

PPB

Crash course

Module- C

Lec-03

Data Communication Network and EFT Systems

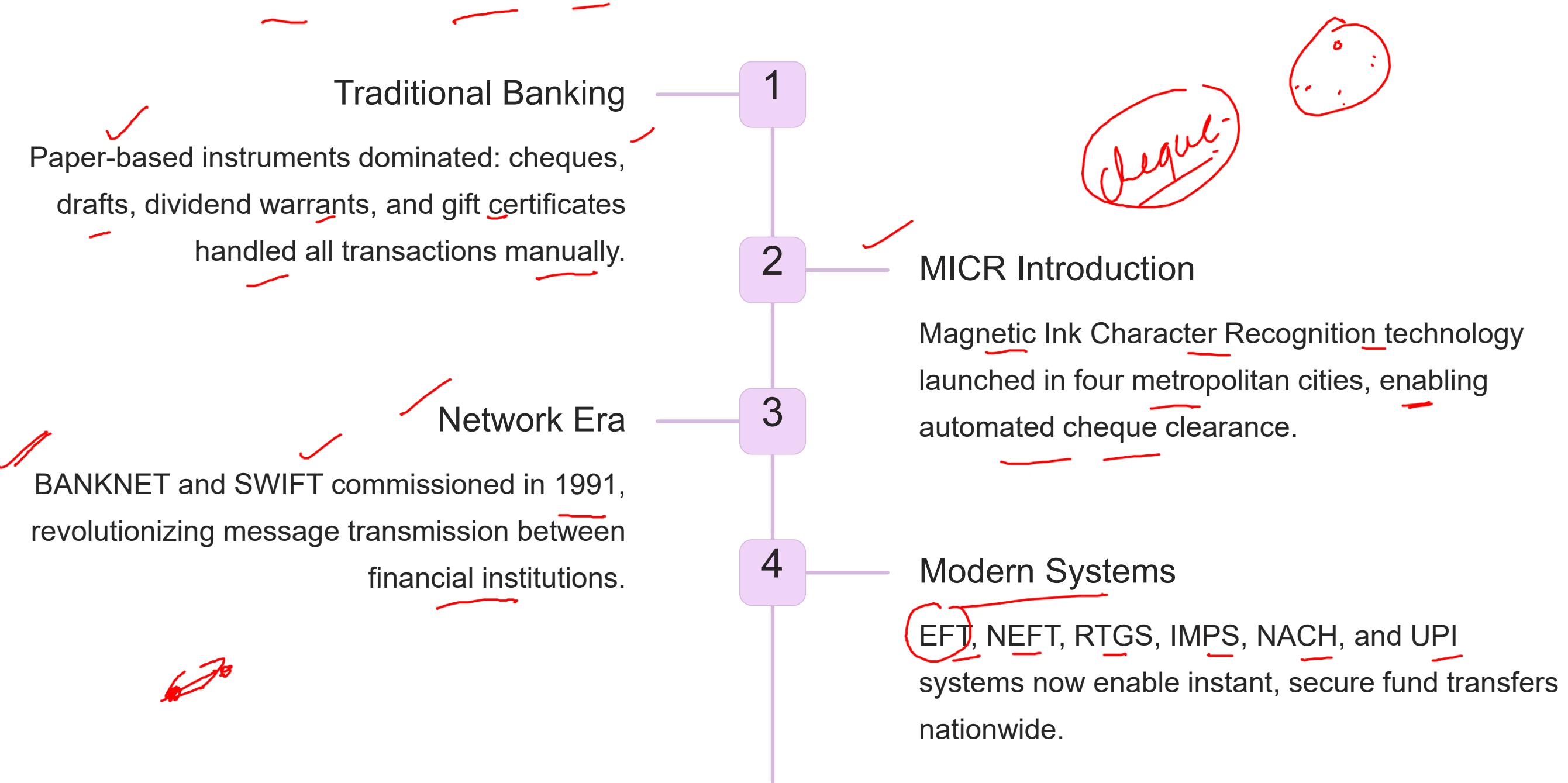
Data
Network
Rowi



Banking Technology and Data Communications

Understanding the Evolution of Electronic Financial Systems

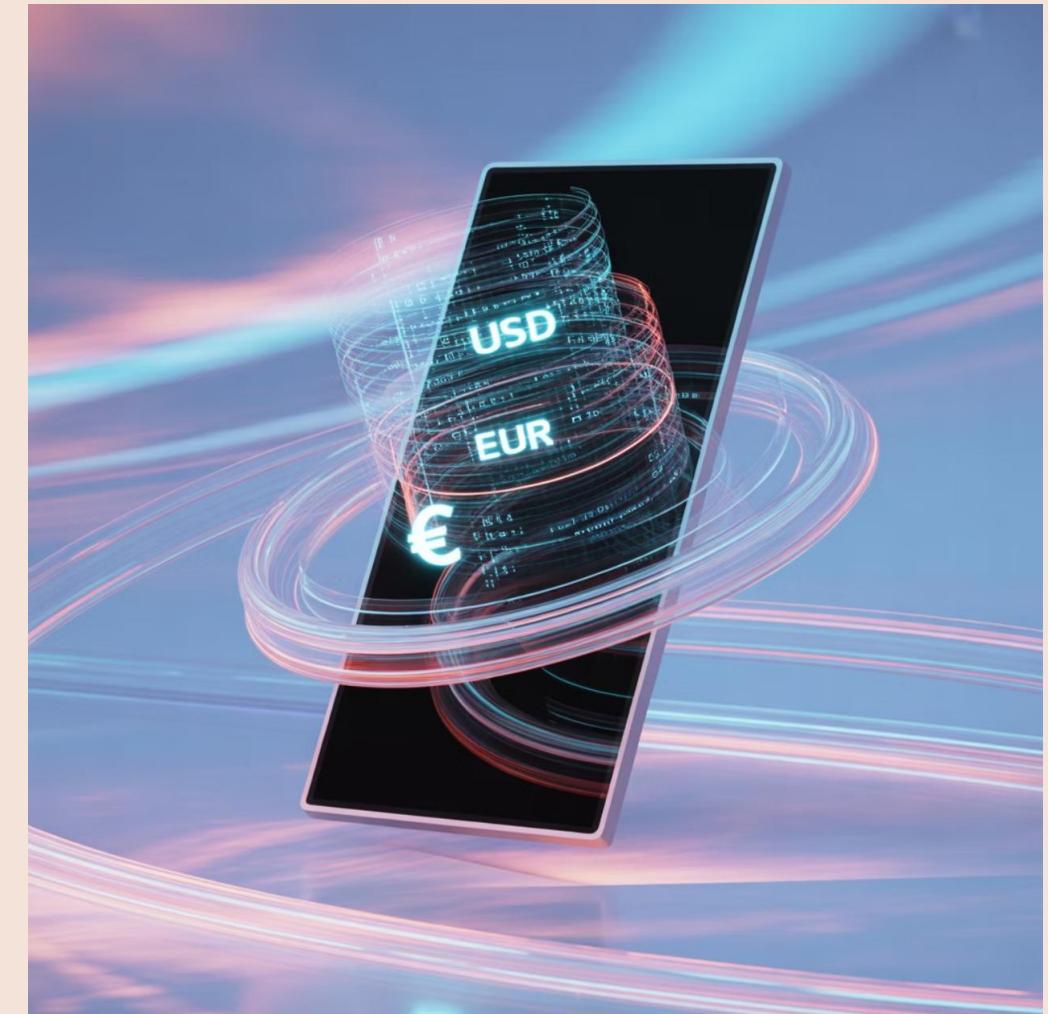
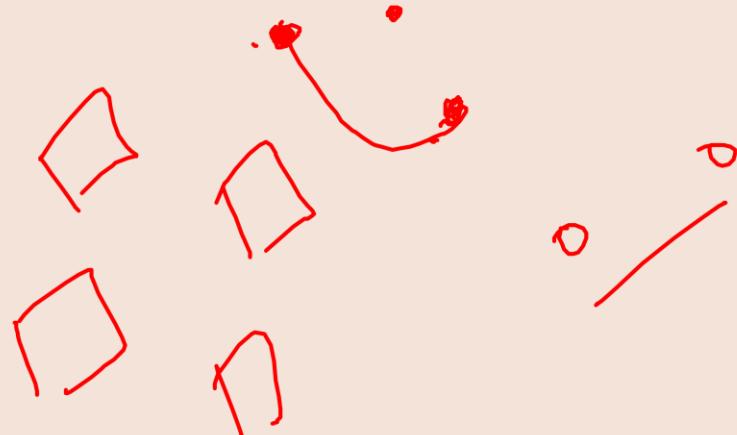
The Digital Banking Revolution



Electronic Funds Transfer Systems

Electronic funds transfer revolutionized banking by replacing manual paper processing with automated digital transactions. Unlike conventional transfers, EFT processes and transmits information electronically, enabling customers to transfer funds from anywhere.

