## CPE with Time

CPE is an enumeration of platforms, and originally each entry has a version associated with it, so that different versions of the same platform will be treated as individual platforms. In order to comprehensively understand the evolution of vulnerability associated with platforms, we did the analysis with the original entries, and also with entries where versions are merged. If one CVE affects several versions of the same platform, the frequency will be counted as “1”.

First, the overall most frequent platforms are presented in the following tables. Google Chrome dominates the table of version specific analysis, but ranked 17 in version-merged analysis. It shows that vulnerabilities affecting Google Chrome is consistent throughout each version. The same vulnerabilities are mostly inherited by the next version, and few new vulnerabilities appear. It could also be caused by the fact that Google Chrome provides more frequent version updates. In such a case, version-merged analysis would provide better insights.

Table 1 Top 20 Platforms (ranked by frequency) over all time. Left: version merged, Right: version specific

|  |  |
| --- | --- |
| **ID** | **frequency** |
| mozilla:firefox | 21315 |
| mozilla:thunderbird | 15959 |
| mozilla:seamonkey | 15875 |
| sun:jre | 7842 |
| sun:jdk | 7333 |
| adobe:flash\_player | 5637 |
| adobe:acrobat | 4894 |
| adobe:acrobat\_reader | 4627 |
| oracle:jdk | 3337 |
| oracle:jre | 3267 |
| apple:mac\_os\_x | 3199 |
| adobe:adobe\_air | 2817 |
| apple:iphone\_os | 2699 |
| linux:linux\_kernel | 2321 |
| microsoft:windows\_server\_2008 | 2290 |
| apple:mac\_os\_x\_server | 2245 |
| google:chrome | 2000 |
| sun:sdk | 1935 |
| cisco:ios | 1761 |
| microsoft:windows\_xp | 1761 |

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| --- | --- |
| **ID** | **frequency** |
| google:chrome:1.0.154.53 | 513 |
| google:chrome:1.0.154.59 | 510 |
| mozilla:firefox:1.0 | 509 |
| google:chrome:2.0.172.30 | 506 |
| google:chrome:2.0.172.33 | 506 |
| google:chrome:2.0.172.37 | 505 |
| google:chrome:2.0.172.28 | 503 |
| google:chrome:2.0.172.27 | 502 |
| google:chrome:2.0.172.2 | 502 |
| google:chrome:2.0.170.0 | 502 |
| google:chrome:2.0.169.1 | 502 |
| google:chrome:2.0.169.0 | 502 |
| google:chrome:2.0.172.38 | 502 |
| google:chrome:2.0.172.8 | 502 |
| google:chrome:3.0.182.2 | 502 |
| google:chrome:1.0.154.65 | 502 |
| google:chrome:3.0.195.33 | 495 |
| google:chrome:3.0.190.2 | 494 |
| google:chrome:1.0.154.43 | 488 |
| google:chrome:1.0.154.36 | 488 |

Table 2 shows the frequencies of CPE over different time intervals. It can be seen that CPE entries change over time. SunOS was the number one frequent CPE from 1988 to 1995, but it was not in top 10 in the following years. Mozilla on the other hand became the main source of CVE after 2002. From another point of view, platforms recorded in CVE were mostly operating systems before 2003, and afterwards application-related platforms, such as jdk, firefox, acrobat, etc. started to rise.

