

Lightning Node Infrastructure Setup Experience by teemie ⚡

Thailand Bitcoin Conference 2024

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- [https://github.com/teemie1/LNWorkshop/blob/main/LN Node Infra Experience - TBC2024.pdf](https://github.com/teemie1/LNWorkshop/blob/main/LN%20Node%20Infra%20Experience%20-%20TBC2024.pdf)

Topics

How to Install

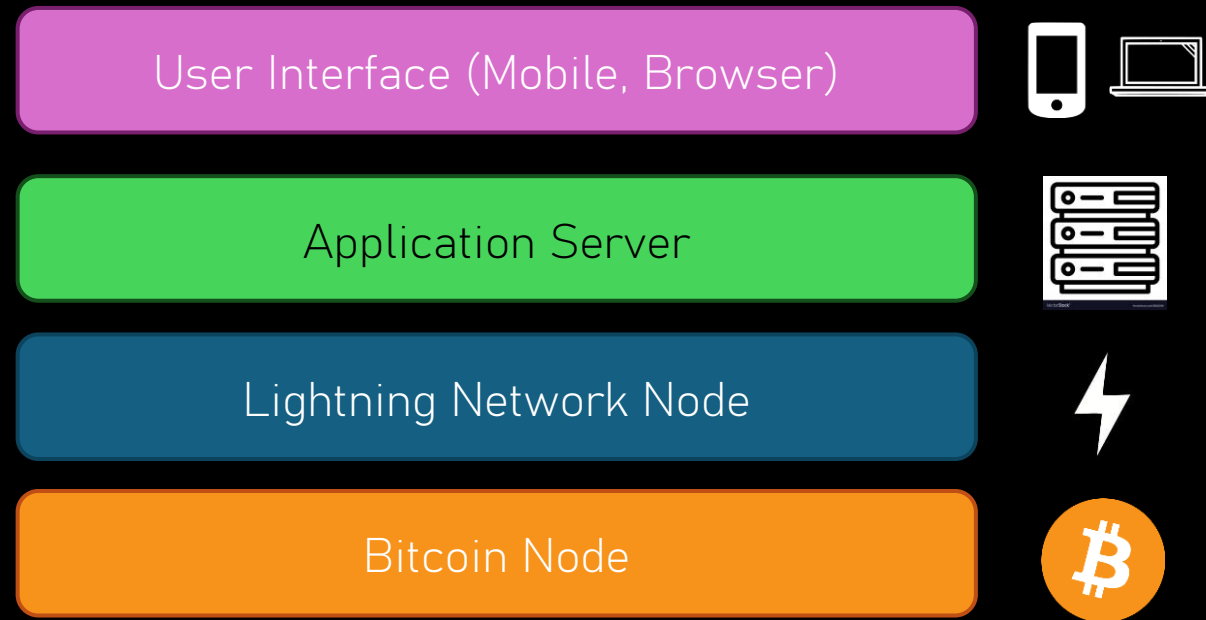
Architecture of node implementation

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



- 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)



