

In the name of God.

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This article is only for providing some basic knowledge, definitions, and understanding at the public level, and there won't be any technical terms.

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IP-to-IP (IPtoIP, IP2IP, or IP/IP) and IP-to-ID (IPtoID, IP2ID, or IP/ID) Offline Transactions

One of the most significant types of transactions in the offline banking world is the IP2IP transaction and the IP2ID transaction, which in today's world and under conditions of banking recessions are exceedingly practical. It can be stated that this type of transaction constitutes the greatest assistance to the economic system of a country.

What Are the Applications of IP Transactions, and What Type of Transaction Is Referred to as IP2IP in the Banking Network?

IP2IP (Internet Protocol to Internet Protocol) transactions, or in effect, silent transfers, have been designed and developed for supporting or concealed structures and for the creation of large-scale financial exchanges within the banking system. However, the execution of this type of transaction is an exceedingly difficult undertaking for both the sender and the receiver. In this type of transaction, should both parties wish to carry out the transfer in a lawful manner, they must obtain numerous permits from various organizations and bodies, particularly monetary oversight organizations. The names of some of these bodies were mentioned in previous articles, and brief explanations regarding the type of operation and specialization of each body were provided.

This type of transaction is conducted lawfully for several different reasons, the most principal of which may be enumerated as follows:

1. Establishing balance within the banking network and treasuries throughout the world and rectifying imbalances.
2. Equalizing and balancing the deficits of banks operating under the central bank of each country.
3. Settling interbank deficits and debts, whether domestically or internationally.
4. Monetization and the creation of backing and financial volume for printed money or fiat money (fiduciary currency), also known as decree money.
5. Creating backing through this type of transaction for the printing of new and approved currency with backing.
6. Creating digital money and constructing new monetary structures in every type and every currency (monetary unit) of a digital nature.

It is preferable to first discuss the IP2IP transaction:

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IP-to-IP Offline Transactions and Their Role in the Transformation of the Global Financial System

In today's world, speed, security, and accessibility in financial transactions have become vital necessities. One of the recent innovations in this domain is the concept of IP-to-IP (IP2IP) transactions. Should this technology also prove executable in an offline mode, it would provide remarkable capabilities for regions lacking internet infrastructure, countries with traditional financial systems, and societies embroiled in sanctions or economic crises. In this article, we examine this type of transaction, its applications, advantages, challenges, and its ramifications in various countries.

1) Balancing Bank Deficits Using IP2IP Offline Transactions

1-1. Definition of Bank Deficits

Bank deficits refer to a set of withdrawals or financial deductions from a customer's account or from the bank's operational balances, which may arise from various activities such as cash withdrawals, fund transfers, service fees, taxes, or systemic errors. These deficits are reflected in account balances and may appear at different times as actual, temporary, or erroneous entries.

Example: If a transaction fee is mistakenly deducted twice from an account, this deficit must be identified and corrected. Such instances cause discrepancies in the balance between the bank and the customer.

1-2. Primary Causes of Deficit Creation

Erroneous financial transactions: Incorrect data entry during transaction registration or systemic errors.

Banking charges: Service fees such as fund transfers, card issuance, bank SMS notifications, etc.

Unauthorized or duplicate withdrawals: Arising from network disruptions or cyberattacks.

Discrepancies between banks: When one bank has sent funds but the destination bank has not confirmed receipt.

Human errors: In manual recording of documents or daily financial reports.

Precise control of bank deficits is vital to ensure the accuracy of financial operations and maintain public trust in the banking system. Should these discrepancies not be identified and rectified in a timely manner, they may result in the following consequences:

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Disruption in customer accounts.

Damage to the bank's credibility.

Inaccurate financial reports to regulatory bodies such as the central bank.

Tax and audit problems.

Risk of financial crimes in the event of repeated errors.

1-3. Traditional Challenges in Deficit Balancing

In traditional methods, banks rely upon centralized systems for deficit balancing. These systems require continuous server connectivity, high processing resources, and specialized human personnel. Under circumstances such as internet outages, natural disasters, or congestion in the banking network (for instance, during year-end periods), balance operations may experience delays.

Common challenges:

Delays in updating account balances.

Incomplete transactions due to system failures.

Heavy costs of maintaining balance servers.

1-4. The Role of Innovative Technologies in Resolving These Issues

In recent years, technological solutions such as blockchain, digital wallets, and peer-to-peer (P2P) transactions have been transforming the landscape of financial systems. One of these innovative solutions is IP-to-IP offline (IP2IP Offline) transactions, which can record, balance, and reconcile deficits even without direct internet connectivity.

