

Keynote II

서상민 / Ground X

Challenges for Blockchain Mass Adoption



서상민, Sam,
Ph.D.

Head of Tech, Ground X

- Leading the development of Klaytn, SDK, toolkits and services

Senior Engineer, Samsung Research

- Neural network inference framework for on-device AI
- Tizen toolchain development

Assistant Computer Scientist, Argonne National Lab.

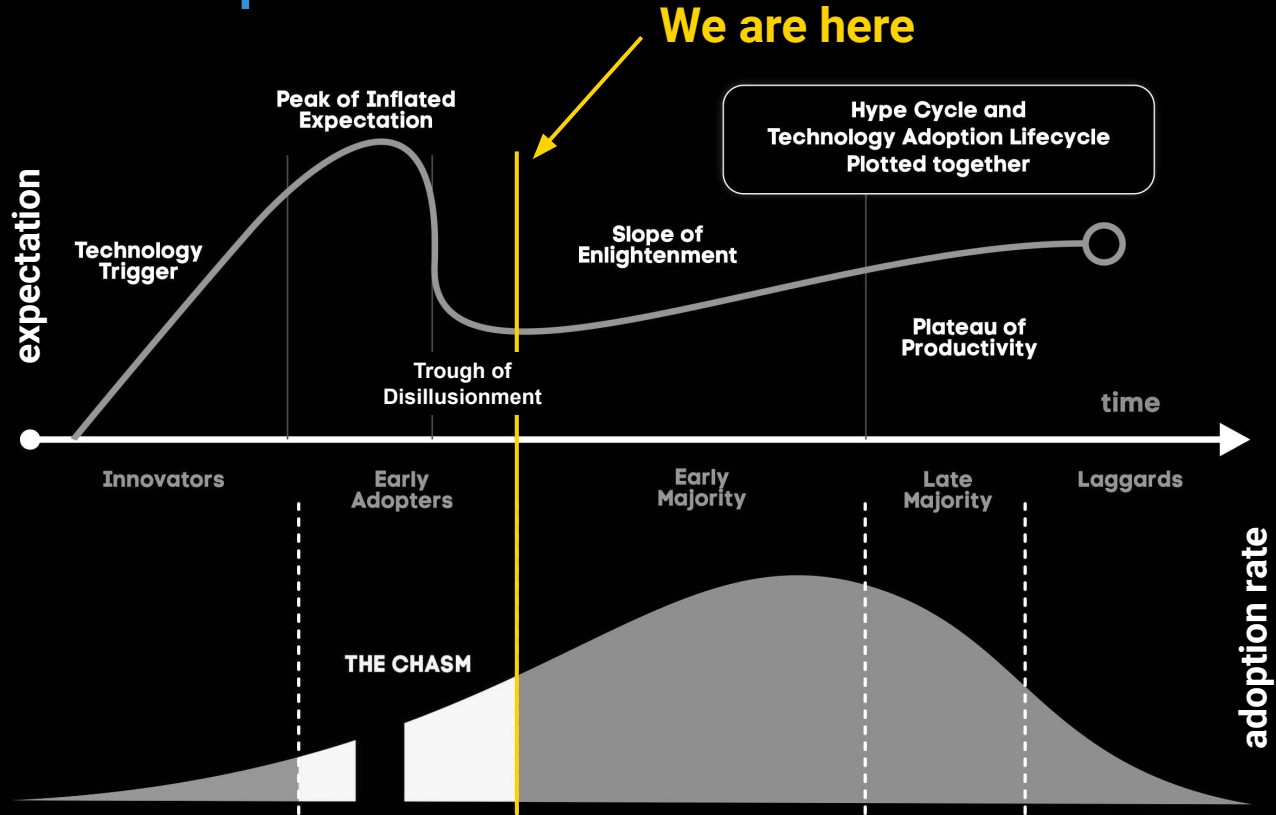
- MPICH: A High-Performance, Portable Implementation of the MPI Standard
- ARGO: An Exascale Operating System and Runtime Research Project
- BOLT: OpenMP over Lightweight Threads

Ph.D. in Computer Science, Seoul National University

- Performance optimizations of parallel programming models on heterogeneous multicore architectures

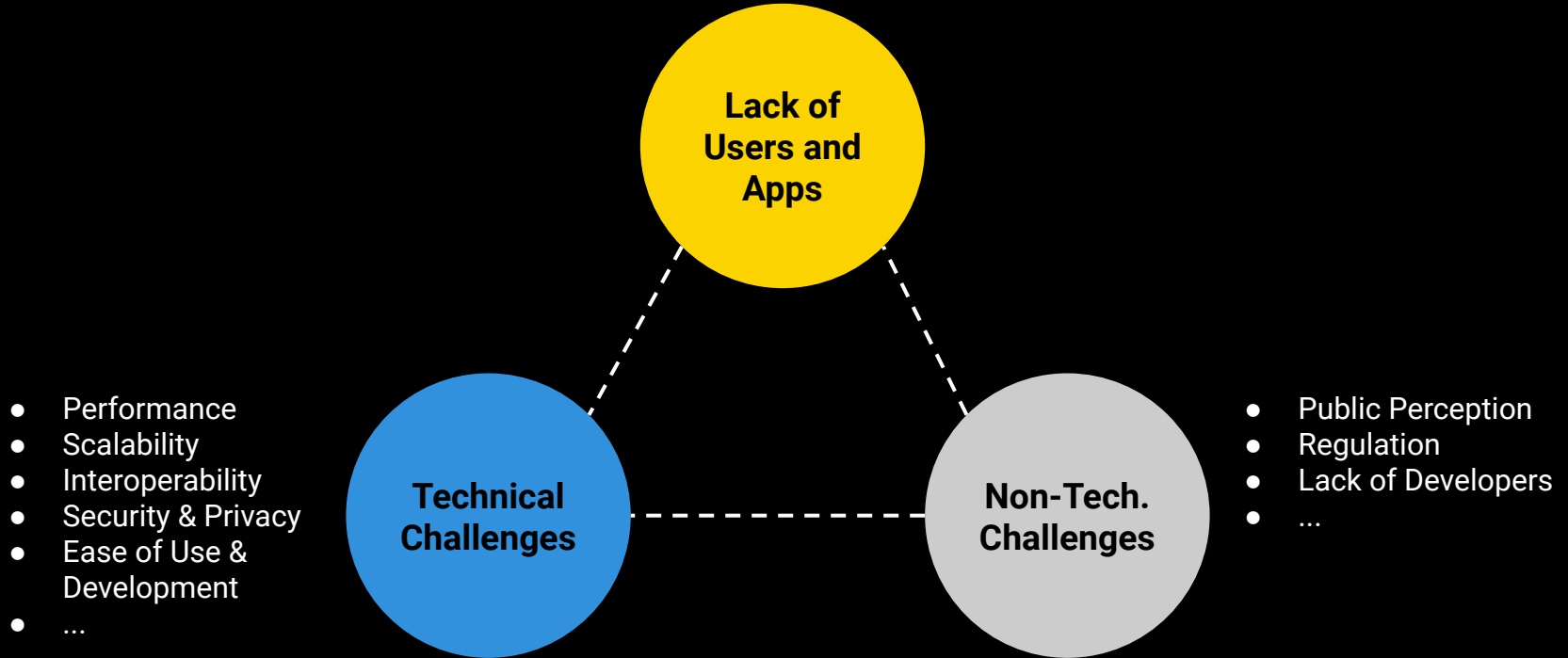
Are We Using Blockchains in Everyday Life?