Table 2 Top 10 Platform (ranked by frequency) of Each Time Interval. Above: merged version. Below: specific versions.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1988 - 1995 | | | 1996 - 2002 | | | 2003 - 2009 | | | 1998 - 2016 | | |
| Platform ID | Frequency | Percentage | Platform ID | Frequency | Percentage | Platform ID | Frequency | Percentage | Platform ID | Frequency | Percentage |
| sun:sunos | 36 | 17.31% | sun:solaris | 420 | 3.71% | mozilla:firefox | 2561 | 3.30% | mozilla:firefox | 18754 | 10.54% |
| sco:unix | 19 | 9.13% | microsoft:windows\_nt | 366 | 3.24% | mozilla:thunderbird | 1542 | 1.99% | mozilla:seamonkey | 14607 | 8.21% |
| sgi:irix | 17 | 8.17% | redhat:linux | 329 | 2.91% | sun:jre | 1535 | 1.98% | mozilla:thunderbird | 14417 | 8.10% |
| sun:solaris | 13 | 6.25% | microsoft:windows\_2000 | 300 | 2.65% | apple:mac\_os\_x | 1327 | 1.71% | sun:jre | 6290 | 3.54% |
| sco:open\_desktop | 11 | 5.29% | hp:hp-ux | 275 | 2.43% | linux:linux\_kernel | 1284 | 1.66% | sun:jdk | 6088 | 3.42% |
| ibm:aix | 11 | 5.29% | sgi:irix | 273 | 2.41% | mozilla:seamonkey | 1268 | 1.64% | adobe:flash\_player | 5487 | 3.08% |
| hp:hp-ux | 10 | 4.81% | freebsd:freebsd | 264 | 2.33% | sun:jdk | 1235 | 1.59% | adobe:acrobat | 4235 | 2.38% |
| next:next | 5 | 2.40% | ibm:aix | 205 | 1.81% | apple:mac\_os\_x\_server | 1187 | 1.53% | adobe:acrobat\_reader | 4024 | 2.26% |
| sco:open\_desktop\_lite | 5 | 2.40% | microsoft:ie | 177 | 1.57% | microsoft:windows\_xp | 1046 | 1.35% | oracle:jdk | 3337 | 1.88% |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1988 - 1995 | | | 1996 - 2002 | | | 2003 - 2009 | | | 1998 - 2016 | | |
| Platform ID | Frequency | Percentage | Platform ID | Frequency | Percentage | Platform ID | Frequency | Percentage | Platform ID | Frequency | Percentage |
| sun:sunos:4.1.1 | 15 | 4.26% | microsoft:windows\_nt:4.0 | 101 | 0.39% | linux:linux\_kernel:2.6.0 | 264 | 0.08% | google:chrome:3.0.182.2 | 495 | 0.03% |
| sun:sunos:4.1 | 12 | 3.41% | sun:solaris:2.5.1 | 96 | 0.37% | linux:linux\_kernel:2.6.1 | 244 | 0.07% | google:chrome:2.0.172.38 | 495 | 0.03% |
| sun:sunos:4.1.2 | 8 | 2.27% | sun:solaris:2.6 | 94 | 0.37% | linux:linux\_kernel:2.6.2 | 231 | 0.07% | google:chrome:2.0.172.37 | 495 | 0.03% |
| sun:sunos:4.0.3 | 8 | 2.27% | microsoft:windows\_2000 | 90 | 0.35% | linux:linux\_kernel:2.6.10 | 231 | 0.07% | google:chrome:2.0.172.33 | 495 | 0.03% |
| ibm:aix:3.2 | 7 | 1.99% | sun:solaris:7.0 | 88 | 0.34% | linux:linux\_kernel:2.6.11 | 222 | 0.07% | google:chrome:2.0.172.8 | 495 | 0.03% |
| sco:open\_desktop:2.0 | 6 | 1.70% | hp:hp-ux:11.00 | 77 | 0.30% | linux:linux\_kernel:2.6.11.6 | 213 | 0.06% | google:chrome:2.0.172.30 | 495 | 0.03% |
| sgi:irix:5.2 | 6 | 1.70% | microsoft:internet\_information\_server:4.0 | 77 | 0.30% | linux:linux\_kernel:2.6.11.5 | 212 | 0.06% | google:chrome:2.0.172.28 | 495 | 0.03% |
| sun:sunos:4.1.3 | 6 | 1.70% | hp:hp-ux:10.20 | 75 | 0.29% | linux:linux\_kernel:2.6.11.7 | 210 | 0.06% | google:chrome:2.0.172.27 | 495 | 0.03% |
| hp:hp-ux:9 | 6 | 1.70% | sun:solaris:2.5 | 75 | 0.29% | linux:linux\_kernel:2.6.11.8 | 209 | 0.06% | google:chrome:2.0.172.2 | 495 | 0.03% |

Table 3 Platforms Appeared in Every Time Interval. Above: merged version. Below: specific versions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **1988 - 1995** | **1996 - 2002** | **2003 - 2009** | **2010 - 2016** |
| bsd:bsd | 2 | 4 | 4 | 1 |
| cisco:ios | 3 | 96 | 728 | 934 |
| debian:debian\_linux | 2 | 138 | 451 | 197 |
| freebsd:freebsd | 1 | 264 | 430 | 105 |
| hp:hp-ux | 10 | 275 | 177 | 22 |
| ibm:aix | 11 | 205 | 167 | 50 |
| linux:linux\_kernel | 1 | 96 | 1284 | 940 |
| novell:netware | 1 | 20 | 31 | 37 |
| sendmail:sendmail | 3 | 17 | 86 | 2 |
| sgi:irix | 17 | 273 | 105 | 1 |
| slackware:slackware\_linux | 2 | 44 | 54 | 4 |
| sun:solaris | 13 | 420 | 547 | 4 |
| sun:sunos | 36 | 103 | 1 | 176 |

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| --- | --- | --- | --- | --- |
| **Frequency** | **1988 - 1995** | **1996 - 2002** | **2003 - 2009** | **2010 - 2016** |
| bsd:bsd:4.3 | 1 | 1 | 1 | 1 |
| cisco:ios:9.1 | 2 | 3 | 1 | 11 |
| freebsd:freebsd:3.0 | 1 | 25 | 6 | 4 |
| freebsd:freebsd:3.1 | 1 | 21 | 7 | 4 |
| freebsd:freebsd:3.2 | 1 | 24 | 7 | 4 |
| freebsd:freebsd:3.3 | 1 | 25 | 7 | 4 |
| freebsd:freebsd:3.4 | 1 | 20 | 7 | 4 |
| linux:linux\_kernel:2.6.20.1 | 1 | 22 | 121 | 226 |
| sun:solaris | 1 | 6 | 5 | 1 |

Table 3 shows the CPEs that have appear in all time intervals. Not surprisingly, it shows that CPEs are not consistent over time. Excluding the few entries that have low frequency overall, for instance bsd:bsd:4.3, the rest of the entries either increase over time or drop after a peak. Combining with the fact that weakness types are consistent over time, it is possible to conclude that although vulnerabilities tend to be fixed in platforms over time, some vulnerabilities constantly show up in newly rising platforms.