The Lightning Network: More than just payments

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Overview

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- How can we utilize this to build interesting apps that can talk to lightning and bitcoin nodes directly.
- Why would you want to do this, and what kinds of applications are possible.

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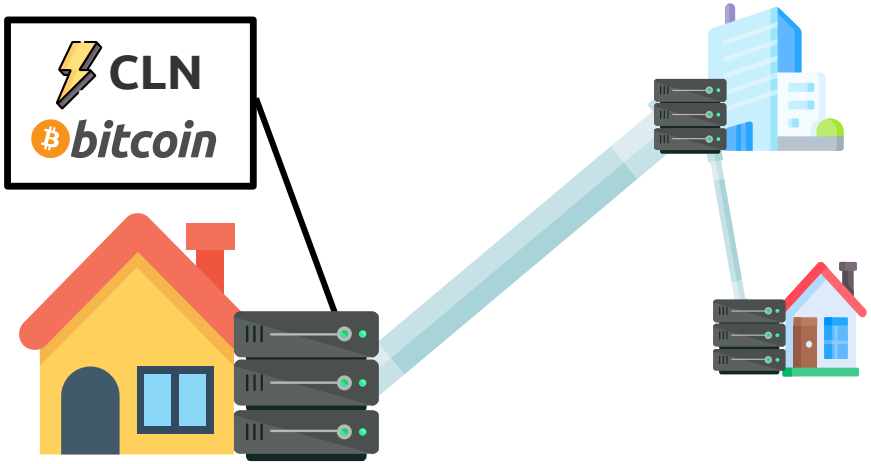
- Intermediary certificate authorities can forge certificates, allowing interception of traffic. This isn't just theoretical, this has actually happened by state actors in Iran to snoop on gmail users.
- Due to the sensitive nature of internet money, it deserves a better protocol for secure communications that is simpler and can't be intercepted.

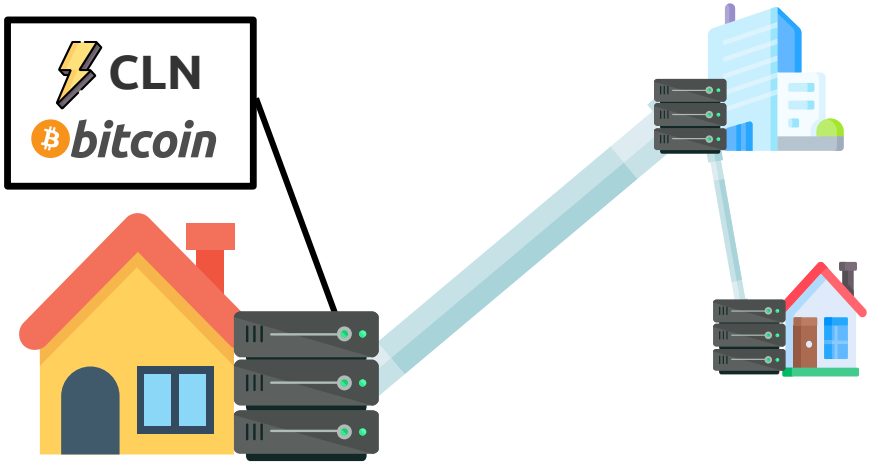
Enter the lightning network

- The Lightning Network doesn't build on the web, it is a distinct internet protocol with it's own security properties.



Enter the lightning network

- The Lightning Network doesn't build on the web, it is a distinct internet protocol with it's own security properties.
- You can connect to a lightning node in a similar way you would connect to a web server, so why not just communicate to a node directly to list products and pay for things?



Aside: Importance of running nodes

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- With bitcoin-core and a lightning node you can keep your transactions completely private and you don't have to outsource anything. You have a working bank + visa stack within your own organization or home.
- Now that we agree that running node is the best way to interact with the Bitcoin economy, what would be the best way to iteract with them?

