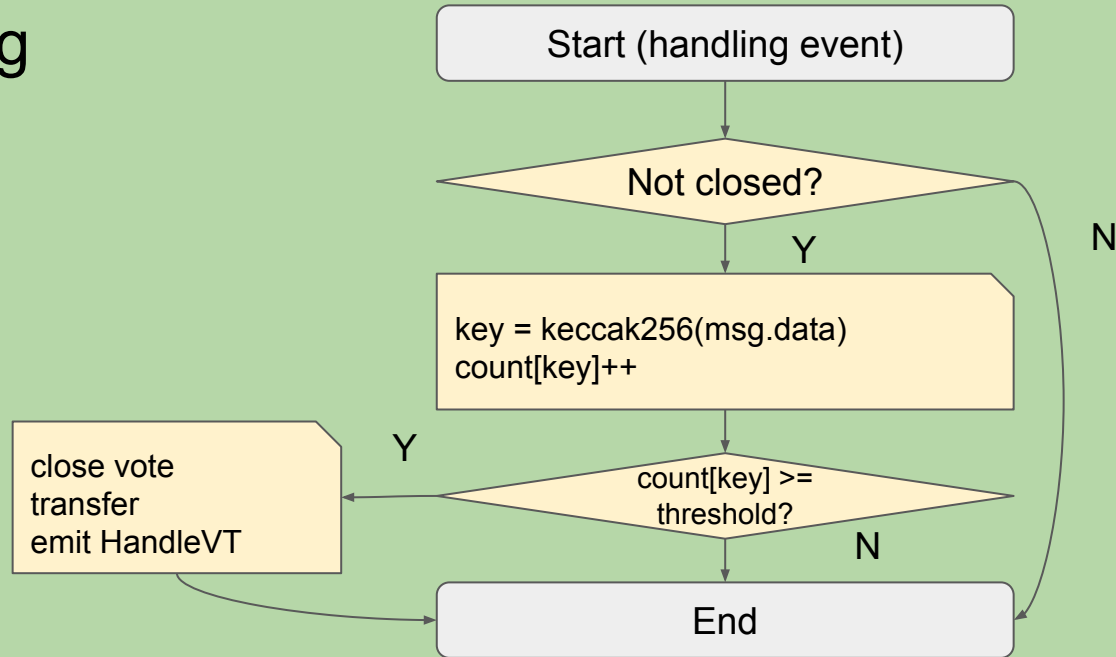


# Multi-Bridge Architecture



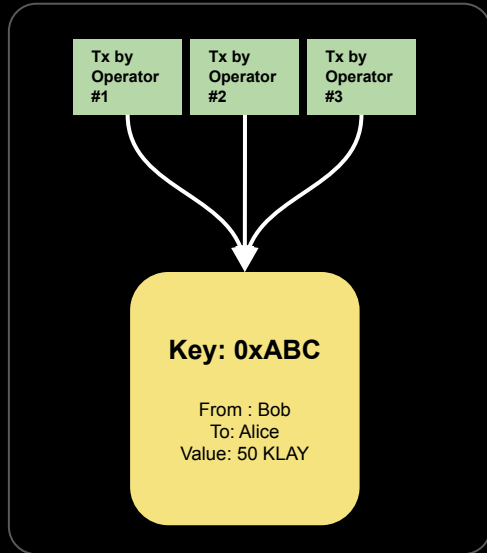
# Multi-Bridge Architecture

## Voting

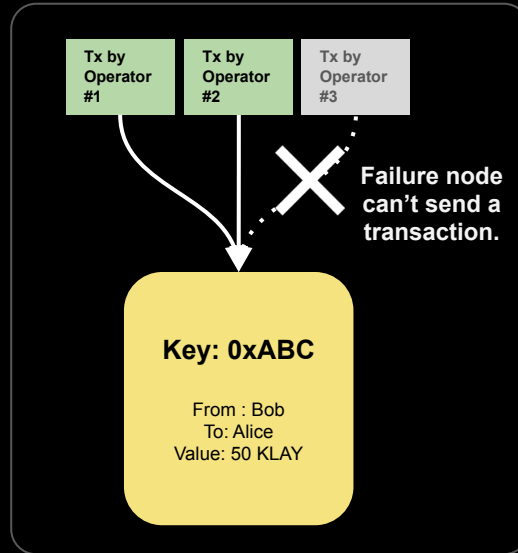


