ldns heap Out-of-bound Read

1. Version:

1.7.1

2. Vulnerability detect

The fuzz info is as follow:

INFO: Seed: 499159114

INFO: Loaded 2 modules (7085 inline 8-bit counters): 6823 [0x7f28727f5d60, 0x7f28727f7807), 262 [0x374d20, 0x374e26),

INFO: Loaded 2 PC tables (7085 PCs): 6823 [0x7f28727f7808,0x7f2872812278), 262 [0x374e28,0x375e88),

../ldns-verify-zone: Running 1 inputs 1 time(s) each.

Running: ./w16wcrash-b6944107c6d8af77d22189cdb7f2b18e7ef8a188

==========

==18590==ERROR: AddressSanitizer: heap-buffer-overflow on address 0x616000001192 at pc 0x7f287278a0ae bp 0x7fff1aa7ef90 sp 0x7fff1aa7ef88

READ of size 1 at 0x616000001192 thread T0

#0 0x7f287278a0ad in ldns_rr_new_frm_str_internal /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:368:11

#1 0x7f2872788973 in ldns_rr_new_frm_str /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:669:9

#2 0x7f287278c605 in ldns_rr_new_frm_fp_l /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:780:8

#3 0x7f28727d59b7 in ldns_zone_new_frm_fp_l /home/work/build-ldns171-with-clang/../ldns-1.7.1/zone.c:227:7

#4 0x7f2872725093 in ldns_dnssec_zone_new_frm_fp_l /home/work/build-ldns171-with-clang/../ldns-1.7.1/dnssec_zone.c:645:11

#5 0x36637a in real_main /home/work/build-ldns171-with-clang/../ldns-1.7.1/examples/ldns-verify-zone.c:790:6

#6 0x367c87 in LLVMFuzzerTestOneInput /home/work/build-ldns171-with-clang/../ldns-1.7.1/examples/ldns-verify-zon

e.c:879:13

#7 0x26f44a in fuzzer::Fuzzer::ExecuteCallback(unsigned char const*, unsigned long) (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x26f44a)

#8 0x25e737 in fuzzer::RunOneTest(fuzzer::Fuzzer*, char const*, unsigned long) (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x25e737)

#9 0x264661 in fuzzer::FuzzerDriver(int*, char***, int (*)(unsigned char const*, unsigned long)) (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x264661)

#10 0x28afe2 in main (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x28afe2)

#11 0x7f2870b69b96 in __libc_start_main (/lib/x86_64-linux-gnu/libc.so.6+0x21b96)

#12 0x25d029 in _start (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x25d029)

0x616000001192 is located 0 bytes to the right of 530-byte region [0x616000000f80,0x616000001192)
allocated by thread T0 here:

#0 0x3368d3 in malloc (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x3368d3)

#1 0x7f28726f47db in ldns_buffer_new_frm_data /home/work/build-ldns171-with-clang/../ldns-1.7.1/buffer.c:48:18

#2 0x7f287278954d in ldns_rr_new_frm_str_internal /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:260:2

#3 0x7f2872788973 in ldns_rr_new_frm_str /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:669:9

#4 0x7f287278c605 in ldns_rr_new_frm_fp_l /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:780:8

#5 0x7f28727d59b7 in ldns_zone_new_frm_fp_l /home/work/build-ldns171-with-clang/../ldns-1.7.1/zone.c:227:7

#6 0x7f2872725093 in ldns_dnssec_zone_new_frm_fp_l

/home/work/build-ldns171-with-clang/../ldns-1.7.1/dnssec_zone.c:645:11

#7 0x36637a in real_main /home/work/build-ldns171-with-clang/../ldns-1.7.1/examples/ldns-verify-zone.c:790:6

#8 0x367c87 in LLVMFuzzerTestOneInput /home/work/build-ldns171-with-clang/../ldns-1.7.1/examples/ldns-verify-zone.c:879:13

#9 0x26f44a in fuzzer::Fuzzer::ExecuteCallback(unsigned char const*, unsigned long) (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x26f44a)

