# MediNomi

## A DEX-driven Payment and Financing System
## for Medical Businesses

**August, 2020**

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# 1. What is MediNomi?

Pulling itself out of a strong blast of ICO storm in 2017, the blockchain industry has now been looking for products that will bring blockchain's value to non-tech, non-business consumer audience. Recently, many mainnets have been competitively launched, but the service products that users really can feel grounded in practical applications are not brought in view. This is one of the reasons why blockchain services having ties with the real economy (e.g., payment networks for social commerce such as Terra, and microgrid platforms such as Power Ledger) are drawing much public attention. The medical field is no exception. For example, projects such as *MediBloc* and *Pationtory* are aiming at safely managing and distributing medical data by applying blockchain technologies.

A variety of blockchain-based services relating to medicine are recently coming on, but there are by far no blockchain-based medical services that treat patients (and hospitals, for that matter) as beneficiaries. Although cryptocurrency-based payment settlement for medical expenses is considered to be very important in health care where blockchain technology can be optimally utilized, yet the market witnesses no actualized services as such.

The MediNomi project aims to build a realistic blockchain-based token economy in terms of which all the interested parties involving patients, medical students, medical practitioners, and hospitals are incentivized to utilize the MediNomi system for medical payment and loan-servicing.

- **MediPay**, one of the two services of MediNomi, serves as a payment settlement system for uninsured medical services which benefits both patients and hospitals.
- **MediFi**, MediNomi's DeFi (Decentralized Finance) service, provides medical students, (starting) medical practitioners and hospitals with the financial resources that they need in an easier and more economical way.

# 2. MediPay

## 2.1 Market Condition

Medical insurance is one of the most important social problems in modern society, and uninsured medical services, which cannot be covered by insurance, causes various problems with regard to market transparency. In Korea, all of the medical treatments and procedures not covered by National Health Insurance are classified as uninsured medical practice. Uninsured medical services in turn are classified into 'statutory uninsured' and 'arbitrary

uninsured' medical services. Arbitrary uninsured medical services are basically illegal, and some of them are allowed only if certain conditions are met.[1] Uninsured medical services are classified as 'uninsured in principle' (medical services such as plastic surgery and skin care that are not related to treatment of disease), 'medically uninsured' (untested but cost-effective medical services) and 'financially uninsured' (medical services excluded from coverage due to high costs of treatment).

The uninsured-in-principle medical services include LASIK, LASEK, cosmetic surgery, skin cosmetic surgery, etc. Among them, the size of the domestic plastic surgery market is about 5 trillion won,[2] and dermatology is 18% of the cosmeceutical field, which is about 2.1 trillion won.[3] In addition, the treatment of foreign patients can be legally processed as arbitrary uninsured medical services. As of 2015, the global medical tourism industry is expected to grow 15% annually for 10 years, to reach $ 143.8 billion by 2022.[4] The domestic medical tourism industry has also grown in size and is rapidly expanding. It is estimated that the medical tourism yielded the value-added creation of 2.1 trillion won by attracting 360,000 foreign patients in 2016 and the employment inducement effect was 52,000.[5]

## 2.2 Problems with Uninsured-in-principle Medical Expenses

One of the biggest problems of arbitrary uninsured medical services is that the patient has no other option but to follow the prices autonomously set by medical institutions. The difference in the price of the uninsured items between medical institutions is found to be 7.5 times on average. It is true that even considering the realistic price inconsistency of the first, second and third medical institutions, there still exists an irrational difference. This hinders the rational choice of consumers, making it difficult to expect effects of inducing price competition, and ultimately leads to consumer distrust of doctors and hospitals.

In addition, the entire medical expenses of the uninsured items including VAT are transferred to the patient when the medical fee is paid on the patient's credit card. Even when the payment is made in installments, the patient has to bear the burden of the excessive credit card fees. In the case of cash settlement, a secret discount of about 10% is usually offered, but this leads to the burden of lump-sum payment on the patient, and the patient is likely to be abused as a

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[1] The Korean Supreme Court handed down the ruling that uninsured medical services be allowed on the responsibility of medical institutions only if there are 'inevitability', 'medical validity' and 'consent of patient' on relevant medical services.

[2] International Society of Aesthetic Plastic Surgery(ASAPS), 2017.

[3] "Anti-aging: A New Growth Engine", Samsung Economic Research Institute (SERI), 2013.

[4] Allied Market Research, 2017.

