



# **ESP8266 SDK API Guide**

**Version 1.1.2**

Espressif Systems IOT Team

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## 1. Preambles

ESP8266 WiFi SoC offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, it boots up directly from an external flash. It has integrated cache to improve the performance of the system in such applications. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface.

ESP8266EX is amongst the most integrated WiFi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on-chip SRAM, besides the Wi-Fi functionalities. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs; codes for such applications are provided in examples in the SDK.

Sophisticated system-level features include fast sleep/wake context switching for energy-efficient VoIP, adaptive radio biasing for low-power operation, advanced signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation.

The SDK based on ESP8266 IoT platform offers users an easy, fast and efficient way to develop IoT devices. This programming guide provides overview of the SDK as well as details on the API. It is written for embedded software developers to help them program on ESP8266 IoT platform.



## 2. Overview

The SDK provides a set of interfaces for data receive and transmit functions over the Wi-Fi and TCP/IP layer so programmers can focus on application development on the high level. Users can easily make use of the corresponding interfaces to realize data receive and transmit.

All networking functions on the ESP8266 IoT platform are realized in the library, and are not transparent to users. Instead, users can initialize the interface in `user_main.c`.

`void user_init(void)` is the default method provided. Users can add functions like firmware initialization, network parameters setting, and timer initialization in the interface.

`void user_rf_pre_init(void)` need to be added in `user_main.c` since SDK\_v1.1.0, refer to IOT\_Demo. It is provided for RF initialization. User can call `system_phy_set_rfoption` to set RF option in `user_rf_pre_init`. If RF is disable, ESP8266 station and soft-AP are both disabled.

The SDK provides APIs to handle JSON, and users can also use self-defined data types to handle the them.

Notice:

- Using non-OS SDK which is single-threaded, any task should not occupy CPU too long;
  - ▶ If a task occupied CPU for a long time, ESP8266 can't feed the dog, will cause a watchdog reset;
  - ▶ Task should not occupy CPU more than 10 ms, otherwise may cause Wi-Fi connection break.
- We suggest to use a timer to check periodically.
- Using non-OS SDK, please don't call any function defined with `ICACHE_FLASH_ATTR` in interrupt handler.
- We suggest to use RTOS SDK, RTOS can schedule different tasks.



## 3. Application Programming Interface (APIs)

### 3.1. Software Timer

Timer APIs can be found: `/esp_iot_sdk/include/osapi.h`. Please be noted that `os_timer` APIs listed below are software timer, they are executed in task, so timer callback may not be precisely executed at the right time, it depends on priority. If you need a precise timer, please use hardware timer which will be executed in hardware interrupt, refer to `hw_timer.c`.

- For the same timer, `os_timer_arm` (or `os_timer_arm_us`) cannot be invoked repeatedly. `os_timer_disarm` should be invoked first.
- `os_timer_setfn` can only be invoked when the timer is not enabled, i.e., after `os_timer_disarm` or before `os_timer_arm` (or `os_timer_arm_us`).

#### 1. `os_timer_arm`

**Function:**

Enable a millisecond timer.

**Prototype:**

```
void os_timer_arm (  
    ETSTimer *ptimer,  
    uint32_t milliseconds,  
    bool repeat_flag  
)
```

**Parameters:**

`ETSTimer *ptimer` : Timer structure

`uint32_t milliseconds` : Timing, Unit: millisecond

- ▶ if called `system_timer_reinit`, the maximum value allowed to input is `0x41893`
- ▶ if didn't call `system_timer_reinit`, the maximum value allowed to input is `0xFFFFFFFF`

`bool repeat_flag` : Whether the timer will be invoked repeatedly or not

**Return:**

null



## 2. `os_timer_disarm`

**Function:**

Disarm timer

**Prototype:**

```
void os_timer_disarm (ETSTimer *ptimer)
```

**Parameters:**

`ETSTimer *ptimer` : Timer structure

**Return:**

null

## 3. `os_timer_setfn`

**Function:**

Set timer callback function.

For enabled timer, timer callback has to be set.

**Prototype:**

```
void os_timer_setfn(  
    ETSTimer *ptimer,  
    ETSTimerFunc *pfunction,  
    void *parg  
)
```

**Parameters:**

`ETSTimer *ptimer` : Timer structure

`ETSTimerFunc *pfunction` : timer callback function

`void *parg` : callback function parameter

**Return:**

null

## 4. `system_timer_reinit`

**Function:**

Reinitiate the timer when you need to use microsecond timer

**Notes:**

1. Define `USE_US_TIMER`;
2. Put `system_timer_reinit` at the beginning of `user_init` , in the first sentence.

**Prototype:**

```
void system_timer_reinit (void)
```



**Parameters:**

    null

**Return:**

    null

### 5. `os_timer_arm_us`

**Function:**

    Enable a microsecond timer.

**Notes:**

1. Define `USE_US_TIMER`;
2. Put `system_timer_reinit` at the beginning of `user_init` , in the first sentence.

**Prototype:**

```
void os_timer_arm_us (  
    ETSTimer *ptimer,  
    uint32_t microseconds,  
    bool repeat_flag  
)
```

**Parameters:**

`ETSTimer *ptimer` : Timer structure  
`uint32_t microseconds` : Timing, Unit: microsecond, the minimum value is 0x64, the maximum value allowed to input is 0xFFFFFFFF  
`bool repeat_flag` : Whether the timer will be invoked repeatedly or not

**Return:**

    null

## 3.2. Hardware Timer

Hardware timer APIs can be found in `/esp_iot_sdk/examples/driver_lib/hw_timer.c`. User can use it according to "`readme.txt`" which in folder `driver_lib`.

NOTE:

- if use NMI source, for autoloader timer , parameter `val` of `hw_timer_arm` can't be less than 100.
- if use NMI source, this timer has highest priority, can interrupt other ISR.
- if use FRC1 source, this timer can't interrupt other ISR.
- APIs in `hw_timer.c` can not be called when PWM APIs are using, because they are using the same hardware timer.





### 1. hw\_timer\_init

**Function:**

Initialize the hardware ISR timer

**Prototype:**

```
void hw_timer_init (  
    FRC1_TIMER_SOURCE_TYPE source_type,  
    u8 req  
)
```

**Parameters:**

`FRC1_TIMER_SOURCE_TYPE source_type` : ISR source of timer

`FRC1_SOURCE`, timer use FRC1 ISR as ISR source.

`NMI_SOURCE`, timer use NMI ISR as ISR source.

`u8 req` : 0, not autoloading

1, autoloading mode

**Return:**

none

### 2. hw\_timer\_arm

**Function:**

Set a trigger timer delay to enable this timer.

**Prototype:**

```
void hw_timer_arm (uint32 val)
```

**Parameters:**

`uint32 val` : Timing

- in autoloading mode :
  - For `FRC1_SOURCE`, range : 50 ~ 0x7fffff;
  - For `NMI_SOURCE`, range : 100 ~ 0x7fffff;
- in non autoloading mode, range : 10 ~ 0x7fffff;

**Return:**

none

### 3. hw\_timer\_set\_func

**Function:**

Set timer callback function.



For enabled timer, timer callback has to be set.

**Prototype:**

```
void hw_timer_set_func (void (* user_hw_timer_cb_set)(void) )
```

**Parameters:**

```
void (* user_hw_timer_cb_set)(void) : Timer callback function
```

**Return:**

```
none
```

#### 4. hardware timer example

```
#define REG_READ(_r)      (*(volatile uint32 *) (_r))
#define WDEV_NOW()      REG_READ(0x3ff20c00)
uint32 tick_now2 = 0;
void hw_test_timer_cb(void)
{
    static uint16 j = 0;
    j++;

    if( (WDEV_NOW() - tick_now2) >= 1000000 )
    {
        static u32 idx = 1;
        tick_now2 = WDEV_NOW();
        os_printf("b%u:%d\n", idx++, j);
        j = 0;
    }
}

void ICACHE_FLASH_ATTR user_init(void)
{
    hw_timer_init(FRC1_SOURCE, 1);
    hw_timer_set_func(hw_test_timer_cb);
    hw_timer_arm(100);
}
```



### 3.3. System APIs

#### 1. system\_restore

**Function:**

Reset to default settings of following APIs : `wifi_station_set_auto_connect`, `wifi_set_phy_mode`, `wifi_softap_set_config` related, `wifi_station_set_config` related, `wifi_set_opmode`, and APs information recorded by `#define AP_CACHE`

**Prototype:**

```
void system_restore(void)
```

**Parameters:**

    null

**Return:**

    null

#### 2. system\_restart

**Function:**

Restart

**Prototype:**

```
void system_restart(void)
```

**Parameters:**

    null

**Return:**

    null

#### 3. system\_init\_done\_cb

**Function:**

Call this API in `user_init` to register a system-init-done callback.

**Note:**

`wifi_station_scan` has to be called after system init done and station enable.

**Prototype:**

```
void system_init_done_cb(init_done_cb_t cb)
```

**Parameter:**

`init_done_cb_t cb` : system-init-done callback

**Return:**

    null



**Example:**

```
void to_scan(void) { wifi_station_scan(NULL, scan_done); }  
void user_init(void) {  
    wifi_set_opmode(STATION_MODE);  
    system_init_done_cb(to_scan);  
}
```

#### 4. system\_get\_chip\_id

**Function:**

Get chip ID

**Prototype:**

```
uint32 system_get_chip_id (void)
```

**Parameters:**

NULL

**Return:**

Chip ID

#### 5. system\_get\_vdd33

**Function:**

Measure the power voltage of VDD3P3 pin 3 and 4, unit: 1/1024 V

**Note:**

- `system_get_vdd33` can only be called when TOUT pin is suspended
- The 107th byte in `esp_init_data_default.bin` (0~127byte) is named as "vdd33\_const", when TOUT pin is suspended vdd33\_const must be set as 0xFF, that is 255

**Prototype:**

```
uint16 system_get_vdd33(void)
```

**Parameter:**

none

**Return:**

power voltage of VDD33, unit: 1/1024 V

#### 6. system\_adc\_read

**Function:**

Measure the input voltage of TOUT pin 6, unit: 1/1024 V

**Note:**



- `system_adc_read` is only available when wire TOUT pin to external circuitry, Input Voltage Range restricted to 0 ~ 1.0V.
- The 107th byte in `esp_init_data_default.bin`(0~127byte) is named as "vdd33\_const", and when wire TOUT pin to external circuitry, the vdd33\_const must be set as real power voltage of VDD3P3 pin 3 and 4.
- The range of operating voltage of ESP8266 is 1.8V~3.6V, the unit of vdd33\_const is 0.1V, so effective value range of vdd33\_const is [18, 36].

**Prototype:**

```
uint16 system_adc_read(void)
```

**Parameter:**

none

**Return:**

input voltage of TOUT pin 6, unit: 1/1024 V

## 7. `system_deep_sleep`

**Function:**

Configures chip for deep-sleep mode. When the device is in deep-sleep, it automatically wakes up periodically; the period is configurable. Upon waking up, the device boots up from `user_init`.

**Note:**

- Hardware has to support deep-sleep wake up (`XPD_DCDC` connects to `EXT_RSTB` with 0R).
- `system_deep_sleep(0)`: there is no wake up timer; in order to wakeup, connect a GPIO to pin `RST`, the chip will wake up by a falling-edge on pin `RST`

**Prototype:**

```
void system_deep_sleep(uint32 time_in_us)
```

**Parameters:**

`uint32 time_in_us` : during the time (us) device is in deep-sleep

**Return:**

null



### 8. `system_deep_sleep_set_option`

**Function:**

Call this API before `system_deep_sleep` to set what the chip will do when next deep-sleep wake up.

**Prototype:**

```
bool system_deep_sleep_set_option(uint8 option)
```

**Parameter:**

`uint8 option` :

`deep_sleep_set_option(0)`: Radio calibration after deep-sleep wake up depends on `esp_init_data_default.bin` (0~127byte) byte 108.

`deep_sleep_set_option(1)`: Radio calibration is done after deep-sleep wake up; this increases the current consumption.

`deep_sleep_set_option(2)`: No radio calibration after deep-sleep wake up; this reduces the current consumption.

`deep_sleep_set_option(4)`: Disable RF after deep-sleep wake up, just like modem sleep; this has the least current consumption; the device is not able to transmit or receive data after wake up.

**Return:**

true : succeed

false : fail

### 9. `system_phy_set_rfoption`

**Function:**

Enable RF or not. This API can only be called in `user_rf_pre_init`.

**Note:**

Function `system_phy_set_rfoption` is similar to `system_deep_sleep_set_option`, if they are both called, it will disregard `system_deep_sleep_set_option` which is called before deep-sleep, and refer to `system_phy_set_rfoption` which is called when deep-sleep wake up.

**Prototype:**

```
void system_phy_set_rfoption(uint8 option)
```

**Parameter:**

`uint8 option` :

`system_phy_set_rfoption(0)` : Radio calibration after deep-sleep wake up depends on `esp_init_data_default.bin` (0~127byte) byte 108.

`system_phy_set_rfoption(1)` : Radio calibration is done after deep-sleep wake up; this increases the current consumption.



`system_phy_set_rfoption(2)` : No radio calibration after deep-sleep wake up; this reduces the current consumption.

`system_phy_set_rfoption(4)` : Disable RF after deep-sleep wake up, just like modem sleep; this has the least current consumption; the device is not able to transmit or receive data after wake up.

**Return:**  
none

### 10. `system_phy_set_max_tpw`

**Function:**  
Set maximum value of RF TX Power, unit : 0.25dBm

**Prototype:**  
`void system_phy_set_max_tpw(uint8 max_tpw)`

**Parameter:**  
`uint8 max_tpw` : maximum value of RF Tx Power, unit : 0.25dBm, range [0, 82]  
it can be set refer to the 34th byte (`target_power_qdb_0`) of `esp_init_data_default.bin(0~127byte)`

**Return:**  
none

### 11. `system_phy_set_tpw_via_vdd33`

**Function:**  
Adjust RF TX Power according to VDD33, unit : 1/1024 V

**Note:**  
When TOUT pin is suspended, VDD33 can be got by `system_get_vdd33`;  
When wire TOUT pin to external circuitry, `system_get_vdd33` can not be used.

**Prototype:**  
`void system_phy_set_tpw_via_vdd33(uint16 vdd33)`

**Parameter:**  
`uint16 vdd33` : VDD33, unit : 1/1024V, range [1900, 3300]

**Return:**  
none



## 12. system\_set\_os\_print

**Function:**

Turn on/off print logFunction

**Prototype:**

```
void system_set_os_print (uint8 onoff)
```

**Parameters:**

uint8 onoff

**Note:**

onoff==0: print function off

onoff==1: print function on

**Default:**

print function on

**Return:**

null

## 13. system\_print\_meminfo

**Function:**

Print memory information, including data/rodata/bss/heap

**Prototype:**

```
void system_print_meminfo (void)
```

**Parameters:**

null

**Return:**

null

## 14. system\_get\_free\_heap\_size

**Function:**

Get free heap size

**Prototype:**

```
uint32 system_get_free_heap_size(void)
```

**Parameters:**

null





**Return:**

`uint32` : available heap size

### 15. `system_os_task`

**Function:**

Set up tasks

**Prototype:**

```
bool system_os_task(  
    os_task_t    task,  
    uint8        prio,  
    os_event_t   *queue,  
    uint8        qlen  
)
```

**Parameters:**

`os_task_t task` : task function

`uint8 prio` : task priority. 3 priorities are supported: 0/1/2; 0 is the lowest priority. This means only 3 tasks is allowed to set up.

`os_event_t *queue` : message queue pointer

`uint8 qlen` : message queue depth

**Return:**

true: succeed

false: fail

**Example:**

```
#define SIG_RX      0
#define TEST_QUEUE_LEN  4
os_event_t *testQueue;
void test_task (os_event_t *e) {
    switch (e->sig) {
        case SIG_RX:
            os_printf(sig_rx %c/n, (char)e->par);
            break;
        default:
            break;
    }
}
void task_init(void) {
    testQueue=(os_event_t *)os_malloc(sizeof(os_event_t)*TEST_QUEUE_LEN);
    system_os_task(test_task,USER_TASK_PRI0_0,testQueue,TEST_QUEUE_LEN);
}
```

**16. system\_os\_post**

**Function:** send message to task

**Prototype:**

```
bool system_os_post (
    uint8 prio,
    os_signal_t sig,
    os_param_t par
)
```

**Parameters:**

**uint8 prio** : task priority, corresponding to that you set up  
**os\_signal\_t sig** : message type  
**os\_param\_t par** : message parameters

**Return:**

true: succeed  
false: fail

**Referring to the above example:**

```
void task_post(void) {
    system_os_post(USER_TASK_PRI0_0, SIG_RX, 'a');
}
```

**Printout:**

```
sig_rx a
```



### 17. system\_get\_time

**Function:**

Get system time (us).

**Prototype:**

```
uint32 system_get_time(void)
```

**Parameter:**

null

**Return:**

System time in microsecond.

### 18. system\_get\_rtc\_time

**Function:** Get RTC time, as denoted by the number of RTC clock periods.

**Example:**

If `system_get_rtc_time` returns 10 (it means 10 RTC cycles), and `system_rtc_clock_cal_i_proc` returns 5.75 (means 5.75us per RTC cycle), then the real time is  $10 \times 5.75 = 57.5$  us.

**Note:**

System time will return to zero because of `system_restart`, but RTC still goes on.

- reset by pin `EXT_RST` : RTC memory won't change, RTC timer returns to zero
- watchdog reset : RTC memory won't change, RTC timer won't change
- `system_restart` : RTC memory won't change, RTC timer won't change
- power on : RTC memory is random value, RTC timer starts from zero
- reset by pin `CHIP_EN` : RTC memory is random value, RTC timer starts from zero

**Prototype:**

```
uint32 system_get_rtc_time(void)
```

**Parameter:**

null

**Return:**

RTC time

### 19. system\_rtc\_clock\_cal\_i\_proc

**Function:**

Get RTC clock period.



**Note:**

RTC clock period has decimal part.

RTC clock period will change according to temperature, so RTC timer is not very precise.

**Prototype:**

```
uint32 system_rtc_clock_cal_i_proc(void)
```

**Parameter:**

null

**Return:**

RTC clock period (in us), bit11~ bit0 are decimal. ((RTC\_CAL \* 100)>> 12 )

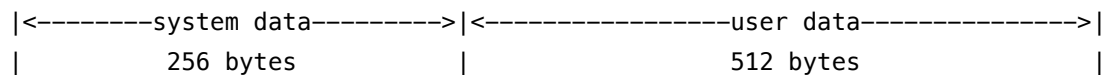
**Note:**

see RTC demo in Appendix.

