Loupe: ASPLOS'24 Supplementary Materials

In these supplementary materials we first present the full support plans obtained with Loupe on our entire data set of 116 applications, for 11 OSes under development focusing on compatibility with Linux applications. We also provide a description of each application measured with Loupe referenced in the "Apps supported" column.

1. Full Support Plans

We present below the full support plans obtained with Loupe for 11 open-source OSes: Unikraft[1], Google Fuchsia[2], Kerla[3], Google Zephyr[4], HermiTux[5], Google gVisor[6], Graphene[7], FreeBSD Linuxulator[8], Browsix[9], OSv[10], and Linux' nolibc[11].

Unikraft (commit 7d6707f, supports 174 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(70 apps)
1	15	131, 204, 334, 273, 217, 283, 286, 319, 230, 192, 332, 191, 58, 314, 315, 234, 263, 203	-	+ erlang, openjdkzulu9, openjdkzulu8, vertx, dacapo, rhino, akka, darktable, zookeeper, jetty, kafka, embulk-example, activemq, rust, aircrack-ng
2	131	267, 258	-	+ dropwizard-example, traefik, consul, blogbench
3	309	-	-	+ java-httpserver, wrk
4	258	219, 326	-	+ golang-httpserver
5	219	-	-	+ golang-netiterate, golang-pie-example
6	58	67, 29, 149, 221, 31	30	+ golang-example, gimp
7	283	299	-	+ minecraft-server
8	27	-	-	+ mongodb
9	149, 334	-	-	+ gegl
10	273	-	-	+ gnupg
11	204	-	-	+ linpack, jython
12	221	-	-	+ libreoffice
13	26	-	151	+ cassandra
14	263	-	-	+ ocrmypdf
15	286, 319	-	-	+ elixir
16	67, 29, 30	237	-	+ gnuradio

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1 https://github.com/unikraft
2 https://github.com/vsrinivas/fuchsia
3 https://github.com/nuta/kerla
4 https://github.com/zephyrproject-rtos/zephyr
5 https://github.com/ssrg-vt/hermitux
6 https://github.com/google/gvisor
7 https://github.com/gramineproject/graphene
8 https://github.com/freebsd/freebsd-src
9 https://github.com/plasma-umass/browsix
10 https://github.com/cloudius-systems/osv
11 https://github.com/torvalds/linux/tree/master/tools/include/nolibc

Unikraft (commit 7d6707f, supports 174 system calls)				
Step	Implement	Stub	Fake	Apps supported
17	64, 66, 220	-	-	+ dbench
18	208, 209, 206	207	-	+ aio-stress
19	289, 277, 237	-	-	+ fio
20	203, 239	-	-	+ mysql
21	267, 259, 238	-	-	+ amg

Fuchsia (commit 5d20758, supports 152 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(78 apps)
1	128	273, 334	302	+ pbzip2
2	280	99, 326, 24, 58, 219, 285	-	+ golang-httpserver
3	302	230, 33, 74, 222, 223, 144, 146, 147, 143, 75, 40, 105, 92	-	+ rhino, derby, vertx, dropwizard-example, haproxy, mono, zookeeper, nginx
4	219	-	-	+ activemq, minecraft-server
5	100	-	-	+ golang-pie-example, golang-example, dhrystone
6	33	-	-	+ lighttpd
7	230	-	-	+ java-httpserver
8	270	-	-	+ erlang
9	58	67, 140, 141, 29, 149, 221, 31	332, 30	+ elixir, gimp
10	37	-	-	+ openssl
11	74	-	-	+ kafka
12	85	162	-	+ iozone
13	162	-	-	+ blogbench
14	24	237	-	+ octave
15	99, 27	-	-	+ mongodb
16	88, 86	-	-	+ ocrmypdf
17	221, 334	-	151	+ cassandra
18	149	-	-	+ gegl
19	273	-	-	+ linpack
20	75	-	-	+ jython, gnupg, libreoffice
21	285, 238	-	-	+ amg
22	67, 29, 30	-	-	+ gnuradio
23	64, 66, 220	-	-	+ dbench
24	208, 209, 206	207	-	+ aio-stress
25	289, 277, 237	-	-	+ fio
26	105, 140, 141, 239	-	-	+ mysql

Kerla (commit 73a1873, supports 58 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(7 apps)
1	257, 262, 17	131, 10, 11, 204, 302, 334, 273, 21, 8, 99, 100, 87, 192, 102, 137, 332, 56, 191, 148, 157, 288, 289, 290, 40, 232, 105, 106, 107, 233, 18, 116, 53, 54, 213, 104, 108, 95, 98, 138, 82, 280, 221, 314, 315, 28, 285	-	+ rust-pie-example, netperf, npb-ft, npb-bt, uperf, python3, npb-sp, blackscholes, npb-ep, imagemagick, postmark, npb-is, whetstone, lua, busybox, ffmpeg, stream, groonga, kong, perlhello, rpm, npb-ua, gmic, aobench, lzma, npb-cg, mruby, npb-lu, iperf3