[5] Korea Institute for Industrial Economics and Trade (KIET), 2017.

means of tax avoidance of the doctor. On the hospital side, too, the credit card settlement process leads to a worsening of profitability due to the occurrence of 2-3% settlement fee, and the high discount rate practice of cash settlement makes it more difficult to improve profitability. Furthermore, the hospital faces the burden of receiving tax avoidance charges. From December 1, 2016, uninsured medical care costs went into being disclosed based on the medical law, and the pressure to eliminate the 'information asymmetry' between providers (doctors and hospitals) and consumers (patients, families, and the general public) looks unavoidable. From April 1, 2017, the number of medical institutions to disclose uninsured medical expenses is expanded to 3,752, and standardization items for disclosure have been gradually increasing to 200. HIRA (Health Insurance Review & Assessment Service) is also making continuous efforts to identify and standardize uninsured medical services.

Medical tourism, which occupies a considerable portion of the market of uninsured medical services, also faces a number of problems. In the case of overseas patients, many of them are victimized by improper operation of unauthorized or illegal agencies connecting patients and hospitals. Agency fees are as high as 15-30%, and these costs are passed on to the patient. In most cases, medical services are provided through simple visits and surgeries. Therefore, there is no way to select appropriate medical care prior to visiting Korean hospitals or obtain the information on medical expenses in advance. Also, there is no way to get after-care services after returning home. Although medical tourism consumers are increasingly distrustful about Korean medical services, the lack of information on medical institutions and medical services is leading to a vicious circle in which foreign patients are not provided with appropriate medical services. With respect to payment of medical expenses, medical tourism which requires only cash settlement imposes inconvenience on overseas patients, and in the case of card settlement, various problems such as exceeding limit are occurring.

## 2.3 Goal of MediPay

Given the market conditions described above, it is urgent for both patients and hospitals to overcome the absurdity of medical insurance payment practices as well as securing the market transparency of uninsured medical services. The market that MediPay is noticing is the uninsured-in-principle medical services, which have nothing to do with the market of insured medical services. MediPay is a blockchain model that benefits both the patient and the hospital by creating a healthy token economy with respect to payment of medical expenses and medical services.

The ultimate goal of MediPay is to improve the payment practices of uninsured medical expenses, which currently have many problems, and to provide blockchain-based services that benefit both patients and hospitals. To this end, MediPay provides a way for payment to

be made through cryptocurrency transfer between patient and hospital that blocks the agency's ill-gotten profits and does not go through the credit card company and PG (Payment Gateway).

Settlements by MediPay's cryptocurrency (i.e., MDC) allow hospitals to reduce the burden of credit card fees or cash discounts. Hospitals can use the MediPay environment to attract patients by offering reasonable discounts to patients on a portion of the benefits resulting from using the MediPay system.

With MediPay, patients can now choose from a variety of payment methods and affordable medical services. It is also possible to make an installment payment, which is impossible in the case of cash settlement. This makes it possible to significantly reduce the burden of lump sum payment of medical expenses only by paying a commission that is significantly lower than the credit card installment payment. In the case of overseas patients, there is no need to pay a high commission fee for the agency, and it is possible to select quality medical services at a reasonable price. It also reduces the inconvenience of exchanging large amounts of cash for medical service payments and the risks associated with exchange rates.

Along with these payment services, MediPay plans to introduce the management function of medical services to maximize the convenience of patients (especially, overseas patients) in terms of providing a medical service environment of the proactive and follow-up management rather than one-off. For this purpose, MediPay will provide appropriate medical service information through remote video consultations between patients and doctors, which will be operated in a way to enhance customer satisfaction and reliability through regular follow-up services mediated by the consultation link.

Through this approach to payment and medical services, MediPay seeks to build a token economy that benefits both consumers and hospitals.

# 3. MediFi

## 3.1 Market Condition and Problems

The blockchain industry has been seeing a variety of platforms and services continuously coming out in the market, but it is still hard to find the realistic products and services that the public can experience. In the meantime, new models to increase the profitability of cryptocurrency are recently being developed. For example, BlockFi has developed the model that pays a compound interest of 6% per year if a user stakes his/her cryptocurrency, and

lends these financial resources to institutional investors and raises profits. In two weeks, the amount of cryptocurrency equivalent to $ 25 million was collected in BlockFi's account. Nexo, based in Europe, is the world's first blockchain model to provide loan-servicing that uses cryptocurrencies as collateral, and SALT Lending, a blockchain platform in the United States, provides loan services in 35 states. Blockchain-based loan servicing is closely related to the real economy, so the holders of cryptocurrencies are looking at the possibility of a new profit model beyond simple profit-taking. In this regard, it is worth noting the diagnosis of Noel Acheson, a *coindesk* writer: "The focus on yield implies a growing maturity and could entice new investors in as the dovish stance of central banks perpetuates the dearth of income elsewhere."[6]