#10 0x25e737 in fuzzer::RunOneTest(fuzzer::Fuzzer*, char const*, unsigned long) (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x25e737)

#11 0x264661 in fuzzer::FuzzerDriver(int*, char***, int (*)(unsigned char const*, unsigned long)) (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x264661)

#12 0x28afe2 in main (/home/work/build-ldns171-with-clang/fuzz/ldns-verify-zone+0x28afe2)

#13 0x7f2870b69b96 in __libc_start_main (/lib/x86_64-linux-gnu/libc.so.6+0x21b96)

SUMMARY: AddressSanitizer: heap-buffer-overflow /home/work/build-ldns171-with-clang/../ldns-1.7.1/rr.c:368:11 in ldns_rr_new_frm_str_internal

Shadow bytes around the buggy address:

0x0c2c7fff81e0: fa fa fa fa fa fa fa fa fa fa fa fa fa fa fa fa

0x0c2c7fff81f0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

0x0c2c7fff8200: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

0x0c2c7fff8210: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

0x0c2c7fff8220: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

=>0x0c2c7fff8230: 00 00[02]fa fa fa fa fa fa fa fa fa fa fa fa

0x0c2c7fff8240: fa fa fa fa fa fa fa fa fa fa fa fa fa fa fa fa

0x0c2c7fff8250: fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd

0x0c2c7fff8260: fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd

0x0c2c7fff8270: fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd

0x0c2c7fff8280: fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd fd

Shadow byte legend (one shadow byte represents 8 application bytes):