# Multi-Bridge Scenarios

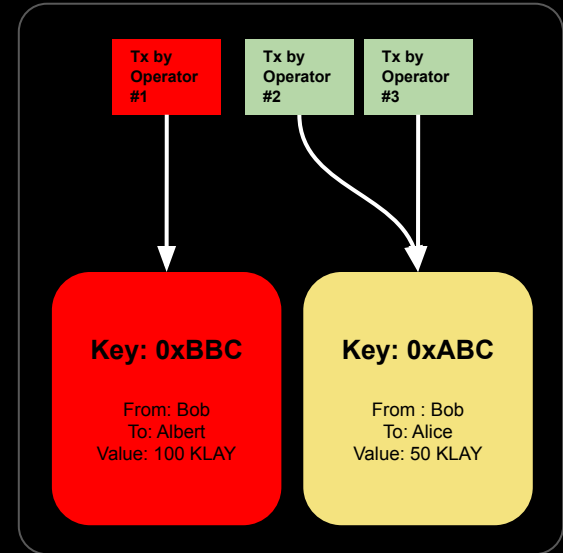
## Case 1: Normal transfer



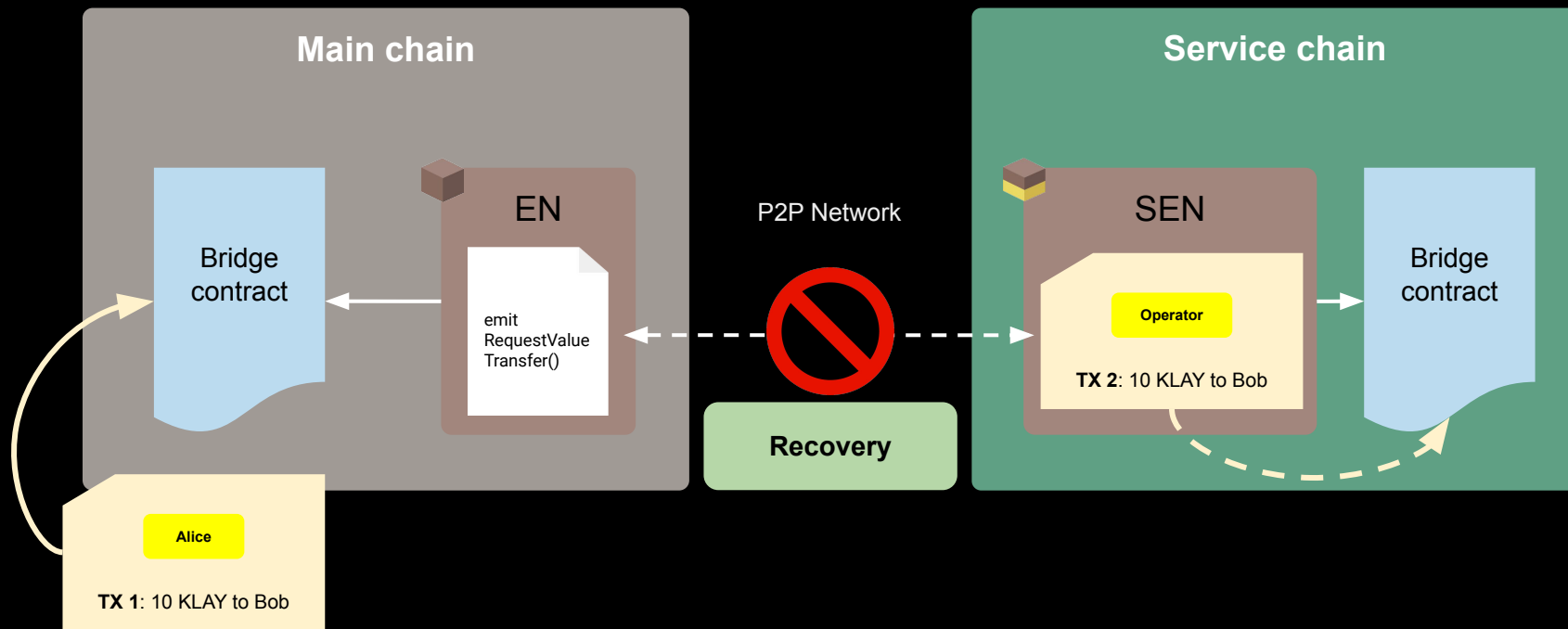
## Case 2: Node failure



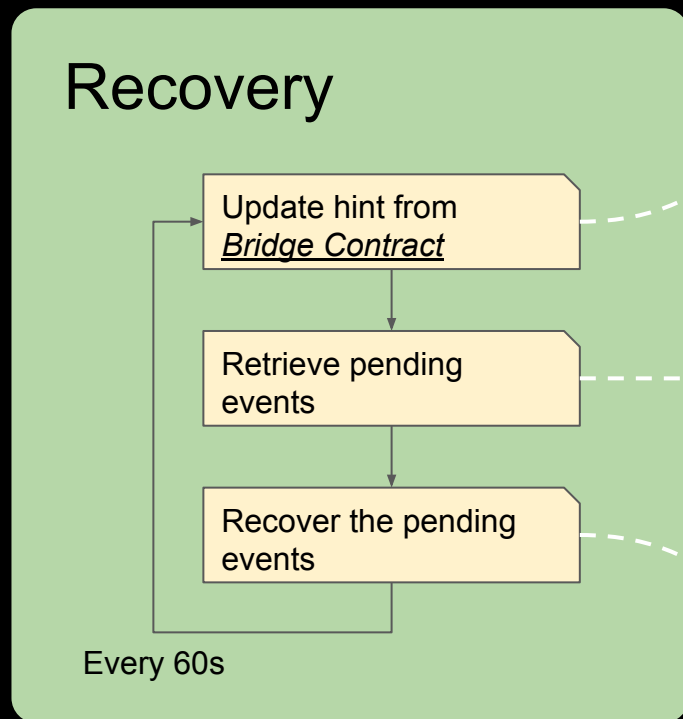
