RTL9607C
SINGLE-CHIP PON

Interrupt
Application Note
(CONFIDENTIAL: Development Partners Only)

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REVISION HISTORY

Revision	Release Date	Summary
1.0.0	2017/06/02	First Release

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1. Overview

Since switch core provided the interface of MII, GMII to connect to CPU and CPU is a port included in switch. 9607C provided the interrupt and IRQ functionality for monitoring and handling events from ASIC. Below is the switch interrupt architecture:

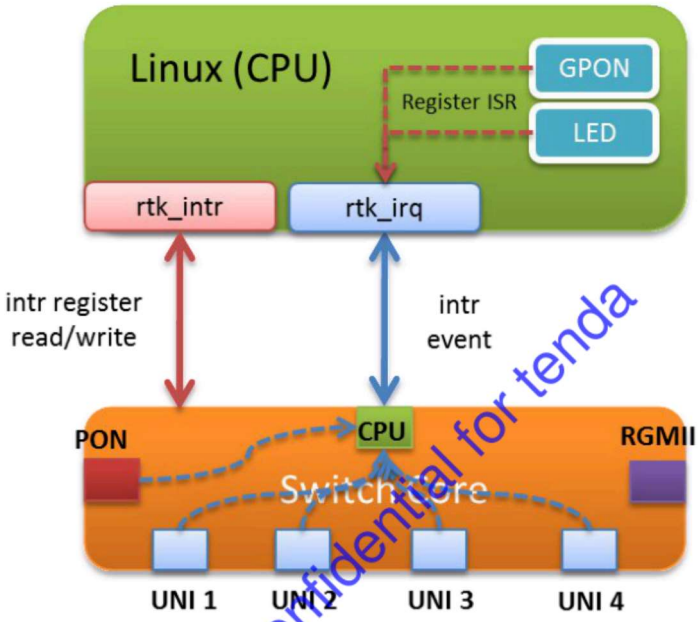

Figure 1. Switch Interrupt architecture

2. Interrupt Polarity

Interrupt function support 1 bit polarity setting. User can select pull low or pull high enable interrupt. The table 1 show the configure register INTR_CONTROL.

Table 1. Interrupt polarity configure

Field Name	Bits	Description
INTR_POLARITY	1	Pull high or pull low enable 0b0: Pull high 0b1: Pull low

3. Interrupt Mask Register

Interrupt function support number of 15 IMR (interrupt mask registers) for enabled or disabled each types of event. The supported IMR list as below:

Table 2. Interrupt Mask Register (INTR_IMR)

Field Name	Bits	Description
LINK_CHANGE	1	Enable port linking change interrupt 0b0: Disable 0b1: Enable
METER_EXCEEDED	1	Meter-limit-exceed interrupt
LEARN_OVER	1	Over L2 learning limit interrupt
SPEED_CHANGE	1	Port link speed changed
SPECIAL_CONGEST	1	At lease one pert have entered special congest mode
LOOP_DETECTION	1	Have loop detected or loop recoved situation happen
ACL_ACTION	1	ACL interrupt
GPHY_EVENT	1	GPHY interrupt
SERDES_EVENT	1	Serdes interrupt
GPON_EVENT	1	Fiber mode GPON interrupt
EPON_EVENT	1	Fiber mode EPON interrupt
DYING_GASP_EVENT	1	Gying gasp interrupt
THERMAL_ALARM	1	Thermal alarm
SMART_CARD	1	Smart card reader interrupt
Crash	1	Switch crash interrupt
FB_EVENT	1	Flow based interrupt
TOD	1	ToD for software time update
SFP	1	SFP
PTP_PON_TOD_UPDATE	1	PON ToD Update interrupt
PTP_1_SEC_EVENT	1	PTP 1 second interrupt

4. Interrupt Mask Status

For each IMR, interrupt function support each one status bit for checking interrupt is happened or not. When interrupt of ASIC is triggered, ASIC will pull low the interrupt I/O until IMS is cleared than voltage will be recovered. Below is the list of supported IMS table:

Table 3. Interrupt mask status(INTR_IMS)

