

UNIT 5

E-Payment Systems

(6 Hours) — MIS and E-Business (CACS301)

5.1 Introduction to E-Payment Systems

An Electronic Payment (e-payment) system is any mechanism that allows funds to be exchanged electronically between a buyer and a seller, typically without the physical transfer of cash or paper instruments. E-payment systems are the financial backbone of e-commerce — without a fast, secure, and trusted way to move money online, none of the browsing, ordering, or digital-goods delivery that customers experience would be commercially viable.

Modern e-payment systems must satisfy several competing requirements simultaneously: they must be secure against fraud and interception, fast enough for real-time or near-real-time confirmation, interoperable across banks and payment networks, and convenient enough that ordinary consumers will actually adopt them in place of cash. This unit surveys the major categories of e-payment instruments — from payment cards to mobile wallets to cryptocurrency — that make up today's digital payment landscape.

5.2 Online Payment Cards

Payment cards remain the most familiar e-payment instrument. Although they differ in how the underlying funds are settled, all card types share a common physical/virtual form factor and rely on the same card-network rails (Visa, Mastercard, etc.) for authorization and clearing.

5.2.1 Credit Cards

A credit card allows the holder to borrow funds, up to a pre-approved credit limit, from the issuing bank to pay for goods and services. The cardholder repays the bank later — either in full by the due date (avoiding interest) or over time through minimum monthly payments (accruing interest on the outstanding balance).

5.2.2 Charge Cards

A charge card looks similar to a credit card but has no pre-set spending limit and, critically, requires the full outstanding balance to be paid off at the end of each billing cycle — there is no revolving credit or interest-bearing balance. Failure to pay in full typically results in penalty fees rather than interest charges.

5.2.3 Debit Cards

A debit card is linked directly to the cardholder's bank/checking account. When used, funds are withdrawn (debited) immediately or near-immediately from the linked account, so the cardholder can only spend money that is actually available in the account — there is no borrowing involved.

5.2.4 Smart Cards

A smart card embeds a microprocessor chip (rather than only a magnetic stripe) that can store and process data securely on the card itself. Smart cards can hold multiple applications — payment, identity, loyalty points, transit fare — and support stronger cryptographic authentication than magnetic-stripe-only cards, making them significantly more resistant to cloning and fraud.

Card Type	Funding Source	Repayment / Settlement	Key Feature
Credit Card	Bank's line of credit	Full or partial (revolving), interest on balance	Pre-set credit limit
Charge Card	Bank's line of credit	Full balance due each cycle	No pre-set spending limit
Debit Card	Own bank account	Immediate deduction	No borrowing; spend only what you have
Smart Card	Chip-based (varies)	Depends on application loaded	On-card microprocessor; multi-application, high security

5.3 Processing Cards Online & Credit Card Payment Procedure

When a card is used for an online (card-not-present) purchase, several parties cooperate behind the scenes to move the transaction from the shopping cart to a completed, funded sale. The core participants are the Cardholder, the Merchant, the Acquiring Bank (the merchant's bank), the Card Network (e.g. Visa, Mastercard), and the Issuing Bank (the cardholder's bank).

