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Innovative R&D by NTT

How blockchain could change Web-based content distribution

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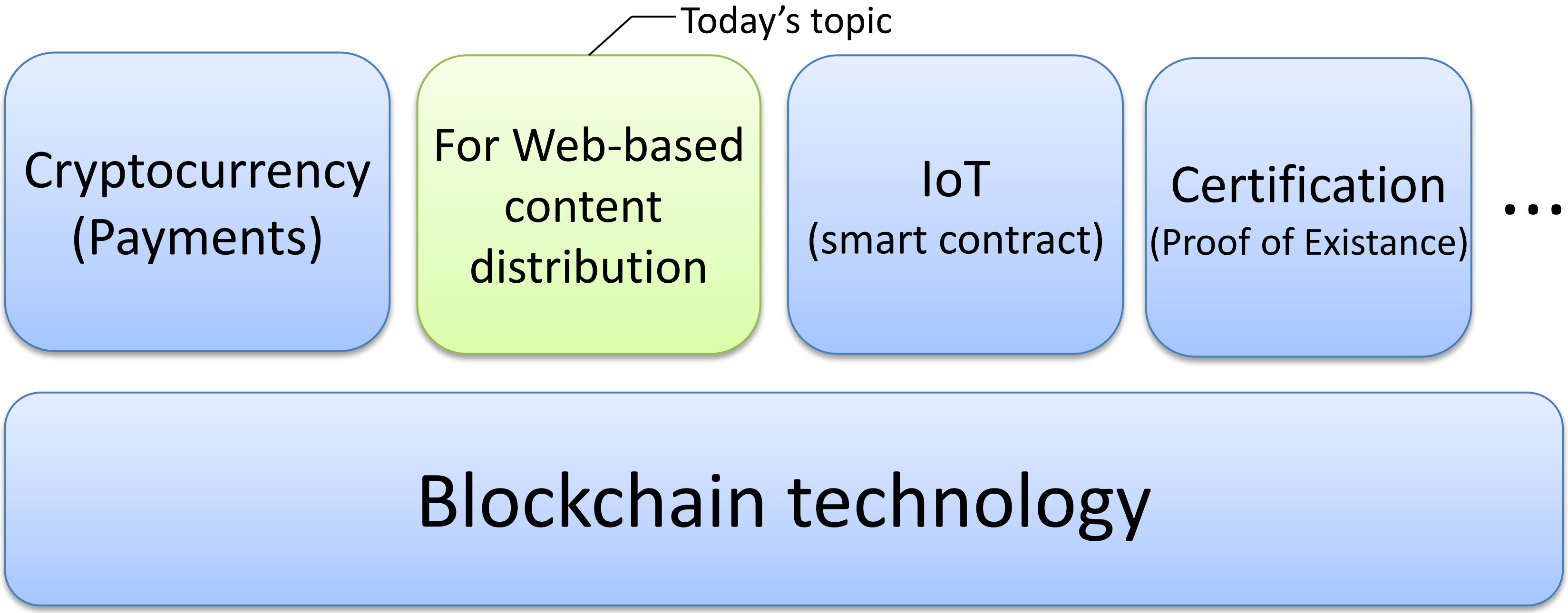
IRC: #BCWCD

Background

- **Blockchain technology:** bitcoin's core technology
- **Its most important feature:** enabling **decentralized, robust and tamper-proof** method for recording data in trustless network
- Robustness proven as bitcoin continues even today
  - **Applications other than cryptocurrency** garnering much attention

Blockchain Application

- Many types of applications based on blockchain technology
  - Cryptocurrency: first application
- One of the hottest area of emerging innovation



Today's topic

Cryptocurrency (Payments)

For Web-based content distribution

IoT (smart contract)

Certification (Proof of Existance)

…

Blockchain technology

Main focus

- **Open discussion on:**
  - Acceptability of blockchain applications for Web-based content distribution
  - Possibility of standardizing in W3C

Agenda

13:30 - 13:35 : Brief introduction to session

13:35 - 13:45 : Blockchain technology details

13:45 - 14:00 : Concept of Web-based content distribution

- How to apply blockchain tech. and what can be achieved
- [DEMO] Example of direct license control

