

Simplified Application of Blockchain For Astronomical Data



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Joshua Habka
SPS2010 Observational Astronomy



Joshua Habka

EASY TO UNDERSTAND
EDUCATIONAL USE ONLY

Florida Institute of Technology

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What Is The Blockchain?



It is a decentralized, open network. This is what Bitcoin is built on.



It allows for Smart Contracts, autonomous programs ran in certain conditions



Data can be stored on the blockchain, using IPFS

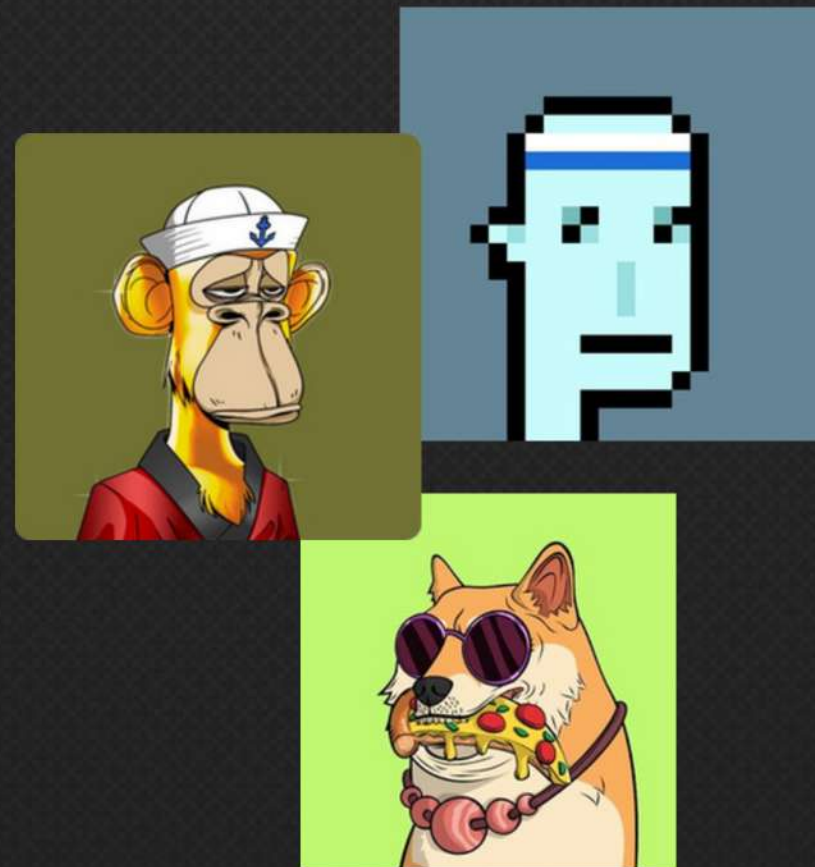


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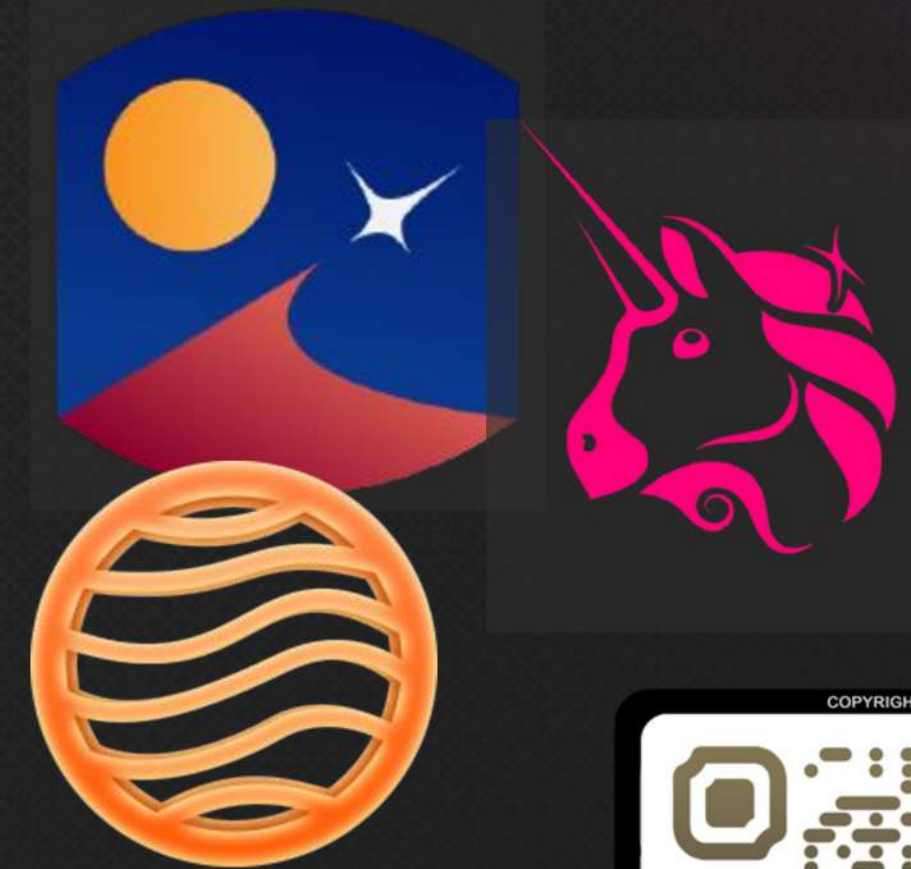
Familiar Examples