The current social standing of doctors is much lower than in the past, and as the threshold of lending to starting medical practitioners is getting higher due to the conservative loan policy of financial institutions, many doctors are having difficulty in practicing. Existing medical institutions which have entered into a fiercely competitive system are increasingly in need of financial resources for publicity marketing, medical equipment introduction and hospital remodeling/expansion. However, it is a reality that they are also experiencing considerable difficulties due to one-track loan system and high interest rates. Even if financing is possible, the interest rate for the first financial sector runs to 3.5%~5%, and the second financial lending for doctors with low credit scores requires a high interest rate ranging from 10% to 30%. The current loan system can be seen only as an extremely backward system that focuses only on interest income, with little consideration of the characteristics of the medical sector, as opposed to a precise analysis of the expertise and safety of the profession and the history of individual financial operations.

Under the circumstances of the current financing market, it would be a great support for doctors and medical institutions if they could be offered easy loan procedures and reasonable interest rates.

Many medical students are also experiencing economic difficulties due to the murderous tuition fees of medical graduate schools. If student loan services with reasonable interest rates are available, they can have a positive impact on the supply and demand of medical personnel.

## 3.2 Goal of MediFi

MediFi is a blockchain-based P2P financial service for medical graduate students, practitioners, and hospitals. By focusing first on P2P loan-servicing between medical doctors

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[6] Acheson, Noelle, "Returns on Crypto Assets: The Hidden Message," *Coindesk*, April 7, 2019.

and medical graduate students,[7] it would be possible to start the business quickly without a large amount of capital. Loan screening will be conducted through collaboration with relevant fintech and consulting companies.

MediFi's initial operating funds are secured by "successful doctors" with cash reserves of over 2 billion won or annual income of 200 million won whose investment money will be used for operating MediFi financing. The MediFi system will be built so that it takes only 15 minutes from loan application to approval, and the borrower can choose the interest rate (floating and fixed interest rate), repayment period, and repayment method. Through strict loan criteria, the loan is approved according to whether the borrower is currently working or whether he/she can start working within 90 days after he/she is offered a job. Because MediFi is a business connected with a reliable human ecosystem in that borrowers and lenders are all medical specialists, it is expected that the incidence of bad debt will be considerably low. Even if the collection of loans is expected to be difficult, MediFi will be designed to maintain the soundness of the loan fund by providing consulting services to relieve the debtor. As the size of MediFi grows, it will also be possible to expand MediFi's services to PF (Project Financing) for the construction of new medical buildings.

# 4. Token Economy of MediNomi

## 4.1 MediNomi Tokens: MDC and MDN

The MediNomi ecosystem is operated on the basis of two tokens, MDC (MediCash Token) and MDN (MediNomi Token). As a crypto-backed stablecoin, MDC is pegged one for one to USD. MDC, however, differs from other stablecoins such as Dai and Terra in that it is absolutely non-volatile, which means that 1 MDC always has the fixed value of 1 USD, and can be used as such for any transactions in the MediNomi economy. MDC is primarily used as a means of payment to ensure the soundness of the uninsured medical market. It is also to be used for payment settlement between hospitals and suppliers of medicine and medical consumables, which will help to make their transactions more efficient and smooth.

Another token operated by MediNomi is MDN, which serves as the backbone of MediNomi's token economy. MDN is a PoS (Proof-of-Stake) token responsible for the governance of MediNomi to consolidate the security and stability of the MediNomi platform. In terms of token

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[7] This loan system is inspired by the financing system of SoFi which started the online loan service by linking university alumni and students. With its successful financing system, SoFi has grown to a big company with over 1,300 employees.

economy, it plays a role to collateralize MDCs, so non-volatile MDCs can always be generated from locked-up MDNs.[8] (As mentioned above, the value of MDC is fixed at USD, but the amount of MDCs that the user gets at the time of MDC-minting may marginally vary due to price-volatility of MDN.) For operations of MediNomi's token economy, a fixed amount of MDNs are issued through a single inflation at the beginning of the MediNomi service. The total volume of MDNs and the exchange value at issuance are as follows.

• Total Issue Amount: 1 billion MDNs
• 1 MDN = 0.1 USD

Considering the market breadth of the medical businesses that we are focusing on, the initial circulation volume of MDNs looks moderate. Thus, it is possible to issue additional MDNs when the MDN pool reaches the deflationary juncture due to MediNomi's revving-up economy, which creates a need for increasing MediNomi's reserves.

## 4.2 Token Economy of MediPay

Basically, MediPay offers an alternative to cash and credit card payment in the market of uninsured-in-principle medical expenses. It relieves the consumer's burden of lump-sum cash preparation, and alleviates the burden of overseas patients' exchanging and carrying out large amounts of money. For hospitals, it provides an environment in which the profit structure can be improved by avoiding the problems of credit card fees and agency commissions. For these services, MediPay receives 0.5% of MDC payment as a fee, which is much lower than 2~3% of credit card fees.

