## Index

Account hacking, 269 Account state, 149-150 Accounting. See also Auditing, 25-26, 39, 351-352 for crypto assets, 342-344 systems, 146-147 treatment. 346 Ackerman case, 229 Actual cash value (ACV), 219 Ad valorem taxis, 312-313 Advanced financial services, 75-76 Advanced network-based information systems, 275 Aflac (AFL), 279 Agent, 31 Agent-based models (ABMs), 134 Agile model, 270 AIP gateway, 167 Air-gapped asset, 349 Airdrops, 245, 248 Algorand, 75 Alternative history attack, 111 Altman Z-score, 40 American Institute of Certified Public Accountants (AICPA), 359-360 Anonymity, 68, 72 Anonymity data, 90-91 Application blockchain interface (ABCI), 176 Application programming interfaces (APIs), 166, 284–285, 334 Application specific integrated circuits (ASICs), 73, 109 Artificial intelligence (AI), 10, 35-38, 189, 191-197, 294 applications with database and extension with blockchain, 197 - 200

blockchain technology and, 42 combining AI and blockchain for managing and monetizing healthcare data, 300-301 data analytics, 192-193 data capture, 191 data computing, 192 data storage, 191-192 descriptive analytics, 193-195 in other domains and extension with blockchain, 199-200 predictive analytics, 195-196 prescriptive analytics, 197 system infrastructure, 191-192 Artificial neural networks (ANNs), 36 Asset backed tokens, 75 Asset-backed coins. See Stablecoins Association rules, 193-194 Assurance, 360–362 services. 359 Asynchronous byzantine fault tolerant (aBFT), 76-77 ATBCOIN, 230 Atomic swaps, 184-185 Audit, 360 Auditing. See also Accounting access and validation controls, 366-369 blockchain governance, 365-366 digital assets, 359 digital assets on blockchain, 363-364 external auditing and assurance, 360-362 internal controls over financial reporting, 364-371 limitations and challenges to auditors, 370-371

management's assertions and audit evidence utilizing blockchain, 361 rights, 363-364 smart contract testing, 369-370 valuation, 363 Auditing Standard 1105, 362 Auditors, limitations and challenges to, 370-371 Authenticity, 126 Automation, 18–19 Availability, 296 Balancing feedback loop, 134 Bank Secrecy Act, 224 Bayesian statistics, 195-196 BC. See Bitcoin (BTC) Big data, 193 Binance, 27, 348 Bitcoin (BTC), 7, 19-20, 34, 70-71, 74-75, 85, 88, 99, 101, 171, 175, 252, 325 background economics and limitations, 174–175 blockchain, 103-108, 171 PoW example case, 103-108 protocol, 75 Block, 52–54 reward, 132 Blockchain, 3-7, 9-10, 13, 15, 17-24, 31, 50–52, 141, 157, 207, 275, 297, 359 architecture of, 52-55 auditing digital assets on, 363-364 block hashing, 56 blockchain for sustainable development, 40 business process improvement, 40 - 41components, 15-16 concepts, 50 consensus, 20-21 consensus algorithms, 59-60 credit scoring, 34-37

crypto tax compliance, 252-254 cryptocurrency, 16-17 cryptographic hashing, 55-56 decentralization. 51-52 decreased costs, 163-164 distributed ledger, 57-59 efficiency, 160 elements, 157-159 FAQs applied retroactively or as of date of issuance, 247 Forced Fit to and, 226 foreign reporting guidance, 249 fraud detection using, 43-44 governance, 365-366 Hard Forks and Airdrops, 248 and healthcare industry, 41-43 immutability, 52 implementation, 27 importance in internet age, 23-24 interoperability, 166-167 interpreting third-party information reporting standards, 248-249 key properties of, 51 lack of standardization, 165 managing food supply, 37-38 managing water usage during climate change, 37 Merkle hash tree and root, 57 models, 24-25 obstacles to blockchain adoption, 26 operational procedure, 60-61 predicating customer default in e-commerce, 44 promise of, 25-27, 160-164 real-time accounting and credit-risk modeling, 39-40 regulatory ambiguity, 167-168, 246-252 review and emerging applications, 32-45 second chance of, 174 sharing services, 38-39

