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

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Are We Using Blockchains in Everyday Life?

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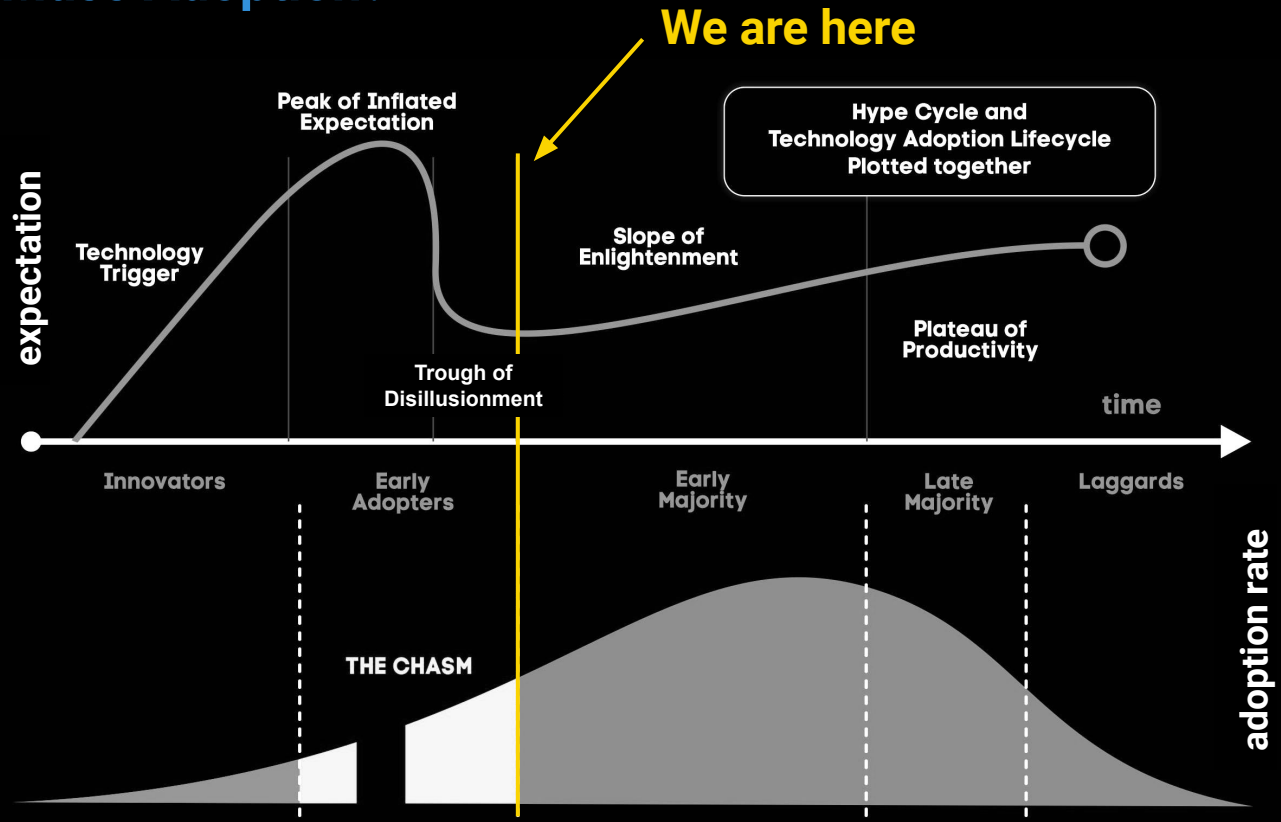
Blockchain Mass Adoption?



source: https://medium.com/tozex/application-of-the-diffusion-of-innovation-theory-to-blockchain-technology-b4d9535507fa

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Challenges for Blockchain Mass Adoption

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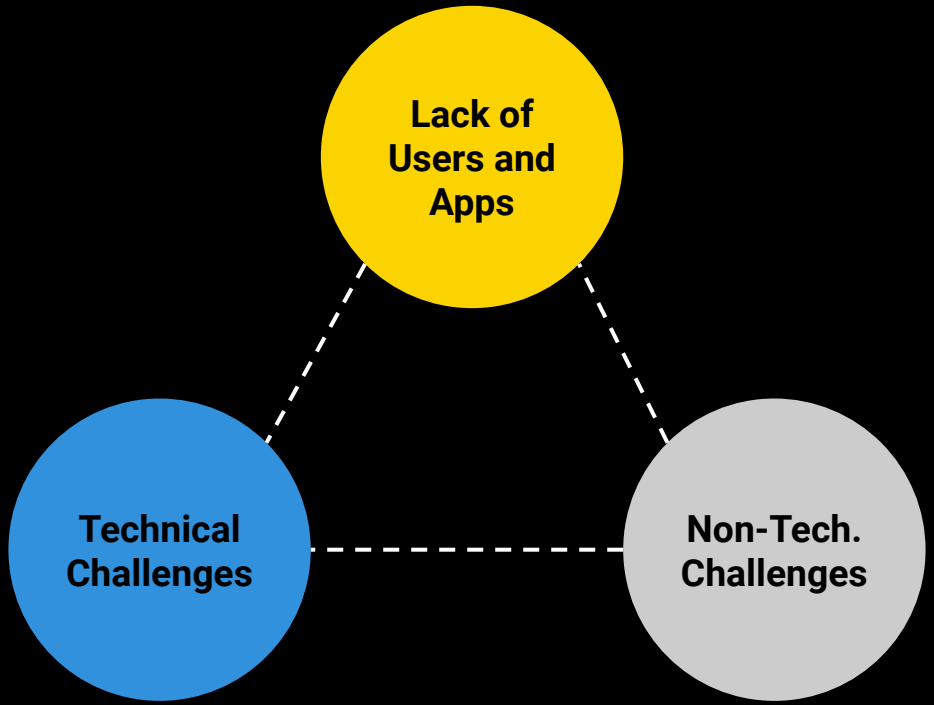
Challenges for Blockchain Mass Adoption



- Performance
- Scalability
- Interoperability
- Security & Privacy
- Ease of Use & Development
- ...