Cryptocurrencies



NFTs



DAOs



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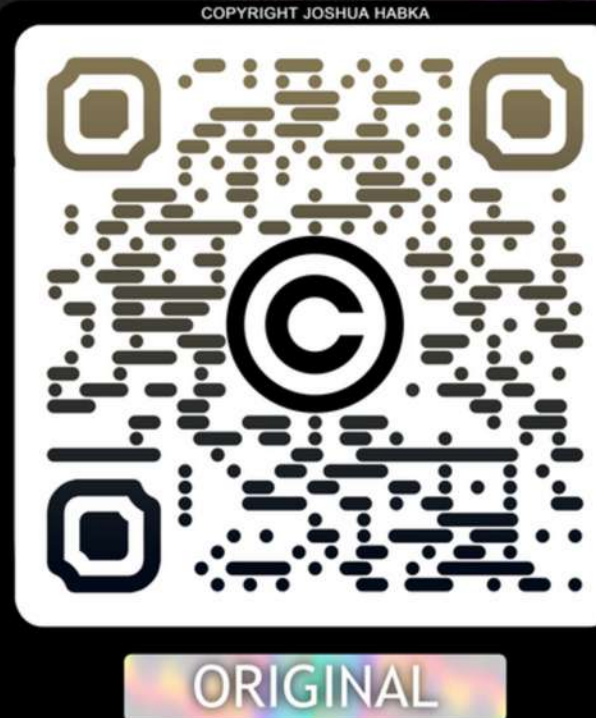
What Is A Smart Contract?

Automatic

A smart contract is a program which automatically executes events and actions when certain input requirements are matched. There is no middleman or central authority.

Like An API.

A smart contract is like an API(Application Programming Interface) for a dApp frontend using traditional programming, instead it interfaces with the blockchain instead of traditional databases(like S3)



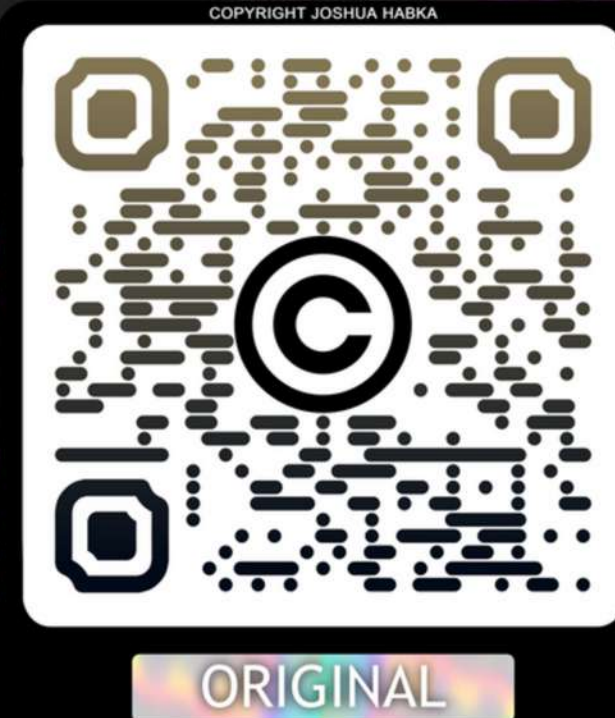
What Is the IPFS?

Decentralized Storage

Files are hosted on nodes, protocols deployed on computers, anyone can setup an IPFS node. This creates redundancy.. This additional removes a central authority having control of a file.

Immutable

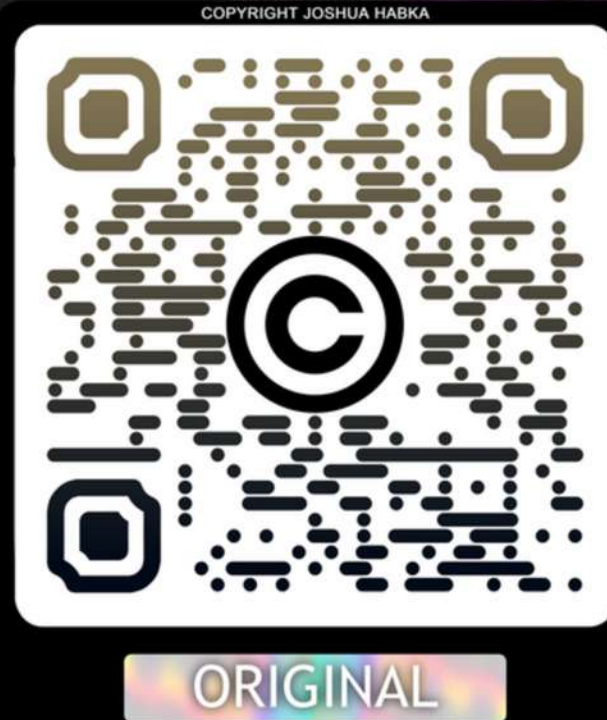
Once a file is deployed and has a unique id, it cannot be modified, protecting the integrity of the data. Newer versions of a file can be uploaded by referencing the old identifier(like Google Docs file versions)