signature, 57 speed and scalability, 164-165 staking reward taxation, 249-251 state of, 172-173 tax implications of virtual currency, 241-246 taxation related to capital formation. 251–252 technical challenges, 61-62, 164-167 technology, 3-4, 55-60, 223, 259-261, 325 as tool to break poverty chain, 44-45 traceability, 162-163 transparency, 160-162 types of blockchain networks, 50-51 virtual currency question, 251 2019 Virtual Currency Guidance, 246-247 for voting, 280-281 Blockchain adoption, 301–305 barriers. 301-304 blockchain-based healthcare systems, 304-305 challenges and considerations to blockchain implementation, 267-269 data malleability challenges, 269 data size and system bandwidth challenges, 268 decision metrics, 267 evaluating organizational capabilities, 264-267 identifying purpose for implementing blockchain, 261-262 identifying real cost of implementing blockchain, 262-264 implementation risks, 265-266 life cycle approach to implementation, 270-272 maintaining blockchain, 267 personnel qualifications, 265

preparing for blockchain implementation, 260-264 system latency challenges, 268 system scalability challenges, 268-269 system security challenges, 269 system throughput challenges, 268 technical and organizational capability, 265 technological challenges, 268-269 total cost of ownership, 266 transaction authentication challenges, 269 Blockchain applications investment management and reporting, 321-322 for mortgage originations, 319 for mortgage servicing, 319-320 physical maintenance and monitoring, 321 property management and leasing for. 320-321 for real estate finance, 318-322 to real estate operations, 320-322 for real estate transactions, 316-318 for secondary market operations, 320 Blockchain layers, 83–85 CBDCs, 92–93 comparing private and public blockchains, 86-88 evaluating non-public blockchain, 96-97 motivating hybrid blockchains, 88-92 payment system projects by monetary authorities, 93-94 private blockchains, 85-86 transportation tracking, 94 Blockchain networks, 121 model selection, 264 Blockchain-based digital assets, 121 Blockchain-based evaluation systems, 38

Blockchain-based healthcare data management, 298-301 combining AI and blockchain for managing and monetizing healthcare data, 300–301 on-and off-chain data management, 299-300 Blockchain-based healthcare systems, 304-305 Blockchain-based identity management approaches, 304-305 Blockchain-based property record, 317 Blockchain-based sharing services, 39 Blockchain-powered real property records. 315-316 Borderless money, 19-20 "Break-glass" mechanisms, 303 Bribery attack, 114 BTC for Liquid Bitcoin (L-BTC), 179 - 180Burn-and-mint equilibrium model (BME model), 129 Burn-and-mint tokens, 129 Business applications of blockchain, 146-149 business-to-business transactions made secure and simple, 148-149 positive disruptions in business practices, 146-148 Business model, 167 Business process improvement, 40-41 Business-to-business transactions (B2B transactions), 148–149 Business-to-consumer transactions (B2C transactions), 148 Byzantine Fault Tolerance (BFT), 59-60, 100 Byzantine Generals' Problem, 100 Byzantine-fault tolerance method, 116-117

CargoX, 332 Cash conversion cycle (CCC), 329 Censorship resistance, 68, 71–72 Central bank cryptocurrency (CBCC), 92-93 Central bank digital currencies (CBDCs), 17, 91–93 Central processing units (CPUs), 101 Centralization, 22 of mining, 109-110 Centroid-based clustering, 194 Certified Professional Accountants (CPA), 359–360 Chain-split refresher, 178 Chainanchor, 148 Chainlink, 182 Charitable contributions of virtual currencies, 245 Chief financial officer (CFO), 212 **CKAN. 122** Class action litigation, 229-230 Classical AI, 189 Climate change, water usage management during, 37 Closing process, 316 CLSNet. 286 Clustering, 194–195 Coin, 32 CoinTracker. io, 253-254 Cold wallet. 349 Commercial crime insurance policies, 209-212 policies, 10 Commercial general liability policies (CGL policies), 213-216 Commodities Futures and Trading Commission (CFTC), 11, 241, 343 Complex adaptive dynamics Computer-Aided Design (cadCAD), 135 Computational problem solving, 34 Computer fraud, 212–213 Confidentiality, 295

Capital, 351

Conflict minerals, 162–163 Consensus, 99, 176 methodology, 15, 21 protocols, 55, 68-71 Consensus algorithms, 8, 49-50, 59-60 **BFT**, 60 **PoET**, 60 PoS. 60 PoW, 59 Consensus mechanisms, 8, 99-100, 143, 325-326 Byzantine-fault tolerance method, 116-117 DBFT, 116–117 delegated proof of stake, 114-115 other consensus mechanisms, 114-117 PBFT, 116-117 PoA, 116 PoB, 116 PoC, 116 PoET, 115 PoR, 115-116 PoW, 101-103 ProgPoW, 115 proof of stake, 112-114 proof of storage, 115 proof of work/proof of stake hybrid, 115 Consortium blockchain, 85-86, 94, 159, 171 model, 25 Constraints, 133 Consumer adoption of blockchain blockchain improvement, 144-146 business applications, 146-149 consumer applications, 149-151 effect on individuals, 149-151 functions in government, 143-144 government applications, 142-146 Control disclosures, 352-354 Convex programming, 197 CoreLogic, 315-316 Corporate governance, 39