## Case 3: Invalid attempt



# Recovery



# Recovery

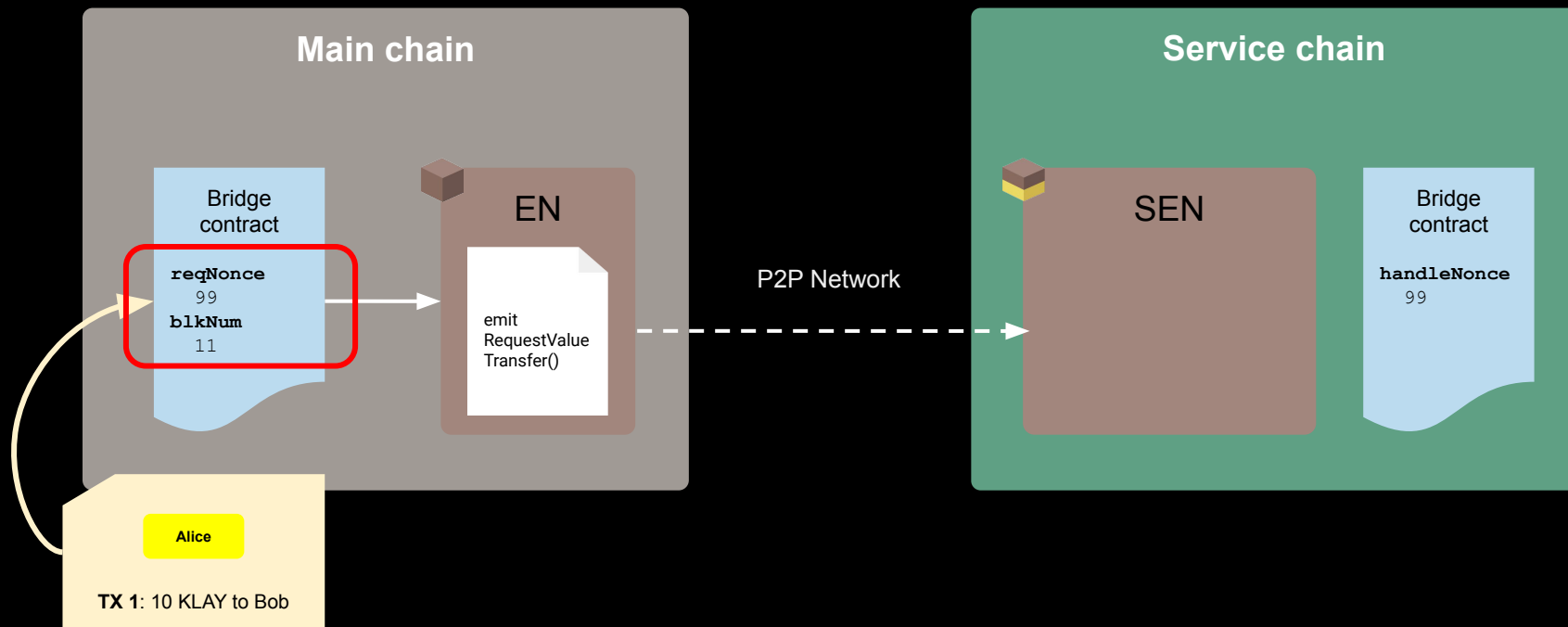


- requestNonce
- handleNonce
- blkNum

- Check recovery condition
  - $requestNonce \neq handleNonce$
