

2021 Thesis

NFT-based Data Management System (DMS), Metaverse-Oriented Cloud Management Platforms (CMPs).

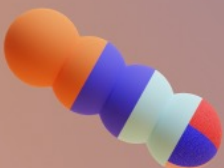
- 1 NFT-based Data Management as a Service (DMaaS)
- 2 Metaverse-Oriented Multi-Cloud Management Platforms (CMPs)
- 3 Use cases in Artificial Intelligence & Machine Learning Applications



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Arthur: Shawn Lin

Reviewed: Adam, DNFT Protocol CTO





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Preface

According to [Bloomberg's news](#), the University of California, Berkeley, made a report of the Nobel Prize-winning research results into an NFT, which records the documents and data forms related to gene editing and cancer immunotherapy, using the ERC721 token standard, was auctioned at Foundation on June 2nd.

NFT for Nobel Prize-Winning Data to Be Auctioned by UC Berkeley

By [Susan Decker](#) + Follow

- ▶ University to sell data for gene editing and immunotherapy
- ▶ Proceeds to fund further scientific research, university says



The University of California at Berkeley campus, in Berkeley, Calif. *Photographer: Justin Sullivan/Getty Images*

Digital data related to Nobel Prize-winning inventions for gene editing and cancer immunotherapy will be sold connected to non-fungible tokens next week, a novel way for the University of California at Berkeley to raise money for research.

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1. Introduction: Data Management System (DMS)

Data Management System (DMS) is system software used to create and manage databases for any project. DMS provides users with a systematic way to create, retrieve, update, and manage data for your project or program.

1.1 Simple Explanation of DMS Business

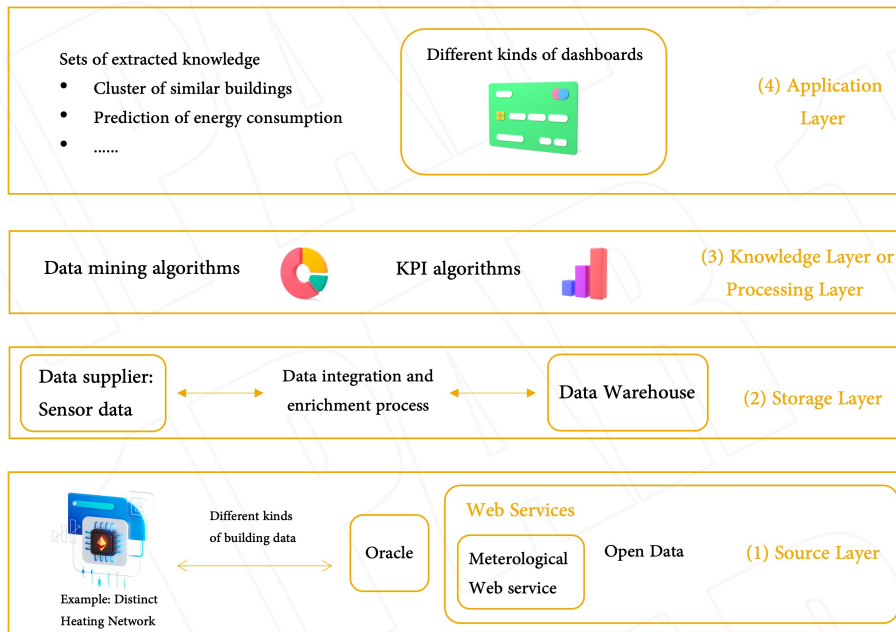
As a traditional industry field of the Internet, the data management system is actually very easy to understand. We can use different software to input, store and process data. For example, software from Microsoft Excel, SPSS from IBM, Smartsheet and so on.

DMS is highly valued and is welcomed by retail users and institutional users because it can effectively manage data and allow users to easily perform multiple tasks.

Among them, what caught our attention even more is the data analysis part of the big data management system. Companies such as [Oracle](#) are already proficient in using [machine learning and artificial intelligence \(AI\)](#) to visualize data models. The use of machine learning and AI will be able to build an [autonomous database](#) can automatically perform many data analysis and data recall tasks.

Layers of Data Management System

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Reference: ScienceDirect

Reference : [ScienceDirect](#)



These cloud data platforms provided by third parties are actually very simple to [explain](#), that is, users do not need to build any databases, computer rooms, analysis models and algorithms themselves, but use the software provided by these third parties on a paid or membership basis. The intensive calculations are handed over to these service providers, and only the data sets, analysis results, and visualization effects transmitted from the service providers will appear on the user side.

At the end of this concept introduction, we must clearly distinguish the coverage of several terms, cloud, big data, data cloud, cloud computing vs. cloud data management. The subject of data management involves a lot of software, but cloud data management is generally classified as: cloud data management is a subset of cloud. Cloud computing has a larger scope than the so-called big data, which includes not only data, but also all computer resources such as storage and computing power.

1.2 Market Size of DMS

The market size of this industry is much larger than we thought. From the perspectives of global revenue, the scale of listed companies, and academic research fields, we believe that this industry is in a stage of development and transformation in the wave of traditional Internet. But this also gives the DMS room to transform to the Web3 protocol.

Opportunities in the Data Management Market, Asia Pacific, 2020

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Asia Pacific is expected to witness high growth in the near future as it's growing at a rapid space.

