

## CHAPTER : IT TRENDS, TECHNOLOGY & ARTIFICIAL INTELLIGENCE

### SECTION 1: DIGITAL PAYMENTS & CURRENCIES

#### UPI (Unified Payments Interface)

- Full form: Unified Payments Interface
- Launched: April 11, 2016 by NPCI (National Payments Corporation of India)
- Allows direct bank-to-bank transfers via mobile using a VPA (Virtual Payment Address)
- Uses MPIN (4 or 6-digit) for authentication; cannot be used to apply for loans directly
- UPI 2.0 launched August 2018 — added signed intent/QR, one-time mandates, invoice verification, overdraft facility
- UPI Circle (late 2025): allows up to 5 secondary users with ₹15,000 monthly limits

#### Current Scale (as of 2026):

- UPI processed approximately 24,162 crore transactions in financial year 2025-26 — a 12,000-fold surge from its launch. Monthly transaction volume hit an all-time high of 2,264 crore in March 2026. Daily usage: nearly 66 crore transactions per day with a daily value of about ₹0.86 lakh crore.
- UPI now commands nearly 85% of India's total digital payment volume, expanding from just 21 banks at launch to over 703 participating banks.
- UPI surpassed 500 million unique users by early 2026. PhonePe holds 48.3% market share and Google Pay holds 37%, with the top two apps processing over 85% of UPI volume.
- UPI Lite supports offline transactions up to ₹5,000 total limit in 2026, boosting low-connectivity access. RuPay credit cards on UPI reached widespread adoption in 2026.
- UPI is accepted in 7+ countries including Sri Lanka, Mauritius, UAE, Singapore, Bhutan, Nepal, and France. Indian tourists can now pay with UPI in 27 countries.
- Per-transaction limit: ₹1 lakh (general); ₹2 lakh for capital markets/insurance; ₹5 lakh for IPO/retail direct
- Transaction success rate: 99.2%

#### NEFT (National Electronic Funds Transfer)

- One-to-one interbank fund transfer system, operated by RBI
- Established November 2005 by IDRBT (Institute for Development and Research in Banking Technology)

#### RTGS (Real Time Gross Settlement)

- Real-time online transfer system; minimum ₹2,00,000; no maximum limit
- Maintained by RBI; ideal for high-value transactions

#### IMPS (Immediate Payment Service)

- Instant 24x7 interbank fund transfer; managed by NPCI; launched 2010
- Objectives: mobile banking access, simple payments by mobile number, foundation for full mobile banking

#### Internet Banking (Net Banking)

- Also called e-banking; features: multiple account management, NEFT/RTGS transfers, bill payments, FD creation
- Most secure login method: Two-Factor Authentication (2FA)
- IFSC code identifies a specific bank branch for transfers
- Risk: phishing attacks; cash deposit NOT possible through internet banking

#### Mobile Wallets / E-Wallets

- Digital apps for secure payment storage and transactions; also called "mobile money"

#### Popular wallets (Name — Year — Founder/Owner):

- PayPal — 1998 — Max Levchin, Peter Thiel, Luke Nosek
- Amazon Pay — 2007 — Amazon Inc.
- Paytm — 2010 — Vijay Shekhar Sharma (One97 Communications)
- Google Pay — 2011 (rebranded 2018) — Google
- Apple Pay — 2014 — Apple Inc.

- PhonePe — 2015 — Sameer Nigam, Rahul Chari
- BHIM Pay — 2016 — NPCI (BHIM = Bharat Interface for Money); available in 13 Indian languages
- Bharat Pay — 2018 — Ashneer Grover, Shashvat Nakrani

### Digital Rupee / CBDC (Central Bank Digital Currency)

- India's ₹ (Digital Rupee) retail pilot has scaled significantly and is now interoperable with UPI via universal QR codes
- Globally: Project Agora (2026) is testing multicurrency unified ledgers using tokenization for cross-border payments

### QR Code (Quick Response Code)

- 2D (matrix) barcode storing URLs, text, payment details
- Invented by Denso Wave (subsidiary of Toyota) in 1994
- Can encode: numeric, alphanumeric, binary, kanji data
- QR = Quick Response; cannot store large files

### Cryptocurrency

- Digital/virtual currency using cryptography; decentralised; not controlled by any government or bank
- 1,000+ cryptocurrencies globally
- Examples: Bitcoin, Ethereum, Ripple, Dogecoin, Solana

