



India's Unified Payment Gateway

for real-time payment transactions.

Unified Payment Interface (UPI)



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1. Background

The genesis of India's unified payment solution

Prior to 2016, India used a number of different systems to transfer money between banks. The traditional forms included RTGS, IMPS and NEFT. With the plethora of systems, rules and growing paper burden, there was a need for a unified system that could automate and standardise India's payment platforms.

In 2016, NPCI set out with a mandate to change the face of India's payment systems. It developed the Unified Payments Interface (UPI) as an architecture framework with a set of standard Application Programming Interface (API) specifications to facilitate online payments. The aim was to simplify and provide a single interface across all NPCI systems, thereby creating interoperability and a superior customer experience. The pilot program, with 21 member banks, was launched on 11th April, 2016, by Dr. Raghuram G. Rajan, Governor, RBI, in Mumbai. From 25th August, 2016, a growing number of banks started to upload their UPI enabled apps to the Google Play store.



2. Introduction

Real-time payments with the Unified Payments Interface (UPI)

The Unified Payments Interface (UPI) is a revolutionary, user-friendly, real time payment solution that facilitates inter-bank transactions, and enables greater digital payments adoption in the country. Developed and launched by the National Payments Corporation of India in 2016, UPI is now one of the most preferred payment solutions in India, with over a billion transactions every month.

UPI's core function is to support easy and secure money transfers between bank accounts. It does this by adding multiple bank accounts into a single mobile application, allowing for seamless fund transfers and merchant payments from one place. It also enables 'peer to peer' and 'peer to merchant' collection requests, which can be scheduled and paid as requested.

Payments can be made using a UPI ID, UPI Number, Account number, and an Indian Financial System Code (IFSC). Payment security is as per applicable RBI guidelines using a 1-click 2-factor authentication where the second factor of authentication is the

UPI PIN. UPI is also available through the Unstructured Supplementary Services Data (USSD) channel to enable UPI members to cater to users of feature phones.

Types of transactions supported by UPI

A. Financial transactions

UPI supports the following financial transactions:

Pay Request:

A transaction where the initiating customer 'pushes' funds to the intended beneficiary. Payment address includes mobile number and MMID, account number with IFSC, and Virtual ID.

Collect Request:

A transaction where the customer is 'pulling' funds from the intended remitter by using a Virtual ID.

B. Non-financial transactions

UPI will support the following types of non-financial transactions on any PSP app.

- ▶ Registration for mobile banking *
- ▶ One Time Password (OTP) generation
- ▶ Set/change PIN
- ▶ Transaction status check
- ▶ Raising disputes/queries

*Mobile banking registration is only possible if the mobile number (which is to be registered) is already registered with the issuer bank for SMS /mobile alerts.

UPI can be accessed on all major platforms such as Android and iOS with apps developed by members for versions of Android 4.2.2 and iOS 8.1 and above.



3. Business Uses

What are the business uses of UPI?

Universal uses

UPI provides the following capabilities through a set of Application Programming Interfaces (APIs).

- Using a personal mobile as the primary device for all payments, including person to person, person to entity, and entity to person.
- Using a personal mobile to 'Pay' someone (push) as well as 'Collect' from someone (pull).
- Using a mobile number, card number, and account number in a unified way. In addition, the ability to pay and collect using 'UPI IDs' that are 'aliases' to the VPA.
- Making payments by providing an address without having to ever provide account details or credentials on third party applications or websites.
- Sending 'collect' requests to others (person to person or entity to person) with a 'pay by' date, which allows customers to pay at a later date without blocking the money in the account.
- Pre-authorising multiple recurring payments (utilities, school fees, subscriptions, etc.) with a one-time secure authentication and rule-based access, similar to ECS.
- Enabling all PSPs to use a standard set of APIs for any-to-any push and pull payments.
- Using PSP bank's sponsored UPI applications, which enable payments from any account using a UPI ID by entering the UPI PIN.
- Using a fully interoperable system across all PSPs without having silos and closed systems.
- Making payments with one-click two-factor authentication, using a personal phone, and without any acquiring devices or physical tokens.