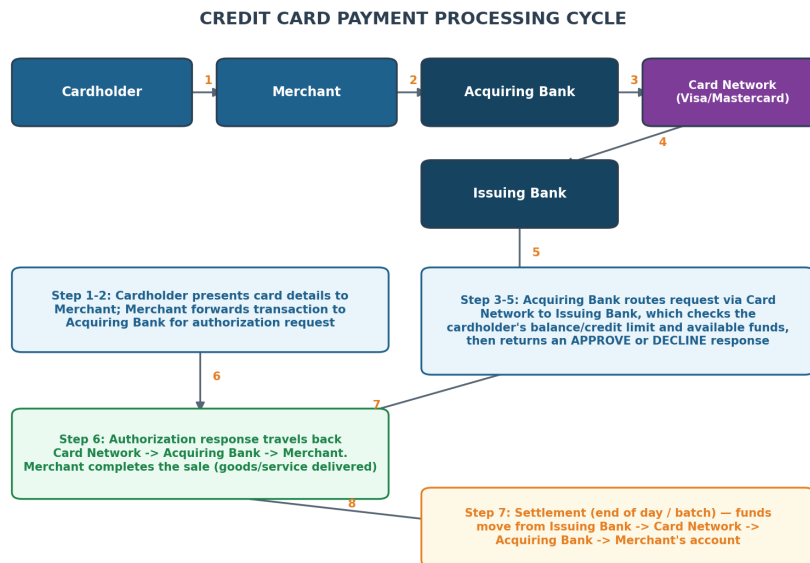


Figure 5.1: The end-to-end credit card payment processing cycle

Example: Steps in the Credit Card Payment Procedure

1. The cardholder enters card details at checkout on the merchant's website.
2. The merchant's payment gateway forwards an authorization request to its Acquiring Bank.
3. The Acquiring Bank routes the request through the Card Network to the cardholder's Issuing Bank.
4. The Issuing Bank checks the account status, available credit/funds, and fraud risk, then returns APPROVE or DECLINE.
5. The approval flows back through the Card Network and Acquiring Bank to the Merchant.
6. On approval, the merchant completes the order and (typically at day's end) submits a batch for capture.
7. In the settlement phase, funds actually move from the Issuing Bank, through the Card Network, to the Acquiring Bank, and finally into the merchant's account (minus interchange/processing fees).

Note: The 'authorization' step only reserves/verifies the funds; the actual movement of money happens later, during 'settlement' — these are two distinct stages of the same overall procedure.

5.4 E-Micropayments

E-micropayments are electronic payments of very small monetary value — often just a few cents or a fraction of a currency unit — used for things like a single news article, a song download, an in-app purchase, or per-use access to online content. Traditional card processing carries a relatively high fixed cost per transaction, which makes standard card rails inefficient for such tiny amounts, so micropayment systems typically use alternative mechanisms.

- **Account Aggregation:** Many small charges are accumulated and billed together as a single larger transaction (e.g. monthly mobile carrier billing).
- **Stored-Value / Pre-paid Balances:** Users pre-load a wallet balance, and micropayments are simply deducted from that balance without needing a full card-network round trip each time.
- **Token / Digital Currency Systems:** Small-value digital tokens are exchanged directly between parties, reducing per-transaction overhead.

5.5 E-Checking and its Processing Online

An e-check (electronic check) is the digital equivalent of a paper check — it carries the same legal and banking information (payer account, routing number, amount, and an electronic signature/authorization) but is transmitted, verified, and cleared entirely electronically instead of via a physical paper document.

5.5.1 How E-Checking Works Online

- The payer authorizes the payment by entering bank account and routing details (or through a pre-authorized mandate) on a merchant or payment processor's site.
- The payment processor validates the account information and converts the authorization into an electronic transaction record.
- The transaction is submitted into the banking clearing system (commonly the ACH network — see Section 5.6) for interbank settlement.
- Funds move from the payer's bank account to the payee's bank account, typically within one to a few business days.

Note: Unlike card payments, which are usually authorized in real time, e-checks generally clear in batches, so confirmation of final payment can take longer even though the initial authorization is instant.

5.6 Automated Clearing House (ACH) Network

The Automated Clearing House (ACH) network is a batch-processing electronic funds transfer system used to move money directly between bank accounts. It underlies direct deposit of salaries, recurring bill payments, business-to-business payments, and the processing of e-checks described above. Rather than settling each transaction individually and instantly, ACH transactions are collected, netted, and settled in batches at scheduled intervals, which keeps per-transaction costs very low.

