ESP8266 Reset Causes and Common Fatal Exception Causes

Version 1.0

About This Guide

This guide introduces the methods to identify the causes of ESP8266 reset and common Fatal exceptions.

The guide structure is as follows:

Chapter	Title	Content
Chapter 1	Reset Causes	Introduction to two methods of identifying ESP8266 reset causes: ROM code and user program.
Chapter 2	Common Fatal Exceptions and Causes	Introduction to common ESP8266 Fatal exceptions and their causes.

Release Notes

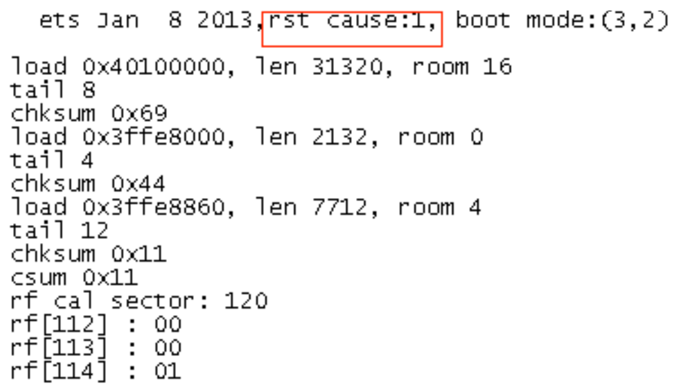
Date	Version	Release notes
2016.08	V1.0	Initial Release.

Table of Contents

1. Reset Causes

1.1. Identifying Reset Cause in ROM Code

Each time ESP8266 reboots, ROM code will print out the number for the reset cause, as the following figure shows. Users can verify the cause of the reset based on the number. Use this debugging method when you can not start the user program and need to analyze the cause of the reset.



```
 ets Jan  8 2013,rst cause:1, boot mode:(3,2)

load 0x40100000, len 31320, room 16
tail 8
chksum 0x69
load 0x3ffe8000, len 2132, room 0
tail 4
chksum 0x44
load 0x3ffe8860, len 7712, room 4
tail 12
chksum 0x11
csum 0x11
rf cal sector: 120
rf[112] : 00
rf[113] : 00
rf[114] : 01
```

The following table shows reset causes printed in ROM code.

Table 1-1. Identifying Reset Cause in ROM Code

Rst cause No.	Cause
0	Undefined
1	Power reboot
2	External reset or wake-up from Deep-sleep
4	Hardware WDT reset

⚠ ***Notice*:**

The reboot state will not change after software WDT reset or software reset. For example, when the first reset is caused by power reboot, rst cause number is 1. After software reset, the rst cause number will still be 1.

1.2. Identifying Reset Cause Using User Program

Users can also identify the reset cause by adding application layer program, which provides relatively comprehensive analysis of the reset cause. Use this method when garbled output is printed where crash occurs and can not be debugged.

Add the following code segment:

```
struct rst_info *rtc_info = system_get_rst_info();

os_printf("reset reason: %x\n", rtc_info->reason);
```

```
            if (rtc_info->reason == REASON_WDT_RST ||

                rtc_info->reason == REASON_EXCEPTION_RST ||

                rtc_info->reason == REASON_SOFT_WDT_RST) {

                if (rtc_info->reason == REASON_EXCEPTION_RST) {

                    os_printf("Fatal exception (%d):\n", rtc_info-
>exccause);

                }

                os_printf("epc1=0x%08x, epc2=0x%08x, epc3=0x%08x,
excvaddr=0x%08x, depc=0x%08x\n",

                        rtc_info->epc1, rtc_info->epc2, rtc_info-
>epc3, rtc_info->excvaddr, rtc_info->depc);//The address of the last
crash is printed, which is used to debug garbled output.

        }
```

For information on `system_get_rst_info()` and associated data structures, please refer to *ESP8266 Non-OS SDK API Reference* and *ESP8266 RTOS SDK API Reference* (link: espressif.com/en/support/download/documents).

The following table shows the reset causes identified by adding user program.

Table 1-2. Identifying Reset Cause Using User Program

Rst cause No.	Cause	GPIO state
0	Power reboot	Changed
1	Hardware WDT reset	Changed
2	Fatal exception	Unchanged
3	Software watchdog reset	Unchanged
4	Software reset	Unchanged
5	Deep-sleep	Changed
6	Hardware reset	Changed

2. Common Fatal Exceptions and Causes

When a program crashes, users can debug the crash based on the Fatal exception number. The following table shows common Fatal exceptions and their possible causes.

Table 2-1. Common Fatal Exceptions and Causes

Fatal exception No.	Description	Possible Causes
0	Invalid command	1. Damaged BIN binaries 2. Wild function pointers
6	Division by zero	Division by zero
9	Unaligned read/write operation addresses	1. Unaligned read/write Cache addresses 2. Wild function pointers
28/29	Access to invalid address	1. Access to Cache after it is turned off 2. Wild function pointers

For example:

```
Fatal exception (28):
epc1=0x4025bfa6, epc2=0x00000000, epc3=0x00000000,
excvaddr=0x0000000f, depc=0x00000000
```

- If ***user1.1024.new.2.bin*** is used, verify the exception address "0x4025bfa6" in ***user1.1024.new.2.S*** file. Add print to user's code to debug the Fatal exception.
- If ***eagle.irom0text.bin*** is used, verify the cause of the Fatal exception in ***eagle.S*** file.
- If the address of exception can not be found, it means that the crash occurs during an interrupt. Or, there is a code problem in ROM, such as
  - *4000e190 <memset>*
  - *4000df48 <memcpy>*
  - *4000dea8 <memcmp>*
  - *4000de84 <bzero>*
  - *4000e1e0 <strstr>*