	Kerla (commit `73a1873`, supports 58 system calls)			
Step	**Implement**	**Stub**	**Fake**	**Apps supported**
2	10	229, 230, 77, 81, 24, 281, 234, 35	120, 118, 291, 293, 25	+ python2, inkscape, openjdkzulu9, golang-pie-httpserver, iperf, zstd, rsvg, rawtherapee, webassembly
3	302	143, 144, 145, 146, 147	-	+ mono
4	307	-	47	+ wrk
5	8	-	-	+ tesseract-ocr, npb-dc, derby
6	21	25, 75, 269	-	+ openjdkzulu8, darktable
7	-	112, 203	-	+ aircrack-ng
8	-	32, 58, 293	-	+ gccgo
9	128	-	-	+ pbzip2
10	87	-	-	+ sqlite
11	24	237	-	+ octave
12	293	263	-	+ rust
13	202	-	-	+ dropwizard-example
14	32	115, 84	-	+ dacapo, rhino, jetty, embulk-example
15	56	-	-	+ weborf
16	54	291, 292	-	+ httpd
17	213	-	-	+ twmemproxy
18	46	-	-	+ vertx, cryptsetup
19	230	-	-	+ java-httpserver
20	162	-	-	+ blogbench
21	290	-	-	+ node-express
22	291	-	-	+ rust-httpserver
23	233	-	-	+ nodejs
24	232	222, 78, 223	-	+ akka, zookeeper, keydb, haproxy
25	53	91, 93	330	+ redis, deno
26	11	-	-	+ lighttpd
27	288	-	-	+ h2o
28	131	97, 267, 258	-	+ traefik, caddy
29	281	-	-	+ golang-httpclient
30	18	92	-	+ nginx
31	97	73, 47	-	+ consul
32	100	-	-	+ dhrystone
33	37	-	-	+ openssl
34	85	-	-	+ iozone
35	77, 47	27, 19	-	+ envoy
36	19, 270	283, 319, 286, 271	-	+ erlang
37	25, 58	67, 140, 141, 219, 29, 31	30	+ gimp
38	81, 82	-	-	+ activemq
39	283, 219	290	-	+ minecraft-server
40	273, 334	-	-	+ linpack
41	258, 292	247	-	+ golang-netiterate
42	280	326	-	+ golang-pie-example
43	247	-	-	+ golang-example
44	28	-	-	+ golang-httpserver
35	229, 26, 221	-	151	+ cassandra
46	157, 102	-	-	+ kafka
47	98, 149	-	-	+ gnupg
48	67, 29, 30	-	-	+ gnuradio
49	137, 138, 99	-	-	+ gegl
50	73, 27	-	-	+ mongodb
51	208, 209, 206	207	-	+ aio-stress
52	88, 204, 263	-	-	+ ocrmypdf
53	104, 107, 108	-	-	+ jython

	Kerla (commit `73a1873`, supports 58 system calls)			
Step	**Implement**	**Stub**	**Fake**	**Apps supported**
54	64, 66, 220, 84	-	-	+ webfsd, dbench
55	75, 93, 269	-	-	+ libreoffice
56	289, 277, 237	-	-	+ fio
57	112, 319, 286, 271	-	-	+ elixir
58	259, 267, 203, 238, 285	-	-	+ amg
59	105, 106, 140, 141, 239, 116, 95	-	-	+ mysql

	Zephyr (commit `9d159ba`, supports 55 system calls)			
Step	**Implement**	**Stub**	**Fake**	**Apps supported**
0	-	-	-	(6 apps)
1	59, 158	257, 262, 202, 10, 12, 13, 334, 17, 273, 21, 218, 231, 107, 108, 302, 318	-	+ perl
2	257, 262, 17	131, 204, 217, 39, 99, 100, 14, 137, 149, 157, 63, 89, 186, 95, 98	-	+ rust-pie-example, npb-mg, netperf, npb-ft, npb-bt, uperf, python3, npb-sp, blackscholes, npb-ep, imagemagick, postmark, npb-is, whetstone, lua, npb-dc, ffmpeg, stream, groonga, perlhello, rpm, npb-ua, gmic, aobench, lzma, npb-cg, mruby, npb-lu, iperf3
3	10	28, 138, 332, 221	25	+ python2, iperf, cryptsetup, zstd, rsvg, webassembly
4	213	232, 233	-	+ twmemproxy
5	231	288, 281, 234, 15	291, 293	+ tesseract-ocr, golang-pie-httpserver
6	89	290, 110, 86, 280, 314, 315, 285, 128, 237	120, 118	+ inkscape, octave
7	128	-	-	+ pbzip2
8	5	-	-	+ rawtherapee
9	56	-	-	+ weborf
10	100	-	-	+ dhrystone
11	85	-	-	+ iozone
12	217, 21	25, 18, 75, 269, 112, 203	-	+ darktable, aircrack-ng
13	12	6	-	+ sqlite
14	318	291, 292, 80, 20, 22, 90, 61	47	+ httpd
15	307	230	-	+ wrk
16	63	33, 289, 40, 105, 106, 116	-	+ kong
17	13, 15	81, 229	-	+ openjdkzulu9
18	302	293	-	+ openjdk8zulu, derby, vertx
19	218	144, 145, 143	-	+ mono
20	61	192, 191	-	+ busybox
21	202	58	-	+ dacapo, rhino
22	32	115, 84	-	+ jetty, embulk-example
23	293	-	-	+ dropwizard-example
24	37	-	-	+ openssl