AUTOMATED CLEARING HOUSE (ACH) NETWORK

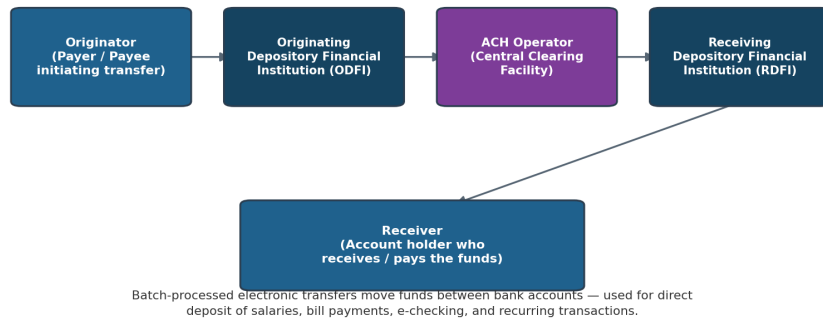


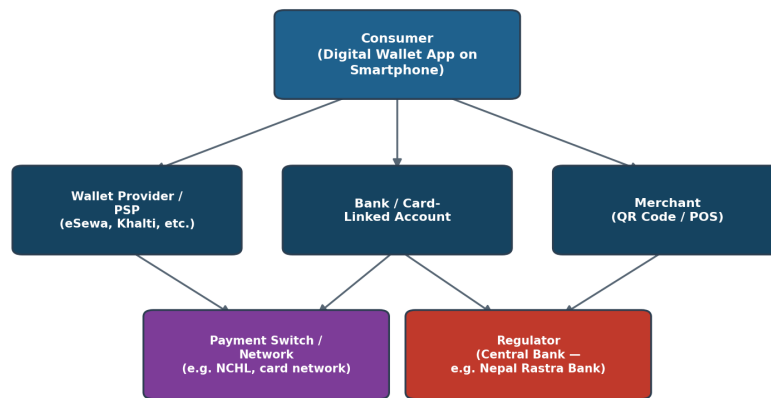
Figure 5.2: Flow of funds through the Automated Clearing House (ACH) network

Participant	Role
Originator	The individual or organisation that initiates the ACH transaction (payer or payee).
Originating Depository Financial Institution (ODFI)	The originator's bank; submits the transaction into the ACH network.
ACH Operator	The central clearing facility that batches, sorts, and routes transactions between banks.
Receiving Depository Financial Institution (RDFI)	The receiver's bank; posts the incoming transaction to the receiver's account.
Receiver	The individual or organisation whose account is credited or debited.

5.7 Mobile Payments (Digital Wallet)

A digital wallet (mobile wallet) is a software application, usually running on a smartphone, that securely stores payment credentials — linked bank accounts, cards, or a pre-loaded cash balance — and allows the user to make payments by tapping, scanning a QR code, or authorizing a transaction within the app, without needing to present a physical card or cash.

MOBILE PAYMENT (DIGITAL WALLET) ECOSYSTEM



The wallet provider links the consumer's funding source (bank/card) to a mobile app. Transactions are routed through a payment switch/network to the merchant's account, while the central bank regulates and oversees all participants for security and compliance.

Figure 5.3: Participants in a typical mobile payment / digital wallet ecosystem

5.7.1 Mobile Payment Participants

- **Consumer:** The end user who installs the wallet app and initiates payments.
- **Wallet Provider / Payment Service Provider (PSP):** The company operating the wallet platform (e.g. a fintech firm) that manages the app, user balances, and merchant relationships.
- **Bank / Card Issuer:** Supplies the underlying funding source that the wallet is linked to, or holds the wallet's pooled float account.
- **Merchant:** Accepts wallet payments, typically via a QR code or point-of-sale (POS) integration.
- **Payment Switch / Network:** Routes and settles transactions between the wallet provider, banks, and merchants.
- **Regulator (Central Bank):** Licenses payment service operators/providers and sets rules to protect consumers and financial stability.

5.7.2 Issues in Mobile Payments

- **Interoperability:** Wallets operated by different providers may not always be able to transact directly with one another without a shared switch/standard.
- **Security:** Loss or theft of the phone, malware, and phishing attacks targeting wallet credentials are ongoing risks.
- **Regulatory Compliance:** Anti-money-laundering (AML) and know-your-customer (KYC) requirements must be enforced by wallet providers.

- **Digital Divide:** Adoption depends on smartphone ownership, internet access, and digital literacy, which are uneven across populations.
- **Trust & Dispute Resolution:** Users need confidence that failed or fraudulent transactions will be refunded promptly.

5.8 International Payments

Cross-border e-commerce requires payment mechanisms that can move funds between parties in different countries, currencies, and banking systems. International e-payments introduce additional complexity beyond domestic transactions.