## 20. system\_rtc\_mem\_write

**Function:**

During deep sleep, only RTC still working, so maybe we need to save some user data in RTC memory. Only user data area can be used by user.



**Note:**

RTC memory is 4 bytes aligned for read and write operations. Parameter `des_addr` means block number(4 bytes per block). So, if we want to save some data at the beginning of user data area, `des_addr` will be  $256/4 = 64$ , `save_size` will be data length.

**Prototype:**

```
bool system_rtc_mem_write (  
    uint32 des_addr,  
    void * src_addr,  
    uint32 save_size  
)
```

**Parameter:**

`uint32 des_addr` : destination address (block number) in RTC memory,  
`des_addr >= 64`  
`void * src_addr` : data pointer.  
`uint32 save_size` : data length ( byte)



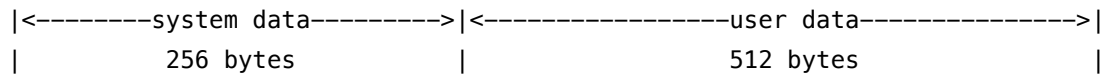
**Return:**

true: succeed  
false: fail

**21. system\_rtc\_mem\_read**

**Function:**

Read user data from RTC memory. Only user data area should be accessed by the user.



**Note:**

RTC memory is 4 bytes aligned for read and write operations. Parameter src\_addr means block number(4 bytes per block). So, to read data from the beginning of user data area, src\_addr will be 256/4=64, save\_size will be data length.

**Prototype:**

```
bool system_rtc_mem_read (  
    uint32 src_addr,  
    void * des_addr,  
    uint32 save_size  
)
```

**Parameter:**

uint32 src\_addr : source address (block number) in rtc memory, src\_addr >= 64  
void \* des\_addr : data pointer  
uint32 save\_size : data length, byte

**Return:**

true: succeed  
false: fail

**22. system\_uart\_swap**

**Function:**

UART0 swap. Use MTCK as UART0 RX, MTDO as UART0 TX, so ROM log will not output from this new UART0. We also need to use MTDO (U0CTS) and MTCK (U0RTS) as UART0 in hardware.

**Prototype:**

```
void system_uart_swap (void)
```



**Parameter:**

null

**Return:**

null

### 23. system\_uart\_de\_swap

**Function:**

Disable UART0 swap. Use original UART0, not MTCK and MTDO.

**Prototype:**

```
void system_uart_de_swap (void)
```

**Parameter:**

null

**Return:**

null

### 24. system\_get\_boot\_version

**Function:**

Get version info of boot

**Prototype:**

```
uint8 system_get_boot_version (void)
```

**Parameter:**

null

**Return:**

Version info of boot.

**Note:**

If boot version  $\geq 3$  , you could enable boot enhance mode (refer to [system\\_restart\\_enhance](#))

### 25. system\_get\_userbin\_addr

**Function:** Get address of the current running user bin (user1.bin or user2.bin).

**Prototype:**

```
uint32 system_get_userbin_addr (void)
```

**Parameter:**

null



**Return:**

Start address info of the current running user bin.

### 26. system\_get\_boot\_mode

**Function:** Get boot mode.

**Prototype:**

```
uint8 system_get_boot_mode (void)
```

**Parameter:**

null

**Return:**

```
#define SYS_BOOT_ENHANCE_MODE 0  
#define SYS_BOOT_NORMAL_MODE 1
```

**Note:**

Enhance boot mode: can load and run FW at any address;  
Normal boot mode: can only load and run normal user1.bin (or user2.bin).

### 27. system\_restart\_enhance

**Function:**

Restarts system, and enters enhance boot mode.

**Prototype:**

```
bool system_restart_enhance(  
    uint8 bin_type,  
    uint32 bin_addr  
)
```

**Parameter:**

```
uint8 bin_type : type of bin  
#define SYS_BOOT_NORMAL_BIN 0 // user1.bin or user2.bin  
#define SYS_BOOT_TEST_BIN 1 // can only be Espressif test bin  
uint32 bin_addr : start address of bin file
```

**Return:**

true: succeed  
false: Fail

**Note:**

`SYS_BOOT_TEST_BIN` is for factory test during production; you can apply for the test bin from Espressif Systems.



### 28. `system_update_cpu_freq`

**Function:**

Set CPU frequency. Default is 80MHz.

**Prototype:**

```
bool system_update_cpu_freq(uint8 freq)
```

**Parameter:**

```
uint8 freq : CPU frequency
#define SYS_CPU_80MHz 80
#define SYS_CPU_160MHz 160
```

**Return:**

```
true: succeed
false: fail
```

### 29. `system_get_cpu_freq`

**Function:**

Get CPU frequency.

**Prototype:**

```
uint8 system_get_cpu_freq(void)
```

**Parameter:**

```
null
```

**Return:**

```
CPU frequency, unit : MHz.
```

### 30. `system_get_flash_size_map`

**Function:**

Get current flash size and flash map.

Flash map depends on the selection when compiling, more details in document "2A-ESP8266\_\_IOT\_SDK\_User\_Manual"

**Structure:**

```
enum flash_size_map {
    FLASH_SIZE_4M_MAP_256_256 = 0,
    FLASH_SIZE_2M,
    FLASH_SIZE_8M_MAP_512_512,
    FLASH_SIZE_16M_MAP_512_512,
```





```
FLASH_SIZE_32M_MAP_512_512,  
FLASH_SIZE_16M_MAP_1024_1024,  
FLASH_SIZE_32M_MAP_1024_1024  
};
```

**Prototype:**

```
enum flash_size_map system_get_flash_size_map(void)
```

**Parameter:**

none

**Return:**

flash map

### 31. system\_get\_rst\_info

**Function:**

Get information about current startup.

**Structure:**

```
enum rst_reason {  
    REANSON_DEFAULT_RST      = 0,    // normal startup by power on  
    REANSON_WDT_RST          = 1,    // hardware watch dog reset  
    // exception reset, GPIO status won't change  
    REANSON_EXCEPTION_RST    = 2,  
    // software watch dog reset, GPIO status won't change  
    REANSON_SOFT_WDT_RST     = 3,  
    // software restart ,system_restart , GPIO status won't change  
    REANSON_SOFT_RESTART     = 4,  
    REANSON_DEEP_SLEEP_AWAKE = 5,    // wake up from deep-sleep  
};  
  
struct rst_info {  
    uint32 reason;    // enum rst_reason  
    uint32 exccause;  
    uint32 epc1;  
    uint32 epc2;  
    uint32 epc3;  
    uint32 excvaddr;  
    uint32 depc;
```



```
};
```

**Prototype:**

```
struct rst_info* system_get_rst_info(void)
```

**Parameter:**

none

**Return:**

Information about startup.

### 32. os\_memset

**Function:**

Set value of memory

**Prototype:**

```
os_memset(void *s, int ch, size_t n)
```

**Parameter:**

`void *s` - pointer of memory

`int ch` - set value

`size_t n` - size

**Return:**

none

**Example:**

```
uint8 buffer[32];  
os_memset(buffer, 0, sizeof(buffer));
```

### 33. os\_memcpy

**Function:**

copy memory

**Prototype:**

```
os_memcpy(void *des, void *src, size_t n)
```

**Parameter:**

`void *des` - pointer of destination

`void *src` - pointer of source

`size_t n` - memory size



**Return:**

none

**Example:**

```
uint8 buffer[4] = {0};  
os_memcpy(buffer, "abcd", 4);
```

### 34. os\_strlen

**Function:**

Get string length

**Prototype:**

```
os_strlen(char *s)
```

**Parameter:**

char \*s – string

**Return:**

string length

**Example:**

```
char *ssid = "ESP8266";  
os_memcpy(softAP_config.ssid, ssid, os_strlen(ssid));
```

### 35. os\_printf

**Function:**

print format

**Note:**

Default to be output from UART 0. `uart_init` in `IOT_Demo` can set baud rate of UART, and `os_install_putc1((void *)uart1_write_char)` in it will set `os_printf` to be output from UART 1.

**Prototype:**

```
os_printf(const char *s)
```

**Parameter:**

const char \*s – string

**Return:**

none

**Example:**

```
os_printf("SDK version: %s \n", system_get_sdk_version());
```



### 36. `os_bzero`

**Function:**

Set the first `n` bytes of string `p` to be `0`, include `'\0'`

**Prototype:**

```
void os_bzero(void *p, size_t n)
```

**Parameter:**

`void *p` - pointer of memory need to be set `0`  
`size_t n` - length

**Return:**

none

### 37. `os_delay_us`

**Function:**

Time delay, max : 65535 us

**Prototype:**

```
void os_delay_us(uint16 us)
```

**Parameter:**

`uint16 us` - time, unit: us

**Return:**

none

### 38. `os_install_putc1`

**Function:**

Register print output function.

**Prototype:**

```
void os_install_putc1(void(*p)(char c))
```

**Parameter:**

`void(*p)(char c)` - pointer of print function

**Return:**

none

**Example:**

`os_install_putc1((void *)uart1_write_char)` in `uart_init` will set `os_printf` to be output from UART 1, otherwise, `os_printf` default output from UART 0.



### 3.4. SPI Flash Related APIs

#### 1. spi\_flash\_get\_id

**Function:**

Get ID info of spi flash

**Prototype:**

```
uint32 spi_flash_get_id (void)
```

**Parameters:**

null

**Return:**

SPI flash ID

#### 2. spi\_flash\_erase\_sector

**Function:**

Erase sector in flash

**Note:**

More details in document Espressif IOT Flash RW Operation

**Prototype:**

```
SpiFlashOpResult spi_flash_erase_sector (uint16 sec)
```

**Parameters:**

`uint16 sec` : Sector number, the count starts at sector 0, 4KB per sector.

**Return:**

```
typedef enum{
    SPI_FLASH_RESULT_OK,
    SPI_FLASH_RESULT_ERR,
    SPI_FLASH_RESULT_TIMEOUT
} SpiFlashOpResult;
```

#### 3. spi\_flash\_write

**Function:**

Write data to flash. Flash read/write has to be 4-bytes aligned.

**Note:**

More details in document Espressif IOT Flash RW Operation

**Prototype:**

```
SpiFlashOpResult spi_flash_write (  
    uint32 des_addr,  
    uint32 *src_addr,  
    uint32 size  
)
```

**Parameters:**

```
uint32 des_addr : destination address in flash.  
uint32 *src_addr : source address of the data.  
uint32 size      : length of data
```

**Return:**

```
typedef enum{  
    SPI_FLASH_RESULT_OK,  
    SPI_FLASH_RESULT_ERR,  
    SPI_FLASH_RESULT_TIMEOUT  
} SpiFlashOpResult;
```

#### 4. spi\_flash\_read

**Function:**

Read data from flash. Flash read/write has to be 4-bytes aligned.

**Prototype:**

```
SpiFlashOpResult spi_flash_read(  
    uint32 src_addr,  
    uint32 * des_addr,  
    uint32 size  
)
```

**Parameters:**

```
uint32 src_addr: source address in flash  
uint32 *des_addr: destination address to keep data.  
uint32 size:     length of data
```

**Return:**

```
typedef enum {  
    SPI_FLASH_RESULT_OK,  
    SPI_FLASH_RESULT_ERR,  
    SPI_FLASH_RESULT_TIMEOUT  
} SpiFlashOpResult;
```

**Example:**

```
uint32 value;
```



```
uint8 *addr = (uint8 *)&value;

spi_flash_read(0x3E * SPI_FLASH_SEC_SIZE, (uint32 *)addr, 4);

os_printf("0x3E sec:%02x%02x%02x%02x\r\n", addr[0], addr[1], addr[2],
addr[3]);
```

### 5. system\_param\_save\_with\_protect

**Function:**

Write data into flash with protection. Flash read/write has to be 4-bytes aligned.

Protection of flash read/write : use 3 sectors (4KBytes per sector) to save 4KB data with protect, sector 0 and sector 1 are data sectors, back up each other, save data alternately, sector 2 is flag sector, point out which sector is keeping the latest data, sector 0 or sector 1.

**Note:**

More details about protection of flash read/write in document “99A-SDK-Espressif IOT Flash RW Operation” <http://bbs.espressif.com/viewtopic.php?f=21&t=413>

**Prototype:**

```
bool system_param_save_with_protect (
    uint16 start_sec,
    void *param,
    uint16 len
)
```

**Parameter:**

**uint16 start\_sec** : start sector (sector 0) of the 3 sectors which used for flash read/write protection.

For example, in IOT\_Demo we could use the 3 sectors (3 \* 4KB) starts from flash 0x3D000 for flash read/write protection, so the parameter **start\_sec** should be 0x3D

**void \*param** : pointer of data need to save

**uint16 len** : data length, should less than a sector which is 4 \* 1024

**Return:**

true, succeed;

false, fail



## 6. system\_param\_load

**Function:**

Read data which saved into flash with protection. Flash read/write has to be 4-bytes aligned.

Protection of flash read/write : use 3 sectors (4KBytes per sector) to save 4KB data with protect, sector 0 and sector 1 are data sectors, back up each other, save data alternately, sector 2 is flag sector, point out which sector is keeping the latest data, sector 0 or sector 1.

**Note:**

More details about protection of flash read/write in document “99A-SDK-Espressif IOT Flash RW Operation” <http://bbs.espressif.com/viewtopic.php?f=21&t=413>

**Prototype:**

```
bool system_param_load (  
    uint16 start_sec,  
    uint16 offset,  
    void *param,  
    uint16 len  
)
```

**Parameter:**

`uint16 start_sec` : start sector (sector 0) of the 3 sectors which used for flash read/write protection. It can not sector 1 or sector 2.

For example, in IOT\_Demo we could use the 3 sectors (3 \* 4KB) starts from flash 0x3D000 for flash read/write protection, so the parameter `start_sec` is 0x3D, can not be 0x3E or 0x3F.

`uint16 offset` : offset of data saved in sector  
`void *param` : data pointer  
`uint16 len` : data length,  $offset + len \leq 4 * 1024$

**Return:**

true, succeed;  
false, fail

## 7. spi\_flash\_set\_read\_func

**Function:**

Register user-define SPI flash read API.

**Note:**





This API can be only used in SPI overlap mode, please refer to `esp_iot_sdk`  
`\examples\driver_lib\driver\spi_overlap.c`

**Prototype:**

```
void spi_flash_set_read_func (user_spi_flash_read read)
```

**Parameter:**

`user_spi_flash_read read` : user-define SPI flash read API

**Parameter Definition:**

```
typedef SpiFlashOpResult (*user_spi_flash_read)(  
    SpiFlashChip *spi,  
    uint32 src_addr,  
    uint32 * des_addr,  
    uint32 size  
)
```

**Return:**

none



### 3.5. Wi-Fi Related APIs

`wifi_station` APIs and other APIs which set/get configuration of ESP8266 station can only be called if ESP8266 station is enabled.

`wifi_softap` APIs and other APIs which set/get configuration of ESP8266 soft-AP can only be called if ESP8266 soft-AP is enabled.

Flash system parameter area is the last 16KB of flash.

#### 1. `wifi_get_opmode`

**Function:**

get WiFi current operating mode

**Prototype:**

```
uint8 wifi_get_opmode (void)
```

**Parameters:**

null

**Return:**

WiFi working modes:

0x01: station mode

0x02: soft-AP mode

0x03: station+soft-AP

#### 2. `wifi_get_opmode_default`

**Function:**

get WiFi operating mode that saved in flash

**Prototype:**

```
uint8 wifi_get_opmode_default (void)
```

**Parameters:**

null

**Return:**

WiFi working modes:

0x01: station mode

0x02: soft-AP mode

0x03: station+soft-AP



### 3. `wifi_set_opmode`

**Function:**

Sets WiFi working mode as station, soft-AP or station+soft-AP, and save it to flash. Default is soft-AP mode.

**Note:**

Versions before `esp_iot_sdk_v0.9.2`, need to call `system_restart()` after this api; after `esp_iot_sdk_v0.9.2`, need not to restart.

This configuration will be saved in flash system parameter area if changed.

**Prototype:**

```
bool wifi_set_opmode (uint8 opmode)
```

**Parameters:**

`uint8 opmode`: WiFi operating modes:  
0x01: station mode  
0x02: soft-AP mode  
0x03: station+soft-AP

**Return:**

true: succeed  
false: fail

### 4. `wifi_set_opmode_current`

**Function:**

Sets WiFi working mode as station, soft-AP or station+soft-AP, and won't save to flash

**Prototype:**

```
bool wifi_set_opmode_current (uint8 opmode)
```

**Parameters:**

`uint8 opmode`: WiFi operating modes:  
0x01: station mode  
0x02: soft-AP mode  
0x03: station+soft-AP

**Return:**

true: succeed  
false: fail

### 5. `wifi_station_get_config`

**Function:**

Get WiFi station current configuration



**Prototype:**

```
bool wifi_station_get_config (struct station_config *config)
```

**Parameters:**

```
struct station_config *config : WiFi station configuration pointer
```

**Return:**

```
true: succeed  
false: fail
```

## 6. `wifi_station_get_config_default`

**Function:**

Get WiFi station configuration that saved in flash

**Prototype:**

```
bool wifi_station_get_config_default (struct station_config *config)
```

**Parameters:**

```
struct station_config *config : WiFi station configuration pointer
```

**Return:**

```
true: succeed  
false: fail
```

## 7. `wifi_station_set_config`

**Function:**

Set WiFi station configuration, and save it to flash

**Note:**

- This API can be called only if ESP8266 station is enabled.
- If `wifi_station_set_config` is called in `user_init`, there is no need to call `wifi_station_connect` after that, ESP8266 will connect to router automatically; otherwise, need `wifi_station_connect` to connect.
- In general, `station_config.bssid_set` need to be 0, otherwise it will check bssid which is the MAC address of AP.
- This configuration will be saved in flash system parameter area if changed.

**Prototype:**

```
bool wifi_station_set_config (struct station_config *config)
```

**Parameters:**

`struct station_config *config`: WiFi station configuration pointer

**Return:**

true: succeed

false: fail

**Example:**

```
void ICACHE_FLASH_ATTR
user_set_station_config(void)
{
    char ssid[32] = SSID;
    char password[64] = PASSWORD;
    struct station_config stationConf;

    stationConf.bssid_set = 0; //need not check MAC address of AP

    os_memcpy(&stationConf.ssid, ssid, 32);
    os_memcpy(&stationConf.password, password, 64);
    wifi_station_set_config(&stationConf);
}

void user_init(void)
{
    wifi_set_opmode(STATIONAP_MODE); //Set softAP + station mode
    user_set_station_config();
}
```

## 8. `wifi_station_set_config_current`

**Function:**

Set WiFi station configuration, won't save to flash

**Note:**

- This API can be called only if ESP8266 station is enabled.
- If `wifi_station_set_config_current` is called in `user_init`, there is no need to call `wifi_station_connect` after that, ESP8266 will connect to router automatically; otherwise, need `wifi_station_connect` to connect.
- In general, `station_config.bssid_set` need to be 0, otherwise it will check bssid which is the MAC address of AP.