Zephyr (commit `9d159ba`, supports 55 system calls)

	Implement	Stub	Fake	Apps supported
25	90	263	-	+ rust
26	230	-	-	+ gccgo, java-httpserver
27	80	-	-	+ blogbench
28	290	-	-	+ node-express
29	291	-	-	+ rust-httpserver
30	233	91, 93	330	+ deno
31	232	-	-	+ nodejs, akka, zookeeper
32	47	27, 19	-	+ envoy
33	22	78	-	+ haproxy
34	186	-	-	+ redis, keydb
35	288, 131	97, 267, 258	-	+ traefik, caddy
36	281	-	-	+ golang-httpclient
37	20	-	-	+ h2o
38	18	92	-	+ nginx
39	97	73	-	+ consul
40	33, 14	-	-	+ lighttpd
41	19, 270	271, 62, 283, 286, 319	-	+ erlang
42	25, 58	67, 140, 141, 121, 219, 29, 31	30	+ gimp
43	81, 39	-	-	+ activemq
44	283, 219	299	-	+ minecraft-server
45	273, 334	-	-	+ linpack
46	258, 292	247	-	+ golang-netiterate
47	280	326	-	+ golang-pie-example
48	247	-	-	+ golang-example
49	28	-	-	+ golang-httpserver
50	107, 108	-	-	+ webfsd
51	229, 26, 221	-	151	+ cassandra
52	157, 62	-	-	+ kafka
53	98, 149, 86	-	-	+ gnupg
54	99, 204, 110	-	-	+ jython
55	137, 138	-	-	+ gegl
56	88, 263	-	-	+ ocrmypdf
57	73, 27	-	-	+ mongodb
58	67, 29, 30	-	-	+ gnuradio
59	208, 209, 206	207	-	+ aio-stress
60	64, 66, 220, 84	-	-	+ dbench
61	75, 93, 269	-	-	+ libreoffice
62	289, 277, 237	-	-	+ fio
63	112, 319, 286, 271	-	-	+ elixir
64	259, 267, 203, 238, 285	-	109	+ amg
65	105, 106, 140, 141, 239, 116, 95	-	-	+ mysql

HermiTux (commit `cde4e84`, supports 92 system calls)

Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(6 apps)

HermiTux (commit `cde4e84`, supports 92 system calls)

Step	Implement	Stub	Fake	Apps supported
1	59	290, 100, 137, 138, 314, 14, 334, 82, 86, 280, 221, 285, 315, 157, 318, 98, 269, 143, 144, 145, 146, 147, 288, 233, 281, 15, 55, 332, 149, 128, 237, 77, 116	120, 118, 77, 291, 293	+ inkscape, rust-pie-example, darktable, npb-mg, netperf, npb-ft, npb-bt, uperf, python3, npb-sp, mono, tesseract-ocr, golang-pie-httpserver, iperf, blackscholes, npb-ep, imagemagick, postmark, npb-is, perl, zstd, whetstone, rsvg, lua, npb-dc, rawtherapee, ffmpeg, stream, groonga, sqlite, perlhello, octave, rpm, aircrack-ng, npb-ua, gmic, aobench, lzma, weborf, npb-cg, mruby, webassembly, npb-lu, iperf3, iozone, python3, webfsd
2	213	232	-	+ twmemproxy
3	230	-	-	+ blogbench
4	15	81, 90, 53, 293, 291	47	+ openjdkzulu9, derby, openjdk8zulu, vertx, dacapo, java-httpserver
5	32	115	-	+ jetty, embulk-example
6	318	292, 61, 289, 106, 105	-	+ httpd, kong
7	307	-	-	+ wrk
8	46	-	-	+ cryptsetup
9	128	-	-	+ pbzip2
10	288	258, 267	-	+ caddy
11	293	-	58	+ traefik, dropwizard-example
12	58	67, 270, 121, 219, 29, 31	30	+ gimp
13	61	192, 191	-	+ busybox
14	90	263	-	+ rhino, rust
15	290	-	-	+ gccgo, node-express
16	291	-	-	+ rust-httpsserver
17	233	-	-	+ nodejs
18	232	222, 223	-	+ akka, zookeeper, keydb, haproxy, h2o
19	53	91, 93, 92	330	+ redis, deno, nginx
20	281	73, 47	-	+ golang-httpclient, consul
21	334	-	-	+ linpack
22	100	-	-	+ dhrystone
23	37	-	-	+ openssl
24	270, 47	283, 319, 286, 271	-	+ erlang
25	77	-	-	+ envoy
26	82, 157	-	-	+ kafka
27	81	-	-	+ activemq
28	98	-	-	+ jython
29	26, 221	-	151	+ cassandra
30	14, 55	-	-	+ lighttpd

