Application Note

CPE

Broadband CPE GMAC WAN

REV. 0.1

CPE-AN1300-R

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Revision History

Revision	*Date*	*Change Description*
CPE-AN1300-R	07/28/14	Initial release

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About This Document

Purpose and Audience

This document describes the Gigabit MAC (GMAC) as a Wide Area Network (WAN) port feature, the Command Line Interface (CLI), and the user parameters.

This document is intended for software and system engineers.

Acronyms and Abbreviations

In most cases, acronyms and abbreviations are defined on first use.

Acronyms and abbreviations in this document are also defined in "Acronyms and Abbreviations" on page 18.

For a comprehensive list of acronyms and other terms used in Broadcom documents, go to: http://www.broadcom.com/press/glossary.php.

Document Conventions

The following conventions may be used in this document:

Convention	*Description*
Bold	User input and actions: for example, type **exit**, click **OK**, press **Alt+C**
`Monospace`	Code: `#include <iostream>` HTML: `<td rowspan = 3>` Command line commands and parameters: `wl [-l] <command>`
< >	Placeholders for *required* elements: enter your <username> or `wl <command>`
[ ]	Indicates *optional* command-line parameters: `wl [-l]` Indicates bit and byte ranges (inclusive): [0:3] or [7:0]

Technical Support

Broadcom provides customer access to a wide range of information, including technical documentation, schematic diagrams, product bill of materials, PCB layout information, and software updates through its customer support portal (https://support.broadcom.com). For a CSP account, contact your Sales or Engineering support representative.

In addition, Broadcom provides other product support through its Downloads and Support site (http://www.broadcom.com/support/).

Introduction

The earlier devices contain ROBO and an IMP port with four IUDMA channels. The IMP port is the only way the host (MIPS or FAPs) processor can receive or transmit packets to the ROBO switch. The IMP port is limited to ~1G in each direction (RX and TX).

The GMAC allows forwarding 2G of bidirectional data.

Build

By default the GMAC feature is enabled in all BCM63268 profiles and board parameters, starting in release 4.12L.06. The GMAC feature is usable only when GMAC is enabled both in the board parameters and also in the *menuconfig*.

Board Parameters

Using board parameters, a user can decide to override and disable the GMAC feature even after the GMAC feature has been compiled-in during the build process (using `make menuconfig`). After making the changes, follow the regular procedure for the CFE build and flashing the image.

Enabling GMAC

To enable the GMAC feature at run time (in addition to `make menuconfig`) for a given board, define the `bp_ulDeviceOptions` parameter and assign a `BP_DEVICE_OPTION_ENABLE_GMAC` value to it in the board parameters as shown in the example below:

```
{bp_ulDeviceOptions,          .u.ul = BP_DEVICE_OPTION_ENABLE_GMAC },
```

Disabling GMAC

To disable the GMAC feature at run time (in addition to `make menuconfig`) for a given board, either do not define the `bp_ulDeviceOptions` parameter or do not assign a `BP_DEVICE_OPTION_ENABLE_GMAC` value to it in the board parameters.

Menu Configuration

Enabling GMAC

To enable the GMAC feature, use the *make menuconfig* command in a Linux command prompt before the build.

```
$ make menuconfig
```

Then navigate to **menuconfig > Ethernet and VLAN Selection > <M> Support for GMAC**.

Use the space bar to select the GMAC.

Note: The GMAC feature can be either statically built (*) with the Linux kernel, built as a module (M), or be compiled out.

Disabling GMAC

To disable the GMAC feature, use the *make menuconfig* command in a Linux command prompt before the build.

```
$ make menuconfig
```

Then navigate to **menuconfig > Ethernet and VLAN Selection > <M> Support for GMAC**.

Use the space bar to deselect the GMAC feature.

Note: The GMAC feature can be either statically built (*) with the Linux kernel, built as module (M), or may be compiled out.

GMAC WAN

The GMAC WAN support allows the user to configure the CPE such that 2G of the bidirectional data can be forwarded (1G upstream and 1G downstream). The GMAC is outside the ROBO switch and connected to UBUS. The host (MIPS/FAP) can receive (transmit) data from (to) GMAC similar to the IUDMA channels on the IMP port. The GMAC shares a common GPHY with the ROBO port-3, i.e., either GMAC is active and using the GPHY or the ROBO port is active and using the GPHY.