**Prototype:**

```
bool wifi_station_set_config_current (struct station_config *config)
```



**Parameters:**

`struct station_config *config`: WiFi station configuration pointer

**Return:**

true: succeed  
false: fail

### 9. `wifi_station_connect`

**Function:**

To connect WiFi station to AP

**Note:**

- If ESP8266 has already connected to a router, then we need to call `wifi_station_disconnect` first, before calling `wifi_station_connect`.
- Do not call this API in `user_init`. This API need to be called after system initialize done and ESP8266 station enable.

**Prototype:**

`bool wifi_station_connect (void)`

**Parameters:**

null

**Return:**

true: succeed  
false: fail

### 10. `wifi_station_disconnect`

**Function:**

Disconnects WiFi station from AP

**Note:**

Do not call this API in `user_init`. This API need to be called after system initialize done and ESP8266 station enable.

**Prototype:**

`bool wifi_station_disconnect (void)`

**Parameters:**

null

**Return:**

true: succeed  
false: fail



### 11. wifi\_station\_get\_connect\_status

**Function:**

Get connection status of WiFi station to AP

**Prototype:**

```
uint8 wifi_station_get_connect_status (void)
```

**Parameters:**

null

**Return:**

```
enum{
    STATION_IDLE = 0,
    STATION_CONNECTING,
    STATION_WRONG_PASSWORD,
    STATION_NO_AP_FOUND,
    STATION_CONNECT_FAIL,
    STATION_GOT_IP
};
```

### 12. wifi\_station\_scan

**Function:**

Scan all available APs

**Note:**

Do not call this API in `user_init`. This API need to be called after system initialize done and ESP8266 station enable.

**Prototype:**

```
bool wifi_station_scan (struct scan_config *config, scan_done_cb_t cb);
```

**Structure:**

```
struct scan_config {
    uint8 *ssid;        // AP's ssid
    uint8 *bssid;       // AP's bssid
    uint8 channel;      //scan a specific channel
    uint8 show_hidden; //scan APs of which ssid is hidden.
};
```

**Parameters:**

```
struct scan_config *config: AP config for scan
if config==null: scan all APs
if config.ssid==null && config.bssid==null && config.channel!=null:
    ESP8266 will scan the specific channel.
scan_done_cb_t cb: callback function after scan
```



**Return:**

true: succeed  
false: fail

### 13. scan\_done\_cb\_t

**Function:**

Callback function for wifi\_station\_scan

**Prototype:**

```
void scan_done_cb_t (void *arg, STATUS status)
```

**Parameters:**

`void *arg`: information of APs that be found, refer to struct `bss_info`  
`STATUS status`: get status

**Return:**

null

**Example:**

```
wifi_station_scan(&config, scan_done);  
static void ICACHE_FLASH_ATTR scan_done(void *arg, STATUS status) {  
    if (status == OK) {  
        struct bss_info *bss_link = (struct bss_info *)arg;  
        bss_link = bss_link->next.stqe_next; //ignore first  
        ...  
    }  
}
```

### 14. wifi\_station\_ap\_number\_set

**Function:**

Sets the number of APs that will be cached for ESP8266 station mode.  
Whenever ESP8266 station connects to an AP, it keeps caches a record of this AP's SSID and password. The cached ID index starts from 0.

**Note:**

This configuration will be saved in flash system parameter area if changed.

**Prototype:**

```
bool wifi_station_ap_number_set (uint8 ap_number)
```

**Parameters:**

`uint8 ap_number`: the number of APs can be recorded (MAX: 5)





**Return:**

true: succeed  
false: fail

### 15. wifi\_station\_get\_ap\_info

**Function:**

Get information of APs recorded by ESP8266 station.

**Prototype:**

```
uint8 wifi_station_get_ap_info(struct station_config config[])
```

**Parameters:**

`struct station_config config[]`: information of APs, array size has to be 5.

**Return:**

The number of APs recorded.

**Example:**

```
struct station_config config[5];  
int i = wifi_station_get_ap_info(config);
```

### 16. wifi\_station\_ap\_change

**Function:**

Switch ESP8266 station connection to AP as specified

**Prototype:**

```
bool wifi_station_ap_change (uint8 new_ap_id)
```

**Parameters:**

`uint8 new_ap_id` : AP's record id, start counting from 0.

**Return:**

true: succeed  
false: fail

### 17. wifi\_station\_get\_current\_ap\_id

**Function:**

Get the current record id of AP.

**Prototype:**

```
uint8 wifi_station_get_current_ap_id ();
```

**Parameter:**

null



**Return:**

The index of the AP, which ESP8266 is currently connected to, in the cached AP list.

### 18. `wifi_station_get_auto_connect`

**Function:**

Checks if ESP8266 station mode will connect to AP (which is cached) automatically or not when it is powered on.

**Prototype:**

```
uint8 wifi_station_get_auto_connect(void)
```

**Parameter:**

    null

**Return:**

    0:     will not connect to AP automatically;  
    Non-0: will connect to AP automatically.

### 19. `wifi_station_set_auto_connect`

**Function:**

Set whether ESP8266 station will connect to AP (which is recorded) automatically or not when power on. Default to enable auto-connect.

**Note:**

Call this API in `user_init`, it is effective in this current power on; call it in other place, it will be effective in next power on.

This configuration will be saved in flash system parameter area if changed.

**Prototype:**

```
bool wifi_station_set_auto_connect(uint8 set)
```

**Parameter:**

    uint8 set: Automatically connect or not:  
        0: will not connect automatically  
        1: to connect automatically

**Return:**

    true: succeed  
    false: fail

### 20. `wifi_station_dhcpc_start`

**Function:**

Enable ESP8266 station DHCP client.



**Note:**

DHCP default enable.

This configuration interacts with static IP API ([wifi\\_set\\_ip\\_info](#)):

If enable DHCP, static IP will be disabled;

If enable static IP, DHCP will be disabled;

This will depend on the last configuration.

**Prototype:**

```
bool wifi_station_dhcpc_start(void)
```

**Parameter:**

null

**Return:**

true: succeed

false: fail

## 21. [wifi\\_station\\_dhcpc\\_stop](#)

**Function:**

Disable ESP8266 station DHCP client.

**Note:**

DHCP default enable.

**Prototype:**

```
bool wifi_station_dhcpc_stop(void)
```

**Parameter:**

null

**Return:**

true: succeed

false: fail

## 22. [wifi\\_station\\_dhcpc\\_status](#)

**Function:** Get ESP8266 station DHCP client status.

**Prototype:**

```
enum dhcp_status wifi_station_dhcpc_status(void)
```

**Parameter:**

null



**Return:**

```
enum dhcp_status {  
    DHCP_STOPPED,  
    DHCP_STARTED  
};
```

### 23. wifi\_station\_set\_reconnect\_policy

**Function:**

Set whether reconnect or not when ESP8266 station disconnected from AP

**Note:**

We suggest to call this API in `user_init`

This API can only be called when ESP8266 station enable.

**Prototype:**

```
bool wifi_station_set_reconnect_policy(bool set)
```

**Parameter:**

`bool set` - true, enable reconnect; false, disable reconnect

**Return:**

true: succeed

false: fail

### 24. wifi\_station\_get\_rssi

**Function:**

Get rssi of the AP which ESP8266 station connected to

**Prototype:**

```
sint8 wifi_station_get_rssi(void)
```

**Parameter:**

none

**Return:**

< 0 : succeed, return rssi

31 : fail, return error code



### 25. `wifi_station_set_hostname`

**Function:**

Set ESP8266 station DHCP hostname

**Prototype:**

```
bool wifi_station_set_hostname(char* hostname)
```

**Parameter:**

`char* hostname` : hostname, max length: 32

**Return:**

true: succeed

false: fail

### 26. `wifi_station_get_hostname`

**Function:**

Get ESP8266 station DHCP hostname

**Prototype:**

```
char* wifi_station_get_hostname(void)
```

**Parameter:**

none

**Return:**

hostname

### 27. `wifi_softap_get_config`

**Function:**

Get WiFi soft-AP current configuration

**Prototype:**

```
bool wifi_softap_get_config(struct softap_config *config)
```

**Parameter:**

`struct softap_config *config` : ESP8266 soft-AP config

**Return:**

true: succeed

false: fail



### 28. wifi\_softap\_get\_config\_default

**Function:**

Get WiFi soft-AP configuration that saved in flash

**Prototype:**

```
bool wifi_softap_get_config_default(struct softap_config *config)
```

**Parameter:**

```
struct softap_config *config : ESP8266 soft-AP config
```

**Return:**

```
true: succeed  
false: fail
```

### 29. wifi\_softap\_set\_config

**Function:**

Set WiFi soft-AP configuration and save it to flash

**Note:**

- This API can be called only if ESP8266 soft-AP is enabled.
- This configuration will be saved in flash system parameter area if changed.
- In soft-AP + station mode, ESP8266 soft-AP will adjust its channel configuration to be as same as ESP8266. More details in appendix or BBS <http://bbs.espressif.com/viewtopic.php?f=10&t=324>

**Prototype:**

```
bool wifi_softap_set_config (struct softap_config *config)
```

**Parameter:**

```
struct softap_config *config : WiFi soft-AP configuration pointer
```

**Return:**

```
true: succeed  
false: fail
```

### 30. wifi\_softap\_set\_config\_current

**Function:**

Set WiFi soft-AP configuration, won't save it to flash

**Note:**

- This API can be called only if ESP8266 soft-AP is enabled.



- In soft-AP + station mode, ESP8266 soft-AP will adjust its channel configuration to be as same as ESP8266. More details in appendix or BBS <http://bbs.espressif.com/viewtopic.php?f=10&t=324>

**Prototype:**

```
bool wifi_softap_set_config_current (struct softap_config *config)
```

**Parameter:**

```
struct softap_config *config : WiFi soft-AP configuration pointer
```

**Return:**

```
true: succeed  
false: fail
```

### 31. `wifi_softap_get_station_num`

**Function:**

Number count of stations which connected to ESP8266 soft-AP

**Prototype:**

```
uint8 wifi_softap_get_station_num(void)
```

**Parameter:**

```
none
```

**Return:**

```
how many stations connected to ESP8266 soft-AP
```

### 32. `wifi_softap_get_station_info`

**Function:**

Get connected station devices under soft-AP mode, including MAC and IP

**Note:**

This API can only be used when ESP8266 soft-AP DHCP enabled.

**Prototype:**

```
struct station_info * wifi_softap_get_station_info(void)
```

**Input Parameters:**

```
null
```

**Return:**

```
struct station_info* : station information structure
```



### 33. `wifi_softap_free_station_info`

**Function:**

Frees the struct `station_info` by calling the `wifi_softap_get_station_info` function

**Prototype:**

```
void wifi_softap_free_station_info(void)
```

**Input Parameters:**

    null

**Return:**

    null

**Examples 1 (Getting MAC and IP information):**

```
struct station_info * station = wifi_softap_get_station_info();
struct station_info * next_station;
while(station) {
    os_printf(bssid : MACSTR, ip : IPSTR/n,
              MAC2STR(station->bssid), IP2STR(&station->ip));
    next_station = STAILQ_NEXT(station, next);
    os_free(station); // Free it directly
    station = next_station;
}
```

**Examples 2 (Getting MAC and IP information):**

```
struct station_info * station = wifi_softap_get_station_info();
while(station){
    os_printf(bssid : MACSTR, ip : IPSTR/n,
              MAC2STR(station->bssid), IP2STR(&station->ip));
    station = STAILQ_NEXT(station, next);
}
wifi_softap_free_station_info(); // Free it by calling functions
```

### 34. `wifi_softap_dhcps_start`

**Function:** Enable ESP8266 soft-AP DHCP server.

**Note:**

DHCP default enable.

This configuration interacts with static IP API (`wifi_set_ip_info`):

    If enable DHCP, static IP will be disabled;

    If enable static IP, DHCP will be disabled;

This will depend on the last configuration.





**Prototype:**

```
bool wifi_softap_dhcps_start(void)
```

**Parameter:**

null

**Return:**

true: succeed  
false: fail

### 35. `wifi_softap_dhcps_stop`

**Function:** Disable ESP8266 soft-AP DHCP server.

**Note:** DHCP default enable.

**Prototype:**

```
bool wifi_softap_dhcps_stop(void)
```

**Parameter:**

null

**Return:**

true: succeed  
false: fail

### 36. `wifi_softap_set_dhcps_lease`

**Function:**

Set the IP range that can be got from ESP8266 soft-AP DHCP server.

**Note:**

This API has to be called during DHCP server disable(`wifi_softap_dhcps_stop`)

This configuration only take effect on next `wifi_softap_dhcps_start`, if then `wifi_softap_dhcps_stop` is called; user needs to call this API to set IP range again if needed, then call `wifi_softap_dhcps_start` to take effect.

**Prototype:**

```
bool wifi_softap_set_dhcps_lease(struct dhcps_lease *please)
```

**Parameter:**

```
struct dhcps_lease {  
    struct ip_addr start_ip;  
    struct ip_addr end_ip;  
};
```



**Return:**

true: succeed  
false: fail

**Example:**

```
void dhcps_lease_test(void)
{
    struct dhcps_lease dhcp_lease;
    const char* start_ip = "192.168.5.100";
    const char* end_ip = "192.168.5.105";

    dhcp_lease.start_ip.addr = ipaddr_addr(start_ip);
    dhcp_lease.end_ip.addr = ipaddr_addr(end_ip);
    wifi_softap_set_dhcps_lease(&dhcp_lease);
}
```

or

```
void dhcps_lease_test(void)
{
    struct dhcps_lease dhcp_lease;
    IP4_ADDR(&dhcp_lease.start_ip, 192, 168, 5, 100);
    IP4_ADDR(&dhcp_lease.end_ip, 192, 168, 5, 105);
    wifi_softap_set_dhcps_lease(&dhcp_lease);
}
```

### 37. wifi\_softap\_dhcps\_status

**Function:** Get ESP8266 soft-AP DHCP server status.

**Prototype:**

```
enum dhcp_status wifi_softap_dhcps_status(void)
```

**Parameter:**

null

**Return:**

```
enum dhcp_status {
    DHCP_STOPPED,
    DHCP_STARTED
};
```

### 38. wifi\_softap\_set\_dhcps\_offer\_option

**Function:**



Set ESP8266 soft-AP DHCP server option.

**Structure:**

```
enum dhcps_offer_option{
    OFFER_START = 0x00,
    OFFER_ROUTER = 0x01,
    OFFER_END
};
```

**Prototype:**

```
bool wifi_softap_set_dhcps_offer_option(uint8 level, void* optarg)
```

**Parameter:**

uint8 level - OFFER\_ROUTER set router option

void\* optarg - default to be enable

bit0, 0 disable router information from ESP8266 softAP DHCP server;

bit0, 1 enable router information from ESP8266 softAP DHCP server;

**Return:**

true : succeed

false : fail

**Example:**

```
uint8 mode = 0;
wifi_softap_set_dhcps_offer_option(OFFER_ROUTER, &mode);
```

### 39. wifi\_set\_phy\_mode

**Fuction:** Set ESP8266 physical mode (802.11b/g/n).

**Note:** ESP8266 soft-AP only support bg.

**Prototype:**

```
bool wifi_set_phy_mode(enum phy_mode mode)
```



**Parameter:**

```
enum phy_mode mode : physical mode
enum phy_mode {
    PHY_MODE_11B = 1,
    PHY_MODE_11G = 2,
    PHY_MODE_11N = 3
};
```

**Return:**

```
true : succeed
false : fail
```

### 40. wifi\_get\_phy\_mode

**Function:**

Get ESP8266 physical mode (802.11b/g/n)

**Prototype:**

```
enum phy_mode wifi_get_phy_mode(void)
```

**Parameter:**

```
null
```

**Return:**

```
enum phy_mode{
    PHY_MODE_11B = 1,
    PHY_MODE_11G = 2,
    PHY_MODE_11N = 3
};
```

### 41. wifi\_get\_ip\_info

**Function:**

Get IP info of WiFi station or soft-AP interface

**Prototype:**

```
bool wifi_get_ip_info(
    uint8 if_index,
    struct ip_info *info
)
```

**Parameters:**

```
uint8 if_index : the interface to get IP info: 0x00 for STATION_IF, 0x01 for SOFTAP_IF.
struct ip_info *info : pointer to get IP info of a certain interface
```



**Return:**

true: succeed  
false: fail

**42. wifi\_set\_ip\_info**

**Function:**

Set IP address of ESP8266 station or soft-AP

**Note:**

To set static IP, please disable DHCP first ([wifi\\_station\\_dhcpc\\_stop](#) or [wifi\\_softap\\_dhcps\\_stop](#)):

If enable static IP, DHCP will be disabled;

If enable DHCP, static IP will be disabled;

**Prototype:**

```
bool wifi_set_ip_info(  
    uint8 if_index,  
    struct ip_info *info  
)
```

**Prototype:**

```
uint8 if_index : set station IP or soft-AP IP  
#define STATION_IF    0x00  
#define SOFTAP_IF    0x01  
struct ip_info *info : IP information
```

**Example:**

```
struct ip_info info;  
wifi_station_dhcpc_stop();  
wifi_softap_dhcps_stop();  
  
IP4_ADDR(&info.ip, 192, 168, 3, 200);  
IP4_ADDR(&info.gw, 192, 168, 3, 1);  
IP4_ADDR(&info.netmask, 255, 255, 255, 0);  
wifi_set_ip_info(STATION_IF, &info);  
  
IP4_ADDR(&info.ip, 10, 10, 10, 1);  
IP4_ADDR(&info.gw, 10, 10, 10, 1);  
IP4_ADDR(&info.netmask, 255, 255, 255, 0);  
wifi_set_ip_info(SOFTAP_IF, &info);  
wifi_softap_dhcps_start();
```



**Return:**

true: succeed  
false: fail

**43. wifi\_set\_macaddr**

**Function:**

Sets MAC address

**Note:**

Can only be used in `user_init`.