- 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

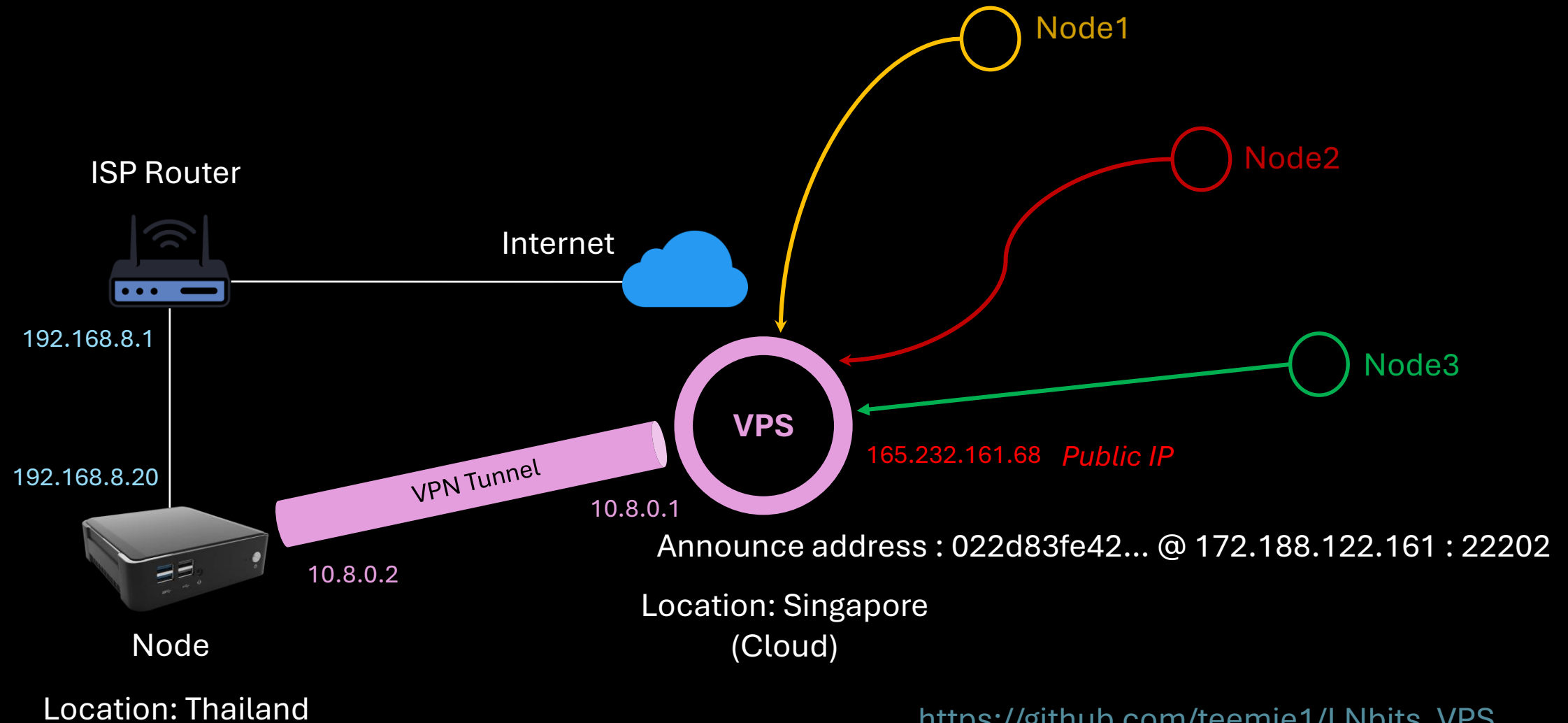
Node Networking

- 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)