Cosmos, 176–177 Cost, 23, 88 Cost identification of implementing blockchain, 262-264 adapting internal procedures and processes, 264 attracting and retaining qualified people, 264 data conversion and programming costs, 263-264 hardware costs, 262 selecting blockchain network model, 264 software costs, 262-263 COVID-19, 18–19, 162–163 virus, 304 Credit reporting, 35 Credit scoring, 34-37 Credit-risk modeling, 39-40 Crime policies, 209 Cross-authenticatio, 167 Cross-border logistics, 331–332 Cross-chain atomic swaps, 184-185 chain-split refresher, 178 compatibility, 185-186 interoperability approach, 167 technology, 177-178 Crypto accounting. See also Bitcoin (BTC) accounting for crypto assets, 342 - 344control disclosures, 352-354 custody, 348-349 disclosures, 351 governmentally managed crypto assets, 349-351 smart contracts, 354-355 stablecoin reporting, 346-348 Crypto assets. See also Bitcoin (BTC), 13, 17-18, 22, 341 accounting for, 342-344 complicating factors, 343-344 ecosystem, 21-22

governmentally managed, 349–351 intangible classification, 342-343 technology, 20 valuation of, 344-346 volatility, 343 Crypto collectibles, 128 Crypto exchanges, 75 Crypto R, 245 Crypto S, 245 Crypto tax compliance, 252-254 ideology, 254 poor to no information reporting, 253 reconciliation burden, 253-254 Crypto tokens, 121-122 Cryptocurrencies. See also Virtual currencies (VCs), 13, 16-17, 67, 126, 207, 219, 220, 223, 254, 299, 341, 343 agnostic, 285 bitcoin, 4 Forced Fit to and, 226 options, 6 sheer volatility of, 224 Cryptoeconomics, 8, 67, 69-71, 132 - 133Cryptographic/cryptography, 31, 341 algorithms, 49 hash, 102 hashing, 49-50, 55-56 signature, 146-147 tokens, 121 "Cryptographically secured ledger", 223 Cryptopia, 348 Currency, 20 option, 283 swap, 283-284 Custody, 348-349 Cyber insurance policies, 10, 216–219 Cybersecurity, 27 threat, 223-224 Cypherpunks, 175–176

Dai (cryptocurrency-backed stablecoin), 127 Danish tax authority (SKAT), 288 DAO Hack, 178 dApps, 132 Dash, 249-250 Data, 189 analytics, 192-193 breach, 216 capture, 191 computing, 192 conversion and programming costs, 263-264 immutability, 89–90 management, 312-313 mining, 189 privacy, 90-91 processing, 22 science, 189 storage, 191-192 traceability, 296 Database, 190 De Facto interoperability, 175-176 Decentralization, 9, 22, 51-52, 68, 71, 159, 172-173, 370-371 Decentralized applications (dApps), 8, 125, 171 Decentralized Autonomous Organization (DAO), 75-76, 89, 135-136, 207, 223 Decentralized cryptocurrencies, 16-17, 344 Decentralized cryptocurrency exchanges (DEXs), 75-76 Decentralized finance (DeFi), 76, 171 Decentralized markets, 68 Decentralized network governance, 135-136 Decentralized P2P blockchain networks, 8 Decision metrics, 267 Decision tree, 195

Delegated Byzantine fault tolerant (DBFT), 116-117 Delegated Proof of Stake (DPoS), 68–70, 114–115 Demand-supply matching problem, 325-326 Denial of service attack (DoS attack), 111 Denial-of-service attacks, 269 Density-based methods, 194 Depository Trust and Clearing Company (DTCC), 278-279 Depository Trust Corporation (DTC), 278-279 Descriptive analytics, 193–195 association rules, 193-194 clustering, 194-195 DevOps model, 270 DGB, 194-195 Difficulty target, 53 Digest. See Cryptographic hash Digital age, 207 assets, 363 currency, 141-142 tokens, 75, 126 transactions, 3-4 Digitization, 18–19 Digitizing identities on blockchain for real estate, 287 Digix Gold Token (DGX), 91–92 "Dimensional interference", 37 Discount tokens, 129 Discrete token, 126 Distributed computing, 68 Distributed denial of service attacks (DDoS), 71-72 Distributed hash table (DHT), 299 Distributed ledger, 49–50, 55, 57–59 Distributed ledger technology (DLT), 3-4, 83, 90, 275, 277 layer Hierarchy of, 90