UPI Autopay

- ▶ UPI autopay allows customers to set recurring payments for their UPI transactions.
- ▶ Recurring payments up to INR 2,000 can be set at the frequency desired.
- ▶ A one-time authorisation needs to be provided by the customer.

RuPay card

A first-of-its-kind global card payment network was developed by NPCI in India and enabled by UPI for wide acceptance at shops, ATMs, and online.

Bharat Interface for Money (BHIM) app

BHIM is a UPI enabled app that lets customers make simple payment transactions quickly and easily. Customers can make instant bank-to-bank payments, pay and collect money using just a mobile number or UPI ID, or scan and pay using a QR code.

UPI Lite

Based on current trends, it is estimated that a large percentage of future digital payment transactions will be of low-value transactions below Rs. 200. UPI Lite is a new customer-friendly pre-approved payment solution that utilises existing protocols to enable these low value transactions without placing transaction traffic loads on core banking systems in real-time. Issuing banks can allocate a refillable 'on-device stored value' for their existing UPI app using customers who opt for UPI Lite. As per current mandates, a 'stored value' balance limit of Rs. 2,000 is available, which the customer can use for offline transactions below Rs. 200 and replenish as necessary from a UPI linked bank account.

- a) For transactions and on-device store value refills, UPI PIN is required.
- b) For UPI Lite services, customer opt-in consent is required.
- c) Key features:
 - ▶ Balance available on home screen
 - ▶ Top-up when prompted

- ▶ 1FA transactions (device biometric / pattern validation for transaction authentication to be provided)
- ▶ Disable UPI Lite services (Residual balances are credited back to the customer)
- ▶ Daily SMS notifications for UPI Lite transactions.

Bank enabled Pay Requests

A customer can make a pay request by 'pushing' funds to the beneficiary using their Account Number/IFS Code, Mobile Number/MMID, and UPI ID, which is also known as a Virtual Address.

Bank enabled Collect Requests

A customer can make a Collect Request transaction where the customer can 'pull' funds from the remitter by using their UPI ID, which is known as a Virtual Address. In case of Pull transactions, the customer will have the option to define the expiry time of the Collect Request (up to 45 days). In case the customer has not defined the expiry time, the default time of 30 minutes will apply. The Payment System Provider (PSP) has to provide a customer with the option of defining a minimum validity of 1 minute, in case the customer is selecting an expiry time.

UPI Intent based payments

For UPI Intent based transactions, UPI users have the flexibility to make payments at the time of online checkout by selecting from any of the UPI certified apps installed on their mobile phones. The customer can conveniently make payments without switching between applications. The moment a customer selects 'Pay by UPI' during the check-out stage on a merchant app, all the UPI apps linked to the embedded merchant app, or other UPI enabled apps that intend to initiate the payment, are displayed. The customer can then select a preferred UPI enabled app, which opens with the merchant's payment details. The customer will then need to authenticate with their UPI PIN to complete a secure transaction, or the payment will be declined.

UPI 123 Pay

This service is designed to be more inclusive and reach over 400 million feature phone users in the country. The service uses an account number and phone number while leveraging Dual Tone Multi-Frequency (DTMF) signalling technology and follows the UPI two-factor authentication protocol for transactions.

UPI for ASBA (IPO)

- ▶ Customers can provide their UPI ID as a payment option while subscribing to IPOs on the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). All they need to do is tell their brokers to provide their UPI ID as the payment option while making the IPO application.
- ▶ Customers can enjoy the instant fund transfer experience of UPI while subscribing to an IPO
- ▶ Instant mandate creation ensures real-time application submission
- ▶ Customer support for transaction-related issues

4. Business Benefits

What are the business benefits of UPI?

Universal benefits

Mobile-first customisable design

Developed to embrace the smartphone boom in India and customers shifting to digital and mobile-based solutions, the mobile phone has been defined as the primary device for payment authorization. This transforms the acquiring infrastructure requirements to make them simple, low-cost, and universal.

