So 文件调试记录：

cmd 输入：

1.Adb forward tcp:23900 tcp:23900　(打开端口转发)

```
C:\Users\zhukeyu>adb forward tcp:23900 tcp:23900
23900
```

2.Adb shell　(打开安卓的 shell)

2.1Cd /data/local/tmp（放着一些常用的需要的工具）

2.2./as64 –p23900

```
C:\Users\zhukeyu>adb shell
sailfish:/ # cd /data/local/tmp
sailfish:/data/local/tmp # ./as64 -p23900
IDA Android 64-bit remote debug server(ST) v1.22. Hex-Rays (c) 2004-2017
Listening on 0.0.0.0:23900...
=========================================================
[1] Accepting connection from 127.0.0.1...
```

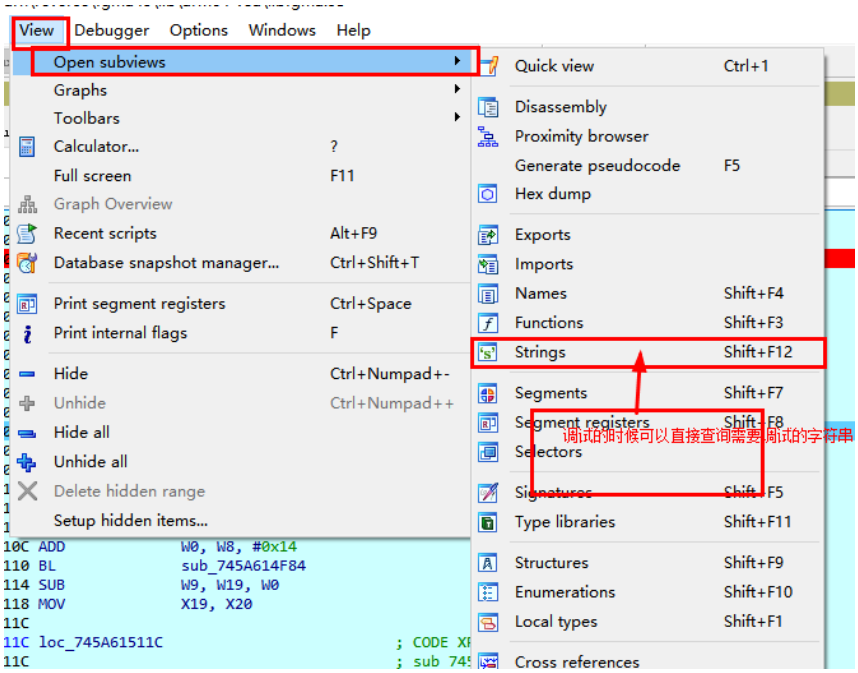
3.Cd /sdcard　(存放包的路径)

/data/local/tmp/tcpdump –I wlan0 –s 0 –w fg_1.pcap(使用 tcpdump 进行抓包)

Adb pull /sdcard/fa_1.pcap

IDA 双开，一个为了静态调试，一个为了动态过程

使用 ida 打开 so 文件，等待加载完成，打开 view->open subviews->strings，可以进行查询字符串。



调试步骤

目标：获取 IP 池

libfgma.so

使用 ida 加载 so 文件,进行 so 文件逆向分析。

Addroid 逆向自由门 app 之静态分析

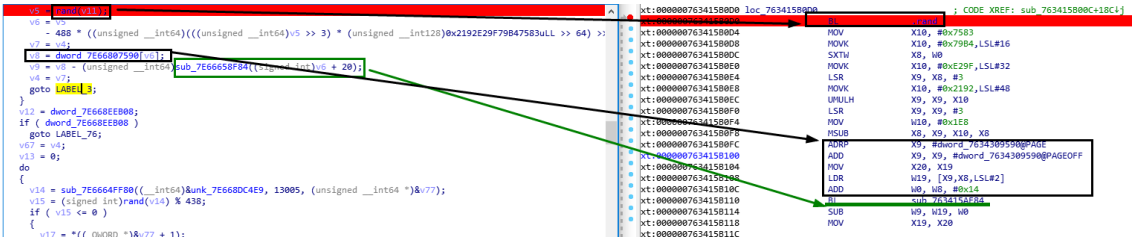
1.先定位到 connect 函数

connect 函数的原型： int connect(int sockfd, const struct sockaddr* server_addr, socklen_t addrlen)　第二个参数是 ip 地址

```
    }
LABEL_3:
    v93 = v9;
    connect(v69, &v92, 16LL);
    __FD_SET_chk(v69, &v94, 128LL);
    ++v4;
    if ( (signed int)v69 > (signed int)v70 )
      v3 = v69 + 1;
```

2.继续向上查找，第二个参数是从哪里获取的?