The GMAC has a known limitation that it does not support 10/100 Mbps link speed. As a work-around for the GMAC 10/100 Mbps limitation, the driver uses the GMAC when the negotiated link speed is 1000 Mbps and switches to the ROBO port when the link speed is 10/100 Mbps. If the bidirectional data rate requirements are less than 900 Mbps, there is no need to use the GMAC.

The driver can be configured either to always use the ROBO port or switch between the GMAC and ROBO MAC based on the negotiated link speed. This configuration is done by setting the GMAC mode.

Notes:

- As a prerequisite to using the GMAC mode, the user should configure the ROBO port-3 as a WAN interface.
- The same binary with GMAC support can be used for both BCM63268C0 and BCM63268D0 chips. When the driver detects that the chip is BCM63268C0 it will automatically disable the support for GMAC.
- When ROBO port-3 is configured as LAN port, and the ROBO port-3 behavior is like the other LAN (ports-0, port-1, etc.) GMAC is not used.

Caution! ROBO LAN-2-LAN switching should not be disabled.

FAP Compiled-in

When the FAP is compiled-in through *make menuconfig*, the FAPs are used for both upstream and downstream data paths. FAP0 handles the upstream traffic, and similarly FAP1 handles downstream traffic.

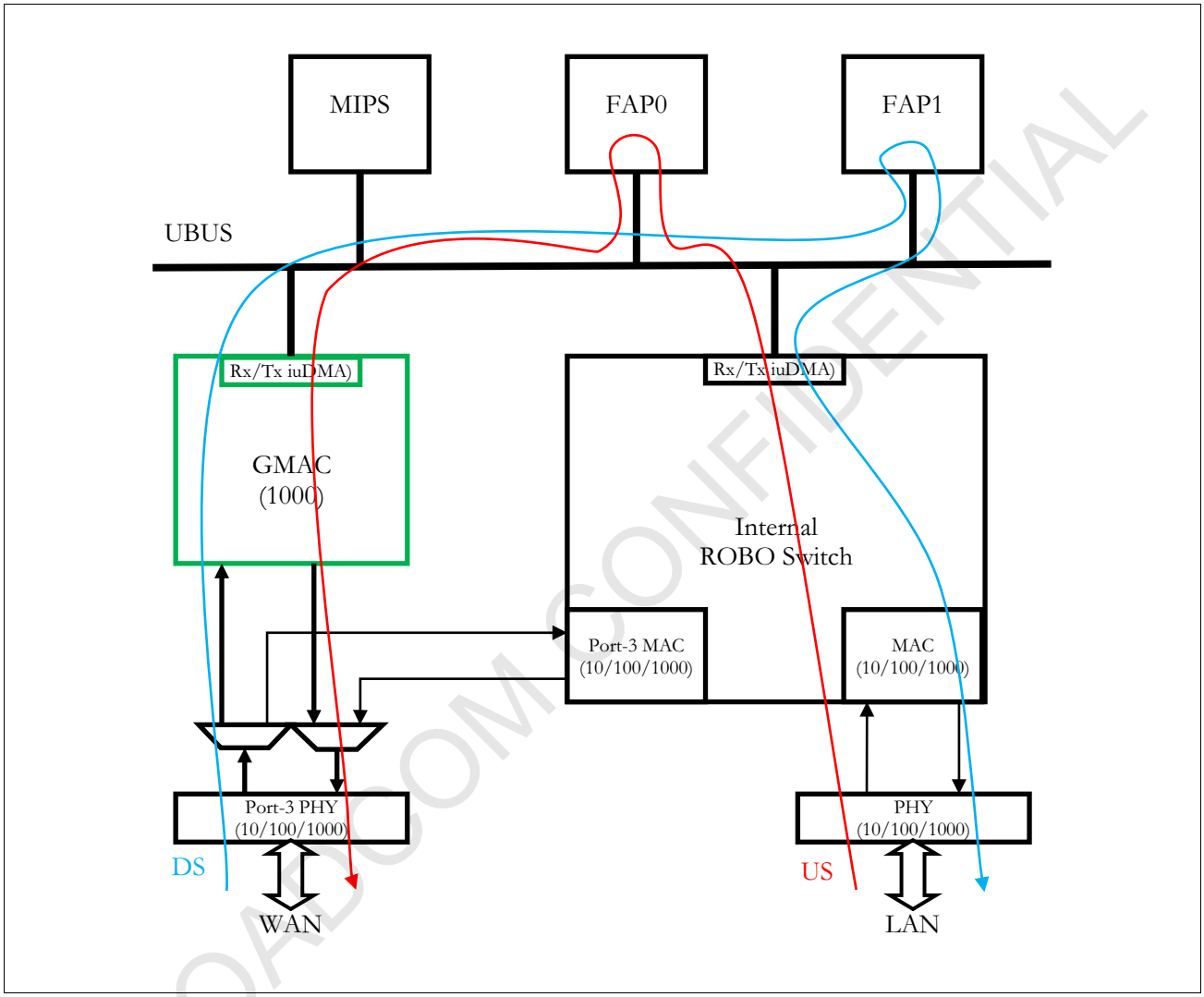
Link Speed Mode

When the mode is configured as link speed, every time the link comes up, the negotiated link speed decides the active MAC: GMAC or ROBO port. This is the default mode when the driver is initialized. This mode is useful if the 1000 Mbps support is required and the QoS and traffic management supported by FAP is sufficient.

1000 Mbps

If the negotiated link speed is 1000 Mbps and the GMAC is made active, then the packet data path is as shown in the Figure 1.

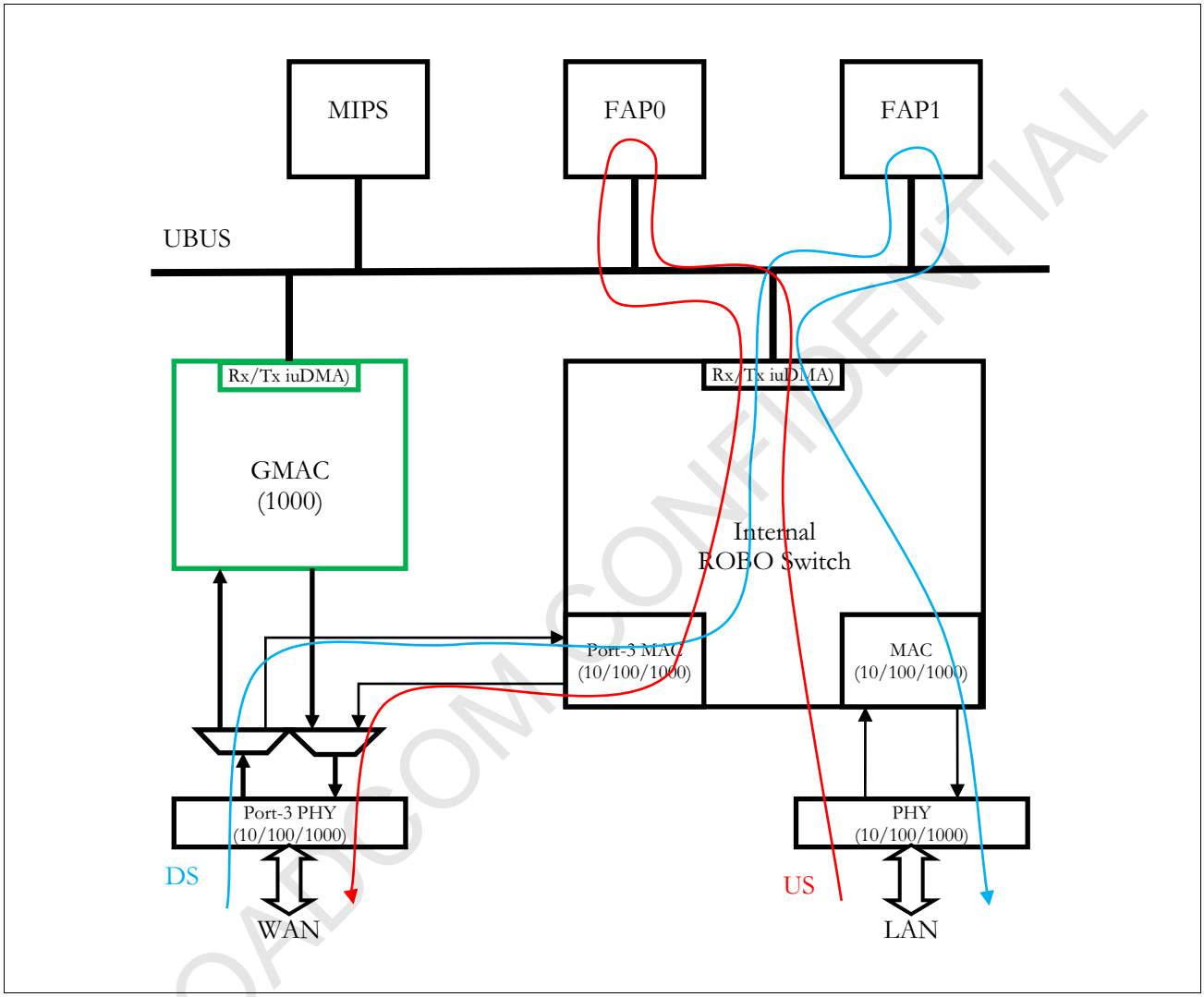
Figure 1: Link Speed Mode (GMAC is Active)