Push and pull payments for innovative use-cases

- ▶ Payments can be initiated by either the sender (payer) or the receiver (payee).

- For pay requests: the initiating customer 'pushes' funds to the intended beneficiary.
- For collect requests: the customer 'pulls' funds from the intended sender using the UPI ID.

User-friendly, single-click, two-factor authentication

- UPI follows the one-click, two-factor authentication protocol.
- When a transfer transaction is initiated using a smart phone, the device fingerprint (IMEI number or other technical detail unique to the device) is passed as the first factor of authentication.
- The second factor is the UPI PIN number, which has to be physically keyed in by the user/ sender on their initiating device - usually a mobile phone.

Easily identified across payment options

- The UPI ID creates a common identifier for the customer to send or receive money from anyone.
- It provides the user with a single, unified interface for all payment transactions, across all UPI linked accounts.

Interoperability from authentication to payment institutions

- UPI allows for full interoperability between multiple identifiers such as a mobile number and new UPI ID across all UPI-based payment apps and the institutions that participate in the UPI ecosystem.
- It allows money to be transferred instantly across UPI linked bank accounts in the ecosystem.

Flexibility for Third Party/Merchant/Developer

Based on the business requirements, UPI offers 3rd party/merchants/developers options ranging from simple integration options such as intent or web collect, to complex and detail oriented designs through SDK and API models.

Exponential innovation

UPI offers Application Programming Interfaces (APIs) that are minimalistic, fully functional, and allow for innovations in user interface, convenience features, authentication schemes, and mobile devices to be incorporated without having to change the core API structure.

Available on feature phones and voice-based payments

UPI functionality enables feature phone and voice-based payments. In essence, a user does not need to have a smartphone and internet connectivity to make a UPI payment.

For Banks

- High-security high speed payment transactions
- Single-click, two-factor authentication
- Universal application for transactions
- Low cost by leveraging existing infrastructure
- Safer, secured and innovative
- Payment basis Single/ Unique Identifier
- Enables seamless merchant transactions
- Scalable collections and disbursements

For merchants

- Seamless fund collection from customers - single identifiers
- No risk of storing customer's virtual address like in cards
- Ability to accept payments from customers not having credit/debit cards
- Suitable for e-com and m-com transactions
- Resolves the challenges of exact change cash payments, cash security/portability, or Cash on Delivery issues
- Single-click 2FA facility for the customer - seamless Pull
- In-App Payments (IAP)

For customers

- Round-the-clock availability
- Single application for accessing different bank accounts.
- Conveniently make utility bill payments, over-the-counter (OTC) payments, and QR Code (Scan and Pay) payments.
- Make merchant payments with a single application or in-app payments
- Use of Virtual ID is more secure, no credential sharing
- Single-click authentication
- Ability to raise complaints from mobile apps directly

Support for non-financial transactions

UPI also enables non-financial transactions such as:

- Mobile Banking Registration
- One Time Password (OTP) generation
- UPI PIN Set/Change
- UPI transaction status check



5. Participants

Who are the participants in the UPI ecosystem?

NPCI

NPCI is the owner, network operator, service provider, and coordinator of the UPI Network.

Banks

Banks and payment banks with an RBI-approved mobile banking license and IMPS capability are eligible for UPI. Banks or PPIs should broadly perform the functions/roles mentioned below:

- ▶ **Payer PSP** - Member bank as a Payer PSP can onboard a customer into a UPI app, allowing the customer to register for UPI services and provide options to approve a financial transaction or non-financial request wherever necessary.
- ▶ **Payee PSP** - A bank in the role of Payee PSP can onboard a customer/merchant to receive money or raise a collect request. This is also known as a beneficiary/resolving PSP.
- ▶ **Remitter Bank** - All UPI users need to have a banking account with a UPI enabled bank. While performing a transaction, the user's bank account will be debited. The remitting bank also holds the responsibility of authenticating the UPI PIN set by the customer.
- ▶ **Beneficiary Bank** - Any credit going to a UPI user will be credited to a beneficiary's bank account. The bank receiving the funds in UPI transactions will be acting as a beneficiary bank.

