

# DELPHI DIGITAL

## Lightning Network Thematic Insights



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# Executive Summary

Bitcoin excels at being a censorship-resistant, disinflationary, non-sovereign currency and store-of-value. These characteristics, at the heart of Bitcoin's value proposition, are made possible through its design and decentralized network. However, there is a trade-off being made here on purpose. In return for these unique strengths, Bitcoin's blockchain, which we'll refer to as "Layer 1" throughout this report, does not facilitate instant transactions with near zero fees (although it still transfers value faster and cheaper than the legacy financial system).

Why? This largely comes down to two reasons: 1) a new block is mined approximately every 10 minutes, and 2) the size of each block is capped. These factors lead to a limited number of transactions that can be confirmed quickly by being included in the next block. If there are too many transactions trying to be confirmed at the same time, a backlog starts to form. Transactions that want to be confirmed sooner rather than later start paying higher fees as an incentive for miners to include them in the next block. Ultimately, these dynamics lead to a fee market and wait times on Bitcoin.

The knee-jerk reaction is to assume this is bad for Bitcoin and that it won't be able to compete with other, newer cryptocurrencies that offer faster transactions at a cheaper cost. Remember though, Bitcoin is designed this way on purpose. Generally speaking, while other cryptocurrencies may have an advantage in speed and cost, it is typically at the expense of decentralization and, ultimately, security. As a result, few alternative cryptocurrencies can seriously compete with Bitcoin as a store-of-value ("SoV"). Our team believes a cryptocurrency must be considered a SoV to have any chance at gaining widespread adoption as a medium of exchange. We originally wrote about this in our "[State of Bitcoin](#)" report from December.

Well, why doesn't Bitcoin just increase the size of its blocks so it can fit more transactions? Growing the size of each block, grows the size of the blockchain, making it harder to run a node and, again, furthers centralization. Yes, this also decreases fees but, surprisingly, over the long-run this is a bad thing. Without an on-chain fee market, Bitcoin could prove unsustainable by the end of the next decade when block rewards significantly diminish.

With this in mind, how is Bitcoin supposed to improve as a transactional currency, while maintaining an on-chain fee market and in a way that doesn't lead to centralization of the network? In January 2016, Joseph Poon and Thaddeus Dryja published a paper with their proposed solution: **Lightning Network**. In this report, we'll discuss how Lightning works, its growth, whose building it and how you can start using it.

## Lightning Developers:



[Lightning Labs](#)



[Blockstream](#)



[ACINQ](#)

## Non-Custodial Lightning Wallets:



[Lightning App](#)



[Casa Node](#)



[Lightning Peach](#)



[Breez](#)



[Joule](#)



[Eclair](#)



[Zap](#)



[Spark](#)

## E-Commerce Integrations:



[BTCPay Server](#)



[Peach Commerce & Terminal](#)



[Strike](#)



[OpenNode](#)



[Lightning Charge](#)

