OpenSource for the OpenSource

A Knot DNS Developer's Diary

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Summary

- GitLab
- Continuous Integration
- Code Coverage
- Static Code Analysis
- Cyclomatic Complexity

Premises

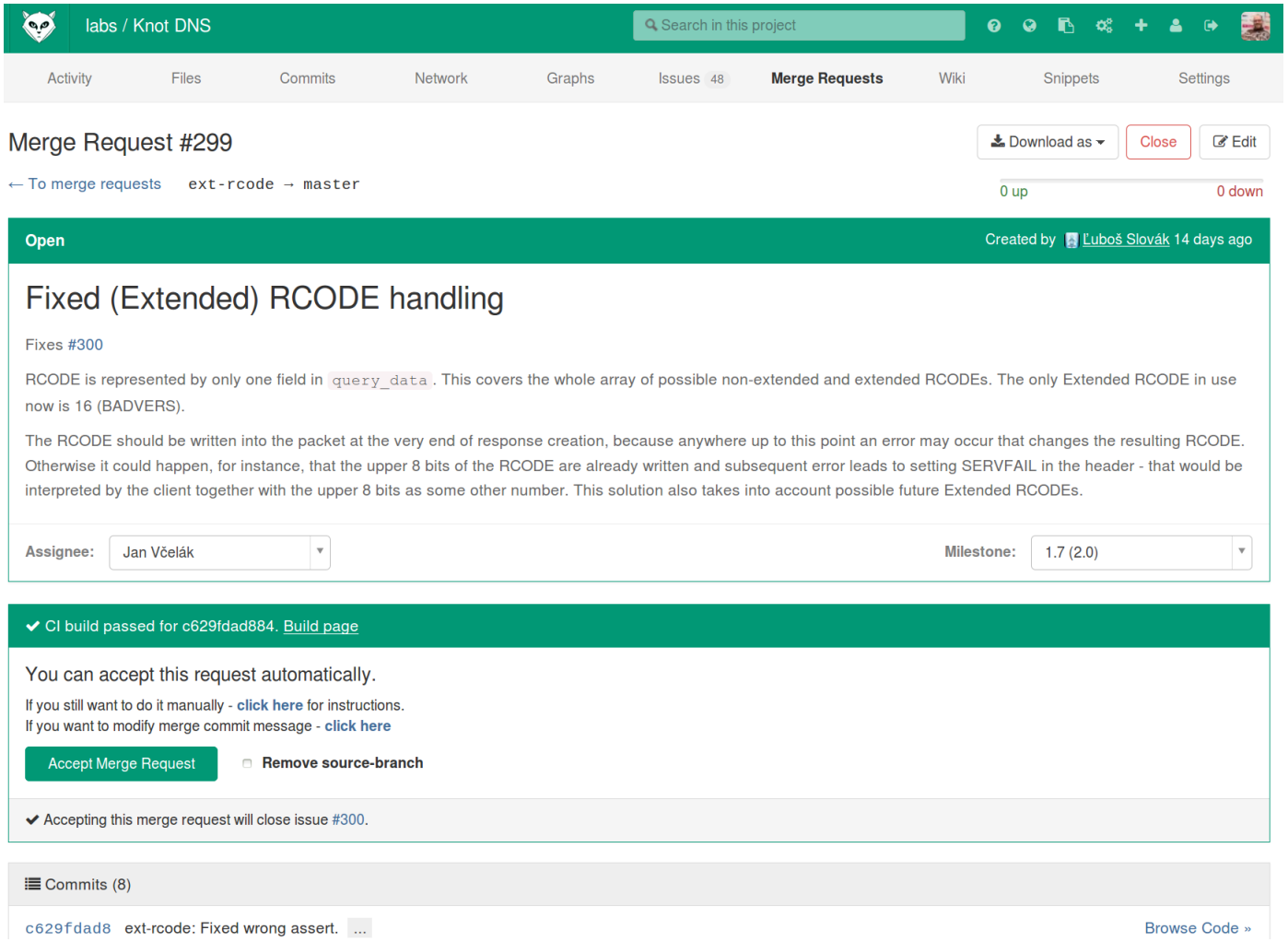
GitLab

- GitHub like service in Ruby or Rails
- Web Interface to Git
- LightWeight Issue Tracker
- Wiki
- Public, Internal & Private Projects