Bank Account holders / Customers

Any customer who is on-boarded by a bank with a UPI enabled account and a UPI ID can utilise the services.

Merchants

Participating merchants are those who are on-boarded by their banks to accept UPI enabled payments from customers.

Corporates

UPI also provides the ability for large technology companies, 3rd party processors, and aggregators to connect to banks and provide extensive services to end consumers.

Roles and Responsibilities

NPCI

- 1) NPCI is the owner, network operator, service provider, and coordinator of the UPI Network.
- 2) NPCI reserves the right to either operate and maintain the UPI network on its own or provide or operate necessary services through third party service providers.
- 3) NPCI will provide and maintain the network infrastructure relevant to the operation of the UPI platform, maintain uptime, and ensure timely settlements to banks.
- 4) NPCI may revise the UPI architecture and its procedural guidelines as and when required.
- 5) NPCI has the right to call for documents relating to the architecture, operating model, and other technology related aspects of the UPI solution which the bank/PPI/PSP is planning to develop or has developed.
- 6) All certification stages will require sign-off from the concerned UPI team.
- 7) NPCI may notify PSP and TPAP of any problems encountered in the UPI platform, that are attributable to the telecommunication network, as well as any complaints received from customers from time to time.
- 8) NPCI issues circulars from time to time, to disclose major decisions, to relevant stakeholders, which all banks/PPIs/ PSPs will have to adhere to.

On-boarding

The Payment Service Provider/member should be a regulated entity by RBI under the Banking Regulations Act 1949, should be authorised by RBI for providing mobile banking service.

The member should comply with the Procedural Guidelines, certification requirements operating and risk guidelines and circulars issued by NPCI from time to time.

The bank should be live on IMPS. (PPI is not required to be part of IMPS)

Additionally, any bank which intends to participate in UPI as a PSP, should ensure that while the bank's technology platform can be outsourced, its functions 'as a PSP' cannot be outsourced.

This implies that the PSP Bank has an equal ownership of other banks' customers' data as its own customer base. Furthermore, the PSP has to provide an audit report for the data centre and PSP App by a CISA equivalent auditor.

Qualified Security Assessors (QSAs) empanelled by the PCI Council will conduct audits at least once annually. The QSA will verify the app and the following:

- a. System level Security
- b. Network / Data Centre Security
- c. Risk tools to be adequate
- d. Procedures and Policies
- e. Annual Certification process

In addition, the member has to provide a declaration in writing to abide by:

- i. All the terms and conditions of the Unified Payments Interface Procedural Guidelines and Circulars, notifications, and directions are issued by NPCI from time to time.
- ii. All the guidelines issued by relevant authorities from time to time with respect to payment system operations.

User on-boarding in UPI:

Customers can be on-boarded onto UPI through the platforms mentioned below:

- 1) The BHIM Mobile Application
- 2) UPI Bank PSP Apps
- 3) Third Party UPI Compliant Apps
- 4) *99# (USSD)

- 5) Each bank's mobile banking apps that support UPI
 - 6) 123Pay – Unified Payment Interface (UPI) for feature phone and voice-based payments
- The tools listed above cover the complete gamut of mobile devices in India and also cover both the data base of customers connected to mobile data and customers not connected to mobile data.

De-boarding

Relevant documents need to be shared by the TPAP and the bank, as detailed below, for de-boarding from UPI

TPAP will share the set of confirmations and clearances for de-boarding as given below:

- a. Request letter to the sponsor bank/ NPCI regarding their interest in de-boarding as an UPI TPAP, stating reasons or issues with certain timelines.
- b. Request letter to the sponsor bank/ NPCI stating whether they would want to continue as a merchant app in the ecosystem.
- c. Confirmation on dispute handling for 180 days even after de-boarding the TPAP on UPI payment for customer convenience. After the completion of 180 days, data will be purged and confirmation shall be provided to NPCI regarding no storage of payment data with the application system.
- d. TPAP to confirm the data elements that will be available with them for customer dispute handling for the time period.
- e. TPAP must notify their UPI users about the suspension of UPI services via push notifications/ email or SMS.
- f. TPAP to confirm that only a new version of their app (which will not act as a TPAP) will be available on play store/ appstore and the same will not have UPI CL in it.