Blockchain Mass Adoption?




Challenges for Blockchain Mass Adoption


Challenges for Blockchain Mass Adoption



Lack of Users and Apps

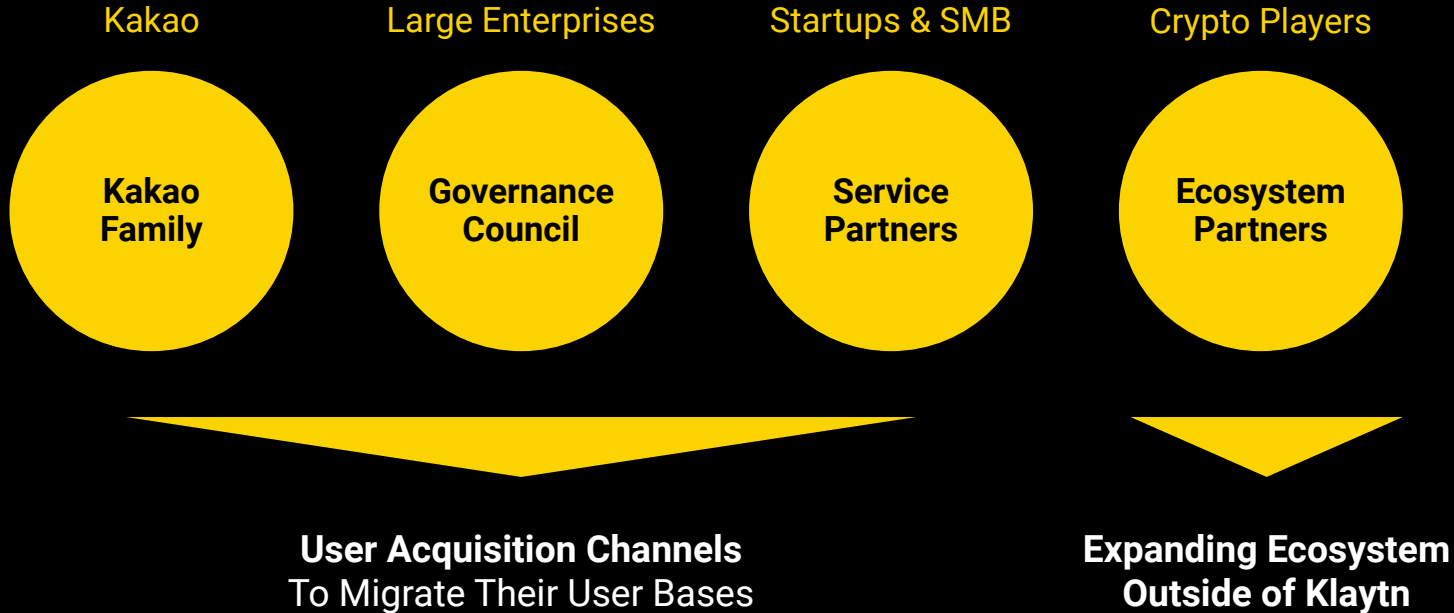
The State of Apps and Platforms

	Mobile Apps
Number of APPS	~5.8 M
Number of Users	~250 M
Key Players	

Blockchain Apps
~2,000
~2.4 M


Building Practical Use Cases with Partners on Klaytn

Klaytn is adding more and more partners who have potentials to build their own blockchain apps and bring their existing users into Klaytn



Klaytn on STATE OF THE DAPPS

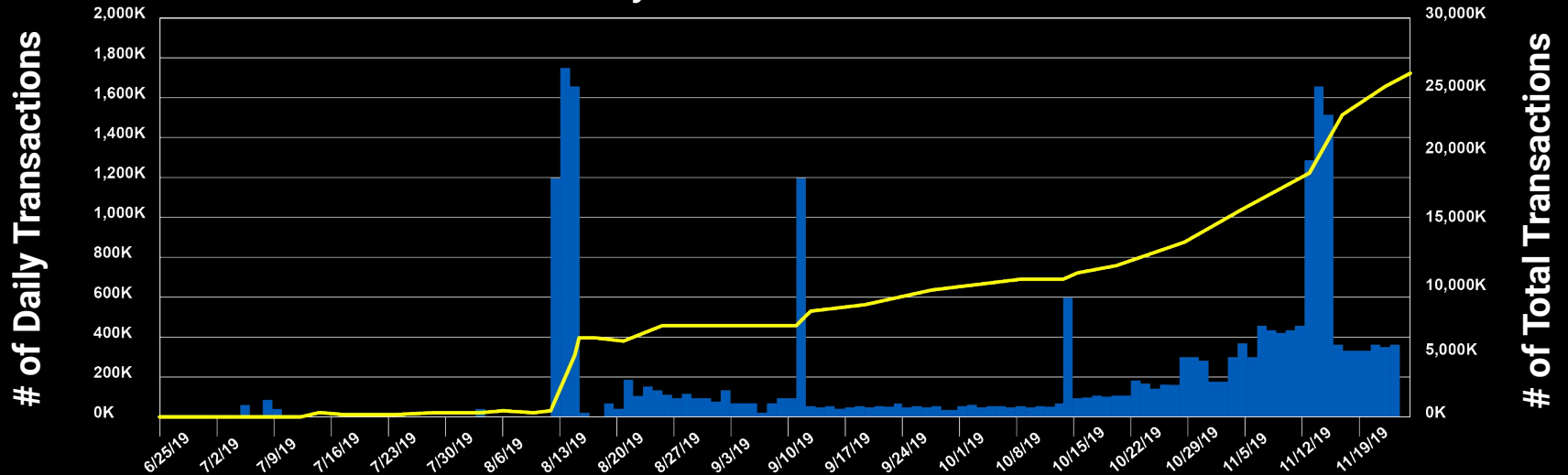
Platforms					
Platform	Total DApps	Daily active users ?	Transactions (24hr) ?	Volume (24hr) ?	# of contracts
Ethereum	2,690	23.04k	83.37k	189.98k	3.9k
EOS	313	11.44k	420.41k	334.39k	480
Steem	91	9.26k	325.65k	105.83k	160
Klaytn	21	40.55k	204.32k	0	53
POA	19	208	3.55k	0	48
NEO	17	1.85k	5.33k	0	25
xDai	12	5	7	0	39
Loom	10	?	?	?	70
GoChain	7	?	?	?	17
OST	2	54	694	17.31k	2

* Data collected on Nov. 25, 2019

Klaytn Mainnet's Growth Rate

Since its launch in June 2019, Klaytn Mainnet successfully established rapid rate of adoption and growth by business entities