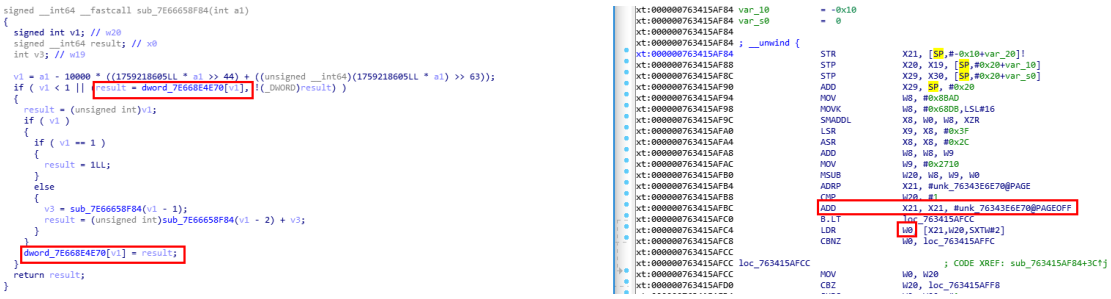
从下图可以看出 v9=v8 – sub_93f84()，v8 是表 dword_242590 中索引为 v6 的值。



```
    v70 = v3;
    v10 = socket(2LL, 1LL, 0LL);
    *(_DWORD *)&v79[4 * v4] = v10;
    if ( v10 == -1 )
      return sub_8B094(v66, &byte_2936BF);
    v69 = v10;
    v11 = sub_9AFE4();
    v92 = -1157562366;
    if ( !(v68 & 1) )
    {
      v5 = rand(v11);
      v6 = v5
         - 488 * ((unsigned __int64)(((unsigned __int64)v5 >> 3) * (unsigned __int128)0x2192E29F79B47583uLL >> 64) >> 3);
      v7 = v4;
      v8 = dword_242590[v6];
      v9 = v8 - (unsigned __int64)sub_93F84((signed int)v6 + 20);
      v4 = v7;
      goto LABEL_3;
    }
    v12 = dword_329B08;
```

3.跳转进函数 sub_93f84()，发现返回值其实是另一张表的值,且索引值是上一张表格加 20

```
    v8 = dword_7E66807590[v6];
    v9 = v8 - (unsigned __int64)sub_7E66658F84((signed int)v6 + 20);
    v4 = v7;
    goto LABEL_3;
  }
```