**Prototype:**

```
bool wifi_set_macaddr(  
    uint8 if_index,  
    uint8 *macaddr  
)
```

**Parameter:**

`uint8 if_index` : set station MAC or soft-AP mac  
#define STATION\_IF 0x00  
#define SOFTAP\_IF 0x01  
`uint8 *macaddr` : MAC address

**Example:**

```
char sofap_mac[6] = {0x16, 0x34, 0x56, 0x78, 0x90, 0xab};  
char sta_mac[6] = {0x12, 0x34, 0x56, 0x78, 0x90, 0xab};  
wifi_set_macaddr(SOFTAP_IF, sofap_mac);  
wifi_set_macaddr(STATION_IF, sta_mac);
```

**Return:**

true: succeed  
false: fail

**44. wifi\_get\_macaddr**

**Function:** get MAC address

**Prototype:**

```
bool wifi_get_macaddr(  
    uint8 if_index,  
    uint8 *macaddr  
)
```



**Parameter:**

```
uint8 if_index : set station MAC or soft-AP mac
#define STATION_IF    0x00
#define SOFTAP_IF     0x01
uint8 *macaddr : MAC address
```

**Return:**

```
true: succeed
false: fail
```

### 45. wifi\_set\_sleep\_type

**Function:**

Sets sleep type for power saving. Set `NONE_SLEEP_T` to disable power saving.

**Note:** Default to be Modem sleep.

**Prototype:**

```
bool wifi_set_sleep_type(enum sleep_type type)
```

**Parameters:**

```
enum sleep_type type : sleep type
```

**Return:**

```
true: succeed
false: fail
```

### 46. wifi\_get\_sleep\_type

**Function:**

Gets sleep type.

**Prototype:**

```
enum sleep_type wifi_get_sleep_type(void)
```

**Parameters:**

```
null
```

**Return:**

```
enum sleep_type {
    NONE_SLEEP_T = 0;
    LIGHT_SLEEP_T,
    MODEM_SLEEP_T
};
```



### 47. wifi\_status\_led\_install

**Function:**

Installs WiFi status LED

**Prototype:**

```
void wifi_status_led_install (  
    uint8 gpio_id,  
    uint32 gpio_name,  
    uint8 gpio_func  
)
```

**Parameter:**

uint8 gpio\_id : gpio number  
uint8 gpio\_name : gpio mux name  
uint8 gpio\_func : gpio function

**Return:**

null

**Example:**

```
Use GPIO0 as WiFi status LED  
#define HUMITURE_WIFI_LED_IO_MUX PERIPHS_IO_MUX_GPIO0_U  
#define HUMITURE_WIFI_LED_IO_NUM 0  
#define HUMITURE_WIFI_LED_IO_FUNC FUNC_GPIO0  
wifi_status_led_install(HUMITURE_WIFI_LED_IO_NUM,  
    HUMITURE_WIFI_LED_IO_MUX, HUMITURE_WIFI_LED_IO_FUNC)
```

### 48. wifi\_status\_led\_uninstall

**Function:** Uninstall WiFi status LED

**Prototype:**

```
void wifi_status_led_uninstall ()
```

**Parameter:**

null

**Return:**

null

### 49. wifi\_set\_broadcast\_if

**Function:**

Set ESP8266 send UDP broadcast from station interface or soft-AP interface, or both station and soft-AP interfaces. Default to be soft-AP.

**Note:**





If set broadcast interface to be station only, ESP8266 softAP DHCP server will be disable.

**Prototype:**

```
bool wifi_set_broadcast_if (uint8 interface)
```

**Parameter:**

```
uint8 interface : 1:station; 2:soft-AP, 3:station+soft-AP
```

**Return:**

```
true: succeed  
false: fail
```

### 50. wifi\_get\_broadcast\_if

**Function:**

Get interface which ESP8266 sent UDP broadcast from. This is usually used when you have STA + soft-AP mode to avoid ambiguity.

**Prototype:**

```
uint8 wifi_get_broadcast_if (void)
```

**Parameter:**

```
null
```

**Return:**

```
1: station  
2: soft-AP  
3: both station and soft-AP
```

### 51. wifi\_set\_event\_handler\_cb

**Function:**

Register Wi-Fi event handler

**Prototype:**

```
void wifi_set_event_handler_cb(wifi_event_handler_cb_t cb)
```

**Parameter:**

```
wifi_event_handler_cb_t cb - callback
```

**Return:**

```
none
```

**Example:**

```
void wifi_handle_event_cb(System_Event_t *evt)  
{  
    os_printf("event %x\n", evt->event);  
}
```



```
switch (evt->event) {
    case EVENT_STAMODE_CONNECTED:
        os_printf("connect to ssid %s, channel %d\n",
            evt->event_info.connected.ssid,
            evt->event_info.connected.channel);

        break;
    case EVENT_STAMODE_DISCONNECTED:
        os_printf("disconnect from ssid %s, reason %d\n",
            evt->event_info.disconnected.ssid,
            evt->event_info.disconnected.reason);

        break;
    case EVENT_STAMODE_AUTHMODE_CHANGE:
        os_printf("mode: %d -> %d\n",
            evt->event_info.auth_change.old_mode,
            evt->event_info.auth_change.new_mode);

        break;
    case EVENT_STAMODE_GOT_IP:
        os_printf("ip:" IPSTR ",mask:" IPSTR ",gw:" IPSTR,
            IP2STR(&evt->event_info.got_ip.ip),
            IP2STR(&evt->event_info.got_ip.mask),
            IP2STR(&evt->event_info.got_ip.gw));

        os_printf("\n");
        break;
    case EVENT_SOFTAPMODE_STACONNECTED:
        os_printf("station: " MACSTR "join, AID = %d\n",
            MAC2STR(evt->event_info.sta_connected.mac),
            evt->event_info.sta_connected.aid);

        break;
    case EVENT_SOFTAPMODE_STADISCONNECTED:
        os_printf("station: " MACSTR "leave, AID = %d\n",
            MAC2STR(evt->event_info.sta_disconnected.mac),
            evt->event_info.sta_disconnected.aid);

        break;
    default:
        break;
}

void user_init(void)
```



```
{  
    // TODO: add your own code here....  
    wifi_set_event_handler_cb(wifi_handle_event_cb);  
}
```



### 3.6. Upgrade (FOTA) APIs

#### 1. `system_upgrade_userbin_check`

**Function:**

Checks user bin

**Prototype:**

```
uint8 system_upgrade_userbin_check()
```

**Parameter:**

none

**Return:**

0x00 : UPGRADE\_FW\_BIN1, i.e. user1.bin

0x01 : UPGRADE\_FW\_BIN2, i.e. user2.bin

#### 2. `system_upgrade_flag_set`

**Function:**

Sets upgrade status flag.

**Note:**

If you using `system_upgrade_start` to upgrade, this API need not be called.

If you using `spi_flash_write` to upgrade firmware yourself, this flag need to be set to `UPGRADE_FLAG_FINISH`, then call `system_upgrade_reboot` to reboot to run new firmware.

**Prototype:**

```
void system_upgrade_flag_set(uint8 flag)
```

**Parameter:**

uint8 flag:

```
#define UPGRADE_FLAG_IDLE      0x00
```

```
#define UPGRADE_FLAG_START    0x01
```

```
#define UPGRADE_FLAG_FINISH   0x02
```

**Return:**

null

#### 3. `system_upgrade_flag_check`

**Function:**

Gets upgrade status flag.

**Prototype:**

```
uint8 system_upgrade_flag_check()
```



**Parameter:**

    null

**Return:**

```
#define UPGRADE_FLAG_IDLE      0x00
#define UPGRADE_FLAG_START    0x01
#define UPGRADE_FLAG_FINISH   0x02
```

#### 4. **system\_upgrade\_start**

**Function:**

    Configures parameters and start upgrade

**Prototype:**

```
bool system_upgrade_start (struct upgrade_server_info *server)
```

**Parameters:**

```
struct upgrade_server_info *server : server related parameters
```

**Return:**

    true: start upgrade  
    false: upgrade can't be started.

#### 5. **system\_upgrade\_reboot**

**Function:** reboot system and use new version

**Prototype:**

```
void system_upgrade_reboot (void)
```

**Parameters:**

    none

**Return:**

    none



### 3.7. Sniffer Related APIs

#### 1. `wifi_promiscuous_enable`

**Function:**

Enable promiscuous mode for sniffer

**Note:**

- (1) promiscuous mode can only be enabled in station mode.
- (2) During promiscuous mode (sniffer), ESP8266 station and soft-AP are disabled.
- (3) Before enable promiscuous mode, please call `wifi_station_disconnect` first
- (4) Don't call any other APIs during sniffer, please call `wifi_promiscuous_enable(0)` first.

**Prototype:**

```
void wifi_promiscuous_enable(uint8 promiscuous)
```

**Parameter:**

```
uint8 promiscuous :  
    0: disable promiscuous;  
    1: enable promiscuous
```

**Return:**

```
null
```

#### 2. `wifi_promiscuous_set_mac`

**Function:**

Set MAC address filter for sniffer.

**Note:**

This filter only be available in the current sniffer phase, if you disable sniffer and then enable sniffer, you need to set filter again if you need it.

**Prototype:**

```
void wifi_promiscuous_set_mac(const uint8_t *address)
```

**Parameter:**

```
const uint8_t *address : MAC address
```

**Return:**

```
null
```

**Example:**

```
char ap_mac[6] = {0x16, 0x34, 0x56, 0x78, 0x90, 0xab};
```



```
wifi_promiscuous_set_mac(ap_mac);
```

### 3. `wifi_set_promiscuous_rx_cb`

**Function:**

Registers an RX callback function in promiscuous mode, which will be called when data packet is received.

**Prototype:**

```
void wifi_set_promiscuous_rx_cb(wifi_promiscuous_cb_t cb)
```

**Parameter:**

`wifi_promiscuous_cb_t cb` : callback

**Return:**

null

### 4. `wifi_get_channel`

**Function:**

Get channel number for sniffer functions

**Prototype:**

```
uint8 wifi_get_channel(void)
```

**Parameters:**

null

**Return:**

Channel number

### 5. `wifi_set_channel`

**Function:**

Set channel number for sniffer functions

**Prototype:**

```
bool wifi_set_channel (uint8 channel)
```

**Parameters:**

`uint8 channel` : channel number

**Return:**

true: succeed  
false: fail



### 3.8. smart config APIs

#### 1. smartconfig\_start

**Function:**

Start smart configuration mode, to connect ESP8266 station to AP, by sniffing for special packets from the air, containing SSID and password of desired AP. You need to broadcast the SSID and password (e.g. from mobile device or computer) with the SSID and password encoded.

**Note:**

- (1) This api can only be called in station mode.
- (2) During smart config, ESP8266 station and soft-AP are disabled.
- (3) Can not call `smartconfig_start` twice before it finish, please call `smartconfig_stop` first.
- (4) Don't call any other APIs during smart config, please call `smartconfig_stop` first.

**Prototype:**

```
bool smartconfig_start(  
    sc_type type,  
    sc_callback_t cb,  
    uint8 log  
)
```

**Parameter:**

`sc_type type` : smart config protocol type: AirKiss or ESP-TOUCH.  
`sc_callback_t cb` : smart config callback; executed when smartconfig status changed;

parameter `status` of this callback shows the status of smartconfig:

- if `status == SC_STATUS_LINK`, parameter `void *pdata` is a pointer of `struct station_config`;
- if `status == SC_STATUS_LINK_OVER`, parameter `void *pdata` is a pointer of mobile phone's IP address, 4 bytes. This is only available in ESPTOUCH, otherwise, it is `NULL`.
- otherwise, parameter `void *pdata` is `NULL`.

`uint8 log` : 1: UART output logs; otherwise: UART only outputs the result.

**Return:**

true: succeed  
false: fail





**Example:**

```
sc_type  SC_Type;

void ICACHE_FLASH_ATTR
sc_smartconfig_done(sc_status status, void *pdata)
{
    switch(status) {
        case SC_STATUS_WAIT:
            os_printf("SC_STATUS_WAIT\n");
            break;
        case SC_STATUS_FIND_CHANNEL:
            os_printf("SC_STATUS_FIND_CHANNEL\n");
            break;
        case SC_STATUS_GETTING_SSID_PSWD:
            os_printf("SC_STATUS_GETTING_SSID_PSWD\n");
            break;
        case SC_STATUS_LINK:
            os_printf("SC_STATUS_LINK\n");
            struct station_config *sta_conf = pdata;

            wifi_station_set_config(sta_conf);
            wifi_station_disconnect();
            wifi_station_connect();
            break;
        case SC_STATUS_LINK_OVER:
            os_printf("SC_STATUS_LINK_OVER\n");
            if (SC_Type == SC_TYPE_ESPTOUCH) {
                uint8 phone_ip[4] = {0};
                memcpy(phone_ip, (uint8*)pdata, 4);
                printf("Phone ip: %d.%d.%d.%d\n", phone_ip[0], phone_ip[1], phone_ip[2], phone_ip[3]);
            }
            smartconfig_stop();
            break;
    }
}

SC_Type = SC_TYPE_ESPTOUCH;
smartconfig_start(SC_TYPE_ESPTOUCH, smartconfig_done);
```



## 2. smartconfig\_stop

**Function:**

stop smart config, free the buffer taken by `smartconfig_start`.

**Note:**

Whether connect to AP succeed or not, this API should be called to free memory taken by `smartconfig_start`.

**Prototype:**

```
bool smartconfig_stop(void)
```

**Parameter:**

null

**Return:**

true: succeed  
false: fail

## 3.9. SNTP APIs

### 1. sntp\_setserver

**Function:**

Set SNTP server by IP address, support 3 SNTP server at most

**Prototype:**

```
void sntp_setserver(unsigned char idx, ip_addr_t *addr)
```

**Parameter:**

`unsigned char idx` : SNTP server index, support 3 SNTP server at most (0 ~ 2) ; index 0 is the main server, index 1 and 2 are as backup.  
`ip_addr_t *addr` : IP address; users need to ensure that it's a SNTP server

**Return:**

none

### 2. sntp\_getserver

**Function:**

Get IP address of SNTP server which set by `sntp_setserver`

**Prototype:**

```
ip_addr_t sntp_getserver(unsigned char idx)
```

**Parameter:**

`unsigned char idx` : SNTP server index, support 3 SNTP server at most (0 ~ 2)



**Return:**

IP address

### 3. `sntp_setservername`

**Function:**

Set SNTP server by domain name, support 3 SNTP server at most

**Prototype:**

```
void sntp_setservername(unsigned char idx, char *server)
```

**Parameter:**

`unsigned char idx` : SNTP server index, support 3 SNTP server at most (0 ~ 2) ; index 0 is the main server, index 1 and 2 are as backup.

`char *server` : domain name; users need to ensure that it's a SNTP server

**Return:**

none

### 4. `sntp_getservername`

**Function:**

Get domain name of SNTP server which set by `sntp_setservername`

**Prototype:**

```
char * sntp_getservername(unsigned char idx)
```

**Parameter:**

`unsigned char idx` : SNTP server index, support 3 SNTP server at most (0 ~ 2)

**Return:**

domain name

### 5. `sntp_init`

**Function:**

SNTP initialize

**Prototype:**

```
void sntp_init(void)
```

**Parameter:**

none



**Return:**  
none

## 6. `sntp_stop`

**Function:**

Stop SNTP

**Prototype:**

```
void sntp_stop(void)
```

**Parameter:**

none

**Return:**

none

## 7. `sntp_get_current_timestamp`

**Function:**

Get current timestamp from basic time (1970.01.01 00: 00: 00 GMT + 8) ,  
uint:second

**Prototype:**

```
uint32 sntp_get_current_timestamp()
```

**Parameter:**

none

**Return:**

time stamp

## 8. `sntp_get_real_time`

**Function:**

Get real time (GMT + 8)

**Prototype:**

```
char* sntp_get_real_time(long t)
```

**Parameter:**

`long t` - time stamp

**Return:**

real time



### 9. `sntp_set_timezone`

**Function:**

Set time zone

**Prototype:**

```
bool sntp_set_timezone (sint8 timezone)
```

**Note:**

Before call `sntp_set_timezone`, please call `sntp_stop` first

**Parameter:**

`sint8 timezone` – time zone, range: -11 ~ 13

**Return:**

true, succeed;

false, fail

**Example:**

```
sntp_stop();  
  
if( true == sntp_set_timezone(-5) ) {  
    sntp_init();  
}
```

### 10. `SNTP` Example

```
ip_addr_t *addr = (ip_addr_t *)os_zalloc(sizeof(ip_addr_t));  
sntp_setservername(0, "us.pool.ntp.org"); // set server 0 by domain name  
sntp_setservername(1, "ntp.sjtu.edu.cn"); // set server 1 by domain name  
ipaddr_aton("210.72.145.44", addr);  
sntp_setserver(2, addr); // set server 2 by IP address  
sntp_init();  
os_free(addr);  
  
uint32 current_stamp;  
current_stamp = sntp_get_current_timestamp();  
os_printf("sntp: %d, %s \n",current_stamp, sntp_get_real_time(current_stamp));
```



## 4. TCP/UDP APIs

Found in [esp\\_iot\\_sdk/include/espconn.h](#). The network APIs can be grouped into the following types:

- **General APIs:** APIs can be used for both TCP and UDP .
- **TCP APIs:** APIs that are only used for TCP.
- **UDP APIs:** APIs that are only used for UDP.
- **mDNS APIs:** APIs that related to mDNS

### 4.1. Generic TCP/UDP APIs

#### 1. `espconn_delete`

**Function:**

Delete a transmission.

**Note:**

Corresponding creation API :

TCP: [espconn\\_accept](#),

UDP: [espconn\\_create](#)

**Prototype:**

```
sint8 espconn_delete(struct espconn *espconn)
```

**Parameter:**

`struct espconn *espconn` : corresponding connected control block structure

**Return:**

0 : succeed

Non-0 : error, return error code [ESPCONN\\_ARG](#) – illegal argument, can't find network transmission according to structure [espconn](#)

#### 2. `espconn_gethostbyname`

**Function:**

DNS



**Prototype:**

```
err_t espconn_gethostbyname(  
    struct espconn *pespconn,  
    const char *hostname,  
    ip_addr_t *addr,  
    dns_found_callback found  
)
```

**Parameters:**

```
struct espconn *espconn : corresponding connected control block structure  
const char *hostname    : domain name string pointer  
ip_addr_t *addr        : IP address  
dns_found_callback found : callback
```

**Return:**

```
err_t : ESPCONN_OK - succeed  
       ESPCONN_INPROGRESS - error code : already connected  
       ESPCONN_ARG - error code : illegal argument, can't find network  
transmission according to structure espconn
```

**Example as follows. Pls refer to source code of IoT\_Demo:**

```
ip_addr_t esp_server_ip;  
LOCAL void ICACHE_FLASH_ATTR  
user_esp_platform_dns_found(const char *name, ip_addr_t *ipaddr, void *arg)  
{  
    struct espconn *pespconn = (struct espconn *)arg;  
    os_printf(user_esp_platform_dns_found "%d.%d.%d.%d/n",  
        *((uint8 *)&ipaddr->addr), *((uint8 *)&ipaddr->addr + 1),  
        *((uint8 *)&ipaddr->addr + 2), *((uint8 *)&ipaddr->addr + 3));  
}  
void dns_test(void) {  
    espconn_gethostbyname(pespconn,iot.espressif.cn, &esp_server_ip,  
        user_esp_platform_dns_found);  
}
```

### 3. espconn\_port

**Function:** get void ports

**Prototype:**

```
uint32 espconn_port(void)
```

**Parameter:**

```
null
```



**Return:**

`uint32` : id of the port you get

#### 4. `espconn_regist_sentcb`

**Function:**

Register data sent function which will be called back when data are successfully sent.

