

OpenSource for the OpenSource

A Knot DNS Developer's Diary

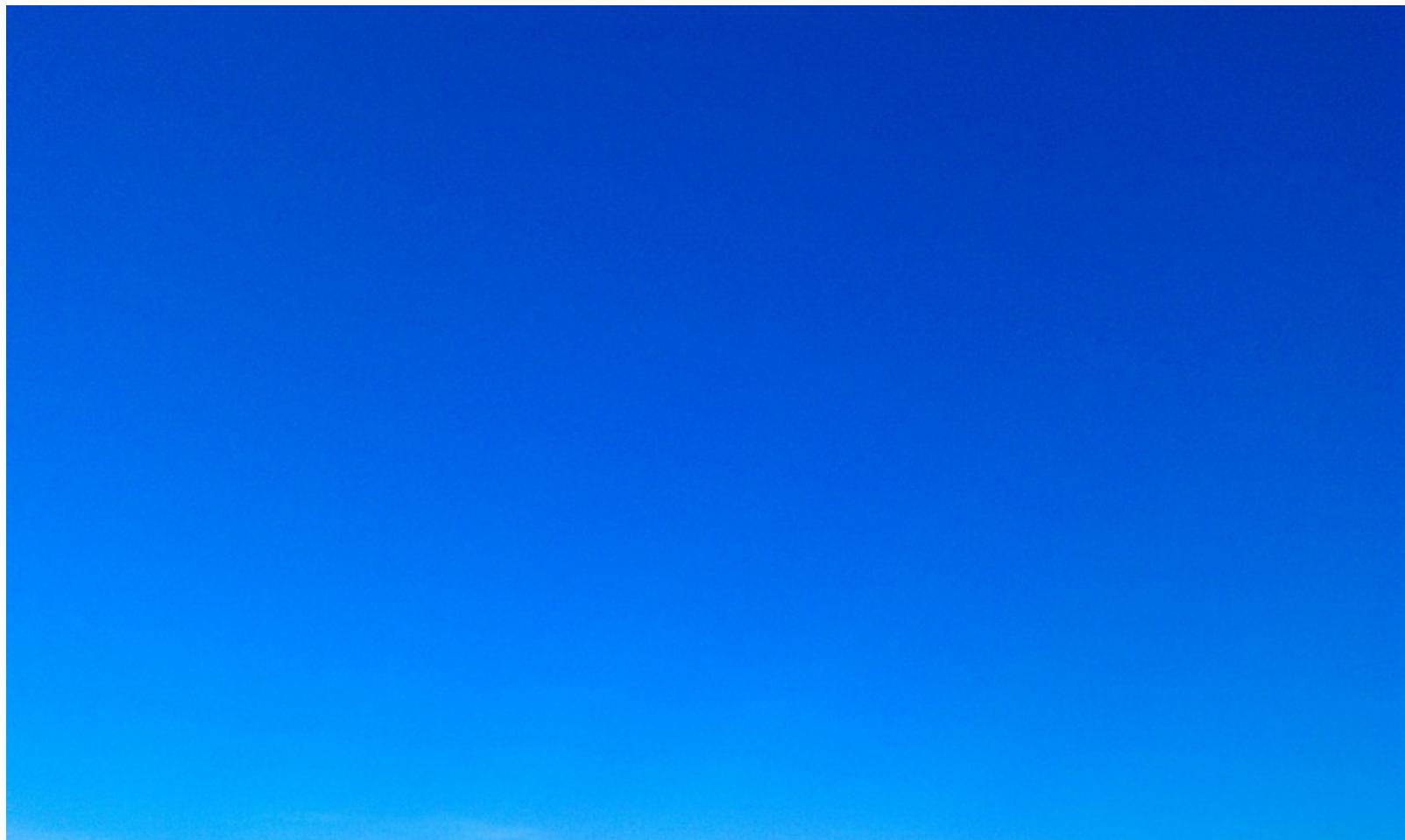
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Summary

- 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

The screenshot shows a GitLab interface for a project named "labs / Knot DNS". The top navigation bar includes links for Activity, Files, Commits, Network, Graphs, Issues (48), Merge Requests (selected), Wiki, Snippets, and Settings. A search bar and various project management icons are also present.