2.1 \$Million 2020-end



5.7 \$Million 2025 - predicted

CAGR:
22.3%

The global data management market size is estimated to be 2.1 \$billion in 2020, and projected to reach 5.7 \$billion by 2025, at an **Compound Annual Growth Rate (CAGR) of 22.3%**



(i) The increasing demand for risk management solution and rise in the requirement of on-time authentic information would drive the growth of the data market in APAC region



(ii) New products developments would offer lucrative opportunities for unique market players, including hybrid data solutions, blockchain-based data solutions, etc., in the next 5 years.



(iii) The increased risk due to the lack of controlled governance with an end-to-end view in the time of COVID-19.



(iv) The growing digitalization across APAC region to deal with a massive amount of data would drive the adoption of data management solutions and services in the region.

Reference: [Marketsandmarkets Research Ltd.](#)

Reference: [Marketandmarkets Research Ltd.](#)



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According to a leading research institution in the data management market, the global enterprise data management market will be worth US\$72.79 billion in 2020. It is expected to expand at a compound annual growth rate (CAGR) of 13.8% from 2021 to 2028. The normalization of the work-at-home model has increased the demand for software-based value-added services.

Data Management Software Developers, Key Companies Profiled, 2021

IBM Corporation

ORACLE
Oracle Corporation

SAP
SAP SE

aws
Amazon Web Service, Inc

teradata.
Teradata

talend
Talend

EnterWorks
BY WINSHUTTLE
Enterworks (Winshuttle, LLC)

Mindtree
MindTree, Ltd.

MICRO FOCUS
Microfocus

Informatica
Informatica

BROADCOM
Symantec
Broadcom (Symantec)

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Data management solution providers dominate the global market with a revenue share of more than 35% in North America in 2020. The Asia-Pacific market is expected to see significant growth during the forecast period. Point-to-point, open-access open-source software for remote management and access to large amounts of data may promote the demand for data management.

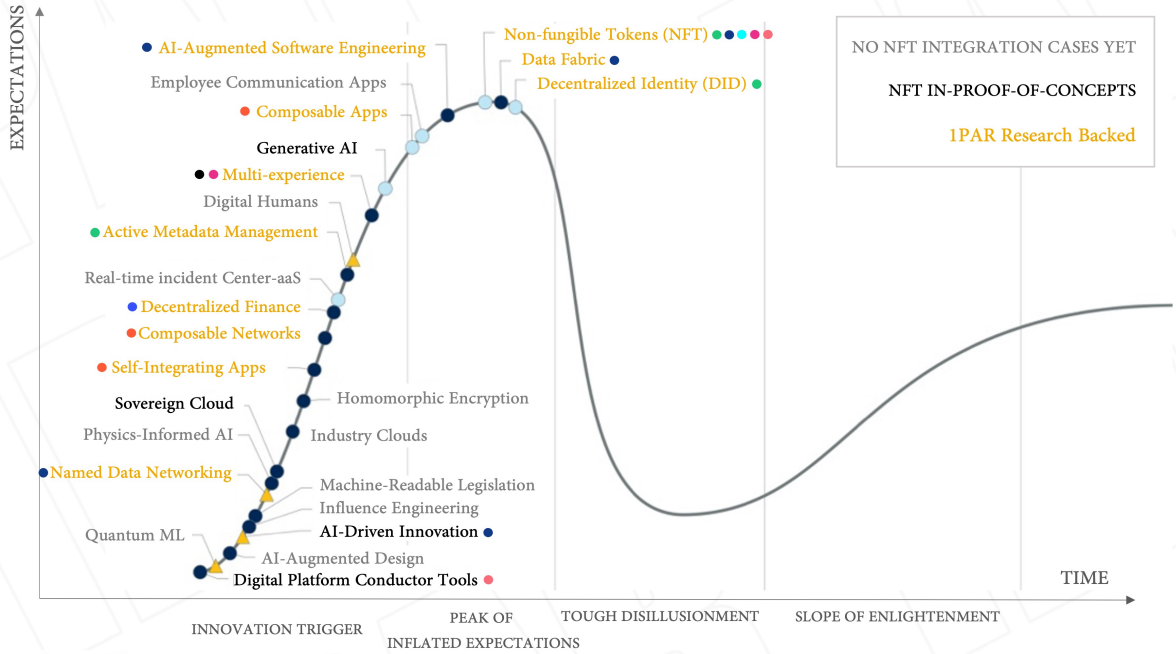


2. Why the Data Management Can Be Close to NFT

Hype Cycle for Emerging Technologies, esp. NFT technology involved, 2021

Reference: Gartner, 2021

-  Litentry
-  Konomi Network
-  Saito Network
-  DNFT Protocol
-  Clout.art
-  RMRK & Kanaria
-  Kodadot
-  Metaprime Network



NO NFT INTEGRATION CASES YET
 NFT IN-PROOF-OF-CONCEPTS
 1PAR Research Backed



Plateau will be reached:

- < 2 yrs.
- 2-5 yrs.
- 5-10 yrs.
- ▲ >10 yrs.
- ✗ Obsolete before plateau

* Projects are arranged in time order of participation.

Reference: [Gartner \(August 2021\)](#)

The whole crypto industry knows that this graph from Gartner, in which NFT is at the top of the bubble, we have adjusted in the chart. Although we think that the relatively raw product form of NFT may be in the bubble stage, The various schemes of metadata management, data network, and AI in the graph can be combined with the form of NFT tokenization, and they are still in the 'innovation trigger' state.