Lightning as the communication layer for the Bitcoin Economy

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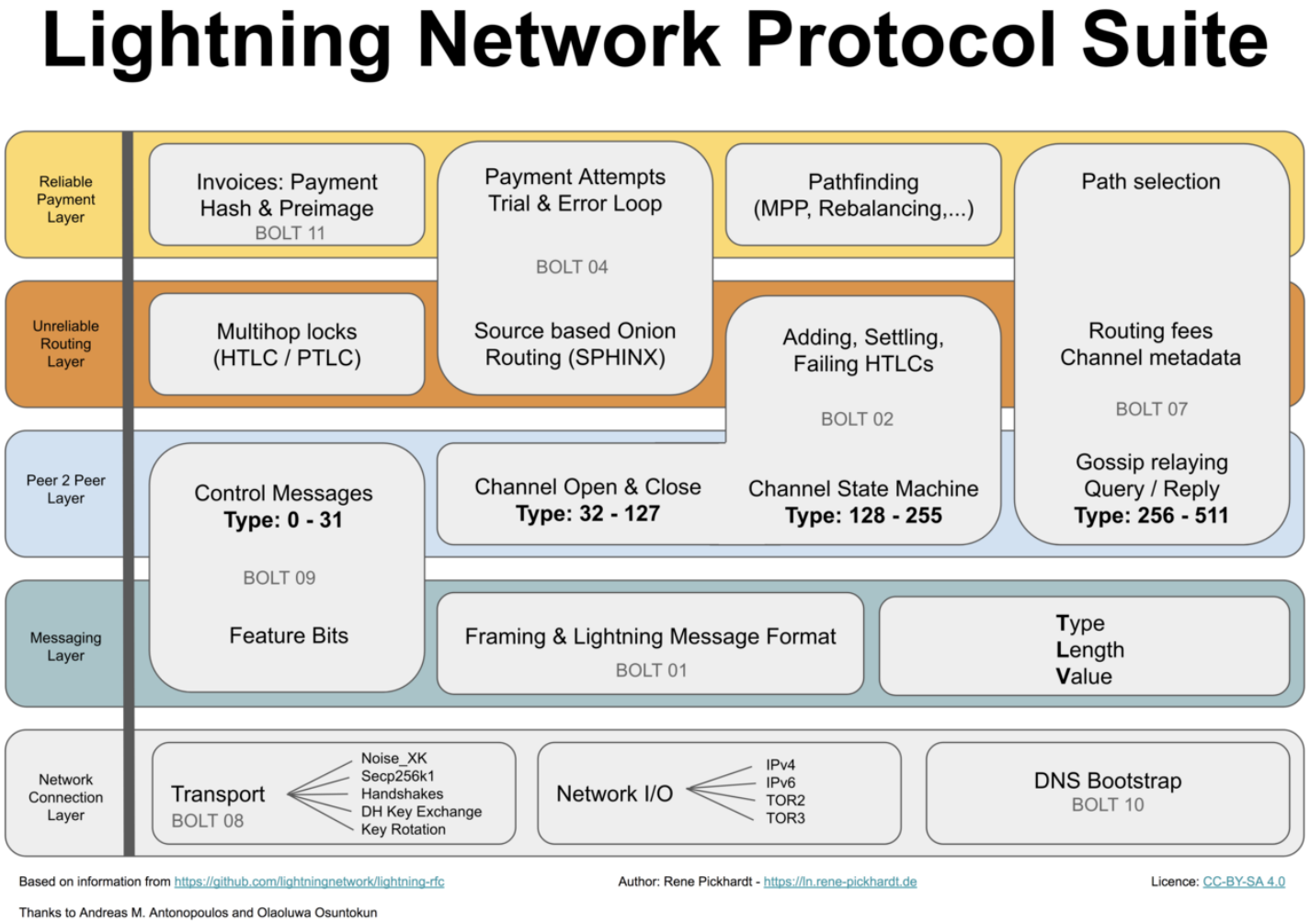
- This shifts the burden of development into client applications instead of pushing it onto the business owner who just wants to sell products, or a user who just wants to use their CLN node as a wallet.


