

# OpenSource for the OpenSource

## A Knot DNS Developer's Diary

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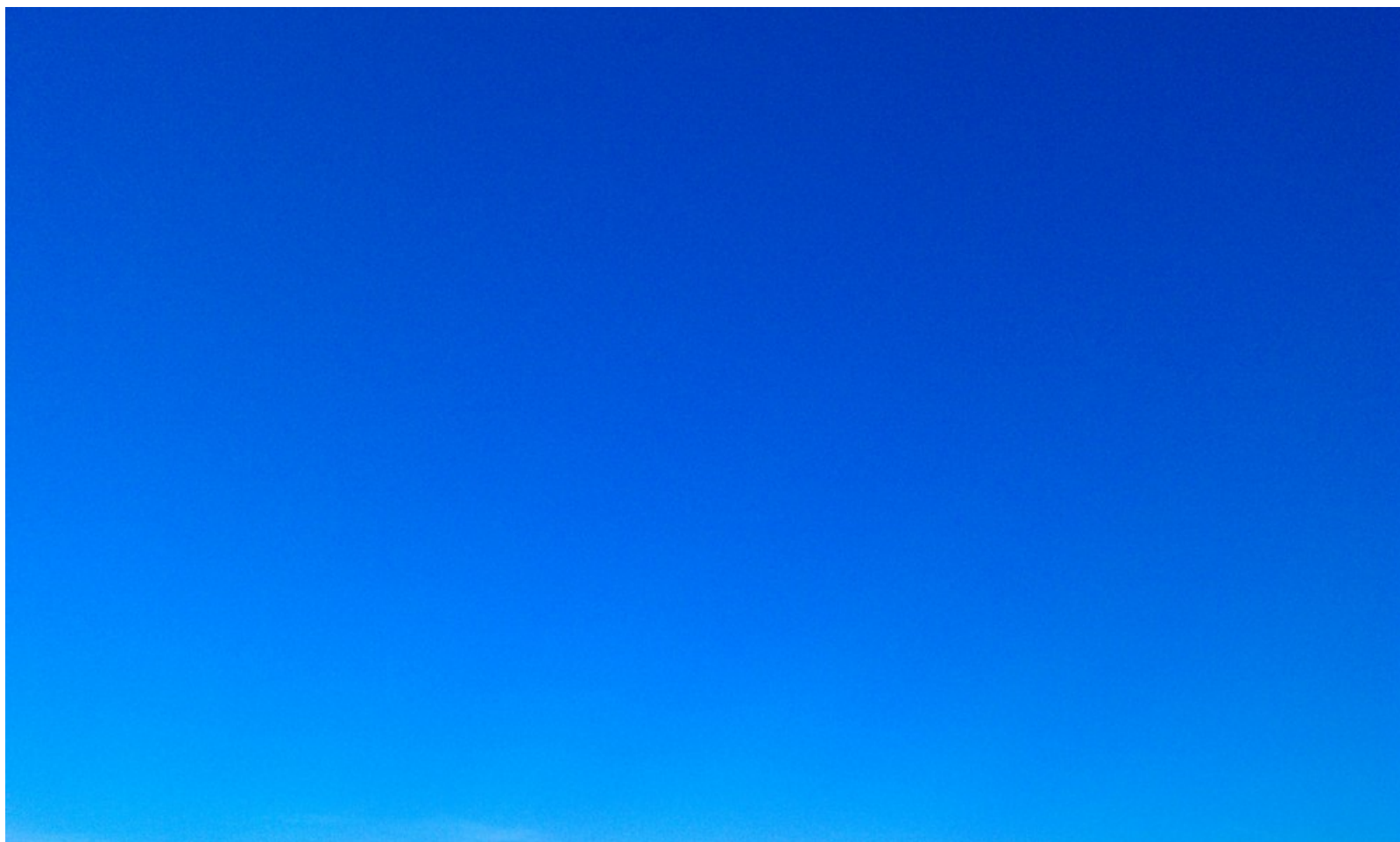


# Summary

- 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 Merge Request page for the project 'labs / Knot DNS'. The page title is 'Merge Request #299'. The source branch is 'ext-r-code' and the target branch is 'master'. The merge request is in an 'Open' state, created by 'Luboš Slovák' 14 days ago. The title of the merge request is 'Fixed (Extended) RCODE handling'. The description includes a reference to 'Fixes #300' and explains that RCODE is represented by only one field in 'query\_data'. It states that the only Extended RCODE in use now is 16 (BADVERS). The description also notes that the RCODE should be written into the packet at the very end of response creation, because anywhere up to this point an error may occur that changes the resulting RCODE. Otherwise, it could happen, for instance, that the upper 8 bits of the RCODE are already written and subsequent error leads to setting SERVFAIL in the header - that would be interpreted by the client together with the upper 8 bits as some other number. This solution also takes into account possible future Extended RCODEs. The assignee is 'Jan Včelák' and the milestone is '1.7 (2.0)'. A green banner indicates that the CI build passed for commit 'c629fdad884'. Below this, there is a message: 'You can accept this request automatically. If you still want to do it manually - click here for instructions. If you want to modify merge commit message - click here'. There are two buttons: 'Accept Merge Request' and 'Remove source-branch'. A note at the bottom of the banner says: 'Accepting this merge request will close issue #300.' At the bottom of the page, there is a section for 'Commits (8)' with one commit visible: 'c629fdad8 ext-r-code: Fixed wrong assert. ...'. There is a 'Browse Code >' link next to the commit.