- Public Perception
- Regulation
- Lack of Developers
- ...

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Lack of Users and Apps

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The State of Apps and Platforms

	Mobile Apps	Blockchain Apps
Number of APPS	~5.8 M	~2,000
Number of Users	~250 M	~2.4 M
Key Players		

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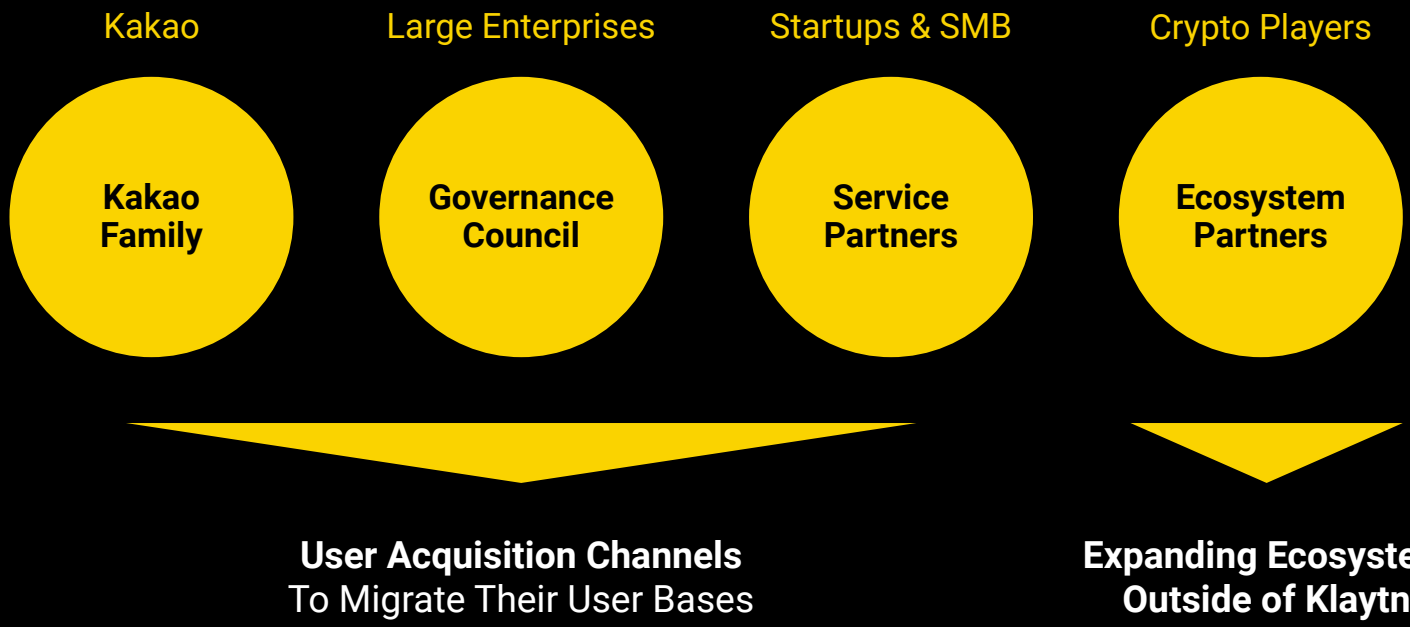
Building Practical Use Cases with Partners on Klaytn

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



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Klaytn on STATE OF THE ĐAPPS

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

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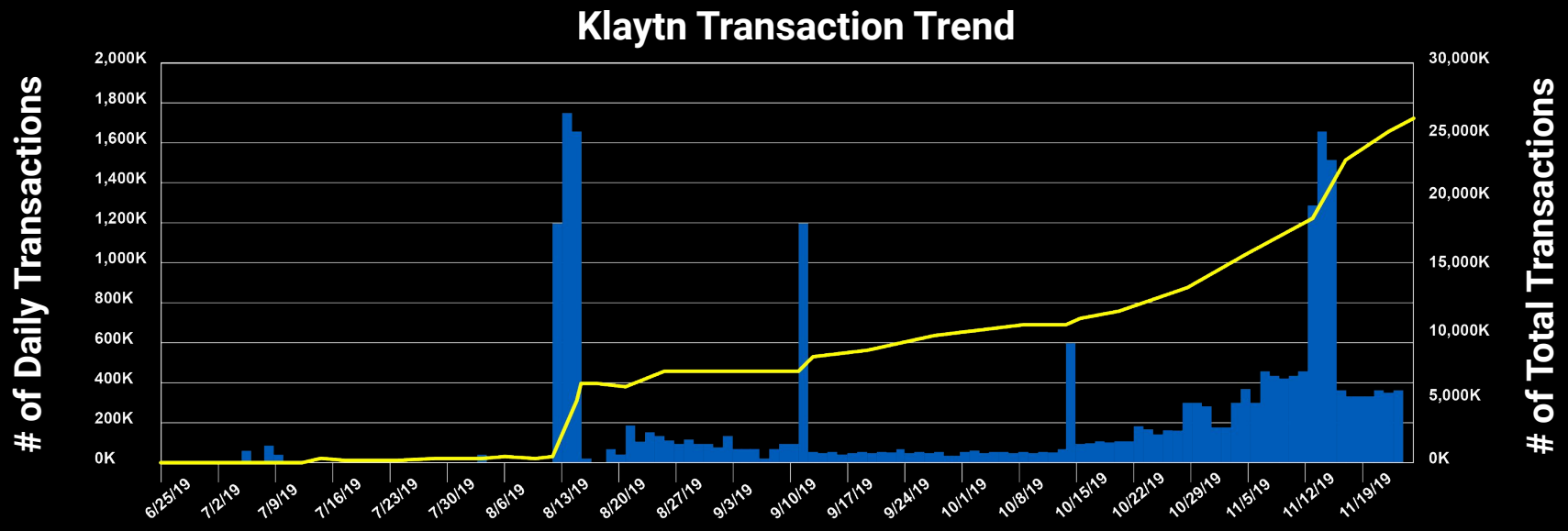
Klaytn Mainnet's Growth Rate