Data management and NFT have high composability. Any unique data calling program has scarcity and uniqueness. Both blocks and data sets can be transmitted for exchanging, transfers, and verification. And the management of these data vs. the processing of NFTs can also be called on the marketplace Dapps. One of our statements: Note that data management and data storage are different here. We refer to data management based on the NFT form, but the content will not deep dive into decentralized storage.

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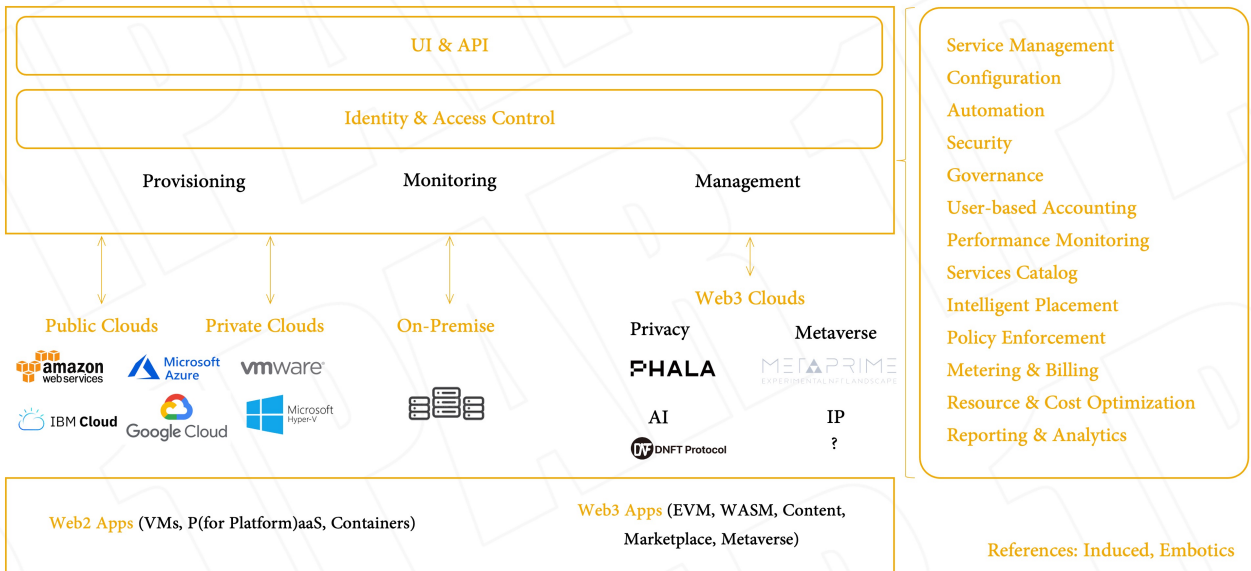
3. What Is Cloud Management Platform (CMP)

The Cloud Management Platform (CMP) is a set of software tools that other projects can use to manage the deployments of their cloud suppliers. IT admins use these tools to control and monitor cloud computing resources. This allows better control of the cloud environment, optimization of cost and performance, and enhanced security. The architecture of CMP varies greatly. Some CMPs are native applications, but other CMPs are software as a service (SaaS) product.

If cloud is the market of explosive information, then CMP is the center of multiple markets. CMPs try to bridge these complex states so that you can organize and manage all cloud suppliers from one location. Of course, a CMP will not do all the work. These functions are academically classified by committees composed of several institutions.

A General Framework of a Multi-Cloud Management Platform

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References: [induced](#), [embotics](#)

3.1 Blockchain-Based Data Management and Cloud Management Platform

For many high-concurrency scenarios, the blockchain will not stop at the current scenarios such as DeFi and NFT. It will be stuck, slow, or even impossible to proceed at all, or it may cause other problems (such as security) due to the stoppage of block-producing. Many projects are trying the most suitable scaling solutions for Ethereum: switch to PoS (Proof-of-Stake) based on PoW (Proof-of-Work),