by Hiroki Watanabe

14:00 - 14:25 : Open discussion

14:25 - 14:30 : Wrap-up

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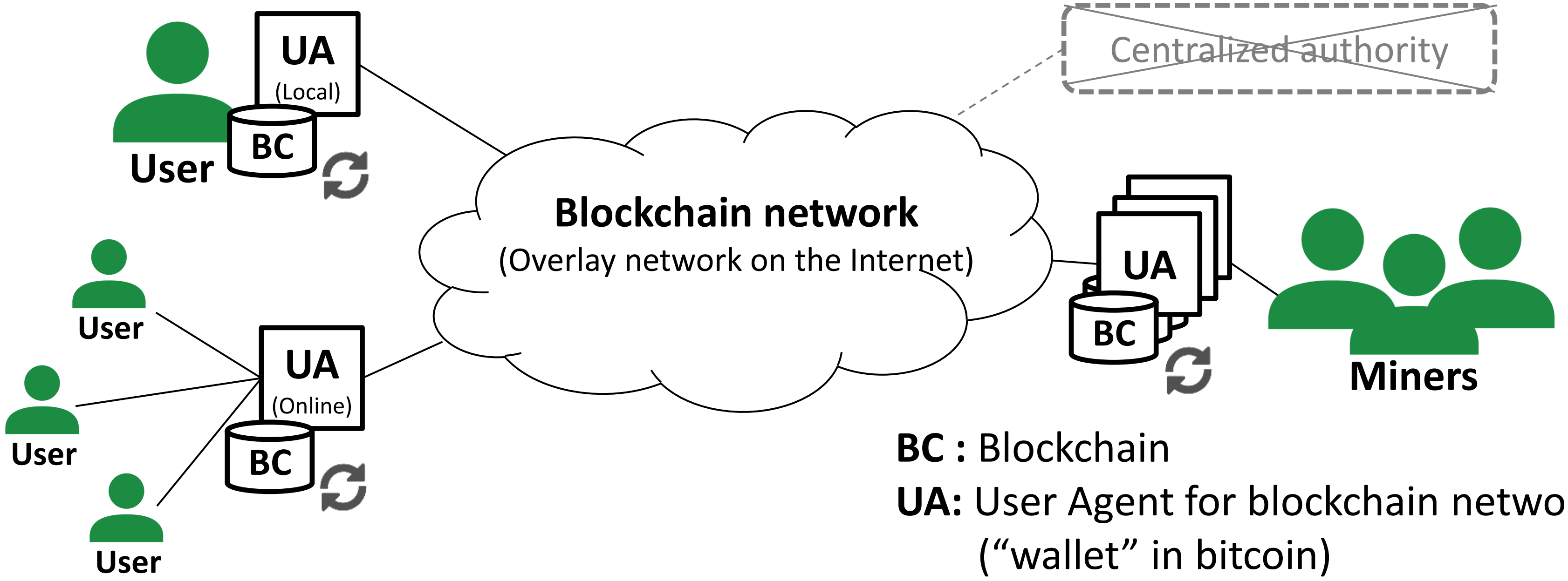
Blockchain technology details

Blockchain technology

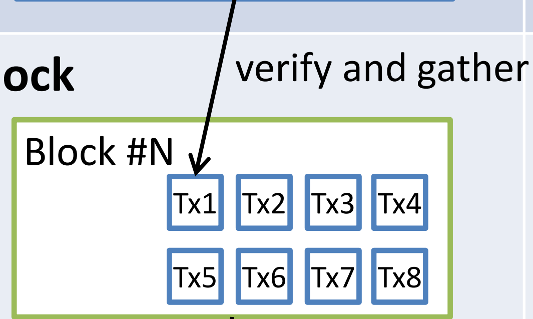
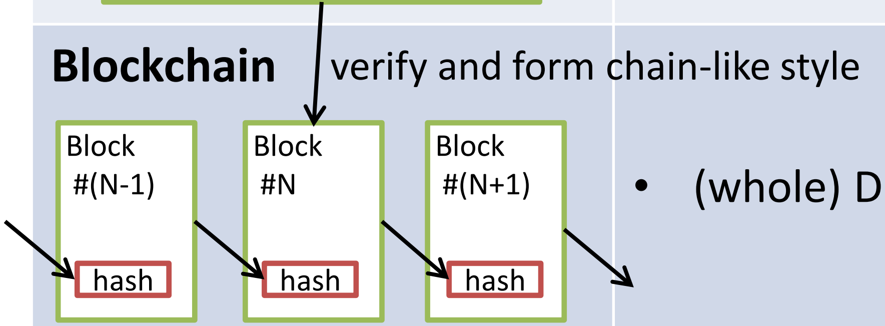
- **Blockchain:** something like database for specific use
  - Each of participants has blockchain
  - All blockchains become finally same by gradually synchronization
- **No master blockchain:** no centralized authority
  - Miners play very important role