HermiTux (commit cde4e84, supports 92 system calls)				
Step	Implement	Stub	Fake	Apps supported
31	149, 86	-	-	+ gnupg
32	137, 138	-	-	+ gegl
33	93, 269	-	-	+ libreoffice
34	283, 219	299	-	+ minecraft-server
35	73	-	-	+ mongodb
36	88, 263	-	-	+ ocrmypdf
37	258, 292	247	-	+ golang-netiterate
38	280	326	-	+ golang-pie-example
39	247	-	-	+ golang-httpserver
40	319, 286, 271	-	-	+ golang-example, elixir
41	67, 29, 30	-	-	+ gnuradio
42	64, 66, 220	-	-	+ dbench
43	208, 209, 206	207	-	+ aio-stress
44	289, 277, 237	-	-	+ fio
45	267, 259, 285, 238	-	109	+ amg
46	105, 106, 116, 239	-	-	+ mysql

gVisor (commit 6961f3e, supports 259 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(All 116 apps)

Graphene (commit fb71e43, supports 161 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(94 apps)
1	280	98, 99, 326, 73, 219, 285, 334	-	+ golang-httpserver
2	100	-	-	+ dhrystone
3	334	-	-	+ openssl, linpack
4	221	157	151	+ cassandra
5	25	29, 67, 149, 31	332, 30	+ gimp
6	219	-	-	+ golang-pie-example
7	283	286	-	+ golang-example, minecraft-server
8	157	-	-	+ kafka
9	162	-	-	+ blogbench
10	73, 99	-	-	+ mongodb
11	149	-	-	+ gegl
12	98	-	-	+ libreoffice, jython
13	96	-	-	+ gnupg
14	88	-	-	+ ocrmypdf
15	285, 238	-	-	+ amg
16	286, 319	-	-	+ elixir
17	67, 29, 30	-	-	+ gnuradio
18	64, 66, 220	-	-	+ dbench
19	208, 209, 206	207	-	+ aio-stress
20	239	-	-	+ mysql
21	289, 277	-	-	+ fio

FreeBSD Linuxulator (commit 07de869, supports 295 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(114 apps)
1	238	-	-	+ amg
2	289, 237	-	-	+ fio
3	239	-	-	+ mysql

Browsix (commit 04f0830, supports 26 system calls)				
Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(6 apps)

Browsix (commit 04f0830, supports 26 system calls)				
Step	Implement	Stub	Fake	Apps supported
1	9, 59, 158	262, 8, 72, 10, 11, 12, 13, 202, 334, 17, 273, 21, 218, 102, 104, 107, 108, 302, 318	-	+ perl
2	17, 262	157, 131, 204, 7, 87, 99, 100, 14, 89, 95, 137, 186, 83, 149, 63, 98, 228	-	+ rpm, rust-pie-example, whetstone, mruby, npb-bt, postmark, npb-ep, npb-sp, npb-lu, npb-ft, imagemagick, stream, lua, perlhello, npb-mg, lzma, npb-ua, uperf, aobench, netperf, npb-cg, gmic, groonga, iperf3,
3	10	35, 233, 234, 15, 24, 281, 28, 138, 60, 221, 332, 55	291, 25	+ python3, npb-is, ffmpeg, python2, blackscholes, golang-pie-httpserver, webassembly, rsvg, iperf,
4	128	-	-	+ rawtherapee, pbzip2
5	8	-	-	+ tesseract-ocr
6	72	-	-	+ npb-dc, zstd
7	100	-	-	+ dhrystone
8	21	112, 203, 269	-	+ aircrack-ng
9	90	32, 58	-	+ gccgo
10	290	48, 20	232	+ node-express
11	291	232, 45	-	+ rust-httpserver
12	89	82, 86, 280, 314, 315, 285	120, 118	+ inkscape
13	15	192, 56, 191	-	+ busybox
14	131	258	-	+ caddy
15	56	97	44	+ traefik
16	85	162, 77, 74	-	+ iozone
17	43, 7	44	-	+ weborf
18	213, 87	-	-	+ twmemproxy
19	12	-	-	+ sqlite
20	318	292, 22, 23	47	+ httpd
21	63	33, 289, 40, 105, 106, 18, 116, 53	-	+ kong
22	60, 13	81, 229, 230	-	+ openjdkzulu9
23	83	25, 75, 2, 263	120	+ openjdk8zulu, darktable, rust
24	202	-	-	+ dacapo
25	302	-	-	+ rhino
26	230	-	-	+ vertx, dropwizard-example, java-httpserver
27	218	143, 144, 145, 146, 147	-	+ mono
28	46	-	-	+ cryptsetup
29	32	-	-	+ jetty
30	-	115, 84	-	+ embulk-example
31	37	-	-	+ openssl
32	162	-	-	+ blogbench
33	24	237	-	+ octave
34	233	-	-	+ nodejs
35	232	-	-	+ akka, zookeeper
36	22	-	-	+ redis
37	186	-	-	+ keydb
38	20	-	-	+ h2o
39	53	91, 93	330	+ deno
40	44	222, 78, 223	-	+ haproxy
41	45	-	-	+ derby
42	307	-	-	+ wrk
43	281	-	-	+ golang-httpclient
44	283, 219	299, 286	-	+ minecraft-server

Browsix (commit `04f0830`, supports 26 system calls)