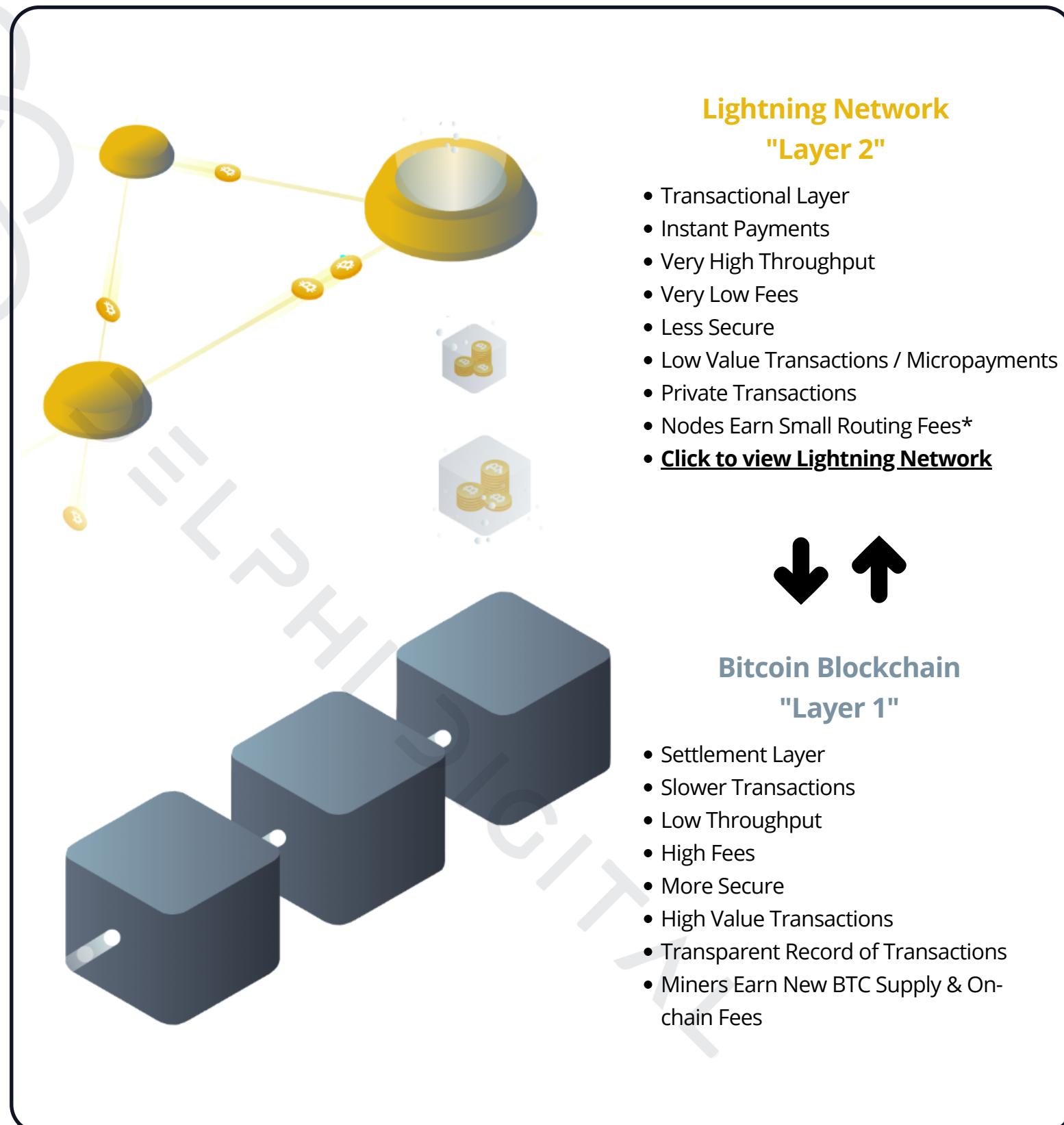
# Lightning Overview

Lightning Network is a second layer built on top of, and grounded in the underlying security of, Bitcoin's blockchain. Expanding functionality by building on different layers has been done before. In fact, it's how the internet was built, whether or not the end-user realizes it. In the future as UI improves, Lightning users may not realize much of a difference as well.

By scaling on Layer 2, Bitcoin can maintain its low throughput on Layer 1. This essentially creates a bottleneck, which, in the future, can lead to a high on-chain fee market to the benefit of Bitcoin's security model. Effectively, this transitions Layer 1 into a settlement layer for high value transactions, while Layer 2 becomes a trust-minimized, transactional layer for every day users. At a high-level, this is how Lightning works:

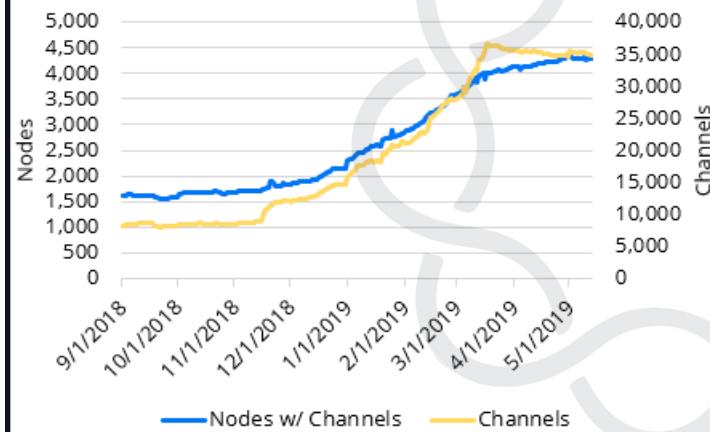
- 1) Users run a Lightning Node.
- 2) Two users lock funds in a multisig on the blockchain. This opens a bi-directional payment channel between both of their Lightning Nodes.
- 3) Lightning transactions instantly update the balance of the payment channel without needing to involve the blockchain. The transaction data is stored locally on the Lightning Node.
- 4) As more Lightning Nodes come online, and more payment channels connect them, a peer-to-peer mesh network begins to form. This means that even if two nodes don't directly connect, they can still transact as payments are routed over the network of connected nodes.
- 5) To settle, a user closes their payment channel, with the net balance finally being broadcast to the blockchain.