BC : Blockchain

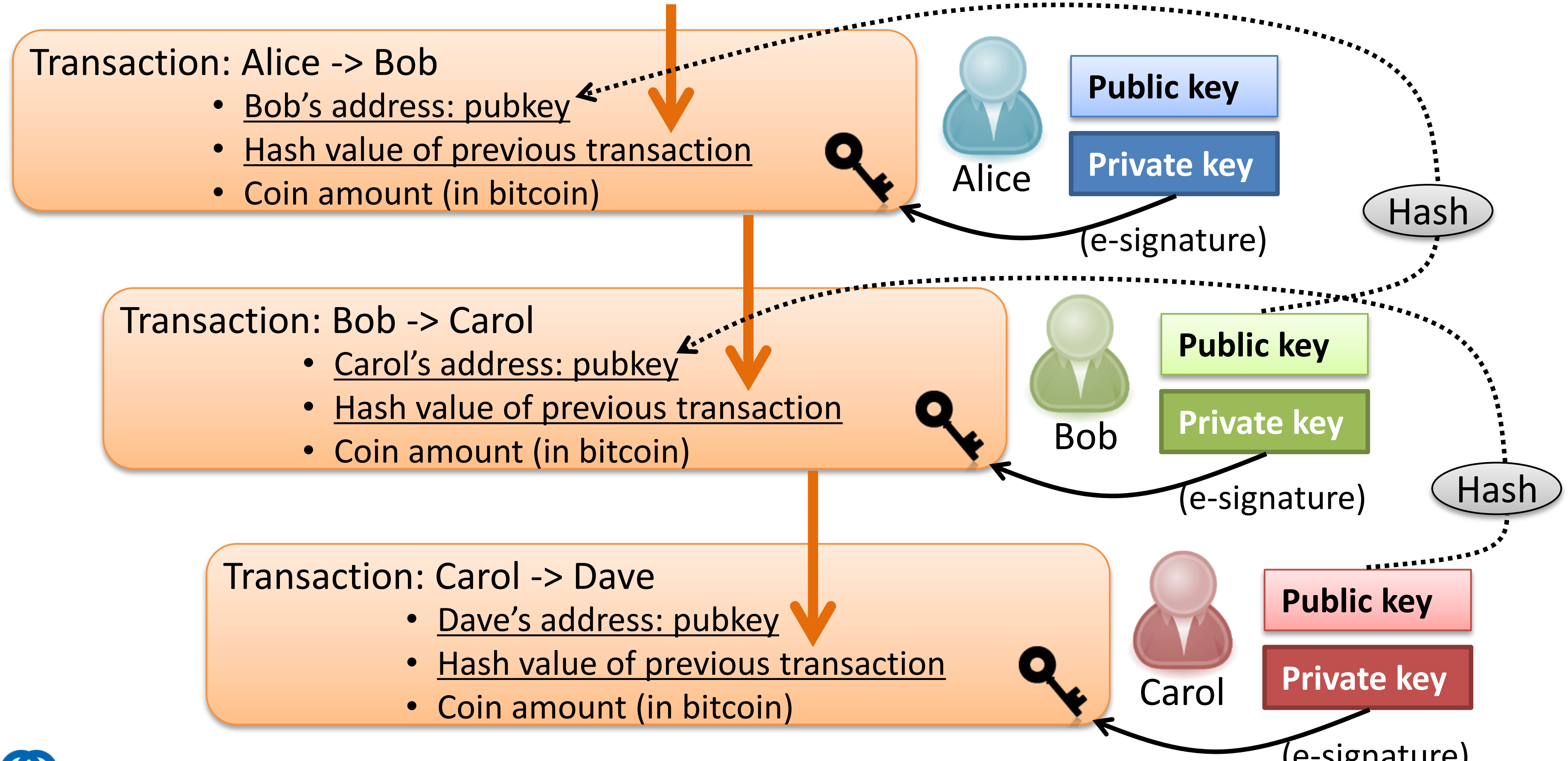
UA: User Agent for blockchain network,
(“wallet” in bitcoin)

Comparing to database

In blockchain	In database	Additional explanation in terms of blockchain
Transaction Transaction: Tx1 (ex. 1btc From Alice to Bob)	• Insert query • data	• Users can directly transact each other without needing intermediary
Block  verify and gather Block #N Tx1 Tx2 Tx3 Tx4 Tx5 Tx6 Tx7 Tx8	(none)	• Made by miners • Excluding wrong transactions • Connecting a new block needs difficult calculation
Blockchain  verify and form chain-like style Block #(N-1) hash Block #N hash Block #(N+1) hash	• (whole) Database	• All history • Many participants have

Data structure: transaction more detail

- All transfer history recorded by chain-like form
  - Proof of ownership (e.g. holding bitcoin)
- Only owner can issue new transaction because needing e-signature



Transaction: Alice -> Bob
- Bob's address: pubkey
- Hash value of previous transaction
- Coin amount (in bitcoin)