MDN serves to back or collateralize MDC, thereby maintaining MDC's value hard-pegged to USD. Basically, the MediPay token economy is operated by the circulation volume of MDCs generated from MDN. There are two ways the users can secure MDCs. Either way, they should first join the MediNomi ecosystem by purchasing MDNs with their crypto- or fiat-currency at the exchange, and then can freely employ their MDNs for arbitrage trading or interest earnings. When a user needs MDCs for medical treatment, he/she can lock up a certain amount of MDNs and get the needed MDCs whose amount is only limited by the over-collateralization ratio.[9] The user can regain his/her locked-up MDNs by returning the same amount of MDCs that he/she received at the time of minting. A certain amount of 'stability

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[8] It can be said that MDN is deposited to create a CDP (Collateralized Debt Position), and MDC is generated from CDP, as proposed in Maker's Dai Stablecoin System.
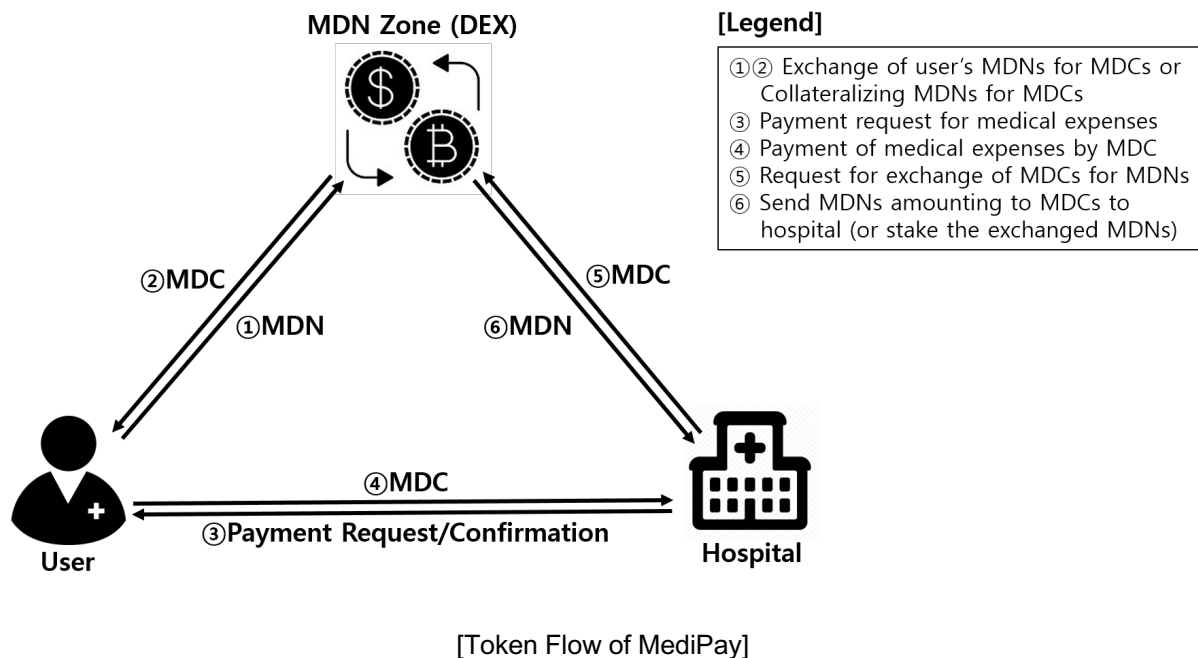
[9] The initial over-collateralization ratio is expected to be 150%. For example, by collateralizing 10 MDNs (amounting to 1 USD), the user gets 0.66 MDC (that is, 0.66 USD). However, this ratio could change depending on how massively MediPay is adopted along with wholesome transactions.

fee'[10] (to be paid in MDN) along the lines of MakerDAO, is charged for MDN reimbursement. Another way of securing MDCs, which makes MediNomi differ from the existing crypto-backed stablecoin models, is that MDNs can be directly converted to MDCs at the current MDN-MDC exchange rate. For MDN-MDC exchange, 0.1% of commission is charged, which is much lower than that of fiat money exchange. (The fee is equivalent to the transaction fee of cryptocurrency exchanges in general.) In these exchange transactions, MDN works like a kind of 'convertible currency'. Since MDC has zero-volatility, the user can earn more MDCs if the value of MDN is higher than the face value (i.e., 0.1 USD). This way of getting MDCs would be useful for a user who knows in advance how much MDCs would be charged for his/her medical treatment. And it would also relieve the user from worrying about MDN-MDC exchange fluctuation. All that matters for the user is how much or less MDCs he/she gets at the time of exchange. It also mitigates the disadvantage of crypto-backed stablecoin which requires over-collateralization and leads to inefficient use of liquidity. However, locking-up of MDNs could be still a preferable option for the users who expect the value of MDN to rise, since they can always reimburse MDNs by returning the same amount of MDCs received at the time of minting. One thing to note here is that since unlike stablecoins such as Dai, MDCs cannot be purchased or sold at the exchange, MDCs converted from MDNs can only be used for medical payment or MDN reimbursement.