It's important to note that Lightning is still a work in progress, with outstanding issues/challenges (e.g. routing failures, the need for a node to stay online, etc.). However, developers have made significant progress tackling these problems.



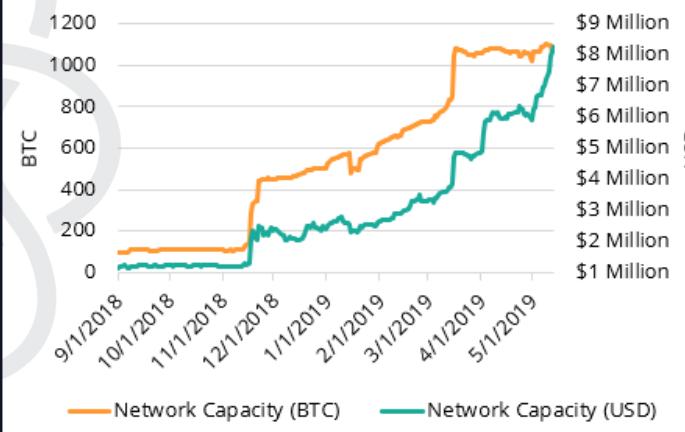
# Network Statistics

## Nodes w/ Channels vs Channels



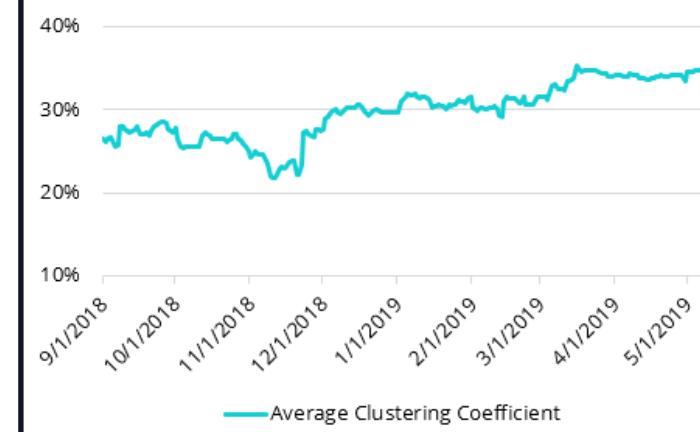
- **Nodes w/ Channels Growth:** +263%
- **Channels Growth:** +422%
- **Positive or Negative:** **Positive**

## Network Capacity (BTC vs USD)



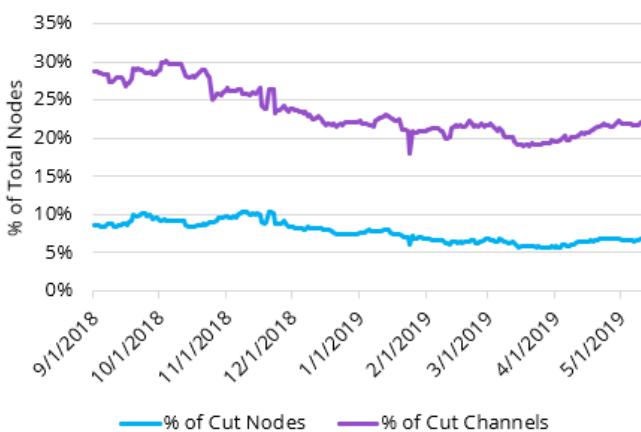
- **Network Capacity (BTC) Growth:** +1143%
- **Positive or Negative:** **Positive**