Step	Implement	Stub	Fake	Apps supported
45	77, 47	27, 19	-	+ envoy
46	25, 58	67, 140, 141, 270, 121, 29, 31	30	+ gimp
47	97, 18	73	-	+ consul
48	11	92	-	+ nginx
49	81, 82	-	-	+ activemq
50	67, 29, 30	-	-	+ gnuradio
51	258, 292, 14	247	-	+ golang-netiterate
52	280	326	-	+ golang-pie-example
53	247	-	-	+ golan-example
54	28	-	-	+ golang-httpserver
55	33, 55	-	-	+ lighttpd
56	19, 270	319, 271	-	+ erlang
57	208, 209, 206	207	-	+ aio-stress
58	273, 228, 334	-	-	+ linpack
59	229, 26, 221	-	151	+ cassandra
60	99, 73, 27	-	-	+ mongodb
61	74, 157, 102	-	-	+ kafka
62	104, 107, 108	-	-	+ webfsd
63	98, 204	-	-	+ jython
64	149, 86	-	-	+ gnupg
65	88, 263	-	-	+ ocrmypdf
66	137, 138	-	-	+ gegl
67	289, 277, 269, 237	-	-	+ fio
68	75, 84, 93	-	-	+ libreoffice
69	64, 66, 220	-	-	+ dbench
70	259, 285, 203, 238	-	109	+ amg
71	112, 319, 286, 271	-	-	+ elixir
72	105, 106, 140, 141, 239, 48, 116, 95	-	-	+ mysql

OSv (commit 6fd4a65, supports 180 system calls)

Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(107 apps)
1	86	-	-	+ gnupg
2	128	-	137	+ pbzip2, mongodb
3	88	137	-	+ ocrmypdf
4	85	-	-	+ iozone
5	259	-	-	+ amg
6	137, 138	-	332	+ libreoffice, gegl
7	64, 66, 220	-	-	+ dbench

Linux nolibc (commit `7efd762`, supports 44 system calls)

Step	Implement	Stub	Fake	Apps supported
0	-	-	-	(6 apps)
1	158	257, 262, 72, 202, 10, 13, 334, 17, 273, 21, 218, 102, 231, 104, 107, 108, 302, 318, 99, 100, 14, 137, 149, 157, 41, 42, 63, 89, 98, 228, 49, 50, 54	-	+ perl, npb-mg, netperf, npb-ft, npb-bt, uperf, python3, npb-sp, blackscholes, npb-ep, imagemagick, postmark, npb-is, whetstone, lua, npb-dc, ffmpeg, stream, groonga, perlhello, rpm, npb-ua, gmic, aobench, lzma, npb-cg, mruby, npb-lu, iperf3
2	10	138, 28, 332, 221, 24	25	+ python2, rsvg, webassembly
3	231	288, 35, 233, 234, 15, 51, 281	291, 293	+ tesseract-ocr, golang-pie-httpserver
4	89	290, 79, 82, 52, 280, 314, 315, 285	120, 118	inkscape

Linux nolibc (commit `7efd762`, supports 44 system calls)

Step	Implement	Stub	Fake	Apps supported
5	21	25, 18, 75, 269, 203, 58, 293	-	+ darktable, aircrack-ng, gccgo
6	41	55	-	+ iperf
7	128	-	-	+ pbzip2
8	72	-	-	+ zstd
9	5	6	-	+ rawtherapee, sqlite
10	15	192, 56, 191	-	+ busybox
11	13	81, 77, 229, 230	-	+ openjdkzulu9
12	24	237	-	+ openjdk8zulu, octave
13	293	263	-	+ rust
14	202	-	-	+ dacapo
15	63	115, 84, 53	-	+ embulk-example
16	302	-	-	+ rhino
17	218	143, 144, 145, 146, 147	-	+ mono
18	100	-	-	+ dhrystone
19	85	162	-	+ iozone
20	162, 230	-	-	+ blogbench
21	49, 50	232, 43, 48, 20, 213, 291	-	+ jetty, dropwizard-example, java-httpserver
22	318	289, 40, 105, 106, 45, 116	-	+ kong
23	213	-	-	+ vertx
24	54	44	-	+ twmemproxy
25	56	22	47	+ httpd
26	37	-	-	+ openssl
27	43	-	-	+ weborf
28	46	-	-	+ cryptsetup
29	290	-	-	+ node-express
30	291	-	-	+ rust-httpserver
31	233	-	-	+ nodejs
32	232	-	-	+ akka
33	51	-	-	+ zookeeper
34	53	91, 93	330	+ deno
35	288, 131	97, 267, 258	-	+ traefik, caddy
36	20	-	-	+ h2o
37	14, 55	-	-	+ lighttpd
38	44, 45	-	-	+ derby
39	22	222, 72, 223	-	+ haproxy
40	52	-	-	+ keydb
41	18	-	-	+ nginx, redis
42	42, 307	-	-	+ wrk
43	281	-	-	+ golang-httpclient
44	97	73, 47	-	+ consul
45	258	219, 247	-	+ golang-netiterate
46	77, 47	27, 19	-	+ envoy
47	19, 270	283, 319, 286, 271	-	+ erlang
48	280, 219	326	-	+ golang-pie-example
49	247	-	-	+ golang-example
50	28	-	-	+ golang-httpserver
51	283	299	-	+ minecraft-server
52	81, 82	-	-	+ activemq
53	204, 263	-	-	+ ocrmypdf
54	67, 29, 30	-	-	+ gnuradio
55	208, 209, 206	207	-	+ aio-stress
56	273, 228, 334	-	-	+ linpack
57	228, 26, 221	-	151	+ cassandra
58	98, 149, 102	-	-	+ gnupg
59	157, 79	-	-	+ kafka
60	319, 286, 271	-	-	+ elixir
61	137, 138, 99	-	-	+ gegl
62	73, 27	-	-	+ mongodb
63	104, 107, 108	-	-	+ jython
64	64, 66, 220, 84	-	-	+ webfsd, dbench
65	75, 93, 269	-	-	+ libreoffice
66	289, 277, 237	-	-	+ fio