Lightning Network Protocol Suite
Reliable Payment Layer
Invoices: Payment Hash & Preimage
BOLT 11
Payment Attempts Trial & Error Loop
BOLT 04
Pathfinding (MPP, Rebalancing,...)
Path selection
Unreliable Routing Layer
Multihop locks (HTLC / PTLC)
Source based Onion Routing (SPHINX)
Adding, Settling, Failing HTLCs
BOLT 02
Routing fees
Channel metadata
BOLT 07
Peer 2 Peer Layer
Control Messages
Type: 0 - 31
BOLT 09
Feature Bits
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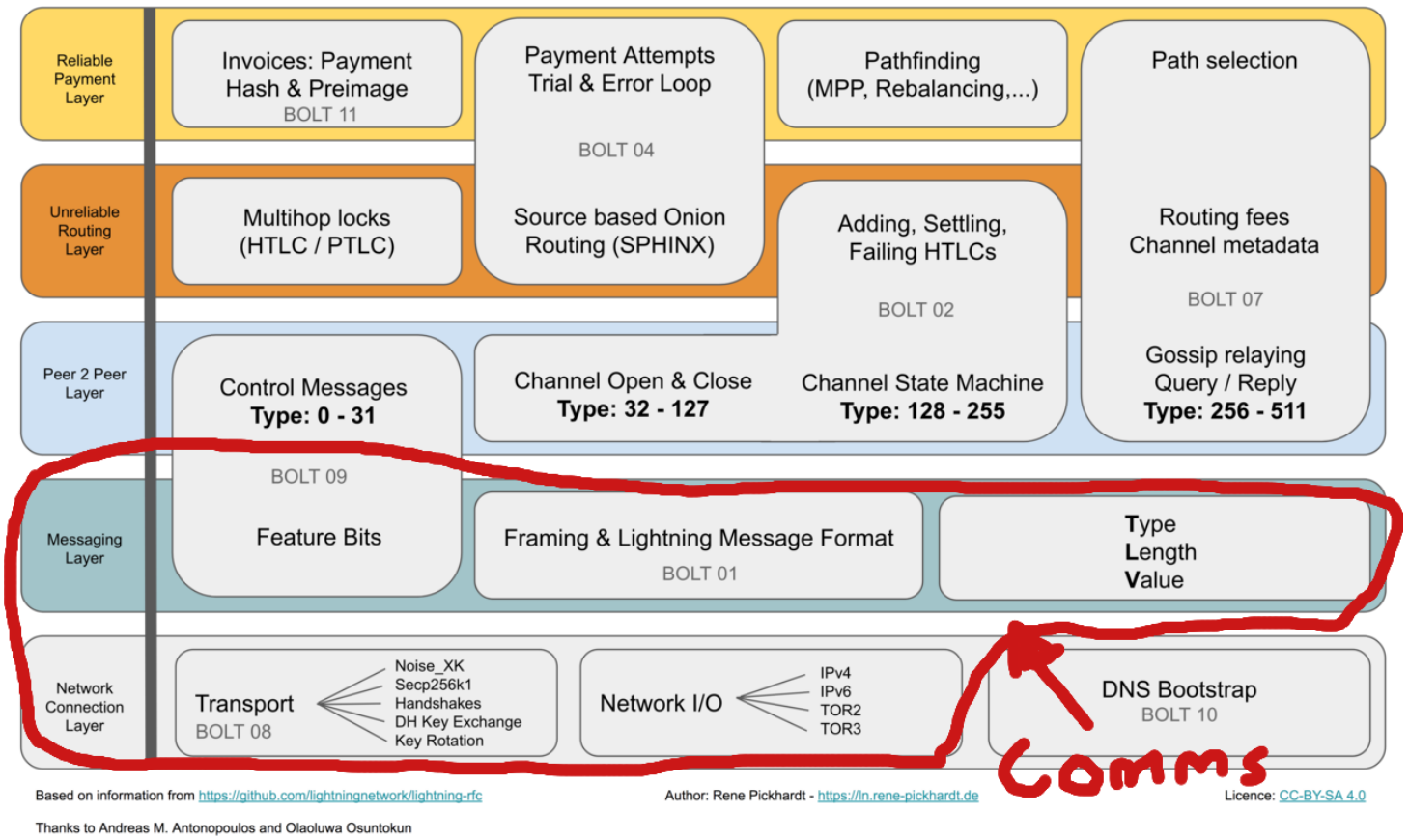
Type: 32 - 127
Channel State Machine
Type: 128 - 255
Gossip relaying
Query / Reply
Type: 256 - 511
Messaging Layer
Framing & Lightning Message Format
BOLT 01
Type