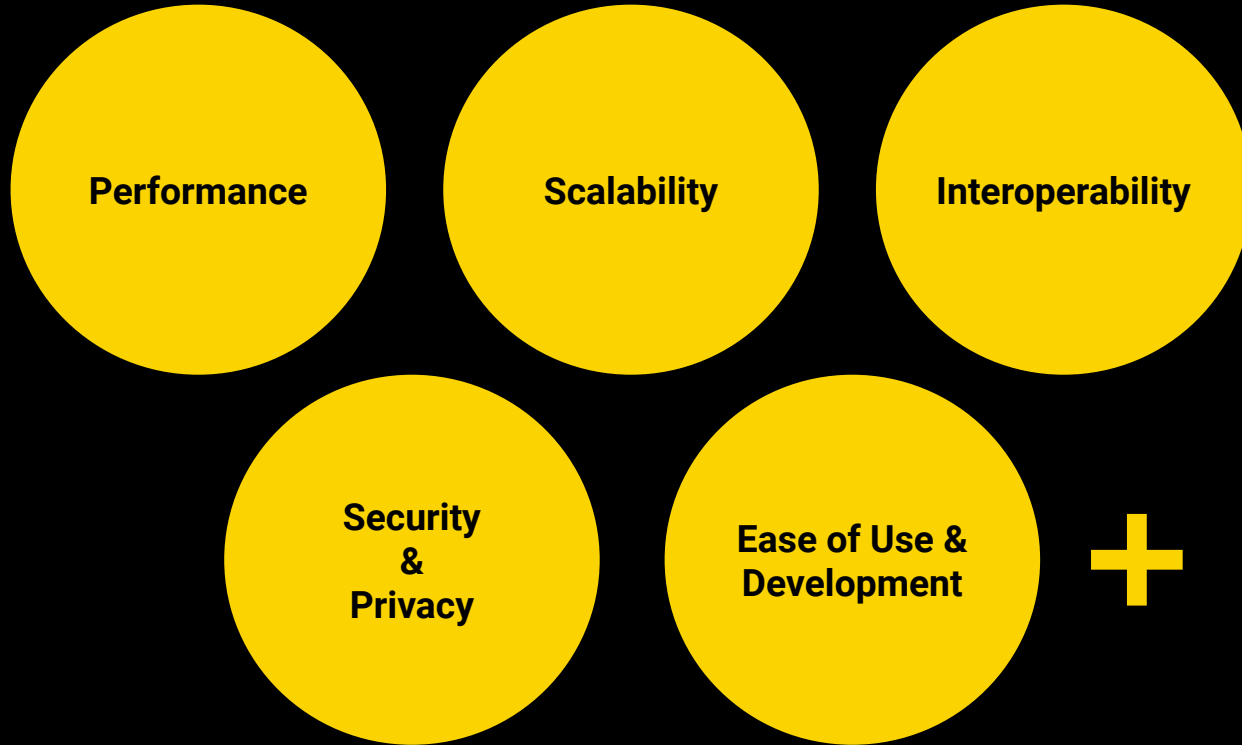
Klaytn Transaction Trend



* Data range: June ~ November 2019

Technical Challenges

Technical Challenges



Technical Challenge I

Performance



	Bitcoin	Ethereum	Ripple	EOS	Stellar
Time to finality	15 min	6 min	4 sec	180 sec	2-5 sec
Transactions per second (TPS)	7	15	1,500	3,000	1,000

Blockchains for Supply Chain Management: Architectural Elements and Challenges Towards a Global Scale Deployment. Logistics, Litke et. al. (2019). <https://medium.com/perlin-network/bite-sized-2-why-is-tps-time-to-finality-important-bd01baffdf05>

Klaytn Cypress Performance

Latency

1 sec
block interval

Enables mobile
app-like performance

Throughput

4,000
TPS

Supports production-grade
enterprise usage

Technical Challenge II

Scalability

Scalable Performance on HPC



Nuri (Korea Meteorological Administration)

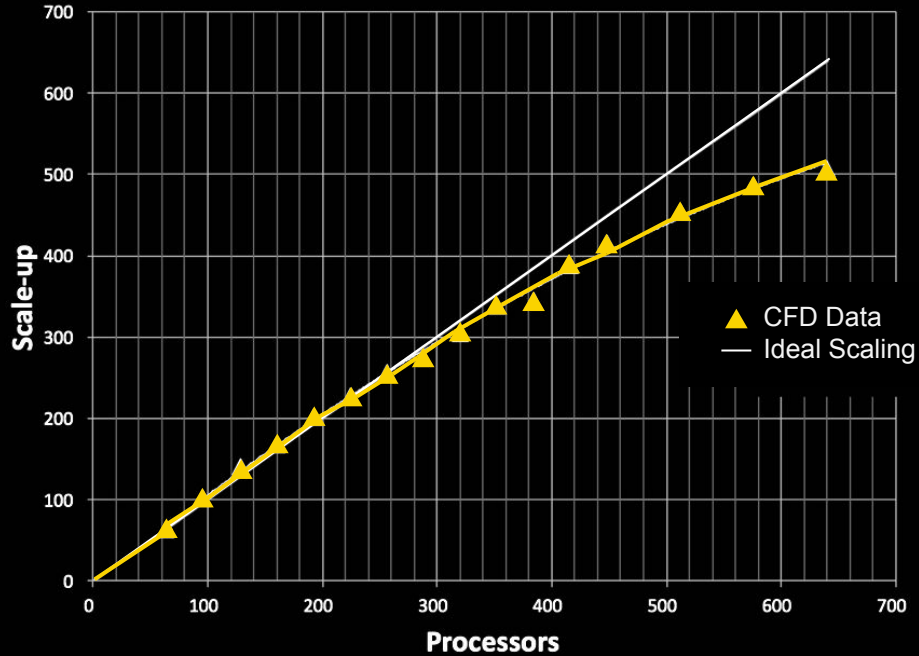
- **69,600 cores / 2.4 PFLOPS**
- **#113 supercomputer (Nov. 2019)**



Summit (Oak Ridge National Lab., USA)

- **2,414,592 cores / 148.6 PFLOPS**
- **#1 supercomputer (Nov. 2019)**

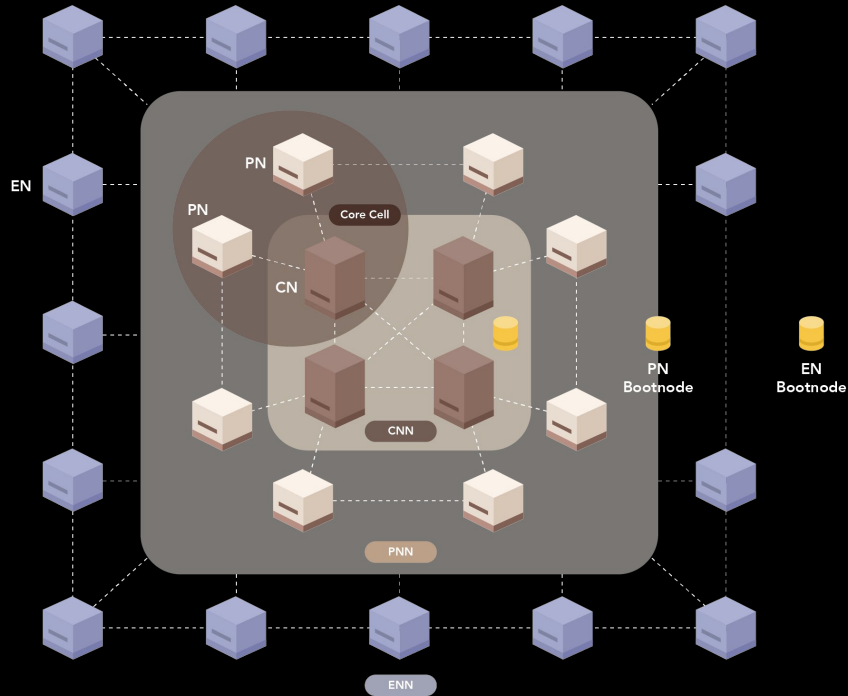
Scalable Performance on HPC



**The more the processors (nodes),
The higher the performance**

graph: <https://aws.amazon.com/blogs/compute/real-world-aws-scalability/>

How about Current Blockchains?

