

1 Appendix 1: IOC Indicator Types and Information

2 System's Type and Services Provided Lists

3 Indicator of compromise types:

- 4 Question: Select the indicator type (**DESIGN NOTE: Dropdown containing the following options:**
- 5 1. Hash(es) – MD5
 - 6 2. Hash(es) – SHA-256
 - 7 3. Domain name(s)
 - 8 4. URL(s)
 - 9 5. IPv4 address(es)
 - 10 6. IPv6 address(es)
 - 11 7. Email address(es)
 - 12 8. Autonomous system(s)
 - 13 9. Email message(s) (**DESIGN NOTE: Allow option to upload email headers separate from**
 - 14 email body.)
 - 15 10. Network traffic
 - 16 11. File system directory(ies)
 - 17 12. File metadata
 - 18 13. Mutex(es)
 - 19 14. Software metadata
 - 20 15. System processes
 - 21 16. User account(s)
 - 22 17. Windows registry
 - 23 18. X 509 certificate(s)

24 System types and services provided:

- 25 Question: Systems Type & Services Provided (**DESIGN NOTE: Multi select**) (**DESIGN NOTE: Modify**
- 26 **dropdown lists accordingly.**)
- 27 a. **[Type]** Endpoint devices (non-server devices)
 - 28 1. **[Device]** Authentication token or device
 - 29 i. Application/Operating systems (OS) (**DESIGN NOTE: i.1-2 repeated for each option**
 - 30 **selected**)
 - 31 1. Unique OS Name (**DESIGN NOTE: See Appendix 5 for recommended list of OS**
 - 32 **Systems. Design for advanced drop-list “auto-fill”.**)
 - 33 2. Unique OS Version (**DESIGN NOTE: Open text box**)
 - 34 2. **[Device]** Desktop
 - 35 3. **[Device]** Laptop
 - 36 4. **[Device]** Media (e.g., backup tapes, disk media (e.g., CDs, DVDs), documents, flash
 - 37 drive or card, hard disk drive, media player, recorder)

- 38 5. **[Device]** Mobile phone or smartphone
- 39 6. **[Services]** Peripheral (e.g., printer, copier, fax, identity smart card, payment card (such
- 40 as a magstripe or EMV))
- 41 7. **[Device]** Point of sale (POS) terminal
- 42 8. **[Device]** Tablet
- 43 9. **[Device]** Telephone
- 44 10. **[Device]** Voice over Internet Protocol (VoIP) phone
- 45 11. **[Device]** Other/unknown (**DESIGN NOTE: Open text**)
- 46 b. **[Type]** Servers
- 47 1. **[Services]** Active Directory (AD) Components
- 48 i. Application/Operating systems (OS) (**DESIGN NOTE: i.1-8 repeated for each option**
- 49 selected)
- 50 1. Unique OS Name (**DESIGN NOTE: See Appendix 5 for recommended list of OS**
- 51 Systems. Design for advanced drop-list “auto-fill”.)
- 52 2. Unique OS Version (**DESIGN NOTE: Open text box**)
- 53 2. **[Services]** Certificate Authority (CA)
- 54 3. **[Services]** Domain Name System (DNS)
- 55 4. **[Services]** Dynamic Host Configuration Protocol (DHCP)
- 56 5. **[Services]** Email
- 57 6. **[Services]** File
- 58 7. **[Services]** File Transfer Protocol (FTP)
- 59 8. **[Services]** Kerberos
- 60 9. **[Services]** Lightweight Directory Access Protocol/Lightweight Directory Access
- 61 Protocol over Secure Sockets Layer (LDAP/LDAP[S])
- 62 10. **[Services]** Network Time Protocol (NTP)
- 63 11. **[Services]** Print
- 64 12. **[Services]** Remote log(s) (e.g., email, VPN, Syslog, R-Syslog, Syslog-NG)
- 65 13. **[Services]** Remote Shell (RSH)
- 66 14. **[Services]** Security Information and Event Management (SIEM)
- 67 15. **[Services]** Secure Shell (SSH)
- 68 16. **[Services]** TELNET
- 69 17. **[Services]** Virtual Private Network (VPN)
- 70 18. **[Services]** Web
- 71 19. **[Services]** Voice over Internet Protocol (VoIP) Gateways
- 72 20. **[Services]** Authentication, Authorization, and Accounting (AAA) Services (e.g.,
- 73 Radius, Terminal Access Controller Access-Control System [TACACS])
- 74 21. **[Services]** Operational (OT) and Open-Source Software (OSS) types (e.g., Apache
- 75 HTTP Server)
- 76 22. **[Services]** Other
- 77 i. List the additional server type(s) (**DESIGN NOTE: Open text**)

- 78 1. Application/Operating systems (OS) (**DESIGN NOTE: i.1-8 repeated for each**
79 **option selected**)
80 1. Unique OS Name (**DESIGN NOTE: See Appendix 5 for**
81 **recommended list of OS Systems. Design for advanced drop-**
82 **list “auto-fill”.**)
83 2. Unique OS Version (**DESIGN NOTE: Open text box**)
84 c. **[Type]** Network Devices
85 1. **[Device]** Firewalls
86 i. Application/Operating systems (OS) (**DESIGN NOTE: i.1-8 repeated for each option**
87 **selected**)
88 1. Unique OS Name (**DESIGN NOTE: See Appendix 5 for recommended list of OS**
89 **Systems. Design for advanced drop-list “auto-fill”.**)
90 2. Unique OS Version (**DESIGN NOTE: Open text box**)
91 2. **[Device]** Intrusion Detection System (IDS)
92 3. **[Device]** Intrusion Protection System (IPS)
93 4. **[Device]** Hub
94 5. **[Device]** Load Balancers
95 6. **[Device]** Proxies
96 7. **[Device]** Routers
97 8. **[Device]** Switches
98 9. **[Device]** Other
99 i. Application/Operating systems (OS) (**DESIGN NOTE: i.1-8 repeated for each option**
100 **selected**)
101 1. Unique OS Name (**DESIGN NOTE: See Appendix 5 for recommended list of OS**
102 **Systems. Design for advanced drop-list “auto-fill”.**)
103 2. Unique OS Version (**DESIGN NOTE: Open text box**)
104 d. **[Type]** Identity providers (IdP)
105 1. **[Services]** Active Directory
106 2. **[Services]** Active Directory Federation Services (ADFS)
107 3. **[Services]** Amazon
108 4. **[Services]** Azure Active Directory
109 5. **[Services]** Facebook
110 6. **[Services]** Google Workspace
111 7. **[Services]** Lightweight Directory Access Protocol (LDAP)
112 8. **[Services]** Login.gov
113 9. **[Services]** Ping Federate
114 10. **[Services]** OpenID Connect
115 i. Provide the name of the provider(s) (**DESIGN NOTE: Open text**)
116 11. **[Services]** Okta
117 12. **[Services]** Security Assertion Markup Language (SAML)
118 i. Provide the name of the provider(s) (**DESIGN NOTE: Open text**)
119 13. **[Services]** Other identity providers

- 120 i. Provide the name of the identity provider(s) (DESIGN NOTE: Open text)

121 Appendix 2: Terms and Definitions

- 122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
1. **Breach:** “the loss of control, compromise, unauthorized disclosure, unauthorized acquisition, or any similar occurrence where (1) a person other than an authorized user accesses or potentially accesses personally identifiable information or (2) an authorized user accesses or potentially accesses personally identifiable information for an other than authorized purpose.” *[from OMB M-17-12]*
 2. **C-I-A Triad Definitions and Examples:** The concepts of confidentiality, integrity, and availability (CIA), often referred to as the “CIA triad,” represent the three pillars of information security.
 - a. “Confidentiality” refers to “preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information.” [e.g., threat actor has access to your information or an information system, without consent.]
 - b. “Integrity” refers to “guarding against improper information modification or destruction and ensuring information non-repudiation and authenticity.” [e.g., a threat actor has modified or deleted your information, without your consent.]
 - c. “Availability” refers to “ensuring timely and reliable access to and use of information.” [e.g., a threat actor has impeded you from accessing or operating the information system or information in the way you intended (DDOS)]
[definitions derived from page 1 of NIST SP 1800-25 Vol. A]
 3. **CISA National Cyber Incident Scoring System (NCISS)¹:** A scoring system that is based on the NIST SP 800-61 Revision 2 and tailored to include entity-specific potential impact categories that allow CISA personnel to evaluate risk severity and incident priority from a nationwide perspective.
 4. **Common Vulnerabilities and Exposures (CVE):** A program that identifies, defines, and catalogs publicly disclosed cybersecurity vulnerabilities. (<https://cve.mitre.org/>)
 5. **Compromise:** Per the National Institute of Standards and Technology (NIST) Special Publication (SP) 800-152: The unauthorized disclosure, modification, substitution, or use of sensitive data (e.g., keys, metadata, or other security-related information) or the unauthorized modification of a security-related system, device or process in order to gain unauthorized access.
 6. **Countermeasure:** See “Defensive Measure”
 7. **Critical Infrastructure:** “systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on the security, national economic economy, national public health or safety, or any combination of those matters”. *[from section 1016(e) of the USA Patriot Act of 2001 (42 U.S.C. 5195c(e))]*
 8. **Critical “System/Services/Property”:** “Specific entity [system/service/property] that is of such extraordinary importance that its incapacitation or destruction would have a very serious, debilitating effect on the ability of a nation [or organization, business, entity] to continue to function effectively; [a system/service/property of great] importance to a

¹ <https://www.cisa.gov/news-events/news/cisa-national-cyber-incident-scoring-system-nciss>

- 163 mission or function, or continuity of operations. *Derived from “critical asset” page 135-*
 164 *136 and critically page 139 of <https://www.dhs.gov/publication/dhs-lexicon>*
- 165 9. **Cyber Threat Indicator (CTI):** Per the Cybersecurity Information Sharing Act of 2015:
 166 Information that is necessary to describe or identify:
- 167 a. malicious reconnaissance, including anomalous patterns of communications that
 - 168 appear to be transmitted for the purpose of gathering technical information related
 - 169 to a cybersecurity threat or security vulnerability,
 - 170 b. method of defeating a security control or exploitation of a security vulnerability,
 - 171 c. security vulnerability, including anomalous activity that appears to indicate the
 - 172 existence of a security vulnerability,
 - 173 d. method of causing a user with legitimate access to an information system or
 - 174 information that is stored on, processed by, or transiting an information system to
 - 175 unwittingly enable the defeat of a security control or exploitation of a security
 - 176 vulnerability,
 - 177 e. malicious cyber command and control,
 - 178 f. the actual or potential harm caused by an incident, including a description of the
 - 179 information exfiltrated as a result of a particular cybersecurity threat,
 - 180 g. any other attribute of a cybersecurity threat, if disclosure of such attribute is not
 - 181 otherwise prohibited by law, or
 - 182 h. any combination thereof.²
- 183 10. **Cyber Threat Information:** Any information that can help an organization identify,
 184 assess, monitor, and respond to cyber threats. This includes indicators of compromise;
 185 tactics, techniques, and procedures used by threat actors; suggested actions to detect,
 186 contain, or prevent attacks; and the findings from the analyses of incidents.
- 187 11. **Cyber Threat Intelligence:** Per NIST SP 800-150: Any information that can help an
 188 organization identify, assess, monitor, and respond to cyber threats.
- 189 12. **Defensive Measure:** Per the Cybersecurity Information Sharing Act of 2015: An action,
 190 device, procedure, signature, technique, or other measure applied to an information
 191 system or information that is stored on, processed by, or transiting an information system
 192 that detects, prevents, or mitigates a known or suspected cybersecurity threat or security
 193 vulnerability.
- 194 EXCLUSION—The term “defensive measure” does not include a measure that destroys,
 195 renders unusable, provides unauthorized access to, or substantially harms an information
 196 system or data on an information system not belonging to—
- 197 a. the private entity operating the measure, or
 - 198 b. another entity or federal entity that is authorized to provide consent and has
 - 199 provided consent to that private entity for operation of such measure.³
- 200 13. **Enterprise Networks:** Networks and systems that consist of and/or support information
 201 for the following platforms: Windows, macOS, Linux, Azure AD, Office 365, Google
 202 Workspace, SaaS, IaaS, Network management devices (e.g., routers, switches, hubs,
 203 etc.), and Containers.
 204

2 ² 6 U.S.C. § 1501(6).

3 ³ 6 U.S.C. § 1501(7).