Linux nolibc (commit `7efd762`, supports 44 system calls)				
Step	Implement	Stub	Fake	Apps supported
67	259, 267, 203, 238, 285	-	-	+ amg
68	105, 106, 140, 141, 239, 48, 116	-	-	+ mysql

2. Description of Applications & Workloads

We present below the list of applications and workloads that were measured by Loupe, along with a description of what was exactly measured and a link with more details regarding the application's execution.

App. name	Binary traced	Workload	Link
activemq	activemq	activemq-admin performing the list command.	https://github.com/cloudius-systems/osv-apps/tree/master/apache-activemq
aio-stress	aio-stress	Run with parameters -s 25m -r 64k -t 1	https://openbenchmarking.org/test/pts/aio-stress-1.1.3
aircrack-ng	aircrack-ng	Run with parameters -S -Z 5	https://openbenchmarking.org/test/pts/aircrack-ng
akka	The JVM	The JVM running akka while netcat connects to the port akka listens to	https://github.com/cloudius-systems/osv-apps/tree/master/akka-example
amg	mpirun	mpirun running the algebraic multigrid benchmark (amg) with parameters -n 96 96 96	https://openbenchmarking.org/test/pts/amg
aobench	aobench	The aobench lightweight ambient occlusion renderer running with default parameters	https://openbenchmarking.org/test/pts/aobench
blackscholes	PARSEC blackscholes	The PARSEC Blackscholes benchmark running with parameters 1 in_64K.txt output-file	https://parsec.cs.princeton.edu/
blogbench	blogbench	BlogBench benchmark running with default parameters	https://openbenchmarking.org/test/pts/blogbench
busybox	busybox ash	Busybox' ash shell running a few sample scripts	https://github.com/cloudius-systems/osv-apps/tree/master/busybox
caddy	caddy	Caddy server running while wrk accesses its listening port	https://github.com/caddyserver/caddy
cassandra	The JVM	The JVM running cassandra, while cassandra-test runs with parameters write n=1000 -rate threads=1	https://github.com/cloudius-systems/osv-apps/tree/master/cassandra
consul	consul server	Consul server running while a client issuing the consul member command	https://github.com/hashicorp/consul
cryptsetup	cryptsetup	Run with the benchmark command line parameter	https://openbenchmarking.org/test/system/cryptsetup

App. name	Binary traced	Workload	Link
dacapo	The JVM	The JVM running the dacapo benchmark	https://openbenchmarking.org/test/pts/dacapobench
darktable	darktable-cli	darktable-cli processes the openbechmarkin.org image input	https://openbenchmarking.org/test/system/darktable
dbench	dbench	Run with parameters -t 5 1	https://openbenchmarking.org/test/pts/dbench
deno	deno	The deno typescript/JS runtime running an example script from the osv-apps repo	https://github.com/cloudius-systems/osv-apps/tree/master/deno
derby	The JVM	The JVM running Apache's derby while while derby's ij command accesses the server	https://github.com/cloudius-systems/osv-apps/tree/master/apache-derby
dhrystone	dhrystone	Benchmark run with default parameters	https://github.com/Keith-S-Thompson/dhrystone/blob/master/v2.1/dhrystone.c
django	python3	Python3 running the Django test suite.	https://docs.djangoproject.com/en/dev/internals/contributing/writing-code/unit-tests/
dropwizard-example	dropwizard	The dropwizard server receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/dropwizard-example
elixir	elixir	Elixir outputs version information	https://github.com/cloudius-systems/osv-apps/tree/master/elixir
embulk-example	The JVM	The JVM running Embulk transferring data from CVS format to stdout1	https://github.com/cloudius-systems/osv-apps/tree/master/embulk-example
envoy	envoy	The Envoy proxy receiving requests from wrk	https://github.com/envoyproxy/envoy
erlang	erlang	Erlang runs a hello world script	https://github.com/cloudius-systems/osv-apps/tree/master/erlang
ffmpeg	ffmpeg	ffmpeg running on the sample data from openbenchmarking.org	https://openbenchmarking.org/test/pts/ffmpeg
fio	fio	fio running a series of sequential/random direct IO workloads in a file	https://github.com/axboe/fio
flask	python3	python3 running the flask test suite	https://github.com/pallets/flask
gccgo	gccgo	The gccgo compiler processes a hello world go source file	https://github.com/cloudius-systems/osv-apps/tree/master/gccgo-example
gegl	gegl	GEGL processing the openbenchmarking.org workload	https://openbenchmarking.org/test/system/gegl