- **Currency Conversion:** Funds must typically be converted between currencies, exposing parties to exchange-rate risk and conversion fees.
- **Correspondent Banking & SWIFT:** Traditional international bank transfers rely on a network of correspondent banks connected via messaging systems such as SWIFT.
- **Card Network Cross-Border Fees:** International card transactions typically carry additional cross-border and currency-conversion fees charged by the card networks and issuing banks.
- **Regulatory Variation:** Each country enforces its own foreign-exchange controls, AML/KYC rules, and consumer-protection laws, which international payment providers must navigate simultaneously.
- **Emerging Cross-Border Rails:** Newer systems — including interoperable QR-code standards and blockchain-based transfers — are increasingly used to speed up and reduce the cost of international remittances.

5.9 Emerging E-Commerce Payment Systems & Issues: Cryptocurrency and Virtual Currency

5.9.1 Cryptocurrency

A cryptocurrency (e.g. Bitcoin, Ethereum) is a decentralised digital currency secured by cryptography and typically recorded on a distributed ledger called a blockchain. Unlike traditional e-payment systems, cryptocurrencies generally do not depend on a central bank or single intermediary to validate and record transactions; instead, a distributed network of participants (miners/validators) collectively maintains and confirms the ledger.

5.9.2 Virtual Currency

A virtual currency is a broader category of digital money that exists only in electronic form and is typically issued and controlled by a private entity (e.g. loyalty points, in-game currency, or a platform-specific credit) rather than a government. Cryptocurrencies are a subset of virtual

currencies that additionally use decentralised cryptographic ledgers; many other virtual currencies remain fully centralised and controlled by the issuing platform.

5.9.3 Key Issues

- **Price Volatility:** Cryptocurrency values can fluctuate sharply, making them risky as a store of value or unit of account for everyday commerce.
- **Regulatory Uncertainty:** Many jurisdictions are still developing clear legal frameworks for taxation, consumer protection, and AML compliance around crypto assets.
- **Scalability & Transaction Speed:** Some blockchain networks process far fewer transactions per second than established card networks, limiting throughput at scale.
- **Security of Custody:** Loss of private keys, exchange hacks, and wallet-related fraud can result in irreversible loss of funds.
- **Environmental Concerns:** Certain consensus mechanisms (e.g. proof-of-work mining) consume significant amounts of electricity.
- **Consumer Understanding:** The technical complexity of wallets, keys, and blockchain concepts remains a barrier to mainstream adoption for ordinary e-commerce use.

Note: Because regulatory treatment of cryptocurrency and virtual currency differs significantly from country to country and continues to evolve rapidly, businesses accepting these instruments must monitor the applicable legal framework in each market they operate in.

5.10 Case Study: Emerging Trends in Online Payment Systems in Nepal

Nepal's digital payment ecosystem has expanded rapidly over the past several years, driven by rising smartphone and internet penetration, active promotion by Nepal Rastra Bank (NRB — the central bank), and the entry of multiple licensed Payment Service Operators (PSOs) and Payment Service Providers (PSPs). The journey began with the launch of eSewa in 2009 as Nepal's pioneering digital wallet, and has since grown into a diverse ecosystem including Khalti, IME Pay, ConnectIPS, Namaste Pay, and numerous bank-linked mobile and internet banking services.

5.10.1 Growth in Digital Payment Adoption

According to Nepal Rastra Bank's payment system oversight data, digital wallet users grew from roughly 6.3 million in mid-2020 to more than 28 million by mid-2026, while debit card users nearly doubled to approximately 13.9 million over the same broad period, and credit card users roughly doubled to around 331,000. ConnectIPS — the interbank real-time payment platform operated by Nepal Clearing House Limited — expanded from about 160,000 users to more than

1.5 million users, reflecting rising comfort with direct bank-to-bank digital transfers.