The amount of MDCs that users get in exchange of MDNs naturally depends on the market price of MDN. For example, if the value of MDN is high, they will get more MDCs in exchange, and vice versa. Nevertheless, the difference in exchange rate is expected to be marginal in the early stage of MediPay service. As the ecosystem of MediNomi is vitalized, the value of MDN sure will increase, which is beneficial for both MediNomi and MDN holders. However, both of them could suffer loss on MDN downswing. This kind of big loss, known as "Black Swan event", is very unlikely to happen because the primary purpose of getting MDCs from MDNs is to use MDCs for payment settlement. However, we plan to implement MediNomi protocol in terms of which MDN collaterals are involuntarily liquidated for the sake of MediNomi economy in case the value of MDN reveals a sharp downswing. The way MDNs are liquidated is as follows: When the value of MDN falls below the designated line where the value of MDC gets intolerably higher than that of MDN, the MediNomi protocol sells the user's staked MDNs, and buys back the user's borrowed MDCs, thus terminating the smart contract. Again, this is not very likely to happen, and the MediNomi system will include this liquidation procedure as a last resort to stabilize the MediNomi ecosystem.

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[10] The stability fee can be thought of as the interest rate for minting (i.e., borrowing) MDCs. MDN holders determine the percentage of stability fee through MediNomi's governance system.
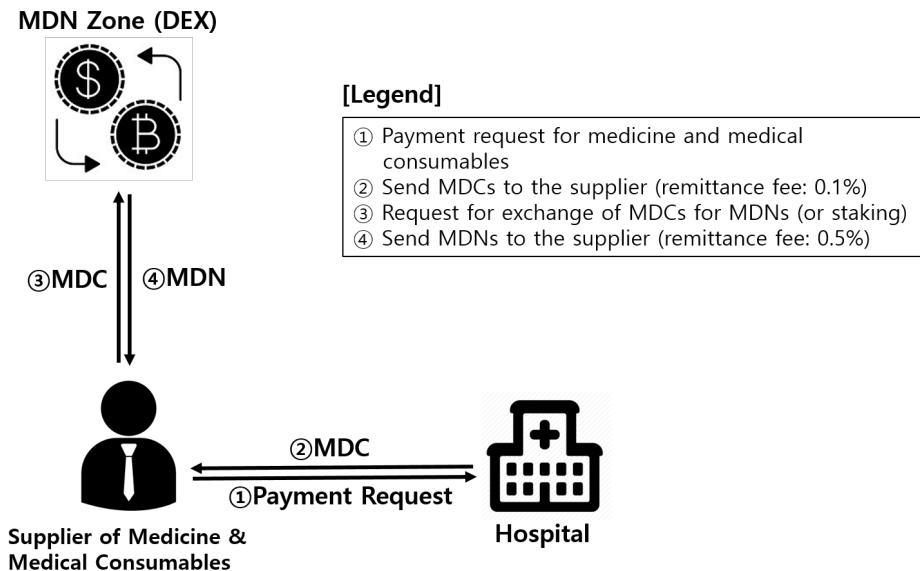
With MDCs as a settlement currency, the patient can avoid the management risks and high commissions caused by the exchange of foreign fiat currencies. The hospital may immediately make a request to exchange the amount of MDCs paid for medical expenses for the MDNs, which in turn can be exchanged for other cryptocurrencies or fiat currency. If they expect the value of MDN to increase, they may hold their MDNs for arbitrage trading, or stake them to participate in MediFi's investment portfolio. The hospital can apply an autonomous discount rate to MDC-paying customers so that the use of MDC can benefit the patient. The hospital is still able to secure a reasonable level of profits in terms of the low exchange fees, the reasonable pricing of medical expenses, and the prevention of the agency's ill-gotten profits. These payment settlement and reward systems are expected to lead to the activation of MediPay, which will create a virtuous circle of MediPay's token economy.