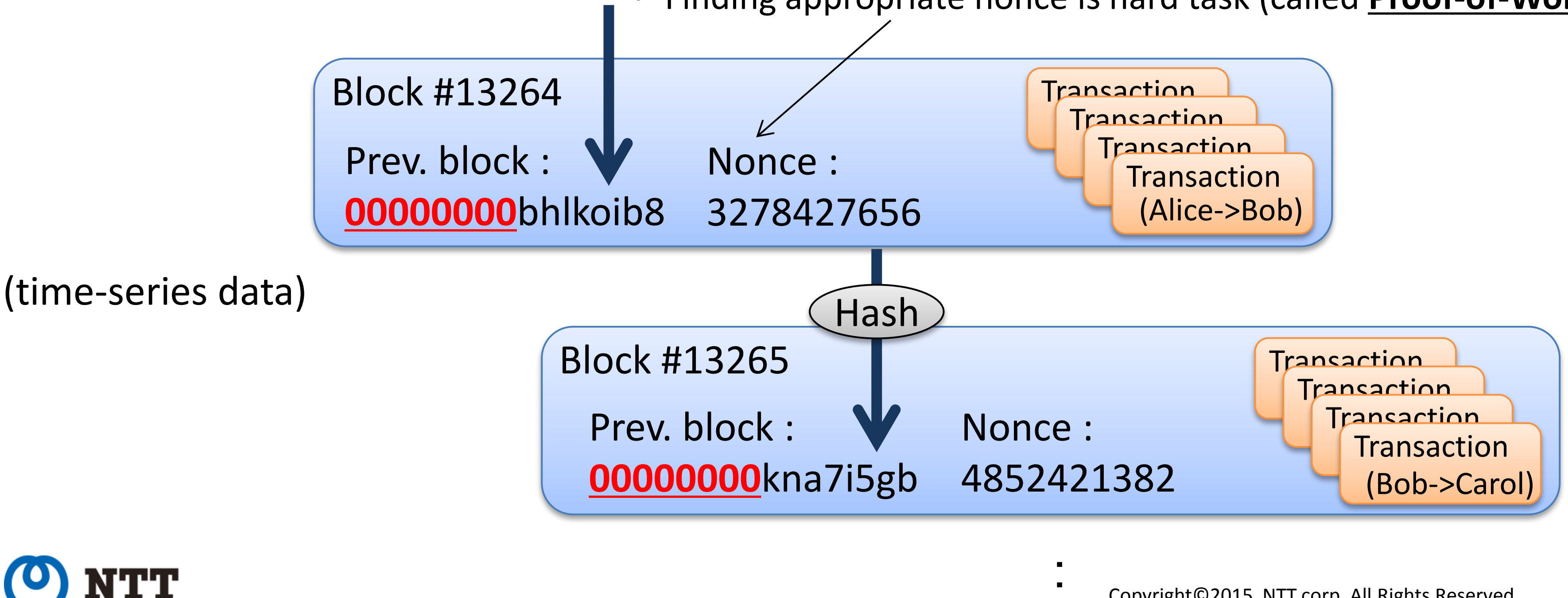
Transaction: Bob -> Carol
- Carol's address: pubkey
- Hash value of previous transaction
- Coin amount (in bitcoin)

Transaction: Carol -> Dave
- Dave's address: pubkey
- Hash value of previous transaction
- Coin amount (in bitcoin)

Data structure: blockchain more detail

- Transactions are gathered as a block
- To approve as correct block, satisfying certain condition is needed
  - (In bitcoin,) First n digits of new block's hash value must be zero
- Tamper-proof: every block after attacker's target have to be regenerated

- additional data to make first n digits of block's hash value zero
- Finding appropriate nonce is hard task (called **Proof-of-Work**)



(time-series data)

Block #13264

Prev. block : 00000000bhlkoib8

Nonce : 3278427656

Transaction

Transaction

Transaction

Transaction (Alice->Bob)

Hash

Block #13265

Prev. block : 00000000kna7i5gb

Nonce : 4852421382

Transaction

Transaction

Transaction

Transaction (Bob->Carol)

⋮

Summary of blockchain technology

- Blockchain has **high tamper-proof** feature
  - Chain-like form transaction and block
  - E-signature
- **Verification** at each stage increases security
  - Miners verify transactions and exclude wrong ones when making new block
  - Participants who have blockchain verify new block when synchronizing
- Blockchain technology is so simple that it can apply to various areas