layer-component-process configuration of, 84 Distributed network, 3-4 Distribution, 9, 158 Dividend payments, blockchain for, 287-288 Double spending, 99, 110 problem, 59 Double-spend attack, 268 Double-spend problem, 171 Double-spending, 18 problem, 23, 32 Dual coin system, 92 Due diligence, 316–317 E-commerce, 23 predicating customer default in, 44 Electronic funds transfer (EFT), 34 Electronic health records (EHR), 41, 294-295 Electronic medical sharing, 43 Electronic voting, 278 Encryption, 9, 15-16, 158 Enigma, 148 Enterprise implementation, 88 Enterprise resource planning (ERP), 327, 333, 334 EOS, 7 EOSIO, 74–77 Equifax, 35 Escrow, 220 Ether. See Ethereum (ETH) Ethereum (ETH), 7, 74-76, 126, 130, 175, 207-208, 231 blockchain, 88 chain, 178 Ethereum-based NFTs, 131 Ethereum Classic chain (ETC chain), 178 Exchange-traded fund (ETF), 127-128 Exonum, 300 Experian, 35

External auditing and assurance, 360-362 Fair market value (FMV), 242 Fair value measurement, 363 Federal Bureau of Investigation (FBI), 208-209 Federal Emergency Management Agency (FEMA), 282 Fiat currency, 17-18 51% attack, 114 Finance, AI in, 198 Finance, blockchain applications in blockchain for dividend payments, 287 - 288blockchain in real estate, 286-287 FX trading, 283-286 insurance applications, 281-282 opportunities and limitations of blockchains, 276-277 shareholder voting, 277-281 Financial accounting, 359-360 reports, 39 Financial Accounting Standards Board (FASB), 341 Financial Crimes Enforcement Network (FinCen), 11, 224, 241 Financial crisis, 40 Financial Industry Regulatory Authority (FINRA), 11, 241 Financial networks, 68 Financial reporting, 35-36 internal controls over, 364-371 Financial resources, 351 Financial services and markets, 25-26 Financial statement auditing, 362 Finney attack, 110 First-in, first out (FIFO), 39, 242 Flight insurance, blockchain application in, 281-282 Food safety and transportation, 25-26 Food supply management, 37-38 FoodTrust, 332

Forced Fit to cryptocurrency and blockchain, 226 Ford Motor (F), 279 Foreign Account Tax Compliance Act (FATCA), 249 Foreign Bank Account Report (FBAR), 249 Foreign exchange (FX), 12, 275 blockchain applications in, 284-286 blockchain in practice for, 286 operations, 284 swap, 283 Foreign reporting guidance, 249 Forks, 245 Foundation for Interwallet Operability (FIO), 183-184 Fraud detection using blockchain technology, 43-44 Frequently asked questions (FAQs), 11, 242, 247 applied retroactively or as of date of issuance, 247 Functional system, 316-317 Fundraising events, 223 Funds transfer fraud, 209 FX trading. See also Foreign exchange (FX), 283-286 instruments, 283-284 key participants, 283 Gen-Z individuals, 24 General Data Protection Regulation in Europe, 304 Generally accepted accounting principles (GAAP), 244 Genesis block, 54 Genetic algorithms (GA), 36 Genetic programming (GP), 36, 44 Genie Energy (GNE), 279

Geocoding, 313

Global Data Protection Regulation (GDPR), 123

Global positioning system (GPS), 191 Global shipping, 331–332 Global Shipping Business Network (GSBN), 331-332 Governance tokens, 128-129 Governmentally managed crypto assets, 349-351 government crypto asset example, 350-351 Graphic processing units (GPUs), 109, 192 Great Depression (1929), 225 Grid-based methods, 194-195 Grinding attack. See Precomputing attack Hackers, 150 Hard fork, 76, 208, 248 Hardware costs, 262 Hardware demand, 109 Hash code, 143 Hash Ids. 32 Hash value, 56 Hashes, 34 Hashing, 101 HawkClient smart contract system, 180 Health information exchanges (HIE), 41, 294-295 Health Insurance Portability and Accountability Act of 1996 (HIPAA), 296 Healthcare, blockchain applications in applying blockchain in different healthcare scenarios, 297-298 blockchain adoption, 301-305 blockchain-based healthcare data management, 298-301 motivation and advantages of, 295-298 requirements, 295-296 Healthcare, 27 AI in, 198-199 blockchain and healthcare industry, 41 - 43blockchain applications in, 12