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



* Data range: June ~ November 2019

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Technical Challenges

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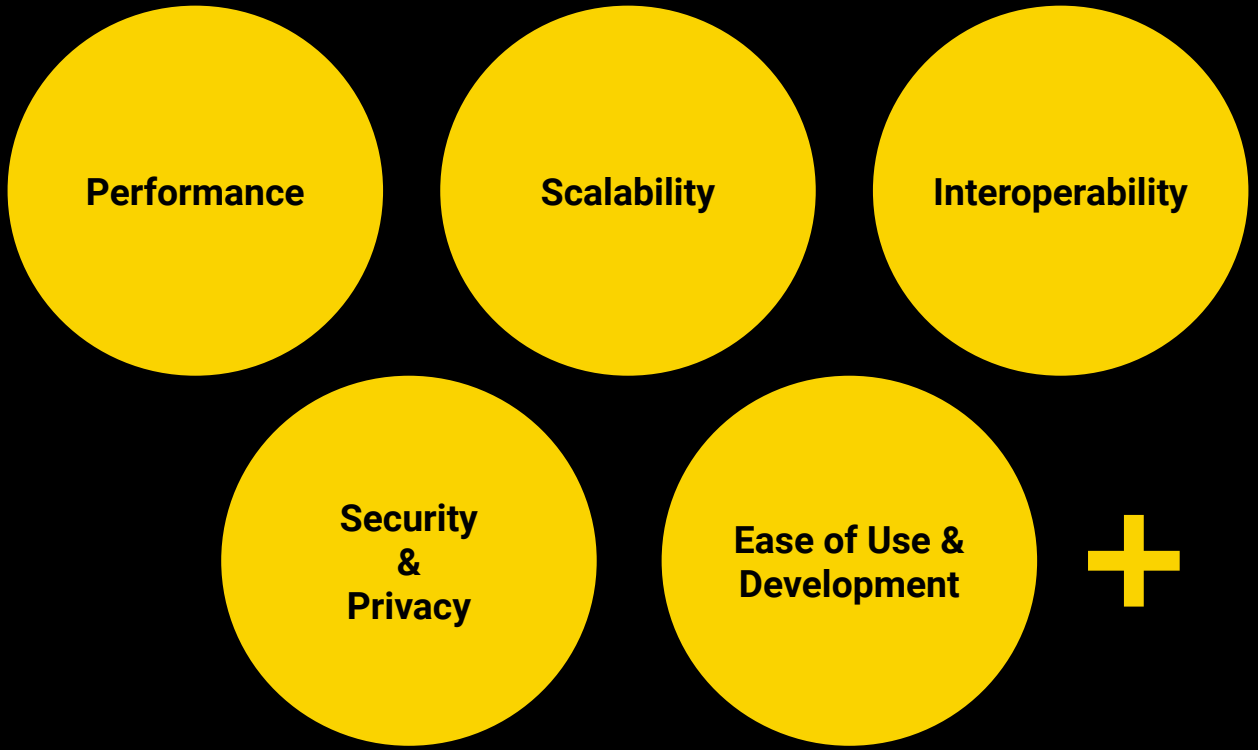
Technical Challenges



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Technical Challenge I
Performance

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	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

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Klaytn Cypress Performance

Latency

1 sec

block interval

Enables mobile
app-like performance

Throughput

4,000

TPS

Supports production-grade
enterprise usage

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Technical Challenge II
Scalability

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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)

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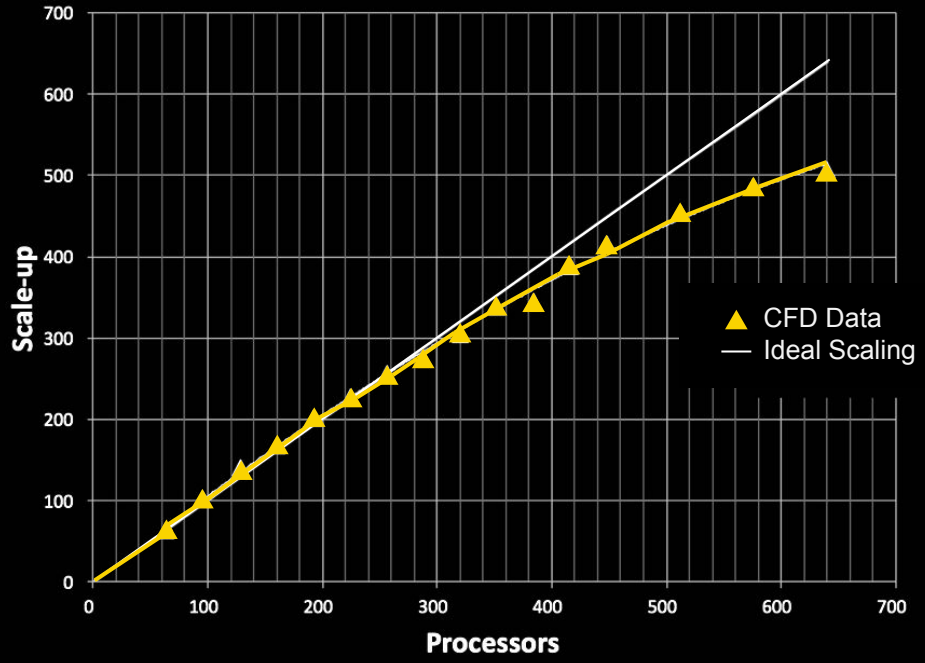
figure 1: http://www.hani.co.kr/arti/society/environment/714335.html
figure 2: https://en.wikipedia.org/wiki/Summit_(supercomputer)