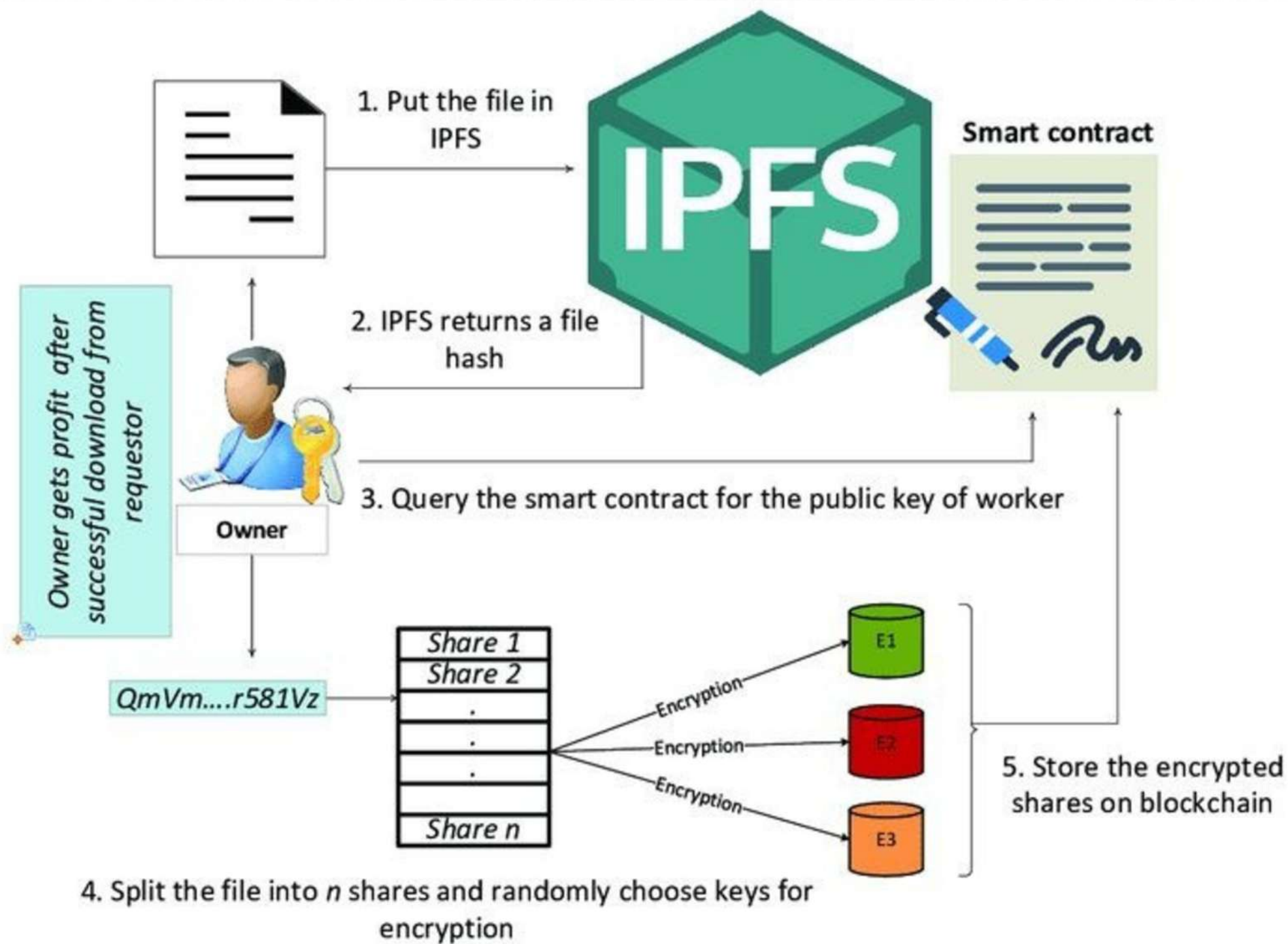
What Is An IPFS Gateway?

Like A Bridge

IPFS Gateways are like bridges which transform content from one protocol to the IPFS protocol. This is mostly used to go from HTTP to IPFS. They allow files to be read from an HTTP protocol(used for dApps)



How Does IPFS Work?



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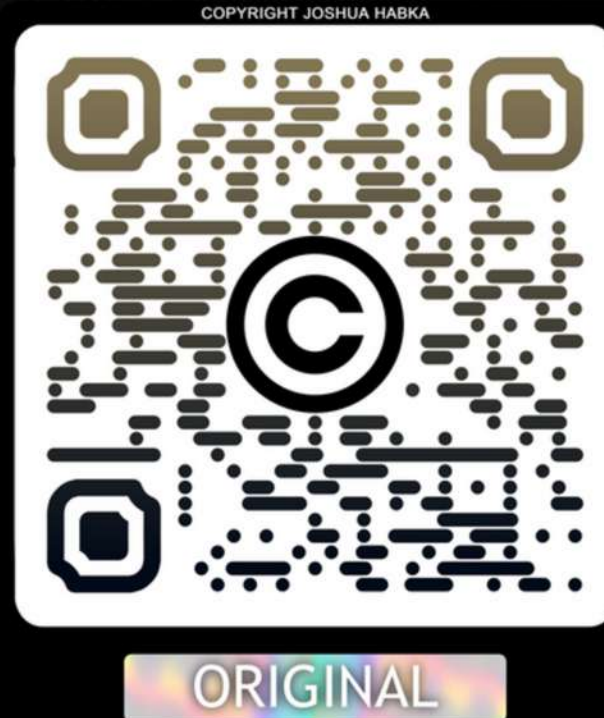
Storing Astronomical Data

Let's start with a simple example.