Addressable: 00

Partially addressable: 01 02 03 04 05 06 07

Heap left redzone: fa

Freed heap region: fd

Stack left redzone: f1

Stack mid redzone: f2

Stack right redzone: f3

Stack after return: f5

Stack use after scope: f8

Global redzone: f9

Global init order: f6

Poisoned by user: f7

Container overflow: fc

Array cookie: ac

Intra object redzone: bb

ASan internal: fe

Left alloca redzone: ca

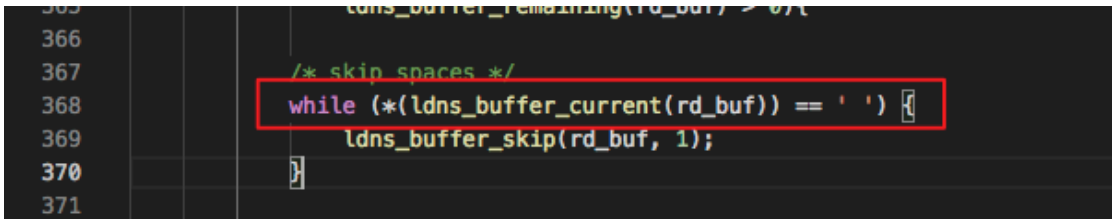
Right alloca redzone: cb

Shadow gap: cc

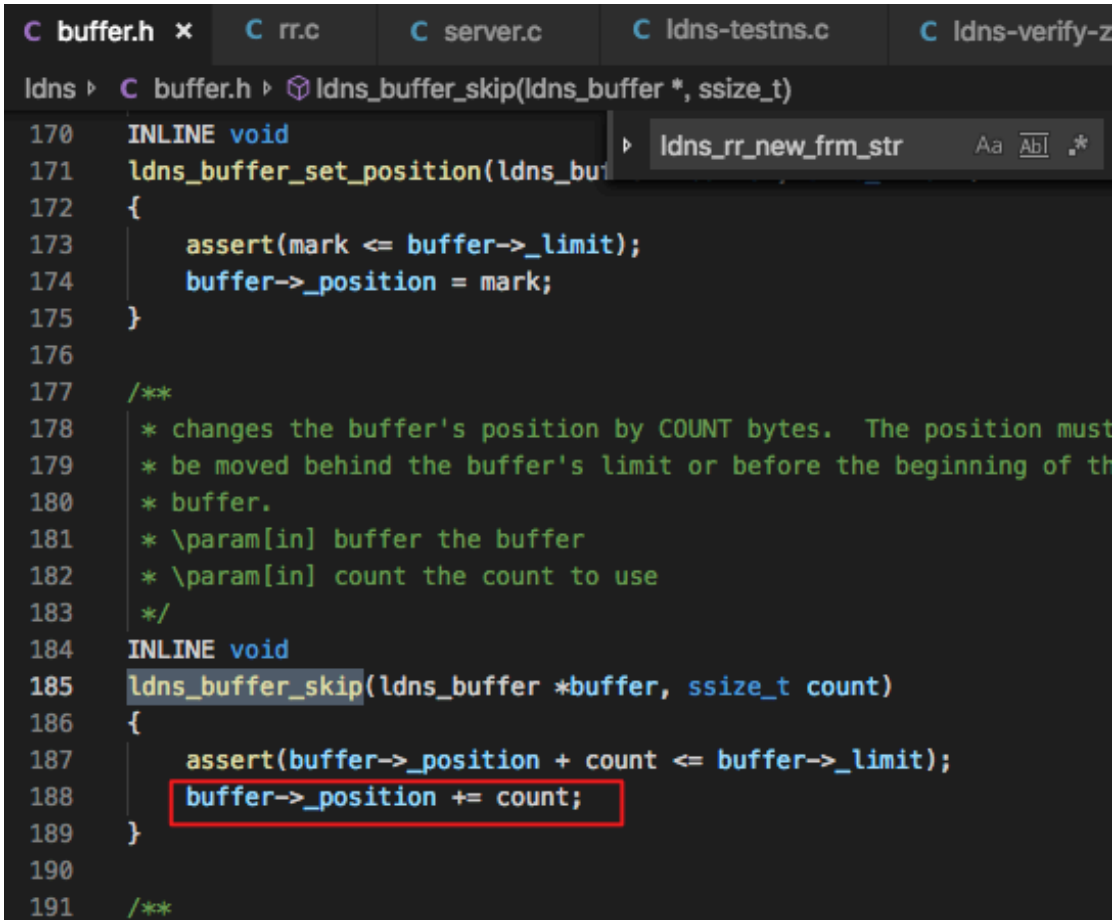
==18590==ABORTING

3. Analysis:

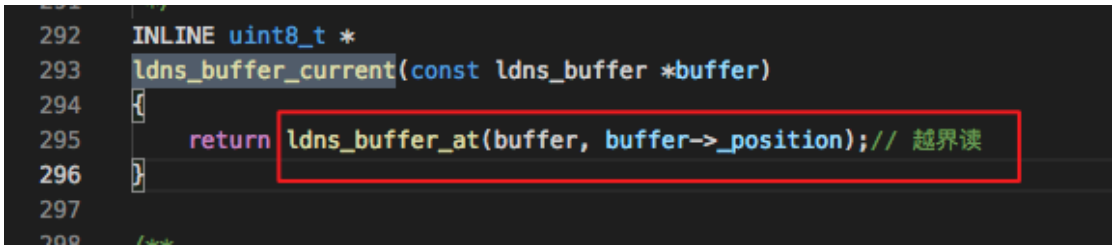
From the log of libfuzzer, the problem lies in the ldns_rr_new_frm_str_internal function of rr.c, offset by 368 lines, as follows:



Here, when the rd_buf is read, an out-of-bounds access occurs. As long as rd_buf reads out '', the ldns_buffer_skip is called to perform the postion offset 1. The definition of ldns_buffer_skip is as follows:



Can see that the offset of position is count Follow the ldns_buffer_current function and find the following definition in line 293 of buffer.h:



It can be parsed by calling ldns_buffer_at, which is located in line 257 of buffer.h:

```
255     */
256    INLINE uint8_t *
257    ldns_buffer_at(const ldns_buffer *buffer, size_t at)// 漏洞函数
258    {
259        assert(at <= buffer->_limit);// 边界校验问题
260        return buffer->_data + at;
261    }
262
```

