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C 言語の OSS Project における Macro 変数利用の調査

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表 1 利用したコンパイル option

| option | 出力内容 | 呼び方 |
|--------|------------------|------------------|
| なし | Clone 後の Project | Original Project |

表 2 Target projects

| id | projectName | summary | commitHash |
|----|-------------------|---|------------------------------|
| 1 | zstd | Compression library (v1.5.1) | 791626dfb92acf4a3d3ba034263 |
| 2 | radare2 | Reverse engineering framework (5.5.4) | 1703da75e247871e6fa22d33085 |
| 3 | nginx | HTTP and reverse proxy server (1.21.5) | 3a7d332aef234d394e5fa2722cc |
| 4 | mimikatz | Windows penetration test tool (2.2.0-20210810-2) | 7f02230226b04591f9685e74b6e |
| 5 | goaccess | Real-time web log analyzer (v1.5.4) | 72876319542c2575a05627ab6b9 |
| 6 | micropython | Programming language interpreter (v1.17) | 7c54b6428058a236b8a48c93c25 |
| 7 | bcc | BPF (Berkeley Package Filter) creation tool (v0.23.0) | 67f59ee80fcf5deedaacba1436d5 |
| 8 | Nuklear | Cross-platform GUI library (4.9.5) | 3e91905e82c3cad01435d4a8a6c |
| 9 | nnn | Terminal file manager (v4.4) | 65eddfef7b9f02f685145005a8ff |
| 10 | timescaledb | Time-series SQL database (2.5.1) | a2530ab5f251ba9680d2c27049c |
| 11 | hashcat | Password recovery utility (6.2.5) | fe1d3f95bb1d3235e8973bd95f9 |
| 12 | nginx-rtmp-module | nginx media streaming server module (v1.2.2) | 23e1873aa62acb58b7881eed2a5 |
| 13 | qmkFirmware | Keyboard firmware (0.15.13) | 7c186ebb974b4bbadbb74a7610f |
| 14 | tengine | Web server (extended from nginx) (2.3.3) | ae3ff4619d133ff15d6dad4b8fab |
| 15 | twemproxy | KVS proxy (0.5.0) | 894d78378c0720642184e5bbfcb |
| 16 | ish | iOS Linux shell (1.2.3) | f5dabd67f6bb46f93b4c591a9fb |
| 17 | skynet | Online game framework (v1.5.0) | 38e5b1ca1ca4c0ea37df17984f4 |
| 18 | robotjs | Desktop automation library (v0.6.0) | 99021d82cea1fe15f6a3cc1ae0c |
| 19 | brotili | Compression library (v1.0.9) | e61745a6b7add50d380cfd7d388 |
| 20 | tig | Text-mode git interface (2.5.5) | 72187884af29085691698868ff2 |
| 21 | kcp | Protocol implementation (1.7) | 38e0c9366e4a72c749ff0bcd9f1 |
| 22 | reactos | Operating system (0.4.14) | 9963bba88bdca8516369b9814a |
| 23 | openwrt | Operating system (v21.02.1) | b4d7885af70a42df7577157b96f |

表 3 Target project files

| projectName | cFiles | hFiles | allFiles | targetRate |
|-------------|--------|--------|----------|---------------------|
| radare2 | 1257 | 631 | 4445 | 0.4247469066366704 |
| ish | 108 | 108 | 461 | 0.4685466377440347 |
| goaccess | 35 | 35 | 119 | 0.5882352941176471 |
| brofli | 33 | 60 | 369 | 0.25203252032520324 |
| nnn | 2 | 8 | 113 | 0.08849557522123894 |
| nginx | 230 | 113 | 499 | 0.687374749498998 |

表 4 C file loc

| projectName | sum | fileNum | average |
|-------------|--------|---------|--------------------|
| radare2 | 730700 | 1257 | 581.304693715195 |
| ish | 24033 | 108 | 222.52777777777777 |
| goaccess | 31494 | 35 | 899.8285714285714 |
| brofli | 21035 | 33 | 637.4242424242424 |
| nnn | 8843 | 2 | 4421.5 |
| nginx | 190635 | 230 | 828.8478260869565 |