This NFT has these features:

- Mouth: Phoneme Vuh
- Background: Blue
- Fur: Trippy
- Eyes: Heart
- Hat: King's Crown



Storing Astronomical Data

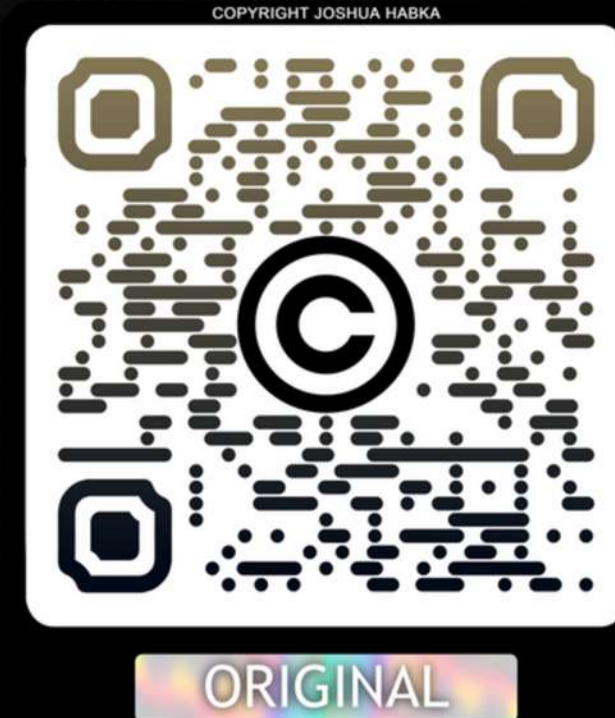
Now, we can parse this data in JSON format.

This NFT has these features:

- Mouth: Phoneme Vuh
- Background: Blue
- Fur: Trippy
- Eyes: Heart
- Hat: King's Crown



```
{  
  "attributes": [  
    {  
      "trait_type": "Mouth",  
      "value": "Phoneme Vuh"  
    },  
    {  
      "trait_type": "Background",  
      "value": "Blue"  
    },  
    {  
      "trait_type": "Fur",  
      "value": "Trippy"  
    },  
    {  
      "trait_type": "Eyes",  
      "value": "Heart"  
    },  
    {  
      "trait_type": "Hat",  
      "value": "King's Crown"  
    }  
  ]  
}
```



Storing Astronomical Data

A smart contract forms these properties into an image using code and deploys to IPFS.

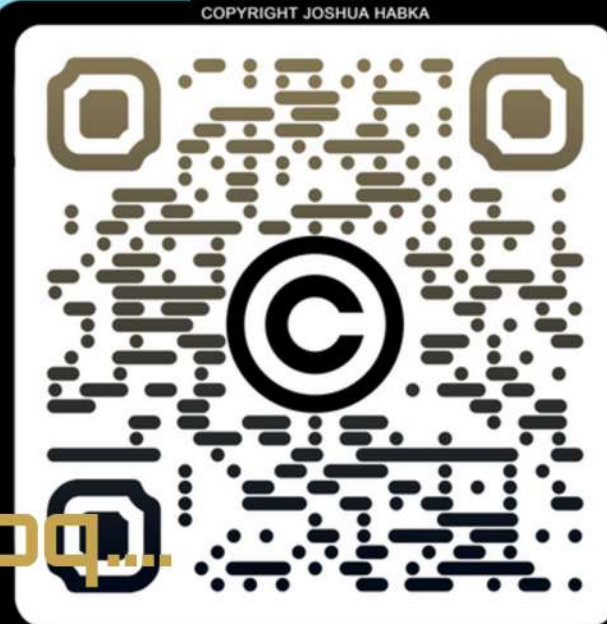


WRITE

GATEWAY



CID: QmQDoroq...