Here we see a problem when checking the boundary, comparing at with buffer->_limit, throwing an exception if it is greater, or returning the offset byte if it is less than or equal to Leading to a 1 byte access, we continue to return to the ldns_rr_new_frm_str_internal function to see how the buffer is initialized. Here we find the initialization part of rd_buf, in line 260 of rr.c:

```
249
250                status = LDNS_STATUS_SYNTAX_TYPE_ERR;
251                goto error;
252            }
253        }
254
255        if (ldns_bget_token(rr_buf, rdata, "\0", LDNS_MAX_PACKETLEN) == -1) {
256            /* apparently we are done, and it's only a question RR
257             * so do not set status and go to ldnserror here
258             */
259        }
260        ldns_buffer_new_frm_data(rd_buf, rdata, strlen(rdata));// 从rdata里读入到rd_buf里
261
```

See here is to read rdata into rd_buf, follow up the function, in line 41 of buffer.c:

```
void
ldns_buffer_new_frm_data(ldns_buffer *buffer, const void *data, size_t size)
{
    assert(data != NULL);

    buffer->_position = 0; // 位置
    buffer->_limit = buffer->_capacity = size;// 结束
    buffer->_fixed = 0;
    buffer->_data = LDNS_XMALLOC(uint8_t, size);
    if(!buffer->_data) {
        buffer->_status = LDNS_STATUS_MEM_ERR;
        return;
    }
    memcpy(buffer->_data, data, size);
    buffer->_status = LDNS_STATUS_OK;

    ldns_buffer_invariant(buffer);
}
```

rd_buf

rdata

Here we see that the _limit parameter is the size of the buffer, so it goes back to the vulnerability location.

```
255   */
256   INLINE uint8_t *
257   ldns_buffer_at(const ldns_buffer *buffer, size_t at)// 漏洞函数
258   {
259       assert(at <= buffer->_limit);// 边界校验问题
260       return buffer->_data + at;
261   }
262
```

Here, when at ==buffer->_limit, the returned value is buffer[buffer->_limit], that is, reading one byte out of bounds Continue to find the source of the variable rdata in ldns_rr_new_frm_str_internal, the source is as follows:

```
254
255       if (ldns_bget_token(rr_buf, rdata, "\0", LDNS_MAX_PACKETLEN) == -1) {
256           /* apparently we are done, and it's only a question RR
257            * so do not set status and go to ldnserror here
258            */
259       }
```

It is read by rr_buf through the ldns_bget_token function, which is an analytic function, and rr_buf is assigned as follows:

```
177
178       ldns_buffer_new_frm_data(rr_buf, (char*)str, strlen(str));
179
180       /* split the rr in its parts -1 signals trouble */
181       if (ldns_bget_token(rr_buf, owner, "\t\n ", LDNS_MAX_DOMAINLEN) == -1){
182
183           status = LDNS_STATUS_SYNTAX_ERR;
184           goto error;
```

It is assigned by str, and str is the second parameter of ldns_rr_new_frm_str_internal as follows:

```
111  */
112 static ldns_status
113 ldns_rr_new_frm_str_internal(ldns_rr **newrr, const char *str,
114                              uint32_t default_ttl, const ldns_rdf *origin,
115                              ldns_rdf **prev, bool question
116 {
117     ldns_rr *new;
118     const ldns_rr_descriptor *desc;
119     ldns_rr_type rr_type;
120     ldns_buffer *rr_buf = NULL;
121     ldns_buffer *rd_buf = NULL;
122     uint32_t ttl_val;
123     char  *owner = NULL;
124     char  *ttl = NULL;
125     ldns_rr_class clas_val;
126     char  *clas = NULL;
```

View the caller of this function:

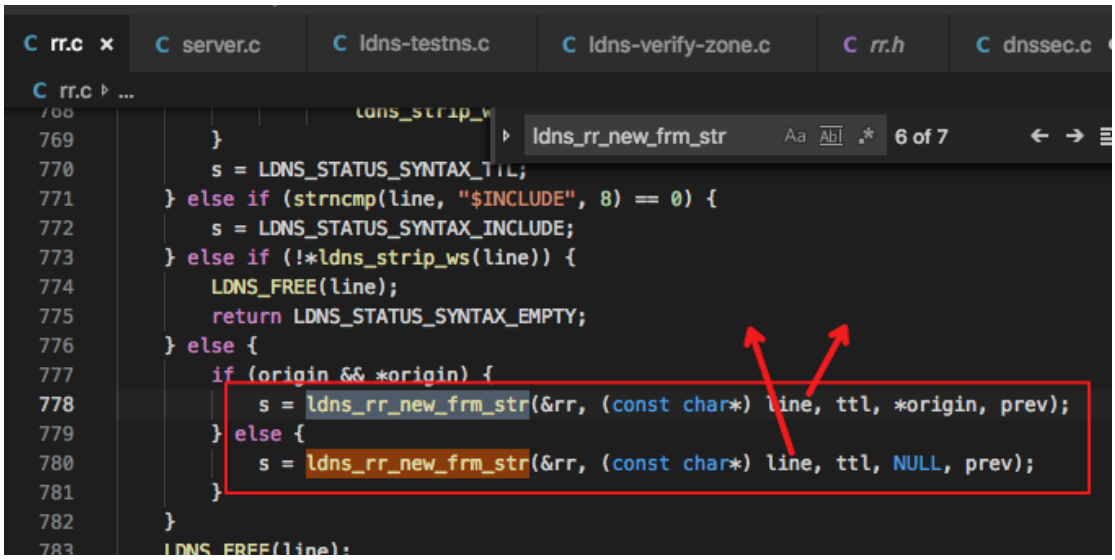
buffer.h | rr.c | parse.c | dnssec.c | buffer.c

rr.c ▸ ...