- 205 14. **Facility:** “[P]lace in a building, building, installation, structure, land, and other real
 206 property and any fixture or equipment necessary to do something.” [from page 235 of
 207 <https://www.dhs.gov/publication/dhs-lexicon>].
- 208 15. **Functional Impact:** A measure of the actual, ongoing impact to the organization. In
 209 many cases (e.g., scans and probes or a successfully defended attack), little or no impact
 210 may be experienced due to the incident [CISA National Incident Cyber Scoring System).
 211 CISA National Cyber Incident Scoring System (NCISS) | [https://www.cisa.gov/news-](https://www.cisa.gov/news-events/news/cisa-national-cyber-incident-scoring-system-nciss)
 212 [events/news/cisa-national-cyber-incident-scoring-system-nciss](https://www.cisa.gov/news-events/news/cisa-national-cyber-incident-scoring-system-nciss)]
- 213 16. **Impact:** is defined by CDM as “the loss of confidentiality, integrity, or availability that
 214 could be expected to have an adverse effect on organizational operations or
 215 organizational assets or individuals [CDM Glossary of Terms,
 216 <https://confluence.cdmdashboard.com/display/CKB/Glossary+of+Terms>] or, the
 217 magnitude of harm that can be expected to result from the consequences of unauthorized
 218 disclosure of information, unauthorized modification of information, unauthorized
 219 destruction of information, or loss of information or information system availability.
 220 [NIST SP 800-60 Vol. 2 Rev. 1 under Impact]
- 221 17. **Impacted System:** An IT asset or system which has experienced a loss of confidentiality,
 222 integrity, or availability resulting in an adverse effect on the organization.
- 223 18. **Incident:** A violation or imminent threat of violation of computer security policies,
 224 acceptable use policies, or standard security practices. (NIST SP 800-61 Rev. 2 under
 225 Incident)
- 226 19. **Incident Response Life Cycle:** The incident response process has several phases. The
 227 following are listed in life cycle order, however, each stage is not linear and can be
 228 revisited at any part of the incident life cycle as new information is discovered and
 229 triggers actions in a previously visited stage:
- 230 a. **Identification and Detection Stage:** Stage of an incident lifecycle that involves
 231 the “process of monitoring the events occurring in a computer system or network
 232 and analyzing them for signs of possible incidents and, based on various methods,
 233 (technology, human, etc.) has detected an anomaly and identified it as evidence of
 234 a possible incident. This is usually the beginning stage of an incident but can
 235 continue to occur throughout the lifecycle if events are still maturing and analysis
 236 provides further evidence of abnormal activity. [derived from “Intrusion
 237 Detection” page A-2 of NIST SP 800-94]
- 238 b. **Analysis Stage:** Stage of an incident life cycle that involves a process of
 239 examining [the systems] in terms of [but not limited to] their operation,
 240 configuration, and physical presence, in terms of "its constituent parts so as to
 241 reveal new meaning by investigation of the [system] elements to distinguish
 242 problems, situations, or anomalies for instructional solutions or other suitable
 243 interventions that optimize performance." Entering in the Analysis phase involves
 244 the transition from 'Something Happened' [Identification and Detection] to
 245 understanding 'What has Happened'. [derived from page28 of
 246 <https://www.dhs.gov/publication/dhs-lexicon>]
- 247 c. **Containment Stage:** Stage of the incident lifecycle that involves undertaking
 248 initial short-term activities to prevent an “incident [from] overwhelm[ing]
 249 resources or increase[ing] damage. Containment provides time for developing a
 250 tailored remediation strategy.” It can involve many different approaches based on

- 251 the known type of incident (e.g. email-borne malware, or network-based DDOS)
252 as determined during the Analysis Stage. The containment stage is most
253 successful when combined with “criteria for determining the appropriate strategy
254 including potential damage to and theft of resources, need for evidence
255 preservation, service availability (e.g., network connectivity, services provided to
256 external parties), time and sources needed to implement the strategy, effectiveness
257 of the strategy (e.g., partial containment, full containment)[, and duration of the
258 solution (e.g., emergency workaround to be removed in four hours, temporary
259 workaround to be removed in two weeks, permanent solution[.]”[derived from
260 page 35 of NIST SP 800-61 r2]
- 261 d. **Eradication Stage:** Stage of the incident life cycle the follows one or more
262 containment activities and results of further analysis that “may be necessary to
263 eliminate components of the incident, such as deleting malware and disabling
264 breached user accounts, as well as identifying and mitigating all vulnerabilities
265 that were exploited. During eradication, it is important to identify all affected
266 hosts within the organization so that they can be remediated [and remove any
267 remnants of invalid computer code, invalid system accounts and other threat actor
268 influenced system configurations to eliminate the threat.] For some incidents,
269 eradication is either not necessary or is performed during recovery (e.g., files are
270 restored from valid backups). [derived from page 37 of NIST SP 800-61 r2]
- 271 e. **Recovery Stage:** Stage in the incident lifecycle where “administrators restores
272 systems to normal operations, confirm that systems are functioning normally, and
273 (if applicable) remediate vulnerabilities to prevent similar incidents. Recovery
274 may involve such actions as restoring systems from clean backups, rebuilding
275 systems from scratch, replacing compromised files with clean versions, installing
276 patches, changing passwords, and tightening network perimeter security (e.g.,
277 firewall rulesets, boundary router access control lists). Higher levels of system
278 logging or network monitoring are often part of the recovery process.” In
279 conjunction with the eradication stage, recovery “should be done in a phased
280 approach so that remediation steps are prioritized. For large-scale incidents,
281 recovery may take months,” with the early phases focused on “increasing] the
282 overall security with relatively quick (days to weeks) high value changes,” and
283 “later phases focus[ed] on longer-term changes (e.g., infrastructure changes) and
284 ongoing work to keep the enterprise as secure as possible.” [derived from page 37
285 of NIST SP 800-61 r2]
- 286 20. **Indicators of Compromise (IOC):** IOCs are forensic artifacts from intrusions that are
287 identified on organizational systems at the host or network level. IOCs provide valuable
288 information on systems that have been compromised. IOCs can include the creation of
289 registry key values. IOCs for network traffic include Universal Resource Locator or
290 protocol elements that indicate malicious code command and control servers. The rapid
291 distribution and adoption of IOCs can improve information security by reducing the time
292 that systems and organizations are vulnerable to the same exploit or attack. [NIST SP
293 800-53, Rev. 5, page 343] or, Per NIST SP 800-61 Revision 2: A sign that an incident
294 may have occurred or may be currently occurring.
- 295 21. **Industrial Control Networks:** Operational Technology are programmable systems or
296 devices that interact with the physical environment (or manage devices that interact with

297 the physical environment). These systems/devices detect or cause a direct change through
 298 the monitoring and/or control of devices, processes, and events. Examples include
 299 industrial control systems, building management systems, fire control systems, and
 300 physical access control mechanisms. (*Operational technology - Glossary | CSRC*
 301 (*nist.gov*))

302 22. **Information System:** A discrete set of information resources organized for the
 303 collection, processing, maintenance, use, sharing, dissemination, or disposition of
 304 information, including, but not limited to, operational technology systems such as
 305 industrial control systems, supervisory control and data acquisition systems, distributed
 306 control systems, and programmable logic controllers.

307 23. **Informational Impact:** In addition to functional impact, incidents may also affect the
 308 confidentiality, integrity and availability of the information stored or processed by
 309 various systems. The information impact category is used to describe the type of
 310 information lost, compromised, or corrupted. [*derived from CISA National Incident*
 311 *Cyber Scoring System, [https://www.cisa.gov/news-events/news/cisa-national-](https://www.cisa.gov/news-events/news/cisa-national-cyber-incident-scoring-system-nciss)*
 312 *cyber-incident-scoring-system-nciss*].

313 24. **Mobile Device Networks:** Mobile devices/networks that have access to entity resources
 314 and network-based effects that can be used by adversaries. This includes supported
 315 devices for the following platforms: Android, iOS.

316 25. **Operational Technology:** Programmable systems or devices that interact with the
 317 physical environment (or manage devices that interact with the physical environment).
 318 These systems/devices detect or cause a direct change through the monitoring and/or
 319 control of devices, processes, and events. Examples include industrial control systems,
 320 building management systems, fire control systems, and physical access control
 321 mechanisms. (*Operational technology - Glossary | CSRC (nist.gov)*)

322 26. **Organization:** An entity of any size, complexity, or positioning within an organizational
 323 structure, including federal agencies, private enterprises, academic institutions, state,
 324 local, or tribal governments, or as appropriate, any of their operational elements. [*FIPS*
 325 *200, <https://doi.org/10.6028/NIST.FIPS.200>*]

326 27. **Personally Identifiable Information (PII):** Per OMB Memorandum M-17-12:
 327 Information that can be used to distinguish or trace an individual’s identity, either alone
 328 or when combined with other information that is linked or linkable to a specific
 329 individual.

330 28. **Public Health Impact:** Public health impacts are defined as “impact on affected
 331 population measured based on new and increased death, disease, injury, and disability.”
 332 [*as defined by National Risk Management Center (NRMC)*]

333 29. **Public Safety Impact:** Public health impacts are defined as “impact on affected
 334 population measured based on new and increased death, disease, injury, and disability.”
 335 [*as defined by National Risk Management Center (NRMC)*]

336
 337

338

339 Appendix 3: Incident Type/Categories

340 Incident Types Involving Malware (based on [VERIS](#) with some modifications⁴):

- 341 1. Adware
- 342 2. Backdoor (enable remote access)
- 343 3. Brute force attack
- 344 4. Capture data from application or system process
- 345 5. Capture data stored on system disk
- 346 6. Client-side attack (client-side or browser attack (e.g., redirection, XSS, MitB))
- 347 7. Click fraud or Bitcoin mining
- 348 8. C2 (command and control)
- 349 9. Destroy data (destroy or corrupt stored data)
- 350 10. Disable controls (disable or interfere with security controls)
- 351 11. DoS (denial of service attack)
- 352 12. Downloader (pull updates or other malware)
- 353 13. Exploit vulnerability in code (vs misconfiguration or weakness)
- 354 14. Export data to another site or system
- 355 15. Packet sniffer (capture data from network)
- 356 16. Password dumper (extract credential hashes)
- 357 17. RAM scraper or memory parser (capture data from volatile memory)
- 358 18. Ransomware (encrypt or seize stored data)
- 359 19. Rootkit (maintain local privileges and stealth)
- 360 20. Scan network (scan or footprint network)
- 361 21. Spam (send spam)
- 362 22. Spyware/Keylogger (spyware, keylogger or form-grabber (capture user input or activity))
- 363 23. SQL injection attack
- 364 24. Adminware (system or network utilities (e.g., PsTools, Netcat))
- 365 25. Worm (propagate to other systems or devices)

367 Incident Types Involving Hacking (based on [VERIS](#) with some modifications⁵):

- 368 1. Abuse of functionality
- 369 2. Brute force or password guessing attacks
- 370 3. Buffer overflow
- 371 4. Cache poisoning
- 372 5. Session prediction: Credential or session prediction
- 373 6. CSRF: Cross-site request forgery
- 374 7. XSS: Cross-site scripting
- 375 8. Cryptanalysis
- 376 9. DoS: Denial of service

4 ⁴ [Enumerations \(verisframework.org\)](#)

5 ⁵ [Enumerations \(verisframework.org\)](#)

- 377 10. Foot-printing and fingerprinting
- 378 11. Forced browsing or predictable resource location
- 379 12. Format string attack
- 380 13. Fuzz testing
- 381 14. HTTP request smuggling
- 382 15. HTTP request splitting
- 383 16. Integer overflows
- 384 17. LDAP injection
- 385 18. Mail command injection
- 386 19. MitM: Man-in-the-middle attack
- 387 20. Null byte injection
- 388 21. Offline cracking: Offline password or key cracking (e.g., rainbow tables, Hashcat, JtR)
- 389 22. OS commanding
- 390 23. Path traversal
- 391 24. RFI: Remote file inclusion
- 392 25. Reverse engineering
- 393 26. Routing detour
- 394 27. Session fixation
- 395 28. Session replay
- 396 29. Soap array abuse
- 397 30. Special element injection
- 398 31. SQL injection
- 399 32. SSI injection
- 400 33. URL redirector abuse
- 401 34. Use of backdoor or C2
- 402 35. Use of stolen creds
- 403 36. XML attribute blowup
- 404 37. XML entity expansion
- 405 38. XML external entities
- 406 39. XML injection
- 407 40. XPath injection
- 408 41. XQuery injection
- 409 42. Virtual machine escape

412 **Incident Types Involving Social Engineering** (based on [VERIS](#) with some
413 modifications ⁶):

- 414 1. Baiting (planting infected media)
- 415 2. Bribery or solicitation
- 416 3. Elicitation (subtle extraction of info through conversation)

6 ⁶ [Enumerations \(verisframework.org\)](https://verisframework.org)

- 417 4. Extortion or blackmail
- 418 5. Forgery or counterfeiting (fake hardware, software, documents, etc.)
- 419 6. Influence tactics (leveraging authority or obligation, framing, etc.)
- 420 7. Scam (online scam or hoax (e.g., scareware, 419 scam, auction fraud))
- 421 8. Phishing (or any type of *ishing)
- 422 9. Pretexting (dialogue leveraging invented scenario)
- 423 10. Propaganda or disinformation
- 424 11. Spam (unsolicited or undesired email and advertisements)

427 **Incident Types Involving Misuse of Assets** [sometimes called “Insider Threats”]
428 (based on [VERIS](#) with some modifications ⁷):

- 429 1. Knowledge abuse: Abuse of private or entrusted knowledge
- 430 2. Privilege abuse: Abuse of system access privileges
- 431 3. Embezzlement, skimming, and related fraud
- 432 4. Data mishandling: Handling of data in an unapproved manner
- 433 5. Email misuse: Inappropriate use of email or IM
- 434 6. Net misuse: Inappropriate use of network or Web access
- 435 7. Illicit content: Storage or distribution of illicit content
- 436 8. Unapproved workaround or shortcut
- 437 9. Unapproved hardware: Use of unapproved hardware or devices
- 438 10. Unapproved software: Use of unapproved software or services

441 **Incident Types Involving Human (or Technology) Errors** (based on [VERIS](#) with
442 some modifications ⁸):

- 443 1. Classification error (classification or labeling error)
- 444 2. Data entry error
- 445 3. Disposal error
- 446 4. Gaffe (social or verbal slip)
- 447 5. Loss or misplacement
- 448 6. Maintenance error
- 449 7. Misconfiguration
- 450 8. Misdelivery (direct or deliver to wrong recipient)
- 451 9. Omission (something intended, but not done)
- 452 10. Physical accidents (e.g., drops, bumps, spills)
- 453 11. Capacity shortage (poor capacity planning)
- 454 12. Programming error (flaws or bugs in custom code)
- 455 13. Publishing error (private info to public doc or site)
- 456 14. Malfunction (technical malfunction or glitch)

⁷ [Enumerations \(verisframework.org\)](#)

⁸ [Enumerations \(verisframework.org\)](#)

457

458 Appendix 4: Critical Infrastructure Sectors and Subsectors

459 (DESIGN NOTE: Ensure we have most approved critical infrastructure sector and subsector list per CISA data
460 standards where applicable (Office of the Chief Information Officer - Active Data Standards - All Items
461 (sharepoint.com))

