5 Data Structure for IPDC Transmission (2-c)

Research on the Data Structure and Entry Encoding Required for IPDC Transmission.

5.1 Data structure and transmission data

5.1.1 Data structure and transmission data

The data to be transmitted via IPDC will consist of block header information as shown below. Each parameter is obtained from the block information retrieved from the Cardano blockchain and structured as custom JSON data. The file name follows the rule head_{block height}.json, ensuring a unique name within the system. In IPDC transmission, it is assumed that if the latest information is available, it will be sent.

Table : Structure of Block Header Information

block_vrf		Retrieved from Blockfrost
confirmations		Retrieved from Blockfrost
epoch		Retrieved from Blockfrost
epoch_slot		Retrieved from Blockfrost
fees		Retrieved from Blockfrost
hash		Retrieved from Blockfrost
height		Retrieved from Blockfrost
next_block		Retrieved from Blockfrost
op_cert		Retrieved from Blockfrost
op_cert_counter		Retrieved from Blockfrost
output		Retrieved from Blockfrost
previous_block		Retrieved from Blockfrost
size		Retrieved from Blockfrost
slot		Retrieved from Blockfrost
slot_leader		Retrieved from Blockfrost
time		Retrieved from Blockfrost
tx_count		Retrieved from Blockfrost
ipdc_hash		A value hashed from height, hash, previous_block, and block_body_hash value
ipdc_previous_block		ipdc_hash of the previous block
block_body_hash		transaction root

5.2 IPDC Transmission

5.2.1 IPDC Transmission Protocol and Transmission Process

The IPDC protocol follows the model below. This time, we will use the yellow parts. The block header JSON information is divided into UDP packets using the Flute protocol, and the split IP packets are encapsulated in ULE (Unidirectional Lightweight Encapsulation). They are then transmitted using the broadcasting protocol (MPEG-2 TS format).

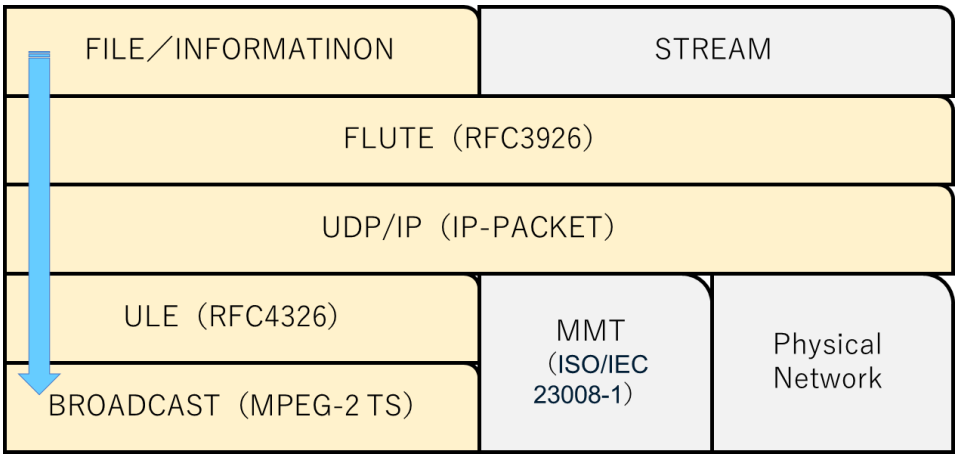


FIGURE: IPDC PROTOCOL STACK (SEND DIRECTION)

<Transmission Process>

JSON information is generated from the block header retrieved from the blockchain. This JSON information is fragmented using FLUTE and encapsulated as IP packets, which are then transmitted through the digital broadcasting system. In Japan, this is realized using terrestrial television, which is the most widely used broadcasting medium.