Cleartnet Connection for Lightning Node

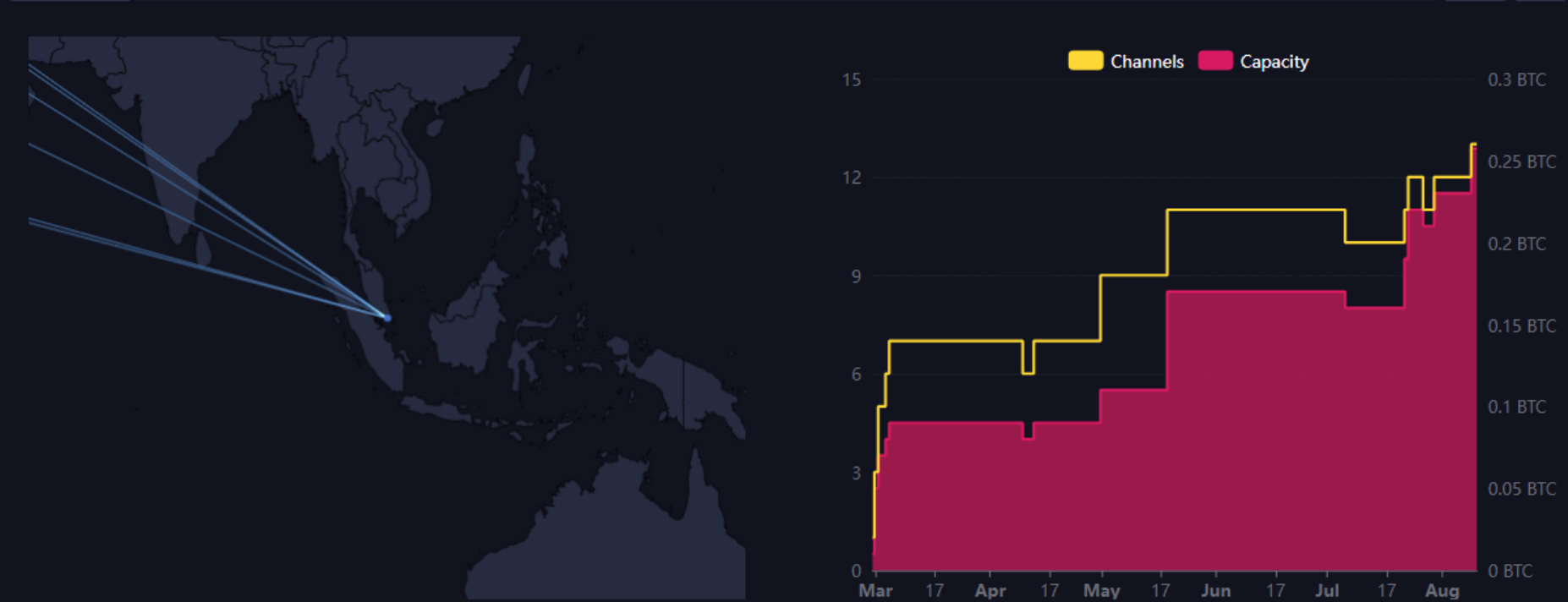


Active capacity	25,750,000 sats \$15,652	First seen	2024-01-25 00:48 (7 months ago)
Active channels	13	Last update	2024-08-10 11:48 (3 hours ago)
Average channel size	1,980,769 sats \$1,204	Color	#ff9900
Location	Singapore, undefined Singapore sg	ISP	Microsoft Azure [ASN 8075]
Avg channel distance	11.9k km · 7.4k mi	Features	8000000000000000000000000000... Details

เครื่องอยู่ประเทศไทย แต่ใน lightning network เห็นว่าอยู่ในประเทศสิงคโปร์

เครื่องอยู่ประเทศไทย แต่ใน lightning network เห็นว่าอยู่ในประเทศสิงคโปร์

IPv4 02491e5a8d534bf5bd0dfd3688d5a2c18cc85b36ede0c9612168aef9e72febc26b@172.188.122.161:22202



