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Foundations & Frontiers

A 2-Day Deep Dive into Blockchain Technology

FA-0120 · two-day

DevOps, Cloud & Infrastructure

Introduction

Blockchain is everywhere these days, and for good reason—it's actually changing how entire industries handle transactions and build trust. This two-day deep dive cuts through the hype to show you how blockchain really works, from the ground up.

You'll get your hands dirty with real examples—think supply chain tracking, digital asset creation, and other stuff companies are actually using right now. We'll balance the technical side with practical case studies so you can see both the massive potential and the real-world headaches that come with implementing this technology.

Your instructor has been in the trenches for over 30 years and focuses on what actually works in the field, not just textbook theory. By the end, you'll understand not just how blockchain operates, but where it makes sense to use it—and where it doesn't.

Learning Outcome

By the end of the course, participants will be able to:

- Describe blockchain structures, cryptographic hashing, consensus algorithms, and smart contracts.
- Explain differences between public, private, consortium, and hybrid blockchains.
- Illustrate end-to-end block creation and network propagation.
- Analyze real-world blockchain deployments and assess use-case fit.

- Recognize typical challenges (e.g., scalability, governance, compliance) and mitigation strategies.
- Consider future directions: tokenization, DeFi, permissioned networks, digital asset workflows.

Prerequisite

- Basic understanding of databases, networking concepts, and cryptographic principles (hashing, digital signatures).
- Comfort with technical diagrams and logical workflows.

Training outline

1. 1. Blockchain Foundations

Distributed Ledger Architecture

- Blocks, chains, Merkle trees, cryptographic hashing (SHA-256)
- Genesis block and immutability foundations

Peer-to-Peer Networks & Node Roles

- Types of nodes (full, light, validator), propagation, orphan blocks, forks

Consensus Mechanisms

- Proof-of-Work vs. Proof-of-Stake, BFT models
- Trade-offs: security, scalability, decentralization

Blockchain Types

- Public (e.g., Bitcoin, Ethereum), Private, Consortium (e.g., Canton Network), Hybrid models

2. 2. Key Technical Components

Cryptography & Security

- Hashing, Merkle roots, digital signatures, wallet key management
- Threat vectors: 51% attacks, double-spend, smart-contract vulnerabilities

Smart Contracts & Virtual Machines

- Functionality via Ethereum, TVM (TON), Daml (Canton)

Sharding & Scalability

- Horizontal scaling models (e.g., TON's multi-chain architecture)

3. 3. Blockchain in Action: Generation & Networks

Genesis Process & Block Creation

- Mining, staking, block validation, transaction lifecycle

Network Deployment Models

- Permissionless vs. permissioned strategies
- Case spotlight: Canton Network (financial institutions interoperability and atomic settlements)

4. 4. Live Case Studies

Procurement & Contracts

- Hitachi using Hyperledger Fabric for paperless, secure procurement with ~3,500 vendors

Real-World Asset Tokenization

- Dubai's DAMAC & MANTRA partnership: $1billion real-estate tokenization pilot
- Mastercard Multi-Token Network: cross-border payments, carbon credits, and fiat-crypto flows

Maritime Environmental Monitoring

- Polygon-based IoT integration for MARPOL sulfur monitoring

Consortium Finance Use Case

- Canton Network enabling regulated asset tokenization (e.g., eurobonds, gold) with privacy-preserving multi-party consent

5. 5. Deployment Challenges & Ecosystem Considerations

Governance & Regulatory Compliance

- Third-party validation vs. self-certification (Lessons from Aura, Prada)
- Navigating MiCA, FATF, and global guidance—e.g., BBVA via Visa VTAP

Scalability vs. Security Trade-offs

- Balancing TPS, throughput, decentralization in real deployments

Interoperability & Integration

- Connecting multiple platforms: Corda, Solana, public & private chains

6. 6. Future Trends & Industry Trajectories

DeFi, Tokenized Assets & CBDC

- Expanding DeFi, stablecoins, CBDC pilot trends

Enterprise Blockchain Consortiums

- Canton Network adoption by major banks (HSBC, BoA, MAS)

Emerging Architectures

- Agent-centric vs. blockchain (e.g., Holochain) and parallel-chain solutions

7. 7. Hands-On Demonstrations (Optional Segment)

- Mini exercise: Build & simulate a basic block/chain in Python or using a Hyperledger Fabric sandbox
- Review real contract data structures, consensus flowcharts, and validate chain state

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