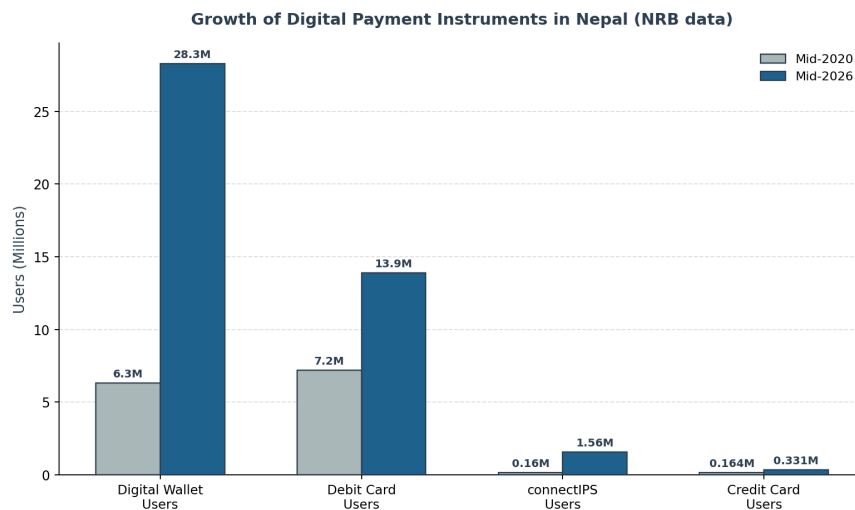


Figure 5.4: Approximate growth in Nepal's digital payment user base, mid-2020 vs mid-2026 (NRB data)

5.10.2 Key Trends

- **QR Code Payments:** QR-based payment, championed by platforms such as FonePay and adopted by most major wallets and banks, has become one of the cheapest and fastest ways for merchants of any size to accept digital payment.
- **Interoperability Push:** NRB has actively encouraged interoperable QR standards and real-time settlement infrastructure so that a payment initiated on one bank's app or wallet can be received seamlessly by a merchant using a different provider.
- **Wallet Consolidation:** The sector has seen strategic mergers among wallet providers (for example, the 2025 merger of Khalti and IME Pay), reflecting a maturing and increasingly competitive market.
- **Cross-Border QR Payments:** Nepal has begun enabling cross-border QR payment corridors, allowing travellers and remittance senders to transact digitally across national boundaries with growing transaction volumes.
- **Rising E-Commerce Card Usage:** Online card payments for goods and services have grown steadily as more consumers shop through e-commerce platforms and social-media-based businesses.

5.10.3 Ongoing Challenges

- **Digital Divide:** Adoption remains concentrated in urban areas; rural connectivity and financial literacy still lag behind.
- **Cash Dependence:** Despite rapid digital growth, cash continues to dominate a large share of everyday retail transactions across the country.

- **Cybersecurity & Consumer Protection:** As transaction volumes rise, so does the importance of fraud prevention, dispute resolution, and public awareness of safe digital payment practices.
- **Regulatory Coordination:** Ensuring consistent rules across the growing number of licensed PSOs/PSPs, banks, and card networks requires continuous regulatory oversight.

Key Takeaways

- ✓ Payment cards (credit, charge, debit, smart) differ mainly in funding source and settlement timing, but share common card-network processing rails.
- ✓ The credit card payment procedure separates 'authorization' (real-time approval) from 'settlement' (later movement of actual funds).
- ✓ E-micropayments and e-checking use aggregation, stored-value, or batch-clearing (ACH) mechanisms to keep small or account-based payments cost-effective.
- ✓ The ACH network enables low-cost, batch-based bank-to-bank transfers underlying direct deposit, e-checks, and recurring payments.
- ✓ Mobile payments (digital wallets) involve consumers, wallet providers, banks, merchants, payment switches, and regulators, and face interoperability and security challenges.
- ✓ International payments add currency conversion, correspondent banking, and cross-border regulatory complexity.
- ✓ Cryptocurrency and virtual currency are emerging, largely decentralised alternatives to traditional e-payment rails, but carry volatility, regulatory, and security concerns.
- ✓ Nepal's digital payment ecosystem — led by eSewa, Khalti, IME Pay, and ConnectIPS — has grown rapidly since 2020, with QR payments and interoperability initiatives driving continued momentum despite persistent digital-divide and cash-dependence challenges.

— End of Unit 5 —