### Bitcoin (BTC):

- Created by Satoshi Nakamoto (pseudonym); whitepaper 2008; officially launched 2009
- Smallest unit: Satoshi
- Decentralised; anonymous transactions; no government/bank control

### Electronic Payment System (E-Payment)

- Mode of payment over an electronic network (internet); safe, speedy, cost-effective alternative to cash

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## SECTION 2: CLOUD COMPUTING & INFRASTRUCTURE

### Cloud Computing

- Delivery of computing services (storage, servers, databases, networking, software, analytics) over the internet
- Also called cloud storage; requires only internet to access data
- Examples: Google Drive, AWS, Microsoft Azure, OneDrive, iCloud

### Service Models:

- IaaS (Infrastructure as a Service): Virtualized resources — AWS, Microsoft Azure. Provides most control over infrastructure.
- PaaS (Platform as a Service): App development platform — Google App Engine, Heroku
- SaaS (Software as a Service): Subscription-based software — Google Workspace, Microsoft 365, Dropbox
- HaaS (Hardware as a Service): NOT a standard cloud model

Primary benefit: On-demand self-service. Windows 10 syncs files using OneDrive.

### Cloud 3.0 Era (2025-2026 Trends)

- Industry is entering the Cloud 3.0 era, driven by the need to manage AI workloads, data sensitivity, and low-latency inference
- Rise of Sovereign Clouds: Networks designed to keep national data legally and physically within a country's borders
- Serverless AI: Global serverless computing market growing at 14.1% CAGR (2025–2030); reduces deployment times by 64.8% and total cost of ownership by up to 42.3%
- 85% of data center insiders believe nuclear energy is key to meeting AI-driven future demand
- Operators increasingly use behind-the-meter local energy solutions due to grid constraints from AI boom

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## SECTION 3: ARTIFICIAL INTELLIGENCE (AI)

### Core Concepts

- Father of AI: John McCarthy
- AI = Artificial Intelligence (not Automated Intelligence)
- Programming languages used: LISP, Java, Python
- Machine Learning = subfield of AI that builds systems learning from data without explicit programming

**Types of AI:**

- Narrow AI (Weak AI): Designed for specific tasks; cannot go beyond programmed scope. Examples: Siri, recommendation algorithms, self-driving cars
- General AI (Strong AI): Human-like intelligence across multiple tasks. Example: Deep Blue (IBM) — defeated chess champion Garry Kasparov

**Applications of AI:**

- Healthcare: Diagnostic tools, personalised medicine, drug discovery, medical imaging analysis
- Finance: Fraud detection, algorithmic trading, risk management, customer service
- Retail: Personalised recommendations, inventory management, chatbots
- Transportation: Autonomous vehicles, route optimisation, traffic management
- Education: Adaptive learning, virtual tutors, administrative automation
- Manufacturing: Predictive maintenance, quality control, supply chain optimisation
- Entertainment: Content recommendation systems, video game AI
- Agriculture: Crop monitoring, precision farming, yield prediction, pest control

**Popular AI Tools — Updated as of 2026 (Name — Year — Developer):**

- Siri — 2011 — Apple
- Alexa — 2014 — Amazon
- Cortana — 2014 — Microsoft
- Google Assistant — 2016 — Google
- Bixby — 2017 — Samsung
- IBM Watson Assistant — 2018 — IBM
- ChatGPT — 2022 — OpenAI (Full form: Chat Generative Pre-Trained Transformer)
- Gemini — 2023 — Google DeepMind (latest: Gemini 3.1 Pro, released February 2026)
- Copilot — 2023 — Microsoft (Wave 3 update: March 2026; now uses Claude, GPT, and Microsoft models)
- DeepSeek AI Chatbot — 2025 — DeepSeek (China)
- Qwen 2.5-Max — 2025 — Alibaba
- GPT-5.4 — 2026 — OpenAI (released March 2026; 1 million token context window)
- Claude Opus 4.7 — 2026 — Anthropic (leads on long-horizon coding benchmarks)
- Grok 4 — 2026 — xAI (Elon Musk; integrates live data from X/Twitter)

In 2026, no single model dominates every category. Grok 4 and Claude Opus 4.6 lead coding benchmarks. Gemini 3.1 Pro leads reasoning. Claude produces the most natural prose. GPT-5.4 is considered the best all-rounder with the largest ecosystem.

