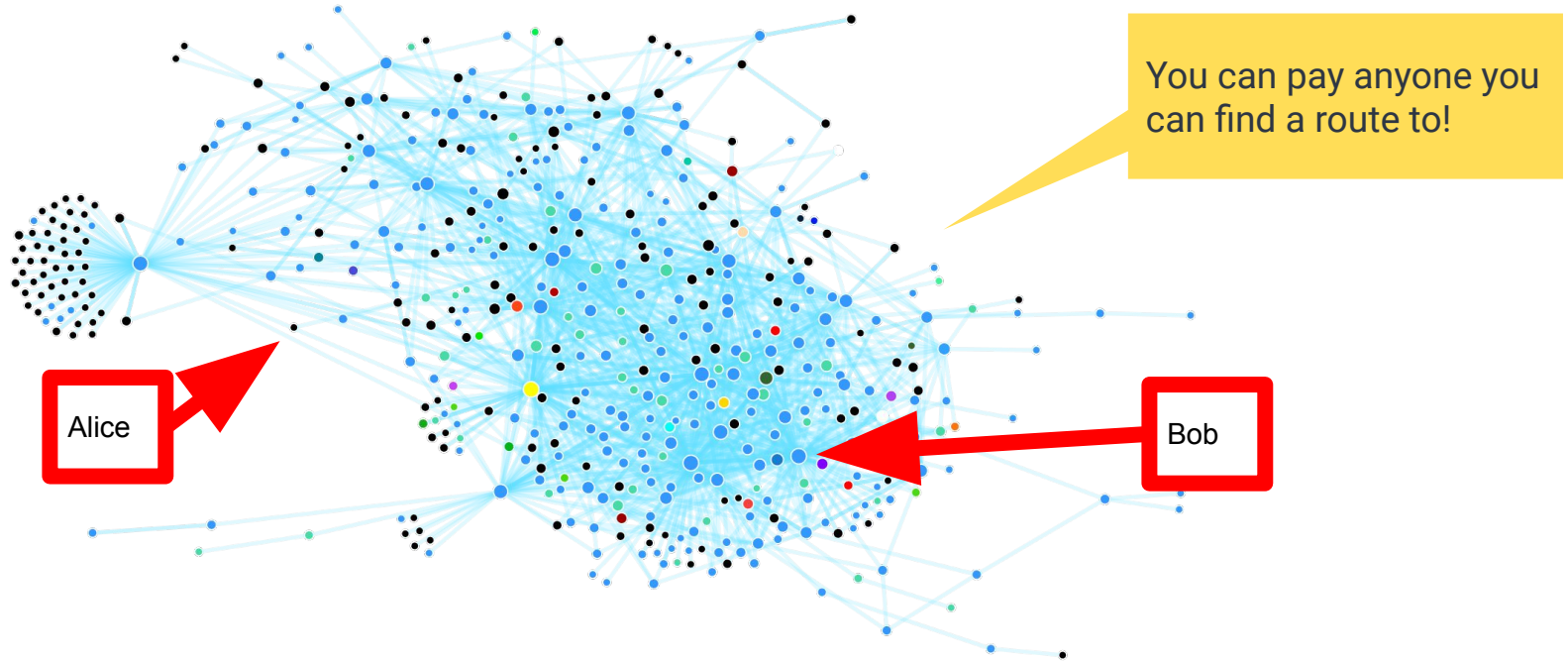# Routing Failures

Chaincode LN residency - NY 2019

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# Network of Payment Channels

Routing

Routing in LN mixes 2 different concepts:

- How to find a route ?
  - This is not really part of the LN protocol. You can compute routes locally, ask someone to do it for you…
- How to send and relay payments once you have a route?
  - This is part of LN
  - Sender creates an "onion" packet that tells each node what the next hop is
  - Nodes "peel off" their own decryption layer, and forward the decrypted packet