462 Format of list is as follows:

- 463 • Sector
- 464 o Subsector

- 465
- 466 • Chemical sector
- 467 o Chemical manufacturing or processing plant
- 468 o Chemical transport
- 469 o Chemical storage warehousing and storage
- 470 o Chemical end user
- 471 o Regulatory, oversight, or industry organization
- 472 • Commercial facilities sector
- 473 o Entertainment and media
- 474 o Gaming
- 475 o Lodging
- 476 o Outdoor events
- 477 o Public assembly
- 478 o Real estate
- 479 o Retail
- 480 o Sports leagues
- 481 • Communications sector
- 482 o Information services
- 483 o Telecommunications
- 484 o Regulatory, oversight, or industry organization
- 485 • Critical Manufacturing sector
- 486 o Primary metal manufacturing
- 487 o Machinery manufacturing
- 488 o Electrical equipment, appliance, and component manufacturing
- 489 o Transportation manufacturing
- 490 o Non-critical manufacturing facility
- 491 • Dams sector
- 492 o Dam project
- 493 o Dams control operations facility
- 494 o Levees and hurricane barriers
- 495 o Navigation locks

- 496 o Mine tailing and industrial waste impoundment
- 497 o Regulatory, oversight, or industry organization
- 498 • Defense industrial base sector
- 499 o Defense manufacturing facility
- 500 o Defense research and development facility
- 501 o Defense logistics and asset management facility
- 502 o Defense industrial base administration and regulatory facility
- 503 • Emergency services sector
- 504 o Law enforcement
- 505 o Fire and emergency services
- 506 o Emergency medical services
- 507 o Emergency management
- 508 o Public works
- 509 o Emergency communication
- 510 • Energy sector
- 511 o Electricity
- 512 o Petroleum
- 513 o Natural gas
- 514 o Coal
- 515 o Ethanol
- 516 o Biodiesel
- 517 o Hydrogen
- 518 • Financial Services sector
- 519 o Banking and credit
- 520 o Securities, commodities, or financial investment
- 521 o Insurance company
- 522 • Food and agriculture sector
- 523 o Supply
- 524 o Processing, packaging, and production
- 525 o Agriculture and food product storage and distribution warehouse
- 526 o Agriculture and food product transportation
- 527 o Agriculture and food product distribution
- 528 o Agriculture and food supporting facility
- 529 o Regulatory, oversight, or industry organization
- 530 • Government services and facilities sector
- 531 o Elections facilities
- 532 o K-12 education facilities
- 533 o Government education facility
- 534 o Military facility
- 535 o National monument & icon
- 536 o Personnel-oriented government facility

- 537 o Service-oriented government facility
- 538 o Government sensor or monitoring facility
- 539 o Government space facility
- 540 o Government storage or preservation facility
- 541 • Healthcare and public health sector
- 542 o Direct patient healthcare
- 543 o Health information technology
- 544 o Fatality/mortuary services
- 545 o Medical materials
- 546 o Laboratories, blood, and pharmaceuticals
- 547 o Public health services
- 548 o Healthcare educational facility
- 549 o Regulatory, oversight, or industry organization
- 550 • Information technology sector
- 551 o Hardware production
- 552 o Software production
- 553 o Operational support service facility
- 554 o Internet-based content, information, and communications services
- 555 • Nuclear reactors, materials, and waste sector
- 556 o Nuclear reactor facility
- 557 o Nuclear material processing and handling facility
- 558 o Nuclear waste facility
- 559 • Transportation systems sector
- 560 o Aviation
- 561 o Maritime
- 562 o Freight rail
- 563 o Highway and motor carrier
- 564 o Pipeline
- 565 o Postal and shipping
- 566 o Mass transit
- 567 • Water and wastewater systems sector
- 568 o Drinking water
- 569 o Wastewater
- 570 o Regulatory, oversight, or industry organization

571 Appendix 5 Operating Systems

572 [List of operating systems - Wikipedia](https://en.wikipedia.org/wiki/List_of_operating_systems) (https://en.wikipedia.org/wiki/List_of_operating_systems)

573 Proprietary

574 Acorn Computers

- 575 • [Arthur](#)
- 576 • [ARX](#)
- 577 • [MOS](#)
- 578 • [RISC iX](#)
- 579 • [RISC OS](#)

580 Amazon

- 581 • [Fire OS](#)

582 Amiga Inc.

- 583 • [AmigaOS](#)
 - 584 • [AmigaOS 1.0-3.9](#) (Motorola 68000)
 - 585 • [AmigaOS 4](#) (PowerPC)
- 586 • [Amiga Unix](#) (a.k.a. Amix)

587 Amstrad

- 588 • [AMSDOS](#)
- 589 • [Contiki](#)
- 590 • [CP/M 2.2](#)
- 591 • [CP/M Plus](#)
- 592 • [SymbOS](#)

593 Apple

- 594 • [Apple II](#)
 - 595 • [Apple DOS](#)
 - 596 • [Apple Pascal](#)
 - 597 • Apex (Colorado School of Mines)
 - 598 • [ProDOS](#)
 - 599 • [GS/OS](#)
 - 600 • [GNO/ME](#)
 - 601 • [Contiki](#)
- 602 • [Apple III](#)
 - 603 • [Apple SOS](#)
- 604 • [Apple Lisa](#)
- 605 • [Mac](#)
 - 606 • [Classic Mac OS](#)
 - 607 • [A/UX \(UNIX System V with BSD extensions\)](#)
 - 608 • [Copland](#)
 - 609 • [MkLinux](#)
 - 610 • [Pink](#)
 - 611 • [Rhapsody](#)
 - 612 • [macOS](#) (formerly Mac OS X and OS X)
 - 613 • [macOS Server](#) (formerly Mac OS X Server and OS X Server)
- 614 • [Apple Network Server](#)
 - 615 • [IBM AIX](#) (Apple-customized)
- 616 • [Apple MessagePad](#)
 - 617 • [Newton OS](#)
- 618 • [iPhone and iPod Touch](#)
 - 619 • [iOS](#) (formerly iPhone OS)

- 620
 - 621
 - 622
 - 623
 - 624
 - 625
 - 626
 - 627
 - 628
 - 629
 - 630
 - 631
 - 632
 - 633
 - 634
 - 635
 - 636
 - 637
 - 638
 - 639
 - 640
 - 641
 - 642
 - 643
 - 644
 - 645
 - 646
 - 647
 - 648
 - 649
 - 650
 - 651
 - 652
 - 653
 - 654
 - 655
 - 656
 - 657
 - 658
 - 659
 - 660
 - 661
 - 662
 - 663
 - 664
 - 665
 - 666
 - 667
 - 668
 - 669
 - 670
- [iPad](#)
 - [iPadOS](#)
 - [Apple Watch](#)
 - [watchOS](#)
 - [Apple TV](#)
 - [tvOS](#)
 - Embedded operating systems
 - [bridgeOS](#)
 - [Apple Vision Pro](#)
 - [visionOS](#)
 - Embedded operating systems
 - [A/ROSE](#)
 - [iPod software](#) (unnamed embedded OS for [iPod](#))
 - Unnamed [NetBSD](#) variant for [Airport Extreme](#) and [Time Capsule](#)
- Apollo Computer, Hewlett-Packard**
- [Domain/OS](#) – One of the first network-based systems. Run on [Apollo/Domain](#) hardware. Later bought by [Hewlett-Packard](#).
- Atari**
- [Atari DOS](#) (for 8-bit computers)
 - [Atari TOS](#)
 - [Atari MultiTOS](#)
 - [Contiki](#) (for 8-bit, ST, Portfolio)
- BAE Systems**
- [XTS-400](#)
- Be Inc.**
- [BeOS](#)
 - [BeIA](#)
 - [BeOS r5.1d0](#)
 - [magnussoft ZETA](#) (based on [BeOS r5.1d0](#) source code, developed by [yellowTAB](#))
- Bell Labs**
- [Unix](#) ("Ken's new system," for its creator ([Ken Thompson](#)), officially Unics and then Unix, the prototypic operating system created in Bell Labs in 1969 that formed the basis for the [Unix family](#) of operating systems)
 - UNIX Time-Sharing System v1
 - UNIX Time-Sharing System v2
 - UNIX Time-Sharing System v3
 - UNIX Time-Sharing System v4
 - UNIX Time-Sharing System v5
 - [UNIX Time-Sharing System v6](#)
 - MINI-UNIX
 - [PWB/UNIX](#)
 - USG
 - [CB Unix](#)
 - [UNIX Time-Sharing System v7](#) (It is from Version 7 Unix (and, to an extent, its descendants listed below) that almost all Unix-based and Unix-like operating systems descend.)
 - [Unix System III](#)
 - Unix System IV
 - [Unix System V](#)
 - Unix System V Releases 2.0, 3.0, 3.2, 4.0, and 4.2

- 671 • [UNIX Time-Sharing System v8](#)
- 672 • [UNIX Time-Sharing System v9](#)
- 673 • [UNIX Time-Sharing System v10](#)
- 674 Non-Unix Operating Systems:
- 675 • [BESYS](#)
- 676 • [Plan 9 from Bell Labs](#)
- 677 • [Inferno](#)
- 678 **Burroughs Corporation, Unisys**
- 679 • [Burroughs MCP](#)
- 680 **CII**
- 681 • [Siris 8](#)
- 682 **Commodore International**
- 683 • [GEOS](#)
- 684 • [AmigaOS](#)
- 685 • [AROS Research Operating System](#)
- 686 **Control Data Corporation**
- 687 **Lower 3000 series**
- 688 • [SCOPE](#) (Supervisory Control Of Program Execution)^[11]
- 689 **Upper 3000 series**
- 690 • [SCOPE](#) (Supervisory Control Of Program Execution)^[2]
- 691 • [Drum SCOPE](#)^[3]
- 692 **6x00 and related Cyber**
- 693 • [Chippewa Operating System](#) (COS)^[4]
- 694 • [MACE](#) (Mansfield and Cahlander Executive)
- 695 • [Kronos](#) (Kronographic OS)^[5]
- 696 • [NOS](#) (Network Operating System)^{[6][7]}
- 697 • [NOS/VE](#) (NOS Virtual Environment)
- 698 • [SCOPE](#) (Supervisory Control Of Program Execution)^[8]
- 699 • [NOS/BE NOS Batch Environment](#)^[9]
- 700 • [SIPROS](#) (Simultaneous Processing Operating System)^[10]
- 701 **Star-100**
- 702 [Multiple Console Time Sharing System](#) (MCTS), from General Motors Research
- 703 **CloudMosa**
- 704 • [Puffin OS](#)
- 705 **Convergent Technologies**
- 706 • [Convergent Technologies Operating System](#) (CTOS) – later acquired by [Unisys](#)
- 707 **Cromemco**
- 708 • [Cromemco DOS](#) (CDOS) – a Disk Operating system compatible with [CP/M](#)
- 709 • [Cromix](#) – a multitasking, multi-user, [Unix](#)-like OS for [Cromemco](#) microcomputers
- 710 with [Z80A](#) and/or [68000](#) CPU
- 711 **Data General**
- 712 • [AOS](#) for 16-bit [Data General Eclipse](#) computers and [AOS/VS](#) for 32-bit (MV series) Eclipses,
- 713 [MP/AOS](#) for microNOVA-based computers
- 714 • [DG/UX](#)
- 715 • [RDOS](#) Real-time Disk Operating System, with variants: RTOS and DOS (not related to [PC](#)
- 716 [DOS](#), [MS-DOS](#) etc.)
- 717 **Datapoint**
- 718 • [CTOS](#) Cassette Tape Operating System for the [Datapoint 2200](#)^[11]
- 719 • [DOS](#) Disk Operating System for the Datapoint 2200, 5500, and 1100^[12]
- 720 **DDC-I, Inc.**
- 721 • [Deos](#) – Time & Space Partitioned RTOS, Certified to DO-178B, Level A since 1998

- 722 • [HeartOS](#) – POSIX-based Hard Real-Time Operating System
 723 **Digital Research, Inc.**
 724 • [CP/M](#)
 725 • [CP/M](#) CP/M for [Intel 8080/8085](#) and [Zilog Z80](#)
 726 • [Personal CP/M](#), a refinement of CP/M
 727 • [CP/M Plus](#) with BDOS 3.0
 728 • [CP/M-68K](#) CP/M for [Motorola 68000](#)
 729 • [CP/M-8000](#) CP/M for [Zilog Z8000](#)
 730 • [CP/M-86](#) CP/M for [Intel 8088/8086](#)
 731 • [CP/M-86 Plus](#)
 732 • [Personal CP/M-86](#)
 733 • [MP/M](#) Multi-user version of CP/M-80
 734 • [MP/M II](#)
 735 • [MP/M-86](#) Multi-user version of CP/M-86
 736 • [MP/M 8-16](#), a dual-processor variant of MP/M for 8086 and 8080 CPUs.
 737 • [Concurrent CP/M](#), the successor of CP/M-80 and MP/M-80
 738 • [Concurrent CP/M-86](#), the successor of CP/M-86 and MP/M-86
 739 • [Concurrent CP/M 8-16](#), a dual-processor variant of Concurrent CP/M for 8086
 740 and 8080 CPUs.
 741 • [Concurrent CP/M-68K](#), a variant for the 68000
 742 • [DOS](#)
 743 • [Concurrent DOS](#), the successor of Concurrent CP/M-86 with PC-MODE
 744 • [Concurrent PC DOS](#), a Concurrent DOS variant for IBM compatible PCs
 745 • [Concurrent DOS 8-16](#), a dual-processor variant of Concurrent DOS for 8086 and
 746 8080 CPUs
 747 • [Concurrent DOS 286](#)
 748 • [Concurrent DOS XM](#), a real-mode variant of Concurrent DOS with EEMS
 749 support
 750 • [Concurrent DOS 386](#)
 751 • [Concurrent DOS 386/MGE](#), a Concurrent DOS 386 variant with
 752 advanced graphics terminal capabilities
 753 • [Concurrent DOS 68K](#), a port of Concurrent DOS to Motorola 68000 CPUs with DOS
 754 source code portability capabilities
 755 • [FlexOS 1.0 – 2.34](#), a derivative of Concurrent DOS 286
 756 • [FlexOS 186](#), a variant of FlexOS for terminals
 757 • [FlexOS 286](#), a variant of FlexOS for hosts
 758 • [Siemens S5-DOS/MT](#), an industrial control system based on FlexOS
 759 • [IBM 4680 OS](#), a [POS](#) operating system based on FlexOS
 760 • [IBM 4690 OS](#), a POS operating system based on FlexOS
 761 • [Toshiba 4690 OS](#), a POS operating system based on IBM 4690
 762 OS and FlexOS
 763 • [FlexOS 386](#), a later variant of FlexOS for hosts
 764 • [IBM 4690 OS](#), a POS operating system based on FlexOS
 765 • [Toshiba 4690 OS](#), a POS operating system based on IBM 4690
 766 OS and FlexOS
 767 • [FlexOS 68K](#), a derivative of Concurrent DOS 68K
 768 • [Multiuser DOS](#), the successor of Concurrent DOS 386
 769 • [CCI Multiuser DOS](#)
 770 • [Datapac Multiuser DOS](#)
 771 • [Datapac System Manager](#), a derivative of Datapac Multiuser DOS
 772 • [IMS Multiuser DOS](#)