Length
Value
Network Connection Layer
Transport
BOLT 08
Noise_XK
Secp256k1
Handshakes
DH Key Exchange
Key Rotation
Network I/O
IPv4
IPv6
TOR2
TOR3
DNS Bootstrap
BOLT 10
Based on information from https://github.com/lightningnetwork/lightning-rfc
Author: Rene Pickhardt - https://ln.rene-pickhardt.de
Licence: CC-BY-SA 4.0
Thanks to Andreas M. Antonopoulos and Olaoluwa Osuntokun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Comms
Based on information from https://github.com/lightningnetwork/lightning-rfc
Author: Rene Pickhardt - https://ln.rene-pickhardt.de
Licence: CC-BY-SA 4.0
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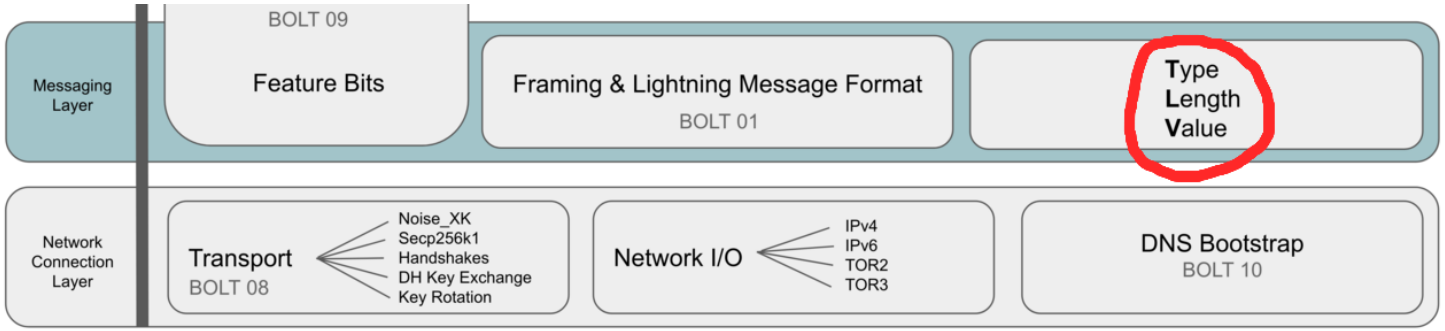
TLVs



