Lightning Node Infrastructure Setup Experience by teemie ⚡

Thailand Bitcoin Conference 2024

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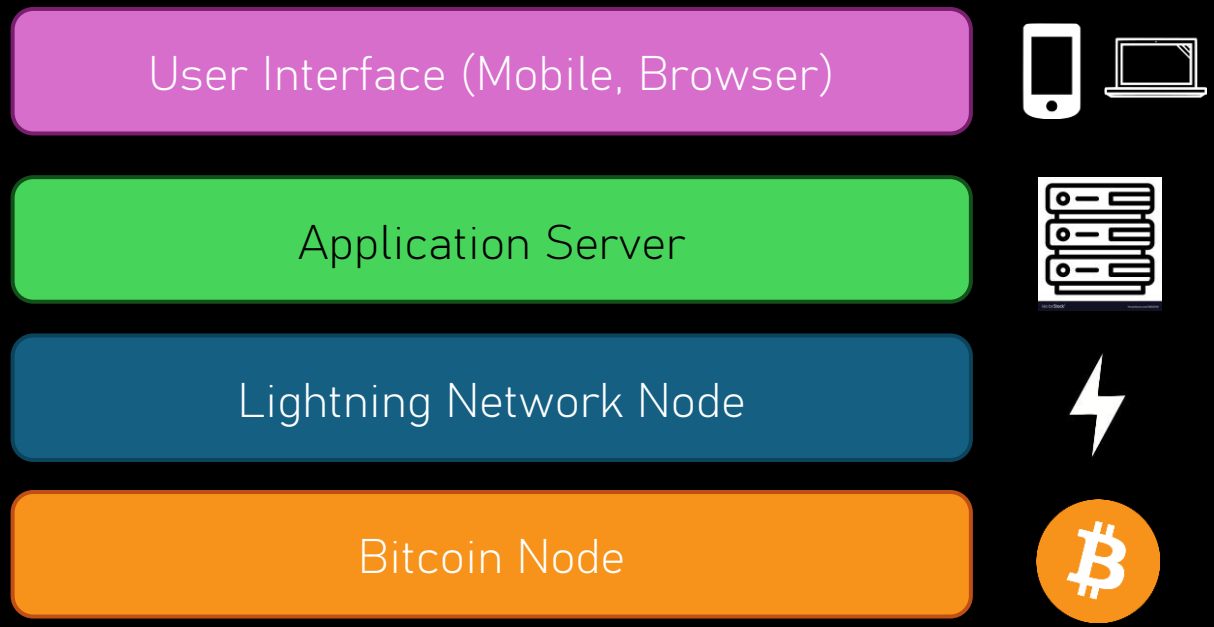
- https://tinyurl.com/46643nst

Topics

- How to Install
- Architecture of node implementation
- Node Networking
- Backup and High Availability
- Case Study

Lightning Application Architecture



How to install

Recommendation

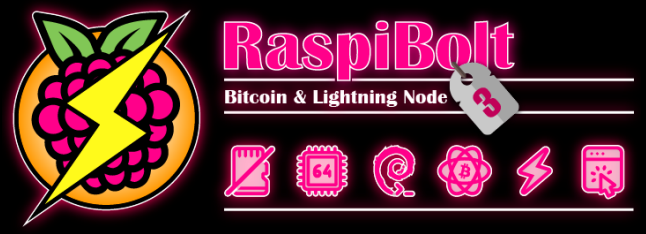
- Node Software Bundle/Helper
  - Umbrel, Start9, MyNode, Raspiblitz
  - Easy to install but maybe not clear understanding

❌

- Bare Metal Installation
  - Install each software by yourself
  - Step-by-step command
  - More understand, more capability to manage node

✅

Raspberry Pi (ARM CPU)



MiniPC (x86 CPU)

Node Implementation

- Select your best choice

- Implementation in Golang
- Developed by Lightning Lab
- Pros
  - Most popular, 90%+ in the lightning network
  - More lightning management tools (RTL,Thunderhub, LNDg, BOS, rebalance-lnd etc.)
  - More developer, more issues to resolved
  - Support for Simple Taproot Channel, Taproot Asset etc.
- Cons
  - Bad database management (boltdb: channel.db)
  - Not support dual funded channel, splicing, bolt12 payment