**Prototype:**

```
sint8 espconn_regist_sentcb(  
    struct espconn *espconn,  
    espconn_sent_callback sent_cb  
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`espconn_sent_callback sent_cb` : registered callback function

**Return:**

`0` : succeed  
Non-`0` : error code `ESPCONN_ARG` - illegal argument, can't find network transmission according to structure `espconn`

#### 5. `espconn_regist_recvcb`

**Function:**

register data receive function which will be called back when data are received

**Prototype:**

```
sint8 espconn_regist_recvcb(  
    struct espconn *espconn,  
    espconn_recv_callback recv_cb  
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`espconn_recv_callback recv_cb` : registered callback function

**Return:**

`0` : succeed  
Non-`0` : error code `ESPCONN_ARG` - illegal argument, can't find network transmission according to structure `espconn`





### 6. `espconn_sent_callback`

**Function:**

Callback after the data are sent

**Prototype:**

```
void espconn_sent_callback (void *arg)
```

**Parameters:**

`void *arg` : pointer corresponding structure `espconn`. This pointer may be different in different callbacks, please don't use this pointer directly to distinguish one from another in multiple connections, use `remote_ip` and `remote_port` in `espconn` instead.

**Return:**

null

### 7. `espconn_rcv_callback`

**Function:**

callback after data are received

**Prototype:**

```
void espconn_rcv_callback (  
    void *arg,  
    char *pdata,  
    unsigned short len  
)
```

**Parameters:**

`void *arg` : pointer corresponding structure `espconn`. This pointer may be different in different callbacks, please don't use this pointer directly to distinguish one from another in multiple connections, use `remote_ip` and `remote_port` in `espconn` instead.

`char *pdata` : received data entry parameters

`unsigned short len` : received data length

**Return:**

null

### 8. `espconn_sent`

**Function:**

Send data through WiFi

**Note:**

Please call `espconn_sent` after `espconn_sent_callback` of the pre-packet.



**Prototype:**

```
sint8 espconn_sent(  
    struct espconn *espconn,  
    uint8 *psent,  
    uint16 length  
)
```

**Parameters:**

```
struct espconn *espconn : corresponding connected control block structure  
uint8 *psent : sent data pointer  
uint16 length : sent data length
```

**Return:**

```
0 : succeed  
Non-0 : error code  
  
ESPCONN_MEM - Out of memory  
ESPCONN_ARG - illegal argument, can't find network transmission according  
to structure espconn
```

## 4.2. TCP APIs

TCP APIs act only on TCP connections and do not affect nor apply to UDP connections.

### 1. espconn\_accept

**Function:**

Creates a TCP server (i.e. accepts connections.)

**Prototype:**

```
sint8 espconn_accept(struct espconn *espconn)
```

**Parameter:**

```
struct espconn *espconn : corresponding connected control block structure
```

**Return:**

```
0 : succeed  
Non-0 : error code  
  
ESPCONN_MEM - Out of memory  
ESPCONN_ISCONN - Already connected  
ESPCONN_ARG - illegal argument, can't find TCP connection according to  
structure espconn
```



## 2. `espconn_secure_accept`

**Function:**

Creates an SSL TCP server.

**Note:**

- (1) Only created one SSL server is allowed, this API can be called only once, and only one SSL client is allowed to connect.
- (2) If SSL encrypted packet size is larger than ESP8266 SSL buffer size (default 2KB, set by `espconn_secure_set_size`), SSL connection will fail, will enter `espconn_reconnect_callback`
- (3) SSL related APIs named as `espconn_secure_XXX` are different from normal TCP APIs, so please don't mixed use. In SSL connection, only `espconn_secure_XXX` APIs, `espconn_regist_XXX` APIs and `espconn_port` can be used.

**Prototype:**

```
sint8 espconn_secure_accept(struct espconn *espconn)
```

**Parameter:**

`struct espconn *espconn` : corresponding connected control block structure

**Return:**

0 : succeed

Non-0 : error code

`ESPCONN_MEM` - Out of memory

`ESPCONN_ISCONN` - Already connected

`ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

## 3. `espconn_regist_time`

**Function:**

Register timeout interval of ESP8266 TCP server.

**Note:**

Call this API after `espconn_accept`, before listened a TCP connection.

This timeout interval is not very precise, only as reference.

If timeout is set to 0, timeout will be disable and ESP8266 TCP server will not disconnect TCP clients has stopped communication. This usage of `timeout=0`, is deprecated.



**Prototype:**

```
sint8 espconn_regist_time(
    struct espconn *espconn,
    uint32 interval,
    uint8 type_flag
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`uint32 interval` : timeout interval, unit: second, maximum: 7200 seconds  
`uint8 type_flag` : 0, set all connections; 1, set a single connection

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

#### 4. `espconn_get_connection_info`

**Function:**

Get a connection's info in TCP multi-connection case

**Prototype:**

```
sint8 espconn_get_connection_info(
    struct espconn *espconn,
    remot_info **pcon_info,
    uint8 typeflags
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`remot_info **pcon_info` : connect to client info  
`uint8 typeflags` : 0, regular server;1, ssl server

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

#### 5. `espconn_connect`

**Function:**

Connect to a TCP server (ESP8266 acting as TCP client).

**Prototype:**

```
sint8 espconn_connect(struct espconn *espconn)
```



**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure

**Return:**

0 : succeed

Non-0 : error code

`ESPCONN_RTE` - Routing Problem

`ESPCONN_MEM` - Out of memory

`ESPCONN_ISCONN` - Already connected

`ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 6. `espconn_connect_callback`

**Function:** successful listening (ESP8266 as TCP server) or connection (ESP8266 as TCP client) callback, register by `espconn_regist_connectcb`

**Prototype:**

```
void espconn_connect_callback (void *arg)
```

**Parameter:**

`void *arg` : pointer corresponding structure `espconn`. This pointer may be different in different callbacks, please don't use this pointer directly to distinguish one from another in multiple connections, use `remote_ip` and `remote_port` in `espconn` instead.

**Return:**

null

### 7. `espconn_regist_connectcb`

**Function:**

Register connection function which will be called back under successful TCP connection

**Prototype:**

```
sint8 espconn_regist_connectcb(  
    struct espconn *espconn,  
    espconn_connect_callback connect_cb  
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure

`espconn_connect_callback connect_cb` : registered callback function



**Return:**

0 : succeed  
Non-0 : error code [ESPCONN\\_ARG](#) - illegal argument, can't find TCP connection according to structure [espconn](#)

**8. espconn\_set\_opt**

**Function:** Set option of TCP connection

**Prototype:**

```
sint8 espconn_set_opt(  
    struct espconn *espconn,  
    uint8 opt  
)
```

**Structure:**

```
enum espconn_option{  
    ESPCONN_START = 0x00,  
    ESPCONN_REUSEADDR = 0x01,  
    ESPCONN_NODELAY = 0x02,  
    ESPCONN_COPY = 0x04,  
    ESPCONN_KEEPALIVE = 0x08,  
    ESPCONN_END  
}
```

**Parameter:**

[struct espconn \\*espconn](#) : corresponding connected control structure  
[uint8 opt](#) : Option of TCP connection, refer to [espconn\\_option](#)  
bit 0: 1: free memory after TCP disconnection happen need not wait 2 minutes;  
bit 1: 1: disable nagle algorithm during TCP data transmission, quiken the data transmission.  
bit 2: 1: use 2920 bytes write buffer for the data [espconn\\_sent](#) sending.  
bit 3: 1: enable TCP keep alive

**Return:**

0 : succeed  
Non-0 : error code [ESPCONN\\_ARG](#) - illegal argument, can't find TCP connection according to structure [espconn](#)

**Note:**

In general, we need not call this API;  
If call [espconn\\_set\\_opt](#), please call it in [espconn\\_connect\\_callback](#).



### 9. `espconn_clear_opt`

**Function:**

Clear option of TCP connection.

**Prototype:**

```
sint8 espconn_clear_opt(  
    struct espconn *espconn,  
    uint8 opt  
)
```

**Structure:**

```
enum espconn_option{  
    ESPCONN_START = 0x00,  
    ESPCONN_REUSEADDR = 0x01,  
    ESPCONN_NODELAY = 0x02,  
    ESPCONN_COPY = 0x04,  
    ESPCONN_KEEPALIVE = 0x08,  
    ESPCONN_END  
}
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`uint8 opt` : option of TCP connection, refer to `espconn_option`

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 10. `espconn_set_keepalive`

**Function:**

Set configuration of TCP keep alive .

**Prototype:**

```
sint8 espconn_set_keepalive(struct espconn *espconn, uint8 level, void*  
    optarg)
```

**Structure:**

```
enum espconn_level{  
    ESPCONN_KEEPIDLE,  
    ESPCONN_KEEPINTVL,
```



```
    ESPCONN_KEEPCNT
```

```
}
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`uint8 level` : Default to do TCP keep-alive detection every `ESPCONN_KEEPIDLE`, if there in no response, retry `ESPCONN_KEEPCNT` times every `ESPCONN_KEEPINTVL`. If still no response, considers it as TCP connection broke, goes into `espconn_reconnect_callback` .

Notice, keep alive interval is not precise, only for reference, it depends on priority.

description:

`ESPCONN_KEEPIDLE` - TCP keep-alive interval, unit: 500 millisecond

`ESPCONN_KEEPINTVL` - packet interval during TCP keep-alive, unit: 500 millisecond

`ESPCONN_KEEPCNT` - maximum packet count of TCP keep-alive

`void* optarg` : value of parameter

**Return:**

0 : succeed

Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

**Note:**

In general, we need not call this API;

If needed, please call it in `espconn_connect_callback` and call `espconn_set_opt` to enable keep alive first.

## 11. `espconn_get_keepalive`

**Function:**

Get value of TCP keep-alive parameter

**Prototype:**

```
sint8 espconn_set_keepalive(struct espconn *espconn, uint8 level, void* optarg)
```

**Structure:**

```
enum espconn_level{  
    ESPCONN_KEEPIDLE,
```





```
    ESPCONN_KEEPINTVL,  
    ESPCONN_KEEPCNT  
}
```

**Parameter:**

`struct espconn *espconn` : corresponding connected control block structure

`uint8 level` :

- `ESPCONN_KEEPIDLE` - TCP keep-alive interval, unit: 500 millisecond
- `ESPCONN_KEEPINTVL` - packet interval during TCP keep-alive, unit: 500 millisecond
- `ESPCONN_KEEPCNT` - maximum packet count of TCP keep-alive

`void* optarg` : value of parameter

**Return:**

0 : succeed

Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

## 12. espconn\_reconnect\_callback

**Function:**

Enter this callback when error occurred, TCP connection broke. This callback is registered by `espconn_regist_reconcb`

**Prototype:**

```
void espconn_reconnect_callback (void *arg, sint8 err)
```

**Parameter:**

`void *arg` : pointer corresponding structure `espconn`. This pointer may be different in different callbacks, please don't use this pointer directly to distinguish one from another in multiple connections, use `remote_ip` and `remote_port` in `espconn` instead.

`sint8 err` : error code

- `ESCONN_TIMEOUT` - Timeout
- `ESPCONN_ABRT` - TCP connection aborted
- `ESPCONN_RST` - TCP connection abort
- `ESPCONN_CLSD` - TCP connection closed
- `ESPCONN_CONN` - TCP connection
- `ESPCONN_HANDSHAKE` - TCP SSL handshake fail



`ESPCONN_PROTO_MSG` - SSL application invalid

**Return:**  
none

### 13. `espcnncn_regnst_reconcb`

**Function:**

Register reconnect callback

**Note:**

`espcnncn_reconnect_callback` is more like a network-broken error handler; it handles errors that occurred in any phase of the connection. For instance, if `espcnncn_sent` fails, `espcnncn_reconnect_callback` will be called because the network is broken.

**Prototype:**

```
sint8 espcnncn_regnst_reconcb(  
    struct espcnncn *espcnncn,  
    espcnncn_reconnect_callback recon_cb  
)
```

**Parameters:**

`struct espcnncn *espcnncn` : corresponding connected control block structure  
`espcnncn_reconnect_callback recon_cb` : registered callback function

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espcnncn`

### 14. `espcnncn_disconnect`

**Function:**

disconnect a TCP connection

**Prototype:**

```
sint8 espcnncn_disconnect(struct espcnncn *espcnncn)
```

**Parameters:**

`struct espcnncn *espcnncn` : corresponding connected control structure

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espcnncn`



### 15. `espconn_regist_disconcb`

**Function:**

Register disconnection function which will be called back under successful TCP disconnection

**Prototype:**

```
sint8 espconn_regist_disconcb(  
    struct espconn *espconn,  
    espconn_connect_callback discon_cb  
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`espconn_connect_callback connect_cb` : registered callback function

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` – illegal argument, can't find TCP connection according to structure `espconn`

### 16. `espconn_regist_write_finish`

**Function:**

Register a callback which will be called when all sending data is completely write into write buffer or sent. Need to call `espconn_set_opt` to enable write-buffer first.

**Note:**

write-buffer is used to keep TCP data that waiting for sending, users can enable it by `espconn_set_opt`. Then users can call `espconn_sent` to send next packet in `write_finish_callback` instead of `espconn_sent_callback`.

**Prototype:**

```
sint8 espconn_regist_write_finish (  
    struct espconn *espconn,  
    espconn_connect_callback write_finish_fn  
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`espconn_connect_callback write_finish_fn` : registered callback function



**Return:**

0 : succeed  
Non-0 : error code [ESPCONN\\_ARG](#) – illegal argument, can't find TCP connection according to structure [espconn](#)

### 17. [espconn\\_secure\\_set\\_size](#)

**Function:**

Set buffer size of encrypted data (SSL)

**Note:**

Buffer size default to be 2Kbytes. If need to change, please call this API before [espconn\\_secure\\_accept](#) (ESP8266 as TCP SSL server) or [espconn\\_secure\\_connect](#) (ESP8266 as TCP SSL client)

**Prototype:**

`bool espconn_secure_set_size (uint8 level, uint16 size)`

**Parameters:**

`uint8 level` : set buffer for ESP8266 SSL server/client:

- `0x01` SSL client;
- `0x02` SSL server;
- `0x03` both SSL client and SSL server

`uint16 size` : buffer size, range: 1 ~ 8192, unit: byte, default to be 2048

**Return:**

true : succeed  
false : fail

### 18. [espconn\\_secure\\_get\\_size](#)

**Function:**

Get buffer size of encrypted data (SSL)

**Prototype:**

`sint16 espconn_secure_get_size (uint8 level)`

**Parameters:**

`uint8 level` : buffer for ESP8266 SSL server/client:

- `0x01` SSL client;
- `0x02` SSL server;
- `0x03` both SSL client and SSL server



**Return:**  
buffer size

### 19. `espconn_secure_connect`

**Function:**

Secure connect (SSL) to a TCP server (ESP8266 is acting as TCP client.)

**Note:**

- (1) Only one connection is allowed when ESP8266 as SSL client, this API can be called only once, or call `espconn_secure_disconnect` to disconnect first, then call this API to create another SSL connection.
- (2) If SSL encrypted packet size is larger than ESP8266 SSL buffer size (default 2KB, set by `espconn_secure_set_size`), SSL connection will fail, will enter `espconn_reconnect_callback`
- (3) SSL related APIs named as `espconn_secure_XXX` are different from normal TCP APIs, so please don't mixed use. In SSL connection, only `espconn_secure_XXX` APIs, `espconn_regist_XXX` APIs and `espconn_port` can be used.

**Prototype:**

```
sint8 espconn_secure_connect (struct espconn *espconn)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure

**Return:**

0 : succeed  
Non-0 : error code

`ESPCONN_MEM` - Out of memory

`ESPCONN_ISCONN` - Already connected

`ESPCONN_ARG` - illegal argument, can't find TCP connection

according to structure `espconn`

### 20. `espconn_secure_sent`

**Function:** send encrypted data (SSL)

**Note:**

Please call `espconn_secure_sent` after `espconn_sent_callback` of the pre-packet.