## Clustering Coefficient



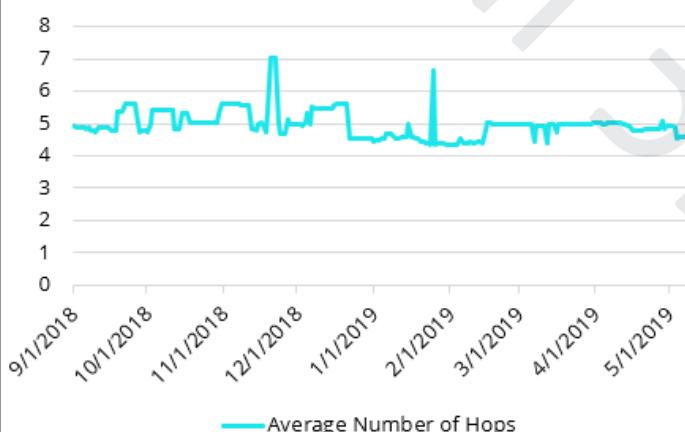
- **Clustering Coefficient % Increase:** +32%
- **Positive or Negative:** **Positive**

## Cut Nodes vs Cut Channels



- **% Cut Nodes of Total Decrease:** -28%
- **% Cut Channels of Total Decrease:** -31%
- **Positive or Negative:** **Positive**

## Eccentricity



- **Avg. Number of Hops (Last 30 Days):** 4.82

## Nodes & Capacity by Country

Country	% Total Capacity (BTC)	% Total Nodes
United States	58.0%	23.7%
Germany	7.4%	7.9%
Canada	5.6%	5.2%
France	4.4%	2.9%
Netherlands	2.4%	3.5%
Ireland	2.4%	0.5%
Switzerland	1.6%	2.0%
Bulgaria	1.2%	0.3%
United Kingdom	1.1%	2.8%
Australia	1.1%	1.3%
Italy	0.6%	1.0%
Japan	0.6%	0.8%
Czech	0.5%	0.7%
Singapore	0.5%	1.0%
Ukraine	0.5%	0.4%

# Implementations & Standards

Now that we've explained Lightning Network and analyzed its growth, it's important to understand who is building it. There are at least 7 implementations being developed that vary by programming language and team. To ensure that these different implementations would be compatible with one another, the Basis of Lightning Technology ("BOLT") was established as a set of standards developers could choose to comply with.

Below, we chose to highlight the 3 most popular implementations, which are all compliant with BOLT. While compatibility is the goal, it's important to emphasize that this is very much a work in progress still. If you click [here](#), you can view a historical record of compatibility test results which depict this. In the following slides, we'll provide an overview for the developers behind each implementation and the other LN technologies they are building.

## **Basis of Lightning Technology ("BOLT")**

- BOLT 1: Base Protocol
- BOLT 2: Peer Protocol for Channel Management
- BOLT 3: Bitcoin Transaction and Script Formats
- BOLT 4: Onion Routing Protocol
- BOLT 5: Recommendations for On-chain Transaction Handling
- BOLT 7: P2P Node and Channel Discovery
- BOLT 8: Encrypted and Authenticated Transport
- BOLT 9: Assigned Feature Flags
- BOLT 10: DNS Bootstrap and Assisted Node Location
- BOLT 11: Invoice Protocol for Lightning Payments

## **Lightning Implementations**



### **Lightning Network Daemon (LND)**

- Developer: Lightning Labs
- Language: Golang
- Github: [/lightningnetwork/lnd](https://github.com/lightningnetwork/lnd)



### **c-lightning**

- Developer: Blockstream
- Language: C
- Github: [/ElementsProject/lightning](https://ElementsProject/lightning)



### **eclair**

- Developer: ACINQ
- Language: Scala
- Github: [/ACINQ/eclair](https://ACINQ/eclair)

# Lightning Labs



Lightning Labs was founded in January 2016 when Lightning Network white paper authors, Poon and Dryja, joined forces with Elizabeth and Olaojuwa to spearhead development on LND. They are based out of San Francisco and currently have a team of 11 employees.



**LND** - Also known as Lightning Network Daemon, is a Lightning Network implementation written in Golang. It is the most popular implementation.



**Neutrino** - It's a light client that allows non-custodial Lightning wallets to verify BTC transactions with improved privacy, minimized trust, and without needing to sync the full Bitcoin blockchain.

## Key Personnel



**Elizabeth Stark**   
CEO and Co-Founder



**Olaoluwa Osuntokun**   
CTO and Co-founder



**Bryan Vu**   
VP of Product

## Lightning Specific Technologies

### Links



[Website](#)



[Github](#)



[Twitter](#)

## Funding



**\$2.5 Million**

The company raised \$2.5M in funding in March 2018 from investors including Twitter co-founder Jack Dorsey, Litecoin creator Charlie Lee, Digital Currency Group, Square executive Jacqueline Reses and others.