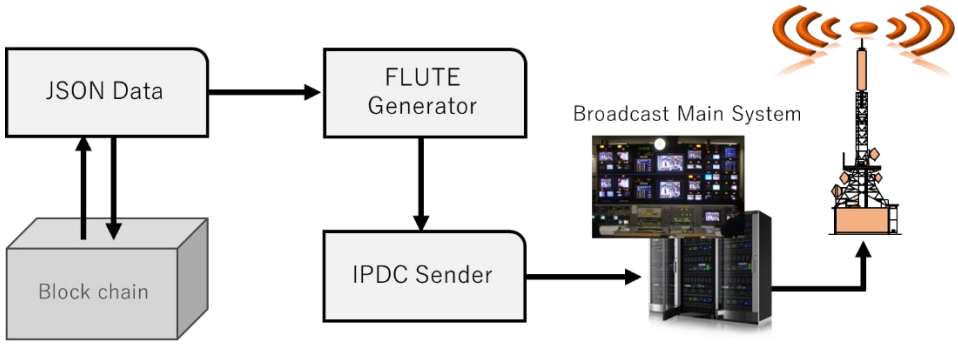


FIGURE : BLOCK DIAGRAM FOR IPDC TRANSMISSION

5.2.2 IPDC Transmission Process Flow

The process flow for IPDC transmission is shown in the following diagram. The IPDC transmission support tool continuously generates JSON information from the latest block information on the Cardano blockchain. The IPDC transmission system retrieves this JSON and broadcasts it as IPDC. *In the future, a more secure method will be used to retrieve the information instead of FTP.