Scalable Performance on HPC



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

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

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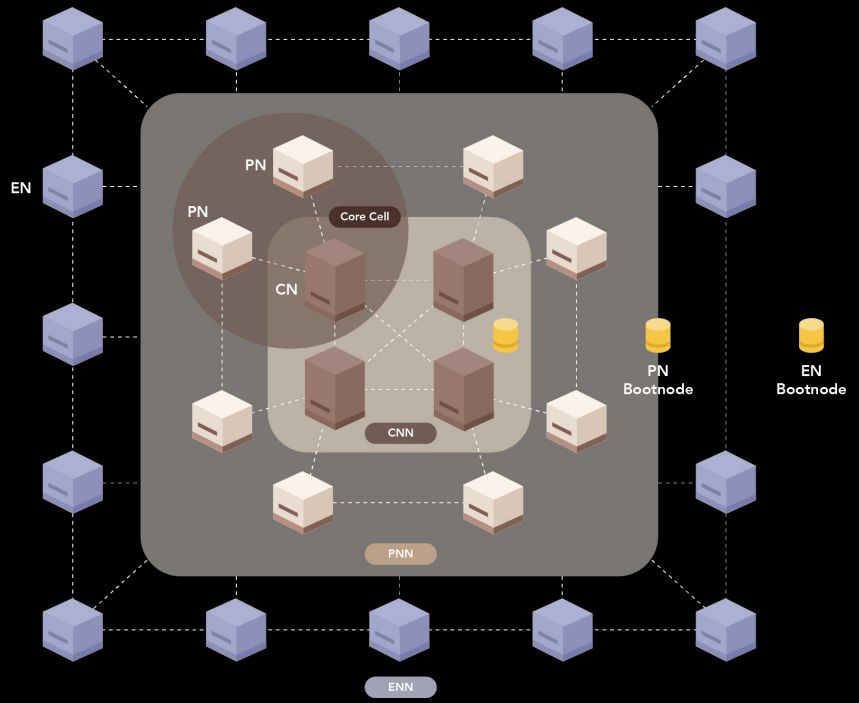
How about Current Blockchains?



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

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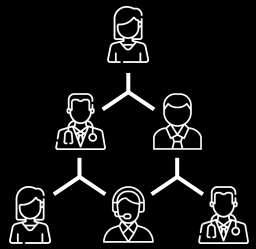
Scalability Trilemma

SECURITY



DECENTRALIZATION

SCALABILITY

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

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Scaling Solutions

1st Layer (On-Chain)

Sharding (Ethereum)

Hard Fork:

SEGWIT

2nd Layer (Off-Chain)

Service Chain (Klaytn)

Plasma (Ethereum)

Trinity Network (NEO)

Raiden Network (Ethereum)

Lightning Network (Bitcoin)

Distributed Ledgers

Directed Acyclic Graphs:

Tangle:

Block-Lattice:

Consensus Mechanism

Proof-of-Authority:

Byzantine Fault Tolerance
- Delegated:
- Federated:
- Practical:

Delegated Proof-of-Stake:

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

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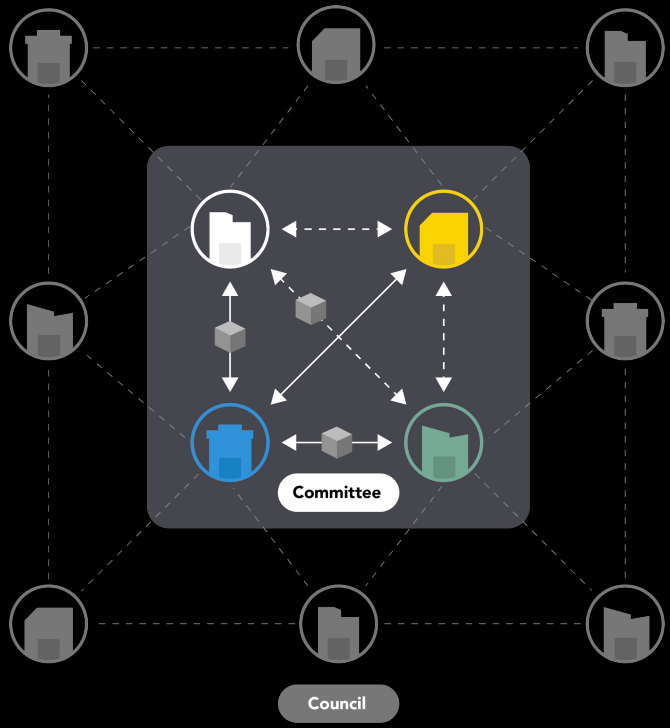
Klaytn Scalability - Consensus

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



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Klaytn Scalability - Exploiting Parallelism (1st Layer)

Parallelizing Compute-Intensive Tasks	**Isolating Network Resources**
Limiting Concurrency with a Worker Pool	**Utilizing Fine-Grained Locking**

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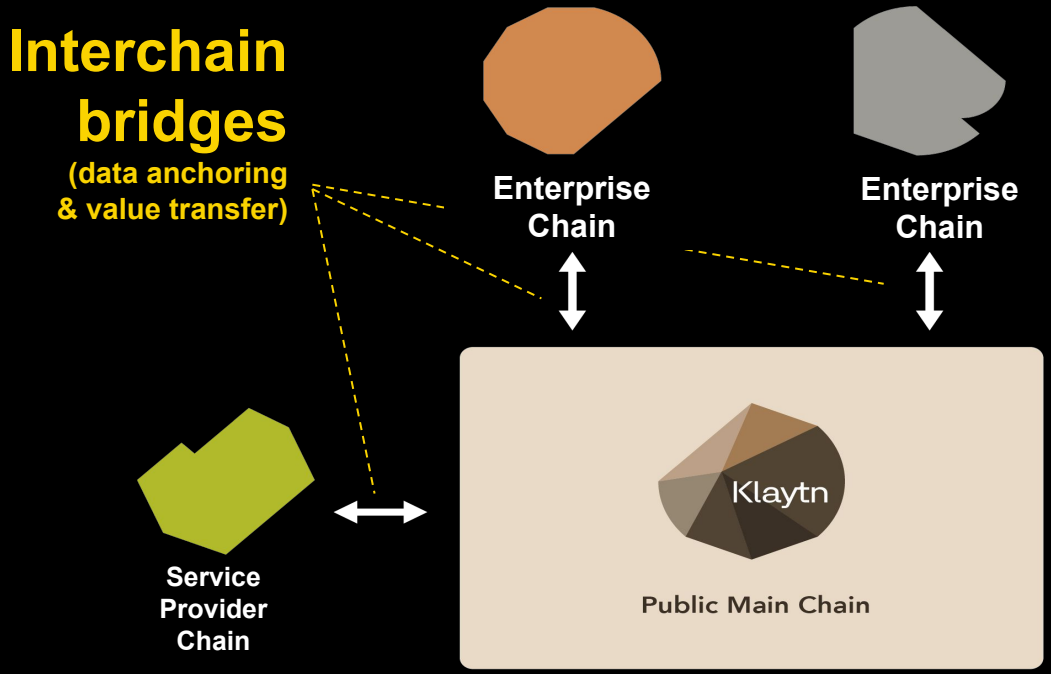
Klaytn Scalability - Service Chain (2nd Layer)