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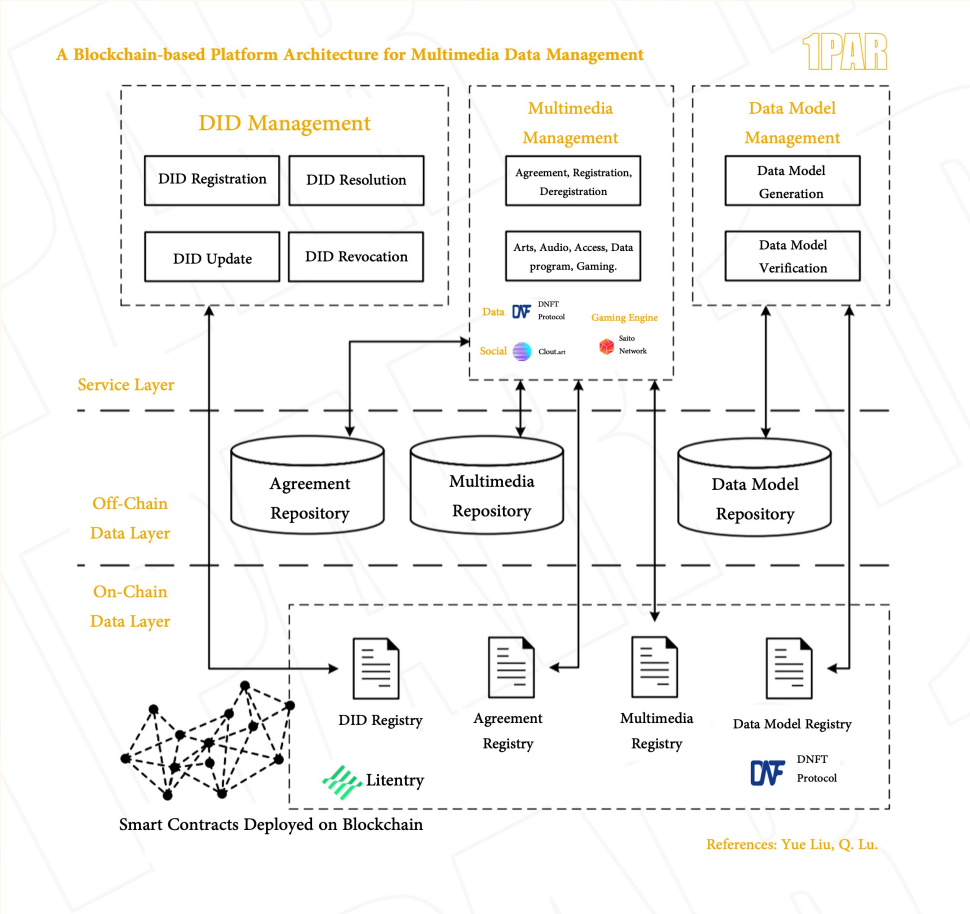
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then compress transaction data (solution of [Rollups](#)), or build the shard structure, but this development process is very long. If we do not break the blockchain structure, we can learn from the design of the cloud computing.

Both traditional and Web3 protocol-based cloud computing platforms have horizontal scaling and vertical scaling.

- I. Horizontal scaling is parallel, and tasks are divided and processed in different areas.
 - II. Vertical scaling means increasing the processing capacity of a single device.
-
- I. One is represented by Oasis, Phala, and PlatON. By connecting trusted computing hardware as a computing device to the network, the hardware device has high computing power and security capabilities, and these single devices (or clusters) can independently undertake tasks. The processing work is achieved in parallel outside the consensus layer.
 - II. The second is represented by Dfinity, IOTA, and Filecoin. Through the development of new algorithms at the consensus layer, the finality process of block transaction will be changed, and then through improving the scalability, the computing power and space of a single computing device will be increased, that is, vertical scaling of cloud computing.

So how to manage multiple Web3 cloud suppliers? Reference: [Yue Liu, Q. Lu.](#)



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In the multimedia data management architecture shown in the figure above, this data framework can be linked to either the off-chain data center (Off-chain data layer: Web2 cloud center) or the on-chain data center (On-chain data layer: Web3 cloud center) to interact. The front-end interactive page (service layer) can interact with Web2 and Web3 at the same time.

- I. Among them, we classify it into decentralized identity (DID), call control,
- II. And the most important multi-media data management (here is the use case of our portfolio: [DNFT Protocol](#)).
- III. The decentralized identity management here can use the combination of identity registration, updates, resolutions, and revocations to form identity aggregation ([Litentry](#) is developing a user-centric identity aggregator).

The object to be managed here:

- I. if it is multimedia, can be the data content, data structure or even data calculation program stored on the chain in various forms.
- II. It can be a general copy of any form of content, and it can be an NFT specially minted for the ownership, membership, marking and access control, or [RMRK's multi-resource NFT](#) of above, [raising on Ethereum and Kusama](#), that can be changeable, evolvable and combinable.

3.2 In the Blockchain-based Metaverse Apps, Why Necessary to Manage the Multi Clouds in the Future?

After inquiring a large number of articles, we were disappointed to say that in the reports from dev companies with traditional Internet backgrounds, those research institutions and consulting institutions with traditional financial backgrounds, their analysis did not include the fungible tokens. However, the attitude towards NFT is more friendly, according to [Reuters](#), stating that NFT has become a carrier of modern popular culture from the edge of the crypto community.

It's not clear to what extent it is possible to fully replicate the "[ready player one](#)" metaverse of real life, or how long it will take to develop. Many platforms in the blockchain-based metauniverse are still developing augmented reality (AR) and virtual reality (VR) technologies, which will enable users to fully interact in virtual space. Accounting and consulting giant [PwC predicts](#) that by 2030, VR and AR technologies will bring about \$1.5 trillion in growth to the global economy, compared with \$46.5 billion in 2019.

1confirmation cofounder, [Nick Tomaino believes](#) that today, to many people, NFT looks like a speculative toy, but it may be the decisive factor in determining the metaverse world in the next few decades. He divides reality and metaverse into three categories:

- I. Meatspace (real world),
- II. Corporate Metaverse (Internet organization-led, Facebook, Twitter, etc),
- III. Open Metaverse.

We specifically refer to Open metaverse in this article, and only discuss the online world where user-owned decentralized organizations, (Ethereum and more) control the perception, property, and money globally. In contrast, meatspace (the real world) is more conducive to old institutional powers, Corporate Metaverse is <

more conducive to new institutional powers, and Open Metaverse is quite the most optimal.