**Prototype:**

```
sint8 espconn_secure_sent (  
    struct espconn *espconn,  
    uint8 *psent,  
    uint16 length  
)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure  
`uint8 *psent` : sent data pointer  
`uint16 length` : sent data length

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 21. `espconn_secure_disconnect`

**Function:** secure TCP disconnection(SSL)

**Prototype:**

```
sint8 espconn_secure_disconnect(struct espconn *espconn)
```

**Parameters:**

`struct espconn *espconn` : corresponding connected control block structure

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 22. `espconn_secure_ca_disable`

**Function:**

Disable SSL CA (certificate authenticate) function

**Note:**

- CA function is disabled by default, more details in document "ESP8266\_\_SDK\_\_SSL\_User\_Manual"
- If user want to call this API, please call it before `espconn_secure_accept` (ESP8266 as TCP SSL server) or `espconn_secure_connect` (ESP8266 as TCP SSL client)

**Prototype:**

```
bool espconn_secure_ca_disable (uint8 level)
```



**Parameter:**

`uint8 level` : set configuration for ESP8266 SSL server/client:

- `0x01` SSL client;
- `0x02` SSL server;
- `0x03` both SSL client and SSL server

**Return:**

true : succeed  
false : fail

### 23. `espconn_secure_ca_enable`

**Function:**

Enable SSL CA (certificate authenticate) function

**Note:**

- CA function is disabled by default, more details in document “ESP8266\_\_SDK\_\_SSL\_User\_Manual”
- If user want to call this API, please call it before `espconn_secure_accept` (ESP8266 as TCP SSL server) or `espconn_secure_connect` (ESP8266 as TCP SSL client)

**Prototype:**

`bool espconn_secure_ca_enable (uint8 level, uint16 flash_sector)`

**Parameter:**

`uint8 level` : set configuration for ESP8266 SSL server/client:

- `0x01` SSL client;
- `0x02` SSL server;
- `0x03` both SSL client and SSL server

`uint16 flash_sector` : flash sector in which CA (`esp_ca_cert.bin`) is downloaded. For example, `flash_sector` is `0x3B`, then `esp_ca_cert.bin` need to download into flash `0x3B000`

**Return:**

true : succeed  
false : fail



#### 24. `espconn_tcp_get_max_con`

**Function:**

Get maximum number of how many TCP connection is allowed.

**Prototype:**

```
uint8 espconn_tcp_get_max_con(void)
```

**Parameter:**

null

**Return:**

Maximum number of how many TCP connection is allowed.

#### 25. `espconn_tcp_set_max_con`

**Function:**

Set the maximum number of how many TCP connection is allowed.

**Prototype:**

```
sint8 espconn_tcp_set_max_con(uint8 num)
```

**Parameter:**

`uint8 num` : Maximum number of how many TCP connection is allowed.

**Return:**

0 : succeed

Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

#### 26. `espconn_tcp_get_max_con_allow`

**Function:**

Get the maximum number of TCP clients which are allowed to connect to ESP8266 TCP server.

**Prototype:**

```
sint8 espconn_tcp_get_max_con_allow(struct espconn *espconn)
```

**Parameter:**

`struct espconn *espconn` : corresponding connected control structure

**Return:**

> 0 : Maximum number of TCP clients which are allowed.

< 0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`





### 27. `espconn_tcp_set_max_con_allow`

**Function:**

Set the maximum number of TCP clients allowed to connect to ESP8266 TCP server.

**Prototype:**

```
sint8 espconn_tcp_set_max_con_allow(struct espconn *espconn, uint8 num)
```

**Parameter:**

`struct espconn *espconn` : corresponding connected control structure  
`uint8 num` : Maximum number of TCP clients which are allowed.

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 28. `espconn_recv_hold`

**Function:**

Puts in a request to block the TCP receive function.

**Note:**

The function does not act immediately; we recommend calling it while reserving 5\*1460 bytes of memory.  
This API can be called more than once.

**Prototype:**

```
sint8 espconn_recv_hold(struct espconn *espconn)
```

**Parameter:**

`struct espconn *espconn` : corresponding connected control structure

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 29. `espconn_recv_unhold`

**Function:**

Unblock TCP receiving data (i.e. undo `espconn_recv_hold`).

**Note:**

This API takes effect immediately.

**Prototype:**

```
sint8 espconn_recv_unhold(struct espconn *espconn)
```



**Parameter:**

`struct espconn *espconn` : corresponding connected control structure

**Return:**

0 : succeed

Non-0 : error code `ESPCONN_ARG` - illegal argument, can't find TCP connection according to structure `espconn`

### 4.3. UDP APIs

#### 1. `espconn_create`

**Function:** create UDP transmission.

**Prototype:**

`sin8 espconn_create(struct espconn *espconn)`

**Parameter:**

`struct espconn *espconn` : corresponding connected control block structure

**Return:**

0 : succeed

Non-0 : error code

`ESPCONN_ISCONN` - Already connected

`ESPCONN_MEM` - Out of memory

`ESPCONN_ARG` - illegal argument, can't find UDP transmission according to structure `espconn`

#### 2. `espconn_igmp_join`

**Function:**

Join a multicast group

**Prototype:**

`sin8 espconn_igmp_join(ip_addr_t *host_ip, ip_addr_t *multicast_ip)`

**Parameters:**

`ip_addr_t *host_ip` : IP of host

`ip_addr_t *multicast_ip` : IP of multicast group

**Return:**

0 : succeed

Non-0 : error code `ESPCONN_MEM` - Out of memory



### 3. `espconn_igmp_leave`

**Function:**

Quit a multicast group

**Prototype:**

```
sint8 espconn_igmp_leave(ip_addr_t *host_ip, ip_addr_t *multicast_ip)
```

**Parameters:**

`ip_addr_t *host_ip` : IP of host  
`ip_addr_t *multicast_ip` : IP of multicast group

**Return:**

0 : succeed  
Non-0 : error code `ESPCONN_MEM` – Out of memory

### 4. `espconn_dns_setserver`

**Function:**

Set default DNS server. Two DNS server is allowed to be set.

**Note:**

Only if ESP8266 DHCP client is disabled (`wifi_station_dhcpc_stop`), this API can be used

**Prototype:**

```
void espconn_dns_setserver(char numdns, ip_addr_t *dnsserver)
```

**Parameter:**

`char numdns` : DNS server ID, 0 or 1  
`ip_addr_t *dnsserver` : DNS server IP

**Return:**

none

## 4.4. mDNS APIs

### 1. `espconn_mdns_init`

**Function:**

mDNS initialization

**Note:**



(1) Only ESP8266 station support mDNS, please get IP address of ESP8266 station first, then call this API to initial mDNS;

(2) `txt_data` has to be set as “ `key = value` ”, as **Example**;

**Structure:**

```
struct mdns_info{
    char *host_name;
    char *server_name;
    uint16 server_port;
    unsigned long ipAddr;
    char *txt_data[10];
};
```

**Prototype:**

```
void espconn_mdns_init(struct mdns_info *info)
```

**Parameter:**

```
struct mdns_info *info : mdns information
```

**Return:**

```
none
```

**Example:**

```
struct mdns_info *info = (struct mdns_info *)os_zalloc(sizeof(struct
mdns_info));
info->host_name = "espressif";
info->ipAddr = station_ipconfig.ip.addr; //ESP8266 station IP
info->server_name = "iot";
info->server_port = 8080;
info->txt_data[0] = "version = now";
info->txt_data[1] = "user1 = data1";
info->txt_data[2] = "user2 = data2";
espconn_mdns_init(info);
```

## 2. `espconn_mdns_close`

**Function:**

```
close mDNS, corresponding creation API : espconn_mdns_init
```



**Prototype:**

```
void espconn_mdns_close(void)
```

**Parameter:**

none

**Return:**

none

### 3. espconn\_mdns\_server\_register

**Function:**

register mDNS server

**Prototype:**

```
void espconn_mdns_server_register(void)
```

**Parameter:**

none

**Return:**

none

### 4. espconn\_mdns\_server\_unregister

**Function:**

unregister mDNS server

**Prototype:**

```
void espconn_mdns_server_unregister(void)
```

**Parameter:**

none

**Return:**

none

### 5. espconn\_mdns\_get\_servername

**Function:**

Get mDNS server name

**Prototype:**

```
char* espconn_mdns_get_servername(void)
```

**Parameter:**

none



**Return:**  
server name

### 6. `espconn_mdns_set_servername`

**Function:**  
Set mDNS server name

**Prototype:**  
`void espconn_mdns_set_servername(const char *name)`

**Parameter:**  
`const char *name` – server name

**Return:**  
none

### 7. `espconn_mdns_set_hostname`

**Function:**  
Set mDNS host name

**Prototype:**  
`void espconn_mdns_set_hostname(char *name)`

**Parameter:**  
`char *name` – host name

**Return:**  
none

### 8. `espconn_mdns_get_hostname`

**Function:**  
Get mDNS host name

**Prototype:**  
`char* espconn_mdns_get_hostname(void)`

**Parameter:**  
none

**Return:**  
host name

### 9. `espconn_mdns_disable`

**Function:**  
Disable mDNS , corresponding creation API : `espconn_mdns_enable`



**Prototype:**

```
void espconn_mdns_disable(void)
```

**Parameter:**

none

**Return:**

none

## 10. espconn\_mdns\_enable

**Function:**

Enable mDNS

**Prototype:**

```
void espconn_mdns_enable(void)
```

**Parameter:**

none

**Return:**

none



## 5. Application Related

### 5.1. AT APIs

for AT APIs examples, refer to [esp-iot-sdk/examples/at/user/user\\_main.c](http://esp-iot-sdk/examples/at/user/user_main.c).

#### 1. `at_response_ok`

**Function:**

Output `OK` to AT Port (UART0)

**Prototype:**

```
void at_response_ok(void)
```

**Parameter:**

null

**Return:**

null

#### 2. `at_response_error`

**Function:**

output `ERROR` to AT Port (UART0)

**Prototype:**

```
void at_response_error(void)
```

**Parameter:**

null

**Return:**

null

#### 3. `at_cmd_array_regist`

**Function:**

register user-define AT commands.

Can be called only once to register all user-define AT commands.

**Prototype:**

```
void at_cmd_array_regist (  
    at_function * custom_at_cmd_arrar,  
    uint32 cmd_num  
)
```





**Parameter:**

`at_function * custom_at_cmd_arrar` : Array of user-define AT commands  
`uint32 cmd_num` : Number counts of user-define AT commands

**Return:**

null

**Example:**

refer to [esp\\_iot\\_sdk/examples/at/user/user\\_main.c](#)

#### 4. `at_get_next_int_dec`

**Function:**

parse int from AT command

**Prototype:**

`bool at_get_next_int_dec (char **p_src,int* result,int* err)`

**Parameter:**

`char **p_src` : \*p\_src is the AT command that need to be parsed  
`int* result` : int number parsed from the AT command  
`int* err` : 1: no number is found; 3: only '-' is found.

**Return:**

`true`: parser succeeds (NOTE: if no number is found, it will return True, but returns error code 1)  
`false`: parser is unable to parse string; some probable causes are: int number more than 10 bytes; string contains termination characters '/r'; string contains only '-'.

**Example:**

refer to [esp\\_iot\\_sdk/examples/at/user/user\\_main.c](#)

#### 5. `at_data_str_copy`

**Function:** parse string from AT command

**Prototype:**

`int32 at_data_str_copy (char * p_dest, char ** p_src,int32 max_len)`

**Parameter:**

`char * p_dest` : string parsed from the AT command  
`char ** p_src` : \*p\_src is the AT command that need to be parsed  
`int32 max_len` : max string length that allowed



**Return:**

length of string:

`>=0`: succeed and returns the length of the string

`<0` : fail and returns -1

**Example:**

refer to [esp\\_iot\\_sdk/examples/at/user/user\\_main.c](#)

## 6. `at_init`

**Function:**

AT initialize

**Prototype:**

```
void at_init (void)
```

**Parameter:**

null

**Return:**

null

**Example:**

refer to [esp\\_iot\\_sdk/examples/at/user/user\\_main.c](#)

## 7. `at_port_print`

**Function:**

output string to AT PORT(UART0)

**Prototype:**

```
void at_port_print(const char *str)
```

**Parameter:**

`const char *str` : string that need to output

**Return:**

null

**Example:**

refer to [esp\\_iot\\_sdk/examples/at/user/user\\_main.c](#)

## 8. `at_set_custom_info`

**Function:**

User-define version info of AT which can be got by AT+GMR.

**Prototype:**

```
void at_set_custom_info (char *info)
```



**Parameter:**

`char *info` : version info

**Return:**

null

### 9. `at_enter_special_state`

**Function:**

Enter processing state. In processing state, AT core will return `busy` for any further AT commands.

**Prototype:**

`void at_enter_special_state (void)`

**Parameter:**

null

**Return:**

null

### 10. `at_leave_special_state`

**Function:**

Exit from AT processing state.

**Prototype:**

`void at_leave_special_state (void)`

**Parameter:**

null

**Return:**

null

### 11. `at_get_version`

**Function:**

Get Espressif AT lib version.

**Prototype:**

`uint32 at_get_version (void)`

**Parameter:**

null

**Return:**

Espressif AT lib version



## 12. `at_register_uart_rx_intr`

**Function:**

Set UART0 to be used by user or AT commands.

**Note:**

This API can be called multiple times.

Running AT, UART0 default to be used by AT commands.

**Prototype:**

```
void at_register_uart_rx_intr(at_custom_uart_rx_intr rx_func)
```

**Parameter:**

`at_custom_uart_rx_intr` : register a UART0 RX interrupt handler so that UART0 can be used by the customer, while if it's NULL, UART0 is assigned to AT commands.

**Return:**

null

**Example:**

```
void user_uart_rx_intr(uint8* data, int32 len)
{
    // UART0 rx for user
    os_printf("len=%d \r\n", len);
    os_printf(data);

    // change UART0 for AT
    at_register_uart_rx_intr(NULL);
}
void user_init(void){ at_register_uart_rx_intr(user_uart_rx_intr); }
```

## 13. `at_response`

**Function:**

Set AT response

**Note:**

`at_response` outputs from UART0 TX by default which is same as `at_port_print`. But if called `at_register_response_func`, the string of `at_response` will be the parameter of `response_func`, users can define their own behavior.

**Prototype:**

```
void at_response (const char *str)
```



**Parameter:**

`const char *str` : string

**Return:**

none

#### 14. `at_register_response_func`

**Function:**

Register callback of `at_response` for user-define response. After called `at_register_response_func`, the string of `at_response` will be the parameter of `response_func`, users can define their own behavior.

**Prototype:**

`void at_register_response_func (at_custom_response_func_type response_func)`

**Parameter:**

`at_custom_response_func_type` : callback of `at_response`

**Return:**

none



## 5.2. Related JSON APIs

Found in : `esp_iot_sdk/include/json/jsonparse.h` & `jsontree.h`

### 1. `jsonparse_setup`

**Function:**

json initialize parsing

**Prototype:**

```
void jsonparse_setup(  
    struct jsonparse_state *state,  
    const char *json,  
    int len  
)
```

**Parameters:**

`struct jsonparse_state *state` : json parsing pointer  
`const char *json` : json parsing character string  
`int len` : character string length

**Return:**

null

### 2. `jsonparse_next`

**Function:**

Returns jsonparse next object

**Prototype:**

```
int jsonparse_next(struct jsonparse_state *state)
```

**Parameters:**

`struct jsonparse_state *state` : json parsing pointer

**Return:**

int : parsing result

### 3. `jsonparse_copy_value`

**Function:**

Copies current parsing character string to a certain buffer



**Prototype:**

```
int jsonparse_copy_value(  
    struct jsonparse_state *state,  
    char *str,  
    int size  
)
```

**Parameters:**

`struct jsonparse_state *state` : json parsing pointer  
`char *str` : buffer pointer  
`int size` : buffer size

**Return:**

`int` : copy result

#### 4. `jsonparse_get_value_as_int`

**Function:**

Parses json to get integer

**Prototype:**

```
int jsonparse_get_value_as_int(struct jsonparse_state *state)
```

**Parameters:**

`struct jsonparse_state *state` : json parsing pointer

**Return:**

`int` : parsing result

#### 5. `jsonparse_get_value_as_long`

**Function:**

Parses json to get long integer

**Prototype:**

```
long jsonparse_get_value_as_long(struct jsonparse_state *state)
```

**Parameters:**

`struct jsonparse_state *state` : json parsing pointer

**Return:**

`long` : parsing result

#### 6. `jsonparse_get_len`

**Function:**

Gets parsed json length



**Prototype:**

```
int jsonparse_get_value_len(struct jsonparse_state *state)
```

**Parameters:**

```
struct jsonparse_state *state : json parsing pointer
```

**Return:**

```
int : parsed json length
```

### 7. jsonparse\_get\_value\_as\_type

**Function:**

Parses json data type

**Prototype:**

```
int jsonparse_get_value_as_type(struct jsonparse_state *state)
```

**Parameters:**

```
struct jsonparse_state *state : json parsing pointer
```

**Return:**

```
int : parsed json data type
```

### 8. jsonparse\_strcmp\_value

**Function:**

Compares parsed json and certain character string

**Prototype:**

```
int jsonparse_strcmp_value(struct jsonparse_state *state, const char *str)
```

**Parameters:**

```
struct jsonparse_state *state : json parsing pointer
```

```
const char *str : character buffer
```

**Return:**

```
int : comparison result
```

### 9. jsontree\_set\_up

**Function:**

Creates json data tree





**Prototype:**

```
void jsontree_setup(  
    struct jsontree_context *js_ctx,  
    struct jsontree_value *root,  
    int (* putchar)(int)  
)
```

**Parameters:**

`struct jsontree_context *js_ctx` : json tree element pointer  
`struct jsontree_value *root` : root element pointer  
`int (* putchar)(int)` : input function

**Return:**

null

### 10. jsontree\_reset

**Function:**

Resets json tree

**Prototype:**

```
void jsontree_reset(struct jsontree_context *js_ctx)
```

**Parameters:**

`struct jsontree_context *js_ctx` : json data tree pointer

**Return:**

null

### 11. jsontree\_path\_name

**Function:**

get json tree parameters

**Prototype:**

```
const char *jsontree_path_name(  
    const struct jsontree_cotext *js_ctx,  
    int depth  
)
```

**Parameters:**

`struct jsontree_context *js_ctx` : json tree pointer  
`int depth` : json tree depth

**Return:**

`char*` : parameter pointer



### 12. jsontree\_write\_int

**Function:**

write integer to json tree

**Prototype:**

```
void jsontree_write_int(  
    const struct jsontree_context *js_ctx,  
    int value  
)
```

**Parameters:**

`struct jsontree_context *js_ctx` : json tree pointer  
`int value` : integer value

**Return:**

null

### 13. jsontree\_write\_int\_array

**Function:**

Writes integer array to json tree

**Prototype:**

```
void jsontree_write_int_array(  
    const struct jsontree_context *js_ctx,  
    const int *text,  
    uint32 length  
)
```

**Parameters:**

`struct jsontree_context *js_ctx` : json tree pointer  
`int *text` : array entry address  
`uint32 length` : array length

**Return:**

null

### 14. jsontree\_write\_string

**Function:**

Writes string to json tree



**Prototype:**

```
void jsontree_write_string(  
    const struct jsontree_context *js_ctx,  
    const char *text  
)
```

**Parameters:**

```
struct jsontree_context *js_ctx : json tree pointer  
const char* text : character string pointer
```

**Return:**

```
null
```

### 15. jsontree\_print\_next

**Function:**

```
json tree depth
```

**Prototype:**

```
int jsontree_print_next(struct jsontree_context *js_ctx)
```

**Parameters:**

```
struct jsontree_context *js_ctx : json tree pointer
```

**Return:**

```
int : json tree depth
```

### 16. jsontree\_find\_next

**Function:**

```
find json tree element
```

**Prototype:**

```
struct jsontree_value *jsontree_find_next(  
    struct jsontree_context *js_ctx,  
    int type  
)
```

**Parameters:**

```
struct jsontree_context *js_ctx : json tree pointer  
int : type
```

**Return:**

```
struct jsontree_value * : json tree element pointer
```



## 6. Definitions & Structures

### 6.1. Timer

```
typedef void ETSTimerFunc(void *timer_arg);
typedef struct _ETSTIMER_ {
    struct _ETSTIMER_ *timer_next;
    uint32_t timer_expire;
    uint32_t timer_period;
    ETSTimerFunc *timer_func;
    void *timer_arg;
} ETSTimer;
```

### 6.2. WiFi Related Structures

#### 1. Station Related