GitLab for Code Review

- Doesn’t enforce the process
- Branching is CHEAP in Git
- Put every new code in branch
- Create Merge Request
- Integrate with Continuous Integration

GitLab for Code Review

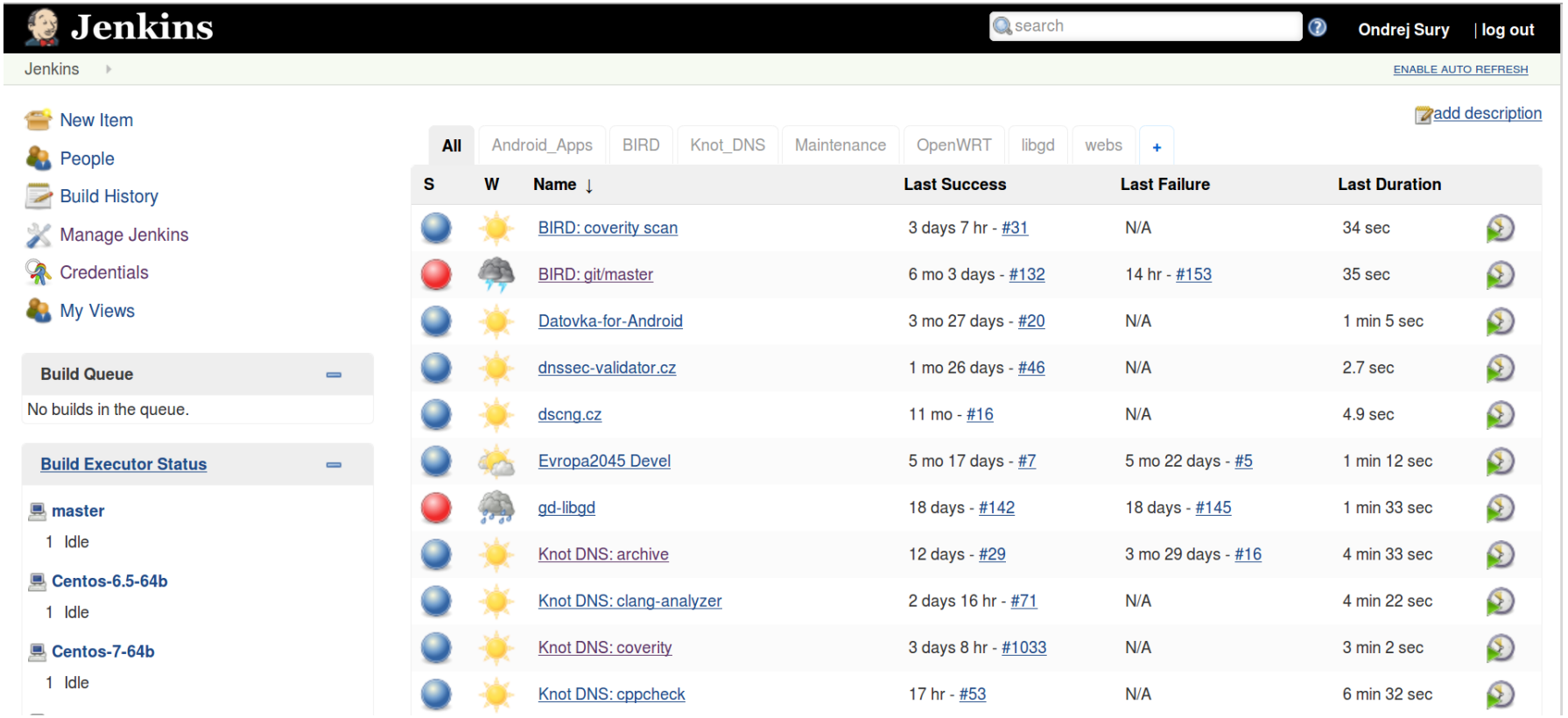


Continuous Integration

- Jenkins – continuous integration server written in Java
- Define environment (build slaves)
- Define jobs (how to build the project)
- Define triggers
  - On Every Commit
  - On Every Sunday
  - On Every Successful Build of other project