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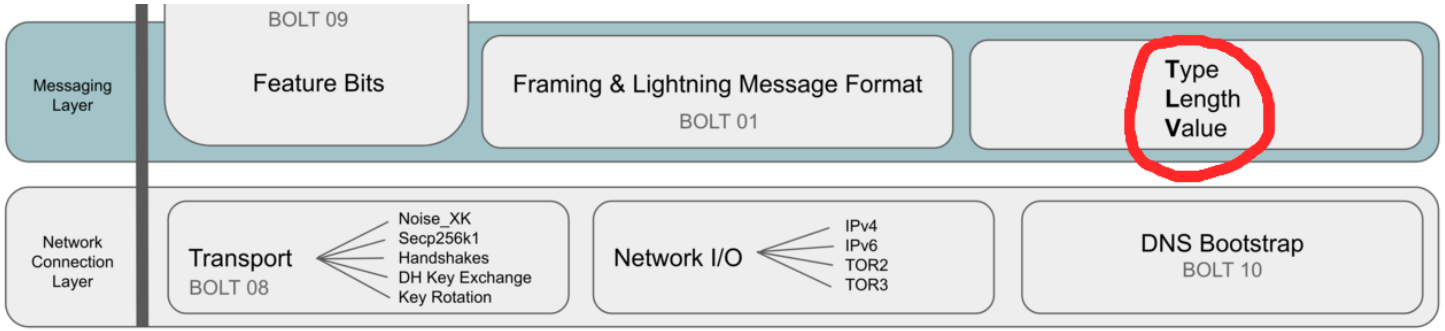
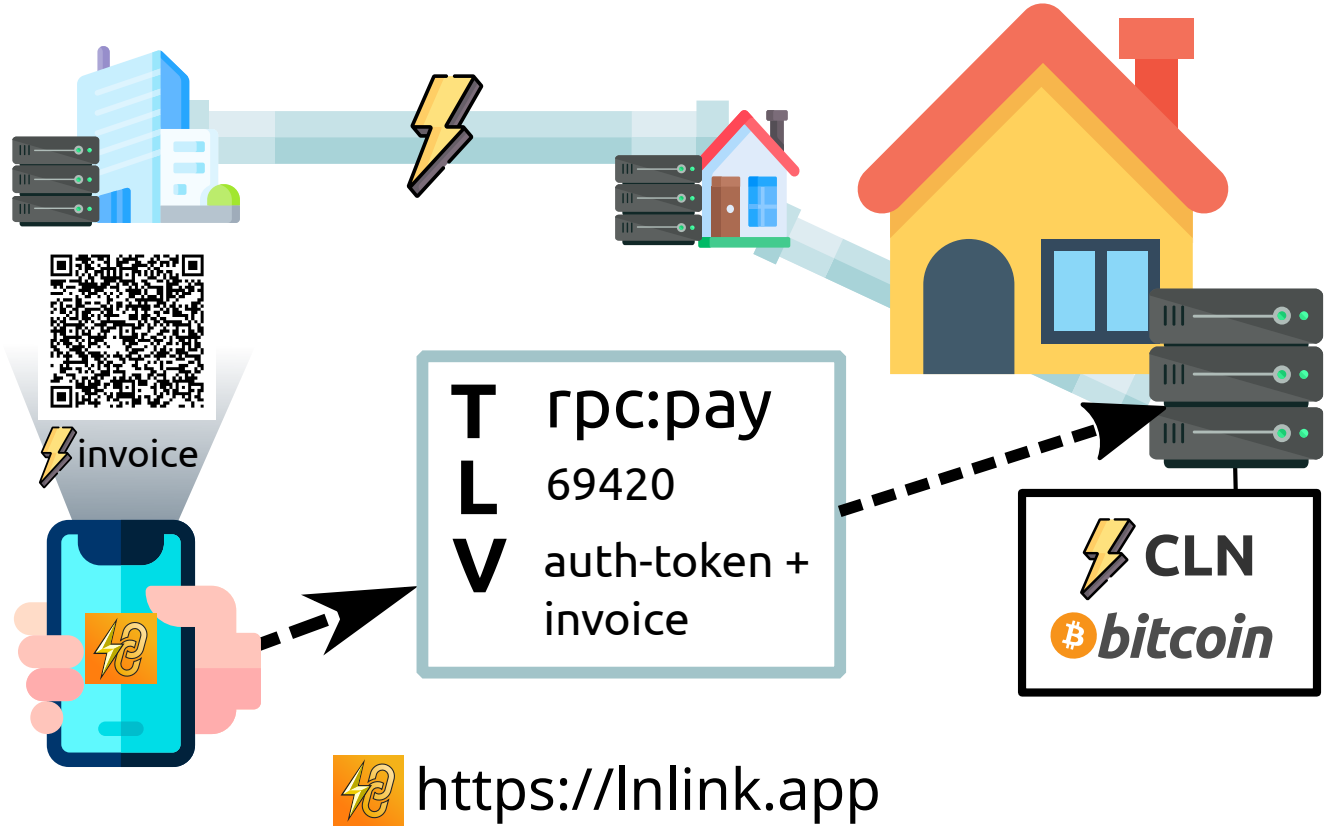


