CLAIMS

1. A distributed ledger, DLT, communication module embodied in software configured for connecting a distributed ledger technology, DLT, platform with a global consensus module for consensus ordering and timestamping, wherein the DLT communication module comprising:

a state adopter module configured to retrieve and push to the global consensus module transactions submitted to the DLT platform, the transactions at least referencing local states and/or local state changes of the DLT platform; and a status provider module configured to maintain and track the transactions processed by the global consensus module;

wherein the state adopter module is configured to search in the status provider module for processed transactions containing any of the local states and/or local state changes referenced in the submitted transactions, and upon finding matching transactions notifying the at least one DLT platform of the valid processing of the submitted transactions by the global consensus module.

2. A DLT communication module according to claim 1, wherein the state adopter module comprises a local state communication module configured to retrieve transactions submitted to the DLT platform.

3. A DLT communication module according to claim 2, wherein the. local communication module comprises a communication protocol library comprising a plurality of communication protocols, each associated with a DLT platform configuration.

4. A DLT communication module according to claim 3, wherein the local communication module is configured to identify the communication configuration of the connected DLT platform and accordingly select a compatible communication protocol from the communication protocol library to enable the exchange of information.

5. A DLT communication module according to claim 4, wherein the local communication module is configured to convert the format of information exchanged between the connected DLT platform and the global consensus module.

6. A DLT communication module according to any one of the preceding claims, wherein the state adopter module comprises a DLT state checking module configured to search in the status provider module for historical transactions consuming any of the DLT local states associated with the submitted transaction, and to compare the unique consensus orders and

timestamps of the any historical transaction identified as consuming any of the DLT local states to detect previous attempts for consuming the DLT local states associated with the submitted transaction, and optionally wherein the DLT state checking module is configured for retrieving information on consumed DLT local states from a local DLT consensus module.

7. A DLT communication module according to claim 6, wherein the DLT state checking module is configured upon detecting that the local states associated with the submitted transaction have been consumed by a previous transaction, the state adopter module is configured to notify the distributed ledger platform to reject the submitted transaction, otherwise the state adopter module is configured to notify the DLT platform to validate the submitted transaction.

8. A DLT communication module according to any one of the preceding claims, wherein the status provider module is a mirroring computing node configured to push global DLT state changes of the global consensus module to the state adopter module.

9. An atomic swap engine embodied in software for orchestrating the exchange of digital records involved in an atomic swap transaction between at least one initiator party and at least one collaborator party, the digital records involved in the atomic swap transaction being stored in corresponding DLT platforms associated with the at least one initiator party and at least one collaborator party, the atomic swap system comprising:

a connector module configured to process and execute atomic swap transaction requests received from at least one initiator party via a client application involving the exchange of digital records stored in at least one initiator party DLT platform and digital records stored in at least one collaborator party DLT platform;

a global consensus module configured to validate, record and track state changes of the connected DLT platforms participating in the atomic swap transactions; and

at least one DLT communication modules according to claims 1 to 8, configured to communicatively couple each DLT platform to the global consensus module;

wherein upon receiving via a client application software a notification from the at least one collaborating party that the atomic swap transaction is accepted, the connector module is configured to locate and validate the digital records referenced in the atomic swap request in the corresponding initiator party DLT platform and collaborator party DLT platform,

execute the atomic swap transaction by assigning the digital records in the initiator DLT platform to the at least one collaborating party and the digital records in the collaborating DLT platform to the at last one initiator party, and locking the exchanged digital records in the corresponding initiator and collaborator DLT platforms,

request the at least one initiator party DLT platform to push, via the corresponding DLT communication module, the DLT local state change introduced by the execution of the atomic swap transaction to the global consensus module,

upon receiving a confirmation from the corresponding DLT communication module that the atomic swap transaction is validly processed by the global consensus module, to transfer to the at least one initiator party and at least one collaborator party a key to release the exchanged digital records in the corresponding DLT platforms, and wherein the global consensus module comprises a global conflict resolver, GCR, module and a global DLT, the global conflict resolver comprising a consensus module configured to apply a consensus protocol arranged to provide ordering and global consensus on the local DLT state changes, the global DLT being configured to track the global state of the GCR such that a state change in a DLT platform results in a change in the global DLT state of the GCR.