This transformation eliminated geographical barriers, bringing banking services directly to customers' doorsteps through secure, real-time processing capabilities.



Data Communication Networks: The Foundation

Cost Reduction

Networks drastically reduce costs and time for data transfer between remote locations and central processing systems.

Resource Sharing

Distributed systems share resources through telecommunications links, optimizing operational efficiency.

Global Connectivity

Networks connect geographically dispersed computer systems worldwide, enabling seamless international banking.



Data

Network Components: Transmission Devices



Modems: Digital-Analog Conversion

Modems function as critical interface devices, converting digital signals to analog for transmission over telephone lines. The transmitting modem modulates digital data into analog signals, while the receiving modem demodulates them back to digital format.

Available as internal computer cards or external devices, modems overcome signal attenuation issues in long-distance digital transmission.

Transmission Media Technologies



Twisted Pair Cables

Two insulated copper wires twisted together minimize cross-talk and signal distortion. Cost-effective and widely used for terminal-to-computer connections up to 150 meters.



Coaxial Cables

Inner copper core surrounded by insulation and protective sheath. Prevents signal interference and supports high-speed digital transmission at 500 megabits per second.

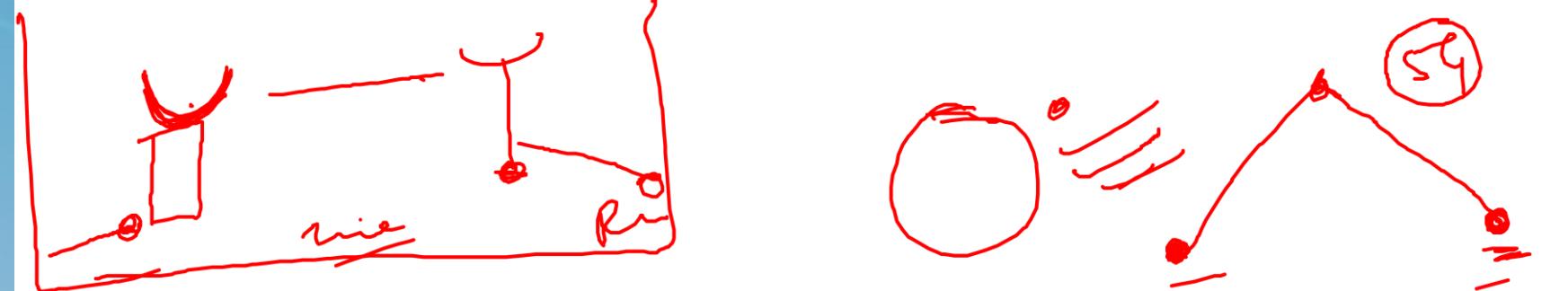
500mb/s



Optical Fiber

Revolutionary technology using light beams through glass or plastic fibers. Delivers 2 gigabits/sec with superior quality, speed, and immunity to electromagnetic interference.

2GB/s



Wireless Communication Systems

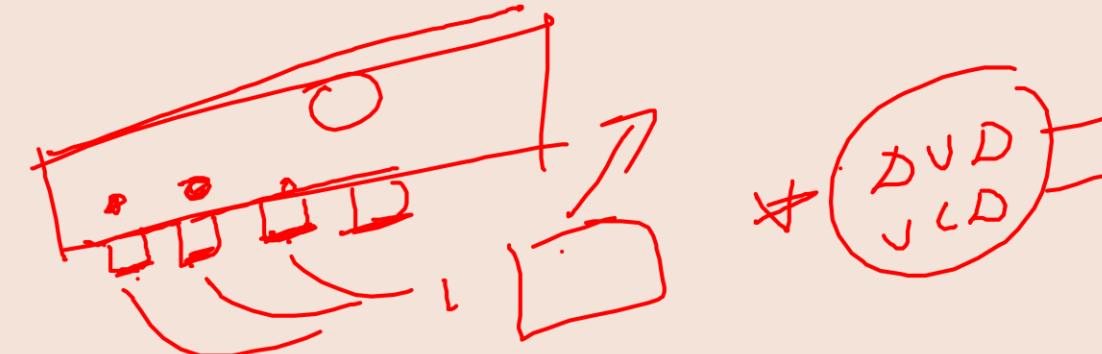
Microwave Systems

High-frequency radio signals modulated to carry data across tower-mounted antennae. Signals are amplified and retransmitted along routes, connecting to satellite networks.

Communication Satellites

Stationary satellites equipped with transponders link multiple earth stations. Single relay stations broadcast to wide geographical areas, enabling global applications like email and internet services.

Transmission Processors



Message Switches

Store and forward data from multiple terminals over single communication channels, queuing messages for CPU processing.

Multiplexers

Enable multiple signals to transmit simultaneously over one physical channel, combining inputs from various sources.

Front-End Processors

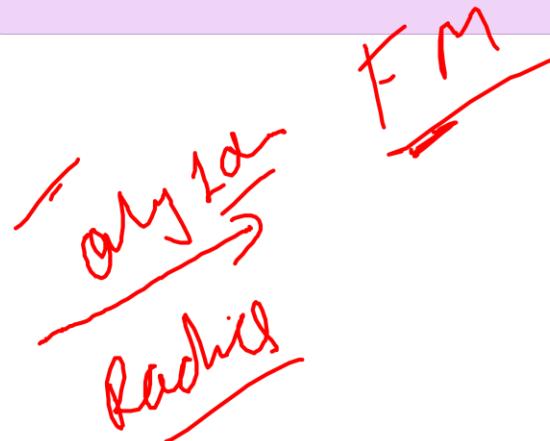
Small computers interfacing host systems with peripheral devices, handling data transfer, error detection, and correction tasks.



Data Transmission Modes

Simplex

One-directional transmission only.
Sender cannot receive; receiver
cannot send. Example: commercial
radio broadcasts.



Half-Duplex

Bidirectional transmission, but only
one direction at a time. Transmitter
waits for response before sending.
Example: **walkie-talkies.**



Full Duplex

Simultaneous two-way transmission
providing faster communication
without directional delays. Example:
four-wire telephone modems.



BANKNET: India's Banking Network

Commissioned in 1991 following recommendations by the T.N. Anantharam Iyer Committee, BANKNET established India's first cooperative banking communication network.

This packet-switched X.25 network connected nodes in Mumbai, Delhi, Chennai, and Kolkata, with a central switching center in Nagpur using mesh topology.

COMET software enabled 400 simultaneous users per node, supporting message creation, editing, and various fund transfer applications including telegraphic transfers and bank-to-bank transactions.

Networking

Bank Network



Major Network Systems in India

01

INAS/INET

Interbank National Authorization System provided electronic authorization, later combined with INET for electronic settlement services using X.25 packet switching technology.