This article endeavors to demonstrate how, through the utilization of IP2IP offline technology, the process of managing bank deficits can be rendered intelligent, rapid, and independent of online infrastructure. Through technical, legal, financial, and practical analysis, a roadmap for implementing this technology within the banking network will be presented.

2) Bank Reconciliation

2-1. What Is the Concept of Bank Reconciliation?

Bank reconciliation is the process of comparing and synchronizing the balances recorded in bank accounts with internal accounting records or customer statements.

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This operation is conducted for the purpose of identifying potential discrepancies, errors, unauthorized withdrawals, or unrecorded transactions.

In essence, bank reconciliation ensures that:

What has been recorded in the organization's or bank's internal systems corresponds with the actual bank balance.

All withdrawals and deposits have been correctly executed and documented.

Suspicious or erroneous transactions are identified and corrected.

Simple example: If a company's account shows a balance of 100 billion Rials, but the bank statement shows 99.8 billion Rials, the cause of this discrepancy must be determined and rectified. This process is precisely what is meant by "balancing" or "reconciliation."

2-2. Daily Account Reconciliation:

In modern banking, daily reconciliation is among the most critical responsibilities of the treasury and accounting department. In this process, all transactions executed during the day (withdrawals, deposits, transfers, fees, etc.) are matched against the banking system's data.

Key stages of daily reconciliation:

Gathering information from transaction systems (POS), mobile banking, internet banking, branches, ATMs, etc.

Receiving official reports from the bank or payment switches.

Matching detailed transactions with internal ledgers.

Identifying discrepant items.

Recording corrections or following up on discrepancies for the following day.

Objectives of daily reconciliation:

- a) Maintaining financial transparency.
- b) Preventing account deficits or surpluses.
- c) Preparing daily reports for the central bank or regulatory bodies.

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2-3. Common Banking Discrepancies:

Discrepancies refer to instances in which transactions or balances in the bank system report and the internal report or customer account do not correspond. The causes of these discrepancies are varied and are sometimes related to human or technological errors.

Most Common Types of Discrepancies:

No.	Type of Discrepancy	Description
1	Timing discrepancy	Recording of a transaction with a delay in the central system
2	User error discrepancy	Incorrect entry of amount, account number, or date
3	Fee discrepancy	Incorrect or duplicate deduction of fees from the customer's account
4	Systemic discrepancy	Incorrect or duplicate deduction of fees from the customer's account
5	Refund discrepancy	Failed transaction mistakenly classified as a withdrawal

3) Comprehensive Introduction to IP2IP Transactions

3-1. Definition of IP2IP Offline Banking

In IP2IP (Internet Protocol to Internet Protocol) offline banking transactions, financial information is exchanged directly through IP addresses between the servers of two banks, without the need for connection to a central server, the central bank's server, or active internet. Unlike traditional transactions that rely upon banks and intermediary networks, in this method of transfer, two users directly conduct financial exchanges with one another through a local network.

In offline mode, this exchange can be carried out through the following technologies:

- Wi-Fi Direct
- Bluetooth
- NFC
- Local Area Network without internet (LAN)

3-2. Principal Components of an IP2IP Offline Transaction

For such a transaction to be feasible, both devices must be equipped with specific infrastructure:

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a) Offline digital wallet:

Software or an application installed on a mobile device or computer that possesses the capability of maintaining digital balances, signing transactions with a private key, verifying incoming transactions, and locally recording transactions.

b) Cryptographic infrastructure:

The utilization of asymmetric encryption (Public/Private Key) to ensure the authenticity of the sender and receiver, the integrity of transferred information, and the immutability of data.

c) Data transfer protocol (P2P Protocol):

A protocol similar to BitTorrent or Mesh networks that guarantees information is exchanged between two IPs with minimal latency and the highest level of security.

d) Local recording and storage system (Local Ledger):

Each device must store the transaction until connection to the bank's main network is established, and upon connection, report it accordingly.

3-3. Stages of Executing an IP2IP Offline Transaction

A practical example of payment in a rural store without internet is as follows:

1. The buyer and the seller both possess offline digital wallets.
2. The seller activates his device in Wi-Fi Direct mode.
3. The buyer connects to the seller's network.
4. The amount and transaction information are entered into the application.
5. The buyer signs the transaction with his private key.
6. The seller's device verifies the signature and records the transaction.
7. The balances on both devices are updated.
8. The transaction is stored in the local memory of both devices.

Upon connection to the internet, the transaction is reported to the bank (sync).

4) What Is an IP2IP Offline Transaction?**4-1. Introduction to IP2IP Offline Architecture (Fundamental Definition)**

IP2IP offline transactions are designed in such a manner that in the absence of any internet connection or communication with the bank's central server, they can execute financial transactions between two parties (for instance, customer and seller) with complete security, immutable recording, and subsequent synchronization capability.