Heuristic search, 197 HL Fabric, 286 Hot wallet, 348, 349 Howey test, 210, 225, 228-232 Human error in recording office, 318 Hybrid blockchain, 34, 85 applications, 91 data immutability, 89-90 data privacy and anonymity, 90-91 motivating, 88-92 stablecoins, 91-92 Hybridizing AI, 37 Hyperledger (HL), 284-286 Fabric, 299-300 Sawtooth's framework, 60 Hypertext Transfer Protocol (HTTP), 124-125 IBM, 262 e-BL project, 94-95 Food Trust, 330

Identification (ID), 242 "Identity-checking" blockchain, 89 "Immunity passports", 304-305 Immutability, 9, 52, 101, 158, 370-371 Inflation, 19 Information frictions, 161 Information system (IS), 276 Information technology (IT), 262 Information technology general controls (ITGCS), 365 Initial coin offerings (ICOs), 75, 128, 223, 251-252 Initial exchange offerings (IEOs), 251-252 Innovation frictions, 161-162 Insurance, 25-26, 207 claims, 27 Insurance applications, blockchain and, 281-282 application in flight insurance, 281-282

application in risk-pooling, 282

Insurance Services Office (ISO), 215-216 Integrating technology, 38 Integrity, 295-296 Intellectual property, 25-27 management, 41-42 Intended audience, 6 Inter Planetary File System (IPFS), 299 Inter-Blockchain Communication protocol (IBC protocol), 176 Interaction frictions, 161 Interest income, 250 Internal controls over financial reporting, 364-371 Internal Revenue Bulletins (IRBs), 247 Internal Revenue Code (IRC), 250 Internal Revenue Service (IRS), 10-11, 214, 224, 241, 247, 346 International Accounting Standards Board (IASB), 341 Internet, 49, 173-174, 316 of blockchains, 23-24, 172 Internet 2.0, 15 Internet of Things Application (IOTA), 171-172 Internet Protocol (IP), 124-125 Interoperability, 9-10, 26, 171-172, 285 innovations in, 184 Interoperability of blockchain (Interopchains), 166-167, 176-177 Cosmos, 176-177 cross-chain technology, 177-178 Polkadot, 177 Interoperation, 61 InterPlanetary File System (IPFS), 125 Interpreting third-party information reporting standards, 248-249 Investment contract, 10–11

Investment management and reporting, blockchain applications for, 321-322 Investors, 242 Just-in-time (JIT), 35-36 KSI, 304 Last-in, first out (LIFO), 39, 242 Liability insurance, 10 Libra, 94 stablecoins, 127-128 Libra Association model, 17, 86 Life cycle approach, 270-272 development phase, 271 implementation phase, 272 integration and testing phase, 272 operation and maintenance phase, 272planning phase, 270 systems analysis and requirements phase, 270-271 systems design phase, 271 Life cycle model, 11–12 Lightning, 184–185 Like kind exchange, 244-245 Linear regression, 195 Liquid, 75 sidechain, 179-180 Listings, blockchain for, 287 Liveness/denial of service attack, 114 Logistics, 25-26 regression, 37 Long short-term memory network (LSTM network), 38 Long Term Capital Management (LTCM), 19 Long-range attack, 113 Machine learning (ML), 38, 189, 300 Majority attack, 111 Maker (MKR), 92 MakerDAO, 92

MapReduce, 192 Marking-to-market, 346 Massachusetts Bay Insurance Company (MBIC), 212 MasterCard. 175 Mastercoin, 75 Mechanism design theory, 132–133 Medical record sharing, 43 Medium of exchange (MoE), 126 tokens, 127-128 MedRec, 151 Megabyte (MB), 164 Melon Protocol, 135–136 Merkle hash tree and root, 49–50, 55, 57 Merkle root, 53, 103 hash, 103-104 Merton model, 40 Microsoft SQL Server, 262 Millennials, 24 Miners, 16, 52, 54-55, 74, 243-244 Mining, 56, 101-102 pools, 109-110 MiPasa, 301-302, 304 Modularity, 285 Monetary authorities, payment system projects by, 93-94 Monetary networks, 68 Monetizing healthcare data, 300-301 Money, 17–20, 210 borderless, 19-20 Mortgage Electronic Registration System, Inc. (MERS), 318 Mortgage originations, blockchain applications for, 319 Mortgage servicing, blockchain applications for, 319-320 Multicoin Capital, 129 Multiple listing service (MLS), 316 National Conference of State Legislatures (NCSL), 223 National Science Foundation Network