**Key AI Facts (India):**

- School of AI established in Delhi in 2020
- Madhya Pradesh: first Indian state to teach AI in school education
- CAIR (Centre for Artificial Intelligence), Bangalore: India's leading AI institute, established 1986
- India's AI Portal: indiaai.gov.in (launched September 2020)
- CogX: world's leading AI conference, held annually in London
- Japan: leads the world in implementing AI in manufacturing robots
- As of August 2025, over 38,000 GPUs have been made available to Indian startups at subsidised rates; AIKosh hosts 1,500 datasets and 217 AI models.

**AI Trends in 2026:**

- 2026 is called the "Year of Truth for AI" — AI is maturing into the backbone of enterprise architecture
- "AI eating software": AI now autonomously generates, integrates, and maintains software components
- AI agents acting as digital coworkers in workplaces; organisations adding ambient security safeguards
- AI as scientific collaborator: generating hypotheses and controlling lab experiments
- AI bridging global health gaps through advanced diagnostic systems with accuracy far exceeding average physicians
- Reasoning is now the default mode, not a separate product. OpenAI's GPT-5.4 Thinking, Claude Opus 4.7, and Gemini 3.1 Pro all blend reasoning into the main model. The "o-series" branding by OpenAI is discontinued.

**AI Regulation:**

- EU: General-Purpose AI Code of Practice (July 2025) — places strict safety and evaluation requirements on models presenting systemic risks
- In November 2025, MeitY released the India AI Governance Guidelines under the IndiaAI Mission. These rest on seven core principles called "Sutras": Trust is the Foundation, People First, Innovation over Restraint, Fairness and Equity, Accountability, Understandable by Design, and a seventh principle on safety.
- The framework proposes institutional mechanisms: an AI Governance Group (inter-ministerial), a Technology and Policy Expert Committee, and the IndiaAI Safety Institute for monitoring and capacity building. India has consciously chosen not to enact a dedicated AI law at this stage, instead relying on existing laws with targeted amendments.
- AI (Ethics and Accountability) Bill, 2025: Private Member's Bill introduced December 2025 in Lok Sabha — proposes an Ethics Committee for AI, mandatory ethical reviews, bias audits, and penalties up to ₹5 crore (not yet enacted)

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## SECTION 4: BLOCKCHAIN & QUANTUM COMPUTING

### Blockchain

- Decentralised digital ledger recording transactions across multiple computers
- Secure, transparent, immutable — once data is added, it cannot be altered
- Used in: cryptocurrency, supply chain management, smart contracts, voting systems
- Technology underpinning Bitcoin and Ethereum
- Cryptography = storing and transmitting data in coded form so only intended parties can read it
- Technology used to ensure security and integrity of online government transactions: Blockchain

### Quantum Computing (Latest 2025-26)

- Rapidly moving toward hybrid systems where quantum processors, AI, and supercomputers work in tandem
- QFOR: new Deep Reinforcement Learning framework developed to intelligently allocate tasks across quantum cloud nodes
- Still in research/hybrid phase; not yet mainstream for commercial use

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## SECTION 5: ROBOTICS

### Core Concepts

- Father of Robotics: Joseph Engelberger
- The word "robot" comes from Czech word robota meaning forced labor or drudgery
- Combines engineering, computer science, and AI
- Part necessary for robot movement: Sensors
- Japan leads the world in implementing AI in manufacturing robots

### Notable Robots (Name — Description):

- Unimate — First industrial robot (George Devol and Joseph Engelberger, 1960s)
- ASIMO — Humanoid robot by Honda; walks, talks, interacts with humans
- Roomba — Robotic vacuum cleaner by iRobot
- Curiosity Rover — NASA Mars exploration robot
- Sophia — Humanoid by Hanson Robotics; received Saudi Arabia citizenship October 2017
- Manav — Indian humanoid by A-SET Training and Research Institutes (Dewakar Vaish)
- Vyom Mitra — ISRO humanoid developed for space missions
- Daksh — DRDO bomb disposal robot
- Brabo — Industrial robot by Tata Motors (TAL Manufacturing Solutions)
- Khamosh Prahari — Indian Army surveillance robot
- Drone Bhim — Indian delivery drone for medical/essential supplies