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Technical Challenge III
Interoperability

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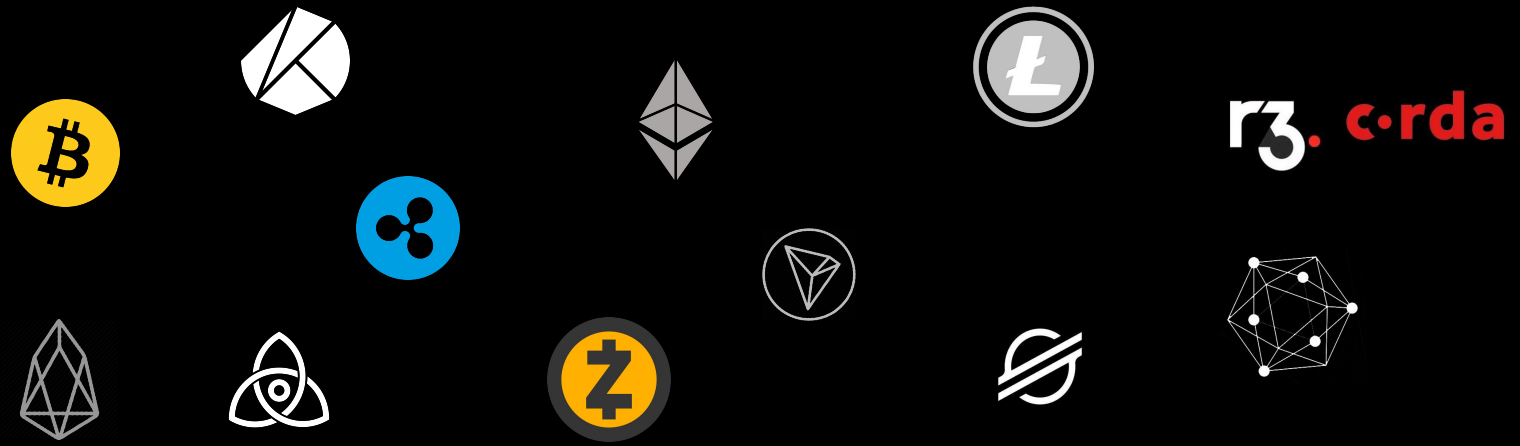
Can One Blockchain Protocol Rule All Others and Be a Standard?



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Community says “No”

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

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

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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

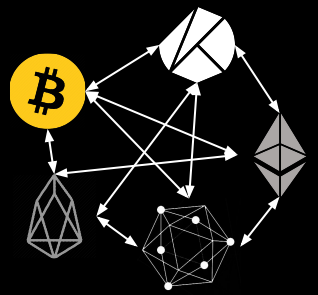
Methods

Notary Schemes

Relaychain & Parachains

Cross-Chain Hash Locking

Multi-Chain Weaving



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Technical Challenge IV
Security & Privacy

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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.

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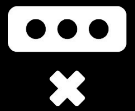
Blockchain Security Issues

Key Management



Denial of Service

Endpoint Security

Intentional Misuse

Code Vulnerabilities

Data Protection

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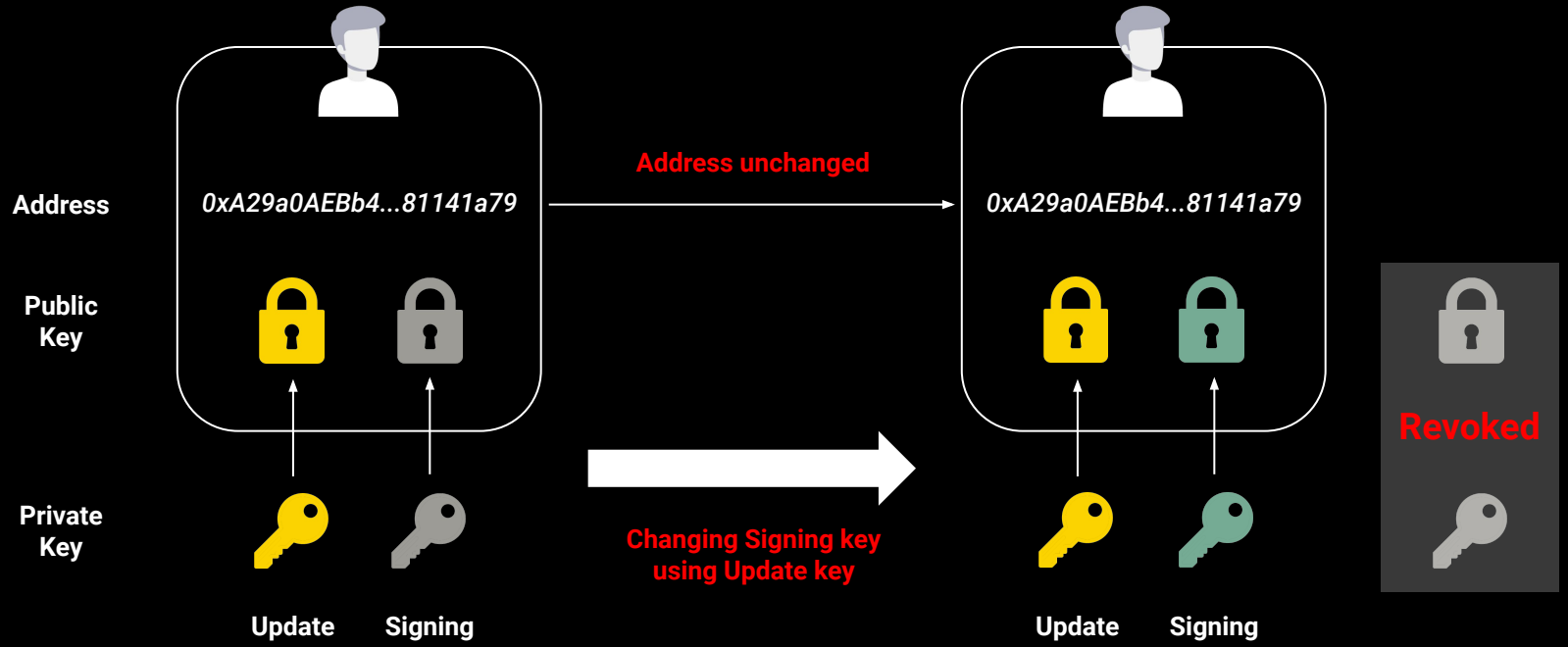
Klaytn Account Model for Better Security