02

NICNET

Established in 1976 by National Informatics Centre, India's largest satellite-based WAN serving government and banking communication needs through secure VPN services.

03

RBINet

Communication software developed in C for DOS and UNIX systems, enabling free-format messaging and file transfers over BANKNET infrastructure with enhanced security features.

National
Informatics
Centre
later
INET

INFINET: The Modern Solution

1



Following Saraf Committee recommendations, RBI established the Indian Financial Network (INFINET) in Hyderabad. This VSAT-based satellite network overcame poor terrestrial line quality issues.

Now managed by Indian Financial Technology and Allied Services (IFTAS), INFINET operates as a closed-user MPLS network facilitating RTGS, NEFT, and government payment systems across the banking sector.

COG

securebank

Your future. simplified.



Internet Banking Revolution

- 1 ARPANET Origins
Late 1960s military and university research network laid the foundation for global internet connectivity.
JS
- 2 Public Access
1989 NSFNET replaced military networks, making internet infrastructure available to the general public worldwide.
JS
- 3 Banking Integration
Financial institutions now leverage internet protocols (SLIP, PPP) and web browsers for comprehensive online banking services.

Internet Services for Banking

Topology

1

Communication Services

Electronic mail, Telnet remote access, and Voice over Internet Protocol (VoIP) enable instant global communication between financial institutions.

2

Information Retrieval

File Transfer Protocol (FTP), Archie search tools, and Gopher systems facilitate secure document and data exchange.

3

Web Services

World Wide Web provides comprehensive banking portals with linked resources for easy customer access to financial information.

4

Video Conferencing

Point-to-point and multi-point video systems enable face-to-face banking consultations and remote business meetings.

EFT Systems: Past, Present & Future

1954 ✓

MICR Introduction
American Bankers Association introduced Magnetic Ink Character Recognition for automated cheque processing

1972 ✓

First ACH
Automated Clearing House operations began in the USA following SCOPE committee recommendations

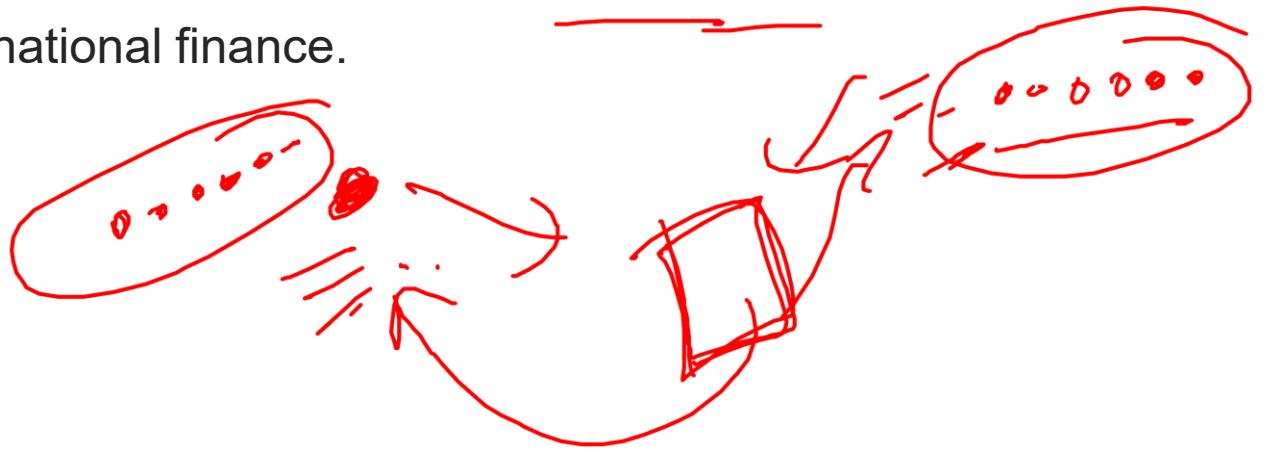
1991 ✓

SWIFT & Networks
India commissioned BANKNET and SWIFT systems, revolutionizing interbank communications

Today's Indian banking ecosystem includes ATMs, POS systems, NEFT, RTGS, IMPS, UPI, and Cheque Truncation Systems, creating a comprehensive digital payment infrastructure that serves millions of customers with secure, instant financial transactions.

SWIFT: The Backbone of Global Banking

Exploring the Society for Worldwide Interbank Financial Telecommunication and modern electronic payment systems that power international finance.



Founded 1973 ✓

239 banks across 15 countries
unified international transaction
processing

11,000+ Institutions

Financial institutions and
corporations spanning 215
countries worldwide

22 Million Daily

Messages processed daily for
payments, securities, trade
finance, and treasury

SWIFT operates as a cooperative non-profit organization under Belgian law, headquartered in Brussels. This financial messaging platform has revolutionized how banks communicate globally.

SWIFT's Core Architecture

True Paperless Banking

SWIFT is fundamentally a message transmission system that processes all transactions without exchanging paper, banknotes, cheques, or drafts. This represents the epitome of digital banking infrastructure.

In India, all nationalized banks are SWIFT members, with bank locations connected to the SWIFT Regional Processor in Mumbai, ensuring seamless integration with the global network.



Key Features of SWIFT

*move up
you*

24/7 Global Operations

Operational throughout the year, twenty-four hours daily, ensuring continuous global connectivity

Instant Worldwide Transmission

Messages reach any part of the world almost immediately through advanced telecommunications

Standardized Formats

400+ different standardized message formats
streamline inter-bank transactions globally

Guaranteed Delivery

Financial liability assumed for accuracy and timely delivery of all validated messages

SWIFT Message Categories



Customer Payments

Payments and cheques processing



Financial Trading

Securities and trading transactions



Documentary Credits

Letters of credit and guarantees



Cash Management

Liquidity and status monitoring



Institutional Transfers

Bank-to-bank fund movements

SWIFT Security Framework

Authentication Mechanism

Automated version of telegraphic test keys calculated on entire message text, ensuring any changes are immediately detected.

Encryption Controls

Data confidentiality maintained through network-level encryption available to all users.

Checksum Protection

Prevents automatic changes during transmission using both message text and receiver address verification.