encrypted for A

encrypted for B
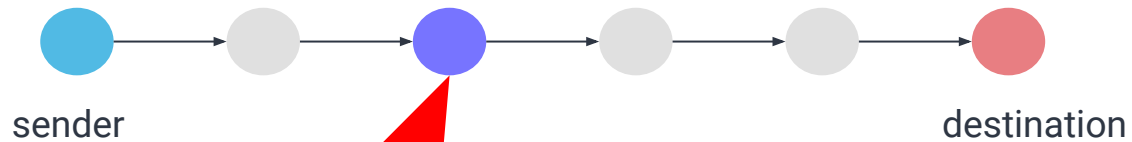
encrypted for C

encrypted for D
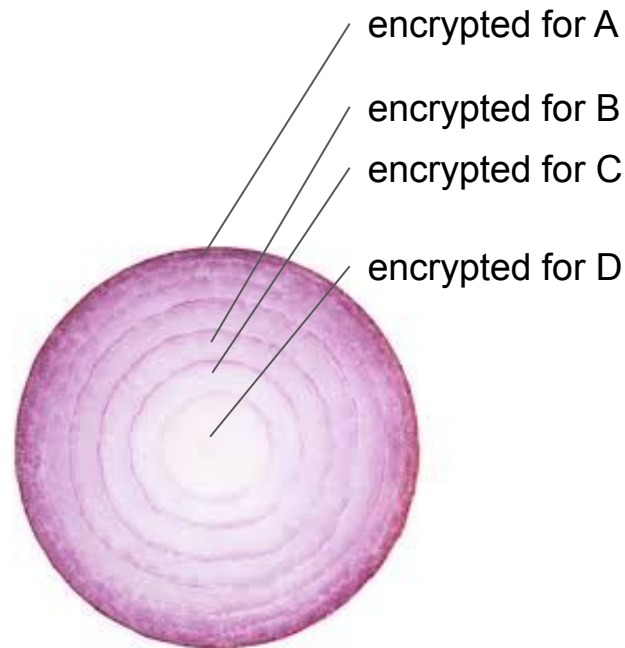
Routing Table

- Node Announcement
- Channel Announcement
- Channel Update
    - 1 for each "side" of the channel
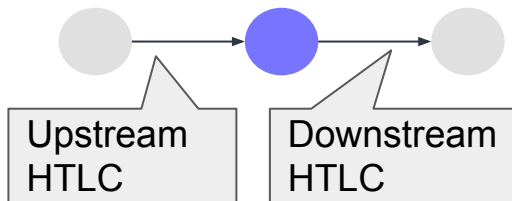   - Contains info that you need to route through a channel

Routing

sender

destination
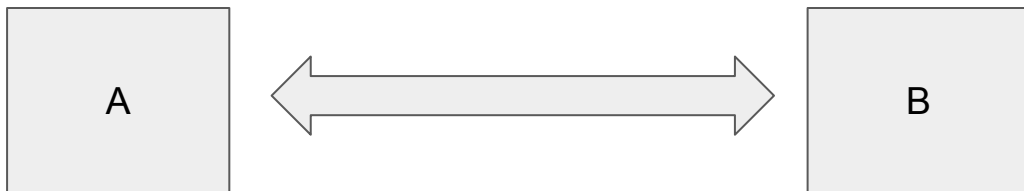
Peels off its own onion layer, to reveal:
- nex hop (short channel id)
- amount
- CLTV delay

Routing Failures

- Upstream HTLC
  - Amount
  - CLTV expiry
- Downstream HTLC
  - Short channel id
  - Amount
  - CLTV expiry
- Why would it fail ?

Routing Failures

- Badly formatted HTLC
- Upstream errors
    - Balance
    - Number/value of pending payments
- Relay errors
    - Relay fees not met
    - CLTV delta not met
    - Balance/pending payments errors
- No such channel
- Channel is offline

Routing Failures

- Different types of errors
  - 0x8000 (BADONION): unparsable onion encrypted by sending peer
  - 0x4000 (PERM): permanent failure (otherwise transient)
  - 0x2000 (NODE): node failure (otherwise channel)
  - 0x1000 (UPDATE): new channel update enclosed
- Errors returned to the sender using the same shared secrets
  - Can currently be gamed
- Sender will either
  - try the same route with updated fee/cltv parameters
  - temporarily ban the failing channel and try another route
  - fail the payment

Routing Failures

- Sender needs a "good enough" routing table:
- Missing nodes/channel => cannot compute a route
- Outdated info => fail and retry
  - Bad UX
  - Instant payments no longer instant
- How to efficiently synchronize routing tables ?

Routing Table Sync

Basic Version: broadcast gossip messages

- Node Announcements
- Channel Announcements
- Channel Updates