Jenkins

Jenkins – main page



GitLab Jenkins Integration

- GitLab CI – only for Ruby Projects
- GitLab2Jenkins – thin server emulating GitLab CI
- Starts a build for every Merge Request
- Reports back a result of the build

Code Coverage

- You do have the tests, right?
- But how much code is covered by tests?
- gcov – part of GNU CC
  - CFLAGS=”-O0 -g -fprofile-arcs -ftest-coverage”
  - LDFLAGS=”-lgcov”
- lcov – generates web from gcov output

lcov output

LCOV - code coverage report

			Hit	Total	Coverage
Current view:	top level	**Lines:**	24420	62760	38.9 %
Test:	Knot DNS 1.6.0 Code Coverage	**Functions:**	1487	1643	90.5 %
Date:	2014-11-05				
Legend:	Rating: low: < 75 % medium: >= 75 % high: >= 90 %				

Directory	Line Coverage		Functions	
common	76.0 %	1161 / 1528	73.8 %	121 / 164
common/namedb	73.4 %	177 / 241	88.2 %	30 / 34
common/trie	82.4 %	453 / 550	88.0 %	44 / 50
knot	67.1 %	106 / 158	87.5 %	7 / 8
knot/conf	57.4 %	1118 / 1949	71.0 %	71 / 100
knot/ctl	34.5 %	346 / 1002	43.1 %	31 / 72
knot/dnssec	82.5 %	1053 / 1276	93.9 %	77 / 82
knot/modules	85.6 %	167 / 195	100.0 %	14 / 14
knot/nameserver	86.6 %	1762 / 2034	100.0 %	158 / 158
knot/server	78.4 %	1467 / 1870	97.7 %	125 / 128
knot/updates	84.4 %	902 / 1069	98.2 %	107 / 109
knot/worker	93.5 %	115 / 123	100.0 %	16 / 16
knot/zone	80.5 %	1887 / 2344	96.6 %	173 / 179
knot/zone/events	90.1 %	439 / 487	100.0 %	49 / 49
libknot	78.3 %	1692 / 2161	95.5 %	148 / 155
libknot/dnssec	78.4 %	772 / 985	96.7 %	87 / 90
libknot/packet	93.5 %	718 / 768	98.9 %	88 / 89
libknot/processing	90.2 %	174 / 193	96.6 %	28 / 29
libknot/rrtype	87.7 %	507 / 578	97.8 %	88 / 90
libknot/util	96.1 %	49 / 51	100.0 %	14 / 14
zscanner	21.7 %	9355 / 43198	84.6 %	11 / 13

Generated by: LCOV version 1.10

Static Code Analysis

- clang-analyser
  - Part of LLVM suite
  - Analyses code as part of compilation
  - Integrates with Jenkins
- cppcheck
  - Integrates with Jenkins
- OCLint – a static code analysis

clang-analyser summary

Knot_DNS_clang_analyzer - scan-build results

User:	beast@fedora.jenkins.labs.nic.cz
Working Directory:	/home/beast/beast/workspace/Knot_DNS_clang_analyzer
Command Line:	make all check
Clang Version:	clang version 3.4 (tags/RELEASE_34/final)
Date:	Sun Nov 2 16:15:41 2014