10/100 Mbps

The GMAC does not support 10/100 Mbps. So when the negotiated link speed is 10/100 Mbps the ROBO port is made active, the packet data path is as shown in the Figure 2.

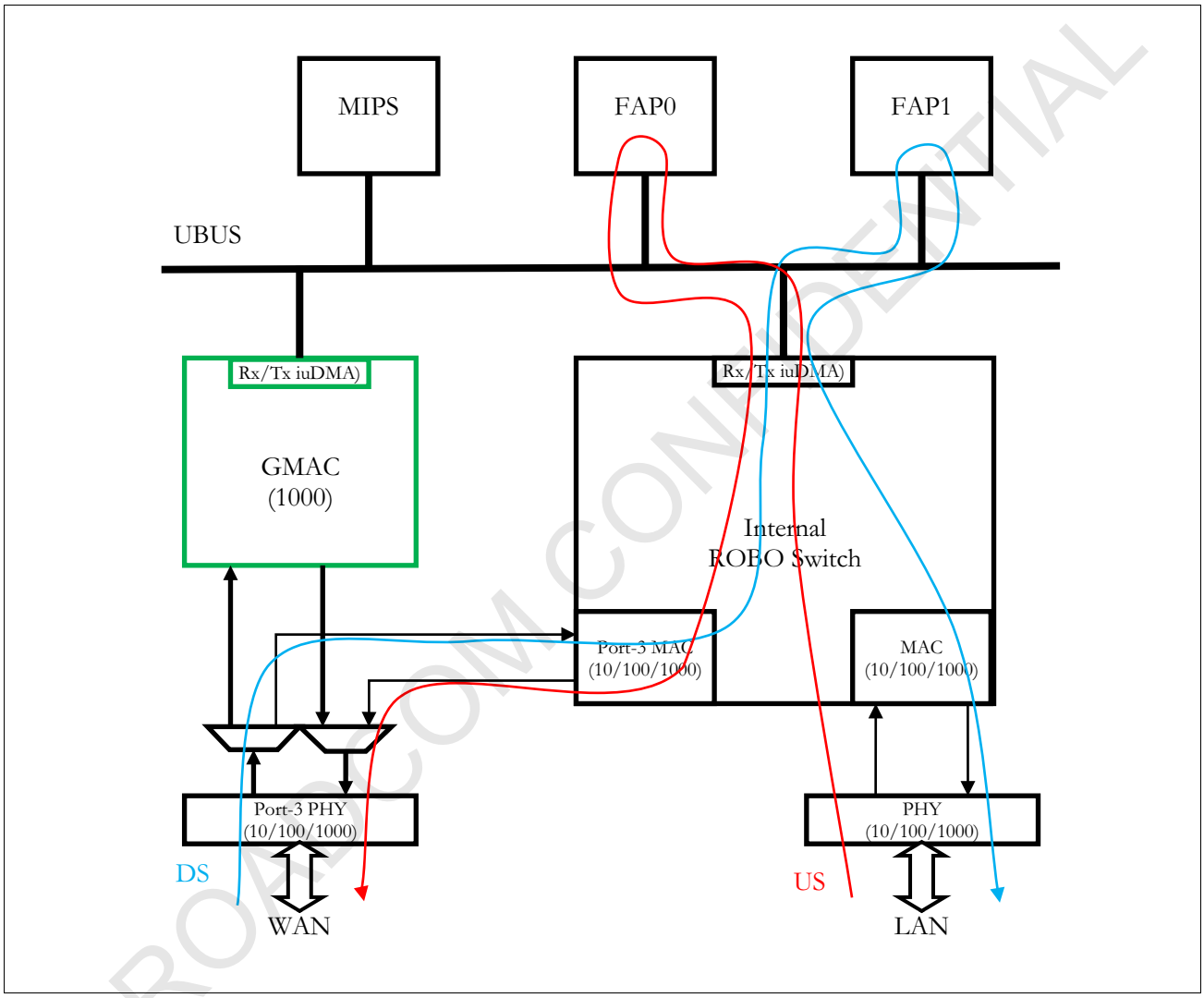
Figure 2: Link Speed Mode (ROBO Port is Active)