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As previously mentioned, the foundation of this type of transaction is based upon the direct exchange of data between two devices through the following platforms:

- a) Wi-Fi Direct
- b) Bluetooth
- c) NFC
- d) Local Area Network without internet (LAN)

4-2. Precise Stages of Executing an IP2IP Transaction in Offline Mode

In this section, the operational stages of an IP2IP offline transaction are explained in detail:

Stage One: Generation of Cryptographic Keys in Vaults or Wallets

Each user (sender and receiver) possesses a vault or offline digital wallet that has been previously generated for them and includes the following:

Public Key: A shareable identifier for receiving funds.

Private Key: Confidential and solely for signing transactions.

These keys establish the foundation for user identity authentication and transaction security in the network.

Stage Two: Initiation of Communication Between Two Devices

One of the devices (for example, the seller) activates the Wi-Fi Direct or Bluetooth network. The buyer connects to this network. The wallet applications of both parties automatically identify the opposite device.

Stage Three: Entering Transaction Details

The buyer enters the amount of money and the receiver's identifier (for instance, their account number or public key) into the wallet.

The initial transaction information includes the following:

- a) Sender identifier (Public Key)
- b) Receiver identifier
- c) Amount
- d) Local time

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e) Transaction identifier

Stage Four: Digital Signing of the Transaction

The buyer digitally signs the transaction using their private key.

Signing process:

a) The transaction data is summarized in the form of a hash.

b) This hash is encrypted with the private key.

The result is a "digital signature" that is attached to the transaction.

This signature proves that the transaction has genuinely been issued by the wallet owner and has not been altered.

Stage Five: Transmission to Receiver and Signature Validation

a) The signed transaction is sent to the seller's device.

b) The receiver uses the sender's public key to verify the signature.

c) A new hash is generated from the data.

d) Using the signature and public key, the received signature is decrypted.

e) If there is a match, the signature is valid.

If the signature is forged or the transaction has been altered, the verification process fails.

Stage Six: Recording and Storing the Transaction on Both Devices

After verification:

a) Both devices record the transaction in encrypted form in their local database.

b) The transactions are stored in an immutable structure such as a signed log or in the form of a block file.

c) The balance in each wallet is updated.

Stage Seven: Awaiting Subsequent Synchronization with the Central Network

Both devices retain the transaction in local memory until the internet or banking network becomes available again. Subsequently, the wallets automatically:

a) Send and synchronize the transactions;

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- b) Update the central balance;
- c) Enable the identification and review of transactions by supervisory authorities.

4-3. Security in IP2IP Offline Transactions (Mechanisms and Challenges)

a) Digital Signature Security

The basis of transaction validity rests upon asymmetric encryption. Algorithms such as:

RSA

ECDSA

EdDSA

are employed, which are unforgeable except through access to the private key.

b) Prevention of Double Spending

In offline mode, since the central bank is not instantaneously apprised of the transaction, the possibility of double spending exists.

Solutions:

Specified ceiling for offline transactions (for instance, a maximum of 5 million Tomans)

Limitation on the number of daily transactions

Timestamped Signatures

Mandatory synchronization after several transactions

c) Protection of the Private Key

The private key must be securely maintained in encrypted memory or secure chips (Secure Enclave).

Access to the key = possibility of signature forgery

4-4. Advantages of Bilateral Confirmation in This Architecture

Both parties confirm and store the transaction; in the event of a malfunction in one device, evidence exists in the other device, and potential errors are easily traceable. Furthermore, it creates shared responsibility and enhances transparency between customer and merchant.

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4-5. Comparison of IP2IP Offline with Conventional Payment Methods

Principal characteristics of IP2IP offline transactions:

- a) Does not require permanent internet connection.
- b) Transfer latency is extremely low (instantaneous), variable, and network-dependent.
- c) Security is signature-based, relying upon the private key.
- d) Transaction fees are extremely minimal or virtually zero, determined according to the gateway and network switch.
- e) Suitable for underprivileged regions.
- f) Transaction review capability exists.

IP2IP offline transactions, through the utilization of advanced encryption, digital signatures, and direct communication without intermediaries, are capable of providing precise, rapid, and secure performance for financial payments in the absence of internet. The bilateral recording of transactions and the possibility of subsequent synchronization have transformed this system into a suitable option for resilient, flexible, and inclusive banking.

5) Why Do Banks Need IP2IP Systems?

In today's world, where speed, security, and financial accessibility are considered key elements of competition in banking systems, the utilization of innovative technologies such as IP-to-IP transactions has been proposed as an intelligent response to longstanding challenges and emerging needs. This technology not only creates advantages for customers but also enables banks to effectively utilize resources, reduce risk, and expand their market reach.