- 773 • IMS [REAL/32](#), a derivative of Multiuser DOS
- 774 • IMS [REAL/NG](#), the successor of REAL/32
- 775 • [DOS Plus](#) 1.1 – 2.1, a single-user, multi-tasking system derived from Concurrent DOS
- 776 4.1 – 5.0
- 777 • [DR-DOS](#) 3.31 – 6.0, a single-user, single-tasking native DOS derived from Concurrent
- 778 DOS 6.0
 - 779 • Novell [PalmDOS](#) 1.0
 - 780 • Novell "[Star Trek](#)"
 - 781 • [Novell DOS 7](#), a single-user, multi-tasking system derived from DR DOS
 - 782 • Caldera [OpenDOS](#) 7.01
 - 783 • Caldera [DR-DOS](#) 7.02 and higher

784 **Digital Equipment Corporation, Compaq, Hewlett-Packard, Hewlett Packard Enterprise**

- 785 • [Batch-11/DOS-11](#)
- 786 • [OS/8](#)
- 787 • [RSTS/E](#) – multi-user time-sharing OS for [PDP-11s](#)
- 788 • [RSX-11](#) – multiuser, multitasking OS for PDP-11s
- 789 • [RT-11](#) – single user OS for PDP-11
- 790 • [TOPS-10](#) – for the PDP-10
- 791 • [TENEX](#) – an ancestor of [TOPS-20](#) from [BBN](#), for the PDP-10
- 792 • [TOPS-20](#) – for the PDP-10
- 793 • [DEC MICA](#) – for the [DEC PRISM](#)
- 794 • [Digital UNIX](#) – derived from OSF/1, became HP's [Tru64 UNIX](#)
- 795 • [Ultrix](#)
- 796 • [VMS](#) – originally by [DEC](#) (now by VMS Software Inc.) for the [VAX](#) mini-computer range; later
- 797 renamed OpenVMS and ported to [Alpha](#), and subsequently ported to Intel [Itanium](#) and then
- 798 to [x86-64](#)
- 799 • [WAITS](#) – for the PDP-6 and PDP-10

800 **ENEA AB**

- 801 • [OSE](#) – Flexible, small footprint, high-performance RTOS for control processors

802 **Fujitsu**

- 803 • [Towns OS](#)
- 804 • [XSP](#)
- 805 • [OS/IV](#)
- 806 • [MSP](#)
- 807 • [MSP-EX](#)

808 **GEC Computers**

- 809 • [COS](#)
- 810 • [DOS](#)
- 811 • [OS4000](#)

812 **General Electric, Honeywell, Bull**

- 813 • [Real-Time Multiprogramming Operating System](#)
- 814 • [GCOS](#)
- 815 • [Multics](#)

816 **Google**

- 817 [Android OS](#) on the [Samsung Galaxy Z](#) smartphones
- 818 • [ChromiumOS](#) is an open source operating system development version of ChromeOS. Both
- 819 operating systems are based on the [Linux](#) kernel.
- 820 • [ChromeOS](#) is designed to work exclusively with web applications, though has been
- 821 updated to run Android apps with full support for Google Play Store. Announced on July
- 822 7, 2009, ChromeOS is currently publicly available and was released summer 2011. The

- 823 ChromeOS source code was released on November 19, 2009, under the BSD license as
 824 ChromiumOS.
- 825 • [Container-Optimized OS](#) (COS) is an operating system that is optimized for running
 826 Docker containers, based on [ChromiumOS](#).^[13]
 - 827 • [Android](#) is an operating system for mobile devices. It consists of [Android Runtime](#) (userland)
 828 with Linux (kernel), with its Linux kernel modified to add drivers for mobile device hardware and
 829 to remove unused Vanilla Linux drivers.
 - 830 • [gLinux](#), a Linux distribution that Google uses internally
 - 831 • [Fuchsia](#) is a [capability-based real-time](#) operating system (RTOS) [scalable](#) to universal devices, in
 832 early development, from the tiniest [embedded](#) hardware, [wristwatches](#), tablets to the largest
 833 personal computers. Unlike ChromeOS and Android, it is not based on the Linux kernel, but
 834 instead began on a new microkernel called "Zircon", derived from "Little Kernel".
 - 835 • [Wear OS](#) a version of [Google's Android operating system](#) designed for [smartwatches](#) and
 836 other [wearables](#).
- 837 **Green Hills Software**
- 838 • [INTEGRITY](#) – Reliable Operating system
 - 839 • [INTEGRITY-178B](#) – A DO-178B certified version of [INTEGRITY](#).
 - 840 • [μ-velOSity](#) – A lightweight [microkernel](#).
- 841 **Harris Computer Systems**
- 842 • [Vulcan O/S](#) – Proprietary O/S for [Harris Computer Systems](#) (HCX)
 - 843 • [CX/UX](#) – Proprietary UNIX based OS for Harris' computers (MCX)
- 844 **Heathkit, Zenith Data Systems**
- 845 • [HDOS](#) – ran on the [H8](#) and Heath/[Zenith Z-89](#) series
 - 846 • [HT-11](#) – a modified version of [RT-11](#) that ran on the [Heathkit H11](#)
- 847 **Hewlett-Packard, Hewlett Packard Enterprise**
- 848 • [HP Multi-Programming Executive](#) (MPE, MPE/XL, and MPE/iX) – runs on HP 3000 and HP
 849 e3000 mini-computers
 - 850 • [HP-UX](#) – runs on HP9000 and Itanium servers (from small to mainframe-class computers)
- 851 **Honeywell**
- 852 • [CP-6](#), CP-V work-alike for Honeywell Level/66
- 853 **Huawei**
- 854 • [HarmonyOS](#)
 - 855 • [HarmonyOS NEXT](#)
 - 856 • [LiteOS](#)
 - 857 • [EulerOS](#)
- 858 **Intel Corporation**
- 859 • [iRMX](#) – real-time operating system originally created to support the Intel 8080 and 8086
 860 processor families in embedded applications.
 - 861 • [ISIS](#), [ISIS-II](#) – "Intel Systems Implementation Supervisor" was an environment for development
 862 of software within the Intel microprocessor family in the early 1980s on
 863 their [Intellec](#) Microcomputer Development System and clones. ISIS-II worked with 8 inch floppy
 864 disks and had an editor, cross-assemblers, a linker, an object locator, debugger, compilers
 865 for [PL/M](#), a BASIC interpreter, etc. and allowed file management through a console.
 - 866 • [iMAX 432](#) - an operating system for systems based on Intel's [iAPX 432](#) architecture.
- 867 **IBM**
- 868 *Further information: [History of IBM mainframe operating systems](#)*
- 869 **On early mainframes: 1410, 7010, 704, 709, 7090, 7094, 7040, 7044, 7030**
- 870 • [BESYS](#) – for the [IBM 7090](#)
 - 871 • [Compatible Time-Sharing System](#) (CTSS) – developed at MIT's Computation Center for use on a
 872 modified [IBM 7094](#)
 - 873 • **FORTRAN Monitor System** (FMS) – for the [IBM 709](#) and [7090](#)

- 874 • [GM OS & GM-NAA I/O](#) – for the [IBM 704](#)
- 875 • [IBSYS](#) – tape based operating system for [IBM 7090](#) and [IBM 7094](#)
- 876 • **7040/7044 Operating System (16/32K)** - 7040-PR-150
- 877 • [IJMON](#) – A bootable serial I/O monitor for loading programs for the [IBM 1400 series](#) ^[citation needed]
- 878 • **1410 Processor Operating System** (PR-155) for the [1410](#) and [7010](#)
- 879 • [SHARE Operating System](#) (SOS) – for the [IBM 704](#) and [709](#)
- 880 • [University of Michigan Executive System](#) (UMES) – for the [IBM 704](#), [709](#), and [7090](#))
- 881 **On S/360, S/370, and successor mainframes**
- 882 • [OS/360 and successors](#) on IBM S/360, S/370, and successor mainframes
 - 883 • [OS/360](#) (first official OS targeted for the [System/360](#) architecture)
 - 884 • PCP (Primary Control Program, a kernel and a ground breaking automatic space
 - 885 allocating file system)
 - 886 • [MFT](#) (original Multi-programming with a Fixed number of Tasks, replaced by
 - 887 MFT II)
 - 888 • [MFT II](#) (Multi-Programming with a Fixed number of Tasks, had up to 15 fixed
 - 889 size application partitions, plus partitions for system tasks, initially defined at
 - 890 boot time but redefinable by operator command)
 - 891 • [MVT](#) (Multi-Programming with a Variable number of Tasks, had up to 15
 - 892 application regions defined dynamically, plus additional regions for system tasks)
 - 893 • **M65MP** (MVT with support for a multiprocessor 360/65)
 - 894 • [OS/VS](#) (port of OS/360 targeted for the [System/370 virtual memory](#) architecture (OS/370
 - 895 is not the correct name for OS/VS1 and OS/VS2.) OS/VS has the following variations:
 - 896 • [OS/VS1](#) (Operating System/Virtual Storage 1, Virtual-memory version of
 - 897 OS/360 MFT II)
 - 898 • **OS/VS1 Basic Programming Extensions** (BPE) adds device support
 - 899 and VM handshaking
 - 900 • OS/VS2 (Operating System/Virtual Storage 2, Virtual-memory version of
 - 901 OS/360 MVT)
 - 902 • OS/VS2 R1 (Called [Single Virtual Storage](#) (SVS), Virtual-memory
 - 903 version of OS/360 MVT but without multiprocessing support)
 - 904 • OS/VS2 R2 through R3.8 (called [Multiple Virtual Storage](#), MVS,
 - 905 eliminated most need for VS1).
 - 906 • [MVS/SE](#) (MVS System Extensions)
 - 907 • [MVS/SP](#) (MVS System Product) V1
 - 908 • **MVS/370** refers to OS/VS2 MVS, MVS/SE and MVS/SP Version 1
 - 909 • [MVS/XA](#) (MVS/SP V2, supports S/370 Extended Architecture, [31-bit](#) addressing)
 - 910 • [MVS/ESA](#) (MVS supported Enterprise Systems Architecture, horizontal addressing
 - 911 extensions: data only address spaces called Dataspaces)
 - 912 • **MVS/SP V3**
 - 913 • **MVS/ESA SP V4** (a Unix environment was available for MVS/ESA SP V4R3)
 - 914 • **MVS/ESA SP V5** (the UNIX environment was bundled in this and all
 - 915 subsequent versions)
 - 916 • [OS/390](#) replacement for MVS/ESA SP V5 with some products bundled
 - 917 • [z/OS z/Architecture](#) replacement for OS/390 with [64-bit](#) virtual addressing
 - 918 • [Phoenix/MVS](#) (Developed at [Cambridge University](#))
 - 919 • [DOS/360 and successors](#) on IBM S/360, S/370, and successor mainframes
 - 920 • [BOS/360](#) (early interim version of DOS/360, briefly available at a few Alpha & Beta
 - 921 System/360 sites)
 - 922 • [TOS/360](#) (similar to BOS above and more fleeting, able to boot and run from 2x00 series
 - 923 tape drives)

- 924
- 925
- 926
- 927
- 928
- 929
- 930
- 931
- 932
- 933
- 934
- 935
- 936
- 937
- 938
- 939
- 940
- 941
- 942
- 943
- 944
- 945
- 946
- 947
- 948
- 949
- 950
- 951
- 952
- 953
- 954
- 955
- 956
- 957
- 958
- 959
- 960
- 961
- 962
- 963
- 964
- 965
- 966
- 967
- 968
- 969
- 970
- 971
- 972
- 973
- 974
- [DOS/360](#) (Disk Operating System (DOS), multi-programming system with up to 3 partitions, first commonly available OS for System/360)
 - DOS/360/RJE (DOS/360 with a control program extension that provided for the monitoring of remote job entry hardware (card reader & printer) connected by dedicated phone lines)
 - [DOS/VS](#) (First DOS offered on System/370 systems, provided virtual storage)
 - [DOS/VSE](#) (also known as VSE, upgrade of DOS/VS, up to 14 fixed size processing partitions)
 - **VSE/Advanced Functions** (VSE/AF) - Additional functionality for DOS/VSE
 - [VSE/SP](#) (program product including DOS/VSE and VSE/AF)
 - VSE/ESA, replaces VSE/SP, supports ESA/370 and [ESA/390](#) with 31-bit addresses
 - [z/VSE](#) (latest version of the four decades old DOS lineage, supports 64-bit addresses, multiprocessing, multiprogramming, SNA, TCP/IP, and some virtual machine features in support of Linux workloads)
 - [CP/CMS](#) (Control Program/Cambridge Monitor System) and successors on IBM S/360, S/370, and successor mainframes
 - [CP-40/CMS](#) (for System/360 Model 40)
 - [CP-67/CMS](#) (for System/360 Model 67)
 - [Virtual Machine Facility/370](#) (VM/370) - the CP [virtual machine hypervisor](#), [Conversational Monitor System](#) (CMS) operating system and supporting facilities for System/370 (24-bit addresses)
 - **VM/370 Basic System Extensions Program Product** (VM/BSE, AKA BSEPP) is an enhancement to VM/370
 - **VM/370 System Extensions Program Product** (VM/SE, AKA SEPP) is an enhancement to VM/370 that includes the facilities of VM/BSE
 - **Virtual Machine/System Product** (VM/SP) replaces VM/370, VM/BSE and VM/SE.
 - **Virtual Machine/Extended Architecture** (VM/XA) refers to three versions of VM that support System/370 Extended Architecture (S/370-XA) with 31-bit virtual addresses
 - **Virtual Machine/Extended architecture Migration Aid** (VM/XA MA) - Intended for MVS/370 to MVS/XA migration
 - **Virtual Machine/Extended Architecture Systems Facility** (VM/XA SF) - new release of VM/XA MA with additional functionality
 - **Virtual Machine/Extended Architecture System Product** (VM/XA SP) - Replaces VM/SP, VM/SP HPO and VM/XA SF
 - **Virtual Machine/Enterprise Systems Architecture** (VM/ESA), supports S/370, ESA/370 and [ESA/390](#) (a Unix environment was available starting with^[14] Version 2.)
 - [z/VM](#) (z/Architecture version of the VM OS with 64-bit addressing). Starting with Version 3,^[15] the Unix environment was standard.
- Further information: [History of CP/CMS](#)
- TPF Line (Transaction Processing Facility) on IBM S/360, S/370, and successor mainframes (largely used by airlines)
 - [ACP](#) (Airline Control Program)
 - [TPF](#) (Transaction Processing Facility)
 - [z/TPF](#) ([z/Architecture](#) extension)
 - [Unix-like](#) on IBM S/360, S/370, and successor mainframes
 - [AIX/370](#) (IBM's Advanced Interactive eXecutive, a System V Unix version)
 - [AIX/ESA](#) (IBM's Advanced Interactive eXecutive, a System V Unix version)
 - [OpenSolaris for System z](#)
 - [UTS](#) (developed by Amdahl)
 - [Linux on IBM Z](#)