  - $prevHandleNonce == handleNonce$
- Get pending events
  - $FilterRequestVT(blkNum, current)$

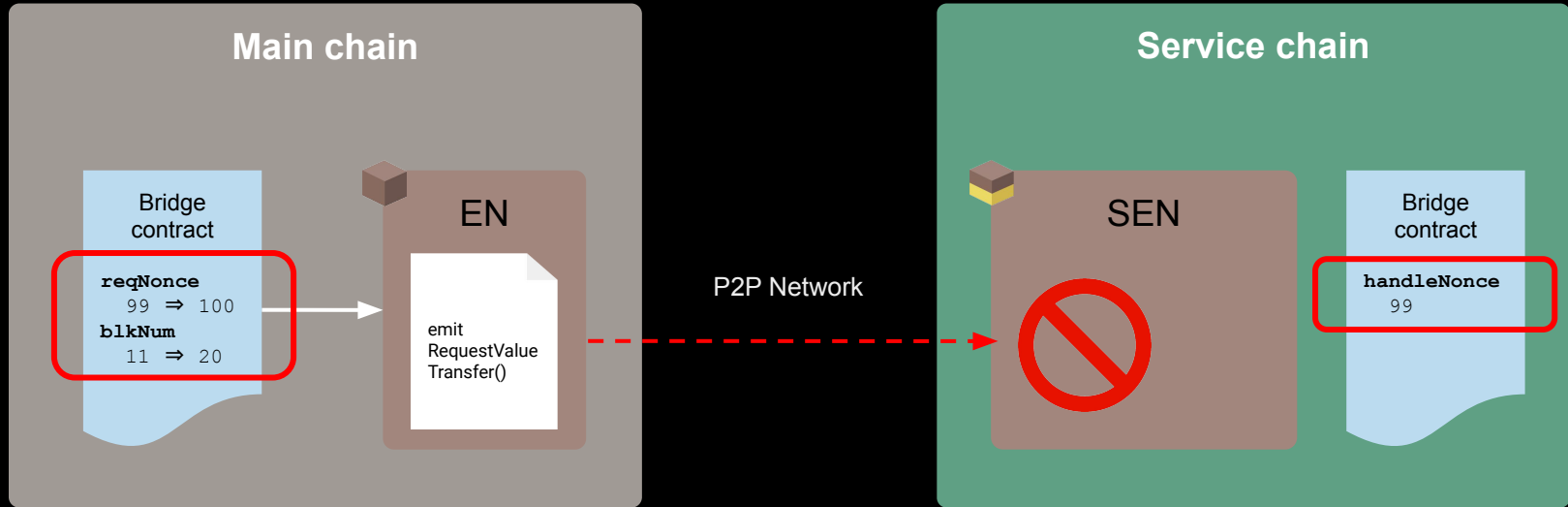
- Re-send the pending transactions
  - Duplicated tx is reverted by checking nonce