4 sat/vB is 4000perkb or 1000perkw

CORE LIGHTNING

- Implementation in C
- Developed by Blockstream
- Pros
  - Less resource consumption (fast)
  - Follow BOLT standard
  - Support for Dual Fund Channel, Splicing, Bolt12 payment etc.
  - First implementation with postgresql replication
- Cons
  - Several little bugs (Gossip, dependency bug, compatible bug)
  - Bad payment algorithm
  - Complex command line (low level command)
  - Unit is msat, fee is perkb or perkw (4 sat/vB is 4000perkb or 1000perkw)
  - Not many management tool (RTL, LNbits)
  - Update too often (4 times/year)

eclair

- Implementation in Scala (Java)
- Developed by ACINQ
- Pros
  - Run the biggest node (ACINQ). The developers is the node runner. And LSP for Phoenix
  - Actor model architecture for splitting role to several machines. The scaling solution for very big node.
  - Because of Java, it can be running on Windows!
  - Support for Splicing and Bolt12 payment
- Cons
  - Not popular, less than 5% in the lightning network
  - No on-chain wallet, use bitcoin-core wallet for on-chain fund

Node Implementation Selection

- Select your best choice

More Tools, Easy
Manage and support

Most Advanced LN
Features

For big node

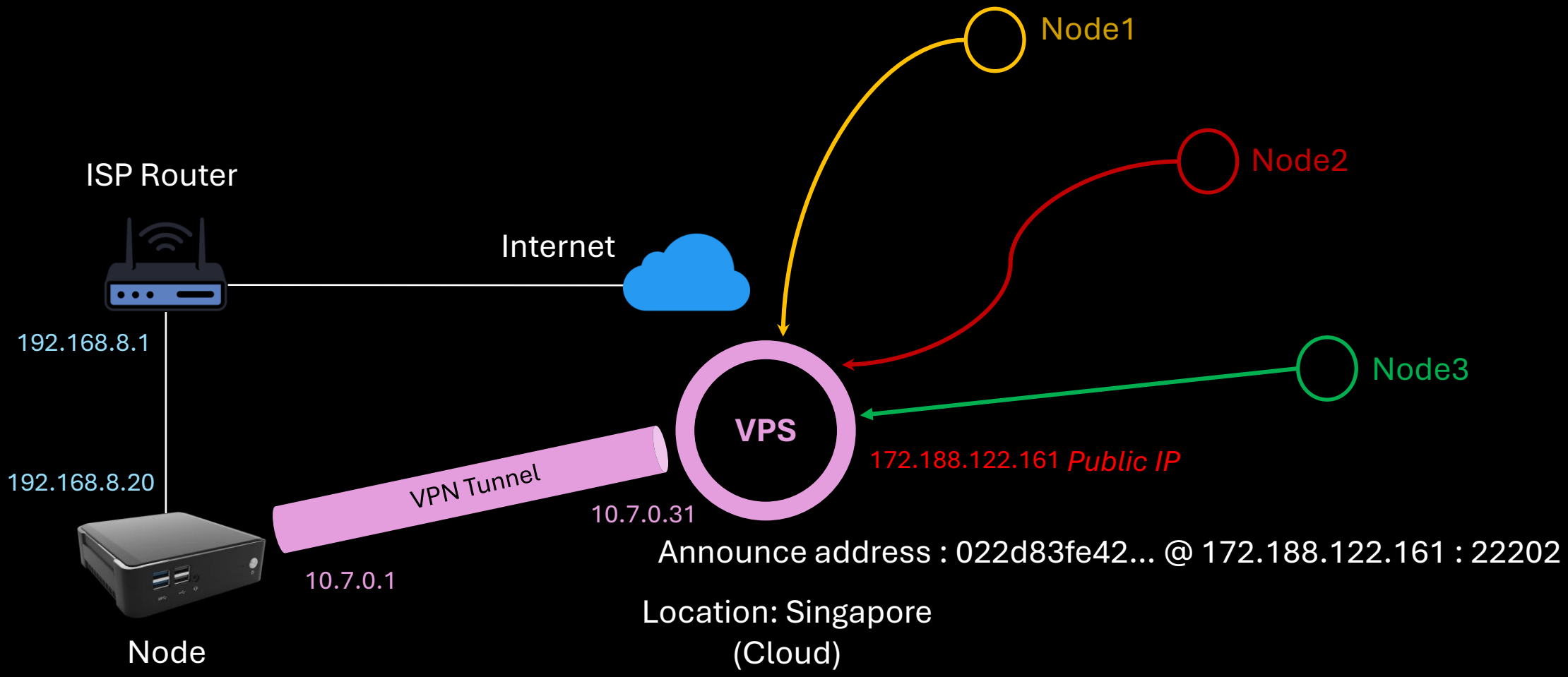
Node Networking

- How to remote access to node from outside.
  - Tor Network (Onion Address)
    - Slow response time
    - Not recommended ❌
  - Virtual Private Network (VPN)
    - Public Services (Zerotier, Tailscale)
    - Self install VPN (Wireguard ✅, OpenVPN)

Node Networking (Cont.)

- Node connectivity
  - Tor only node
    - Connect by onion address
    - Slow response time
    - Not recommended ❌
  - Clearnet node / Hybrid node ✅
    - Connect by IP address
    - Need VPS for public IP address hosted (paid services)

Clearnet Connection for Lightning Node



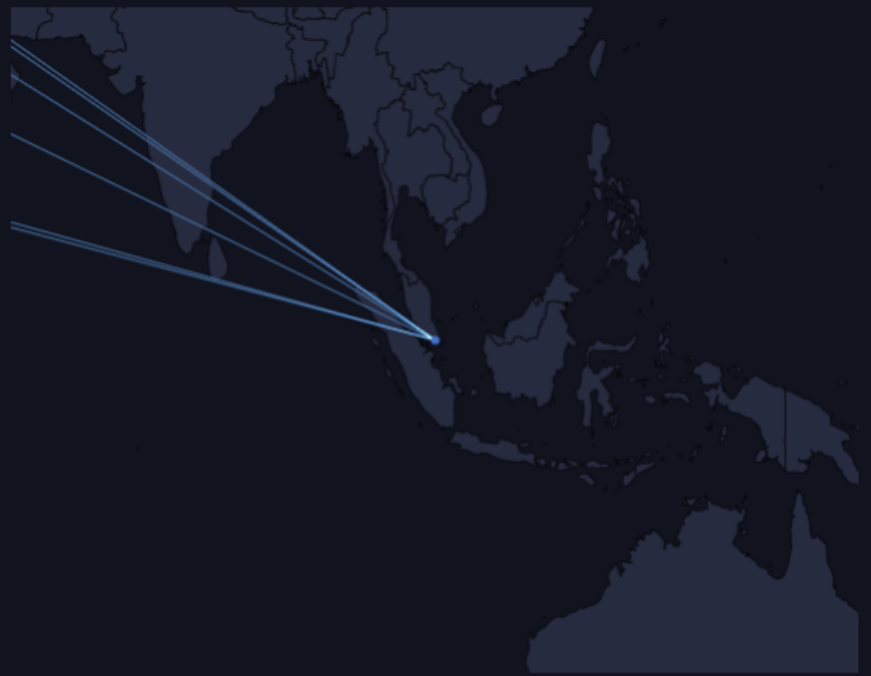
https://github.com/teemie1/LNbits_VPS

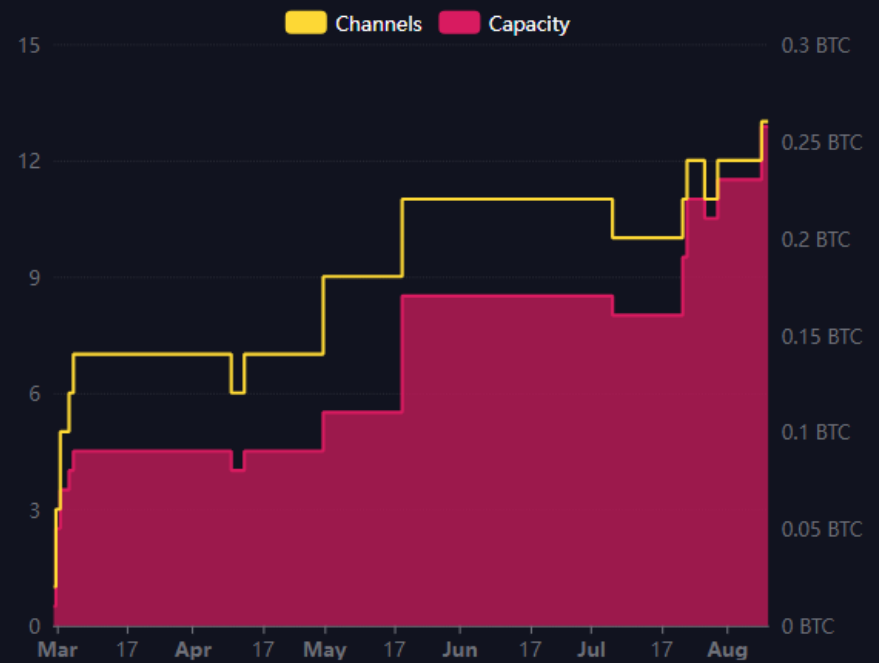
02491e5a8d534bf5bd0dfd3688d5a2c18cc85b36ede0c9612168aef9e72febc26b