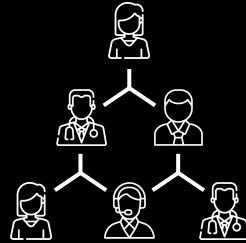


**Do They Provide Higher Performance
If More Nodes Join the Network?**

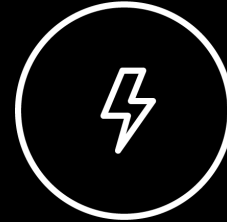
Scalability Trilemma



SECURITY



DECENTRALIZATION



SCALABILITY

No blockchain can have all 3 attributes;
They must choose **2 out of 3** of the attributes.

Scaling Solutions


1st Layer (On-Chain)


Sharding (Ethereum)

Hard Fork:




Distributed Ledgers

Directed Acyclic Graphs: 


Tangle: 


Block-Lattice: 


2nd Layer (Off-Chain)

Service Chain (Klaytn) 



Plasma (Ethereum)

Trinity Network (NEO) 






Raiden Network (Ethereum) 




Lightning Network (Bitcoin) 

Consensus Mechanism

Proof-of-Authority:  

Byzantine Fault Tolerance

- Delegated: 
- Federated:  
- Practical:  

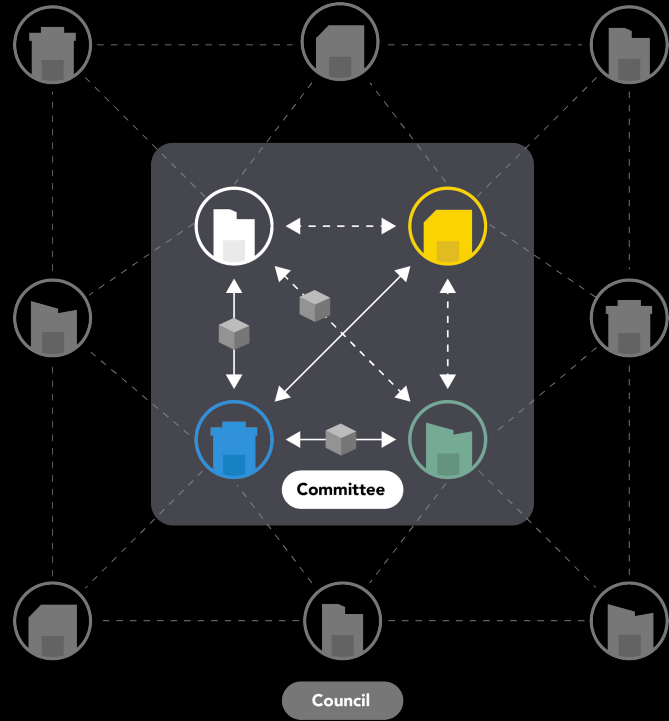
Delegated Proof-of-Stake:     

<https://masterthecrypto.com/blockchain-scalability-solutions-crypto-scaling-solutions/>

Klaytn Scalability - Consensus

Securely Scalable BFT

- Trustful node operators form a network called **Governance Council (GC)**
- For each block, Klaytn randomly selects a subset of the council using VRF; we call this subset a **Committee**
- Klaytn runs BFT on a chosen Committee to achieve fast, efficient consensus



Klaytn Scalability - Exploiting Parallelism (1st Layer)

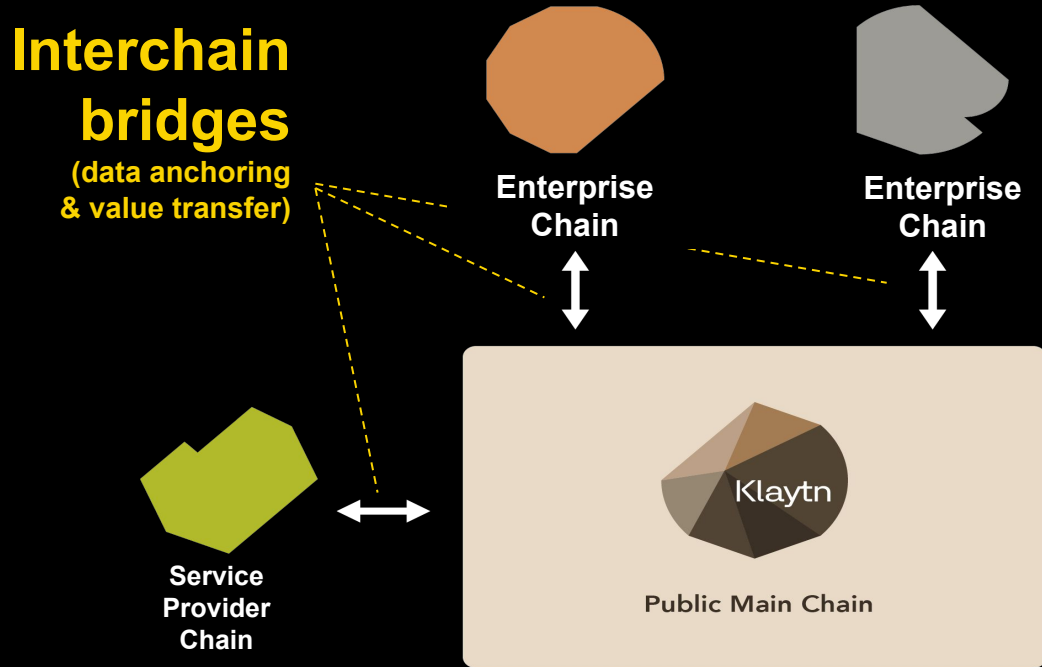
**Parallelizing
Compute-Intensive Tasks**

Isolating Network Resources

**Limiting Concurrency
with a Worker Pool**

Utilizing Fine-Grained Locking

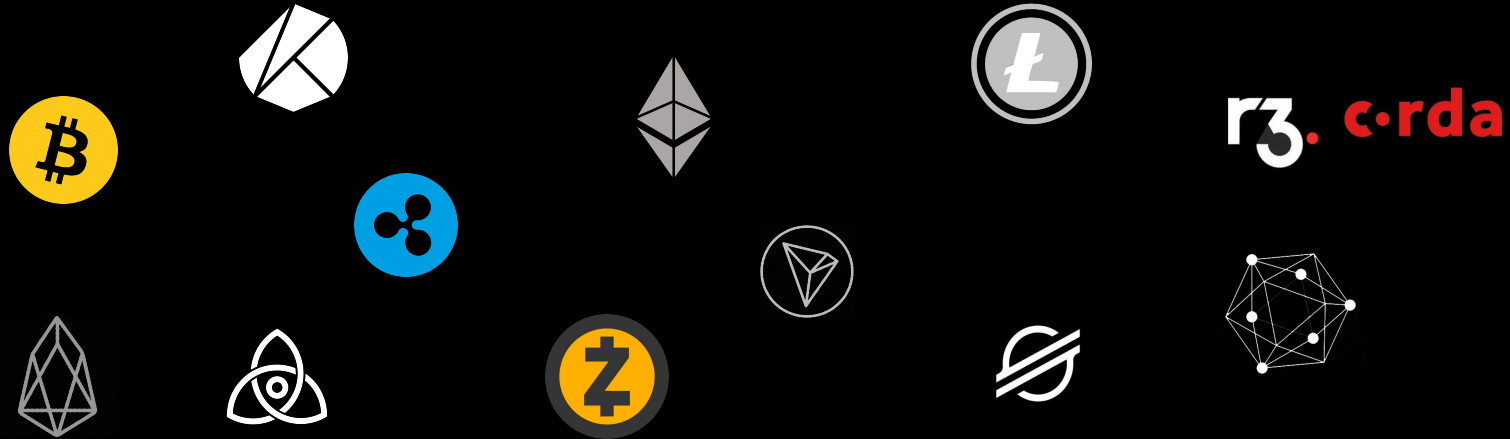
Klaytn Scalability - Service Chain (2nd Layer)



Technical Challenge III

Interoperability

Can One Blockchain Protocol Rule All Others and Be a Standard?