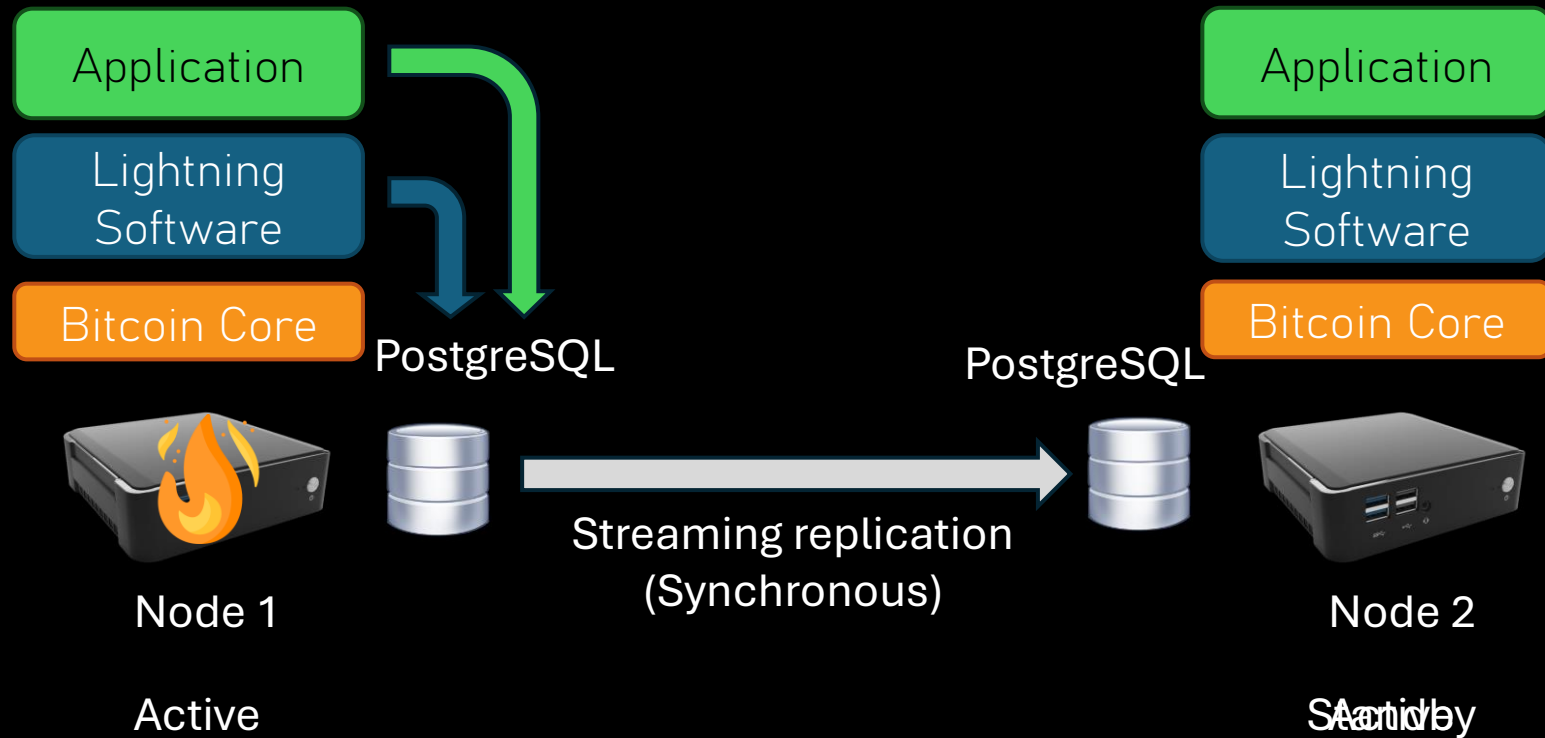
Backup

- 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
- satsNumber of Channels
0 ChannelsLast 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 one bad connected channel with multiple rebalance tasks

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

Satsdays.Com  

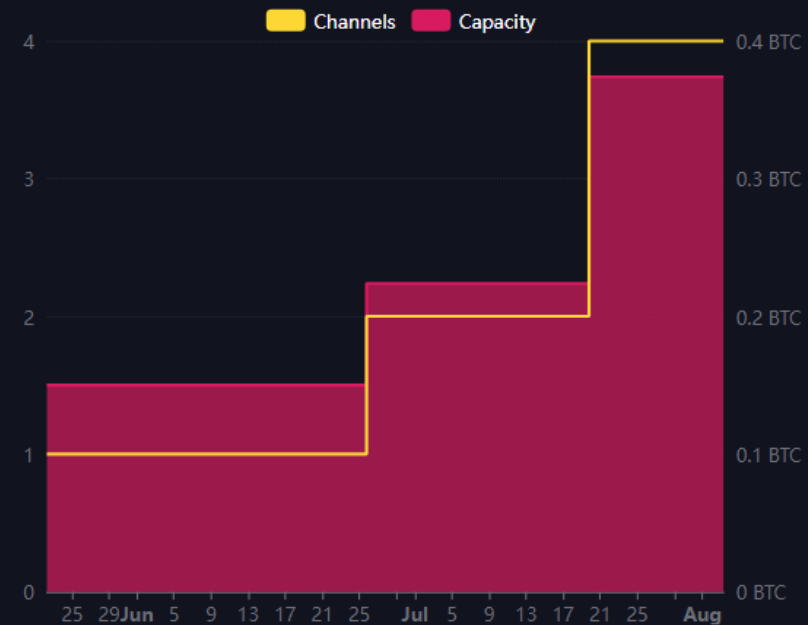
Active capacity 37,387,500 sats \$23,006