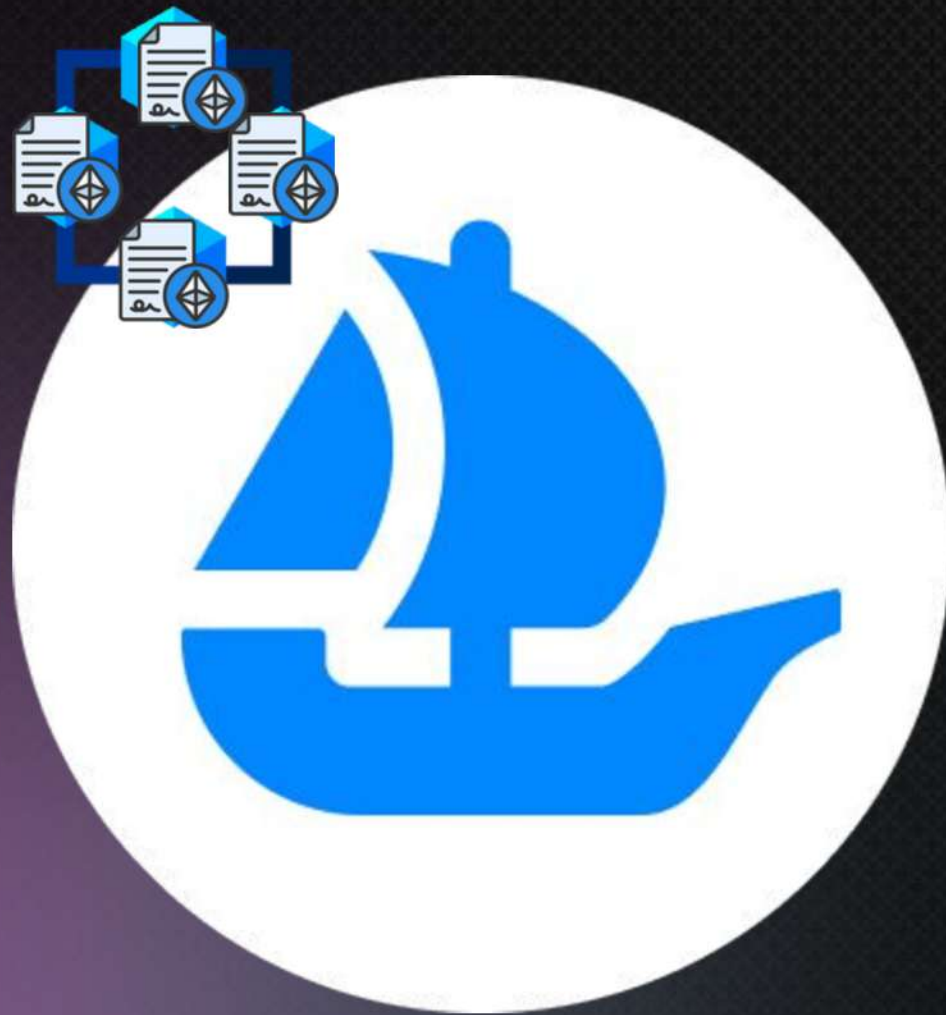


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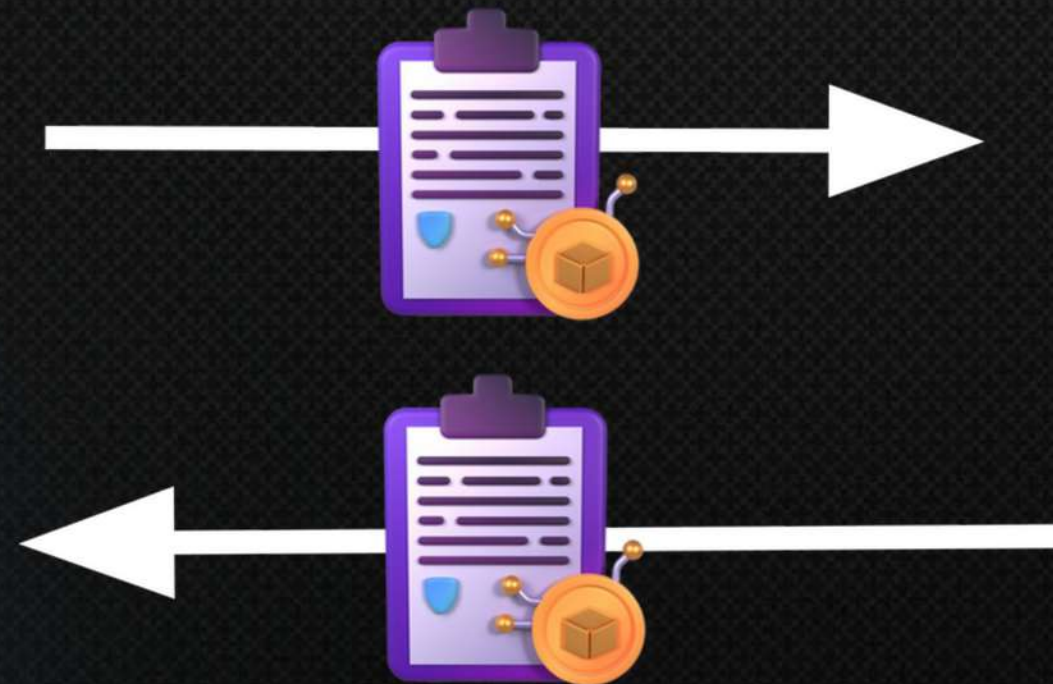
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Storing Astronomical Data