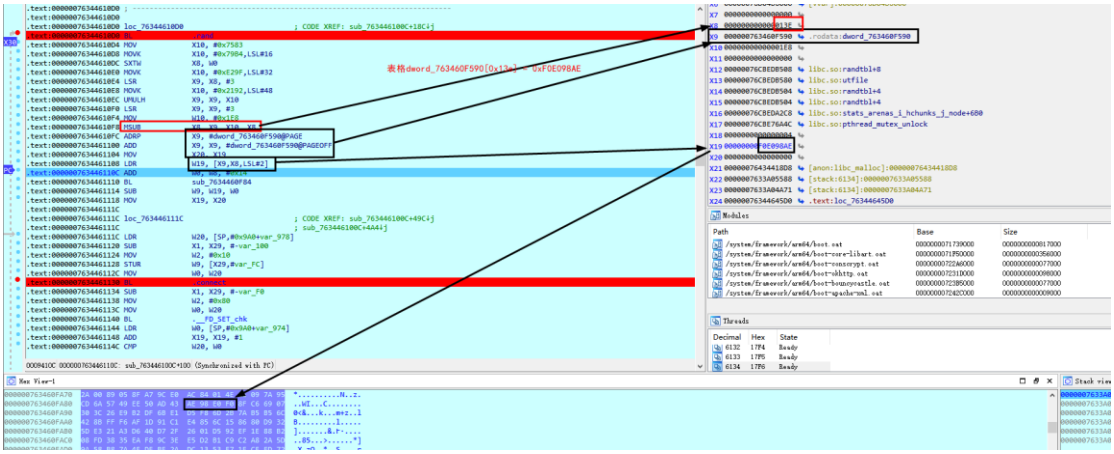


Addroid 逆向自由门 app 之动态调试

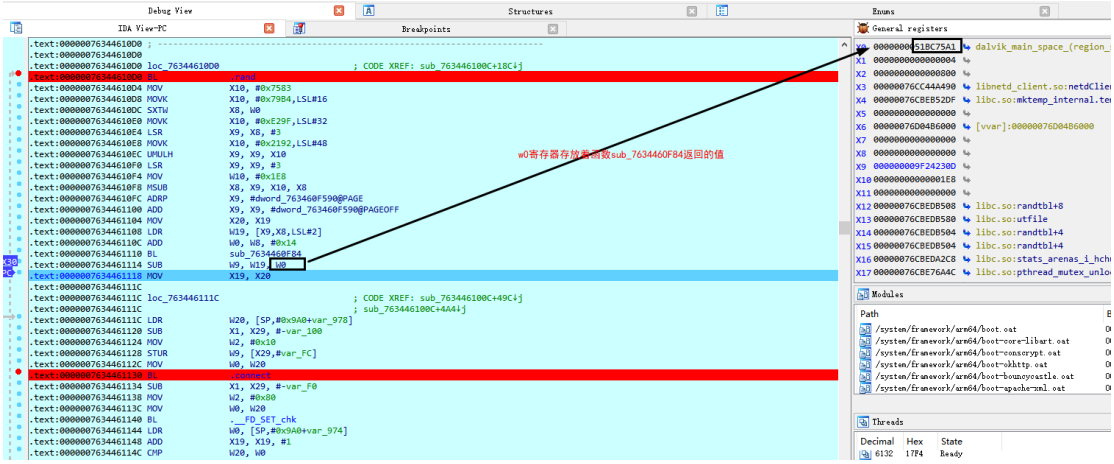
1.设置两个断点

```
.text:000000745A6150D0 loc_745A6150D0                          ; CODE XREF: sub_745A61500C+18C↓
.text:000000745A6150D0 BL              .rand
.text:000000745A6150D4 MOV             X10, #0x7583
.text:000000745A6150D8 MOVK            X10, #0x79B4,LSL#16
.text:000000745A6150DC SXTW            X8, W0
.text:000000745A6150E0 MOVK            X10, #0xE29F,LSL#32
.text:000000745A6150E4 LSR             X9, X8, #3
.text:000000745A6150E8 MOVK            X10, #0x2192,LSL#48
.text:000000745A6150EC UMULH           X9, X9, X10
.text:000000745A6150F0 LSR             X9, X9, #3
.text:000000745A6150F4 MOV             W10, #0x1E8
.text:000000745A6150F8 MSUB            X8, X9, X10, X8
.text:000000745A6150FC ADRP            X9, #dword_745A7C3590@PAGE
.text:000000745A615100 ADD             X9, X9, #dword_745A7C3590@PAGEOFF
.text:000000745A615104 MOV             X20, X19
.text:000000745A615108 LDR             W19, [X9,X8,LSL#2]
.text:000000745A61510C ADD             W0, W8, #0x14
.text:000000745A615110 BL              sub_745A614F84
.text:000000745A615114 SUB             W9, W19, W0
.text:000000745A615118 MOV             X19, X20
.text:000000745A61511C
.text:000000745A61511C loc_745A61511C                          ; CODE XREF: sub_745A61500C+49C↓
.text:000000745A61511C                                         ; sub_745A61500C+4A4↓j
.text:000000745A61511C LDR             W20, [SP,#0x9A0+var_978]
.text:000000745A615120 SUB             X1, X29, #-var_100
.text:000000745A615124 MOV             W2, #0x10
.text:000000745A615128 STUR            W9, [X29,#var_FC]
.text:000000745A61512C MOV             W0, W20
.text:000000745A615130 BL              .connect
.text:000000745A615134 SUB             X1, X29, #-var_F0
.text:000000745A615138 MOV             W2, #0x80
```