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



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Efforts to Improve Privacy on Blockchain

Privacy Coins

Zero-Knowledge Proof Based

ZCOIN, Bitcoin Private, ZCASH, KOMODO, HORIZEN, PIVX

TOR Based

DeepOnion, VERGE

CoinJoin Based

Dash, CLOAK

Others

MONERO, NAV COIN

Privacy Infrastructure

privatesend, STARKWARE, NUCYPHER, KOVRI, RingCT, zkSNARKs, Bulletproofs, erocoin PROTOCOL

Privacy Decryption

NEUTRINO, CHAINALYSIS, ELLIPTIC

Privacy Layers

COVA COVALENT.AI, KEEP, ORIGO, OASISLABS, enigma

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

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Technical Challenge V
Ease of Use and Development

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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.

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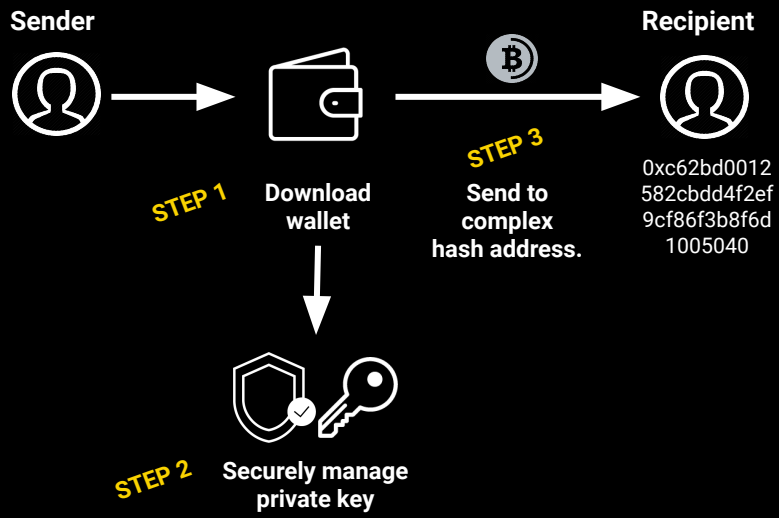
Klip's Seamless & Hassle-Free User Experience

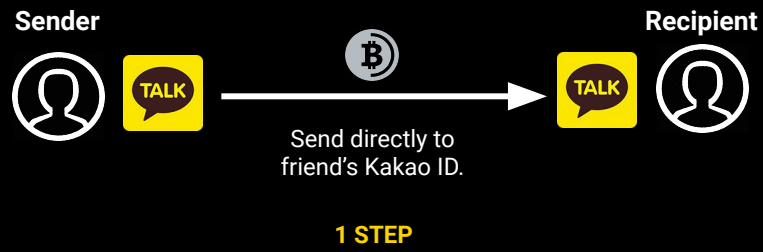
TYPICAL BLOCKCHAIN UX

Typical blockchain user experience is often fragmented



KLIP UX

Integrating with KakaoTalk and Klip offers familiar, seamless user experience



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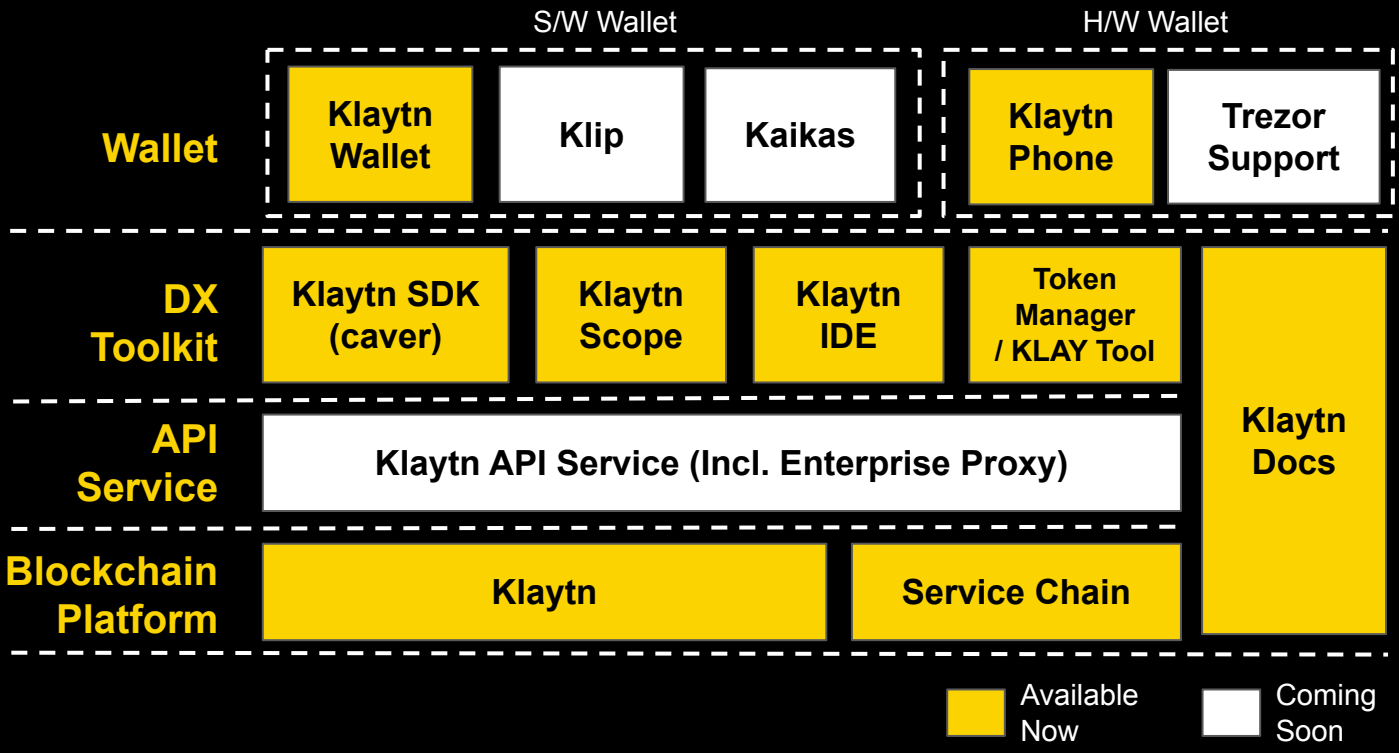
Klaytn Developer Tools



