

Quick Start Guide for RTKM

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Introduction

RTKM is a pre-allocated memory management feature. It manages memory sizes larger than 1 page size (4096 bytes¹). It can prevent the memory fragmentation issue during something like install/uninstall or any dynamic memory requesting operation from the WiFi driver, but the cost is there will be always some memories occupied til the end of RTKM life cycle.

1. Support driver

AX series and driver version higher than 1.19.

2. Setup RTKM

It can configure by CONFIG_RT KM in *Makefile* or *platform/{platform}.mk*

{value} : n/m/y

n: not support

m: standalone

The driver will build two ko modules (*rtkm.ko* and *{rtk wi-fi}.ko*).

Insert *rtkm.ko* **before** insert *wi-fi.ko*.

the rtkm memory will be released only when the *rtkm.ko* is removed.

y: built-in

The driver only build one *{rtk wi-fi}.ko*

the rtkm memory will be released when the module is removed.

3. Pre-allocate memory

Method 1: Predefined Macros in *Makefile* or *platform/{platform}.mk*

You can define the *RTKM_MPOOL_{0 ~ 8}* to allocate usage per page order pool size.

RTKM_MPOOL_{order}={value}

```
CONFIG_RT KM = y
EXTRA_CFLAGS += -DRTKM_MPOOL_0=0
EXTRA_CFLAGS += -DRTKM_MPOOL_1=12292
```

¹ In x86 Linux, one page size is 4Kb

```
EXTRA_CFLAGS += -DRTKM_MPOOL_2=1
EXTRA_CFLAGS += -DRTKM_MPOOL_3=132
EXTRA_CFLAGS += -DRTKM_MPOOL_4=0
EXTRA_CFLAGS += -DRTKM_MPOOL_5=0
EXTRA_CFLAGS += -DRTKM_MPOOL_6=0
EXTRA_CFLAGS += -DRTKM_MPOOL_7=3
EXTRA_CFLAGS += -DRTKM_MPOOL_8=0
```

Method 2: module parameter

You can use the module parameter *mpool* to allocate usage per page order pool size.

mpool: pre-allocated memory pool (array of int)

```
$ insmod rtkm.ko mpool=0,12292,1,132,0,0,0,3,0
```

Order	mpool	Size ² (byte)	Trace bit mask	Default value
0	RTKM_MPOOL_0	0x1000	0x01	0
1	RTKM_MPOOL_1	0x2000	0x02	0
2	RTKM_MPOOL_2	0x4000	0x04	0
3	RTKM_MPOOL_3	0x8000	0x08	0
4	RTKM_MPOOL_4	0x10000	0x10	0
5	RTKM_MPOOL_5	0x20000	0x20	0
6	RTKM_MPOOL_6	0x40000	0x40	0
7	RTKM_MPOOL_7	0x80000	0x80	0
8	RTKM_MPOOL_8	0x100000	0x100	0

Note: Please contact FAE for initial value setting.

4. Checking and Debugging

Checking current pre-allocate memory usage.

```
$ cat /proc/net/rtl8852bu/rtkm
===== RTKM
=====
order    use    peak    alloc+    size
-----
  1    12291    12292    12292 100696064
  2         1         1         1   16384
  3      132      132      132  4325376
  7         2         2         3  1572864
sum    12426    12427    12428 106610688
```

Debugging/Tracing pre-allocate memory

Enable debug trace by set the bit mask.

Method 1: proc file system

echo order bit mask to /proc/net/rtl8852bu/rtkm

```
$ echo 0x8 > /proc/net/rtl8852bu/rtkm
```

Method 2: module parameter

² In x86 system, size = PAGE_SIZE(4Kb) * (1 << Order)

parm: rtkm_trace:Trace memory pool (uint)

```
$ insmod rtkm.ko rtkm_trace=0x8
```

Driver logs:

```
rtkm: _kmalloc: require(00000000c52a3603, 32768) usage(3 132/132)
dbg_rtw_zmalloc+0x58/0xac [8852bu]
phl_register_tx_ring+0xf7/0x1a8 [8852bu]
phl_alloc_stainfo_sw+0x8eb/0x983 [8852bu]
rtw_phl_wifi_role_alloc+0x5e6/0x9f1 [8852bu]
```

Memory leak

When rtkm destroy, if the memory entries still in used, rtkm will print trace log for debugging.

Negative example log:

```
rtkm: rtkm_prealloc_destroy
rtkm: rtkm_destroy_phy
rtkm: ===== RTKM
=====
rtkm: order      use      peak    alloc+    size
rtkm: -----
rtkm:    1        1        1     4098    33570816
rtkm: rtkm_destroy_phy: memory leak! order=1 num=1
rtkm: rtkm_destroy_phy: rb tree leak! order=1
rtkm: rtkm_destroy_phy: memory leak! (00000000bc134dab, 8192)
dbg_rtw_zmalloc+0x58/0xac [8852bu]
alloc_txring+0x7f/0x150 [8852bu]
_rtw_init_xmit_priv+0x33d/0x37e [8852bu]
rtw_init_drv_sw+0x80/0x1bd [8852bu]
rtkm: rtkm_prealloc_destroy: done
```

5. Document revision history

Version	Date YYYY-MM-DD	Remarks
1.0	2022-05-17	Initial release