World's first robot restaurant: Beijing, 2015

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## SECTION 6: E-GOVERNANCE & DIGITAL SERVICES

### E-Governance

- Digitalisation of government functions for efficiency, transparency, and accessibility
- Formally launched in India in 2006 through the National e-Governance Plan (NeGP)

- Reduces administrative costs; primary goal: use technology to improve government services
- Pillars: People, Process, Resources, Technology
- Key benefit: Enhanced transparency and accountability

### Types:

- G2C (Government to Citizen) — e-District
- G2B (Government to Business) — GST Portal
- G2G (Government to Government) — e-Office
- G2E (Government to Employee) — National e-Governance Services Portal

### Key E-Governance Portals:

- DigiLocker: Launched 1 July 2015; requires Aadhaar; stores PAN, DL, Voter ID, Aadhaar card
- UMANG: Single platform for multiple government services
- GeM (Government e-Marketplace): Public procurement of goods and services
- Bhoomi Portal: Karnataka's land records management system
- Passport Seva: Online passport services
- Income Tax e-Filing: Online return filing
- RTI Online: Right to Information requests
- EPFO Portal: Provident Fund services
- National Scholarship Portal: Government scholarships
- Saral Haryana: Citizen service portal for Haryana
- e-Procurement System: Online tendering for government departments

Note: Bhoomi, Balasharma, Mukhya Vahini are e-Governance projects in Karnataka

## SECTION 7: E-COMMERCE

### E-Commerce

- Buying and selling of goods and services over the internet; breaks geographical barriers

### Types:

- B2C (Business to Consumer): Amazon, Flipkart, Myntra, Ajo
- B2B (Business to Business): India Mart, Alibaba, ThomasNet
- C2C (Consumer to Consumer): Quikr, OLX, eBay
- C2B (Consumer to Business): Shutterstock, Google AdSense, Freelancer
- C2G (Consumer to Government): MP Online, E-Challan
- B2G (Business to Government): GoWin, FedBid

### Key Companies (Name — Year — Founder — Location):

- Amazon — 1994 — Jeff Bezos — Seattle, USA
- eBay — 1995 — Pierre Omidyar — San Jose, USA
- Alibaba — 1999 — Jack Ma, Peng Lei — Hangzhou, China
- Myntra — 2007 — Mukesh Bansal et al. — Bangalore
- Flipkart — 2007 — Sachin Bansal, Binny Bansal — Bangalore
- Snapdeal — 2010 — Kunal Bahl, Rohit Bansal — Gurgaon
- Meesho — 2015 — Vidit Aatrey, Sanjeev Barnwal — Bangalore

## SECTION 8: OTHER KEY IT CONCEPTS

### Digital Signature

- Authenticates sender identity; ensures document integrity and prevents forgery
- Private key = signs the document; Public key = verifies/identifies
- Advantages: identifies signatory, maintains integrity, prevents forgery, encrypts data

### OTP (One Time Password)

- Unique temporary code; valid for single session; usually 6 digits; expires within minutes

### Biometric Sensor

- Captures fingerprints, facial features, or iris for identity verification
- Fingerprints are most commonly used

### GIS (Geographical Information System)

- Computer-based system for storing and manipulating geographical data
- Most frequently used technology to manage and digitise e-land records

**VR vs AR**

- Virtual Reality (VR): Fully immersive digital environment; primary sense targeted = Vision
- Augmented Reality (AR): Overlays digital information onto the real world

**Digital Library**

- Organised collection of e-books, journals, images, audio/video in electronic formats
- Examples: Project Gutenberg, Internet Archive

**OTT (Over-The-Top)**

- Delivery of media content directly over the internet without cable/satellite subscriptions
- Reliance Entertainment launched India's first OTT platform in 2008
- Popular platforms: Netflix, Amazon Prime, Voot, MX Player, Hotstar

**Other Concepts**

- Morphing: Special effect transitioning one image to another through seamless animation
- Flowchart: Visual/graphical representation of an algorithm
- CERT-IN: Computer Emergency Response Team of India (national cybersecurity agency)
- Section 65 of IT Act 2000: Tampering with documents
- BharatNet: Government initiative for rural broadband/internet access
- Digital India Program key feature: Ensuring digital literacy for all
- IndiaAI Mission: Government initiative with 10,000+ GPUs, AIKosh dataset platform, three AI Centres of Excellence (Healthcare, Agriculture, Sustainable Cities); fourth announced for Education (₹500 crore)