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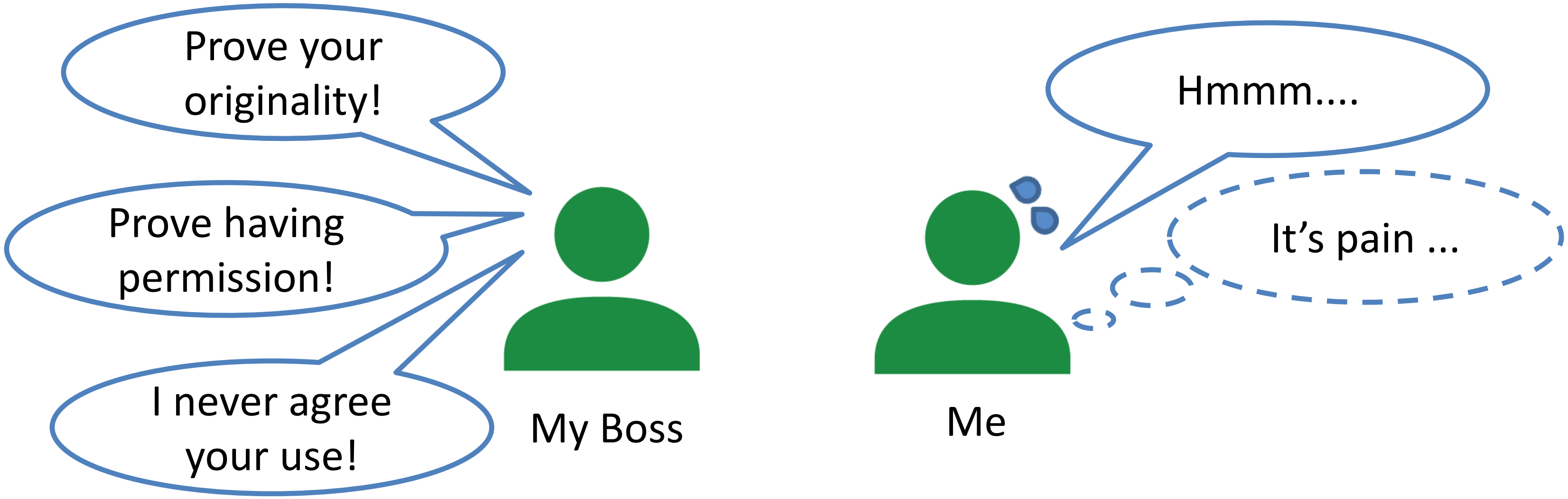
How to apply blockchain technology and what can be achieved for Web-based content distribution

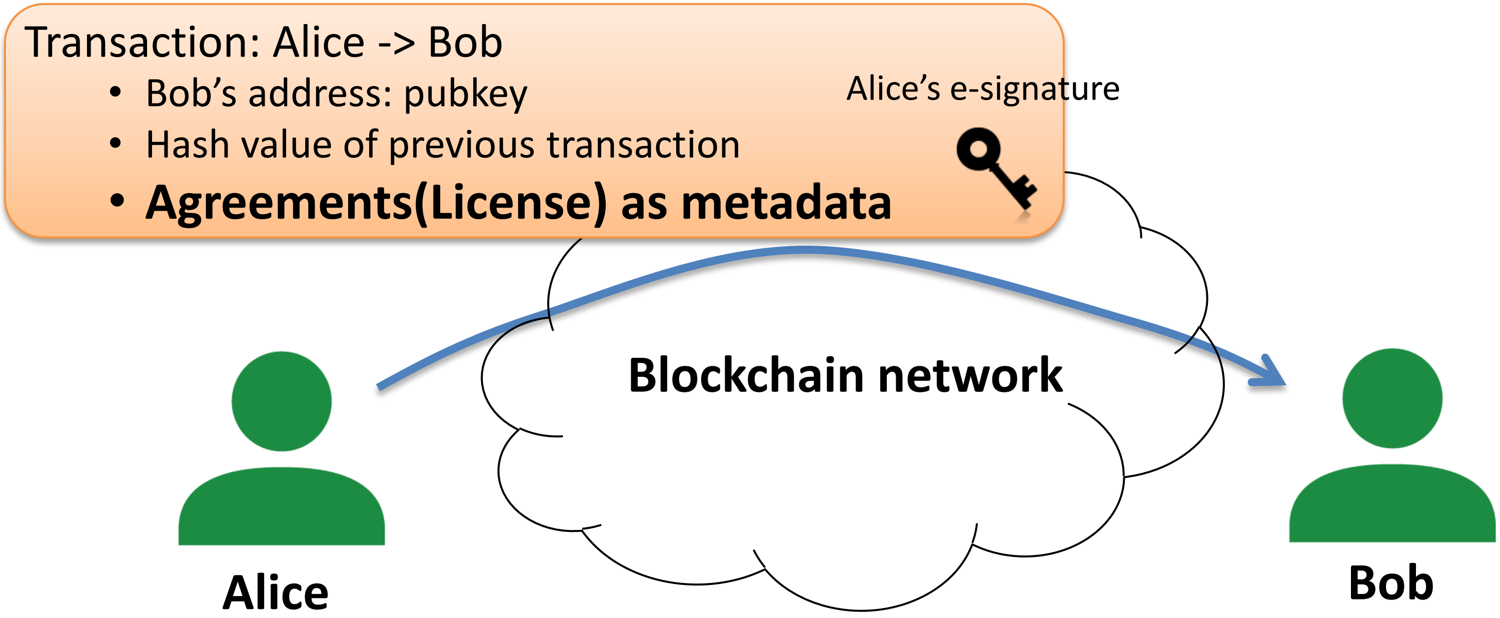
Motivation

- Sometimes, we must prove correctness of Web contents
  - Originality , permission and more...
- Conventional method of making a contract is taken time
  - Blockchain is suitable to record exchanges between two or more people
  - Enabling management by consortium style is consistent with Openness of the Web



Concept

- Metadata included in transaction can be used for agreements
  - This transaction becomes secure and transparent proof
- By using blockchain as timestamp, it helps to clarify originality
  - Existence of the content at certain time is proven