Community says “No”

ConsenSys Research

Avoiding Blockchain Balkanization

Lessons from the early Internet on why we need blockchain interoperability

** Balkanization: becoming a series of unconnected systems operating alongside, but siloed from, each other*

source: <https://consensys.net/research/avoiding-blockchain-balkanization/>

Blockchain Interoperability Methods

Interoperability

- The ability for blockchains to exchange data between platforms
- The ability of any blockchain to be able to prove the state of other blockchains

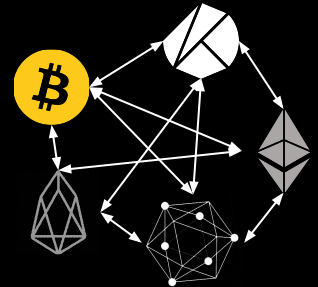
Methods

Notary Schemes

Relaychain & Parachains

Cross-Chain Hash Locking

Multi-Chain Weaving



Technical Challenge IV

Security & Privacy

Security and Privacy Requirements, Properties and Techniques

	S&P Requirements	S&P Properties	Corresponding S&P Techniques
Supported in Bitcoin	Consistency	Consistency	Consensus algorithms
	Integrity	Tamper-resistance	Hash chained storage
	Availability	Resistance to DDoS attacks	Consensus algorithms with Byzantine fault
	Prevention of double-spending	Resistance to double-spending attacks	Signature and verification
	Anonymity	Pseudonymity	Public key as pseudonyms
Need to be enhanced	Unlinkability	Unlinkability	Mixing, anonymous signature
	Confidentiality	Confidentiality	ABE, HE, SMPC, NIZK, TEE-based solutions, game-based solutions
		Resistance to the majority (51%) consensus attack	Consensus algorithms that do not depend on computing power

Security and Privacy on Blockchain, Zhang et al., Journal of ACM Computing Surveys, July 2019.

Blockchain Security Issues



Key Management



Denial of Service



Endpoint Security



Intentional Misuse



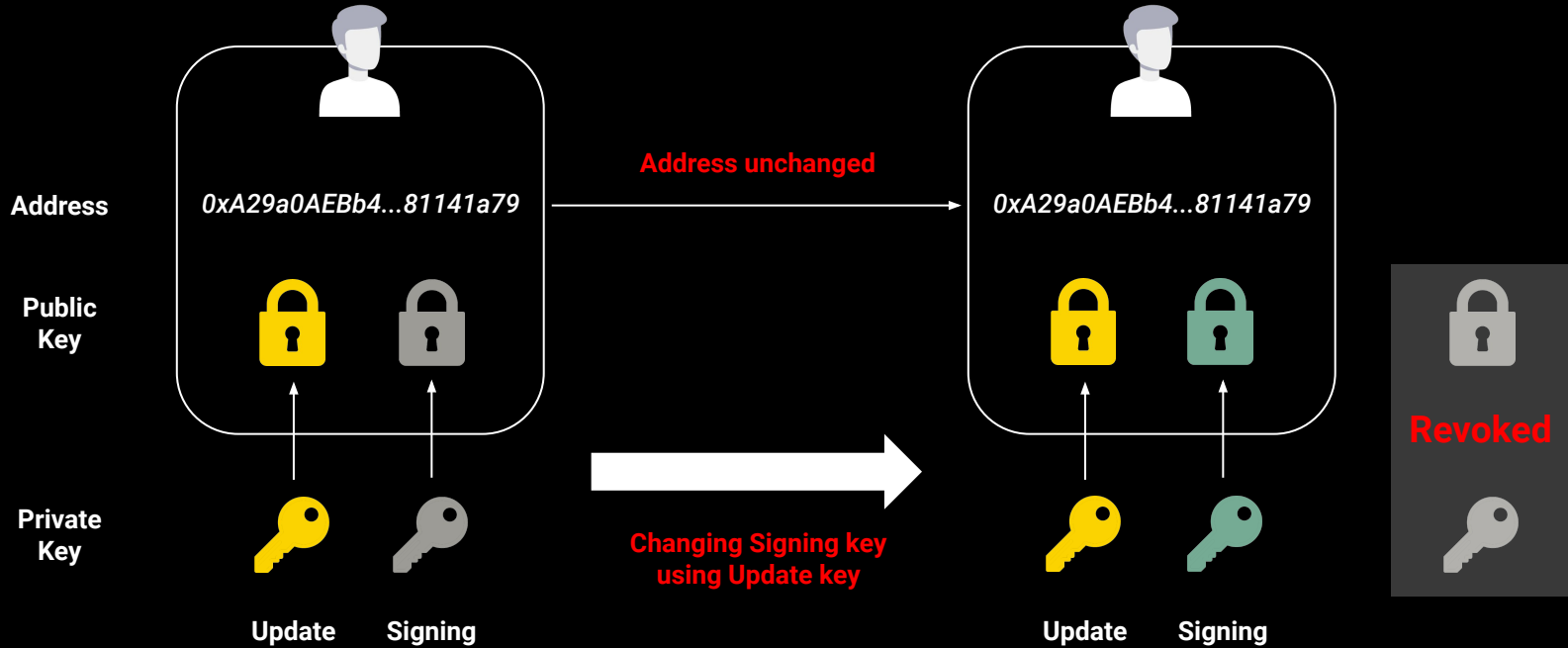
Code Vulnerabilities



Data Protection

Klaytn Account Model for Better Security

Improved security with role-based keys: update and signing roles



Efforts to Improve Privacy on Blockchain

Privacy Coins

Zero-Knowledge Proof Based



TOR Based



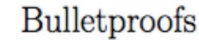
CoinJoin Based



Others



Privacy Infrastructure



Privacy Decryption



Privacy Layers



* source: <https://konfidio.com/blockchain/explained/what-privacy-coins-are-out-there/>

Technical Challenge V

Ease of Use and Development

Technical Challenge - Ease of Use and Development

User Experience (UX)

Blockchain needs simple, intuitive, and hassle-free UX. Current blockchain UX is similar to the Internet UX before web browsers.

Blockchain Invisibility

Blockchain should be easily used without understanding complicated blockchain technology, just as Internet is used.

Development Environment

Coding, debugging, and testing of blockchain applications should be simpler, and smart contracts should be easily integrated with legacy systems.