# Recovery

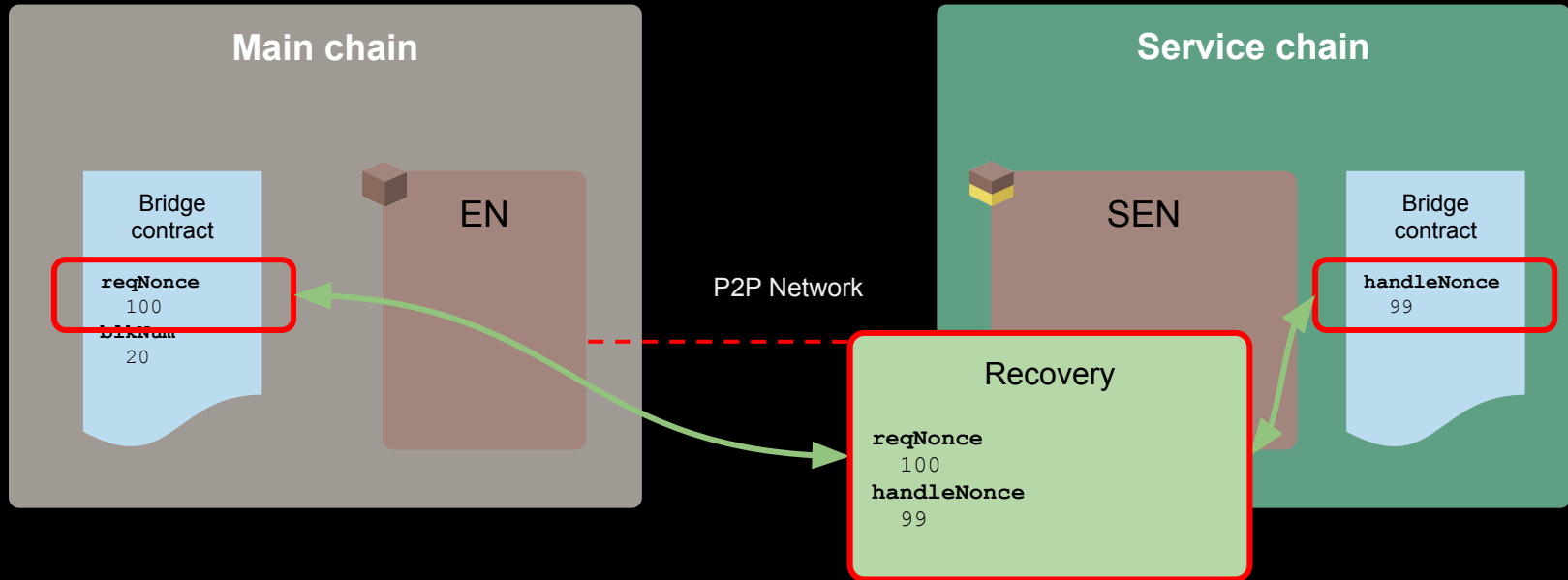




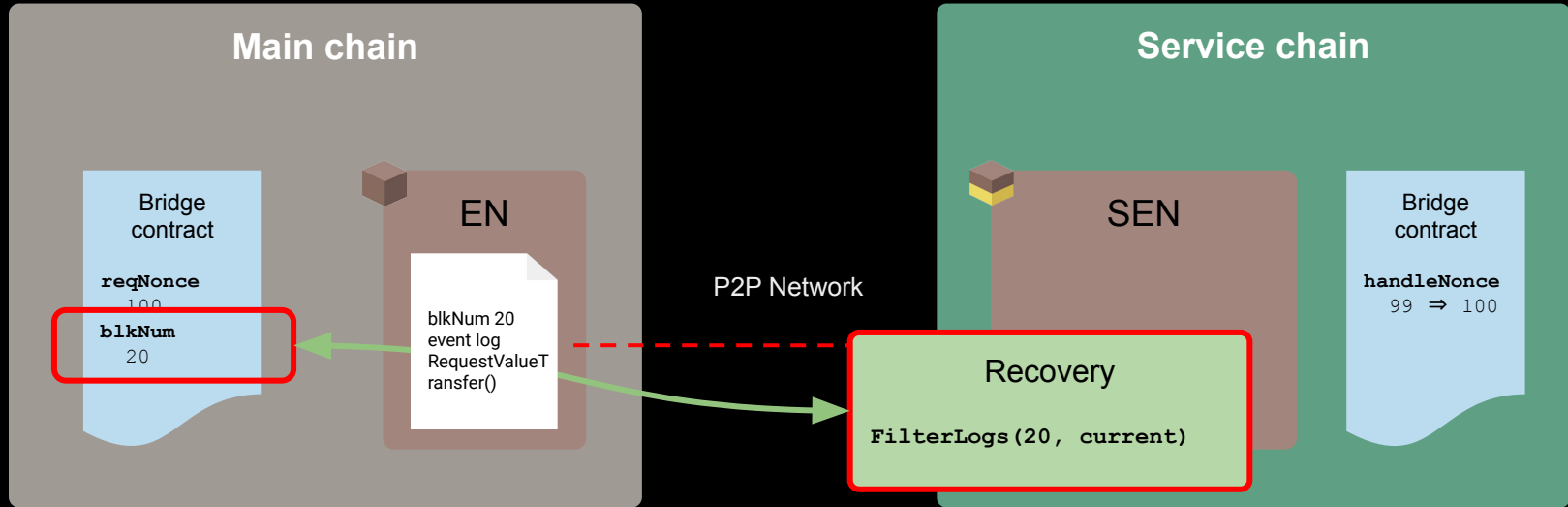
# Recovery



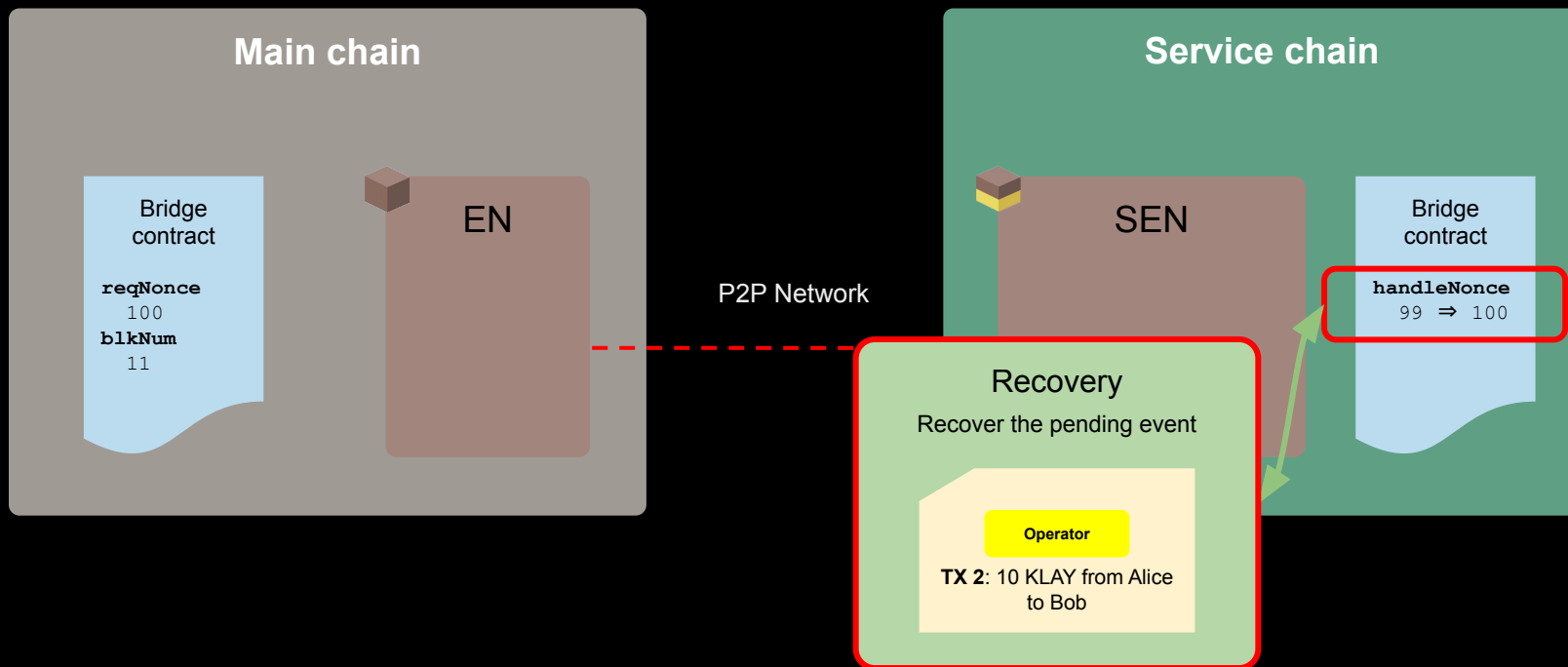