Transaction: Alice -> Bob

- Bob's address: pubkey
- Hash value of previous transaction
- **Agreements(License) as metadata**

Use cases

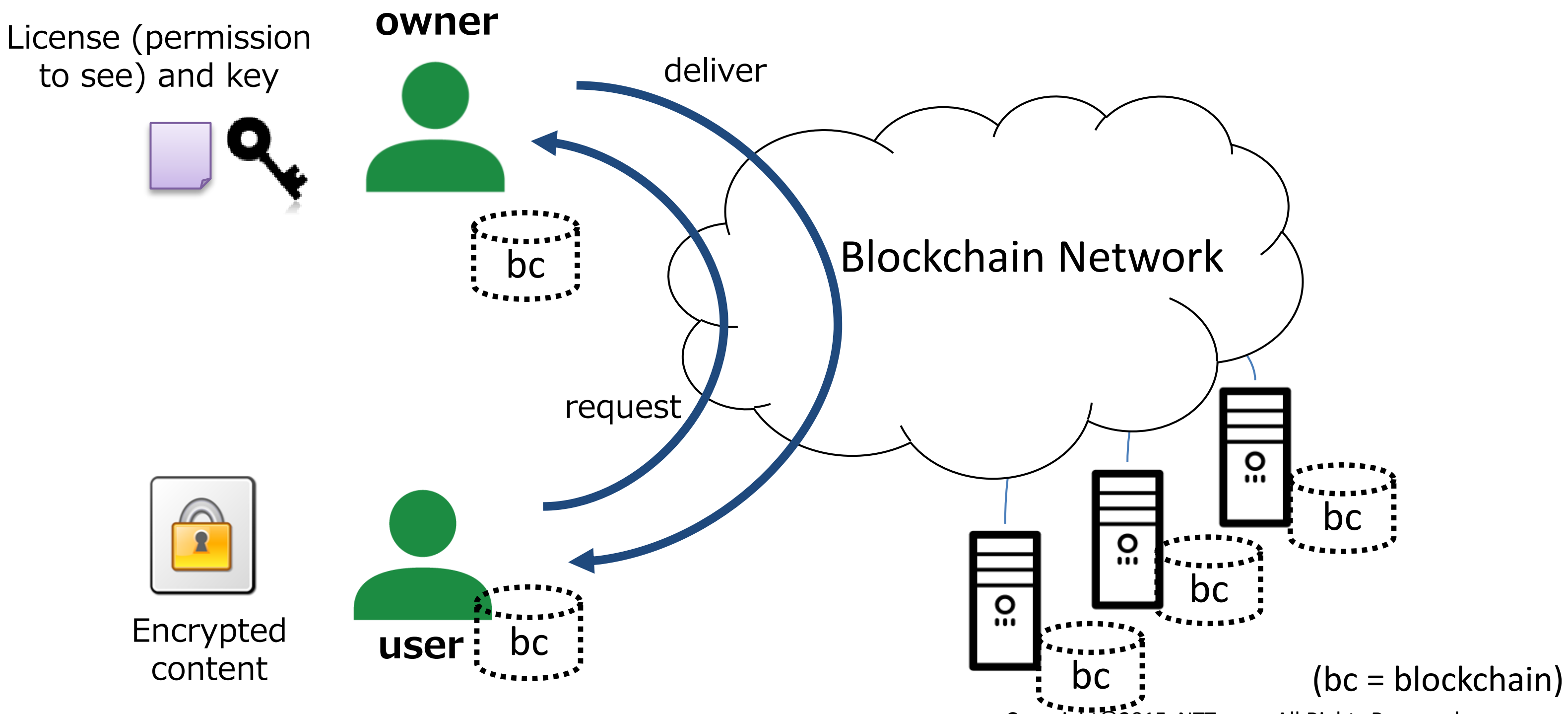
- Proving correct use (i.e., having agreements)
- Proving contents originality
- **[DEMO] Direct license control for contents creators**

[DEMO]
Direct license control for content creators

In this demo, we use “BIG BUCK BUNNY”.
(c) copyright 2008, Blender Foundation / www.bigbuckbunny.org