**MDN Zone (DEX)**

**[Legend]**
① ② Exchange of user's MDNs for MDCs or Collateralizing MDNs for MDCs
③ Payment request for medical expenses
④ Payment of medical expenses by MDC
⑤ Request for exchange of MDCs for MDNs
⑥ Send MDNs amounting to MDCs to hospital (or stake the exchanged MDNs)

②MDC  ⑤MDC
①MDN  ⑥MDN

④MDC
③Payment Request/Confirmation

**User**   **Hospital**

[Token Flow of MediPay]

As mentioned in Section 2.3, MediPay provides an environment that allows consumers to use medical services after acquiring sufficient information on the treatment and expenses through video call counseling before visiting the hospital, which will serve to improve patient satisfaction and reliability. In order to provide consultation services for overseas customers, a reasonable amount of MDCs will be charged as a fee for providing the services including translation, and 50% of this MDC fee will be paid to the doctor as a consultancy fee. Post-management services will operate in the same way. With this quality consultation service, many sticky problems of the uninsured medical service market such as lack of information and patient-doctor trust formation will be mitigated.

As a general-purpose payment method for medical businesses, MediPay will also be used for transactions between hospitals and suppliers of medicine and medical consumables, which

works almost the same way as the consumer-hospital payment settlement. Hospitals can use their MDCs to pay MediNomi-registered suppliers for the expenses of medicine and medical consumables they purchased. The suppliers can immediately exchange the received MDCs for the MDNs at MediNomi DEX.



**MDN Zone (DEX)**

**[Legend]**
① Payment request for medicine and medical consumables
② Send MDCs to the supplier (remittance fee: 0.1%)
③ Request for exchange of MDCs for MDNs (or staking)
④ Send MDNs to the supplier (remittance fee: 0.5%)

③MDC  ④MDN

②MDC
①Payment Request

**Supplier of Medicine & Medical Consumables**

**Hospital**

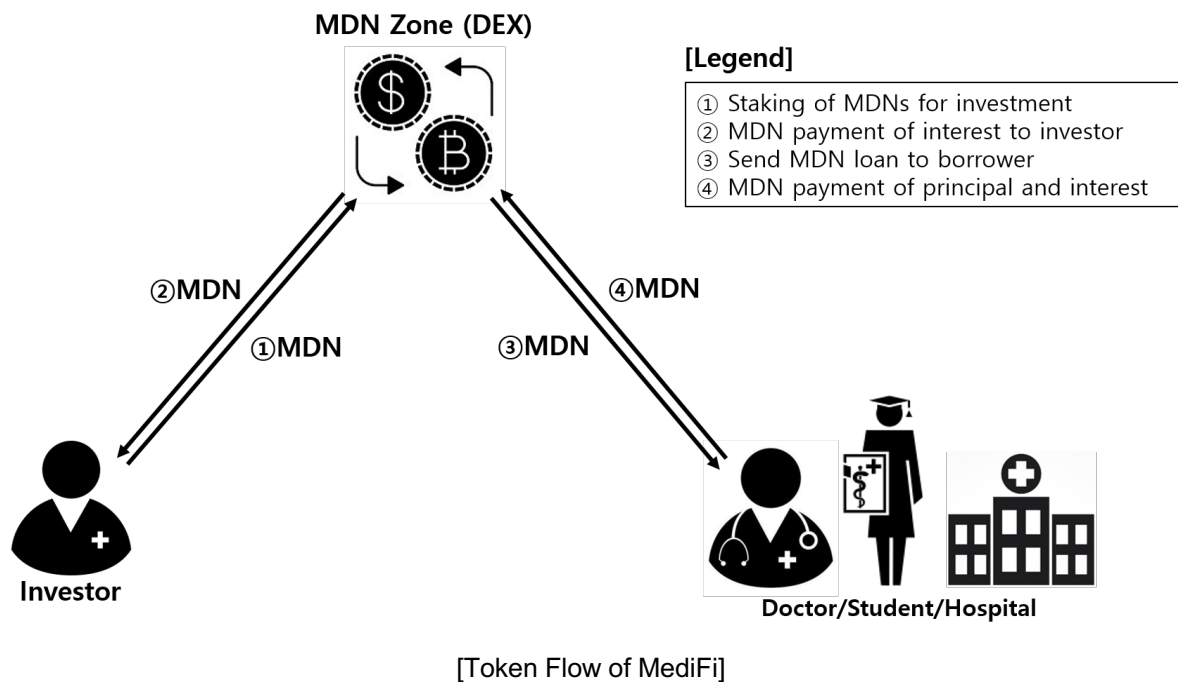[Token Flow between Hospitals and Suppliers]

# 4.3 Token Economy of MediFi

MediFi will be put into force when the token economy of MediNomi matures to the extent that it is possible to start the loan business, but as mentioned in Section 3.2, it is also possible to implement the service by operating the initial MDN investment staked by the participating doctors.[11] MDC tokens used to pay for medical expenses can also be exchanged for MDNs and staked for MediFi's fund management for lending services.