Field Name	Bits	Description
LINK_CHANGE	1	Enable port linking change interrupt 0b0: Disable 0b1: Enable
METER_EXCEEDED	1	Meter-limit-exceed interrupt
LEARN_OVER	1	Over L2 learning limit interrupt
SPEED_CHANGE	1	Port link speed changed
SPECIAL_CONGEST	1	At lease one pert have entered special congest mode
LOOP_DETECTION	1	Have loop detected or loop recoved situation happen
ACL_ACTION	1	ACL interrupt
GPHY_EVENT	1	GPHY interrupt
SERDES_EVENT	1	Serdes interrupt
GPON_EVENT	1	Fiber mode GPON interrupt
EPON_EVENT	1	Fiber mode EPON interrupt
DYING_GASP_EVENT	1	Gying gasp interrupt
THERMAL_ALARM	1	Thermal alarm
SMART_CARD	1	Smart card reader interrupt

Crash	1	Switch crash interrupt
FB_EVENT	1	Flow based interrupt
TOD	1	ToD for software time update
SFP	1	SFP
PTP_PON_TOD_UPDAT	1	PON ToD Update interrupt
PTP_1_SEC_EVENT	1	PTP 1 second interrupt

5. Interrupt Status Indicator

For more details status, interrupt function provided the indicator to which event is happened in each IMS. For example, link changed has two types of event: linkup and linkdown. For separate these two events, you can use the indicators. Table 4 is the list of supported indicators.

Table 4. Interrupt Indicators

Field Name	Bits	Description
PORT_LINKDOWN_INDICATOR	12	Per port had been link down state， write 1 to clear
PORT_LINKUP_INDICATOR	12	Per port had been link up state， write 1 to clear
L2_LRN_OVER_STS	13	System and per Port L2 learning limit number overed status. The over status will be clear by software only. ASIC will not clear the over bit after per learning number was below limitation. Bit 0-11:per port Bit 12:per system 0b0:below limit number status 0b1:over limit number status
SPEED_CHANGE_INDICATOR	12	Per-port link speed changed status 0b0:not changed 0b1:changed
SC_P_STS	12	Per port entering special congest mode status 0b0 :normal 0b1 :in special conguest mode
METER_LB_EXCEED_STS	48	Per meter execced status， write 1 to clear 0b0:haven't been exceeded 0b1:have been exceeded
RLDP_LP_ENTER_STS	5	Port mask of looped ports
RLDP_LP_LEAVE_STS	5	Port mask of looping releasing
G/EPHY_STS	5	Per-port G/EPHY status change

6. Interrupt Request

Interrupt request function is supported in Linux kernel for modules to register it's interrupt handler. The switch core interrupt request id is 8. The details configure, please see 7.6.

7. API

Realtek API provides a series of interface to let users setup the Interrupt function without writing register

and table directly. This section will discuss these APIs and gives the example.

7.1. Initialization

rtk_intr_init and ***rtk_irq_init*** is the first API users should call before setup any configuration. This API will disable all of interrupt mask register and clear all of interrupt mask status. Indicator of port link down, link up and speed change will also be cleared.

7.2. Set & Get IMR

The ***rtk_intr_imr_set*** API will set the specific interrupt mask register and ***rtk_intr_imr_get*** can get current IMR setting.

Example:

```
/*
  Enable Link chagne interrupt
*/

rtk_enable_t   state;
int32 ret ;
uint32 type = INTR_TYPE_LINK_CHANGE ;
state = ENABLED ;
if((ret= rtk_intr_imr_set(type,state)) != RT_ERR_OK)
{
    return ret;
}
if((ret= rtk_intr_imr_get(type,&state)) != RT_ERR_OK)
{
    return ret;
}
```


7.3. Get & Clear IMS

The ***rtk_intr_ims_get*** API can be used to check the status of each interrupts. If event is happened, user can call the ***rtk_intr_ims_clear*** API to clear the event after event handler.

