

# Piccolo Research

Independent research on blockchain startups and ICO's

## An independent review of Celer Network (**CELR**)

16 March 2019 (revised from 11 Jul 2018) - Lennard Neo

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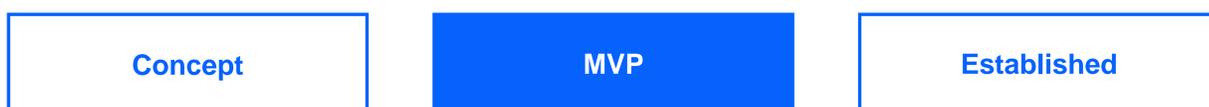
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# CELER NETWORK (CELR)

## A universal off-chain scaling solution for every blockchain

### Summary

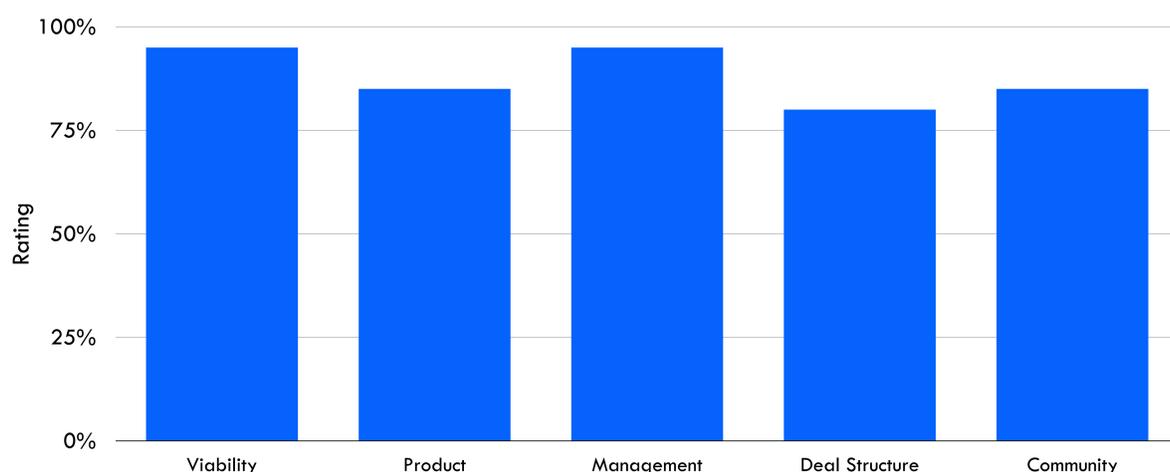
Celer Network is a layer-2 scalable solution that operates on top of existing blockchains. The technology uses off-chain scaling techniques to achieve billions of TPS (transaction per second) in a trusted and secured environment. Its ability to provide immense performance and flexibility allows users to easily build, operate and use highly scalable dApps (decentralised applications).



### Updates from the previous report (11 Jul 2018)

- Upgraded our rating for Celer Network from 4 stars to 4.5 stars
- Specified token sale details on Binance Launchpad
- Updated roadmap and milestones achieved
- CelerX (known as cWallet) Beta launched in Feb 2019 on IOS and Andriod, which was only an MVP previously
- Achieved 20,000X reduction on transaction latency
- Celer had established a business operations team and extensive partnerships since the previous report

### Birds-Eye View



Buy



#### General

Ticker:	CELR
Website:	<a href="#">Click here</a>
Sale Period:	19 Mar 2019 2PM (UTC)
White Paper:	<a href="#">Click here</a>

#### Sale info

Pricing:	\$0.0067
Accepted:	BNB
Min Goal:	NA
Cap:	\$4m
Token Sale %	6%
Escrow:	Yes
Bonus:	NA

#### Checklist

Management:	✓
Product:	✓
Commercial:	✓
Interest:	✓
Fulfilment:	⚠

## Company overview

Celer Network is based in the US with an objective of bringing internet scalability to all blockchains. By resolving issues related to the value of transfer and the limitations of on-chain consensus such as bottlenecks and privacy, Celer's platform will help to achieve the much-needed scalability for blockchain technology. The system can be easily integrated into existing or future blockchain, allowing them to achieve higher throughput and privacy.

## Commercial & Technical Strategy

Celer uses an off-chain technique, allowing parties to execute contracts in a trustless environment. The team is a strong advocate of this methodology as they believe it is more efficient in supporting the scalability of dApps. Celer Network encompasses a full-stack architecture, named cStack, which is broken down into 4 distinct modules. Each module fulfils a typical function and has the flexibility to adopt new implementations or changes when necessary.

