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(54) Title: METHOD FOR ENTRUSTING BLOCKCHAIN OPERATIONS CONTENTS

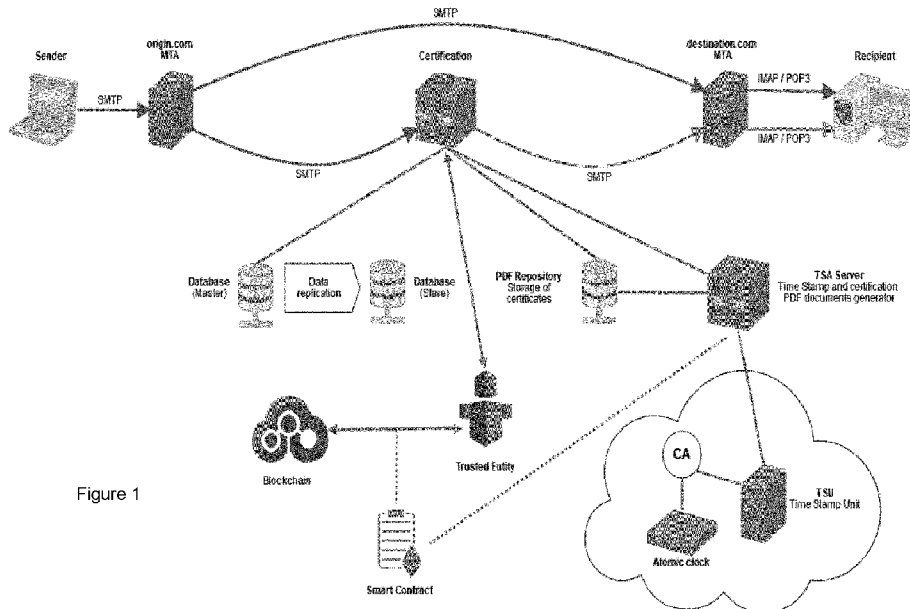


Figure 1

(57) Abstract: The method of the invention implements the access to a blockchain ledger or to feed smart contracts with message related data, in at least one of the previous steps, the output resulting from carrying out any one or at least one of said steps is then submitted to the trusted entity to feed a smart contract so the said trusted entity may feed the smart contract with the electronic certificate; then the trusted entity may submit information to a blockchain to be used by smart contracts. By doing so the data resulting from any of the cited steps is loaded as a smart contract that can be invoked when needed to retrieve data from the blockchain and use it, for example, to prove the veracity of any message related data loaded.



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METHOD FOR ENTRUSTING BLOCKCHAIN OPERATIONS CONTENTS

Background

Blockchain, at its core, is valuable because it's a secure method for storing data. Bitcoin functions as a currency because its immutable ledger records data on every transaction, ensuring that no one can claim to own a token they've already spent.

Industries ranging from healthcare to logistics to energy generation are exploring blockchain because it serves as a source of shared, agreed-upon truth via data stored on the blockchain network.

A feature of some blockchains is the capability to create "smart contracts." For example, the Ethereum and Hyperledger blockchain platforms permit the recording of software programs within a block on the blockchain itself. This software automatically performs certain actions on the blockchain when a prescribed condition is met. As an example, a supplier who today ships goods to a customer, sends an invoice, and waits 30, 45, or 90 days for payment would prefer to have the order in a "smart contract" that pays automatically the customer acknowledges receipt of goods on the blockchain. Alternatively, the software can trigger payment based on data from an outside source, sometimes referred to as an "oracle" in the art. For example, "parametric" travel insurance could pay automatically if an airline cancels a flight, with the airline's flight records being the "trusted entity".

However, data can also be a hindrance to blockchain users and developers. Decentralized applications (DApps) built on Ethereum often need to access vast amounts of data, but an October 2017 analysis determined that storing one gigabyte of data on Ethereum would cost about \$5 million.