App. name	Binary traced	Workload	Link
gimp	gimp	Gimp processing the openbenchmarking.org workload	https://openbenchmarking.org/test/system/gimp
gmic	gmic	G'MIC processing sample images from openbenchmarking.org	https://openbenchmarking.org/test/system/gmic
gnupg	gnupg	GnuPG encrypting sample data from openbenchmarking.org	https://openbenchmarking.org/test/pts/gnupg
gnuradio	gnuradio	GNU Radio processing sample data from openbenchmarking.org	https://openbenchmarking.org/test/system/gnuradio
golang-example	go	The Go runtime running a hello world program	https://github.com/cloudius-systems/osv-apps/tree/master/golang-example
golang-httpclient	A simple HTTP client written in Go	The client fetching the Google landing page	https://github.com/cloudius-systems/osv-apps/tree/master/golang-httpclient
golang-httpserver	A simple HTTP server written in Go	The server receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/golang-httpserver
golang-netiterate	A simple program written in Go enumerating network interfaces and IPs	Run with default parameters	https://github.com/cloudius-systems/osv-apps/tree/master/golang-net-iterate
golang-pie-example	A Go hello world program compiled as Position Independent Executable	Run with default parameters	https://github.com/cloudius-systems/osv-apps/tree/master/golang-pie-example
golang-pie-httpserver	An HTTP server written in GO and compiled as position independent executable	The server receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/golang-pie-httpserver
groonga	groonga	Groonga outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/groonga
h2o	H2o webserver	The H2O web server receiving requests from wrk	https://h2o.examp1e.net/
haproxy	haproxy	HAProxy receiving requests from wrk	https://www.haproxy.org/
httpd	apache2	Apache httpd server receiving requests from wrk	https://httpd.apache.org/
imagemagick	imagemagick	ImageMagick converting a sample image from jpg to png	https://imagemagick.org/index.php
inkscape	inkscape	Inkscape processing sample data from openbenchmarking.org	https://openbenchmarking.org/test/system/inkscape

App. name	Binary traced	Workload	Link
iozone	iozone	Iozone running the openbenchmarking.org configuration	https://openbenchmarking.org/test/system/iozone
iperf	iperf	Initialization process of iperf (in server mode)	https://github.com/cloudius-systems/osv-apps/tree/master/iperf
iperf3	iperf3	Initialization process of iperf3 (in server mode)	https://github.com/cloudius-systems/osv-apps/tree/master/iperf3
java-httpserver	The JVM	The JVM running a HTTP server, receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/java-httpserver
jetty	The JVM	Loupe tracing the JVM running Jetty's demo app, receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/jetty
jython	jython	Jython processing a hello world script	https://github.com/cloudius-systems/osv-apps/tree/master/jython
kafka	The JVM	The JVM running Kafka processing the producer perf test benchmark	https://gist.github.com/ueokande/b96eadd798fff852551b80962862bfb3
keydb	keydb-server	The KeyDB server processing the keydb-benchmark	https://github.com/Snapchat/KeyDB
kong	nginx	The Kong's nginx server receiving requests from wrk	https://github.com/Kong/kong
leveldb	leveldb	LevelDB passing its test suite	https://github.com/google/leveldb
libreoffice	libreoffice	LibreOffice converting a sample ODT document from openbenchmarking.org into PDF	https://openbenchmarking.org/test/system/libreoffice
lighttpd	lighttpd	Lighttpd receiving requests from wrk	https://github.com/lighttpd/lighttpd1.4
linpack	linpack	The Linpack benchmark running with default parameters	https://people.math.sc.edu/Burkardt/workshops/bootcamp_2008_vt/linpack_bench/linpack_bench.c
lua	lua	The lua interpreter running a hello world script	https://github.com/cloudius-systems/osv-apps/tree/master/lua-hello
lzma	lzma	LZMA compressing sample data from openbenchmarking.org	https://openbenchmarking.org/test/pts/compress-lzma
memcached	memcached	Memcached passing its test suite	https://github.com/memcached/memcached
minecraft-server	The JVM	The JVM running the Minecraft server receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/minecraft-server

App. name	Binary traced	Workload	Link
mongodb	mongodb	MongoDB running the Mongo-perf benchmark	https://github.com/mongodb/mongo-perf
mono	mono	A hello world C# application running on top of mono	https://github.com/cloudius-systems/osv-apps/tree/master/mono-example
mruby	mruby	The mruby shell initializing	https://github.com/cloudius-systems/osv-apps/tree/master/mruby
mysql	mysql	MySQL processing the sysbench oltp_read_write benchmark	https://github.com/akopytov/sysbench/blob/master/src/lua/oltp_read_write.lua
netperf	netper	Netperf outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/netperf
nginx	nginx	Nginx receiving request from wrk	https://github.com/nginx/nginx
node-express	node	NodeJS running a toy web server receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/node-express-example
nodejs	node	NodeJS processing an ad-hoc regex-based benchmark	https://github.com/nodejs/node
npb-bt	bt.S.x	The NAS parallel benchmark Block Tri-diagonal solver running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-cg	cg.S.x	The NAS parallel benchmark Conjugate Gradient running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-dc	dc.S.x	The NAS parallel benchmark Data Cube running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-ep	ep.S.x	The NAS parallel benchmark Embarrassingly Parallel running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-ft	ft.S.x	The NAS parallel benchmark 3D fast Fourier Transform running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-is	is.S.x	The NAS parallel benchmark Integer Sort running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-lu	lu.S.x	The NAS parallel benchmark Lower-Upper Gauss-Seidel solver running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-mg	mg.S.x	The NAS parallel benchmark Multi-Grid running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-sp	sp.S.x	The NAS parallel benchmark Scalar Penta-diagonal solver running problem class S	https://www.nas.nasa.gov/software/npb.html
npb-ua	ua.S.x	The NAS parallel benchmark Unstructured Adaptive mesh running problem class S	https://www.nas.nasa.gov/software/npb.html