Bug Summary

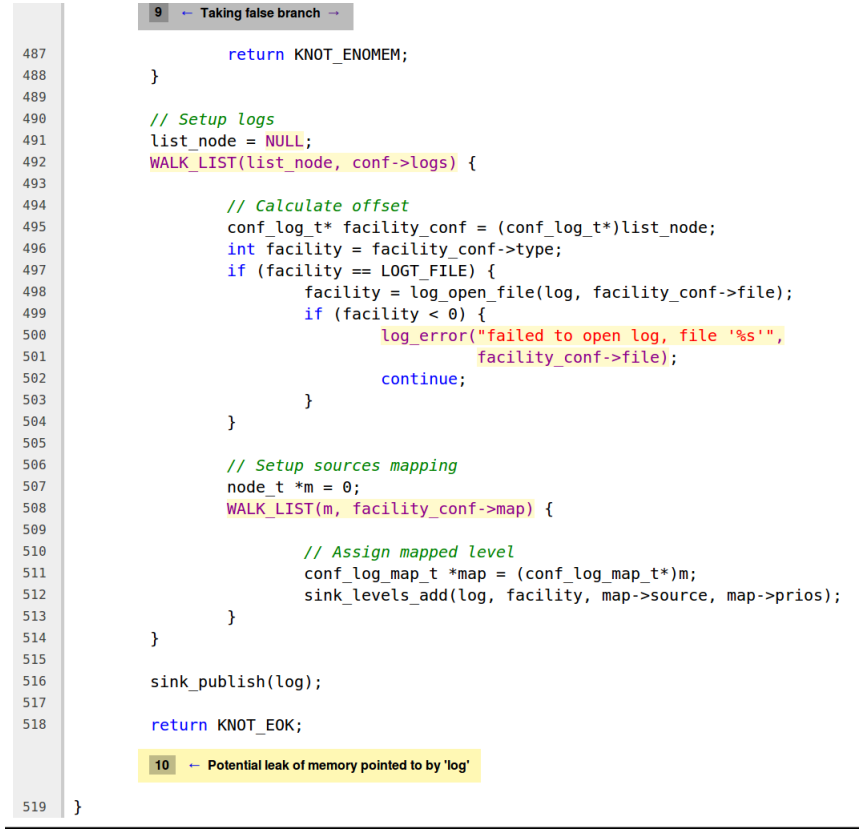
Bug Type	Quantity	Display?
All Bugs	**19**	☑
API		
Argument with 'nonnull' attribute passed null	5	☑
Dead store		
Dead assignment	2	☑
Logic error		
Dereference of null pointer	10	☑
Memory Error		
Memory leak	1	☑
Unix API		
Undefined allocation of 0 bytes (CERT MEM04-C; CWE-131)	1	☑

clang-analyser example

Reports

Bug Group	Bug Type ▾	File	Line	Path Length	
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	167	10	View Report
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	161	9	View Report
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	175	11	View Report
API	Argument with 'nonnull' attribute passed null	tests/dnssec_nsec3.c	70	4	View Report
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	181	12	View Report
Dead store	Dead assignment	tests/namedb.c	131	1	View Report
Dead store	Dead assignment	src/knot/conf/libknotd_la-cf-parse.c	1946	1	View Report
Logic error	Dereference of null pointer	src/knot/conf/libknotd_la-cf-parse.c	423	62	View Report
Logic error	Dereference of null pointer	tests/pkt.c	48	28	View Report
Logic error	Dereference of null pointer	src/knot/dnssec/zone-sign.c	81	15	View Report
Logic error	Dereference of null pointer	tests/dthreads.c	91	3	View Report
Logic error	Dereference of null pointer	tests/changeset.c	38	3	View Report
Logic error	Dereference of null pointer	tests/pkt.c	108	11	View Report
Logic error	Dereference of null pointer	tests/rrset.c	31	8	View Report
Logic error	Dereference of null pointer	tests/rrset.c	32	8	View Report
Logic error	Dereference of null pointer	tests/conf.c	45	5	View Report
Logic error	Dereference of null pointer	src/common/mempool.c	109	3	View Report
Memory Error	Memory leak	src/common/log.c	518	10	View Report
Unix API	Undefined allocation of 0 bytes (CERT MEM04-C; CWE-131)	tests/dnssec_sign.c	45	6	View Report