Active capacity	25,750,000 sats $15,652	First seen	2024-01-25 00:48 *(7 months ago)*
Active channels	13	Last update	2024-08-10 11:48 *(3 hours ago)*
Average channel size	1,980,769 sats $1,204	Color	#ff9900
Location	Singapore, undefined Singapore SG	ISP	Microsoft Azure [ASN 8075]
Avg channel distance	11.9k km · 7.4k mi	Features	800000000000000000000000... Details

เครื่องอยู่ประเทศไทย แต่ใน lightning network เห็นว่าอยู่ในประเทศสิงคโปร์

IPv4 02491e5a8d534bf5bd0dfd3688d5a2c18cc85b36ede0c9612168aef9e72febc26b@172.188.122.161:22202





Backup

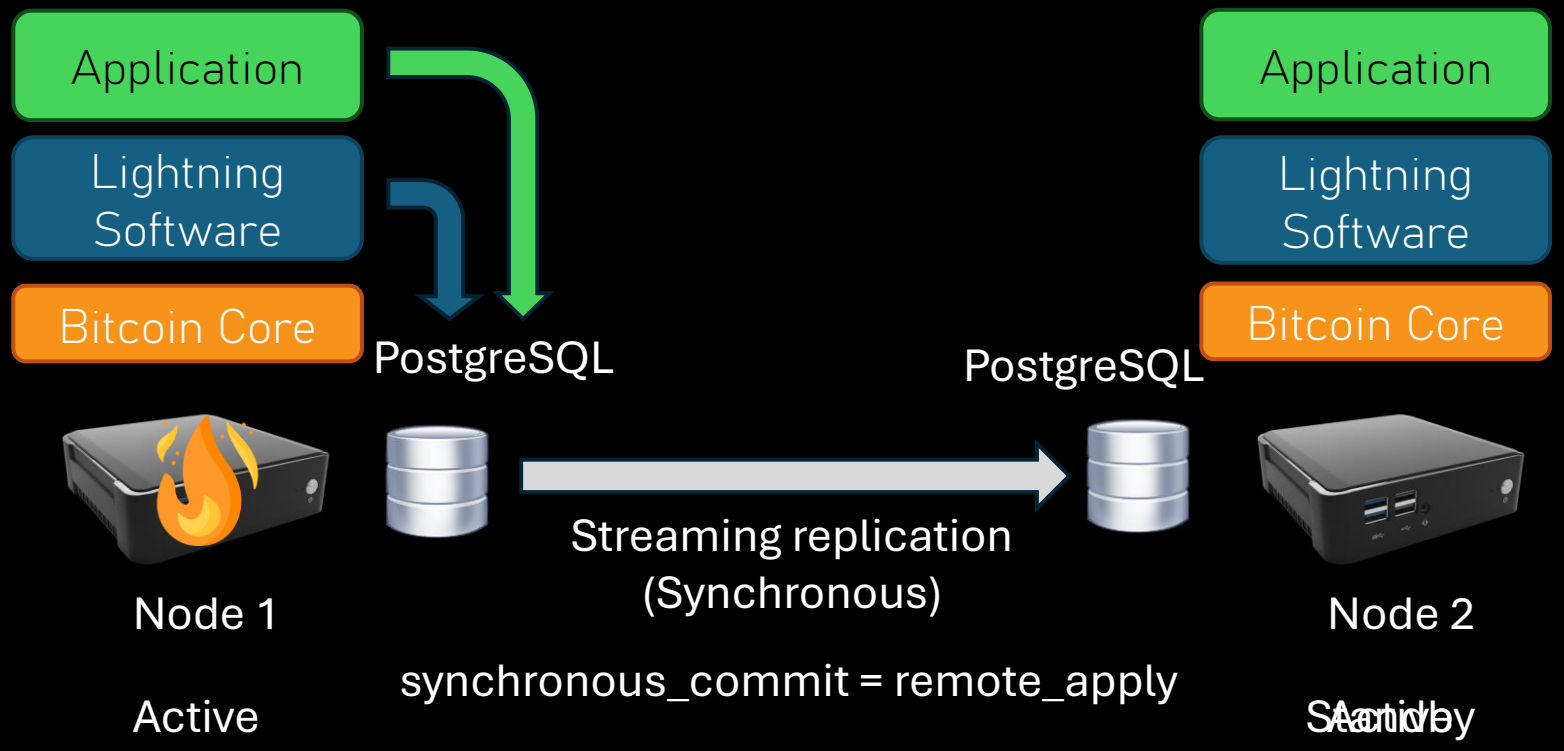
- On-Chain Recovery
  - LND – 24 word seeds (aezeed)
  - CLN – HSM Secret
- Off-Chain Recovery (lightning channel)
  - LND – SCB (Static Channel Backup)
  - CLN – Emergency backup, redundant sqlite file

