## INDEX

Adaptable security program management continuous audit cycles, 39 continuous improvements, 37 risk treatment, 37, 38 Advanced Encryption Standard (AES), 98 Apple's iPhone, 61 Application programming interfaces (APIs), 80 Artificial intelligence (AI), 15,69 Attestation, 195 Augmented intelligence (AI), 69 Authenticated encryption with associated data (AEAD), 98 Authentication/ authorization decentralized identity, 133, 139-140 identity proofing, 133 - 134individual credential, 143 - 144

multifactor authentication, 137 - 139OpenID, 132 PAKE, 134-135 passwords, 132, 134-135 public key pairs, 135 - 137single credential, 141-143 single (reduced) sign-on (SSO), 140-141 WebAuthn, 132 Automated Certificate Management Environment (ACME), 2, 110-113 Automated system posture assessment Common Information Model (CIM), 168 Network Endpoint Assessment (NEA), 166 NIST's SCAPv2.0, 166-167, 169

Software Inventory Message and Attributes (SWIMA), 168 standardized protocol, 166 system integrity verification, 167 Tripwire integrity assessment, 168 Autonomous system numbers (ASNs), 115Biometrics, 138 Bit Index Explicit Replication (BIER), 116, 118 Board-level program evaluation/guidance adaptable security program management, 37–39 control automation, 46 - 51data-centric security models, 21 governance and risk management, 24–28 multiparty compute (MPC), 23 outsource applications, 21 partner and supply chain vendors, 20 posture assessment, 21 secure and hardened operating systems, 21

security control framework selection, 28 - 36security program evaluation, 23-24 supplements to frameworks, 39-46 trends, 19 two-factor secure single sign-on technology, 22 Border Gateway Protocol (BGP), 175 Center for Internet Security (CIS), 39 Centralized services, 177 Chromebooks, 61 CloudFlare, 92 Code signing, 63 Common Information Model (CIM), 168 Confidentiality, integrity, and availability (CIA), 16 Containers, end point, 154 - 156Continuous audit cycles, 27, 39 Control automation Distributed Management Task Force (DMTF), 49 management information base (MIB), 48Simple Network Management

Protocol (SNMP), 48 Tripwire, 50 Web-Based Enterprise Management (WBEM), 49 zero trust model, 46 Crypto Forum Research Group (CFRG), 135Cryptographic algorithms, 98-99 Data-centric security models, 11-12, 55, 75 - 76data leakage patterns, 57 fine-grained controls, 57 - 58Data management, 78 Data protection, 76-83 Decentralized identity, 133, 139 - 140Defense-in-depth, 12 DELL Unified Workspace, 55 Demilitarized zone (DMZ) model, 184 Deployment, encryption, 128 Destination Options (DO), 121 - 122Distributed Denial of Service (DDoS), 175 - 176Distributed Management Task Force (DMTF), 49

Domain Name Service (DNS), 87-88 DNS over HTTPS (DOH), 90-93 DNS over TLS (DOT), 89-90 filtering, 116-117 Domain Name System Security Extensions (DNSSEC), 86-87 Ecosystem, 196 Encryption, 99-100 application and deployment, 74 data-centric security, 75 - 76data protection, 76-83 edge termination to data center, 6 end-to-end encryption protocol, 5 meta-data, 4 pervasive monitoring, 83-85 session signaling information, 4 shift to ubiquitous, 74 transport layer protocols, 5 user control data, 76-83 End point apps, 154-156 automated system posture assessment. See Automated system posture assessment

containers, 154-156 definition, 145 managing security, 169 - 172micro-services, 154–156 organizations, 147–148, 163 - 165secure operating systems. See Secure operating systems supply chain attestation. See Supply chain attestation End-to-end encryption protocol, 5, 54, 94-95 application, 96-97 transport encryption, 102 Entity Attestation Tokens (EAT), 161 European Union with the General Data Protection Regulation (EUGDPR), 44 Exceptional access, 14 Extended Validation (EV), 3 Federal Information Security Management Act of 2002 (FISMA), 32 Firewalls, 184–187 Flow Identifier, 120 Generic Network Virtualization