In most blockchain networks, all nodes must re-verify the state of the network after each transaction-which means the more data the network contains, the slower and more resource-intensive each transaction becomes. Increasing the speed at which the Bitcoin network can verify data is one of the main argument proponents for increasing block size limits offer.

On-chain transactions take some time to accumulate enough confirmations to ensure that they can-not be reversed; accepting a transaction without any confirmations is potentially risky. Confirmations take time and the time they take to accumulate is random. Off-chain transaction systems can record that a transaction
5 has happened immediately, and, subject to the guarantees of the system itself, immediately guarantee it won't be reversed.

All on-chain transactions are recorded publicly on the block chain; Bitcoin transactions are not inherently anonymous. It may be possible for a third-party to
10 use the block chain transaction data to determine the source and/or destination of a transaction if they can gather enough information linking addresses to identities. Because off-chain transactions do not happen on the block chain they need not be public. Using cryptographic techniques such as tokens it can be made impossible for even the operators of the system itself to determine who participated in a
15 transaction.

Besides, miners usually charge fees to confirm a transaction. While currently the demand for transactions is sufficiently low that fees are relatively small, and transactions can often be confirmed for free, for many applications even paying a
20 few cents per transaction is unaffordable. In addition, Bitcoin currently has a limit of 7 transactions per second, the block size limit. This limit is related to the scalability of the system, and one option to achieve higher transaction volumes is to keep the block size limit as is and use off-chain transactions for lower-value transactions; with higher volumes fees for transactions done on-chain will rise due to supply and
25 demand.

So, an on-chain transaction occurs and is considered valid when the blockchain is modified to reflect the transaction on the public ledger. It involves the transaction being validated and authenticated by a suitable number of participants, recording of
30 the details of the transaction on the suitable block, and broadcasting of the necessary information to the whole blockchain network, which makes it irreversible. This kind transaction can be reversed only after most of the network's hashing power comes to an agreement. Essentially, every step linked to an on-chain transaction

occurs on the blockchain, and the blockchain status is modified to reflect the occurrence and validity of the transaction. (For more, see What does a block chain record in a bitcoin exchange transaction).

- 5 An off-chain transaction is the movement of value outside of the block chain that can be executed instantly whereas on-chain transactions can have a lengthy lag time depending upon the network load and number of transactions waiting in the queue to be confirmed. Additionally, off-chain transactions offer more security and anonymity to the participants, because details are not publicly broadcast. In case of
10 on-chain transactions, it is possible to partially derive a participant's identity by studying transaction patterns.

While an on-chain transaction modifies the blockchain and depends on the blockchain to determine its validity an off-chain transaction may rely on other
15 methods to record and validate the transaction. Like on-chain transactions all parties must agree to accept the method by which the transaction occurs, the question then being, how can those parties be convinced that the movement of value has happened, will not be reversed, and can be exchanged in the future for something of value?

20

With an on-chain transaction those questions are answered by the party's faith in the Bitcoin system as a whole. For instance, a transaction (after some number of confirmations) can only be reversed if a majority of hashing power agrees to reverse the transaction. The parties to the transaction are trusting that most of the hashing
25 power in existence is controlled by "honest" parties who will not attempt to reverse the transaction.

If the sender and recipient do not trust each other or would simply prefer someone else record and guarantee the transaction, they can use a trusted third party to
30 record and guarantee the transaction. Most of the conventional banking and electronic payment systems work this way.

So it is an object of the invention to provide a method based on a trusted third party in a blockchain environment working with smart contracts which contain value and only unlock that value if certain pre-defined conditions are met. When a particular value is reached, i.e. a signature is added, the smart contract changes its state and
5 executes the programmatically predefined algorithms, automatically triggering an event on the blockchain, in the very an event related to the electronic message and any associated event thereof. The primary task of the trusted third party is to provide these values to the smart contract in a secure and trusted manner.

10 Description

The object of the invention is a method for entrusting blockchain transactions contents, wherein at least one transmitting user and at least one configured to interact with a trusted entity connected to a ledger of a blockchain.