  - SCB & Emergency backup – Request help from peer node to force close channels and bring all fund back to on-chain
  - Redundant sqlite file – Bring all channels back to online

High Availability

- Hardware Redundancy : RAID Adapter + Multiple Disks
  - Expensive
- Software Redundancy : ZFS ZPOOL, BtrFS RAID, MDADM RAID
  - Cheaper, is it work? Data consistency?
- Data Redundancy: PostgreSQL Replication
  - Redundant node with data consistency

PostgreSQL Replication



Case Study : moo2

- Implementation: LND
- Capacity size: ~0.4 BTC
- Number of channels: 20+
- Duration: 29-Jul-2022 – 20-Mar-2023
- Objective: routing node
- Network Connectivity: Tor & Clearnet
- Backup: SCB, copy backup file to cloud and telegram
- High availability: N/A

Favorite 1 Notifications 0

moo2

03edc0...3da145

Total Capacity
- sats

Number of Channels
0 Channels

Last Update
1 year ago

Closure Types

7d

No closed channels found.

Latest Closed Channels

					Last Rate (ppm)					
	Channel Id	Closing Date	Channel Age	Peer	Local	Remote	Capacity	Closing Cost	Transactions	Closure Type
1	746144x166x1	Mar 20, 2023	246d 16h 30m	033ef46fa6...	150	100	2,500,000	750 sats	✓Open ×Close	Force Closure
2	748229x1157x1	Mar 12, 2023	223d 11h	speedysat...	150	1	1,000,000	2,568 sats	✓Open ×Close	Force Closure
3	746141x347x0	Mar 11, 2023	236d 12h 40m	TutDatNode	150	21	2,500,000	2,813 sats	✓Open ×Close	Force Closure
4	748458x769x1	Mar 11, 2023	220d 10h 20m	CHILLYCALE...	150	10	1,000,000	5,938 sats	✓Open ×Close	Force Closure
5	748433x314x0	Mar 11, 2023	220d 14h 20m	nodular	150	10	1,000,000	3,394 sats	✓Open ×Close	Force Closure

What happened to moo2 ?

- Most channels were forced closed simultaneously
- There was multiple rebalance tasks with one bad connected channel

Case Study : Satsdays.Com

- Implementation: Core Lightning
- Capacity size: 0.37 BTC
- Number of channels: 4
- Duration: 22-May-2024 – Now
- Objective: personal payment node
- Network Connectivity: Tor & Clearnet
- High availability: PostgreSQL replication between 2 machines at different location