clang-analyser example report



```
                9  ← Taking false branch →
487                     return KNOT_ENOMEM;
488             }
489
490             // Setup logs
491             list_node = NULL;
492             WALK_LIST(list_node, conf->logs) {
493
494                     // Calculate offset
495                     conf_log_t* facility_conf = (conf_log_t*)list_node;
496                     int facility = facility_conf->type;
497                     if (facility == LOGT_FILE) {
498                             facility = log_open_file(log, facility_conf->file);
499                             if (facility < 0) {
500                                     log_error("failed to open log, file '%s'",
501                                               facility_conf->file);
502                                     continue;
503                             }
504                     }
505
506                     // Setup sources mapping
507                     node_t *m = 0;
508                     WALK_LIST(m, facility_conf->map) {
509
510                             // Assign mapped level
511                             conf_log_map_t *map = (conf_log_map_t*)m;
512                             sink_levels_add(log, facility, map->source, map->prios);
513                     }
514             }
515
516             sink_publish(log);
517
518             return KNOT_EOK;
               10  ← Potential leak of memory pointed to by 'log'
519     }
```

cppcheck results (1)

Cppcheck Results

Summary

Severity	Count	Delta
Error	3	
Warning	1	
Style	75	
Performance	7	
Portability	8	
Information	7	
No category	0	
Total	101	

Details

Show issues highlighted on a single page

- all
- new and solved
- new
- solved
- unchanged

State	File	Line	Severity	Type	Inconclusive	Message
solved			information	missingInclude	false	Cppcheck cannot find all the include files (use --check-config for details)
solved			information	missingInclude	false	Cppcheck cannot find all the include files (use --check-config for details)

cppcheck results (2)

unchanged	dthreads.c	91	warning	nullPointer	false	Possible null pointer dereference: unit - otherwise it is redundant to check it against null.
unchanged	common-knot/heap.c	67	style	variableScope	false	The scope of the variable 'e1' can be reduced.
unchanged	common-knot/heap.c	81	style	variableScope	false	The scope of the variable 'e1' can be reduced.
unchanged	common/hhash.c	175	style	variableScope	false	The scope of the variable 'empty' can be reduced.
unchanged	common/hhash.c	176	style	variableScope	false	The scope of the variable 'dist' can be reduced.
unchanged	common/net.c	181	style	variableScope	false	The scope of the variable 'ret' can be reduced.
unchanged	common/net.c	61	style	unreadVariable	false	Variable 'flag' is assigned a value that is never used.
unchanged	common/trie/hat-trie.c	356	style	variableScope	false	The scope of the variable 'k' can be reduced.
unchanged	common/trie/hat-trie.c	481	style	variableScope	false	The scope of the variable 'key' can be reduced.
unchanged	common/trie/hat-trie.c	499	style	variableScope	false	The scope of the variable 'd' can be reduced.
unchanged	common/trie/hat-trie.c	519	style	variableScope	false	The scope of the variable 'u' can be reduced.
unchanged	common/trie/hat-trie.c	520	style	variableScope	false	The scope of the variable 'key' can be reduced.
unchanged	knot/ctl/process.c	58	style	variableScope	false	The scope of the variable 'buf' can be reduced.
unchanged	knot/server/server.h	45	style	unnecessaryForwardDeclaration	false	The struct 'conf_t' forward declaration is unnecessary. Type struct is already declared earlier.
unchanged	knot/dnssec/zone-nsec.c	126	style	variableScope	false	The scope of the variable 'ret' can be reduced.
unchanged	knot/ctl/remote.c	293	style	variableScope	false	The scope of the variable 'soa_rrs' can be reduced.
unchanged	knot/nameserver/axfr.c	76	style	variableScope	false	The scope of the variable 'node' can be reduced.
unchanged	knot/server/rrl.h	44	style	unnecessaryForwardDeclaration	false	The struct 'zone_t' forward declaration is unnecessary. Type struct is already declared earlier.
unchanged	knot/nameserver/nsec_proofs.c	781	style	variableScope	false	The scope of the variable 'ret' can be reduced.
unchanged	knot/nameserver/internet.c	313	style	variableScope	false	The scope of the variable 'node' can be reduced.
unchanged	knot/server/rrl.c	235	style	variableScope	false	The scope of the variable 'f' can be reduced.