MediFi basically operates as a P2P loan system between a lender and a borrower. The lender is doctors and hospitals, or individual MDC/MDN holders, who will receive fixed interest earnings from their MDN staking. In the case of doctors and hospitals, they have the option of choosing the profits created by the value increase of MDN (arbitrage trading), or switching their staked MDNs to the investment when an investment request is made. Individual users

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[11] It seems desirable to operate MediFi's initial investment fund by connecting medical graduate students who wish to receive a loan with their alumni doctors in a way of applying the financing model of SoFi. This will contribute to enhancing the reliability of the services by highlighting the social functions of MediFi at the beginning of the business. SoFi started its business in this way and expanded its services to become a successful online finance company with 1,300 employees.

possessing MDCs for MediPay services can also exchange their (remaining) MDCs for MDNs and stake them for future profits.



**MDN Zone (DEX)**

**[Legend]**
① Staking of MDNs for investment
② MDN payment of interest to investor
③ Send MDN loan to borrower
④ MDN payment of principal and interest

②MDN
①MDN
④MDN
③MDN

**Investor**

**Doctor/Student/Hospital**

[Token Flow of MediFi]

MediFi shares with investors the interest earnings which significantly lower than that of the financial sector. MediFi also secures the financial resources of the system operation resources by imposing a small currency exchange fee.

# 5. Implementation of MediNomi DEX

## 5.1 COSMOS Hub and MDN Zone

The COSMOS network, one of the representative third-generation blockchain platforms, is an interchain protocol that enables transactions between various kinds of chains under the slogan of 'Internet of Blockchains'. To ensure interoperability and run a high-performance blockchain network, the COSMOS network adopted a PoS (Proof-of-Stake) algorithm that is different from the existing consensus algorithms. The COSMOS network uses the proprietary PBFT (Practical Byzantine Fault Tolerance) PoS algorithm called "Tendermint", which was devised to solve the problems of resource waste and scalability that Bitcoin and Etherium's PoW (Proof-of-Work) algorithms suffer from. The COSMOS network is a platform that can be used for various services, but the finality and interoperability provided by the COSMOS network particularly have a more powerful efficacy when payment settlement systems are constructed.

What matters most in a blockchain-based payment system is 'finality'. There are two types of finality: probabilistic finality and fast finality. In the case of fast finality, after a certain block point, the transaction is fixed at 100%. In the case of probabilistic finality, however, it is possible to invalidate the transaction theoretically by overwriting the block although it has a very low probability. Even with fast generation of blocks and massive TPS capacity, what really matters to me, as an interested party for payment settlement, is when my payment transaction is received and I will finally be able to confirm my transactional information in the block, that is, when the block is overwritten so that I can be sure it will not be invalidated. If one block is generated every 0.5 second and 600 additional blocks should be created to probabilistically finalize the transaction, it means that the payment is finalized after waiting for 5 minutes during which 600 blocks are created. On the other hand, if there is a chain with a block creation rate of 20 seconds, the payment settlement can be finalized much faster compared to the probabilistic finality chain with a block generation rate of 0.5 second.

Another important factor when designing a blockchain payment system is 'interoperability'. In order for users with various digital assets to use blockchain services for payment, it is common to change their cryptocurrencies through an external exchange. Because it is difficult for the exchange of assets between different chains to be performed on the blockchain, it is necessary to provide a deposit and withdrawal wallet and to collect and display orders in order to trade the assets issued on multiple platforms. However, the existing exchanges have many problems such as hacking risk, insider embezzlement, market manipulation, and internal transactions. In order to use an exchange, furthermore, it is necessary to go through an unfavorable user interface such as membership registration and KYC (Know Your Customer), so many users make excursions from the process of exchanging assets. In order to solve this problem, payment services have appeared that exchange cryptocurrencies by operating a decentralized exchange on a blockchain or by introducing an escrow function. However, these services also have platform limitations because tokens using the same blockchain can be only exchanged. Using a DEX built on COSMOS network could be one of the best ways to get around the above-mentioned problems. An exchange created on the basis of the interoperability of COSMOS network can exchange all kinds of digital assets regardless of blockchains and can provide a safe trading environment free from hacking or insider embezzlement because the user has the right to control their assets. Based on this kind of DEX, the payment system can be built that users with various cryptocurrencies can easily use.

MediNomi's DEX through MDN Zone on COSMOS network also aims to implement the services that facilitate the distribution of various cryptocurrencies for payment of medical expenses and financing, thereby providing the safe and sound settlement services and realizing the convenient circulation of digital assets.