**cChannel** – The foundation layer that interacts with the blockchain and upper layers. Uses both state channel and sidechain techniques, which are important for off-chain scaling.

**cRoute** – Utilizing Distributed Balanced Routing (DBR) to distribute payment traffic, achieving 15x higher throughput as compared to existing solutions. DBR mediates the mediocre performance of “shortest path routing” algorithms and improves channel balancing, decentralisation, resilience and privacy.

**cOS** – The off-chain dApp operating system that runs on development framework (SDK) and runtime system, allowing developers to build and operate off-chain dApps easily.

**cEconomy** – An economic model to balance the tradeoffs between off-chain scalability against liquidity and availability. The goal is to create network effect and provide stable liquidity throughout the system using 3 crucial components:

- Proof of Liquidity Commitment (PoLC)
- Liquidity Backing Auction (LiBA)
- State Guardian Network (SGN)

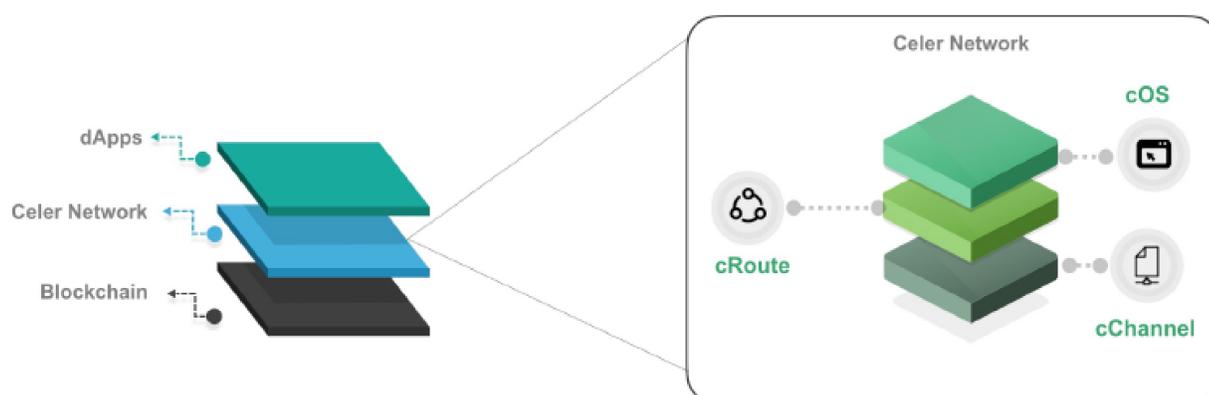


Figure: Celer Network cStack Architecture

## Roadmap

The project team has been focusing on developing the technology, and establishing partnerships for the past 7 months. On the whole, the team has met their roadmap deliverables on time and were ahead of schedule in several of their intended milestones. Also, the team has been busy attending meetups, events and developer conferences in the prior months.

Roadmap	Developments	Status
<b>Q3 2018</b>	cChannel: generalized state channel contract release cRoute: continued research and evaluation cOS: SDK private beta release cEconomy: PoLC testnet launch Community: 400 cApp developers onboard	<i>Completed</i> <i>Completed</i> <i>Completed</i> <i>Completed</i> <i>Completed with 1150 signups</i>
<b>Q4 2018</b>	cChannel: multi-blockchain support cRoute: large-scale emulation and algorithm tuning cOS: SDK public v1.0 release cEconomy: PoLC mainnet launch Community: first off-chain service provider launch	<i>Completed in Q3 2018</i> <i>Completed</i> <i>Completed</i> <i>Delayed to Q2 2019</i> <i>Completed</i>
<b>Q1 2019</b>	cChannel: enhanced generalised state channel capability with more use cases support cRoute: implementation and test cOS: SDK public v2.0 release cEconomy: LiBA and SGN testnet launch Community: more third-party cApps to onboard	<i>In Progress</i> <i>In Progress</i> <i>In Progress</i> <i>In Progress</i> <i>In Progress, a few onboarded in Q4 2018</i>
<b>Newly Added</b>	cEconomy: PoLC and LiBA security audit	<i>In Progress</i>
<b>Newly Added</b>	Alpha launch of CelerX (previously known as cWallet)	<i>Completed in Q4 2018</i>
<b>Q2 2019</b>	cChannel: Ethereum mainnet rollout and continued blockchain expansion and integration cRoute: test and initial deploy cOS: SDK public v3.0 release cEconomy: PoLC mainnet launch Community: onboard off-chain service providers	
<b>H2 2019</b>	cChannel: cross-chain interoperability cRoute: production measurement and optimization cOS: SDK public v4.0 release to enhance UX for real-world use cases cEconomy: SGN and LiBA main net launch Community: continue to grow Celer-enabled application ecosystem with sustainable new app funnel	