ROBO Port Mode

When mode is configured as ROBO port (Figure 2), the active MAC will always be the ROBO port (GMAC is not used irrespective of the link speed). The behavior in this configuration is the same as before the GMAC was introduced. This mode is useful if the 1000 Mbps support is not required (the bidirectional rate should be less than 900 Mbps). Either the ROBO switch or FAP QoS and traffic management features can be used.

Figure 3: ROBO Port Mode



FAP Compiled-out

When the FAP is compiled-out through *make menuconfig*, all the modes and packet data paths are similar to when FAP is compiled-in, except the flows (both upstream and downstream) are handled by MIPS instead of FAPs.

CLI

To see the list of GMAC CLI commands, type **gmac** at the shell prompt.

```
# gmac
GMAC Control Utility:

NOTE:
1. GMAC should be present on the chip, and
2. ROBO port should be already configured as WAN.
3.

::: Usage:

:::::: GMAC Driver:
       gmac status
       gmac set --mode <0|1>
          mode: 0 = ROBO (def), 1 = Link Speed
       gmac get --mode
       gmac dump --mib <0|1>
          mib: 0 = partial, 1 = all
```

GMAC Status

To see the GMAC status, type the following at the shell prompt:

```
# gmac status
============ GMAC Status ============
enabled = 1 wan = 1 mode = 1 active = 1
link_up = 1 link_speed = 1000
```

The GMAC status command prints the following information (Table 1) on the console:

Table 1: GMAC Status Commands

Field	*Description*
enabled	The GMAC is present on this chip, GMAC support compiled-in, and the board parameters has also enabled the GMAC.
wan	ROBO port-3 has been configured as WAN port.
mode	The current mode configured for GMAC WAN feature. • 0 = ROBO port will be active irrespective of the connected link speed. • 1 = The current link speed decides which interface will be active. 1000 Mbps: GMAC is active (active = 1) 10/100 Mbps: ROBO port (active = 0)

Table 1: GMAC Status Commands (Cont.)

Field	Description
active	The active WAN interface through which RX and TX data will pass. • 1 = GMAC • 0 = ROBO port
link_up	Link status as seen by GMAC driver. • 1 = Link up • 0 = Link down
link_speed	The current link speed if the link status is up. • 1000 = 1000 Mbps • 100 = 100 Mbps • 10 = 10 Mbps

GMAC Set Mode

To see the GMAC status, type the following at the shell prompt:

```
# gmac set --mode mode
```

The GMAC command sets are listed in Table 2.

Table 2: GMAC Command Sets

Field	Description
mode	The current mode configured for GMAC WAN feature. • 0 = ROBO port will be active irrespective of the connected link speed. • 1 = The current link speed decides which interface will be active. Basically, the MACs can switch based on the link speed. 1000 Mbps: GMAC will become active 10/100 Mbps: ROBO port will become active

GMAC Get Mode

To see the current GMAC mode, type the following at the shell prompt:

```
# gmac get --mode
```

This GMAC modes are listed in Table 3.

Table 3: Current GMAC Mode

Field	*Description*
mode	Gets the current mode configured for GMAC WAN feature. • 0 = ROBO port is active irrespective of the connected link speed. • 1 = The current link speed decides which interface is active. 1000 Mbps: GMAC is active 10/100 Mbps: ROBO port as active

GMAC Dump MIB

```
# gmac dump –mib <0|1>

gmac dump –mib command dumps partial or all MIB counters for the GMAC only.
```

Caution!