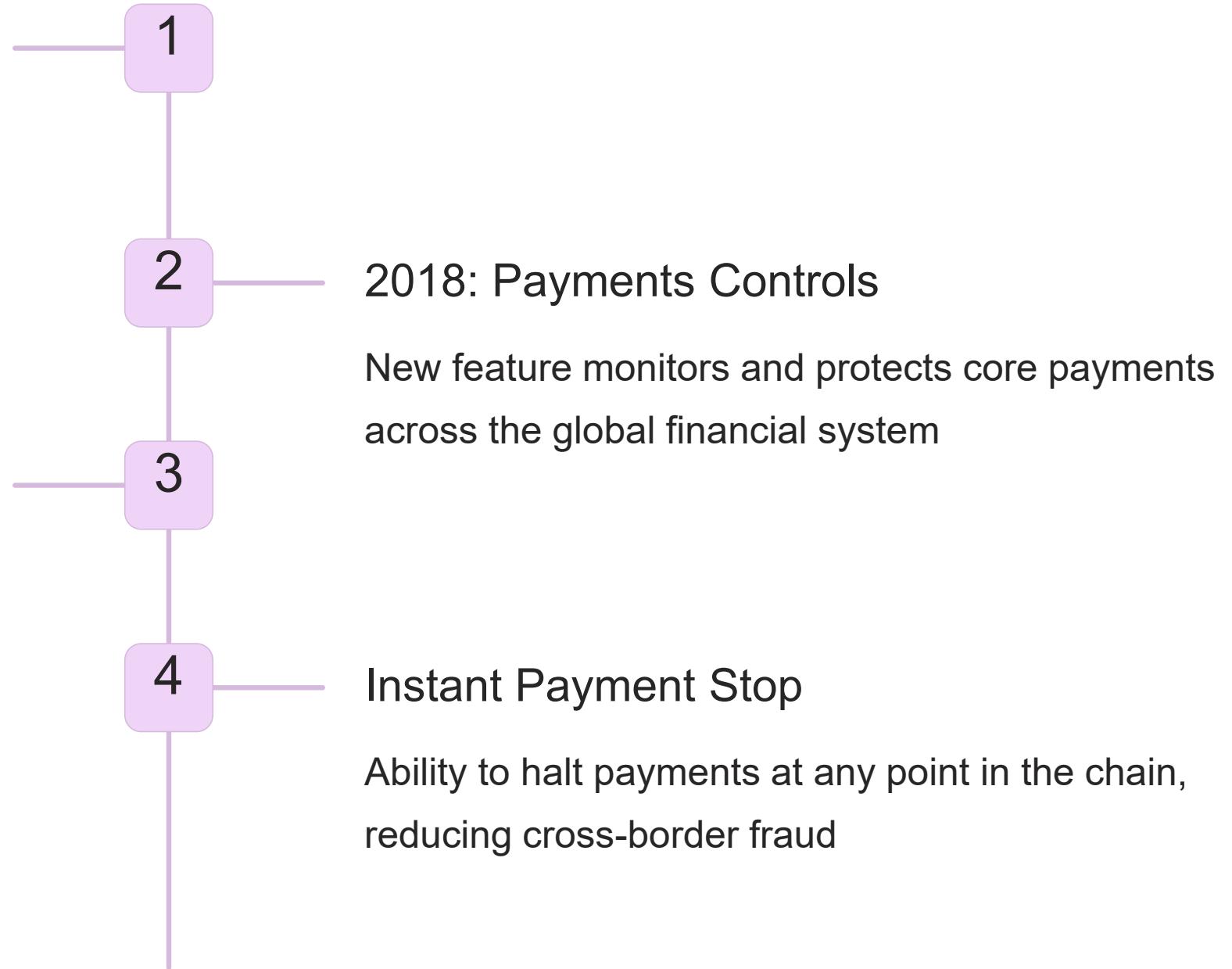
Recent SWIFT Innovations

2016: Security Response

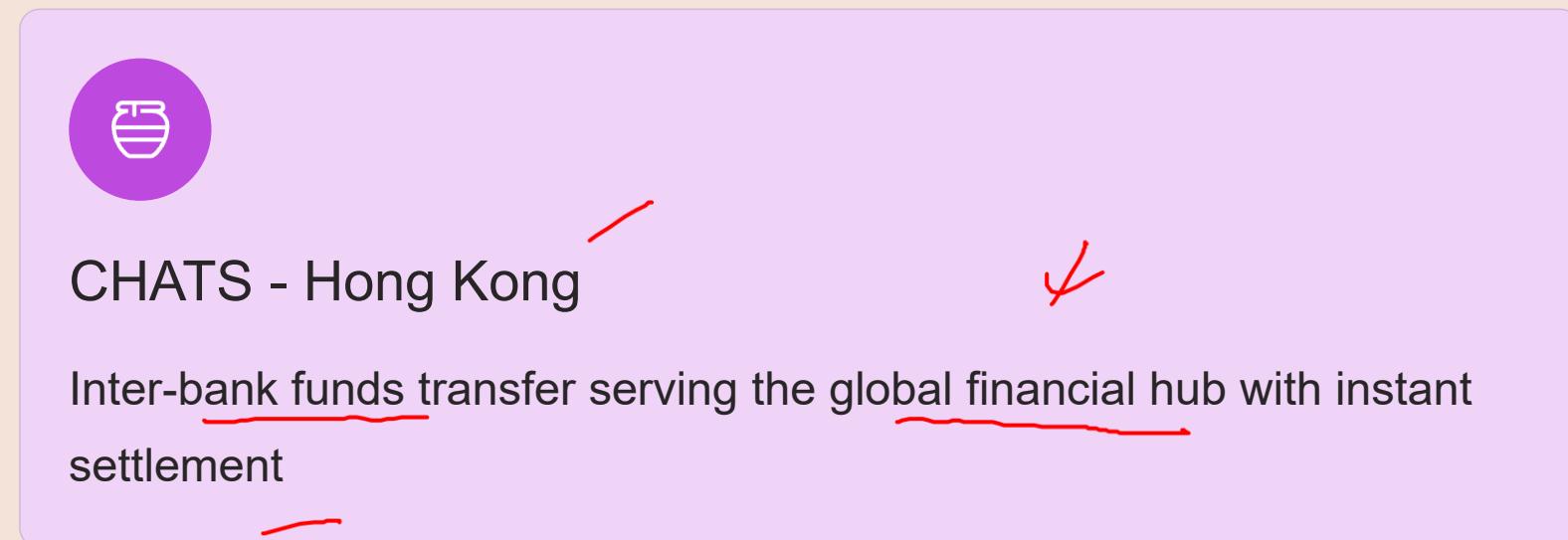
After Bangladesh Bank fraud, SWIFT implemented new safeguards to neutralize risks

SWIFT GPI Launch

Global Payments Innovation enables fast, secure transfers with full transparency



Automated Clearing Systems



US Federal Wire Systems



Fedwire Network

Operating since 1956, the Federal Reserve Wire System connects 800+ banks across twelve districts. Each Federal Reserve Bank controls regional commercial banks with three access modes:

- Direct computer-to-computer connectivity
- Terminal access through leased lines
- Dial-up facility for flexible transmission



Electronic Payment Systems in India

India's journey from MICR clearing to comprehensive electronic systems has revolutionized banking efficiency. The Reserve Bank of India has progressively introduced sophisticated payment mechanisms.