# Recovery



# Recovery



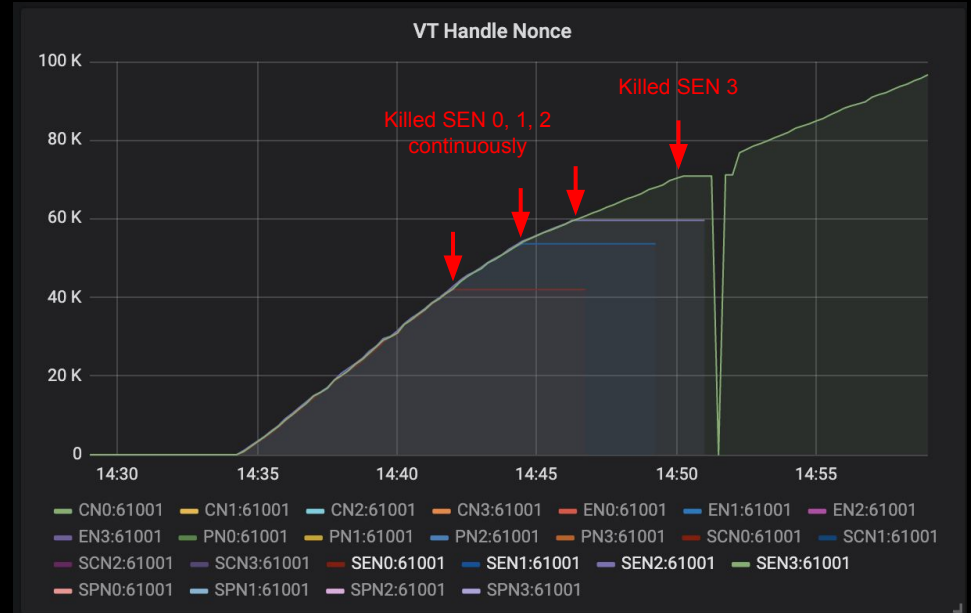
# Recovery



# Test Results

## Multi-bridge