10. An atomic swap engine according to claim 9, wherein the atomic swap engine comprises a cryptographic module configured to anonymise the retrieved transactions and optionally, wherein the cryptographic module is configured to anonymize the retrieved transaction by removing and/or obfuscating sensitive information attributed to a specific data subject.

11. An atomic swap engine according to claim 10, wherein the cryptographic module is configured to hash and/or encrypt the retrieved transactions.

12. An atomic swap engine according to any one of claims 10 or 11, wherein the connector module is configured to lock the exchanged digital records using a state hash value key generated by means of the cryptographic module from a hash function obtained from a state change of the at least one initiator DLT platform, and optionally, wherein the cryptographic module is configured to generate separate state hash value keys for the at least one initiator party and at least one collaborator party to inlock the respective swapped digital records.

13. An atomic swap engine according to claim 12, wherein the initiator party key is generated based on the state hash value and a reference to the state changes of the global consensus module distributed ledger platform.

14. An atomic swap engine according to any one of claims 10 to 13, wherein the connector module is communicatively coupled to an escrow module configured to lock the digital records involved in the atomic swap transaction using the generated state has value keys and optionally, wherein the escrow module comprises a smart contract programme operating on each connected DLT platform, which is configured to lock the digital records with time-bounds using hash locks and time locks generated from cryptographic hash functions and cryptographic signatures.

15. An atomic swap engine according to any claim 14, wherein the escrow module is configured to release the locked digital records upon certain conditions of the atomic swap execution being satisfied.

16. An atomic swap engine according to any one of claims 9 to 15, wherein the global consensus module comprises a global committee selection module configured for selecting Transaction checker (TC) nodes from connected DLT platform to form a set of global transaction consensus nodes participating in the validation, recording and tracking of state changes of the connected DLT platforms participating in the atomic swap transactions.

17. An atomic swap engine according to claim 16, wherein the global selection module is configured to select the TC nodes based on a number of parameters that are defined according to and satisfy fault tolerance principles or rational behaviour models.

18. An atomic swap engine according to any one of the claims 9 to 17, wherein the global consensus module is configured to submit each transaction for validation to the global committee selection module and record each valid transaction in a global distributed ledger platform.

19. An atomic swap engine according to claim 18, wherein the global consensus module is configured to link local state changes of each connected DLT platform to the global state changes of the global distributed ledger platform.

20. A software embodied atomic swap method for performing an atomic swap transaction for the exchange of digital records between at least one initiator party and at least one collaborator party, the digital records involved in the atomic swap transaction being stored in corresponding DLT platforms associated with the at least one initiator party and at least one collaborator party, the atomic swap method comprising:

communicatively coupling by means of at least one DLT communication module according to claims 1 to 8 each DLT platform participating in the atomic swap engine to a global consensus module;

processing and executing atomic swap transaction requests received from at least one initiator party via a client application involving the exchange of digital records stored in at least one initiator party DLT platform and digital records stored in at least one collaborator party DLT platform; and

validating at the global consensus module the atomic swap transactions; wherein processing and executing an atomic swap transaction comprising:

locating and validating the digital records referenced in the atomic swap request in the corresponding initiator party DLT platform and collaborator party DLT platform;

executing the atomic swap transaction by assigning the digital records in the initiator DLT platform to the at least one collaborating party and the digital records in the collaborating DLT platform to the at last one initiator party, and locking the exchanged digital records in the corresponding initiator and collaborator DLT platforms,

applying a consensus protocol provides ordering and global consensus on the local DLT state changes;

tracking the global state of a global conflict resolver that applies the consensus protocol in a global DLT;

performing a state change in the global DLT in response to a change in either the initiator DLT or the collaborator DLT;

requesting the at least one initiator party DLT platform to push, via the corresponding DLT communication module, the DLT local state change introduced by the execution of the atomic swap transaction to the global consensus module; and

transferring to the at least one initiator party and at least one collaborator party a key to release the exchanged digital records in the corresponding DLT platforms.