1995: ECS Introduction

Electronic Clearing System launched as upgrade to paper-based systems

*credit -
debit*

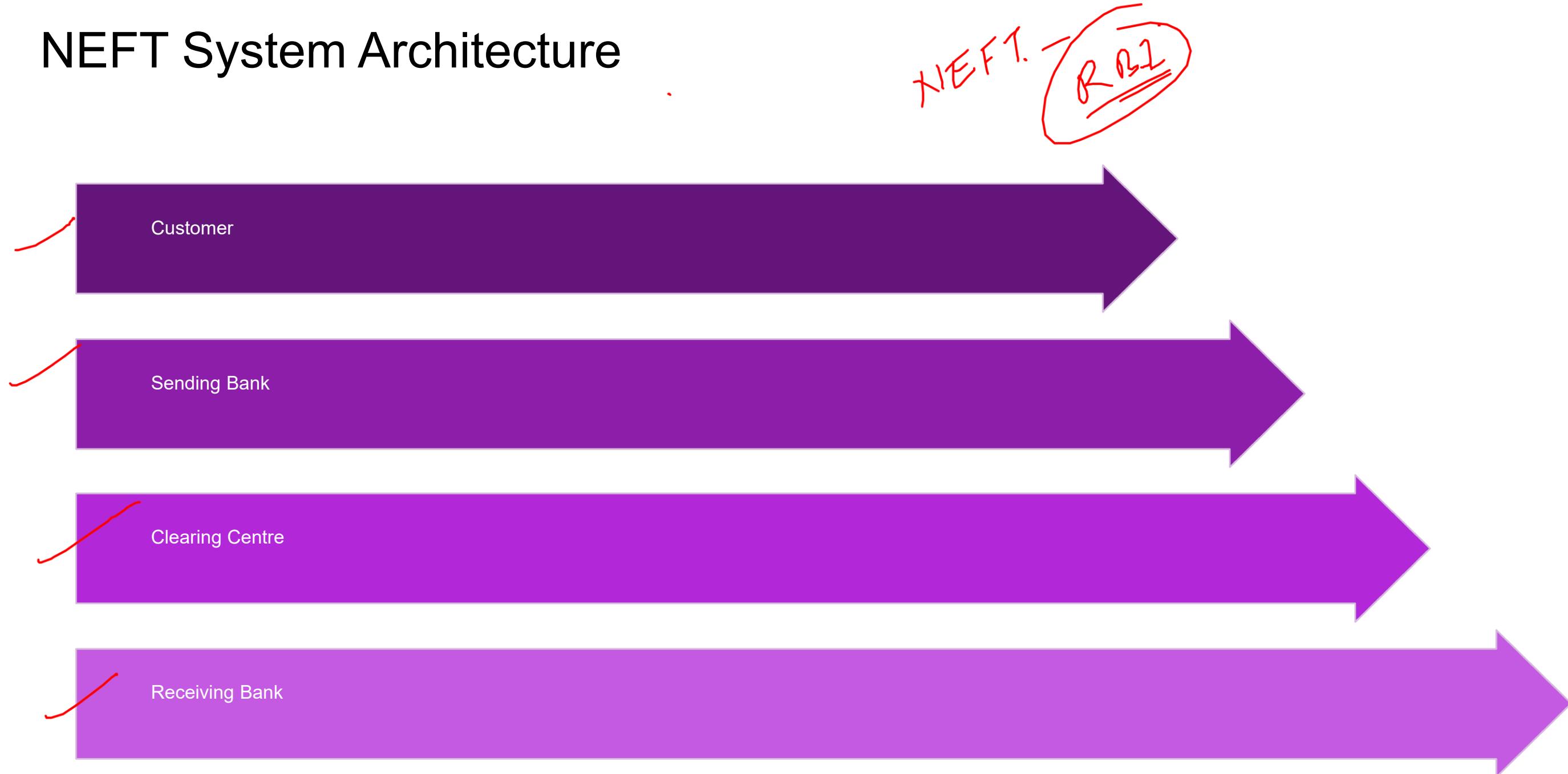
1996: EFT Implementation

Electronic Funds Transfer system based on Saraf Committee recommendations

2005: NEFT Launch

National Electronic Fund Transfer system for networked branches

NEFT System Architecture



The National Electronic Fund Transfer system operates through five key participants: Sending Bank's Branch, NEFT Service Centre, National Clearing Centre, Receiving Bank's Service Centre, and Beneficiary Branch.

NEFT Enhanced Operations

24x7 Availability

Since December 2019, NEFT operates continuously with 48 half-hourly batches daily

1/2 hour

No Amount Limits

Transactions can include paisa components with no upper-value restrictions

Automated Processing

Straight-through processing enables transactions outside banking hours

DNS - Day and Night Settlement
ISO 20022
VTR - 16 digit

Real-Time Gross Settlement (RTGS)

Core Principles

RTGS processes payment instructions on a continuous, real-time basis with gross settlement. Each transaction is final and irrevocable, settled in RBI books.

Next Generation Platform

Introduced in 2013, NG-RTGS uses ISO 20022 messaging standards for enhanced performance and security.

~~22 digit~~ ~~2 digits~~
~~22 digit~~ ~~2 digits~~
- 2 loc
- 20
MP
UTP
22 digit

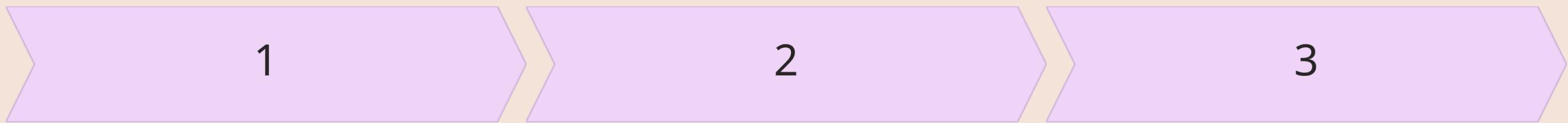


24x7x365 availability ensures seamless high-value transactions with no maximum

Cheque Truncation System Evolution



signatu



MICR Clearing
Physical instruments traveled to 66 centres for processing

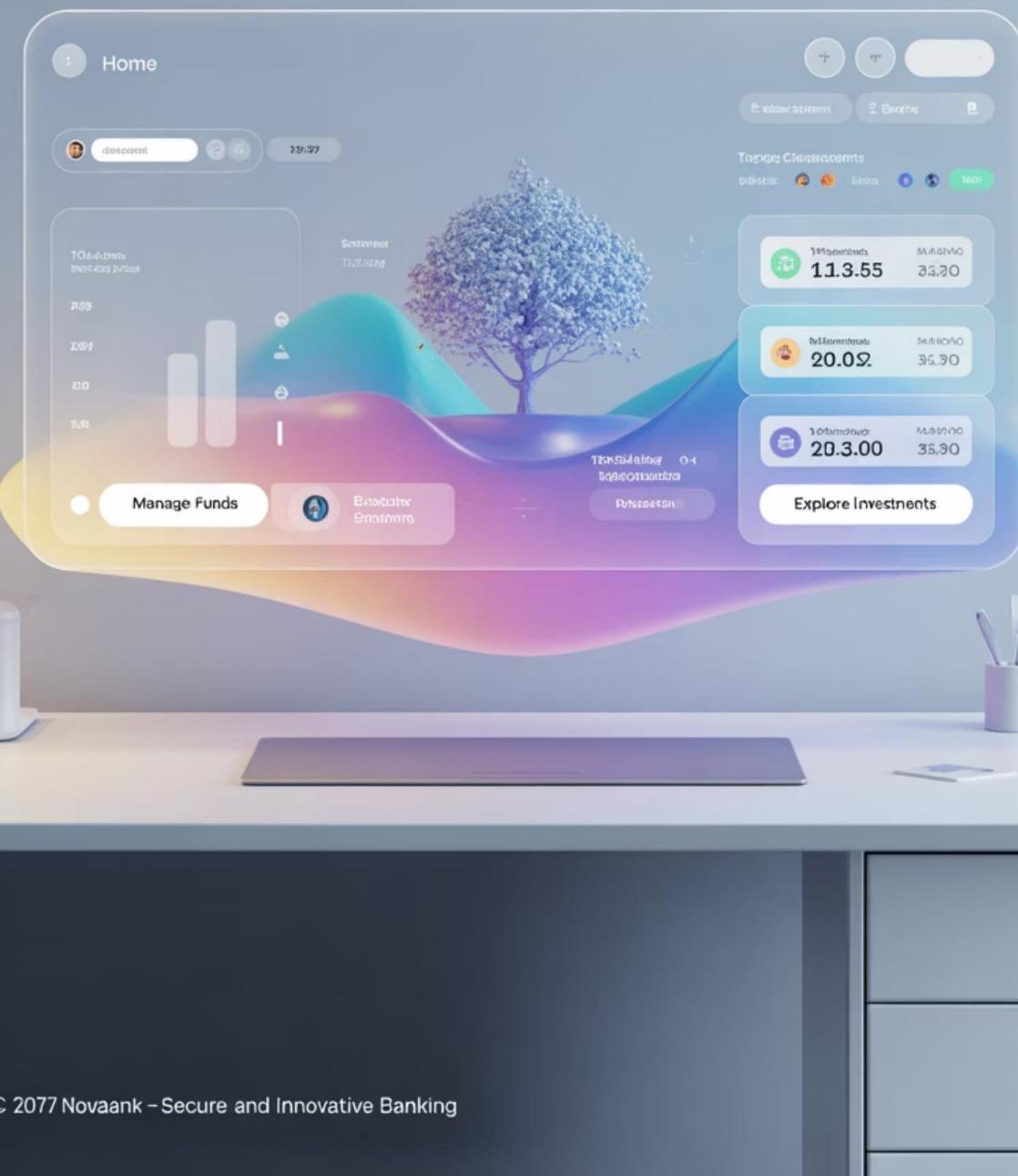
CTS Implementation
Electronic images replace physical movement, improving efficiency

Grid Settlement
Three regional grids enable T+1 settlement across locations

Cheque Truncation System eliminates physical instrument movement through digital image processing, significantly reducing clearing cycle time while maintaining security through digital signatures and encryption.