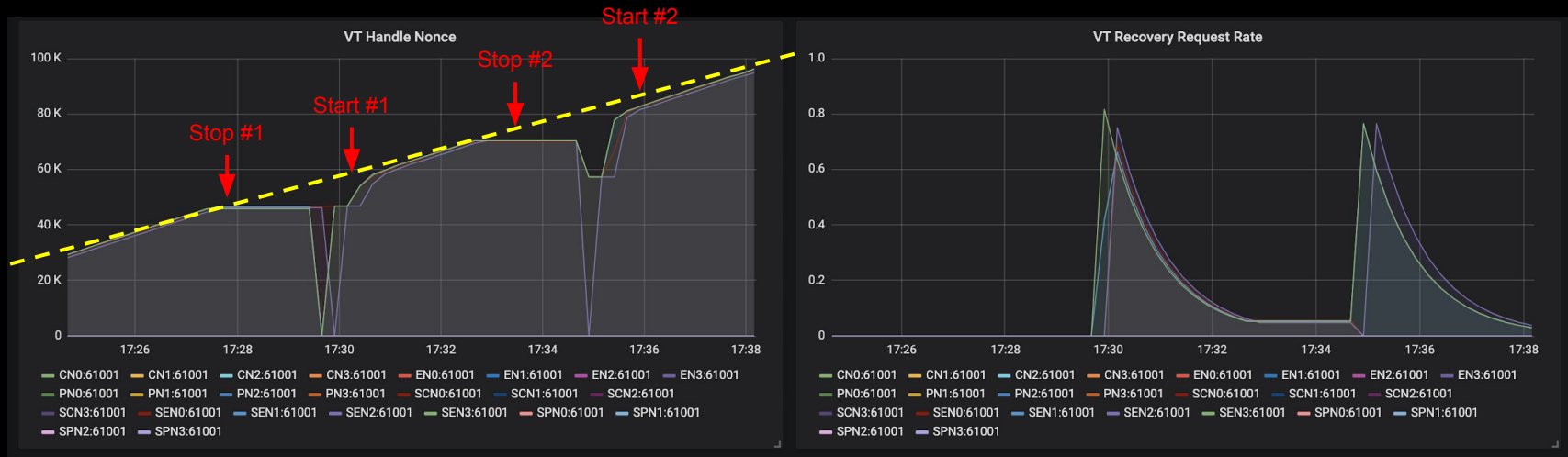
- EN 4 (main-bridge 4), SEN 4 (sub-bridge 4), threshold 1
- Value transfer (Main Chain ↔ Service Chain)