## Partnerships

Celer Network has established 9 technical partnerships. Here are several notable ones:

- Dfinity – Celer to provide off-chain scaling solution on the Dfinity Platform (a public blockchain)
- L4 – A collaboration to develop open-source state channels technology
- Quarkchain – Celer to provide off-chain solution on Quarkchain’s sharding architecture
- QTUM – QTUM to integrate Celer’s off-chain solutions into their blockchain platform
- Chainlink – Celer to integrate off-chain conditional state transitions with Chainlink’s decentralised oracle network

## Team

The team currently consists of 16 employees, 4 of whom are co-founders with backgrounds from UIUC, UC Berkeley, MIT, Princeton, and a wealth of experience in distributed systems and game theories.

**Dr Mo Dong (Co-Founder)** – An expert in distributed systems, blockchain networks and the application of game theory in protocol design, with over 10 years of experience. He was also the founding employee and product manager of Veriflow, where he led a team in building a highly scalable verification and distributed system infrastructure. He obtained his PhD in computer science from the University of Illinois at Urbana-Champaign.

**Dr Junda Liu (Co-Founder)** – Having spent over 7 years with Google as a software engineer, Dr Liu successfully launched several projects including B4, Jupiter and Project Fi (a \$100m per year business). He contributed to research papers in areas encompassing high performance and large-scale networks. He obtained his PhD in computer science from UC Berkeley and currently holds 6 US patents.

**Dr Xiaozhou Li (Co-Founder)** – Dr Li has over 7 years of experience. Previously with Barefoot Network driving the technical development of projects with multi-billion operations per second. His field of research includes distributed systems, networking, storage and specialises in the development of scalable algorithms and protocols. He obtained his PhD in computer science from Princeton University.

**Dr Qingkai Liang (Co-Founder)** – An expert in network systems with over 5 years of experience. His specialisation lies in online learning algorithms and building ultra-low latency networks. He holds a PhD in Computer Networks from MIT.

Additional team members include:

- 8 Platform and Mobile Developers
- 2 Designers
- 2 Marketing & Operations Personnel

## Advisors

There are currently 3 advisors for Celer Network.

Dr Christos Kozyrakis (Technical Advisor) – Professor @ Stanford University, Fellow @ ACM and IEEE

Dr Alan Mishchenko (Technical Advisor) – Research Scientist @ UC Berkeley

The Late Dr Shoucheng Zhang (Advisor) – Professor @ Stanford University, Founder @ Danhua Capital

## Token Sale

Celer raised a total of \$31m (\$7.46m in Seed, \$23.25m in Private Sale) during prior capital raising rounds. Total token supply will be fixed with 33% allocated for token sale (including seed and private rounds) and 25% for mining rewards.

Token Details	Details
Token Symbol	CELR
Token Type	Utility
Issuance Platform	Ethereum (ERC20)
Total No. of Tokens	10,000,000,000
Price per Token	\$0.0067
Bonuses	NA
Softcap	NA
Hardcap	USD 4m (Investors own 6% if Hard Cap reached)
Market Cap Valuation	USD 66.67m (Fully Diluted basis assuming hard cap reached)
Market Cap (Based on Initial Cir. Supply)	USD 13.2m
Token Lockup (Investors)	3 months vesting (Private), 10 months vesting (Seed)
Token Lockup (Team)	3 months lock up and 2 year vesting thereafter
Private-sale Date	Aug 2018
Public sale Date	19 Mar 2019 2:00 PM (UTC)
Token Distribution	Within 15 days after sale ends

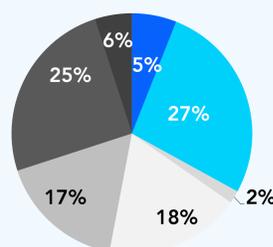
Celer will utilize the fund on technology developments (70%), marketing (15%), legal (10%), and business development (5%). Tokens raised will be stored in cold wallet with multi signature support.

