

AT32F407/437 PTP Daemon

Introduction

This sample code demonstrates how to implement IEEE1588 protocol based on Ethernet network.

Applicable products:

Part number	AT32F407xx
	AT32F437xx

List of peripherals:

Main peripherals	EMAC
	GPIO
	USART

1 Application method

1.1 Hardware requirements

- 1) LED2/LED3
- 2) USART1(PA9/PA10)
- 3) AT-START-F407/ AT-START-F437 evaluation board
- 4) Ethernet cable

1.2 Software requirements

- 1) SourceCode
 - at32f407_ptp_daemon/ at32f437_ptp_daemon source code
 - PTP Daemon source code
 - LWIP source code
 - AT32 driver library
- 2) Doc
 - SC0082_AT32F407_437_LWIP_FreeRTOS_V2.0.1

Note: All projects are built around keil 5. If users want to use them in other compiling environments, please refer to AT32F407_Firmware_Library_V2.x.x/project/at_start_f407/templates (such as IAR6/7, keil 4/5) for a simple change.

1.3 Example of application

- 1) Open the at32f407_ptp_daemon/ at32f437_ptp_daemon source code, compile and download to the evaluation board;
- 2) Install ptpd on Ubuntu (connected to the Internet) and enter instruction “sudo apt-get install ptpd”;
- 3) Configure the PC IP address segment to be the same as that of evaluation board, as shown in Figure 1;
- 4) Enter instruction “sudo ptpd -C -E -s -l enp0s3”, where “enp0s3” is the name of network card in Ubuntu, which can be accessed and modified through instruction “ifconfig”, as shown in Figure 2.

Note: If the data received and sent by the network port is occasionally lost, check whether the amount of code exceeds the zero-wait area of the chip. In this case, users can selectively compile important codes into the zero-wait area.