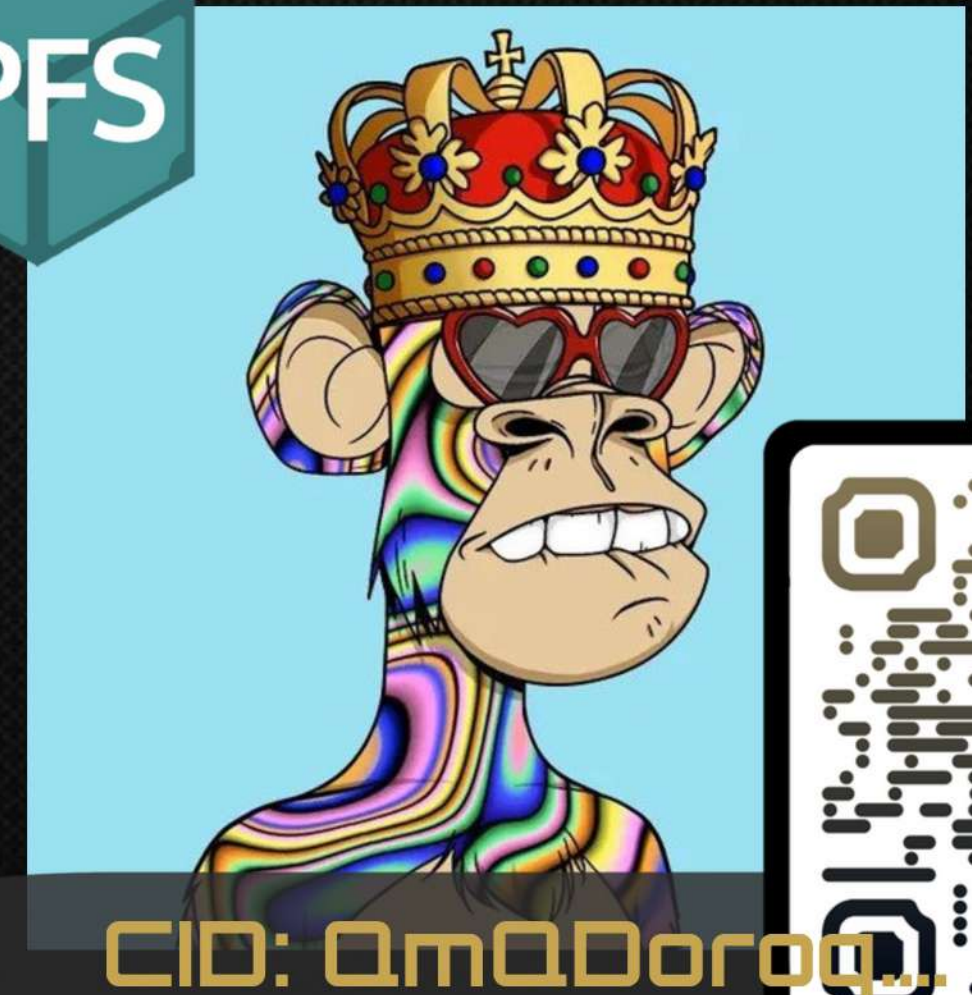
This NFT can be fetched from IPFS from platforms like OpenSea to render data to end user.



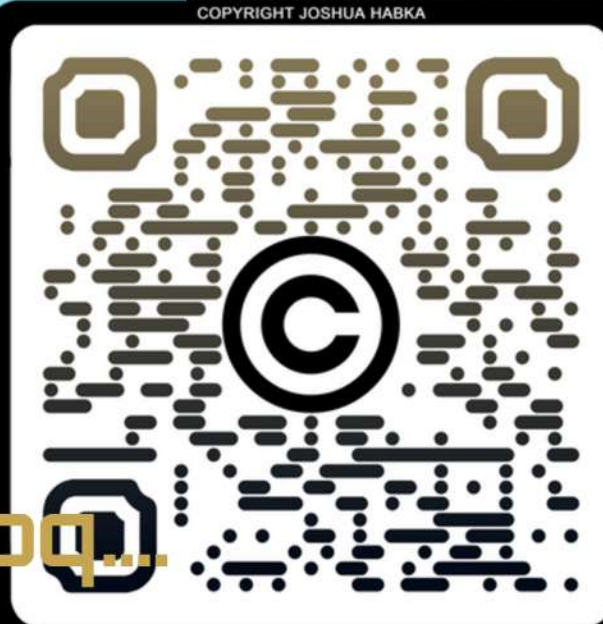
ipfs:// QmQDoroq....



SCHEMA, PNG, CID



CID: QmQDoroq....



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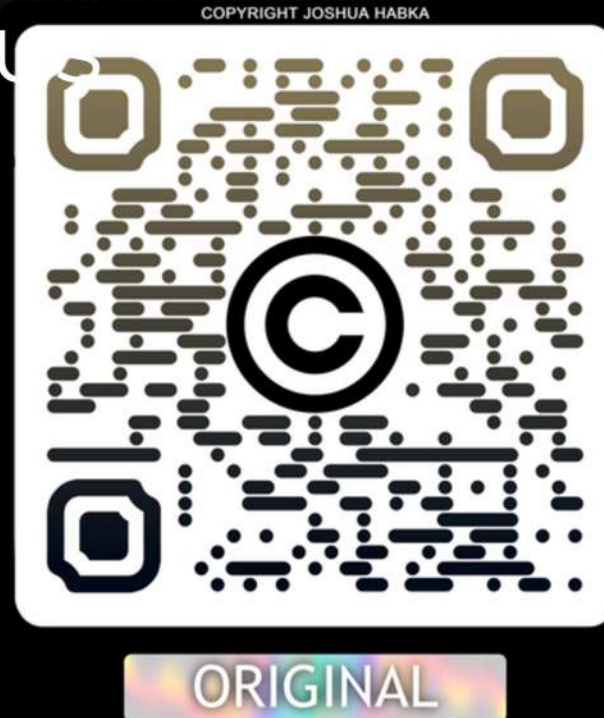
Storing Astronomical Data