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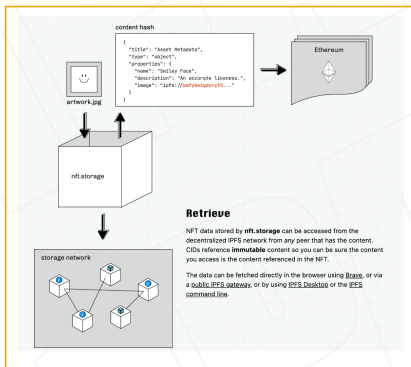
4. Use Case: NFT-based Data Management as a Service (DMaaS)

Since NFT can be used to verify the uniqueness of items, any program can belong to items, and any data can be the input, carrier, and output of the program. Then, for example, digital art and digital ownership, for example, we can use NFT to manage digital copyrights.

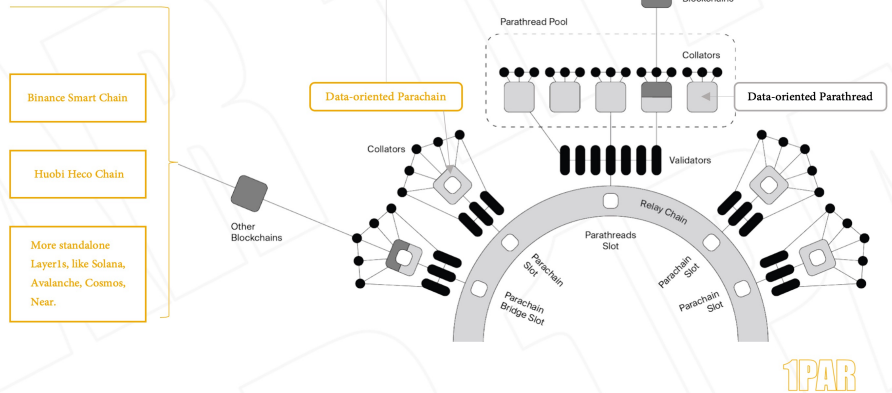
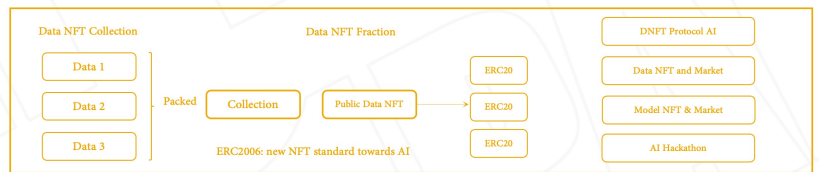
This NFT-based 'program' can provide a blockchain-based digital rights management platform and middleware privacy encryption to realize digital scarcity. These NFT 'programs' can contain media such as videos, books, music, and source code, and of course can also be used to represent any scarce data and data models and implement these data. We can abstract these data and define their rules.

A Designing Architecture for Data Management as a Service, building with NFTs

Reference:
Polkadot,
DNFT Protocol,
NFT.Storage.



Decentralized Storage of NFT Resources: including arts, audios, tickets, vouchers, memberships, data modelling programs, computing programs and more.



References: Polkadot, [DNFT Protocol](#), NFT.Storage

Use the NFT processing method to package and manage the data and further call, instead of passing the data to the block of the Layer1 blockchain as in the past, but the token standard of the upper layer.

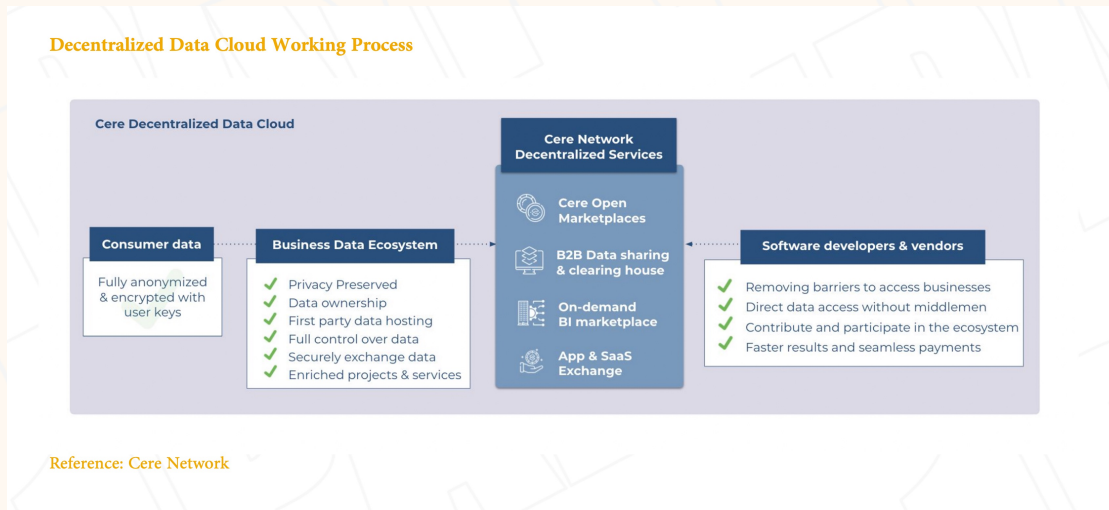
- NFT-based data packages should be able to **collect multiple resources** and package them into one NFT and be able to **package multiple NFTs** into one NFT set, which makes it easy to package multiple data subsets into a large data set.
- We can optimize the NFT token standard according to the type of data or the type of program, such as identity data, AI computing model or machine learning computing model.
- In this way, users can upload this type of data and model programs and use their NFTs. Each time they use them, they need to pay a certain native token and the royalties for later use of this type of data model (which's packed as, this type of NFT).