**SECTION 9: KEY ABBREVIATIONS**

AI — Artificial Intelligence

AR — Augmented Reality

VR — Virtual Reality

IoT — Internet of Things

ML — Machine Learning

SaaS — Software as a Service

PaaS — Platform as a Service

IaaS — Infrastructure as a Service

RPA — Robotic Process Automation

UAV — Unmanned Aerial Vehicle (Drone)

BHIM — Bharat Interface for Money

NEFT — National Electronic Funds Transfer

RTGS — Real Time Gross Settlement

IMPS — Immediate Payment Service

UPI — Unified Payments Interface

OTP — One Time Password

QR — Quick Response

GIS — Geographical Information System

CCTV — Closed Circuit Television

USB — Universal Serial Bus

HDMI — High Definition Multimedia Interface

SIM — Subscriber Identity Module

CAD — Computer Aided Design

GPRS — General Packet Radio Service

CBDC — Central Bank Digital Currency

DPDPA — Digital Personal Data Protection Act

LLM — Large Language Model

GenAI — Generative Artificial Intelligence



NBCC

**SECTION 10: 30 PRACTICE Questions WITH ANSWERS**

- Q1. UPI stands for? → Unified Payments Interface  
Q2. UPI was introduced by? → NPCI  
Q3. NEFT established in? → 2005  
Q4. Minimum RTGS transfer? → Rs 2,00,000  
Q5. IMPS started in? → 2010  
Q6. NOT a cloud service model? → HaaS  
Q7. Google Drive, SkyDrive, Dropbox are examples of? → Cloud Storage Services  
Q8. Full form of BHIM? → Bharat Interface for Money  
Q9. BHIM Pay launched by? → NPCI  
Q10. QR codes invented by? → Denso Wave (subsidiary of Toyota)  
Q11. QR stands for? → Quick Response  
Q12. Smallest unit of Bitcoin? → Satoshi  
Q13. Father of AI? → John McCarthy  
Q14. ChatGPT launched in? → 2022  
Q15. Full form of ChatGPT? → Chat Generative Pre-Trained Transformer  
Q16. Father of Robotics? → Joseph Engelberg  
Q17. ISRO robot for space missions? → Vyom Mitra  
Q18. DigiLocker launched on? → 1 July 2015  
Q19. Technology for e-land records? → GIS  
Q20. e-Governance India launched via? → National e-Governance Plan (NeGP)  
Q21. Amazon represents which e-commerce model? → B2C  
Q22. Paytm founded when and by whom? → 2010, Vijay Shekhar Sharma  
Q23. G2B type of e-Governance? → GST Portal  
Q24. Sophia robot got citizenship of? → Saudi Arabia  
Q25. Which country leads in AI for manufacturing? → Japan  
Q26. Blockchain is best described as? → Decentralised digital ledger across multiple computers  
Q27. VR displays target which sense? → Vision  
Q28. Bhoomi Portal is for which state? → Karnataka  
Q29. Example of Narrow AI? → Siri  
Q30. OTP is typically how many digits? → 6 digits  
Q31. UPI's all-time high monthly transactions were recorded in? → March 2026 (2,264 crore transactions)  
Q32. India's AI Governance Guidelines were released by which ministry? → MeitY (Ministry of Electronics and Information Technology), November 2025  
Q33. How many "Sutras" are in India's AI Governance Guidelines? → 7  
Q34. Which body will monitor AI safety in India under the new guidelines? → AI Safety Institute (AISi)  
Q35. UPI Lite supports offline transactions up to what limit in 2026? → ₹5,000 total wallet balance  
Q36. PhonePe's UPI market share in 2026? → 48.3%  
Q37. UPI now commands what percentage of India's digital payment volume? → ~85%  
Q38. Which AI model leads on coding benchmarks in 2026? → Claude Opus 4.7 / Grok 4 (both competitive at top)  
Q39. What is the IndiaAI dataset platform called? → AIKosh  
Q40. Gemini 3.1 Pro was released in? → February 2026 by Google DeepMind