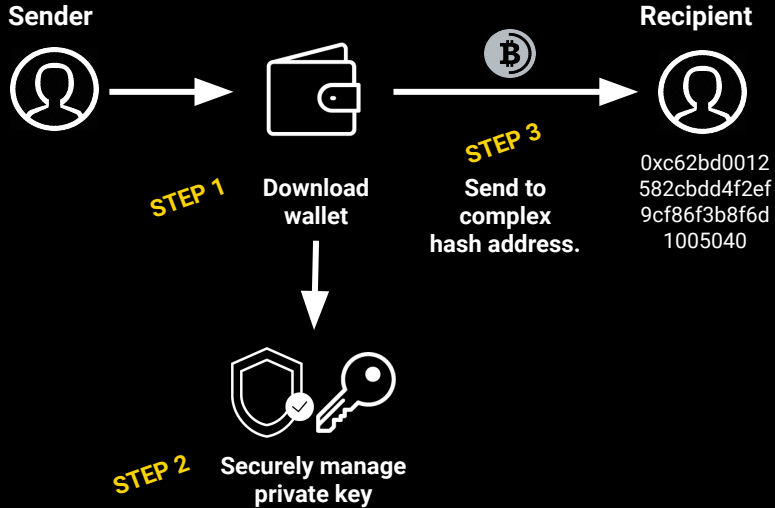
Standards

Blockchain needs standards for interoperable interface, migration, and development productivity.

Klip's Seamless & Hassle-Free User Experience

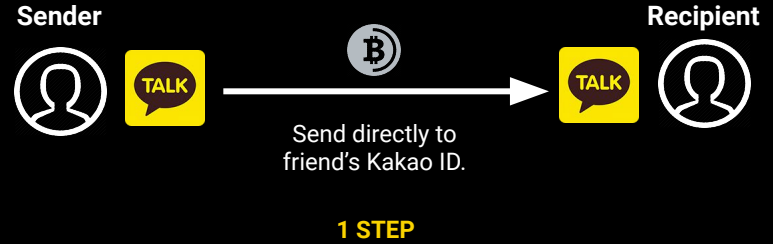
TYPICAL BLOCKCHAIN UX

Typical blockchain user experience is often fragmented

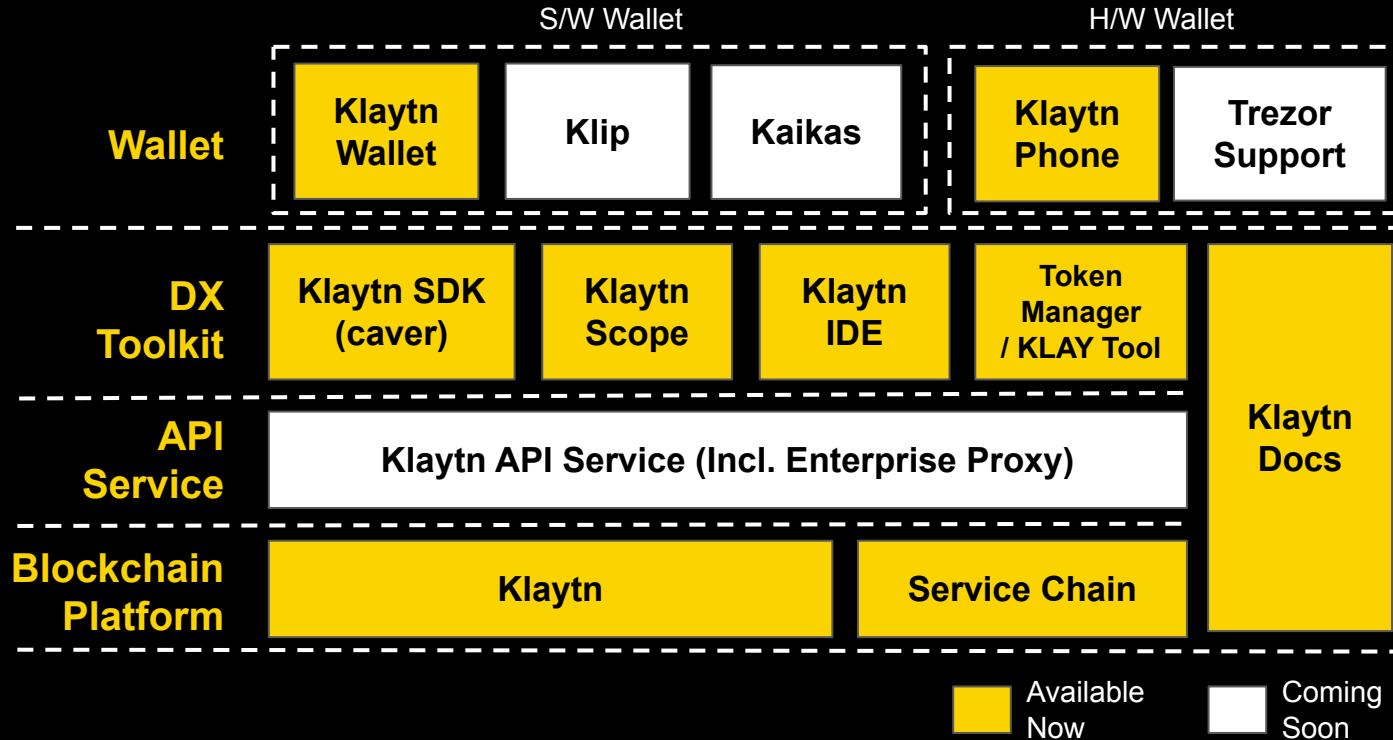


KLIP UX

Integrating with KakaoTalk and Klip offers familiar, seamless user experience

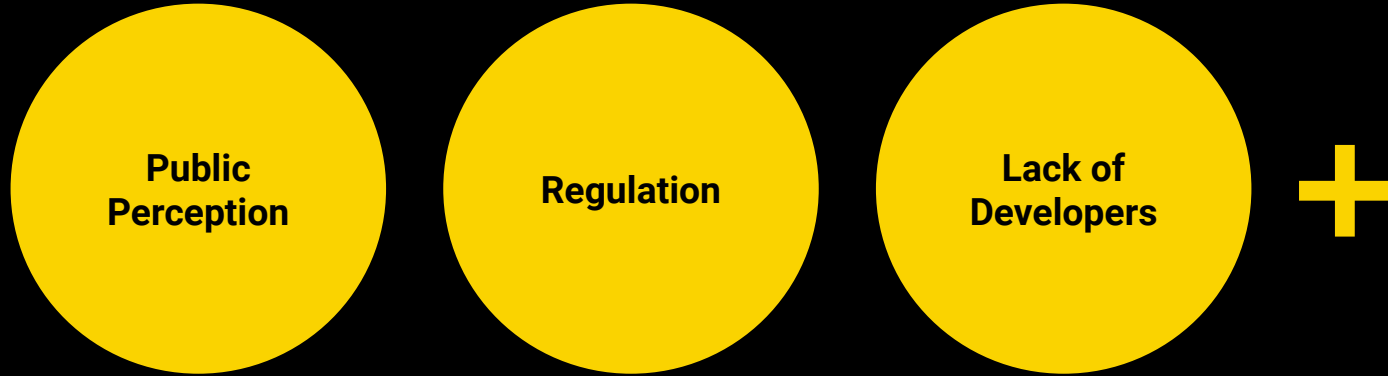


Klaytn Developer Tools



Non-Technical Challenges

Non-Technical Challenges



Non-Technical Challenge I

Public Perception

Public Perception on Blockchain

- Challenge of anonymity
 - Money laundering
- Criminal connection
 - Bitcoin used in the black market and the dark web
- Needs public acknowledgement and marketing



fig: <https://www.forbes.com/sites/jasonbloomberg/2017/12/28/using-bitcoin-or-other-cryptocurrency-to-commit-crimes-law-enforcement-is-onto-you/#2616d8eb3bdc>

Ground X's Leadership on Blockchain for Social Impact

BLOCKCHAIN FOR SOCIAL IMPACT CONFERENCE

HEYGROUND B1
CHANGEMAKERS

GROUND X

Blockchain for Social Impact Donation and Blockchain

This document is the final report containing the results of the «improving Donation Culture Through Blockchain» project. The objectives of the «improving Donation Culture Through Blockchain» project are understanding the donation and fundraising sector and its problems, identifying issues that can be resolved with blockchain technology, operating a pilot program, and demonstrating the potential of blockchain through this endeavor. This project was facilitated by Kakao's blockchain subsidiary, Ground X, and the leading nonprofit organizations of South Korea participated as the initial idea contributors.