### The main token functionalities are 4 folds:

- Currency/ payment transaction – CELRs circulated on the network will be used to facilitate fees incurred by platform users
- Staking/ Mining – Users will be able to earn CELR tokens through the PoLC mining process by locking up their tokens in the network. The number of tokens earned will increase with value and duration of the lock-up
- Lending and borrowing – CELR tokens are utilised in crowd lending based on varying interest rates through their LiBA model. Priority is given to those who have higher staked tokens
- Insurance – CELR users can stake their tokens into SGN and earn fees by helping other users (insurance buyers) guard their state when they are offline. Insurance buyers are obliged to pay a fee for this service

### Token Sale Split

- Launchpad Sale
- Advisors
- Foundation
- Marketing & Ecosystem
- Seed/Private Round
- Team
- Mining Rewards



## Investors

Celer Network has obtained investments from several strategic investors. Some of the notable investors include:

**FBG Capital** – FBG Capital is a digital asset management company that focuses on blockchain-based projects. Past investments include Libra Credit Network, Eximchain, Taxa, Republic Protocol, MakerDAO, Zilliqa, Ripio.

**DHVC (Danhua Capital)** - DHVC is a VC fund that invests primarily in early stage and growth stage company with disruptive technology. Past investments include Polychain capital seed round, Fcoin, Libra Credit Network, Origin Protocol, Open Platform, Ankr Network, TrustToken, Certik, Mainframe, Ontology.

**Pantera Capital** – An investment fund that focuses on ventures, tokens and projects related to blockchain technology, digital and crypto assets. Prior investments include 0x, Augur, Filecoin, Kyber Network, OmiseGO, ripple, Zcash.

## Community Engagement / Social Media

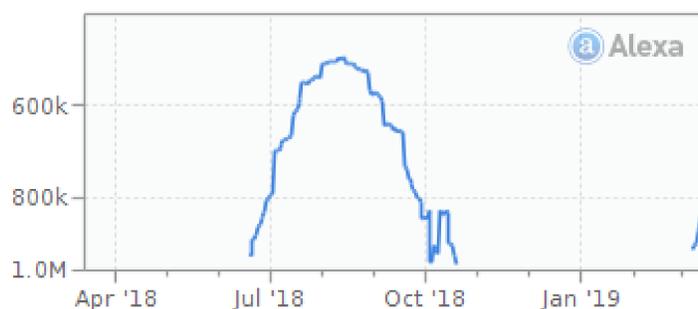
Celer Network has established several social media channels to engage their community. The team has constantly provided weekly updates on Twitter and Medium pages to highlight the project developments. Although website traffic had peaked in Aug 2018, the project is regaining traction in the past couple of weeks based on Alexa Rankings. The top 3 visitors by countries are US, India and Vietnam respectively.

Here are the project social media statistics as per the report date:

- Telegram (English) - 30,300+ members
- Twitter – 9,215 followers
- YouTube – 194 subscribers, 7,800+ views
- Medium – 949 Followers

### Alexa Traffic Ranks

How is this site ranked relative to other sites?



## Competitor Analysis

Celer Network is entering a competitive space with many layer-2 scalability solutions, with the most notable one being Lightning Network. The latter is an off-chain solution for the Bitcoin Network boasting over 7,300 nodes and network capacity of \$3.2m. As Lightning Network does not operate a native token, we will list two other closest competitors instead.

Project Name	Celer Network	Raiden Network	Trinity Network
<b>Infrastructure Type</b>	State Channel with Sidechains	Payment Channel Network	Payment Channel Network
<b>Sector</b>	Micro payments	Micro payments	Micro payments
<b>Symbol</b>	CELR	RDN	TNC
<b>Blockchain Support</b>	Multiple	Ethereum	NEO, Ethereum
<b>Mobile Wallets</b>	IOS, Android	NA	Android
<b>Transaction per Seconds (TPS)</b>	Theoretical: unlimited Practical: 40 (with Centauri Testnet)	Theoretical: 1m Practical: NA	Theoretical: 100m Practical: NA
<b>Product Stage</b>	Beta	Mainnet	Mainnet
<b>Mainnet Launch</b>	Q2 2019	Q4 2018	Q3 2018
<b>Initiation Year</b>	2018	2017	2018
<b>Current Token Price</b>	\$0.0067 (IEO)	\$0.339	\$0.0032
<b>Market Cap Valuation</b>	\$13.2m (based on initial cir. supply)	\$17.1m	\$1.1m