From sponsor banks:

- a. Request letter from sponsor banks stating the TPAP's request of de-boarding themselves as a TPAP.
- b. Request letter from the sponsor bank stating whether the TPAP would want to continue as a merchant app in the ecosystem, if any.

6. Use Cases

How is the UPI service used?

Fulfilling a money request

Shom receives a notification on his phone. It is a message from a UPI ID asking him if he wishes to send Rs. 5000. He recognises that the message is from his younger brother, who is studying in another city. After calling his brother and checking with him, Shom then uses his own UPI app to accept the fund request and authenticate the transaction with his M-PIN. In a few seconds, he gets a successful transaction notification SMS on his phone from his bank. His brother calls to thank him for the instant fund transfer.

In-app payment within the same mobile of the customer.

Ashok' is a student who uses a personal MyStar app video application to select, pay for and watch a movie for, Rs. 25 on his Android enabled phone. He banks with DiBank (the PSP in this case) and uses their UPI-enabled mobile application.

The MyStar application creates a UPI payment link with all the necessary parameters populated. As DiBank PSP app is registered for UPI link, it starts the app and takes Ashok straight to the pay screen with all the relevant values pre-populated. Ashok verifies the information shown on the screen and clicks 'pay' to complete the payment and enjoy the movie he selected.

DTH payment from home

'Nadeem' is a DTH subscriber who wishes to pay his on-demand subscription fee. He selects the channel and clicks 'Buy Now'. The DTH program shows the details along with a QR code for UPI payment. Nadeem opens the UPI application on his mobile and scans the QR code given on his TV screen, which takes him straight to the pay screen with all values pre-populated from the QR code, which contains the standard

UPI link. Nadeem verifies the information on the pay screen and clicks 'pay' to complete the payment. He gets a confirmation on his mobile and the TV channel is automatically turned on for his viewing pleasure.

UPI Autopay

Reshma uses this capability to automatically pay her OTT content platform's monthly subscription fees of Rs. 500. She sets a UPI recurring mandate at 'check out' and provides the one-time UPI PIN in her app. Subsequent fee payments will be auto-deducted from the customer's linked bank account.

Credit card bill payment

Vaishanvi is clearing up around the house when she finds last month's credit card bill that she had forgotten to pay. Today is the last day for payments, and she realises that she needs to pay the amount before she is charged interest. She uses her smartphone to open her UPI enabled app and clicks on the credit card payment option. She enters her card details and it auto-populates the amount she needs to pay. She is able to pay by using her secret M-PIN to authenticate the transaction.

Merchant payment using BHIM app

Saira wants to treat her best friend who is visiting her from the USA. Saira takes her friend to a trendy cafe where they proceed to order coffee and snacks. At the time of paying the bill, Saira realises that her credit card has passed its validity date. So she smoothly takes out her smartphone, accesses her UPI enabled BHIM app, and uses the scan to pay feature to pay the cafe bill.

Non-financial transaction - change UPI M-PIN

Ramakant wants to change his M-PIN for security purposes. He enters his old UPI PIN and preferred new UPI PIN (the UPI PIN that he would like to set) and clicks on Submit. After clicking on submit, Ramakant gets a notification of either a successful change of his M-PIN or a failure. In the event of failure, he will need to submit the request again.

7. Acts

Banking Regulations Act 1949

Payment and Settlement Systems Act, 2007 (PSS Act)

Section 43A of IT Act, 2000 and the IT Rules, 2011

Section 25 of the Payment and Settlement Systems Act, 2007 (PSS Act)