```
struct station_config {
    uint8 ssid[32];
    uint8 password[64];
    uint8 bssid_set;
    uint8 bssid[6];
};
```

**Note:**

BSSID as MAC address of AP, will be used when several APs have the same SSID.

If `station_config.bssid_set==1` , `station_config.bssid` has to be set, otherwise, the connection will fail.

In general, `station_config.bssid_set` need to be 0.

#### 2. soft-AP related

```
typedef enum _auth_mode {
    AUTH_OPEN = 0,
    AUTH_WEP,
    AUTH_WPA_PSK,
    AUTH_WPA2_PSK,
    AUTH_WPA_WPA2_PSK
} AUTH_MODE;
struct softap_config {
```



```
uint8 ssid[32];
uint8 password[64];
uint8 ssid_len;
uint8 channel;           // support 1 ~ 13
uint8 authmode;         // Don't support AUTH_WEP in soft-AP mode
uint8 ssid_hidden;      // default 0
uint8 max_connection;   // default 4, max 4
uint16 beacon_interval; // 100 ~ 60000 ms, default 100
};
```

**Note:**

If `softap_config.ssid_len==0`, check ssid till find a termination characters; otherwise, it depends on `softap_config.ssid_len`.

### 3. scan related

```
struct scan_config {
    uint8 *ssid;
    uint8 *bssid;
    uint8 channel;
    uint8 show_hidden; // Scan APs which are hiding their SSID or not.
};

struct bss_info {
    STAILQ_ENTRY(bss_info) next;
    u8 bssid[6];
    u8 ssid[32];
    u8 channel;
    s8 rssi;
    u8 authmode;
    uint8 is_hidden; // SSID of current AP is hidden or not.
};

typedef void (* scan_done_cb_t)(void *arg, STATUS status);
```

### 4. WiFi event related structure

```
enum {
    EVENT_STAMODE_CONNECTED = 0,
    EVENT_STAMODE_DISCONNECTED,
    EVENT_STAMODE_AUTHMODE_CHANGE,
    EVENT_STAMODE_GOT_IP,
    EVENT_SOFTAPMODE_STACONNECTED,
```



```
    EVENT_SOFTAPMODE_STADISCONNECTED,  
    EVENT_MAX  
};  
  
enum {  
    REASON_UNSPECIFIED           = 1,  
    REASON_AUTH_EXPIRE          = 2,  
    REASON_AUTH_LEAVE           = 3,  
    REASON_ASSOC_EXPIRE         = 4,  
    REASON_ASSOC_TOOMANY        = 5,  
    REASON_NOT_AUTHED           = 6,  
    REASON_NOT_ASSOCED          = 7,  
    REASON_ASSOC_LEAVE          = 8,  
    REASON_ASSOC_NOT_AUTHED     = 9,  
    REASON_DISASSOC_PWRCAP_BAD  = 10, /* 11h */  
    REASON_DISASSOC_SUPCHAN_BAD = 11, /* 11h */  
    REASON_IE_INVALID           = 13, /* 11i */  
    REASON_MIC_FAILURE          = 14, /* 11i */  
    REASON_4WAY_HANDSHAKE_TIMEOUT = 15, /* 11i */  
    REASON_GROUP_KEY_UPDATE_TIMEOUT = 16, /* 11i */  
    REASON_IE_IN_4WAY_DIFFERS   = 17, /* 11i */  
    REASON_GROUP_CIPHER_INVALID = 18, /* 11i */  
    REASON_PAIRWISE_CIPHER_INVALID = 19, /* 11i */  
    REASON_AKMP_INVALID         = 20, /* 11i */  
    REASON_UNSUPP_RSN_IE_VERSION = 21, /* 11i */  
    REASON_INVALID_RSN_IE_CAP   = 22, /* 11i */  
    REASON_802_1X_AUTH_FAILED   = 23, /* 11i */  
    REASON_CIPHER_SUITE_REJECTED = 24, /* 11i */  
  
    REASON_BEACON_TIMEOUT        = 200,  
    REASON_NO_AP_FOUND           = 201,  
};  
  
typedef struct {  
    uint8 ssid[32];  
    uint8 ssid_len;  
    uint8 bssid[6];  
    uint8 channel;  
} Event_StaMode_Connected_t;
```



```
typedef struct {
    uint8 ssid[32];
    uint8 ssid_len;
    uint8 bssid[6];
    uint8 reason;
} Event_StaMode_Disconnected_t;

typedef struct {
    uint8 old_mode;
    uint8 new_mode;
} Event_StaMode_AuthMode_Change_t;

typedef struct {
    struct ip_addr ip;
    struct ip_addr mask;
    struct ip_addr gw;
} Event_StaMode_Got_IP_t;

typedef struct {
    uint8 mac[6];
    uint8 aid;
} Event_SoftAPMode_StaConnected_t;

typedef struct {
    uint8 mac[6];
    uint8 aid;
} Event_SoftAPMode_StaDisconnected_t;

typedef union {
    Event_StaMode_Connected_t          connected;
    Event_StaMode_Disconnected_t       disconnected;
    Event_StaMode_AuthMode_Change_t    auth_change;
    Event_StaMode_Got_IP_t             got_ip;
    Event_SoftAPMode_StaConnected_t    sta_connected;
    Event_SoftAPMode_StaDisconnected_t sta_disconnected;
} Event_Info_u;

typedef struct _esp_event {
```



```
uint32 event;
Event_Info_u event_info;
} System_Event_t;
```

## 5. smart config structure

```
typedef enum {
    SC_STATUS_WAIT = 0,          // Please don't start connection in this phase
    SC_STATUS_FIND_CHANNEL,     // Start connection by APP in this phase
    SC_STATUS_GETTING_SSID_PSWD,
    SC_STATUS_LINK,
    SC_STATUS_LINK_OVER,       // Got IP, connect to AP successfully
} sc_status;
typedef enum {
    SC_TYPE_ESPTOUCH = 0,
    SC_TYPE_AIRKISS,
} sc_type;
```

## 6.3. JSON Related Structure

### 1. json structure

```
struct jsontree_value {
    uint8_t type;
};

struct jsontree_pair {
    const char *name;
    struct jsontree_value *value;
};

struct jsontree_context {
    struct jsontree_value *values[JSONTREE_MAX_DEPTH];
    uint16_t index[JSONTREE_MAX_DEPTH];
    int (* putchar)(int);
    uint8_t depth;
    uint8_t path;
    int callback_state;
};
```





```
struct jsontree_callback {
    uint8_t type;
    int (* output)(struct jsontree_context *js_ctx);
    int (* set)(struct jsontree_context *js_ctx,
                struct jsonparse_state *parser);
};

struct jsontree_object {
    uint8_t type;
    uint8_t count;
    struct jsontree_pair *pairs;
};

struct jsontree_array {
    uint8_t type;
    uint8_t count;
    struct jsontree_value **values;
};

struct jsonparse_state {
    const char *json;
    int pos;
    int len;
    int depth;
    int vstart;
    int vlen;
    char vtype;
    char error;
    char stack[JSONPARSE_MAX_DEPTH];
};
```

## 2. json macro definition

```
#define JSONTREE_OBJECT(name, ...) /
static struct jsontree_pair jsontree_pair_##name[] = {__VA_ARGS__}; /
static struct jsontree_object name = { /
    JSON_TYPE_OBJECT, /
    sizeof(jsontree_pair_##name)/sizeof(struct jsontree_pair), /
    jsontree_pair_##name }
```



```
#define JSONTREE_PAIR_ARRAY(value) (struct jsontree_value *)(value)
#define JSONTREE_ARRAY(name, ...) /
static struct jsontree_value* jsontree_value_##name[] = {__VA_ARGS__}; /
static struct jsontree_array name = { /
    JSON_TYPE_ARRAY, /
    sizeof(jsontree_value_##name)/sizeof(struct jsontree_value*), /
    jsontree_value_##name } /
```

## 6.4. espconn parameters

### 1. callback function

```
/** callback prototype to inform about events for a espconn */
typedef void (* espconn_rcv_callback)(void *arg, char *pdata, unsigned short len);
typedef void (* espconn_callback)(void *arg, char *pdata, unsigned short len);
typedef void (* espconn_connect_callback)(void *arg);
```

### 2. espconn

```
typedef void* espconn_handle;
typedef struct _esp_tcp {
    int remote_port;
    int local_port;
    uint8 local_ip[4];
    uint8 remote_ip[4];
    espconn_connect_callback connect_callback;
    espconn_reconnect_callback reconnect_callback;
    espconn_connect_callback disconnect_callback;
    espconn_connect_callback write_finish_fn;
} esp_tcp;

typedef struct _esp_udp {
    int remote_port;
    int local_port;
    uint8 local_ip[4];
    uint8 remote_ip[4];
} esp_udp;

/** Protocol family and type of the espconn */
```



```
enum espconn_type {
    ESPCONN_INVALID    = 0,
    /* ESPCONN_TCP Group */
    ESPCONN_TCP        = 0x10,
    /* ESPCONN_UDP Group */
    ESPCONN_UDP        = 0x20,
};

/** Current state of the espconn. Non-TCP espconn are always in state
    ESPCONN_NONE! */
enum espconn_state {
    ESPCONN_NONE,
    ESPCONN_WAIT,
    ESPCONN_LISTEN,
    ESPCONN_CONNECT,
    ESPCONN_WRITE,
    ESPCONN_READ,
    ESPCONN_CLOSE
};

enum espconn_option{
    ESPCONN_START = 0x00,
    ESPCONN_REUSEADDR = 0x01,
    ESPCONN_NODELAY = 0x02,
    ESPCONN_COPY = 0x04,
    ESPCONN_KEEPAKIVE = 0x08,
    ESPCONN_END
}

enum espconn_level{
    ESPCONN_KEEPIKLE,
    ESPCONN_KEEPIKVL,
    ESPCONN_KEEPIKNT
}

/** A espconn descriptor */
struct espconn {
    /** type of the espconn (TCP, UDP) */
    enum espconn_type type;
    /** current state of the espconn */
```



```
enum espconn_state state;
union {
    esp_tcp *tcp;
    esp_udp *udp;
} proto;
/** A callback function that is informed about events for this espconn */
espconn_recv_callback recv_callback;
espconn_sent_callback sent_callback;
uint8 link_cnt;
void *reverse; // reversed for customer use
};
```

## 6.5. interrupt related definition

```
/* interrupt related */
#define ETS_SPI_INUM      2
#define ETS_GPIO_INUM    4
#define ETS_UART_INUM    5
#define ETS_UART1_INUM   5
#define ETS_FRC_TIMER1_INUM 9

/* disable all interrupts */
#define ETS_INTR_LOCK()      ets_intr_lock()
/* enable all interrupts */
#define ETS_INTR_UNLOCK()    ets_intr_unlock()

/* register interrupt handler of frc timer1 */
#define ETS_FRC_TIMER1_INTR_ATTACH(func, arg) \
ets_isr_attach(ETS_FRC_TIMER1_INUM, (func), (void *) (arg))

/* register interrupt handler of GPIO */
#define ETS_GPIO_INTR_ATTACH(func, arg) \
ets_isr_attach(ETS_GPIO_INUM, (func), (void *) (arg))
```



```
/* register interrupt handler of UART */
#define ETS_UART_INTR_ATTACH(func, arg) \
ets_isr_attach(ETS_UART_INUM, (func), (void *) (arg))

/* register interrupt handler of SPI */
#define ETS_SPI_INTR_ATTACH(func, arg) \
ets_isr_attach(ETS_SPI_INUM, (func), (void *) (arg))

/* enable a interrupt */
#define ETS_INTR_ENABLE(inum)    ets_isr_unmask((1<<inum))

/* disable a interrupt */
#define ETS_INTR_DISABLE(inum)  ets_isr_mask((1<<inum))

/* enable SPI interrupt */
#define ETS_SPI_INTR_ENABLE()    ETS_INTR_ENABLE(ETS_SPI_INUM)

/* enable UART interrupt */
#define ETS_UART_INTR_ENABLE()  ETS_INTR_ENABLE(ETS_UART_INUM)

/* disable UART interrupt */
#define ETS_UART_INTR_DISABLE() ETS_INTR_DISABLE(ETS_UART_INUM)

/* enable frc1 timer interrupt */
#define ETS_FRC1_INTR_ENABLE()  ETS_INTR_ENABLE(ETS_FRC_TIMER1_INUM)

/* disable frc1 timer interrupt */
#define ETS_FRC1_INTR_DISABLE() ETS_INTR_DISABLE(ETS_FRC_TIMER1_INUM)

/* enable GPIO interrupt */
#define ETS_GPIO_INTR_ENABLE()  ETS_INTR_ENABLE(ETS_GPIO_INUM)

/* disable GPIO interrupt */
```



```
#define ETS_GPIO_INTR_DISABLE() ETS_INTR_DISABLE(ETS_GPIO_INUM)
```



## 7. Peripheral Related Drivers

### 7.1. GPIO Related APIs

Please refer to [/user/user\\_plug.c](#).

Users can apply to Espressif Systems for GPIO document which contains more details.

#### 1. PIN Related Macros

The following macros are used to control the GPIO pins' status.

```
PIN_PULLUP_DIS(PIN_NAME)
```

```
    Disable pin pull up
```

```
PIN_PULLUP_EN(PIN_NAME)
```

```
    Enable pin pull up
```

```
PIN_FUNC_SELECT(PIN_NAME, FUNC)
```

```
    Select pin function
```

**Example:**

```
PIN_FUNC_SELECT(PERIPHS_IO_MUX_MTDI_U, FUNC_GPIO12); // Use MTDI pin as  
GPIO12.
```

#### 2. gpio\_output\_set

**Function:** set gpio property

**Prototype:**

```
void gpio_output_set(  
    uint32 set_mask,  
    uint32 clear_mask,  
    uint32 enable_mask,  
    uint32 disable_mask  
)
```

**Input Parameters:**

```
uint32 set_mask : set high output; 1:high output; 0:no status change
```

```
uint32 clear_mask : set low output; 1:low output; 0:no status change
```

```
uint32 enable_mask : enable output bit
```

```
uint32 disable_mask : enable input bit
```

**Return:**

```
    null
```



**Example:**

```
gpio_output_set(BIT12, 0, BIT12, 0):  
    Set GPIO12 as high-level output;  
gpio_output_set(0, BIT12, BIT12, 0):  
    Set GPIO12 as low-level output  
gpio_output_set(BIT12, BIT13, BIT12|BIT13, 0):  
    Set GPIO12 as high-level output, GPIO13 as low-level output.  
gpio_output_set(0, 0, 0, BIT12):  
    Set GPIO12 as input
```

### 3. GPIO input and output macro

```
GPIO_OUTPUT_SET(gpio_no, bit_value)  
    Set gpio_no as output bit_value, the same as the output example in 5.1.2  
GPIO_DIS_OUTPUT(gpio_no)  
    Set gpio_no as input, the same as the input example in 5.1.2.  
GPIO_INPUT_GET(gpio_no)  
    Get the level status of gpio_no.
```

### 4. GPIO interrupt

```
ETS_GPIO_INTR_ATTACH(func, arg)  
    Register GPIO interrupt control function  
ETS_GPIO_INTR_DISABLE()  
    Disable GPIO interrupt  
ETS_GPIO_INTR_ENABLE()  
    Enable GPIO interrupt
```

### 5. gpio\_pin\_intr\_state\_set

**Function:**

set GPIO interrupt state

**Prototype:**

```
void gpio_pin_intr_state_set(  
    uint32 i,  
    GPIO_INT_TYPE intr_state  
)
```





**Input Parameters:**

```
uint32 i : GPIO pin ID, if you want to set GPIO14, pls use GPIO_ID_PIN(14);
GPIO_INT_TYPE intr_state : interrupt type as the following:
typedef enum {
    GPIO_PIN_INTR_DISABLE = 0,
    GPIO_PIN_INTR_POSEDGE = 1,
    GPIO_PIN_INTR_NEGEDGE = 2,
    GPIO_PIN_INTR_ANYEGDE = 3,
    GPIO_PIN_INTR_LOLEVEL = 4,
    GPIO_PIN_INTR_HILEVEL = 5
} GPIO_INT_TYPE;
```

**Return:**

```
null
```

### 6. GPIO Interrupt Handler

Follow the steps below to clear interrupt status in GPIO interrupt processing function:

```
uint32 gpio_status;
gpio_status = GPIO_REG_READ(GPIO_STATUS_ADDRESS);
//clear interrupt status
GPIO_REG_WRITE(GPIO_STATUS_W1TC_ADDRESS, gpio_status);
```

## 7.2. UART Related APIs

By default, UART0 is debug output interface. In the case of dual UART, UART0 works as data receive and transmit interface, and UART1 as debug output interface. Please make sure all hardware are correctly connected.

Users can apply to Espressif Systems for UART document which contains more details.

### 1. uart\_init

**Function:**

Initializes baud rates of the two uarts

**Prototype:**

```
void uart_init(
    UartBautRate uart0_br,
    UartBautRate uart1_br
)
```



**Parameters:**

UartBautRate uart0\_br : uart0 baud rate  
UartBautRate uart1\_br : uart1 baud rate

**Baud Rates:**

```
typedef enum {  
    BIT_RATE_9600    = 9600,  
    BIT_RATE_19200   = 19200,  
    BIT_RATE_38400   = 38400,  
    BIT_RATE_57600   = 57600,  
    BIT_RATE_74880   = 74880,  
    BIT_RATE_115200  = 115200,  
    BIT_RATE_230400  = 230400,  
    BIT_RATE_460800  = 460800,  
    BIT_RATE_921600  = 921600  
} UartBautRate;
```

**Return:**

null

## 2. uart0\_tx\_buffer

**Function:**

Sends user-defined data through UART0

**Prototype:**

```
void uart0_tx_buffer(uint8 *buf, uint16 len)
```

**Parameter:**

uint8 \*buf : data to send later  
uint16 len : the length of data to send later

**Return:**

null

## 3. uart0\_rx\_intr\_handler

**Function:**

UART0 interrupt processing function. Users can add the processing of received data in this function. (Receive buffer size: 0x100; if the received data are more than 0x100, pls handle them yourselves.)

**Prototype:**

```
void uart0_rx_intr_handler(void *para)
```

**Parameter:**

void \*para : the pointer pointing to RcvMsgBuff structure



**Return:**  
null

### 7.3. I2C Master Related APIs

Users can apply to Espressif Systems for I2C document which contains more details.

#### 1. i2c\_master\_gpio\_init

**Function:**  
Set GPIO in I2C master mode

**Prototype:**  
`void i2c_master_gpio_init (void)`

**Input Parameters:**  
null

**Return:**  
null

#### 2. i2c\_master\_init

**Function:**  
Initialize I2C

**Prototype:**  
`void i2c_master_init(void)`

**Input Parameters:**  
null

**Return:**  
null

#### 3. i2c\_master\_start

**Function:** configures I2C to start sending data

**Prototype:**  
`void i2c_master_start(void)`

**Input Parameters:**  
null

**Return:**  
null



#### 4. `i2c_master_stop`

**Function:**

configures I2C to stop sending data

**Prototype:**