- 975 • Others on IBM S/360, S/370, and successor mainframes:
- 976 • [BOS/360](#) (Basic Operating System)
- 977 • [Distributed Processing Programming Executive/370](#) (DPPX/370) a port of DDPX
- 978 from [8100](#) to S/370.
- 979 • [MTS](#) (Michigan Terminal System, developed by a group of universities in the US,
- 980 Canada, and the UK for the IBM System/360 Model 67, System/370 series, and
- 981 compatible mainframes)
- 982 • [RTOS/360](#) (IBM's Real Time Operating System, ran on 5 NASA custom System/360-
- 983 75s)^[16]
- 984 • [TOS/360](#) (Tape Operating System)
- 985 • [TSS/360](#) (IBM's Time Sharing System)
- 986 • [MUSIC/SP](#) (developed by [McGill University](#) for IBM System/370)
- 987 • [ORVYL](#) and [WYLBUR](#) (developed by [Stanford University](#) for IBM System/360)
- 988 **On PC and Intel x86 based architectures**
- 989 • [PC DOS](#), IBM DOS
- 990 • PC DOS 1.x, 2.x, 3.x (developed jointly with Microsoft)
- 991 • IBM DOS 4.x, 5.0 (developed jointly with Microsoft)
- 992 • PC DOS 6.1, 6.3, 7, 2000, 7.10
- 993 *See also:* [MS-DOS and Windows](#)
- 994 • [OS/2](#)
- 995 • OS/2 1.x (developed jointly with Microsoft)
- 996 • OS/2 2.x
- 997 • [OS/2 Warp 3](#) (ported to PPC via [Workplace OS](#))
- 998 • [OS/2 Warp 4](#)
- 999 • [eComStation](#) (Warp 4.5/Workspace on Demand, rebundled by Serenity Systems
- 1000 International)
- 1001 • [ArcaOS](#) (Warp 4.52 based system sold by Arca Noae, LLC)
- 1002 • [IBM 4680 OS](#) version 1 to 4, a [POS](#) operating system based on [Digital Research's Concurrent](#)
- 1003 [DOS 286](#) and [FlexOS 286](#) 1.xx
- 1004 • [IBM 4690 OS](#) version 1 to 6.3, a successor to 4680 OS based on [Novell's FlexOS](#)
- 1005 [286/FlexOS 386](#) 2.3x
- 1006 • [Toshiba 4690 OS](#) version 6.4, a successor to 4690 OS 6.3
- 1007 • [Unix-like](#) on [PS/2](#)
- 1008 • [AIX](#) (IBM's Advanced Interactive eXecutive, a System V Unix version)
- 1009 **On other hardware platforms**
- 1010 • [IBM Series/1](#)
- 1011 • [EDX](#) ([Event Driven Executive](#))
- 1012 • [RPS](#) (Realtime Programming System)
- 1013 • [CPS](#) (Control Programming Support, subset of RPS)
- 1014 • [SerIX](#) (Unix on Series/1)
- 1015 • [IBM 1130](#)
- 1016 • [DMS](#) (Disk Monitor System)
- 1017 • [IBM 1800](#)
- 1018 • [TSX](#) (Time Sharing eXecutive)
- 1019 • [MPX](#) (Multi Programming eXecutive)
- 1020 • [IBM 8100](#)
- 1021 • [DPCX](#) (Distributed Processing Control eXecutive)
- 1022 • [DPPX](#) (Distributed Processing Programming Executive)
- 1023 • [IBM System/3](#)
- 1024 • [DMS](#) (Disk Management System)
- 1025 • [IBM System/34](#), [IBM System/36](#)

- 1026 • [SSP](#) (System Support Program)
- 1027 • [IBM System/38](#)
- 1028 • [CPF](#) (Control Program Facility)
- 1029 • [IBM System/88](#)
- 1030 • [Stratus VOS](#) (developed by [Stratus](#), and used for IBM [System/88](#), [Original equipment manufacturer](#) from Stratus)
- 1031
- 1032 • [IBM AS/400](#), iSeries, System i, [IBM Power Systems](#)
- 1033 • [IBM i](#) (previously known as OS/400 and i5/OS, descendant of System/38 CPF, includes
- 1034 System/36 SSP and AIX environment)
- 1035 • [UNIX](#) on [IBM RT PC](#)
- 1036 • [AOS](#) (a BSD Unix version, not related to [Data General AOS](#))
- 1037 • [AIX](#) (Advanced Interactive eXecutive, a System V Unix version)
- 1038 • [UNIX](#) on [POWER ISA](#), [PowerPC](#), and [Power ISA](#)
- 1039 • [AIX](#) (Advanced Interactive eXecutive, a System V Unix version)
- 1040 • Others
- 1041 • [Workplace OS](#) (a [microkernel](#) based operating system including OS/2, developed and
- 1042 canceled in the 1990s)
- 1043 • [K42](#) (open-source research operating system on [PowerPC](#) or [x86](#) based cache-coherent
- 1044 multiprocessor systems)
- 1045 • [Dynix](#) (developed by [Sequent](#), and used for IBM [NUMA-Q](#) too)

International Computers Limited

- 1047 • [J](#) and [MultiJob](#) – for the System 4 series mainframes
- 1048 • [GEORGE](#) 2/3/4 General ORGanisational Environment – used by [ICL 1900 series](#) mainframes
- 1049 • [Edinburgh Multiple Access System](#) (EMAS) for the [ICL System 4/75](#), from the [University of Edinburgh](#), later ported to other systems.
- 1050 • [Executive](#) – used on the 1900 and 290x range of minicomputers. A modified version of Executive
- 1051 was also used as part of GEORGE 3 and 4.
- 1052 • [TME](#) – used on the ME29 minicomputer
- 1053 • [ICL VME](#) – including early variants VME/B and VME/2900, appearing on the [ICL 2900](#)
- 1054 [Series](#) and Series 39 mainframes, implemented in [S3](#)
- 1055 • [VME/K](#) – on early smaller 2900s

Jide

- 1057
- 1058 • [Remix OS](#)

Jolla

- 1059
- 1060 • [Sailfish OS](#)

KaiOS

- 1061
- 1062 • [KaiOS](#)

Lynx Real-time Systems, LynuxWorks, Lynx Software Technologies

- 1063
- 1064 • [LynxOS](#)

Meizu

- 1065
- 1066 • [Flyme OS](#)

Microsoft Corporation

- 1067
- 1068 • [Xenix](#) (licensed version of Unix; licensed to [SCO](#) in 1987)
- 1069 • [MS-DOS](#) (developed jointly with IBM, versions 1.0–6.22)
- 1070 • [Z-DOS](#)
- 1071 • [MS-Net](#)
- 1072 • [MS-DOS 4.0 \(multitasking\)](#)
- 1073 • [MS-DOS 7](#)
- 1074 • [MSX-DOS](#) (developed by MS Japan for the MSX 8-bit computer)
- 1075 • [DOS/V](#)
- 1076 • [OS/2](#) 1.x (developed jointly with IBM until version 1.3)

- 1077 • [LAN Manager](#)
- 1078 • [Windows](#) (16-bit and 32-bit preemptive and cooperative multitasking, running atop MS-DOS)
- 1079 • [Windows 1.0](#) (Windows 1)
- 1080 • [Windows 2.0](#) (Windows 2 – separate version for i386 processor)
- 1081 • [Windows 2.1](#) (Windows/286, Windows/386)
- 1082 • [Windows 3.0](#) (Windows 3)
- 1083 • [Windows 3.1x](#) (Windows 3.1)
- 1084 • [Windows for Workgroups 3.1](#) (Codename Snowball)
- 1085 • [Windows 3.2](#) (Chinese-only release)
- 1086 • [Windows for Workgroups 3.11](#)
- 1087 • [Windows 95](#) (codename Chicago – Windows 4.0)
- 1088 • [Windows 98](#) (codename Memphis – Windows 4.1)
- 1089 • [Windows Millennium Edition](#) (Windows ME – Windows 4.9)
- 1090 • [Windows NT](#) (Full 32-bit or 64-bit kernel, not dependent on MS-DOS)
- 1091 • [Windows NT 3.1](#)
- 1092 • [Windows NT 3.5](#)
- 1093 • [Windows NT 3.51](#)
- 1094 • [Windows NT 4.0](#)
- 1095 • [Windows 2000](#) (Windows NT 5.0)
- 1096 • [Windows XP](#) (Windows NT 5.1)
- 1097 • [Windows Server 2003](#) (Windows NT 5.2)
- 1098 • [Windows Fundamentals for Legacy PCs](#) (based on Windows XP)
- 1099 • [Windows Vista](#) (Windows NT 6.0)
- 1100 • [Windows Azure](#) (Cloud OS Platform) 2009
- 1101 • [Windows Home Server](#) (based on Windows Server 2003)
- 1102 • [Windows Server 2008](#) (based on Windows Vista)
- 1103 • [Windows 7](#) (Windows NT 6.1)
- 1104 • [Windows Server 2008 R2](#) (based on Windows 7)
- 1105 • [Windows Home Server 2011](#) (based on Windows Server 2008 R2)
- 1106 • [Windows 8](#) (Windows NT 6.2)
- 1107 • [Windows RT](#)
- 1108 • [Windows Phone 8](#)
- 1109 • [Windows Server 2012](#) (based on Windows 8)
- 1110 • [Windows 8.1](#) (Windows NT 6.3)
- 1111 • [Windows Phone 8.1](#)
- 1112 • [Windows Server 2012 R2](#) (based on Windows 8.1)
- 1113 • [Windows 10](#) (Windows NT 10.0)
- 1114 • [Windows 10 Mobile](#)
- 1115 • [Windows Server 2016](#)
- 1116 • [Windows Server 2019](#)
- 1117 • [Windows 11](#) (Windows NT 10.0)
- 1118 • [Windows Server 2022](#)
- 1119 • [Windows Server 2025](#)
- 1120 • [Windows CE](#) (OS for handhelds, embedded devices, and real-time applications that is similar to other versions of Windows)
- 1121 • [Windows CE 3.0](#)
- 1122 • [Windows CE 5.0](#)
- 1123 • [Windows Embedded CE 6.0](#)
- 1124 • [Windows Embedded Compact 7](#)
- 1125 • [Windows Embedded Compact 2013](#)
- 1126 • [Windows Mobile](#) (based on Windows CE, but for a smaller form factor)
- 1127

- 1128 • [Windows Phone 7](#)
- 1129 • [KIN OS](#)
- 1130 • [Xbox system software](#)
- 1131 • [Xbox \(first generation\) system software](#)
- 1132 • [Xbox 360 system software](#)
- 1133 • [Xbox One system software](#)
- 1134 • [Xbox Series X/S system software](#)
- 1135 • [Singularity](#) – A research operating system written mostly in [managed code](#) (C#)
- 1136 • [Midori](#) – A managed code operating system
- 1137 • [SONiC](#)
- 1138 • [Azure Sphere](#)
- 1139 • [CBL-Mariner](#)
- 1140 **MIT**
- 1141 • [Altair DOS](#) – An early disk operating system for the [Altair 8800](#) machine. ^[citation needed]
- 1142 **MontaVista**
- 1143 • MontaVista [Mobilinux](#)
- 1144 **Motorola**
- 1145 • [VERSAdos](#)
- 1146 **NCR Corporation**
- 1147 • [TMX](#) – Transaction Management eXecutive.
- 1148 • [IMOS](#) – Interactive Multiprogramming Operating System (circa 1978), for the NCR Century 8200 series minicomputers.^[17]
- 1149 • [VRX](#) – Virtual Resource eXecutive.
- 1150 • [VRX](#) – Virtual Resource eXecutive.
- 1151 **NeXT**
- 1152 • [NeXTSTEP](#)
- 1153 **Nintendo**
- 1154 • [ES](#) – a computer operating system developed originally by Nintendo and since 2008 by Esrille. It is open source and runs natively on x86 platforms.
- 1155 • [Wii system software](#)
- 1156 • [Wii U system software](#)
- 1157 • [Nintendo Switch system software](#)
- 1158 • [Nintendo Switch system software](#)
- 1159 **Novell**
- 1160 • [NetWare](#) – network operating system providing high-performance network services. Has been superseded by Open Enterprise Server line, which can be based on NetWare or Linux to provide the same set of services.
- 1161 • [UnixWare](#)
- 1162 • [Novell "SuperNOS"](#) – a never released merge of NetWare and UnixWare
- 1163 • [Novell "Corsair"](#)
- 1164 • [Novell "Exposé"](#)
- 1165 • [Open Enterprise Server](#) – the successor to NetWare
- 1166 • [Open Enterprise Server](#) – the successor to NetWare
- 1167 • [Open Enterprise Server](#) – the successor to NetWare
- 1168 **Open Mobile Platform**
- 1169 • [Aurora OS](#) – the successor to Sailfish OS (not to be confused with a different [Aurora OS](#))
- 1170 **Quadros Systems**
- 1171 • [RTXC Quadros](#) RTOS – proprietary C-based RTOS used in embedded systems
- 1172 **RCA**
- 1173 • [Time Sharing Operating System](#) (TSOS) – first OS supporting virtual addressing of the main storage and support for both timeshare and batch interface
- 1174 • [Time Sharing Operating System](#) (TSOS) – first OS supporting virtual addressing of the main storage and support for both timeshare and batch interface
- 1175 **RoweBots**
- 1176 • DSPnano RTOS – 8/16 Bit Ultra Tiny Embedded Linux Compatible RTOS
- 1177 **Samsung Electronics**
- 1178 • [Bada](#)