5-1. Traditional Banking Challenges and Infrastructural Limitations

Banks have consistently faced substantial problems and costs in the domains of money transfer, transaction recording and settlement, account reconciliation, and data security. In traditional systems, every transaction requires connection to a central server, and the costs of maintaining data centers, settlement infrastructure, and interbank fees are also high. In the event of internet or server outages, the entire system is disrupted. Furthermore, banks have limited access to customers in remote regions. Consequently, IP2IP technology can eliminate many of these obstacles through the development of peer-to-peer (P2P) payments, even in offline mode.

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5-2. Strategic Necessity for Independence and Resilience

In today's geopolitical landscape, with the intensification of sanctions or global disruptions in internet and international settlement networks such as the SWIFT network, banks are seriously pursuing technological independence and infrastructural resilience.

IP2IP offline systems provide the capability to ensure that, even under crisis conditions: firstly, banking transactions are executed; secondly, account balances are updated; and thirdly, customers benefit from payment services. These advantages constitute an economic security imperative, particularly for countries that lack robust internet infrastructure or are subject to sanctions.

5-3. Optimization of Banks' Operational Costs

One of the perpetual concerns of banks is the reduction of operational costs. Implementation of the IP2IP system reduces costs for the following reasons:

No.	Item	Description
1	Elimination of intermediary servers in numerous transactions	Reduction of pressure on data centres
2	Execution of transactions without dependence on national switches	Reduction of fees and settlements
3	No requirement for continuous connection	Reduction of internet and communication infrastructure costs
4	Utilization of local networks: NFC, Wi-Fi Direct	Suitable for areas without network coverage

5-4. Customer Acquisition and Retention in Underserved Areas

Many banks, due to infrastructural limitations, are unable to extend their digital services to rural, mountainous, or remote areas. Therefore, through the utilization of IP2IP technology:

Customers can conduct transactions without the need for internet.

Banks will be capable of expanding their target community.

Projects such as cash subsidies, government assistance, or local payments are facilitated.

In effect, banks can maintain and develop their market share even in areas lacking internet connectivity.



5-5. Facilitation of Microtransactions and Daily Payments

In the traditional model, executing microtransactions (less than 100,000 Tomans) is not economically justifiable for banks, as infrastructure costs and fees sometimes exceed the transaction amount. Consequently, the IP2IP system is highly suitable for this type of payment:

- a) High speed;
- b) Zero or extremely low fees;
- c) Capability of execution without connection;
- d) Suitable for purchases from street vendors, markets, transportation fleets, etc.

5-6. Convergence with Forward-Looking Technologies

IP2IP systems readily converge with emerging technologies such as:

- a) National cryptocurrencies (CBDC)
- b) Smart Contracts
- c) IoT-based payments
- d) 5G networks and self-organizing networks (Mesh)

Banks that develop this technology today will be able to enter novel financial ecosystems tomorrow without the need for fundamental transformation.

5-7. Increased Transparency and Reduction of Banking Discrepancies

Through instantaneous and digital recording of transactions at the user-to-user level: firstly, banking discrepancies are reduced; secondly, account balances become more precise; thirdly, regulatory reporting is simplified; fourthly, the possibility of systematic audit trails is strengthened. Ultimately, this matter is of critical importance for banks, particularly in coordination with the central bank and regulatory authorities.

Banks require the implementation of IP2IP systems for survival, growth, and competition in the digital economy. This technology, in addition to cost reduction and increased accessibility, constitutes a suitable solution for microtransactions, crisis conditions, and future financial development. Banks that embark upon this path sooner will possess a long-term competitive advantage in the digital banking landscape.

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Conclusion

The studies conducted in this article have demonstrated that IP2IP offline banking technology, as the new generation of peer-to-peer payments, possesses significant capacities for the transformation of the banking system, including:

- Operational independence of banks from centralized networks;
- Reduction of dependence on internet during times of crisis;
- Facilitation of banking access in remote areas;
- Reduction of banking discrepancies and acceleration of reconciliation;
- Optimization of banks' infrastructural costs;
- Enhancement of financial inclusion in the country;
- Synergy with national cryptocurrencies and digital wallets.
- Nevertheless, the successful implementation of this technology requires precise design, legal support, and controlled experimentation (pilot) in a real-world environment.

IP2IP offline transactions represent an innovative pathway for facilitating payments, reducing dependence on internet infrastructure, and supporting underprivileged segments of society. This technology, if properly developed, can constitute a component of the future of global digital banking. To realize this future, there is a need for the formulation of intelligent regulations, strengthening of local infrastructure, and the participation of technological communities.

End of Article Number Fourteen.

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