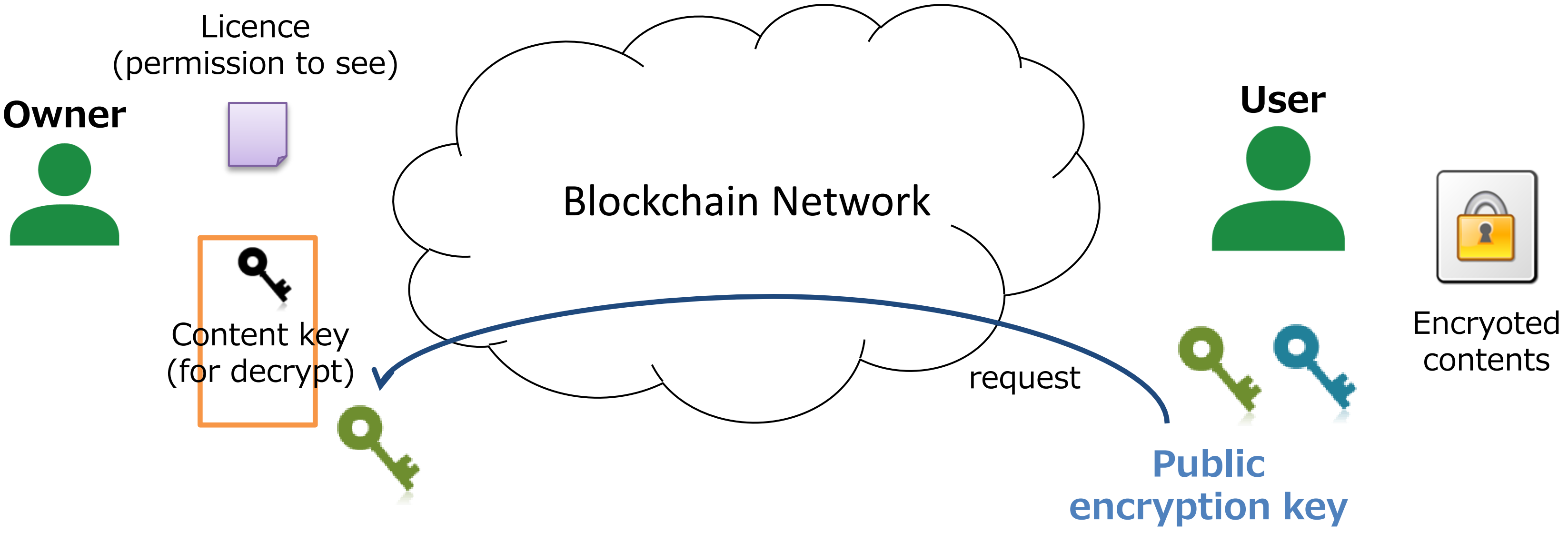
Scenario

- System enabling control of encrypted content via blockchain
  - User gets encrypted content beforehand from internet
  - License and decrypt key requested to content owner
  - Blockchain works as public database to transfer license



When transferring license and key

- Secure transfer
  - Blockchain open database, so anyone can get content key
  - Content key should be encrypted by user's public key
- Web-based interface by using **MSE(Media Source Extensions)** and **Cryptography API**



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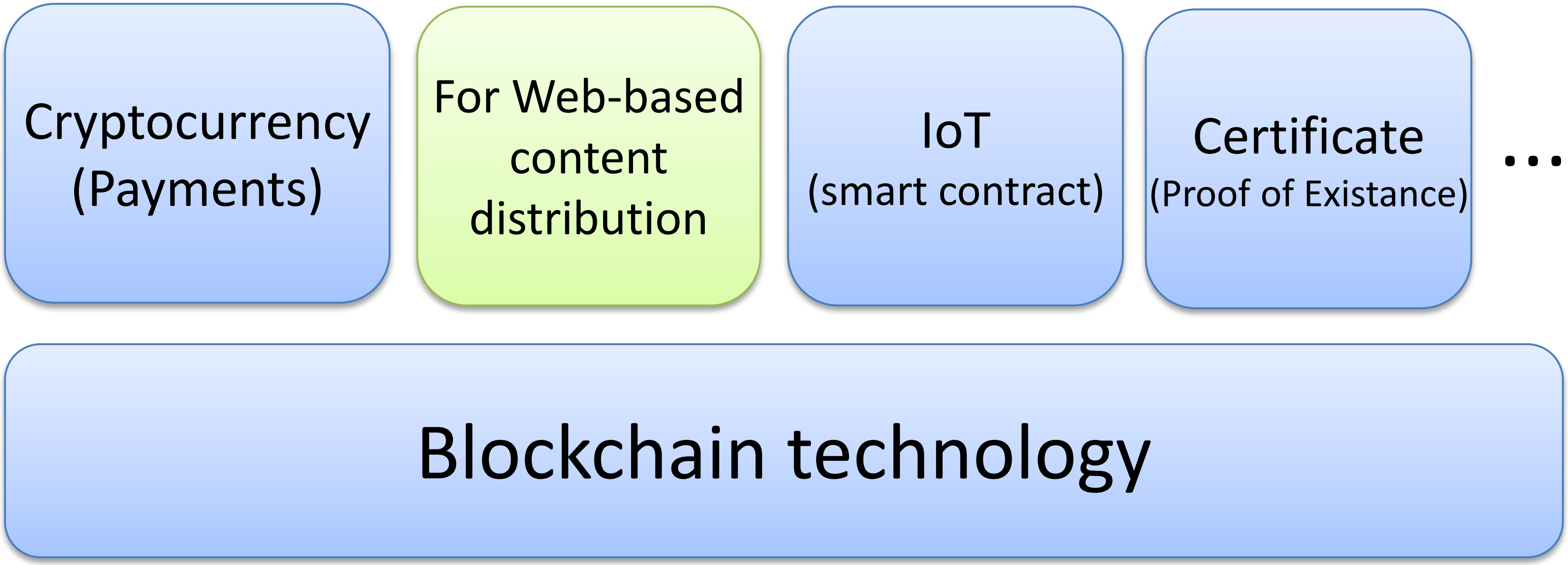
Before open discussion