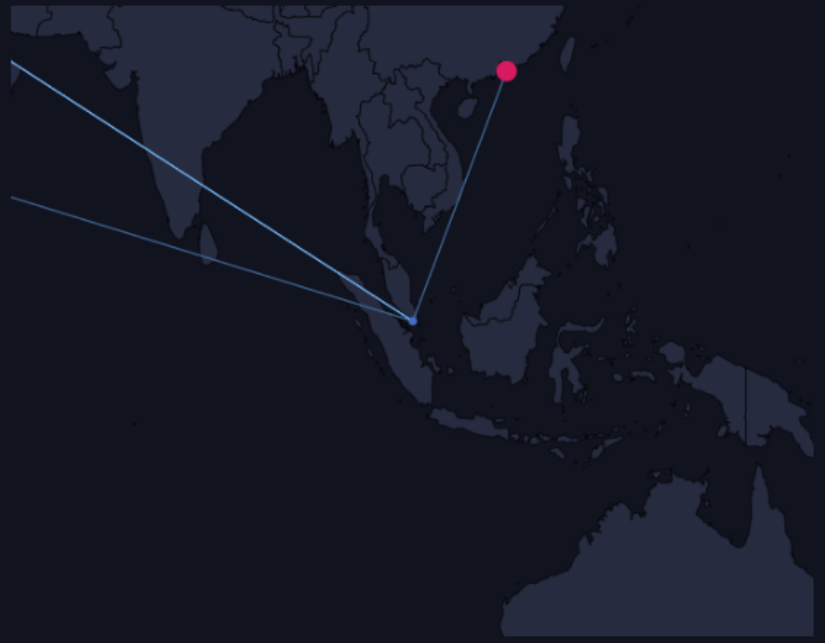
Lightning node

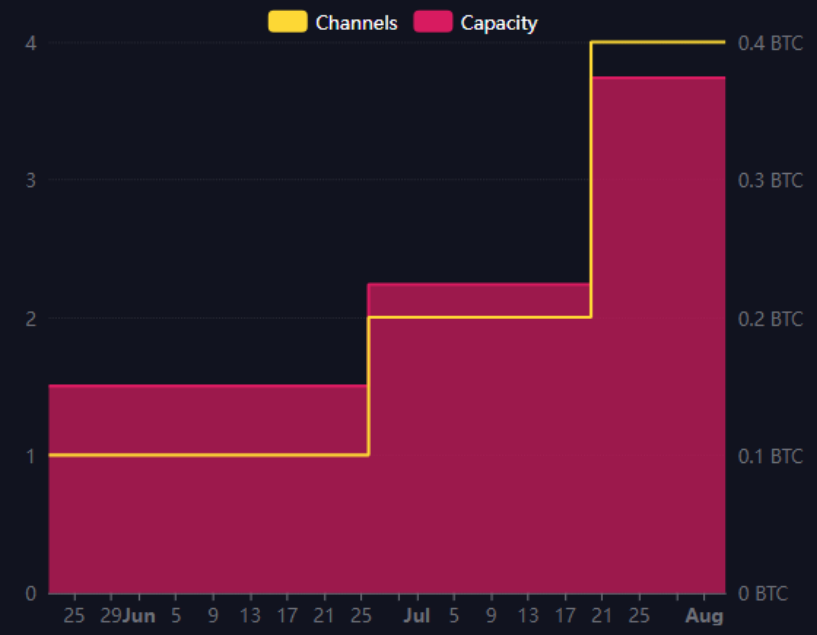
Satsdays.Com

0234591e856f9c789cc36fac67e54641243e99003640b123b74f62a490f789a4dd

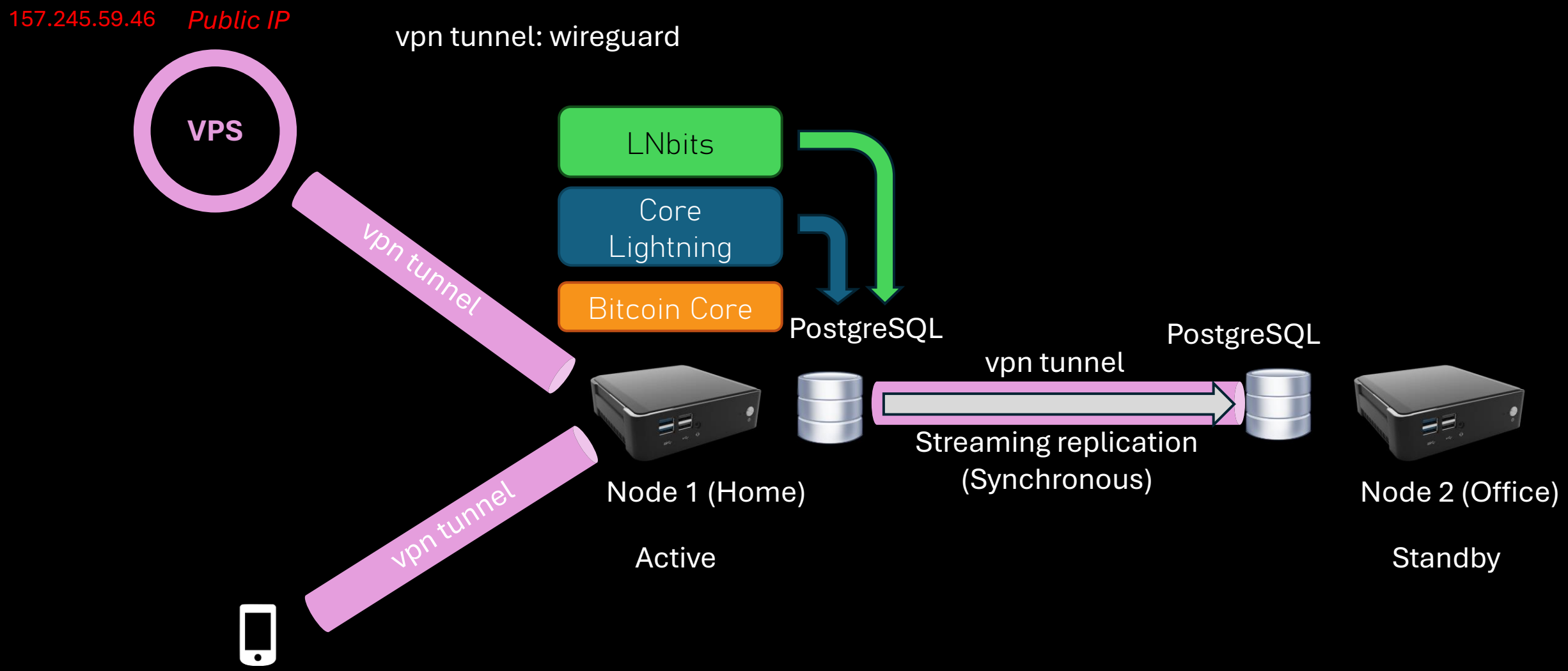
Active capacity	37,387,500 sats $23,006	First seen	2024-05-22 11:56 *(2 months ago)*
Active channels	4	Last update	2024-05-22 13:26 *(2 months ago)*
Average channel size	9,346,875 sats $5,752	Color	#ffa500
Location	Singapore, undefined Singapore sg	ISP	Digital Ocean [ASN 14061]
Avg channel distance	9.5k km · 5.9k mi	Features	800000000000000000000000... Details

IPv4 ▾ 0234591e856f9c789cc36fac67e54641243e99003640b123b74f62a490f789a4dd@157.245.59.46:9735