- 1179 • [Tizen](#) is an operating system based on the Linux kernel, a project within the Linux Foundation
- 1180 and is governed by a Technical Steering Group (TSG) while controlled by Samsung and backed
- 1181 by Intel. Tizen works on a wide range of Samsung devices including smartphones, tablets, smart
- 1182 TVs, PCs and wearable.
- 1183 • [Orsay](#)
- 1184 • [One UI](#) - Android skin
- 1185 **Scientific Data Systems (SDS)**
- 1186 **SDS 900 series**
- 1187 • [Berkeley Timesharing System](#) for the [SDS 940](#)
- 1188 **SDS Sigma series**
- 1189 • [Universal Time-Sharing System](#) CP-V, CP-R
- 1190 • [Xerox Operating System](#) (XOS)
- 1191 • GORDO from UCLA^[18]
- 1192 • [Ésope \(operating system\)](#) from IRIA for the Sigma 7 and CII 10070^[19]
- 1193 **SCO, SCO Group**
- 1194 Source:^[20]
- 1195 • [Xenix](#), Unix System III based distribution for the Intel 8086/8088 architecture
- 1196 • [Xenix](#) 286, Unix System V Release 2 based distribution for the Intel 80286 architecture
- 1197 • [Xenix](#) 386, Unix System V Release 2 based distribution for the Intel 80386 architecture
- 1198 • [SCO Unix](#), SCO UNIX System V/386 was the first volume commercial product licensed by
- 1199 AT&T to use the UNIX System trademark (1989). Derived from AT&T System V Release 3.2
- 1200 with an infusion of Xenix device drivers and utilities plus most of the SVR4 features
- 1201 • [SCO Open Desktop](#), the first 32-bit graphical user interface for UNIX Systems running
- 1202 on Intel processor-based computers. Based on [SCO Unix](#)
- 1203 • [SCO OpenServer](#) 5, AT&T UNIX System V Release 3 based
- 1204 • [SCO OpenServer](#) 6, SVR5 (UnixWare 7) based kernel with SCO OpenServer 5 application and
- 1205 binary compatibility, system administration, and user environments
- 1206 • [UnixWare](#)
- 1207 • [UnixWare](#) 2.x, based on AT&T System V Release 4.2MP
- 1208 • [UnixWare](#) 7, UnixWare 2 kernel plus parts of 3.2v5 (UnixWare 2 + OpenServer 5 =
- 1209 UnixWare 7). Referred to by [SCO](#) as SVR5
- 1210 **Silicon Laboratories (formerly Micrium Inc.)**
- 1211 • [Micrium OS](#) - customized μ C/OS-III for Silicon Laboratories's SoC products
- 1212 **Sinclair Research**
- 1213 • [Sinclair BASIC](#) was used in the 8-bit home computers from [Sinclair Research](#) and [Timex](#)
- 1214 [Sinclair](#). It was included in the ROM, and the computers booted to the Basic interpreter. Various
- 1215 versions exist, with the latter ones supporting disk drive operations.
- 1216 **Sony**
- 1217 • [PlayStation Vita system software](#)
- 1218 • [PlayStation 3 system software](#)
- 1219 • [PlayStation 4 system software](#)
- 1220 • [PlayStation 5 system software](#)
- 1221 **SYSGO**
- 1222 • [PikeOS](#) – a certified real time operating system for safety and security critical embedded systems
- 1223 **Tandem Computers, Compaq, Hewlett-Packard, Hewlett Packard Enterprise**
- 1224 • [NonStop OS](#) - formerly Guardian (Tandem), then NonStop Kernel, then NonStop OS; runs on
- 1225 HPE's NonStop line of servers
- 1226 **Tandy Corporation**
- 1227 • [TRSDOS](#) – A floppy-disk-oriented OS supplied by Tandy/Radio Shack for their [TRS-80](#) Z80-
- 1228 based line of personal computers. Eventually renamed as LS-DOS or LDOS.
- 1229 • [Color BASIC](#) – A ROM-based OS created by Microsoft for the [TRS-80 Color Computer](#).^[21]

- 1230 • [NewDos/80](#) – A third-party OS for Tandy's TRS-80 personal computers.
- 1231 • [DeskMate](#) – Operating system created by Tandy Corporation and introduced with the [Tandy](#)
- 1232 [1000](#) computer. ^[citation needed]
- 1233 **TCSC (later NCSC)**
- 1234 • [Edos](#) – enhanced version of IBM's [DOS/360](#) (and later [DOS/VS](#) and [DOS/VSE](#)) operating system
- 1235 for [System/360](#) and [System/370](#) IBM mainframes
- 1236 **Texas Instruments**
- 1237 • [TI-RTOS Kernel](#) – Real-time operating system for TI's embedded devices.
- 1238 **TRON Project**
- 1239 • [TRON](#) – open [real-time operating system kernel](#)
- 1240 • [T-Kernel](#)
- 1241 **UNIVAC, Unisys**
- 1242 • [EXEC I](#)
- 1243 • [EXEC II](#)
- 1244 • [EXEC 8/OS 1100/OS 2200](#)
- 1245 • [VS/9](#), successor to [RCA TSOS](#)
- 1246 • [OS/4](#) for 9000 series
- 1247 **Valve**
- 1248 • [SteamOS](#) - a [Arch](#) based operating system for [Handheld gaming PC](#)
- 1249 **Wang Laboratories**
- 1250 • [WPS](#) Wang Word Processing System. Micro-code based system.
- 1251 • [OIS](#) Wang Office Information System. Successor to the WPS. Combined the WPS and VP/MVP
- 1252 systems.
- 1253 **Weston Embedded Solutions**
- 1254 • [μC/OS-II](#) – a small pre-emptive priority based multi-tasking kernel
- 1255 • [μC/OS-III](#) – a small pre-emptive priority based multi-tasking kernel, with unlimited number of
- 1256 tasks and priorities, and round-robin scheduling
- 1257 • [Cesium RTOS](#) - commercial continuation of Micrium's [μC/OS-III](#) forked from the open-sources
- 1258 release
- 1259 **Wind River Systems**
- 1260 • [VxWorks](#) – Small footprint, scalable, high-performance RTOS for embedded microprocessor
- 1261 based systems. ^[22]
- 1262 **Zilog**
- 1263 • [Z80-RIO](#)
- 1264 **Other**
- 1265 **Lisp-based**
- 1266 • [Lisp Machines, Inc.](#) (also known as LMI) used an operating system written in [MIT's Lisp](#)
- 1267 [Machine Lisp](#).
- 1268 • [Symbolics Genera](#) written in a systems dialect of the [Lisp](#) programming language
- 1269 called [ZetaLisp](#) and Symbolics [Common Lisp](#). Genera was ported to a virtual machine for
- 1270 the [DEC Alpha](#) line of computers.
- 1271 • [Texas Instruments' Explorer Lisp machine](#) workstations also had systems code written in [Lisp](#)
- 1272 [Machine Lisp](#).
- 1273 • [Xerox 1100](#) series of Lisp machines used an operating system also written in [Interlisp](#), and was
- 1274 also ported to a virtual machine called "Medley."
- 1275 **For Elektronika BK**
- 1276 • [ANDOS](#)
- 1277 • [CSI-DOS](#)
- 1278 • [MK-DOS](#)
- 1279 **Non-standard language-based**
- 1280 • [Pilot](#) operating system – written in the [Mesa](#) language and used on [Xerox Star](#) workstations.

- 1281 • [PERQ](#) Operating System (POS) – written in PERQ [Pascal](#).
- 1282 **Other proprietary non-Unix-like**
- 1283 • Operating system for [Эльбрус-1 \(Elbrus-1\)](#) and [Эльбрус-2](#) – used for application, job control, system programming,^[23] implemented in [цЭль-76 \(AL-76\)](#).
- 1284 • [Business Operating System](#) (BOS) – developed to be ported across microcomputers.
- 1285 • [EOS](#) – developed by [ETA Systems](#) for use in their [ETA-10](#) line of [supercomputers](#)
- 1286 • [EMBOS](#) – developed by [Elxsi](#) for use on their [mini-supercomputers](#)
- 1287 • [GCOS](#) – a proprietary operating system originally developed by [General Electric](#)
- 1288 • [MAI Basic Four](#) – An OS implementing [Business Basic](#) from MAI Systems.
- 1289 • [Michigan Terminal System](#) – Developed by a group of universities in the US, Canada, and the UK for use on the IBM System/360 Model 67, the System/370 series, and compatible mainframes
- 1290 • [MUSIC/SP](#) – an operating system developed for the S/370, running normally under VM
- 1291 • OS ES – an operating system for [ES EVM](#)
- 1292 • [PC-MOS/386](#) – DOS-like, but multiuser/multitasking
- 1293 • Prolog-Dispatcher – used to control Soviet [Buran](#) space shuttle.
- 1294 • [SINTRAN III](#) – an operating system used with [Norsk Data](#) computers.
- 1295 • [SkyOS](#) – commercial desktop OS for PCs
- 1296 • [SODA](#) – used by the [Odra 1204](#) computers.^[24]
- 1297 • [THEOS](#)
- 1298 • [TSX-32](#) – a 32-bit operating system for x86 platform.
- 1299 • TX990/TXDS, [DX10](#) and [DNOS](#) – proprietary operating systems for [TI-990](#) minicomputers
- 1300 **Other proprietary Unix-like and POSIX-compliant**
- 1301 • [Aegis \(Apollo Computer\)](#)
- 1302 • [Amiga Unix](#) (Amiga ports of Unix System V release 3.2 with Amiga A2500UX and SVR4 with Amiga A3000UX. Started in 1990, last version was in 1992)
- 1303 • [Coherent \(Unix-like OS from Mark Williams Co. for PC class computers\)](#)
- 1304 • [DC/OSx \(DataCenter/OSx—an operating system developed by Pyramid Technology for its MIPS-based systems\)](#)
- 1305 • [DG/UX \(Data General Corp\)](#)
- 1306 • [DNIX from DIAB](#)
- 1307 • [DSPnano RTOS \(POSIX nanokernel, DSP Optimized, Open Source\)](#)
- 1308 • [HeliOS developed and sold by Perihelion Software mainly for transputer-based systems](#)
- 1309 • [Interactive Unix \(a port of the UNIX System V operating system for Intel x86 by Interactive Systems Corporation\)](#)
- 1310 • [IRIX from SGI](#)
- 1311 • [MeikOS](#)
- 1312 • [NeXTSTEP \(developed by NeXT; a Unix-based OS based on the Mach microkernel\)](#)
- 1313 • [OS-9 Unix-like RTOS. \(OS from Microware for Motorola 6809 based microcomputers\)](#)
- 1314 • [OS9/68K Unix-like RTOS. \(OS from Microware for Motorola 680x0 based microcomputers; based on OS-9\)](#)
- 1315 • [OS-9000 Unix-like RTOS. \(OS from Microware for Intel x86 based microcomputers; based on OS-9, written in C\)](#)
- 1316 • [OSF/1 \(developed into a commercial offering by Digital Equipment Corporation\)](#)
- 1317 • [OPENSTEP](#)
- 1318 • [QNX \(POSIX, microkernel OS; usually a real time embedded OS\)](#)
- 1319 • [Rhapsody \(an early form of Mac OS X\)](#)
- 1320 • [RISC iX – derived from BSD 4.3, by Acorn computers, for their ARM family of machines](#)
- 1321 • [RISC/os \(a port by MIPS Technologies of 4.3BSD for its MIPS-based computers\)](#)
- 1322 • [RMX](#)
- 1323 • [SCO UNIX \(from SCO, bought by Caldera who renamed themselves SCO Group\)](#)
- 1324 • [SINIX \(a port by SNI of Unix to the MIPS architecture\)](#)