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For this type of use-as-a-service, we can design a repurchase and destruction mechanism. Part of the NFT transaction fees, storage taxes, recycling auctions, and other costs will be allocated to the governance committee, so that the processed data packaged into NFT has more post-service value. The token economy and value capture mechanism will also be upgraded and iterated through governance, forming an autonomous data service model. The decentralized autonomous governance of the protocol is maintained through the committee, oracles, storage mechanism management, and recycling mechanism management.

5. Use Case: Metaverse-Oriented Multi Cloud Management Platforms (CMPs)

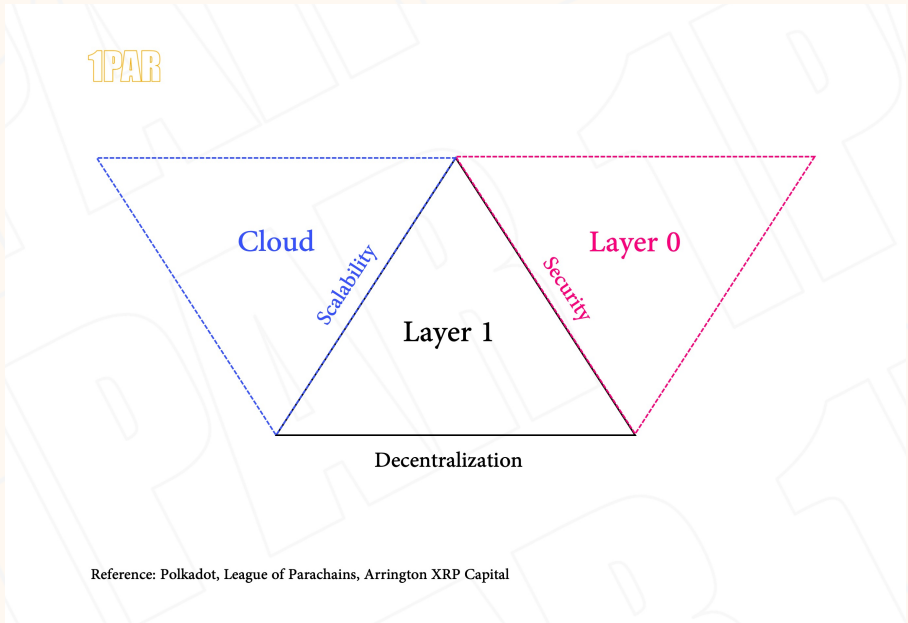


Some serve different blockchain heterogeneous architectures, and some are based on the environmental characteristics of multi-cloud access. These Web3 cloud management platforms can provide a unified multi-cloud management platform for almost all applications such as Metaverse apps, Gamefi games, virtual galleries, etc.

To meet the public and internal use and testing requirements, this kind of cloud management platform, you can call it 'cloud aggregator' in a more Web3 protocol way, it should support the integration of various public cloud and private cloud data. The unique data model ensures that customers can achieve unified DevOps and maintenance.

Metaverse apps that can serve multi-chain will be the future trend, and multi-cloud might be the inevitable trend in the future. Of course, NFT or metaverse apps (especially, AR and VR) is just a small reason. The storage and distribution of computing power will be the absolute driving force of a multi-cloud future.

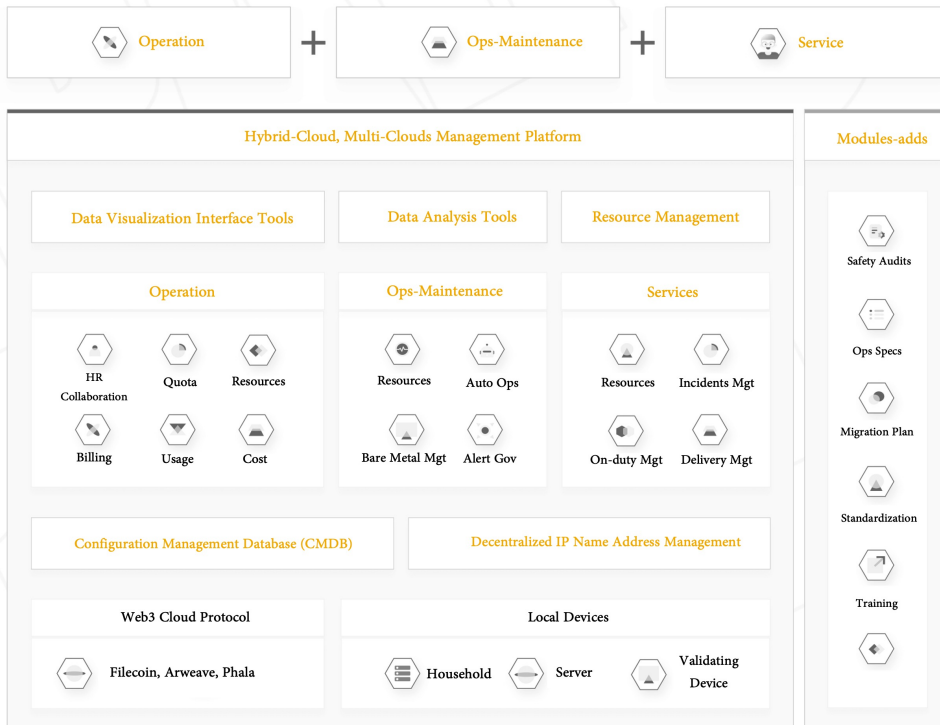
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Reference: [Polkadot, League of Parachains, Arrington XRP Capital](#)

By analogy, in more mature role-playing games or large-scale collaborative projects in all industries, a platform with solid cloud computing operations should integrate organizational structure, resource pool management, quota management, resource usage analysis, and cost analysis into one, easy to help this kind of native apps and derive projects built around metaverse realize the change from cost center to business value creation.