Encapsulation (GENEVE), 115 - 116Google's BeyondCorp model, 16 Governance, Risk, and Compliance (GRC), 45 Homomorphic encryption, 99, 100 Hop-by-hop extension header, 122 Identity proofing, 133–134 Incident detection/ prevention attestation, 192–193 behavioral analysis, 193 data encryption, 193 Distributed Denial of Service (DDoS), 175 - 176firewalls, 184-187 hardware-based attacks, 189-190 intrusion detection, 184-187 patterns, 177 posture assessment, 192 responses, 182-184 sharing groups, 193 social engineering, 188-189 supply chain, 189-190 trust models. See Trust models Indicators of Behavior (IoB), 182

Individual credential, 143-144 Inevitable shift, market demands, 67-69 Information security professional deficit, 15 - 17Interception, 85 Interconnected trends, 1 data-centric security models, 11-12 deployment of encryption, 2-4 information security professional deficit, 15 - 17strong encryption, 4–7 transport protocol stack evolution, 7-11 user control of data, 13 - 15Internet Assigned Numbers Authority (IANA), 98 Internet Engineering Task Force (IETF), 2 Internet Key Exchange Protocol v 2, 124 Internet Protocol Security (IPSEC), 124–125 definition, 124 encryption management, 125 Internet Protocol Version 6 (IPV6)definition, 119–120 **Destination** Options (DO), 121–122

factors, 120 Flow Identifier, 120 Metadata, 121 network address translation (NAT), 121 privacy techniques, 122 - 124protocol stack evolution, 127 - 129routing overlay protocols, 121 Internet Research Task Force (IRTF), 123, 135 Internet Society, 120 Intrinsically secure systems, 177 Intrusion detection, 184-187 JSON Object Signing and Encryption (JOSE), 162 Key Management Interoperability Protocol (KMIP), 110 - 113Lawful interception, 14, 81 Lightweight Directory Access Protocol (LDAP), 141 Machine learning (ML), 15, 69 Mail delivery agent (MDA), 117

Mail transport agents (MTAs), 117 Management information base (MIB), 48 Manufacturer Usage Description (MUD), 59 MAP research group (MAPRG), 123 Metadata, 121 Micro-services, 154-156 Mobile Device Management (MDM), 55 Mobility, 13, 80 Mozilla, 92 Multi-cloud data, 102 Multifactor authentication, 137 - 139Multiparty computation (MPC), 23, 77 Multiprotocol label switching (MPLS), 116 Network address

translation (NAT), 120–121, 121 Network End point Assessment (NEA), 94, 161, 166 Network monitoring, 126 Network Service Headers (NSH), 118 NIST's SCAPv2.0, 166–167, 169 One-time passwords (OTP),

138

Online certificate status protocol (OCSP), 136 OpenID, 132, 144 Open Virtual Network (OVN), 118 OpenvSwitch (OVS), 118 Open Web Application Security Project (OWASP), 40 Opportunistic security, 2, 3 Organizing Transparent Governance, 38 Outsourcing, 70-71 Packet header metadata, 74 PAKE, 134-135 Passwords, 132, 134-135 Path Layer UDP Substrates (PLUS), 10 Patterns that scale, 58 Apple's iPhone, 61 architectural patterns, 65 authorized applications, 62 automated updates and mitigation controls, 60 Chromebooks, 61 code signing, 63 incident response analysis distribution, 66 Manufacturer Usage Description (MUD), 59 SafeBrowsing, 65 supply chain, 63