Daijobbing

ane Onualtiig Banking



Future of Electronic Banking

22M

Daily SWIFT
Messages

Processing volume
demonstrates system
reliability

11K

Global Institutions

Connected across
215 countries

24x7

System
Availability

Continuous
operations for critical
payments

Electronic payment systems have transformed banking from paper-based processes to **instantaneous digital transfers**. With enhanced security, real-time processing, and global connectivity, these systems form the foundation of modern financial infrastructure.

Digital Payment Systems – NPCI

National Payment Corporation of India





Payindia

Your India.
Your Payments.

India's Payment Systems Revolution

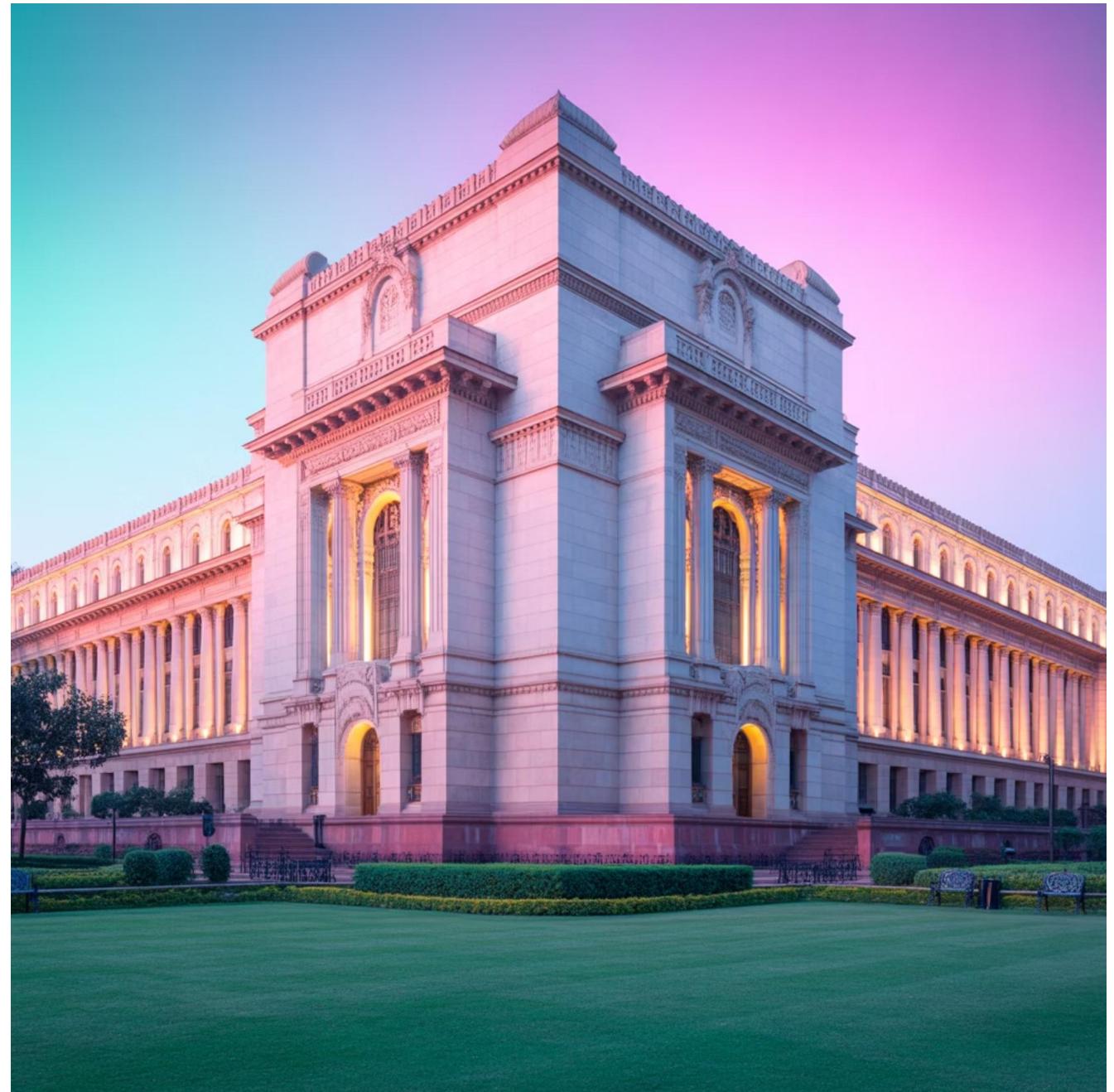
A comprehensive journey through India's transformation into a digital payment powerhouse, exploring the systems that enable seamless financial transactions for over 1.4 billion citizens.

The Foundation: RBI's Vision

Historical Leadership

The Reserve Bank of India pioneered India's payment infrastructure, establishing critical systems like ECS, NEFT, and RTGS that formed the backbone of modern digital payments.

In 2005, the Board for Payment and Settlement Systems was created to consolidate fragmented payment systems into a unified national framework.



~~NPCI~~

12 Core Electronic Clearing Systems

ECS

Electronic Clearing Service

RTGS

Real-Time Gross Settlement

IMPS

Immediate Payment Service

NEFT

National Electronic Fund Transfer

CTS

Cheque Truncation System

UPI

Unified Payments Interface

These systemically important financial market infrastructures (SIFMIs) include NACH, Credit/Debit Cards, PPIs, and specialized clearing systems for government securities and forex.



NPCI

The Game Changer

Founded in December 2008, the National Payments Corporation of India emerged as a not-for-profit organization with a revolutionary mission: provide "anytime, anywhere payment services that are simple, easy to use, safe, secure, fast and cost-effective."

NPCI's Founding Vision

01

Consolidation

Unite multiple systems with varying service levels into a nationwide uniform standard

02

Standardization

Create consistent business processes for all retail payment systems

03

Innovation

Transform India into a 'less-cash' society through cutting-edge payment solutions

Backed by ten core promoter banks including SBI, PNB, ICICI, and HDFC, NPCI operates for the benefit of all member banks and citizens.

NPCI's Product Portfolio



National Financial Switch

*National
Financial
Switch (NFS)*

India's largest shared ATM network connecting over 2.55 lakh ATMs nationwide



UPI & BHIM

Revolutionary real-time payment systems enabling instant bank-to-bank transfers



RuPay Cards

India's domestic card scheme offering lower costs and customized solutions



BBPS & Digital Services

Comprehensive bill payment ecosystem and mobility solutions



National Financial Switch: ATM Revolution ✓

Massive Scale

Launched in 2004 and managed by NPCI since 2009, NFS connects over 1,203 members to 2.55+ lakh ATMs across India, creating the world's most extensive shared ATM network.

Core Services

- Cash withdrawal and balance inquiry
- PIN changes and mini statements
- Interoperable cash deposits
- Card-to-card fund transfers



Advanced value-added services include mobile banking registration, Aadhaar seeding, and statement requests across all participating banks.



NACH: Automated Clearing Powerhouse

National Automated Clearing House revolutionizes bulk transactions for banks, corporates, and government agencies. This web-based solution handles high-volume, repetitive transactions like salary distributions, subsidies, and utility payments.