Example:

```
/*
```

```
  Cehck the Link chagne status and clear it!
*/

rtk_enable_t   state;
int32 ret ;
uint32 type = INTR_TYPE_LINK_CHANGE ;

if((ret= rtk_intr_ims_get(type,&state)) != RT_ERR_OK)
{
    return ret;
}

if((ret= rtk_intr_ims_clear(type)) != RT_ERR_OK)
{
    return ret;
}
```

7.4. Get & Clear Indicator

Interrupt indicators for each IMR, can used to indicator the detail type of event after a specific IMS is triggered. API list show as below:

rtk_intr_linkupStatus_get, rtk_intr_linkupStatus_clear,

rtk_intr_linkdownStatus_get, rtk_intr_linkdownStatus_clear,

rtk_intr_speedChangeStatus_get, rtk_intr_speedChangeStatus_clear,

rtk_intr _gphyStatus_get, rtk_intr_gphyStatus_clear.

More APIs are implemented in each module such as RLDP/ Meter Exceed, etc... If you want to know details, please check to these application notes.

Example:

```
/*
  Cehck the Link up status !
*/

rtk_enable_t   state;
int32 ret ;
if((ret= rtk_intr_linkupStatus_get(&state)) != RT_ERR_OK)
{
    return ret;
```

```
}

if((ret= rtk_intr_linkupStatus_clear(type)) != RT_ERR_OK)
{
    return ret;
}
```

7.5. Set and Get Polarity

The ***rtk_intr_polarity_set*** and ***rtk_intr_polarity_get*** API is use to set or get the interrupt polarity mode.
Example:

```
/*
  Cehck the Link up status !
*/

rtk_intr_polarity_t polar;
int32 ret ;
polar =INTR_POLAR_HIGH ;

if((ret= rtk_intr_polarity_set(polar)) != RT_ERR_OK)
{
    return ret;
}

if((ret= rtk_intr_polarity_get(&polar)) != RT_ERR_OK)
{
    return ret;
}
```


7.6. Register & Unregister ISR

The ***rtk_irq_isr_register*** and ***rtk_irq_isr_unregister*** API is used to register your callback function for a specific IMS.
Example:

```
/*
```

```
  Register a callback function for GPON interrupt
*/

void rtk_gpon_isr_entry(void)
{
  …
}
rtk_intr_type _t type;
int32 ret ;
type =INTR_TYPE_GPON ;

if((ret= rtk_irq_isr_register(type, rtk_gpon_isr_entry)) != RT_ERR_OK)
{
    return ret;
}

if((ret= rtk_irq_isr_unregister(type, rtk_gpon_isr_entry)) != RT_ERR_OK)
{
    return ret;
}
```


7.7. Sample code

This section gives an example for setup a configuration of interrupt. The example setup interrupts for GPON as flow list:

Field	Value	Description
INTR_POLARITY	0	Set Polarity to pull high
IMR_GPON	1	Enable GPON IMR
ISR	gpon_isr_entry	Hook ISR for GPON interrupt
IMS_GPON	1	Write 1 clear for clear GPON event.

Example:

```
if((ret= rtk_intr_imr_set(INTR_TYPE_GPON,DISABLED)) != RT_ERR_OK)
{
      RT_ERR(ret,(MOD_GPON | MOD_DAL), "");
      return ret ;
}

      /*register gpon isr*/
if((ret = rtk_irq_isr_register(INTR_TYPE_GPON,rtk_gpon_isr_entry)) !=
```

```
RT_ERR_OK)
{
      RT_ERR(ret,(MOD_GPON | MOD_DAL), "");
      return ret;
}

if((ret = RT_MAPPER->gpon_activate(initState)) != RT_ERR_OK)
{
      RT_ERR(ret,(MOD_GPON | MOD_DAL), "");
      return ret;
}

/* clear switch interrupt state for GPON*/
 if((ret = rtk_intr_ims_clear(INTR_TYPE_GPON)) != RT_ERR_OK)
{
      RT_ERR(ret,(MOD_GPON | MOD_DAL), "");
      return ret;
 }

 /* switch interrupt mask for GPON */
 if((ret = rtk_intr_imr_set(INTR_TYPE_GPON,ENABLED)) != RT_ERR_OK)
 {
      RT_ERR(ret,(MOD_GPON | MOD_DAL), "");
      return ret;
 }
```

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