YANG modules, 60 Payment Card Industry Data Security Standard (PCI DSS), 44 Personally identifiable information (PII), 42 Pervasive monitoring, 83-85 Pretty Good Privacy (PGP) model, 139 Privacy, 14, 81, 122–124 Protocol stack refresher, 104 - 106Public key infrastructure (PKI), 132, 135-138, 141-143 Public key pairs, 135-137 QUIC protocol, 7, 9, 85-86, 114-115, 127 **Remote Integrity** Verification (RIV), 159 Root of trust, 158-159 Routing overlay protocols autonomous system numbers (ASNs), 115 Bit Index Explicit Replication (BIER), 116, 118 definition, 115 DNS filtering, 116-117 Generic Network Virtualization Encapsulation (GENEVE), 115 - 116

mail delivery agent (MDA), 117 mail transport agents (MTAs), 117 virtual local area networks (VLANS), 115, 117 SafeBrowsing, 65 Secure operating systems ChromeOS, 149 Container OSes, 149 Linux, 149-150, 152 Microsoft, 150-151 **MINIX**, 150 operating systems, 148 UNIX, 149-150, 1.52 Security architecture patterns, 197-198 Security Assertion Markup Language (SAML), 142 Security control framework selection business partners/ customers, 31 cost, 31 ISO 27002, 34, 35 ISO/IEC JTC 1/SC 27, 33 NISTSP800-30, 32 NISTSP800-37, 31 NISTSP800-53, 32 NISTSP800-137, 32 program maturity, 31

regional applicability of business, 30 regulatory requirements, 30 risk tolerance, 31 security level agreements (SLAs), 33 Security controls pass-phrase, 29 password policy, 29 policy guidance, 30 Security Function Chaining (SFC), 117 Security level agreements (SLAs), 21, 33 Security program evaluation, 23-24 Server Name Indicator (SNI), 85 Service Function Chaining (SFC), 186-187 Service function path (SFP), 118 Service level agreements (SLAs), 70 Simple Network Management Protocol (SNMP), 48 Single credential, 141–143 Single (reduced) sign-on (SSO), 140-141 Social engineering, 188-189 Software-Defined Networking (SDN)based IPsec Flow Protection, 125

Software Identification (SWID), 160-161 Software Inventory Message and Attributes (SWIMA), 168 Supply chain attestation code signing, 157, 161 - 162JSON Object Signing and Encryption (JOSE), 162 **Remote Integrity** Verification (RIV), 159 root of trust, 158-159 Software Identification (SWID), 160-161 system measurements, 157Trusted Computing Group (TCG), 158 **Trusted Platform** Module (TPM), 157-159 System Assessment and Continuous Monitoring (SACM), 94 System integrity verification, 167 System measurements, 157 TCPcrypt, 113 Transport layer encryption,

106 - 107

Transport Layer Security (TLS), 85-86, 107 - 110Transport protocol stack evolution Automated Certificate Management Environment (ACME), 110–113 Cloud data, 102 data center architectures, 102end-to-end transport encryption, 102 Internet Protocol Security (IPSEC), 124 - 125Internet Protocol Version 6 (IPV6). See Internet Protocol Version 6 (IPV6) Key Management Interoperability Protocol (KMIP), 110 - 113measurement aids administrators, 103 network and traffic management, 103 Path Layer UDP Substrates (PLUS), 10protocol stack refresher, 104 - 106QUIC, 7, 9, 114-115 routing overlay protocols. See

Routing overlay protocols, 11 TCPcrypt, 113 transport layer encryption, 106-107 transport layer security, 107 - 110Tripwire, 50, 168 Trusted Computing Group (TCG), 158 Trusted execution environment (TEE), 158 Trusted Platform Module (TPM), 157-159 Trust models automated control management, 180 Forum For Incident Response and Security Teams (FIRST), 179 information sharing groups, 178 technologies, 180-181 User control data business drivers, 80 exceptional access, 14 lawful interception, 14 mobility, 13 privacy, 14 Virtualized environments, 126 Virtual local area networks (VLANS), 115, 117 VMware, 68

WebAuthn, 132 Web-Based Enterprise Management (WBEM), 49 Workload mobility, 81 Zero Trust Model, 12, 55–58 Zero Trust Networks, 16, 75

YANG modules, 60, 125