# Blockstream



Blockstream was founded in 2014 by Adam Back, Gregory Maxwell, Pieter Wuille, and others. The 24-person team builds crypto-financial infrastructure based on Bitcoin. Product offerings include Liquid (federated BTC sidechain), data feeds, Blockstream Green (mobile wallet), Blockstream Satellite, and Elements.

## Lightning Specific Technologies



**C-Lightning** - Lightning Network implementation written in C. Their implementation is a go-to code and specification for enterprise Lightning Network deployments on Bitcoin.



**Lightning Charge** - API for lightning web payments. Part of Blockstream's Elements Project. Used at the Blockstream Store

Sources: [Crunchbase](#),

## Key Personnel



**Adam Back**   
CEO and Co-Founder



**Erik Svenson**   
Co-Founder & COO



**Samson Mow**   
Chief Strategy Officer

## Links



[Website](#)



[Github](#)



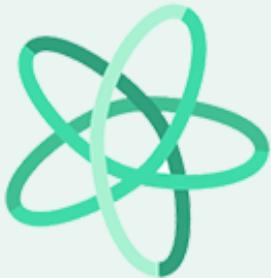
[Twitter](#)

## Funding



**\$101 Million**

Blockstream initially raised \$21M in funding in late 2014 from investors like Khosla Ventures, Real Ventures, Reid Hoffman, amongst others. The company raised another \$55M in a Series A in February 2016. At the end of November 2017, they raised another \$25M from DG Lab Fund.



Founded in 2014, ACINQ is a company focused on developing Lightning Network technology. They have a 4 person team and are based in Paris, France. ACINQ currently runs one of the largest nodes by capacity on the Lightning Network, and created a user friendly explorer.

## Lightning Specific Technologies



**Eclair** - Lightning Network implementation written in Scala.



**Strike** - A Stripe-like API and dashboard that makes it easy for merchants to accept lightning payments.



**Pierre-Marie Padiou**  
CEO



**Fabrice Drouin**  
CTO



**Dominique Padiou**  
Head of Products

## Links



[Website](#)



[Github](#)



[Twitter](#)