From the very beginning, you can start with lighter modules that can be adopted by users. According to the computing resource requirements of this type of project, it is to solve the chain scaling, we would like to recommend building some services that meet the current business situation for the leading Dapps built on the Layer1 chains.



[IBM pointed out](#) in 2021 that 85% of enterprises are in a multi-cloud environment, but only 41% have a multi-cloud strategy. We believe that 95% of NFTs are using decentralized storage solutions. Even if major of them still use IPFS or Arweave, they may not have any plan in multi clouds. Only a small number of NFTs and their NFT projections may would like to build their own multi-cloud strategy.

In terms of data management as a service, if most of the Web3 protocols on the chain involving data, data models, etc. do not plan to build their own programs natively, they use this type of management platform to pay for the service. The protocols with data management functions, especially the NFT-based data management services mentioned above, such as DNFT Protocol, can be built together with these multi-cloud architectures, using these Web3 big data storage providers and cloud providers.

By the same sense, the multi-cloud management platform (MCMP) is a digital use and delivery platform with integration and command and automation management layers and supports multiple technology combinations in a multi-vendor platform.

- I. Some of the consoles or portals can manage multiple Web3 cloud suppliers in the future. It can be owned by technical community, or community-owned, or DAO governed.
- II. Alternatively, MCMP can manage the cloud environment, including the inventory of data processing conditions, the inventory of cloud resources, and their operating conditions.
- III. MCMP with relatively high product granularity should monitor multiple decentralized storage resources or blockchain-based cloud computing resources, including usage costs, control of expense strategies, inventory of cloud resources and data assets.



6. Applications of Industrial Data and Data Assets Packed as NFTs

6.1 Artificial Intelligence and Machine Learning

One of our portfolios, DNFT Protocol uses hierarchical ERC721, ERC1155 and [ERC2006](#). ERC2006 is a NFT token standard, innovated by DNFT team, designed for AI data models. Number 2006 represents the [deep learning proposed in 2006](#), so the number has milestone meaning. The purpose of ERC2006 is to allow data/models in the AI field to adapt to NFT tokenization. However, the problems faced when using NFT to process AI/personal data are: (i) the complexity of personal data, (ii) the ownership of public data, and (iii) the privacy of personal data in transaction circulation.

ERC2006 has these functions in processing information and assets other than AI data:

- I. Aggregate multiple NFTs and pack them into one, called “NFT collection”. It would be friendly to pack multiple individual data into one manageable collection.
- II. The NFT can be fractionized into ERC20 tokens, which is friendly to the ownership of huge data sets (especially public data), which will amicably support NFT mining in AMM/order processing.
- III. Copyright protection, use ZKP, MPC and other cryptographic technologies to authorize viewing.

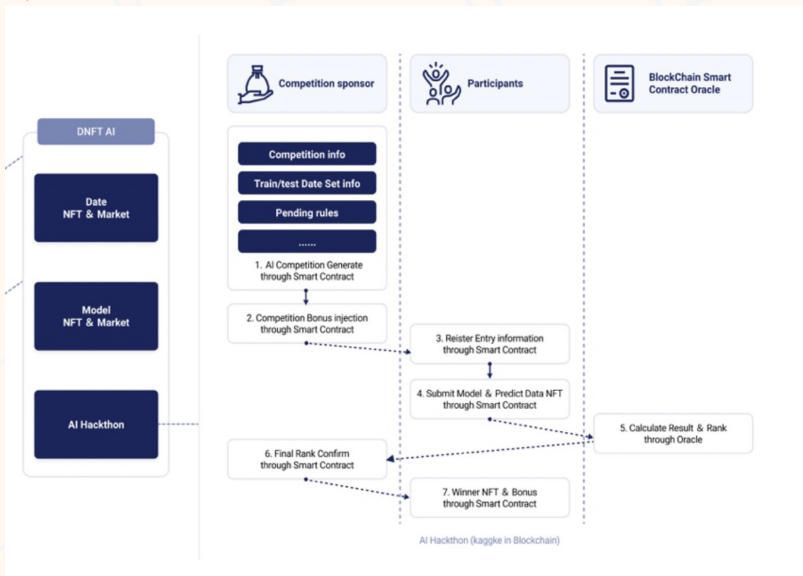
And ERC2006 has these advantages when targeting huge data sets in the field of AI and machine learning.

assets characteristic	ERC-721	ERC-1155	ERC-998	ERC-2006
Uniqueness	Contract assets vary from one asset to another	Contract assets vary from one asset to another	Contract assets vary from one asset to another	Contract assets vary from one asset to another
Data scalability	Supports custom data types	Support the customized data type of sub array	Supports custom data types	Support multiple extensible custom databases
Nested combination	No native nested design	No native nested design	Support nested combination and other association methods of assets	Support nested combination and other association methods of assets
Permission control	The same permission design as homogeneous assets	Control asset access in the form of white list	The same permission design as homogeneous assets	To extend domain data control access
Contractual relationship	The data is stored in the contract database	The data is stored in the contract database	The data is stored in the contract database	Data assets are separated from contracts and exist independently