Now, with NGC 7293



This nebula has these features:

- APMAG: +7.6
- APDIM: 25'
- Constellation: Aquarius



Storing Astronomical Data

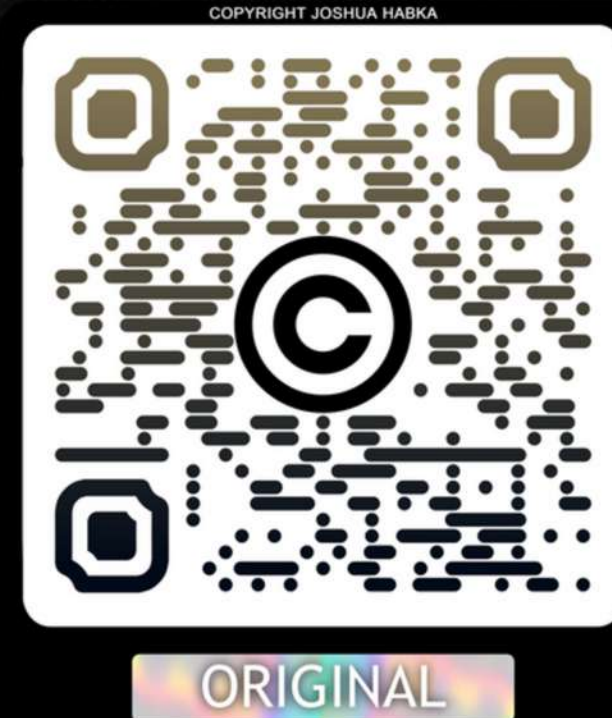
Now, we can parse this data in JSON format.

This nebula has these features:

- APMAG: +7.6
- APDIM: 25'
- Constellation: Aquarius



```
{  
  "attributes": [  
    {  
      "data_type": "apparentMagnitude",  
      "value": "+7.6"  
    },  
    {  
      "data_type": "apparentDimension",  
      "value": "25"  
    },  
    {  
      "data_type": "constellation",  
      "value": "Aquarius"  
    }  
  ]  
}
```



Storing Astronomical Data

Smart Contract initiated by a dApp to create CID on
InterPlanetary File System



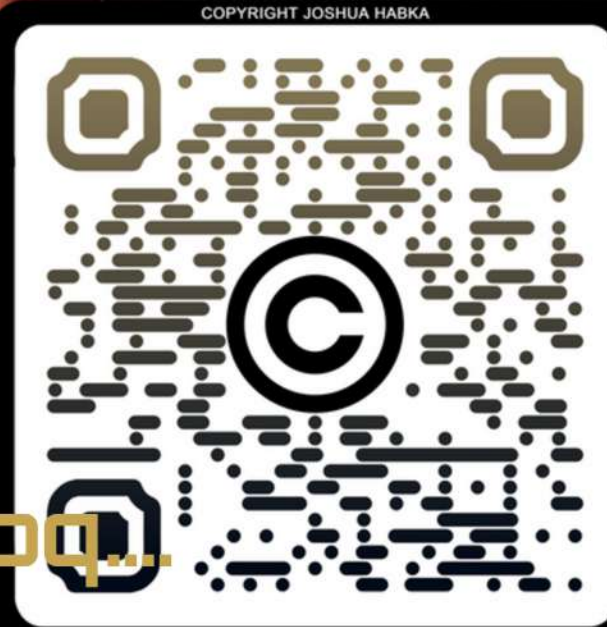
WRITE



GATEWAY



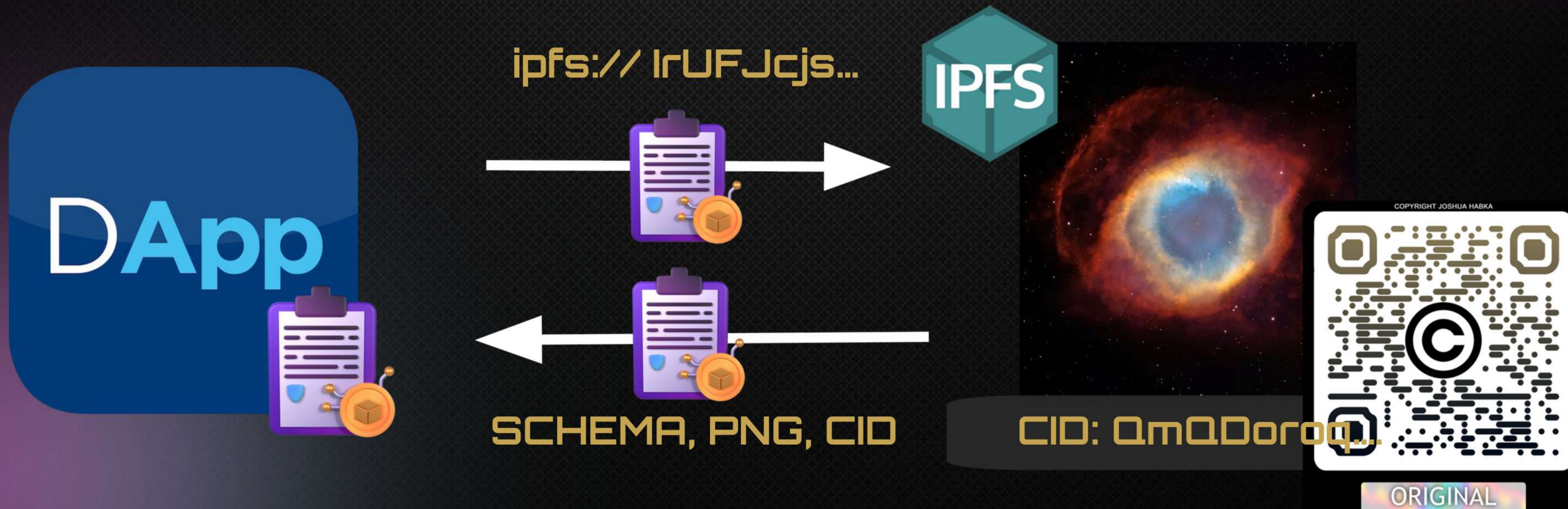
CID: QmQDoroq...