15

The method of the invention comprises the following steps:

- Sending from the transmitting user to the recipient an electronic message related to the transaction through an initial route and a copy of said electronic message to a certification system through a second route.
- 20 • Receiving said copy of the electronic message at the certification system,
- Sending from the certification system to the recipient a second electronic message comprising the copy of the electronic message, so the destination message server of the recipient receives the electronic message through the initial route, and the copy of the electronic message through the second route, wherein
25 the second electronic message comprising the copy of the electronic message.
- Receiving in the incoming message server of the certification system data relative to the delivery of the second electronic message,
- Generating at the certification system an electronic document comprising data related to the preceding steps.
- 30 • Applying a digital signature to the electronic document of the previous step for the creation of an electronic certificate.

Since the method of the invention implements the access to a blockchain ledger in or to the feed smart contracts with message related data, in at least one of the previous steps, the output resulting from carrying out any one or at least one of said steps is then submitted to the trusted entity to feed a smart contract so the said

5 trusted entity may feed the smart contract with the electronic certificate; then the trusted entity may submit information to a blockchain to be used by smart contracts. By doing so the data resulting from any of the cited steps is loaded as a smart contract that can be invoked when needed to retrieve data from the blockchain and use it, for example, to prove the veracity of any message related data loaded.

10

This is quite useful for traceability purposes or as an additional trust layer.

Description of figures

15 Figure 1 depicts a diagram of the method of the invention where the different entities involved are represented as well as their relationship.

Detailed description

20 The object of the invention is based on the use, in a blockchain context, of one trusted third party, also referred as trusted entity throughout this document, which find, verify, and provide real-world data for use in smart contracts; in other words putting data feed into a smart contract.

25 Since Blockchains cannot access data outside their network. The trusted entity is a data feed – provided by third party service – designed for use in smart contracts on the blockchain.; providing external data and trigger smart contract executions when pre-defined conditions meet. In this case such conditions may be selected from any event related to an electronic message or an associated transaction.

30

In this preferred embodiment the trusted entity is defined by a telecommunications operator which is a trusted third party *per-se* and is a part of multi-signature contracts where original trustees sign a contract for triggering events only if certain

conditions are met. Before said event is triggered a trusted entity must sign the smart contract as well. For a trusted entity to work in a blockchain network, a few necessary conditions must be met:

• Multiple endorsers must be able to obtain, from a trusted third party that answers questions in a deterministic fashion without knowing the full context of the transaction, the same answer to preserve the deterministic aspect of a smart contract.

• A durable link must be established between the execution of a smart contract and the response from the trusted entity.

• The confidentiality of the data must be preserved where required.

In a preferred embodiment of the invention a transmitting user, namely a sender, sends an electronic message to a recipient in figure 1, thus initiating a request with a channel being set up and running. At last one of the users has registered and enrolled with an organization's certificate authority (CA) and received back necessary cryptographic material, which is used to authenticate to the network.

A chain code containing a set of key value pairs representing an initial state of a transaction concerning the electronic message or any of the events and contents related therein is installed on the peers and instantiated on the channel. The chain code contains logic defining a set of transaction instructions and the agreed upon a certain status of the message or event related to its content or attachments thereby, namely a certain status of the electronic message: sent, received, read, acknowledged, opened, downloaded, signed or any status relevant to electronic messages, their contents or attachments. An endorsement policy has also been set for this chain code, stating that both peer A and peer B must endorse any transaction. The endorsement policy states that both peer A and peer B must endorse any transaction, therefore the request goes to peer A, which represents the transmitting user and peer B which represents the recipient.

Next, a transaction proposal with a request to invoke a chain code function so that data can be read and/or written to the ledger is generated, using the cryptographic

credentials of the user (preferably the transmitting user requesting the transaction) to produce a unique signature for this transaction proposal.