- 1332 • [Solaris](#) (from Sun, bought by Oracle; a System V-based replacement for SunOS)
- 1333 • [SunOS](#) (BSD-based Unix system used on early Sun hardware)
- 1334 • [SUPER-UX](#) (a port of [System V Release 4.2MP](#) with features adopted
- 1335 from [BSD](#) and [Linux](#) for [NEC SX architecture supercomputers](#))
- 1336 • [System V](#) (a release of AT&T Unix, 'SVR4' was the 4th minor release)
- 1337 • [System V/AT, 386](#) (The first version of AT&T System V UNIX on the IBM 286 and 386 PCs,
- 1338 ported and sold by [Microport](#))
- 1339 • [Trusted Solaris](#) (Solaris with kernel and other enhancements to support [multilevel security](#))
- 1340 • [UniFLEX](#) ([Unix-like](#) OS from [TSC](#) for DMA-capable, extended addresses, Motorola 6809 based
- 1341 computers; e.g. [SWTPC](#), [Gimix](#) and others)
- 1342 • [Unicos](#) (the version of Unix designed for Cray Supercomputers, mainly geared to vector
- 1343 calculations)
- 1344 • UTX-32 (Developed by Gould CSD (Computer System Division), a Unix-based OS that included
- 1345 both BSD and System V characteristics. It was one of the first Unix based systems to receive
- 1346 NSA's C2 security level certification.)^[citation needed]
- 1347 • [Zenix](#), Zenith corporations Unix (a popular USA electronics maker at the time)^[citation needed]
- 1348 **Non-proprietary**
- 1349 **Unix or Unix-like**
- 1350 • [MINIX](#) (study OS developed by [Andrew S. Tanenbaum](#) in the [Netherlands](#))
- 1351 • [Berkeley Software Distribution](#) (BSD), a variant of Unix originally for [DEC PDP-](#)
- 1352 [11](#) and [VAX](#) hardware)
 - 1353 • [FreeBSD](#) (one of the outgrowths of UC Regents' abandonment of [CSRG's](#) 'BSD Unix')
 - 1354 • [DragonFlyBSD](#), forked from FreeBSD 4.8
 - 1355 • [MidnightBSD](#), forked from FreeBSD 6.1
 - 1356 • [GhostBSD](#)
 - 1357 • [TrueOS](#) (previously known as PC-BSD), made for desktop/laptop usage, now
 - 1358 discontinued
 - 1359 • [NomadBSD](#), a project aiming to tend FreeBSD to desktop/laptop needs
 - 1360 • [NetBSD](#) (an embedded device BSD variant)
 - 1361 • [OpenBSD](#) forked from NetBSD
 - 1362 • [Bitrig](#) forked from OpenBSD, discontinued
 - 1363 • [FuguIta](#),^[25] a live OpenBSD fork by a Japanese developer^[26]
 - 1364 • [Darwin](#), created by Apple using code from NeXTSTEP, FreeBSD, and NetBSD
 - 1365 • [GNU](#) (also known as GNU/[Hurd](#))
 - 1366 • [Linux](#) (see also [List of Linux distributions](#)) (alleged to be GNU/Linux^[27] see [GNU/Linux naming](#)
 - 1367 [controversy](#))
 - 1368 • [Android](#)^[28]
 - 1369 • [Android-x86](#)
 - 1370 • [Remix OS](#)
 - 1371 • [EulerOS](#) - Linux commercial distribution for cloud based software by [Huawei](#)
 - 1372 • [openEuler](#) - open-source community version of EulerOS
 - 1373 • [NestOS](#) - open-source cloud based operating system based on EulerOS,
 - 1374 contributed by openEuler community
 - 1375 • [Redox](#) (written in Rust)^[29]
 - 1376 • [OpenSolaris](#)
 - 1377 • [illumos](#), contains original Unix (SVR4) code derived from the [OpenSolaris](#) (discontinued
 - 1378 by Oracle in favor of [Solaris](#) 11 Express)
 - 1379 • [OpenIndiana](#), operates under the illumos Foundation. Uses the illumos kernel,
 - 1380 which is a derivative of [OS/Net](#), which is basically an [OpenSolaris/Solaris](#) kernel
 - 1381 with the bulk of the drivers, core libraries, and basic utilities.
 - 1382 • [Nexenta OS](#), based on the illumos kernel with Ubuntu packages

- 1383 • [SmartOS](#), an illumos distribution for cloud computing with [Kernel-based Virtual Machine](#) integration.
- 1384
- 1385 • [RTEMS](#) (Real-Time Executive for Multiprocessor Systems)
- 1386 • [Syllable Desktop](#)
- 1387 • [VSTa](#)
- 1388 • [Plurix](#) (or Tropix^[30]) (by [Federal University of Rio de Janeiro](#) – UFRJ)
- 1389 • [TUNIS](#) (University of Toronto)
- 1390 • [Xv6](#) - a simple Unix-like teaching operating system from MIT
- 1391 • [SerenityOS](#) - aims to be a modern Unix-like operating system, yet with a look and feel that
- 1392 emulates 1990s operating systems such as [Microsoft Windows](#) and the [classic Mac OS](#).

Non-Unix

- 1394 • [Cosmos](#) – written in C#
- 1395 • [EmuTOS](#) - open source [Atari TOS](#) variant
- 1396 • [FreeDOS](#) – open source [MS-DOS](#) variant
- 1397 • [Genode](#) – operating system framework for microkernels (written in C++)
- 1398 • [Google Fuchsia](#)
- 1399 • [Haiku](#) – open source inspired by [BeOS](#), in development
- 1400 • [Incompatible Timesharing System](#) (ITS) – written in the MIDAS [macro assembler](#) language for
- 1401 the [PDP-6](#) and [PDP-10](#)^[31] by [MIT](#) students
- 1402 • [LiteOS](#)
- 1403 • [MagiC](#) - open source [Atari TOS](#) variant
- 1404 • [OpenHarmony](#) - LiteOS kernel and kernel add-ons side of the kernel tree under Kernel Abstract
- 1405 Layer (KAL) structure
- 1406 • [Uniproton](#) real-time operating system for ultra-low latency and adaptable mixed-critical
- 1407 deployment capabilities contributed by [openEuler](#) community and also part of OpenHarmony
- 1408 add-on kernel
- 1409 • [osFree](#) – OS/2 Warp open source clone
- 1410 • [OSv](#) – written in C++
- 1411 • [Phantom OS](#) – persistent object-oriented
- 1412 • [ReactOS](#) – open source OS designed to be binary compatible with [Windows NT](#) and its variants
- 1413 ([Windows XP](#), [Windows 2000](#), etc.); in development
- 1414 • [\[Redacted\] OS](#) - open source made by [Developed from Scratch](#)
- 1415 • [SharpOS](#) – written in .NET C#
- 1416 • [Visopsys](#) – written in C and assembly by Andy McLaughlin
- 1417 • [Quantix](#)

Research

Unix or Unix-like

- 1419 • [Plan 9 from Bell Labs](#) – distributed OS developed at [Bell Labs](#), based on original Unix design
- 1420 principles yet functionally different and going much further
- 1421 • [Inferno](#) – distributed OS derived from Plan 9, originally from Bell Labs
- 1422 • [9front](#), a derivative open-source project^[32] made to resurrect Plan 9^[33] to passionate
- 1423 developers
- 1424 • [Research Unix](#)^{[34][35]}

Non-Unix

- 1426
- 1427 • [Amoeba](#) – research OS by [Andrew S. Tanenbaum](#)
- 1428 • [Barrelfish](#)
- 1429 • [Croquet](#)
- 1430 • [EROS](#) – microkernel, capability-based
- 1431 • [Harmony](#) – realtime, multitasking, multiprocessing message-passing system developed at the
- 1432 National Research Council of Canada.
- 1433 • [HelenOS](#) – research and experimental operating system

- 1434 • [ILIOS](#) – Research OS designed for routing
- 1435 • [L4](#) – second generation microkernel
- 1436 • [Mach](#) – from OS kernel research at [Carnegie Mellon University](#); see [NeXTSTEP](#)
- 1437 • [Nemesis](#) – Cambridge University research OS – detailed quality of service abilities
- 1438 • [Singularity](#) – experimental OS from Microsoft Research written in [managed code](#) to be
- 1439 highly [dependable](#)
- 1440 • [Spring](#) – research OS from Sun Microsystems
- 1441 • [THE multiprogramming system](#) – by Dijkstra in 1968, at the [Eindhoven University of](#)
- 1442 [Technology](#) in the Netherlands, introduced the first form of software-based memory
- 1443 segmentation, freeing programmers from being forced to use actual physical locations
- 1444 • [Thoth](#) – realtime, multiprocess message-passing system developed at the [University of Waterloo](#).
- 1445 • [Tock](#)
- 1446 • [V](#) – from Stanford, early 1980s^[36]
- 1447 • [Verve](#) – OS designed by Microsoft Research to be verified end-to-end for [type](#)
- 1448 [safety](#) and [memory safety](#)
- 1449 • [Xinu](#) – Study OS developed by [Douglas E. Comer](#) in the United States^[37]

1450 **Disk operating systems (DOS)**

1451 *Main article: [Disk operating system](#)*

- 1452 • [86-DOS](#) (developed at Seattle Computer Products by Tim Paterson for the new Intel 808x CPUs;
- 1453 licensed to [Microsoft](#), became PC DOS/MS-DOS. Also known by its working title QDOS.)
 - 1454 • [PC DOS](#) (IBM's DOS variant, developed jointly with Microsoft, versions 1.0–7.0, 2000,
 - 1455 7.10)
 - 1456 • [MS-DOS](#) (Microsoft's DOS variant for OEM, developed jointly with IBM, versions 1.x–
 - 1457 6.22 Microsoft's now abandoned DOS variant)
- 1458 • [Concurrent CP/M-86 3.1](#) (BDOS 3.1) with [PC-MODE](#) (Digital Research's successor of [CP/M-](#)
- 1459 [86](#) and [MP/M-86](#))
 - 1460 • [Concurrent DOS 3.1-4.1](#) (BDOS 3.1-4.1)
 - 1461 • [Concurrent PC DOS 3.2](#) (BDOS 3.2) (Concurrent DOS variant for IBM
 - 1462 compatible PCs)
 - 1463 • [DOS Plus 1.1, 1.2](#) (BDOS 4.1), 2.1 (BDOS 5.0) (single-user, multi-
 - 1464 tasking system derived from Concurrent DOS 4.1-5.0)
 - 1465 • [Concurrent DOS 8-16](#) (dual-processor variant of Concurrent DOS for 8086 and
 - 1466 8080 CPUs)
 - 1467 • [Concurrent DOS 286 1.x](#)
 - 1468 • [FlexOS 1.00-2.34](#) (derivative of Concurrent DOS 286)
 - 1469 • [FlexOS 186](#) (variant of FlexOS for terminals)
 - 1470 • [FlexOS 286](#) (variant of FlexOS for hosts)
 - 1471 • [Siemens S5-DOS/MT](#) (industrial control system based
 - 1472 on FlexOS)
 - 1473 • [IBM 4680 OS](#) (POS operating system based on FlexOS)
 - 1474 • [IBM 4690 OS](#) (POS operating system based on FlexOS)
 - 1475 • [Toshiba 4690 OS](#) (POS operating system based
 - 1476 on IBM 4690 OS and FlexOS)
 - 1477 • [FlexOS 386](#) (later variant of FlexOS for hosts)
 - 1478 • [IBM 4690 OS](#) (POS operating system based on FlexOS)
 - 1479 • [Toshiba 4690 OS](#) (POS operating system based
 - 1480 on IBM 4690 OS and FlexOS)
 - 1481 • [Concurrent DOS 386 1.0, 1.1, 2.0, 3.0](#) (BDOS 5.0-6.2)
 - 1482 • [Concurrent DOS 386/MGE](#) (Concurrent DOS 386 variant with advanced
 - 1483 graphics terminal capabilities)

- 1484 • [Multiuser DOS](#) 5.0, 5.01, 5.1 (BDOS 6.3-6.6) (successor of Concurrent
- 1485 DOS 386)
- 1486 • [CCI Multiuser DOS](#) 5.0-7.22 (up to BDOS 6.6)
- 1487 • [Datapac Multiuser DOS](#)
- 1488 • [Datapac System Manager](#) 7 (derivative of Datapac
- 1489 Multiuser DOS)
- 1490 • [IMS Multiuser DOS](#) 5.1, 7.0, 7.1 (BDOS 6.6-6.7)
- 1491 • IMS [REAL/32](#) 7.50, 7.51, 7.52, 7.53, 7.54, 7.60, 7.61,
- 1492 7.62, 7.63, 7.70, 7.71, 7.72, 7.73, 7.74, 7.80, 7.81, 7.82,
- 1493 7.83, 7.90, 7.91, 7.92, 7.93, 7.94, 7.95 (BDOS 6.8 and
- 1494 higher) (derivative of Multiuser DOS)
- 1495 • IMS [REAL/NG](#) (successor of REAL/32)
- 1496 • [Concurrent DOS XM](#) 5.0, 5.2, 6.0, 6.2 (BDOS 5.0-6.2) (real-mode variant of
- 1497 Concurrent DOS with EEMS support)
- 1498 • [DR-DOS](#) 3.31, 3.32, 3.33, 3.34, 3.35, 5.0, 6.0 (BDOS 6.0-7.1) single-
- 1499 user, single-tasking native DOS derived from Concurrent DOS 6.0)
- 1500 • Novell [PalmDOS](#) 1 (BDOS 7.0)
- 1501 • Novell [DR DOS "StarTrek"](#)
- 1502 • [Novell DOS 7](#) (single-user, multi-tasking system derived from
- 1503 DR DOS, BDOS 7.2)
- 1504 • Novell DOS 7 updates 1-10 (BDOS 7.2)
- 1505 • Caldera [OpenDOS](#) 7.01 (BDOS 7.2)
- 1506 • Enhanced DR-DOS 7.01.0x (BDOS 7.2)
- 1507 • Dell Real Mode Kernel
- 1508 (DRMK)
- 1509 • Novell DOS 7 updates 11–15.2 (BDOS 7.2)
- 1510 • Caldera [DR-DOS](#) 7.02-7.03 (BDOS 7.3)
- 1511 • [DR-DOS "WinBolt"](#)
- 1512 • OEM DR-DOS 7.04-7.05 (BDOS 7.3)
- 1513 • OEM DR-DOS 7.06 (PQDOS)
- 1514 • OEM DR-DOS 7.07 (BDOS 7.4/7.7)
- 1515 • [FreeDOS](#) ([open source](#) DOS variant)
- 1516 • [ProDOS](#) (operating system for the [Apple II](#) series computers)
- 1517 • [PTS-DOS](#) (MS-DOS variant by [Russian](#) company [Phystechsoft](#))
- 1518 • [TurboDOS](#) (Software 2000, Inc.) for [Z80](#) and [Intel 8086](#) processor-based systems
- 1519 • Multi-tasking user interfaces and environments for MS-DOS compatible operating systems
- 1520 • [DESQview](#) + [QEMM 386](#) multi-tasking user interface
- 1521 • [DESQView/X](#) ([X-windowing](#) GUI)