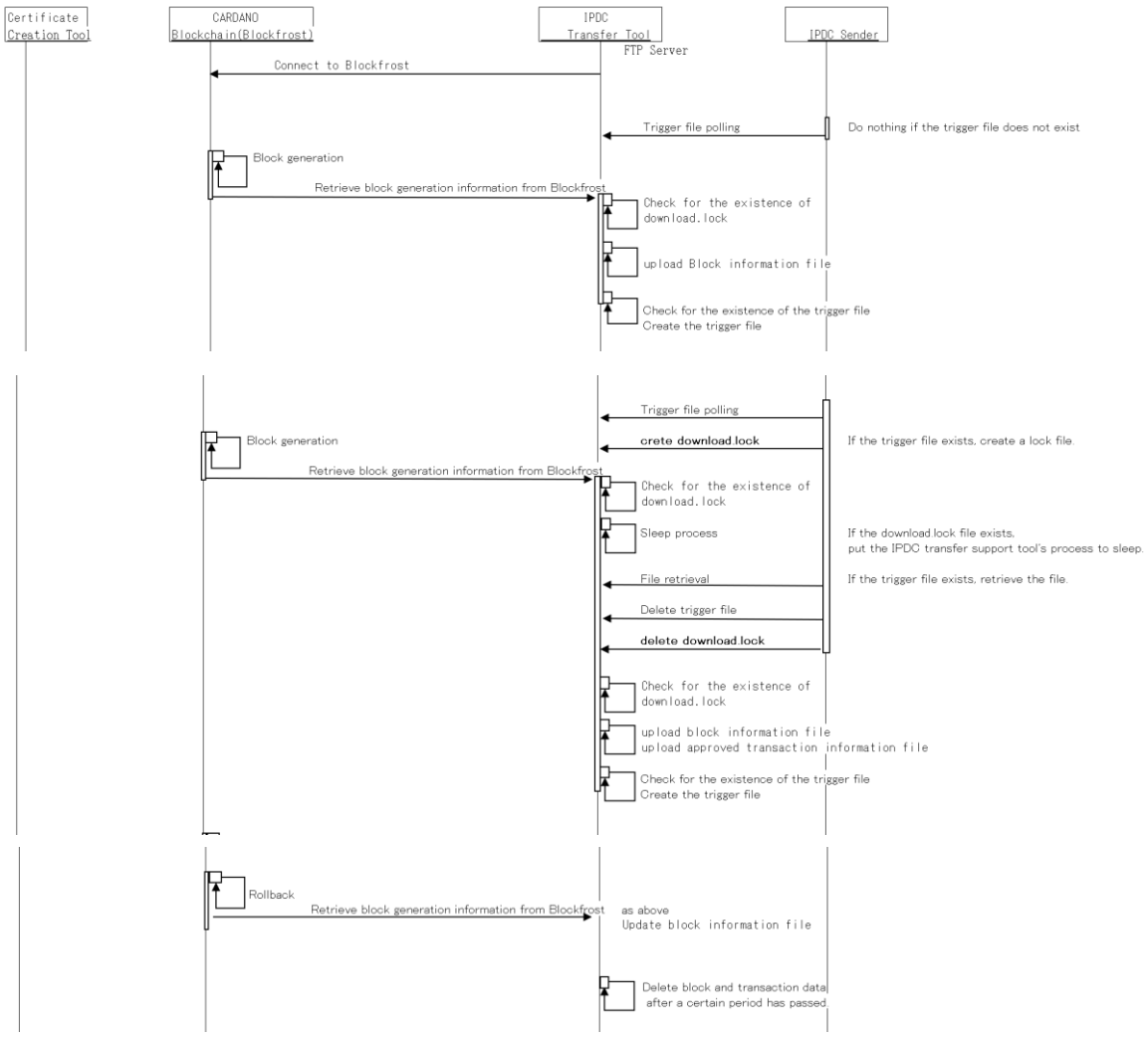


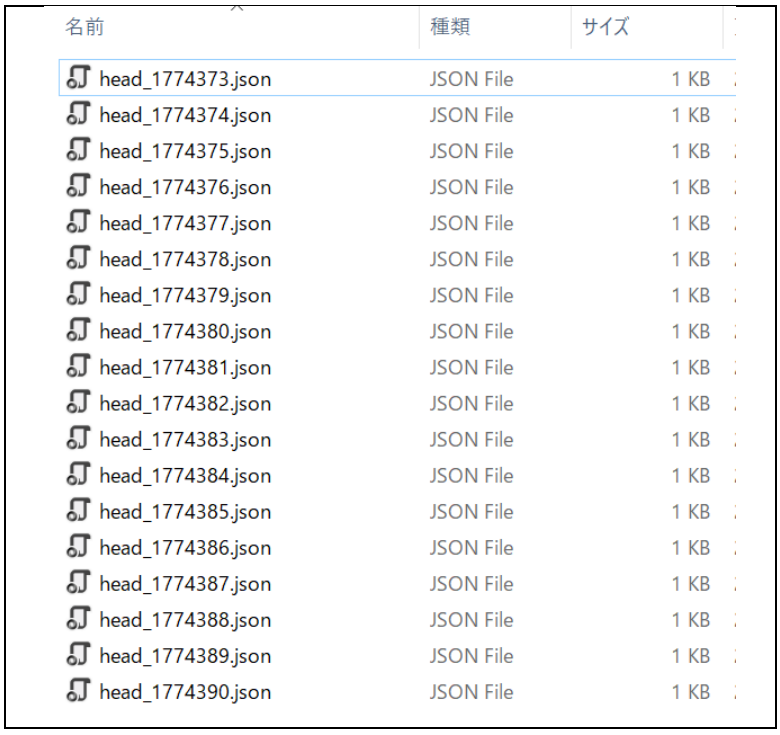
FIGURE : DATA INPUT INTERFACE AND PROCESSING FLOW FOR IPDC TRANSMISSION

6 Data structure after receiving IPDC（3-a)

6.1 Data Structure and Received Data

6.1.1 Received Data and Its Structure

The JSON is obtained via an IPDC dedicated receiver. The received JSON files are managed in a specific folder. In the case where the disaster area lacks internet access and cannot retrieve block information from the Cardano blockchain, the block header information received via IPDC broadcast is used to verify and validate certificates.