5 The application verifies the endorsing peer signatures and compares the proposal responses to determine if the proposal responses are the same. If the chain code only queried the ledger, the application would inspect the query response and would typically not submit the transaction to Ordering Service. If the client application intends to submit the transaction to Ordering Service to update the ledger, the application determines if the specified endorsement policy has been fulfilled before
10 submitting (i.e. did peer A and peer B both endorse). The architecture is such that even if an application chooses not to inspect responses or otherwise forwards an unendorsed transaction, the endorsement policy will still be enforced by peers and upheld at the commit validation phase. The application “broadcasts” the transaction proposal and response within a “transaction message” to the Ordering Service. The
15 transaction will contain the read/write sets, the endorsing peers signatures and the Channel ID. The Ordering Service does not need to inspect the entire content of a transaction in order to perform its operation, it simply receives transactions from all channels in the network, orders them chronologically by channel, and creates blocks of transactions per channel.

20

The blocks of transactions are “delivered” to all peers on the channel. The transactions within the block are validated to ensure endorsement policy is fulfilled and to ensure that there have been no changes to ledger state for read set variables since the read set was generated by the transaction execution. Transactions in the
25 block are tagged as being valid or invalid. Each peer appends the block to the channel’s chain, and for each valid transaction the write sets are committed to current state database. An event is emitted, to notify the client application that the transaction (invocation) has been immutably appended to the chain, as well as notification of whether the transaction was validated or invalidated.

30

In Figure 1 it is depicted how a trusted entity component works with a blockchain network using smart contracts, as it is shown, a client application submits the transaction to each organization that needs to endorse the transaction (as specified

in the endorsement policy). The client application being unaware that the smart contract will delegate a portion of the execution to an external system.

5 Then each of any one of the endorsing peer in each organization issues, preferably in parallel, a request to the trusted third party with enough information so that the trusted entity can correlate the various requests from the different endorsing peers; preferably using a hierarchical data structure implementing an abstract data type (ADT). In a preferred embodiment of the invention this may be accomplished by implementing a hash tree that includes all inputs sent to the smart contract, though
10 it exposes only those fields that must be shared with the trusted entity. Using a hash tree, like a Merkle tree, allows for traceability between the input parameters and the trusted third party's response.

The trusted third party may then correlate the various requests from the different
15 endorsing peers using the binding field to correlate common requests and ensure consistency in the response. The response should also be signed by the trusted third party to avoid any potential tampering. Also, an Apache Kafka topic could be used to ensure ordering of those requests. The trusted third party uses the binding field to correlate common requests. The trusted third party's response structure may
20 include a link between the request hash and the response and a signature from the trusted third party. The endorser peers validate the signature of the trusted third party. The signature and the response data should all be preserved on the ledger to provide auditability.

25 In the light of the above, the sender may send a message to the recipient an electronic message related to the transaction through an initial route and a copy of said electronic message to a certification system through a second route; said copy being received said copy of the electronic message at the certification system.

30 Then, the certification system sends to the recipient a second electronic message comprising the copy of the electronic message, so the destination message server of the recipient receives:

- the electronic message through the initial route, and

- the copy of the electronic message through the second route, wherein the second electronic message comprising the copy of the electronic message.

Once the incoming message server of the certification system receives data relative
5 to the delivery of the second electronic message, an electronic document comprising data related to the procedure described above is generated at the certification system, and digital signature is applied to the electronic document for the creation of an electronic certificate,

10 In at least one of the previous steps, namely sending, accepting, receiving, denying, rebounding or any event related to the transmission of data related to the transaction the method hereby described comprises submitting the result of the step related to any of the events related to the transmission of data related to the transaction to the trusted entity to feed a smart contract wherein said trusted entity feed the smart
15 contract with the electronic certificate; said trusted entity submitting information to a blockchain to be used by smart contracts.

In this way the generated electronic certificate embraces an additional layer of data related to traceability of the data incorporated thereof; hence any of the data
20 embraced by the certificate, or all of it, may have been loaded in the smart contract and added to the ledger; hence the electronic certificate is enhanced by comprising data endorsed by a blockchain environment.

A particular indication in the copy of the electronic message may be inserted before
25 delivering said copy of the electronic message to the recipient; an indication such a string of text.