## 5.2 Implementation of MDN Zone

### 5.2.1 Cosmos SDK

Cosmos-SDK has many advantages over the existing methods of developing a decentralized application (dAapp). Previously, developers had to choose between the two options to develop dAapp: (1) to learn other programming languages such as Solidity and Plutus to create a smart contract or 2) to fork Bitcoin's reference client. Thanks to Cosmos SDK, developers can now use its framework on which they implement their own blockchain. Because the framework is made up of custom modules, developers can quickly and easily develop a blockchain called "zone".

MDN Zone uses Cosmos-SDK to implement various service applications required to realize MediNomi's token economy on the Tendermint Core and consensus algorithm. Cosmos SDK obviously helped us implement the working version of MDN zone in a much easier and faster way.

### 5.2.2 Privacy on Blockchains

Because of the characteristics of blockchain technology, all transactions written on blocks cannot be tampered with, and anyone can inquire into them so that 'peers' who do not know each other can trust each other. This, however, is creating new issues in regard to privacy. Recently, as electronic wallets have become more and more connected to SNS messengers such as Telegram, personal electronic wallet addresses (*i.e.*, public key), unlike bank account numbers, are rapidly becoming available to the public. The problem is that you can inquire into the transaction history of a specific individual such as payment settlements on all of the relevant blockchains by looking up in his/her public wallet address. Obviously, this can lead to serious privacy and security problems. To solve these problems, MDN Zone is developing a DEX module that incorporates the function of private transmission based on 'Unique Ring Signature' technology.

With its advantages in many respects, DEX is not free from problems with privacy. Although DEX has emerged to deal with problems such as hacking and embezzlement occurring on and off at centralized exchanges, it again creates a problem of privacy that leads to disclosing both the customer's assets and the breakdown of his/her orders. The existing centralized exchanges are supposed to play a role to responsibly keep the customer's entrusted assets, and stitch up the transactions through the matching engine when the customer makes an order. In this type of transaction, there is no concern about privacy because the assets and orders that are entrusted to the exchange are not to be disclosed to the public. However, it is difficult

to take appropriate countermeasures when the customer's assets are hacked or the exchange commits internal embezzlement or maliciously fiddle the customer's order. DEX has been introduced to overcome these disadvantages of centralized exchanges, but it also has the task of overcoming the aforementioned privacy problem and various other disadvantages. MediNomi's distributed exchange (also abbreviated as DEX), which has been implemented on MDN Zone and will be further enhanced, allows transaction to be made without entrusting the customer's assets and orders to third parties by combining it with anonymization protocol to keep his/her assets and orders secure.

The Ring Signature technology to be implemented on MDN Zone is the protocol underlying Monero, one the representative anonymous cryptocurrencies. Ring Signature, a cryptographic technique released in 2001,[12] was designed as a way to deliver internal messages while protecting the original informant. It is being used as the mechanism of Menero's cryptographic protocol to protect the transaction history of cryptocurrencies. Monero has since become one of the most representative anonymous cryptocurrencies along with Dash and Zcash. In the Ring Signature mechanism, the asset sender delegates the asset to the ring which collects several transactions instead of directly delegating the receiver the digital key that indicates the right to the asset. The user can directly create a ring, or he/she can join the already created one. If the receiver signs the key file received from the sender with his/her private key, the asset locked in the ring can be settled. When the transactions are collected in the ring and delivered to the receiver, the third party cannot directly match the sender and the receiver, thereby protecting the privacy.

The first working version of MediNomi DEX has been built that is currently ready for providing MediPay services for payment settlement between customers and hospitals. MDN Zone on COSMOS Hub is also armed with Ring Signature functionalities to protect the user's privacy, and will continue to advance MediNomi services rigorously protected by cryptographic techniques such as Unique Ring Signature and Zero Knowledge Proof.

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[12] Rivest, Ron, Adi Shamir and Yael Tauman, "How to leak a secret," ASIACRYPT 2001, *Lecture Notes in Computer Science* Vol. 2248, pp. 552–565, 2001.

# 6. Roadmap

## 2021

Q1:         Implementation of MediPay 1.0

Q2:         MediNomi Token (MDN) Private Sale

Q3:         Launch of MediPay Service and Distribution of dApp

Q4:         Initial Exchange Offering (IEO)

Launch of MediPay Service for Foreign Customers

(mainly focusing on Chinese customers)

## 2022

Q1:         Implementation of MediFi 1.0

Launch of MediFi Service

Q3:         Integration of MediPay/MediFi Services

Q4:         R&D of CRM for Uninsured Medical Services

## 2023

Q1~Q2:         Implementation of MediNomi-CRM 1.0 and Testnet Operation

Q3~Q4:         Launch and Operation of MediNomi CRM