名前	種類	サイズ
head_1774373.json	JSON File	1 KB
head_1774374.json	JSON File	1 KB
head_1774375.json	JSON File	1 KB
head_1774376.json	JSON File	1 KB
head_1774377.json	JSON File	1 KB
head_1774378.json	JSON File	1 KB
head_1774379.json	JSON File	1 KB
head_1774380.json	JSON File	1 KB
head_1774381.json	JSON File	1 KB
head_1774382.json	JSON File	1 KB
head_1774383.json	JSON File	1 KB
head_1774384.json	JSON File	1 KB
head_1774385.json	JSON File	1 KB
head_1774386.json	JSON File	1 KB
head_1774387.json	JSON File	1 KB
head_1774388.json	JSON File	1 KB
head_1774389.json	JSON File	1 KB
head_1774390.json	JSON File	1 KB

FIGURE : FOR EXAMPLE OF FILES(BLOCK HEADER JSON)

6.2 IPDC Receiver

6.2.1 IPDC Receiving Protocol and Receiving Processing

The IPDC protocol is the following model. When receiving, the yellow part is used in reverse to the sender. IP packets received using the broadcast protocol (MPEG-2 TS format) are reconstructed by Flute and can be obtained as the original file. This file can be stored at a wide range of receiving points that can receive broadcast radio waves, making it effective.

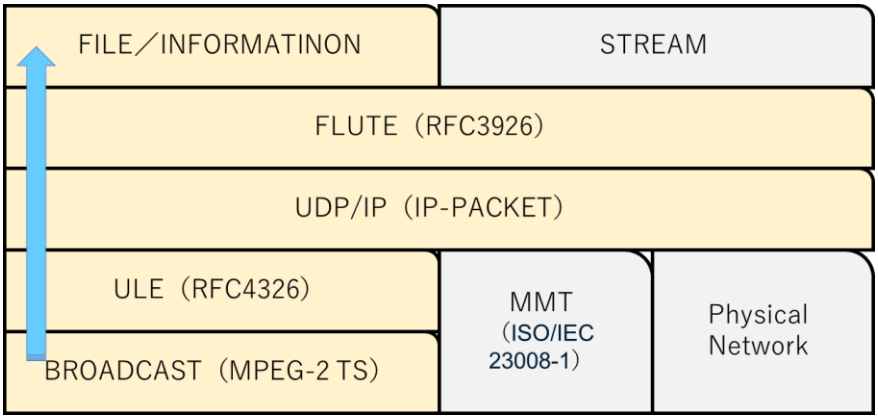


FIGURE: IPDC PROTOCOL STACK (RECEIVE DIRECTION)

<Reception Process>

To receive the broadcast, an IPDC receiver is used. Within the receiver, FLUTE is configured as the IP layer, so the FLUTE packets are reassembled to reconstruct the original file. This allows the file to be retrieved as it was at the time of transmission, and this file is then used to perform verification processes.

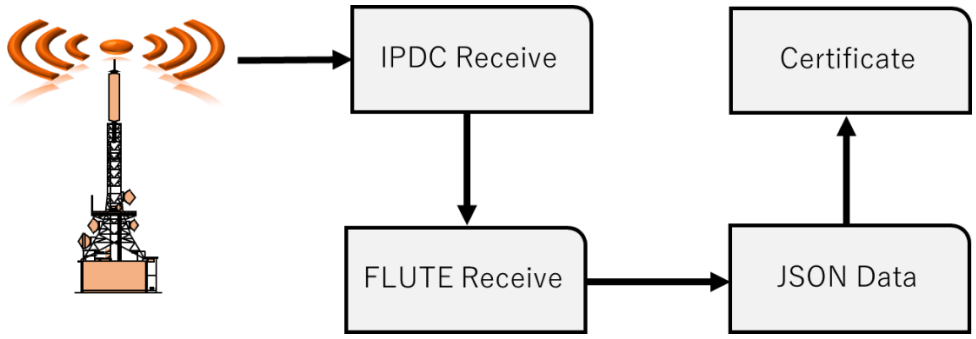


FIGURE : BLOCK DIAGRAM FOR IPDC RECEPTION