DIAMONDS BLOCKCHAINED

4DP 4DC 4D-NFT White Paper

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Investment in Diamonds Made Smart and Accessible

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Abstract

4D Platform (4DP), 4D Coin (4DC), and **4D Non-fungible Token (4D-NFT)** represent a modern approach to the traditional diamond market, which resolves existing limitations and provides access to an attractive investment niche and consume grade diamonds to a broad consumer range.

This is achieved by combining traditional diamond trading practices with modern AI and blockchain technologies crafted into an online platform (4DP). Specifically, **4DP** does:

1. Serves as a gateway for consumers to the pool of diamond brokers to trade diamonds on customer's behalf.
2. Allows to buy and sell certified diamonds in exchange of traditional (fiat) and crypto currencies.
3. Issues transferable and tradable NFT tokens – 4D-NFTs – for each purchased diamond or diamond lot.
4. Provides blockchain ledger of all diamond transactions.
5. Ensures authenticity and genuineness of customers' diamonds.
6. Stores customers' diamonds in custody.
7. Ships customers' diamonds upon a request.
8. Provides AI-powered diamond price estimation.

Each of the platform capabilities discussed in detail in this document.

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Software and real-world components of 4DP

The 4D Platform (**4DP**) consists of the following software components:

- Customer's wallet.
- Customer's diamond vault.
- Mobile and web applications.
- Blockchain engine:
    - Smart contracts.
    - Blockchain coin, **4DC**.
    - Blockchain NFT tokens, **4D-NFT**.
    - Blockchain ledger of all transactions.
- AI-powered diamond price estimating and price forecasting module, **4D-AI**.
- Fiat and crypto-currency exchange module, crypto exchange connector.
- Administrative control panel.
- API, common backend, service bus.

The 4DP platform includes the following real-world processes and facilities:

- Partnership with diamond broker companies and procedure to deliver diamonds from/to the trading floor.
- Diamond storage facilities.
- Diamond shipping procedure.
- Auditing and certification by an independent third-party provider.

Handling of diamonds

4D Platform provides a feasible way for customers to participate in diamond trading business. This is achieved through collaboration with major diamond brokers having access to diamond trade floors in Ramat-Gan, Dubai, New York and Surat.

4D Coin

4D Coin (4DC) is the currency of the platform. All the transactions are calculated, funded, and executed using 4DC. The coin is freely tradable at all major cryptocurrency exchanges.

Originally 4DC issued in the following proportions:

- 50% is offered at the initial coin offering (ICO).
- 40% of the coins is allocated to the 4DP trust to finance future development and maintenance of the platform.
- 10% is provided to selected early investors.

The following issuance model will be used:

- During the ICO there will be 10M 4DC released at the target sale price of 0.8-1.0 USDT per 1 4DC, the mechanism intended to fund the 4D platform.
- The proceeds from the ICO will be used to pay for initial platform development, set up, and bounties, as well as all necessary arrangements for handling diamonds in the real world.
- 0.30 of the total amount initially issued will be issued per year at the 4DP currency exchange module to allow platform users to cover asset purchases and transaction fees.

The issuance breakdown would produce the following distribution, if none of the initially distributed coins are not sold on the market:

	At launch	1 year	5 years
Currency units	1.000	1.300	2.500
ICO	50%	38%	20%
Early investors	20%	15%	8%
4DP trust	30%	23%	12%
Market	0%	23%	60%

The linear supply growth model, same as for Ethereum, gives future currency users a fair chance to acquire currency units. Once the linear supply rate becomes equal to the coin loss rate an equilibrium will be reached. Coin loss will happen because of coin misplacement, death, and such. The coin loss rate can be approximated as a percentage of the total volume in circulation.

Buying diamonds

To buy diamonds a customer executes the following steps:

1. Prices of all available diamonds are estimated by the 4D-AI based on the current diamond values provided by the Rapaport report, RapNet, and IDEX monitoring, $P_{estimated}$, and provided on 4DP web and mobile application. Prices calculated in the currency of the trading floor and automatically converted to 4DC. The AI powered search will prioritize data from the exchanges we are physically present at, though data from RapNet and IDEX will be fed into the system either through integration or a bot.