Figures as of report date, Source: Coinmarketcap

## Strengths

- Strong short-term potential attributed to Binance Launchpad listing. Successful past projects on Launchpad includes BitTorrent (10X ATH) and Fetch AI (5X ATH)
- The team has extensive experience in academic research with varying fields of expertise, which complements the project
- A strong panel of strategic investors, which had a track record of successful past investments
- Beta launch of CelerX on IOS and Andriod, with Centauri testnet previously processed ~1.1m transactions
- Achieved 20,000X transaction latency reduction to Ethereum
- The flexibility of Celer's architecture to be implemented across different blockchains rather than just a single blockchain.
- Celer's Github has a total of 39 repositories, 8 public and 31 private, none of which is copied/forked from other codes
- Traction of dApps building on top of Celer

## Weaknesses

- Slight delay in roadmap particularly PoLC and LiBA mainnet launches
- As Celer is a layer-2 solution, the project is dependable on the success of other blockchain networks they collaborated with
- Initial circulating supply ~20%, where tokens from the private round (14%) are unlocked together with launchpad round (6%). This creates additional supply and differs from past Launchpad sales of BTT and FET where only Launchpad round tokens are unlocked

## Opportunities

- **The need for scaling solutions** – It is evident that after the Cryptokitties saga, which caused network congestions, high transactions costs and massive delays has escalated the need for higher throughput solutions. Indeed, many projects are providing scaling solutions, however, progress has been slow with limited developments. Moreover, most scaling solutions cater to specific blockchains such as Lightning Network for Bitcoin, Raiden for Ethereum and Trinity for NEO. Celer's unique proposition to cater their solution to all blockchains provides them with an opportune advantage
- **Off-chain vs On-chain solutions** - Off-chain solutions will be able to free up network capacity as compared to on-chain solutions, which greatly improves network traffic and prevents congestion. In addition, the deployment of the off-chain solution is more efficient than an on-chain upgrade as it reduces disruption to the network.

## Threats

- The number of off-chain scaling solutions do not lack in the markets. Even though Celer portrays an advantage against their competitors regarding higher throughput (x15 faster) and greater channel utilisation ratios (x20 more), we have yet to see a breakthrough nor adoption in technical developments in off-chain solutions.
- Competitors such as Raiden (0.47x vs ICO) and Trinity (0.05x vs ICO) have underperformed in absolute terms, which emphasize the lack of investors' attention towards such projects.



Figure: 1y returns of Raiden (RDN) vs Trinity (TNC)

## Conclusion

Piccolo Research upgrades its rating on Celer Network from 4 stars to 4.5 stars and re-iterates a favourable **'Buy'** rating for the project. Celer's off-chain full stack architecture coupled with their crypto economics mechanism puts the project favourably as a more advanced technology against its peers. Furthermore, the team has delivered most of the project milestones on time, and we remain confident in the team's abilities to create the final product.

Overall, for the reasons listed, Piccolo highlights several reasons to affirm our rating:

- A unique proposition that provides a scaling solution to all blockchains compared to others that cater to a single blockchain
- Successful launch of CelerX and achieving 20,000X latency reduction on Ethereum reinforce the viability of the project
- Significant traction gain in developing the business objectives with major partnerships formed
- Binance Launchpad listing adds to the project's credibility and increased marketing exposure
- The team has both academic and technical expertise and has the capabilities to execute deliverables

Notwithstanding the above, Piccolo acknowledges several obstacles given that Celer is operating in a competitive environment, within the complex nature of providing off-chain scaling solutions. Furthermore, general interest in layer-2 scaling solution has been rather subdued with the exception of Lightning Network. However, technical developments have been progressive, and it is only a matter of time before adoption kicks in.

In light of the preceding, Piccolo Research recommends a **'Buy'** rating on Celer Network.

## **About the Analyst**

Lennard specializes in fundamental and technical analysis in digital asset investments. He became acquainted with blockchain, cryptocurrency and ICOs in 2016, and recently decided to take a meaningful step away from traditional banking to join this industry. Previously, Lennard spent 3 years with an investment bank in forex and debt capital markets. Prior to this, he also had entrepreneurship experience working with an e-commerce startup and a local social enterprise. Lennard graduated with a master's degree in Applied Finance and is fluent in English, Chinese with a basic in Korean. He is a CFA level III candidate.

## **Ratings Definition**

Monitor – Continue observation until clarity of information is provided

Sell/ Avoid – Investment is associated with high risk of losing capital

Hold/ Neutral – To maintain current levels of position until the next updated release

Spec Buy – A speculative opportunity for investors with higher risk tolerance

Buy – A high conviction buying opportunity

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