The initial idea contributors were composed of the leading nonprofit organizations of South Korea including Good Neighbors, The Beautiful Foundation, The Asian Naman Foundation, Kids and Future Foundation, GuideStar Korea, Korea Association of Fundraising Professionals, and The Happiness Foundation. Fundraiser professionals from other organizations also offered their experiences and ideas through phone calls, emails, and face-to-face meetings.

The «improving Donation Culture Through Blockchain» project operated for eight months starting with the first meeting in October 2018 and ending in June 2019. The results of this project have been organized into the four following categories, with details following in the rest of this report. The results of first category, the «Current state of the donation and fundraising sectors», were mostly based on the ideas of and discussions shared with project contributors.

1. Current state of the donation and fundraising sector
2. The characteristics of blockchain technology
3. The overlap between donation and blockchain
4. The summary of pilot programs

Blockchain technology is open source that grows through its community of developers and the developers' voluntary contribution. Following the community spirit of keeping blockchain technology open source, the results of this project have been released to the public in its entirety. Ground X hopes that the results from this project, created from the collective intelligence and cooperation, will become a 'public good' that benefits many people.

GROUND X

02 Donation Journey and Pain Points

	STEP 1 Pre-Fundraising	STEP 2 Fundraising	STEP 3 Allocation	STEP 4 Tracking and Reporting	STEP 5 Post-Fundraising
# Donation Journey	<ul style="list-style-type: none"> • Disclosure of information • Nonprofit organizations announce their business on their official website and outline the details of the operation. • Donors can find further information through GuideStar Korea and other channels. 	<ul style="list-style-type: none"> • Public fundraising (Project planned before fundraising) • Digital search engines, banner ads, suggest online project through official website • Face-to-face (F2F) • Television programs • DTV • Crowdfunding (e.g., Kakaotalk Together and Hoor's Happy Bean) • Corporate fundraising (Funds raised before planning a project) <ul style="list-style-type: none"> • A corporation first suggests a budget and projects are created and proposed according to the budget • Government subsidies • Other <ul style="list-style-type: none"> • KIDCA (Korea Child Community Fund) funds from the Community Chest of Korea 	<ul style="list-style-type: none"> • They don't separate the project <ul style="list-style-type: none"> • Domestic projects • To raise branches or partner community centers • Business consultation agency (e.g., directly transferred to hospitals for medical research patients) • Directly to beneficiaries • Overseas projects <ul style="list-style-type: none"> • Insurance partners or country office • The charity does not operate in project • Sent to the head office and distributed to local offices 	<ul style="list-style-type: none"> • System <ul style="list-style-type: none"> • Internal financial accounting system • Receipts for funds from KIDCA and the Community Chest of Korea • Channels <ul style="list-style-type: none"> • Official website • Annual report / brochure • Email / letter • Text message / phone call • Customers <ul style="list-style-type: none"> • Storytelling with topics such as the results of the project, its progress, and effectiveness 	<ul style="list-style-type: none"> • Donor management and privileges <ul style="list-style-type: none"> • To request continued support and provide donor privileges
# Pain Points and Difficulties in Each Step of the Donation Journey	<ul style="list-style-type: none"> • Is the essential information the donor needs to know open and accessible? • Has the donor sufficiently understood the relevant information before donating? 	<ul style="list-style-type: none"> • How can the declining number of raising regular donors be treated? • Will donations increase if transparency is secured? • What needs to be made transparent, and how far should the transparency of each stage for their degree of transparency do donors want? • How can the different interests of donors be identified? • How will donors' anxiety and fear of implementing new technology be alleviated? (e.g., personal information issued) • What preparations must be made as the age group of target donors change? (e.g., Millennials, digital natives) 	<ul style="list-style-type: none"> • How can the issue of donations being temporarily concentrated in specific projects or campaigns get down when he is asked? • How much information needs to be revealed and how should the opening costs contribute to the continuous existence of a project? (to be revealed to the public?) 	<ul style="list-style-type: none"> • Given the rights and primary issues of the beneficiaries, how far can they disclose their usage and results? • What contents, channels and methods can give donors the feeling of "in involved continuously"? • How should impact metrics be defined? • What are the environments and tools that can reduce the resource burden of proofing receipts and focus more on the business that is essential? 	<ul style="list-style-type: none"> • How will the following relationships be developed and maintained among donors, organizations, and beneficiaries? • How can we automate manually managed customer data?

18

Donation 19

Non-Technical Challenge II

Regulation

Regulation on Blockchain

- Lack of regulation
 - Users fear losing their investments and are less motivated to adopt blockchains
- “Regulation is the first key for establishing blockchain technology at it will provide the lacking level of trust.”
 - Julian-Andre Winter, head of asset management at The Naga Group



Blockchain Regulation in Progress

coingeek

NEWS

CONFERENCES

HOW TO BUY BSV?

VENTURES

| TECH 3 NOVEMBER 2019

Steve Kaaru

This week in tech: Blockchain regulation takes center stage in China, Korea, India and more

Blockchain technology is going to power the future—that much is clear. But in order to do so, there must be enabling regulations and policies that can foster its growth. More countries are recognizing this, and this week saw quite some effort to establish regulatory frameworks. China continued in its role as a global powerhouse, with India, Korea and even Australia also making headlines. This week also saw a number of blockchain startups raise funding, with one founder invested in.

Chinese Government Forms New Committee to Regulate Blockchain Technology

By ALLISON JIANG

3 days ago

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Home > Daily Drip > Chinese Government Forms New Committee to Regulate Blockchain Technology

In a highly centralized country like China, blockchain technology has always been slightly rocky terrain. But China's ever-evolving relationship with blockchain took a new step forward on Wednesday when the Standardization Administration of China (SAC) announced the formation of a national standards committee for blockchain regulation.

The SAC, which is authorized by the Chinese government and represents China in the International Organization for Standardization, released a statement that the organization is assembling several technological committees to improve China's "economic development and social governance." This included blockchain and other elements of the sharing economy.

More than just crypto: blockchain usage grows amidst greater regulation

By Emma Olsson | 19 November 2019

With countries such as [China](#) and [Germany](#) laying the groundwork for their blockchain legislation in the past few months, and financial services still undecided on the uses of blockchain, it is apt to re-evaluate the uses of the distributed ledger technology (DLT).

Blockchain often connotes cryptocurrencies, but the technology has many uses: increasing speed and security in cross-border transactions, smart contracts, digital identity – to name a few. As blockchain regulation becomes more commonplace, the application of the technology has the potential to grow in prevalence.

NEWS

Nov 25, 2019

News Op-Eds Press Releases About Advertise Publish Press Release The Satoshi Report

REGULATION
By Kevin Helms

Oct 31, 2019

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Korean Presidential Committee Pushes to Legalize Crypto

Non-Technical Challenge III

Lack of Developers

Lack of Developers

Lack of Skilled Developers

Finding capable software engineers for developing blockchains or apps is too tricky.