Source: [ERC2006, DNFT Protocol Doc](#)

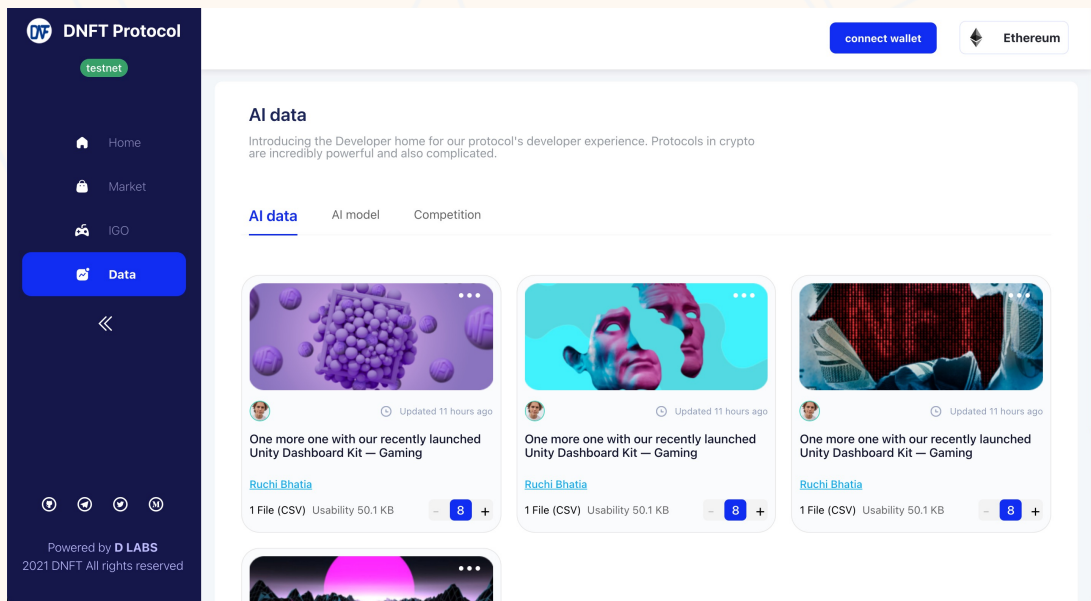
The following demonstrates the process of testing the AI program and the final winning NFT (the winner of the AI program participating in the test):





Source: [DNFT Whitepaper, p.15](#)

These products are currently available on the launchapp of DNFT Protocol's testnet, as well as on data management as service and AI:



The [Data section](#) of DNFT Protocol is the developer hub for the protocol's developer experience. The valid data files currently verified by the platform are displayed on the AI interface (the AI Data column).

- And data models (AI Model column), these data models are packaged in the form of NFT, through the purchase and consumption of native tokens, \$DNF, to purchase part of the ownership and obtain the right to use.
- In the Competition column, these pages are for AI and machine learning data model competitions. On this page, developers can see the topics of the competition, deadlines and reward amounts, rules, and the current leading teams.

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7. Concluding Thoughts

This thesis focuses on the research and exploration of the NFT-based data management system in the Web3 protocol, and the multi-cloud management platform based on the future trend of multi-cloud.

We firmly believe that the core value of NFT assets is not entirely concentrated in the NFT assets themselves, but around NFTs, products and applications derived from the surrounding NFT technology. This article combines the Web3 project that we mainly support, selects the structure and vision of DNFT Protocol, and covers solid cutting-edge infrastructure such as Litentry, Saito Network, RMRK and so on.

The crypto market has passed the stage that could be called baby two years ago. The data market in the Web3 protocol is vast, and the multi-cloud strategy is also an unexplored place for the Web3 cloud. We hope that in the future exploration of DNFT Protocol, we can see more point-to-point, no-credit solutions for data and data management, and return users' rights to data to users, but with a more innovative or breakthrough Way. We look forward to the new NFT primitives and multi-cloud market can have their own Satoshi-moment in the NFT field.

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8. Appendix

- [DNFT Protocol](#), esp. featured
Decentralized NFT cross-chain & AI application, and bridge of NFT cross-chain assets, especially for machine learning and AI model.
- [Litentry](#)
Build a User-Centric world with blockchain, a network that supports cross-chain aggregated identities, built on Substrate, ready for Polkadot.
- [MyCryptoProfile](#)
From metaverse to social network, My Crypto Profile is a Web3.0 identity linker for Ethereum & Twitter, powered by Litentry.
- [Saito Network](#)
Saito is a layer one blockchain that pays nodes in the P2P network instead of miners or stakers, delivering a permissionless and scalable network capable of powering decentralized versions of Web2 Apps.
- [RMRK](#)
Eternally liquid, forward compatible, nested, conditional, & multi-resourced NFTs. RMRK (pronounced "remark") is a set of NFT Legos that give NFTs infinite extensibility, hosted on the Kusama blockchain, without the need for parachains or smart contracts.
- [Clout.art](#)
Clout.art turns your most valuable content, such as your most successful Instagram posts, into unique NFTs. Your content becomes part of a valuable collection of assets and a source of income.
- [Kodadot](#)
Carbon neutral Kusama native NFT platform, built on RMRK Protocol.
- [Metaprime Network](#)
Experimental NFT-focused infrastructure, to provide streamline signals for highly illiquid goods with low-velocity appraisal.

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