1522 Network operating systems

1523 Main article: [Network operating system](#)

- 1524 • [Banyan VINES](#) – by [Banyan Systems](#)
- 1525 • [Cambridge Ring](#)
- 1526 • [Cisco IOS](#) – by [Cisco Systems](#)
- 1527 • [Cisco NX-OS](#) – previously SAN-OS
- 1528 • [CTOS](#) – by [Convergent Technologies](#), later acquired by [Unisys](#)
- 1529 • [Data ONTAP](#) – by [NetApp](#)
- 1530 • [ExtremeWare](#) – by [Extreme Networks](#)
- 1531 • [ExtremeXOS](#) – by [Extreme Networks](#)
- 1532 • [Fabric OS](#) – by [Brocade](#)
- 1533 • [JunOS](#) – by Juniper
- 1534 • [NetWare](#) – networking OS by [Novell](#)

- 1535 • [Network operating system](#) (NOS) – developed by [CDC](#) for use in their Cyber line of
- 1536 supercomputers
- 1537 • [Novell Open Enterprise Server](#) – Open Source networking OS by [Novell](#). Can incorporate
- 1538 either [SUSE Linux](#) or Novell NetWare as its kernel
- 1539 • [Plan 9](#) – distributed OS developed at [Bell Labs](#), based on Unix design principles but not
- 1540 functionally identical
- 1541 • [Inferno](#) – distributed OS derived from Plan 9, originally from Bell Labs
- 1542 • [SONiC](#)
- 1543 • [TurboDOS](#) – by Software 2000, Inc.
- 1544 **Generic, commodity, and other**
- 1545 • [BLIS/COBOL](#)
- 1546 • [A2](#) formerly named Active Object System (AOS), and then Bluebottle (a concurrent and active
- 1547 object update to the [Oberon operating system](#))
- 1548 • [BS1000](#) by [Siemens](#)
- 1549 • [BS2000](#) by [Siemens](#), now BS2000/OSD from [Fujitsu Siemens](#) (formerly [Siemens Nixdorf](#)
- 1550 [Informationssysteme](#))
- 1551 • [BS3000](#) by [Siemens](#) (rebadging of Fujitsu's MSP operating system)^[38]
- 1552 • [Contiki](#) for various, mostly 8-bit systems, including the [Apple II](#), [Atari 8-bit computers](#), and
- 1553 some [Commodore](#) machines.
- 1554 • [FLEX9](#) (by [Technical Systems Consultants](#) (TSC) for Motorola 6809 based machines; successor
- 1555 to [FLEX](#), which was for Motorola 6800 CPUs)
- 1556 • [Graphics Environment Manager](#) (GEM) (windowing GUI for CP/M, DOS, and [Atari TOS](#))
- 1557 • [GEOS](#) (popular windowing GUI for PC, Commodore, Apple computers)
- 1558 • [JavaOS](#)
- 1559 • [JNode](#) (Java New Operating System Design Effort), written 99% in Java (native compiled),
- 1560 provides own JVM and JIT compiler. Based on [GNU Classpath](#).^{[39][40]}
- 1561 • [JX](#) Java operating system that focuses on a flexible and robust operating system architecture
- 1562 developed as an open source system by the University of Erlangen.
- 1563 • [KERNAL](#) (default OS on Commodore 64)
- 1564 • MERLIN for the [Corvus Concept](#)
- 1565 • [MorphOS](#) (Amiga compatible)
- 1566 • [MSP](#) by [Fujitsu](#) (successor to OS-IV), now MSP/EX,^[41] also known as Extended System
- 1567 Architecture (EXA), for 31-bit mode
- 1568 • [NetWare](#) (networking OS by [Novell](#))
- 1569 • [Oberon \(operating system\)](#) (developed at ETH-Zürich by [Niklaus Wirth](#) et al.) for the Ceres and
- 1570 Chameleon workstation projects
- 1571 • [OSD/XC](#) by [Fujitsu-Siemens](#) (BS2000 ported to an emulation on a Sun SPARC platform)
- 1572 • [OS-IV](#) by [Fujitsu](#) (based on early versions of IBM's [MVS](#))
- 1573 • [Pick](#) (often licensed and renamed)
- 1574 • [PRIMOS](#) by [Prime Computer](#) (sometimes spelled PR1MOS and PR1ME)
- 1575 • [Sinclair QDOS](#) (multitasking for the [Sinclair QL](#) computer)
- 1576 • [SSB-DOS](#) (by [Technical Systems Consultants](#) (TSC) for [Smoke Signal Broadcasting](#); a variant
- 1577 of [FLEX](#) in most respects)
- 1578 • [SymbOS](#) (GUI based multitasking operating system for [Z80](#) computers)
- 1579 • [Symobi](#) (GUI based modern micro-kernel OS for [x86](#), [ARM](#) and [PowerPC](#) processors, developed
- 1580 by Miray Software; used and developed further at [Technical University of Munich](#))
- 1581 • [TripOS](#), 1978
- 1582 • [TurboDOS](#) (Software 2000, Inc.)
- 1583 • [UCSD p-System](#) (portable complete programming environment/operating system/virtual machine
- 1584 developed by a long running student project at [UCSD](#); directed by Prof [Kenneth Bowles](#); written
- 1585 in [Pascal](#))

- 1586 • [VOS](#) by [Stratus Technologies](#) with strong influence from [Multics](#)
- 1587 • VOS3 by [Hitachi](#) for its IBM-compatible mainframes, based on IBM's [MVS](#)
- 1588 • [VM2000](#) by [Siemens](#)
- 1589 • [Visi On](#) (first GUI for early PC machines; not commercially successful)
- 1590 • [VPS/VM](#) (IBM based, main operating system at [Boston University](#) for over 10 years.)

Hobby

Main article: [Hobbyist operating system](#)

- 1593 • [AROS](#) – AROS Research Operating System (formerly known as Amiga Research Operating System)
- 1594 • [AtheOS](#) – branched to become [Syllable Desktop](#)
- 1595 • [Syllable Desktop](#) – a modern, independently originated OS; see [AtheOS](#)
- 1596 • [BareMetal](#)
- 1597 • DSPnano RTOS
- 1598 • [EmuTOS](#)
- 1599 • [EROS](#) – Extremely Reliable Operating System
- 1600 • [HelenOS](#) – based on a preemptible microkernel design
- 1601 • LSE/OS
- 1602 • [MenuetOS](#) – extremely compact OS with [GUI](#), written entirely in [FASM](#) assembly language
- 1603 • [KolibriOS](#) – a fork of MenuetOS
- 1604 • MMURTL^[42] (Message based MUltitasking Real-Time kernel, pronounced 'Myrtle')^[43]
- 1605 • [SerenityOS](#)
- 1606 • [SerpaeOS](#)
- 1607 • [TempleOS](#) – biblical-themed OS, written in HolyC by Terry Davis
- 1608 • [ToaruOS](#)
- 1609 • [PonyOS](#)

Embedded

Mobile operating systems

Main article: [Mobile operating system](#)

- 1614 • [DIP DOS](#) on [Atari Portfolio](#)
- 1615 • [Embedded Linux](#) (see also [Linux for mobile devices](#))
- 1616 • [Android](#)
- 1617 • [CalyxOS](#)
- 1618 • [ColorOS](#)
- 1619 • [DivestOS](#)
- 1620 • [EMUI](#)
- 1621 • [Flyme OS](#)
- 1622 • [GrapheneOS](#)
- 1623 • [Kali NetHunter](#)
- 1624 • [LineageOS](#)
- 1625 • [MIUI](#)
- 1626 • [One UI](#)
- 1627 • [Replicant](#)
- 1628 • See also [List of custom Android distributions](#)
- 1629 • [Firefox OS](#)
- 1630 • [KaiOS](#)
- 1631 • [Ångström distribution](#)
- 1632 • [Familiar Linux](#)
- 1633 • [Mæmo](#) based on [Debian](#) deployed on [Nokia's Nokia 770](#), [N800](#) and [N810](#) Internet Tablets.
- 1634 • [OpenZaurus](#)
- 1635

- 1636 • [webOS](#) from [Palm, Inc.](#), later [Hewlett-Packard](#) via acquisition, and most recently at [LG](#)
- 1637 • [Electronics](#) through acquisition from Hewlett-Packard^[44]
- 1638 • [Access Linux Platform](#)
- 1639 • [bada](#)
- 1640 • [Openmoko Linux](#)
- 1641 • [OPhone](#)
- 1642 • [MeeGo](#) (from merger of [Maemo](#) & [Moblin](#))
- 1643 • [Moblin](#)
- 1644 • [MotoMagx](#)
- 1645 • [Qt Extended](#)
- 1646 • [Sailfish OS](#)
- 1647 • [Tizen](#) (earlier called [LiMo Platform](#))
- 1648 • [Ubuntu Touch](#)
- 1649 • [postmarketOS](#)
- 1650 • [Inferno](#) (distributed OS originally from [Bell Labs](#))
- 1651 • [Magic Cap](#)
- 1652 • [MS-DOS](#) on [Poqet PC](#), [HP 95LX](#), [HP 100LX](#), [HP 200LX](#), [HP 1000CX](#), [HP OmniGo 700LX](#)
- 1653 • [NetBSD](#)
- 1654 • [Newton OS](#) on [Apple MessagePad](#)
- 1655 • [Palm OS](#) from Palm, Inc; now spun off as PalmSource
- 1656 • [PEN/GEOS](#) on [HP OmniGo 100](#) and [120](#)
- 1657 • [PenPoint OS](#)
- 1658 • [Plan 9](#) from Bell Labs
- 1659 • [PVOS](#)
- 1660 • [Symbian OS](#)
- 1661 • [EPOC](#)
- 1662 • [Windows CE](#), from Microsoft
- 1663 • [Pocket PC](#) from Microsoft, a variant of Windows CE
- 1664 • [Windows Mobile](#) from Microsoft, a variant of Windows CE
- 1665 • [Windows Phone](#) from Microsoft
- 1666 • [DSPnano RTOS](#)
- 1667 • [iOS](#)
- 1668 • [watchOS](#)
- 1669 • [tvOS](#)
- 1670 • [iPod software](#)
- 1671 • [iPodLinux](#)
- 1672 • [iriver clix](#) OS
- 1673 • [RockBox](#)
- 1674 • [BlackBerry OS](#)
- 1675 • [PEN/GEOS](#), [GEOS-SC](#), [GEOS-SE](#)
- 1676 • [Symbian platform](#) (successor to [Symbian OS](#))
- 1677 • [BlackBerry 10](#)
- 1678 • [HarmonyOS](#)
- 1679 **Routers**
- 1680 • [CatOS](#) – by [Cisco Systems](#)
- 1681 • [Cisco IOS](#) – originally Internetwork Operating System by [Cisco Systems](#)
- 1682 • [DNOS](#) – by [DriveNets](#)
- 1683 • [Inferno](#) – distributed OS originally from [Bell Labs](#)
- 1684 • [IOS-XR](#) – by [Cisco Systems](#)
- 1685 • [JunOS](#) – by [Juniper Networks](#)
- 1686 • [LCOS](#) – by [LANCOM Systems](#)^[45]

- 1687 • [Linux](#)
- 1688 • [OpenWrt](#)
- 1689 • [DD-WRT](#)
- 1690 • [LEDE](#)
- 1691 • [Gargoyle](#)
- 1692 • [LibreCMC](#)
- 1693 • [Zeroshell](#)
- 1694 • [FTOS](#) – by [Force10 Networks](#)
- 1695 • [FreeBSD](#)
- 1696 • [Huawei VRP](#) (Versatile Routing Platform) that many Huawei devices operate on^[46]
- 1697 • [LiteOS](#)
- 1698 • [HarmonyOS](#)
- 1699 • [OpenHarmony](#)
- 1700 • [EulerOS](#)
- 1701 • [openEuler](#)
- 1702 • [m0n0wall](#)
- 1703 • [OPNsense](#)
- 1704 • [pfsense](#)
- 1705 • [List of wireless router firmware projects](#)
- 1706 **Other embedded**
- 1707 • [Apache Mynewt](#)
- 1708 • [ChibiOS/RT](#)
- 1709 • [Contiki](#)
- 1710 • [ERIKA Enterprise](#)
- 1711 • [eCos](#)
- 1712 • [NetBSD](#)
- 1713 • [Nucleus RTOS](#)^[47]
- 1714 • [NuttX](#)
- 1715 • [Minix](#)
- 1716 • [NCOS](#)
- 1717 • [freeRTOS, openRTOS, safeRTOS](#)
- 1718 • [Fuchsia](#)
- 1719 • [OpenEmbedded](#) (or [Yocto Project](#))
- 1720 • [OpenHarmony](#)
- 1721 • [pSOS](#) (Portable Software On Silicon)
- 1722 • [PX5 RTOS](#)
- 1723 • [QNX](#) – Unix-like real-time operating system, aimed primarily at the embedded systems market.
- 1724 ^[48]
- 1725 • [REX OS](#) – microkernel; usually an embedded cell phone OS
- 1726 • [RIOT](#)
- 1727 • [ROM-DOS](#)
- 1728 • [TinyOS](#)
- 1729 • [ThreadX](#)
- 1730 • [Tock](#)
- 1731 • [RT-Thread](#)
- 1732 • [DSPnano RTOS](#)
- 1733 • [Windows IoT](#) – formerly [Windows Embedded](#)
- 1734 • [Windows CE](#)
- 1735 • [Windows IoT Core](#)
- 1736 • [Windows IoT Enterprise](#)
- 1737 • Wind River [VxWorks RTOS](#).^[22]

- 1738 • [Wombat](#) – microkernel; usually real-time embedded
- 1739 • [Zephyr](#)
- 1740 • [LiteOS](#)
- 1741 **LEGO Mindstorms**
- 1742 • [brickOS](#)
- 1743 • [leJOS](#)
- 1744

DRAFT