Average channel size	9,346,875 sats	\$5,752
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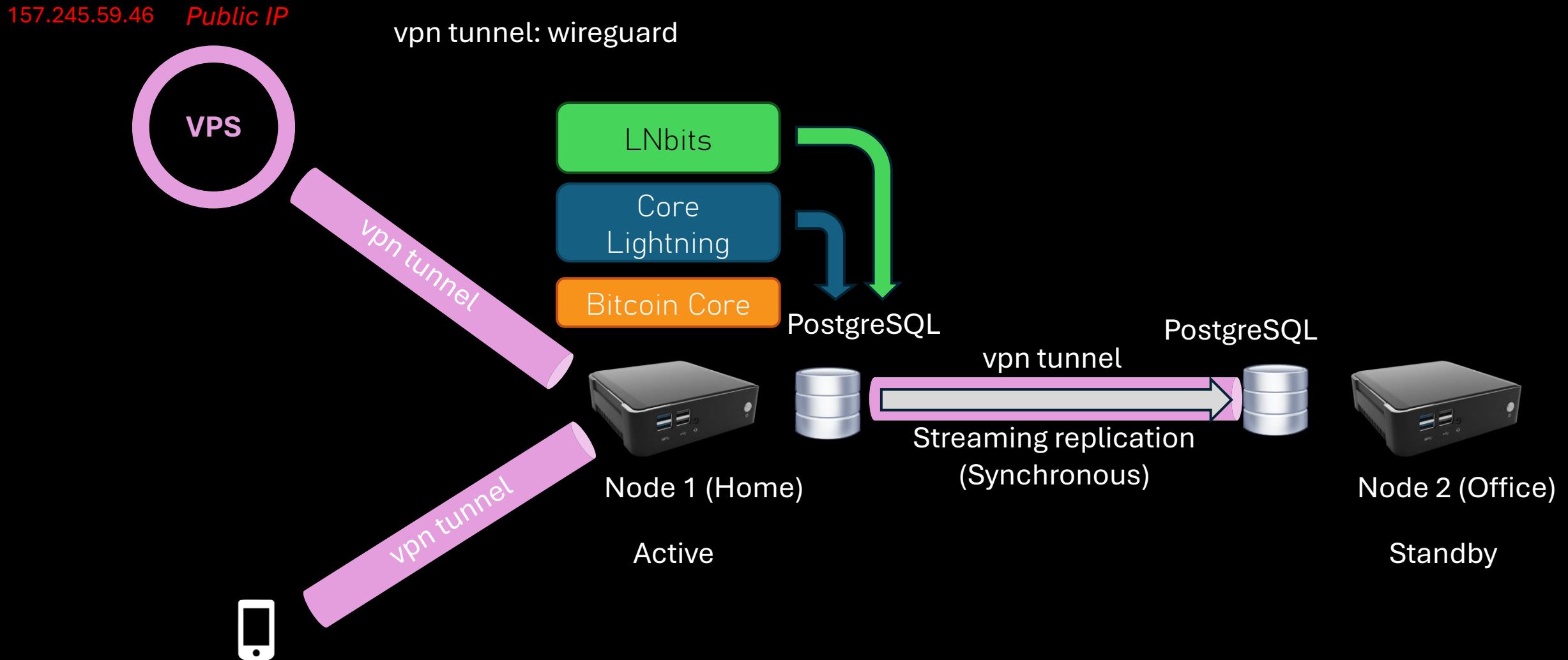
Avg channel distance 9.5k km · 5.9k mi