https://jenkins.labs.nic.cz/job/Knot_DNS_cppcheck/53/cppcheckResult/

Complexity Tools

- OCLint – a static code analysis
  - Possible bugs – empty if/else/try/catch/finally statements
  - Unused code – unused local variables and parameters
  - Complicated code – high cyclomatic complexity, NPath complexity and high NCSS
  - Redundant code – redundant if statement and useless parentheses
  - Code smells – long method and long parameter list
  - Bad practices – inverted logic and parameter reassignment

OCLint results

OCLint Report

Summary

Total Files	Files with Violations	Priority 1	Priority 2	Priority 3	Compiler Errors	Compiler Warnings	Clang Static Analyzer
252	216	0	1651	28187	64	2	0

File	Location	Rule Name	Priority	Message
functions.c	746:9	unnecessary else statement	3	
functions.c	777:2	short variable name	3	Variable name with 1 characters is shorter than the threshold of 3
functions.c	731:1	high cyclomatic complexity	2	Cyclomatic Complexity Number 14 exceeds limit of 10
functions.c	98:1	long variable name	3	Variable name with 25 characters is longer than the threshold of 20
functions.c	134:1	long variable name	3	Variable name with 26 characters is longer than the threshold of 20
functions.c	170:1	long variable name	3	Variable name with 24 characters is longer than the threshold of 20
functions.c	206:1	long variable name	3	Variable name with 25 characters is longer than the threshold of 20
functions.c	286:1	long variable name	3	Variable name with 22 characters is longer than the threshold of 20
functions.c	317:1	long variable name	3	Variable name with 28 characters is longer than the threshold of 20

scan-build.labs.nic.cz/oclint/oclint-knot-ff03630b.html

http://scan-build.labs.nic.cz/oclint/knot_result-e8056213.html

Cyclomatic Complexity

Cyclomatic complexity is a software metric (measurement). It was developed by Thomas J. McCabe, Sr. in 1976 and is used to indicate the complexity of a program. It is a quantitative measure of the complexity of programming instructions.

Source: Wikipedia

Cyclomatic Complexity

- Lizard – a simple code complexity analyzer that counts:
  - the nloc (lines of code without comments)
  - CCN (cyclomatic complexity number)
  - token count of functions
  - parameter count of functions

Lizard results

```
================================================
!!!! Warnings (CCN > 15) !!!!
================================================
  NLOC    CCN   token  PARAM  location
------------------------------------------------
      94     22    503      1 ASORT_PREFIX( sort )@78-188@./src/common/array-sort.h
      99     34    705      4 base32hex_decode@290-415@./src/common/base32hex.c
      58     18    351      4 base64_decode@195-269@./src/common/base64.c
      89     16    412      2 main@72-175@./src/zscanner/tests/zscanner-tool.c
   71783  26075 423195      4 parse_block@165-73074@./src/zscanner/scanner.c
[...]
     135     48    900      1 main@432-605@./tests-extra/tools/zone_generate.py
     117     31    805      1 main@96-246@./tests-extra/runtests.py
================================================================================
Total nloc  Avg.nloc  Avg CCN  Avg token  Fun Cnt  Warning cnt   Fun Rt   nloc Rt
--------------------------------------------------------------------------------
    128201        48    14.80     293.21     2425           58      0.02    0.67
```

Resources

- GitLab – https://about.gitlab.com/
- CZ.NIC GitLab – https://gitlab.labs.nic.cz/
- Jenkins – https://jenkins-ci.org/
- CZ.NIC Jenkins – https://jenkins.labs.nic.cz/
- GitLab2Jenkins – https://gitlab.labs.nic.cz/labs/gitlab2jenkins
- clang-analyser – http://clang-analyzer.llvm.org/
- cppcheck – http://cppcheck.sourceforge.net/
- OCLint – http://oclint.org/
- Lizard – https://github.com/terryyin/lizard