Figure 1. Set PC network segment

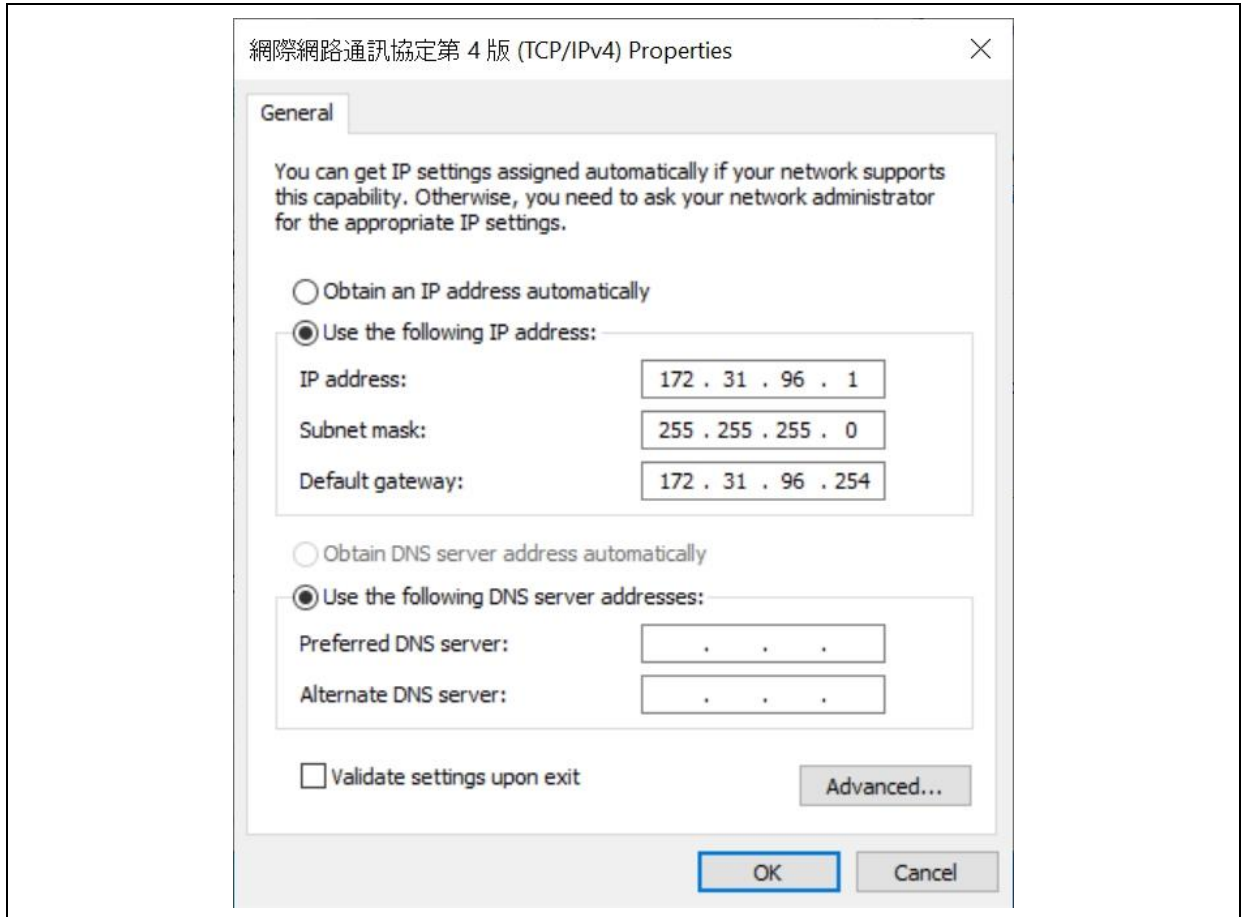


Figure 2. Ubuntu starts PTP Daemon client to synchronize time with MCU

```

rtt min/avg/max/mdev = 0.211/0.299/0.390/0.053 ms
joe-chen@joechen-VirtualBox:~$ sudo ptpd -C -E -s -i enp0s3
[sudo] password for joe-chen:
1987-01-06 05:41:06.293499 ptpd2[49682].startup (info)      (___) Configuration
OK
1987-01-06 05:41:06.293728 ptpd2[49682].startup (info)      (___) Successfully a
cquired lock on /var/run/ptpd2.lock
1987-01-06 05:41:06.293844 ptpd2[49682].startup (notice)   (___) PTPDv2 started
successfully on enp0s3 using "slaveonly" preset (PID 49682)
1987-01-06 05:41:06.293916 ptpd2[49682].startup (info)      (___) TimingService.
PTP0: PTP service init
1987-01-06 05:41:06.294864 ptpd2[49682].enp0s3 (info)      (init) Observed_drift
loaded from kernel: 0 ppb
1987-01-06 05:41:06.397057 ptpd2[49682].enp0s3 (notice)   (lstn_init) Now in st
ate: PTP_LISTENING
1987-01-06 05:41:07.197392 ptpd2[49682].enp0s3 (info)      (lstn_init) New best
master selected: 000044fffe455601(unknown)/1
1987-01-06 05:41:07.197424 ptpd2[49682].enp0s3 (notice)   (slv) Now in state: P
TP_SLAVE, Best master: 000044fffe455601(unknown)/1 (IPv4:172.31.96.101)
1987-01-06 05:41:08.197370 ptpd2[49682].enp0s3 (notice)   (slv) Received first
Sync from Master
1987-01-06 05:41:08.197560 ptpd2[49682].enp0s3 (critical) (slv) Offset above 1
second. Clock will step.
1987-01-06 05:41:08.197621 ptpd2[49682].enp0s3 (error)   (slv) Could not set s

```

Figure 3. PTP packet

The image shows a Wireshark capture of Precision Time Protocol (PTP) packets on interface enp0s3. The packet list pane displays the following data:

No.	Time	Source	Destination	Protocol	Length	Info
281	35.116059704	172.31.96.101	224.0.1.129	PTPv2	86	Follow Up Message
287	36.085395951	172.31.96.101	224.0.0.107	PTPv2	96	Peer Delay Req Message
288	36.116051620	172.31.96.101	224.0.1.129	PTPv2	86	Sync Message
289	36.116052264	172.31.96.101	224.0.1.129	PTPv2	86	Follow Up Message
290	36.116052405	172.31.96.101	224.0.1.129	PTPv2	106	Announce Message
292	37.065437659	172.31.96.101	224.0.0.107	PTPv2	96	Peer Delay Req Message
293	37.115712224	172.31.96.101	224.0.1.129	PTPv2	86	Sync Message
294	37.115712512	172.31.96.101	224.0.1.129	PTPv2	86	Follow Up Message
299	38.115829057	172.31.96.101	224.0.1.129	PTPv2	86	Sync Message
300	38.115829296	172.31.96.101	224.0.1.129	PTPv2	86	Follow Up Message
301	38.115829315	172.31.96.101	224.0.1.129	PTPv2	106	Announce Message
305	39.115405355	172.31.96.101	224.0.1.129	PTPv2	86	Sync Message
306	39.115405626	172.31.96.101	224.0.1.129	PTPv2	86	Follow Up Message

The packet details pane for the selected packet (No. 287) shows the following structure:

- Frame 6: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface enp0s3, id 0
- Ethernet II, Src: Castle_45:56:01 (00:00:44:45:56:01), Dst: IPv4mcast_01:81 (01:00:5e:00:01:81)
- Internet Protocol Version 4, Src: 172.31.96.101, Dst: 224.0.1.129
- User Datagram Protocol, Src Port: 319, Dst Port: 319
- Precision Time Protocol (IEEE1588)
 - transportSpecific: 0x8
 - messageId: Sync Message (0x0)
 - Reserved: 0
 - versionPTP: 2
 - messageLength: 44
 - subdomainNumber: 0
 - Reserved: 0
 - flags: 0x0200
 - correction: 0.000000 nanoseconds
 - Reserved: 0

The packet bytes pane shows the raw data in hexadecimal and ASCII format:

```

0000 01 00 5e 00 01 81 00 00 44 45 56 01 08 00 45 00  ..A...DEV...E...
0010 00 48 00 10 00 00 ff 11 cd 8e ac 1f 60 65 e0 00  ..H.....e...
0020 01 81 01 3f 01 3f 00 34 4e 2b 80 02 00 2c 00 00  ...??.4N+...
0030 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ...
0040 44 ff fe 45 56 01 00 01 00 05 00 00 00 00 00  D-EV.....
0050 00 41 3b 9a 69 b0  ;i
    
```

At the bottom of the window, the status bar indicates: wireshark_enp0s3_19870106054056_Q54u8K.pcapng, Packets: 313 • Displayed: 126 (40.3%), Profile: Default.

2 Revision history

Table 1. Document revision history

Date	Version	Revision note
2022.09.19	2.0.0	Initial release.

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