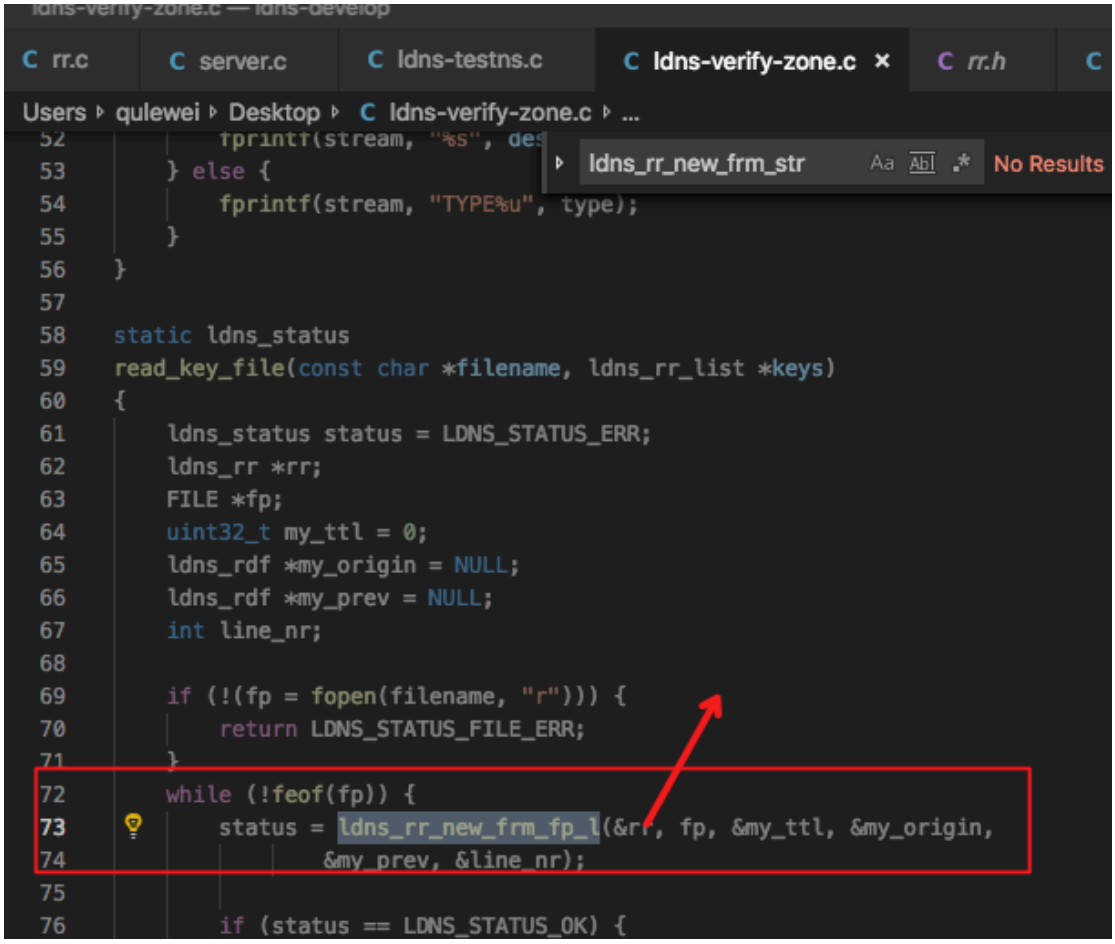
rr_buf

```
661     return status;
662 }
663
664 ldns_status
665 ldns_rr_new_frm_str(ldns_rr **newrr, const char *str,
666                     uint32_t default_ttl, const ldns_rdf *origin,
667                     ldns_rdf **prev)
668 {
669     return ldns_rr_new_frm_str_internal(newrr,
670                                         str,
671                                         default_ttl,
672                                         origin,
673                                         prev,
674                                         false);
675 }
676
677 ldns_status
678 ldns_rr_new_question_frm_str(ldns_rr **newrr, const char *str,// 第二个参数
679                              const ldns_rdf *origin, ldns_rdf **prev)
680 {
681     return ldns_rr_new_frm_str_internal(newrr,
682                                         str,
683                                         0,
684                                         origin,
685                                         prev,
686                                         true);
687 }
```

Look at the caller ldns_rr_new_frm_str function, in ldns-verify-zon.c:



Its caller is: ldns_rr_new_frm_fp_l, which is called in ldns-verify-zone.c as follows:



That is, the final payload is the zone file. In summary: the process is as follows:

a) ldns_rr_new_frm_fp_l read into the zone file for parsing;

b) the parameter is passed to the ldns_rr_new_frm_str function;

c) The parameter is assigned to str by the ldns_rr_new_frm_str_internal function;

d) assign str to rr_buf via the ldns_buffer_new_frm_data function;

e) assign rr_buf to rdata via the ldns_bget_token function;

f) Use ldns_buffer_new_frm_data again to assign rdata to rd_buf

g) Finally, the ldns_buffer_current is called in the loop, and the out-of-bounds access occurs when ldns_buffer_skip is performed.

5. Repair plan

The judgment is made in ldns_rr_new_frm_str_internal as follows:

```
/* skip spaces */
while (ldns_buffer_position(rd_buf) < ldns_buffer_limit(rd_buf) &&
*(ldns_buffer_current(rd_buf)) == ' ') {
ldns_buffer_skip(rd_buf, 1);
}
if (ldns_buffer_position(rd_buf) < ldns_buffer_limit(rd_buf) &&
*(ldns_buffer_current(rd_buf)) == '\"') {
delimiters = "\"\0";
ldns_buffer_skip(rd_buf, 1);
quoted = true;
} else if (ldns_rr_descriptor_field_type(desc, r_cnt)
== LDNS_RDF_TYPE_LONG_STR) {
status = LDNS_STATUS_SYNTAX_RDATA_ERR;
goto error;
}
```

If you want to solve the remaining problems, it is recommended to modify the constraint relationship of _position, _limit, _capacity in buffer.h.