表 5 defined macro per file info

| project name | file num | variety of macro num | mean | median | variance | stdev |
|--------------|----------|----------------------|--------|--------|-----------|---------|
| radare2 | 957 | 20020 | 27.421 | 4.0 | 17174.409 | 131.051 |
| nginx | 178 | 1489 | 10.618 | 3.0 | 338.283 | 18.392 |
| goaccess | 19 | 389 | 21.79 | 4.0 | 3023.51 | 54.99 |
| nnn | 9 | 4193 | 467.2 | 10.0 | 1505941.7 | 1227.2 |
| ish | 116 | 1543 | 15.302 | 3.0 | 1444.717 | 38.009 |
| brofli | 69 | 330 | 7.35 | 2.0 | 259.41 | 16.11 |

表 6 available macro per file info

| project name | file num | variety of macro num | mean | median | variance | stdev |
|--------------|----------|----------------------|-----------|--------|--------------|-----------|
| radare2 | 1727 | 30105 | 3492.5298 | 4006.0 | 3884546.9063 | 1970.9254 |
| nginx | 339 | 26256 | 5545.041 | 5708.0 | 2369479.998 | 1539.312 |
| goaccess | 39 | 4181 | 1965.56 | 2004.0 | 688511.88 | 829.77 |
| nnn | 9 | 9324 | 1802.7 | 1310.0 | 2323377.5 | 1524.3 |
| ish | 167 | 9064 | 2077.832 | 1638.0 | 1498494.49 | 1224.13 |
| brofli | 88 | 2336 | 936.82 | 1018.0 | 120950.86 | 347.78 |

表 7 whole macro per file info

| project name | file num | variety of macro num | mean | median | variance | stdev |
|--------------|----------|----------------------|-----------|--------|--------------|-----------|
| radare2 | 1727 | 30411 | 3519.2693 | 4040.0 | 3945235.0868 | 1986.2616 |
| nginx | 339 | 26331 | 5590.44 | 5758.0 | 2400397.176 | 1549.322 |
| goaccess | 39 | 4207 | 1978.69 | 2028.0 | 701428.27 | 837.51 |
| nnn | 9 | 9348 | 1805.9 | 1312.0 | 2334693.1 | 1528.0 |
| ish | 167 | 9152 | 2083.994 | 1640.0 | 1509681.898 | 1228.691 |
| brofli | 88 | 2432 | 946.72 | 1022.0 | 125531.7 | 354.3 |

表 8 used macro per file info

| project name | file num | variety of macro num | mean | median | variance | stdev |
|--------------|----------|----------------------|--------|--------|----------|--------|
| radare2 | 1339 | 6183 | 12.344 | 7.0 | 624.342 | 24.987 |
| nginx | 271 | 1006 | 20.882 | 16.0 | 423.653 | 20.583 |
| goaccess | 30 | 304 | 15.5 | 7.0 | 314.4 | 17.73 |
| nnn | 3 | 270 | 92.7 | 11.0 | 21772.3 | 147.6 |
| ish | 121 | 828 | 14.23 | 7.0 | 354.83 | 18.84 |
| brofli | 62 | 129 | 5.08 | 2.0 | 48.5 | 6.96 |

表 9 frequncy of macro use file in each project

| project name | file num | target file num | rate |
|--------------|----------|-----------------|--------|
| radare2 | 1888 | 1339 | 0.7092 |
| nginx | 343 | 271 | 0.7901 |
| goaccess | 70 | 30 | 0.4286 |
| nnn | 10 | 3 | 0.3 |
| ish | 216 | 121 | 0.5602 |
| brofli | 93 | 62 | 0.6667 |

表 10 appearance of define directive in each project

| project name | file num | target file num | rate |
|--------------|----------|-----------------|--------|
| radare2 | 1888 | 957 | 0.5069 |
| nginx | 343 | 178 | 0.519 |
| goaccess | 70 | 19 | 0.2714 |
| nnn | 10 | 9 | 0.9 |
| ish | 216 | 116 | 0.537 |
| brofli | 93 | 69 | 0.7419 |