Our questions

1. What do you think about blockchain application for Web-based content distribution?
2. How about standardizing in W3C and What point?
   - BC Apps for Web-based content distribution itself ?
   - Browser function (JS API) to access blockchain ? **(detail in next slide)**



Cryptocurrency (Payments)

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Certificate (Proof of Existance)

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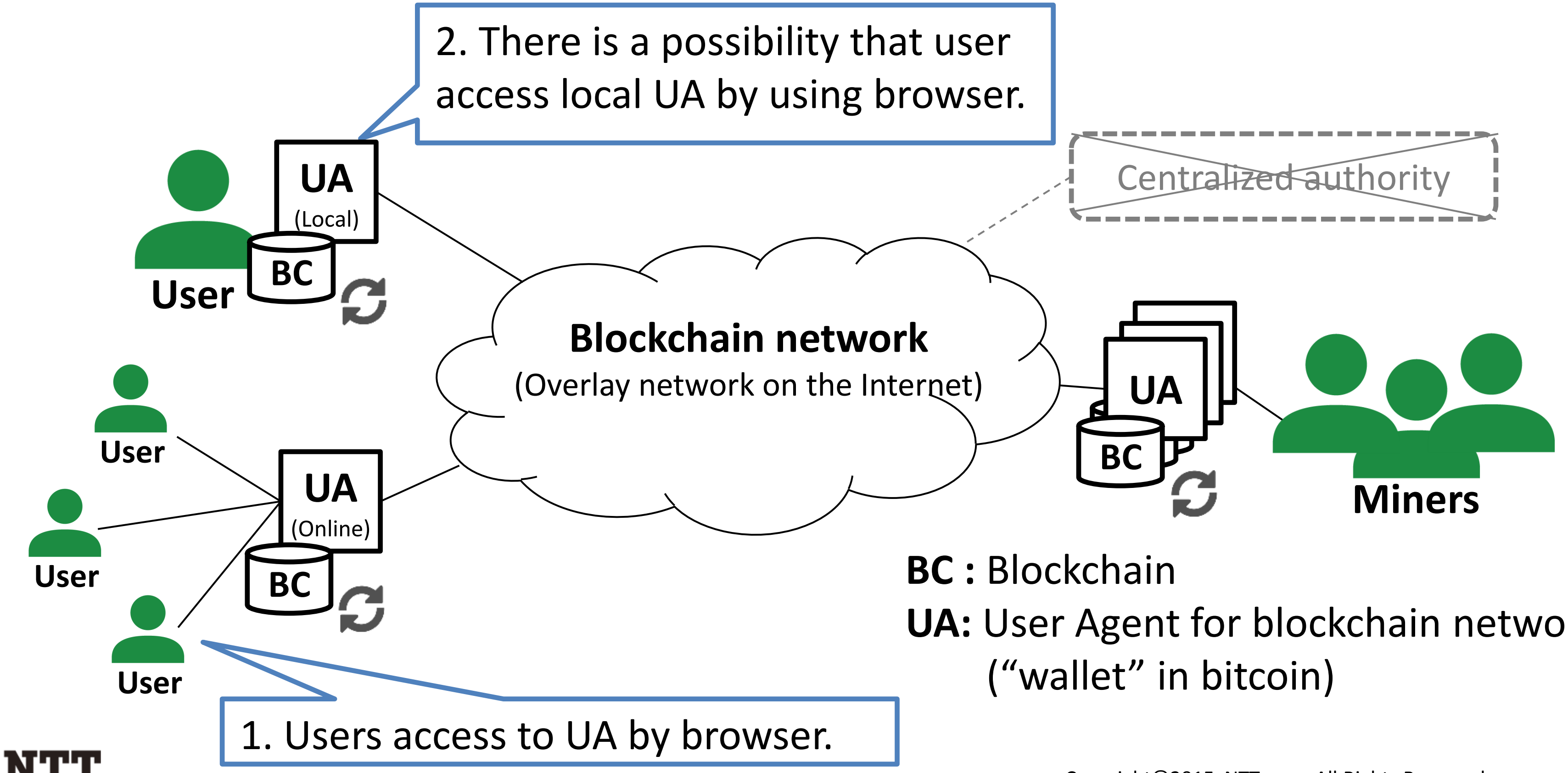
Blockchain technology

Our questions (cont.)

- Even if there are many types of blockchain application, common browsers functions might be needed.
  - User <-> browser <-> UA <-> BC network



2. There is a possibility that user access local UA by using browser.

1. Users access to UA by browser.

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