(NSFNET), 173

National Security Agency (NSA), 15 - 16Nature, 208 Neo, 249-250 Network agents, 32-33 layer, 83-85 neural, 196 New York Stock Exchange (NYSE), 279-280 Node, 16, 52, 54–55 Non-standard consensus protocols, 70 Nonce, 53, 55, 149-150 Nonfungible tokens (NFTs), 131 Non-public blockchain evaluation, 96-97 North American Securities Administrators Association (NASAA), 235 Nothing-at-stake attack, 113 Notice 201421, 242, 244-245, 247, 250 - 251Objectives, 133 Off-chain data, 150 management, 299 Office of National Coordinator for Health Information Technology (ONC), 294 OKcash, 249-250 Omnibus account, 348 On-chain data, 150 on management, 299 One-confirmation attack. See Vector 76 attack OneName, 150 Open source blockchain networks, 122 OptiGrid, 194-195 Oracles, 151, 167, 181–182, 262 Chainlink, 182 FIO, 183–184 Tellor, 181–182 Original equipment manufacturer (OEM), 326-327

Orphan block, 54, 72 Owners, 314-315 Ownership, 148-149, 314 P2P validation protocol, 73 Paper voting, 278 Parachain, 177 Parcel location, 312-313 Payer/payee, 244 Payment card industry, 175 finality, 34 Payment system projects by monetary authorities, 93-94 private payment system issuances, 94 PCAOB Auditing Standards, 370–371 Peer-to-peer (P2P), 69, 101 blockchain networks, 8 electronic system, 32 network, 49, 142, 327, 341 network co-ops, 121-122 system, 260 transactions, 275 transfers, 16 Permissioned blockchains, 151, 159 Permissioned blocks, 146–147 Permissioned process, 85 Permissioned technology implementations, 299 Permissionless blockchain, 159 Permissionless blocks, 146–147 Permissionless process, 85 Permissionless technology implementations, 299 Permit peer-to-peer transactions (P2P transactions), 163-164 Personal property, 250-251 Personally identifiable information (PII), 208-209 Physical assets, 363 Physical maintenance and monitoring, blockchain applications for, 321

Plotting, 116 Polkadot, 177 Ponzi schemers, 226 Posterior corruption, 113 Practical Byzantine fault tolerant (PBFT), 116-117 Precision medicine, 294 Precomputing attack, 113 Predictive analytics, 195-196 Prescriptive analytics, 197 Previous hash, 53 Price stability mechanism, 92 Price volatility, 17 Privacy, 33 Private blockchain, 34–35, 85–86, 99, 171 comparing public blockchains and, 86-88 network, 51 Private data collection, 300 Private ledgers, 34 Private payment system issuances, 94 Proctor & Gamble Company (P&G), 199 Product safety and recalls, 330-331 Programmatic Proof of Work (ProgPoW), 115 Programmatically executable transactions (PETs), 83-85 Proof of activity (PoA), 116 Proof of burn (PoB), 116 Proof of capacity (PoC), 116 Proof of Elapsed Time (PoET), 59, 60, 115 Proof of retrievability (PoR), 115-116 Proof of Stake (PoS), 49-50, 59-60, 68-70, 100, 112-114, 150, 171-172, 249-250 delegated, 114-115 51% attack, 114 issues of PoS consensus mechanisms, 113-114 liveness/denial of service attack, 114 long-range attack, 113

nothing-at-stake attack, 113 precomputing attack, 113 proof of work/proof of stake hybrid, 115 sybil attack, 114 Proof of storage, 115 Proof of Work (PoW), 20-21, 49-50, 59, 68-70, 100-103, 132, 171-172, 243-244 additional concerns with, 110-112 alternative history attack, 111 bitcoin blockchain and, 103-108 centralization of mining and mining pools, 109-110 DoS attack, 111 Finney attack, 110 hardware demand, 109 hashing, 101 issues of PoW consensus mechanisms, 108–112 majority attack, 111 power requirements, 109 process, 32-34 protocol, 74 race attack, 110 selfish mining attack, 111–112 SHAs, 102-103 strategy, 143-144 Sybil attack, 111 system, 87 Vector 76 attack, 111 Proof-of-state (PoS), 21 Proper disposition method, 253 Property management and leasing, blockchain applications for, 320-321 Proprietary payment tokens, 129 Public blockchain, 7, 31, 34-35, 67-68, 318 background on, 68-73 bitcoin. 74-75 common attributes of, 71-72 comparing private blockchains and, 86-88