2.点击运行，成功断在第一个断点处。继续单步执行，可以看到 x9 寄存器中存放的是从表 dword_242590 获取的值。



3.继续单步执行，然后单步步入函数 sub_93f84()中，通过寄存器 x0 带回返回值。



4.0xf0e098ae – 0x51bc75a1 = 0x9f24230d,执行到下一个断点，查看第二个参数的值为 0x9f24230d,符合预期值。

5.跳转到查看表格 dword_242590 和表格 dword_31fe70 查找到对应位置存放着该值，然后计算 ip 池。

可以看到表格为一个固定的含有 488 个元素的表格。并且由此可以推断 v6 的取值范围为 0-487

```
.bss:0000007DB92E3E70 ; unsigned int dword_7DB92E3E70[10000]
.bss:0000007DB92E3E70 dword_7DB92E3E70 DCD 0, 1, 1, 2, 3, 5, 8, 0xD, 0x15, 0x22, 0x37, 0x59, 0x90, 0xE9, 0x179
.bss:0000007DB92E3E70                                          ; DATA XREF: sub_7DB9057F84+30↑o
.bss:0000007DB92E3E70                                          ; sub_7DB9057F84+38↑o
.bss:0000007DB92E3E70 DCD 0x262, 0x3DB, 0x63D, 0xA18, 0x1055, 0x1A6D, 0x2AC2, 0x452F, 0x6FF1
.bss:0000007DB92E3E70 DCD 0xB520, 0x12511, 0x1DA31, 0x2FF42, 0x4D973, 0x7D8B5, 0xCB228, 0x148ADD
.bss:0000007DB92E3E70 DCD 0x213D05, 0x35C7E2, 0x5704E7, 0x8CCCC9, 0xE3D1B0, 0x1709E79, 0x2547029
.bss:0000007DB92E3E70 DCD 0x3C50EA2, 0x6197ECB, 0x9DE8D6D, 0xFF80C38, 0x19D699A5, 0x29CEA5DD
.bss:0000007DB92E3E70 DCD 0x43A53F82, 0x6D73E55F, 0xB11924E1, 0x1E8D0A40, 0xCFA62F21, 0xEE333961
.bss:0000007DB92E3E70 DCD 0xBDD96882, 0xAC0CA1E3, 0x69E60A65, 0x15F2AC48, 0x7FD8B6AD, 0x95CB62F5
.bss:0000007DB92E3E70 DCD 0x15A419A2, 0xAB6F7C97, 0xC1139639, 0x6C8312D0, 0x2D96A909, 0x9A19BBD9
.bss:0000007DB92E3E70 DCD 0xC7B064E2, 0x61CA20BB, 0x297A859D, 0x8B44A658, 0xB4BF2BF5, 0x4003D24D
.bss:0000007DB92E3E70 DCD 0xF4C2FE42, 0x34C6D08F, 0x2989CED1, 0x5E509F60, 0x87DA6E31, 0xE62B0D91
.bss:0000007DB92E3E70 DCD 0x6E057BC2, 0x54308953, 0xC2360515, 0x16668E68, 0xD89C937D, 0xEF0321E5
.bss:0000007DB92E3E70 DCD 0xC79FB562, 0xB6A2D747, 0x7E428CA9, 0x34E563F0, 0xB327F099, 0xE80D5489
.bss:0000007DB92E3E70 DCD 0x9B354522, 0x834299AB, 0x1E77DECD, 0xA1BA7878, 0xC0325745, 0x61ECCFBD
.bss:0000007DB92E3E70 DCD 0x221F2702, 0x840BF6BF, 0xA62B1DC1, 0x2A371480, 0xD0623241, 0xFA9946C1
.bss:0000007DB92E3E70 DCD 0xCAFB7902, 0xC594BFC3, 0x909038C5, 0x5624F888, 0xE6B5314D, 0x3CDA29D5
.bss:0000007DB92E3E70 DCD 0x238F5B22, 0x606984F7, 0x83F8E019, 0xE4626510, 0x685B4529, 0x4CBDAA39
.bss:0000007DB92E3E70 DCD 0xB518EF62, 0x1D6999B, 0xB6EF88FD, 0xB8C62298, 0x6FB5AB95, 0x287BCE2D
.bss:0000007DB92E3E70 DCD 0x983179C2, 0xC0AD47EF, 0x58DEC1B1, 0x198C09A0, 0x726ACB51, 0x8BF6D4F1
.bss:0000007DB92E3E70 DCD 0xFE61A042, 0x8A587533, 0x88BA1575, 0x13128AA8, 0x9BCCA01D, 0xAEDF2AC5
.bss:0000007DB92E3E70 DCD 0x4AABCAE2, 0xF98AF5A7, 0x4436C089, 0x3DC1B630, 0x81F876B9, 0xBFBA2CE9
.bss:0000007DB92E3E70 DCD 0x41B2A3A2, 0x16CD08B, 0x431F742D, 0x448C44B8, 0x87ABB8E5, 0xCC37FD9D
.bss:0000007DB92E3E70 DCD 0x53E3B682, 0x201BB41F, 0x73FF6AA1, 0x941B1EC0, 0x81A8961, 0x9C35A821
.bss:0000007DB92E3E70 DCD 0xA4503182, 0x4085D9A3, 0xE4D60B25, 0x255BE4C8, 0xA31EFED, 0x2F8DD4B5
.bss:0000007DB92E3E70 DCD 0x39BFC4A2, 0x694D9957, 0xA30D5DF9, 0xC5AF750, 0xAF685549, 0xBBC34C99
.bss:0000007DB92E3E70 DCD 0x6B2BA1E2, 0x26EEEE7B, 0x921A905D, 0xB9097ED8, 0x4B240F35, 0x42D8E0D
.bss:0000007DB92E3E70 DCD 0x4F519D42, 0x537F2B4F, 0xA2D0C891, 0xF64FF3E0, 0x9920BC71, 0x8F70B051
.bss:0000007DB92E3E70 DCD 0x28916CC2, 0xB8021D13, 0xE09389D5, 0x9895A6E8, 0x792930BD, 0x11BED7A5
.bss:0000007DB92E3E70 DCD 0x8AE80862, 0x9CA6E007, 0x278EE869, 0xC435C870, 0xEBC4B0D9, 0xAFFA7949
```