App. name	Binary traced	Workload	Link
ocrmypdf	ocrmypdf	OCRMyPDF processing sample data from openbenchmarking.org	https://openbenchmarking.org/test/system/ocrmypdf
octave	octave	Octave processing a benchmark from openbenchmarking.org	https://openbenchmarking.org/test/system/octave-benchmark
openjdk8zulu	Zulu JVM v8	The Zulu JVM v8 outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/openjdk8-zulu-full
openjdkzulu9	Zulu JVM v9	The Zulu JVM v9 outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/openjdk-zulu-9-and-above
openssl	openssl	OpenSSL running its speed measurement feature (--speed switch)	https://openbenchmarking.org/test/pts/openssl
pbzip2	pbzip2	Pbzip2 compressing sample data from openbenchmarking.org	https://openbenchmarking.org/test/system/compress-pbzip2
perl	perl	Perl outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/perl
perlhello	perl	Perl running a hello world script	https://github.com/cloudius-systems/osv-apps/tree/master/perl-hello
postmark	postmark	The postmark benchmark running with its default configuration	https://packages.debian.org/bullseye/postmark
python	python3	Python3 (cpython) running its entire test suite	https://github.com/python/cpython
python2	python2	Python2 outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/python2x
python3	python3	Python3 outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/python3x
rawtherapee	rawtherapee	RawTherapee processing sample images from openbenchmarking.org	https://openbenchmarking.org/test/system/rawtherapee
redis	redis-server	Redis processing the redis-benchmark	https://github.com/redis/redis/blob/unstable/src/redis-benchmark.c
rhino	rhino	The Rhino JS engine running a hello world script	https://github.com/cloudius-systems/osv-apps/tree/master/rhino
rpm	rpm	The RPM package manager outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/rpm
rsvg	rsvg	RSVG/librsvg converting between formats sample data from openbenchmarking.org	https://openbenchmarking.org/test/system/rsvg

App. name	Binary traced	Workload	Link
ruby	ruby	CRuby running its entire test suite	https://github.com/cloudius-systems/osv-apps/tree/8f8e5930fda707b05f32f7f1b82bf12a023e6dee/ruby
rust	rustc	The rustc compiler compiling a hello world source file	https://www.rust-lang.org/
rust-httpserver	A simple web server written in Rust	A simple web server written in Rust, receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/8f8e5930fda707b05f32f7f1b82bf12a023e6dee/rust-httpserver
rust-pie-example	A Rust PIE hello world executable	Simply running the executable	https://github.com/cloudius-systems/osv-apps/tree/8f8e5930fda707b05f32f7f1b82bf12a023e6dee/rust-pie-example
sqlite	A C application sending various SQL queries to a SQLite database	Simply running the executable	https://sqlite.org/index.html
stream	stream	The STREAM memory bandwidth measurement benchmark	https://www.cs.virginia.edu/stream/
tesseract-ocr	tesseract-ocr	Tesseract-OCR processing sample data from openbenchmarking.org	https://openbenchmarking.org/test/system/tesseract-ocr
Traefik	traefik	The Traefik proxy receiving requests from wrk	https://github.com/traefik/traefik
twmemproxy	twmemproxy	The twmemproxy/nutcracker proxy reciving requests from wrk	https://github.com/twitter/twemproxy
uperf	uperf	The Uperf network performance measurement tool outputting version information	https://github.com/cloudius-systems/osv-apps/tree/master/uperf
vertx	The JVM	The JVM running a simple vertx server, processing requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/vertx
webassembly	wasmer	The Wasmer WebAssembly runtime executing a hello world LUA script	https://github.com/cloudius-systems/osv-apps/tree/master/webassembly
webfsd	webfsd	The Webfsd web server receiving requests from wrk	https://github.com/ourway/webfsd
weborf	weborf	The Weborf web server receiving requests from wrk	https://ltworf.github.io/weborf/
whetstone	whetstone	The Whetstone benchmark	https://netlib.org/benchmark/whetstone.c
wrk	wrk	The wrk benchmarking tool submitting requests to a web server	https://github.com/cloudius-systems/osv-apps/tree/master/wrk

App. name	Binary traced	Workload	Link
zookeeper	The JVM	The JVM running an Apache ZooKeeper server receiving requests from wrk	https://github.com/cloudius-systems/osv-apps/tree/master/apache-zookeeper
zstd	zstd	Zstd compressing sample data from openbenchmarking.org	https://openbenchmarking.org/test/pts/compress-zstd