cryptoeconomics and consensus protocol, 69-71 EOSIO, 76–77 Ethereum, 75-76 examples, 74-76 network, 50-51 potential benefits and challenges of, 73 Sia. 77 Zcash, 76 Public key, 31, 144 Public ledger, 341 Public private key functionality, 32 Public/permissionless blockchain, 24 - 25Public/private partnerships, 95-96 QCAD, 127 Quadriga cryptocurrency exchange, 364 QuadrigaCX, 348 Quantum computing, 208 Quantum Resistant Ledger Foundation (QRL Foundation), 208 Quintessential function, 17–18 R3 Corda blockchain implementation, 299 - 300Race attack, 110 Radio-frequency identification (RFID), 333 Ransomware, 145–146 Rating systems, 44 Real estate, 12–13, 25–26, 311–312 blockchain-powered real property records, 315-316 case of parcel location and data management, 312-313 chain of title and proof of claim of real property assets, 313-314 deal, 312 information, 27 issues and challenges, 312-316

mortgage originations, blockchain applications for, 319 mortgage servicing, blockchain applications for, 319-320 parties with interests or obligations to real property assets, 314-315 real estate finance, blockchain applications for, 318–322 real estate operations, blockchain applications to, 320-322 real estate transactions, blockchain applications for, 316–318 secondary market operations, blockchain applications for. 320 Real estate, blockchain in, 286–287 blockchain for listings, 287 digitizing identities, 287 Real estate investment trusts (REITs), 322 Real property, 311-312 Real-time accounting, 39-40 Real-time transmission of information, 16 Record. 83-85 Regulatory ambiguity, 167-168 Regulatory sandbox, 168 Replacement cost value (RCV), 219 Report of Foreign Bank and Financial Accounts (FBAR), 249 Reputation systems, 43 Reserve-backed system, 92 Retrospective medical data, 294 Return on investment (ROI), 326 Revenue Rule, 245 Rex MLS Blockchain, 287 Rights, 363-364 Risk control, 198 Risk management CGL policies. 213-216 commercial crime insurance policies, 209-212 computer fraud, 212-213

cyber insurance policies, 216-219 future and other solutions. 219 - 220Risk-pooling, blockchain application in. 282 Root hash, 57 RSK sidechain, 180 RSK-ETH bridge, 180-181 Sarbanes-Oxley Act (2002), 365 Satoshi Nakamoto, 4 Scalability, 61, 171–172 Search process, 316 Secondary market operations, blockchain applications for, 320 Secure Hash Algorithms (SHAs), 102-103 Securities and Exchange Commission (SEC), 10-11, 223, 226, 241, 278-279, 343 disciplinary cases, 226-229 timeline of SEC pronouncements, 230-233 Securities Exchange Act (1934), 225, 231 Securities laws, 225-230 class action litigation, 229-230 Forced Fit to cryptocurrency and blockchain, 226 SEC disciplinary cases, 226-229 Security, 171-172, 225, 285 Security token offerings (STOs), 251-252 Self-custody crypto-asset holdings, 348-349 Self-sovereign identity, 150 Selfish mining attack. 111–112 Semi-Automatic Ground Environment (SAGE), 190 Sentiment analysis, 38 SHA 256. See also Secure Hash Algorithms (SHAs), 102 bit encryption methodology, 15-16

encryption methodology, 21 hash. 55 Share classes, 279 Shareholder voting, 277-281 blockchain for voting, 280-281 complications, 279-280 DTC, 278-279 electronic and paper voting, 278 share classes, 279 Sharing services, 38-39 Shash rate, 134-135 Shavers case, 228 ShipChain, 332 Short-range attack. See Bribery attack Sia. 7 Sia blockchain, 77 Sidechains, 178–180 liquid, 179–180 RSK, 180 Simple attack, 113 Small and medium enterprises (SMEs), 24 Smart cities, blockchain-based sharing services in, 38-39 Smart contracts (SCs), 35-36, 100, 143, 151, 163, 180, 280–281, 316-317, 328-329, 334, 354-355 testing, 369-370 transaction automation through, 334-335 Smart parking, 38 Snap Inc. (SNAP), 279 Social Engineering, 217 Soft fork, 208 Software costs, 262-263 Speed of transactions, 23 Spiral model, 270 Spot transaction, 283 Stablecoins, 17, 91-92, 345 considerations, 347-348 reporting, 346-348 Stake bleeding attack, 113 Staking reward taxation, 249-251