Satsdays.Com Node Architecture



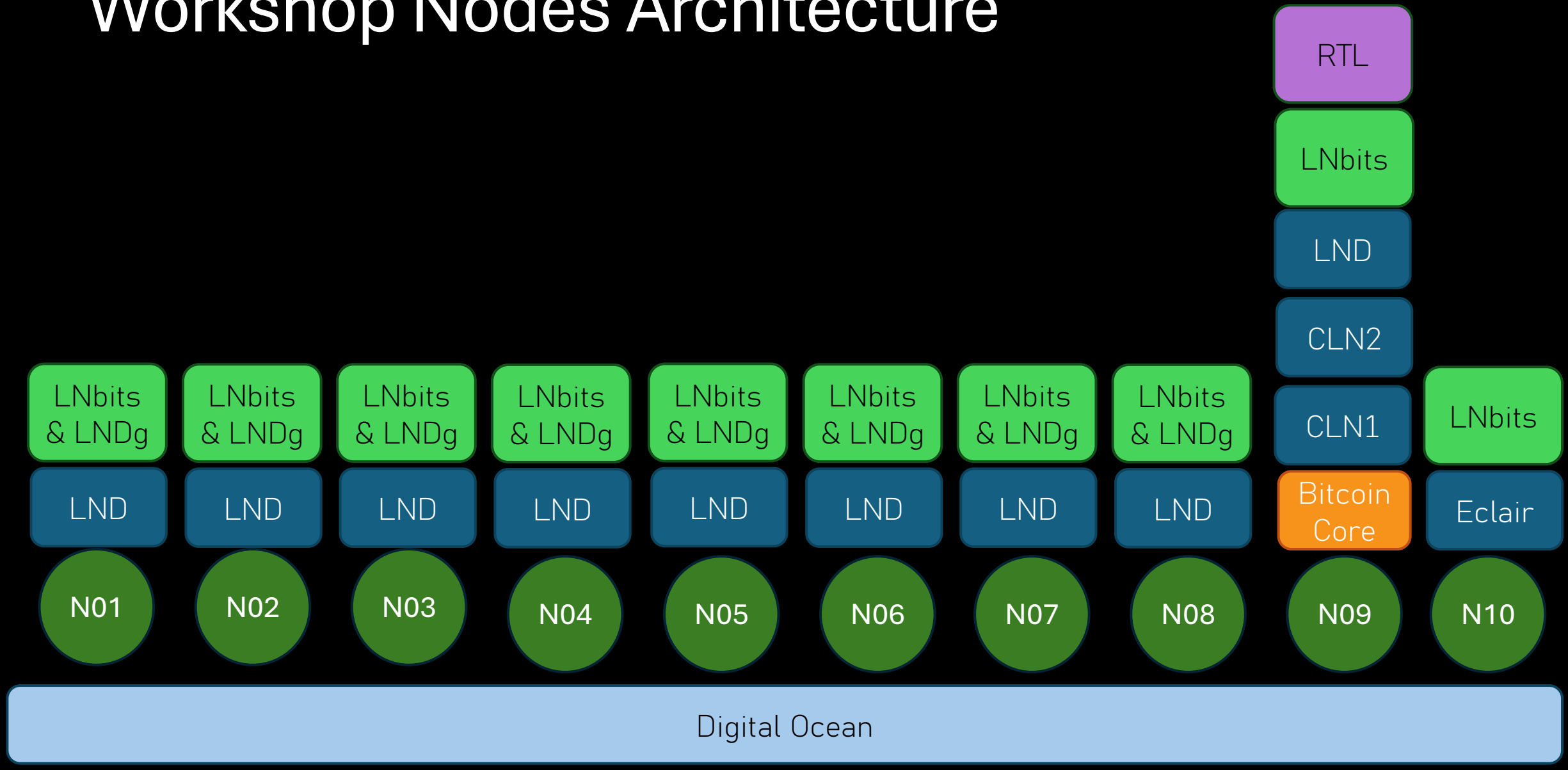
Case Study : 4th LN Workshop

- Implementation: LND, Core Lightning, Eclair
- Number of Machines: 10 VPS on Digital Ocean
- Number of Nodes: 12 Nodes (LND:9, CLN:2, Eclair:1)
- Duration: Jan – Feb 2024
- Objective: Lab workshop
- Network Connectivity: Clearnet in testnet3 environment

Workshop Nodes Setup

- All machines were running in Digital Ocean Cloud
- Limited to 10 Virtual Private Servers (VPS) for 12 nodes
- Some lightning nodes had to be running on same machine
- Setup only one bitcoin core node for all lightning nodes
- LND, LNbits and LNDg of each node run separately
- RTL run only one instance can manage all nodes
- All nodes were Clearnet because they had public IP addresses

Workshop Nodes Architecture



References

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  - Raspibolt - https://raspibolt.org/
  - Minibolt - https://v2.minibolt.info/
- Node Implementation
  - LND - https://github.com/lightningnetwork/lnd
  - Core Lightning - https://github.com/ElementsProject/lightning
  - Eclair - https://github.com/ACINQ/eclair
- Networking
  - Clearnet VPS - https://github.com/teemie1/LNbits_VPS
- Backup
  - LND Recovery – https://docs.lightning.engineering/lightning-network-tools/lnd/disaster-recovery
  - CLN Recovery - https://docs.corelightning.org/docs/recovery
- PostgreSQL replication - https://github.com/gabridome/docs/blob/master/c-lightning_with_postgresql_reliability.md
- PostgreSQL Synchronous Commit - https://www.enterprisedb.com/blog/cheat-sheet-configuring-streaming-postgres-synchronous-replication
- 4th Workshop Setup - https://github.com/teemie1/blog/blob/main/038_2nd_workshop_config.md
- 4th Workshop Procedure - https://github.com/teemie1/LNWorkshop/blob/main/2024-02_BTC-LN_Workshop.md

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thank you!