Since the method for entrusting blockchain transactions contents of the invention embraces the use of blockchain technology preserving the signature and the
30 response data the ledger to provide auditability is also provided as an optional feature of required.

In alternate embodiment of the invention and in order to reliably enable blockchain features, any one of all of the endorsing peers may verify that the transaction proposal is well formed, that the transaction proposal has not been submitted already in the past, and that the signature is valid; then it is verified that the transmitting user is properly authorized to perform the proposed operation on that channel (namely, each endorsing peer ensures that the submitter satisfies the channel's Writers policy). Then the endorsing peers may take the transaction proposal inputs as arguments to the invoked chain code function and a chaincode is executed against the current state database to produce transaction results including a response value, read set, and write set.

In any of the aforementioned embodiments the signature might be validated by means of a peer component that allows them to verify transaction requests arriving from clients and to sign transaction results.

15

Claims

1. Method for entrusting blockchain transactions contents, wherein at least one transmitting user configured to interact with a trusted entity connected to a ledger of a blockchain, the method comprising:

- 5
- sending from the transmitting user to a recipient:
 - an electronic message related to the transaction through an initial route,
 - a copy of said electronic message to a certification system through a second route,
- 10
- receiving said copy of the electronic message at the certification system,
 - sending from the certification system to the recipient a second electronic message comprising the copy of the electronic message, so the destination message server of the recipient receives:
 - the electronic message through the initial route, and
 - the copy of the electronic message through the second route, wherein
- 15
- the second electronic message comprising the copy of the electronic message,
 - receiving in the incoming message server of the certification system data relative to the delivery of the second electronic message,
- 20
- generating at the certification system an electronic document comprising data related to the preceding steps, and
 - applying a digital signature to the electronic document of the previous step for the creation of an electronic certificate,

the **method being characterised by** comprising, in at least one of the previous steps, further submitting the result of the step to the trusted entity to feed a smart contract wherein said trusted entity feed the smart contract with the electronic certificate; said trusted entity submitting information to a blockchain to be used by smart contracts.

30 2. The method for entrusting blockchain transactions contents of any one of the preceding claims further comprising inserting a particular indication in the copy of the electronic message before delivering said copy of the electronic message to the recipient.

3. The method for entrusting blockchain transactions contents of any one of the preceding claims further comprising preserving the signature and the response data the ledger to provide auditability.

5

4. The method for entrusting blockchain transactions contents of any one of the preceding claims further comprising the endorsing peers:

- verifying that:
 - the transaction proposal is well formed,
 - 10 ○ the transaction proposal has not been submitted already in the past,
 - the signature is valid, and
 - the transmitting user is properly authorized to perform the proposed operation on an specific channel, and
- taking transaction proposal inputs as arguments to the invoked chain code
15 function,

wherein the method further comprises executing a chaincode against the current state database to produce transaction results including a response value, read set, and write set.

20 5. The method for entrusting blockchain transactions contents of any one of the preceding claims wherein the signature is validated by means of a peer component that allows to verify transaction requests arriving from clients and to sign transaction results.