2. A customer selects parameters (4C+) and quantities of the diamonds to purchase and issues a buy order using web or mobile application. Alternatively, a customer can choose to buy standardized investment diamonds that are always in the pool. Investment diamonds tend to have a high price threshold, on the other hand, low grade stones sometimes are less liquid. 4D Platform will help customers to find balance in the investment, given the fact that diamonds are rather a wealth preservation commodity (they are far less volatile than fiat) than a day-trading instrument.

3. Upon receiving a buy order, a smart contract is generated, which is fulfilled in the following order:
    a. The customer deposits 4DC cryptocurrency into the contract in the amount of:

$$Deposit = 1.25 * P_{estimated} + 2 * F_{broker} + F_{3DP} + F_{storage},$$

where $P_{estimated} - estimated\ diamonds\ price,$
$F_{broker} - broker\ fees,$
$F_{3DP} - 3DP\ transaction\ fees,$
$F_{storage} - 3DP\ storage\ fees.$

    b. The 4DP places an order with a broker for specified qualities, weights, and quantities of diamonds.
    c. A broker buys specified diamonds at market price and is compensated for the purchase price and commission.
    d. Bill of sale, GIA certificate, any other documents confirming the transaction are attached to the smart contract.
    e. The 4DP implements all necessary anti-tampering measures including but not limited to tamper-free boxing, laser etching of diamonds and attaches proofs of the measures to the smart contract.
    f. A 4D-NFT token is generated for each diamond/diamond lot and linked to the smart contract. The 4D-NFT tokens prove the ownership of diamonds, upon the customer's will they can be marked as transferable and tradable.

g. The 4DP transfers purchased diamonds to the storage facility, proof of the step is attached to the smart contract.

h. The customer gets notification, verifies all the artefacts on the smart contract and either accepts the transaction or declines it.
If **the contract is accepted**, then in the same transaction:
- the 4D-NFT token(s) transferred to the customer,
- the customer is credited back a part of the original deposit according to the formula:

$$If\ P_{actual} > P_{estimated}\ then$$
$$Credit = Deposit - \left(P_{actual} + F_{broker} + F_{3DP} + F_{storage}\right),$$

$$If\ P_{actual} \leq P_{estimated}\ then$$
$$Credit = Deposit - \left(P_{estimated} + F_{broker} + F_{3DP} + F_{storage}\right) + Reward,$$

where $P_{estimated} - estimated\ by\ 4D - AI\ diamonds\ purchase\ price,$
$P_{actual} - actual\ diamonds\ purchase\ price,$
$Reward = \frac{P_{estimated} - P_{actual}}{2},$
$F_{broker} - broker\ fees,$
$F_{3DP} - 3DP\ transaction\ fees,$
$F_{storage} - 3DP\ storage\ fees.$

- the 4DP is credited with the remaining balance of the original deposit,
- the smart contract is executed, the proper record is added to the ledger.

If **the contract is rejected**, then in the same transaction:
- the 4D-NFT tokens transferred to the 4DP pool,
- the customer is credited back the original deposit with deduction of broker fees, 4DP transaction fees, and 15% purchase price restocking fee according to the formula:

$$Credit = Deposit - \left(0.15 * P_{actual} + F_{storage}\right),$$

where $P_{actual} - actual\ diamonds\ purchase\ price,$
$F_{storage} - 3DP\ storage\ fees.$

- the 4DP is credited with the remaining balance of the original deposit,
- the smart contract is executed, the proper record is added to the ledger.

Notes of interest:

- 4D-AI estimation engine ensures that originally deposited amount will be sufficient to accommodate for price fluctuations while a broker negotiates the purchase. The 1.25 multiplier gives necessary margin for executing the order.