- Packets on the lightning network are composed of three data elements: type, length, and value
- By including custom data in these packets, we can talk to a lightning node as if we were making a web request.

Example: Paying invoices with your node



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- Manage your lightning node channels from your phone, access your point-of-sale from your phone or anywhere.
- No Tor needed, no VPN needed, which are sometimes blocked on certain networks.

Example: Crowdfunding without a web server

Damus Android crowdfund

If ya'll help crowdfund me an android phone I can start working on an android version

Donations

This is a bolt12 offer, you can pay this with a CLN node. Otherwise press the button to get a bolt11 invoice.

REQUEST BOLT11 INVOICE

Total: **3,371,451.625 / 3,000,000 sats goal (1.1e+2%)**

Recent Donors

Note	Amount	
we got ya. @SN	16,537 sats	28 days ago

Example: Crowdfund code

```
async function make_request(method, rune, params) {
    const LNSocket = await lnsocket_init()
    const ln = LNSocket()

    ln.genkey()
    await ln.connect_and_init("03f3c108ccd536b8526841f0a5c58212bb9e6584a1eb493080e7c1cc34f82dad71",
"wss://cln.jb55.com:443")

    const {result} = await ln.rpc({ rune, method, params })

    ln.disconnect()
    return result
}

function fetch_tipjar_summary() {
    const rune = "b3Xsg2AS2cknHYa6H94so7FAVQVdnRSP6Pv-1WOQEBc9NCZtZXRob2Q9b2ZmZXItc3VtbWFyeQ=="
    return make_request("offer-summary", rune, {
        offerid: "2043536dfec68d559102f73510927622812a230cfdda079e96fccbfe35a96d11",
        description: "@damus-android",
        limit: 5
    })
}

function make_invoice(description) {
    const rune = "LZwGZJO7wZgmoScFQb5reZ0Ii8qPKCeUfTb-UcbDxWw9MTImbWV0aG9kPWludm9pY2U="
    description = (description && `${description} @damus-android`) || "@damus-android donation"
    return make_request("invoice", rune, {
        msatoshi: "any",
        label: `damus-android-${new Date().getTime()}`,
        description: description
    })
}
```

Example: Manage your bitcoin-core node

1 2 3: lnlink-core

Bitcoin Wallet

Transactions | Descriptors | ☑ Masked

Transactions

Date	Amount	Label	Type
3 days ago	🙈	shakepay-2022-07-13	receive
11 days ago	🙈	shakepay-2022-06-05	receive
21 days ago	🙈	3NL...	send
29 days ago	🙈	375...	send
1 months ago	🙈	shakepay-2022-05-08	receive
2 months ago	🙈	shakepay-2022-04-11	receive
2 months ago	🙈	35G...	send
2 months ago	🙈	3Me...	send
3 months ago	🙈	shakepay-2022-03-08	receive

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- bitcoin-core is not designed to be accessed from an external network, typically due to the web concerns as described in previous slides.
- Lightning provides a secure way to access your node remotely. From a mobile app or http webpage, you can generate addresses, get notifications when you receive funds, manage your bitcoin wallet from anywhere, create onchain transactions, etc.

Insocket

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- https://github.com/jb55/lnsocket

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- For example all examples require a plugin called commando which allows you to call CLN's jsonrpc over lightning itself. Perhaps one day CLN could have commando available via a config option, or provide a cross-node standard for lightning RPC.
- The bitcoin-core example required me to write a plugin that exposes bitcoin-core's jsonrpc as CLN rpc. This allowed me to call bitcoin's jsonrpc via commando over lightning.

Conclusion

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- It looks like Lightning could become the *communications layer* for the Bitcoin economy.

Thanks

The End