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Non-Technical Challenges

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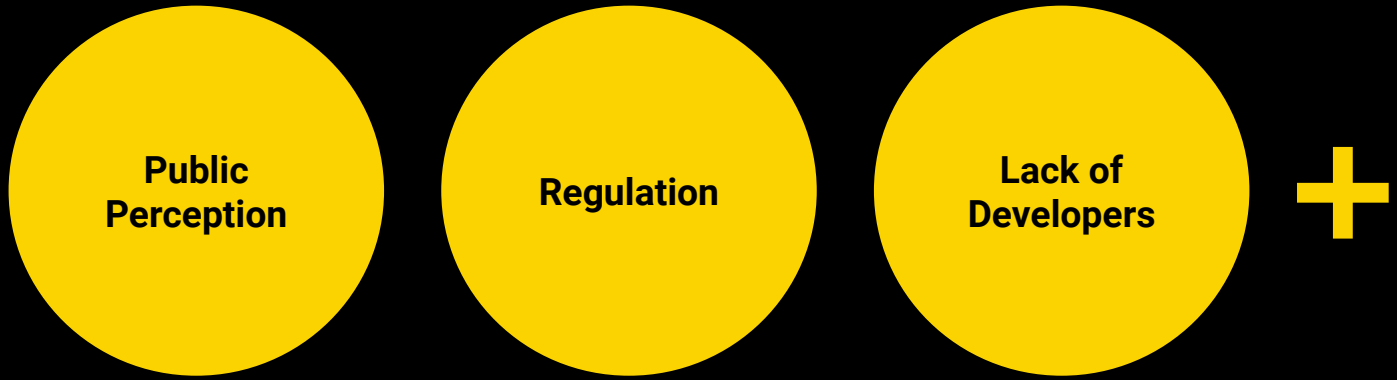
Non-Technical Challenges



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Non-Technical Challenge I
Public Perception

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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

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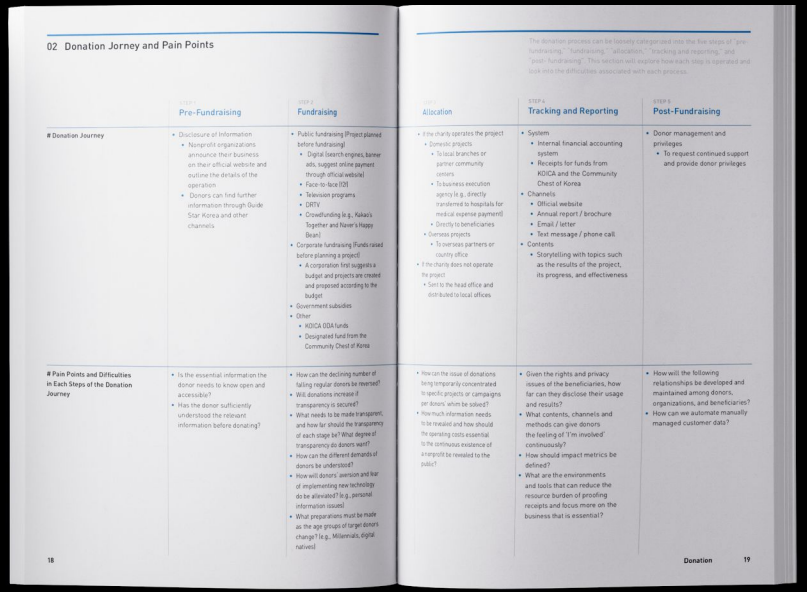
Ground X's Leadership on Blockchain for Social Impact



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Non-Technical Challenge II
Regulation

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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

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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
number of global powerhouses. China continued in its r
crypto and blockchain hub, with India, Korea and even A
week also saw a number of blockchain startups raise fur
founder invested in.

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.

Chinese Government Forms New Committee to Regulate Blockchain Technology

By ALLISON JIANG 3 days ago

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.

NEWS

Nov 25, 2019

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

REGULATION
by Kevin Helms
Oct 31, 2019

Korean Presidential Committee Pushes to Legalize Crypto

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Non-Technical Challenge III
Lack of Developers

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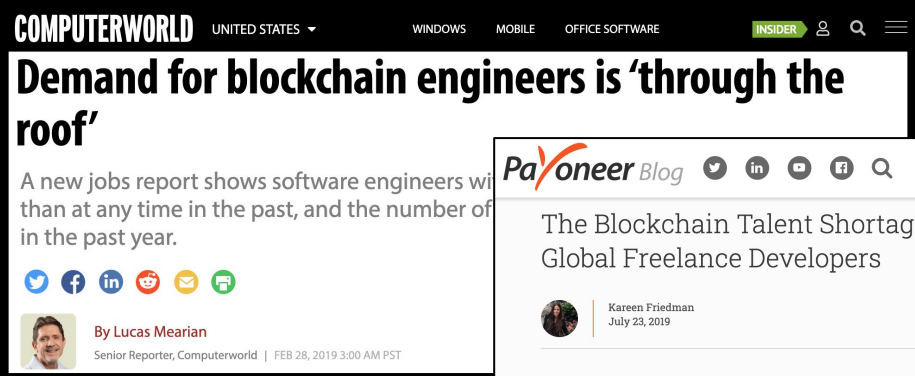
Lack of Developers