- The broker fees are fixed, depend on the size and composition of the lot, and can be easily reviewed in the 4DP application.
- 4DP charges consist of two parts: transaction fees and storage fees. The transaction fees cover all the handling of the purchased diamonds and are not refundable. Storage fees cover insurance and storage of the diamonds for at least 5 years. After that a customer must either prolong the storage agreement, or order and pay for delivery to her premises, or issue a sell order. Storage fees are refundable if a customer decides to reject the contract.
- Once a customer accepts the contract, the excessive part of the original deposit is credited back to her as a part of smart contract execution. Specifically:
    - A broker fee as it was reserved twice to cover a possible future sale of the lot in case of contract rejection.
- Upon issuing a buying order a customer automatically agrees to buy specified lot at a market price at the time of transaction plus any applicable fees.
    - Difference between the multiplied by 1.25 estimated price and the larger of the estimated and the actual purchase price.
- If a broker negotiates and buys a lot at a price, which is better, than originally estimated, a customer and 4DP equally share the profits of this transaction. This is reflected in the Credit calculation formula above.
- A customer has an option to reject the contract after a lot was purchased and processed, but before it was put into the permanent storage. In this case the following fees will be forfeited:
    - Broker fees covering initial purchase and later sale of the lot.
    - The 4DP processing fees covering diamond transportation to the storage facility, anti-tamper boxing, laser etching, all 3rd party fees for auditing and certification.
    - 15% of the purchase price restocking fee covering the 4DP costs to sell the lot to other customers.
- Storage fees are refundable and will be returned to the customer in prorated amount. If a customer decides to reject the contract, all of the storage fees are refunded.

Selling diamonds

A customer can sell any lot of diamonds s/he owns.

To do so s/he needs to issue a sale order at market price minus all the transaction fees. Upon issuance of an order a new smart contract is created. The customer has two selling options: 1) Listing, 4DP lists the diamonds on RapNet/IDEX/other and executes the sale once the asking price is met. 2) Fast track, 4DP ships the selected lot of diamonds to the trading floor and works with a broker to sell it as soon as possible while staying within the acceptable discount margin.

Once the sale completes, the necessary evidence of sale (bill of sale, electronic transaction record) is attached to the smart contract.

A customer gets the proceeds of the sale after the broker and 4DP fees are paid.

Diamond storage

4DP provides secure insured storage at the custody of a reputable storage partner.

Diamond shipping

Upon a 4D-NFT owner's request a lot of diamonds can be shipped to the owner in the real world. A customer is responsible for all the handling fees.

Shipping of a lot does not change the ownership of the linked NFT token, but the token is marked as untrusted. Depending on anti-tampering measures taken during the issuance of the token, different revalidation procedures to ensure the diamonds in the lot are genuine will be required. Essentially, a 4D-NFT token can be marked trusted again only once diamonds in the lot are inspected in our premises and securely stored.

*Note: At the time of writing the whitepaper, 4DP team is considering making all deliveries final.

Software components

As noted, the following software components make up the 4DP platform.

- Customer's wallet.
- Customer's diamond vault, a blockchain twin of customer's diamond lots.
- Mobile and web applications for customers to access all aspects of the platform, to manage a wallet and a vault.
- Blockchain engine:
    - Smart contracts
    - Blockchain NFT tokens.
    - Blockchain ledger of all transactions.
- AI-powered diamond price estimating and price forecasting module, **4D-AI**.
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The detailed functionality of the components is defined below.

Customer's wallet

The wallet is where customer's crypto funds are recorded. It also keeps a track of all the transactions with references to ledger records, vault lots and other details to provide full transparency of transactions.

A customer must have sufficient available funds in the wallet to place orders for diamond lots or to cover shipping fees for shipping the owned diamond lots out of the 4DP.

Customer's vault

This is a blockchain twin of customer's owned diamond lots that are in custody of the 4DP. Every purchased lot is matched with a unique NFT, which:

- Unambiguously specifies every diamond in the lot along with related certificates.
- Links the lot and every diamond in it to the smart contracts and blockchain transaction ledger.
- Links the lot and every diamond in it to the audit and other records and documents, confirming diamonds' origin and 4DP path.

A customer can review all the records at any time.

Mobile and web applications

Applications serve as the control panel for all the interactions between a customer and the 4DP, specifically:

- Provide multi-factor state-of-the-art customer's authentication.
- Provide access to the customer's wallet.