Features800000000000000000000000...Details

ON 



Satsdays.Com Node Architecture



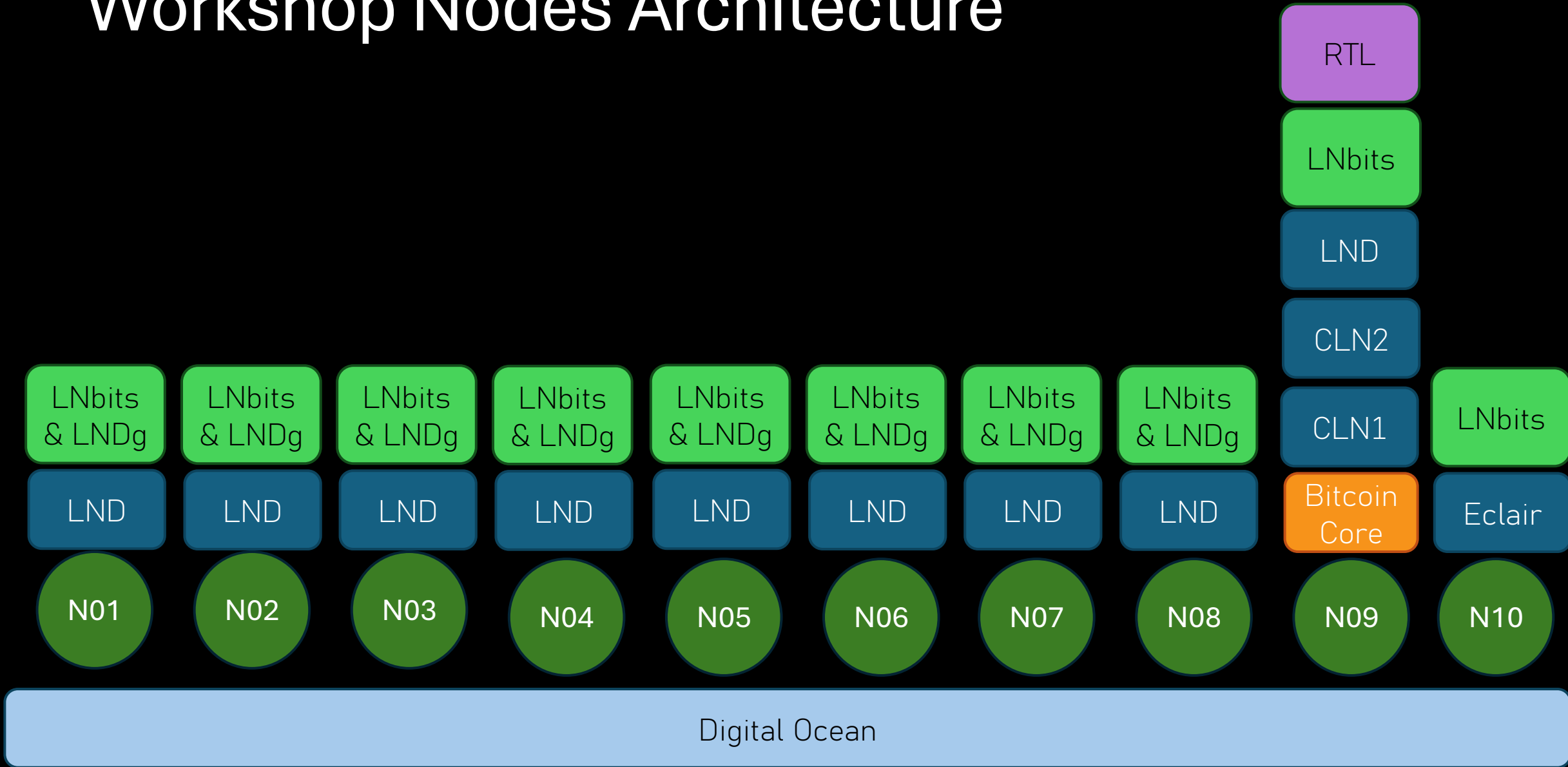
Case Study : 4th LN Workshop

- 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

- How to install
 - 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
- 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!