COMPUTERWORLD UNITED STATES ▾ WINDOWS MOBILE OFFICE SOFTWARE INSIDER 🔍 ☰

Demand for blockchain engineers is 'through the roof'

A new jobs report shows software engineers with blockchain skills in demand more than at any time in the past, and the number of jobs is growing rapidly in the past year.



By Lucas Mearian

Senior Reporter, Computerworld | FEB 28, 2019 3:00 AM PST

Payoneer Blog 🔍 ☰ SUBSCRIBE

The Blockchain Talent Shortage: Opt for Global Freelance Developers

Karen Friedman
July 23, 2019

Today, blockchain is one of the fastest-growing areas for all types of businesses and holds the potential to improve security and transparency for companies everywhere, and in every industry. Financial institutions like **JP Morgan Chase** and retail outlets like **Walmart** are eager to introduce blockchain to their business by hiring top developers.

Lack of Education

One barrier hindering blockchain technology diffusion is the lack of proper education on the innovative technology.

Forbes Billionaires Innovation Leadership Money Business Small Business Lifestyle

35,799 views | Apr 11, 2018, 05:05am

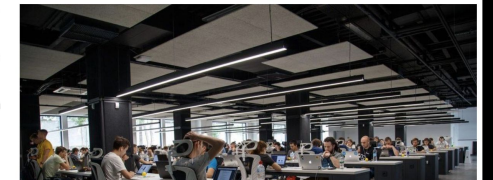
The Demand For Blockchain Engineers Is Skyrocketing, But Blockchain Itself Is Redefining How They're Employed



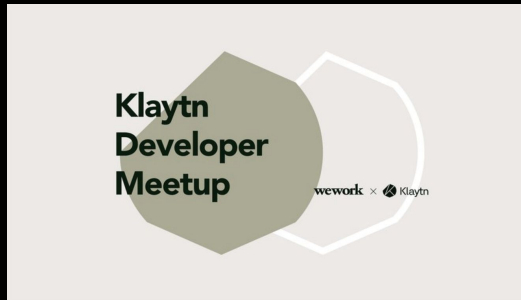
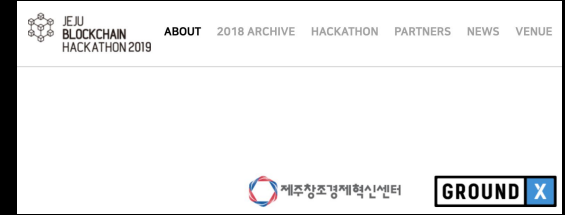
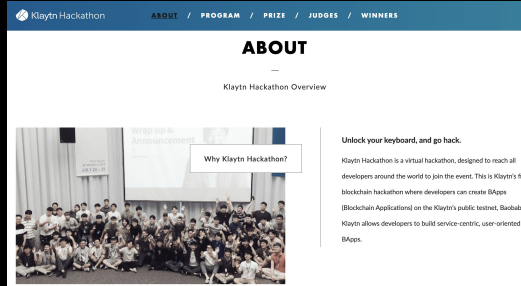
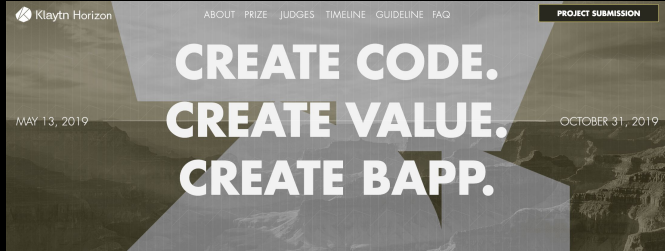
Sherman Lee Contributor @

Asia

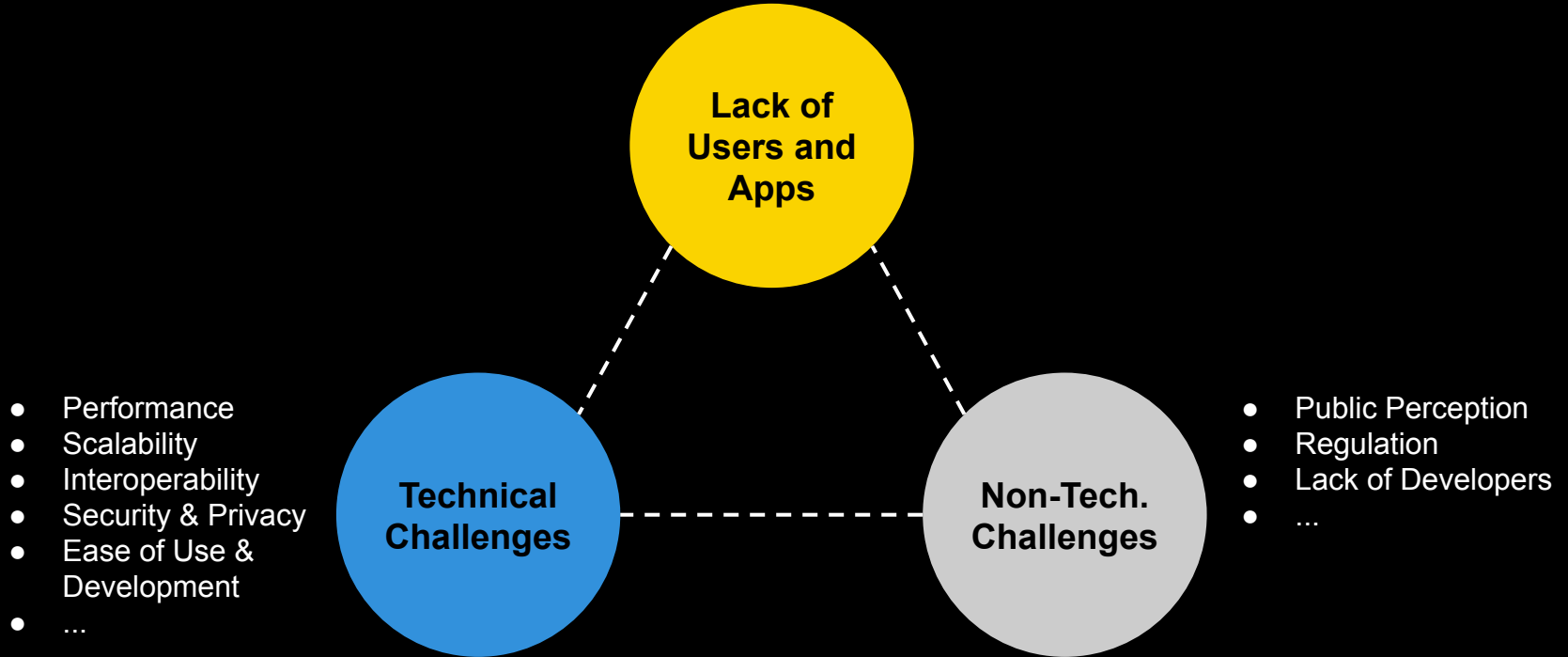
I write about deep tech, crypto, and artificial intelligence.



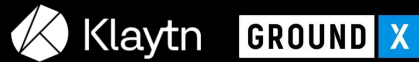
Klaytn's Community Activities



Challenges for Blockchain Mass Adoption



It's Time to **Build.**



THANK YOU

Ground X
27F, 521, Teheran-ro,
Gangnam-gu, Seoul, Republic of Korea