# 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

The screenshot shows the Jenkins web interface. At the top, there's a navigation bar with the Jenkins logo, a search bar, and the user name 'Ondrej Sury' with a 'log out' link. Below the navigation bar, there's a sidebar on the left with navigation links: 'New Item', 'People', 'Build History', 'Manage Jenkins', 'Credentials', and 'My Views'. The main content area displays a table of builds, filtered by 'All' (with other filters like 'Android\_Apps', 'BIRD', etc., visible). The table has columns for 'S' (status), 'W' (weather icon), 'Name', 'Last Success', 'Last Failure', and 'Last Duration'. Below the table, there are two sections: 'Build Queue' (showing 'No builds in the queue') and 'Build Executor Status' (showing three executors: 'master', 'Centos-6.5-64b', and 'Centos-7-64b', each with '1 Idle' status).

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








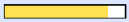

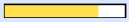











- You do have the tests, right?
- But how much code is covered by tests?
- gcov – part of GNU CC
  - CFLAGS="-O0 -g -fprofile-arcs -ftest-coverage"
  - LDFLAGS="-lgcov"
- lcov – generates web from gcov output



# Icov output

## LCOV - code coverage report

Current view: <b>top level</b>	Hit	Total	Coverage
Test: <b>Knot DNS 1.6.0 Code Coverage</b>	Lines: 24420	62760	<b>38.9 %</b>
Date: <b>2014-11-05</b>	Functions: 1487	1643	<b>90.5 %</b>
Legend: Rating: <span style="color: red;">low: &lt; 75 %</span> <span style="color: orange;">medium: &gt;= 75 %</span> <span style="color: green;">high: &gt;= 90 %</span>			

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

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

## Bug Summary

Bug Type	Quantity	Display?
<b>All Bugs</b>	<b>19</b>	<input checked="" type="checkbox"/>
<b>API</b>		
Argument with 'nonnull' attribute passed null	5	<input checked="" type="checkbox"/>
<b>Dead store</b>		
Dead assignment	2	<input checked="" type="checkbox"/>
<b>Logic error</b>		
Dereference of null pointer	10	<input checked="" type="checkbox"/>
<b>Memory Error</b>		
Memory leak	1	<input checked="" type="checkbox"/>
<b>Unix API</b>		
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	<a href="#">View Report</a>
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	161	9	<a href="#">View Report</a>
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	175	11	<a href="#">View Report</a>
API	Argument with 'nonnull' attribute passed null	tests/dnssec_nsec3.c	70	4	<a href="#">View Report</a>
API	Argument with 'nonnull' attribute passed null	tests/dnssec_keys.c	181	12	<a href="#">View Report</a>
Dead store	Dead assignment	tests/namedb.c	131	1	<a href="#">View Report</a>
Dead store	Dead assignment	src/knot/conf/libknotd_la-cf-parse.c	1946	1	<a href="#">View Report</a>
Logic error	Dereference of null pointer	src/knot/conf/libknotd_la-cf-parse.c	423	62	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/pkt.c	48	28	<a href="#">View Report</a>
Logic error	Dereference of null pointer	src/knot/dnssec/zone-sign.c	81	15	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/dthreads.c	91	3	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/changeset.c	38	3	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/pkt.c	108	11	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/rrset.c	31	8	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/rrset.c	32	8	<a href="#">View Report</a>
Logic error	Dereference of null pointer	tests/conf.c	45	5	<a href="#">View Report</a>
Logic error	Dereference of null pointer	src/common/mempool.c	109	3	<a href="#">View Report</a>
Memory Error	Memory leak	src/common/log.c	518	10	<a href="#">View Report</a>
Unix API	Undefined allocation of 0 bytes (CERT MEM04-C; CWE-131)	tests/dnssec_sign.c	45	6	<a href="#">View Report</a>



# clang-analyser example report

```
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;
519 }
```

9 ← Taking false branch →

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/](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/oclint-knot-ff03630b.html)

[http://scan-build.labs.nic.cz/oclint/knot\\_result-e8056213.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>