6.由此就可以计算 ip 池

dword_242590[idx] - dword_31FE70[idx+20]就可以获取到 ip 池。

7.继续进行分析，可以看到此处代码分为了两个分支

```
do
{
  v70 = v3;
  v10 = socket(2LL, 1LL, 0LL);
  *(_DWORD *)&v79[4 * v4] = v10;
  if ( v10 == -1 )
    return sub_7E66650094(v66, &byte_7E668586BF);
  v69 = v10;
  v11 = sub_7E6665FFE4();
  v92 = -1157562366;
  if ( !(v68 & 1) )
  {
    v5 = rand(v11);
    v6 = v5
       - 488 * ((unsigned __int64)(((unsigned __int64)v5 >> 3) * (unsigned __int128)0x2192E29F79B47583uLL >> 64) >> 3);
    v7 = v4;
    v8 = dword_7E66807590[v6];
    v9 = v8 - (unsigned __int64)sub_7E66658F84((signed int)v6 + 20);
    v4 = v7;
    goto LABEL_3;
  }
  v12 = dword_7E668EEB08;
  if ( dword_7E668EEB08 )
    goto LABEL_76;
  v67 = v4;
  v13 = 0;
```

1：已经获取到了ip直接跳转进行连接

2：没有获取到ip跳转到域名处

8.第一个分支为上面分析的获取 ip 然后建立连接，第二个分支为获取域名

```
LABEL_3:
    v93 = v9;
    connect(v69, &v92, 16LL);
    __FD_SET_chk(v69, &v94, 128LL);
    ++v4;
    if ( (signed int)v69 > (signed int)v70 )
      v3 = v69 + 1;
    else
      v3 = v70;
  }
LABEL_76:
      v9 = dword_7E668EEB0C[dword_7E668EEB5C];
      dword_7E668EEB5C = dword_7E668EEB5C + 1 - (dword_7E668EEB5C + 1) / v12 * v12;
    }
    else
    {
      v9 = 0;
    }
```

知道ip的地址，connect进行连接，第二个参数为ip地址

9.第二个分支继续向上查找，可以看到域名也是从一个表格中获取的。

```
LABEL_58:
      v35[v30] = 0;
      v73 = v76;
      v72 = *(_OWORD *)&v74;
      if ( v77 & 1 )
        operator delete(v78);
      if ( v72 & 1 )
        v38 = (char *)v73;
      else
        v38 = (char *)&v73 + 1;
      v39 = gethostbyname(v38);
      if ( v39 )
      {
        v40 = *(_DWORD ***)(v39 + 24);
        v41 = *v40;
        if ( *v40 )
        {
          v42 = 0LL;
          v43 = dword_7E668EEB08;
          v44 = &dword_7E668EEB0C[dword_7E668EEB08];
          do
          {
            v44[v42++] = *v41;
            v41 = v40[(unsigned int)v42];
          }
          while ( v41 );
          dword_7E668EEB08 = v43 + v42;
        }
      }
      if ( v72 & 1 )
        operator delete(v73);
      ++v13;
    }
    while ( v13 != 2 );
    v12 = dword_7E668EEB08;
    v4 = v67;
    if ( dword_7E668EEB08 )
    {
```