## Funding

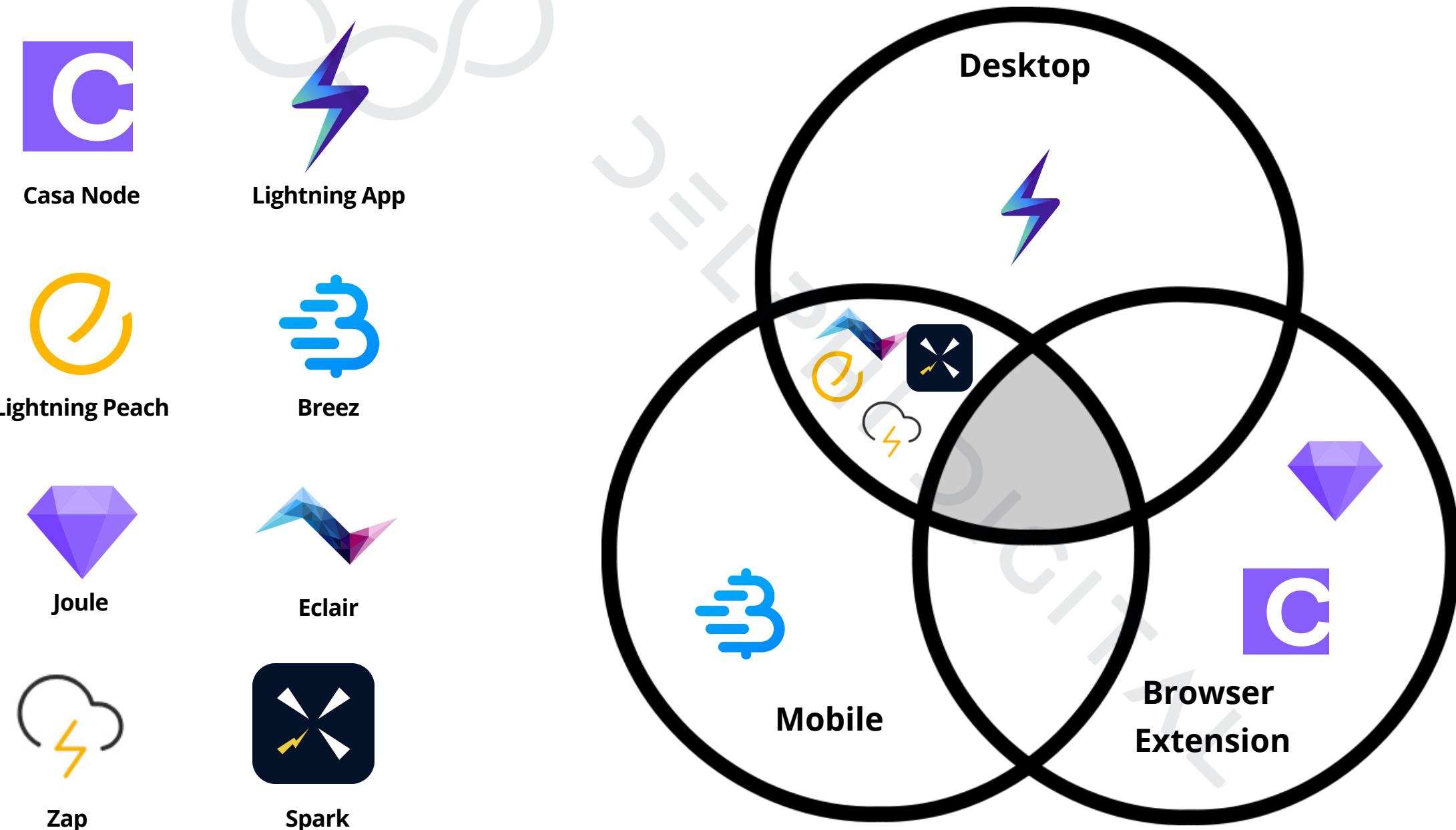


**\$1.7 Million**

In October 2018, ACINQ raised \$1.7 million during a Series Seed funding led by Serena Capital, with the participation of Bertrand Diard (Talend), Sébastien Lucas, Bitcoin trader Alistair Milne and Yves Weisselberger (KDS, Snapcar). The funding was used to grow the engineering team and develop new Lightning-based services.

# Non-Custodial Lightning Wallets

To interact with the Lightning Network, you first need to download a wallet that supports it. Below, we have highlighted a few prominent, non-custodial wallets that make using Lightning today a possibility. Why are we only focusing on non-custodial wallets? Because they allow users to hold their own private keys and, as a result, maintain control of their Bitcoin. **Not your keys, not your Bitcoin.** While these wallets offer superior security, onboarding new users can be difficult at the moment, given that the user also needs to run a lightning node (see page 13 to learn how). However, products such as Casa Node, which offers a plug-and-play Bitcoin and Lightning Node out of the box do make this easier. Over time, as the technology matures we can expect these frictions to lessen.



# E-Commerce Integrations

MERCHANTS need an easy way to accept Lightning Network payments to further its adoption. Fortunately, there are a variety of projects that already have working solutions for this. If successful, integrating Lightning as a payment option would be more than just a cool experiment, it would make a lot of business sense. For example, a comparable payment processor on the internet is Stripe, which charges a ~3% fee on each transaction. This is significantly more than lightning-based payment processors, as seen below, which charge anywhere from 0-1% per transaction fee. This is Lightning's competitive advantage.



BTCPAY

- **Developer:** Open-source community
- **Fees:** 0% transaction fees
- **Description:** Stripe-like API for web payments and point of sale app that is non-custodial.
- **Plugins:** Currently available for WooCommerce, Magento, PrestaShop and Drupal.



by Blockstream

- **Developer:** Blockstream
- **Fees:** N/A
- **Description:** API for lightning web payments. Part of Blockstream's Elements Project. Used at the Blockstream Store.
- **Plugins:** Currently available for WooCommerce.



- **Developer:** ACINQ
- **Fees:** 1% transaction fee, free automated withdrawals, manual withdrawals charge 0.0005 BTC, Strike pays on-chain fees
- **Description:** Stripe-like API for web payments.
- **Plugins:** Currently available for WooCommerce with PrestaShop and Shopify coming soon.



opennode

- **Developer:** OpenNode
- **Fees:** 1% transaction fee, OpenNode pays on-chain fees, 2% fee to convert BTC into fiat and deposit into a bank
- **Description:** Stripe-like API for web payments.
- **Plugins:** Currently available for WooCommerce, PrestaShop, Opencart and Shopify.