Stale block, 54 Stateful Web, 124-126 Statistical AI, 189 STING, 194–195 Stitch Fix (SFIX), 279 Stock-and-flow diagrams, 134 Store of value (SoV), 126 tokens, 127-128 Stored ledger, 3-4 Strategic Hub for Innovation and Financial Technology (FinHub), 210 Supply chains, 37 areas of benefits and improvements, 329-332 blockchain in, 326-329 current and emerging adoption and implementation issues, 332-335 ERP systems, 334 global shipping and cross-border logistics, 331-332 processes, 298 product safety and recalls, 330-331 **RFID**, 333 role of existing technologies, 333-334 top management support, 335 transaction automation through smart contracts, 334-335 trust among supply chain partners, 335 Support vector machines (SVMs), 36, 196 Sustainable development, blockchain for, 40 Sybil attack, 111, 114 System dynamics modeling, 135 Systems development life cycle (SDLC), 270 Tamper resistant/resistance, 20, 68, 72

ledger, 15

Tax implications of virtual currency, 241-246 lot ID method, 242 Tax Cuts and Jobs Act (TCJA), 244-245 Taxation related to capital formation, 251-252 Telegram Group case, 228 Tellor, 181-182 Temporary regime application of securities laws, 225-230 other pending solutions, 233-235 timeline of SEC pronouncements, 230 - 233Tenants, 314-315 Tether, 75, 91–92 Tezos, 249–250 Third-party data aggregator tools, 253-254 Time, 313–314 Timestamp server, 32, 53 Title insurance, 311, 315 Token bridge, 180-181 RSK-ETH bridge, 180-181 Token contract, 129 Token economies, 8 cryptoeconomics, 132-133 design, 131-133 SoV and MoE tokens, 127-128 token engineering, 133–136 token fundamentals, 126-131 token standards, 129-131 token taxonomy, 127–129 utility tokens, 128-129 Web 3.0 technology, 122-126 Token engineering, 8, 133-136 Token-network fit, 133–134 Tokenization, 9, 158-159 Total cost of ownership (TCO), 259-260, 266 Traceability, 296 of information, 162–163

Tracking mechanism, 13 Tradeable tokens, 129 TradeLens, 162, 332 Traditional assets, 363 Traditional fiat currencies, 15 Traditional information systems, 276 Traditional intangibles, 363 Traditional supply chains, 326–327 Transactions, 148-149 automation through smart contracts, 334-335 Transactions per second (TPS), 164, 171 Transfer learning, 42 Transparency, 23, 68, 72 of blockchain, 160-162 Transportation tracking, 94 identity verification projects by public/private partnerships, 95-96 TransUnion, 35 Trapdoor, 304 Triangle framework, 38 Trojan horses, 269 Tron, 75 Trustless systems, 121 Turing complete protocol, 76 Two-token system, 129 Two-way peg, 180 tZero ATS blockchain, 287-288 Uniform Commercial Code (UCC), 210 Unverified identity, 147 US Food and Drug Administration, 43 US Government Accountability Office (GAO), 246-247 US Postage Service, 312-313 USD Coin (USDC), 91-92, 127 Users, 314-315 Utility tokens, 128-129

Validators, 74

Valuation in auditing, 363 of crypto assets, 344-346 Vector 76 attack, 111 Verification, 370-371 Version, 53 Virtual currencies (VCs). See also Cryptocurrencies, 11, 18, 241 airdrops and forks, 245 calculating capital gains and losses, 243 charitable contributions of, 245 general treatment, 242 investors, 242 like kind exchange, 244-245 miners, 243-244 payer/payee, 244 question, 246 tax implications of, 241-246 Virtual Currency Businesses Act, 233 Virtual Currency Guidance (2019), 246-247 Virtual currency question, 251 Virtual machines, 68 Virtual reality, 235 Viruses, 269

VISA, 175 Voatz application, 141 Voting, blockchain for, 280-281 Wallets, 348, 349 standards, 182-184 Walmart pilot, 330 Waltonchain project, 94-95 Water usage management during climate change, 37 Waterfall model, 270 Wealth management, 198 Web 3.0 technology, 8, 122-126 Stateful Web and Web 3.0 stack, 124-126 web evolution, 123-124 Weimar Republic of Germany, 19 Whales, 244-245 Work tokens, 129 World Wide Web (WWW), 191 Consortium, 173-174 Zcash, 7, 76

Zero-knowledge proofs, 173 Zillow, 315–316 Zones, 176