先获取域名

10.修改指令进行动态调试

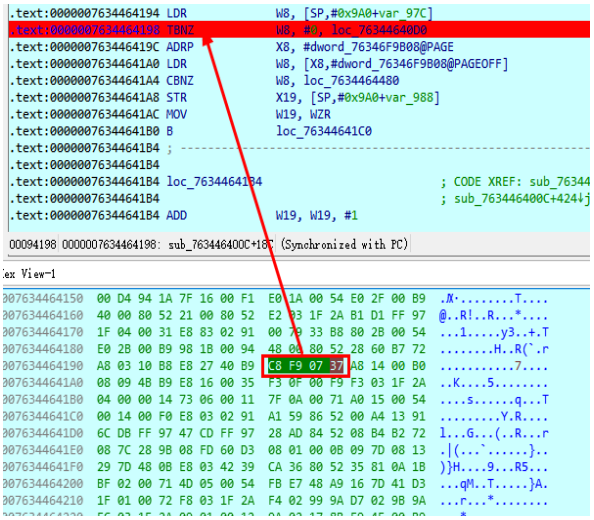
将 TBZ 指令修改为 TBNZ 指令

```
.text:0000007634464190 STUR            W8, [X29,#var_100]
.text:0000007634464194 LDR             W8, [SP,#0x9A0+var_97C]
.text:0000007634464198 TBZ             W8, #0, loc_76344640D0
.text:000000763446419C ADRP            X8, #dword_76346F9B08@PAGE
.text:00000076344641A0 LDR             W8, [X8,#dword_76346F9B08@PAGEOFF]
.text:00000076344641A4 CBNZ            W8, loc_7634464480
.text:00000076344641A8 STR             X19, [SP,#0x9A0+var_988]
.text:00000076344641AC MOV             W19, WZR
.text:00000076344641B0 B               loc_76344641C0
.text:00000076344641B4 ; ---------------------------------------------------------
.text:00000076344641B4
.text:00000076344641B4 loc_7634464184                          ; CODE XREF: sub_7634
.text:00000076344641B4                                         ; sub_763446400C+424↓
.text:00000076344641B4 ADD             W19, W19, #1

00094198 0000007634464198: sub_763446400C+18C (Synchronized with PC)

ox View-1

07634464150  00 D4 94 1A 7F 16 00 F1  E0 7A 00 54 E0 2F 00 B9  .N·........T....
07634464160  40 00 80 52 21 00 80 52  E2 03 1F 2A B1 D1 FF 97  @..R!..R...*....
07634464170  1F 04 00 31 E8 83 02 91  00 79 33 B8 80 2B 00 54  ...1.....y3..+.T
07634464180  E0 2B 00 B9 98 1B 00 94  48 00 80 52 28 60 B7 72  .....H..R(`.r
07634464190  A8 03 10 B8 E8 27 40 B9  C8 F9 07 36 A8 14 00 B0  .........6....
076344641A0  08 09 4B B9 E8 16 00 35  F3 0F 00 F9 F3 03 1F 2A  ..K....5.......
076344641B0  04 00 00 14 73 06 00 11  7F 0A 00 71 A0 15 00 54  ....s......q...T
076344641C0  00 14 00 F0 E8 03 02 91  A1 59 86 52 00 A4 13 91  .........Y.R....
076344641D0  6C DB FF 97 47 CD FF 97  28 AD 84 52 08 B4 B2 72  l...G...(..R...r
076344641E0  08 7C 28 9B 08 FD 60 D3  08 01 00 0B 09 7D 08 13  .|(...`......}..
076344641F0  29 7D 48 0B E8 03 42 39  CA 36 80 52 35 81 0A 1B  )}H....9...R5...
07634464200  BF 02 00 71 4D 05 00 54  FB E7 48 A9 16 7D 41 D3  ...qM..T.....}A.
07634464210  1F 01 00 72 F8 03 1F 2A  F4 02 99 9A D7 02 9B 9A  ...r...*........
```



将断点下在判断的地方，运行可以看到不会再进入 loc_763415A0D0,然后继续运行，可以获取到寄存器 x1 中存放的域名。