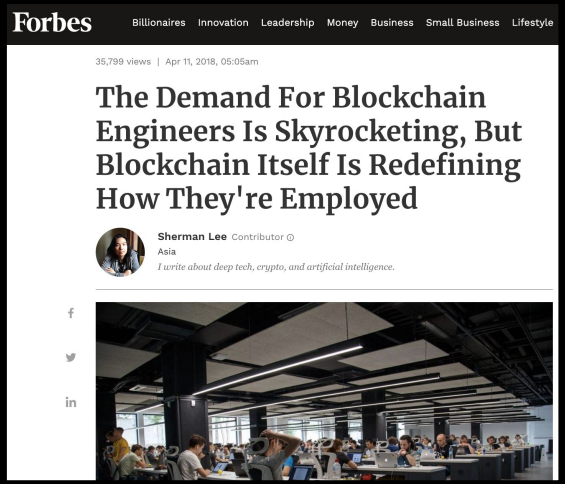
Lack of Skilled Developers

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

Lack of Education

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





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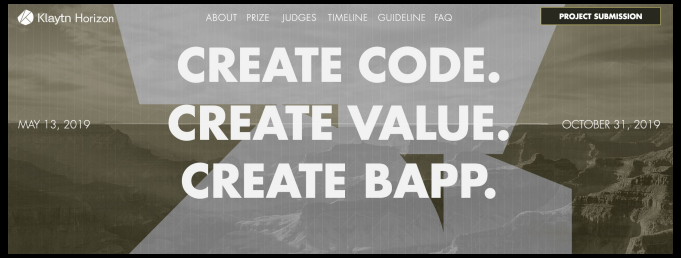
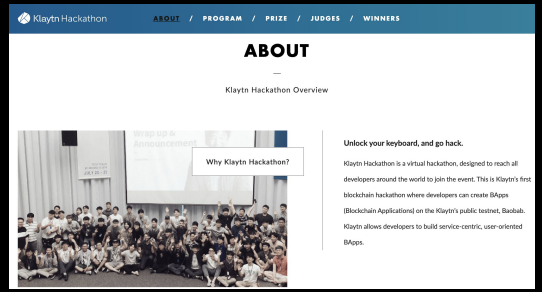
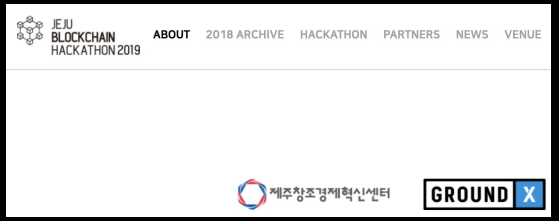
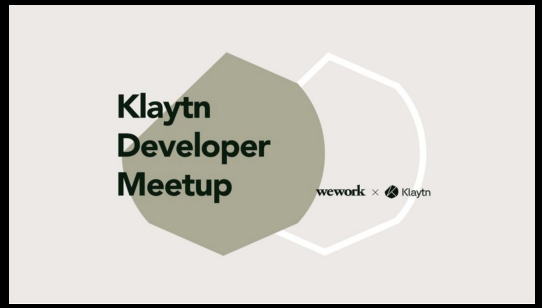
Klaytn's Community Activities









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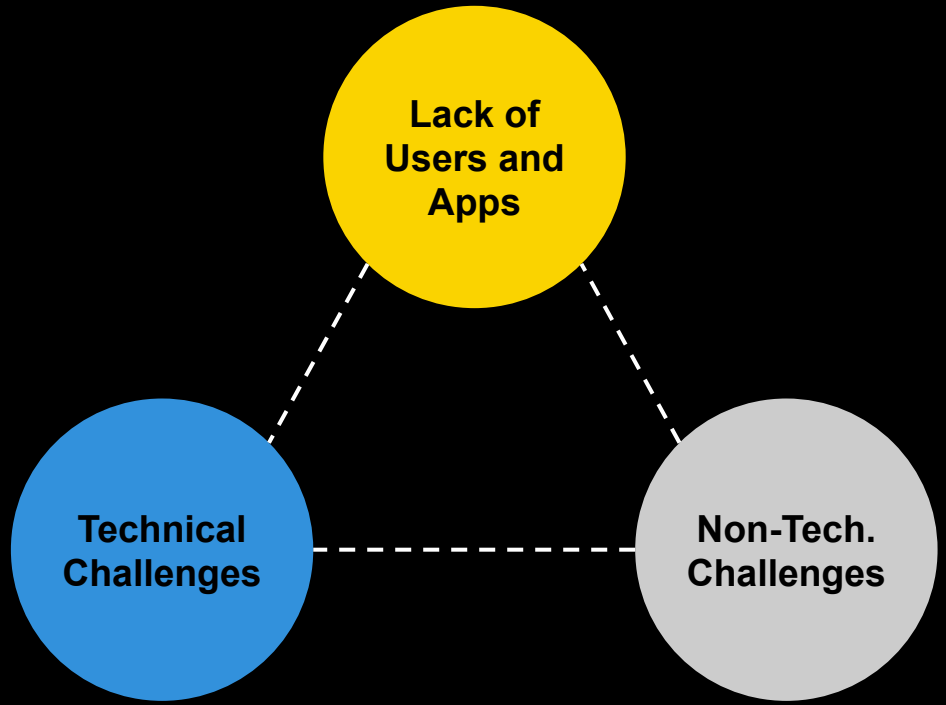
Challenges for Blockchain Mass Adoption



- Performance
- Scalability
- Interoperability
- Security & Privacy
- Ease of Use & Development
- ...

- Public Perception
- Regulation
- Lack of Developers
- ...

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It’s Time to Build.

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THANK YOU

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