BITFURY  
Lightning Peach

- **Developer:** Bitfury
- **Fees:** 1% transaction fee or 1 Satoshi, Peach pays on-chain fees
- **Description:** 1) Peach Commerce is a Stripe-like API for web payments and 2) Peach Terminal is a hardware device for PoS terminals.
- **Plugins:** Currently available for PrestaShop with Magento & WooCommerce coming soon.

# Potential Features

Our team attended Consensus 2019, where we watched a presentation by Christian Decker, a Lightning Developer at Blockstream. While Lightning has a long list of potential features that could be added in the future, Christian was able to highlight some interesting ones, which we have shared below. It's important to note that there's no set time frame for when these may be added, if they are ever added at all.

- Splice In and Splice Out** — Add or remove funds from an existing channel or perform on-chain payments from a channel
- Multipath Routing** — Split larger payments across multiple channels
- Streamed Payments** — Send a payment without an invoice or make multiple payments based upon one invoice
- Payment Decorrelation** — Makes it harder to correlate payment hops on the network for better security
- Dual Funded Channels** — Both parties contribute funds to a channel
- Fee Hooks** — Decide fees ahead of time, instead of being subject to variable Lightning Network fees
- Trampoline Payments** — Removes the need for nodes to sync the entire network topology
- Bitcoin Info Relay** — Notify Lightning Network peers about channels that have closed and block headers.

# Run a Lightning Node

Interested in running a lightning node? If you are, Pierre Rochard at Bitcoin Advisory has made it relatively simple.

First, follow the instructions [here](#) and download the Lightning Power Node Launcher. Afterwards, follow the instructions [here](#) to download Zap wallet. Once those steps have been completed, you'll be able to deposit BTC into your Zap wallet and fund payment channels.

If you're looking for another node to connect with just reach out to ours! You'll be able to search for our node and open a channel using the information provided to the right.

Please keep in mind, however, that the Lightning Network is still a work in progress and it is possible to lose funds testing it out. As a result, it's recommended that you only move a small amount of BTC onto it just in case.

**Node Name:**  
Delphi\_Digital

**Public Key:**  
022e63bd7c3f4bb7b87bd87a04a6024dc6f7  
6e633f9c1cae0ee0424a070dabc927



# Leader Commentary



**"How do we get the Lightning Network to \$1B in capacity and/or what is the biggest outstanding problem that hasn't been solved yet?"**



**Elizabeth Stark**  
CEO of Lightning Labs

"While many people are focused on total network capacity, it's not really the right metric. It's about the efficiency of capital more than the amount of capital. You could have \$10M on the network and if allocated effectively, reach \$1B in total throughput on the Lightning Network with 100x turnover in daily transaction volume. At Lightning Labs we are working on enabling the efficient allocation of capital on the network."



**Jeremy Welch**  
Founder of Casa

"The path to \$1B+ in capacity is already present in the Lightning Network. 1000+ BTC in liquidity is already committed despite an intentional system handicap. Current developers have limited the amount per channel while in beta. As the number of nodes and users rises, and the channel cap is lifted by developers in a future code release enabling each user to commit more funds per channel, and as the price of Bitcoin rises — the path to \$1B+ becomes clearer"



**Pierre Rochard**  
Founder of Bitcoin Advisory

"The biggest problem that hasn't been solved yet is transitioning from the autodidactic technical user, to the trained non-technical user. It seems simple to us now, but we were all trained in school on how to make change with bills and coins. We can't pretend that UI/UX alone solves user education!"

# Disclosures

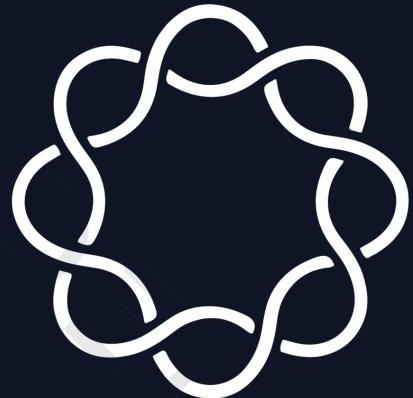
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