- 1 **Government Benefits**
Direct benefit transfers and subsidy distributions
- 2 **Corporate Payments**
Salary, dividend, and pension disbursements
- 3 **Utility Collections**
Loan EMIs, insurance premiums, and bill payments

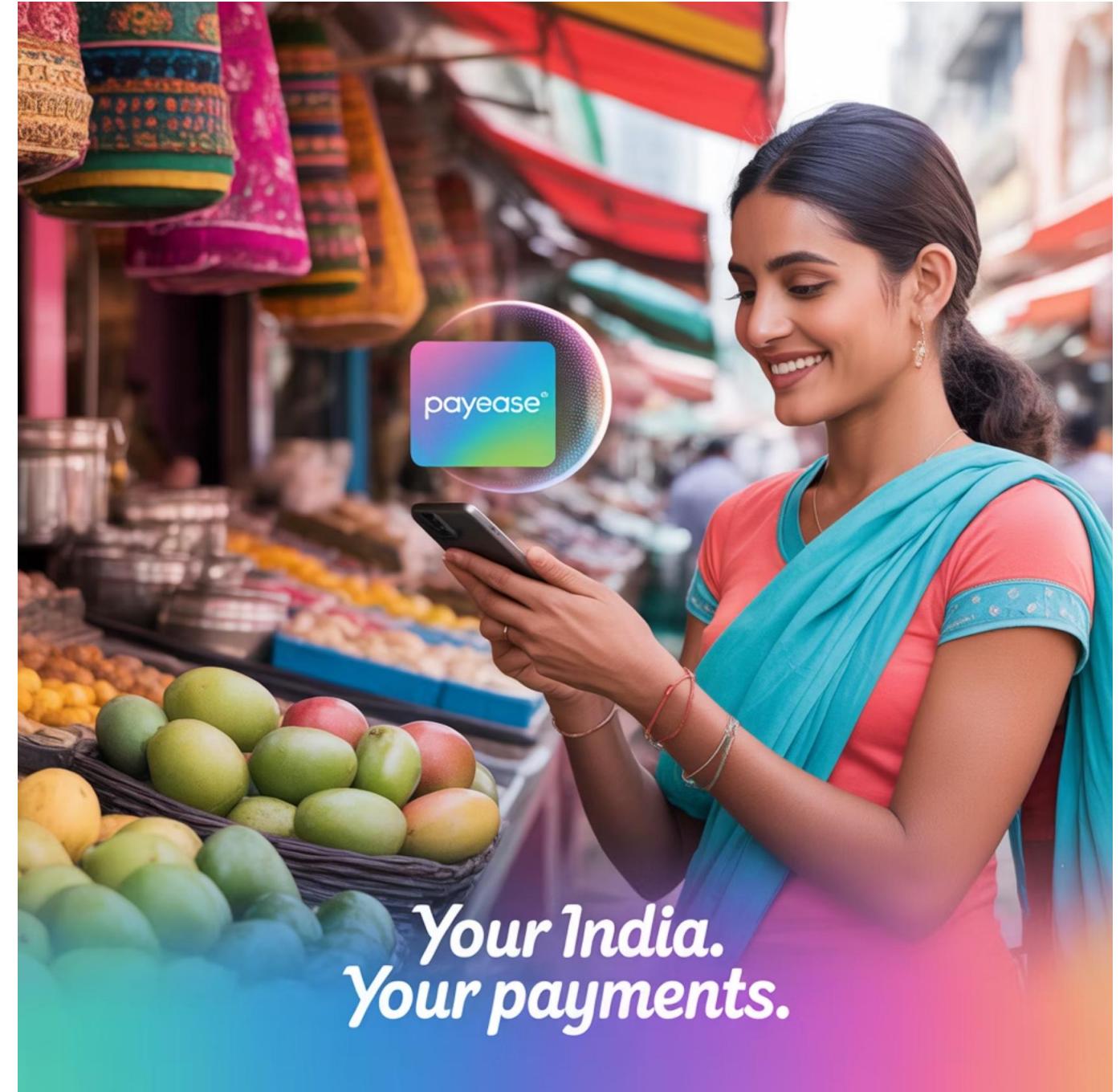
IMPS: Instant Payment Revolution

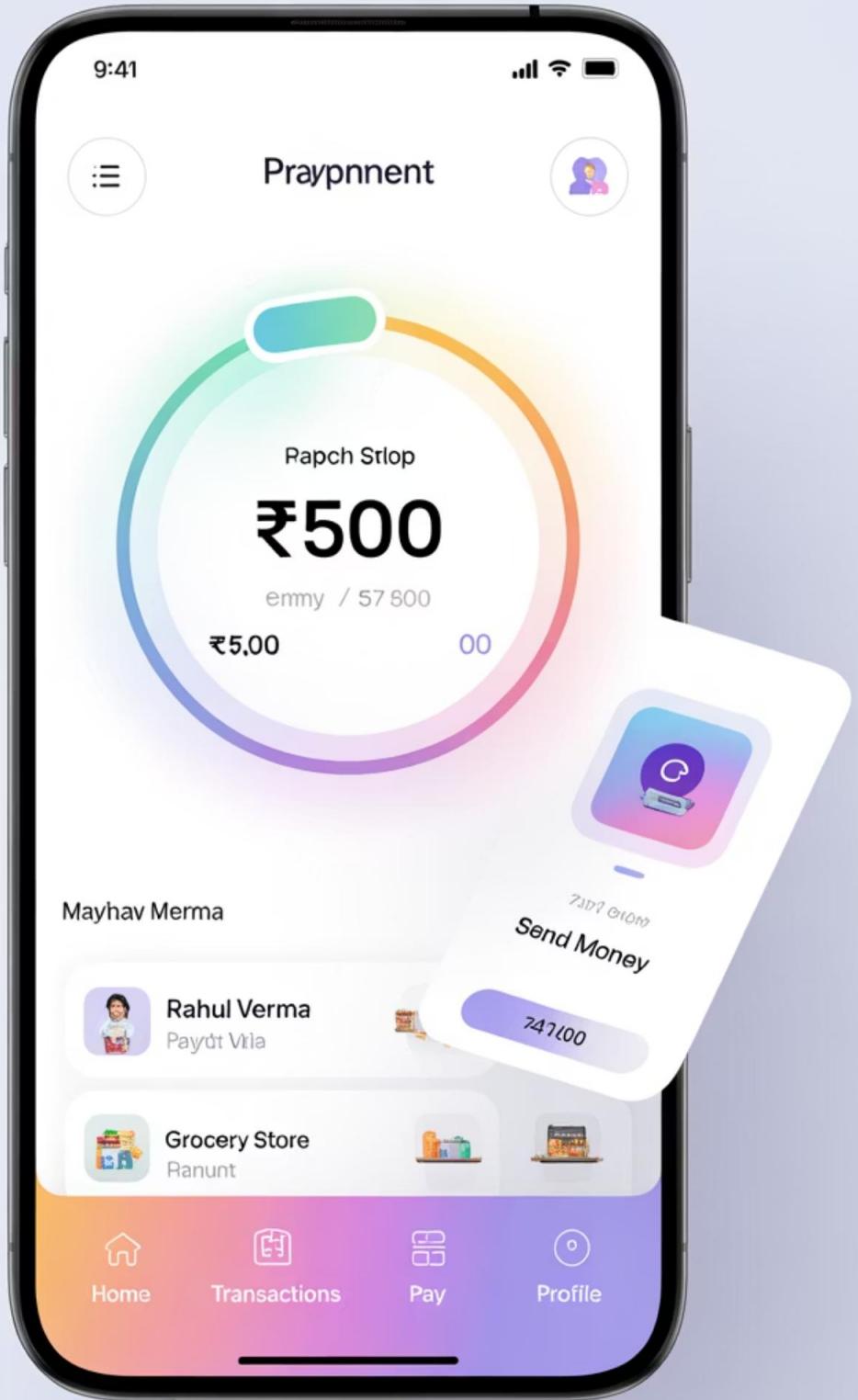
24x7 Availability

Immediate Payment Service delivers instant, inter-bank fund transfers available round-the-clock, including holidays. Built on NFS infrastructure, IMPS supports multiple channels: mobile, internet, ATM, SMS, and USSD.