- The ROBO port-3 and GMAC both share the PHY and act as one WAN port. At times, the GMAC is active and at other times the ROBO port is active. The ROBO port-3 shows the cumulative counters (GMAC plus ROBO port-3 combined) for the WAN port. So, use `ethswctl –c mibdump –p 3 –a` CLI command to see the counters in WAN port-3.
- As a side effect, the packets RX and TX from *MIPS/FAP* are not the same as shown by `ethswctl –c mibdump –p 8 –a`. Now the MIPS/FAP can receive/transmit packet from/to two different IuDMA blocks (ROBO IMP port and GMAC). The number of packets TX by MIPS/FAP is the sum of packets RX by ROBO IMP port (port 8) and the packets TX by GMAC. Similarly, the number of packets RX by MIPS/FAP is the sum of packets TX by ROBO IMP port and the packets RX by GMAC.
- Several of the GMAC counters do not exactly match the ROBO port counters. GMAC only maintains 32-bit counters for octets instead of 64-bit counters by ROBO.

```
# gmac dump --mib 0
TxUnicastPkts:             4675070
TxMulticastPkts:                 4
TxBroadcastPkts:                 4
TxDropPkts:                      0

RxUnicastPkts:             2126855
RxMulticastPkts:                 0
RxBroadcastPkts:                 8
RxDropPkts:                      0
```

```
# gmac dump --mib 1
TxUnicastPkts:             4675070
TxMulticastPkts:                 4
TxBroadcastPkts:                 4
TxDropPkts:                      0
TxOctetsLo:             2820485382
TxOctetsHi:                      0
TxQoSPkts:                 4675078
TxCol:                           0
TxSingleCol:                     0
TxMultipleCol:                   0
TxDeferredTx:                    0
TxLateCol:                       0
TxExcessiveCol:                  0
TxFrameInDisc:                   0
TxPausePkts:                     0
TxQoSOctetsLo:          2820485382
TxQoSOctetsHi:                   0

RxUnicastPkts:             2126855
RxMulticastPkts:                 0
RxBroadcastPkts:                 8
RxDropPkts:                      0
RxJabbers:                       0
RxAlignErrs:                     0
RxFCSErrs:                       0
RxFragments:                     0
RxOversizePkts:                  0
RxExcessSizeDisc:                0
RxOctetsLo:             3228564960
RxOctetsHi:                      0
RxUndersizePkts:                 0
RxPausePkts:                     0
RxGoodOctetsLo:         3228564960
RxGoodOctetsHi:                  0
RxSAChanges:                     0
RxSymbolError:                   0
RxQoSPkts:                 2126863
RxQoSOctetsLo:          3228564960
RxQoSOctetsHi:                   0
RxPkts64Octets:                  6
RxPkts65to127Octets:             3
RxPkts128to255Octets:            0
RxPkts256to511Octets:            0
RxPkts512to1023Octets:           0
RxPkts1024to1522Octets:    2126854
RxPkts1523to2047:                0
RxPkts2048to4095:                0
RxPkts4096to8191:                0
RxPkts8192to9728:                0
```

API

GMAC exports a few APIs in the user space. The GMAC API prototypes are defined in *CommEngine/userspace/private/include/gmacctl_api.h*.

GMAC Set Mode

Prototype:

```
intt gmacctl_set_mode( int mode );
```

Parameters:

`mode`: current GMAC mode.

The mode for GMAC WAN interface:

- 0 = ROBO port will be active irrespective of the connected link speed.
- 1 = The current link speed decides which interface will be active.

  1000 Mbps: GMAC will become active

  10/100 Mbps: ROBO port will become active

Return Value:

Success: 0

Failure: -1

Description:

This API sets the current mode for GMAC WAN interface.

GMAC Get Mode

Prototype:

```
intt gmacctl_get_mode( int *mode_p );
```

Parameters:

`*mode_p`: Pointer to the variable in which the current GMAC mode is returned.

Return Value:

Success: 0, and the value returned in `mode_p` is valid

Failure: -1

Description:

This API gets the current mode for GMAC WAN.

Acronyms and Abbreviations

Acronym	*Definition*
CPE	Customer Premises Equipment
FAP	Forward Assist Processor
IP	Internet Protocol version 4
GMAC	Gigabit MAC external to the ROBO switch but connected to UBUS
QoS	Quality of Service
RXBD	RX buffer descriptor
ROBO	ROBO switch internal to chip
WAN	Wide Area Network

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