25

Drawings

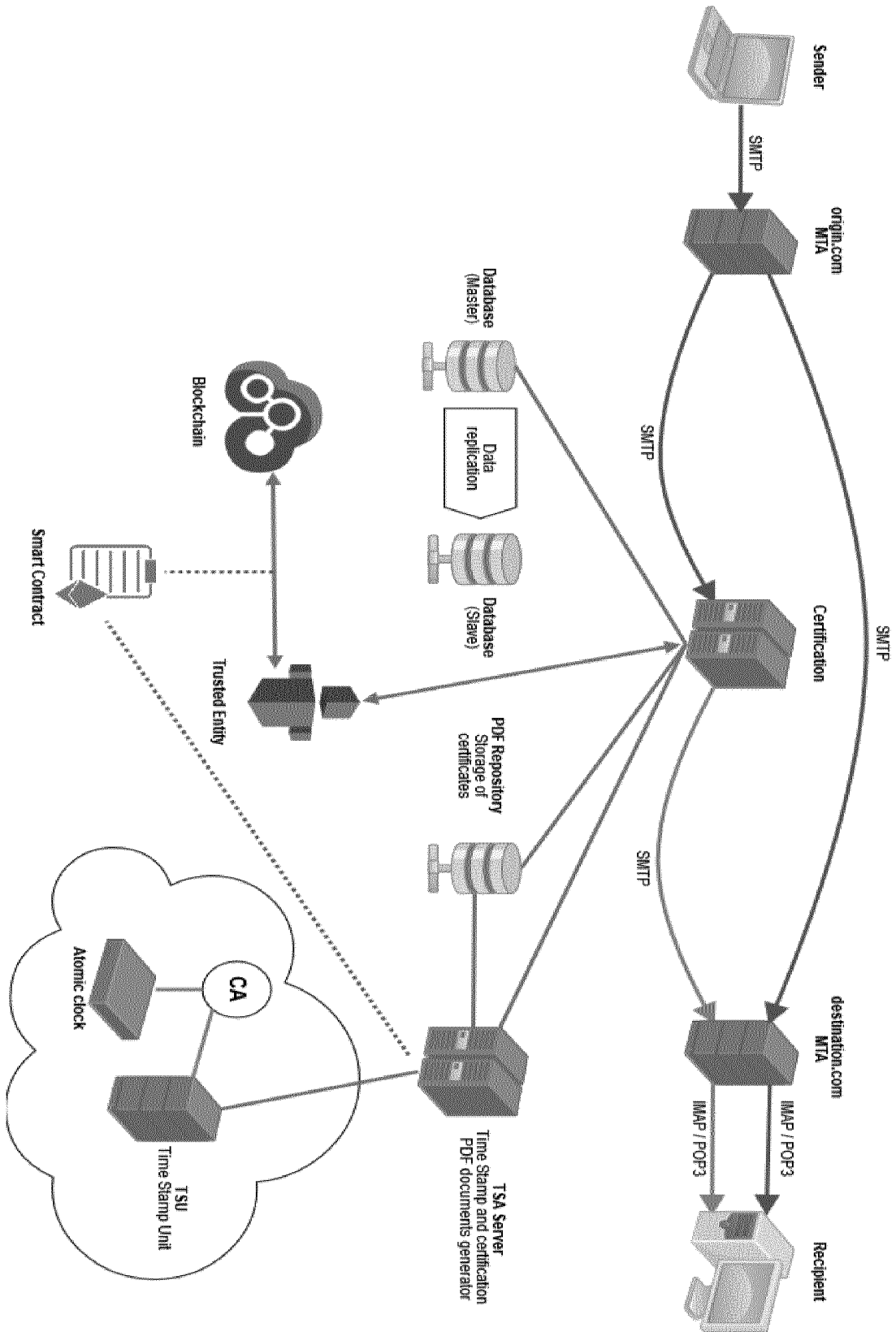


Figure 1

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F21/64 H04L29/06
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2019/139037 A1 (KHALIL RAMY ABDELMAGEED EBRAHIM [CH] ET AL) 9 May 2019 (2019-05-09) paragraphs [0029], [0052] - [0094]; figures 3-6 -----	1-5
X	Anonymous: "White Paper . ethereum/wiki Wiki . Github", 11 June 2015 (2015-06-11), XP055519858, Retrieved from the Internet: URL:https://web.archive.org/web/20150611185326/https://github.com/ethereum/wiki/wiki/White-Paper [retrieved on 2018-10-29] the whole document ----- -/--	1-5

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Widera, Sabine
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/061470

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2018/089761 A1 (STRADLING ADAM [DE] ET AL) 29 March 2018 (2018-03-29) paragraphs [0022] - [0090]; figures 1, 2 -----	1-5
A	WO 2018/204541 A1 (LUTHER SYSTEMS [US]) 8 November 2018 (2018-11-08) pages 21-29; figures 10,11 -----	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2020/061470

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