```
void i2c_master_stop(void)
```

**Input Parameters:**

null

**Return:**

null

#### 5. `i2c_master_send_ack`

**Function:**

Sends I2C ACK

**Prototype:**

```
void i2c_master_send_ack (void)
```

**Input Parameters:**

null

**Return:**

null

#### 6. `i2c_master_send_nack`

**Function:**

Sends I2C NACK

**Prototype:**

```
void i2c_master_send_nack (void)
```

**Input Parameters:**

null

**Return:**

null

#### 7. `i2c_master_checkAck`

**Function:**

Checks ACK from slave

**Prototype:**

```
bool i2c_master_checkAck (void)
```



**Input Parameters:**

null

**Return:**

true: get I2C slave ACK

false: get I2C slave NACK

### 8. `i2c_master_readByte`

**Function:**

Read one byte from I2C slave

**Prototype:**

```
uint8 i2c_master_readByte (void)
```

**Input Parameters:**

null

**Return:**

`uint8` : the value that was read

### 9. `i2c_master_writeByte`

**Function:**

Write one byte to slave

**Prototype:**

```
void i2c_master_writeByte (uint8 wrdata)
```

**Input Parameters:**

`uint8 wrdata` : data to write

**Return:**

null

## 7.4. PWM Related

Herein only introduces the PWM related APIs in `pwm.h`. Users can apply to Espressif Systems for PWM document which contains more details.

PWM APIs can not be called when APIs in `hw_timer.c` are using, because they are using the same hardware timer.

### 1. `pwm_init`

**Function:**

Initialize PWM function, including GPIO selection, period and duty cycle.

**Note:**

This API can be called only once.

**Prototype:**

```
void pwm_init(  
    uint32 period,  
    uint8 *duty,  
    uint32 pwm_channel_num,  
    uint32 (*pin_info_list)[3])
```

**Parameter:**

`uint32 period` : PWM period

`uint8 *duty` : duty cycle of each output

`uint32 pwm_channel_num`: PWM channel number

`uint32 (*pin_info_list)[3]`: GPIO parameter of PWM channel, it is a pointer of  $n * 3$  array which defines GPIO register, IO reuse of corresponding PIN and GPIO number.

**Return:**

null

**Example:**

```
uint32 io_info[][3] =  
    {{PWM_0_OUT_IO_MUX, PWM_0_OUT_IO_FUNC, PWM_0_OUT_IO_NUM},  
     {PWM_1_OUT_IO_MUX, PWM_1_OUT_IO_FUNC, PWM_1_OUT_IO_NUM},  
     {PWM_2_OUT_IO_MUX, PWM_2_OUT_IO_FUNC, PWM_2_OUT_IO_NUM}};  
  
pwm_init(light_param.pwm_period, light_param.pwm_duty, 3, io_info);
```

## 2. pwm\_start

**Function:**

Starts PWM. This function needs to be called after PWM config is changed.

**Prototype:**

```
void pwm_start (void)
```

**Parameter:**

null

**Return:**

null



### 3. `pwm_set_duty`

**Function:**

Sets duty cycle of a PWM output. Set the time that high-level single will last, duty depends on period, the maximum value can be  $\text{Period} * 1000 / 45$ . For example, 1KHz PWM, duty range is 0 ~ 22222

**Note:**

After set configuration, `pwm_start` need to be called to take effect.

**Prototype:**

```
void pwm_set_duty(uint8 duty, uint8 channel)
```

**Input Parameters:**

`uint8 duty` : the time that high-level single will last, duty cycle will be  $(\text{duty} * 45) / (\text{period} * 1000)$

`uint8 channel` : PWM channel, depends on how many PWM channels is used, in `IOT_Demo` it depends on `#define PWM_CHANNEL`

**Return:**

null

### 4. `pwm_get_duty`

**Function:**

Gets duty cycle of PWM output, duty cycle will be  $(\text{duty} * 45) / (\text{period} * 1000)$

**Prototype:**

```
uint8 pwm_get_duty(uint8 channel)
```

**Input Parameters:**

`uint8 channel` : PWM channel, depends on how many PWM channels is used, in `IOT_Demo` it depends on `#define PWM_CHANNEL`

**Return:**

`uint8` : duty cycle of PWM output

### 5. `pwm_set_period`

**Function:**

Sets PWM period, unit: us. For example, for 1KHz PWM, period is 1000 us

**Note:**

After set configuration, `pwm_start` need to be called to take effect.

**Prototype:**

```
void pwm_set_period(uint32 period)
```



**Input Parameters:**

`uint32 period` : PWM period, unit: us

**Return:**

null

## 6. `pwm_get_period`

**Function:**

Gets PWM period.

**Prototype:**

```
uint32 pwm_get_period(void)
```

**Parameter:**

null

**Return:**

PWM period, unit: us.

## 7. `get_pwm_version`

**Function:**

Get version information of PWM.

**Prototype:**

```
uint32 get_pwm_version(void)
```

**Parameter:**

none

**Return:**

PWM version





## 8. Appendix

### 8.1. ESPCONN Programming

#### 1. TCP Client Mode

##### Notes

- ESP8266, working in Station mode, will start client connection when given an IP address.
- ESP8266, working in soft-AP mode, will start client connection when the devices which are connected to ESP8266 are given an IP address.

##### Steps

- Initialize `esppconn` parameters according to protocols.
- Register connect callback function, and register reconnect callback function.
  - ▶ (Call `esppconn_regist_connectcb` and `esppconn_regist_reconcb` )
- Call `esppconn_connect` function and set up the connection with TCP Server.
- Registered connected callback function will be called after successful connection, which will register the corresponding callback function. Recommend to register disconnect callback function.
  - ▶ (Call `esppconn_regist_recvcb` , `esppconn_regist_sentcb` and `esppconn_regist_disconcb` in connected callback)
- When using receive callback function or sent callback function to run disconnect, it is recommended to set a time delay to make sure that the all the firmware functions are completed.

#### 2. TCP Server Mode

##### Notes

- If ESP8266 is in Station mode, it will start server listening when given an IP address.
- If ESP8266 is in soft-AP mode, it will start server listening.

##### Steps

- Initialize `esppconn` parameters according to protocols.
- Register connect callback and reconnect callback function.
  - ▶ (Call `esppconn_regist_connectcb` and `esppconn_regist_reconcb` )
- Call `esppconn_accept` function to listen to the connection with host.



- Registered connect function will be called after successful connection, which will register corresponding callback function.
  - ▶ (Call [espconn\\_regist\\_recvcb](#) , [espconn\\_regist\\_sentcb](#) and [espconn\\_regist\\_disconcb](#) in connected callback)

### 3. espconn callback

Register Function	Callback	Description
<a href="#">espconn_regist_connectcb</a>	<a href="#">espconn_connect_callback</a>	TCP connected successfully
<a href="#">espconn_regist_reconcb</a>	<a href="#">espconn_reconnect_callback</a>	Error occur, TCP disconnected
<a href="#">espconn_regist_sentcb</a>	<a href="#">espconn_sent_callback</a>	Sent TCP or UDP data
<a href="#">espconn_regist_recvcb</a>	<a href="#">espconn_recv_callback</a>	Received TCP or UDP data
<a href="#">espconn_regist_write_finish</a>	<a href="#">espconn_write_finish_callback</a>	Write data into TCP-send-buffer
<a href="#">espconn_regist_disconcb</a>	<a href="#">espconn_disconnect_callback</a>	TCP disconnected successfully

Notice: Parameter [arg](#) of callback is the pointer corresponding structure [espconn](#). This pointer may be different in different callbacks, please don't use this pointer directly to distinguish one from another in multiple connections, use [remote\\_ip](#) and [remote\\_port](#) in [espconn](#) instead.

## 8.2. RTC APIs Example

Demo code below shows how to get RTC time and to read and write to RTC memory.

```
#include "ets_sys.h"
#include "osapi.h"
#include "user_interface.h

os_timer_t rtc_test_t;
#define RTC_MAGIC 0x55aaaa55

typedef struct {
    uint64 time_acc;
    uint32 magic ;
    uint32 time_base;
}RTC_TIMER_DEMO;

void rtc_count()
```



```
{
    RTC_TIMER_DEMO rtc_time;
    static uint8 cnt = 0;
    system_rtc_mem_read(64, &rtc_time, sizeof(rtc_time));

    if(rtc_time.magic!=RTC_MAGIC){
        os_printf("rtc time init...\r\n");
        rtc_time.magic = RTC_MAGIC;
        rtc_time.time_acc= 0;
        rtc_time.time_base = system_get_rtc_time();
        os_printf("time base : %d \r\n",rtc_time.time_base);
    }

    os_printf("=====\r\n");
    os_printf("RTC time test : \r\n");

    uint32 rtc_t1,rtc_t2;
    uint32 st1,st2;
    uint32 cal1, cal2;

    rtc_t1 = system_get_rtc_time();
    st1 = system_get_time();

    cal1 = system_rtc_clock_cali_proc();
    os_delay_us(300);

    st2 = system_get_time();
    rtc_t2 = system_get_rtc_time();

    cal2 = system_rtc_clock_cali_proc();
    os_printf(" rtc_t2-t1 : %d \r\n",rtc_t2-rtc_t1);
    os_printf(" st2-t2 : %d \r\n",st2-st1);
    os_printf("cal 1 : %d.%d \r\n", ((cal1*1000)>>12)/1000,
((cal1*1000)>>12)%1000 );
    os_printf("cal 2 : %d.%d \r\n",((cal2*1000)>>12)/1000,
((cal2*1000)>>12)%1000 );
    os_printf("=====\r\n\r\n");
    rtc_time.time_acc += ( ((uint64)(rtc_t2 - rtc_time.time_base)) *
( (uint64)((cal2*1000)>>12)) );
}
```



```
os_printf("rtc time acc : %lld \r\n",rtc_time.time_acc);
os_printf("power on time : %lld us\r\n", rtc_time.time_acc/1000);
os_printf("power on time : %lld.%02lld S\r\n", (rtc_time.time_acc/
10000000)/100, (rtc_time.time_acc/10000000)%100);

rtc_time.time_base = rtc_t2;
system_rtc_mem_write(64, &rtc_time, sizeof(rtc_time));
os_printf("-----\r\n");

if(5== (cnt++){
    os_printf("system restart\r\n");
    system_restart();
}else{
    os_printf("continue ... \r\n");
}
}

void user_init(void)
{
    rtc_count();
    os_printf("SDK version:%s\n", system_get_sdk_version());

    os_timer_disarm(&rtc_test_t);
    os_timer_setfn(&rtc_test_t,rtc_count,NULL);
    os_timer_arm(&rtc_test_t,10000,1);
}
```

### 8.3. Sniffer Structure Introduction

ESP8266 can enter promiscuous mode (sniffer) and capture IEEE 802.11 packets in the air.

The following HT20 packets are support:

- 802.11b
- 802.11g
- 802.11n (from MCS0 to MCS7)
- AMPDU types of packets



The following are not supported:

- HT40
- LDPC

Although ESP8266 can not completely decipher these kinds of IEEE80211 packets completely, it can still obtain the length of these special packets.

In summary, while in sniffer mode, ESP8266 can either capture completely the packets or obtain the length of the packet:

- Packets that ESP8266 can decipher completely; ESP8266 returns with the
  - ▶ MAC address of the both side of communication and encryption type and
  - ▶ the length of entire packet.
- Packets that ESP8266 can only partial decipher; ESP8266 returns with
  - ▶ the length of packet.

Structure [RxControl](#) and [sniffer\\_buf](#) are used to represent these two kinds of packets. Structure [sniffer\\_buf](#) contains structure [RxControl](#).

```
struct RxControl {
    signed rssi:8;           // signal intensity of packet
    unsigned rate:4;
    unsigned is_group:1;
    unsigned:1;
    unsigned sig_mode:2;    // 0:is 11n packet; 1:is not 11n packet;
    unsigned legacy_length:12; // if not 11n packet, shows length of packet.
    unsigned damatch0:1;
    unsigned damatch1:1;
    unsigned bssidmatch0:1;
    unsigned bssidmatch1:1;
    unsigned MCS:7;        // if is 11n packet, shows the modulation
                           // and code used (range from 0 to 76)
    unsigned CWB:1; // if is 11n packet, shows if is HT40 packet or not
    unsigned HT_length:16; // if is 11n packet, shows length of packet.
    unsigned Smoothing:1;
    unsigned Not_Sounding:1;
    unsigned:1;
    unsigned Aggregation:1;
    unsigned STBC:2;
    unsigned FEC_CODING:1; // if is 11n packet, shows if is LDPC packet or not.
```



```
    unsigned SGI:1;
    unsigned rxend_state:8;
    unsigned ampdu_cnt:8;
    unsigned channel:4; //which channel this packet in.
    unsigned:12;
};

struct LenSeq{
    u16 len; // length of packet
    u16 seq; // serial number of packet, the high 12bits are serial number,
           // low 14 bits are Fragment number (usually be 0)
    u8 addr3[6]; // the third address in packet
};

struct sniffer_buf{
    struct RxControl rx_ctrl;
    u8 buf[36 ]; // head of ieee80211 packet
    u16 cnt;     // number count of packet
    struct LenSeq lenseq[1]; //length of packet
};

struct sniffer_buf2{
    struct RxControl rx_ctrl;
    u8 buf[112];
    u16 cnt;
    u16 len; //length of packet
};
```

Callback `wifi_promiscuous_rx` has two parameters ( `buf` and `len`). `len` means the length of `buf`, it can be: `len = 128`, `len = X * 10`, `len = 12` :

**Case of LEN == 128**

- `buf` contains structure `sniffer_buf2`: it is the management packet, it has 112 bytes data.
- `sniffer_buf2.cnt` is 1.
- `sniffer_buf2.len` is the length of packet.

**Case of LEN == X \* 10**

- `buf` contains structure `sniffer_buf`: this structure is reliable, data packets represented by it has been verified by CRC.



- `sniffer_buf.cnt` means the count of packets in `buf`. The value of `len` depends on `sniffer_buf.cnt`.
  - ▶ `sniffer_buf.cnt==0`, invalid buf; otherwise, `len = 50 + cnt * 10`
- `sniffer_buf.buf` contains the first 36 bytes of ieee80211 packet. Starting from `sniffer_buf.lenseq[0]`, each structure `lenseq` represent a length information of packet. `lenseq[0]` represents the length of first packet. If there are two packets where (`sniffer_buf.cnt == 2`), `lenseq[1]` represents the length of second packet.
- If `sniffer_buf.cnt > 1`, it is a AMPDU packet, head of each MPDU packets are similar, so we only provide the length of each packet (from head of MAC packet to FCS)
- This structure contains: length of packet, MAC address of both sides of communication, length of the head of packet.

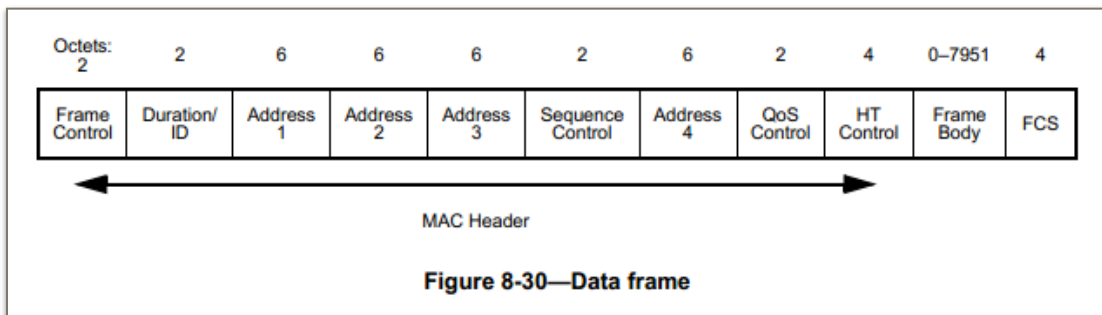
Case of LEN == 12

- `buf` contains structure `RxControl`; but this structure is not reliable, we can not get neither MAC address of both sides of communication nor length of the head of packet.
- For AMPDU packet, we can not get the count of packets or the length of packet.
- This structure contains: length of packet, `rss` and `FEC_CODING`.
- `RSSI` and `FEC_CODING` are used to guess if the packets are sent from same device.

Summary

We should not take too long to process the packets. Otherwise, other packets may be lost.

The diagram below shows the format of a ieee80211 packet:



- The first 24 bytes of MAC Header of data packet are needed:
  - ▶ `Address 4` field depends on `FromDS` and `ToDS` which is in `Frame Control`;
  - ▶ `QoS Control` field depends on `Subtype` which is in `Frame Control`;
  - ▶ `HT Control` field depends on `Order Field` which is in `Frame Control`;
  - ▶ More details are found in IEEE Std 80211-2012.



- For WEP packets, MAC Header is followed by 4 bytes IV and before FCS there are 4 bytes ICV.
- For TKIP packet, MAC Header is followed by 4 bytes IV and 4 bytes EIV, and before FCS there are 8 bytes MIC and 4 bytes ICV.
- For CCMP packet, MAC Header is followed by 8 bytes CCMP header, and before FCS there are 8 bytes MIC.

#### 8.4. ESP8266 soft-AP and station channel configuration

Even though ESP8266 can be in soft-AP + station mode, it actually has only one hardware channel. So in soft-AP + station mode, ESP8266 soft-AP will adjust its channel configuration to be as same as ESP8266 station.

This limitation may cause some inconvenience in softAP + station mode users need to pay attention, for example:

Case 1.

- (1) If user connect ESP8266 station to a router(e.g. router is in channel 6)
- (2) Then set ESP8266 softAP by [wifi\\_softap\\_set\\_config](#)
- (3) The API may return true, but channel will always be channel 6. Because we have only one hardware channel.

Case 2.

- (1) If user set ESP8266 softAP a channel number(e.g. channel 5) by [wifi\\_softap\\_set\\_config](#)
- (2) Some stations connected to ESP8266 softAP.
- (3) Then connect ESP8266 station to a router of which channel number is different (e.g. channel 6).
- (4) ESP8266 softAP has to adjust its channel to be as same as ESP8266 station, in this case, is channel 6.
- (5) So the stations that connected to ESP8266 softAP in step 2 will be disconnected because of the channel change.