- Provide access to the customer's the vault.
- Allow to manage customer's account, open, close, modify account information.
- Drive smart contract generation and provide smart contract execution tracking.
- Provide a view of the transaction ledger specific to the customer's transactions, as well as transactions run in the fiat and crypto-currency exchange module.
- Show inventory/catalogue of available for purchase diamond lots.
- Allow build a diamond lot purchase request with price estimate.

Blockchain engine

The blockchain engine is the core of the 4DP, which ensures transparency and immutability of transaction by keeping them on the public blockchain.

Smart contracts

The smart contracts orchestrate a sequence of interdependent transactions to protect the interests of all the involved parties. The smart contracts are run on the public blockchain, which provides transparency and auditability of all the transactions.

NFT tokens

4D-NFTs (non-fungible tokens) are issued for each purchased diamond lot. Each token uniquely corresponds to a specific lot of diamonds and serves as a blockchain representation of the real-world assets. All artefacts related to the specific lot are accessible through the lot's 4D-NFT.
*Note: At the time of writing the whitepaper, 4DP team is considering to issue a token for each diamond, as it will give customers more flexibility in liquidating their assets.

Any 4D-NFT can be converted to a transferrable 4D-NFT (4D-NFT). t4D-NFTs are an extended version of 4D-NFT, which recorded on the same public blockchain. In addition to all the benefits and capabilities of a 4D-NFT, t4D-NFT ownership can be transferred to an arbitrary 3rd party upon execution of a transfer smart contract for a nominal fee. A new owner then is in full control of the associated diamond lot and can sell the lot, ship the lot out from 4DP, or transfer the lot at her will.

Diamond transaction ledger

The public blockchain transactions ledger keeps the record of all purchase, sell, ship out, transfer transactions on the 4DP. It can be independently viewed and audited by customers or 3rd parties.

4D-AI diamond price estimation and price forecasting engine

The price estimation engine is a built-in feature of the 4DP and provides accurate price estimates based on the current market conditions and characteristics of a particular diamond.

4D-AI outputs are used when determining the amount of deposit for buy orders and to provide customers estimated value of the lots in their possession.

Fiat and Crypto currency exchange module, 4D Exchange

4D Coin will be tradable at major cryptocurrency exchanges once ICO done. t4D-NFTs will be tradeable at selected major cryptocurrency exchanges once they issued.

In addition to the external exchanges the 4DP implements its own 4D exchange module – 4D Exchange – that serves the following purposes:

1. It allows to convert fiat and other cryptocurrencies to 4D Coin inside the 4DP infrastructure. 4DC is the only cryptocurrency used for all calculations and transactions on the 4DP.
2. It provides a trading platform for t4D-NFTs (transferrable 4D non-fungible tokens). Other customers can bid on the available for sale t4D-NFTs and acquire ownership of the corresponding diamond lots upon execution of a transfer smart contract.
3. It serves as the in-port for the 4DC supply. All generated 4D coins are initially available through 4D Exchange.

Administrative module

The module allows the 4DP manage the platform, user management, perform real-world transactions, resolve customer's issues, introduce new features, monitor and tune performance of the platform.

The personal information of 4DP customers is not collected and thus is not accessible through the administrative module or any other means. It is up to 4DP customer to decide if they want to deanonymize their accounts and link them to their real-world identities. If such decision is explicitly made by a customer, all real-world information is stored in physically separated system and accessible by dedicated 4DP personnel with strict control of the access privileges.

Common backend

This is the orchestration layer that allows all the software components to communicate to each other. The component provides "translation" between different representation of platform artefacts for the purpose of user- and system-facing components.

Public automated programming interface (API)

At the time of writing, the 4DP does not provide any public facing interfaces for customers or users to automate transactions. All the smart contracts and blockchain transaction on the public blockchain can be inspected using the standard means for viewing such artefacts on the blockchain. Specific realization details are published in RFCs, see *References*.

References

1. 4DP public repository at GitHub
2. Ethereum white paper
3. ER721
4. ER20
5. 4D smart contract RFC
6. TRON?