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Storing Astronomical Data

dAPP fetching data from the InterPlanetary File System



What About Live Content?

Like Orbits?

Doesn't immutability mean that live content cannot exist? It can't but it can.

Modifying Existing Data

You cannot modify data which has been uploaded to the blockchain due to the nature of the self-confirming ledger which acts as a "chain".



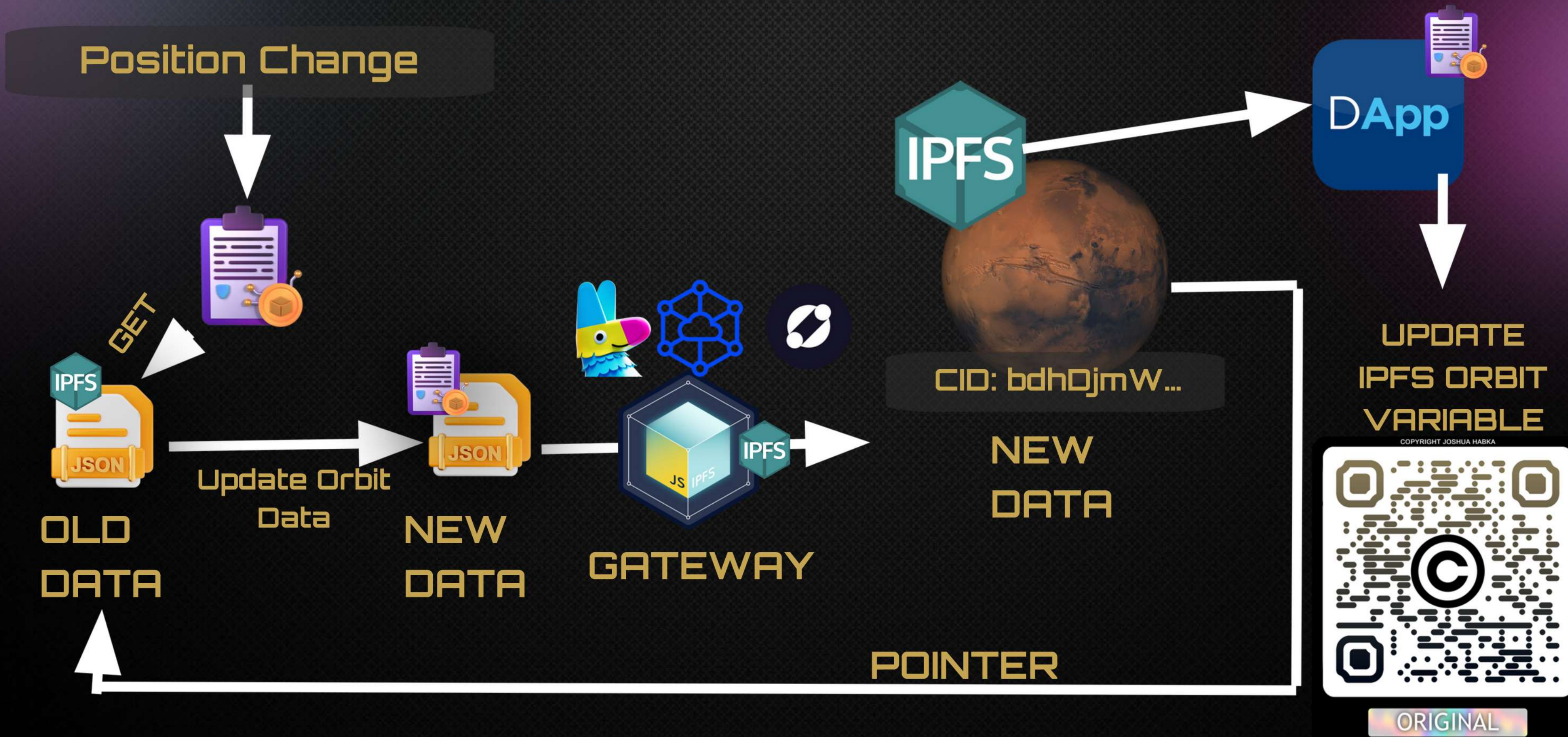
Creating New Data

You can create new data on IPFS. The best way to "update" data, add a pointer to the old data and a new CID(identifier) which associates the new data.



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Updating Astronomical Data



Thank You

JOSHUA HABKA

Joshua Habka

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