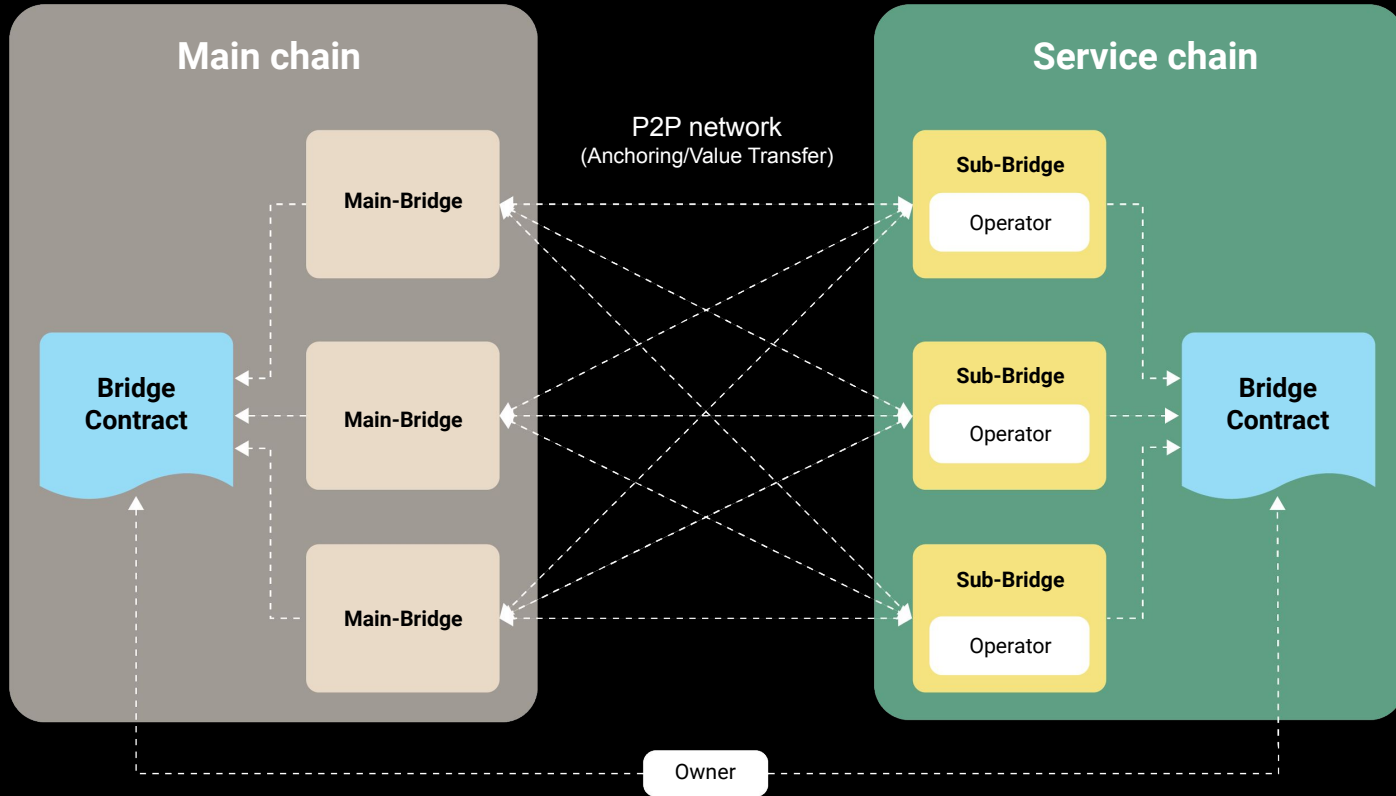
# Test Results

## Recovery

- Value transfer (Main Chain → Service Chain)
- Repeatedly stop and start all SENS



# Future Work



# THANK YOU

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