Key Features

- Real-time fund transfers
- Multi-channel accessibility
- Mobile Money Identifier (MMID) system
- Two-factor authentication





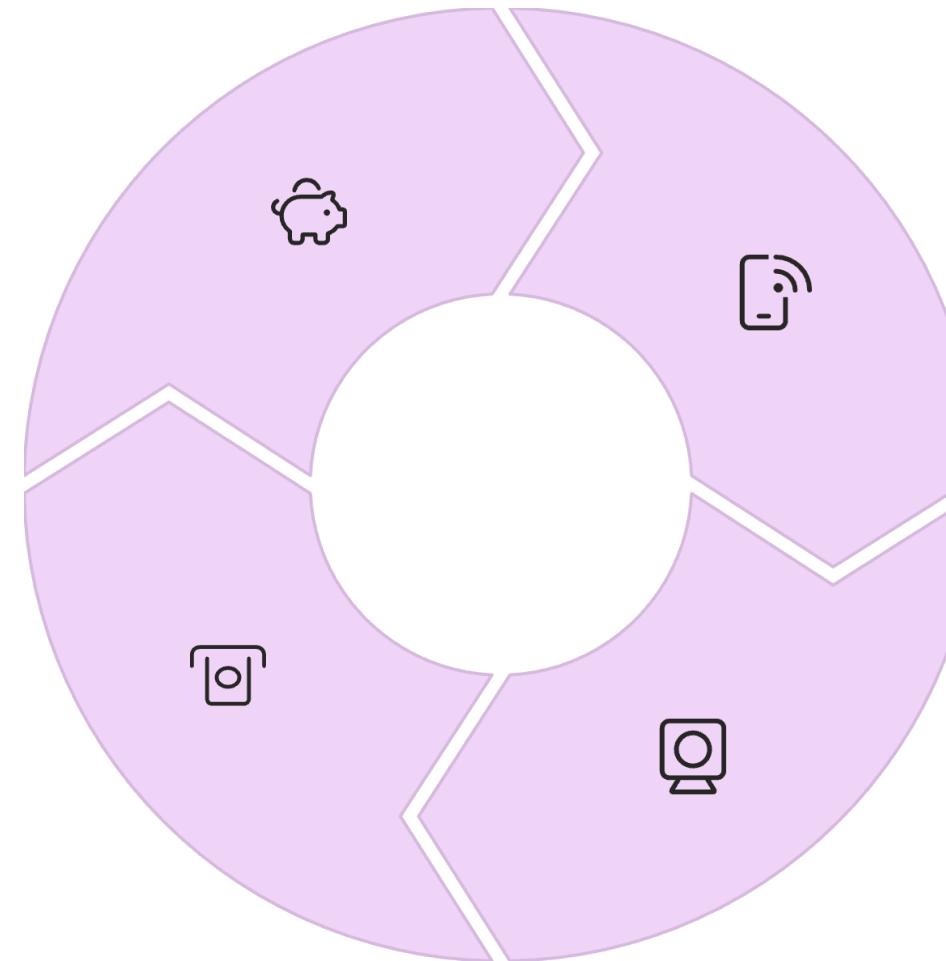
UPI

The Game-Changing Innovation

Unified Payments Interface transforms multiple bank accounts into a single mobile application, merging banking features, fund routing, and merchant payments seamlessly. Available 24x7x365 with single-click, two-factor authentication.

UPI: Technical Architecture

Bank Integration
Multiple bank accounts linked to single virtual address



Mobile Registration
SMS-enabled mobile numbers create secure payment addresses

Authentication
UPI PIN and two-factor security protocols

UPI 2.0: Advanced Features

One-Time Mandate

Pre-authorize transactions with fund blocking capability for delayed debits, enabling secure "pay later" scenarios with digital signature validation.

Overdraft Integration

Link OD accounts showing both available and actual balances, expanding payment options for eligible customers.

Invoice Attachments

Review invoices securely before payment authorization through verified merchant attachment links.

Signed QR Security

Enhanced security with signed QR codes and intents, reducing tampering risks and unauthorized entities.

BHIM: Empowering Digital India



Universal Access

Bharat Interface for Money democratizes UPI payments through a government app supporting 20 regional languages and comprehensive payment features.

Key Capabilities

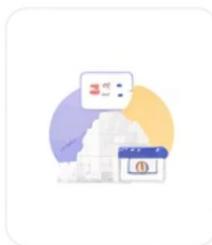
- Send/request money via VPA or QR codes
- Transaction limits: ₹1,00,000 per transaction/day
- Split bills and payment reminders
- IPO applications and UPI Autopay

Bill payment poyoudur in India.

Go to Payeasy

Conorciud

Search



Fullbehins Payment

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20.3.100
2025 1000 + 100000

Bill

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Bill



Electricity

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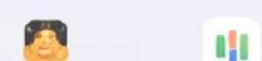


Water

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Internet

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Mobile

20.204 465.225



DTH

20.2.00 465.225

BBPS: One-Stop Bill Payment

Bharat Bill Payment System creates an interoperable ecosystem for "Anytime Anywhere" bill payments with certainty, reliability, and safety. Multiple payment modes with instant SMS confirmations.

BBPCU

NPCI as central clearing unit setting standards and procedures

BBPOU

Banks and non-banks authorized as operating units

Agents

Customer touchpoints across retail outlets and branches

RuPay: India's Card Revolution

Domestic Advantage

"Rupee + Payment" = RuPay represents India's sovereign card scheme, reducing transaction costs through domestic processing while protecting Indian consumer data within national borders.

Product Range

- Classic, Platinum & Select variants
- Contactless and tokenization technology
- International acceptance and lounge access
- Insurance coverage and cashback schemes



Digital India: Government's Vision



Digital India programme transforms India into a digitally empowered society and knowledge economy by 2030, ensuring electronic access to government services for all citizens through robust internet infrastructure and digital literacy.

Key Digital Infrastructure

Bharat Broadband Network

National Optical Fiber Network connecting 2.5 lakh Gram Panchayats across 641 districts with high-speed internet infrastructure.

DigiLocker Platform

Secure cloud-based digital wallet for storing and sharing verified documents, eliminating physical paperwork through Aadhaar-linked storage.

GeM Portal

One-stop government procurement platform ensuring transparency, with average buyer savings of 9.75% through cashless, contactless transactions.

Security & Cloud Infrastructure

CERT-IN Protection

Indian Computer Emergency Response Team serves as the nodal agency for cybersecurity, providing incident prevention, response services, and security quality management under IT Amendment Act 2008.

MeghRaj Cloud Initiative

Government's "GI Cloud" programme optimizes ICT spending while accelerating e-service delivery through distributed cloud environments with standardized protocols.



Multiple cloud services including PaaS, IaaS, SaaS, and specialized security services



Payments Vision 2025: Future Roadmap

3x

Digital Transaction Growth

Target increase in digital payment volume

50%+

UPI Growth Rate
Average annualized expansion target

8%

Payment-to-GDP Ratio
Transaction turnover target

0.25%

Cheque Usage Limit
Maximum share of total retail payments

RBI's vision: "E-Payments for Everyone, Everywhere, Everytime" through Integrity, Inclusion, Innovation, Institutionalisation, and Internationalisation.



India's Digital Payment Success Story

From fragmented systems to unified digital excellence, India has created the world's most comprehensive payment ecosystem. NPCI's innovations—UPI, BHIM, RuPay, and BBPS—serve 1.4+ billion citizens through secure, instant, and inclusive financial services.

"Today's India demonstrates how technology improves access to education, healthcare, and agriculture while promoting transparency and accountability through faceless, cashless, and paperless governance."

The foundation for a robust, secure Digital India is now reality, transforming how a nation conducts commerce and connects communities.

Thank You



Comment Your Feedback