The main content is a "Merge Request #299" titled "Fixed (Extended) RCODE handling". The request was created by Luboš Slovák 14 days ago. It has 0 upvotes and 0 downvotes. The status is "Open".

The merge request details the fix for issue #300, which involves handling RCODEs correctly. It states that RCODE is represented by one field in `query_data`. The only Extended RCODE in use is 16 (BADVERS). The RCODE should be written at the end of the response creation to avoid conflicts with other errors.

Assignee is set to Jan Včelák, and the Milestone is 1.7 (2.0).

At the bottom of the merge request page, there is a summary of CI build status: "CI build passed for c629fdad884. Build page". It also provides options to accept the request automatically or manually, and to modify the merge commit message. A note indicates that accepting the request will close issue #300.

The commit history section shows 8 commits, with the latest being "c629fdad8 ext-rcode: Fixed wrong assert. ...". There is a link to "Browse Code".



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 – main page

Jenkins

search

Ondrej Sury | log out

ENABLE AUTO REFRESH

New Item

People

Build History

Manage Jenkins

Credentials

My Views

Build Queue

No builds in the queue.

Build Executor Status

master

1 Idle

Centos-6.5-64b

1 Idle

Centos-7-64b

1 Idle

All

Android_Apps

BIRD

Knot_DNS

Maintenance

OpenWRT

libgd

webs

+ add description

S	W	Name ↓	Last Success	Last Failure	Last Duration
●	☀	BIRD: coverity scan	3 days 7 hr - #31	N/A	34 sec
●	☁️	BIRD: git/master	6 mo 3 days - #132	14 hr - #153	35 sec
●	☀	Datovka-for-Android	3 mo 27 days - #20	N/A	1 min 5 sec
●	☀	dnssec-validator.cz	1 mo 26 days - #46	N/A	2.7 sec
●	☀	dscng.cz	11 mo - #16	N/A	4.9 sec
●	☁️	Evropa2045 Devel	5 mo 17 days - #7	5 mo 22 days - #5	1 min 12 sec
●	☁️	gd-libgd	18 days - #142	18 days - #145	1 min 33 sec
●	☀	Knot DNS: archive	12 days - #29	3 mo 29 days - #16	4 min 33 sec
●	☀	Knot DNS: clang-analyzer	2 days 16 hr - #71	N/A	4 min 22 sec
●	☀	Knot DNS: coverity	3 days 8 hr - #1033	N/A	3 min 2 sec
●	☀	Knot DNS: cppcheck	17 hr - #53	N/A	6 min 32 sec



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

Current view: top level		Hit	Total	Coverage
Test: Knot DNS 1.6.0 Code Coverage		Lines: 24420	62760	38.9 %
Date: 2014-11-05		Functions: 1487	1643	90.5 %
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	<input checked="" type="checkbox"/>
API		
Argument with 'nonnull' attribute passed null	5	<input checked="" type="checkbox"/>
Dead store		
Dead assignment	2	<input checked="" type="checkbox"/>
Logic error		
Dereference of null pointer	10	<input checked="" type="checkbox"/>
Memory Error		
Memory leak	1	<input checked="" type="checkbox"/>
Unix API		
Undefined allocation of 0 bytes (CERT MEM04-C; CWE-131)	1	<input checked="" type="checkbox"/>



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
488
489
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515
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517
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519 }

    return KNOT_ENOMEM;
}

// Setup logs
list_node = NULL;
WALK_LIST(list_node, conf->logs) {

    // Calculate offset
    conf_log_t* facility_conf = (conf_log_t*)list_node;
    int facility = facility_conf->type;
    if (facility == LOGT_FILE) {
        facility = log_open_file(log, facility_conf->file);
        if (facility < 0) {
            log_error("failed to open log, file '%s'",
                      facility_conf->file);
            continue;
        }
    }
    // Setup sources mapping
    node_t *m = 0;
    WALK_LIST(m, facility_conf->map) {

        // Assign mapped level
        conf_log_map_t *map = (conf_log_map_t*)m;
        sink_levels_add(log, facility, map->source, map->prios);
    }
}
sink_publish(log);

return KNOT_EOK;

10 ← Potential leak of memory pointed to by 'log'
}
```



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 scan-build.labs.nic.cz/oclint/knot-ff03630b.html	317:1	long variable name	3	Variable name with 28 characters is longer than the threshold of 20

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>

